

## FHIR Introduction to Profiling

Lilian Minne, Firely



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**firely**

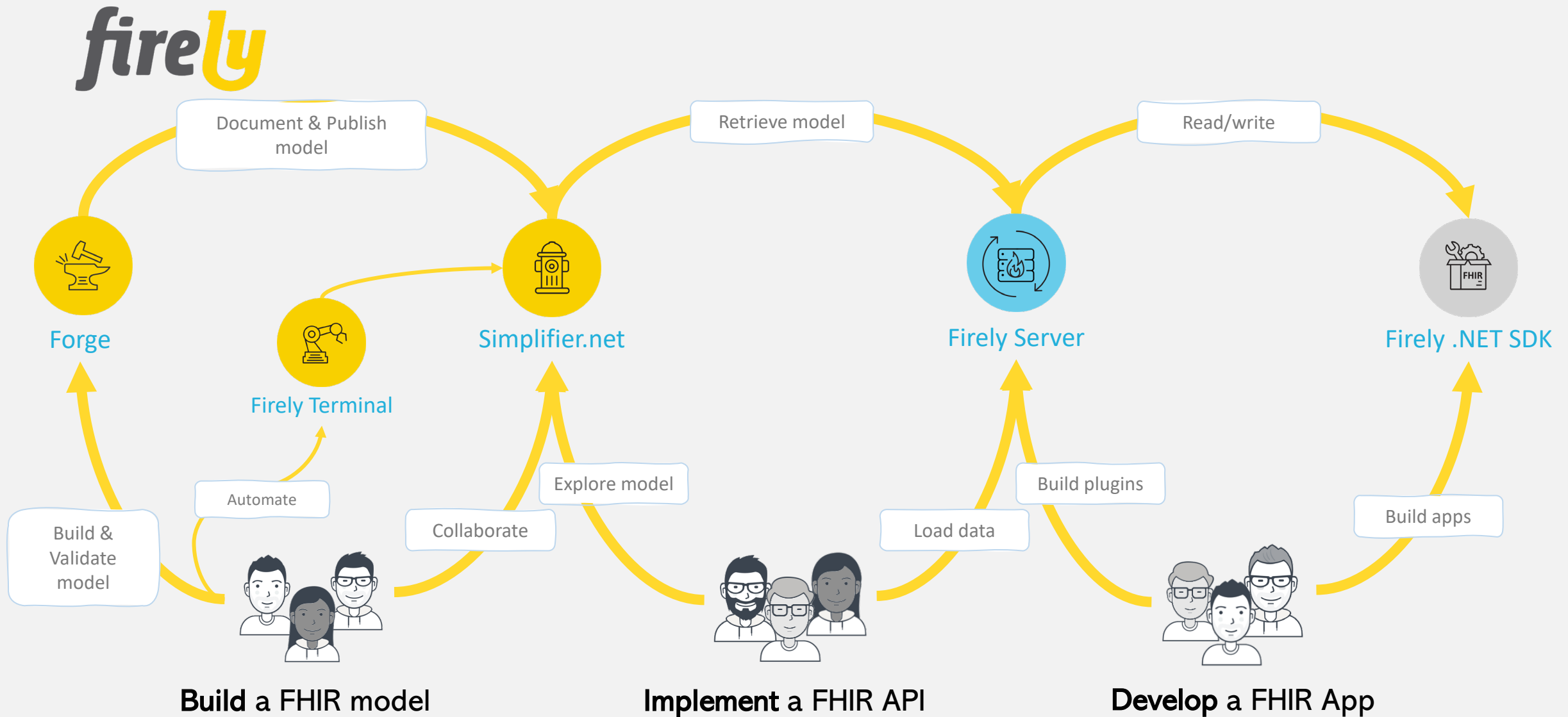
**HL7<sup>®</sup>**  
International

## Who am I?

- Name: Lilian Minne
- Company: Firely, Amsterdam
- Background:
  - FHIR team since 2017
  - FHIR (profiling) consultant
  - Projects: Dutch birth care standard, Dutch national intensive care evaluation

*fire***ly**





## Topics

1. The need for profiling
2. FHIR Conformance layer
3. Profiles/Extensions
4. Packages
5. Registry and Tooling



# FHIR Profiling Overview

## 1. The need for profiling



## Why do we need profiling?

- FHIR provides a *platform specification*  
  
“Standard building blocks for interoperability solutions”
- Single set of resources for many different contexts in healthcare
- Requires further adaptation to context of use

