



Introduction to Fast Healthcare Interoperability Resource (FHIR)

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If HL7 were starting afresh today, what would the interoperability standards look like?



- Version 2: Extremely successful but not well suited to newer requirements
- Version 3: robust model but difficult to implement
- Clinical Document Architecture (CDA): Hugely successful but designed for document exchange mechanism

New use cases: mobile devices, online space, current standards were not a good fit;



Grahame Grieve surveyed the industry for best practices in modern interoperability frameworks outside the healthcare space;

Fast Healthcare Interoperability Resources (FHIR)
grew out of this work.

- **Easy to develop:** shallow learning curve and minimal custom tooling requirements
- Easy to implement
- **Semantically Robust:** can be mapped back to other standards
- **Implementer friendly:** uses common tools and formats, and web-based technologies for the specification
- The artifacts should be able to be validated electronically - as far as that is possible
- Integrates well with and leverages modern web-based communication technologies (HTTP, XML, JSON, etc.).

What is FHIR?



Standard to share healthcare data



Enables better & more efficient healthcare

- Why?
 - Better patient care
 - More efficient delivery
- How?

Enable improve adoption & consistent implementation,

 - Designed for implementers
 - Simple but extensible
 - Modern technology
 - Strong community

Healthcare-related interoperability

Administration

Clinical Care

Research

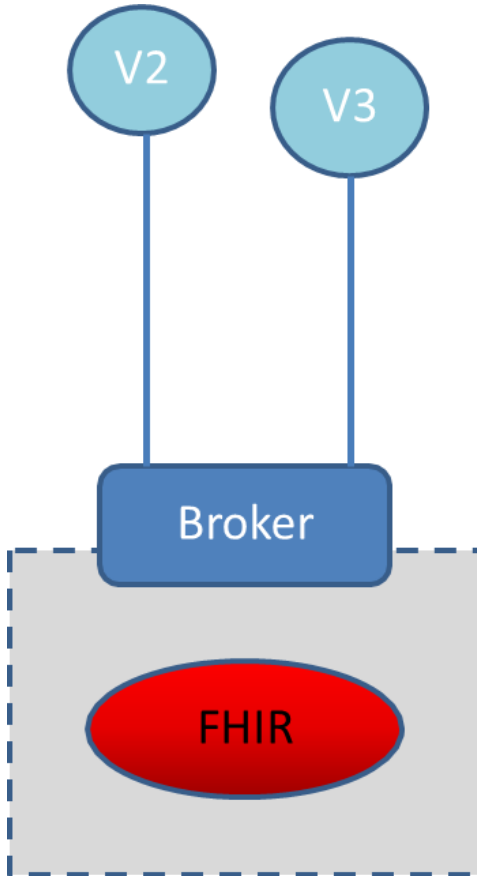
Other

- FHIR is released under an open license.
- FHIR is maintained and owned by HL7 International
- You can redistribute FHIR, create derivative specifications or implementation - related products and services
- Derivative Specifications cannot redefine what conformance to FHIR means
- You cannot claim that HL7 or any of its members endorses your derived [thing] because it uses content from this specification

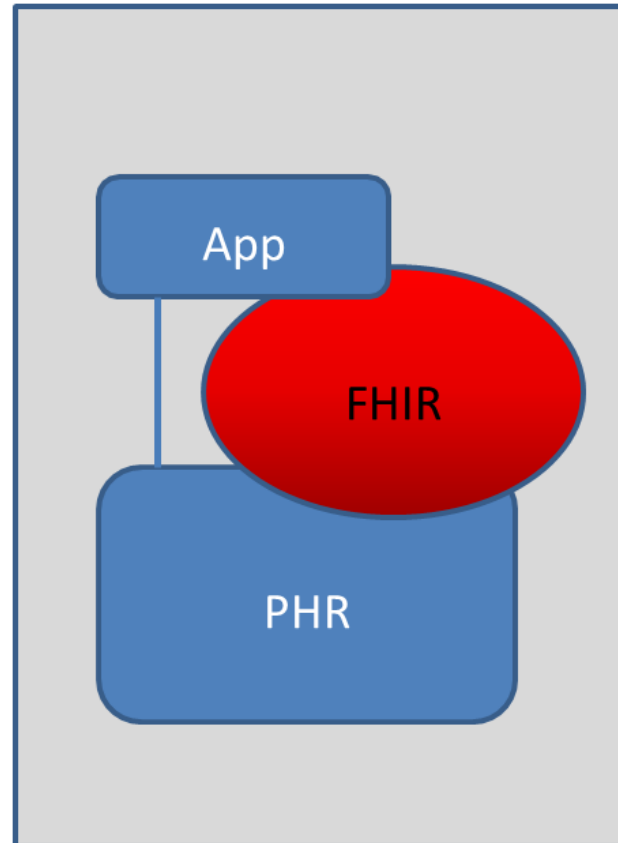
Note: Implementers do not need to be a member of HL7 International to use FHIR (although there are other benefits of being a member)

