FHIR 101

March 6, 2024

Diego Kaminker, HL7 DCSIO, diego@hl7.org

With input and materials from:
- Viet Nguyen, HL7 CSIO
- Dan Vreeman, HL7 CSDO

This session will be recorded.

Agenda

- Welcome from Civitas Networks for Health
- Purpose and Objective of Today's Training
- Part 1 – Introduction to HL7
- Part 2 – Introduction to FHIR
- Part 3 – The FHIR Toolbox

Housekeeping Reminders

- This is a Zoom webinar.

- Please make sure you are muted.

- Please feel free to put questions or comments in the Q&A. These will be answered at the end – time permitting.

- This session is being recorded.

For questions following the meeting, reach out to **mvalu@civitasforhealth.org**

ABOUT CIVITAS

Civitas Networks for Health is a national collaborative comprised of over 170 member organizations working to use health information exchange, health data, and multi-stakeholder, cross-sector approaches to improve health.

Civitas educates, promotes, and influences both the private sector and policymakers on matters of interoperability, quality, coordination, health equity, and cost-effectiveness of health care. The network supports local health innovators by amplifying their voices at the national level and increasing the exchange of valuable resources, tools, and ideas.

in Civitas Networks for Health   X @civitas4health

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Demographic Data Standards Development

Project Team

- This effort is a partnership between Civitas Networks for Health (Civitas), AHIP, and Health Level 7 (HL7) International.

Objective/Scope

- AHIP has funded Civitas to launch a project in partnership with HL7 International to support refinement and development of improved demographic data questions and response choices for race, ethnicity, language, sexual orientation, gender, disability status, military experience, and spirituality.

Next Session

- Language and Spirituality | March 20 from 3pm-5pm ET

Purpose & Objective

- Provide educational sessions for all interested stakeholders on core topics related to standards development and health information exchange.

- Introduce the concept of Fast Healthcare Information Resources (FHIR®).

- This 101-level presentation requires no prior knowledge or experience and is open to anyone who is interested in learning more about FHIR.
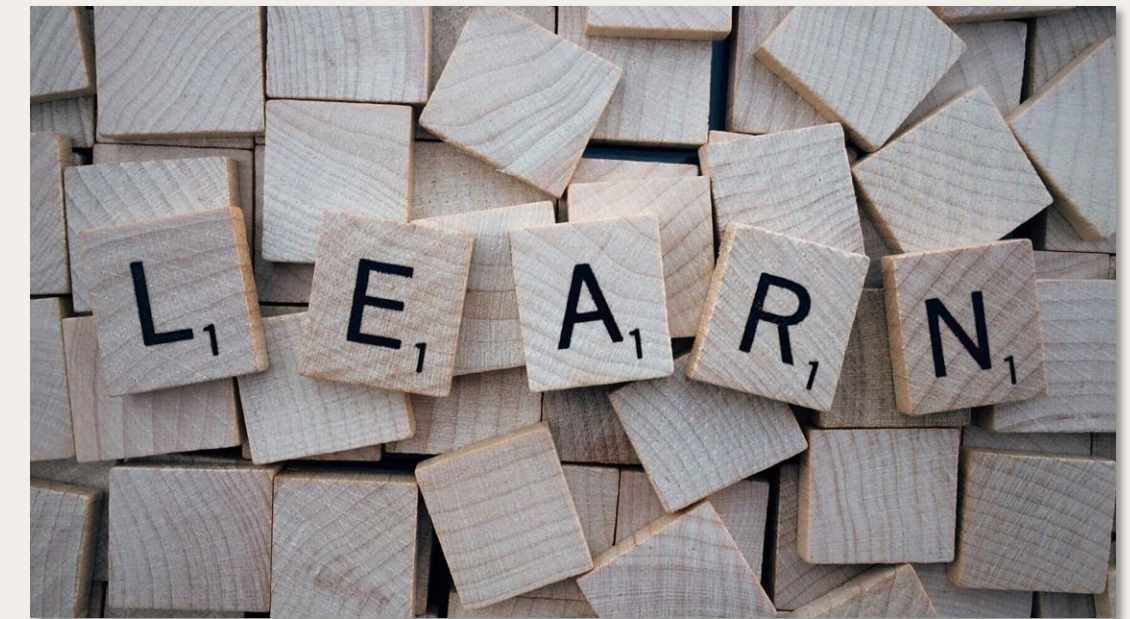
PART 1 – INTRODUCTION TO HL7

- HL7's Global Reach
- What are healthcare data standards?
- What do we mean by interoperability?
- How does policy drive standards development and adoption?
- Coordination of Standards Development and Implementation
- Why Are Policies Important to implementers?
- FHIR Accelerators

Health Level Seven® International (HL7®)

- Not-for-profit
- ANSI-accredited standards development organization (SDO)
- Dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services

Vision

- A world in which everyone can securely access and use the right health data when and where they need it.

Mission

- To provide standards that empower global health data interoperability.

Education on Demand: HL7® training Straight from the Source

HL7 International's Global Reach

- **HL7 Mission:** To provide standards that empower **global** health data interoperability.
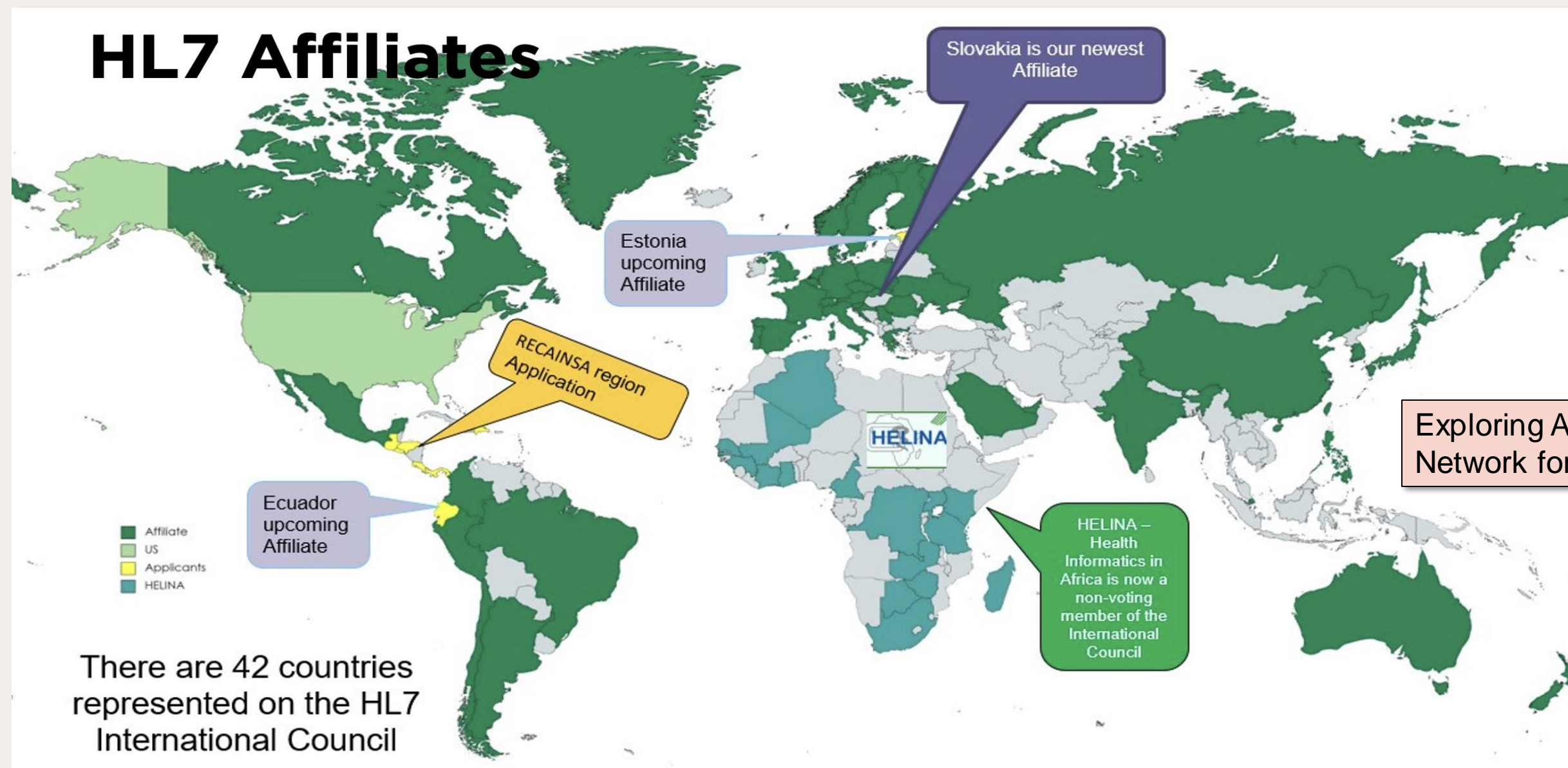
- 50+ Countries
- 500+ Corporate Members
- 1600+ Individual Members
- Thousands of contributors

What are "Healthcare Data Standards"?

