Introduction to FHIR

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Who am I?

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What is FHIR?

• The latest HL7 standard for exchanging electronic healthcare information
• Defines a simplified approach to implementation w/o sacrificing information integrity
• Defines “Resource” as the basic building block of all exchangeable content
• hl7.org/fhir
The Acronym

- F – Fast (to design and to implement)
  - Relative – No technology can make implementation as fast we like
- H – Healthcare
  - That’s why we’re here
- I – Interoperable
  - Ditto
- R – Resources
  - Building blocks (our next focus)
The Goals of FHIR

• Implementer Focus
• Target the 80% (common stuff)
• Use today’s web technologies
• Support human readability
• Paradigm & architecturally agnostic
• Open Source
Implementer Focus

• Specification is written for one target audience... Implementers
  • Rationale, modeling approaches, etc. kept elsewhere
  • Make the resources **simple** and easy to understand and use
  • Multiple Implementation tools to help get you started from day 1
    • Publicly available test servers
    • Starter APIs published with spec
      • C#, Java, Pascal, ObjectiveC, Javascript
  • Lots and lots of examples (and they’re valid too)
Support the 80%

• Focus on scenarios that the implementers ask for
• Decision to include content into the core specification:
  • “We only include data elements if we are confident that most normal implementations using that resource will make use of the element” (80% rule)
• Other content is included through creation of Profiles and Extensions
Web Technologies

• Same technologies that drive Google, Facebook, Twitter
  • HTTP
  • REST API
  • XML, JSON, RDF
  • Datatypes are W3C compliant
  • HTTPS, OAuth, etc. for security functions
It’s all about the Resources...

• Building blocks...
Resources: What are they?

• The Content model
• The Thing that is exchanged
  • Via REST (FHIR Restful API), Messages, Documents
• Informed by much past work, inside and outside of HL7
  • HL7: version 2, version 3 (RIM), CDA
  • Other SDOs: openEHR, CIMI, ISO 13606, IHE, DICOM
• Can be represented in multiple syntaxes: JSON, XML, Turtle
• May include Human-Readable Narrative (XHTML)
• Allow for extensions, and can be profiled
Resource Definitions

Patient (DomainResource)

- identifier: Identifier [0..*]
- active: boolean [0..1]
- name: HumanName [0..*]
- telecom: ContactPoint [0..*]
- gender: code [0..1] « AdministrativeGender »
- birthDate: date [0..1]
- deceased[x]: Type [0..1] « boolean | dateTime »
- address: Address [0..*]
- maritalStatus: CodeableConcept [0..1] « Marital Status »
- multipleBirth[x]: Type [0..1] « boolean | integer »
- photo: Attachment [0..*]
- generalPractitioner: Reference [0..*] « Organization | Practitioner | PractitionerRole »
- managingOrganization: Reference [0..1] « Organization »

Communication [0..*]

- language: CodeableConcept [1..1] « CommonLanguages »
- preferred: boolean [0..1]

Link

- other: Reference [1..1] « Patient | RelatedPerson »
- type: code [1..1] « LinkType »

Contact

- relationship: CodeableConcept [0..*] « PatientContactRelationship »
- name: HumanName [0..1]
- telecom: ContactPoint [0..*]
- address: Address [0..1]
- gender: code [0..1] « AdministrativeGender »
- organization: Reference [0..1] « Organization »
- period: Period [0..1]
What is a Resource?

**FHIR Resources**
- Administrative
  - Patient, Practitioner, Organization, Location, Group
- Clinical Concepts
  - AllergyIntolerance, Condition, Encounter, Medication
- Infrastructure/Conformance
  - Composition, MessageHeader, CapabilityStatement

**Not FHIR Resources**
- Gender Too small
- Electronic Health Record Too big
- Blood Pressure Too specific
Connecting Resources

- **Condition**
- **Patient**
- **DiagnosticReport**
- **Procedure**
- **Encounter**
- **Perform**
- **Practitioner**

**FHIR resource**
- "container" of information that represent something in the real world
- Link between resources
REST – Data at a location - a resource’s ID

https://server.org/fhir/Patient/1234

resource type

endpoint

id

Note: This URL resolves to the current version of a resource
It’s also specific to a server.
May give XML, or JSON, depending on server default
REST: JSON

```
https://server.org/fhir/Patient/1234?_format=json
```

endpoint

resource type

id

command

Gets the same patient but returns as JSON instead
REST: Search

https://server.org/fhir/Patient?name=smith

Note – no id specified.
Search terms are pre-defined, for each resource type
Resource Identifiers

• 2 different ‘sorts’ of identity
  • “Id” identifies a resource on a (REST) server
    • Is Metadata
    • Will change between servers
  • Identifier
    • Business identifier
    • Is an element in the (core) resource
REST: Search, by identifier

https://server.org/fhir/Patient?identifier=MRN456

Note – no id specified, but instead a query, by identifier. Also possible (not shown here) to specify what type of identifier it is.
Public FHIR Servers for Testing


• More than a dozen publicly available test servers (and clients)
• Support for multiple FHIR versions (DSTU2, STU3, and current R4 draft/CI)
• Maintained and supported by the FHIR community
Paradigms

FHIR supports four interoperability paradigms
REST

• Simple, out-of-the-box interoperability
• Leverages HTTP methods: GET, POST, etc.
• Pre-defined operations
  • Create, Read, Update, Delete
  • Also: History, Read Version, Search, Patch, Validate, Capabilities, Batch & Transaction
• Works best where control resides on client side and a trust relationship exists
Documents

