



AIRA
AMERICAN IMMUNIZATION
REGISTRY ASSOCIATION

Emerging Standards

AIRA Discovery Session

April 23rd, 2018

4pm Eastern



Overview

- Presentation
 - Emerging Standards: HL7 V2, HL7 V3, FHIR, and what we need to consider
- Questions, Comments and Discussion



Today's Speakers:

- Nathan Bunker, AIRA Senior Technical Project Manager
- Eric Larson, AIRA Senior Technical Project Manager





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Nathan Bunker

Eric Larson

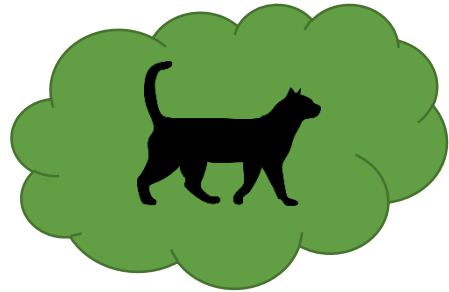
Goals for Today

- Necessary Components of a Standard
- Discuss how that applies to
 - HL7 V2
 - HL7 V3
 - FHIR
- Explore where FHIR could be used

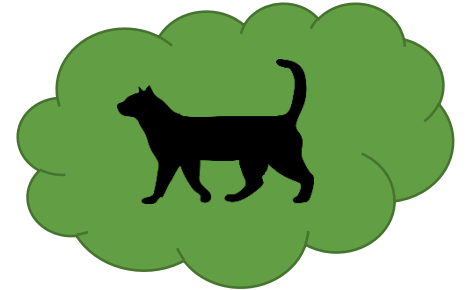


Interoperability is Communication

Human
Communication



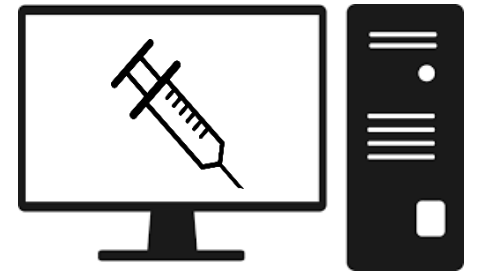
CAT



Computer
Interoperability



HL7



Communication Needs Three Things

- Place
 - Living Room
 - Starbucks
 - Telephone
 - Letter
- Language
 - English
 - American Sign Language
 - Klingon
- Vocabulary
 - Sports
 - Politics
 - Cooking

All Communication Requires Constraints

Going forward, take notice of all the constraints that are required for proper communication



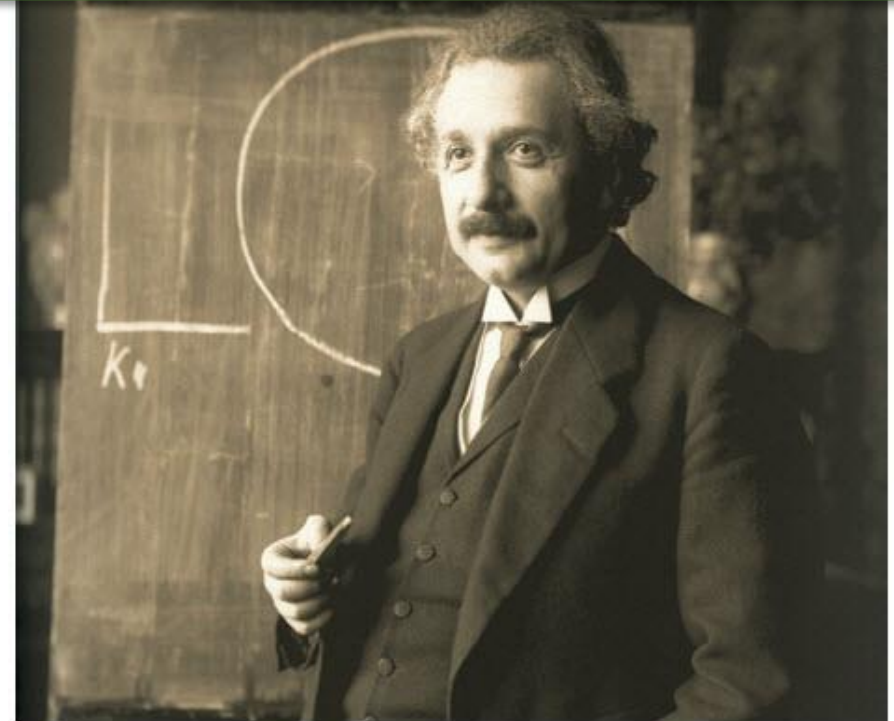
Communication Needs Three Things

- Place

What would you need to be able to communicate with Einstein about his 1905 paper "On the Electrodynamics of Moving Bodies" where he proposed $E = mc^2$?

