COMP3342:
Health Systems Interoperability and Integration

Interoperability Data Exchange Standards

Time: Mon/Wed : 14:00-15:20 Location: Masri304 Section: 1

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Birzeit University

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

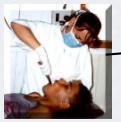
Medical Terminologies: Coding Standards

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

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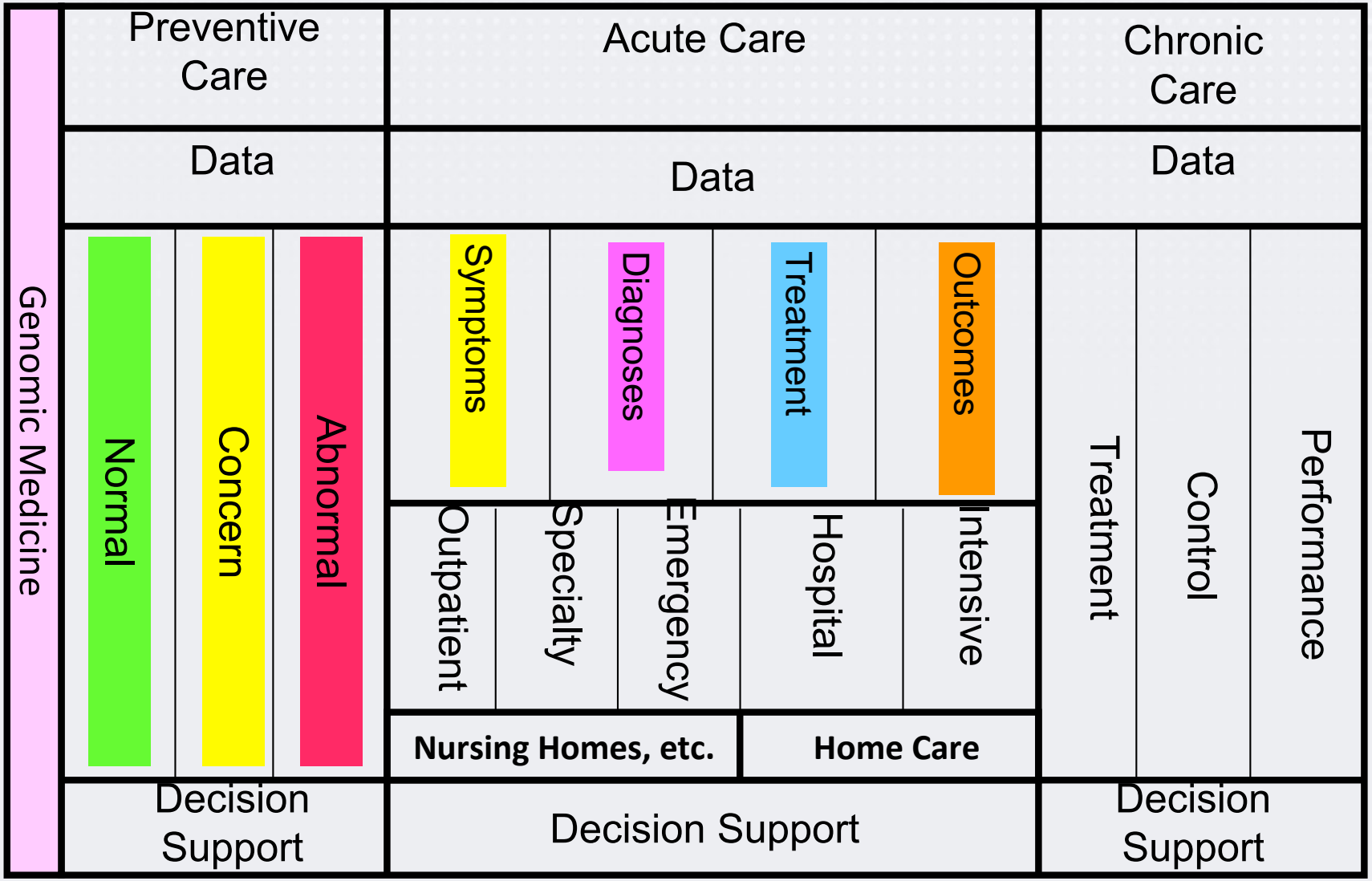
Interoperability Standards

Data exchange standards

A view of the healthcare world



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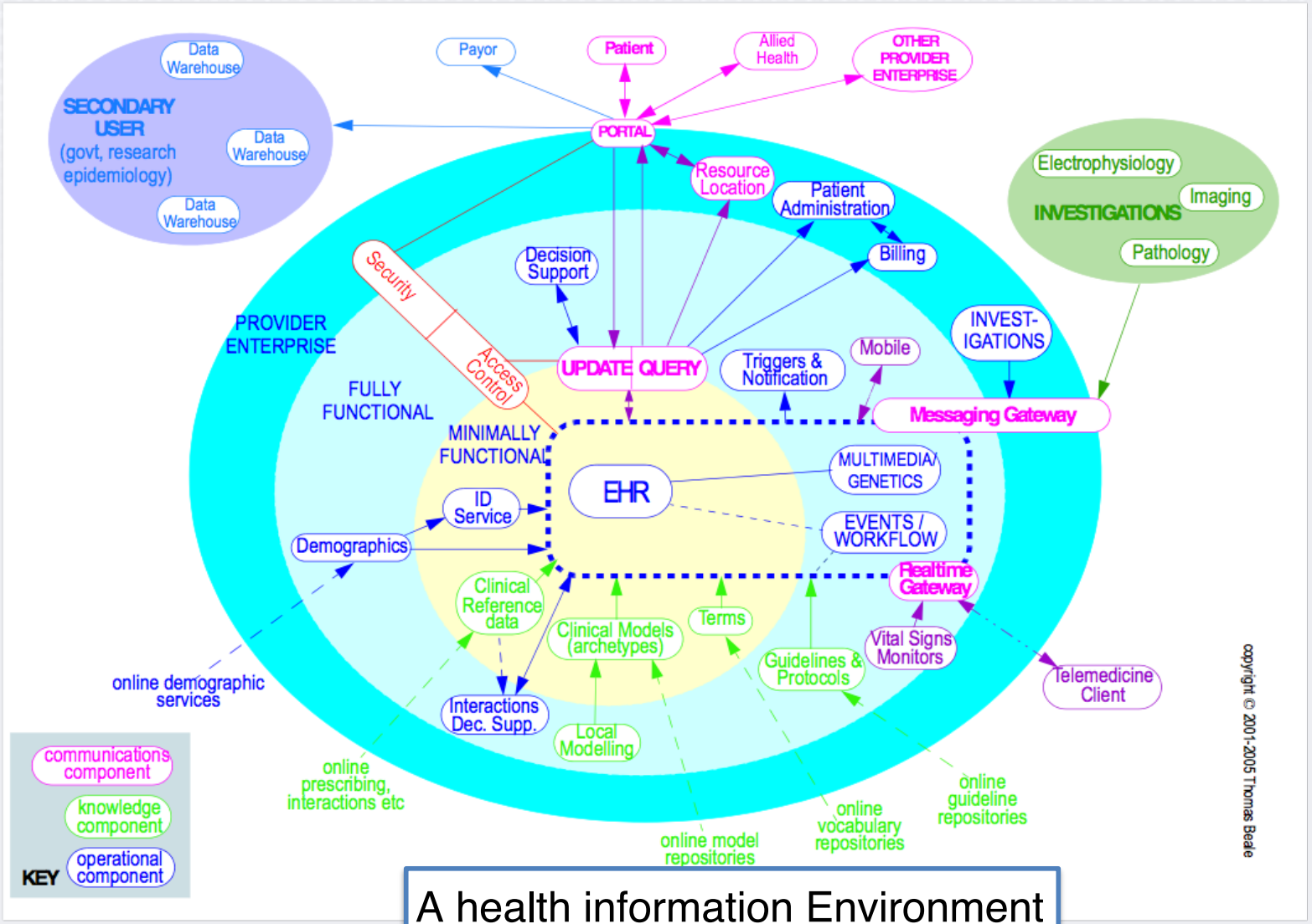
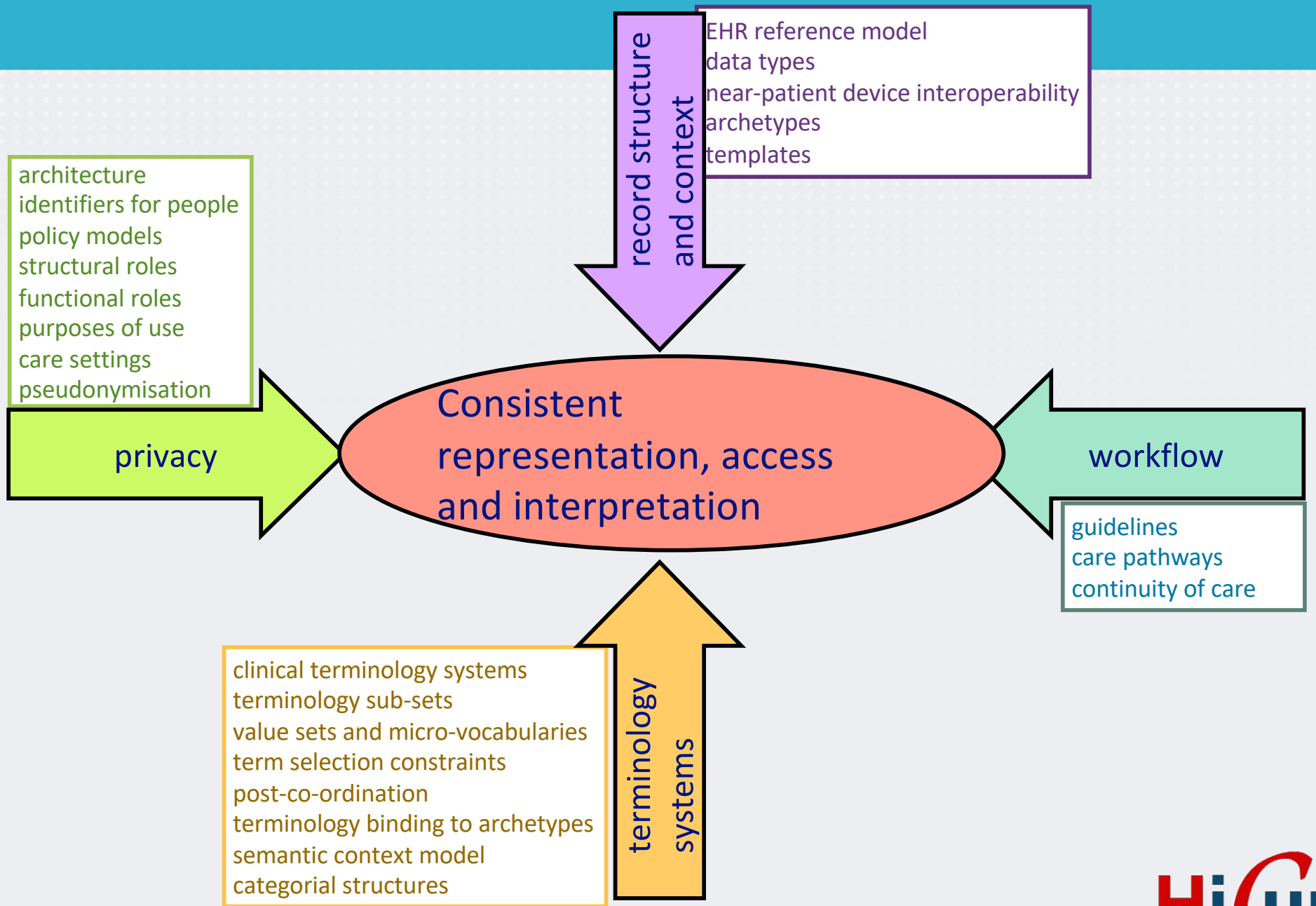
Health Information Environment



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

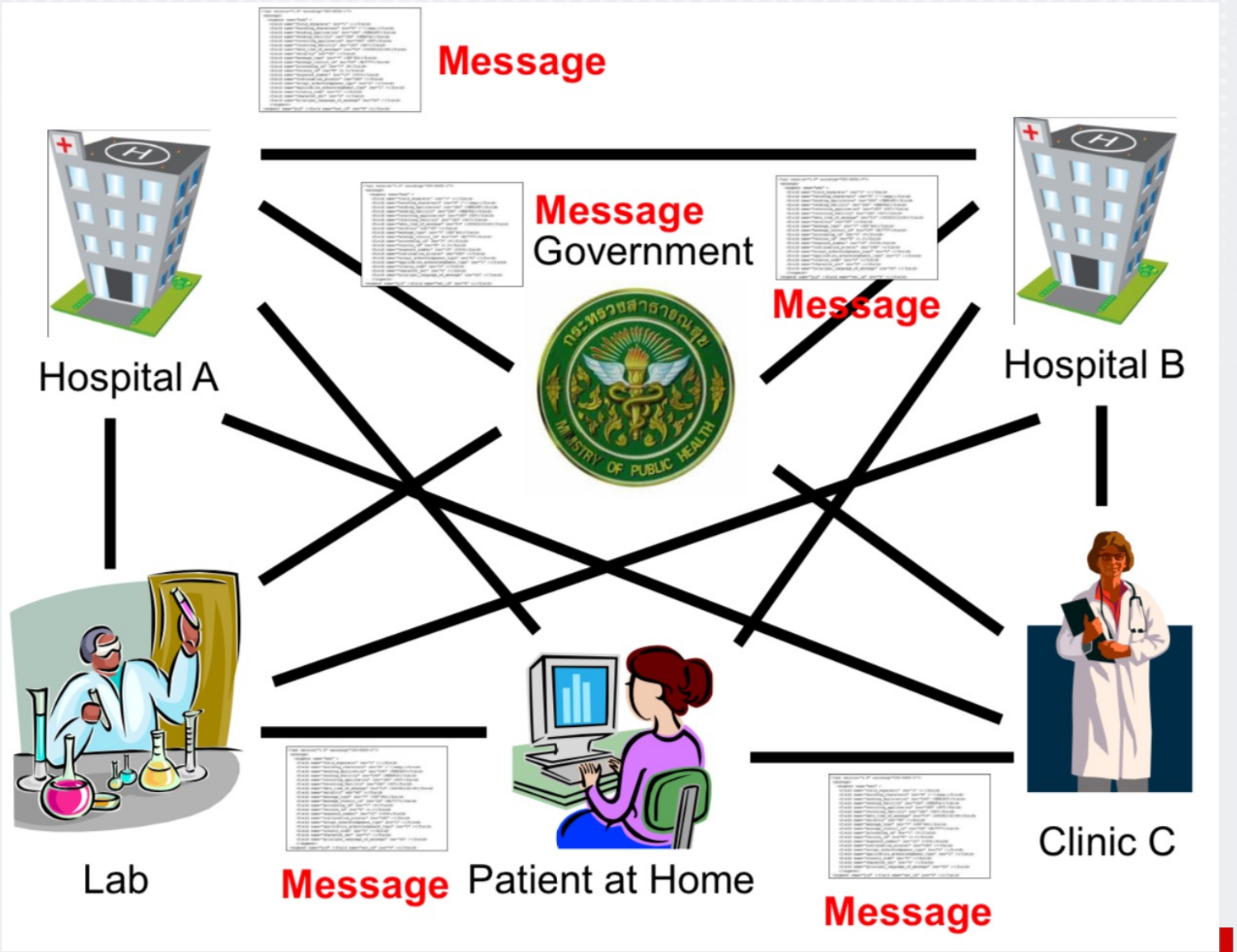
Message Exchange

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

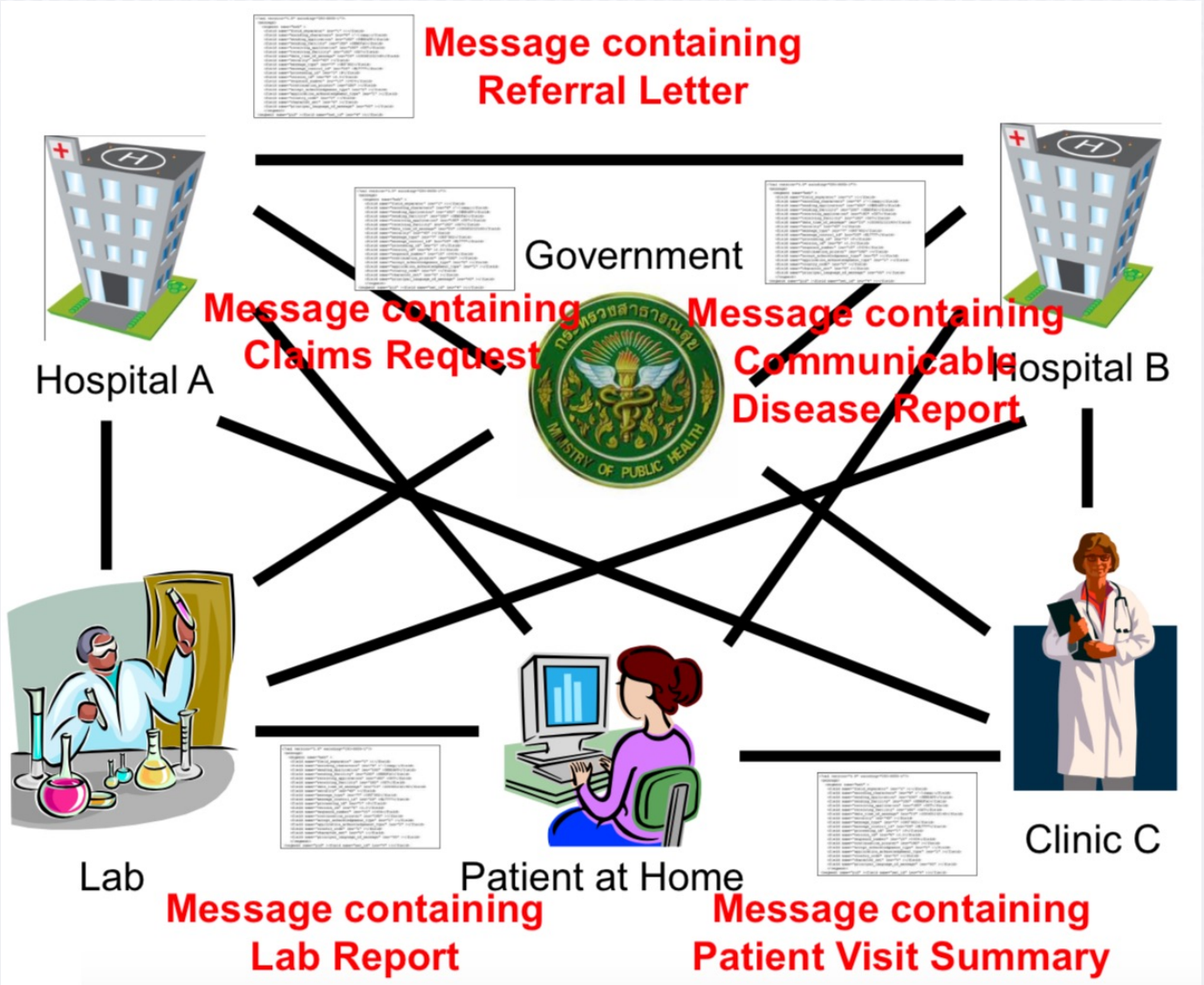
Document Exchange

- 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

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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.

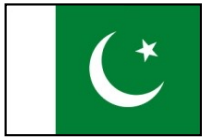
More than 55 HL7 International Affiliates / Countries


Argentina


Romania


Puerto Rico


Philippines

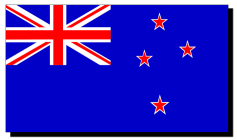

Pakistan


Norway


Australia


Russia

And growing


New Zealand


Austria

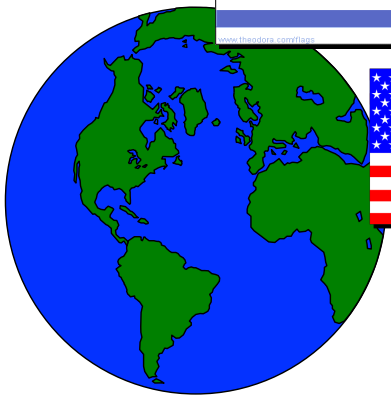

Singapore


Malaysia

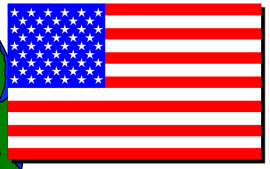
Uruguay

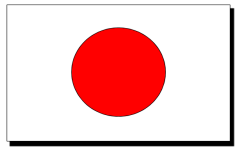

Bosnia and Herzegovina


South Korea



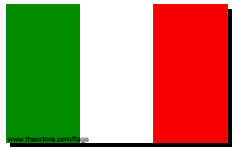
United States



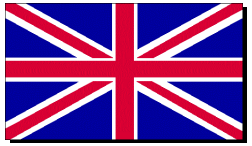

Japan


Brazil


Spain


Italy

Sweden

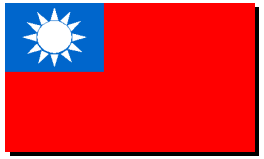

United Kingdom


India

Canada

Switzerland

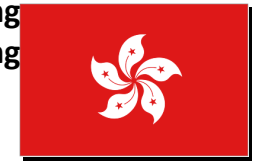
Taiwan



The Netherlands

Turkey

Hong Kong

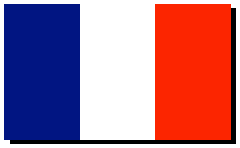



China


Croatia


Czech Republic


Finland


France


Germany

Greece

Health Level Seven (HL7)

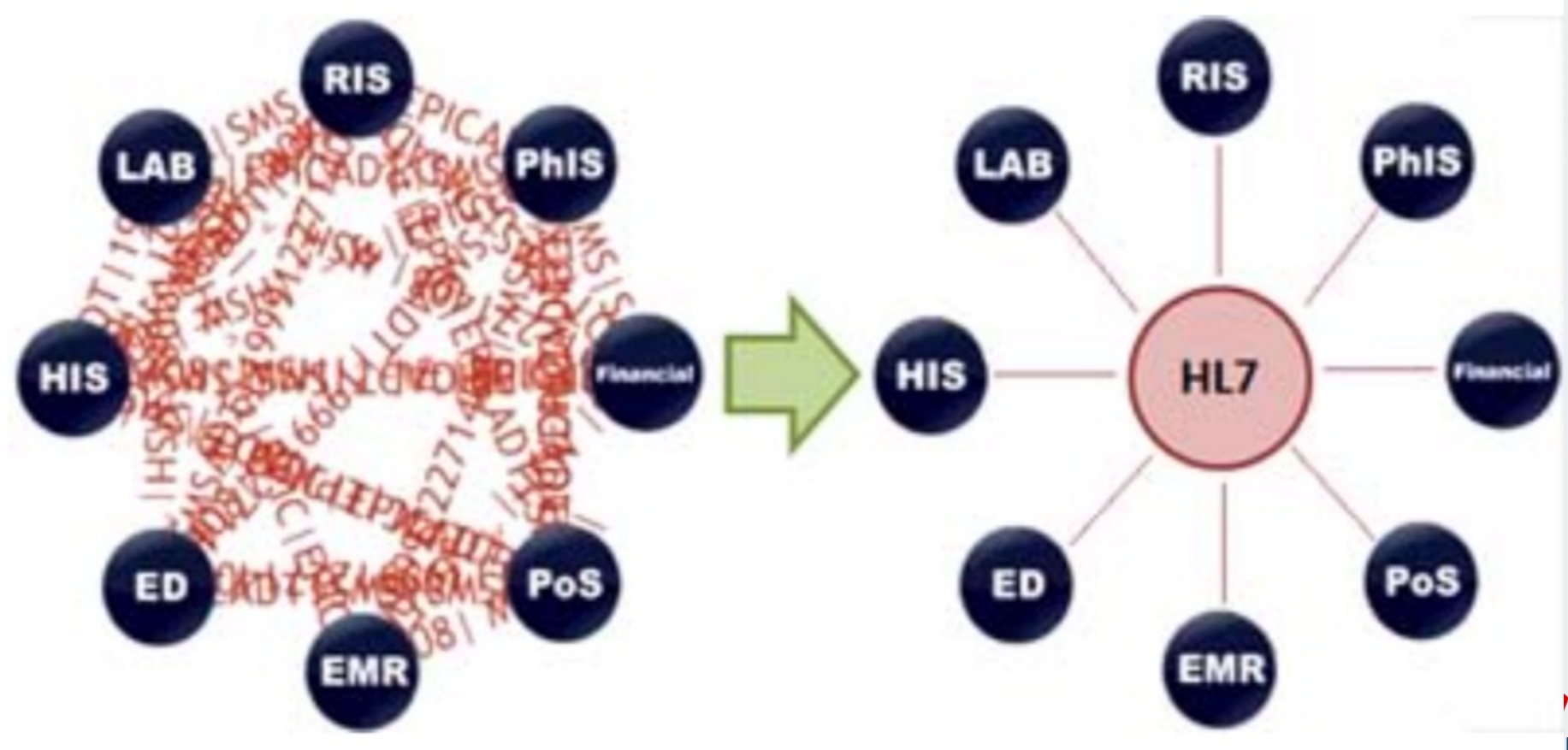
- HL7 refers to
  - the seventh level of the International Organization for Standardization (ISO) seven-layer communications model for Open Systems Interconnection (OSI) - the application level.
- HL7 provides standards for interoperability with aims to
  - improve care delivery, optimize workflow, reduce 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

