How to read a FHIR implementation guide & the benefits for software developers

17.09.2024 - EPR Projectathon, Bern

ahdis
making health data agile

Agenda

- **What is a FHIR implementation guide**
  - IGs for guidance on using FHIR in specific use cases
  - Content of an IG
- **How to read a FHIR implementation guide**
  - How to navigate in an IG and where to find what
- **FHIR implementation guides benefits for software developers**
  - IGs as a computable specification
  - Feedback and improvement
- **Q & A**
- **Supporting information**
  - Understanding some of the artifacts/profiling concepts of an IG
  - Further links

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What is a FHIR implementation guide

FHIR

Resources & APIs

- **FHIR® is a standard for health care data exchange, published by HL7®.**
  - F   Fast
  - H   Healthcare
  - I   Interoperability
  - R   Resources

- **FHIR contains two primary components:**
  - Resources: a collection of information models that define the data elements, constraints and relationships for the "business objects"
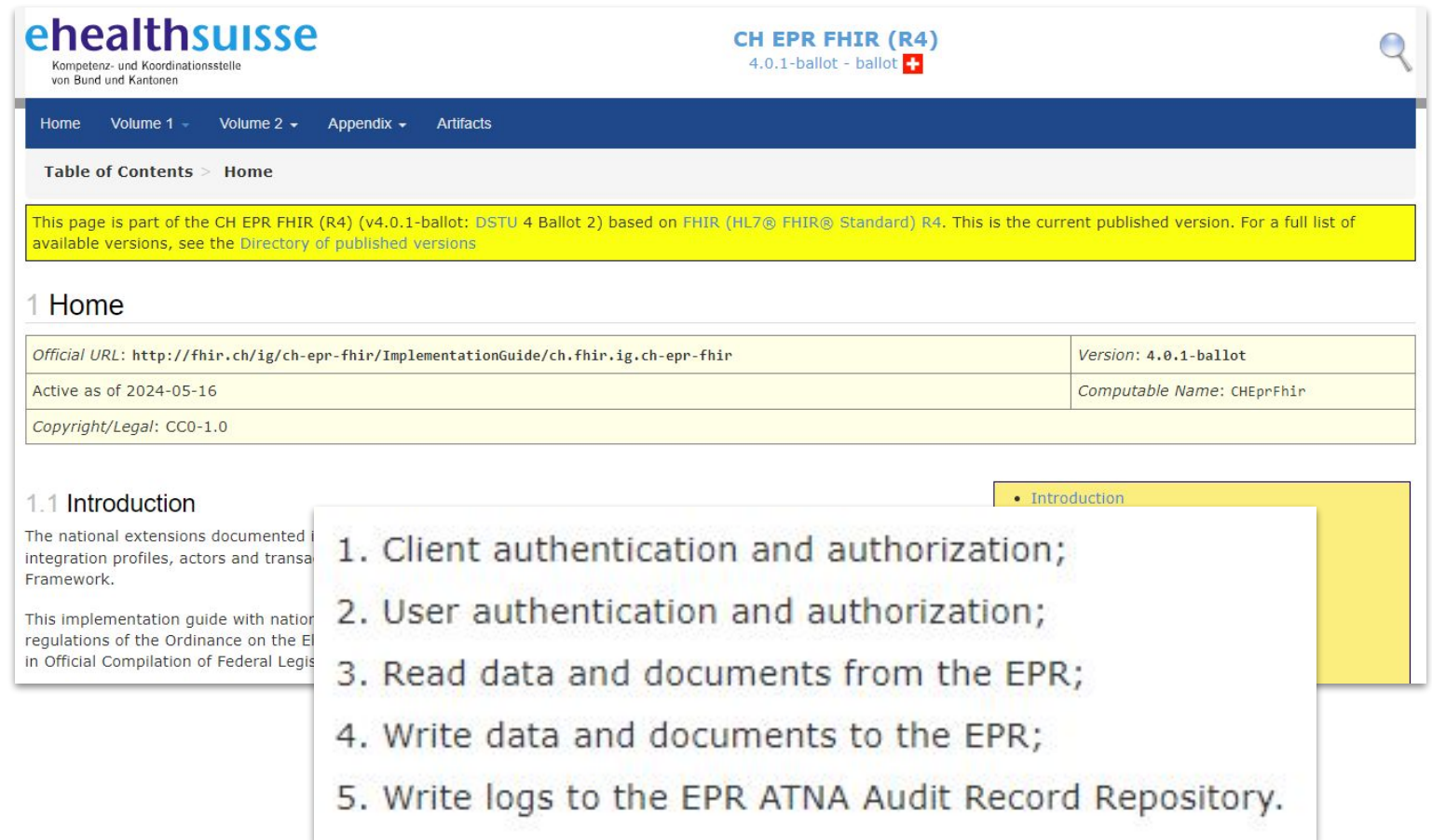 - APIs: a collection of well-defined interfaces for interoperating between two applications.

FHIR IG

Formal definition

- **A FHIR implementation guide (IG)** is a set of rules about how FHIR resources are used to solve a particular problem, with associated documentation to support and clarify the usage.

- **ImplementationGuide** is a resource (like almost everything in FHIR), which is used to gather all the parts of an implementation guide into a logical whole and to publish a computable definition of all the parts.

FHIR IG

A published specification on how FHIR is applied for a given use case

FHIR IG

Content

- IGs contain **documentation** (html, png, …).

- IGs contain **conformance resources:** A set of logical statements which implementations must conform to.

