Critical Success Factors to Achieve Interoperability - Part 2:
Ensuring Successful, Reliable, and Secure Document Creation, Access, Dissemination, and Exchange

David S. Mendelson
Michael L. Glickman
Michael H. Nusbaum

DISCLAIMER: The views and opinions expressed in this presentation are those of the author and do not necessarily represent official policy or position of HIMSS.
Learning Objectives

- To illustrate the pervasive and enduring document format and exchange standards provided by IHE (XDS, XDSi, CT, CCD)
- To demonstrate how some products, like PACS, have IHE "baked in" as de facto industry standards.
- To recognize how ONC's MU-2 and emerging MU-3 standards include IHE artifacts.
- To outline how IHE adoption and deployment in the US exists within a global community.
Conflict of Interest Disclosure

David Mendelson, MD
• Nuance Advisory Board
• GE Advisory Board

Michael Glickman, MSE
• Has no real or apparent conflicts of interest to report.

Michael H. Nusbaum, BASC, MHSA, FHIMSS
• Has no real or apparent conflicts of interest to report.
IMAGE SHARING
a core component of interoperability

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Icahn School of Medicine at Mount Sinai
Senior Associate- Clinical Informatics
Co-chair IHE International Board
Learning Objectives

• Importance of Sharing Imaging Exams and Reports
• Importance of Standards
• IHE profiles relevant to Image Sharing
• RSNA ImageShare project
Image sharing - Why?

• Benefit of historical exam during interpretation
• Rapidly growing cost of healthcare especially growing utilization of imaging
  – Overutilization- Inappropriate Utilization
  – Prevent duplicate exam because a recent exam is inaccessible
• Radiation exposure- reduction
• Quality
  – Expedites clinical care through easy availability of imaging examination
Sharing Healthcare Information in the Cloud

- Hospital
- Imaging Center
- Clinical Trial
- 2nd Radiologist
- Primary Doctor
- Consultant
- 2nd Hospital
- Patient
- Patient Surrogate
Challenges to exchange

• Who pays for an exchange infrastructure
• What is the persistence of the information in the exchange
• Are images different from other forms of healthcare data
• Easy secure access is good for the patient
  – Does it endanger the provider? - is this an impediment?
  – Economic adjustments and evolution are likely to occur
    • Balance of cost control vs. Quality
    • Reduction in Radiation exposure
  – Not all patients agree
Development - IHE Domains and Profiles

- Anatomic Pathology
- Cardiology
- Dental
- Eye Care
- **IT Infrastructure (ITI)**
  - Laboratory
  - Patient Care Coordination
  - Patient Care Devices
  - Pharmacy
  - Quality, Research and Public Health
  - Radiation Oncology
- **Radiology**
  - Mammography
- **XDS, XDS-I**
  - Cross Enterprise Document Sharing
- **XCA, XCA-I**
  - Cross Community Access
- **XDR, XDR-I**
  - Cross-Enterprise Document Reliable Interchange
    - Document sharing in the absence of a registry and repository
- **XDM**
  - Cross-enterprise Document Media Interchange
- **XUA**
  - Cross Enterprise User Assertion Integration Profile
- **XDS-SD**
  - Cross-Enterprise Sharing of Scanned Documents
- **BPPC**
  - Basic Patient Privacy Consents
- **ATNA**
  - Audit Trail and Node Authentication
Interoperability Profiles - Radiology specific

- PDI  Portable Documents for Imaging
- IRWF  Import Reconciliation Workflow
- TCE Teaching File and Clinical Trial Export

Trial Implementation
- IOCM  Imaging Object Change Management
- MIMA  Multiple Image Manager/Archive
- IID  Invoke Image Display

Development
- Mobile Access to Health Documents - Imaging
IHE-XDS
(Cross-Enterprise Document Sharing)
Importing an Exam

• Establish a standard viewing environment for clinicians for outside exams.
• Allow them to designate exams for import from this environment
• Import into local PACS