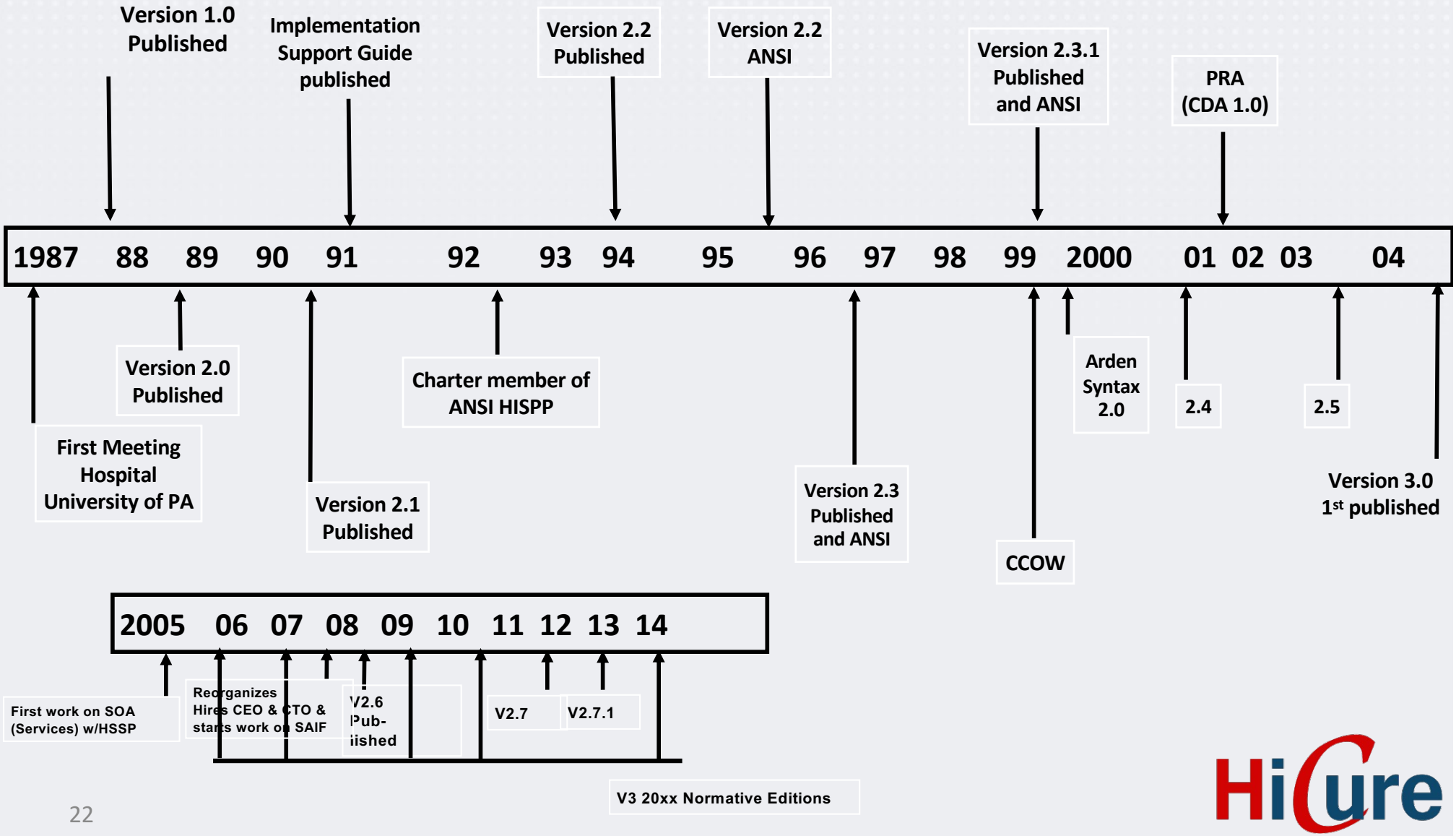
- Clinical Messaging exchange Standards (e.g., HL7 v2.x and v3.0).
  - Very important-they define how healthcare information is packaged and communicated from one party to another.
- Clinical Conceptual Standards (e.g. HL7 V3 RIM): they define **structure** of the clinical **content** (of messages and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

- HL7 enables exchanges of medical data between both health systems within the same health organisation and across different health organisations



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

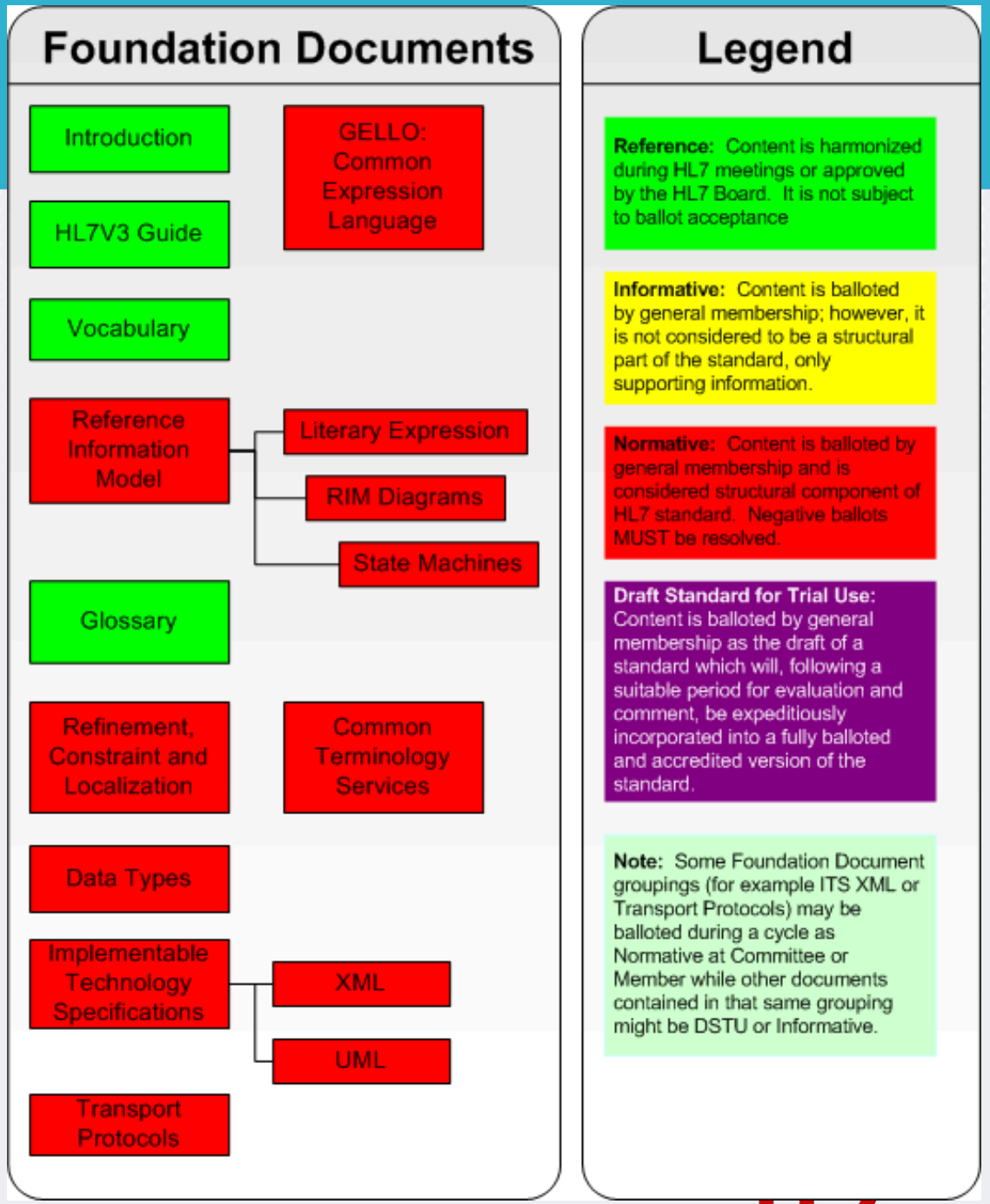
- First widely used version 2.1 published in **1991**
- Used in **>90%** provider organisations in the US and widely supported by vendors in Europe.
- Generally requires bi-lateral negotiations between communicating parties.
- Backwards-fitted (opposite strategy/approach for V3 HL7 International Reference 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

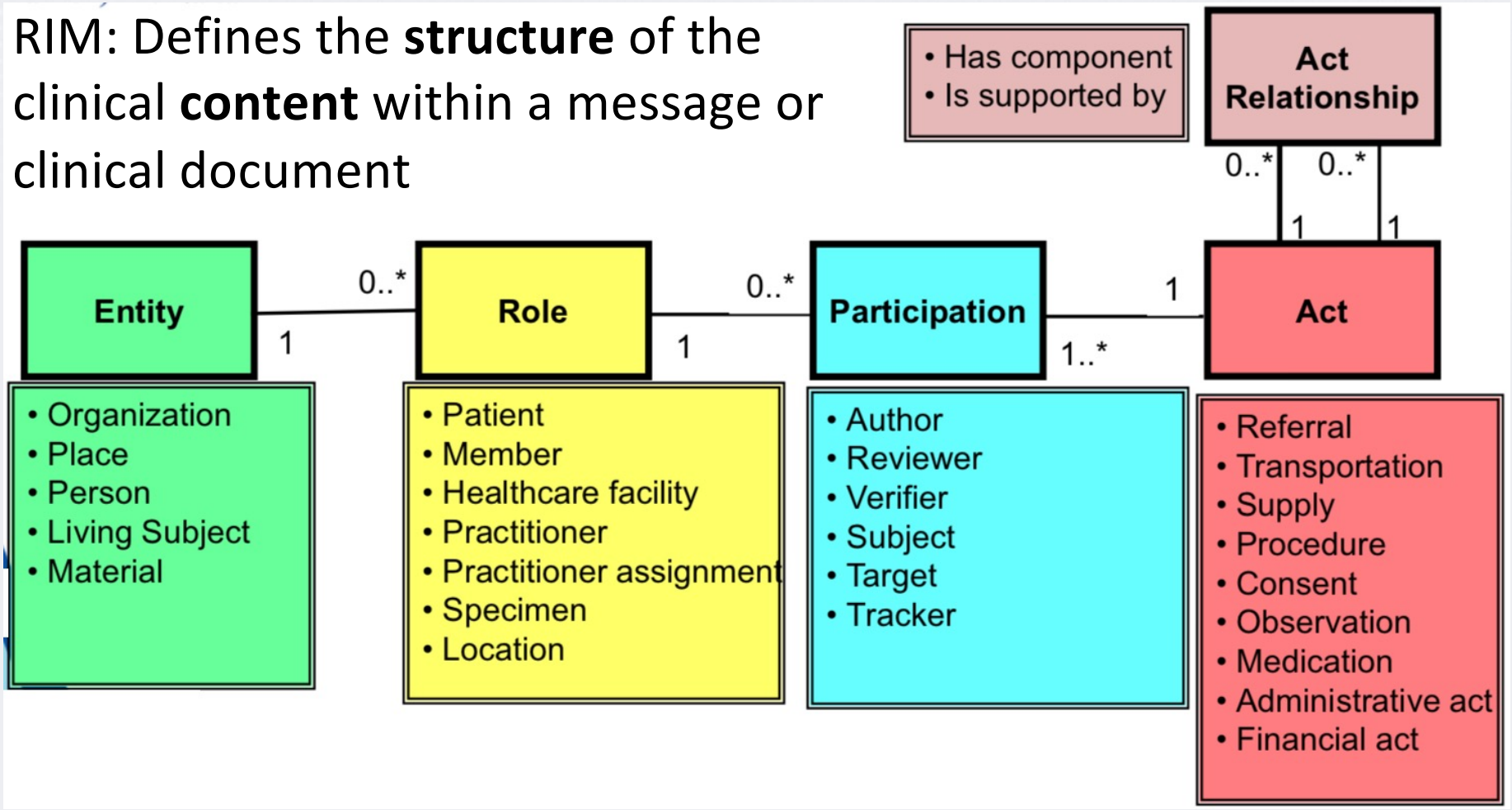
First approved for publication in September, 2004.

Usable version Published in 2010

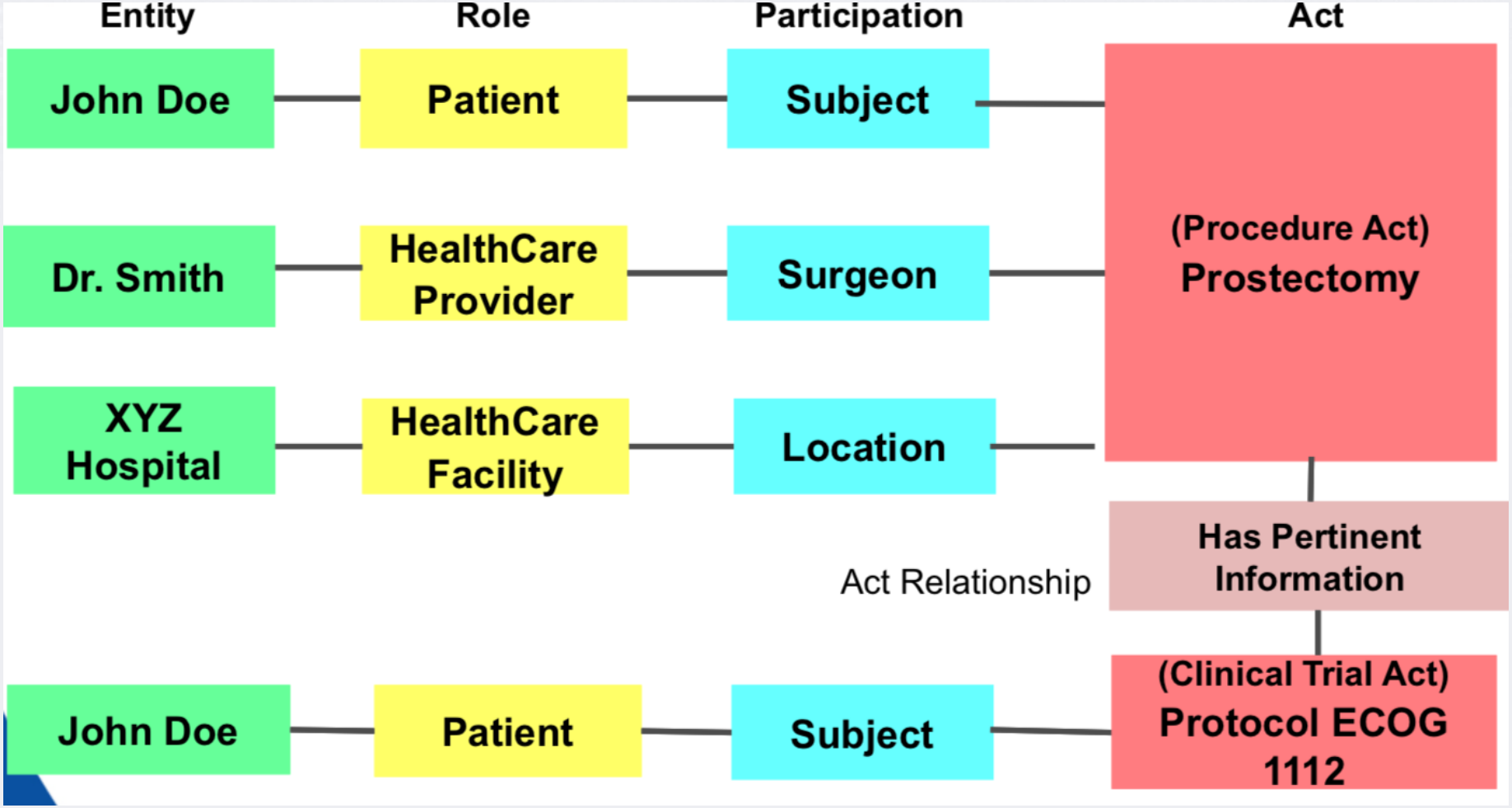


HL7 V3: Reference Information Model (RIM)

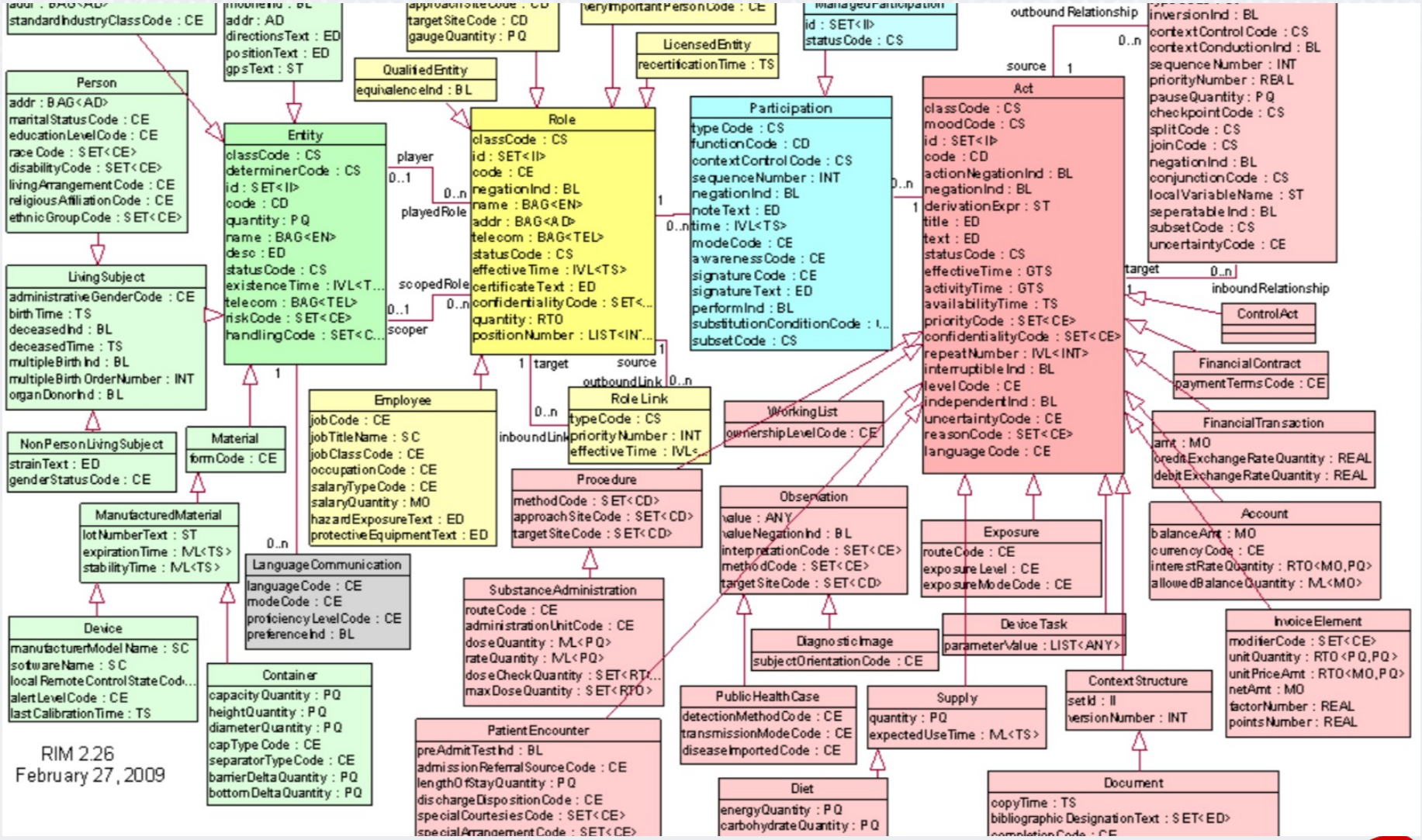
RIM: Defines the **structure** of the clinical **content** within a message or clinical document