In the context of health care, the term data standards encompasses *methods, protocols, terminologies, and specifications* for the *collection, exchange, storage, and retrieval of information* associated with health care applications, including medical records, medications, radiological images, payment and reimbursement, medical devices and monitoring systems, and administrative processes (Washington Publishing Company, 1998).

https://www.ncbi.nlm.nih.gov/books/NBK216088

Policy and Governance

Clinical & Administrative Processes

Applications and Analytics

Data and Knowledge Representation

Infrastructure

Interoperability

Privacy

Security

Safety

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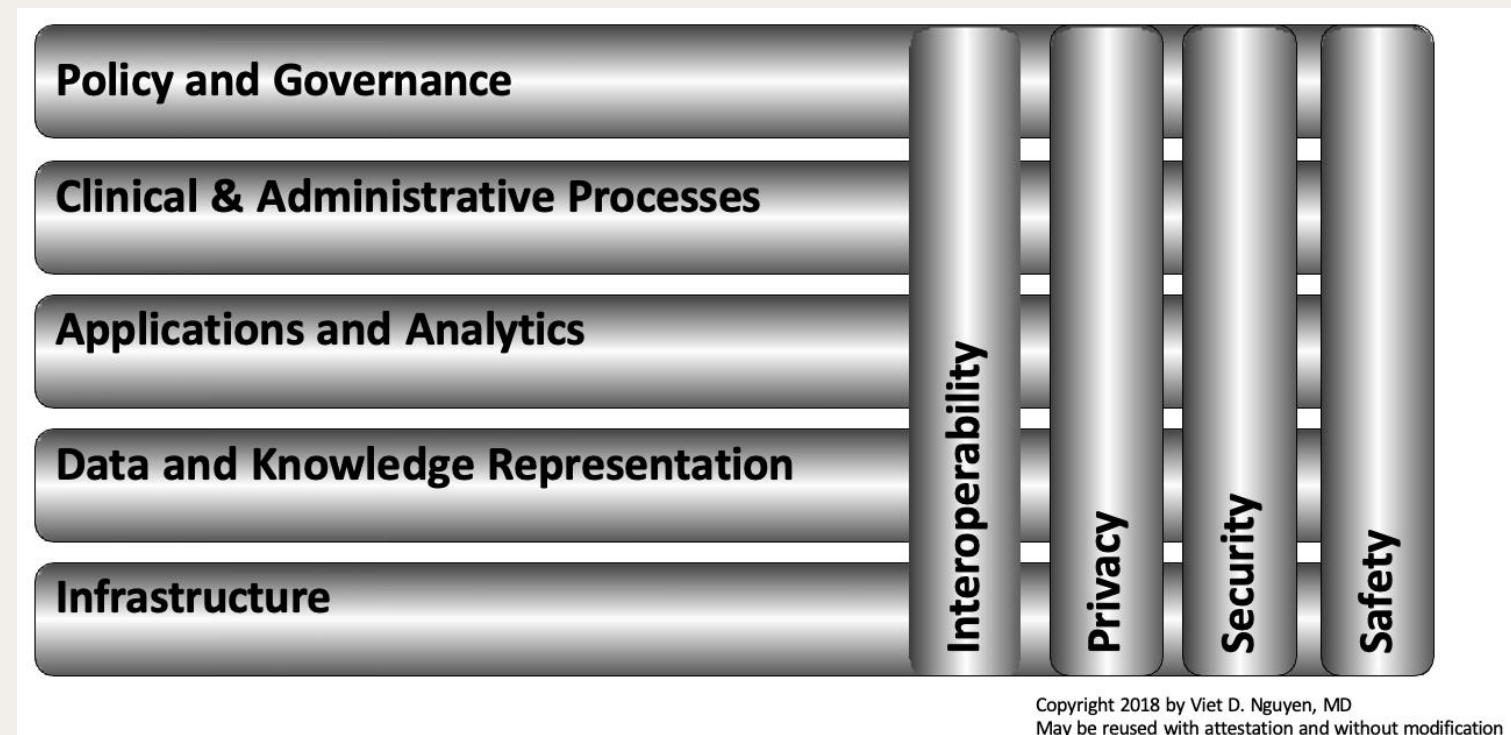
How does policy drive standards development and adoption?

- Listening to stakeholder needs.
- Direct support of standards development and adoption.
- Setting of standards directly – e.g. HIPAA, ONC Cures Act.
- Adoption by agencies.

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Coordination of Standards Development and Implementation
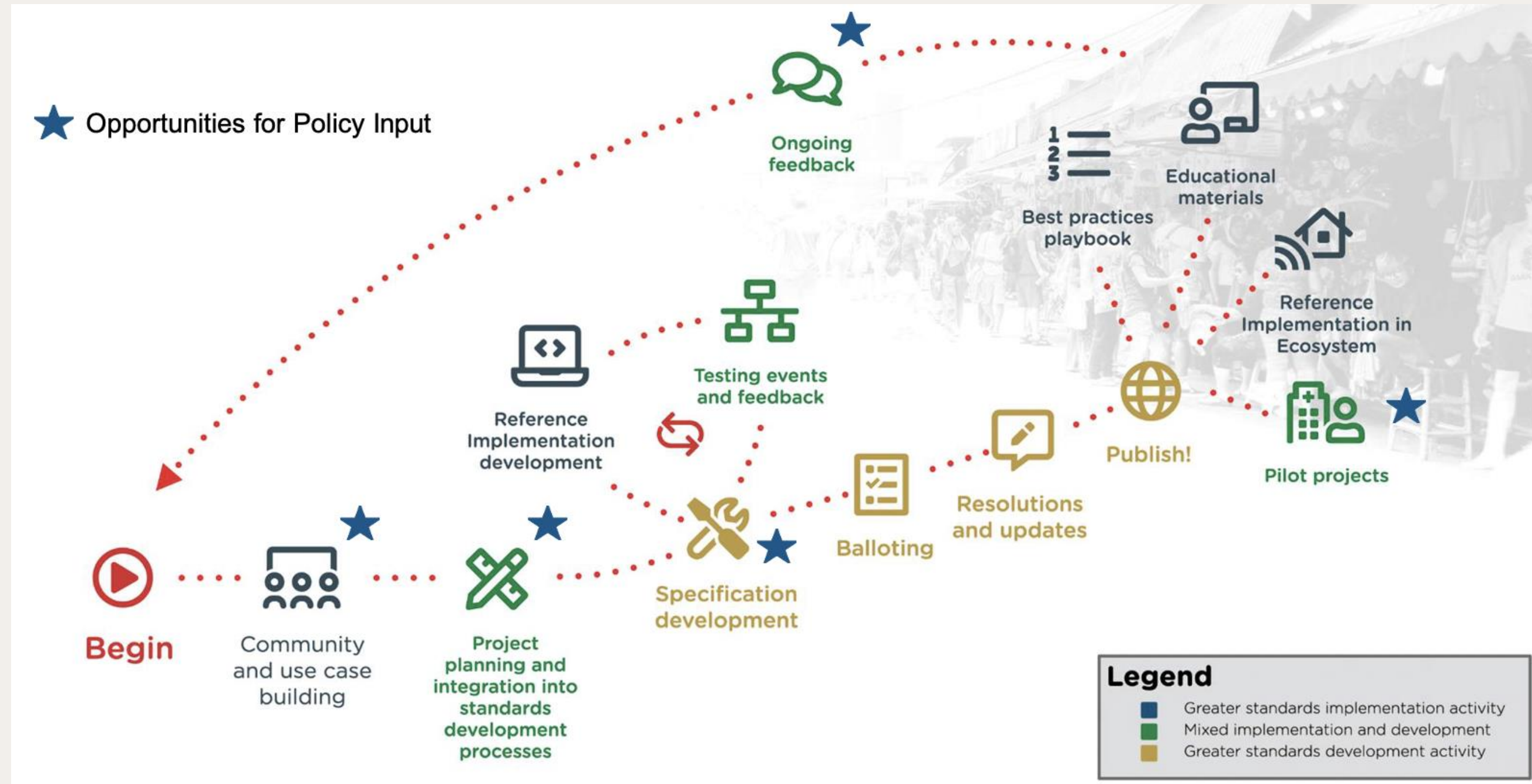
Why are policies important to implementers?

- Legal and regulatory requirements and compliance
- Standards and guidelines for implementation for certification
- Privacy and security
- Data governance
- Consent management
- Collaboration and partnerships
- Technological infrastructure
- Education and training
- Continuous improvement

Interoperability must move from a compliance activity to a strategic initiative.

The HL7 FHIR Accelerator Program

- Stakeholders with shared goal + policy radar + implementers + standard development

PART 2 – INTRODUCTION TO FHIR

- What is an API and what is a healthcare API?
- Overview of FHIR
- Benefits of FHIR
- FHIR Versioning
- FHIR Essential Concepts
- Navigating the Specification
- Resources, Profiles, and Operations
- FHIR Extensions

