

HL7 – FHIR OVERVIEW

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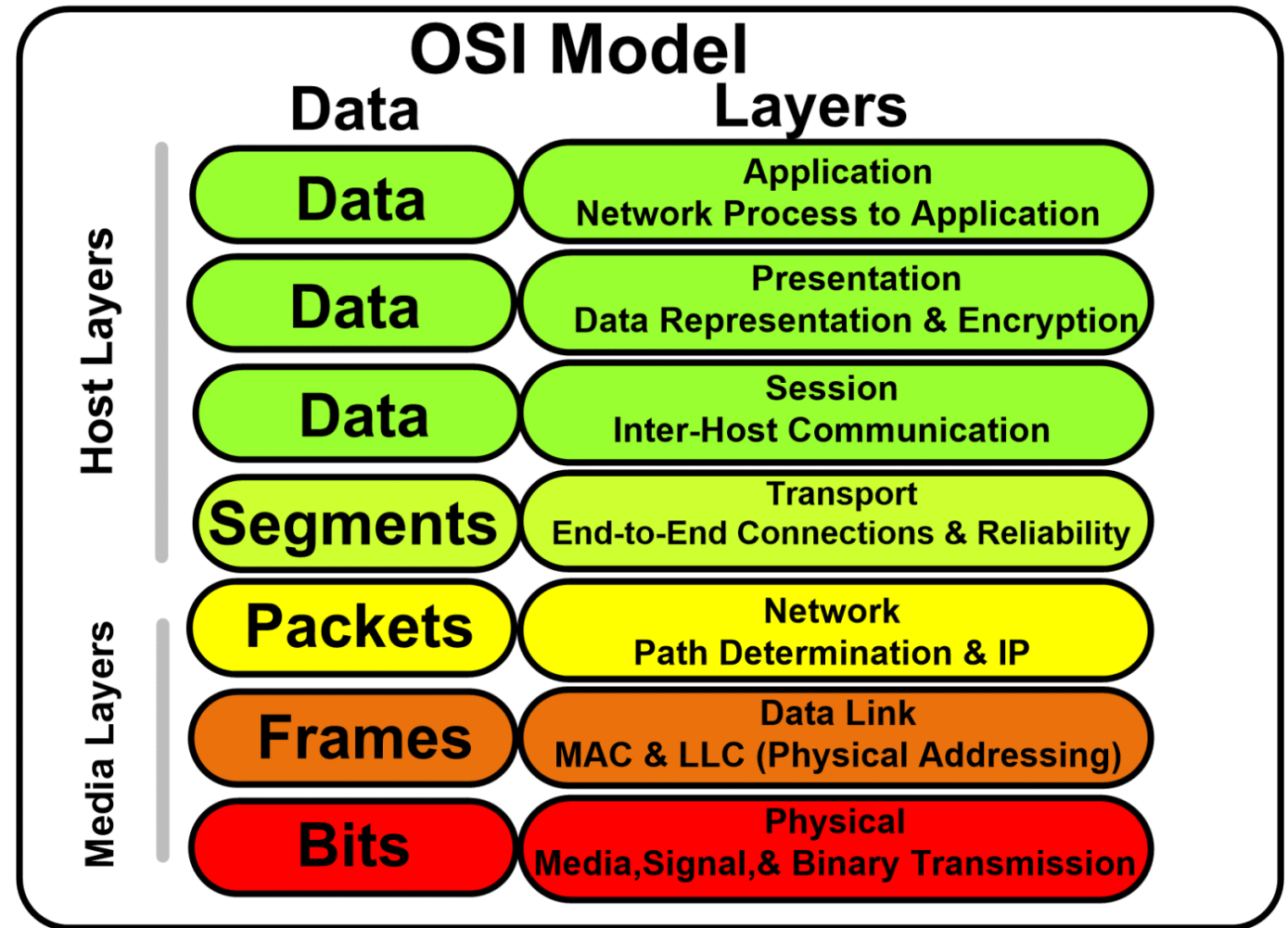
RTI International

WHAT IS HL7?

