

Record Lifecycle Events on FHIR  
W5 Analysis Project and  
October FHIR Connectathon Track 4

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11 September 2015

<http://www.hl7.org/fhir>

# FHIR Infrastructure Resources

## Infrastructure

### Information Tracking:

- Questionnaire 0
- QuestionnaireResponse 0
- Provenance 0 ←
- AuditEvent 0 ←

### Documents & Lists:

- Composition 2
- DocumentReference 0
- DocumentManifest 0
- List 0

### Structure:

- Basic 1
- Binary 3
- Bundle 3
- Media 1

### Exchange:

- MessageHeader 2
- OperationOutcome 5
- Parameters 0
- Subscription 1

# Targets

- FHIR W5 Report Analysis
  - Current Build: <http://hl7-fhir.github.io/w5.html?>
- DSTU-2 Publication
  - September 2015
- FHIR Connectathon 10
  - EHR Record Lifecycle Architecture (Track 4)
  - 3-4 October 2015, HL7 Atlanta

# Mapping to FHIR

Requirements	Are Fulfilled by...
ISO/HL7 10781 EHR-S FM R2 Record Infrastructure (RI) → 24(+7) Record Lifecycle Events	Implementable FHIR Resources
<u>Basic Lifecycle Event</u>	<ul style="list-style-type: none"><li>• AuditEvent</li></ul>
<u>Provenance Lifecycle Event</u> when Record Entry content is <b>originated</b> or <b>updated</b>	<ul style="list-style-type: none"><li>• AuditEvent</li><li>• Provenance</li><li>• Other new/updated resource(s) → corresponding to Action Taken</li></ul>

↑ Resources may also be indivisibly and immutably bound by one or more digital signatures in a Record Entry.

# Fundamentals

- Actors take Actions
- Actors may be individuals, organizations and/or software/devices
- EHR and PHR Record Entries document (show evidence of) Actions Taken in health and healthcare
- Actions and Record Entries have separate (yet corresponding) sets of metadata
- Thus: Action W5 + Record Entry W5

# Action/Record Entry W5 Metadata

<b>Action</b>	<b>Is documented/evidenced by</b>	<b>Record Entry</b>
<p><b><u>Action W5:</u></b>                      Who/role – Action focus, subject, patient                      Who/role – Action performer, assistant, witness                      What – Action taken                      When – Action date/time/duration                      Where – Action physical location                      Why – Action rationale, purpose</p>		<p><b><u>Record Entry W5:</u></b>                      Who/role – Entry target, subject, patient                      Who/role – Entry author, scribe, verifier, attester, witness...                      What – Entry Action: originate, update, verify, attest, exchange...                      When – Entry date/time                      Where – Entry device ID, network address                      Why – Entry rationale, purpose</p>
<p><b>Expressed across all FHIR resources</b></p>		<p><b><u>Fully Expressed</u> in FHIR AuditEvent and Provenance resources when bound to other FHIR resources</b></p>

