



# HL7 Overview

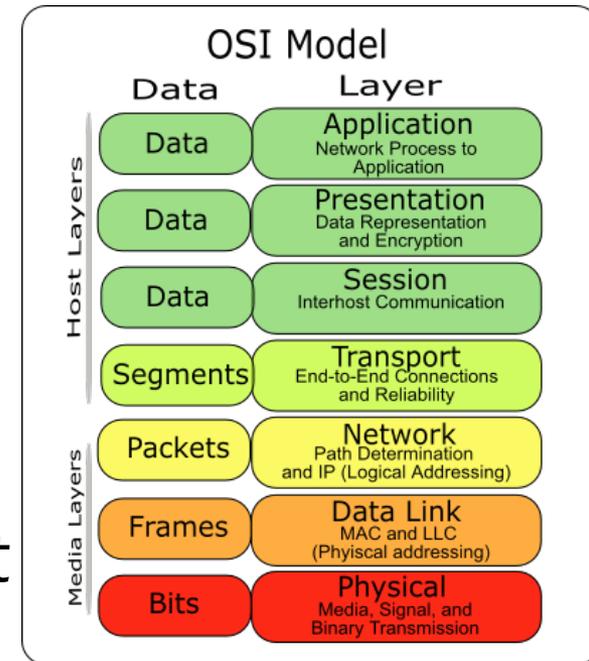
Byoung-Kee Yi, PhD

Samsung Medical Center  
Digital Health Dept, SAIHST, SKKU

HL7 Korea  
ISO/TC215 Health informatics

# HL7 International

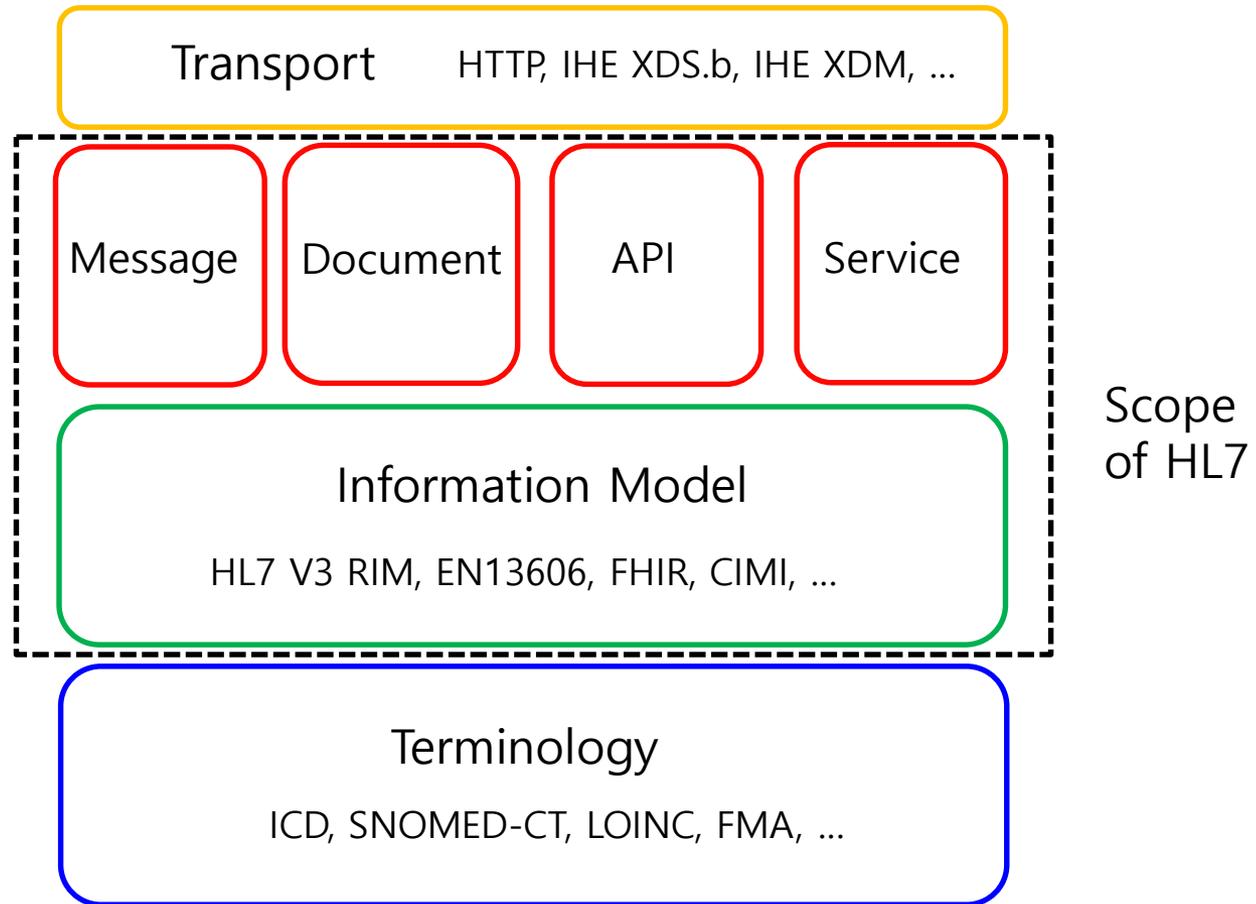
- Health Level Seven
  - Application layer (layer 7) in OSI model for medical purposes
- An international standards development organization (SDO)
  - Founded in 1987
- Vision: to create the best and most widely used standards in healthcare
  - Offers a comprehensive set of standards for clinical/medical uses



