# FHIR and Interoperability

Partners in Interoperability

March 21, 2017

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# Current Situation

- Each EHR vendor uses a proprietary database schema, proprietary models and unique terminology to represent clinical data
  - Some standardization of codes is now occurring, but
  - Data is not consistent vendor to vendor, or even organization to organization within the same vendor
- This means that:
  - Sharing data is difficult
  - Sharing executable software across vendors is impossible
  - **Each useful application is created or re-created on each different platform (and we pay for it!)**
  - There are unmet needs for health care applications and decision support
  - Software costs are higher than they need to be

# SMART on FHIR®© – Open Platform Architecture

SOA Orchestration

mHealth

OAuth

FHIR® REST API

FHIR Profiles from CIMI models

SMART™ Web Apps

Trusted App Registry

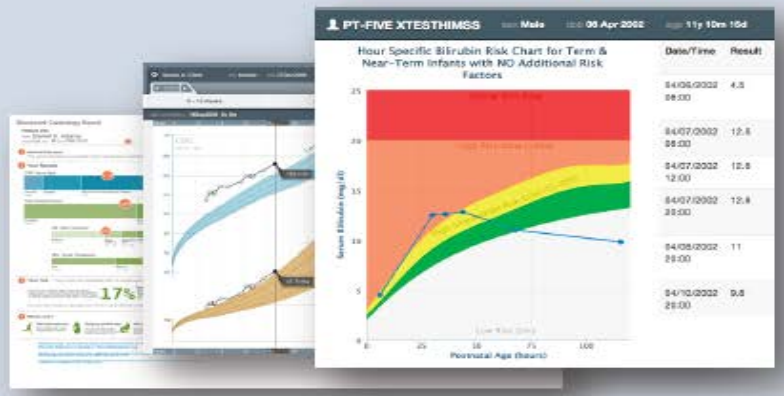
Children's Hospital Boston

Intermountain Healthcare

visualdx

"polyglot"

HARVARD MEDICAL SCHOOL




http://smartplatforms.org/smart-on-fhir/

Exhibit Heterogeneous Systems

Cerner
Booth# 6965

Intermountain Healthcare
Booth# 3903

Epic

Others…

# The path to interoperability

# What is HL7 FHIR©®?

- A set of modular components called “Resources”
- Resources refer to each other using URLs
  - Build a web to support healthcare process
- Exchange resources between systems
  - Using a RESTful API (e.g. web approach)
  - As a bundle of resources (messages, documents)

# FHIR: Core Resources

AdverseReaction
Alert
AllergyIntolerance
CarePlan
Composition
ConceptMap
Condition
Conformance
Device
DeviceObservationReport
DiagnosticOrder
DiagnosticReport
DocumentReference
DocumentManifest
Encounter
FamilyHistory

Group
ImagingStudy
Immunization
ImmunizationRecommendation
List
Location
Media
Medication
MedicationAdministration
MedicationDispense
MedicationPrescription
MedicationStatement
MessageHeader
Observation
OperationOutcome
Order

OrderResponse
Organization
Other
Patient
Practitioner
Procedure
Profile
Provenance
Query
Questionnaire
RelatedPerson
SecurityEvent
Specimen
Substance
Supply
ValueSet

# Observation Resource

**Observation (DomainResource)**

identifier : Identifier [0..*] status : code [1..1] « ObservationStatus! »

code : Code

subject : R

encounter

effective[x

value[x] : T

« Quan

Attac

interpretation : CodeableConcept [0..1] « Observation Interpretation+ »

method : CodeableConcept [0..1] « Observation Methods?? »

specimen : Reference [0..1] « Specimen »

device : Reference [0..1] « Device|DeviceMetric »