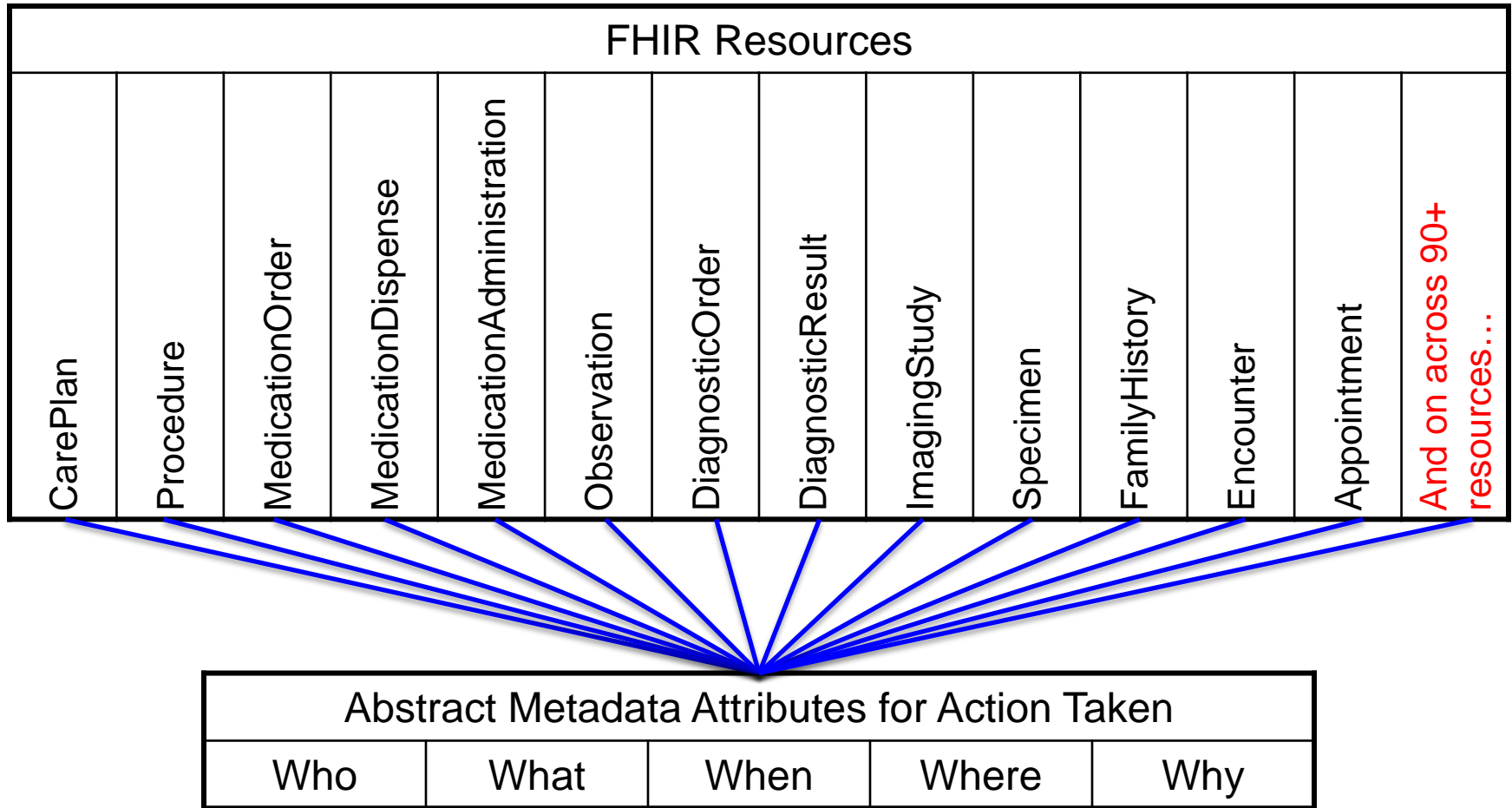
Actors have specific...

# Action and Record Entry Roles

Action Roles	Record Entry Roles
<ul style="list-style-type: none"><li>• Action Focus, Subject</li><li>• Action Performer</li><li>• Action Witness</li></ul>	<ul style="list-style-type: none"><li>• Entry Target</li><li>• Entry Author</li><li>• Entry Recorder (Enterer)</li><li>• Entry Verifier</li><li>• Entry Attester</li><li>• Entry Informant</li><li>• Source/Copy From</li></ul>

## Action Metadata

# Abstract Attributes





# Fundamentals

- EHR/PHR Record Entries:
  - Have a lifespan:
    - Point of origination to ultimate point of destruction/deletion
    - Point of origination to each ultimate point of retention, access/use
  - Have one or more lifecycle events occurring over the course of their lifespan:
    - Originate/retain, update, verify, attest, view/access and more
  - Retain relevant W5 metadata to document/evidence authenticity of, and accountability for:
    - Lifecycle events, content and data state changes
  - Enable transparency/traceability:
    - From point of origination to each point of access/use
    - Evidencing W5 metadata from each previous lifecycle event

## Record Lifecycle Events on FHIR Project

# Fundamentals

FHIR Instance	Origination	Retention
<b>Persistent</b> (native) artifact	Captured in EHR, PHR or other system Record Entries	Retained on source system for legal retention period
<b>Transient</b> artifact	Created for purposes of exchange	Retained on source and/or receiver system for limited time