- Language

- Vocabulary



Communication Needs Three Things

- Place



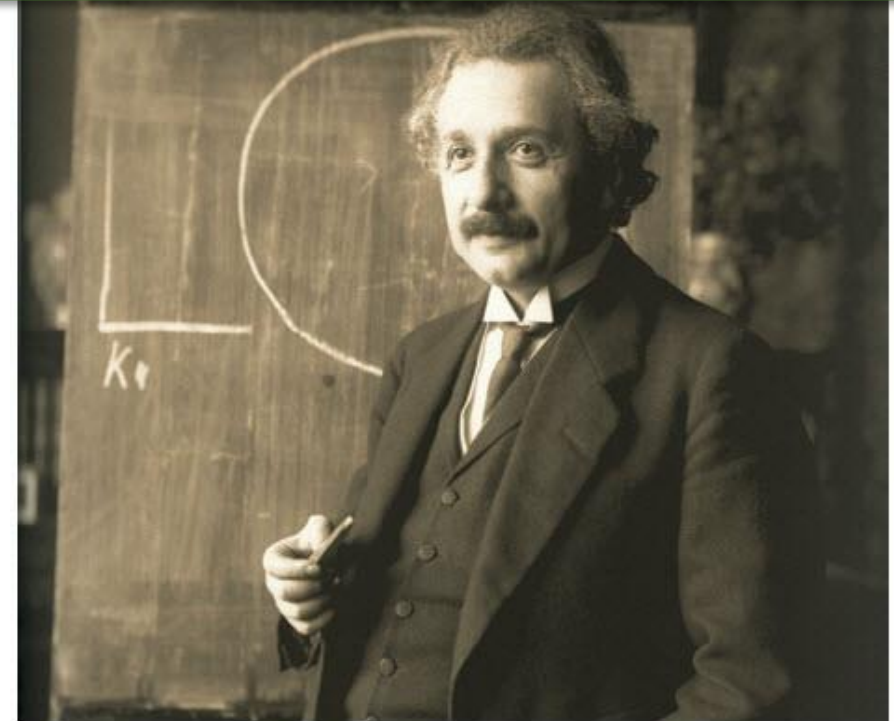
Park Bench in Zurich in 1905



- Language

- Vocabulary

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Communication Needs Three Things

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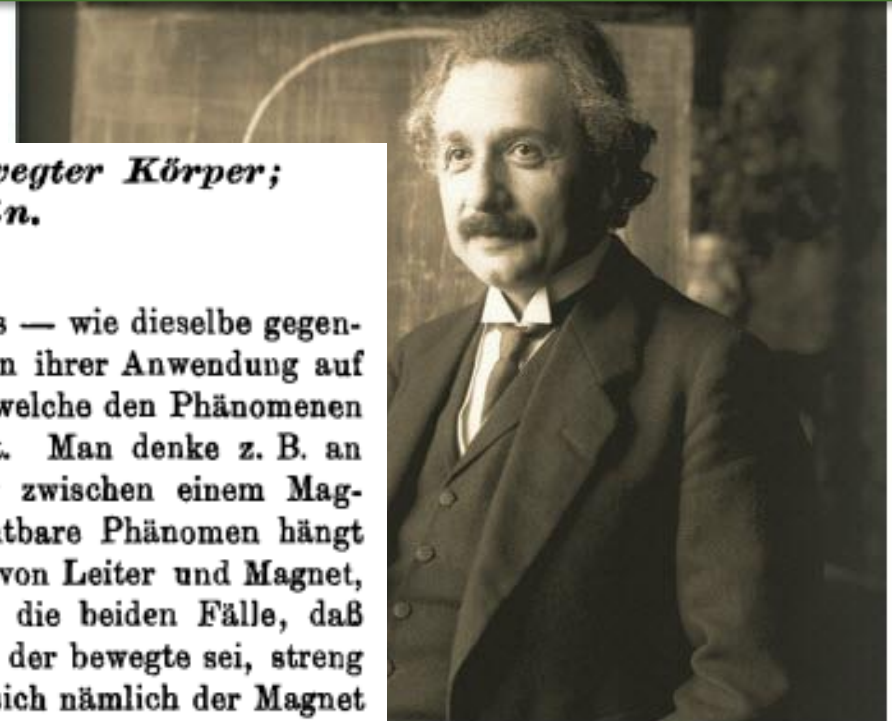
- Language

German

- Vocabulary

3. *Zur Elektrodynamik bewegter Körper;* *von A. Einstein.*

Daß die Elektrodynamik Maxwells — wie dieselbe gegenwärtig aufgefaßt zu werden pflegt — in ihrer Anwendung auf bewegte Körper zu Asymmetrien führt, welche den Phänomenen nicht anzuhaften scheinen, ist bekannt. Man denke z. B. an die elektrodynamische Wechselwirkung zwischen einem Magneten und einem Leiter. Das beobachtbare Phänomen hängt hier nur ab von der Relativbewegung von Leiter und Magnet, während nach der üblichen Auffassung die beiden Fälle, daß der eine oder der andere dieser Körper der bewegte sei, streng voneinander zu trennen sind. Bewegt sich nämlich der Magnet und ruht der Leiter, so entsteht in der Umgebung des Magneten ein elektrisches Feld von gewissem Energiewerte, welches an



Communication Needs Three Things

- Place



Park Bench in Zurich in 1905



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Elektrodynamik Maxwells –
Maxwells Electrodynamics

