COMP3342:
Health Systems Interoperability and Integration

Interoperability Data Exchange Standards

Time: Tuesday+ Thursday: 11:25-12:45

Location: Masri 204

Section: 1

HiCure
Excellence in Health Informatics Integrated Curricula

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Birzeit University

Co-funded by the Erasmus+ Programme of the European Union

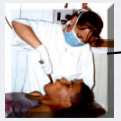
Medical Terminologies: Coding Standards

Learning Objectives:

1. Identify and understand the purpose data exchange related standards and their purpose:
    1. HL7: v2.x, v3.x
    2. CDA
    3. IHE
    4. DICOM
2. Understand the function and use of communication interoperability server - Mirth connect

What to exchange or Interoperate?






STANDARDS

DATA

Analysis

- Statistics
- Research
- Clinical Trials
- Surveillance

KNOWLEDGE

PROCESS

- Patient Safety
- Quality
- Low cost
- Accessible

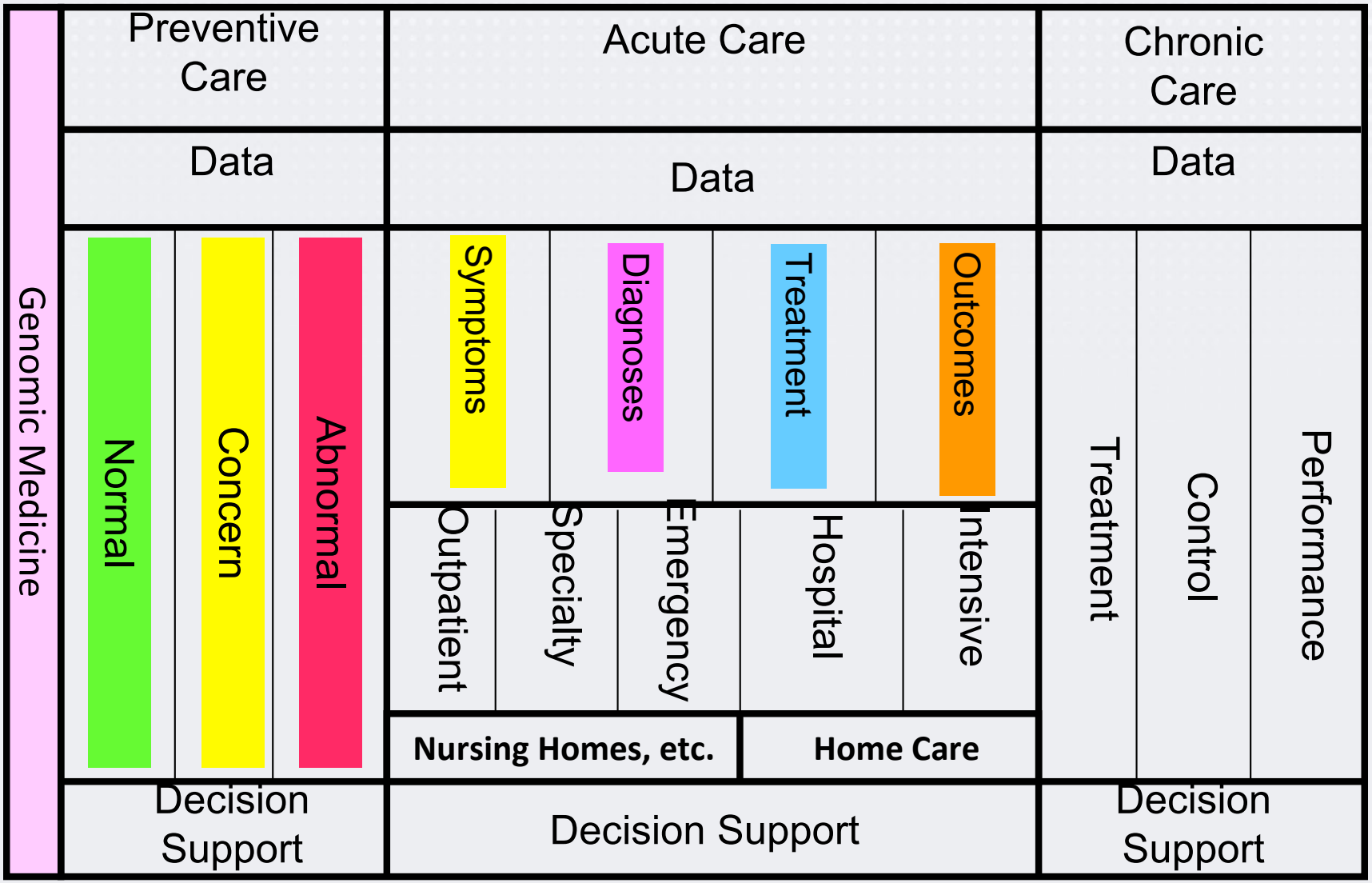
- Public/Private Partnership
- Vendor/Provider Partnership

