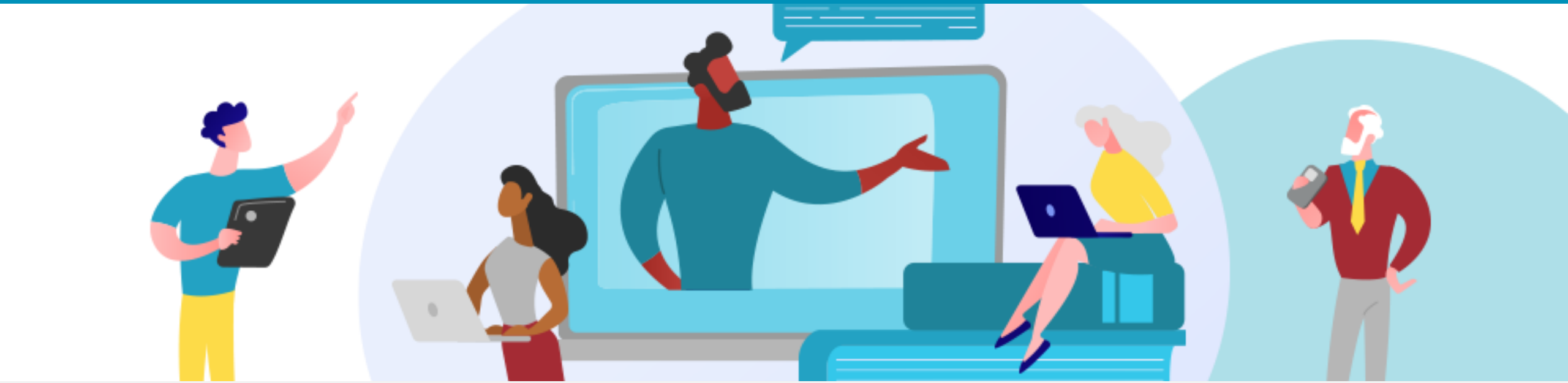
HL7® FHIR® DevDays

JUNE | 2021

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

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Mark Kramer

- Chief Engineer, MITRE Health Innovation Center

Chris Moesel

- Prinicipal 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® Shorthand™

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

Monday	Tuesday	Wednesday	Thursday
Introduction to FHIR 11:00 – 11:45	Introduction Profiling 1:00 – 1:45	Accelerating your IG production 1:00 – 1:45	FHIR Registry & Packages 1:00 – 1:45
	Profiling with Forge 2:15 – 3:00	IG with IG Publisher 2:15 – 3:00	Publishing with Simplifier.net 2:15 – 3:00
You are here →	Create an IG with FHIR Shorthand 3:15 – 4:00		Advanced FHIR Shorthand and Tools 3:15 – 4:00
	Create an IG with FHIR Shorthand 4:15 – 5:00		

FSH Background

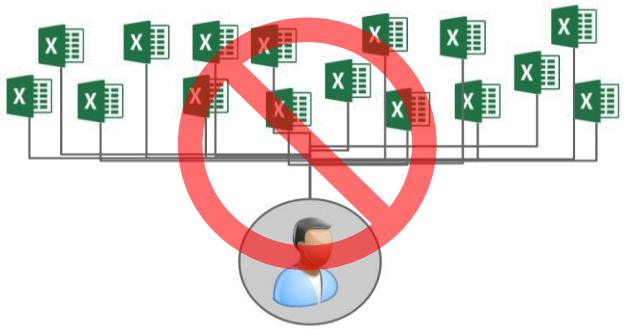
FHIR Profiles and Implementation Guides

- 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

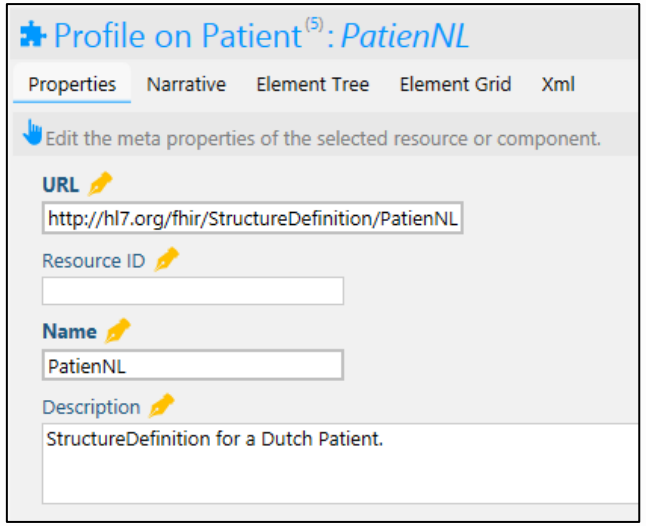
Spreadsheets



User Interfaces

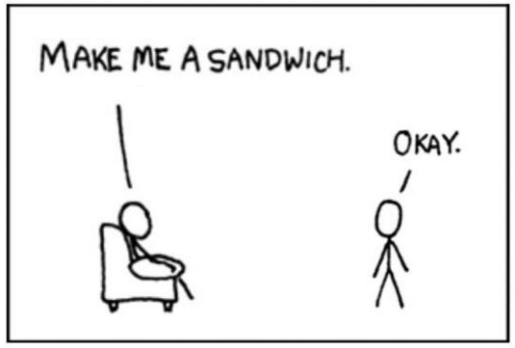
Trifolia-on-FHIR

Forge



Command-Driven

FHIR® Shorthand™




```
Profile: MyPatient
Parent: Patient
* name 1..* MS
```

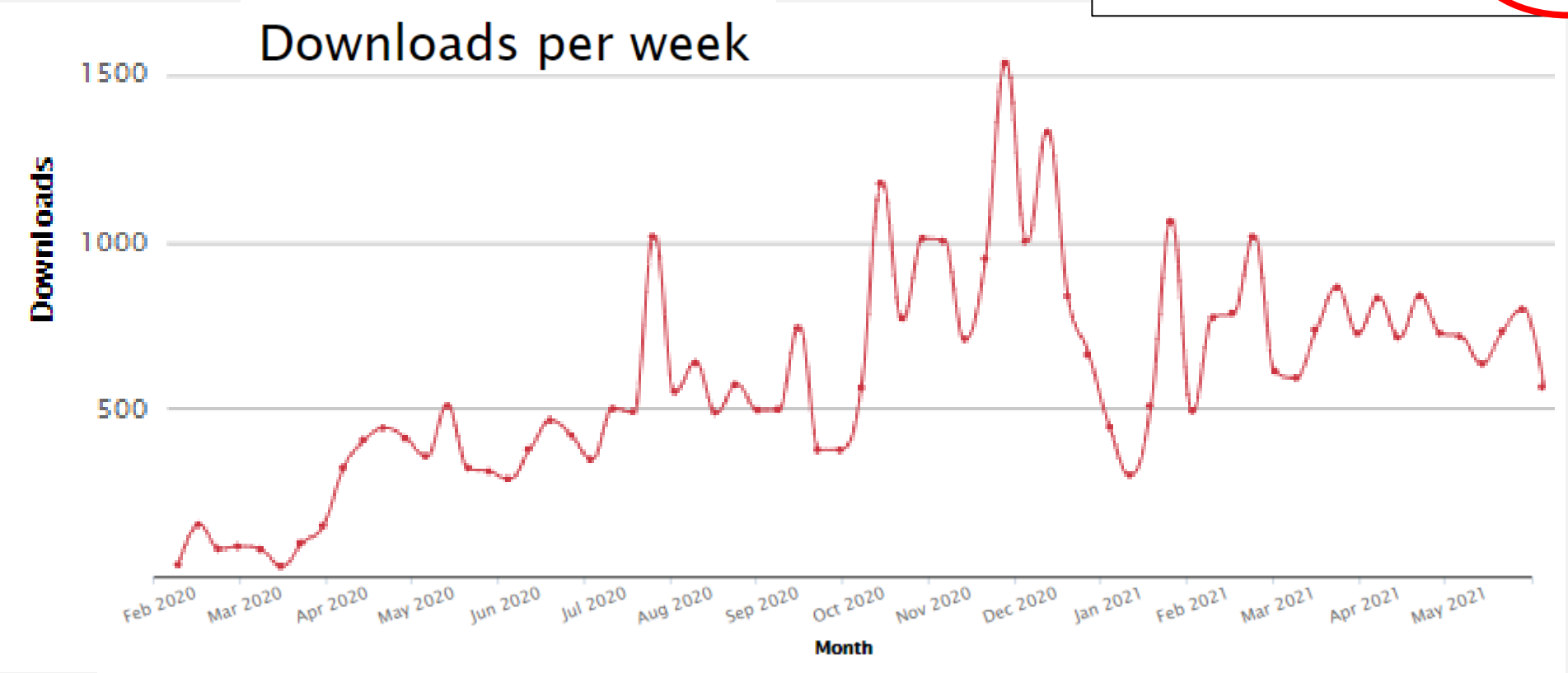
Advantages of FHIR Shorthand Profiling Language

- 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*:

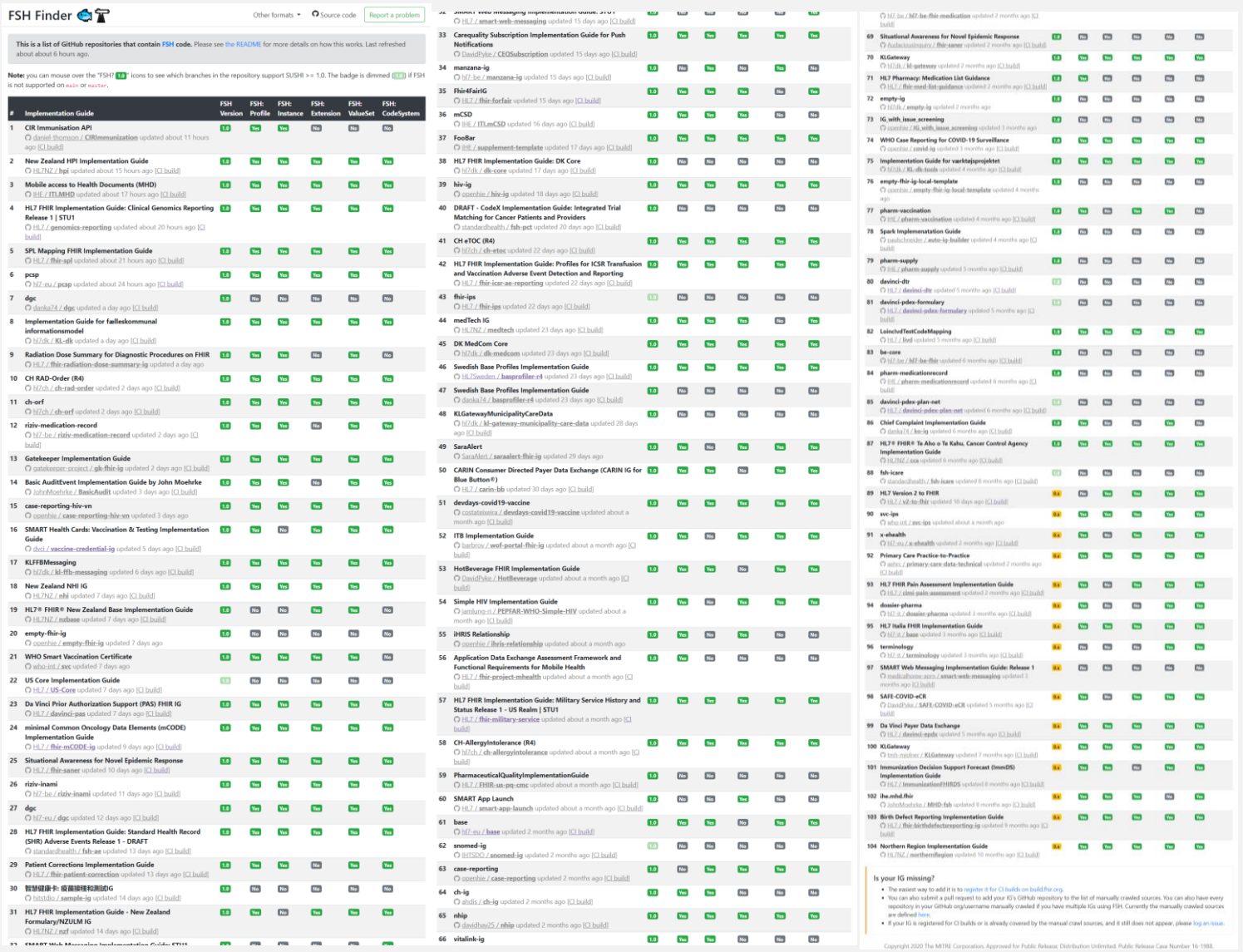
package	downloads
fsh-sushi	39,685



FSH Finder

100+ Implementation Guides

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



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

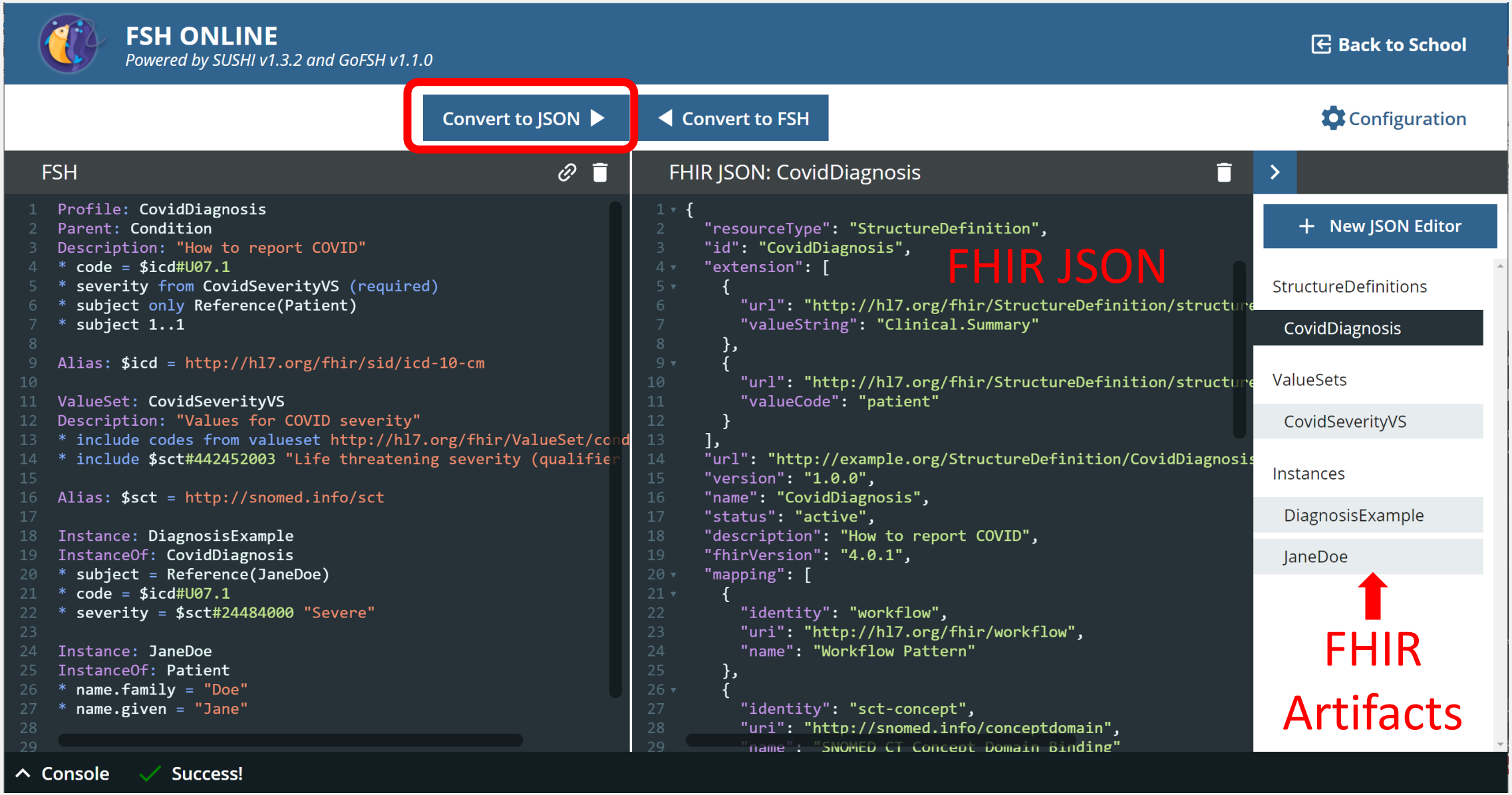
2. Add SNOMED-CT code for "life threatening"

```
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"
```

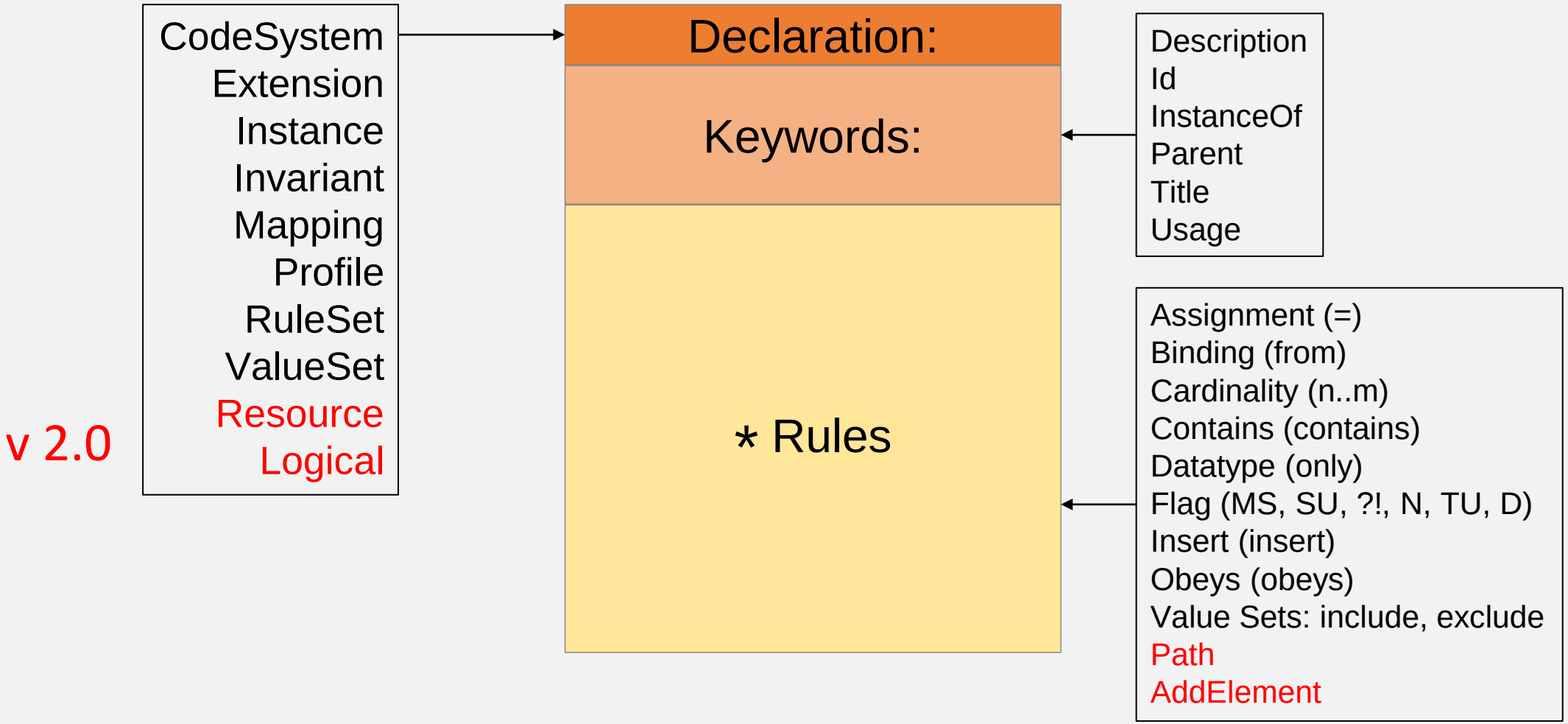

FSH ONLINE
Powered by SUSHI v1.3.2 and GoFSH v1.1.0
Back to School
Convert to JSON
Convert to FSH
Configuration
FSH
FHIR JSON: CovidDiagnosis
FHIR JSON
New JSON Editor
StructureDefinitions
CovidDiagnosis
ValueSets
CovidSeverityVS
Instances
DiagnosisExample
JaneDoe
FHIR Artifacts
Console
Success!

Things to Remember

Key:
{substitute}
<path>

- 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}...*

Anatomy of a FSH item:



Automating Repeated Patterns with Rule Sets

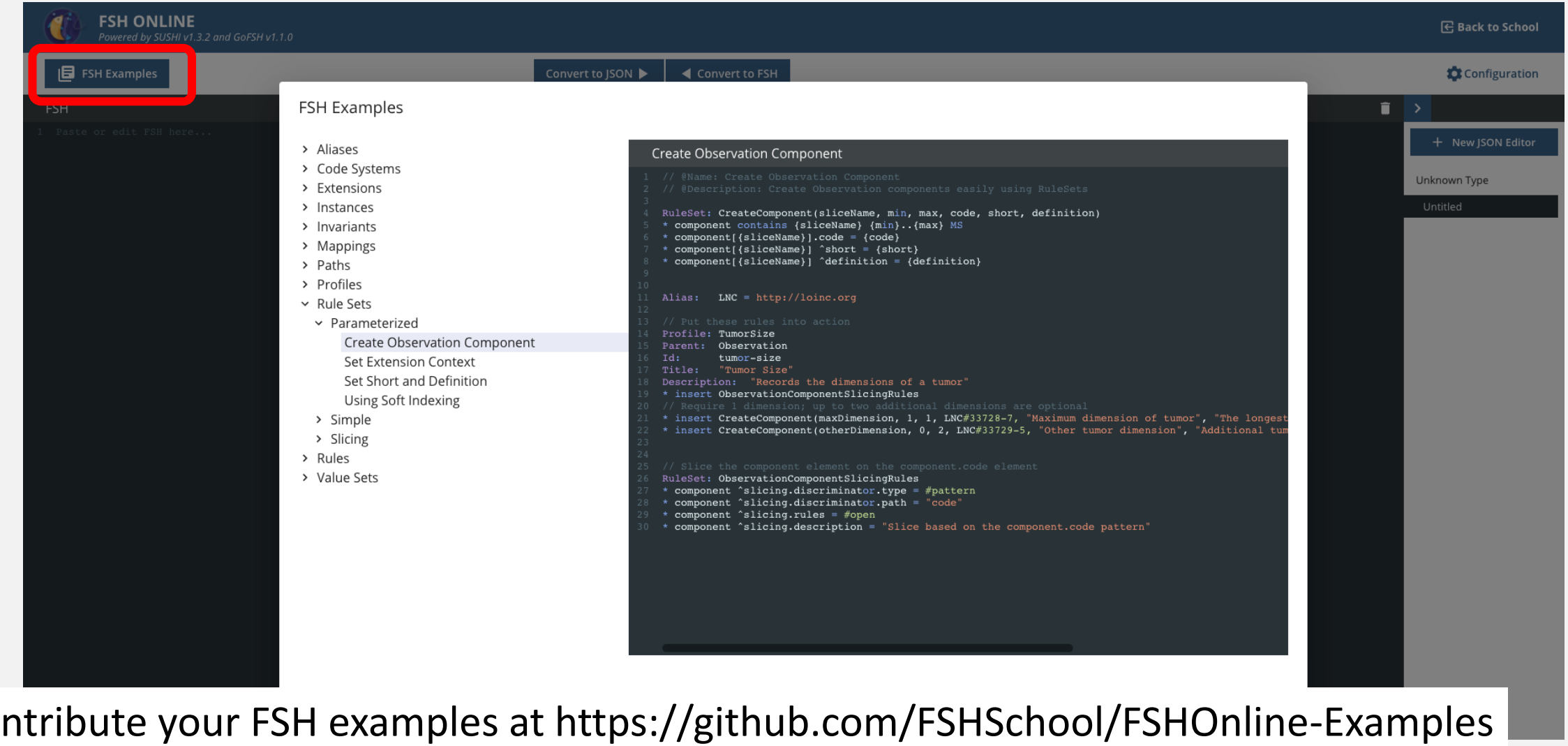
- "Don't repeat yourself" principle
- Share best practices with others

```
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



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

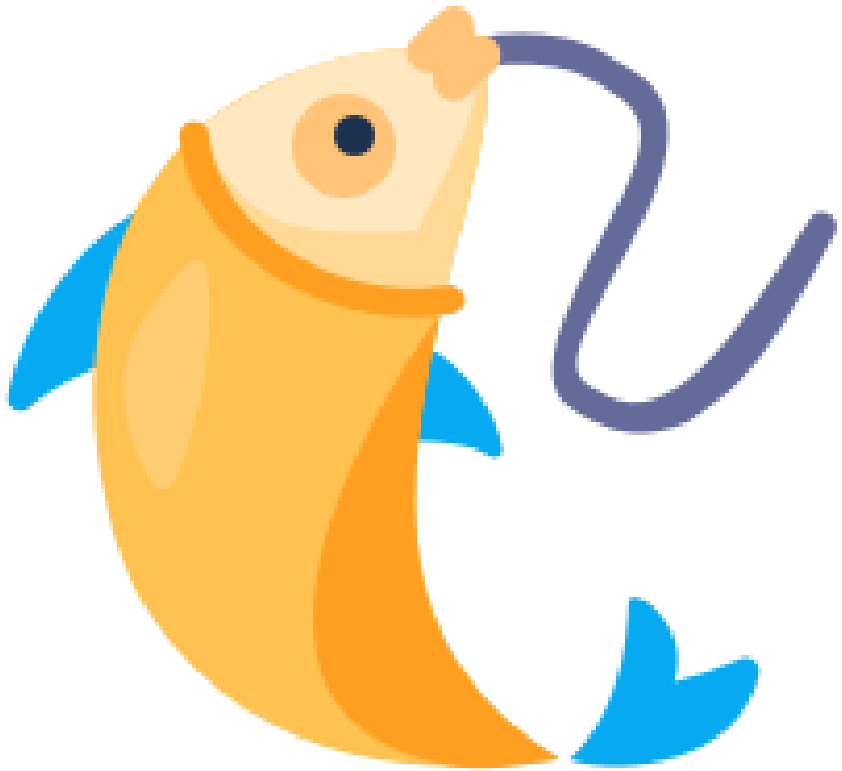
- Then insert into the Extension definition:

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

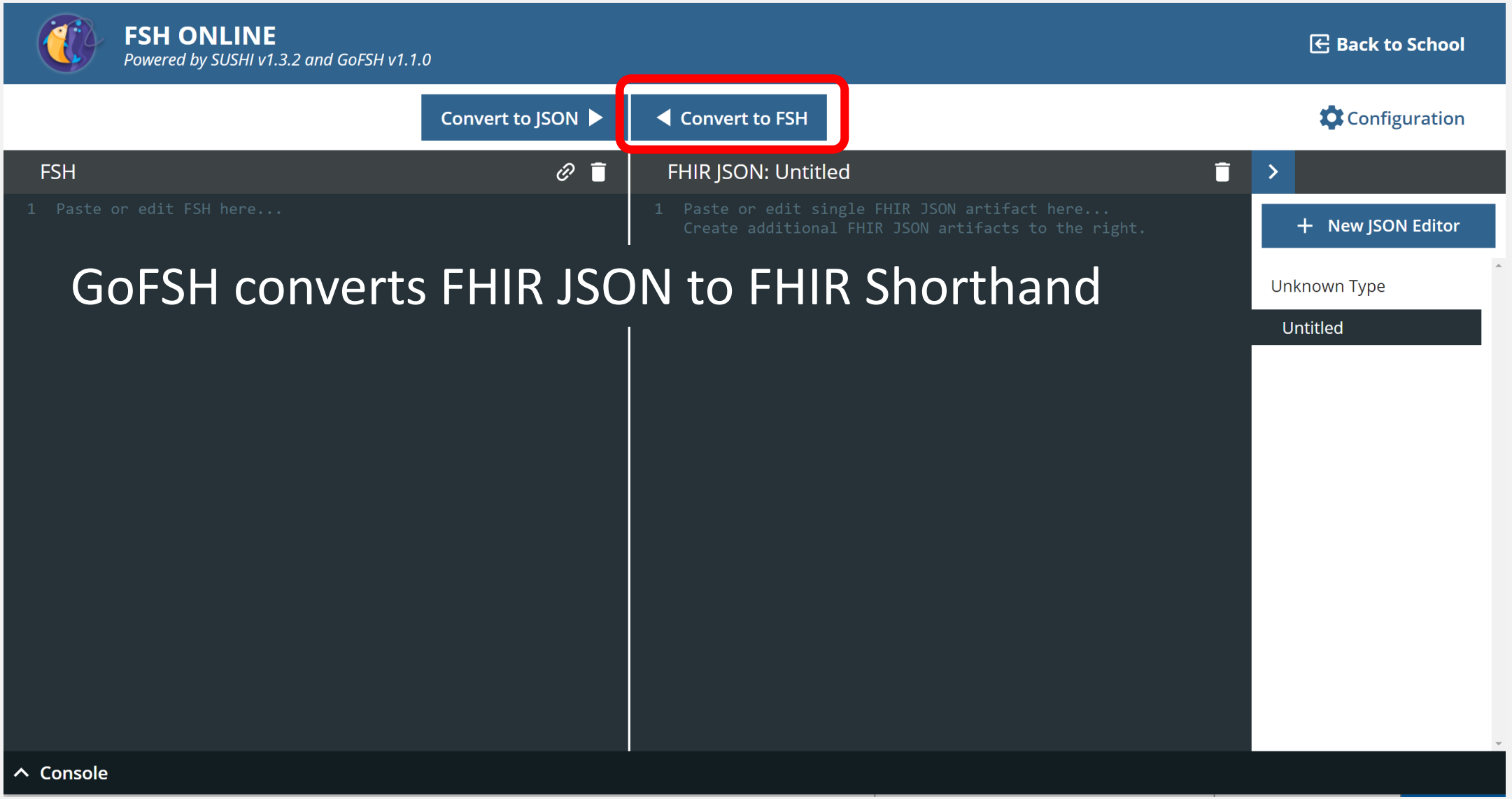
Add the Extension to the CovidCondition Profile

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



GoFSH converts FHIR JSON to FHIR Shorthand

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