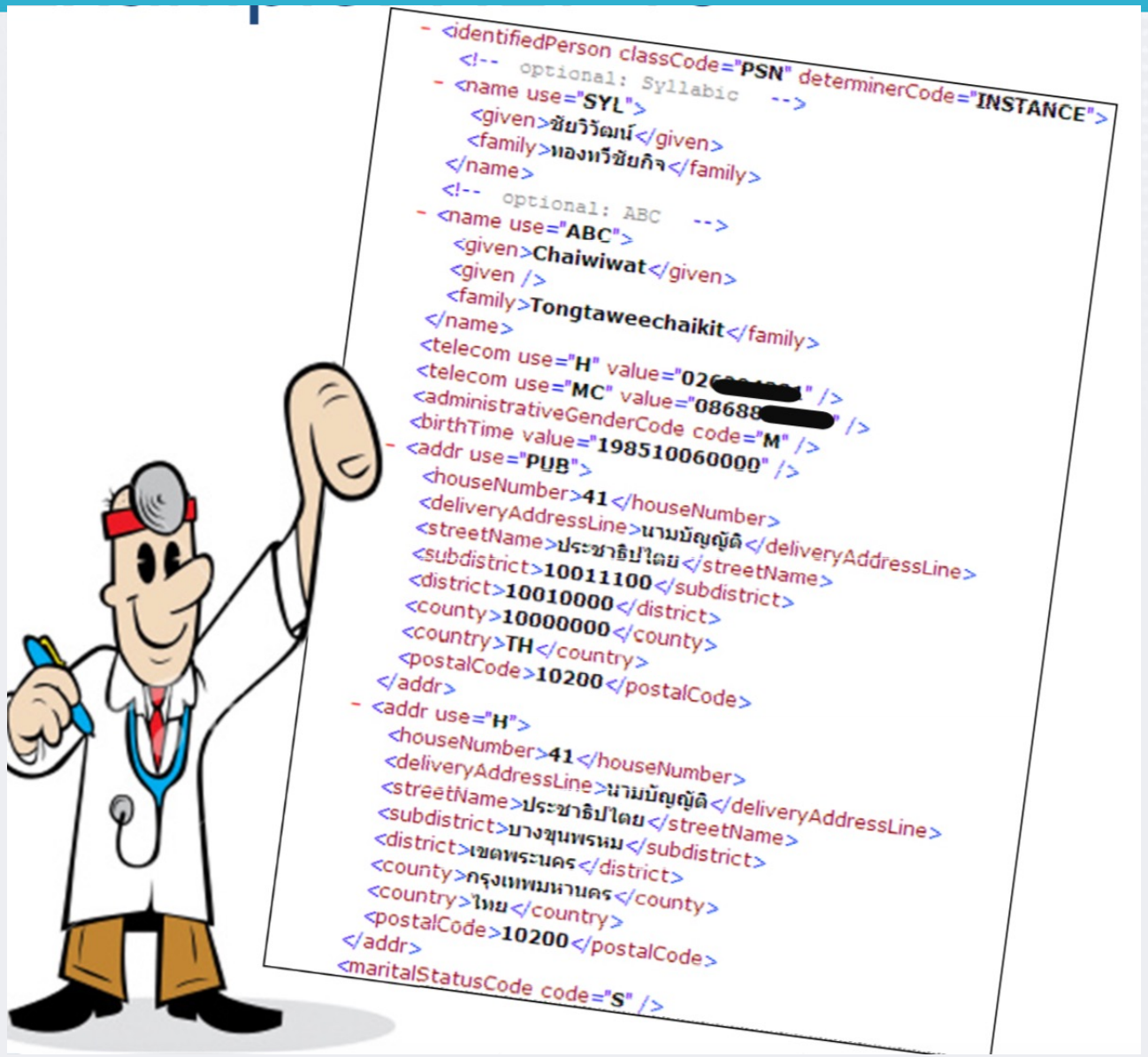
HL7 V3: RIM UML Instance: Example



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>
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    <streetName>ประชาธิปไตย</streetName>
    <subdistrict>10011100</subdistrict>
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    <county>10000000</county>
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- <addr use="H">
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    <country>ไทย</country>
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  </addr>
  <maritalStatusCode code="S" />
```
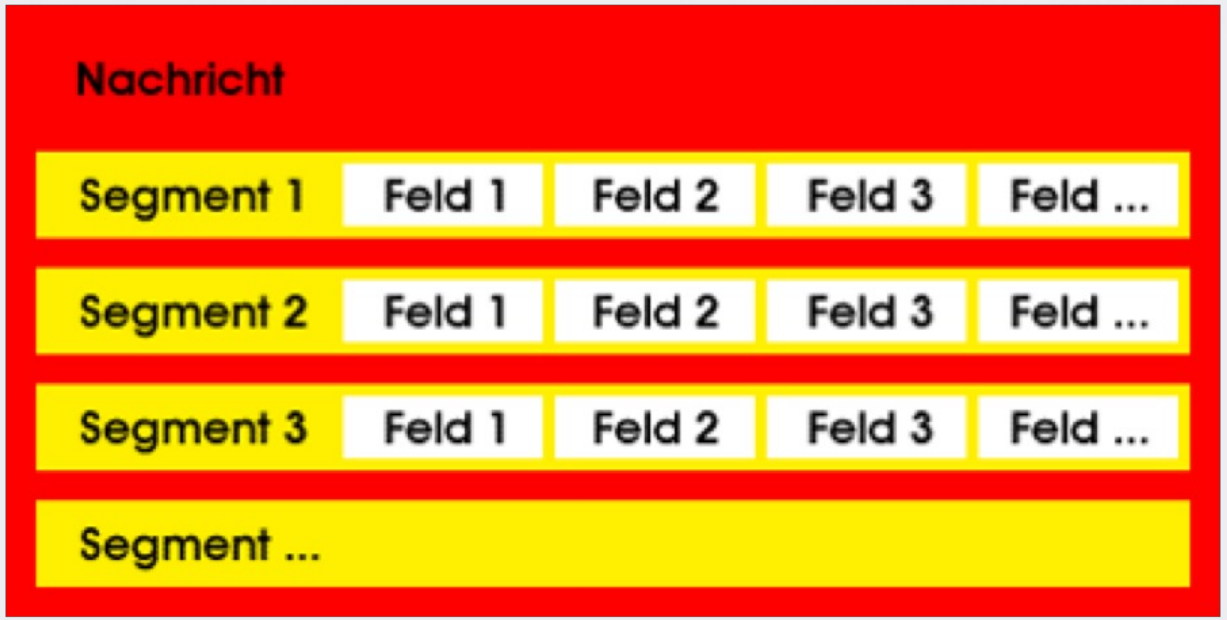
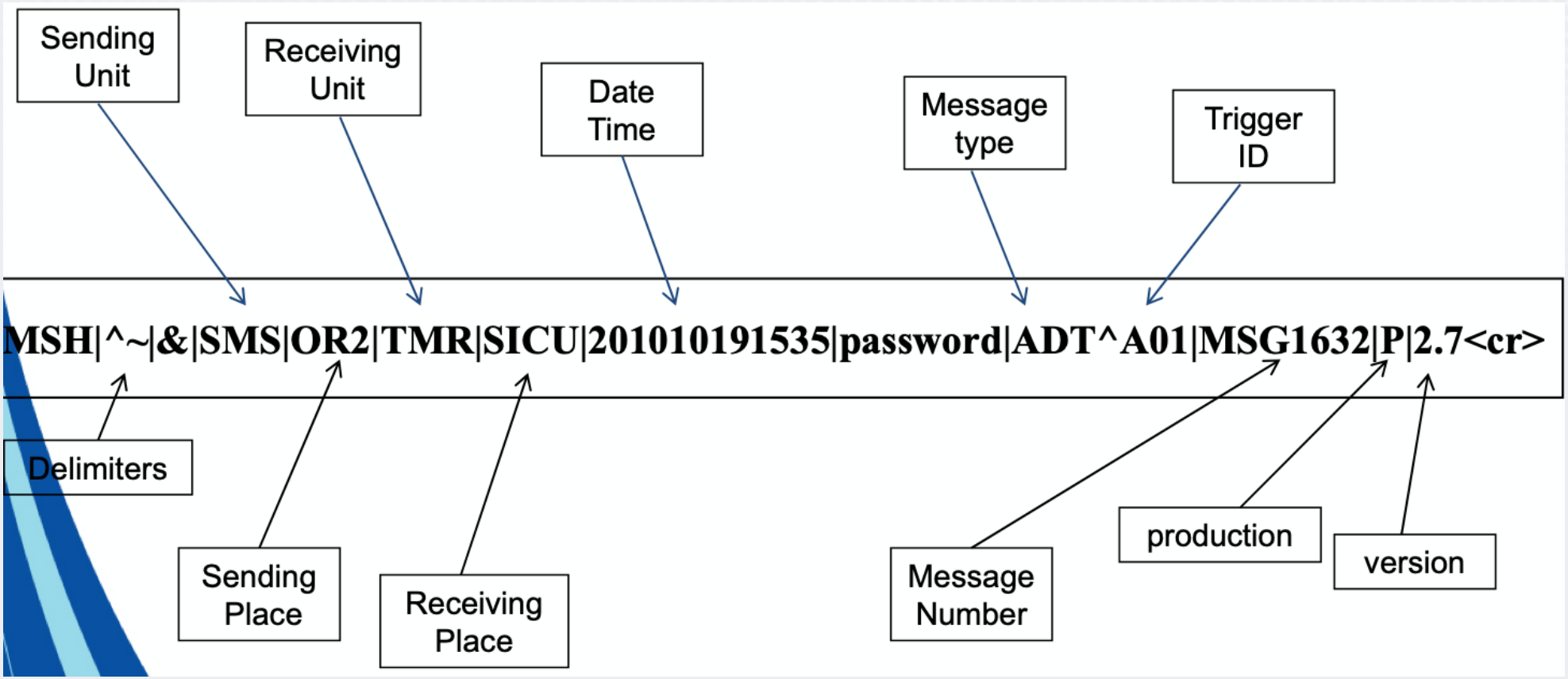

HL7 v2: Message Structure

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



HL7 v2 Message Segment Header



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

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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

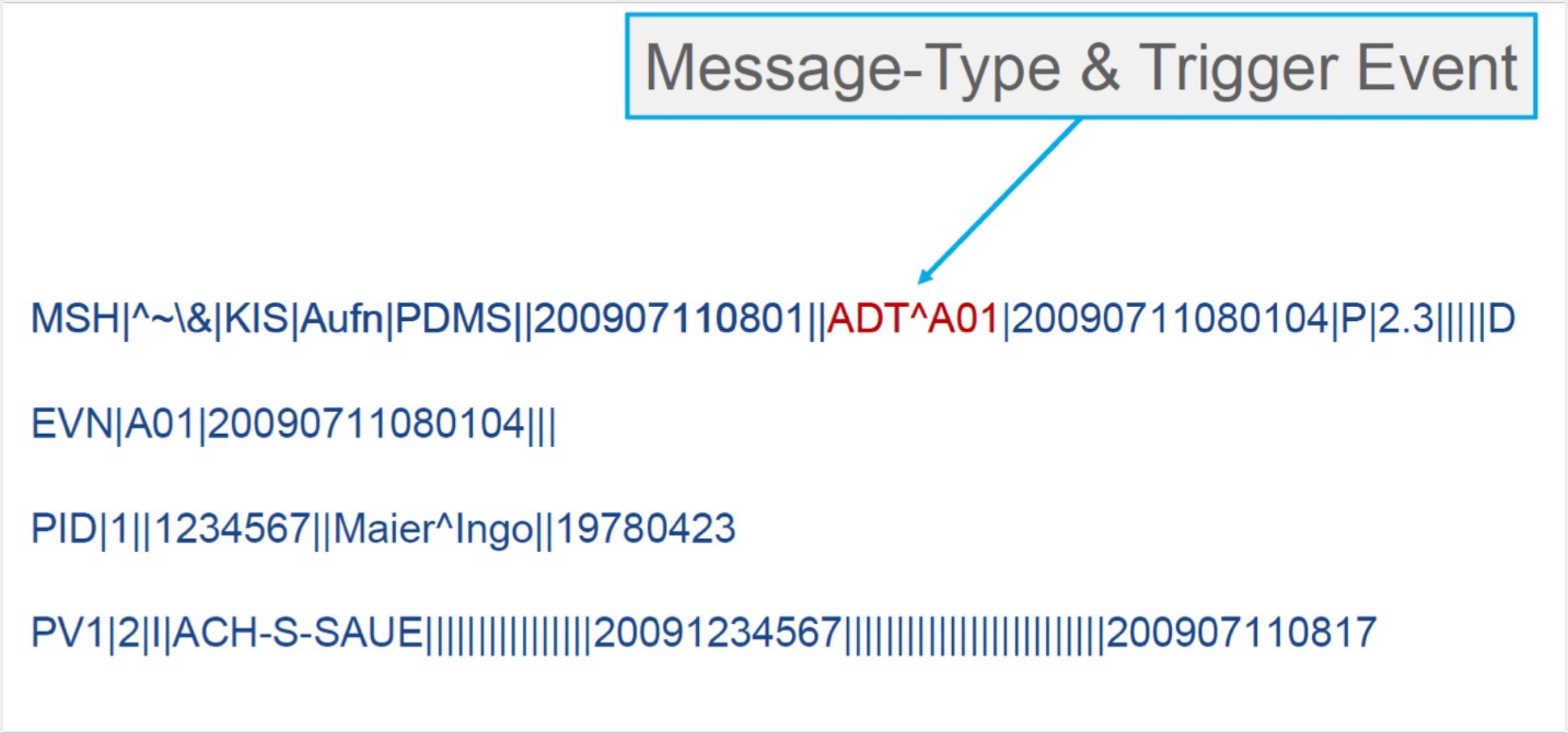
Segment-ID	Description
MSH	Message Header
EVN	Event
PID	Patient Identification
PV1	Patient Visit
OBR	Observation Request
OBX	Observation Result
DG1	Diagnosis
PR1	Procedure
FT1	Financial Transaction

HL7 v2: Segment - Delimiter

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.

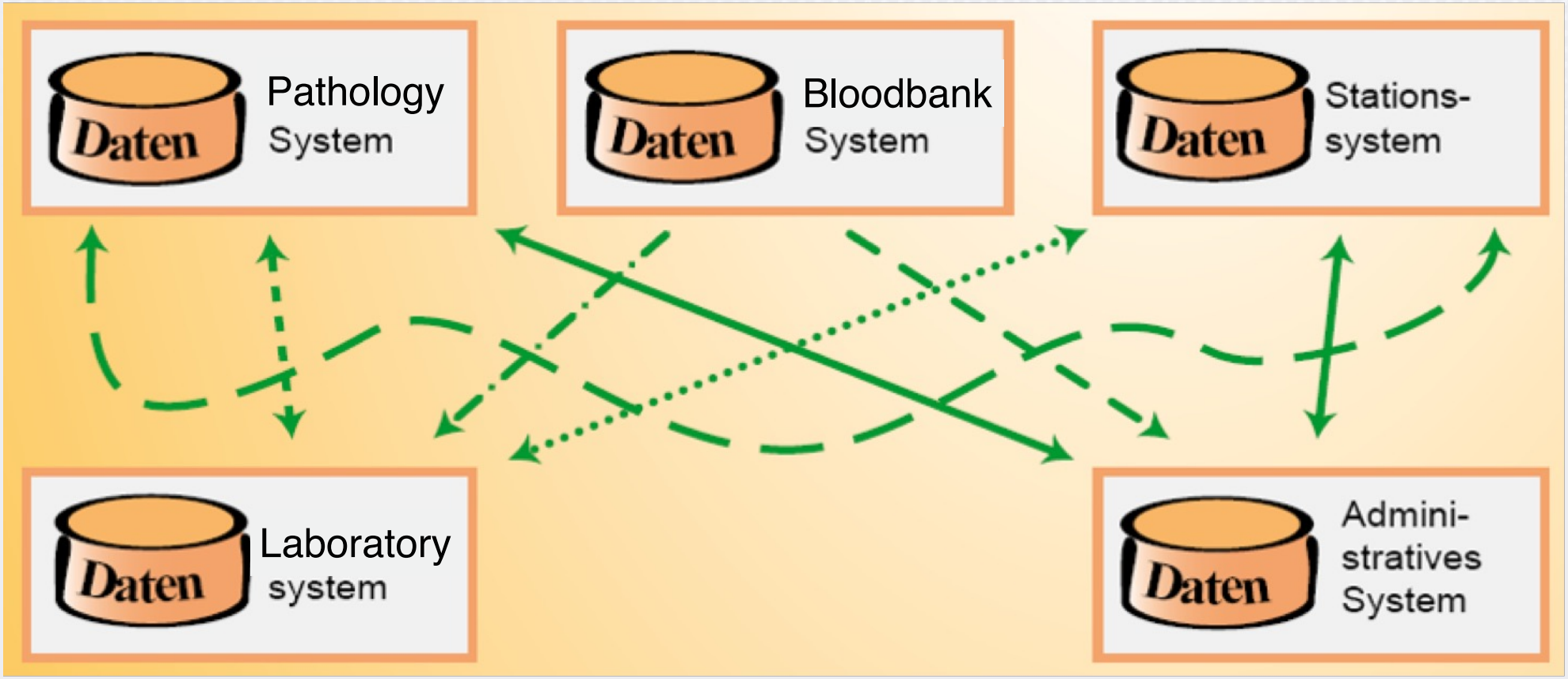
HL7 v2: Message Tools

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

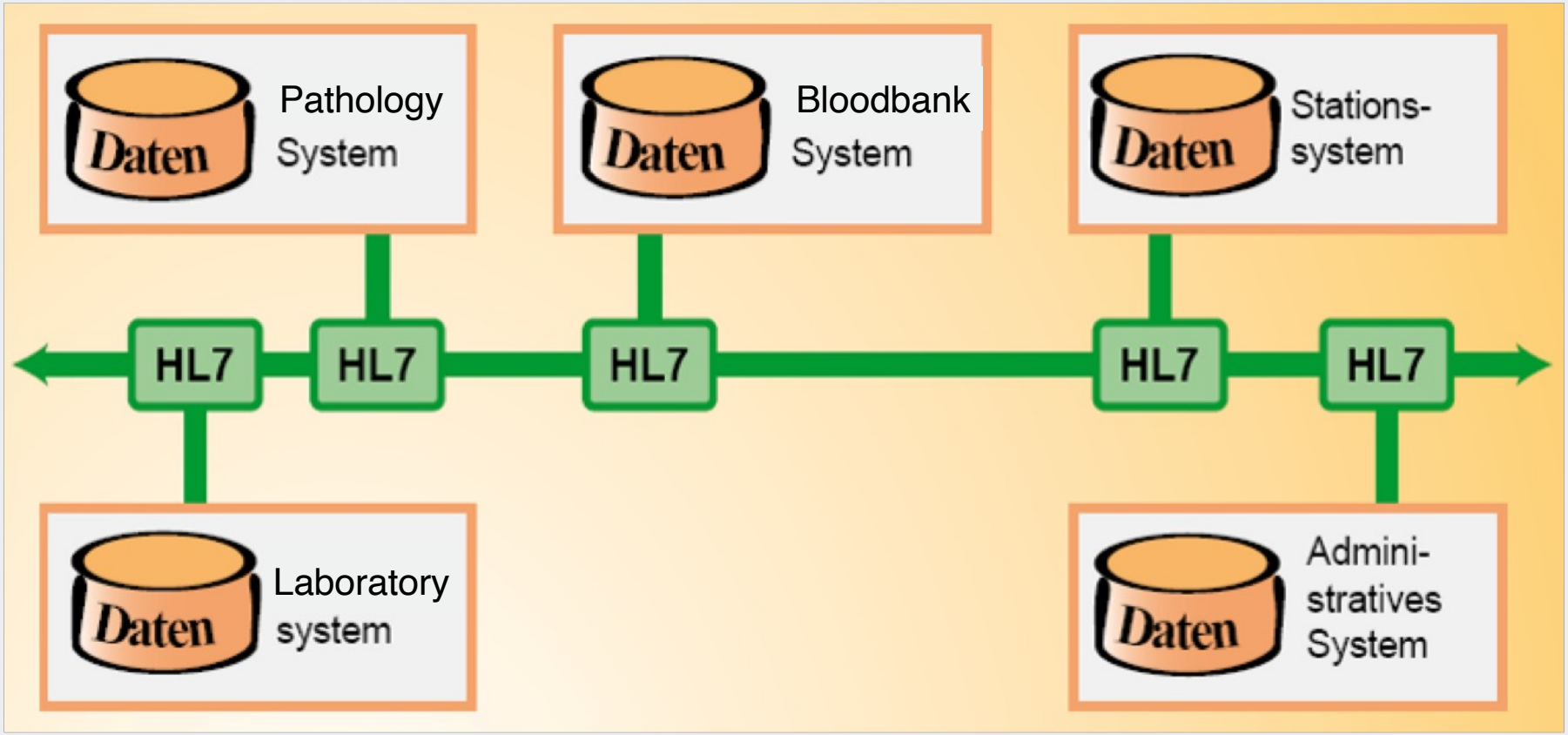
Communication interoperability Server

Mirth Connect (NextGen)

Communication without HL7



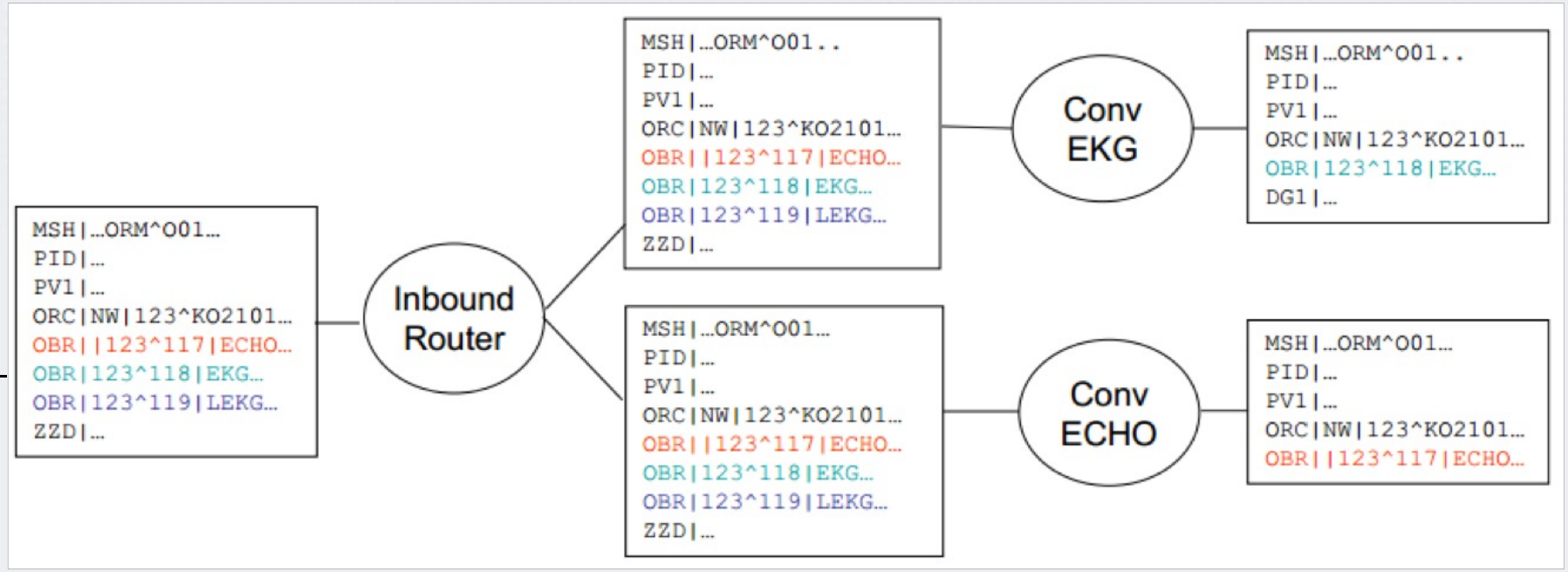
Communication with HL7



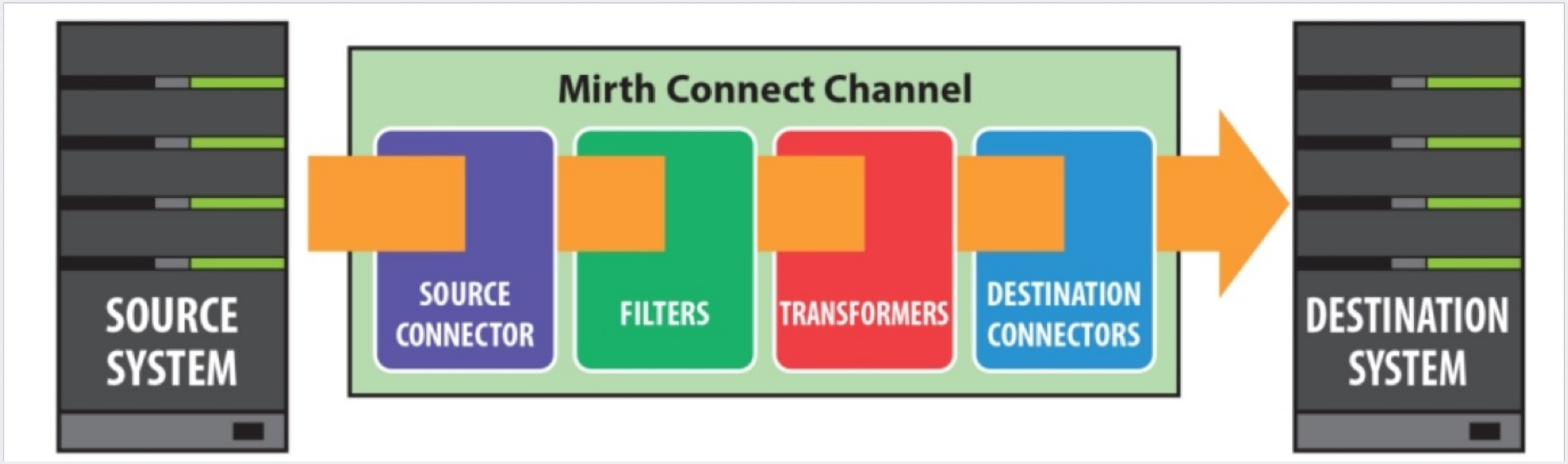
Mirth Connect Server

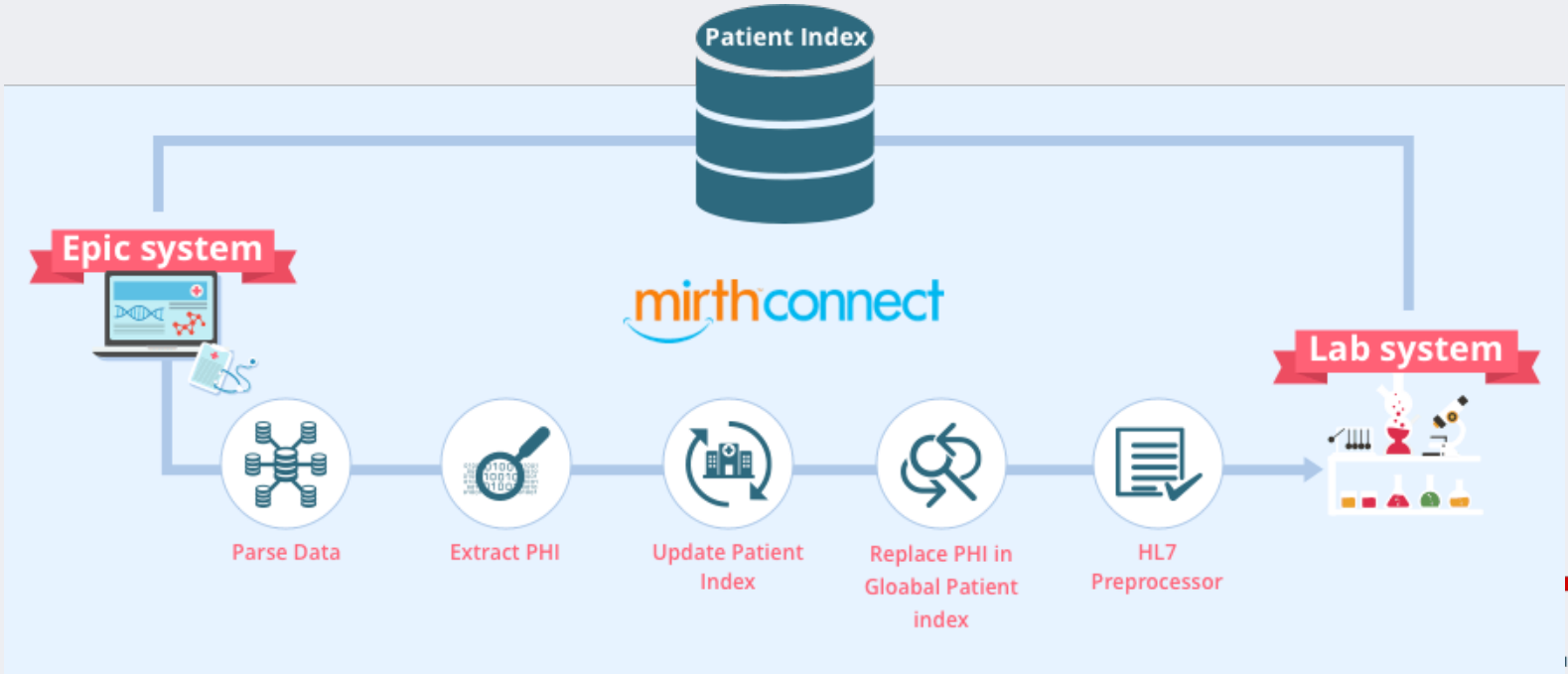
– v

Communication Server

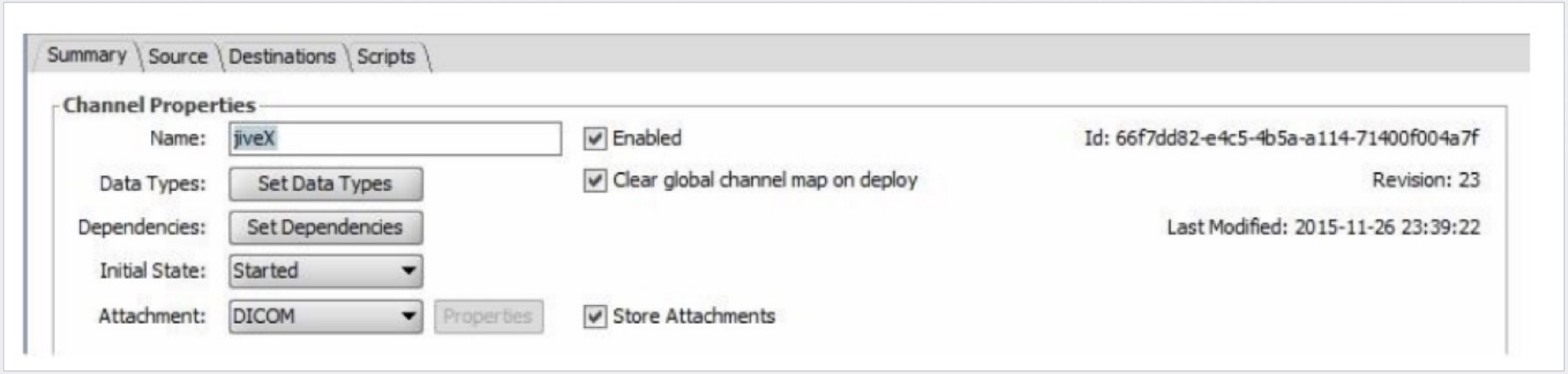


Mirth Connect Server

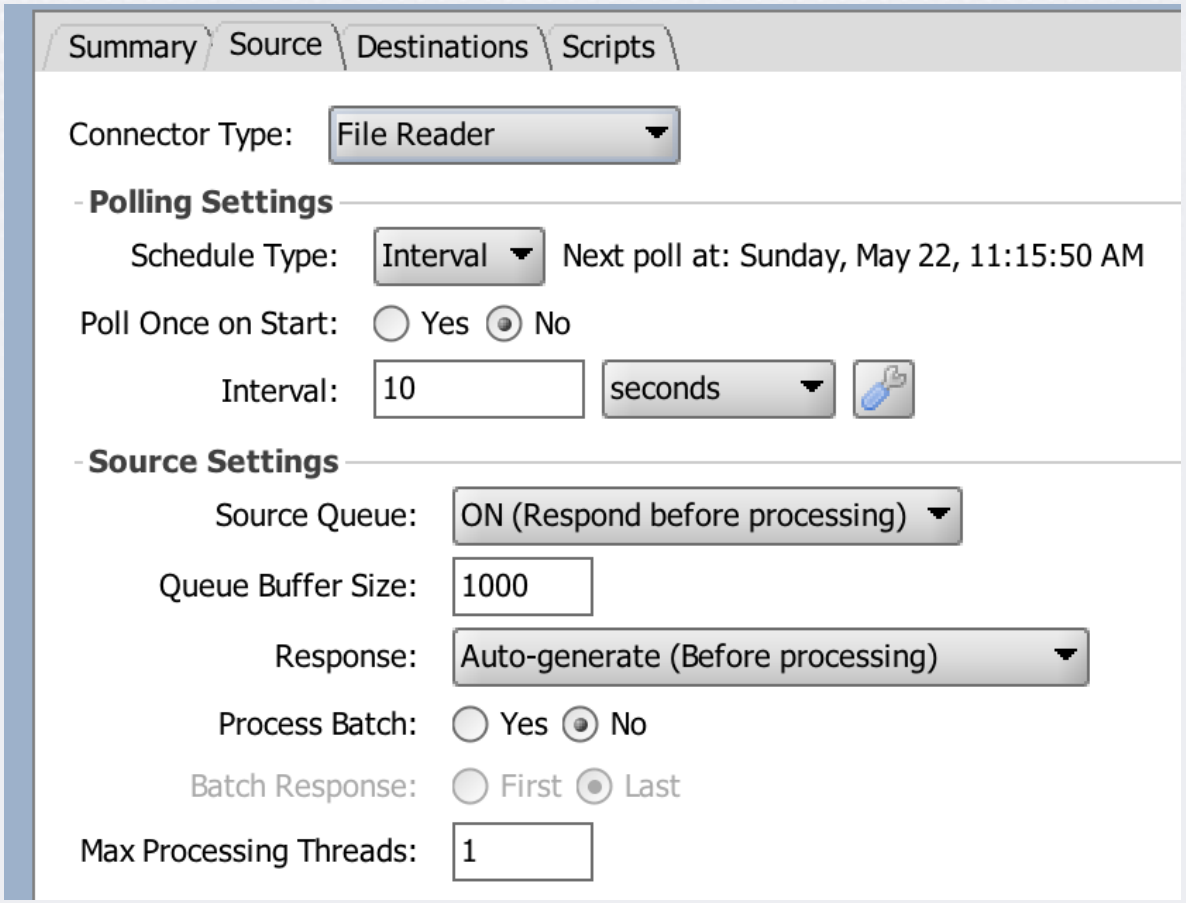


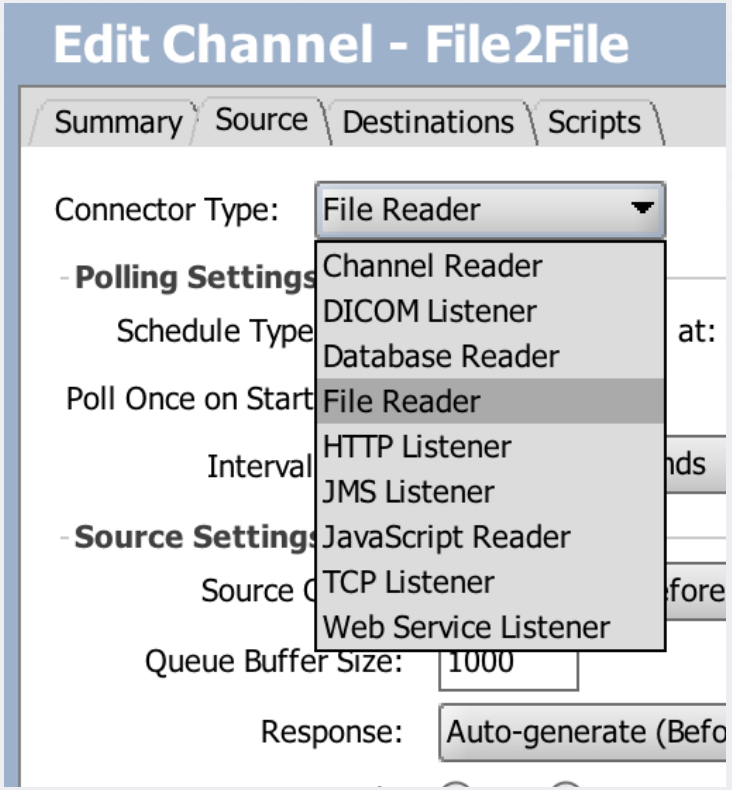


Mirth Connect: Creating a Channel

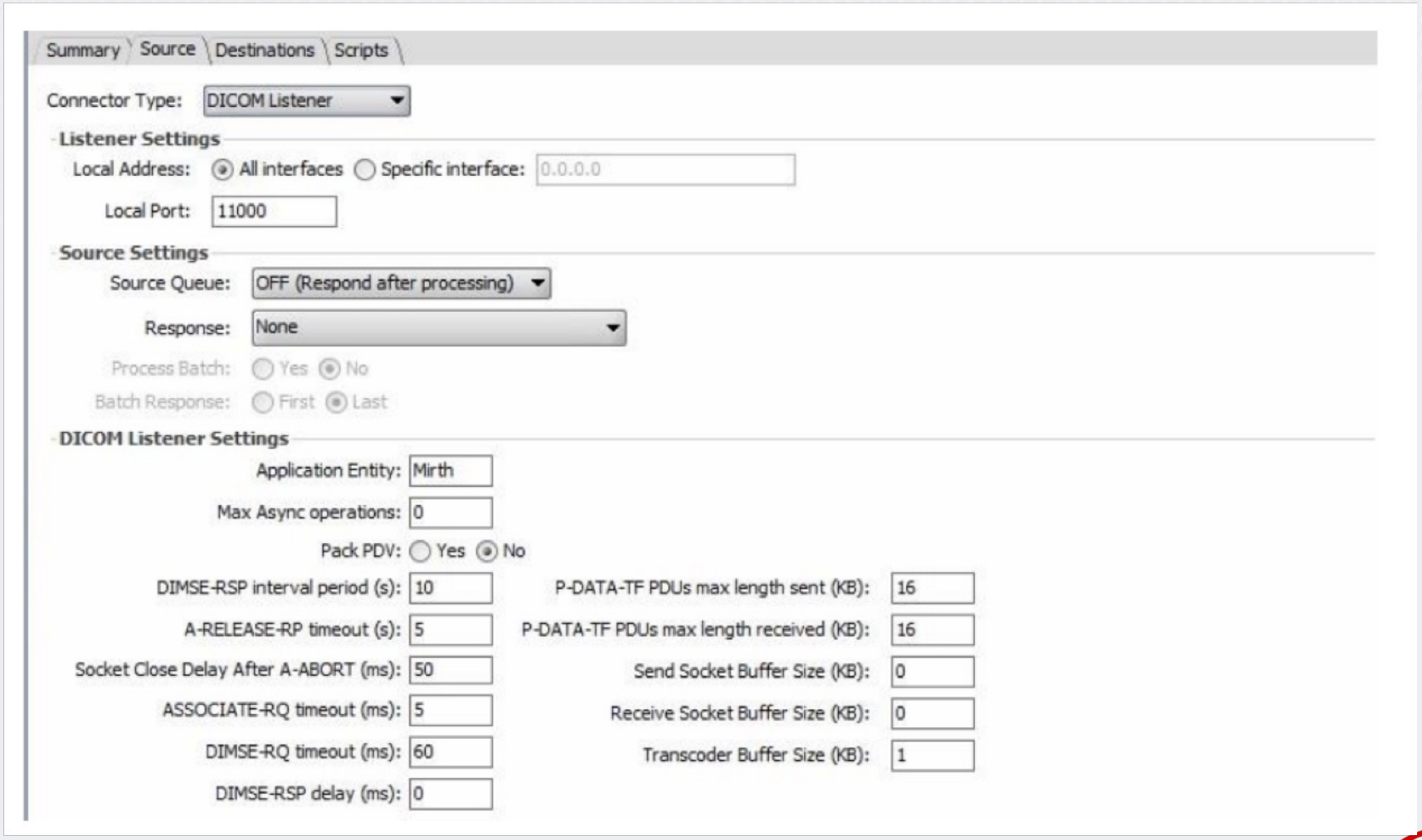


Mirth Connect: Specify Source

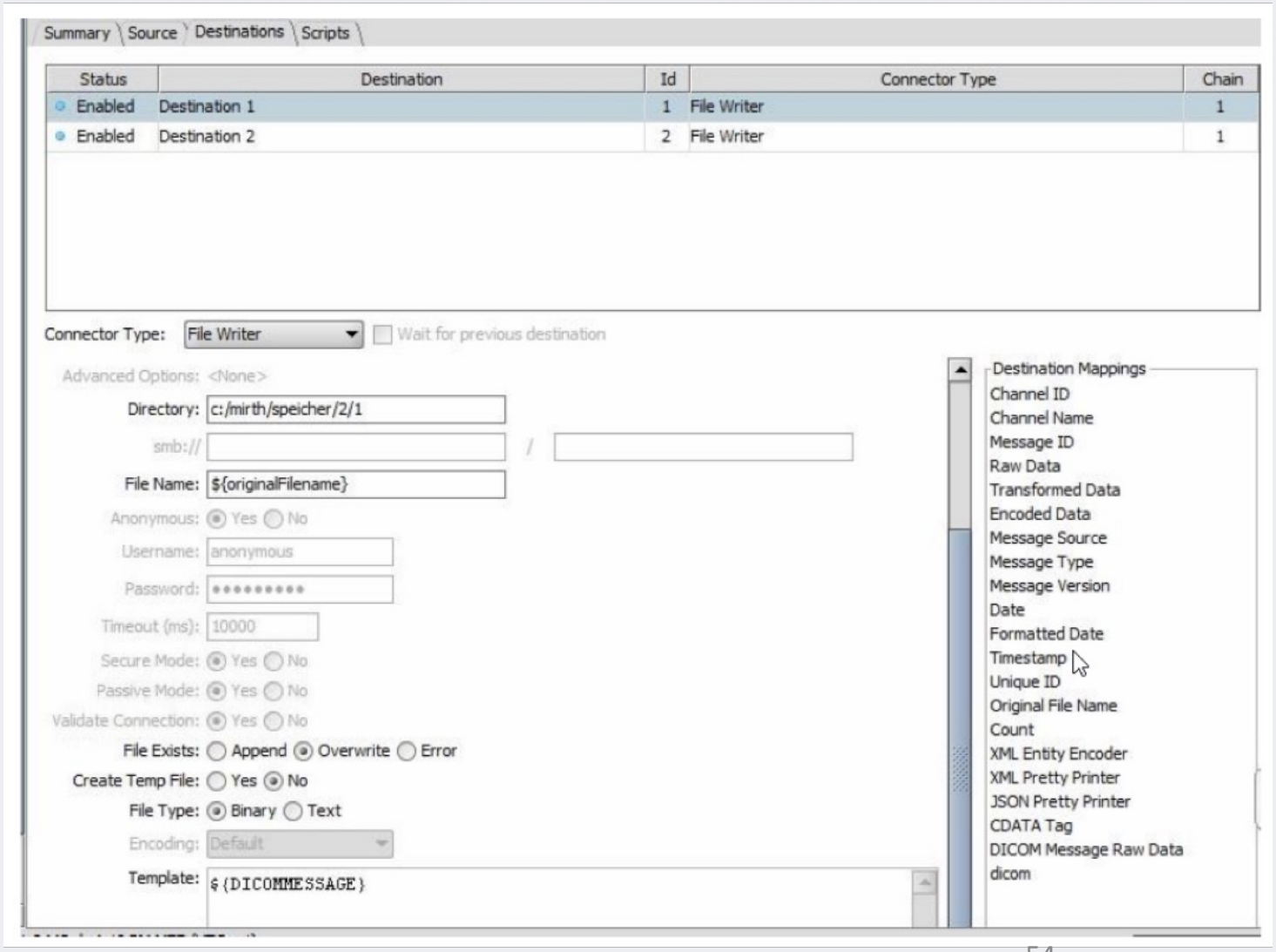




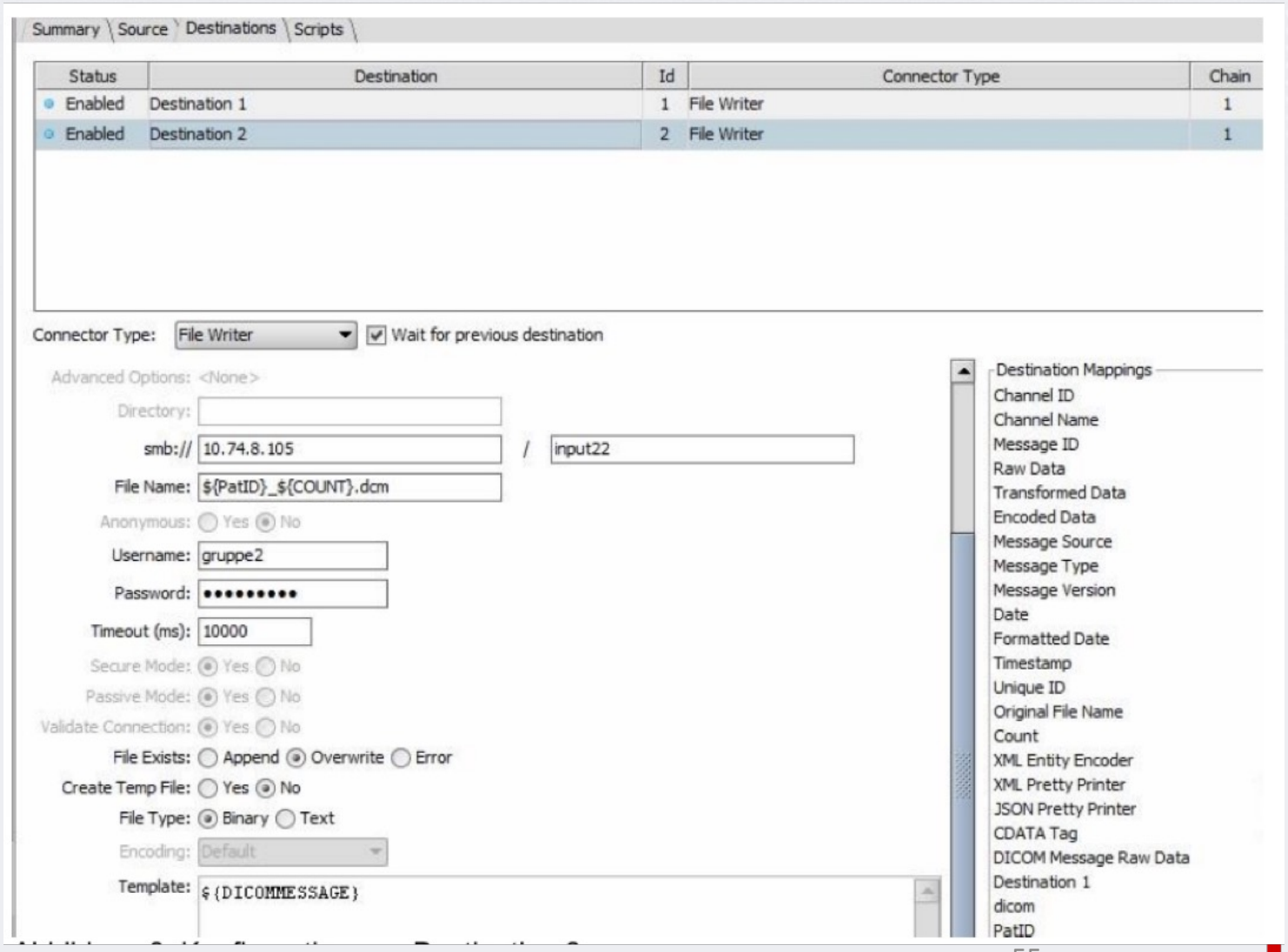
Mirth Connect: Specify Source



Mirth Connect: Specify Destination(s)



Mirth Connect: Specify Destination(s)



Exchange Standards: Document exchange

HL7v3-Clinical Document Architecture (CDA)

HL7: Exchange Standards

HL7 Versions

- HL7 Version 2.x messaging
- HL7 Version 3 messaging
- HL7 Clinical Document Architecture (CDA)
- HL7 Fast Healthcare Interoperability Resources (FHIR)

Exchange is a Need in Healthcare

Vast amounts of patient data collected through direct clinical interactions

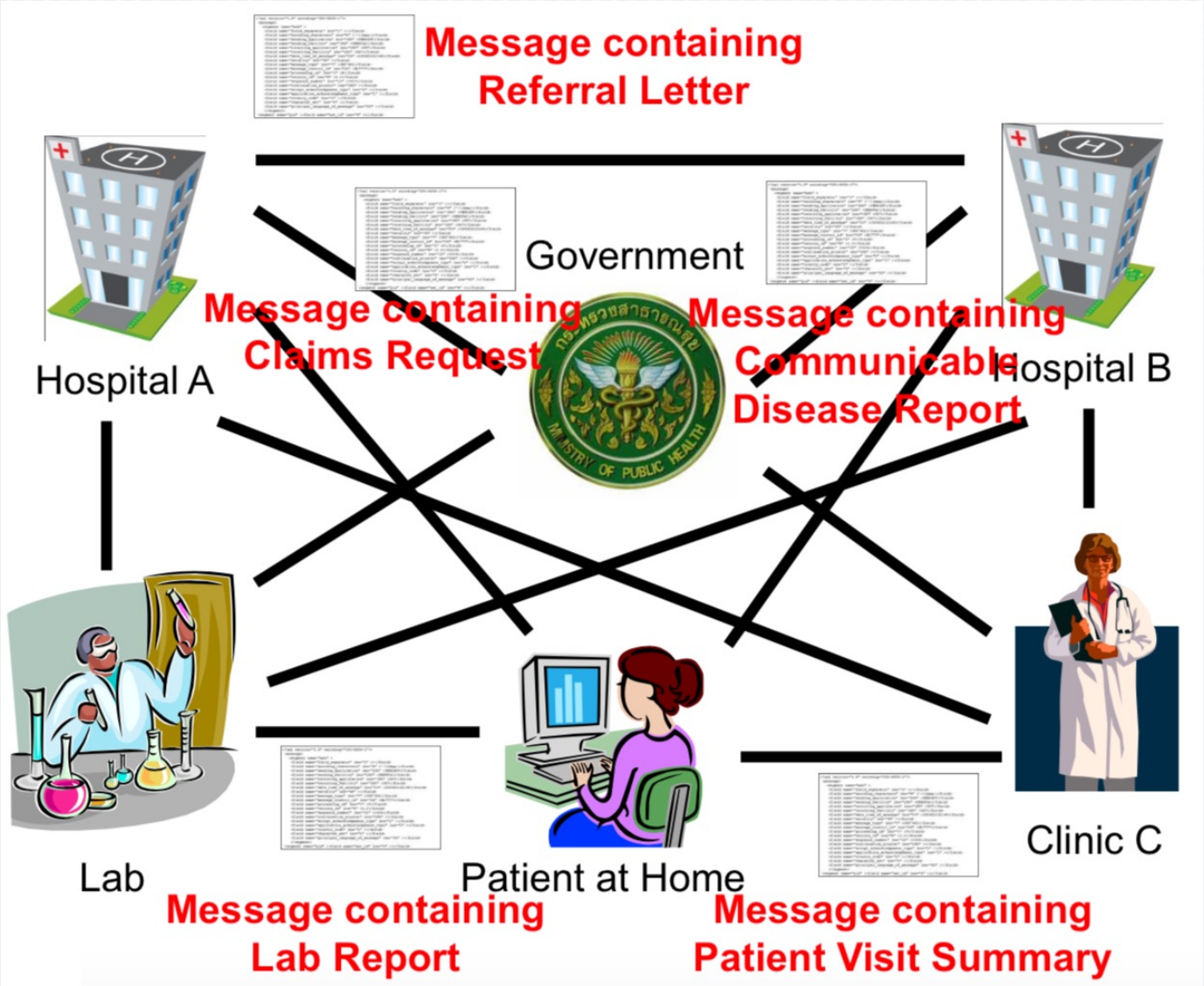
Medical information such as vitals, orders, prescriptions, discharge summaries, etc. dictated or recorded by hand

All of this clinical data was stored as paper records (documents) at each point of care

If patient health records needed to be shared between providers, they usually required manual exchange (e.g. fax, "snail mail")

- Coordination of care between providers slow, costly; patient outcomes inconsistent
- Duplicative healthcare services (e.g. labs imaging) frequent

Clinical Document Exchange



Clinical Documents

THE MEDICAL CENTER OF CENTRAL MASSACHUSETTS

EMERGENCY

MEDICAL RECORD COPY

Ex. A-1

ROOM:

PT'S LAST NAME	FIRST	MIDDLE	MAIDEN NAME	SEX	R	AGE	ACCOUNT NO.	MED. REC. NO.
Thomas				M	C	43Y	9062373	~~804292~~

PT'S ADDRESS	ZIP	PHONE NO.	MAR	DATE OF BIRTH	SOCIAL SECURITY NO.	F/C
9 Crescent St Shrewsbury MA 01545		000000	X	09//27/49	014409215	B

PT'S EMPLOYER	EMPLOYER'S ADDRESS	CITY	STATE	ZIP	PHONE NO.
Known					

NEXT OF KIN	ADDRESS	CITY	STATE	ZIP	PHONE NO.	RELATION	DATE/TIME OF ARRIVAL
Unknown MARY WERNER					878-3120	SIS	09/29/92 0?

OUTPATIENT STATUS	ATTENDING PHYSICIAN	REL.	ASSG
Eye Inj	Misc 298/90		

ATTENDING	PTP	SERVICE	OCC	REG. CD.	REG. BY	REASON	SUBSCRIBER/CO.	LINE
Jasons	E	ER	11		914	NG	Unknown	

INSURANCE CO. 1	GROUP NO.	CERTIFICATE NO.	SUBSCRIBER	SEX	REL.
Blue Cross		009379759	King Thomas	M	PT
INSURANCE CO. 2	GROUP NO.	CERTIFICATE NO.	SUBSCRIBER	SEX	REL.
INSURANCE CO. 3	GROUP NO.	CERTIFICATE NO.	SUBSCRIBER	SEX	REL.

SIGNATOR NAME	ADDRESS	CITY	STATE	ZIP	PHONE NO.
King Thomas	129 Crescent St Shrewsbury M A 01545				000000

MODE OF ARRIVAL	REFER	ID BAND	ALLERGIES
CAR		YES NO	IVP ~~dye~~ Dye

TRIAGE TIME	TETANUS STATUS	LMP	WGT	T	P	R	BP	VISUAL ACUITY R	L
2[10] A	5-6 yrs Ago			98.8	92	24	134/78		

CURRENT MEDS: penicillin, ethemorsone

HEALTH/SOCIAL Hx: carpal tunnel, sinusitis

SVT - AFib, blind x 1 yr @ 6 yrs old, appy, tonsil, HTN

CHIEF COMPLAINT: Someone poked his fingernail thru my eyeball - leaking vitreous fluid

HISTORY OF PRESENT ILLNESS: Dr O'Connell into evaluate pt immediately - eye shield applied

Pt's #20 started - difficulty - NS locked - Flagyl hung; WPD into interview pt ie: patient + Cousin + sister in to pt. Dr Ariella into examine pt's eye. 3:30 PM Discharge instructions given and pt left Ambulatory c sister and cousin JHerman RN

TIME	BP	P	R	TEMP	PULSE OX