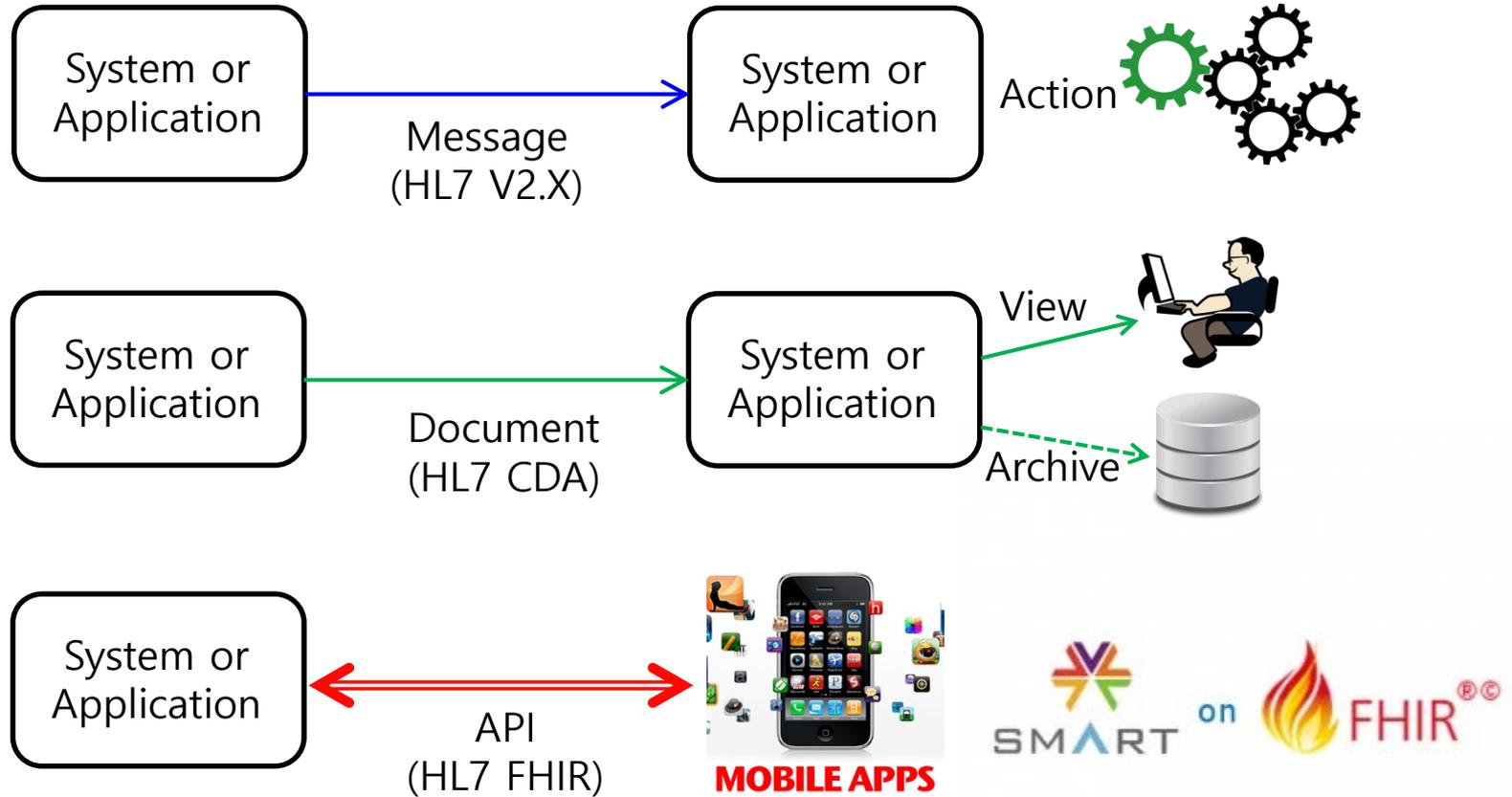
# HL7 Work Groups

- A
  - Affiliate Due Diligence
  - Anatomic Pathology
  - Anesthesia
  - Architectural Review
  - Arden Syntax
  - [Attachments](#)
- B
  - Board Motions
- C
  - Child Health
  - [Clinical Decision Support](#)
  - [Clinical Genomics](#)
  - Clinical Interoperability Council
  - [Clinical Quality Information](#)
  - Clinical Statement
  - Community Based Collaborative Care
  - [Conformance & Guidance for Implementation/Testing](#)
- D
  - Domain Experts Steering Division
- E
  - Education
  - [Electronic Health Records](#)
  - Electronic Services
  - Emergency Care
- F
  - Financial Management
  - Foundation and Technology Steering Division
- G
  - Governance and Operations
- H
  - [Health Care Devices](#)
- I
  - [Imaging Integration](#)
  - [Implementable Technology Specifications](#)
  - [Infrastructure and Messaging](#)
  - International Council
  - International Mentoring Committee
- M
  - Marketing
  - [Mobile Health](#)
  - Modeling and Methodology
- N
  - Nomination Committee
- O
  - Orders and Observations
  - Organizational Relations
  - Outreach Committee for Clinical Research
- P
  - Patient Administration
  - Patient Care
  - Pharmacy
  - Policy Advisory Committee
  - Process Improvement
  - Project Services
  - Public Health and Emergency Response
  - Publishing
- R
  - Recognition and Awards
  - Regulated Clinical Research Information Management
  - RIM Based Application Architecture
- S
  - Security
  - Services Oriented Architecture
  - Strategic Initiative Committee
  - Structure and Semantic Design Steering Division
  - [Structured Documents](#)
- T
  - Technical and Support Services Steering Division
  - Technical Steering Committee
  - Templates
  - Terminology Authority
  - Tooling
- V
  - Vocabulary

