DICOM & HL7: Integration of Imaging and Information Systems

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DICOM & HL7: Integration of Imaging and Information Systems

Topics:

- Communication of Imaging Results
- Transcribed Diagnostic Imaging Report
- DICOM SR and HL7 CDA (Scenarios and Mapping)
- SR Diagnostic Imaging Report Transformation Guide
- HL7 Clinical Document Architecture
- HL7 CDA Diagnostic Imaging Report Implementation Guide
- HL7 CDA DIR IG Sample Report
- Radiation Dose Summary Report
- HL7 Messages
- RSNA Report Templates
- RESTful Services

Communication of Imaging Results

How can electronic / structured documents exchange support healthcare processes?

- **Improve report quality**
  - Controlled entry and check of key data
  - Defined structure and semantics
  - Quantitative data
  - Key images, graphics

- **Transformation of reporting processes**
  - Faster communication of results
  - Coordination of clinical tasks
  - Distribution of machine-processable results
  - Extended search capabilities and analyses

Transcribed Diagnostic Imaging Report

- Text-based Transcribed Diagnostic Imaging Report (TID 2005, PS 3.16)
- Optionally includes references to relevant DICOM images (conveyed by KOS "For Report Attachment") in a separate "Key Images" section as well as associated presentation state references
- TID 2005 (subset of TID 2000) can be transformed to HL7 CDA R2
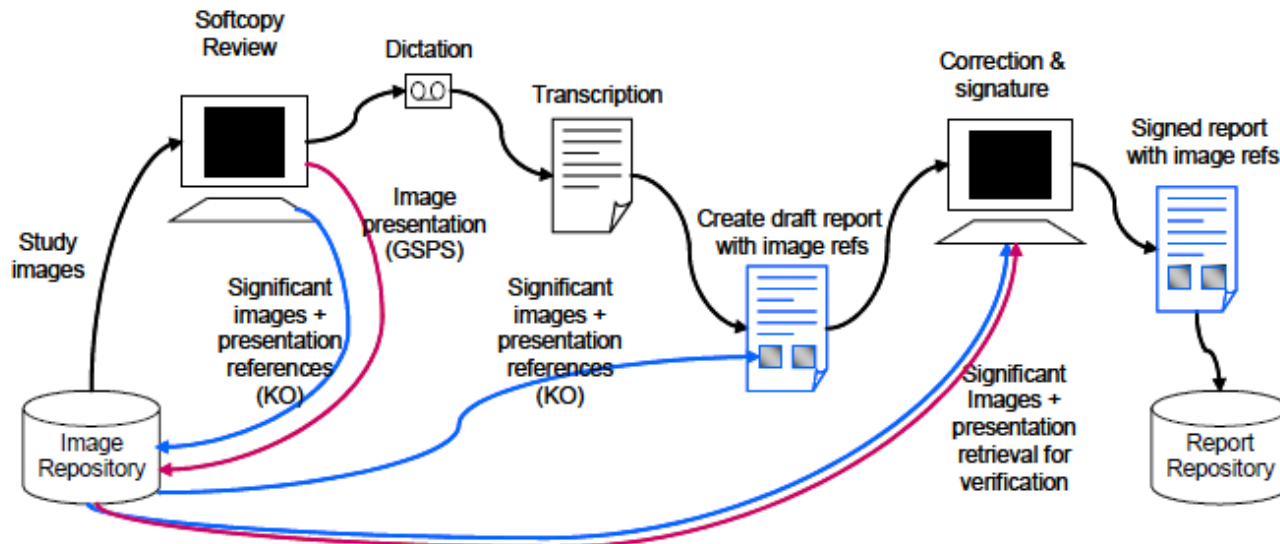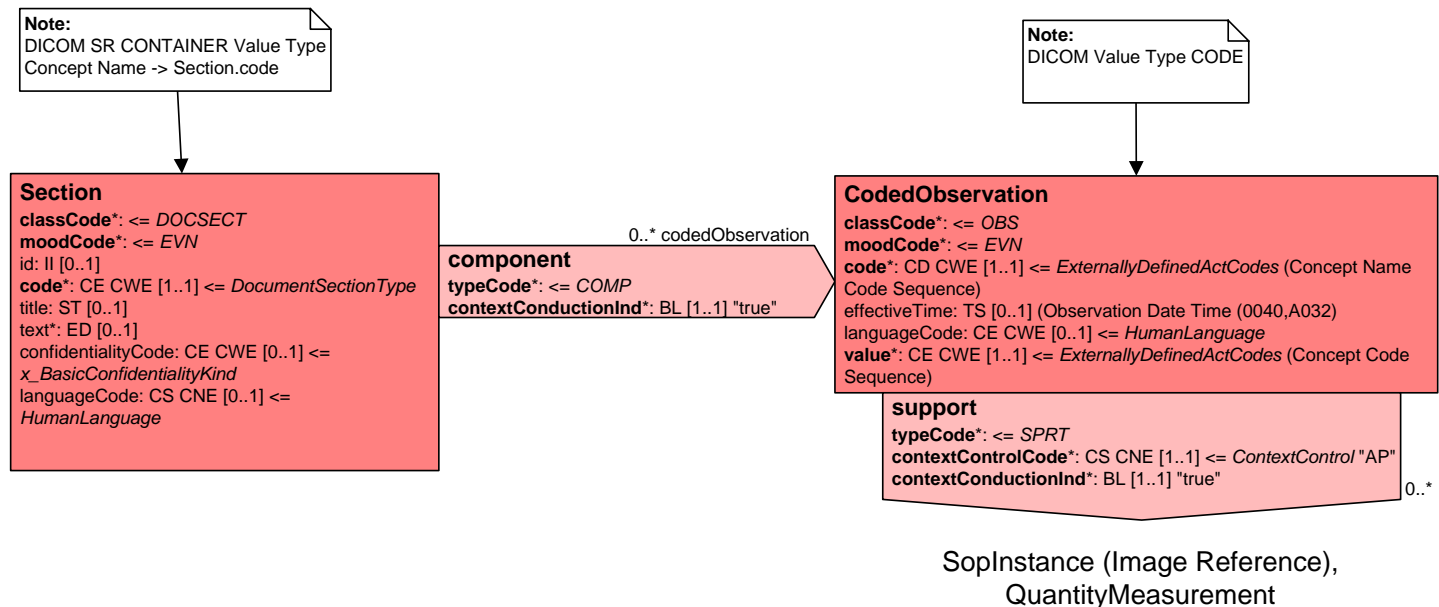
DICOM SR and HL7 CDA (Scenarios and Mapping)
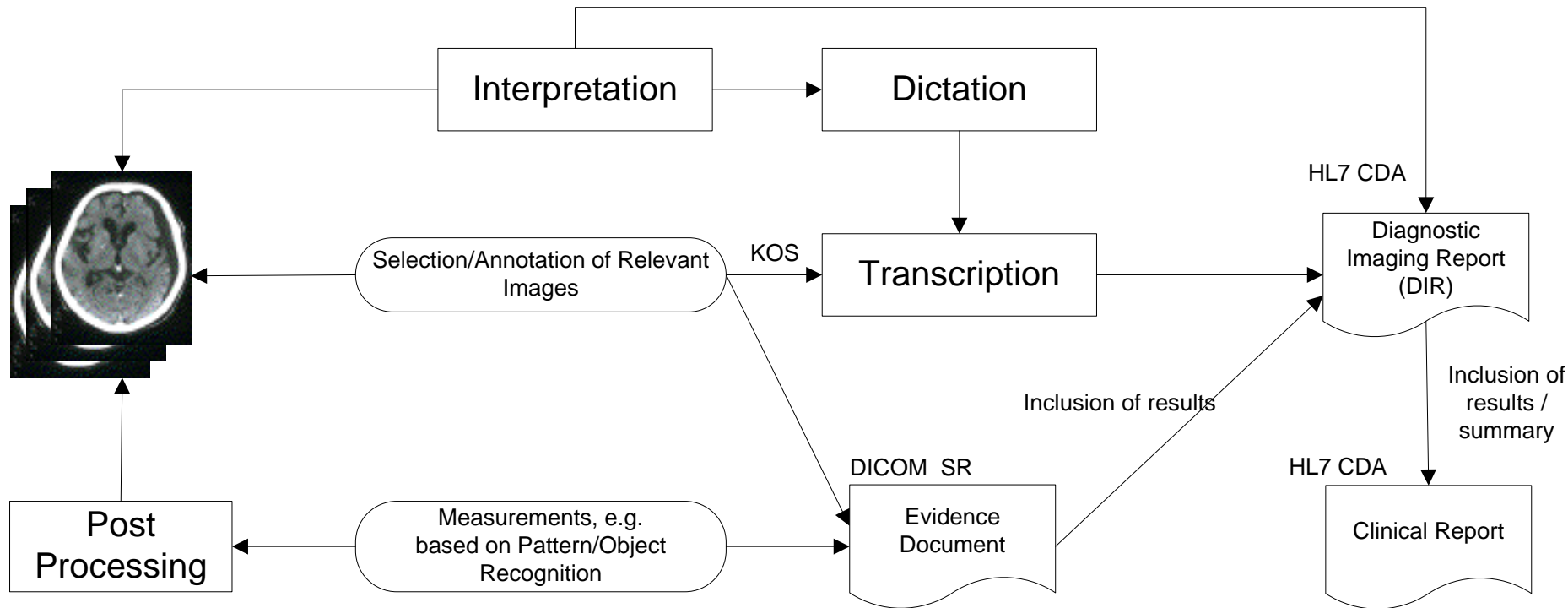
Inclusion of evidence document contents into final diagnostic imaging reports has been addressed in DICOM Part 20 "Transformation of DICOM to and from HL7 Standards", Annex A "SR Diagnostic Imaging Report Transformation Guide"

