August 2019

Federated Health Information Model (FHIM) Profile Builder

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The Open Group
Jason Lee

Introduction

Jason Lee PhD, Director, OpenGroup Healthcare Vertical

- The Open Group is a global consortium that enables the achievement of business objectives through technology standards. Our diverse membership of more than 600 organizations includes customers, systems and solutions suppliers, tools vendors, integrators, academics, and consultants across multiple industries.
- The mission of The Open Group is to drive the creation of Boundaryless Information Flow™ achieved by:
- Working with customers to capture, understand, and address current and emerging requirements, establish policies, and share best practices
- Working with suppliers, consortia, and standards bodies to develop consensus and facilitate interoperability, to evolve and integrate specifications and open source technologies
- Offering a comprehensive set of services to enhance the operational efficiency of consortia
- Developing and operating the industry's premier certification service and encouraging procurement of certified products

Boundaryless Information Flow achieved through global interoperability in a secure, reliable, and timely manner is the Open Group's motto.

The Open Group: in its healthcare vertical's Making Standards Work® effort is developing an FHIM Profile Builder to generate HL7 FHIR and CDA information exchanges. (FHIM is the Federated Health Information Model).

The Open Group works with customers and suppliers of technology products and services, and with consortia and other standards organizations to capture, clarify, and integrate current and emerging requirements, establish standards and policies, and share best practices. The Open Group standards ensure openness, interoperability, and consensus.

This presentation summarizes the FHIM Profile builder and its components. The FHIM Profile Builder is important because, HL7 FHIR and Healthcare IT related government policies are rapidly evolving and maturing. Current, FHIR tools are fragmented and require deep expertise of the underlying standard and the details related to information exchange requirements. They are not seamless to use. Also, there is significant implementation variability among seemingly similar FHIR profiles. FHIR implementers often lack standards experience and produce specifications that are ambiguous resulting in poor cross platform interoperability.

Meeting the Open Group Boundaryless Information Flow vision is one of the highest FHIM Profile Builder value propositions, which lies in its ability to efficiently and effectively assist developers and clinical stakeholders, with FHIM-harmonized FHIR resource patterns, to build workflow-specific (without special effort) interoperability components (e.g., FHIR profiles, CDA templates, etc.). This is a big deal!

Why do we need the FHIM and the FHIM Profile Builder?

- One of the highest value propositions for the FHIM lies in its ability to assist developers and clinical stakeholders by building interoperability components, using HL7 FHIR, CDA, V2, etc. which can be used by other developers and stakeholders (without special effort) in their APIs, component's and services.
- FHIR is immensely popular, in large part because it is easy to use and solves the data transfer problem in interoperability.
- However, FHIR, by design, does not ensure that health data that is meaningfully shared in one implementation instance can be meaningfully shared in any other implementations.
- As a result, the widespread adoption of FHIR is producing thousands of profiles that cannot be reused without special effort.
- A FHIM profile builder would assist the FHIR, CDA, V2 communities by producing consistent-reusable standard-based profiles, and thereby help significantly advance interoperability.

FHIM Profile Builder Benefits

The FPB Model Driven Architecture approach addresses both modeling and implementation issues and accelerates creation of FHIR profiles and implementation guides by:

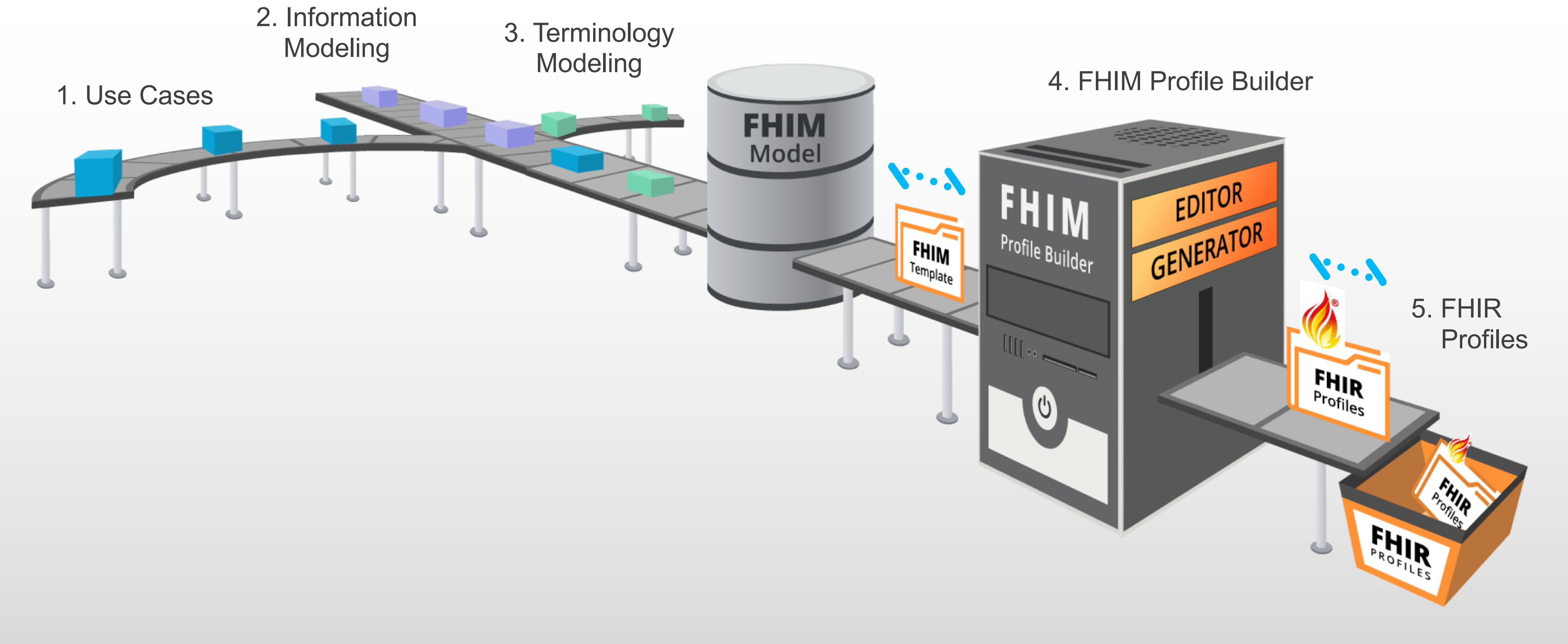
- Providing tools that are easier to use and that
- Generate profiles and guides more efficiently
- With improved accuracy and improved reuse
- Making users more effective and productive
- Reducing implementation variability
- Maintaining traceability to legislation, policies and requirements.

FPB Profile Editor: Future Enhancements

- Allow users to organize their profiles into Implementation Guides
- Use FHIR Implementation Guide resource to store the information in FHIM or an associated FHIR server
- Create FHIR profiles to describe the constraints needed to represent FHIM logical content as FHIR Structure Definition resources using the FHIR API specification (Search, Create, Update operations)
- Examples provided in Github FPB Profile Editor project: https://github.com/FHIMS/FHIMProfileBuilderWeb
- Create a FHIM template based on a another existing FHIM template (e.g., create an organization-specific template from a US-Core specification template)
- Change the base structure from a “class” to a “template”
- Connect the Profile Editor to a FHIR Terminology Server to access existing value sets
- Support changes to value set members and adding terminology constraints to coded information from the FHIM
- Add more options to the Profile Generator in addition to FHIR Profiles Integration with a Terminology Server
- Create a set of FHIM templates corresponding to US Core FHIR profiles
- These pre-loaded templates can then be used to efficiently create extensions to US Core FHIR Profiles that are conformant to the existing US Core FHIR profiles
- A possible Profile Editor enhancement is GoldenLayout at https://golden-layout.com/

