



The slide features a blue header with the text "TOMORROW TODAY" in large white letters. Above the text are binary digits: "01100001 01111001" and below it are more binary digits: "01101111 01110010 01110010 01101111 01110111". The main title "FHIR Core Concepts and Best Practices" is centered in large blue text. Below the title is a subtitle "Version 1.0" in smaller blue text. The author information "Bradley Strecker Sr. Software Engineer" is in the top right. The date "Date 10/04/2017" is at the bottom left. The Cerner logo is in the bottom right.

FHIR

Core Concepts and Best Practices

01110100 01101111 01101101

Bradley Strecker
Sr. Software Engineer

Date 10/04/2017

 Cerner®

Basically a brief overview of how to browse the FHIR spec, browse FHIR Versions, look up API documentation from the FHIR Spec and Cerner's FHIR documentation as well as run through a few quick exercises depending on time.

Ignite Learning Lab:

http://bit.ly/chc_learning_lab

Getting Started: HL7 Community

The screenshot shows the FHIR DSTU2 index page. At the top, there's a navigation bar with links: Home, Documentation, Implementation, Resources, Clinical, Administrative, Infrastructure, and Financial. Below the navigation bar, a yellow box contains a message about the second DSTU2 version being permanent. A blue speech bubble labeled "Versioning" points to this box. The main content area has a header "Welcome to FHIR®" with a sub-header about first-time users. A blue speech bubble labeled "Introductions" points to this section. Below the welcome message, there's a "DSTU updates" section with two bullet points: one for Oct-24-2015 and another for May-15-2016. A blue speech bubble labeled "Updates" points to the May-15-2016 update. To the right of the updates, there's a "Major Sections" section with five icons: General Documentation (book), Implementation & Exchange (cogwheel), Clinical Resources (two people), Administrative Resources (two people), and Infrastructural Resources (server). A blue speech bubble labeled "Support" points to the Clinical Resources icon. On the left, there's a "Quick Links" sidebar with sections for Documentation (Resource List, JSON, XML & RDF, REST API & Search, Data Types, Using Terminologies, Extensions, Full table of contents) and Implementation (Downloading, Adapting FHIR, Implementation Guides, FHIR Schemas & Schematron, Examples: XML, JSON, Code: Java, C#, Pascal, iOS, JS, XML, Common Use Cases & Profiles, Security). A blue speech bubble labeled "Cheatsheets & Info" points to the Implementation section. On the right, there's an "External Links" sidebar with links: Support Links (StackOverflow, Public Test Servers & Software), How FHIR is developed (FHIR Wiki), Implementation guide registry, and Blogs that cover FHIR. A blue speech bubble labeled "Support" points to the External Links section. At the bottom right of the page, the URL <http://hl7.org/fhir/dstu2/index.html> is displayed.

Versioning

Introductions

Support

Updates

Cheatsheets
& Info

<http://hl7.org/fhir/dstu2/index.html>

HL7 INTERNATIONAL

Page Discussion Read View source View history Search Log in

FHIR

Fast Healthcare Interoperability Resources (FHIR, pronounced "Fire") defines a set of "Resources" that represent granular clinical concepts. The resources can be managed in isolation, or aggregated into complex documents. Technically, FHIR is designed for the web; the resources are based on simple XML or JSON structures, with an HTTP-based RESTful protocol where each resource has predictable URLs. Where possible, open Internet standards are used for data representation.

Community Participation Rules: [FHIR Code of Conduct](#), [FHIR Intellectual Property Rules](#)



FHIR Implementation	FHIR Development	Organizational
<ul style="list-style-type: none">• The current specification: http://www.hl7.org/fhir/ [or the development version v2]<ul style="list-style-type: none">▪ FHIR Specification Feedback (DSTU 2)▪ FHIR Profiles from other Organizations• Contact Information<ul style="list-style-type: none">▪ FHIR Support Page▪ Implementation help: ask questions about FHIR [ask questions about FHIR v2]▪ Formal Contact point for the project: fhircontact@hl7.org▪ FHIR Chat (Zulip) [chat.fhir.org community expectations]▪ FHIR gForge Tracker for change requests/ corrections▪ FHIR Project Team Leads (FHIR Core Team): [Grahame Grieve v2], [Lloyd Kramer v2], [Lloyd McKenzie v2]▪ List server - project email• Help / Getting Started<ul style="list-style-type: none">▪ FHIR Starter - tutorial▪ FHIR Teaching - sources of FHIR teaching, training, and tutorials▪ FHIR Cheat Sheet v1 (DSTU 1)▪ FHIR Cheat Sheet v2 (DSTU 2)▪ FHIR Cheat Sheet v3 (DSTU 3)▪ Help desk FAQs & knowledge-base articles [HL7 members only]▪ FHIR Tools Registry - a list of useful tools for FHIR implementers▪ FHIR for Clinical Users - an introduction to FHIR for non-technical people that will migrate to the specification in the future▪ FHIR User Group	<ul style="list-style-type: none">• How to:<ul style="list-style-type: none">▪ FHIR DSTU monitoring - how to monitor DSTU feedback▪ FHIR Ballot Prep - tasks for the next ballot and milestone dates▪ FHIR Desired FMM Tracking Spreadsheet▪ FHIR Build Process - Setting up and running the FHIR build process▪ How to create resources (and How to create types)▪ Materials: gForge v2, SVN Trunk v2<ul style="list-style-type: none">▪ For read-only SVN access, use "anonymous" and your email as a password.▪ For Commit privileges, send a request to lloyd@imcanaida.com▪ FHIR resource and profile proposals - proposals for new resources & profiles▪ FHIR Profile authoring - Creating and maintaining FHIR profiles (see also Profile Tooling)▪ FHIR Change requests - Process for managing and resolving▪ FHIR_gForge_Tracker - Guidance for using the gForge tracker, including for ballot reconciliation• Implementation Guides<ul style="list-style-type: none">▪ FHIR Implementation Guides - General http://wiki.hl7.org/index.php?title=FHIR	<ul style="list-style-type: none">• FHIR Infrastructure Work Group<ul style="list-style-type: none">▪ FHIR Workflow Project• Governance<ul style="list-style-type: none">▪ FHIR Governance Process▪ FHIR Governance Board (FGB)▪ FHIR Management Group (FMG)▪ Modeling and Methodology (MmM)▪ Work Groups▪ FHIR Escalation Processes▪ FHIR Ballot Process▪ FHIR Web Server Hosting Record▪ FMM Tracking Sheet v2• Agendas<ul style="list-style-type: none">▪ Baltimore WGM (next meeting, Sept. 2016)▪ Past Working Group Meetings (list of agendas/notes)▪ MmM agendas & minutes▪ FGB Agendas & Minutes v2▪ FMG Agendas & Minutes v2

Getting Started

This screenshot shows the FHIR DSTU2 homepage. At the top, there's a navigation bar with links to Home, Documentation, Implementation, Resources, Clinical, Administrative, Infrastructure, and Financial. Below the navigation bar, a yellow banner states: "This is the second DSTU version of FHIR in its permanent home [it will always be available at this URL]. For a full list of available versions, see the [Directory of published versions](#)." A main heading "Welcome to FHIR®" is followed by a sub-headline: "First time here? See the [executive summary](#), the [developer's introduction](#), or the [clinical introduction](#), and then the [FHIR overview](#) / [roadmap](#). See also the [open license](#) (and don't miss the [full Table of Contents](#) or you can [search this specification](#))."

The page features several sections:

- Major Sections:** General Documentation, Implementation & Examples, Clinical, Administrative Resources, and Infrastructure.
- Resources:** A blue speech bubble pointing to the "Resources" section of the sidebar.
- Spec Details:** A blue speech bubble pointing to the "Implementation Guides" section of the sidebar.
- Reference Libraries:** A blue speech bubble pointing to the "Code: Java, C# (.NET), Pascal, iOS (.NET), XML, Common Use Cases & Profiles, Security" section of the sidebar.

