



Models to Support the EPHTN:

Discussion of the HL7 RIM, and the PHIN
Logical Data Model

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Agenda



Discuss the relationship between models and data interchange from the perspective of Health Level Seven's RIM, and CDC's Public Health Information Network Logical Data Model (PHIN-LDM).

Provide a perspective for integrating these models into the development of the Public Health Environmental Tracking Network



Outline



- Using models to achieve interoperability
- Introduction to HL7's Reference Information Model
- Introduction to the PHIN-LDM



EPHTN Challenge: 2004



- Collection, analysis, and management of a variety of health, environmental, and related data from wide variety of sources and contexts to strategically *and* tactically analyze, react to, and manage events-of-interest to the health and welfare of the public.

- Information-of-interest includes
 - ★ Environmental exposure
 - ★ Person demographics
 - ★ Disease/health hazard incidence
 - ★ Population geographic locations and migrations
 - ★ Emissions and patterns of dispersion



EPHTN Challenge: 2004



- Timely and accurate capture and analysis of geographically and temporally dispersed data is not possible without scalable, high-performance data stores connected to reliable, integrated network topologies.
- All data exchanged/processed in the overarching context must be 'understandable' at a machine-to-machine level
 - ◆ Computable Semantic Interoperability



Interchange vs Interoperability



- **interoperability**

: ability of two or more systems or components to exchange information and to *predictably use* the information that has been exchanged.

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

Syntactic
interoperability
(interchange)

Semantic
interoperability



The Pillars of Semantic Interoperability

Necessary but not Sufficient



- **Common model across all domains-of-interest**
 - ◆ **Information model vs Data model**
- **Model grounded on robust data type specification**
- **Methodology for binding terms from concept-based terminologies**
- **A formally defined process for defining specific structures to be exchanged between machines, i.e. a “messaging standard”**



How Can the model be “All Things to All People”?



- Construction framework:
 - ◆ High-level abstract structures
 - ◆ Well-defined set of data types
 - ◆ Well-defined interfaces to terminologies
 - ◆ Basis for all interchange structures

- Healthcare Domains (clinical, administrative, financial) are defined by the combination of common structures and unique terminologies



HL7 Version 3.0 Reference Information Model

The HL7 Reference Information Model is the source from which other HL7 information models and message specifications are derived.

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What is the HL7 RIM?



- The RIM (Reference Information Model) is documentation of information from the healthcare domain.
- It is used as a common reference for the data content of all HL7 version 3 standards.
- The RIM has graphical expression and an accompanying data dictionary.
- It is expressed using the Unified Modeling Language notation.





What is the HL7 RIM?

