





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

George W. Beeler, Jr. Ph.D.

Co-Chair, HL7 Modeling & Methodology Committee

Principal, Beeler Consulting LLC

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

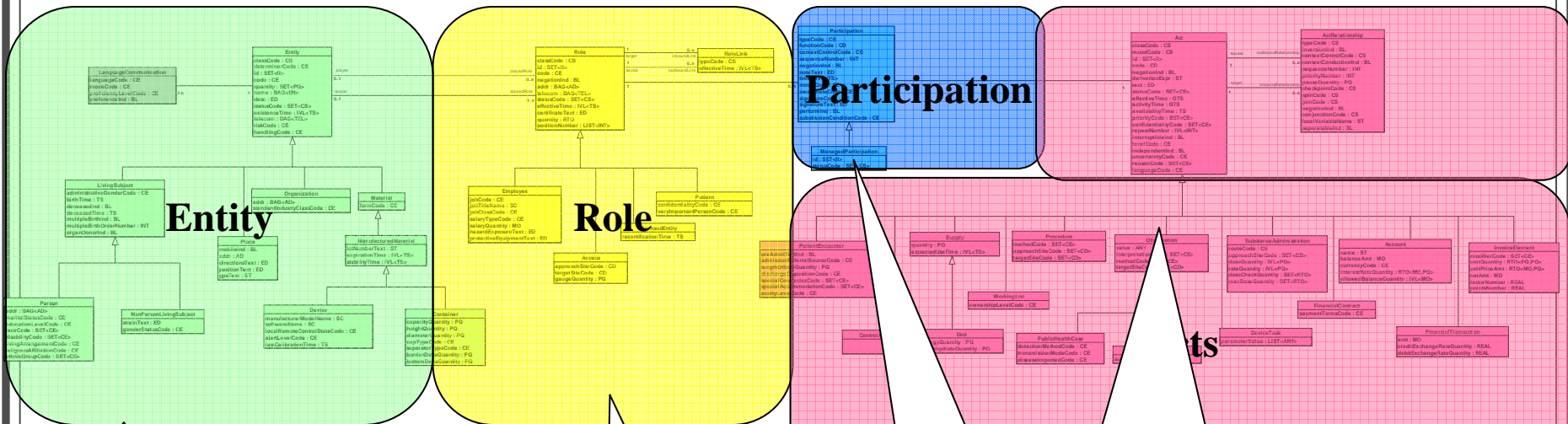


How is Version 3 “better”?

- **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: documents, messages, services, applications
- **Maintain a repository** of the semantic content to assure a single source, and enable development of support tooling



Class Diagram – Normative RIM Release 1



Physical things of interest ...
 Persons, Organizations, Places, ...

... take on Roles in health care ...
 Patient, Physician, Employer

... participate in Acts ...
 Encounters, Observations, procedures, medications ...

Entities in Roles participate as ...
 Performer, Author, target



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.

