



FHIR for specifiers

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Who am I?



- **Name:** Michel Rutten
- **Company:** Furore, Amsterdam
- **Background:**
 - Professional software developer since 1998
 - Microsoft .NET; Healthcare industries
 - Technical Specialist at Furore since May 2014
 - Member of the Furore FHIR development team
 - Specialized in FHIR Profiling
 - *Toolsmith* - Lead developer of Forge



Contents of this tutorial



-
- Introduction to FHIR Conformance Layer
 - Principal components
 - FHIR Conformance Resources
 - Implementation Guides
 - ValueSet
 - Profiles
 - StructureDefinition
 - Extensions
 - Formal Constraints & FluentPath
 - Logical Models
 - ClinFhir Resource Builder
 - Registry





INTRODUCTION

FHIR CONFORMANCE LAYER

The need for profiling



-
- Many different contexts in healthcare, but a single set of Resources
 - FHIR provides a “platform specification”
 - Requires further adaptation to context of use



The need for profiling



Need to be able to describe adaptations based on use and context

- Which resources and elements are used?
- Which API features are used?
- Which terminologies are used?
- How to map these to local requirements/implementations?



The need for profiles



Allow for these usage statements to be:

- Authored in a structured manner
- Published in a repository
- Used as the basis for validation, code, report and UI generation.



Define FHIR “Profiling”?



General term:

- The process of creating a conformance resource
- The process of creating a conformance package
- The process of creating an implementation guide

Define FHIR “Profile”



-
- A set of constraints on a FHIR resource
 - A set of constraints on another FHIR profile

 - But also refers to:
 - An implementation guide
 - A conformance package



PRINCIPAL COMPONENTS FHIR CONFORMANCE LAYER

Conformance Resources



Terminology

Value Set

Concept Map

Naming System

Content

Structure Definition

Data Element

Operations

Conformance

Operation Definition

Search Parameter

Misc.

Implementation Guide

Test Script

Terminology



ValueSet

- Define which terminologies to use in which elements

NamingSystem

- Define namespaces with unique symbols

ConceptMap

- Define mappings between terms from different systems

Content



StructureDefinition

- Define data structures
- Define restrictions and/or extensions

DataElement

- Define data elements (ISO 11179)

Operations Control



Conformance

- Define server capabilities
- Define supported API methods

OperationDefinition

- Define additional (custom) operations

SearchParameter

- Define additional (custom) searches

Miscellaneous



ImplementationGuide

- Author and publish an implementation guide

TestScript

- Define compliance tests against a FHIR server

Conformance Resource



Conformance

ValueSet

Structure
Definition

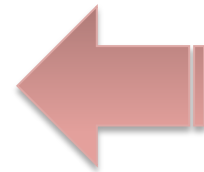
Concept
Map

SearchParam
Definition

NamingSystem

Operation
Definition

Conformance



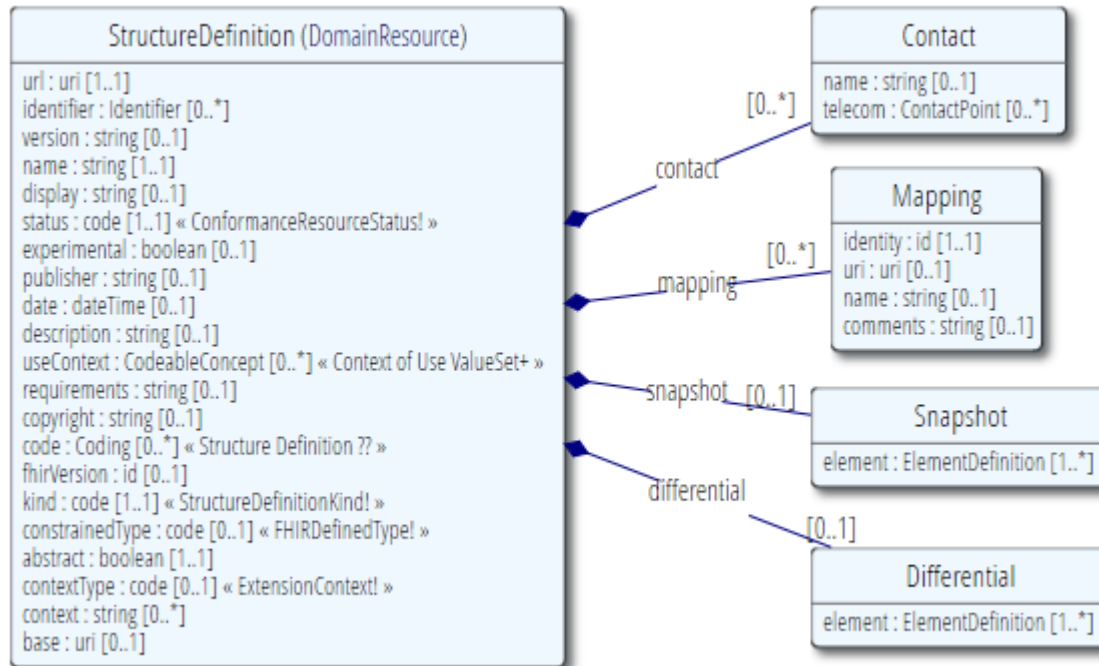
TestScript



OVERVIEW

FHIR CONFORMANCE RESOURCES

StructureDefinition



Defines datastructures

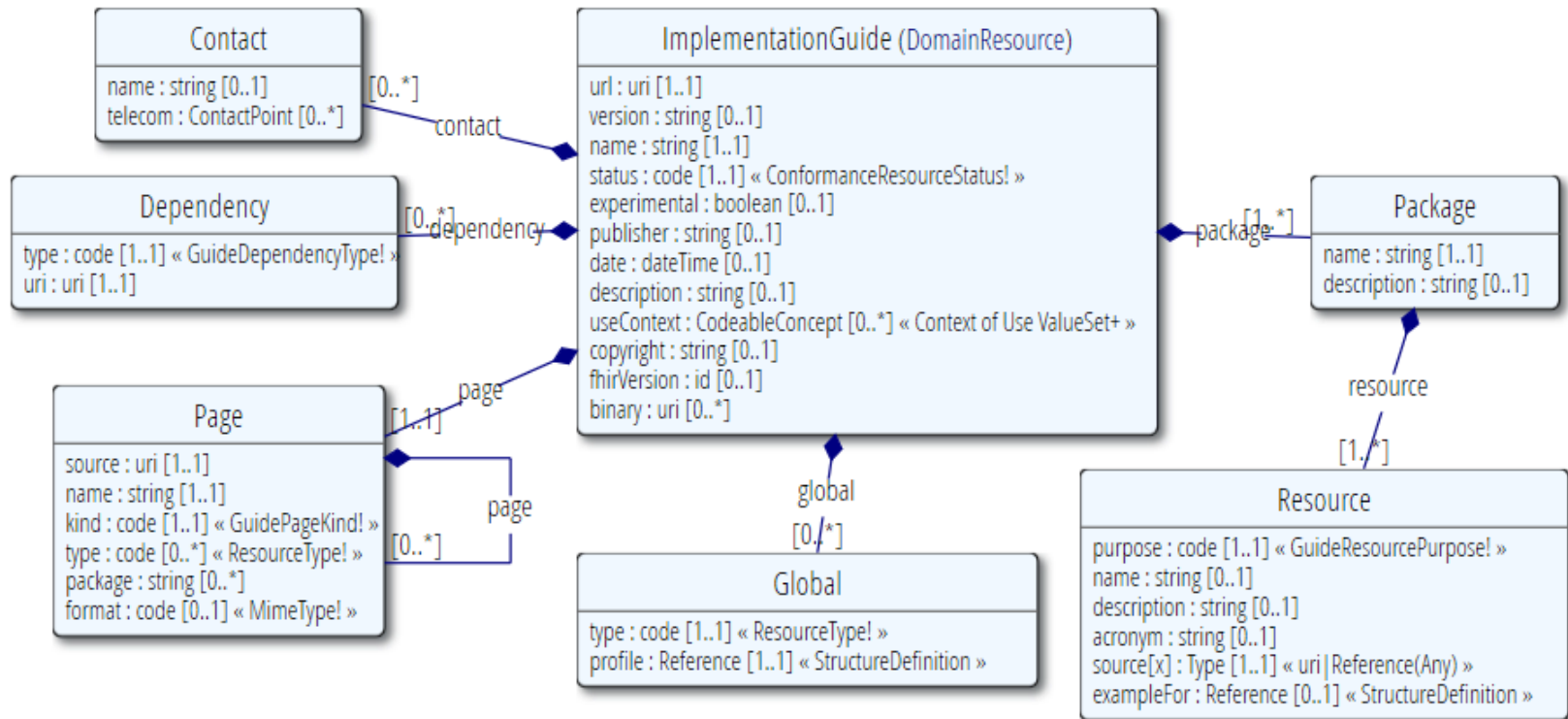
- Core resources & datatypes (see [validation.zip](#))
- Constraints on resources & datatypes
- Extensions

StructureDefinition



- Share/publish to repository / registry
- Compare
- Validate resource
- Use to drive
 - Code generation
 - Report generation
 - UI generation (e.g. ClinFhir ResourceBuilder)
- *Computable!*

ImplementationGuide



- **Define scope of usage**
- **Describes requirements for an implementation**

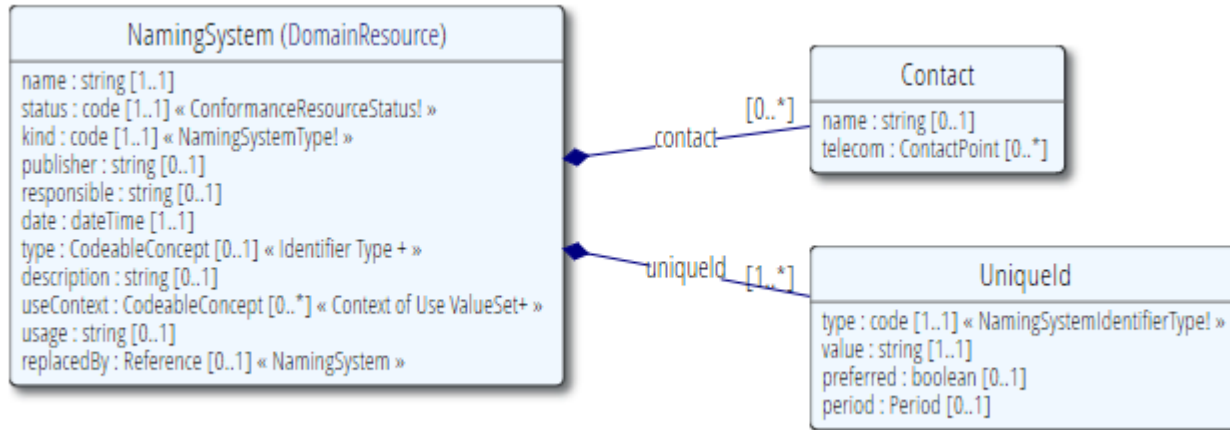
ImplementationGuide



Usage:

- Allow authors to publish an implementation guide
- Allow tools to validate conformance
- *Computable!*

NamingSystem



Describes “logical” numbering systems in use

- What’s the name?
- What are equivalent uri/uuid/oids

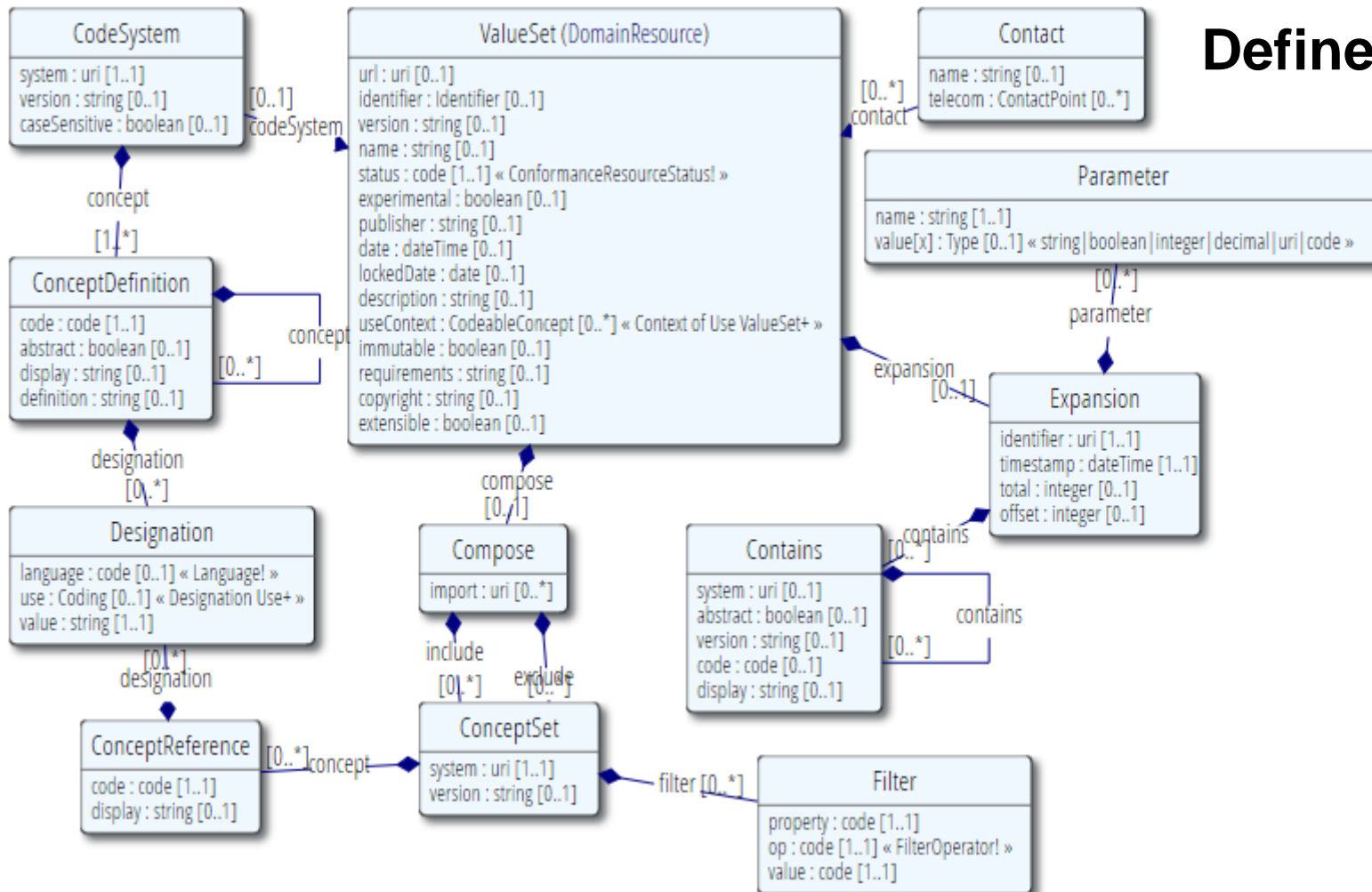
Represents a "System" used within the Identifier and Coding data types.