The FHIR Standard: https://hl7.org/fhir/

FHIR Bibliography: https://danielvreeman.com/project/fhir-bibliography/

Data Exchange with HL7 – Brief History

- **Messaging** - HL7 v2.x : 1987…
- **Clinical Document Architecture** - CDA R2 : 2000…
- **Services** – EIS/CTS: 2002…
- **Resource Based API** - FHIR: 2012…
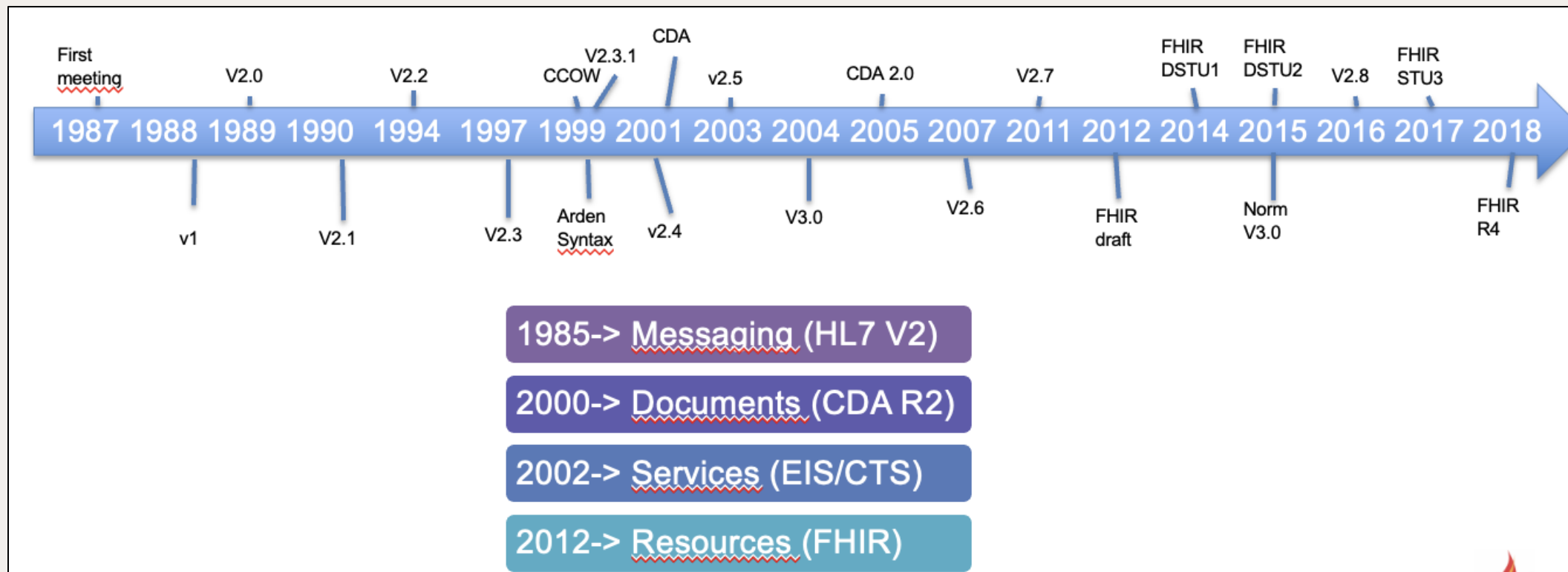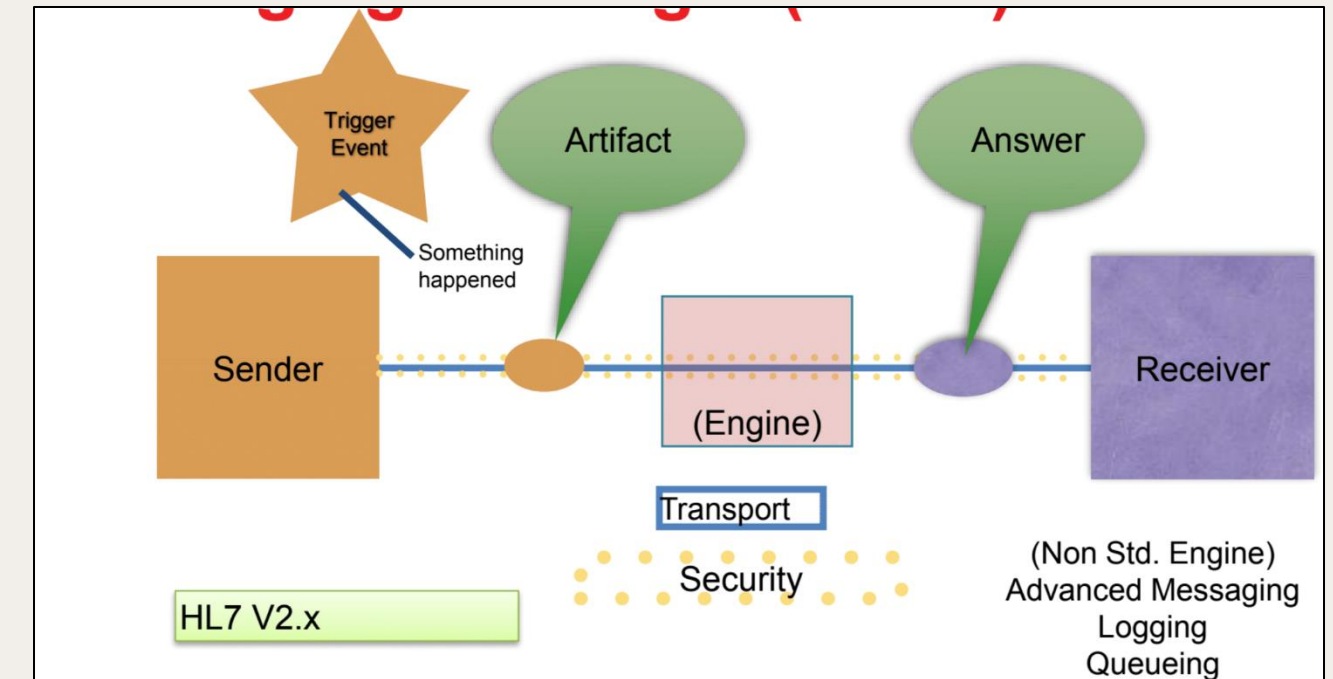
What is an API?

- The World Has Been Changed By Application Programming Interfaces (APIs)…
- "API": Application Program Interface : A way for one system to call another. A **<u>CONTRACT.</u>**
- Local vs Remote APIs vs RESTful APIs
- Proprietary (lock in) vs Open/Standard APIs
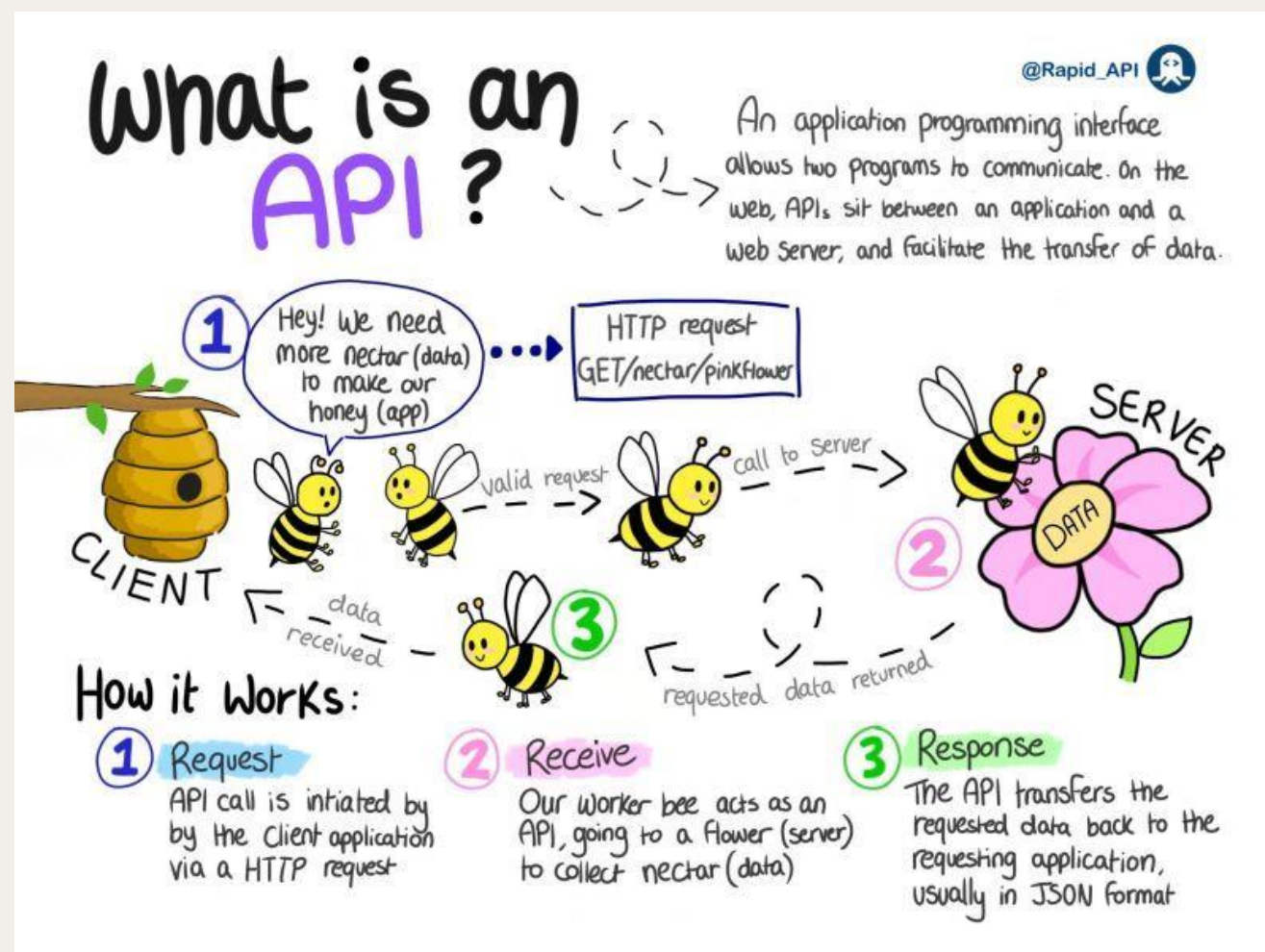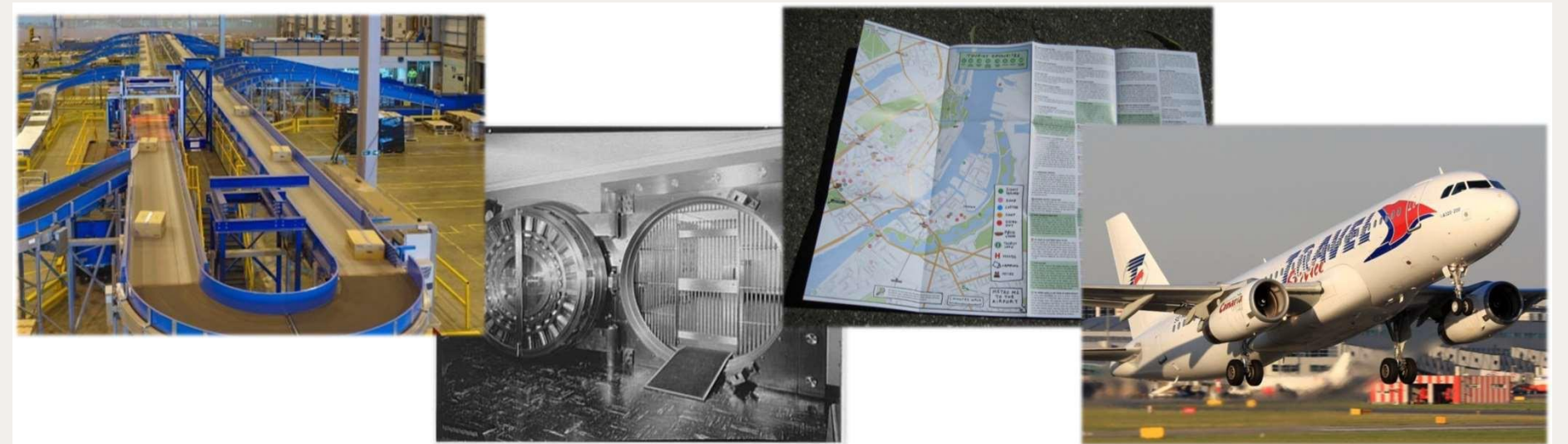
APIs are good for:
Access data from third parties
Hide complexity
Extend functionality
Centralize security
Standardize access to data

Overview of FHIR

- **F**ast **H**ealthcare **I**nteroperability **R**esources

- RESTful APIs explain how 99% of the web and the clouds services works today.