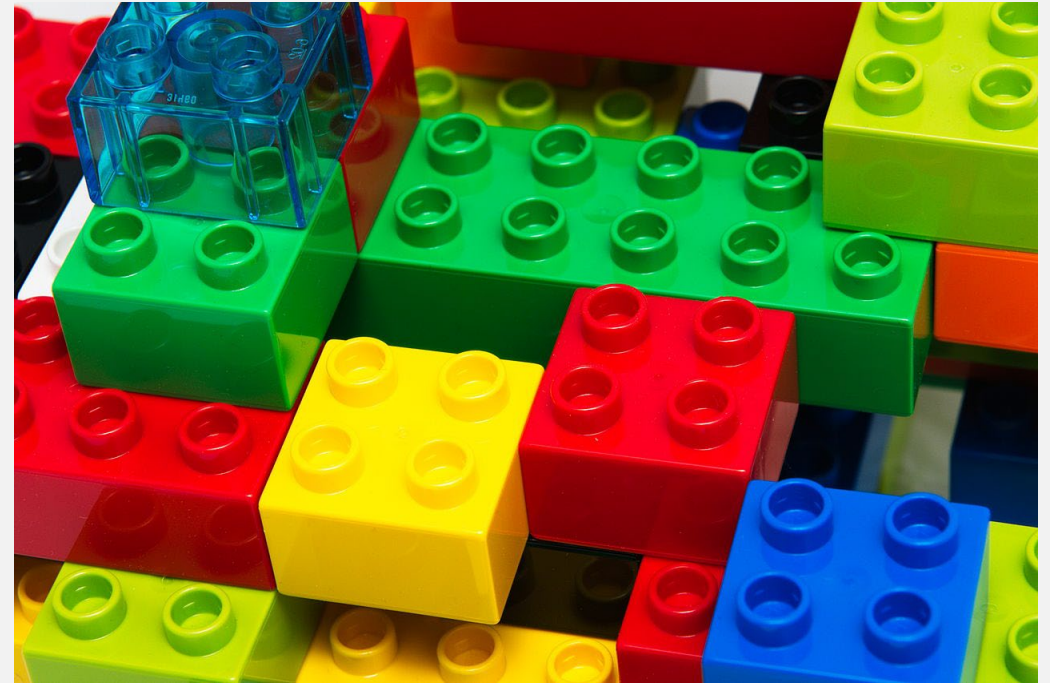




# Profiling

Describe adaptations based on use & context:

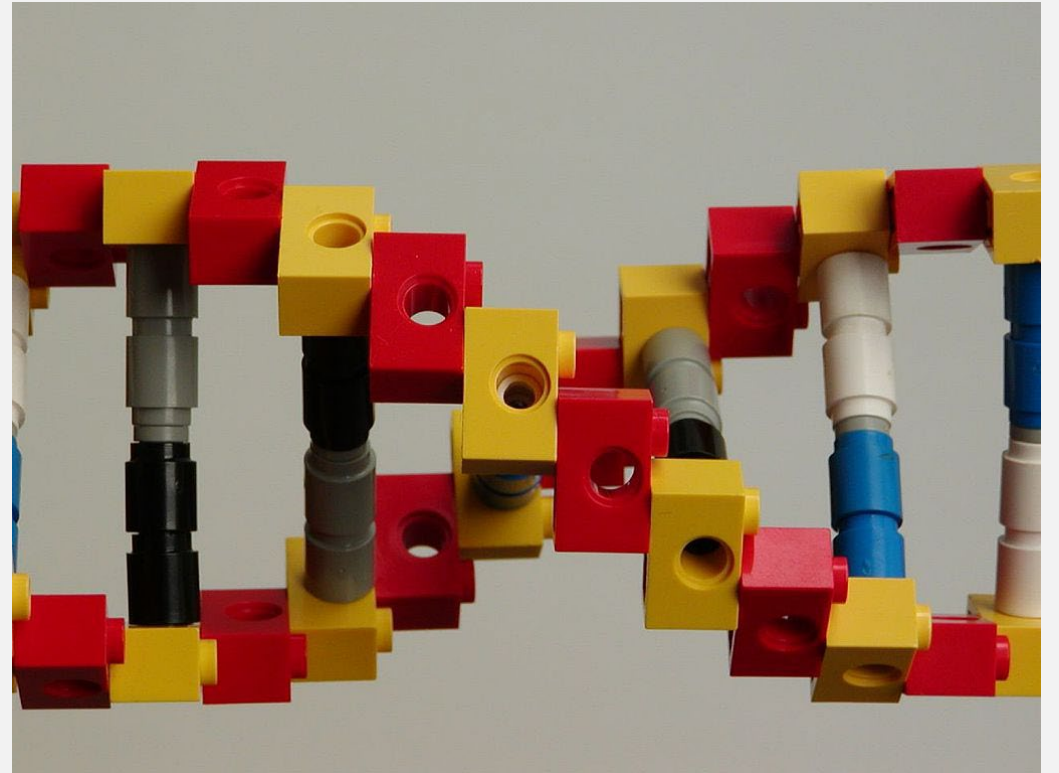
- Which resources & elements are used?
- Which API features are used?
- Which terminologies are used?
- How to map these to local requirements?



