



Tutorial: Create an Implementation Guide with FHIR Shorthand

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HL7 FHIR DevDays 2021, Virtual Edition, June 7–10, 2021 | @HL7 | @FirelyTeam | #fhirdevdays | www.devdays.com

ORGANIZED BY



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Quality
Language FHIR®
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FHIR Shorthand at DevDays

1. Introduction to FHIR Shorthand (this session)

- Advantages of FSH
- Basic FSH grammar
- Experiment using FSH Online

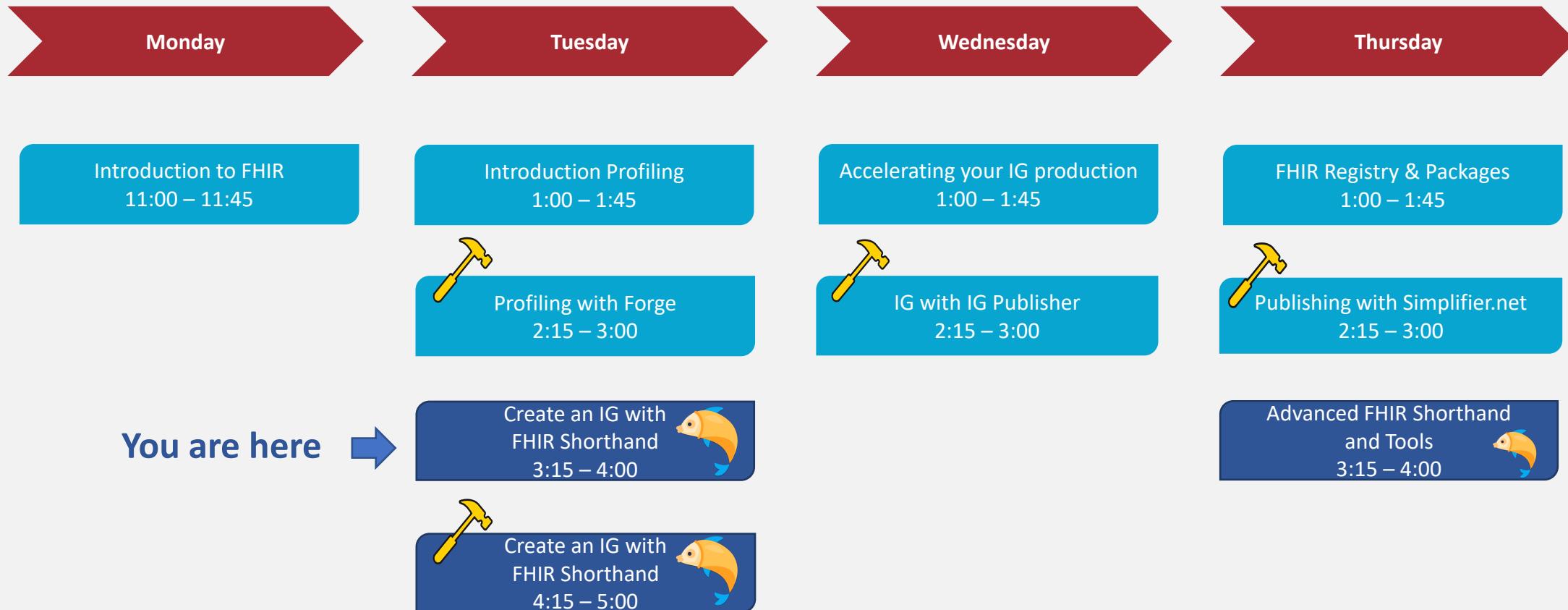
2. Let's Build with FSH (next up @ 4:15 Eastern US time today)

- Creating Implementation Guides
- Converting an existing IG to FSH

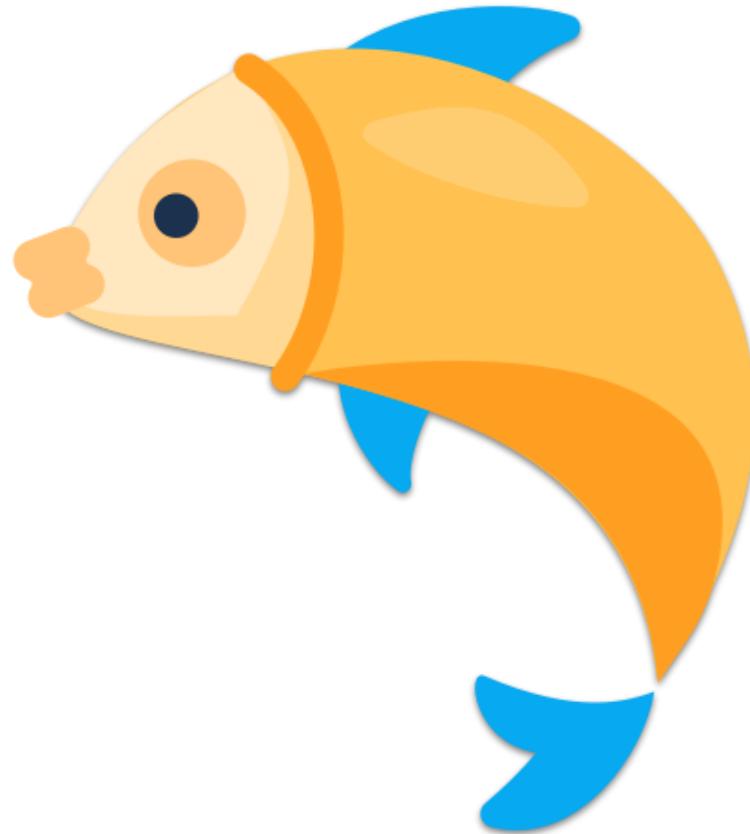
3. Advanced FHIR Shorthand and Tools (Thursday @ 3:15 Eastern US)

- Fabulous FSH 2.0 features

Track overview: Let's Build a FHIR specification



FSH
Background



FHIR Profiles and Implementation Guides

- Base FHIR does not provide the specifics required to implement most exchanges
- **Profiles** are FHIR's way to provide additional details
 - A FHIR profile specifies acceptable codes, extensions, restrictions on data types, and more
- Profiles are collected into **Implementation Guides (IGs)** that describe national standards or complete use cases
- Implementers use IGs to create actual APIs

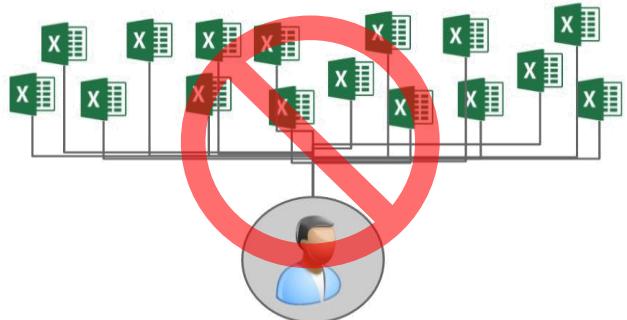
Profiling Approaches



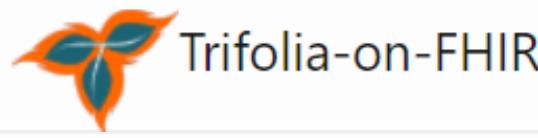
Hand-Editing



Spreadsheets



User Interfaces



Profile on Patient⁽⁵⁾: PatienNL

Properties Narrative Element Tree Element Grid Xml

Edit the meta properties of the selected resource or component.

URL

<http://hl7.org/fhir/StructureDefinition/PatienNL>

Resource ID

Name

PatienNL

Description

StructureDefinition for a Dutch Patient.

Command-Driven



MAKE ME A SANDWICH.

OKAY.

Profile: MyPatient

Parent: Patient

* name 1...* MS

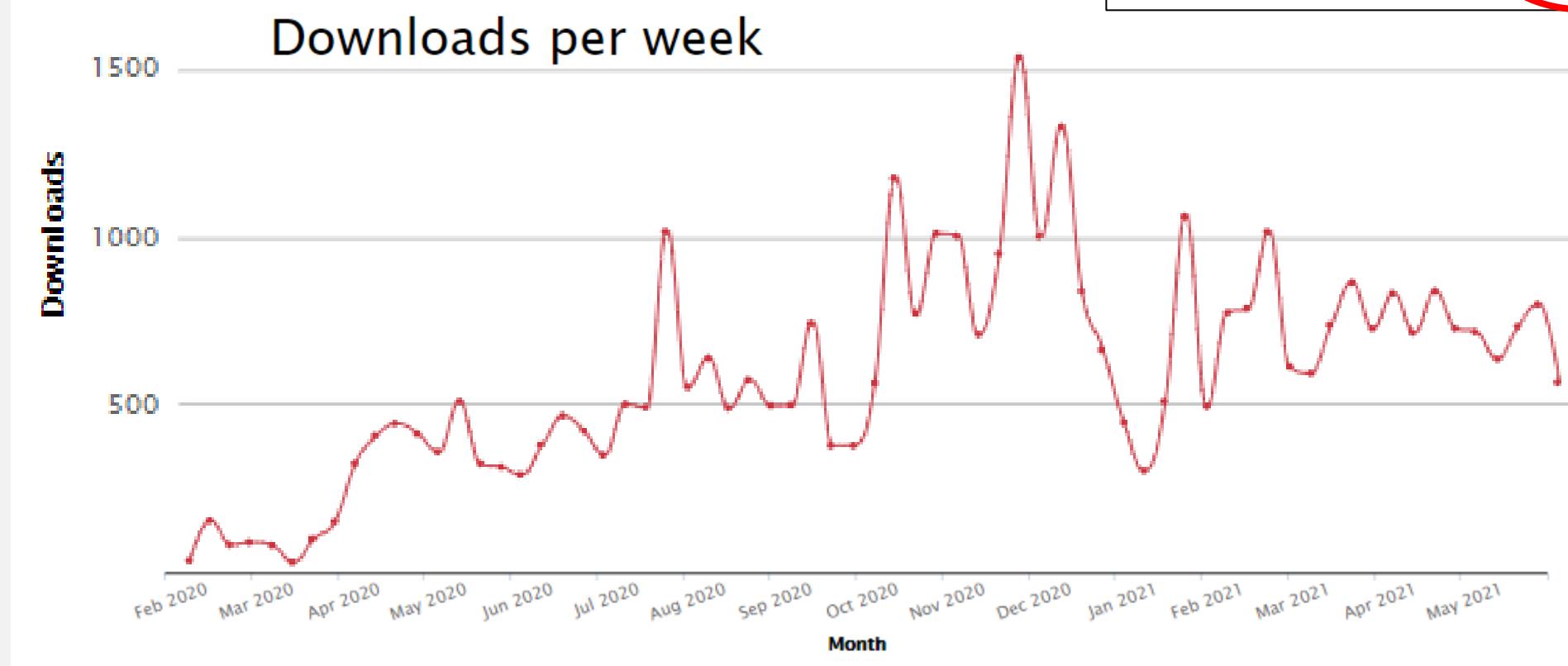
Advantages of FHIR Shorthand Profiling Language

- Concise, readable, understandable
- Rapid changes via text operations: copy, paste, search, and replace
- Perfect for source code control (branching, merging, diffs)
- Error checking and incorporation of best practices
- Complete: FSH does ***everything*** you can do by manually editing
 - Profiles, extensions, value sets, code systems, invariants, mappings
 - Resources and logical models (NEW!)
- HL7 Standard and integrated with HL7 FHIR IG Publisher

FSH Consumption

Total number of downloads between 2020-02-12 and 2021-05-27:

package	downloads
fsh-sushi	39,685



FSH Finder

100+ Implementation Guides

- US
- New Zealand
- Switzerland
- Belgium
- Denmark
- Sweden
- WHO
- DaVinci
- Covid SANER, Logica
- CARIN Blue Button
- SMART Vaccine Credential

FSH Finder 

This is a list of GitHub repositories that contain **FSH** code. Please see the [README](#) for more details on how this works. Last refreshed about 6 hours ago.

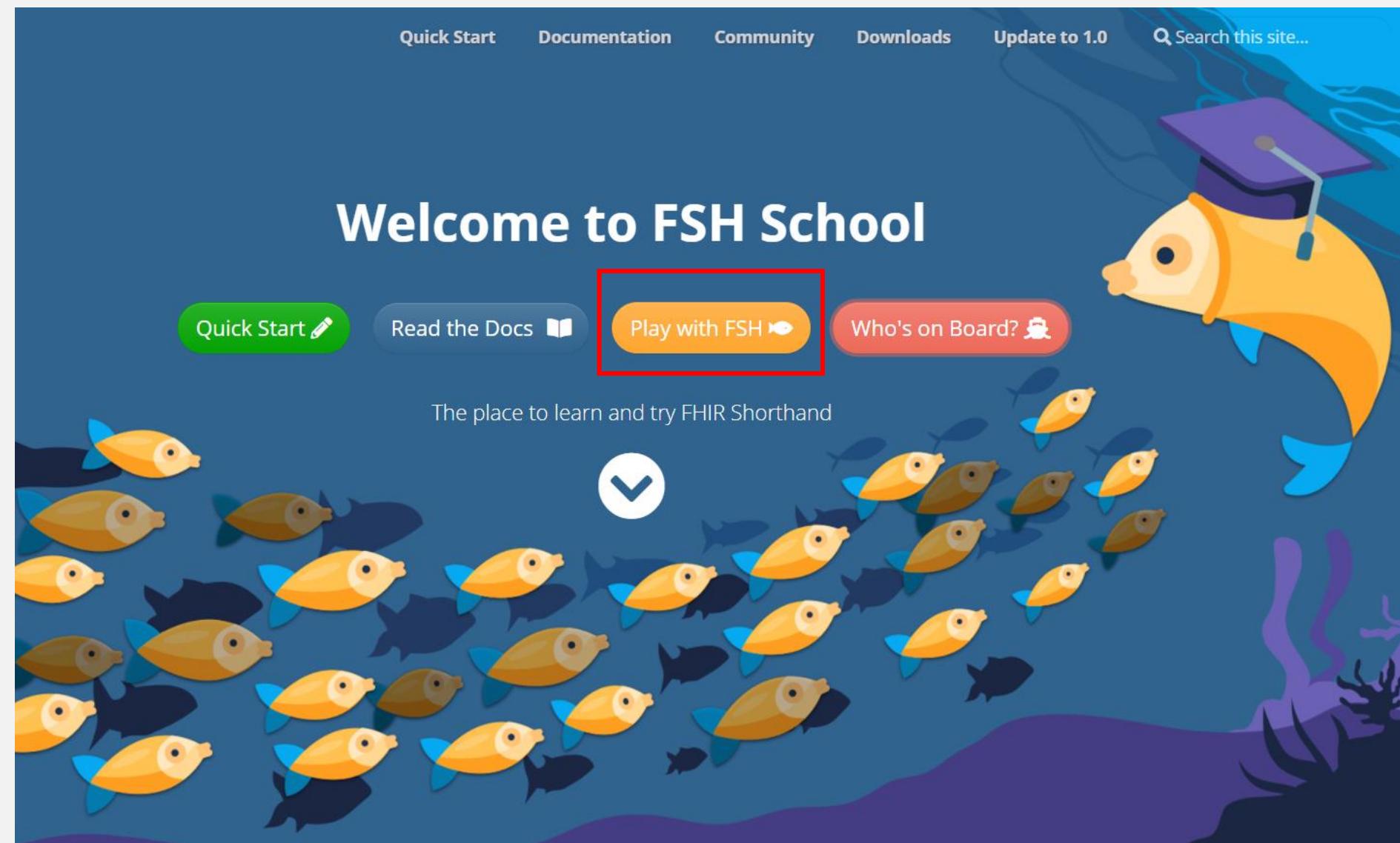
Note: you can mouse over the 'FSH' icons to see which branches in the repository support SUSHI >= 1.0. The badge is dimmed () if FSH is not supported on [main](#) or [master](#).