Note: HAPI is the recommended Java Reference implementation
<http://hapifhir.io/index.html>

Specification Versioning

Latest: STU 3
AKA: 3.0.1

All Published Versions of FHIR

This table provides a list of all the versions of FHIR (Fast Health Interoperability Resources) that are available. See also the directory of [FHIR Implementation Guides](#).

Date	Version	Description
Current Versions		
Apr 19, 2017	3.0.1	Current Official Published Version (Currently: Release 3 with 2 technical errata)
(current)	(last commit)	Current Development build (about 30min behind version control; may be incoherent and change rapidly)
STU 3 sequence		
Apr 19, 2017	3.0.1	FHIR Release 3 (STU) with 1 technical errata (Permanent Home) Technical Errata Archive (zip): v3.0.0
Dec 6, 2016	1.8.0	FHIR STU3 Candidate + Connectathon 14 (San Antonio)
Aug 11, 2016	1.6.0	FHIR STU3 Ballot + Connectathon 13 (Baltimore)
Mar 30, 2016	1.4.0	CQF on FHIR Ballot + Connectathon 12 (Montreal)
Dec 3, 2015	1.1.0	GAO Ballot + draft changes to main FHIR standard
DSTU 2 sequence		
Oct 24, 2015	1.0.2	DSTU 2 (Official version) with 1 technical errata (Permanent home)
Aug 31, 2015	1.0.0	DSTU 2 QA Preview + CQF Ballot (Sep 2015)
April 2, 2015	0.5.0	DSTU 2 Ballot version (May 2015 Ballot)
Dec 12, 2014	0.4.0	Draft For Comment (January 2015 Ballot)
DSTU 1 sequence		
Sept 30, 2014	0.0.82	DSTU 1 (Official version) with 2 technical errata (Permanent home)
Sep 7, 2013	0.11	DSTU 1 Ballot version
Dec 4, 2012	0.06	2nd Draft for Comment (January 2013 Ballot)
Sep 9, 2012	0.05	1st Draft for Comment (Sept 2012 Ballot)
Historical Versions		
May 14, 2012	0.01	First version labelled as "FHIR"
Aug, 2011	0.01	Original Proposal, labelled as RfH

Note: Subsequent to Sept 2013, the FHIR version policy was changed.

<http://hl7.org/fhir/directory.html>

iii. Service Root URLs	Document
i. Open Sandbox	Encounter
ii. Secure Sandbox	Immunization
iii. Resource	Medication
iv. Parameters	MedicationRequest
iv. Client Errors	Observation
v. HTTP Verbs	Patient
vi. Authorization	
vii. Pagination	
viii. Cross-Origin Resource Sharing	
Current Version	
Cerner's implementation currently supports the DSTU 2 Final (1.0.2) version of the FHIR® standard.	
Latest Millennium Production: DSTU2/1.0.2	
http://fhir.cerner.com/millennium/dstu2/	

Which Version?

- Multiple Available
- Deprecate Oldest
- Time to Uplift Applications



Multiple Versions:

- Currently May2015 (DSTU2) and DSTU2 Final. May2015 is deprecated
- Resources will be uplifted and stood up in the new version individually and callable in our Sandbox (FHIRPLAY) environment
- Once available in FHIRPLAY developers are free to begin playing with the new services
- New services won't be available in production environments until there is like-for-like functionality and there has been sufficient testing

Deprecate Oldest:

- Old version (DSTU2 Final) won't be deprecated until after new version has like-for-like functionality with DSTU2 Final and we feel that sufficient time has passed since the availability of the newer version.

Time to uplift:

- Varies by the differences between the spec versions

① [fhir.cerner.com/may2015/#current-version](#)
If you have any problems or requests, please post to our [development group](#).

i. Current Version
ii. Schema
 I. Media Types
iii. Service Root URL
 I. Open Sandbox
 II. Secure Sandbox
 III. Resources
 IV. Parameters
iv. Client Errors
v. HTTP Verbs
vi. Authorization
vii. Pagination
viii. Cross Origin

Current

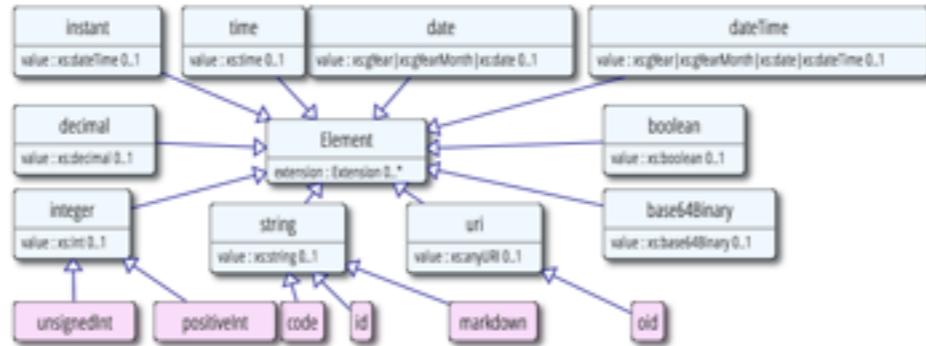
This document describes the DSTU 2 May Ballot (0.5.0) implementation, which is deprecated.
We recommend updating applications to the latest available production implementation: [DSTU 2 Final \(1.0.2\)](#).

We recommend updating applications to the latest available production implementation: [DSTU 2 Final \(1.0.2\)](#).

Data Types

Primitive Types

1.19.0.1 Primitive Types



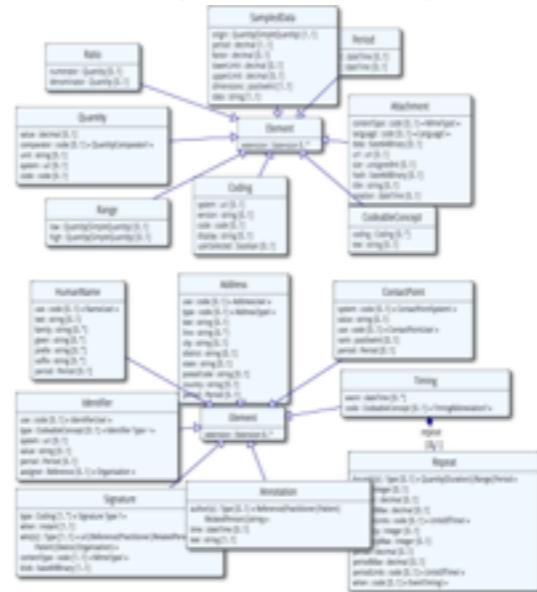
<http://hl7.org/fhir/dstu2/datatypes.html#primitive>

Surprises

- Decimal: 1.01, 1.010
- Instant vs DateTime
- DateTime vs Date vs Time

- Decimals, precision matters (e.g.: use big decimal)
- Instant is for machines, DateTime is for humans. Instant MUST have seconds and zone.
- DateTime is year, year/month, year/month/day, year/month/day/time (must have zone if there's a time). Seconds are required (XML definition/schema), but can be ignored or zero.
- Date is year, year/month, year/month/day
- Time is zone-less, dateless (see you at 8:00 AM every day)

Complex Types



<http://hl7.org/fhir/dstu2/datatypes.html#complex>

Code Systems

Design Note: This specification defines two types for representing coded values:

- **Coding:** a simple direct reference to a code defined by a code system
- **CodeableConcept:** a text description and/or a list of Codings (i.e. a list of references to codes defined by code systems)

The **Coding** data type corresponds to the simple case of selecting a single code from a code list. However this type is rarely used in the FHIR specifications; long experience with exchanging coded values in HL7 shows that in the general case, systems need to be able to exchange multiple translation codes, and/or an original text.