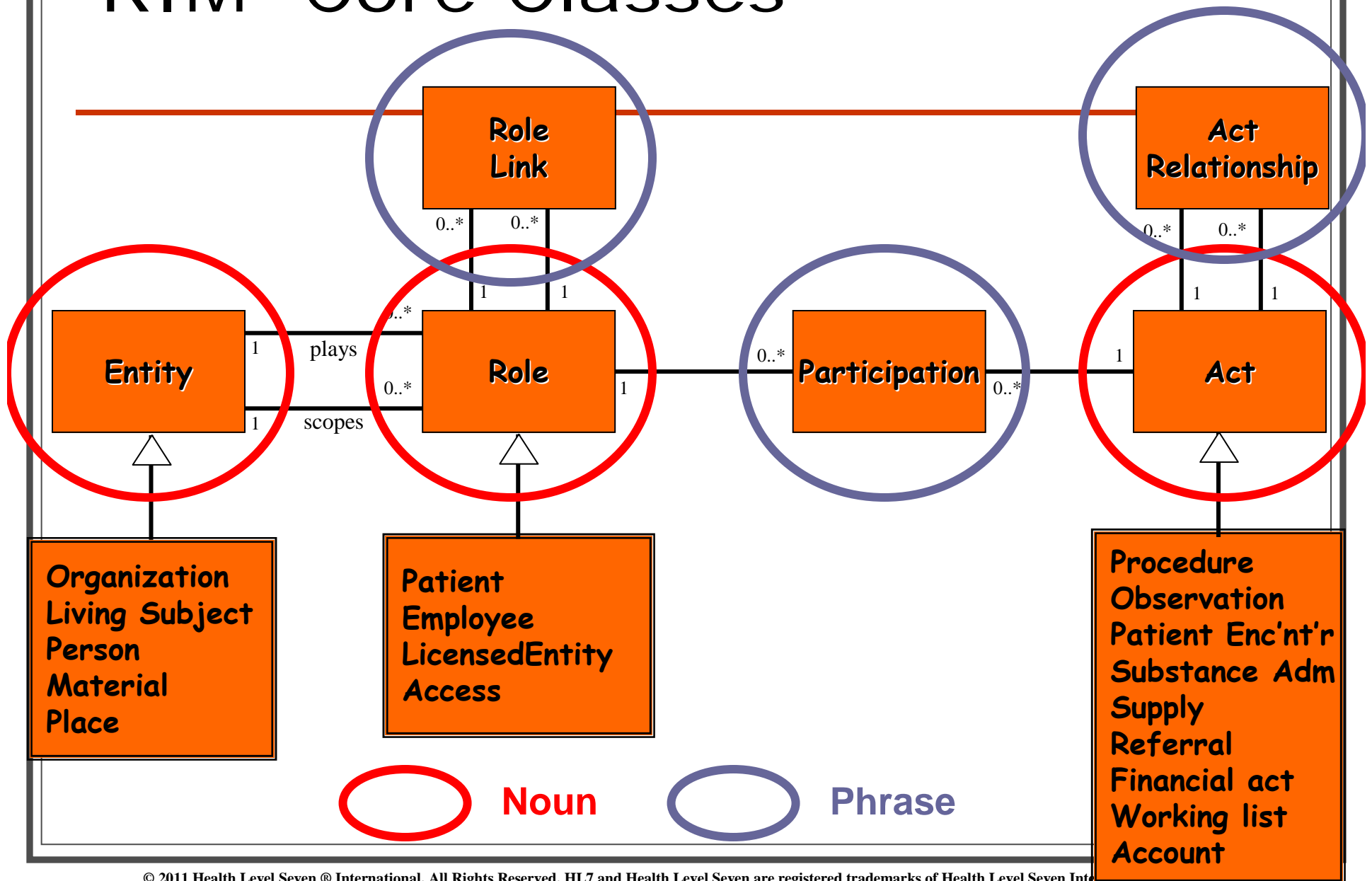


Five core concepts of the RIM

- 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



“Rules” for HL7 Designs

- An HL7 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 is 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 is defined as a collection of codes with associated designations and meanings [as simple as a table, as complex as SNOMED-CT]

Value Set represents a uniquely identifiable set of valid concept representations, where any concept representation can be tested to determine whether or not it is a member of the value set [usually the concept representations are drawn from a single Code System].

Domain-to-ValueSet Binding is an assertion that a particular Value Set provides a complete representation of the content of the Concept Domain using values drawn from a particular code system(s)



Domain-Value Set Binding Example

The screenshot displays three panels from an HL7 software interface:

- Domains:** A tree view showing various domains. 'AcknowledgementDetailSyntaxErrorCode' is highlighted with a red box.
- Code Systems:** A list of code systems. 'AcknowledgementDetailSyntaxErrorCode' is selected, showing a list of codes including 'SYN (Syntax error)', 'SYN100 (Required association missing)', 'SYN101 (Required attribute missing)', 'SYN102 (Data type error)', 'SYN103 (Value not found in code system)', 'SYN104 (Invalid code system in CNE)', 'SYN110 (Number of association repetitions)', and 'SYN112 (Number of attribute repetitions)'. A red box highlights the 'SYN' code and its sub-codes.
- Value Sets:** A list of value sets. 'AcknowledgementDetailSyntaxErrorCode - 3 Unions with' is selected, showing a list of value sets including 'SYN (Syntax error)'. A red box highlights this value set.