- IGs contain **examples:** Instances that illustrate the intent of the profiles defined in the implementation guide.

https://hl7.org/fhir/R4/implementationguide.html

FHIR IG

Content
(common artifacts,
no complete list)

- **Behavior: Capability Statements, Search Parameters**
  - Rules about which API features are used, and how
- **Structures: Profiles (Resources, Data Types), Extensions**
  - Rules about which resource elements are or are not used, and what additional elements are added that are not part of the base specification (80/20 rule)
- **Terminology: Value Sets, Code Systems**
  - Rules about which terminologies are used in particular elements
- **Example: Example Instances**
  - Helpful entry point to understand the implementation of the use case in FHIR

https://hl7.org/fhir/R4/implementationguide.html

FHIR IG

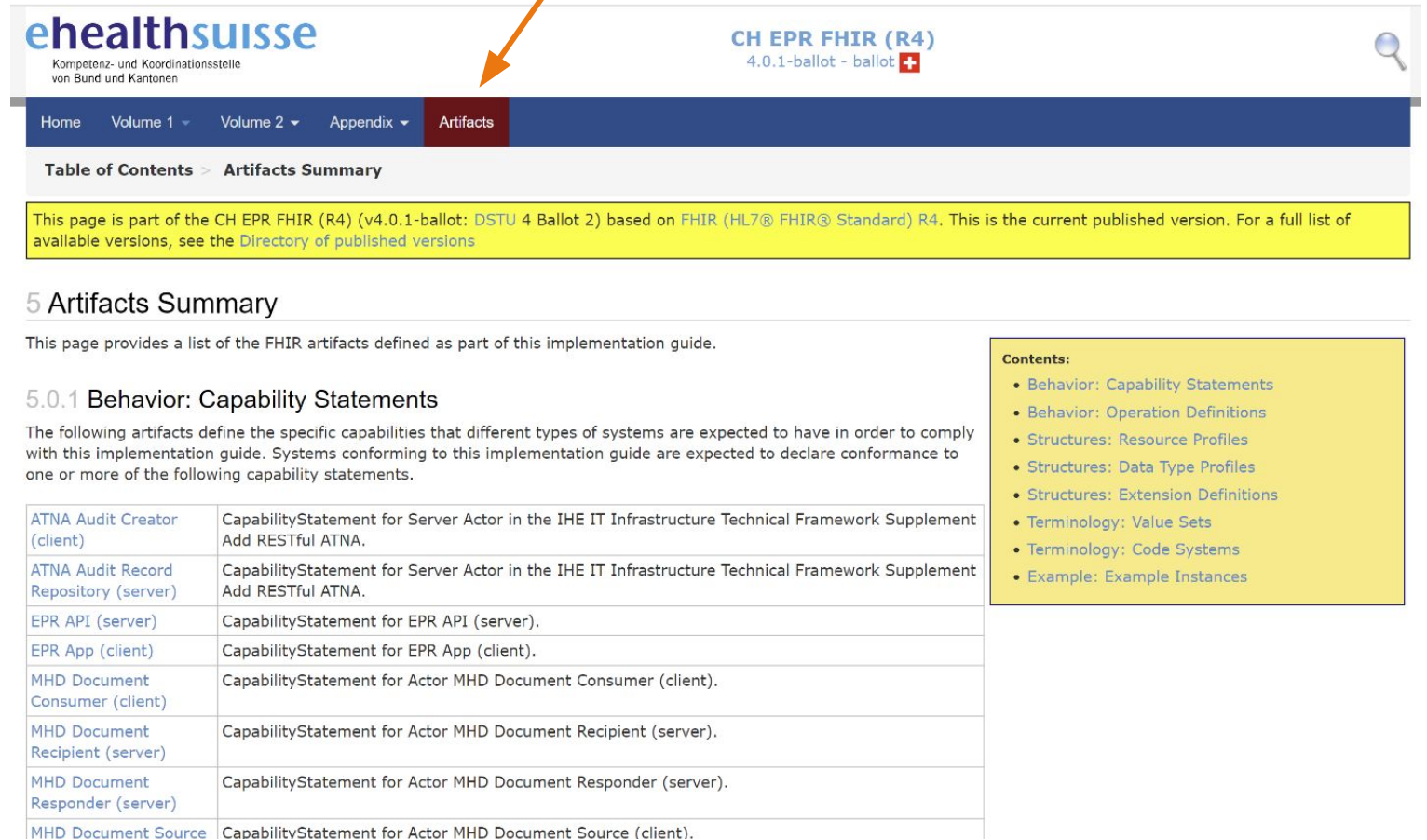Content overview
- Behavior
- Structures
- Terminology
- Example
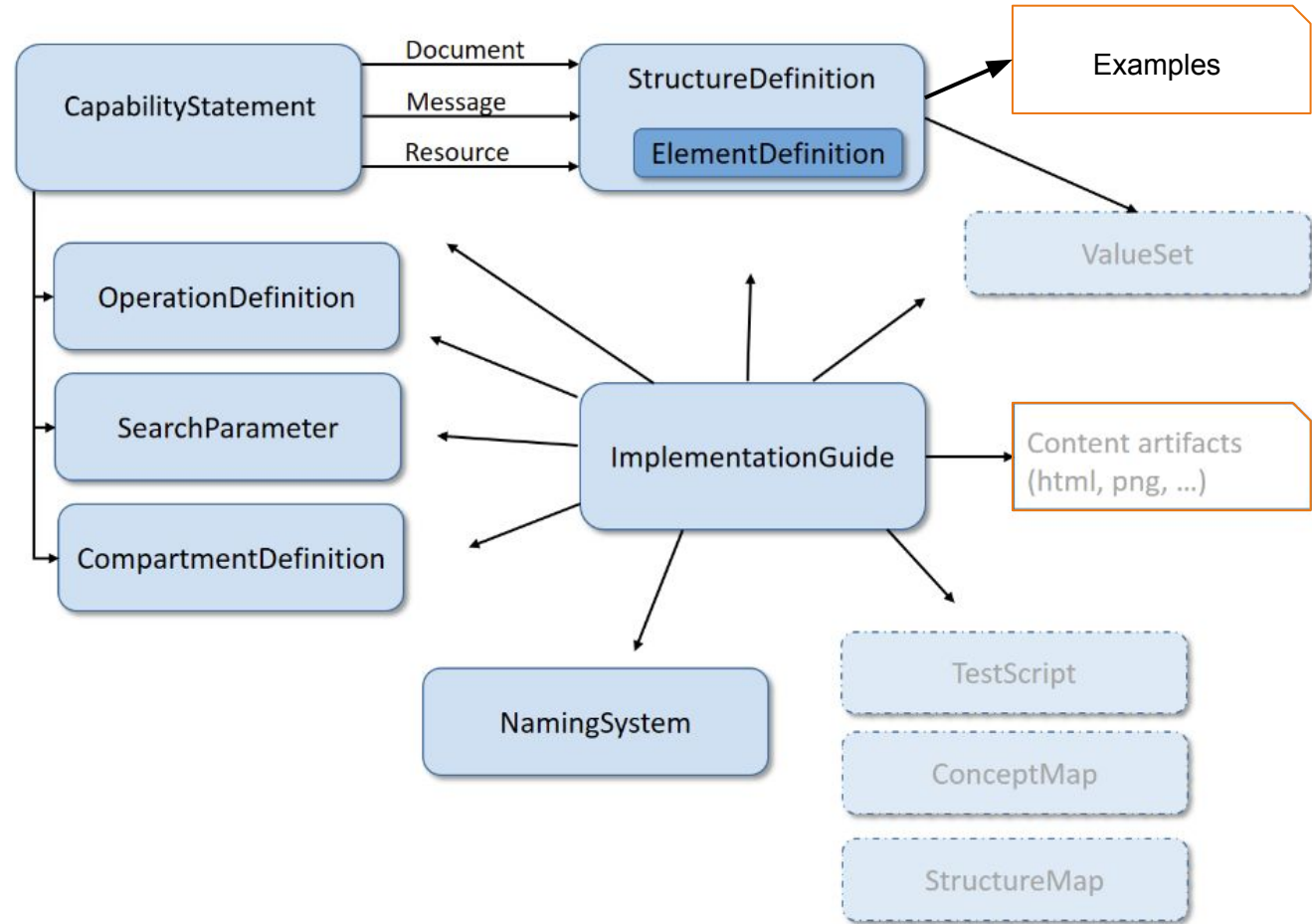
FHIR IG