Privacy, Security, Trust, Integrity

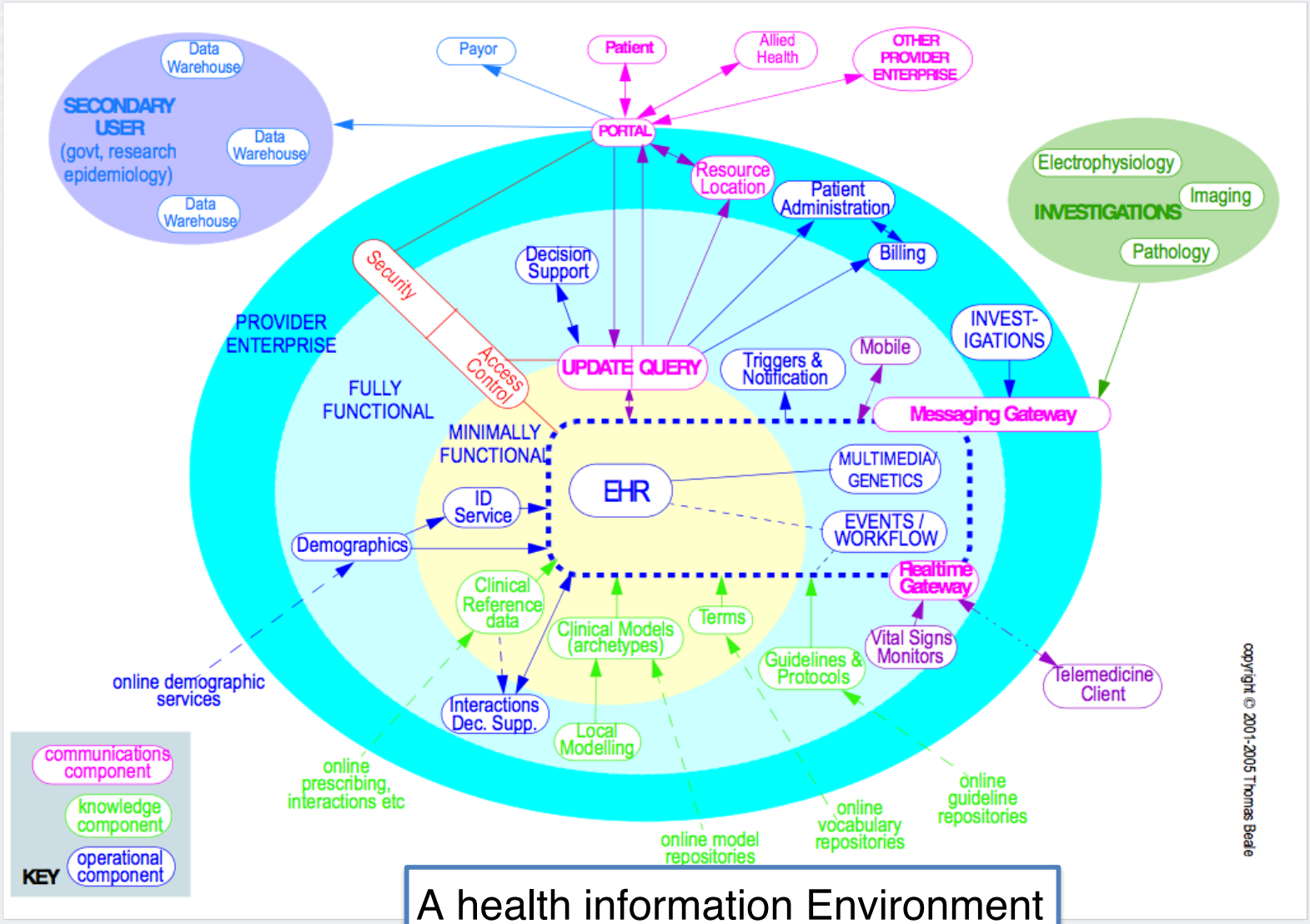
Interoperability Standards

Data exchange standards

A view of the healthcare world

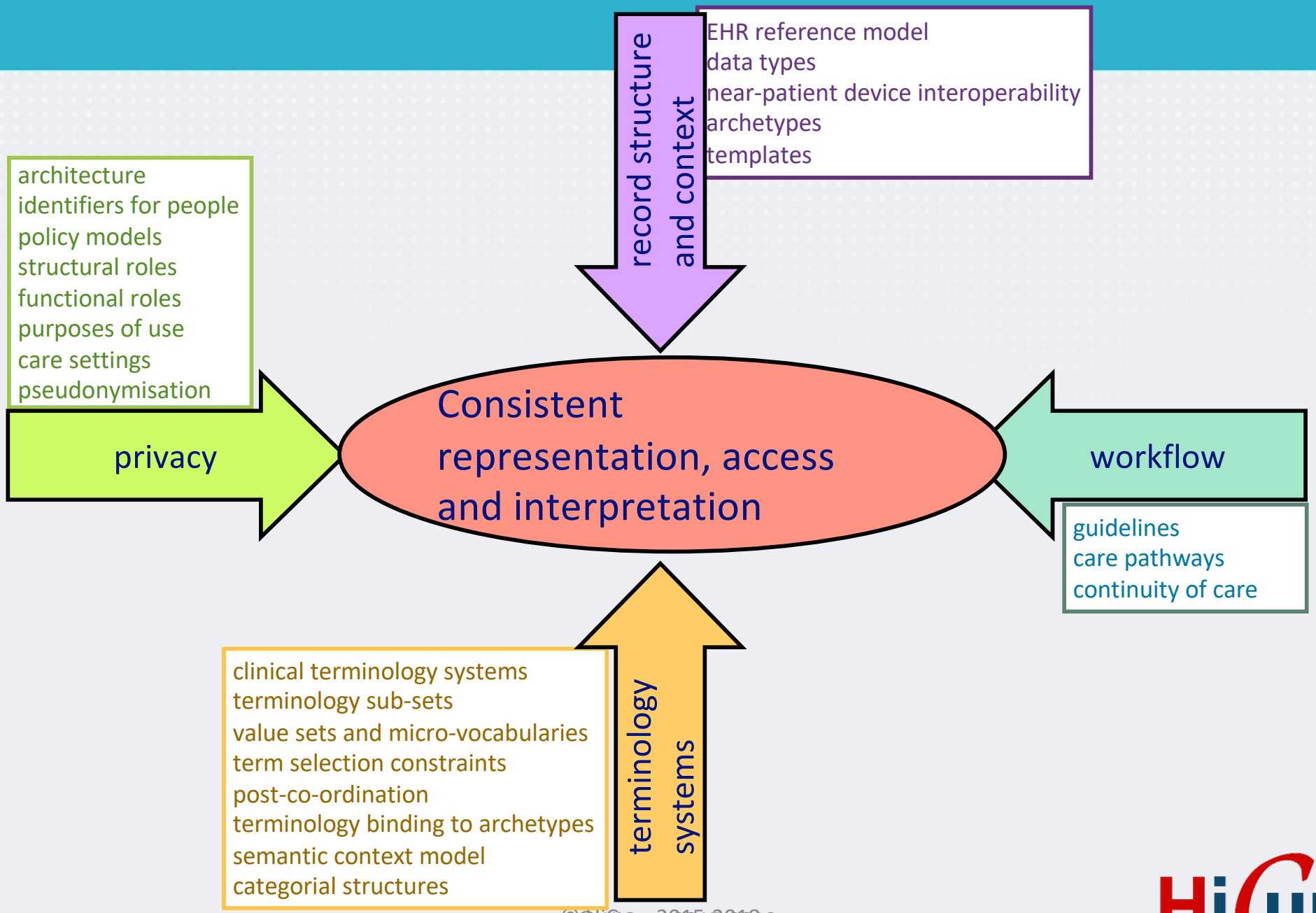


Health Information Environment



A health information Environment

Clinical Information and Processes



Standards relevant to Data Exchange

Business	**ISO 18308 EHR Architecture Requirements** HL7 EHR Functional Model
Information models	EHR interoperability Reference Model ISO/EN 13606-1 HL7 Clinical Message Interoperability V2.x HL7 Clinical Message Interoperability V3.x HL7 Clinical Document Architecture (CDA) IHE Integration of Healthcare Enterprise Profiles Cross-Enterprise Document Sharing -XDS.b Patient Identifier Referencing - PIX DICOM: For representing and transmitting Radiology Image
Security	EHR Communication Security ISO/EN 13606-4 ISO 22600 Privilege Management and Access Control ISO 14265 Classification of Purposes of Use of Personal Health Information
Clinical knowledge	Terminologies: SNOMED CT, etc. Clinical data structures: Archetypes etc.

Exchange Standards

Define what and how to exchange data between EHRs

Exchange of Clinical Data between EHRs

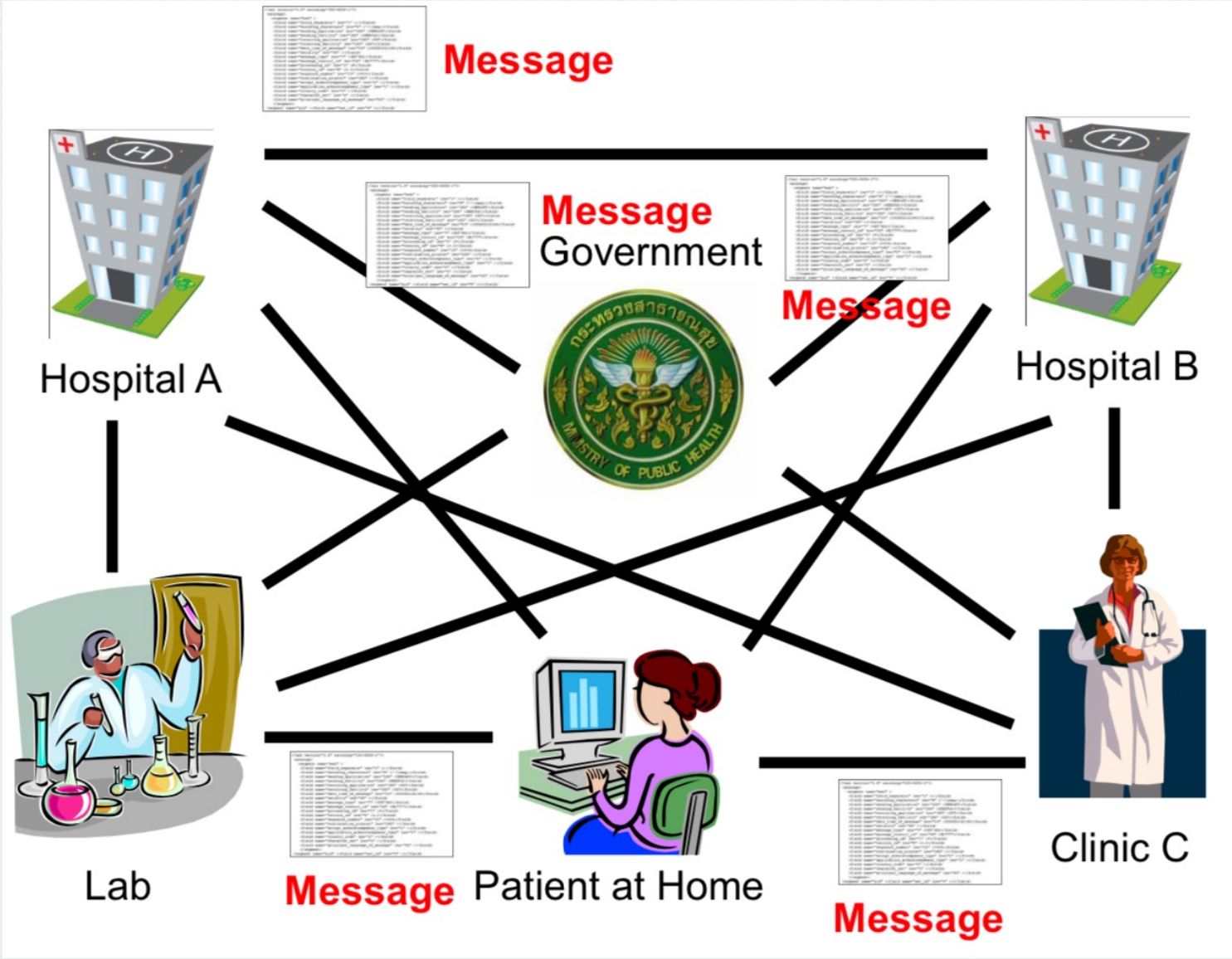
Message Exchange

- Goal: Specify format for exchange of data
- Internal vs. external messages
- Examples
  - HL7 v.2
  - HL7 v.3 Messaging
  - DICOM
  - NCPDP

