## Agenda

- What is CONNECT?
- CONNECT: Alignment to Gateway Services
- CONNECT Architecture: Big Picture
- CONNECT Architecture: Component Details
- CONNECT Architecture: v 2.1 Changes
CONNECT: WHAT IS IT?
What is CONNECT?

A Federal Health Architecture multi-agency initiative to address:
- Emerging Nationwide Health Information Network (NHIN)
- Agency participation in the NHIN Trial Implementations 2008
- Agency/Non-Agency participation in NHIN limited productions/pilots 2009

A technology solution for secure interoperable health information exchange:
- A Platform for Participation
- A Platform for Innovation
CONNECT Architecture: Joint Effort

- CONNECT Program Management Office
- CONNECT Development Team
- Federal Partners in the Federal Consortium
Federal and Private-Sector Partners Using CONNECT for NHIN in 2009*

**Agency (7)**
- Department of Defense **
- Department of Veterans Affairs **
- Social Security Administration **
- Indian Health Service **
- Centers for Disease Control and Prevention **
- National Cancer Institute **
- National Disaster Medical System **

**Private Sector (15)**
- CareSpark
- Cleveland Clinic Foundation
- Community Health Information Collaborative
- Delaware Health Information Network
- Healthbridge
- Healthlinc (Bloomington Hospital)
- MedVirginia **
- INHS
- Kaiser Permanente
- Long Beach Network For Health
- Lovelace Clinic Foundation
- Minnesota Community Health Information Collaborative (CHIC)
- New York eHealth Collaborative
- NCHICA
- NMHIC
- Regenstrief Institute
- West Virginia Health Information Network
- Wright State University **

**State Level (3)**
- New York State Department of Health **
- Washington State Department of Health **
- Indiana State Department of Health

*Via demonstration and/or production activities.
** Using the CONNECT Solution
CONNECT Goals/Objectives

Enable Exchange of Health Information

- Federal agencies
- Non-federal agencies

Create Solution using NHIN conventions, agreements and core services

- Flexible
- Open source
CONNECT Driving Requirements from Federal Partners

Open platform

Support for multiple operating systems

Readily extensible

Commercial support available

Fully functional out-of-the-box

Customizable
CONNECT: Alignment to Gateway Services
CONNECT: Tools for Information Exchange

FHA’s CONNECT Initiative provides three related tools to enable organizations to connect to the NHIN:

The Gateway, which implements the core services defined by the NHIN

Enterprise Service Components, which provide robust tools for indexing patient identities, maintaining patient health documents, implementing business rules for authorizing the release of medical information and more

Universal Client, a client framework for developers to implement enterprise service components
Architectural Principals

- Flexible, extensible architecture built on Java/OpenESB/Glassfish
- Fully implements all client and supplier interfaces for existing NHIN services
- All components have web service interfaces
- Adapters can be created for any existing health information systems
- Implementers can use supplied enterprise components, or substitute their own
Architecture Overview

NHIN Profiles
- Consumer Preferences Profile
  - Store and exchange consumer preferences for sharing of personal health information
- Other Profiles in Development
  - GIPSE (Biosurveillance)

NHIN Services
- Discovery Services
  - Subject Discovery
  - Authorized Case Follow-up
  - Query for Documents
  - NHIE Service Registry
- Information Exchange Services
  - Retrieve Documents
  - Query Audit Log
  - Health Information EvenMessaging

Messaging, Security and Privacy Foundation
- Messaging
  - Message Transport
  - Services Definition
- Security
  - Public Key Infrastructure
  - Encryption
  - Digital Signature
- Authorization Framework
  - Requestor Authentication
  - Requestor Authorization

CONNECT Gateway and Adapter Architecture
• First released with CONNECT 2.0
  – the topic of today’s session

• More complete version to be released with CONNECT 2.1
  – covering…

  all 6 NHIN services and HIEM support for NHIN profiles, and

  all 4 Enterprise Service Components for Release 2.1
CONNECT Architecture: Big Picture
CONNECT Architecture
Message from NHIN

Architecture: Release 2.0
(message from NHIN)

NHIN Connect Gateway

NHIN Message Orchestration Components
- Subject Discovery
- Document Query
- Document Retrieve
- Subscription Management
- Notification Processing
- Audit Reporting
- UDDI Update Manager

NHIN Connect Core Components
- Patient Correlation Repository
- Audit Repository
- Document Cache
- Connection Manager
- Subscription Repository
- Others

Non-SAML

Agency Adapter

Adapter Service Bus
- Document Repository
- Document Registry
- MPI
- Policy Engine
- Subscription Repository
- Re-Identification

SDK Services
- Data Transforms
- Terminology Services
- Others

Legend
- NHIN Connect Components
- Customizable Components
- Replaceable Components
- Message
CONNECT Architecture
Message to NHIN