	TIME	RATE	DEVICE	SITE	I.V. SOLUTION
EKG	2[30] A	—	#20	RFA	NS lock
MONITOR			Betadine prep c aseptic technique		
O_2					
DEXSTICK ___ mg					

MEDICATION DOSE & ROUTE	TIME	SITE	INIT.	MD
Kefzol 1 Gm IV	2[30] A	RFA	JH	
TT-50 0.5cc IM	2[45] A	H	JH	

X-RAY	HISTORY	TRANSPORT TYPE	TIME IN	TIME OUT

MEDICAL RECORD CALLED ☐ MEDICARE ADV. ☐

LAB TEST	TIME	INIT.	LAB TEST	TIME	INIT.	LAB TEST	TIME	INIT.	LAB TEST	TIME	INIT.
			CHEM 12			THROAT CULTURE			STOOL CULT/O&P		
			HEPATITIS SCREEN			URINE/URINE C&S			TOX SCREEN		
			T&H/T&C ___ units			BLD CULT X 2			WET PREP/KOH		
			UCG			GC/CHLAMYDIA			OTHER:		
			HCG/QUANT HCG			SPUTUM CULTURE					
			RAPID STREP			WOUND CULTURE					

PHYSICIAN'S SIGNATURE: JHerman RN 118

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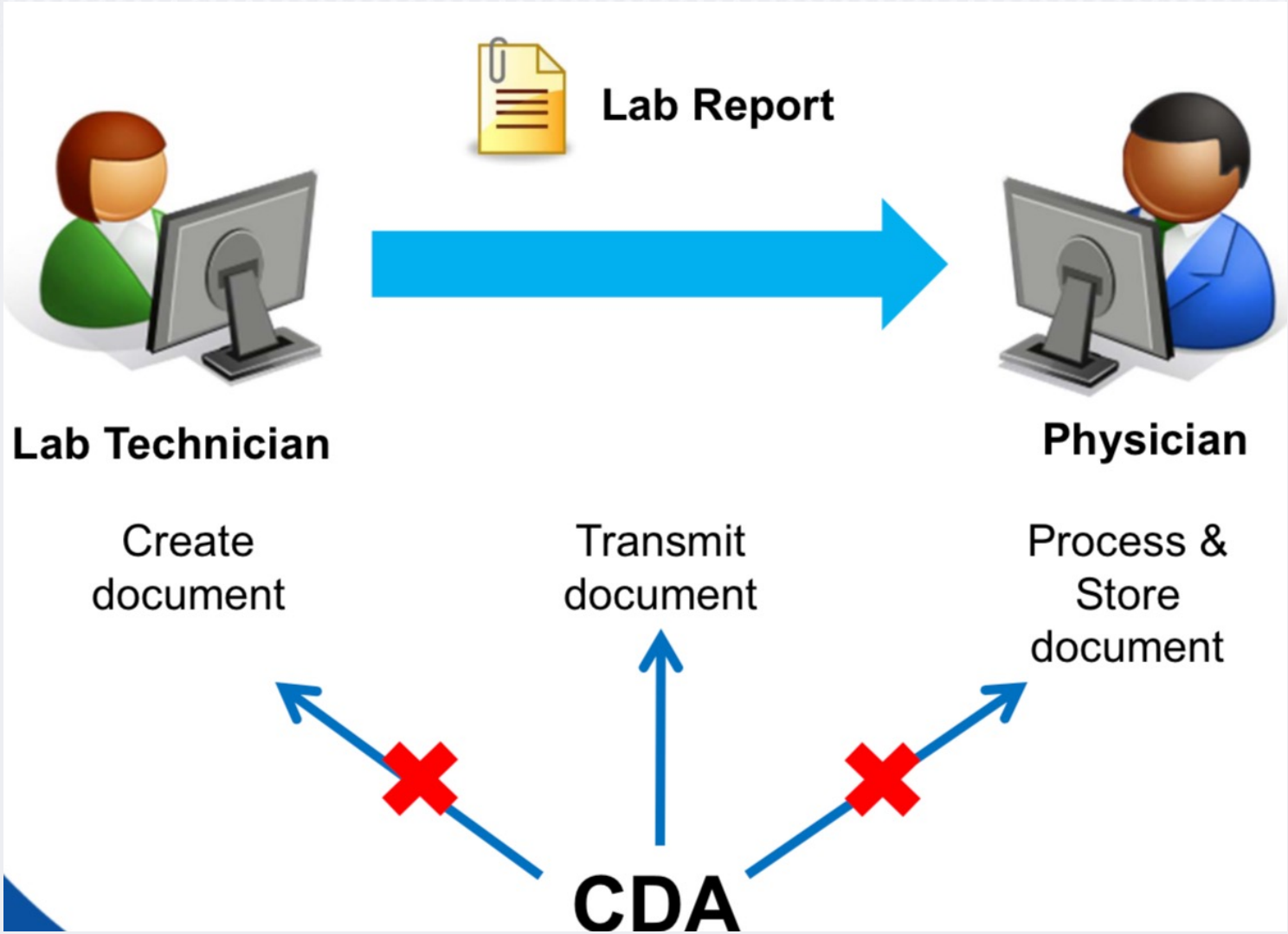
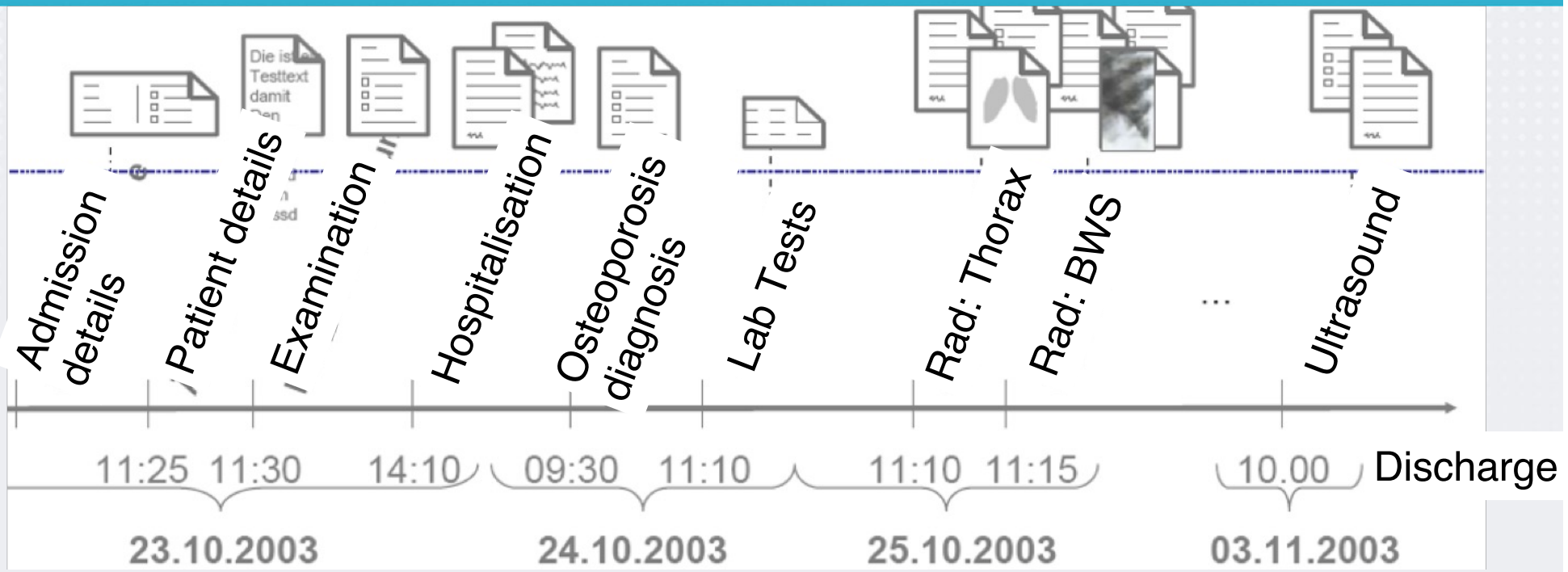
Clinical Documents



Clinical Process vs Clinical Documents



Documents in the clinical process from admission to discharge

Registration → Admission → Diagnostics → Therapy → Discharge

Clinical Process

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HL7: Document Exchange Standards

- HL7 CDA (Clinical Document Architecture)
  - CDA has Release 1 and 2.
  - Provides an exchange model for clinical documents e.g. discharge summaries and progress clinical notes
  - Aims at bringing a real-world view to patient medical records in which:
    - Healthcare providers can understand
    - Healthcare applications can **atomically process**
  - HL7 CDA is a subset of HL7 v2.x or HL7 v3 message

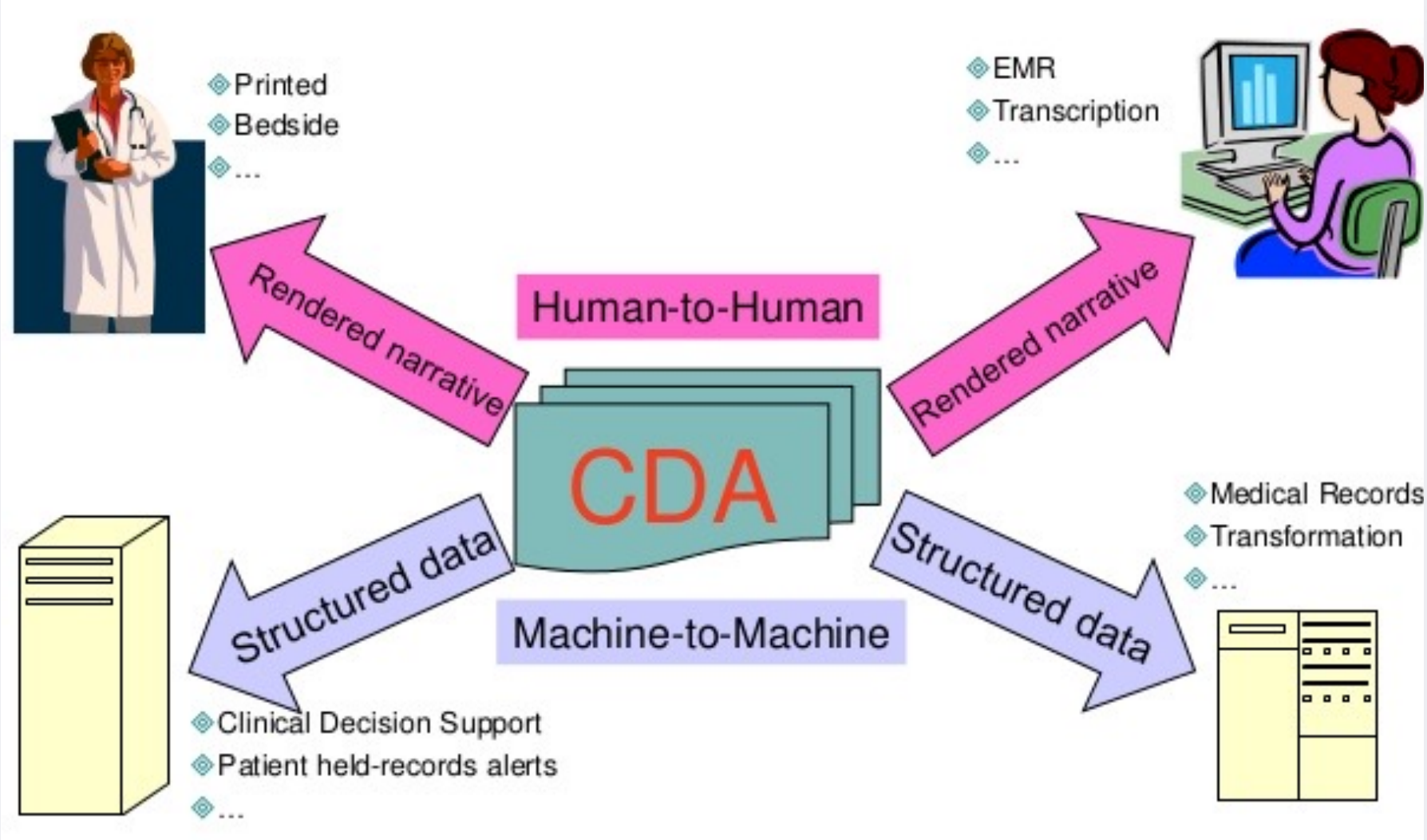
Clinical Documents: Different formats

HL7: Document Exchange Standards

- HL7 CDA (Clinical Document Architecture)
  - " A document markup standard that specifies structure & semantics of clinical documents for the purpose of exchange"
  - Focuses on document exchange,
  - A document is packaged in a message during exchange
  - A patient medical record as an XML-based documents

=> CDA is not designed for document storage, just exchange?!

HL7: Document Exchange Standards



A Clinical Document

- A CDA document is a complete information record that can include:
  - Text
  - Images
  - Sounds
  - Other information or media

- Clinical content of the document is defined by the HL7 V3 RIM – CDA only standardizes/defines the structure required to exchange documents.

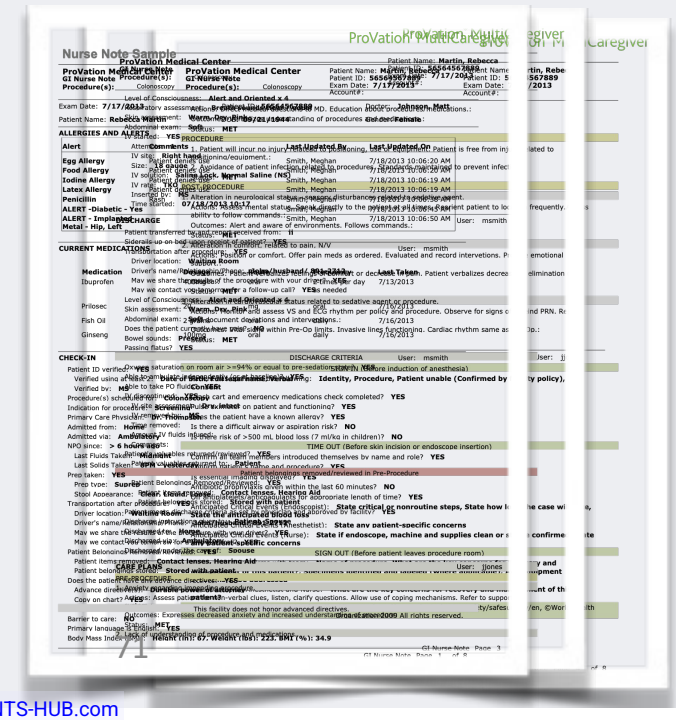
CDA

- CDA = Clinical Document Architecture
- CDA is a HL7-standard
- XML-standard to exchange structured documents

- A key distinction between **HL7 messages** and **HL7 CDA** documents
  - **messages** are packets of data sent from one system to another, get incorporated into the receiving system.
  - **documents** are basically electronic versions of physical clinical documents

CDA

- An electronic equivalent of a paper document
- Has an author/attester
- Represents a point in time view of data
- Persists as an artifact over time
- Supports simple to very complex document types



ProVation MultiCaregiver

ProVation Medical Center
GI Nurse Note
Procedure(s): Colonoscopy

Patient Name: **Martin, Rebecca**
Patient ID: **56564567889**
Exam Date: **7/17/2013**
Account#:

Level of Consciousness: **Alert and Oriented x 4**
Respiratory assessment: **Breath sounds clear / equal**
Skin assessment: **Warm, Dry, Pink**
Abdominal exam: **Soft**
IV started: **YES**
Attempts: **1**
IV site: **Right hand**
Size: **18 gauge**
IV solution: **Saline Lock, Normal Saline (NS)**
IV rate: **TKO**
Inserted by: **MS**
Time started: **07/18/2013 10:17**

DISCHARGE User: msmith

Patient transferred by and report received from: **ii**
Siderails up on bed upon receipt of patient? **YES**
Transportation after procedure: **YES**
Driver location: **Waiting Room**
Driver's name/Relationship/Phone: **John/husband/ 891-2712**
May we share the results of the procedure with your driver? **YES**
May we contact you tomorrow for a follow-up call? **YES**
Level of Consciousness: **Alert and Oriented x 4**
Skin assessment: **Warm, Dry, Pink**
Abdominal exam: **Soft**
Does the patient currently have pain? **NO**
Bowel sounds: **Present**
Passing flatus? **YES**

DISCHARGE CRITERIA

Oxygen saturation on room air >=94% or equal to pre-sedation state? **YES**
Able to ambulate independently (or at baseline)? **YES**
Able to take PO fluids? **YES**
IV discontinued: **YES**
IV site assessment: **Drv, intact**
IV removed by: **MS**
Time removed:
Amount IV fluids infused:
Comments:
Patient's valuables returned/reviewed? **YES**
Patient valuables returned to: **Patient**

Patient belongings removed/reviewed in Pre-Procedure

Patient Belongings Removed/Reviewed: **YES**
Patient items removed: **Contact lenses, Hearing Aid**
Patient belongings stored: **Stored with patient**
Patient meets discharge criteria as set by physician and approved by facility? **YES**
Discharge instructions given to: **Patient, Spouse**
Discharged to: **Home**