- Health Level Seven → HL7
 - HL7 is a standards development organization for **medical** data
 - Keeper of international standards for the transfer of clinical and administrative data between software applications by various **healthcare** providers.
 - Origin of these standards comes from the application layer in the OSI (Open Systems Interconnection) model. Application layer was layer 7.
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DEEPER DIVE ON OSI

- Characterizes and standardizes the communications of a telecom or computing system.
- This is the layer closest to the user, and well as has direct input with software application.
- [OSI-model-info-084.png \(720×1701\) \(planetechusa.com\)](#)
(Pizza Metaphor!)



FHIR (FAST HEALTHCARE INTEROPERABILITY RESOURCES)

- Standard created by HL7 that describes data formats and elements, as well as an API (application programming interface) for exchanging electronic health records.
 - Successful and widely implemented due to:
 - -Mobile friendly
 - -Able to scale up and down based on legacy systems and modern APIs
 - The secret sauce was as EHRs began to mature and interoperability and healthcare data exchange was needed, FHIR allowed data elements such as patient name, ID, medications, diagnostic reports, and etc. – to be individually retrieved and manipulated.
 - Previously, this was more of a “whole document” approach. Which was slow, inefficient, and not able to scale up to next technological leap.
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FHIR RESOURCES

Resources – The basic building block of the FHIR specification.

- Defines how data are to be structured and exchanged
- Intended to be generic to fit a wide range of use cases
- Refer to each other using Uniform Resource Locator (URL)
- Known Location (server)
- Defined Meaning (FHIR Specification)
- Discrete Data (patient, family history, document, medication, list)

Profiles – resources that are restricted to certain constraints to implement a generic resource for a specific use case.

- Defined value sets
 - FHIR Extensions
 - Administrative and clinical use-cases
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FOR THE DEVELOPERS

Can use JSON or XML for data representation/encoding.

2.17.3 Example Resource: Patient

This simple example shows the important parts of a resource: a local extension, the human readable HTML presentation, and the standard defined

```
<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>
  <active value="true"/>
  <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>
</Patient>
```

Resource Identity & Metadata

Human Readable Summary

Extension with URL to definition

Standard Data:

- MRN
- Name
- Gender
- Birth Date
- Provider

FOR THE DEVELOPERS

Codes Example:

“system”: <http://loinc.org>,

“code”: “718-7”,

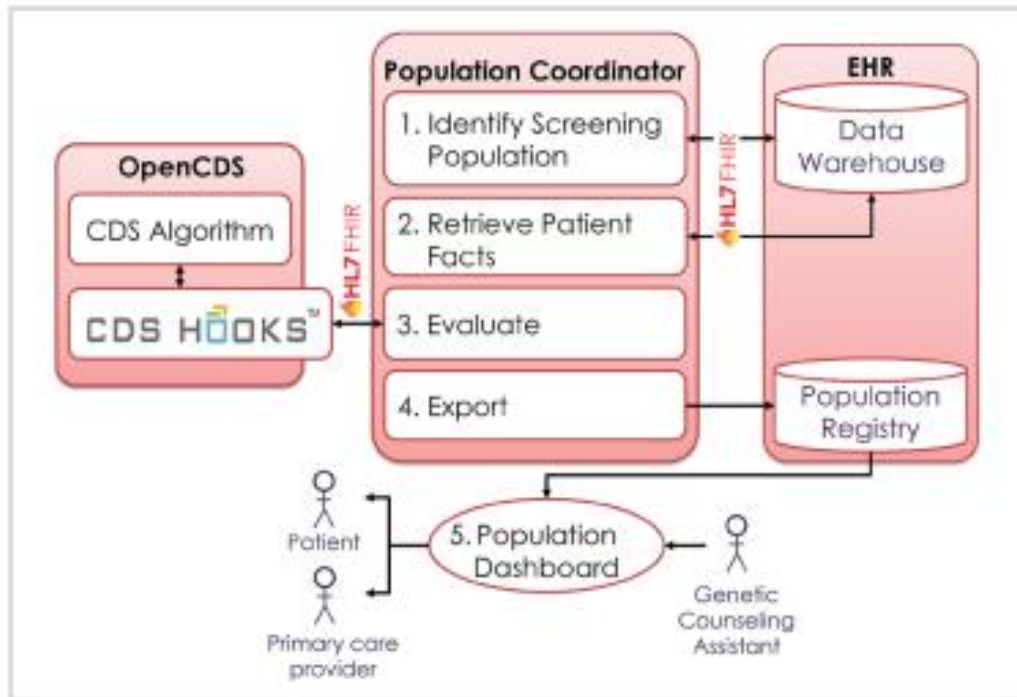
“display”: “Hemoglobin
mass/volume in blood”

