

OpenMRS Radiology Module

OpenMRS Radiology Module is a module adding capabilities of a Radiology Information System (RIS) onto OpenMRS. This module connects the open source enterprise electronic medical record system OpenMRS (<http://www.openmrs.org>) with the open source clinical image and object management system dcm4chee (<http://www.dcm4che.org>).



Project status

OpenMRS Radiology Module is not yet officially released to the OpenMRS modules (<https://modules.openmrs.org>). The API and UI are not yet stable and subject to frequent changes.

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1. Overview

The most important URLs are

- Source code: <https://github.com/openmrs/openmrs-module-radiology>
- Issues: <https://issues.openmrs.org/browse/RAD>
- Wiki: <https://wiki.openmrs.org/display/docs/Radiology+Module>

- Documentation: <http://github.com/teleivo/openmrs-module-radiology-docs>

Host and Port configuration

This guide assumes that your



- OpenMRS installation can be reached at <http://localhost:8080/openmrs/>
- dcm4chee listens to <http://localhost:8081/dcm4chee-web3>

Please adjust the URLs accordingly.

2. Installation

To setup OpenMRS with the OpenMRS Radiology Module and dcm4chee you have two main options

2.1. "Manual"

Follow installation instructions of both projects

- <https://dcm4che.atlassian.net/wiki/display/ee2/Installation>
- <https://wiki.openmrs.org/display/docs/Installing+OpenMRS>

and execute all the necessary steps yourself.

2.2. Devops

Follow

- <https://github.com/teleivo/puppet-openmrs-radiologydcm4chee>

which will do most of the steps for you.



You will need a stable internet connection. The setup is downloading all necessary archives (a few hundred MBs) from different sites that may or may not be responding well in your area. People have reported timeout issues. If this does not work out for you I suggest you go the "manual" route.

3. Deployment

Deployment of the Radiology Module consists of deploying all necessary dependencies and then the module itself into OpenMRS.

You need to login to your OpenMRS instance as administrative user and go to the Administration, Manage Modules page and add the modules shown in the following sections.

3.1. Module Dependencies

The Radiology Module currently depends on the OpenMRS EMRAPI Module (<https://github.com/openmrs/openmrs-module-emrapi>) version 1.13 which itself has a bunch of dependencies.

You can get the dependencies at OpenMRS modules (<https://modules.openmrs.org>).

The following list is a suggested order in which we have managed to successfully deploy the necessary dependencies:

1. providermanagement - version 2.3
2. uiframework - version 3.4
3. uilibrary - version 1.5
4. emrapi - version 1.13
5. event - version 2.2.1
6. reporting - version 0.9.8.1
7. htmlwidgets - version 1.7.0
8. calculation - version 1.1
9. serialization.xstream - version 0.2.9
10. metadatasharing - version 1.1.9
11. metadatamapping - version 1.0.1



Do not worry about alerts you might get due to a modules dependencies not being met. Just go ahead and deploy its dependencies and hit the start button of the module which created the alert. You might also be

able to add newer versions of the modules listed here.

3.2. Module Package

Since there has not been an official release yet you need to compile the Radiology Module yourself.

Please follow the instructions at <https://github.com/openmrs/openmrs-module-radiology>.

4. Configuration

At this point I expect you to have OpenMRS 1.11.4 installed, OpenMRS Radiology Module deployed and dcm4chee up and running.

Whats missing is the connection (DICOM, HL7) between OpenMRS Radiology Module and the dcm4chee PACS and the setup of the DICOM web viewer in the PACS.

4.1. OpenMRS Radiology Module

Follow the steps as shown to finish configuration of the OpenMRS Radiology Module.

4.1.1. Radiology Concept Classes

Before you can start to enter radiology orders you need to define the orderable procedures within your facility.

To do that you need to go to the Administration, Settings page and select "Radiology" in the menu on the left side.