Discharged via: **Ambulatory**
Discharged under the care of: **Spouse**

CARE PLANS User: jjones

PRE-PROCEDURE

1. Anxiety regarding impending procedure.
   Actions: Assess patient for non-verbal clues, listen, clarify questions. Allow use of coping mechanisms. Refer to support system.:
   Outcomes: Expresses decreased anxiety and increased understanding of procedure:
   Status: **MET**
2. Lack of understanding of procedure and medications.

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Example- Physician Letter as a CDA

Klinik und Poliklinik für Urologie

UKM
Universitätsklinikum
Münster

Direktor: Univ.-Prof. Dr.med. L. Hertle

Herrn
Dres. med. Tschuschke und Rutte
Urologie
Windthorststr. 19

48143 Münster

48149 Münster, 11.07.2002

Hausadresse:
Albert-Schweitzer-Str. 33
48149 Münster
Vermittlung: 0251 83-0

Urologische Poliklinik
Sekretariat: 0251 83-47441
Durchwahl: 0251 83-47446
Fax: 0251 83-49739

Empfänger:
Dres. med. Tschuschke und Rutte, 48143 Münster, Windthorststr. 19
Nachrichtlich an:
Dres. med. Fechtrup/Prahl/Paulus, 48149 Münster, Himmelreichallee 37

Diktat: erstellt

Kurzarztbrief

Herr Ernst Testpatient 1, geb. am 01.01.1930
54332 Wasserliesch, Waldstr. 1

Sehr geehrter Herr Kollege,

nachfolgend berichten wir über Ihren Patienten, Herrn Ernst Testpatient 1, der sich in der Zeit vom 12.04.2000 bis zum 11.07.2002 in unserer stationären Behandlung befand.

Diagnosen:

Typhus abdominalis
aktuell:
Meningitis bei anderenorts klassifizierten Mykosen G02.1*
Sonstiger und nicht näher bezeichneter mechanischer Ileus K56.6

Prozeduren:

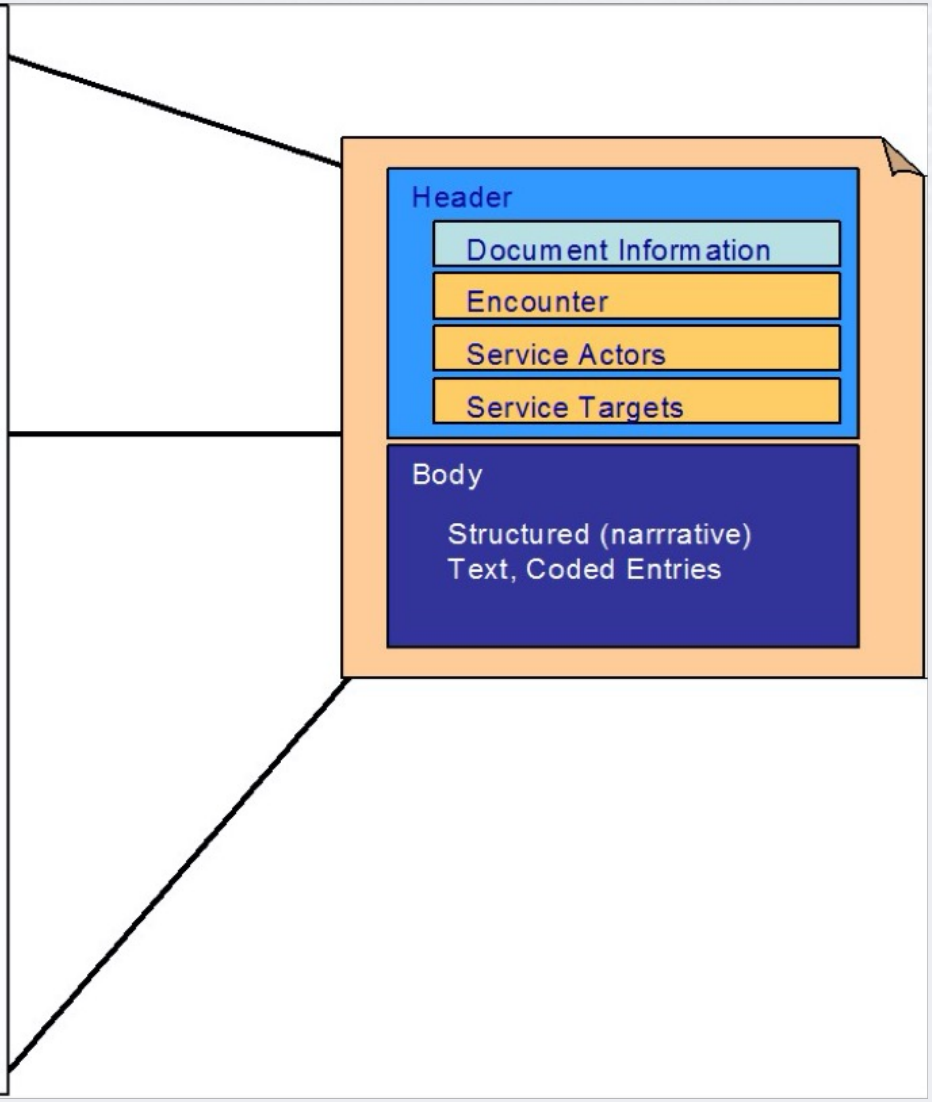
Naht Muskel 5-853.1
Exzision u. Destruktion intrazerebrales Tumorgewebe hirneigen Lok.on.A 5-015.00
Inzisionsbiopsie Augenlid 1-520

Anamnese und körperlicher Untersuchungsbefund:

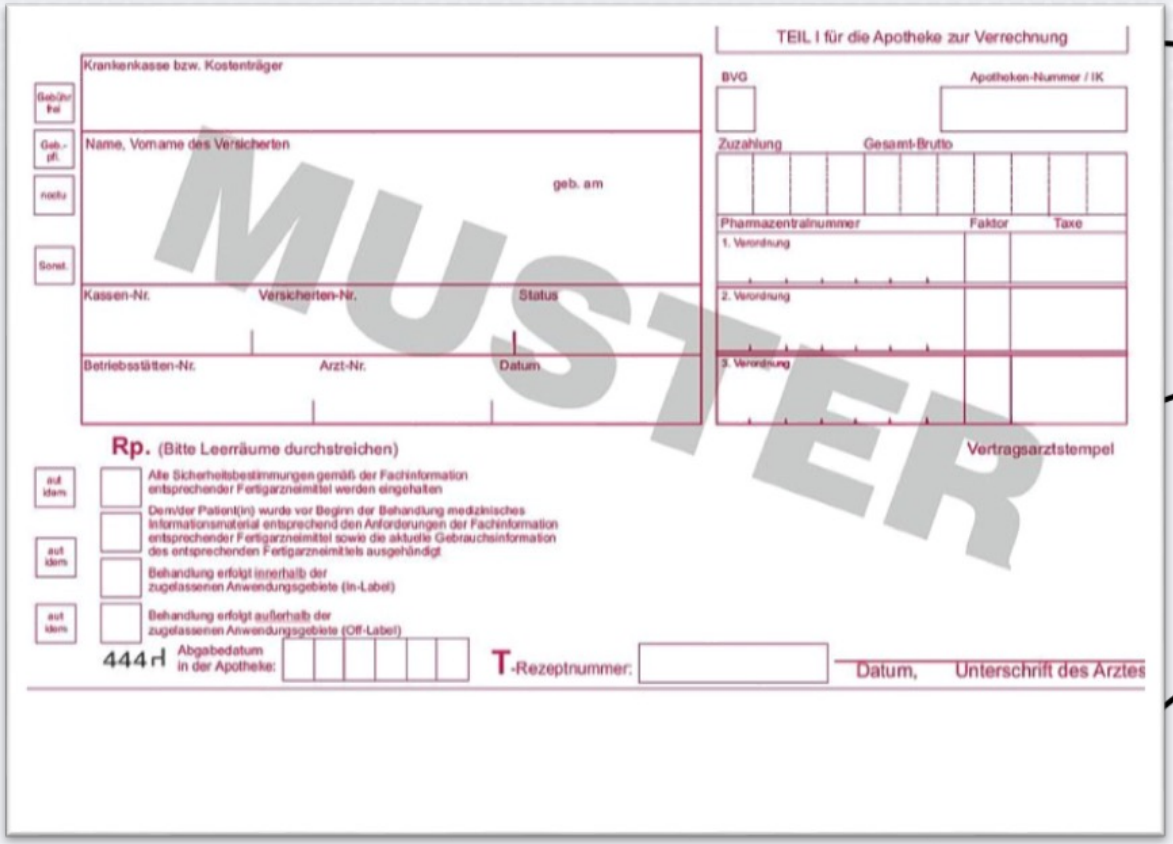
Lorem ipsum dolor sit amet, consectetuer adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut wisi enim ad minim veniam, quis nostrud exerci tation ullamcorper suscipit lobortis nisl ut aliquip ex ea commodo consequat. Duis autem vel eum iriure dolor in hendrerit in vulputate velit esse molestie consequat, vel illum dolore eu feugiat nulla facilisis at vero eros et accumsan et iusto odio dignissim qui blandit praesent luptatum zzril delenit augue duis dolore te feugait nulla facilisi.

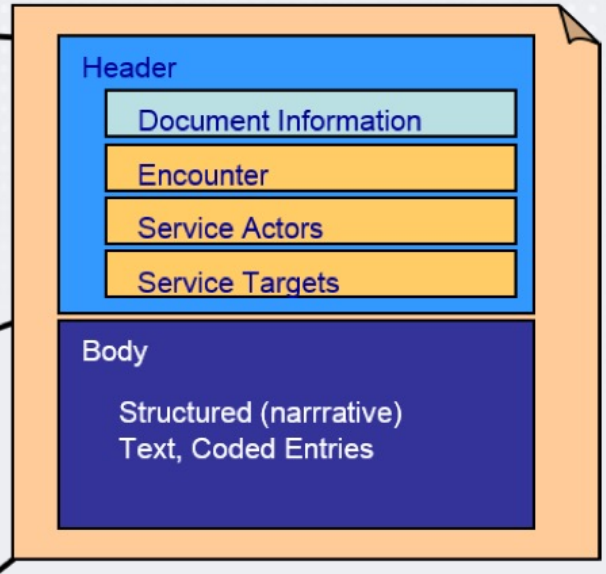
Labor: ☒

5.12.2000: .: Serumchemie I: Harnstoff-N 14 < 24 mg/dl; Kreatinin 0.8 < 1.1 mg/dl; Bilirubin (ges.) 0.3 < 1.2 mg/dl; GOT 40 + < 15 U/l; GPT 42 + < 19 U/l; Gamma-GT 29 + < 18 U/l; Alkalische Phosphatase 67 60 - 170 U/l; LDH 248 + < 240 U/l; PCHE 2919 - 3500 - 9500 U/l; CK 68 < 70 U/l; CK-MB < 10 U/l CK-MB; Lipase 58 < 190 U/l; CRP 1.4 + < 0,5 mg/dl; Kleines Blutbild; Leukozyten 10.80 + 4,0 - 10,0 Tsd./µl; Thrombozyten 153 150 - 350 Tsd./µl; Gerinnung; TPZ/Quick 78 70 - 130 %; INR 0.85 - 1.1 INR; PTT 39 + 24 - 36 sek.; Antithrombin III 72 - 80 - 120 %; Blut/Plasma; Laktat < 0,3 - 0.4 - 2.0 mmol/l nldm; Heparinisiertes Blut; Troponin I i.Serum folgt ng/ml <=; CK-MB : CK-MB-Bestimmung nur, wenn CK > 80 U/l.; INR: Angabe von INR bei Quick < 50 % : nldm : neuer Referenzbereich ab dem 14.09.00:



Example- medical order as a CDA





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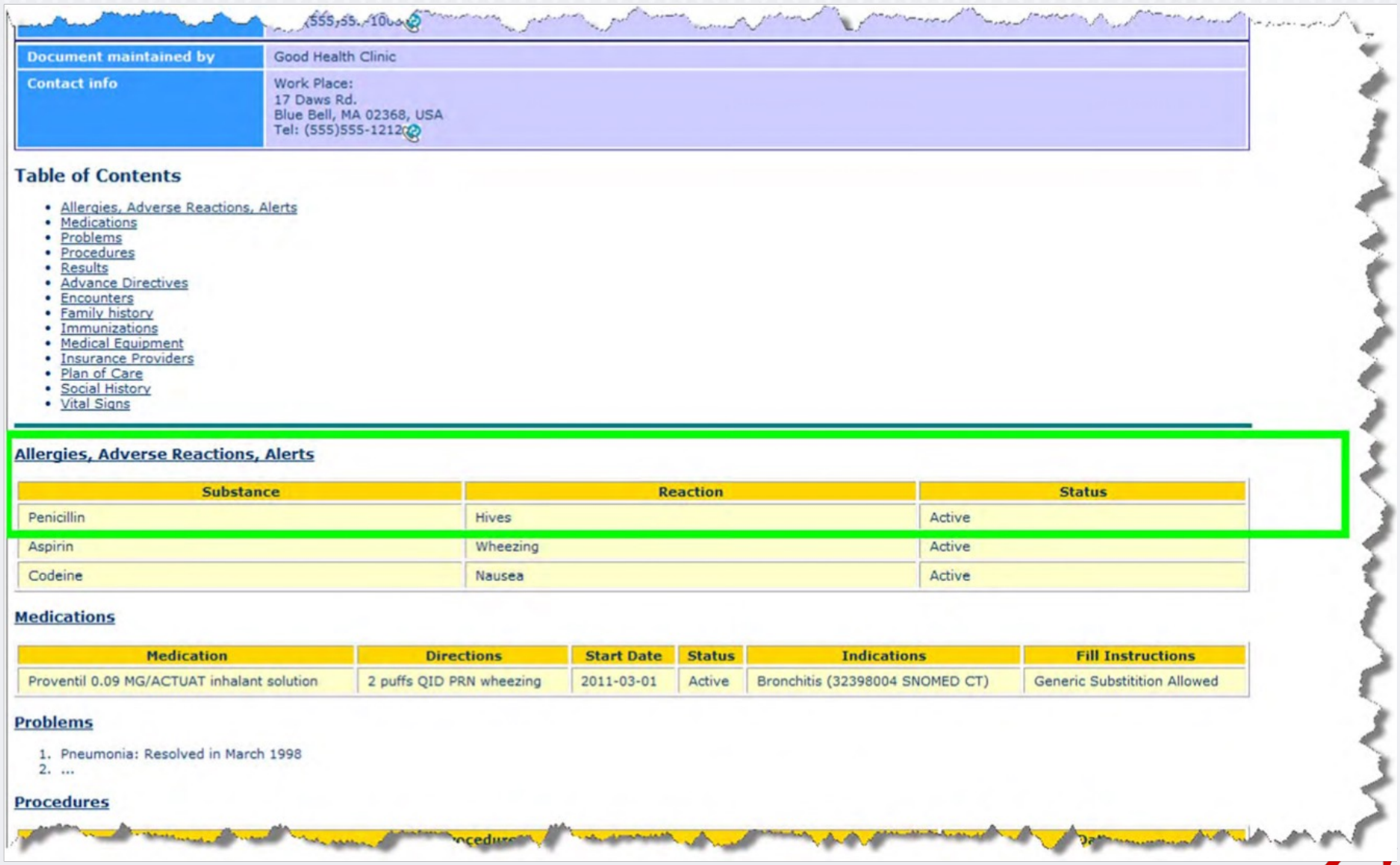
Example: CCD (Continuity of Care Document)



Document maintained by	Good Health Clinic
Contact info	Work Place: 17 Daws Rd. Blue Bell, MA 02368, USA Tel: (555)555-1212

Table of Contents

- Allergies, Adverse Reactions, Alerts
- Medications
- Problems
- Procedures
- Results
- Advance Directives
- Encounters
- Family history
- Immunizations
- Medical Equipment
- Insurance Providers
- Plan of Care
- Social History
- Vital Signs

Allergies, Adverse Reactions, Alerts

Substance	Reaction	Status
Penicillin	Hives	Active
Aspirin	Wheezing	Active
Codeine	Nausea	Active

Medications

Medication	Directions	Start Date	Status	Indications	Fill Instructions
Proventil 0.09 MG/ACTUAT inhalant solution	2 puffs QID PRN wheezing	2011-03-01	Active	Bronchitis (32398004 SNOMED CT)	Generic Substitition Allowed

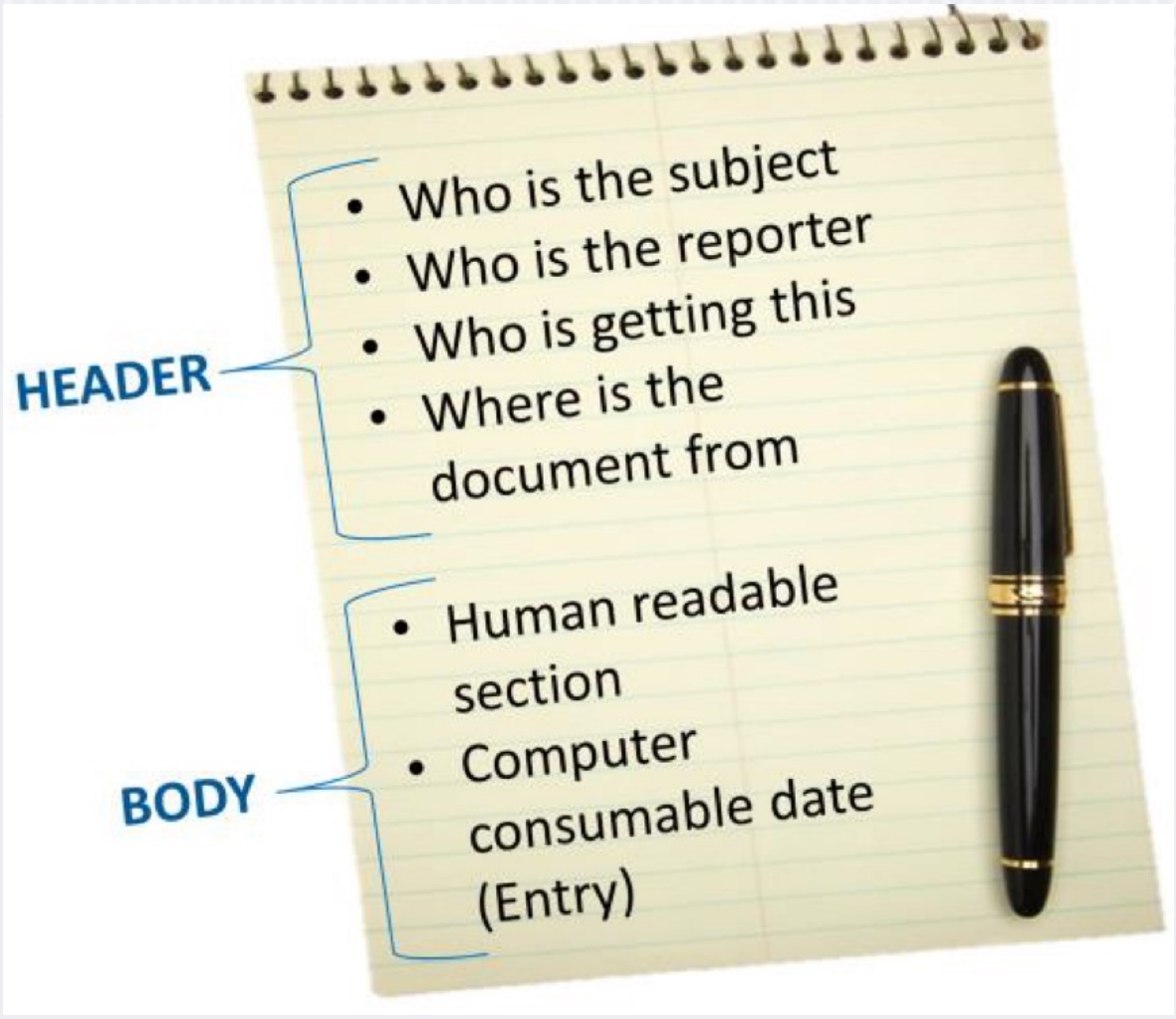
Problems

1. Pneumonia: Resolved in March 1998
2. ...

Procedures

Example: CCD -underlying XML

CDA- Structure



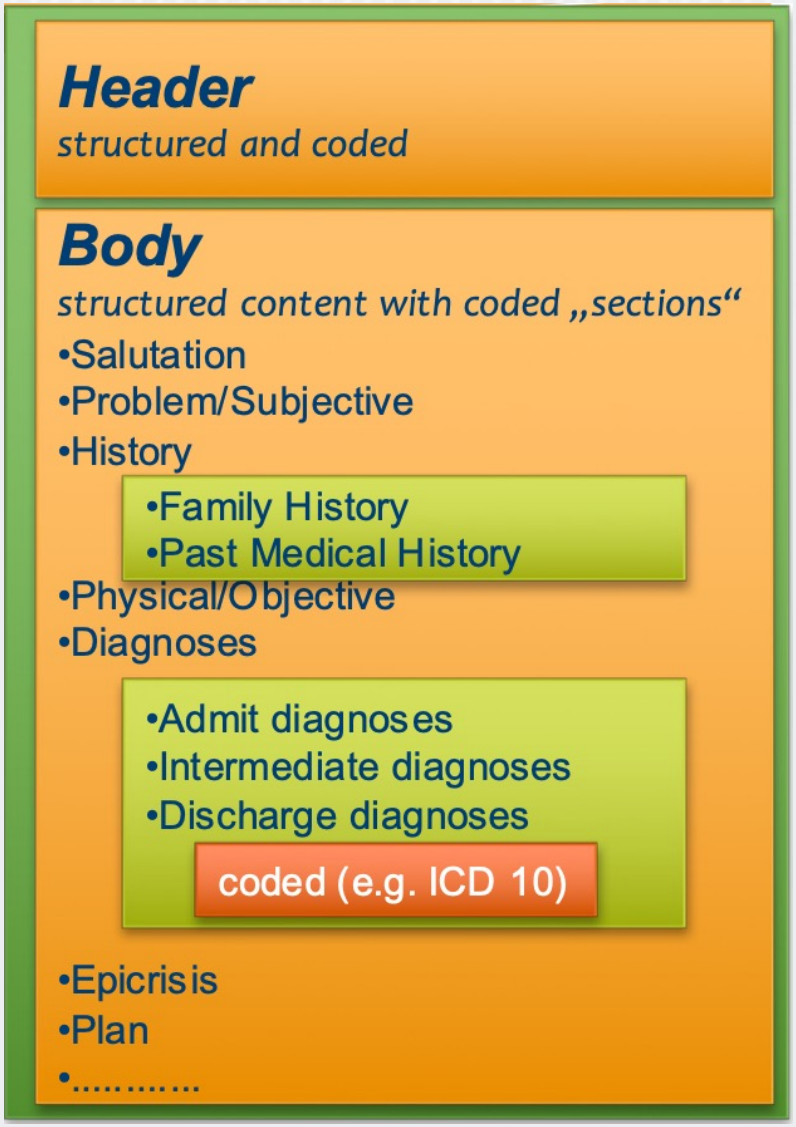
- The **header component** provides information about:
  - The type of CDA and the basic structure
  - Who the document is about
  - Who "wrote" it
  - Where it came from
  - Where it is going
  - When it was created
- The **body section** of a document is composed of :
  - Narrative block information, which is text that a human can read in a browser.
  - The Entry block then contains the same data described in the Narrative block, but in a structured format that a computer can read

CDA- Structure

A CDA-Document consists of two parts

- CDA-Header:
  - Document
  - Author
  - Patient
- CDA-Body:
  - Clinical Observations
  - Diagnoses, Procedures