#	Implementation Guide	FSH Version	FSH: Profile	FSH: Instance	FSH: Extension	FSH: ValueSet	FSH: CodeSystem
1	CIR Immunisation API	 	 	 	 	 	 
2	New Zealand HPI Implementation Guide	 	 	 	 	 	 
3	Mobile access to Health Documents (MHD)	 	 	 	 	 	 
4	HL7 FHIR Implementation Guide: Clinical Genomics Reporting Release 1 STU3	 	 	 	 	 	 
5	SPL Mapping FHIR Implementation Guide	 	 	 	 	 	 
6	pcp	 	 	 	 	 	 
7	dgc	 	 	 	 	 	 
8	Implementation Guide for fellekommunal informationssystems	 	 	 	 	 	 
9	Radiation Dose Summary for Diagnostic Procedures on FHIR	 	 	 	 	 	 
10	CH RAD-Order (RA)	 	 	 	 	 	 
11	ch-orf	 	 	 	 	 	 
12	riziv-medication-record	 	 	 	 	 	 
13	Gatekeeper Implementation Guide	 	 	 	 	 	 
14	Basic Audit Implementation Guide by John Meekeke	 	 	 	 	 	 
15	case-reporting-hiv	 	 	 	 	 	 
16	SMART Health Cards: Vaccination & Testing Implementation Guide	 	 	 	 	 	 
17	KLFMBMessaging	 	 	 	 	 	 
18	New Zealand NHG	 	 	 	 	 	 
19	HL7 FHIR New Zealand Base Implementation Guide	 	 	 	 	 	 
20	empty-fhir-ig	 	 	 	 	 	 
21	WHO Smart Vaccination Certificate	 	 	 	 	 	 
22	US Core Implementation Guide	 	 	 	 	 	 
23	Da Vinci Prior Authorization Support (PAS) FHIR IG	 	 	 	 	 	 
24	minimal Common Oncology Data Elements (mCODE) Implementation Guide	 	 	 	 	 	 
25	Situational Awareness for Novel Epidemic Response	 	 	 	 	 	 
26	riziv-ignite	 	 	 	 	 	 
27	dgc	 	 	 	 	 	 
28	HL7 FHIR Implementation Guide: Standard Health Record (SHR) Adverse Events Release 1 - DRAFT	 	 	 	 		



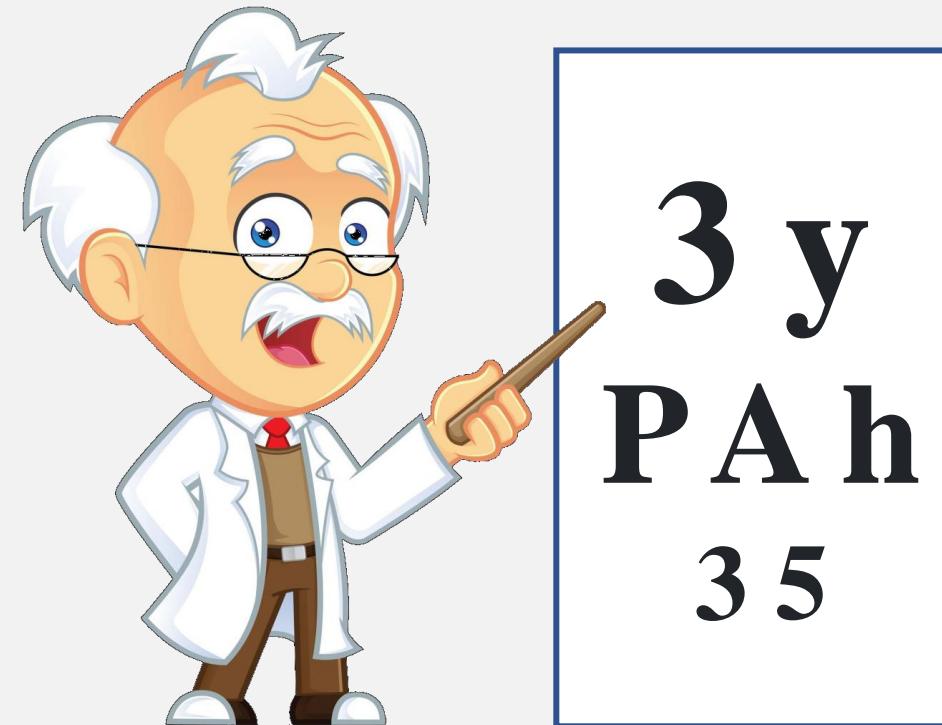
Let's Dive
into FSH

Go to
fshschool.org



Follow along:

<https://bit.ly/3yPAh35>



Example: COVID-19 Diagnosis Profile

1. Base on Condition
2. Diagnosis code U07.1
3. Bind severity to a required value set
4. Require a Patient as subject

```
Profile: CovidDiagnosis
Parent: Condition
Description: "How to report COVID"
* code = $icd#U07.1
* severity from CovidSeverityVS (required)
* subject only Reference(Patient)
* subject 1..1

Alias: $icd = http://hl7.org/fhir/sid/icd-10-cm
```

COVID-19 Severity Value Set

1. Start with the FHIR [condition-severity](#) value set

- Include these codes as defined in <http://snomed.info/sct>

Code	Display
24484000	Severe
6736007	Moderate
255604002	Mild

2. Add SNOMED-CT code for "life threatening"

```
ValueSet: CovidSeverityVS
Description: "Values for COVID severity"
* include codes from valueset http://hl7.org/fhir/ValueSet/condition-severity
* include $sct#442452003 "Life threatening severity (qualifier value)"

Alias: $sct = http://snomed.info/sct
```

Add an example of the profile:

1. Create an instance of CovidDiagnosis
2. Set the subject, code, and severity
3. Create the sample patient

```
Instance: DiagnosisExample
InstanceOf: CovidDiagnosis
Description: "Simple example"
* subject = Reference(JaneDoe)
* code = ICD10#U07.1
* severity = SCT#24484000 "Severe"
```

```
Instance: JaneDoe
InstanceOf: Patient
Description: "Minimal patient"
* name.family = "Doe"
* name.given = "Jane"
```


FSH ONLINE
Powered by SUSHI v1.3.2 and GoFSH v1.1.0

Back to School

Convert to JSON ►
◀ Convert to FSH
Configuration

FSH

```

1 Profile: CovidDiagnosis
2 Parent: Condition
3 Description: "How to report COVID"
4 * code = $icd#U07.1
5 * severity from CovidSeverityVS (required)
6 * subject only Reference(Patient)
7 * subject 1..1
8
9 Alias: $icd = http://hl7.org/fhir/sid/icd-10-cm
10
11 ValueSet: CovidSeverityVS
12 Description: "Values for COVID severity"
13 * include codes from valueset http://hl7.org/fhir/ValueSet/cond
14 * include $sct#442452003 "Life threatening severity (qualifier"
15
16 Alias: $sct = http://snomed.info/sct
17
18 Instance: DiagnosisExample
19 InstanceOf: CovidDiagnosis
20 * subject = Reference(JaneDoe)
21 * code = $icd#U07.1
22 * severity = $sct#24484000 "Severe"
23
24 Instance: JaneDoe
25 InstanceOf: Patient
26 * name.family = "Doe"
27 * name.given = "Jane"
28
29
  
```

FHIR JSON: CovidDiagnosis

```

1 {
2   "resourceType": "StructureDefinition",
3   "id": "CovidDiagnosis",
4   "extension": [
5     {
6       "url": "http://hl7.org/fhir/StructureDefinition/structuredefinition-alias",
7       "valueString": "Clinical.Summary"
8     },
9     {
10       "url": "http://hl7.org/fhir/StructureDefinition/structuredefinition-include",
11       "valueCode": "patient"
12     }
13   ],
14   "url": "http://example.org/StructureDefinition/CovidDiagnosis",
15   "version": "1.0.0",
16   "name": "CovidDiagnosis",
17   "status": "active",
18   "description": "How to report COVID",
19   "fhirVersion": "4.0.1",
20   "mapping": [
21     {
22       "identity": "workflow",
23       "uri": "http://hl7.org/fhir/workflow",
24       "name": "Workflow Pattern"
25     },
26     {
27       "identity": "sct-concept",
28       "uri": "http://snomed.info/conceptdomain",
29       "name": "SNOMED CT Concept Domain Binding"
  
```

Convert to JSON ►
◀ Convert to FSH
Configuration

FSH
FHIR JSON
Configuration

+
New JSON Editor

-
StructureDefinitions

-
CovidDiagnosis

-
ValueSets

-
CovidSeverityVS

-
Instances

-
DiagnosisExample

-
JaneDoe

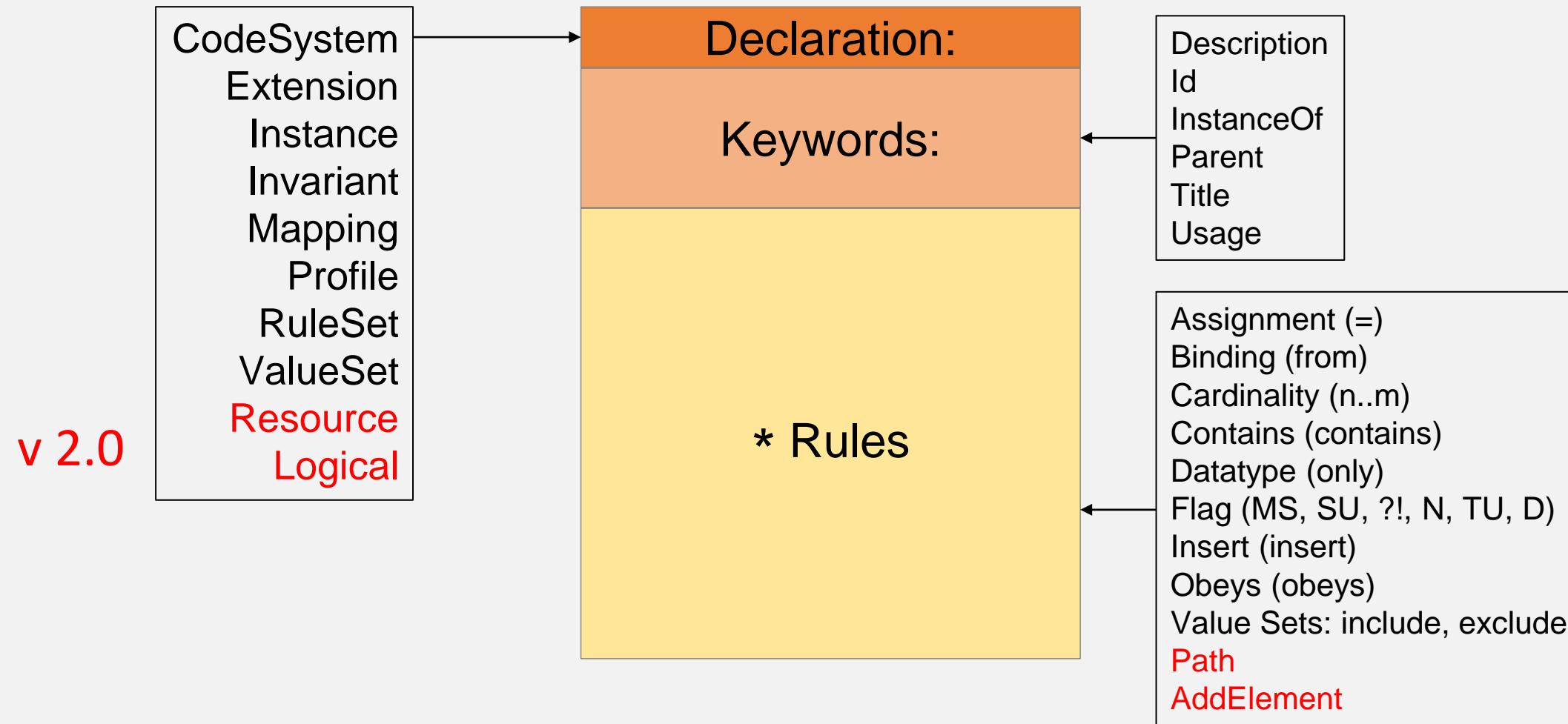
↑
FHIR Artifacts

Things to Remember

- Keywords: **Profile and Parent**
- Keywords: **Instance and InstanceOf**
- Codes: {code system}#{code}
- Assignments: * <element> = {value}
- Binding rule: * <coded element> **from** {value set} ({bindingstrength})
- Cardinality rule: * <element> {min}..{max}
- Data Type rule: * <element> **only** {datatype1} **or** {datatype2}...

Key:
{substitute}
<path>

Anatomy of a FSH item:



Automating Repeated Patterns with Rule Sets

- "Don't repeat yourself" principle
- Share best practices with others

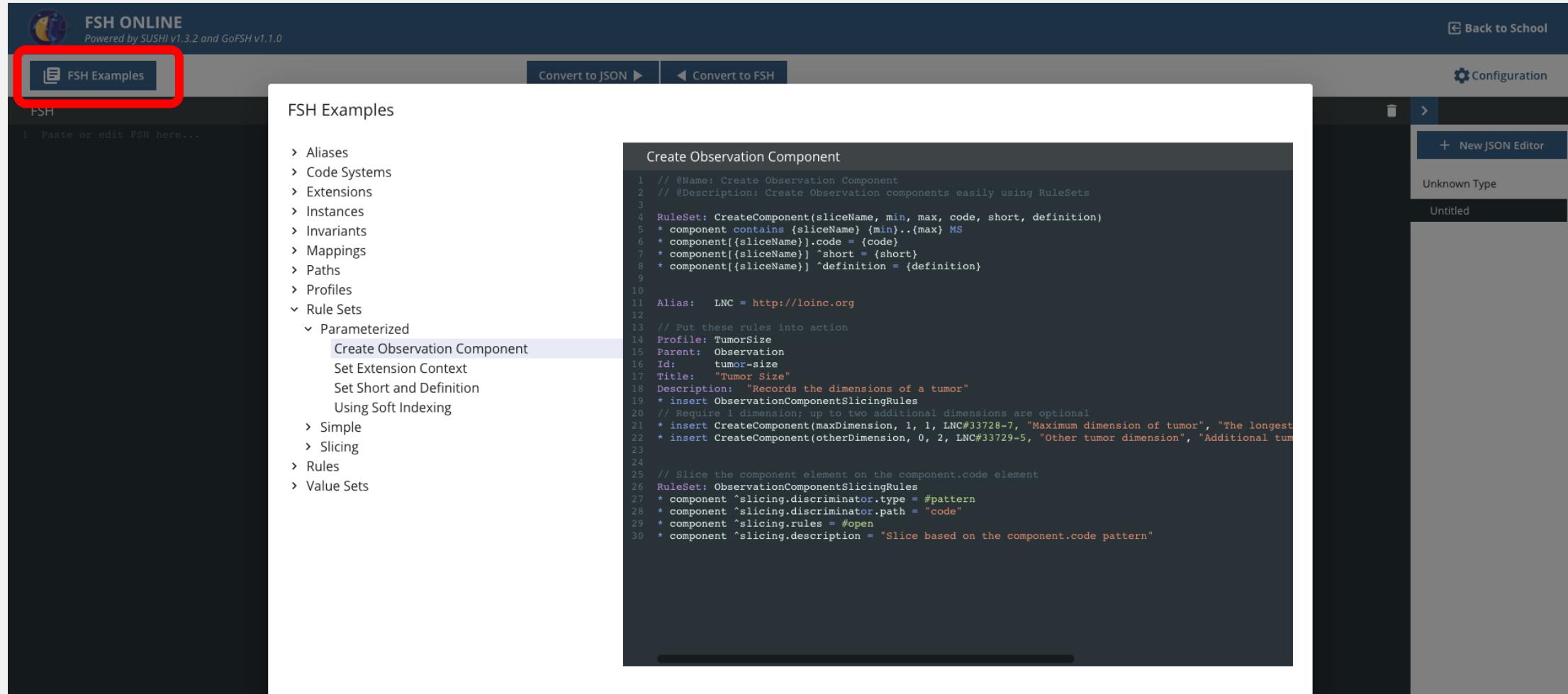
```
RuleSet: CreateComponent(sliceName, min, max, code, short, definition)
* component contains {sliceName} {min}..{max} MS
* component[{sliceName}].code = {code}
* component[{sliceName}] ^short = {short}
* component[{sliceName}] ^definition = {definition}

RuleSet: ObservationComponentSlicingRules
* component ^slicing.discriminator.type = #pattern
* component ^slicing.discriminator.path = "code"
* component ^slicing.rules = #open
* component ^slicing.description = "Slice based on the component.code pattern"
```