# W5 Evidence

- Show how W5 metadata is expressed (evidenced) in FHIR resources
  - Across FHIR resources
  - As evidence of authenticity and accountability
- Show how Record Entry W5 metadata is expressed (evidenced) in FHIR resources
  - AuditEvent and Provenance
- Establish as Best Practice
  - Full capture of Action W5 and Record Entry W5
  - Creation and binding of FHIR AuditEvent and Provenance (if applicable)

# Ideally...

At each Record Lifecycle/CRUDE Event...	
Action W5 metadata...	Record Entry W5 metadata...
<ul style="list-style-type: none"><li>• May be expressed in &lt;any&gt; resource</li><li>• Is expressed with a high degree of consistency across &lt;all&gt; resources:<ul style="list-style-type: none"><li>• Resource.element name</li><li>• Description</li><li>• Data type</li><li>• Code/value set, if any</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Is expressed in AuditEvent resource</li><li>• Is also expressed in Provenance resource when resource content is <i>originated or updated</i></li><li>• If carried in &lt;any&gt; resource (whether or not bound to AuditEvent or Provenance), is expressed with a high degree of consistency</li></ul>

Current Build

## FHIR W5 Report

- Now Referencing Current Build
- Compilation now includes all W5 metadata
  - Who, What, When, Where, Why
  - Also Id, Id.version, Class, Status, Grade
- Across
  - FHIR Clinical, Administrative, Infrastructure Domains
- Two Sections
  - Concise: FHIR Resources + Attributes
  - Full: FHIR Resources + Attributes + Data Types

# Use Cases

- FHIR RLE Use Cases to demonstrate use of
  - Audit log evidence (AuditEvent) and
  - EHR record entry evidence (Provenance bound to FHIR Action-related Resources)
- Security Audit – Glen Marshall
- Pharmacy Medication Tracking – Julia Chan

# Notes/Issues

- W5 metadata attributes are designated by resource owner WG
- Significance of empty cells:
  - No equivalent W5 Metadata Attribute? or
  - Not yet evaluated? or
  - Inadequate definition of W5 concept/term?
- Inability to bind Resources at REST
  - New/updated resources to AuditEvent and Provenance
  - Encryption, signature, timestamp

# Notes/Issues

- Identify overlap between FHIR AuditEvent and Provenance metadata and that of other resources
- Ensure W5 synchrony at same Action Instant (point in time)?
  - As captured in FHIR instance
  - Need Synchronous Snapshot to ensure we can actually track: **Who did What, When, Where and Why**



3-4 October – HL7 Meeting – Atlanta

# October FHIR Connectathon

- [October 2015 FHIR Connectathon Link](#)
- Track 4
- Piggyback on other Track Scenarios
  - Tracks 1, 3, 5, 6
- Identify CRUDE points
- Add AuditEvent to all Scenarios
- Add Provenance resource to CU Scenarios, as appropriate

# Track 1 - Patient

Scenario		CRUDE	AuditEvent	Provenance
1	Register a New Patient	C	Yes	Yes
2	Update a Patient	U	Yes	Yes
3	Retrieve Patient History	R	Yes	N/A
4	Search for a Patient on Name	R	Yes	N/A

## EHR-S FM Record Lifecycle Events on FHIR

# Links

- RLE on FHIR Materials – HL7 EHR Interop Wiki:
  - [http://wiki.hl7.org/index.php?title=EHR\\_Interoperability\\_WG](http://wiki.hl7.org/index.php?title=EHR_Interoperability_WG)
- FHIR DSTU-2 – Record Lifecycle Event Implementation Guide
  - <http://www.hl7.org/fhir/2015May/ehrs-rle.html>
- FHIR W5 Report (Current Build)
  - <http://hl7-fhir.github.io/w5.html?>
- FHIR Connectathon 10
  - [http://wiki.hl7.org/index.php?title=FHIR\\_Connectathon\\_10](http://wiki.hl7.org/index.php?title=FHIR_Connectathon_10)

## Example – Medication Order

# Action and Record Entry Metadata

	Action Metadata	Record Entry Metadata
Who	Action Subject (Patient) Johnny Walker Role: Subject	Entry Subject (Patient) Johnny Walker Role: Record Target
	Action Organization Bay City Medical Center	
	Action Practitioner/Performer Doctor Sally Smith Role: Performer	Entry Source – Author or Scribe Nurse Janice Jones Role: Recorder
		Entry Source – System/Device Erstwhile EHR/Device XX123456