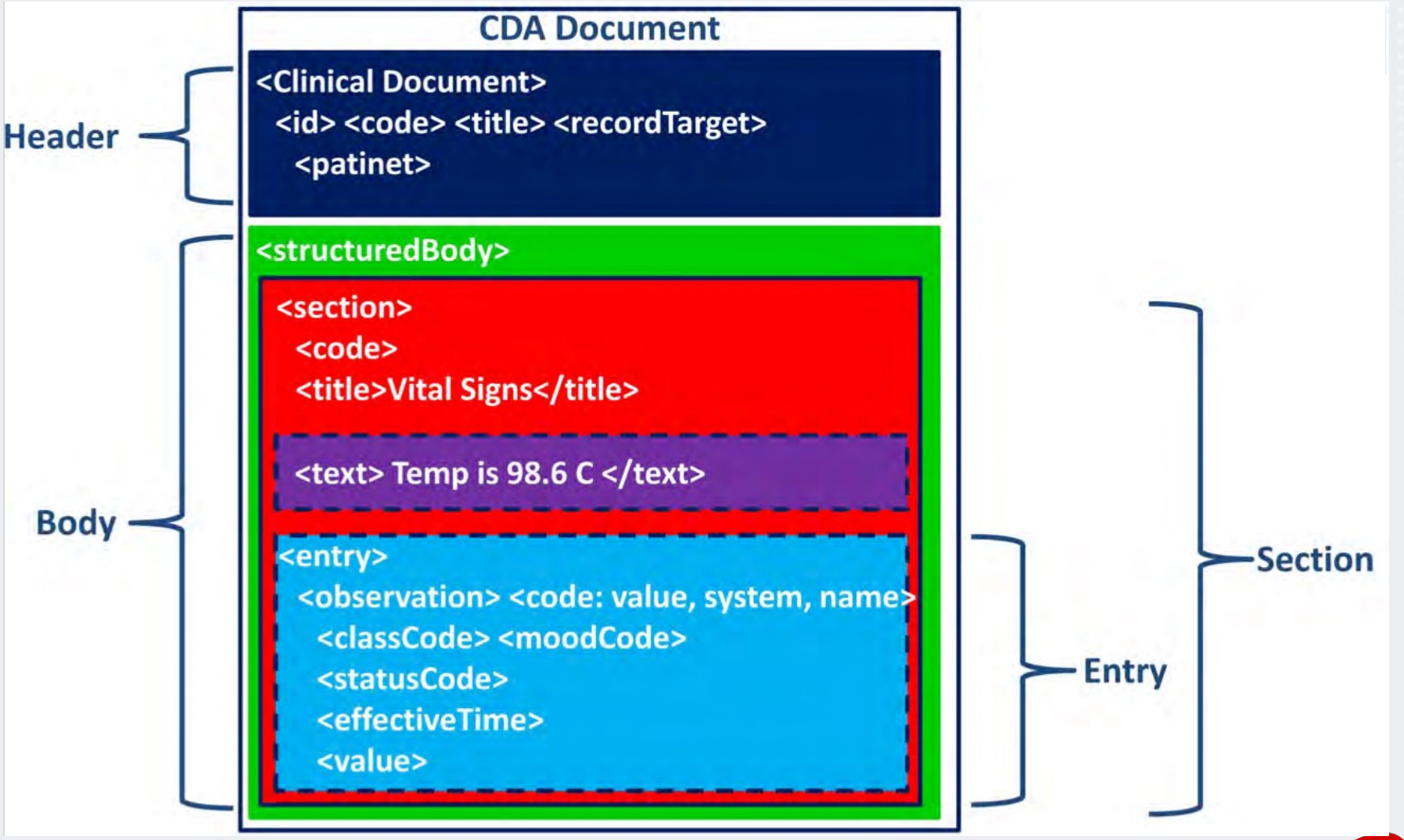
CDA- Structure



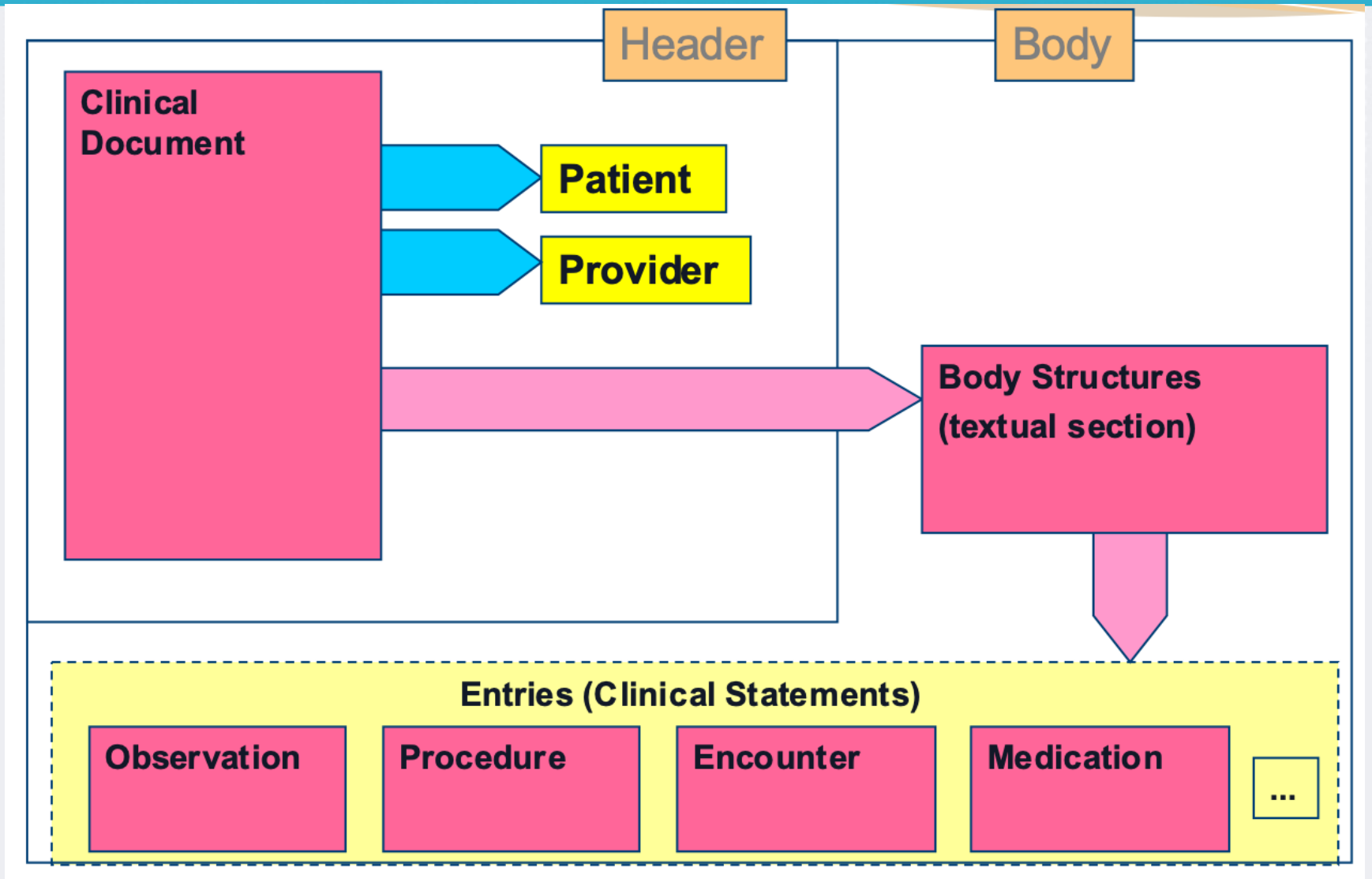
Form

- A header provides the context:
  - To facilitate the exchanges and the management of the documents, their compilation in the patient record
- A body
  - clinical information, ordered into sections, paragraphs, lists, tables, …
- Encoded in XML
  - Comprehensive/readable for the human…
  - …and for the computers
  - – can be validated by a schema

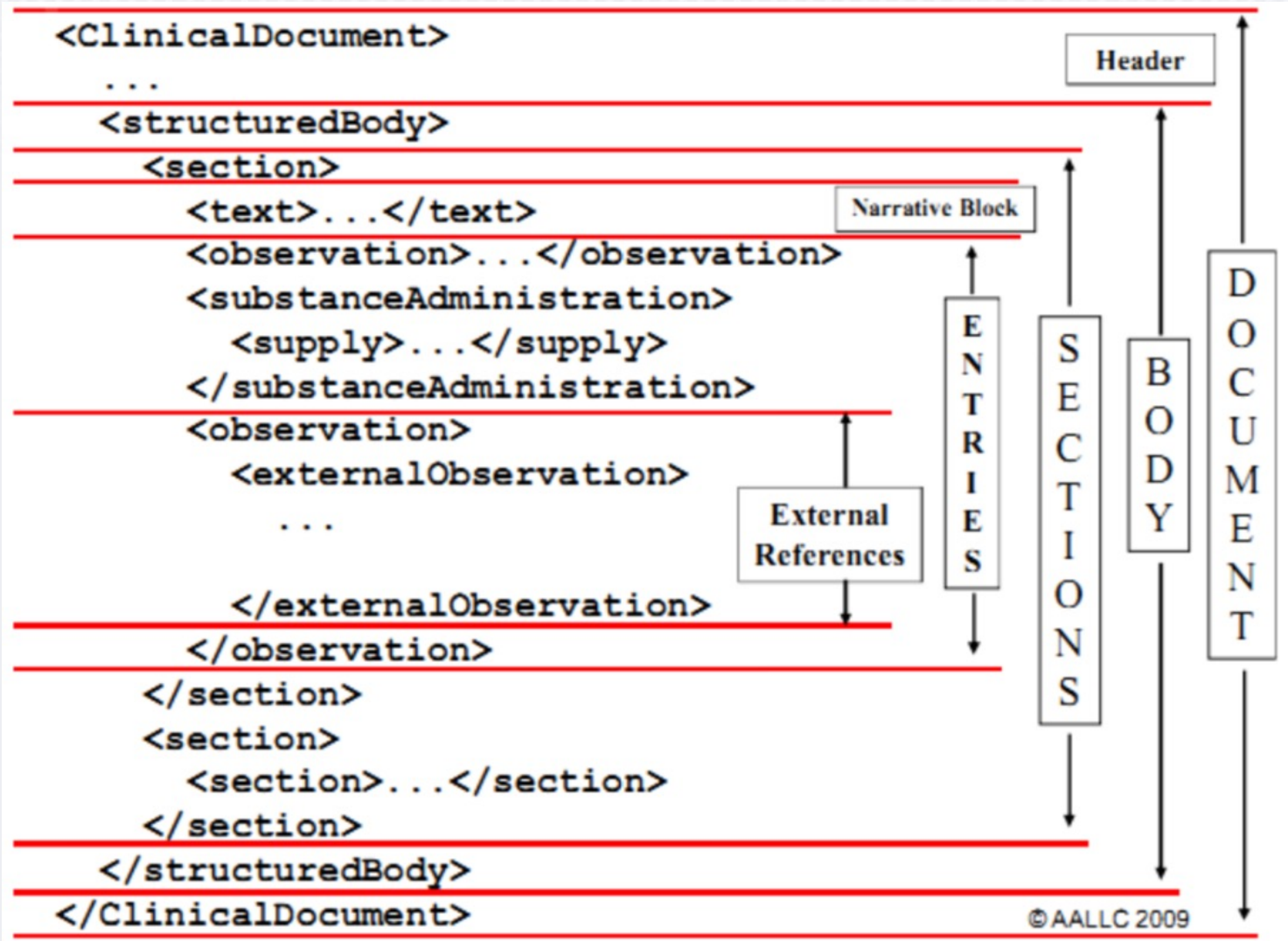
CDA- Structure-Example



CDA- Structure



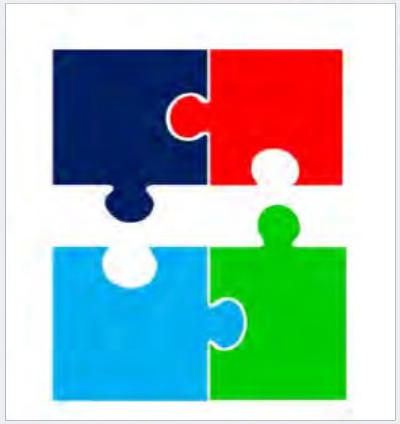
CDA (Major Components): Example

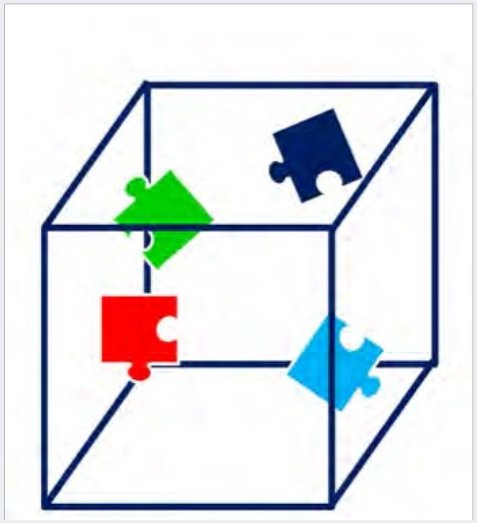


CDA- Methodology: made up of Blocks

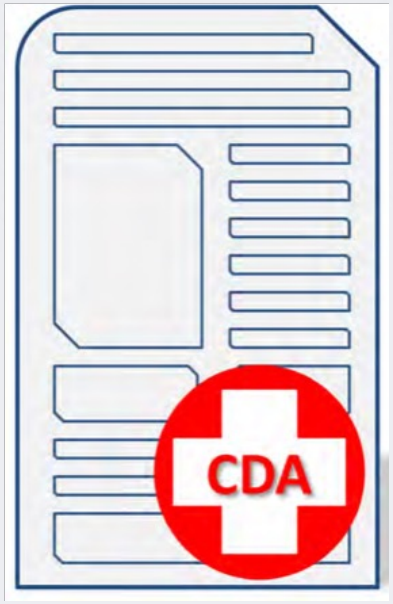
CDA defines building blocks which can be used to contain healthcare data elements that can be captured, stored, accessed, displayed and transmitted electronically for use and reuse in many formats

Sets of these CDA standardized building blocks can be arranged for whatever needs exist





This approach offers tremendous flexibility; it allows for the creation of a comprehensive variety of clinical documents which share common design patterns and use a single base standard



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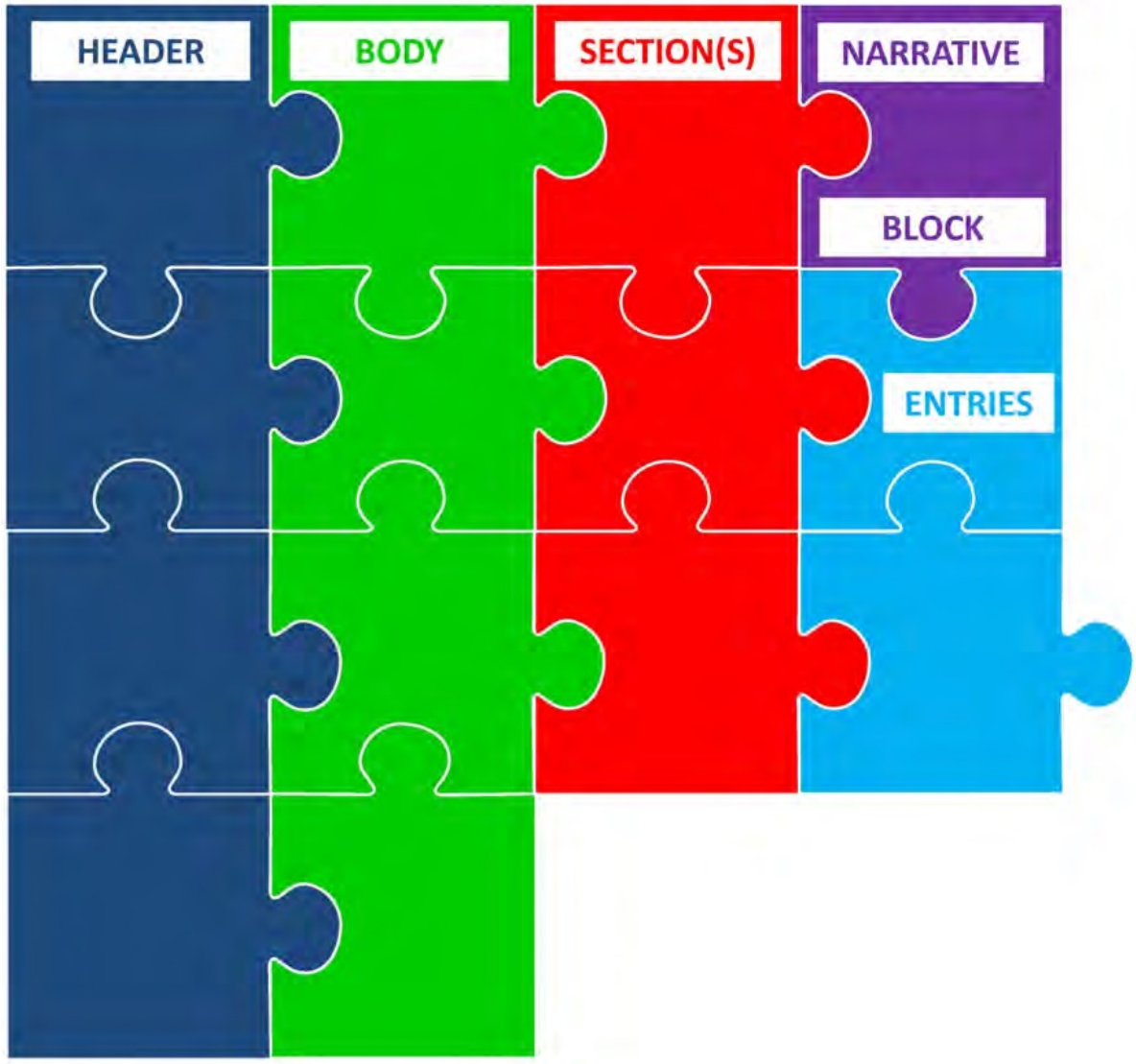
CDA- Structure



Every CDA document must have AT LEAST a **Header** AND a One **Section**.

XML enables both human and machine readability.

The XML structure for a CDA document nests data in the following way:

» Header
» Body
» » Section(s)
» » » Narrative Block
» » » Entry(s)

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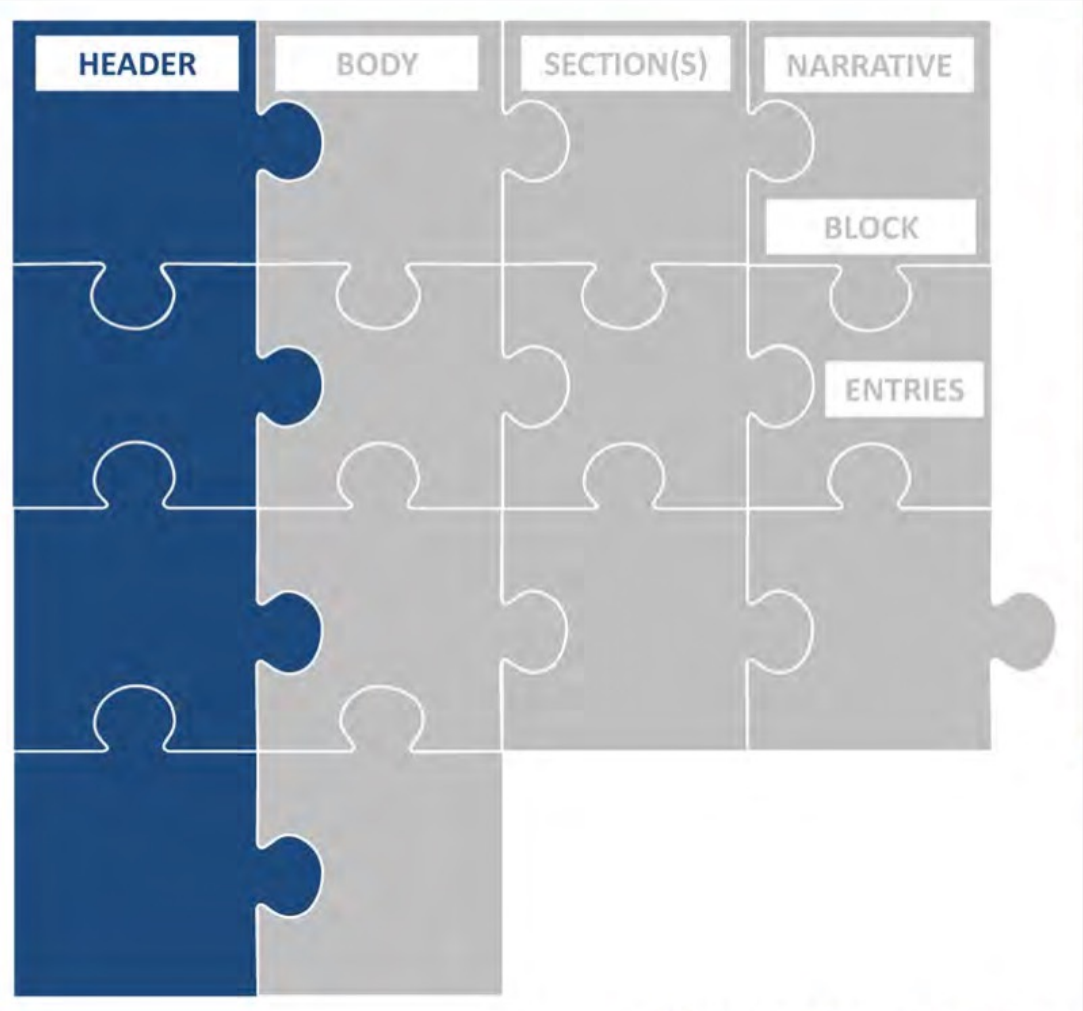
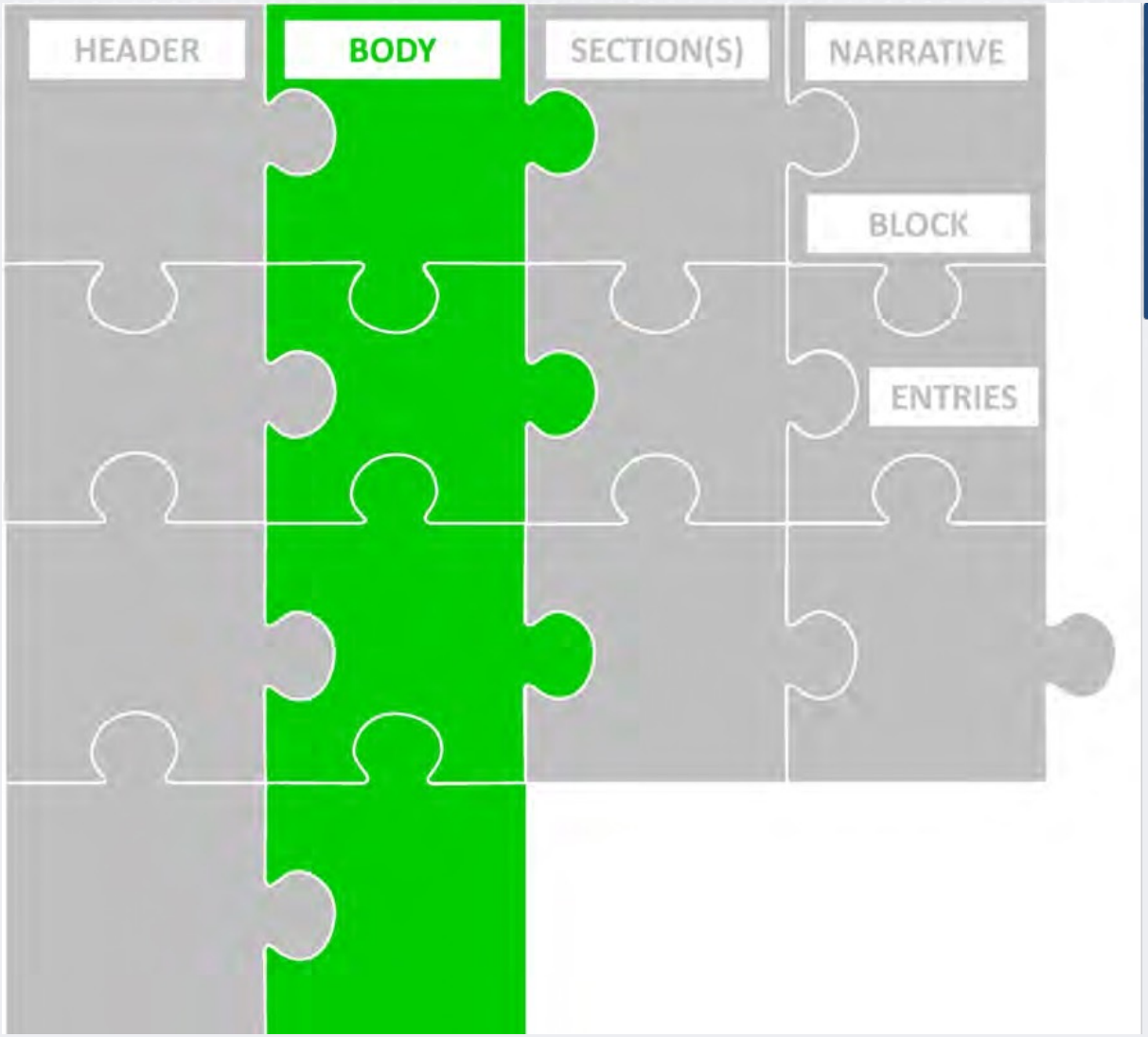
CDA Structure- Header



The **Header** sets the context for the clinical document as a whole and:

- enables clinical document exchange across and within institutions;
- facilitates clinical document management ; and
- facilitates compilation of an individual patient's clinical documents into a electronic patient record.

CDA Structure- Body



The **Body** contains the clinical report and can contain an unstructured "blob" or structured content organizes in one or more **Sections**.

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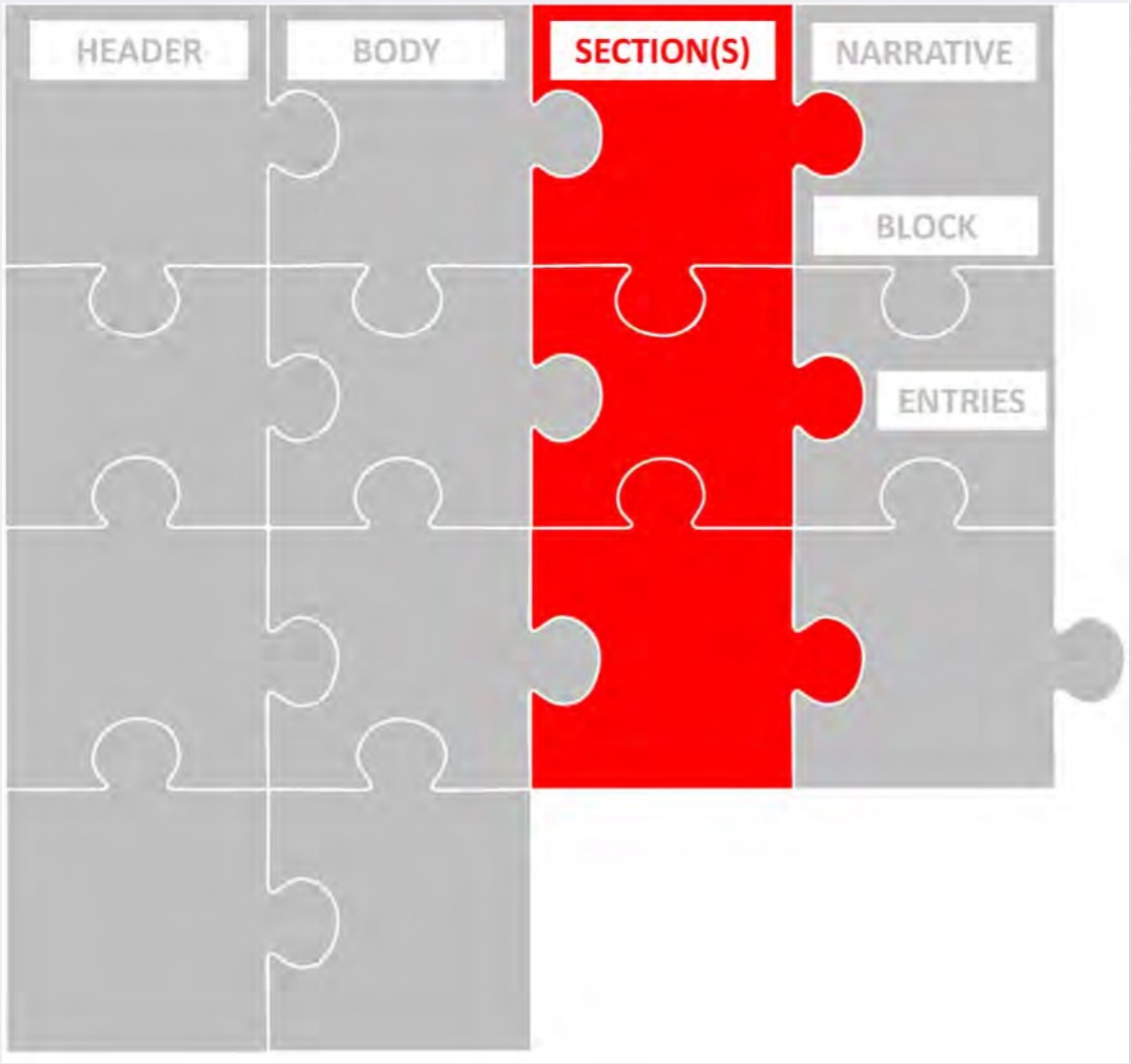
CDA XML Structure- Section(s)



Each **Section** contains one **Narrative Block** and zero to many coded **Entries**.

Examples include:

- **Allergies**
- **Meds**
- **Problems**
- **Immunizations**
- **Vital Signs**

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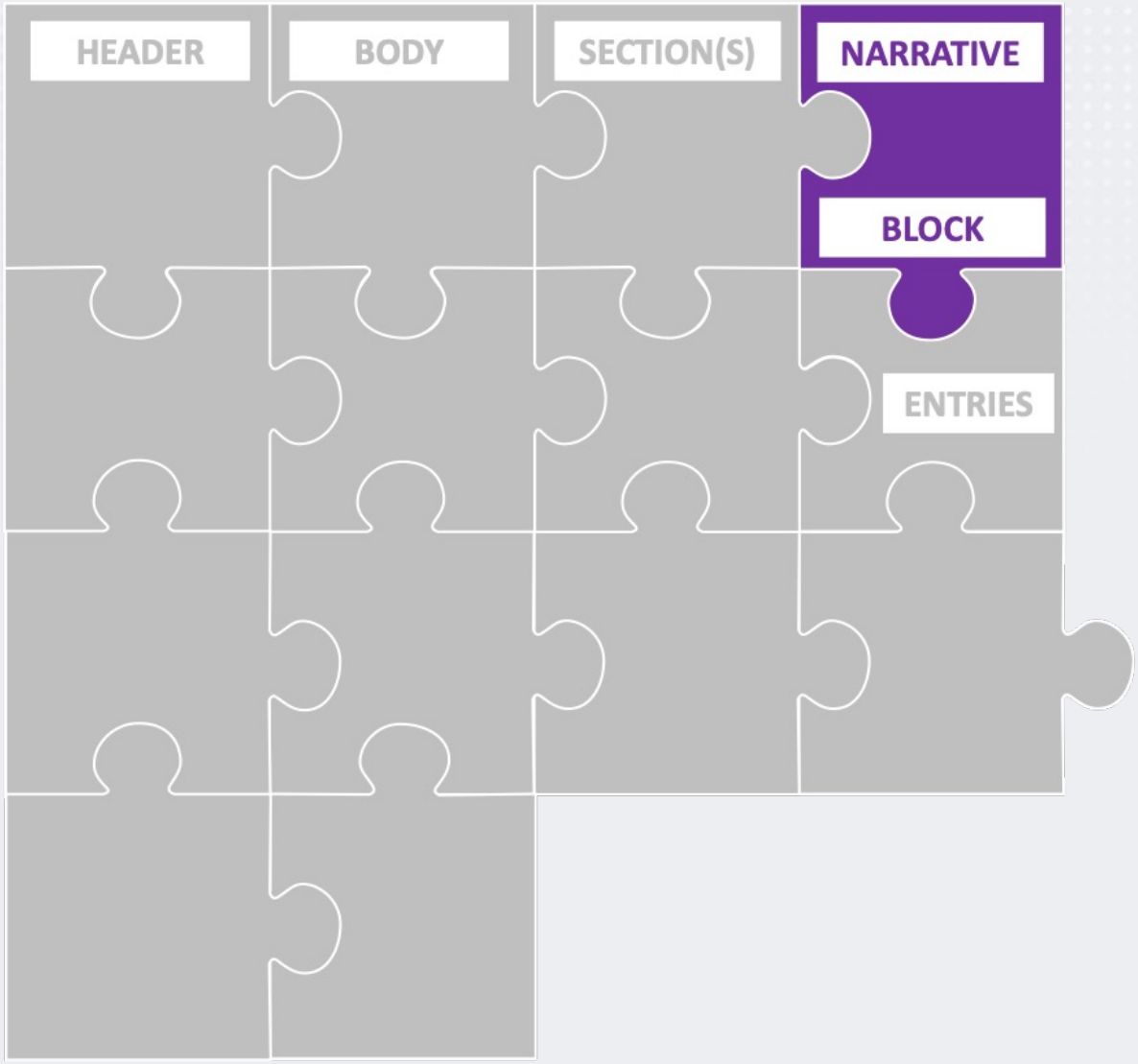
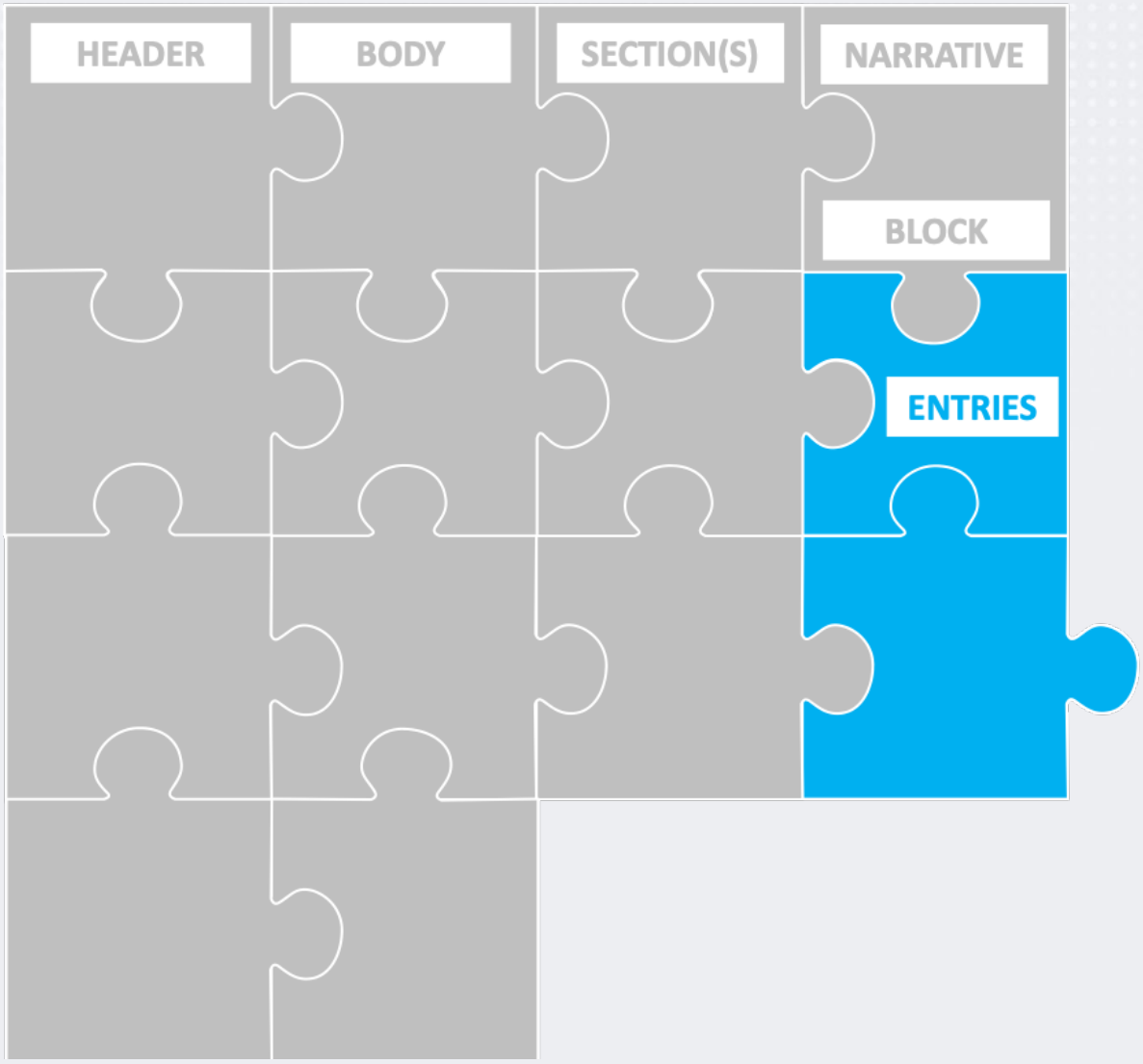
CDA XML Structure- Narrative Block(s)



Narrative Blocks allows "human-readability" of a CDA document. Within a document section, the narrative block represents content to be rendered for viewing.

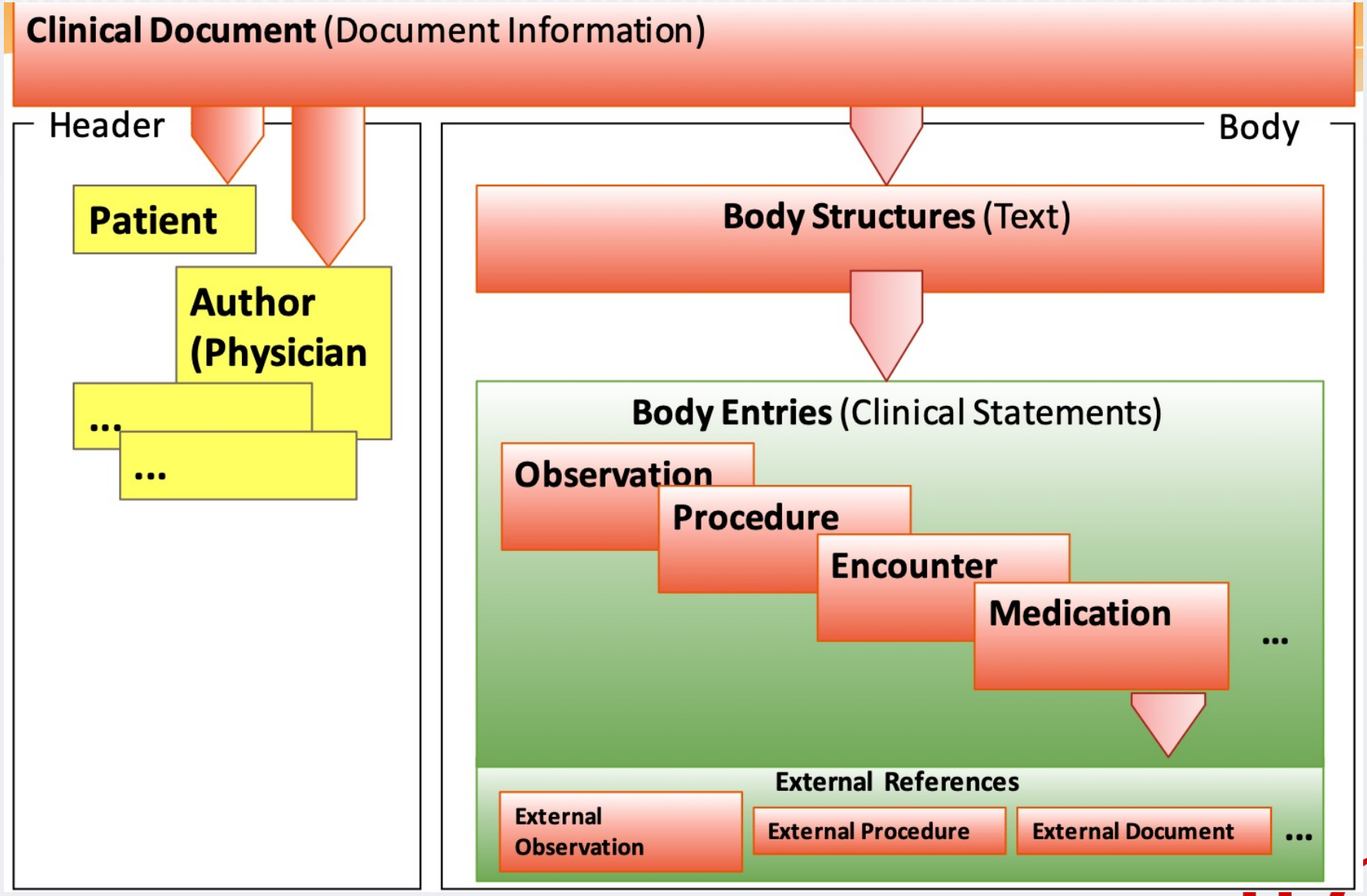
The **Narrative Block** has fixed markup, and must be populated by the document originator.

CDA XML Structure- Entries

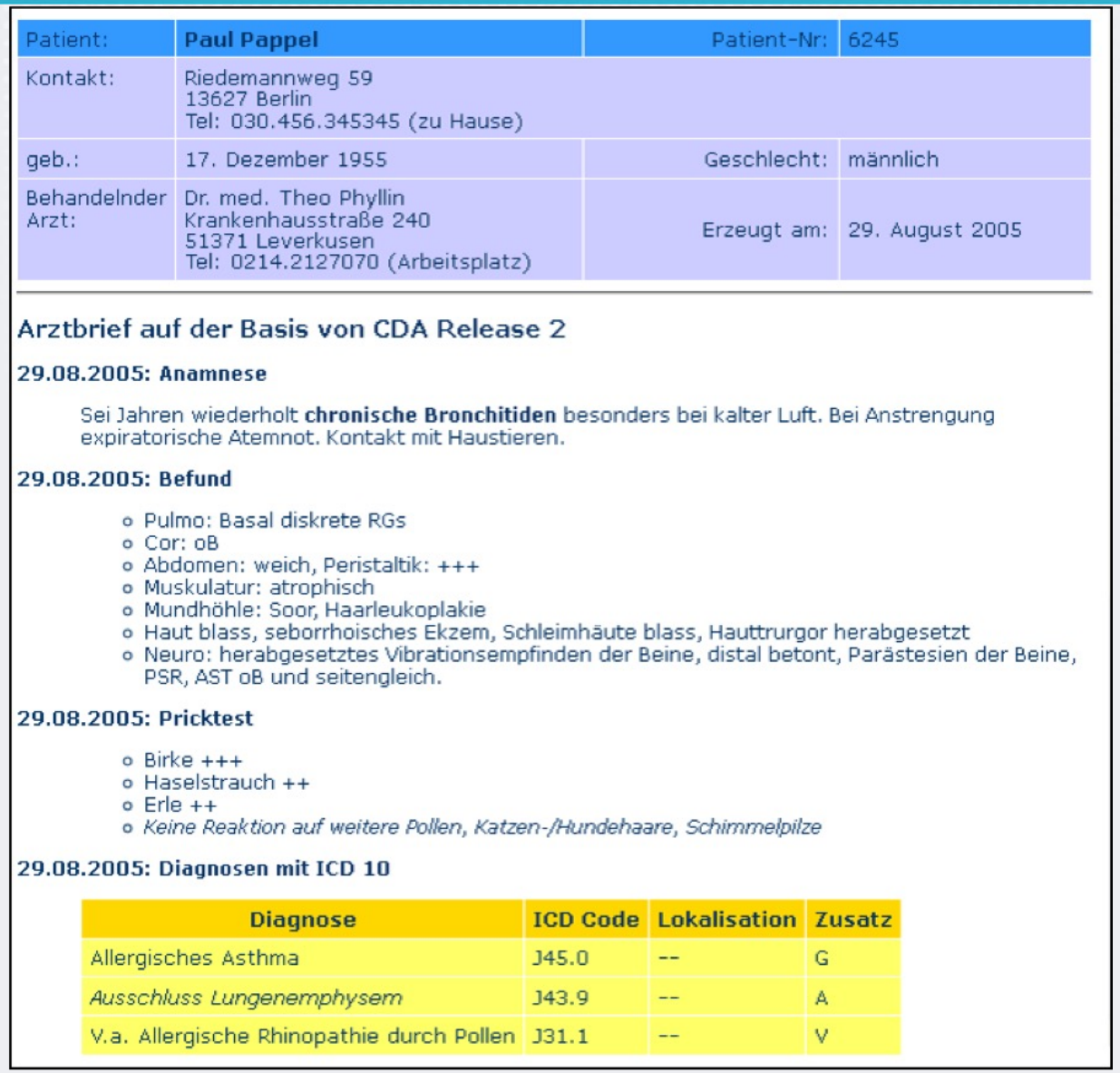


Entries allows "machine-readability" (e.g. decision support applications). Within a document section, an entry represents structured content for further computer processing.

CDA Structure: Entries



CDA XML Structure: Stylesheets, as document



Patient:	**Paul Pappel**	Patient-Nr:	6245
Kontakt:	Riedemannweg 59 13627 Berlin Tel: 030.456.345345 (zu Hause)		
geb.:	17. Dezember 1955	Geschlecht:	männlich
Behandelnder Arzt:	Dr. med. Theo Phyllin Krankenhausstraße 240 51371 Leverkusen Tel: 0214.2127070 (Arbeitsplatz)	Erzeugt am:	29. August 2005

Arztbrief auf der Basis von CDA Release 2

29.08.2005: Anamnese

Sei Jahren wiederholt **chronische Bronchitiden** besonders bei kalter Luft. Bei Anstrengung expiratorische Atemnot. Kontakt mit Haustieren.

29.08.2005: Befund

- Pulmo: Basal diskrete RGs
- Cor: oB
- Abdomen: weich, Peristaltik: +++
- Muskulatur: atrophisch
- Mundhöhle: Soor, Haarleukoplakie
- Haut blass, seborrhoisches Ekzem, Schleimhäute blass, Hauttrurgor herabgesetzt
- Neuro: herabgesetztes Vibrationsempfinden der Beine, distal betont, Parästesien der Beine, PSR, AST oB und seitengleich.

29.08.2005: Pricktest

- Birke +++
- Haselstrauch ++
- Erle ++
- *Keine Reaktion auf weitere Pollen, Katzen-/Hundehaare, Schimmelpilze*

29.08.2005: Diagnosen mit ICD 10

Diagnose	ICD Code	Lokalisation	Zusatz
Allergisches Asthma	J45.0	--	G
Ausschluss Lungenemphysem	J43.9	--	A
V.a. Allergische Rhinopathie durch Pollen	J31.1	--	V

Stylesheets:
e.g. XSLT (Extensible Stylesheet Language Transformations) for XML documents

CDA Structure: Header- Elements

- The **header component** provides information about:
  - The type of CDA and the basic structure
  - Who the document is about
  - Who "wrote" it
  - Where it came from
  - Where it is going
  - When it was created

Header- Elements

- ID
- Title
- Time-Information
- Confidentiality
- Patient

CDA Structure: Header- Author

