



# Understanding HL7: Messaging with SNOMED and LOINC

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Chair Nursing Clinical LOINC Subcommittee



# Objectives

- Describe HL7 structure, v2.x and v3.0
- Describe messaging structure of HL7 using standardized terminology



# Outline

- HL7 Historical Overview
- HL7 Version 2.x
  - Structure
  - Standardized Terminology (LOINC/SNOMED)
- HL7 Version 3 (Reference Information Model)
  - Structure
  - Standardized Terminology (LOINC/SNOMED)
  - Templates

# Why Standards?

- Data exchange

- Intrahospital (Lab to EHR)
- Interhospital (Patient Records)
- Government (Disease Reporting)
- Across Settings (Inpatient to Home Health)

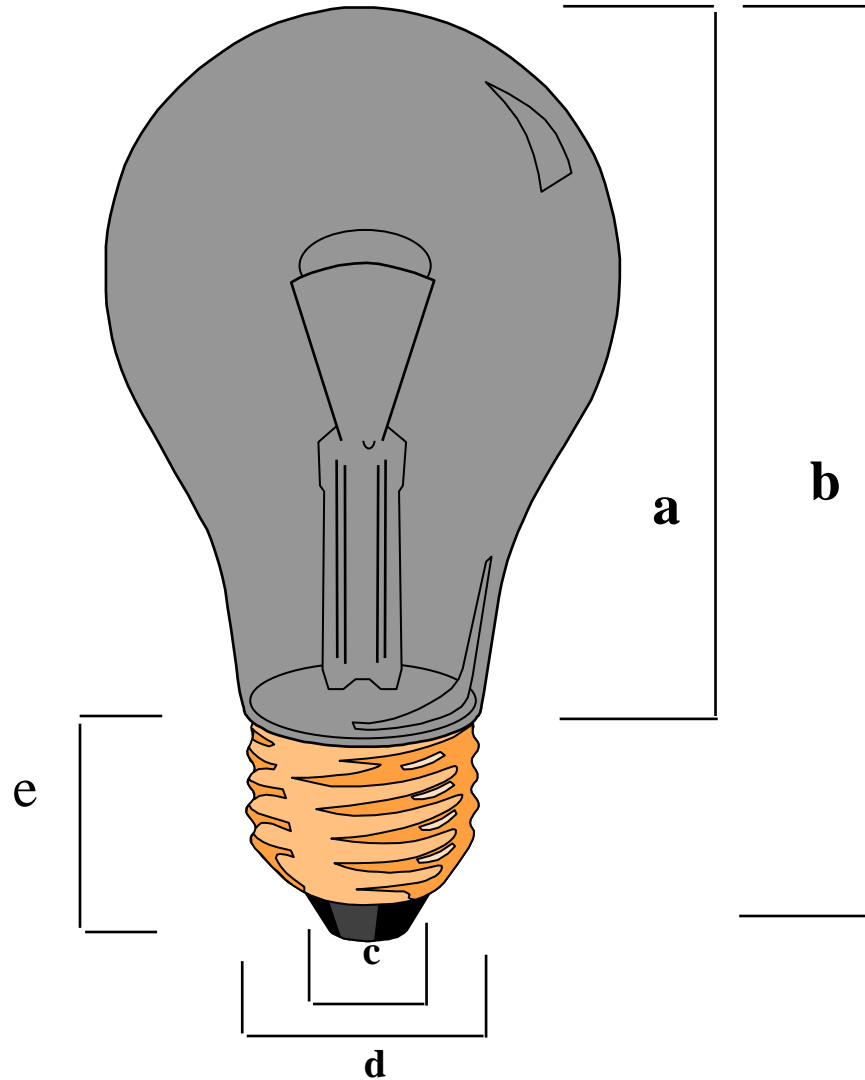
- Codes and vocabulary



# Benefits of Standards

Impedance 25.43 ohms  
255 lumen

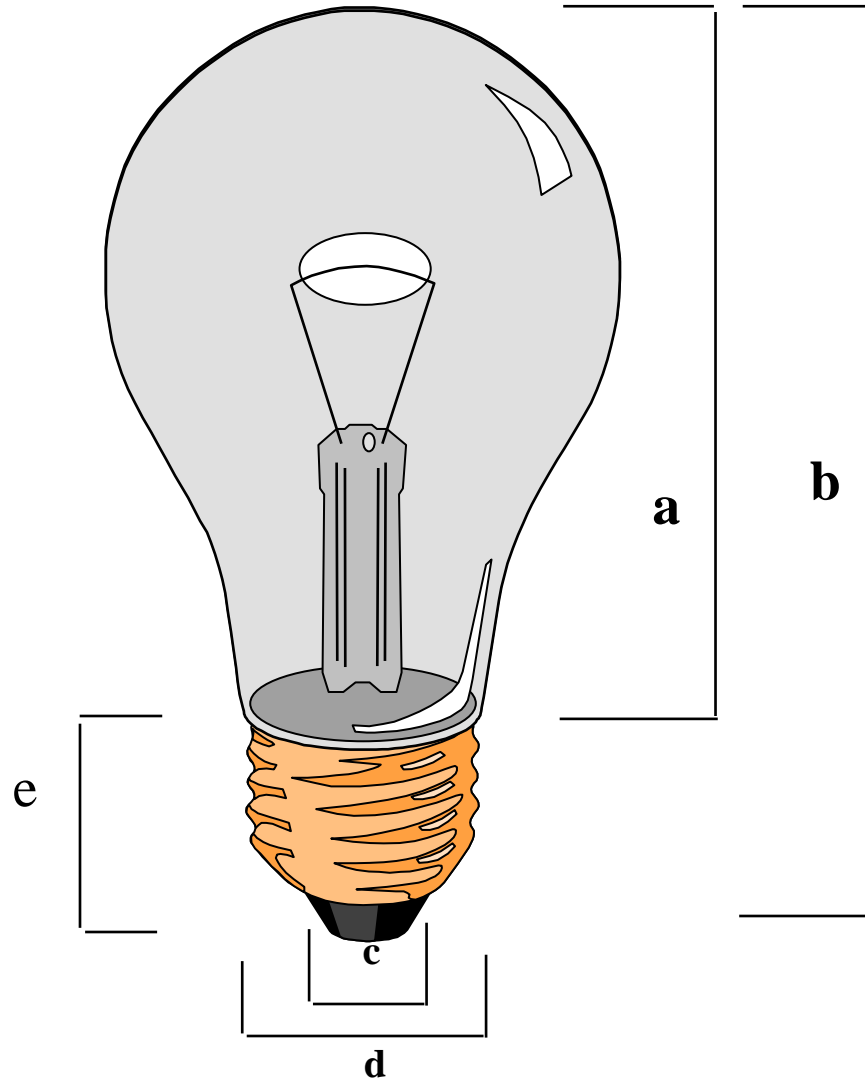
$a = 2.55''$   
 $b = 3.00''$   
 $c = 0.35''$   
 $d = 1.00''$   
 $e = 0.85''$   
33 deg



# Benefits of Standards

Impedance 25.43 ohms  
255 lumen

a = 2.55"  
b = 3.00"  
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e = 0.85"  
33 deg





# Goal of Standards

- Information and data sharing
- Enable Evidence-Based Practice