The **Coding** data type is used directly when there is certainty that the value must be selected directly from one of the available codes, and the list of possible codes is agreed to by all participants. This is not usually the case in the context of FHIR - general interoperability - so Coding is mostly used in extensions, which are usually intended to be defined for a well-controlled context of use.

<http://hl7.org/fhir/dstu2/datatypes.html#codesystem>

Code: codified value (usually from a set of values) to represent a concept.

Coding: Code + meta data (e.g., system, version)

CodeableConcept allows you to choose a list of codes, e.g.: multiple terminologies

CodeableConcept references Coding, Coding references a Code.

Code: m, f, unk

Coding: m, + system

CodeableConcept: Relationship type for patient contacts, Observation type (e.g.: height/weight, Loinc, SNOMED)

Formats

- JSON and/or XML
- Via Accept or Content-Type headers
- Via _format parameter

<http://hl7.org/fhir/dstu2/http.html#mime-type>

Resources

Resources

- Patient, Condition, MedicationOrder...
- All resources have metadata
- All resources have narrative
- Structured data items
- [base]/[Resource] (case sensitive)
 - [base]/Patient

<http://hl7.org/fhir/dstu2/resource.html>

3.0 Resource Index

Categorized | Alphabetical

This page is provided to help find resources quickly. There is also a more detailed classification, ontology, and description.

Clinical General	Care Provision	Medication & Immunization	Diagnostics
<ul style="list-style-type: none">▪ AllergyIntolerance 1▪ Condition (Problem) 2▪ Procedure 1▪ ClinicalImpression 0▪ FamilyMemberHistory 1▪ RiskAssessment 0▪ DetectedIssue 1	<ul style="list-style-type: none">▪ CarePlan 1▪ Goal 1▪ ReferralRequest 1▪ ProcedureRequest 1▪ NutritionOrder 1▪ VisionPrescription 0	<ul style="list-style-type: none">▪ Medication 1▪ MedicationOrder 1▪ MedicationAdministration 1▪ MedicationDispense 1▪ MedicationStatement 1▪ Immunization 1▪ ImmunizationRecommendation 1	<ul style="list-style-type: none">▪ Observation 3▪ DiagnosticReport 3▪ DiagnosticOrder 1▪ Specimen 1▪ BodySite 0▪ ImagingStudy 2▪ ImagingObjectSelection 1
Identification			
Individuals:	Groups:	Entities:	Devices:
<ul style="list-style-type: none">▪ Patient 3▪ Practitioner 1▪ RelatedPerson 1	<ul style="list-style-type: none">▪ Organization 1▪ HealthcareService 1▪ Group 1	<ul style="list-style-type: none">▪ Location 1▪ Substance 1▪ Person 1▪ Contact 0	<ul style="list-style-type: none">▪ Device 1▪ DeviceComponent 1▪ DeviceMetric 1
Workflow			
Patient Management:	Scheduling:	Workflow #1:	Workflow #2:
<ul style="list-style-type: none">▪ Encounter 1▪ EpisodeOfCare 1▪ Communication 1▪ Flag 1	<ul style="list-style-type: none">▪ Appointment 1▪ AppointmentResponse 1▪ Schedule 1▪ Slot 1	<ul style="list-style-type: none">▪ Order 0▪ OrderResponse 0▪ CommunicationRequest 1▪ DeviceUseRequest 0▪ DeviceUseStatement 0	<ul style="list-style-type: none">▪ ProcessRequest 0▪ ProcessResponse 0▪ SupplyRequest 0▪ SupplyDelivery 0
Infrastructure			
Information Tracking:	Documents & Lists:	Structure:	Exchange:

<http://hl7.org/fhir/dstu2/resourcelist.html>

That number to the side...?

Maturity Levels

- Risk for change
- Lower number, highest risk
- 0-5

<http://hl7.org/fhir/dstu2/resource.html#maturity>

If you are adverse to change, choose 4+
... which doesn't exist in DSTU 2

Terminology Bindings

Terminology Bindings

5.1.2.1 Terminology Bindings

Path	Definition	Type	Reference
Patient.gender Patient.contact.gender	The gender of a person used for administrative purposes.	Required	AdministrativeGender
Patient.maritalStatus	The domestic partnership status of a person.	Required	Marital Status Codes
Patient.contact.relationship	The nature of the relationship between a patient and a contact person for that patient.	Extensible	PatientContactRelationship
Patient.animal.species	The species of an animal.	Example	AnimalSpecies
Patient.animal.breed	The breed of an animal.	Example	AnimalBreeds
Patient.animal.genderStatus	The state of the animal's reproductive organs.	Example	GenderStatus
Patient.communication.language	A human language.	Required	IETF language tag ↗
Patient.link.type	The type of link between this patient resource and another patient resource.	Required	LinkType

<http://hl7.org/fhir/dstu2/patient.html#tx>

Terminology Bindings are how the FHIR spec indicates the valid values for given codifiable field. Each resource should have a Terminology Bindings table at the bottom which calls out the resource field, the binding strength, and the ValueSet defining the set of valid codes which can be used to populate the resource field.

Type/Binding Strength

required	To be conformant, instances of this element SHALL include a code from the specified value set
extensible	To be conformant, instances of this element must include a code from the specified value set if any of the codes within the value set can apply to the concept being communicated. If the valueset does not cover the concept (based on human review), alternate codings (from different code systems, including local ones) or (data type allowing) text) may be included instead.
preferred	Instances are encouraged, to draw from the specified codes for interoperability purposes but are not required to do so to be considered conformant
example	Instances are not expected or even encouraged to draw from the specified value set. The value set merely provides examples of the types of concepts intended to be included

<http://hl7.org/fhir/dstu2/terminologies.html#strength>

Required: for codeableConcept, you can't just send "text"

Terminology Bindings	
Condition.code	
Description	Identification of the condition or diagnosis.
Details:	SNOMED CT System: http://snomed.info/sct
Details:	ICD-9-CM System: http://hl7.org/fhir/sid/icd-9-cm
Details:	ICD-10-CM System: http://hl7.org/fhir/sid/icd-10-cm
Condition.category	
Description	A category assigned to the condition.
Note	Category codes <code>diagnosis</code> , <code>problem</code> and <code>health-concern</code> are supported for search and retrieve functionality. Codes <code>diagnosis</code> and <code>problem</code> are supported for conditions add and update functionality.
Details:	Condition Category Codes System: http://hl7.org/fhir/condition-category
http://fhir.cerner.com/millennium/dstu2/general-clinical/condition/#terminology-bindings	

If a binding isn't "required" by core spec, we'll call out what our binding strength is in documentation

Narrative

*“Any resource that is a domain resource (almost all types of resource) may include a **human-readable** narrative that contains a summary of the resource, and may be used to represent the content of the resource to a human. If narrative is present, it SHALL reflect all content needed for a human to **understand the essential clinical and business information** otherwise encoded within the resource. Resource definitions may define what content should be represented in the narrative to ensure clinical safety.”*

<http://hl7.org/fhir/dstu2/narrative.html#Narrative>

It is often the fall back if a client application doesn't understand the FHIR resource in question

```
..."text": {

    "status": "generated",

    "div": "<div><table><tbody><tr><td>Name</td><td>Peter James <b>Chalmers</b> ("Jim")</td></tr><tr><td>Address</td><td>534 Erewhon, Pleasantville, Vic, 3999</td></tr><tr><td>Contacts</td><td>Home: unknown. Work: (03) 5555 6473</td></tr><tr><td>Id</td><td>MRN: 12345 (Acme Healthcare)</td></tr></tbody></table></div>

}..."
```

Narrative.text.div is restricted to a strict subset of xhtml designed to reduce security concerns. See the Narrative.text.div documentation for specifics about what tags are and aren't allowed.