```
Alias: $vitalsigns = http://hl7.org/fhir/StructureDefinition/vitalsigns

Profile: observation-bodyheight
Parent: $vitalsigns
Id: bodyheight
Title: "Observation Body Height Profile"
Description: "FHIR Body Height Profile"
* ^extension[0].url = "http://hl7.org/fhir/StructureDefinition/structure
* ^extension[=].valueMarkdown = "#### Complete Summary of the Mandatory R
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structure
* ^extension[=].valueInteger = 5
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structu
* ^extension[=].valueCode = #oo
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structu
* ^extension[=].valueCode = #trial-use
* ^status = #draft
* ^experimental = false
* ^date = "2018-08-11"
* ^publisher = "Health Level Seven International (Orders and Observations
* ^contact.telecom.system = #url
* ^contact.telecom.value = "http://www.hl7.org/Special/committees/orders/i
* . 0..*
* . ^short = "FHIR Body Height Profile"
* . ^definition = "This profile defines  how to represent Body Height obse
* code ^short = "Body Height"
* code ^definition = "Body Height."
* code ^comment = "additional codes that translate or map to this code are
* code ^alias[0] = "Test"
* code ^alias[+] = "Name"
```

FHIR JSON: bodyheight

```
{
  "resourceType" : "StructureDefinition",
  "id" : "bodyheight",
  "text" : {
    "status" : "generated",
    "div" : "<div xmlns=\"http://www.w3.org/1999/xhtml\">to do</div>"
  },
  "extension" : [{
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-sum
    "valueMarkdown" : "#### Complete Summary of the Mandatory Requirements\r
  },
  {
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm
    "valueInteger" : 5
  },
  {
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-wg"
    "valueCode" : "oo"
  },
  {
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-sta
    "valueCode" : "trial-use"
  }],
  "url" : "http://hl7.org/fhir/StructureDefinition/bodyheight",
  "version" : "4.0.1",
  "name" : "observation-bodyheight",
  "title" : "Observation Body Height Profile",
  "status" : "draft",
  "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

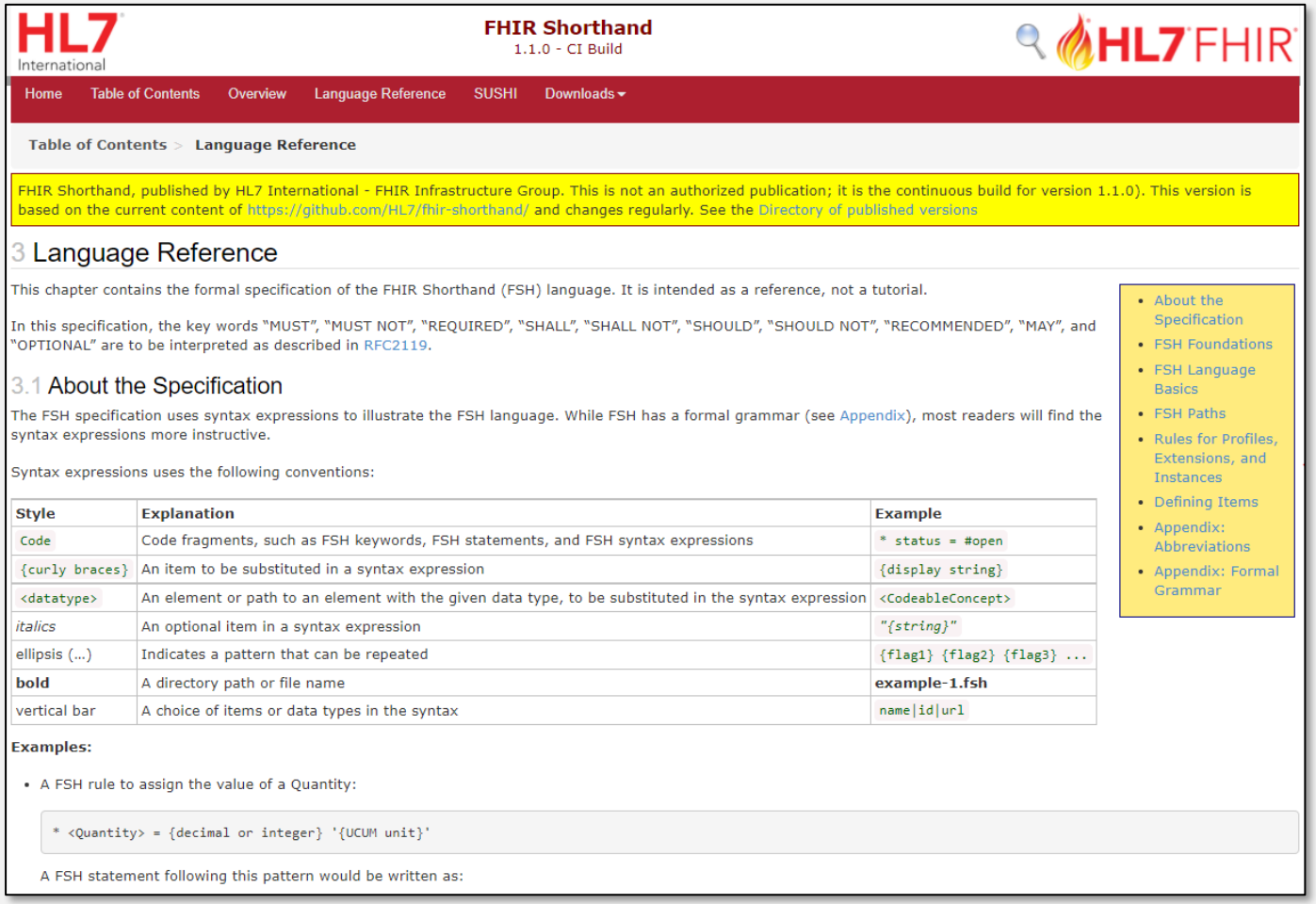
```
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
* ^extension[=].valueInteger = 5
```

(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



HL7 International

FHIR Shorthand
1.1.0 - CI Build

HL7 FHIR

Home | Table of Contents | Overview | Language Reference | SUSHI | Downloads

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.

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

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

Examples:

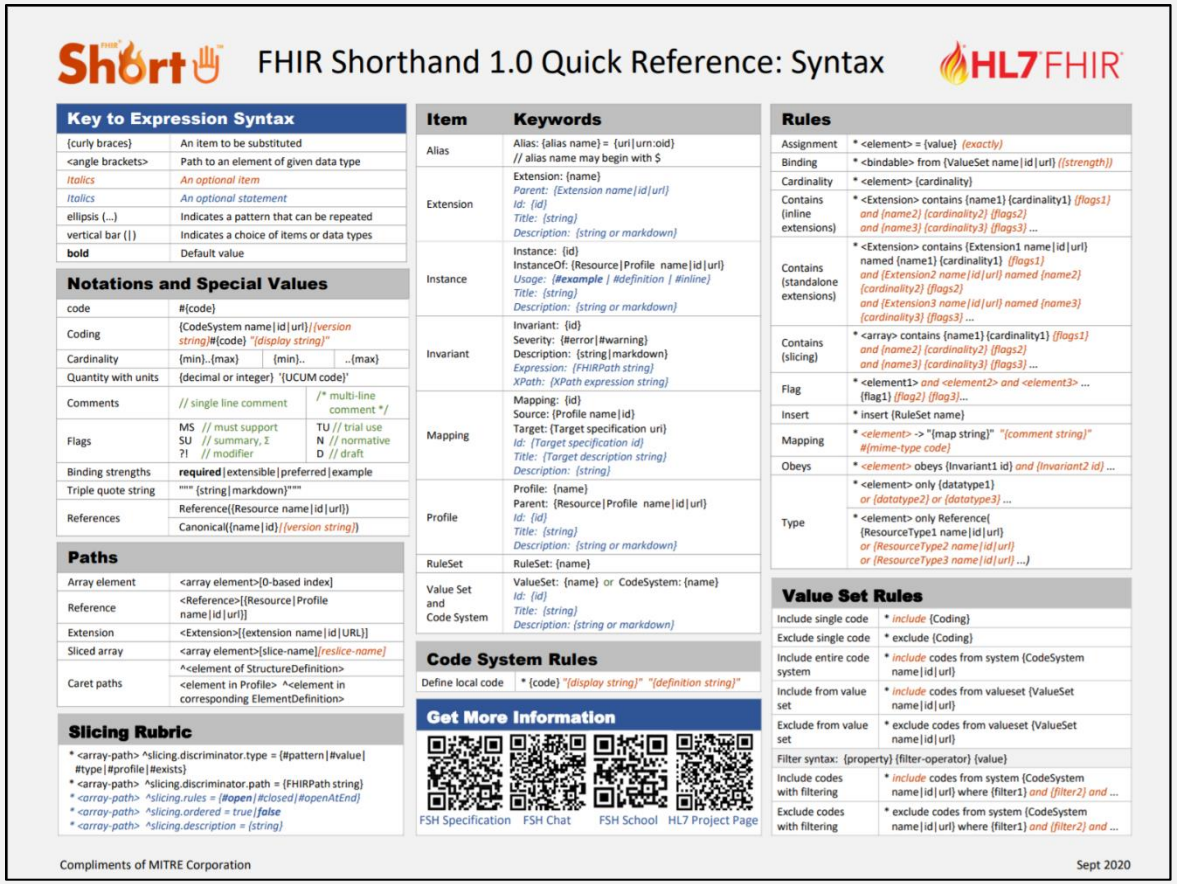
- A FSH rule to assign the value of a Quantity:

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

A FSH statement following this pattern would be written as:

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

Downloads → Quick Reference Card



Short FHIR Shorthand 1.0 Quick Reference: Syntax — HL7 FHIR

Key to Expression Syntax

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

Notations and Special Values

code	#{code}		
Coding	{CodeSystem name|id|url}*{version string}*#{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, Σ ?! // modifier	TU // trial use N // normative D // draft	
Binding strengths	**required**|extensible|preferred|example		
Triple quote string	""" {string|markdown}"""		
References	Reference({Resource name|id|url})		
	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]*{reslice-name}*
Caret paths	^<element of StructureDefinition>
	<element in Profile> ^<element in corresponding ElementDefinition>

