
HLZ

HL7 Ambassador Series: Version 3 Family of Standards

George W. Beeler, Jr. Ph.D.

Co-Chair, HL7 Modeling & Methodology Work Group
Emeritus Staff, Mayo Foundation

Principal, Beeler Consulting LLC

woody@beelers.com

HL7 International
A Brief Overview

The HL7 Organization

- Founded in 1987, Health Level Seven International (HL7), with members in over 55 countries, is a not-for-profit, ANSI-accredited standards developing organization
- HL7 is dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and management, delivery and evaluation of health services
- HL7's 2,300+ members include approximately 500 corporate members who represent more than 90% of the information systems vendors serving healthcare
- Over 43 healthcare standards from anatomic pathology to vocabulary

HL7 Mission - Interoperability Goals

- HL7's mission is to provide standards for interoperability that:
  - improve care delivery
  - optimize workflow
  - reduce ambiguity
  - enhance knowledge transfer
- Wide range of healthcare standards: clinical, clinical genomics, administrative, clinical research, electronic claims attachments, public health, personal health, etc

HL7 High Level Goals

- **Develop coherent, extendible standards that permit structured, encoded healthcare information** of the type required to support patient care, to be exchanged between computer applications, while preserving the meaning

- **Promote the use of HL7 standards worldwide** through the creation of HL7 International Affiliate organizations

HL7 High Level Goals

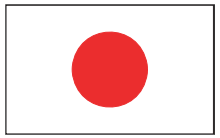
- **Stimulate, encourage and facilitate domain experts** from healthcare industry stakeholder organizations **to participate in HL7** to develop healthcare information standards in their area of expertise

- **Collaborate with healthcare information technology users** to ensure that HL7 standards meet real-world requirements, and that appropriate standards development efforts are initiated by HL7 to meet emergent requirements

An International Organization with Over 30 HL7 Affiliates


Argentina

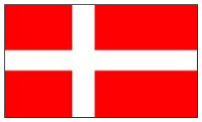

Czech Republic


Japan


New Zealand


Taiwan


Australia


Denmark

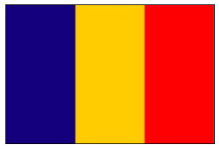

South Korea


The Netherlands


Turkey


Austria


Finland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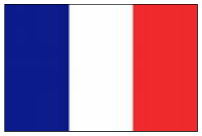
United Kingdom


Brazil


France


Russia


United States


Canada


Germany


Singapore

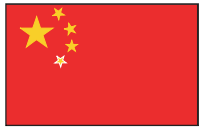

Uruguay


Chile


Greece

And growing


Spain


China


Hong Kong


Luxembourg


Sweden

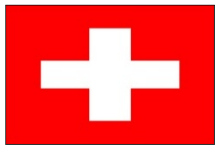

Columbia


India


Croatia


Italy


Mexico


Switzerland

HL7 Standards

- Examples
  - Version 2 messaging
  - Version 3 messaging and documents
  - The Reference Information Model (RIM)
  - Clinical Document Architecture
  - EHR specifications
  - Clinical Genetics
- Best Known
  - HL7 Version 2.x Standards
    - Used in over 95% of hospitals and medical centers in US
  - CDA (Clinical Document Architecture) standards
    - A Version 3 standard that defines XML documents for persistence within and transfer within health care institutions

HL7's Version 3 Standards: The Essence of Model-driven Standards

George W. Beeler, Jr. Ph.D.

Co-Chair, HL7 Modeling & Methodology Work Group

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woody@beelers.com

Mission

- HL7 provides standards for interoperability that improve care delivery, optimize workflow, reduce ambiguity and enhance knowledge transfer among all of our stakeholders, including healthcare providers, government agencies, the vendor community, fellow SDOs and patients. In all of our processes we exhibit timeliness, scientific rigor and technical expertise without compromising transparency, accountability, practicality, or our willingness to put the needs of our stakeholders first.

HL7 Mission (2)

- Interoperability

  "Ability of two or more systems or components to exchange information and to use the information that has been exchanged"

  - [IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries, IEEE, 1990]

Functional interoperability

Semantic interoperability

Core requirements for standard exchanges

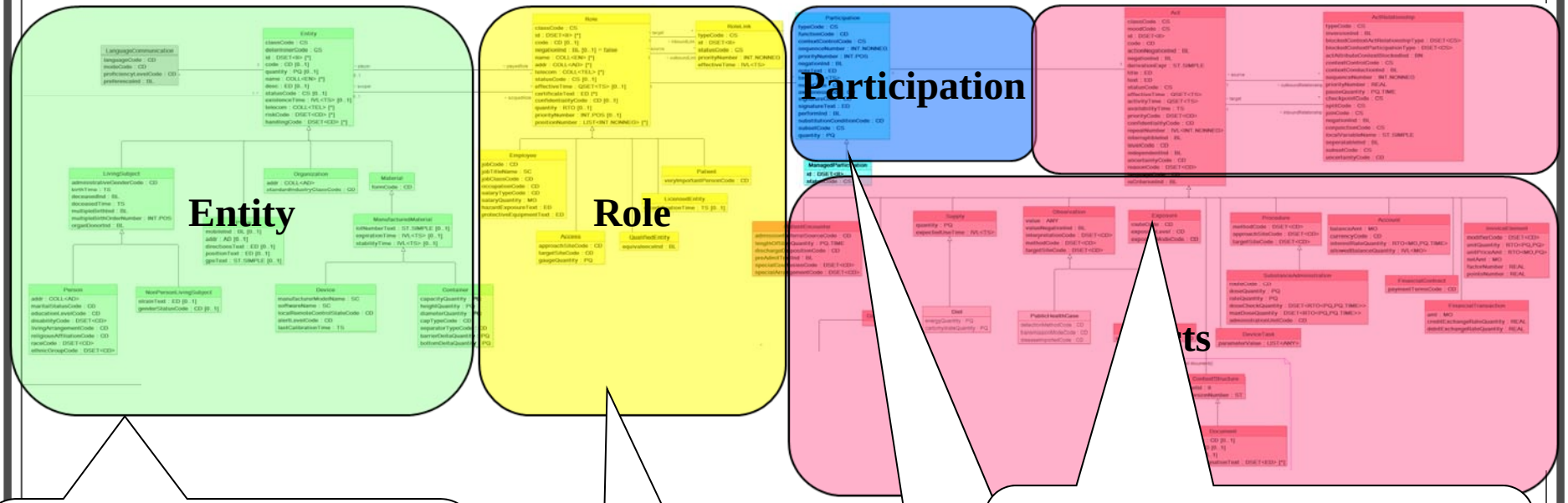
- Nouns –items we communicate about
  - Typically **actions** and physical **things** (persons, places, etc.)
- Phrases - the **essential bindings** between nouns
  - An action **happens to** a person
  - One action **causes** another
  - A person **performs** an action
- Vocabulary & model – common definitions
  - Assure common perspective
  - Prescribe the nouns and phrases we can use

How is Version 3 “better”*?