```
<author>
    <time value="2000040714"/>
    <assignedAuthor>
        <id extension="KP00017" root="2.16.840.1.113883.19"/>
        <assignedPerson>
            <name>
                <given>Robert</given>
                <family>Dolin</family>
                <suffix>MD</suffix>
            </name>
        </assignedPerson>
        <representedOrganization>
            <id extension="M345" root="2.16.840.1.113883.19"/>
        </representedOrganization>
    </assignedAuthor>
</author>
```

Header- Elements

- ID
- Title
- Time-Information
- Confidentiality
- Patient

CDA Structure: Header- Record Target

```
<recordTarget>
    <patientRole>
        <id extension="12345" root="2.16.840.1.113883.19"/>
        <patient>
            <name>
                <given>Henry</given>
                <family>Levin</family>
                <suffix>the 7th</suffix>
            </name>
            <administrativeGenderCode code="M" codeSystem="2.16.840.1.113883.5.
            <birthTime value="19320924"/>
        </patient>
        <providerOrganization>
            <id extension="M345" root="2.16.840.1.113883.19"/>
        </providerOrganization>
    </patientRole>
</recordTarget>
```

Header- Elements

- ID
- Title
- Time-Information
- Confidentiality
- Patient

CDA Structure: Header- Legal Authenticator

