Patient Demographics Consumer Architecture & API Documentation

Version 0.4.0

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Contents

1. Introduction 4
2. Getting Started 5
   2.1 Platform Requirements 5
   2.2 Source Files 5
   2.3 Dependencies 5
      2.3.1 Other OHT Plugins 5
      2.3.2 External Sources 6
   2.4 Resources 6
      2.4.1 Other OHF plugin documentation 6
      2.4.2 HL7 Standard 2.5 6
      2.4.3 IHE ITI Technical Framework 6
      2.4.4 Newsgroup 6
3. API Documentation 7
   3.1 Use Case - ITI-21 Patient Demographics Query 7
      3.1.1 Flow of Execution 8
      3.1.2 Sample Code 9
   3.2 Use Case - ITI-22 Patient Demographics and Visit Query 12
4. Security 13
   4.1 Node Authentication 13
   4.2 Auditing 13
5. Configuration 14
   5.1 Conformance Profile 14
   5.2 Test Configuration 15
6. Debugging Recommendations 16
7. IHE Connectathon MESA Tests 17
   7.1 Plugin Testing 17
   7.2 Bridge Testing 17
8. IHE Connectathon Tests 18
   8.1 Plugin Testing 18

1. Introduction

Open Health Tools is an open source community with a vision of enabling a ubiquitous ecosystem where members of the Health and IT professions can collaborate to build interoperable systems that enable patients and their care providers to have access to vital and reliable medical information at the time and place it is needed. Open Health Tools will generate a vibrant active ecosystem involving software product and service companies, medical equipment companies, health care providers, insurance companies, government health service agencies, and standards organizations.

- http://www.openhealthtools.org

The Open Health Tools IHE Profiles project participates in the committee meetings of relevant healthcare standards and interoperability organizations and brings that expertise to our open source community through the development and support of several key client side interoperability profile implementations. The IHE Profiles project will significantly lower the barriers towards the availability of interoperable healthcare systems.

- https://iheprofiles.projects.openhealthtools.org

The Integrating the Healthcare Enterprise (IHE) is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care. Systems developed in accordance with IHE communicate with one another better, are easier to implement, and enable care providers to use information more effectively.

- www.ihe.net

The IHE Technical Frameworks are a resource for users, developers and implementers of healthcare imaging and information systems. They define specific implementations of established standards to achieve effective systems integration, facilitate appropriate sharing of medical information and support optimal patient care. They are expanded annually, after a period of public review, and maintained regularly by the IHE Technical Committees through the identification and correction of errata.

- http://www.ihe.net/Technical_Framework/index.cfm

This document corresponds to the Open Health Tools IHE Profiles plugin implementation of the IHE ITI Technical Framework actor Patient Demographics Consumer for the implementation of the ITI-21 Patient Demographics Query Transaction that was used successfully by several systems at the 2007 and 2008 IHE Connectathon. Also supported in 2008 is the transaction ITI-22 Patient Demographics and Visit Query. The code and documentation are released under the Eclipse Public License (EPL).

2. Getting Started

2.1 Platform Requirements

Verify that the following platform requirements are installed on your workstation, and if not follow the links provided to download and install.

Eclipse SDK 3.2 or higher	http://www.eclipse.org/downloads/
Java JDK 1.5.0 or higher	http://java.sun.com/javase/downloads/index.jsp

2.2 Source Files

Information on how to access the Open Health Tools SVN technology repository is found on the website:

https://iheprofiles.projects.openhealthtools.org/source/browse/iheprofiles/

Download:

- org.openhealthtools.ihe.utils
- org.openhealthtools.ihe.common.hl7v2.client
- org.openhealthtools.ihe.pdq.consumer

For details regarding plugin contents, see the README.txt located in the resources/doc folder of each plugin.

2.3 Dependencies

The Patient Demographics Consumer has dependencies on other plugins and external sources.