THE Open GROUP

FHIM Profile Builder Process



1. Use Cases

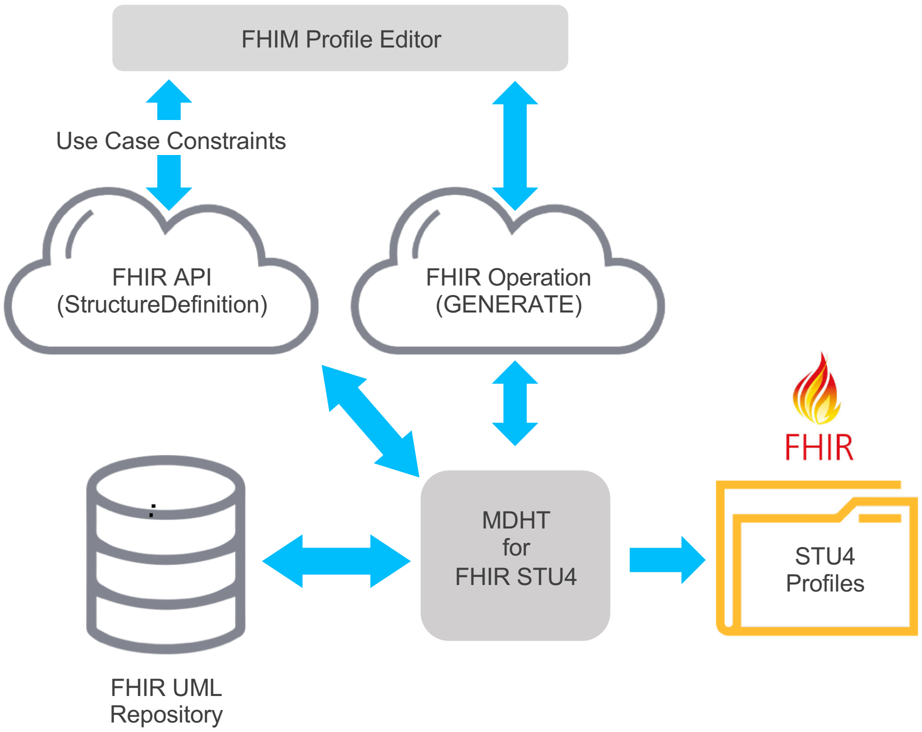
2. Information Modeling

3. Terminology Modeling

4. FHIM Profile Builder

5. FHIR Profiles

FPB 2019 Overview



FPB Editor GET

→ GET: FHIM Element Name

← Return: StructureDefinition

FPB Editor POST: FHIM Template StructureDefinition

→ POST: FHIM Template StructureDefinition

← Return: FHIM Template ID

FPB Editor StructureDefinition/generate

→ GENERATE

← RETURN: FHIR Profile ID/Version

FPB Editor GET: FHIR Profile ID & Version

→ GET: FHIR Profile ID & Version

← Return: FHIR Profile

FHIM Profile Builder™
FPB Editor

fhim

Federated Health Information Model

FPB: Profile editor overview

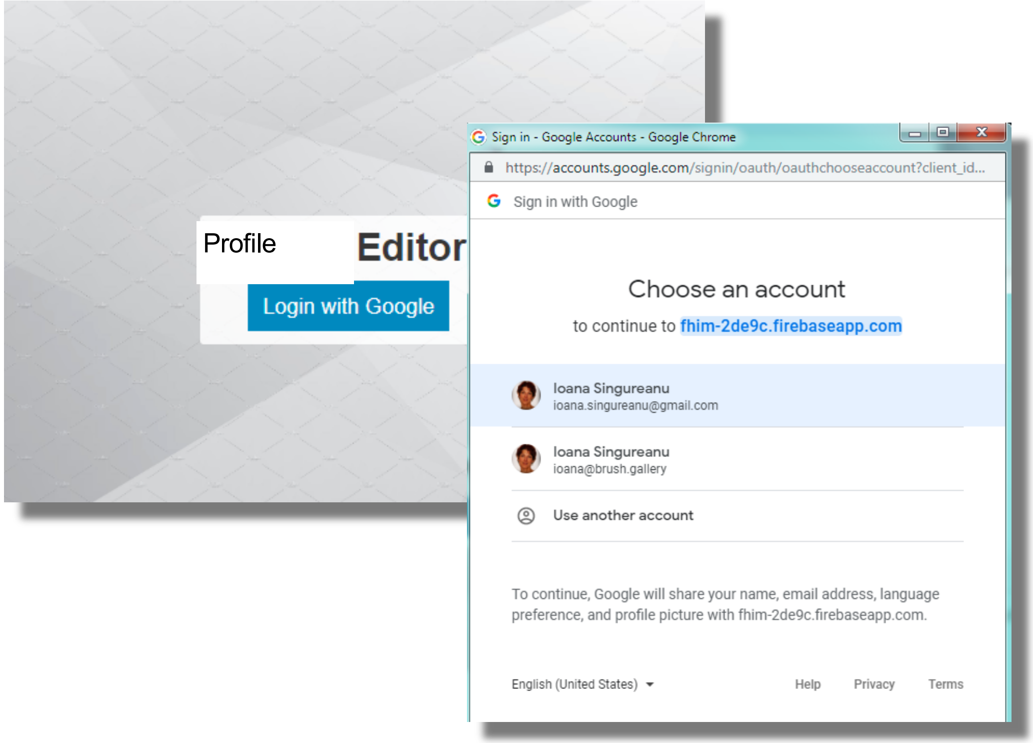
- A component of the FHIM Profile Builder
- A web-based tool intended for business analysts and integrators (users)
- It allows users to identity what data elements are necessary to fulfill one or more interoperability use cases and define the contents of a standard-based transaction or resource
- The user may create a FHIM Template by retrieving a FHIM class and identifying which data elements are mandatory, supported, or not supported according to their implementation requirements/use cases
- The user can save a template for further editing or
- The user can invoke the FHIM Profile Generator to create a FHIR profile based on the data elements in the template

Login screen

- Google OAuth2 developer SDK (firebase)

Future enhancement:

- This capability should reuse Open Group authorization server intended to give members access to tools and resources


Profile
Editor
Login with Google
Sign in - Google Accounts - Google Chrome
https://accounts.google.com/signin/oauth/oauthchooseaccount?client_id...
Sign in with Google

Choose an account

to continue to fhim-2de9c.firebaseapp.com

Ioana Singureanu
ioana.singureanu@gmail.com

Ioana Singureanu
ioana@brush.gallery

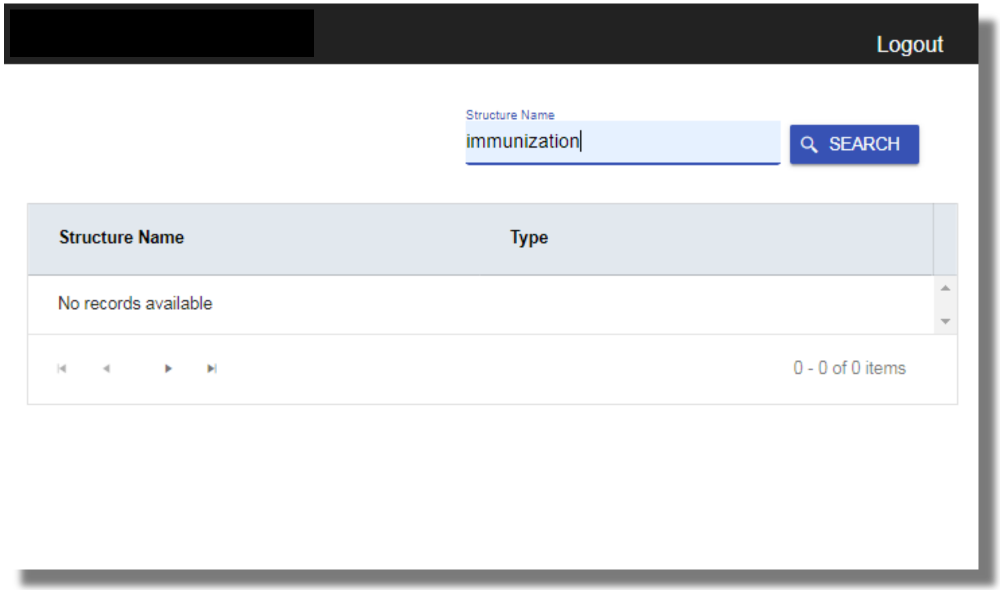
Use another account

To continue, Google will share your name, email address, language preference, and profile picture with fhim-2de9c.firebaseapp.com.