ValueSet



Define codes



ValueSet



Code System

- Defines a set of codes with meanings (also known as enumeration, terminology, classification, and/or ontology)

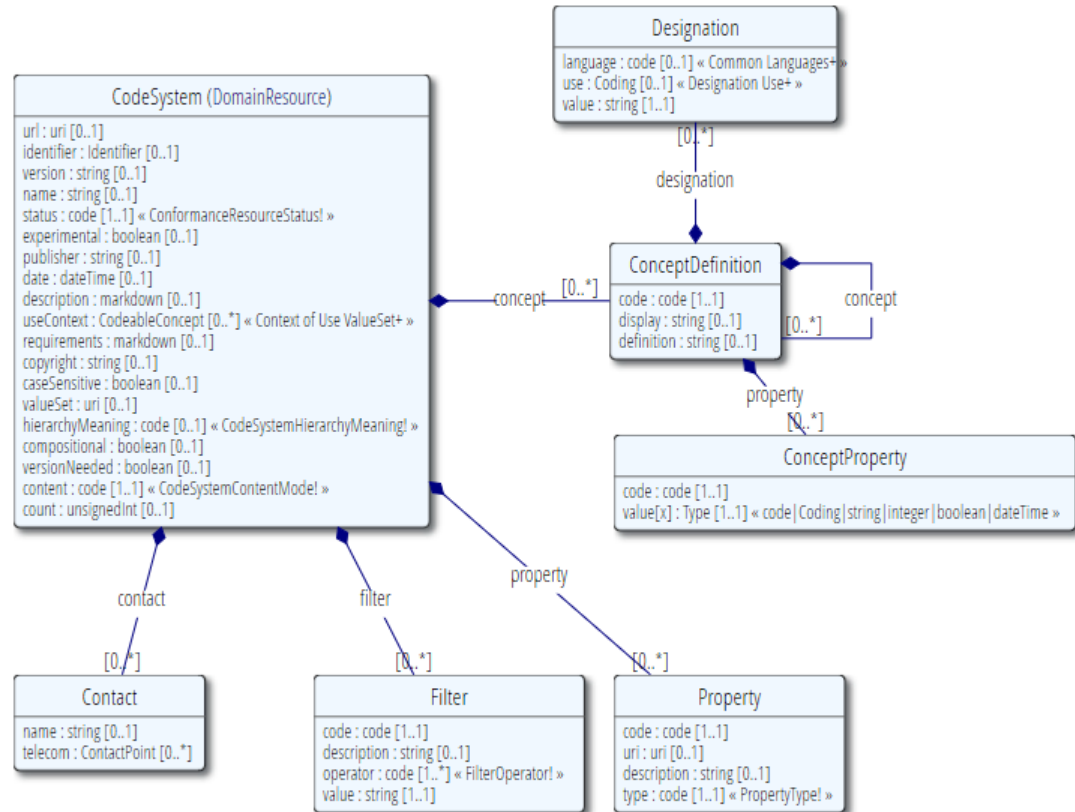
Value Set

- Selects a set of codes from those defined by one or more code systems

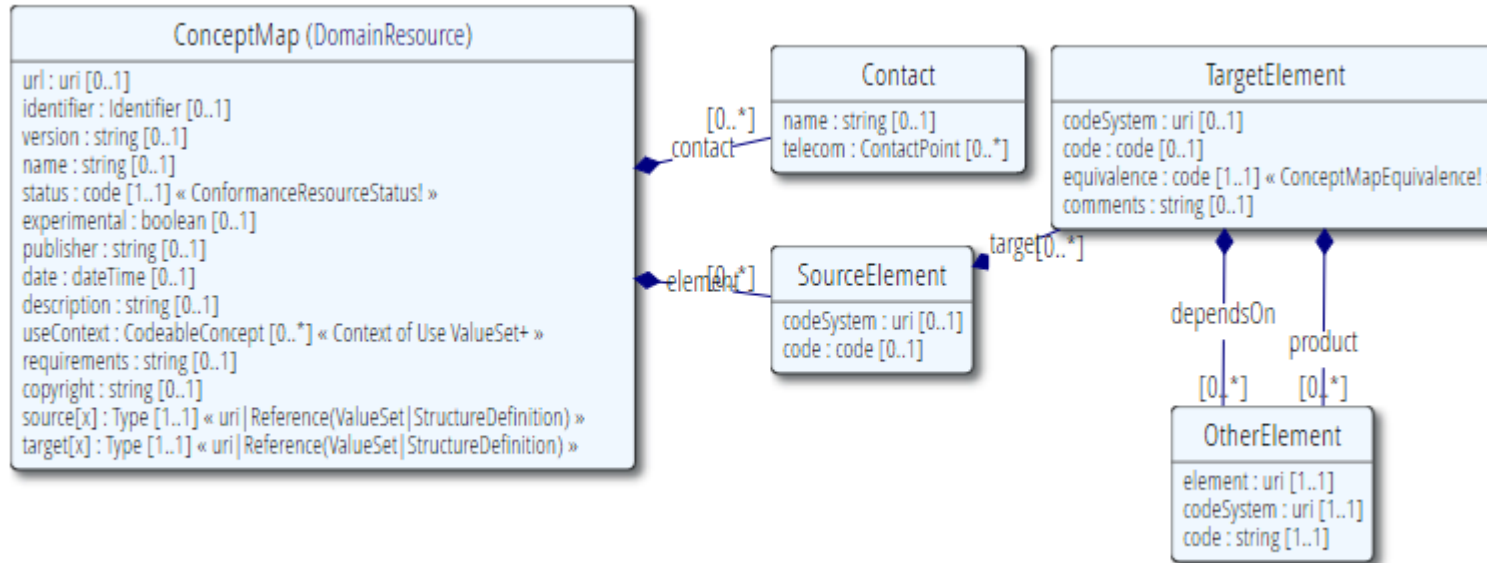
STU3: CodeSystem



- DSTU2 Component of ValueSet
- STU3 New separate resource



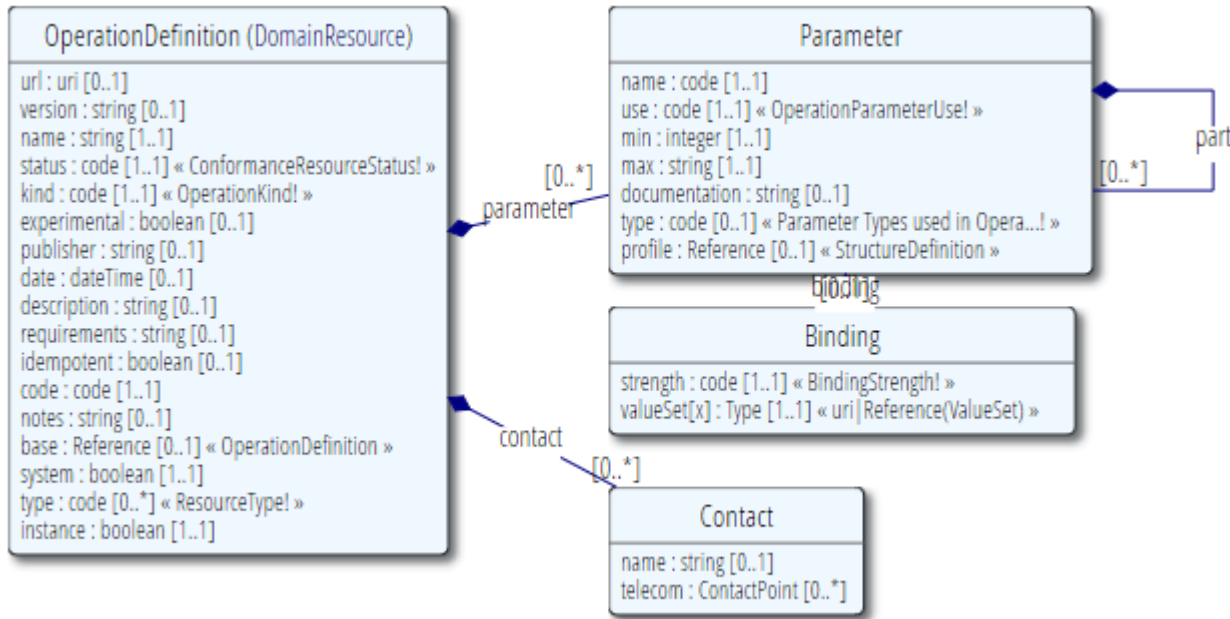
ConceptMap



Define mapping

From one set of concepts to one or more other concept(s)

OperationDefinition



- **Extend/restrict the API**
- **Defines interactions**



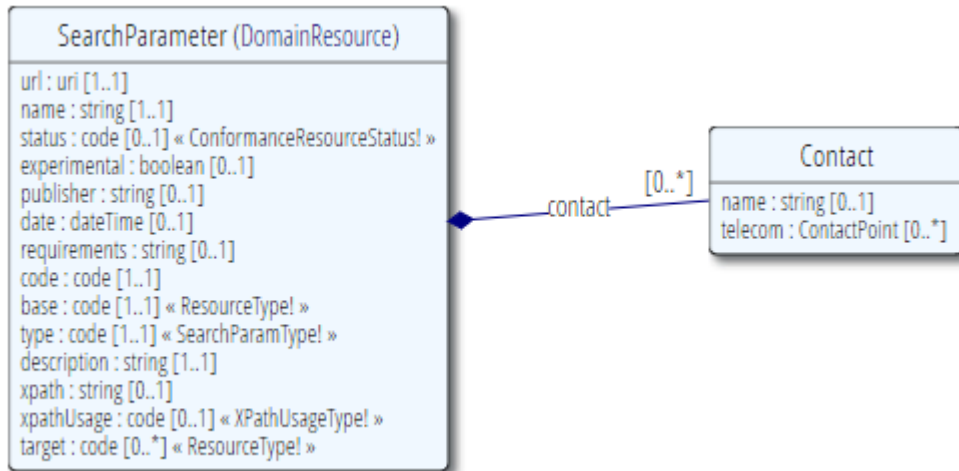
Operation Definition



Describes additional operations over and above the RESTful interactions defined in the specification

- What is the name?
- Input/output parameters
- What does it do?
- Works on which resources?

SearchParameter



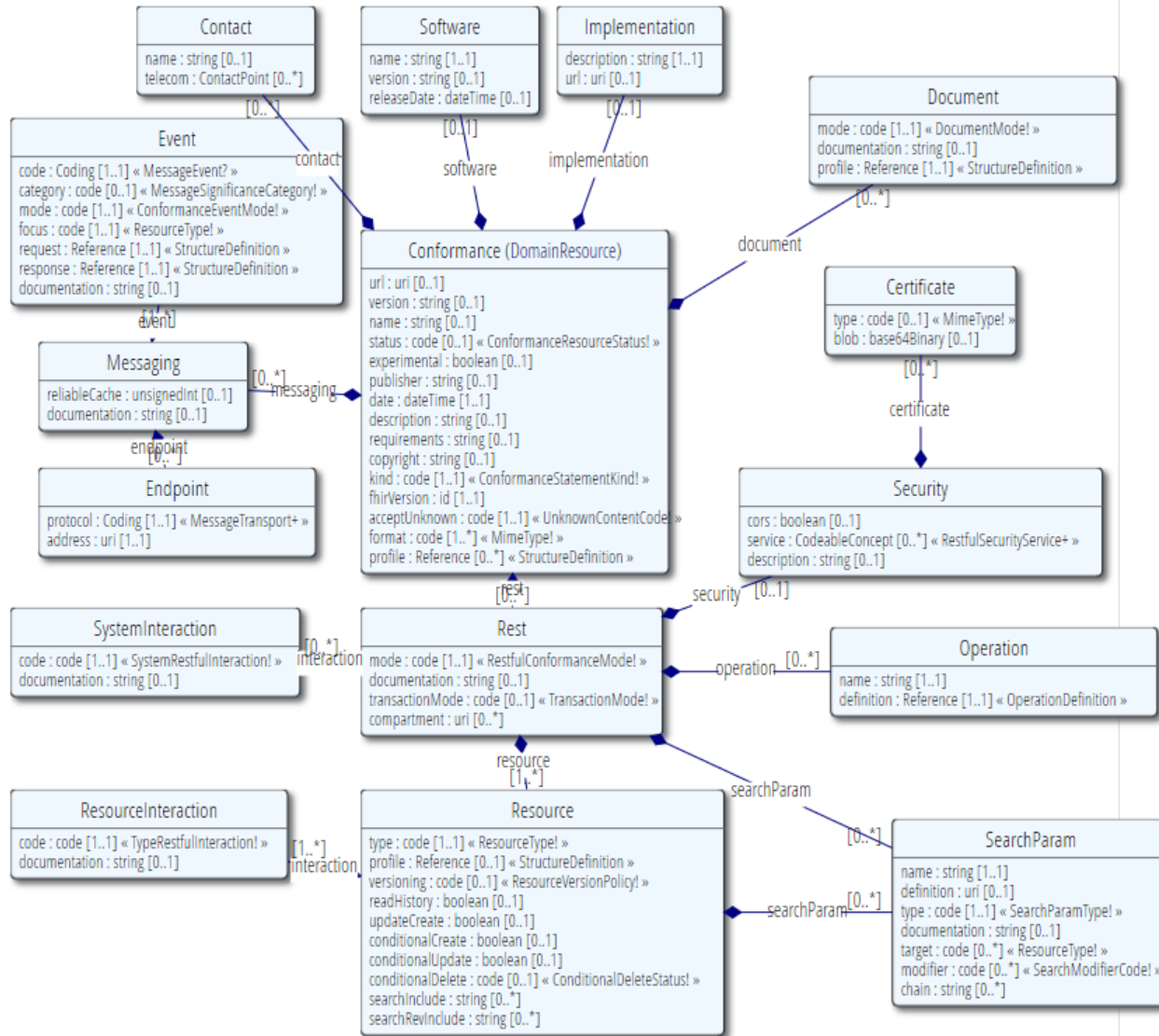
Extend/restrict searches

Describes additional searches to filter resources

- What is the name?
- Elements filtered
- Resource the search works on



Conformance



A set of capabilities of a FHIR Server

Binds all conformance resources together



Conformance



Describes how a client or server uses or should use the FHIR API

- Which wire formats supported?
- Which resources?
- Which operations supported?
- Which profiles supported?
- Is this a test server?
- What's the name of the software?

Used in the core spec



For implementer convenience, the specification itself publishes its base definitions using these same resources!

4.20.4 Resource Content

1.18.0.6 Quantity

See also [Examples](#), [Detailed Descriptions](#) and [Mappings](#)

1.23.2.1.1557 Value Set <http://hl7.org/fhir/vs/observation-valueabsentreason>

This is a value set defined by the FHIR project.

Codes specifying why the result (Observation.value[x]) is missing

Detailed Descriptions: [XML](#) or [JSON](#).

This value set contains 8 concepts

1.23.2.1.1557.1 Observation Value Absent Reason

This value set defines the set of code for identifying the reason why the expected result in Observation.value[x] is missing.

This value set defines its own terms in the system <http://hl7.org/fhir/data-absent-reason>

Code	Display	Definition
unknown	Unknown	The value is not known
asked	Asked	The source human does not know the value
temp	Temp	There is reason to expect (from the workflow) that the value may become known



Used in the core spec



For implementer convenience, the specification itself publishes its base definitions using these same resources!

