Fall 2010-09-19

MirthConnect howto document

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Recommended Citation

Pardon, Sebastien and Berry, Damon, "MirthConnect howto document" (2010). *Reports*. 2.
https://arrow.tudublin.ie/teapotrep/2

Funder: Health Information and Quality Authority

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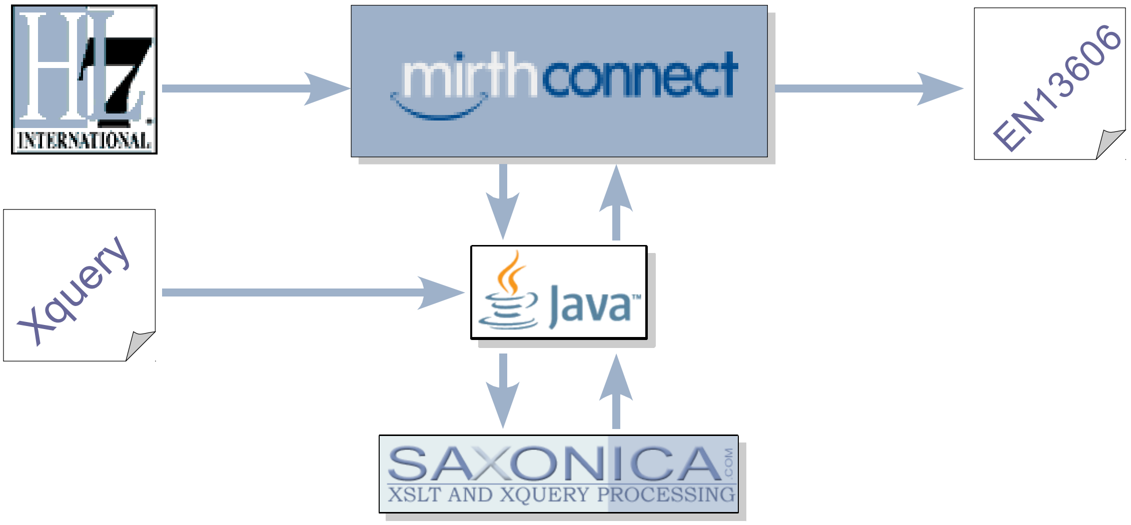
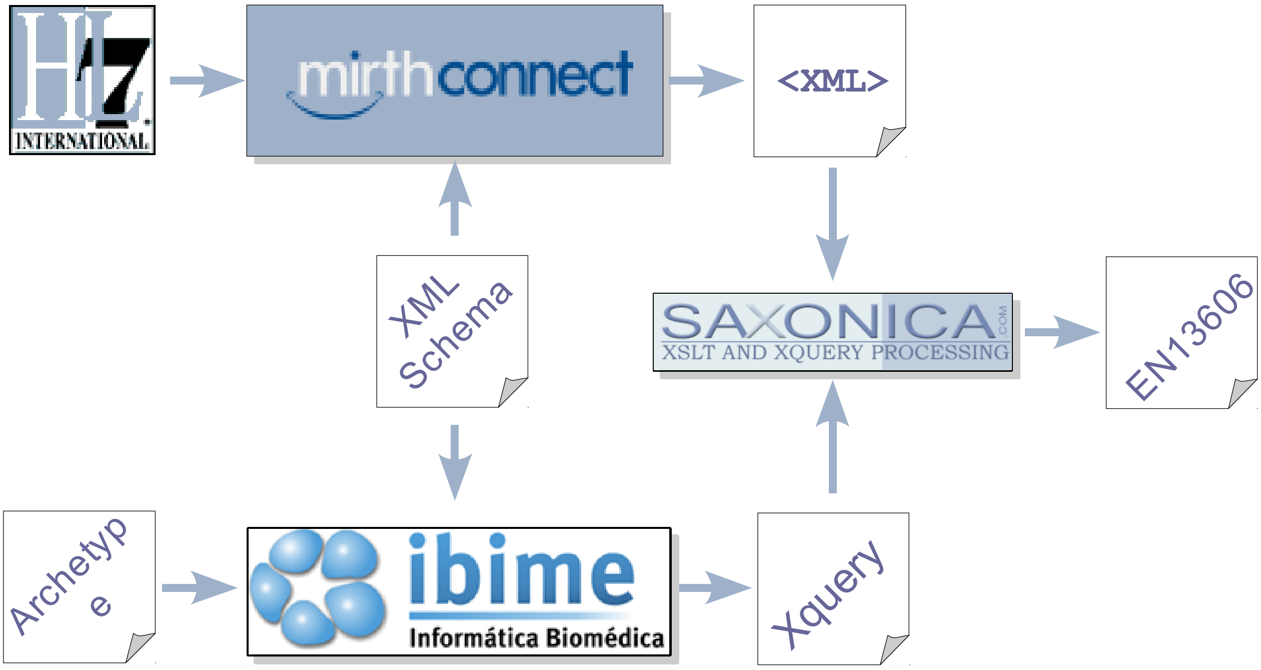
Introduction

This document aims at describing the steps involved in installing and configuring Mirth Connect so as to produce an EN13606-compliant record extract from an HL7v2 message using the LinkedEHR-produced xquery.



Drawing 1: Process flow



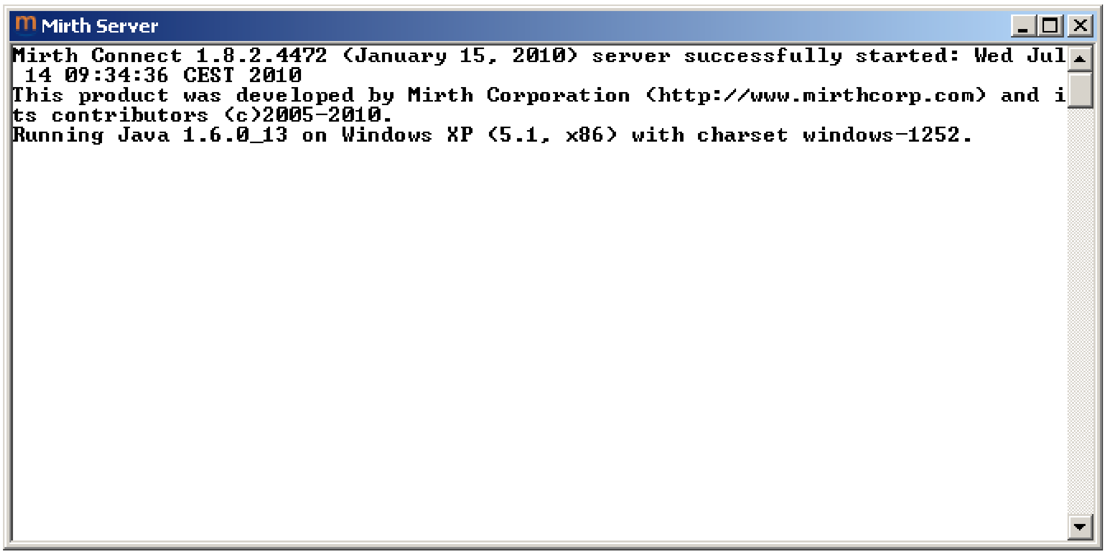
Drawing 2: Data flow

Requisites

- Mirth Connect: you can download the software at http://www.mirthcorp.com/community/downloads. The version used for this manual is 1.8.2.4472.1351.
- The Saxon library for Xquery parsing: you can download the software at http://saxon.sourceforge.net/. The version used in this manual is Home Edition 9-2-0-5j
- The LinkEHR Xquery. For this manual we used the mapping of simple xml for a Blood Pressure Archetype
- The xquery jar file containing the Converter class. This is the extension to Mirth Connect that bridges the channel transformers with the Saxon library

Installation

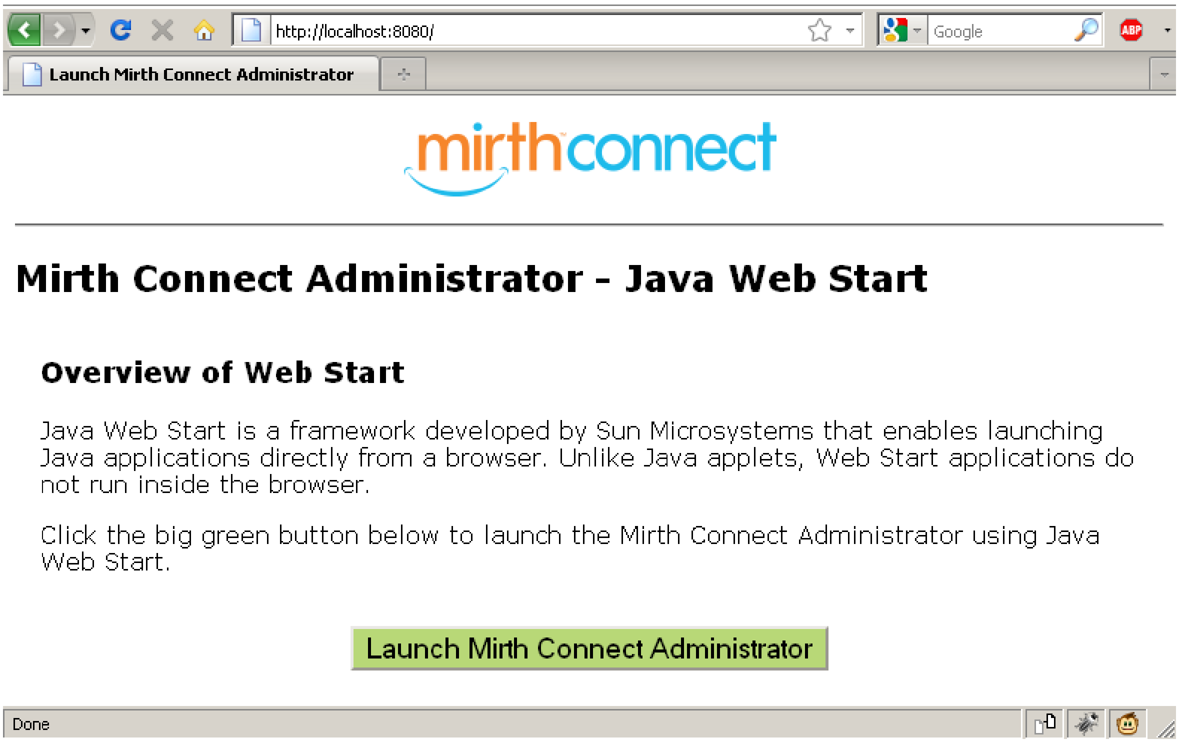
- Install Mirth Connect. Refer to the Mirth Connect website and manual for information regarding the installation procedure. This document refers to the Mirth Connect installation directory as $MIRTH_HOME$
- Locate the Saxon library (saxon9he.jar) and open it with a Zip-file manager. Remove the services/ directory from the META-INF/ directory. This directory contains configuration information that conflict with Mirth Connect.
  Copy the modified jar file to the $MIRTH_HOME$/lib/custom/ directory
- Copy the xquery jar file to the $MIRTH_HOME$/lib/custom/ directory
- Start the Mirth Server or service (depending on the choice you made during the Mirth Connect installation procedure). If you chose to use the server, the following window should appear.



```
Mirth Connect 1.8.2.4472 (January 15, 2010) server successfully started: Wed Jul
 14 09:34:36 CEST 2010
This product was developed by Mirth Corporation (http://www.mirthcorp.com) and i
ts contributors (c)2005-2010.
Running Java 1.6.0_13 on Windows XP (5.1, x86) with charset windows-1252.
```

Illustration 1: Mirth Server Window

- Start a web browser and go http://localhost:8080/
  this will display the Mirth Connect Administrator Java Web Start page were you will be able to launch the Administrator.