English (United States)
Help
Privacy
Terms

Search Screen

- Enter a “structure name” to search classes and templates defined in FHIM
- The search string will use the structure name:
- Class name
- A composite name for Template
- Base class name
- Organization
- Template title
- Template version


[redacted]

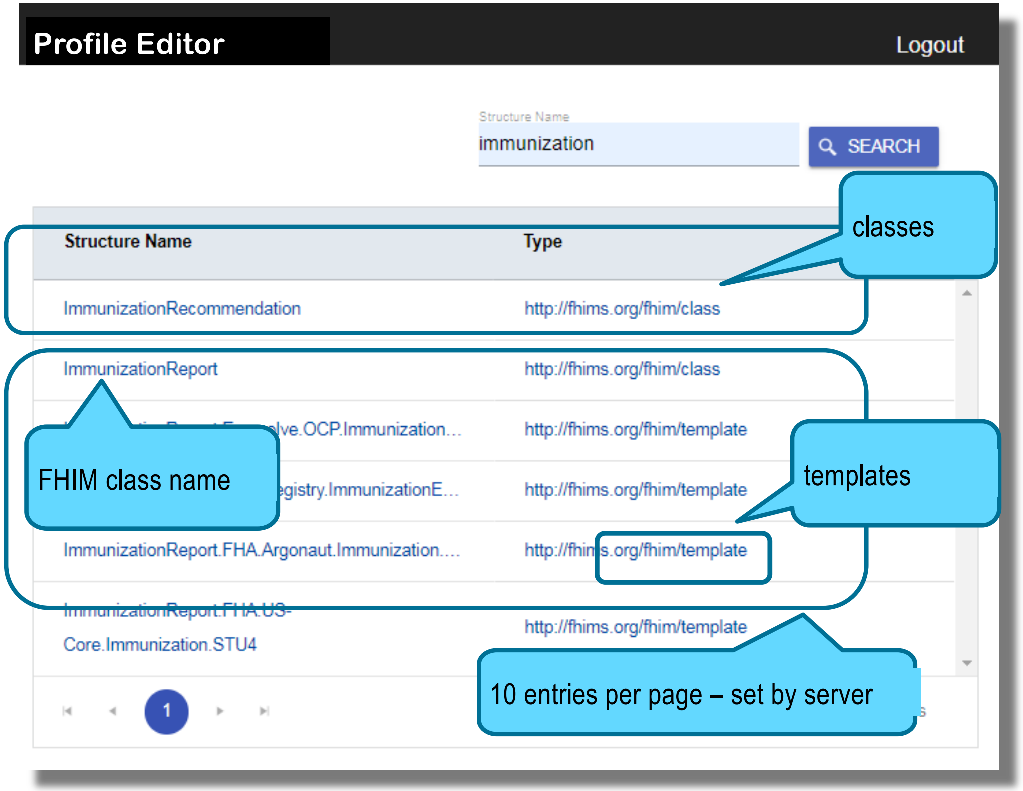
Structure Name
immunization

Structure Name	Type
No records available	

0 - 0 of 0 items

Profile Editor

- The structured returned from the server are displayed by “structure name” and “type”
- They can be sorted by those columns
- By default they are all sorted by class name
- This way the users can find everything related to the specific class with one query
- The structure name consists of The class name if the type is “class” or
- A composite name if the type of structure is “template”
- Base class name (E.g. `ImmunizationReport`)
- Organization (e.g `FHA`)
- Implementation Guide (e.g. `US-Core, Argonaut, CRN`)
- Template title (e.g. `Immunization`)
- Template version (e.g. `STU4, 1.1`, etc.)

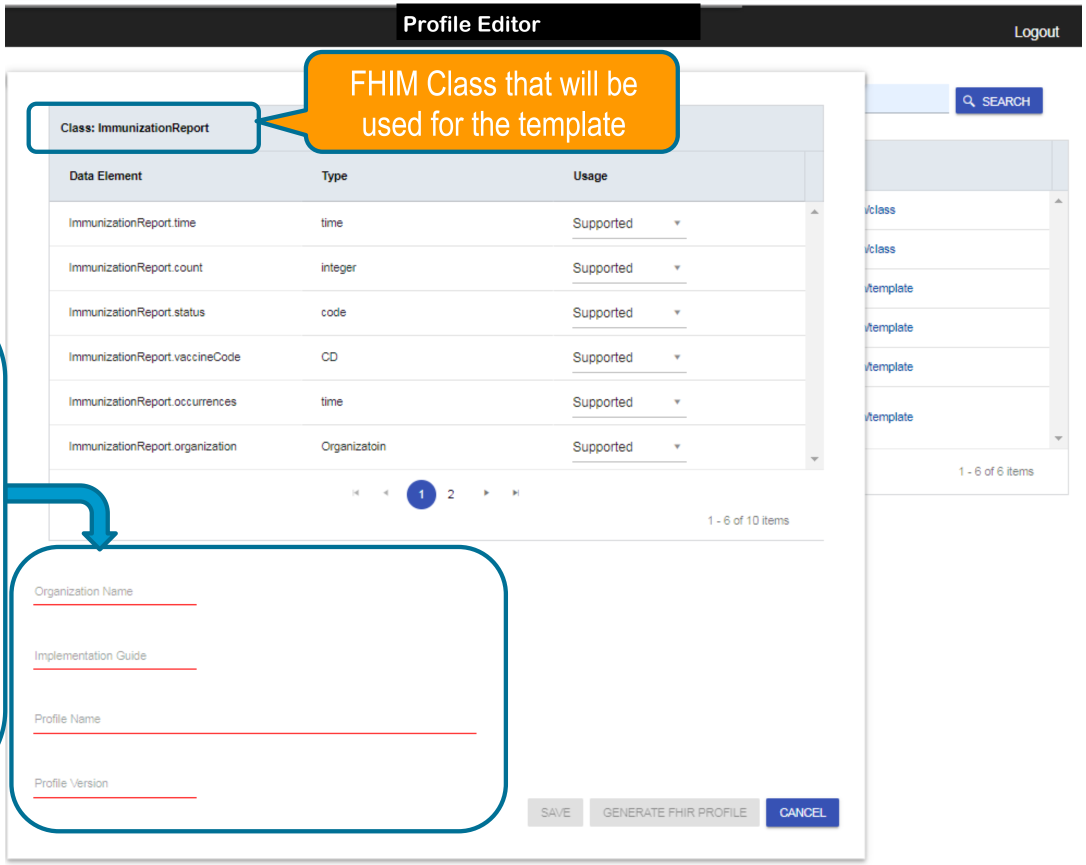


Structure Name	Type
ImmunizationRecommendation	http://fhims.org/fhim/class
ImmunizationReport	http://fhims.org/fhim/class
lve.OCP.Immunization...	http://fhims.org/fhim/template
gistry.ImmunizationE...	http://fhims.org/fhim/template
ImmunizationReport.FHA.Argonaut.Immunization....	http://fhims.org/fhim/template
ImmunizationReport.FHA.US-Core.Immunization.STU4	http://fhims.org/fhim/template

Create a template from a FHIM class

If the user selects a **class** from the list, the user may edit “usage” and metadata:

- Organization responsible for the project, implementation guide, and profile
- Implementation Guide that contains the template
- Template title
- Template version



