

HL7 and FHIR: The New Standard for Health Exchange Interoperability

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Lantana

CONSULTING GROUP

About Us

Liora Alschuler

- Long-time activist developing, promoting interoperability
- Day job: Lantana CEO

Rick Geimer

- Developer of standards & software, HL7 CDA-on-FHIR Lead
- Day job: Lantana CTO

Agenda

Local Liora

- Standards Landscape 2015
- FHIR in Context

Remote Rick

- FHIR Fundamentals
- Current Work and Status of the Draft Standard

Local Liora

- Is your Roadmap on FHIR?
- Wrap

Both

- Q&A

Standards Landscape 2015

Liora Alschuler

In the Beginning...

Good old HL7 V2

- Proprietary, idiosyncratic syntax
- Fixed field
- Z-segments for extensibility

Did well enough

- Interfaced early administrative, clinical systems with administrative data (ADT)
- Labs – sort of, still struggling with standard coding
- Some registries (immunization, for example)

Did poorly or not at all

- Clinical decision support
- Claims adjudication (attachments)
- Extra-enterprise continuity of care
- Not to mention value-based care

Move to Non-Healthcare-Specific Methods

Extensible Markup Language (XML) introduced to HL7 in 1997

- Industry standard syntax, more OTS tools, validation services
- Modest advance in V2.XML
- Introduced “sparsely populated tree structure” for clinical documents
 - Rich clinical content
 - Narrative & structured data

HL7 Version 3

- Model-based
- XML default syntax
- In theory, one model/syntax/methodology for both messages & documents

Documents vs. Messages

Feature	Documents	Messages
Life cycle	Persistent	Temporal
Communication	Between people	Between applications
Relation with practitioners	Trained for creation/reading	Don't understand
Legal aspects	Recognized legal status	No recognized legal status
Definition	Best practice	Ad hoc
Context	Document level	Segmented
Completeness	Complete	Fragmented

Clinical Document Architecture (CDA)

Clinical documents

- Defined: authenticated part of clinical record, less like EDI and more like a contract
- Human readability: required
- Machine readable (coded data): option, defined by templates, per use case

“Architecture”: constrain for specific use cases

- Continuity of Care
- Discharge Summary, H&P, etc.
- Healthcare Associated Infections
- Quality Reporting...

Idiosyncratic to conform to V3 methodology

- Ideal: data imported into, exported out of documents seamlessly through V3 API
- Reality: V3 messaging impractical

Some things work well, some not so well

- Good: human readability, single stylesheet rendering, consistent metadata
- Not so well: template definition complex, narrative/coded data management difficult
- No comparable messaging/API

FHIR in Context

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FHIR

Updated to current syntax, APIs

- JSON &/or XML
- RESTful services
- Digital signature defined
- Single sign-on defined

Unified model/structure for messages, documents, APIs

CDA & FHIR



Reference Information Model

- Highly abstract
- Act, Participation, Role...



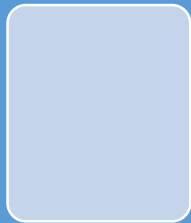
Reference Information Model

- Highly abstract
- Act, Participation, Role...



Refined Information Model

- Generic CDA
- Observation, Procedure, etc.



Templated CDA

- CCD or C-CDA or QRDA
- Allergy – Intolerance Observation, Problem Observation, etc.



Resource

- FHIR component for msg, doc
- AllergyIntolerance, Condition, etc.



Profile

- Localized resource
- DAF-AllergyIntolerance, DAF-Condition, etc.

