Transactions to Transformation

Powered by Lantana

Disclaimer

Conference presentations are intended for educational purposes only and do not replace independent professional judgment. Statements of fact and opinions expressed are those of the participants individually and, unless expressly stated to the contrary, are not the opinion or position of the Workgroup for Electronic Data Interchange, its cosponsors, or its committees. The Workgroup for Electronic Data Interchange does not endorse or approve, and assumes no responsibility for, the content, accuracy or completeness of the information presented.

Speaker Information

Rick Geimer

- Co-Chair FHIR Infrastructure Working Group
- Former Co-Chair Structured Documents Working Group
- Member of CDA Management Group, SDWG, and Attachments workgroups
- HL7 CDA R2 Certified Specialist
- Co-Editor, CDA Consolidation and many other Implementation Guides
- Lead: C-CDA on FHIR project
- Day job: Lantana Chief Innovation Officer
- rick.geimer@lantanagroup.com

Lantana Consulting Group

Mission:
- Improve healthcare through health information technology (IT)
- Lead the industry through our consulting and volunteer practice

Services:
- Software & standard development & implementation
- Terminology, data governance, and education
- Strategic advice for health IT planning, design, and purchasing

Agenda

- Overview
- Working with patient demographics
- X12 and FHIR
- Understanding FHIR Implementation Guides (IGs) and Profiles
- Industry efforts creating IGs
  - Argonaut
  - US Core (USCDI)
  - Da Vinci
- Lunch
- Demonstrations and Q/A

Session Overview

- FHIR Connectathon
  - Hand's-on live event, usually involving some programming
  - Typically 2 full days, in person
  - Many show up knowing little about FHIR, leave with working source code
- Today's Session
  - Connectathon-ish
  - Half day
  - Hands off if you want, but can follow along on computer, or even phone
  - Should leave knowing how to fish in the FHIR pond

FHIR Experience Prerequisites

This sessions assumes some FHIR implementation experience:

- What is FHIR
- Exposure to RESTful APIs and CRUD operations
- Resources
- Code Systems (ICD-10, LOINC, SNOMED, etc.)
- Identifiers (MRN, SSN, etc.)
- Basic knowledge of XML and/or JSON

Tools (if you want to follow along)

- Normal folks
    - Pen and paper
    - Web browser
    - HAPI user interface (if using phone, may need to request desktop site)
    - http://fhirtest.uhn.ca/
- Overachievers
    - Text Editor or XML/JSON editor
    - REST Client (Postman, etc.)

Guided Exercise: Patient Demographics using FHIR

- Search for Patient resources (example: Patient?name=John)
- Read (GET) one of those Patient resources
- Copy the XML or JSON for that Patient
- Create a new Patient resource using that XML/JSON, but change the last name
- Note the location header returned, that will have the new ID
- Read (GET) your new Patient resource
- Change something (name, date of birth, gender, etc.) and update (PUT) the resource
- View the version history of your resource
- Delete (DELETE) your resource
- Attempt to read the deleted resource (what happens?)
- Revive your DELETED resource

FHIR and X12

X12 and HL7

- An agreement between X12 and HL7 is in progress
- Nothing final yet, but some likely outcomes:
    - FHIR to X12 mappings
    - Allowing X12 terminology in FHIR resources
    - Not so much a technical problem as an IP problem
- Some Da Vinci IGs (for example Prior Auth) require FHIR to X12 transformations for HIPAA compliance

FHIR Content in X12 Transactions

- FHIR Content can appear as Base64 encoded data in X12 Transactions

- Example:
  - A Base64 Encoded FHIR Resource in the Binary Data Segment (BDS) of an X12 275 transaction