- **Conceptual foundation** – a single, common reference information model to be used across HL7
- **Semantic foundation** – in explicitly defined concept domains drawn from the best terminologies
- **Abstract design methodology** that is technology-neutral – able to be used with whatever is the preferred technology: information resources, documents, messages, services, applications
- **Maintain a repository** of the semantic content to assure a single source, and to enable development of support tooling

  - * **“Better”** than prior standards that were not model-driven

Class Diagram – Normative RIM Release 5



Physical things of interest …
Persons, Organizations, Places,

- 9
- 30

… **take on Roles in health care** …
Patient, Physician, Employer

Entities in Roles participate as …
Performer, Author, target

… **participate in Acts** …
Encounters, Observations, procedures, medications …

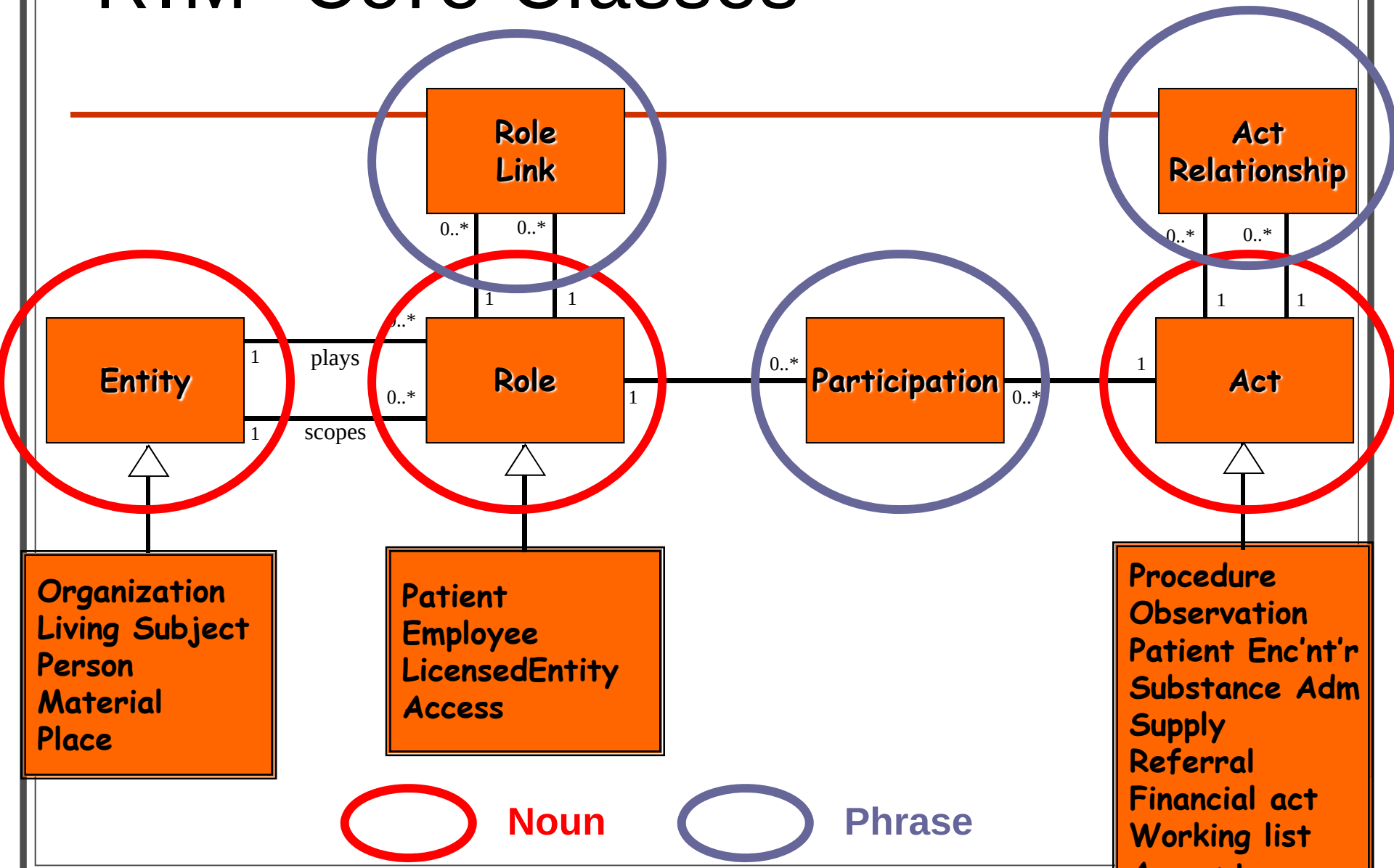
Action – the focus of health care communication & documentation

- The reason we want to automate health care data is to be able to document the actions taken to treat a patient:
  - A request or order for a test is an action
  - The report of the test result is an action
  - Creating a diagnosis based on test results is an action
  - Prescribing treatment based on the diagnosis is an action
- In simple terms, a medical record is a record of each of the individual actions that make up the diagnosis, treatment and care of a patient.

Five core concepts of the RIM

- Every happening is an Act
  - Procedures, observations, medications, supply, registration, etc.
- Acts are related through an ActRelationship
  - composition, preconditions, revisions, support, etc.
- Participation defines the context for an Act
  - author, performer, subject, location, etc.
- The participants are Roles
  - patient, provider, practitioner, specimen, employee etc.
- Roles are played by Entities
  - persons, organizations, material, places, devices, etc.

RIM Core Classes



HL7 Information Model Design Rules

- An HL7 information model can not include any “class”, that is not a sub-type of a defined class in the RIM
- The “Associations” and “Attributes” used must be subtypes of the associations and attributes defined for that class in the RIM
- Cardinality, data types and other class properties, can be restricted from their RIM values, but not extended.

Binding Terminology to a Model

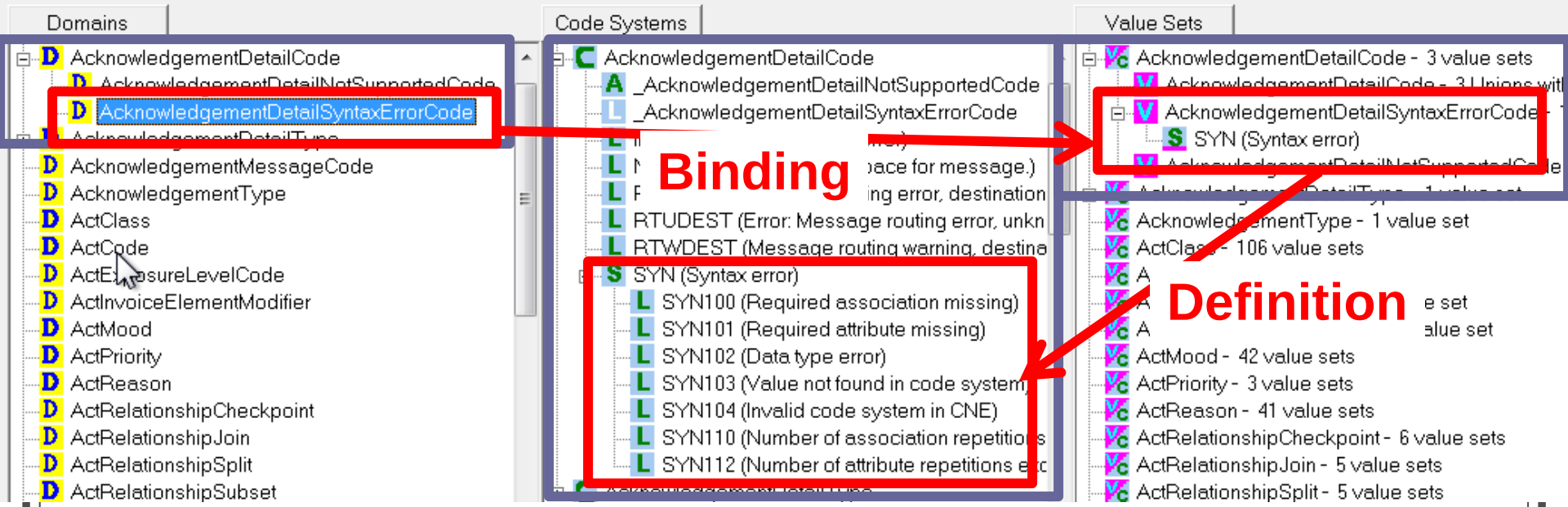
Concept Domain: a named category of like concepts (semantic type) that will be bound to one or more coded elements [documented by specifying a name, a narrative definition]

Code System: collection of uniquely identifiable concepts with associated representations, designations, associations, and meanings. [as simple as a table, as complex as SNOMED-CT]

Value Set represents a uniquely identifiable set of valid concept identifiers, where any concept identifier in a coded element can be tested to determine whether it is a member of the Value Set at a specific point in time.

