



HL7 FHIR DevDays 2017



FHIR Documents

Rick Geimer, Chief Innovation Officer, Lantana Consulting Group



Amsterdam, 15-17 November | [@fhir_furore](#) | [#fhirdevdays17](#) | [www.fhirdevdays.com](#)

Instructor

- Rick Geimer
 - Co-Chair Structured Documents Working Group
 - HL7 CDA R2 Certified Specialist
 - Co-Editor, CDA Consolidation and many other implementation guides
 - Lead: C-CDA on FHIR project
 - Day job: Chief Innovation Officer, Lantana Consulting Group
 - rick.geimer@lantanagroup.com

Lantana Consulting Group

- Our Mission
 - Improve healthcare through health information technology (IT)
 - Lead the industry through consulting and volunteer practice
- Our Services
 - Software and standard development and implementation
 - Terminology, data governance, and education
 - Strategic advice for health IT planning, design, and purchasing

Lantana
CONSULTING GROUP

Outline

- Overview of Clinical Documents
- FHIR Documents
- The Composition Resource
- Document Bundles
- Document Operations and APIs

Clinical Documents

- This is a document
- and this
- and this
- and this
- and this
- and this
- and this



Clinical Documents

- **Persistence** – A clinical document continues to exist in an unaltered state, for a time period defined by local and regulatory requirements. **Note:** documents outlive the servers (and often the syntax) on which they are created.
- **Stewardship** – A clinical document is maintained by an organization entrusted with its care.
- **Potential for authentication** – A clinical document is an assemblage of information that is intended to be legally authenticated.
- **Context** – A clinical document establishes the default context for its contents.
- **Wholeness** – Authentication of a clinical document applies to the whole and does not apply to portions of the document without the full context of the document.
- **Human readability** – A clinical document is human-readable.

Why are documents important?

- The clinical record has a dual nature
 - Data
 - Narrative
- Documents support that duality
 - Essential for disparate teams—different disciplines, contexts, or clinical systems
 - Developers need coded data to drive applications
 - Clinicians often say that the most important part of the clinical record is the narrative written by their colleagues

FHIR Documents

Lantana
CONSULTING GROUP



POSITION STATEMENT: CLINICAL DOCUMENTS AND FHIR

Adopted August 1, 2014; revised April 10, 2015

This position statement addresses the relationship between HL7's Clinical Document Architecture (CDA) product line and the Fast Health Interoperability Resource (FHIR) product line. It was prepared jointly by Lantana Consulting Group—a recognized leader in the CDA community—and Grahame Grieve, Health Intersections, the FHIR project lead. This statement is not official policy. It is our hope that it will stimulate discussion and possibly guide policy makers, architects, and implementers as well as standards developers.

This April 10, 2015 revision updates the position in light of progress under the second FHIR ballot as a Draft Standard for Trial Use and Project Argonaut. *In short, we find that the gaps between DSTU 1 and CDA have been identified, many addressed, and that we are on track to meet the objectives laid out here through the coming round of ballot reconciliation.*

FHIR Documents

- **Position:** FHIR is the document future
- **Call to action:**
 - Define, document, and promote a future where clinical documents and Application Programming Interfaces (APIs) share a common syntax and set of resources
 - Establish, in technical and regulatory policy, a smooth roadmap to the future of clinical document exchange