- Increase Quality Care
  - Reduce redundant data entry
  - Reduce errors in transmission
  - Generate Alerts
- Secondary Data Use
  - Quality Measures
  - Research



# Interoperability Definition

“Any meaningful exchange of utterances depends upon the prior existence of an agreed upon set of semantic and syntactic rules”.

ISO TR9007:1987 *Information Processing Systems – Concepts and Technology for the Conceptual Schema and the Information Base*





# Levels of Interoperability

- *Basic* – allows messages to be exchanged between computer systems
  - Word processing documents, spreadsheets
- *Functional* – describes the standard syntax (format) of the message
  - Document templates, forms, data structures
  - Message standards
- *Semantic* – meaning from sending and receiving application is the same.
  - Requires use of standard vocabularies within the message

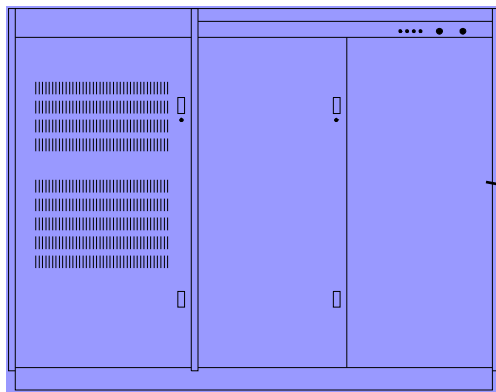
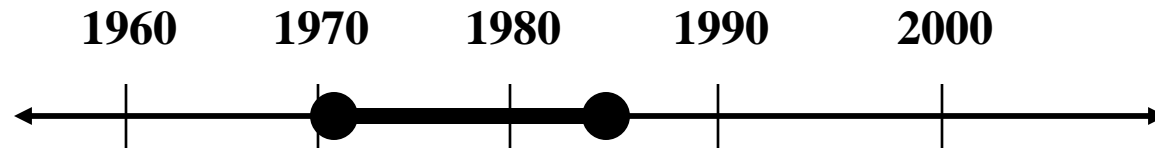


# Barriers to Data Quality and Interoperability

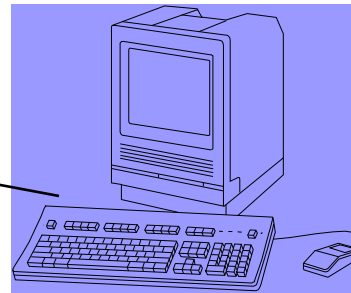
“The challenges ahead aren’t about hardware and software, but underlying integration issues such as vocabulary and clinical concepts.”