# 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.





# FHIR Profiling Overview

## 2. FHIR Conformance layer



# FHIR Conformance Resources

## Content

Structure Definition

Element Definition

Graph Definition

## Terminology

Naming System

Code System

Value Set

Concept Map

## Operations

Operation  
Definition

Search Parameter

Structure Map

## Misc.

Capability  
Statement

Implementation  
Guide

Test Script

Test Report

# StructureDefinition

Defines data structures:

- Resources
- Datatypes
- Constraints (*“profiles”*) on resources & datatypes
- Extensions
- Logical Models

# OperationDefinition

- Defines REST interactions
  - Name of the operation
  - Input/output parameters
  - Behavior
  - Works on which resources?
- Extend/restrict the API



# SearchParameter

- Defines named search parameters for REST API
  - Name
  - Interpretation?
  - Supports which resources?
  - Matches which resource elements?
- Extend/restrict the API



# CapabilityStatement

Defines supported:

- Serialization formats
- Operations
- Resources, interactions, search parameters
- Profiles

Usage:

- Advertise supported capabilities
- Describe required capabilities

Name	Flags	Card.	Type	Description & Constraints
CapabilityStatement	I N		DomainResource	A statement of system capabilities
rest	Σ I	0..*	BackboneElement	
mode	Σ	1..1	CodeableConcept	
documentation		0..1	Markdown	
security	Σ TU	0..1	BackboneElement	
cors	Σ	0..1	Boolean	
service	Σ	0..*	CodeableConcept	
description		0..1	Markdown	
resource	Σ I	0..*	BackboneElement	
type	Σ	1..1	CodeableConcept	
profile	Σ	0..1	CanonicalReference	
supportedProfile	Σ TU	0..*	CanonicalReference	
documentation		0..1	Markdown	
interaction		0..*	BackboneElement	
code		1..1	CodeableConcept	
documentation		0..1	Markdown	
versioning	TU	0..1	CodeableConcept	
readHistory	TU	0..1	Boolean	
updateCreate	TU	0..1	Boolean	
conditionalCreate	TU	0..1	Boolean	
conditionalRead	TU	0..1	CodeableConcept	
conditionalUpdate	TU	0..1	Boolean	
conditionalDelete	TU	0..1	CodeableConcept	
referencePolicy	TU	0..*	CodeableConcept	
searchInclude	TU	0..*	String	
searchRevInclude	TU	0..*	String	
searchParam		0..*	BackboneElement	

```

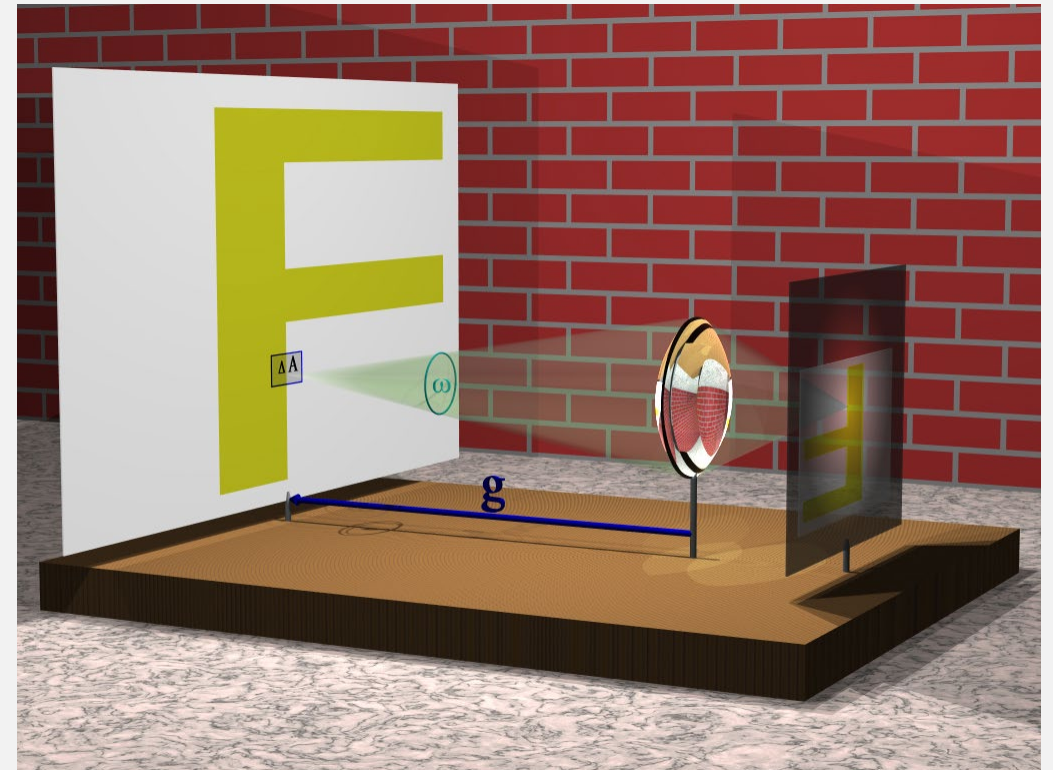
{
  "resourceType": "CapabilityStatement",
  "id": "d0ba6889-7bb9-4c01-bcd0-740ccc1900e3",
  "meta": {},
  "language": "en-US",
  "url": "metadata",
  "version": "1.0",
  "name": "Vonk FHIR server 3.6.1 CapabilityStatement",
  "status": "active",
  "experimental": true,
  "date": "2020-06-16T16:17:52.8706409+00:00",
  "publisher": "Firely",
  "contact": [],
  "kind": "instance",
  "software": {
    "name": "Vonk",
    "version": "3.6.1",
    "releaseDate": "2020-06-15T15:59:33+00:00"
  },
  "implementation": {},
  "fhirVersion": "4.0.1",
  "format": [
    "xml",
    "json"
  ],
  "rest": [
    {
      "mode": "server",
      "resource": [
        {
          "type": "Account",
          "interaction": [
            {
              "code": "create"
            },
            {
              "code": "delete"
            }
          ]
        }
      ]
    }
  ]
}