The setting that needs to be specified is called "Radiology Concept Classes" as shown below

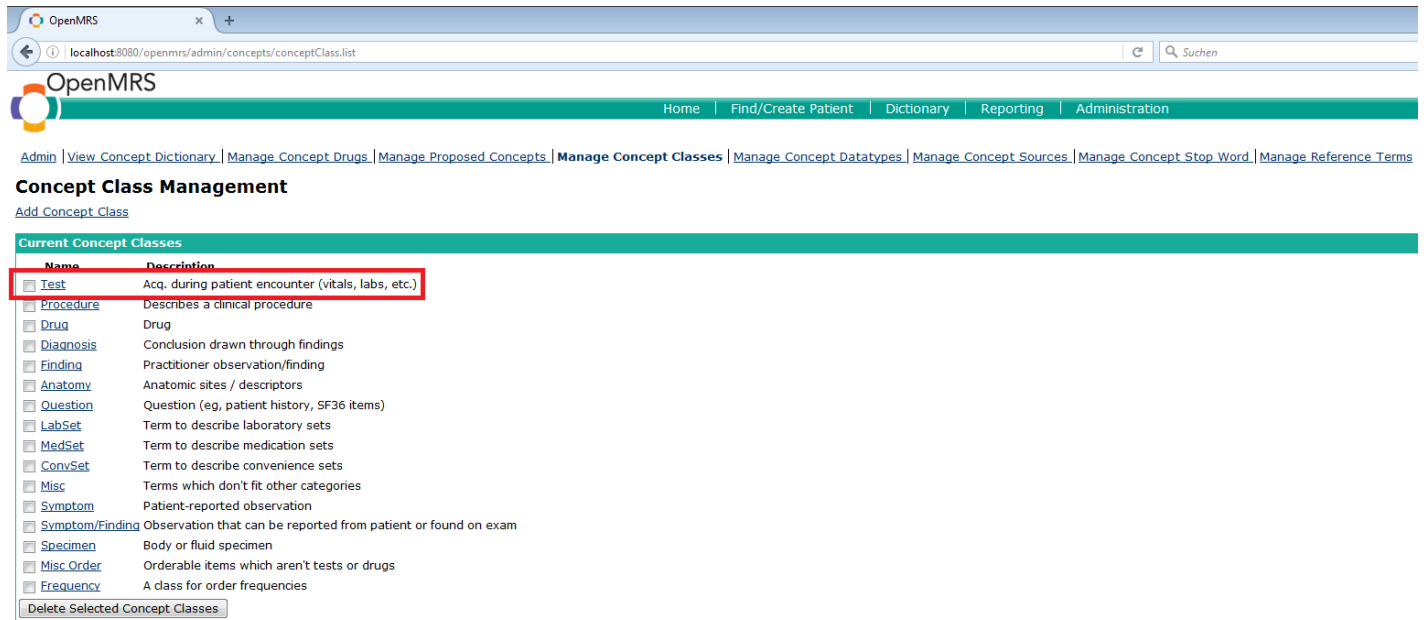
The screenshot shows the OpenMRS Settings page. On the left is a navigation menu with 'Settings' selected. The main content area is titled 'Settings' and contains various configuration options. The 'Radiology Care Setting' section is expanded, showing a list of 'Radiology Concept Classes'. The first entry in this list is highlighted with a red box and contains the UUID: 194b8a0d-3520-48f2-bab4-77f2d450e5c7. Other UUIDs visible include 13fc9b4a-49ed-429c-9d6e-ca003b387a3d, dbdb9a9b-56ea-11e3-a47f-08002719a237, and fe898a34-1ade-11e1-9c71-00248140a5eb.

You can enter any list of OpenMRS concept class UUIDs.

