Implementation Guide

Public Health Information eXchange (PHIX)

Version: 1.3.1.0

Prepared by:
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EXECUTIVE SUMMARY

The purpose of the Public Health Laboratory Interoperability Solutions and Solution Architecture (PHLISSA) project is to support building Public Health Laboratories' capacity to exchange laboratory orders and results electronically with other Public Health Laboratories, Public Health Agencies, and clinical care stakeholders as mandated by the American Recovery and Reinvestment Act (ARRA). This objective will be accomplished simultaneously on three fronts: Architecture, Interoperability Hub / PHIX, and Enterprise Service Bus (ESB). The implementation and installation directives provided in this document are specific to the PHIX installation. The PHIX Implementation Guide provides instructions for installation and basic configuration of the PHIX software.

REVISION HISTORY

VERSION #	IMPLEMENTER	DATE	EXPLANATION
1.0.01	Mike Trebatoski	07-21-2011	Initial Deployment – Hub
1.1	Paul DeJong	07-25-2011	Completed all component sections other than Linker and DIRECT for 1.1 software release.
1.1 rev 2	Paul DeJong	8-19-2011	Edits based on installation in CDC R&D Lab
1.1 rev 3	Paul DeJong	9-29-2011	Updates for PHIX v1.1 release
1.2	Paul DeJong	11-16-2011	Updates for PHIX v1.2 release / Portal Hard Launch.
1.3	Paul DeJong	01-19-2012	Updates for PHIX v1.3 release: MSS now distinct download
1.3.1.0	Paul DeJong	2-4-2012	Few typos corrected for v1.3.1.0. Updated distro file name for new version number.

TABLE OF CONTENTS

ACRONYM LIST

CDC	Centers for Disease Control and Prevention
ebXML	Electronic Business Extensible Markup Language
FAQs	Frequently Asked Questions
FTP	File Transfer Protocol
JDBC	Java Database Connectivity
LDAP	Lightweight Directory Access Protocol
PC	Personal Computer
PartyID	Party Identifier
PHIX	Public Health Information eXchange
SDN	Secure Data Network
SQL	Structured Query Language
SSL	Secure Socket Layer
TLS	Transport Layer Security
TransportQ	Transport Queue
URL	Uniform Resource Locator
WorkerQ	Worker Queue

1.0 Introduction

The Public Health Information eXchange (PHIX) Implementation Guide will assist with the installation, configuration, and upgrade of the PHIX product.

The PHIX Implementation Guide provides instructions to correctly install and configure the PHIX to send and receive messages from clinical care and public health partners.

1.1 License

Software developed specifically for the PHIX is licensed under The Apache License, Version 2.0. A copy of this license is available inside the distribution file described in Section 3. Other third-party components of the PHIX are covered under their own licenses, as described in the NOTICE.txt file also contained in the distribution file.

1.2 References

NAME	DESCRIPTION
PHIX Release Notes	Description of supported environments, software requirements, explanation of upgrade path, and a list of new features and bug fixes made since the prior release. Filename: PHIX_ Release_Notes.pdf
PHIX - NwHIN DIRECT REST Reference Implementation	Detailed instructions on generating sample certificates for use with NwHIN DIRECT REST. Filename: PHIX_NwHIN_DIRECT_REST_Reference_Implementation.pdf
PHIX - Linker Software	Detailed instructions on installing, configuring, and testing the PHIX Linker/Anonymizer software. Filename: PHIX_LINKER_Software.pdf

2.0 Installation Requirements

2.1.1 Compatible Platforms

This product has been tested on the following platforms with the following characteristics:

- Operating Systems for the Application:
    - Windows XP Professional Version 2002 Service Pack 3
    - Windows Server 2008 Standard Edition Service Pack 2

- Databases:
    - Database: PostgreSQL version 9.0.6-1

- Application Servers:
    - Apache Tomcat version 7.0.14 (for Linker/Anonymizer)
    - JBoss version 5.1.0.GA (for MSS and PHIX services)

- Java:
    - Java version 1.6.0_30 - Java(TM) Development Kit (JDK)
    - Apache Maven version 2.2.1

- Internet Browsers:
    - Firefox 4,5,6,7
    - Microsoft Internet Explorer 8

- Other:
    - Mirth Connect 2.1.1
    - HAPI v1.0
    - MSS: Custom Apache Derby build (based on 3.6), including custom VADS Lite Derby build
    - NHIN Direct REST Java reference implementation version 0.0.1
    - Maven 2.2.1
    - Linker/Anonymizer: Custom PHIX build
    - hMailServer 4.4.3

2.1.2 Resource Requirements

- Processor: Intel Pentium 4 CPU 3.80GHz
- Memory (RAM): 3.00 GB minimum
- System type: 32-bit (x86) or 64-bit (x64) Intel architecture
- Two PHIX installations are required in order to run the included demonstration scenarios and to use DIRECT REST

3.0 Distribution

The software required for a complete PHIX installation consists of a .zip file plus a number of third-party downloads.

PHIX_1_3_1_0.zip: contains most of the PHIX software and configuration files required for running the PHIX

The following sections of this document describe the necessary PHIX components and third-party dependencies that make up a PHIX installation. They should be installed in the order listed in this document by a user with Administrator privileges. When a download is necessary, version numbers and download URLs are provided.

For each item, a specific installation location is suggested. While it is possible to use other locations, using the suggested locations will greatly reduce the amount of configuration required to install and deploy the PHIX.

Some of the items require additional configuration based on how the PHIX will function (i.e., as PHIX1 or PHIX2 in the included demonstration scenarios). In these cases, configuration instructions are included.

