DevDays 10th Edition

HL7® FHIR® DevDays

NOV | 2020

Introduction to FHIR Shorthand

Mark Kramer and Chris Moesel, MITRE Corporation

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ORGANIZED BY firely

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Mark Kramer

- Chief Engineer for Health Innovation Center

Chris Moesel

- Prinicipal Software Systems Engineer

MITRE

Non-profit R&D funded by the US government

INFERNO

mCODE™

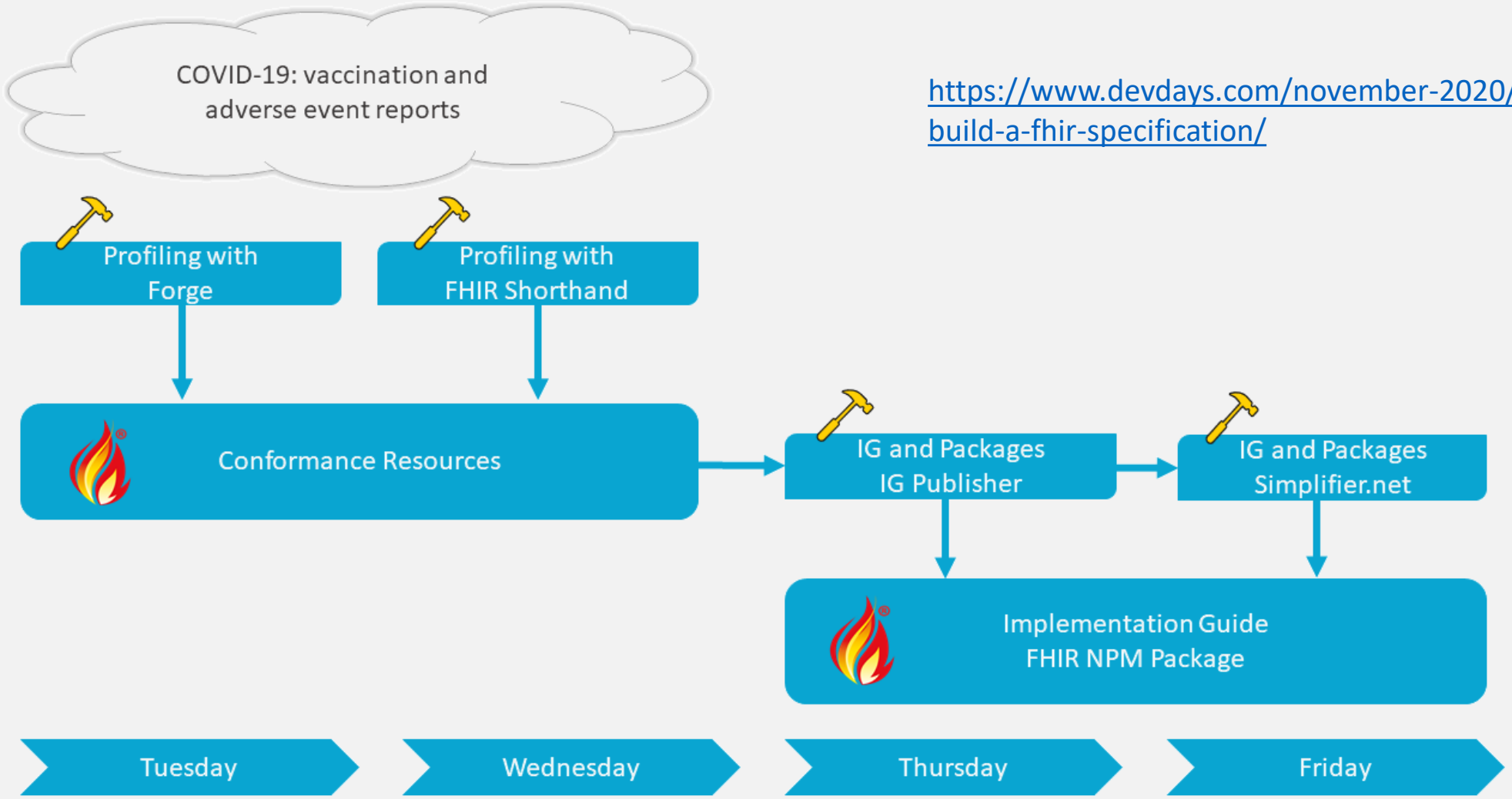
SYNTHEA

Clinical Quality Language

COVID-19 | Healthcare Coalition

Sara Alert™
Secure monitoring and reporting for public health

Profiling Tutorials and Let's Build Sequence



https://www.devdays.com/november-2020/lets-build-a-fhir-specification/

Learning Objectives Tutorial/Let's Build

Learn:

- The purpose of FHIR Shorthand
- How it compares to other methods of creating Implementation Guides
- Basic grammar

Build:

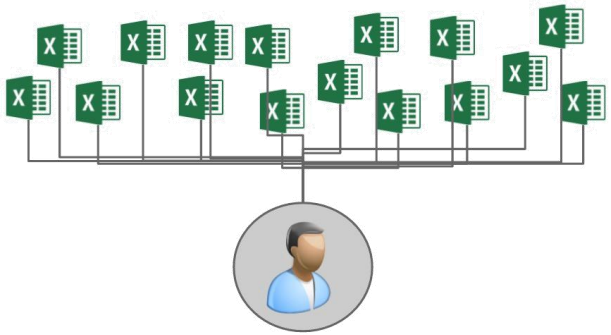
- Your first profile in FHIR Shorthand
- Use SUSHI, the FHIR Shorthand compiler

What is FHIR Shorthand (FSH)?

- A **language** for profiling and implementation guide (IG) creation
- Part of the FHIR family of standards, currently Standard for Trial Use (STU 1)
- Seamlessly integrated with the HL7 FHIR IG Publisher
- Open source and free to use

