Informatics for Integrating Biology and the Bedside

i2b2 Cell Messaging
Data Repository (CRC) Cell

Document Version: 1.2

I2b2 Software Release: 1.4

1 Table of Contents

2 Document Version History

Date	Version	Description	Author(s)
12/01/2006	0.9	First Version	Kristel Hackett
05/10/2007	1.0	Revision	Vivian Gainer
09/05/2007	1.1	Revision 1.1 changes	Rajesh Kuttan
06/30/2008	1.1	Share Panel definition between the Setfinder and PDO request (<constrain_by_date>, <constrain_by_value>). Setfinder request to support more result type. Requesting for patient count and gender count xml.	Rajesh Kuttan
10/27/2008	1.1	Data upload message added	Rajesh Kuttan
08/17/2009	1.2	Updated PID and EID	Rajesh Kuttan
08/17/2009	1.2	Updated version info	Janice Donahoe

3 Introduction

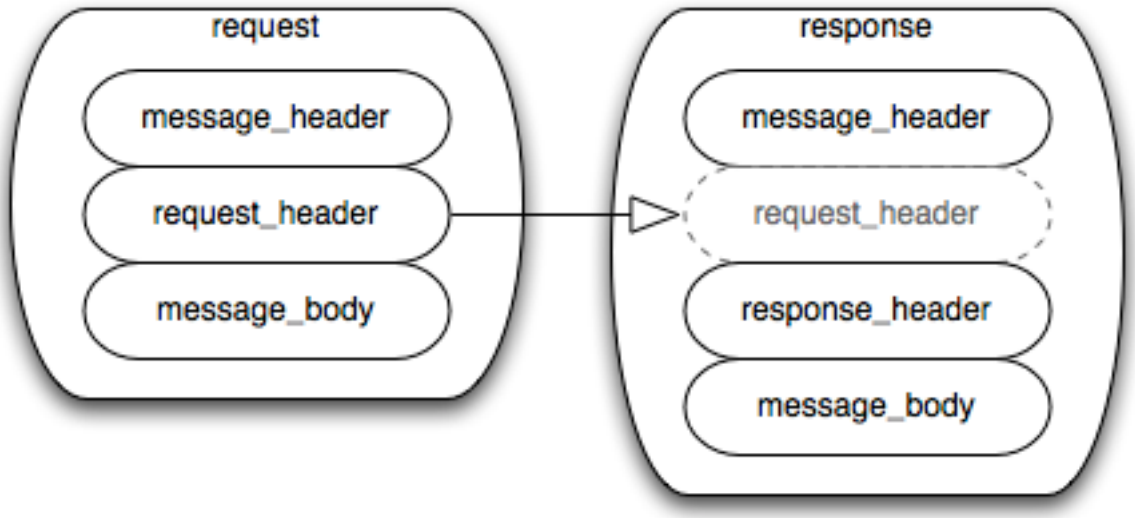
This document gives an overview of i2b2 cell messaging as well as a more detailed description of message formats specific to the Data Repository (CRC) Cell.

3.1 The i2b2 Hive

The 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. The i2b2 hive is a set of cells or modules that have a common messaging protocol that allow the cells to interact using web services and XML messages.

3.2 i2b2 Messaging Overview

All cells in the i2b2 hive must communicate using standard i2b2 XML messages. This message specifies certain properties that are common to cells and essential to the administration tasks associated with sending, receiving and processing messages. All requests are sent using a <request> tag and responses are returned using a <response> tag. The same <message_header> tag is used for both. The <request_header> is used for requests but may optionally be echoed back in the response. The response must include a <response_header>. The XSD specification of the i2b2 message permits individual cells to add cell-specific XML in the <message_body> tag. This cell-specific XML need not extend the i2b2 message schema since the i2b2 schema will allow insertion of tags from any namespace into the <message_body> tag. The following table illustrates the basic top-level elements contained within the request and response messages.



The i2b2 XML schema consists of three XSD files:

- **i2b2.xsd**
  This schema is not used directly to create i2b2 messages, but is included in the i2b2_request.xsd and the i2b2_response.xsd. It defines the <message_header> tag.

- **i2b2_request.xsd**
  This schema is used for validating i2b2 request messages. It defines the <i2b2:request> tag, which includes the <message_header> tag.

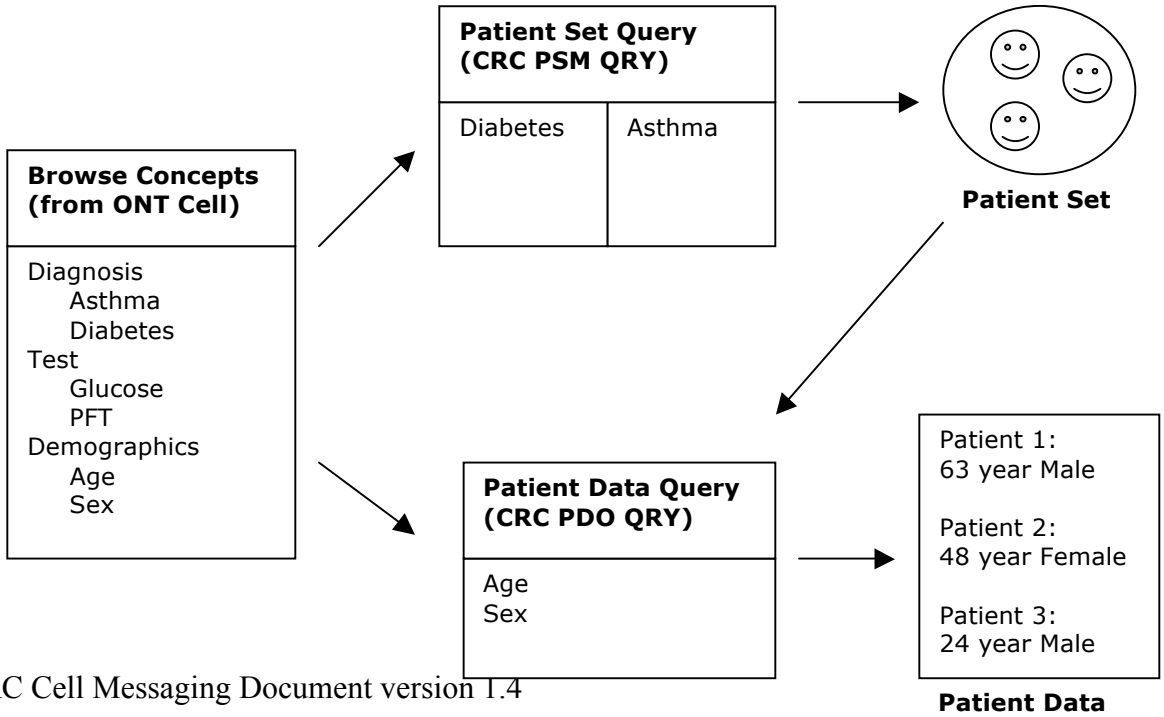
- **i2b2_response.xsd**
  This schema is used for validating i2b2 response messages. It defines the <i2b2:response> tag, which includes the <message_header> tag.

4 Data Repository (CRC) Cell Messaging Detail

The Data Repository Cell is one of the core cells in the i2b2 hive. Since much of the data in the repository is clinical in nature, it has also come to be known as the Clinical Research Chart (CRC) and the terms "data repository" and "CRC" are used interchangeably. The data repository is a warehouse of patient phenotypic and genotypic data that interacts with other cells to provide information for users. Communication with the CRC Cell, like all cells in the i2b2 hive, is handled via standardized XML web services. These XML messages conform to the i2b2 messaging standard described above, which allows cell-specific XML within the <message_body> tag. The rest of this document describes CRC-specific web services and the XML formats that encode them and illustrates how these XML messages are used to accomplish a set of interactions that correspond to typical CRC use cases.

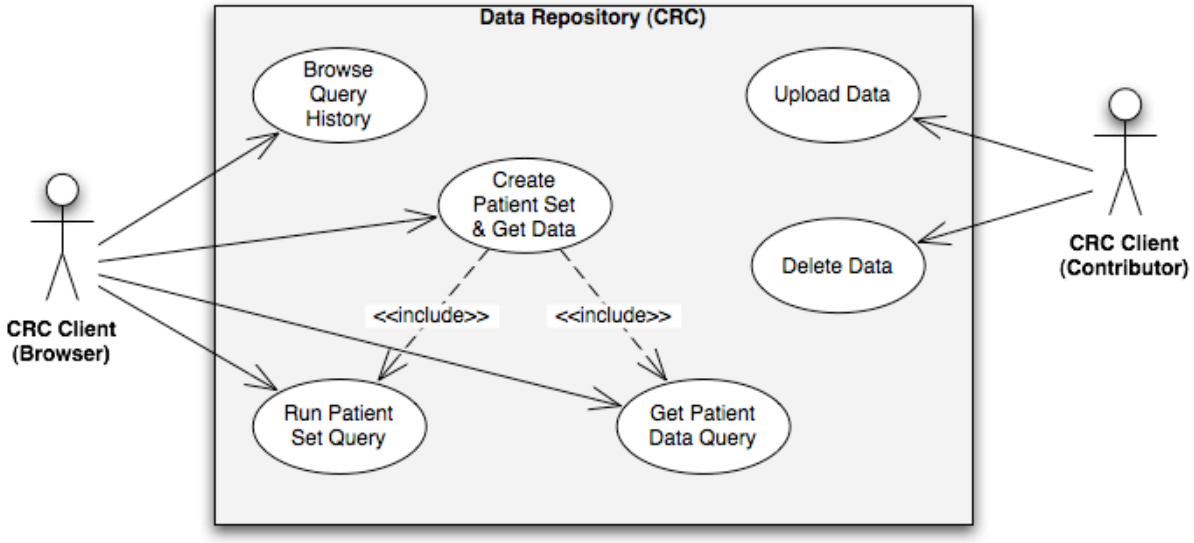
A typical CRC Client may want to define a patient set and then request patient data on that set. Both of these tasks require the user to first interact with another cell called the Ontology Management (ONT) Cell in order to choose concept codes to define the CRC request. Although the specific interactions with the ONT Cell are not described in this document, the following diagram shows the basic flow of information.

This diagram describes how a user may get the ages and genders for all patients who have either diabetes or asthma. The user starts by selecting the diagnoses 'Diabetes' and 'Asthma' from the ONT cell; these define the 'Patient Set Query', which creates a patient set in the data repository. Then the user selects the demographic concepts 'Age' and 'Sex' from the ONT cell to define the 'Patient Data Query'. The patient data query returns the age and gender for all patients in the data set, those with diabetes or asthma.