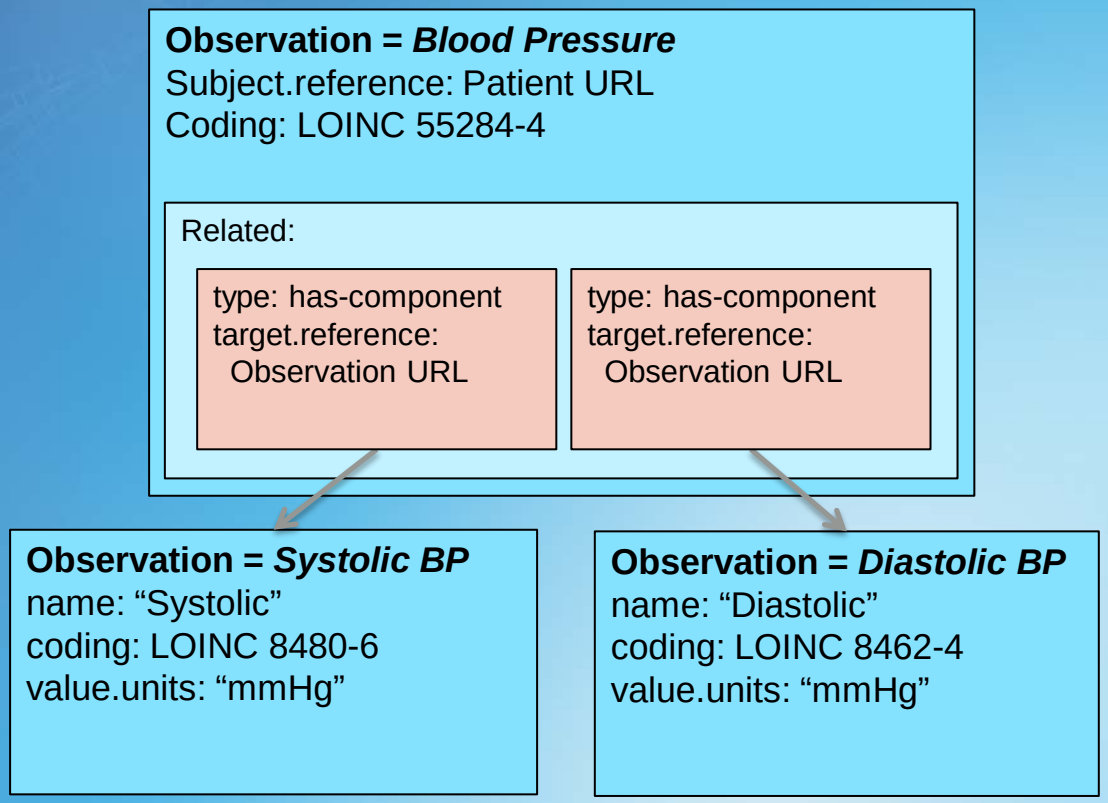
Observation

subject: Doe, John; #12345

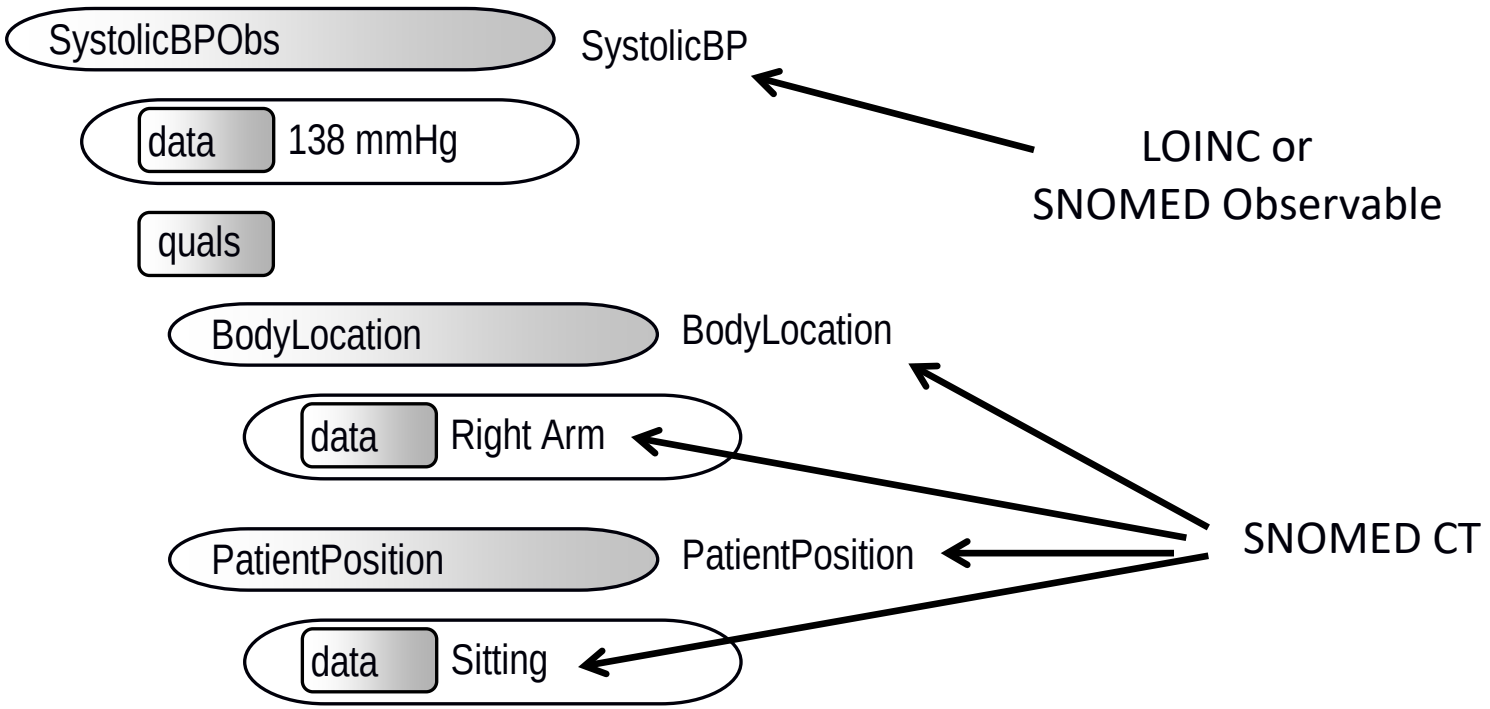
code: 8480-6, Systolic BP

value: 120 mmHg

# Profile for "Blood pressure"



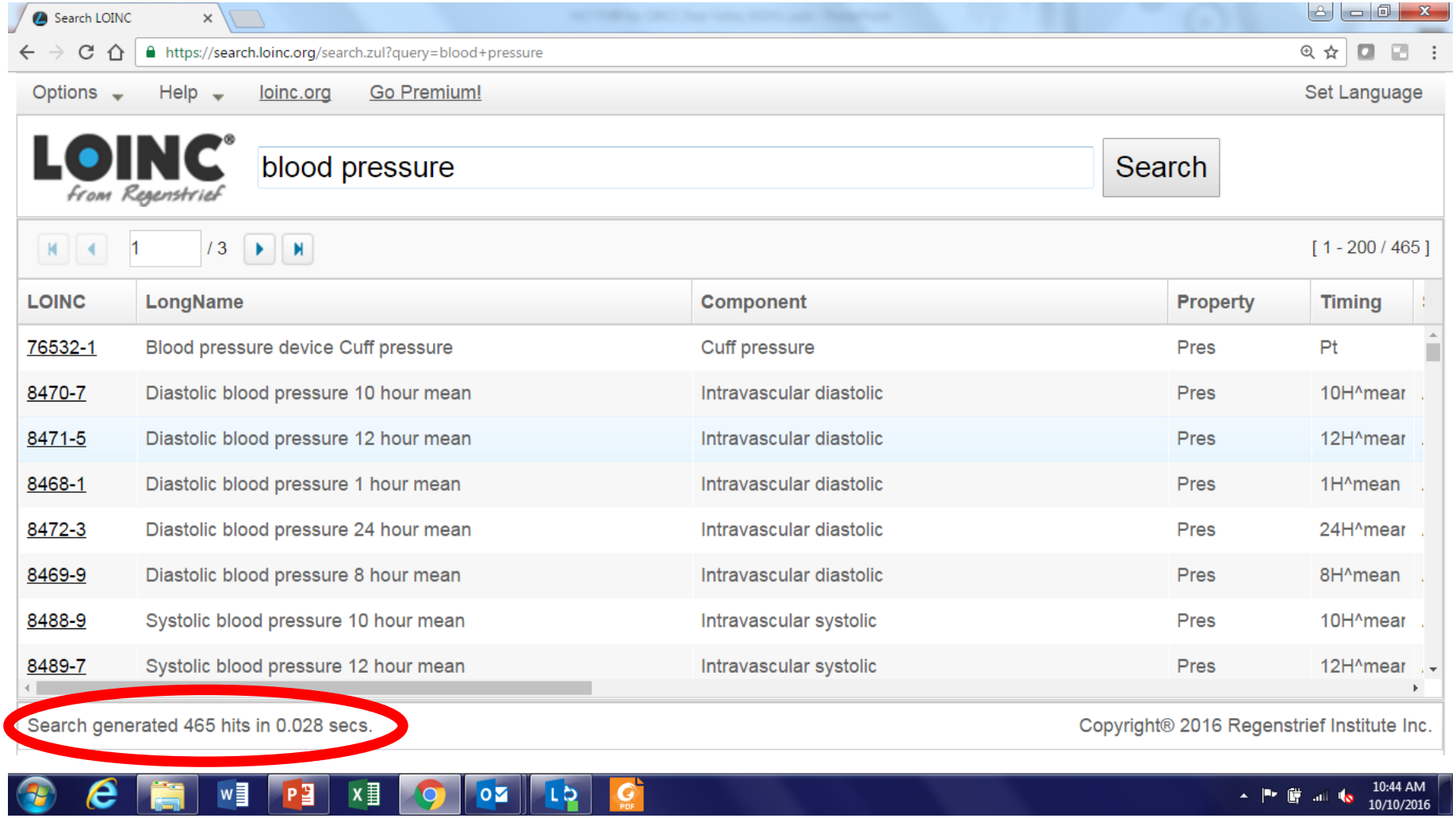
# Graphic of a Detailed Clinical Model



# People Use LOINC Codes Differently

- Variations on use of methodless and method specific codes
- Confusion on blood versus serum or plasma
- Confusion on properties
- Confusion on NAR vs NOM
- Etc.

# LOINC Codes for Blood Pressure



# Terminology Entropy

- No true interoperability because
  - Vendors use different models/profiles
  - Government agencies use different models/profiles
  - Provider organizations use different models/profiles
  - Professional organizations use different models/profiles

