FHIR Profiling - Overview and Introduction

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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 & Conformance
  • Tool smith; Lead developer of Forge
Topics

1. The need for profiling
2. FHIR Conformance layer
3. Profiles
4. Extensions
5. Implementation Guides
6. Registry
FHIR Profiling - Overview and Introduction

1. The need for profiling
Why do we need profiling?

• Many different contexts in healthcare, but only a single set of resources
• FHIR provides a “platform specification”
• Requires further adaptation to context of use
Profiling

Describe adaptations based on use & context:
• Which resources & elements are used?
• Which API features are used?
• Which terminologies are used?
• How to map these to local requirements?
Profiling

Allow for these usage statements:

• To be authored in a **structured** manner
  • Independent of serialization format
• To be published in a repository
• To drive validation, code generation etc.
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2. FHIR Conformance layer
StructureDefinition

• Defines data structures
• Core datatypes
• Core resources
• Constraints on resources & datatypes
• Extensions
• Logical Models
StructureDefinition

- Publish to repository/registry
- Compare
- Transform
- Validate resource
- Generate code
- Generate UI

- Computable!
OperationDefinition

• Defines REST interactions
  • Name of the operation
  • Input/output parameters
  • Behavior
  • Works on which resources?

• Extend/restrict the API

• Computable!
SearchParameter

• Defines named search parameters for REST API
  • Name
  • Interpretation?
  • Supports which resources?
  • Matches which resource elements?

• Extend/restrict the API

• Computable!
CapabilityStatement

• Defines capabilities of a FHIR server
• Binds all conformance resources together

Usage:
• Advertise supported capabilities
• Describe required capabilities

• Computable!
CapabilityStatement

Defines supported:
• Serialization formats
• Security services
• Operations
• Search Parameters
• Resources
• Profiles
ImplementationGuide

- Defines scope of usage
- Describes requirements for a FHIR implementation
- Specifies links to:
  - Relevant FHIR artifacts (e.g. profiles, other IGs)
  - Editorial content (documentation)
- Usage:
  - Allow authors to publish an implementation guide
  - Allow tools to validate conformance
- *Computable!*
FHIR Conformance Module
Used to define the FHIR core spec

- Core datatypes
- Core resources
- Standard REST operations
- Standard search parameters
- Standard terminology

- Bootstrap
- Eat Your Own Dogfood
Canonical Url

• Unique identifier for a conformance resource
• Reference to a conformance resource
• Author-assigned
• Cf. resource Id (server-assigned)

• Example: http://hl7.org/fhir/StructureDefinition/Patient
## Canonical Url

<table>
<thead>
<tr>
<th>EU Server</th>
<th>US Server</th>
<th>Asia Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>NL-Core-Patient</td>
<td></td>
</tr>
<tr>
<td>Resource Id</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
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3. Profiles
Profile

Define constraints on:
• A FHIR core datatype
• A FHIR core resource
• Another FHIR profile

Also used loosely to refer to:
• An implementation guide
• A conformance package

What is the difference between a resource and a datatype?
Layered profiles

More specific

Conform to

Conform to

Conform to

Conform to

More generic

Volume

Volume
StructureDefinition

Metadata:
• Canonical url
• Name, Title
• Status (draft, active)
• Date, Version (author assigned)
• Author, publisher, contact, ...
• Base profile
StructureDefinition

List of ElementDefinitions:

- Name, cardinality, data type
- Definitions, usage notes, requirements
- Default or fixed values
- Complex constraints, length limits
- Terminology bindings
- Mappings to other specifications
Referring to a profile

**Observation Resource**

- **Observation**
  - Cholesterol
- **Value**: 6.3 mmol/L
- **Status**: High

**Observation Profile**

- **StructureDefinition**
  - **Name**: LDLCholesterol
  - **URL**: `http://acme.org/fhir/StructureDefinition/LDLCholesterol`

**Profile Tag**

- I'm conforming to profile: `http://acme.org/fhir/StructureDefinition/LDLCholesterol`

**Validate**

- Simplifier.net

**Resolve**

- Acme.org
Versioning – non breaking change(s)

• Compatible
• Old data can still be
  • validated against new profile
  • Correctly interpreted against new profile
• Maintain same canonical url
• Bump author-assigned version
Versioning - breaking changes

• Incompatible with previous profile version
• Must assign new canonical url

Published profiles should be considered as *eternal contracts*
## Differential vs. Snapshot

<table>
<thead>
<tr>
<th>Differential component</th>
<th>Snapshot Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial list of definitions for elements constrained by this profile</td>
<td>Complete list of definitions for all elements in the datatype or resource</td>
</tr>
<tr>
<td>Specifies only constraints introduced by this profile</td>
<td>Specifies all constraints, incl. inherited from base</td>
</tr>
<tr>
<td>Authored by modeler</td>
<td>Computer-generated (FHIR Operation)</td>
</tr>
<tr>
<td>Relatively small (KBs)</td>
<td>Fairly large (MBs)</td>
</tr>
<tr>
<td>For efficient data interchange &amp; storage</td>
<td>For processing (validation, code generation, reporting etc.)</td>
</tr>
</tbody>
</table>
Authoring Profiles

