HL7 FHIR DevDays 2017

HL7® FHIR®

FHIR: Transforming other content

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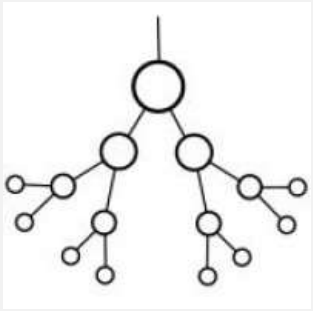
Amsterdam, 15-17 November | @fhir_furore | #fhirdevdays17 | www.fhirdevdays.com

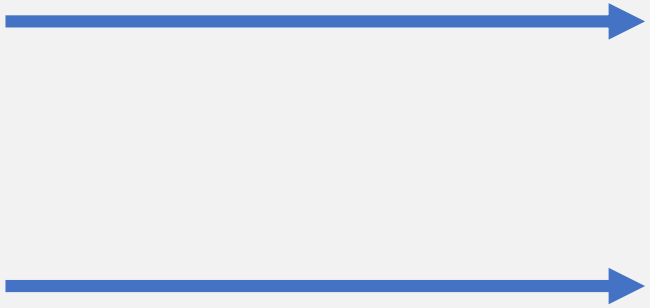
Common problems

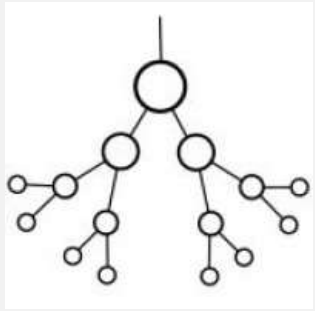
- Implementing FHIR as a façade on an existing data store
- Using an interface engine to convert from v2 or CDA to FHIR
- Converting Specifications into FHIR Profiles
- Converting from FHIR to a wide variety of outputs
  - Including supporting additional media types e.g.

```
GET [base]/Appointment/example
  Accept: text/calendar
```

Understanding the problem







Transformation Technologies

Common Choices:

- 3GL (Java, C#, Javascript…)
- XSLT
- Transform language / Toolkit
- MDMI
- FHIR Mapping Language

Criteria:

- Clarity / Traceability
- Expressiveness
- Performance
- Portability
- Comfort / Experience

Transforming Data: Portability

- Write a transform in your language of choice
- Can you take that transform, and run it somewhere else?
  - Is the language/runtime portable
  - Does the system provide compatible services

- Transforms need system support:
  - Converting between literal references and loaded data structures
  - Persisting identifiers, or creating new Identifiers
  - Terminology Services (validation/translation)

Levels of mapping

- **Skeletal**: just enough information to indicate where different models align structurally. Anything else is left to the reader's imagination
- **Notional:** Mappings done at class/attribute level and indicate that the elements are about the same thing. Types might not match up, may be special conditions and assumptions

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- **Conceptual:** Mappings are done to primitive data types. Not all the value domains of all attributes are fully mapped, and special cases may not be accounted for
- **Executional**. Mappings account for the full value domain. All the special cases are handled. Construction issues are fully described.

Notional Mappings

8.1.14.4 Mappings for HL7 v2 Mapping (http://hl7.org/v2)

Patient	
identifier	PID-3
active	
name	PID-5, PID-9
telecom	PID-13, PID-14, PID-40
gender	PID-8
birthDate	PID-7
deceased[x]	PID-30 (bool) and PID-29 (datetime)
address	PID-11
maritalStatus	PID-16
multipleBirth[x]	PID-24 (bool), PID-25 (integer)

Skeletal Mappings

6.2.11.1 Mappings for RIM Mapping (http://hl7.org/v3)

Consent	FinancialConsent
identifier	.id
status	.statusCode
scope	
category	CNTRCT
patient	Role
dateTime	FinancialConsent effectiveTime
consentingParty	
organization	
source[x]	
policy	
authority	
uri	

Nearly Conceptual Mappings

8.1.14.1 Mappings for RIM Mapping (http://hl7.org/v3)

Patient	Patient[classCode=PAT]
identifier	id
active	statusCode
name	name
telecom	telecom
gender	player[classCode=PSN|ANM and determinerCode=INSTANCE]/administrativeGender
birthDate	player[classCode=PSN|ANM and determinerCode=INSTANCE]/birthTime
deceased[x]	player[classCode=PSN|ANM and determinerCode=INSTANCE]/deceasedInd, player[classCode=PSN|ANM and determinerCode=INSTANCE]/deceasedTime

Other kinds of Mappings

8.1.14.2 Mappings for LOINC code for the element (http://loinc.org)

Patient	
identifier	
active	
name	
telecom	
gender	
birthDate	21112-8
deceased[x]	