SR Diagnostic Imaging Report Transformation Guide

DICOM
Digital Imaging and Communications in Medicine

- Facilitate the exchange of imaging based observations between imaging information systems and clinical information systems (PS 3.20)
- Mapping constrained TID 2000 Basic Diagnostic Imaging Report DICOM SR documents (PS 3.16) to HL7 CDA Diagnostic Imaging Reports (HL7 CDA R2 DIR IG, R1-2009).
- UML class diagrams illustrate the mapping

Note:
DICOM SR CONTAINER Value Type
Concept Name -> Section.code

Note:
DICOM Value Type CODE

Section
classCode*: <= *DOCSECT*
moodCode*: <= *EVN*
id: II [0..1]
code*: CE CWE [1..1] <= *DocumentSectionType*
title: ST [0..1]
text*: ED [0..1]
confidentialityCode: CE CWE [0..1] <=
x_BasicConfidentialityKind
languageCode: CS CNE [0..1] <=
HumanLanguage

component
typeCode*: <= *COMP*
contextConductionInd*: BL [1..1] "true"

0..* codedObservation

CodedObservation
classCode*: <= *OBS*
moodCode*: <= *EVN*
code*: CD CWE [1..1] <= *ExternallyDefinedActCodes* (Concept Name Code Sequence)
effectiveTime: TS [0..1] (Observation Date Time (0040,A032)
languageCode: CE CWE [0..1] <= *HumanLanguage*
value*: CE CWE [1..1] <= *ExternallyDefinedActCodes* (Concept Code Sequence)

support
typeCode*: <= *SPRT*
contextControlCode*: CS CNE [1..1] <= *ContextControl* "AP"
contextConductionInd*: BL [1..1] "true"

