Practical Use of IHE for Interoperability in Hospitals and National eHealth Projects

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Agenda

- Brief Introduction to IHE
- Patient Identification and Management
- Sharing Health Records
- Clinical Content (HL7 CDA, DICOM)
- Security and Privacy
IHE: A Framework for Interoperability

- A common framework for harmonizing and implementing multiple standards
  - Application-to-application
  - System-to-system
  - Setting-to-setting
- Enables seamless health information movement within and between enterprises, regions, nations
- Promotes unbiased selection and coordinated use of established healthcare and IT standards to address specific clinical needs

IHE: Connecting Standards to Care

- Healthcare professionals work with industry
- Coordinate implementation of standards to meet clinical and administrative needs
  - Clinicians and HIT professionals identify the key interoperability problems they face
  - Providers and industry work together to develop and make available standards-based solutions
  - Implementers follow common guidelines in purchasing and integrating effective systems

IHE: A forum for agreeing on how to implement standards and processes for making it happen
The IHE Development Domains
13 Years of Steady Evolution 1998 – 2011

- Radiology since 1998
- Cardiology since 2004
- Radiation Oncology since 2004
- Pathology since 2006
- Laboratory since 2006
- IT Infrastructure since 2003
- Quality Research & Public Health since 2006
- Patient Care Devices since 2005
- Patient Care Coordination since 2004
- Eye Care since 2006
- Radiation Oncology since 2004
- Radiology since 2004
- Patient Care Coordination since 2004
- Pharmacy since 2009

Categories of Healthcare Communication Services

- Document Sharing
  - Source-persisted and attested health records
- Dynamic Information Access
  - Specific info snapshot provided on demand
- Workflow Management
  - 2 or more entities synchronize a task
- Patient and Provider ID Mgt
- Security
  - e.g. access to last 6 months historical labs and encounter summaries
  - e.g. get a current list of allergies or med list from a source
  - e.g. order a lab test, track status and receive results
Patient Management IHE Profiles

- Go to: [www.ihe.net/Technical_framework](http://www.ihe.net/Technical_framework)
- Patient Demographic Query (PDQ) - IT Infrastructure
  - E.g. Vol. 2a (ITI TF-2a): Transactions (PDQ)
- Patient Identifier Cross-Referencing (PIX) - IT Infrastructure
  - E.g. Vol. 2a (ITI TF-2a): Transactions (PIX)
- Cross-Community Patient Discovery (XCPD) - IT Infrastructure
  - E.g. Cross-Community Patient Discovery Supplement

PDQ Summary

- Patient Demographic Query (PDQ) profile
  - Given a partial set of patient demographics...
    - Return set of matching patients, their demographics and corresponding patient identifiers
    - If supplier supports visit data, search criteria may include combination of demographic and visit data
      - Patient Demographics and Visit Query is an optional transaction for both Patient Demographics Consumer and Supplier

[Diagram of PDQ process]
PDQ Attributes

Uses HL7 V2.5 Query Messages

- Patient Identifier List (R), Patient Name (R), Date/Time of Birth (R2), Administrative Sex (R2), Patient Address (R2), Patient Account Number (R2)
- PD1 (Patient Additional Demographics) segment
- Patient Class, Assigned Patient, Location, Attending Doctor, Referring Doctor, Consulting Doctor, Hospital Service, Admitting Doctor, Visit Number
- PV2 (Patient Visit – Additional Information) segment
- QRI (Query Response Instance) segment

Patient Identifier Cross-referencing (PIX)

- Allow all enterprise participants to register the identifiers they use for patients in their domain
- Participants retain control over their own domain’s patient index(es)
- Support domain systems’ queries for mapping across other systems’ identifiers for their patients
- Optionally, notify domain systems when other systems update identifiers mapping for their patients
Patient Identifier Cross-referencing for MPI