4.1 Use Case

The CRC Cell is a repository of clinical data and has a set of services that respond to requests for patient data. A request might be issued by a client cell which is used by a researcher conducting a clinical trial in order to help gather a cohort. There are two types of clients or users, the 'browsing client' and the 'contributing client'. The contributing client adds content to the CRC by uploading patient data or deleting data by removing previous uploads. The browsing client has four possible interactions with the repository cell. The user may create queries that define patient sets, browse previous queries, rerun existing patient set queries and get specific patient data from a patient set.



4.2 Services / Messages

The CRC Cell provides services that support the interactions necessary for each of the four use cases described in the previous section. The services expect different message request types for each specific behavior or request.

4.2.1 Browse Query History

- Get a List of Saved Query Definitions – provides a list of all prior queries created by a client/user.
- Get a List of Saved Query Results – provides query results for given query run/instance.
- Get an XML Definition of a Defined Query – returns definition of the query

4.2.2 Run Patient Set Query

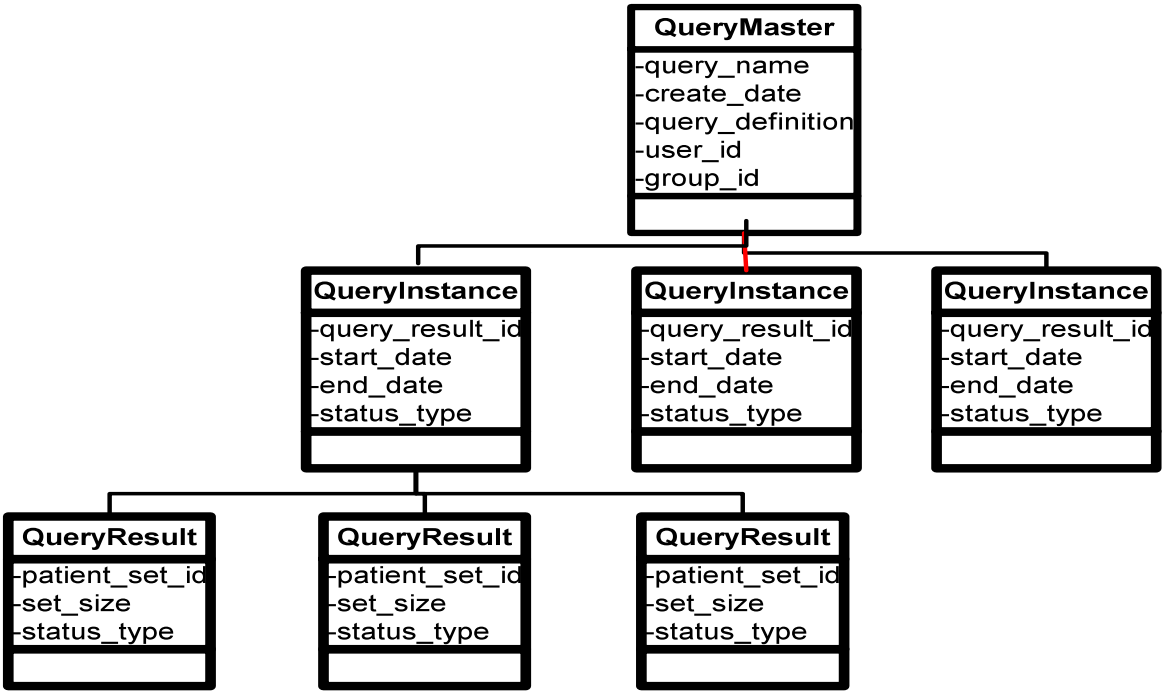
- Run Patient Set Query – runs the query and returns the result and its status

4.2.3 Get Patient Data Query

- Get Patient Data From a Patient Set - returns patient data object for the given patient set

4.3 Patient Set Query Service:

4.3.1 Conceptual Model:



QueryMaster holds master information about the query like the query name, query definition, user id, group_id. The query_definition element in QueryMaster holds the xml representation of the query constraint; its details are described below.

The run information of the query is recorded in QueryInstance and is created when ever the query is executed. There can be multiple QueryInstances for one QueryMaster and one QueryInstance can have multiple QueryResults. QueryResult typically holds result information of the query, such as id of patient set, the patient set size and result status.

4.3.2 Panel Definition Details :

The Panel is the common definition used to query the mart. The Panel holds one or more <items>. The <item> constraints are OR-ed and the <panel> constraints are AND-ed in the query. Both the Setfinder and PDO request share this panel definition.

Example:

Italicized and *Gray* are optional for both setfinder and PDO schema.
Gray items (no italics) are required only if the parent container is being used.
Italicized items are optional but **only** for setfinder schema.
All others are required.

```
<panel name="name0">
  <panel_number># of panel</panel_number>
  <panel_date_from time="start_date" inclusive="yes"></panel_date_from>
  <panel_date_to time="start_date" inclusive="yes"></panel_date_to>
  <panel_accuracy_scale>1</panel_accuracy_scale>
  <invert>0</invert>
  <total_item_occurrences operator="EQ/NE/GT/GE/LT/LE">
          1</total_item_occurrences>
  <item>
         <hlevel>3</hlevel>
         <item_name>item_name0</item_name>
         <item_key>item_key0</item_key>
         <item_icon>item_icon0</item_icon>
         <tooltip>tooltip0</tooltip>
         <class>ENC</class>
         <constrain_by_value>
               <value_operator>EQ/NE/GT/GE/LT/LE/IN
                     /BETWEEN/LIKE</value_operator>
               <value_constraint>value_constraint0</value_constraint>
               <value_unit_of_measure>unit</value_unit_of_measure>
               <value_type>TEXT/NUMBER/FLAG/MODIFIER</value_type>
         </constrain_by_value>
         <constrain_by_date>
               <date_from time="start_date" inclusive="yes">
                     2006-05-04</date_from>
               <date_to time="start_date" inclusive="yes">
                     2006-05-04</date_to>
         </constrain_by_date>
         <dim_tablename>dim_tablename0</dim_tablename>
         <dim_columnname>dim_columnname0</dim_columnname>
         <dim_dimcode>dim_dimcode0</dim_dimcode>
         <dim_columndatatype>dim_columndatatype0</dim_columndatatype>
         <dim_operator>dim_operator0</dim_operator> LIKE
         <facttablecolumn>facttablecolumn0</facttablecolumn>
         <item_color>
         <item_shape>
         <item_row_number>
         <item_is_synonym>
   </item>
</panel>
```

Element Name	Description
Panel	Panel is a concept to group item within them. The set of observation facts for each item filter are unioned at the panel level. Panel has the attribute, "name" which is the key field for the panel and it is unique.
panel_number	Panel number, just the serial number starting with 1.
panel_date_from	Apply the observation fact's start date condition at the panel level.
Panel_date_to	Apply the observation fact's end date condition at the panel level.
Invert	The invert value could be "1" or "0". If this value is "1", then query applies "NOT" condition for whole panel.
total_item_occurrences	Select the events only if the total number of occurrence is greater or equal to this value.
Item	Item contains the filter and query building information, like the item key, dimension table column name, data type, etc.
Hlevel	Hierarchy level, not required for this implementation.
Item_name	Name of the item, this is not required element and mostly for UI purposes.
Item_table	Dimension table name
Item_key	Item key representing the unique path of concepts available in metadata schema or the ontology cell. The format of item_key is [\\Dimension\concept path].
Tooltip	This is not required element and is mostly for UI purposes.
Class	This is not used, but just added to the specification. This is could be used to classify the data, for example whether we need fact's image data, text data, etc.

Constrain_by_value	To constrain the observation value of a concept.
	`<constrain_by_value>`
	`<value_operator>EQ/NE/GT/GE/LT/LE/ IN/BETWEEN/LIKE</value_operator>`
	`<value_constraint></value_constraint>`
	`<value_unit_of_measure></value_unit_of_measure>`
	`<value_type>TEXT/NUMBER /FLAG/MODIFIER</value_type>`
	`</constrain_by_value>`
	
	Example 'IN' Operator:

	<value_constraint> *('NEG','NEGATIVE')</value_constraint>* *Example 'BETWEEN' Operator:* *<value_constraint> 100 and 200</value_constraint>* ***Following shows how the sql will be build for different operators:*** TEXT – valueflag_cd = 'T' and tval_char = ? NUMBER – valueflag_cd = 'N' and nval_num = ? and tval_char = ? FLAG – valueflag_cd = ? MODIFIER – valueflag_cd = 'M' and tval_char = ?
constrain_by_date	Apply start and end date constraint for the item. *<constrain_by_date>* <date_from time="start_date/end_date" inclusive="yes"> </date_from> <date_to time="start_date/end_date" inclusive="yes"> </date_to> *</constrain_by_date>*
Dim_tablename	Name of the dimension table to join with the fact table. i.e. 'concept_dimension', 'provider_dimension', etc. This information is used to construct dimension filter SQL. For example: select * from **observation_fact** where **facttablecolumn** in (Select **dim_columnname** from **dim_tablename** where **dim_columnname** like **dim_dimcode**) .
Dim_columnname	Column name of the dimension table.
Dim_dimcode	This is same as the concept path. i.e. '\i2b2\Diagnoses'
Dim_columndatatype	The data type of dimension table's filter column. Default is String
Dim_operator	The conditional operator for filtering. The default is 'LIKE' operator. Other values are 'LE', 'GE', 'EQ'.
facttablecolumn	This is name of the column in the observation fact table to join the dimension table.
item_color	UI rendering attribute.
item_shape	UI rendering attribute.
item_row_number	UI rendering attribute.
item_is_synonym	UI rendering attribute.

