Introduction to the
Fast Healthcare Interoperability Resources (FHIR) specification webinar

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• What is FHIR
• What will you need to play with FHIR
• What should you know when playing with FHIR
• FHIR and clinical terminology
• FHIR Operations
What is FHIR

• Grahame Grieve wrote the initial strawman version of FHIR between May and August 2011, it was called ‘Resources for Health (RFH)’

• FHIR today is still a standard for trial use (STU) and currently at STU3.0.1

• FHIR Release 4 will be the first release that begins to contain normative elements

• FHIR is more than just a transport format, unlike its HL7 predecessors it defines how to send and receive content as well as the format.

• FHIR is a RESTful API, many of today’s most successful web companies are built around a RESTful architecture, Facebook, LinkedIn, Twitter and thousands of others.

• Extensibility was built into FHIR from day one, it focuses of the 80% and allows extensibility to cover the rest.
What is FHIR

Health Level Seven (HL7) standards:

- HL7 V2
- HL7 V3 (RIM)
- HL7 CDA (RIM)
- HL7 FHIR (Fast Healthcare Interoperability Resources)
Messaging, Document and Resource paradigm

• **HL7 V2 Messaging**
  • An event happened and here is the data about that event

• **CDA Document**
  • A document that is published

• **FHIR Resources**
  • FHIR has a Messaging & Document paradigm but is primarily a Resource oriented paradigm
  • The resources represent granular clinical concepts, linked together to form a web of information and higher level concepts (such as a Pathology Report or Discharge Summary)
What will you need to play with FHIR

The Specification

FHIR STU 3, V3.0.1


The NCTS will be using STU3.0.1
What will you need to play with FHIR

**Tools**

**A laptop or PC**
"yes we have had people come without one"

**HTTP Post Client**
Postman, Fiddler ..etc.

**Text editor of choice**
Notepad++, Sublime, VS Code, text..etc.

**A FHIR server or endpoint**
These are provided and are also publicly available
There is a big list of them here:

**Must have**

**Optional**

**Development Environment**
Visual Studio, Eclipse, NetBeans ..etc.

**FHIR development libraries**
Java, .NET, Pascal
What will you need to play with FHIR


Read these three

**Documentation Index**

This page provides an index to the key commonly used documentation pages for FHIR.

**Framework**
- Conformance Rules
- Resource Life Cycles
- References between Resources
- Compartments
- Narrative
- Extensibility
- Formats: XML, JSON, & RDF
- Terminologies (Code Systems, Value Sets)
- FHIRPath

**Exchanging Resources**
- RESTful API (HTTP)
- Search + Search Param Registry
- Operations
  - Documents
  - Messaging
  - Services

**Base Types**
- Data Types (Base)
- Metadata Types

**Adopting & Using FHIR**
- Profiling FHIR
- Downloads - Schemas, Code, Tools
- Validating Resources
- Mapping Language (tutorial)
- Testing Implementations

**Safety & Security**
- Security & Security Labels
- Clinical Safety
What will you need to play with FHIR


Familiarise yourself with the layout of a FHIR Resource page.

The Patient resource is a friendly place to start.

All resource pages are structured the same way.

Concentrate on the structure diagram for the resource and the Search parameters at the bottom of the page.
What will you need to play with FHIR

Familiarise your self with the following terminology FHIR Operations as these are key to the NCTS connectathon:

- Value Set Expansion
- Concept Translation
- Value Set based Validation
What should you know when playing with FHIR

- You should be mildly familiar with either XML or JSON
What should you know when playing with FHIR

• You will need to know the basic use of a HTTP post client, (PUT, POST, GET DELETE)

I would highly recommend Postman as seen on the right.
What should you know when playing with FHIR

Searching

**GET:**  [https://someserver/fhir/Patient?family=millar](https://someserver/fhir/Patient?family=millar)

Give me all Patient resources where the family name contains ‘millar’

**GET:**  [https://someserver/fhir/Patient?family=millar&given=angus](https://someserver/fhir/Patient?family=millar&given=angus)

Give me all Patient resources where the family name contains ‘millar’ and given name contains ‘angus’

**GET:**  [https://someserver/fhir/Patient?family=millar&given=angus,gus](https://someserver/fhir/Patient?family=millar&given=angus,gus)

Given me all Patient resources where the family name contains ‘millar’ and given contains ‘angus’ or ‘gus’