```
<legalAuthenticator>
    <time value="20000408"/>
    <signatureCode code="S"/>
    <assignedEntity>
        <id extension="KP00017" root="2.16.840.1.113883.19"/>
        <assignedPerson>
            <name>
                <given>Robert</given>
                <family>Dolin</family>
                <suffix>MD</suffix>
            </name>
        </assignedPerson>
        <representedOrganization>
            <id extension="M345" root="2.16.840.1.113883.19"/>
        </representedOrganization>
    </assignedEntity>
</legalAuthenticator>
```

Header- Elements

- ID
- Title
- Time-Information
- Confidentiality
- Patient

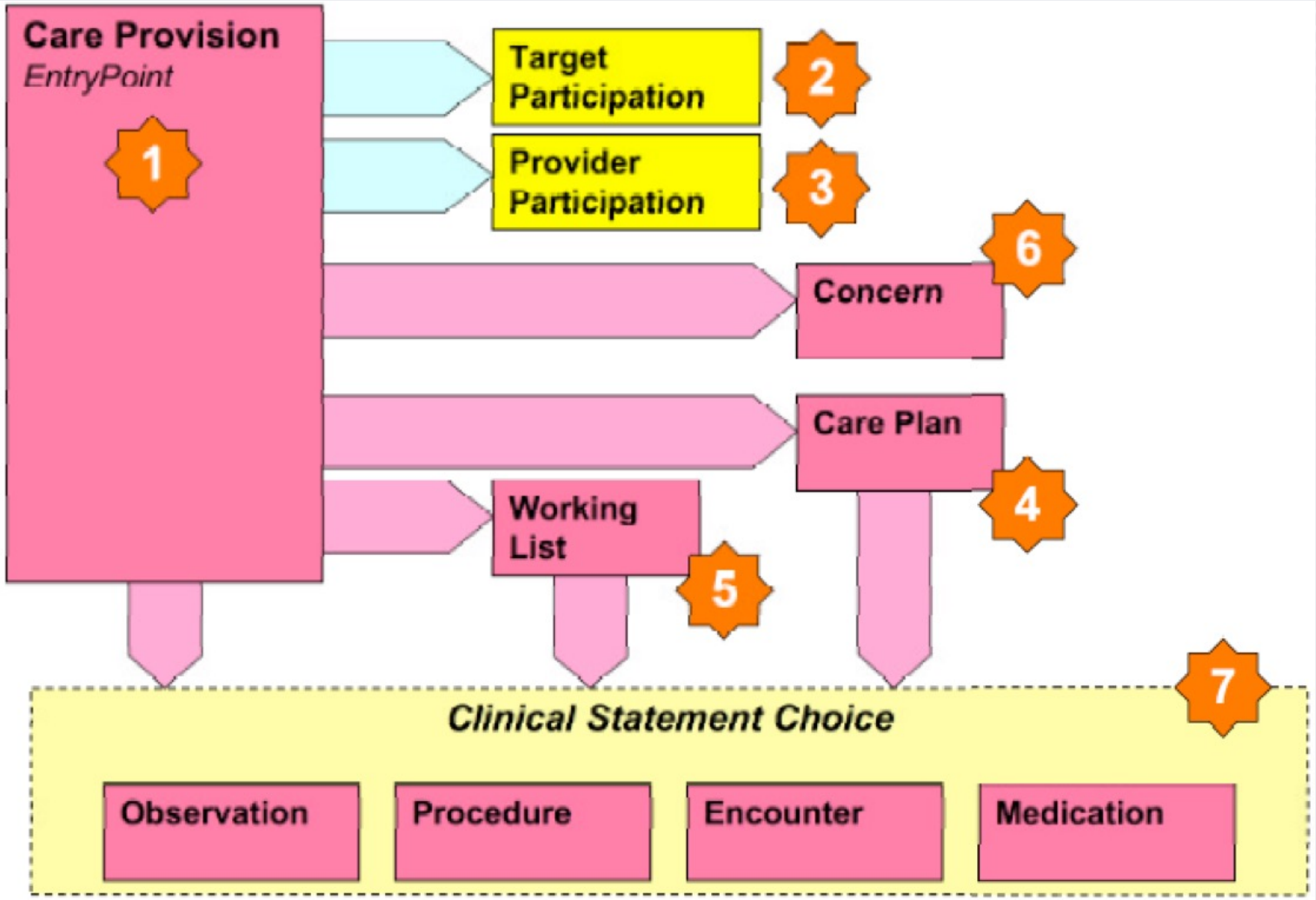
CDA Structure: Header- Custodian

```
<custodian>
    <assignedCustodian>
        <representedCustodianOrganization>
            <id extension="M345" root="2.16.840.1.113883.19"/>
            <name>Good Health Clinic</name>
        </representedCustodianOrganization>
    </assignedCustodian>
</custodian>
```

Header- Elements

- ID
- Title
- Time-Information
- Confidentiality
- Patient

e.g. CDA-Order Form



Building order of HL7 CDA

HiCure
Excellence in Health Informatics Integrated Curricula

Data Integration

IHE - Integrating the Healthcare Enterprise

IHE – Integrating the Healthcare Enterprise

- Founded in 1998
- addresses the process-level
- IHE defines use-cases for relevant IT-processes, these are referred to as *profiles*,
- Defines and provides integration profiles and services:
  - Cross-Enterprise Document Sharing (XDS.b)
  - Patient Identifier Referencing (PIX)
  - Patient Demographics Query (PDQ)

- Tested in Connectathon

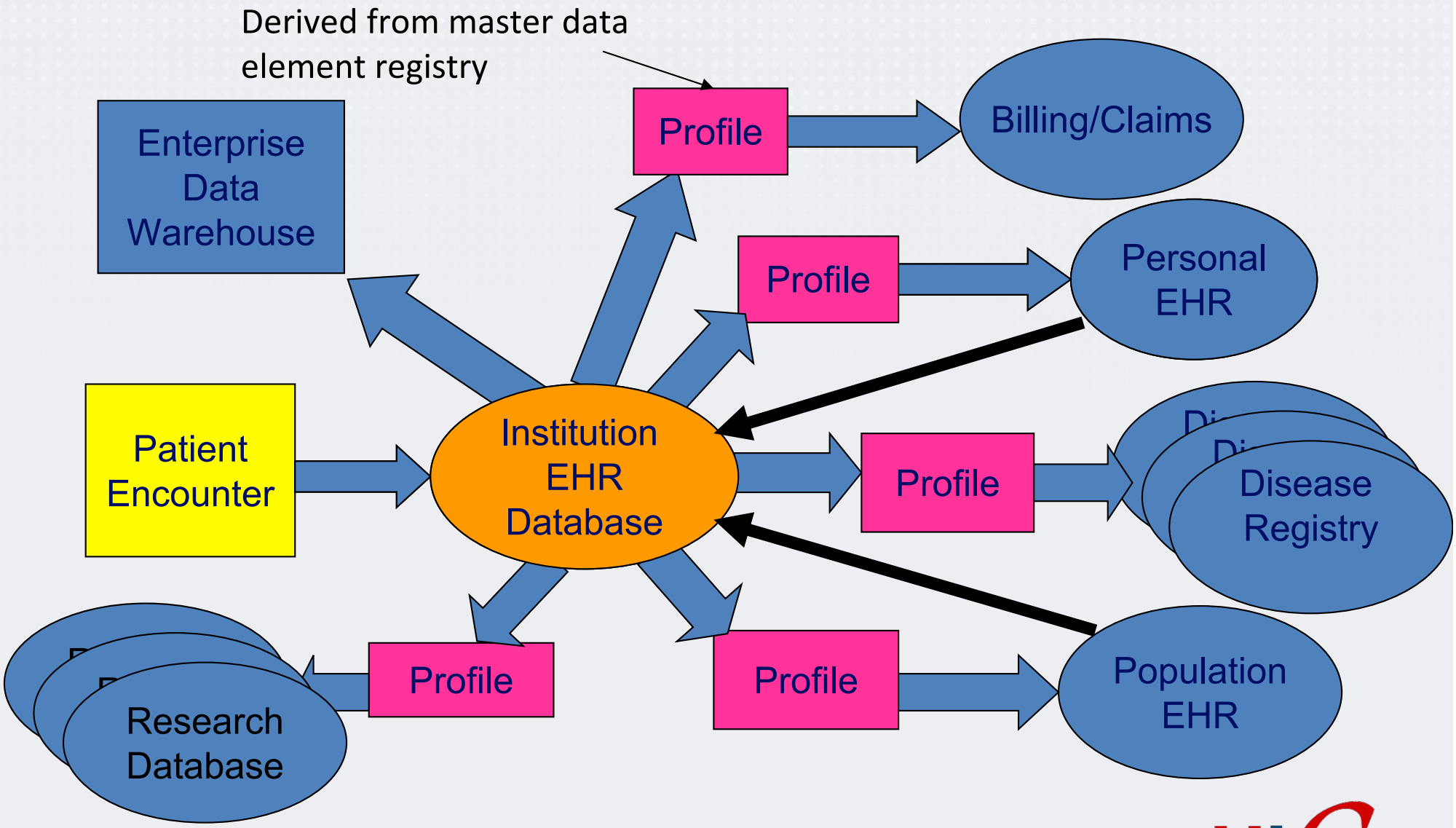
IHE - Profiles and Medical Domains

- Using one profile for all medical domain will create a very complex data profile.
  - Such profile will also include unnecessary non meaningful data elements for individual clinical transfers.

- IHE takes the approach that each medical domain has its specific data requirements for easier data integration and data completeness.

- IHE developed specific data integration profiles for a set of medical domains.

IHE: Integration using Profiles



IHE - Domains

- IHE developed specific profiles for specific medical domains. IHE medical domains include:
  - Anatomic Pathology
  - Cardiology
  - Eye Care
  - IT Infrastructure
  - Laboratory
  - Patient Care Coordination
  - Patient Care Device
  - Pharmacy
  - Quality, Research and Public Health
  - Radiation Oncology
  - Radiology

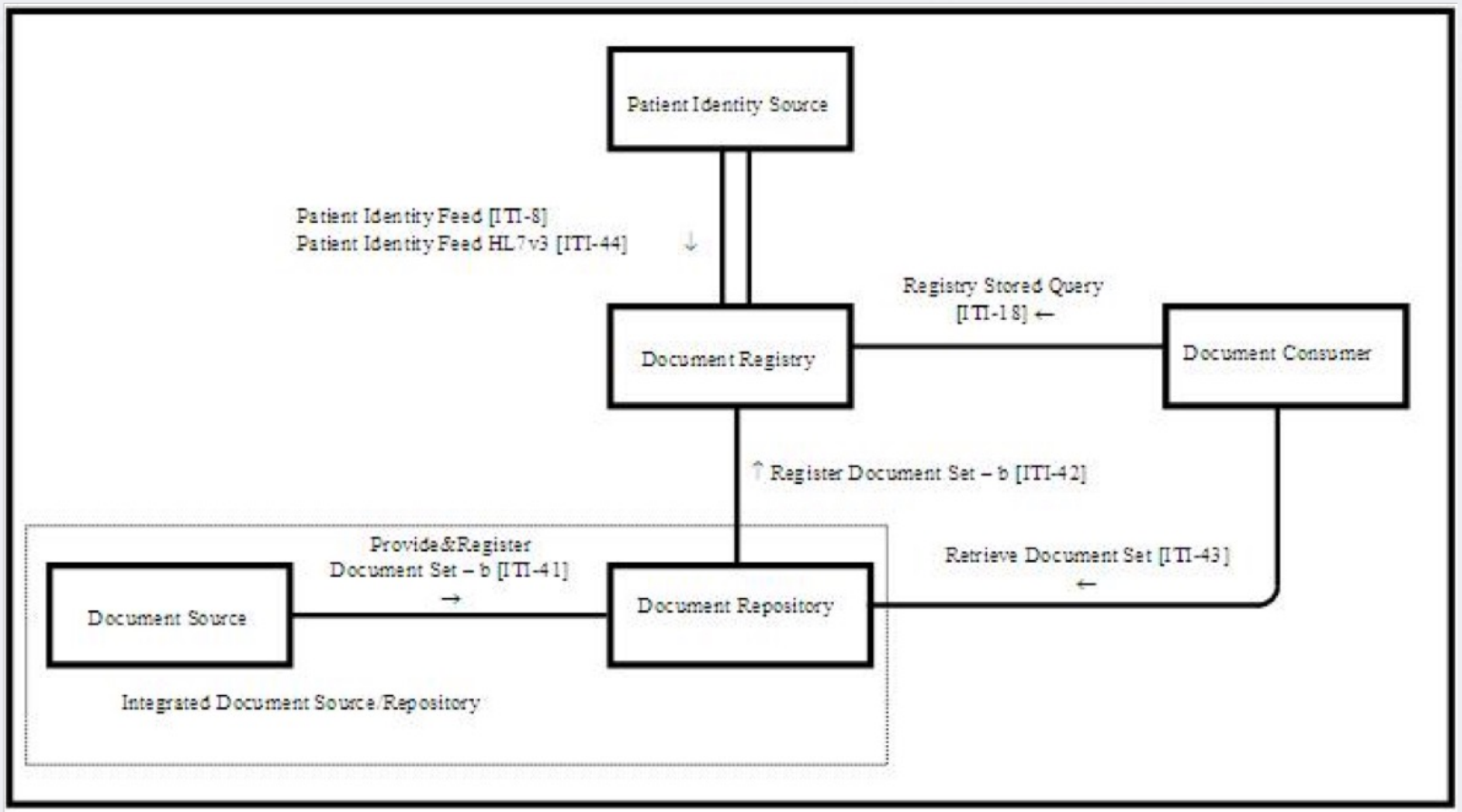
IHE - Profiles (Examples)

Cross-Enterprise Document Sharing (XDS.b)

is focused on providing a standard-based specification for managing the sharing of documents between any healthcare enterprise

- A Document Repository is responsible for storing documents in a transparent, secure, reliable and persistent manner and responding to document retrieval requests.
- A Document Registry is responsible for storing information about those documents.
- Documents are provided by one or more Document Sources.
- They are then accessed by one or more Document Consumers.

IHE - Profiles (Examples)



IHE - Profiles (Examples)

Patient Identifier Referencing (PIX)

supports the cross-referencing of patient identifiers from multiple Patient Identifier Domains by:

- Transmitting patient identity information from an identity source to the Patient Identifier Cross-reference Manager.
- Providing the ability to access the list(s) of cross-referenced patient identifiers either via a query/ response or via an update notification.

IHE - Profiles (Examples)

Patient Demographics Query (PDQ)

- Allows a Patient Demographics Supplier actor to receive a Patient Demographics Query request from the Patient Demographics Consumer actor, and returns demographics information.
- When the Patient Demographics Supplier Actor is grouped with actors in other IHE profiles that perform patient information reconciliation activities, the PDQ Supplier Actor may use the updated information to respond to PDQ Queries.
- Patient Demographics Supplier Actor: is an actor (e.g., healthcare organisation, a patient Doctor) that is allowed to access patient personal and demographic information.

IHE - Connectathon

- Developed profiles tested into annually organised connectathons.
- In connectathons, developer test IHE profiles on real data for different medical domains.

Image Exchange Standards

DICOM- Digital Imaging and Communication in Medicine