Level of abstraction

DAF stands for Data Access Framework, a US Realm FHIR Implementation Guide

FHIR Fundamental

Rick Geimer

About REST and Resources

REST

“Representational state transfer” – an architecture for how to connect systems

Outcomes

- Simple stable interfaces
- High Performance / Scalability
- Visible Process (e.g., can debug)
- Portability
- Reliability (resistance to failure)

REST Operations

CRUD(E):

Create – create a new instance of data

Read – get the content (state) of an instance of data

Update – change the content of an instance of data

Delete – remove the instance of data

Execute – get the instance of data (?) to do something for you

FHIR Resources

Administrative

- Patient, Practitioner, Organization, Location, Coverage, Invoice

Clinical Concepts

- Allergy, Condition, Family History, Care Plan

Infrastructure

- Document, Message, Profile, Conformance

Business Operations in FHIR

Register a patient:

- Create a Patient Resource

Admit a patient:

- Create an Encounter Resource

Move a patient from one bed to another

- Find and update the encounter resource

Prepare a list of medications to administer

- Search through the medication prescriptions for a patient (and then apply logic)

The FHIR Framework

Scope - Domains

- Clinical Records
- Medication Management
- Diagnostic Ordering and Reporting
- Device management & data collection
- Appointments, Administration and Billing
- Clinical Referrals
- Decision Support
- Security / Infrastructure

Scope - Contexts

Internal Application APIs (plug-in extensibility)

Integration inside and between healthcare institutions

- Continuity of care
- Secondary data use (public health, quality, research, safety)

Health information exchanges

Internet Web Portals

National Health Records (for nations that recognize that concept)

New applications: ex: Social Web healthcare monitoring
(Healthbook)


Guide to the Specification



Current Build

[Home](#) [Documentation](#) [Implementation](#) [Resources](#) [Clinical](#) [Administrative](#) [Infrastructure](#) [Financial](#)

Home

This is the Continuous Integration Build of FHIR (will be incorrect/inconsistent at times). See the [Directory of published versions](#) 

0 Welcome to FHIR®

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](#)).

Major Sections:



General
Documentation



Implementation
& Exchange



Clinical
Resources



Administrative
Resources



Infrastructural
Resources

Guide to the Specification (cont.)

Quick links:

Documentation

- [Resource List](#)
- [JSON, XML & RDF](#)
- [REST API & Search](#)
- [Data Types](#)
- [Using Terminologies](#)
- [Extensions](#)
- [Full table of contents](#)

Implementation

- [Downloads](#)
- [Adapting FHIR for local use](#)
- [Implementation Guides](#)
- [FHIR Schemas & Schematrons](#)
- [Examples: XML, JSON](#)
- [Code: Java, C# \[↗\]\(#\), Pascal, iOS \[↗\]\(#\), JS, XML](#)
- [Common Use Cases & Profiles](#)
- [Security](#)

External Links

- [Support Links \[↗\]\(#\)](#) (StackOverflow, Forum, etc.)
- [Public Test Servers & Software \[↗\]\(#\)](#)
- [How FHIR is developed \[↗\]\(#\)](#)
- [FHIR Wiki \[↗\]\(#\)](#)
- [Implementation guide registry \[↗\]\(#\)](#)
- [Blogs that cover FHIR \[↗\]\(#\)](#)
- [Translations: Russian \[↗\]\(#\), Japanese \[↗\]\(#\)](#)

Guide to the Specification (cont.)

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:

- [AllergyIntolerance](#) 0
- [Condition \(Problem\)](#) 0
- [Procedure](#) 0
- [ClinicalImpression](#) 0
- [FamilyMemberHistory](#) 0
- [RiskAssessment](#) 0
- [DetectedIssue](#) 1

Care Provision:

- [CarePlan](#) 0
- [Goal](#) 0
- [ReferralRequest](#) 0
- [ProcedureRequest](#) 0
- [NutritionOrder](#) 0
- [VisionPrescription](#) 0

Medication & Immunization:

- [Medication](#) 0
- [MedicationOrder](#) 0
- [MedicationAdministration](#) 0
- [MedicationDispense](#) 0
- [MedicationStatement](#) 0
- [Immunization](#) 1
- [ImmunizationRecommendation](#) 1

Diagnostics:

- [Observation](#) 4
- [DiagnosticReport](#) 3
- [DiagnosticOrder](#) 1
- [Specimen](#) 1
- [BodySite](#) 0
- [ImagingStudy](#) 0
- [ImagingObjectSelection](#) 0

Identification

Individuals:

- [Patient](#) 5
- [Practitioner](#) 3
- [RelatedPerson](#) 0

Groups:

- [Organization](#) 4
- [HealthcareService](#) 0
- [Group](#) 0

Entities:

- [Location](#) 1
- [Substance](#) 0
- [Person](#) 1

Devices:

- [Device](#) 0
- [DeviceComponent](#) 0
- [DeviceMetric](#) 0

Workflow

Patient Management:

- [Encounter](#) 0
- [EpisodeOfCare](#) 0
- [Communication](#) 0
- [Flag](#) 0

Scheduling:

- [Appointment](#) 0
- [AppointmentResponse](#) 0
- [Schedule](#) 0
- [Slot](#) 0

Workflow #1:

- [Order](#) 0
- [OrderResponse](#) 0
- [CommunicationRequest](#) 0
- [DeviceUseRequest](#) 0
- [DeviceUseStatement](#) 0

Workflow #2:

- [ProcessRequest](#) 0
- [ProcessResponse](#) 0
- [SupplyRequest](#) 0
- [SupplyDelivery](#) 0

Infrastructure

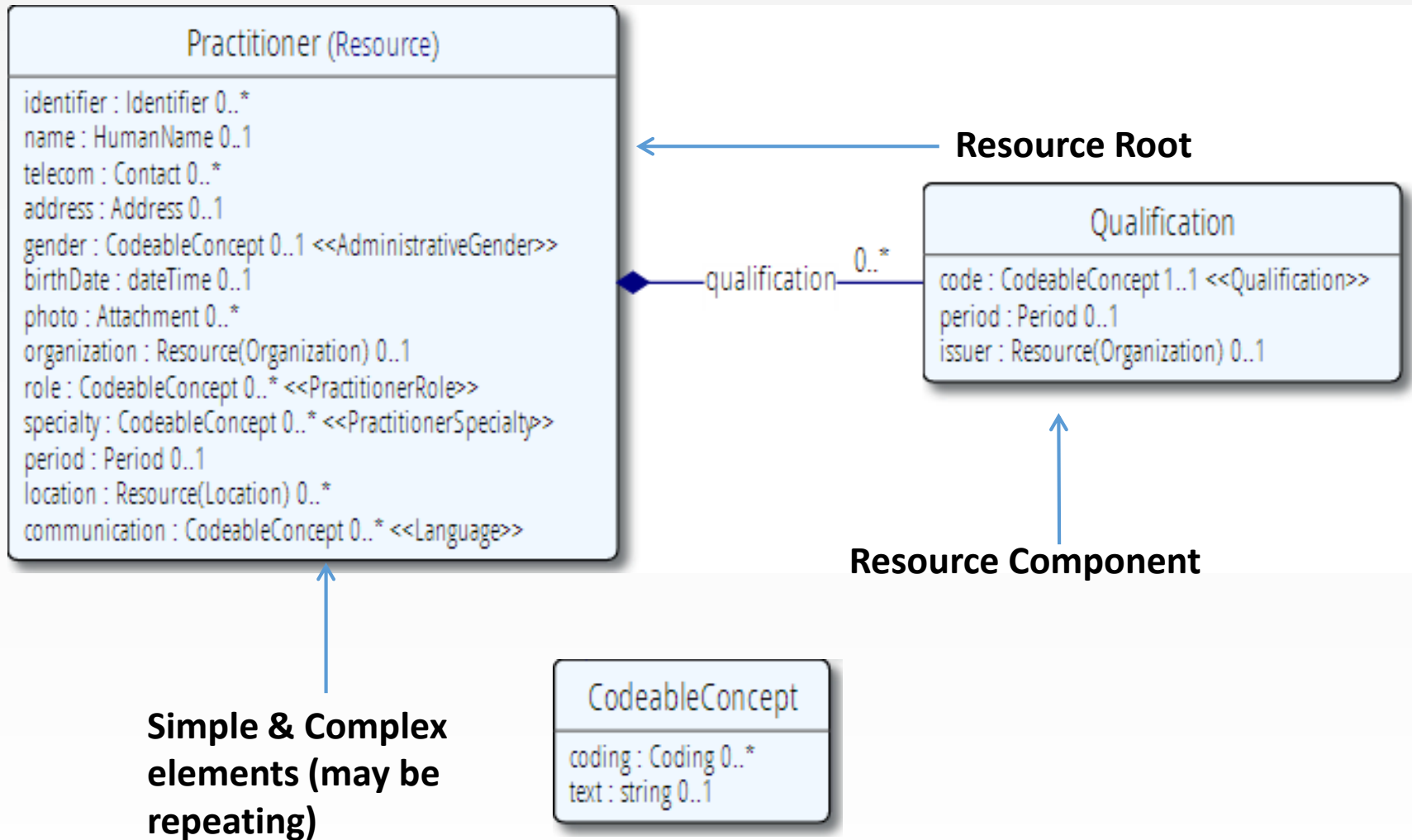
Information Tracking:

Documents & Lists:

Structure:

Exchange:

Example Resource Definition



Resource Elements

Resources are defined as an XML structure based on desired wire syntax

Hierarchy of elements

Each element has

- Name
- Either a datatype or nested elements
- Cardinality
 - All collections are nested in a containing element
- Definition
- Coded Elements: Binding to Value Set

```
<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

Extensions

FHIR has a standard framework for extensions

- V2: Z-Segments
- CDA: foreign namespaces

Every FHIR element can be extended

Every extension has:

- Reference to a computable definition
- Value – from a set of known types

Every system can read, write, store and exchange all legal extensions

All extensions are valid by schema etc.

Governing Extensions

Any system can add extensions to a resource.

That doesn't make it a good idea – they're only really useful if trading partners understand them.

FHIR has a sliding scale governance for extensions.

- Local Projects
- Domain standards (e.g., Best Practice Cardiology)
- National Standards (e.g., Standard US Realm Extensions)
- HL7 published extensions (corner cases with international scope)

What's the goal here?

In most areas of healthcare standards, there is wide variability.

- Between systems, countries, institutions, clinicians

Choices:

- Specification only supports core – no one can use it
- Specification adds everything – no one understands it
- Specification picks winners – they can use it
- Allow extensions that people can use
 - With governance arrangements

Extensions tame the specification.

Example Extension

Add "Eye Color" to patient resource:

- Pick a URL
- Choose a "type"
- Declare and publish the extension (at the URL)

