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:

Atlas	Soft
McKesson	SunQuest
Pacific Knowledge Systems	TechniData

- 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:

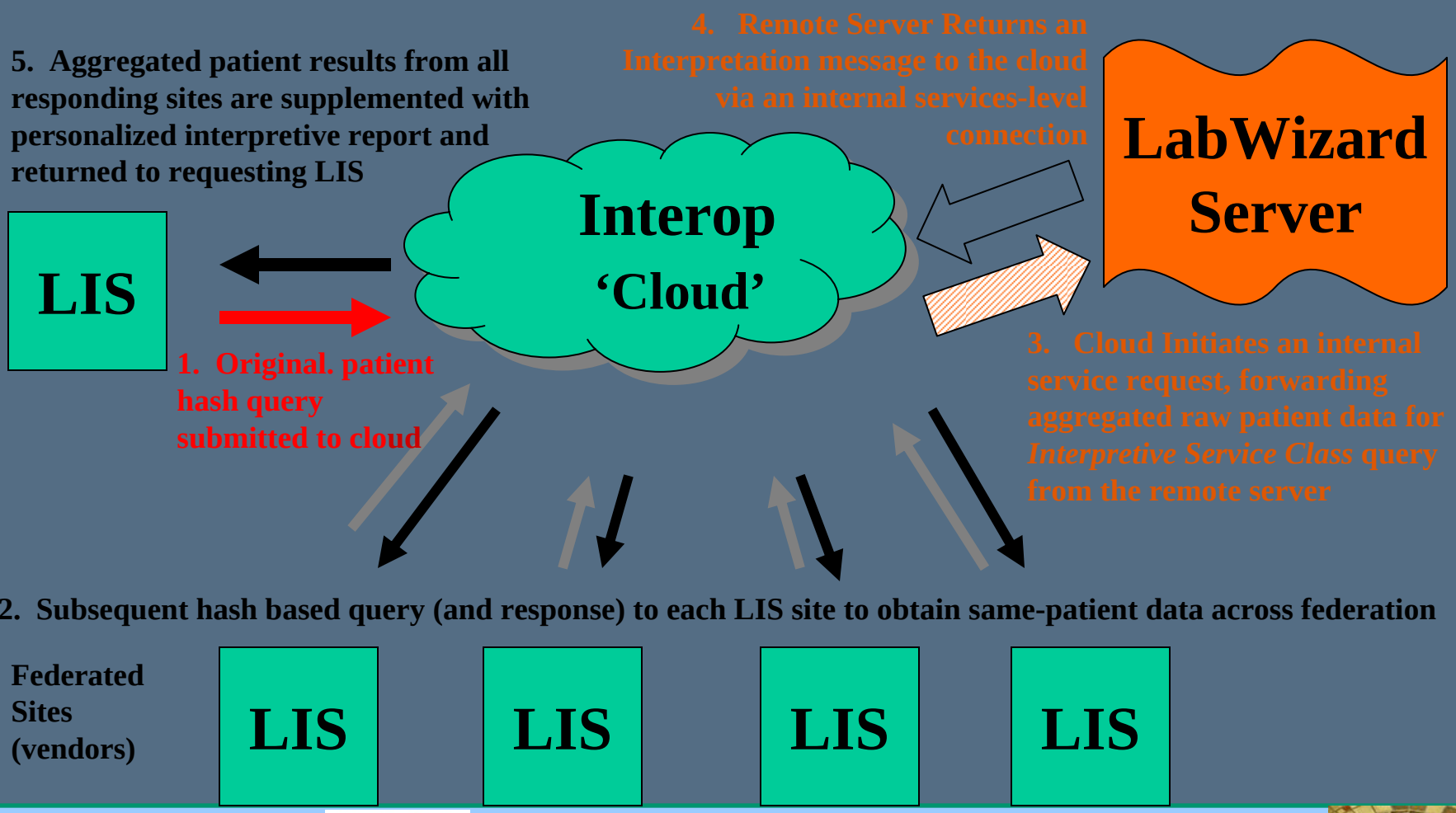
- eXtensible Markup Language (XML)
- Federated architectures
- Properly adjudicated namespaces and strongly typed concepts and data elements (ISO-11179)
- Service-oriented Architectures (SOAs) and normalized data models
- Grid Computing
- Cloud Service Architectures
- De-identification Algorithms

