



**HEALTH
SAMURAI**

Introduction to FHIR® for health plans

Mapping data to claims, encounters and clinical data
Implementation guides, pre-built adapters

April, 2020



FHIR is our specialty. We have built FHIR systems since 2012. Our mature and scalable Aidbox FHIR platform powers more than 20 enterprise healthcare solutions that serve millions of patients.

5 facts about us

- | **16 years** in Health IT
- | **8 years** contributing to FHIR
- | **20+** FHIR projects in production
- | **Own Aidbox FHIR Platform**
- | **1.5M+** patients in one installation



What is FHIR®?

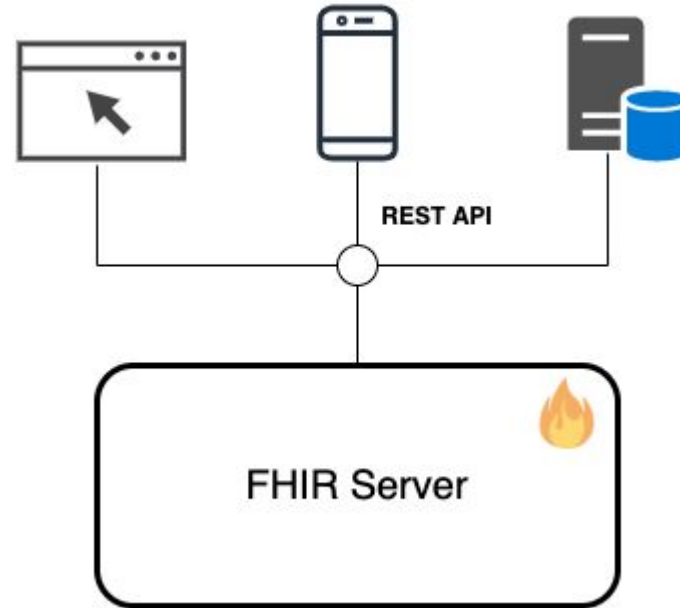
- Latest Hot HL7® Standard
- Open Community - chat.fhir.org
- Ecosystem of tools and solutions

What is FHIR®?

FHIR is a specification of REST service.

WWW paradigm. Like a site with healthcare data.

Apply web technology to Health Care



Informational Model

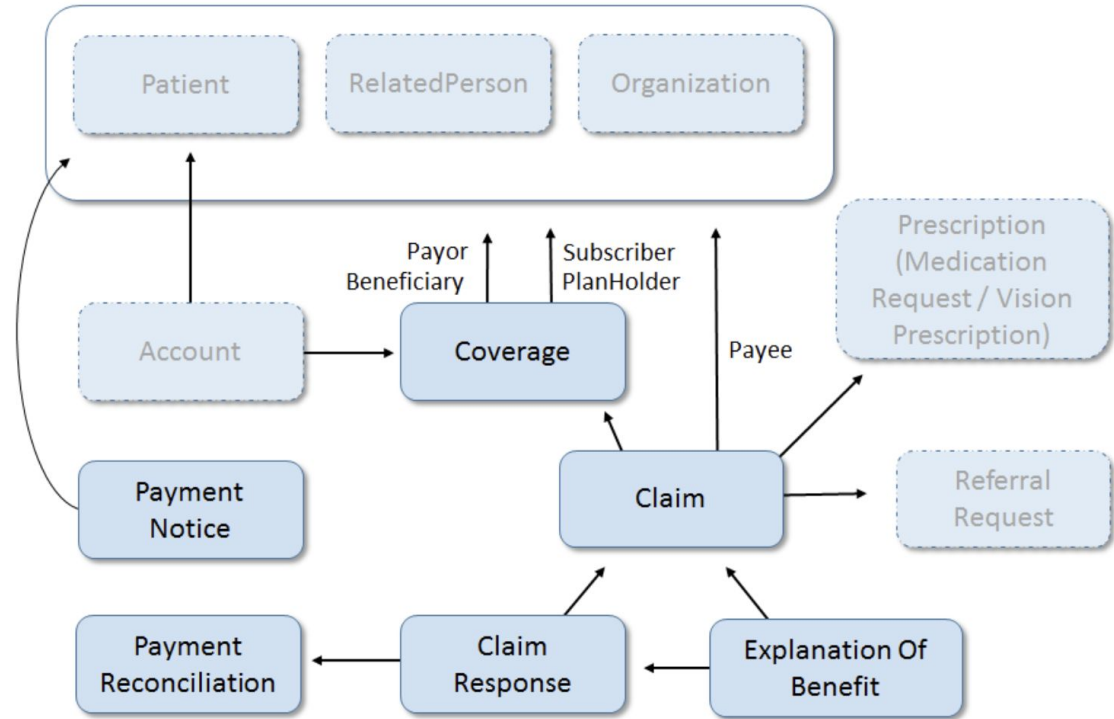
- Resources & Data Types
- Terminology framework
- Extensions & Profiles