FHIM Class that will be used for the template

Class: ImmunizationReport

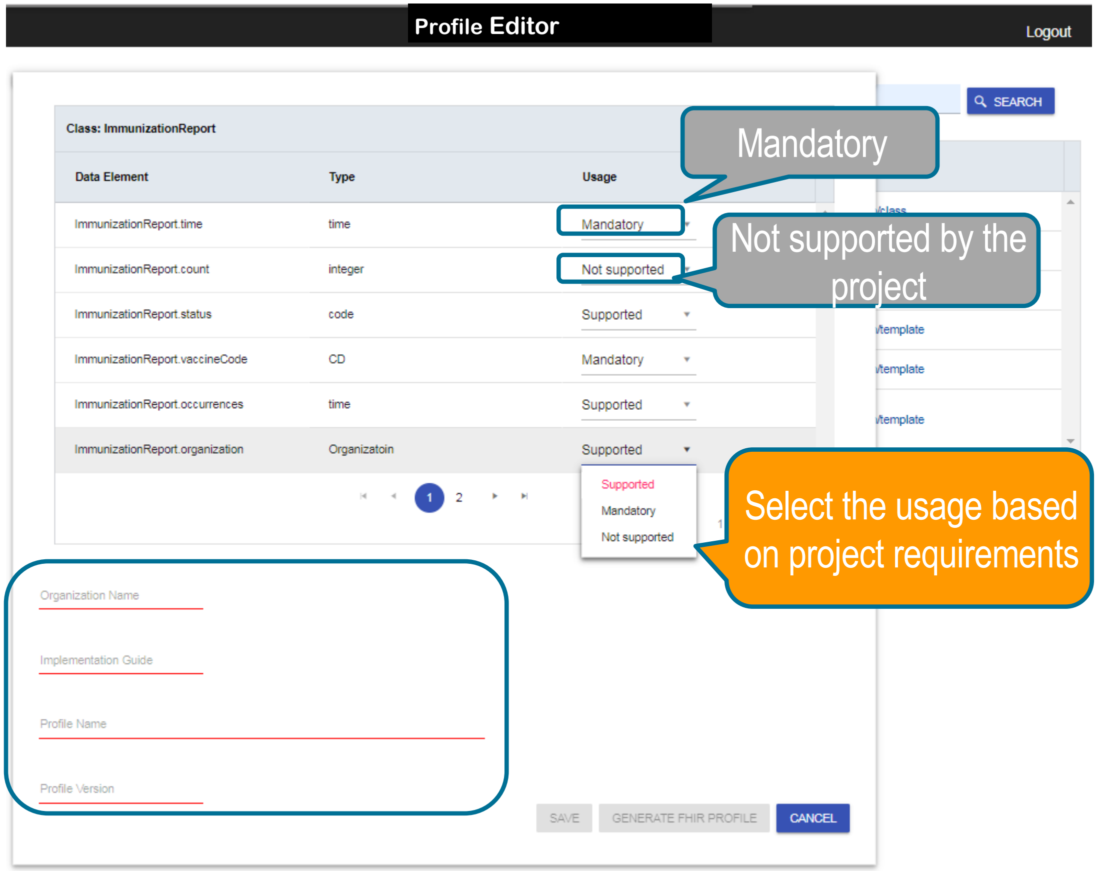
Data Element	Type	Usage
ImmunizationReport.time	time	Supported
ImmunizationReport.count	integer	Supported
ImmunizationReport.status	code	Supported
ImmunizationReport.vaccineCode	CD	Supported
ImmunizationReport.occurrences	time	Supported
ImmunizationReport.organization	Organizatoin	Supported

1 - 6 of 10 items

Create a template from a FHIM class

- If the user identifies which data element/attributes of the FHIM class are either mandatory, supported, or not required or prohibited (not supported).

- The Save button is disabled until the metadata is filled out →



Class: ImmunizationReport

Data Element	Type	Usage
ImmunizationReport.time	time	Mandatory
ImmunizationReport.count	integer	Not supported
ImmunizationReport.status	code	Supported
ImmunizationReport.vaccineCode	CD	Mandatory
ImmunizationReport.occurrences	time	Supported
ImmunizationReport.organization	Organizatoin	Supported

Organization Name

Implementation Guide

Profile Name

Profile Version

Mandatory

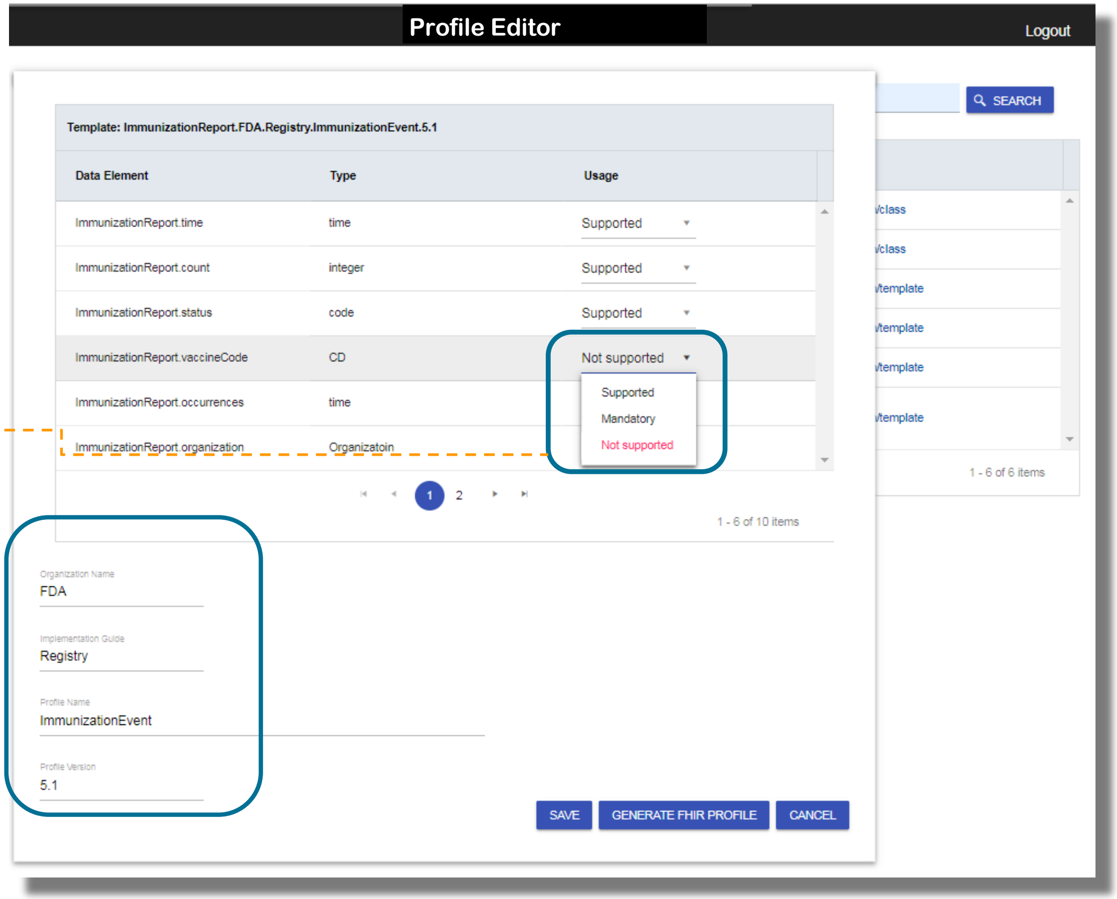
Not supported by the project

Select the usage based on project requirements

Edit a template

If the user selects a template from the list of matching results, the user may edit "usage" and metadata:

- Organization
- Implementation Guide that contains the template
- Template title
- Template version



Template: ImmunizationReport.FDA.Registry.ImmunizationEvent.5.1

Data Element	Type	Usage
ImmunizationReport.time	time	Supported
ImmunizationReport.count	integer	Supported
ImmunizationReport.status	code	Supported
ImmunizationReport.vaccineCode	CD	Not supported
ImmunizationReport.occurrences	time	
ImmunizationReport.organization	Organizatoin	