Red arrows and text annotations illustrate the binding process:

- A red arrow points from the 'AcknowledgementDetailSyntaxErrorCode' domain to the 'SYN (Syntax error)' value set, labeled **Binding**.
- A red arrow points from the 'SYN (Syntax error)' value set to the 'SYN100 (Required association missing)' code, labeled **Definition**.

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 two semantic foundations – a reference information model and a complete, carefully-selected set of terminology domains
- Require all Version 3 standards to draw from these two common resources
- Use software-engineering style tools to support the process.



Tools – for developers and implementers

- Enabled by the presence of “processable” representations of V3 standards – data bases and XML representations
- Tools for defining, refining and documenting these designs
 - Enforce the “rules” for refinement and localization
 - Draw their starting content from RIM, Vocabulary and previous models
 - Produce processable artifacts that allow this cycle to repeat
- Designed to allow rapid deployment and application of the specifications to particular locale

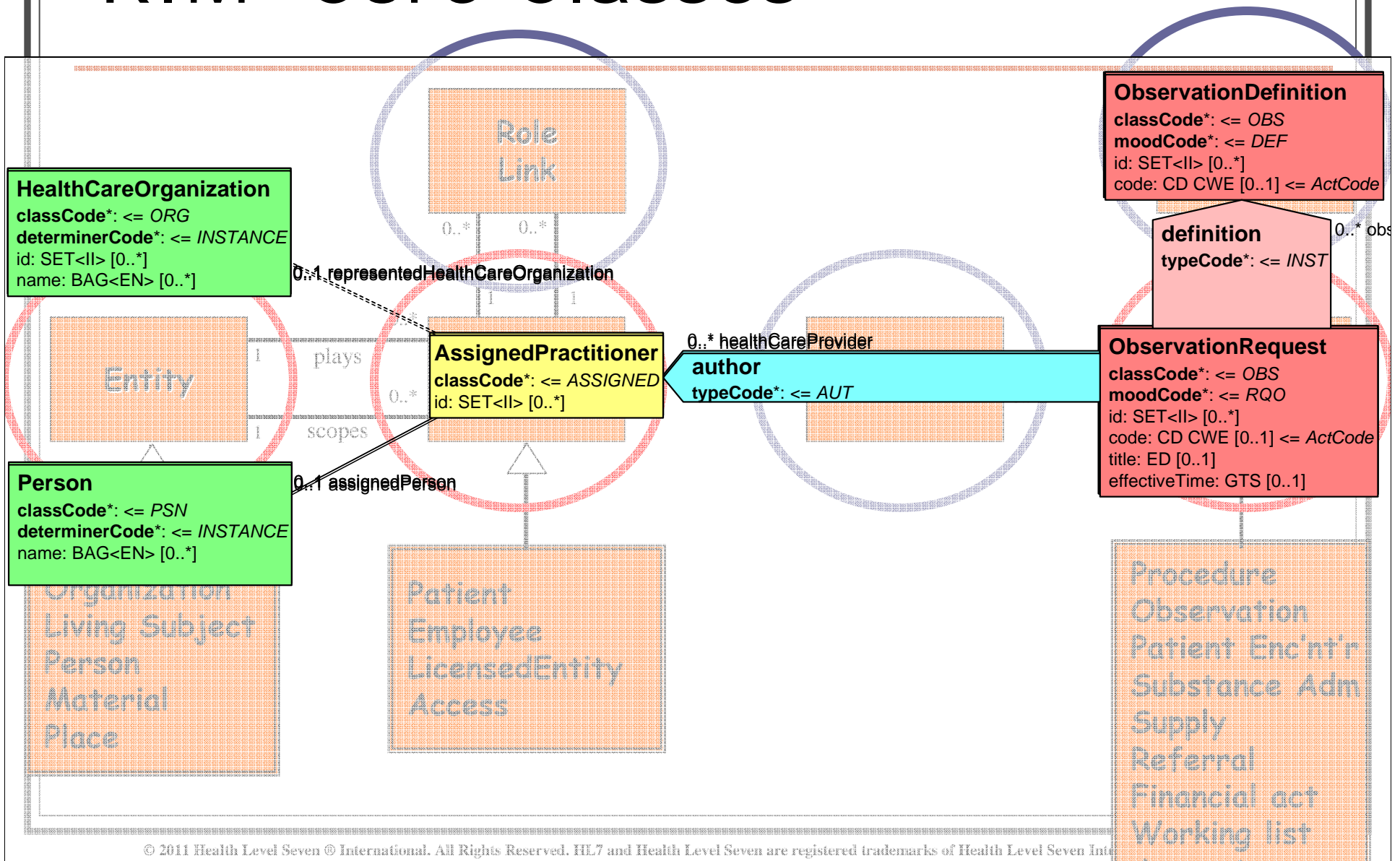


The problem

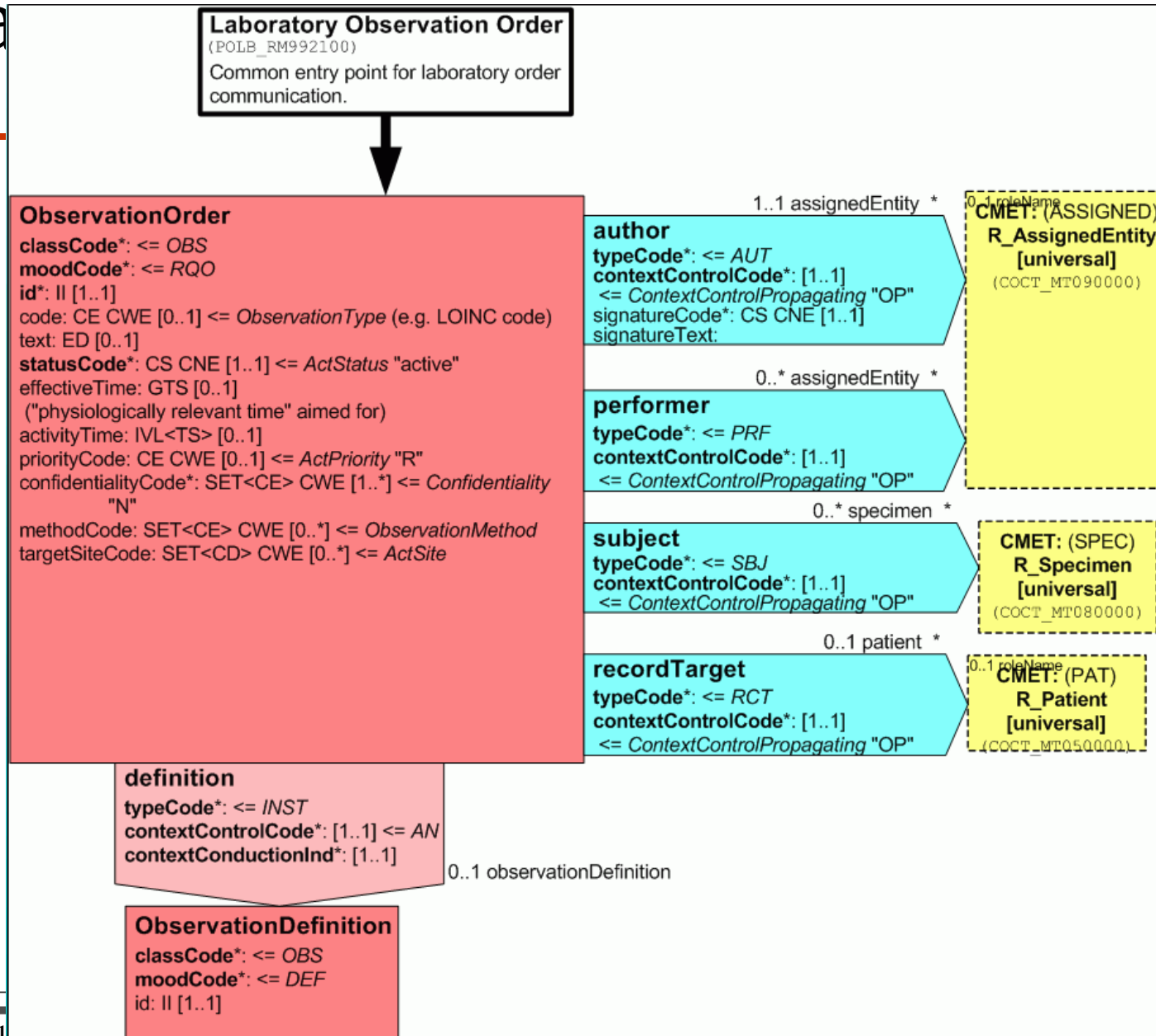
Storyboard: A clinician, using a local medical office support system, orders a lab test for one of her patients. The test will be performed on a specimen collected at her office. She will send the specimen by courier, and expects to receive a confirmation that the test will be performed, and a result of the test.