4.0 Java

Java is the virtual machine environment required by several of the PHIX components. The version currently used is JDK 1.6.0_30 (Java 1.6.0_18 was also tested). Please download the entire JDK, not just the JRE. Please download the 32-bit version, even if you are running on a 64-bit architecture! This will ensure compatibility with other software components.

4.1 Download

Obtain the software from:
http://www.oracle.com/technetwork/java/javase/downloads/index.html

Version:
JDK 1.6.0_30 for 32-bit Windows

Full filename:
jdk-6u30-windows-i586.exe

4.2 Installation

Execute the jdk-6u30-windows-i586.exe installation file. Install Java to this custom directory:
c:\ jdk1.6.0_30

When prompted, allow the JRE portion of the JDK to be installed in the default location within "Program Files".

Set the JAVA_HOME system environment variable to c:\jdk1.6.0_30 .

Modify the PATH system environment variable by appending c:\jdk1.6.0_30\bin .

4.3 Verification

Open a new Windows Command Prompt. Run the following two commands and verify that the output matches the following:

```
C:\Users\Dejonpa>java -version
java version "1.6.0_30"
Java(TM) SE Runtime Environment (build 1.6.0_30-b11)
Java HotSpot(TM) Client VM (build 20.4-b02, mixed mode, sharing)
```

```
C:\Users\Dejonpa>javac -version
javac 1.6.0_30
```

5.0 PostgreSQL

The PostgreSQL 9 RDBMS is required for the following services: ComponentRoutingService, StructuralValidationService, and Linker/Anonymizer.

5.1   Download

Obtain the software from:

http://www.enterprisedb.com/products-services-training/pgdownload#windows

Version:

Version 9.0.6-1 binary for 32-bit Windows (x86)

or

Version 9.0.6-1 binary for 64-bit Windows (x64)

Full filename:

postgresql-9.0.6-1-windows.exe

or

postgresql-9.0.6-1-windows-x64.exe

5.2   Installation

Execute the downloaded file. Install PostgreSQL to this custom directory:

C:\PostgreSQL\9.0

Install the data directory to:

C:\PostgreSQL\9.0\data

During installation, set the "postgres" admin user password to "hub4cdc" when prompted; alternatively, set the "postgres" admin user password to another password, then update the value of the "password" property inside the database.properties file inside both of the PHIX web service war files (See PHIX Services. By default, these services are installed to C:\mss35\MSS\jboss\server\default\deploy\ComponentRoutingService.war, StructuralValidationService.war). Accept the default PostgreSQL port of 5432. Do not choose the option to install "Stack Builder" when prompted.

5.3   Restore PHIX databases

Locate the hub.backup file located inside the db\ directory within the PHIX_1_3_1_0.zip file and extract it to a temporary directory. Start the pgAdmin III utility that was installed as part of the

PostgreSQL installation. In the left-hand navigation area, right-click on "PostgreSQL 9.0" under "Servers (1)" and select "Connect'. Enter your "postgres" admin user password ("hub4cdc", or whatever password you selected above). Right-click on the "Databases" item in the tree, and select "New database…" from the menu. Name the database "hub", leave the options set to their defaults, and click the "ok" button. Right-click on the "hub" icon now located under "Databases" in the tree, and select "Restore…" Enter the path to the extracted hub.backup file and click the "ok" button. Click the "done" button and exit pgAdmin III.

Locate the BioSenseLinker.backup file located inside the db\ directory within the PHIX_1_3_1_0.zip file and extract it to a temporary directory. Start the pgAdmin III utility that was installed as part of the PostgreSQL installation. In the left-hand navigation area, right-click on "PostgreSQL 9.0" under "Servers (1)" and select "Connect'. Enter your "postgres" admin user password ("hub4cdc", or whatever password you selected above). Right-click on the "Databases" item in the tree, and select "New database…" from the menu. Name the database "BioSenseLinker", leave the options set to their defaults, and click the "ok" button. Right-click on the "BioSenseLinker" icon now located under "Databases" in the tree, and select "Restore…" Enter the path to the extracted .backup file and click the "ok" button. Click the "done" button and exit pgAdmin III.

5.4 "hub" database configuration

In order to run the demonstration, the organization table inside the PHIX database needs to be updated to reflect the PHIX server names that are functioning as PHIX 1 and PHIX 2. For a server functioning as PHIX 1 and named phix1.domain.com, a server functioning as PHIX 2 and named phix2.domain.com, and a notification email of notify@server.com, execute the following SQL commands inside the pgAdmin III utility to update the configuration:

```
update organization set direct_email='hub@phix1.domain.com',
notification_email='notify@server.com',ws_host='phix1.domain.com:8081',
hub_host='phix1.domain.com',error_email='notify@server.com' where id in (2,4);

update organization set direct_email='hub@phix2.domain.com',
notification_email='notify@server.com',ws_host='phix2.domain.com:8081',
hub_host='phix2.domain.com',error_email='notify@server.com' where id in (1,3,5);
```

5.5 Verification

Inside pgAdmin III, inside the left-side navigation pane, you should see the BioSenseLinker and hub databases listed. If you drill into BioSenseLinker → Schemas → public → Tables, you should see eight tables listed. If you drill into hub → Schemas → public → Tables, you should see three tables listed.

6.0 MSS and JBoss

The Message Subscription Service (MSS) software is a standalone product developed by CDC. It consists of a set of web services that provide code validation, translation, and subscription functionality; and a web-based interface for configuration. It normally utilizes the Rhapsody integration engine, but the PHIX replaces Rhapsody with Mirth Connect. The PHIX uses a customized version of MSS that contains the Apache Derby open-source embedded database system and is based on MSS version 3.6. This version of MSS runs on a configured version of JBoss 5.1.0, which is included as part of the MSS installation.

