

# AML

## Archetype Modeling Language

*Improving interoperability of information models*

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Pre-Thesis Seminar

By

# Deepak Sharma

Master of Science

Biomedical Informatics & Computational Biology

University of Minnesota, Rochester

April 23, 2015

# Advisers

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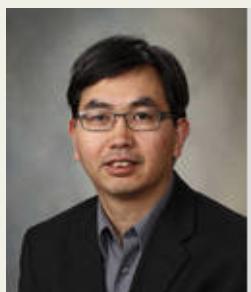
## **Dr. Christopher G. Chute, MD, Dr. P.H.**

Bloomberg Distinguished Professor of Health Informatics,  
Professor of Medicine, Public Health, and Nursing,  
Chief Health Information Research Officer,  
John Hopkins Medicine Professor,  
John Hopkins, Baltimore, Maryland.



## **Dr. Claudia Neuhauser, PhD.**

Director of Informatics Institute,  
Interim Director, Minnesota Supercomputing Institute,  
Office of the Vice President for Research,  
Director of Graduate Studies, Biomedical Informatics & Computational Biology  
University Of Minnesota, Minneapolis, Minnesota.



## **Dr. Guoqian Jiang, MD, PhD.**

Associate Professor of Biomedical Informatics,  
Associate Consultant in Department of Health Sciences Research,  
Division of Biomedical Statistics & Informatics,  
Mayo Clinic College of Medicine,  
Rochester, Minnesota.

# Mentor

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## **Harold R. Solbrig, MS**

Technical Specialist II,  
Division of Biomedical Statistics & Informatics,  
Mayo Clinic,  
Rochester, Minnesota.

# Agenda

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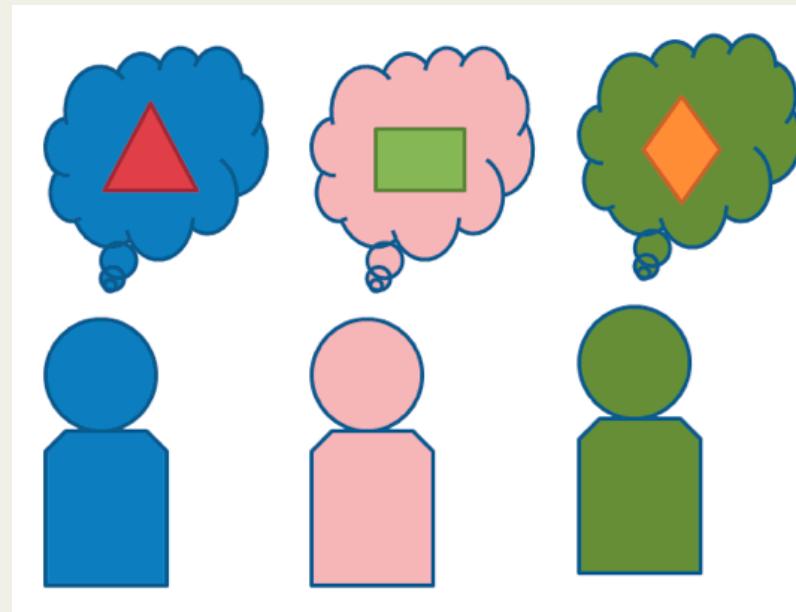
- Archetypes – what, why?
- Archetype Modeling Language
- AML Tooling

# Interoperability Problem

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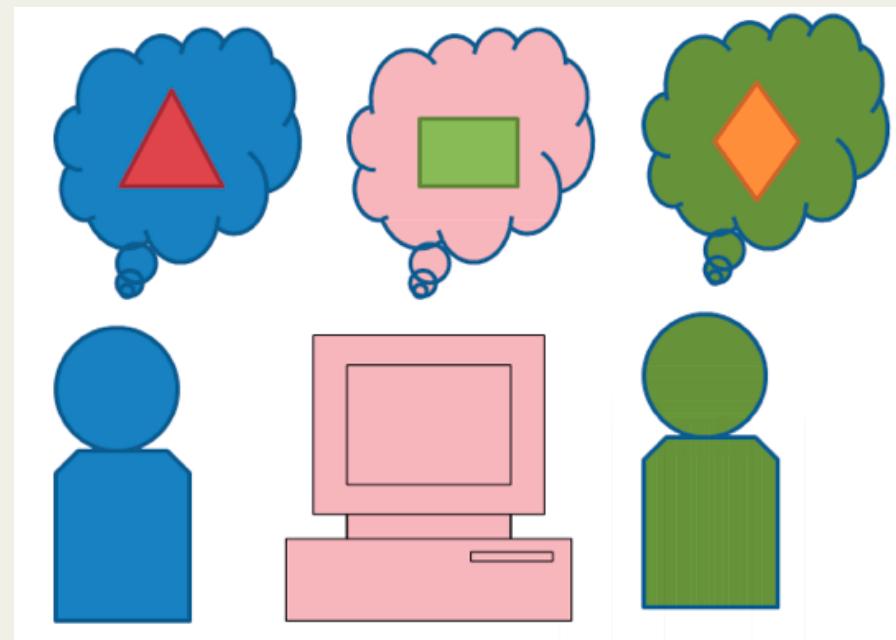
Exchange or share information:

- How to be “On The Same Page”?
  - Data
  - Semantics



# Interoperability Problem

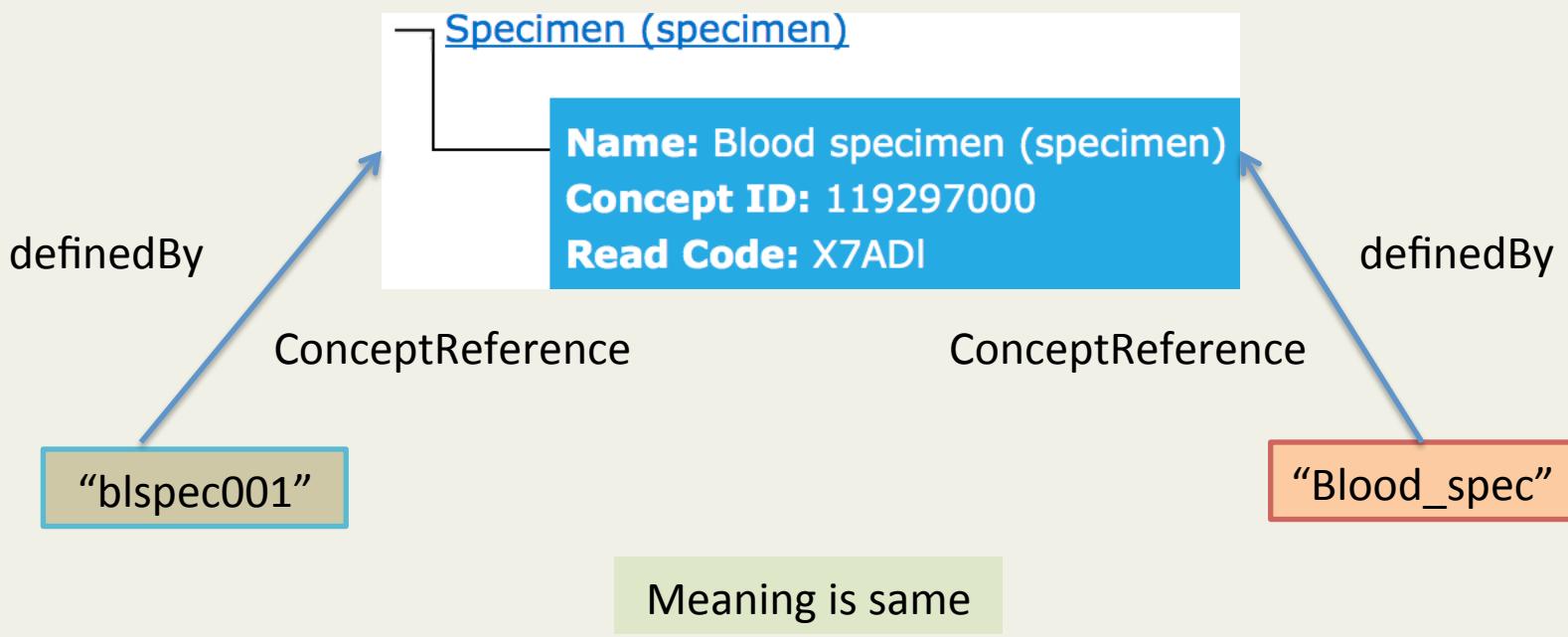
- Standards - Model/Schema/Metadata
  - Proprietary (not shared freely)
  - Finding semantics – mapping, transforms
- Multiple
  - organizations
  - systems



# Terminology Binding

Meaning is defined with coded terms:

- Blood Specimen – SNOMED ID: 122560006



# IsoSemantic Models – Example of Problem (from Dr. Linda Bird)

e.g. “Suspected Lung Cancer”

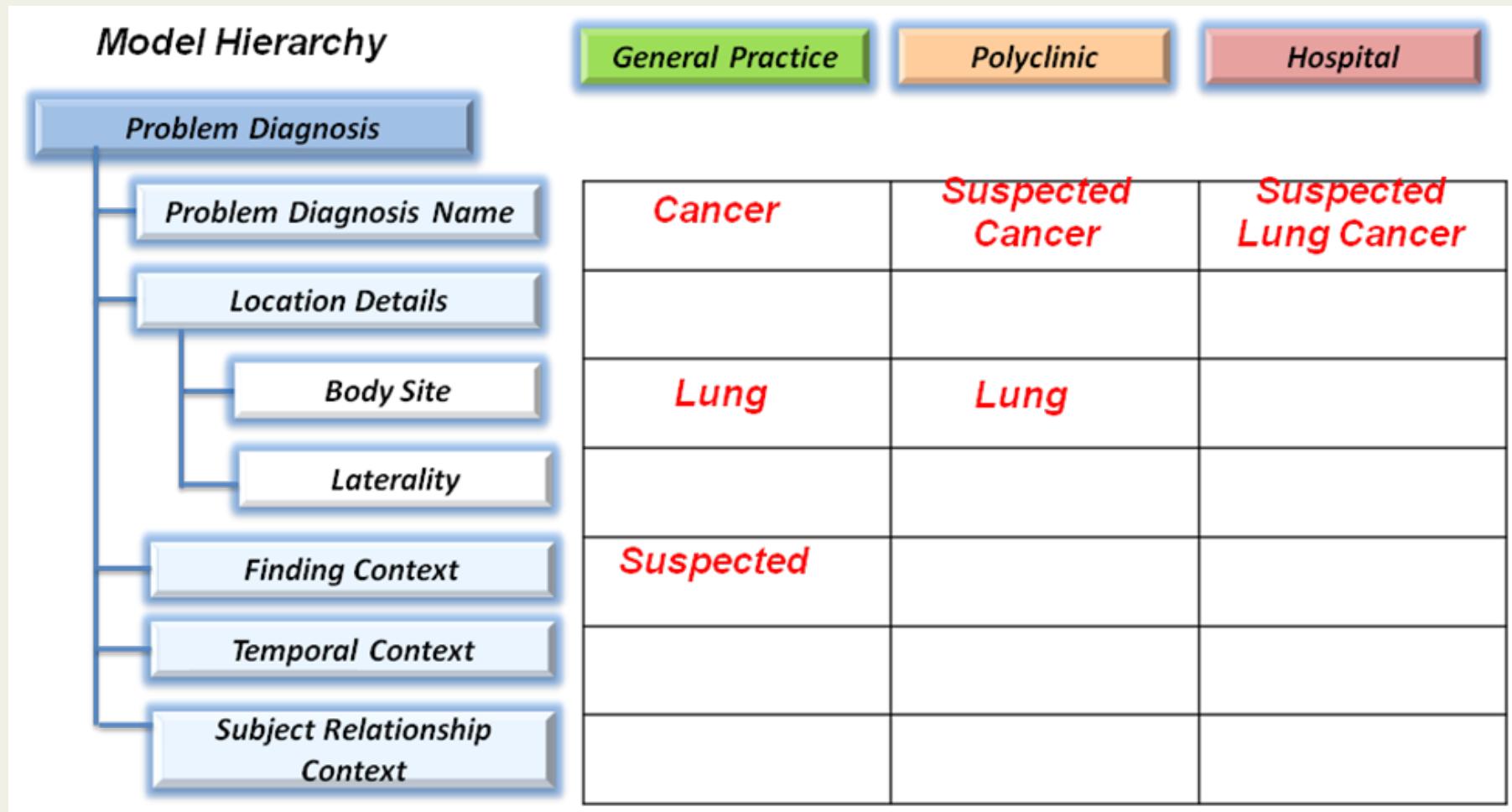
The image displays three separate dialog boxes, each representing a different healthcare setting: General Practice (green), Polyclinic (orange), and Restructured Hospital (pink). Each box contains fields for 'Prob/Dx' and 'Body Site', and a status section with radio buttons for 'Suspected', 'Confirmed', and 'Not found'. The 'Prob/Dx' field in all three boxes shows 'Cancer' or 'Suspected cancer'. The 'Body Site' field shows 'Lung'. The status section in the General Practice box has 'Suspected' selected. The 'OK' and 'Cancel' buttons are at the bottom of each box.