Resources

	Categorized	Alphabetical	R2 Layout	By Maturity	Security Category	By Standard
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 Individuals <ul style="list-style-type: none"> • Patient N • Practitioner 3 • PractitionerRole 2 • RelatedPerson 2 • Person 2 • Group 1 		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 	

<https://www.hl7.org/fhir/resourcelist.html>

Financial Module Resources



<https://www.hl7.org/fhir/financial-module.html>

Patient

Data type

Cardinality

Description

ValueSet Binding

References

Patient	N	DomainResource	Information about an individual or animal receiving he. Elements defined in Ancestors: id, meta, implicitRules, An identifier for this patient
identifier	Σ 0..*	Identifier	
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 + Rule: SHALL at least contain a contact's details or a
relationship	0..*	CodeableConcept	The kind of relationship Patient Contact Relationship (Extensible)
name	0..1	HumanName	A name associated with the contact person
telecom	0..*	ContactPoint	A contact detail for the person
address	0..1	Address	Address for the contact person
gender	0..1	code	male female other unknown AdministrativeGender (Required)
organization	I 0..1	Reference(Organization)	Organization that is associated with the contact
period	0..1	Period	The period during which this contact person or organiz

Resource

JSON & XML formats

YAML, Protobuf ...

```
{
  "resourceType": "Patient",
  "id": "example",
  "identifier": [
    {
      "use": "usual",
      "type": {
        "coding": [
          {
            "system": "http://terminology.hl7.org/CodeSystem/v2-0203",
            "code": "MR"
          }
        ]
      },
      "system": "urn:oid:1.2.36.146.595.217.0.1",
      "value": "12345",
      "period": {
        "start": "2001-05-06"
      },
      "assigner": {
        "display": "Acme Healthcare"
      }
    }
  ],
  "active": true,
  "name": [
    {
      "use": "official",
      "family": "Chalmers",
      "given": [
        "Peter",
        "James"
      ]
    },
    {
      "use": "usual",
      "given": [
        "Jim"
      ]
    },
    {
      "use": "maiden",
      "family": "Windsor",
      "given": [
        "Peter",
        "James"
      ]
    }
  ]
}
```



Operational Model (REST API)

- CRUD/Hx
- Search
- Subscriptions
- Bulk API
- ...

CRUD (demo)

- POST /Patient
- GET /Patient/p-1
- PUT /Patient/p-1
- PATCH /Patient/p-1
- DELETE /Patient/p-1



Search API

8.1.12 Search Parameters

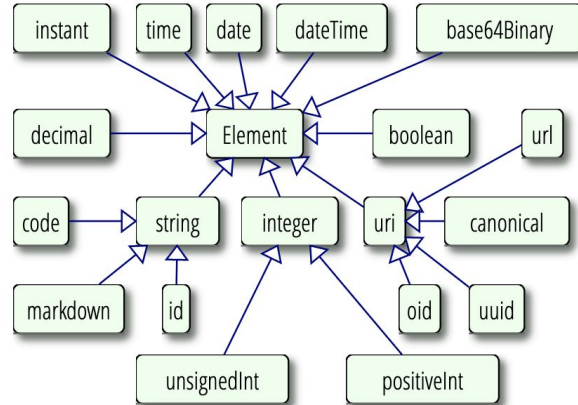
Search parameters for this resource. The [common parameters](#) also apply. See [Searching](#) for more information about searching in REST, messaging, and services.