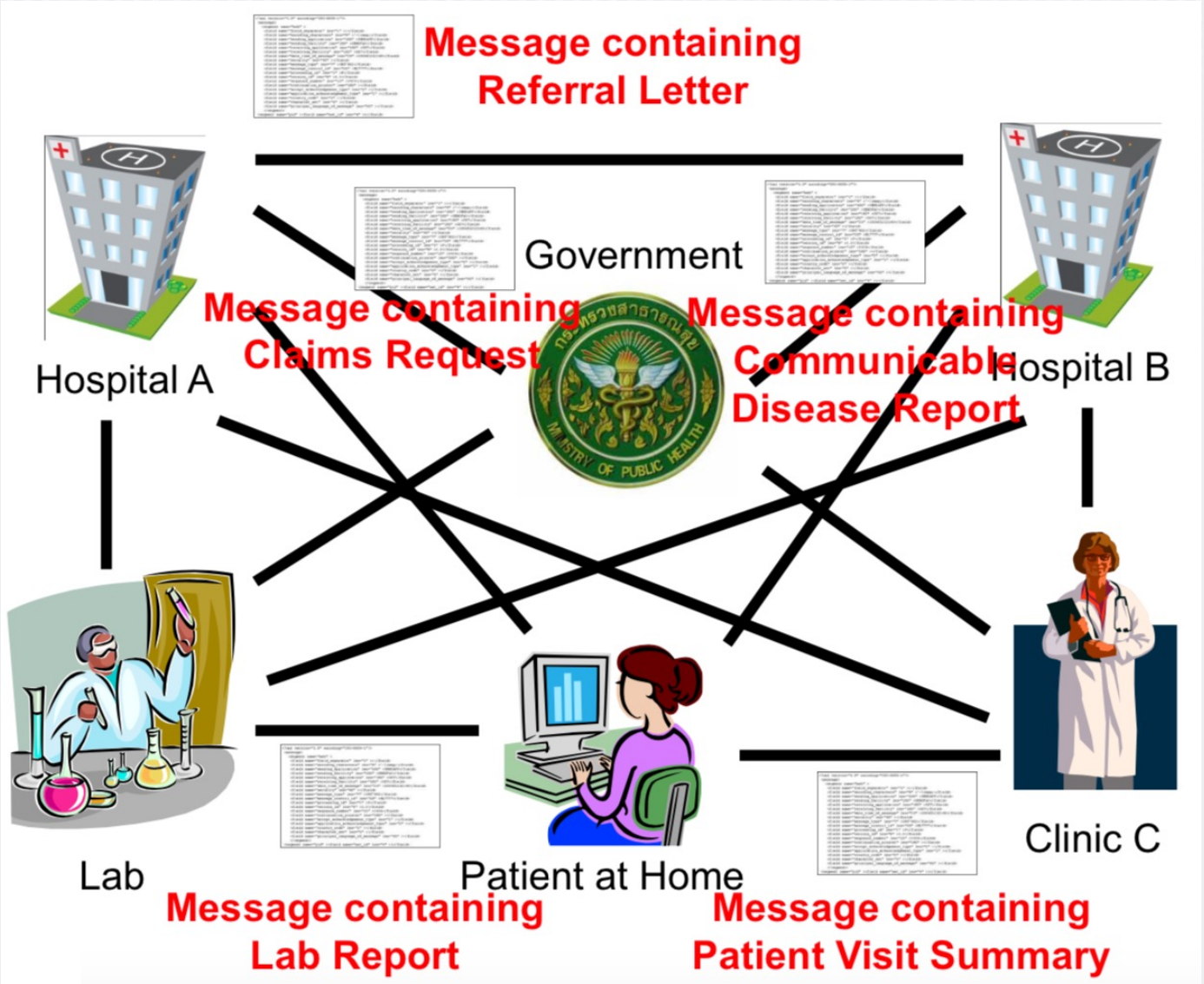
Document Exchange

- Goal: Specify format for exchange of "documents"
- Examples
  - HL7 v.3 Clinical Document Architecture (CDA)
  - ASTM Continuity of Care Record (CCR)
  - HL7 Continuity of Care Document (CCD)

Message Exchange



Clinical Document Exchange



Exchange Standards

Health Level 7 (HL7)

Introduction Video

https://vimeo.com/8830861

HL7: Health Level Seven

- HL7:
  - is a framework and a set of standards for
    - Exchanging, integration, sharing, and retrieval of electronic health information across various healthcare applications
      - Across different departments in a hospital and Across chain of hospitals,
      - Across regional, national, and international healthcare orgs.
- Founded in 1987, is an all-volunteer, not-for-profit organization involved in development of international healthcare standards
- is one of several American National Standards Institute (ANSI) - accredited Standards Developing Organizations (SDOs)
- Focuses on both **clinical** and **administrative** data .
- is the global authority on standards for interoperability of health information technology with members in more than **55** countries.