Profiling Approaches

Spreadsheet

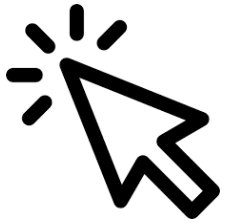


phasing out

Point-and-Click

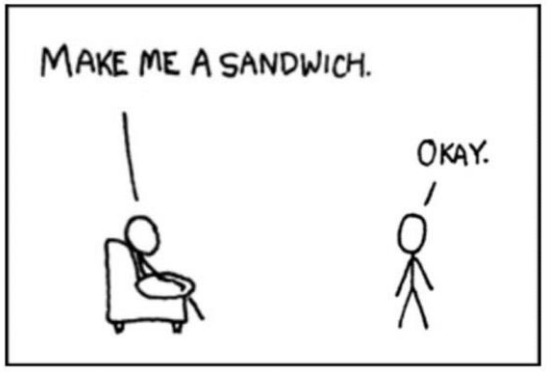
Forge

Trifolia-on-FHIR



Command

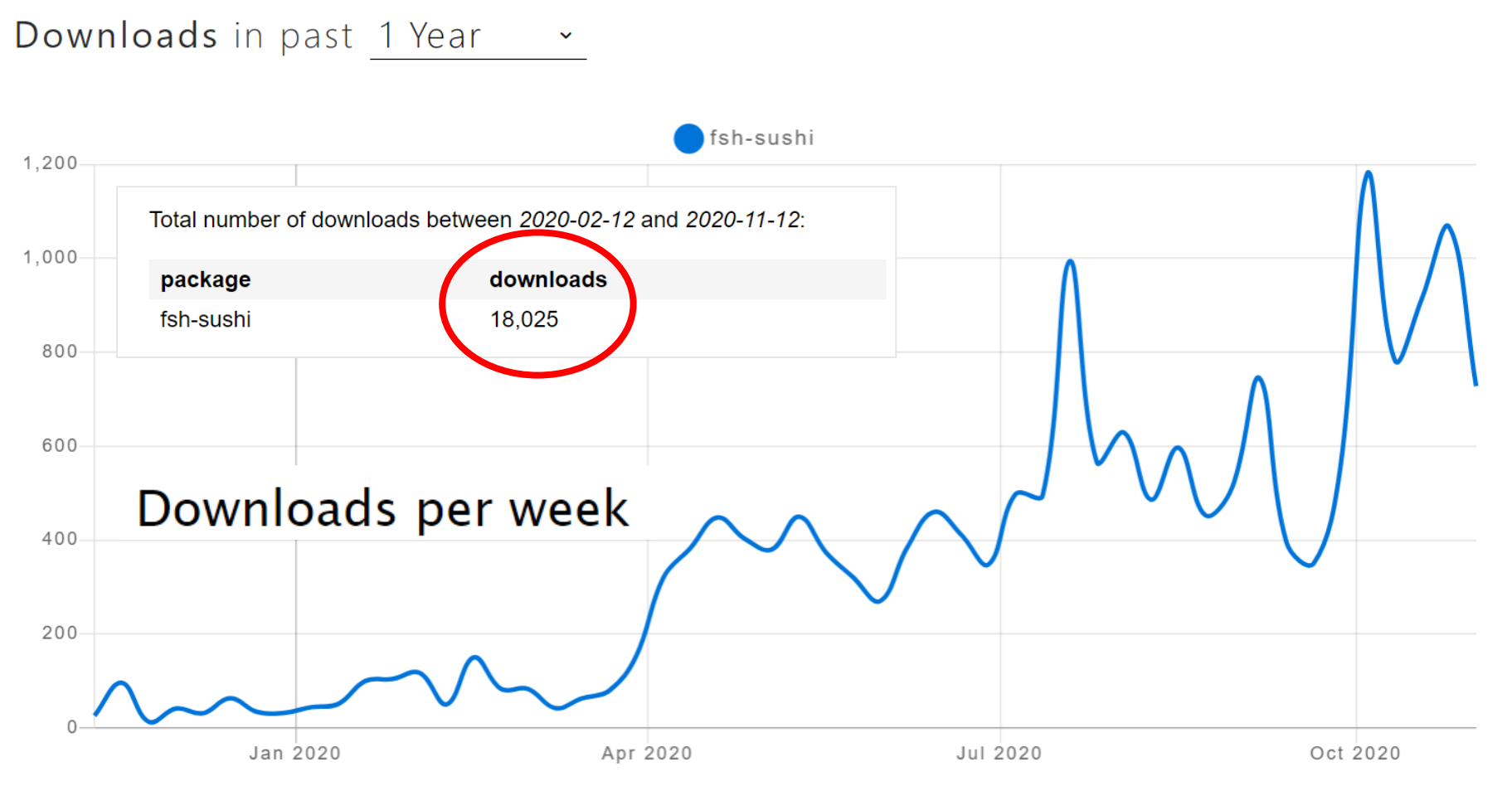
FHIR® Shorthand™

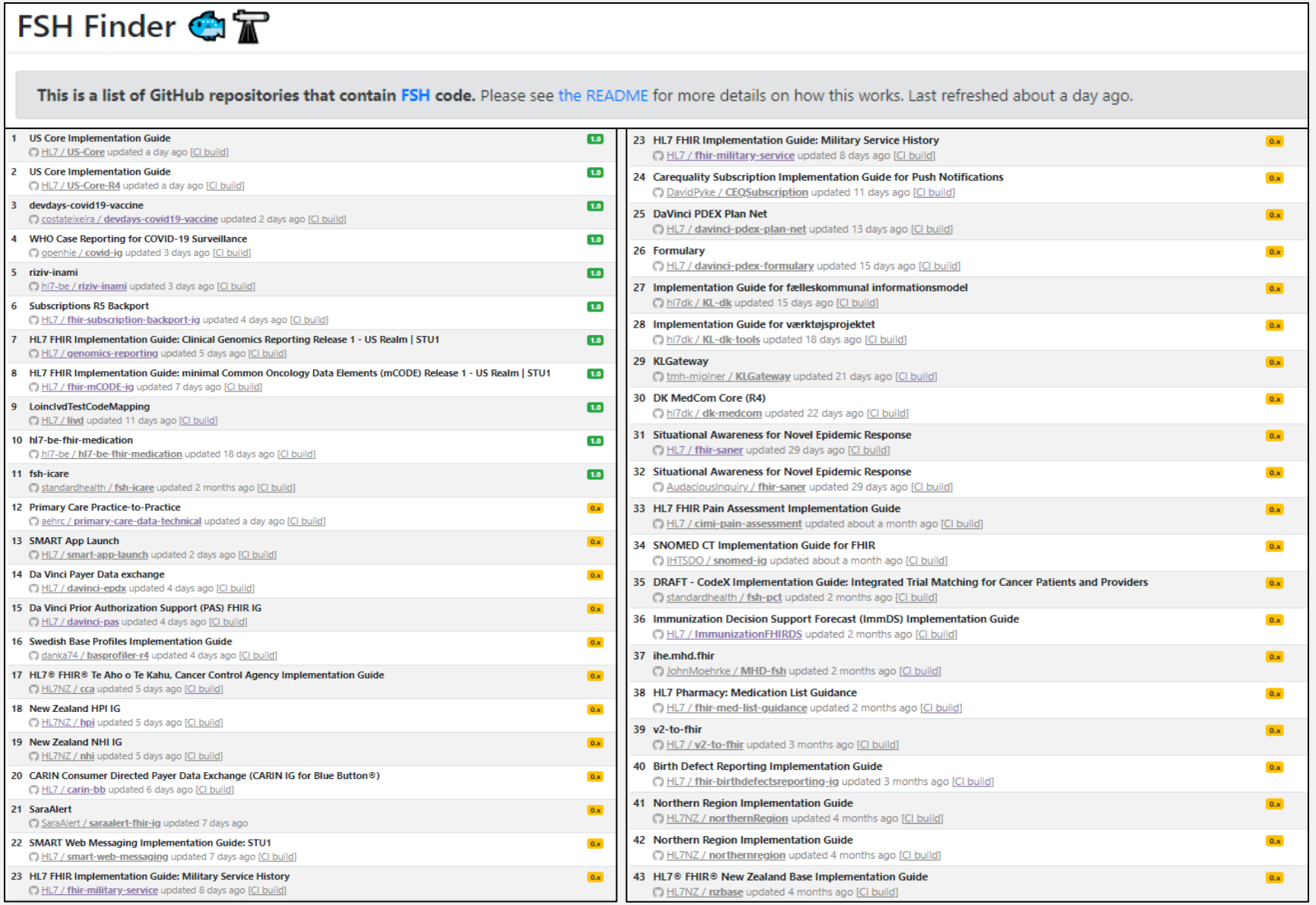


The FSH Family of Tools

- FSH Language Specification -- HL7 FHIR Standard
- School of FSH -- web site with documentation, tools, examples
- FSH On line -- interactive FHIR Shorthand
- Go FSH -- convert existing implementation guides into FSH (beta)
- SUSHI Init -- instantly set up a new project
- VS Code extension -- code highlighter for VS Code editor
- SUSHI -- compile FSH into FHIR Artifacts
- FSH Finder -- web crawler to find FSH projects

FSH Consumption is Rising





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 a day ago.