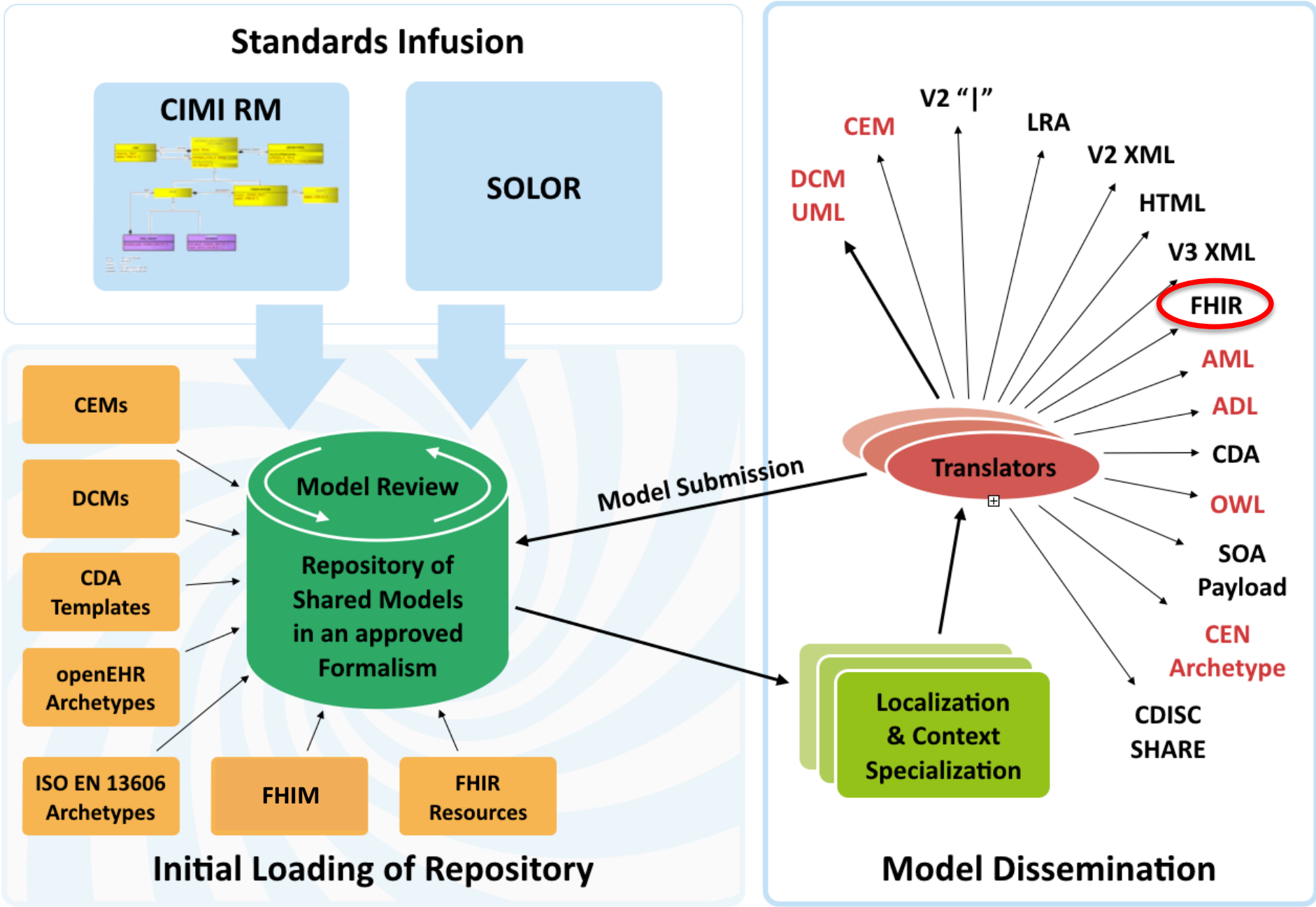
# CIMI

- The Clinical Information Modeling Initiative (CIMI) is an HL7 Work Group that is producing detailed clinical information models to enable interoperability of health care information systems
- CIMI was initiated during a “Fresh Look” session at an HL7 meeting in 2011
- CIMI models are free for use for all purposes
- See http://www.opencimi.org/ for more details

# CIMI Goals

- Create a shared repository of detailed clinical information models
- Repository is open to everyone and models are licensed free for use at no cost
- Where the models:
  - Are expressed in an approved formalism
    - Archetype Definition Language (ADL)
    - Archetype Modeling Language (AML)
  - Are based on a core reference model, including a set of base data types
  - Have formal bindings to standard coded terminologies

# CIMI Model Development Lifecycle



# How to Get Involved

- HL7
  - Partners in Interoperability
    - October 18, 2016 Johns Hopkins University, Baltimore
    - Standardizing data across medical specialties
  - Argonauts
    - Working on implementation of SMART on FHIR services
    - http://argonautwiki.hl7.org/index.php?title=Main_Page
- Healthcare Services Platform Consortium
  - https://healthservices.atlassian.net/wiki/display/HSPC/Healthcare+Services+Platform+Consortium
  - Joint project with ACOG and the Office of Population Affairs
  - Meeting on SOA architecture, knowledge sharing, terminology and modeling
    - November 7, 2016 New Orleans

# Options for How to Do the Hard Work

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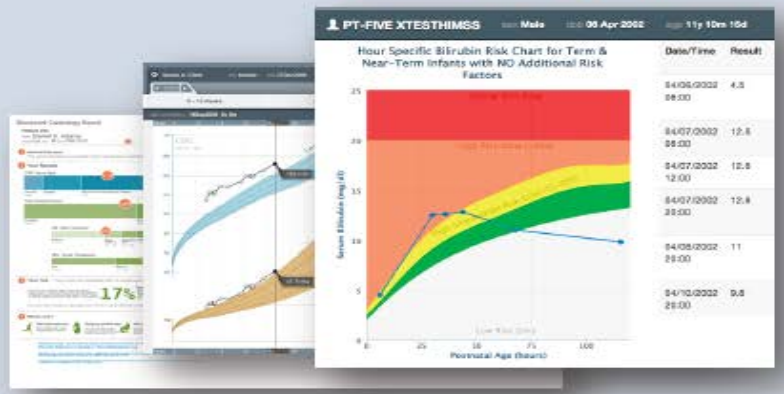

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**The Hard Work of Standardizing**