- FHIR defines for Distributed Healthcare Data:
  - the content "resources" and
  - the methods "API"

  - Consistent, simple to use content model resources / Supports all paradigms of exchange
  - Designed with implementers in mind / Freely available
  - Detailed on-line, hyperlinked specification / Freely available tooling, servers, libraries

Transport: HTTPs / other

Security: oAUTHx / other

Syntax: XML / JSON (preferred) / RDF

Structure: FHIR Resources/Datatypes

Methods: HTTP methods / other

Terminology: FHIR terminology + other

REST APIs explain how 99% of the web and the clouds services works today

FHIR is the web, for healthcare

Now…YOU try it: →
https://tinyurl.com/tryfhir

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Benefits of FHIR

- **For Patients**
  - Improved patient engagement, enabled through FHIR-enabled applications.

- **For Organizations**
  - Major vendor commitment, faster deployment.
  - Standards based API to support internal application development.
  - Data standards to support analytics and population management.

- **For Clinicians**
  - Access to a more complete patient record and improved decision-making tools.

- **For Implementers**
  - Familiar tooling and technologies, open-source code libraries, active community.
  - Validation services.
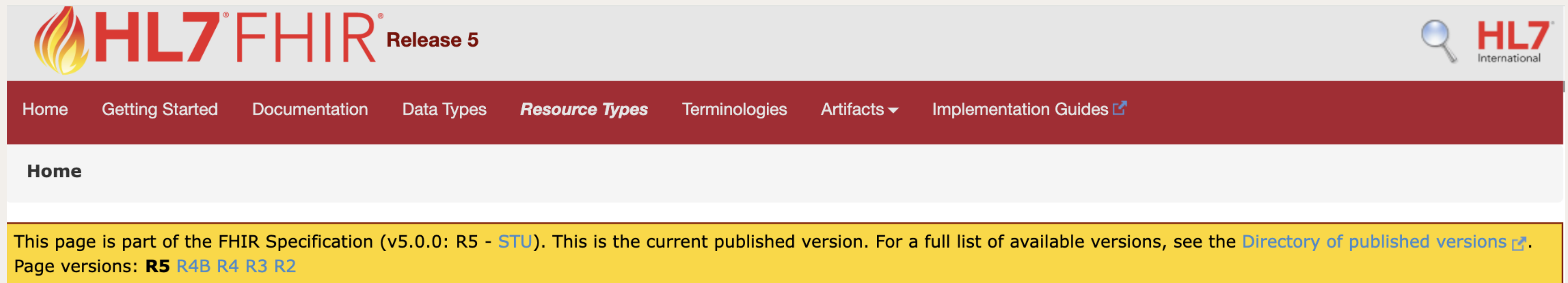
Navigating the Specification

- **Getting Started:** "elevator" pitch for different roles in your organization: architect, policy maker, developer.

- **Documentation:** How everything works: API exchange, documents, messages, syntax.

- **Data Types:** Building Blocks for Resources.

- **Resource Types:** How the actual content is defined: patients, providers, organizations, problems, etc.

- **Terminologies:** Which codes to use in coded elements, or where to find them (external).
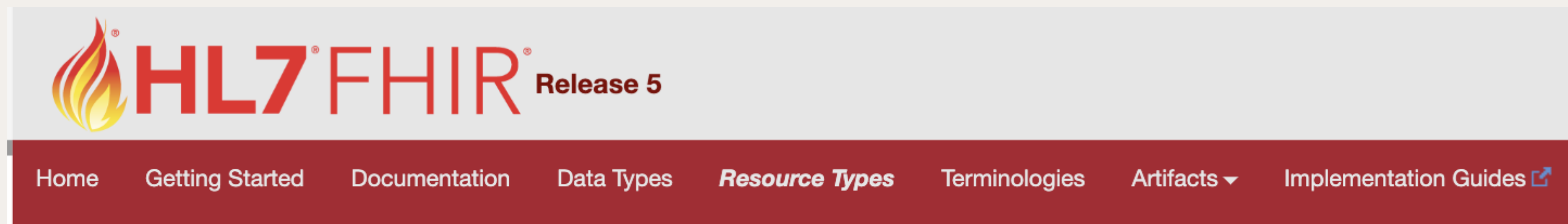
FHIR Versions & Timeline

- **Current US regulations points to FHIR R4/R4B.**   Last version: FHIR R5 (2023)
  DSTU2: 2015 STU3: 2016   R4: 2019   R5: 2023 (minor)   R6: 2025? (major)

HL7 FHIR Release 5

| Home | Getting Started | Documentation | Data Types | **Resource Types** | Terminologies | Artifacts ▾ | Implementation Guides ⧉ |

Home

This page is part of the FHIR Specification (v5.0.0: R5 - STU). This is the current published version. For a full list of available versions, see the Directory of published versions ⧉.
Page versions: **R5** R4B R4 R3 R2

R4B: R4+Subscriptions

FHIR Essential Concepts: Resources

- Resource: **Minimum Artifact to Exchange**, sweet spot in size and granularity.
- Not a complete EHR for a patient, not a single type of result, not a single attribute for a patient.

Categorized FHIR Resource Types
https://hl7.org/fhir/resourcelist.html

Example Resource Definition ("Patient")
https://hl7.org/fhir/patient.html

FHIR Essential Concepts: FHIR Resource Example

- Representing real life using FHIR Resources

55 y.o. AA male with hypertension and diabetes

Encounter 1

History: Patient is seen at and afterhours urgent care for a sore throat for 3 days. He has had a mild fever up to 101 Fahrenheit. He denies any other respiratory or gastrointestinal symptoms.
Medications: metoprolol and glipizide. Allergies: none. Social History: non-smoker. Married. 3 adult children.

Vital signs: temperature 100.5 F, BP 110/75, RR 12, HR 70, O2 Sat 97% on room air
On exam he has pus over his tonsils. His neck lymph nodes are enlarged. The rest of the exam is normal
Lab: Rapid strep test is positive
Assessment and Plan: Streptococcal sore throat. Patient is prescribed amoxicillin

Encounter 2

History: Patient returns with a rash over his chest that began after he started the amoxicillin. He admits that he has never taken amoxicillin before. He has no other respiratory symptoms. His fever and sore throat have resolved.

Vital signs are normal.
Exam shows a raised rash over patient's chest and arms
Assessment: penicillin allergy. Strep throat resolving
Plan: Patient was switched to azithromycin

Legend:
- Patient
- Encounter
- Condition
- Observation
- Medication
- Allergy Intolerance
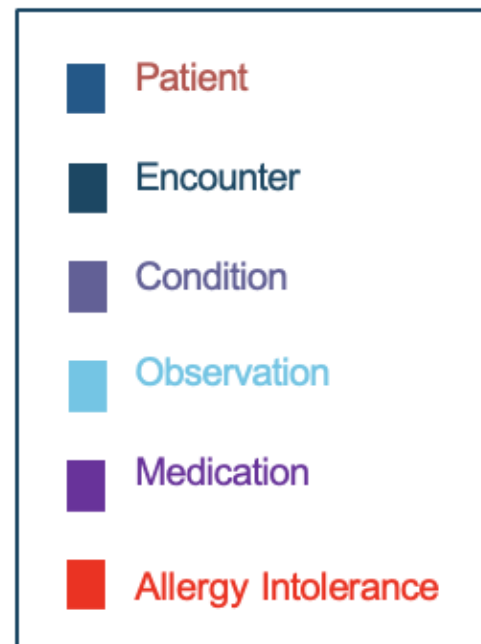
FHIR RESTful API

- Most common way to exchange resources…HTTP GET/PUT/POST to an Endpoint.
- The RESTful API defines a set of common interactions read, update, search, etc. performed on a repository of typed resources.
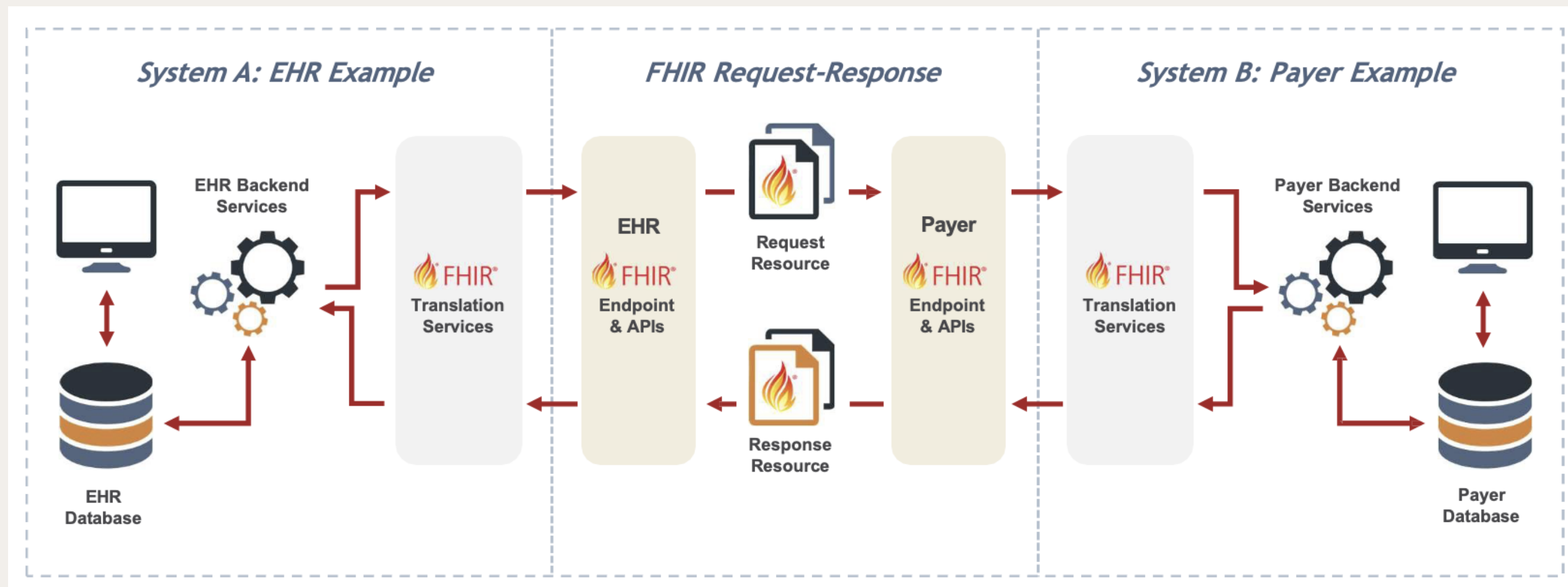
FHIR Operations

- When FHIR RESTful is not enough, and you need the server to apply special algorithms before answering.