More than 55 HL7 International Affiliates / Countries


Argentina


Romania


Puerto Rico


Philippines

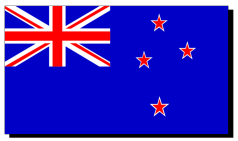

Pakistan


Norway


Australia


Russia

And growing


New Zealand


Austria

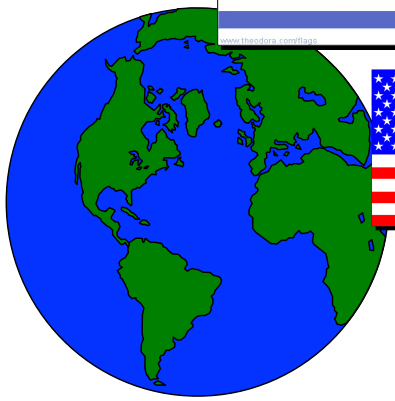

Singapore

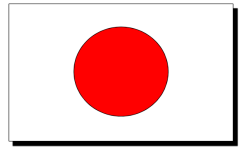

Uruguay


Malaysia


Bosnia and Herzegovina


South Korea


United States


Japan


Brazil


Spain

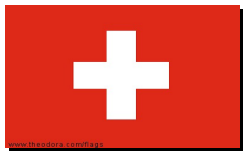

Italy

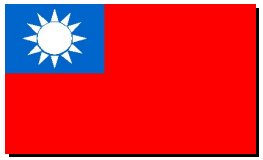

Sweden


United Kingdom


India

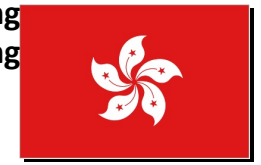

Canada


Switzerland


Taiwan


The Netherlands


Turkey

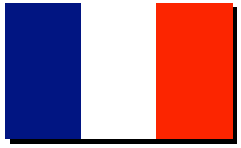

Hong Kong


China


Croatia


Czech Republic


Finland


France


Germany


Greece

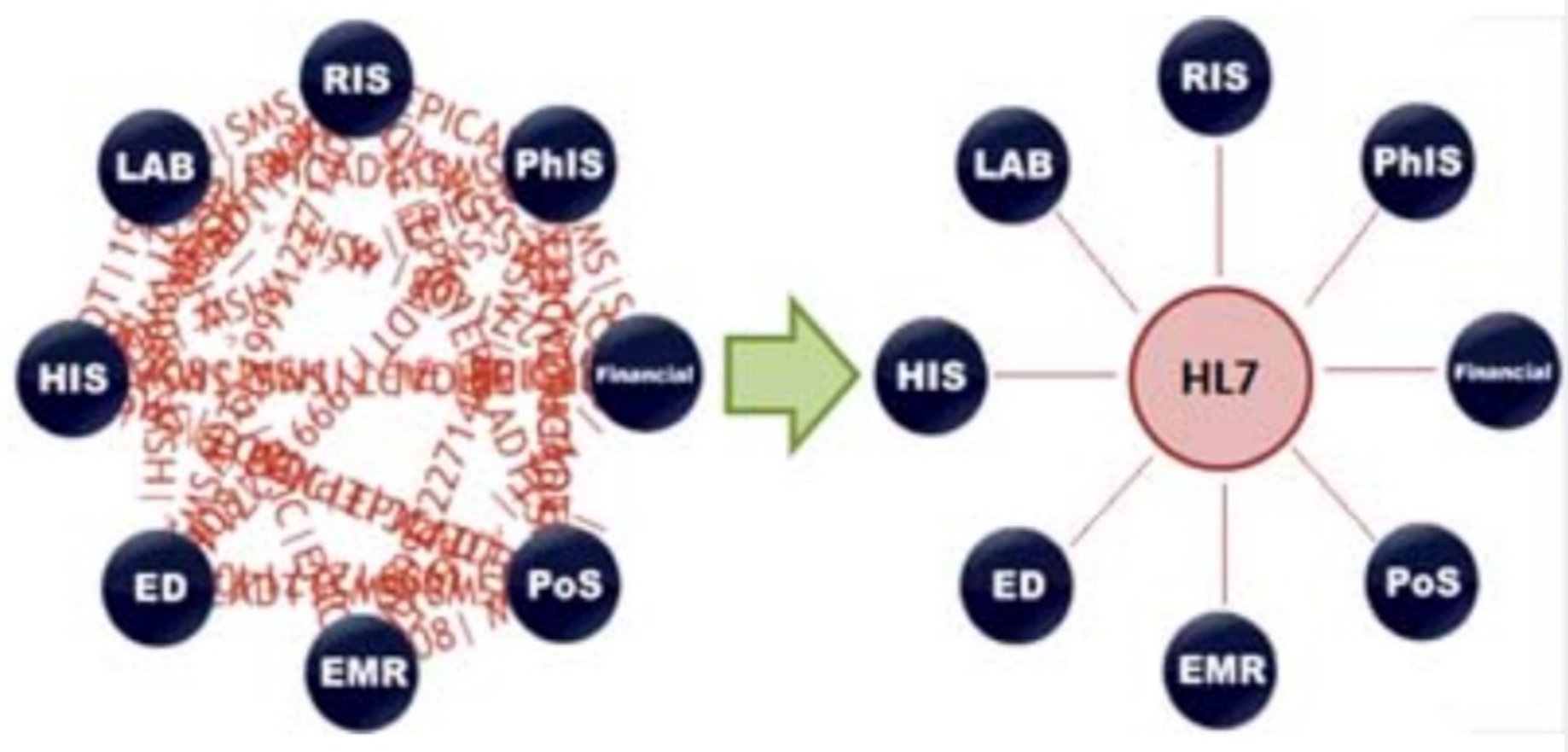
Health Level Seven (HL7)

- HL7 refers to
  - the seventh level of the International Organization for Standardization (ISO) seven-layer communications model for Open Systems Interconnection (OSI) - the application level.
- HL7 provides standards for interoperability with aims to
  - improve care delivery, optimize workflow, reduce ambiguity and enhance (medical) knowledge transfer between all parties: patients, government, healthcare providers and vendors.
- HL7 supports various functions in healthcare settings:
  - Patient Administration
  - Clinical Laboratory and Observation Reporting
  - Medical Record Management

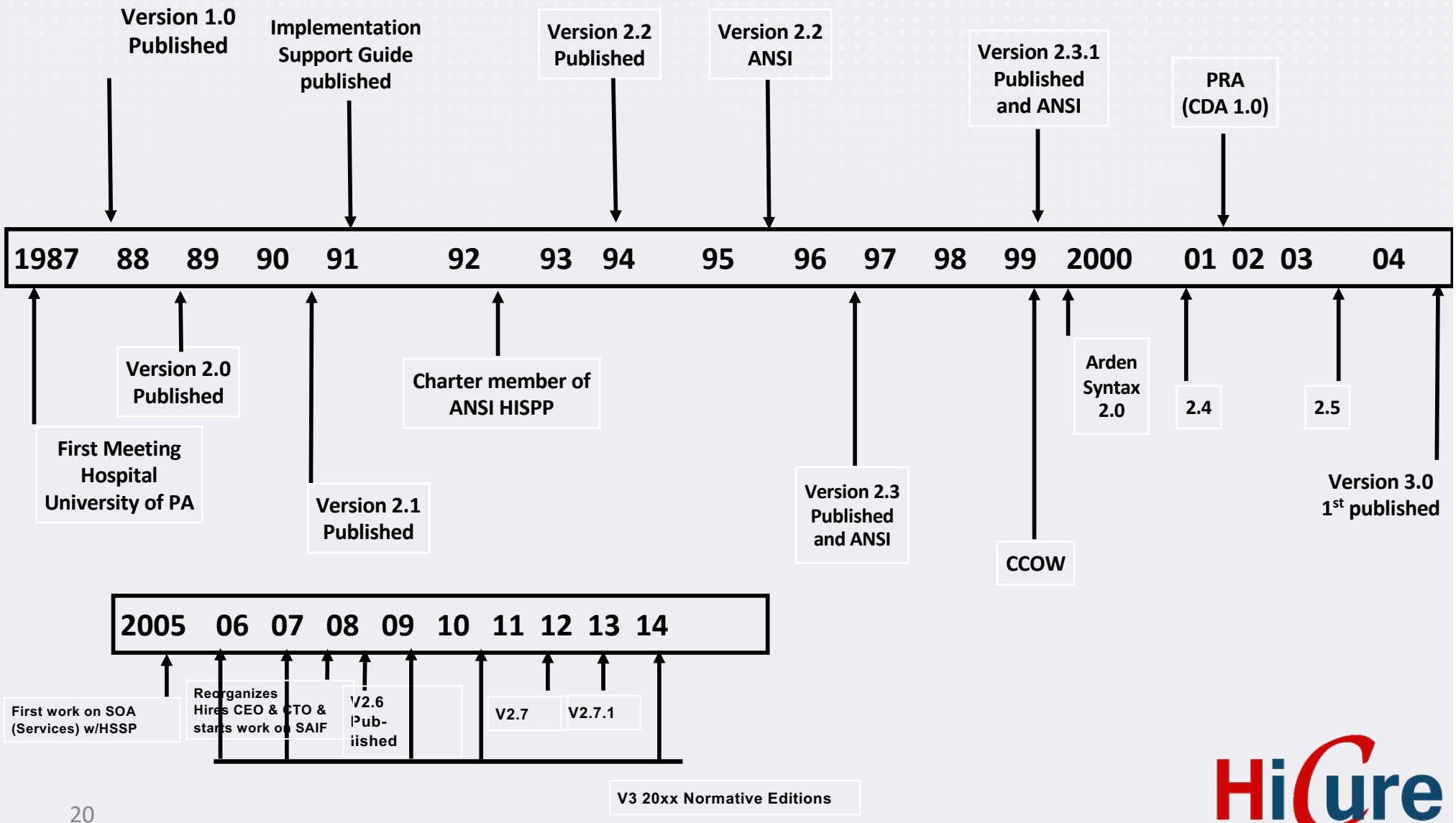
HL7: Types of Standards

- Clinical Messaging exchange Standards (e.g., HL7 v2.x and v3.0).
  - Very important-they define how healthcare information is packaged and communicated from one party to another.
- Clinical Conceptual Standards (e.g. HL7 V3 RIM): they define **structure** of the clinical **content** (of messages and documents)
- Clinical Document (Architecture) Standards (e.g., HL7 CDA) : structure of the clinical **document**
- Clinical Application Standards (e.g., HL7 CCOW, HL7 FHIR).

HL7: Purpose



History of HL7



HL7: Message Exchange Standards

- HL7 v2.x
  - Supports a hospital workflow
  - Supports electronic exchange of healthcare data across various healthcare applications
  - Uses **textual**, a non-XML, encoding syntax based on segments
- HL7 v3
  - Extension to v2.x, supports ALL healthcare workflow
    - Provides more information about **messages** being exchanged
    - Specifies the roles of message sender and receiver
    - Specifies actions that have to be taken in response to message
    - Allowes message exchange during patient care delivery
  - HL7 v3 is an **XML** based messages
    - XML (eXtensible Markup Language), is an information/data formatting/structure language used to exchange data over the Web, in a format both human-readable and machine-readable.

