Introduction to FHIR

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Who am I?

- **Name:** Casey McGruder
- **Company:** Oracle
- **Background:**
  - Software-as-a-Service (aka ‘Cloud’)
  - REST API Writer
  - Volunteer editor for the FHIR specification
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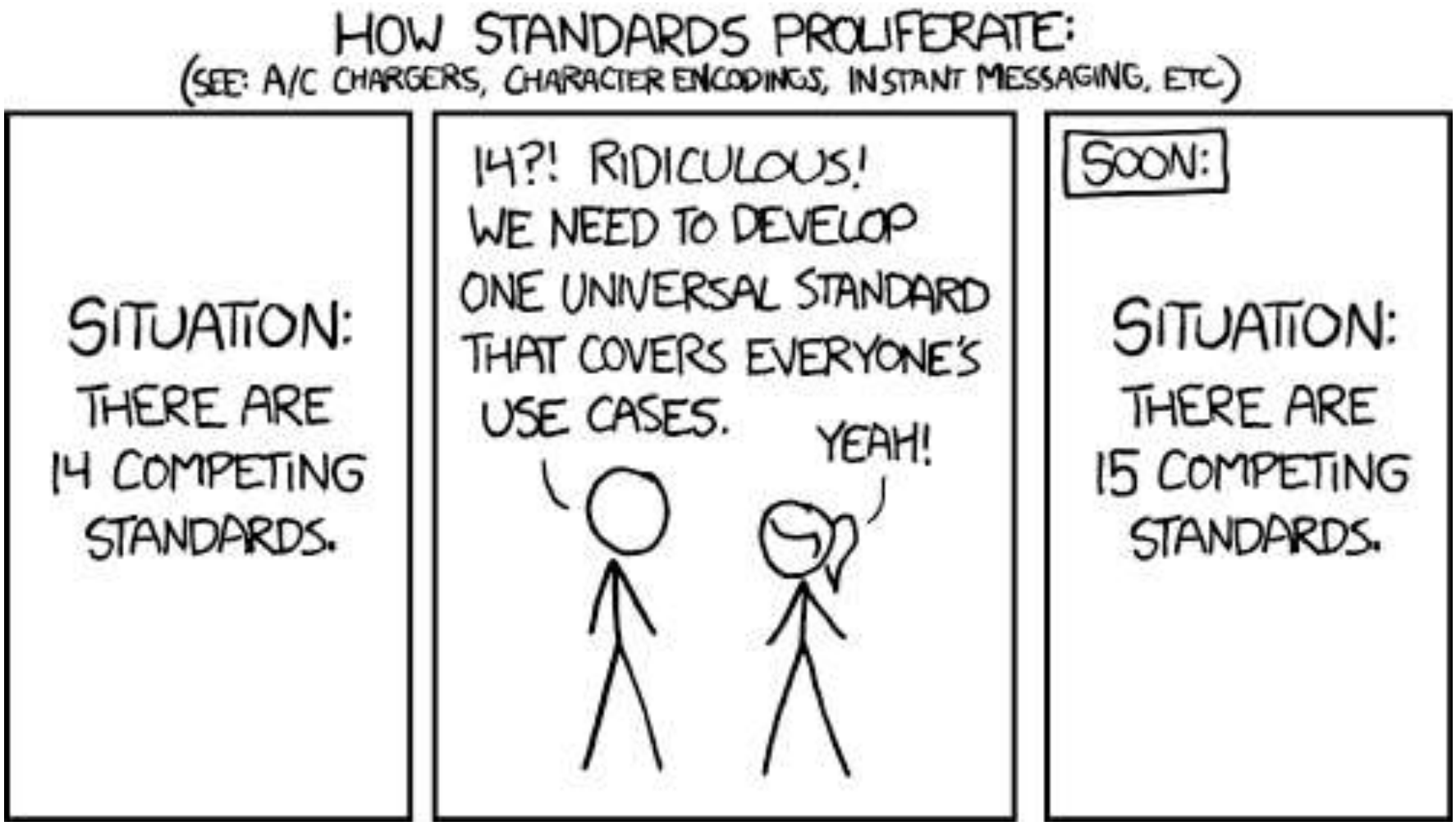
My Story

- Why did I become interested in health standards?
  - Education in the biological sciences
  - Experience with a startup company
  - Mother's cancer diagnosis
  - I wanted to be part of the solution



http://xkcd.com/927

Existing healthcare standards and bodies

- HL7 – v2, v3, CDA
- OpenEHR
- CDISC – SDTM, ADAM, define.xml
- X1
- CTS
- ISO – 11179, 21090, etc.
- DICOM
- W3C – Xforms, XSD
- Many others

Do we really need one more?