4.3.2.1 Request and Response message structure :

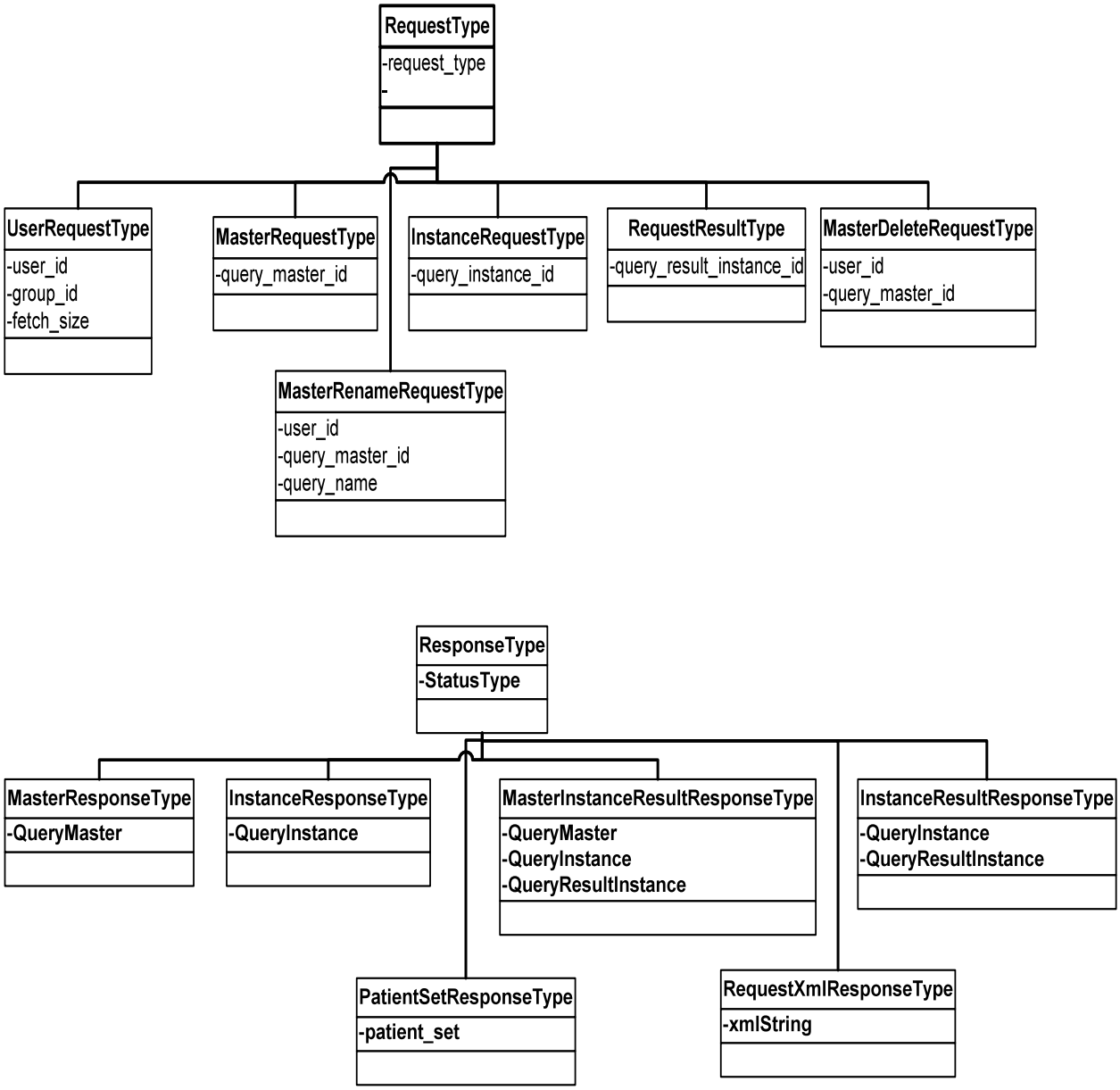
The patient set request/response message structure is divided into three parts: 1. PSMHeader 2. Request and 3. Response. For a request message, the <psmheader> and <request> parts are required; while a response message requires only the <response> part.

```
<i2b2:message_body>
     <crc:psmheader>
        <request_type></request_type>
     </crc:psmheader>

     <crc:request>
           …

     </crc:request>

     <crc:response>
           …

     </crc:response>
</i2b2:message_body>
```

Element name	Description
<psmheader>	Header has a <request_type> element, which will carry operation name. Each operation name have a specific request/response combination. Following are list of supported operation names: CRC_QRY_getRequestXml_fromQueryMasterId CRC_QRY_getQueryMasterList_fromUserId CRC_QRY_runQueryInstance_fromQueryDefinition CRC_QRY_getQueryMasterList_fromGroupId CRC_QRY_getQueryResultInstanceList_fromQueryInstanceId CRC_QRY_getQueryInstanceList_fromQueryMasterId CRC_QRY_deleteQueryMaster CRC_QRY_renameQueryMaster CRC_QRY_runQueryInstance_fromQueryMasterId CRC_QRY_getResultDocument_fromResultInstanceId CRC_QRY_getResultType CRC_QRY_runQueryInstance_fromAnalysisDefinition CRC_QRY_cancelQuery CRC_QRY_updateResultInstanceDescription
<request>	The <request> is modeled as an object using a polymorphic approach. All operation specific request objects inherit a base RequestType object containing a request_type attribute as shown in section 4.3.3.
<response>	The <response> is also modeled as an object using a

	polymorphic approach. All operation specific response objects inherit a base ResponseType object containing a StatusType attribute as shown in section 4.3.3.

4.3.3 Request and Response Object Model



The following chart shows the different request and response types for each service type listed above. The RequestType column describes what input is expected and the ResponseType column describes what output is expected.

Operation	RequestType						ResponseType					
	User	Master (Query)	Instance (Query Run)	QueryDefinition	PatientSet	ObservationFact	Master (Query)	Instance (Query Run)	Result	RequestXml	MasterInstanceResult	PatientData
Get a List of Saved Query Definitions	x						x					
Get a List of Saved Query Runs		x						x				
Get a List of Saved Query Results			x						x			
Get XML Definition of a Defined Query		x								x		
Run (New) Patient Set Query				x							x	
Run (Existing) Patient Set Query		x									x	
Get Patient Data From a Patient Set					x							x
Get Patient Data From Observation Fact						x						x

4.3.4 Use Case Scenario:

4.3.4.1 Execute a query and get its results.

The service query's the mart using the query definition and generates output based on the result option. Each query request and its results will be recorded under the given user id and project id.

The server will read the value <result_waittime_ms> from the <request_header> and if the query did not complete before the wait time specified in the request, it will send a response to the client with "PENDING" status. The client can later send a query instance request to see if the query is completed and get the query result information.

The service supports following result options. "PATIENTSET", "PATIENT_COUNT_XML" ," PATIENT_GENDER_COUNT_XML", "PATIENT_AGE_COUNT_XML", "PATIENT_VITALSTATUS_COUNT_XML", "PATIENT_RACE_COUNT_XML". If the result option (<result_output_list>) is not specified in the request, then the default result option is "PATIENTSET".

Result Output Name	Description	Output Value
PATIENT_COUNT_XML	Returns patient Count in i2b2 result xml format. The i2b2 result format is similar to the name-value pair.(i2b2_result_msg.xsd)	<i2b2_result_envelope xmlns:ns9=http://www.i2b2.org/xsd/hive/msg/result/1.1/> <body> <result name="patient_count"> <data type="int" column="patient_count">1559 </data> </ns9:result> </body> </i2b2_result_envelope>
PATIENT_GENDER_COUNT_XML,	Returns patient gender count in i2b2 result xml format. Refer i2b2_result_msg.xsd for i2b2 result format.	<i2b2_result_envelope xmlns:ns9=http://www.i2b2.org/xsd/hive/msg/result/1.1/> <body> <result name="patient_gender_count"> <data type="int" column="male_count">1559 </data> <data type="int" column="female_count">4256</data> </ns9:result> </body> </i2b2_result_envelope>

PATIENTSET	The patient set from the query will be persisted in the database	Not Applicable

Message Request and Response :

Request Type	Request	Response
CRC_QRY_runQueryInstance_fromQueryDefinition	query_definition_requestType	master_instance_result_responseType

Example :

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

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

    <crc:request xsi:type="crc:query_definition_requestType">
        <query_definition>
            <query_name/>
            <query_description/>
            <panel>
                <panel_number>1</panel_number>
                <panel_date_from>2000-12-30T00:00:00</panel_date_from>
                <panel_date_to>2000-12-30T00:00:00</panel_date_to>
                <invert>0</invert>
                <total_item_occurrences>1</total_item_occurrences>
                <item>
                    <item_key>\\rpdr\RPDR\Diagnoses</item_key>
                </item>
            </panel>
        </query_definition>
        <result_output_list>
            <result_output name="PATIENT_COUNT_XML"/>
            <result_output name="PATIENT_GENDER_COUNT_XML "/>
            <result_output name="PATIENT_AGE_COUNT_XML "/>
            <result_output name="PATIENT_VITALSTATUS_COUNT_XML "/>
            <result_output name="PATIENT_RACE_COUNT_XML "/>
            <result_output name="PATIENTSET"/>
        </result_output_list>
    </crc:request>

    <crc:response xsi:type="crc:master_instance_result_responseType">
        <query_master>
            <query_master_id>0</query_master_id>
            <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>1</result_type_id>
                <name>PATIENTSET</name>
                <description/>
            </query_result_type>
            <set_size>0</set_size>
             <obfuscate_method>OBTOTAL</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>3</status_type_id>
                <name>FINISHED</name>
                <description/>
            </query_status_type>
        </query_result_instance>
        <query_result_instance>
            <result_instance_id>0</result_instance_id>
            <query_instance_id>0</query_instance_id>
            <query_result_type>
                <result_type_id>4</result_type_id>
                <name> PATIENT_COUNT_XML </name>
                <description/>
            </query_result_type>
            <set_size>0</set_size>
            <obfuscate_method>OBSUBTOTAL</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>3</status_type_id>
                <name>FINISHED</name>
                <description/>
            </query_status_type>
        </query_result_instance>
    </crc:response>
</message_body>
```

4.3.4.2 Scenario : Check if the query is completed and get its results

This request accepts a query_instance_id and returns query status information. i.e. COMPLETED, RUNNING, ERROR, etc.

Request Type	Request	Response
CRC_QRY_getQueryResultInstanceList_fromQueryInstanceId	instance_requestType	result_responseType

Example:

```
<message_body>
   <psmheader>
        <user login="demo">demo</user>
        <patient_set_limit>0</patient_set_limit>
        <estimated_time>0</estimated_time>
        <request_type>
              CRC_QRY_getQueryResultInstanceList_fromQueryInstanceId
        </request_type>
  </psmheader>

  <request xsi:type="ns4:instance_requestType"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <query_instance_id>6280</query_instance_id>
  </request>

  <response xsi:type="ns5:result_responseType"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" >
        <query_result_instance>
            <result_instance_id>6280</result_instance_id>
            <query_instance_id>6280</query_instance_id>
            <query_result_type>
                <result_type_id>1</result_type_id>
                <name>PATIENTSET</name>
            </query_result_type>
            <set_size>2000</set_size>
            <start_date>2007-09-06T10:42:14.000-04:00</start_date>
            <end_date>2007-09-06T10:42:15.000-04:00</end_date>
            <query_status_type>
                <status_type_id>3</status_type_id>
                <name>FINISHED</name>
            </query_status_type>
        </query_result_instance>
    </response>
  </message_body>
```

4.3.4.3 Scenario : Get the query result(xml output) by result instance id.

Pass the query result instance id and get the query result. If the result instance have a xml output, then the xml output will be passed in the <xml_value> and the <xml_value> element will contain a i2b2 result xml document.

Request Type	Request	Response
CRC_QRY_getResultDocument_fromResultInstanceId	result_requestType	crc_xml_result_responseType

Example :

