JUDCon

JBoss Users & Developers Conference

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Using the JBoss ESB in the Implementation of a Standards Compliant Health Information Exchange

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Health Information Exchange

- The Problem
- The Solution
- What's Next

Health Information Exchange
The Problem

Hartford HealthCare ("HHC") aspires to be the next generation of integrated health systems, marked by strong patient focus, heightened efficiency, consistent quality performance and open, collaborative sharing of best practices. It is dedicated to providing patients with an exceptional, coordinated care experience and a single, high standard of service. A hallmark of HHC's vision is to strengthen access to care close to home for patients by enhancing local healthcare delivery capabilities. In addition, HHC aims to create a culture and organizational structure where clinical care, education and research are supported to bring the latest technology and discoveries, clinical excellence and innovation to the patient and community.

Hartford HealthCare

Health Information Exchange
The Problem

HHC's partners include a tertiary care teaching hospital, three community hospitals, two regional behavior health centers, a statewide clinical laboratory operation, a large primary care physician practice group, a regional home care system and a physical therapy and rehabilitation network.

The Hospital of Central Connecticut
A Hartford HealthCare Partner

Windham Hospital
A Hartford HealthCare Partner

Eastern Rehabilitation Network
A Hartford HealthCare Partner

MidState Medical Center
A Hartford HealthCare Partner

Hartford Hospital
A Hartford HealthCare Partner

Natchaug Hospital
A Hartford HealthCare Partner

Alliance Occupational Health
A member of the Central Connecticut Health Alliance

Rushford
A Hartford HealthCare Partner

Connecticut Center for Healthy Aging

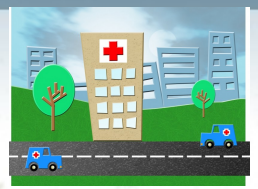
Clinical Laboratory Partners

Hartford Specialists
A Hartford HealthCare Partner

VNA HealthCare
A Hartford HealthCare Partner

MidState Medical Group
A Hartford HealthCare Partner

Hartford Medical Group
A Hartford HealthCare Partner



Other Hospitals

emdeon

Emdeon

HHC Network

CT HIE
NwHIN

HHC Network

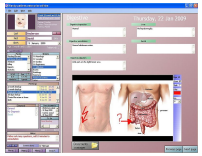
HHC Network

HHC
HIE

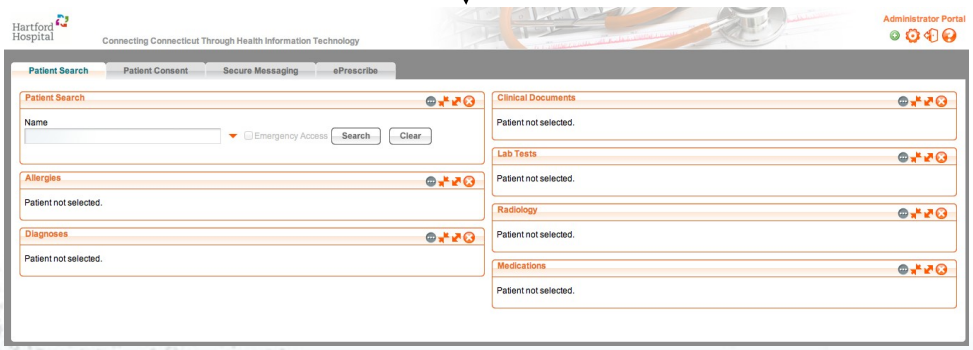
Allscripts
Enterprise

Allscripts
MyWay

Other EHR's



Other EHRs



Provider GUI

Health Information Exchange
The Solution - IHE

- Integrating the Healthcare Enterprise (IHE) Based Document Exchange
- JBoss ESB to implement bridge to the Health Information Exchange (IHE)

Health Information Exchange
The Solution - IHE

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 need 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.

Health Information Exchange The Solution - IHE

IHE International is composed of the 510 member organizations from around the world