The need

- There has been a need to share healthcare information electronically for a long time
  - HL7 v2 is nearly 30 years old
- Vendors are facing increasing *pressure* to broaden the scope of sharing
  - Across organizations, disciplines, even borders
  - Mobile & cloud-based applications
  - Faster – integration in days or weeks, not months or years

Genesis of FHIR

- What would a healthcare exchange look like if we started from scratch using modern approaches?
  - Web search for success markers led to RESTful based APIs (more on these later)
  - Exemplar: Highrise is a fully-compliant REST API (https://github.com/basecamp/highrise-api)
- Drafted a healthcare exchange API based on this approach

FHIR - the acronym

- F – Fast (to design & implement)
- H – Healthcare
- I – Interoperability
- R – Resources

Contextual drivers for FHIR

- **Shift in healthcare**

  Patient in control, sharing data across organizations

- **Shift from offline to online**

  From desktop to cloud, from browser to app

- **Shift towards data transparency**

  FHIR acts as an ‘open API’ to access data in these silo-like EHR’s.

- **Shift towards analytics**

  FHIR uses data structures that allow one to easily slice and dice the data for analytical purposes.

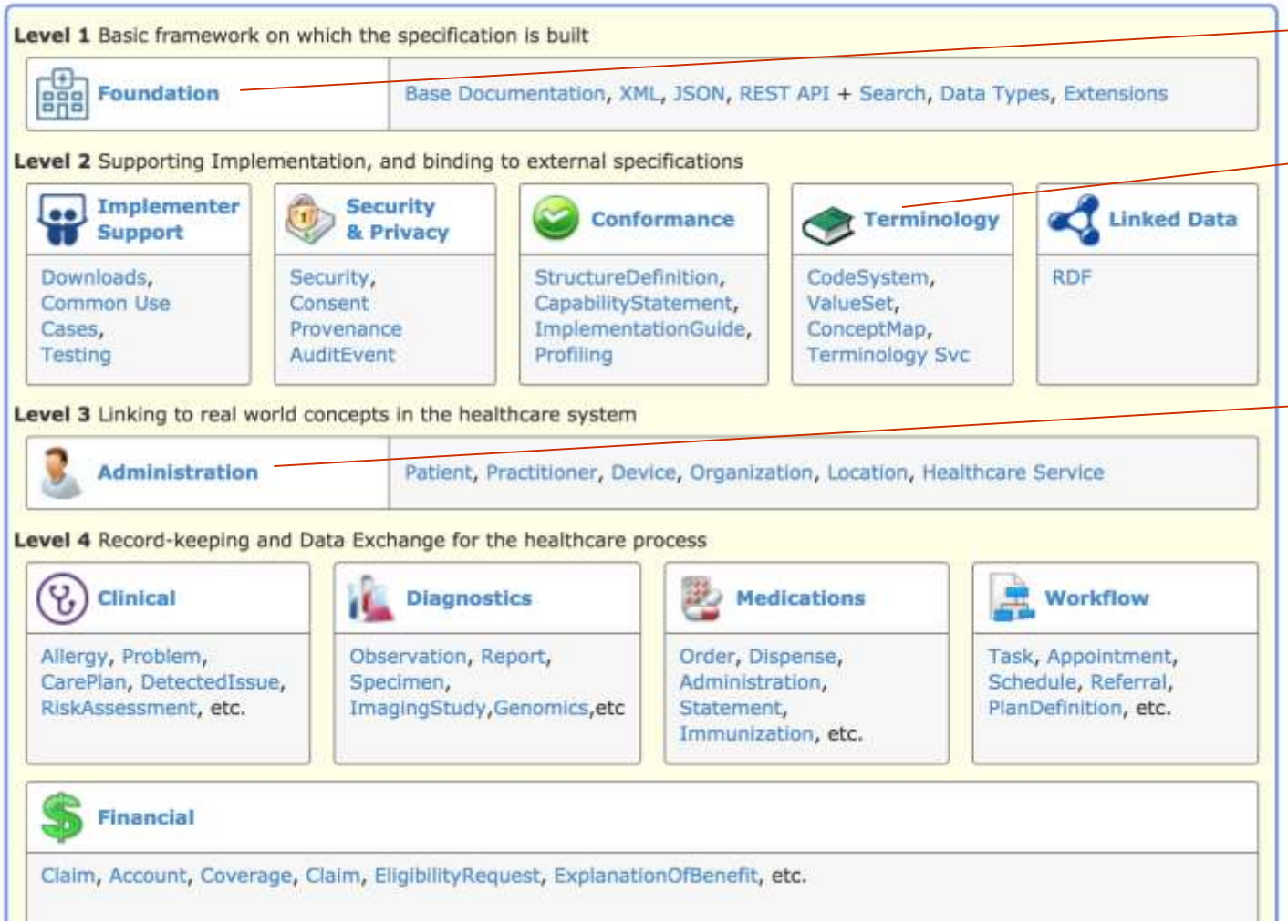
FHIR Manifesto

- Focus on **Implementers**
- Target support for **common scenarios**
- Leverage cross-industry **web technologies**
- Require **human readability** as base level of interoperability
- Make content open and **freely available**
- Support multiple **paradigms** & architectures
- Demonstrate best practice **governance**

Implementer Focus

- Specification is written for one target audience: implementers (that's not just programmers)
  - Rationale, modeling approaches, etc. kept elsewhere
- Publicly available test servers
- Starter reference implementations published with spec
  - Java, C#, Pascal, XML, JavaScript, and Swift
- Connectathons to verify specification approaches
- Instances you can read and understand ☺
- Lots of examples (and they're valid too)

FHIR Modules



How will information be exchanged?

How are terminologies being used?

The base data that the other modules link to for clinical content

FHIR standards development process

Draft (DSTU)

- Draft standard for trial use. Not considered complete and still in the 'in development' stage and probably has known issues. Use at your own risk!

Trial Use (STU)

- Standard for trial use. Considered complete, well-reviewed, and approved as an official standard. Note that all aspects of the specification are potentially subject to change. FHIR is currently at release 3 STU.