Its easy to find these UUIDs via "Manage Concept Classes" link in the admin page

The screenshot shows the OpenMRS Administration page. The 'Administration' menu is selected, and the 'Concepts' section is expanded. The 'Manage Concept Classes' link is highlighted with a red box. Other links in the 'Concepts' section include 'View Concept Dictionary', 'Manage Concept Drugs', 'Manage Proposed Concepts', 'Manage Concept Sources', 'Manage Concept Stop Word', and 'Manage Reference Terms'. The page also shows other administrative sections like 'Users', 'Patients', 'Person', 'Visits', 'Encounters', 'Providers', 'Locations', 'Observations', 'Scheduler', 'Programs', 'Modules', 'Calculation Module', 'Metadata Mapping', 'Metadata Sharing', 'Manage Report Definitions', 'Analysis & Reporting', 'Provider Management Module', 'REST Web Services', and 'Radiology Module'.

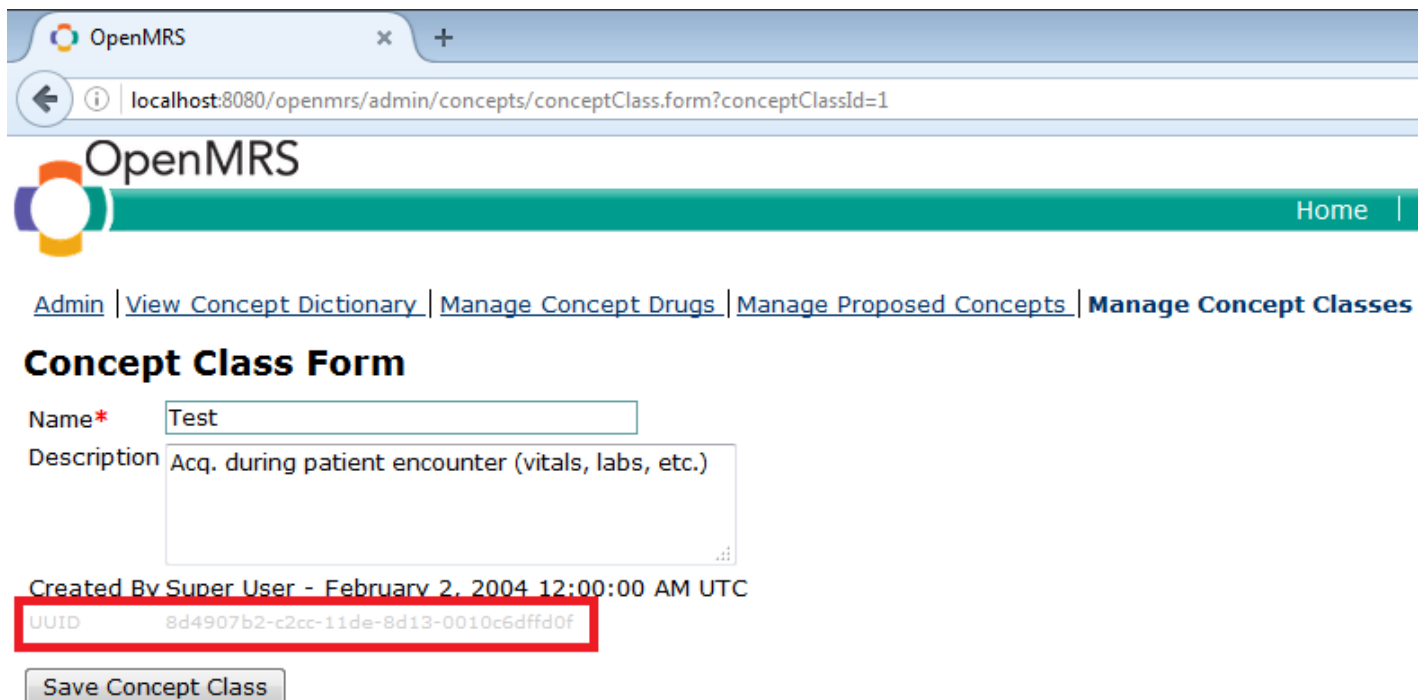
Click on any concept class you wish to configure, for example "Test"



The screenshot shows the OpenMRS web interface. At the top, there's a navigation bar with links for Home, Find/Create Patient, Dictionary, Reporting, and Administration. Below that, a breadcrumb trail includes Admin, View Concept Dictionary, Manage Concept Drugs, Manage Proposed Concepts, and Manage Concept Classes. The main heading is "Concept Class Management" with a sub-link "Add Concept Class". A table titled "Current Concept Classes" lists various categories. The "Test" class is highlighted with a red box. At the bottom of the table, the "Delete Selected Concept Classes" button is visible.