Setting	Prob/Dx	Body Site	Status	Action
General Practice	Cancer	Lung	Suspected	OK / Cancel
Polyclinic	Suspected cancer	Lung	None	OK / Cancel
Restructured Hospital	Suspected lung cancer	None	None	OK / Cancel

Courtesy: Dr. Stanley M. Huff (Intermountain Healthcare), and Dr. Linda Bird

# IsoSemantic Models – Example Instances (from Dr. Linda Bird)

e.g. “Suspected Lung Cancer”



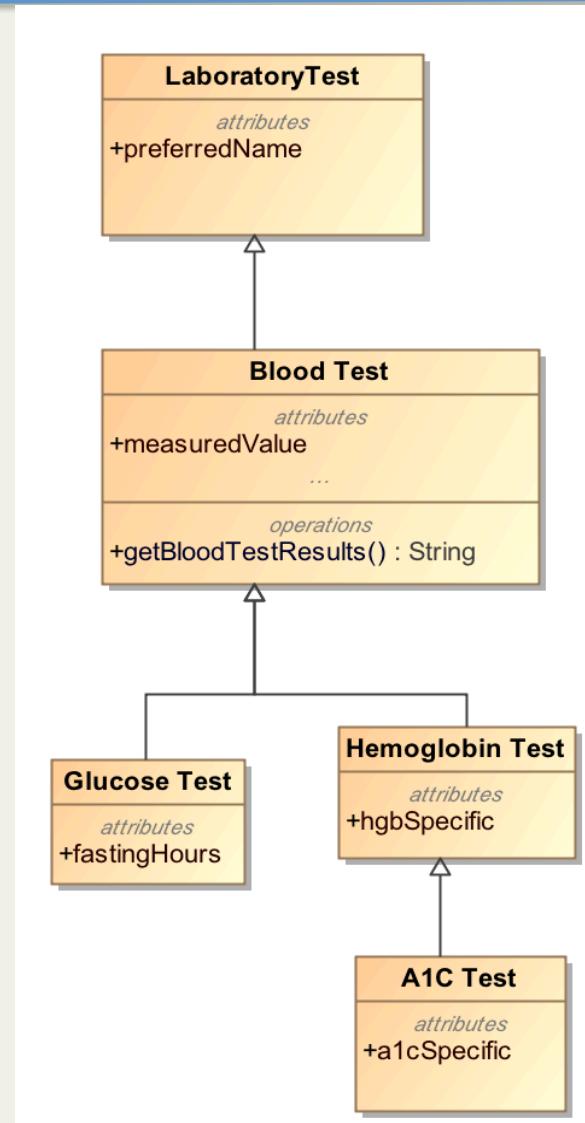
# Modeling Approach

- Top-Down Modeling

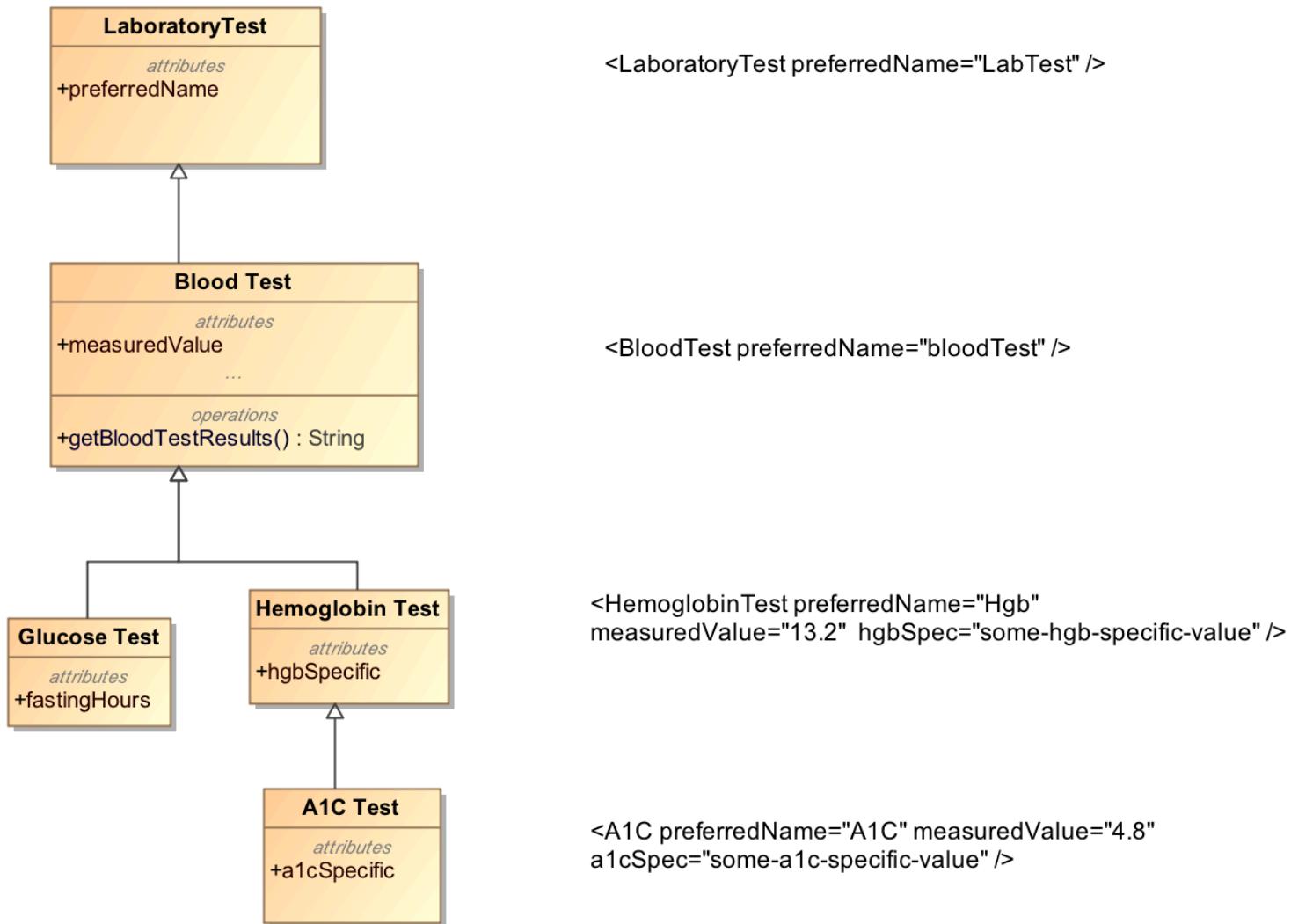
Generic → Specific

At each level we specialize

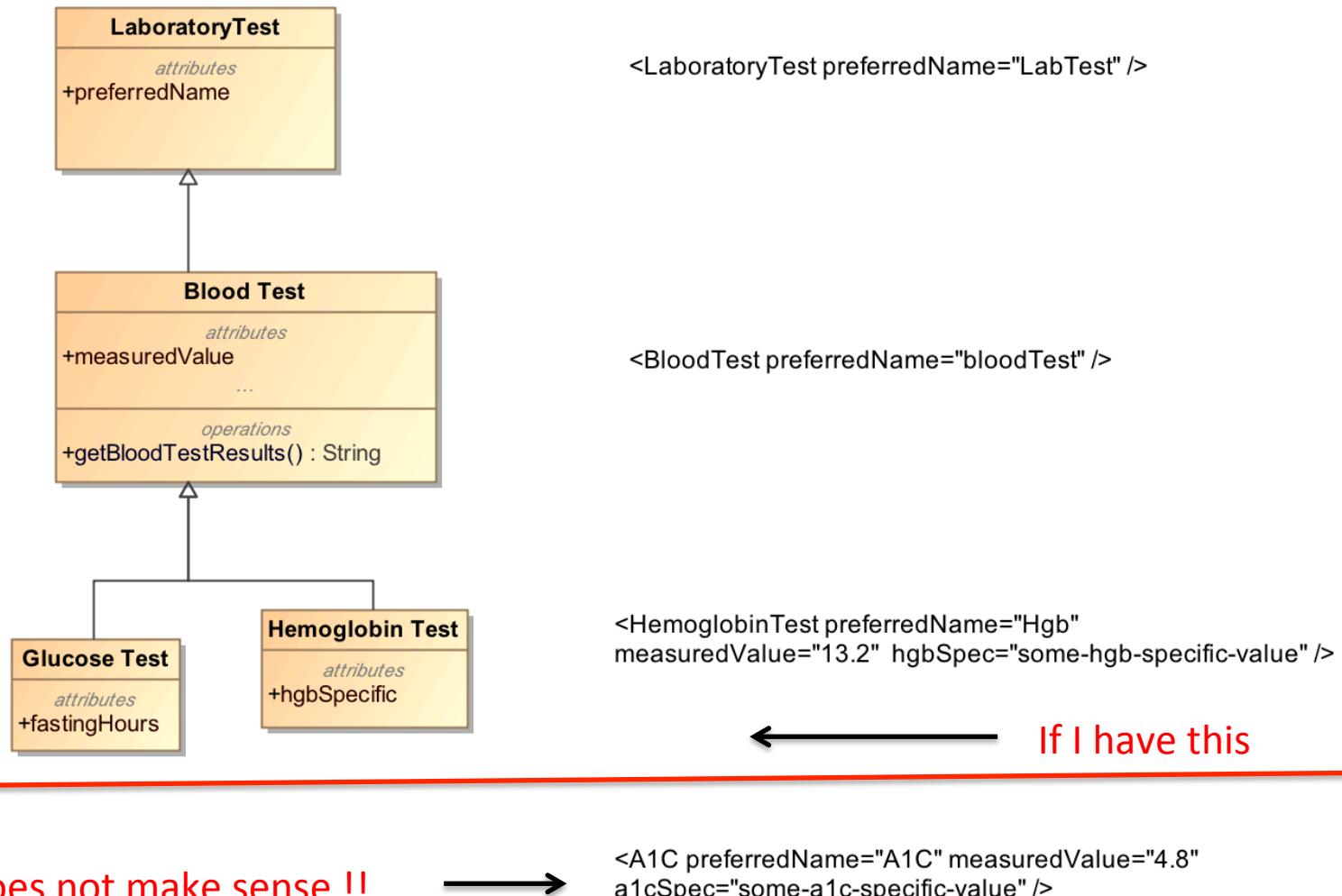
- Properties
- Associations



# Top-Down Modeling Approach



# Top-Down Modeling Approach



This does not make sense !!



<A1C preferredName="A1C" measuredValue="4.8" a1cSpec="some-a1c-specific-value" />

# Bottom-Up Modeling Approach

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- Constraint or Bottom-up Modeling
  - Start with a general model
  - Becomes the most abstract level of exchange
  - Specialize by
    - Cardinality
    - Values and value ranges
    - Optional/Mandatory/Prohibited
    - Enumeration subsets

# Bottom-Up Modeling Approach

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- Constraints on shared model:

Abnormal A1C Test = Set of Constraints

- LaboratoryTest {1}

- measuredValue {1..\*}

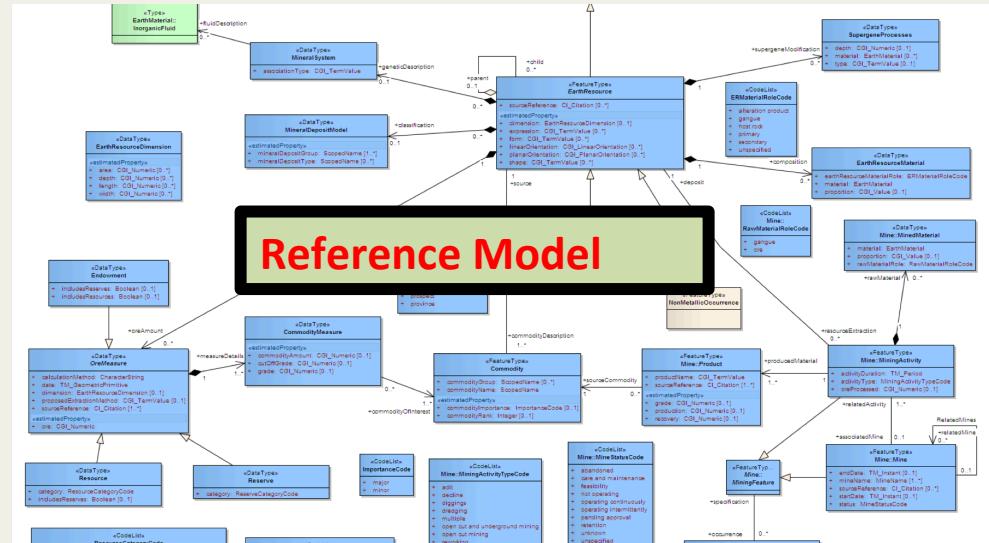
- $\{x \mid x \text{ in } \{\text{measuredValues}\},$