6.1   Download

MSS software is available from an access-controlled area of the PHIX Portal, a link to which is provided from the downloads URL below. To request access to this area, please contact Gautam Kesarinath at gfk0@cdc.gov .

http://phix.phiresearchlab.org/downloads.jsf

6.2   Installation

Locate the mss35 subdirectory inside the mss_36_derby.zip file and extract the entire folder with all subdirectories to the C:\ directory. This will install MSS in the C:\mss35 directory. JBoss is configured to use port 8080. If a different port is desired, you will have to update all the web service invocations from within the PHIX Mirth Connect channels (see Mirth Connect section).

6.3   Running

The JBoss AS that hosts the MSS Portal, MSS Services, and PHIX Services can be started manually by executing C:\mss35\MSS\jboss\bin\run.bat. Alternatively, JBoss be installed as a service from within an administrative Windows Command Prompt by running "C:\mss35\MSS\jboss\bin\service.bat install". It is recommended that JBoss be installed as a service with Startup Type set to "Automatic" within non-development environments. Once installed as a service, JBoss can be started via the Windows Service Manager, or will start automatically after reboot if Startup Type is set to "Automatic".

6.4   Verification

Correct installation and deployment of MSS, JBoss can be verified by accessing this URL after starting JBoss:

http://localhost:8080/jbossws/services

Information for three deployed web services should be displayed: SubscriptionService, CodeValidationService, and TranslationService.

You should also verify that you can access the MSS web portal at:

http://localhost:8080/mssportal

The default user is "admin" with a blank password. The password can be changed within the MSS Portal. After you successfully log in and the main portal page loads, you will see a list of menu options on the left side, and a Dashboard in the main screen showing the "BIRT Report Viewer" that is usually used to monitor various MSS statistics. This version of MSS was generated specifically for PHIX, and is fully-functional other than the BIRT Report Viewer; therefore, you will see an Exception box in the middle of the page. It will not affect any MSS or PHIX functionality.

On the main MSS Portal screen, click on "Subscriptions" in the bottom-left. Then expand the "Subscription Management" folder. Next, expand the "Subscribers" option. You should see several program areas, including Salmonellosis, Hepatitis C, and Influenza Program Areas.

7.0 PHIX Services

The PHIX Services are a pair of web services that are hosted on the JBoss application service. For simplicity, the PHIX Services should be deployed in the same JBoss AS installation that MSS uses and that were installed in the MSS and JBoss section.

7.1 Installation

Locate the services subdirectory inside the PHIX_1_3_1_0.zip file. Within this directory, locate the two .war files: ComponentRoutingService.war and StructuralValidationService.war. Extract these two files to the following directory: C:\mss35\MSS\jboss\server\default\deploy. The services will be deployed alongside the MSS services installed in the MSS and JBoss section. You will need to restart the JBoss server if it is already running in order for the deployments to complete.

7.2 Running

Running the services is accomplished in the same way as described in the MSS and JBoss: Running section.

7.3 Verification

Correct installation and deployment of the PHIX Services can be verified by accessing this URL after starting JBoss:

http://localhost:8080/jbossws/services

In addition to the three MSS services already installed, you should also see these new services: ComponentRoutingService, StructuralValidationService.

8.0 Mirth Connect

Mirth Connect is a healthcare integration engine that is the backbone of the PHIX. It receives HL7 messages from either Mirth Connect web services or NHIN DIRECT, consumes the various web services that constitute the PHIX functionality, performs necessary transformations, produces any appropriate response to the message, and archives the results. The version of Mirth Connect currently used with the PHIX is 2.1.1.

8.1 Download

Obtain the software from:
http://www.mirthcorp.com/community/downloads

Version:
Mirth Connect 2.1.1 for 32-bit Windows

Full filename:
mirthconnect-2.1.1.5490.b781-windows.exe

You may need to locate the file underneath the archived downloads in order to find this version. If a newer version of Mirth exists, it may work, but will be untested with PHIX.

8.2 Installation

Execute the mirthconnect-2.1.1.5490.b781-windows.exe installation file. Install Mirth Connect to this custom directory:
C:\MirthConnect2

When prompted during installation, replace the default port values with these settings:
Administrator launcher port: 9080
Administrator port: 9443
Server JMX Port: 1199

Choose the option to install Mirth as a service. Select the defaults for the remaining prompts and complete the installation. If you launch Mirth Connect, you will be prompted to register with Mirth Corporation. Once you are finished, please exit and stop the Mirth Connect service if it is running, as you will altering the Mirth Connect configuration in the next step.

Next, locate the demo\ directory within the PHIX_1_3_1_0.zip file. This directory contains a subdirectory named phixdata\. Extract the phixdata\ directory to C:\. This will create a directory named C:\phixdata.

Locate the mirth_channels\ directory within the PHIX_1_3_1_0.zip file and extract this directory along with all subdirectories to a temporary directory.

8.3 Configuration

8.3.1 Edit DIRECT Properties

Edit the "mcserver.vmoptions" file located inside the C:\MirthConnect2 directory and append the following (do not remove any of the items already present in the file):

```
-Djavax.net.ssl.trustStore=C:\nhin-d-rest\spring-maven-poc\etc\truststore
-Djavax.net.ssl.trustStorePassword=password
-Dgov.cdc.phlissa.hub.direct.fromAddress=hub@someserver.org
-Dgov.cdc.phlissa.hub.direct.fromPassword=hub
-Dgov.cdc.phlissa.hub.direct.host=someserver.org
-Dgov.cdc.phlissa.hub.direct.port=8555
```

Change the gov.cdc.phlissa.hub.direct.fromAddress and gov.cdc.phlissa.hub.direct.host properties to reflect the fully qualified domain name you are installing the PHIX on. For example, for a server named server.domain.com, the two lines should be edited to read:

```
-Dgov.cdc.phlissa.hub.direct.fromAddress=hub@server.domain.com
[…]
-Dgov.cdc.phlissa.hub.direct.host=server.domain.com
```

Edit the "mcservice.vmoptions" file located inside the C:\MirthConnect2 directory. Repeat the same additions and changes you just made with the "mcserver.vmoptions" file.