Organization Name: FDA

Implementation Guide: Registry

Profile Name: ImmunizationEvent

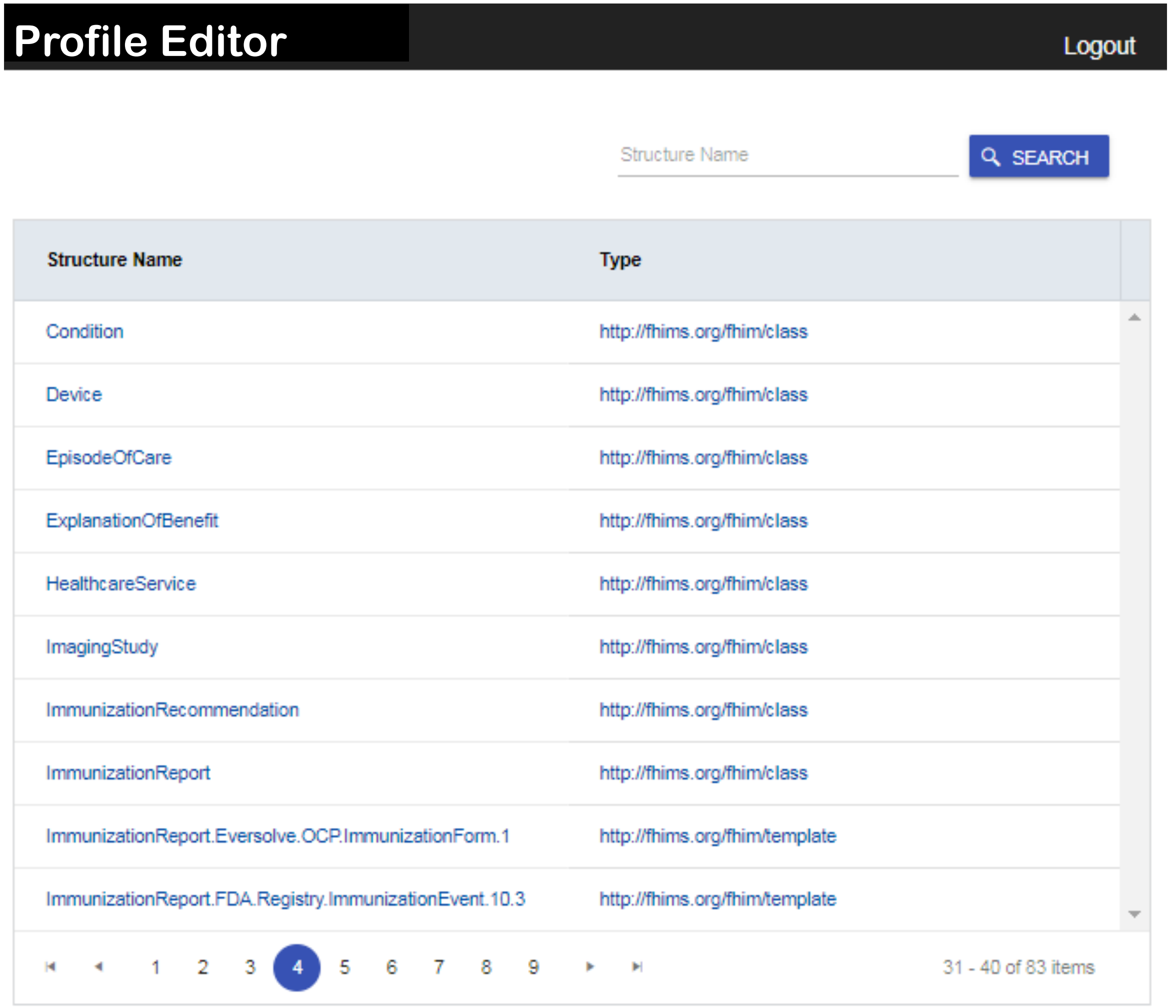
Profile Version: 5.1

Search – after saving a template

- If the search string is left blank, all the structures will be queried and displayed in alphabetical order, by structure name
- Template structure names contain the base class
- After saving changes, a search operation will retrieve the latest.

Future enhancement:

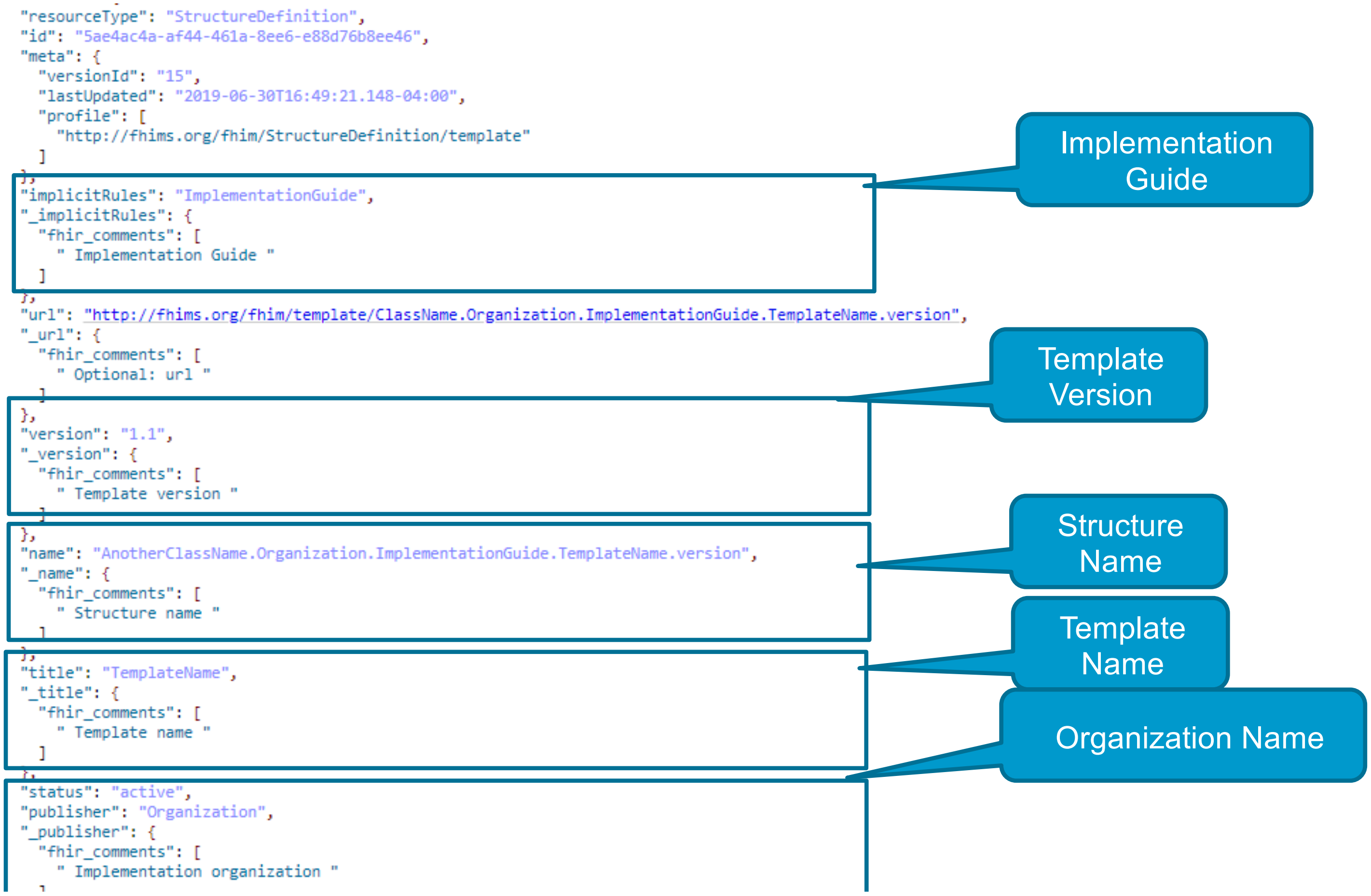
- Each update creates a new version, future enhancements may access previous versions of a template



Structure Name	Type
Condition	http://fhims.org/fhim/class
Device	http://fhims.org/fhim/class
EpisodeOfCare	http://fhims.org/fhim/class
ExplanationOfBenefit	http://fhims.org/fhim/class
HealthcareService	http://fhims.org/fhim/class
ImagingStudy	http://fhims.org/fhim/class
ImmunizationRecommendation	http://fhims.org/fhim/class
ImmunizationReport	http://fhims.org/fhim/class
ImmunizationReport.Eversolve.OCP.ImmunizationForm.1	http://fhims.org/fhim/template
ImmunizationReport.FDA.Registry.ImmunizationEvent.10.3	http://fhims.org/fhim/template