- Online queries to a RESTful server by a mobile or web application
- Using the XDS-compatible resources to store and locate documents (which could be FHIR documents, CDA, PDF, etc.) through the MHD Profile
- Internal messaging of events where you would generally use HL7 V2.x Admission, Discharge and Transfer (ADT) messages
- Sending a discharge summary to a repository

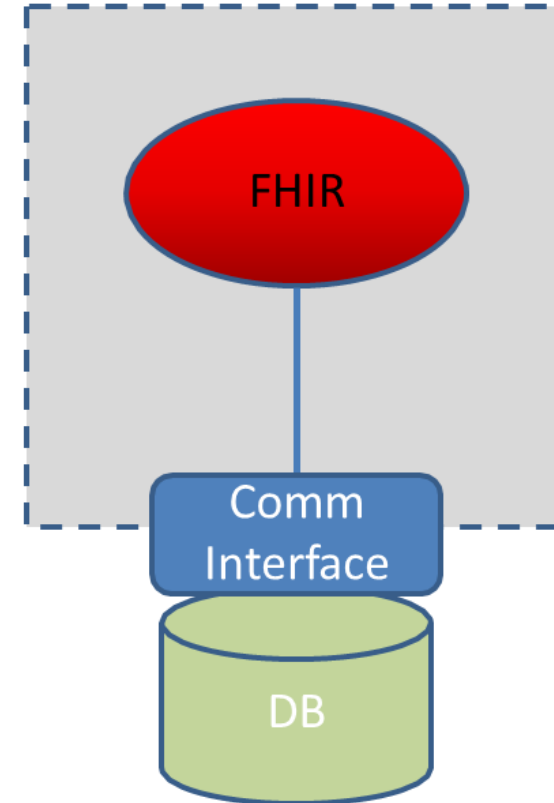
Using FHIR - Example Architectures



Message broker +
FHIR engine



FHIR server with
existing back end



FHIR server and FHIR
back end

- There are a number of FHIR key concepts, including:
 - Resources
 - Extensions
 - Data types
 - Bundles
 - Profiles

- A resource is the smallest unit of exchange that ‘makes sense’ in interoperability. E.g. – an Observation, a Patient or a Condition.
- Building blocks of all FHIR artifacts ~140-150
- Resource has:
 - Identity: something that identifies it as a logical ‘thing’
 - URI: location where it can be found
- A resource is made up of elements, each of which is a particular data type.

8.1.2 Resource Content

Structure	UML	XML	JSON	Turtle	R3 Diff	All
Structure						
Name	Flags	Card.	Type	Description & Constraints		
Patient	N		DomainResource	Information about an individual or animal receiving health care services Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension		
identifier	Σ	0..*	Identifier	An identifier for this patient		
active	?! Σ	0..1	boolean	Whether this patient's record is in active use		
name	Σ	0..*	HumanName	A name associated with the patient		
telecom	Σ	0..*	ContactPoint	A contact detail for the individual		
gender	Σ	0..1	code	male female other unknown AdministrativeGender (Required)		
birthDate	Σ	0..1	date	The date of birth for the individual		
deceased[x]	?! Σ	0..1		Indicates if the individual is deceased or not		
deceasedBoolean			boolean			
deceasedDateTime			dateTime			
address	Σ	0..*	Address	An address for the individual		
maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient MaritalStatus (Extensible)		
multipleBirth[x]		0..1		Whether patient is part of a multiple birth		
multipleBirthBoolean			boolean			
multipleBirthInteger			integer			
photo		0..*	Attachment	Image of the patient		
contact	I	0..*	BackboneElement	A contact party (e.g. guardian, partner, friend) for the patient + Rule: SHALL at least contain a contact's details or a reference to an organization		
relationship		0..*	CodeableConcept	The kind of relationship Patient Contact Relationship (Extensible)		