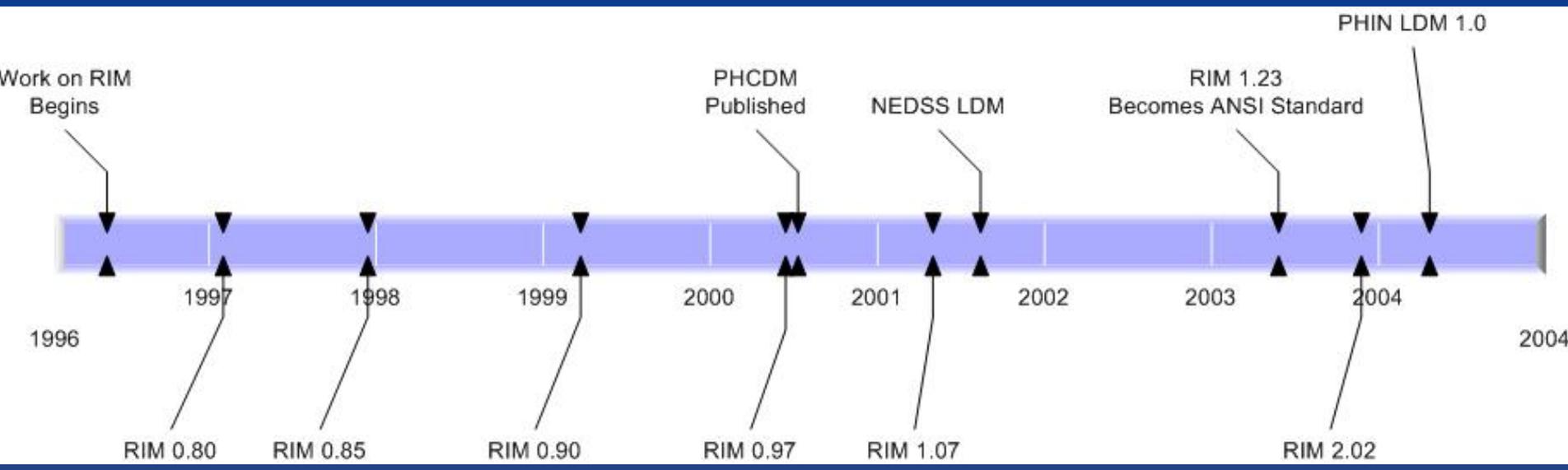


- The HL7 RIM is a highly abstract data model
 - ◆ Provides semantic interoperability. Stores domain concepts in a manner that is understandable for reference. Provides a set of technology neutral specifications to facilitate database modeling and schema design supporting the development of PHIN compliant systems.

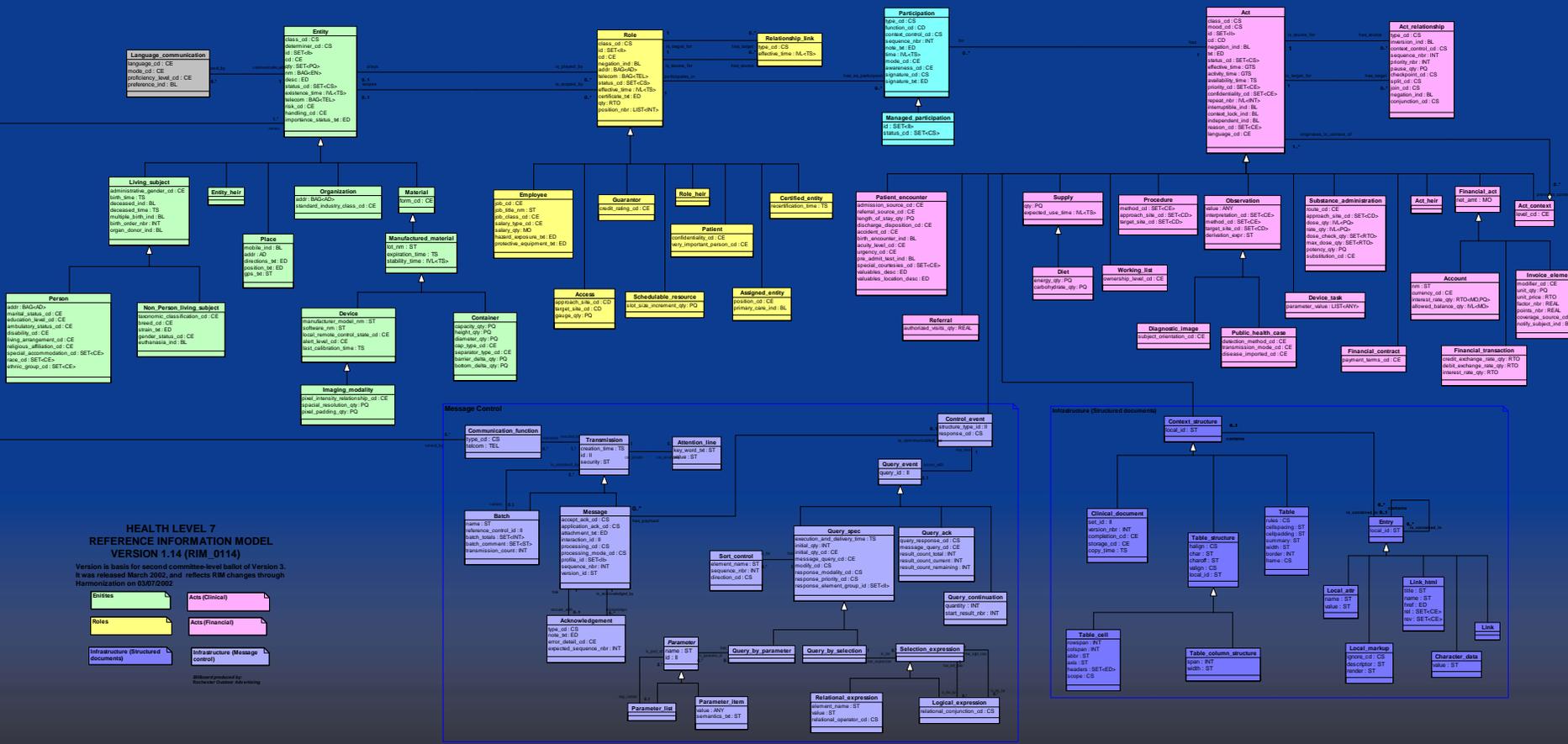
- It is not a recipe for a deployable physical model, although insights to that model may be gained.
 - ◆ Provides a bridge between the subject matter expert's view and the system developer's view of the information requirements for public health.