Name	Peter James Chalmers ("Jim")
Address	534 Erehon, Pleasantville, Vic, 3999
Contacts	Home: unknown. Work: (03) 5555 6473
Id	MRN: 12345 (Acme Healthcare)

Exercise 1

Exercise 1

- Identify the FMM (maturity model) of the Following resources for DSTU 2:
 - Patient
 - Condition
 - Observation
 - Coverage

Exercise 1: Answer

- Identify the FMM (maturity model) of the Following resources for DSTU 2: <http://hl7.org/fhir/dstu2/resourcelist.html>
 - Patient: 3
 - Condition: 2
 - Observation: 3
 - Coverage: 0

Exercise 2

Exercise 2

- What type of authorization does the Patient search operation accept?

Exercise 2: Answer

- Practitioner
- Patient
- System (sandbox only)

You can click on the auth types to get more information

Search

Search for Patients that meet supplied query parameters:

Authorization

Implementation Note

We have an endpoint secured with [OAuth 2.0](#) with support for [SMART Applications](#). Refer to the extensions on the [Conformance.rest.security](#) element in our server [metadata](#).

- The [Patient.anum](#)
- If the current user has any parameters, click [View](#) to view.

Each resource interaction documents the type of authentication acceptable (patient, provider, and/or system). While an interaction may list system authentication, this is currently available only in sandbox for beta testing and is not available in production yet.

Please reference the [authorization](#) documentation for details on how to authorize with our server.

Authorization Types

Practitioner | Patient

Parameters

Name
_id

Pagination

The pagination links are included in the Bundle when a resource returns multiple items. It is important to follow these Link header values instead of constructing your own URLs.

<http://fhir.cerner.com/millennium/dstu2/#authorization>

<http://fhir.cerner.com/millennium/dstu2/individuals/patient/#authorization-types>

Keep in mind that system is “beta” right now - only available in sandbox and not yet in prod

Exercise 3

Exercise 3

- What search parameters does the Millennium DSTU 2 implementation of Patient support? Are there any limitations or considerations?

Exercise 3: Answer

- Query by: id
- Query by a combination of: identifier, birthdate, name, family, given, phone, email, address-postalcode, gender
- _count (paging)
- name, family, given support “:exact”
- identifier, name, family, given, phone, email, address-postalcode, gender can only have a single value
- birthdate supports providing a range
- [http://fhir.cerner.com/millennium/dstu2/individuals/patient/
#parameters](http://fhir.cerner.com/millennium/dstu2/individuals/patient/#parameters)

	search param, or _id	example: 1234-56-78
phone	This and/or any other search param, or _id	token The patient's phone number. Example: 1111111111
email	This and/or any other search param, or _id	token The patient's email address. Example: example@example.com
address-postalcode	This and/or any other search param, or _id	string The postal code in the address details of the patient. Example: 11111
gender	No	token The gender of the patient. Example: male
_count	No	number The maximum number of results to return. Defaults to 20.

Notes:

- Either the `_id`, or a combination of `identifier`, `birthdate`, `name`, `given`, `family`, `address-postalcode`, `phone`, or `email` parameters must be provided.
- The `gender` parameter may only be provided if at least one of `identifier`, `birthdate`, `name`, `given`, `family`, `address-postalcode`, `phone`, or `email` parameters is provided.
- The `name`, `family`, and `given` parameters support the 'exact' modifier and will search for current names only.
- The `identifier`, `name`, `family`, `given`, `phone`, `email`, `address-postalcode`, or `gender` parameters may be provided exactly once and may have only a single value.
- The `birthdate` parameter may be provided twice to indicate a date range, but must contain the inclusive prefixes 'le' and 'ge'
- The `birthdate` parameter may be provided once with the following prefixes: 'ge', 'le', 'gt', 'lt', 'eq'

Read

Read

- “By ID”
- [base]/[Resource]/[id]
- [base]/Patient/123ABC

<http://hl7.org/fhir/dstu2/http.html#read>

id vs identifier

- id: logical identifier, must be unique within the FHIR server and resource
- identifier: business identifier or “alias”
 - SSN
 - MRN
 - Military ID

<http://hl7.org/fhir/dstu2/resource.html#id>

Search

5.1.9 Search Parameters

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

Name	Type	Description	Paths
active	token	Whether the patient record is active	Patient.active
address	string	An address in any kind of address/part of the patient	Patient.address
address-city	string	A city specified in an address	Patient.address.city
address-country	string	A country specified in an address	Patient.address.country
address-postalcode	string	A postalCode specified in an address	Patient.address.postalCode
address-state	string	A state specified in an address	Patient.address.state
address-use	token	A use code specified in an address	Patient.address.use
animal-breed	token	The breed for animal patients	Patient.animal.breed
animal-species	token	The species for animal patients	Patient.animal.species
birthdate	date	The patient's date of birth	Patient.birthDate
careprovider	reference	Patient's nominated care provider, could be a care manager, not the organization that manages the record	Patient.careProvider (Organization, Practitioner)
deathdate	date	The date of death has been provided and satisfies this search value	Patient.deceasedDateTime
deceased	token	This patient has been marked as deceased, or as a death date entered	Patient.deceased[x]
email	token	A value in an email contact	Patient.telecom/system=email)
family	string	A portion of the family name of the patient	Patient.name.family
gender	token	Gender of the patient	Patient.gender
given	string	A portion of the given name of the patient	Patient.name.given
identifier	token	A patient identifier	Patient.identifier
language	token	Language code (irrespective of use value)	Patient.communication.language
link	reference	All patients linked to the given patient	Patient.link.other

<http://hl7.org/fhir/dstu2/patient.html#search>

Search param, or _id		Example: 1234-56-78	
phone	This and/or any other search param, or _id	token	The patient's phone number. Example: 1111111111
email	This and/or any other search param, or _id	token	The patient's email address. Example: example@example.com
address-postalcode	This and/or any other search param, or _id	string	The postal code in the address details of the patient. Example: 11111
gender	No	token	The gender of the patient. Example: male
_count	No	number	The maximum number of results to return. Defaults to 25.

Notes:

- Either the `_id`, or a combination of `identifier`, `birthdate`, `name`, `given`, `family`, `address-postalcode`, `phone`, or `email` parameters must be provided.
- The `gender` parameter may only be provided if at least one of `identifier`, `birthdate`, `name`, `given`, `family`, `address-postalcode`, `phone`, or `email` parameters is provided.
- The `name`, `family`, and `given` parameters support the '`exact`' modifier and will search for current names only.
- The `identifier`, `name`, `family`, `given`, `phone`, `email`, `address-postalcode`, OR `gender` parameters may be provided exactly once and may have only a single value.
- The `birthdate` parameter may be provided twice to indicate a date range, but must contain the inclusive prefixes '`le`' and '`ge`'.
- The `birthdate` parameter may be provided once with the following prefixes: '`ge`', '`le`', '`gt`', '`lt`', '`eq`'

<http://fhir.cerner.com/millennium/dstu2/individuals/patient/#parameters>

2.1.1.2 Introduction

In the simplest case, a search is executed by performing a `GET` operation in the RESTful framework:

```
GET [base]/[resourcetype]?name=value&...
```

For this RESTful search (see [definition in RESTful API](#)), the parameters are a series of name=[value] pairs encoded in the URL or as an application/x-www-form-urlencoded submission for a POST:

```
POST [base]/[type]/_search{?[parameters]{&_format=[mime-type]}}
```

The server determines which of the set of resources it serves meet the specific criteria, and returns the results in the HTTP response as a [bundle](#) which includes the resources that are the results of the search.

