HL7® FHIR® DevDays 2020

FHIRPath

Mirjam Baltus, Firely

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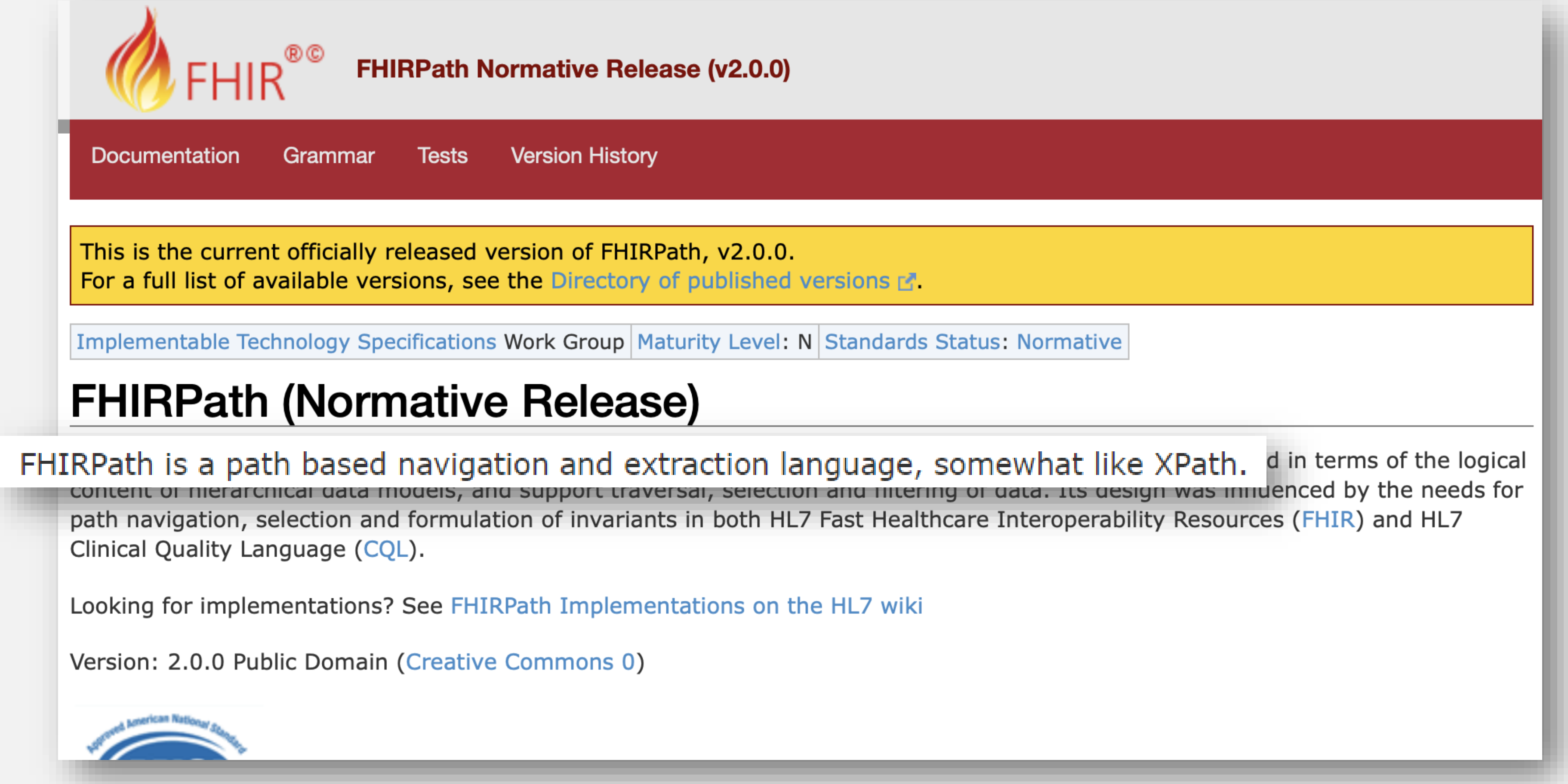
Who am I?

- Name: Mirjam Baltus
- Company: Firely, Amsterdam

- Background:
  - FHIR team since 2012
  - FHIR trainer

- Slides: bit.ly/MirjamsTraining

What is FHIRPath?



FHIRPath Normative Release (v2.0.0)

This is the current officially released version of FHIRPath, v2.0.0.
For a full list of available versions, see the Directory of published versions.

Implementable Technology Specifications Work Group | Maturity Level: N | Standards Status: Normative

FHIRPath (Normative Release)

FHIRPath is a path based navigation and extraction language, somewhat like XPath.

d in terms of the logical content of hierarchical data models, and support traversal, selection and filtering of data. Its design was influenced by the needs for path navigation, selection and formulation of invariants in both HL7 Fast Healthcare Interoperability Resources (FHIR) and HL7 Clinical Quality Language (CQL).