A Brief History of Time



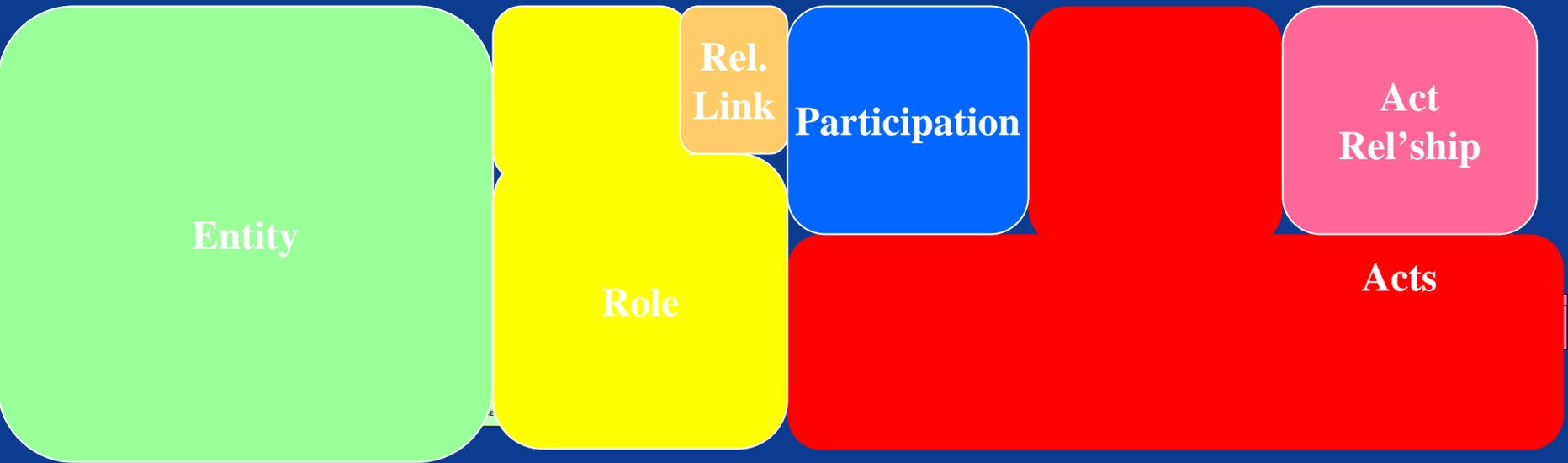
Reference Information Model V2.02 November 2003



HEALTH LEVEL 7
REFERENCE INFORMATION MODEL
VERSION 1.4 (RIM 0114)
Version is basis for second committee-level ballot of Version 3.
It was released March 2002, and reflects RIM changes through
Harmonization on 03/07/2002