You will find an artifact list in the IG, but this is not the easiest way to get familiar with an IG.

Let's find a better way!

How to read a FHIR implementation guide

Navigation
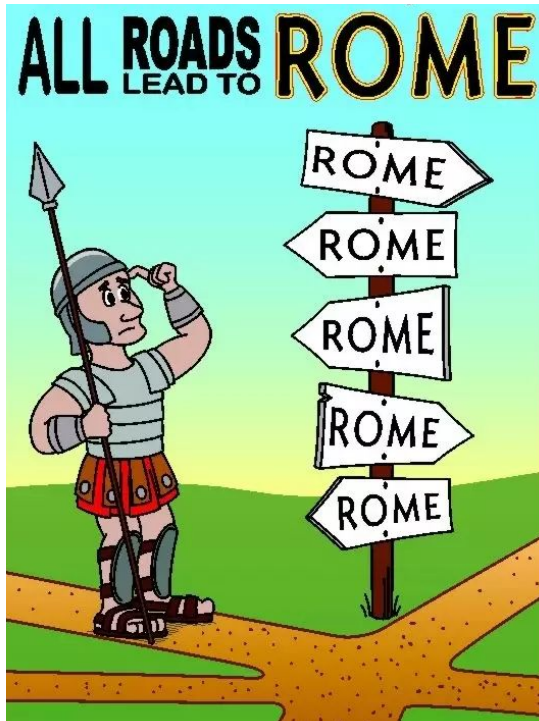
- Many implementation guides have a **similar structure**, which can make navigating them easier.
- Thanks to the HTML format, many elements are **interlinked** (including links to the base FHIR specification).
- There's no one right way to navigate; you'll find **what works best for you**. I'll just highlight some options.

Home

Welcome to the IG, it's worth reading the text ;-)

- **General introduction/overview to the topic**
  - Use case/domain
  - Purpose for the IG
  - Background and (external) sources
  - Content overview
- **Some considerations/expectations**
  - Key words
  - Must support
  - etc.
- **Additional information (not to start with)**
  - Metadata about the IG (title, version, package id, etc.)
  - STU Note & Changelog, Download
  - IP Statements, Cross Version Analysis, Dependency Table, Globals Table

https://fhir.ch/ig/ch-epr-fhir/index.html

Home

1.1 Introduction

The national extensions documented in this implementation gu...
integration profiles, actors and transactions provided in Volum...
Framework.

This implementa...
regulations of th...
in Official Compl...

1.2 Conformance Expectations

The key words MUST, MUST NOT, REQUIRED, SHA...
in [RFC2119 ☑].

This implementation guide uses `Must Support` in S...

1.2.1 Scope of precisions

The extensions, restrictions and translations speci...

- SMART on FHIR ☑
- IUA ☑
- PDQm ☑
- PIXm ☑
- MHD ☑
- mCSD ☑
- RESTful ATNA ☑

1.2.2 National integration profiles

The following national integration profiles are inclu...

- PPQm

1.2.3 Related profiles, actors and transacti...

The FHIR API specifications to read audit trails is o...
Guide ☑.

1.3 Overview

1.3.1 Introduction

This national extension is motivated by the intention to provide FHIR based profiles for the Swiss EPR by extending the IHE FHIR based mobile profiles. The IHE FHIR based mobile profiles use technologies (REST, OAuth, etc.) which are widely spread in the developer community and may be used for Web Applications, for example in web based primary systems or portals.

This national extension strictly separates the authentication and authorization of the applications use to access the EPR on behalf of the user and the authentication and authorization of the user itself. By using this separation this national extension closely follows the underlying IUA Trial Implementation and OAuth 2.1:

- Client authentication - an application identifies and authenticates to an authorization server.
- Client authorization - an application is authorized by the user or system policy to access data and documents on behalf of the user.
- User authentication - a natural person identifies and authenticates using an Identity Provider with the authenticators registered for the natural person.
- User authorization - provision of an access token which includes the information required to perform authorization decisions and policy enforcement.

The scope of this extension covers the following use cases:

1. Client authentication and authorization;
2. User authentication and authorization;
3. Read data and documents from the EPR;
4. Write data and documents to the EPR;
5. Write logs to the EPR ATNA Audit Record Repository.