0..*

SopInstance (Image Reference),
QuantityMeasurement

HL7 Clinical Document Architecture (CDA)

Document Header
- Related Acts: Encounter, Order, Parent Document…
- Participations: PatientRole, Author…

Document Body
- Section with Narrative Text
- Structured Section Entries
- External References

Section
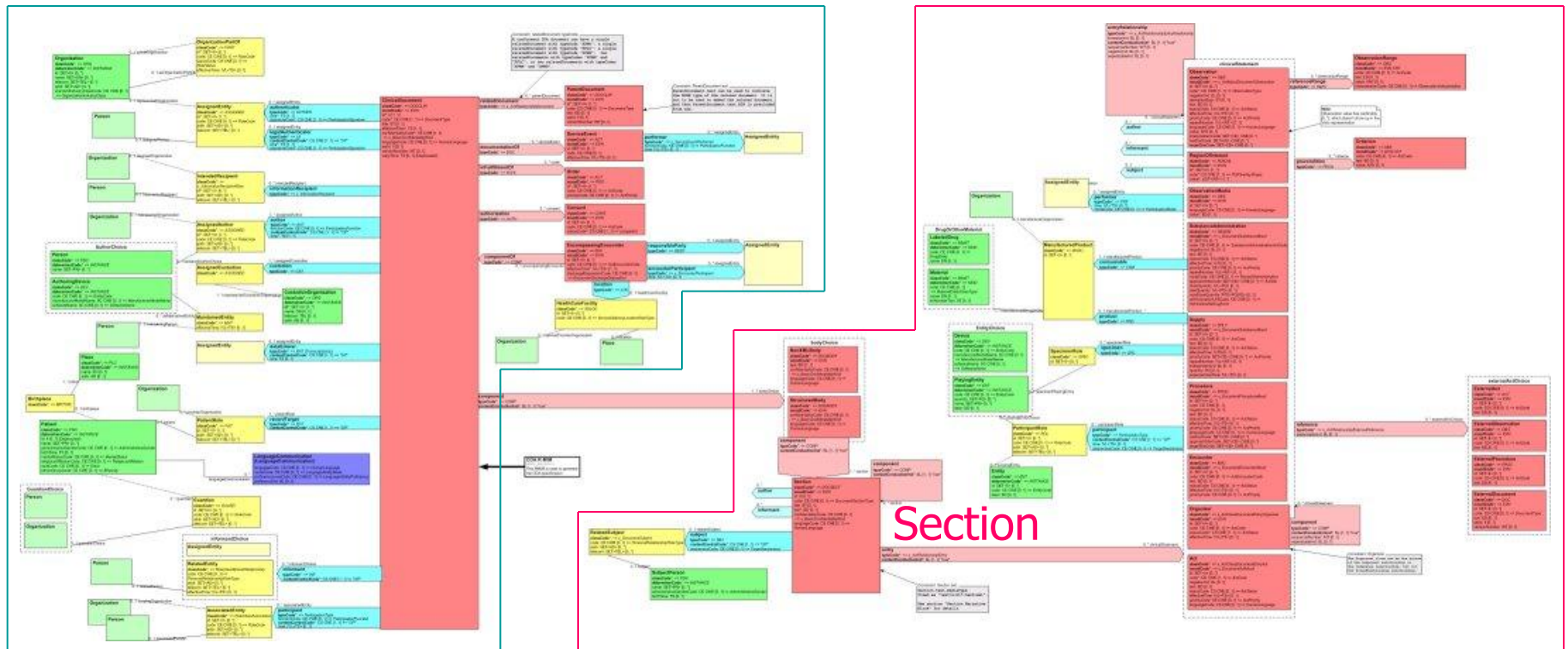
CDA R2 Document Header

Participations:
- authenticator
- legalAuthenticator
- informationRecipient
- author
- custodian
- dataEnterer
- recordTarget
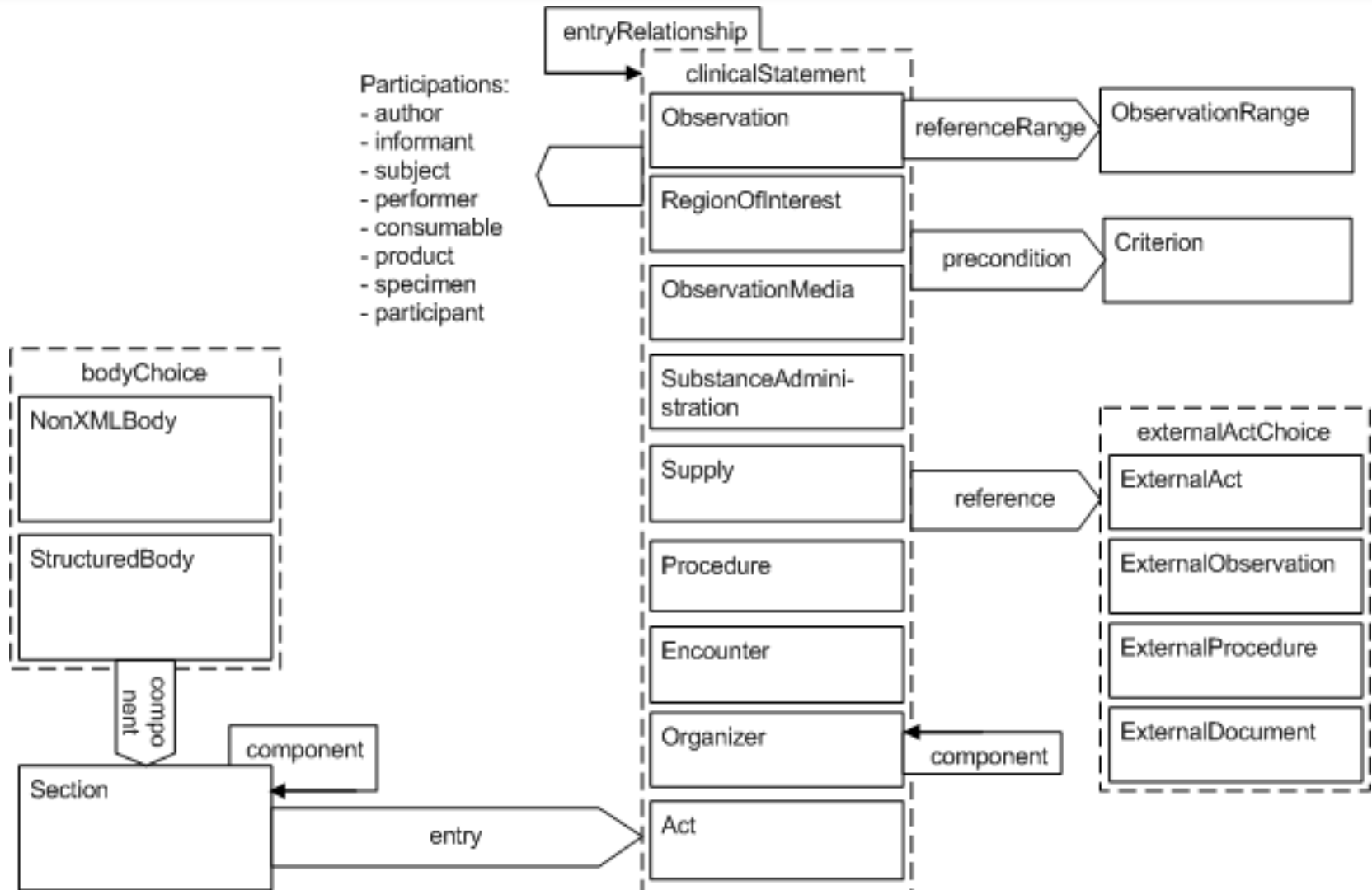- informant
- participant