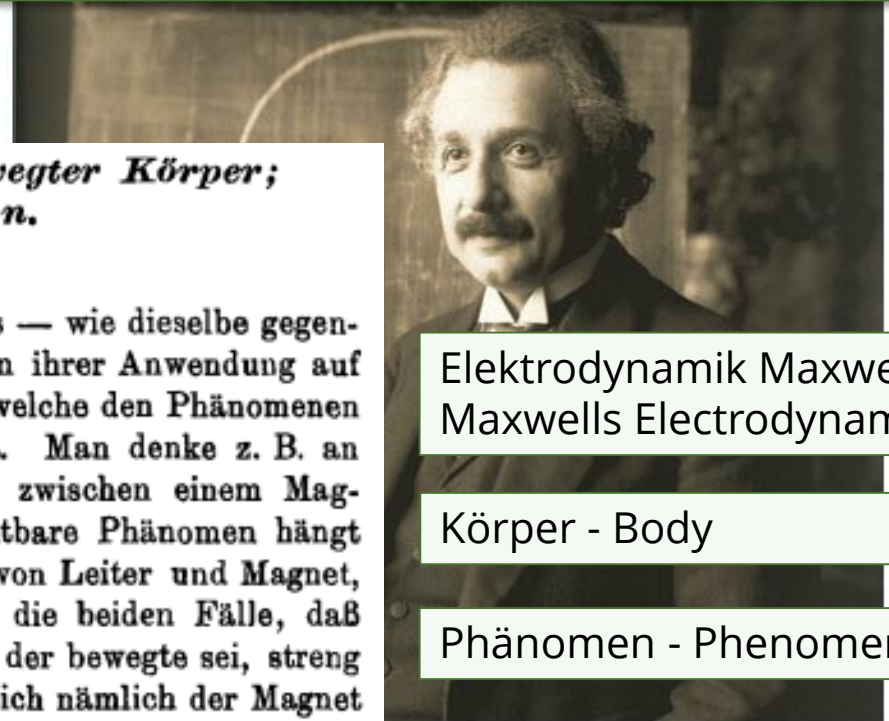
Körper - Body

Phänomen - Phenomenon

Wechselwirkung - Interaction

- Vocabulary

Physics



Interoperability Needs Three Things

- Transport (Place)
 - CDC WSDL
 - Web Service
 - FTP
- Standard (Language)
 - HL7 v2.5.1
 - HL7 v3
- Vocabulary
 - CVX – Vaccinations
 - NDC – Vaccination Products
 - MVX – Manufacturers

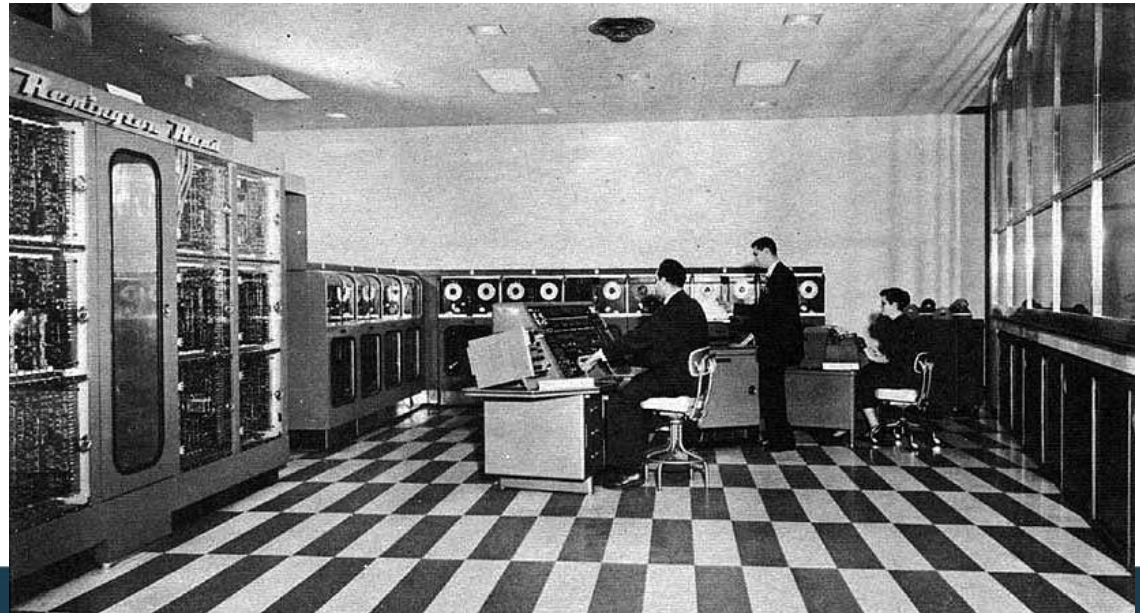


Immunization Messaging in the 1950's

- Transport
 - US Mail
- Standard
 - English
- Vocabulary
 - Vaccine Concepts

Date: October 16, 1967
To: State Health Department
From: Dr. Smith's Office
Attention: Immunization Bureau

Please be advised that today Dr. Julien Smith administered a smallpox vaccination to Frank Hardy, born April 5, 1951.