Applying Rule Sets ("insert" rules)

```
Profile: TumorSize
Parent: Observation
Id: tumor-size
Title: "Tumor Size"
Description: "Records the dimensions of a tumor"
* insert ObservationComponentSlicingRules
* insert CreateComponent(maxDimension, 1, 1, LNC#33728-7, "Maximum dimension of tumor",
"The longest tumor dimension")
* insert CreateComponent(otherDimension, 0, 2, LNC#33729-5, "Other tumor dimension",
"Additional tumor dimensions should be ordered from largest to smallest")
```

Get or share FSH Examples



The screenshot shows the FSH Online interface. At the top left is the FSH Online logo with the text "FSH ONLINE" and "Powered by SUSHI v1.3.2 and GoFSH v1.1.0". On the right side are buttons for "Back to School" and "Configuration". Below the logo is a navigation bar with a red box around the "FSH Examples" button. To the right of the navigation bar are "Convert to JSON" and "Convert to FSH" buttons. The main content area has a sidebar on the left with a tree view of FSH examples categories: Aliases, Code Systems, Extensions, Instances, Invariants, Mappings, Paths, Profiles, Rule Sets (with a "Parameterized" section expanded, showing "Create Observation Component", "Set Extension Context", "Set Short and Definition", and "Using Soft Indexing"), Simple, Slicing, Rules, and Value Sets. The main panel displays the FHIR System "Create Observation Component" with the following FSH code:

```
1 // @Name: Create Observation Component
2 // @Description: Create Observation components easily using RuleSets
3
4 RuleSet: CreateComponent(sliceName, min, max, code, short, definition)
5 * component contains {sliceName} {min}..{max} MS
6 * component[{sliceName}].code = {code}
7 * component[{sliceName}] ^short = {short}
8 * component[{sliceName}] ^definition = {definition}
9
10 Alias: LNC = http://loinc.org
11
12 // Put these rules into action
13 Profile: TumorSize
14 Parent: Observation
15 Id: tumor-size
16 Title: "Tumor Size"
17 Description: "Records the dimensions of a tumor"
18 * insert ObservationComponentSlicingRules
19 // Require 1 dimension; up to two additional dimensions are optional
20 * insert CreateComponent(maxDimension, 1, 1, LNC#33728-7, "Maximum dimension of tumor", "The longest")
21 * insert CreateComponent(otherDimension, 0, 2, LNC#33729-5, "Other tumor dimension", "Additional tum")
22
23
24 // Slice the component element on the component.code element
25 RuleSet: ObservationComponentSlicingRules
26 * component ^slicing.discriminator.type = #pattern
27 * component ^slicing.discriminator.path = "code"
28 * component ^slicing.rules = #open
29 * component ^slicing.description = "Slice based on the component.code pattern"
30
```

contribute your FSH examples at <https://github.com/FSHSchool/FSHOnline-Examples>

Define an Extension

1. Create Extension
2. Constrain value[x] to CodeableConcept
3. Bind value[x] to a value set
4. Define the value set

```
Extension: ConditionCertainty
Description: "The certainty of diagnosis"
* value[x] only CodeableConcept
* value[x] from ConditionCertaintyVS

ValueSet: ConditionCertaintyVS
Description: "Degree of confidence the condition is present"
* $sct#415684004 "Suspected (qualifier value)"
* $sct#410592001 "Probably present (qualifier value)"
* $sct#41060500 "Confirmed present (qualifier value)"
```

Add an Extension Context (optional)

- The preceding extension can only be applied to Conditions. The way to limit this is:

```
* ^context[0].type = #element  
* ^context[0].expression = "Condition"
```

- This is hard to remember, so consider capturing in a reusable Rule Set:

```
RuleSet: ExtensionContext(path)  
* ^context[+].type = #element  
* ^context[=].expression = "{path}"
```

Note: You must copy the rule set into your project. FSH does not have libraries at the current time

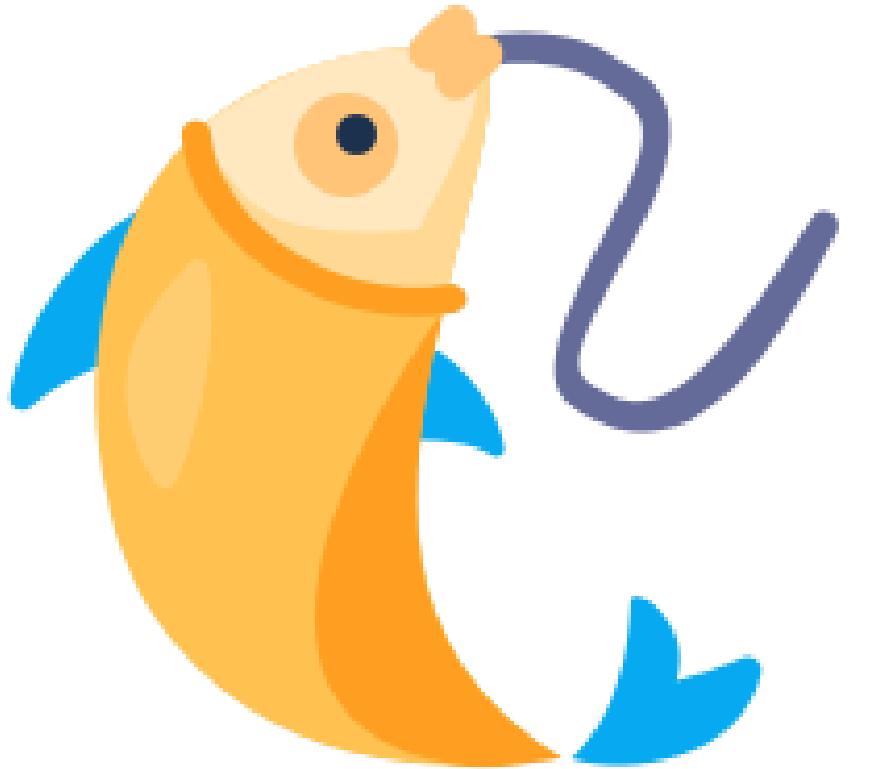
- Then insert into the Extension definition:

```
* insert ExtensionContext(Condition)
```

Add the Extension to the CovidCondition Profile

1. Add the extension
2. Use the element name "certainty"
3. Set cardinality 0..1
4. Add "Must Support"

```
Profile: CovidDiagnosis
Parent: Condition
Description: "How to report COVID"
* code = $icd#U07.1
* severity from CovidSeverityVS (required)
* subject only Reference(Patient)
* extension contains ConditionCertainty named certainty 0..1 MS
```



Learn FSH
using GoFSH



The screenshot shows the GoFISH online interface. At the top, there's a navigation bar with a logo, the text "FSH ONLINE Powered by SUSHI v1.3.2 and GoFISH v1.1.0", a "Back to School" link, and a "Configuration" link. Below the navigation bar, there are two main input fields: "FSH" on the left and "FHIR JSON: Untitled" on the right. Between these fields is a button labeled "Convert to JSON ▶" and another button labeled "◀ Convert to FSH". The "Convert to FSH" button is highlighted with a red rectangle. To the right of the JSON field, there are links for "Delete" and "Move", and a "New JSON Editor" button. A sidebar on the right lists "Unknown Type" and "Untitled". At the bottom left, there's a "Console" section.

FSH ONLINE
Powered by SUSHI v1.3.2 and GoFISH v1.1.0

Convert to JSON ▶

◀ Convert to FSH

FSH

FHIR JSON: Untitled

Convert to FSH

Configuration

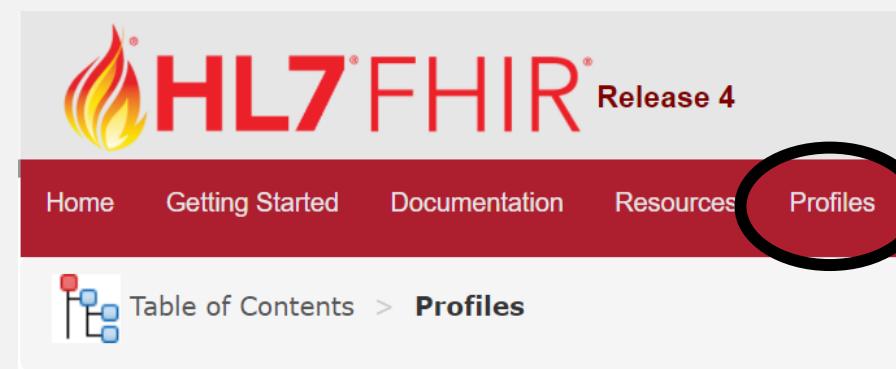
New JSON Editor

Unknown Type

Untitled

Console

Try this: Convert Body Height Vital Signs Profile to FSH



- <https://www.hl7.org/fhir/bodyheight.profile.json>
 - Or Profiles: observation-bodyheight → JSON → Raw JSON
- **Copy and paste** into right pane of FSH Online
- Click **Convert to FSH**

GoFSH Converted FHIR profile:

FSH

```

1 Alias: $vitalsigns = http://hl7.org/fhir/StructureDefinition/vitalsigns
2
3 Profile: observation-bodyheight
4 Parent: $vitalsigns
5 Id: bodyheight
6 Title: "Observation Body Height Profile"
7 Description: "FHIR Body Height Profile"
8 * ^extension[0].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
9 * ^extension[=].valueMarkdown = "#### Complete Summary of the Mandatory Requirements"
10 * ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-wg"
11 * ^extension[=].valueInteger = 5
12 * ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-starter"
13 * ^extension[=].valueCode = #oo
14 * ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
15 * ^extension[=].valueCode = #trial-use
16 * ^status = #draft
17 * ^experimental = false
18 * ^date = "2018-08-11"
19 * ^publisher = "Health Level Seven International (Orders and Observations"
20 * ^contact.telecom.system = #url
21 * ^contact.telecom.value = "http://www.hl7.org/Special/committees/orders/index.html"
22 * . 0..*
23 * . ^short = "FHIR Body Height Profile"
24 * . ^definition = "This profile defines how to represent Body Height observations"
25 * code ^short = "Body Height"
26 * code ^definition = "Body Height."
27 * code ^comment = "additional codes that translate or map to this code are"
28 * code ^alias[0] = "Test"
29 * code ^alias[+] = "Name"

```

FHIR JSON: bodyheight

```

1 {
2   "resourceType" : "StructureDefinition",
3   "id" : "bodyheight",
4   "text" : {
5     "status" : "generated",
6     "div" : "<div xmlns=\"http://www.w3.org/1999/xhtml\">to do</div>"
7   },
8   "extension" : [
9     {
10       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-summary",
11       "valueMarkdown" : "#### Complete Summary of the Mandatory Requirements\r\n\r\n"
12     },
13     {
14       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm",
15       "valueInteger" : 5
16     },
17     {
18       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-wg",
19       "valueCode" : "oo"
20     },
21     {
22       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-starter",
23       "valueCode" : "trial-use"
24     }
25   ],
26   "url" : "http://hl7.org/fhir/StructureDefinition/bodyheight",
27   "version" : "4.0.1",
28   "name" : "observation-bodyheight",
29   "title" : "Observation Body Height Profile",
30   "status" : "draft",
31   "experimental" : false.

```



Additional Syntax:

- Caret (^) refers to metadata in the StructureDefinition

```
* ^experimental = false
* ^date = "2018-08-11"
* ^publisher = "Health Level Seven International (Orders and Observations Workgroup)"

* code ^short = "Body Height"
* code ^definition = "Body Height."
```

- [0], [+], [=] refer to first, next, same array elements

```
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
* ^extension[=].valueInteger = 5
```

(indicate the FHIR Maturity of this profile = 5 using extension on StructureDefinition)

FSH Resources and Tools

- [FSH Language Specification](#) -- HL7 FHIR Standard
- [SUSHI](#) -- compile FSH into FHIR Artifacts
- [FSH School](#) -- web site with documentation, tools, examples
- [FSH Online](#) -- interactive FHIR Shorthand with examples
- [GoFSH](#) -- convert existing implementation guides into FSH (beta)
- [FSH Finder](#) -- web crawler to find FSH projects
- [VS Code extension](#) -- code highlighter for VS Code editor
- [# shorthand](#) -- Zulip chat channel

Language Reference: FHIR Shorthand IG

FHIR Shorthand
1.1.0 - CI Build

Table of Contents > Language Reference

FHIR Shorthand, published by HL7 International - FHIR Infrastructure Group. This is not an authorized publication; it is the continuous build for version 1.1.0). This version is based on the current content of <https://github.com/HL7/fhir-shorthand/> and changes regularly. See the [Directory of published versions](#)

3 Language Reference

This chapter contains the formal specification of the FHIR Shorthand (FSH) language. It is intended as a reference, not a tutorial.

In this specification, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in [RFC2119](#).

3.1 About the Specification

The FSH specification uses syntax expressions to illustrate the FSH language. While FSH has a formal grammar (see [Appendix](#)), most readers will find the syntax expressions more instructive.

Syntax expressions uses the following conventions:

Style	Explanation	Example
<code>Code</code>	Code fragments, such as FSH keywords, FSH statements, and FSH syntax expressions	<code>* status = #open</code>
{curly braces}	An item to be substituted in a syntax expression	<code>{display string}</code>
<code><datatype></code>	An element or path to an element with the given data type, to be substituted in the syntax expression	<code><CodeableConcept></code>
<i>italics</i>	An optional item in a syntax expression	<code>"{string}"</code>
ellipsis (...)	Indicates a pattern that can be repeated	<code>{flag1} {flag2} {flag3} ...</code>
bold	A directory path or file name	<code>example-1.fsh</code>
vertical bar	A choice of items or data types in the syntax	<code>name id url</code>

Examples:

- A FSH rule to assign the value of a Quantity:

```
* <Quantity> = {decimal or integer} '{UCUM unit}'
```

A FSH statement following this pattern would be written as:



- About the Specification
- FSH Foundations
- FSH Language Basics
- FSH Paths
- Rules for Profiles, Extensions, and Instances
- Defining Items
- Appendix: Abbreviations
- Appendix: Formal Grammar

<http://build.fhir.org/ig/HL7/fhir-shorthand/>

Downloads → Quick Reference Card

 **FHIR Shorthand 1.0 Quick Reference: Syntax** 

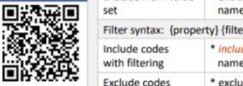
Key to Expression Syntax	
{curly braces}	An item to be substituted
<angle brackets>	Path to an element of given data type
<i>Italics</i>	An optional item
<i>Italics</i>	An optional statement
ellipsis (...)	Indicates a pattern that can be repeated
vertical bar ()	Indicates a choice of items or data types
bold	Default value