Looking for implementations? See FHIRPath Implementations on the HL7 wiki

Version: 2.0.0 Public Domain (Creative Commons 0)

http://hl7.org/fhirpath

Features

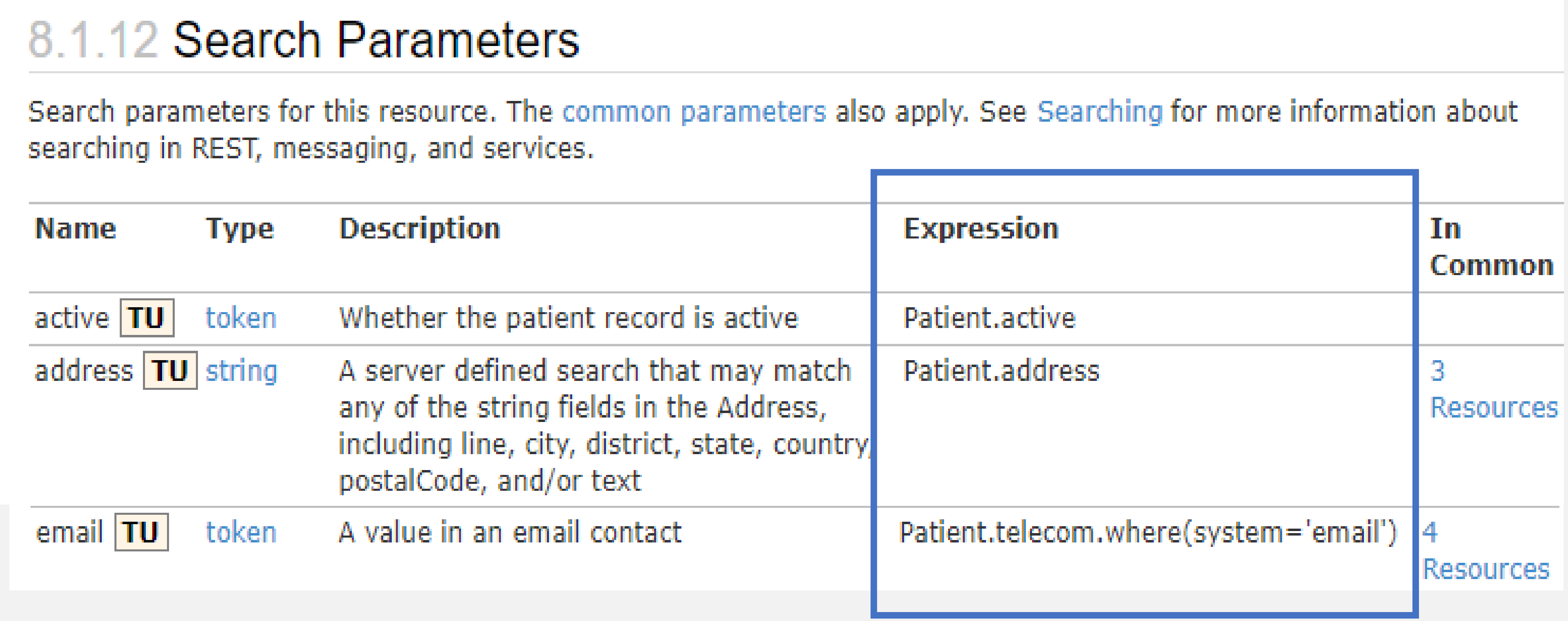
- **Graph-traversal**: FHIRPath is a graph-traversal language
- **Fluent**: FHIRPath has a syntax based on the Fluent Interface pattern
- **Collection-centric**: FHIRPath deals with all values as collections
- **Platform-independent**: FHIRPath can be implemented in any platform
- **Model-independent**: FHIRPath deals with data as an abstract model, allowing it to be used with any information model

- Despite the name, is *not* strictly limited to use within FHIR

Uses for FHIRPath (in FHIR)

- Navigate or “point” to parts of an instance
  - e.g. to define (new) search parameters and FHIR Patch
- Formulate predicates against the model in profiles
  - Formal constraints/invariants in StructureDefinition
- Extract data from an instance
  - e.g. narrative generation
  - Indexing values

Example: Patient search parameters

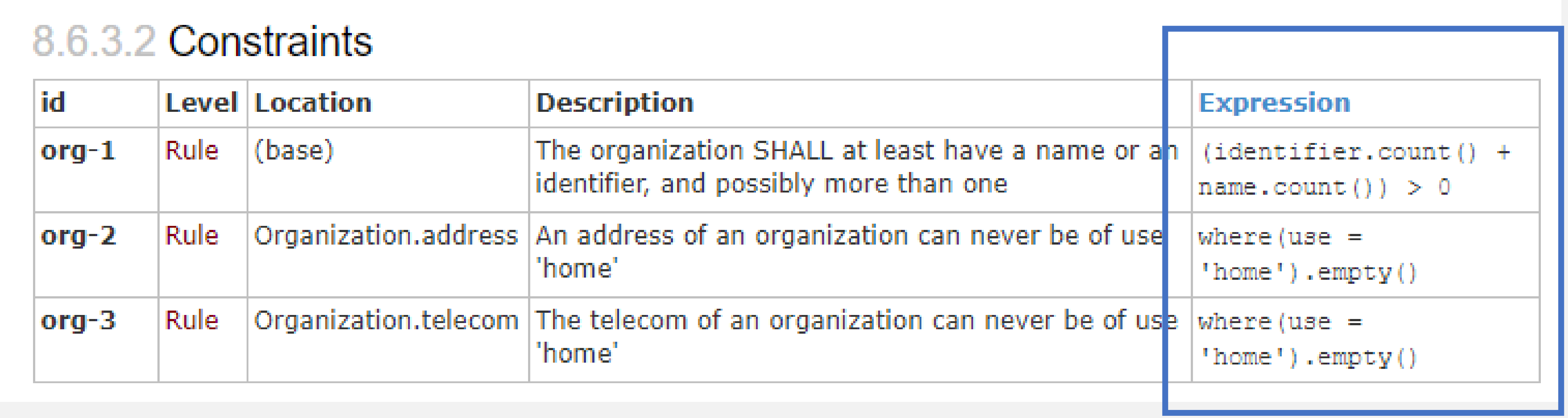


8.1.12 Search Parameters

Search parameters for this resource. The common parameters also apply. See Searching for more information about searching in REST, messaging, and services.