```
<Patient xmlns="http://hl7.org/fhir">  
  <extension url="http://acme.org/fhir/patient#eyecolor">  
    <valueCode value="brown"/>  
  </extension>  
  ...
```

Narrative

All resources carry an html representation of their content.

It's a clinical safety issue:

- The receiver has a fall back option if the system is not sure it fully understands the content

It is not mandatory, but **SHOULD** be present.

In a closed ecosystem, with extremely tight control and strong conformance testing, it may not be necessary.

- But things often change over time
- So using narrative is highly recommended
- Saves effort when used downstream from the original author

Narrative XHTML

Narrative is XHTML

Formatting allowed:

- Tables, lists, divs, spans
- Bold, Italics, styles, etc.
- E.g., all static content

Features not allowed:

- Objects, scripts, forms – any active content
- Links, Stylesheets, iframes – web context
- Local storage, Microdata (no active content)

Concerns are security and clinical safety.

CDA on FHIR

FHIR Documents

Similar to CDA

Collection of resources bound together

- Root is a “Composition” resource
- Just like CDA header

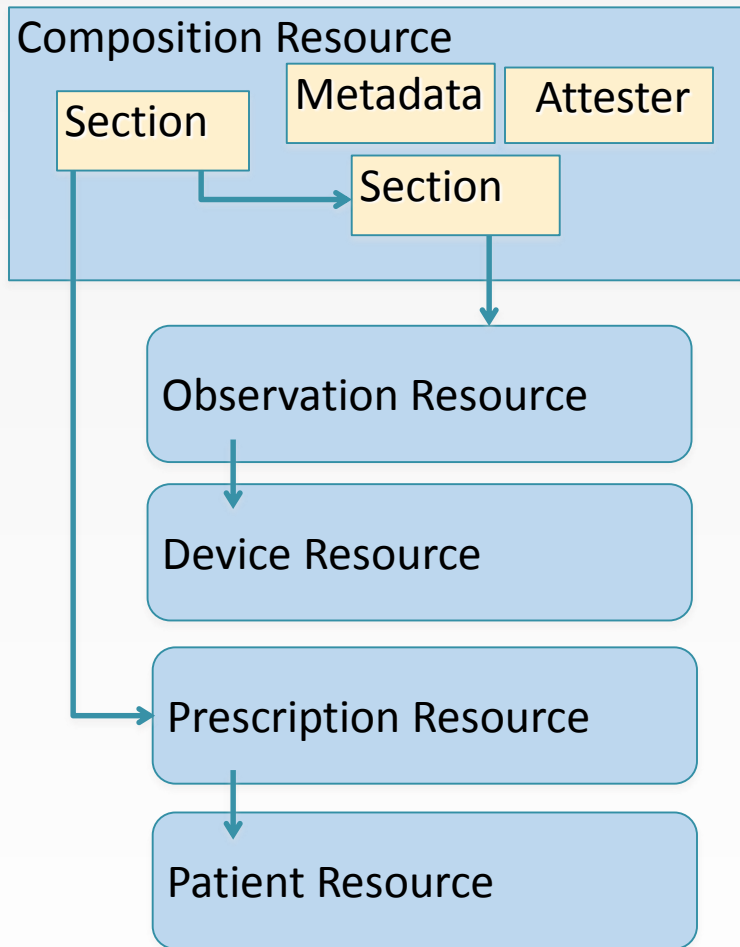
Sent as a Bundle resource

One context

Can be signed, authenticated, etc.

A FHIR document has the same obligations as a CDA document

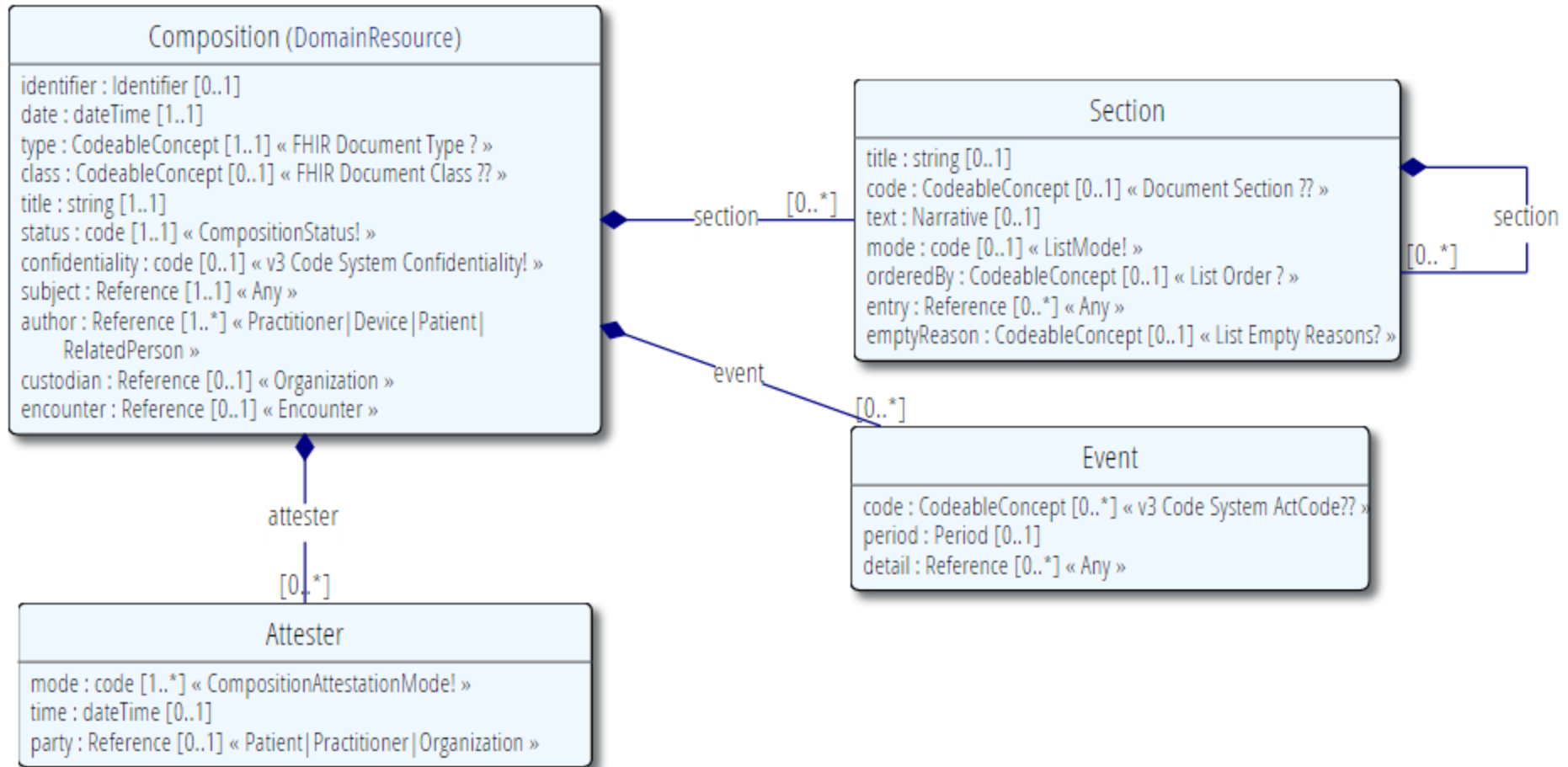
Documents – are Bundles