HL7 International Version 2.x

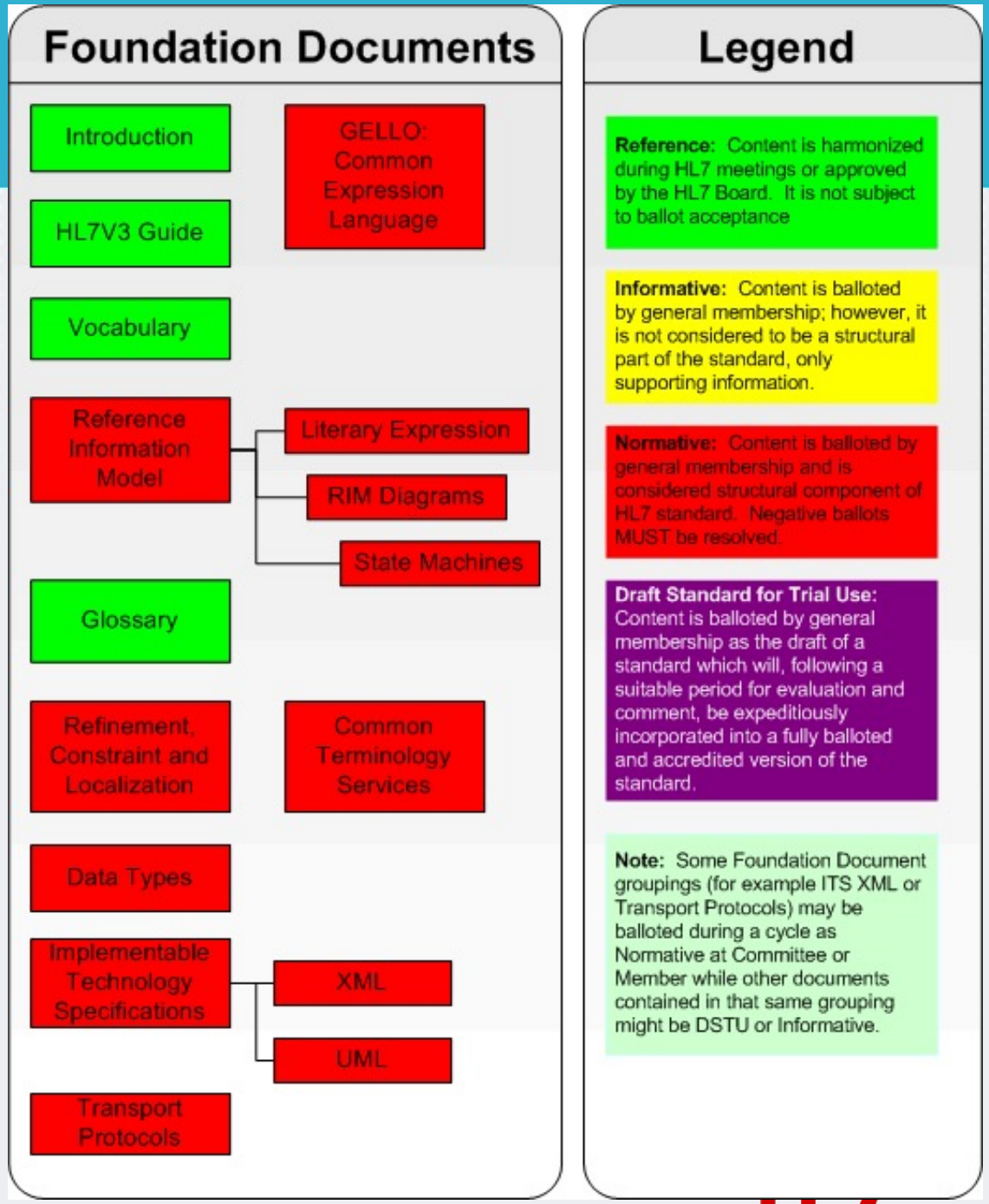
- First widely used version 2.1 published in **1991**
- Used in **>90%** provider organisations in the US and widely supported by vendors in Europe.
- Generally requires bi-lateral negotiations between communicating parties.
- Backwards-fitted (opposite strategy/approach for V3 HL7 International Reference Information Model (RIM))
- Not well **normalised** –i.e. **not semantically** correct.
- Not designed to define **processes.**
- Most implementations are a mix of versions ranging from 2.1 to 2.3 (current version is 2.8)

HL7 Version 3

HL7 International Version 3

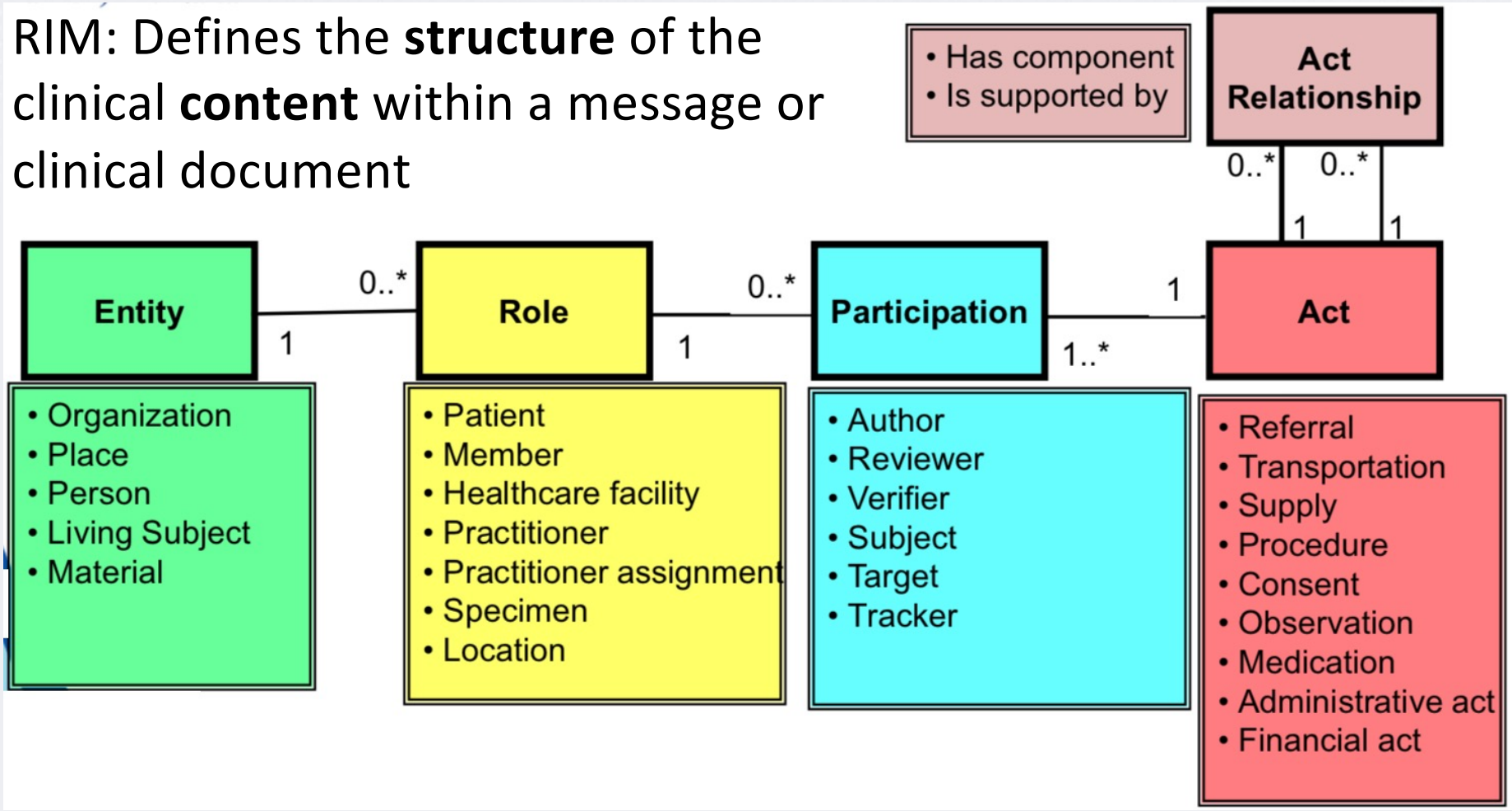
First approved for publication in September, 2004.