```
<message_body>
      <psmheader>
            <request_type>
               CRC_QRY_getResultDocument_fromResultInstanceId
            </request_type>
      </psmheader>

      <ns4:request xsi:type="ns4:result_requestType"
            xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <query_result_instance_id>7953</query_result_instance_id>
      </ns4:request>

      <ns4:response xsi:type="ns4:crc_xml_result_responseType">
            <status>
                <condition type="DONE">DONE</condition>
            </status>
            <query_result_instance>
                <result_instance_id>7953</result_instance_id>
                <query_instance_id>8192</query_instance_id>
                <query_result_type>
                    <result_type_id>4</result_type_id>
                    <name>PATIENT_GENDER_COUNT_XML</name>
                    <description>PATIENT GENDER COUNT XML</description>
                </query_result_type>
                <set_size>5815</set_size>
                <start_date>2008-07-02T11:07:05.000-04:00</start_date>
                <end_date>2008-07-02T11:07:05.000-04:00</end_date>
                <query_status_type>
                    <status_type_id>3</status_type_id>
                    <name>FINISHED</name>
                    <description>FINISHED</description>
                </query_status_type>
            </query_result_instance>
            <crc_xml_result>
                <xml_result_id>804</xml_result_id>
                <result_instance_id>7953</result_instance_id>
                <xml_value><?xml version="1.0" encoding="UTF-8"
                        standalone="yes"?>
                  <ns9:i2b2_result_envelope
                    xmlns:ns9="http://www.i2b2.org/xsd/hive/msg/result/1.1/">
                    <body>
```

```
                    <ns9:result name="patient_gender_count">
                     <data type="int" column="male_count">1559</data>
                     <data type="int" column="female_count">4256</data>
                    </ns9:result>
                  </body>
                </ns9:i2b2_result_envelope>
              </xml_value>
            </crc_xml_result>
      </ns4:response>
</message_body>
```

4.3.4.4 Scenario : Run an Analysis Plug-in and get the status

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

Example :

```
    <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>
        <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>
```

4.3.4.5 Scenario : Get a list of queries by user id.

This request fetches a list of query master information for the given user id. The client can also specify how many query master items to return from the server using the <fetch_size> element. The server returns query master items in descending order of query creation time.

Request Type	Request	Response
CRC_QRY_getQueryMasterList_fromUserId	user_requestType	master_responseType

Example :

```
<message_body>
     <psmheader>
           <request_type>
                 CRC_QRY_getQueryMasterList_fromUserId
           </request_type>
     </psmheader>

     <request xsi:type="ns3:user_requestType"
           xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
           <user_id>user1</user_id>
           <fetch_size>100</fetch_size>
     </request>

     <response xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
           xsi:type="ns5:master_responseType">
           <status>
               <condition type="DONE">DONE</condition>
           </status>
           <query_master>
               <query_master_id>6302</query_master_id>
               <name>  1 y-Femal-Rheum@10:17:55</name>
               <user_id>demo</user_id>
               <group_id>Asthma</group_id>
               <create_date>2007-09-06T22:17:57.000-04:00</create_date>
           </query_master>
           <query_master>
               <query_master_id>6301</query_master_id>
               <name>  10 ye-Female@10:42:41</name>
               <user_id>demo</user_id>
               <group_id>Asthma</group_id>
               <create_date>2007-09-06T10:42:42.000-04:00</create_date>
           </query_master>
    </response>
</message_body>
```

4.3.4.6 Scenario: Get query definition from master id

This request will return <query_definition> information for the given query master id.

Request Type	Request	Response
CRC_QRY_getRequestXml_fromQueryMasterId	master_requestType	request_xml_responseType

Example :

```
     <message_body>
       <psmheader>
           <request_type>
                 CRC_QRY_getRequestXml_fromQueryMasterId
```

```
        </request_type>
    </psmheader>

    <request xsi:type="ns4:master_requestType"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <query_master_id>6300</query_master_id>
     </request>

     <response xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:type="request_xml_responseType ">
        <status>
            <condition type="DONE">DONE</condition>
        </status>
        <request_xml><![CDATA[
            <query_definition>
                <query_name/>
                <query_description/>
                <query_timing>ANY</query_timing>
                <specificity_scale>0</specificity_scale>
                <query_date_from>2000-12-30T00:00:00</query_date_from>
                <query_date_to>2000-12-30T00:00:00</query_date_to>
                <panel>
                    <panel_number>0</panel_number>
                    <panel_date_from>
                          2000-12-30T00:00:00
                    </panel_date_from>
                    <panel_date_to>2000-12-30T00:00:00</panel_date_to>
                    <invert>0</invert>
                    <total_item_occurrences>0</total_item_occurrences>
                    <item>
                        <hlevel>0</hlevel>
                        <item_name/>
                        <item_table/>
                        <item_key/>
                        <item_icon/>
                        <tooltip/>
                        <class/>
                    </item>
                </panel>
            </query_definition>]]>
          </request_xml>
      </response>
</message_body>
```

4.3.4.7 Scenario : Rename a query

Use this request to change the name of the query. If the same user already has the query with the specified name, then the server will return error in the <status> tag.

Request Type	Request	Response
CRC_QRY_renameQueryMaster	master_rename_requestType	master_responseType

Example:

```
 <message_body>
    <psmheader>
       <user login="demo">demo</user>
       <patient_set_limit>0</patient_set_limit>
       <estimated_time>0</estimated_time>
       <request_type>CRC_QRY_renameQueryMaster</request_type>
   </psmheader>

   <request xsi:type="ns4:master_rename_requestType"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
       <user_id>demo</user_id>
       <query_master_id>5997</query_master_id>
       <query_name>Demographics@03:21:10 -n[07-20-2007 ]</query_name>
   </request>

   <response xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
             xsi:type="ns5:master_responseType">
       <status>
           <condition type="DONE">DONE</condition>
       </status>
       <query_master>
           <query_master_id>5997</query_master_id>
           <name>Demographics@03:21:10 -n[07-20-2007 ]</name>
           <user_id>demo</user_id>
       </query_master>
   </response>
</message_body>
```

4.3.4.8 Scenario : Delete a query

Use this request to remove a query and its results. Delete will not permanently remove the query; it will just set the delete flag to true.

Request Type	Request	Response
CRC_QRY_deleteQueryMaster	master_delete_requestType	master_responseType

Example:

```
<message_body>
   <psmheader>
        <user login="demo">demo</user>
        <patient_set_limit>0</patient_set_limit>
        <estimated_time>0</estimated_time>
        <request_type>CRC_QRY_deleteQueryMaster</request_type>
   </psmheader>

   <request xsi:type="ns4:master_delete_requestType"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <user_id>demo</user_id>
        <query_master_id>5997</query_master_id>
    </request>

  <response xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:type="ns5:master_responseType">
        <status>
            <condition type="DONE">DONE</condition>
        </status>
        <query_master>
            <query_master_id>5997</query_master_id>
        </query_master>
   </response>
</message_body>
```

4.4 Patient Data Object Query Service:

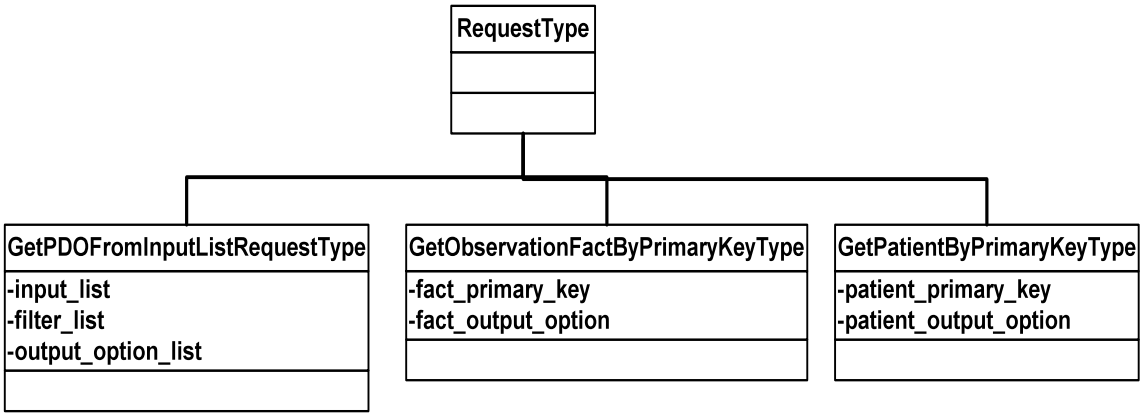
As the name suggests, these queries return Patient data objects (PDO) in the response message as specified by the request message's patient set and the filter criteria. The message structure divided into three parts: 1. PdoHeader, 2. Request and 3. Response. For the request message, the <pdoheader> and <request> parts are required, while for the response message, only the <response> part is required.

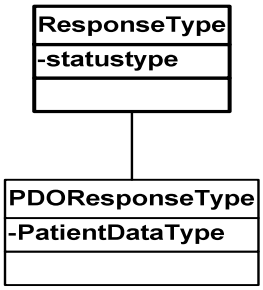
```
<i2b2:message_body>
   <crc:pdoheader>
       <request_type>GetPDOFromInputList_requestType</request_type>
        . . .
   </crc:pdoheader>