**Morgan Passiment, American Medical Colleges**

# Historical Perspective



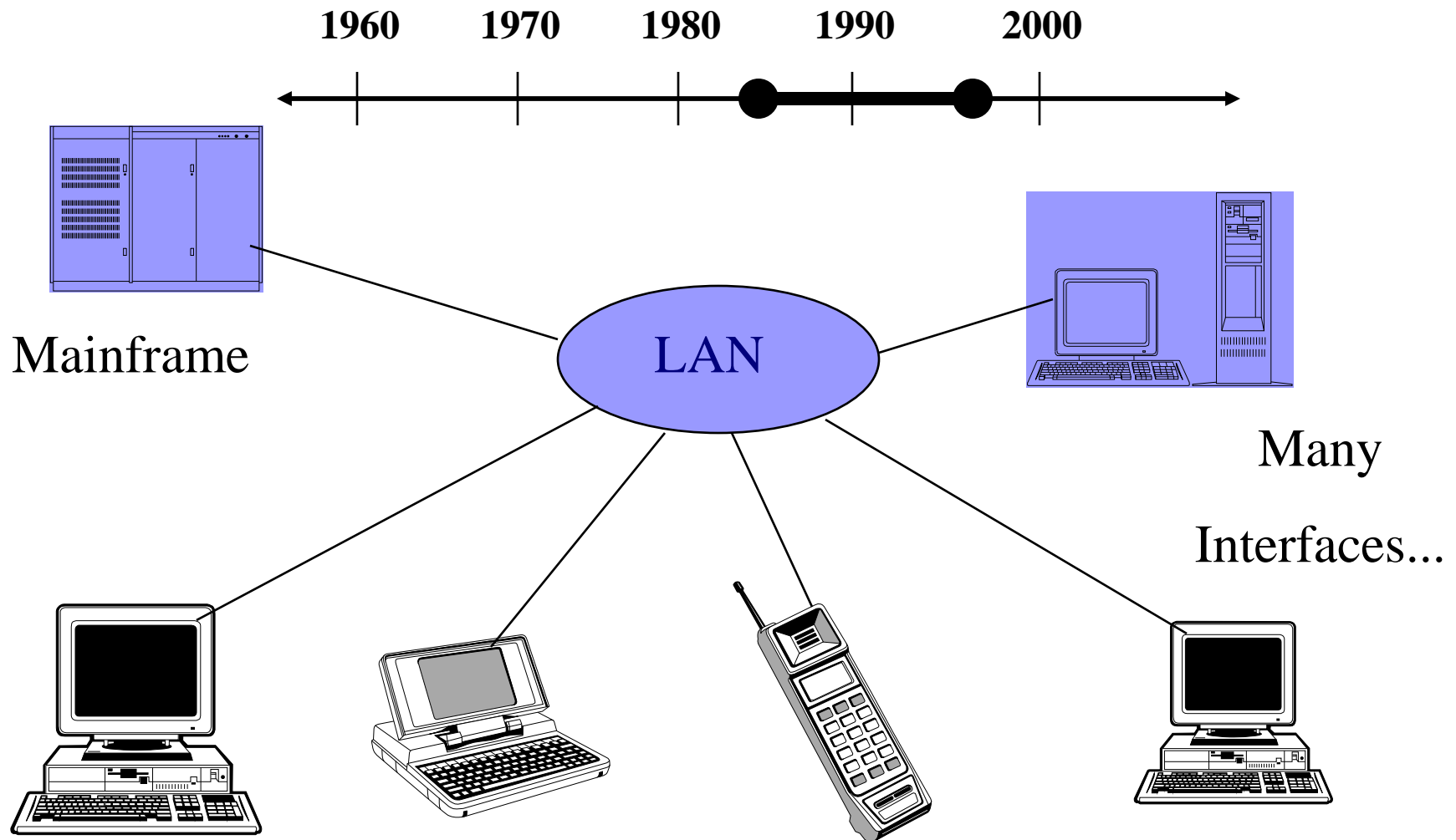
Mainframe



Mini

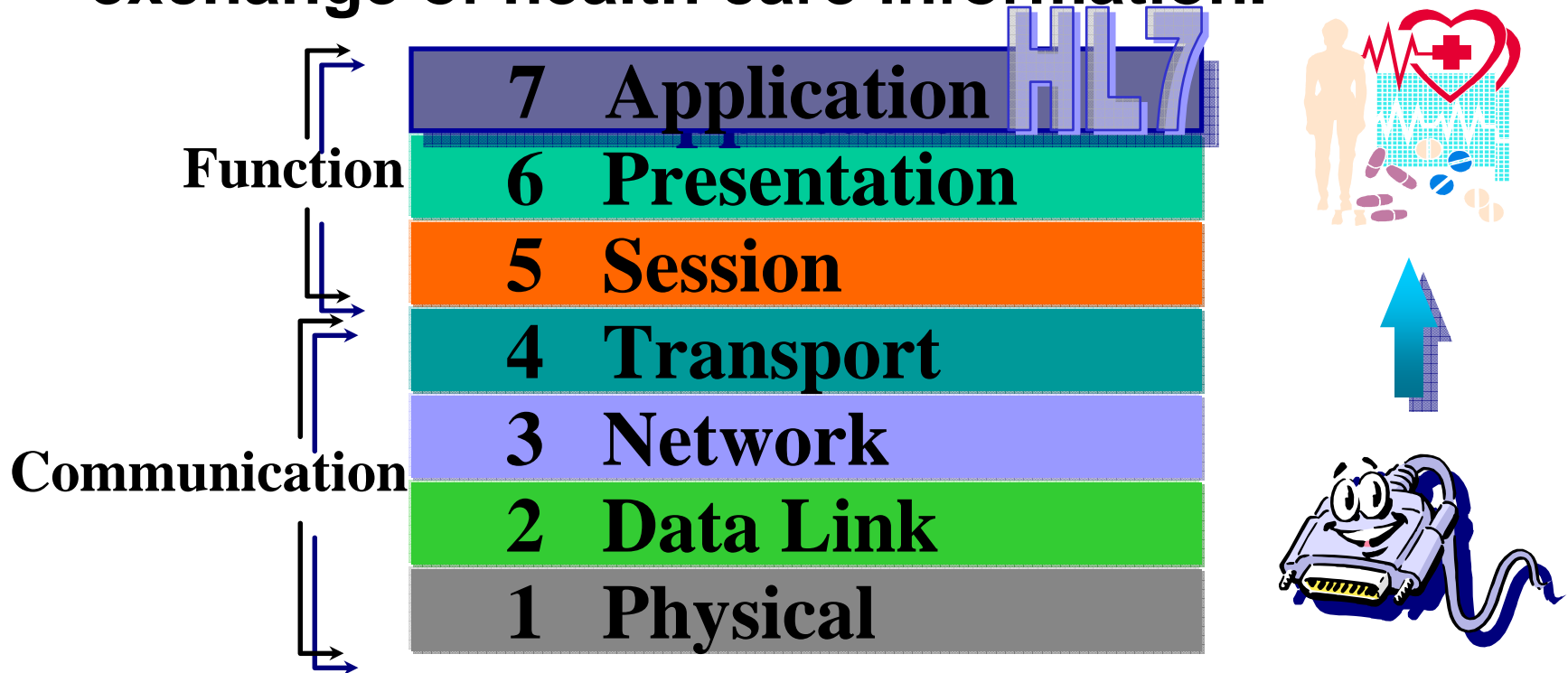
Order entry,  
Census and  
Charges  
Interfaces

# Historical Perspective...



# What does “HL7” mean?

A domain-specific, common protocol for the exchange of health care information.



ISO-OSI Communication Architecture Model



# HL7 Background

- Started in late 1980's to address interoperability among clinical systems
- Focus
  - Patient information (ADT) systems
  - Billing
  - Laboratory Data Systems
- Original scope was the exchange of information between healthcare systems



# HL7 Background (continued)

First viable standard was Version 2

- Released early 1990's
- Specified message syntax and structure
- (Most) content and semantics were left to the implementers
- Version 2.5, which was approved in 2003 is still in wide use today



# HL7 Mission

“... to create flexible, cost effective approaches, standards, guidelines, methodologies, and related services for *interoperability* between healthcare information systems.”





