INTERNET TECHNOLOGIES FOR THE DISTRIBUTION OF DICOM STRUCTURED REPORTS WITHIN HEALTHCARE INTRANETS

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DICOM Structured Reports

- a way of encoding structured information
  - hierarchical tree of content items, using DICOM object syntax

- provides strict and clear documentation of meaning
  - text, categorical codes, numeric measurements, inter-item relationships

- includes links to the source diagnostic data
  - references to UIDs of DICOM images, waveforms, etc.
DICOM SR Documents in XML

- exchange radiology reports and related data easily across the healthcare enterprise
- make radiology reports concurrently:
  - machine processable
  - human readable
  - web enabled
- data integration with general purpose research and academic tools
What are Web Services?

- a middleware platform that facilitates program-to-program interactions
- is a URI-addressable software resource with certain functionality
- can be located by its registration in discovery agencies

Service Oriented Architecture

Service Requestor

Service Provider

Discovery Agencies

Find

Publish

Interact
Web Services Technologies

- uses XML based messages conveyed by internet protocols
- offers a mechanism for the description of its own interface
- provides security mechanisms
Web Service System Overview

DIM Web Service

- C-Find
- C-Move
- C-Store

DICOM services (SOPs)

- Conversion
- Policy module
- DICOM source broker
- Administration module
- Web service methods
  - Query
  - Retrieve
  - Store
  - Login

HTTP/SOAP

XML

DICOM servers

DICOM clients
DIM Web Service Functionality

- offers facilities to handle SR documents:
  - search at different levels of the DICOM information model
  - retrieve in XML format
  - store as DICOM

- supports various access policies based on predefined user roles
  - user authentication
  - different access levels
DICOM SR to XML

- Look-up table for DICOM-to-XML tag translation
- XSLT transformation to convert to another XML schema

DICOM SR Document

... 
(0040,a730) 
(0040,a010) - "CONTAINS"  
(0040,a040) - "TEXT"  
(0040,a043)  
(0008,0100) - "121060"  
(0008,0102) - "DCM"  
(0008,0104) - "History"  
(0040,A160) - "67 year old male ... " 
...

XML SR Document

... 
<contentSequence>
  <documentRelationshipMacro  
    relationshipType="CONTAINS" />
  <documentContentMacro  
    valueType="TEXT"  
    textValue="67 year old male... " >
    <conceptNameCodeSequence  
      codeValue="121060"  
      codingSchemeDesignator = "DCM"  
      codeMeaning="History" />
  </documentContentMacro>
</contentSequence>
Implementation Issues

- **technologies**
  - C# (MS .Net Framework 1.1)
  - DicomObjects 4.1 (Medical Connections)
  - XML/SOAP

- **system requirements**
  - MS Internet Information Server >5.x
  - MS .Net Framework 1.1
  - MS SQL Server 2000 Desktop Engine (MSDE)

- **security**
  - SSL, user authentication
Demo Application

Web DICOM viewer

XML/SOAP

DIM Web Service

DICOM

DICOM servers

web browser
Towards Integration with Educational Tools

- integration with data and medical images directly from DICOM sources
- assistance for dynamic teaching files generation
- easy development without prior knowledge of DICOM standard
- security on different levels
current work

towards a cluster of web services

- 1st tier: facades for legacy systems

- 2nd tier: added value services: data mining & knowledge extraction
Conclusion

a web service to support communication and integration of DICOM SR servers with other applications using internet standards

- teaching file authoring tools
- internet based medical e-learning environments
- medical research support tools
- medical expert systems
- other healthcare information systems
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