8.3.2 Change Mirth Connect log level

Edit the log4j.properties file located in the C:\MirthConnect2\conf directory. Change all eight default log levels listed in the "Mirth Connect channel logging" section from DEBUG to INFO.

8.3.3 Restore Channels

Now start the Mirth service, either through the Windows Service Manager, or by going to the "Mirth Connect" program group and selecting "Mirth Connect Server." Next, start the "Mirth Connect Server Manager" under the "Mirth Connect" program group. This will display the

Mirth "M" logo in the system tray. Right-click on this icon and select "Start Mirth" if it is not greyed-out. Then right-click again and select "Launch Administrator". The default username and password are both "admin". The password can now be changed by selecting the "Users" option on the left-side menu.

Click on the "Channels" option on the left-side menu. Under "Channel Tasks", select the "Import Channel" option. Browse to the mirth_channels\ directory inside the temporary directory you created in the Installation section above, and select the "01_PHIX.xml" file and click "Open". If you are warned that this channel was created with an earlier version of Mirth, and do you wish to convert the file, select "Yes". Once the channel information is populated, select "Save Changes" under the "Channel Tasks" group. Repeat this task for each of the four channels in the mirth_channels\ directory (01_ PHIX.xml, 01_ PHIX _DIRECT_RECV.xml, 01_ PHIX _FILE_READER.xml, 01_ PHIX _WS_RECV.xml).

8.3.4   Edit PHIX Instance-Specific Configuration in 01_PHIX Channel

Click on the "Channels" option under the "Mirth Connect" group. Double-click on the 01_PHIX channel. Click on the Source tab. Click on the "Edit Transformer (1)" option under the "Channel Tasks" group. Edit the contained values to reflect the Hub instance you are configuring (either "PHIX 1" or "PHIX 2"), updating it to reflect the fully-qualified domain name of the server you are configuring. For example, for server.domain.com to be installed as PHIX 1,

```
channelMap.put('hubInstanceName', 'PHIX 1');
channelMap.put('hubHost', 'server.domain.com');
channelMap.put('hubInstanceEmailFromAddr', 'administrator@server.domain.com');
channelMap.put('hubInstanceWebSvcHost', 'server.domain.com:8081');
```

The Mirth Connect native web services do not accept variables in WSDL URLs, so it was necessary to hard-code these locations. If you will be using Mirth Connect native web services for message transport, you will need to edit the following destinations inside the 01_PHIX channel: Send ACK msg (to PHIX1), Send ACK msg (to PHIX2), Send msg to Receiving Facility WS (to PHIX1), Send msg to Receiving Facility WS (to PHIX2). For each of these, edit the WSDL URL to contain the name of the server that will be functioning as PHIX1 or PHIX2:

```
http://server.domain.com:8081/services/Mirth?wsdl
```

 Additionally, edit the filters on these four destinations and change the outermost conditional check to reflect PHIX1 or PHIX2 as appropriate. These settings will only be used if you are using Mirth native web services for 2-PHIX transport, but setting these values will not hurt anything even if you do not use Mirth web services.

```
if ($('receivingFacilityWebSvcHost') == 'server.domain.com:8081')
```

8.3.5   Edit Hub Instance-Specific Configuration in 01_PHIX_DIRECT_RECV Channel

Click on the "Channels" option under the "Mirth Connect" group. Double-click on the 01_PHIX_DIRECT_RECV channel. Click on the Source tab. In the "Directory" field at the top of the form, change the domain name portion at the end of the field (i.e, text after the last ampersand "@") to the fully-qualified name of the server you are configuring. E.g, for a server named "server.domain.com", the entire field should now read: "C:/nhin-d-rest/spring-maven-poc/data/hub@server.domain.com". Do not select the "Test Read" button at this time to test if the directory is writable, since the directory will not be created until DIRECT receives its first message at this address.

8.3.6   Enable and Deploy channels

Click on the "Channels" option under the "Mirth Connect" group. For each of the four PHIX channels just imported, highlight the channel, right-click, and select "Enable". Then right-click, and select "Deploy."

8.4   Verification

At this point, you can only verify that the channels deployed correctly. Select the "Dashboard" option from the top-left Mirth navigation pane. You should see all four channels with Status set to "Started".

You will verify the rest of the functionality when executing the demonstration scenarios in the Running the Demonstration section.

9.0 hMailServer

hMailServer 4.4.3 is a simple open source email mail server used by the PHIX for sending notification emails. Version 4 was selected, since starting with Version 5, the product is still free, but no longer open source. In a production environment, a production email server like Microsoft Exchange Server could be configured for sending these email notifications.

9.1   Download

Obtain the software from:
http://www.hmailserver.com/index.php?page=download_archive

Version:
hMailServer 4.4.3 – Build 285

Full filename:
hMailServer-4.4.3-B285.exe

9.2   Installation

Execute the hMailServer-4.4.3-B285.exe installation file. You will select an administrator password during installation. Install hMailServer to the default directory and use the other default installation options.

