



DICOM Structured Reporting Overview

Harry Solomon

GE Healthcare

RSNA Industry Forum
on Structured Reporting

DICOM Structured ~~Reporting~~

- The scope of DICOM SR is the **standardization of structured data and clinical observations in the imaging environment.**
- SR objects record observations made for an imaging-based diagnostic or interventional procedure, particularly those that describe or reference images, waveforms, or specific regions of interest.

Most important in the stages before report creation

Why do you need to know about DICOM SR?

- DICOM SR is the standard to exchange structured data produced in the course of image acquisition or post-processing, where:
 - Leveraging the DICOM infrastructure is easy and desirable
 - Results should be managed with other study evidence
- Replaces legacy kludges
 - Manually transcribed worksheets, screen scrapes from analysis apps, one-off integrations
- Examples
 - Sonographer measurements
 - Computer-aided detection results
 - QC notes about images
 - Radiation dose reports
 - Image exchange manifests

DICOM SR is not “Structured Data Entry”

- Hierarchical pull-down menus for results capture or report creation is often denoted “structured reporting”
- DICOM does not standardize applications or data entry techniques
- Structured data entry is a valuable means of creating SR content *in certain circumstances*
 - Standard SR templates and value sets can support the implementation of structured data entry forms

Key Aspects of DICOM SR

- SR documents are encoded using DICOM standard data elements and leverage DICOM network services (storage, query/retrieve)
- SR uses DICOM Patient/Study/Series information model (header), plus hierarchical tree of “Content Items”
- Extensive use of coded nomenclature
 - Allows use of vocabulary/codes from non-DICOM sources (especially LOINC and SNOMED, possibly RadLex)
- Templates define content constraints for specific types of documents / reports

SR Content Item Tree

Arrows are parent-child relationships

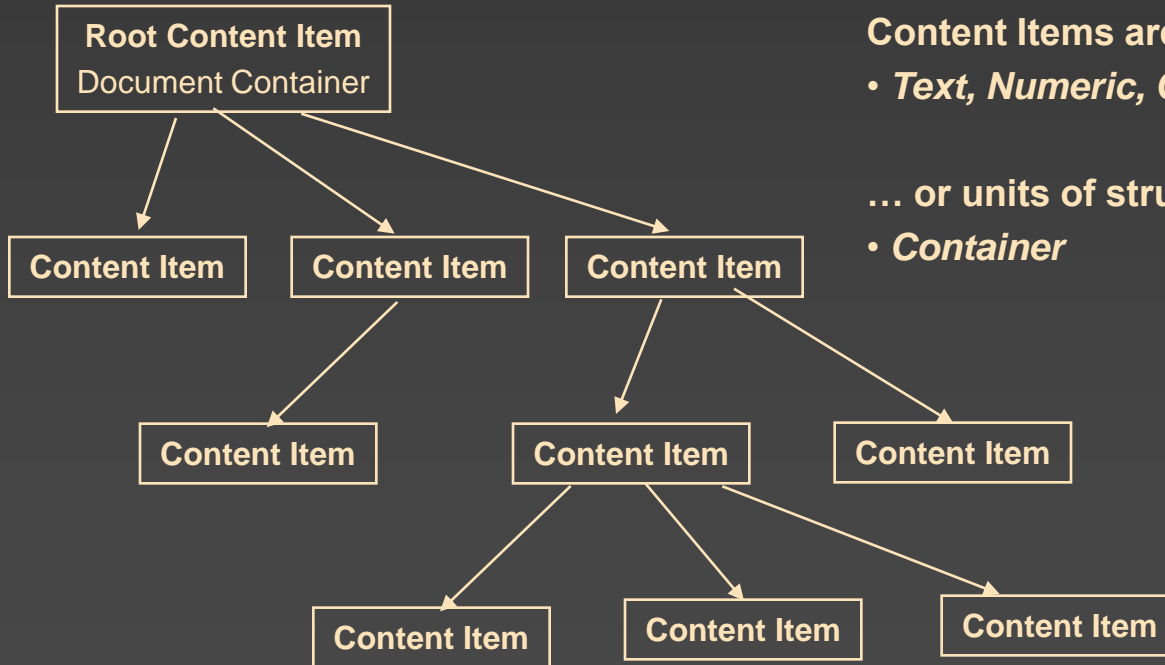
- *Contains, Has properties, Inferred from, etc.*

Content Items are units of meaning ...