This extension covers two options:

1. Generic EPR API option – This option adresses primary systems or portals using the basic EPR flows replacing the XDS.b related and PIX/PDQ V3 profiles with the FHIR based profiles;
2. SMART on FHIR – This option adresses modular portals or primary systems that want to connect to the Swiss EPR using SMART on FHIR.

1.3.2 Profiles, actors and transactions

The following figure shows the profiles, actors and transactions specified or referenced in this national extension:

Profiles, actors and transactions covered in this national extension

EPR App		EPR API	
IUA Authorization Client	Get Access Token [ITI-71], Get Authorization Server Metadata [ITI-103]	IUA Authorization Server	Authenticate User → User Authentication Provider
	Incorporate Access Token [ITI-72]		
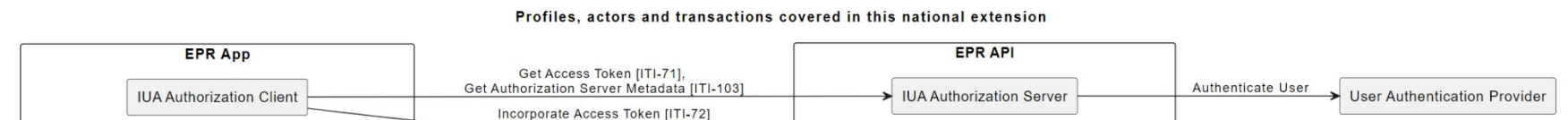
Content

Get an overview of the content

- **Volume 1 (IHE integration profiles)**

- **Volume 2 (IHE transactions)**

- **Appendix**

  - Profiles

  - Extensions

  - Terminology

  - Capability Statements

  - etc.

- **Artifacts**

- **Every IG is similar but different, so take a moment to familiarize yourself.**

https://fhir.ch/ig/ch-epr-fhir/toc.html

Content of the IG

Use the IG

Find what you need for your use case

- *Demo example:*
  - *Integration profile: MHD*
  - *Transaction: Provide Document Bundle [ITI-65]*
- **Entry points** in the IG:
  - Home: General information
  - Volume 1: Mobile Access to Health Documents (MHD) with XDS on FHIR
  - Volume 2: Provide Document Bundle [ITI-65]
- **And from there you will find the relevant information via links (IHE specification, profiles with examples, capability statement etc.).**

Home

Home

1.3.2 Profiles, actors and transactions

The following figure shows the profiles, actors and transactions specified or referenced in this national extension:

Profiles, actors and transactions covered in this national extension

EPR App		EPR API
IUA Authorization Client	Get Access Token [ITI-71], Get Authorization Server Metadata [ITI-103]	IUA Authorization Server
	Incorporate Access Token [ITI-72]	Authenticate User → User Authentication Provider
		IUA Resource Server
Patient Demographics Consumer	Mobile Patient Demographics Query [ITI-78]	Patient Demographics Supplier
PIXm Patient Identifier Cross-reference Consumer	Mobile Patient Identifier Cross-reference Query [ITI-83]	
PIXm Patient Identity Source	Patient Identity Feed FHIR [ITI-104]	PIXm Patient Identifier Cross-reference Manager
MHD Document Source	Provide Document Bundle [ITI-65], Update Document Metadata [CH:MHD-1]	MHD Document Recipient
MHD Document Consumer	Find Document Lists [ITI-66], Find Document References [ITI-67], Retrieve Document [ITI-68]	MHD Document Responder

https://fhir.ch/ig/ch-epr-fhir/index.html

Volume 1 - Mobile Access to Health Documents

2.4 Mobile Access to Health Documents (MHD) with XDS on FHIR

This section specifies Swiss national extensions to the Mobile Access to Health Documents (MHD) with XDS on FHIR Profile, which is published ⧉ as an IHE ITI Trial Implementation profile.

The national extensions adds a [...] the Document Source to the Document Recipient.

2.4.1 Scope

An EPR App can query, retriev[...] [commu]nity using the transaction of the MHD profile. An EPR App can Update Document Metada[...] this national extension.

2.4.2 Use Cases

In addition to the Document S[...] [nat]ional extension defines the following Use Cases:

2.4.2.1 Document Metadata update from a Health Care professional with a primary system

A Healthcare professional has published a document in his own community for the patient but needs to update the metadata of the document. The healthcare professional updates the metadata (e.g. title) in the primary systems and submits the updated metadata to the community. The metadata which is allowed to be updated is defined in Annex 5.1 1.12.1.

2.4.2.2 Patient changes confidentiality code of a document

A patient wants to change the confidentiality code of one of his documents. The patient updates the confidentiality code in the portal and the portal submits the updated metadata to the community.

- Scope
- Use Cases
- Actors and Transactions
- Actor options
- Required Actor Groupings
- Process Flow
- Security Consideration

https://fhir.ch/ig/ch-epr-fhir/iti-mhd.html

Volume 1 - Mobile Access to Health Documents

2.4.3 Actors and Transactions

MHD Actor Diagram
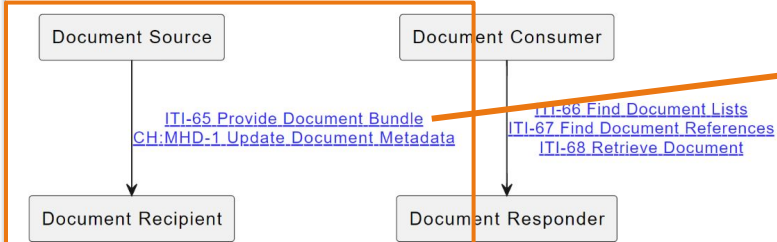
This figure shows the actors directly involved in the *Mobile Access to Health Documents* Profile and the relevant transactions between them.

2.4.4 Actor options

For all actors the Comprehensive Metadata Option and the XDS on FHIR Option SHALL be supported. For all actors the Metadata as defined in Annex 3 SHALL be supported.