Process Flow Showing ID Domains & Transactions

Patient Identity Domain A

Patient Identity Cross-reference Manager

Patient Identity Domain B

Patient Identity Domain C

Internal Domain Transactions

Other IHE Actor

Patient Identification Cross References

Patient Identity Source

Patient Identity Cross-referencing for MPI

Patient Identity Cross-reference Manager

Patient Identity Domain A

Patient Identity Domain B

Patient Identity Domain C

Patient Identity Cross References

Patient Identification Cross-referencing Domain

Id=123
Id=235

Patient Identification Domain A

Id=456
Id=2RT

Patient Identification Domain B

Id=456
Id=2RT

Patient Identification Domain C

Id=456
Id=2RT

Patient Identification Cross-referencing Domain

Id=X456
Id=Y921
Id=D456
Id=DF45

Patient Identity Consumer

Patient Identity Cross References

Patient Identification Cross-reference Domain

Id=3TY
Id=2RT

Patient Identification Cross-reference Domain

Id=3TY
Id=2RT

Patient Identification Cross-reference Domain

Id=3TY
Id=2RT

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Id=2RT

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Patient Identification Cross-reference Domain

Id=3TY
Id=2RT

Patient Identification Cross-reference Domain
Cross-Community Patient Discovery (XCPD)

- The means to locate communities which hold patient relevant health data and
- The translation of patient identifiers across communities holding the same patient’s data

- Multiple primary residences — patients sometimes maintain more than one primary residence and may get care in more than one community. To deliver quality care the communities will need to exchange data about this type of patient.
- Patient Move — patients move from one community to another and healthcare data needs to be exchanged.
- Vacationer — patients travel away from their primary location for vacation and business reasons. Care may be necessary in another community and healthcare data must be exchanged to facilitate that care.

Typically, a patient goes through a sequence of encounters in different Care Settings:

- Acute Care (Hospital)
- GPs and Clinics (Ambulatory)
- Other Specialized Care (incl. Diagnostics Services)
- Long Term Care

Continuity of Care: Patient Longitudinal Record
Building and accessing Documents

- Longitudinal Record as used across-encounters
- Documents Registry
- Long Term Care
- PCPs and Clinics (Ambulatory)
- Acute Care (Inpatient)
- Other Specialized Care or Diagnostics Services

Sharing Health Records

- Go to: [www.ihe.net/Technical_framework](http://www.ihe.net/Technical_framework)
- Cross Enterprise Document Sharing (XDS) - IT Infrastructure
  - E.g. IT Infrastructure Technical Framework (XDS.b)
- Cross-Community Access (XCA) - IT Infrastructure
  - E.g. Cross Community Access Supplement
Cross-enterprise Document Sharing (XDS)

- Cross-Enterprise Document Sharing simplifies clinical data management by defining interoperable infrastructure. **Transparency = Ease of Evolution**

- Patients have guaranteed portability and providers may share information without concerns of aggregation errors. **Digital Documents = Patients and providers empowerment**

- Supports both centralized and decentralized repository architectures. **Ease of federation nationally. Flexible privacy, Flexibility of configurations**

- Addresses the need for a longitudinal healthcare data (health records). Complements to interactive workflow or dynamic access to data.

Cross-Enterprise Document Sharing (XDS.b) Actor/Transaction Diagram
Cross-Community Access (XCA)

- The Cross-Community Access (XCA) profile supports:
  - the means to query and retrieve patient relevant medical data held by other communities

- Guiding principles and scope:
  - Sharing of documents across communities
  - Re-use of XDS transactions
  - Document Consumer consistency
    - Requirements of Document Consumer are the same as for local document query and retrieval

XCA Transaction Diagram
Responding grouped with Doc Consumer
XDS/XCA is Established

- XDS/XCA uses the most recent Web Services stds (MTOM/XOP)
- National eHealth examples:
  - First implementation in region of Genoa - Italy since early 2006
  - US Nationwide Health Information Network (NwHIN) leverages IHE profiles (XCA, XDR, XCPD, BPCC, ATNA)
  - XDS use in several national and regional projects: Austria, France, South Africa, Italy, Netherlands, USA, Japan, Switzerland, Canada
  - 23 Country European epSOS Project: IHE-Europe hosting Industry Team, support project interoperability conformance testing (XCA, XCPD, ATNA, XUA, BPCC, CDA Content Modules from PCC)
- 4 open source toolkits available, numerous product implementations in EMRs and Infrastructure offerings
- Over 150 implementations IHE XDS/XCA Connectathon tested