Name	Description
<input checked="" type="checkbox"/> Test	Acq. during patient encounter (vitals, labs, etc.)
<input type="checkbox"/> Procedure	Describes a clinical procedure
<input type="checkbox"/> Drug	Drug
<input type="checkbox"/> Diagnosis	Conclusion drawn through findings
<input type="checkbox"/> Finding	Practitioner observation/finding
<input type="checkbox"/> Anatomy	Anatomic sites / descriptors
<input type="checkbox"/> Question	Question (eg, patient history, SF36 items)
<input type="checkbox"/> LabSet	Term to describe laboratory sets
<input type="checkbox"/> MedSet	Term to describe medication sets
<input type="checkbox"/> ConvSet	Term to describe convenience sets
<input type="checkbox"/> Misc	Terms which don't fit other categories
<input type="checkbox"/> Symptom	Patient-reported observation
<input type="checkbox"/> Symptom/Finding	Observation that can be reported from patient or found on exam
<input type="checkbox"/> Specimen	Body or fluid specimen
<input type="checkbox"/> Misc Order	Orderable items which aren't tests or drugs
<input type="checkbox"/> Frequency	A class for order frequencies

And copy the UUID you see greyed out at the bottom



The screenshot shows the "Concept Class Form" in OpenMRS. The "Name" field contains "Test" and the "Description" field contains "Acq. during patient encounter (vitals, labs, etc.)". Below the form, it shows "Created By Super User - February 2, 2004 12:00:00 AM UTC". The "UUID" field, which is greyed out, contains the value "8d4907b2-c2cc-11de-8d13-0010c6dffd0f" and is highlighted with a red box. A "Save Concept Class" button is at the bottom.

Paste this concept class UUIDs into the "Radiology Concept Classes" settings field and hit "Save".

4.2. Dcm4chee

Follow all the steps exactly as shown in the images to configure the connection between the OpenMRS Radiology Module and dcm4chee and to setup the DICOM web viewer weasis in dcm4chee.

Go to <http://localhost:8081/jmx-console/> (<http://localhost:8081/jmx-console/>) and login as default admin user