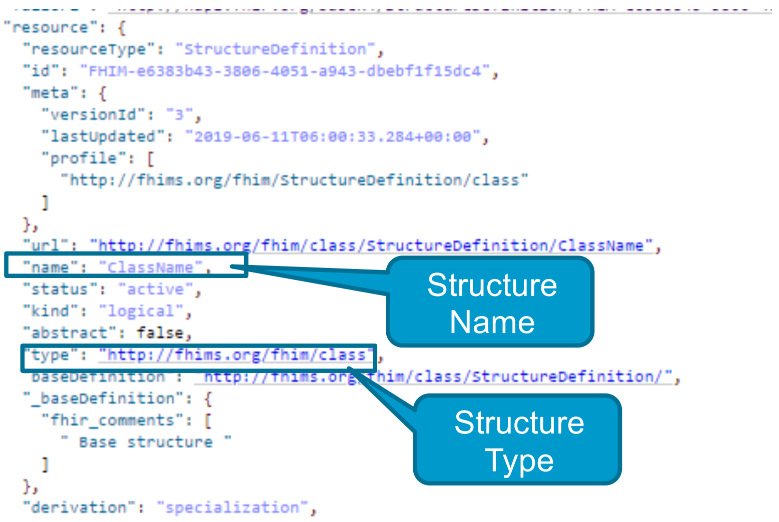
31 - 40 of 83 items

FHIM Template as a StructureDefinition

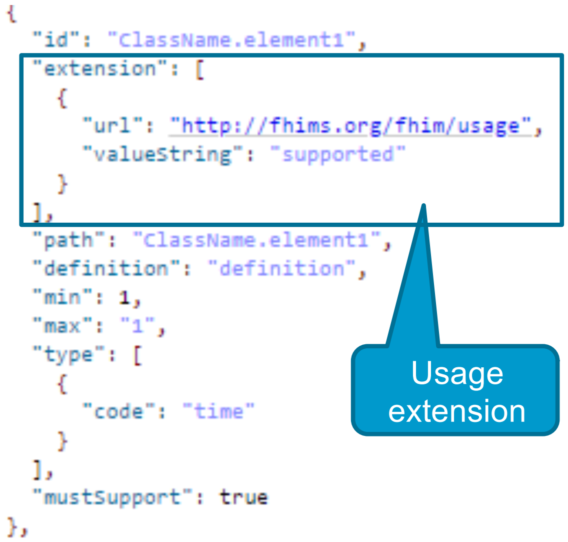


```
"resourceType": "StructureDefinition",
"id": "5ae4ac4a-af44-461a-8ee6-e88d76b8ee46",
"meta": {
  "versionId": "15",
  "lastUpdated": "2019-06-30T16:49:21.148-04:00",
  "profile": [
    "http://fhims.org/fhim/StructureDefinition/template"
  ]
},
"implicitRules": "ImplementationGuide",
"_implicitRules": {
  "fhir_comments": [
    " Implementation Guide "
  ]
},
"url": "http://fhims.org/fhim/template/ClassName.Organization.ImplementationGuide.TemplateName.version",
"_url": {
  "fhir_comments": [
    " Optional: url "
  ]
},
"version": "1.1",
"_version": {
  "fhir_comments": [
    " Template version "
  ]
},
"name": "AnotherClassName.Organization.ImplementationGuide.TemplateName.version",
"_name": {
  "fhir_comments": [
    " Structure name "
  ]
},
"title": "TemplateName",
"_title": {
  "fhir_comments": [
    " Template name "
  ]
},
"status": "active",
"publisher": "Organization",
"_publisher": {
  "fhir_comments": [
    " Implementation organization "
  ]
```

FHIM Class as a StructureDefinition (FHIR R3, R4)



```
"resource": {
  "resourceType": "StructureDefinition",
  "id": "FHIM-e6383b43-3806-4051-a943-dbebf1f15dc4",
  "meta": {
    "versionId": "3",
    "lastUpdated": "2019-06-11T06:00:33.284+00:00",
    "profile": [
      "http://fhims.org/fhim/StructureDefinition/class"
    ]
  },
  "url": "http://fhims.org/fhim/class/StructureDefinition/ClassName",
  "name": "ClassName",
  "status": "active",
  "kind": "logical",
  "abstract": false,
  "type": "http://fhims.org/fhim/class",
  "baseDefinition": "http://fhims.org/fhim/class/StructureDefinition/",
  "_baseDefinition": {
    "fhir_comments": [
      " Base structure "
    ]
  },
  "derivation": "specialization",
```



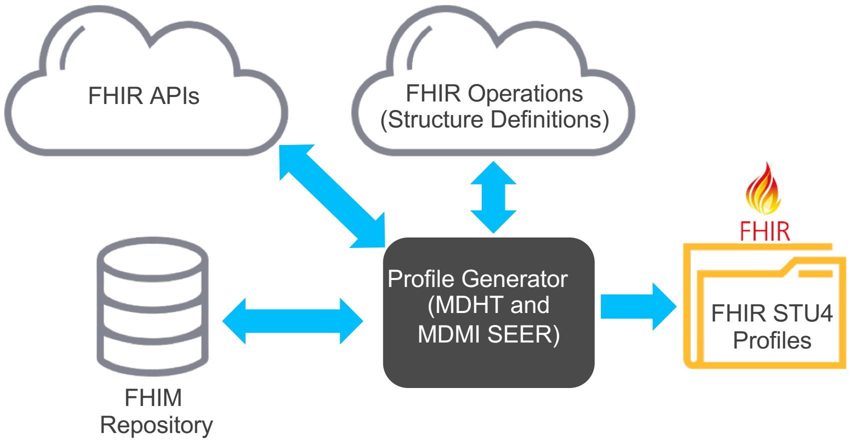
```
{
  "id": "ClassName.element1",
  "extension": [
    {
      "url": "http://fhims.org/fhim/usage",
      "valueString": "supported"
    }
  ],
  "path": "ClassName.element1",
  "definition": "definition",
  "min": 1,
  "max": "1",
  "type": [
    {
      "code": "time"
    }
  ],
  "mustSupport": true
},
```

FHIM Profile Builder™
FPB Generator

fhim

Federated Health Information Model

FPB Profile Generator Overview


FHIR APIs
FHIR Operations (Structure Definitions)
FHIR
Profile Generator (MDHT and MDMI SEER)
FHIM Repository
FHIR STU4 Profiles

1) FPB Editor GET from FHIM Repository

→ **GET**: FHIM Element Name

⇠ **Return**: StructureDefinition

2) FPB Editor POST to FHIM Repository

→ **POST**: FHIM Template StructureDefinition

⇠ **Return**: FHIM Template ID

3) FPB Editor GENERATE to Profile Generator

→ **GENERATE** (FHIM Template ID)

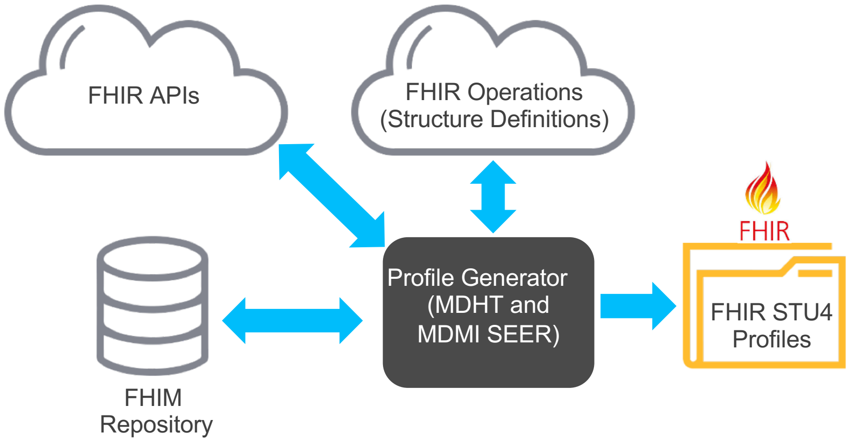
⇠ **RETURN:** FHIR Profile ID/Version

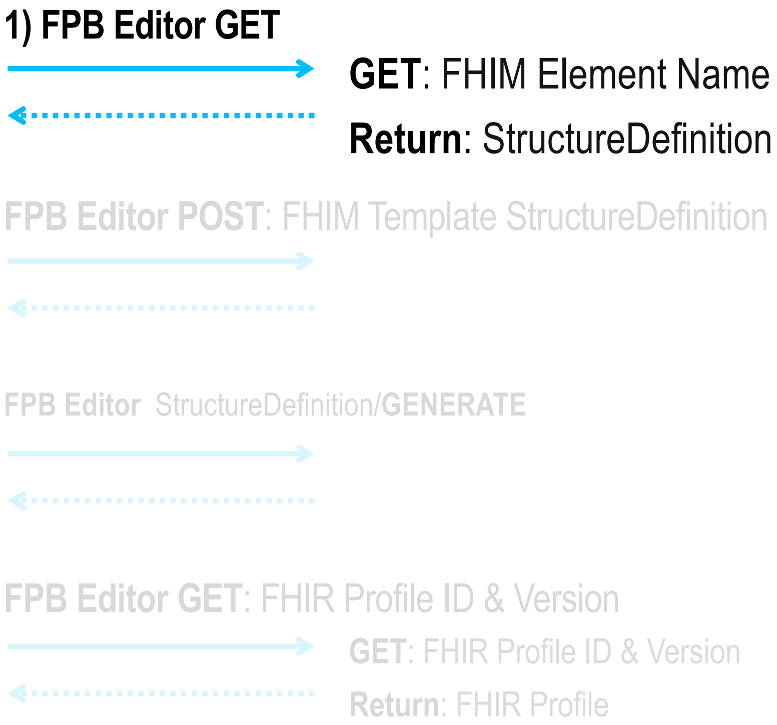
4) FPB Editor GET from Profile Generator