Executable Mappings in RDF

2.26.3.10 Mappings for Ontological RIM Mapping (http://hl7.org/orim)

Coding	fhir:Coding rdfs:subClassOf dt:CDCoding
system	fhir:Coding.system rdfs:subPropertyOf dt:CDCoding.codeSystem
version	fhir:Coding.version rdfs:subPropertyOf dt:CDCoding.codeSystemVersion
code	fhir:Coding.code rdfs:subPropertyOf dt:CDCoding.code
display	fhir:Coding.display rdfs:subPropertyOf dt:CDCoding.displayName
userSelected	fhir:Coding.userSelected fhir:mapsTo dt:CDCoding.codingRationale. fhir:Coding.userSel fhir:Coding.userSelected.map a fhir:Map; fhir:target dt:CDCoding.codingRationale. fhir: dt:CDCoding.codingRationale\#O]

FHIR Support for Transformation

- Concept Map
  - Defines relationships between concepts defined in code systems
  - Terminology Server can execute $translate
  - FHIR provides some concept maps
- Profiles
  - Mapping Structure
- Structure Map
  - Defines transformations from one data set to another
  - Libraries (and servers) and perform the translation
  - FHIR provides R2 ←→ R3 transforms (incomplete)

FHIR Concept Map

source		0..1	uri	Code System (if value set crosses code systems)
sourceVersion		0..1	string	Specific version of the code system
target		0..1	uri	System of the target (if necessary)
targetVersion		0..1	string	Specific version of the code system
element		1..*	BackboneElement	Mappings for a concept from the source set
code		0..1	code	Identifies element being mapped
display		0..1	string	Display for the code
target	I	0..*	BackboneElement	Concept in target system for element + *If the map is narrower or inexact, there SHALL be some comments*
code		0..1	code	Code that identifies the target element
display		0..1	string	Display for the code
equivalence	?!	0..1	code	relatedto | equivalent | equal | wider | subsumes | narrower | specializes | inexact | unmatched | disjoint ConceptMapEquivalence (Required)
comment	I	0..1	string	Description of status/issues in mapping

Implicit Code Systems

StructureDefinition	The `StructureDefinition.url` (canonical URL) is the `system`. Each `.snapshot.element.id` in the snapshot is a code in the code system
Questionnaire	The `Questionnaire.url` (canonical URL) is the `system`. Each `.item.linkId` in the snapshot is a code in the code system. Items with no linkId cannot be addressed
Medication	Medication resources are a bit different, since they don't have a canonical URL, and there are not multiple items in a resource. So to refer to a medication resource, the system is [base]/Medication, where base is the server address. The Logical Id of the resource is the code

$translate

```
GET [base]/ConceptMap/$translate?system=http://hl7.org/fhir/composition-status
  &code=preliminary&source= http://hl7.org/fhir/ValueSet/composition-status
  &target=http://hl7.org/fhir/ValueSet/v3-ActStatus
```

$translate response

```
HTTP/1.1 200 OK
[other headers]

{
  "resourceType" : "Parameters",
  "parameter" : [
    {
    "name" : "result",
    "valueBoolean" : "true"
    },
    {
      "name" : "outcome",
      "valueCoding" : {
        "system" : "http://hl7.org/fhir/v3/ActStatus",
        "code" : "active",
      }
    }
  ]
}
```

Profile Mappings

StructureDefinition

mapping	I	0..*	BackboneElement	External specification that the content is mapped to *+ Must have at least a name or a uri (or both)*
identity		1..1	id	Internal id when this mapping is used
uri	I	0..1	uri	Identifies what this mapping refers to
name	I	0..1	string	Names what this mapping refers to
comment		0..1	string	Versions, Issues, Scope limitations etc.

ElementDefinition

mapping	Σ	0..*	Element	Map element to another set of definitions
identity	Σ	1..1	id	Reference to mapping declaration
language	Σ	0..1	code	Computable language of mapping MimeType (Required)
map	Σ	1..1	string	Details of the mapping
comment	Σ	0..1	string	Comments about the mapping or its use

Defined Mappings in the spec

- LOINC
- SNOMED CT (2 kinds)
- V2 messages
- V3 RIM (+ oRIM)
- DICOM
- XDS
- openEHR
- CDISC
- QUICK / QIDAM
- CPhA3
- vCard / iCal
- W3C Prov
- Dublin Core
- MDMI

FHIR Mapping Language

- A declarative mapping language that transforms data from one DAG-M to another
- DAG-M = Directed Acyclic Graph with metadata
  - Metadata = each element has name, type, cardinality
- Context
  - 1 or more Input DAG-Ms
  - 0 to many Output DAG-Ms
  - System API that provides system services

Declarative vs Procedural

- Procedural Transform
  - Describes a set of methods with conditions
  - Follow the method, get the right output

- Declarative Transform
  - Describes the precise relationships with conditions
  - Apply a standard method, get the right output
  - Inspect the relationships, derive additional meaning

FHIR Mapping Language

- FHIR Mapping Language is purely declarative
- Can apply to any content that is a DAG-M
  - Auto: FHIR Resources / FHIR Logical Models (incl. CDA, v2)
  - Coding: Library is provided with appropriate bridge service
- Can inspect the maps, and generate profiles from them
- Mappings are uni-directional
  - Can flip them over, but guard conditions are often missing