2.4.5 Required Actor Groupings

The Actors Document Recipient and Document Responder MUST be grouped according to the XDS on FHIR grouping condition see Table 33.3-1: MHD - Actors Required Grouping. This national extension enforces authentication and authorization for access control. Therefore actors of this profile must be grouped with actors of other profiles according to the following table:

Actor	Required Grouping	Optionality
Document Recipient	IUA Resource Server	R
Document Responder	IUA Authorization Client	R
Document Source	IUA Authorization Client	R
Document Consumer	IUA Authorization Client	R

Table 2: Grouping of MHD actors required by this national extension.

2.4.6 Process Flow

For the process flow of this profile and its interplay with the other profiles see sequence diagrams.

2.4.7 Security Consideration

This national extension enforces authentication and authorization of access to the Patient Identity Manager using the IUA profile with extended access token as described in IUA.

3.6 Provide Document Bundle [ITI-65]

This section describes the additional requirements for the Swiss EPR of the Provide Document Bundle [ITI-65] ⧉ transaction defined in the MHD Profile published in the IHE ITI Trial Implementation "Mobile Access to Health Documents".

3.6.1 Scope

In the Swiss EPR the transaction is used by the MHD Document Source to store documents in the EPR.

3.6.2 Actor Roles

Actor: Document Source
Role: Sends documents and metadata to the Document Recipient.
Actor: Document Recipient
Role: Accepts the document and metadata sent from the Document Source.
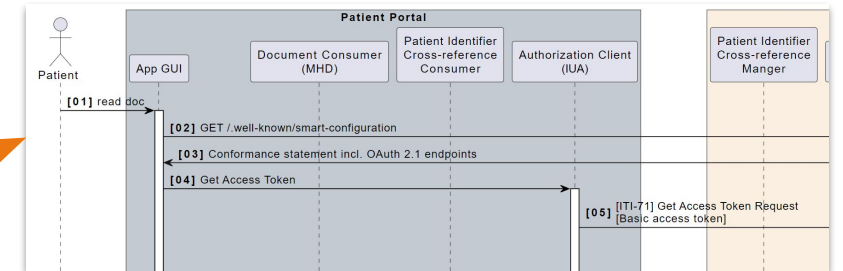
3.1 Get Access Token [ITI-71]

This section describes the national extension for the Swiss EPR to the Get Access Token [ITI-71] ⧉ t IUA profile published in the IHE IT Infrastructure Technical Framework Trial Implementation "Interne this transaction, the OAuth Authorization Code grant type option is enforced for security reasons.

https://fhir.ch/ig/ch-epr-fhir/iti-mhd.html

Volume 2 - Provide Document Bundle [ITI-65]

3.6 Provide Document Bundle [ITI-65]

This section describes the additional requirements for the Swiss EPR of the Provide Document Bundle [ITI-65] transaction defined in the MHD Profile published in the IHE ITI Trial Implementation "Mobile Access to Health Documents".

3.6.1 Scope

In the Swiss EPR the transaction is used by the MHD Document Source to store documents in the EPR.

3.6.2 Actor Roles

Actor: Document Source
Role: Sends documents and metadata to the Document Recipient.
Actor: Document Recipient
Role: Accepts the document and metadata sent from the Document Source.
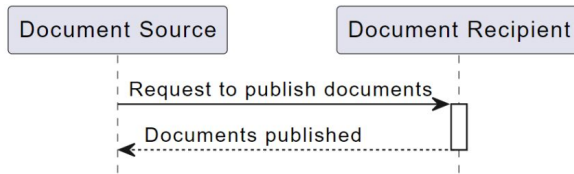
3.6.3 Referenced Standards

1. Mobile access to Health Documents (MHD), Rev. 4.2.1 – Trial-Implementation, August 2, 2023
2. This MHD Profile is based on Release 4 of the HL7® FHIR® standard.

https://fhir.ch/ig/ch-epr-fhir/iti-65.html

Volume 2 - Provide Document Bundle [ITI-65]

3.6.4 Messages

Interaction Diagram for [ITI-65]

Document Source → Document Recipient

Request to publish documents

Documents published

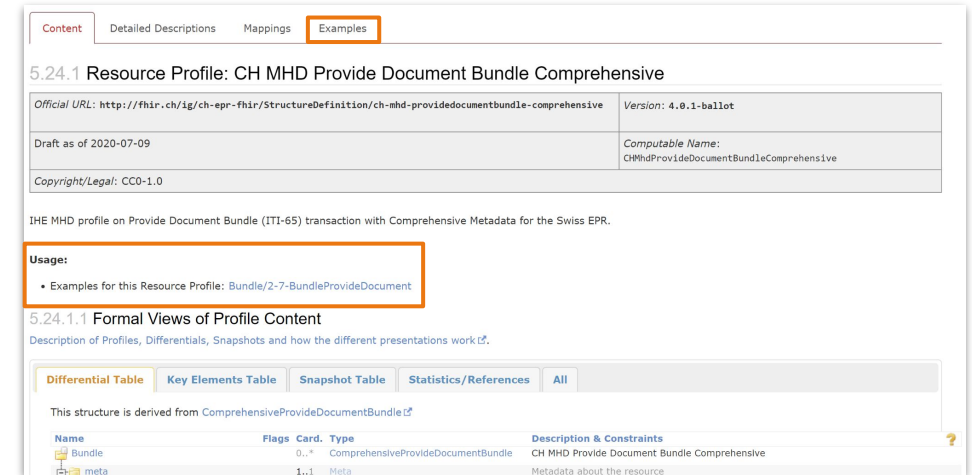#### 3.6.4.1 Provide Document Bundle Request Message

The FHIR `Bundle.meta.profile` shall have the following value:

`https://profiles.ihe.net/ITI/MHD/StructureDefinition/IHE.MHD.Comprehensive.ProvideBundle`

The additional Swiss EPR metadata is defined with:

- DeletionStatus (Annex 5.1 1.2.4.1)
- SubmissionSet.Author.AuthorRole (Annex 5.1 1.2.4.3)
- DocumentEntry.originalProviderRole (Annex 5.1 1.2.4.4)

The request Bundle SHALL follow the CH MHD Provide Document Bundle Comprehensive Profile (example: Bundle: 2-7-BundleProvideDocument).