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US Postal Standards

Letter writing conventions

Standard layouts and spacing



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Gregorian Calendar



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Organizations

Clinician

Patient

Vaccination



Development of HL7 v2 Messaging

- HL7 v2
 - First developed in the late 1980's
 - Computer communication in the hospital space
 - Hospital departments needed to be connected
- Transport
 - Networks were new, hospitals had to choose a network vendor
 - HL7 v2 left network design to others
 - Transport is out-of-scope for HL7 v2



Development of HL7 v2 Messaging

- HL7 v2 Format
 - Compact format
 - Easy for computer software to read
- Vocabulary
 - Tightly coupled with standard

Date: October 16, 1967
To: State Health Department
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Please be advised that today Dr. Julien Smith administered a smallpox vaccination to Frank Hardy, born April 5, 1951.

```
MSH|^~\&||Dr Julien Smith||Immunization Bureau|19671016  
PID||||Hardy^Frank||19510405  
RXA|||19671016||75^Smallpox^CVX
```

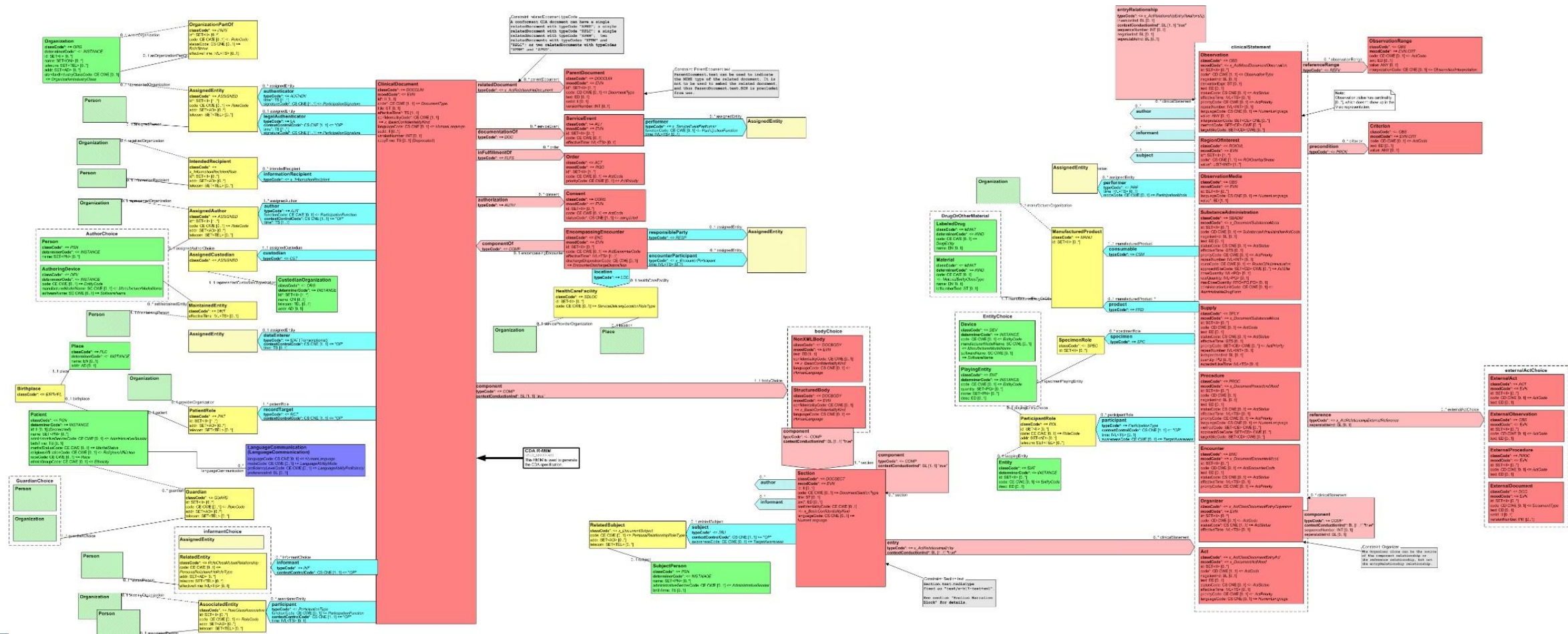


HL7 v3 Introduction

- HL7 v3
 - Developed in the 1990's to address shortcomings in V2
 - Uses other standards such as XML
 - Created Reference Information Model (RIM)
 - A “modeler's paradise”
 - In use in Canada, UK and probably some other countries
- Transition to HL7 v3
 - HL7 2.3 would be the last HL7 v2 standard published
 - The next version published was HL7 2.3.1
 - HL7 will soon be publishing HL7 v2.9



v3 RIM



- Clinical Document Architecture - CDA

- CDA uses HL7 v3
 - Most common use of HL7 v3 in the US
 - EHR can encode clinical record in common format
- Document not a Message
- Can contain immunization data too

