Integrating the Healthcare Enterprise: IHE... Background, Overview, and Radiology Status

J.A. Seibert, Ph.D.
Department of Radiology
University of California Davis Health System
Sacramento, California

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Learning Objectives
- Provide an overview of the background, history, and process of Integrating the Healthcare Enterprise (IHE)
- Describe the space in which IHE functions and how stakeholders are involved
- Give examples of radiology profiles, actors, and transactions pertinent to the diagnostic medical physicist
Snapshot of electronic medical imaging in 1997

**Background**

- **1990’s**: RSNA instrumental in DICOM promotion / adoption; system interoperability required use of the HL7 standard
- **1997**: Progress toward producing turnkey devices able to “plug and play” with existing standards—required definition of specific use-cases and specific architectures
- **1998**: Engagement with the Healthcare Information and Management Systems Society (HIMSS) to establish momentum and direction for system interoperability —..... the IHE effort was initiated

**Background**

- Initially conceived as a 3 – 5 year project with the premise:
  - Annual cycle of proposed technical specifications
  - Testing of implementations occur at “connectathons”
  - Public demonstrations will demonstrate value
- **Year 1:**
  - Problem of scheduling radiology workflow from patient registration / ordering / scheduling ... to ... image acquisition / transfer / archival / distribution
  - Involved DICOM and HL7, with multiple devices (PACS, RIS, HIS)
  - 47 systems and 24 vendors were present at RSNA 1999
Background

- Year 2, Year 3, ....
- In 2005 there were 7 integration profiles
- In 2016 there are 21 integration profiles & 23 supplements for trial implementation (Radiology only)
- Project is ongoing and now in 17th year
- IHE is now a global organization spanning multiple domains

IHE Domain Committees

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

Integrating the Healthcare Enterprise

- Initiative by healthcare professionals and industry to:
  - Improve the way computer systems in healthcare share information
  - Promote the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs
  - Enable care providers to use information more effectively in support of optimal patient care
Integrating the Healthcare Enterprise: What?

- Establishes Technical Framework of Integration Profiles to meet critical interoperability needs
- Guides vendor implementation strategies
- Provides effective shorthand for use in purchase specifications
- Enables providers to use information more effectively from systems developed with IHE integration profiles
- Improves system communication and eases implementation

Integrating the Healthcare Enterprise: How?

- Identify a set of use-cases requiring a common architecture
- Define an Integration Profile to support those use-cases
- Define a specific clinical use case
  - Determine clinical information and workflow needs
  - Address needs by set(s) of “actors” and “transactions”

Integration Profile, Actors, Transactions, Connectathon

- **Integration Profile**: Precise description of how standards are to be implemented to address a specific clinical integration need, definitions of the clinical use case, and set of actors and transactions that address the need
- **Actor**: a system or application responsible for certain information or tasks, which supports a specific set of IHE transactions to communicate with other actors
- **Transaction**: exchange of information between actors, describing how to use an established standard (DICOM, HL7, W3C) to exchange information
- **Connectathon**: process to test implementations at a live, structured, multi-vendor event in a supervised environment
Goal: Build IHE Mammography Image Profile

- Challenges:
  - Two types of image data
  - Different vendor attributes / image data
  - Common use of CAD
  - Importance of prior studies
  - Image size, orientation, layout
  - MQSA requirements (USA)
For Presentation vs For Processing?

- Which image provides an equalization of the breast skin line?
- Which image is used by CAD in mammography?

Types of Image Data

- "For Presentation" image data
- "For Processing" image data
- Mammo CAD structured report

Hanging Protocols

- Determined by
  - View type (CC vs. MLO)
  - Specialty view type
  - Laterality
  - Patient orientation

Preferred layout
**Hanging Protocols**
- Generic image display
  - Series based
  - Image order as acquired
  - Image orientation as acquired

**Variances in image size**
- Typical "Fit to Viewport" effect

**Recognizing tissue vs air**
- Window / Level adjustments
  - Recognize skin line
  - Pad outside data to pre-determined value
- Maintain black air gap during window / level operations and inverted pixel data
True size film printing

- Film size vs. detector size
- Precision with <2% error

24 x 30 cm
18 x 24 cm

Printing: minimal borders at chest wall

- Centered images
- Images offset on chest wall side: Minimal borders

Mammography Image: Integration via IHE

- Meets desire to have multiple FFDM vendors, and use any vendor’s workstation for diagnosis
- Ensures FFDM modalities provide adequate information for downstream applications
- Ensures systems support required data objects for interoperability
- Defines image display and printing operations for effective and efficient diagnosis
Radiation Exposure Monitoring

• Create, store, manage, retrieve, and use the DICOM Radiation Dose Structured Report object
Radiation Dose Structured Report (RDSR): IR example

• Reference point: 11007 mGy
• Largest dose by position: 2200 mGy

Radiation Dose metrics

• Modalities:
  • Computed Tomography
    • CTDvol & DLP
  • Interventional Radiology, Cardiology & Fluoroscopy
    • DAP, RP AX, kV - mAs, geometry tracking
  • Radiography
    • Exposure index, Deviation Index: IEC 62494-1
  • Mammography
    • Average Glandular Dose, Incident dose, Compression
Increased radiation dose awareness

- Access to radiation dose software
- Identification of high-dose studies (why?)
- Provision of patient-specific dose metrics

The IHE REM profile

- Addresses the efficient collection and distribution of dose information, but is just a tool.....
- Profile removes data collection and management burdens
- ...... But it is up to the site to put the information to use

IHE Radiology: expanding applications and implementations

Current technical framework

Supplements for Trial Implementation
IHE-RO

- Radiation Oncology implementations
- Uniquely applied to interoperability challenges in management of RO operations and workflow
- Detailed overview in the subsequent presentations

Summary

- From limited expectations & planned extinction, IHE is expanding and evolving to solve critical clinical interoperability needs
- IHE defines Integration Profiles that use standards to solve interoperability problems
- The Technical Framework contains the Integration Profiles that have gone through the validation (connectathon) process
- Specifying IHE Integration Profiles in RFPs ensures compatibility and functionality for given tasks and interoperability