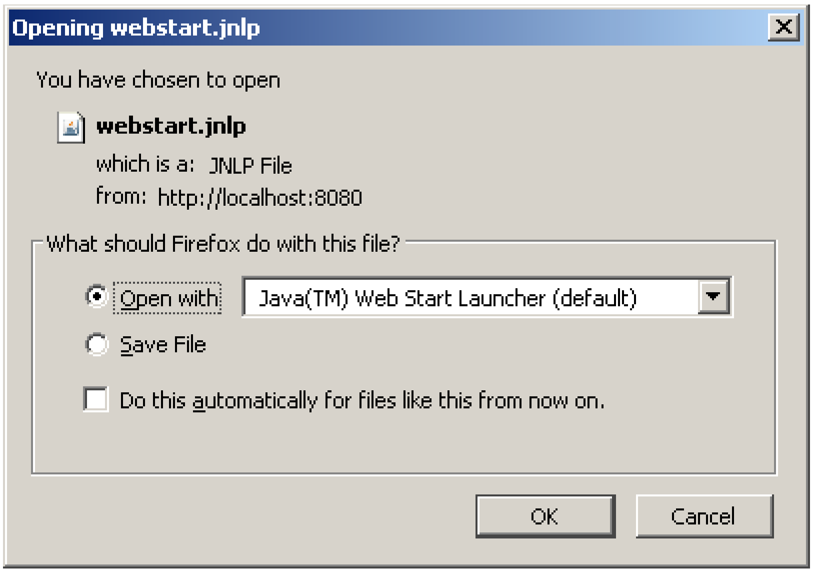
Mirth Connect Administrator - Java Web Start

Overview of Web Start

Java Web Start is a framework developed by Sun Microsystems that enables launching Java applications directly from a browser. Unlike Java applets, Web Start applications do not run inside the browser.

Click the big green button below to launch the Mirth Connect Administrator using Java Web Start.

Illustration 2: Mirth Connect Administrator - Java Web Start



You have chosen to open

webstart.jnlp

which is a: JNLP File

from: http://localhost:8080

What should Firefox do with this file?

● Open with Java(TM) Web Start Launcher (default)

○ Save File

□ Do this automatically for files like this from now on.

Illustration 3: Opening webstart

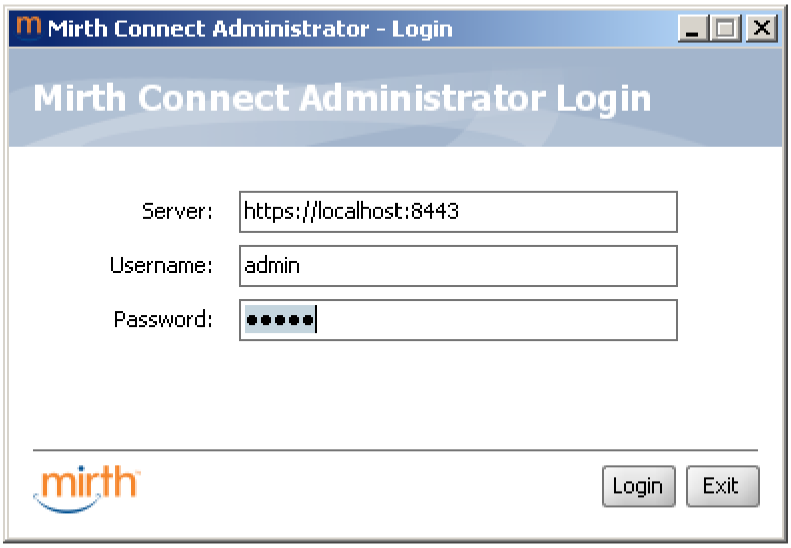
Configuration

This section focuses on the creation of channels that will parse an HL7v2 message file from the c:\ehrland directory and produce an XML record extract to the c:\ehrland directory.

In order to do so we will create 2 channels:

- HL7v2 to simple xml: This channel will parse the HL7 message file and map it to the xml format used during the LinkEHR mapping procedure. This xml message (referred to as "simple xml") will then be sent to the next channel
- simple xml to EHRCom xml: This channel will receive the simple xml message and invoke the xquery converter class to produce an EN13606-compliant xml message that will then be written to the target directory.

Log on to the Mirth Connect Administrator. The default username and password are admin/admin.


Mirth Connect Administrator - Login
Mirth Connect Administrator Login
mirth
Login
Exit

Server: https://localhost:8443

Username: admin

Password: •••••

Illustration 4: Mirth Connect Administrator - Login

The administrator presents an empty dashboard. Select **Channels** on the top-left-hand Mirth Connect menu and then **New Channel** from the Channel Tasks menu.

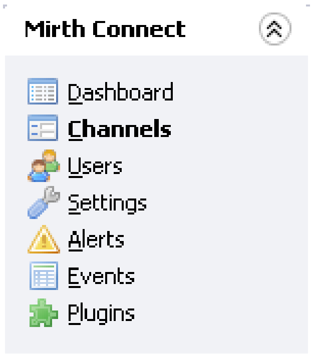


Illustration 5: Mirth Connect menu

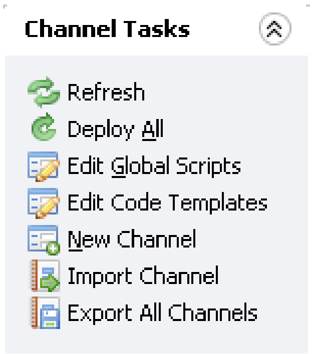
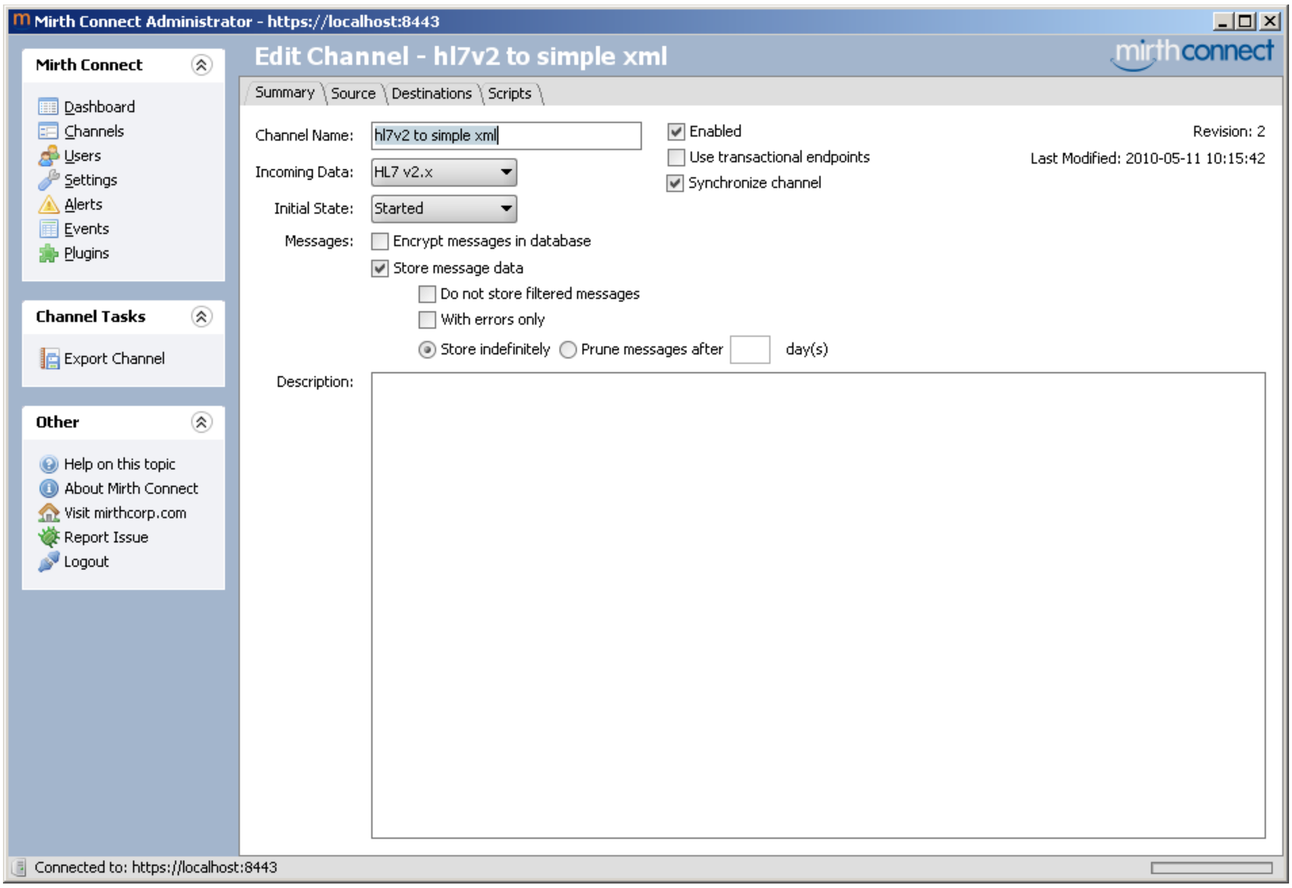


Illustration 6: Channel Tasks menu

HL7v2 to simple xml channel

Create a new channel named “**HL7v2 to simple xml**” of incoming data type “**HL7 v2.x**”. Make sure the channel is **enabled** and **synchronized**.



Edit Channel - hl7v2 to simple xml

Channel Name: hl7v2 to simple xml

Incoming Data: HL7 v2.x

Initial State: Started

Messages: □ Encrypt messages in database

☑ Store message data

□ Do not store filtered messages

□ With errors only

● Store indefinitely ○ Prune messages after day(s)