Name	Type	Description	Expression	In Common
active TU	token	Whether the patient record is active	Patient.active	
address TU	string	A server defined search that may match any of the string fields in the Address, including line, city, district, state, country, postalCode, and/or text	Patient.address	3 Resources
email TU	token	A value in an email contact	Patient.telecom.where(system='email')	4 Resources

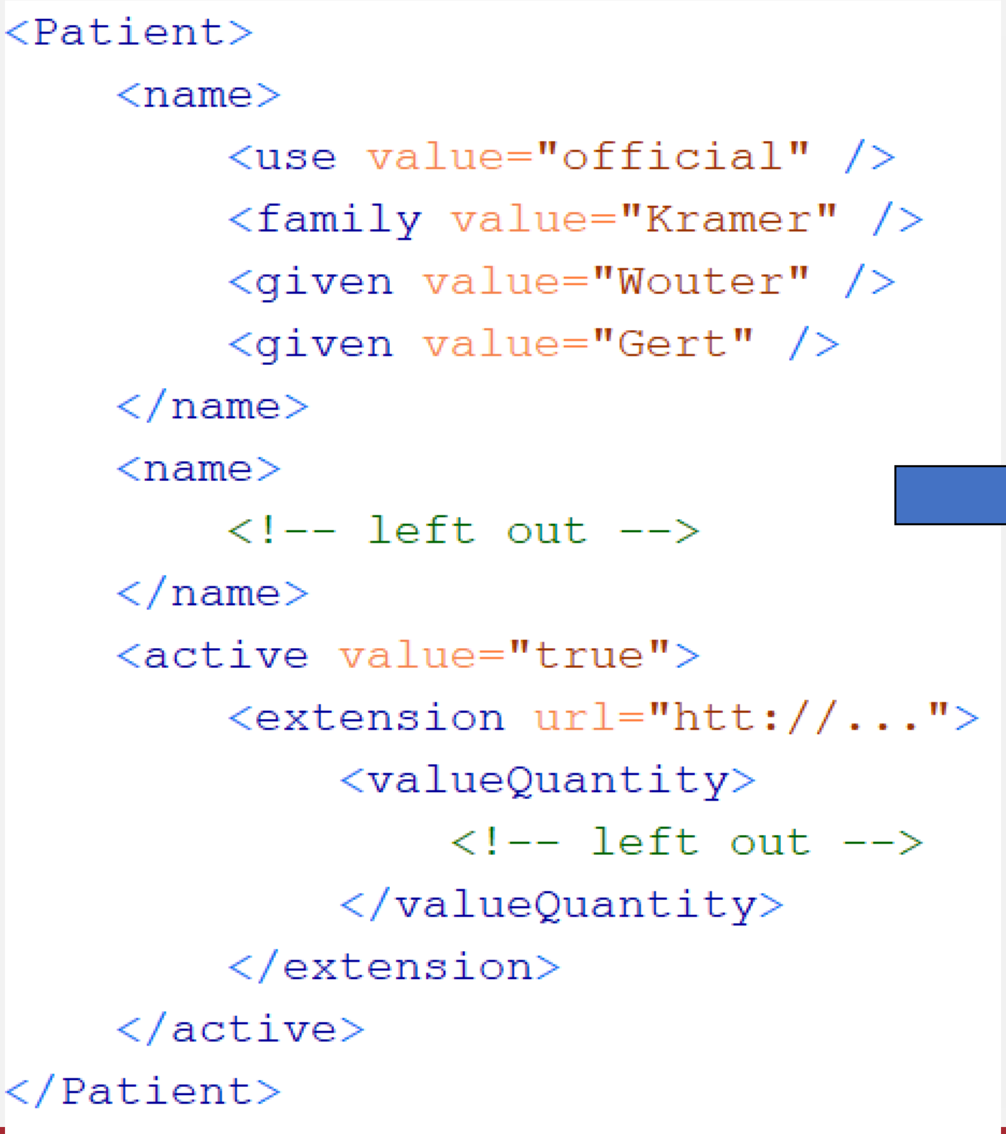
Example: Organization invariants