Vocabulary Binding: the mechanism of identifying specific codes to be used to express the semantics of coded model elements in HL7 information models or coded data type properties. May be “context” binding between a value set and a concept domain, or a “model” binding of a data element to a value set or a single concept.)

Domain–Value Set Binding Example



Concept Domain defines concepts to represent an attribute in a particular design

Code system provides a set of coded concepts

Value set selects a sub-set of the coded concepts

Binding asserts that a particular value set "satisfies" the domain

The “essence” of Version 3

- Apply the ‘best practices’ of software development to developing standards – a model-based methodology
- Predicate all designs on three semantic foundations – a reference information model, a specification of data types, and a complete, carefully-selected set of terminology domains
- Require all Version 3 standards to draw from these three common resources
- Use software-engineering style tools to support the process.

The “definition” of Version 3

- A family of specifications
- Usable on a variety of technology platforms
- Built upon a shared set of core models
- Constructed in a fashion to permit the rapid development of comprehensive, fully constrained specifications

Bringing it together

- One Reference Model, one set of tools, one process produce
  - A simple common resource for patient
  - Standard clinical documents for an array of uses
  - Large, rich sets of information– electronic claims, clinical trial data
  - Clinical genomics information structures
- All taken from RIM to schemas, **and published** with a single set of effective tools

Version 3 Normative Editions

- HL7 ballots individual Version 3 standards
  - Under our consensus process
  - Ballot until you satisfy your own toughest critics – your self
- These are registered as ANSI specifications
- Standards are grouped informally as:
  - Domains – topics of healthcare interest
  - Common – Content shared by/across domains
  - Infrastructure – enables communication
  - Foundation – the basis for the V3 family of standards
- They are published annually in a comprehensive "Normative Edition"

Content of V3 Normative Editions

- Final publication form of all Normative Specifications (ANSI registered)
- Supporting Reference Material – methodology guide, readers guides, etc.
- Processable representations of all content – XML interchange format, schemas, etc.
- Documented dependency hierarchy

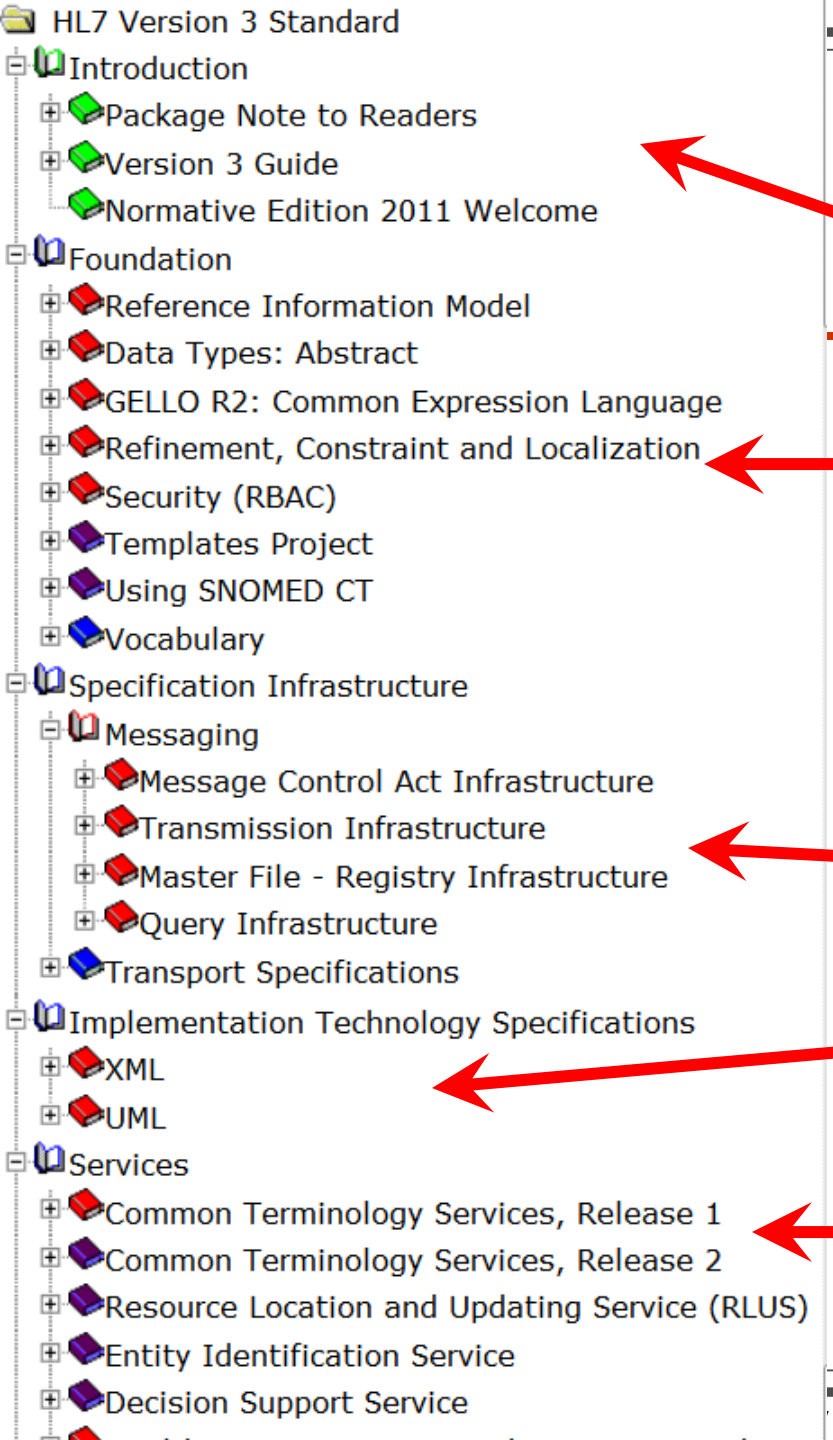


Table of Contents

Help for readers

Fundamental models, including – ANSI-ISO RIM, ISO/HL7/CEN data types, vocabulary, constraint rules, etc