Architecture: Release 2.0
(message to NH-IN)
Orchestrated vs. Pass Through Mode

CHOICE OF PATH BASED ON CONFIGURATION

NHIN Message Receiver

Internal NHIN Message Orchestrator

Adapter Interface Pass-Through
## CONNECT Development Environment

<table>
<thead>
<tr>
<th>Item</th>
<th>Version</th>
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CONNECT Architecture: Component Details
Subject Discovery Context Diagram

- Organization’s Existing Systems
  - MPI
  - Clinical Data
  - End User System
  - User

- CONNECT
  - matches
  - announce patients

- NHIN
  - Provider System (e.g., EHR or NHIE)
  - End User System

- Provider
Subject Discovery – Add Subject (From NHIN) Sequence Diagram
Subject Discovery – Add Subject (To NHIN) Sequence Diagram
Subject Discovery – Update (To/From NHIN)

Subject Discovery – Revoke (To/From NHIN)
Document Query (From NHIN)
Sequence Diagram

sd Query for Documents (from NHIN)

Remote Gateway
Document Query (To NHIN)
Sequence Diagram
Document Retrieve (From NHIN)

Sequence Diagram
Document Retrieve (To NHIN)
Sequence Diagram

Diagram: Document Retrieve (to NHIN)

1. Adapter
Once transmitted, the generated document must remain available and unaltered.

Document reference may be expired if and only if no retrieve document request was processed for the document.
CONNECT Architecture: v2.1 Changes
Enterprise Service Components

- **Master patient index (MPI)**
  - Sun MURAL/MDM, Stable release dated 4/24/2009

- **Document registry/repository**
  - NIST XDS Repository v. 2
  - Object, Metadata and Artifacts Registry (OMAR) v. 2.1, final 1

- **Policy engine**
  - OpenSSO, Express Build 7 dated 4/10/2009
  - Jericho

- **Audit repository**
  - CONNECT implementation using MySQL
## CONNECT Development Environment Version 2.1

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Movement away from BPEL/ESB

Perceived **ESB benefits not realized**

- Primarily used SOAP binding (others not used/needed)
- GlassFishESB – features of individual components not fully implemented
- NMR
  - Not dynamically configurable
  - Had to place all services into single large composite application
  - Does not work when crossing machine boundaries

Perceived **BPEL benefits not realized**

- Development of moderate to complex logic in BPEL is cumbersome
- Graphical view for complex BPEL code is unusable
- Performance was unacceptable when making BPEL changes
- Simplification of BPEL caused creation of even more web services
Movement away from BPEL/ESB (cont.)

Additional Issues with ESB and BPEL

Integrated GlassFishESB

- Combined stack tied NHIN CONNECT to a particular vendor
- Upgrades to newer versions is very time-consuming
- Integrated solution is based on older individual components
- Bug fixes are done on new versions of the individual components and these are not available in the integrated solution
- Resolution of issues are difficult because they span multiple vendor development teams
- Memory consumption has become a big issue
- Run-time performance on CONNECT 2.0 degraded because of the necessity of handling “replaceable components”
- Code reuse is very difficult within BPEL
- BPEL cannot handle complex processing issues needed by CONNECT
Adoption of Component Proxy Approach

• Move toward Java/Enterprise Java Bean (EJB) solution

• Using Spring Framework

• Replaceable components have both java and web service implementations
  – Configuration selection done at run-time
  – Contains a no-op implementation as well

• Enables portability to other tools/platforms

• Migration of current BPEL/ESB to component proxy will be done over time

• After full migration, will change from GlassFishESB to individual components (e.g. GlassFish, NetBeans, etc.)
CONNECT 2.2 Roadmap

• Gateway Level:
  – Security Enhancement
  – HIEM PROFILE: CDC GIPSE (to support Biosurveillance)
• Enterprise Service Components
  – Document Registry/Repository Enhancement
  – Enterprise Class MPI (2.2 Enhancement)
  – Fine-Grain Policy Engine
• Universal Client
  – Security and Context Management Infrastructure
CONNECT Seminar
Presentations are Available for Download Online at
www.connectopensource.org
Backup Slides
Query Audit Log Context Diagram
Query Audit Log (From NHIN) Sequence Diagram
Query Audit Log (To NHIN)

Sequence Diagram
Authorized Case Follow-up
Context Diagram

Organization's Existing Systems

- MPI
- Clinical Data
- End User System
- User

CONNECT

- ID request re-identification
- NHIN

PH Official

- Authentication authorization
- ID request re-identification

Remote Gateway

- Warehouse
Authorized Case Follow-up (To NHIN) Sequence Diagram
Health Information Event Messaging (HIEM) Context Diagram
HIEM: Receive Subscribe Message (From NHIN) Sequence Diagram
HIEM: Receive Subscribe Message (To NHIN) Sequence Diagram
HIEM: Receive Unsubscribe Message (To NHIN) Sequence Diagram
HIEM: Receive Notify Message (From NHIN) Sequence Diagram
HIEM: Receive Notify Message (To NHIN) Sequence Diagram