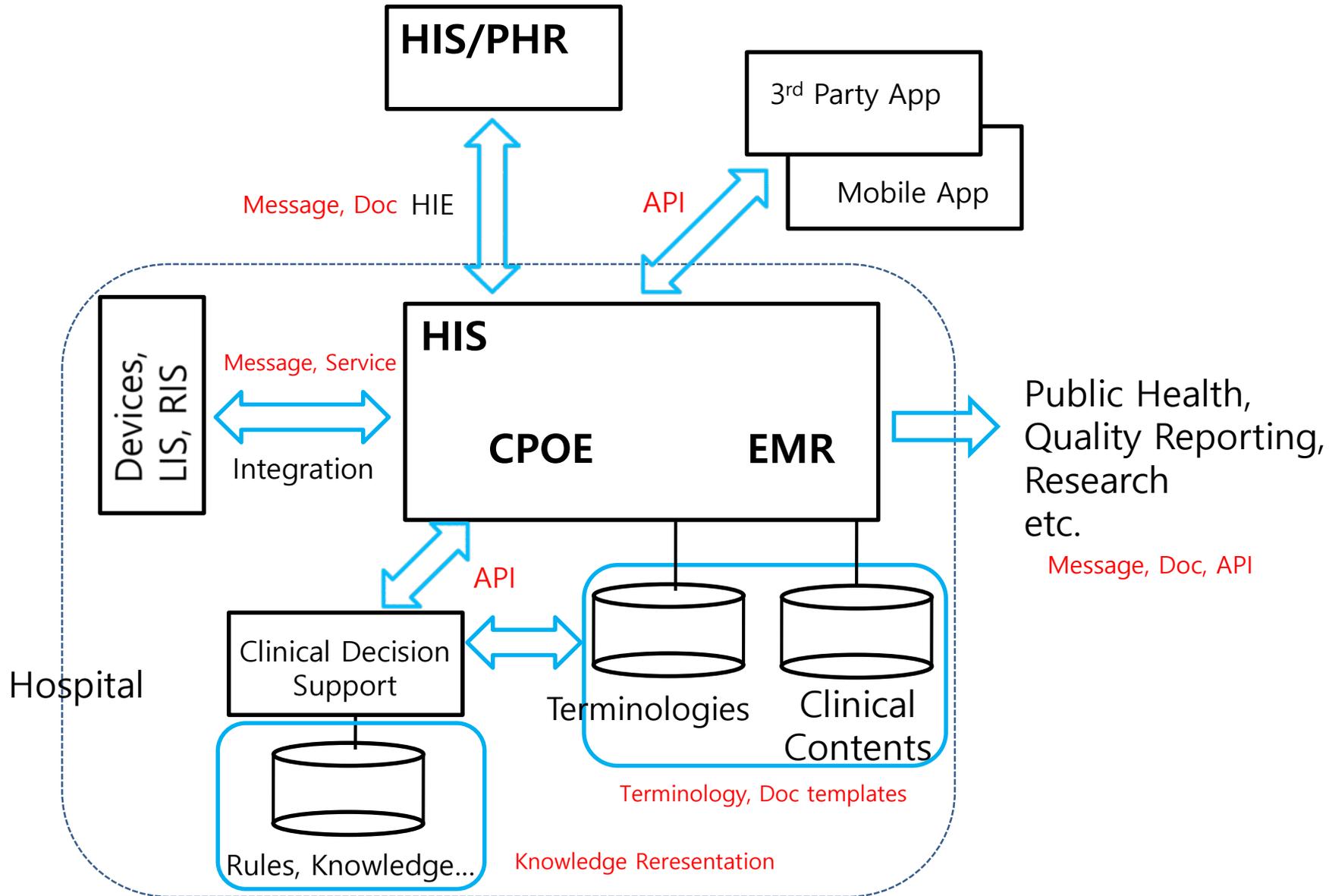
# Health information standards



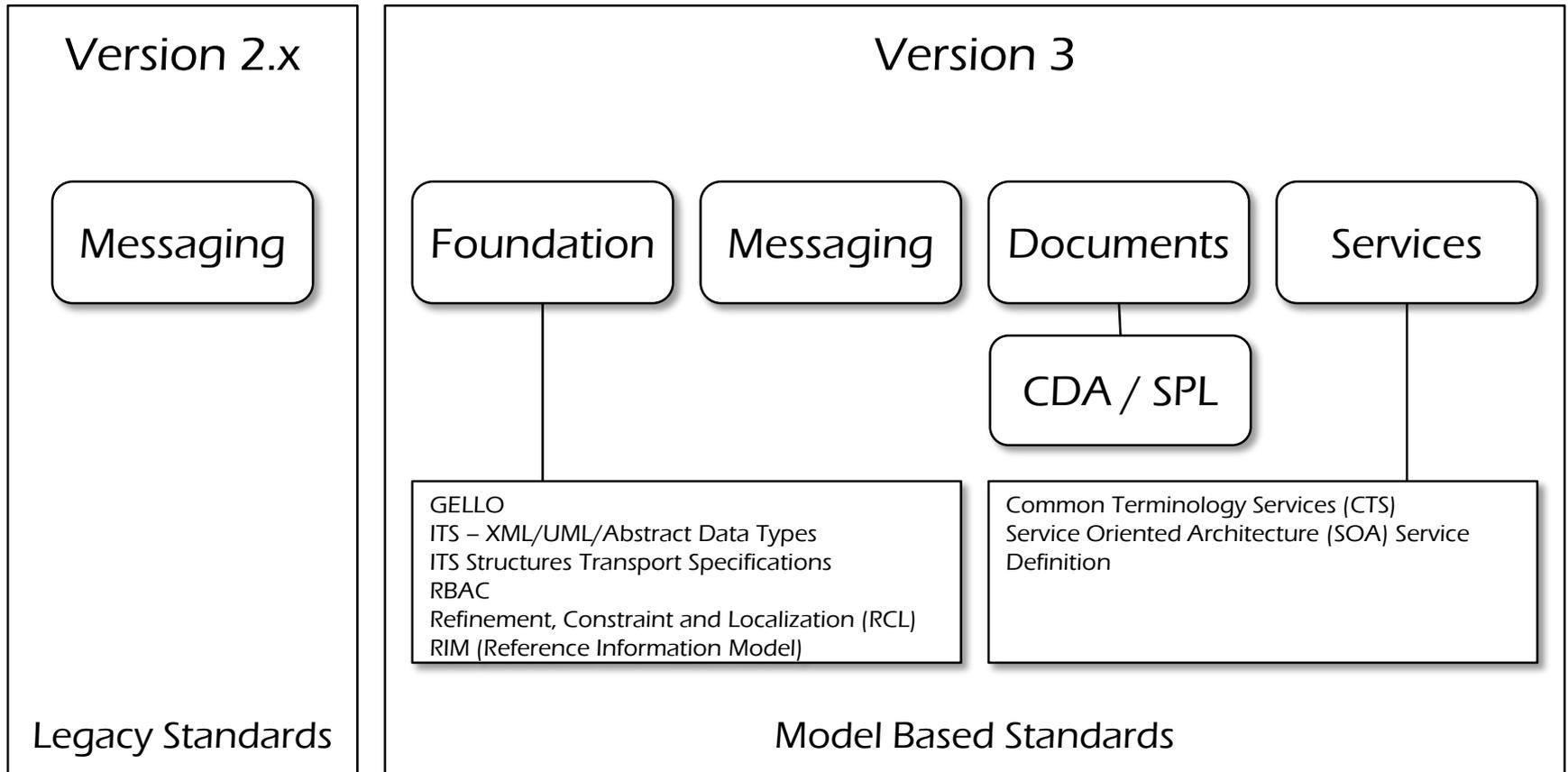
# Message, Document, and API



# Standards in Action

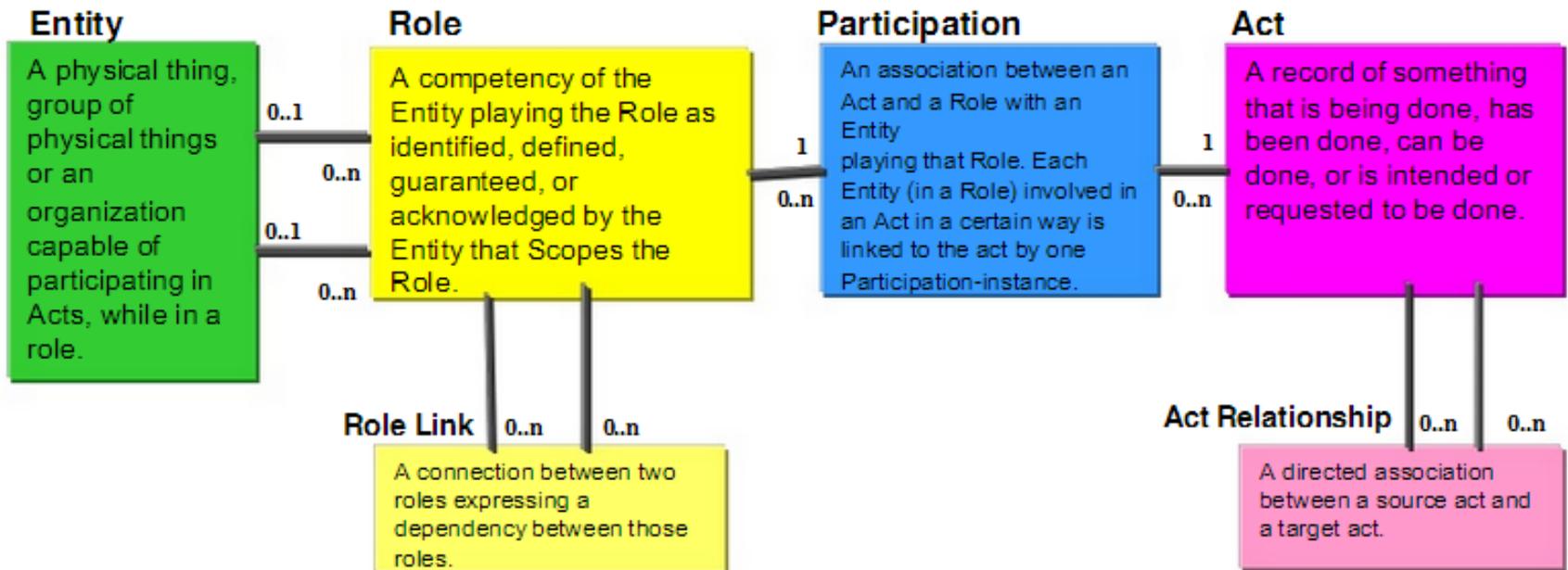


# HL7 V2 & V3 Standards

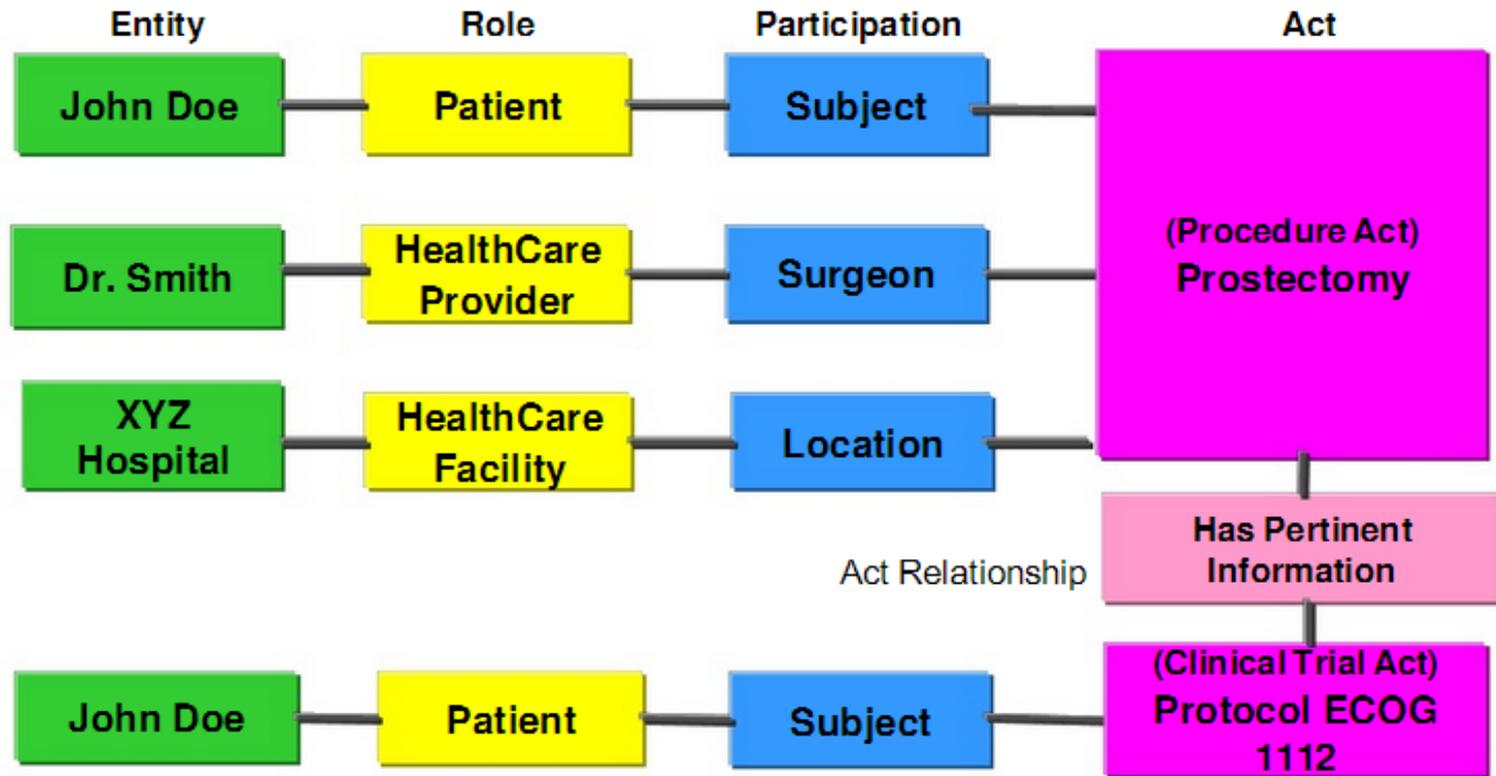