IHE, Global Standards-Based Profiles Adopted in National & Regional Projects (sample)

For more complete list see: tinyurl.com/wwXDS
Clinical Content Profiles

- Go to: [www.ihe.net/Technical_framework](http://www.ihe.net/Technical_framework)
- XDS-Medical Summary (XDS-MS) - Patient Care Coordination
  - Medical Summary, Discharge Summary, Referral, Encounter Summary
- Specialize Patient Records - Patient Care Coordination
  - Antepartum
  - Delivery
  - New Born
  - Imaging Reports and Images (radiology, cardiology, etc.)
- Enterprise Cross Sharing of Scanned Documents (XDS-SD) - IT Infrastructure

XDS-MS Medical Summary or PHR Extract Exchange
Profile based on HL7 CDA Rel 2 and HL7 CCD IG

- Structured and Coded Header
  - Patient, Author, Authenticator, Institution, Time of Service, etc.
- Structured Content with coded sections:
  - Vital Signs
  - Medication
  - List of Surgeries
  - Allergies
  - Social History
  - Problems
  - Plan of Care

- Level 1: Header always structured and coded
- Level 2: Title-coded sections with non-structured nor coded content (text, lists, tables).
  - Simple Viewing (XML Style sheet)
- Level 2: Med, Problems and Allergies as highly structured text.
  - Text easy to import/parse
- Level 3: Med Problems and Allergies have a fine-grain structure with optional coding. Coding Scheme explicitly identified.

XDS-MS and XPHR enable both semantic interoperability & simple viewing!
Content of the Referral Summary (IHE XDS-MS)

<table>
<thead>
<tr>
<th>Referral Summary (XDS-MS) Data Elements (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason for Referral</td>
</tr>
<tr>
<td>History Present Illness</td>
</tr>
<tr>
<td>Active Problems</td>
</tr>
<tr>
<td>Current Meds</td>
</tr>
<tr>
<td>Allergies</td>
</tr>
<tr>
<td>History of Past Illness</td>
</tr>
<tr>
<td>List of Surgeries</td>
</tr>
<tr>
<td>Immunizations</td>
</tr>
<tr>
<td>Family History</td>
</tr>
<tr>
<td>Social History</td>
</tr>
<tr>
<td>Pertinent Review of Systems</td>
</tr>
<tr>
<td>Vital Signs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Referral Summary (XDS-MS) Data Elements (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Exam</td>
</tr>
<tr>
<td>Relevant Diagnostic Surgical Procedures / Clinical Reports (Including links)</td>
</tr>
<tr>
<td>Relevant Diagnostic Test and Reports (Labs, Imaging, EKG’s, etc) including links.</td>
</tr>
<tr>
<td>Plan of Care (new meds labs, or x-rays ordered)</td>
</tr>
<tr>
<td>Advance Directives</td>
</tr>
<tr>
<td>Patient Administrative Identifiers</td>
</tr>
<tr>
<td>Pertinent Insurance Information</td>
</tr>
</tbody>
</table>

Use of a shared XDS infrastructure to access Radiology Reports and Images (XDS-I)

Between Radiology and:
• Imaging specialists
• Non-imaging clinicians

Hospital
PACS B
Radiology -to- Radiology
PACS A
Imaging Center
Physician Practice
Radiology -to- Physicians
Same XDS Infrastructure (Registry and Repositories) for medical summaries and imaging information!
Document Metadata Subscription (DSUB)

- Defines a subscription which allows for the matching of metadata during the publication of a new document for a given patient, and results in the delivery of a notification
- Enabled within an XDS Affinity Domain or XCA environment
- Use Cases
  - Emergency Department: Notification of new document availability during treatment
  - Primary Care Management: PCP receives notification when new documents for patient are available