RIM Class Diagram V2.03 – March 2004





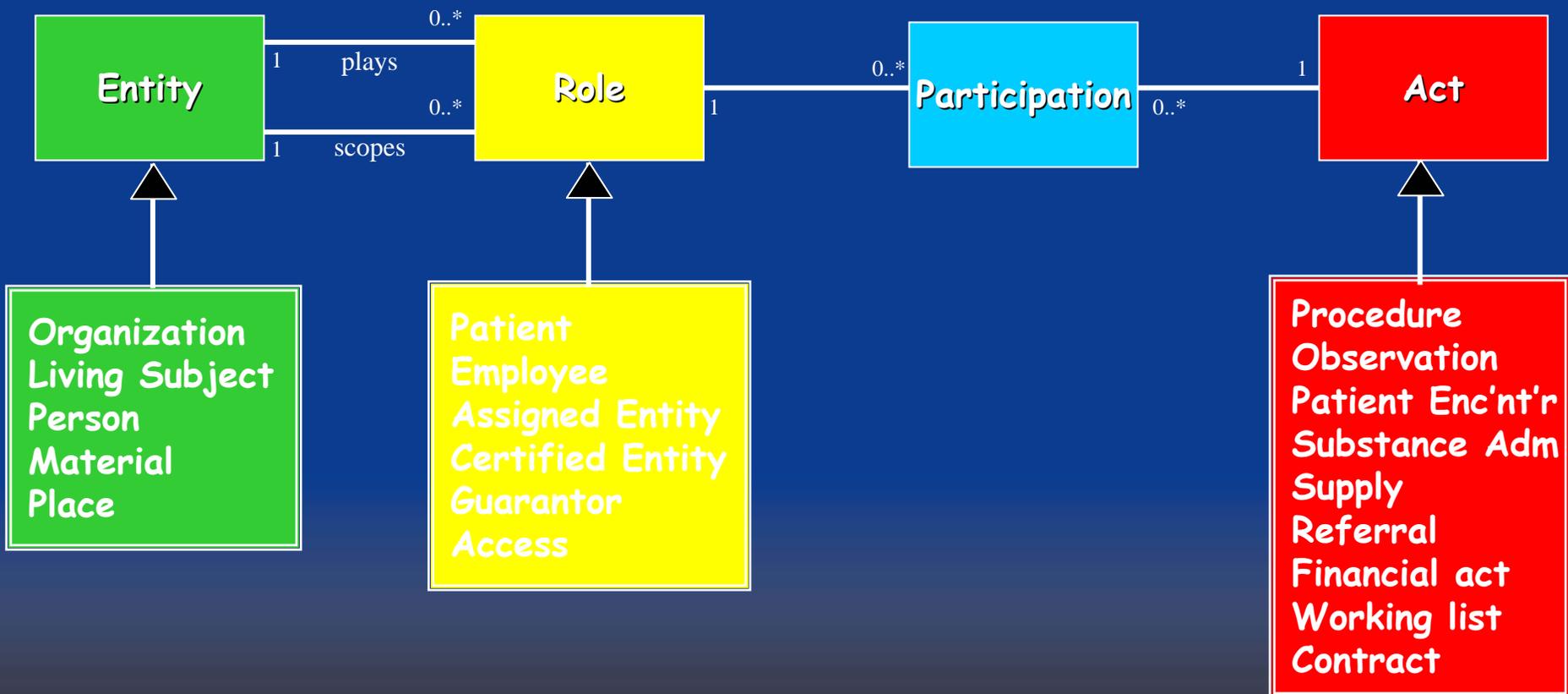
Core concepts of RIM



- 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, specimen, etc.
- Roles are played by **Entities**
 - ◆ persons, organizations, material, places, devices, etc.



RIM Core Classes





Relations and Participants



Related Acts

- Encounter
- Sub-Acts
- Reference Range
- Definition
- Precondition
- Transportation
- Account
- Diagnosis
- Reason



Participating Roles

- Author
- Responsible Party
- Attender
- Patient
- Performer
- Location
- Specimen
- Administered Product



Act_Relationship



- Association between two acts.
- From simple groupings of acts to complex associations such a timed action plans.
- Examples:
 - ◆ inFulfillmentOf [an order]
 - ◆ componentOf [an encounter]

AR!





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)





Roles: Played and Scoped"