☑ Enabled

□ Use transactional endpoints

☑ Synchronize channel

Revision: 2

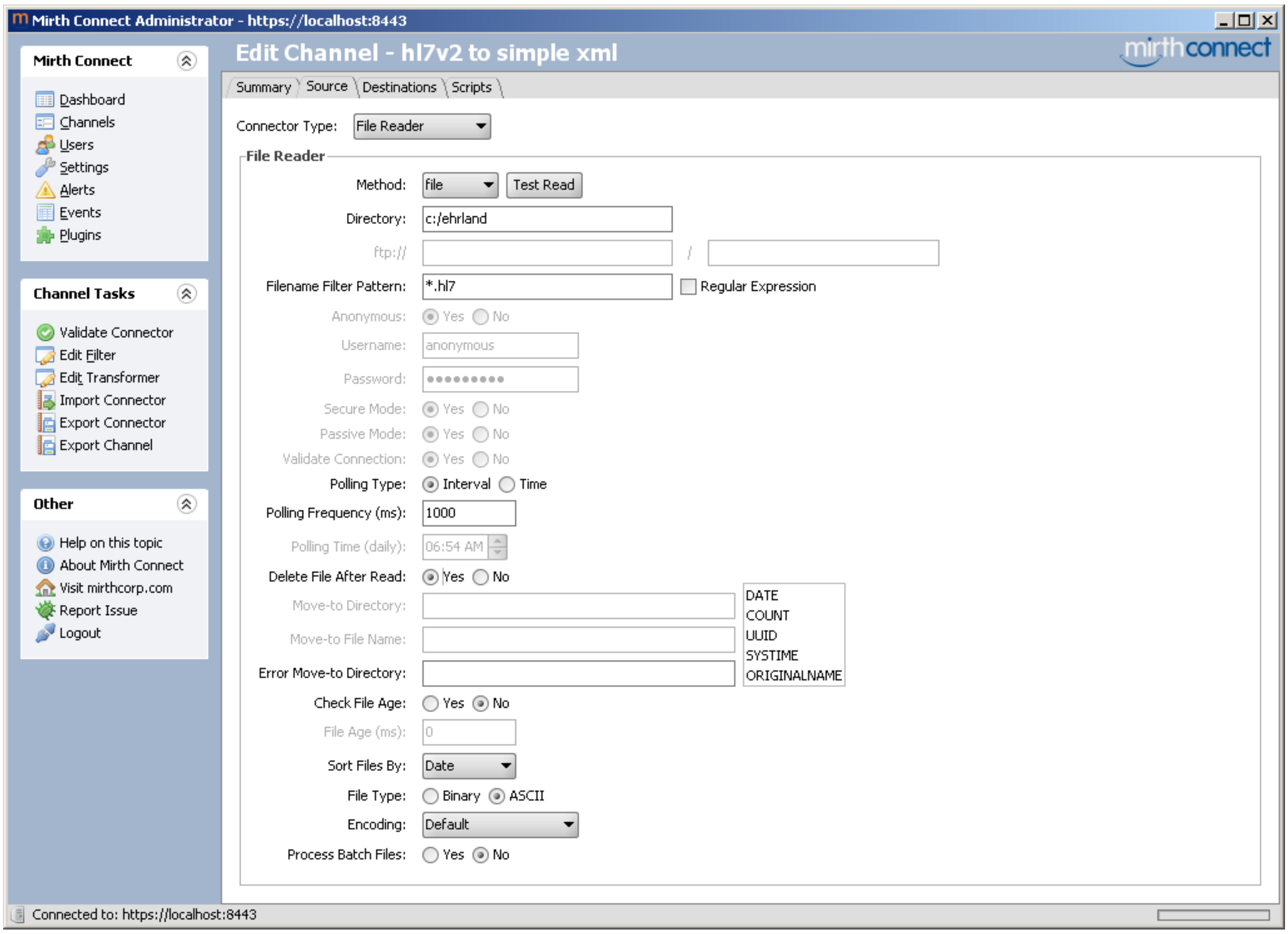
Last Modified: 2010-05-11 10:15:42

Description:

Connected to: https://localhost:8443

Illustration 7: HL7v2 to simple xml - summary

As the channel will read HL7 message file (with extension .hl7) from the c:\ehrland directory, on the **Source** tab panel select the **File Reader** connector type, insert c:/ehrland as the directory and ***.hl7** as the file pattern. You can use the Test Read button to control if Mirth Connect is able to access the directory. Make sure that the **Delete File After Read** option is set to **Yes**.



Connector Type: File Reader

File Reader

Method: file

Directory: c:/ehrland

ftp:// /

Filename Filter Pattern: *.hl7 □ Regular Expression

Anonymous: ● Yes ○ No

Username: anonymous

Password: ●●●●●●●●●

Secure Mode: ● Yes ○ No

Passive Mode: ● Yes ○ No

Validate Connection: ● Yes ○ No

Polling Type: ● Interval ○ Time

Polling Frequency (ms): 1000

Polling Time (daily): 06:54 AM

Delete File After Read: ● Yes ○ No

Move-to Directory:

Move-to File Name:

Error Move-to Directory:

Check File Age: ○ Yes ● No

File Age (ms): 0

Sort Files By: Date

File Type: ○ Binary ● ASCII

Encoding: Default

Process Batch Files: ○ Yes ● No

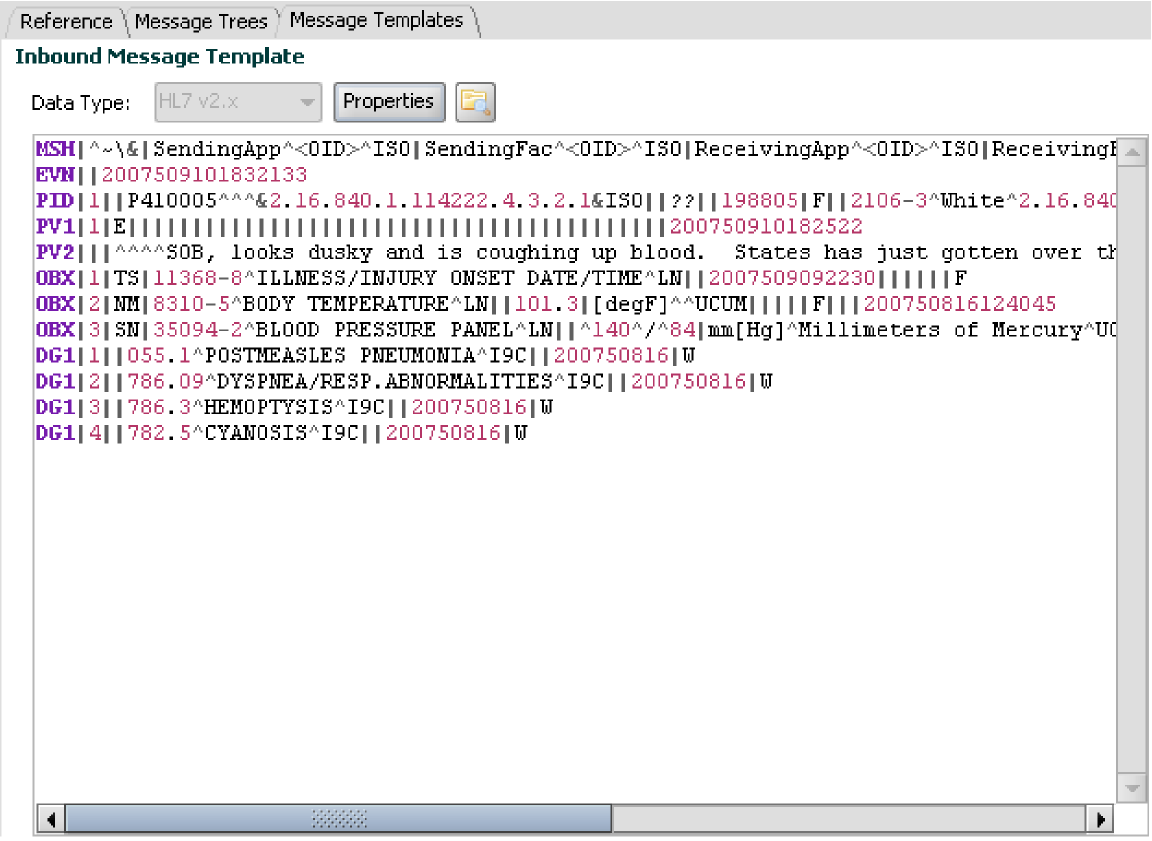
Illustration 8: HL7v2 to simple xml - source

As the destination will be a channel we have yet to create, on the Destinations tab create a New Destination (from the **Channel Tasks** menu) of type **Channel Writer**. We will leave the channel name blank for the moment.

In the template section insert the xml data structure that was used for the LinkEHR xquery mapping procedure:

```
<?xml version="1.0" encoding="UTF-8" ?>
<data>
      <patient id="">
            <systolic></systolic>
            <diastolic></diastolic>
            <position>1</position>
            <date></date>
      </patient>
</data>
```

In order to perform the mapping from an HL7v2 message to our xml format we will need to use some transformers. In the **Channel Tasks** menu select **Edit Transformer**. On the right-hand side in the **Message Templates** tab panel, insert an example HL7v2 message as shown in Illustration 9.



Inbound Message Template

Data Type: HL7 v2.x

```
MSH|^~\&|SendingApp^<OID>^ISO|SendingFac^<OID>^ISO|ReceivingApp^<OID>^ISO|ReceivingF
EVN||2007509101832133
PID|1||P410005^^^&2.16.840.1.114222.4.3.2.1&ISO||??||198805|F||2106-3^White^2.16.840
PV1|1|E||||||||||||||||||||||||||||||||||||||||||200750910182522
PV2|||^^^^SOB, looks dusky and is coughing up blood.  States has just gotten over th
OBX|1|TS|11368-8^ILLNESS/INJURY ONSET DATE/TIME^LN||2007509092230||||||F
OBX|2|NM|8310-5^BODY TEMPERATURE^LN||101.3|[degF]^^UCUM|||||F|||200750816124045
OBX|3|SN|35094-2^BLOOD PRESSURE PANEL^LN||^140^/^84|mm[Hg]^Millimeters of Mercury^UC
DG1|1||055.1^POSTMEASLES PNEUMONIA^I9C||200750816|W
DG1|2||786.09^DYSPNEA/RESP.ABNORMALITIES^I9C||200750816|W
DG1|3||786.3^HEMOPTYSIS^I9C||200750816|W
DG1|4||782.5^CYANOSIS^I9C||200750816|W
```

Illustration 9: HL7 Message Templates

Mirth Connect will automatically interpret the message and will provide its hierarchical representation in the **Message Trees** tab panel as shown in Illustration 10.

This panel can be used to easily create a transformer.

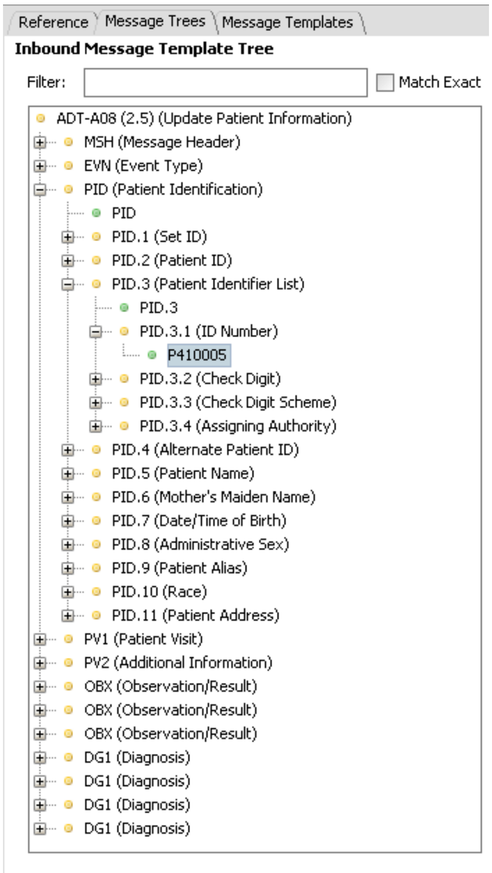
In the Transformer Task menu select **Add New Step** of type **Mapper** to be added to the **Channel Map**.

For the patient identifier we can use the **pid** variable name. In the Message Tree pane, drag the child node of the **`PID.3.1`** node and drop it into the Mapping section. It should automatically write

```
msg['PID']['PID.3']['PID.3.1'].toString()
```

Repeat the procedure with a step called **systolic** referring to the child node of **`OBX.5.2`**.

Repeat the procedure with a step called **diastolic** referring to the child node of **`OBX.5.4`**.