1 **US Core Implementation Guide** 1.0
HL7 / US-Core updated a day ago [CI build]

2 **US Core Implementation Guide** 1.0
HL7 / US-Core-R4 updated a day ago [CI build]

3 **devdays-covid19-vaccine** 1.0
costateixeira / devdays-covid19-vaccine updated 2 days ago [CI build]

4 **WHO Case Reporting for COVID-19 Surveillance** 1.0
openhie / covid-ig updated 3 days ago [CI build]

5 **riziv-inami** 1.0
hl7-be / riziv-inami updated 3 days ago [CI build]

6 **Subscriptions R5 Backport** 1.0
HL7 / fhir-subscription-backport-ig updated 4 days ago [CI build]

7 **HL7 FHIR Implementation Guide: Clinical Genomics Reporting Release 1 - US Realm | STU1** 1.0
HL7 / genomics-reporting updated 5 days ago [CI build]

8 **HL7 FHIR Implementation Guide: minimal Common Oncology Data Elements (mCODE) Release 1 - US Realm | STU1** 1.0
HL7 / fhir-mCODE-ig updated 7 days ago [CI build]

9 **LoincIvdTestCodeMapping** 1.0
HL7 / livd updated 11 days ago [CI build]

10 **hl7-be-fhir-medication** 1.0
hl7-be / hl7-be-fhir-medication updated 18 days ago [CI build]

11 **fsh-icare** 1.0
standardhealth / fsh-icare updated 2 months ago [CI build]

12 **Primary Care Practice-to-Practice** 0.x
aehrc / primary-care-data-technical updated a day ago [CI build]

13 **SMART App Launch** 0.x
HL7 / smart-app-launch updated 2 days ago [CI build]

14 **Da Vinci Payer Data exchange** 0.x
HL7 / davinci-epdx updated 4 days ago [CI build]

15 **Da Vinci Prior Authorization Support (PAS) FHIR IG** 0.x
HL7 / davinci-pas updated 4 days ago [CI build]

16 **Swedish Base Profiles Implementation Guide** 0.x
danka74 / basprofiler-r4 updated 4 days ago [CI build]

17 **HL7® FHIR® Te Aho o Te Kahu, Cancer Control Agency Implementation Guide** 0.x
HL7NZ / cca updated 5 days ago [CI build]

18 **New Zealand HPI IG** 0.x
HL7NZ / hpi updated 5 days ago [CI build]

19 **New Zealand NHI IG** 0.x
HL7NZ / nhi updated 5 days ago [CI build]

20 **CARIN Consumer Directed Payer Data Exchange (CARIN IG for Blue Button®)** 0.x
HL7 / carin-bb updated 6 days ago [CI build]

21 **SaraAlert** 0.x
SaraAlert / saraalert-fhir-ig updated 7 days ago

22 **SMART Web Messaging Implementation Guide: STU1** 0.x
HL7 / smart-web-messaging updated 7 days ago [CI build]

23 **HL7 FHIR Implementation Guide: Military Service History** 0.x
HL7 / fhir-military-service updated 8 days ago [CI build]

23 **HL7 FHIR Implementation Guide: Military Service History** 0.x
HL7 / fhir-military-service updated 8 days ago [CI build]

24 **Carequality Subscription Implementation Guide for Push Notifications** 0.x
DavidPyke / CEQSubscription updated 11 days ago [CI build]

25 **DaVinci PDEX Plan Net** 0.x
HL7 / davinci-pdex-plan-net updated 13 days ago [CI build]

26 **Formulary** 0.x
HL7 / davinci-pdex-formulary updated 15 days ago [CI build]

27 **Implementation Guide for fælleskommunal informationsmodel** 0.x
hl7dk / KL-dk updated 15 days ago [CI build]

28 **Implementation Guide for værktøjsprojektet** 0.x
hl7dk / KL-dk-tools updated 18 days ago [CI build]

29 **KLGateway** 0.x
tmh-mjolner / KLGateway updated 21 days ago [CI build]

30 **DK MedCom Core (R4)** 0.x
hl7dk / dk-medcom updated 22 days ago [CI build]

31 **Situational Awareness for Novel Epidemic Response** 0.x
HL7 / fhir-saner updated 29 days ago [CI build]

32 **Situational Awareness for Novel Epidemic Response** 0.x
AudaciousInquiry / fhir-saner updated 29 days ago [CI build]

33 **HL7 FHIR Pain Assessment Implementation Guide** 0.x
HL7 / cimi-pain-assessment updated about a month ago [CI build]

34 **SNOMED CT Implementation Guide for FHIR** 0.x
IHTSDO / snomed-ig updated about a month ago [CI build]

35 **DRAFT - CodeX Implementation Guide: Integrated Trial Matching for Cancer Patients and Providers** 0.x
standardhealth / fsh-pct updated 2 months ago [CI build]

36 **Immunization Decision Support Forecast (ImmDS) Implementation Guide** 0.x
HL7 / ImmunizationFHIRDS updated 2 months ago [CI build]

37 **ihe.mhd.fhir** 0.x
JohnMoehrke / MHD-fsh updated 2 months ago [CI build]

38 **HL7 Pharmacy: Medication List Guidance** 0.x
HL7 / fhir-med-list-guidance updated 2 months ago [CI build]

39 **v2-to-fhir** 0.x
HL7 / v2-to-fhir updated 3 months ago [CI build]

40 **Birth Defect Reporting Implementation Guide** 0.x
HL7 / fhir-birthdefectsreporting-ig updated 3 months ago [CI build]

41 **Northern Region Implementation Guide** 0.x
HL7NZ / northernRegion updated 4 months ago [CI build]

42 **Northern Region Implementation Guide** 0.x
HL7NZ / northernregion updated 4 months ago [CI build]

43 **HL7® FHIR® New Zealand Base Implementation Guide** 0.x
HL7NZ / nzbase updated 4 months ago [CI build]

> FSH is a joy!

David Hay,
ClinFHIR, blogger

> The ability to create implementation guides, value sets, code systems, and any sample resource you might ever want in this simple language is simply fantastic.