StructureDefinition for observation

Raw XML

```
<StructureDefinition xmlns="http://hl7.org/fhir" id="StructureDefinition-observation"
  <id val="StructureDefinition-observation"
  <meta>
    <lastUpdated>
  </meta>
  <text>
    <status value="draft"
  </text>
  <div xmlns="http://www.w3.org/1999/xhtml"
  <url value="http://hl7.org/fhir/StructureDefinition/observation"
  </url>
  <name value="Observation"
  </name>
  <publicURL value="http://hl7.org/fhir/StructureDefinition/observation"
  </publicURL>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
```

StructureDefinition for Quantity

Raw XML

```
<StructureDefinition xmlns="http://hl7.org/fhir" id="StructureDefinition-quantity"
  <id val="StructureDefinition-quantity"
  <meta>
    <lastUpdated>
  </meta>
  <text>
    <status value="draft"
  </text>
  <div xmlns="http://www.w3.org/1999/xhtml"
  <url value="http://hl7.org/fhir/StructureDefinition/quantity"
  </url>
  <name value="Quantity"
  </name>
  <publicURL value="http://hl7.org/fhir/StructureDefinition/quantity"
  </publicURL>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
```

Definition for Value Set Observation Value Absent Reason

Raw XML

```
<ValueSet xmlns="http://hl7.org/fhir" id="ValueSet-observation-value-absent-reason"
  <id val="ValueSet-observation-value-absent-reason"
  <meta>
    <lastUpdated>
  </meta>
  <prof>
  </prof>
  <status value="draft"
  </status>
  <div xmlns="http://www.w3.org/1999/xhtml"
  <url value="http://hl7.org/fhir/ValueSet/observation-value-absent-reason"
  </url>
  <extension base="http://hl7.org/fhir/ValueSet"
  </extension>
  <url value="http://hl7.org/fhir/ValueSet/observation-value-absent-reason"
  </url>
  <version>
  </version>
  <name value="Observation Value Absent Reason"
  </name>
  <publicURL value="http://hl7.org/fhir/ValueSet/observation-value-absent-reason"
  </publicURL>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
  <contact>
    <tele>
      <sy>
        <va>
      </sy>
    </tele>
  </contact>
```

v3 map for AddressUse

Raw XML

```
<ConceptMap xmlns="http://hl7.org/fhir" id="ConceptMap-address-use-v3"
  <id val="ConceptMap-address-use-v3"
  <meta>
    <lastUpdated>
  </meta>
  <status value="generated"/>
  <div xmlns="http://www.w3.org/1999/xhtml"
  <h2>v3 map for AddressUse (http://hl7.org/fhir/cm/v3/address-use)</h2>
  <p>Mapping from
    <a href="address-use.html">http://hl7.org/fhir/vs/address-use</a> to
    <a href="v3/AddressUse/index.html">http://hl7.org/fhir/v3/vs/AddressUse</a>
  </p>
  <p>Draft. Published on 30-Sep 2014 18:9 by HL7 (FHIR Project) (
    <a href="http://hl7.org/fhir">http://hl7.org/fhir</a>,
    <a href="mailto:fhir@lists.hl7.org">fhir@lists.hl7.org</a>).
  </p>
  <p>v3 Map (AddressUse)</p>
  <br/>
  <table class="grid">
    <tr>
      <td>
        <b>Source Code</b>
      </td>
    </tr>
    <tr>
      <td>
        <b>Equivalence</b>
      </td>
    </tr>
  </table>
```





IMPLEMENTATION GUIDES

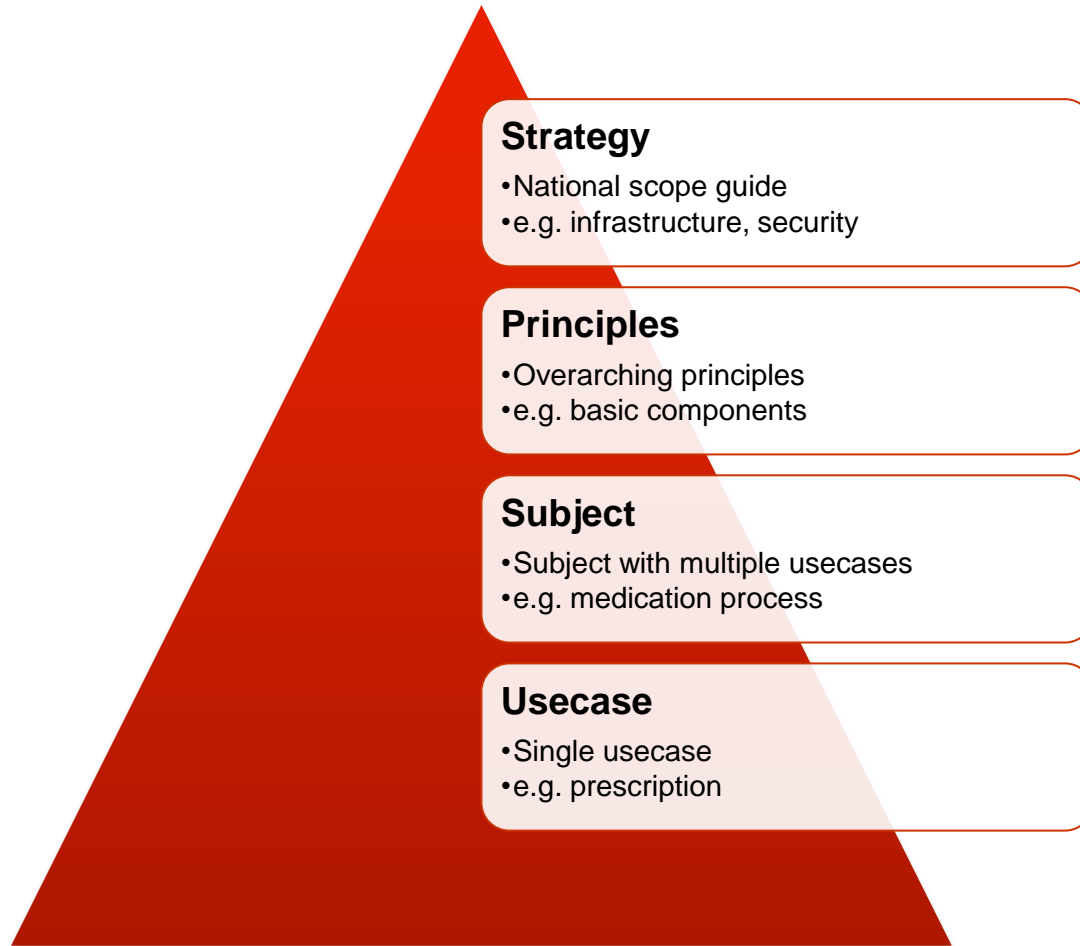
Examples



-
- fhir.hl7.org
 - Implementation > Implementation Guides

 - Argonaut
 - DAF
 - QICore
 - SDC
 - USLab

Different Kinds



Typical Content



- Title
- Table of contents
- Document information
- Introduction to the guide
- Principles & background
- Functional requirements and high-level use cases
- Design considerations
- Package contents (= use case?)
- Privacy and security guidance
- Testing and certification
- Appendix
- List of all artifacts used in this guide

ImplementationGuide



Resource introduced in DSTU2 1.0

Defines:

- Conformance Packages
 - Conformance Resources
- Implementer Documentation Pages

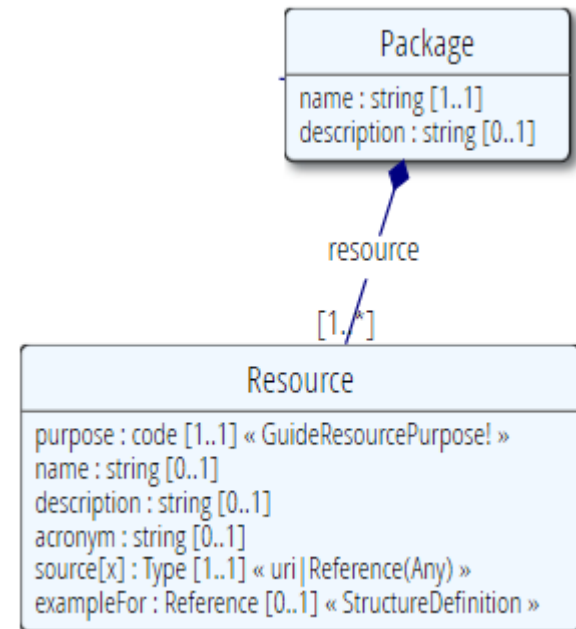
Maturity level 0...



Conformance Package



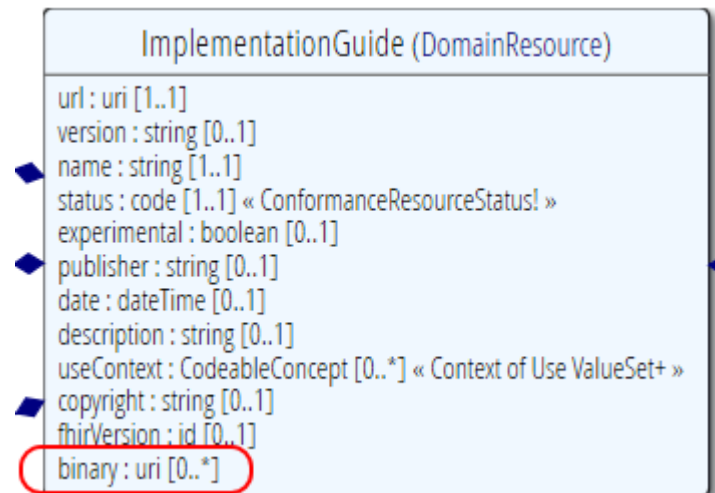
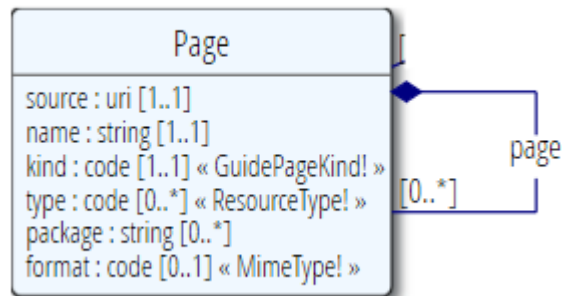
- Defines a set of conceptually related conformance resources
- Provides example resources
- Allows conformance validation of resources



Documentation Pages



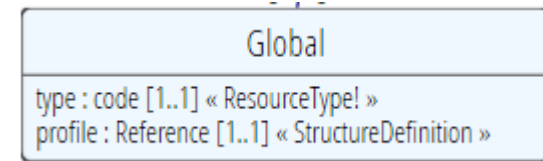
- Instructions for implementers
- Provides detailed description of the included conformance resources
- E.g. HTML, Markdown
- Binaries: css, js, img, ...



Global Profiles



- A set of profiles that all resources covered by this implementation guide must conform to



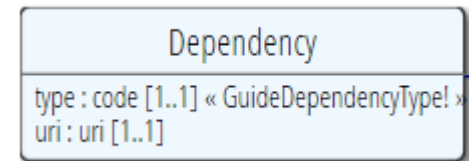
- Note: A resource can conform to the default profile by conforming to any profile derived from it

Dependencies



- Other ImplementationGuide resources this guide depends on

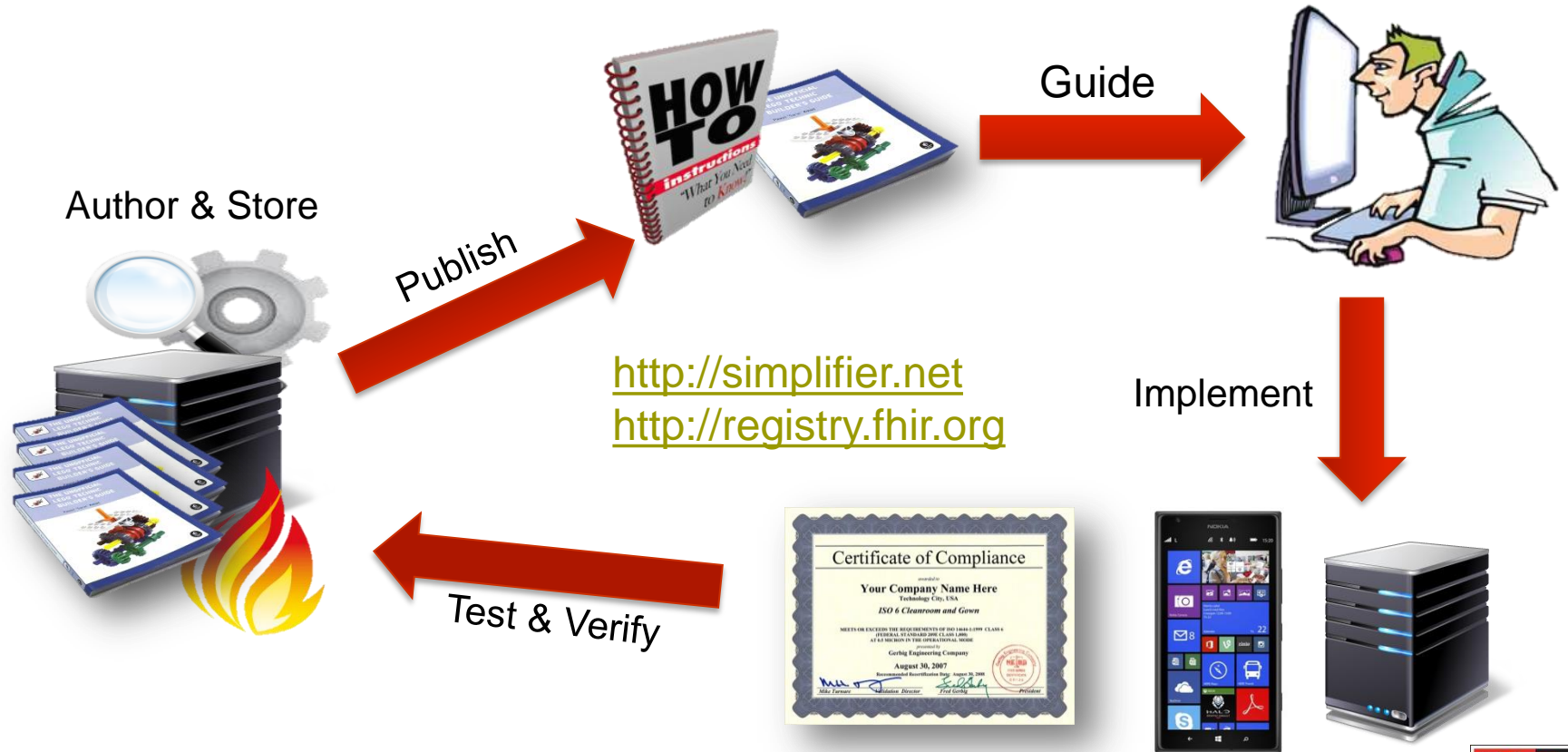
- Corporate-wide IG's
- National IG's



- Type

- Reference (hyperlink)
- Inclusion (embed)

Publish!