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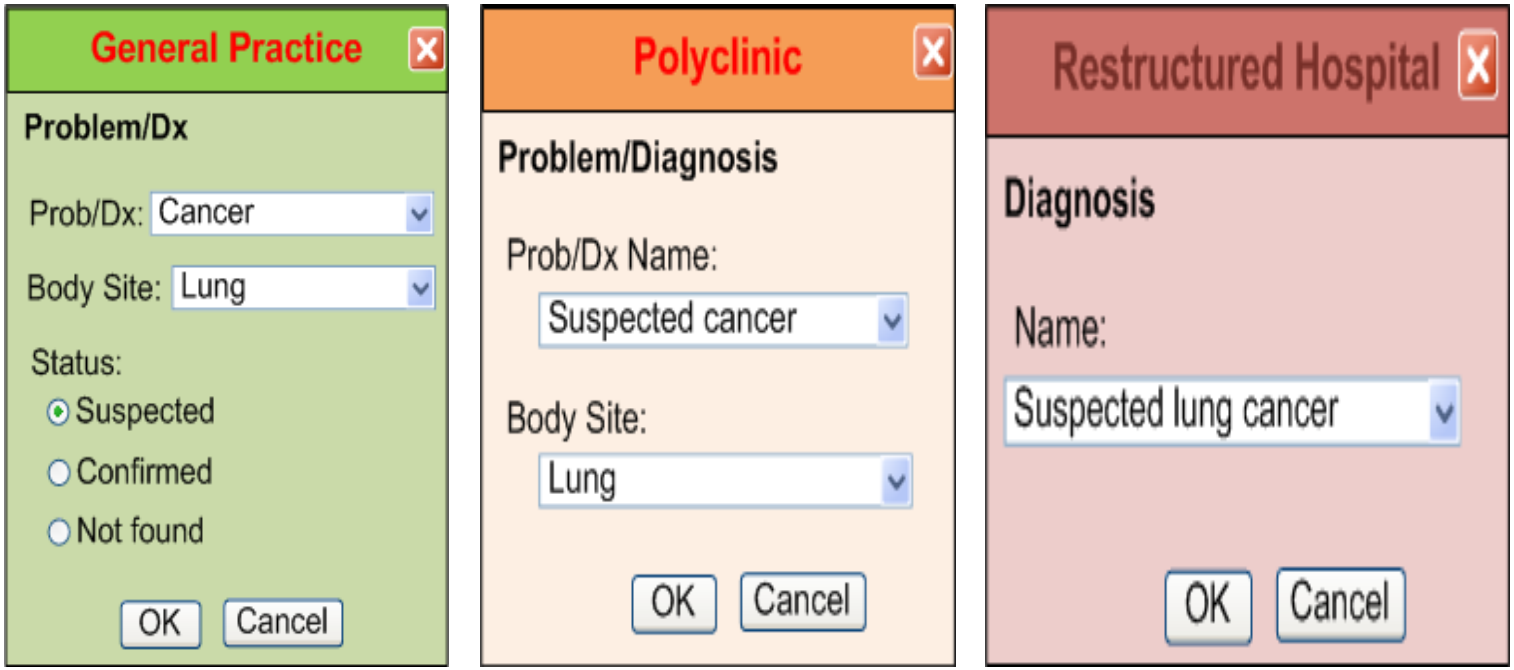
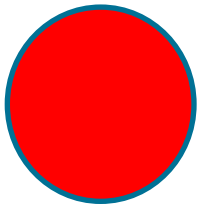
# IsoSemantic Models – Example of Problem

*(from Dr. Linda Bird)*

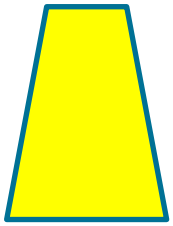
e.g. “uspected ung ancer”



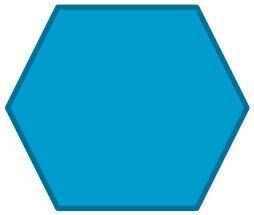
# Data Comes in Different Shapes and Colors