FHIR Profiles

- A profile is a set of constraints on a resource represented as a structure definition.
- **"This not just a FHIR Patient Resource, it is a FHIR Patient for the US".**

FHIR Extensions

- An extension is the FHIR approach to adding valid data requirements to a resource.
- Example – US Core race extensions on Patient resource.

Name	Flags	Card.	Type	Description & Constraints
🔒 Patient		0..*	Patient	Information about an individual or animal receiving health care services
● race		0..1	(Complex)	(USCDI) US Core Race Extension URL: http://hl7.org/fhir/us/core/StructureDefinition/us-core-race
● ethnicity		0..1	(Complex)	(USCDI) US Core ethnicity Extension URL: http://hl7.org/fhir/us/core/StructureDefinition/us-core-ethnicity
● tribalAffiliation		0..*	(Complex)	(USCDI) Tribal Affiliation Extension URL: http://hl7.org/fhir/us/core/StructureDefinition/us-core-tribal-affiliation
● birthsex		0..1	code	Birth Sex Extension URL: http://hl7.org/fhir/us/core/StructureDefinition/us-core-birthsex Binding: Birth Sex (required): Code for sex assigned at birth
● sex		0..1	code	(USCDI) Sex Extension URL: http://hl7.org/fhir/us/core/StructureDefinition/us-core-sex Binding: Sex (required): Concepts limited to Male, Female, Patient Sex Unknown, asked-declined.
● genderIdentity		0..*	CodeableConcept	(USCDI) The individual's gender identity URL: http://hl7.org/fhir/us/core/StructureDefinition/us-core-genderIdentity Binding: Gender Identity (extensible)
📁 identifier	S	1..*	Identifier	(USCDI) An identifier for this patient
📁 system	S	1..1	uri	(USCDI) The namespace for the identifier value
📁 value	S	1..1	string	(USCDI) The value that is unique within the system.
📁 name	S C	1..*	HumanName	(USCDI) A name associated with the patient us-core-6: At least name.given and/or name.family are present or, if neither is available, the Data Abs present.

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FHIR Terminology

- Terminologies are the collections of codified concepts used in FHIR.

4.3.0.1 External Code systems

URI	Source	Use with HL7 Standards	OID (for non-FHIR systems)
http://snomed.info/sct	SNOMED CT (SNOMED International ↗)	Using SNOMED CT with HL7 Standards ↗ See also the SNOMED CT Usage Summary which summarizes the use of SNOMED CT in the base FHIR Specification.	2.16.840.1.113883.6.96
http://www.nlm.nih.gov/research/umls/rxnorm	RxNorm (US NLM ↗)	Using RxNorm with HL7 Standards ↗	2.16.840.1.113883.6.88
http://loinc.org	LOINC (LOINC.org ↗)	Using LOINC with HL7 Standards ↗	2.16.840.1.113883.6.1
https://fhir.infoway-inforoute.ca/CodeSystem/pCLOCD	pCLOCD (pCLOCD ↗)	Using pCLOCD with HL7 Standards ↗	2.16.840.1.113883.2.20.5.1
http://unitsofmeasure.org	UCUM: (UnitsOfMeasure.org ↗) Case Sensitive Codes	Using UCUM with HL7 Standards ↗	2.16.840.1.113883.6.8
http://www.ama-assn.org/go/cpt	AMA CPT codes ↗	Using CPT with HL7 Standards ↗	2.16.840.1.113883.6.12
http://va.gov/terminology/medrt	MED-RT (Medication Reference Terminology) ↗	Using MED-RT with HL7 Standards ↗	2.16.840.1.113883.6.345

8.1.3.1 Terminology Bindings

Path	ValueSet	Type	Documentation
Patient.gender	AdministrativeGender	Required	The gender of a person used for administrative purposes.
Patient.maritalStatus	MaritalStatusCodes	Extensible	This value set defines the set of codes that can be used to indicate the marital status of a person.
Patient.contact.relationship	PatientContactRelationship	Extensible	The nature of the relationship between the patient and the contact person.
Patient.contact.gender	AdministrativeGender	Required	The gender of a person used for administrative purposes.
Patient.communication.language	AllLanguages (a valid code from Tags for the Identification of Languages ↗)	Required	This value set includes all possible codes from BCP-47 (see http://tools.ietf.org/html/bcp47)
	Common Languages	starter	
Patient.link.type	LinkType	Required	The type of link between this Patient resource and another Patient/RelatedPerson resource.

This value set contains 4 concepts

Expansion based on AdministrativeGender v5.0.0 (CodeSystem)

Code	System	Display	Definition	v2 map for AdministrativeGender ↗
male	http://hl7.org/fhir/administrative-gender	Male	Male.	~M ↗
female	http://hl7.org/fhir/administrative-gender	Female	Female.	~F ↗
other	http://hl7.org/fhir/administrative-gender	Other	Other.	>A ↗(Source concept 'other' is broader than target concept 'Ambiguous' because target concept does not include 'Other') >O ↗(Source concept 'other' is broader than target concept 'Other' because target concept does not include 'Ambiguous')
unknown	http://hl7.org/fhir/administrative-gender	Unknown	Unknown.	~U ↗

PART 3 – THE FHIR TOOLBOX

- The FHIR Toolbox: SMART-On-FHIR, CDS-HOOKS, FHIR Bulk, CQL
- Implementation Guides
- US CORE vs US CDI
- Example Scenarios: Payer Data Exchange, Prior Authorization

The FHIR Toolbox

- More than one standard (FHIR). A standard family, with several tools.
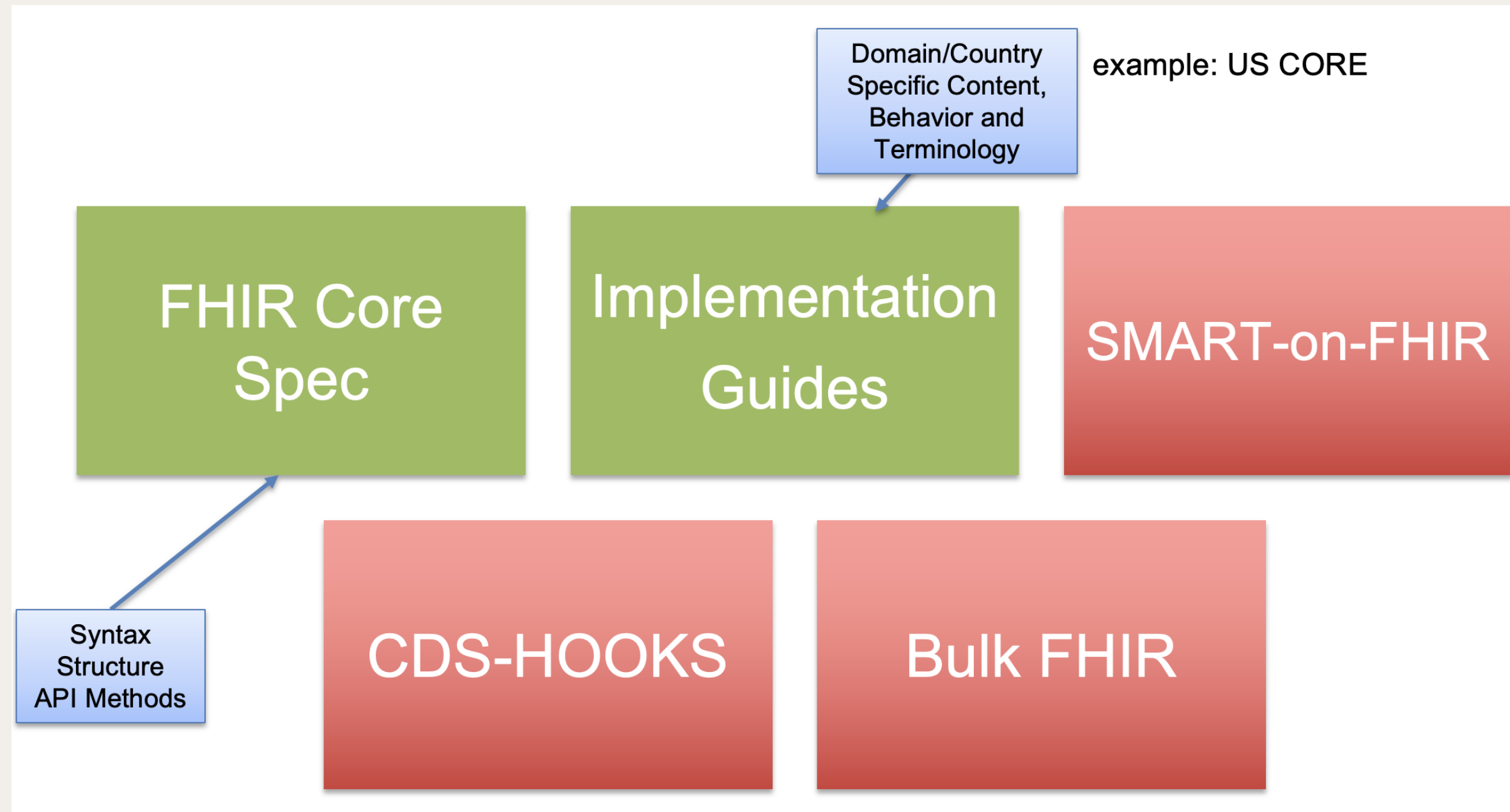
Why do we need Implementation Guides?