Downtown Hospital

Uptown Hospital

Joe Smith



Doctor

Patient



Entity



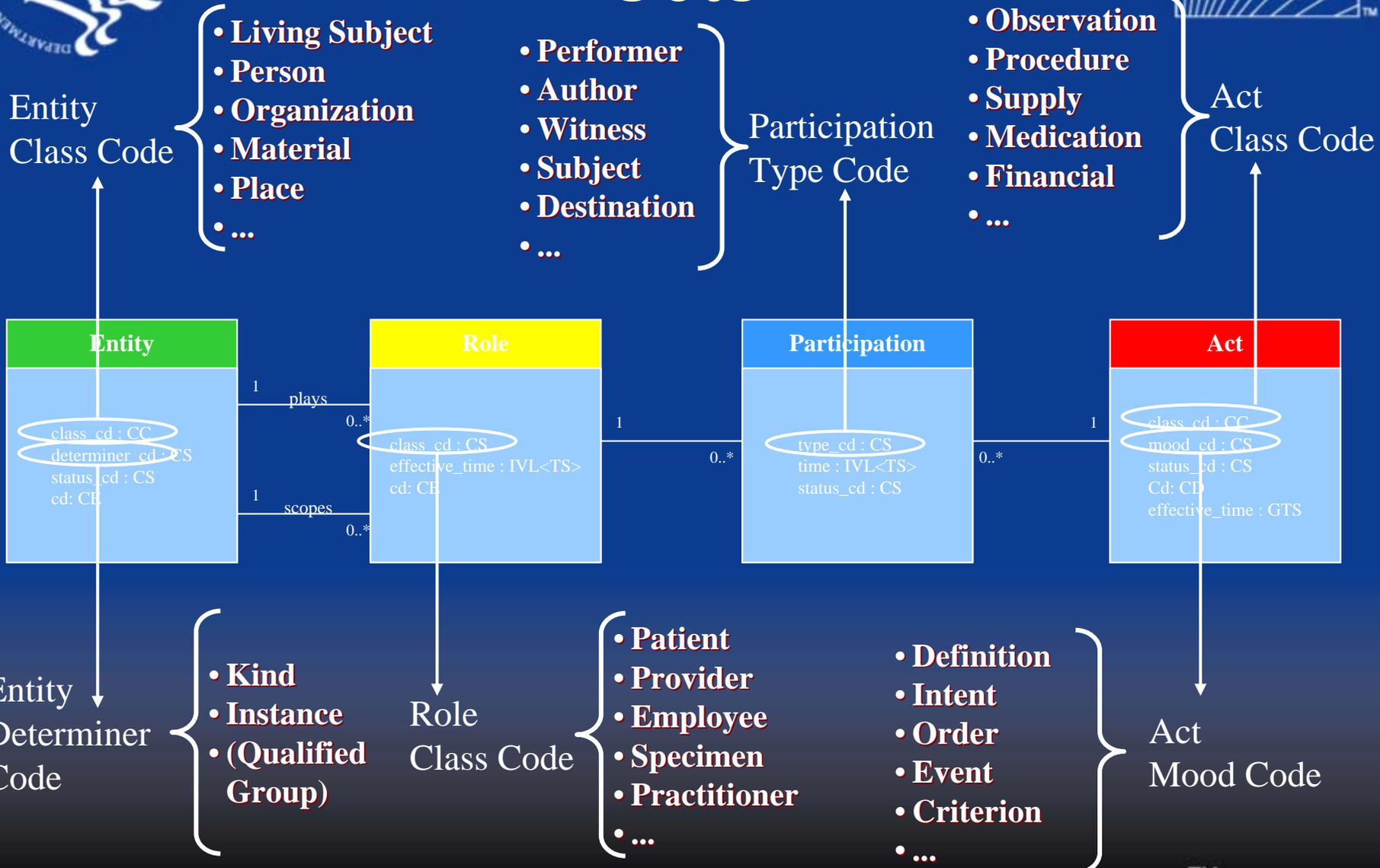
- The Person, Place, or Thing that it is all about.
 - ◆ However, an entity could be an organization.
 - ◆ It could be a non-person living thing
- We use entity to capture information about the party who plays the role, and,
- Playing or scoping that role, participates in the act.