• Similar to CDA
• Collection of resources bound together
  • Root is a “Composition” resource
  • Just like CDA header
• Sent as a Bundle (FHIR Resource)
• Single context
• Can be signed, authenticated, etc.
Messages

• Similar to v2 and v3 messaging
• Also a collection of resources in a Bundle (FHIR Resource)
  • Root is a “MessageHeader” resource
• Allows request/response behavior for both request and response payloads
• Event-driven
  • e.g. Send lab order request, get back result
• Can be asynchronous
  • Requires agreement between partners on protocols and responsibilities
Service Oriented Architecture (SOA)

Combination of previous paradigms

• (based on SOA principles)
• Ultra complex workflows
• Ultra simple workflows
• Individual resources or collections (in Bundle, contained resources or other formats)
• Use HTTP or use something else
• Only constraint is that you’re passing around FHIR resources in some way, manner, shape or form
Regardless of **paradigm** the content is **the same**

Receive a lab result in a message...

- **Lab System**
- **FHIR Message**
- **FHIR (facade) Repository**
- **FHIR Document**
- **National Exchange**

...Package it in a discharge summary document
FHIR Specification (hl7.org/fhir)
Useful links: Resources, introductions, REST API
# FHIR Publication Directory

[http://hl7.org/fhir/directory.html](http://hl7.org/fhir/directory.html)

## 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.

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Current Versions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr 19, 2017</td>
<td>3.0.1</td>
<td>Current Official Published Version <em>(Currently: Release 3 with 1 technical errata)</em></td>
</tr>
<tr>
<td>(current)</td>
<td>(last commit)</td>
<td>Current Development build (about 30min behind version control, may be incoherent and change rapidly)</td>
</tr>
<tr>
<td><strong>R4 sequence</strong></td>
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<tr>
<td>Aug 21, 2018</td>
<td>3.5.0</td>
<td>R4 Ballot #2 : Mixed Normative/Trial use (Second Normative ballot + Baltimore Connectathon)</td>
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<tr>
<td>Apr 3, 2018</td>
<td>3.3.0</td>
<td>R4 Ballot #1 : Mixed Normative/Trial use (First Normative ballot)</td>
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<tr>
<td>Dec 20, 2017</td>
<td>3.2.0</td>
<td>Draft for comment / First Candidate Normative Content</td>
</tr>
<tr>
<td><strong>STU 3 sequence</strong></td>
<td></td>
<td></td>
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<tr>
<td>Apr 19, 2017</td>
<td>3.0.1</td>
<td><strong>FHIR Release 3</strong> (STU) with 1 technical errata (Permanent Home)</td>
</tr>
<tr>
<td>Dec 6, 2016</td>
<td>1.8.0</td>
<td>FHIR STU3 Candidate + Connectathon 14 (San Antonio)</td>
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RESTful API
http://hl7.org/fhir/http.html

• The Instance Level, Type Level and Whole System Interactions are listed at the top of the page.

• Clicking on any specific interaction will display the details of that interaction; e.g. update will show all of the FHIR requirements for updating resources.
Patient - Resource Content

http://hl7.org/fhir/patient.html#resource

- The **Structure** tab shows the element organization.
- The **Card.** stands for cardinality and defines the min and max occurrences of an element.
- The **Type** lists the FHIR data type; e.g. name is of type HumanName. Clicking on HumanName will show its structure.
Data Types
http://hl7.org/fhir/datatypes.html

• The Primitive and Complex Types are displayed at the top of the page.
• Clicking on any specific data type will display the details of that type; e.g. CodeableConcept will show the structure of that data type.
FHIR Maturity Model
http://hl7.org/fhir/versions.html#maturity

0: Draft
1: + No build warnings
2: + Successfully exchanged/tested between 3 systems (Connectathon)
3: + Verified by WG; formally balloted
4: + Scope tested; formal publication; multiple projects
5: + Published 2+ release cycles; 5+ independent production deployments
6: Normative
CapabilityStatement

• Documents the capabilities of a FHIR client and server
• A client should examine the CapabilityStatement of a server to determine its supported behavior
• The CapabilityStatement:
  • is a key part of the FHIR conformance framework
  • is a statement of the features, rules and behaviors of a FHIR system
  • may be used for system compatibility testing, code generation, or as the basis for conformance testing
• To declare themselves “FHIR Conformant”, a system MUST publish a CapabilityStatement: http://hl7.org/fhir/STU3/http.html#capabilities
StructureDefinition

- A resource that describes a structured set of data element definitions and their associated rules of usage
  - how resource elements and/or data types are used or not used
  - resource or data type extensions
  - Value Set references that specify the content of coded elements
- Describes (Profiles) the base content defined in the specification
- Describes (Profiles) how these structures are utilized in implementation guides
FHIR Timeline

• The first normative content is scheduled for FHIR R4 this year (2018).
Recap: What Does FHIR provide?

• Resources (building blocks)
• Extensions (embrace these :-) 
• Methodology: Bundles, Profiles 
• Syntax: XML, JSON, RDF(Turtle) 
• Human Readability 
• CapabilityStatement, StructureDefinition 
• Multiple Paradigms: REST, Messaging, Documents, Services 
• Extensive online documentation
Discussion (Q & A)
Thank you!