Content | Detailed Descriptions | Mappings | Examples

5.24.1 Resource Profile: CH MHD Provide Document Bundle Comprehensive

Official URL: http://fhir.ch/ig/ch-epr-fhir/StructureDefinition/ch-mhd-providedocumentbundle-comprehensive	*Version*: 4.0.1-ballot
Draft as of 2020-07-09	*Computable Name*: CHMhdProvideDocumentBundleComprehensive
Copyright/Legal: CC0-1.0	

IHE MHD profile on Provide Document Bundle (ITI-65) transaction with Comprehensive Metadata for the Swiss EPR.

Usage:
- Examples for this Resource Profile: Bundle/2-7-BundleProvideDocument
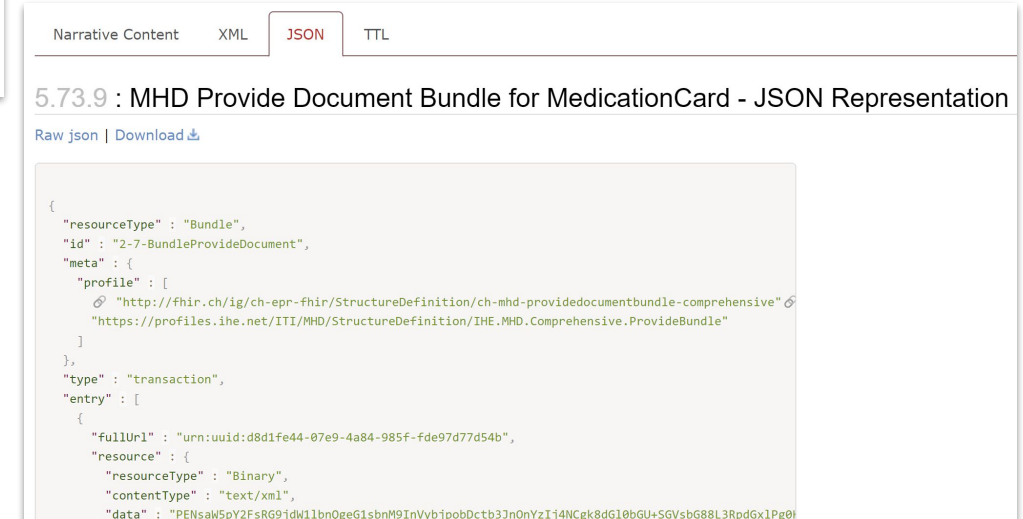
5.24.1.1 Formal Views of Profile Content

Description of Profiles, Differentials, Snapshots and how the different presentations work.

Differential Table | Key Elements Table | Snapshot Table | Statistics/References | All

This structure is derived from ComprehensiveProvideDocumentBundle

Name	Flags	Card.	Type	Description & Constraints
Bundle		0..*	ComprehensiveProvideDocumentBundle	CH MHD Provide Document Bundle Comprehensive
meta		1..1	Meta	Metadata about the resource

Narrative Content | XML | **JSON** | TTL

5.73.9 : MHD Provide Document Bundle for MedicationCard - JSON Representation

Raw json | Download

```
{
  "resourceType" : "Bundle",
  "id" : "2-7-BundleProvideDocument",
  "meta" : {
    "profile" : [
      "http://fhir.ch/ig/ch-epr-fhir/StructureDefinition/ch-mhd-providedocumentbundle-comprehensive"
      "https://profiles.ihe.net/ITI/MHD/StructureDefinition/IHE.MHD.Comprehensive.ProvideBundle"
    ]
  },
  "type" : "transaction",
  "entry" : [
    {
      "fullUrl" : "urn:uuid:d8d1fe44-07e9-4a84-985f-fde97d77d54b",
      "resource" : {
        "resourceType" : "Binary",
        "contentType" : "text/xml",
        "data" : "PENsaW5pY2FsRG9jdW1lbnQgeG1sbnM9InVybjpob Dctb3JnOnYzIj4NCgk8dGl0bGU+SGVsbG88L3RpdGxlPg0
```

https://fhir.ch/ig/ch-epr-fhir/iti-65.html

Volume 2 - Provide Document Bundle [ITI-65]

3.6.4.1.1 DeletionStatus

The optional metadata about the DeletionStatus of the document is represented in the DocumentReference using the extension with the URL http://fhir.ch/ig/ch-epr-fhir/StructureDefinition/ch-ext-deletionstatus. The values are defined in the ValueSet DocumentEntry.Ext.EprDeletionStatus ⧉.

3.6.4.1.2 SubmissionSet.Author.AuthorRole

The SubmissionSet.Author element MAY be used to track the user who made the latest changes to the document metadata. If present, the value of the AuthorRole attribute SHALL be taken from the SubmissionSet.Author.AuthorRole value set with the OID 2.16.756.5.30.1.127.3.10.1.41. The required metadata about the AuthorRole of the Author is represented in the List for the SubmissionSet using the extension with the URL http://fhir.ch/ig/ch-epr-fhir/StructureDefinition/ch-ext-author-authorrole. The values are defined in the ValueSet SubmissionSet.Author.AuthorRole ⧉.

3.6.4.1.3 DocumentEntry.originalProviderRole

An extra metadata attribute SHALL be used to distinguish document originally provided by patients or their representatives from documents originally provided by healthcare professionals, assistants, technical users or document administrators. The extra metadata attribute SHALL be set by the Document Source actor to the role value of the current user and SHALL NOT be updated by Update Initiator or Document Administrator actors. The required metadata about the originalProviderRole of the Author is represented in the DocumentReference using the extension with the URL http://fhir.ch/ig/ch-epr-fhir/StructureDefinition/ch-ext-author-authorrole. The values are defined in the ValueSet DocumentEntry.originalProviderRole ⧉.

3.6.4.2 Provide Document Bundle Response Message

The response Bundle SHALL follow the CH MHD Provide Document Bundle Comprehensive Response Profile (example: Bundle: 2-7-BundleProvideDocument-Response).