- username: admin
- password: admin

4.2.1. Setup Weasis

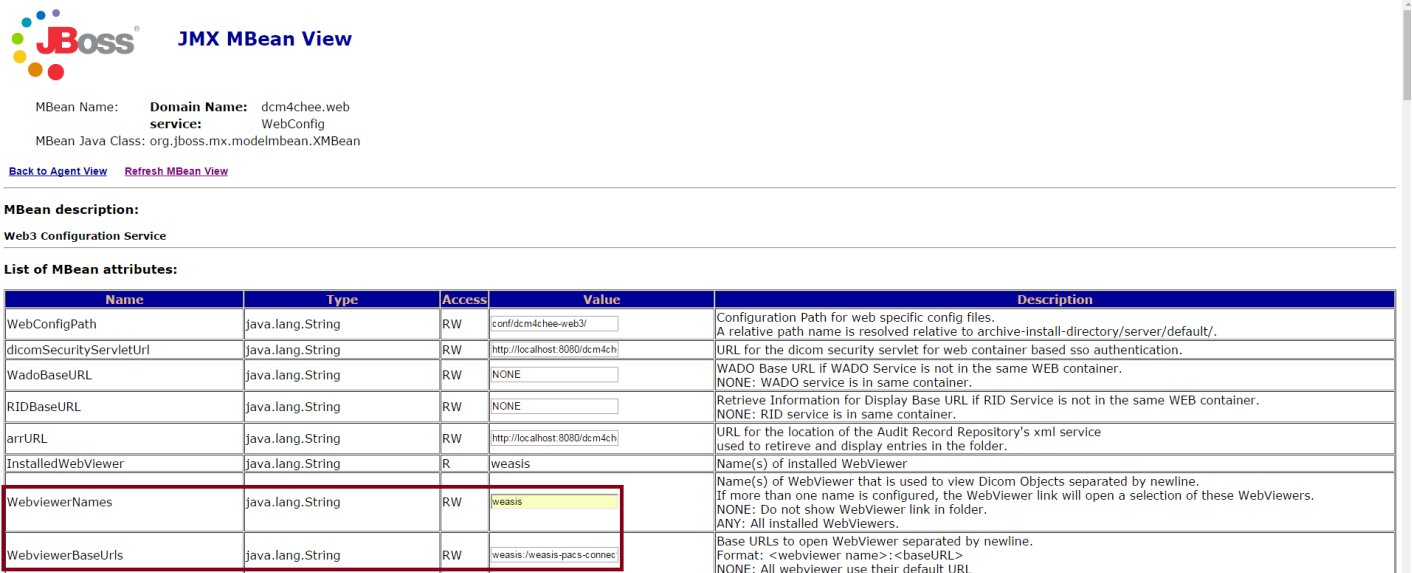
To configure weasis as the DICOM web viewer used by dcm4chee go to section **dcm4chee.web service=WebConfig**

(<http://localhost:8081/jmx-console/HtmlAdaptor?>

[action=inspectMBean&name=dcm4chee.web%3AService%3DWebConfig](http://localhost:8081/jmx-console/HtmlAdaptor?action=inspectMBean&name=dcm4chee.web%3AService%3DWebConfig))

and set

- WebviewerNames: weasis
- WebviewerBaseUrls: weasis:/weasis-pacs-connector/viewer



JBoss JMX MBean View

MBean Name: **Domain Name:** dcm4chee.web
service: WebConfig
MBean Java Class: org.jboss.mx.model.mbean.XMBean

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MBean description:
Web3 Configuration Service

List of MBean attributes:

Name	Type	Access	Value	Description
WebConfigPath	java.lang.String	RW	<input type="text" value="conf/dcm4chee-web3/"/>	Configuration Path for web specific config files. A relative path name is resolved relative to archive-install-directory/server/default/.
dicomSecurityServletUrl	java.lang.String	RW	<input type="text" value="http://localhost:8080/dcm4ch"/>	URL for the dicom security servlet for web container based sso authentication.
WadoBaseURL	java.lang.String	RW	<input type="text" value="NONE"/>	WADO Base URL if WADO Service is not in the same WEB container. NONE: WADO service is in same container.
RIDBaseURL	java.lang.String	RW	<input type="text" value="NONE"/>	Retrieve Information for Display Base URL if RID Service is not in the same WEB container. NONE: RID service is in same container.
arrURL	java.lang.String	RW	<input type="text" value="http://localhost:8080/dcm4ch"/>	URL for the location of the Audit Record Repository's xml service used to retrieve and display entries in the folder.
InstalledWebViewer	java.lang.String	R	<input type="text" value="weasis"/>	Name(s) of installed WebViewer
WebviewerNames	java.lang.String	RW	<input type="text" value="weasis"/>	Name(s) of WebViewer that is used to view Dicom Objects separated by newline. If more than one name is configured, the WebViewer link will open a selection of these WebViewers. NONE: Do not show WebViewer link in folder. ANY: All installed WebViewers.
WebviewerBaseUrls	java.lang.String	RW	<input type="text" value="weasis/weasis-pacs-connec"/>	Base URLs to open WebViewer separated by newline. Format: <webviewer name>:<baseURL> NONE: All webviewer use their default URL