→ **GET**: FHIR Profile ID & Version

⇠ **Return**: FHIR Profile

FPB Profile Generator: Get by Name Service


FHIR APIs
FHIR Operations (Structure Definitions)
FHIR
Profile Generator (MDHT and MDMI SEER)
FHIR STU4 Profiles
FHIM Repository


1) FPB Editor GET

GET: FHIM Element Name

Return: StructureDefinition

FPB Editor POST: FHIM Template StructureDefinition

FPB Editor StructureDefinition/**GENERATE**

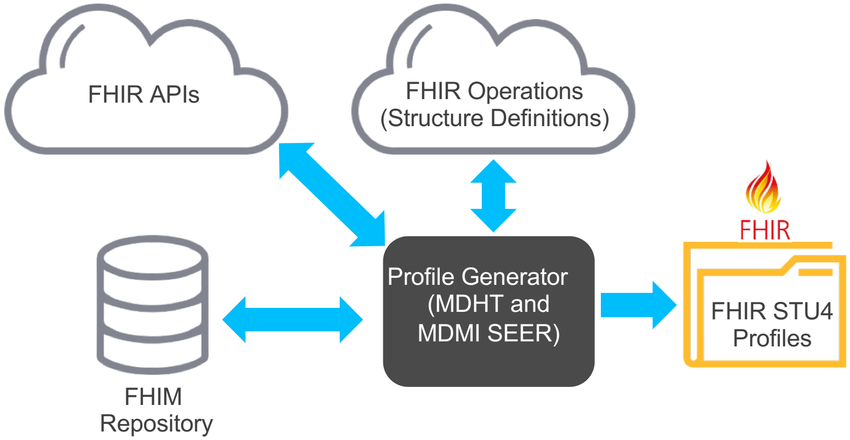
FPB Editor GET: FHIR Profile ID & Version

GET: FHIR Profile ID & Version

Return: FHIR Profile

STEP 1: To FHIM GET by Name Service	Step 1: From FHIM GET by Name Service
FHIM Element Name	Corresponding FHIM Element(s) based on name as collection of Structured Definitions

FPB Profile Generator : Post Service


FHIR APIs
FHIR Operations (Structure Definitions)
Profile Generator (MDHT and MDMI SEER)
FHIM Repository
FHIR
FHIR STU4 Profiles

1) FPB Editor GET

GET: FHIM Element Name

Return: StructureDefinition

2) FPB Editor POST to Profile Generator

POST: FHIM Template StructureDefinition

Return: FHIM Template ID

FPB Editor StructureDefinition/GENERATE

GENERATE

RETURN: FHIR Profile ID/Version

FPB Editor GET: FHIR Profile ID & Version

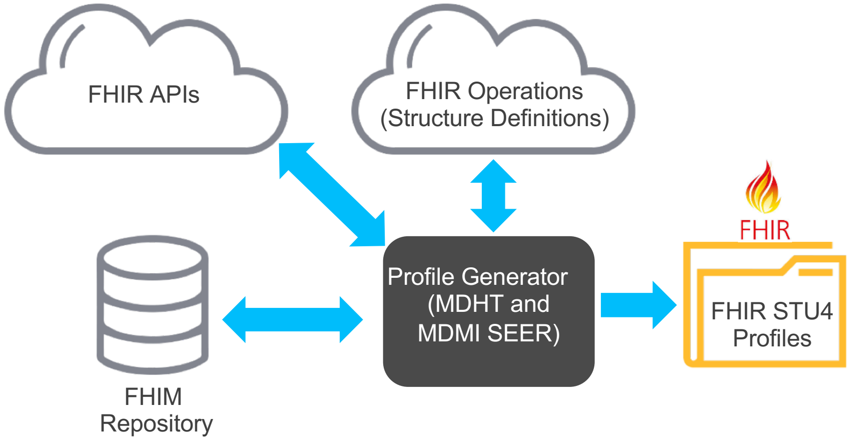
GET: FHIR Profile ID & Version

Return: FHIR Profile

STEP 2: To Profile Generator Post Service	Step 2: From Profile Generator Post Service
FHIM Template Structure Definition	FHIM Template ID

Classification: Unrestricted

FPB Profile Generator : Generate Service



FPB Editor GET

→ **GET**: FHIM Element Name

← **Return**: StructureDefinition

2). FPB Editor POST: FHIM Template StructureDefinition

→ **POST**: FHIM Template StructureDefinition

← **Return**: FHIM Template ID

3) FPB Editor GENERATE

→ **GENERATE**

← **RETURN:** FHIR Profile ID/Version

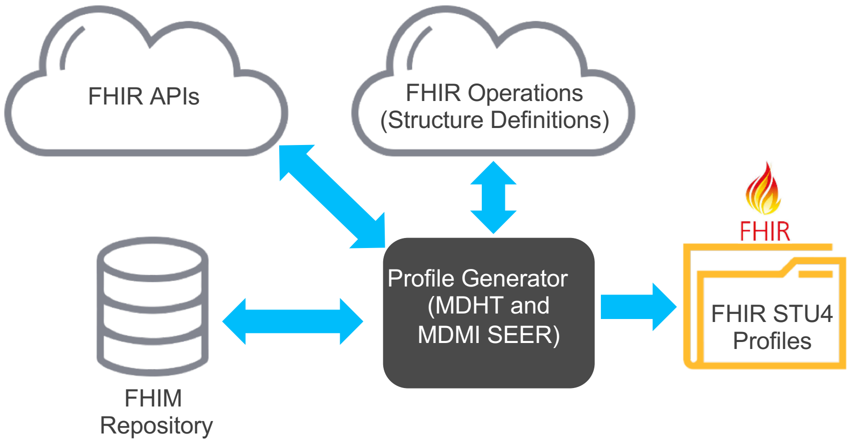
FPB Editor GET: FHIR Profile ID & Version

→ **GET**: FHIR Profile ID & Version

← **Return**: FHIR Profile

STEP 3: To Generate Service	STEP 3: From Generate Service
FHIM Template ID	FHIR Profile ID