Message wrappers and so on

Implementation technologies

Service specifications

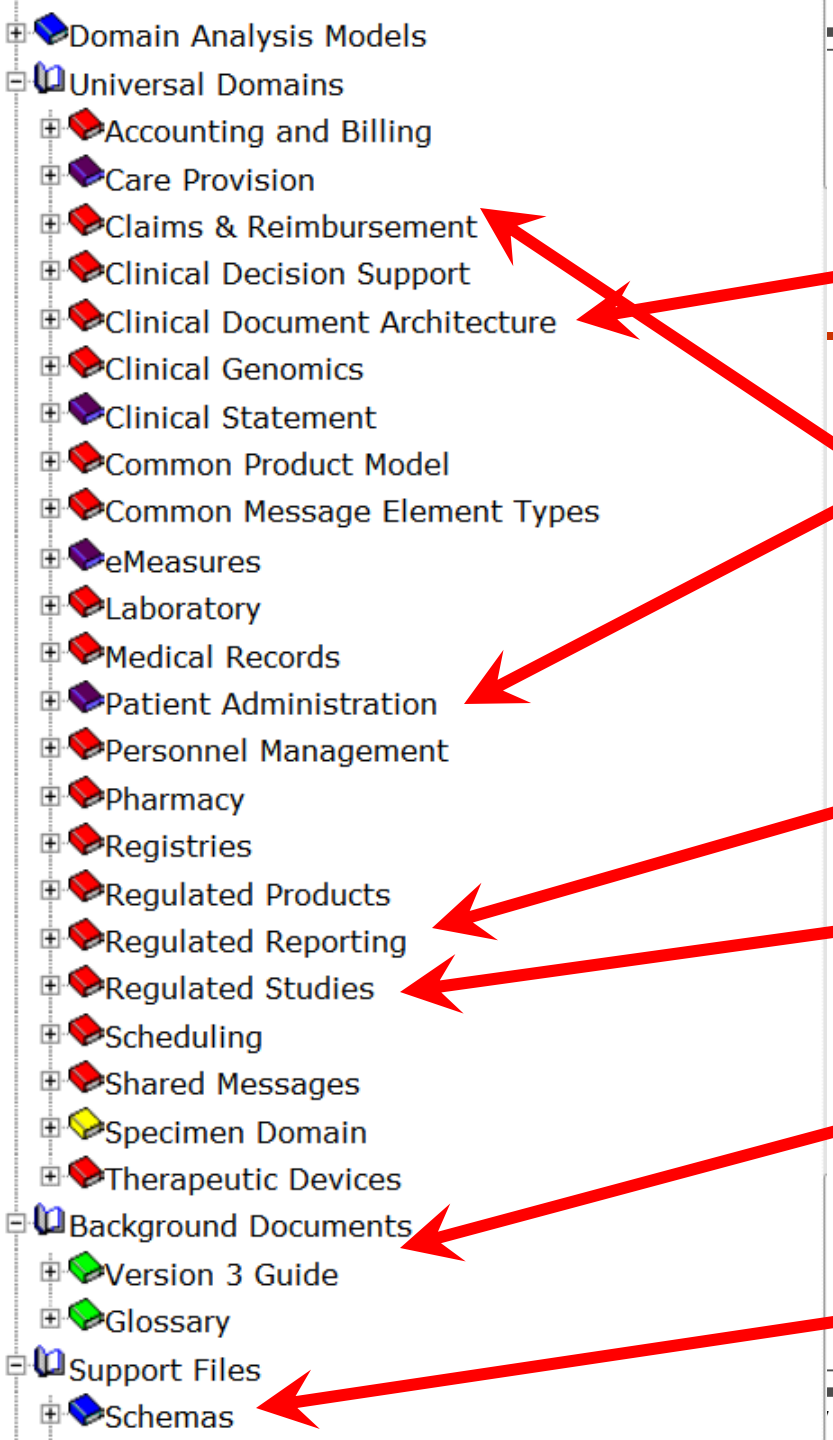


Table of Contents

CDA

Patient and insurance accounting, Patient management, Scheduling

Public Health Messaging

Clinical studies

Supporting documents

Schemas

Version 3 - where is it being used?

As CDA documents, as SOA designs, as interchanged Messages

- In large-scale projects deriving from governmental mandates
- For communications between multiple, independent, “non-integrated” entities
- Whereever there are requirements to communicate parts of an EHR and to maintain the integrity of the EHR data relationships

V3 Lessons

- “Universal interoperabilty” demands great detail captured in complex specifications
- Simpler paradigms – CDA documents, Structured Product Labeling, localized interoperability – that focus on selected areas have had greater uptake
- HL7 has a wealth of good designs in a variety of domains of interest; in common model elements; and in universal data types, but needs to simplify the end product for implementers.

V3 Directions (selected)

- CDA R3 – Extends base design model so that the document can include content from any RIM-based model
- Green – CDA – Support simplified implementation CDA documents
- RIMBAA (RIM-Based Application Architecture) – a development environment established solely on RIM-based elements
- FHIR* - (Fast Health Interoperability Resources) – Will develop and standardize a suite of information “resources” that can be readily implemented

V3 Directions (FHIR)

FHIR* - (pronounced “fire”):

- Draws requirements from the best of V3, V2 & CDA
- 80-20 rule – the 20% of content that meets 80% of needs
- Rigorously mapped to HL7/ISO RIM and Data Types
- Represents each resource once, not in many variants
- Includes RIM-mapped extension formalism to meet specific needs
- Uses business names to promote understanding & adoption
- Targeted to RESTful transport, but supports documents, messaging, SOA and more **[* Google “FHIR”]**

The power of HL7 and Version 3

- Consensus standards, developed by volunteers who come from countries around the world to undertake "practical" informatics
- Welcoming new participants, and their ideas
- Founded on solid principles of system design, focusing on models & terminology
- Models that emphasize clinical concepts, and the supporting context needed for decision support, clinical decision making and just plain "solid patient care"

Questions on V3? (more RIM to come)

Introduction to: HL7 Reference Information Model (RIM)

ANSI/HL7 RIM R5-2012 and ISO 21731

George W. Beeler, Jr., Ph.D.

Emeritus Staff, Mayo Foundation

Principal, Beeler Consulting LLC

RIM Milestones

Note: 20th & 15th Anniversaries

- Concept proposed in 1992 by ANSI/HISPP **Joint Working Group for a Common Data Model** (in which HL7 was a key participant)
- HL7 undertook development formally in 1997, building on models contributed by members
- Process of Harmonization established to advance the state of the model
- RIM 1.0 (first non-draft RIM) – Published Jan 2001
- **ANSI/HL7 RIM Release 1** – Approved July 2003
- **ISO 21731 (RIM Release 1)** approved 2006
- RIM changed to ANSI "Continuous Maintenance Process" January 2009
- Ballot of RIM R2 and R3 completed 2009 & 2010

HL7 – Version 3

- Initial HL7 standards (Version 2) were based on a pragmatic ‘just do it’ approach to standards
- HL7 saw the need to revise and formalize the process
  - to assure consistency of the standards
  - to meet plug’n’play demands
  - to be able to adopt and leverage new technologies for both HL7 and its users
- Adopted the new methodology in 1997
  - based on best development & design practices
  - supports ‘distributed’ development across committees
  - is technology neutral