Types of Resource in FHIR



1.2 Resource Index

FHIR Infrastructure Work Group	Maturity Level: N/A	Standards Status: Informative
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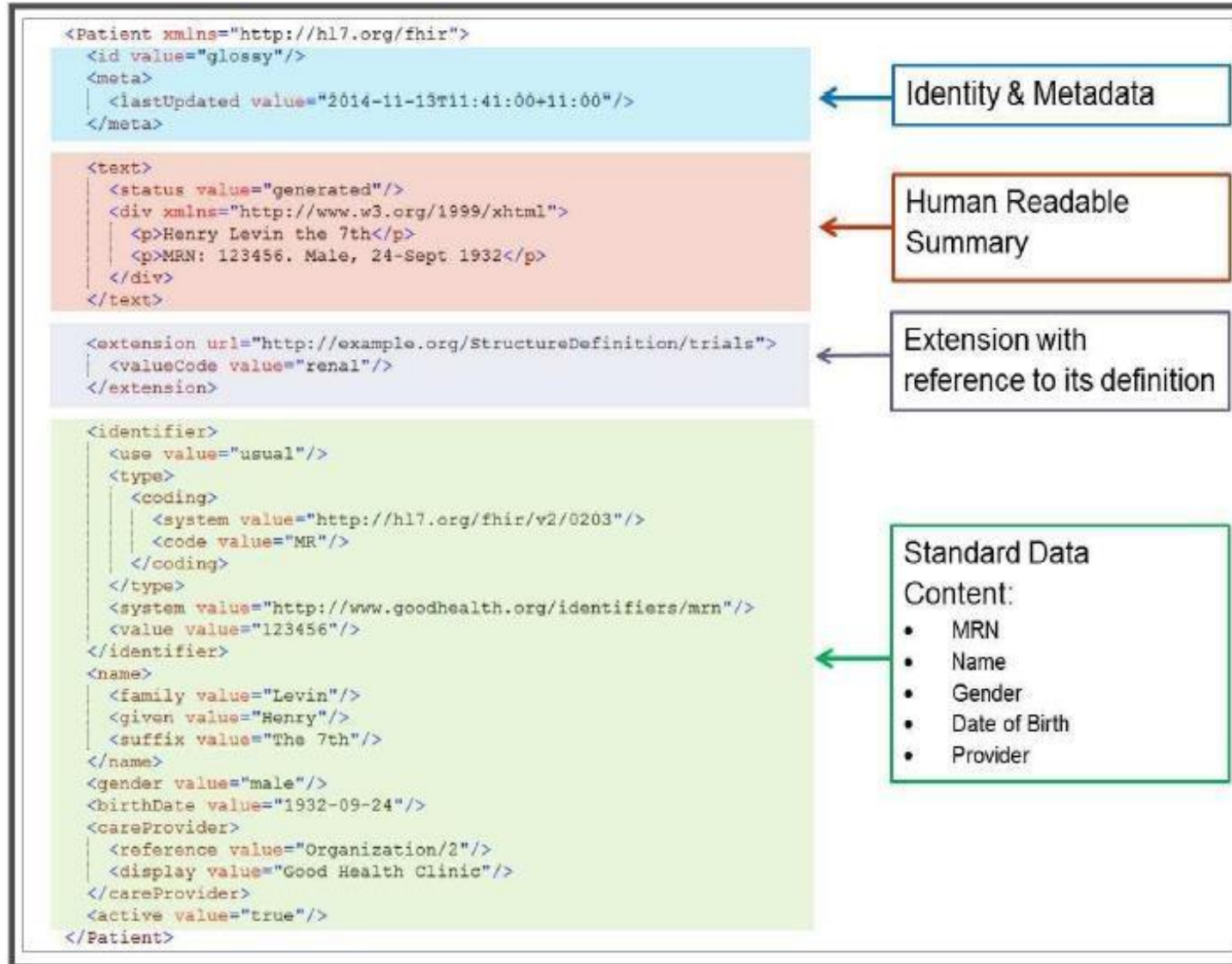
This page is provided to help find resources quickly. There is also a more detailed classification, ontology, and description. For background to the layout on the layers in this page, see the Architect's Overview. See also the abstract Base Resources Resource and DomainResource.