9.3   Configuration

After installation, verify that the hMailServer service is running. Then run the "hMailServer Administrator" program from the hMailServer program group. Enter the administrator password you selected during installation. Once connected, right-click on Domains and select "add". On the "General" tab, enter the fully qualified name of the PHIX server you are installing in the "Domain name" field. Check the "Active" checkbox. Then click "Save". This will create an entry with the domain name you just entered under Domains in the left-hand menu. Expand this item, right-click on Accounts, and choose "Add". Enter an Account address named "administrator", select "User" under Administration level, check the "Active" checkbox, and click "Save". The user you create here must match the hubInstanceEmailFromAddr variable you set during Mirth Connect configuration, so if you choose a notification address other than "administrator", update the Mirth channel configuration accordingly. On the left hand menu under Settings→Protocols, ensure that SMTP server is checked. Highlight the SMTP protocol under Settings→Protocols, select the "Delivery of e-mail" tab, enter the fully-qualified name of the server you are configuring in the "Host name" field, and click on the "save" button.

You may need to open port 25 through your operating system or organizational firewall settings, depending on your environment.

9.4   Verification

While hMailServer is running, open a Windows Command Prompt as administrator. Run the following commands, replacing the administrator@yourserver.organization.org address with the value you configured when setting up the Mirth Connect 01_PHIX channel source transformer, and replacing testaddress@organization.org with a valid email address. Text that you will enter is boldfaced.


```
C:\> telnet localhost 25

220 M6500 ESMTP
HELO yourserver.organization.org
250 Hello.
MAIL FROM: <administrator@yourserver.organization.org>
250 OK
RCPT TO: <testaddress@organization.org>
250 OK
DATA
354 Please start mail input.
This is a test message from hMailServer.
.
250 Mail queued for delivery.
quit
221 Closing connection.  Good bye.

Connection to host lost.
```

You should receive the test email message at the address you specified in the RCPT TO line.

10.0   Linker / Anonymizer

The PHIX Linker / Anonymizer is adopted from the CDC BioSense project. It runs as a Tomcat web application and PostgreSQL database, as well as Mirth Connect channel destinations, transformers, and Java utilities that are used to access the web application.

10.1 Installing the Linker Database

Installation of the database was described in the [PostgreSQL section](#) of this document.

10.2 Installing the Linker Web Application

Locate the Linker\Tomcat\ directory inside the PHIX_1_3_1_0.zip file. Extract the Tomcat directory to C:\ .   The Linker is configured to run on port 8500.

10.3 Running the Linker Web Application

The Linker can be started by executing C:\Tomcat\bin\startup.bat. It can be installed as a service by running "C:\Tomcat\bin\service.bat install" as administrator. This will install a Tomcat as a service named "Linker", and labeled "PHIX Linker Anonymizer" within the Windows Service Manager. It is recommended that Tomcat be installed as a service with Startup Type set to "Automatic-Delayed" within non-development environments. Tomcat should always be started after JBoss to avoid a JMX port conflict. Once installed as a service, Tomcat can started via the Windows Service Manager, or will start automatically after reboot if Startup Type is set to "Automatic-Delayed".

10.4 Verification

To verify that the PHIX Linker/Anonymizer is installed correctly, ensure that Tomcat is started, and then access this URL from a web browser: http://localhost:8500/bioSense/viewer/Query.jsp. The default username and password are both "Admin". You can enter any patient ID, then select "Search." You will not get any results at this time since the database does not yet contain patient data, but you should see the initial search page, and see a "Patient or visit not found. Try again" message when searching.

10.5 Additional Information

The [PHIX – LINKER Software document](#) contains additional information about installing, customizing, and testing the PHIX Linker / Anonymizer.

11.0 NwHIN DIRECT REST Reference Implementation

NwHIN DIRECT is a transport specification for delivery of messages. It is required in two-PHIX environments for the demonstration scenarios to be executed without reconfiguration.

11.1 NwHIN DIRECT REST Installation

Locate the nhin-d-rest\ directory inside the PHIX_1_3_1_0.zip file. Extract it to C:\ .

11.2 Generate Certificate

A certificate signed by a certificate authority must be generated for use by this NwHIN DIRECT installation.

If you wish to generate a sample certificate for non-production use, follow the instructions in the PHIX - NwHIN DIRECT REST Reference Implementation.docx document described in the References section of the Introduction.

Once you obtain "keystore" and "truststore" files for your certificate and certificate authority, copy them to C:\nhin-d-rest\spring-maven-poc\etc and proceed with the NwHIN DIRECT REST configuration.

11.3 Maven Download

Completing the installation and configuration requires Apache Maven.

Obtain the software from:
http://maven.apache.org/download.html

Version:
Maven 2.2.1 Binary zip

Full filename:
apache-maven-2.2.1-bin.zip

Extract this zip file to C:\, creating C:\apache-maven-2.2.1 . Append C:\apache-maven-2.2.1\bin to your PATH system environment variable.

11.4 Java Cryptography Extension Download

Obtain the software from:

http://www.oracle.com/technetwork/java/javase/downloads/index.html

Version:

Java Cryptography Extension (JCE) Unlimited Strength Jurisdiction Policy Files 6

Full filename:

jce_policy-6.zip

Extract the two .jar files contained within this zip file to C:\jdk1.6.0_30\jre\lib\security.