Forge - Lipid



<http://hl7.org/implement/standards/fhir/lipid-report.html>



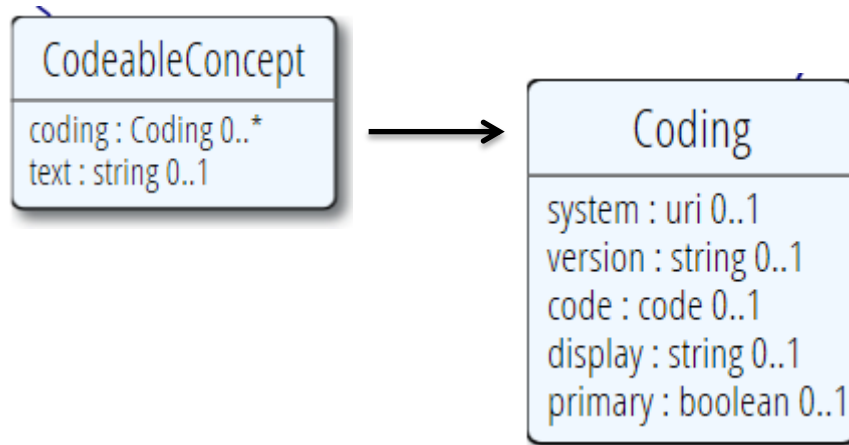


VALUE SETS

Coded types



In a Profile, we may want to limit the codes that can possibly be used in coded elements in the Resources

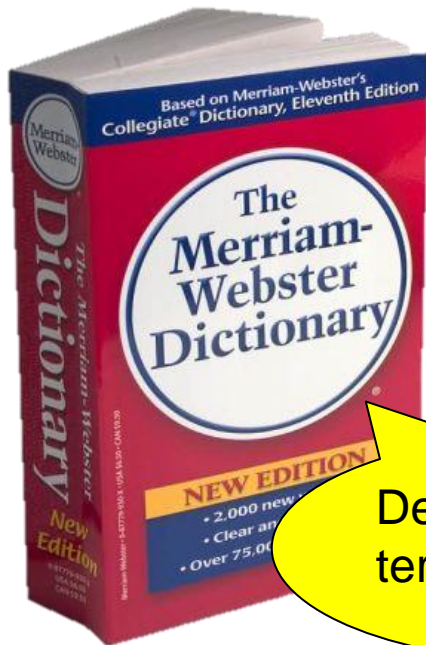


Codes are defined
in *code systems*

```
<problem>
  <system value="http://snomed.info/sct" />
  <code value="128045006:{363698007=56459004}" />
</problem>
```



CodeSystem vs. ValueSet



Takes concepts from...

“Dante’s deadly sins”

- Pride
- Envy
- Wrath
- Sloth
- Avarice
- Gluttony

Definition of terms

An enumeration of terms

“Code System”

“ValueSet”

Example: SNOMED-CT

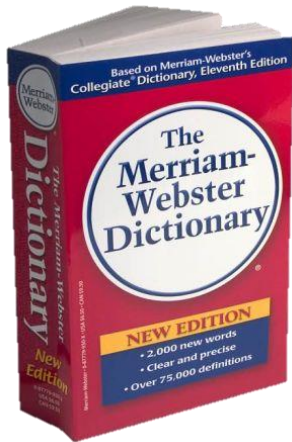
Example: “Childhood diseases”



"Special" cases



No need to write them all down!



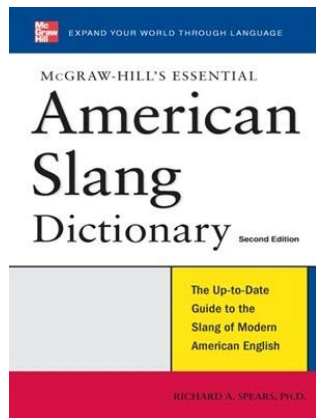
Takes concepts from...

"All words under B"
"All words in the Merriam-Webster dictionary"

Takes concepts from...

"Words for 'nerd'"

- Bookworm
- Geek
- Grind
- Weenie
- Wonk
- Dink (slang)
- Dork (slang)
- Swot (slang)



Takes concepts from...

Can take concepts from multiple coding systems!



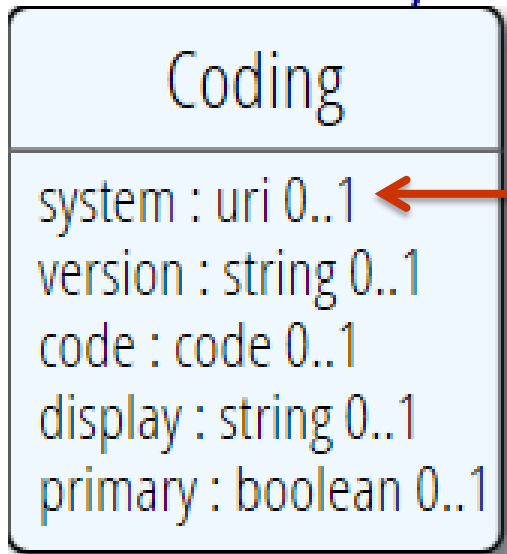
Identification of CodeSystems



- If you refer to CodeSystems, you use a URL (instead of OID in v2 and v3):
 - <http://snomed.info/sct>
 - <http://loinc.org>
 - <http://hl7.org/fhir/sid/icd-10>
- We have introduced them for v2 and v3:
 - <http://hl7.org/fhir/v2/0078>
 - <http://hl7.org/fhir/v3/ActClass>



Coded types (again)



← The uri of the system

```
<problem>  
  <system value="http://snomed.info/sct" />  
  <code value="128045006:{363698007=56459004}" />  
</problem>
```



ValueSets



1.23.2.1.571 Value Set <http://hl7.org/fhir/vs/daf-encounter-reason> 🌐

This is a value set defined by the FHIR project.

Encounter Diagnoses Value set to describe the specific encounter code.

Detailed Descriptions: [XML](#) or [JSON](#).

This value set does not contain a fixed number of concepts

1.23.2.1.571.1 DAF Encounter Diagnoses 🌐

Encounter Diagnoses: a specific code indicating type of service provided: SNOMED CT, ICD-10-AM, or CPT

Copyright Statement: This value set includes content from SNOMED CT, which is copyright © 2002+ International Health Terminology Standards Development Organisation (IHTSDO), and distributed by agreement between IHTSDO and HL7. Implem use of SNOMED CT is not covered by this agreement

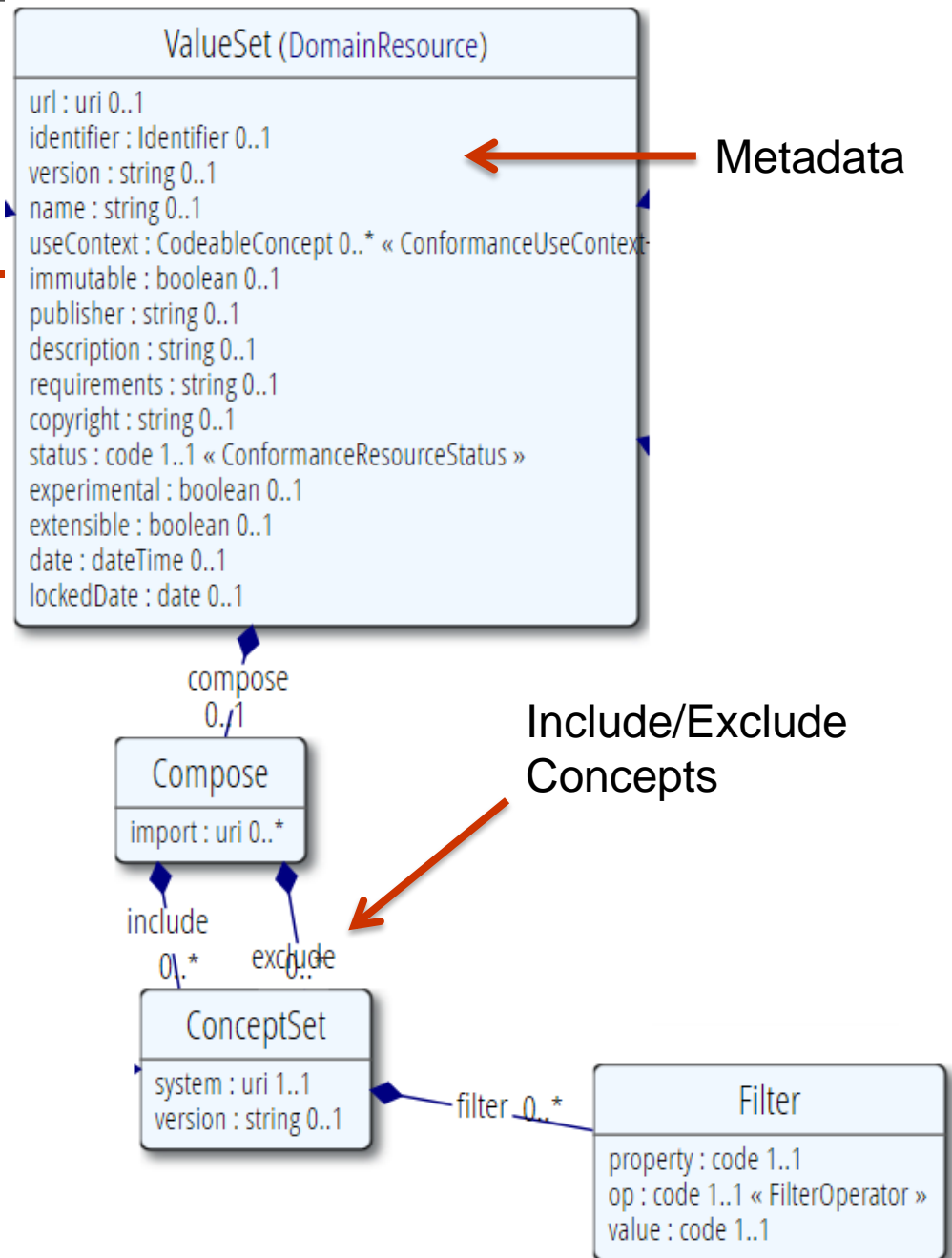
This value set includes codes defined in other code systems, using the following rules:

- Include all codes defined in <http://snomed.info/sct>
- Include all codes defined in <http://hl7.org/fhir/sid/icd-10>
- Include all codes defined in <http://www.ama-assn.org/go/cpt>

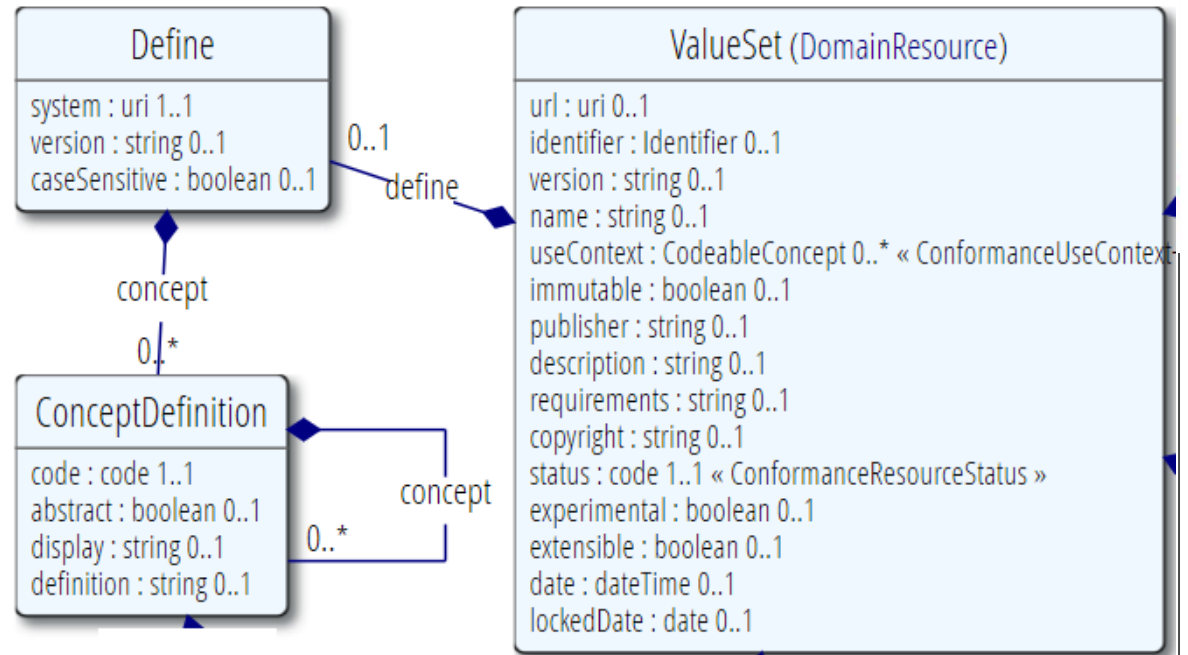
ValueSets

This models what we have been discussing so far:

- A ValueSet has metadata (much like Profile: identifier, version, name, etc)
- A ValueSet is built by *inclusion* of terms from CodeSystems
- A ValueSet can *exclude* specific codes from other valuesets
- A ValueSet can *import* codes from other ValueSets



ValueSets



But it can also enumerate (and so indirectly **define**) all concepts for a **new** codesystem

- A ValueSet has metadata (much like Profile: identifier, version, name, etc)
- A ValueSet is built by *defining* terms from and for a **new** CodeSystem
- These new concepts have a *display* label and a *definition*
- ...and may be hierarchically organized

Bindings



MyObservation

code

value[x]

dataAbsentReason

Valueset binding

Name

ObservationValueAbsentReason

Strength

4.20.3.1 Terminology Bindings

Path	Definition	Type	Reference
Observation.status	Codes providing the status of an observation.	Required	ObservationStatus
Observation.category	Codes for high level observation categories .	Example	Observation Category Codes
Observation.code Observation.component.code	Codes identifying names of simple observations.	Example	LOINC Codes
Observation.dataAbsentReason Observation.component.dataAbsentReason	Codes specifying why the result (Observation.value[x]) is missing.	Extensible	Observation Value Absent Reason
Observation.interpretation	Codes identifying interpretations of observations.	Extensible	Observation Interpretation Codes
Observation.bodySite	Codes describing anatomical locations. May include laterality.	Example	SNOMED CT Body Structures
Observation.method	Methods for simple observations.	Example	Observation Methods
Observation.referenceRange.meaning	Code for the meaning of a reference range.	Example	Observation Reference Range Meaning Codes
Observation.related.type	Codes specifying how two observations are related.	Required	ObservationRelationshipType



Profiling bindings



- Depending on “core” spec, you can:
 - “required”: not specify a different binding
 - “extensible”: specify a different binding if needed
 - “preferred”: specify a different binding if desired
 - “example”: very likely specify a different binding
- Change the bindings as specified in core:
 - Define a new ValueSet
 - Allow additional codes, Restrict to a subset
 - Specify whether implementers of your profile can deviate from your valueset.



This is not too hard...



```
<ValueSet xmlns="http://hl7.org/fhir">
  <id value="lipid-ldl-codes"/>
  <meta>
    <lastUpdated value="2015-04-03T14:24:32.000+11:00"/>
    <profile value="http://hl7.org/fhir/StructureDefinition/valueset-shareable-definiti
on"/>
  </meta>
  <text>
    <status value="generated"/>
    <div xmlns="http://www.w3.org/1999/xhtml"><!-- Snipped for brevity --></div>
  </text>
  <extension url="http://hl7.org/fhir/StructureDefinition/valueset-oid">
    <valueUri value="urn:oid:2.16.840.1.113883.4.642.2.444"/>
  </extension>
  <url value="http://hl7.org/fhir/vs/lipid-ldl-codes"/>
  <version value="0.5.0"/>
  <name value="LDLCodes"/>
  <publisher value="HL7 (FHIR Project)"/>
  <contact>
    <telecom>
      <system value="url"/>
      <value value="http://hl7.org/fhir"/>
    </telecom>
    <telecom>
      <system value="email"/>
      <value value="fhir@lists.hl7.org"/>
    </telecom>
  </contact>
  <description value="LDL Cholesterol codes - measured or calculated"/>
  <copyright value="This content from LOINC??LOINC?? is copyright ?? 1995 Regenstrief I
nstitute, Inc. and
the LOINC Committee, and available at no cost under the license at http://loinc.org/
terms-of-use"/>
  <status value="draft"/>
  <experimental value="false"/>
  <date value="2015-04-03T14:24:32+11:00"/>
  <compose>
    <include>
      <system value="http://loinc.org"/>
      <concept>
        <code value="18262-6"/>
        <display value="LDL Cholesterol (Calc)"/>
      </concept>
      <concept>
        <code value="13457-7"/>
        <display value="LDL Cholesterol (Assay)"/>
      </concept>
    </include>
  </compose>
</ValueSet>
```



ValueSet Editor



-
- Grahame
 - Apelon
 - ...