Categorized	Alphabetical	R2 Layout	By Maturity	Security Category	By Standards Status	By Committee
Foundation	Conformance <ul style="list-style-type: none"> CapabilityStatement N StructureDefinition N ImplementationGuide 1 SearchParameter 3 MessageDefinition 1 OperationDefinition N CompartmentDefinition 1 StructureMap 2 GraphDefinition 1 ExampleScenario 0 					
	Terminology <ul style="list-style-type: none"> CodeSystem N ValueSet N ConceptMap 3 NamingSystem 1 TerminologyCapabilities 0 					
	Security <ul style="list-style-type: none"> Provenance 3 AuditEvent 3 Consent 2 					
Base	Documents <ul style="list-style-type: none"> Composition 2 DocumentManifest 2 DocumentReference 3 CatalogEntry 0 					
	Other <ul style="list-style-type: none"> Basic 1 Binary N Bundle N Linkage 0 MessageHeader 4 OperationOutcome N Parameters N Subscription 3 					
	Individuals <ul style="list-style-type: none"> Patient N Practitioner 3 PractitionerRole 2 RelatedPerson 2 Person 2 Group 1 					
Clinical	Entities #1 <ul style="list-style-type: none"> Organization 3 OrganizationAffiliation 0 HealthcareService 2 Endpoint 2 Location 3 					
	Entities #2 <ul style="list-style-type: none"> Substance 2 BiologicallyDerivedProduct 0 Device 2 DeviceMetric 1 					
	Workflow <ul style="list-style-type: none"> Task 2 Appointment 3 AppointmentResponse 3 Schedule 3 Slot 3 VerificationResult 0 					
Clinical	Management <ul style="list-style-type: none"> Encounter 2 EpisodeOfCare 2 Flag 1 List 1 Library 2 					
	Summary <ul style="list-style-type: none"> AllergyIntolerance 3 AdverseEvent 0 Condition (Problem) 3 Procedure 3 FamilyMemberHistory 2 ClinicalImpression 0 DetectedIssue 1 					
	Diagnostics <ul style="list-style-type: none"> Observation N Media 1 DiagnosticReport 3 Specimen 2 BodyStructure 1 ImagingStudy 3 QuestionnaireResponse 3 MolecularSequence 1 					
Clinical	Medications <ul style="list-style-type: none"> MedicationRequest 3 MedicationAdministration 2 MedicationDispense 2 MedicationStatement 3 Medication 3 MedicationKnowledge 0 Immunization 3 ImmunizationEvaluation 0 ImmunizationRecommendation 1 					
	Care Provision <ul style="list-style-type: none"> CarePlan 2 CareTeam 2 Goal 2 ServiceRequest 2 NutritionOrder 2 VisionPrescription 2 RiskAssessment 1 RequestGroup 2 					
	Request & Response <ul style="list-style-type: none"> Communication 2 CommunicationRequest 2 DeviceRequest 1 DeviceUseStatement 0 GuidanceResponse 2 SupplyRequest 1 SupplyDelivery 1 					
Support <ul style="list-style-type: none"> Coverage 2 		Billing <ul style="list-style-type: none"> Claim 2 		Payment <ul style="list-style-type: none"> PaymentNotice 2 		General <ul style="list-style-type: none"> Account 2

- A number or an N letter next to the Resource represents FHIR Maturity Level (FMM)
- The FMM values range from 0 to 5 and finally N (Normative)
- More information can be referred at:

<http://www.hl7.org/implement/standards/fhir/versions.html#maturity>

Key Parts of a Resource



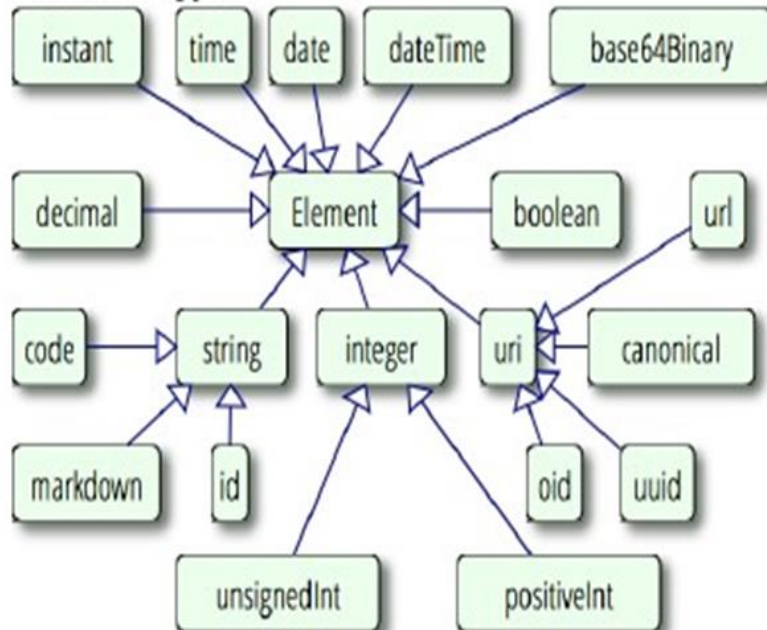
- Identity, Version, Last Updated
- Narrative or text section
- Element that is needed by our implementation but is not included in the core data set
- Structured, defined data, Core Dataset

- Additional requirements can be implemented as extensions.
- Every element in a resource can have extension child elements to represent additional information that is not part of the basic definition of the resource
- Extensions require a formal published definition that can be used by application developers or the applications themselves, to help integrate extensions into the healthcare process they support.
- An extension definition must make it clear why the extension exists, where and how it's used and what information does the extension convey.