   <crc:request>
      . . .
   </crc:request>

   <crc:response>
      . . .
   </crc:response>
</i2b2:message_body>
```

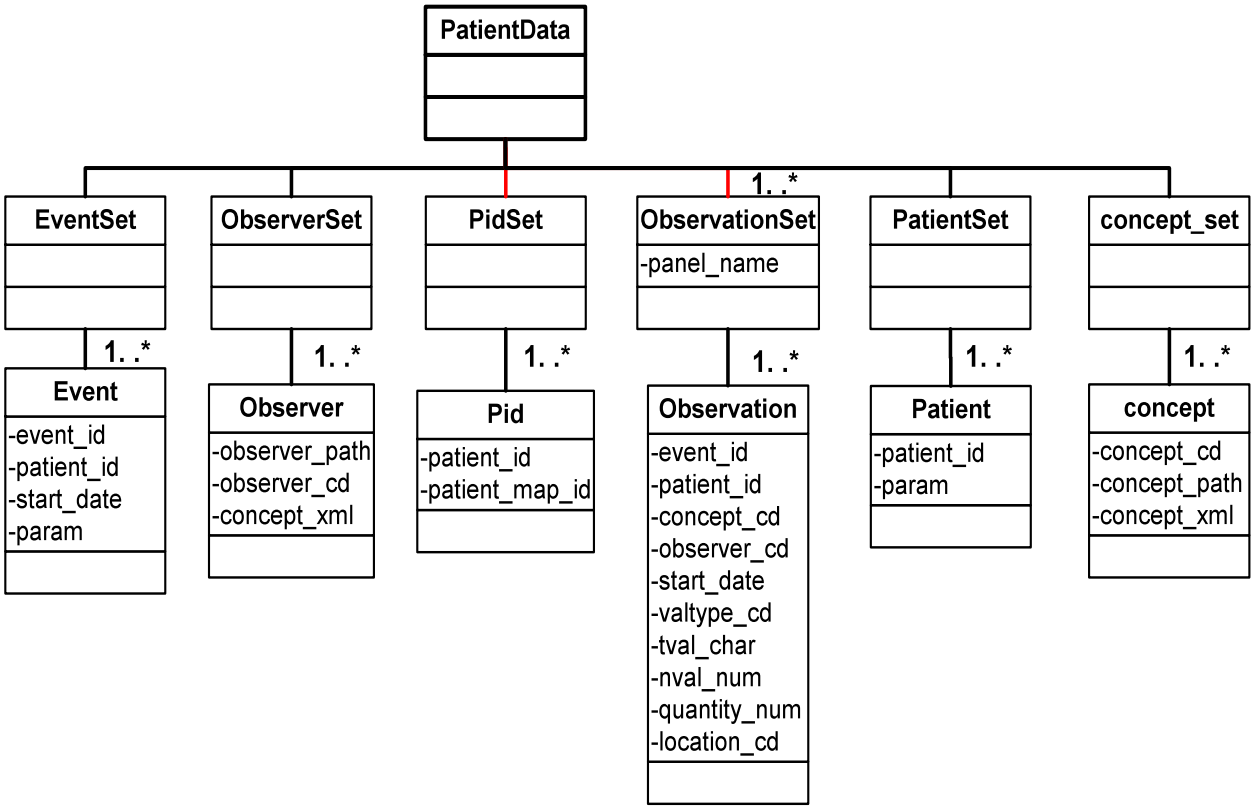
4.4.1 Request and Response message structure :

Element name	Description
<pdoheader>	Header contains a <request_type> element, which will carry operation name. Each operation name has a specific request/response combination. Following are list of supported operation names: getPDO_fromInputList get_observationfact_by_primary_key get_patient_by_primary_key get_event_by_primary_key get_concept_by_primary_key get_observer_by_primary_key
<request>	The <request> is modeled as an object using a polymorphic approach. All operation specific request objects inherit a base RequestType object as shown in section 4.4.2.
<response>	The <response> is also modeled as an object using a polymorphic approach. All operation specific response objects inherit a base PDOResponseType object containing a StatusType attribute and a PatientData object as shown in section 4.3.3.

4.4.2 Request and Response Object Model







4.4.3 Use Case Scenario

4.4.3.1 Scenario: Get patient data from a patient set id.

This request divided into three parts: an input_list, a filter_list and an output_option. The input_list accepts either the id of the patient set or a list of patient ids. The filter_list holds a list of panels. Panels in turn have item details which are used in constructing a PDO query. And finally the output_option specifies which set of patient data to return. Each of the patient data sections in output_option has attributes to specify the level of detail data expected in the response.

Request Type	Request	Response
`getPDO_fromInputList`	GetPDOFromInputList_requestType	master_responseType

Input Option list Type :

The input list to the PDO request can be either be in one of the following format. i.e. the patient_list , encounter_list , pid_list and eid_list.

Element Name	Description
patient_list	The patient list input can be in, one of the three forms. a)patient set id(<patient_set_coll_id>) or b)the enumeration list of patient id(<patient_id>) or c)the entire patients of datamart(<entire_patient_set>). Example for <patient_list> : <patient_list max="10" min="0"> <patient_id index="0">86850</patient_id> <!- - OR - - > <patient_set_coll_id>4741</patient_set_coll_id> <!- - OR - - > <entire_patient_set >true</entire_patient_set> </patient_list>
encounter_list	The encounter_list input format is similar to the patient_list. This list can be in one of the three forms. a)encounter set id (<encounter_set_coll_id>) b)the encumeration list of encounter id(<encounter_id>) c)the entire encounters of datamart(<entire_encounter_set>)
pid_list	The pid_list consist of the list of enumerated patient_ide and its source value and this input allows the user to query the data via the patient_ide and its source. The PDO service first maps the patient_ide to the patient_num before querying the datamart. Example for <pid_list> : <pid_list> <pid index="1" source="MGH_E">PAT_MGH_001</pid> <pid index="2" source="BWH_E">PAT_BWH_001</pid> </pid_list>
eid_list	The eid_list consist of the list of enumerated encounter_ide and its source value and this input allows the user to query the data via the encounter_ide and its source. The PDO service first maps the encounter_ide to the encounter_num before querying the datamart. Example for <eid_list> : <eid_list> <eid index="1" source="MGH_E">ENC_MGH_001</pid> <eid index="2" source="BWH_E">ENC_BWH_001</pid> </eid_list>

Filter List Type :

Please refer the above Panel Definition Section 4.3.2 .

Output Option List Type :

This option specifies the list of sections that is required in the PDO response.

Attribute Name	Description	Implemented
name=”asattributes | none”	**This option specifies to return the names for the codes when ereturning PDO data. The names for the codes should be available in the code_lookup table.**	**Yes**
phi=”encrypted | unencrypted”		**No**
time=”nozone | withzone”		**No**

Example :

```
<!-- output options -- >
<output_option name=”asattributes”>
    <patient_set select="using_filter_list" onlykeys="true"/>
    <concept_set select="using_filter_list" onlykeys="true"/>
    <observation_set blob="false" onlykeys="false"/>
    <event_set select="using_filter_list" onlykeys="true"/>
    <pid_set select="using_filter_list" onlykeys="true"/>
    <eid_set select="using_filter_list" onlykeys="true"/>
    <observer_set_using_filter_list onlykeys="true"/>
</output_option>
```

The following are the available options for each element in the <output_option>.

Attribute Name	Description
onlykeys = “true | false”	**If this option is “true”, then only the primary keys will be retuned. If it is “false”, then all the fields except the blob and tech data fields will be returned.**
blob=”true | false”	**This option specifies whether the blob field is required in the output.**
techdata = “true | false”	**This option specifies whether the tech data fields is required in the output. Following are the few tech data fields: soucesystem_cd, import_date,**

	update_date, etc.
select = "using_filter_list | using_input_list"	**There are couple of ways to select the PDO data.** **If the select option is "using_input_list", then the returned data will be just based on the <input_list> and no fact table will be used to return the data.** **If it is "using_filter_list", then return the data that satisfies the <filter_list> constrains when applied on the fact table.**

Element Name	Description

patient_set	Return the set of Patient dimension data either for the input list list or from the patient present in the observation set.
	
	`<output_option>`
	`  <patient_set select="using_filter_list" onlykeys="true"/`
	`</output_option>`

observation_set	Return the observation set of the patient data object. There could be a multiple number of <observation_set> returned and the number of <observation_set> returned will be equal to number of panel defined in the filter list. Observation set has the attribute "panel_name" which corresponds to "name" attribute defined in the <panel>.
event_set	Return the set containing event/visit dimension data occurring i the observation set or from the input list.
pid_set	Return the patient mapping table's information for the given input list or from the observation set. patient_ide patient_ide_source patient_num patient_ide_status 1000000 HIVE 1000000 A 1000001 HIVE 1000001 A 123 MGH 1000001 A 777 BWH 1000001 A <pid_set> <!—pid with only the hive number - -> <pid>

	<patient_id status="A" source="HIVE">1000000</patient_id> </pid> <!- - pid with hive number and mapping patient_ide's - -> <pid> <patient_id status="A" source="HIVE">1000001</patient_id> <patient_map_id status="A" source="MGH">123</patient_map_id> <patient_map_id status="A" source="BWH">777</patient_map_id> </pid> </pid_set>
eid_set	Return the encounter mapping table's information for the given input list or from the observation set.
observer_set_using_filter_list	Return the set containing observer/provider dimension data occurring in the observation set.
concept_set_using_filter_list	Return the set of concept dimension data occurring in the observation set.

Example:

```
<message_body>

    <crc:pdoheader>
        <request_type>getPDO_fromInputList</request_type>
    </crc:pdoheader>

    <crc:request xsi:type="ns2:GetPDOFromInputList_requestType"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

        <!- - input list - - >
        <input_list>
              <patient_list max="300" min="1">
               <patient_set_coll_id>100</patient_set_coll_id>
               </patient_list>
               <!- - or - - >
              <event_list/>
               <!- - or - - >
               <pid_list min="1" max="3">
                  <pid index="1" source="HIVE">9876</pid>
                  <pid index="3" source="HIVE">1</pid>
              </pid_list>
               <!- - or - - >
               <eid_list min="1" max="5">
                  <eid index="1" source="HIVE">12222313</eid>
              </eid_list>
         </input_list>

        <!- - filter  list - - >
```

```
<filter_list>
   <panel name="panel1">
      <panel_invert>0</panel_invert>
      <panel_accuracy_scale></panel_accuracy_scale>
      <panel_start_date><panel_start_date>
      <panel_end_date></panel_end_date>
      <item>
            <item_name> </item_name>
            <item_key> </item_key>
            <item_icon> </item_icon>
            <item_tooltip></item_tooltip>
            <dim_tablename> </dim_tablename>
            <dim_columnname> </dim_columnname>
            <dim_dimcode></dim_dimcode>
            <dim_columndatatype> </dim_columndatatype>
            <dim_operator> </dim_operator>
            <facttablecolumn></facttablecolumn>
            <value_constraint>
                  <value_type></value_type>
                  <value_operator></value_operator>
                  <value_unitofmeasure></value_unitofmeasure>
                  <value></value>
           </value_constraint>
      </item>
      ...
   </panel>