# HL7 V3

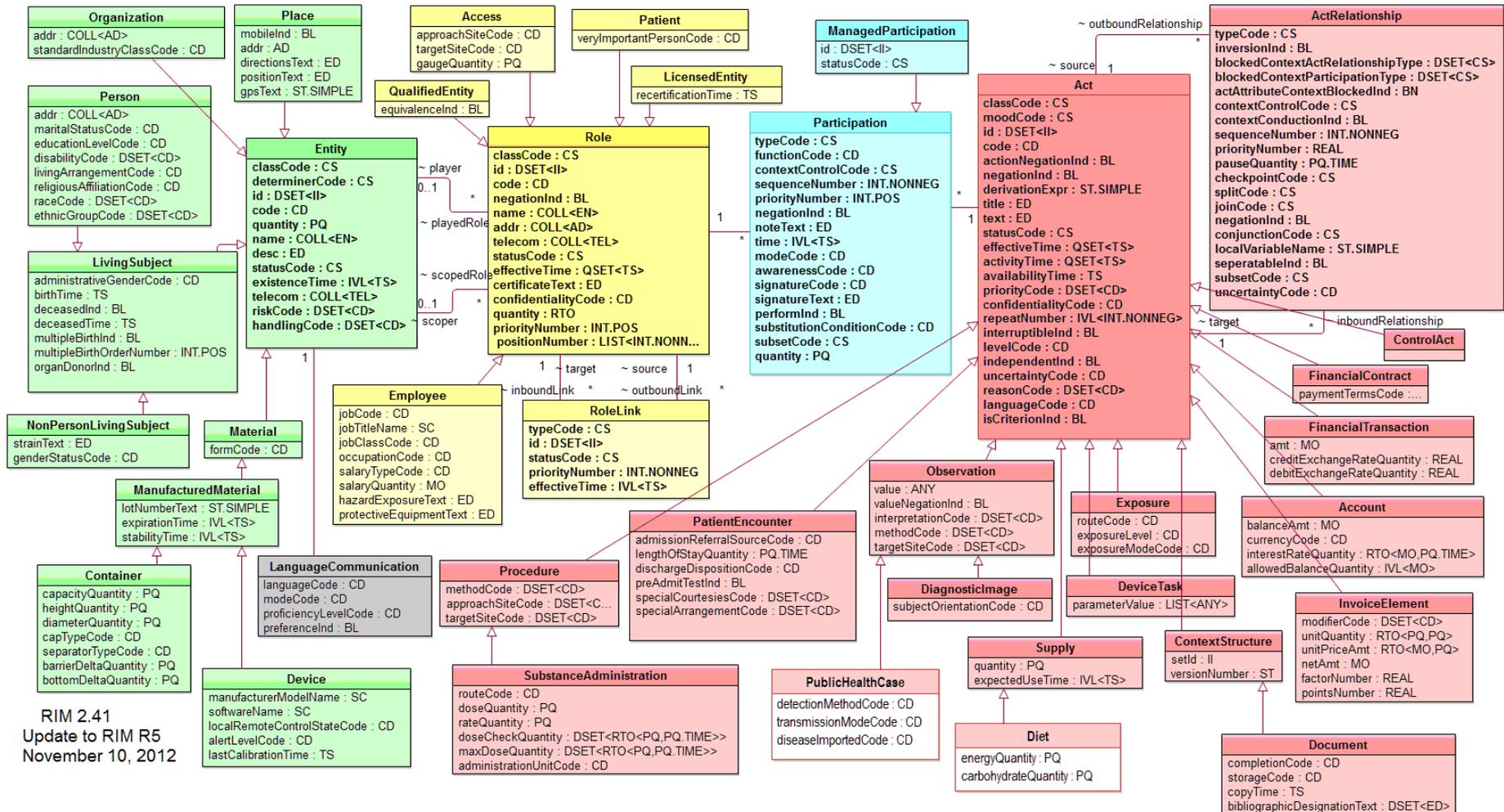
- HL7 V3 RIM (Reference Information Model)
  - Basic data model for HL7 V3 standards
  - Explicit representation of semantics and relationships
  - Consists of six backbone classes