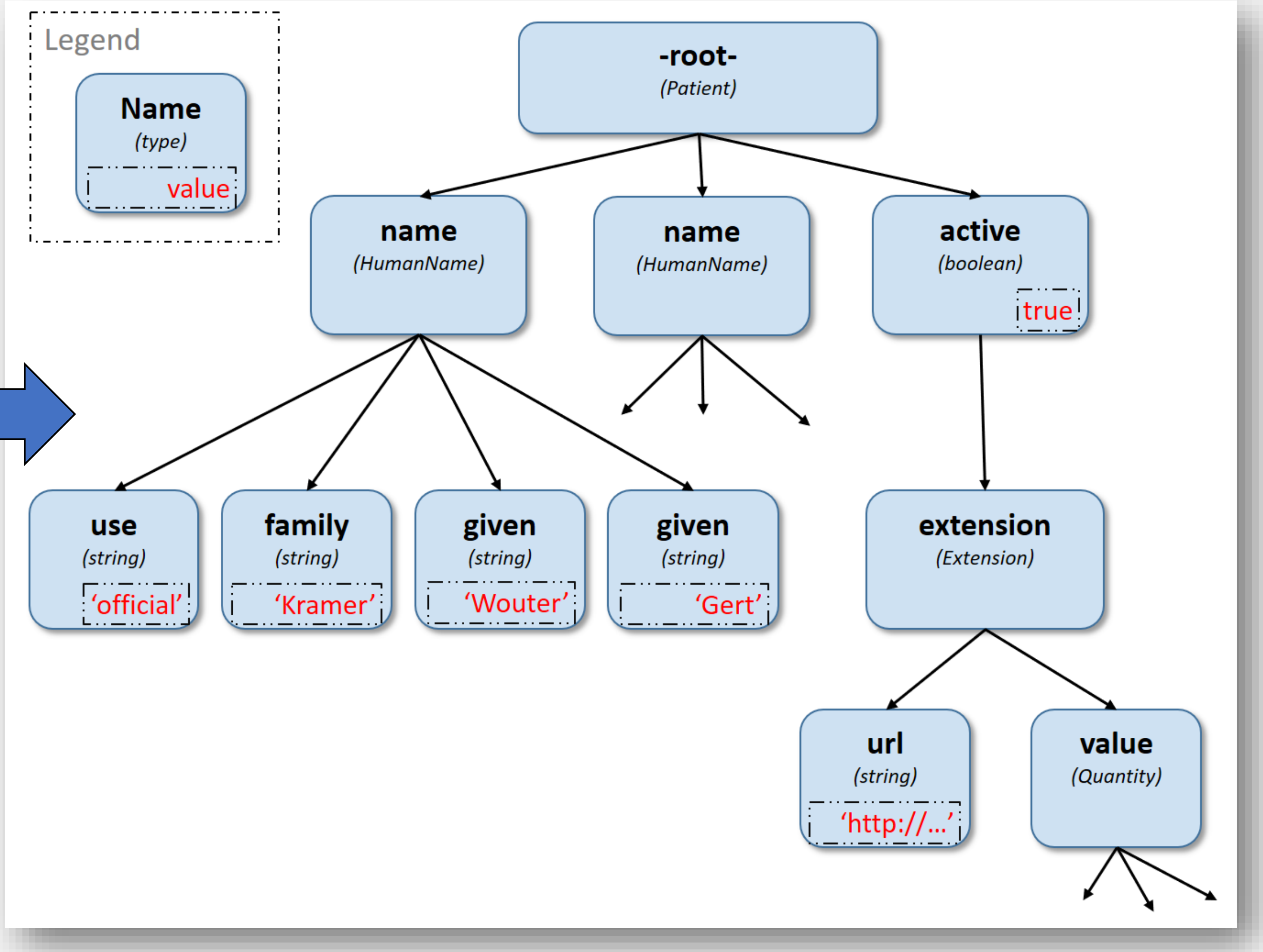
8.6.3.2 Constraints

id	Level	Location	Description	Expression
org-1	Rule	(base)	The organization SHALL at least have a name or an identifier, and possibly more than one	`(identifier.count() + name.count()) > 0`
org-2	Rule	Organization.address	An address of an organization can never be of use 'home'	`where(use = 'home').empty()`
org-3	Rule	Organization.telecom	The telecom of an organization can never be of use 'home'	`where(use = 'home').empty()`

