Profiling with clinFHIR

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Plan for the sessions

- Yesterday
  - Review overall process
  - Review key FHIR elements
  - ‘Clinical’ Models
    - Information, Resources, References

- Today
  - Structured and Coded data
  - Profiling: create/view FHIR artifacts
    - ValueSet
    - Extension Definition
    - Profile
    - Implementation Guide
The road to FHIR (aka the process)

Clinician / Business Analyst

Clinical Problem → Information Model → Resources Model → References Graph → FHIR artifacts

FHIR Expert / Terminology
Profiling
Adapting FHIR to your needs: Profiling

- Many different contexts in healthcare, but want a single set of Resources
- Need to be able to describe ‘usage of FHIR’ based on context
- Allow for these usage statements to:
  - Authored in a structured manner
  - Published in a registry & Discoverable
  - Used as the basis for validation, code, report and UI generation.

- 3 main aspects:
  - Constraining a resource - remove element, change multiplicity fix values
  - Change coded element binding
  - Adding a new element (an extension)

- Profiling adapts FHIR for specific scenarios
  - A statement of use
For example…

- Limit names to just 1 (instead of 0..*)
- Change maritalStatus to another set of codes that extends the one from HL7 international
- Require that the identifier uses the NHI number – and is required
- Don’t support photo
- Add an extension to support ethnicity
This talk:

- 3 Main aspects
  - Coded data (and identifiers)
    - Binding to a ValueSet
  - Extensions
  - The Profile
- Implementation Guide
Structured and coded data
Why have structured / coded data

- Structured vs Coded
- Coded:
  - Greatly improves quality of exchange
    - ‘semantic’ interoperability
  - Secondary uses
    - Decision Support
    - Analytics
    - Population Health
    - Reporting
Resource type structure in the spec

<table>
<thead>
<tr>
<th>Name</th>
<th>Flags</th>
<th>Card.</th>
<th>Type</th>
<th>Description &amp; Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient</td>
<td></td>
<td></td>
<td>DomainResource</td>
<td>Information about an individual or animal receiving health care services</td>
</tr>
<tr>
<td>identifier</td>
<td>Σ</td>
<td>0..*</td>
<td>Identifier</td>
<td>Elements defined in Ancestors: id, meta, implicitRules, language, text, cont</td>
</tr>
<tr>
<td>active</td>
<td>⌂ ?! Σ</td>
<td>0..1</td>
<td>boolean</td>
<td>An identifier for this patient</td>
</tr>
<tr>
<td>name</td>
<td>Σ</td>
<td>0..*</td>
<td>HumanName</td>
<td>Whether this patient’s record is in active use</td>
</tr>
<tr>
<td>telecom</td>
<td>Σ</td>
<td>0..*</td>
<td>ContactPoint</td>
<td>A name associated with the patient</td>
</tr>
<tr>
<td>gender</td>
<td>Σ</td>
<td>0..*</td>
<td>code</td>
<td>A contact detail for the individual</td>
</tr>
<tr>
<td>birthDate</td>
<td>Σ</td>
<td>0..1</td>
<td>date</td>
<td>male</td>
</tr>
<tr>
<td>deceased[x]</td>
<td>Σ</td>
<td>0..1</td>
<td>boolean</td>
<td>AdministrativeGender (Required)</td>
</tr>
<tr>
<td>deceasedBoolean</td>
<td>⌂ ?! Σ</td>
<td>0..1</td>
<td>boolean</td>
<td>The date of birth for the individual</td>
</tr>
<tr>
<td>address</td>
<td>Σ</td>
<td>0..*</td>
<td>Address</td>
<td>Indicates if the individual is deceased or not</td>
</tr>
<tr>
<td>maritalStatus</td>
<td>0..1</td>
<td></td>
<td>CodeableConcept</td>
<td>Addresses for the individual</td>
</tr>
<tr>
<td>multipleBirth</td>
<td>0..1</td>
<td></td>
<td>CodeableConcept</td>
<td>Marital (civil) status of a patient</td>
</tr>
<tr>
<td>multipleBirthBoolean</td>
<td>0..1</td>
<td></td>
<td>boolean</td>
<td>Marital Status Codes (Extensible)</td>
</tr>
<tr>
<td>multipleBirthInteger</td>
<td>0..1</td>
<td></td>
<td>integer</td>
<td>Whether patient is part of a multiple birth</td>
</tr>
<tr>
<td>photo</td>
<td>0..*</td>
<td></td>
<td>Attachment</td>
<td>Image of the patient</td>
</tr>
<tr>
<td>contact</td>
<td>1</td>
<td>0..*</td>
<td>BackboneElement</td>
<td>A contact party (e.g. guardian, partner, friend) for the patient + SHALL at least contain a contact’s details or a reference to an organization</td>
</tr>
<tr>
<td>relationship</td>
<td>0..*</td>
<td></td>
<td>CodeableConcept</td>
<td>The kind of relationship</td>
</tr>
</tbody>
</table>

v2 Contact Role (Extensible)
Datatypes

- Datatypes in resource type definition
  - Backbone element
  - ‘choice’ data types
    - Eg deceased[x]
- Identifiers
- Review coded data
  - ValueSet binding
Data types: Primitive