- $x > \text{SomeThresholdValueforA1C}\}$

# Archetype

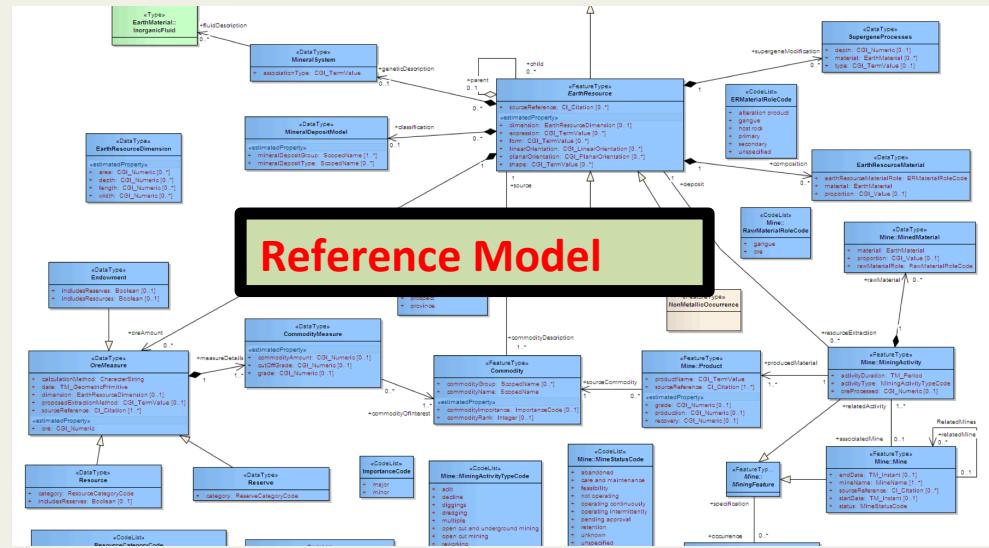
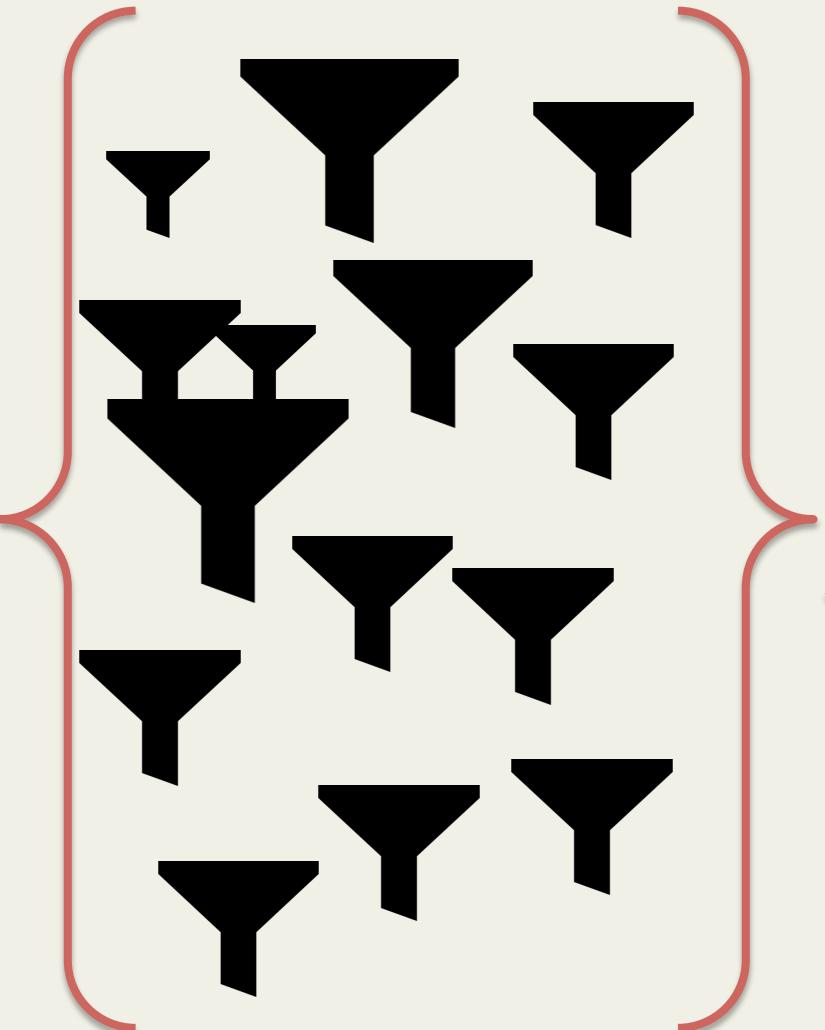
Constraints on  
Reference Model  
Elements

“about”



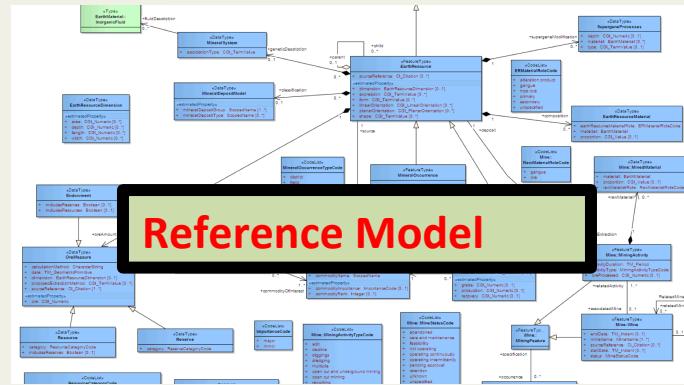
Archetype

# Archetypes



# Archetype Library

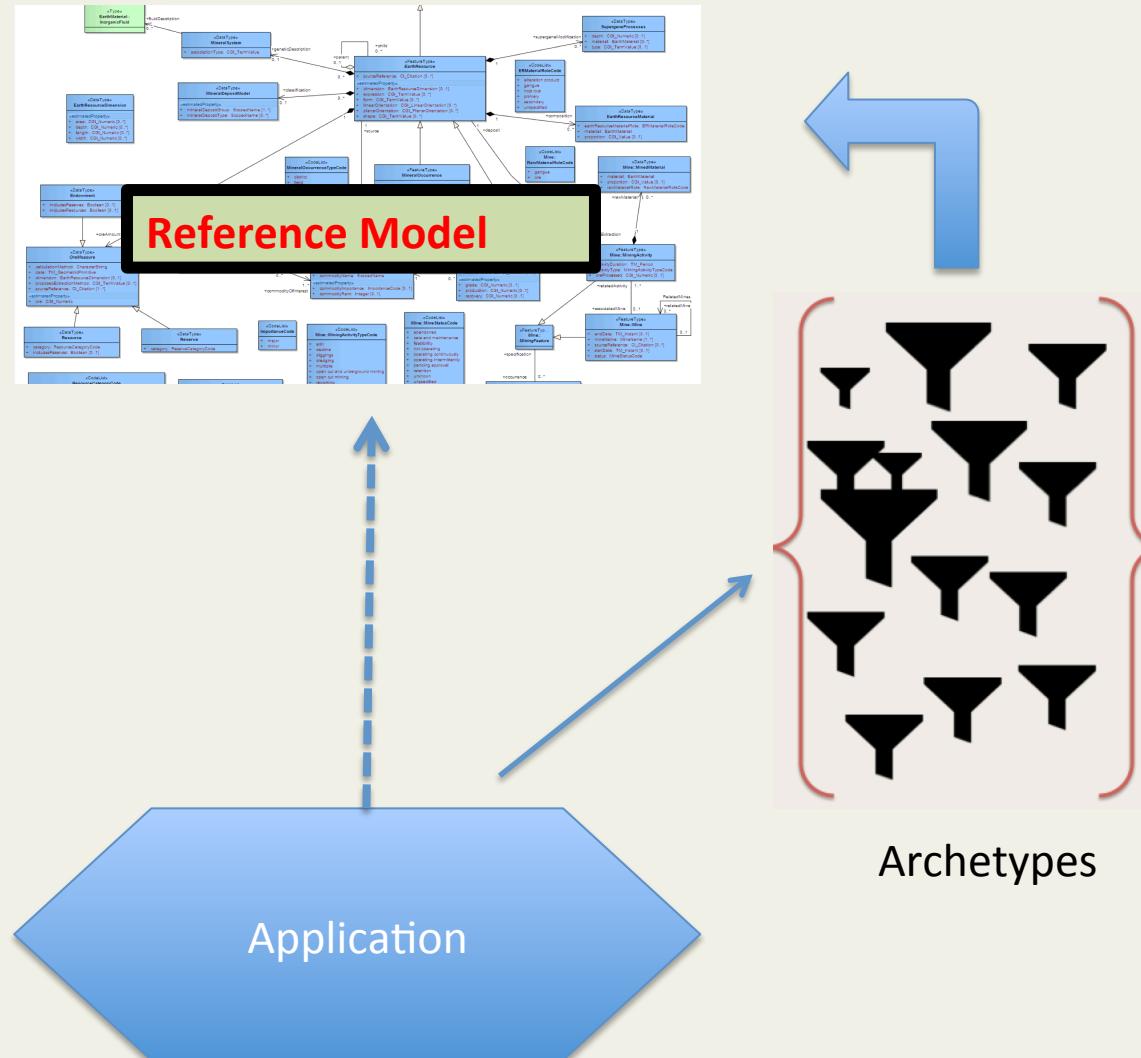
# Without Archetypes



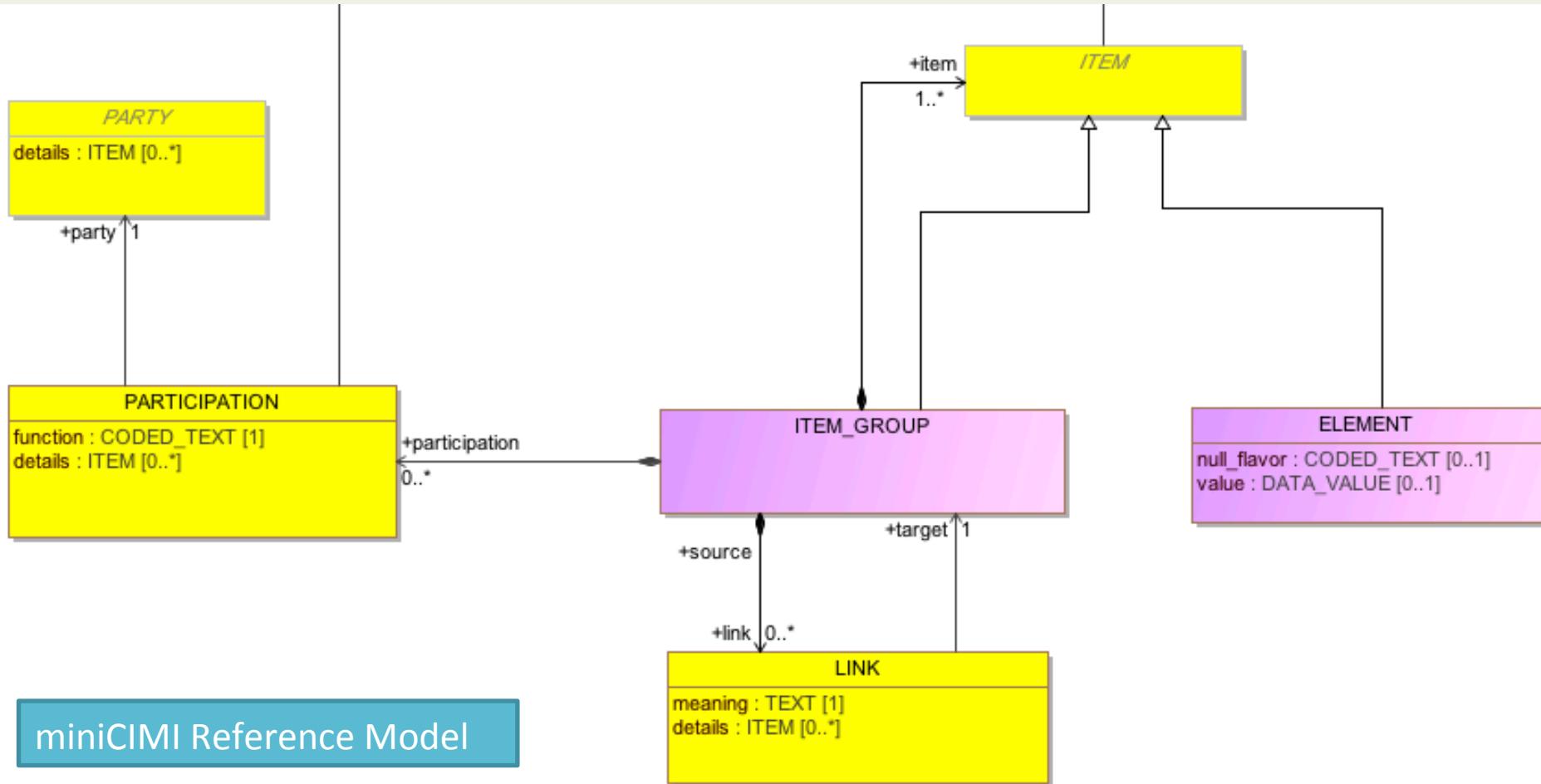
Application  
codes constraints:  
LaboratoryTest == “A1C”,  
measuredValue > threshold  
value

## Other constraints...

# With Archetypes

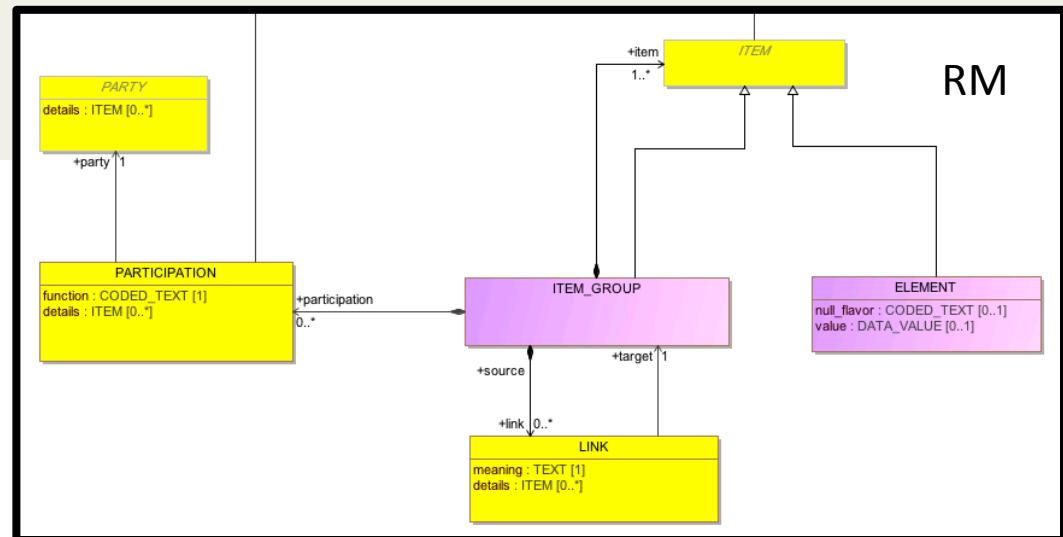
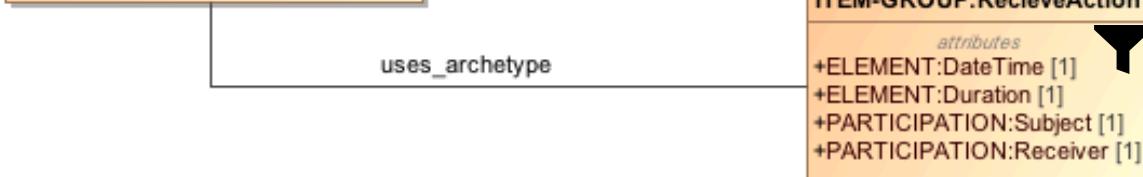
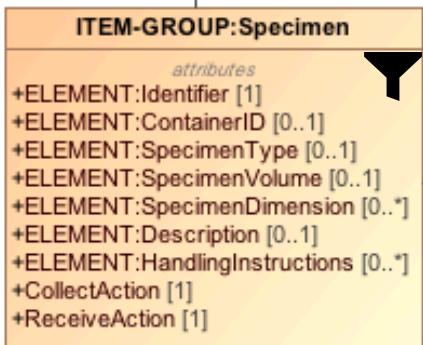


# Reference Model Example



# An Archetype Example

Simple Example: Specimen collection from a body site



# Clinical Models

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We can create .... more Clinical Models =>

For Example:

Laboratory Test,

Diagnostics,

Specimen , and so on...