Base 64 Encoded FHIR Content

X12 275

TWFuIGlzIGRpc3Rpbmd1aXNoZWQsIG5vdCBvbmx5IGJ5IGhpcyByZWFzb24sIGJ1dCBieSB0aGlzIHN
pbmd1bGFyIHBhc3Npb24gZnJvbSBvdGhlciBhbmltYWxzLCB3aGljaCBpcyBhIGx1c3Qgb2YgdGhlIG
1pbmQsIHRoYXQgYnkgYSBwZXJzZXZlcmFuY2Ugb2YgZGVsaWdodCBpbiB0aGUgY29udGludWVkIGFuZ
CBpbmRlZmF0aWdhYmxlIGdlbmVyYXRpb24gb2Yga25vd2xlZGdlLCBleGNlZWRzIHRoZSBzaG9ydCB2
ZWhlbWVuY2Ugb2YgYW55IGNhcm5hbCBwbGVhc3VyZS4=
…..

ST*275*1001*006020

BGN*11*0001*20120

NM1*PR*2*ABC INSUR

NM1*41*2*XYZ SERVI

NM1*1P*HOLY HILLS HOSP*****XX1666666666~

NX1*1P~

N3*2345 WINTER BLVD~

N4*MIAMI*FL*33132~

NM1*QC*1*JACKSON*JACK*J***MI*987654320~

REF*EJ*JACKSON123~

REF*EA*STHHL12345~

DTP*472*D8*20111229~

LX*1~

TRN*2*1822634840~

STC*R4:11490-0:20120103:LOI*20120103~

DTP*368*D8*20120110~

CAT*AE*MB~

OOI*1*47*ATTACHMENT~

BDS*ASC*6289*……… <BASE 64 ENCODED CDA GO

SE*27*1001~

Unencoded FHIR Content

```
<DocumentReference xmlns="http://hl7.org/fhir">
   <id value="25"/>
   <identifier>
      <system value="urn:ietf:rfc:3986"/>
      <value value="urn:uuid:e9f61375-cc32-43e0-98b9-d5e15767bbf0"/>
   </identifier>
   <status value="current"/>
   <type>
      <coding>
         <system value="http://loinc.org"/>
         <code value="34117-2"/>
         <display value="History and Physical"/>
      </coding>
      <text value="History and Physical"/>
   </type>
…
</DocumentReference>
```

Understanding FHIR Implementation Guides and Profiles

Why Create IGs?

- The base FHIR Specification is generic and has international scope.

- The specification focuses on defining capabilities, and creating an ecosystem.

- IGs constrain and tailor the base spec for particular data exchanges, or to solve particular problems.

- Examples include:
  - National standards
  - Vendor consortiums
  - Clinical societies

Key Content of IGs

- Prose Documentation
- Profiles
- Extensions
- Terminology
- Operations
- Capability Statements
- Examples
- Downloads

- The look and feel of current FHIR IGs often differ widely
- HL7 is has developed a common IG publishing template, but it is still in testing and not required yet

The FHIR IG Registry

Allows searching for IGs based on

- Free text
- Category
- Organization (Authority)
- Country
- FHIR version

https://registry.fhir.org/guides

FHIR Profiles

- FHIR is generic and international in scope
  - Most data elements are optional out of the box
  - Most CodeableConcept fields do not require specific terminologies
  - Some data elements did not meet FHIR's 80/20 rule and thus are not in the base spec, requiring extensions
- Profiling address these issues to meet
  - National exchange requirements
  - Use case or specialty specific requirements
  - Custom organizational requirements

Profiling Process Overview

Create StructureDefinition resource

Populate profile metadata   Name, URL, description, etc.

Add constraints   Cardinality, terminology, etc.
Most of the work is in this step.

Create conforming example instance (optional)

Validate (optional)

Add to IG and publish (optional)

Adding Constraints

ADJUSTING
CARDINALITY

TERMINOLOGY
BINDING

SLICING

MUST-SUPPORT

CREATING/ADDING
EXTENSIONS

Cardinality

Represents the minimum and maximum values for a given property

Most FHIR properties are optional (min = 0)

Profiles can make

- Optional items required

- Repeating items singular

Profiles cannot make

- Required items optional

- Singular items repeating (except via extensions)

Common cardinalities:

- zero or one [0..1]

- exactly one [1..1]