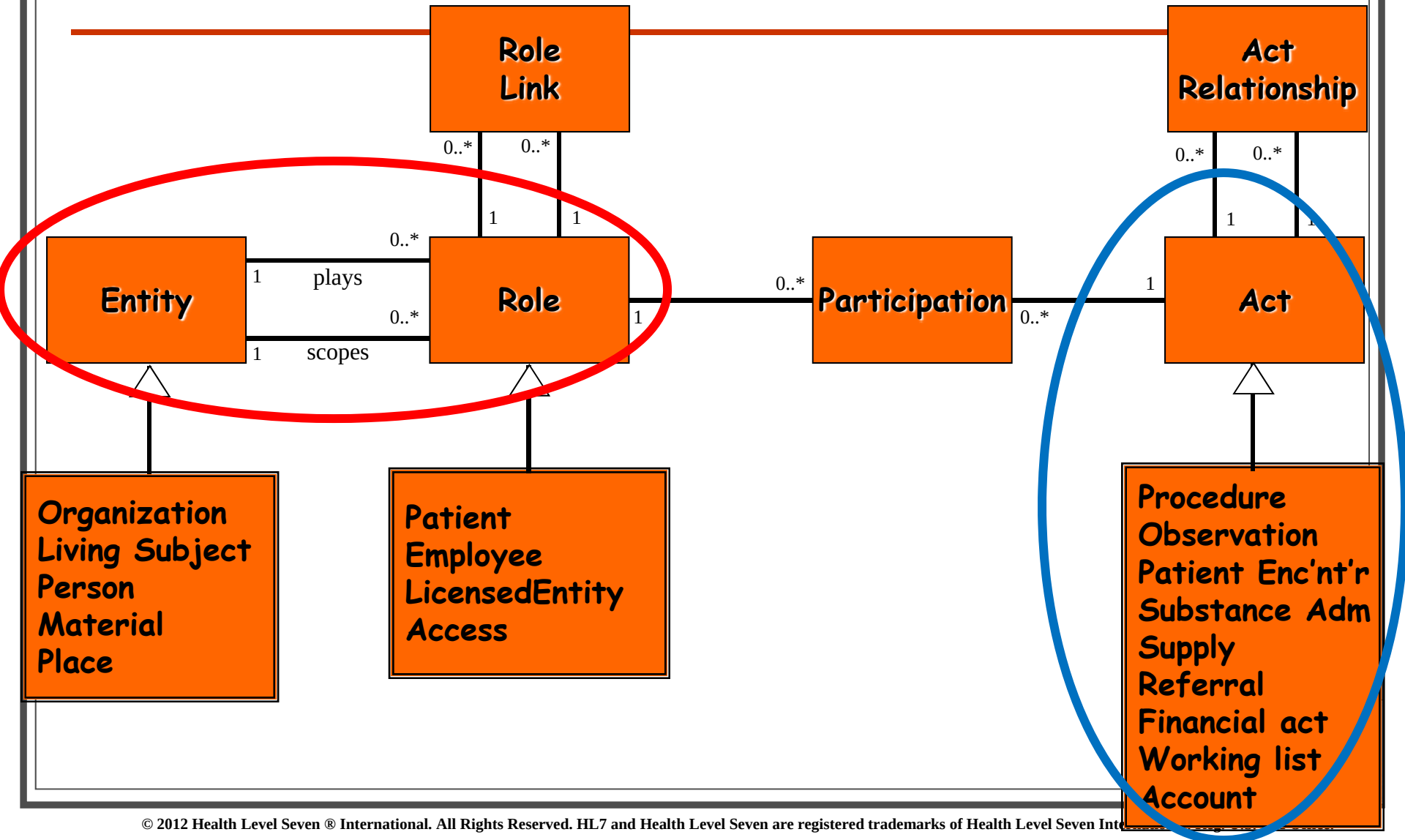
HL7 Version 3

- Methodology based on shared models
  - Reference Information Model (RIM)
    - of the health care information domain
  - Defined vocabulary domains
    - Drawn from the best available terminologies
    - Directly linked to the RIM
    - Supported by robust communication techniques
  - Data Types model
- Harmonization process that
  - Assures each member and committee a voice in the process, yet
  - Produces a **single** model as the foundation for HL7 standards
- Continuous balloting – begun in 2009 – produces a new release each year. R5 balloting begins May 2012

The “essence” of Version 3

- Apply the ‘best practices’ of software development to developing standards – a model-based methodology
- Predicate all designs on three semantic foundations – a reference information model, a robust set of data types, and a complete, carefully-selected set of terminology domains
- Require all Version 3 standards to draw from these three common resources
- Use software-engineering style tools to support the process.

RIM Core Classes



Associations between Roles and Entities: "Played and Scoped"

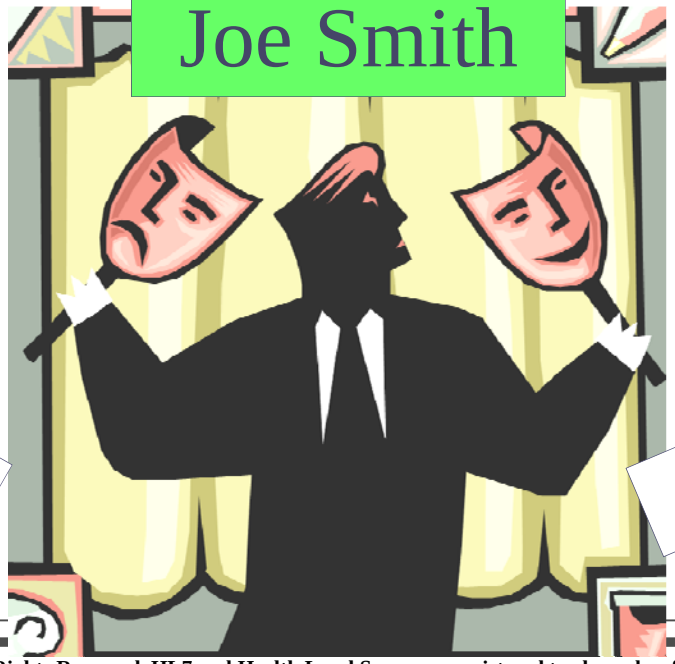
Downtown Hospital

Scoped By

Uptown Hospital

Scoped By

Joe Smith



Doctor

Plays

Patient

Plays

Is “Act” sufficient?

- How can a single act class represent all of the elements of clinical action – their definition, request, order, report?
- Answer: the Act “**mood**” code –

  “A code specifying whether the Act is an activity that has happened, can happen, is happening, is intended to happen, or is requested/demanded to happen.

Principle Act 'moods'

definition (DEF) – Definition of an act, formerly a "master file"

intent (INT) – an intention to plan or perform an act

request (RQO) – a request or order for a service from a request "placer" to a request "fulfiller"

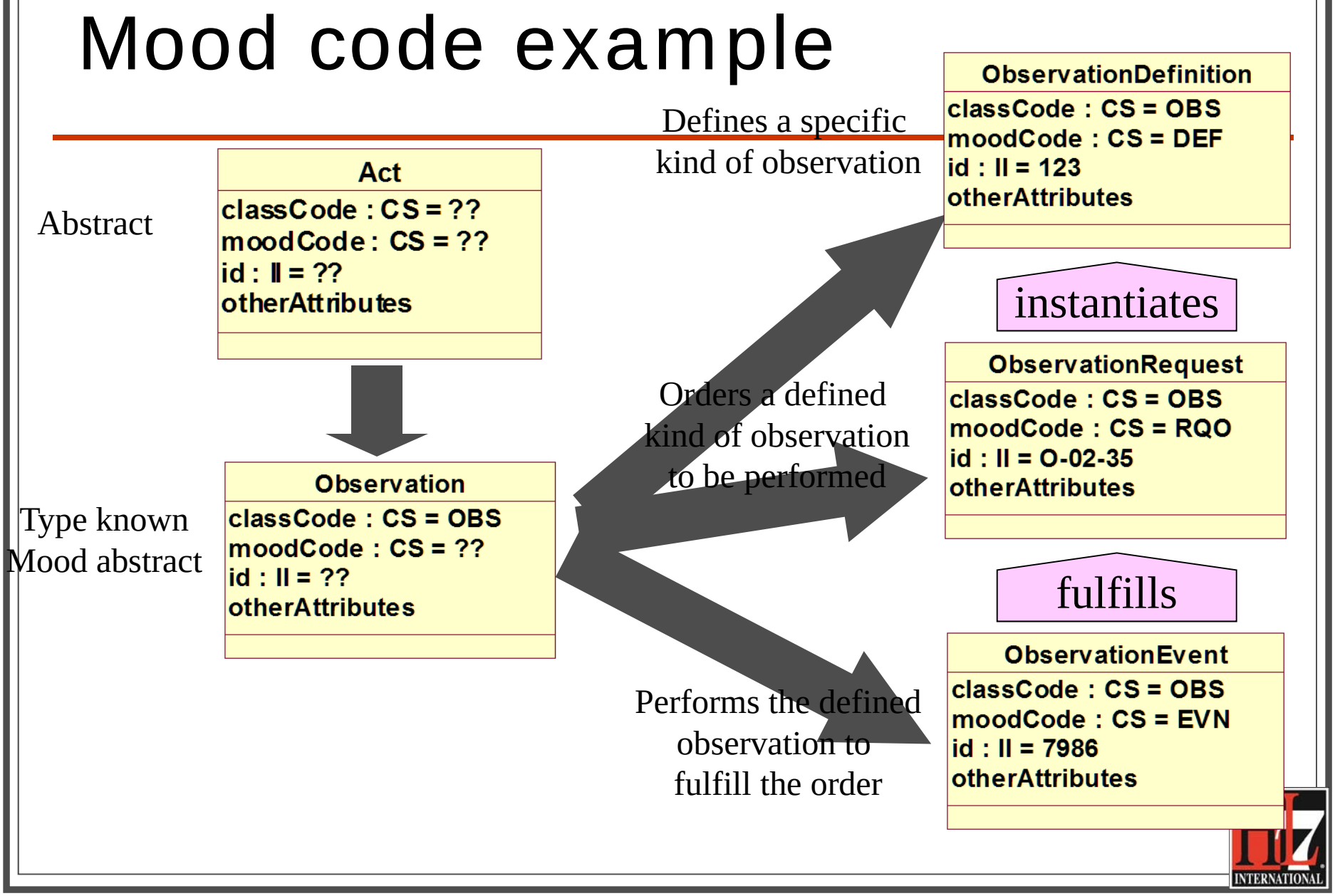
promise (PRMS) – intent to perform that has the strength of a commitment

confirmation (CNF) – promise that has been solicited via an order

event (EVN) – an act that actually happens, includes the documentation (report) of the event