# RIM UML Instance Scenario



# HL7 RIM Normative Content



# V3 Message

- Despite great anticipation, V3 messaging is **not popular**
  - Hardly adopted in US.
  - Some adoptions in Europe, Canada, and Australia
- Major problem: too complex!
- FHIR (Fast Healthcare Interoperability Resources) is next generation messaging from HL7
  - Less complex, more flexible
  - Could be HL7 V4

# Clinical Document Architecture (CDA)

- The most widely adopted application of HL7 V3
- For clinical information exchange/sharing between healthcare providers

# CDA = Header + Body

- CDA Header
  - Patient, provider, and encounter information
- CDA Body
  - Clinical report
  - Discharge Summary
  - Care Record Summary
  - Progress Note
  - H&P
  - Public health report
  - ... any content that carries a signature

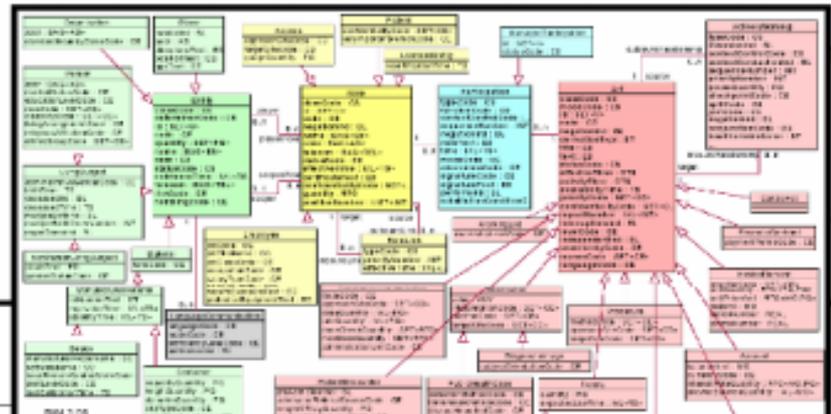


# CDA body: Machine processable

## ■ Model-based computable semantics

- Observation
- Procedure
- Organizer
- Supply
- Encounter
- Substance Administration
- Observation Media
- Region Of Interest
- Act

```
<title>Past Medical History</title>
- <text>
- <list>
- <item>
  <content ID="a1">Asthma</content>
</item>
+ <item>
+ <item>
</list>
</text>
- <entry>
- <observation classCode="COND" moodCode="Optional"
  <code code="39154008"
```



# CDA: Incremental semantic interoperability

Standard HL7 metadata

Simple XML for point of care human readability

RIM semantics for reusable computability (“semantic interoperability”)

```
CDA Header
*****
-->
<typeId root="2.16.840.1.113883.1.3" extension="POCD_HL7" />
<templateId root="2.16.840.1.113883.3.27.1.7.6" />
```

## History of Present Illness

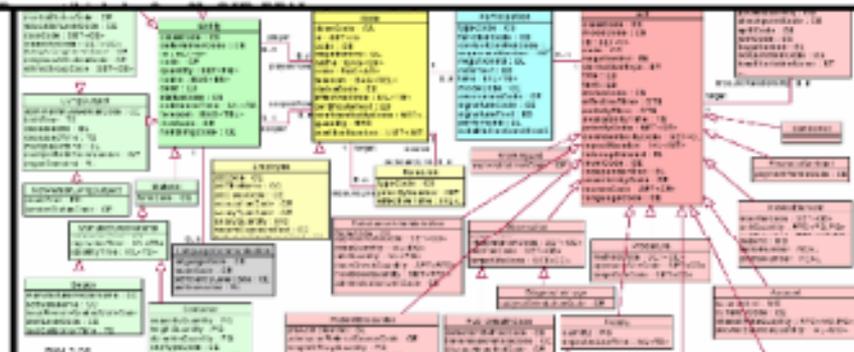
Henry Levin, the 7<sup>th</sup> is a 67 year old male referred for further asthma management. Onset of asthma in 1998. He was hospitalized twice last year, and already twice this year. He has not been able to be weaned off steroids several months.

## Past Medical History

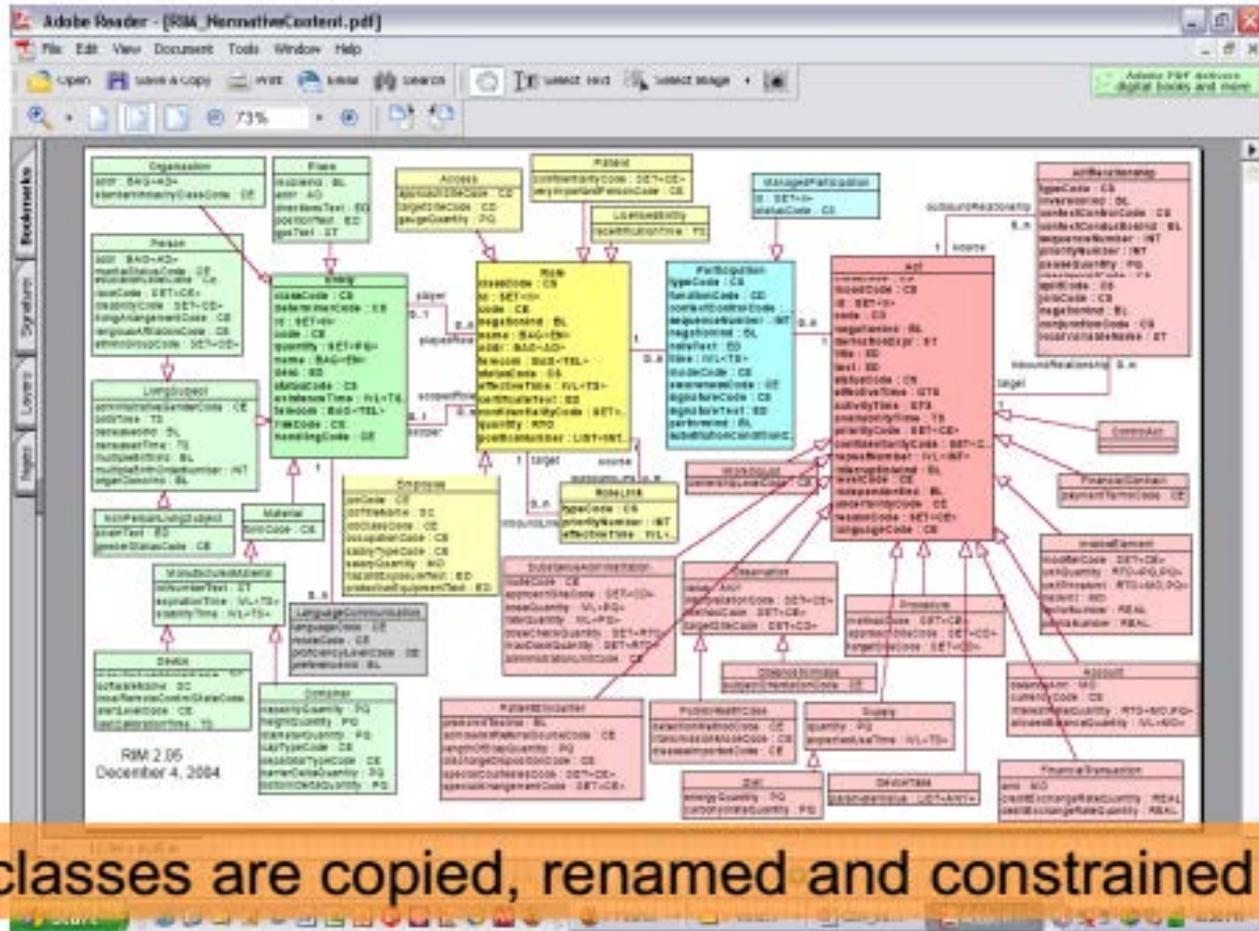
- Asthma
- Hypertension (see HTN.cda for details)
- Osteoarthritis, right knee

