IHE based Interoperability – Benefits and Challenges

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Outline

- Introduction
  - Why is interoperability important for trans-institutional Shared Electronic Health Records (SEHR)?

- Methods
  - Literature analysis
  - Interviews with domain experts
  - Implementation and Connectathon experience

- Results
  - Definition of criteria for interoperability assessment
  - Evaluation of IHE integration profiles according to those Criteria

- Discussion
Subject and Motivation

- Cooperation and optimized work flows in health care institutions is expected to improve quality and efficiency while reducing costs. [Collen, 1970]

- A Shared Electronic Health Record (SEHR) requires a variety of subsystems to collaborate:
  - HIS / CIS in hospitals
  - GP's Praxis systems
  - Infrastructure components
    - Data Repository and Indices
    - Patient Identification Systems
    - etc...

Interoperability should provide for medical data to be seamlessly transferred between and interpreted identically within involved Subsystems.
Problem Context

- A clear definition of interoperability which covers the requirements for SEHRs is missing

- It is unclear if existing IHE Integration Profiles fully support interoperability for Shared Electronic Health Records
  - What is covered by IHE?
  - Which issues are still open?

- It is unclear which extensions have to be applied to IHE Profiles to support required interoperability
Objectives

- Definition of interoperability with special emphasis on
  - SEHRs and
  - Healthcare services in general

- Extraction of assessment criteria for interoperability evaluation

- Evaluation of existing IHE Integration Profiles with regard to:
  - Coverage of extracted criteria
  - Modifications of IHE Integration Profiles required to support those criteria
Methods

- Analysis of existing literature for identification of interoperability requirements
  - PubMed
  - IEEE
- Interviews with domain experts in the fields of:
  - Structured documents conversion of non-structured data
    (Innsbruck University Hospital)
  - Security, patient identification, accounting and billing
    (Sozialversicherungs-Chipkarten Betriebs- und Errichtungsgesellschaft m.b.H (SVC) e-card operating company)
  - Security, availability considerations
    (Österreichische Datenschutzkommission: Austrian data protection experts)
  - Data standards, user and domain requirements
    (Österreichische Ärztekammer: Austrian Medical Association)
- Experiences in implementing IHE Profiles and Connectathons
Results
Interoperability

IEEE defines interoperability as the:

“Ability of a system or a product to work with other systems or products without special effort on the part of the customer” [IEEE, 2007]

- But what are the exact requirements for SEHRs?
- --> Use the same requirements for interoperability consideration as for the design of SEHRs!

Source: The World Wide Web Consortium (W3C) [lists.w3.org]
**Interoperability Criteria**

- **Interfaces:**
  - Has a common structure of interfaces been agreed on?

- **Semantics:**
  - Are data interpreted identically on systems of different vendors?

- **Legal and organizational aspects:**
  - Are local legal and organizational requirements correctly considered?

- **Security:**
  - Is the security level of a system to be decreased for the sake of interoperability?

--> Evaluate to which extent each requirement is covered by existing IHE Integration Profiles <---
Interoperability on Interface Level (1/2)

Implementation Experiences...

- Basic concept of IHE is successful
- Partly inconsistent standards (e.g. Optional fields in ebXML messages)
  - No specification whether optional fields should be completely absent or have empty elements in XML
- Vendors have their systems specially tuned for the Connectathon
  - Majority of vendors have validation turned off for the sake of passing tests
- XDS.a and XDS.b rely on ebXML (encapsulated in SOPAP via Web Services)
  - Much harder to implement than plain WS
  - WS* Security profiles can not be directly applied
  - XDS metadata can not be generated from WSDL
Interoperability on Interface Level (2/2)

- IHE defines clinical use cases to support interoperability
  - IHE specifies standardized actors and transactions
  - Systems compliant to IHE support basic interoperability of their technical interfaces

But...

- IHE leaves many details open for implementation
  - Supports the market, different vendors
  - Affects interoperability because of different interpretation of the standard
- Systems can be further developed after conformity has been attested
  - Systems can be further improved after the Connectathon
  - Side effects can break interoperability
Interoperability on Semantic Level

- IHE starts to cover semantic interoperability
  - Clinical Document Architecture (CDA) as common data standard
  - Content profiles to standardize medical contents based on clinical semantics
- CDA allows language independent sharing of medical content
  - Level 3 supports LOINC and other medical dictionaries

Challenges...

- A fine-grained structure of CDA level 3 is necessary
- Workflow of data capturing has to be changed
  - No free text entries
  - Organizational challenge
  - Medical stuff must be motivated to use rigid form-based data input
Interoperability on Legal and Organizational Level

- IHE originates from mainly from US and English speaking countries
  - IHE covers “global” requirements for clinical workflows
  - IHE only slowly starts to care about regional requirements
  - IHE Europe is slowly gaining power

Challenges...

- It is important for IHE to support regional requirements
- Development of local extensions
- Integrate local extension to a holistic concept without braking interoperability
  - Local extensions should support local context, but
  - must remain interoperable with the international Integration Profiles
- To which extent may local extension be “localized”??
Interoperability on Security Level (1/2)

Implementation Experiences...

- IHE supports secure communication on network level (TLS)
- ATNA has a weak transport mechanism: Syslog via UDP
  - Lack of security and reliability for audit messages
- ATNA audit messages do not sufficiently cover Austrian legal requirements
  - ATNA messages are not reliable
  - ATNA messages are generated per Transaction,
    - But a “per Healthcare Professional” view is required
- Coverage of fine grained Patient-controlled access control policies with existing Integration Profiles is a mayor challenge for IHE
Interoperability on Security Level (2/2)

- IHE uses a modular approach (dedicated Integration Profiles) to solve Security issues
  - Audit Trail and Node Authentication (ATNA) for secure communication between nodes and meaningful logging messages
  - Cross Enterprise User Assertion (XUA) for secure identification of a user's or system's identity across institutional boundaries
  - Basic Patient Privacy Concepts (BPPC) for enforcing access control policies based on the patient's consent
- Security can be plugged in at a later time
  - Simplifies implementation and testing

But...

- Security should be an integral part of each system by design
- Only by integrating security application level security (end-to-end security can be achieved)
Discussion

- IHE definitely improve interoperability
  - Standard clinical workflows are vastly covered by IHE Integration Profiles
- Integrated and consistent security for all IHE Profiles remains a major challenge
- Existing Integration Profiles could benefit from respecting local and regional requirements
  - Local extensions
  - without breaking interoperability
- Coordination of regional initiatives
  - To avoid uncoordinated groups with proprietary extensions / implementations
- Feedback of implementors can help profiles to improve
Thank you for your attention!
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