And share them

“Shared Clinical Information Models”

– help improve Interoperability

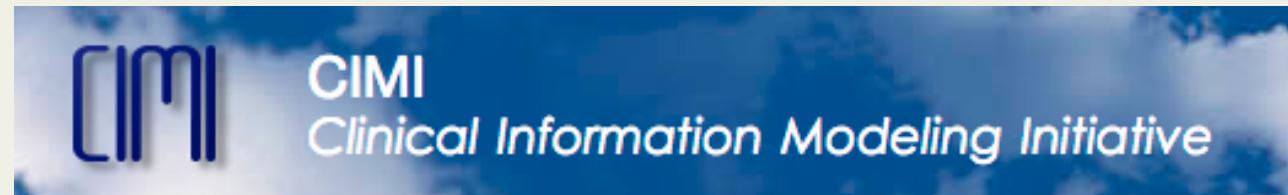
# Agenda

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- Archetypes – what, why? 
- Archetype Modeling Language
- AML Tooling

# Clinical Information Modeling Initiative

- Since 2011
- <http://www.opencimi.org/>



## Mission Statement

**“Improve the interoperability of healthcare systems through shared implementable clinical information models”**

*(A Single Curated Collection)*

# CIMI – Strategic Goal

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**“Be able to share data, applications, reports, alerts, protocols, and decision support modules with anyone in the WORLD”**

Source: <http://www.opencimi.org/>

# CIMI – Target Domains

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- EHR data storage
- Message and service payload
- Decision logic (queries of EHR data)
- Clinical trials data (clinical research)
- Quality measures
- Normalization of data for secondary use
- Creation of structured data entry screens
- Capture of coding output from NLP

Source: <http://www.opencimi.org/>

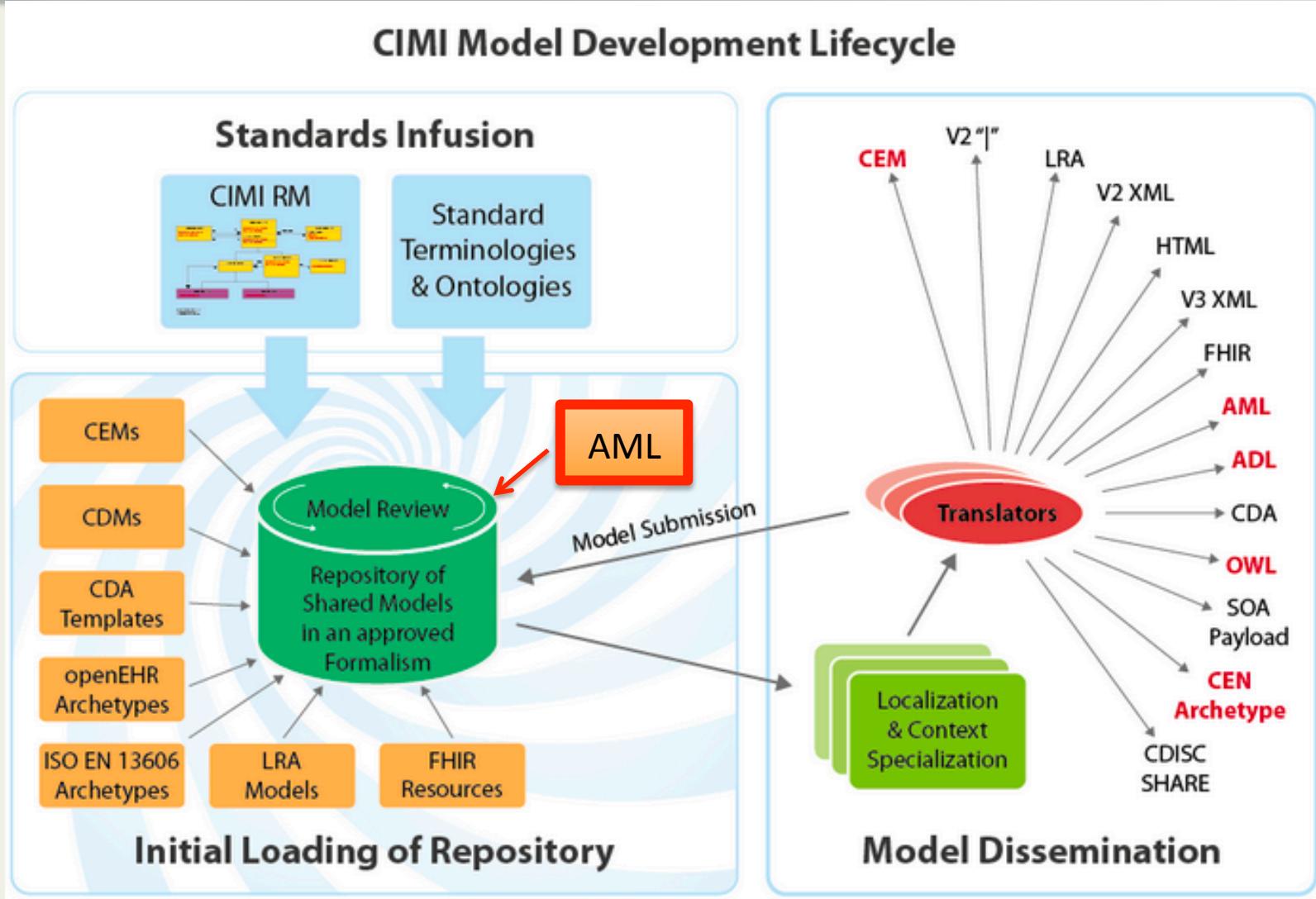
# CIMI – Deliverables

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- **Shared repository** of clinical information models
- **Single formalism** with 2 representations:
  - ADL & AML
- **Formal bindings** to standard terminologies
- Model Repository:
  - **Open & free for use**

Source: <http://www.opencimi.org/>

# CIMI – Shared Repository



# CIMI – Standard Terminologies

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- Model Elements are bound to Standard Terminologies and Ontologies:
  - **SNOMED CT** - primary and preferred  
*Systematized Nomenclature of Medicine – Clinical Terms*
  - **LOINC** - approved  
*Logical Observation Identifiers Names and Codes*
- SNOMED CT CIMI Identifier for extension
- Value-sets only by reference vs. list of values

# CIMI – Model Browser

CIMI Browser February 4, 2015 Release

specimen

CIMI-CORE-ITEM\_GROUP.microscopic\_observation\_i  
CIMI-CORE-ITEM\_GROUP.microscopic\_observation\_i  
CIMI-CORE-ITEM\_GROUP.microscopic\_observation\_i  
CIMI-CORE-ITEM\_GROUP.microscopic\_observation\_i  
CIMI-CORE-ITEM\_GROUP.mycobacterium\_sp\_identifie  
CIMI-CORE-ITEM\_GROUP.mycoplasma\_hominis\_pres  
CIMI-CORE-ITEM\_GROUP.neisseria\_gonorrhoeae\_pre  
CIMI-CORE-ITEM\_GROUP.neisseria\_gonorrhoeae\_rna  
CIMI-CORE-ITEM\_GROUP.number\_of\_specimens\_rec  
CIMI-CORE-ITEM\_GROUP.number\_of\_specimens teste  
CIMI-CORE-ITEM\_GROUP.ova\_and\_parasites\_identifie  
CIMI-CORE-ITEM\_GROUP.parainfluenza\_virus\_1\_ag\_p  
CIMI-CORE-ITEM\_GROUP.parainfluenza\_virus\_ag\_pre  
CIMI-CORE-ITEM\_GROUP.polymorphonuclear\_cells\_p  
CIMI-CORE-ITEM\_GROUP.respiratory\_syncytial\_virus\_a  
CIMI-CORE-ITEM\_GROUP.respiratory\_syncytial\_virus\_a  
CIMI-CORE-ITEM\_GROUP.specimen.v3.0.0  
CIMI-CORE-ITEM\_GROUP.specimen\_collection\_site.v1  
CIMI-CORE-ITEM\_GROUP.specimen\_drawn\_from.v1.0.

Compiled Tree	ADL Source	ODIN Source	JSON Source	XML Source	YAML Source	Mindmap
specimen (material_entity)						
item						
Cluster   CIMI-CORE-ITEM_GROUP.cluster.v1						
Element [0..*]						
Identifier [0..*]						
Name [0..1]						
Description [0..*]						
Specimen identifier [0..1]						
Container identifier [0..1]						
Source specimen identifier [0..1]						
Specimen type [0..1]						
Specimen description [0..1]						
Specimen volume [0..1]						
Specimen weight [0..*]						
Specimen dimension [0..*]						
Specimen size description [0..1]						
Sequence number [0..1]						
Specimen additive [0..1]						
Specimen handling risk [0..1]						
Special handling instructions [0..*]						
Collect action   CIMI-CORE-ITEM_GROUP.collect_action.v1						
Receive action   CIMI-CORE-ITEM_GROUP.receive_action.v1						

Source:

<http://www.clinicalelement.com/cimi-browser>

# Other Efforts

- VDR Virtual Data Repository
- VPR Virtual Patient Repository

## Status of this Wiki and of DCM in and outside HL7 space

The material on this part of the wiki on DCM cannot be considered as 'owned' by HL7. In contrary, it is to a large extend not (only) HL7 material. This wiki page is hosted by HL7 WG Patient Care to discuss these matters, as a result of different WGM meetings where participants of OpenEHR, CEN, ISO, HL7 and researchers in the area requested that at least one of the organizations facilitate further work. The more neutral [www.detailedclinicalmodel.org](http://www.detailedclinicalmodel.org) website is currently not always accessible for such discussions and in particular it does not facilitate file storage. Further, the DCM website is highjacked almost every other week, rendering it unsafe for our work.

The top 10 draft examples of DCM presented in the area further on in this HL7 PC wiki are formally owned by Nictiz, the Netherlands, with Results 4 Care employees being the authors. Nictiz has a charter to make this material publicly available after being finalized. Public consultation is part of the finalization to take place. Feedback from within the HL7 community and from outside the HL7 community will be solicited.

## DCM work at ISO

New Work Item Proposal 13972 quality criteria and methodology for Detailed Clinical Models was accepted by ISO member states in

# ADL Workbench

The screenshot shows the Archetype Definition Language (ADL) 1.5 Workbench interface. The top menu bar includes File, Edit, View, History, Repository, RM Schemas, XML, Tools, and Help. A toolbar below the menu contains CKM, Compile, and other icons. The main workspace displays the 'OBS.apgar.v1' archetype under the 'openEHR-EHR-OBSERVATION.apgar.v1' file. The interface features several tabs: Description, Definition, Terminology, Annotations, Paths, Slots (0/0), Source, Serialised (flat), Validity, and Statistics. On the left, a tree view shows the structure of archetypes, including INSTRUCTION (10) and OBSERVATION (83). The central area contains a diagram for the 'Blood Pressure' observation. The diagram includes nodes for Data (Systolic, Diastolic, Mean Arterial Pressure, Pulse Pressure), Comment, Position, Confounding factors (Exertion, Sleep status, Tilt), any event, and 24 hour average. It also includes State, Protocol (Cuff size, Location, Method, Mean Arterial Pressure Formula, Diastolic endpoint, Device), and Events. The right side of the interface has a panel for 'Tree Zoom' and 'Detail Level' settings, and a bottom section for the 'Expression tree' and 'Expression value'.

# OpenEHR - CKM

The screenshot shows the OpenEHR Clinical Knowledge Manager (CKM) interface. The top navigation bar includes links for Archetypes, Templates, Termsets, Release Sets, Projects, Reports, and Help. A URL bar at the top right contains the address <http://openehr.org/ckm/>. The left sidebar features filters for Subdomain (All subdomains), Project or Incubator (All projects), and status (All active, Under review, Published). Below these are buttons for Archetypes, Templates, and Search. The main content area displays the definition of the Address archetype in ADL1.5. The code defines the Address archetype with its various components and cardinalities.

```
definition
    CLUSTER[at0000] matches { -- Address
        items cardinality matches {1..*; unordered} matches {
            CLUSTER[at0001] occurrences matches {0..*} matches { -- Address
                items cardinality matches {1..*; unordered} matches {
                    ELEMENT[at0006] matches { -- Address Type
                        value matches {
                            DV_CODED_TEXT matches {
                                defining_code matches {
                                    [local]:
                                        at0011, -- Residential
                                        at0012, -- Correspondence
                                        at0013, -- Business
                                        at0014] -- Temporary
                                }
                            }
                        }
                    }
                }
            ELEMENT[at0002] occurrences matches {0..1} matches { -- Unstructured address
                value matches {
                    DV_TEXT matches {*}
                }
            }
        }
        CLUSTER[at0003] occurrences matches {0..1} matches { -- Structured address
            items cardinality matches {1..*; unordered} matches {
                ELEMENT[at0005] occurrences matches {0..1} matches { -- Property number
                    value matches {
                        DV_TEXT matches {*}
                    }
                }
                ELEMENT[at0009] occurrences matches {0..4} matches { -- Address line
                    value matches {
                        DV_TEXT matches {*}
                    }
                }
            }
        }
        ELEMENT[at0004] occurrences matches {0..1} matches { -- Post code
            value matches {
                DV_TEXT matches {*}
            }
        }
    }
}
```

ADL1.5

# AML

---

- AML Preliminary submission to OMG
  - in November 2014
- Currently being revised...
- AML specification is collection of UML artifacts:
  - Profiles, stereotypes
  - Data types
  - Classes, Packages
- <https://github.com/opencimi/AML>
  - (in a bit of disarray at the moment)

# Unified Modeling Language

---

- UML is an OMG standard
- Creating and exchanging Models - (XMI)
- Create:
  - Classes, Properties, Associations, Enumeration
  - Generalization / Specialization
  - Extension Mechanism
    - Stereotypes, tags, constraints (OCL)
  - Profiles
    - Collection of Stereotypes, domain specific

# OCL

---

- Constraints are in “Object Constraint Language” – OCL:

Textual Language to describe constraints, e.g.