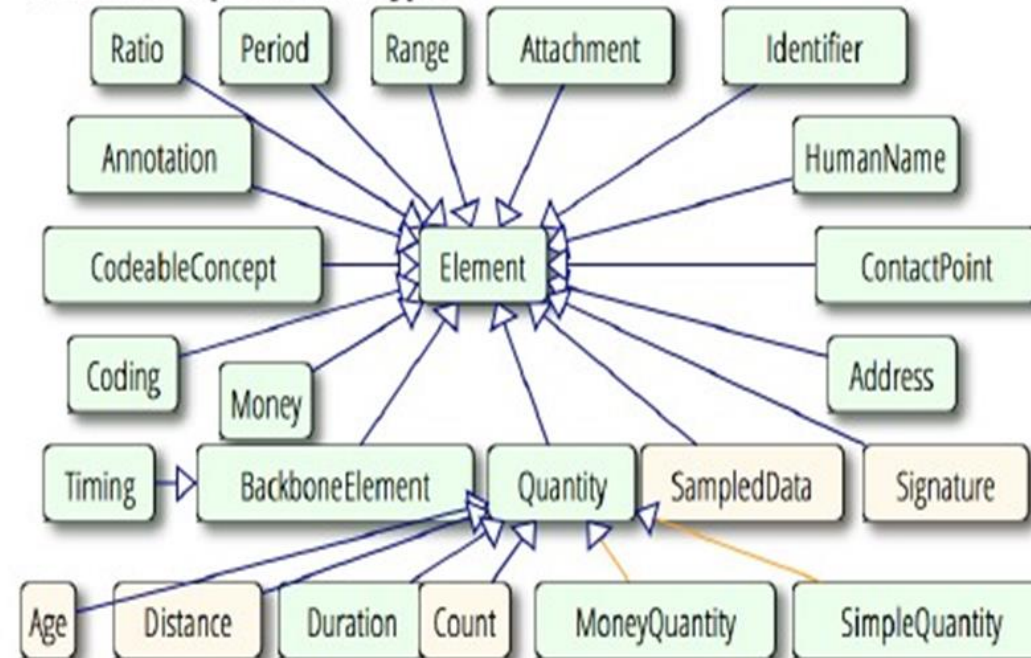
- FHIR specification defines a set of data types that are used for the resource elements.
- Each element within a resource is of a particular data type.
- Two categories of data types,
 - Simple/Primitive types: Single elements
 - Complex types: Reusable clusters of elements
- Based on the W3C schema.