Based on w3c schema and ISO data types

- Stick to the “80% rule” – only expose what most will use
  - Simplified
Identifiers

- Identifies an object (Person) within a given system
  - Eg National Identifier (NHI), Drivers License, HPI
- Main sub components:
  - System – what ‘sort’ of identifier
  - Value – unique within the system
- NamingSystem resource
Coded datatypes

- **code**: "status" : "confirmed"
- **Coding**: {
  "code": "C3214954",
  "display": "cashew nut allergenic extract Injectable"
}
- **CodeableConcept**: {
  "coding": [{
    "system": "http://snomed.info/sct",
    "code": "39579001",
    "display": "Anaphylactic reaction"
  }],
  "text" : "Anaphylaxis"
}
ValueSet
ValueSet

- A context specific subset of one or more Code Systems
- Bound to an element
- Promotes consistency between applications
- Key component of Terminology
  - Also CodeSystem
- Start thinking about in Information model
- Used by a number of services
  - $expand
Terminology Sub-system

Code System:
Defines a set of concepts with a coherent meaning

Code Display Definition

- SNOMED CT / LOINC / RxNORM
- ICPC, MIMS + 100s more
- ICD-X+
- A drug formulary
- Custom
Terminology Sub-system

Code System:
Defines a set of concepts with a coherent meaning

Code
Display
Definition

Value Set:
A selection of a set of codes for use in a particular context

Selects
Terminology Sub-system

Code System: Defines a set of concepts with a coherent meaning

- Code
- Display
- Definition

Value Set: A selection of a set of codes for use in a particular context

Element Definition: Type and Value set reference

- Binding:
  - Connection between element and ValueSet
  - Strength determines if can change
Terminology Sub-system

- **Code System**: Defines a set of concepts with a coherent meaning
  - Code
  - Display
  - Definition

- **Value Set**: A selection of a set of codes for use in a particular context

- **Element Definition**: Type and Value set reference

- **Element**: code/Coding/CodeableConcept

- Selects
- Binds
- Refers to
- Conforms
Terminology Sub-system

Code System:
Defines a set of concepts with a coherent meaning

Value Set:
A selection of a set of codes for use in a particular context

Element Definition:
Type and Value set reference

Instance
Element:
code/
Coding/
CodeableConcept

Define
Selects
Binds
Conforms
Refers to
Demo

- Adding structures and coded data to the scenario
Demo

- Viewing/Building a ValueSet in clinFHIR
Extension Definition
Extension Definitions

‣ Also a StructureDefinition
  • Defines the content of a single extension

‣ Simple or Complex
  ‣ Complex has children

‣ Definition:
  • Available on the web
  • Canonical Url – Globally unique identifier
    - Resolvable or Registry

‣ In resource instance:
  • Reference to Canonical Url
    • Recipient can always find out definition
  • Extension or ModifierExtension
Demo

- Create an Extension Definition
The ‘Profile’
The ‘profile’

- On a single resource type
- Defined by StructureDefinition resource
  - Same as used for core resources
- Defines each element
  - Path, name, dataType, binding, multiplicity, mapping & much more
  - Including allowable extension points
- Can use Forge tooling to build
  - clinFHIR (and others) for learning/viewing
- US Core (was DAF)
clinFHIR: Profiling support

- Build from Logical Model
  - On single resource
- Main options
  - Remove elements
  - Add extensions
  - Change Bindings
- This is not Forge!
Demo

- Build a profile
Implementation Guide
Implementation Guide

- Brings all the artifacts together
  - Clinical & FHIR
- Demo of guide
  - CareConnect (UK)
Main Conformance artifacts

- StructureDefinition
  - Profile and Extension Definitions
  - In resources model
- ValueSet
  - From Information model
- CodeSystem
- ConceptMap
- NamingSystem
- ImplementationGuide
Exercises

Notes

- Getting started
  - Set servers (hapi-3)
  - Create user account
- Use initials for model name
- Remember to save models

Process

1. Choose resource to profile
2. Build Logical model (single resource)
3. Edit model
   1. Constrain
   2. Extend
   3. Re-bind
4. Create profile
clinFHIR help on the FHIR Chat

https://chat.fhir.org/#narrow/stream/clinFHIR
More information

From HL7
- wiki.hl7.org/index.php?title=FHIR
- http://www.fhir.org/

Community
- https://chat.fhir.org/
- List server (fhir@lists.hl7.org)
- Stack Overflow (tag FHIR)

Blogs
- https://fhirblog.com/
- https://thefhirplace.com/
- https://brianpos.com

Libraries
- Java (http://hapifhir.io/)
- C# (NuGet HL7.FHIR) Tooling
- Forge (http://fhir.fhirbase.com/forge)
- http://clinfhir.com/

Tooling
- Forge (http://fhir.fhirbase.com/forge)
- http://clinfhir.com/

Test servers
- https://fhirblog.com/2016/10/19/setting-up-your-own-fhir-server-for-profiling/
All done!