The National Information Exchange Model (NIEM) and Prescription Monitoring Information eXchange
Disclosures

Bob Slaski declares no conflicts of interest or financial interest in any product or service mentioned in this program, including grants, employment, gifts, stock holdings, and honoraria.

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The National Information Exchange Model (NIEM) and the Health Community

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Activity Type: Knowledge-Based

Following this presentation, attendees should be able to:
1. Describe the purpose and scope of the National Information Exchange Model.
2. List the key tenets of the PMIX architecture.
3. Explain the end-to-end encryption and security provided by PMIX.
4. Describe the functioning of the RxCheck hub and intrastate hubs in the PMIX architecture.
5. Describe the life cycle tools provided for PMIX NIEM implementation.
National Information Exchange Model (NIEM) is a very comprehensive data model that was originally developed by the Criminal Justice community. It has expanded beyond its roots in the Departments of Justice and Homeland Security to include the Health and Human Services domain. NIEM is based on the eXtensible Markup Language (XML) but has a highly rigorous set of rules and an increasingly broad set of data elements. One of the most visible examples of the use of NIEM in health IT is use of NIEM for the Prescription Monitoring Information eXchange (PMIX). PMIX has deployed NIEM based information exchanges for interstate sharing. NIEM has recently formalized the methodology for using the very popular Unified Modeling Language (UML) to define information exchanges and automatically create the necessary NIEM artifacts. This session will explain NIEM and its increasing role in the health domain using PMIX as an example and describe the new UML tools to harness the power of NIEM.
Educational Objectives

1. Describe the purpose and scope of the National Information Exchange Model.

2. List the key tenets of the PMIX architecture.

3. Explain the end-to-end encryption and security provided by PMIX.

4. Describe the functioning of the RxCheck hub and intrastate hubs in the PMIX architecture.

5. Describe the life cycle tools provided for PMIX NIEM implementation, e.g. NIEM UML.
Background

- Problem: Prescription drug diversion
  [www.youtube.com/watch?v=J7DHMqHFSB8](http://www.youtube.com/watch?v=J7DHMqHFSB8)
  (viewer discretion advised)

- Prescription monitoring programs (PMPs) are among the most effective tools available to identify and prevent drug diversion

- PMP Information eXchange (PMIX) – Secure, reliable, sustainable interstate exchange of prescription drug history
NIEM

- National (international) data model and exchange definition methodology
- Cross domain, geographic, political borders
- Strong federal sponsorship - Federal Departments (Justice, HHS) are lead sponsors
- www.niem.gov
NIEM Value Proposition

- Common exchange data
- NIEM Simplified short video – NIEM value proposition explained using a policing example
  http://www.youtube.com/watch?v=BA1jY8LJ8tM
NIEM Adoption

- NIEM is a key tenet of the PMIX Architecture and has been adopted for all PMIX exchanges
NIEM Domains

- Health and Human Services
- Justice
Information Exchange using technologies requires that the structure, format and semantics of the data "on the wire" be precisely understood and specified.

Information Exchange Based On NIEM

XML data "on the wire"

Model Driven Information Sharing with NIEM-UML
IEPD Life Cycle

- Information Exchange Package Documentation (IEPD)
Information sharing based on NIEM-UML

Automatic Generation w/ NIEM UML

XML data “on the wire”
Using Model Driven Architecture (MDA) for NIEM Information Exchange has multiple advantages:

- Models are easier for both business and technical stakeholders to understand.
- MDA helps reduce the time and cost to develop and maintain information sharing solutions.
- NIEM Naming, design and packaging rules are automatically applied and validated.
- Processes, services and information can be part of a coherent system and system of systems architecture across the full life-cycle of solutions.
- Multiple technologies can be supported using different MDA generation patterns, such as JSON or the Semantic Web.
Using NIEM-UML to Model Information Exchanges

NIEM-UML Profile

Design and Model

NIEM-UML Information Exchange Model

XML data “on the wire”
PMIX Architecture Overview

Prescription Monitoring Program Information Exchange (PMIX) Architecture Version 1.0, April 2012
PMIX Architecture Tenets

- National Information Exchange Model (NIEM) data and metadata
- Reliable Secure Global Reference Architecture (GRA) Web Services Profile
- PMP-to-PMP security using Public Key Infrastructure (PKI)
- Hub connections (hub to hub capability)
PMIX Architecture Concept

- GRA service standard
- Directory and Public Key Infrastructure
- Hubs
- End-to-end Security
- NIEM data standard

NIEM data standard

SEAL

POST OFFICE

POST OFFICE

NIEM data standard
NIEM and GRA

Use of NIEM and GRA ensures compatible data formats and interoperability of the underlying information exchanges including message security.
Security

- State-to-state message level security
- Transport security (SSL) between states and hub including client authentication
PMIX Directory

- Central Shared repository for X.509 certificates, authorizations, contact information
- PMIX Directory maintained as an LDAP server
- PMIX LDAP Extensions
  - Base – description, preferences, authorizations
  - Contact – contact information
  - Certificate – X.509 certificate
  - Request Profile – required fields
  - Hub-Hub – configuration, hub endpoint
Interstate PMP Hub Sharing
Hubs and Hub-to-hub Exchanges

- A hub provides secure routing services to direct information exchanges
- Hubs can exchange data through other hubs
Hubs and Hub-to-hub Exchanges

- Hub-to-hub connections must comply with the PMIX Hub-to-Hub Service Specification
- State hub, referred to as a State Routing Service (SRS), can be optionally deployed to provide a state with the ability to more easily add in-state exchanges in the future
PMIX Architecture Specifications