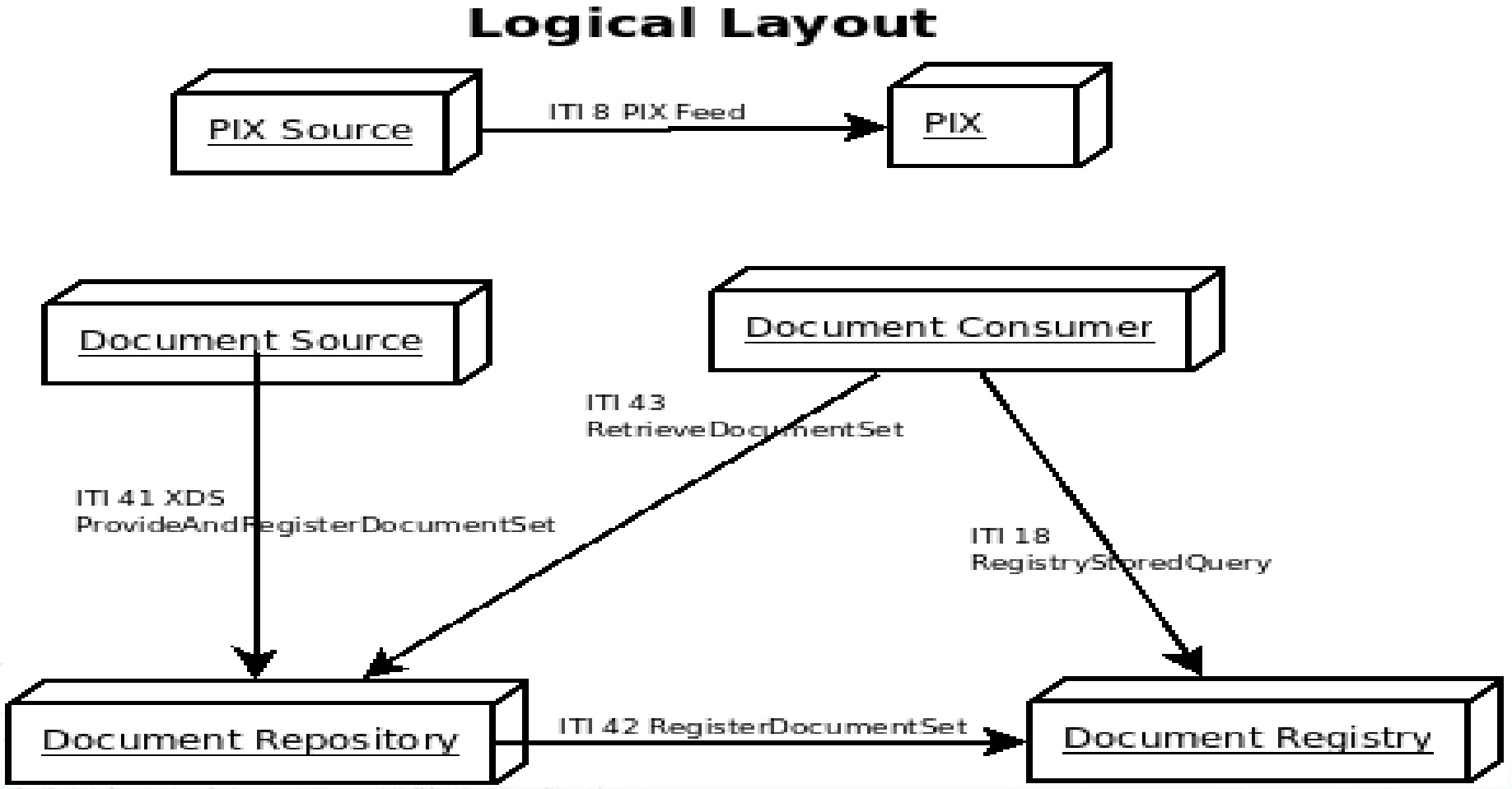
- Healthcare Professional Associations (64)
- Healthcare Education and Research Organizations (32)
- Trade Associations (9)
- Healthcare IT and Consulting Companies (383)
- Government Agencies and Public-Private Partnerships (19)
- Standards Organizations (7)
- Health Information Exchanges (3)
- Healthcare Provider Organizations (21)

Health Information Exchange
The Solution - IHE

IHE Domains

- Anatomic Pathology
- Cardiology
- Eye Care
- IT Infrastructure
- Laboratory
- Patient Care Coordination
- Patient Care Devices
- Quality, Research and Public Health
- Radiation Oncology
- Radiology

Health Information Exchange
The Solution - IHE



Health Information Exchange The Solution - IHE

IHE Technical Framework Actors

- Audit Trail and Node Authentication - Basic security through (a) functional access controls, (b) defined security audit logging and (c) secure network communications.
- Basic Patient Privacy Consents - method for recording a patient's privacy consent acknowledgment to be used for enforcing basic privacy appropriate to the use.
- Consistent Time - enables system clocks and time stamps of computers in a network to be synchronized (median error less than 1 second).
- Cross Enterprise Document - Share and discover electronic health record documents between healthcare enterprises, physician offices, clinics, acute care in-patient facilities and personal health records.