## Medications

- Theodur 200mg BID

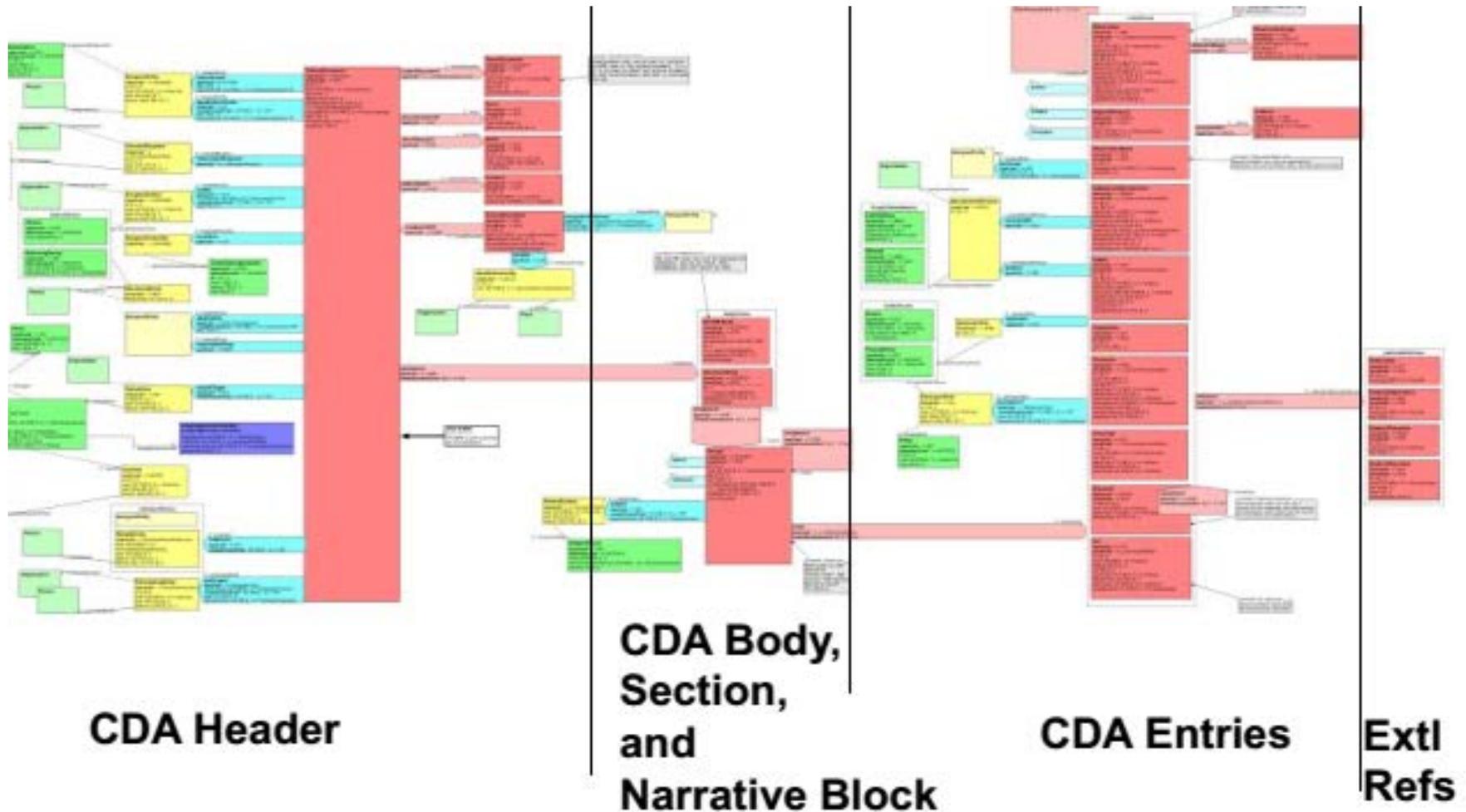


# How CDA is derived from the RIM

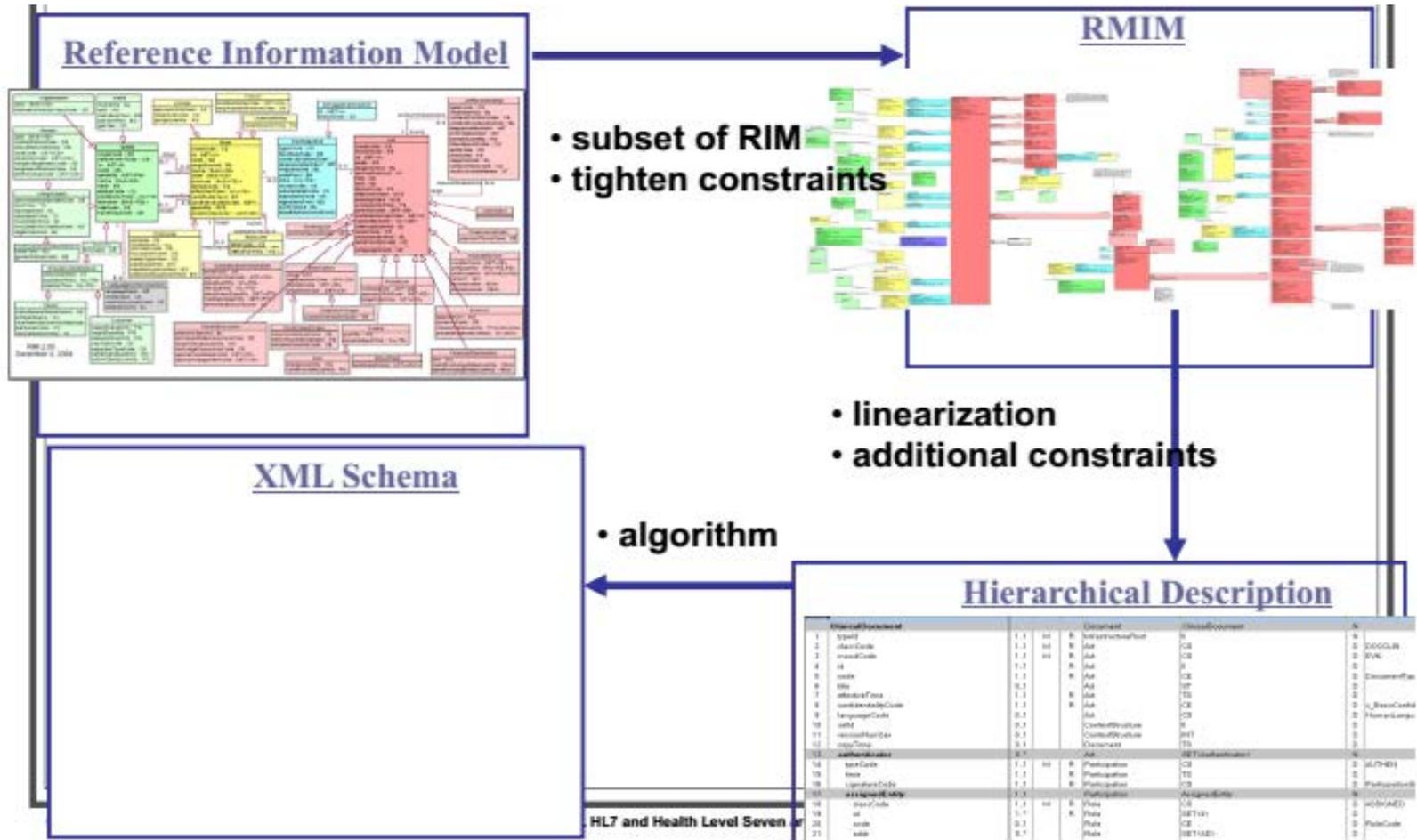


RIM classes are copied, renamed and constrained

# CDA RMIM (Refined Message Information Model)



# How the CDA is Developed and Maintained: just enough HL7 Development Framework





# Example: Diagnosis of asthma

```
<observation classCode="OBS" moodCode="EVN">
<templateId root="2.16.840.1.113883.10.20.22.4.4" />
<!-- Problem Observation template -->
<id root="d11275e7-67ae-11db-bd13-0800200c9a66" />
<code code="409586006"
      codeSystem="2.16.840.1.113883.6.96"
      displayName="Complaint" />
<statusCode code="completed" />
<effectiveTime>
  <low value="1950" />
</effectiveTime>
<value xsi:type="CD" code="195967001"
      codeSystem="2.16.840.1.113883.6.96"
      displayName="Asthma" />
...
```

Code is the  
**question:**  
"what is the  
complaint?"

Value is the  
**answer:**  
"Asthma"



FHIR<sup>®</sup> ©

# FHIR, FHIR, and FHIR!

- Fast Healthcare Interoperability Resources
  - Strong candidate for HL7 V4
  - More rigorous than V2, more flexible than V3
  - Mostly likely replace V2 and V3 messaging
  - Likely replace CDA, but not so sure

# Background

- Increasing pressure to broaden scope of sharing
  - ✓ Across organizations, disciplines, even borders
  - ✓ Mobile & cloud-based applications
  - ✓ Faster – integration in days or weeks, not months or years