ValueSet Editor



The screenshot shows the ValueSet Editor application window. A modal dialog box titled "Value Sets on http://fhir-dev.healthintersections.com.au/open" is open, displaying a table of value sets. The table has columns for Name, Status, Identifier, Publisher, and Description. Below the table is a filter input field and "Open" and "Cancel" buttons.

Name	Status	Identifier	Publisher	Description
Condition/Diagnosis Certainty	draft	http://hl7.org...	FHIR Project team	Example value set for Condition/Problem/Diagnosis certainty
QICore Condition Criticality Codes	draft	http://hl7.org...	HL7 Clinical Quality Inform...	Value Set for QICore Condition Criticality (Example)
Reasons for rejecting device use request codes	draft	http://hl7.org...	HL7 Clinical Quality Inform...	The value set to instantiate this attribute should be drawn from a termi...
QICore Diagnostic Order Precondition	draft	http://hl7.org...	Health Level Seven, Inc. ...	The condition, state, or problem that the patient is in or has prior to a t...
Reasons for rejecting a diagnostic order	draft	http://hl7.org...	HL7 Clinical Quality Inform...	The value set to instantiate this attribute should be drawn from a termi...
Reasons for canceled or refused encounter codes	draft	http://hl7.org...	HL7 Clinical Quality Inform...	The value set to instantiate this attribute should be drawn from a termi...
SNOMED CT Qualifier For Type of Diagnosis Codes	draft	http://hl7.org...	Health Level Seven, Inc. ...	This value set includes all the "Qualifier for type of diagnosis" SNOMED ...
Flag Category Codes	draft	http://hl7.org...	HL7 Clinical Quality Inform...	Value Set for Flag Category (Example). This value set defines category ...
Reasons for rejecting goal codes	draft	http://hl7.org...	HL7 Clinical Quality Inform...	The value set to instantiate this attribute should be drawn from a termi...
SNOMED CT Dosages Codes	draft	http://hl7.org...	Health Level Seven, Inc. ...	This value set includes all the "Dosages" SNOMED CT codes (i.e. codes ...
Body Position	draft	http://hl7.org...	HL7 Clinical Quality Inform...	SNOMED CT code system values descending from the following:body p...
QICore Observation Delta Value Set Definition	draft	http://hl7.org...	HL7 Clinical Quality Inform...	Code indicating how the current observation compares to previous obser...
QICore Observation Verification Method	draft	http://hl7.org...	HL7 Clinical Quality Inform...	Code for method by which the observation result was validated, e.g., h...
Disability Value Set	active	http://hl7.org...	Health Level Seven, Inc. ...	Disability is broadly defined as a physical or mental condition that limits ...
Military Service Codes	draft	http://hl7.org...	HL7 Clinical Quality Inform...	Value Set for Military Service (Example)
SNOMED CT Priorities Codes	draft	http://hl7.org...	Health Level Seven, Inc. ...	This value set includes all the "Priorities" SNOMED CT codes (i.e. codes ...
Reasons for rejecting a referral request	draft	http://hl7.org...	HL7 Clinical Quality Inform...	The value set to instantiate this attribute should be drawn from a termi...
QuantityComparator	draft	http://hl7.org...	HL7 (FHIR Project)	How the Quantity should be understood and represented.
MaxOccurs	draft	http://hl7.org...	HL7 (FHIR Project)	Flags an element as having unlimited repetitions
Questionnaire Answer Codes	draft	http://hl7.org...	HL7 International - Patien...	Example list of codes for answers to questions. (Not complete or necess...
QuestionnaireResponseStatus	draft	http://hl7.org...	HL7 (FHIR Project)	Lifecycle status of the questionnaire response.
Questionnaire Category Codes	draft	http://hl7.org...	HL7 International - Patien...	Example list of potential categories for questionnaires.
Questionnaire Question UI Control Codes	draft	http://hl7.org...	HL7 International - Patien...	Starter set of user interface controls that might be used when capturin...
Questionnaire Question Codes	draft	http://hl7.org...	HL7 International - Patien...	Example list of codes for questions and groups of questions. (Not neces...
QuestionnaireStatus	draft	http://hl7.org...	HL7 (FHIR Project)	Lifecycle status of the questionnaire.
AllergyIntoleranceCertainty	draft	http://hl7.org...	HL7 (FHIR Project)	Statement about the degree of clinical certainty that a Specific Substan...
AllergyIntoleranceSeverity	draft	http://hl7.org...	HL7 (FHIR Project)	Clinical assessment of the severity of a reaction event as a whole, pote...



ValueSet Editor



The screenshot shows the 'ValueSet Editor' application window. The title bar reads 'qicore-priority on - ValueSet Editor'. The interface includes a menu bar (File, Edit, Tools, Help), a toolbar with various icons, and a main workspace. On the left, there is a 'Value Set Structure' panel with sections for 'Value Set Information', 'Code Defined By Value Set', 'Import Value Set:', 'Include Codes:', 'Exclude Codes:', and 'Expansion'. The main workspace is titled 'Evaluate' and contains a 'Text Filter:' input field and a table with 17 codes. The table has three columns: 'System', 'Code', and 'Display'. The 'System' column lists 'http://snomed.info/sct' for all entries. The 'Code' column lists various SNOMED CT codes, and the 'Display' column lists their corresponding display names. On the right side of the workspace, there is a 'Navigation to the webp.' panel with an information icon and a list of suggestions, including 'Retype the address.'.

System	Code	Display
http://snomed.info/sct	21282002	Repeat emergency
http://snomed.info/sct	25876001	Emergency (qualifier value)
http://snomed.info/sct	44408006	Reclassified and rescheduled (qualifier value)
http://snomed.info/sct	49499008	Stat (qualifier value)
http://snomed.info/sct	50811001	Routine (qualifier value)
http://snomed.info/sct	58334001	Rescheduled (qualifier value)
http://snomed.info/sct	64695001	Repeat elective (qualifier value)
http://snomed.info/sct	76561005	Reclassified (qualifier value)
http://snomed.info/sct	88694003	Immediate (qualifier value)
http://snomed.info/sct	103390...	Elective (qualifier value)
http://snomed.info/sct	103391...	Urgency (qualifier value)
http://snomed.info/sct	394848...	Normal priority (qualifier value)
http://snomed.info/sct	394849...	High priority (qualifier value)
http://snomed.info/sct	416774...	Scheduled - priority (qualifier value)
http://snomed.info/sct	441808...	Delayed priority (qualifier value)
http://snomed.info/sct	709122...	As soon as possible (qualifier value)
http://snomed.info/sct	234100...	Unscheduled (qualifier value)





PROFILES

Profiling a resource



“Must use only the Dutch national patient identifier”

+ *“Need to register an administrative race code for a Patient in the US”*

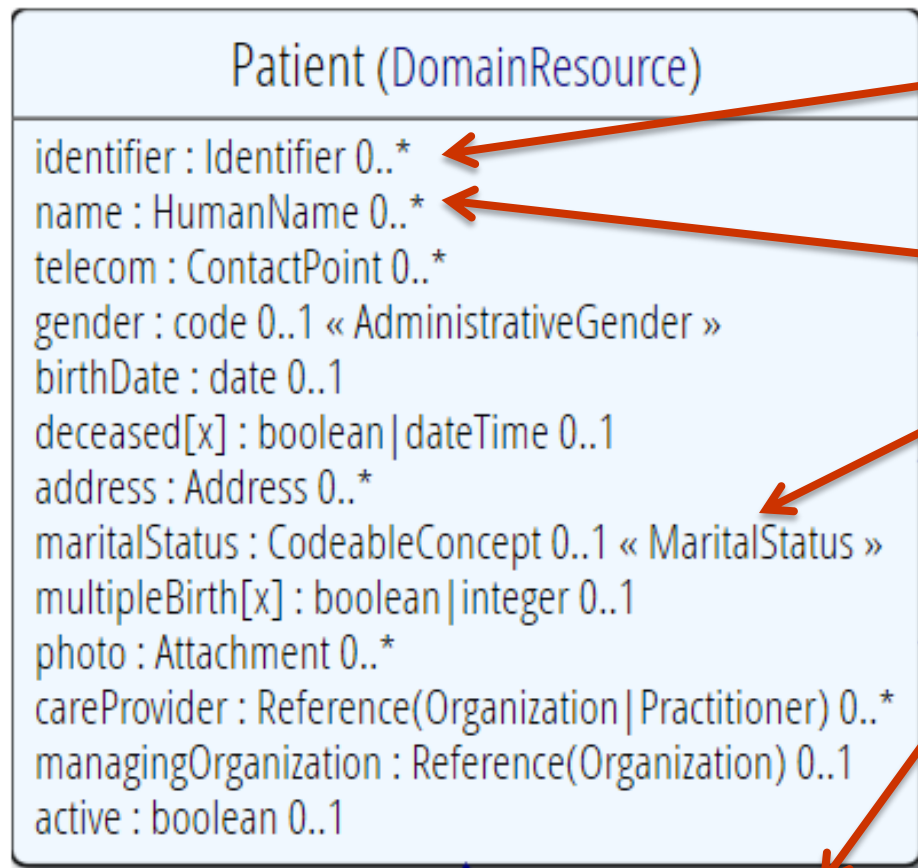
“Patient Discharge documents must at least contain section “Discharge Medication” and section “Discharge Diagnosis”

+ *“In our Patient registration system, we use these maritalStatus codes beyond those provided by HL7...”*

“Our patient registration system, only supports having one single name per Patient”



Profiling a resource



Demand that the identifier uses your national patient identifier

Limit names to just 1 (instead of 0..*)

Limit maritalStatus to another set of codes that extends the one from HL7 international

Add an extension to support "RaceCode"

Note: hardly any mandatory elements in the core spec!



Uses for profiles



-
- Server & client may publish and check their conformance to a profile
 - Validating instances, messages
 - Implement "FHIR spec-like" website from Profiles as part of an Implementation Guide



In v3 CDA... "text-based"



indicate Medication Started	low	1..1	SHALL
indicate Medication Stopped	high	1..1	SHALL
administrationTiming	effectiveTime	0..1	SHOULD
	@operator	1..1	SHALL
	repeatNumber	0..1	MAY
route	routeCode	0..1	MAY
site	approachSiteCode	0..1	MAY
dose	doseQuantity	0..1	SHOULD

Medications Section With Coded Entries Required

[section: templateId 2.16.840.1.113883.10.20.22.2.1.1 (open)]

The following constraints apply to a Medications section in which entries are required.

1. Conforms to Medications Section (entries optional) template (2.16.840.1.113883.10.20.22.2.1).
2. **SHALL** contain exactly one [1..1] **templateId** (CONF:7568) such that it
 - a. **SHALL** contain exactly one [1..1] **@root**="2.16.840.1.113883.10.20.22.2.1.1" (CONF:10433).
3. **SHALL** contain exactly one [1..1] **@code**="10160-0" History of medication use (CodeSystem: LOINC 2.16.840.1.113883.6.1) (CONF:7569).
4. **SHALL** contain exactly one [1..1] **title**="Medications" (CONF:7570).
5. **SHALL** contain exactly one [1..1] **text** (CONF:7571).
6. **SHALL** contain at least one [1..*] **entry** (CONF:7572) such that it
 - a. **SHALL** contain exactly one [1..1] Medication Activity (2.16.840.1.113883.10.20.22.4.16) (CONF:7573).
 - b. If medication use is unknown, the appropriate nullFlavor **MAY** be present (see unknown information in Section 1) (CONF:10077).

HL7 Implementation Guide for CDA® Release 2:

IHE Health Story Consolidation, DSTU Release 1.1

(US Realm)

Draft Standard for Trial Use

July 2012



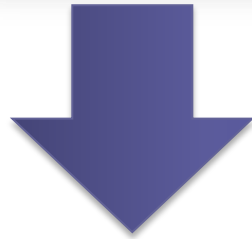
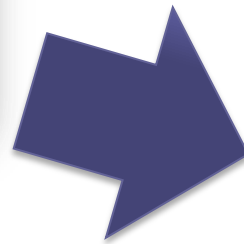
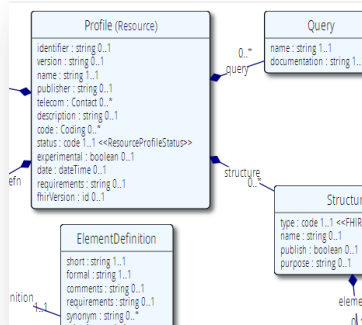
Write by hand...? Forge!



Download for free from <http://simplifier.net/>



Publish!



Find & maintain



<http://simplifier.net>
<http://registry.fhir.org>

Retrieve & use



Who publishes?