Item	Keywords	Rules
Alias	Alias: {alias name} = {uri urn:oid} // alias name may begin with \$	Assignment * <element> = {value} <i>(exactly)</i> Binding * <bindable> from {ValueSet name id url} <i>(strength)</i>
Extension	Extension: {name} Parent: {Extension name id url} Id: {id} Title: {string} Description: {string or markdown}	Cardinality * <element> <i>(cardinality)</i> Contains (inline extensions) * <Extension> contains {name1} <i>(cardinality1)</i> <i>(flags1)</i> and {name2} <i>(cardinality2)</i> <i>(flags2)</i> and {name3} <i>(cardinality3)</i> <i>(flags3)</i> ... * <Extension> contains {Extension1 name id url} named {name1} <i>(cardinality1)</i> <i>(flags1)</i> and {Extension2 name id url} named {name2} <i>(cardinality2)</i> <i>(flags2)</i> and {Extension3 name id url} named {name3} <i>(cardinality3)</i> <i>(flags3)</i> ...
Instance	Instance: {id} InstanceOf: {Resource Profile name id url} Usage: {example #definition #inline} Title: {string} Description: {string or markdown}	Contains (standalone extensions) * <Extension> contains {Extension1 name id url} named {name1} <i>(cardinality1)</i> <i>(flags1)</i> and {Extension2 name id url} named {name2} <i>(cardinality2)</i> <i>(flags2)</i> and {Extension3 name id url} named {name3} <i>(cardinality3)</i> <i>(flags3)</i> ...
Invariant	Invariant: {id} Severity: {error #warning} Description: {string markdown} Expression: {FHIRPath string} XPath: {XPath expression string}	Contains (slicing) * <array> contains {name1} <i>(cardinality2)</i> <i>(flags1)</i> and {name2} <i>(cardinality2)</i> <i>(flags2)</i> and {name3} <i>(cardinality3)</i> <i>(flags3)</i> ... * <element1> and <element2> and <element3> ... (flag1) <i>(flag2)</i> <i>(flag3)</i> ...
Mapping	Mapping: {id} Source: {Profile name id} Target: {Target specification url} Id: {Target specification id} Title: {Target description string} Description: {string}	Flag * insert {RuleSet name} Mapping * <element> -> {map string} " {comment string}" # <i>(mime-type code)</i> Obeyes * <element> obeys {Invariant id} and {Invariant2 id} ... * <element> only {datatype1} or {datatype2} or {datatype3} ... * <element> only Reference<{ResourceType1 name id url} {ResourceType2 name id url} {ResourceType3 name id url} ...>
Profile	Profile: {name} Parent: {Resource Profile name id url} Id: {id} Title: {string} Description: {string or markdown}	Type RuleSet: {name} Value Set and Code System ValueSet: {name} or CodeSystem: {name} Id: {id} Title: {string} Description: {string or markdown}
RuleSet	RuleSet: {name}	
Value Set and Code System	ValueSet: {name} or CodeSystem: {name} Id: {id} Title: {string} Description: {string or markdown}	

Notations and Special Values	
code	# <code></code>
Coding	{CodeSystem name id url} <i>(version string)</i> # <code></code> " {display string}"
Cardinality	{min..}{max} ..{min..} ..{max}
Quantity with units	{decimal or integer} '{UCUM code}'
Comments	// single line comment /* multi-line comment */
Flags	MS // must support SU // summary, Z ?! // modifier
Binding strengths	required extensible preferred example
Triple quote string	''' {string markdown}'''
References	Reference({Resource name id url})
Canonical	Canonical({name id version string})

Paths	
Array element	<array element>[0-based index]
Reference	<Reference>[{Resource Profile name id url}]
Extension	<Extension>[{extension name id URL}]
Sliced array	<array element>[slice-name id reslice-name]
Caret paths	^<element of StructureDefinition>
	<element in Profile> ^<element in corresponding ElementDefinition>

Slicing Rubric	
* <array-path> ^slicing.discriminator.type = #pattern	#pattern #profile #exists
* <array-path> ^slicing.discriminator.path = {FHIRPath string}	
* <array-path> ^slicing.rules = #open #closed #openAtEnd	
* <array-path> ^slicing.order = true false	
* <array-path> ^slicing.description = {string}	

Get More Information	
	FSH Specification
	FSH Chat
	FSH School
	HL7 Project Page

Compliments of MITRE Corporation

Sept 2020

Syntax

 **FHIR Shorthand 1.0 Quick Reference: Examples** 

Item	Keywords	Rules
code	#confirmed	Assignment Alias: UCUM = http://unitsofmeasure.org
Coding and CodeableConcept	http://snomed.info/sct#363346000 "Malignant neoplastic disease (disorder)" ICD10CM#C004	Binding Alias: \$GenderIdentity = http://hl7.org/fhir/StructureDefinition/patient-genderIdentity
Cardinality	0..1 1..1 2..* (two-sided) ..1 1.. 2.. (one-sided)	Assignment // end of line or single line
Comments	// This comment continues over multiple lines /*	Code system Title: "AICC Fair Use" Description: "A small subset of AICC staging codes used for IG examples."
References	Reference(Patient) Reference(Practitioner) Canonical(MyPatient)	Extension Extension: TreatmentTerminationReason Id: treatment-termination-reason Title: "Treatment Termination Reason" Description: "Reason for stopping a treatment."

Paths	
Nested element	stage.assessment
Array element	name[0].given[1]
Choice [x] element	valueQuantity, valueReference
Reference choices	performer[Organization]

Item	Keywords	Rules
Invariant	invariant: us-core-8 Description: "Patient.name.given or Patient.name.family both SHALL be present"	Contains (inline extension) * extension contains treatmentIntent 0..1 MS and terminationReason 0..1 MS
Instance	instance: TumorMarkerExample01 instanceOf: TumorMarker Usage: #example Description: "Epidermal growth factor example."	Contains (standalone extension) * extension contains \$GenderIdentity named genderIdentity 0..1 MS and http://hl7.org/fhir/StructureDefinition/patient-disability named disability 0..1 MS
Invariant	invariant: us-core-8 Description: "Patient.name.given or Patient.name.family both SHALL be present"	Contains (slicing) * component contains GeneStudied 0..* MS and VariationCode 0..* and GenomicDNAChange 0..1
Extension	extension:deceased[X] M ?! SU * reasonCode and extension:terminationReason MS	Flag * deceased[X] M ?! SU * reasonCode and extension:terminationReason MS
Instance	instance: TumorMarkerExample01 instanceOf: TumorMarker Usage: #example Description: "Epidermal growth factor example."	Insert * insert USCoreTerminologyRuleSet
Mapping	mapping: USCancerPatientToArgonaut Source: USCancerPatient Target: "http://unknown.org/Argonaut-DQ-DSTU2" Id: argonaut-dq-dstu2 Title: "Argonaut DSTU2"	Mapping * -> "Patient" # identifier.system -> "Patient.identifier.system"
Type	obeyes us-core-6 and us-core-9 * value[x] only CodeableConcept * effective[x] only dateOrPeriod * subject only Reference(CancerPatient) * asserter only Reference(Practitioner or Patient)	Obeyes * obeys us-core-6 and us-core-9 * value[x] only CodeableConcept * effective[x] only dateOrPeriod * subject only Reference(CancerPatient) * asserter only Reference(Practitioner or Patient)

Value Set Rules		
Single code	* include Coding	Value Set Single code * SCT#54102005 "G1 grade (finding)"
Exclude single code	* exclude Coding	Exclude single code * exclude SCT#12619005
Include entire code system	* include codes from system {CodeSystem name id url}	All codes in system * includes codes from system HGVS
Include from value set	* include codes from valueSet {ValueSet name id url}	Filter Rules for SNOMED-CT (assumes code system aliased as 'SCT')
Exclude from value set	* exclude codes from valueSet {ValueSet name id url}	Subsumption * include codes from system SCT where concept is-a #123037004 "Body Structure"
Filter syntax: {property} {filter-operator} {value}		Exclude subsumption * exclude codes from system SCT where concept is-a #128462008 "Secondary malignant neoplastic disease (disorder)"

Item	Keywords	Rules
Code System Rule	Local code definition * NED "No Evidence of Disease" "No physical evidence of disease on exam or imaging tests."	

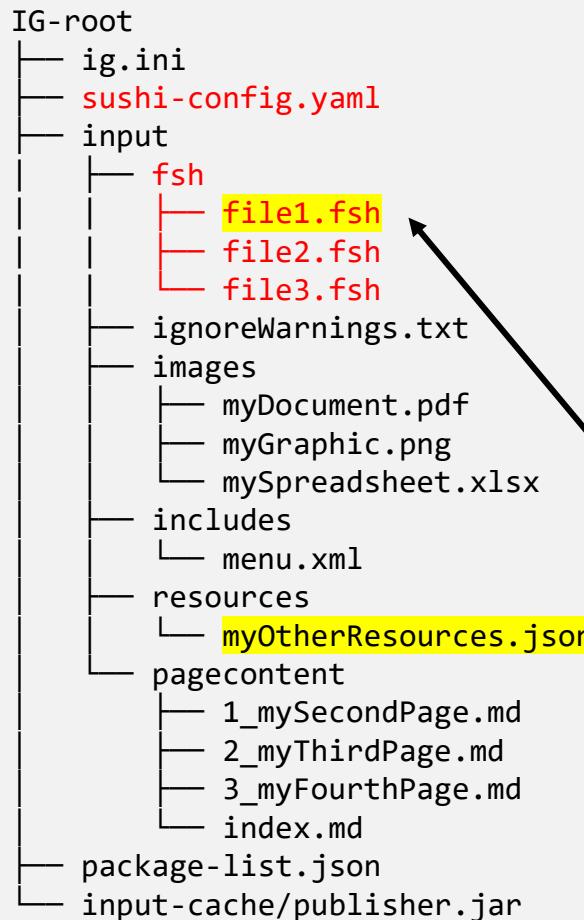
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Sept 2020

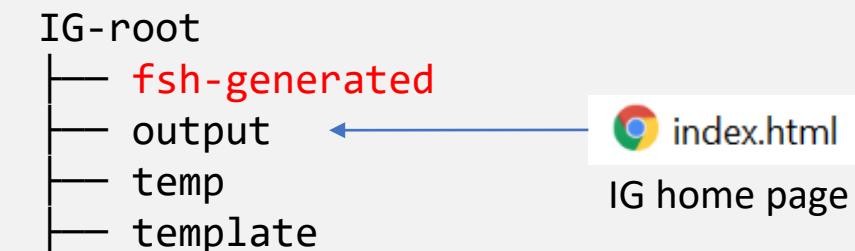
Examples

Look Ahead to Let's Build (next session)

Creating a FSH Implementation Guide



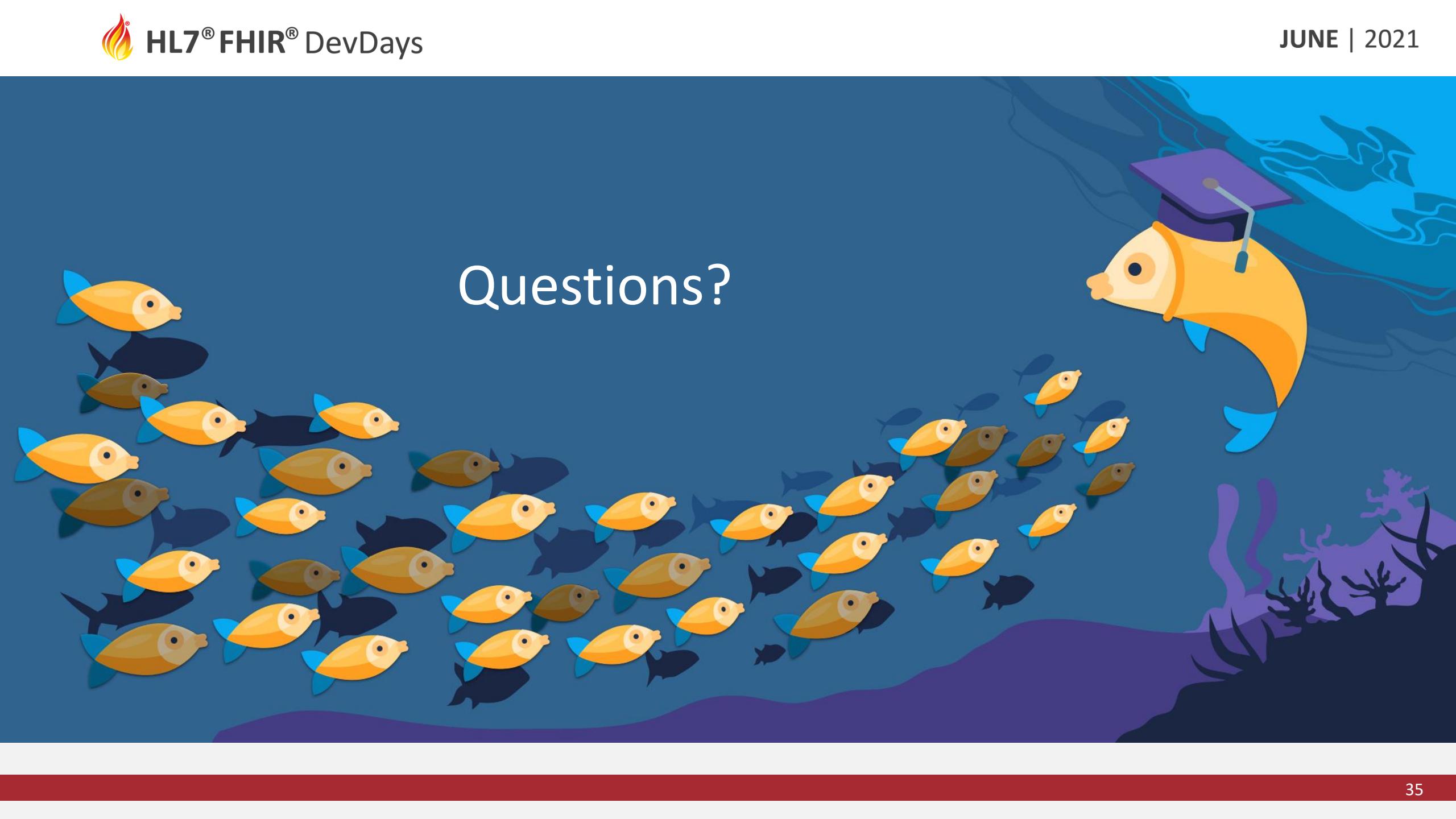
run HL7 IG publisher
(runs SUSHI for you)



You can mix FSH with resources
created by Trifolia or Forge

Prepare for Let's Build (next session)

- Install **Node.js LTS** edition from <https://nodejs.org/>
- Install **SUSHI** and **GoFSh**
 - Open a terminal and run: `npm install -g fsh-sushi`
 - Open a terminal and run: `npm install -g gofsh`
- Install **VS Code** (if text editor is needed)
 - <https://code.visualstudio.com/download>



Questions?

ORGANIZED BY



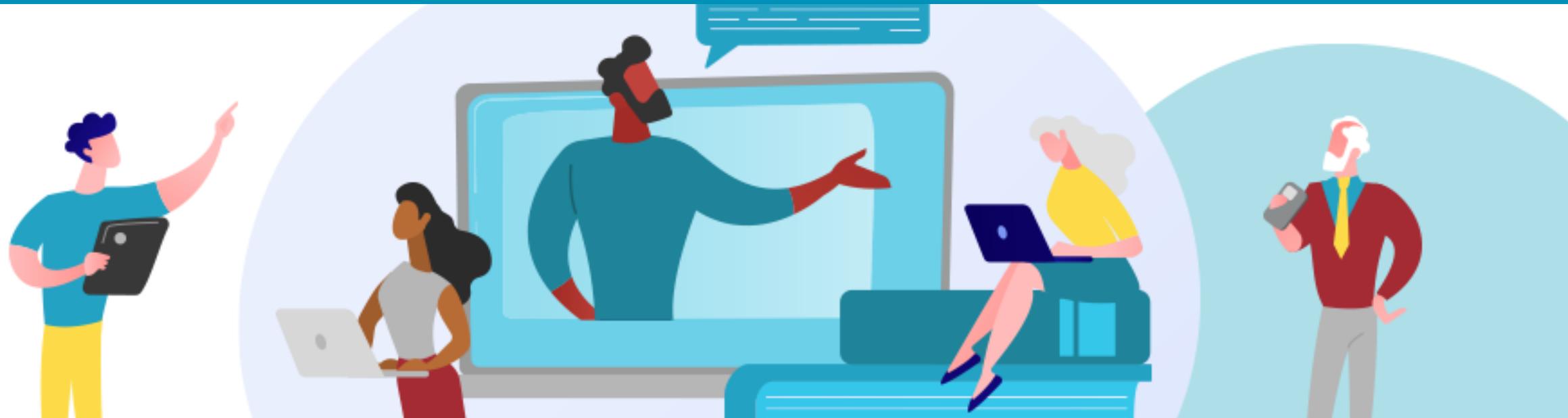
PARTNER





Tutorial: Create an Implementation Guide with FHIR Shorthand

Mark Kramer and Chris Moesel, MITRE Corporation



HL7 FHIR DevDays 2021, Virtual Edition, June 7–10, 2021 | @HL7 | @FirelyTeam | #fhirdevdays | www.devdays.com

ORGANIZED BY



PARTNER



Mark Kramer

- Chief Engineer, MITRE Health Innovation Center

Chris Moesel

- Principal Software Systems Engineer

 MITRE

Not-for-profit R&D institution working in the public interest and funded by the US government