Inbound Message Template Tree

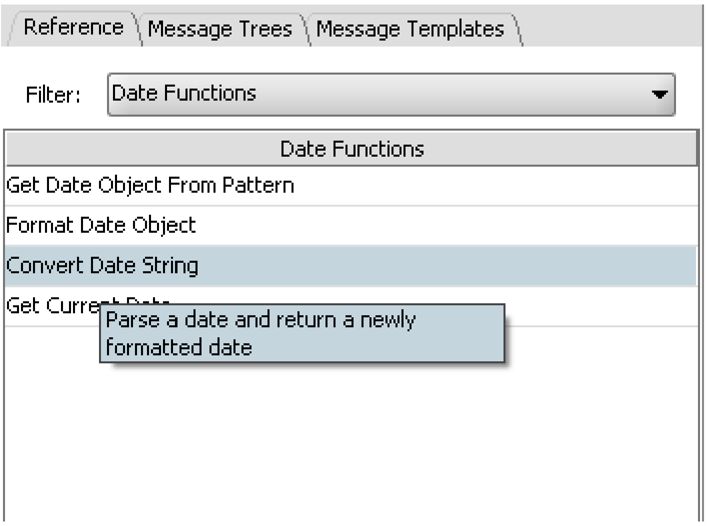
Filter: □ Match Exact

```
ADT-A08 (2.5) (Update Patient Information)
  MSH (Message Header)
  EVN (Event Type)
  PID (Patient Identification)
    PID
    PID.1 (Set ID)
    PID.2 (Patient ID)
    PID.3 (Patient Identifier List)
      PID.3
      PID.3.1 (ID Number)
        P410005
      PID.3.2 (Check Digit)
      PID.3.3 (Check Digit Scheme)
      PID.3.4 (Assigning Authority)
    PID.4 (Alternate Patient ID)
    PID.5 (Patient Name)
    PID.6 (Mother's Maiden Name)
    PID.7 (Date/Time of Birth)
    PID.8 (Administrative Sex)
    PID.9 (Patient Alias)
    PID.10 (Race)
    PID.11 (Patient Address)
  PV1 (Patient Visit)
  PV2 (Additional Information)
  OBX (Observation/Result)
  OBX (Observation/Result)
  OBX (Observation/Result)
  DG1 (Diagnosis)
  DG1 (Diagnosis)
  DG1 (Diagnosis)
  DG1 (Diagnosis)
```

Illustration 10: HL7 Message Trees

As the date format used by the simple xml differs from the date format used by the HL7 message, we will need to perform some type of conversion on top of the mapping.

Create a new step called **event_date**. In the Reference tab panel filter the various options withe the **Date Functions** value. Drag the **Convert Date String** function into the mapping section. We will need to convert the date from a `yyyyMMdd` format to a `dd-MM-yyyy` one. Finally from the Message Tree Panel we can drag the child node of **`EVN.2.1`** and drop it as the last variable of the conversion procedure.



Filter: Date Functions

Date Functions
Get Date Object From Pattern
Format Date Object
Convert Date String
Get Current Date

Parse a date and return a newly formatted date

Illustration 11: Reference tab panel

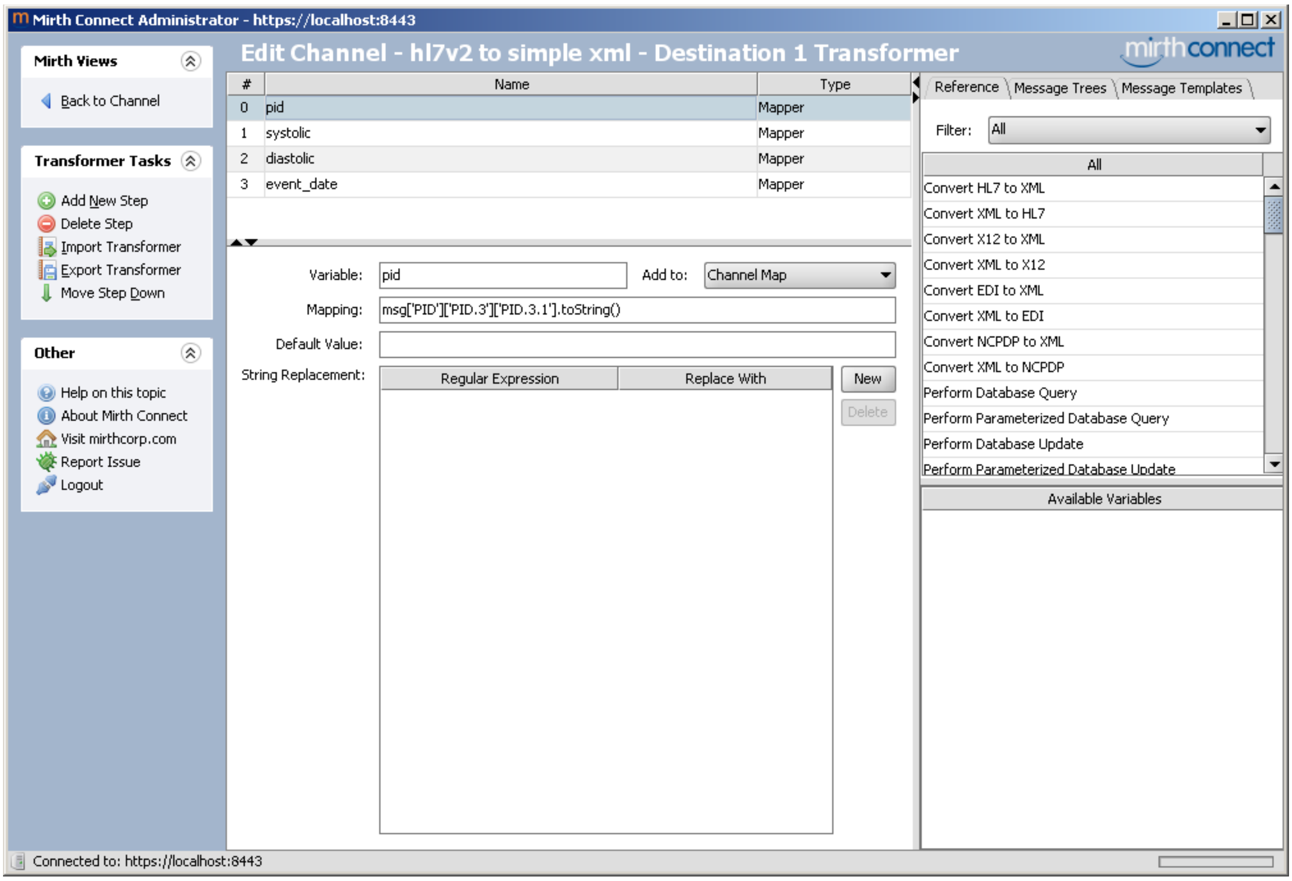
The final result of the mapping should be:

```
        DateUtil.convertDate('yyyyMMdd', 'dd-MM-yyyy', msg['EVN']['EVN.2']
                                ['EVN.2.1'].toString())
```

Here is a summary of the 4 variables:

pid	msg['PID']['PID.3']['PID.3.1'].toString()
systolic	msg['OBX'][2]['OBX.5']['OBX.5.2'].toString()
diastolic	msg['OBX'][2]['OBX.5']['OBX.5.4'].toString()
event_date	DateUtil.convertDate('yyyyMMdd', 'dd-MM-yyyy', msg['EVN']['EVN.2']['EVN.2.1'].toString())

The following picture shows the Transformer section after completion of the 4 mapping variables.



Edit Channel - hl7v2 to simple xml - Destination 1 Transformer

#	Name	Type
0	pid	Mapper
1	systolic	Mapper
2	diastolic	Mapper
3	event_date	Mapper

Variable: pid

Add to: Channel Map

Mapping: msg['PID']['PID.3']['PID.3.1'].toString()

Default Value:

String Replacement:

Regular Expression	Replace With

Filter: All

All
Convert HL7 to XML
Convert XML to HL7
Convert X12 to XML
Convert XML to X12
Convert EDI to XML
Convert XML to EDI
Convert NCPDP to XML
Convert XML to NCPDP
Perform Database Query
Perform Parameterized Database Query
Perform Database Update
Perform Parameterized Database Update

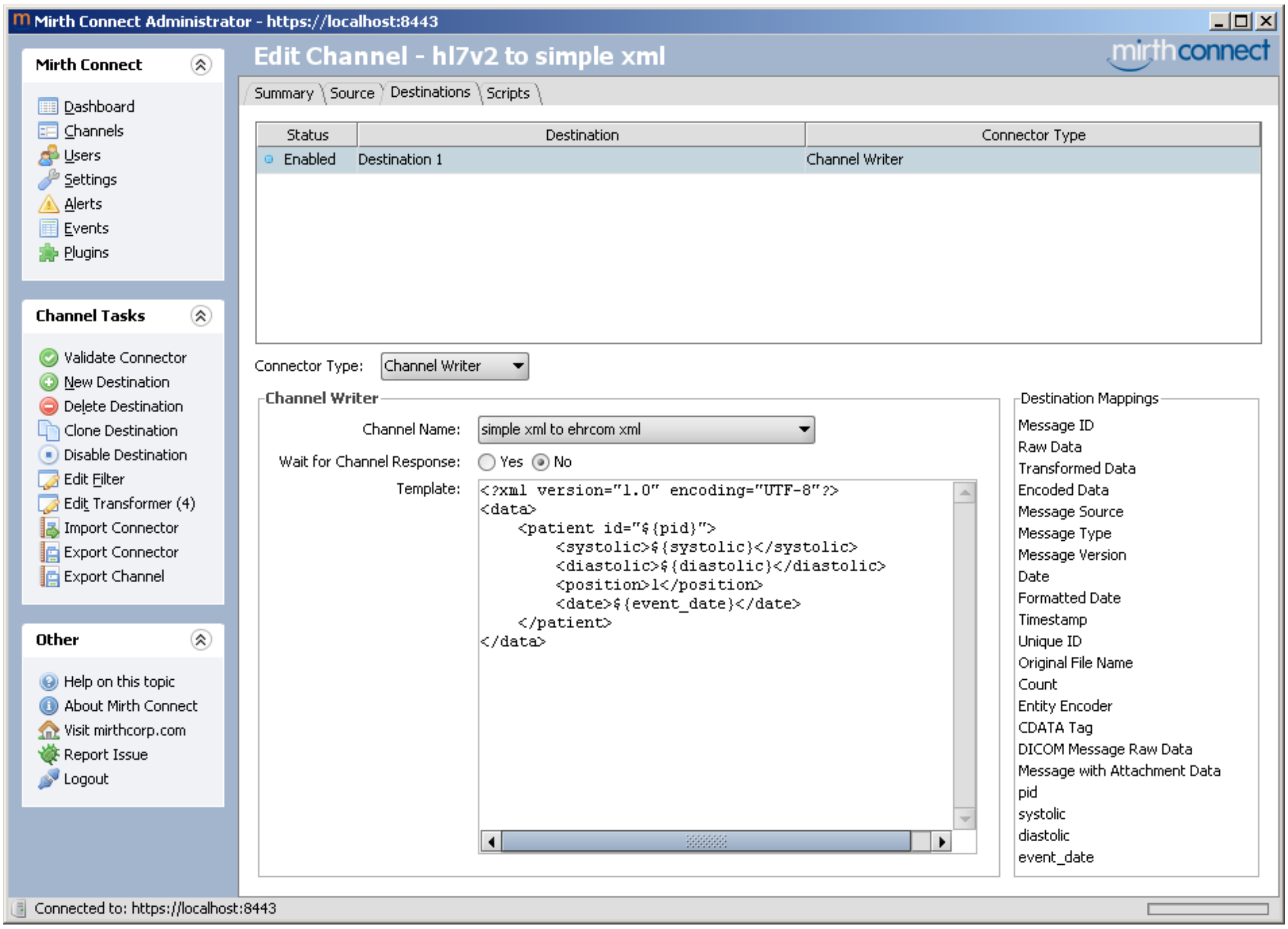
Illustration 12: HL7v2 to simple xml - transformer

In the **Mirth Views** menu on the left-hand side, go back to the channel.