- JSON Report
  - [API-level standards](#) are needed

# Manifesto

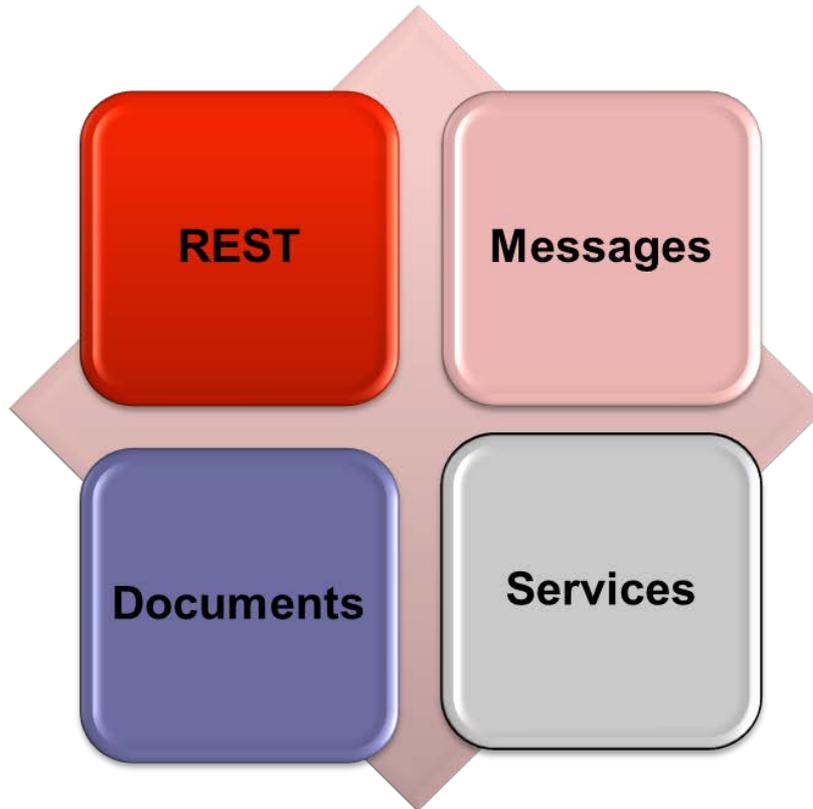
- Focus on *Implementers*
- Target support for *common scenarios*
- Leverage cross-industry *web technologies*
- Require *human readability* as base level of interoperability
- Support *multiple paradigms & architectures*

# FHIR is Free!

- Unencumbered – free for use, no membership required
- <http://hl7.org/fhir> + other versions
- Licensed under CC0: True public domain
- Any use is allowed
- **HL7 enforces the trademark protection**
  - FHIR™ and
  - Logo 

# Paradigm

- 4 interoperability paradigms



# Paradigm - REST

- REST(REpresentational State Transfer)
  - ✓ One of S/W Architectures
  - ✓ HTTP URI + HTTP Method

| REST Element | Meaning             | Expression            |
|--------------|---------------------|-----------------------|
| Resource     | resource            | HTTP URI              |
| Method       | method for resource | HTTP Method(CRUD)     |
| Message      | contents of Method  | HTTP Message Pay Load |

# Resource

- Small logically discrete units of exchange
- Defined behavior and meaning
- Known identity / location (URI)
- Smallest unit of transaction



# FHIR Resources



Home > Resources

### 3.0 Resource Index

**Categorized** | Alphabetical

This page is provided to help find resources quickly. There is also a more detailed classification, ontology, and description.