ClinicalDocument

Related Acts:
- ParentDocument
- ServiceEvent
- Order
- Consent
- EncompassingEncounter

component

bodyChoice

CDA R2 Document Body

CDA Key Elements

```
<ClinicalDocument>
    ...        <!--HEADER  (PARTICIPATIONS, RELATED ACTS)-->

    <structuredBody>

      <section>
        <text></text>                       <!--NARRATIVE BLOCK-->
      </section>

      <section>
        <text>...</text>
        <entry>                             <!--STRUCTURED ENTRIES-->
          <observation>…</observation>
        </entry>
       </section>

    </structuredBody>

  </ClinicalDocument>
```

HL7 CDA Diagnostic Imaging Report Implementation Guide (DIR IG)

- DIR IG includes the CDA header and document body constraints of CDA R2 Diagnostic Imaging Reports

- Contains a consulting specialist's interpretation of image data (intended for use in Radiology, Endoscopy, Cardiology, and other imaging specialties)

- Used to convey the interpretation to the referring (ordering) physician and become part of the patient's medical record

- Consistent with the DICOM "SR Diagnostic Imaging Report Transformation Guide" (PS 3.20, Annex A)

- Allows for creating Diagnostic Imaging Reports in HL7-based information systems and integrating DICOM SR based imaging results

- Created and published in cooperation with HL7 Structured Documents WG
  - Universal Realm DIR IG published in 2009
  - US Realm DIR IG included in „IHE Health Story Consolidation, Release 1.1" document (Consolidated CDA for clinical documents supporting Meaningful Use Stage 2, also contains Procedure Note IG)

CDA Diagnostic Image Observation including WADO Reference:

```
…
<observation classCode="DGIMG" moodCode="EVN">
  <templateId root="2.16.840.1.113883.10.20.6.2.8"/>
  <!-- (0008,1155) Referenced SOP Instance UID-->
  <id root="1.2.840.113619.2.62.994044785528.20060823.200608232232322.3"/>
  <!-- (0008,1150) Referenced SOP Class UID -->
  <code code="1.2.840.10008.5.1.4.1.1.1" codeSystem="1.2.840.10008.2.6.1" codeSystemName="DCMUID"
displayName="Computed Radiography Image Storage">
  </code>
  <text mediaType="application/dicom">
    <!--reference to CR DICOM image (PA view) -->
    <reference value="http://www.example.org/wado?requestType=WADO&amp;
studyUID=1.2.840.113619.2.62.994044785528.114289542805&amp;
seriesUID=1.2.840.113619.2.62.994044785528.20060823223142485051&amp;
objectUID=1.2.840.113619.2.62.994044785528.20060823.200608232232322.3&amp;
contentType=application/dicom"/>
  </text>
  <effectiveTime value="20060823223232"/>
  <!-- entryRelationship elements containing Purpose of Reference or Referenced Frames observations may go here -->
</observation>
…
```

HL7 CDA DIR IG Sample Report (2)

CDA Templates: Basis for validation of documents (Schematron or equivalent)

```
<ClinicalDocument xmlns="urn:hl7-org:v3" xmlns:voc="urn:hl7-org:v3/voc" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
            <typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040"/>
            <templateId root="2.16.840.1.113883.10.20.6"/>
            <id root="2.16.840.1.113883.19.4.27"/>
            <code code="18748-4" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LOINC"
displayName="Diagnostic Imaging Report"/>
            …
</ClinicalDocument>
```

HL7 CDA DIR IG Sample Report (3)

CDA documents transformed from DICOM SR reports refer to the SR as the parent document:

```
…
<!-- transformation of a DICOM SR -->
<relatedDocument typeCode="XFRM">
  <parentDocument>
    <id root="1.2.840.113619.2.62.994044785528.20060823.200608232232322.9"/>
    <!-- SOP Instance UID (0008,0018) of SR sample document-->
  </parentDocument>
</relatedDocument>
…
```