Slicing Rubric

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

Item	Keywords
Alias	Alias: {alias name} = {uri|urn:oid} // alias name may begin with $
Extension	Extension: {name} *Parent: {Extension name|id|url}* *Id: {id}* *Title: {string}* *Description: {string or markdown}*
Instance	Instance: {id} InstanceOf: {Resource|Profile name|id|url} *Usage: {**#example** | #definition | #inline}* *Title: {string}* *Description: {string or markdown}*
Invariant	Invariant: {id} Severity: {#error|#warning} Description: {string|markdown} *Expression: {FHIRPath string}* *XPath: {XPath expression string}*
Mapping	Mapping: {id} Source: {Profile name|id} Target: {Target specification uri} *Id: {Target specification id}* *Title: {Target description string}* *Description: {string}*
Profile	Profile: {name} Parent: {Resource|Profile name|id|url} *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}*

Code System Rules

Define local code	* {code} *"{display string}"* *"{definition string}"*

Get More Information

FSH Specification · FSH Chat · FSH School · HL7 Project Page

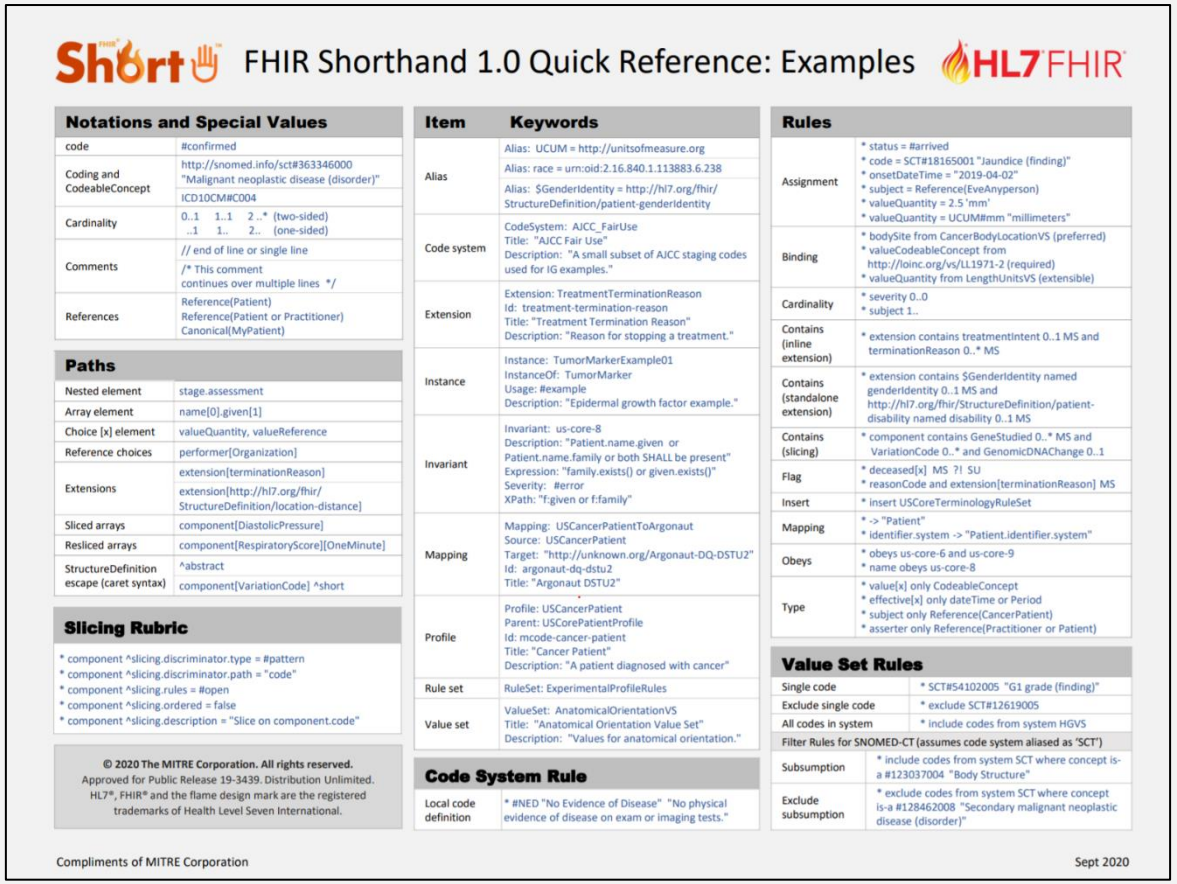
Rules	
Assignment	* <element> = {value} *(exactly)*
Binding	* <bindable> from {ValueSet name|id|url} *{strength}*
Cardinality	* <element> {cardinality}
Contains (inline extensions)	* <Extension> contains {name1} {cardinality1} *{flags1} and {name2} {cardinality2} {flags2} and {name3} {cardinality3} {flags3}* ...
Contains (standalone extensions)	* <Extension> contains {Extension1 name|id|url} named {name1} {cardinality1} *{flags1} and {Extension2 name|id|url} named {name2} {cardinality2} {flags2} and {Extension3 name|id|url} named {name3} {cardinality3} {flags3}* ...
Contains (slicing)	* <array> contains {name1} {cardinality1} *{flags1} and {name2} {cardinality2} {flags2} and {name3} {cardinality3} {flags3}* ...
Flag	* <element1> *and <element2> and <element3>* ... {flag1} *{flag2} {flag3}*...
Insert	* insert {RuleSet name}
Mapping	* *<element>* -> "{map string}" *"{comment string}" #{mime-type code}*
Obeys	* *<element>* obeys {Invariant1 id} *and {Invariant2 id}* ...
Type	* <element> only {datatype1} *or {datatype2} or {datatype3}* ... * <element> only Reference({ResourceType1 name|id|url} *or {ResourceType2 name|id|url} or {ResourceType3 name|id|url} ...)*

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} *and {filter2} and* ...
Exclude codes with filtering	* exclude codes from system {CodeSystem name|id|url} where {filter1} *and {filter2} and* ...

Compliments of MITRE Corporation — Sept 2020

Syntax



Short FHIR Shorthand 1.0 Quick Reference: Examples — HL7 FHIR

Notations and Special Values

code	#confirmed
Coding and CodeableConcept	http://snomed.info/sct#363346000 "Malignant neoplastic disease (disorder)"
	ICD10CM#C004
Cardinality	0..1 1..1 2..* (two-sided) ..1 1.. 2.. (one-sided)
Comments	// end of line or single line
	/* This comment continues over multiple lines */
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]
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.ordered = false
* component ^slicing.description = "Slice on component.code"

Item	Keywords
Alias	Alias: UCUM = http://unitsofmeasure.org
	Alias: race = urn:oid:2.16.840.1.113883.6.238
	Alias: $GenderIdentity = http://hl7.org/fhir/StructureDefinition/patient-genderIdentity
Code system	CodeSystem: AJCC_FairUse Title: "AJCC Fair Use" Description: "A small subset of AJCC staging codes used for IG examples."
Extension	Extension: TreatmentTerminationReason Id: treatment-termination-reason Title: "Treatment Termination Reason" Description: "Reason for stopping a treatment."
Instance	Instance: TumorMarkerExample01 InstanceOf: TumorMarker Usage: #example Description: "Epidermal growth factor example."
Invariant	Invariant: us-core-8 Description: "Patient.name.given or Patient.name.family or both SHALL be present" Expression: "family.exists() or given.exists()" Severity: #error XPath: "f:given or f:family"
Mapping	Mapping: USCancerPatientToArgonaut Source: USCancerPatient Target: "http://unknown.org/Argonaut-DQ-DSTU2" Id: argonaut-dq-dstu2 Title: "Argonaut DSTU2"
Profile	Profile: USCancerPatient Parent: USCorePatientProfile Id: mcode-cancer-patient Title: "Cancer Patient" Description: "A patient diagnosed with cancer"
Rule set	RuleSet: ExperimentalProfileRules
Value set	ValueSet: AnatomicalOrientationVS Title: "Anatomical Orientation Value Set" Description: "Values for anatomical orientation."

Code System Rule

Local code definition	* #NED "No Evidence of Disease" "No physical evidence of disease on exam or imaging tests."

Rules	
Assignment	* status = #arrived * code = SCT#18165001 "Jaundice (finding)" * onsetDateTime = "2019-04-02" * subject = Reference(EveAnyperson) * valueQuantity = 2.5 'mm' * valueQuantity = UCUM#mm "millimeters"
Binding	* bodySite from CancerBodyLocationVS (preferred) * valueCodeableConcept from http://loinc.org/vs/LL1971-2 (required) * valueQuantity from LengthUnitsVS (extensible)
Cardinality	* severity 0..0 * subject 1..
Contains (inline extension)	* extension contains treatmentIntent 0..1 MS and terminationReason 0..* MS
Contains (standalone extension)	* extension contains $GenderIdentity named genderIdentity 0..1 MS and http://hl7.org/fhir/StructureDefinition/patient-disability named disability 0..1 MS
Contains (slicing)	* component contains GeneStudied 0..* MS and VariationCode 0..* and GenomicDNAChange 0..1
Flag	* deceased[x] MS ?! SU * reasonCode and extension[terminationReason] MS
Insert	* insert USCoreTerminologyRuleSet
Mapping	* -> "Patient" * identifier.system -> "Patient.identifier.system"
Obeys	* obeys us-core-6 and us-core-9 * name obeys us-core-8
Type	* value[x] only CodeableConcept * effective[x] only dateTime or Period * subject only Reference(CancerPatient) * asserter only Reference(Practitioner or Patient)

Value Set Rules

Single code	* SCT#54102005 "G1 grade (finding)"
Exclude single code	* exclude SCT#12619005
All codes in system	* include 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)"

Compliments of MITRE Corporation — Sept 2020

Examples

Look Ahead to Let's Build (next session)

Creating a FSH Implementation Guide

```
IG-root
├── ig.ini
├── sushi-config.yaml
├── input
│   ├── fsh
│   │   ├── file1.fsh
│   │   ├── file2.fsh
│   │   └── file3.fsh
│   ├── ignoreWarnings.txt
│   ├── images
│   │   ├── myDocument.pdf
│   │   ├── myGraphic.png
│   │   └── mySpreadsheet.xlsx
│   ├── includes
│   │   └── menu.xml
│   ├── resources
│   │   └── myOtherResources.json
│   └── pagecontent
│       ├── 1_mySecondPage.md
│       ├── 2_myThirdPage.md
│       ├── 3_myFourthPage.md
│       └── index.md
├── package-list.json
└── input-cache/publisher.jar
```

run HL7 IG publisher
(runs SUSHI for you)

```
IG-root
├── fsh-generated
├── output
├── temp
└── template
```

index.html
IG home page

You can mix FSH with resources created by Trifolia or Forge

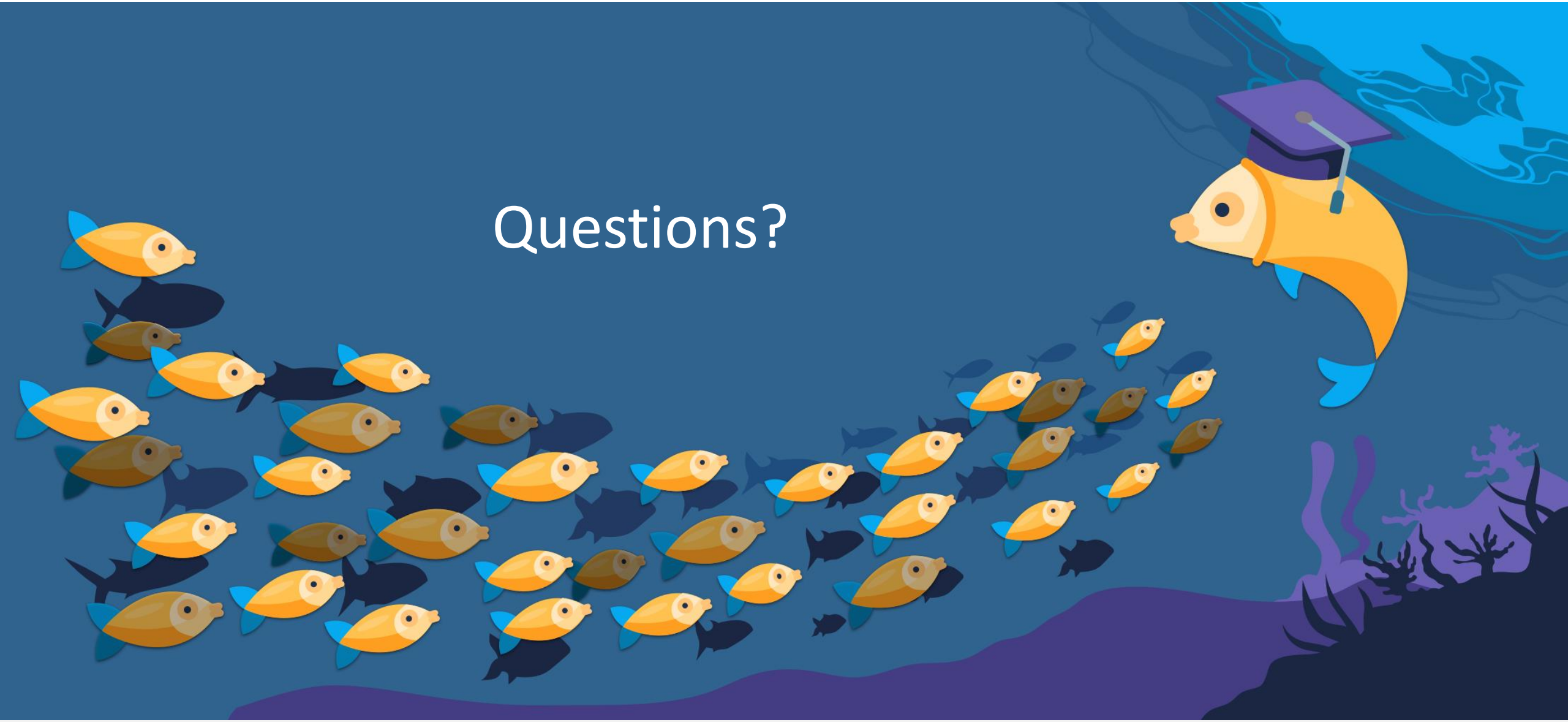
Prepare for Let's Build (next session)