12.14.3 Resource Content

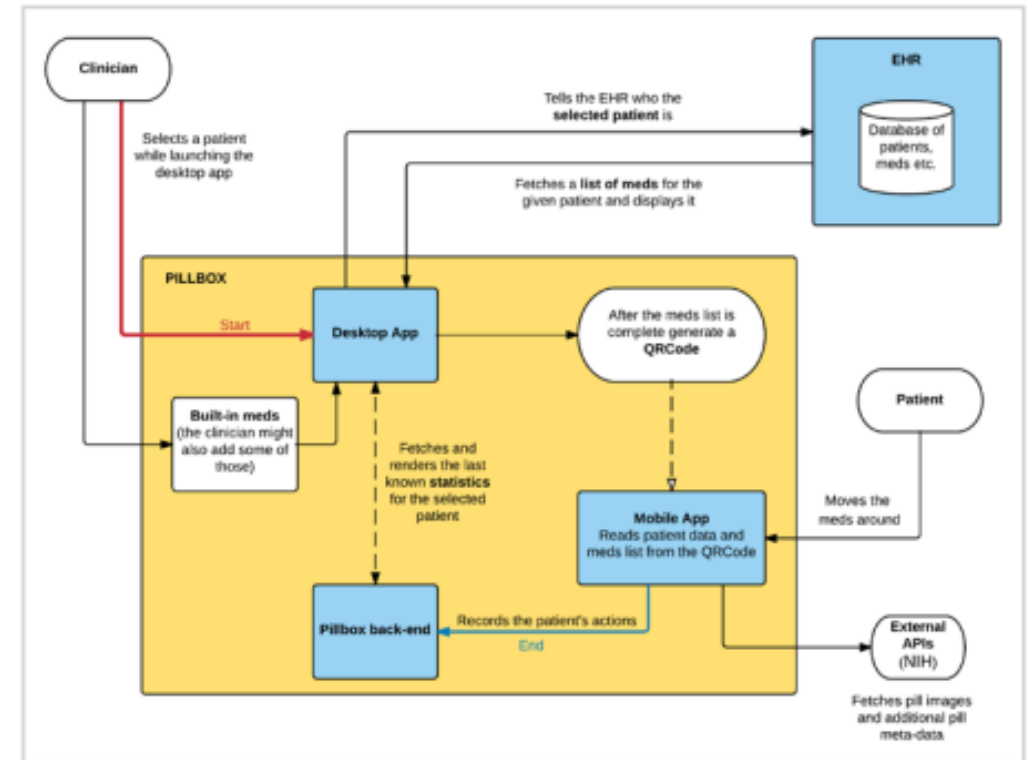
| Structure | UML | XML | JSON | Turtle | R3 Diff | All |
|-----------------------|-------|-------|--|--|---------|-----|
| Structure | | | | | | |
| Name | Flags | Card. | Type | Description & Constraints | | |
| ServiceRequest | I TU | | DomainResource | A request for a service to be performed + Rule: orderDetail SHALL only be present if code is present Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension | | |
| identifier | Σ | 0..* | Identifier | Identifiers assigned to this order | | |
| instantiatesCanonical | Σ | 0..* | canonical(ActivityDefinition PlanDefinition) | Instantiates FHIR protocol or definition | | |
| instantiatesUri | Σ | 0..* | uri | Instantiates external protocol or definition | | |
| basedOn | Σ | 0..* | Reference(CarePlan ServiceRequest MedicationRequest) | What request fulfills | | |
| replaces | Σ | 0..* | Reference(ServiceRequest) | What request replaces | | |
| requisition | Σ | 0..1 | Identifier | Composite Request ID | | |
| status | ?! Σ | 1..1 | code | draft active on-hold revoked completed entered-in-error unknown RequestStatus (Required) | | |
| intent | ?! Σ | 1..1 | code | proposal plan directive order original-order reflex-order filler-order instance-order option RequestIntent (Required) | | |
| category | Σ | 0..* | CodeableConcept | Classification of service Service Request Category Codes (Example) | | |
| priority | Σ | 0..1 | code | routine urgent asap stat Request priority (Required) | | |
| doNotPerform | ?! Σ | 0..1 | boolean | True if service/procedure should not be performed | | |
| code | Σ | 0..1 | CodeableConcept | What is being requested/ordered Procedure Codes (SNOMED CT) (Example) | | |
| orderDetail | Σ I | 0..* | CodeableConcept | Additional order information Service Request Order Details Codes (Example) | | |