# Why HL7?

- Decrease time and cost of implementation
- Approach “plug-and-play”
- Enable data sharing
  - Mergers due to managed care
  - Regional or national clinical studies
  - Disease prevention and control
- Enable sharing of decision support modules
  - Alerts
  - Protocols
  - Clinical pathways



# HL7 Standard Versions

- 2.0 (1988)      Prototype
- 2.1 (1990)      First standard
- 2.2 (1994)      Widely Adopted
- 2.3 (1997)      In operation
- 2.3.1 (1999)    **Current ANSI standard**
- 2.7 (2007)      In ballot
- **3.0**              Balloting of Prototype in 2000,  
balloting of formal  
specifications in 2001



# HL7 Version 2.x

# Version 2 HL7 Message

```
MSH|^~\&|||19941122100053||ORU^M01|
EVN|M01|199411181141|
PID|||661041||GARDNER^REED^M|
PV1||I|E7^703^^LDS|
OBR||^A000520|LYTES^Serum Electrolytes|
OBX|1|NM|NAS^Serum Sodium|1|138|mmol/L|
OBX|2|NM|K^Serum Potassium|1|3.2|mmol/L|
OBX|3|NM|CL^Serum Chloride|1|114|mmol/L|
OBX|4|NM|CO2^Serum CO2|1|24|mmol/L|
```