• IHE solutions
  – [PDI] **Portable Data for Imaging** provides reliable interchange of image data and diagnostic reports on CDs for importing, printing, or optionally, displaying in a browser.
  – [IRWF] **Import Reconciliation Workflow** manages importing images from CDs, hardcopy, etc. and reconciling identifiers to match local values.
A Standards Based Solution

NIBIB/RSNA Image Sharing Project
NIBIB/RSNA Image Sharing Project  
A Standards Based Solution

• Consumer controls the flow of information – Patient Engagement
  – Diminishes the need for BAAs between enterprises
    • Imaging Site to Clearinghouse
    • Clearinghouse to PHR

• Bootstrap an IHE based network
  – IHE generally has not focused on consumer driven solutions but rather on institutional and enterprise workflow
  – Primary emphasis is Consumer Control through PHRs
  – Can be extended to other forms of sharing
    • HIE

• Security and Confidentiality are drivers
• Replacement / Alternative to CD

• 5 Academic Institutions
• Develop a solution for all Radiology Sites
• Establish a clearinghouse
• Engage PHRs
Image Sharing/Elements of Solution

• Edge Server
  – Register a patient
  – Listens to a Radiology Information System (RIS)- looking for a complete exam
  – Retrieves Image set from PACS and Report from RIS
  – Send both to clearinghouse
    • PHI hidden; an RSNA ID and 2\textsuperscript{nd} factor security token are used to identify the patient

• Clearinghouse (XDS-I) – functions as a secure router
  – Transiently hold encrypted patient data

• PHR
  – Consumer controls upload and future access
    • Must have RSNA ID available and know answer to 2\textsuperscript{nd} factor question
  – Develop web based viewers
  – Download full DICOM data set

• Misc Consumers
Image Sharing Systems Overview
Radiology Dept
Search for Patients

Logged in successfully

MRN: 9999990
Patient Name: test
Search
Simple Search

<table>
<thead>
<tr>
<th>Name</th>
<th>MRN</th>
<th>Sex</th>
<th>Date of Birth</th>
</tr>
</thead>
<tbody>
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<td>TEST, SHARE</td>
<td>9999990</td>
<td>M</td>
<td>May 1, 1950</td>
</tr>
<tr>
<td>Accession #</td>
<td>Exam Desc</td>
<td>Most Recent Change</td>
<td>Status</td>
</tr>
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<td>----------</td>
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<tr>
<td>5786424</td>
<td>RA MRI KNEE LEFT WITHOUT CONTRAST</td>
<td>July 26, 2011 14:06</td>
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<tr>
<td>5825155</td>
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<td>FINALIZED</td>
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<td>August 24, 2011 23:06</td>
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<tr>
<td>5825160</td>
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<tr>
<td>5825161</td>
<td>DU Mammography Bilateral</td>
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<tr>
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<td>5842712</td>
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<tr>
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<td>September 11, 2011 23:59</td>
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<tr>
<td>5845482</td>
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<td>September 11, 2011 23:59</td>
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<td>September 14, 2011 06:36</td>
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<td>5848920</td>
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<td>FINALIZED</td>
</tr>
</tbody>
</table>
Enter Password

Please ask the patient to enter the password they would like to use to retrieve his/her images.

**Note:** Passwords are case sensitive

Show password in plain text? □

Password

Confirm Password

Patient's Email (optional)

Send Cart
Patient Name: TEST, PATIENT, A
Date of Birth: 1976-11-08
Token: rxubu979
Password:

Write your password on the line above
Your password is case sensitive
site-help-desk-message
Image Enabled PHR- DELL
### Import Documents