Critical concept – "Mood" is not a status code. Each instance of the Act class may have one and only one value for 'mood' Thus, an act in "order" mood that orders an act in definition mood and results in an Act in 'event' mood are three different acts, related through the act relationship.

Mood code example



Consider the Act of "Room Cleaning"

- Mood: Proposal
  - PRP
- Mood: Order/Request
  - RQO
- Mood: Promise
  - PRMS
- Mood: Event
  - EVN

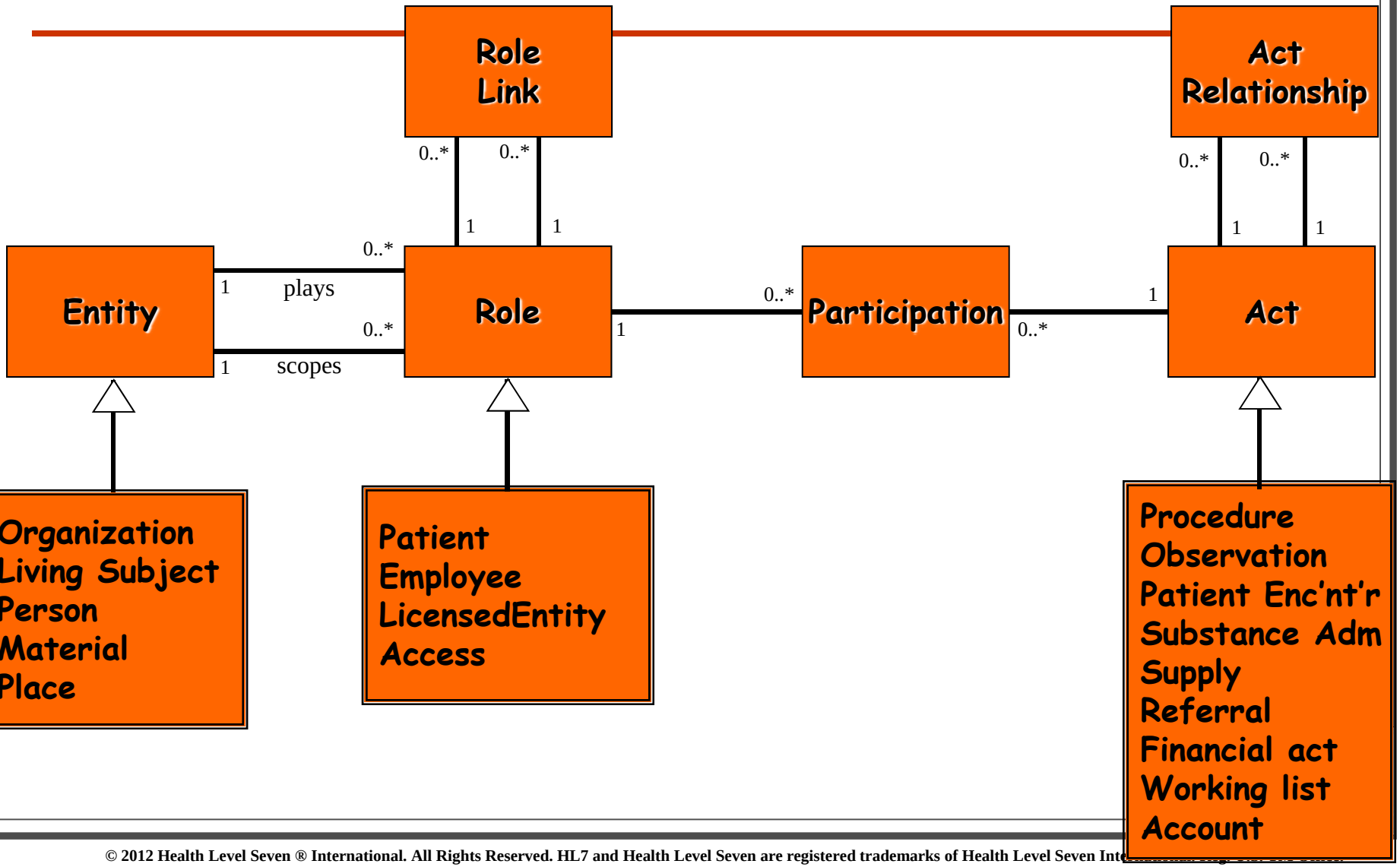
Why don't you clean your room today honey?

Clean your room!

I will already!

Room is cleaned.