DSUB and XDS Work Together

Diagram showing the interaction between XDS, DSUB, and other healthcare systems like Hospital Record, Specialist Record, Clinical IT System, and Document Registry.
Security and Privacy

- Go to: [www.ihe.net/Technical_framework](http://www.ihe.net/Technical_framework)
- **Consistent Time (CT)- IT Infrastructure**
  - E.g. IT Infrastructure Technical Framework (CT)
- **Audit Trail and Node Authentication (ATNA) - IT Infrastructure**
  - E.g. IT Infrastructure Technical Framework (ATNA)
- **Basic Patient Privacy Consent (BPPC) - IT Infrastructure**
  - E.g. IT Infrastructure Technical Framework (BPPC)

### Consistent Time

- **Meet a basic security requirement**
  - System clocks and time stamps of the many computers in a network must be synchronized
  - Lack of consistent time creates a “security hole” for attackers
  - Synchronization ±1 second is generally sufficient
- **Achieve cost savings/containment**
  - Use the Network Time Protocol (NTP) standard defined in RFC 1305
  - Leverage existing Internet NTP services, a set-up option for mainstream operating systems
Audit Trail and Node Authentication (ATNA)

- Secure Node or Secure Application
- Access Controls
  - Functional – can be shown to enforce policies
- Audit Controls
  - SYSLOG + IHE/DICOM/RFC3881 Audit Message
  - Auditable Events
- Network Controls
  - Mutually Authenticated TLS, encryption
  - Or S/MIME or WS-Security or physical isolation

ATNA Authenticate Node
Patient Privacy Problem

- In a cross-enterprise or cross-community environment how are the Privacy Preferences of the Patient (Consumer) made known and thus enforced?
- Consent is given and retracted
- Consent in some environments is only for a specific time
- There may be many consents relevant to different organizations or situations
- Need to support Privacy Policies beyond consent, such as authorizing research access
Basic Patient Privacy Consent

- Develop “Patient Privacy Policies” for an affinity domain
  - Policies assigned an worldwide unique identifier
  - Default rules when patient does not create their own policy document
- A “Patient Privacy Policy Acknowledgement Document” is created identifying that the patient has agreed to the policy or policies
  - Policy documents managed via XDS
- Assumes Access Control is implemented with sufficient ability to enforce any Patient Privacy Policy allowed by the Patient Privacy Domain

IHE-XDS is part of a family of profiles

- Regional, national, local or disease-centric networks need a consistent set of Integration Profiles
- Fifteen Integration Profiles completed and tested, plus five ready to implement = Standards-based interoperability building blocks for
  - Rich Document Content for end-to-end application interoperability
  - Patient identification management
  - Security and privacy
  - Notification and data capture

**IHE-XDS + related IHE Integration profiles provide a complete interoperability solution**
IHE Integration Profiles for Health Info Nets

What is available and in trial implementation

Clinical and PHR Content
- Emergency Referrals
- PHR Extracts/Updates
- ObGyn Documents
- Lab Results Document
- Scanned Documents
- Imaging Information
- Medical Summary (Meds, Allergies, etc)
- Format of the Document Content and associated coded vocabulary

Security & Privacy
- Baseline Patients Privacy Consents
- Access Control
- Cross-Enterprise User Authentication
- Provides trusted identity
- Document Digital Signature
- Assuring “true-copy and origin

Patient ID Mgmt
- Patient Demographics Query
- Patient Identifier Cross-referencing
- Map patient identifiers across independent identification domains

Health Data Exchange
- Cross-Enterprise Document Sharing
- Registration, distribution and access across health enterprises of clinical documents forming a longitudinal record
- Cross-Enterprise Document PI-PI Reliable Interchange
- Cross-Enterprise Document Media Interchange
- Cross-Community Access

Other
- Audit Trail & Node Authentication
- Centralized privacy audit trail and node to node authentication to create a secured domain
- Consistent Time
- Coordinate time across networked systems

Final Text Approved
Trial Implementation-2009 – Final Txt 2010