Data Types

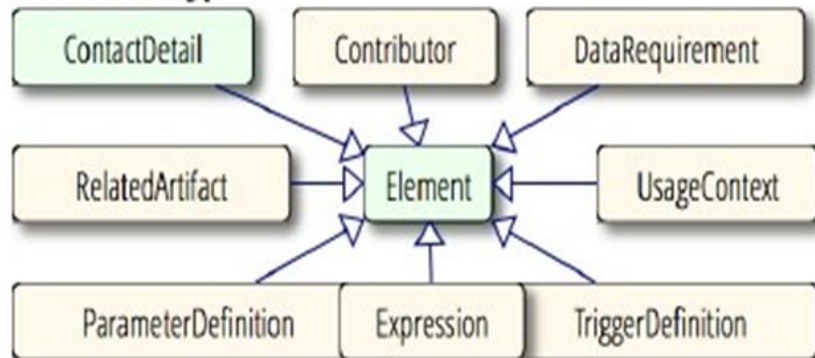
Primitive Types



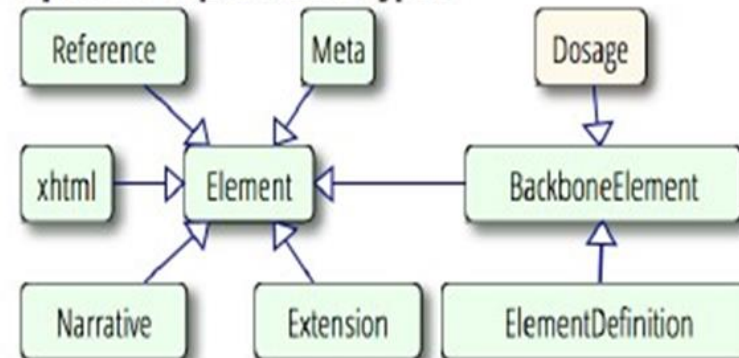
General-Purpose Data types



Metadata Types



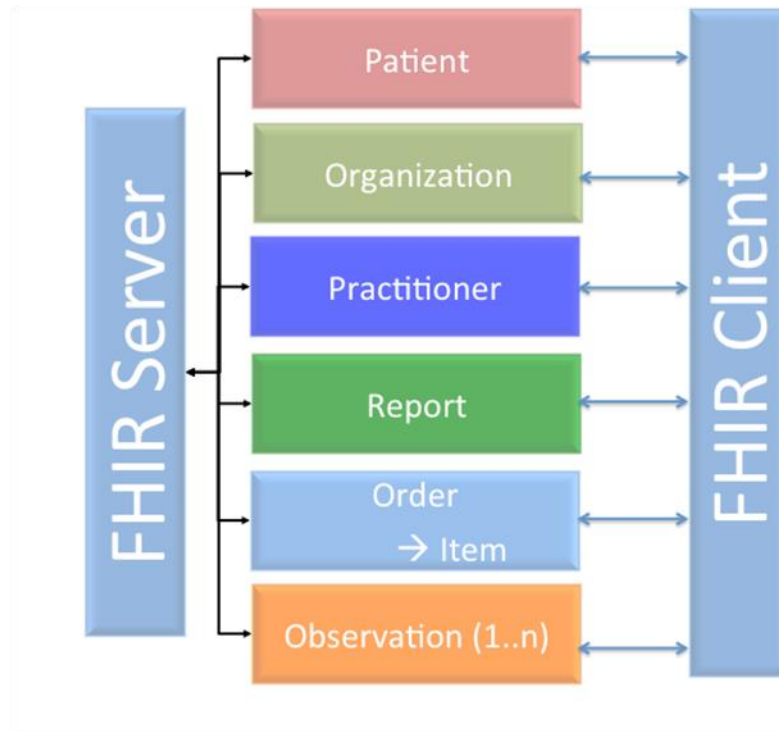
Special Purpose Data types



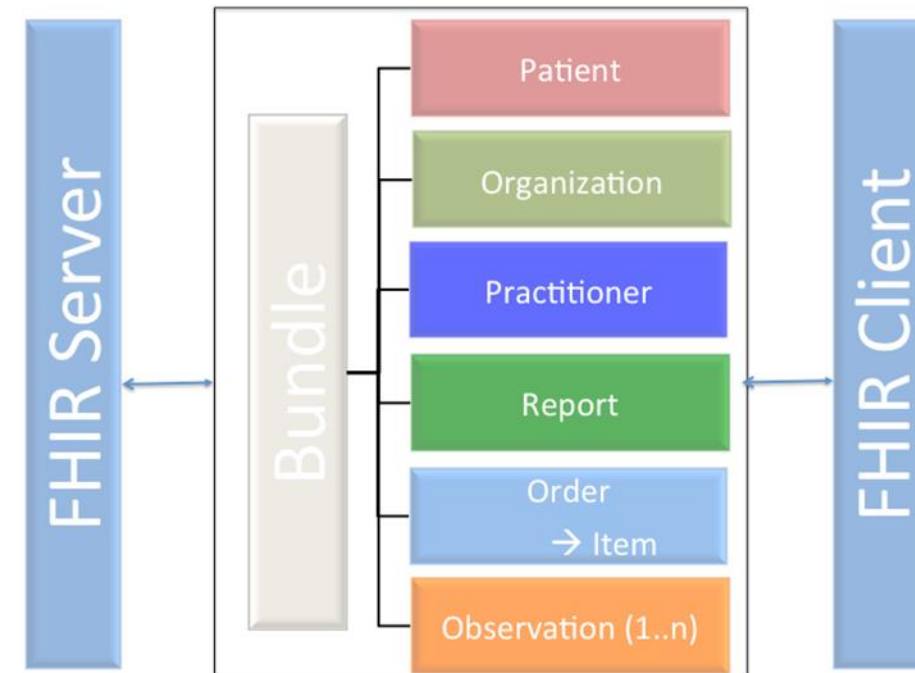
- Need: There are many situations where a collection of resources is required. These includes:
 - The results of a search
 - The collection of versions of a particular resource
 - A FHIR document
 - A FHIR message
 - A batch of resources to be processed

Bundles

- A lab report in FHIR can be represented as a set of related resources: patient, requesting physician, observations, report in PDF format, order.



Multiple resources meaning multiple round trips to the FHIR server



Multiple resources bundled for a Lab Report into a transaction

- The header contains:
 - The title of the feed
 - The time (as an instant) when it was created
 - An id for the bundle. This is used if the bundle is saved
 - A number of link elements. These are used to describe the application that created the bundle, and URLs that can be used for paging
- Each entry contains:
 - A title to give a summary of the entry
 - An Id, an absoluteURI that points to the logical Id of the resource in the entry element
 - The time (as an instant) when the resource in the entry was last updated
 - (optionally) A link element that does point to the version in the bundle

- FHIR can be used in multiple and diverse contexts
- Same concept can be implemented in different systems using different components, attributes, etc.
- Each server can implement a subset of the specification in terms of capabilities, content, format and transport mechanisms.