Give me all Patient resources where an identifier is a Medicare number value of ‘2950156481’

- All the search parameters for each Resource are defined in the FHIR specification.
- Some servers may not support all search parameters.
- All FHIR servers must be able to return a resource that defines what they do support at: [https://someserver/fhir/metadata](https://someserver/fhir/metadata)
- There are more complex searches such as Chaining and includes


Give me all DiagnosticReport resources linked to Patient resources where the family name contains ‘millar’
What should you know when playing with FHIR

Searching

GET: https://someserver/fhir/Patient?family=millar

Give me all Patient resources where the family name contains ‘millar’

8.1.11 Search Parameters

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
<th>Expression</th>
<th>In Common</th>
</tr>
</thead>
<tbody>
<tr>
<td>family</td>
<td>string</td>
<td>A portion of the family name of the patient</td>
<td>Patient.name.family</td>
<td>1 Resources</td>
</tr>
<tr>
<td>gender</td>
<td>token</td>
<td>Gender of the patient</td>
<td>Patient.gender</td>
<td>3 Resources</td>
</tr>
<tr>
<td>general-practitioner</td>
<td>reference</td>
<td>Patient’s nominated general practitioner, not the organization that manages the record</td>
<td>Patient.generalPractitioner (Practitioner, Organization)</td>
<td></td>
</tr>
<tr>
<td>given</td>
<td>string</td>
<td>A portion of the given name of the patient</td>
<td>Patient.name.given</td>
<td>1 Resources</td>
</tr>
<tr>
<td>identifier</td>
<td>token</td>
<td>A patient Identifier</td>
<td>Patient.identifier</td>
<td></td>
</tr>
<tr>
<td>language</td>
<td>token</td>
<td>Language code (irrespective of use value)</td>
<td>Patient.communication.language</td>
<td></td>
</tr>
<tr>
<td>link</td>
<td>reference</td>
<td>All patients linked to the given patient</td>
<td>Patient.link.other (Patient, RelatedPerson)</td>
<td></td>
</tr>
</tbody>
</table>

- At the bottom of every Resource page is the search parameters for that resource
- Each search parameter has a Type
- There are only 8 types:
  - Number
  - Date/DateTime
  - String
  - Token
  - Reference
  - Composite
  - Quantity
  - URI

- Each type is has a format
What should you know when playing with FHIR🔥

Searching


Give me all Patient resources where a Medicare number identifier is found with the value 2950156481

Search parameter name: identifier
Search parameter Type: Token

Token format

Syntax

[parameter]=[system][code]

Example

identifier=http://ns.electronichealth.net.au/id/medicare-number |2950156481

Every search parameter type is described in the FHIR specification at Documentation/Search:

http://hl7.org/fhir/search.html#2.21.1
What should you know when playing with FHIR 🇦🇺

There are only a small number of concepts you need to understand to be able to interact with a FHIR server effectively.

These concepts are not so much FHIR concepts but rather RESTful and HTTP concepts.

A HTTP request and response only has 4 board concepts:

- **URL**: The address you are sending the request to: e.g. https://someserver/fhir/Patient
- **Method**:  
  - **POST**: Create
  - **GET**: Read
  - **PUT**: Update or Create
  - **DELETE**: Delete
- **HTTP Headers**: A list of parameter and value pairs e.g. Accept: application/fhir+json
- **Body**: The payload of data being sent, generally a FHIR resource formatted in XML or JSON; in our case
What should you know when playing with FHIR

- **URL**
- **Method**
- **Headers**
- **Body**
What should you know when playing with FHIR 🔥

What is content negotiation?

XML  JSON
What should you know when playing with FHIR 🔥

- You need to understand what content negotiation is and the appropriate ‘Accept’ and ‘Content-Type’ header to use with FHIR, it’s easy!
What should you know when playing with FHIR 🔥

This is a basic HTTP Request or Response

| URL: GET | https://SomeServer.com/fhir |

<table>
<thead>
<tr>
<th>Header</th>
<th>Body</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accept:</strong> application/fhir+xml</td>
<td><strong>XML</strong></td>
</tr>
<tr>
<td><strong>Content-Type:</strong></td>
<td></td>
</tr>
</tbody>
</table>
What should you know when playing with FHIR 🔥