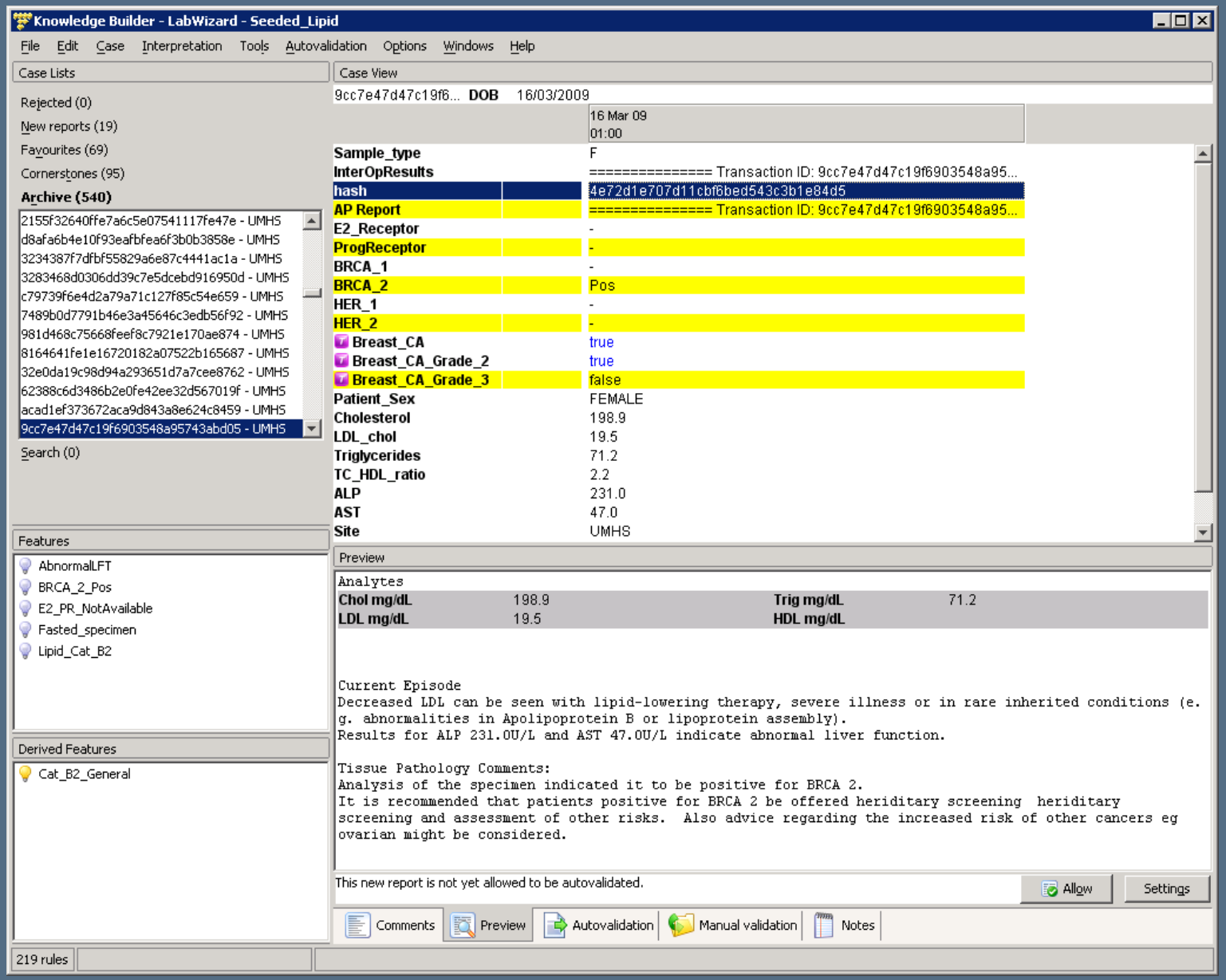
Achievements from the Pilot:

- 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





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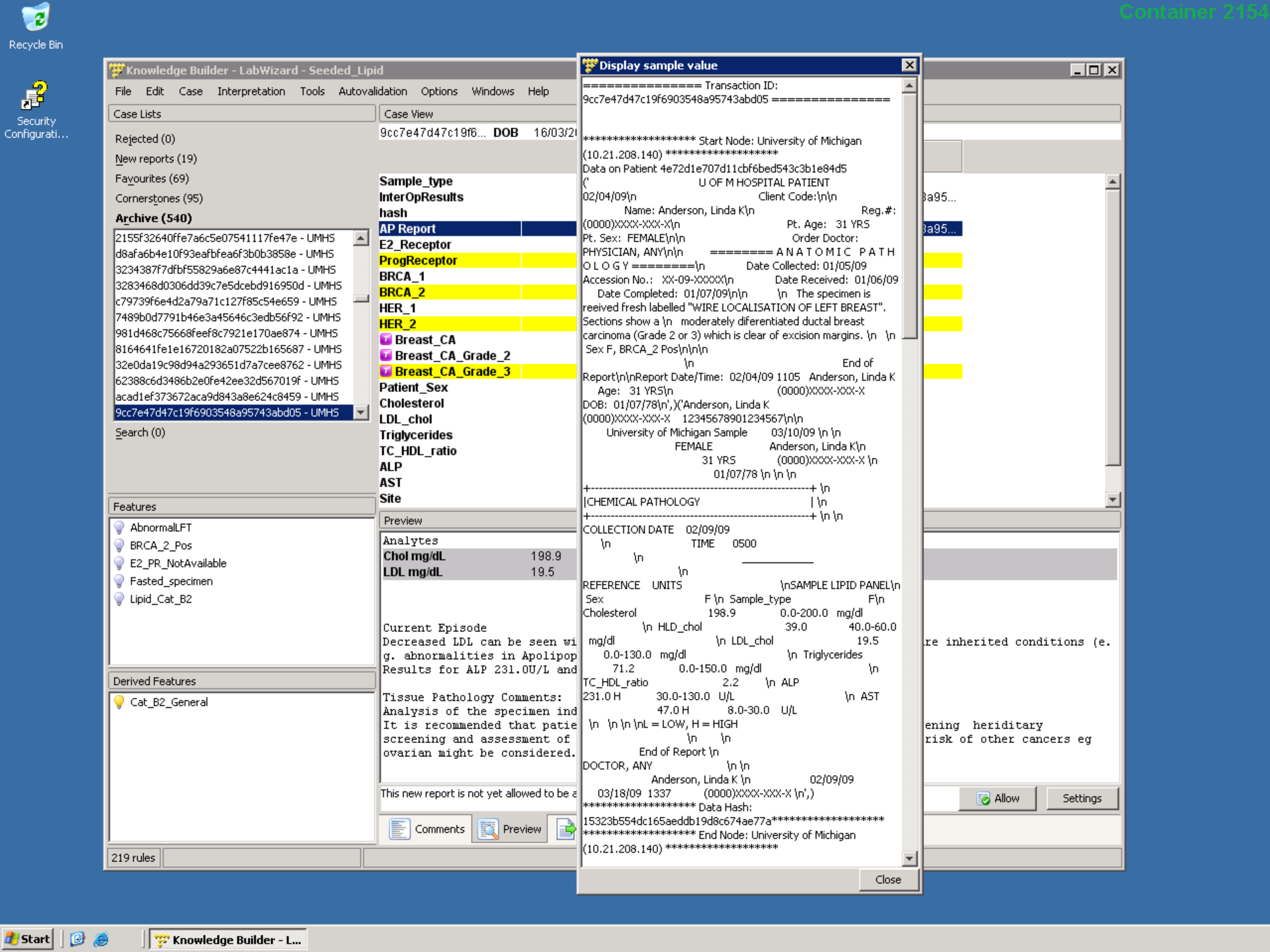
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Recycle Bin
Security Configurati...
Knowledge Builder - LabWizard - Seeded_Lipid
File Edit Case Interpretation Tools Autovalidation Options Windows Help
Case Lists
Rejected (0)
New reports (19)
Favourites (69)
Cornerstones (95)
Archive (540)
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E2_PR_NotAvailable
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Derived Features
Cat_B2_General
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InterOpResults
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AP Report
E2_Receptor
ProgReceptor
BRCA_1
BRCA_2
HER_1
HER_2
Breast_CA
Breast_CA_Grade_2
Breast_CA_Grade_3
Patient_Sex
Cholesterol
LDL_chol
Triglycerides
TC_HDL_ratio
ALP
AST
Site
Preview
Analytes
Chol mg/dL 198.9
LDL mg/dL 19.5
Current Episode
Decreased LDL can be seen wi
g. abnormalities in Apolipop
Results for ALP 231.0U/L and
Tissue Pathology Comments:
Analysis of the specimen ind
It is recommended that patie
screening and assessment of
ovarian might be considered.
This new report is not yet allowed to be a
Comments
Preview
Allow
Settings
219 rules
re inherited conditions (e.
ening heriditary
risk of other cancers eg
Display sample value
========== Transaction ID:
9cc7e47d47c19f6903548a95743abd05 ==========
********** Start Node: University of Michigan
(10.21.208.140) **********
Data on Patient 4e72d1e707d11cbf6bed543c3b1e84d5
(' U OF M HOSPITAL PATIENT
02/04/09\n Client Code:\n\n