Name	Type	Description	Expression
active TU	token	Whether the patient record is active	Patient.active
address TU	string	A server defined search that may match any of the string fields in the Address, including line, city, district, state, country, postalCode, and/or text	Patient.address
address-city TU	string	A city specified in an address	Patient.address.city
address-country TU	string	A country specified in an address	Patient.address.country
address-postalcode TU	string	A postalCode specified in an address	Patient.address.postalCode
address-state TU	string	A state specified in an address	Patient.address.state
address-use TU	token	A use code specified in an address	Patient.address.use
birthdate TU	date	The patient's date of birth	Patient.birthDate
death-date TU	date	The date of death has been provided and satisfies this search value	(Patient.deceased as dateTime)
deceased TU	token	This patient has been marked as deceased, or as a death date entered	Patient.deceased.exists() and Patient.deceased != false
email TU	token	A value in an email contact	Patient.telecom.where(system='email')

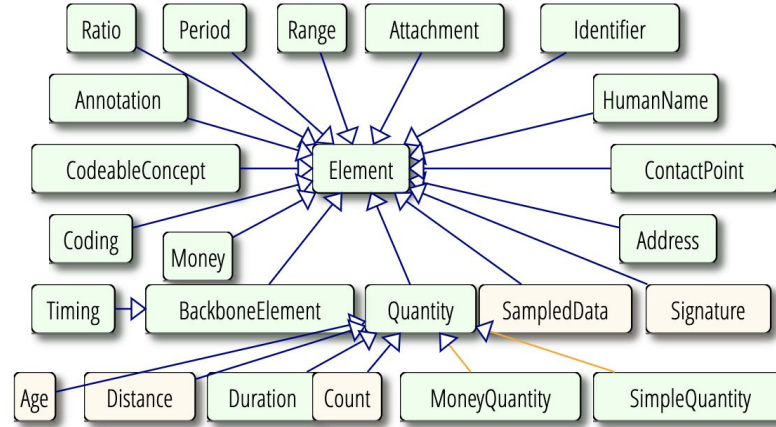


Data Types

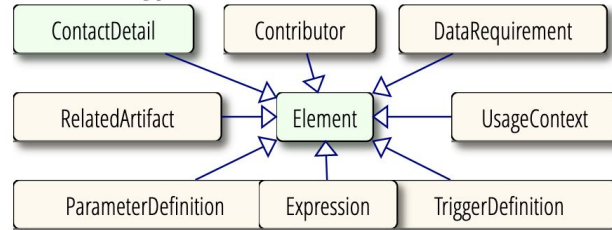
Primitive Types



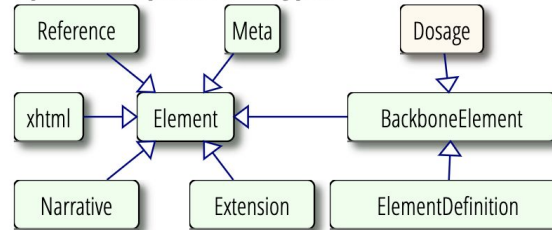
General-Purpose Data types









Metadata Types



Special Purpose Data types



Coded Types

Name	Flags	Card.	Type	Description & Constraints
 Coding	Σ N		Element	A reference to a code defined by a terminology system Elements defined in Ancestors: id , extension
 system	Σ	0..1	uri	Identity of the terminology system
 version	Σ	0..1	string	Version of the system - if relevant
 code	Σ	0..1	code	Symbol in syntax defined by the system
 display	Σ	0..1	string	Representation defined by the system
 userSelected	Σ	0..1	boolean	If this coding was chosen directly by the user