Profiles - Need

Add Patient Allergy

Carlson, Steven W. 11/14/1933 77y M

Type: ☒ Allergy ☐ Intolerance

Allergy: Blackberries

Status: Active

Onset Date: 02/13/1970

Reactions:

- ☒ Skin Rashes/Hives
- ☐ Nausea/Vomiting/Diarrhea
- ☐ Shock/Unconsciousness
- ☐ Anemia/Blood Disorder
- ☐ Asthma/Shortness of Breath
- ☐ Other

Comments:

☐ Add Multiple

Save Cancel

Allergies

Allergy: Penicillin G Sodium

Details: Nausea

Generic: 1282 Class: 0

Molecule:

Class:

Navigation buttons: << < > >>

Delete Cancel Save

**Different system
approaches to the
same concept**

Add reaction

Search:

☐ Drug class

☐ Ingredient

☐ Product

☒ Non drug

☐ Other

Nature of reaction: Bronchospasm

Severity: Moderate

Save Cancel

Add Allergy

Enter allergy:

☐ By drug ☒ By class ☐ Other

SHT RECEPTOR BLOCKERS
ACE INHIBITORS
ALPHA-ADRENERGIC BLOCKERS
ALUMINIUM HYDROXIDE AGENTS
AMINOGLYCOSIDES

Nature of reaction:

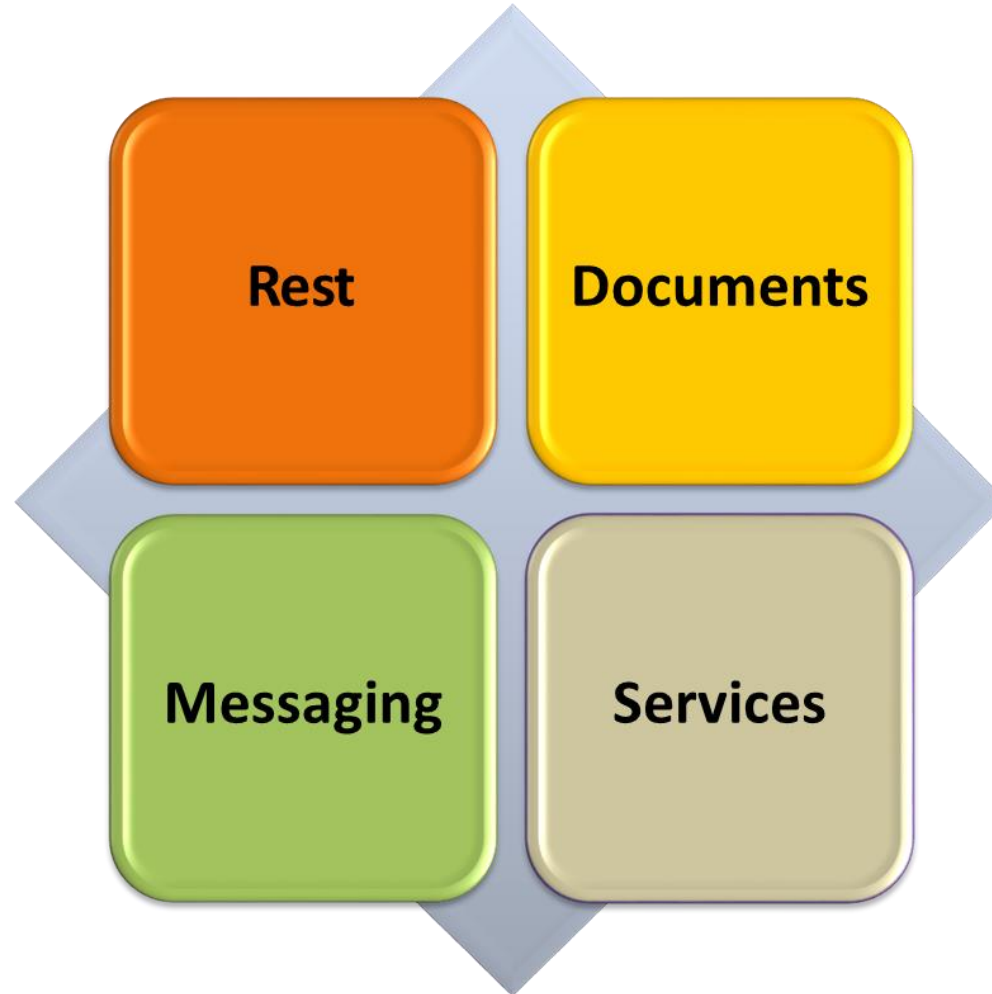
Add Cancel

- FHIR brings a new view to conformance and validation: profiles, conformance statements, and implementation guides can be created using FHIR resources, and a FHIR server can validate instances of resources against these profiles as one of the defined operations.
- FHIR introduces built-in profiling: a profile is defined and verified using the same standard and by the same servers.

Why do we create profiles?