Usable version Published in 2010

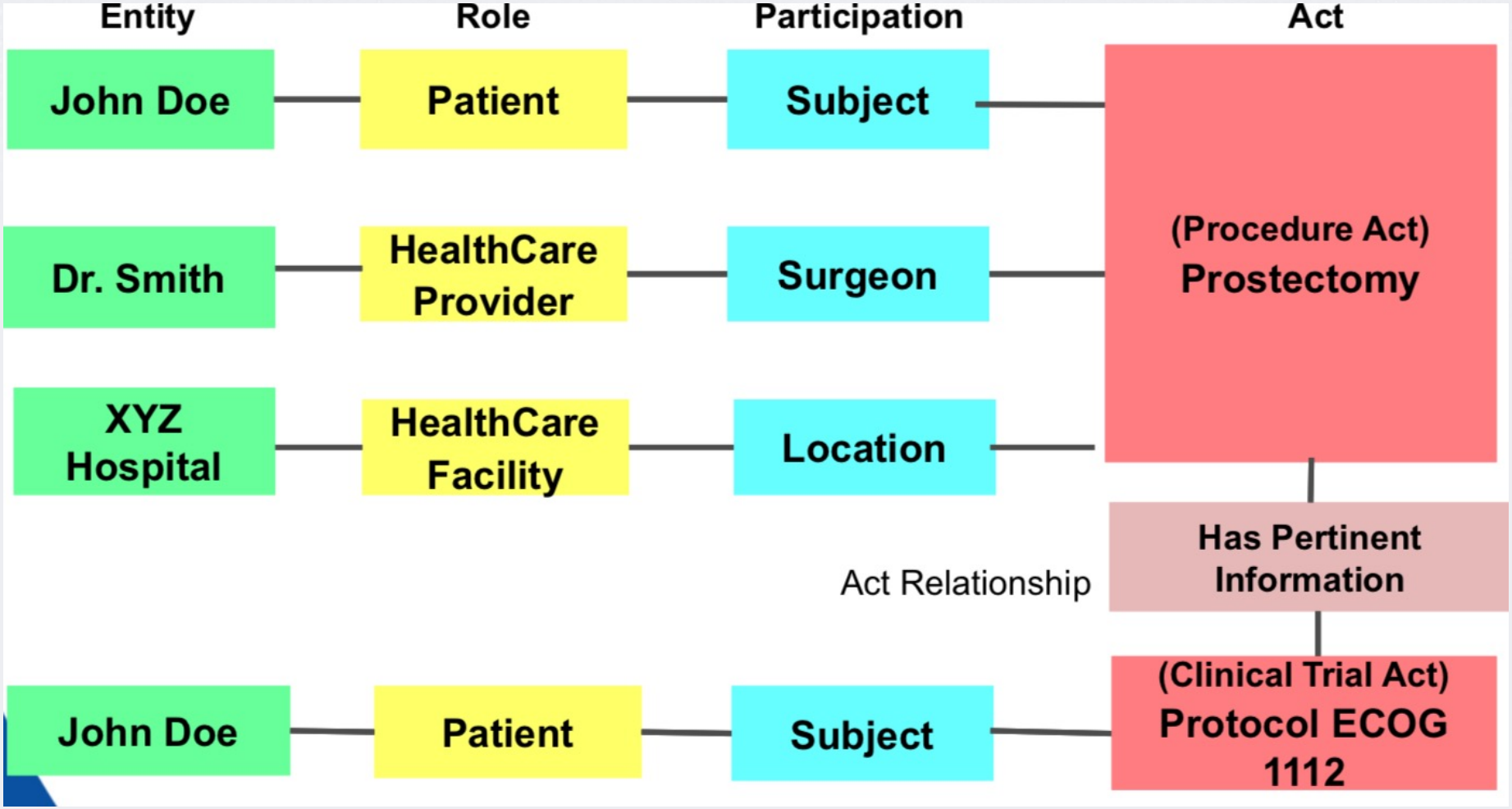


HL7 V3: Reference Information Model (RIM)

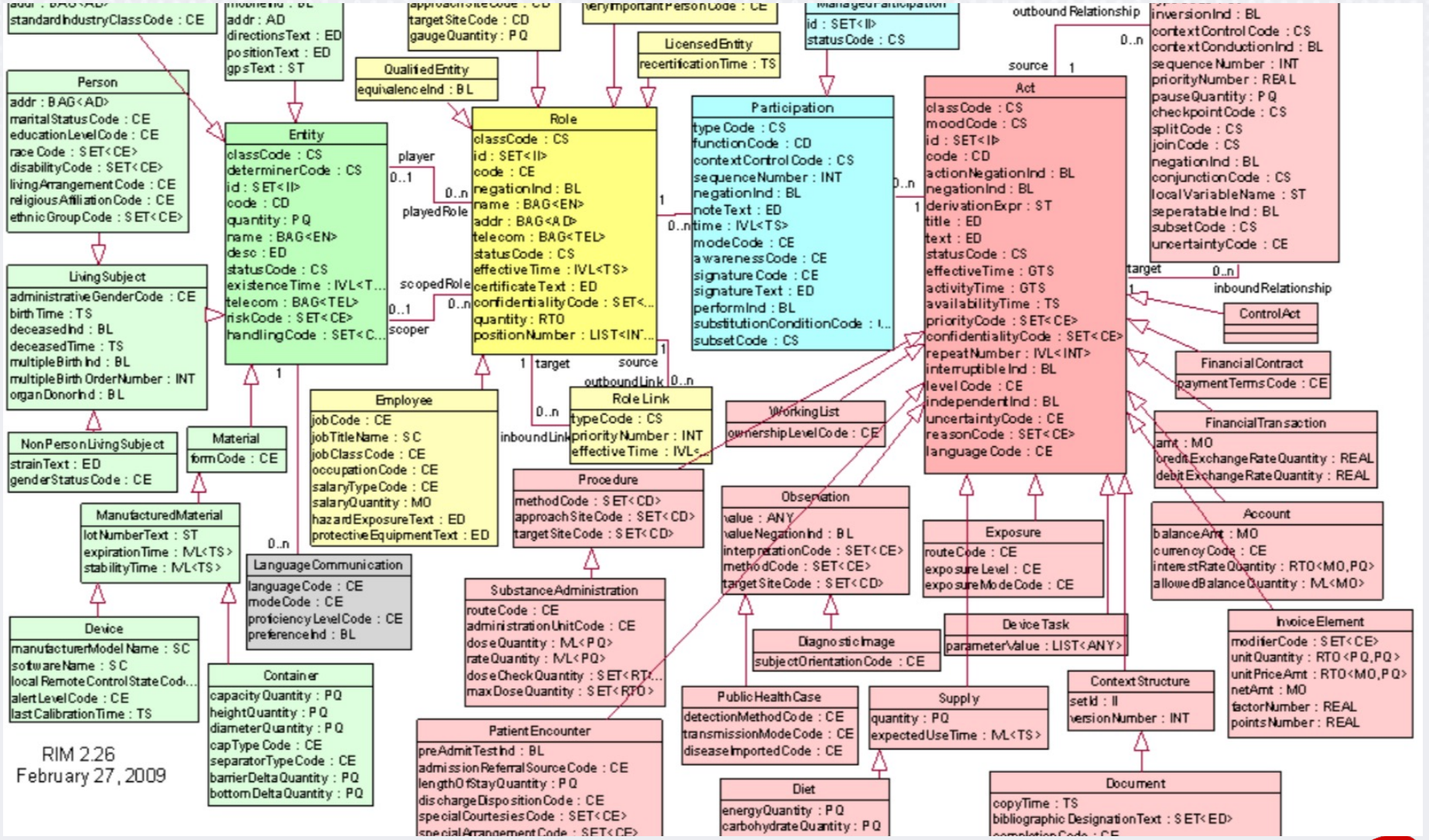
RIM: Defines the **structure** of the clinical **content** within a message or clinical document