Health Information Exchange The Solution - IHE

Standards used in IHE Actors

- HL7 – Health level 7 messaging standards for message transmission protocols and message content. Both version 2 and 3 standards are used.
- CDA – The clinical document architecture is an XML-based markup standard intended to specify the encoding, structure and semantics of clinical documents for exchange.
- Web Services standards around digital signatures, MTOM, and more
- ebXML
- etc ...

Health Information Exchange
The Solution - CDA

CDA Documents

- An XML document consisting of a header and a body
- The header identifies the patient, provider, document type, etc.
- The body has a mandatory human-readable part + an optional encoded part.
- The human-readable part is attested and contains the complete content.
- Either XML or any MIME encoded BLOB e.g. *.doc, *.pdf, *.tif
- The encoded portion, if present, can always be safely ignored by recipients unable to process it.
- HL7 version 3 Reference Implementation Model (RIM) is used extensively in the encoded part.

Health Information Exchange The Solution - CDA

CDA Documents

- *Level I* – The unconstrained CDA specification (CDA header with body that may contain text, pdf, etc..)
- *Level II* – The CDA specification with section-level templates applied (CDA header with and XML body containing human readable information)
- *Level III* – The CDA specification with entry-level templates applied (CDA header, human readable section in XML format, and additional elements in XML format with encoded information for the section they are part of). This is the “machine” readable level capable of representing information at a concept level. HL7 RIM used for entry coding.

Health Information Exchange
The Solution - HL7

HL7v3 RIM

Health Information Exchange
The Solution - CDA

CDA Document Example

Health Information Exchange The Solution - MOSS

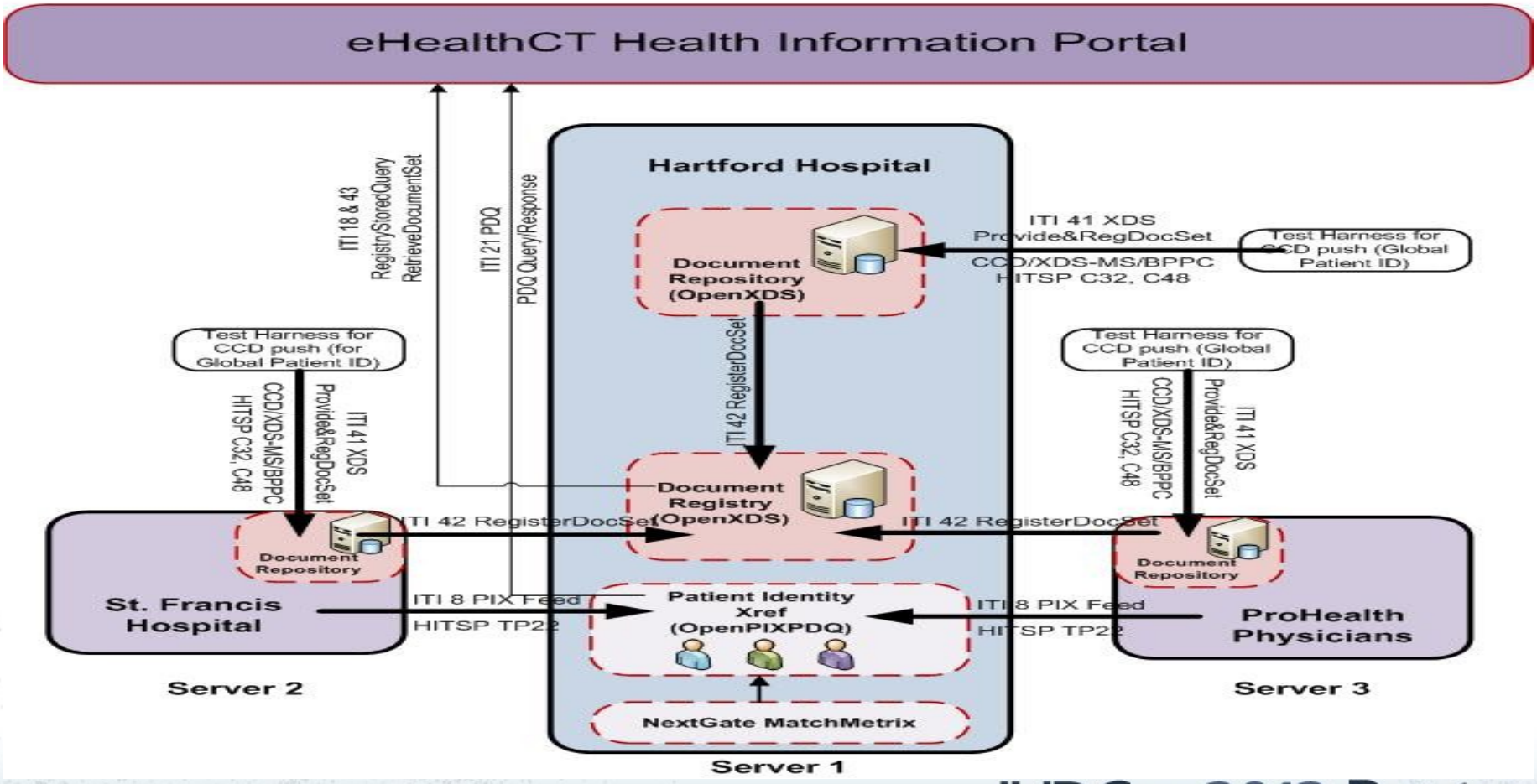
Misys Open Source Solutions (MOSS)