   <panel name="panel2">
      <panel_invert>0</panel_invert>
      <panel_accuracy_scale></panel_accuracy_scale>
      <panel_start_date><panel_start_date>
      <panel_end_date></panel_end_date>
      <item>
            <item_name> </item_name>
            <item_key> </item_key>
            <item_icon> </item_icon>
            <item_tooltip></item_tooltip>
            <dim_tablename> </dim_tablename>
            <dim_columnname> </dim_columnname>
            <dim_dimcode></dim_dimcode>
            <dim_columndatatype> </dim_columndatatype>
            <dim_operator> </dim_operator>
            <facttablecolumn></facttablecolumn>
            <value_constraint>
                  <value_type></value_type>
                  <value_operator></value_operator>
                  <value_unitofmeasure></value_unitofmeasure>
                  <value></value>
           </value_constraint>
      </item>
   </panel>
   ...
</filter_list>


<!-- output options -- >
```

```
    <output_option>
        <patient_set select="using_filter_list" onlykeys="true"/>
        <concept_set select="using_filter_list" onlykeys="true"/>
        <observation_set blob="false" onlykeys="false"/>
        <event_set select="using_filter_list" onlykeys="true"/>
        <pid_set select="using_filter_list" onlykeys="true"/>
        <eid_set select="using_filter_list" onlykeys="true"/>
        <observer_set_using_filter_list onlykeys="true"/>
        <! — To specify generalized dimension type - ->
        <dimension_set_using_filter_list dimensionname=”dimension1”
                onlykeys=”true”/>
    </output_option>
</crc:request>

<! - - response begin -- >
<response>
    <patient_data>
      <!- - patient set section begins →
       <patient_set>
          <patient>
                <patient_id>patient_id6</patient_id>
                <param column="vital_status_cd"
                name="date interpretation code">param3</param>
                <param column="birth_date"
                 name="birthdate">param3</param>
                <param column="death_date"
                 name="date of death">param3</param>
                <param column="sex_cd"
                  name="gender">param3</param>
                <param column="age_in_years_num"
                  name="age">param3</param>
                <param column="language_cd"
                  name="language">param3</param>
                <param column="race_cd"
                      name="race">param3</param>
                <param column="religion_cd"
                      name="religion">param3</param>
                <param column="marital_status_cd"
                     name="marital status">param3</param>
                <param column="statecityzip_path_char"
                 name="zip code hierarchy">param3</param>
          </patient>
          ..
        <patient_set>

       <!- - concept set section begins →
        <concept_set>
           <concept>
             <concept_path>concept_path0</concept_path>
             <concept_cd>concept_cd0</concept_cd>
             <name_char>name_char0</name_char>
```

```
      </concept>
     ..
    </concept_set>

  <!- - observation set section begins →
  <observation_set panel_name=”panel1”>
      <observation>
         <event_id source="source3">event_id3</event_id>
         <patient_id>patient_id9</patient_id>
         <concept_cd name="name0">concept_cd3</concept_cd>
         <observer_cd soruce="soruce0">observer_cd3</observer_cd>
         <start_date>2006-05-04T18:13:51.0Z</start_date>
         <modifier_cd name="name1">modifier_cd0</modifier_cd>
         <valuetype_cd>valuetype_cd0</valuetype_cd>
         <tval_char>tval_char0</tval_char>
         <nval_num units="units0">3.141592653589</nval_num>
         <valueflag_cd name="name2">valueflag_cd0</valueflag_cd>
         <quantity_num>3.141592653589</quantity_num>
         <units_cd>units_cd0</units_cd>
         <end_date>2006-05-04T18:13:51.0Z</end_date>
         <location_cd name="name3">location_cd0</location_cd>
      </observation>
      <observation>
      ..
      </observation>
</observation_set>

<observation_set panel_name=”panel2”>
      <observation>
       ..
      </observation>
      <observation>
       ..
      </observation>
      ..
 </observation_set>

 <!- - event set section begins -- >
 <event_set>
      <event>
        <event_id source="source0">event_id0</event_id>
        <patient_id>patient_id0</patient_id>
        <start_date>2006-05-04T18:13:51.0Z</start_date>
        <end_date>2006-05-04T18:13:51.0Z</end_date>
        <param column="inout_cd" name="in vs. outpatient
code"></param>
        <param column="location_cd" name="location code"></param>
        <param column="location_path"
            name="location hierarchy"></param>
      <param column="active_status_cd"
            name="date interpretation code"></param>
      </event>
      . .
 </event_set>

<!- - observer/provider set section begins -- >
```

```
          <observer_set>
               <observer>
                  <observer_path>observer_path0</observer_path>
                  <observer_cd>observer_cd0</observer_cd>
                  <name_char>name_char3</name_char>
               </observer>
               ..
          </observer_set>

          <!- - pid set section begins -- >
          <pid_set>
             <pid>
                <patient_id status="A" source="HIVE">123456</patient_id>
             </pid>
             <pid>
               <patient_id status="A" source="HIVE">234567</patient_id>
               <patient_map_id status="A" source="EMP_E">ABC1
               </patient_map_id>
               <patient_map_id status="A" source="MGH_E">XYZ1
               </patient_map_id>
             </pid>
             ..
           </pid_set>
        </crc:patient_data>
    </response>
     <!- - response end -- >
</message_body>
```

4.4.3.2 Scenario: Get Observation blob by primary key.

This request returns observation blob using observation primary key

Example:

```
  <message_body>
      <pdoheader>
          <request_type>get_observationfact_by_primary_key</request_type>
    </pdoheader>

    <ns5:request
        xsi:type="ns5:GetObservationFactByPrimaryKey_requestType"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <fact_primary_key>
            <event_id>2004005981</event_id>
            <patient_id>52003</patient_id>
            <concept_cd>LCS-I2B2:c1009c</concept_cd>
            <observer_id>03840261</observer_id>
            <start_date>1995-08-24T00:00:00.179-05:00</start_date>
        </fact_primary_key>
        <fact_output_option select="using_filter_list" onlykeys="false"/>
    </ns5:request>
```

```
   <response>
       <patient_data>
           <observation_set>
             <observation>
                <event_id source="source3">event_id3</event_id>
                <patient_id>patient_id9</patient_id>
                <concept_cd name="name0">concept_cd3</concept_cd>
                <observer_cd soruce="soruce0">observer_cd3</observer_cd>
                <start_date>2006-05-04T18:13:51.0Z</start_date>
                 <observation_blob><![CDATA[
                   patient notes]]>
                 </observation_blob>
             </observation >
         </observation_set>
       </patient_data>
     </response>
</message_body>
```

4.5 Data Upload Messages

The data loading process loads the data to three main sections of data mart: a) Dimension tables, b) Mapping table and c) Observation Fact table. Except for the observation_fact table, the data load will perform the insert or update operation based on two criteria: whether the data exists in the respective tables and whether the PDO's update date is greater than the existing data's update date.

For example the following table, shows the condition for update and insert operation for the visit_dimension table.

Loading Visit_Dimension	Condition
UPDATE	INPUT.ENCOUNTER_NUM = OBSFACT.ENCOUNTER_NUM AND INPUT.PATIENT_NUM = OBSFACT.PATIENT_NUM AND INPUT.UPDATE_DATE > OBSFACT.UPDATE_DATE
INSERT	INPUT.ENCOUNTER_NUM != OBSFACT.ENCOUNTER_NUM OR INPUT.PATIENT_NUM != OBSFACT.PATIENT_NUM

The data load on the observation_fact table is slightly different compared to other tables and it can be divided into two cases.

Case 1: Refresh Observation Fact

This case assumes the user is trying to load a fresh set of observation facts and expects to delete any old observation facts which have matching encounter_num and patient_num. Set append_flag="false" to support this case.

Case 2: Incremental Observation Fact

In this case the user has the option to just add new observation facts that may match an existing observation_fact entry's encounter_num and patient_num. The user should make sure they are sending a unique observation fact, which will not result in duplicating an existing observation_fact entry. Set append_flag="true" to support this case.

i2b2 Import: Append Flag

Assumption: *the record(s) in the update file (new record) has the same primary key as a record(s) in the associated table (existing record).*

Primary Key includes:

- Encounter number
- Patient number
- Concept code
- Start date
- Modifier code
- Observer code

Append Flag = True

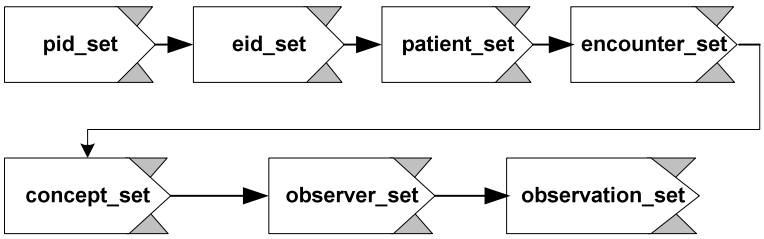
Following conditions will result in the new record **replacing** the existing record:

new record update date	equal to (=)		update date on the existing record	
new record update date	greater than (>)		update date on the existing record	
new record update date	is not null	AND	update date on the existing record	null
new record update date	null	AND	update date on the existing record	null

Following conditions will result **ignoring** the new record and **not** updating the existing record:

new record update date	less than (<)		update date on the existing record	
new record update date	null	AND	update date on the existing record	is not null

The loader process loads the PDO data in certain order based on the data dependency of the data mart. The order of the data load is shown in the below diagram.



4.5.1 Use Case Scenario

4.5.1.1 Scenario: Upload data in Patient Data Object XML.

The data load request message can be divided into three sections. The <input_list> specifies the location of PDO document and the <load_list> specifies the PDO sections to load. Finally, the <output_list> specifies the output expected from the upload process. In addition, certain dependencies exist for loading some sections of PDO. The following table shows the dependencies for loading the individual PDO section.

Load PDO section	Dependent PDO section
event_set	eid_set
patient_set	pid_set
observation_set	eid_set, pid_set, event_set , patient_set
concept_set, observer_Set, eid_set, pid_set	NONE

For example to load a single observation fact, the required sections of PDO XML are shown below. Please note the dependency section in the PDO is optional, if they exist in the data mart. For more specific example on loading patient and encounter mapping, please refer to the CRC data design document.