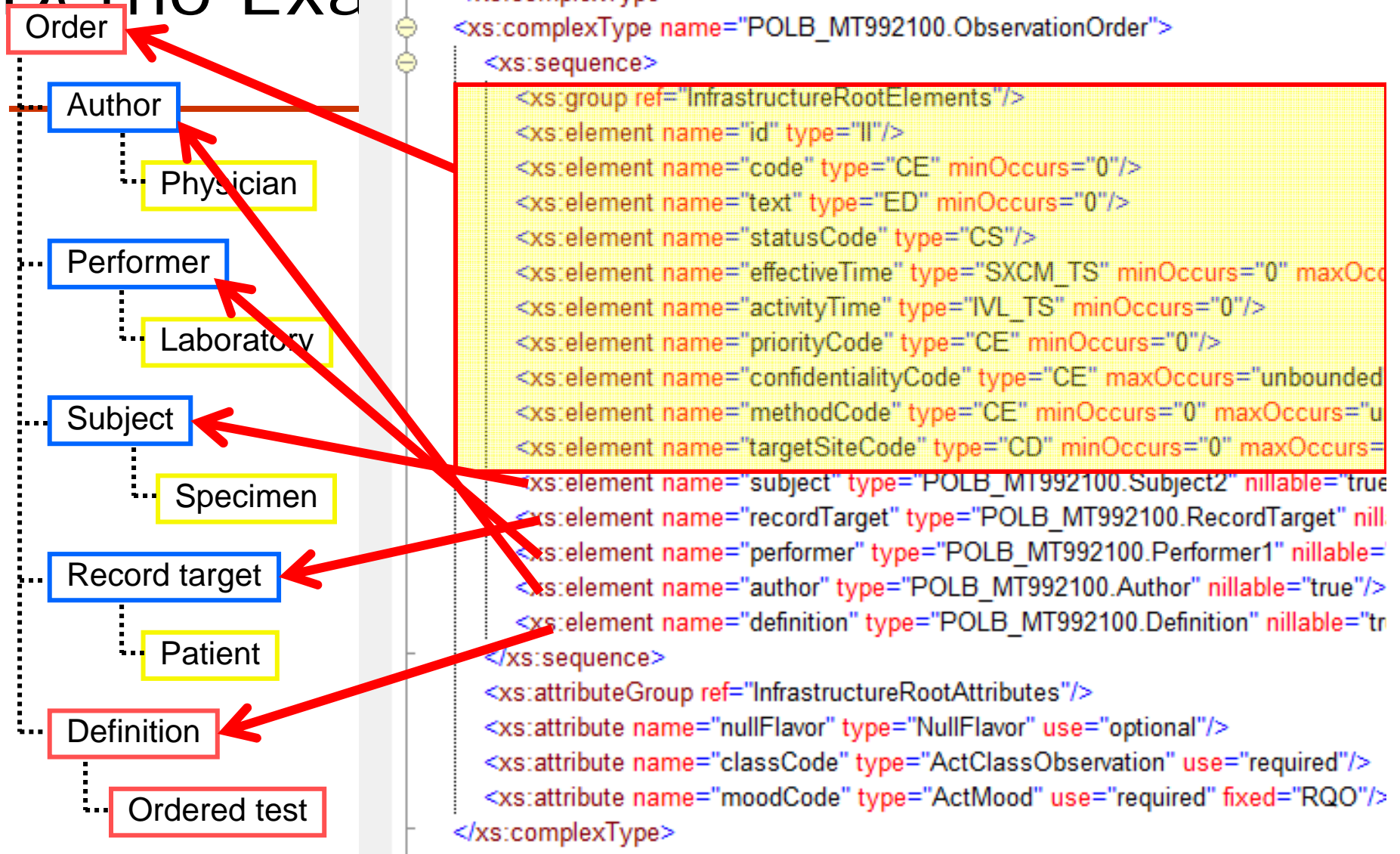
RIM Core Classes



Assembling content – relational phra



Demo Example - POIR RM992100



The essence of Version 3

- A family of specifications
- Built upon a single model of
 - How we construct our messages
 - The domain of discourse
 - The attributes used
- Constructed in a fashion to rapidly develop a comprehensive, fully constrained specification in XML



Bringing it together

- One Reference Model, one set of tools, one process produce
 - The mundane – a Common element for patient
 - The complex – a specification to communicate annotated ECGs for clinical trials
 - Large, rich sets – electronic claims, clinical trial data
 - The esoteric – clinical genomics
 - The basics – message control (headers)
- All taken from RIM to schemas, **and published** with a single set of effective tools



Version 3 Normative Editions

- After 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
- Grouped informally as:
 - Domains – topic of healthcare interest
 - Common – Content shared by/across domains
 - Infrastructure – enables communication
 - Foundation – the basis for the V3 family of standards
- And bundled into 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 – data bases, XML interchange format, schemas, etc.
- Documented dependency hierarchy



Table of Contents

Help for readers

Fundamental models - RIM, vocabulary, data types, rules

Message wrappers and so on

Patient and insurance accounting, Patient management, Scheduling

CDA

Public Health Messaging

Clinical studies

- HL7 Version 3 Standard
 - Introduction
 - Package Note to Readers
 - Version 3 Guide
 - Foundation
 - Reference Information Model
 - Data Types: Abstract
 - Vocabulary
 - Refinement and Localization
 - GELLO: Common Expression Language
 - Specification Infrastructure
 - Messaging
 - Master File / Registry Infrastructure
 - Message Control Act Infrastructure
 - Query Infrastructure
 - Transmission Infrastructure
 - Transport Specifications
 - Implementation Technology Specifications
 - XML
 - UML
 - Services
 - Common Terminology Services
 - Domains
 - Common Domains
 - Administrative Management Domains
 - Account and Billing
 - Claims & Reimbursement
 - Patient Administration
 - Scheduling
 - Health and Clinical Management Domains
 - Clinical Document Architecture
 - Medical Records
 - Public Health Reporting
 - Regulated Studies
 - Background Documents
 - Version 3 Guide
 - Glossary
 - Support Files
 - Schemas