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  <text>
    <list>
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      <item>Aspirin - Wheezing</item>
      <item>Codeine - Itching and nausea</item>
    </list>
  </text>
  <entry>
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      <code code="247472004" codeSystem="2.16.840.1.113883.6.96"
        codeSystemName="SNOMED CT" displayName="Hives">
        <originalText><reference value="#A1"/></originalText>
      </code>
      <entryRelationship typeCode="MFST">
        <observation classCode="OBS" moodCode="EVN">
          <code code="91936005" codeSystem="2.16.840.1.113883.6.96"
            codeSystemName="SNOMED CT" displayName="Allergy to penicillin"/>
          </observation>
        </entryRelationship>
      </observation>
    </entry>
  </section>
```



Vocabulary - Vaccines

- Vaccine Code Sets

- <https://www.cdc.gov/vaccines/programs/iis/code-sets.html>

- CVX

- Generic vaccination concept: “Hep A & Hep B” but not “Twinrix”
 - Represents both currently administered vaccines and historical vaccinations

- MVX

- Manufacturer of vaccination

- NDC

- National Drug Code assigned by the Federal Drug Administration (FDA)
 - Universal product identifiers
 - Very specific identification: “10 dose box of Twinrix manufactured by GlaxoSmithKline”



Vocabulary - LOINC

- Logical Observation Identifier Names and Codes
 - A universal code system for test, measurements, and observations
 - Created by Regenstrief Institute
 - <http://loinc.org/>
 - Free to use
- Used in
 - HL7 v2
 - HL7 v3
 - HL7 FHIR



Vocabulary - SNOMED

- Systemized Nomenclature of Medicine
 - Started by the College of American Pathologists in 1973
 - Released as SNOMED CT in 2002
 - From website:
 - Is the most comprehensive, multilingual clinical healthcare terminology in the world.
 - Is a resource with comprehensive, scientifically validated clinical content.
 - Enables consistent, processable representation of clinical content in electronic health records.
 - Is mapped to other international standards.
 - Is already used in more than fifty countries.

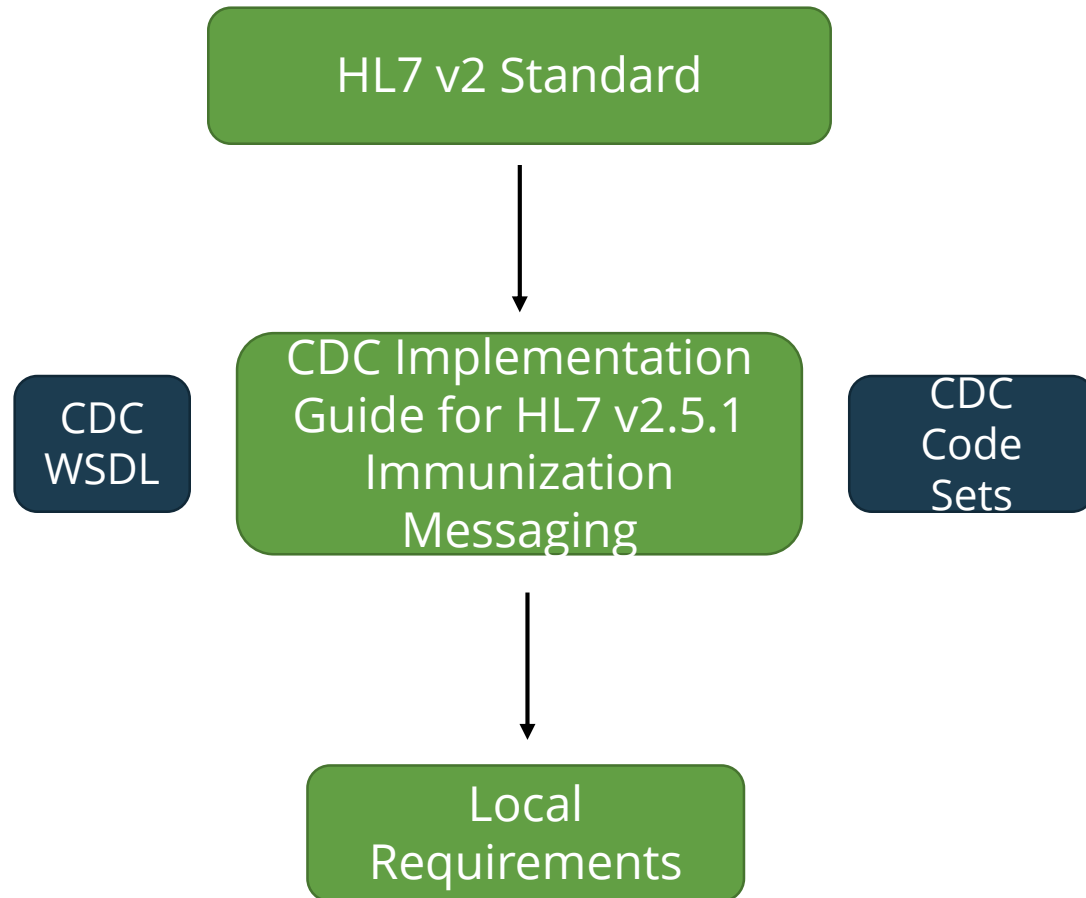


Vocabulary – ICD & CPT

- International Classification of Disease - ICD
 - World Health Organization (WHO) system
 - Current version is ICD-10, replacing ICD-9
 - Focused on diagnosis
- Current Procedural Terminology - CPT