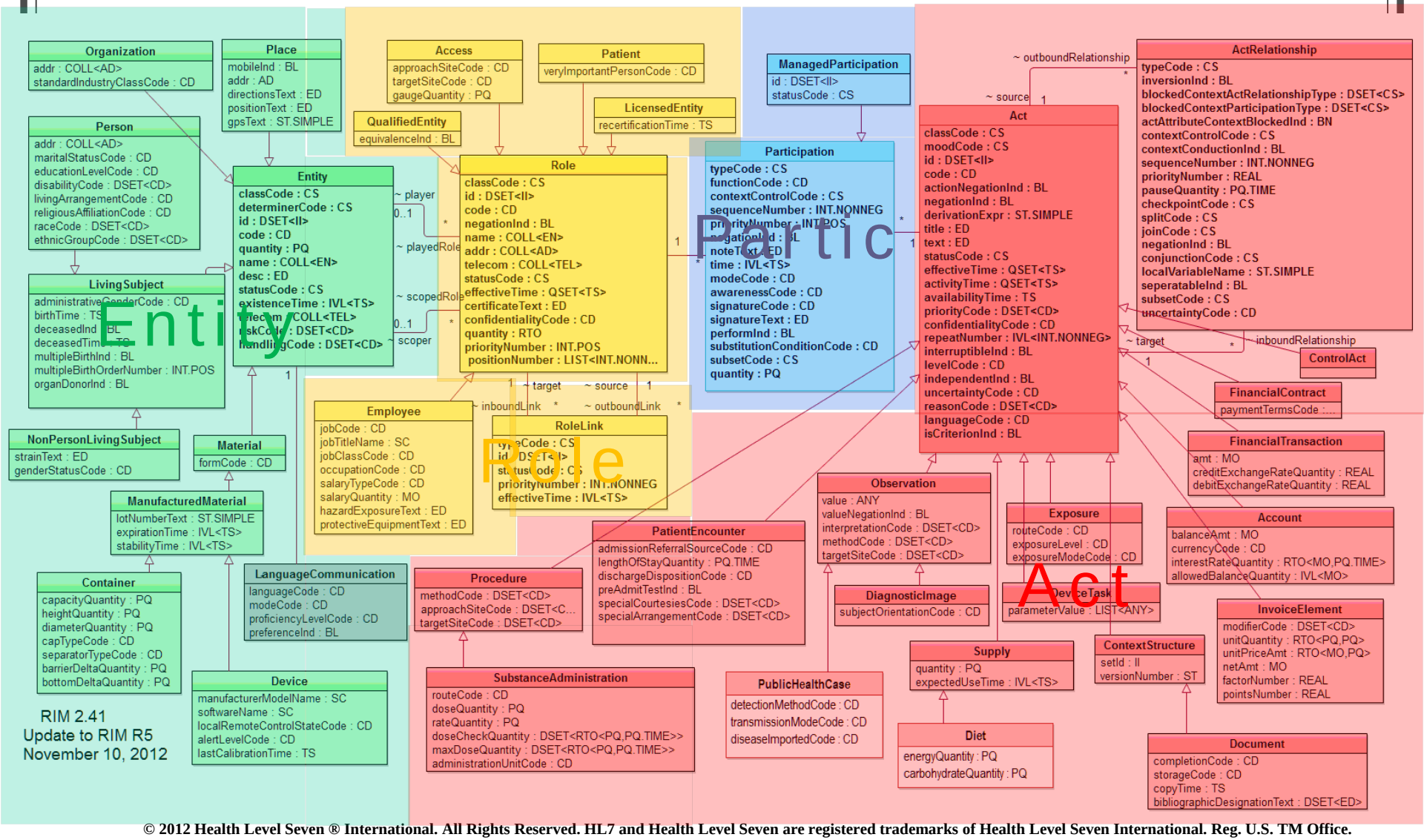
RIM Core Classes



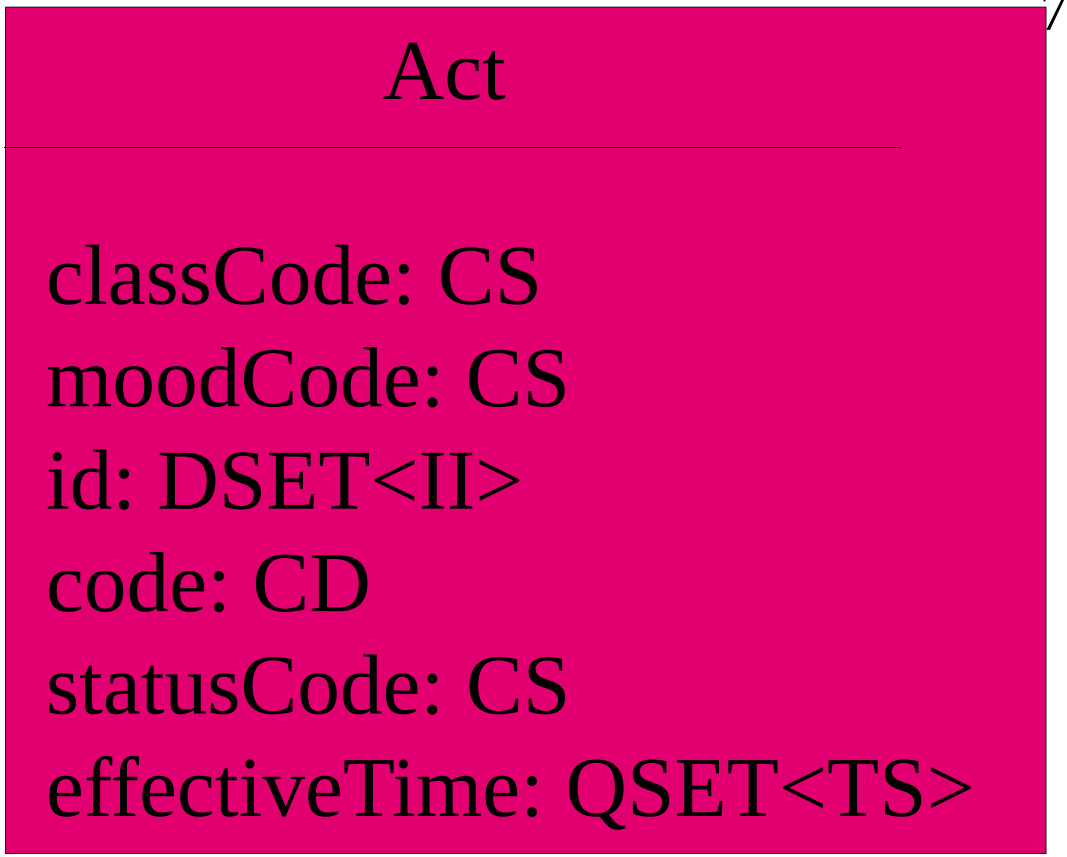
Brief Survey of RIM

- Basis of HL7 V3 is single model with only six back-bone classes and a couple of dozen specializations.
- Abstracted by type hierarchies and “mood”
- Displayed on a single 8-1/2 x 11 sheet ---

RIM Core Classes

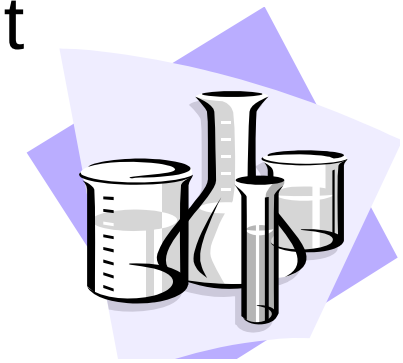


V3: All About Acts



Acts Have Class

- ENC - Encounter
- OBS - Observation (lab)
- SBADM - Substance Administration (pharmacy - admin)
- SPLY - Supply (pharmacy - dispense)
- CLINDOC - Document



Act.classCode :: CS (1..1) Mandatory

Concept domain: ActClass

Acts Can Have Codes

External coding systems:

- Lab Observation Act Codes could be LOINC codes.

```
<code
code="1554-5"
codeSystemName="LN"
displayName="Serum Glucose“
/>
```

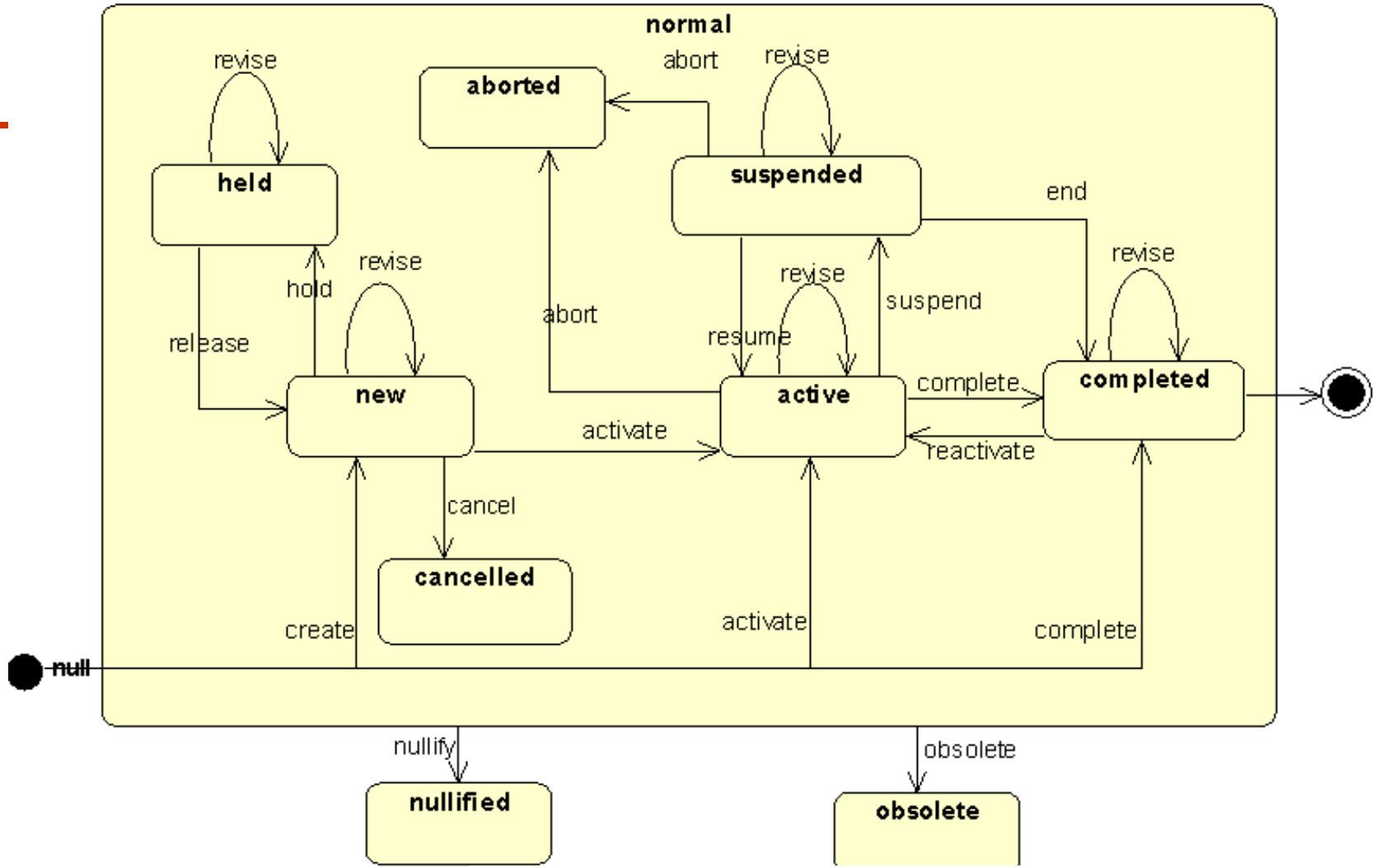
- HL7 defined:
  - Encounter Type are Act Codes.