- Java implementation of IHE Technical Framework Profiles (PIX,PDQ,XDS)
- Implements “server side” IHE profiles
- Provides value added portal and clinical portlet integration (ePrescribe, secure mail, document routing, etc..)

http://www.misysoss.com/

Health Information Exchange
The Solution - MOSS

Alpha-Pilot Implementation Diagram



Health Information Exchange
The Solution - PIX/PDQ

Health Information Exchange
The Solution – XDS Repository

Health Information Exchange
The Solution – XDS Registry

Health Information Exchange
The Solution – MOSS Portal

Health Information Exchange The Solution - JBoss ESB

JBoss ESB

- Implement HL7 MLLP protocol gateway
- Implement message transformation
- Implement “client side” IHE profiles
- GUI for error resubmission
- Project code named OpenBoardingPass and contributed to the Open Health Tools forge with other MOSS components

Health Information Exchange The Solution - OHT

Open Health Tools (OHT)

- Open Health Tools (OHT) is dedicated to improving the health of people through the transformation of health information technologies (health IT).
- The vision of Open Health Tools is to enable a ubiquitous ecosystem where members of the Health and IT professions can collaborate to build open, standards-based 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.
- Home of OpenBoardingPass, OpenXDS, OpenATNA, OpenDSUB amongst others

http://www.openhealthtools.org/

Health Information Exchange The Solution – Open Source

Open Source Projects Leveraged

- JBoss ESB 4.10 (http://www.jboss.org/jbossesb)
- Eclipse IDE (http://www.eclipse.org) - Primary IDE used for development
- HAPI (http://hl7api.sourceforge.net) - HL7 Gateway and message transformation
- SmartGWT (http://code.google.com/p/smartgwt) - Error recovery GUI

Health Information Exchange The Solution – Open Source

Open Source Projects Leveraged (Cont.)

- SmartGWT UI-Binder (http://code.google.com/p/uibinding-smartgwt) - Used with SmartGWT in GUI
- GWTP (http://code.google.com/p/gwt-platform) - Used as MVP framework in GUI
- RestEasy (http://www.jboss.org/resteasy) - Used in GUI

Health Information Exchange The Solution – Open Source

Open Source Projects Leveraged (Cont.)

- Weld (http://www.-seamframework.-org/Weld) - Used in GUI
- JBoss AS v. 7.1.1 (http://www.jboss.org/jbossas) - Used as platform for web GUI
- MySQL v5.1.x (http://www.mysql.com/) - Database for OpenBoardingPass and web GUI (Enterprise version also used for patient and document repositories)

Health Information Exchange The Solution - JBoss ESB

ESB Native HL7 Gateway

- Used HAPI (http://hl7api.sourceforge.net/) to provide HL7 MLLP protocol.
- Wrapped into ESB life cycle implementation of AbstractManagedLifecycle class
- Supports the ACK/NAK protocol required for HL7 messaging
- Inbound message can be optionally parsed using HAPI parsers and delivered to ESB service.

Health Information Exchange The Solution - JBoss

HL7 MLLP

- Minimal Lower Layer Protocol
- For transmitting via TCP/IP
- Header and trailer characters are added to the message to identify the beginning and end of a message as TCP/IP is a continuous stream of bytes

Health Information Exchange The Solution - JBoss ESB

Message Transformation

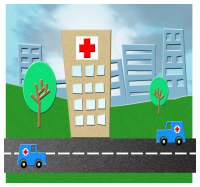
- Translators built to handle specific clinical messages, namely discharge summaries in HL7 v2.3 format and transform them into CDA level 1 or 2 documents. These documents are suitable for IHE based document exchange.