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
</table>

**DOB**: 1926-06-29  
**RSNAID**: [Enter]  
**PIN**: [Enter]  

[Search]
### My Documents

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-05-11 14:28</td>
<td>Images</td>
<td>Diagnostic Imaging Report</td>
</tr>
<tr>
<td>2011-05-11 14:28</td>
<td>Images</td>
<td>Diagnostic Imaging Report</td>
</tr>
<tr>
<td>2011-05-11 14:15</td>
<td>Images</td>
<td>Diagnostic Imaging Report</td>
</tr>
<tr>
<td>2011-05-11 09:40</td>
<td>Images</td>
<td>Diagnostic Imaging Report</td>
</tr>
<tr>
<td>2011-05-11 09:40</td>
<td>Report</td>
<td>Diagnostic Imaging Report</td>
</tr>
</tbody>
</table>
MR RIGHT KNEE: 

CLINICAL INDICATION: Tear of medial meniscus.

TECHNIQUE: Axial, sagittal and coronal sequences were performed.

OBSERVATIONS: The lateral meniscus is unremarkable. Medial meniscus demonstrates some degenerative signals which do not touch the inferior articular surface of knee joint, for example series 4, images 5-6. However, on image 7, a small, globular focus abuts the inferior articular surface near the free edge; this is compatible with a tear. Quadriiceps tendon and patellar tendon are intact. Anterior cruciate ligament and posterior cruciate ligament are intact. Medial collateral ligament and fibular collateral ligaments are intact.

As far as can be seen, the articular cartilage is unremarkable. Moderate amount of suprapatellar fluid is identified.

IMPRESSION: DEGENERATIVE CHANGES AND TEAR, POSTERIOR HORN OF MEDIAL MENISCUS; MODERATE AMOUNT OF SUPRAPATELLAR FLUID.

COMMENT: THERE IS SUGGESTION OF A MEDIAL PATELLAR PLICA.
Patient PHR view
Patient and Dr. PHR view
Patient account permits sharing
Advantages of Approach

• Push model
  – No Query of PACS from outside the firewall
• Full DICOM data set is available
  – Web viewers
  – Download and Import to PACS
• Report is available
• Historical exams can be sent simultaneously
• Consumer controls flow of information
  – Affords the patient the ability to select what information to share
    • Is this good?
RSNA Image Share- Current status

- Patients enrolled in production environment- 7000
  - Jan 4, 2014
- Approximately 30% have closed the loop and used the PHR

- 4 Academic sites are live
  - Mount Sinai, UCSF, University of Maryland, Mayo Clinic
- Last sites are navigating local issues and hope to be live within a few months
- 3 Community practices are live
Patient Responses

• Love it!
  – It’s about time
  – This is great
  – My doctor was really pleased to have access to my images

• Problems
  – Couldn’t access my images
  – Got my images- but difficult
  – My doctor couldn’t see my images
Next steps - New NIBIB (NIH) contract

- New Funding awarded by NIH for 2 years + 2 option years
- Expansion of network
  - **Vendor Adoption of Edge Server (Open Source)**
  - Vendor migration to XDS for all services
  - New use cases
- Leverage XDS infrastructure/ network
  - PHR
  - HIE
  - XDR
- Edge Server as a platform
  - Comparative Effectiveness
  - CDS
  - Radiation Monitoring
  - Peer Review
  - Quality Metrics

- DICOM evolution
  - Restful services
  - Separation of Metadata from pixel data
    - Enables discovery
    - Viewer
- Refine Workflow
  - Initial workflow is to replace a CD
  - Exam updates
  - Download DICOM data and archive in a local PACS
  - EHR Integration
Sign up today!

Streamline implementing at your site!
- No cost to you or the patient (2 years of storage)
- RSNA Image Share provides a server if needed
- Implementation manager will come on site - no charge
- Help desk for patients

- ImageShare@RSNA.org
Health Information Exchange

a core component of interoperability

Michael L. Glickman, MSE
President, Computer Network Architects, Inc.
Chair-Elect US Technical Advisory Group (TAG) to ISO TC215, Health Informatics
Board Member, Clinical Data Interchange Standards Consortium