```



# StructureMap

- Map of relationships between 2 structures
- Based on *FHIR Mapping Language*
- Can be used to transform data

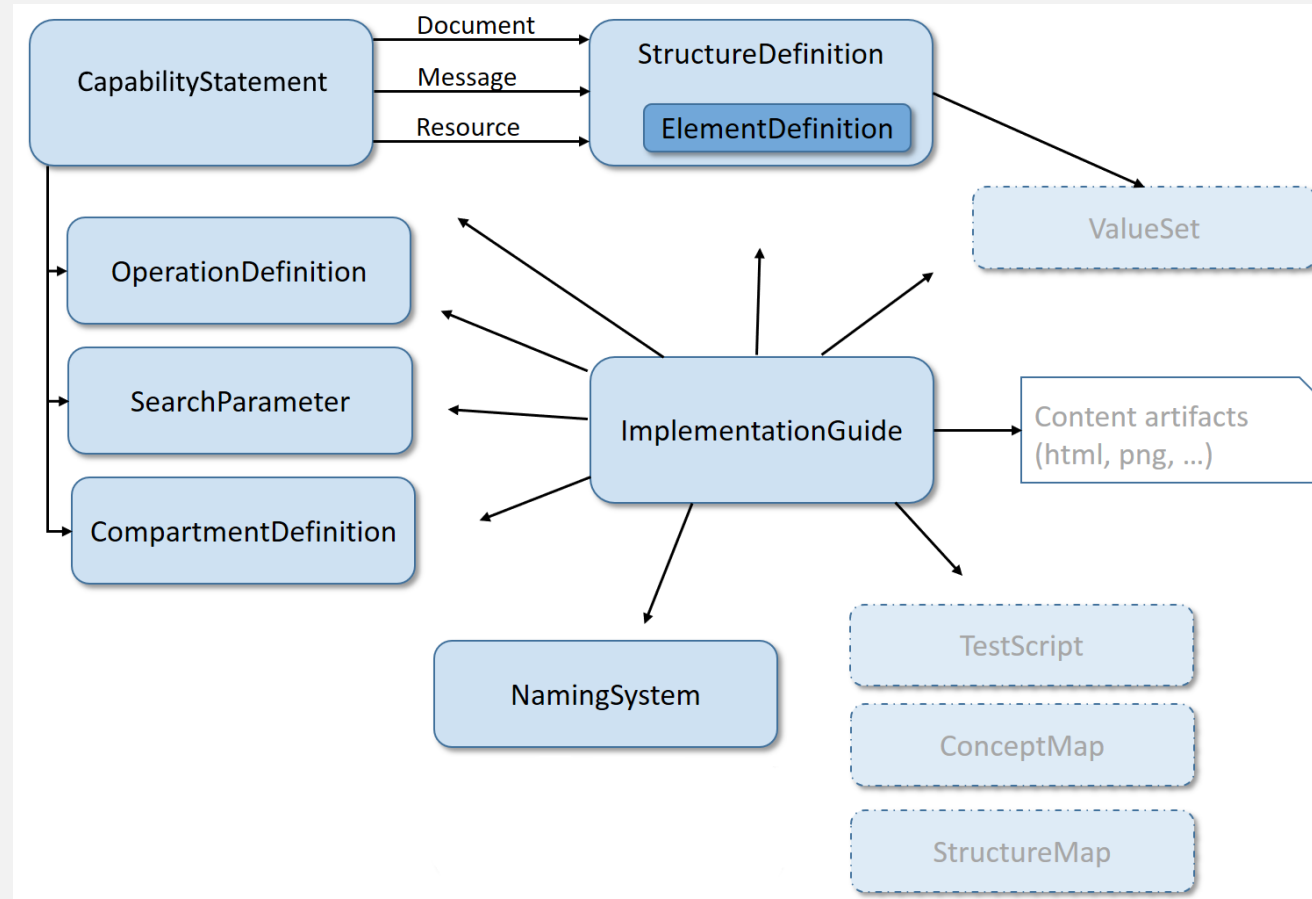


# ImplementationGuide

- Describes requirements for a FHIR implementation
- Specifies links to:
  - Relevant FHIR artifacts (e.g. profiles)
  - Editorial content (documentation)
- Usage:
  - Publish an implementation guide
  - Validate conformance