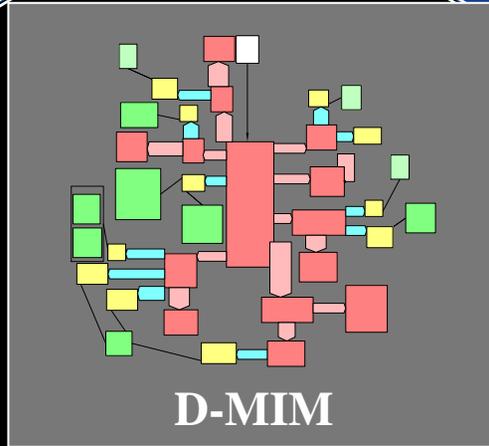
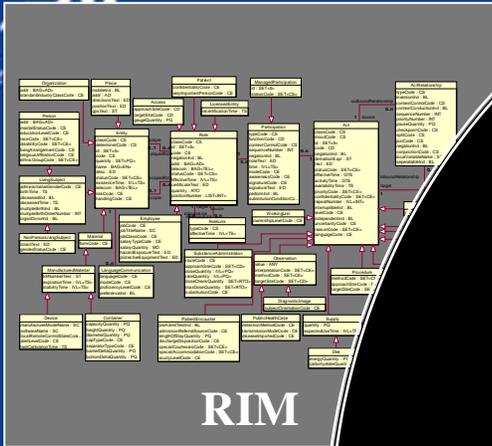
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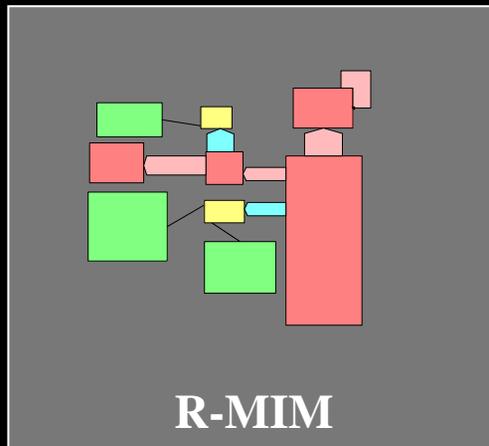
RIM Core Attribute Value Sets



HL7 V3 Message Design



Design Information Model



HMD



PHIN Logical Data Model

The PHIN-LDM provides a common point of reference for databases and applications within the domain of public health

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Goals of PHIN-LDM 1.0



It is a *Logical* Data Model for Public Health

- based on incremental refinements and extensions to the current NBS LDM V1.1.
- Includes concept modeling required by NBS, STARRS, PVS, Outbreak Management and Rash Surveillance. The focus is on moving all systems forward to a consistent model, rather than absorbing inconsistent models.
- Provides a target for new areas and domains, and thus will be extendable and shareable with concepts required by additional projects



Goals of PHIN LDM 1.0



- Is consistent with the HL7 V3 development framework; uses the HL7 ANSI standard Reference Information Model (RIM), data types, and vocabulary.
- Does not address physical database modeling, does not model to, or provide specific behavior for any existing physical schema.



Adaptation to Change



- “Living” document
- Will ALWAYS be under revision
 - ◆ Versions approx bi-annually
 - ◆ Technical corrections as needed
- Establish stakeholder active participation
 - ◆ Feed forward through HL7 PHER (Public Health and Emergency Response)
 - ◆ PHIN Data Model stakeholder group



The PHIN-LDM V1.0 is



- consistent with the HL7 RIM V2.03,
- includes only those classes that are needed for public health
- extends the RIM with public health classes and attributes, specifically to handle nationally notifiable conditions, and syndromic surveillance, bioterrorism response related health related activities.