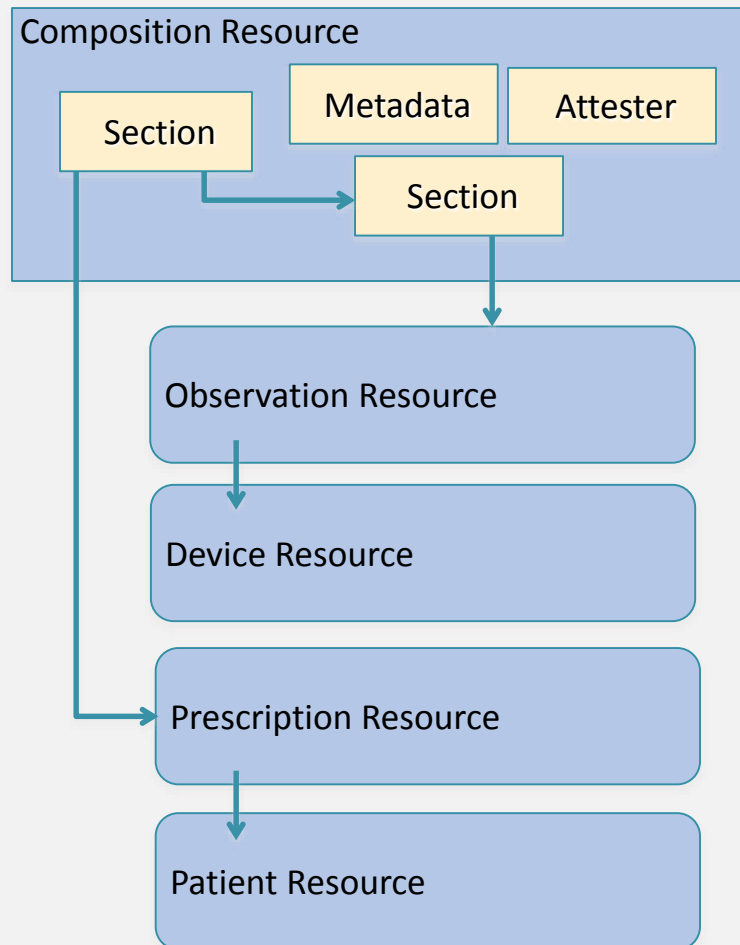
FHIR Documents

- Address CDA use case for clinical documents
- Collection of resources bound together
 - Root is a Composition resource
 - Much like the CDA header + narrative
- Sent as a Bundle resource
- Can be signed, authenticated, etc.
- Has the same basic obligations as a CDA document
- Full rules: <http://build.fhir.org/documents.html>

Why FHIR Developers Might be Interested in Documents

- Load FHIR servers with massive amounts of existing data
 - Most electronic health record (EHR) systems export CDA
 - Their CDA export capabilities are more stable than many of their FHIR APIs (if any)
 - Converting CDA to FHIR is one of the quickest standardized path to Big Data in healthcare today
- Comply with existing requirements
 - FHIR is simpler than CDA
 - Teach developers to create FHIR documents, then convert to CDA for compliance with existing regulations
 - FHIR as an API for creating CDA documents
- Prepare for when FHIR documents are the norm