 - American Medical Association (AMA) system
 - Focused on procedures
 - Immunizations can be represented in CPT
- More Information: <http://www.healthfusion.com/blog/2014/health-topics/medical-coding/whats-difference-icd-cpt-loinc-snomed-ct/>



Bringing it All Together



- Constraints at many levels
- HL7 v2 Standard
 - Basic structure
- CDC
 - Adds additional constraints
- Local Program
 - Adds final constraints needed for successful operation



Future of V2

Today, Tomorrow, Foreseeable Future

- IIS should focus on version 2.5.1 Release 1.5 IG with
 - Addendum
 - ACK Guidance Document
 - RSP Guidance Document
 - LOINC Guidance Document
 - CDC WSDL
- Use NIST conformance tools
 - <https://hl7v2-iz-r1.5-testing.nist.gov/iztool/#/home>

After That?

- SISC is in the process of balloting an IG for Version 2.8.2
- No plans or timeline to supplant V2.



FHIR

Fast Healthcare Interoperability Resources

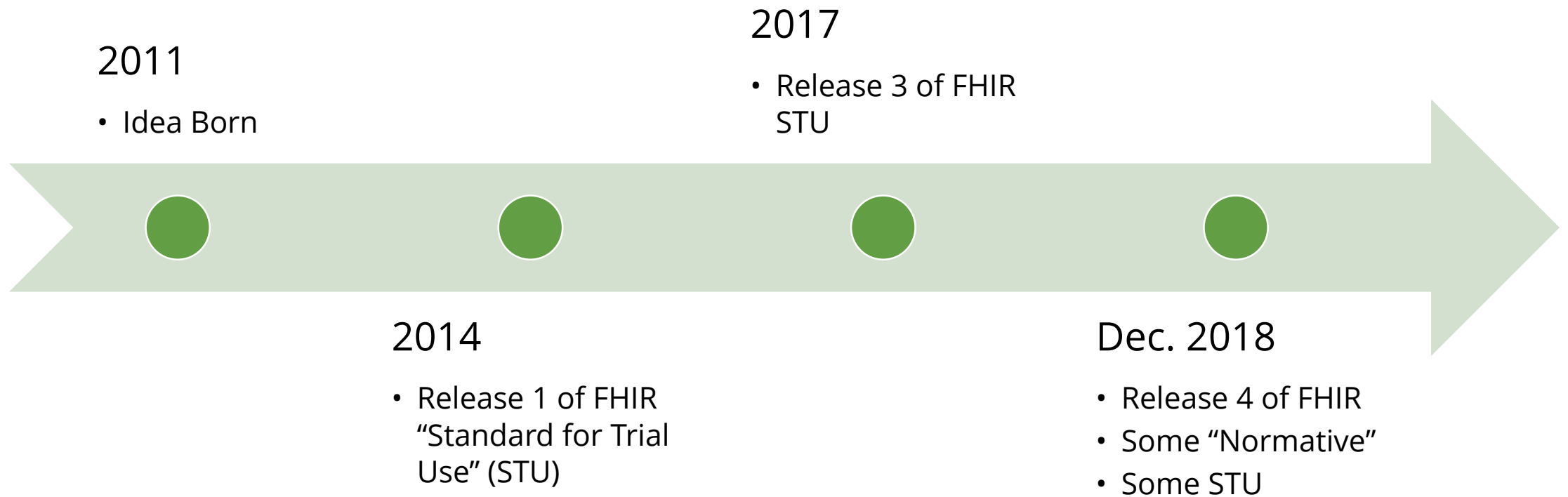


History

- First Imagined in 2011 by Grahame Grieve from Australia
 - Originally called “Resources for Health”
- This was based on two major points in 2011
 - HL7 Fresh Look Task Force asked for ideas
 - Grahame’s proclamation that “HL7 V3 has failed”



Path Towards Becoming a Standard



FHIR Basics – Comparing to V2

- HL7 V2 has “Segments”; FHIR has “Resources”
 - These can be thought of as roughly equivalent
 - V2 has a PID segment, FHIR has a Patient Resource
 - V2 has a RXA segment, FHIR has an Immunization Resource
- V2 has fields; FHIR has Data Elements
 - Date of Birth:
 - V2 has PID-7, FHIR has Patient.birthDate
- Both have data types
 - Date is the data type for the Date of Birth.
 - Note: These data types aren’t necessarily equivalent between V2 and FHIR
- Where possible, Vocabulary is reused
 - Vaccine related codes are the same (CVX, MVX, route, site)



HL7 v2 PID Segment

SEQ	LEN	DT	OPT	RP/#	TBL#	ELEMENT NAME
1	4	SI	O			Set ID - PID
2	20	CX	B			Patient ID
3	250	CX	R	Y		Patient Identifier List
4	20	CX	B	Y		Alternate Patient ID - PID
5	250	XPN	R	Y		Patient Name
6	250	XPN	O	Y		Mother's Maiden Name
7	26	TS	O			Date/Time of Birth
8	1	IS	O		0001	Administrative Sex
9	250	XPN	B	Y		Patient Alias
10	250	CE	O	Y	0005	Race
11	250	XAD	O	Y		Patient Address
12	4	IS	B		0289	County Code
13	250	XTN	O	Y		Phone Number - Home
14	250	XTN	O	Y		Phone Number - Business
15	250	CE	O		0296	Primary Language
16	250	CE	O		0002	Marital Status
17	250	CE	O		0006	Religion