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Learning Objectives

- Importance of Sharing Information via a Health Information Exchange
- Importance of Standards to achieve Interoperability
- IHE profiles and Standards relevant to Health Information Exchange
- Strategies for Managing the patient matching conundrum
- Understanding achieving leverage from the marketplace consolidation underway
Health Information Exchange

A verb and a noun known by many monikers over 3 decades
• Community Health Information Network (CHIN) (1990s)
• Regional Health Information Organization (RHIO) (2000s)
• Health Information Exchange (HIE) today
• Whatever they are called, they are imperative elements of the landscape
  • The interoperable exchange of health information requires aggregation points
  • Every creator can not communicate directly with every consumer and verse visa
  • The N²-N problem
    • 100 connections talking to each other requires 9,900 connections
    • Topologically speaking 100 connections connected via an HIE requires 101 connections
  • The realities of the marketplace including effective economies of scale will produce the right level of consolidation
Barriers to Usage

Patient Matching is a continuing conundrum

• Must create a **Patient Identifier Cross-reference manager**
• Patient Demographics based matching mechanism
• Early work required much tuning of the matching algorithms
• Due to data breach concerns SS# is seldom used as a matching parameter
  • Adversely effected the matching rate significantly
• Zip code does not always work well either, e.g., the dense population and shared zip codes within Manhattan
• Processing matches vs. potential matches is an operational necessity
  • Time consuming, but required for data integrity
• A work-around until HIMSS and ONC can develop a framework for a national patient identifier
Barriers to Usage

Patient Consent

- Opt-in vs. Opt-out tradeoffs
- In one HIE implementation < 10% of patients have provided written consent for a provider to access their data
- Need strategies so patients understand the advantages of sharing data and consent
  - Must include privacy and security policies and procedures that are implemented and enforced
  - Providers need to explain advantages of sharing
    - Far more than reducing duplicative tests
    - Collect throughout the workflow
    - Identify “go to” person
  - Narrow-networks of providers
  - Voluntary Universal Patient IDs
Case Study of a Successful HIE

**Healthix** formed by the merger of three downstate New York State Health Information Exchanges

- Original participants NYCLIX (Manhattan) and LIPIX (Long Island) were the first HIEs to exchange PHI data using the original ONC National Health Information Network framework
- Recent merger with BHIX (Brooklyn) has created the largest HIE in New York State
  - Total patients with clinical data in Healthix: 11,000,000
  - Total Medical Record Numbers: 20,200,000
  - Clinicians and Care Managers authorized to access patient data: 8,000
Map of Participant Hospitals and Nursing Homes

- Hospitals are represented by red circles.
- LTC Facilities are represented by blue circles.
## Participants (1/17/14)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Care - Hospitals</td>
<td>51 Hospitals with 20,812 beds</td>
</tr>
<tr>
<td>Long Term Care (LTC)</td>
<td>21 LTC Facilities with 9,134 beds</td>
</tr>
<tr>
<td>Ambulatory Medical Practices</td>
<td>6 FQHCs</td>
</tr>
<tr>
<td></td>
<td>21 Physician Practices</td>
</tr>
<tr>
<td>Public Health Agencies</td>
<td>Correctional Health Services</td>
</tr>
<tr>
<td></td>
<td>OMH South Beach Psychiatric Center</td>
</tr>
<tr>
<td></td>
<td>NYC DOHMH - Emergency Patient Search</td>
</tr>
<tr>
<td>Medicaid Health Homes</td>
<td>Brooklyn Health Home and CBC</td>
</tr>
<tr>
<td></td>
<td>Continuum’s Health Home.</td>
</tr>
<tr>
<td>Health Plans</td>
<td>5</td>
</tr>
<tr>
<td>Radiology Groups</td>
<td>3 independent imaging groups.</td>
</tr>
<tr>
<td>Behavioral Health (BHs) and CBOs</td>
<td>Many, both in Medicaid Health Homes and separately.</td>
</tr>
<tr>
<td>De-Identified Research</td>
<td>Mount Sinai AHRQ/CMMI projects</td>
</tr>
<tr>
<td></td>
<td>PCORI grant to NYC-Clinical Data Research Network (CDRN)</td>
</tr>
<tr>
<td>Research with Identifiable PHI</td>
<td>NYC-CDRN</td>
</tr>
</tbody>
</table>
Standards Based Infrastructure

Necessary to create economies of scale, albeit there are still many to chose from.