Finding – Suspected Lung Cancer

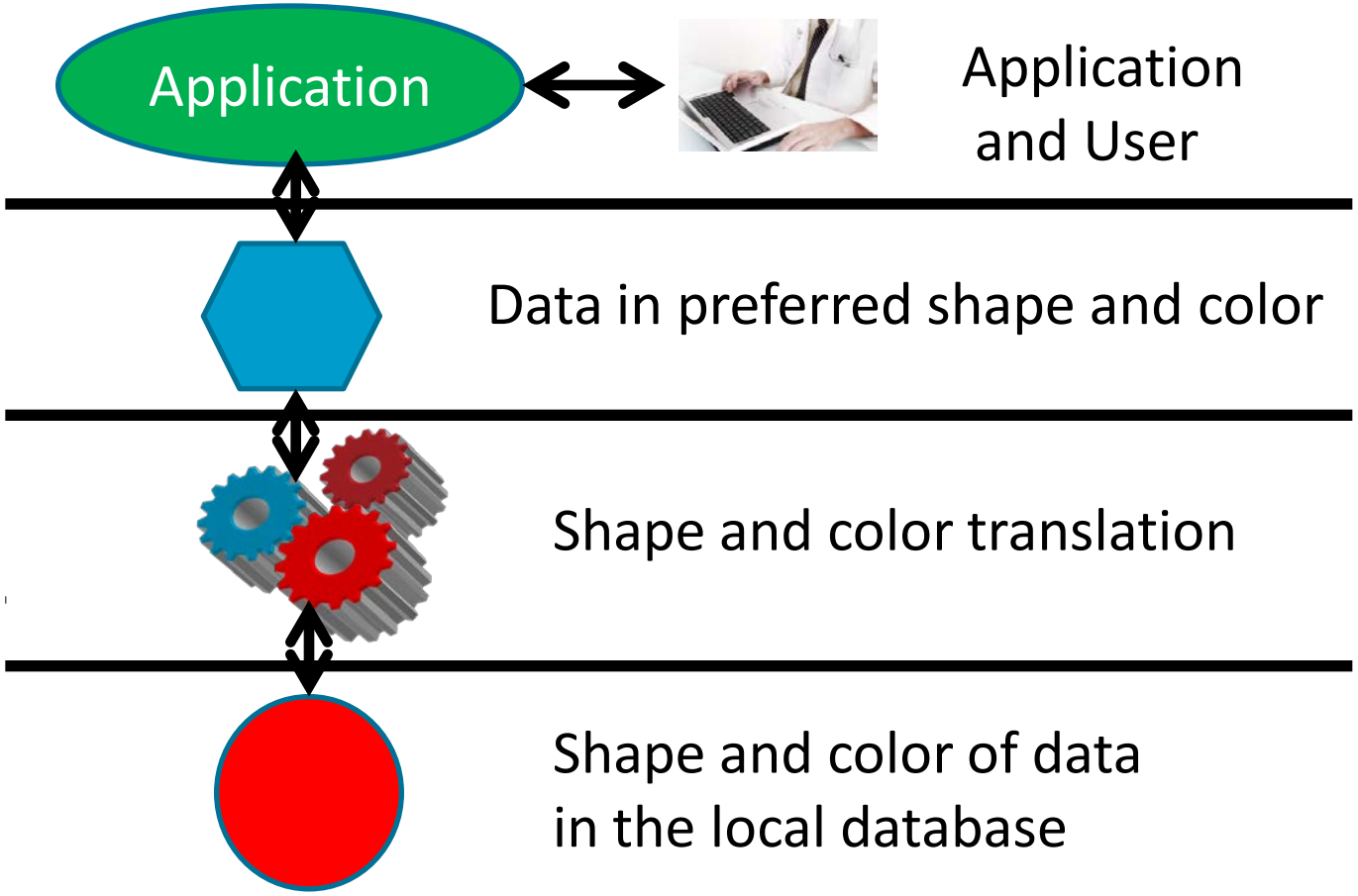


Finding – Suspected Cancer
Location – Lung

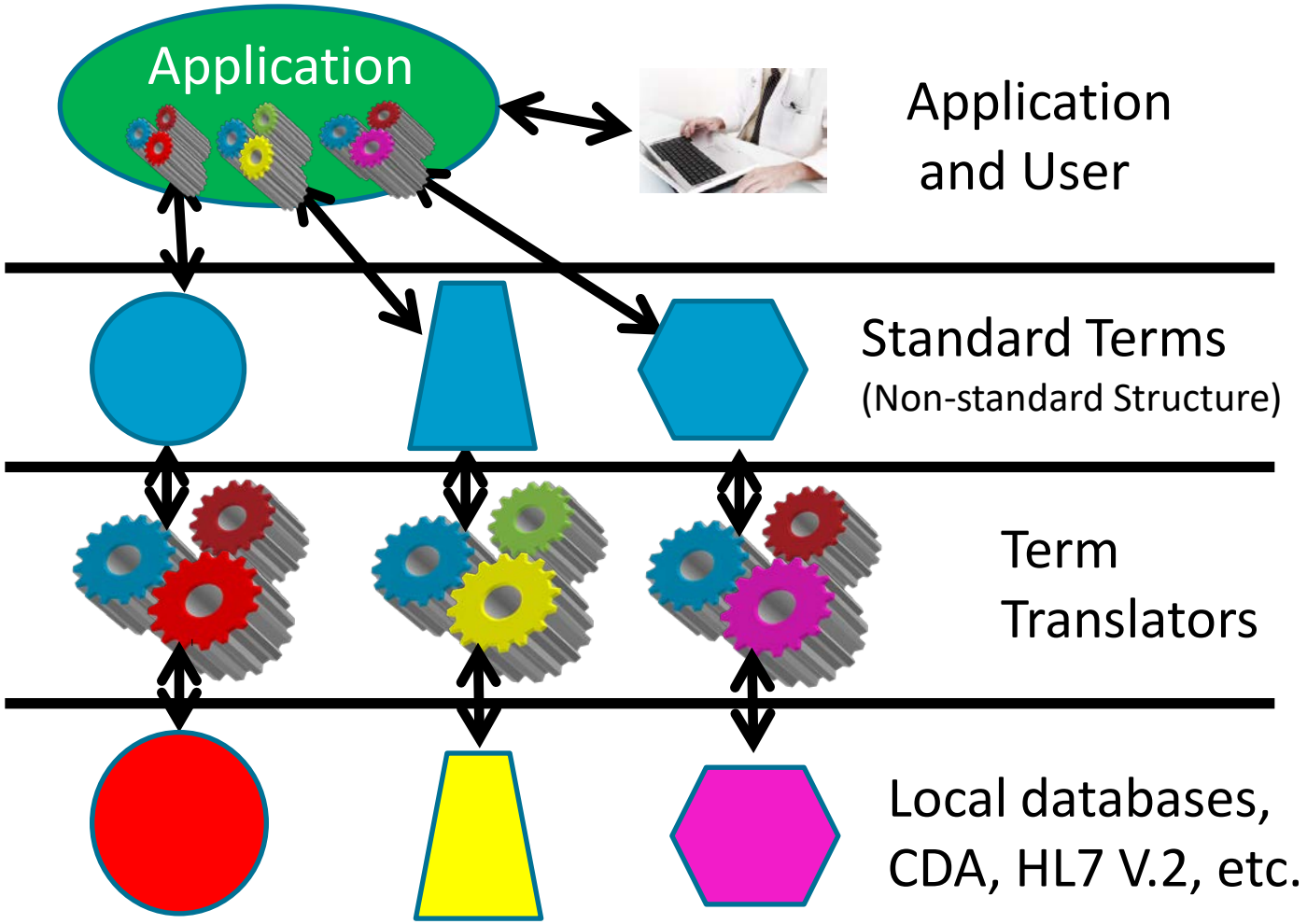


Finding – Cancer
Location – Lung
Certainty – Suspected
**(Let's say this is the preferred shape)**