- at least one [1..*]

- zero or more [0..*]

- at least one and not more than n [1..n]

Name	Flags	Card.	Type
Patient	N		DomainResource
identifier	Σ	0..*	Identifier
active	?! Σ	0..1	boolean

Terminology Binding

Identifies the allowable codes for a coded field

Binding options

- Fixed
  - Typically single code/system, everything not specified is prohibited (e.g. display)
- Pattern values
  - Typically single code/system, everything not specified is allowed
- ValueSet
  - Binding to a ValueSet resource (i.e. a list of codes that can be validated)
- Binding strength
  - Options: required, extensible, preferred, or example
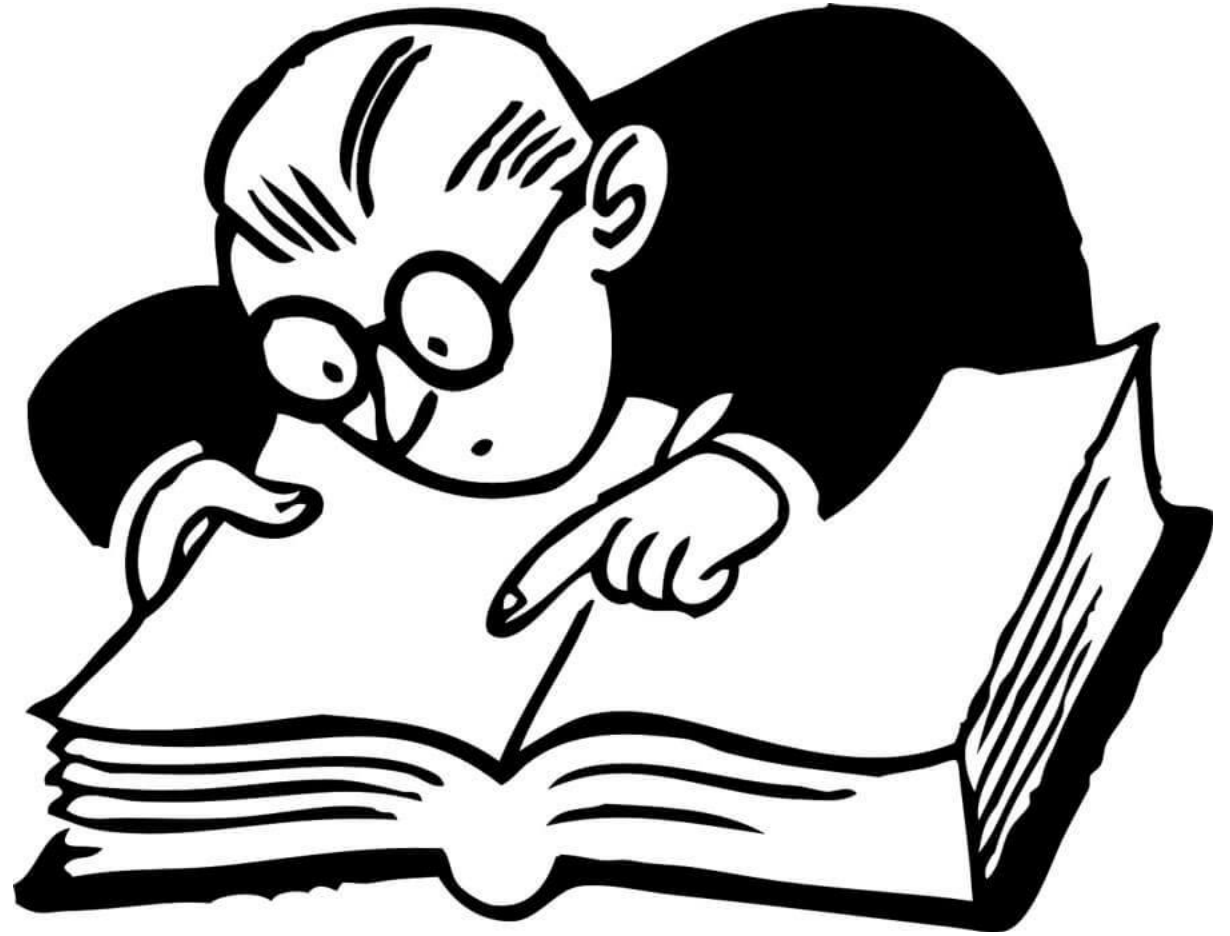
Slicing