18	250	CX	O			Patient Account Number
19	16	ST	B			SSN Number - Patient
20	25	DLN	B			Driver's License Number - Patient
21	250	CX	O	Y		Mother's Identifier
22	250	CE	O	Y	0189	Ethnic Group
23	250	ST	O			Birth Place
24	1	ID	O		0136	Multiple Birth Indicator
25	2	NM	O			Birth Order
26	250	CE	O	Y	0171	Citizenship
27	250	CE	O		0172	Veterans Military Status
28	250	CE	B		0212	Nationality
29	26	TS	O			Patient Death Date and Time
30	1	ID	O		0136	Patient Death Indicator
31	1	ID	O		0136	Identity Unknown Indicator
32	20	IS	O	Y	0445	Identity Reliability Code
33	26	TS	O			Last Update Date/Time
34	241	HD	O			Last Update Facility
35	250	CE	C		0446	Species Code
36	250	CE	C		0447	Breed Code
37	80	ST	O			Strain
38	250	CE	O	2	0429	Production Class Code
39	250	CWE	O	Y	0171	Tribal Citizenship

HL7 FHIR Patient Resource

Structure	UML	XML	JSON	All
Structure				
Name	Flags	Card.	Type	Description & Constraints
Patient			DomainResource	Information about an individual or animal receiving health care services
identifier		Σ 0..*	Identifier	An identifier for this patient
active		?! Σ 0..1	boolean	Whether this patient's record is in active use
name		Σ 0..*	HumanName	A name associated with the patient
telecom		Σ 0..*	ContactPoint	A contact detail for the individual
gender		Σ 0..1	code	male female other unknown AdministrativeGender (Required)
birthDate		Σ 0..1	date	The date of birth for the individual
deceased[x]		?! Σ 0..1		Indicates if the individual is deceased or not
deceasedBoolean			boolean	
deceasedDateTime			dateTime	
address		Σ 0..*	Address	Addresses for the individual
maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient Marital Status Codes (Required)
multipleBirth[x]		0..1		Whether patient is part of a multiple birth
multipleBirthBoolean			boolean	
multipleBirthInteger			integer	
photo		0..*	Attachment	Image of the patient
contact		I 0..*	BackboneElement	A contact party (e.g. guardian, partner, friend) for the patient SHALL at least contain a contact's details or a reference to an organization
relationship		0..*	CodeableConcept	The kind of relationship PatientContactRelationshipin (Extensible)



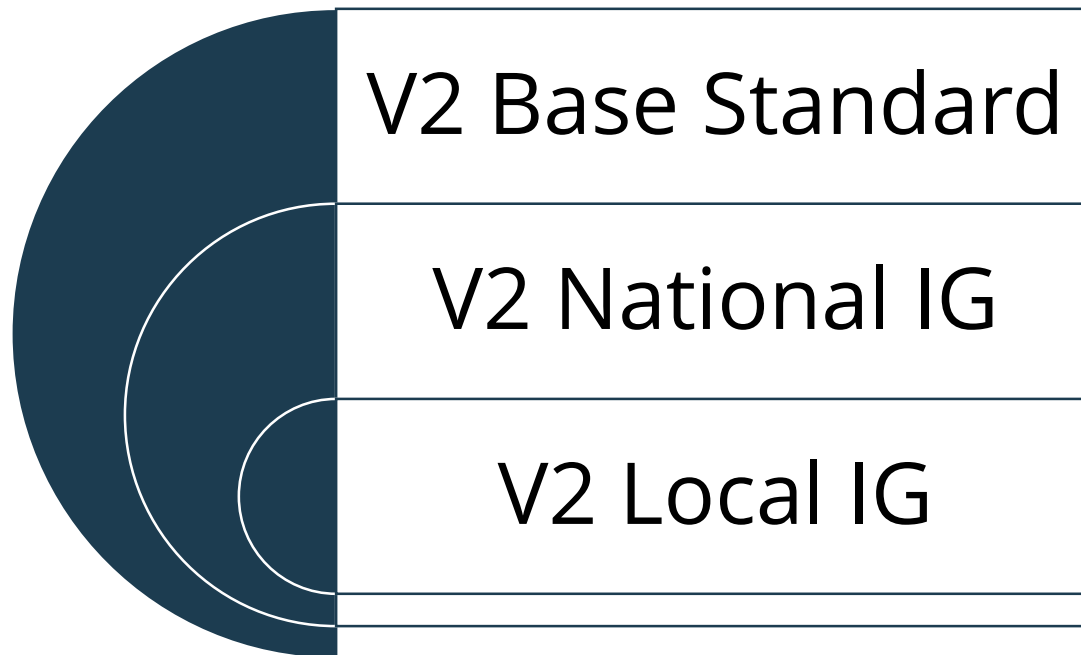
FHIR Basics – Differences from V2

- On-the-wire format
 - V2: Pipes, carrots, tildes, slashes, ampersand (MSH|^~\&|)
 - FHIR: XML or JSON (JavaScript Object Notation)
- Transport
 - V2: Not defined, hence the need for CDC WSDL
 - FHIR: REST
- Usage Patterns