<http://www.hl7.org/Profile/iso-21090>



<http://www.hl7.nl/Profile/patient-nl>



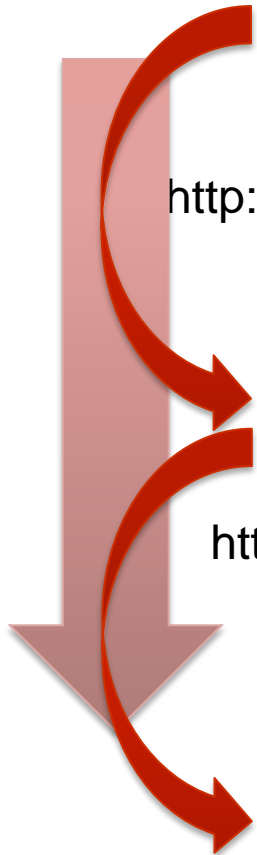
<http://www.health4all.nl/h4all-vitals>



<http://www.data4all.nl/d4all-obs>



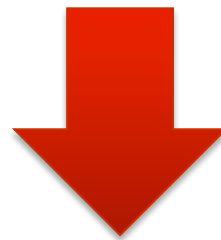
<http://www.fit4all.nl/f4all-vitals>



Layered profiles

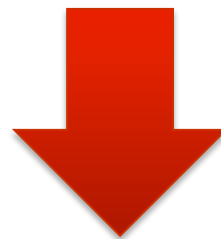


- HL7 Norge adapts Patient for Norway



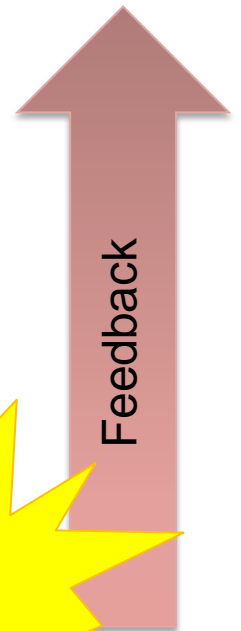
Constrain

- Helse Nord/Vest/... introduces regional differences

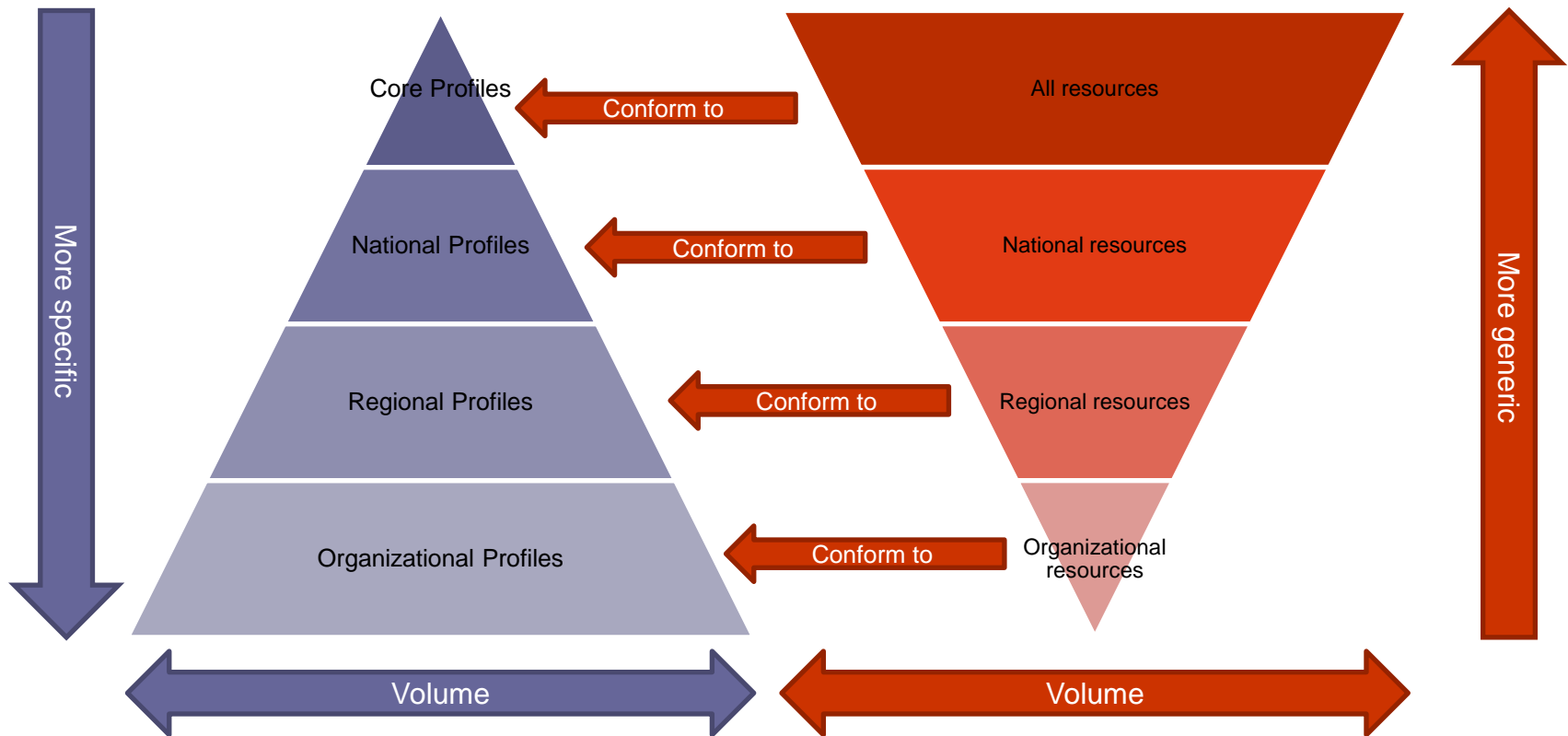


Constrain

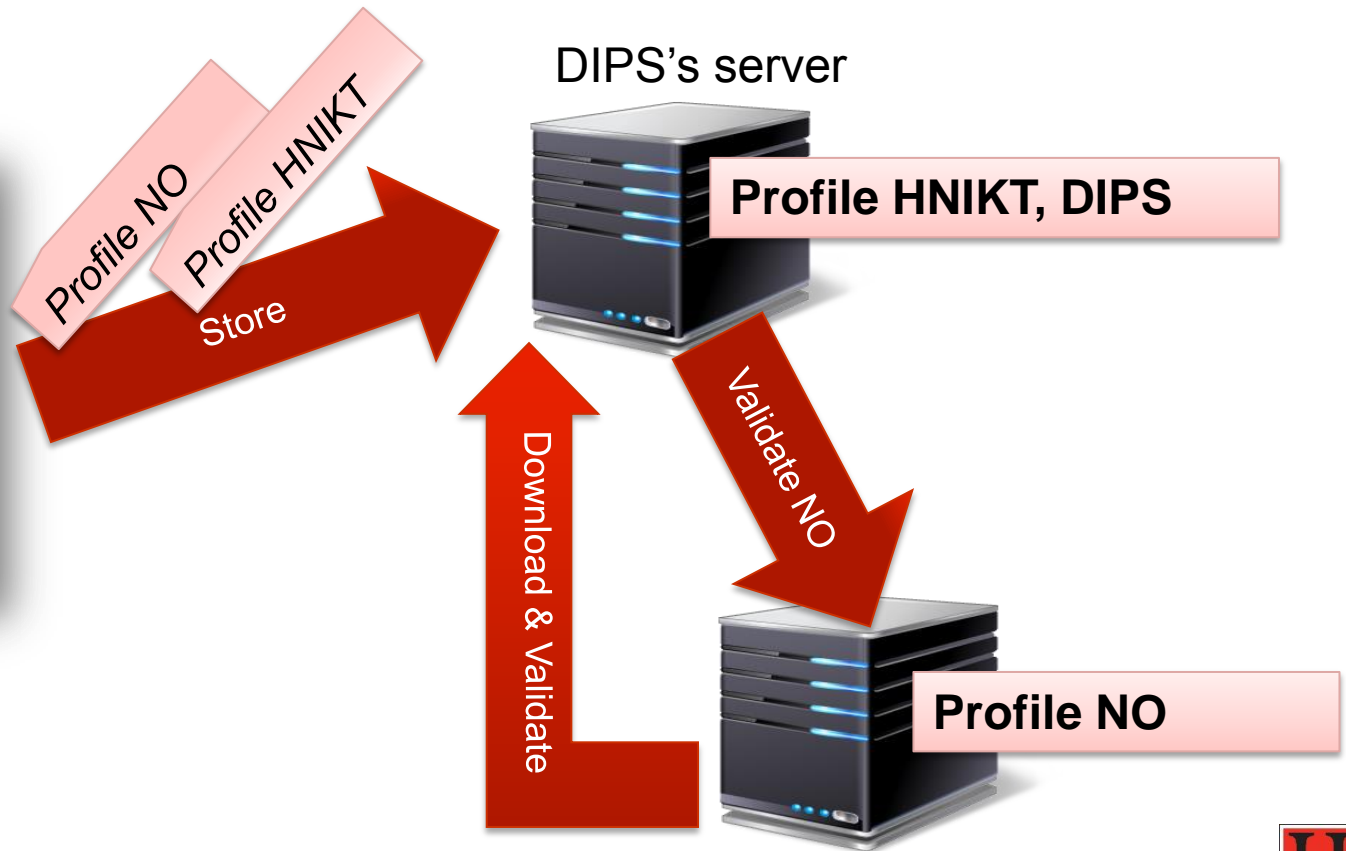
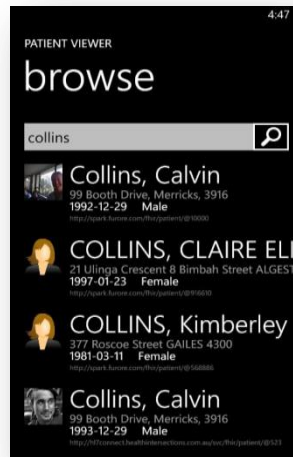
- Use-case specific constraints



Layered profiles



(Distributed) validation



Norway national validation server



Examples...



■ Let's look at DAF Profiles

- <http://fhir.hl7.org>
 - Implementation
 - Implementation Guides
 - ✓ DAF

■ Simplifier

- <https://simplifier.net/ui/ig/SIG>

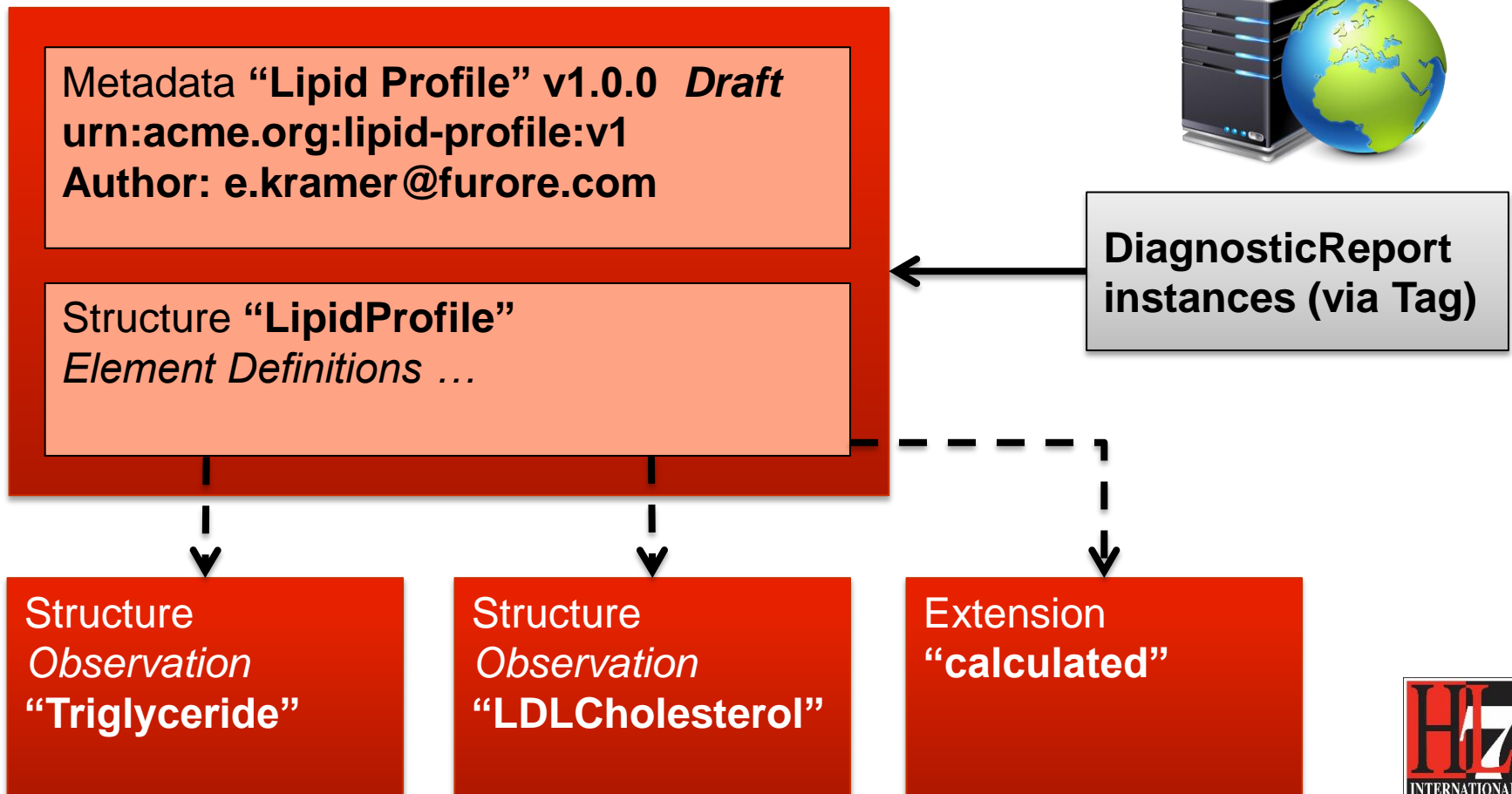


METADATA AND VERSIONS

What's in a profile?



StructureDefinition for DiagnosticReport



Referring to a profile



Observation

Cholesterol

6.3 mmol/L

High

(recommended 4.5)

I'm conforming to
<http://acme.org/StructureDefinition/LDLCholesterol>

<http://acme.org/>



<http://acme.org/StructureDefinition/LDLCholesterol>

Metadata "Lipid Profile" v1.0.0 Draft
urn:acme.org:lipid-profile:v1
Author: e.kramer@furore.com

Structure
"cholesterol"



Versioning...



- A “version” – author assigned
- So what if you *change* something after publishing?
 - Just a typo? Change of definition?
 - Make something optional that wasn't?
 - Make something mandatory that was optional?
 - Add an extension?



“Non-breaking change”?



- If old data can still be:
 1. Validated against the new profile
 2. Correctly interpreted against the new profile
 - This can only be determined by the profile’s authors (and even depends on the way it is used)
- A breaking change means you are producing *a new profile*
 - The profile’s author-assigned identifier changes
 - A new Profile on the server, with a new REST



Authoring a FHIR Profile



- Excel (build tool)

- *You're entering a world of pain...*

- Lantana Trifolia Workbench

- <https://trifolia.lantanagroup.com/>

- MDHT

- UML Based modelling tool

- <https://projects.eclipse.org/projects/modeling.mdht>

- Forge

- FHIR-specific profiling tool



Authoring a Profile



- Let's try this in Forge
 - Click “New Profile”
 - Select base resource, e.g. Observation
 - Edit metadata on tab page “Properties”
 - Name
 - URL
 - Save!
- That was easy!





STRUCTURE DEFINITIONS

What's in a profile?



Conformance Package: Lipid Report

Structure
Diagnostic Report
"Lipid Profile"

Extension
"calculated"

Structure
Observation
"Cholesterol"

Structure
Observation
"Triglyceride"

Structure
Observation
"LDLCholesterol"

Structure
Observation
"HDLCholesterol"



DiagnosticReport
instances (via Tag)



What's in a profile?



StructureDefinition: *DiagnosticReport*

Metadata **“Lipid Profile” v1.0.0 Draft**
urn:acme.org:lipid-profile:v1
Author: john.smith@furore.com

Structure **“LipidProfile”**
Element Definitions ...



Resource Reference

Structure Definition
Observation
“Triglyceride”

Structure Definition
Observation
“LDLCholesterol”

Structure Definition
Extension
“calculated”



Structure Definitions



- Profiles contain “Structure Definitions”
 - Base definition of a core Resource or Datatype
 - A set of constraints on (nested) elements of a Resource or Datatype
 - An extension definition



Observation resource



Observation (DomainResource)

```
code : CodeableConcept 1..1 « (ObservationType) »
value[x] : Quantity| CodeableConcept| string| Range|
  Ratio| SampledData| Attachment| time|
  dateTime| Period 0..1 « (ObservationValue) »
dataAbsentReason : CodeableConcept 0..1 « ObservationValueAbsentReason+ »
interpretation : CodeableConcept 0..1 « ObservationInterpretation+ »
comments : string 0..1
applies[x] : dateTime| Period 0..1
issued : instant 0..1
status : code 1..1 « ObservationStatus »
reliability : code 0..1 « ObservationReliability »
bodySite[x] : CodeableConcept| Reference(BodySite) 0..1 « (BodySite) »
method : CodeableConcept 0..1 « (ObservationMethod) »
identifier : Identifier 0..*
subject : Reference(Patient| Group| Device| Location) 0..1
specimen : Reference(Specimen) 0..1
performer : Reference(Practitioner| Organization|
  Patient| RelatedPerson) 0..*
device : Reference(Device| DeviceMetric) 0..1
encounter : Reference(Encounter) 0..1
```

0..*

related

0..*

referenceRange

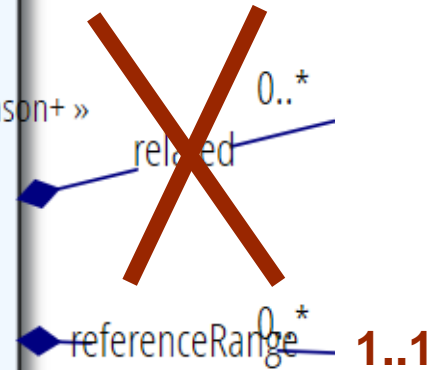


Let's start constraining



Observation (DomainResource)

```
code : CodeableConcept 1..1 « (ObservationType) »
value[x] : Quantity | CodeableConcept | string | Range |
Ratio | SampledData | Attachment | time | 0..1
dateTime | Period 0..1 « (ObservationValue) »
dataAbsentReason : CodeableConcept 0..1 « ObservationValueAbsentReason+ »
interpretation : CodeableConcept 0..1 « ObservationInterpretation+ »
comments : string 0..1 "if no value..."
applies[x] : dateTime | Period 0..1
issued : instant 0..1
status : code 1..1 « ObservationStatus »
reliability : code 0..1 « ObservationReliability » = 'ok'
bodySite[x] : CodeableConcept | Reference(BodySite) 0..1 « (BodySite) »
method : CodeableConcept 0..1 « (ObservationMethod) »
identifier : Identifier 0..*
subject : Reference(Patient | Group | Device | Location) 0..1 1..1
specimen : Reference(Specimen) 0..1
performer : Reference(Practitioner | Organization |
  Patient | RelatedPerson) 0..*
device : Reference(Device | DeviceMetric) 0..1
encounter : Reference(Encounter) 0..1
```



Subject 0..1?
Why not 1..1
in spec?