FHIR Documents are Bundles of Resources



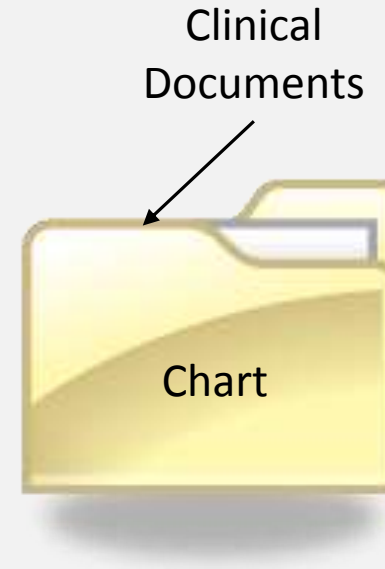
```

<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 `<Composition />` element to the `<Observation />`, `<Device />`, and `<Patient />` elements, and from the `<Prescription />` element to the `<Prescription />` element.

Composition Resource

- Contains
 - Patient
 - Author
 - Custodian
 - Type of document (e.g., Discharge Summary)
 - Attested narrative of the document
- Sufficient for
 - Medical records management
 - Document management
 - Enabling clinical document exchange across and within institutions
 - Human readable documents



Composition in Detail

- Key fields
 - Identifier
 - Date
 - Type
 - Subject
 - Author
 - Attester
 - Custodian
 - Sections and narrative
 - References to other resources

Name	Flags	Card.	Type	Description & Constraints
Composition			DomainResource	A set of resources composed into a single coherent clinical statement with clinical attestation Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension Logical identifier of composition (version-independent)
identifier	X	0..1	Identifier	
status	X I	1..1	code	preliminary final amended entered-in-error CompositionStatus (Required)
type	I	1..1	CodeableConcept	Kind of composition (LOINC if possible) FHIR Document Type Codes (Preferred)
class	I	0..1	CodeableConcept	Categorization of Composition FHIR Document Class Codes (Example)
subject	I	1..1	Reference(Any)	Who and/or what the composition is about
encounter	I	0..1	Reference(Encounter)	Context of the Composition
date	I	1..1	dateTime	Composition editing time
author	I	1..*	Reference(Practitioner Device Patient RelatedPerson)	Who and/or what authored the composition
title	I	1..1	string	Human Readable name/title
confidentiality	X I	0..1	code	As defined by affinity domain ConfidentialityClassification (Required) Attests to accuracy of composition
attester	X	0..*	BackboneElement	
mode	I	1..*	code	personal professional legal official CompositionAttestationMode (Required)
time	I	0..1	dateTime	When the composition was attested
party	X	0..1	Reference(Patient Practitioner Organization)	Who attested the composition
custodian	I	0..1	Reference(Organization)	Organization which maintains the composition
relatesTo	I	0..*	BackboneElement	Relationships to other compositions/documents
code	I	1..1	code	replaces transforms signs appends DocumentRelationshipType (Required)
target[s]	I	1..1	Identifier	Target of the relationship
targetIdentifier			Identifier	
targetReference			Reference(Composition)	
event	X	0..*	BackboneElement	The clinical service(s) being documented
code	I	0..*	CodeableConcept	Code(s) that apply to the event being documented v3 Code System ActCode (Example)
period	X	0..1	Period	The period covered by the documentation
detail	X	0..*	Reference(Any)	The event(s) being documented
section	I	0..*	BackboneElement	Composition is broken into sections + A section must at least one of text, entries, or sub-sections + A section can only have an emptyReason if it is empty
title		0..1	string	Label for section (e.g. for ToC)
code		0..1	CodeableConcept	Classification of section (recommended) Document Section Codes (Example)
text	I	0..1	Narrative	Text summary of the section, for human interpretation
mode	X I	0..1	code	working snapshot changes ListMode (Required) Order of section entries
enteredBy		0..1	CodeableConcept	List Order Codes (Preferred)
entry	I	0..*	Reference(Any)	A reference to data that supports this section
emptyReason	I	0..1	CodeableConcept	Why the section is empty List Empty Reasons (Preferred)
section	I	0..*	see section	Nested Section

Sections and Narrative

- Composition resources contain sections (which may be nested)
- Section narrative markup is XHTML
- Narrative contains the attested text of the document
- OK for sections to consist of only human readable text (i.e., no machine processable resources)

First: Human Readable

```

<section>
  <title value="Allergies and Intolerances"/>
  <code>
    <coding>
      <system value="http://loinc.org"/>
      <code value="48765-2"/>
      <display value="Allergies and adverse reactions"/>
    </coding>
  </code>
  <text>
    <status value="generated"/>
    <div xmlns="http://www.w3.org/1999/xhtml">
      <ul>
        <li>Penicillin - Hives</li>
        ...
      </ul>
    </div>
  </text>
  ...
</section>
  
```

Allergies and Intolerances

- Penicillin - Hives

Next, Coded Data

```
<AllergyIntolerance xmlns="http://hl7.org/fhir">  
  <clinicalStatus value="active"/>  
  <verificationStatus value="confirmed"/>  
  <category value="medication"/>  
  <criticality value="high"/>  
  <code>  
    <coding>  
      <system value="http://snomed.info/sct"/>  
      <code value="418038007"/>  
      <display value="allergy to penicillin"/>  
    </coding>  
  </code>  
</patient>
```