In the **Destination Mappings** section on the bottom-right-hand of the Destinations tab panel we can see the 4 variables previously created. These variables can be dragged and dropped into the **Template** area to complete the xml message.

For example, dragging and dropping the **pid** variable should result in **`${pid}`**. The final template should be

```
<?xml version="1.0" encoding="UTF-8" ?>
<data>
      <patient id="${pid}">
            <systolic>${systolic}</systolic>
            <diastolic>${diastolic}</diastolic>
            <position>1</position>
            <date>${event_date}</date>
      </patient>
</data>
```



Status	Destination	Connector Type
Enabled	Destination 1	Channel Writer

Connector Type: Channel Writer

Channel Writer

Channel Name: simple xml to ehrcom xml

Wait for Channel Response: ○ Yes ● No

Template:

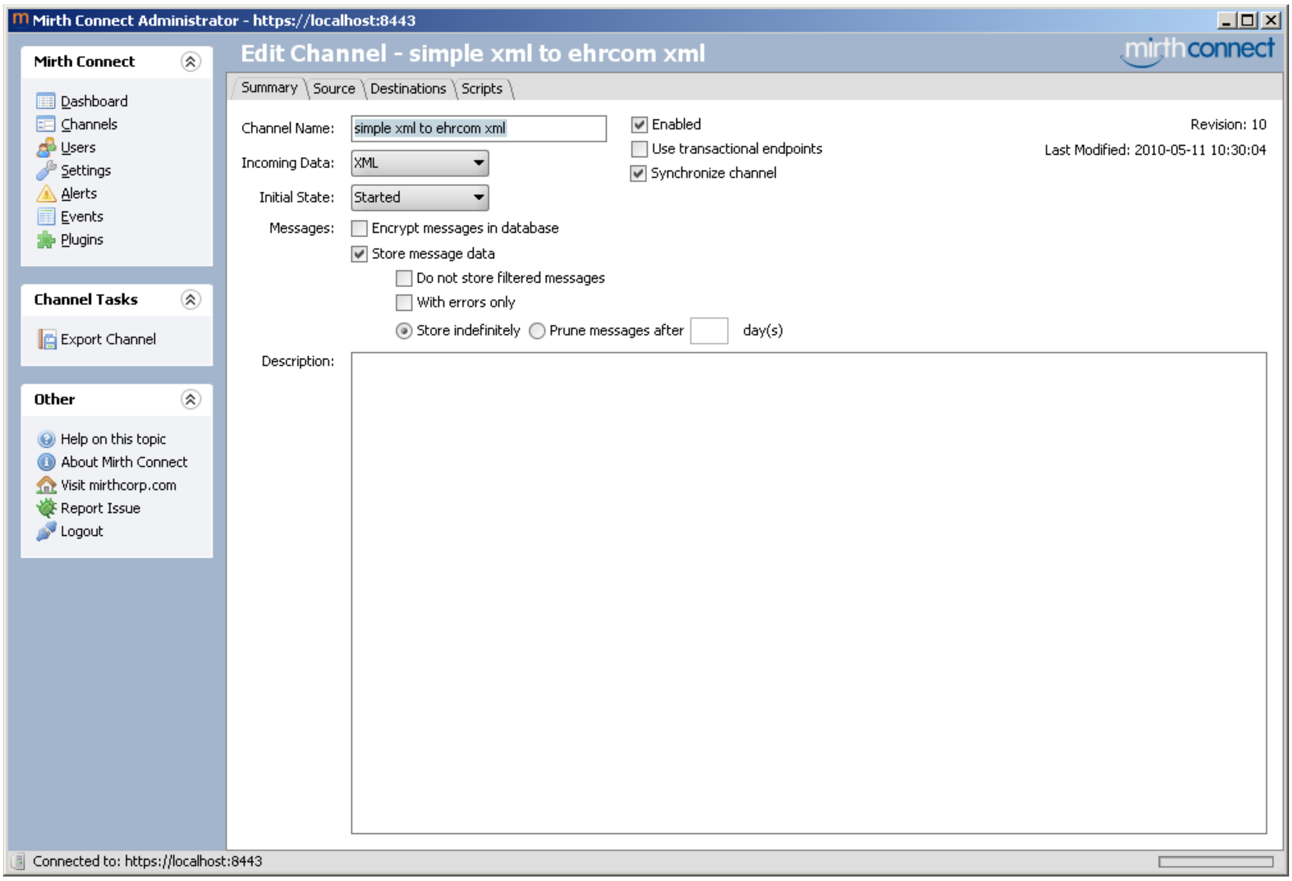
```
<?xml version="1.0" encoding="UTF-8"?>
<data>
    <patient id="${pid}">
        <systolic>${systolic}</systolic>
        <diastolic>${diastolic}</diastolic>
        <position>1</position>
        <date>${event_date}</date>
    </patient>
</data>
```

Illustration 13: HL7v2 to simple xml - destinations

You can save the channel in the **Channel Tasks** menu and go back to the Channel list by clicking **Channels** in the **Mirth Connect** menu.

Simple xml to EHRCom xml

Create a new channel named “**simple xml to EHRCom xml**” of incoming data type “**XML**”. Make sure the channel is **enabled** and **synchronized**.



Edit Channel - simple xml to ehrcom xml

Channel Name: simple xml to ehrcom xml

Incoming Data: XML

Initial State: Started

Messages: □ Encrypt messages in database

☑ Store message data

□ Do not store filtered messages

□ With errors only

● Store indefinitely ○ Prune messages after day(s)

Description:

☑ Enabled

□ Use transactional endpoints

☑ Synchronize channel

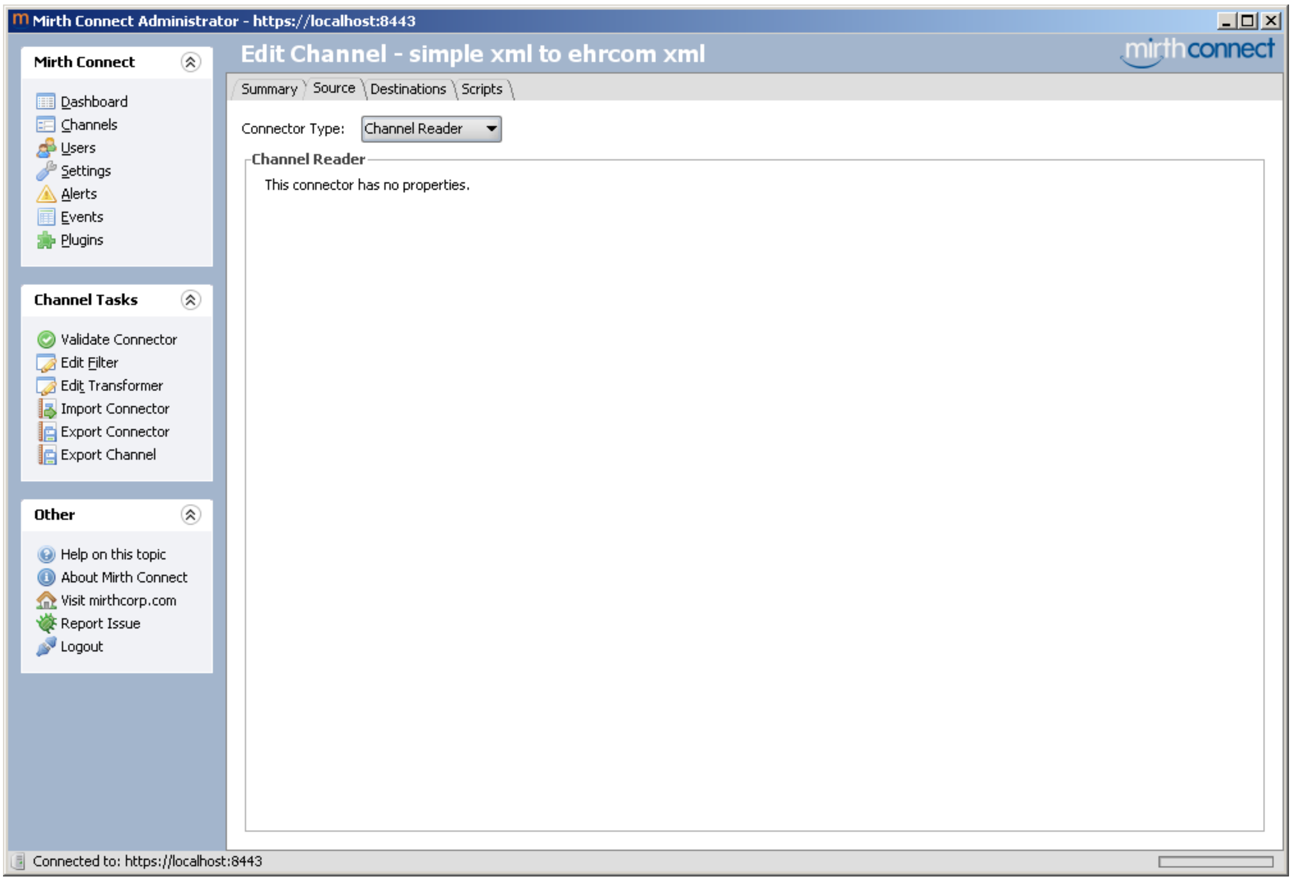
Revision: 10

Last Modified: 2010-05-11 10:30:04

Connected to: https://localhost:8443

Illustration 14: simple xml to EHRCom xml - summary

As the channel will read a message provided by another channel, on the **Source** tab panel select the **Channel Reader** connector type.