```
<patient_data>

  <observation_set>
   <observation update_date="2006-05-04T18:13:51.0Z"
       sourcesystem_cd="TEST">
       <event_id source="MGHE">MENT001</event_id>
       <patient_id source="MGHP">MPAT001</patient_id>
       <concept_cd name="C">i2b2CD</concept_cd>
       <observer_cd source="TEST">@</observer_cd>
       <start_date>2006-05-04T18:13:51.0Z</start_date>
```

```
            <modifier_cd>modifier_cd</modifier_cd>
            <valuetype_cd>valuetype_cd0</valuetype_cd>
            <nval_num units="units0">3.141592653589</nval_num>
            <valueflag_cd name="name8">valueflag_cd0</valueflag_cd>
            <quantity_num>3.141592653589</quantity_num>
            <confidence_num>3.141592653589</confidence_num>
          </observation>
       </observation_set>

       <pid_set>
         <pid>
             <patient_id status="A" update_date="2006-05-04T18:13:51.0Z"
             sourcesystem_cd="TEST" source="MGHP">MPAT001</patient_id>
        </pid>
       </pid_set>

       <eid_set>
         <eid>
             <event_id source="MGHE" patient_id="MPAT001"
              patient_id_source="MGHP" status="A"
              update_date="2006-05-04T18:13:51.0Z"
              sourcesystem_cd="TEST">MENT001</event_id>
        </eid>
       </eid_set>

        <event_set>
         <event update_date="2006-05-04T18:13:51.0Z"
              sourcesystem_cd="TEST">
             <event_id source="MGHE">MENT001</event_id>
             <patient_id source="MGHP">MPAT001</patient_id>
            <start_date>2006-05-04T18:13:51.0Z</start_date>
             <end_date>2006-05-04T18:13:51.0Z</end_date>
          </event>
        </event_set>

 </patient_data>
```

Request Message:

```
<message_body>
 <publish_data_request>
  <input_list>
     <data_file>
       <location_uri protocol_name="FR|LOCAL">location_uri0</location_uri>
       <data_format_type>PDO</data_format_type>
       <source_system_cd>source_system_cd0</source_system_cd>
       <load_label>load_label0</load_label>
      </data_file>
   </input_list>
   <load_list commit_flag="true" clear_temp_load_tables="false">
      <load_observation_set ignore_bad_data="true"/>
      <load_event_set ignore_bad_data="true"/>
      <load_patient_set ignore_bad_data="true"/>
      <load_observer_set ignore_bad_data="true"/>
      <load_eventid_set ignore_bad_data="true"/>
      <load_pid_set ignore_bad_data="true"/>
      <load_eid_set ignore_bad_data="true"/>
      <load_concept_set encrypt_blob="false" ignore_bad_data="true"/>
    </load_list>
    <output_list detail="true">
       <observation_set onlykeys="true" blob="false" techdata="false"/>
```

```
      <patient_set onlykeys="true" blob="false" techdata="false"/>
      <event_set onlykeys="true" blob="false" techdata="false"/>
      <observer_set onlykeys="true" blob="false" techdata="false"/>
      <concept_set onlykeys="true" blob="false" techdata="false"/>
      <pid_set onlykeys="true" blob="false" techdata="false"/>
      <eid_set onlykeys="true" blob="false" techdata="false"/>
      <eventid_set onlykeys="true" blob="false" techdata="false"/>
    </output_list>
  </publish_data_request>
</message_body>
```

<table>
<tr><td><input_list></td><td>This section of xml will carry input information such as the location of PDO file, it's data format, etc.

<table>
<tr><td></td><td></td></tr>
<tr><td>location_uri</td><td>The location of the input PDO file.</td></tr>
<tr><td>protocol_name</td><td>Protocol name, which specifies the service how to access the PDO file in the location_uri. (FR – File Repository, LOCAL – File resides in the server local folder)</td></tr>
<tr><td>data_format_type</td><td>PDO (Patient Data Object XML)</td></tr>
<tr><td>source_system_cd</td><td>Upload's source system code</td></tr>
<tr><td>load_label</td><td>User's load label</td></tr>
<tr><td></td><td></td></tr>
</table></td></tr>
<tr><td><load_list></td><td>This section of the request holds the load options.
<table>
<tr><td>commit_flag</td><td>The current implementation supports only "true" value. This is placeholder for future release. If this flag set to false, system will just run all the load process for the given PDO data and will not perform commit. This is useful option to check, whether the given PDO data, have the valid information</td></tr>
<tr><td>clear_temp_
load_tables</td><td>This flag specifies whether to clean up staging area. Turn this flag false for debug purpose.</td></tr>
<tr><td>ignore_bad_data</td><td>Not implemented, will be part of future release.</td></tr>
<tr><td>load_observation
set, append_flag</td><td>Load or update fact entry coming from input PDO data. If the append_flag = 'true' is specified then the PDO's fact information is just added to the stored fact and will not do any updates.</td></tr>
<tr><td>load_event_set</td><td>The information from the PDO's <event_set> is used to load to the visit_dimension table.</td></tr>
<tr><td>load_patient_set</td><td>The information from the PDO's <patient_set> is used to load to the patient_dimension table</td></tr>
<tr><td>load_observer_set</td><td>The information from the PDO's <observer_set> is used to load to the provider_dimension table</td></tr>
<tr><td>load_pid_set</td><td>The information from the PDO's <pid_set> is used to load to the patient_mapping table.</td></tr>
</table></td></tr>
</table>

	load_eid_set	The information from the PDO's <eventid_set> is used to load to the encounter_mapping table.
	load_concept_set	The information from the PDO's <concept_set> is used to load to the concept_dimension
<output_list>	This section of the request is used for getting upload process status information.	
	detail	This attribute is a placeholder for a future release. The attribute specifies whether the response message should have detailed information. If the value is false, then the service will return just the count of inserted and updated records. Otherwise a separated file with inserted, updated records will be created.
	observation_set	This element specifies the process to fetch the details of updated records on the observation_fact table.
	onlykeys	Return primary key fields in the response
	blob	Return blob field in the response
	techdata	Return techdata field in the response
	patient_set	The element specifies the process to fetch the details of updated records on the patient_dimension table
	event_set	The element specifies the process to fetch the details of updated records on the visit_dimension table
	observer_set	The element specifies the process to fetch the details of updated records on the provider_dimension table
	concept_set	The element specifies the process to fetch the details of updated records on the concept_dimension table
	pid_set	The element specifies the process to fetch the details of updated records on the patient_mapping table
	eid_set	The element specifies the process to fetch the details of updated records on the encounter_mapping table

Response Message:

```
<message_body>
 <load_data_response>
   <status>
     <condition type="ERROR|DONE" coding_system="">error message</condition>
   </status>
   <upload_id>upload_id0</upload_id>
   <user_id>user_id0</user_id>
   <data_file_location_uri protocol_name="FR|LOCAL"> location_uri0
   </data_file_location_uri>
   <load_status>load_status0</load_status>
   <transformer_name>transformer_name0</transformer_name>
```

```
   <start_date>2006-05-04T18:13:51.0Z</start_date>
   <end_date>2006-05-04T18:13:51.0Z</end_date>
   <message>message0</message>
   <observation_set inserted_record="0" ignored_record="0" total_record="0">
      <ignored_patient_data_file_uri protocol_name="FR|LOCAL"> uri0
      </ignored_patient_data_file_uri>
      <message>message1</message>
   </observation_set>
   <patient_set inserted_record="0" ignored_record="0" total_record="0">
      <ignored_patient_data_file_uri protocol_name="FR|LOCAL">
      </ignored_patient_data_file_uri>
      <message>message2</message>
    </patient_set>
    <event_set inserted_record="0" ignored_record="0" total_record="0">
    </event_set>
    <observer_set inserted_record="0" ignored_record="0" total_record="0">
    </observer_set>
    <concept_set inserted_record="0" ignored_record="0" total_record="0">
    </concept_set>
    <pid_set inserted_record="0" ignored_record="0" total_record="0">
    </pid_set>
    <eventid_set inserted_record="0" ignored_record="0" total_record="0">
    </eventid_set>
  </load_data_response>
</message_body>
```

4.5.1.2 Scenario: Get Upload status info by upload_id and user_id.

This message will fetch a list of upload status information based on user_id or will fetch a single upload status by upload_id.

Request Message:

```
<message_body>
  <get_upload_info_request>
   <user_id>user_id</user_id>
   <upload_id>100<upload_id/>
  </get_upload_info_request>
</message_body>
```

Response Message:

```
<message_body>
  <load_data_list_response>
    <load_data_response>
     Please refer section 4.5.1.1 for <load_data_response/>
    </load_data_response>
    . . . .
```

```
  <load_data_list_response>
</message_body>
```

4.6 Message Explanations

This section defines message elements in the CRC namespace (http://www.i2b2.org/xsd/cell/crc/psm/1.1/ and http://www.i2b2.org/xsd/cell/crc/pdo/1.1/) Each element defined will have an implied prefix of crc: unless another namespace is explicitly stated. Elements from other namespaces, which are included within CRC elements, will be listed but not expanded or defined in this document. Refer to other cell documents to get specific details on those elements.

4.6.1 Header

The <header> is the first CRC element within an i2b2 <message_body>. This section defines the elements shown in the example header shown, below.

```
<crc:header>
      <user login=""></user>
      <data_source></data_source>
      <patient_set_limit>0</patient_set_limit>
      <estimated_time>0</estimated_time>
      <create_date>2002-12-23T00:00:00</create_date>
      <submit_date>2002-12-23T00:00:00</submit_date>
      <complete_date>2002-12-23T00:00:00</complete_date>
      <request_type>getPDO_fromObservationFact</request_type>
</crc:header>
```

header: container for generic information useful for any crc message

user: user information used for authentication and login

data_source: information about the source of the data

patient_set_limit: limit the size of the patient set returned in a query

estimated_time: the time estimated for the query to complete

create_date: the date that a query was created

submit_date: the date that a query was submitted to be executed or run

complete_date: the date that a query finished executing

request_type: a code that tells the service what type of request to expect, which tells it what kind of xml to expect in the rest of the message.

4.6.2 Request

4.6.2.1 xsi:type="crc:user_requestType"

```
<crc:request xsi:type="crc:user_requestType">
      <user_id>some_user_id</user_id>
      <group_id>some_group_id</group_id>
      <fetch_size>5000</fetch_size>
  </crc:request>
```

4.6.2.2 xsi:type="crc:master_requestType"

```
<crc:request xsi:type="crc:master_requestType">
      <query_master_id>0</query_master_id>
  </crc:request>
```

4.6.2.3 xsi:type="crc:instance_requestType"

```
<crc:request xsi:type="crc:instance_requestType">
      <query_instance_id>0</query_instance_id>
  </crc:request>
```

4.6.2.4 xsi:type="crc:query_definition_requestType"