 - V2: Messages
 - FHIR: RESTful API, Messaging, Documents, and Services

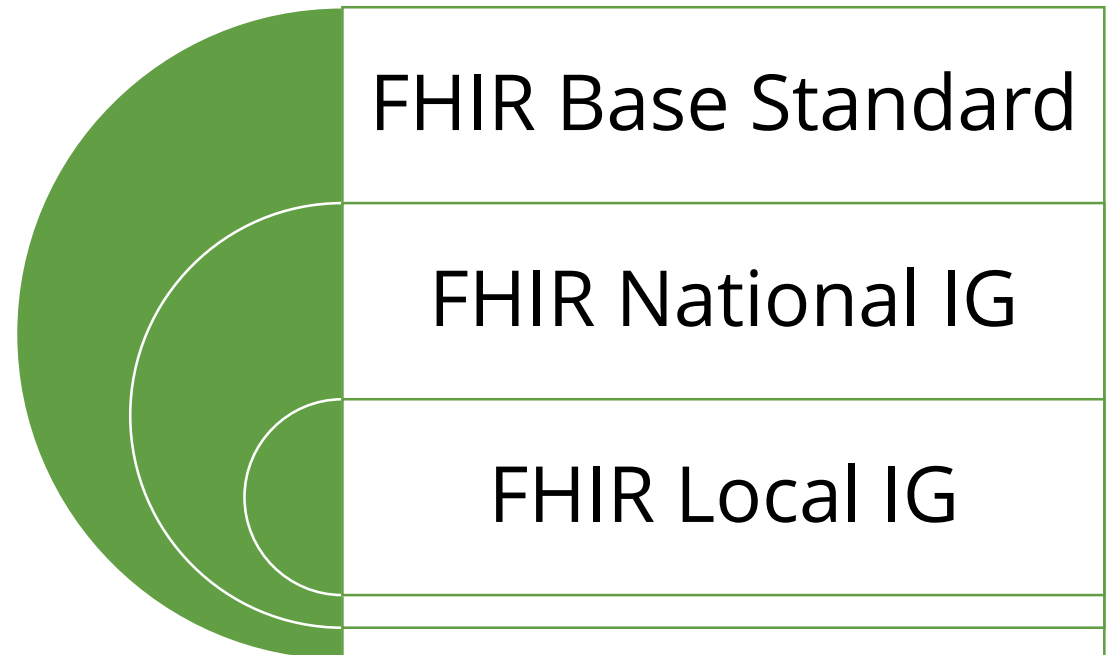


FHIR Basics – Implementation Model

Version 2



FHIR



AIRA/CDC Involvement

- The Public Health Workgroup at HL7 is the owner of the Immunization-related FHIR Resources
 - Craig Newman (CDC) is a Co-chair of Public Health and maintainer of the Immunization-related resources
- Also review and comment on other FHIR resources
- Participated in FHIR Connectathon event



More FHIR Information

- Standard
 - [HL7.org/fhir](http://hl7.org/fhir)
 - This is the currently published standard. Freely available
- Technical Education
 - Free
 - Internet has tons of articles and youtube videos
 - These are of varying quality and rarely developed by FHIR-certified folks
 - Paid
 - HL7.org provides several classes with certified instructors



So Where Could We use FHIR?



First, what wouldn't be a good idea

- Replace V2 for Submission and Query to an IIS
- Why?
 - It's not about technical feasibility. FHIR can do this
 - It's about cost and return on investment
 - We would be collecting the same information with the same quality, but spend years transitioning for the sake of using something new
 - Is this decision forever? Probably not, but for now doing the same thing with a different standard doesn't make sense



Possible Ideas?

- Some IIS have been looking into replacing their CDS engine.
- There are now a growing number of CDS engines on the market.
- How does an IIS communicate with an external CDS engine?
 - Today? Each CDS engine uses a different mechanism
 - Some based in older standards; some based on proprietary interfaces
- FHIR would be a good candidate so all CDS engines use the same standard
 - A small focused group including AIRA and CDC are working on defining an Implementation Guide for this.



Other Ideas

- Think of places where the EHR User needs to log into the IIS
 - Reminder/Recall?
 - Using something called “SMART on FHIR” (think of apps for an EHR),
 - the App could request a list of patients due for shots from the IIS
 - Compare that list against future Appointments in the EHR
 - Those patients from the IIS that don’t have an appointment would be the key patients in need of a reminder letter
 - Inventory Reconciliation
 - Vaccine Ordering
 - Data Quality Reports



Questions

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Thanks so much!