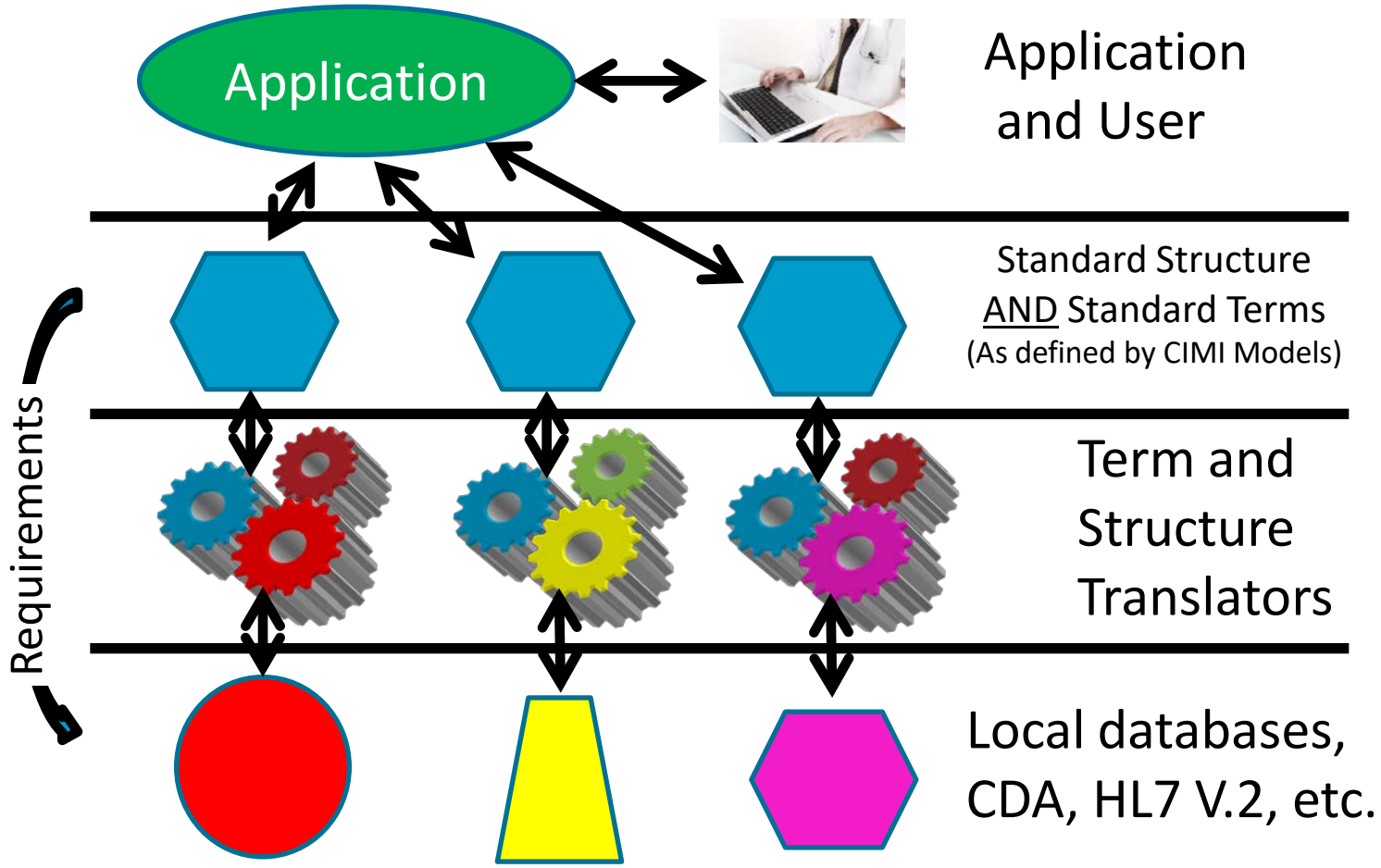
# Data Standardized in the Service



# Partial Interoperability



# Preferred Strategy – Full Interoperability



# Reasons to do it on the server side

- Person writing the translation is most likely to understand the meaning of the data in their own database.
- The person writing the translation only has to understand their own data and the preferred model.
  - They can optimize query execution for their own system
- The query for the data is simpler.  If the application has to write a query that will work for all shapes, the query will be inefficient to process by every system.