Health Information Exchange The Solution – JBoss ESB

Client side IHE profiles

- Provide connectivity to HIE through implementation of specific IHE technical framework interactions
- Specifically
  - Patient Identity Feed (ITI-8)
  - PIX Query (ITI-9)
  - Provide and Register Document Set.b (ITI-41)

Health Information Exchange
The Solution – JBoss ESB



Hospital ADT

HL7v2 Message

HL7 Gateway

Transformation and routing

JBoss ESB

PIX Message

PIX Manager

Patient Identity Feed (ITI-8)

Health Information Exchange The Solution - JBoss ESB

HL7 Gateway Configuration

```
<listener busidref="hl7v2Inbound-bus" is-gateway="true
   maxThreads="1" name="HL7v2Inbound-listener">
   <property name="applications">
      <app
applicationClassName="org.openhealthtools.jboss.esb.hl7v2.hapi.server.application.impl.ESBAwareHAPIGenericAppli
cation" loggerImpl="org.openhealthtools.jboss.esb.hl7v2.hapi.messagelogger.impl.Log4JMessageLogger"
   mBeanProp="pixInboundListenerHL7App" messageType="ADT"
   triggerEvents="A01,A03,A04,A08,A13,A18,A40" triggerVersions="*" />
   </property>
   <property name="bodyDestination" value="HL7Message" />
   <property name="gatewayClass"
```

Health Information Exchange The Solution - JBoss ESB

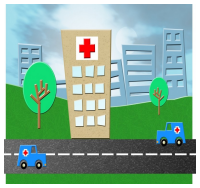
HL7 Gateway Configuration (cont.)

```
value="org.openhealthtools.jboss.esb.hl7v2.listener.HL7v2Listener" />
   <property name="hl7ServerName" value="HL7v2PixMessageListenerServer" />
   <property name="keyStoreLocation" value="@KEY_STORE_LOCATION@" />
   <property name="keyStorePwd" value="@KEY_STORE_PASSWORD@" />
   <property name="messageManager"
value="org.openhealthtools.jboss.esb.hl7v2.listener.manager.impl.HL7v2MessageManagerEx" />
   <property name="parserClassName" value="org.openhealthtools.jboss.esb.hl7v2.parser.PixPipeParser" />
   <property name="port" value="@OBP_ADT_PORT@" />
   <property name="secureClient" value="@OBP_ADT_SECURE@" />
   <property name="soTimeout" value="3000" />
   <property name="trustStoreLocation" value="@TRUST_STORE_LOCATION@" />
   <property name="trustStorePwd" value="@TRUST_STORE_PASSWORD@" />
   <property name="useHapiMessage" value="true"
</listener>
```

Health Information Exchange
The Solution - JBoss ESB

Sample: pix_connector_jboss-esb

Health Information Exchange
The Solution - JBoss ESB



Hospital Discharge Summary

HL7v2 Message

HL7 Gateway

Transformation and call Web Service

JBoss ESB

CDA Document

ITI-41

XDS Registry

XDS Repository

Submitting a Document (ITI-41)

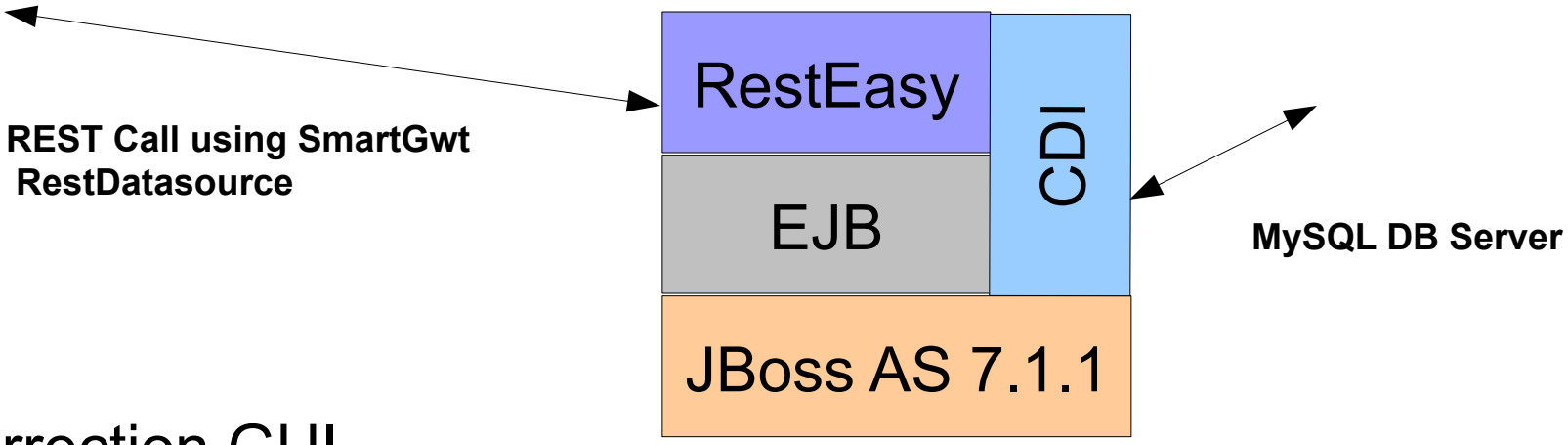
Health Information Exchange
The Solution - JBoss ESB

