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MedBroker
A DICOM and HL7 Integration Product

Whitepaper

Revision 1.0 Oct 19 2009

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Overview

MedBroker™ allows Healthcare products to be integrated using industry standards such as DICOM, HL7 and CCOW, as well as proprietary vendor APIs.

This white paper focuses on the DICOM and HL7 aspects of the product suite.

About DICOM and HL7

DICOM (Digital Imaging and Communications in Medicine) is a widely adopted standard that enables integration and exchange of information in medical imaging. It defines network protocols, file formats and data definitions to ensure seamless interaction between equipment and software from various vendors.

HL7 is a standard for exchanging text oriented data in the health care sector. While DICOM handles exchange of imaging artifacts, HL7 defines the exchange of patient information and radiological data.

IHE is a neutral forum that defines integration profiles and guidelines on top of existing standards. For instance, it defines which DICOM tags are queryable in certain settings.

Open source products

MedBroker builds on top of renowned and widely deployed open source products, such as dcm4chee and Mirth Connect. These are robust systems that provide the extensibility needed to adapt MedBroker to a wide range of integration scenarios.

These open source products, and MedBroker itself, are written in Java and is thus available on a wide range of platforms.

Dcm4chee

Dcm4chee is a fully compliant implementation of the DICOM standard, and is a corner stone in the MedBroker architecture. Features include:

- DICOM Query/Retrieve services, such as work lists.

- MPPS, GPWL, MWL, Storage Commitment, Instance Availability Notification, Study Content Notification, Output Content to CD Media and Hanging Protocols.

- A web based administration tool.

- Archiving (PACS).

- An HL7 gateway. This is the integration point of Mirth Connect.

The various modules in dcm4chee are depicted below:
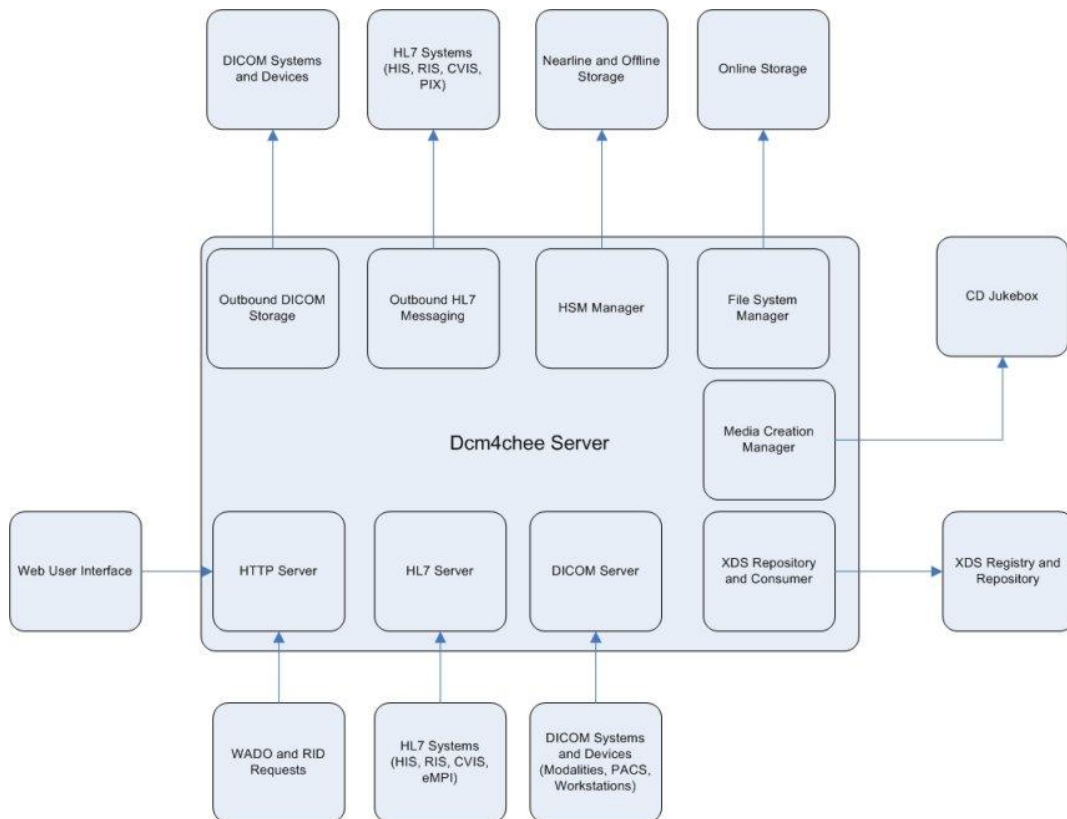
For more detailed information about dcm4chee and DICOM, please see http://www.dcm4che.org/.

Mirth Connect

Mirth Connect is an open source integration engine for the healthcare industry. Using standards and technologies such as HL7, XML and DICOM, messages can be routed, filtered and transformed in various ways.