Name	Flags	Card.	Type	Description & Constraints
 CodeableConcept	Σ N		Element	Concept - reference to a terminology or just text Elements defined in Ancestors: id , extension
 coding	Σ	0..*	Coding	Code defined by a terminology system
 text	Σ	0..1	string	Plain text representation of the concept



ValueSet Binding

















Name	Flags	Card.	Type	Description & Constraints
ExplanationOfBenefit		0..*	ExplanationOfBenefit	
id		1..1	string	
identifier	S	1..*	Identifier	
type		1..1	CodeableConcept	Binding: CARIN Blue Button Claim Type Value Set (extensible)
use		1..1	code	Required Pattern: claim
patient		1..1	Reference(CARIN Blue Button Patient Profile)	
billablePeriod	S	0..1	Period	
insurer		1..1	Reference(CARIN Blue Button Insurance Profile)	

Defining URL:	http://hl7.org/fhir/us/carin/ValueSet/carin-bb-claim-type
Version:	0.1.0
Name:	CARINBBClaimType
Status:	draft
Title:	CARIN Blue Button Claim Type Value Set

Code	Display	Definition
inpatient-facility	Inpatient Facility	
outpatient-facility	Outpatient Facility	
professional-nonclinician	Professional or Non-Clinician	
pharmacy	Pharmacy	
vision	Vision	
oral	Oral	



Extensions

Name	Flags	Card.	Type	Description & Constraints
 Patient		0..*		
...  us-core-race	S	0..1	(Complex)	US Core Race Extension URL: http://hl7.org/fhir/us/core/Stru
...  us-core-ethnicity	S	0..1	(Complex)	US Core ethnicity Extension URL: http://hl7.org/fhir/us/core/Stru
...  us-core-birthsex	S	0..1	code	Extension URL: http://hl7.org/fhir/us/core/Stru Binding: Birth Sex (required)
...  identifier	S	1..*	Identifier	
...  system	S	1..1	uri	
...  value	S	1..1	string	The value that is unique within the sy
...  name	S I	1..*	HumanName	us-core-8: Patient.name.given or Pa
...  family	S I	0..1	string	
...  given	S I	0..*	string	
...  telecom	S	0..*	ContactPoint	
...  system	S	1..1	code	Binding: ContactPointSystem (requir
...  value	S	1..1	string	
...  use	S	0..1	code	Binding: ContactPointUse (required)
...  gender	S	1..1	code	Binding: AdministrativeGender (requ
...  birthDate	S	0..1	date	

Profiles

Basic FHIR Resource

Name	Flags	Card.	Type
ExplanationOfBenefit	TU		DomainResource
identifier		0..*	Identifier
status	?! Σ	1..1	code
type	Σ	1..1	CodeableConcept
subType		0..1	CodeableConcept
use	Σ	1..1	code
patient	Σ	1..1	Reference(Patient)
billablePeriod	Σ	0..1	Period
created	Σ	1..1	dateTime
enterer		0..1	Reference(Practitioner PractitionerRole)
insurer	Σ	1..1	Reference(Organization)
provider	Σ	1..1	Reference(Practitioner PractitionerRole Organization)

Carin Profile

Name	Flags	Card.	Type	Description & Constraints
ExplanationOfBenefit		0..*	ExplanationOfBenefit	
id		1..1	string	
identifier	S	1..*	Identifier	
type		1..1	CodeableConcept	Binding: CARIN Blue Button Claim Ty
use		1..1	code	Required Pattern: claim
patient		1..1	Reference(CARIN Blue Button Patient Profile)	
billablePeriod	S	0..1	Period	
insurer		1..1	Reference(CARIN Blue Button Organization Profile)	
provider		1..1	Reference(CARIN Blue Button Organization Profile)	
related	S	0..*	BackboneElement	
relationship		1..1	CodeableConcept	Binding: CARIN Blue Button Related
payee	S	0..1	BackboneElement	
type		1..1	CodeableConcept	
party		1..1	Reference(CARIN Blue Button Practitioner Role Profile CARIN Blue Button Patient Profile)	