11.5 Install nhin-d-jagent

Complete the following steps using a Windows Command Prompt started as administrator. Text you will enter is boldfaced (enter each command on a single line).

```
C:\>cd nhin-d-rest\spring-maven-poc\support

C:\nhin-d-rest\spring-maven-poc\support>mvn install:install-file -DgroupId=org.n
hind -DartifactId=nhin-d-agent -Dversion=1.0.0-SNAPSHOT -Dpackaging=jar -Dfile=n
hin-d-agent-1.0.0-SNAPSHOT.jar

[Installation will follow, and may take several minutes . . . ]

[INFO] Installing C:\nhin-d-rest\spring-maven-poc\support\nhin-d-agent-1.0.0-SNA
PSHOT.jar to C:\Users\Dejonpa\.m2\repository\org\nhind\nhin-d-agent\1.0.0-SNAPSH
OT\nhin-d-agent-1.0.0-SNAPSHOT.jar
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESSFUL
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 18 seconds
[INFO] Finished at: Thu Nov 10 18:59:03 EST 2011
[INFO] Final Memory: 3M/15M
[INFO] ------------------------------------------------------------------------
```

```
C:\nhin-d-rest\spring-maven-poc\support> cd ..


C:\nhin-d-rest\spring-maven-poc> mvn jetty:run


[Installation will follow, and may take several minutes . . . ]


[DEBUG, DispatcherServlet] Servlet 'nhin-d-rest' configured successfully
2011-11-10 19:08:59.551:INFO::Started SslSocketConnector@0.0.0.0:8555
[INFO] Started Jetty Server
[INFO] Starting scanner at interval of 5 seconds.
<CTRL-C>
[. . .]
Terminate batch job (Y/N)? y
C:\nhin-d-rest\spring-maven-poc>
```

11.6 Change port to 8555

Edit C:\nhin-d-rest\spring-maven-poc\src\main\java\org\nhindirect\platform\rest\RestClient.java.
On line 66, change port 8443 to 8555.

Edit C:\nhin-d-rest\spring-maven-poc\pom.xml. On line 239, change port 8443 to 8555.

Edit C:\nhin-d-rest\spring-maven-poc\etc\domain.properties. The file only needs to contain one
line:

hub@machine.myorganization.org: hub,

Replace machine.myorganization.org with the fully-qualified name of the server you are
configuring.

Edit C:\nhin-d-rest\spring-maven-poc\src\main\webapp\WEB-INF\nhin-d-rest-security.xml

Under the <user-service> element near line 25, add the following user entry:

<user name="hub" password="hub" authorities="ROLE_EDGE"/>

11.7 Install DIRECT Utility Classes to Mirth Connect

Locate the two .jar files, hubdirect.jar and mail-1.4.3.jar, inside the DirectRESTIface\lib\ directory within the PHIX_1_3_1_0.zip file. Extract only the jars to C:\MirthConnect2\custom-lib\ .

11.8 Running/Rebuilding DIRECT

To run or rebuild direct, change to the sprint-maven-poc directory, and run the following command:

```
C:\nhin-d-rest\spring-maven-poc> mvn jetty:run
```

Do this at least once to force a rebuild, even if you plan on installing DIRECT as a Windows service. You can exit with <CTRL-C> once it is running.

11.9 Install DIRECT as a Windows Service

From inside a Windows Command Prompt running as administrator, perform the following steps:

1. Create a Windows service using the sc.exe command: sc create PHIXDirect binPath= "\"C:\nhin-d-rest\spring-maven-poc\srvany.exe\""

2. Open up regedit and goto:
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\PHIXDirect

3. Create a new key: Parameters

4. Create a new String Value under Parameters: Application

   With Value data: C:\nhin-d-rest\spring-maven-poc\phixdirect.bat

5. If desired, set startup type to "auto" inside the Windows service manager

6. Edit the C:\nhin-d-rest\spring-maven-poc\phixdirect.bat file. Comment out the last two lines by prepending "rem" to the beginning on the lines.

7. Start the service. Wait ten minutes, then stop the service. This will download the necessary libraries for the Local System user that the DIRECT service will be running as.

8. Edit the C:\nhin-d-rest\spring-maven-poc\phixdirect.bat file. Comment out the first two lines by prepending "rem" to the beginning on the lines. Remove the "rem" from the beginning of the last two lines.

9. Start the service. It will take several minutes to build the DIRECT REST project the first time. Subsequent restarts will be quicker.

NOTE: There is currently a known issue when stopping the PHIXDirect service that prevents a clean shutdown. If PHIXDirect does not restart correctly using the Windows Service Manager, it may be necessary to reboot the server. If you don't wish to always run the service, set it to "Manual" and only start it when necessary.

11.10 NwHIN DIRECT REST Alternative: Mirth Web Service Transport

If you do not wish to install the NwHIN DIRECT REST Implementation, but still wish to execute the demonstration scenarios in a two-PHIX configuration, you can configure PHIX to use the native web services built into Mirth Connect for a transport mechanism. To do so, perform the following steps:

1. Start the PostgreSQL pgAdmin III program.

2. Connect to the Hub database.

3. Open a query window.

4. Execute the following statement: update organization set xport_type='MIRTH_WS'

Also ensure that you properly configured the PHIX1 and PHIX2 web service endpoints in the 01_PHIX channel, as described in the Mirth Connect section.

11.11 Verification

Correct installation will be verified by correct execution of the steps listed in the Running the Demonstration: Two-PHIX Configuration section.

11.12 Additional Information

The [PHIX – NwHIN DIRECT REST Reference Implementation document](#) contains additional information about installing, customizing, and testing the NwHIN DIRECT REST reference implementation.

12.0   Running the Demonstration

12.1 Two-PHIX Configuration

The demonstration environment requires installing two PHIX instances on separate servers with slightly different configurations. Differences in configuration are described in the above sections (PHIX1, PHIX2). You will also need to configure an email address to receive notifications that are sent to the address specified in the PostgreSQL section of this document.

To run the demonstration, start each of the components listed above as described in their respective sections. Many of the components were installed as services and therefore will not need to be explicitly started. Launch the Mirth Connect Administrator, enter you credentials, and enable and deploy all four PHIX channels. Logging output can be found in the Dashboard area of Mirth Connect during operation.