# QUESTIONS?

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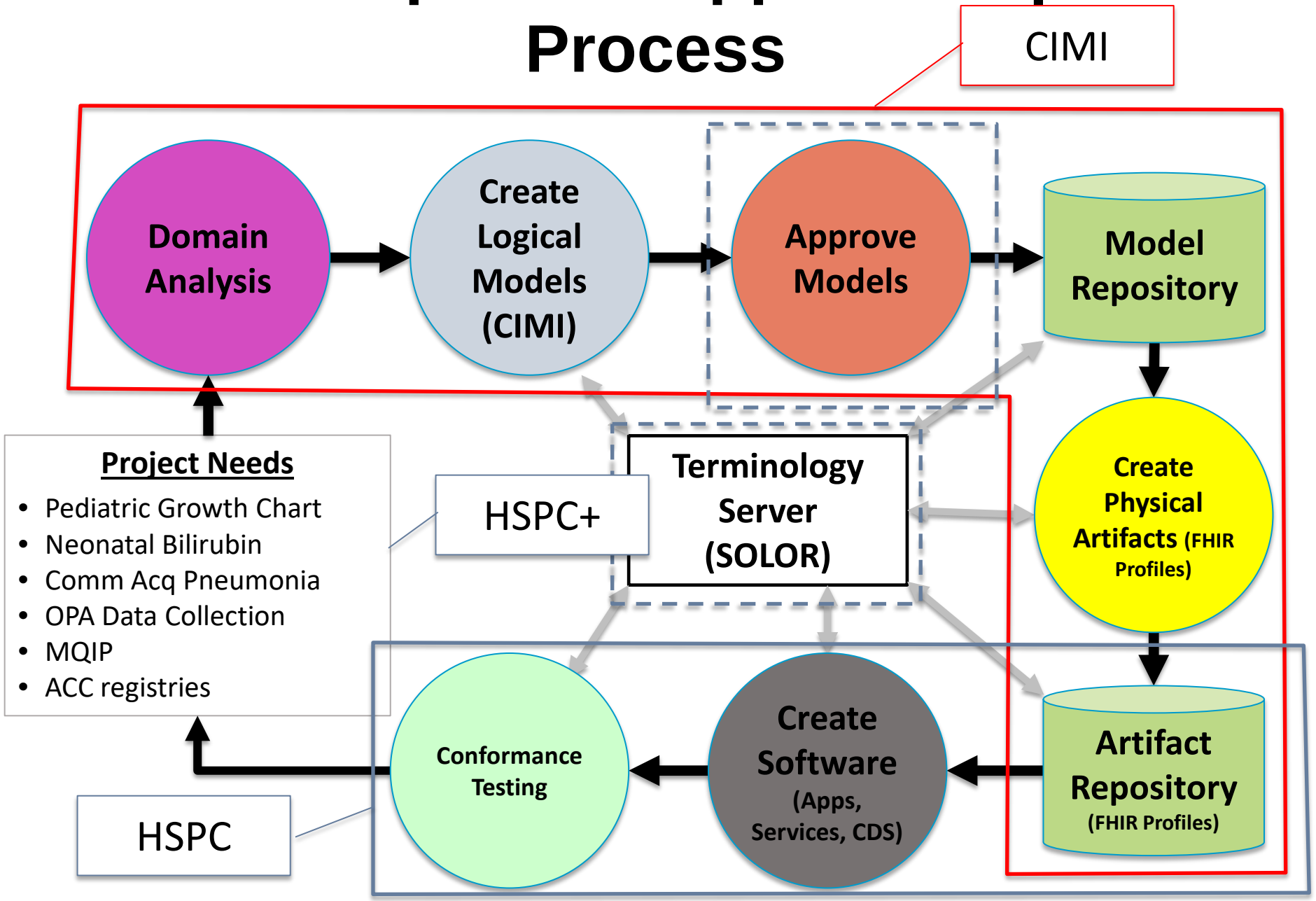
# The Interoperable App Development Process



# Model Repository and Model Adoption

**Model Repository**

| Model Id | Status | Version | Isosemantic Family | Model content | Meta data |
|---|---|---|---|---|---|
| Hematocrit | DSTU | 2 | 2123 | XXXX | YYY |
| Blood Pressure | Incomplete | 1 | 4578 | XXXX | YYY |
| Heart Rate | In Use | 3 | 4190 | XXXX | YYY |
| White Cell Count | In Use | 5 | 1789 | XXXX | YYY |
| Serum Glucose | DSTU | 2 | 3675 | XXXX | YYY |
| Serum Bilirubin | In Use | 3 | 5367 | XXXX | YYY |

**Model Adoption**

| Model Id | Realm | Use Case | Meta data |
|---|---|---|---|
| Heart Rate | US | Public Health Reporting | YYY |
| Hematocrit | AUS | Standard Lab Results | YYY |
| Serum Glucose | US | MU Quality Measure | YYY |
| Serum Glucose | International | CIMI | YYY |
| Serum Glucose | International | openEHR | YYY |
| Serum Bilirubin | HSPC | Neonatal Bilirubin App | YYY |

# Healthcare Services Platform Consortium

## MISSION

**Improve health by creating a vibrant, open ecosystem of interoperable applications, content, and services**

# HSPC Initiatives

- Be a provider led collaboration agent
- Create a reference implementation of common SOA
- Develop terminology and information models for true semantic interoperability
- Support authoring and sharing of knowledge content
- Obtain implementation and adoption of approved standards
- Create a shared technical environment to enable simple and efficient development

# Comments

- We are ***not*** proposing any changes to existing HL7 interfaces
- We support everything that is being done by the Argonauts
- This is a coalition of folks that want to realize the value of true plug-and-play interoperability by use of very explicit FHIR profiles
- One step (application) at a time
  - Not trying to boil the ocean