GET [base]/AllergyIntolerance?patient=123

<http://hl7.org/fhir/dstu2/search.html>

This example is searching for all allergies for patient 123

Paging

Paging

- **Self**, First, Previous, **Next**, Last
- Must use link as provided
 - Changing this has undefined consequences
- _count parameter
 - Less but not more
- For interoperability - handle paging

<http://hl7.org/fhir/dstu2/http.html#paging>

Handle paging in the application, which helps ensure you're run against most servers. Check for the "next" link to see if there are additional pages.

```
  "link": [
    {
      "fhir_comments": [
        "  all search sets include the self link - the server's statement of what it thought it was \n  searching on. The client can use this to cross-check whether the server executed what it \n  asked the server to, if it cares  "
      ],
      "relation": "self",
      "url": "https://example.com/base/MedicationOrder?patient=347&_include=MedicationOrder.medication"
    },
    {
      "fhir_comments": [
        "  now, the link to the next set of results. The actual URL is entirely at the \n  discretion of the server, and is opaque to the client. Many servers will insert \n  some kind of search instance identifier \n  Note that a big set of results will include prev, first, last links as well as next  "
      ],
      "relation": "next",
      "url": "https://example.com/base/MedicationOrder?patient=347&searchId=ff15fd40-ff71-4b48-b366-89c780bed9d0&page=2"
    }
  ]
}
```

The previous link isn't in this example

Writes

Create

- POST [base]/[Resource]
- POST [base]/AllergyIntolerance
- Body (content-type) must match supported FHIR format

<http://hl7.org/fhir/dstu2/http.html#create>

Update

- PUT [base]/[Resource]/[id]
- PUT [base]/AllergyIntolerance/123
- Body (content-type) must match supported FHIR format

<http://hl7.org/fhir/dstu2/http.html#update>

Conditional Update

- Optimistic Locking via “If-Match”
- Example: Version in database: 2a
 - Version in “If-Match”: 1a - failure
 - Version in “If-Match”: 2a - success

<http://hl7.org/fhir/dstu2/http.html#2.1.0.10.2>

Exercise 4

Exercise 4

- Find out the middle name for Patient Fred Smart

Exercise 4: Answer

- Answer: Rick
- GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/Patient/4478007?format=json>
- <http://hl7.org/fhir/dstu2/datatypes.html#HumanName> (middle is subsequent given name)

```
"active": true,  
"name": [  
  {  
    "use": "official",  
    "text": "SMART, FRED RICK",  
    "family": [  
      "SMART"  
    ],  
    "given": [  
      "FRED",  
      "RICK"  
    ],  
    "period": {  
      "start": "2016-08-31T18:24:54.000Z"  
    }  
  },  
  {"gender": "male", ...}
```

Note: Patient vs Person. Person represents people “in the real world” for example, it could link to your patient record in many FHIR servers. In CommonWell, most of the core is the “Person” and the records they’re tied to are Patient. We would use Patient here since we’re looking at patient records in an EHR.

Exercise 5

Exercise 5

- How many **current** allergies or intolerances does Tim Peters have?
 - Current: actual or possible existing allergies or intolerances
 - Hint: What indicates “current” for this FHIR resource?

Exercise 5: Answer

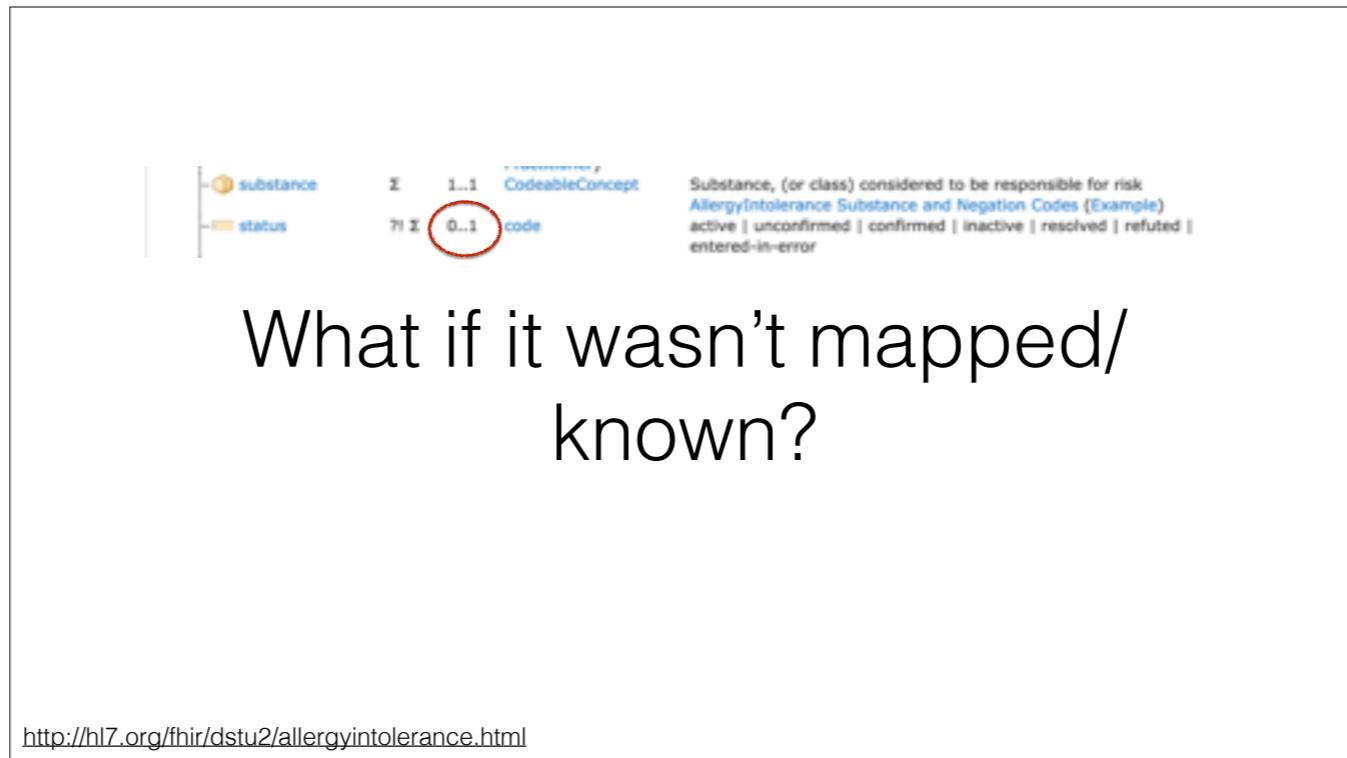
- 26
 - GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/AllergyIntolerance?patient=1316024&format=json>
 - GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/AllergyIntolerance?patient=1316024&status=active,unconfirmed,confirmed&format=json>

Note: AllergyIntolerance/123 is looking up an Allergy by its id (not a patient id). Similarly, AllergyIntolerance?_id=123 is looking up allergy by id, not by the patient id.

This value set has an inline code system <http://hl7.org/fhir/allergy-intolerance-status>, which defines the following codes:

Lvl	Code	Display	Definition
1	active	Active	An active record of a reaction to the Identified Substance.
2	unconfirmed	Unconfirmed	A low level of certainty about the propensity for a reaction to the Identified Substance.
2	confirmed	Confirmed	A high level of certainty about the propensity for a reaction to the Identified Substance, which may include clinical evidence by testing or rechallenge.
1	inactive	Inactive	An inactive record of a reaction to the Identified Substance.
2	resolved	Resolved	A reaction to the Identified Substance has been clinically reassessed by testing or rechallenge and considered to be resolved.
2	refuted	Refuted	A propensity for a reaction to the Identified Substance has been disproven with a high level of clinical certainty, which may include testing or rechallenge, and is refuted.
2	entered-in-error	Entered In Error	The statement was entered in error and is not valid.

<http://hl7.org/fhir/DSTU2/valueset-allergy-intolerance-status.html>



Be aware that querying by a field that isn't required may mean that values that weren't mapped or understood by the FHIR server won't be returned.

In the Allergy case, STU 3 is addressing this issue with allergies by requiring the status and adding an “unknown” that could be used to ensure all possible allergies can be retrieved.

Exercise 6

Exercise 6

- How many different **MedicationOrders** of *Advil Cold and Sinus* does Tim Peters have?