Two spreadsheets document the demonstration messages, routing, and expected results: Message Processing Flow.xlsx and PHLISSA Test Execution Matrix.xlsx. Both are located in the demo\phixdata\doc directory inside the PHIX_1_3_1_0.zip file. Each of the messages listed in the test matrix spreadsheet are placed into an input queue directory on the appropriate PHIX sending instance. Which PHIX instance is the sender is also identified in the spreadsheets. The input queue is located at C:\phixdata\HL7_IN\ on the sending PHIX instance. The demonstration messages are located at C:\phixdata\src msgs\ . Select a message to send and copy it from the source directory to the HL7_IN input queue directory. You should see a large number of log entries appear in the Mirth Connect Administrator Dashboard. Use the Dashboard to read log events on both the sending and receiving PHIX instances. The events should correspond to the expected results as documented in the spreadsheets. Once processing is complete, the transformed message is archived in the C:\phixdata\HL7_TRANSFORMED directory on the receiving PHIX instance.

12.2 One-PHIX Configuration

It is possible to test many features of the PHIX using a single PHIX instance. In order to do so, messages must have their receiving facility set to an organization table entry that corresponds to the PHIX instance being tested. For example, for a PHIX instance installed on phix.myorganization.org, update your organization.hub_host value to phix.myorganization.org:

update organization set hub_host='phix.myorganization.org'

This will cause all demonstration scenario messages included with the PHIX distribution to be routed to the current server, so that no transport will be invoked at all.

12.3 Verification

Start all services described in this document. Select the "S1-1_ORU 2.5.1 salm 1_v3.txt" message located inside c:\phixdata\src message. Place the message in C:\phixdata\HL7_IN .

The following sections describe the output you can expect for both two-PHIX and one-PHIX configurations.

12.3.1 Two-PHIX Configuration

Open Mirth Connect on the PHIX 1 installation and select the option to view the Dashboard. Set the "Log Size" to 99 in the text field at the bottom right of the Mirth Connect window. You should see all four of the deployed PHIX channels on the top half of the screen, and log information on the bottom half. When the "S1-1_ORU 2.5.1 salm 1_v3.txt" message is placed into the c:\phixdata\src message\ directory, scroll all the way to the bottom of the log pane. The first entry you should see is "PHIX INSTANCE-SPECIFIC CONFIGURATION:". Moving up, the next five lines will show you the configuration you set up when first configuring the 01_PHIX channel (hubInstanceName, hubHost, et al.). The next eight lines or so will show you specifics about the message being processed: msgType, msgTriggerEvent, msgHL7VersionID (in this case, ORU, R01, 2.5.1).

Next in the log will be the sending and receiver facility IDs (LAB1 (Laboratory 1), DOH1 (Department of Health 1)). Next you will see the results of the invocation of the ComponentRoutingService, the results of which tell the PHIX which PHIX components will be utilized for 2.5.1 ORU R01 messages coming from LAB1 and being sent to DOH1. After 20 lines or so, you will see "Calling StructuralValidationService". Soon after, you will see that several more components are bypassed since either they are only invoked by the receiving PHIX (PHIX 2), or they are never invoked at all for this specific kind of message. The bypassed components include VocabTranslationService, CodeValidationService, SubscriptionService, and BioSenseLinker.

Finally, you will see a line informing you that the message is being transported to PHIX2, either over NwHIN DIRECT, or Mirth Web Services, followed by some transport-specific output.

You should notice that at the top of the Mirth Connect Dashboard, the statistics of each utilized PHIX channel should be updated appropriately, and errors should all remain "0".

You should receive an email for a "Notifiable Condition Alert" that possible Salmonella has been detected inside the ORU R01 message. The alert will be sent to the email address that you configured in the [Database Configuration section](#).

Next, open up the message event log file located at C:\phixdata\logs\phix_events.log. The most recent entry at the bottom should look similar to the following output, with your specific server names replacing those seen below. Ensure especially that no errors are listed at the bottom.

```
------------------------------------------------------------------------
Date: 11/14/2011 14:02:07
Message DateTime: 20110501230554-0400
Message Control ID: 201105011
HL7 version: 2.5.1  Type: ORU  Event: R01
Sending Facility ID: LAB1,  Receiving Facility ID: DOH1
Incoming Filename: 1321297321676_IN.txt  Transformed Filename:
1321297321676_XFORMED.txt


Site Configuration:
  hubInstanceName: PHIX 1
  hubHost: phlissa-hub1.us.saic.com
  hubInstanceEmailFromAddr: administrator@phlissa-hub1.us.saic.com
  hubInstanceWebSvcHost: phlissa-hub1.us.saic.com:8081


Msg Configuration:
  structural validation: true
  vocabTranslation: true
  codeValidation: true
  subscription: true
  anonymization: false
  addSFTSegment: true
  addSPMSegment: false
  translateToVersion:
  vocabTranslationMSSProfile: PHLISSA
  codeValidationMSSProfile: PHLISSA
  sendingFacilityDirectEmailAddress: hub@phlissa-hub1.us.saic.com
  sendingFacilityNotificationEmail: dejongp@saic.com
  sendingFacilityErrorNotificationEmail: dejongp@saic.com
  sendingFacilityWebSvcHost: dejongp.us.saic.com:8081
```

```
  sendingFacilityXportType: DIRECT
  sendingFacilityHubHost: dejongp.us.saic.com
  receivingFacilityDirectEmailAddress: hub@phlissa-hub1.us.saic.com
  receivingFacilityWebSvcHost: phlissa-hub1.us.saic.com:8081
  receivingFacilityXportType: DIRECT
  receivingFacilityHubHost: dejongp.us.saic.com

Services:
  Component Routing Service: CALLED
  Structural Validation Service: CALLED
  Vocabulary Translation Service: BYPASSED
  Code Validation Service: BYPASSED
  Subscription Service: BYPASSED
  Linker/Anonymizer Service: BYPASSED
  ACK Message: BYPASSED
  Outgoing Message: SENT VIA DIRECT
  PHIX Connector Service: BYPASSED
  Notifiable Condition Email Alert: BYPASSED

Errors:
```

Next, access the Mirth Connect dashboard for PHIX 2. The Mirth Connect log should be similar to one from PHIX 1, but with different configuration and called components. At the top of the log, you should see a line indicating that no transport is necessary, since the message is already at the receiving facility.