- *Text, Numeric, Code, Image, Spatial coordinates, etc.*

... or units of structure

- *Container*



DICOM XML

URL: and Settings/212001442.GEMEDAMERICA/My

DICOM XML

- (1):OB-GYN Ultrasound Procedure Report[CONTAINER] = {
 - (1.1)CONTAINS:Patient Characteristics[CONTAINER] = {
 - (1.2)CONTAINS:Summary[CONTAINER] = {
 - (1.2.1)CONTAINS:EDD[DATE] = 20040607
 - (1.2.2)CONTAINS:EDD from LMP[DATE] = 20040607
 - (1.2.3)CONTAINS:LMP[DATE] = 20030901
 - (1.2.4)CONTAINS:Comment[TEXT] = Exam Comments...Fetus C comments...
 - (1.2.5)CONTAINS:Fetus Summary[CONTAINER] = {SEPARATE CONTAINER} = {
 - (1.2.5.1)HAS OBS CONTEXT:Mother of fetus[PNAME] =
 - (1.2.5.2)HAS OBS CONTEXT:Subject ID[TEXT] = A
 - (1.2.5.3)HAS OBS CONTEXT:Number of Fetuses[NUM] = 3
 - (1.2.5.4)CONTAINS:Gestational Age[NUM] = 220.0 Day
 - (1.2.5.4.1)INFERRED FROM:Table of Values[CODE] = BPD, Hadlock 1984
 - (1.2.5.4.2)HAS PROPERTIES:2 Sigma Upper Value of population[NUM] = 241.0 Day
 - (1.2.5.4.3)HAS PROPERTIES:2 Sigma Lower Value of population[NUM] = 198.0 Day
 - (1.2.5.5)CONTAINS:Gestational Age[NUM] = 221.0 Day
 - (1.2.5.6)CONTAINS:Gestational Age[NUM] = 216.0 Day
 - (1.2.5.7)CONTAINS:Gestational Age[NUM] = 224.0 Day
 - (1.2.5.8)CONTAINS:Gestational Age[NUM] = 219.0 Day

Y/N	Tag	Attribute Name	VR	VM	Value
<input checked="" type="checkbox"/>	>>ITEM 2				
<input checked="" type="checkbox"/>	>>(0040,A010)	RelationshipType	CS	1	CONTAINS
<input checked="" type="checkbox"/>	>>(0040,A040)	ValueType	CS	1	DATE
<input checked="" type="checkbox"/>	>>(0040,A043)	ConceptNameCodeSequence	SQ	1	
<input checked="" type="checkbox"/>	>>>ITEM 1				
<input checked="" type="checkbox"/>	>>>(0008,0100)	CodeValue	SH	1	11779-6
<input checked="" type="checkbox"/>	>>>(0008,0102)	CodingSchemeDesignator	SH	1	LN
<input checked="" type="checkbox"/>	>>>(0008,0104)	CodeMeaning	LO	1	EDD from LMP
<input type="checkbox"/>	>>>ITEM 2				
<input checked="" type="checkbox"/>	>>(0040,A121)	Date	DA	1	20040607
<input checked="" type="checkbox"/>	>>ITEM 3				
<input checked="" type="checkbox"/>	>>(0040,A010)	RelationshipType	CS	1	CONTAINS

Encoded with DICOM attributes

External codes (LOINC)

(1.2.5.4)CONTAINS:Gestational Age[NUM] = 220.0 Day

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- (1.2.5.4.3)HAS PROPERTIES:2 Sigma Lower Value of population[NUM] = 198.0 Day

Measurements with related method and statistical properties

Hierarchical tree structure

The Problem of SR Flexibility

- A document creator can put in anything in any structure
- A document reader must handle every possible document
- Need to constrain the SR content to enable meaningful receiving applications
 - Structure
 - Content



SR Templates

- Like IODs, but for SR content
 - Define attributes (concepts), required/optional, and allowed values
 - Specify hierarchical structure of sections and subsections (containers)
- Specified for a variety of uses, often in conjunction with specialty societies
 - OB/GYN, vascular, echo, and IVUS ultrasound
 - X-ray, CT, and MR angiography
 - Mammo, chest, and colon computer-aided detection
 - Radiation dose

DICOM SR Object Classes

- General use **Enhanced** and **Comprehensive** - Text, coded content, numeric measurements, spatial and temporal ROI references (any template)
- **CAD** - Automated analysis results (SOP Class per CAD template)
- **Key Object Selection** (KO) - Flags one or more images
 - Purpose (“for referring physician”, “for surgery”, ...) and textual note
 - Used for key image notes and image manifests (in IHE profiles)
- **Procedure Log** - For extended duration procedures (e.g., cath)
- **Radiation Dose Report** - Projection X-ray; CT

Summary

- DICOM SR is the standard for exchange of structured data / clinical observations in the imaging environment
- DICOM SR leverages existing imaging infrastructure and toolkits
- DICOM SR is constrained by templates and SOP Classes to improve interoperability for specific use cases

For more information

- DICOM Standard
<ftp://medical.nema.org/medical/dicom/2008>
 - Part 3: SR SOP Classes (Section A.35), SR Modules (Section C.17)
 - Part 16: Templates (Annex A)
- David Clunie's introduction to DICOM SR
<http://www.pixelmed.com/srbook.html>
- IHE use cases for DICOM SR
 - Radiology Technical Framework Vol 1: Key Image Note (Section 8), Evidence Documents (Section 14)
 - Cardiology Technical Framework Vol 1: Evidence Documents (Section 7)