Exercise 6: Answer

- 1
- GET https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationOrder?patient=1316024&status=active,on-hold&_format=json

Paging

- ```
 "link": [
 {
 "relation": "self",
 "url": "https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationOrder?patient=1316024&_count=25&status=active&_con-hold"
 },
 {
 "relation": "next",
 "url": "https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationOrder?patient=1316024&-pageContext=1184038_1184051_1316024_1_1&-pageDirection=NEXT"
 }
],
 • GET https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationOrder?patient=1316024&-pageContext=1184038_1184051_1316024_1_1&-pageDirection=NEXT&_format=json
 • Added _format parameter
```

# MedicationStatement?

- Could have, though question said order.
- Result would have been the same, but statuses would have been “active,intended”

## 4.13.2 Boundaries and Relationships

The Medication domain includes a number of related resources

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MedicationOrder          | An order for both supply of the medication and the instructions for administration of the medicine to a patient.                                                                                                                                                                                                                                                                                                                                |
| MedicationDispense       | Provision of a supply of a medication with the intention that it is subsequently consumed by a patient (usually in response to a prescription).                                                                                                                                                                                                                                                                                                 |
| MedicationAdministration | When a patient actually consumes a medicine, or it is otherwise administered to them                                                                                                                                                                                                                                                                                                                                                            |
| MedicationStatement      | This is a record of medication being taken by a patient, or that the medication has been given to a patient where the record is the result of a report from the patient, or another clinician. A medication statement is not a part of the prescribe->dispense->administer sequence but is a report that such a sequence (or at least a part of it) did take place resulting in a belief that the patient has received a particular medication. |

<http://hl7.org/fhir/dstu2/medicationorder.html#bnr>

## **Exercise 7**

## Exercise 7

- What is the name of the patient with MRN 10000363
  - Hint: the system is urn:oid:1.1.1.1.1.1 (oid)

## Exercise 7: Answer

- Amy Hilton
- GET [https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/Patient?identifier=urn:oid:1.1.1.1.1|10000363&\\_format=json](https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/Patient?identifier=urn:oid:1.1.1.1.1|10000363&_format=json)

```
43 |],
44 | "text": "MRN"
45 | },
46 | "system": "urn:oid:1.1.1.1.1",
47 | "value": "10000363",
48 | "period": {
49 | "start": "2012-05-17T15:24:13.000Z"
50 | }
51 | },
52 |],
53 | "active": true,
54 | "name": [
55 | {
56 | "use": "official",
57 | "text": "Hilton, Amy",
58 | "family": [
59 | "Hilton"
60 |],

```

# Extensions



<http://hl7.org/fhir/dstu2/extensibility.html>

## Extension “Rules”

- They're Expected
- They can nest
- Server/Client cannot reject because of extension
  - Unless it's a modifier

# Examples

Here is an example of an extension in XML:

```
<name>
 <extension url="http://hl7.org/fhir/StructureDefinition/iso-21090-name-use" >
 <valueCode value="I" />
 </extension>
 <text value="Chief Red Cloud"/>
</name>
```

In this example, the name with text = "Chief Red Cloud" is extended to have a name use code of "Indigenous" (defined in ISO 21090, but very rarely used in practice).

In JSON, extensions are represented similarly:

```
"name" : {
 "extension" : [
 {
 "url" : "http://hl7.org/fhir/StructureDefinition/iso-21090-name-use",
 "valueCode" : "I"
 }
],
 "text" : "Chief Red Cloud"
}
```

# Modifier Example

Example: There's no element on `MedicationOrder` to write an "anti-prescription" - an instruction not to take a medication for a particular time. Classical clinical recording systems do not record this as a prescription - but one particular system does, and these "anti-prescription" records need to be shared within the institution where this happens, as they are an important part of the workflow. Hence, applications are allowed to extend a resource with data like this:

```
<MedicationOrder>
 <modifierExtension url="http://example.org/fhir/StructureDefinition/anti-prescription">
 <valueBoolean value="true"/>
 </modifierExtension>
 <!-- ... other content ... -->
</MedicationOrder>
```

Or in JSON:

```
{
 "resourceType" : "MedicationOrder",
 "modifierExtension" : [
 {
 "url" : "http://example.org/fhir/StructureDefinition/anti-prescription",
 "valueBoolean" : "true"
 }
],
 .. other content ...
}
```

Note: this should show in the narrative

[Content](#) [Detailed Descriptions](#) [Mappings](#) [XML](#) [JSON](#)

## Extension: Time of day of birth

URL for this extension:  
<http://hl7.org/fhir/StructureDefinition/patient-birthTime>

Status: draft. Extension maintained by: HL7

The time of day that the Patient was born. This includes the date to ensure that the timezone information can be communicated effectively.

Context of Use: Use on element: Patient.birthDate  
usage info: Insert a list of places where this extension is used

### Extension Content

[Summary](#) [Full Structure](#) [XML](#) [JSON](#) [All](#)

**Full Structure**

Name	Flags	Card.	Type	Description & Constraints
extension		0..1	Extension	URL = <a href="http://hl7.org/fhir/StructureDefinition/patient-birthTime">http://hl7.org/fhir/StructureDefinition/patient-birthTime</a> Time of day of birth: The time of day that the Patient was born. This includes the date to ensure that the timezone information can be communicated effectively. Use on element: Patient.birthDate
extension		0..n		
url		1..1	uri	' <a href="http://hl7.org/fhir/StructureDefinition/patient-birthTime">http://hl7.org/fhir/StructureDefinition/patient-birthTime</a> '
valueDateTime		1..1	dateTime	Value of extension

[Documentation for this format](#)

<http://hl7.org/fhir/dstu2/extension-patient-birthtime.html>

Not a modifier

Extension to patient.birthDate



**Conformance**

# Conformance Resource

- Weird: located at [base]/Conformance [base]/metadata
- Describes the Server
- Step towards auto-config

<http://hl7.org/fhir/dstu2/conformance.html>

Can be used to describe other things, like desired implementations or capabilities, we'll concentrate on describing a FHIR server contract.

Not enough to completely configure, but a step in that direction

# What?

- Which operations?
- Which parameters?
- Which formats?
- Profiles...



It defines a large part of the contract

## **Exercise 8**

## Exercise 8

- Which extensions are supported by the Millennium DSTU 2 Patient resource?

## Exercise 8: Answer

- Time of day of birth
- US Core Ethnicity
- US Core Patient Birth Sex
- US Core Race