- Communicate our colleagues what was decided or expected
- Allow automatic comparison and verification
- Support code generation / run-time discovery
- Create a publish/subscribe ecosystem
- Allow conformance validation

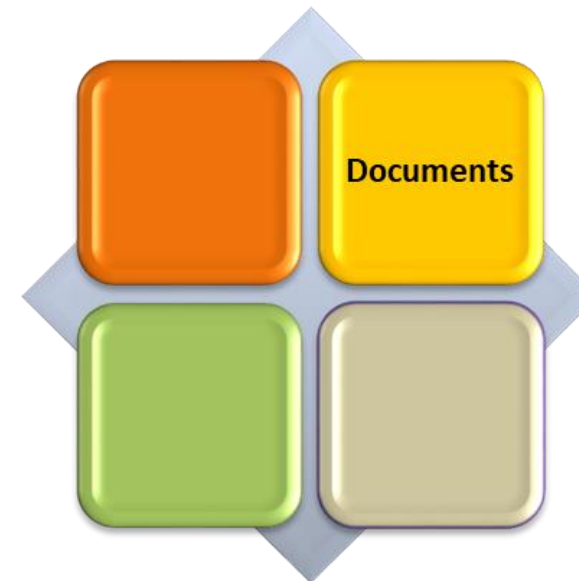
FHIR supports interoperability via 4 paradigms



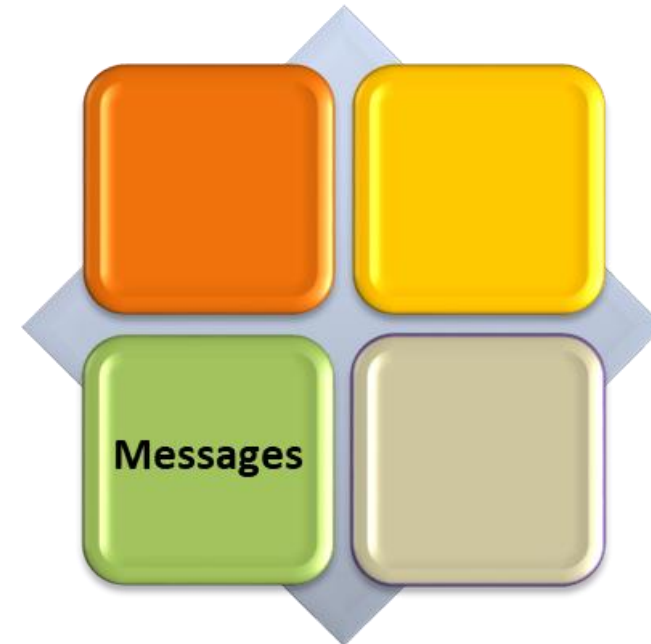
- Simple, out-of-the-box interoperability
- Leverage HTTP: GET, POST, etc.
- Pre-defined operations
- Create, Read, Update, Delete
- Also: Read Version, Search (resource/type/server), History (resource/type/server), Capabilities, Patch, Batch & Transaction



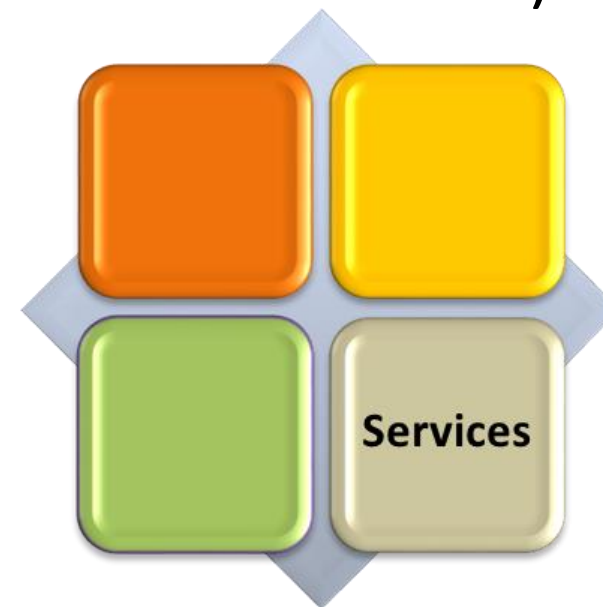
- Similar to CDA
- Collection of resources bound together
 - Root is a “Composition” resource
 - Just like CDA header
- Sent as a Bundle resource
- One context
- Can be signed, authenticated, etc.



- Similar to v2 and v3 messaging
- Also a collection of resources as a bundle resource
- Allows request/response behavior with bundles for both request and response
- Event-driven
 - E.g. Send lab order, get back result
- Can be asynchronous and/or indirect



- Do whatever you like
 - based on SOA principles
 - Ultra complex workflows
 - Ultra simple workflows
 - Individual resources or collections (in Bundles or other formats)
 - Use HTTP or use something else
 - Only constraint is that you're passing around FHIR resources in some shape or manner



Thank You

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