As illustrated below, Mirth Connect relies on the concept of Source and Destination systems. For instance, a source system may be a database containing appointments. A destination system may be an HL7 gateway in a DICOM server or an XML file on a network disk. Each source/destination pair is defined by a *channel*. The *message* sent on a channel may be used to create work lists, update patient information, and so on.

For more advanced needs, Mirth Connect allows a channel to contain Javascript code. This feature is used by MedBroker to implement formatting and filtering requirements.
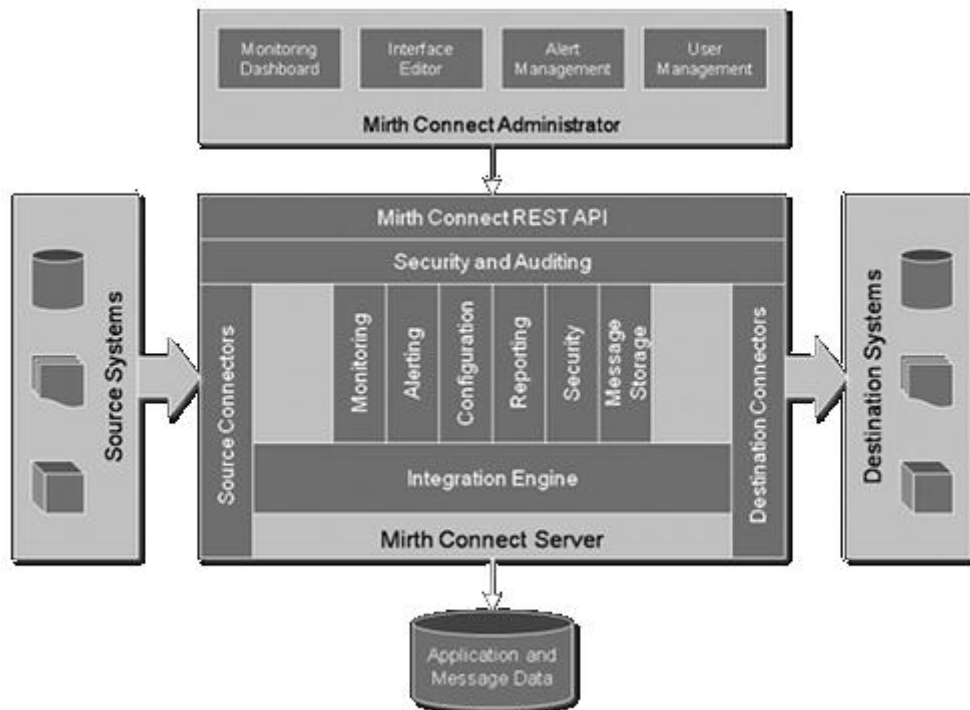
More information about Mirth Connect is available at http://mirthproject.org.

Extensions

Management Console

It is important to get real-time information about the operation of a Healthcare application. While dcm4chee and Mirth Connect offer some tools for monitoring their status, accessing these tools individually is cumbersome. To address this issue, the MedBroker Management Console was developed.

As illustrated above, the console provides maintenance personnel with a quick status of channels, work lists and any errors that might have occurred. In addition, the user is given direct access to the underlying tools and logs.

Automatic Deletion of Work lists

In most cases, work lists only needs to be stored for a limited period of time. To reduce the effort required in keeping the DICOM database small and fast, obsolete work list items can be automatically removed. MedBroker solves this using a JMX extension to dcm4chee.

DICOM Query Library

Mirth Connect does not provide a DICOM source connector, but MedBroker adds this capability through a Java library that can be used from a Javascript source connector.

The purpose of this addition is to enable re-routing of work lists from one DICOM server to another DICOM server (including, but not limited to MedBroker), as well as merging of work lists.

Monitoring facilities

KeyWatch is an open source monitoring system that allows plugins to be added for specific monitoring needs. To help monitor the operation of MedBroker automatically, a plugin that monitors the DICOM server and the Mirth Connect channels was developed. For more information about KeyWatch, please see http://www.keywatch.org.

Case Study: Norwegian Breast Cancer Screening Program

Setup

The Norwegian Breast Cancer Screening Program (NBCSP) is a national screening effort, with screening centers across the country. To increase coverage, several mammography busses are deployed as well.

To serve the screening centers, a centralized MedBroker is installed at the Cancer Registry. But this does not work for busses as they are not always online. As a result, each bus has its own MedBroker installation as well as a periodically replicated database containing the appointments.