Must support?



- Authors: SHALL be capable of providing a value for the element and resource
- Consumers: SHALL be capable of extracting and doing something useful with the data element.
- "Something useful" is context dependent. The Profile SHALL describe what it means for applications to “support” the element



Lipid



The screenshot displays the Forge DSTU2 v1.0 (Atlanta) application window. The main area shows the 'Element Tree' for an 'Example Lipid Profile'. The 'Cholesterol' element is selected, and its properties are shown in the 'Element Properties' panel on the right. The 'Name' is 'Cholesterol', the 'Label' is empty, the 'Code' is empty, the 'Short description' is 'Cholesterol Result', and the 'Definition' is 'Reference to Cholesterol Result'. The 'Comments' field is empty. Below the 'Comments' field is a 'Reason for inclusion and constraint' section with the text: 'Need to support individual results, or report groups of results, where the result grouping is arbitrary, but meaningful. This structure is recursive - observations can contain observations.' The 'Alias' section is also visible, showing a list of aliases: Data, Atomic Value, Result, Atomic result, Data, Test, and Analyte, each with up/down arrows and a delete icon.

Forge DSTU2 v1.0 (Atlanta)

File Options Help

Solution Explorer

Example Lipid Profile

Properties Element Tree Element Grid Xml

Remove Extend Slice Add slice

Example Lipid Profile

- identifier *
- status
- category
- code
- subject
- encounter
- effective[x]
- issued
- performer
- request *
- specimen *
- result *
- Cholesterol
- Triglyceride
- HDL Cholesterol
- LDL Cholesterol
- imagingStudy *
- image *
- conclusion
- codedDiagnosis
- presentedForm *

Element Properties: Cholesterol

Name: Cholesterol

Label:

Code:

Short description: Cholesterol Result

Definition: Reference to Cholesterol Result.

Comments:

Reason for inclusion and constraint: Need to support individual results, or report groups of results, where the result grouping is arbitrary, but meaningful. This structure is recursive - observations can contain observations.

Alias:

- Data
- Atomic Value
- Result
- Atomic result
- Data
- Test
- Analyte

Item Properties

Title: lipidprofile.profile

Type:

Constraint:

Filename: lipidprofile.profile.xml

Location: D:\Docs\Furore\HL7\HL7 WGM Atlanta 2015-09\Tutorial\Lipid\lipidprofile.profile.xml

Last modified: Tue, 06 Oct 2015 10:19:47 GMT





EXTENSIONS

Extension Context



- An extension has a context *type*
 - Resource, Datatype, Extension, Mapping
- And a context *path*
 - (Resource) Observation
 - “The observation was calculated”
 - (Resource) Observation.value
 - “The observation’s ‘value’ was calculated”
 - (Datatype) Quantity
 - “This quantity was calculated” (any Quantity used in any resource!)



Extension Definition



```
<StructureDefinition xmlns="http://hl7.org/fhir">
  <id value="iso21090-EN-qualifier"/>
  <url value="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier"/>
  <name value="LS | AC | NB | PR | HON | BR | AD | SP | MID | CL | IN"/>
  <publisher value="HL7"/>
  <contact>
  <description value="A set of codes each of which specifies a certain subcategory of the name part in addition to the main name part type."/>
  <status value="draft"/>
  <date value="2012-06-24"/>
  <mapping>
  <type value="extension"/>
  <abstract value="false"/>
  <contextType value="datatype"/>
  <context value="HumanName.family"/>
  <context value="HumanName.given"/>
  <context value="HumanName.prefix"/>
  <context value="HumanName.suffix"/>
  <base value="http://hl7.org/fhir/StructureDefinition/Extension"/>
  <snapshot>
  <differential>
    <element>
      <path value="Extension"/>
      <short value="LS | AC | NB | PR | HON | BR | AD | SP | MID | CL | IN"/>
      <definition value="A set of codes each of which specifies a certain subcategory of the name part in addition to the main name part type."/>
      <min value="0"/>
      <max value="*/>
      <type>
        <code value="Extension"/>
      </type>
      <isModifier value="false"/>
      <mapping>
        <identity value="rim"/>
        <map value="ENXP.qualifier"/>
      </mapping>
    </element>
  </differential>
  </snapshot>
</StructureDefinition>
```

Note: multiple contexts!

Extending a name



```
<Patient xmlns="http://hl7.org/fhir">
  <!-- ... -->
  <name>
    <use value="official" />
    <family value="Hochheim-Weilenfels" />
    <given value="Regina" />
    <given value="Johanna" />
    <given value="Maria" />
    <prefix value="Gräfin">
      <extension url="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier" >
        <valueCode value="NB" />
      </extension>
    </prefix>
    <prefix value="Dr. phil.">
      <extension url="http://hl7.org/fhir/StructureDefinition/iso21090-EN-qualifier" >
        <valueCode value="AC" />
      </extension>
    </prefix>
    <suffix value="NCFSA" />
  </name>
  <!-- ... -->
</Patient>
```

Key = location of formal definition

Value = value according to definition



Extensions



- Let's find a representative extension for Practitioner
 - E.g. Classification
 - <http://hl7.org/implement/standards/fhir/extension-practitioner-classification.html>

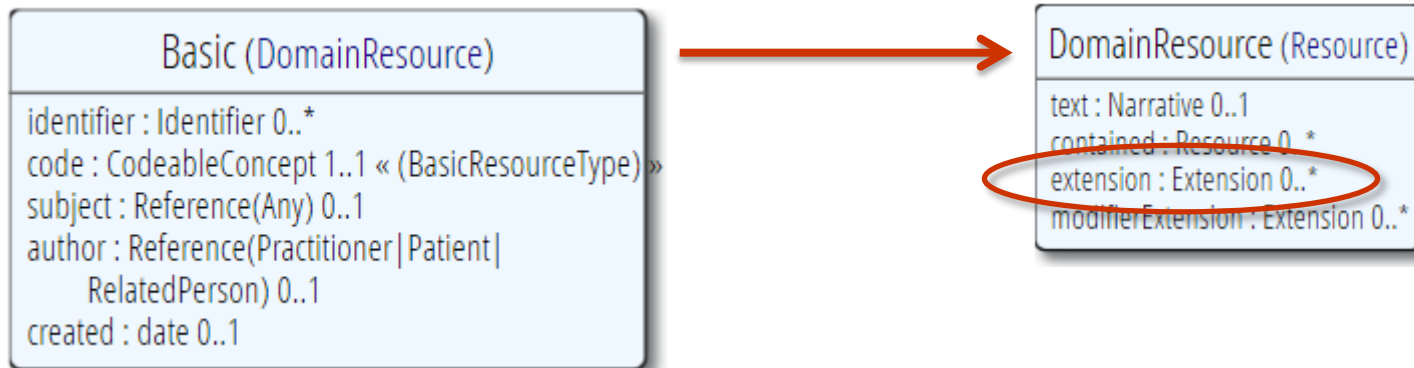
- Add it to the Practitioner



The “Basic” resource



- Now, what if you have the need for a completely “new” resource?



- ...then add extensions for each element





FORMAL CONSTRAINTS

Formal constraints



- ...beyond cardinalities and bindings, there are a lot of other conditions you might want to formulate:
 - “If a Cholesterol value result is not available, use the comments field”
 - “A patient’s birthdate must be on or before today’s date”
- These may concern a single element, or cover multiple elements.



Formal constraints



- Uses free text (human) + **xpath** (executable)
- Constraints should be declared on lowest element in the hierarchy that is common to all nodes referenced by the constraint.
- Identified by (local) '**Key**', involved elements refer to that id
- Specify severity (“error” or “warning”)



Context of the constraint



“If a Cholesterol value result is not available, use the comments field”

Observation (DomainResource)

- code : CodeableConcept 1..1 « (ObservationType) »
- value[x] : Quantity | CodeableConcept | string | Range | Ratio | SampledData | Attachment | time | dateTime | Period 0..1 « (ObservationValue) »
- dataAbsentReason : CodeableConcept 0..1 « ObservationValueAbsentReason »
- interpretation : CodeableConcept 0..1 « ObservationInterpretation+ »
- comments : string 0..1
- applies[x] : dateTime | Period 0..1
- issued : instant 0..1
- status : code 1..1 « ObservationStatus »
- reliability : code 0..1 « ObservationReliability »
- bodySite[x] : CodeableConcept | Reference(BodySite) 0..1 « (BodySite) »
- method : CodeableConcept 0..1 « (ObservationMethod) »
- identifier : Identifier 0..*
- subject : Reference(Patient | Group | Device | Location) 0..1
- specimen : Reference(Specimen) 0..1
- performer : Reference(Practitioner | Organization | Patient | RelatedPerson) 0..*
- device : Reference(Device | DeviceMetric) 0..1
- encounter : Reference(Encounter) 0..1

- This constraint is on the elements “valueQuantity” and “comments”
- We would have to formulate this constraint on the Observation, this is the *context* of the constraint
- We assign the constraint a “key” value that’s unique within the Observations’ constraints
- We refer from both “value[x]” and “comments” to this “key”. This means: if my value changes -> revalidate the constraint



Example XPath



- Keep in mind: the condition is satisfied when the XPath expression evaluates to “true”
- “If a Cholesterol value result is not available, use the comments field”
- Note: to use both is ok!
- Otherwise said: not both empty
- In Xpath: `exists(f:valueQuantity)`
or `exists(f:comment)`
 - That’s a *logical* or, so not exclusive!



More XPath



- “Either a valueQuantity or a comment is permitted”
 - `not (exists (f:valueQuantity) and exists (f:comment))`
- “Can only have normal range if there is a valueQuantity”
 - `exists (f:valueQuantity) or not (exists (f:normalRange))`
- Steal from the spec (e.g. from Profile)



XPath concerns



■ Hard to implement

- XPath 1 is not expressive enough
- Even XPath2 expressions can get very wieldy...

■ Akward syntax

- e.g. slicing, extensions

■ Limited real-world support for XPath 2

- E.g. no .NET library available...

Introducing FluentPath



- Specifically designed for FHIR
- Formerly known as *FHIR Path*
- Convenient operators & constants
 - Easier to define complex constraints
 - Expressive
- Query against multiple sources
 - JSON / XML
 - POJO object model

FluentPath applications



-
- Invariants in ElementDefinition
 - Slicing discriminator
 - Search parameter paths
 - Error message locations in OperationOutcome
 - URL templates in Smart on FHIR's CDS hooks
 - PATCH

FluentPath syntax



- Syntax & formal grammar:
 - <https://github.com/ewoutkramer/fhirpath/blob/master/fluentpath.md>
- Resembles .NET LINQ / Java query expressions
- Example:
 - `Patient.identifier.where(use='official')`
 - `Patient.**.extension('...url...')`

FluentPath vs. XPath



■ FluentPath

- `uniqueId.where(preferred = true).distinct(type)`

■ Xpath

- `not(exists(for $type in distinct-values(f:uniqueId/f:type/@value) return if (count(f:uniqueId[f:type/@value=$type and f:preferred/@value=true()])>1) then $type else ()))`

FluentPath syntax



Path	Description
path.subPath.subPath	Select all the elements on the path
telecom.value	Select all phone numbers (for a patient)
telecom.where(use = 'work').value	Select work phone number
path.value[x].subPath	Select all kinds of value
path.valueQuantity.subPath	Select only values that are quantity

FluentPath libraries



■ Reference implementations

- JavaScript
- Java
- Delphi
- .NET
- Haskell

■ Online demo application

- <http://niquola.github.io/fhirpath-demo/#/>
- Simplifier connector

FluentPath - Acceptance



- Convert FluentPath expressions to
 - Xpath
 - OCL
 - JSON Path
- Promote FluentPath to an official (stand-alone) standard?
 - i.e. broader than just FHIR
- A subset of CQL?



LOGICAL MODELS

Logical Models



- “Tree of data that has no particular use in the FHIR exchange paradigms.”
- Typically used to represent ad-hoc combinations of FHIR data for packaging convenience
- And/or content models as defined by other specifications (e.g. CDA, CIMI, openEHR)

Logical Models



-
- Logical Models may use normal FHIR data types - or even resources
 - Have the full suite of the FHIR definitional framework to call on (e.g. terminology definitions/service, mapping language, etc).