- **What is it?** An implementation guide (IG) is a set of rules about **how FHIR resources are used (or should be used) to solve a particular problem**, with associated documentation to support and clarify the usage. Classically, FHIR implementation guides are published on the web after they are generated using the FHIR Implementation Guide Publisher.

- **Contents**
  - Framework/Guidance
  - Use Cases and Examples
  - FHIR Artifacts
  - Conformance Language
  - Computable Capability Statement
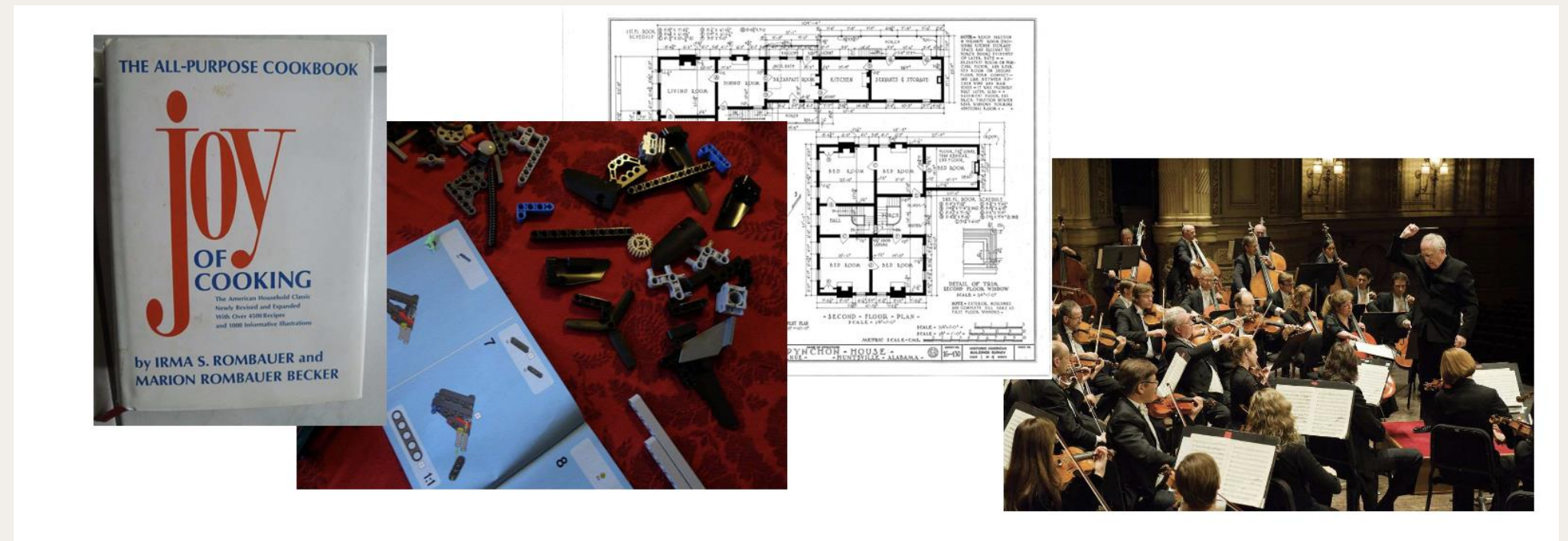
From US CDI to US CORE FHIR IG

- **US CDI:** Definitions from ONC on what should be shared

- **FHIR US CORE:** FHIR Implementation Guide defining precisely

  - **Content:** what is the MINIMAL content for the US

  - **Methods:** how can be patients, allergies, etc. searched

  https://hl7.org/fhir/us/core/STU6.1/

USCDI v3 Summary of Data Classes and Data Elements

US CDI V3: https://www.healthit.gov/isa/sites/isa/files/2022-10/USCDI-Version-3-October-2022-Errata-Final.pdf

SMART-on-FHIR

- Authorization/Authentication: Scopes: what can I read and/or write.

- Launch your special app 'inside' or 'outside' of the HER.

- For mobile apps, too.

- Patients and Practitioners apps have their own rules of engagement (user vs patient).

Reference:

- https://pubmed.ncbi.nlm.nih.gov/34486675/
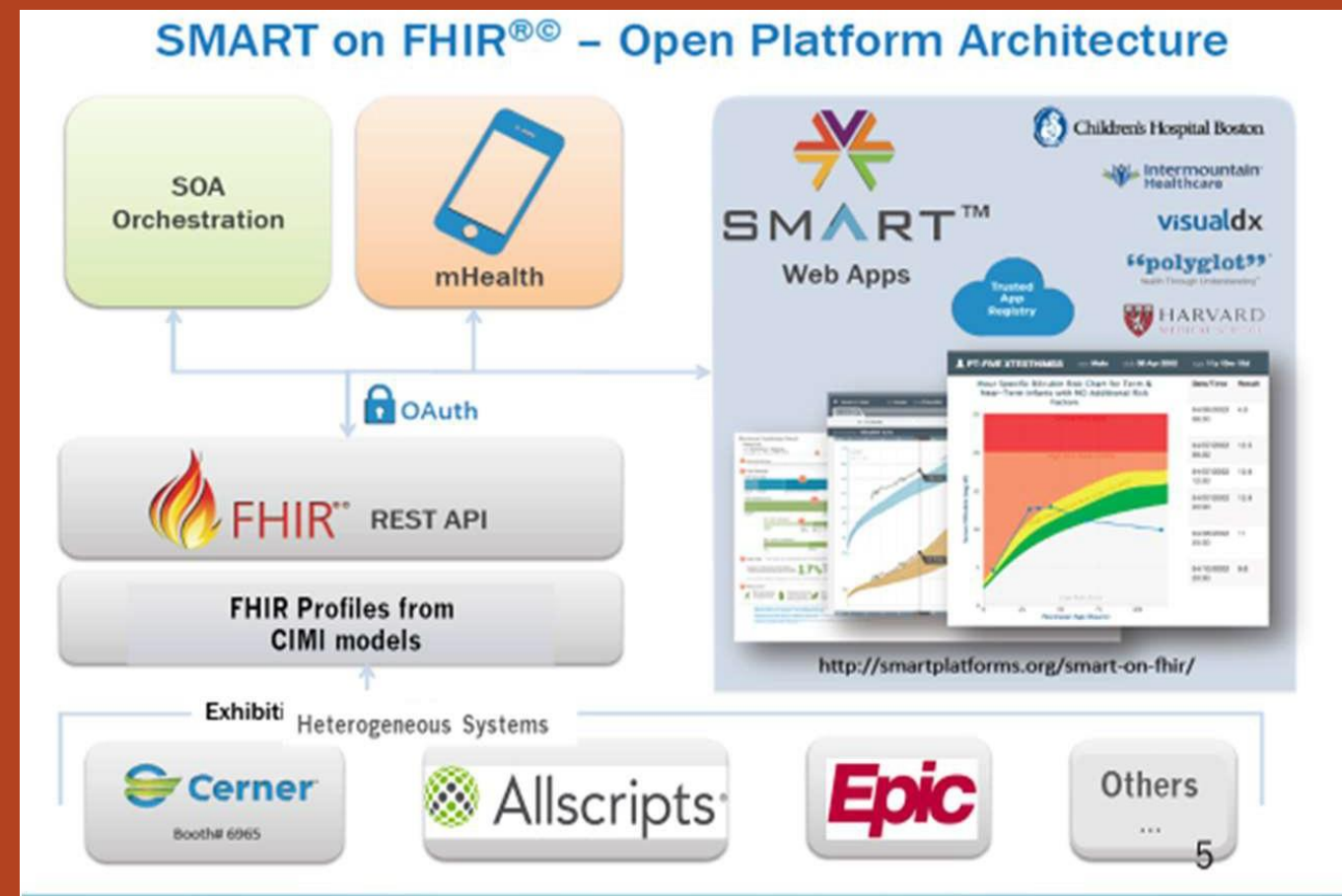
CDS HOOKS

- Remote Clinical Decision Support.

- EHR asks for advice given the context (hook), patient demographics, other required data in the form of FHIR Resources/Access.

- CDS system answers with a series of advices represented by cards.

- EHR can give feedback on the cards.

- Cards may lead to open a link, or actions inside of an EHR (example: cancel, update an order).