Managed by breaking Exchange into three fundamental components:

• Transport, Payload and Vocabulary
• Suite of standards employed includes HL7, Surescripts and IHE profiles
• Over 450 Interfaces
• Support a mix of: internal client coding schemes, CPT, NDC, LOINC and ICD-9
  • Internal outnumbers standardized approximately 2:1
# Standardizing the payload - Message Types

<table>
<thead>
<tr>
<th>Message Types</th>
<th>Message Type Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADT</td>
<td>Demographics and event triggers to indicate events such as patient Registration, Admit, Discharge &amp; Transfer. May include additional info; consent, diagnosis, allergies, next of kin, etc.</td>
</tr>
<tr>
<td>ORU</td>
<td>Order Results for Labs, Radiology, EKG, etc. May also be used for Notes, patient condition, etc.</td>
</tr>
<tr>
<td>MDM</td>
<td>Medical Document Management (Notes) Physician visit notes, discharge summaries, etc.</td>
</tr>
<tr>
<td>ORM</td>
<td>Order Message. Primarily used for Medication Orders in our system. Can be used for Labs, Rads, etc.</td>
</tr>
<tr>
<td>RDE</td>
<td>Pharmacy/Tx Encoded Order Message. Used for Medication Orders</td>
</tr>
<tr>
<td>OMP</td>
<td>Pharmacy/Tx Encoded Order Message. Used for Medication Orders</td>
</tr>
<tr>
<td>PPR</td>
<td>Patient Problem Message. Problem list /diagnoses.</td>
</tr>
<tr>
<td>SIU</td>
<td>Scheduling Information. Used to transfer patient appointments.</td>
</tr>
<tr>
<td>CCDA</td>
<td>Continuity of Care Document. XML based. Contains core patient data including, but not limited to, demographics, diagnoses, results, allergies, medications, etc... (A combination of all HL7 messages)</td>
</tr>
</tbody>
</table>
How to manage hundreds of interfaces

Create re-usable components
• Standards based approaches whenever possible
  • IHE, HL7, DICOM, S&I Framework, etc.
• Consistent Governance
• Formal Change Control Process
  • Change Control Board
  • Communication policies and protocols
  • Tie to Break/Fix triage and remediation
• Implement real-time, proactive monitoring
  • Users shouldn’t be the ones to discover issues
How to manage hundreds of interfaces

Apply the reusable components recognizing the differences in timing, and scope of New Initiative Implementation vs. Operations and Maintenance

New Initiative needs differ based on
• Consolidation
• New Sites
• New Features and Functions

Operation and Maintenance needs differ based on
• Status Quo maintenance
• Break/Fix Triage and Remediation
Sharing Best Practices Globally
*a core component of interoperability*

Michael H. Nusbaum, BASC, MHSA, FHIMSS
President, MH Nusbaum & Associates Ltd.
President, IHE Canada
Director, IHE International Board
IHE International Liaison Officer to ISO/TC215
Learning Objectives

• Appreciate how the IHE Global Deployment Coordination Committee and the IHE World Summit have evolved to speed "lessons learned" from country to country.

• Understand how IHE's library of standards and testing tools continue to evolve as quickly as possible to meet the growing challenges of global health information interoperability.