FHIR Mapping Language



Addresses 2 very different kinds of transformations:

- Structural changes between the source and target structures
- Differences in formats in string (and related) primitives contained within the structures

Syntax



```
map "http://hl7.org/fhir/StructureMap/tutorial" = tutorial

uses "http://hl7.org/fhir/StructureDefinition/tutorial-left" as source
uses "http://hl7.org/fhir/StructureDefinition/tutorial-right" as target

group tutorial
  input "source" : TLeft as source
  input "target" : TRight as target

// rules go here

endgroup
```

Rules - Examples

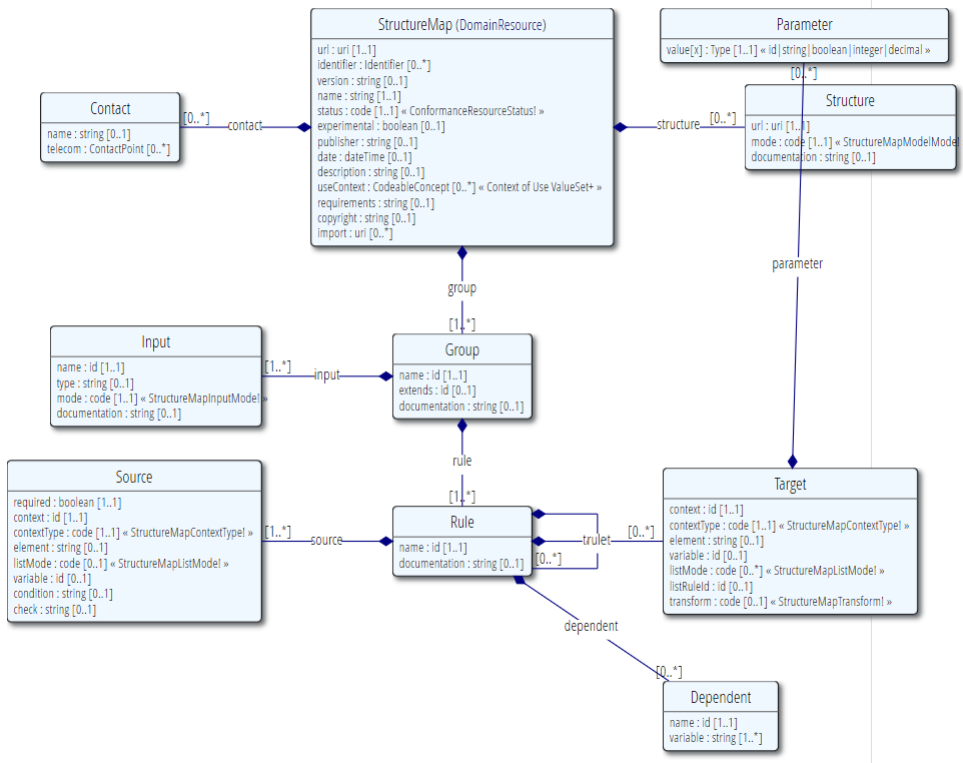


```
// just cut it off at 20 characters
"rule_a20a" : for source.a2 as a make target.a2 = truncate(a, 20)
// ignore it
"rule_a20b" : for source.a2 as a where a1.length <= 20 make target.a2 = a
// error if it's longer than 20 characters
"rule_a20c" : for source.a2 as a check a2.length <= 20 make target.a2 = a

ef_a1: for source.e as s_e make target.e as t_e then {
  ef_a2: for s_e make t_e.f = s_e, t_e.g = "g1"
}

ef_b1: for source.f as s_f make target.e as t_e { first } then {
  ef_b2: for s_f make t_e.f = s_f, t_e.g = "g2"
}
```


STU3: StructureMap





ClinFhir - David Hay

RESOURCE BUILDER

ClinFhir.com



The screenshot shows the ClinFHIR web application in a browser window. The page title is "ClinFhir: Welcome!". The navigation bar includes "Show Servers", "Login", and a settings gear icon. A yellow alert box at the top states: "The issue with ValueSet is fixed, but there's still an issue getting resources from Grahames server. If you [set the data and patient server](#) to one of the other servers, but leave the registry & terminology at Grahames, then all should be well."

The main content area is divided into several sections:

- Description of Tools:** Explains the tooling components, including the Resource builder, Profile builder, and Dashboard Application.
- Messaging:** Describes the messaging facility for communication and includes a "Create message" link.
- Who's doing what:** A section with tabs for "Summary", "Activity", "By Profile", "By Country", and "Raw Data". It shows "Last access from on 2015-10-04 12:09 (4 minutes ago.)"
- News:** A table listing recent updates.
- About FHIR:** Provides background on the FHIR standard.
- Disclaimers:** Includes a warning about data privacy: "Note that all data entered through the tool is saved onto a publicly accessible FHIR Test server. Do NOT save Patient Identifiable data through this tool, and don't assume that any data entered will be saved beyond your session (Contact us if this is an issue for you)".

Date	Item
May 22, 2015	Re-arrangement of UI, able to specify and alter ValueSet in profiles
May 15, 2015	Initial release of clinFHIR at HL7 Clinical Connectathon



Select Profile



Find StructureDefinition

Cancel Select

Query Parameters Results results-table

U.S. Data Access Framework (DAF) Patient Profile
Defines constraints and extensions on the patient resource for use in querying and retrieving patient demographic information.

QICore-Patient
Profile of Patient for decision support/quality metrics. Defines the core set of elements and extensions for quality rule and measure authors.

US Laboratory Patient Profile
Patient

US Laboratory Patient Profile
Patient with expanded contact information

Id: daf-patient
Name: U.S. Data Access Framework (DAF) Patient Profile
Description: Defines constraints and extensions on the patient resource for use in querying and retrieving patient demographic information.
Type:

```
{
  "resourceType": "StructureDefinition",
  "id": "daf-patient",
  "meta": {
    "versionId": "1",
    "lastUpdated": "2015-10-03T10:49:50Z"
  },
  "url": "http://hl7.org/fhir/StructureDefinition/daf-patient",
  "name": "U.S. Data Access Framework (DAF) Patient Profile",
  "display": "DAF-Patient",
  "status": "draft",
  "publisher": "Health Level Seven International (Infrastructure and Messaging)",
  "contact": [
    {
      "telecom": [
        {
          "system": "other",
          "value": "http://www.healthit.gov"
        }
      ]
    }
  ],
  "date": "2014-08-21",
  "description": "Defines constraints and extensions on the patient resource for",
  "fhirVersion": "1.0.1",
  "kind": "resource",
  "constrainedType": "Patient",
  "abstract": false,
}
```



Edit Resource



clinFHIR Resource Builder

clinfhir.com/#

ClinFhir: Create new resource Show Servers Login Settings

Resources New

Select Profile Profiled resource definitions Find new Clear current resource

Core Resource Profiled resource

Clear

/ Patient Menu

Patient.id	0..1	id
Patient.text	0..1	Narrative
A category of humans sharing history, origin or nationality	1..1	CodeableConcept
A category of human sharing heritage	1..1	CodeableConcept
Patient's professed religious affiliation	1..1	CodeableConcept
Mother's Maiden name	1..1	string
Place of Birth for patient	1..1	Address
Patient.modifierExtension	0..*	Extension
Patient.identifier	1..*	Identifier
Patient.active	0..1	boolean
Patient.name	0..*	HumanName
Patient.telecom	0..*	ContactPoint

Current Element: Parent: Patient +

Resource

```
{
  "resourceType": "Patient",
  "meta": {
    "lastUpdated": "2015-10-04T12:17:10-04:00",
    "profile": [
      "http://hl7.org/fhir/StructureDefinition/daf-patient"
    ]
  },
  "text": {}
}
```

Park Resource Save Resource

clinfhir.com/#

Edit Profile



clinFHIR Profile Builder

clinfhir.com

ClinFhir: Create or Edit Profile

Show Servers Login

Select Profile: New Edit

Base Resource: Patient

Display: Header Contents Report Source Preview

Extension: Find New Save

Path	Card	Data Type	Req.	Mult.	Incl.
Patient	0..*	DomainResource	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.identifier	0..*	Identifier	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.active	0..1	boolean	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.name	0..*	HumanName	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.telecom	0..*	ContactPoint	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.gender	0..1	code	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.birthDate	0..1	date	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.deceased[x]	0..1	boolean dateTime	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.address	0..*	Address	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.maritalStatus	0..1	CodeableConcept	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.multipleBirth[x]	0..1	boolean integer	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.photo	0..*	Attachment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patient.contact	0..*	BackboneElement	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Patient

Element Details Json

Element details

Path Patient

Short Information about an individual or animal receiving health care services

Definition Demographics and other administrative information about an individual or animal receiving care or other health-related services.

Requirements

Comments

Mapping

cda	ClinicalDocument.recordTarget.patientRole	
rim	Patient[classCode=PAT]	
w5	administrative.individual	



Simplifier

FHIR REGISTRY

FHIR Registry



S'IMPL'F'ER.NET



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Welcome

You are signed in, just click [here](#) to jump to your portal.

DSTU2

This registry is based on [FHIR DSTU2 v1.0.2](#).

Need to update your profiles from an older version? We might be able to help you [transform](#) them.

FORGE

The official FHIR profile authoring tool

Download **Forge**, the leading FHIR profile authoring tool to start creating your own profiles.

[Download](#)

Projects

Showcases

- [Data Access Framework](#)
- [HSPC](#)
- [QICore](#)
- [Structured Data Capture](#)
- [SMART on FHIR](#)

[Browse all projects...](#)

Popular

- [SMART on FHIR](#) ★ 4
- [ZorgInformatieBouwstenen](#) ★ 4
- [Data Access Framework](#) ★ 3
- [FHIR Core Base Resources](#) ★ 3
- [Finnish PHR](#) ★ 3
- [Laboratory Results Norway](#) ★ 3
- [FHIR Core Datatypes](#) ★ 2
- [FHIR Core v2 Tables](#) ★ 2
- [QICore](#) ★ 2
- [Structured Data Capture](#) ★ 2

FHIR Core

- [FHIR Core Base Resources](#)
- [FHIR Core Datatypes](#)
- [FHIR Core ValueSets](#)
- [FHIR Core SearchParameters](#)
- [FHIR Core Extensions](#)
- [FHIR Core v2 Tables](#)
- [FHIR Core v3 Codesystems](#)

Resources

Popular

- [smart-on-fhir OAuth Endpoint URIs](#) 2
- [core-base-resources Patient](#) 2

StructureDefinitions

- [Account](#) 1
- [Address](#) 2
- [AllergyIntolerance](#) 8

Examples

- [AllergyIntolerance](#) 1
- [Basic](#) 1
- [Binary](#) 1



Find



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FILTER

▼ Search Type

- Publications
- Projects

▼ Global Search

observation

▼ Project Scope

or not

- Core
- International
- National
- Institute
- Regional
- Test

Clear

▼ Nationality

or not

Search nationality.. ▼

▼ Published

- All
- Yes

ademfrequentie Constraint on Observation Project: ZorginformatieBouwstenen Base StructureDefinition for Observation Resource	10/5/2015
afwijkendAdemhalingspatroon Constraint on Observation Project: ZorginformatieBouwstenen Base StructureDefinition for Observation Resource	10/5/2015
nl.nfu.AlcoholGebruik Constraint on Observation Project: ZorginformatieBouwstenen Base StructureDefinition for Observation Resource	10/5/2015
nl.nfu.Bloeddruk Constraint on Observation Project: ZorginformatieBouwstenen Base StructureDefinition for Observation Resource	10/19/2015
diastolischeBloeddruk Constraint on Observation Project: ZorginformatieBouwstenen Base StructureDefinition for Observation Resource	10/5/2015
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diepte Constraint on Observation Project: ZorginformatieBouwstenen Base StructureDefinition for Observation Resource	10/5/2015



Project



SIMPLIFIER.NET



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PROJECT

SMART on FHIR

SMART on FHIR: Tech Stack for Health Apps

☆ Follow

⬇ Download

PUBLIC PROJECT

International

Subscribe

Introduction

Resources

Members

Log

PROJECT DESCRIPTION

SMART on FHIR is a set of open specifications to integrate apps with Electronic Health Records, portals, Health Information Exchanges, and other Health IT systems.

STATISTICS

Most Popular

[OAuth Endpoint URIs](#)

2

Conformance Resources

[StructureDefinition](#)

1

Example Resources

This project does not contain any example resources



PROJECT SCOPE

International



Resource



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Project [QICore](#)

QICore-AllergyIntolerance

☆ Follow

⬇ Download ▾

Profile of AllergyIntolerance for decision support/quality metrics. Defines the core set of elements and extensions for quality rule and measure authors.

Constraint on **AllergyIntolerance**

Draft

PUBLISHED

no version

Canonical

<http://hl7.org/fhir/StructureDefinition/qicore-allergyintolera>

Overview

Table

XML

JSON

History

AllergyIntolerance	AllergyIntolerance	0..*	
AllergyIntolerance.id	id	0..1	
AllergyIntolerance.meta	Meta	0..1	
AllergyIntolerance.implicitRules	uri	0..1	
AllergyIntolerance.language	code	0..1	
AllergyIntolerance.text	Narrative	0..1	
AllergyIntolerance.contained	Resource	0..*	
AllergyIntolerance.extension	Extension	0..1	
AllergyIntolerance.modifierExtension	Extension	0..*	
AllergyIntolerance.identifier	Identifier	0..*	
AllergyIntolerance.onset	dateTime	0..1	
AllergyIntolerance.recordedDate	dateTime	0..1	must support
AllergyIntolerance.recorder	Reference	0..1	
AllergyIntolerance.patient	Reference	1..1	must support
AllergyIntolerance.reporter	Reference	0..1	
AllergyIntolerance.substance	CodeableConcept	1..1	must support
AllergyIntolerance.status	code	0..1	must support
AllergyIntolerance.criticality	code	0..1	must support
AllergyIntolerance.type	code	0..1	must support



Forge – Import/Publish



Publish to Simplifier.net: 'C-CDA on FHIR Care Plan'



Select a FHIR server:

Username: Password:

Project:


Status

Ready! Click Save to publish.



Connectors - Validate




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Project [Forge](#)
Example of a Composition
Example of a Composition

☆ Follow ↔ Connect Options

FluentPath demo
HAPI validate

 **SIMPLIFIER.NET** Michel Rutten

Operation Outcome

Issues **Narrative**

Diagnostics: None of the codes provided are in the value set <http://hl7.org/fhir/ValueSet/doc-typecodes> (<http://hl7.org/fhir/ValueSet/doc-typecodes>, and a code is recommended to come from this value set

Location: /type

Information
Processing

Diagnostics: ValueSet <http://hl7.org/fhir/ValueSet/v3-Confidentiality> not found

Location: /confidentiality

Warning
Processing

Diagnostics: ValueSet <http://hl7.org/fhir/ValueSet/v3-ActCode> not found

Location: /event/code

Warning
Processing

Diagnostics: Display should be 'care provision'

Location: /event/code/coding

Warning
Processing

Validation results



SIMPLIFIER.NET



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Operation Outcome

Issues

Narrative

Diagnostics: None of the codes provided are in the value set <http://hl7.org/fhir/ValueSet/doc-typecodes> (<http://hl7.org/fhir/ValueSet/doc-typecodes>, and a code is recommended to come from this value set

Location: /type

Information
Processing

Diagnostics: ValueSet <http://hl7.org/fhir/ValueSet/v3-Confidentiality> not found

Location: /confidentiality

Warning
Processing

Diagnostics: ValueSet <http://hl7.org/fhir/ValueSet/v3-ActCode> not found

Location: /event/code

Warning
Processing

Diagnostics: Display should be 'care provision'

Location: /event/code/coding

Warning
Processing



Validation results



SIMPLIFIER.NET Implementation Guide Editor

← Back to Portal feedback Preview Users Refresh

Michel Demo IG

- Introduction
- Profiles
 - My Patient
 - Tree
 - Structure**
 - Table
 - UML

Help

- Simplifier IG Help
 - Introduction
 - How to format text?
 - Links and images
 - Tables and lists
 - Rendering FHIR
 - Structure Definition Table
 - NamingSystems
 - New tree (beta)
 - Structure Definition Tree
 - Placeholders
 - Errors
 - Further reading

```

1 This profile describes a custom Patient resource.
2
3 The profile has the following structure:
4
5 {{structure:Forge/MyPatient}}
6
    
```

This profile describes a custom **Patient** resource.

The profile has the following structure:

Name	TagsType	Card.Constraints
Patient	Patient	0..*
id	Σ id	0..1
meta	Σ Meta	0..1
id	id	0..1
extension	Extension	0..*
versionId	Σ id	0..1
lastUpdated	Σ instant	0..1
profile	Σ uri	0..*
security	Σ Coding	0..* Binding: security-labels
id	id	0..1
extension	Extension	0..*
system	Σ uri	0..1
version	Σ string	0..1
code	Σ code	0..1
display	Σ string	0..1
userSelected	Σ boolean	0..1
tag	Σ Coding	0..*
id	id	0..1
extension	Extension	0..*
system	Σ uri	0..1
version	Σ string	0..1
code	Σ code	0..1
display	Σ string	0..1
userSelected	Σ boolean	0..1
implicitRules	?! Σ uri	0..1
language	code	0..1