Encounter Type
Inpatient
Emergency
Ambulatory
Home Health

Act.code :: CD (0..1)

Concept domain: ActCode

Acts Have States



Act.statusCode :: CS (0..1)

Concept domain: ActStatus

Acts Have Moods…

- Further clarifies the meaning of the Act (like Class and Code)
- Specifies if this act is an actual fact (event), or an intention to perform an act - such as a command, goal, appointment, or proposal.
- Signifies a major modality or stage for which a permanent record must be obtained.
- Never changes.
- Alternatively, status can change. Status does not define the Act.

Act.moodCode :: CS (1..1) Mandatory

Concept domain: ActMood

Acts happen at specific times: Act.effectiveTime

Definition: A time expression specifying the focal or operative time of the Act, the primary time for which the Act holds, the time of interest from the perspective of the Act's intention.

Data Type = General Timing Specification (GTS)
Similar to V2 TQ repeat interval

Act.effectiveTime :: QSET<TS> (0..1)

Types of Act Relationships

- COMP - has component
- PERT - has pertinent info
- SEQL - is sequel
- OPTN - has option
- FLFS - fulfills
- RSON - has reason
- INST - instantiates
- PRCN - has precondition
- OUTC - has outcome
- ARR – arrived by
- SUCC - succeeds
- RPLC - replaces
- OCCR - occurrence
- REFV - has reference values
- AUTH - authorized by
- COST - has cost
- GOAL - has goal
- PREV - has previous instance

ActRelationship.typeCode :: CS (1..1) Mandatory

Concept domain: ActRelationshipType

Participation

- Describes the involvement of an *entity* in an *act*.
- The *entity* is playing a *role*

  (Joe Smith plays doctor).
- The *role* participates in an *act*. Examples:
  - Author [of an order]

    (Ordering Doctor)
  - Admitter [of an encounter]

    (Admitting Doctor)

Types of Participations

- AUT - author
- ENT - data entry person
- CBC - call back contact
- PATSBJ - patient subject
- ADM - admitter
- PRF - performer
- ATND - attender
- CNS - consenter
- DIS - discharger
- SPC - specimen
- LOC - location
- CON- consultant
- DST - destination
- DEV - device
- TPA - therapeutic agent
- CSM - consumable
- RESPROV – resp provider

Participation.typeCode :: CS (1..1) Mandatory

Concept domain: ParticipationType

Attributes have Data Types

Release 2 of V3 Data Types was balloted jointly by HL7, ISO TC 215 and CEN TC 251

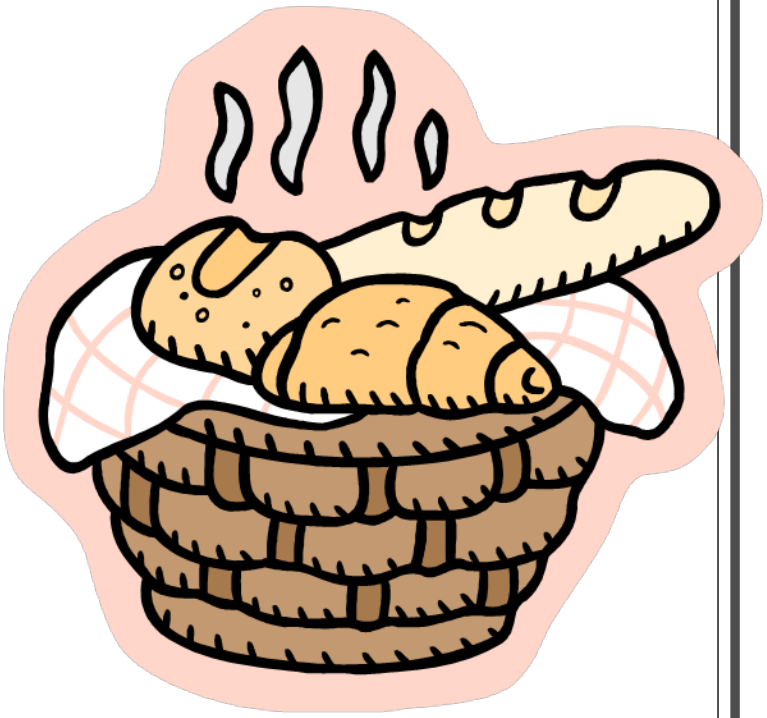
- 10 Foundation: data types from which the rest are built, includes collection data types, boolean, etc.
- 10 Basic data types including string, encapsulated data, coded data types, name, address, etc.
- 7 Numerical and quantity data types, including numbers, money, and ratios
- 10 Quantity collection types including intervals, discrete sets, unordered sets, etc.
- 2 Uncertainty data types
- 33 Flavors (specific constraints) of other data types, including "email address", "organization name",

Many Attributes also have Vocabulary Constraints

- In RIM the contraints are **always** expressed as Concept Domains
- Examples –
  - AcknowledgementCondition .. WorkPlaceAddressUse
  - Act.classCode :: CS (1..1) Mandatory is constrained to concept domain ActClass
- If RIM attribute is type **CS**, then the code system MUST also be specified.
  - This is done by binding the RIM concept domain, in the Universal realm, to a Value set defined as **"all codes"** from the relevant code system with binding strength CNE.
  - Universal means ALL HL7 specifications SHALL use this binding;
  - CNE means that ONLY codes from that value set may be used.

RIM: Food for Thought

- CDA Documents, V3 Messages and FHIR are based on the RIM
- Other objects could also be created from the RIM.
- Do you have an application for the RIM?
- Some vendors are making their internal data models consistent or mappable with the RIM. They are prepared for V3 communication. Are you?



Thank You! – Questions?

George W. Beeler, Jr., Ph.D.
Emeritus Staff, Mayo Foundation
Principal, Beeler Consulting LLC
211 2ND ST NW APT 1012
Rochester, MN 55901
(507)254-4810
woody@beelers.com