# Conformance Module



## Used to define the FHIR core spec

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

 *Eat Your Own Dogfood*



## Canonical Url

- Unique identifier (*uri*) for a conformance resource
  - Author-assigned
  - Shared by all instances
- Compare: Resource Id
  - Server-assigned
  - Unique per instance
- Example: <http://hl7.org/fhir/StructureDefinition/Patient>  
<http://fhir.alp/StructureDefinition/AlpCorePatient>

# FHIR Profiling Overview

## 3. Profiles/Extensions





# Profile

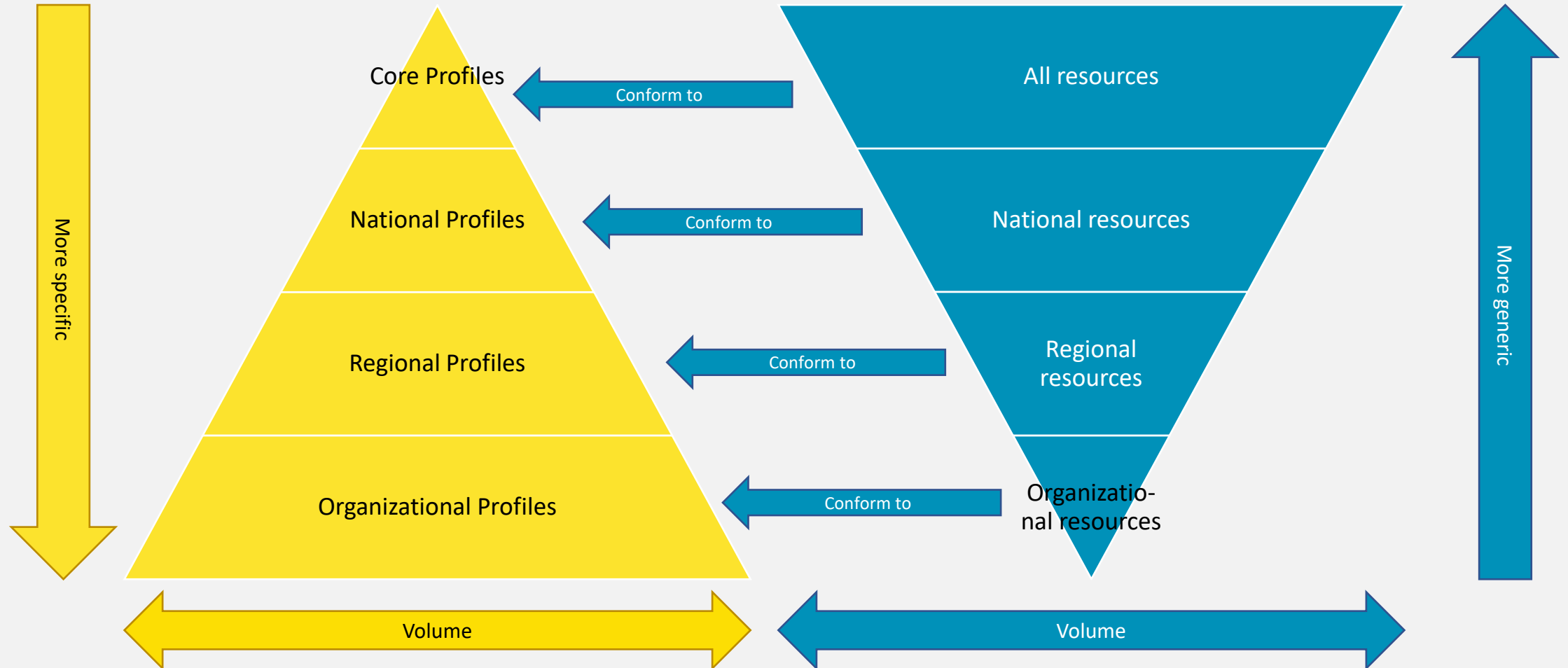
Defines constraints on:

- A FHIR core datatype
- A FHIR core resource
- Another FHIR profile

Also used loosely to refer to:

- An implementation guide
- A conformance package

# Layered Profiles



# 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
- Fixed values
- Complex constraints, length limits
- Terminology bindings
- Mappings to other specifications