- Security is handled.
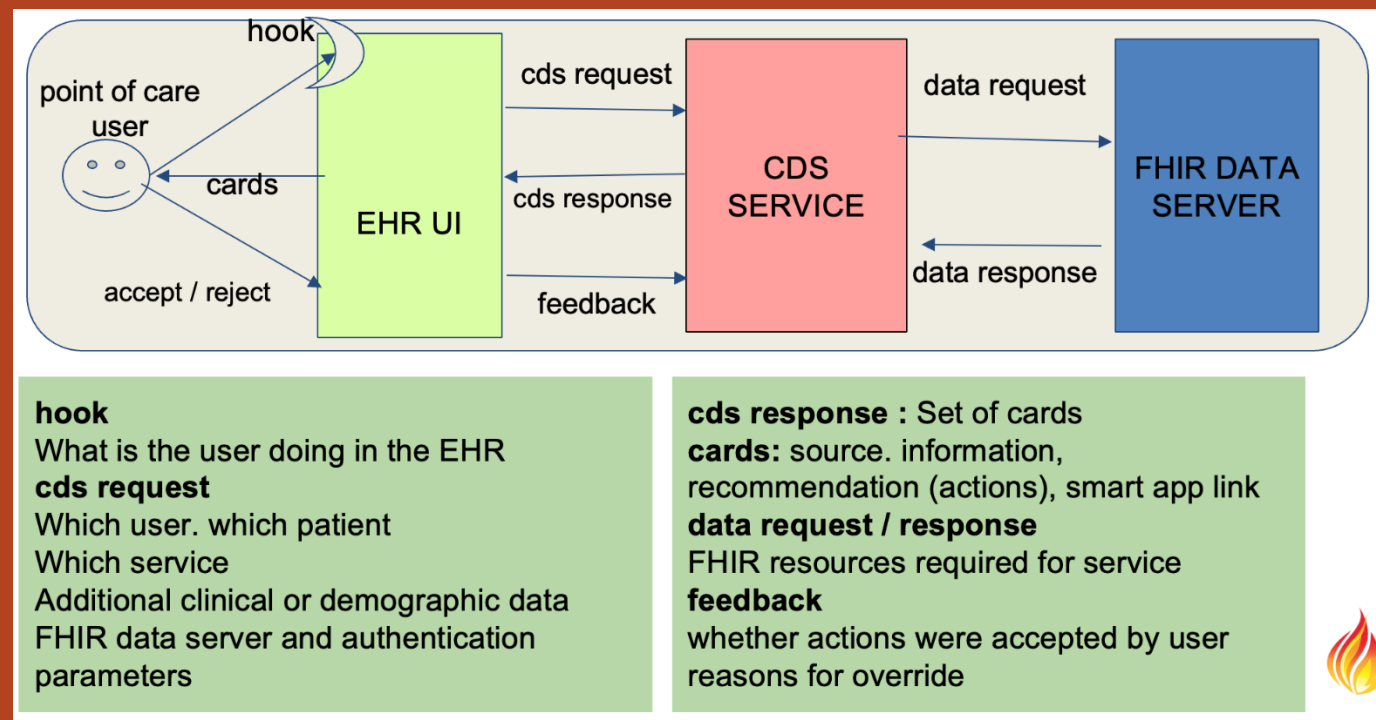
BULK-FHIR

- When you need hundreds of thousands or several million resources for Public Health, Quality Reporting or Research.

- RESTful Synchronic API is too slow (it's prepared to work for a few hundreds resources at a time).

- Bulk FHIR provides an ASYNCHRONIC API and a lean format (ndjson).

- Same resources, different goal and transport.

- Robust authentication/authorization.

Clinical Quality Language

Clinical Quality Language (CQL) — Authors use CQL to produce libraries containing human-readable yet precise logic.

Expression Logical Model (ELM) — ELM XML documents contain machine-friendly rendering of the CQL logic. This is the intended mechanism for distribution of libraries.

Native, Java Script, Drools, SQL — Implementation environments will either directly execute the ELM, or perform translation from ELM to their target environment language.

- High-level, domain-specific language focused on clinical quality and targeted at **measure and decision support** artifact authors.

- Good for representing the data needed from the EHR, and the logic to apply, to calculate numerator and denominator for population quality measures.

- Identify individual conditions or gaps in care.

Reference:

https://cql.hl7.org/index.html
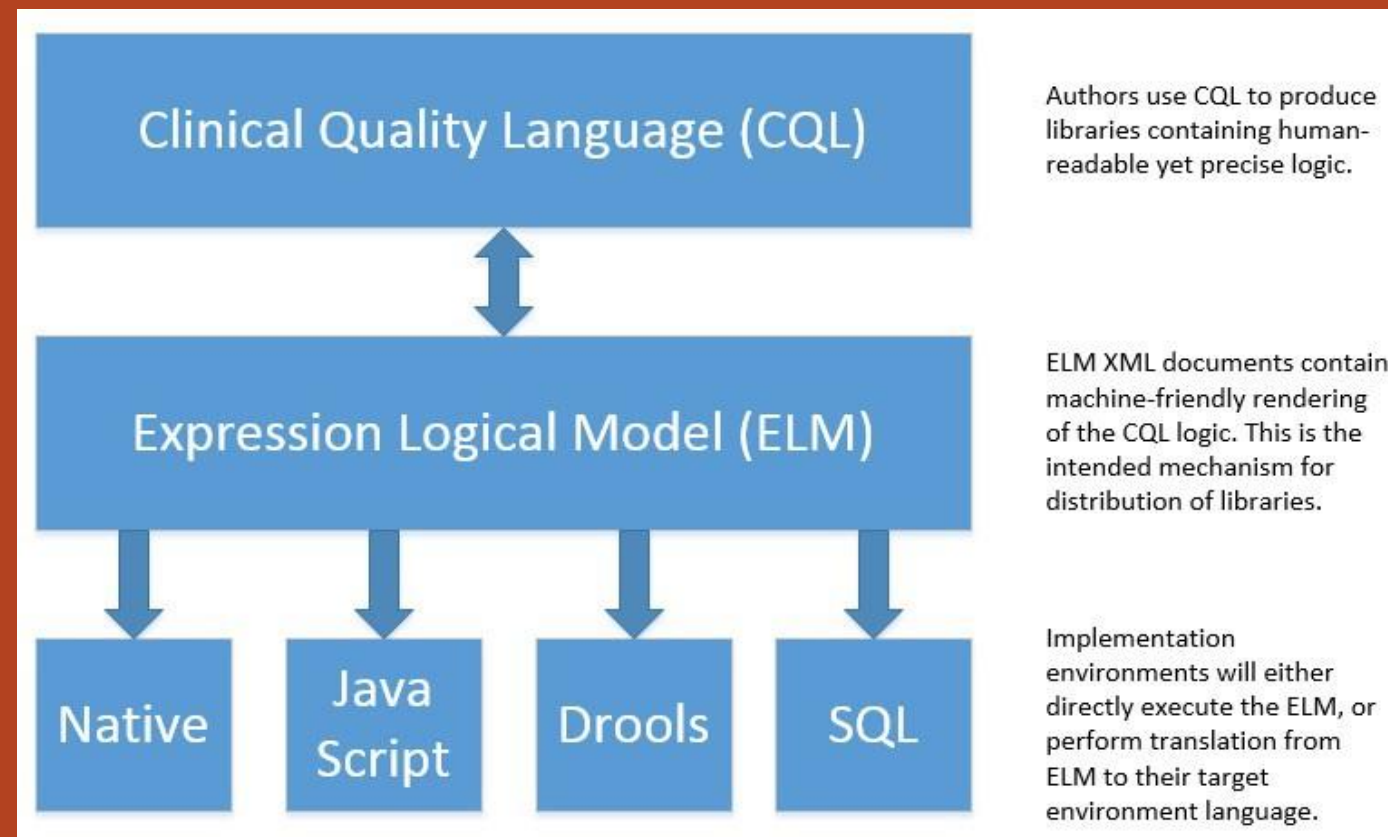
Example Scenario (1): Da Vinci PDEX