<http://fhir.cerner.com/millennium/dstu2/individuals/patient/#extensions>

## **Exercise 9**

## Exercise 9

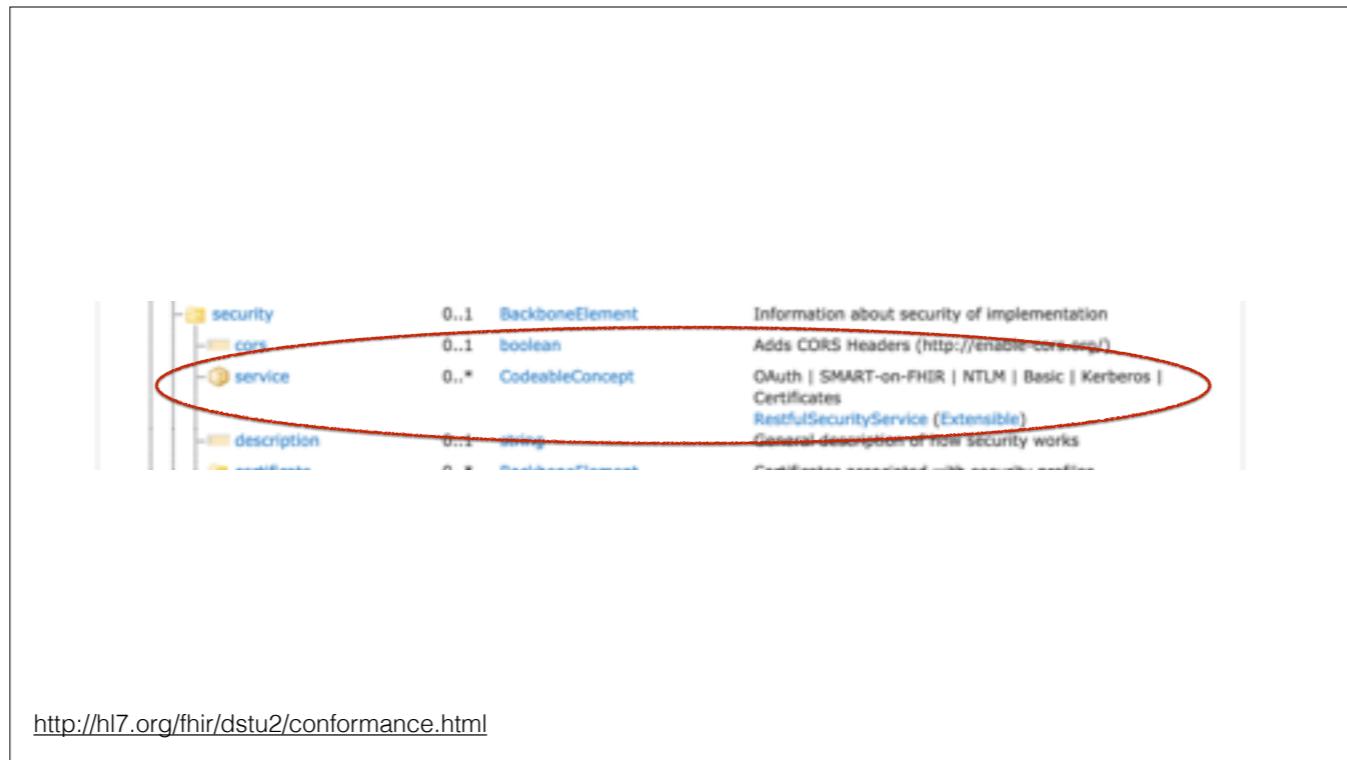
- According to the Conformance statement, does this FHIR server support OAuth? <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/>

Note: Make sure to remove spaces in your URL for FHIR - there should be none, and having spaces in the server URL will cause errors. HTTP URLs are space and case sensitive.

## Exercise 9: Answer

- Answer: No (it's our open endpoint)
- GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/metadata?format=json>

```
],
 "rest": [
 {
 "mode": "server",
 "documentation": "All the functionality defined in FHIR is available via this endpoint. It includes support for all standard FHIR operations (Create, Read, Update, Delete, Search, etc.) and various security features like CORS and OAuth2 authentication.",
 "security": {
 "cors": true
 },
 "resource": [
 {
 "type": "Conformance",
 "interaction": [
 {
 "code": "read"
 }
]
 }
]
 }
]
 }
]
}
```



# Profiles

# What

## 2.13.0.3 Two uses of Profiles

The [Conformance](#) resource describes two different uses for profiles on resources: Resource Profiles and System Profiles. Resource Profiles are specified using the `Conformance.rest.resource.profile` element and System Profiles are specified using the `Conformance.profile` element.

### 2.13.0.3.1 Conformance.rest.resource.profile

These profiles describe the general features that are supported by the system for each kind of resource. Typically, this is the superset of all the different use-cases implemented by the system. This is a resource-level perspective of a system's functionality.

### 2.13.0.3.2 Conformance.profile

These profiles describe the information handled/produced by the system on a per use case basis. Some examples of the uses for these kind of profiles:

- A Laboratory service producing a set of different reports - general chemistry, blood count, etc. Typical labs would support several hundred different reports

<http://hl7.org/fhir/dstu2/profiling.html>

StructureDefinition resource (in DSTU 2)

Detailed description of contracts, per user case or per system

# Rules

- Detailed contract
- Parameters, operations, api calls
- Fields, cardinality
- Terminology binding, extensions
- Must be compatible with core
  - Can't change required binding
  - Cardinality can restrict more (1..\* to 1..1 but not 0..\*)
  - Can't rename fields

Compatible: If core binds as required, you can't change it

If core has 1..\*, you can't change to 0..\*, but can change to 1..1

Goal: must be safe to process a resource without the profile

# DAF Condition

The official URL for this profile is:  
<http://hl7.org/fhir/StructureDefinition/daf-condition>

Defines constraints and extensions on the condition resource for use in querying and retrieving patient's information related to problems which includes conditions, findings, symptoms etc.

This profile was published on Thu, Aug 21, 2014 00:00+1000 as a draft by Health Level Seven International (Infrastructure and Messaging - Data Access Framework).

D.18.1.1 Formal Views of Profile Content 

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

Text Summary	Differential Table	Snapshot Table	XHTML Template	JSON Template	All																																																																								
This structure is derived from Condition. <table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> <th>Plur.</th> <th>Card.</th> <th>Type</th> <th>Description &amp; Constraints</th> </tr> </thead> <tbody> <tr> <td>Condition</td> <td>Condition</td> <td></td> <td>0..*</td> <td>Identifier</td> <td></td> </tr> <tr> <td>- identifier</td> <td>Identifier</td> <td>S</td> <td>0..1</td> <td>Reference(DAF-Patient)</td> <td></td> </tr> <tr> <td>- of patient</td> <td>Reference(DAF-Patient)</td> <td>S</td> <td>1..1</td> <td>Reference(DAF-Encounter)</td> <td></td> </tr> <tr> <td>- of encounter</td> <td>Reference(DAF-Encounter)</td> <td>S</td> <td>0..1</td> <td>Reference(DAF-Pract   DAF-Patient)</td> <td></td> </tr> <tr> <td>- of inserter</td> <td>Reference(DAF-Pract   DAF-Patient)</td> <td>S</td> <td>0..1</td> <td>Code</td> <td></td> </tr> <tr> <td>- of datarecorded</td> <td>Code</td> <td>S</td> <td>0..1</td> <td>CodeableConcept</td> <td><b>Binding:</b> Problem Value Set (extensible)</td> </tr> <tr> <td>- code</td> <td>CodeableConcept</td> <td>S</td> <td>1..1</td> <td>CodeableConcept</td> <td></td> </tr> <tr> <td>- category</td> <td>CodeableConcept</td> <td>S</td> <td>0..1</td> <td>Code</td> <td></td> </tr> <tr> <td>- clinicalstatus</td> <td>Code</td> <td>S</td> <td>1..1</td> <td>CodeableConcept</td> <td>mild   moderate   severe   final</td> </tr> <tr> <td>- severity</td> <td>CodeableConcept</td> <td>S</td> <td>0..1</td> <td>CodeableConcept</td> <td><b>Binding:</b> ConditionDiagnosis Severity (extensible)</td> </tr> <tr> <td>- onset[x]</td> <td>DateTime, Age, Human, Range</td> <td>S</td> <td>0..1</td> <td>Code</td> <td><b>Binding:</b> Unordered, Open, By @type</td> </tr> </tbody> </table>						Name	Type	Plur.	Card.	Type	Description & Constraints	Condition	Condition		0..*	Identifier		- identifier	Identifier	S	0..1	Reference(DAF-Patient)		- of patient	Reference(DAF-Patient)	S	1..1	Reference(DAF-Encounter)		- of encounter	Reference(DAF-Encounter)	S	0..1	Reference(DAF-Pract   DAF-Patient)		- of inserter	Reference(DAF-Pract   DAF-Patient)	S	0..1	Code		- of datarecorded	Code	S	0..1	CodeableConcept	<b>Binding:</b> Problem Value Set (extensible)	- code	CodeableConcept	S	1..1	CodeableConcept		- category	CodeableConcept	S	0..1	Code		- clinicalstatus	Code	S	1..1	CodeableConcept	mild   moderate   severe   final	- severity	CodeableConcept	S	0..1	CodeableConcept	<b>Binding:</b> ConditionDiagnosis Severity (extensible)	- onset[x]	DateTime, Age, Human, Range	S	0..1	Code	<b>Binding:</b> Unordered, Open, By @type
Name	Type	Plur.	Card.	Type	Description & Constraints																																																																								
Condition	Condition		0..*	Identifier																																																																									
- identifier	Identifier	S	0..1	Reference(DAF-Patient)																																																																									
- of patient	Reference(DAF-Patient)	S	1..1	Reference(DAF-Encounter)																																																																									
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- clinicalstatus	Code	S	1..1	CodeableConcept	mild   moderate   severe   final																																																																								
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- onset[x]	DateTime, Age, Human, Range	S	0..1	Code	<b>Binding:</b> Unordered, Open, By @type																																																																								

<http://hl7.org/fhir/dstu2/daf/daf-condition.html>

Part of an Implementation Guide (DAF)

Differential is good at showing differences from core

“Must Support” - it’s fuzzy...