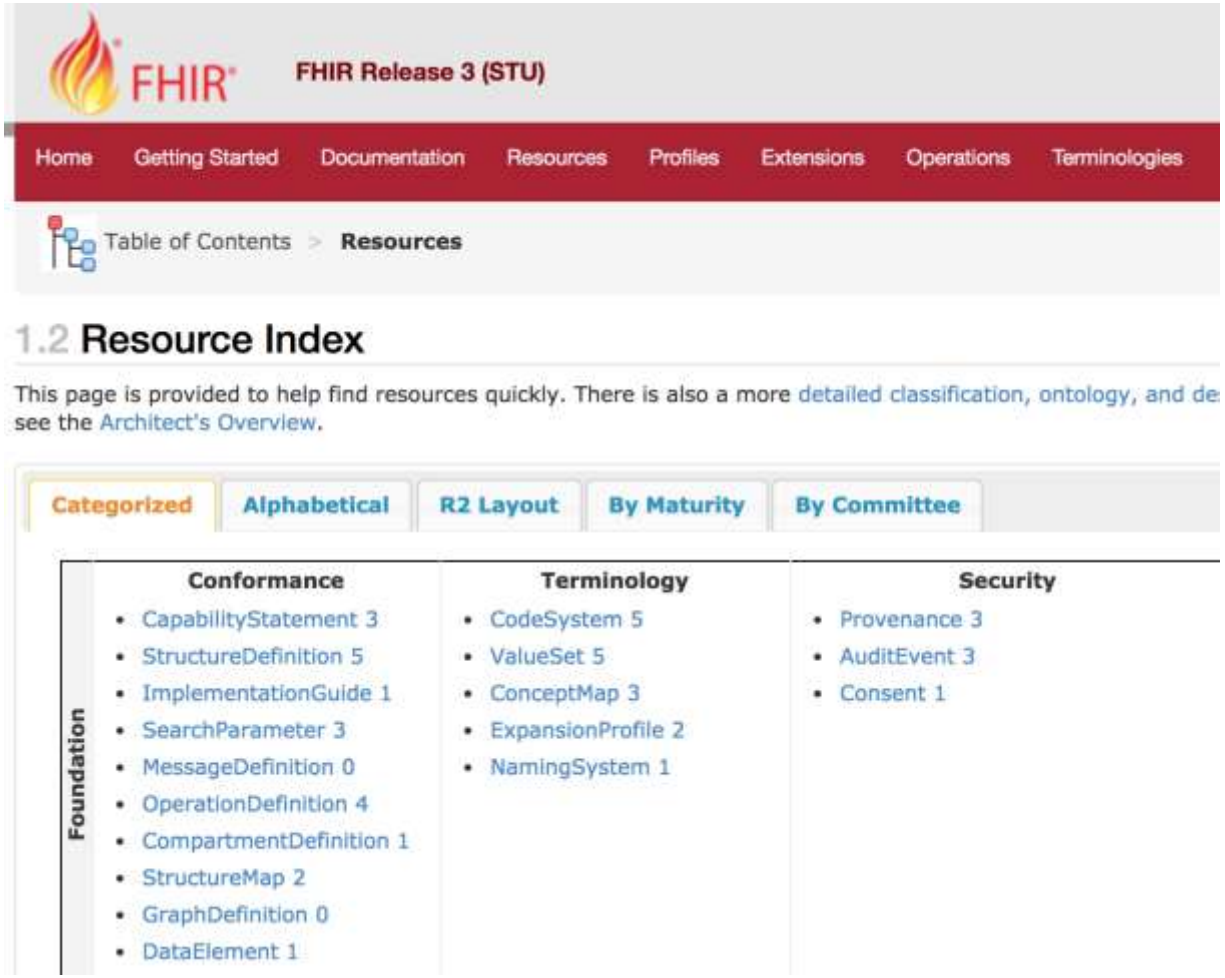
Normative

- Normative is considered to be stable and in production in a wide variety of environments. The content will be 'locked'. Changes are possible, but are infrequent and tightly constrained. Important to note that only portions of the standard will be moved to the normative state based on a maturation model.