Sample: openboardingpass_discharge_obr_to_provreg_jboss-esb

Health Information Exchange The Solution - JBoss ESB

Sample:openboardingpass_xds_outbound _jboss-esb

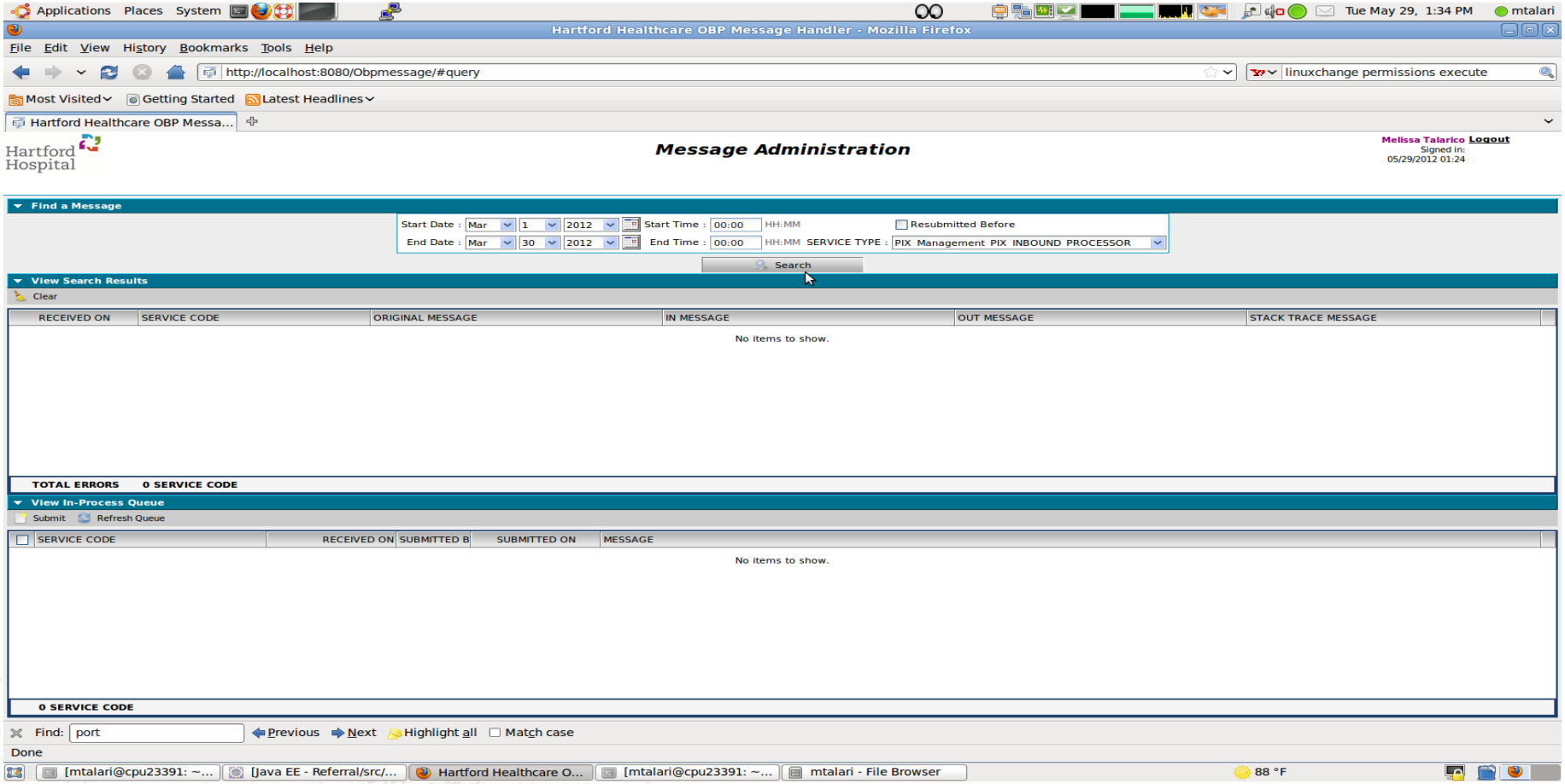
Health Information Exchange
The Solution – JBoss AS