 INFERNO mCODE™ SYNTHEA Clinical
Quality
Language FHIR®
Short™

Track overview: Let's Build a FHIR specification

Monday

Introduction to FHIR
11:00 – 11:45

Tuesday

Introduction Profiling
1:00 – 1:45



Profiling with Forge
2:15 – 3:00

Wednesday

Accelerating your IG production
1:00 – 1:45



IG with IG Publisher
2:15 – 3:00

Thursday

FHIR Registry & Packages
1:00 – 1:45



Publishing with Simplifier.net
2:15 – 3:00

You are here



Create an IG with
FHIR Shorthand
3:15 – 4:00



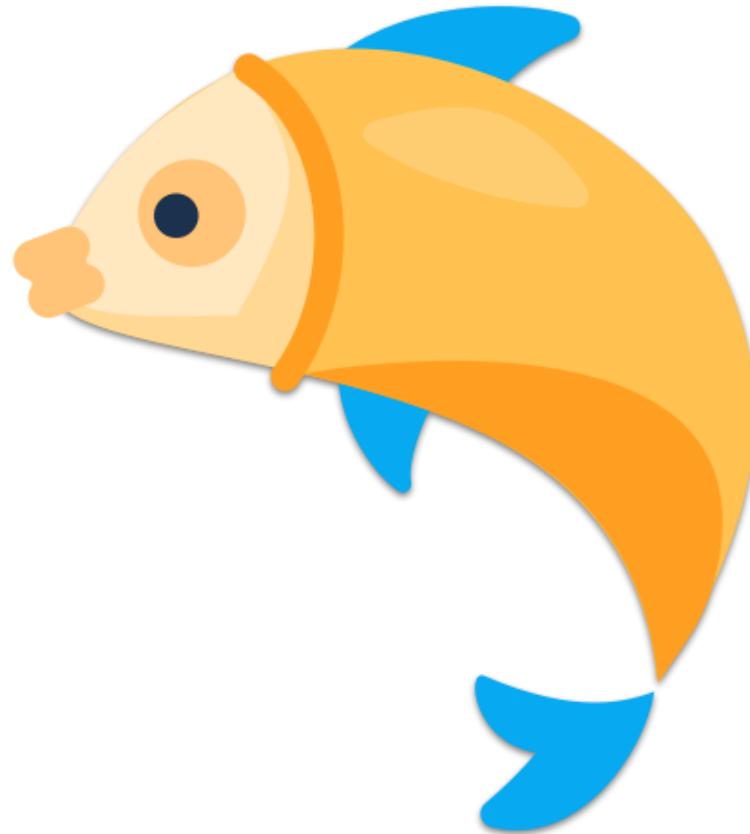
Create an IG with
FHIR Shorthand
4:15 – 5:00



Advanced FHIR Shorthand
and Tools
3:15 – 4:00



FSH
Background



FHIR Profiles and Implementation Guides

- Base FHIR does not provide the specifics required to implement most exchanges
- **Profiles** are FHIR's way to provide additional details
 - A FHIR profile specifies acceptable codes, extensions, restrictions on data types, and more
- Profiles are collected into **Implementation Guides (IGs)** that describe national standards or complete use cases
- Implementers use IGs to create actual APIs

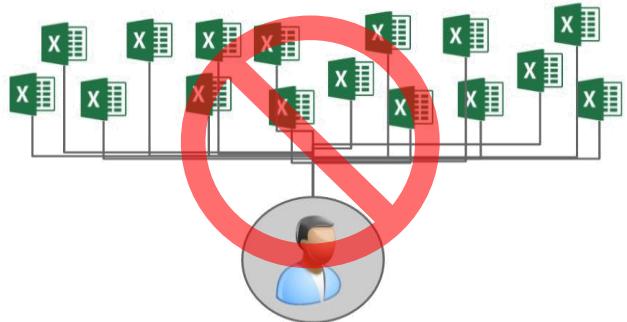
Profiling Approaches



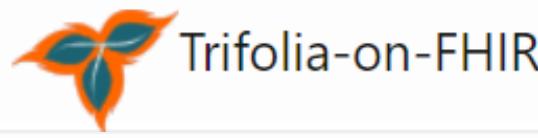
Hand-Editing



Spreadsheets



User Interfaces



Forge

Profile on Patient⁽⁵⁾: PatienNL

Properties Narrative Element Tree Element Grid Xml

Edit the meta properties of the selected resource or component.

URL

<http://hl7.org/fhir/StructureDefinition/PatienNL>

Resource ID

Name

PatienNL

Description

StructureDefinition for a Dutch Patient.

Command-Driven



MAKE ME A SANDWICH.

OKAY.

Profile: MyPatient

Parent: Patient

* name 1...* MS

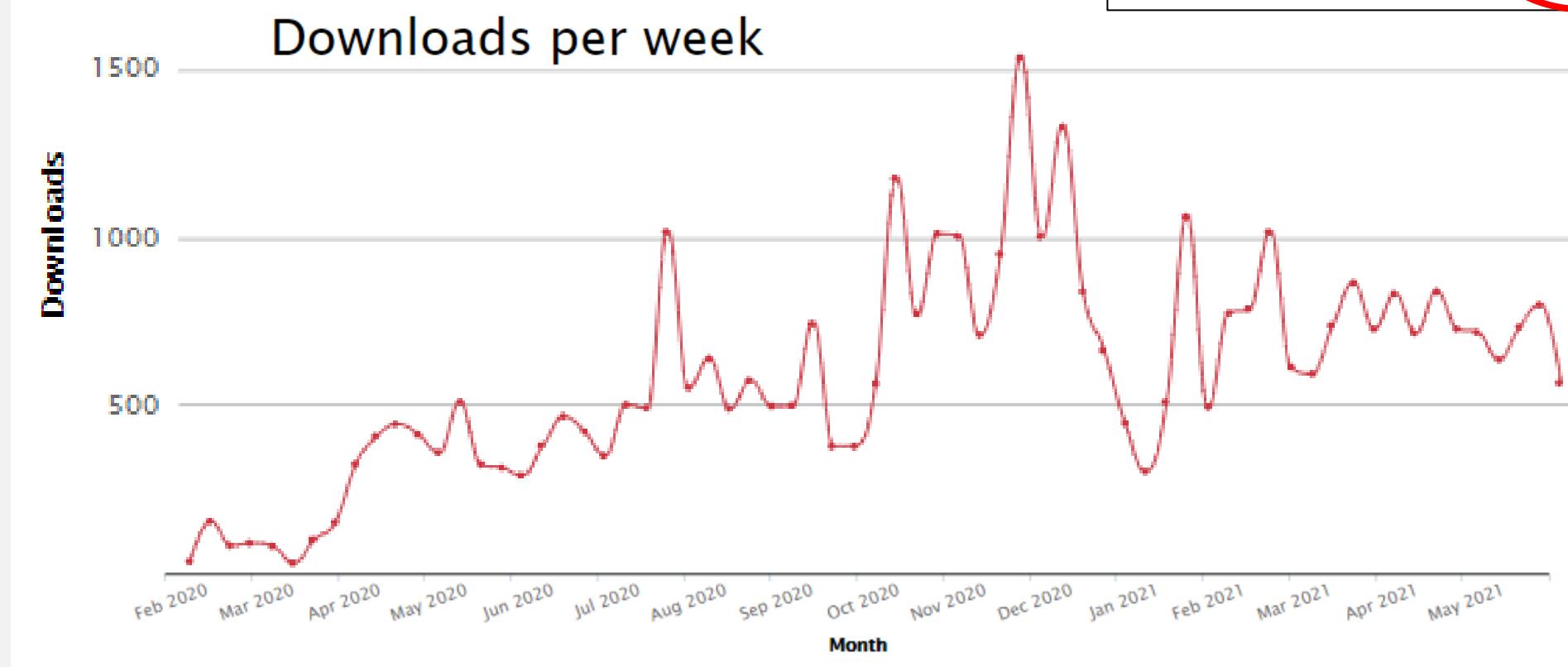
Advantages of FHIR Shorthand Profiling Language

- Concise, readable, understandable
- Rapid changes via text operations: copy, paste, search, and replace
- Perfect for source code control (branching, merging, diffs)
- Error checking and incorporation of best practices
- Complete: FSH does ***everything*** you can do by manually editing
 - Profiles, extensions, value sets, code systems, invariants, mappings
 - Resources and logical models (NEW!)
- HL7 Standard and integrated with HL7 FHIR IG Publisher

FSH Consumption

Total number of downloads between 2020-02-12 and 2021-05-27:

package	downloads
fsh-sushi	39,685



FSH Finder

100+ Implementation Guides

- US
- New Zealand
- Switzerland
- Belgium
- Denmark
- Sweden
- WHO
- DaVinci
- Covid SANER, Logica
- CARIN Blue Button
- SMART Vaccine Credential

FSH Finder 

This is a list of GitHub repositories that contain **FSH** code. Please see the [README](#) for more details on how this works. Last refreshed about 6 hours ago.

Note: you can mouse over the 'FSH' icons to see which branches in the repository support SUSHI >= 1.0. The badge is dimmed () if FSH is not supported on [main](#) or [master](#).

#	Implementation Guide	FSH Version	FSH: Profile	FSH: Instance	FSH: Extension	FSH: ValueSet	FSH: CodeSystem
1	CIR Immunisation API	1.0	No	No	No	No	No
2	New Zealand HPI Implementation Guide	1.0	No	No	No	No	Yes
3	Mobile access to Health Documents (MHD)	1.0	No	No	No	No	Yes
4	HL7 FHIR Implementation Guide: Clinical Genomics Reporting Release 1 STU3	1.0	No	No	No	No	Yes
5	SPL Mapping FHIR Implementation Guide	1.0	No	No	No	No	Yes
6	pcp	1.0	No	No	No	No	Yes
7	dgc	1.0	No	No	No	No	No
8	Implementation Guide for fellekommunal informationssystems	1.0	No	No	No	No	Yes
9	Radiation Dose Summary for Diagnostic Procedures on FHIR	1.0	No	No	No	No	No
10	CH RAD-Order (RA)	1.0	No	No	No	No	Yes
11	ch-orf	1.0	No	No	No	No	Yes
12	riziv-medication-record	1.0	No	No	No	No	Yes
13	Gatekeeper Implementation Guide	1.0	No	No	No	No	Yes
14	Basic Audit/Implementation Guide by John Meehke	1.0	No	No	No	No	Yes
15	case-reporting-hiv	1.0	No	No	No	No	Yes
16	SMART Health Cards: Vaccination & Testing Implementation Guide	1.0	No	No	No	No	Yes
17	KLFFBMessaging	1.0	No	No	No	No	Yes
18	New Zealand NHI IG	1.0	No	No	No	No	Yes
19	HL7 FHIR - New Zealand Base Implementation Guide	1.0	No	No	No	No	Yes
20	empty-fhir-ig	1.0	No	No	No	No	Yes
21	WHO Smart Vaccination Certificate	1.0	No	No	No	No	Yes
22	US Core Implementation Guide	1.0	No	No	No	No	Yes
23	Da Vinci Prior Authorization Support (PAS) FHIR IG	1.0	No	No	No	No	Yes
24	minimal Common Oncology Data Elements (mCODE) Implementation Guide	1.0	No	No	No	No	Yes
25	Situational Awareness for Novel Epidemic Response	1.0	No	No	No	No	Yes
26	riziv-ims	1.0	No	No	No	No	Yes
27	dgc	1.0	No	No	No	No	Yes
28	HL7 FHIR Implementation Guide: Standard Health Record (SHR) Adverse Events Release 1 - DRAFT	1.0	No	No	No	No	Yes
29	Patient Corrections Implementation Guide	1.0	No	No	No	No	Yes
30	智慧医疗-疫苗管理与报告IG	1.0	No	No	No	No	Yes
31	HL7 FHIR Implementation Guide - New Zealand Formulary/NZULM IG	1.0	No	No	No	No	Yes
32	HL7 FHIR Implementation Guide - NZULM IG	1.0	No	No	No	No	Yes

Other formats  

FSH Finder 

This is a list of GitHub repositories that contain **FSH** code. Please see the [README](#) for more details on how this works. Last refreshed about 6 hours ago.

Note: you can mouse over the 'FSH' icons to see which branches in the repository support SUSHI >= 1.0. The badge is dimmed () if FSH is not supported on [main](#) or [master](#).

#	Implementation Guide	FSH Version	FSH: Profile	FSH: Instance	FSH: Extension	FSH: ValueSet	FSH: CodeSystem
33	Carequality Subscription Implementation Guide for Push Notifications	1.0	No	No	No	No	No
34	manzane-ig	1.0	No	No	No	No	No
35	FhirFairG	1.0	No	No	No	No	No
36	mSD	1.0	No	No	No	No	No
37	FooBar	1.0	No	No	No	No	No
38	HL7 FHIR Implementation Guide: DK Core	1.0	No	No	No	No	No
39	hiv-ig	1.0	No	No	No	No	No
40	DRAFT - CodeX Implementation Guide: Integrated Trial Matching for Cancer Patients and Providers	1.0	No	No	No	No	No
41	CH eTOC (RA)	1.0	No	No	No	No	No
42	HL7 FHIR Implementation Guide: Profiles for ICSR Transfusion and Vaccination Adverse Event Detection and Reporting	1.0	No	No	No	No	No
43	fhir-ips	1.0	No	No	No	No	No
44	medTech IG	1.0	No	No	No	No	No
45	DK MedCom Core	1.0	No	No	No	No	No
46	Swedish Base Profiles Implementation Guide	1.0	No	No	No	No	No
47	Swedish Base Profiles Implementation Guide	1.0	No	No	No	No	No
48	KLGatewayMunicipalityCareData	1.0	No	No	No	No	No
49	carin-consumer-direct-data	1.0	No	No	No	No	No
50	Saralert	1.0	No	No	No	No	No
51	CARIN Consumer Directed Data Exchange (CARIN IG for Blue Button®)	1.0	No	No	No	No	No
52	devdays-covid19-vaccine	1.0	No	No	No	No	No
53	ITB Implementation Guide	1.0	No	No	No	No	No
54	HL7 FHIR Implementation Guide	1.0	No	No	No	No	No
55	IHRIS Relationship	1.0	No	No	No	No	No
56	Application Data Exchange Assessment Framework and Functional Requirements for Medical Health	1.0	No	No	No	No	No
57	HL7 FHIR Implementation Guide: Military Service History and Status Release 1 - RELENT STU3	1.0	No	No	No	No	No
58	CH-Allergy/intolerance (RA)	1.0	No	No	No	No	No
59	PharmaceuticalQualityImplementationGuide	1.0	No	No	No	No	No
60	SMART App Launch	1.0	No	No	No	No	No
61	base	1.0	No	No	No	No	No
62	snomed-ig	1.0	No	No	No	No	No
63	case-reporting	1.0	No	No	No	No	No
64	ch-ig	1.0	No	No	No	No	No
65	nhip	1.0	No	No	No	No	No
66	vitalink-ig	1.0	No	No	No	No	No