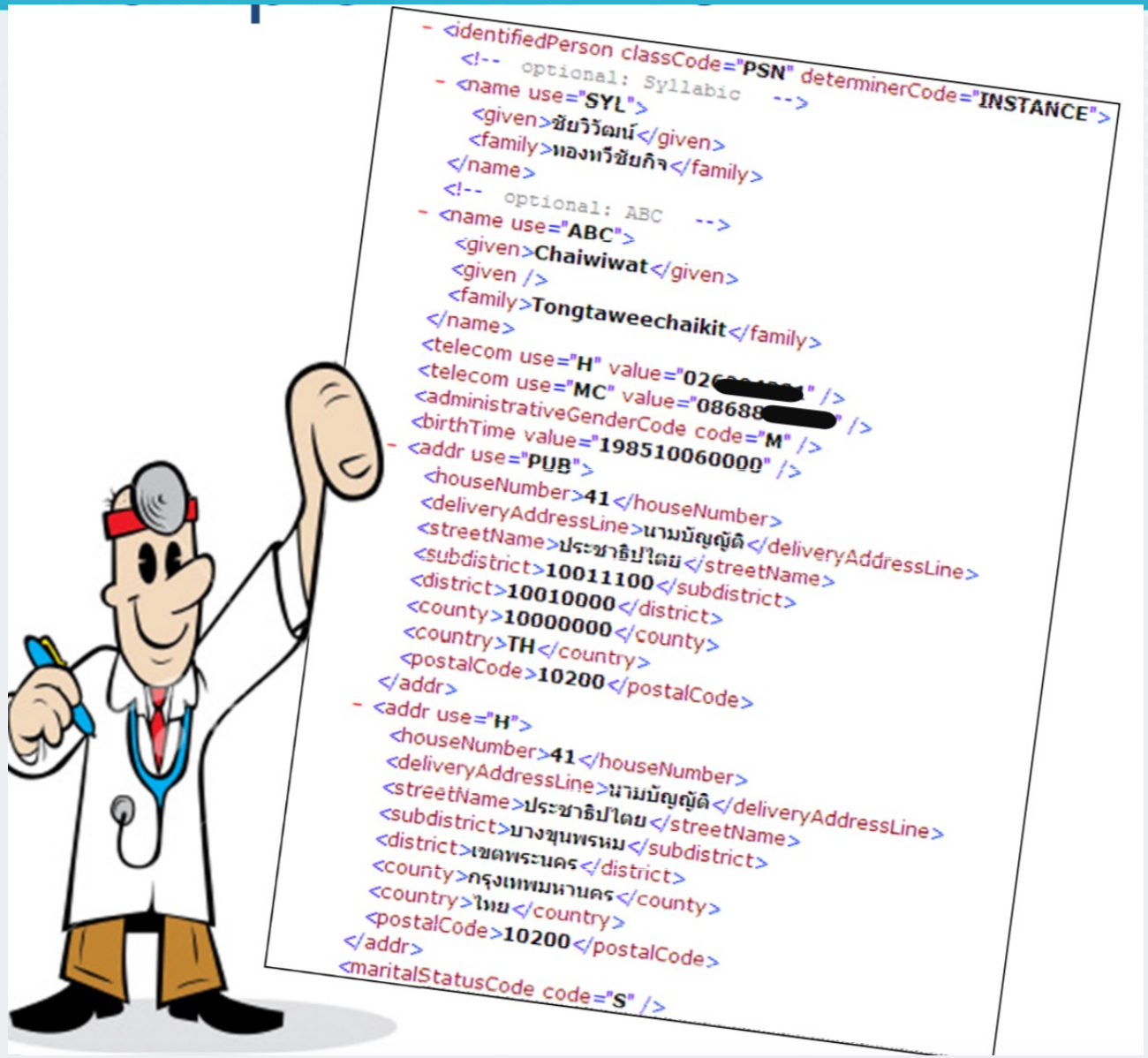
HL7 V3: RIM UML Instance: Example



RIM: UML Model



HL7 V3 message: Example



```
- <identifiedPerson classCode="PSN" determinerCode="INSTANCE">
  <!-- optional: Syllabic -->
  - <name use="SYL">
    <given>ชัยวิวัฒน์</given>
    <family>ทองทวีชัยกิจ</family>
  </name>
  <!-- optional: ABC -->
  - <name use="ABC">
    <given>Chaiwiwat</given>
    <given />
    <family>Tongtaweechaikit</family>
  </name>
  <telecom use="H" value="02[redacted]" />
  <telecom use="MC" value="08688[redacted]" />
  <administrativeGenderCode code="M" />
  <birthTime value="19851006000[redacted]" />
- <addr use="PUB">
    <houseNumber>41</houseNumber>
    <deliveryAddressLine>นามบัญญัติ</deliveryAddressLine>
    <streetName>ประชาธิปไตย</streetName>
    <subdistrict>10011100</subdistrict>
    <district>10010000</district>
    <county>10000000</county>
    <country>TH</country>
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  </addr>
- <addr use="H">
    <houseNumber>41</houseNumber>
    <deliveryAddressLine>นามบัญญัติ</deliveryAddressLine>
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    <subdistrict>บางขุนพรหม</subdistrict>
    <district>เขตพระนคร</district>
    <county>กรุงเทพมหานคร</county>
    <country>ไทย</country>
    <postalCode>10200</postalCode>
  </addr>
  <maritalStatusCode code="S" />
```
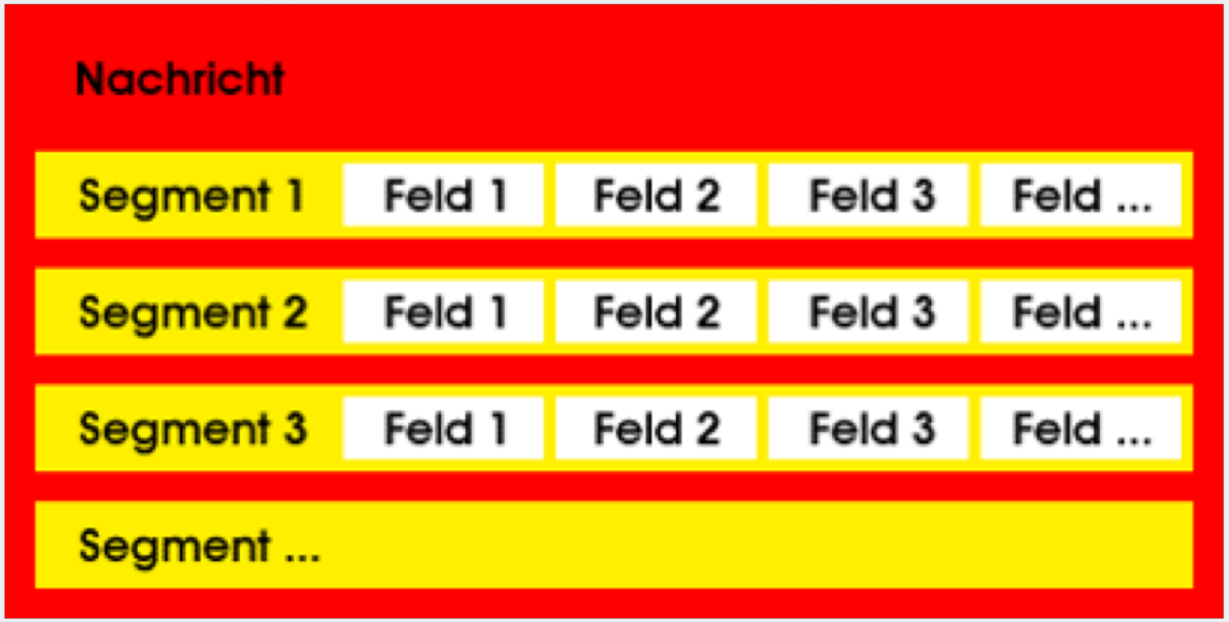
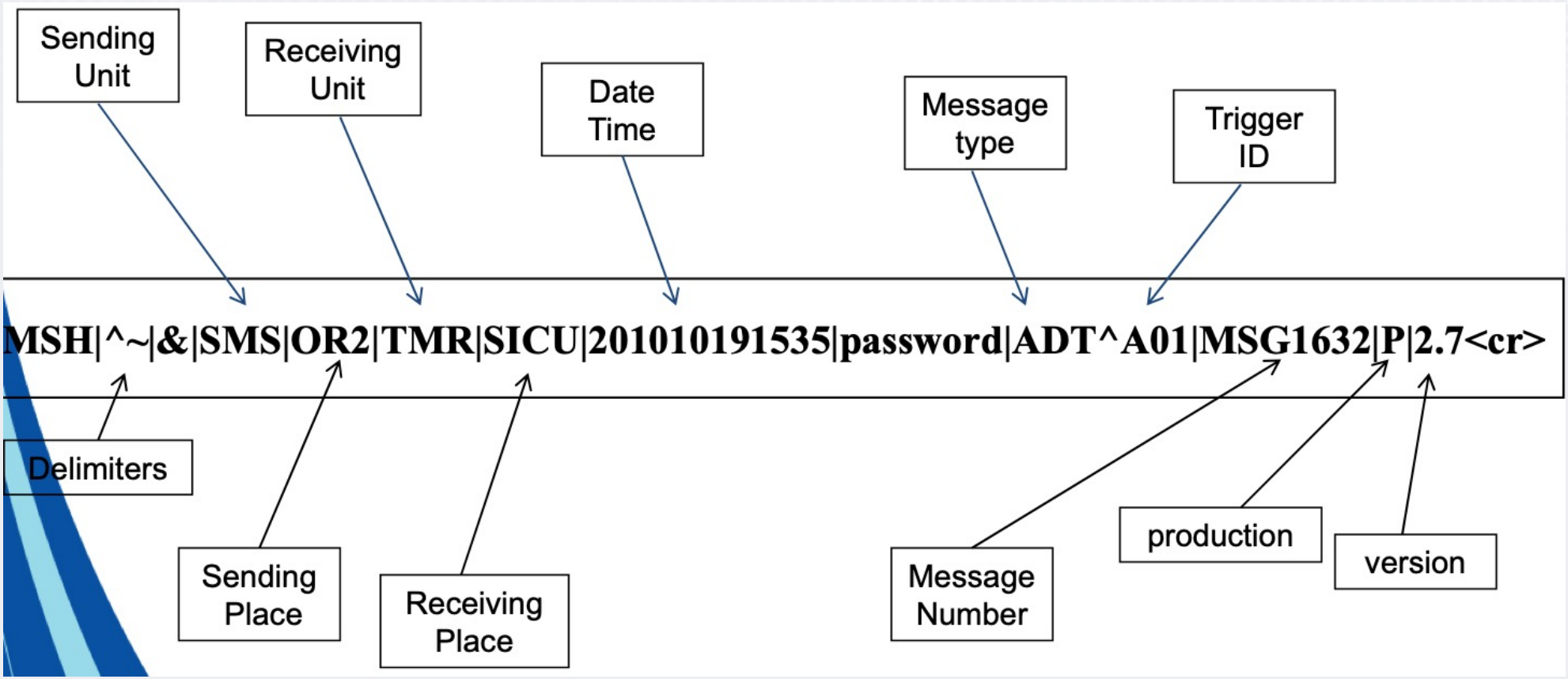