Navigating data



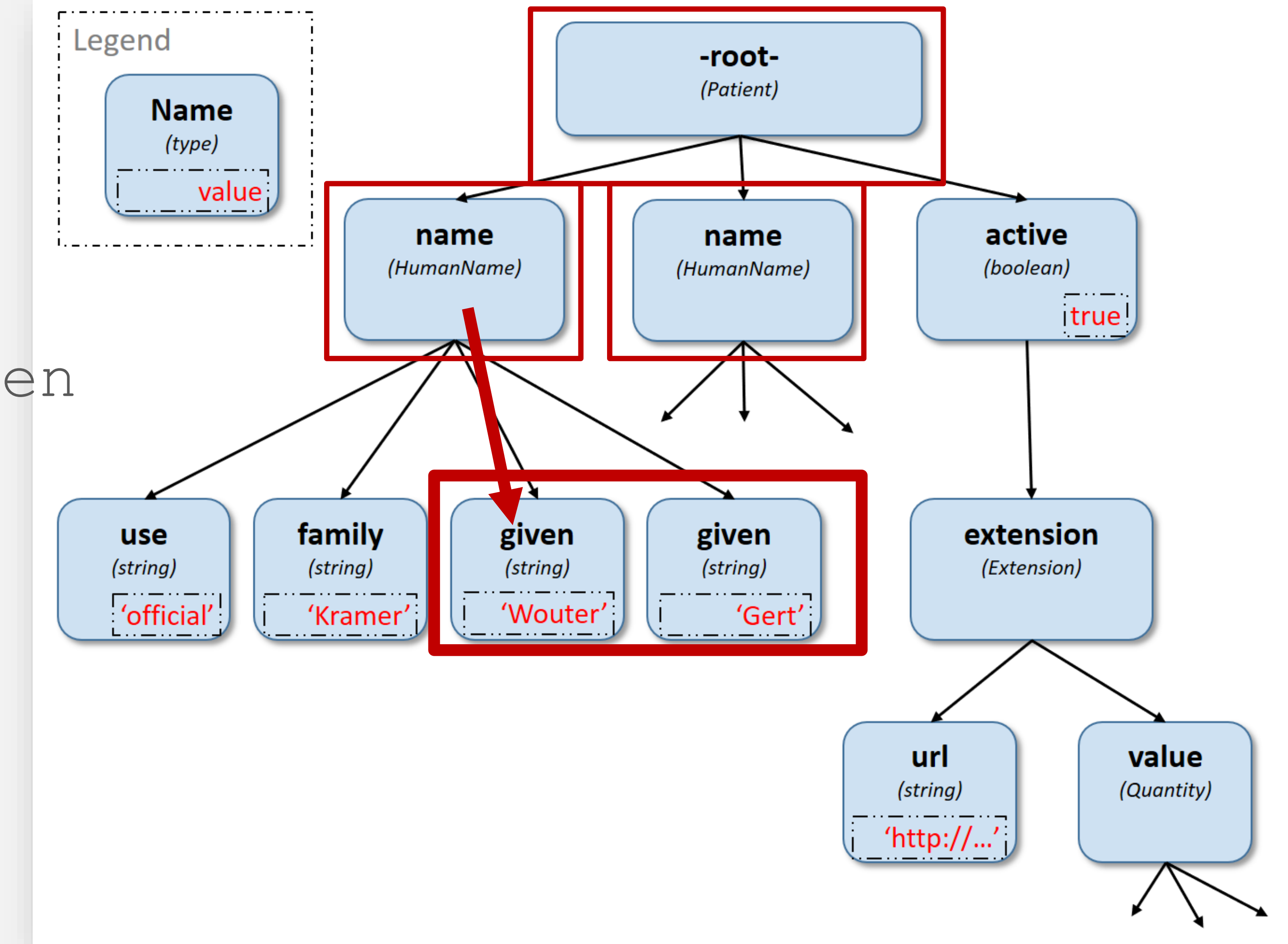
```xml
<Patient>
    <name>
        <use value="official" />
        <family value="Kramer" />
        <given value="Wouter" />
        <given value="Gert" />
    </name>
    <name>
        <!-- left out -->
    </name>
    <active value="true">
        <extension url="htt://...">
            <valueQuantity>
                <!-- left out -->
            </valueQuantity>
        </extension>
    </active>
</Patient>
```



Legend
Name
(type)
value
-root-
(Patient)
name
(HumanName)
name
(HumanName)
active
(boolean)
true
use
(string)
'official'
family
(string)
'Kramer'
given
(string)
'Wouter'
given
(string)
'Gert'
extension
(Extension)
url
(string)
'http://...'
value
(Quantity)