## Example – Medication Order

# Action and Record Entry Metadata

	Action Metadata	Record Entry Metadata
What	Action Taken Medication Order for Ambien 20mg PRN	Entry Origination/Retention evidenced by AuditEvent Provenance + FHIR Resources related to Medication Order MedicationPrescription, et al
When	Action Date/Time 22 Aug 2014 @ 1800	Entry Date/Time 22 Aug 2014 @ 1810
	Action Duration 3 Minutes	
Where	Action Physical Location Ward/Room B/12	Entry Location – IP Address 255.255.255.1
Why	Action Reason/Purpose To Induce Sleep	Entry Reason/Purpose <none entered>

## EHR-S FM Record Infrastructure (RI) – Lifecycle Events

# Plus... More Evidentiary Metadata

Lifecycle Event →	Originate Retain	Amend	Attest	Translate
Record Entry Unique ID	X			
Record Entry Content: Data, Document, Artifact ID(s)	X	X		
Digital Signature(s) – Individual(s)			X	
Digital Signature – Acting System/Device	Any/All			
Corresponding/linked Record Entry(ies)	X	X		
Pointer to Pre-Event Entry, if any: pre update/translation		X		X
Pointer to Post-Event Entry, if any: post update/translation		X		X
Amendment and/or Translation Sequence		X		X
Identity and version of Translation Tool(s), if any				X

# Plus... More Evidentiary Metadata

Lifecycle Event →	Originate Retain	Amend	Attest	Disclose Transmit
Source of Copied Content: if copy/paste, template or boilerplate	X	X		
Event is Known Disclosure Indicator				X
Permissions associated with Record Entry Content	X	X		X
Entries in Event Transaction, if multiple	Set of Entries: <ul style="list-style-type: none"> <li>• Accessed/Viewed</li> <li>• Transmitted</li> <li>• Received</li> <li>• Extracted</li> <li>• Archived/Restored</li> <li>• Destroyed/Deleted</li> <li>• On/Off Legal Hold</li> <li>...</li> </ul>			

# CRUDE Points

- W5 Metadata is captured (in FHIR resource instances) at CRUDE points
  - **Capture**: Originate content in new instance
  - **Read**: Access/view content in existing instance
  - **Update**: Update content in existing instance
  - **Delete**: Purge/destroy existing instance and its content
  - **Execute**: Perform operation(s) on content in existing instance



Record Lifecycle Event (RLE)		CRUDE – At each RLE, per Record Entry instance	New Artifacts Created at RLE
1	Originate/Retain	C New Instance(s)	---
2	Update/Amend	C or U Instance(s)	---
3	Transform/Translate	---	C New transformed/ translated artifact
4	Attest	C or U Instance(s) (Provenance incl. Signature)	---
5	Access/View	R Instance(s)	---
6	Output/Report	---	C New output/report artifact
7	Disclose	---	C New disclosure artifact
8	Transmit	---	C New transmittal artifact
9	Receive/Retain	C New Instance(s)	---
10	De-Identify	---	C New de-identified artifact
11	Pseudonymize	---	C New pseudonymized artifact
12	Re-Identify	[C or U Instance(s)*]	---
13	Extract	---	C New extract artifact
14	Archive	---	C New archive artifact

Basic C/U/R for current Connectathon

<b>Record Lifecycle Event (RLE)</b>		<b>CRUDE – At each RLE, per Record Entry instance</b>	<b>New Artifacts Created at RLE</b>
15	Restore	[C or U Instance(s)*]	---
16	Destroy/Delete	D Instance(s)	---
17	Deprecate	[C or U Instance(s)*]	---
18	Re-Activate	[C or U Instance(s)*]	---
19	Merge	[C or U Instance(s)*]	---
20	Unmerge	[C or U Instance(s)*]	---
21	Link	[C or U Instance(s)*]	---
22	Unlink	[C or U Instance(s)*]	---
23	Add Legal Hold	[C or U Instance(s)*]	---
24	Remove Legal Hold	[C or U Instance(s)*]	---
25	Verify	[C or U Instance(s)*]	---
26	Encrypt	---	C New encrypted artifact
27	Decrypt	[C or U Instance(s)*]	---

\* Depending on system design, RLE may Create or Uppdate Record Entry instance(s) and thus the (one) Provenance Resource is bound to these instance(s).