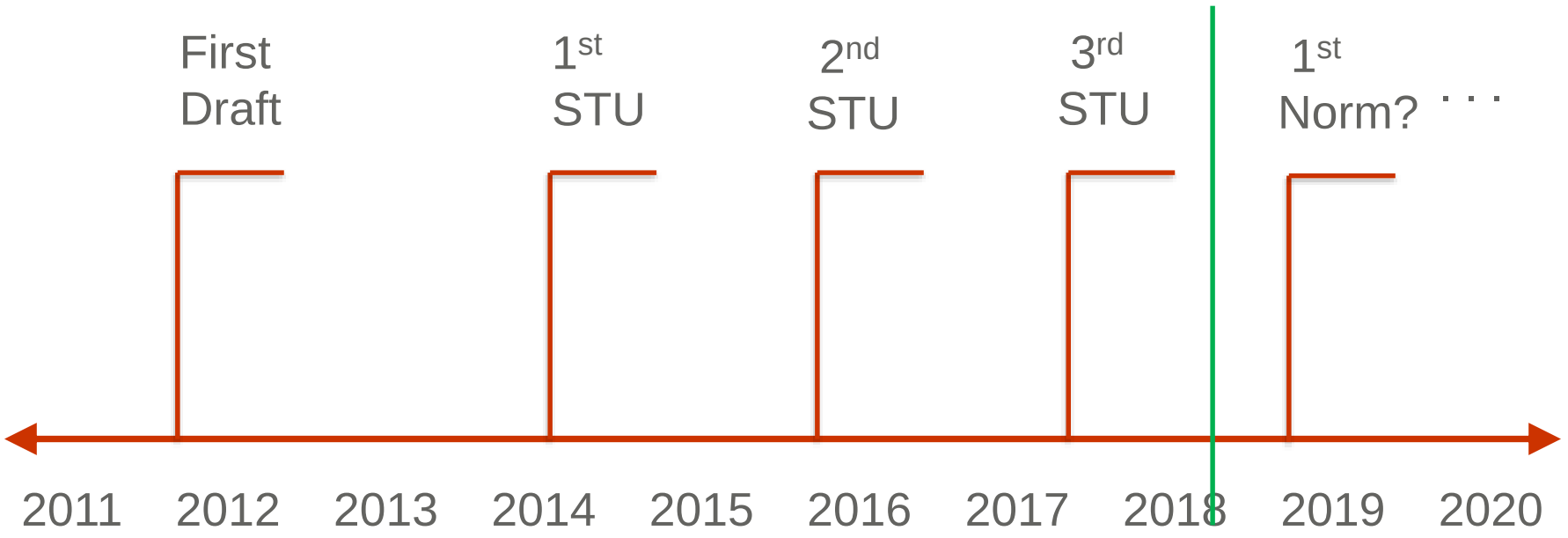
Maturity levels

- Intended to indicate level of stability
  - 1 – Resource is “done”, no build warnings
  - 2 – Tested at approved Connectathon
  - 3 – Passes QA, has passed ballot
  - 4 – Tested across scope, published, prototype implementation
  - 5 – Distinct production implementations, multiple countries