HL7 CDA DIR IG Sample Report (4)

## CDA Section & Corresponding Structured Entry:

```xml
…
<section>
 <templateId root="2.16.840.1.113883.10.20.6.1.2"/>
  <code code="121070" codeSystem="1.2.840.10008.2.16.4" codeSystemName="DCM" displayName="Findings"/>
  <title>Findings</title>
  <text>
   <paragraph>
    <caption>Finding</caption>
    <content ID="Fndng2">The cardiomediastinum is within normal limits…</content>
   </paragraph>
  </text>
  <entry>
   <observation classCode="OBS" moodCode="EVN">
    <!-- Text Observation -->
    <templateId root="2.16.840.1.113883.10.20.6.2.12"/>
    <code code="121071" codeSystem="1.2.840.10008.2.16.4" codeSystemName="DCM" displayName="Finding"/>
    <value xsi:type="ED">
     <reference value="#Fndng2"/>
    </value>
    ...
    <!-- entryRelationships to Quantity Text, Code and Measurement Observations          may go here -->
   </observation>
  </entry>
</section>
…
```

Radiation Dose Summary Report (1)

TID 2006, PS 3.16 "Imaging Report With Conditional Radiation Exposure and Protection Information" (DICOM Suppl. 150)

• Purpose: Documentation of key clinical information for imaging procedures that use ionizing radiation. Combine clinical information and dose summary for patient-oriented tracking of cumulative dose in clinical information systems.

• Re-use relevant dose information from modality dose reports

• Communication of reports to clinical information systems (transformation to HL7 CDA Format)

• Regulatory aspects: Intended to satisfy Euratom Directive1997/43/EC and Compatible National Regulations + California SB 1237 in the US (Focus: Medical exposure of individuals)

• Status: Final Text, 2011

Radiation Dose Summary Report (2)