- Context=Patient  

```
{self.age >= "18"}
```
- Context=SingularAttributeConstraint  

```
{(self.base_Property.redefinedProperty->size()=1) and  
(self.base_Property.upper=1)}
```

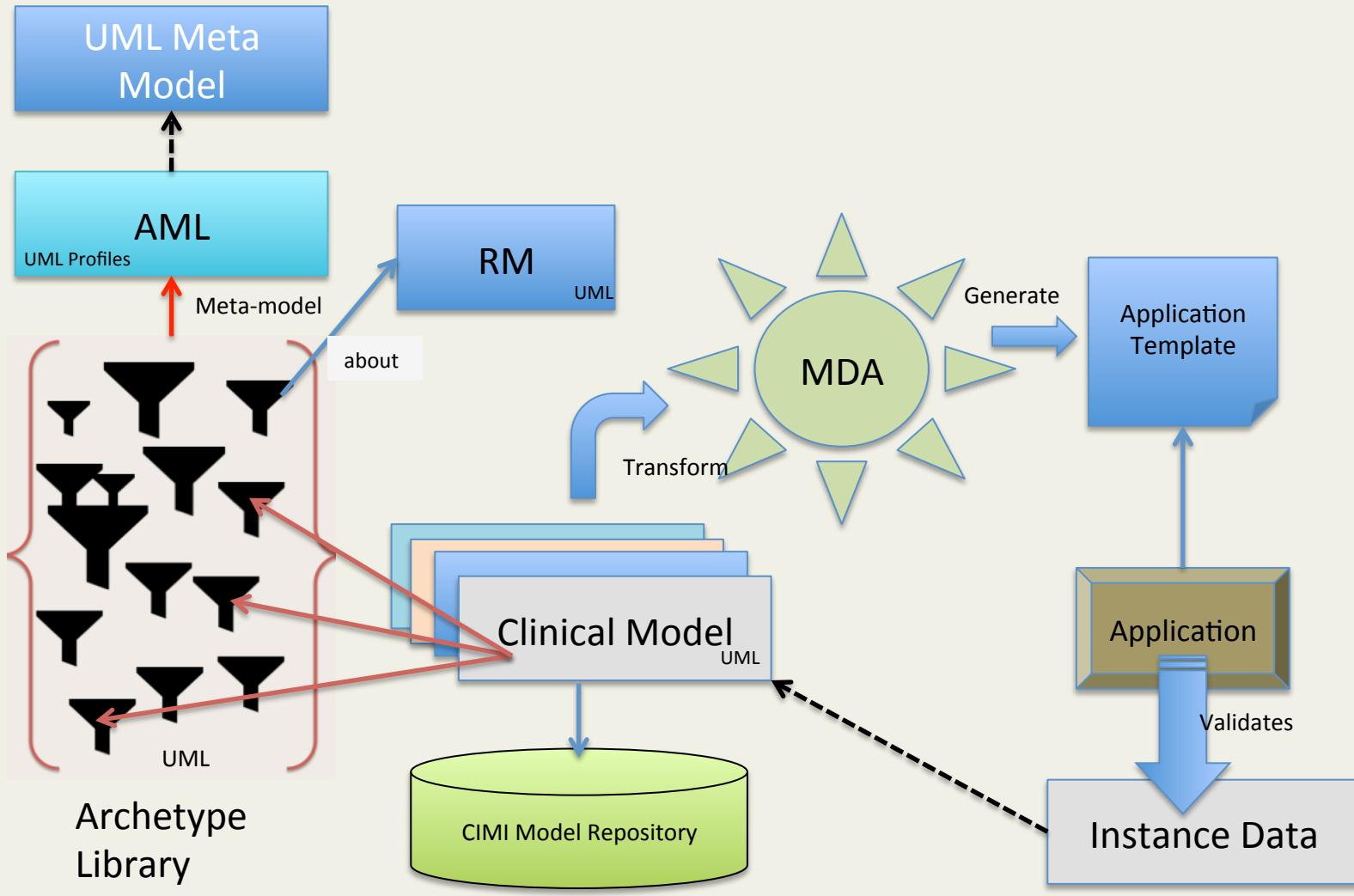
# Archetypes in UML

---

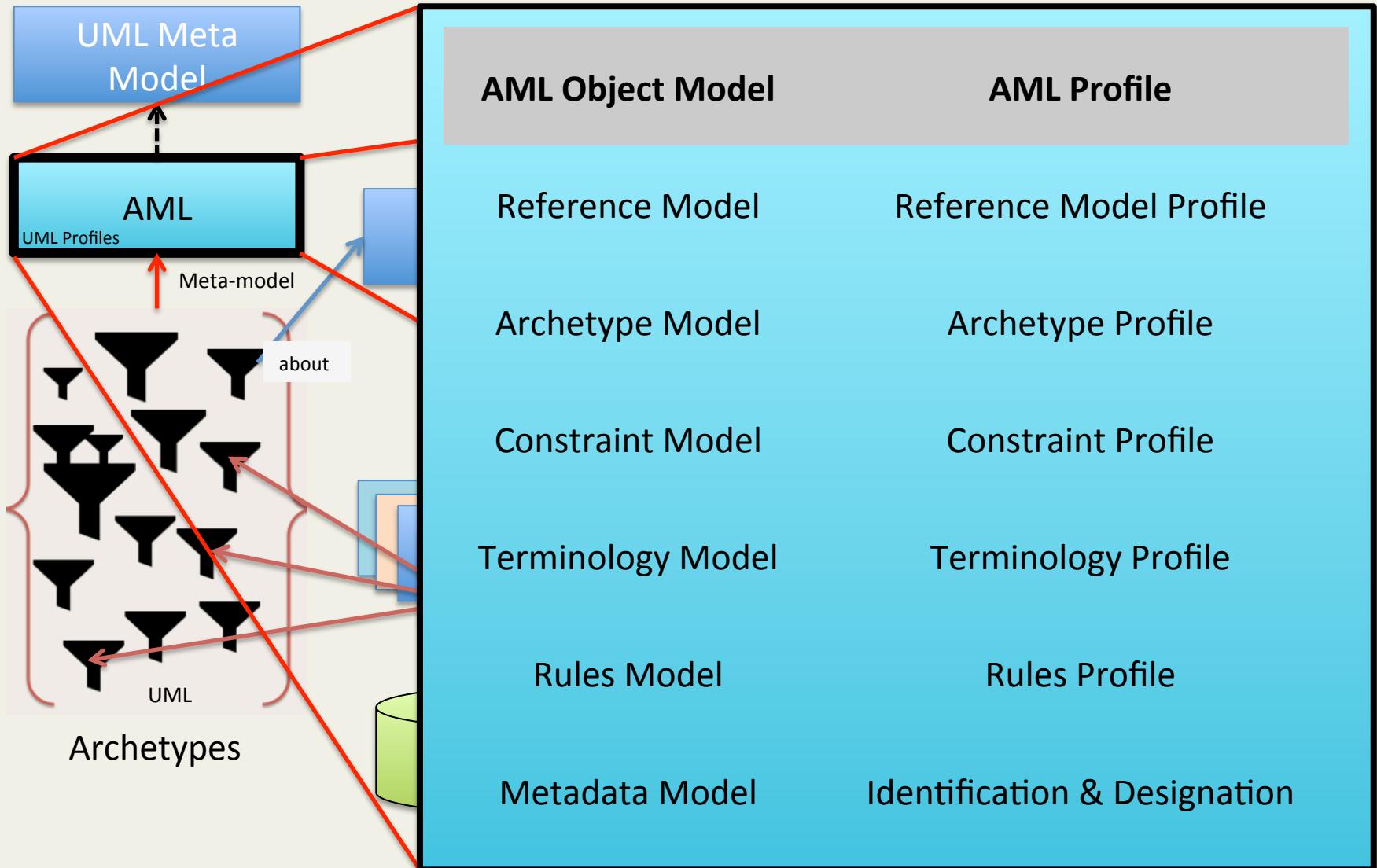
Advantages:

- UML is OMG standard, non-proprietary
- UML is familiar to modelers
- Model-Driven Architecture
- AML works directly with UML RMs

# Clinical Models



# Inside AML Specifications



# Reference Model

---

Describes the characteristics a target Reference Model (RM) must have in order for the constraint model to refer to it predictably

## **Reference Model Profile:**

Defines the set of data types whose values can be directly constrained by an AML Model.

It also specifies a small set of stereotypes that are used to "decorate" a reference model and its various components.

# Archetype Model

---

Defines relationship between archetype libraries, archetypes and archetype versions.

## Archetype Profile:

Constraint related to Archetype Library, Archetype and Archetype Version.

# Constraint Model

---

Illustrates how constraints are defined. This is core part of the AML specifications.

## Constraint Profile:

Defines the modeling elements that may be applied to a reference model and archetype. These elements “constrain” the target model narrowing the semantics and syntax.

# Identification & Designatable

---

Advised by ISO 11179-3

- IdentifiableItem
  - Namespace + id
- DesignatableItem
  - Language + sign + [description]
- Namespaces
- “meaning” linkage from Class

# Terminology Profile

---

Describes how various elements of Standards:

- Common Terminology Services (CTS2)
- ISO 11179 – Metadata Repository (3<sup>rd</sup> Ed.)

can be utilized to bind identifiers and terms used (in archetypes) to terminology resources like:

- Code Systems
- Value Sets and Permissible Values

# Agenda

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- Archetypes – what, why? 
- Archetype Modeling Language 
- AML Tooling

# AML Tooling

---

- AML Object Model (AML-OM)
  - Inspired from ADL Object Model (AOM)
- Existing ADL archetype → AML archetypes
  1. Map AOM → AML-OM
  2. Developing a converter is to visualize real, existing archetypes in AML programmatically
  3. Testing and Constraints validation comes next

# AML Tooling

---

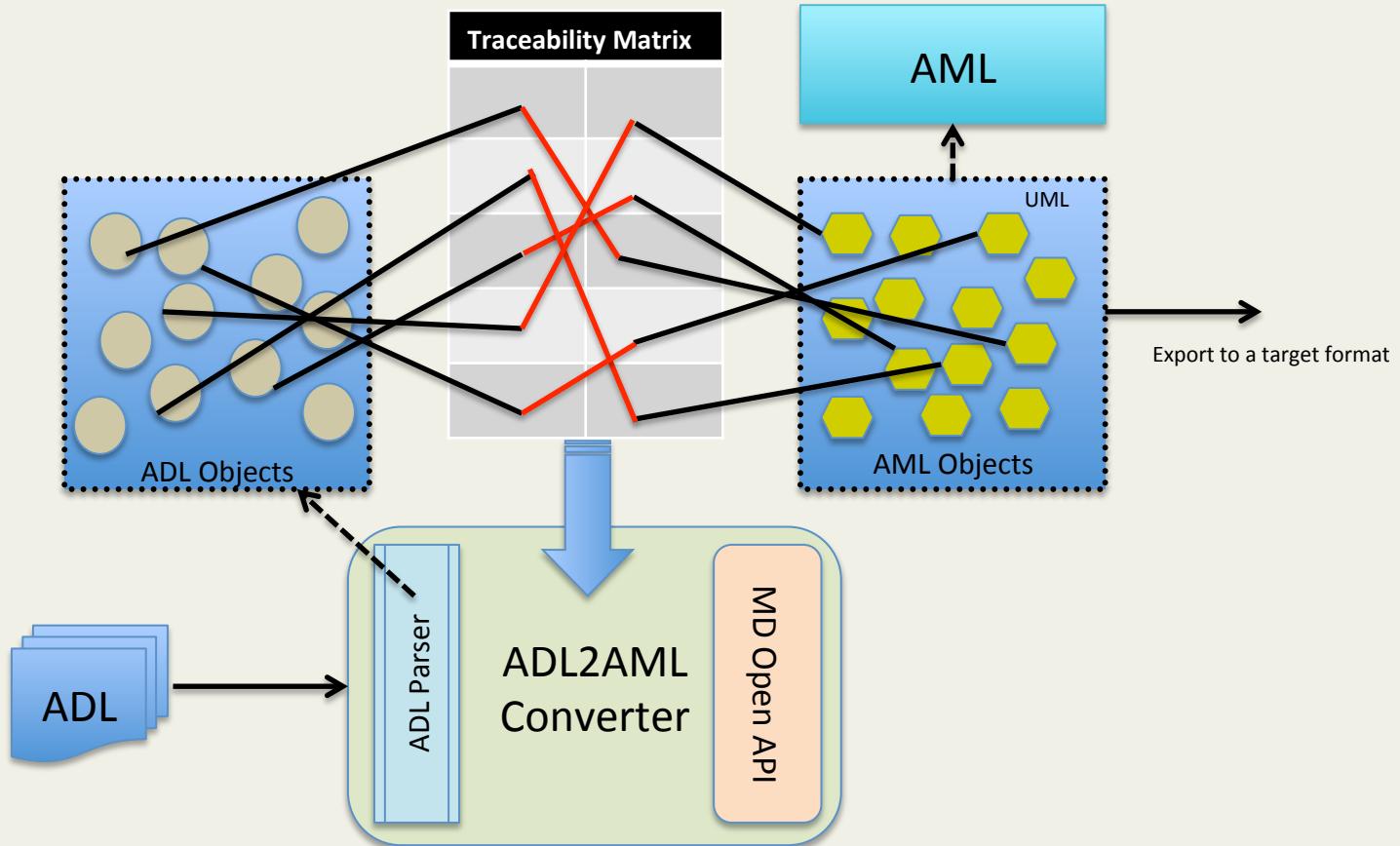
- Project Location:

<https://github.com/semantix/AMLTooling>

- Sub-projects:

- ADL2AMLConverter – The Converter
- AML MD Library – AML Wrapper on MD Open API
- AML MD Plugin – Menu Plug-in to MagicDraw IDE

# ADL2AML Converter



```

archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
  CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
  CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
  original_language = <[ISO_639-1::en]>

description
  original_author = <
    ["name"] = <"Patrick Langford">
    ["organisation"] = <"Intermountain Healthcare">
    ["email"] = <"patrick@neuronsong.com">
    ["date"] = <"10/06/2014">
  >
  details = <
    ["en"] = <
      language = <[ISO_639-1::en]>
      purpose = <"Archetype for CIMI 'specimen collection site' concept">
      use = <"Use for specimen collection site.">
      keywords = <"specimen","collection","site">
    >
  >
  lifecycle_state = <"unmanaged">
  other_contributors = <"Linda Bird <lbi@ihtsdo.org>","Joey Coyle <joey@xcoyle.com>","Stan Huff <Stan Beale <thomas.beale@oceaninformatics.com>>">
  custodian_namespace = <"org.opencimi">
  custodian_organization = <"Clinical Information Modeling Initiative <http://opencimi.org">>
  licence = <"Creative Commons CC-BY <https://creativecommons.org/licenses/by/3.0/>">
  copyright = <"Copyright (c) Clinical Information Modelling Initiative <http://opencimi.org">>
  ip_acknowledgements = <
    ["loinc"] = <"This content from LOINC® is copyright © 1995 Regenstrief Institute, Inc. and the LOINC® Terms of Use can be found at <http://www.loinc.org/terms-of-use>.">
    ["snomed"] = <"This specification includes SNOMED Clinical Terms® (SNOMED CT®) which is used by the International Health Terminology Standards Development Organization (IHTSDO). All rights reserved. SNOMED CT® was originally created by the College of Medical and Dental Sciences of the IHTSDO (www.ihtsdo.org). Use of any SNOMED CT content (including codes, identifiers, term definitions, descriptions and meanings) is subject to the SNOMED CT Affiliate License Agreement (www.ihtsdo.org/license.pdf) or to a written variation to that agreement that has been accepted by the user.">
  >
  definition
    ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
      item matches {
        ELEMENT[id0.0.1.1] matches { -- Body side
          value matches {
            TEXT[id0.0.2.1]
          }
        }
      }
    }
  terminology
    term_definitions = <
      ["en"] = <
        ["id1.1.1.1"] = <
          text = <"Specimen collection site">
        >
        ["id0.0.1.1"] = <
          text = <"Body side">
        >
      >
    >
    term_bindings = <
      ["snomed-ct"] = <
        items = <
          ["id1.1.1.1"] = <http://snomed.info/id/123037004>
          ["id0.0.1.1"] = <http://snomed.info/id/182353008>
        >
      >
    >

```

## An ADL file for archetype “specimen\_collection\_site”

```

archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
  CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
  CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
  original_language = <[ISO_639-1::en]>

description
  original_author = <
    ["name"] = <"Patrick Langford">
    ["organisation"] = <"Intermountain Healthcare">
    ["email"] = <"patrick@neuronsong.com">
    ["date"] = <"10/06/2014">
  >
  details = <
    ["en"] = <
      language = <[ISO_639-1::en]>
      purpose = <"Archetype for CIMI 'specimen collection site' concept">
      use = <"Use for specimen collection site.">
      keywords = <"specimen","collection","site">
    >
  >
  lifecycle_state = <"unmanaged">
  other_contributors = <"Linda Bird <lbi@ihtsdo.org>","Joey Coyle <joey@xcoyle.com>","Stan Huff <Stan Beale <thomas.beale@oceaninformatics.com>>
  custodian_namespace = <"org.opencimi">
  custodian_organization = <"Clinical Information Modeling Initiative <http://opencimi.org">
  licence = <"Creative Commons CC-BY <https://creativecommons.org/licenses/by/3.0/>">
  copyright = <"Copyright (c) Clinical Information Modelling Initiative <http://opencimi.org">
  ip_acknowledgements = <
    ["loinc"] = <"This content from LOINC® is copyright © 1995 Regenstrief Institute, Inc. and the LOINC® Organization. All rights reserved. LOINC® was originally created by the College of Medical and Dental Sciences of the IHTSDO (www.ihtsdo.org). Use of any LOINC content (including codes, identifiers, term definitions, and descriptions) is subject to the LOINC License Agreement (www.ihtsdo.org/license.pdf) or to a written variation to that agreement that has been accepted by the user.">
    ["snomed"] = <"This specification includes SNOMED Clinical Terms® (SNOMED CT®) which is used by the SNOMED International Organization (IHTSDO). All rights reserved. SNOMED CT® was originally created by the College of Medical and Dental Sciences of the IHTSDO (www.ihtsdo.org). Use of any SNOMED CT content (including codes, identifiers, term definitions, and descriptions) is subject to the SNOMED CT Affiliate License Agreement (www.ihtsdo.org/license.pdf) or to a written variation to that agreement that has been accepted by the user.">
  >
definition
  ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
    item matches {
      ELEMENT[id0.0.1.1] matches { -- Body side
        value matches {
          TEXT[id0.0.2.1]
        }
      }
    }
  }

terminology
  term_definitions = <
    ["en"] = <
      ["id1.1.1.1"] = <
        text = <"Specimen collection site">
      >
      ["id0.0.1.1"] = <
        text = <"Body side">
      >
    >
  >
  term_bindings = <
    ["snomed-ct"] = <
      items = <
        ["id1.1.1.1"] = <http://snomed.info/id/123037004>
        ["id0.0.1.1"] = <http://snomed.info/id/182353008>
      >
    >
  >

```

## Archetype Metadata Section

## Constraints/Definition Section

## Terms & Terminology Binding Section

# ADL

```
archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
original_language = <[ISO_639-1::en]>

description
original_author = <
["name"] = "Patrick Langford"
["organisation"] = <"Intermountain Healthcare">
["email"] = <"patrick@neuronsong.com">
["date"] = <"10/06/2014">
>
details = <
["\n"] = <
language = <[ISO_639-1::en]>
purpose = <"Archetype for CIMI 'specimen collection site' concept">
use = <"Use for specimen collection site.">
keywords = <"specimen","collection","site">
>
>
lifecycle_state = <"unmanaged">
other_contributors = <"Linda Beale <thomas.beale@oceaninformatics.com>">
custodian_namespace = <"org.openehr">
custodian_organisation = <"Clinical Information Model (CIMI)">
licence = <"Creative Commons CC-BY-NC-ND 4.0 International License">
copyright = <"Copyright (c) Clinical Information Model (CIMI) 2014. All rights reserved.">
ip_acknowledgements = <
["loinc"] = <"This content follows the LOINC standard. See https://loinc.org/terms-of-use">
["snomed"] = <"This specific archetype is based on the SNOMED CT version 2014R0. All rights reserved. © 2014 International Health Terminology Standard Development Organization (IHTSDO). All rights reserved. This archetype is derived from the SNOMED CT Data Creation System or Data License (www.ihtsdo.org/licensing)">
>
>

definition
ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
item matches {
ELEMENT[id0.0.1.1] matches { -- Body side
value matches {
TEXT[id0.0.2.1]
}
}
}
}

terminology
term_definitions = <
["en"] = <
["id1.1.1.1"] = <
text = <"Specimen collection site">
>
["id0.0.1.1"] = <
text = <"Body side">
>
>
term_bindings = <
["snomed-ct"] = <
items = <
["id1.1.1.1"] = <http://snomed.info/id/123037004>
["id0.0.1.1"] = <http://snomed.info/id/182353008>
>
>
```

ADL

The diagram illustrates the structure of an ADL archetype definition. At the top right, the acronym "ADL" is displayed in large, bold, black letters. Below it, a red diagonal line extends from the top left towards the bottom right, passing through several code snippets. The first snippet is a fragment of an XML-like configuration:

```
archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
original_language = <[ISO_639-1::en]>

description
original_author = <
["name"] = <"Patrick Langford">
["organisation"] = <"Intermountain Healthcare">
["email"] = <"patrick@neuronsong.com">
["date"] = <"10/06/2014">
>
details = <
["n"] = <
language = <[ISO_639-1::en]>
purpose = <"Archetype for CIMI 'specimen collection site' concept">
use = <"Use for specimen collection site.">
keywords = <"specimen", "collection", "site">
>
>
lifecycle_state = <"unmanaged">;
other_contributors = <"Linda B. Beale <thomas.beale@oceaninform.custodian_name_space = <"org.opencodelabs.custodian_organisation = <"Clini
licence = <"Creative Commons CC-BY-NC-SA 4.0 International License">
copyright = <"Copyright (c) Clin
ip_acknowledgements = <
["loinc"] = <"This content follows the IHTSDO Clinical Data Interoperability Standard (CDI)">
["org/terms-of-use"] = <"This specific version of the archetype is intended for use by the organization (IHTSDO). All rights reserved. The IHTSDO is the owner of the intellectual property rights in the IHTSDO Data Creation System or Data License (www.ihtsdo.org/licenses)".>
">
```

The second snippet shows the archetype identifier:

archetype (adl\_version=1.5.1; rm\_release=2.0.2; generated)  
CIMI-CORE-ITEM\_GROUP.specimen\_collection\_site.v1.0.0

The third snippet shows a language setting:

language  
original\_language = <[ISO\_639-1::en]>

Below these snippets, four boxes are arranged horizontally, each with an upward-pointing arrow pointing to a specific part of the identifier string:

- publisher**: points to "CIMI-CORE-ITEM\_GROUP".
- RM Class**: points to "specimen\_collection\_site".
- Archetype Name**: points to "v1.0.0".
- Version**: points to "v2".

Archetype Modeling Language

# ADL

```
archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
CIMI-CORE-ITEM-GROUP.specimen_collection_site.v1.0.0

specialize
CIMI-CORE-ITEM-GROUP.anatomical_location.v2

language
original_language = <[ISO_639-1::en]>

description
original_author = <
["name"] = "Patrick Langford"
["organisation"] = <"Intermountain Healthcare">
["email"] = <"patrick@neuronsong.com">
["date"] = <"10/06/2014">
>
details = <
["n"] = <
language = <[ISO_639-1::en]>
purpose = <"Archetype for CIMI 'specimen collection site' concept">
use = <"Use for specimen collection site.">
keywords = <"specimen","collection","site">
>
>
lifecycle_state = <"unmanaged">
other_contributors = <"Linda Beale <thomas.beale@oceaninformatics.com>">
custodian_namespace = <"org.openehr">
custodian_organisation = <"Creative Commons CC0">
licence = <"Creative Commons CC0 License">
copyright = <"Copyright (c) Creative Commons CC0 License 2014">
ip_acknowledgements = <
["loinc"] = <"This content follows the LOINC standard.">
["org/terms-of-use"] = <"This specific version of the archetype is provided by the International Health Terminology Standardization Consortium (IHTSDO). All rights reserved. The IHTSDO is the owner of the IHTSDO (www.ihtsdo.org) Data Creation System or Data License (www.ihtsdo.org/licensing)">
>
definition
ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
item matches {
ELEMENT[id0.0.1.1] matches { -- Body side
value matches {
TEXT[id0.0.2.1]
}
}
}
}

terminology
term_definitions = <
["en"] = <
["id1.1.1.1"] = <
text = <"Specimen collection site">
>
["id0.0.1.1"] = <
text = <"Body side">
>
>
term_bindings = <
["snomed-ct"] = <
items = <
["id1.1.1.1"] = <http://snomed.info/id/123037004>
["id0.0.1.1"] = <http://snomed.info/id/182353008>
>
>
```