- Da Vinci PDEX (Payer Data Exchange)
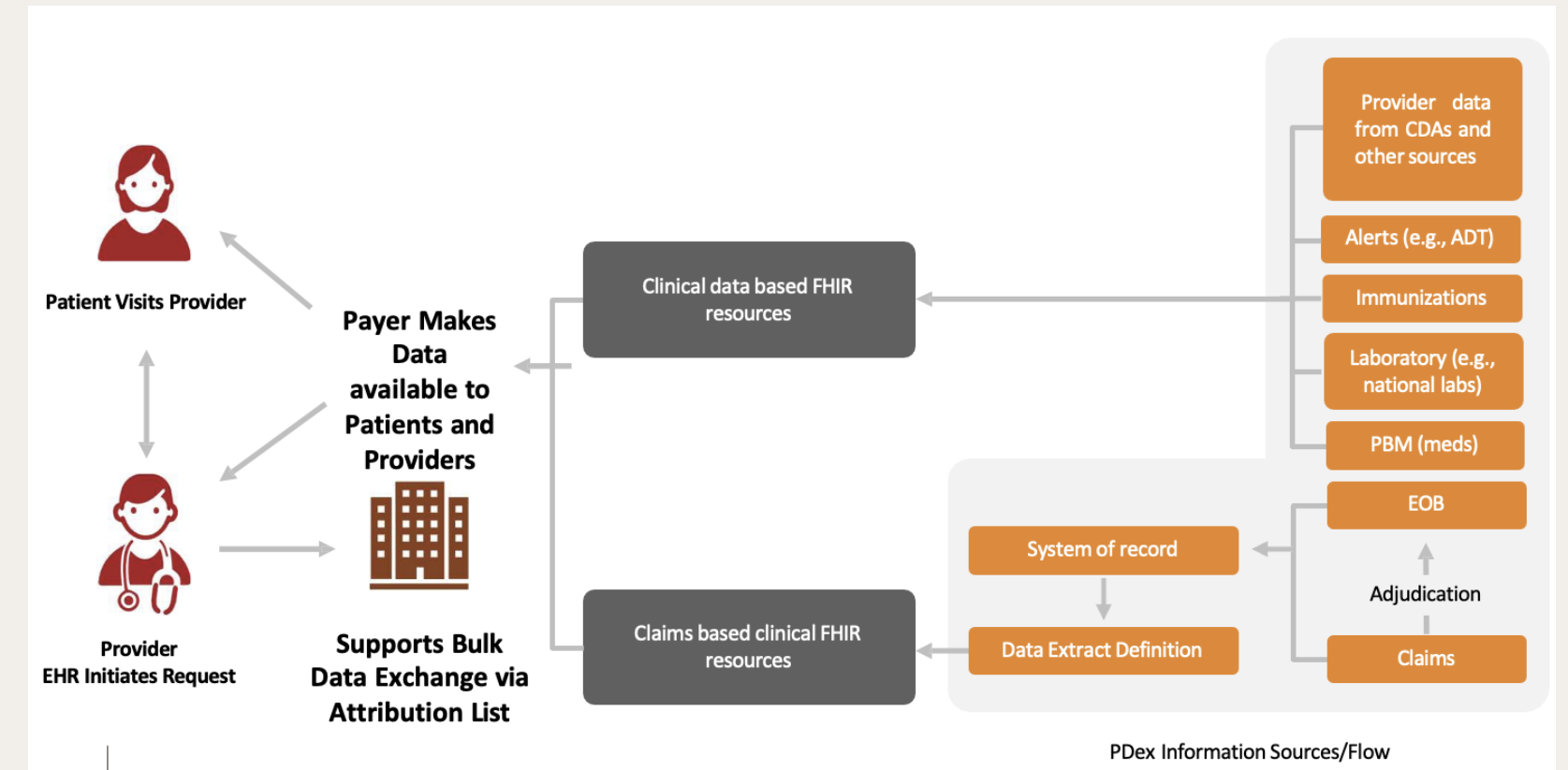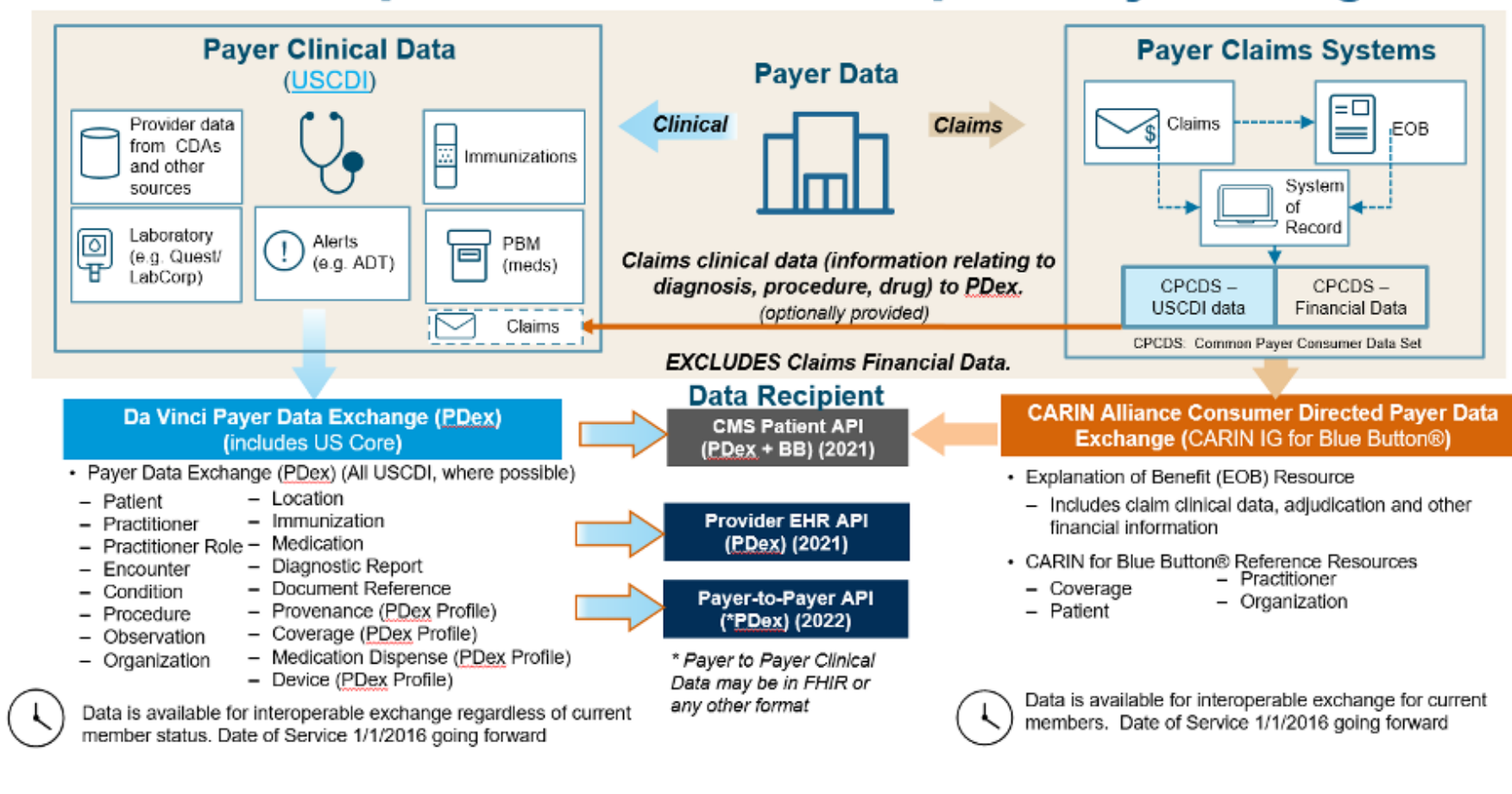
Example Scenario (2): Prior Authorization

- Uses all the FHIR Product Family: FHIR, US Core, CDS Hooks, Smart-on-FHIR, CQL!
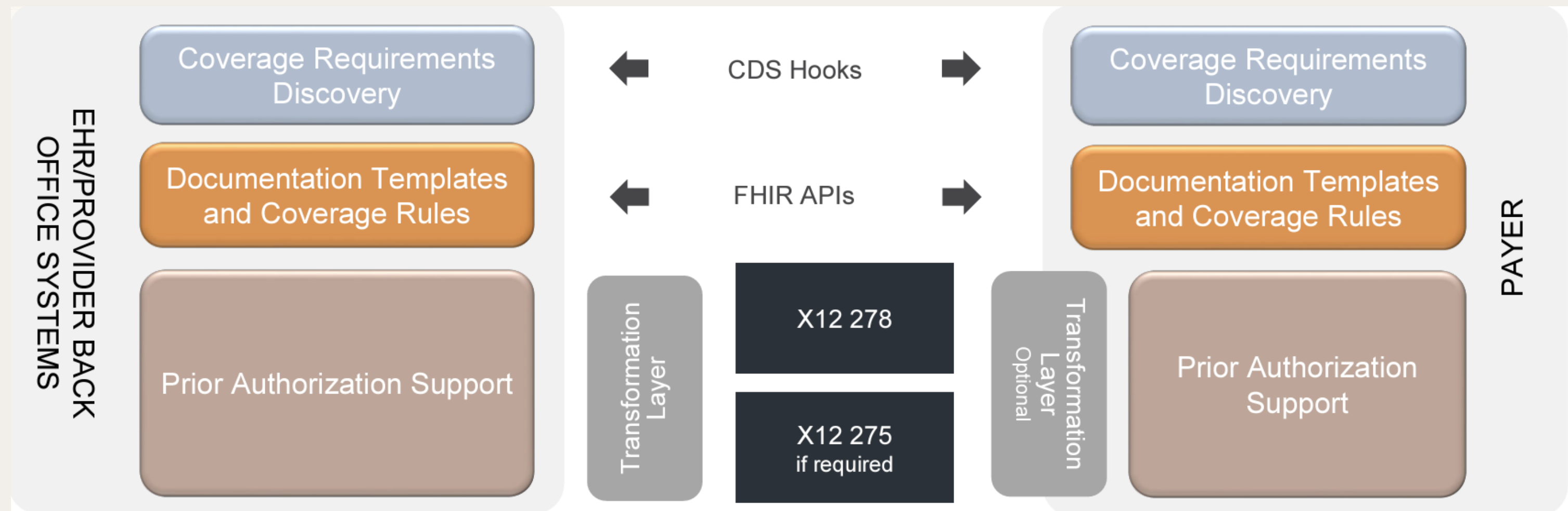
FHIR Timeline and Federal Regulations

CMS Interoperability and Prior Authorization Final Rule.

- Released January 17, 2024.
- Demonstrates CMS' continued commitment to increasing efficiency by *ensuring that health information is readily available* to providers by leveraging Health Level 7® (HL7®) Fast Healthcare Interoperability Resources® (FHIR®) standards.
- **In response to stakeholder comments on the proposed rule, impacted payers have until at least January 1, 2027, to meet the application programming interface (API) development and enhancement requirements.**

The final rule will reduce patient, provider, and payer burden by *streamlining prior authorization processes and moving the industry toward electronic prior authorization.*

FHIR Timeline and Federal Regulations

- Required APIs

Standards	Patient Access API	Provider Access API	Provider Directory API	Payer-To-Payer API	Prior Authorization API
USCDI, at 45 CFR 170.213	✅	✅	N/A	✅	N/A
FHIR Release 4.0.1	✅	✅	✅	✅	✅
HL7 FHIR US Core IG STU 3.1.1	✅	✅	✅	✅	✅
HL7 SMART App Launch Framework IG 1.0.0	✅	✅	❌	❌	✅
HL7 FHIR Bulk Data Access IG v 1.0.0 STU 1	❌	✅	❌	✅	❌
OpenID Connect Core 1.0	✅	❌	❌	❌	❌

FHIR Timeline and Federal Regulations

- Recommended APIs

Implementation Guide	Patient Access API	Provider Access API	Provider Directory API	Payer-To-Payer API	Prior Authorization API
CARIN for Blue Button IG Version STU 2.0.0	✓	✓	✗	✓	✗
FHIR SMART App Launch IG Release 2.0.0 to support Backend Services Authorization	✗	✓	✗	✓	✗
Da Vinci PDex IG Version STU 2.0.0	✓	✓	✗	✓	✗
Da Vinci PDex U.S. Drug Formulary IG Version STU 2.0.1	✓	✗	✗	✗	✗
Da Vinci PDex Plan Net IG Version STU 1.1.0	✗	✗	✓	✗	✗
Da Vinci Coverage Requirements Discovery (CRD) IG Version STU 2.0.1	✗	✗	✗	✗	✓
Da Vinci Documentation Templates/Rules (DTR) IG Version STU 2.0.0	✗	✗	✗	✗	✓
Da Vinci Prior Authorization Support (PAS) IG Version STU 2.0.1	✗	✗	✗	✗	✓

Note: The Patient Access and Provider Directory API were finalized in the CMS *Interoperability and Patient Access* final rule.

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Questions?

Thank You!

Join us for our next session:

HL7 Standards Lifecycle | April 9 from 3-4pm ET

Registration Link: https://civitasforhealth-org.zoom.us/webinar/register/WN_LB5_Quw3RkaTxPF5N9JmkA