Major Challenge: Missing Information

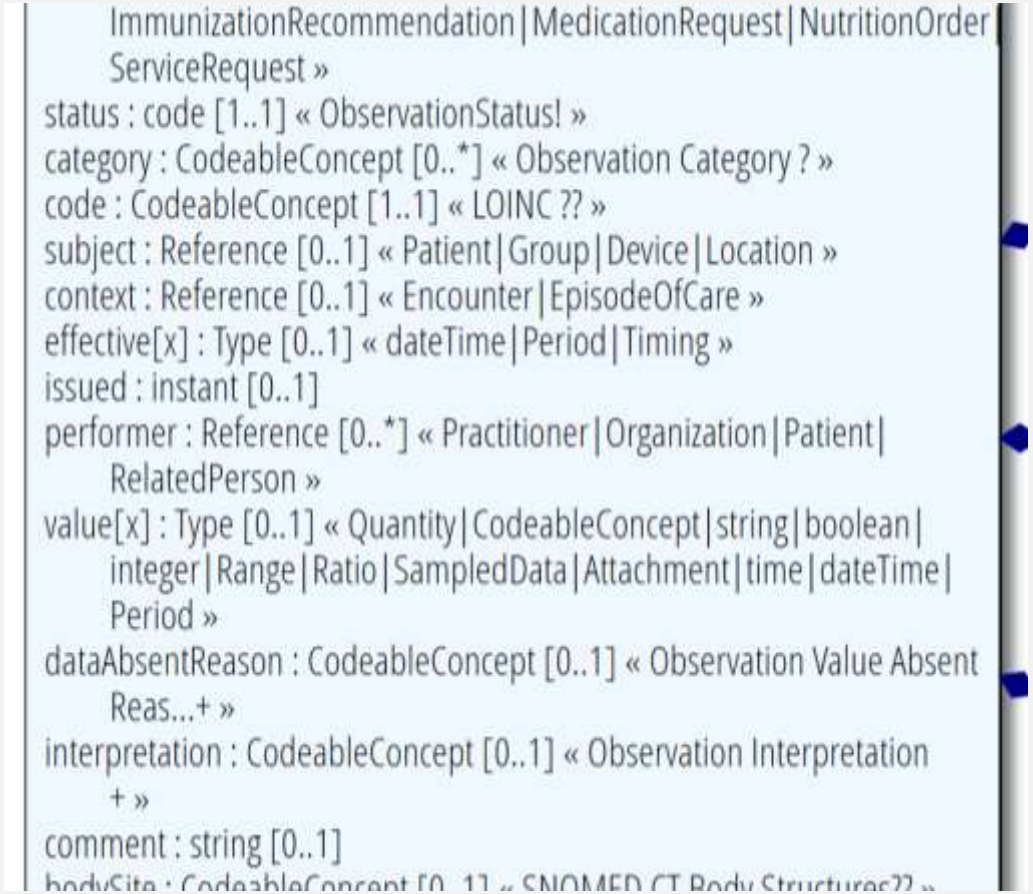
- Source material does not have some data that is needed in destination
  - Most important (and common): Persistent Identifier

Missing Information

MSH|.....

....

OBX|...|^Doctor^David^Dr|....



Missing Information

```
<substanceAdministration classCode="SBADM" moodCode="EVN">
  <id root="552119c8-cbf5-40ff-9b1f-6786c285cd24" />
  <text xsi:type="ST">Take ONE tablet  TWO times daily with food, oral</text>
  <consumable>
    <manufacturedProduct>
      <manufacturedMaterial>
        <code code="56044211-0261-45AF-B2AF-146895A1ACE0" codeSystem="1.2.36.1.2001.1005.11.1" codeSyst
          <originalText>SELGENE 5mg TABLETS, 100</originalText>
        </code>
      </manufacturedMaterial>
    </manufacturedProduct>
  </consumable>
  <entryRelationship typeCode="SPRT" inversionInd="true">
    <observation classCode="OBS" moodCode="EVN">
      <id root="ba88476d-a642-43ce-b303-bfe12a894b94" />
      <code code="103.16593" codeSystem="1.2.36.1.2001.1001.101" codeSystemName="NCTIS Data Components"
      <value xsi:type="CD" code="01" codeSystem="1.2.36.1.2001.1001.101.104.16592" codeSystemName="NCTI
      <entryRelationship typeCode="COMP">
        <observation classCode="OBS" moodCode="EVN">
          <id root="b5fe6083-bffb-4544-a997-0fd0f312cea9" />
          <code code="103.16595" codeSystem="1.2.36.1.2001.1001.101" codeSystemName="NCTIS Data Compone
          <value xsi:type="CD" code="01" codeSystem="1.2.36.1.2001.1001.101.104.16594" codeSystemName="
        </observation>
      </entryRelationship>
    </observation>
  </entryRelationship>
</substanceAdministration>
```

Major Challenge: Missing Information

- Source material does not have some data that is needed in destination
  - Most important (and common): Persistent Identifier
- What to do?
  - Known because of the business context
  - Can be faked with minimal damage to downstream business process
  - Can’t produce at all – can’t actually complete the process
    - (why so few elements are 1..1 in FHIR)

Transforming Other Content

- Questions/Discussion….