Interoperability based on Web Services and a Federated Architecture

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Background:

Nearly four decades of Laboratory information systems development has passed with no attempt to demonstrate interoperability.

Unlike some other developments, communication between laboratory information systems and other on-line repositories still requires specific interface development and associated expert support.
Historical Setting:

• HL.7 as a standard is not constrained
• Current interfaces remain point-to-point and require specialised support
• As this type of interconnectivity increases, the complexity of the health care environment increases towards a technically unsustainable position
• New modern standards of data representation and exchange are required.
The Challenge:

To address this deficit, a challenge was proposed to Vendors by the University of Michigan Pathology Informatics Group in Las Vegas in 2008 to collaborate to develop a true inter-system, operability. University of Michigan agreed to construct a Web-services cloud into which all participating vendors would attach in order to support cross system queries and responses.
Participants:

• Vendors who accepted this challenge included:

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<td>Atlas</td>
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<td>McKesson</td>
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• Early in the development the NCI CaBIG also joined the pilot
• The goal was to build a fully interoperable cloud service and provide a working demonstration at the Las Vegas meeting in one year’s time.
Components considered for Use:

- eXtensible Markup Language (XML)
- Federated architectures
- Properly adjudicated namespaces and strongly typed concepts and data elements (ISO-11179)
- Service-oriented Architectures (SOAs) and normalized data models
- Grid Computing
- Cloud Service Architectures
- De-identification Algorithms
Achievements from the Pilot:

• A strong partnership of Academia and Government with Vendors
• A working example of a complex federated web architecture
• Transfer of data between organisations using a de-identification algorithm
• Cloud services serving all members of the federated architecture
• Value added services delivered from the “cloud” providing compliance with federation rules, decision support and interpretative services
LabWizard in InterOp Project
Personalized Interpretive Reports Integration

5. Aggregated patient results from all responding sites are supplemented with personalized interpretive report and returned to requesting LIS

1. Original patient hash query submitted to cloud

2. Subsequent hash based query (and response) to each LIS site to obtain same-patient data across federation

3. Cloud initiates an internal service request, forwarding aggregated raw patient data for Interpretive Service Class query from the remote server

4. Remote Server Returns an Interpretation message to the cloud via an internal services-level connection

Federated Sites (vendors)
Decreased LDL can be seen with lipid-lowering therapy, severe illness or in rare inherited conditions (e.g. abnormalities in apolipoprotein B or lipoprotein assembly). Results for ALT 201-400 IU/L and AST 47-100 IU/L indicate abnormal liver function.

Tissue Pathology Comments:
Analyses of the specimen indicated it to be positive for BRCA 2.
It is recommended that patients positive for BRCA 2 be offered hereditary screening, hereditary screening and assessment of other risks. Also advice regarding the increased risk of other cancers in ovarian might be considered.

This report is not yet allowed to be auto validated.

[Image of the screen showing a laboratory report]

[Logo of Pacific Knowledge Systems and University of Michigan]
Lessons from the Pilot:

- “Lite” developments can provide significant functional and operational advantages
- Major developments can be delivered easily from within existing systems
- All members of a Federated Architecture benefit from services provided from the Cloud layer
- Value added services delivered from the Cloud can provide compliance with federation rules, decision support and interpreative services
Why is knowledge valuable in the InterOp environment?

Knowledge can:

• aggregate non-standardised shared data
• determine atomic elements from unstructured data
• create Information from Shared Data
• be applied to the aggregated “information” and provide real time decision support for:
  - Processing information according to Federated system rules
  - Routing according local business requirements of each Federated participant
  - Applying Clinical Interpretations and recommendations
Benefits of Shared Information:

- InterOp provides opportunities for Vendor participation in data sharing at minimal costs from within existing applications. This can:
  - Provide a full patient centric view of available information, independent of source
  - Aggregate relevant clinical information directly with diagnostic results
  - Benefit patients and providers in provision of best practice care
- Providing personalised medicine using an evidence based approach, across both testing and consulting environments
Future Developments in LIS InterOp:

- Introduction of semantic standardisation to limit rules required for data processing
- Introduction of specified Data sets for extended pilot validation
- Inclusion of:
  - Inter-Federant processing rules
  - Agreed Interpretation guidelines
  - Site specific business rules (processing and workflow) and actions expected from the service layer
Potential Uses for Shared Knowledge Systems:

• Many e-Health systems are in a nascent status
• Until mature standards for complex clinical data exchange are agreed, application of knowledge can facilitate inter-system data exchange
• In this regard, knowledge bases can provide:
  - decision support at all levels of a shared health record
  - automated actions to manage patient care via relevant clinical pathways
  - alerts and escalations across multiple clinical systems to ensure high levels of quality and safety.