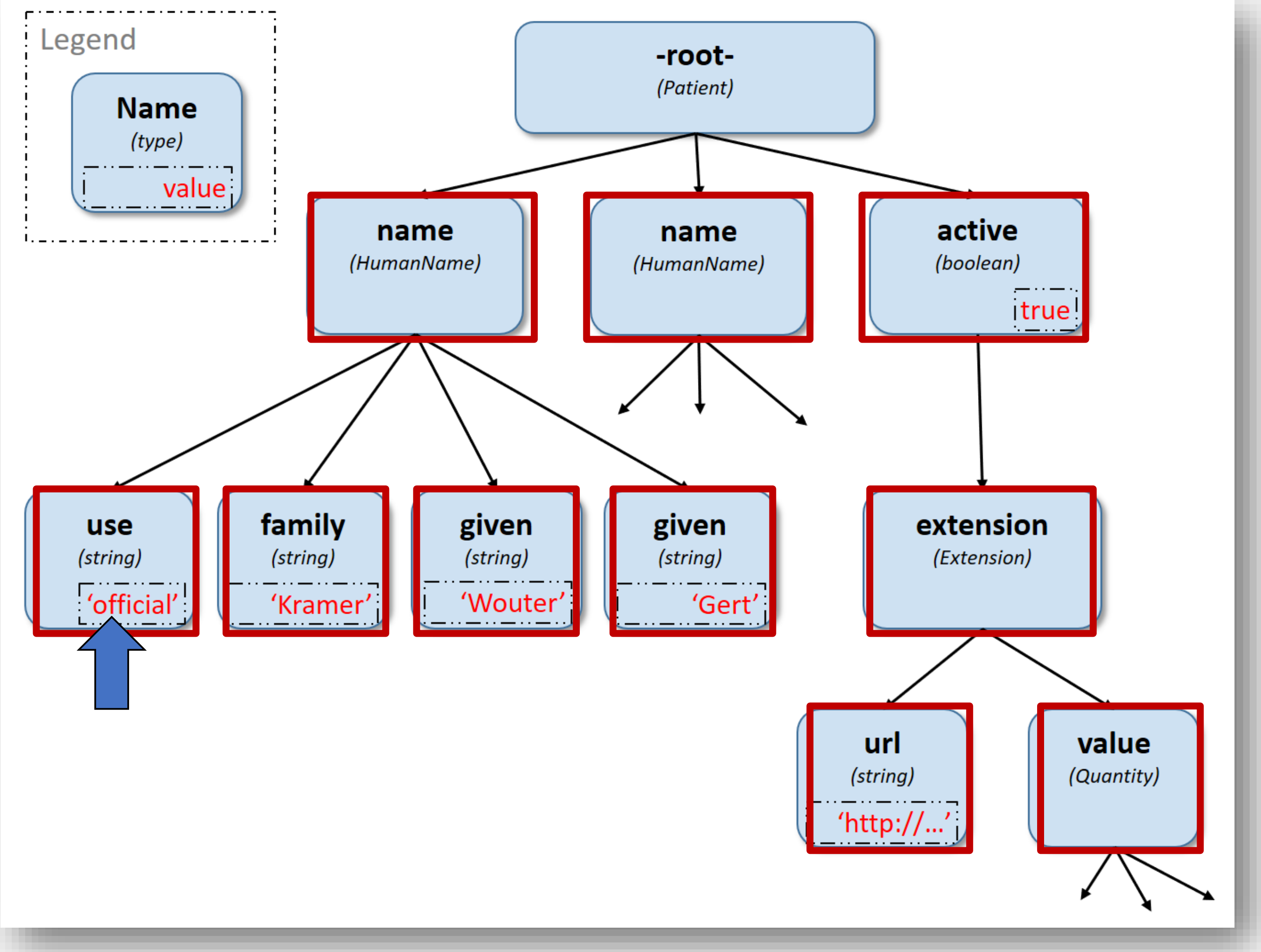
Navigating by name

- By name (=direct child with a given name)
  - `Patient.name.given`
  - `name.given`



Navigating by axis

- By (child) axis
  - Patient.children()
  - Patient.descendants()
- Combinations
  - Patient.descendants().use



Collections

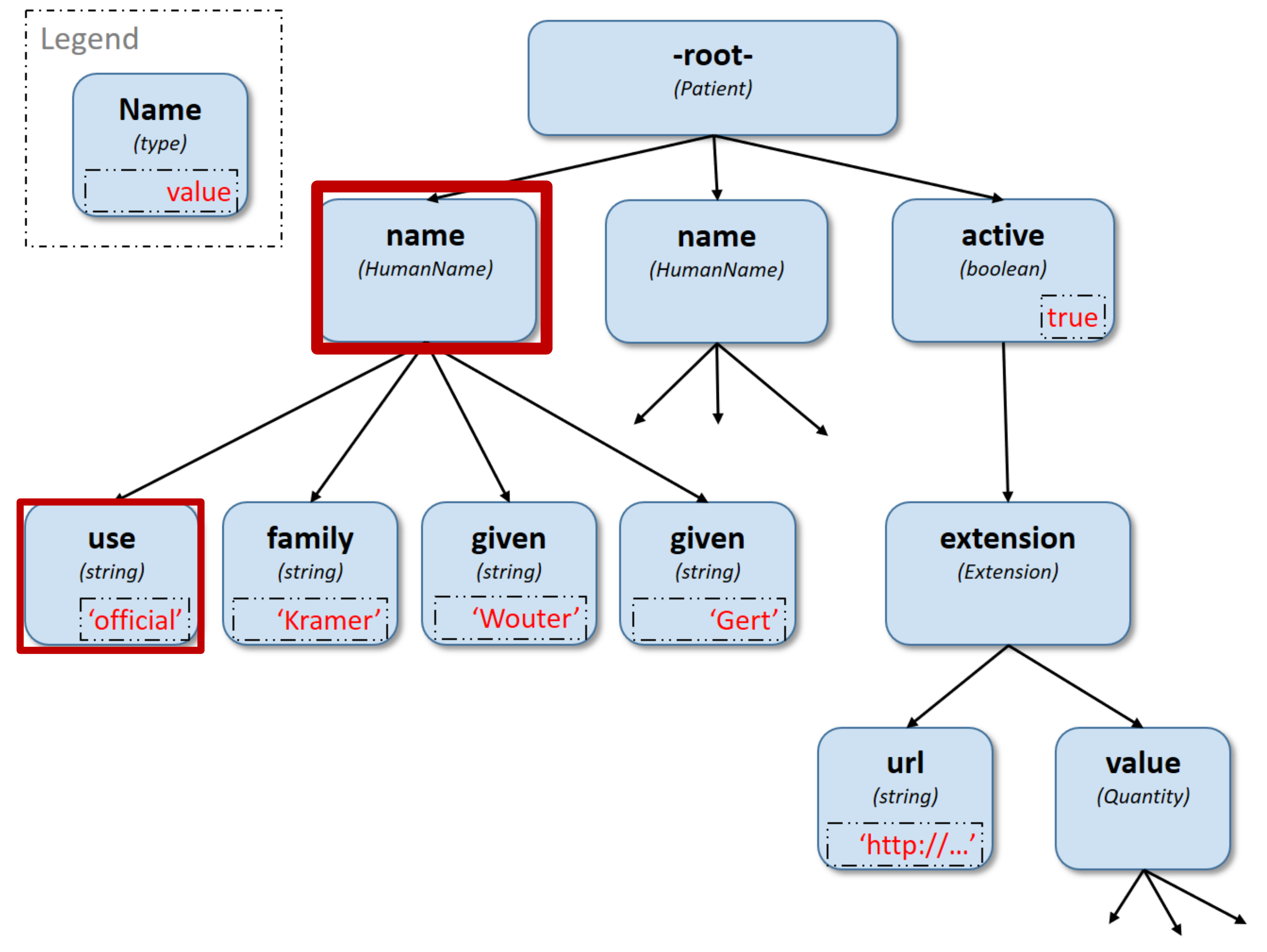
- In FHIRPath, everything is a collection
- This means that you can work with that collection:
  - `Patient.name.count(), Patient.active.count()`
  - `Patient.name.first().given.last()`
  - `Patient.active.first()` *(always the same as Patient.active)*
- Every function returns a collection