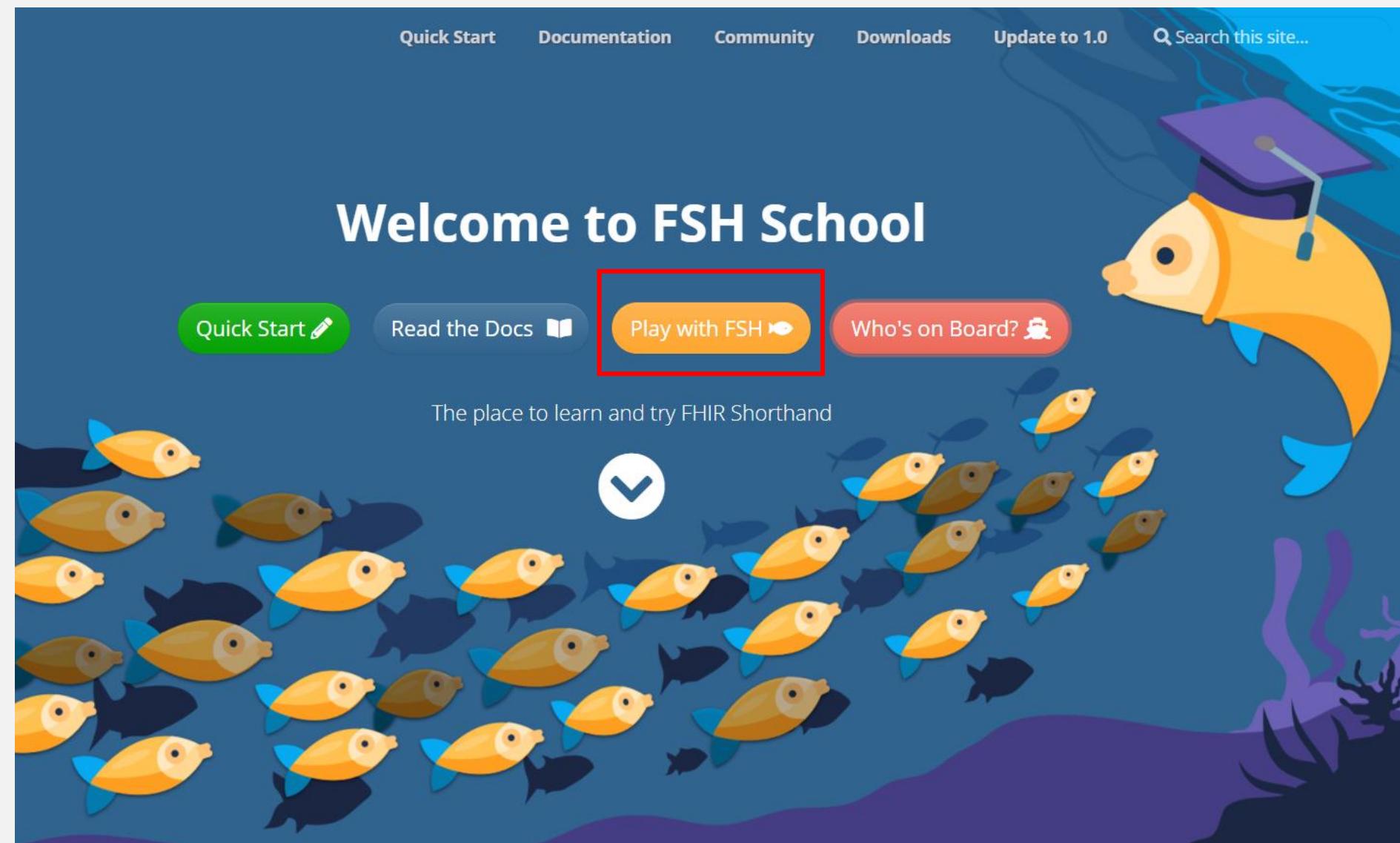
Is your IG missing?

- The easiest way to add it is to register it for CI builds on build.fhir.org.
- You can also submit a pull request to add your IG's GitHub repository to the list of manually crawled sources. You can also have every repository in your GitHub organization manually crawled if you have multiple fhir using FSH. Currently the manually crawled sources are defined here.
- If your IG is registered for CI builds or is already covered by the manual crawl sources, and it still does not appear, please [log an issue](#).



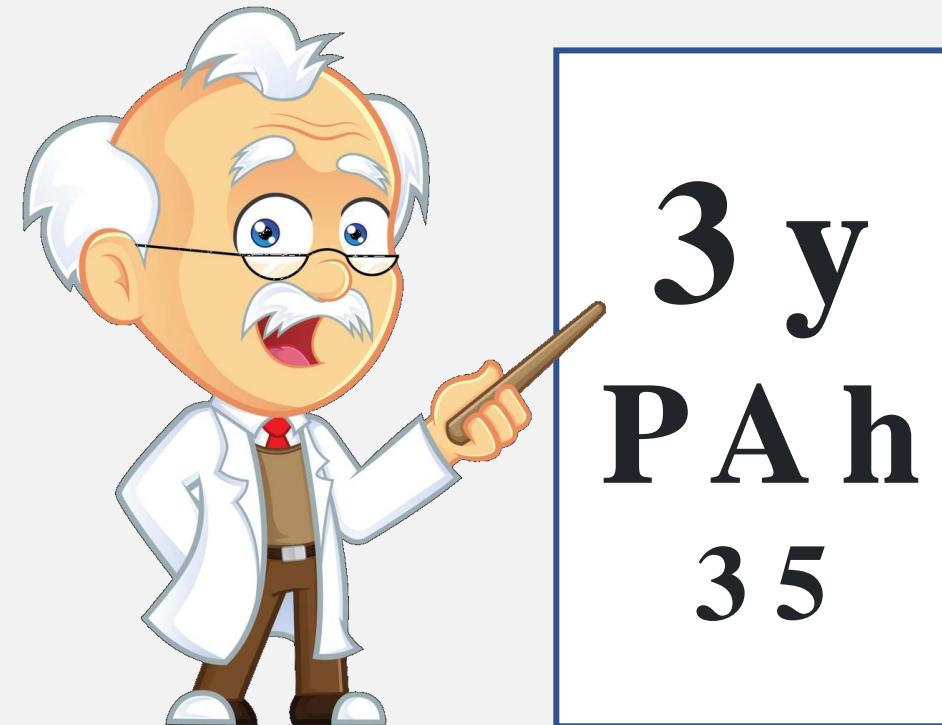
Let's Dive
into FSH

Go to
fshschool.org



Follow along:

<https://bit.ly/3yPAh35>



Example: COVID-19 Diagnosis Profile

1. Base on Condition
2. Diagnosis code U07.1
3. Bind severity to a required value set
4. Require a Patient as subject

```
Profile: CovidDiagnosis
Parent: Condition
Description: "How to report COVID"
* code = $icd#U07.1
* severity from CovidSeverityVS (required)
* subject only Reference(Patient)
* subject 1..1

Alias: $icd = http://hl7.org/fhir/sid/icd-10-cm
```

COVID-19 Severity Value Set

1. Start with the FHIR [condition-severity](#) value set

- Include these codes as defined in <http://snomed.info/sct>

Code	Display
24484000	Severe
6736007	Moderate
255604002	Mild

2. Add SNOMED-CT code for "life threatening"

```
ValueSet: CovidSeverityVS
Description: "Values for COVID severity"
* include codes from valueset http://hl7.org/fhir/ValueSet/condition-severity
* include $sct#442452003 "Life threatening severity (qualifier value)"

Alias: $sct = http://snomed.info/sct
```

Add an example of the profile:

1. Create an instance of CovidDiagnosis
2. Set the subject, code, and severity
3. Create the sample patient

```
Instance: DiagnosisExample
InstanceOf: CovidDiagnosis
Description: "Simple example"
* subject = Reference(JaneDoe)
* code = ICD10#U07.1
* severity = SCT#24484000 "Severe"
```

```
Instance: JaneDoe
InstanceOf: Patient
Description: "Minimal patient"
* name.family = "Doe"
* name.given = "Jane"
```


FSH ONLINE
Powered by SUSHI v1.3.2 and GoFSH v1.1.0

[Back to School](#)

Convert to JSON ►
◀ Convert to FSH
Configuration

FSH

```

1 Profile: CovidDiagnosis
2 Parent: Condition
3 Description: "How to report COVID"
4 * code = $icd#U07.1
5 * severity from CovidSeverityVS (required)
6 * subject only Reference(Patient)
7 * subject 1..1
8
9 Alias: $icd = http://hl7.org/fhir/sid/icd-10-cm
10
11 ValueSet: CovidSeverityVS
12 Description: "Values for COVID severity"
13 * include codes from valueset http://hl7.org/fhir/ValueSet/cond
14 * include $sct#442452003 "Life threatening severity (qualifier"
15
16 Alias: $sct = http://snomed.info/sct
17
18 Instance: DiagnosisExample
19 InstanceOf: CovidDiagnosis
20 * subject = Reference(JaneDoe)
21 * code = $icd#U07.1
22 * severity = $sct#24484000 "Severe"
23
24 Instance: JaneDoe
25 InstanceOf: Patient
26 * name.family = "Doe"
27 * name.given = "Jane"
28
29
  
```

FHIR JSON: CovidDiagnosis

```

1 {
2   "resourceType": "StructureDefinition",
3   "id": "CovidDiagnosis",
4   "extension": [
5     {
6       "url": "http://hl7.org/fhir/StructureDefinition/structuredefinition-alias",
7       "valueString": "Clinical.Summary"
8     },
9     {
10       "url": "http://hl7.org/fhir/StructureDefinition/structuredefinition-include",
11       "valueCode": "patient"
12     }
13   ],
14   "url": "http://example.org/StructureDefinition/CovidDiagnosis",
15   "version": "1.0.0",
16   "name": "CovidDiagnosis",
17   "status": "active",
18   "description": "How to report COVID",
19   "fhirVersion": "4.0.1",
20   "mapping": [
21     {
22       "identity": "workflow",
23       "uri": "http://hl7.org/fhir/workflow",
24       "name": "Workflow Pattern"
25     },
26     {
27       "identity": "sct-concept",
28       "uri": "http://snomed.info/conceptdomain",
29       "name": "SNOMED CT Concept Domain Binding"
  
```

FHIR JSON

↑
FHIR Artifacts

- + New JSON Editor
- StructureDefinitions
- CovidDiagnosis
- ValueSets
- CovidSeverityVS
- Instances
- DiagnosisExample
- JaneDoe

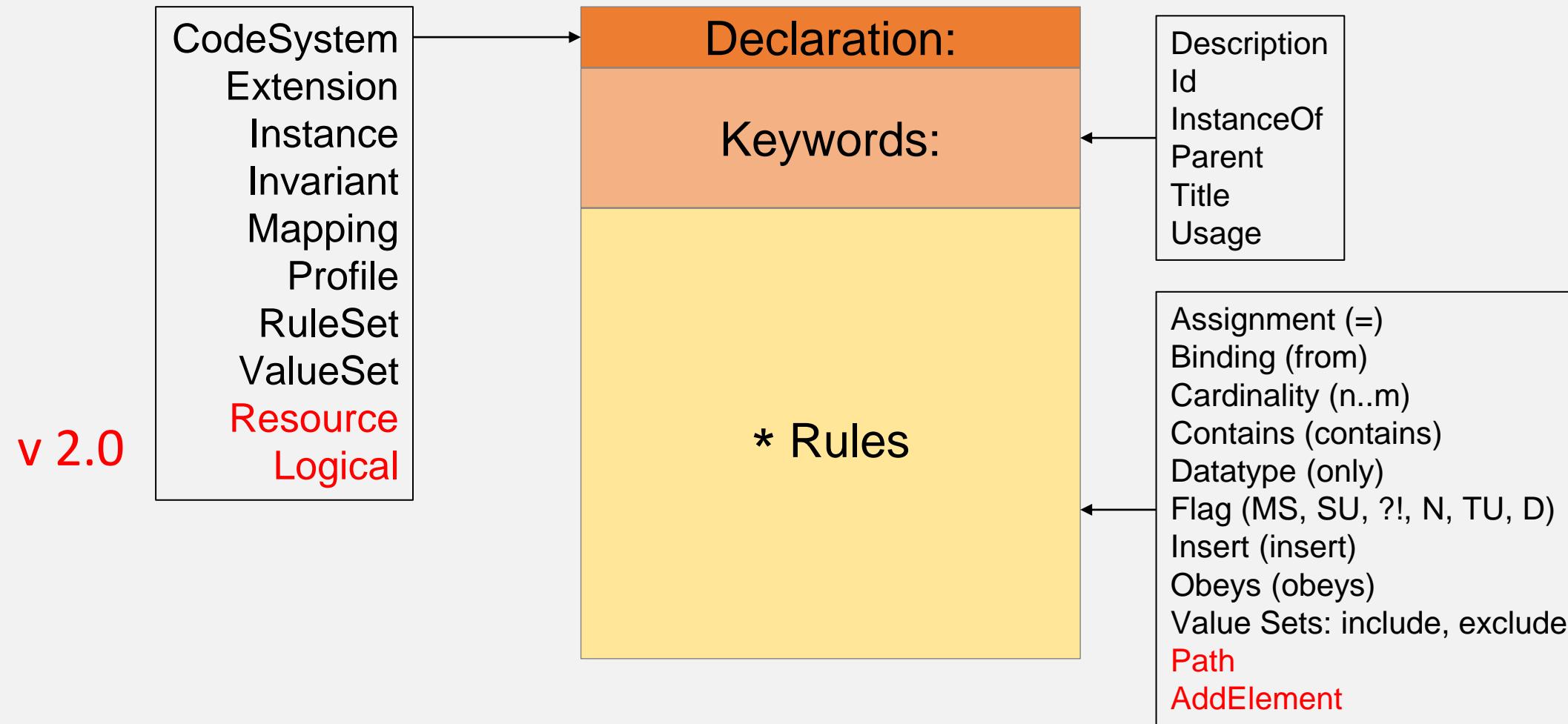
Console
✓ Success!

Things to Remember

- Keywords: **Profile and Parent**
- Keywords: **Instance and InstanceOf**
- Codes: {code system}#{code}
- Assignments: * <element> = {value}
- Binding rule: * <coded element> **from** {value set} ({bindingstrength})
- Cardinality rule: * <element> {min}..{max}
- Data Type rule: * <element> **only** {datatype1} **or** {datatype2}...

Key:
 {substitute}
 <path>

Anatomy of a FSH item:



Automating Repeated Patterns with Rule Sets

- "Don't repeat yourself" principle
- Share best practices with others

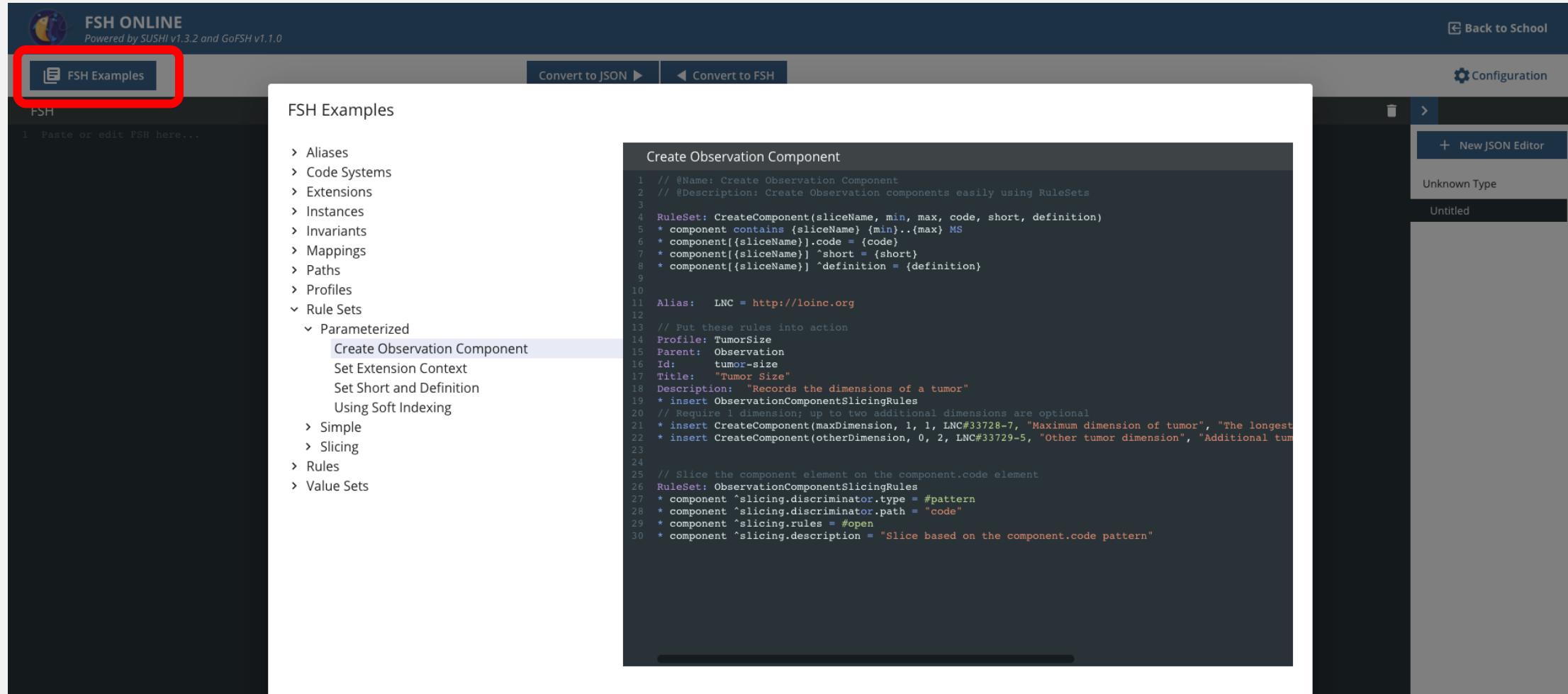
```
RuleSet: CreateComponent(sliceName, min, max, code, short, definition)
* component contains {sliceName} {min}..{max} MS
* component[{sliceName}].code = {code}
* component[{sliceName}] ^short = {short}
* component[{sliceName}] ^definition = {definition}

RuleSet: ObservationComponentSlicingRules
* component ^slicing.discriminator.type = #pattern
* component ^slicing.discriminator.path = "code"
* component ^slicing.rules = #open
* component ^slicing.description = "Slice based on the component.code pattern"
```