	Σ	1..1	
	Σ	1..1	Reference(nl-core-patient)
context		0..1	Reference(Encounter   EpisodeOfCare)
supportingInformation		0..*	Reference(Resource)
authoredOn	Σ	1..1	dateTime
requester	Σ	0..1	BackboneElement
recorder		0..1	Reference(nl-core-practitioner)
reasonCode		0..*	CodeableConcept <span>Binding</span>
reasonReference		0..*	Reference(Observation   ZIB Core)
		0..*	Annotation
		0..*	ZIB Instructions

# Profiling a resource type

Patient	N	DomainResource
- extension: us-core-race	0..1	
identifier	Σ 0..*	Identifier
active	?! Σ 0..1	boolean
name	Σ <del>0..*</del> <b>1..1</b>	HumanName
telecom	Σ 0..*	ContactPoint
gender	Σ 0..1	code
birthDate	Σ 0..1	date
deceased[x]	?! Σ 0..1	
deceasedBoolean		boolean
<del>deceasedDateTime</del>		<del>dateTime</del>
address	Σ 0..*	<b>MyProfiledAddress</b>
<del>maritalStatus</del>	<del>0..1</del>	<del>CodeableConcept</del>

Add an extension to support “RaceCode”

Demand that the identifier uses your national patient identifier















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

Limit choices for datatypes

Use another profiled Resource type

Forbid element (author with care!)

# Example of a profile (us-core-patient)

 Patient		0..*	Patient	Information about an individual or animal receiving health care services
 us-core-race	<b>S</b>	0..1	(Complex)	US Core Race Extension <b>URL:</b> <a href="http://hl7.org/fhir/us/core/StructureDefinition/us-core-race">http://hl7.org/fhir/us/core/StructureDefinition/us-core-race</a>
 us-core-ethnicity	<b>S</b>	0..1	(Complex)	US Core ethnicity Extension <b>URL:</b> <a href="http://hl7.org/fhir/us/core/StructureDefinition/us-core-ethnicity">http://hl7.org/fhir/us/core/StructureDefinition/us-core-ethnicity</a>
 us-core-birthsex	<b>S</b>	0..1	code	Extension <b>URL:</b> <a href="http://hl7.org/fhir/us/core/StructureDefinition/us-core-birthsex">http://hl7.org/fhir/us/core/StructureDefinition/us-core-birthsex</a> <b>Binding:</b> Birth Sex (required)
 identifier	<b>S</b>	1..*	Identifier	An identifier for this patient
 system	<b>S</b>	1..1	uri	The namespace for the identifier value
 value	<b>S</b>	1..1	string	The value that is unique within the system.
 name	<b>S</b> I	1..*	HumanName	A name associated with the patient <b>us-core-8:</b> Either Patient.name.given and/or Patient.name.family SHALL be present or a Data Absent Reason Extension SHALL be present.
 family	<b>S</b> I	0..1	string	Family name (often called 'Surname')
 given	<b>S</b> I	0..*	string	Given names (not always 'first'). Includes middle names
 telecom	<b>S</b>	0..*	ContactPoint	A contact detail for the individual
 system	<b>S</b>	1..1	code	phone   fax   email   pager   url   sms   other <b>Binding:</b> ContactPointSystem (required)
 value	<b>S</b>	1..1	string	The actual contact point details
 use	<b>S</b>	0..1	code	home   work   temp   old   mobile - purpose of this contact point