• Describe how the USA’s outreach program has embraced and included other nations and regions in health information interoperability.
Where the “rubber hits the road”

- IHE develops **globally**, deploys **locally**
- IHE’s success depends entirely on it’s deployment, and the extent to which IHE Integration Profiles are able to improve the ability of systems to interoperate… in actual implementations!!
- Individual success stories from projects
- Sharing success around the world
- Projects leveraging collaboration across international borders
Over 650 Contributing Vendors & Organizations

IHE Organization

IHE International Board

Global Development

Regional Deployment

Anatomic Pathology
Cardiology
Dental
Eye Care
Endoscopy
IT Infrastructure
Laboratory
Patient Care Coordination
Patient Care Devices
Pharmacy
Quality, Research & Public Health
Radiation Oncology
Radiology

IHE NORTH AMERICA
Canada USA

IHE ASIA-OCEANIA
China Japan Korea Taiwan

IHE EUROPE
Austria France Germany Italy
Netherlands Norway Spain
Sweden Switzerland UK

21 Societies Serving as Sponsors
Advancements in IHE Global Development

• Worldwide participation in Domain Committees
• Connectathons around the globe
• Interoperability Showcase demonstration events around the globe
• Emerging Conformity Assessment Framework to be adopted globally
<table>
<thead>
<tr>
<th>Year</th>
<th>(Year)</th>
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<tbody>
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<td>(2003)</td>
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<td>Year 6</td>
<td>(2004)</td>
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<td>(2007)</td>
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<td>(2008)</td>
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<td>(2009)</td>
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<tr>
<td>Year 14</td>
<td>(2012)</td>
</tr>
<tr>
<td>Year 15</td>
<td>(2013)</td>
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- USA
- France
- Germany
- Italy
- Japan
- UK
- Canada
- Korea
- Taiwan
- Norway
- Netherlands
- Spain
- Finland
- New Zealand
- Malaysia
- Brazil
- Switzerland
- Turkey
- Saudi Arabia
- Colombia
Coordination of Deployment Activities
3-Tier Model

Global Deployment Coordination Committee (GDC)

Representatives from each Continental Mirror Committee meet regularly by Tcon

Continental Mirror Committees

<table>
<thead>
<tr>
<th>IHE Americas</th>
<th>IHE Europe</th>
<th>IHE Asia</th>
<th>Others …</th>
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<tbody>
<tr>
<td>US</td>
<td>CDN</td>
<td>FRA</td>
<td>TUR</td>
</tr>
<tr>
<td>JPN</td>
<td>CN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All Deployment Committees are invited to an annual World Summit

IHE World Summit
rotating country/continent, e.g. aligned with another global event like ISO
Sharing Success..

- Success stories are published at http://www.ihe.net
- Success stories are shared at the IHE World Summit events
- Successes of one country are leveraged by other countries
- Share YOUR success: http://ihe.net/Call_for_Success_Stories/
The IHE World Summit

• Began in 2013
• Inaugural event attended by representatives of 25 of 27 national deployment committees
• A forum to:
  – Learn from one another
  – Share ideas
  – Share successes and challenges
  – Share best practice
  – Discuss ways that IHE can become even more effective
  – IHE training for implementers
• Next World Summit – planned for September 2014 in the US
In the 21st Century, the care continuum is ubiquitous

Expectation is that relevant information will be available where it is needed, when it is needed... to support care.

Globalization:
  - A mobile population
  - Global vendors
  - Sustainability of our healthcare systems

Globalization supported by the standards community
Global Initiatives - currently

- USA and the European Union
  - **US-EU eHealth Cooperation Initiative**
    - Launched December 2010 with MOU
    - Workgroups: EHR Interoperability & Workforce Development
  - **Trillium Bridge Project**
    - Launched September 2013
    - Bridging Patient Summaries across the Atlantic
- **USA and UK Healthcare IT MOU**
  - January 2014
  - Sharing common values around healthcare informatics
  - Making it easier for small and medium-sized enterprises to get a foot in the door on both sides of the Atlantic.
- 2016 Olympic Games
  - In development
Example:
Trillium Bridge Project

Patient Summary

Transformation

EU

Transition of Care

US

HL7 CDA Content
IHE XCA/XPD Infrastructure
Questions?

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Thank You!

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