FPB Profile Generator : Generate Sub-processes



FHIR APIs

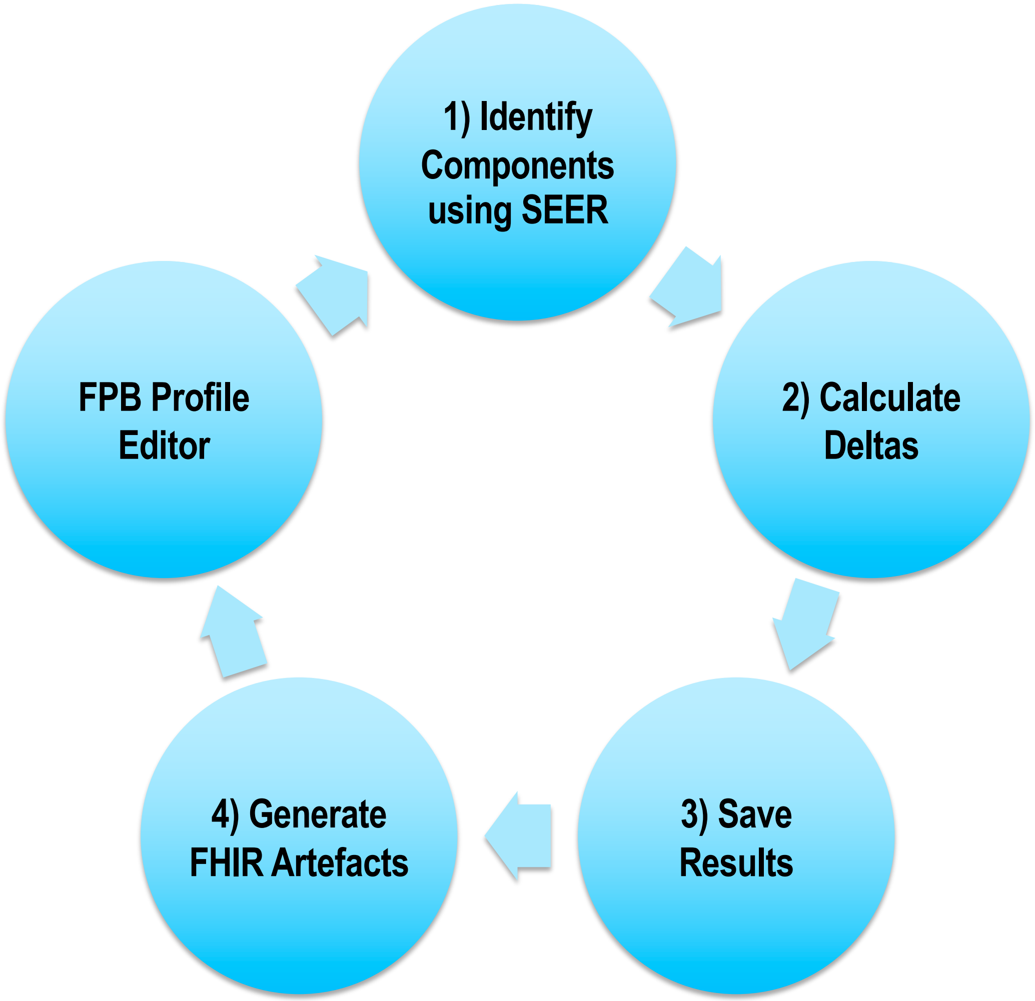
FHIR Operations (Structure Definitions)

FHIM Repository

Profile Generator (MDHT and MDMI SEER)

FHIR

FHIR STU4 Profiles



1) Identify Components using SEER

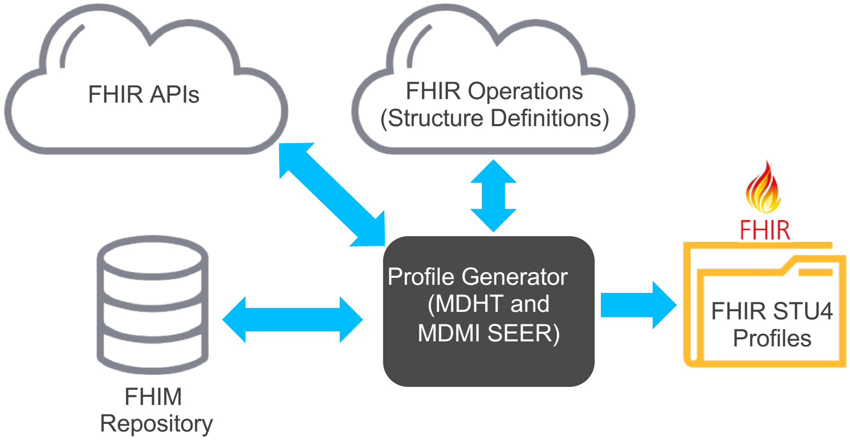
2) Calculate Deltas

3) Save Results

4) Generate FHIR Artefacts

FPB Profile Editor

FPB Profile Generator : GET by ID Service


FHIR APIs
FHIR Operations (Structure Definitions)
FHIM Repository
Profile Generator (MDHT and MDMI SEER)
FHIR
FHIR STU4 Profiles

STEP 4: To Generator GET by ID Service	STEP 4: From Generator Get by ID Service
FHIR Profile ID	FHIR Profile as Structure Definition

FPB Editor GET

GET: FHIM Element Name

Return: StructureDefinition

2). FPB Editor POST: FHIM Template StructureDefinition

POST: FHIM Template StructureDefinition

Return: FHIM Template ID

3) FPB Editor StructureDefinition/**GENERATE**

GENERATE

RETURN: FHIR Profile ID/Version

FPB Editor GET

GET: FHIR Profile ID & Version

Return: FHIR Profile

Classification: Unrestricted

Comparison of US Core and FPB Generated FHIR Profiles

- Task: Using the FHIM Profile Builder Model Driven Architecture approach, generate the equivalent of US Core FHIR profiles (that were originally developed manually)
- Objective: Validate that the FHIM and FPB modeling services can produce high quality, accurate and consistent FHIR profiles that are equivalent to US Core FHIR profiles.
- Use Case: The Immunization for US Core FHIR profile. This profile sets the minimum expectations for the Immunization resource to record, fetch and search immunization history associated with a patient. It identifies which core elements, extensions, vocabularies and value sets SHALL be present in the resource when using this profile.
- Usage scenarios: for the US Core FHIR Immunization profile are:
  - Query for immunizations belonging to a Patient
  - Record immunizations belonging to a Patient
- Conclusion: The FPB generated FHIR profiles duplicate the intent and semantics of the original US Core FHIR profiles. Every element detailed in US Core FHIR Profiles were replicated by the FHIM generated version.

Comparison of US Core and FPB Profiles
Using US Core FHIR Exchange Requirements for Immunizations

FHIR US Core Immunization Element	FHIM Vaccination Event Element	Congruent
status	status	**Yes**
statusReason	statusReason	**Yes**
vaccineCode	vaccineCode	**Yes**
patient	patient	**Yes**
occurrenceDateTime	dateTime	**Yes**
primarySource	source	**Yes**

Conclusions

- FHIM Profile Builder (FPB) will reduce implementation variability a thereby increasing interoperability.
- FBP can generate US Core profiles and extensions
- FPB can generate CDA and other implementations
- FPB is efficient and effective
- FPB is a faster, better and cheaper approach to creating FHIR, CDA and other implementation paradigm profiles and extensions.
- You are invited to participate in FPB evolution and use!

Classification: Unrestricted

FHIM Profile Builder Point of Contact

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✉ j.lee@opengroup.org

☎ (774) 444-0880

@jasonsleephd

Thank You and Please Participate

Glossary

- Binding is the association of a medical term with a terminology or code system or value set, such as SNOMED, LOINC, RxNorm terminology and codes.
- Classes: (in information modeling) sets, collections, concepts, types of objects, or kinds of things.
- Domain: a set of classes, attributes and relationships that describe a subject area.
- Domain Model: a conceptual model of a system which describes the various entities involved in that system and their relationships. In UML modeling, a class diagram is used to represent the domain model.
- Element: an item in a UML information model (e.g., class, data attribute, relationship, etc.).
- Information Model: (in software engineering) a representation of concepts, relationships, constraints, rules and operations to specify data semantics for a chosen domain of discourse. It can provide sharable, stable, and organized structure of information requirements for the domain context.
- Logical Information Model: (in systems engineering) a representation of information, organized in terms of classes and relationships and is independent of any particular technology (database) platform. The logical information model can become the basis of a physical data model and inform the design of a database. Logical information and physical data models are very different in their objectives, goals and content.
- Physical Data Model: a representation of a data design which takes into account the facilities and constraints of a given database management system.
- Reusable: implies that an IT component has been modularized, standardized and tested so that it can be efficiently and effectively used, in similar contexts, by others.
- Semantic Data Model: (in software engineering) a data modeling technique to define the meaning of data within the context of its interrelationships with other data. A semantic data model is an abstraction which defines how the stored symbols relate to the real world. A semantic data model is sometimes called a conceptual data model.
- Terminology: is the study of terms and their use. Terminology denotes a formal discipline which systematically studies the labeling or designating of concepts particular to one or more subject areas of human activity, through research and analysis of terms in context, for the purpose of documenting and promoting correct usage.