Takes a repeating element and splits it into sub-lists with different restrictions

It's like ordering a cake with one slice chocolate, another slice raspberry, etc.
Example: Practitioner.identifier is 0..*, but you can use slicing to say "one of those identifiers must be an NPI"

Must Support

Means implementers SHALL provide "support" for the element in some meaningful way

Often used for items that we want to require, but for which data sometimes does not exist (e.g. allergies)

Extensions

FHIR uses the 80/20 rule to identify what goes in the core spec.

Everything else can be defined as an extension

This keeps the spec manageable

All use cases are expected to require some extensions

Extensions are defined with StructureDefinition resource, just like profiles are.

Key Resources for Profiling

- StructureDefinition
- ValueSet
- CodeSystem

Profiling and Validation

- All FHIR Resources can and should be validated.

- Validation can be done against the base FHIR specification as well as against any profile, and the terminology required in either.

- FHIR provides several validation mechanisms.

Validation Overview

- Validation checks:

  - Structure: Check that all the content in the resource is described by the specification, and nothing extra is present

  - Cardinality: Check that the cardinality of all properties is correct (min & max)

  - Value Domains: Check that the values of all properties conform to the rules for the specified types (including checking that enumerated codes are valid)

  - Coding/CodeableConcept bindings: Check that codes/displays provided in the Coding/CodeableConcept types are valid

  - Invariants: Check that the invariants (co-occurrence rules, etc.) have been followed correctly

  - Profiles: Check that any rules in profiles have been followed (including those listed in the Resource.meta.profile, or in CapabilityStatement, or in an ImplementationGuide, or otherwise required by context)

FHIR Server Validation

- Ask a FHIR server to validate a resource either on the server or provided with an HTTP request.
- Invoking the $validate operation:
- URL: [base]/[Resource]/$validate
- URL: [base]/[Resource]/[id]/$validate
- Can use meta.profile tag in the resource or a profile parameter passed to the $validate operation to validate against a profile.
- Returns an OperationOutcome resource with the results of the validation.

- Example:
- GET /open/Patient/example-patient$validate ?profile=http://hl7.org/fhir/us/core/StructureDefinition/us-core-patient

The FHIR Validator

- A downloadable Java program for validating resources
- Invoking the validator:
- java -jar org.hl7.fhir.validator.jar [params]
- Can use meta.profile tag in the resource or a profile parameter passed to the $validate operation to validate against a profile.
- Key parameters:
- -version: the version of the FHIR specification to use
- -profile: the URL of a profile to validate against
- -ig: the URL of an implementation guide to validate against
- Full details:
- https://wiki.hl7.org/index.php?title=Using_the_FHIR_Validator

Other Validation Options

- XML Schema and Schematron files

- The core FHIR spec contains XML Schema files than can validate against the base spec.

- http://hl7.org/fhir/fhir-all-xsd.zip

- The FHIR IG publishing process also generates Schematron for profiles, but it is not often used (easier to use the FHIR validator or $validate)

- Validation in tools and reference implementations

- Profiling tools often have integrated validation

- Reference implementations (.Net, Java, etc.) have validation methods that can be called programmatically

Industry Efforts Creating IGs

The Argonaut Project

- Consortium of EHR vendors and providers
- Created in response to 2014 JASON Task Force recommendations, calling for FHIR-based APIs for data exchange
- Creates FHIR® IGs addressing functions such as data query, scheduling, clinical notes, bulk data, etc.
- Driver behind ONC's US Core Data for Interoperability (USCDI) initiative
- Initial work included C-CDA to FHIR mappings, but did not create an IG or implementable profiles for clinical documents
- Does not address payer use cases: claims, coverage, prior-authorization, etc.