Keith Boone,
Audacious Inquiry

> FSH has legs

Grahame Grieve
FHIR Product Director

> An immensely useful project

Richard Kavanagh,
Board Member HL7 UK

> I have to admit "Go FSH" fills me with joy - whatever it is the app does

Lloyd McKenzie,
HL7 Canada

Let's Dive into FSH

https://www.freeimages.com/photo/diver-1381076

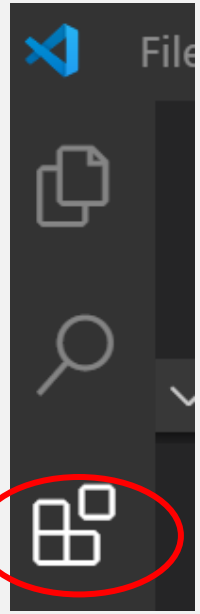
Name	Flags	Card.	Type	Description & Constraints
MedicationRequest		0..*	MedicationRequest	Ordering of medication for patient or group
status	S	1..1	code	active | on-hold | cancelled | completed | entered-in-error | stopped | draft | unknown **Binding:** medicationrequest Status (required)
intent	S	1..1	code	proposal | plan | order | original-order | reflex-order | filler-order | instance-order | option **Binding:** medicationRequest Intent (required)
reported[x]	S	0..1		Reported rather than primary record
reportedBoolean			boolean	
reportedReference			Reference(US Core Patient Profile | US Core Practitioner Profile | US Core Organization Profile)	
medication[x]	S	1..1		Medication to be taken **Binding:** US Core Medication Codes (RxNorm) (extensible)
medicationCodeableConcept			CodeableConcept	
medicationReference			Reference(US Core Medication Profile)	
subject	S	1..1	Reference(US Core Patient Profile)	Who or group medication request is for
encounter	S	0..1	Reference(Encounter)	Encounter created as part of encounter/admission/stay
authoredOn	S	1..1	dateTime	When request was initially authored
requester	S	1..1	Reference(US Core Practitioner Profile | US Core Organization Profile | US Core Patient Profile)	Who/What requested the Request
dosageInstruction	S	0..*	Dosage	How the medication should be taken
text	S	0..1	string	Free text dosage instructions e.g. SIG

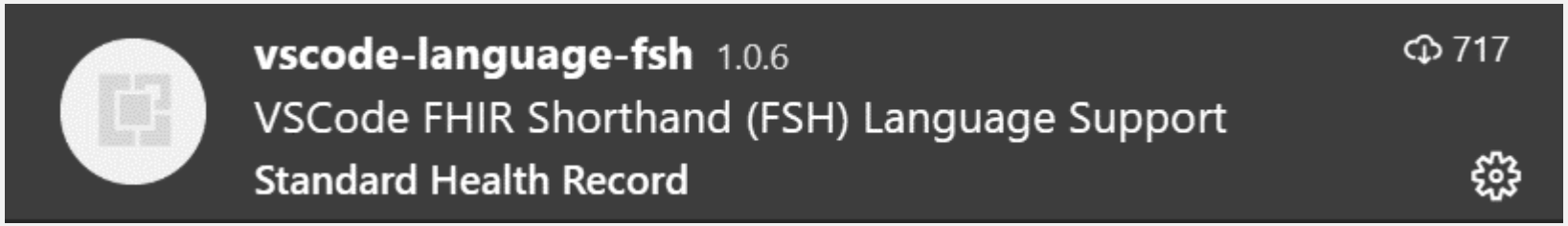
Typical profile:

- Must support
- Cardinality
- Data type
- Value Set Binding

Text Editor for **.fsh** Files

- Any text editor will do, but we suggest Visual Studio Code (https://code.visualstudio.com/download)
- Load any **`.fsh`** file, and VS Code will prompt to install the extension:





```
Profile: MedicationRequestFSH
Parent:  MedicationRequest
Id:      medication-request-fsh
Title:  "Medication Requestion FSH"
Description: "Defines US constraints on MedicationRequest using FSH"
```

Declaration and Keywords

```
* status and intent and reported[x] and medication[x] and subject and encounter and authoredOn and requester and dosageInstruction and dosageInstruction.text MS

* requester 1..1
* authoredOn 1..1
```

Rules

MustSupport and Cardinality

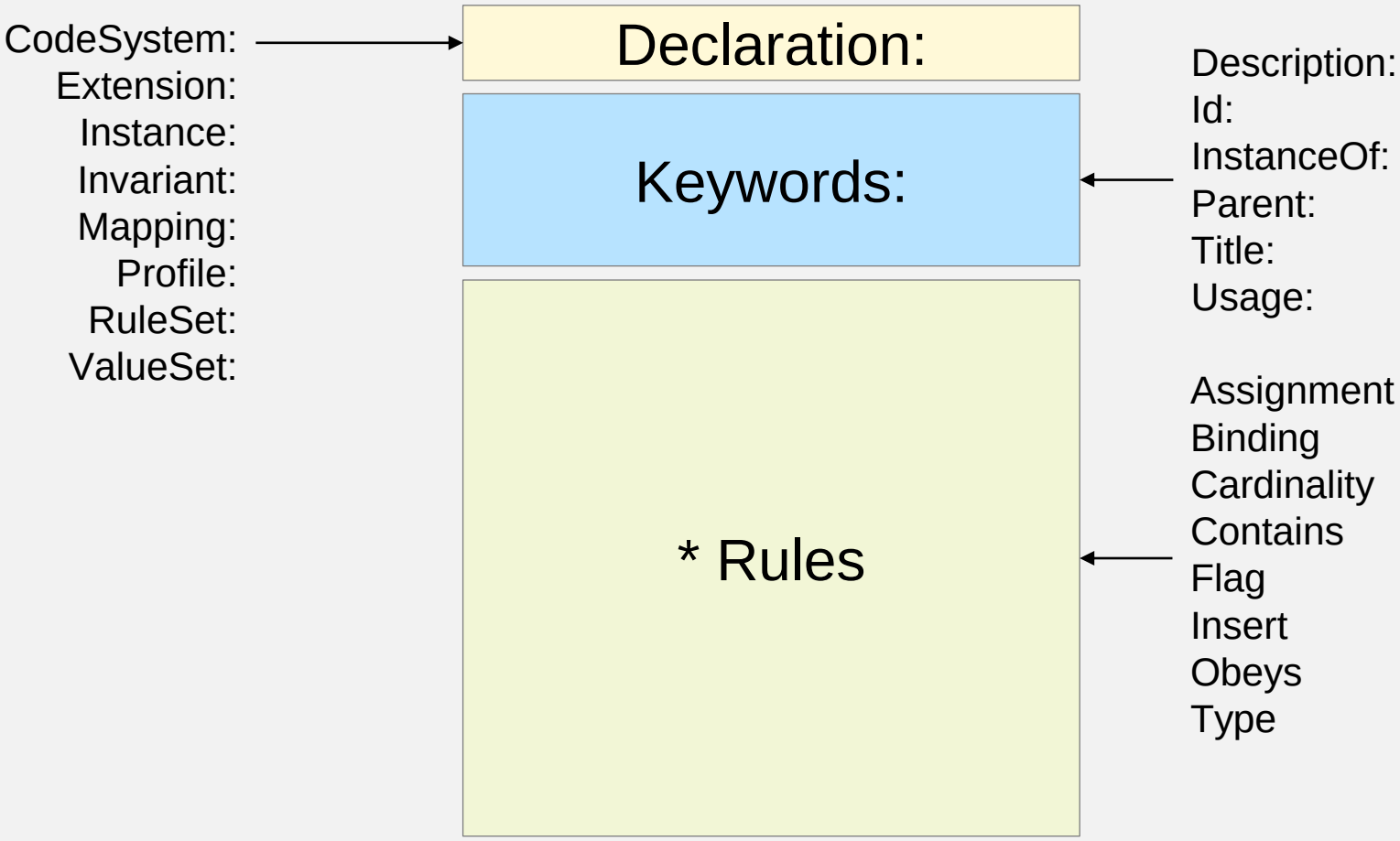
```
* reported[x] only boolean or Reference(us-core-patient or us-core-practitioner or us-core-organization)
* medication[x] only CodeableConcept or Reference(us-core-medication)
* subject only Reference(us-core-patient)
* requester only Reference(us-core-practitioner or us-core-organization or us-core-patient)
```