Content-Type

The **content type** I am giving the FHIR server is in a JSON format

**Content-Type**: application/fhir+json
What should you know when playing with FHIR 🔥

Accept

I Accept content returned to me from the FHIR server in XML format

Accept: application/fhir+xml

GET

XML

FHIR

www.digitalhealth.gov.au
What should you know when playing with FHIR

HTTP Request

URL: GET https://SomeServer.com/fhir

Header
Accept: application/fhir+json
Content-Type: application/fhir+xml

Body

XML

HTTP Response

URL: https://SomeServer.com/fhir

Header
Content-Type: application/fhir+json

Body

JSON

FHIR
What should you know when playing with FHIR 🔥

These will both need to be set by you in your HTTP Post client:

<table>
<thead>
<tr>
<th>Authorization</th>
<th>Headers (2)</th>
<th>Body</th>
<th>Pre-request Script</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accept</td>
<td>application/fhir+xml</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content-Type</td>
<td>application/fhir+json</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What should you know when playing with FHIR

- **URL**
- **Method**
- **Headers**
- **Body**
I highly advise you to visit this FHIR training web site and at a minimum read through the "Simple Patient" exercise.

This interactive web site will walk you through the basics of how to interact with a FHIR server:
- **Create** a test patient resource in a FHIR server,
- **Read** that resource from the FHIR server
- **Update** that resource in the FHIR server
- **Delete** that resource from the FHIR server

Create, Read, Update, Delete (CRUD)
The FHIR Specification has put a lot of effort into improving the maintainability and delivery of clinical terminology.

Some FHIR servers are dedicated to this function and the CSIRO ONTO server is one of these.

There are three core FHIR resource used to manage and use terminology:

- **CodeSystem** - catalogue of codes
- **ValueSet** - collection of codes for use (from one or many CodeSystems)
- **ConceptMap** - mapping from one code in a ValueSet to another code in another ValueSet
Example:
If I worked in an organisation with many hospitals across the world I may create a CodeSystem that lists all the codes for all of my facilities across the globe.

From this CodeSystem I could select all the codes for the Australian hospitals that I want to be displayed in my Patient Administration Systems (PAS) and create a ValueSet for that purpose.

And the Western Australian I want only W.A hospitals to be selected so this could be another ValueSet for use.
FHIR and Clinical Terminology

- A ConceptMap translates codes from one ValueSet to another
- The ConceptMap only translates in one direction

e.g. Translate the ACME hospital codes to Healthcare Provider Identifier – Organisation (HPI-O) numbers
FHIR Operations

• FHIR also acts as an Operations framework
  
  *Much like calling a method or function that does something for you.*

• Operations can be performed at different levels, the dollar sign ‘$’ signifies an operation.

• **Base Operations:**
  
  https://MyFhirServer.com/fhir/$MyOperation

• **Resource Operations:**
  
  https://MyFhirServer.com/fhir/ConceptMap/$MyOperation

• **Resource instance Operations**
  
  https://MyFhirServer.com/fhir/ConceptMap/123456/$MyOperation
There are three key FHIR Operations used in terminology

- **Concept Translation** (*Translate from one code to another*)

- **Value Set Expansion** (*Give me a list of codes from this ValueSet that contain ‘abdo’*)
  GET [base]/ValueSet/23/$expand?filter=abdo

- **Value Set based Validation** (*Confirm that this code is in this ValueSet*)
FHIR Operations

• Beginners trap!
• Concept Translation (*Translate from one code to another*)

```
```

When referencing ValueSets and CodeSystems we are referencing the URL property of the resource and not server’s ValueSet endpoint and resource [id] where the resource is found in the server.

```
<ValueSet xmlns='http://hl7.org/fhir'>
  <id value="IHI-record-status"/>
  <text>
    <div xmlns='http://www.w3.org/1999/xhtml'>
      <h2>IHI Record Status</h2>
      <p>The record status of the Individual Healthcare Identifier (IHI Record Status)</p>
    </div>
    <url value="http://ns.electronichealth.net.au/id/hl1/hl1/1.0/ValueSet/IHI-record-status"/>
    <version value="201408"/>
    <name value='IHI Record Status'/>
    <status value='draft'/>
  </text>
</ValueSet>
```
Questions?
The NCTS FHIR® Connectathon will be held 17 April 2018 in Brisbane


Thank you for attending this webinar