```
<assertedDate value="2000"/>  
<reaction>  
  <manifestation>  
    <coding>  
      <system value="http://snomed.info/sct"/>  
      <code value="247472004"/>  
      <display value="hives"/>  
    </coding>  
  </manifestation>  
  <severity value="mild"/>  
</reaction>  
</AllergyIntolerance>
```

A Bit of Bundle

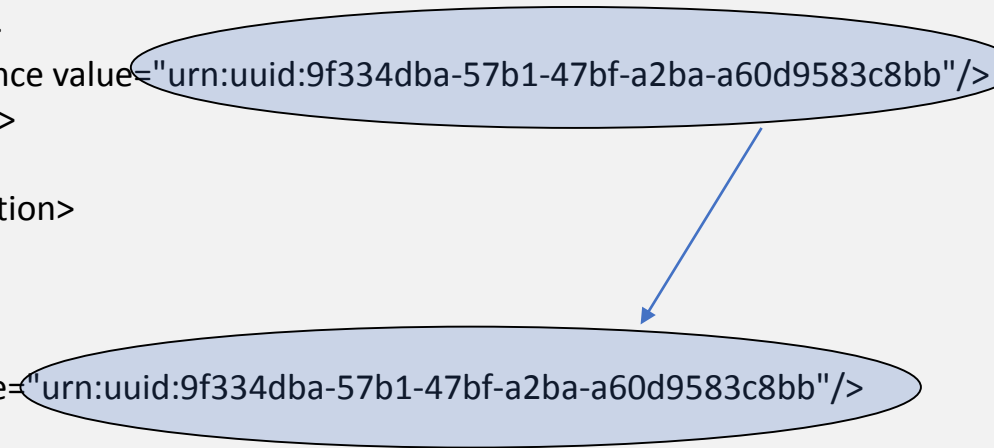
- Type = document
- Bundle.identifier
 - Version dependent
 - Must be globally unique to satisfy the persistence requirement
- First resource is Composition
- Documents must be standalone, so...
- The Bundle should (some would say must) contain all resources referenced from the Composition

name	Flags	Card.	Type	Description & Constraints
Bundle	E 1		Resource	Contains a collection of resources. + fullUrl must be unique in a bundle, or else entries with the same fullUrl must have different meta.versionId + A document must have an identifier with a system and a value + entry-request only for some types of bundles + entry-response only for some types of bundles + total only when a search or history + entry-search only when a search Elements defined in Ancestors: II, meta, implicitRules, language Persistent identifier for the bundle.
identifier	E	0..1	Identifier	
type	E	1..1	code	document message transaction transaction-response batch batch-response history searchset collection BundleType (Required)
total	E 1	0..1	unsignedInt	If search, the total number of matches
link	E	0..*	BackboneElement	Links related to this Bundle
relation	E	1..1	string	See http://www.iana.org/assignments/link-relations/link-relations.xhtml#link-relations-1
url	E	1..1	uri	Reference details for the link
entry	E 1	0..*	BackboneElement	Entry in the bundle - will have a resource, or information + fullUrl cannot be a version specific reference + must be a resource unless there's a request or response Links related to this entry
link	E	0..*	see link	
fullUrl	E	0..1	uri	Absolute URL for resource (server address, or UUID/OID)
resource	E	0..1	Resource	A resource in the bundle
search	E 1	0..1	BackboneElement	Search related information
mode	E	0..1	code	match include outcome - why this is in the result set SearchEntryMode (Required)
score	E	0..1	decimal	Search ranking (between 0 and 1)
request	E 1	0..1	BackboneElement	Transaction Related Information
method	E	1..1	code	GET POST PUT DELETE HTTPVerb (Required)
url	E	1..1	uri	URL for HTTP equivalent of this entry
ifNoneMatch	E	0..1	string	For managing cache currency
ifModifiedSince	E	0..1	instant	For managing update contention
ifMatch	E	0..1	string	For managing update contention
ifNoneExist	E	0..1	string	For conditional creates
response	E 1	0..1	BackboneElement	Transaction Related Information
status	E	1..1	string	Status response code (text optional)
location	E	0..1	uri	The location, if the operation returns a location
etag	E	0..1	string	The etag for the resource (if relevant)
lastModified	E	0..1	instant	Server's date time modified
outcome	E	0..1	Resource	OperationOutcome with hints and warnings (for batch/transaction)
signature	E	0..1	Signature	Digital Signature

Documentation for this format:

References in Bundles