Filtering

`where()` function, with a predicate as an argument:

```
Patient.name
.where(use='official')
```

"Go over `Patient.name` one by one and select the `name` that has the given characteristic"



Testing existence

- empty()
- exists(<criteria>)

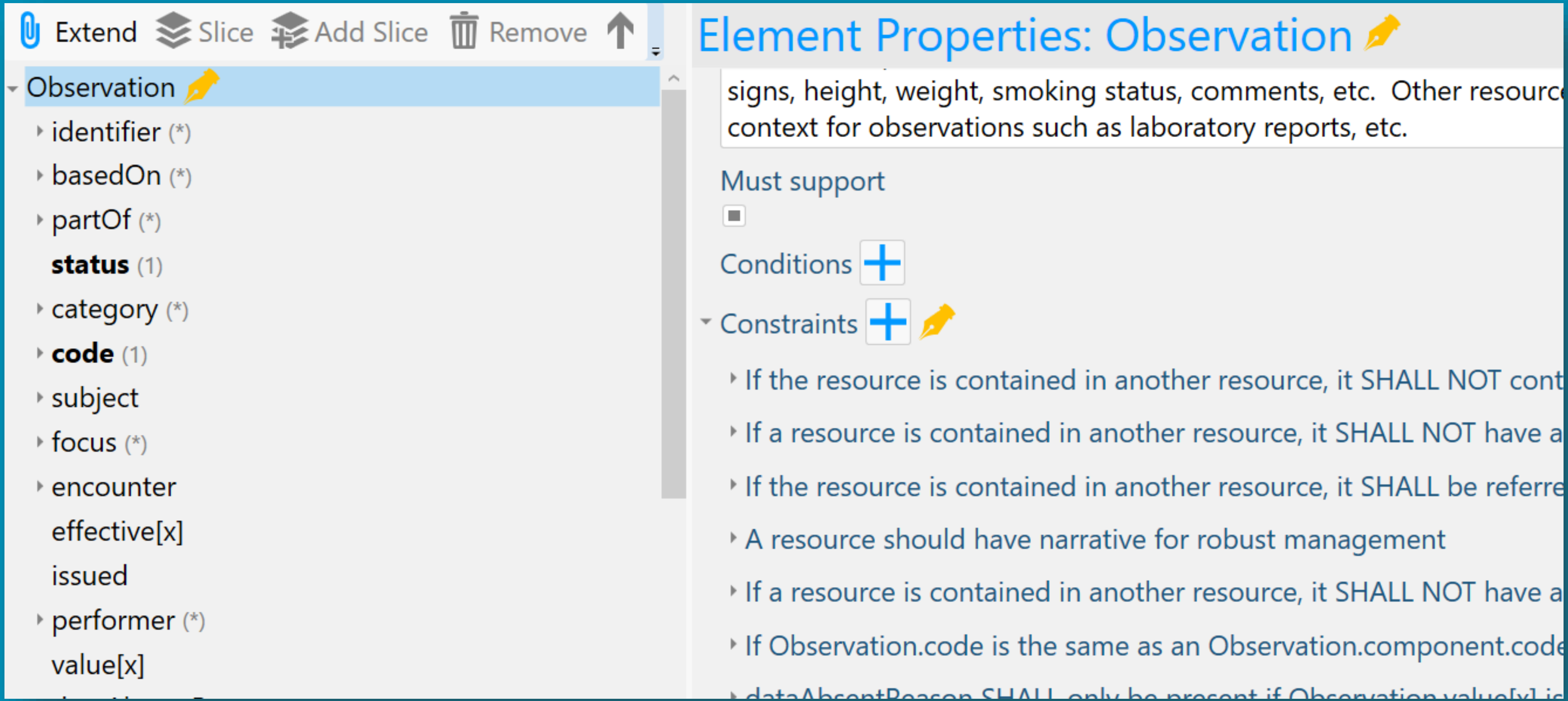
```
identifier.exists()
identifier.exists(use='official')
telecom.exists(system='phone' and use='mobile')
```

Beyond paths

- Boolean operators: `‘and’, ‘or’, ‘xor’, ‘implies’`
- Comparisons: `=, !=, >, <=`, etc.
- String manipulation:
  - substring, startsWith, endsWith, contains
  - matches(regex), replaceMatches(regex)
- *, +, -, /, div, mod, & (concat)

FHIRPath in profiles

- Creating formal constraints



Observation

- identifier (*)
- basedOn (*)
- partOf (*)
- **status** (1)
- category (*)
- **code** (1)
- subject
- focus (*)
- encounter
- effective[x]
- issued
- performer (*)
- value[x]

Element Properties: Observation

signs, height, weight, smoking status, comments, etc. Other resourc
context for observations such as laboratory reports, etc.