Data Type Choices

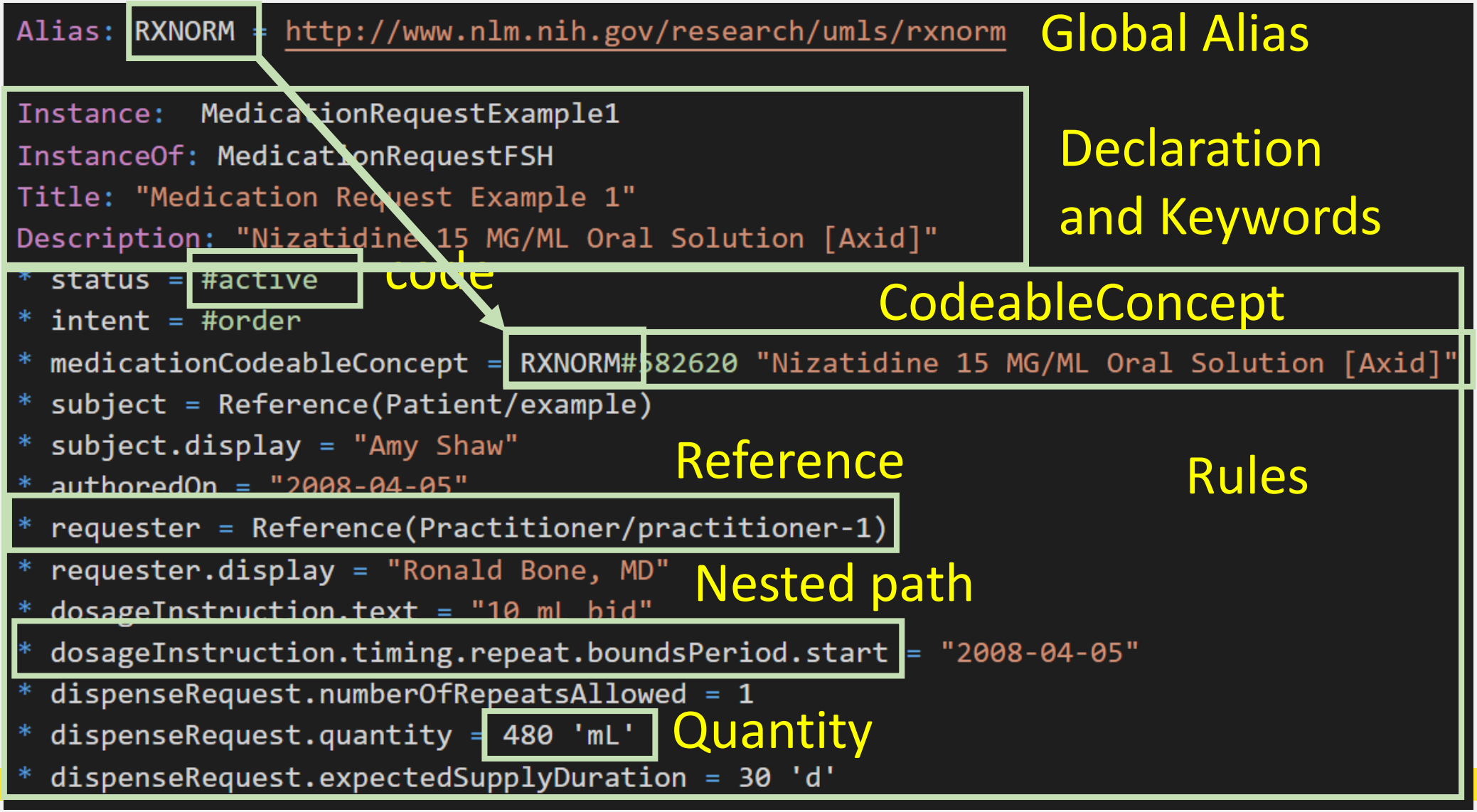
```
* medicationCodeableConcept from us-core-medication-codes (extensible)
```

Value Set Binding

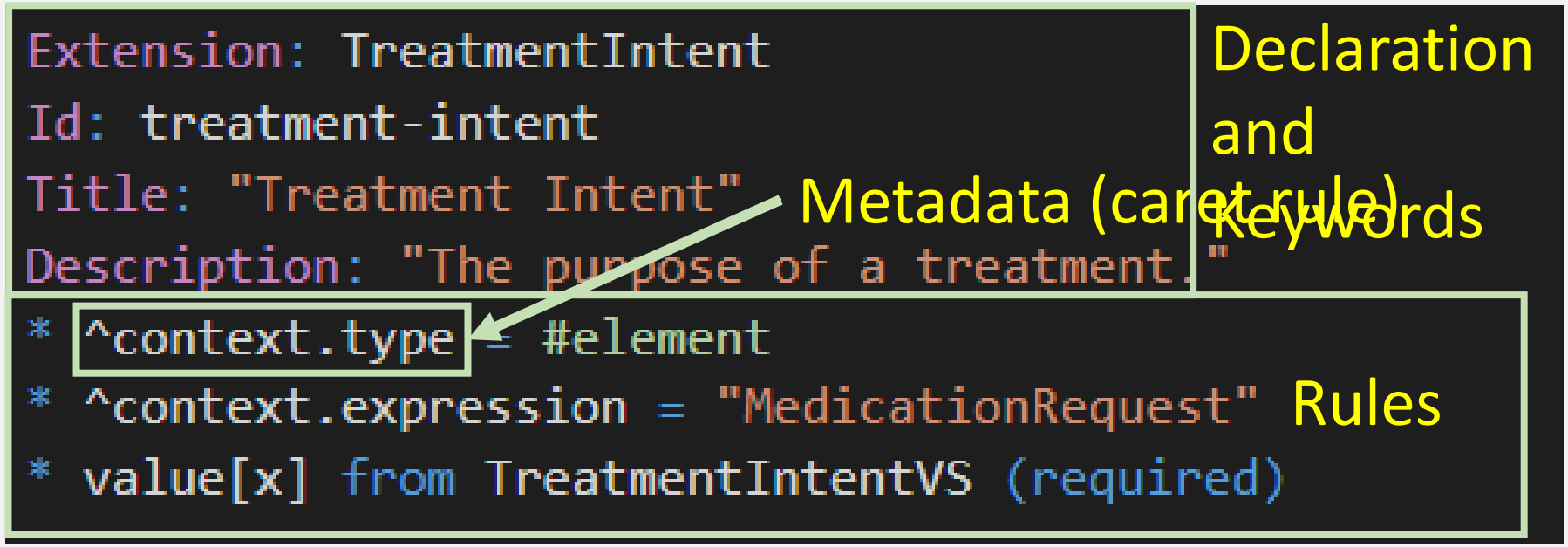
Anatomy of a FSH Item:



Add an Instance (Example):



Define an Extension



Add it to profile with "extension contains" rule:

```
* extension contains TreatmentIntent named treatmentIntent 0..1 MS
```

Define the TreatmentIntentVS value set:

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

ValueSet:  TreatmentIntentVS
Id:   treatment-intent-vs
Title: "Treatment Intent Value Set"
Description:    "The purpose of a treatment."
* ^copyright = "This value set includes content from SNOMED CT, which is copyright © 2002+ International Health Terminology Standards Development Organisation (IHTSDO), and distributed by agreement between IHTSDO and HL7. Implementer use of SNOMED CT is not covered by this agreement"
* include SCT#373808002 "Curative - procedure intent"
* include SCT#363676003 "Palliative - procedure intent"
* include SCT#399707004 "Supportive - procedure intent"
```

Declaration and Keywords

Rules

Include a single code in VS

Intensional definition of a Value Set:

```
ValueSet: TherapeuticIntentVS
Id: therapeutic-intent-vs
Title: "Therapeutic Intent Value Set"
Description: "Demonstration of an intensional value set"

* include codes from system SCT where concept is-a #262202000  "Therapeutic intent"
```

```
Alias: RXNORM = http://www.nlm.nih.gov/research/umls/rxnorm
Alias: SCT = http://snomed.info/sct

Profile: USCoreMedicationRequestFSH
Parent:  MedicationRequest
Id: us-core-medicationrequest
Title: "US Core Medication Requestion"
Description: "Defines US constraints on MedicationRequest"
* status and intent and reported[x] and medication[x] and subject and encounter and authoredOn and requester and
dosageInstruction and dosageInstruction.text MS
* requester 1..1
* authoredOn 1..1
* reported[x] only boolean or Reference(us-core-patient or us-core-practitioner or us-core-organization)
* medication[x] only CodeableConcept or Reference(us-core-medication)
* subject only Reference(us-core-patient)
* requester only Reference(us-core-practitioner or us-core-organization or us-core-patient)
* medicationCodeableConcept from us-core-medication-codes (extensible)
* extension contains TreatmentIntent named treatmentIntent 0..1 MS

Instance:  MedicationRequestExample1
InstanceOf: USCoreMedicationRequestFSH
Title: "Medication Request Example 1"
Description: "Nizatidine 15 MG/ML Oral Solution [Axid]"
* status = #active
* intent = #order
* medicationCodeableConcept = RXNORM#582620 "Nizatidine 15 MG/ML Oral Solution [Axid]"
* subject = Reference(Patient/example)
* subject.display = "Amy Shaw"
* authoredOn = "2008-04-05"
* requester = Reference(Practitioner/practitioner-1)
* requester.display = "Ronald Bone, MD"
* dosageInstruction.text = "10 mL bid"
* dosageInstruction.timing.repeat.boundsPeriod.start = "2008-04-05"
* dispenseRequest.numberOfRepeatsAllowed = 1
* dispenseRequest.quantity = 480 'mL'
* dispenseRequest.expectedSupplyDuration = 30 'd'

Extension: TreatmentIntent
Id: treatment-intent
Title: "Treatment Intent"
Description: "The purpose of a treatment."
* ^context.type = #element
* ^context.expression = "MedicationRequest"
* value[x] only CodeableConcept
* valueCodeableConcept from TreatmentIntentVS (required)

ValueSet:  TreatmentIntentVS
Id:   treatment-intent-vs
Title: "Treatment Intent Value Set"
Description:    "The purpose of a treatment."
* ^copyright = "This value set includes content from SNOMED CT, which is copyright © 2002+ International Health
Terminology Standards Development Organisation (IHTSDO), and distributed by agreement between IHTSDO and HL7.
Implementer use of SNOMED CT is not covered by this agreement"
* include SCT#373808002 "Curative - procedure intent"
* include SCT#363676003 "Palliative - procedure intent"
* include SCT#399707004 "Supportive - procedure intent"
```

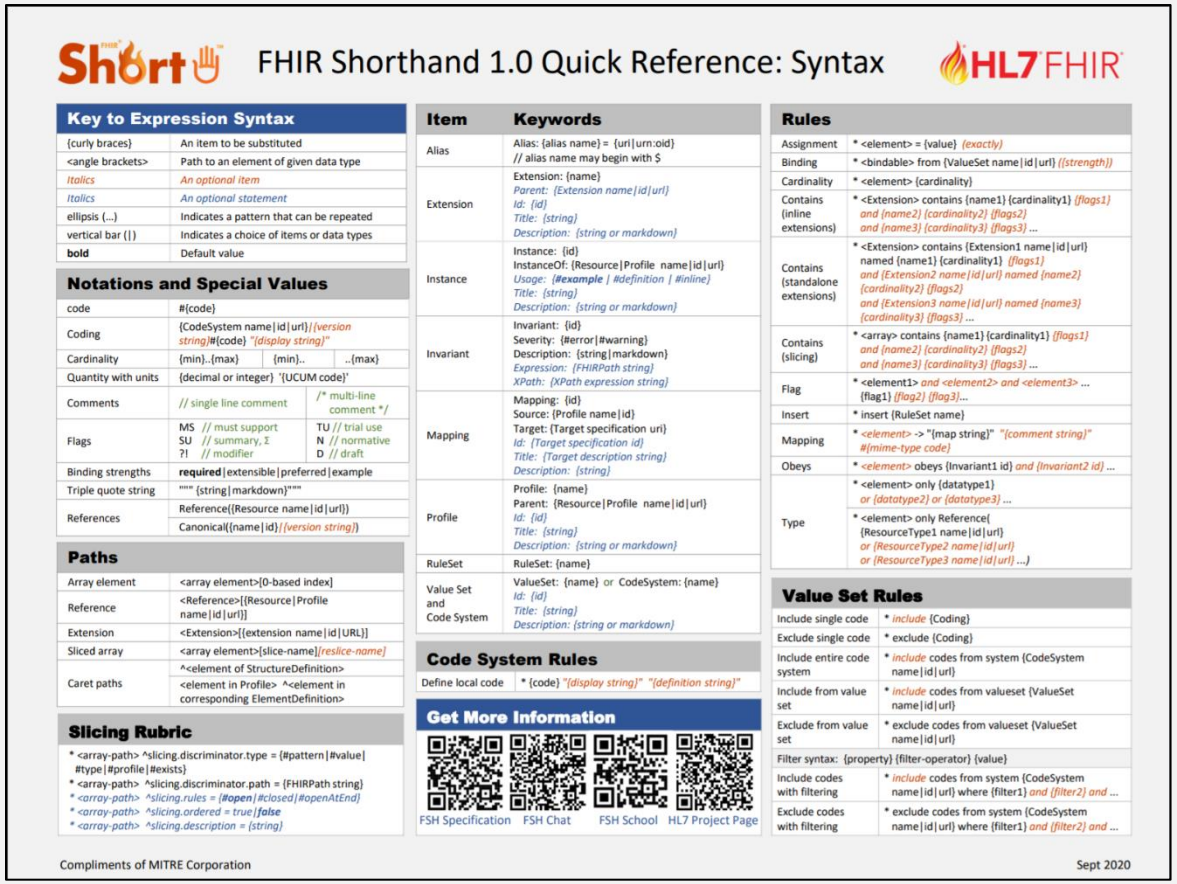
One **.fsh** file - but can be split up arbitrarily

48 lines of FSH =

- 1 Profile
- 1 Instance
- 1 Extension
- 1 Value set

FSH file(s) can be put under source code control in Github (branched, merged, full version management)

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

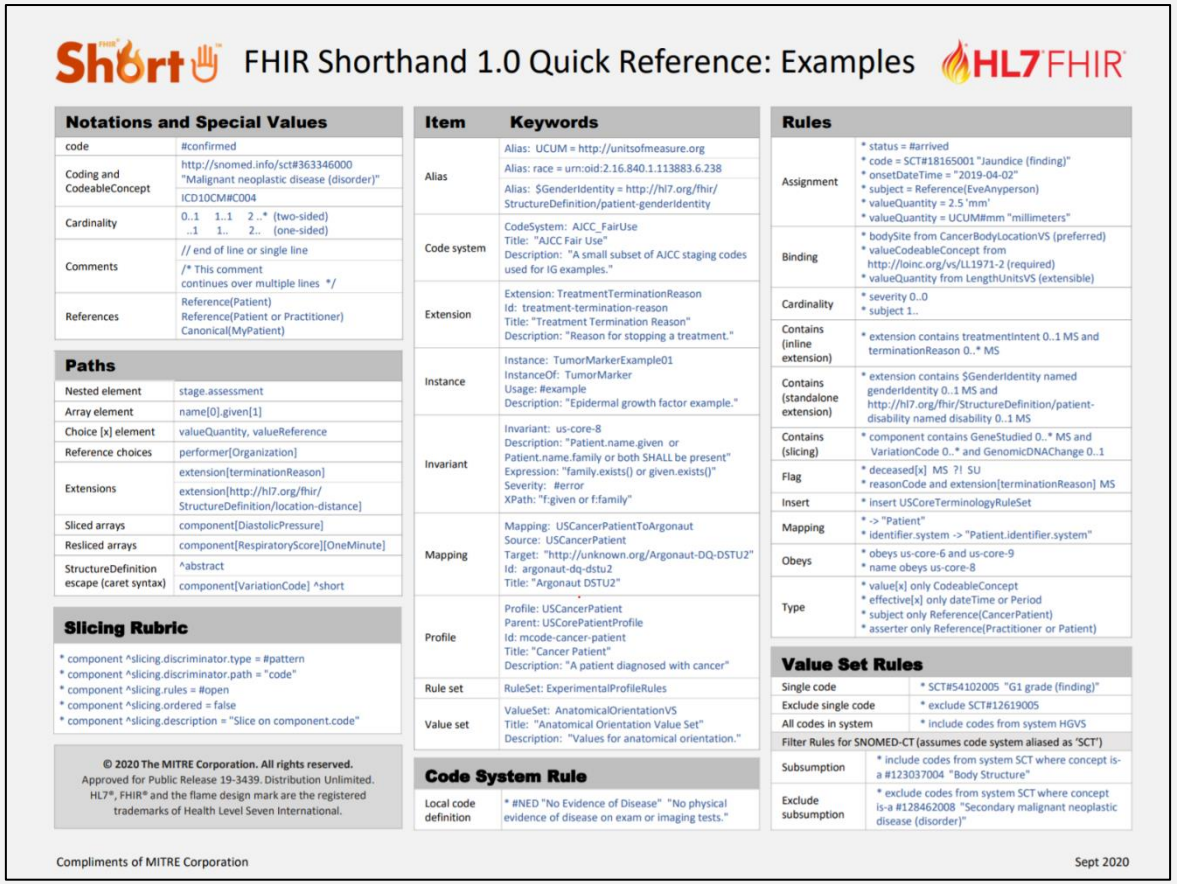
Rules	
Assignment	* <element> = {value} *(exactly)*
Binding	* <bindable> from {ValueSet name|id|url} *({strength})*
Cardinality	* <element> {cardinality}
Contains (inline extensions)	* <Extension> contains {name1} {cardinality1} *{flags1} and {name2} {cardinality2} {flags2} and {name3} {cardinality3} {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"

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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

http://hl7.org/fhir/uv/shorthand/FSHQuickReference.pdf

Directory Structure

normal IG project structure