#### Clinical

|  |   |  |  |
|--|---|--|--|
| <b>General:</b> <ul style="list-style-type: none"><li>AllergyIntolerance 1</li><li>Condition (Problem) 2</li><li>Procedure 1</li><li>ClinicalImpression 0</li><li>FamilyMemberHistory 1</li><li>RiskAssessment 0</li><li>DetectedIssue 1</li></ul> | <b>Care Provision:</b> <ul style="list-style-type: none"><li>CarePlan 1</li><li>Goal 1</li><li>ReferralRequest 1</li><li>ProcedureRequest 1</li><li>NutritionOrder 1</li><li>VisionPrescription 0</li></ul> | <b>Medication &amp; Immunization:</b> <ul style="list-style-type: none"><li>Medication 1</li><li>MedicationOrder 1</li><li>MedicationAdministration 1</li><li>MedicationDispense 1</li><li>MedicationStatement 1</li><li>Immunization 1</li><li>ImmunizationRecommendation 1</li></ul> | <b>Diagnostics:</b> <ul style="list-style-type: none"><li>Observation 3</li><li>DiagnosticReport 3</li><li>DiagnosticOrder 1</li><li>Specimen 1</li><li>BodySite 0</li><li>ImagingStudy 2</li><li>ImagingObjectSelection 1</li></ul> |
|--|---|--|--|

#### Identification

|  |   |   |   |
|--|---|---|---|
| <b>Individuals:</b> <ul style="list-style-type: none"><li>Patient 3</li><li>Practitioner 1</li><li>RelatedPerson 1</li></ul> | <b>Groups:</b> <ul style="list-style-type: none"><li>Organization 1</li><li>HealthcareService 1</li><li>Group 1</li></ul> | <b>Entities:</b> <ul style="list-style-type: none"><li>Location 1</li><li>Substance 1</li><li>Person 1</li><li>Contract 0</li></ul> | <b>Devices:</b> <ul style="list-style-type: none"><li>Device 1</li><li>DeviceComponent 1</li><li>DeviceMetric 1</li></ul> |
|--|---|---|---|

#### Workflow

|   |  |  |   |
|---|--|--|---|
| <b>Patient Management:</b> <ul style="list-style-type: none"><li>Encounter 1</li><li>EpisodeOfCare 1</li><li>Communication 1</li><li>Flag 1</li></ul> | <b>Scheduling:</b> <ul style="list-style-type: none"><li>Appointment 1</li><li>AppointmentResponse 1</li><li>Schedule 1</li><li>Slot 1</li></ul> | <b>Workflow #1:</b> <ul style="list-style-type: none"><li>Order 0</li><li>OrderResponse 0</li><li>CommunicationRequest 1</li><li>DeviceUseRequest 0</li><li>DeviceUseStatement 0</li></ul> | <b>Workflow #2:</b> <ul style="list-style-type: none"><li>ProcessRequest 0</li><li>ProcessResponse 0</li><li>SupplyRequest 0</li><li>SupplyDelivery 0</li></ul> |
|---|--|--|---|

#### Infrastructure

|  |   |   |   |
|--|---|---|---|
| <b>Information Tracking:</b> <ul style="list-style-type: none"><li>Questionnaire 2</li><li>QuestionnaireResponse 2</li><li>Provenance 1</li><li>AuditEvent 2</li></ul> | <b>Documents &amp; Lists:</b> <ul style="list-style-type: none"><li>Composition 2</li><li>DocumentManifest 1</li><li>DocumentReference 2</li><li>List 1</li></ul> | <b>Structure:</b> <ul style="list-style-type: none"><li>Media 1</li><li>Binary 1</li><li>Bundle 2</li><li>Basic 1</li></ul> | <b>Exchange:</b> <ul style="list-style-type: none"><li>MessageHeader 2</li><li>OperationOutcome 2</li><li>Parameters 1</li><li>Subscription 1</li></ul> |
|--|---|---|---|

#### Conformance

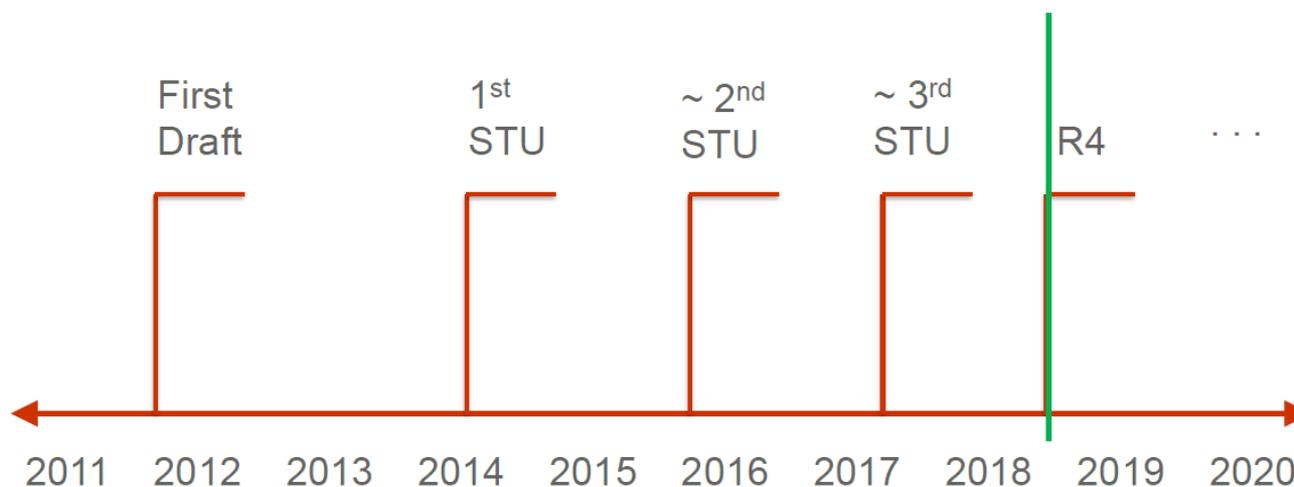
|  |   |  |   |
|--|---|--|---|
| <b>Terminology:</b> <ul style="list-style-type: none"><li>ValueSet 3</li><li>ConceptMap 2</li><li>NamingSystem 1</li></ul> | <b>Content:</b> <ul style="list-style-type: none"><li>StructureDefinition 2</li><li>DataElement 1</li></ul> | <b>Operations Control:</b> <ul style="list-style-type: none"><li>Conformance 2</li><li>OperationDefinition 1</li><li>SearchParameter 1</li></ul> | <b>Misc:</b> <ul style="list-style-type: none"><li>ImplementationGuide 0</li><li>TestScript 0</li></ul> |
|--|---|--|---|

#### Financial

|  |   |   |  |
|--|---|---|--|
| <b>Support:</b> <ul style="list-style-type: none"><li>Coverage 0</li><li>EligibilityRequest 0</li><li>EligibilityResponse 0</li><li>EnrollmentRequest 0</li><li>EnrollmentResponse 0</li></ul> | <b>Billing:</b> <ul style="list-style-type: none"><li>Claim 0</li><li>ClaimResponse 0</li></ul> | <b>Payment:</b> <ul style="list-style-type: none"><li>PaymentNotice 0</li><li>PaymentReconciliation 0</li></ul> | <b>Other:</b> <ul style="list-style-type: none"><li>ExplanationOfBenefit 0</li></ul> |
|--|---|---|--|

Additional Resources will be added in the future. A list of hypothesized resources can be found on the HL7 wiki. Feel free to add any you think are missing or engage with one of the HL7 Work Groups to submit a proposal to define a resource of particular interest.

# FHIR Timeline (planned)



# Web3D & HL7 Collaboration

- HL7 Messages & Documents
  - automatic visualization of clinical info
- Clinical semantics ↔ Graphical representation
  - Terminology/Ontology
    - FMA – Anatomy focused
    - SNOMED – Clinical concepts focused
  - Information model v. terminology
    - Severe pain in the left thumb
    - Suspected lung cancer