Must support

□

Conditions

Constraints

- If the resource is contained in another resource, it SHALL NOT cont
- If a resource is contained in another resource, it SHALL NOT have a
- If the resource is contained in another resource, it SHALL be referre
- A resource should have narrative for robust management
- If a resource is contained in another resource, it SHALL NOT have a
- If Observation.code is the same as an Observation.component.code
- dataAbsentReason SHALL only be present if Observation.value[x] is

Formal constraints

- Beyond cardinalities, there are a lot of other conditions you might want to formulate in your profile:

  “If a Cholesterol value result is not available, use the note field”
  “A patient’s birthdate must be on or before today’s date”

- These may concern a single element, or cover multiple elements

- Expression must evaluate to ‘true’ or ‘false’

Formal constraints

- Constraints should be declared on lowest element in the hierarchy that is common to all nodes referenced by the constraint
- Identified by (local) **‘Key’**, involved elements refer to that id
- Specify severity (“error” or “warning”)

Formal constraint example

“If a Cholesterol value result is not available, use the note field”

- Note: to use both is ok!
- Otherwise said: not both empty
- In FHIRPath:

```
value.as(Quantity).exists() or note.exists()
```

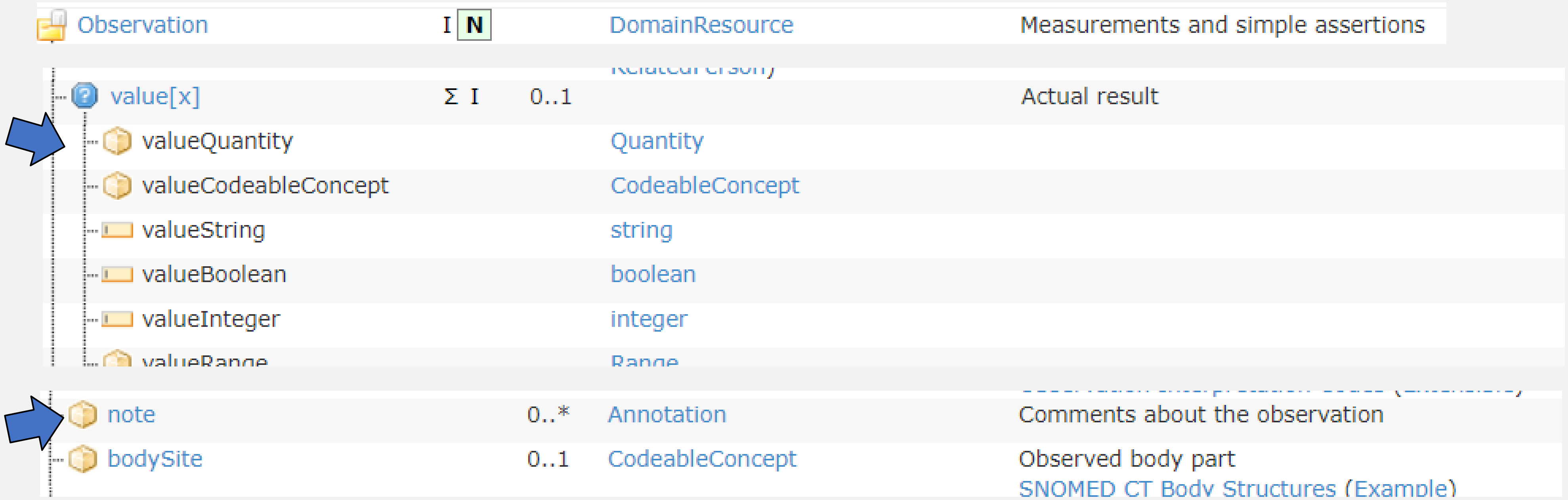
Context of the constraint

“If a Cholesterol value result is not available, use the note field”

- This constraint is on the elements “valueQuantity” and “note”
- We would have to formulate this constraint on the Observation, this is the context of the constraint
- We assign the constraint a “key” value that’s unique within the Observations’ constraints
- We refer from both “value[x]” and “note” to this “key”.

Context of the constraint

“If a Cholesterol value result is not available, use the note field”



Observation	I N		DomainResource	Measurements and simple assertions
			RelatedPerson)	
value[x]	Σ I	0..1		Actual result
valueQuantity			Quantity	
valueCodeableConcept			CodeableConcept	
valueString			string	
valueBoolean			boolean	
valueInteger			integer	
valueRange			Range	
				Observation Interpretation Codes (Extensible)
note		0..*	Annotation	Comments about the observation
bodySite		0..1	CodeableConcept	Observed body part SNOMED CT Body Structures (Example)

FhirPath tools

- Online FHIRPath demo:

  https://hl7.github.io/fhirpath.js/

- FHIRPath tester:

  https://github.com/brianpos/FhirPathTester
  or
  https://www.microsoft.com/en-us/p/fhirpath-tester/

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