FOR THE ANALYSTS

- Use a clinical decision support (CDS) platform for identifying candidates who meet guidelines for genetic evaluation of cancer screening.



- An example of an application that uses HL7 FHIR to pull data from patient's medication list via EHR.



ELECTRONIC PILLBOX

SOME (MORE) EXAMPLES

- SMART (Substitutable Medical Applications, Reusable Technologies) on FHIR
 - SMART is the platform for applications to launch that make use of the FHIR API
 - [CDS Connect: Pain Management Summary \(smarthealthit.org\)](https://smarthealthit.org/cds-connect/pain-management-summary)
 - Dashboard for managing chronic pain. The data selection, filtering, and aggregation logic is expressed using HL7.
 - [Chest Pain Application \(smarthealthit.org\)](https://smarthealthit.org/chest-pain-application)
 - Via Regenstrief Institute. A chest pain app that displays patient data related to a patient complaint of chest pain and pulls in data from EHR.
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OKAY, BUT WHAT DOES IT MEAN?

Healthcare is a notoriously complicated and technologically slow to advance ecosystem. The use of fax machine is still not unheard of, in a time where you can order your pizza + groceries+ scented candle with one app and it arrive in two hours.

We have a few major Electronic Health Record (EHR) vendors who are competing for your information, privacy, and essential “health passport”.

This is in addition to the private sector, where agents such as Wal-mart/Amazon/Target/etc are seeking to cause disruption with the promise of convenience.

This means we live in a world where: Patient Bob has Aetna Insurance, visits a Walmart outpatient clinic, gets his prescription filled at a CVS, and then later visits Duke primary care. That information can either get lost or seamlessly travel along his journey to help the nurses, lab techs, and doctors have the best information for care.

YOU HAVE MY ATTENTION...

- What this is all moving towards is a connected and interoperable world in which any application or request can be made by patient or on patient's behalf.
 - The request will be sent to the patient's EHR, be "bundled" into a HL7 FHIR "package" and returned back to the requesting application/software. Think your MyChart app, iPhone, or various other digital health uses in last few years.
 - The Center for Medicaid and Medicare (CMS) has enacted the "Interoperability and Patient access final rule" (CMS-9115-F). Which will require a select group of CMS-regulated payers to implement a FHIR patient access API. This is the government stepping in and forcing health systems to update legacy systems, and ultimately an addendum to the 21st century cures act.
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WHERE CAN RTI HELP?



In fiscal year 2021, the ONC is particularly interested in applications whose specific aims addresses one of the following areas of interest:



Area 1: Referral Management to Address Social Determinants of Health Aligned with Clinical Care



Area 2: Health IT Tools to Make Electronic Health Records (EHR) Data Research – and Artificial Intelligence (AI)-Ready



Area 3: dbGap on FHIR – Submitters → Phenotypes/Genotypes → Submission Portal = dbGap → Phenotype via FHIR API + Phenotype/Genotype Data → Approved Users

GOBOT TO THE RESCUE!

A database of current FHIR efforts across agencies “would be helpful”.

Need for implementation guides that discuss linking patient data to important agency data sources, such as databases on birth, mortality, and public health.

Mappings (yay!) between various existing common data models (OMOP) and FHIR, clear need to automate this process.

Connect, coordinate, and communicate the various factions working on these projects.

THANK YOU!

ALL OF US - FHIR

- Data collected
 - Consent forms + EHR
 - Surveys
 - Physical Measurements
 - Biosamples
 - Mobile/wearable tech
 - Traditional approach has been to bring data to researchers
 - Cloud-centric approach brings the researchers to the data (facilitates collaboration)
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