**Data Field**

**Segment**

**Component**



# HL7 Observation Message

```
MSH|^~\&|OADD|DADD||19941122100053||ORU^M01|
EVN|M01|199411181141|
PID||661041||TEST^PHARM FIVE^|
PV1|||PSYE^3313^^PCM|
ORC|RE|
OBR|^A000520|LYTES^Serum Electrolytes|
OBX|1|NM|NAS^Serum Sodium|1|138|mmol/L|
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PID||661041||TEST^PHARM FIVE^|  
PV1|||PSYE^3313^^PCM|  
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```



# OBX: name-value pair approach

Other data fields include: date of observation, identity of provider giving observation, normal ranges, abnormal flags

A code that identifies the *datatype* of OBX-5

OBX-5: Data

Status

OBX | | NM | 11289-6^^LN | | 38 | C^^ISO+ | | | | F

A code that identifies the data in OBX-5 (Temp Reading)

A code that identifies the units of numerical data in OBX-5

# OBX: with a coded value

A code that identifies the *datatype* as a coded element

The code is from LOINC

The code is from SNOMED

OBX||CE|883-9^Blood Group^LN||58460004^Group O^SMI|

A code that identifies the data in OBX-5 (ABO Blood Group)

OBX-5: Data  
A code for Group O

# All are using HL7; what is the problem?

- Site 1:

OBX|1|CE|**ABO**^ABO GROUP||**O**^Type O|

- Site 2:

OBX|1|CE|**BLDTYP**^ABO GROUP||**TYPEO**^Type O|

- Site 3:

OBX|1|CE|**ABOTYPE**^ABO GROUP||**OPOS**^Type O|

You and I may know that these are similar results, but our computers will not.

# Goal

- Site 1:

OBX|1|CE|883-9^ABO Type^LN||58460004^Group O^SMI|

- Site 2:

OBX|1|CE|883-9^ABO Group^LN||58460004^Group  
O^SMI|

- Site 3:

OBX|1|CE|883-9^Blood Type^LN||58460004^Group  
O^SMI|

|

Agree on a universal coding system for clinical observations.



# Version 2.x Problems

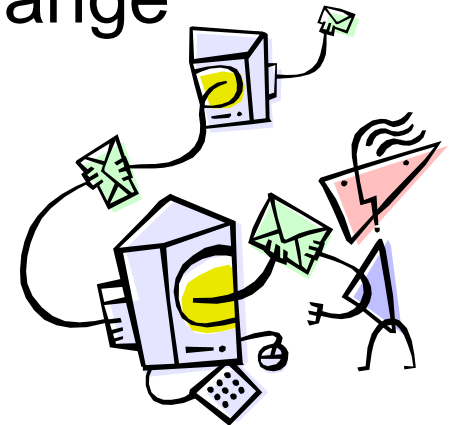
- HL7 specifies message structure
- Everyone uses different terms and codes
  - No formal bindings to standard vocabularies
- Time consuming mapping
- Existing coding systems incomplete