```
<?xml version="1.0" encoding="UTF-8"?>
<Bundle xmlns="http://hl7.org/fhir">
  <id value="ee5590ab-72c0-4c07-9dc0-cc574729cd0a"/>
  <type value="document"/>
  <entry>
    <fullUrl value="urn:uuid:511b05b3-8c3d-4cbe-b9d8-fe5f8666f994"/>
    <resource>
      <Composition>
        <subject>
          <reference value="urn:uuid:9f334dba-57b1-47bf-a2ba-a60d9583c8bb"/>
        </subject>
        ...
      </Composition>
    </resource>
  </entry>
  <entry>
    <fullUrl value="urn:uuid:9f334dba-57b1-47bf-a2ba-a60d9583c8bb"/>
    <resource>
      <Patient>...</Patient>
    </resource>
  </entry>
</Bundle>
```



This example shows UUID URIs, but can be a FHIR server URL such as <http://example.org/fhir/Patient/1>

Rendering FHIR Documents

- When the document is presented for human consumption, applications SHOULD present the collated narrative portions in order:
 - Subject resource Narrative
 - Composition resource Narrative
 - section.text Narratives
- Reference stylesheet (XSLT)
 - Document2HTML.xslt in the XML Tools download
 - <http://hl7.org/fhir/downloads.html>

Demonstration

- Review a FHIR Document Bundle


FHIR APIs

- REST = “Representational state transfer”
(an architecture for how to connect systems)
 - Based on HTTP, the protocol that powers the Web
 - Outcomes
 - Simple stable interfaces
 - High performance / scalability
 - Visible process (e.g., can debug)
 - Portability
 - Reliability (resistance to failure)
- REST in FHIR
 - The FHIR API is composed of RESTful web services

FHIR RESTful URLs

- CRUD(E) operations mapped to HTTP
 - Create new resource: POST to the resource type endpoint
 - Read existing resource: GET
 - Update existing resource: PUT
 - Delete existing resource: DELETE
 - Execute: Use \$operations in the URL

`https://server.org/fhir/Patient/1`



resource type

endpoint

id

Documents and FHIR APIs

- Generating documents
 - Call \$document on a Composition resource
 - Stores at the /Bundle endpoint if persist=true
- Moving documents or storing externally created documents
 - Send to /Bundle or /Binary depending on use case
 - Use PUT to preserve IDs when sending to /Bundle (First, make sure globally unique)
- Decomposing documents
 - POST to the transaction endpoint (May need to be converted to a transaction bundle first)

Managing FHIR Documents

- To satisfy the persistence and stewardship requirements, documents must be stored somewhere (or reproduced on demand)
- The easiest way is on a FHIR server directly, either at the Bundle or Binary endpoint
- Other options include document management systems, clinical data repositories, etc.
- **Important:** documents (especially attested ones) should not be generated, transmitted, then disposed of like a transient message

Validating FHIR Documents

- FHIR validation pack
 - Includes XML Schema and Schematron files
 - <http://build.fhir.org/fhir-all-xsd.zip>
- The FHIR Validator
 - A Java JAR file that runs full FHIR validation
 - <http://build.fhir.org/validator.zip>
- FHIR server validation
 - Most servers to basic resource validation
 - Use the \$validate operation
 - Can validate profiles like C-CDA on FHIR
 - <http://build.fhir.org/operation-resource-validate.html>

Resources

- The FHIR specification
 - Updated continuously
 - Latest balloted version: <http://hl7.org/fhir>
 - Continuous build: <http://build.fhir.org/>
- “FHIR CDA Position Statement and Roadmap”
Lantana white paper co-authored with Grahame Grieve; Updated April, 2015
 - <http://www.lantanagroup.com/resources/publications/>
- Rick Geimer
 - Updated continuously, rebooted occasionally
 - rick.geimer@lantanagroup.com