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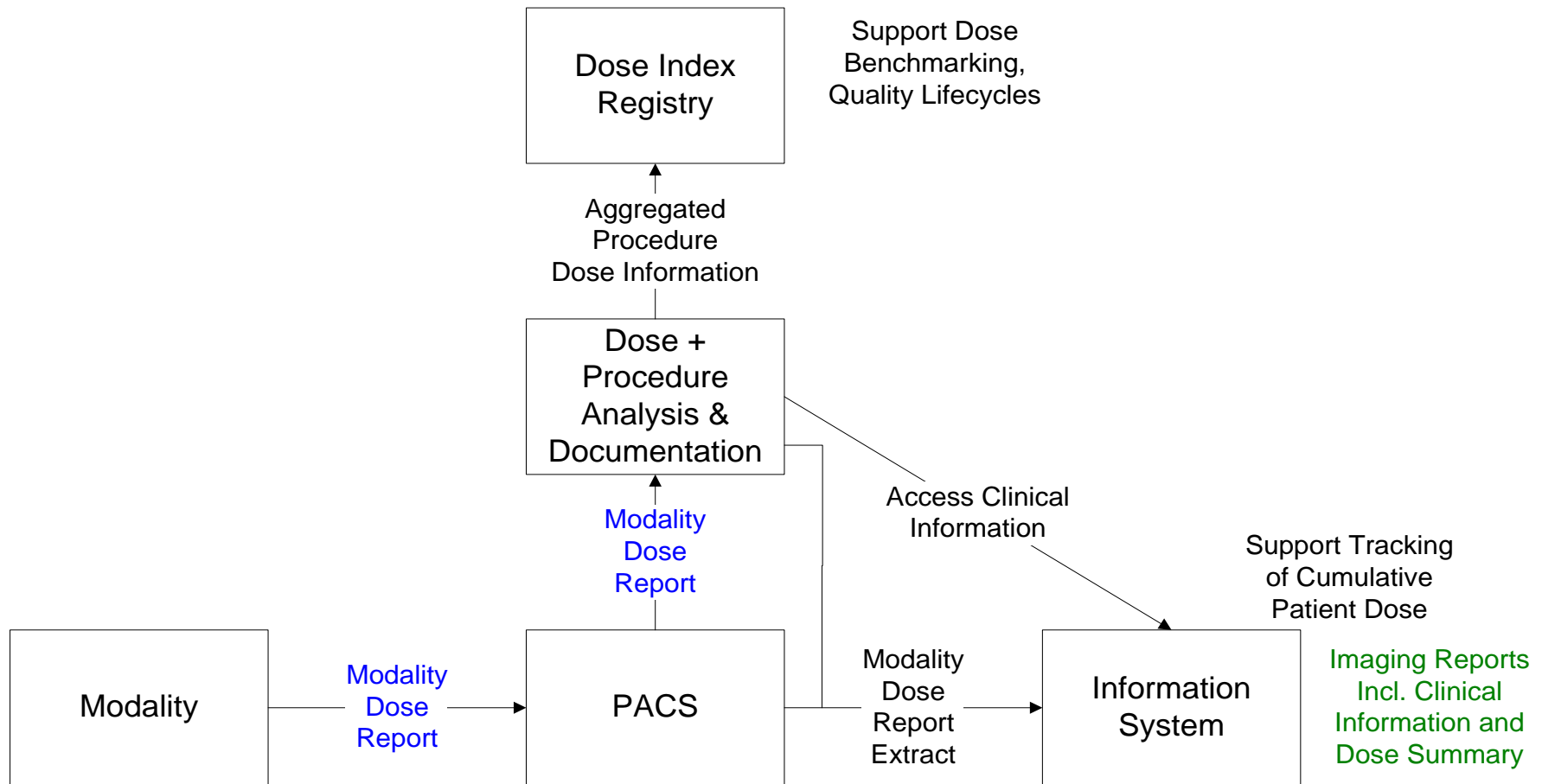
Placer Order Management

IHE Actors in Scheduled Workflow Profile: Order Placer -> Department System Scheduler / Order Filler

• HL7 V2.3.1: ORM General Order Message (Event O01)

• HL7 V2.5.1 Option: OMG General Clinical Order Message (Event O19)

Procedure Scheduled

IHE Actors in Scheduled Workflow Profile: Department System Scheduler / Order Filler -> Image Manager, Report Manager

• HL7 V2.3.1: ORM Message (includes ZDS Segment)

• HL7 V2.5.1 Option: OMI Imaging Order Message (Event O23) with IPC (Imaging Procedure Control) Segment

Observation Reporting

• ORU Unsolicited Observation Message (Event R01)

• MDM Medical Records Document Management Messages should be considered for sending CDA documents

RSNA Report Templates

- RSNA radiology reporting initiative started in 2009

- Comprehensive library of best practice radiology subspecialty templates has been created (https://rsna.org/Reporting_Initiative.aspx and http://www.radreport.org/)

- DICOM WG8 and WG20 are working on DICOM Supp 155 „Templates for Imaging Procedure Reports encoded in CDA" that will focus on RSNA template representation and formal specifications based on CDA R2 Diagnostic Imaging Report Implementation Guide (DIR IG)

RESTful Services

- DICOM RESTful Services are the successors to the original http get-based WADO service (Web Access to DICOM Persistent Objects, PS 3.18)

- WG20 was an early adopter of WADO (e.g. for references to relevant DICOM images in CDA documents)

- WG20 supports the discussions on RESTful Services between DICOM and HL7 (Participation from WG27, HL7 FHIR (Fast Healthcare Interoperable Resources) Project, WG20)

- Focus: Alignment of the specification of basic resources (i.e. ImagingStudy resource) between DICOM and HL7

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Thank you for your attention !