## Complex constraints

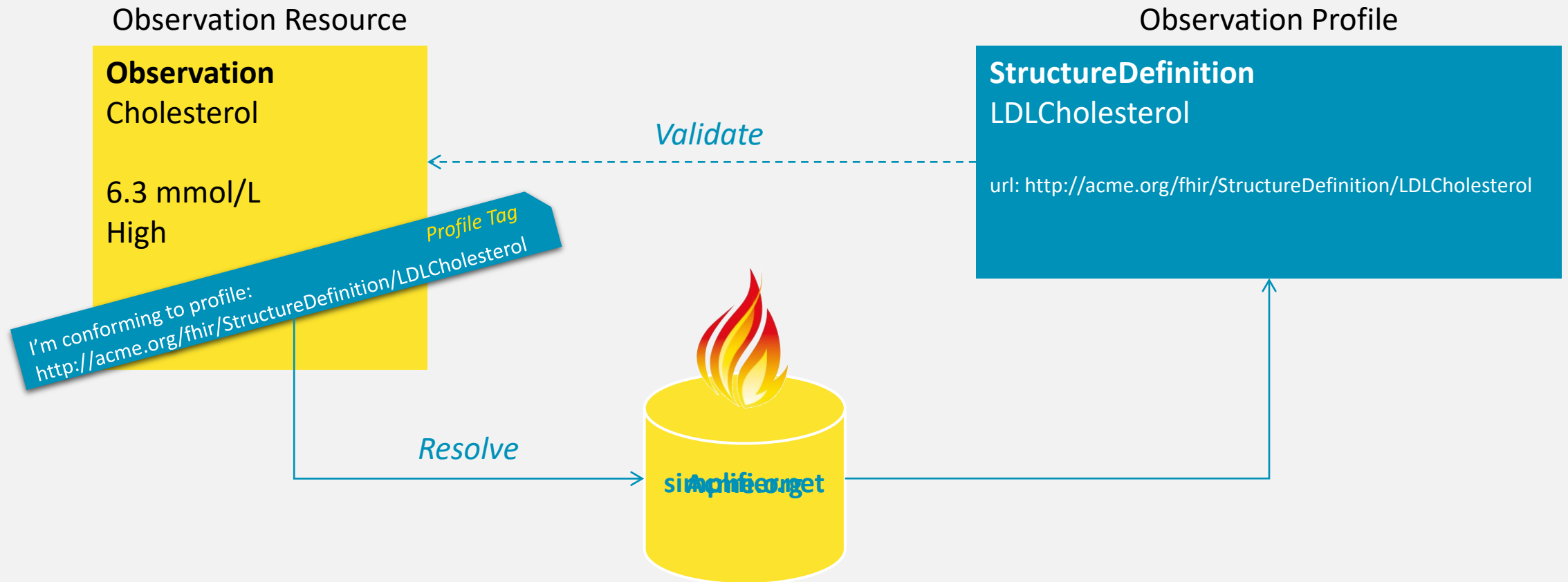
- To express extra rules that go beyond cardinality, etc. use FHIRPath
  - Graph traversal language ([hl7.org/fhirpath](http://hl7.org/fhirpath))
  - Independent of serialization format; supports XML, JSON, RDF, ...
  - Independent of model; supports FHIR, V3, CIMI, QDM, ...
  - Fluent syntax; powerful, expressive and readable

- Example:

`Bundle.type='document' implies (Bundle.timestamp.hasValue())`

- Interested to learn more?  
Come to the FhirPath session (Thu. Jun 9, 2:00 PM - 2:45 PM)

# Referring to a profile



## Extensions

Allows to define and introduce custom elements

Example: Patient race, ethnicity

- Registration is *mandatory* in US
- Registration is *illegal* in EU
- Cannot be defined by the 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



# FHIR Profiling Overview

## 4. Packages



## FHIR Package

Versioned and published set of conceptually related FHIR conformance resources:

- Structure Definitions (Profiles)
- Value Sets
- Operation Definitions
- Search Parameter Definitions
- Example Resources
- ...





# Forge Package Manager























- Browse and download FHIR packages from Simplifier registry
- Add/remove project dependencies
- Select profile extensions from package
- Derive profile from external dependency

Folder: C:\Users\Michel\Documents\Temp\Forge-R4

Project Dependencies

VIEW **Simplifier** Installed SEARCH Search... Search Add Remove

Name	Version	Description	Url
 SliceBugTest			<a href="https://packages.simplifier.net/SliceBugTest/">https://packages.simplifier.net/SliceBugTest/</a>
 Furoretestproject			<a href="https://packages.simplifier.net/Furoretestproject/">https://packages.simplifier.net/Furoretestproject/</a>
 Simplifier.Core.Stu3.DataTypes			<a href="https://packages.simplifier.net/Simplifier.Core.Stu3.DataTypes/">https://packages.simplifier.net/Simplifier.Core.Stu3.DataTypes/</a>
 Simplifier.Core.STU3.ValueSets			<a href="https://packages.simplifier.net/Simplifier.Core.STU3.ValueSets/">https://packages.simplifier.net/Simplifier.Core.STU3.ValueSets/</a>
 Simplifier.Core.STU3.CodeSystems			<a href="https://packages.simplifier.net/Simplifier.Core.STU3.CodeSystems/">https://packages.simplifier.net/Simplifier.Core.STU3.CodeSystems/</a>
 Simplifier.Core.STU3.Extensions			<a href="https://packages.simplifier.net/Simplifier.Core.STU3.Extensions/">https://packages.simplifier.net/Simplifier.Core.STU3.Extensions/</a>
 Simplifier.Core.STU3			<a href="https://packages.simplifier.net/Simplifier.Core.STU3/">https://packages.simplifier.net/Simplifier.Core.STU3/</a>
 Demo.National.PatientCare			<a href="https://packages.simplifier.net/Demo.National.PatientCare/">https://packages.simplifier.net/Demo.National.PatientCare/</a>
 Demo.Regional.PatientCare			<a href="https://packages.simplifier.net/Demo.Regional.PatientCare/">https://packages.simplifier.net/Demo.Regional.PatientCare/</a>
 gefyra.sandbox			<a href="https://packages.simplifier.net/gefyra.sandbox/">https://packages.simplifier.net/gefyra.sandbox/</a>
 ufp.core			<a href="https://packages.simplifier.net/ufp.core/">https://packages.simplifier.net/ufp.core/</a>
 dummy.first			<a href="https://packages.simplifier.net/dummy.first/">https://packages.simplifier.net/dummy.first/</a>
 ProvincialClientRegi.core			<a href="https://packages.simplifier.net/ProvincialClientRegi.core/">https://packages.simplifier.net/ProvincialClientRegi.core/</a>
 basisprofil.de			<a href="https://packages.simplifier.net/basisprofil.de/">https://packages.simplifier.net/basisprofil.de/</a>
 PGO.02			<a href="https://packages.simplifier.net/PGO.02/">https://packages.simplifier.net/PGO.02/</a>
 TestProjekt2.test			<a href="https://packages.simplifier.net/TestProjekt2.test/">https://packages.simplifier.net/TestProjekt2.test/</a>
 Simplifier.Others.Stu3			<a href="https://packages.simplifier.net/Simplifier.Others.Stu3/">https://packages.simplifier.net/Simplifier.Others.Stu3/</a>
 nictiz.fhir.nl.stu3.zib2017			<a href="https://packages.simplifier.net/nictiz.fhir.nl.stu3.zib2017/">https://packages.simplifier.net/nictiz.fhir.nl.stu3.zib2017/</a>
 Simplifier.Core.STU3.Resources			<a href="https://packages.simplifier.net/Simplifier.Core.STU3.Resources/">https://packages.simplifier.net/Simplifier.Core.STU3.Resources/</a>
 Simplifier.Core.STU3.ProfilesOthers			<a href="https://packages.simplifier.net/Simplifier.Core.STU3.ProfilesOthers/">https://packages.simplifier.net/Simplifier.Core.STU3.ProfilesOthers/</a>