3.6.4.3 CapabilityStatement Resource

The CapabilityStatement resource for the **Document Source** is MHD Document Source.

The CapabilityStatement resource for the **Document Recipient** is MHD Document Recipient.

3.6.5 Security Consideration

TLS SHALL be used. This national extension enforces authentication and authorization of access to the Document Recipient using the IUA profile with extended access token. Consequently the *Provide Document Bundle* [ITI-65] request must authorize using the [ITI-72] ⧉ transaction of the IUA profile.

For the `traceparent` header handling refer to Trace Context header.

3.6.5.1 Security Audit Considerations

3.6.5.1.1 Document Source Audit

The **Document Source** shall record an Audit Event for Provide Bundle Transaction at Source ⧉. Audit Example for a Provide Bundle Transaction from source perspective ⧉.

3.6.5.1.2 Document Recipient Audit

The **Document Recipient** shall record an Audit Event for Provide Bundle Transaction at Recipient ⧉. Audit Example for a Provide Bundle Transaction from recipient perspective ⧉.

- **Detailed description**
- **More links to**
  - Extensions
  - Terminology
  - Profiles and the corresponding examples
  - Capability Statements
  - Further guidance (e.g. trace context)

https://fhir.ch/ig/ch-epr-fhir/iti-65.html

FHIR implementation guides benefits for software developers

Benefits

Of a computable
FHIR specification

- **Standardization and quality assurance:** IGs provide consistent, transparent specifications, enabling authors and developers to collaborate effectively. From business rules to formal definitions, concepts are clearly differentiated.
- **Faster Development:** Interoperable outputs enable the reuse of content, which reduces development time and enables code generation, validation and testing.
- **Consistency in publication:** Standardized formats, cycles, and predictable schedules support iterative development and foster more reliable project timelines.

Feedback

Propose a change and contribute to improvement

- **Like the FHIR base specification itself, IGs published by HL7 Switzerland/eHealth Suisse (and others) have a** **Propose a change** **link in their footer.**
  - An issue is automatically created in the corresponding GitHub repository (with reference to the page in the IG where the link was called up).
- **Everyone is welcome to provide valuable feedback on the specifications, which may arise during their implementation.**
  - This is possible at any time, not just during the ballot phase.

Q & A

Contact
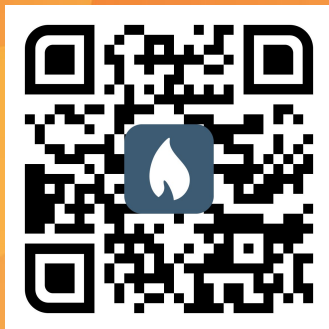
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Supporting information

Profile

Formal views
of the content

- **Differential:** Shows only the changes made to the parent profile, with unchanged elements faded.

- **Snapshot:** Displays the complete set of data elements within the profile, including all changes applied to the base model.

- **Key Elements:** A subset of the snapshot, focusing on critical elements that must be considered for implementation.

Profile

The table

- **A grid-like and hierarchical view of a StructureDefinition**

  - Name: Icon denotes element type; names of elements/slices shown. Links to detailed descriptions for the element.

  - Flags: Indicators that affect implementation behavior. Hover for descriptions.

  - Cardinality (Card.): Minimum and maximum occurrences allowed for the element.

  - Type: Types of elements (e.g., base data types, profiles). Links to type definitions.

  - Description & Constraints: Short element description, terminology binding, fixed values, etc.

Extensions

Consequence of the 80/20 rule

- FHIR **80/20 rule**: Focus on the 20% of requirements that satisfy 80% of the interoperability needs.
- FHIR extensions allow the **addition** of new elements to the standard FHIR resources to support specific use cases or workflows that aren't covered by the base specification.
- Each extension is clearly **defined** with a URL that uniquely identifies it, and should be **published** (in an IG).
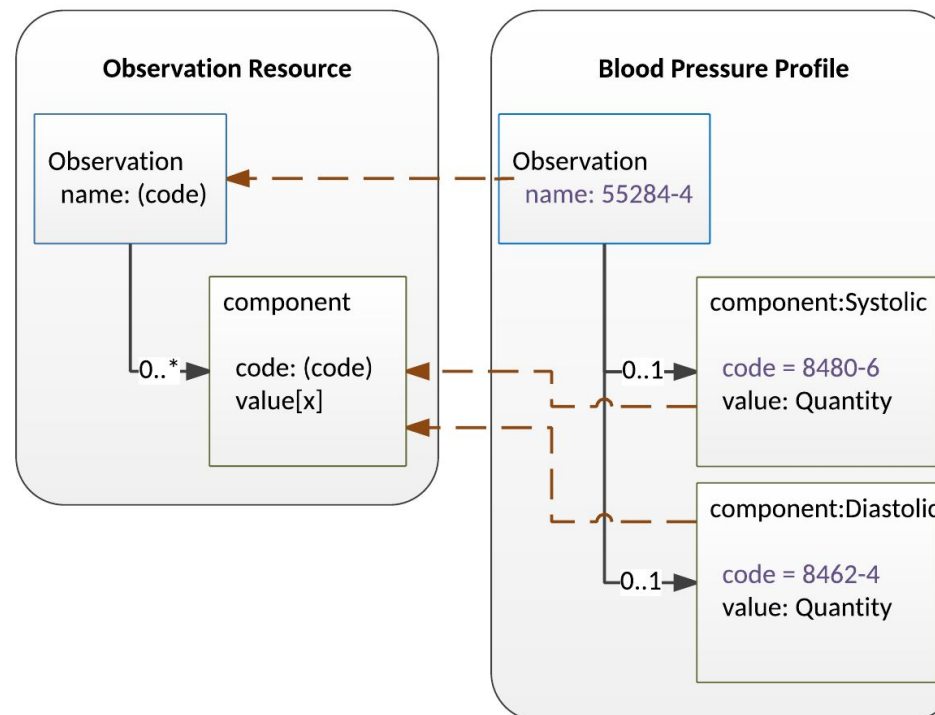
https://hl7.org/fhir/R4/extensibility.html