```
IG-root
├── ig.ini
├── input
│   ├── 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
```

+ FSH

IG project structure + FSH

```
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
```

Configuration File: sushi-config.yaml

Include in top level project directory:

```yaml
id: fhir.example
canonical: http://hl7.org/fhir/example
name: ExampleIG
title: "Example IG Version 0.1.0"
description: "An example IG that demonstrates FSH grammar"
status: draft
license: CC0-1.0
version: 0.1.0
fhirVersion: 4.0.1
copyrightYear: 2020+
releaseLabel: ci-build
dependencies:
  hl7.fhir.us.core: 3.1.0
```

See https://fshschool.org/docs/sushi/configuration/

Running SUSHI from the Command Line

First install SUSHI: `npm install -g fsh-sushi`

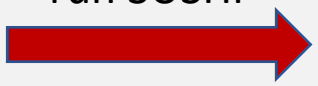
- See https://fshschool.org/docs/sushi/installation/ for more information

1. Open a command window
2. Navigate to the project root directory
3. type **`sushi`** at the prompt

normal IG project structure + FSH

```
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 SUSHI



New folder with generated FHIR artifacts

```
IG-root
├── fsh-generated
│   └── resources
│       ├── CodeSystem-myCodeSystem.json
│       ├── Patient-myPatient-example.json
│       ├── StructureDefinition-myExtension.json
│       ├── StructureDefinition-myProfile.json
│       ├── ValueSet-myValueSet.json
│       └── ImplementationGuide-myIG.json
├── ig.ini
├── sushi-config.yaml
├── input
│   ├── fsh
etc.
```

SUSHI Command Window Output

```
C:\Users\mkramer\Documents\GitHub\devdays-example>sushi
info  path-to-fsh-defs defaulted to current working directory
info  Running SUSHI v1.0.0 (implements FHIR Shorthand specification v1.0.0)
info  Arguments:
info    C:\Users\mkramer\Documents\GitHub\devdays-example
info  No output path specified. Output to .
info  Using configuration file: C:\Users\mkramer\Documents\GitHub\devdays-example\sushi-config.yaml
info  Importing FSH text...
info  Preprocessed 1 documents with 2 aliases.
info  Imported 3 definitions and 1 instances.
info  Checking local cache for hl7.fhir.us.core#3.1.0...
info  Found hl7.fhir.us.core#3.1.0 in local cache.
info  Loaded package hl7.fhir.us.core#3.1.0
info  Checking local cache for hl7.fhir.r4.core#4.0.1...
info  Found hl7.fhir.r4.core#4.0.1 in local cache.
info  Loaded package hl7.fhir.r4.core#4.0.1
info  Converting FSH to FHIR resources...
error No definition for the type "us-core-oganization" could be found.
  File: C:\Users\mkramer\Documents\GitHub\devdays-example\input\fsh\grammar-example.fsh
```

```
error No definition for the type "us-core-oganization" could be found.
  File: C:\Users\mkramer\Documents\GitHub\devdays-example\input\fsh\grammar-example.fsh
```

```
  Line: 11
```

```
info  Assembling Implementation Guide sources...
info  Generated ImplementationGuide-DevdaysLetsBuild.json
info  Assembled Implementation Guide sources; ready for IG Publisher.
```

SUSHI RESULTS

Profiles	Extensions	ValueSets	CodeSystems	Instances
1	1	1	0	1

This was a turtle disaster. 1 Error 0 Warnings

Error messages give a file number and line number

Running the IG Publisher (IGP)