2.3.1 Other OHT Plugins

Patient Demographics Consumer plugins are dependent on additional project plugins. You also need to check-out the following:

• org.eclipse.ohf.hl7v2.core org.eclipse.ohf.utilities org.apache.commons org.apache.axis org.xmlpull.v1	HL7v2 message object plugins and dependencies
• org.openhealthtools.ihe.common.mllp	Minimum Lower Level Protocol
• org.openhealthtools.ihe.atna.auditor org.openhealthtools.ihe.atna.nodeauth org.openhealthtools.ihe.atna.context	Auditing for messages sent and responses received
• org.apache.log4j	Debug, warning, and error logging

2.3.2 External Sources

Message defaults and message restrictions can be specified in an optional XML conformance profile. A sample Q22 Find Candidates (HL7v2.5) conformance profile is included with this plugin in the /resources/conf folder.

2.4 Resources

The following resources are recommended.

2.4.1 Other OHF plugin documentation

The following OHT plugin documents are related to the Patient Demographics Consumer:

- OHT ATNA Audit Client

2.4.2 HL7 Standard 2.5

The Patient Demographics Consumer references standards HL7 version 2.5.

http://www.hl7.org.

2.4.3 IHE ITI Technical Framework

Nine IHE IT Infrastructure Integration Profiles are specified as Final Text in the Version 2.0 ITI Technical Framework: Cross-Enterprise Document Sharing (XDS), Patient Identifier Cross-Referencing (PIX), Patient Demographics Query (PDQ), Audit trail and Node Authentication (ATNA), Consistent Time (CT), Enterprise User Authentication (EUA), Retrieve Information for Display (RID), Patient Synchronized Applications (PSA), and Personnel White Pages (PWP).

The IHE ITI Technical Framework can be found on the following website:
http://www.ihe.net/Technical_Framework/index.cfm#IT.

2.4.4 Newsgroup

Any unanswered technical questions may be posted to the OHT user discussion group.

3. API Documentation

The Patient Demographics Consumer client supports three formats for input. The client will accept:

- a raw HL7 message (String)
- an HL7v2 message object (org.eclipse.ohf.ihe.hl7v2.core Message)
- an ITI-21 Patient Demographics Query message supporting the construction of event:

    QBP^Q22 Patient Demographics Query

Examples for the three types of inputs are found in the org.openhealthtools.ihe.pdq.consumer plugin.

org.openhealthtools.ihe.pdq.consumer >

src_tests > org.openhealthtools.ihe.pdq.consumer.tests > HL7PdqQuery.java
src_tests > org.openhealthtools.ihe.pdq.consumer.tests > MSGPdqQuery.java
src_tests > org.openhealthtools.ihe.pdq.consumer.tests > ClientPdqQuery.java

The files in src_tests use a TestConfiguration.java file for extracting the various file locations and MLLP connection parameters. Update this file with your settings before running the sample code.

A raw HL7 message string should be used as input when the originating application is fully capable of sending and receiving HL7 messages. In this case, the Patient Demographics Consumer client is simply providing auditing, communication with the PIX server, and optional message verification. Server responses are returned to the caller as raw HL7v2 message strings. (HL7PdqQuery)

A message object should be used as input when the originating application is directly using the OHF HL7v2 component which the Patient Demographics Consumer client sits on top of. In this case, the application has taken full responsibility for message creation and reading the response. The Patient Demographics Consumer client is simply providing conversion to raw HL7, auditing, communication with the PIX server, and optional message verification. Server responses are returned to the caller as HL7v2 message objects. (MSGPdqQuery)

A ITI-21 Patient Demographics Query message should be used as input when the originating application has neither support for raw HL7 nor message objects. The Patient Demographics Consumer client provides a friendly interface to set and read message fields as well as auditing, communication with the PIX server, and optional message verification. Server messages are returned to the caller as PdqConsumerResponse objects. (ClientPdqQuery)