Maturity levels (con'd)



FHIR timeline (planned)



What is a Resource?

Examples

- Administrative
  - Patient, Practitioner, Organization, Location, Coverage, Invoice
- Clinical Concepts
  - Allergy, Condition, Family History, Care Plan, Observation (diagnostic)
- Infrastructure
  - Document, Message, Profile, Conformance

Non-examples

- Gender
  - Too small
- Electronic Health Record
  - Too big
- Blood Pressure
  - Too specific
- Intervention
  - Too broad

Human Readable

- Resources have both data and narrative
- The data / narrative dynamic exists throughout the process
- In FHIR, **every** resource can (should) have a human-readable summary
  - Can be direct rendering or human entered

```
<Patient xmlns="http://hl7.org/fhir">
  <id value="glossy"/>
  <meta>
    <lastUpdated value="2014-11-13T11:41:00+11:00"/>
  </meta>

  <text>
    <status value="generated"/>
    <div xmlns="http://www.w3.org/1999/xhtml">
      <p>Henry Levin the 7th</p>
      <p>MRN: 123456. Male, 24-Sept 1932</p>
    </div>
  </text>

  <extension url="http://example.org/StructureDefinition/trials">
    <valueCode value="renal"/>
  </extension>

  <identifier>
    <use value="usual"/>
    <type>
      <coding>
        <system value="http://hl7.org/fhir/v2/0203"/>
        <code value="MR"/>
      </coding>
    </type>
    <system value="http://www.goodhealth.org/identifiers/mrn"/>
    <value value="123456"/>
  </identifier>
  <name>
    <family value="Levin"/>
    <given value="Henry"/>
    <suffix value="The 7th"/>
  </name>
  <gender value="male"/>
  <birthDate value="1932-09-24"/>
  <careProvider>
    <reference value="Organization/2"/>
    <display value="Good Health Clinic"/>
  </careProvider>
  <active value="true"/>
</Patient>
```

Identity & Metadata

Human Readable Summary

Extension with reference to its definition

Standard Data Content:

- MRN
- Name
- Gender
- Date of Birth
- Provider

FHIR Solutions

Resources

+

Extensions

=

Solution

Support "Common" Scenarios

- Inclusion of content in core specification is based on "80%" rule
  - Only include data elements we are confident that most (~80%) of normal implementations will make use of.
  - Other content in extensions (more on this later)
- Resources are simple and easy to understand

Won't extensions break interoperability?

- The 80% + narrative helps provide "base" interoperability
- For "best practices" interoperability
  - **Profile** – constrains structure for particular use cases that are important enough to be described as part of the specification itself. Registry available.
  - **Conformance** – constrains behavior and needed to claim "I'm FHIR conformant"

Web technologies

- FHIR makes no assumptions about the architectural design of systems
- Resources are shared using JSON & XML
- FHIR relies on HTTPS and OAuth 2.0 for security functions. It should be noted that FHIR is not a security protocol, nor does it define any security related functionality.
  - However, specific resources are defined that support audit functionality, digital signatures, etc

What is a RESTful API?

- What's an API?
  - A set of routines, protocols, and tools for building software applications. An API specifies how software components should interact.
- What's a RESTful API?
  - Representational State Transfer, or RESTful APIs, provide interoperability between computer systems on the Internet.
  - It's basically an HTML API built for the Internet. Compared to other web APIs (SOAP, RPC), they're simple, but somewhat limited in functionality.