```
<crc:request xsi:type="crc:query_definition_requestType">
      <query_definition>
          <query_name/>
          <query_description/>
          <query_timing>SAME</query_timing>
          <specificity_scale>0</specificity_scale>
          <query_date_from>2000-12-30T00:00:00</query_date_from>
          <query_date_to>2000-12-30T00:00:00</query_date_to>
          <panel>
              <panel_number>0</panel_number>
              <panel_date_from>2000-12-30T00:00:00</panel_date_from>
              <panel_date_to>2000-12-30T00:00:00</panel_date_to>
              <invert>0</invert>
              <total_item_occurrences>0</total_item_occurrences>
              <item>
                  <hlevel>0</hlevel>
                  <item_name/>
                  <item_table/>
                  <item_key/>
                  <item_icon/>
                  <tooltip/>
                  <class/>
              </item>
          </panel>
      </query_definition>
```

```
        </crc:request>
```

4.6.2.5 xsi:type="crc:getPDO_fromInputList "

```
      <crc:request xsi:type="crc:patient_set_requestType">
            <select_option_list>
                <observation_fact blob="true" before="2005-12-30T00:00:00"
after="2003-12-30T00:00:00"/>
                <patient_dimension fact_related="false"/>
                <provider_dimension/>
                <visit_dimension detail="false"/>
                <concept_dimension status="true"/>
            </select_option_list>
            <filter_list>
               <panel name="panel1">
                  <panel_invert>0</panel_invert>
                  <panel_accuracy_scale></panel_accuracy_scale>
                  <panel_start_date><panel_start_date>
                  <panel_end_date></panel_end_date>
                  <item>
                        <item_name> </item_name>
                        <item_key> </item_key>
                        <item_icon> </item_icon>
                        <item_tooltip></item_tooltip>
                        <dim_tablename> </dim_tablename>
                        <dim_columnname> </dim_columnname>
                        <dim_dimcode></dim_dimcode>
                        <dim_columndatatype> </dim_columndatatype>
                        <dim_operator> </dim_operator>
                        <facttablecolumn></facttablecolumn>
                        <value_constraint>
                              <value_type></value_type>
                              <value_operator></value_operator>
                              <value_unitofmeasure></value_unitofmeasure>
                              <value></value>
                        </value_constraint>
                  </item>
                   ...
               </panel>
            </filter_list>
            <patient_list min="1" max="10">
                <patient_num index="1">50</patient_num>
                <patient_num index="2">24</patient_num>
                <patient_num index="3">78</patient_num>
                <!--
                    <entire_patient_set/>
                    <patient_set_coll_id>0</patient_set_coll_id>
                 -->
            </patient_list>
        </crc:request>
```

4.6.2.6 xsi:type="crc: GetObservationFactByPrimaryKey_requestType "

```
<crc:request xsi:type="crc:observation_fact_set_requestType">
      </event_id>
      </patient_id>
      </concept_cd/>
      </observer_id/>
      </start_date/>
      </modifier_cd/>
  </crc:request>
```

4.6.3 Response

4.6.3.1 xsi:type="crc:master_responseType"

```
<crc:response xsi:type="crc:master_responseType">
      <query_master>
          <query_master_id>0</query_master_id>
          <name/>
          <user_id/>
          <group_id/>
          <create_date>2000-12-30T00:00:00</create_date>
          <delete_date>2000-12-30T00:00:00</delete_date>
          <request_xml/>
          <generated_sql/>
      </query_master>
      <query_master>
          <query_master_id>1</query_master_id>
          <name/>
          <user_id/>
          <group_id/>
          <create_date>2000-12-30T00:00:00</create_date>
          <delete_date>2000-12-30T00:00:00</delete_date>
          <request_xml/>
          <generated_sql/>
      </query_master>
  </crc:response>
```

4.6.3.2 xsi:type="crc:instance_responseType"

```
<crc:response xsi:type="crc:instance_responseType">
      <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>0</status_type_id>
                <name>finished</name>
                <description/>
            </query_status_type>
        </query_instance>
        <query_instance>
            <query_instance_id>1</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>0</status_type_id>
                <name>finished</name>
                <description/>
            </query_status_type>
        </query_instance>
    </crc:response>
```

4.6.3.3 xsi:type="crc:query_result_instanceType"

```
<crc:response xsi:type="crc:result_responseType">
      <query_result_instance>
          <result_instance_id>0</result_instance_id>
          <query_instance_id>0</query_instance_id>
          <query_result_type>
              <result_type_id>0</result_type_id>
              <name>PATIENT_SET</name>
              <description/>
          </query_result_type>
          <set_size>0</set_size>
          <start_date>2000-12-30T00:00:00</start_date>
          <end_date>2000-12-30T00:00:00</end_date>
          <query_status_type>
              <status_type_id>0</status_type_id>
              <name>finished</name>
              <description/>
          </query_status_type>
      </query_result_instance>
      <query_result_instance>
          <result_instance_id>1</result_instance_id>
          <query_instance_id>0</query_instance_id>
          <query_result_type>
              <result_type_id>1</result_type_id>
              <name>ENCOUNTER_SET</name>
              <description/>
          </query_result_type>
          <set_size>0</set_size>
          <start_date>2000-12-30T00:00:00</start_date>
          <end_date>2000-12-30T00:00:00</end_date>
          <query_status_type>
              <status_type_id>0</status_type_id>
```

```
                    <name>finished</name>
                    <description/>
                </query_status_type>
            </query_result_instance>
        </crc:response>
```

4.6.3.4 xsi:type="crc:request_xml_responseType"

```
    <crc:response xsi:type="crc:request_xml_responseType">
          <xml_string><![CDATA[
              <query_definition>
                  <query_name/>
                  <query_description/>
                  <query_timing>ANY</query_timing>
                  <specificity_scale>0</specificity_scale>
                  <query_date_from>2000-12-30T00:00:00</query_date_from>
                  <query_date_to>2000-12-30T00:00:00</query_date_to>
                  <panel>
                      <panel_number>0</panel_number>
                      <panel_date_from>2000-12-
30T00:00:00</panel_date_from>
                      <panel_date_to>2000-12-30T00:00:00</panel_date_to>
                      <invert>0</invert>
                      <total_item_occurrences>0</total_item_occurrences>
                      <item>
                          <hlevel>0</hlevel>
                          <item_name/>
                          <item_table/>
                          <item_key/>
                          <item_icon/>
                          <tooltip/>
                          <class/>
                      </item>
                  </panel>
              </query_definition>
          ]]></xml_string>
        </crc:response>
```

4.6.3.5 xsi:type="crc:master_instance_result_responseType"

```
    <crc:response xsi:type="crc:master_instance_result_responseType">
          <query_master>
              <query_master_id>0</query_master_id>
              <name/>
              <user_id/>
              <group_id/>
              <create_date>2000-12-30T00:00:00</create_date>
              <delete_date>2000-12-30T00:00:00</delete_date>
              <request_xml/>
              <generated_sql/>
          </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>0</status_type_id>
                <name>finished</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>0</result_type_id>
                <name>PATIENT_SET</name>
                <description/>
            </query_result_type>
            <set_size>0</set_size>
            <start_date>2000-12-30T00:00:00</start_date>
            <end_date>2000-12-30T00:00:00</end_date>
            <query_status_type>
                <status_type_id>0</status_type_id>
                <name>finished</name>
                <description/>
            </query_status_type>
        </query_result_instance>
        <query_result_instance>
            <result_instance_id>1</result_instance_id>
            <query_instance_id>0</query_instance_id>
            <query_result_type>
                <result_type_id>1</result_type_id>
                <name>ENCOUNTER_SET</name>
                <description/>
            </query_result_type>
            <set_size>0</set_size>
            <start_date>2000-12-30T00:00:00</start_date>
            <end_date>2000-12-30T00:00:00</end_date>
            <query_status_type>
                <status_type_id>0</status_type_id>
                <name>finished</name>
                <description/>
            </query_status_type>
        </query_result_instance>
    </crc:response>
```

4.6.3.6 xsi:type="crc:instance_result_responseType"

```
    <crc:response xsi:type="crc:instance_result_responseType">
        <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>0</status_type_id>
                <name>finished</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>0</result_type_id>
                <name>PATIENT_SET</name>
                <description/>
            </query_result_type>
            <set_size>0</set_size>
            <start_date>2000-12-30T00:00:00</start_date>
            <end_date>2000-12-30T00:00:00</end_date>
            <query_status_type>
                <status_type_id>0</status_type_id>
                <name>finished</name>
                <description/>
            </query_status_type>
        </query_result_instance>
        <query_result_instance>
            <result_instance_id>1</result_instance_id>
            <query_instance_id>0</query_instance_id>
            <query_result_type>
                <result_type_id>1</result_type_id>
                <name>ENCOUNTER_SET</name>
                <description/>
            </query_result_type>
            <set_size>0</set_size>
            <start_date>2000-12-30T00:00:00</start_date>
            <end_date>2000-12-30T00:00:00</end_date>
            <query_status_type>
                <status_type_id>0</status_type_id>
                <name>finished</name>
                <description/>
            </query_status_type>
        </query_result_instance>
    </crc:response>
```

4.6.3.7 xsi:type="crc:patient_data_responseType"

```
<crc:response xsi:type="crc:patient_data_responseType">
      <crc:patient_data>
            <!-- see PDO cell messaging document -->
      </crc:patient_data>
  </crc:response>
```

4.7 XML Schema Definitions

The CRC XML schema consists of the following XSD files:

- **CRC.xsd**
  This schema is not used directly to create CRC messages, but is included in other CRC_PDO_QRY.xsd and CRC_PSM_QRY.xsd.

- **CRC_PDO_QRY.xsd**
  This schema is used for validating CRC patient data queries and defines a <crc:header> and <crc:sql> tag.

- **CRC_PDO_QRY_request.xsd**
  This schema is not directly used but is included in CRC_PDO_QRY.xsd.

- **CRC_PDO_QRY_response.xsd**
  This schema is not directly used but is included in CRC_PDO_QRY.xsd.

- **CRC_PSM_OBJ.xsd**
  This schema defines the data objects that hold information about patient set queries.

- **CRC_PSM_QRY.xsd**
  This schema is used for validating CRC patient set queries and defines a <crc:header> and <crc:sql> tag.

- **CRC_PSM_QRY_request.xsd**
  This schema is not directly used but is included in CRC_PSM_QRY.xsd.

- **CRC_PSM_QRY_response.xsd**
  This schema is not directly used but is included in CRC_PSM_QRY.xsd.

- **CRC_PSM_QRY_query_definition.xsd**
  This schema validates the xml format that defines a patient set query.

- **CRC_PANEL.xsd**
  This schema defines the panel definition.

- **CRC_UPLOADER_QRY.xsd**
  This schema defines the upload request and response message.

- **I2B2_RESULT_MSG.xsd**
  This schema defines the result format in name-value pairs.