HL7 v2: Message Structure

- Each HL7 v2 message consists of segments
- Segements are separated in fields



HL7 v2 Message Segment Header



See video here: https://vimeo.com/8830861

HL7 v2: Message

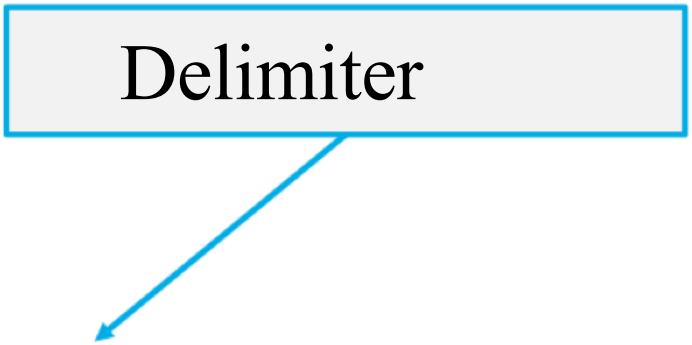
```
MSH|^~\&|KIS|ADT|RIS|ADT|200512151705||ADT^A01^ADT_A01|ADT001|P|2.5^DEU&&HL70399|||AL|
NE|DEU|8859/15|DEU^German^HL70296^^deutsch||
2.16.840.1.113883.2.6.9.38^^2.16.840.1.113883.2.6^ISO
EVN||200512151705||||200512151645
PID|||1234567^^^Beta-Klinik^PI||
Vogel^Marianne^^^^^L^A^^^G~Seeberg^^^^^^M^A^^^G~Vogel^^^^Frau^^D^^^^G||19780521|F|||
Spechtweg 14&Spechtweg&14^^Hamburg^^20355^^H~Spitalstr.
17&Spitalstr.&17^^Hamburg^^20355^^BDL||^PRN^PH^^49^40^7654321^^^^^040/7654321|
^WPN^PH^^49^40^5432^555^^^^040/5432-555|DEU^German^HL70296^^deutsch|
M^married^HL70002^^verheiratet|CAT^catholic^HL70006^^katholisch||||||Heilig-Geist-
Krankenhaus|||DEU^German^HL70171^^deutsch
PV1|1|I|CHI^302^2^IN^^N^A^4|R|||432113^GroÃŸ^Bernhard^^^Dr.^^^Beta-
Klinik^L^^^DN^^^DN^^G||||||||||||0815^^^Beta-Klinik^VN||||||||||||||||||||||||
200512151645
PV2|||||||||20040405|4
ZBE|1234^KIS|200512151705||INSERT
```

HL7 v2: Segment

HL7 v2: Segments

Segment-ID	Description
MSH	Message Header
EVN	Event
PID	Patient Identification
PV1	Patient Visit
OBR	Observation Request
OBX	Observation Result
DG1	Diagnosis
PR1	Procedure
FT1	Financial Transaction

HL7 v2: Segment - Delimiter



MSH|^~\&|KIS|Aufn|PDMS||200907110801||ADT^A01|2009071108O104|P|2.3|||||D

EVN|A01|200907110801O4|||

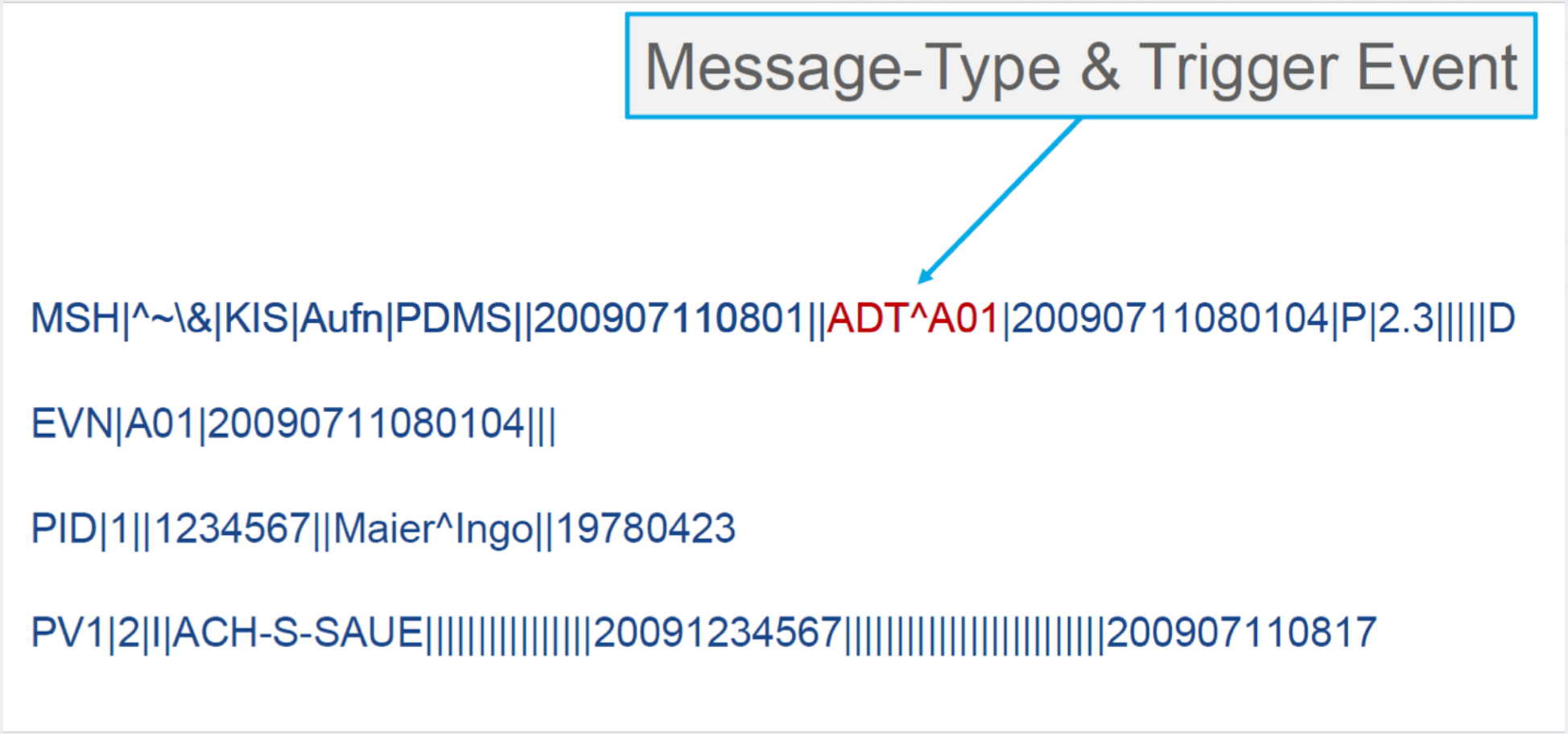
PID|1||1234567||Maier^Ingo||19780423

PV1|2|I|ACH-S-SAUE||||||||||||||20091234567|||||||||||||||||||||200907110817

HL7 v2: Delimiter

Position	Description	Standard-Symbol
1	Component Delimitter	^
2	Repeating Delimitter	~
3	Escape Symbol	\
4	Subcomponent Delimitter	&

HL7 v2: Message Type



HL7 v2: Message Type

Segment-ID	Description
ACK	Acknowledgement
ADT	Admission-Discharge-Transfer
BAR	Billing Account Record
DFT	Detailed Financial Transaction
MDM	Medical Document Management
ORM	Order Message
ORR	Order Response
ORU	Observation Result Unsolicite

HL7 v2: Trigger Event

Segment-ID	Description
A01	Patient admission
A02	Patient transfer
A03	Patient discharge
P01	Chance patient
P03	Sending financial transaction
R01	Result

HL7 v2: Message Type & Trigger Event

- Patient admission: ADT^A01
- Sending diagnosis data: BAR^P01
- Sending result: ORU^R01

The number and kind of segments depends on the message type.

HL7 v2: Message Tools

SEQ	LEN	DT	OPT	ELEMENT NAME
1	1	ST	R	Field Separator
2	4	ST	R	Encoding Characters
3	180	HD	O	Sending Application
4	180	HD	O	Sending Facility
5	180	HD	O	Receiving Application
6	180	HD	O	Receiving Facility
7	26	TS	O	Date/Time Of Message
8	40	ST	O	Security
9	7	CM	R	Message Type