Foundation

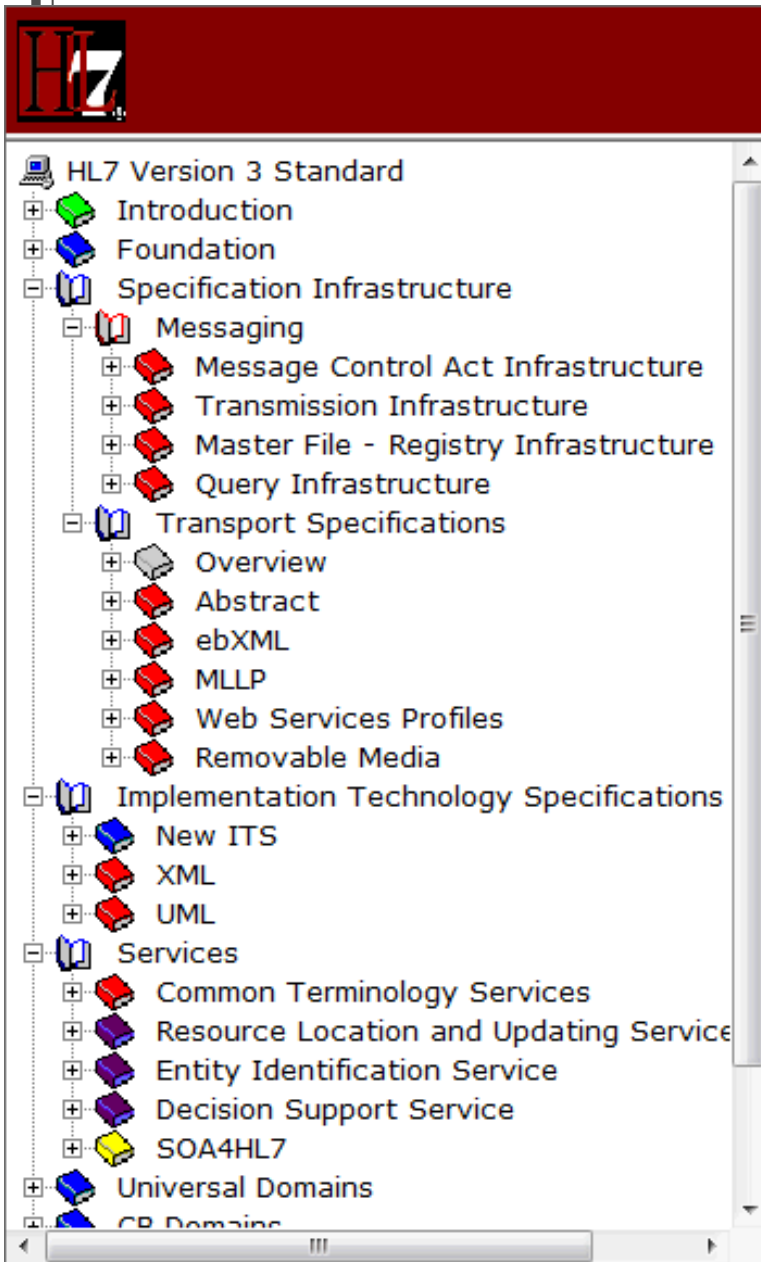


- HL7 Version 3 Standard
 - Introduction
 - Foundation
 - Reference Information Model
 - Data Types: Abstract
 - Data Types: Abstract R2
 - Constraints Project
 - GELLO: Common Expression Language
 - Refinement, Constraint and Localization
 - Security (RBAC)
 - Templates Project
 - Using SNOMED CT
 - Vocabulary
 - Specification Infrastructure
 - Implementation Technology Specifications
 - Services
 - Universal Domains
 - GB Domains
 - Background Documents
 - Support Files
 - Known Issues

ANSI/ISO Standard RIM
Data types as HL7/CEN/ISO Spec
Refinement “rules” standardized
Templates & Terminology in DSTU
Vocabulary concept domains, code
systems & value sets































Infrastructure, Implementation & Services



Messaging and Registry infrastructure
Message Transport in variety of modes
Message expression in XML & UML
Services (SOA) specifications



Array of Specific Domains

- [-]  Universal Domains
 - [+]  Account and Billing
 - [+]  Blood, Tissue and Organ
 - [+]  Care Provision
 - [+]  Clinical Genomics
 - [+]  Claims & Reimbursement
 - [+]  Clinical Decision Support
 - [+]  Clinical Document Architecture
 - [+]  Clinical Statement
 - [+]  Common Message Element Types
 - [+]  Imaging Integration Domain
 - [+]  Immunization
 - [+]  Laboratory
 - [+]  Medication
 - [+]  Materials Management
 - [+]  Medical Records
 - [+]  Observations
 - [+]  Orders
 - [+]  Patient Administration
 - [+]  Personnel Management
 - [+]  Pharmacy
 - [+]  Registries
 - [+]  Public Health
 - [+]  Regulated Products
 - [+]  Regulated Studies
 - [+]  Scheduling
 - [+]  Shared Messages
 - [+]  Specimen Domain
 - [+]  Therapeutic Devices



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



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”

Thank you!