Applying Rule Sets ("insert" rules)

```
Profile: TumorSize
Parent: Observation
Id: tumor-size
Title: "Tumor Size"
Description: "Records the dimensions of a tumor"
* insert ObservationComponentSlicingRules
* insert CreateComponent(maxDimension, 1, 1, LNC#33728-7, "Maximum dimension of tumor",
"The longest tumor dimension")
* insert CreateComponent(otherDimension, 0, 2, LNC#33729-5, "Other tumor dimension",
"Additional tumor dimensions should be ordered from largest to smallest")
```

Get or share FSH Examples



The screenshot shows the FSH Online interface. At the top left is the FSH Online logo with the text "FSH ONLINE" and "Powered by SUSHI v1.3.2 and GoFSH v1.1.0". On the right side are buttons for "Back to School" and "Configuration". Below the logo is a navigation bar with a red box around the "FSH Examples" button. To the right of the navigation bar are "Convert to JSON" and "Convert to FSH" buttons. The main content area has a sidebar on the left with a tree view of FSH examples categories: Aliases, Code Systems, Extensions, Instances, Invariants, Mappings, Paths, Profiles, Rule Sets (with a "Parameterized" section expanded, showing "Create Observation Component", "Set Extension Context", "Set Short and Definition", and "Using Soft Indexing"), Simple, Slicing, Rules, and Value Sets. The main panel displays the FHIR Structured Query Language (FSH) code for "Create Observation Component". The code defines a RuleSet named "CreateComponent" with parameters for sliceName, min, max, code, short, and definition. It includes a Profile named "TumorSize" with a Parent of "Observation", ID "tumor-size", Title "Tumor Size", and Description "Records the dimensions of a tumor". The code also inserts "ObservationComponentSlicingRules" and "CreateComponent" rules for dimensions. The code ends with a RuleSet for "ObservationComponentSlicingRules" defining components based on slicing rules.

```
1 // @Name: Create Observation Component
2 // @Description: Create Observation components easily using RuleSets
3
4 RuleSet: CreateComponent(sliceName, min, max, code, short, definition)
5 * component contains {sliceName} {min}..{max} MS
6 * component[{sliceName}].code = {code}
7 * component[{sliceName}] ^short = {short}
8 * component[{sliceName}] ^definition = {definition}
9
10 Alias: LNC = http://loinc.org
11
12 // Put these rules into action
13 Profile: TumorSize
14 Parent: Observation
15 Id: tumor-size
16 Title: "Tumor Size"
17 Description: "Records the dimensions of a tumor"
18 * insert ObservationComponentSlicingRules
19 // Require 1 dimension; up to two additional dimensions are optional
20 * insert CreateComponent(maxDimension, 1, 1, LNC#33728-7, "Maximum dimension of tumor", "The longest")
21 * insert CreateComponent(otherDimension, 0, 2, LNC#33729-5, "Other tumor dimension", "Additional tum")
22
23
24 // Slice the component element on the component.code element
25 RuleSet: ObservationComponentSlicingRules
26 * component ^slicing.discriminator.type = #pattern
27 * component ^slicing.discriminator.path = "code"
28 * component ^slicing.rules = #open
29 * component ^slicing.description = "Slice based on the component.code pattern"
```

contribute your FSH examples at <https://github.com/FSHSchool/FSHOnline-Examples>

Define an Extension

1. Create Extension
2. Constrain value[x] to CodeableConcept
3. Bind value[x] to a value set
4. Define the value set

```
Extension: ConditionCertainty
Description: "The certainty of diagnosis"
* value[x] only CodeableConcept
* value[x] from ConditionCertaintyVS

ValueSet: ConditionCertaintyVS
Description: "Degree of confidence the condition is present"
* $sct#415684004 "Suspected (qualifier value)"
* $sct#410592001 "Probably present (qualifier value)"
* $sct#41060500 "Confirmed present (qualifier value)"
```

Add an Extension Context (optional)

- The preceding extension can only be applied to Conditions. The way to limit this is:

```
* ^context[0].type = #element  
* ^context[0].expression = "Condition"
```

- This is hard to remember, so consider capturing in a reusable Rule Set:

```
RuleSet: ExtensionContext(path)  
* ^context[+].type = #element  
* ^context[=].expression = "{path}"
```

Note: You must copy the rule set into your project. FSH does not have libraries at the current time

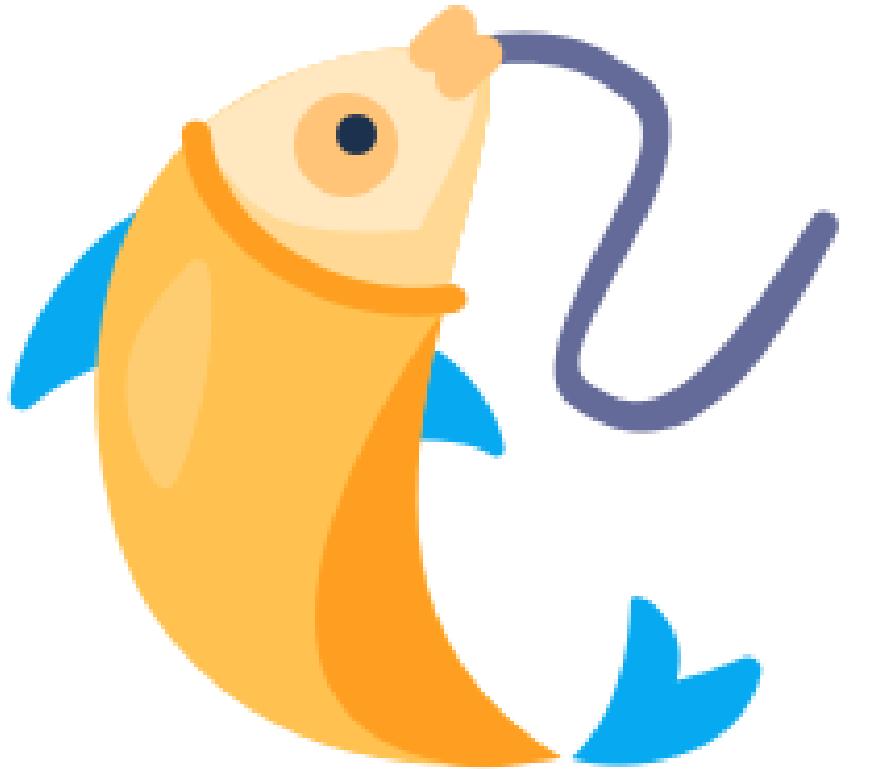
- Then insert into the Extension definition:

```
* insert ExtensionContext(Condition)
```

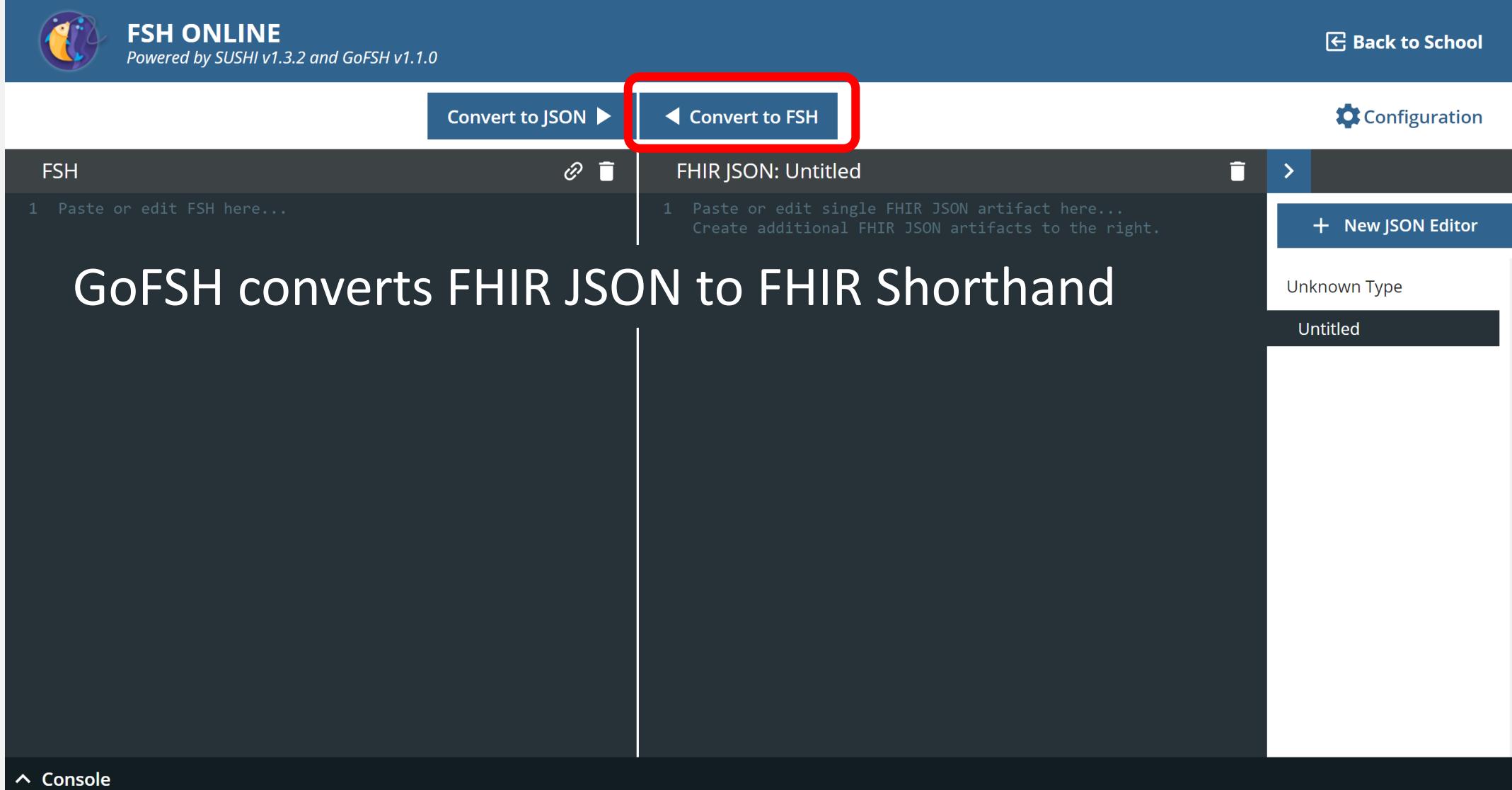
Add the Extension to the CovidCondition Profile

1. Add the extension
2. Use the element name "certainty"
3. Set cardinality 0..1
4. Add "Must Support"

```
Profile: CovidDiagnosis
Parent: Condition
Description: "How to report COVID"
* code = $icd#U07.1
* severity from CovidSeverityVS (required)
* subject only Reference(Patient)
* extension contains ConditionCertainty named certainty 0..1 MS
```

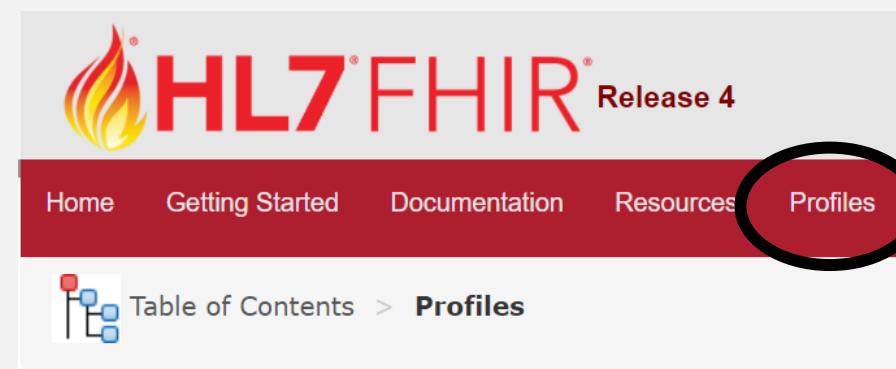


Learn FSH
using GoFSH



The screenshot shows the GoFISH online interface. At the top, there's a navigation bar with a logo, the text "FSH ONLINE Powered by SUSHI v1.3.2 and GoFISH v1.1.0", a "Back to School" link, and a "Configuration" link. Below the navigation bar, there are two main input fields: "FSH" on the left and "FHIR JSON: Untitled" on the right. Between these fields is a button labeled "Convert to JSON ▶" and another button labeled "◀ Convert to FSH". The "Convert to FSH" button is highlighted with a red rectangle. To the right of the JSON field, there are buttons for "Delete" and "Move". Below the input fields, a large title reads "GoFISH converts FHIR JSON to FHIR Shorthand". On the far right, there's a sidebar with a "+ New JSON Editor" button, an "Unknown Type" section, and an "Untitled" section. At the bottom left, there's a "Console" section.

Try this: Convert Body Height Vital Signs Profile to FSH



- <https://www.hl7.org/fhir/bodyheight.profile.json>
 - Or Profiles: observation-bodyheight → JSON → Raw JSON
- **Copy and paste** into right pane of FSH Online
- Click **Convert to FSH**

GoFSH Converted FHIR profile:

FSH

```

1 Alias: $vitalsigns = http://hl7.org/fhir/StructureDefinition/vitalsigns
2
3 Profile: observation-bodyheight
4 Parent: $vitalsigns
5 Id: bodyheight
6 Title: "Observation Body Height Profile"
7 Description: "FHIR Body Height Profile"
8 * ^extension[0].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
9 * ^extension[=].valueMarkdown = "#### Complete Summary of the Mandatory Requirements"
10 * ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-wg"
11 * ^extension[=].valueInteger = 5
12 * ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-starter"
13 * ^extension[=].valueCode = #oo
14 * ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
15 * ^extension[=].valueCode = #trial-use
16 * ^status = #draft
17 * ^experimental = false
18 * ^date = "2018-08-11"
19 * ^publisher = "Health Level Seven International (Orders and Observations"
20 * ^contact.telecom.system = #url
21 * ^contact.telecom.value = "http://www.hl7.org/Special/committees/orders/index.html"
22 * . 0..*
23 * . ^short = "FHIR Body Height Profile"
24 * . ^definition = "This profile defines how to represent Body Height observations"
25 * code ^short = "Body Height"
26 * code ^definition = "Body Height."
27 * code ^comment = "additional codes that translate or map to this code are"
28 * code ^alias[0] = "Test"
29 * code ^alias[+] = "Name"

```

FHIR JSON: bodyheight

```

1 {
2   "resourceType" : "StructureDefinition",
3   "id" : "bodyheight",
4   "text" : {
5     "status" : "generated",
6     "div" : "<div xmlns=\"http://www.w3.org/1999/xhtml\">to do</div>"
7   },
8   "extension" : [
9     {
10       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-summary",
11       "valueMarkdown" : "#### Complete Summary of the Mandatory Requirements\r\n\r\n"
12     },
13     {
14       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm",
15       "valueInteger" : 5
16     },
17     {
18       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-wg",
19       "valueCode" : "oo"
20     },
21     {
22       "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-starter",
23       "valueCode" : "trial-use"
24     }
25   ],
26   "url" : "http://hl7.org/fhir/StructureDefinition/bodyheight",
27   "version" : "4.0.1",
28   "name" : "observation-bodyheight",
29   "title" : "Observation Body Height Profile",
30   "status" : "draft",
31   "experimental" : false.