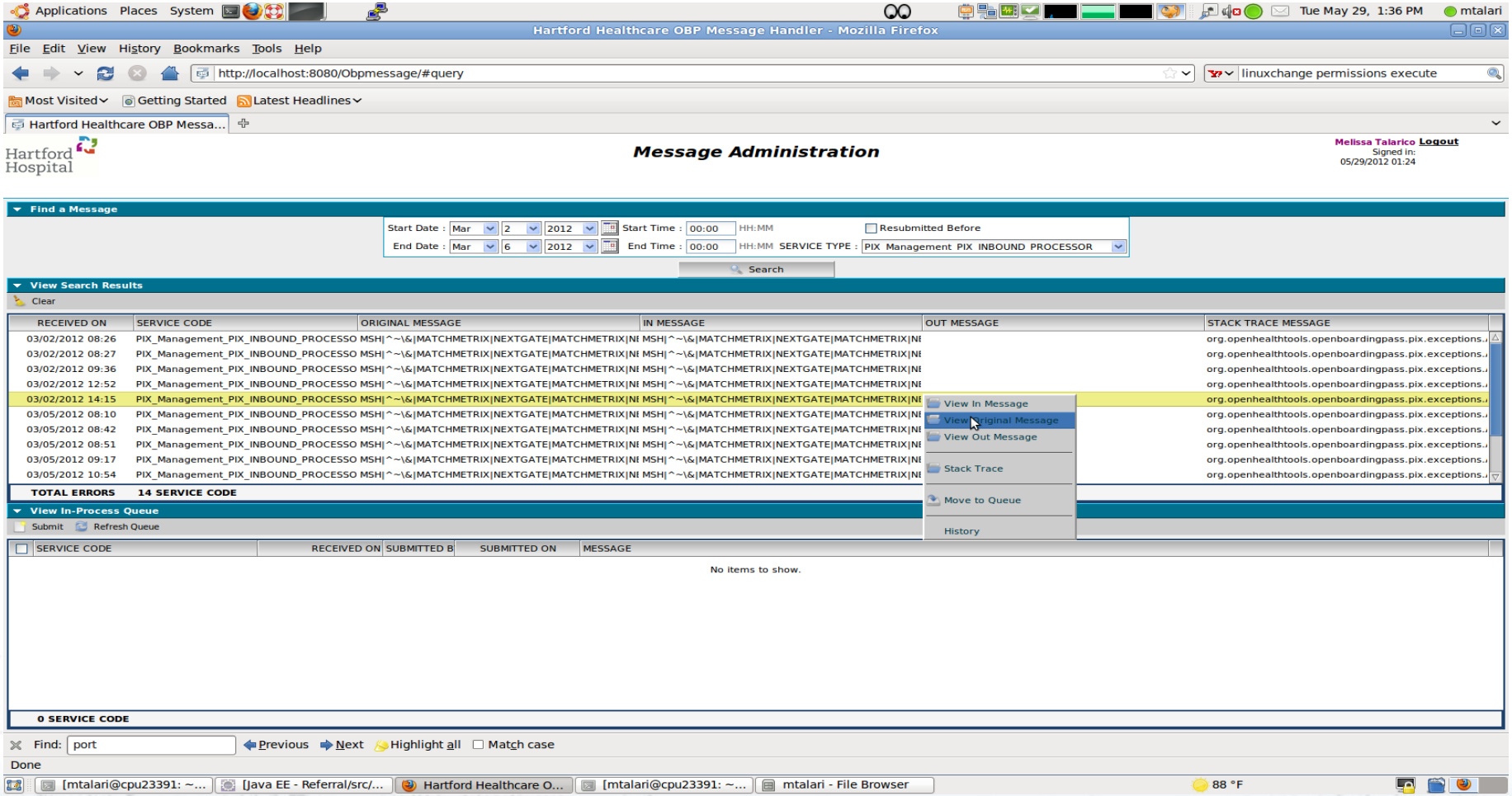
Error Correction GUI

-SmartGWT and SmartGWT UI-Binder for display
-GWTP to support MVP design
-JBoss 7.x for easy deployment and testing