Argonaut Project – IGs

Published

- SMART App Authorization Guide
- Data Query
- Provider Directory
- Scheduling
- CDS Hooks
- Questionnaire
- Clinical Notes

In Progress

- Subscriptions
- CDS Hooks for PAMA
- Argonaut R4
- Provenance

Argonaut – SMART App Authorization Guide

- The SMART App Launch Framework connects third-party applications to Electronic Health Record data, allowing apps to launch from inside or outside the user interface of an EHR system.

- Use Cases:
  - Patients apps that launch standalone
  - Patient apps that launch from a portal
  - Provider apps that launch standalone
  - Provider apps that launch from a portal

Argonaut – Data Query IG

- Based on FHIR® DSTU2 API

- Documents the security and authorization and the querying of the ONC Common Clinical Data Set and static documents.

- Use Cases:
  - Patient uses provider-approved web application to access health data
  - Patient uses provider-approved mobile app to access health data
  - Clinician uses provider-approved web application to access health data
  - Clinician uses provider-approved mobile app to access health data

Argonaut – Provider Directory IG

- Based on FHIR® STU3 API

- Contains the foundation to create a robust provider directory.

- Use Cases:
  - Search for Practitioner by demographics
  - Search for Practitioner within a region (city, state)
  - Search for Organization and facility by:
  - Search for Practitioner by organization relationships

Argonaut – Scheduling IG

- Based on FHIR® STU3 API

- Defines a series of interactions that cover the basic appointment creation workflow for patient-based scheduling, which includes:
  - Registration of patients and updating coverage information
  - Discovery of available appointments
  - Booking the cancelling appointments

- Use Cases:
  - Patient portal scheduling for existing Patients
  - Open scheduling for new Patient or existing Patient
  - Prefetching open slots

Argonaut – CDS Hooks IG

- Can be designed to fit FHIR® STU3 or FHIR® R4 APIs

- CDS Hooks specification that describes a "hook"-based pattern for invoking decision support from within a clinician's workflow

- Use Cases:
  - Synchronous, workflow-triggered CDS calls returning information and suggestions
  - Launching a user-facing SMART app when CDS requires additional interaction

Argonaut – Questionnaire IG

- Based on FHIR$^®$ STU3 API

- Provides a FHIR RESTful API for implementers and guidance to create, use, and share between organizations the standard assessment forms and the assessment responses.

- Use Cases:
  - Static Forms (standard set of questions with no deviation based on response)
  - Adaptive Forms (questions that are given based on previous responses)

Argonaut – Clinical Notes IG

- Based on FHIR® STU3 API

- Provides implementers with FHIR® profiles and guidance to create, use, and share Clinical Notes.

- Use Cases:
  - Argonaut Clinical Notes Profile which is based upon the DocumentReference resource
  - Argonaut Diagnostic Report Profile for Report and Note exchange which is based upon the DiagnosticReport resource

US Core/USCDI IG

- Based on the Argonaut various requirements (Data Query, Clinical Notes …)

- Versions on FHIR® STU3 and R4

- Live walkthrough
  - http://hl7.org/fhir/us/core/

HL7 Da Vinci Project - Overview

- See other slide deck

Demonstrations

Da Vinci CDex Reference Implementation

- Deployed on the Logica Sandbox
  (formerly the HSPC Sandbox)
  - https://sandbox.hspconsortium.org
  - Backed by live FHIR servers (HAPI)
    https://api.logicahealth.org/DaVinciCDexPayer/open
    https://api.logicahealth.org/DaVinciCDexProvider/open

- Create a CommunicationRequest resource as a payer
  - Request additional information

- Respond with a Communication resource as a provider
  - Respond with that information, automatically populated by a FHIR query

HL7 FHIR Collaboration Tools

- Zulip
  https://chat.fhir.org

- Confluence
  https://confluence.hl7.org

- JIRA
  https://jira.hl7.org

Questions?