• Manually author XML/JSON
• Excel (build tool)
• Lantana Trifolia Workbench [link]
• MDHT UML-based modelling tool [link]
• Forge [link]
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4. Extensions
Extensions

Allows to define and introduce custom elements

Example: Patient race, ethnicity

- Registration is *mandatory* in US
- Registration is *illegal* in EU
- Can NOT be included in core Patient resource definition!
Defining an extension

• Defined by StructureDefinition resource
• Unique identifier: canonical url
• Define extension context
  • Where can this extension be used?
  • Target structure: Resource | Datatype | Extension
  • List of type names and/or element paths
• Reusable in many profiles
Using an extension in a resource

• By default, FHIR allows resource instances to specify any number of extension elements
  • Inherited from Element.extension

• A profile can constrain the extension list of each element
  • Require/prohibit certain extensions
  • Disallow extensions

• Extension elements in profiles refer to external extension definitions
Using extensions

**Patient Instance**

Patient
Irma Jongeneel-de Haas
...
Nationality: NL

**Extension value in instance**

**Patient Profile**

StructureDefinition
nl-core-patient
http://hl7.nl/fhir/StructureDefinition/nl-core-patient
Patient.name : HumanName
...
Patient.nationality : Extension(patient-nationality)

**Extension Definition**

StructureDefinition
Patient-nationality
http://hl7.org/fhir/StructureDefinition/patient-nationality

Conforms to profile

Reference to external extension definition
Primitive extension

• Define a single custom element
• Constrain the type of the element value
  • Primitive value
  • Complex value

• Examples:
  • patient-birthTime (dateTime)
  • birthPlace (Address)
Complex extension

• Define a set of related custom elements
  • Elements may be nested (subtree)
• Constrain the type of each element value

• Example: patient-nationality
  • code: CodeableConcept
  • period: Period
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5. Implementation Guides
Implementation Guide Resource

• Define conformance package(s)
  • Set of conceptually related artifacts
• Specify references to external artifacts
  • StructureDefinition
  • OperationDefinition
  • SearchParameter
  • ValueSet
  • Example resources
Implementation Guide Resource

- Define IG content hierarchy
- Specify references to external artifacts
  - Page content files
  - Images, CSS, JavaScript
- Supported page formats:
  - Markdown
  - HTML
IG Resource - Applications

- **Exchange**
  - Inbetween IG authoring and/or publication environments

- **Publish**
  - To registry
  - Render content (website, PDF, print, …)
  - cf. FHIR spec

- **Validate**
  - Deploy to FHIR server
  - Validate resource instances
Authoring Implementation Guides

• IG Builder
  • Official command line tool
  • Can render IG resource as a website

• Examples:
  • FHIR specification
  • DAF Argonaut
Authoring Implementation Guides

• Simplifier
  • Browse & find published IGs
  • Supports online IG authoring & publication
  • Embed rendered artifacts

• Examples:
  • HL7 Germany
  • Devices on FHIR POCD
Authoring & Publication workflows

- **Finalize**
- **Publish**
- **Unpublish**
- **Distribute**
- **Archive**
- **Update**
- **Review**
- **Collaborate**
- **Create**
- **Update**
- **Finalize**

- **Update**
- **Draft**
- **Collaborate**
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6. Registry
Official HL7 FHIR registries

• HL7 FHIR Profile registry
  • [https://registry.fhir.org/](https://registry.fhir.org/)
  • Find official profiles published by HL7 intl. & WG

• HL7 FHIR Implementation Guide registry
  • [http://www.fhir.org/guides/registry](http://www.fhir.org/guides/registry)
  • Browse official HL7 implementation guides
• Public FHIR registry at https://simplifier.net
• Find & browse FHIR profiles, IGs, examples etc.
• Author & publish implementation guides
• Contains:
  • Official HL7 profiles
  • HL7 affiliate profiles
  • Private company profiles
  • Public user profiles
• Official back-end for https://registry.fhir.org/
Next: Profiling Tools Overview

By Vadim Peretokin
Exercises

Print outs available at the registration desk
Download from https://www.fhirdevdays.com/exercises/
FHIR Profiling Academy

FHIR Registry
This is the FHIR profile registry. Find profiles, extensions, value sets, dictionaries, mappings, examples, and more. Explore the registry.

Forge
Download Forge for free to create your own profiles and upload them to Simplifier. Try me now or directly log in and download.

VONK FHIR Server
Run your own FHIR server by downloading a trial version of VONK. Try me now or directly log in and install.
'Hey, careful man! There's a beverage here!' Coffee!