# HL7 Version 3

# Version 3 Goals

- Provide a common model for healthcare.
- Improve clarity and precision of specification
- Improve adaptability of standards to change
- Begin to approach “*plug and play*”





# HL7 V3 RIM - Backbone

## ■ Entity

- People, Places, Physical Things

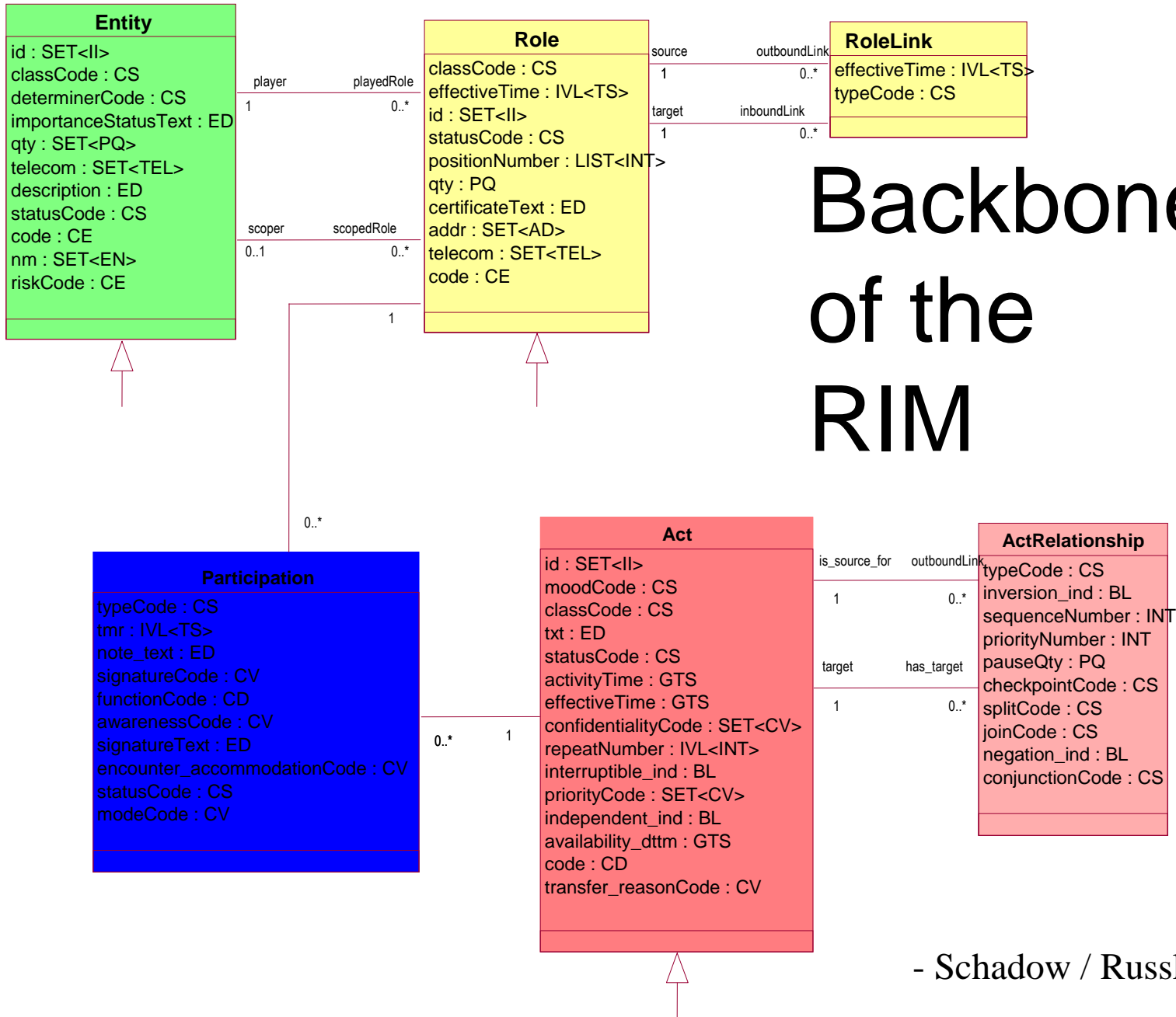
## ■ Associations

- Roles & Relationships

## ■ Act

- Collections of Events





# Backbone of the RIM



# HL7 V3 RIM – Backbone Example

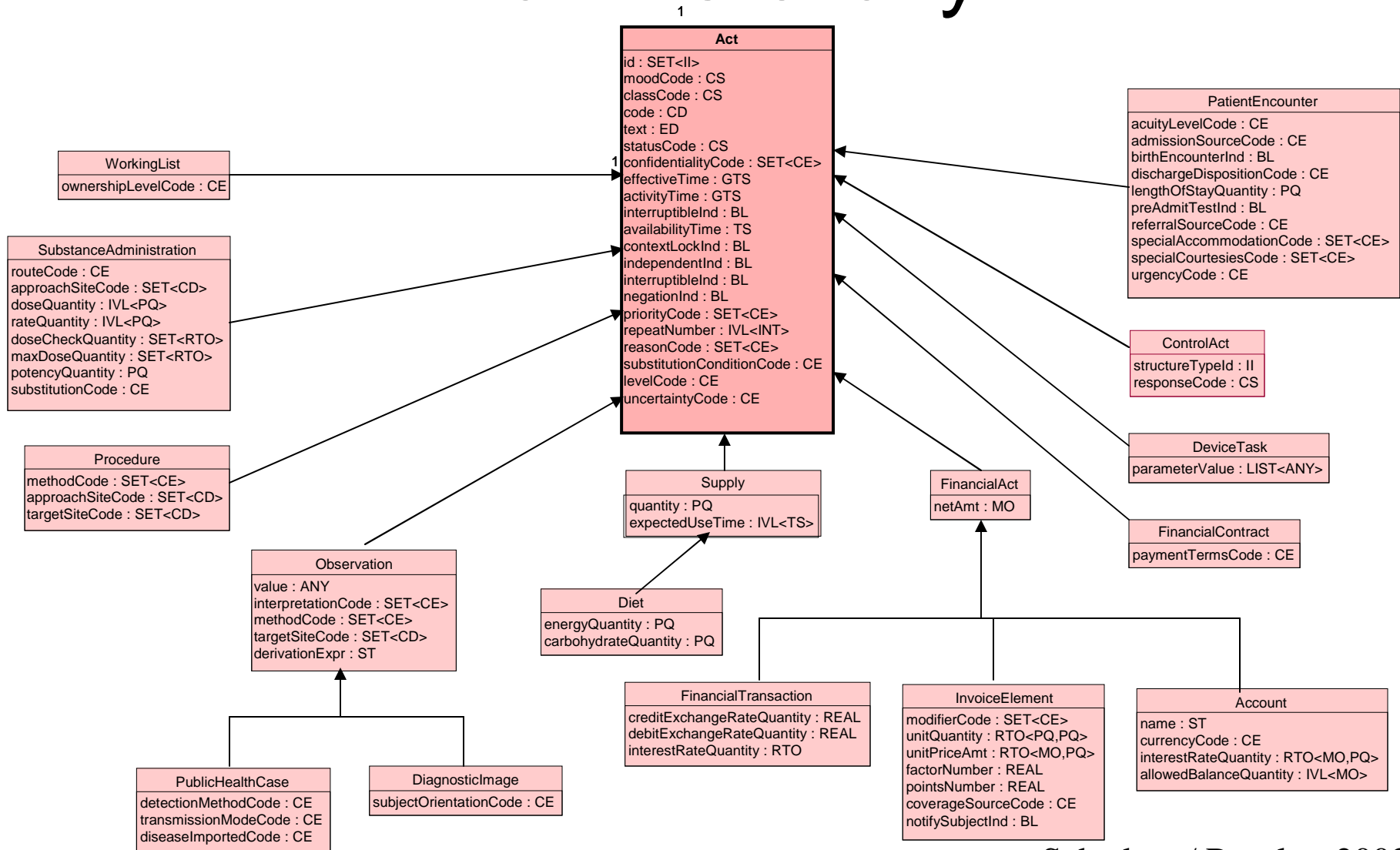
- **Entity = Person**
- **Associations**
  - Role = Patient
- **Act = Observation**



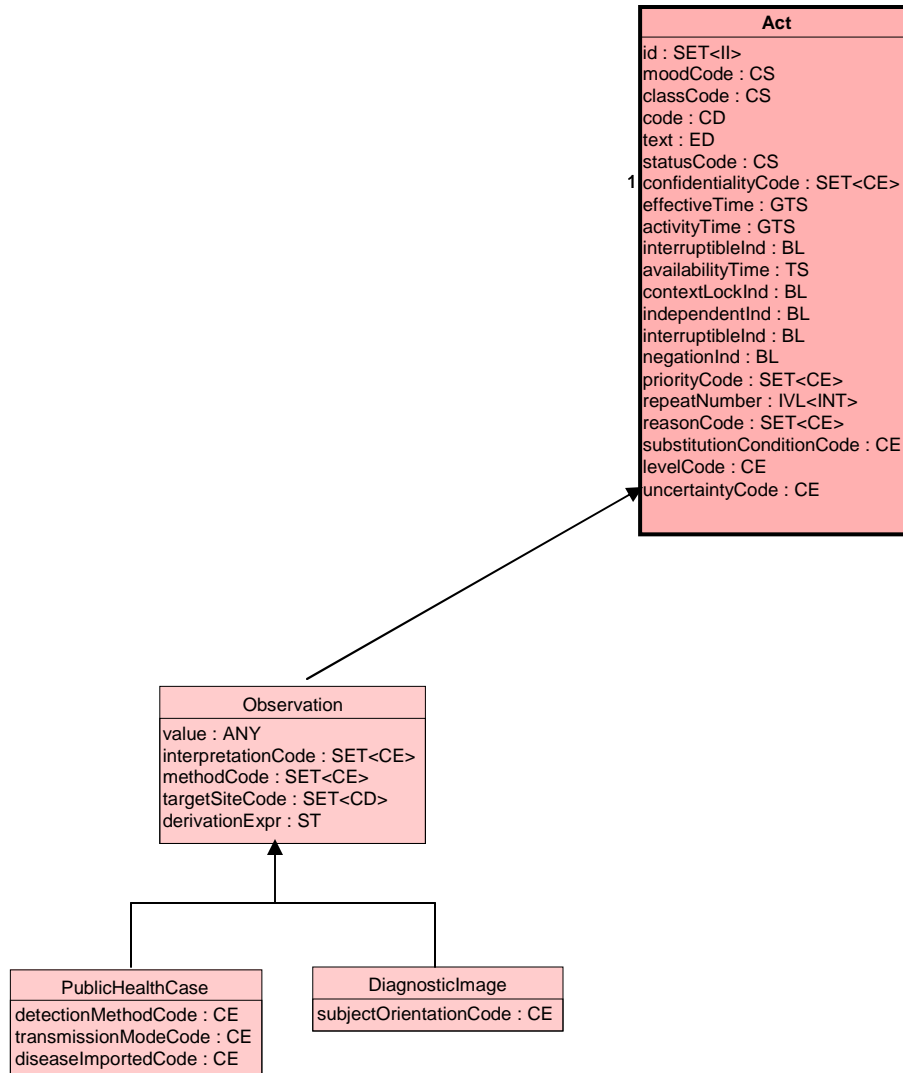
# HL7 Act Examples

- Observation
- Substance Administration
- Patient Encounter
- Working List
- Procedure

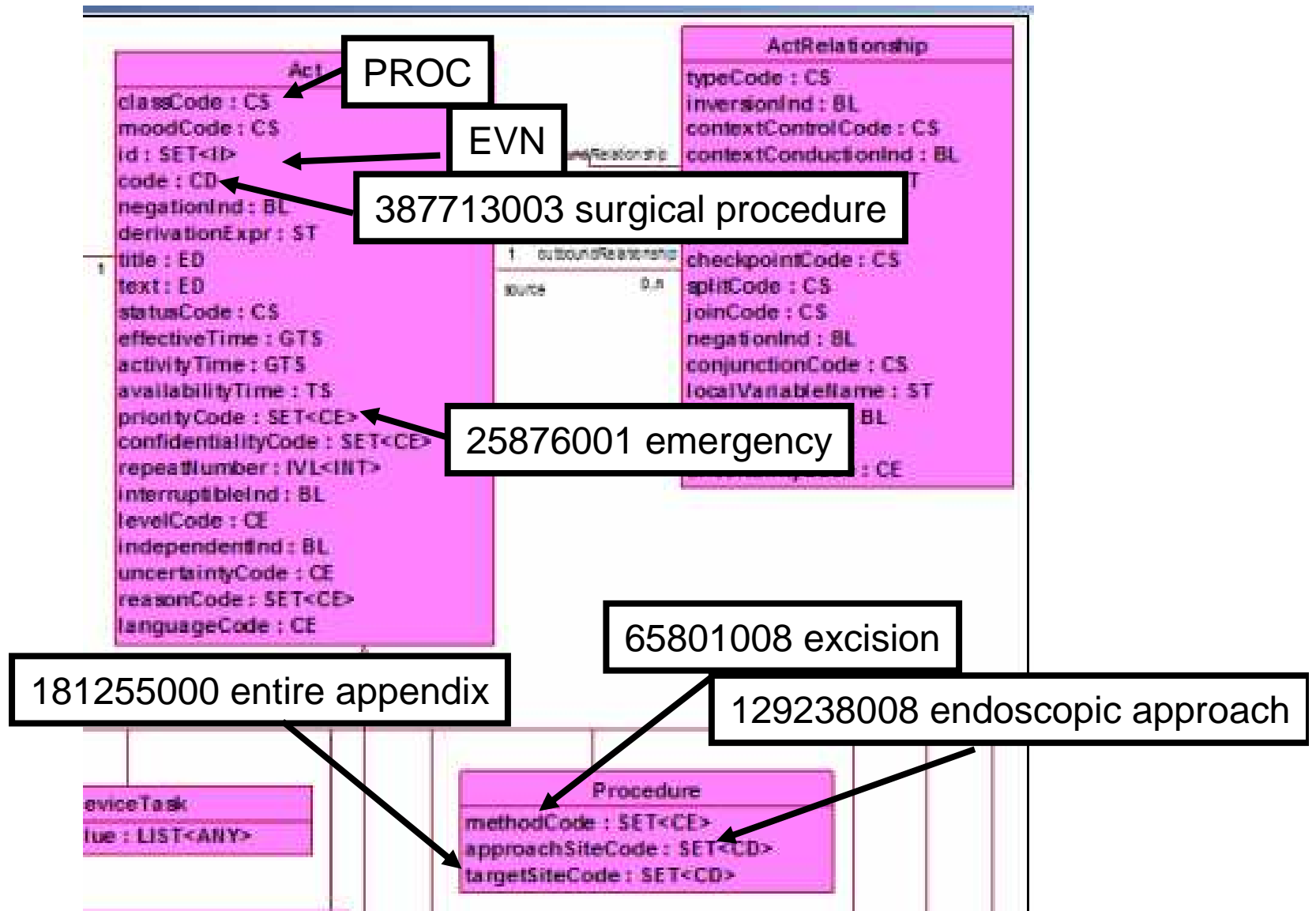
# HL7 RIM Act Hierarchy



# HL7 RIM Observation Hierarchy



# Procedure Act = Appendectomy





# Vocabulary Role in Version 3

- Each coded attribute should be constrained to a specific vocabulary domain
- Codes can be from HL7 or standard external sources
- The coding scheme should be comprehensive for the domain of intended use
- Coding schemes external to HL7 must be registered with HL7



# Examples

**marital\_status\_cd** : **CV** <**MaritalStatus**>

e.g., married, separated, divorced, widowed,  
common-law marriage.

**procedure\_cd** : **CV** <**Procedure**>

e.g., Cholecystectomy, Abdominal  
Hysterectomy, IV Insertion





# Implications for Nursing and You

- HL7 Attendance

- Many Working Groups (Patient Care, Public Health, Structured Documents, etc.)
- [www.HL7.org](http://www.HL7.org)

- Nursing Terminology Development

- Model and Terminology Use

- Template Development starting
- Applications



# Conclusion

- Value of terminology standards
- HL7 Version 2.x
  - Most widely used today
- HL7 Version 3 (Reference Information Model)
- Standardized Terminology can be used in both



# Thank You!



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**QUESTIONS?**