Specialize

Language

```

archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
  CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
  CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
  original_language = <[ISO_639-1::en]>

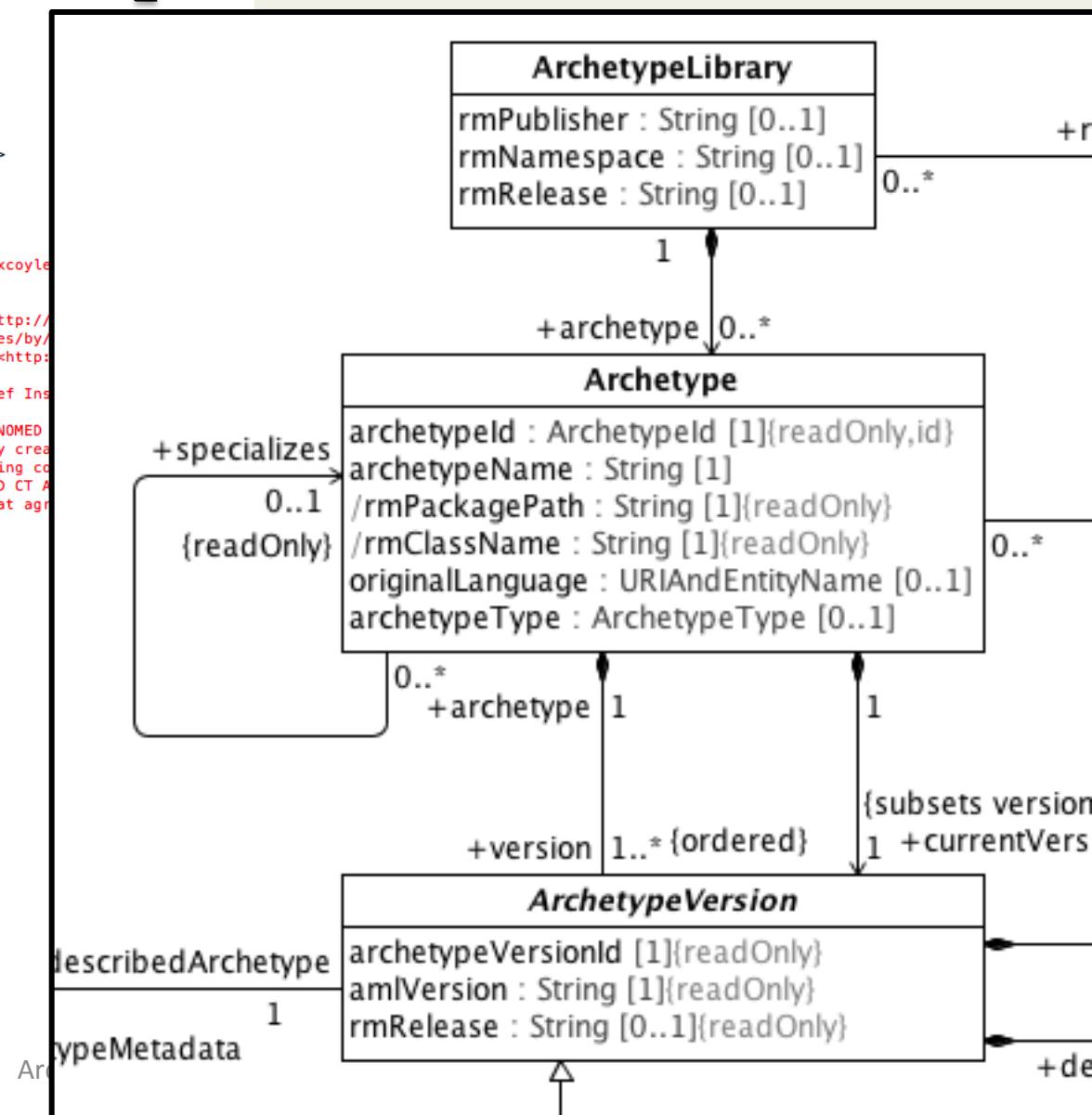
description
  original_author = <
    ["name"] = <"Patrick Langford">
    ["organisation"] = <"Intermountain Healthcare">
    ["email"] = <"patrick@neuronsong.com">
    ["date"] = <"10/06/2014">
  >
  details = <
    ["en"] = <
      language = <[ISO_639-1::en]>
      purpose = <"Archetype for CIMI 'specimen collection site' concept">
      use = <"Use for specimen collection site.">
      keywords = <"specimen","collection","site">
    >
  >
  lifecycle_state = <"unmanaged">
  other_contributors = <"Linda Bird <lbi@ihtsdo.org>","Joey Coyle <joey@xcoyle
Beale <thomas.beale@oceaninformatics.com>">
  custodian_namespace = <"org.opencimi">
  custodian_organization = <"Clinical Information Modeling Initiative <http://
licence = <"Creative Commons CC-BY <https://creativecommons.org/licenses/by/
copyright = <"Copyright (c) Clinical Information Modelling Initiative <http:
ip_acknowledgements = <
  ["loinc"] = <"This content from LOINC® is copyright © 1995 Regenstrief Ins
  .org/terms-of-use">
  ["snomed"] = <"This specification includes SNOMED Clinical Terms® (SNOMED
Organization (IHTSDO). All rights reserved. SNOMED CT® was originally crea
of the IHTSDO (www.ihtsdo.org). Use of any SNOMED CT content (including co
Data Creation System or Data Analysis System as defined in the SNOMED CT A
License (www.ihtsdo.org/license.pdf) or to a written variation to that agr
">
  >

definition
  ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
    item matches {
      ELEMENT[id0.0.1.1] matches { -- Body side
        value matches {
          TEXT[id0.0.2.1]
        }
      }
    }
  }

terminology
  term_definitions = <
    ["en"] = <
      ["id1.1.1.1"] = <
        text = <"Specimen collection site">
      >
      ["id0.0.1.1"] = <
        text = <"Body side">
      >
    >
    >
  term_bindings = <
    ["snomed-ct"] = <
      items = <
        ["id1.1.1.1"] = <http://snomed.info/id/123037004>
        ["id0.0.1.1"] = <http://snomed.info/id/182353008>
      >
    >
  >

```

## Maps to Archetype Model in AML



```

archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
| CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
| CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
| original_language = <[ISO_639-1::en]>

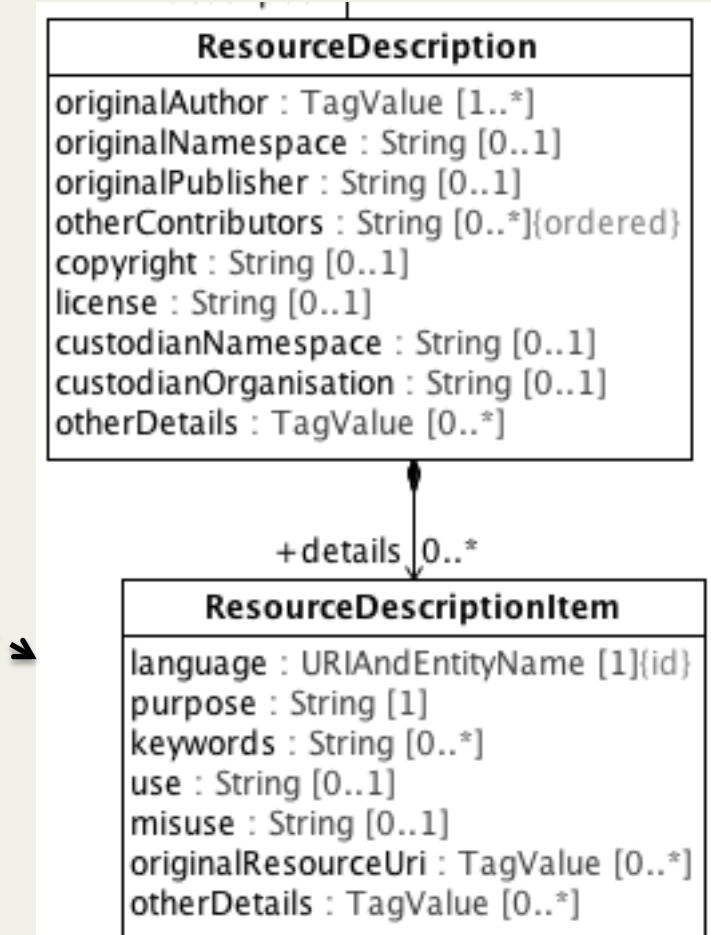
description
| original_author = <
|   ["name"] = <"Patrick Langford">
|   ["organisation"] = <"Intermountain Healthcare">
|   ["email"] = <"patrick@neuronsong.com">
|   ["date"] = <"10/06/2014">
| >
| details = <
|   ["en"] = <
|     language = <[ISO_639-1::en]>
|     purpose = <"Archetype for CIMI 'specimen collection site' concept">
|     use = <"Use for specimen collection site.">
|     keywords = <"specimen","collection","site">
|   >
| >
| lifecycle_state = <"unmanaged">
| other_contributors = <"Linda Bird <lbi@ihtsdo.org>","Joey Coyle <joe@xcoyle.com>","Stan Huff <Stan.Huff@ihtsdo.org>","Thomas Beale <thomas.beale@oceaninformatics.com>">
| custodian_namespace = <"org.opencimi">
| custodian_organisation = <"Clinical Information Modeling Initiative <http://opencimi.org">>
| licence = <"Creative Commons CC-BY <https://creativecommons.org/licenses/by/3.0/>">
| copyright = <"Copyright (c) Clinical Information Modelling Initiative <http://opencimi.org">>
| ip_acknowledgements = <
|   ["loinc"] = <"This content from LOINC® is copyright © 1995 Regenstrief Institute, Inc. and the IHTSDO. All rights reserved. LOINC® is a registered trademark of the International Health Terminology Standards Development Organization (IHTSDO). All rights reserved. SNOMED CT® was originally created by the College of Medical and Dental Sciences of the University of Edinburgh. The SNOMED CT® Data Creation System or Data Analysis System as defined in the SNOMED CT Affiliate License Agreement (www.ihtsdo.org/license.pdf) or to a written variation to that agreement that has been approved by the IHTSDO.">
|   ["snomed"] = <"This specification includes SNOMED Clinical Terms® (SNOMED CT®) which is used by the International Health Terminology Standards Development Organization (IHTSDO). All rights reserved. SNOMED CT® was originally created by the College of Medical and Dental Sciences of the University of Edinburgh. The SNOMED CT® Data Creation System or Data Analysis System as defined in the SNOMED CT Affiliate License Agreement (www.ihtsdo.org/license.pdf) or to a written variation to that agreement that has been approved by the IHTSDO.">
| >
| >
definition
ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
  item matches {
    ELEMENT[id0.0.1.1] matches { -- Body side
      value matches {
        TEXT[id0.0.2.1]
      }
    }
  }
}

terminology
term_definitions = <
| ["en"] = <
|   ["id1.1.1"] = <
|     text = <"Specimen collection site">
|   >
|   ["id0.0.1.1"] = <
|     text = <"Body side">
|   >
| >
| >
term_bindings = <
|   ["snomed-ct"] = <
|     items = <
|       ["id1.1.1"] = <http://snomed.info/id/123037004>
|       ["id0.0.1.1"] = <http://snomed.info/id/182353008>
|     >
|   >
| >

```

**Maps to a ‘Resource’ of Arche Model in AML**

Maps to a ‘Resource’ of Archetype Model in AML



```

archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
  CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
  CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
  original_language = <[ISO_639-1::en]>

description
  original_author = <
    ["name"] = <"Patrick Langford">
    ["organisation"] = <"Intermountain He
    ["email"] = <"patrick@neuronsong.com">
    ["date"] = <"10/06/2014">
  >
  details = <
    ["en"] = <
      language = <[ISO_639-1::en]>
      purpose = <"Archetype for CIMI 'spe
      use = <"Use for specimen collection
      keywords = <"specimen","collection"
    >
  >
  lifecycle_state = <"unmanaged">
  other_contributors = <"Linda Bird <lbi@Beale <thomas.beale@oceaninformatics.co
  custodian_namespace = <"org.opencimi">
  custodian_organisation = <"Clinical Inf
  licence = <"Creative Commons CC-BY <htt
  copyright = <"Copyright (c) Clinical In
  ip_acknowledgements = <
    ["loinc"] = <"This content from LOINC
    .org/terms-of-use">
    ["snomed"] = <"This specification inc
    Organization (IHTSDO). All rights res
    of the IHTSDO (www.ihtsdo.org). Use of any SNOMED CT content (including codes, identifiers, term
    Data Creation System or Data Analysis System as defined in the SNOMED CT Affiliate License Agree
    License (www.ihtsdo.org/license.pdf) or to a written variation to that agreement that has been a
    ">
  >

definition
  ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
    item matches {
      ELEMENT[id0.0.1.1] matches { -- Body side
        value matches {
          TEXT[id0.0.2.1]
        }
      }
    }
  }

definition
  ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
    item matches {
      ELEMENT[id0.0.1.1] matches { -- Body side
        value matches {
          TEXT[id0.0.2.1]
        }
      }
    }
  }

terminology
  term_definitions = <
    ["en"] = <
      ["id1.1.1.1"] = <
        text = <"Specimen collection site">
      >
      ["id0.0.1.1"] = <
        text = <"Body side">
      >
    >
  >
  term_bindings = <
    ["snomed-ct"] = <
      items = <
        ["id1.1.1.1"] = <http://snomed.info/id/123037004>
        ["id0.0.1.1"] = <http://snomed.info/id/182353008>
      >
    >
  >