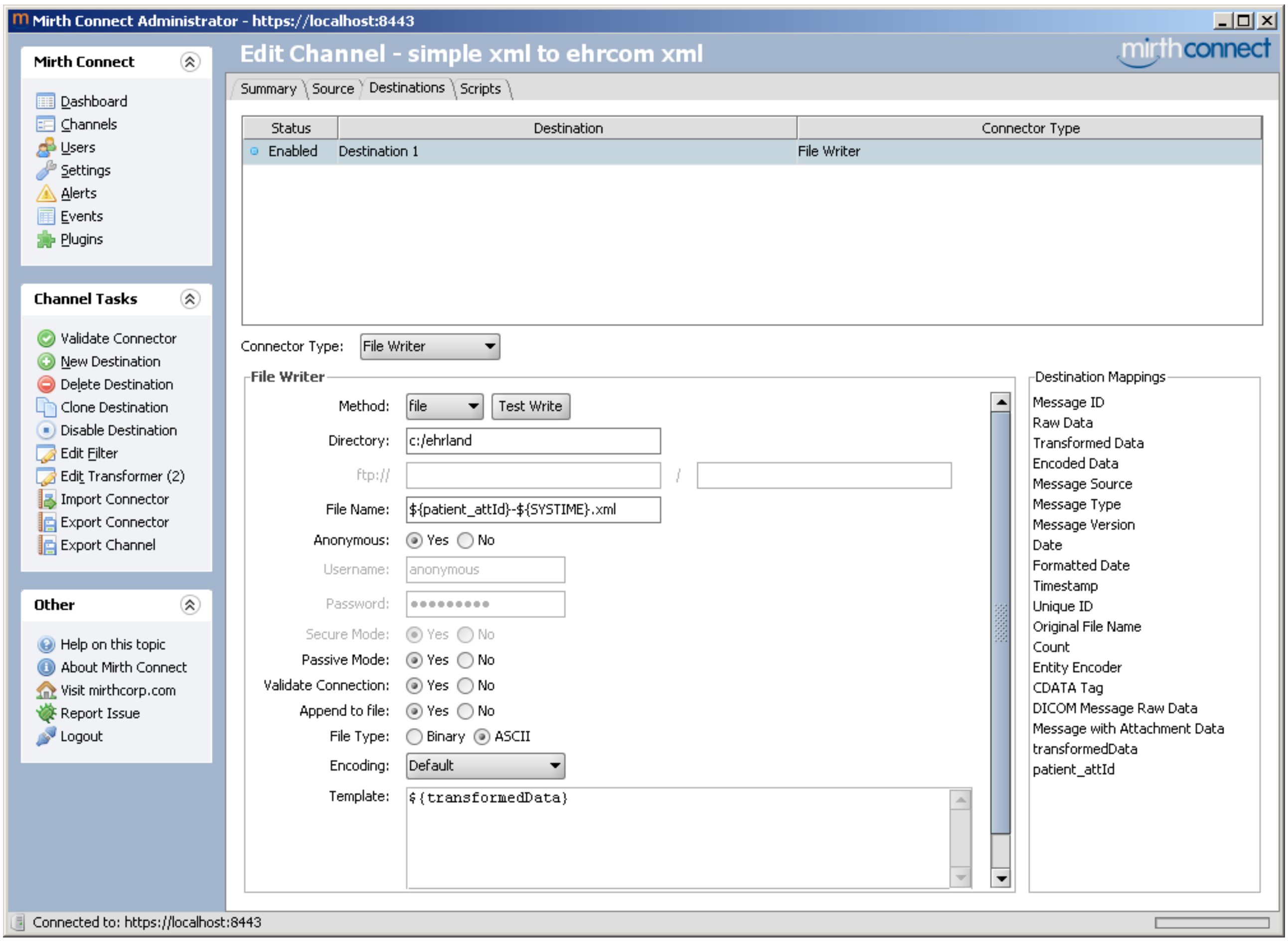
Connector Type: Channel Reader

Channel Reader

This connector has no properties.

Illustration 15: simple xml to EHRCom xml - source

As the channel will write the EN13606-compliant record extract file (with extension .xml) to the c:\ehrland directory, on the **Destinations** tab panel create a new destination (from the **Channel Tasks** menu) of type File Writer. Insert c:/ehrland as the directory. We will fill the other fields once we've created the transformers. You can use the Test Read button to control if Mirth Connect is able to access the directory.



Status	Destination	Connector Type
Enabled	Destination 1	File Writer

Connector Type: File Writer

File Writer

Method: file

Directory: c:/ehrland

ftp://

File Name: ${patient_attId}-${SYSTIME}.xml

Anonymous: ● Yes ○ No

Username: anonymous

Password: ●●●●●●●●●

Secure Mode: ● Yes ○ No

Passive Mode: ● Yes ○ No

Validate Connection: ● Yes ○ No

Append to file: ● Yes ○ No

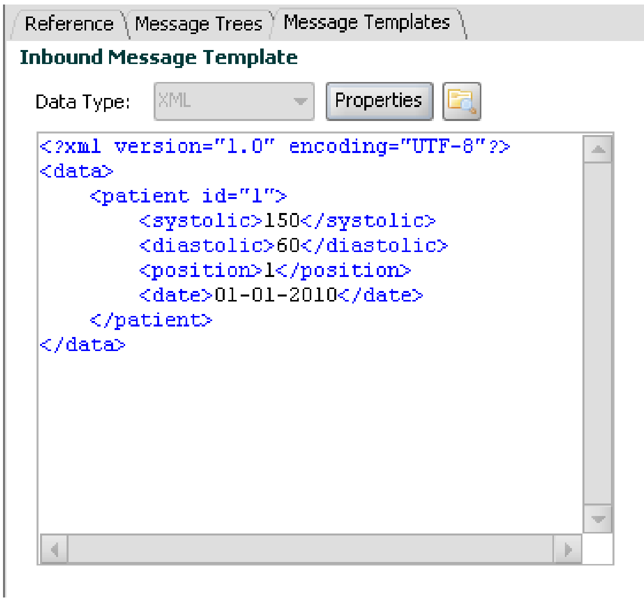
File Type: ○ Binary ● ASCII

Encoding: Default

Template: ${transformedData}

Illustration 16: simple xml to EHRCom xml - destinations

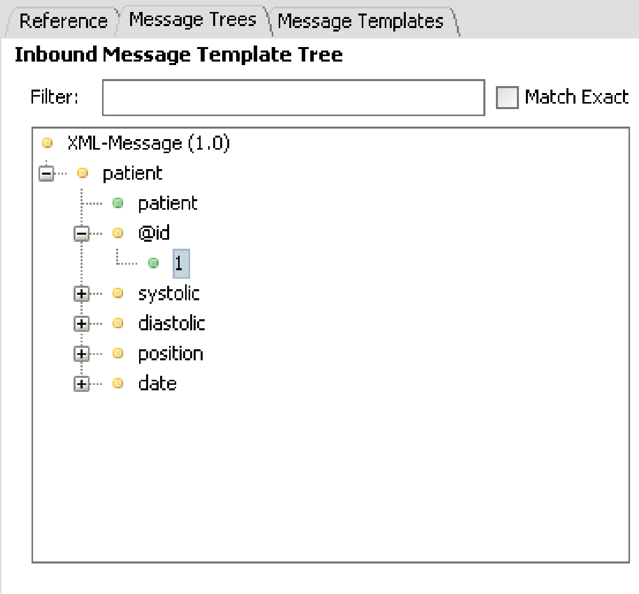
In the **Channel Tasks** menu select **Edit Transformer**. On the right-hand side in the **Message Templates** tab panel, insert a simple xml message as shown in Illustration 17. Mirth Connect will automatically interpret the message and will provide its hierarchical representation in the **Message Trees** tab panel as shown in Illustration 18.



Data Type: XML

```
<?xml version="1.0" encoding="UTF-8"?>
<data>
    <patient id="1">
        <systolic>150</systolic>
        <diastolic>60</diastolic>
        <position>1</position>
        <date>01-01-2010</date>
    </patient>
</data>
```

Illustration 17: XML Message Templates



```
XML-Message (1.0)
patient
    patient
    @id
        1
    systolic
    diastolic
    position
    date
```

Illustration 18: XML Message Trees

In the Transformer Task menu select **Add New Step** of type **Mapper** to be added to the **Channel Map**.

For the patient identifier we can use the **patient_attId** variable name. In the Message Tree pane, drag the child node of the **`@id`** node and drop it into the Mapping section. It should automatically write

```
msg['patient']['@id'].toString()
```

For the transformer handling the data conversion from simple xml to EN13606, as it refers to an external java class, we will need to write the mapping by hand. Create a new step of type **Mapper** to be added to the **Channel Map**.
The external class is called `Converter` from the package `xquery`. On its interface it presents a single function:

```
public static String convert(String in, String file)
```

- The `in` argument represents the simple xml message.
- The `file` argument represents the location of the LinkEHR-produced xquery mapping file.
- The returned value is the converted message (EN13606-compliant record extract).

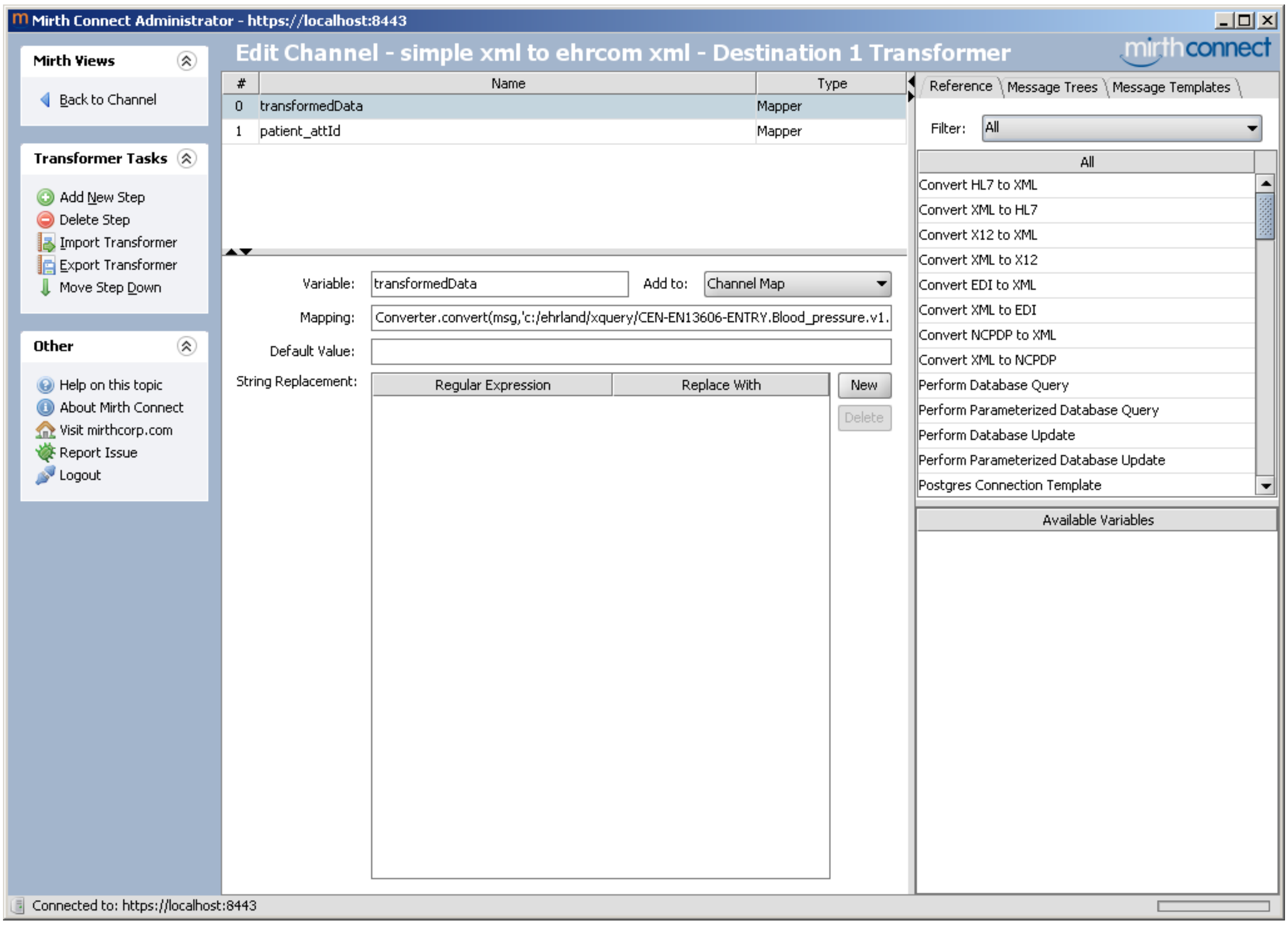
Assuming the xquery mapping file location is c:/ehrland/xquery/CEN-EN13606-ENTRY.Blood_pressure.v1.xquery, and given that the processed message in Mirth Connect can be accessed by calling the `msg` variable, in the Mapping field we should write:

```
Packages.xquery.Converter.convert(msg,'c:/ehrland/xquery/CEN-EN13606-
ENTRY.Blood_pressure.v1.xquery')
```

Here is a summary of the 2 variables:

patient_attId	msg['patient']['@id'].toString()
transformedData	Packages.xquery.Converter.convert(msg,'c:/ehrland/xquery/CEN-EN13606-ENTRY.Blood_pressure.v1.xquery')

The following picture shows the Transformer section after completion of the 2 mapping variables.