- 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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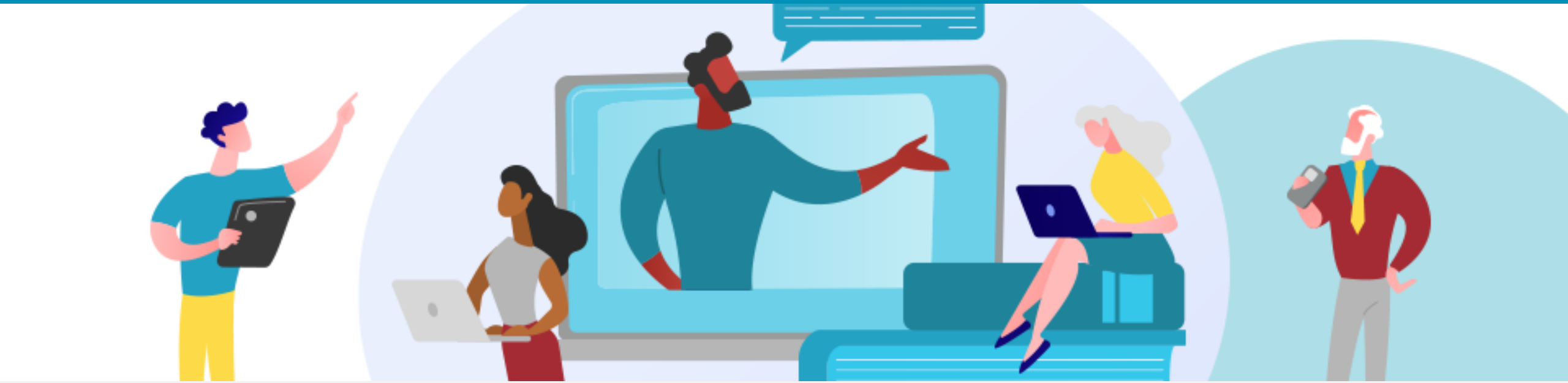
HL7® FHIR® DevDays

JUNE | 2021

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 firely HL7 International | PARTNER HL7® FHIR® FOUNDATION

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® Shorthand™

Track overview: Let's Build a FHIR specification

Monday	Tuesday	Wednesday	Thursday
Introduction to FHIR 11:00 – 11:45	Introduction Profiling 1:00 – 1:45	Accelerating your IG production 1:00 – 1:45	FHIR Registry & Packages 1:00 – 1:45
	Profiling with Forge 2:15 – 3:00	IG with IG Publisher 2:15 – 3:00	Publishing with Simplifier.net 2:15 – 3:00
You are here →	Create an IG with FHIR Shorthand 3:15 – 4:00		Advanced FHIR Shorthand and Tools 3:15 – 4:00
	Create an IG with FHIR Shorthand 4:15 – 5:00		

FSH Background

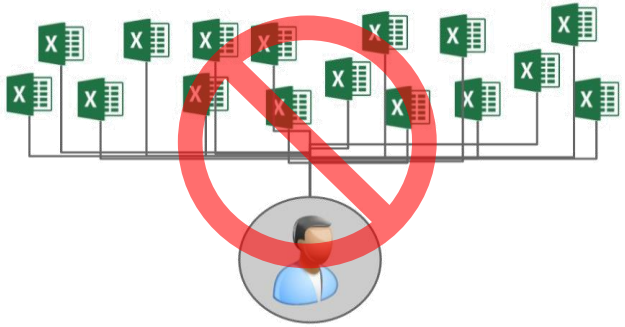
FHIR Profiles and Implementation Guides

- 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

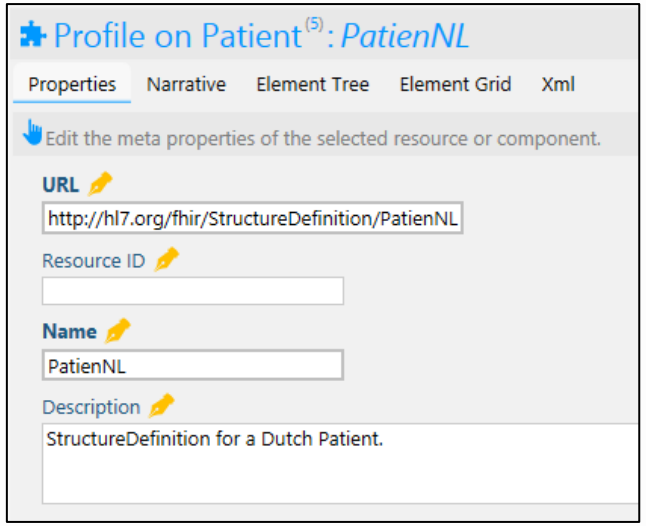
Spreadsheets



User Interfaces

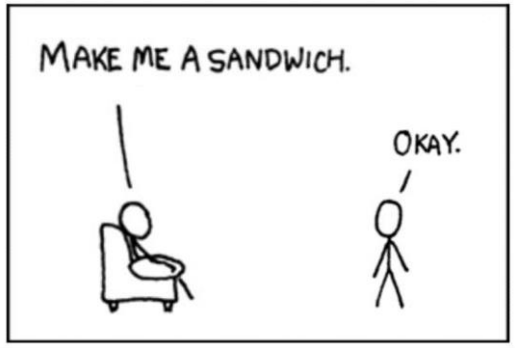
Trifolia-on-FHIR

Forge



Command-Driven

FHIR® Shorthand™




```
Profile: MyPatient
Parent: Patient
* name 1..* MS
```

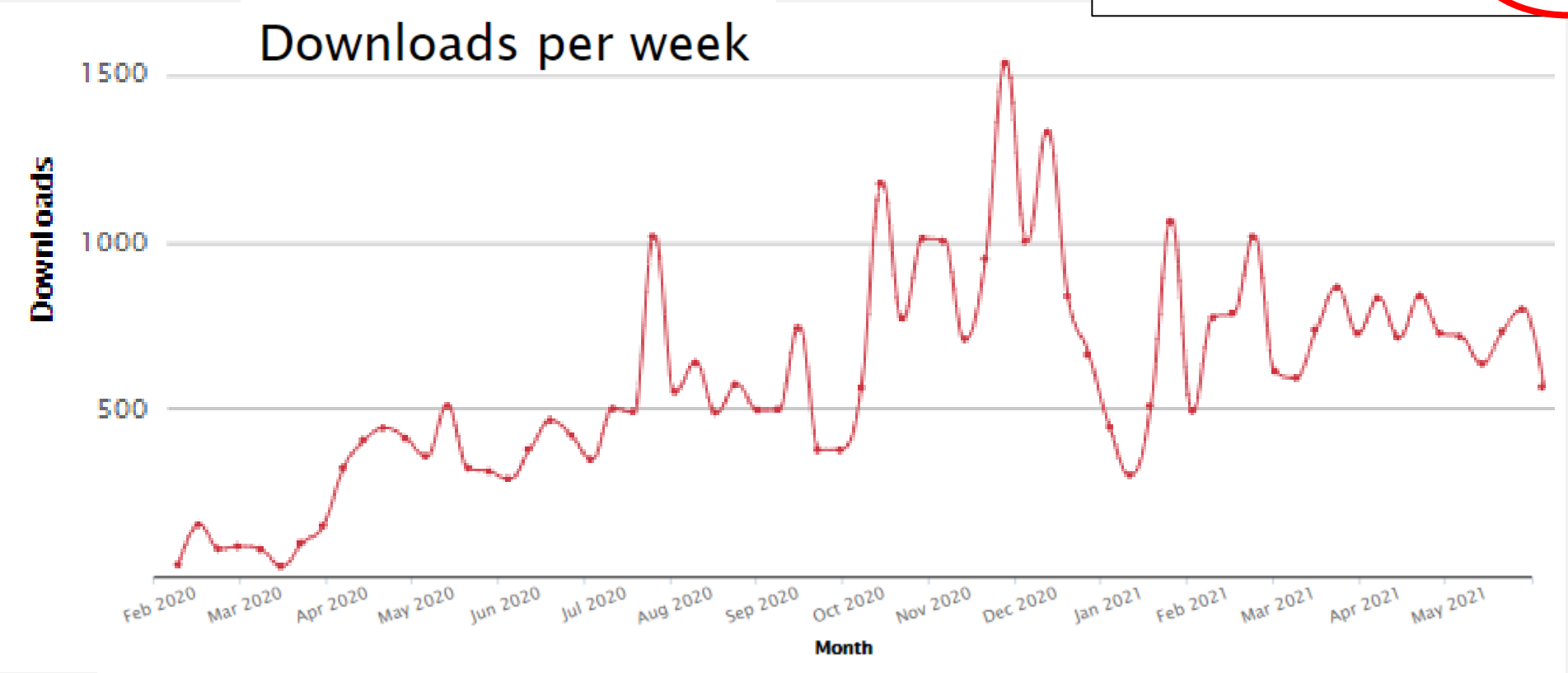
Advantages of FHIR Shorthand Profiling Language

- 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*:

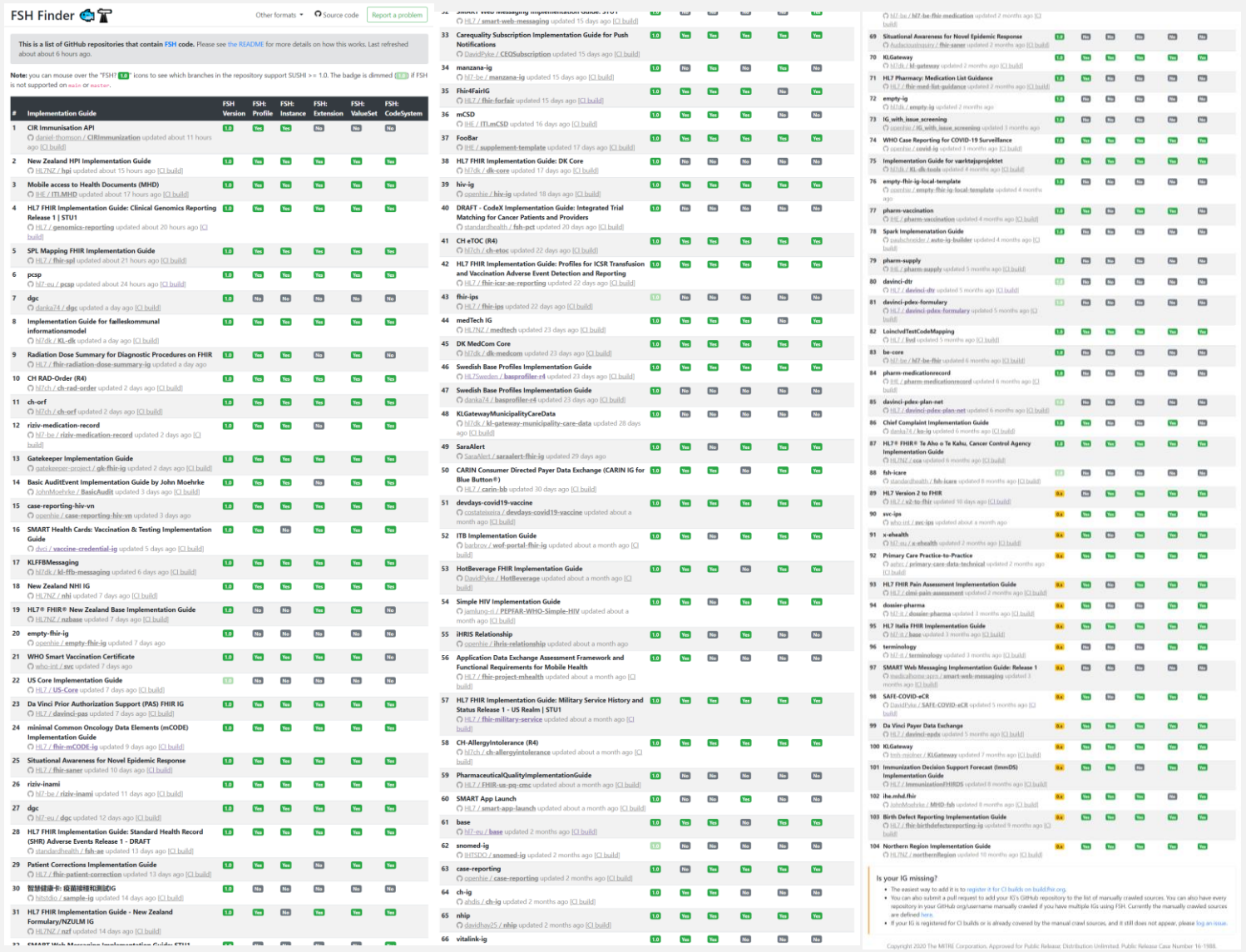
package	downloads
fsh-sushi	39,685



FSH Finder

100+ Implementation Guides

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



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

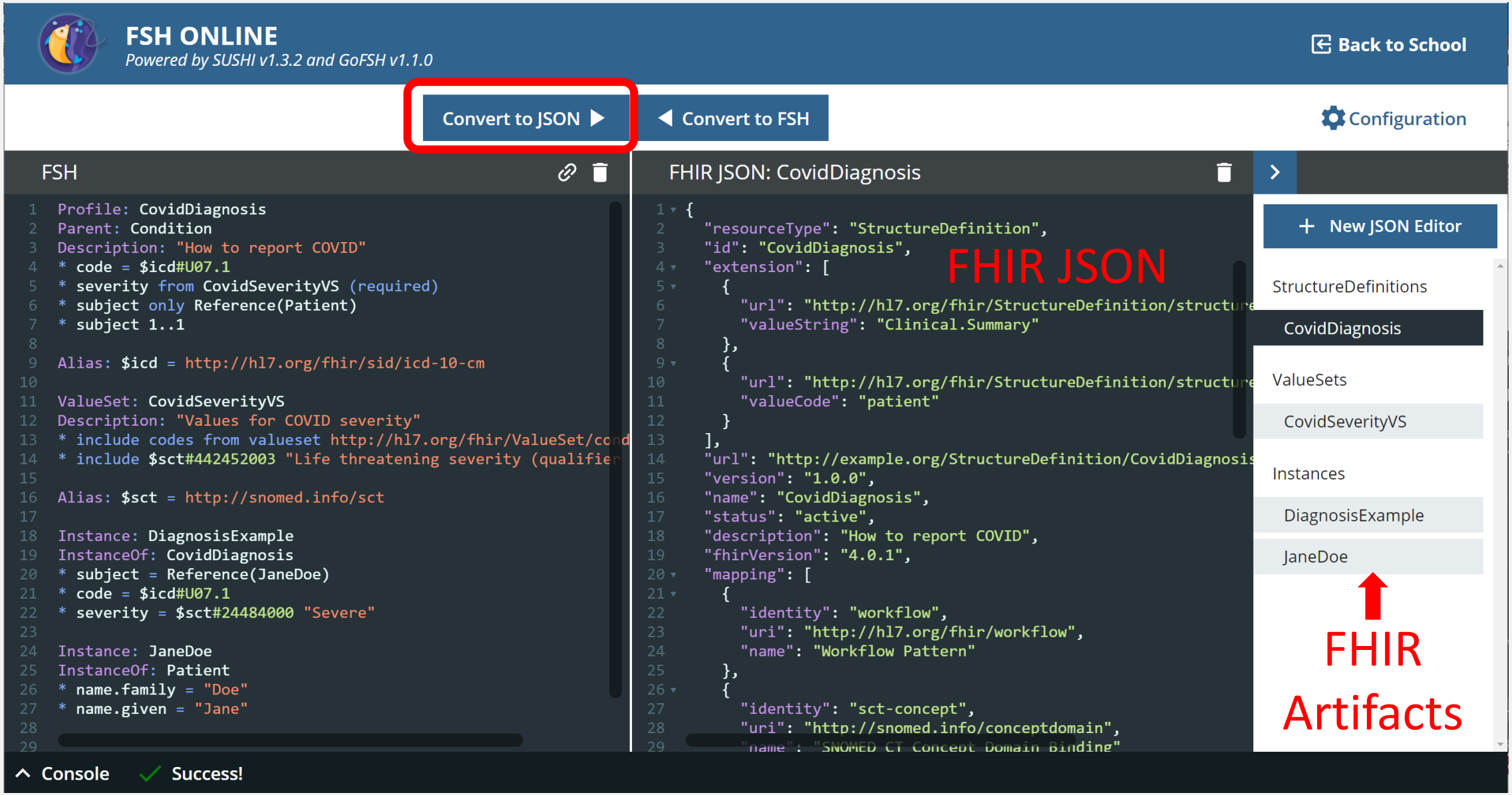
2. Add SNOMED-CT code for "life threatening"

```
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"
```

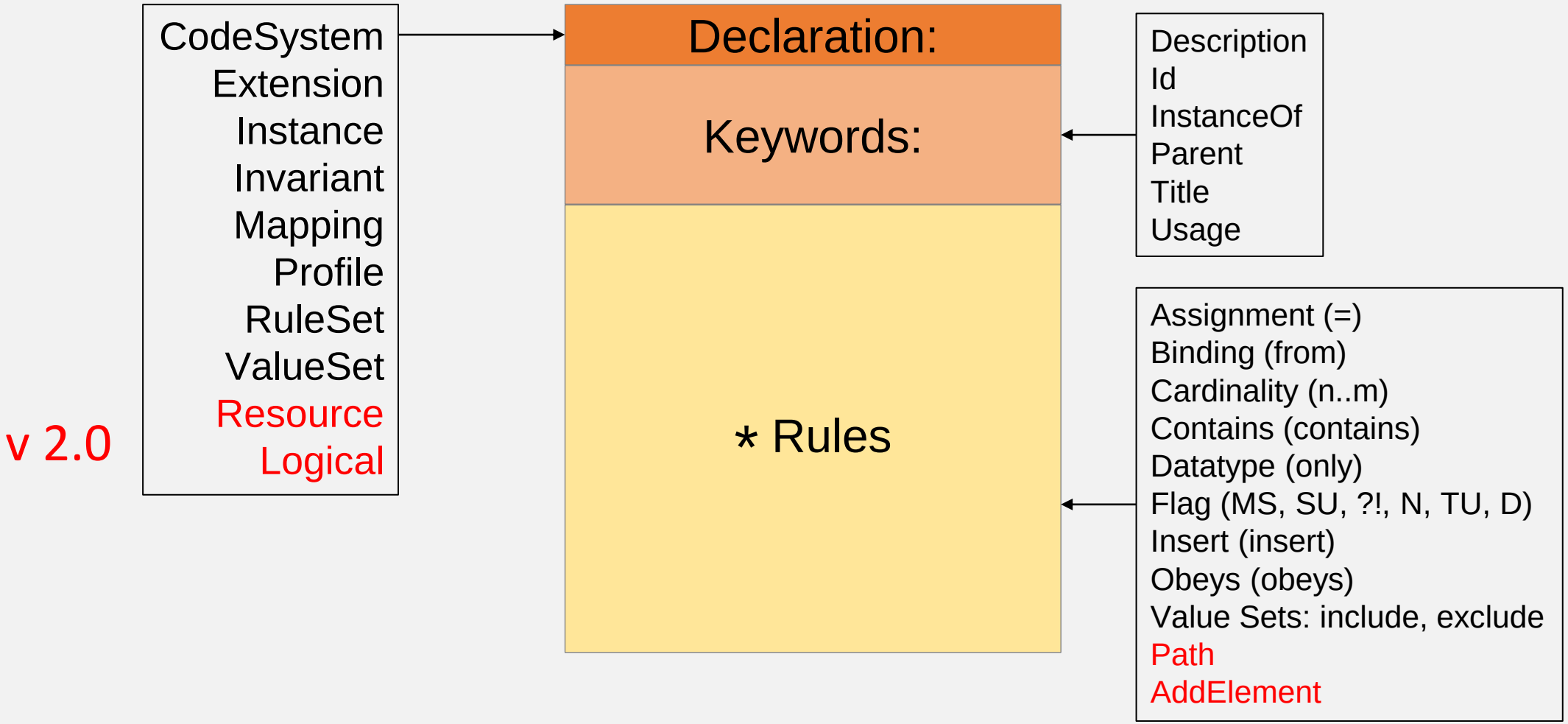

FSH ONLINE
Powered by SUSHI v1.3.2 and GoFSH v1.1.0
Back to School
Convert to JSON
Convert to FSH
Configuration
FSH
FHIR JSON: CovidDiagnosis
FHIR JSON
New JSON Editor
StructureDefinitions
CovidDiagnosis
ValueSets
CovidSeverityVS
Instances
DiagnosisExample
JaneDoe
FHIR Artifacts
Console
Success!

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

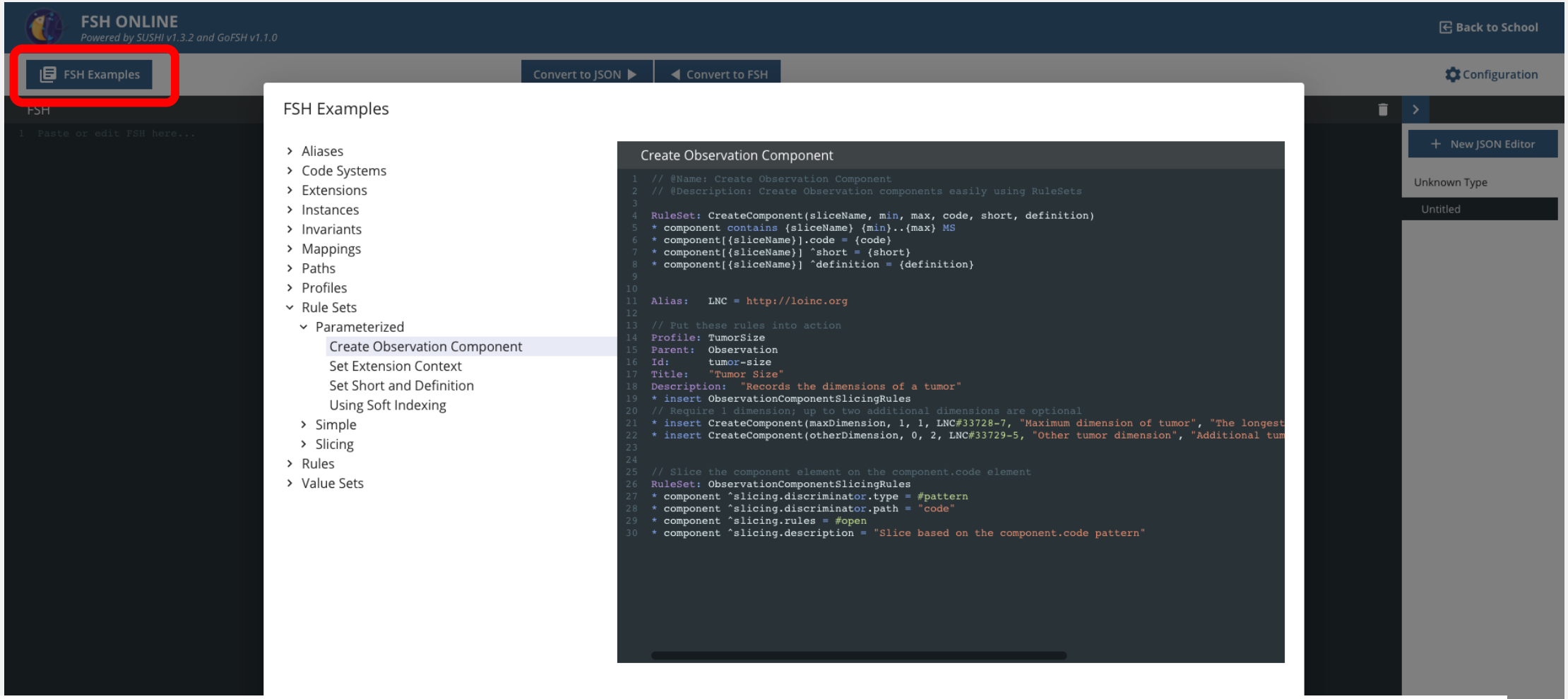
- "Don't repeat yourself" principle
- Share best practices with others

```
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



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

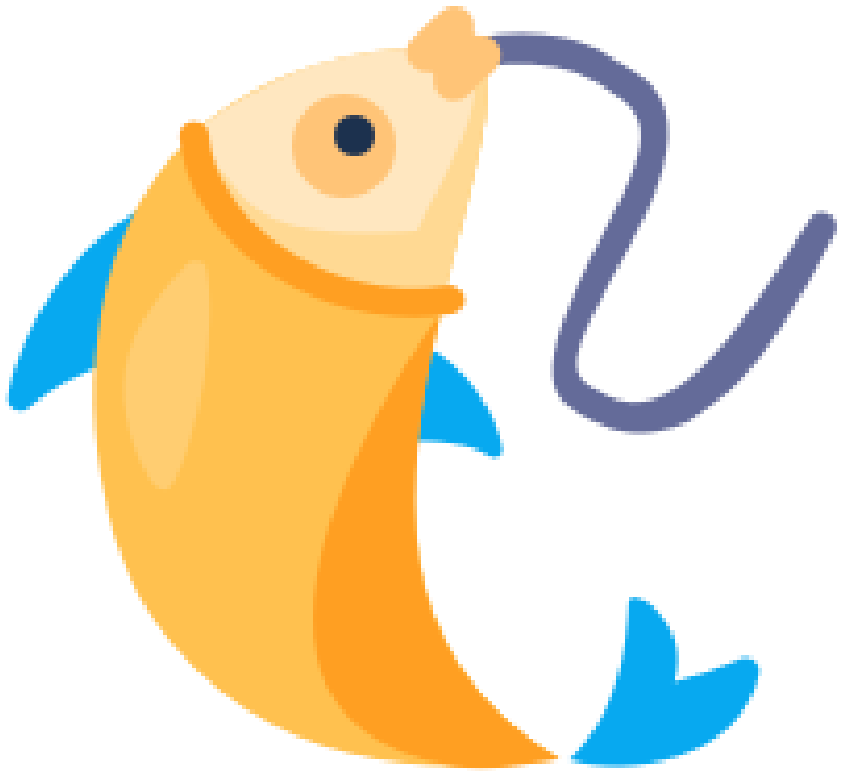
- Then insert into the Extension definition:

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

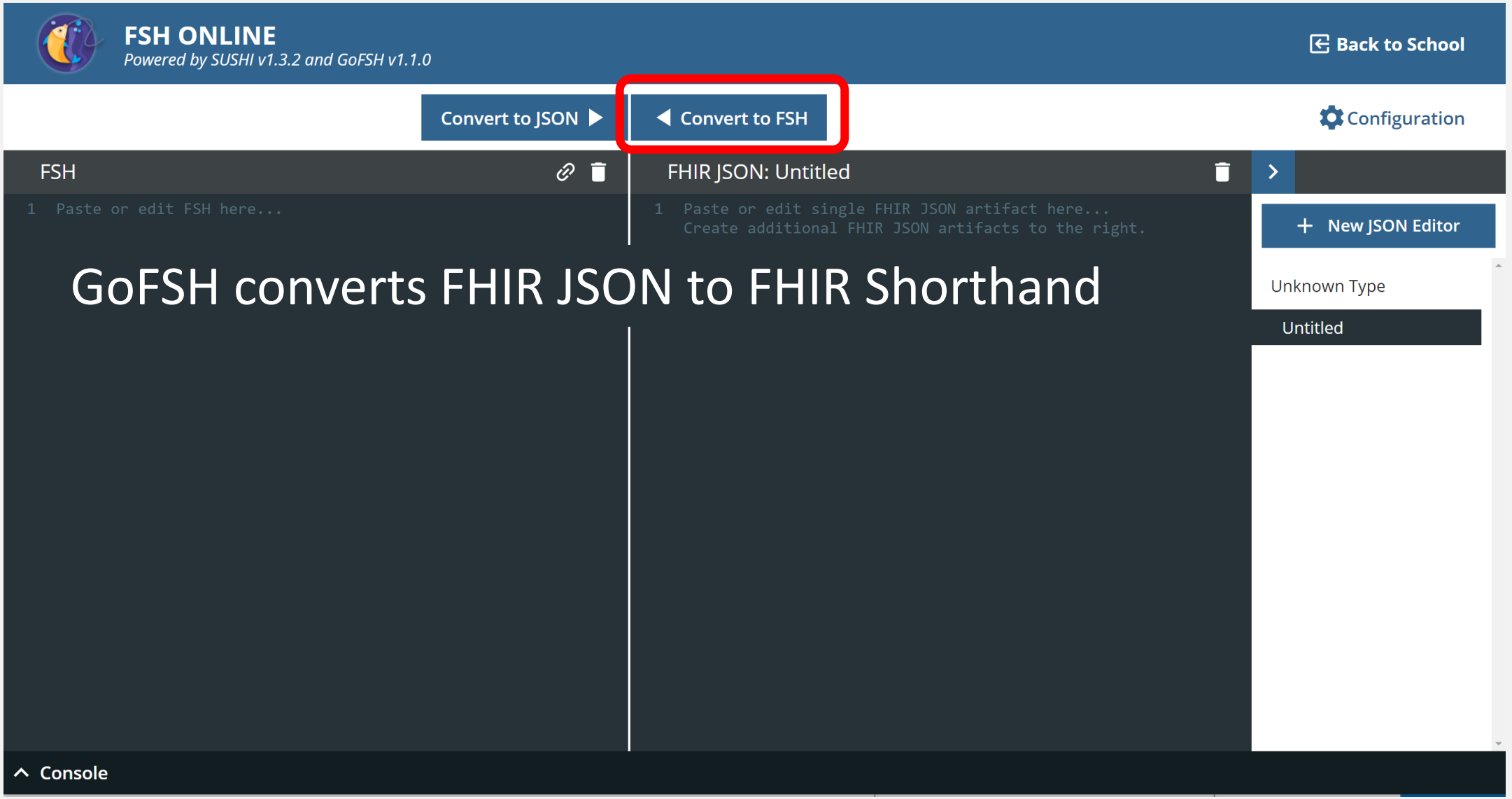
Add the Extension to the CovidCondition Profile

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



GoFSH converts FHIR JSON to FHIR Shorthand

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