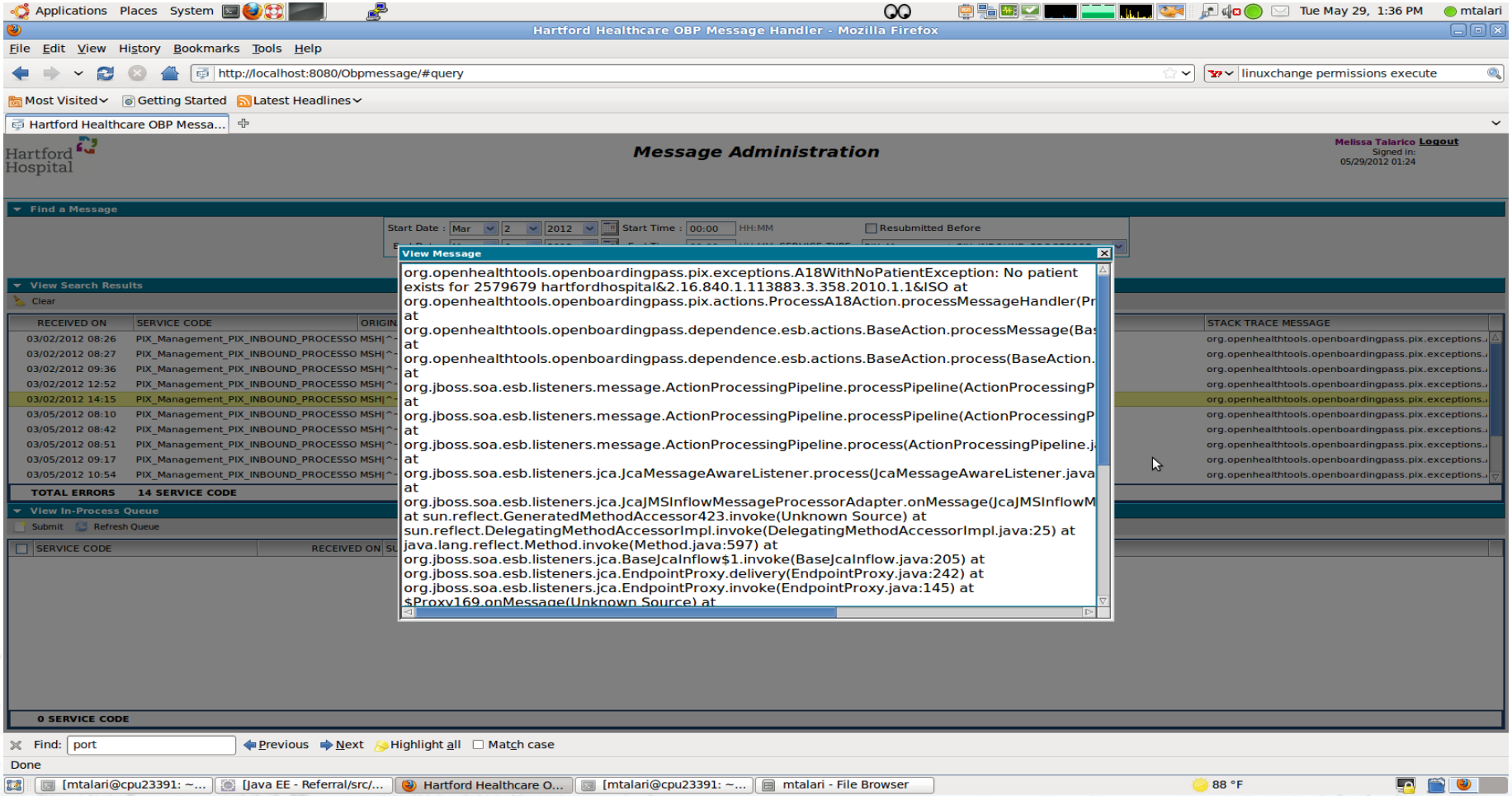
Health Information Exchange
The Solution



Health Information Exchange
The Solution



Health Information Exchange
The Solution



Health Information Exchange What's Next

- Further development on current ESB or move to SwitchYard?
- Additional monitoring capabilities
- More direct integration with Electronic Health Record systems (EHR)

Health Information Exchange
The Solution