```
<Bundle>
  <entry>
    <Composition />
  </entry>
  <entry>
    <Observation />
  </entry>
  <entry>
    <Device />
  </entry>
  <entry>
    <Prescription />
  </entry>
  <entry>
    <Patient />
  </entry>
</Bundle>
```

Yellow arrows in the original image point from the XML elements to the corresponding resource boxes in the diagram on the left: from <Composition /> to the Composition Resource box, from <Observation /> to the Observation Resource box, from <Device /> to the Device Resource box, from <Prescription /> to the Prescription Resource box, and from <Patient /> to the Patient Resource box.

The Composition Resource



The CDA on FHIR Project

Formal project of the HL7 Structured Documents Working Group (SDWG).

Goals:

- Express the CDA use case using FHIR syntax.
- Move away from the complexities of HL7 V3.
- Ensure a unified model and API for both messages and documents.

The Argonaut Project

Goal: develop a first-generation FHIR API and Core Data Services specification for expanded information sharing of electronic health records, documents, and other health information.

Document related tasks:

- Create C-CDA to FHIR mappings
- Identify CDA/FHIR conflicts and address them in the next release of FHIR

FHIR Mapping using Composition and List	XPath	Card.	Verb	Data Type	CONF#	Value
Composition.section	section (identifier: urn:oid:2.16.840.1.113883.10.20.22.2.3)					
-	templateId	1..1	SHALL		7116	
-	@root	1..1	SHALL		9136	2.16.840.1.113883.10
Composition.section.content(List.code)	code	1..1	SHALL		15431	
-	@code	1..1	SHALL		15432	2.16.840.1.113883.6.1
Composition.section.title	title	1..1	SHALL		8891	
Composition.section.content(List.text)	text	1..1	SHALL		7118	
Composition.section.content(List.entry.item)	entry	1..*	SHALL*		7119	
Composition.section.content(List.entry.item(Observation))	organizer	1..1	SHALL		15515	Result Organizer (ider

FHIR DSTU 2 Changes

Change from Atom feed to Bundle resource as the packaging mechanism for documents.

Revamp the section narrative and coded data model to be more like CDA.

- The Composition resource now houses all sections and narrative content.
- Individual resources containing coded data are referenced from Composition.

Numerous minor fixes to address C-CDA/FHIR mapping challenges.

CDA on FHIR is now a core part of the FHIR specification.

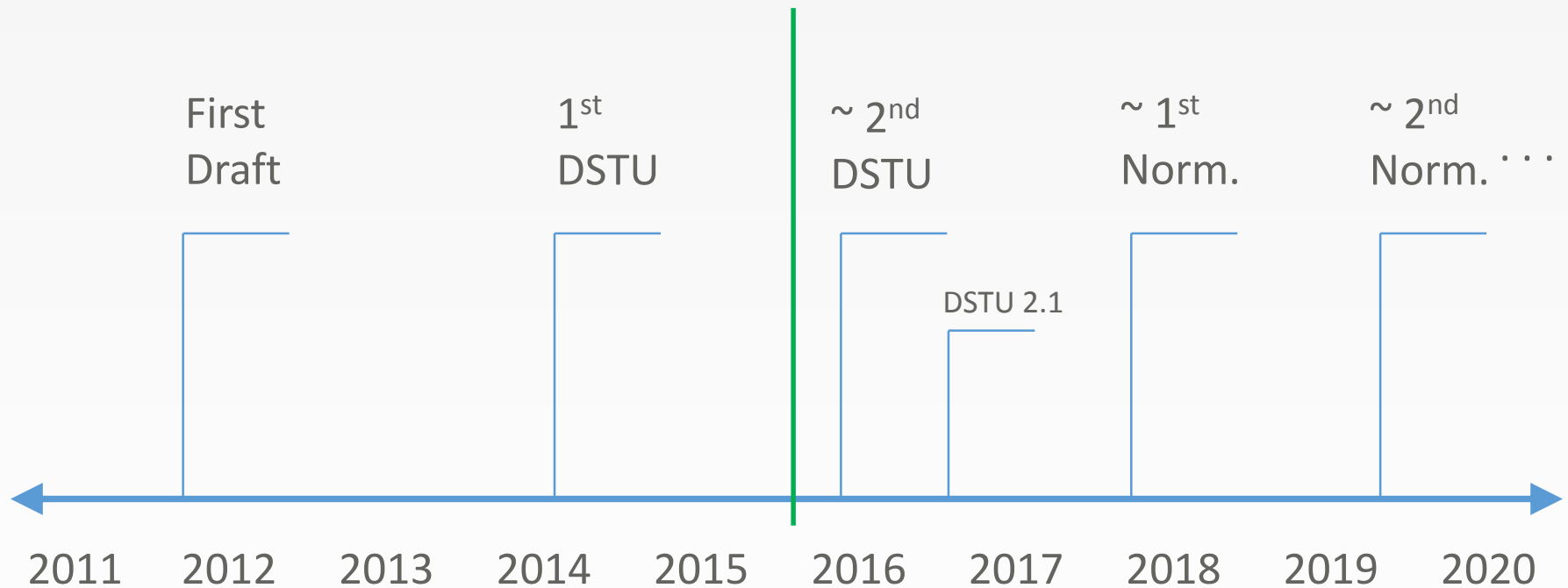
C-CDA on FHIR

- Ongoing project.
- Will take the Argonaut C-CDA to FHIR mappings and build FHIR profiles for C-CDA.
- Requires more work with HL7 Working Groups and other stakeholders.
- Next steps to be discussed at the fall 2015 HL7 Working Group Meeting.

Current Work and Status of FHIR

Rick Geimer

FHIR Timeline (planned)



DSTU 2

Publish Sept 2015

Expected content includes:

- Updates to existing content
 - Check tracker for proposal and agreed changes
- Additional capabilities
 - Publish/subscribe, Web-based “push”, Operations
- New resources
 - Referral, Coverage, Claim, Diet, Common Data Element
- Profiles for CCDA 1.1

What does DSTU mean?

1.0 FHIR Documentation Index