4.2.2. Setup Connection With OpenMRS Radiology Module

To connect the OpenMRS radiology module with dcm4chee you need to

4.2.3. Add New AET

Add the radiology module as DICOM Application Entity at

<http://localhost:8081/dcm4chee-web3/> (<http://localhost:8081/dcm4chee-web3/>) under the tab

Application Entities

Title	Type	Host	Port	Description	TLS	MPPS	Station name	Institution	Department
CDRECORD		localhost	10104	Media Creation Server (part of dcm4chee)	<input type="checkbox"/>	<input type="checkbox"/>			
DCM4CHEE		localhost	11112	This dcm4chee archive instance	<input type="checkbox"/>	<input type="checkbox"/>			

Select **New AET** and enter:

- Title: RADIOLOGY_MODULE
- Type: -
- Hostname: localhost
- Port: 11114
- Description (optional): OpenMRS Radiology Module
- Installed (optional): enable

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Edit AET

Title:

Type:

Hostname:

Port:

Ciphersuite #1:

Ciphersuite #2:

Ciphersuite #3:

Description:

Issuer of Patient ID:

Issuer of Accession Number:

Filesystem Group ID:

Wado URL:

User Id:

Password:

Station Name:

Institution:

Department:

Installed:

Emulate MPPS:

4.2.4. Setup DICOM MPPS Forwarding

To configure DICOM MPPS message forwarding to the OpenMRS radiology module go to section **dcm4chee.archive service=MPPSScu** (<http://localhost:8081/jmx-console/HtmlAdaptor?action=inspectMBean&name=dcm4chee.archive%3AService%3DMPPSScu>) and set

- ForwardingRules: [calling!=RADIOLOGY_MODULE]RADIOLOGY_MODULE



MBean Name: **Domain Name:** dcm4chee.archive
service: MPPSScu
 MBean Java Class: org.jboss.mx.modelmbean.XMBean

[Back to Agent View](#) [Refresh MBean View](#)

MBean description:

DICOM Modality Performed Procedure Step SCU Service. Used to forward MPPS messages received by the MPPS SCP Service.

List of MBean attributes:

Name	Type	Access	Value	Description
Name	java.lang.String	R	MPPSScuService	The class name of the MBean
State	int	R	3	The status of the MBean
StateString	java.lang.String	R	Started	The status of the MBean in text form
AcceptTimeout	int	RW	30000	A-Associate accept timeout in milliseconds. 0 = no timeout.
DIMSETimeout	int	RW	1200000	DIMSE message timeout in ms. 0 = no timeout.
SocketCloseDelay	int	RW	50	Socket close delay in milliseconds after an A-Release response.
MaximumPDULength	int	RW	16382	Maximum protocol data unit (PDU) package length for receiving PDUs.
TcpNoDelay	boolean	RW	<input checked="" type="radio"/> True <input type="radio"/> False	Send packets as quickly as possible (Disable Nagle algorithm).
SendBufferSize	int	RW	0	Buffer size used for socket output. 0 = use platform default.
ReceiveBufferSize	int	RW	0	Buffer size used for socket input. 0 = use platform default.
TLSConfigName	javax.management.ObjectName	RW	dcm4chee.archive:service=T View MBean	Used internally. Do NOT modify.
ForwardingRules	java.lang.String	RW	[calling!=RADIOLOGY_MODULE]RADIOLOGY_MODULE	List of forwarding rules, dependent upon which application - identified by the Calling AE title - sent the MPPS. The comma separated list of AE titles after the (optional) condition defines the forwarding destination (the other MPPS SCP) by its Called AE title. Syntax: rules = (rule { newline rule } 'NONE') (* 'NONE' = no forwarding *) rule = ['[' calling' '[' ! ']' '=' from ']'] to from = aet { '[' aet } (* calling AE titles *) to = aet { ',' aet } (* destination AE titles *) Example: [calling!=ORDER_FILLER]ORDER_FILLER => Forwards received MPPS to ORDER_FILLER, except MPPS received from ORDER_FILLER

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