FHIR and REST APIs

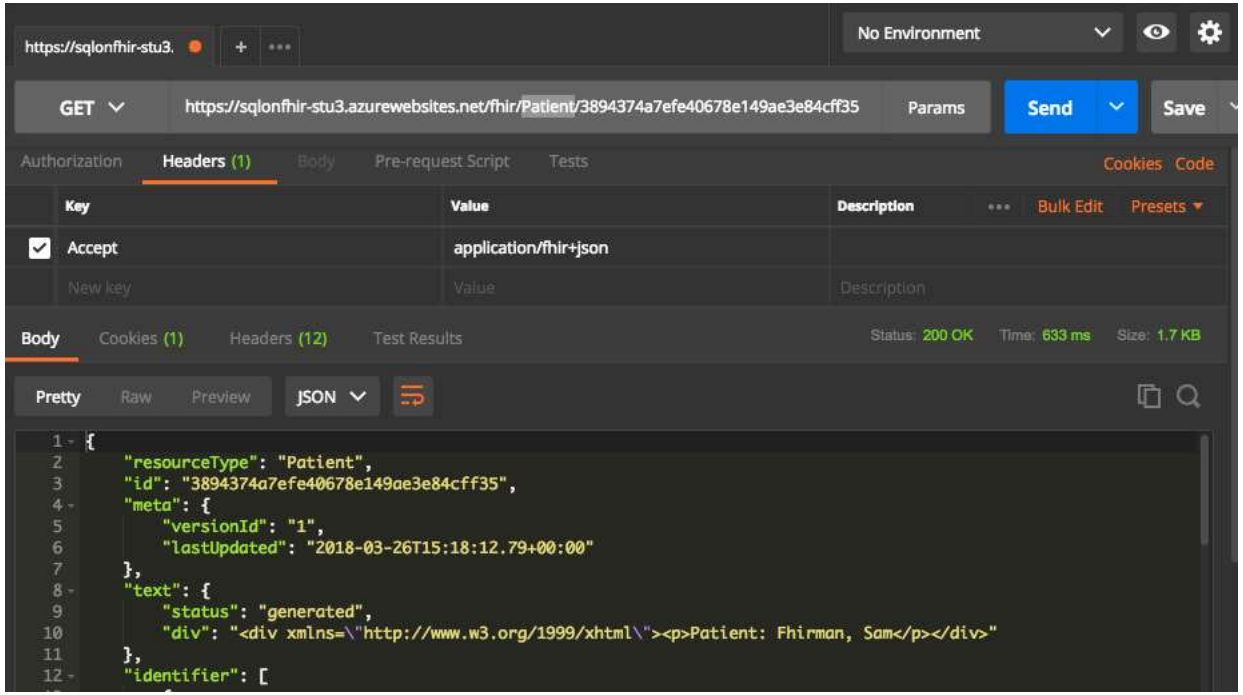
- FHIR provides the means to create RESTful APIs
  - FHIR, combined with RESTful APIs, addresses some of the new use cases such as web, mobile, and cloud. It leverages the web stack. Think interoperability!
  - HIPPA (Health Insurance **Portability** and Accountability Act of 1996).
    - Portability (noun): the ability to be easily carried or moved.
    - The ability of data to be transferred from one machine or system to another.

What can REST APIs do?

- After a REST client authenticates and authorizes with a REST API, it can typically:
  - POST – Create a specified resource
  - GET – Read data from a specified resource
  - PUT – Update a specified resource
  - DELETE – Delete a specified resource
- To use this functionality, a person only needs a REST client and FHIR server.