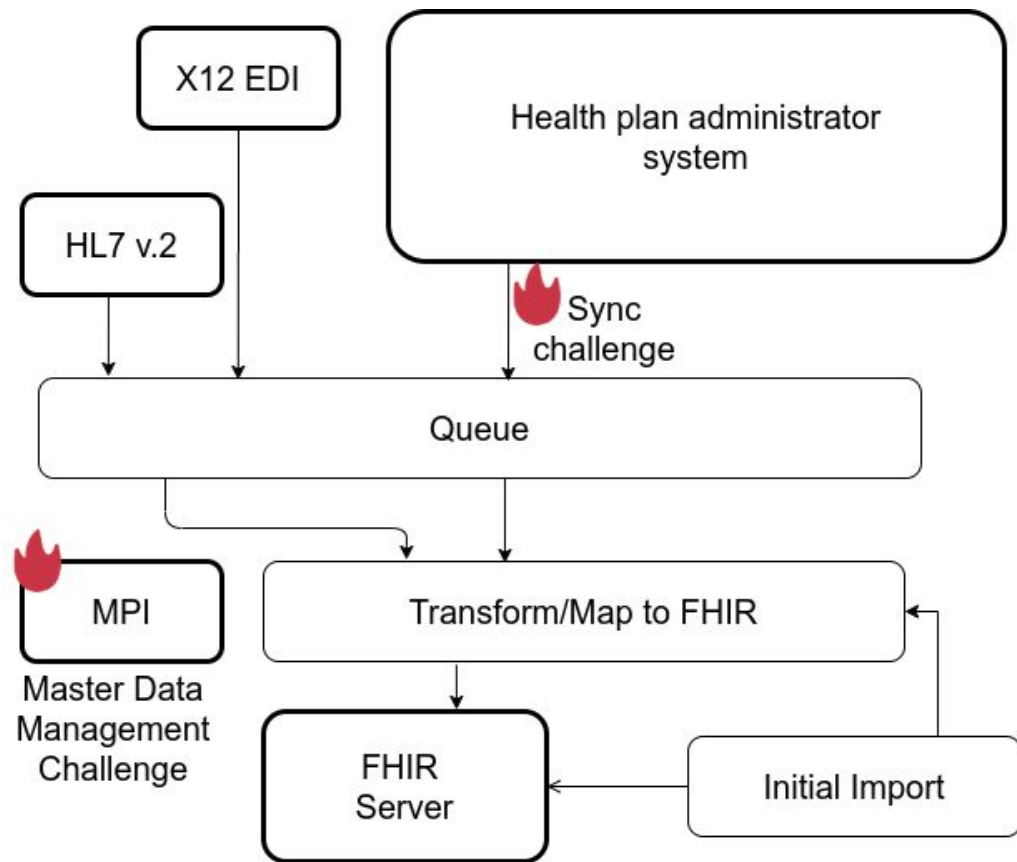


Implementation Guides

Dataset	Implementation guide
Claims & Encounter data	<u>IG CARIN</u>
Clinical Data (<u>USCDI v1</u>) if maintained	<u>US Core IG</u>
Drug Formulary	<u>DaVinci IG</u>
Provider Directory public API	<u>DaVinci IG</u>

Integration architecture

- Initial import
- Updates



Parser (X12 EDI/HL7 v.2)