ITI-21 Patient Demographics Query Message Class

PdqConsumerDemographicQuery
PdqConsumerVisitQuery

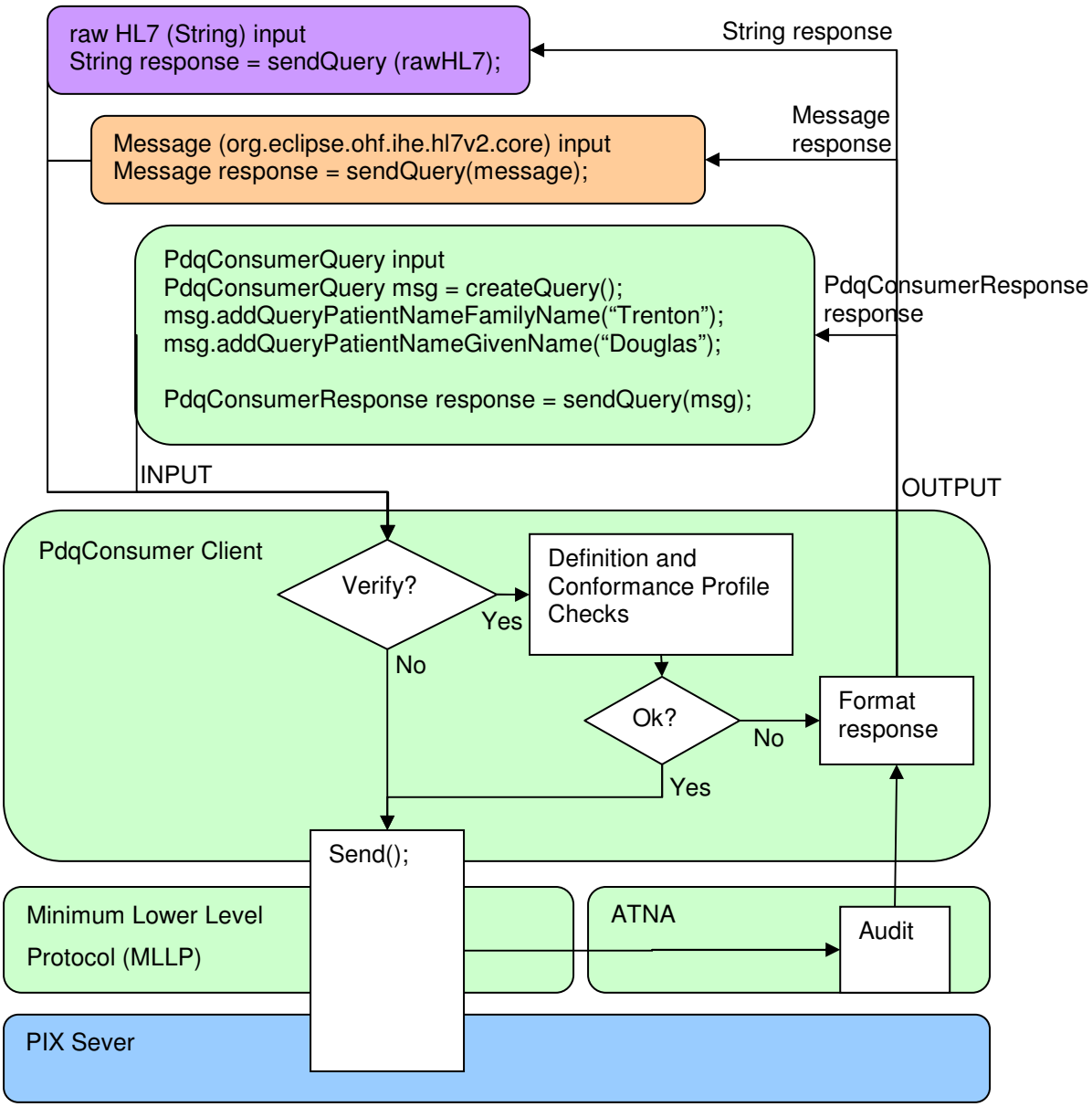
ITI-21 Patient Demographics Query Server Response Class

PdqConsumerResponse

3.1 Use Case - ITI-21 Patient Demographics Query

The Patient Demographics Consumer supports two transactions. This use case demonstrates in step-by-step and with sample code the creation and use of the Patient Demographics Consumer client, including the three input options. It includes example client construction of the event specific message object as input but not the creation of raw HL7 or an HL7v2 Message object.

3.1.1 Flow of Execution



Create a Patient Demographics Consumer object:

1. Construct ITI-21 Patient Demographics Query
2. Construct and associate MLLP (Minimum Lower Level Protocol) Destination
3. Disable auditing if desired.
4. Override the maximum level of validation error allowed before message submission is halted. The levels of error are constants in the OHF HL7v2 CPValidator.java file. The default is to allow up to the warning level.