This page provides an index to the FHIR Documentation. In addition to this documentation, there are [implementation assistance](#) (which has important information about how practical use of FHIR), and the [list of resources](#).

Administration

Documentation Guidance / Background.

- [Full Table of Contents](#)
- [License and Legal Terms](#)
- [Community & Credits](#)
- [Version History](#)
- [Outstanding Issues](#)

Overview

Background and Tutorial Information.

- [1 page Summary \(Glossy\)](#)
- [Overview & Roadmap](#)
- **[Read prior to use \(DSTU Note\)](#)**
- Appendices:
 - [Comparison with other HL7 Specifications](#)
 - [Appendix: How FHIR fits into an EHR](#)
 - [Appendix: Coming Challenges Driving Change](#)

Resources

Underlying Definitions for Resources.

- [Formats: XML, JSON](#)
- [Extensibility \(Examples\)](#)
- [Formal Definitions](#)

Data Types

Common types used throughout FHIR.

- [Using Codes in Resources](#)
- [System List](#)
- [Value Set List](#)
- [V2 Table List](#)
- [V3 Code System / Value set List](#)
- [Mappings between Value sets](#)
- + see the [Value Set Concept Map Resources](#)

"...all aspects of the FHIR specification are potentially subject to change"

Maturity Levels

Intended to indicate level of stability of individual FHIR resources and profiles

- FMM₁ – Resource is “done”, no build warnings
- FMM₂ – Tested at approved Connectathon
- FMM₃ – Passes QA, has passed ballot
- FMM₄* – Tested across scope, published, prototype implementation
- FMM₅* – 5 distinct production implementations, multiple countries, 2

Non-compatible changes at level 4 and 5 will face increased hurdles

Normative FHIR

Will include

- Core specification
- Structural resources
- Subset of other resources
 - Some resources won't go normative right away

Future releases

- Add more resources
- Add profiles on existing resources
- May add elements to resources
 - Very rare

Where do we go from here?

Liora Alschuler

Is your roadmap on FHIR?

FHIR evaporates “V3 messaging”

V2: if not broke... don't replace

CDA

- FHIR retains document concepts
- Improves text/data management
- Unified model/syntax with messages/API
- CDA & C-CDA on FHIR maturing

How do you get there from here?

In the future, we envision a changed standards landscape where:

- Clinical documents and APIs share a common syntax and set of resources;
- Data can be acquired through an API and incorporated into a document or pulled from a document and made available in an API.

In the meanwhile, policy and implementation architectures should:

- Use FHIR where
 - some change in the specification is tolerable as the specification is still in flux
 - the full breadth of healthcare use cases are not required
- Use CDA where
 - Stability of specification critical for investment in clinical information
 - The breadth of use cases are required
- Distinguish between API and document use cases, and retain flexibility while the FHIR specification develops

Lessons

- Highly likely to figure prominently in interoperability
- A work in progress, no promise of stability until ~2017;
- Highly unlikely to hit regulation before then
- V2, CDA/C-CDA, QRDA still required for MU so, build out this infrastructure with forward (FHIR) compatibility

Q&A

Questions?