Name: Anderson, Linda K\n Reg.#:
(0000)XXXX-XXX-X\n Pt. Age: 31 YRS
Pt. Sex: FEMALE\n\n Order Doctor:
PHYSICIAN, ANY\n\n ========= A N A T O M I C P A T H
O L O G Y =========\n Date Collected: 01/05/09
Accession No.: XX-09-XXXXX\n Date Received: 01/06/09
Date Completed: 01/07/09\n\n \n The specimen is
reeived fresh labelled "WIRE LOCALISATION OF LEFT BREAST".
Sections show a \n moderately diferentiated ductal breast
carcinoma (Grade 2 or 3) which is clear of excision margins. \n \n
Sex F, BRCA_2 Pos\n\n\n
\n End of
Report\n\nReport Date/Time: 02/04/09 1105 Anderson, Linda K
Age: 31 YRS\n (0000)XXXX-XXX-X
DOB: 01/07/78\n',)('Anderson, Linda K
(0000)XXXX-XXX-X 12345678901234567\n\n
University of Michigan Sample 03/10/09 \n \n
FEMALE Anderson, Linda K\n
31 YRS (0000)XXXX-XXX-X \n
01/07/78 \n \n \n
+----------+ \n
|CHEMICAL PATHOLOGY | \n
+----------+ \n \n
COLLECTION DATE 02/09/09
\n TIME 0500
\n
\n
REFERENCE UNITS \nSAMPLE LIPID PANEL\n
Sex F \n Sample_type F\n
Cholesterol 198.9 0.0-200.0 mg/dl
\n HLD_chol 39.0 40.0-60.0
mg/dl \n LDL_chol 19.5
0.0-130.0 mg/dl \n Triglycerides
71.2 0.0-150.0 mg/dl \n
TC_HDL_ratio 2.2 \n ALP
231.0 H 30.0-130.0 U/L \n AST
47.0 H 8.0-30.0 U/L
\n \n \n \nL = LOW, H = HIGH
\n \n
End of Report \n
DOCTOR, ANY \n \n
Anderson, Linda K \n 02/09/09
03/18/09 1337 (0000)XXXX-XXX-X \n',)
********** Data Hash:
15323b554dc165aeddb19d8c674ae77a**********
********** End Node: University of Michigan
(10.21.208.140) **********
Close
Start
Knowledge Builder - L...

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 interpretative 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.