Create a tailored HL7v2 message object:

1. Create Patient Demographics Consumer Message. Message field defaults are obtained first from the associated Conformance Profile.
2. Override default settings from conformance profile.
3. Add optional query values.
4. As not all fields have a corresponding method, use the generic method to set these additional values. Use method .addOptionalDemographicSearch(alias, data).
5. Add optional domain restrictions.
6. Add optional number of patients to return restriction.

The Patient Demographics Consumer supports querying data from PID and PD1 segments. Information about the fields, components, and sub-components available in these segments is available in the HL7 Version 2.5 Standard document in Chapter 3 Section 3.4 Message Segments. See transaction ITI-22 Patient Demographics and Visit Query for added query capability over PV1 and PV2 segments.

Send the message:

1. Send message

Read the response message:

1. Read response message fields.

3.1.2 Sample Code

Create a Patient Demographics Consumer Query:

1. Construct ITI-21 Patient Demographics Query

   There are two ways to construct the ITI-21 Patient Demographics Query client. At client creation, HL7 definitions are now automatically loaded for you from the HL7v2 toolkit. You can optionally provide an XML conformance profile for providing message defaults and additional message validation restrictions. The conformance profile can be added at a later time as well.

   In this sample code, TConfig refers to the TestConfiguration.java file mentioned in the beginning of this section. See this file for example formatting of these constants.

```
//pdqQuery set-up
```

```
PdqConsumer pdqQuery = new PdqConsumer();

//pdqQuery set-up with conformance profile
InputStream cpStream = new FileInputStream(TConfig.CPROFILE_PATH);
pdqQuery = new PdqConsumer(cpStream);
cpStream.close();
```

2. Construct and associate MLLP (Minimum Lower Level Protocol) Destination

   Un-Secure Connection:

```
MLLPDestination mllp = new MLLPDestination(TConfig.MLLP_URI);
MLLPDestination.setUseATNA(true);
pdqQuery.setMLLPDestination(mllp);
```

   Secure Connection:

```
MLLPDestination mllps = new MLLPDestination(TConfig.MLLPS_URI);
MLLPDestination.setUseATNA(true);
pdqQuery.setMLLPDestination(mllps);

Properties props = new Properties();
props.setProperty(SecurityDomain.JAVAX_NET_SSL_KEYSTORE, "/x.jks”);
props.setProperty(SecurityDomain.JAVAX_NET_SSL_KEYSTORE_PASSWORD, "pswd");
props.setProperty(SecurityDomain.JAVAX_NET_SSL_TRUSTSTORE, "/y.jks");
props.setProperty(SecurityDomain.JAVAX_NET_SSL_TRUSTSTORE_PASSWORD, "pswd");
SecurityDomain domain = new SecurityDomain("domainXY", props);
ConfigurationManager.registerDefaultSecurityDomain(domain);
```

3. Construct auditing.

```
String auditUser = "Bob Smith";
PDQConsumerAuditor.getAuditor().getConfig().setAuditSourceId(auditUser);
PDQConsumerAuditor.getAuditor().getConfig().setAuditRepositoryURI(TConfig.ATN
A_URI);
```

4. Override the maximum level of validation error allowed before message submission is halted. The levels of error are constants in the OHF HL7v2 CPValidator.java file. The default is to allow up to the warning level.

```
ITEM_TYPE_INFORMATION = 1;
ITEM_TYPE_WARNING = 2;
ITEM_TYPE_ERROR = 3;
ITEM_TYPE_FATAL = 4;

pdqQuery.setMaxVerifyEvent(CPValidator.ITEM_TYPE_INFORMATION);
```

Create a tailored HL7v2 message object:

1. Create Patient Demographics Consumer Message.

```
PdqConsumerQuery msg = pdqQuery.createQuery();
msg.addQueryPatientNameFamilyName("TRENTON");
msg.addQueryPatientNameGivenName("DOUGLAS");
```

2. Override default settings from conformance profile.

```
msg.changeDefaultCharacterSet("UNICODE");
```

3. Add optional query values.

```
msg.addOptionalQuerySex("F");
```

4. As not all fields have a corresponding method, use the generic method to set these additional values. Use method .addOptionalDemographicSearch(alias, data).

```
msg.addOptionalQuerySex("F");
msg.addOptionalDemographicSearch("PID-8", "F");
```

   For this example, the two statements are identical to show that the methods are equivalent.