Mirth Connect Administrator - https://localhost:8443

Edit Channel - simple xml to ehrcom xml - Destination 1 Transformer

#	Name	Type
0	transformedData	Mapper
1	patient_attId	Mapper

Variable: transformedData

Add to: Channel Map

Mapping: Converter.convert(msg,'c:/ehrland/xquery/CEN-EN13606-ENTRY.Blood_pressure.v1.

Default Value:

String Replacement:

Regular Expression	Replace With

Filter: All

Connected to: https://localhost:8443

Illustration 19: simple xml to EHRCom xml - transformers

We can go back to the Destinations tab panel and fill the remaining fields.

From the **Destination Mappings** section on the bottom-right-hand side of the window, drag the `transformedData` variable and drop it into the **Template** field.

Drag the `patient_attId` variable and drop it into the **File Name** field. Repeat the operation with the `Timetsamp` variable so as to form the file name

```
${patient_attId}-${SYSTIME}.xml
```

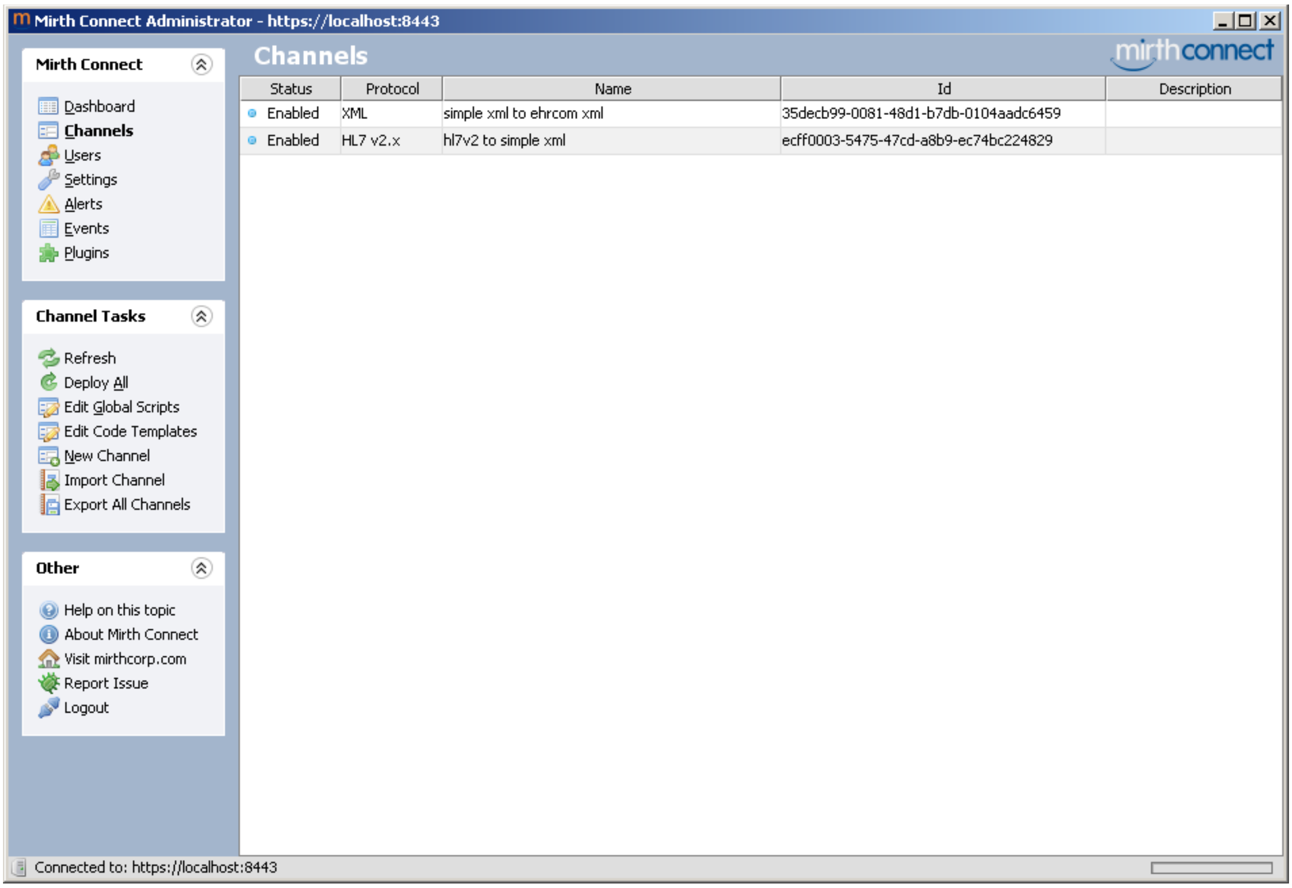
You can save the channel in the **Channel Tasks** menu and go back to the Channel list by clicking **Channels** in the **Mirth Connect** menu.

Select the **HL7v2 to simple xml** channel, go to the **destinations** tab panel and select **simple xml to EHRCom xml** as **Channel Name**. Save the channel in the **Channel Tasks** menu and go back to the Channel list by clicking **Channels** in the **Mirth Connect** menu.

The configuration is complete; we are now ready to deploy the channels.

Deployement

In the **Channels Tasks** menu, select **Deploy All**.

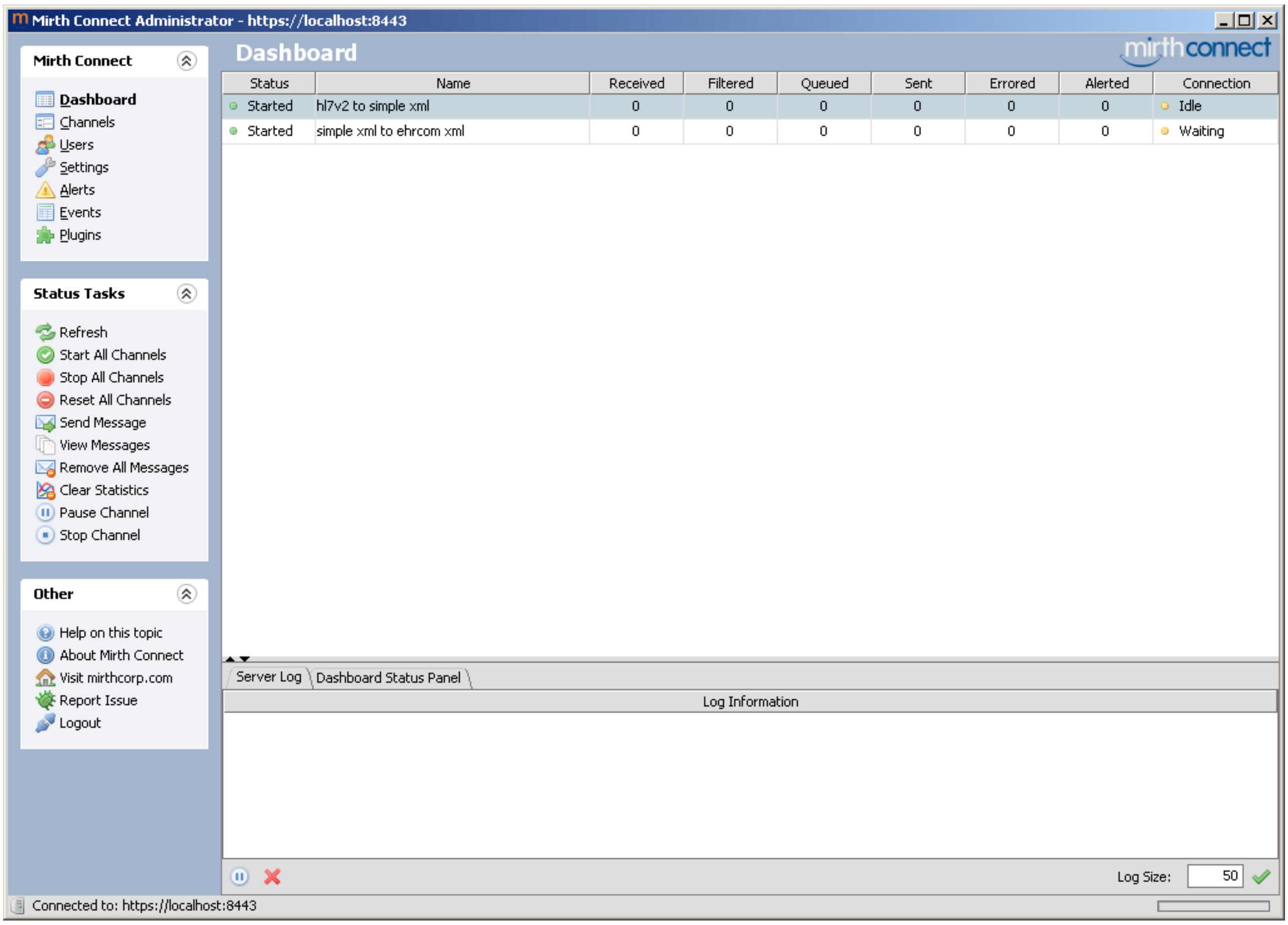


Status	Protocol	Name	Id	Description
Enabled	XML	simple xml to ehrcom xml	35decb99-0081-48d1-b7db-0104aadc6459	
Enabled	HL7 v2.x	hl7v2 to simple xml	ecff0003-5475-47cd-a8b9-ec74bc224829	

Connected to: https://localhost:8443

Illustration 20: Channels

Mirth Connect should switch to the Dashboard and deploy the channels as shown in Illustration 21.