```



Additional Syntax:

- Caret (^) refers to metadata in the StructureDefinition

```
* ^experimental = false
* ^date = "2018-08-11"
* ^publisher = "Health Level Seven International (Orders and Observations Workgroup)"

* code ^short = "Body Height"
* code ^definition = "Body Height."
```

- [0], [+], [=] refer to first, next, same array elements

```
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
* ^extension[=].valueInteger = 5
```

(indicate the FHIR Maturity of this profile = 5 using extension on StructureDefinition)

FSH Resources and Tools

- [FSH Language Specification](#) -- HL7 FHIR Standard
- [SUSHI](#) -- compile FSH into FHIR Artifacts
- [FSH School](#) -- web site with documentation, tools, examples
- [FSH Online](#) -- interactive FHIR Shorthand with examples
- [GoFSH](#) -- convert existing implementation guides into FSH (beta)
- [FSH Finder](#) -- web crawler to find FSH projects
- [VS Code extension](#) -- code highlighter for VS Code editor
- [# shorthand](#) -- Zulip chat channel

Language Reference: FHIR Shorthand IG

FHIR Shorthand
1.1.0 - CI Build

Table of Contents > Language Reference

FHIR Shorthand, published by HL7 International - FHIR Infrastructure Group. This is not an authorized publication; it is the continuous build for version 1.1.0). This version is based on the current content of <https://github.com/HL7/fhir-shorthand/> and changes regularly. See the [Directory of published versions](#)

3 Language Reference

This chapter contains the formal specification of the FHIR Shorthand (FSH) language. It is intended as a reference, not a tutorial.

In this specification, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in [RFC2119](#).

3.1 About the Specification

The FSH specification uses syntax expressions to illustrate the FSH language. While FSH has a formal grammar (see [Appendix](#)), most readers will find the syntax expressions more instructive.

Syntax expressions uses the following conventions:

Style	Explanation	Example
<code>Code</code>	Code fragments, such as FSH keywords, FSH statements, and FSH syntax expressions	<code>* status = #open</code>
{curly braces}	An item to be substituted in a syntax expression	<code>{display string}</code>
<code><datatype></code>	An element or path to an element with the given data type, to be substituted in the syntax expression	<code><CodeableConcept></code>
<i>italics</i>	An optional item in a syntax expression	<code>"{string}"</code>
ellipsis (...)	Indicates a pattern that can be repeated	<code>{flag1} {flag2} {flag3} ...</code>
bold	A directory path or file name	<code>example-1.fsh</code>
vertical bar	A choice of items or data types in the syntax	<code>name id url</code>

Examples:

- A FSH rule to assign the value of a Quantity:

```
* <Quantity> = {decimal or integer} '{UCUM unit}'
```

A FSH statement following this pattern would be written as:



- [About the Specification](#)
- [FSH Foundations](#)
- [FSH Language Basics](#)
- [FSH Paths](#)
- [Rules for Profiles, Extensions, and Instances](#)
- [Defining Items](#)
- [Appendix: Abbreviations](#)
- [Appendix: Formal Grammar](#)

<http://build.fhir.org/ig/HL7/fhir-shorthand/>

Downloads → Quick Reference Card

 **FHIR Shorthand 1.0 Quick Reference: Syntax** 

Key to Expression Syntax	
{curly braces}	An item to be substituted
<angle brackets>	Path to an element of given data type
<i>Italics</i>	An optional item
<i>Italics</i>	An optional statement
ellipsis (...)	Indicates a pattern that can be repeated
vertical bar ()	Indicates a choice of items or data types
bold	Default value

Item	Keywords	Rules
Alias	Alias: {alias name} = {uri urn:oid} // alias name may begin with \$	Assignment * <element> = {value} <i>(exactly)</i> Binding * <bindable> from {ValueSet name id url} <i>(strength)</i>
Extension	Parent: {Extension name id url} id: {id} Title: {string} Description: {string or markdown}	Cardinality * <element> <i>(cardinality)</i> Contains (inline extensions) * <Extension> contains {name1} <i>(cardinality1)</i> <i>(flags1)</i> and {name2} <i>(cardinality2)</i> <i>(flags2)</i> and {name3} <i>(cardinality3)</i> <i>(flags3)</i> ... * <Extension> contains {Extension1 name id url} named {name1} <i>(cardinality1)</i> <i>(flags1)</i> and {Extension2 name id url} named {name2} <i>(cardinality2)</i> <i>(flags2)</i> and {Extension3 name id url} named {name3} <i>(cardinality3)</i> <i>(flags3)</i> ...
Instance	Instance: {id} InstanceOf: {Resource Profile name id url} Usage: {example #definition #inline} Title: {string} Description: {string or markdown}	Contains (standalone extensions) // end of line or single line
Invariant	Invariant: {id} Severity: {error #warning} Description: {string markdown} Expression: {FHIRPath string} XPath: {XPath expression string}	Cardinality 0..1 1..1 2..* <i>(two-sided)</i> ..1 1.. 2.. <i>(one-sided)</i>
Mapping	Mapping: {id} Source: {Profile name id} Target: {Target specification url} Id: {Target specification id} Title: {Target description string} Description: {string}	Contains (slicing) /* This comment continues over multiple lines */
Profile	Profile: {name} Parent: {Resource Profile name id url} Id: {id} Title: {string} Description: {string or markdown}	Comments Reference(Patient) Reference(Patient or Practitioner) Canonical(MyPatient)
Type	RuleSet: {name} Value Set and Code System ValueSet: {name} or CodeSystem: {name} Id: {id} Title: {string} Description: {string or markdown}	Extensions References

Paths	
Array element	<array element>[0-based index]
Reference	<Reference>[{Resource Profile name id url}]
Extension	<Extension>[{extension name id URL}]
Sliced array	<array element>[slice-name {resolver-name}]
Caret paths	^<element of StructureDefinition> <element in Profile> ^<element in corresponding ElementDefinition>

Slicing Rubric	
* <array-path> ^slicing.discriminator.type = #pattern	#value #profile #exists
* <array-path> ^slicing.discriminator.path = {FHIRPath string}	
* <array-path> ^slicing.rules = #open #closed #openAtEnd	
* <array-path> ^slicing.ordering = true false	
* <array-path> ^slicing.description = {string}	

Get More Information	
	FSH Specification
	FSH Chat
	FSH School
	HL7 Project Page

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Syntax

 **FHIR Shorthand 1.0 Quick Reference: Examples** 

Item	Keywords	Rules
code	#confirmed	Assignment * status = #arrived
Alias	http://snomed.info/sct#363346000	* code = SCT#18165001 "jaundice (finding)"
Coding and CodeableConcept	"Malignant neoplastic disease (disorder)"	* subject = Reference(EveAnyPerson)
	ICD10CM#C004	* valueQuantity = 2.5 'mm'
		* valueQuantity = UCU/MMm "millimeters"
Cardinality	0..1 1..1 2..* <i>(two-sided)</i> ..1 1.. 2.. <i>(one-sided)</i>	Binding * bodySite from CancerBodyLocationsVS <i>(preferred)</i>
Code system	// end of line or single line	* valueCodeableConcept from http://loinc.org/vs/LI1971-2 <i>(required)</i>
Comments	/* This comment continues over multiple lines */	* valueQuantity from LengthUnitsVS <i>(extensible)</i>
References	Reference(Patient) Reference(Patient or Practitioner) Canonical(MyPatient)	

Paths	
Nested element	stage.assessment
Array element	name[0].given[1]
Choice [x] element	valueQuantity, valueReference
Reference choices	performer[Organization]
Invariant	invariant: us-core-8
Instance	Description: "Patient.name.given or Patient.name.family or both SHALL be present"
Extensions	extension[terminationReason]
	extension[http://hl7.org/fhir/StructureDefinition/location-distance]
Sliced arrays	component[DiastolicPressure]
Resliced arrays	component[RespiratoryScore][OneMinute]
StructureDefinition escape (caret syntax)	^abstract
	component[VariationCode] ^short

Slicing Rubric	
* component ^slicing.discriminator.type = #pattern	
* component ^slicing.discriminator.path = "code"	
* component ^slicing.rules = #open	
* component ^slicing.ordering = false	
* component ^slicing.description = "Slice on component.code"	

Value Set Rules	
Include single code	* include Coding
Exclude single code	* exclude Coding
Include entire code system	* include codes from system {CodeSystem name id url}
Include from value set	* include codes from valueSet {ValueSet name id url}
Exclude from value set	* exclude codes from valueSet {ValueSet name id url}
Filter syntax: {property} {filter-operator} {value}	
Include codes with filtering	* include codes from system {CodeSystem name id url} where {filter1} <i>and</i> {filter2} <i>and</i> ...
Exclude codes with filtering	* exclude codes from system {CodeSystem name id url} where {filter1} <i>and</i> {filter2} <i>and</i> ...

Code System Rules	
Define local code	* [code] "display string" "definition string"

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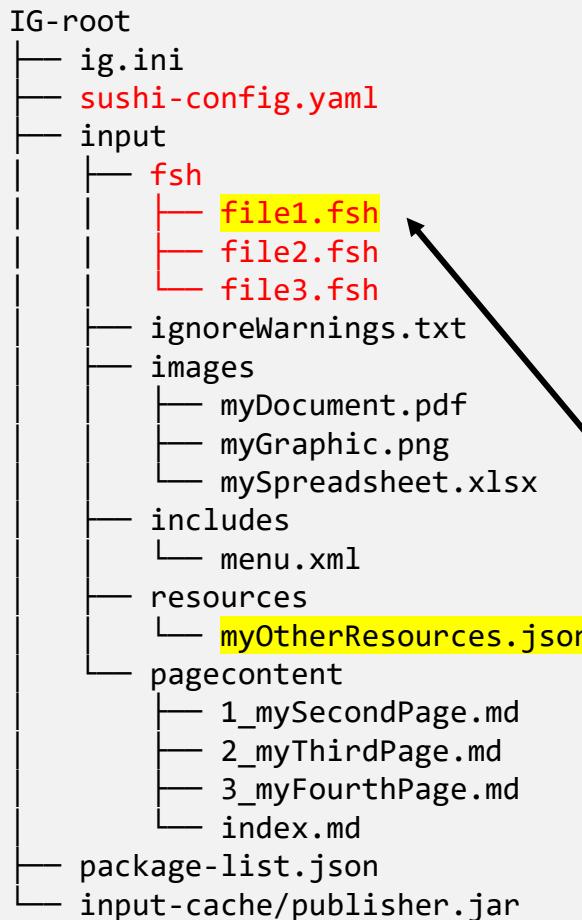
Sept 2020

Examples

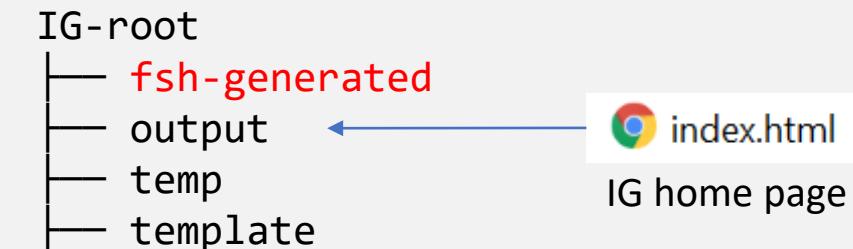
Single code	* SCT#54102005 "G1 grade (finding)"
Exclude single code	* exclude SCT#12619005
All codes in system	* includes codes from system HGVS
Filter Rules for SNOMED-CT (assumes code system aliased as 'SCT')	
Subsumption	* include codes from system SCT where concept is-a #123037004 "Body Structure"
Exclude subsumption	* exclude codes from system SCT where concept is-a #128462008 "Secondary malignant neoplastic disease (disorder)"

Look Ahead to Let's Build (next session)

Creating a FSH Implementation Guide



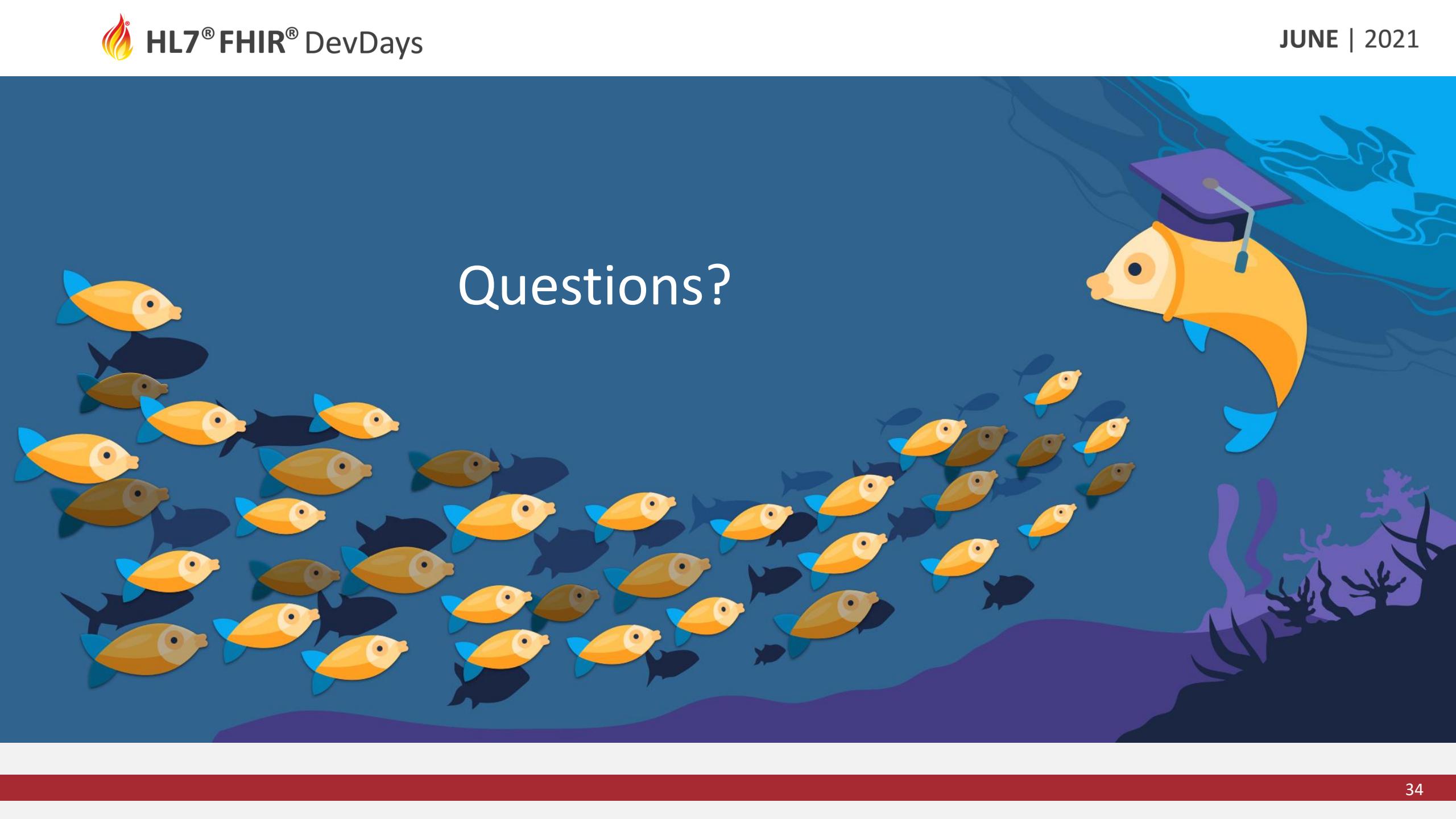
run HL7 IG publisher
(runs SUSHI for you)



You can mix FSH with resources
created by Trifolia or Forge

Prepare for Let's Build (next session)

- Install **Node.js LTS** edition from <https://nodejs.org/>
- Install **SUSHI** and **GoFSh**
 - Open a terminal and run: `npm install -g fsh-sushi`
 - Open a terminal and run: `npm install -g gofsh`
- Install **VS Code** (if text editor is needed)
 - <https://code.visualstudio.com/download>



Questions?

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