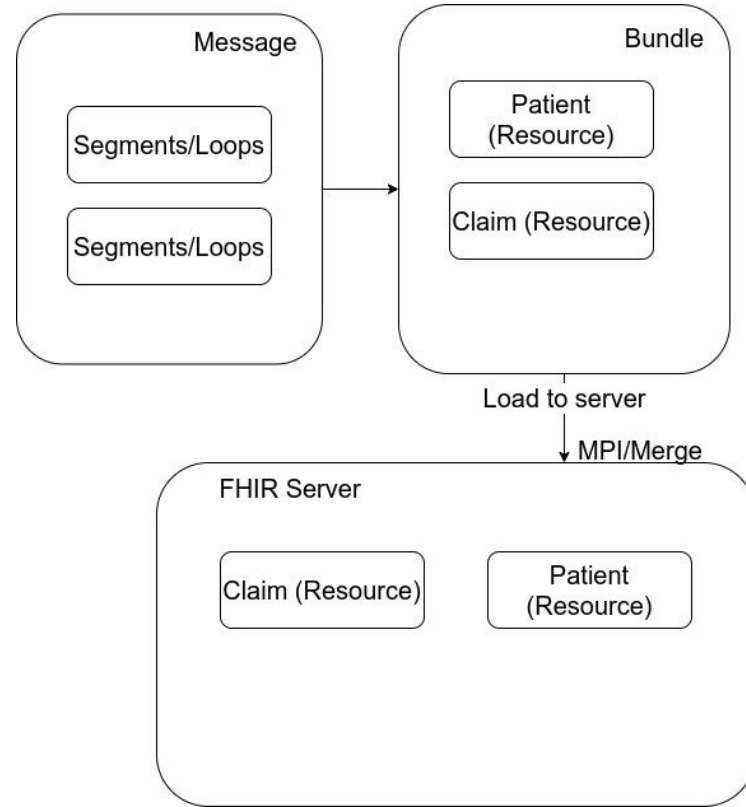
```
"segments": [  
  {  
    "segmentId": "MSH",  
    "fields": {  
      "5": "TO_FACILITY",  
      "2": "FROM_APP",  
      "3": "FROM_FACILITY",  
      "0": "MSH",  
      "1": "^~\\&",  
      "10": "P",  
      "4": "TO_APP",  
      "9": "20180101000000",  
      "8.1": "ADT",  
      "11": "2.5",  
      "8.2": "A01",  
      "6": "20180101000000"  
    }  
  },  
  {  
    "segmentId": "EVN",  
    "fields": {  
      "1": "A01",  
      "2": "20110613083617",  
      "0": "EVN"  
    }  
  },  
]
```

```
message:  
  _separator: '|'  
  proc_id:  
    id: P  
  type:  
    code: ORU  
    event: R01  
  id: RES-OUT.1.1689723  
  sender:  
    app: LAB  
    facility: 88K7777777  
  datetime: '2019-10-27T07:08:00'  
  version:  
    id: '2.1'  
  receiver:  
    app: FR WEBvCMR  
    facility: SAMURAI COUNTY  
    _encoding: "~^\\&"  
  patient_group:  
    patient:  
      name:  
        - given:  
          - SHELTON  
          - R  
          family: CUCUMBER  
        _seqno: '1'  
      gender: F  
      address:  
        - city: SAMURAI CITY  
        line:  
          - 123 SAMURAI ST  
        state: TN  
        postalCode: 90200-9999  
      telecom:  
        - use: home  
        value: 123-111-2222  
        system: phone  
      birthDate: '1970-01-01'
```



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Translation/Mapping



FHIR Mapping

Message vs REST paradigm

- Declarative
 - FHIR mapping language
 - JUTE (JSON Uniform TEmplates) mapping language
<https://github.com/HealthSamurai/jute.clj>
- Via code

FHIR mapping language

<https://www.hl7.org/fhir/mapping-tutorial.html>

```
src.a2 as a -> tgt.a2 = truncate(a, 20); // just cut it off at 20  
characters
```

```
src.a21 as a -> tgt.a21 = cast(a, "integer"); // error if it's  
not an integer
```

```
src.d as d -> tgt.d = translate(d, 'uri-of-concept-map', 'code');
```



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JUTE mapping language

```
1  PUT /Mapping/test
2  Content-Type: text/yaml
3
4  resourceType: Mapping
5  id: test
6  body:
7    resourceType: Bundle
8    type: transaction
9    entry:
10      - resource:
11          resourceType: Patient
12          name:
13            - given: ["$ msg.PID.name.0.given"]
14              family: "$ msg.PID.name.0.family.surname"
15          request:
16            method: POST
17            url: "/fhir/Patient"
```