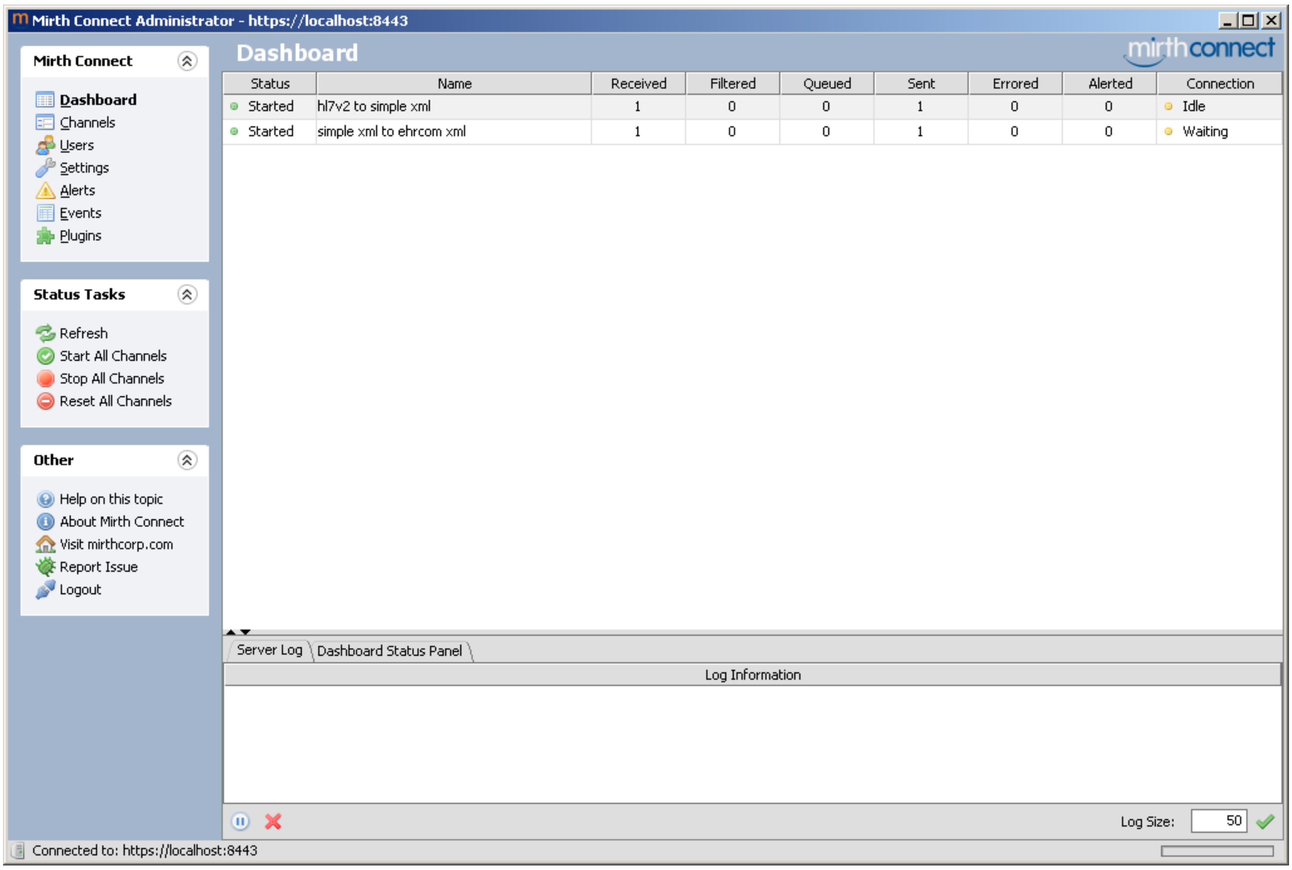


Status	Name	Received	Filtered	Queued	Sent	Errored	Alerted	Connection
● Started	hl7v2 to simple xml	0	0	0	0	0	0	● Idle
● Started	simple xml to ehrcom xml	0	0	0	0	0	0	● Waiting

Illustration 21: Dashboard

Copy an HL7v2 message file with a **.hl7** extension in the c:\ehrland directory . Mirth Connect should detect, process and delete the file after a few seconds, generating an xml file in the same directory. The content of the xml file is an EN13606-compliant record extract containing some of the information of the original HL7 message.

The dashboard should reflect the event by updating the **Received** and **Sent** columns as shown in Illustration 22.

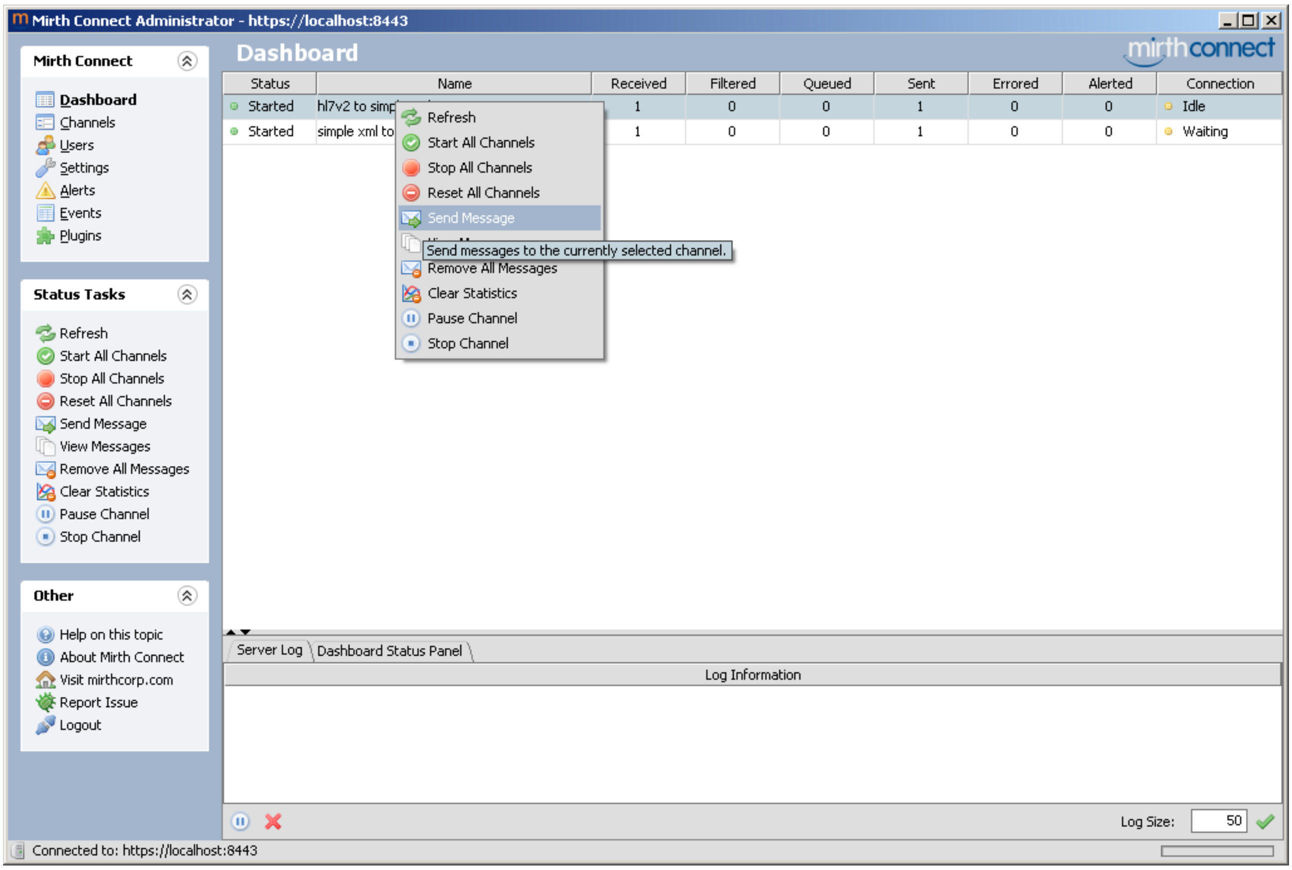


Status	Name	Received	Filtered	Queued	Sent	Errored	Alerted	Connection
● Started	hl7v2 to simple xml	1	0	0	1	0	0	● Idle
● Started	simple xml to ehrcom xml	1	0	0	1	0	0	● Waiting

Connected to: https://localhost:8443

Illustration 22: Dashboard after message processing

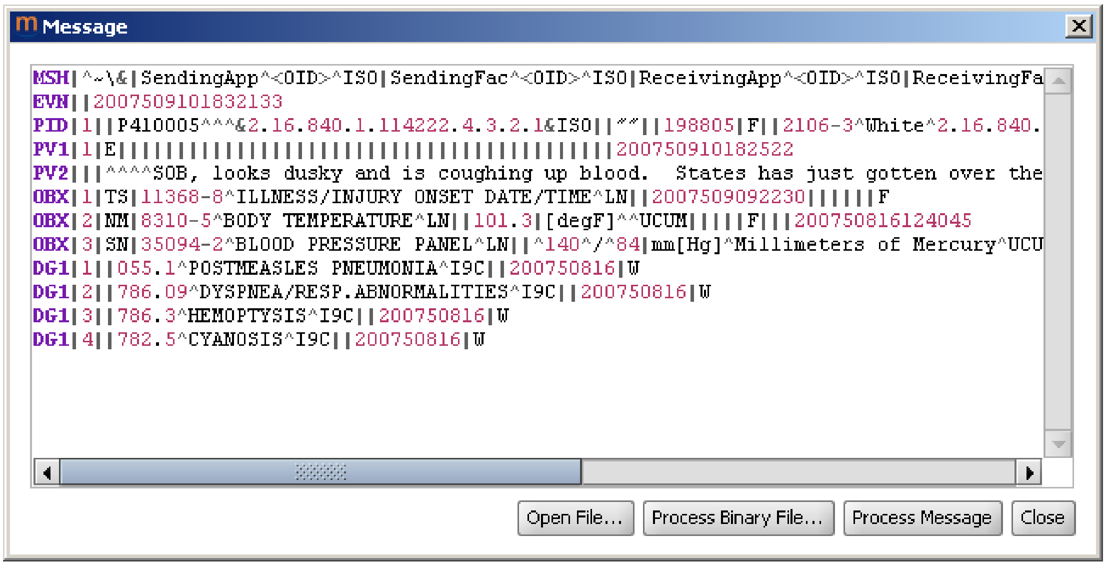
It is also possible to test the channels directly from the Mirth Connect Administrator. From the dashboard select the **HL7v2 to simple xml** channel and in the **Status Tasks** menu select **Send Message**. You can perform the same operation by right-clicking on the channel; the **Status Tasks** menu will be presented as a contextual menu as shown in Illustration 23.



Status	Name	Received	Filtered	Queued	Sent	Errored	Alerted	Connection
Started	hl7v2 to simp	1	0	0	1	0	0	Idle
Started	simple xml to	1	0	0	1	0	0	Waiting

Illustration 23: Status Tasks contextual menu

A Message window will appear. Copy and paste an HL7v2 message into the text area and click the **Process Message** button. The message will bypass the source connector and be processed by the channel as if it was the content of a file with a **.hl7** extension from the c:\ehrland directory.



```
MSH|^~\&|SendingApp^<OID>^ISO|SendingFac^<OID>^ISO|ReceivingApp^<OID>^ISO|ReceivingFa
EVN||2007509101832133
PID|1||P410005^^^&2.16.840.1.114222.4.3.2.1&ISO||“”||198805|F||2106-3^White^2.16.840.
PV1|1|E||||||||||||||||||||||||||||||||||||||||||200750910182522
PV2|||^^^^SOB, looks dusky and is coughing up blood.  States has just gotten over the
OBX|1|TS|11368-8^ILLNESS/INJURY ONSET DATE/TIME^LN||2007509092230||||||F
OBX|2|NM|8310-5^BODY TEMPERATURE^LN||101.3|[degF]^^UCUM|||||F|||200750816124045
OBX|3|SN|35094-2^BLOOD PRESSURE PANEL^LN||^140^/^84|mm[Hg]^Millimeters of Mercury^UCU
DG1|1||055.1^POSTMEASLES PNEUMONIA^I9C||200750816|W
DG1|2||786.09^DYSPNEA/RESP.ABNORMALITIES^I9C||200750816|W
DG1|3||786.3^HEMOPTYSIS^I9C||200750816|W
DG1|4||782.5^CYANOSIS^I9C||200750816|W
```

Illustration 24: Send Message Window