The illustration below depicts the main constituents in the solution.
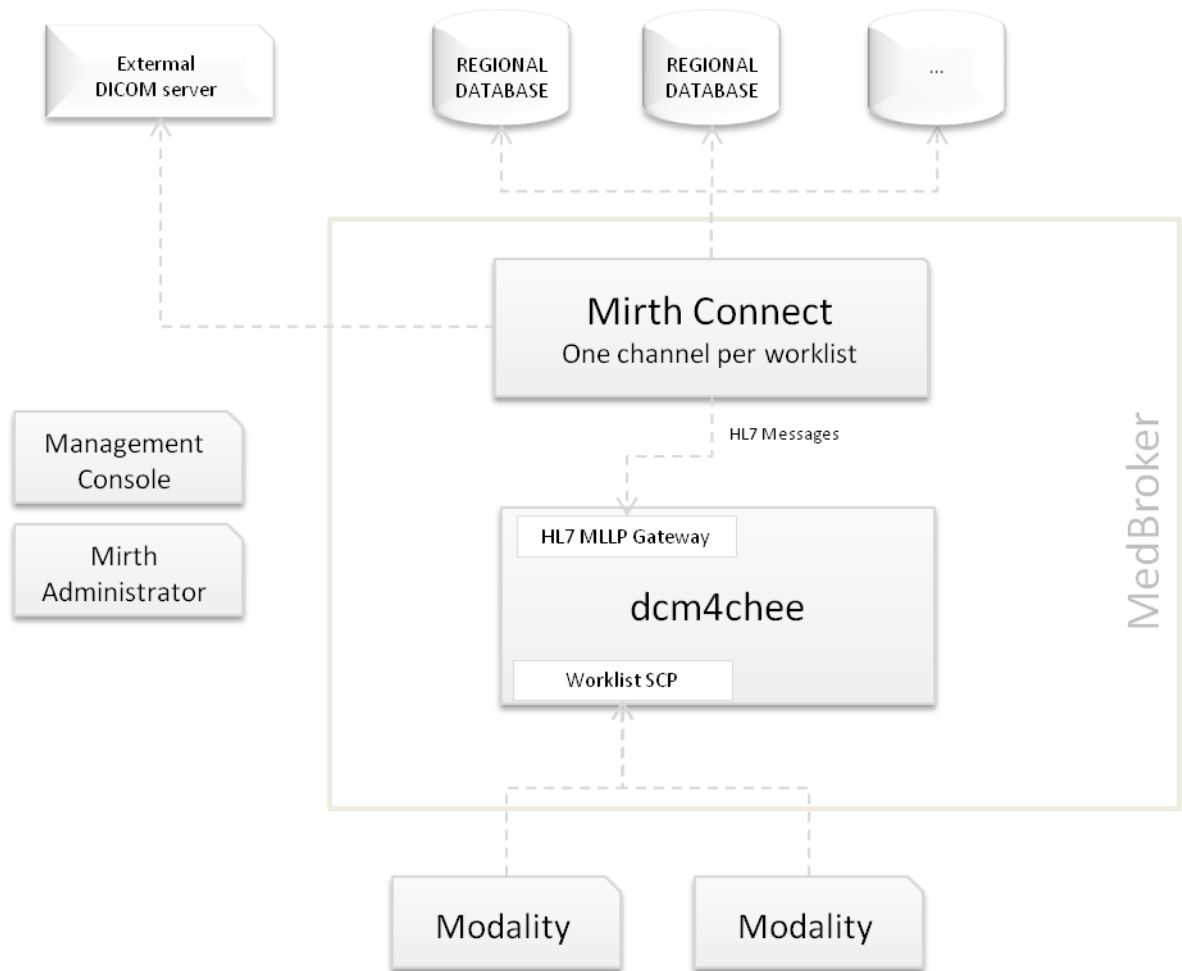
Adding work lists for a region

When a diagnostic center requests the need for DICOM work lists based on appointments in the screening project, MedBroker is utilized to quickly get this into place. Typically, the following steps are taken:

- A new Mirth Connect channel is created. This channel is set up to query the respective regional database for appointments. If the site has special needs due to PACS or Modality requirements, support for this is added as well. One such example is the content and format of patient IDs.

- The modalities at the center are configured to access the MedBroker server.

- The implied networks and firewalls are set up and configured appropriately.

Adding a new site in MedBroker is thus a fairly simple process, and the result is easily verifiable.

Supporting scanning projects

In addition to providing work lists for the day-to-day screening operation, MedBroker is used to simplify the process of scanning existing films. This is

accomplished by setting up channels that query historical appointments and makes these available as DICOM work lists.

Study conclusion

The Norwegian Breast Cancer Screening Program requires continued operation of all systems involved in the daily operation. It is also imperative that new requirements can be accommodated quickly, and that that the systems involved provide good performance and is able to scale as the screening project grows.

MedBroker and its constituent open source products have proven to meet these goals through a robust implementation of the DICOM and HL7 standards. The extensions implemented by MedBroker have met the additional requirements and provided the necessary monitoring tools.

About Keymind Computing

Keymind Computing AS, founded in 1998, is an IT company building innovative products and solutions for the Health Care business. We also offer operational services and we are today operating nation wide IT solutions.

We work in close partnership with our customers helping them to run their business better and to achieve their business goals. We have established relations to leading vendors of Mammography equipment and we offer technology to integrate their products with the hospital's RIS systems.

Reference Customer

One of our main customers is the Breast Cancer Screening programme conducted by the Cancer Registry of Norway. In close cooperation with the customer we have developed a nationwide IT infrastructure containing applications running on a number of regional servers as well as centralized servers with consolidated databases. Keymind Computing is also in charge of the daily operation of this infrastructure.