# FHIR Profiling Overview

## 5. Registry and Tooling



# Official HL7 FHIR registries

- HL7 FHIR Profile registry
  - <https://registry.fhir.org/>
  - Find official profiles published by HL7 intl. & WGs
- HL7 FHIR Implementation Guide registry
  - <http://www.fhir.org/guides/registry>
  - Browse official HL7 implementation guides



# SIMPLIFIER.NET

- Public FHIR registry
- Search, browse & find FHIR conformance resources:
  - Profiles, IGs, Valuesets, Examples, ...
- Contains:
  - Official HL7 profiles
  - HL7 affiliate profiles
  - Private company profiles
  - Public user profiles



<https://simplifier.net>



# SIMPLIFIER.NET

- Validate examples against profiles
  - Are my example resources valid?
- Incoming & outgoing references
  - Who is depending on my profiles/extensions?
- Official back-end for <https://registry.fhir.org/>
  - Publish from Simplifier to HL7 registry
- Create/Download FHIR NPM packages
- Create Implementation Guides

# Profiling tools



- StructureDefinition

(profiles/logical models/extensions)

- [Forge](#), [Trifolia](#), [ClinFHIR](#)

- ImplementationGuide

- [Simplifier](#), [HL7 IG publisher](#)

- CapabilityStatement

- [FHIR Toolkit](#)

- ValueSet, CodeSystem

- [Snapper](#), [ClinFHIR](#)

- SearchParameter

- [Forge](#)

- Operation

- [Forge](#)

- Example instances

- [Fred](#), [NotePad++](#) plugin, [ClinFHIR](#)

disclaimer: this is just a selection, there may be other tools that are not listed here

# What's next?

- Go to one of the modeling sessions:
  - Create an IG with FHIR Shorthand, lets build (2:55pm-3:40pm tomorrow)
  - Building a FHIR data model with Forge, lets build (4:10pm-4:55pm tomorrow)
  - Publishing a FHIR specification, tutorial (11:45am-12:30pm Wednesday)
  - Publishing a FHIR specification with Simplifier, let's build (2pm-2:45pm Wednesday)
  - Comparing profiles & implementation requirements, let's build (2pm-2:45pm Wednesday)
  - Publishing a FHIR specification with IG Publisher, let's build (2:55pm-3:40pm Wednesday)
  - Building dynamic IG's with FHIR Shorthand and FQL, let's build (4:10pm-4:55pm Wednesday)
  - IG publishing and quality control in the cloud , let's build (2pm-2:45pm Thursday)
  - FHIRPath by example, let's build (2pm-2:45pm Thursday)
  - Mapping with FHIR, let's build (2:55pm-3:40pm Thursday)



## Contact

- During DevDays, you can find / reach me here:
  - Via Whova App – Speaker's Gallery
  - chat.fhir.org
  - [lilian@fire.ly](mailto:lilian@fire.ly)
- And you can email [info@fire.ly](mailto:info@fire.ly) for inquiries about FHIR software, solutions & services.

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