5. Add optional domain restrictions.

```
msg.changeDefaultWhatDomainsReturned("HIMSS2005", "", "");
```

6. Add optional number of patients to return restriction. By default this value is set to 10 in an attempt to ensure the audit message does not exceed the maximum size limit.

```
msg.addOptionalQuantityLimit(5);
```

Send the message:

1. Send message

```
String response = pdqQuery.sendQuery(msg, isValidateOn);
Message response = ppdQuery.sendQuery(msg, isValidateOn);
PdqConsumerResponse response = pdqQuery.sendQuery(msg, isValidateOn);
```

Read the response message:

1. Read response

```
//HL7v2 message object
msg.getElement("MSA-1").getAsTableCode();          //message AckCode
msg.getElement("QAK-2").getAsTableDescription();   //message QueryStatus

//PdqConsumerResponse object
response.getResponseAckCode(isExpandCodeToString);
response.getQueryStatus(isExpandCodeToString);
response.getPatientCount();
for (int i=1; i <= response.getPatientCount(); i++) {
```

```
        String patID[] = response.getPatientIdentifier(i, 0);
        String patName[] = response.getPatientName(i);
        logger.debug("  Patient: " + patID[0]
        + "-" + response.getPatientNameFamilyName(i)
        + ", " + patName[1]);
    }
```

3.2 Use Case - ITI-22 Patient Demographics and Visit Query

The Patient Demographics Consumer supports two transactions. This use case is very similar to the prior example, it additionally supports query on HL7 segments PV1 and PV2.

4. Security

4.1 Node Authentication

Transport Layer Security Protocol (TLS) is supported by creating a secure MLLP connection. Information required to instantiate a secure connection to one of the IBM Public Servers is available in the sample code configuration file.

4.2 Auditing

Auditing to an Audit Record Repository is automatically enabled through the ATNA Agent. The Patient Demographics Consumer automatically generates the following audit messages:

- EventID 110100 - Actor Start audit message (EventTypeCode 110120)
- EventID 110112 - Query audit message
- EventID 110107 - Import audit message
- EventID 110100 - Actor Stop audit message (EventTypeCode 110121)

5. Configuration

There are two types of configuration in this release.

5.1 Conformance Profile

Create message default field values, such as message header fields, can now be read from the conformance profile field ConstantValue attribute. This is now supported at all levels: field, component, and sub-component.

Field example:

```
<Field Name="MSH-1 Field Separator" Usage="R" Min="1" Max="1" Datatype="ST"
Length="1" ItemNo="00001" ConstantValue="|"></Field>
```

Component example (in this case only the namespaceId is defaulted):

```
<Field Name="MSH-3 Sending Application" Usage="R" Min="0" Max="1" Datatype="HD"
Length="227" Table="0361" ItemNo="00003">

      <Component Name="MSH-3-1 sending application: namespace ID" Usage="R"
      Datatype="IS" ConstantValue="OHTConsumer1"></Component>

      <Component Name="MSH-3-2 sending application: universal ID" Usage="O"
      Datatype="ST"></Component>

      <Component Name="MSH-3-3 sending application: universal ID type" Usage="O"
      Datatype="ID"></Component>

</Field>
```

Sub-component example (specifies a limit of 5 records):

```
<Field Name="RCP-2 Quantity Limited Request" Usage="O" Min="0" Max="1"
Datatype="CQ" Length="10" Table="0126" ItemNo="00031">

      <Component Name="RCP-2-1 quantity limited request: quantity" Usage="O"
      Datatype="NM" ConstantValue="5"></Component>

      <Component Name="RCP-2-2 quantity limited request: units" Usage="O"
      Datatype="CE">

            <SubComponent Name="RCP-2-2-1 quantity limited request: units:
            identifer" Usage="O" Datatype="ST"
            ConstantValue="RD"></SubComponent>

            <SubComponent Name="RCP-2-2-2 quantity limited request: units: text"
            Usage="O" Datatype="ST"></SubComponent>

            <SubComponent Name="RCP-2-2-3 quantity limited request: units: name
            of coding system" Usage="O" Datatype="ID"></SubComponent>

            <SubComponent Name="RCP-2-2-4 quantity limited request: units:
            alternate identifier" Usage="O" Datatype="ST"></SubComponent>

            <SubComponent Name="RCP-2-2-5 quantity limited request: units:
            alternate text" Usage="O" Datatype="ST"></SubComponent>

      </Component>

</Field>
```