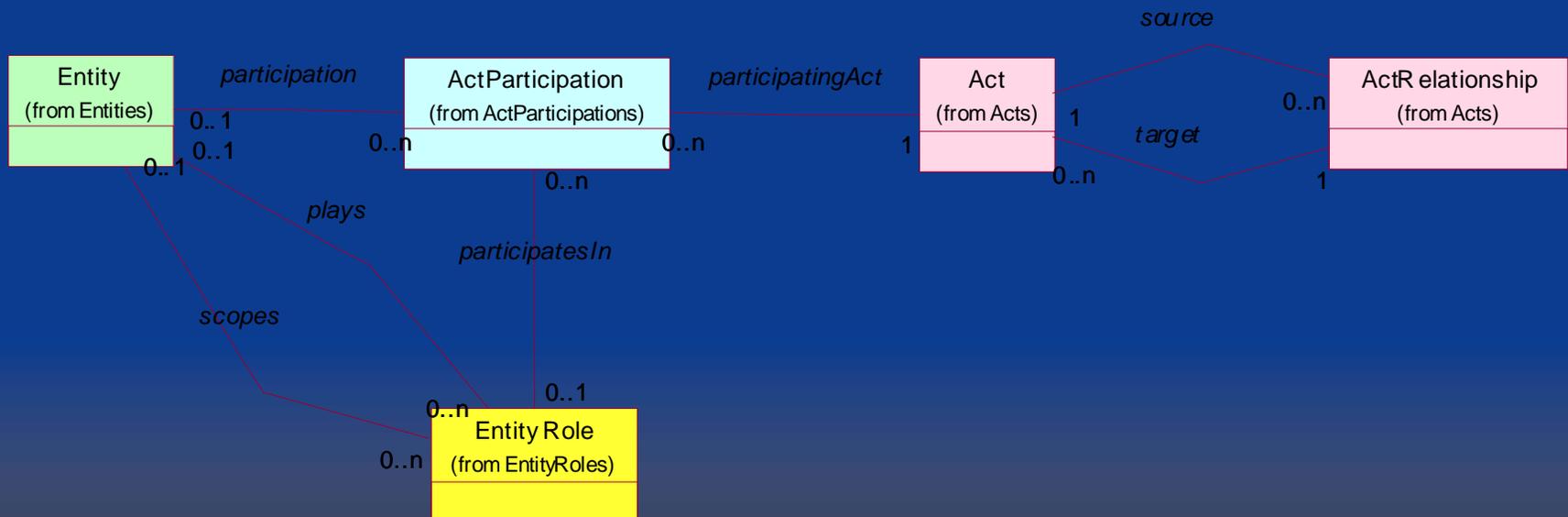
HL7 RIM *based* means that:



- The LDM “backbone” classes directly correspond to core classes in the HL7 RIM.
- Not all RIM backbone classes are represented
- Classes not pertaining to public health are omitted.
- Data types are limited to those required to express public health concepts.