VS Binding

Binding strengths

- **Almost all the elements that have a coded data type are bound to a value set.**
- **The bindings are associated with degrees of flexibility:**
  - required: To be conformant, the concept in this element SHALL be from the specified value set.
  - extensible: To be conformant, codes in this element SHALL be from the specified value set if any of the codes within the value set can apply to the concept being communicated.
  - preferred: Instances are encouraged to draw from the specified codes for interoperability purposes but are not required to do so to be considered conformant.
  - example: Instances are encouraged to draw from the specified codes for interoperability purposes but are not required to do so to be considered conformant.

https://hl7.org/fhir/R4/terminologies.html#strength

Slicing

And discriminators

- **Slicing** means splitting an element that may occur multiple times into a series of sub-lists with specific constraints.
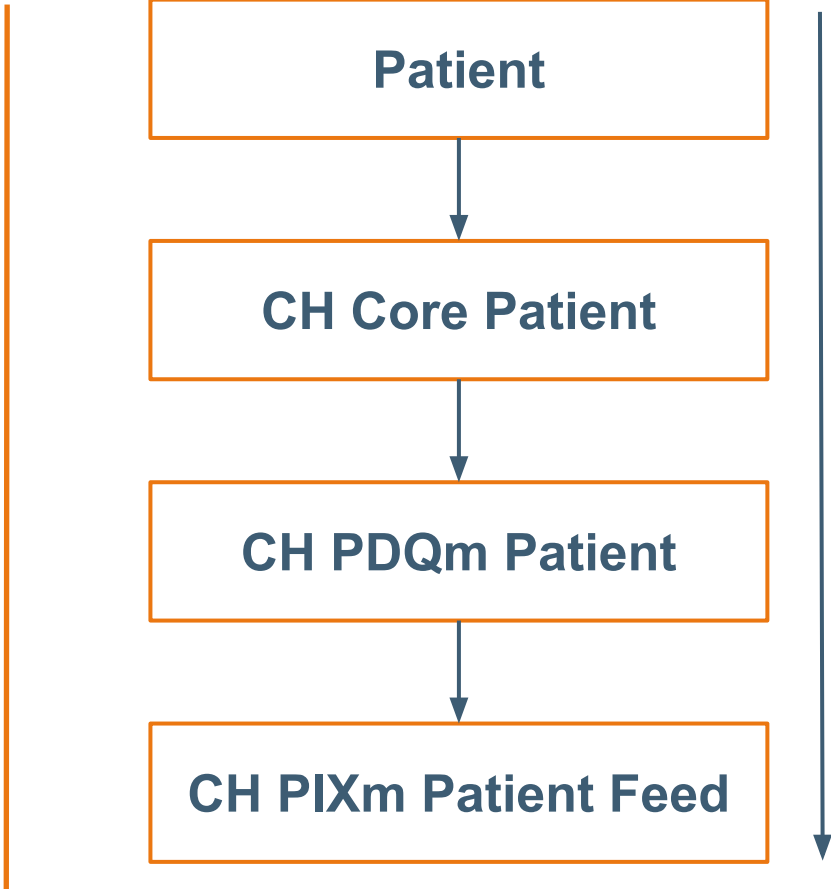


```
<Observation>
    ...
    <component>
        <code {LOINC="8480-6"}/>
        <value ...>
    </component>
    <component>
        <code {LOINC="8462-4"}/>
        <value ...>
    </component>
</Observation>
```

https://hl7.org/fhir/R4/profiling.html#slicing

Dependencies

Between profiles

it becomes stricter
(e.g. cardinality, VS binding)

derived from Patient ⬀

	Flags	Card.	Type
	C	0..*	Patient

derived from CHCorePatient ⬀

	Flags	Card.	Type
		0..*	CHCorePatient

derived from CHPDQmPatient

	Flags	Card.	Type
		0..*	CHPDQmPatient

https://fhir.ch/ig/ch-epr-fhir/StructureDefinition-ch-pixm-patient-feed.html

Dependencies

To other IGs

Versions

And changelog

- **Different versions of an IG**
  - Published (stable) versions:

    https://fhir.ch/ig/ch-epr-fhir/index.html

    https://fhir.ch/ig/ch-epr-fhir/4.0.1-ballot/index.html
  - Continuous integration (ci) build:

    https://build.fhir.org/ig/ehealthsuisse/ch-epr-fhir/

- **Where to find the information**

  - URL (see examples above)

  - IG header, status box, footer

  - Directory of published versions (linked from publication box)

- **It is not the same as the FHIR version**

- **See also the changelog to each version**

  https://fhir.ch/ig/ch-epr-fhir/changelog.html

https://fhir.ch/ig/ch-epr-fhir/history.html

Download

Package

- **FHIR IGs are published in HTML format for human consumption, and as NPM packages for machine consumption.**

- **Where to find the NPM package:**

  - Download link in the IG

    → e.g. https://fhir.ch/ig/ch-epr-fhir/package.tgz

  - Package registry with package id (and version); see footer of the IG

    → e.g. https://registry.fhir.org/package/ch.fhir.ig.ch-epr-fhir%7C4.0.1-ballot

Download

Individual artifacts

- **The IG Publisher (HL7 tool that generates the IG) creates the IG (html, package) from the input files. The IG Publisher generates "Narrative Content" from various sources: e.g. value set with expansion and mappings.**
- **The actual data (for downloading) can be found in the further tabs (e.g. JSON, XML).**

Further Links

Information & help

- **FHIR IG Registries:**
  - Swiss FHIR IGs: https://fhir.ch/
  - HL7 FHIR IGs: https://fhir.org/guides/registry/
- **FHIR Package Registry: https://registry.fhir.org/**
- **Zulip: https://chat.fhir.org/**
- **HL7 Confluence: https://confluence.hl7.org/**
- **Guidance for FHIR IG Creation:**

  https://build.fhir.org/ig/FHIR/ig-guidance/index.html
- **FHIR DevDays: https://www.devdays.com/**
  - > EVENT INFO > Previous editions > PRESENTATIONS & VIDEOS