Open up the message event log file for PHIX 2, located at C:\phixdata\logs\phix_events.log. Your log entry should be similar to the following. Again, verify that no errors are present at the bottom of the log entry.

```
-------------------------------------------------------------------------
Date: 11/14/2011 14:02:19
Message DateTime: 20110501230554-0400
Message Control ID: 201105011
HL7 version: 2.5.1  Type: ORU  Event: RO1
Sending Facility ID: LAB1,  Receiving Facility ID: DOH1
```

Incoming Filename: 1321297329660_IN.txt   Transformed Filename:
1321297329660_XFORMED.txt

Site Configuration:
  hubInstanceName: PHIX 2
  hubHost: dejongp.us.saic.com
  hubInstanceEmailFromAddr: administrator@dejongp.us.saic.com
  hubInstanceWebSvcHost: dejongp.us.saic.com:8081

Msg Configuration:
  structural validation: true
  vocabTranslation: true
  codeValidation: true
  subscription: true
  anonymization: false
  addSFTSegment: true
  addSPMSegment: false
  translateToVersion:
  vocabTranslationMSSProfile: PHLISSA
  codeValidationMSSProfile: PHLISSA
  sendingFacilityDirectEmailAddress: hub@phlissa-hub1.us.saic.com
  sendingFacilityNotificationEmail: dejongp@saic.com
  sendingFacilityErrorNotificationEmail: dejongp@saic.com
  sendingFacilityWebSvcHost: phix2.phiresearchlab.org:8081
  sendingFacilityXportType: DIRECT
  sendingFacilityHubHost: dejongp.us.saic.com
  receivingFacilityDirectEmailAddress: hub@phlissa-hub1.us.saic.com
  receivingFacilityWebSvcHost: phix1.phiresearchlab.org:8081
  receivingFacilityXportType: DIRECT
  receivingFacilityHubHost: dejongp.us.saic.com

Services:
  Component Routing Service: CALLED
  Structural Validation Service: CALLED
  Vocabulary Translation Service: CALLED
  Code Validation Service: CALLED
  Subscription Service: CALLED
  Linker/Anonymizer Service: BYPASSED
  ACK Message: BYPASSED

```
Outgoing Message: BYPASSED
PHIX Connector Service: BYPASSED
Notifiable Condition Email Alert: SENT
```

Errors:

12.3.2 One-PHIX Configuration

The One-PHIX configuration will contain similar output to the Two-PHIX Configuration, with only the message transport information missing. In order to test this configuration, first make sure you have updated your database as described in the One-PHIX Configuration section.

After you place the "S1-1_ORU 2.5.1 salm 1_v3.txt" message in the HL_IN directory, open the Mirth Connect dashboard and verify that you see logging output, and that the message processing statistics at the top are incremented. The error counts should remain 0.

You should also receive the same email alert described in the Two-PHIX Verification section.

Next, open up the message event log file located at C:\phixdata\logs\phix_events.log. The most recent entry at the bottom should look similar to the following output, with your specific server names replacing those seen below. Ensure especially that no errors are listed at the bottom.

```
--------------------------------------------------------------------------
Date: 11/14/2011 15:13:30
Message DateTime: 20110501230554-0400
Message Control ID: 201105011
HL7 version: 2.5.1  Type: ORU  Event: RO1
Sending Facility ID: LAB1,  Receiving Facility ID: DOH1
Incoming Filename: 1321301594187_IN.txt  Transformed Filename:
1321301594187_XFORMED.txt

Site Configuration:
   hubInstanceName: PHIX 2
   hubHost: dejongp.us.saic.com
   hubInstanceEmailFromAddr: administrator@dejongp.us.saic.com
   hubInstanceWebSvcHost: dejongp.us.saic.com:8081

Msg Configuration:
   structural validation: true
   vocabTranslation: true
   codeValidation: true
```

```
subscription: true
anonymization: false
addSFTSegment: true
addSPMSegment: false
translateToVersion:
vocabTranslationMSSProfile: PHLISSA
codeValidationMSSProfile: PHLISSA
sendingFacilityDirectEmailAddress: hub@phlissa-hub1.us.saic.com
sendingFacilityNotificationEmail: dejongp@saic.com
sendingFacilityErrorNotificationEmail: dejongp@saic.com
sendingFacilityWebSvcHost: phix2.phiresearchlab.org:8081
sendingFacilityXportType: DIRECT
sendingFacilityHubHost: dejongp.us.saic.com
receivingFacilityDirectEmailAddress: hub@phlissa-hub1.us.saic.com
receivingFacilityWebSvcHost: phix1.phiresearchlab.org:8081
receivingFacilityXportType: DIRECT
receivingFacilityHubHost: dejongp.us.saic.com

Services:
  Component Routing Service: CALLED
  Structural Validation Service: CALLED
  Vocabulary Translation Service: CALLED
  Code Validation Service: CALLED
  Subscription Service: CALLED
  Linker/Anonymizer Service: BYPASSED
  ACK Message: BYPASSED
  Outgoing Message: BYPASSED
  PHIX Connector Service: BYPASSED
  Notifiable Condition Email Alert: SENT

Errors:
```