If you don't have them, obtain the scripts `_genonce` and `_updatePublisher` from the sample-ig project (https://github.com/FHIR/sample-ig/archive/master.zip) and copy them to your root directory

- See https://fshschool.org/docs/sushi/running/#downloading-the-ig-publisher-scripts

1. Open a command window
2. Run `_updatePublisher`
3. Run `_genonce`

SUSHI will run automatically if the ./input/fsh directory is found

Directory Structure

normal IG project structure + FSH

```
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 IG publisher (runs SUSHI automatically)

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

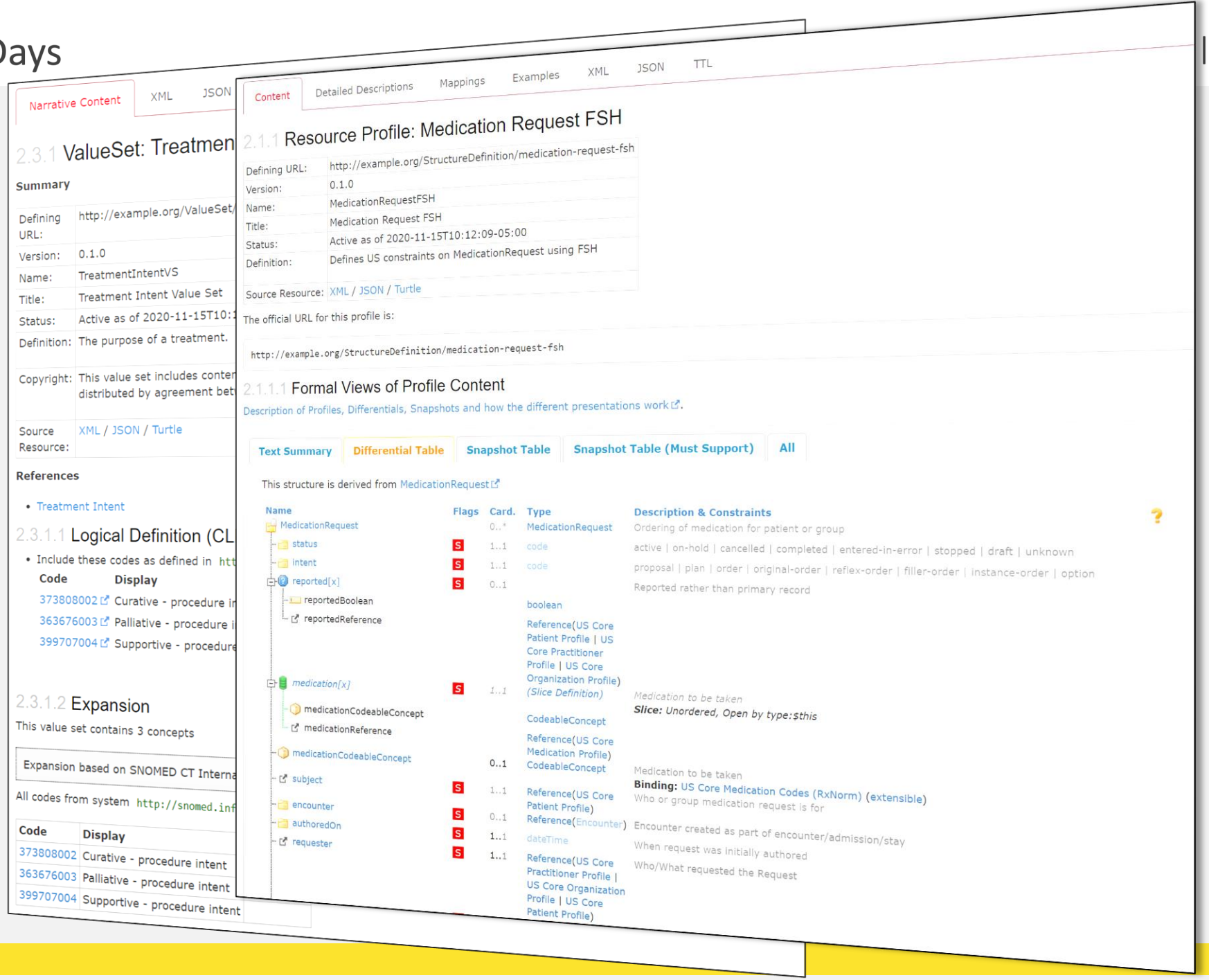
index.html

IG home page

The Resulting IG

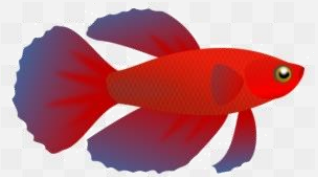
48 lines of FSH:

- 1 Profile
- 1 Instance
- 1 Extension
- 1 Value set



That's great, Mark, but I already have an IG...

Using GoFSH to Convert an Existing IG (beta)



First install gofsh: `npm install -g gofsh`

1. Navigate to the directory above where the StructureDefinitions are located
2. At the command prompt, type: `gofsh`

Results will be appear in /gofsh subdirectory

https://www.clipartmax.com/middle/m2i8H7N4Z5A0Z5b1_betta-002-royalty-free/

Sample GoFSH output

How does it compare to our hand-rolled FSH?

gofsh > resources.fsh

```
Profile: MedicationRequestFSH
Parent: MedicationRequest
Id: medication-request-fsh
Title: "Medication Request FSH"
Description: "Defines US constraints on MedicationRequest using FSH"
* ^text.status = #extensions
* ^version = "0.1.0"
* ^status = #active
* ^date = "2020-11-15T10:12:09-05:00"
* status MS
* intent MS
* reported[x] only boolean or Reference(http://hl7.org/fhir/us/core/StructureDefinition/us-core-patient or http://hl7.org/fhir/us/core/StructureDefinition/us-core-practitioner or http://hl7.org/fhir/us/core/StructureDefinition/us-core-organization)
* reported[x] MS
* medication[x] only CodeableConcept or Reference(http://hl7.org/fhir/us/core/StructureDefinition/us-core-medication)
* medication[x] MS
* medicationCodeableConcept 0..1
* medicationCodeableConcept only CodeableConcept
* medicationCodeableConcept from http://hl7.org/fhir/us/core/ValueSet/us-core-medication-codes (extensible)
* subject only Reference(http://hl7.org/fhir/us/core/StructureDefinition/us-core-patient)
* subject MS
* encounter MS
* authoredOn 1.. MS
* requester 1.. MS
* requester only Reference(http://hl7.org/fhir/us/core/StructureDefinition/us-core-practitioner or http://hl7.org/fhir/us/core/StructureDefinition/us-core-organization or http://hl7.org/fhir/us/core/StructureDefinition/us-core-patient)
* dosageInstruction MS
* dosageInstruction.text MS
```

Review: What did you learn?

- The purpose of FHIR Shorthand
- How it compares to other methods of creating Implementation Guides
- Some FSH grammar
- Creating an IG

Next: Let's Build

- Create your first FHIR Shorthand project
- Hands-on with SUSHI, the FHIR Shorthand compiler

Contact

- During DevDays, you can find / reach me here:
  - Via Whova App – Speaker's Gallery
  - # shorthand channel on chat.fhir.org

  - email: mkramer@mitre.org