```

```

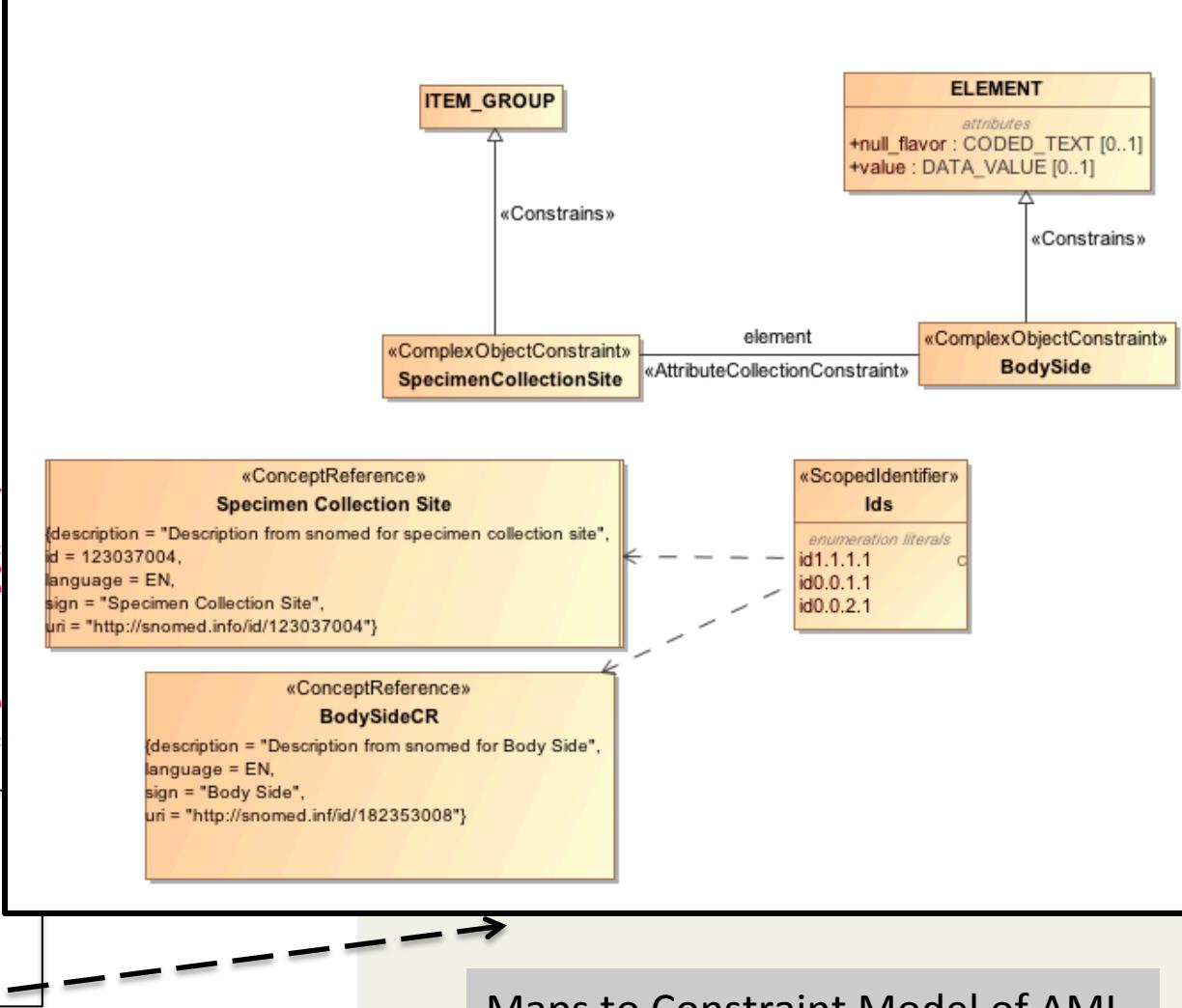
archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
  CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
  original_language = <[ISO_639-1::en]>

description
  original_author = <
    ["name"] = <"Patrick Langford">
    ["organisation"] = <"Intermountain Healthcare">
    ["email"] = <"patrick@neuronsong.com">
    ["date"] = <"10/06/2014">
  >
  details = <
    ["en"] = <
      language = <[ISO_639-1::en]>
      purpose = <"Archetype for CIMI 'specimen collection site'>
      use = <"Use for specimen collection site.">
      keywords = <"specimen","collection","site">
    >
  >
  lifecycle_state = <"unmanaged">
  other_contributors = <"Linda Bird <lbi@ihtsdo.org>","Joey Coy Beale <thomas.beale@oceaninformatics.com>">
  custodian_namespace = <"org.opencimi">
  custodian_organization = <"Clinical Information Modeling Initiative">
  licence = <"Creative Commons CC-BY <https://creativecommons.org/licenses/by/4.0/>">
  copyright = <"Copyright (c) Clinical Information Modelling Initiative">
  ip_acknowledgements = <
    ["loinc"] = <"This content from LOINC® is copyright © 1995 IHTSDO and its partners. All rights reserved. LOINC® is a registered trademark of IHTSDO. All rights reserved. SNOMED CT® was developed by IHTSDO (www.ihtsdo.org). Use of any SNOMED CT content must be in accordance with the SNOMED CT License (www.ihtsdo.org/license.pdf) or to a written variation of it.">
    ["snomed"] = <"This specification includes SNOMED Clinical Organization (IHTSDO). All rights reserved. SNOMED CT® was developed by IHTSDO (www.ihtsdo.org). Use of any SNOMED CT content must be in accordance with the SNOMED CT License (www.ihtsdo.org/license.pdf) or to a written variation of it.">
  >
  definition
    ITEM_GROUP[id1.1.1.1] matches { -- Specimen collection site
      item matches {
        ELEMENT[id0.0.1.1] matches { -- Body side
          value matches {
            TEXT[id0.0.2.1]
          }
        }
      }
    }
  >
  terminology
    term_definitions = <
      ["en"] = <
        ["id1.1.1.1"] = <
          text = <"Specimen collection site">
        >
        ["id0.0.1.1"] = <
          text = <"Body side">
        >
      >
      term_bindings = <
        ["snomed-ct"] = <
          items = <
            ["id1.1.1.1"] = <http://snomed.info/id/123037004>
            ["id0.0.1.1"] = <http://snomed.info/id/182353008>
          >
        >
      >
    >

```



```

archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
  CIMI-CORE-ITEM_GROUP.specimen_collection_site v1.0.0

specialize
  CIMI-CORE-ITEM_GROUP.anatomical_specimen

language
  original_language = <ISO_639-1>

description
  original_author = <
    ["name"] = <"Patrick Land">
    ["organisation"] = <"Intertek">
    ["email"] = <"patrick@neulabs.com">
    ["date"] = <"10/06/2014">
  >

details = <
  ["en"] = <
    language = <"ISO_639-1">
    purpose = <"Archetype definition">
    use = <"Use for specimen collection site">
    keywords = <"specimen", "collection site">
  >
>

lifecycle_state = <"unmanaged">
other_contributors = <"Lindsey Beale <thomas.beale@oceaninstitute.org>">
custodian_namespace = <"org>
custodian_organisation = <"Creative Commons">
licence = <"Creative Commons Attribution-NonCommercial-ShareAlike license">
copyright = <"Copyright (c) IHTSDO. All rights reserved. This content is licensed under the IHTSDO Data Creation System or DCS License (www.ihtsdo.org/licenses)">
ip_acknowledgements = <
  ["loinc"] = <"This content is licensed under the IHTSDO Data Creation System or DCS License (www.ihtsdo.org/licenses)">
  ["snomed"] = <"This specification is the intellectual property of the IHTSDO. All rights reserved. It is based on the SNOMED Clinical Terms version 2014R2. The SNOMED CT® and SNOMED International® trademarks and logos are registered trademarks and service marks of the International Society for Semantic Standardization (ISSS).>
>

definition
ITEM_GROUP[id1.1.1.1] matches {
  item matches {
    ELEMENT[id0.0.1.1] matches { -- Specimen collection site
      value matches {
        TEXT[id0.0.2.1]
      }
    }
  }
}

terminology
term_definitions = <
  ["en"] = <
    ["id1.1.1.1"] = <
      text = <"Specimen collection site">
    >
    ["id0.0.1.1"] = <
      text = <"Body side">
    >
  >
>

term_bindings = <
  ["snomed-ct"] = <
    items = <
      ["id1.1.1.1"] = <http://snomed.info/id/123037004>
      ["id0.0.1.1"] = <http://snomed.info/id/182353008>
    >
  >
>

```

```

terminology
term_definitions = <
  ["en"] = <
    ["id1.1.1.1"] = <
      text = <"Specimen collection site">
    >
    ["id0.0.1.1"] = <
      text = <"Body side">
    >
  >
>

term_bindings = <
  ["snomed-ct"] = <
    items = <
      ["id1.1.1.1"] = <http://snomed.info/id/123037004>
      ["id0.0.1.1"] = <http://snomed.info/id/182353008>
    >
  >
>

```

```

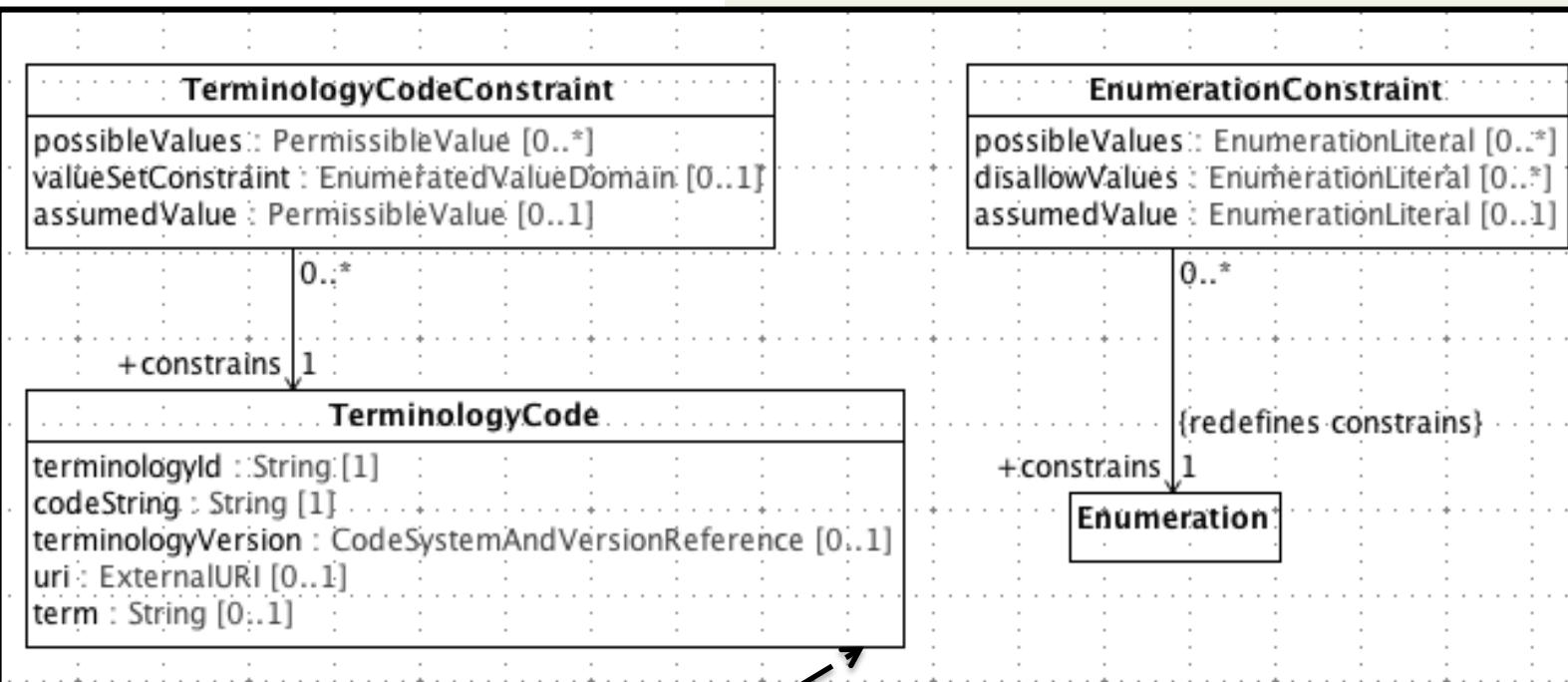
archetype (adl_version=1.5.1; rm_release=2.0.2; generated)
  CIMI-CORE-ITEM_GROUP.specimen_collection_site.v1.0.0

specialize
  CIMI-CORE-ITEM_GROUP.anatomical_location.v2

language
  original_language = <[ISO_639-1::en]>

description
  original_author = <
    ["name"] = <"Patrick L.
    ["organisation"] = <"Institute for Health Informatics
    ["email"] = <"patrick@ifi.uio.no>
    ["date"] = <"10/06/2015
  >
  details = <
    ["en"] = <
      language = <[ISO_639-1::en]>
      purpose = <"Archetype
      use = <"Use for specification">
      keywords = <"specimen collection site">
    >
  >
  lifecycle_state = <"unmanaged">
  other_contributors = <"L.
  Beale <thomas.beale@oceanisolutions.com>
  custodian_namespace = <"http://www.ihtsdo.org/terminology/codesystem/>
  custodian_organisation =
  licence = <"Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License">
  copyright = <"Copyright © 2015 Institute for Health Informatics, University of Oslo, Norway">
  ip_acknowledgements = <
    ["loinc"] = <"This content is based on the LOINC standard version 2.0.1, published by the International Classification of Diseases for Clinical use (ICD-10) Editorial Committee, World Health Organization (WHO). The ICD-10 standard is used as the basis for the SNOMED CT terminology.">
    ["org/terms-of-use"] = <"This specification is based on the SNOMED CT Version 2015R1, published by the International Health Terminology Standards Development Organisation (IHTSDO). The IHTSDO is the owner of the SNOMED CT trademark and the copyright holder of the SNOMED CT content.">
    ["snomed"] = <"This specification is based on the SNOMED CT Version 2015R1, published by the International Health Terminology Standards Development Organisation (IHTSDO). The IHTSDO is the owner of the SNOMED CT trademark and the copyright holder of the SNOMED CT content.">
  >
  >
  definition
    ITEM_GROUP[id1.1.1.1] matches {
      item matches {
        ELEMENT[id0.0.1.1] matches { -- Body side
          value matches {
            TEXT[id0.0.2.1]
          }
        }
      }
    }
  >
  terminology
    term_definitions = <
      ["en"] = <
        ["id1.1.1.1"] = <
          text = <"Specimen collection site">
        >
        ["id0.0.1.1"] = <
          text = <"Body side">
        >
      >
      term_bindings = <
        ["snomed-ct"] = <
          items = <
            ["id1.1.1.1"] = <http://snomed.info/id/123037004>
            ["id0.0.1.1"] = <http://snomed.info/id/182353008>
          >
        >
      >
    >
  >

```



Maps to Terminology Binding Profile of AML

# Agenda

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- Archetypes – what, why? 
- Archetype Modeling Language 
- AML Tooling 

# Completed AML Spec./Tooling Tasks

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- Model 2 Text Transforms:
  - Completed IBM RSA Business Intelligence Report Tool (BIRT) Template to dynamically generate specifications
  - Completed Apache Velocity Template –  
IBM RSA → MagicDraw
- AML API Layer over MagicDraw OpenAPIs
- AML Specifications
  - EA -> RSA -> MD, Release

# Acknowledgements

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- 
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# Thank You

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## Questions & Comments