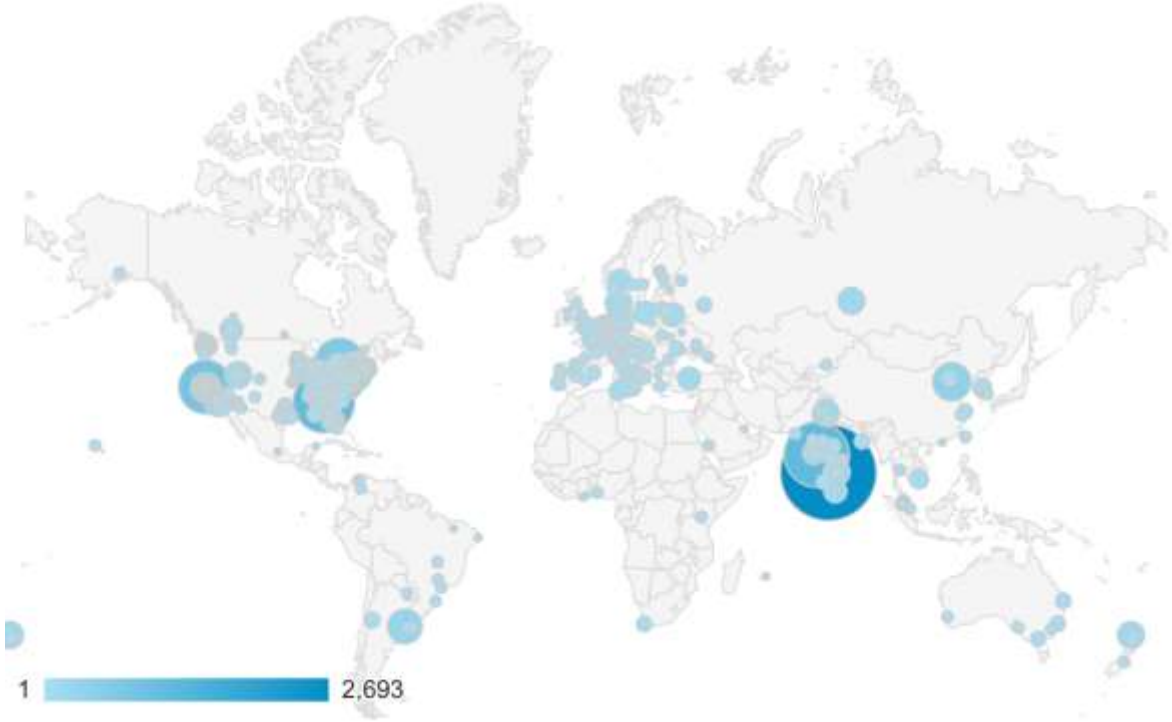
Getting Started

- Install a REST client such as Postman or Advanced REST client (Google Chrome).
- Access a publicly available FHIR server with the REST client.



Who is using FHIR?

- 25+ countries – broad international interest
  - Apple
  - Google
  - Cerner
  - Epic
  - McKesson
  - Allscripts
  - etc…



EHR Vendors

- Many significant EHR vendors have made commitments to advance FHIR
- Voluntarily investing in accelerating the standard
  - Argonaut Project – A private sector initiative to advance industry adoption of modern, open interoperability standards.
  - SMART Health IT – An open, standards based technology platform that enables innovators to create apps that seamlessly and securely run across the healthcare system. For example, they have provided an OAuth 2.0 profile for authorizing apps to access FHIR data within EHR vendor software.

Future impact of FHIR

- FHIR is a disruptive technology
  - Easier to develop
  - Easier to troubleshoot
  - Easier to leverage in production
- Freeing data will enable new business models and new companies. This will spur innovation.
- Competing approaches will have to match the cost, or disappear. The effect is already being felt across the industry.

FHIR as a replacement

- Yes, FHIR has the **potential** to supplant HL7 v2, v3, and even CDA.
- **However**
  - It's probably not going to do so right away.
  - HL7 will support existing product lines so long as the market needs them.
  - Note that HL7 has already developed FHIR profiles for CCDA.
  - HL7 is still offering certification exams for v2, v3, and CDA. And FHIR STU3, of course. ☺

So why use anything else?

- FHIR is relatively new
  - Minimal market share
  - Not yet normative
  - Limited track record
- Business case
  - No one dumps existing working systems just because something new is “better”
  - Most large projects committed to one standard won’t change direction quickly (or even at all)

Risks with FHIR

- FHIR is relatively new
  - Be ready to migrate
  - Caution for mission critical applications
- FHIR is cool
  - Be realistic about what's achievable
  - Work with HL7 to build and register profiles
- FHIR is coming
  - At minimum, monitor
  - Consider whether to pilot to build experience

Next Steps

- Is this something your organization wants/needs to track?
- Monitor
  - Have someone become a member of the **HL7 FHIR Foundation**, the primary community for FHIR implementers.
    - http://www.fhir.org/
- Engage
  - Have someone read through the specs
  - Send someone to development tutorials
  - Have your organization participate in or observe a connectathon
  - Participate in the upcoming STU ballot

Final message

- What's needed is the standard use of terminology and codes to ensure that systems are semantically interoperable.
- FHIR
  - is easier and less expensive to implement
  - is being implemented now
  - is likely to significantly impact health IT
- Decide how you want it to impact **your** organization

Thank You!

http://hl7.org/fhir

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