Jute qualities & benefits

Message vs REST paradigm

- Declarative
- Readable
- You do not need to be a programmer to use
- Open source

Demo

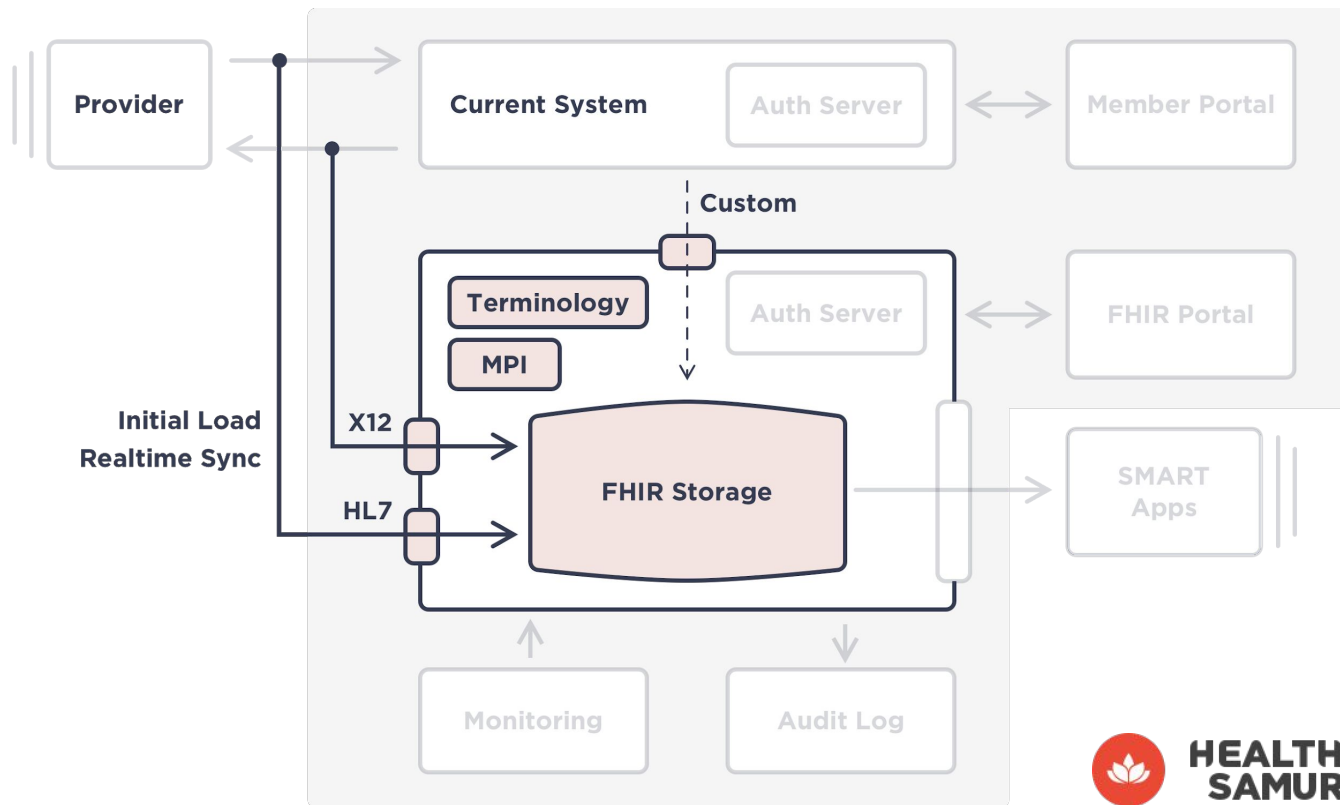
<https://storage.googleapis.com/jute-demo-site/index.html>



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Integration architecture - real example

- Initial import
- Updates





Get in Touch

We are waiting for your call or email!



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