This profile binds Condition.code to a value set, binds severity

# Argonaut IG

- <http://www.fhir.org/guides/argonaut/r2/>
- Standard Profiles for defined use cases
- Address issues from the JASON Task Force reports

<http://hl7.org/fhir/dstu2/iglist.html>

**Questions?**

**More Exercises!**

## **Exercise 10**

## Exercise 10

- Does Fred Smart have a normal blood pressure?
  - Hint: LOINC 55284-4 can be used to find blood pressures

## Exercise 10: Answer

- No - it's High
- GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/Observation?subject%3APatient=4478007&code=http%3A%2F%2Floinc.org%7C55284-4&format=json> (code: http://loinc.org|55284-4)

You need to ensure you properly escape/encode the URL so that protected characters are percent encoded. This is to ensure that the server can interpret the URL correctly. Postman does this for you, and \*some\* http libraries will, but make sure your code (or app) handles this logic to encode or decode as needed.

## 4.20.1 Scope and Usage

Observations are a central element in healthcare, used to support diagnosis, monitor patient status, and even capture demographic characteristics. Most observations are simple name/value pairs.			
resource provi	-  interpretation	0..1 CodeableConcept	Observation Value Absent Reason (Extensible)
	-  comments	0..1 string	High, low, normal, etc.
	-  bodySite	0..1 CodeableConcept	Observation Interpretation Codes (Extensible)
	-  method	0..1 CodeableConcept	Comments about result
	-  specimen	0..1 Reference(Specimen)	Observed body part
	-  device	0..1 Reference(Device   DeviceMetric)	SNOMED CT Body Structures (Example)
	-  referenceRange	1 0..* BackboneElement	How it was done
	-  low	1 0..1 SimpleQuantity	Observation Methods (Example)
	-  high	1 0..1 SimpleQuantity	Specimen used for this observation
	-  meaning	0..1 CodeableConcept	(Measurement) Device
	-  age	0..1 Range	Provides guide for interpretation
	-  text	0..1 string	Must have at least a low or a high or text
	-  related	1 0..* BackboneElement	Low Range, if relevant
	-  type	0..1 code	High Range, if relevant
			Indicates the meaning/use of this range of this range
			Observation Reference Range Meaning Codes (Example)
			Applicable age range, if relevant
			Text based reference range in an observation
			Resource related to this observation
			has-member   derived-from   sequel-to   replaces
			qualified-by   interfered-by   ObservationRelationshipType (Example)

<http://hl7.org/fhir/dstu2/observation.html>

<code>code</code>	N	token	The code or component-code of the observation type. Example: <code>code=http://isinc.org 1094-0,http://isinc.org 3139-3</code>
<code>date</code>	N	date	Date range into which the observation falls. Example: <code>date-gt2014-09-24 Or date-lt2015-09-24T12:00:00.000Z</code>
<code>category</code>	N	token	The category of observations. Example: <code>category=laboratory</code>
<code>_count</code>	N	number	The maximum number of results to return per page. Defaults to se. Capped at 100.

Notes:

- The `subject` parameter must represent a Patient resource and may use the `:Patient` modifier.
- It is recommended to search by either `code` or `date` (or both).
- The `code` parameter:
  - May be a list of comma separated values. A system must be provided for each code.
  - Searches Observation.code and Observation.component.code.
- The `date` parameter may be provided up to two times, and must use the `eq`, `ge`, `gt`, `le`, or `lt` prefixes. When a value is provided without a prefix, an implied `eq` prefix is used. When provided twice, the lower value must have a `ge` or `gt` prefix and the higher value must have an `le` or `lt` prefix.

<http://fhir.cerner.com/millennium/dstu2/diagnostic/observation/#parameters>

## **Exercise 11**

## Exercise 11

- Is Fred Smart currently taking insulin?

## Exercise 11: Answer

- Answer: Yes
- GET [https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationStatement?patient=4478007&\\_format=json](https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationStatement?patient=4478007&_format=json)
- GET [https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationOrder?patient=4478007&\\_format=json](https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationOrder?patient=4478007&_format=json)

## **Exercise 12**

## Exercise 12

- Which has a pacemaker: Fred Smart or Tim Peters?

## Exercise 12: Answer

- Fred
- GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/Device?patient=4478007&format=json>
  - and possibly Google (Medtronic Advisa MRI SureScan)
- GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/Device?patient=1316024&format=json>

## **Exercise 13**

## Exercise 13

- Who is patient Tim Peter's son?

## Exercise 13: Answer

- Answer: Cooper, Timothy
- GET <https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/RelatedPerson?patient=1316024&format=json>

```
- "patient": {
 "reference": "Patient/1316024",
 "display": "PETERS, TIMOTHY"
},
- "relationship": {
 "text": "Son"
},
- "name": {
 "use": "official",
 "text": "COOPER, TIMOTHY",
 - "family": [Array[1]
 0: "COOPER"
],
 - "given": [Array[1]
 0: "TIMOTHY"
],
 - "period": {
 "start": "2013-03-11T07:17:04.000Z"
 }
}

```

## **Exercise 14**

## Exercise 14

- What happens when you query MedicationStatement for Joe Smart and filter by a status of draft? Why?

## Exercise 14: Answer

- Answer: An error (400), because draft isn't in the value set
- GET [https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationStatement?patient=4342010&status=draft&\\_format=json](https://fhir-open.sandboxcerner.com/dstu2/0b8a0111-e8e6-4c26-a91c-5069cbc6b1ca/MedicationStatement?patient=4342010&status=draft&_format=json)
- <http://fhir.cerner.com/millennium/dstu2/general-clinical/condition/#terminology-bindings>

This value set has an inline code system <http://hl7.org/fhir/medication-statement-status>, which defines the following codes:

Code	Display	Definition	v3 Map (ActStatus)
active	Active	The medication is still being taken.	=active
completed	Completed	The medication is no longer being taken.	=completed
entered-in-error	Entered in Error	The statement was entered in error.	=nullified
intended	Intended	The medication may be taken at some time in the future.	

<http://hl7.org/fhir/DSTU2/valueset-medication-statement-status.html>

https://fhir-open.sanc X + Body Cookies Headers (17) Tests No Environment

GET https://fhir-open.sandbox Date → Sun, 12 Mar 2017 18:12:05 GMT

Body Cookies Headers (17) Test Expires → Mon, 01 Jan 1990 00:00:00 GMT

Pretty Raw Preview Text Pragma → no-cache

1 status: invalid code for http Server → Apache

Server-Response-Time → 15.264153

Status → 400 Bad Request

Strict-Transport-Security → max-age=631152000

Transfer-Encoding → chunked

Vary → Origin,User-Agent,Accept-Encoding

X-Content-Type-Options → nosniff

X-Frame-Options → SAMEORIGIN

X-Request-Id → 31e9d5932dbfbdcceb87d3529975a3f9

X-Runtime → 0.015244

Params Send Save Status: 400 Bad Request Time: 745 ms