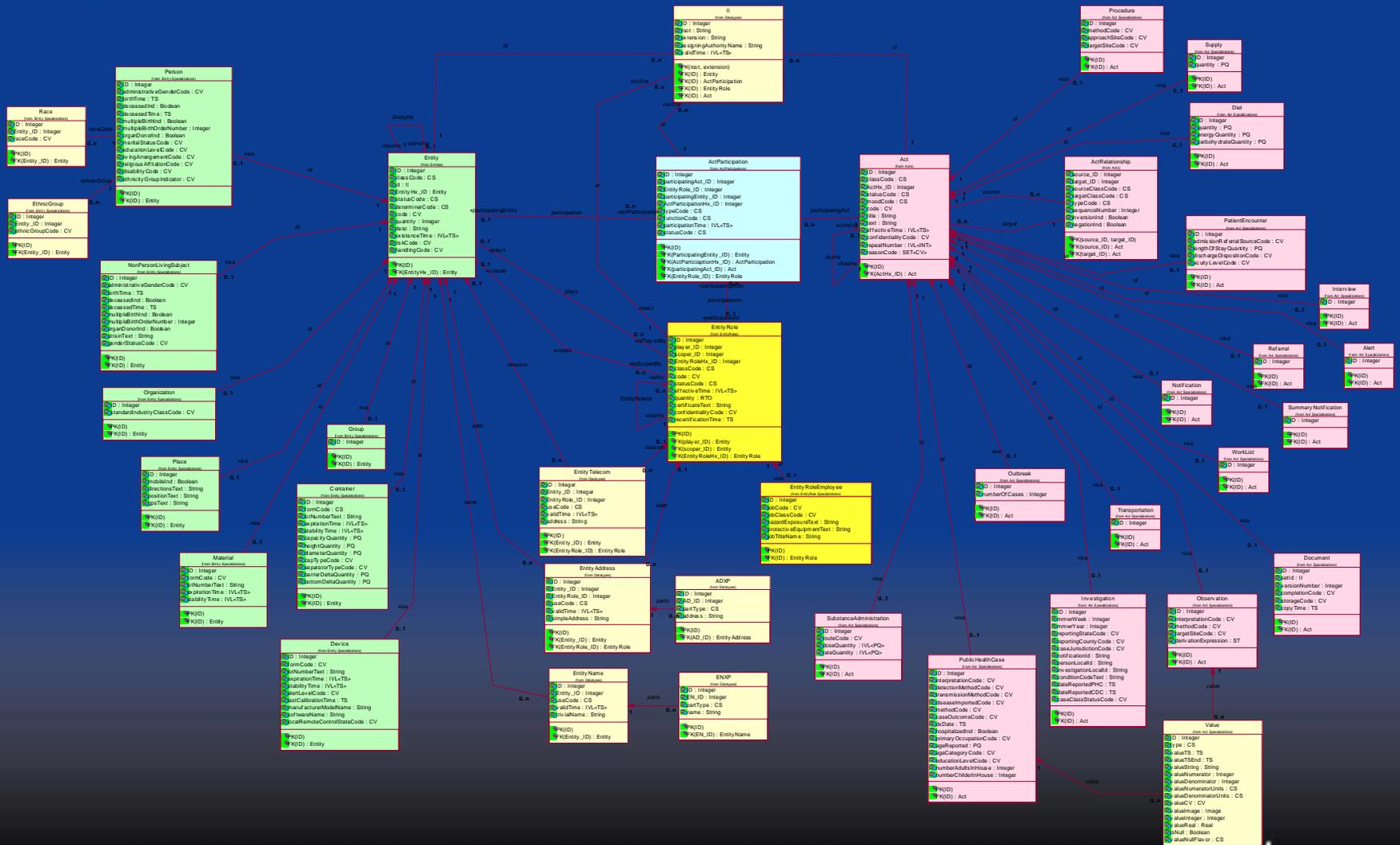


PHIN-LDM Backbone





PHIN-LDM V1.0 Banner



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Future Upkeep



- Changes to the model
 - ◆ The PHIN-LDM will ALWAYS be under revision

- Releases
 - ◆ Versions approx bi-annually
 - ◆ Technical corrections as needed



Evolving the PHIN-LDM



- The current edition is a starting point, not a stopping point.
 - ◆ Input from states and other stakeholders is required to refine and further develop the PHIN LDM.
- CDC will establish a process to
 - ◆ Evolve the model
 - ★ gather input from stakeholders for future modeling needs
 - ★ Establish stakeholder active participation
 - Feed forward to HL7 through HL7 PHER SIG (Public Health and Emergency Response)
 - “Local” PHIN Data Model stakeholder group
 - Details TBD
 - ◆ We are early in this process and value your input
 - ★ How best to gather requirements and incorporate
 - ★ How to be dynamic to state requirements



RIM/PHIN-LDM Harmonization



- The PHIN-LDM needs to become consistent with the HL7 RIM on an ongoing basis and the PHIN data modeling efforts need to feed into the HL7 ballot process.
- Evolution occurs two ways
 - ◆ Local (Public Health) modeling brought forward to HL7
 - ◆ HL7 changes harmonized to PHIN LDM



Material Things



http://www.cdc.gov/phin/data_models/index.htm

- ◆ PHIN-LDM 1.0 User Guide.pdf
- ◆ PHIN-LDM 1.0 Rose Model.mdl
- ◆ PHIN-LDM 1.0 Web Browsable Rose Model.zip

<http://www.hl7.org>

<http://www.hl7.org/v3ballot/html/index.htm>

- ◆ RIM 2.04
- ◆ Latest Version 3 Standards, Ballots, Specs, DSTUs

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Additional Issues for Enabling the Environmental Public Health Tracking Network

Aligning to a common model does not address all the requirements for interoperability.

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Data Type Specification



- Historically DT were considered “formats” for character strings
 - ◆ External representation vs Internal meaning
 - ★ Constraints applied to character strings
 - ◆ COBOL/Basic/PL1 perspective
- Computer Science now recognizes datatypes as the ‘foundation for machine-mediated meaning’
 - ◆ Carefully defined *semantics*
 - ◆ Clearly specified type-specific *operations*



Binding to Concept-Based Terminologies



- **Vocabulary Requirements:**
 - ◆ Use established terminologies, e.g., SNOMED, LOINC, as much as practical.
 - ◆ Create a mechanism to define the subset of a terminology used in a particular situation.
 - ◆ Understand the need to pull concepts from multiple vocabularies.
- **Therefore, key vocabulary notions need to be addressed**
 - ◆ Domain, Realm/Context, Coding System, Concept Code, Value Set
 - ◆ Defining a collection of code sets is not sufficient.



Process and Tools



- Alignment to a model has no meaning, unless we define how will take place.
- Tooling will be needed to support the migration of current data structures and the development of new ones.
- Implementations must also address issues of data movement, security, and confidentiality.



Questions ?



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