```
Alias: $vitalsigns = http://hl7.org/fhir/StructureDefinition/vitalsigns

Profile: observation-bodyheight
Parent: $vitalsigns
Id: bodyheight
Title: "Observation Body Height Profile"
Description: "FHIR Body Height Profile"
* ^extension[0].url = "http://hl7.org/fhir/StructureDefinition/structure
* ^extension[=].valueMarkdown = "#### Complete Summary of the Mandatory R
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structure
* ^extension[=].valueInteger = 5
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structu
* ^extension[=].valueCode = #oo
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structu
* ^extension[=].valueCode = #trial-use
* ^status = #draft
* ^experimental = false
* ^date = "2018-08-11"
* ^publisher = "Health Level Seven International (Orders and Observations
* ^contact.telecom.system = #url
* ^contact.telecom.value = "http://www.hl7.org/Special/committees/orders/i
* . 0..*
* . ^short = "FHIR Body Height Profile"
* . ^definition = "This profile defines  how to represent Body Height obse
* code ^short = "Body Height"
* code ^definition = "Body Height."
* code ^comment = "additional codes that translate or map to this code are
* code ^alias[0] = "Test"
* code ^alias[+] = "Name"
```

FHIR JSON: bodyheight

```
{
  "resourceType" : "StructureDefinition",
  "id" : "bodyheight",
  "text" : {
    "status" : "generated",
    "div" : "<div xmlns=\"http://www.w3.org/1999/xhtml\">to do</div>"
  },
  "extension" : [{
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-sum
    "valueMarkdown" : "#### Complete Summary of the Mandatory Requirements\r
  },
  {
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm
    "valueInteger" : 5
  },
  {
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-wg"
    "valueCode" : "oo"
  },
  {
    "url" : "http://hl7.org/fhir/StructureDefinition/structuredefinition-sta
    "valueCode" : "trial-use"
  }],
  "url" : "http://hl7.org/fhir/StructureDefinition/bodyheight",
  "version" : "4.0.1",
  "name" : "observation-bodyheight",
  "title" : "Observation Body Height Profile",
  "status" : "draft",
  "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

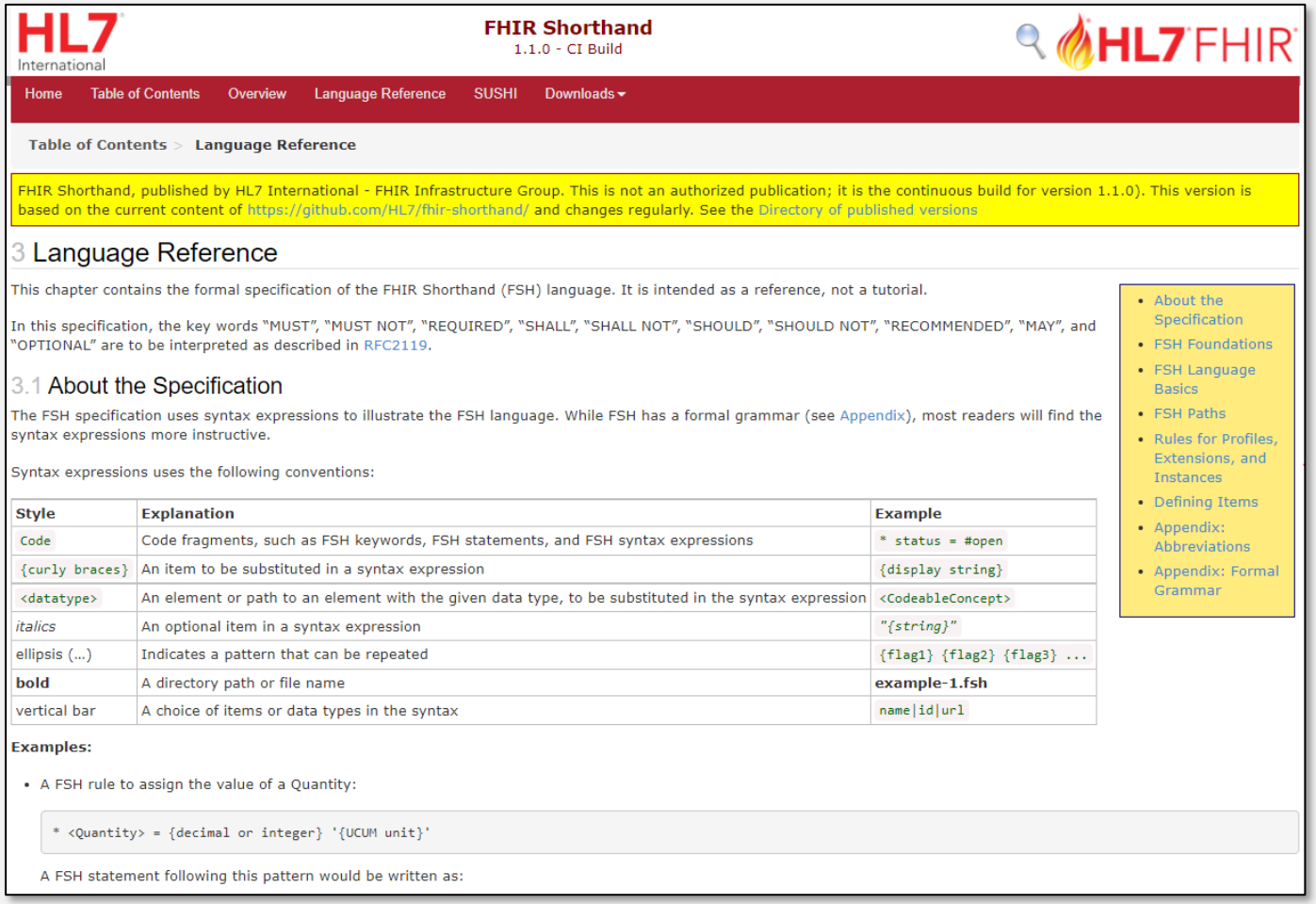
```
* ^extension[+].url = "http://hl7.org/fhir/StructureDefinition/structuredefinition-fmm"
* ^extension[=].valueInteger = 5
```

(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



HL7 International

FHIR Shorthand
1.1.0 - CI Build

HL7 FHIR

Home | Table of Contents | Overview | Language Reference | SUSHI | Downloads

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.

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

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

Examples:

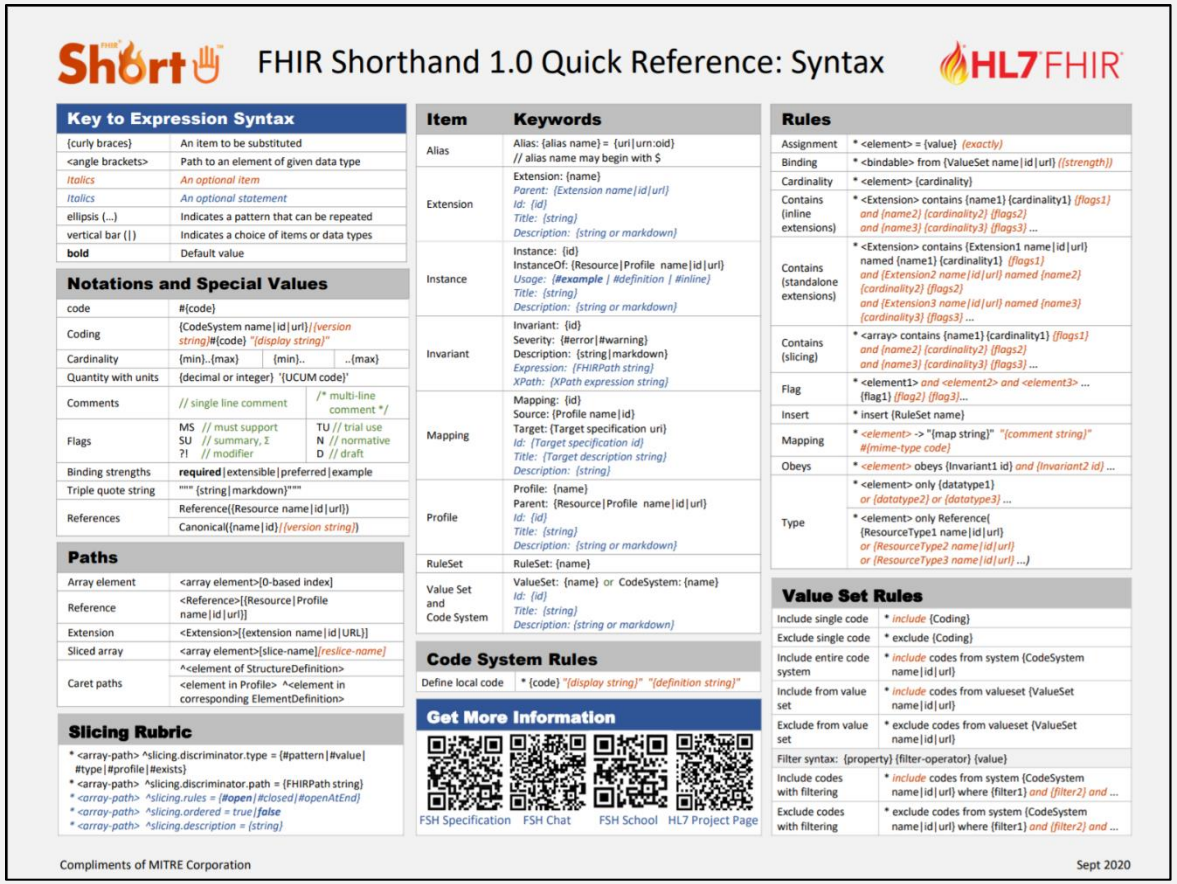
- A FSH rule to assign the value of a Quantity:

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

A FSH statement following this pattern would be written as:

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

Downloads → Quick Reference Card



Short FHIR Shorthand 1.0 Quick Reference: Syntax — HL7 FHIR

Key to Expression Syntax

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

Notations and Special Values

code	#{code}		
Coding	{CodeSystem name|id|url}*{version string}*#{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, Σ ?! // modifier	TU // trial use N // normative D // draft	
Binding strengths	**required**|extensible|preferred|example		
Triple quote string	""" {string|markdown}"""		
References	Reference({Resource name|id|url})		
	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]*{reslice-name}*
Caret paths	^<element of StructureDefinition>
	<element in Profile> ^<element in corresponding ElementDefinition>

Slicing Rubric

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

Item	Keywords
Alias	Alias: {alias name} = {uri|urn:oid} // alias name may begin with $
Extension	Extension: {name} *Parent: {Extension name|id|url}* *Id: {id}* *Title: {string}* *Description: {string or markdown}*
Instance	Instance: {id} InstanceOf: {Resource|Profile name|id|url} *Usage: {**#example** | #definition | #inline}* *Title: {string}* *Description: {string or markdown}*
Invariant	Invariant: {id} Severity: {#error|#warning} Description: {string|markdown} *Expression: {FHIRPath string}* *XPath: {XPath expression string}*
Mapping	Mapping: {id} Source: {Profile name|id} Target: {Target specification uri} *Id: {Target specification id}* *Title: {Target description string}* *Description: {string}*
Profile	Profile: {name} Parent: {Resource|Profile name|id|url} *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}*