5.2 Test Configuration

The files in src_tests now use a TestConfiguration.java file for extracting the various file locations and MLLP connection parameters. Update this file with your settings before running the sample code. Here are the fields that are configured in this file:

```
//basics
public static final String DATA_PATH
public static final String LOG4J_PATH

//HL7PixQuery - run from file
public static final String HL7FILE_PATH

//Conformance profile for second level HL7 verification and defaults
public static final String CPROFILE_PATH

//MLLP Connectivity:
public static URI MLLP_URI
public static URI MLLPS_URI

//TLS: Secure connection parameters
public static final String MLLP_KEYSTORE_NAME
public static final String MLLP_KEYSTORE_PASSWORD
public static final String MLLP_TRUSTSTORE_NAME
public static final String MLLP_TRUSTSTORE_PASSWORD
```

6. Debugging Recommendations

Log statements have been entered throughout the Patient Demographics Consumer plugin source code for assistance in monitoring the progress of the running client. To enable logging, there is a Log4j configuration file.

An example log4j configuration file is in the file /resources/conf/pdqconsumer_log4j.xml. The default configuration writes to a log file in the folder /resources/log.

7. IHE Connectathon MESA Tests

For current information, please refer to the website:

7.1 Plugin Testing

The OHT Patient Demographics Consumer plugin completed testing with the following junits and test scripts.

org.openhealthtools.ihe.pdq.consumer > src_tests > org.openhealthtools.ihe.pdq.consumer.test.mesa >

MESA2007Tests.java	Test11311 – PDQ Exact Name Search
	Test11312 – PDQ Name Search no Match
	Test11315 – PDQ Partial Name Search
	Test11320 – PDQ Complete ID Search Unspecified Domain
	Test11325 – PDQ Complete ID Search Single Domain
	Test11330 – PDQ Complete ID Search Multiple Domains
	Test11335 – PDQ Partial ID Search Single Domain
	Test11350 – PDQ Multi-Key Search 1
	Test11365 – PDQ Continuation Test 1
MESA2009.txt	Sample script for starting the mesa server and running all tests.

7.2 Bridge Testing

The OHT Bridge completed testing with the following junits and test scripts.

org.openhealthtools.bridge.ws > src_tests > org.openhealthtools.bridge.ws.tests.mesa >

TestMESA11311.java	PDQ Exact Name Search
TestMESA11312.java	PDQ Name Search no Match
TestMESA11315.java	PDQ Partial Name Search
TestMESA11320.java	PDQ Complete ID Search Unspecified Domain
TestMESA11325.java	PDQ Complete ID Search Single Domain
TestMESA11335.java	PDQ Partial ID Search Single Domain
TestMESA11350.java	PDQ Multi-Key Search 1
TestMESA11365.java	PDQ Continuation Test 1

org.openhealthtools.ihe.pdq.consumer > src_tests > org.openhealthtools.ihe.pdq.consumer.test.mesa >

MESA2009.txt	Sample script for starting the mesa server and running all tests.

8. IHE Connectathon Tests

8.1 Plugin Testing

The OHT Patient Demographics Consumer plugin completed testing with the following junits.

org.openhealthtools.ihe.pdq.consumer > src_tests >
org.openhealthtools.ihe.pdq.consumer.test.connectathon >

ConnectathonPDQLoadTest.java	2.1 PDQ_Load The initial patient load for PDQ requires use of the Patient Identity Source plugin. This file is a placeholder for the actual junit which is located within the Patient Identity Source connectathon junits - org.openhealthtools.ihe.pix.source > src_tests > org.openhealthtools.ihe.pix.source.test.connectathon
ConnectathonPDQTest.java	2.2 PDQ_Exact_Name 2.3 PDQ_Multiple_Query 2.5 PDQ_Continuation_Test