PMIX Service Specification Package (SSP) V1.0.1 (December 2011)
PMIX Information Exchange Package Documentation (IEPD) as provided in the PMIX SSP V1.0.1
PMIX Hub-to-Hub Service Specification Package V1.0 (March 2012)
PMIX Execution Context Document V1.0 (March 2012)
Service Specification Package

- Service Specification Package
  - Service Description
  - Service Interface Description
  - Security/privacy

- Execution Context
  - Routing Service
  - Key management for Public Key Infrastructure (PKI)
Simple Business Service

- Direct business exchange
- Simple synchronous request/response
- Multithreaded, non-blocking
Flexible Service Interface Options

- Flexible, multiplatform approach
- Levels of Service
  - Application Program Interface
  - Trusted basic web service
  - Secure advanced web service
Springboard

- A standards-based interoperability partnership program managed by the IJIS Institute
- Providing a shared resource venue for industry to work with government to evaluate, test and certify use of information sharing and interoperability standards
- Designed to help advance information sharing in the justice, public safety, health and homeland security operational environments
PMIX Springboard

Certification Primary Site
PMIX Conformant Hub Test Target
PMIX Conformant Hub Test Support
Certification Support Site

Certification Primary Site
PMIX Conformant Hub [Optional]
Certification Target PMP
PMIX Service Testing Capabilities

- PMIX soapUI project provides functional tests
- Tests are fully automated with formal reports
- soapUI provides “mock” service capability
- PMIX soapUI project available for state PMIX testing including interactive forms based console
PMIX soapUI Pro Report

PMIX Testing

Result Metrics

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Start Time</th>
<th>Time Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Case</td>
<td>Tue May 08 09:47:14 EDT 2012</td>
<td>8.382 ms</td>
</tr>
<tr>
<td>Test Case</td>
<td>Tue May 08 09:47:22 EDT 2012</td>
<td>5.995 ms</td>
</tr>
<tr>
<td>Test Case</td>
<td>Tue May 08 09:47:30 EDT 2012</td>
<td>1.582 ms</td>
</tr>
<tr>
<td>Test Case</td>
<td>Tue May 08 09:47:38 EDT 2012</td>
<td>1.095 ms</td>
</tr>
</tbody>
</table>

Test Case Results

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Status</th>
<th>Start Time</th>
<th>Time Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conformance - Positive</td>
<td>PASS</td>
<td>09:47:14</td>
<td>5.995 ms</td>
</tr>
<tr>
<td>Conformance - Negative</td>
<td>PASS</td>
<td>09:47:20</td>
<td>1.604 ms</td>
</tr>
<tr>
<td>Conformance - Fault</td>
<td>PASS</td>
<td>09:47:22</td>
<td>5.595 ms</td>
</tr>
</tbody>
</table>

Conformance - Positive Summary

<table>
<thead>
<tr>
<th>Status</th>
<th>Start Time</th>
<th>Time Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS</td>
<td>09:47:14</td>
<td>5.995 ms</td>
</tr>
</tbody>
</table>

TestStep Results

<table>
<thead>
<tr>
<th>Status</th>
<th>Timestamp</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>09:47:14</td>
<td>HK - John Doe OK took 592 ms</td>
</tr>
<tr>
<td>OK</td>
<td>09:47:15</td>
<td>HK - John Doe OK took 615 ms</td>
</tr>
<tr>
<td>OK</td>
<td>09:47:15</td>
<td>HK - John Doe OK took 862 ms</td>
</tr>
<tr>
<td>OK</td>
<td>09:47:16</td>
<td>HK - John Doe OK took 762 ms</td>
</tr>
<tr>
<td>OK</td>
<td>09:47:17</td>
<td>HK - John Doe OK took 734 ms</td>
</tr>
<tr>
<td>OK</td>
<td>09:47:17</td>
<td>HK - John Doe OK took 1.021 ms</td>
</tr>
<tr>
<td>OK</td>
<td>09:47:19</td>
<td>HK - John Doe OK took 1.000 ms</td>
</tr>
</tbody>
</table>
Implementation Resources

- Service Specification Packages including WSDL, Information Exchange Package Documentation
- State Routing Service (optional Microsoft server component)
- Microsoft .NET C# and open source Java reference implementations and sample code
- PMIX automated digital certificate capability
Continuing Education Review
1. National Information Exchange Model is:

- A) A data model for exchanging data with the federal government.
- B) A comprehensive data model that can serve as the basis for information sharing across different communities of interest at different levels of government and industry.
- C) The statistical model for determining the capacity of national internet service.
- D) None of the above.
2. The PMIX Architecture:

- A) Has four key tenets: use of NIEM, use of the Global Reference Architecture, support for hub exchanges and end-to-end security.

- B) Provides for secure reliable web service information sharing in accordance with industry standards.

- C) Is supported using the RxCheck national hub.

- D) All of the above.
3. The end-to-end encryption and security provided by the PMIX Architecture:

- A) Provides for encryption from the sending state PMP to the receiving state PMP using national encryption standards.
- B) Relies on keeping the public keys secret.
- C) Assumes that a secure network is being used.
- D) Does not rely on a public key infrastructure (PKI).
4. The RxCheck hub:

- A) Has been operational for more than a year.
- B) Supports the exchange of encrypted prescription history reports.
- C) Serves as a national hub for the interstate exchange of PMP data.
- D) All of the above.
5. The PMIX resources for system implementers include;

- A) United Markup Language which provides unified modeling language for defining and expanding information exchanges.
- B) A Service Conformance Package that provides the capability to verify that an implementation meets the PMIX functional standard.
- C) Senior Service Parts that provide the PMIX service specification package needed to implement the PMIX service.
- D) All of the above.