Code System Rules

Define local code	* {code} *"{display string}"* *"{definition string}"*

Get More Information

FSH Specification · FSH Chat · FSH School · HL7 Project Page

Rules	
Assignment	* <element> = {value} *(exactly)*
Binding	* <bindable> from {ValueSet name|id|url} *{(strength)}*
Cardinality	* <element> {cardinality}
Contains (inline extensions)	* <Extension> contains {name1} {cardinality1} *{flags1} and {name2} {cardinality2} {flags2} and {name3} {cardinality3} {flags3}* ...
Contains (standalone extensions)	* <Extension> contains {Extension1 name|id|url} named {name1} {cardinality1} *{flags1} and {Extension2 name|id|url} named {name2} {cardinality2} {flags2} and {Extension3 name|id|url} named {name3} {cardinality3} {flags3}* ...
Contains (slicing)	* <array> contains {name1} {cardinality1} *{flags1} and {name2} {cardinality2} {flags2} and {name3} {cardinality3} {flags3}* ...
Flag	* <element1> *and <element2> and <element3>* ... {flag1} *{flag2} {flag3}*...
Insert	* insert {RuleSet name}
Mapping	* *<element>* -> "{map string}" *"{comment string}" #{mime-type code}*
Obeys	* *<element>* obeys {Invariant1 id} *and {Invariant2 id}* ...
Type	* <element> only {datatype1} *or {datatype2} or {datatype3}* ... * <element> only Reference({ResourceType1 name|id|url} *or {ResourceType2 name|id|url} or {ResourceType3 name|id|url} ...)*

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} *and {filter2} and* ...
Exclude codes with filtering	* exclude codes from system {CodeSystem name|id|url} where {filter1} *and {filter2} and* ...

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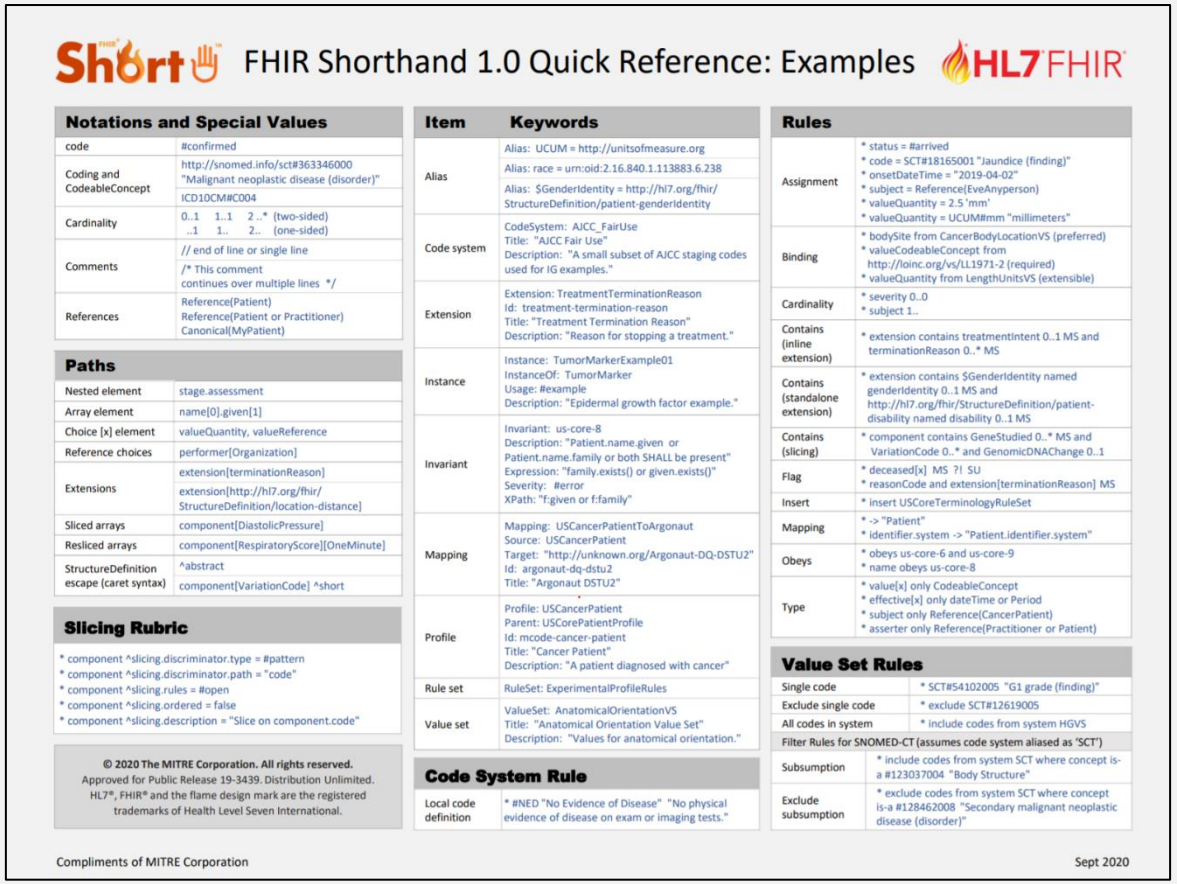
Syntax



Short FHIR Shorthand 1.0 Quick Reference: Examples — HL7 FHIR

Notations and Special Values

code	#confirmed
Coding and CodeableConcept	http://snomed.info/sct#363346000 "Malignant neoplastic disease (disorder)" ICD10CM#C004
Cardinality	0..1 1..1 2..* (two-sided) ..1 1.. 2.. (one-sided)
Comments	// end of line or single line /* This comment continues over multiple lines */
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]
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.ordered = false
* component ^slicing.description = "Slice on component.code"

Item	Keywords
Alias	Alias: UCUM = http://unitsofmeasure.org Alias: race = urn:oid:2.16.840.1.113883.6.238 Alias: $GenderIdentity = http://hl7.org/fhir/StructureDefinition/patient-genderIdentity
Code system	CodeSystem: AJCC_FairUse Title: "AJCC Fair Use" Description: "A small subset of AJCC staging codes used for IG examples."
Extension	Extension: TreatmentTerminationReason Id: treatment-termination-reason Title: "Treatment Termination Reason" Description: "Reason for stopping a treatment."
Instance	Instance: TumorMarkerExample01 InstanceOf: TumorMarker Usage: #example Description: "Epidermal growth factor example."
Invariant	Invariant: us-core-8 Description: "Patient.name.given or Patient.name.family or both SHALL be present" Expression: "family.exists() or given.exists()" Severity: #error XPath: "f:given or f:family"
Mapping	Mapping: USCancerPatientToArgonaut Source: USCancerPatient Target: "http://unknown.org/Argonaut-DQ-DSTU2" Id: argonaut-dq-dstu2 Title: "Argonaut DSTU2"
Profile	Profile: USCancerPatient Parent: USCorePatientProfile Id: mcode-cancer-patient Title: "Cancer Patient" Description: "A patient diagnosed with cancer"
Rule set	RuleSet: ExperimentalProfileRules
Value set	ValueSet: AnatomicalOrientationVS Title: "Anatomical Orientation Value Set" Description: "Values for anatomical orientation."

Code System Rule

Local code definition	* #NED "No Evidence of Disease" "No physical evidence of disease on exam or imaging tests."

Rules	
Assignment	* status = #arrived * code = SCT#18165001 "Jaundice (finding)" * onsetDateTime = "2019-04-02" * subject = Reference(EveAnyperson) * valueQuantity = 2.5 'mm' * valueQuantity = UCUM#mm "millimeters"
Binding	* bodySite from CancerBodyLocationVS (preferred) * valueCodeableConcept from http://loinc.org/vs/LL1971-2 (required) * valueQuantity from LengthUnitsVS (extensible)
Cardinality	* severity 0..0 * subject 1..
Contains (inline extension)	* extension contains treatmentIntent 0..1 MS and terminationReason 0..* MS
Contains (standalone extension)	* extension contains $GenderIdentity named genderIdentity 0..1 MS and http://hl7.org/fhir/StructureDefinition/patient-disability named disability 0..1 MS
Contains (slicing)	* component contains GeneStudied 0..* MS and VariationCode 0..* and GenomicDNAChange 0..1
Flag	* deceased[x] MS ?! SU * reasonCode and extension[terminationReason] MS
Insert	* insert USCoreTerminologyRuleSet
Mapping	* -> "Patient" * identifier.system -> "Patient.identifier.system"
Obeys	* obeys us-core-6 and us-core-9 * name obeys us-core-8
Type	* value[x] only CodeableConcept * effective[x] only dateTime or Period * subject only Reference(CancerPatient) * asserter only Reference(Practitioner or Patient)

Value Set Rules

Single code	* SCT#54102005 "G1 grade (finding)"
Exclude single code	* exclude SCT#12619005
All codes in system	* include 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)"

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Examples

Look Ahead to Let's Build (next session)

Creating a FSH Implementation Guide

```
IG-root
├── ig.ini
├── sushi-config.yaml
├── input
│   ├── fsh
│   │   ├── file1.fsh
│   │   ├── file2.fsh
│   │   └── file3.fsh
│   ├── ignoreWarnings.txt
│   ├── images
│   │   ├── myDocument.pdf
│   │   ├── myGraphic.png
│   │   └── mySpreadsheet.xlsx
│   ├── includes
│   │   └── menu.xml
│   ├── resources
│   │   └── myOtherResources.json
│   └── pagecontent
│       ├── 1_mySecondPage.md
│       ├── 2_myThirdPage.md
│       ├── 3_myFourthPage.md
│       └── index.md
├── package-list.json
└── input-cache/publisher.jar
```

run HL7 IG publisher
(runs SUSHI for you)

```
IG-root
├── fsh-generated
├── output
├── temp
└── template
```

index.html

IG home page

You can mix FSH with resources created by Trifolia or Forge

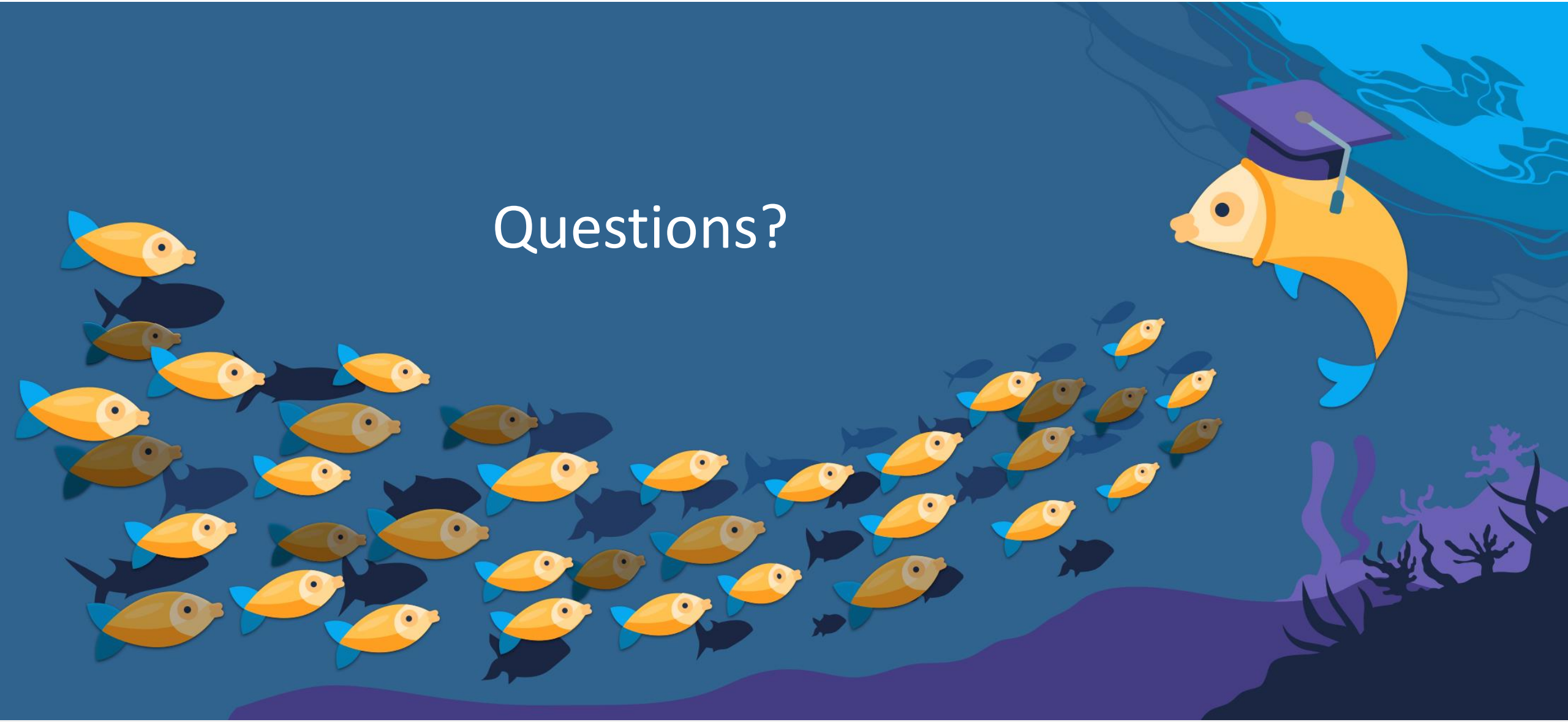
Prepare for Let's Build (next session)

- 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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