

HL7 FHIR

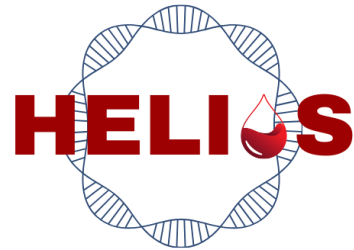
Health Level 7 – Fast Healthcare Interoperability
Resources

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Amsterdam UMC



About me

- Full Professor of Medical Informatics at Amsterdam UMC
- Principal Educator on FAIR Data
- Principal Investigator on Reusable Health Data



Funded by
the European Union

Information models – examples

Model

- Set of common data elements for Rare Diseases Registration

- OMOP-CDM

- OpenEHR

- Phenopackets

- CDISC

- HL7 FHIR

- CARE-SM

Context

- Rare Diseases Registration
- Real-world data
- Clinical data storage
- Bioinformation
- Clinical trials
- **Clinical data exchange**
- Semantic information model



Funded by
the European Union



Outline

- HL7 – organization
- HL7 – standards
- HL7 – FHIR

HL7 organization

- Health Level 7 – named after OSI level 7 (Application level)

OSI model

Layer		Protocol data unit (PDU)	Function ^[26]
Host layers	7 Application	Data	High-level protocols such as for resource sharing or remote file access, e.g. HTTP .
	6 Presentation		Translation of data between a networking service and an application; including character encoding , data compression and encryption/decryption
	5 Session		Managing communication sessions , i.e., continuous exchange of information in the form of multiple back-and-forth transmissions between two nodes
	4 Transport	Segment	Reliable transmission of data segments between points on a network, including segmentation , acknowledgement and multiplexing
Media layers	3 Network	Packet, Datagram ^[27]	Structuring and managing a multi-node network, including addressing , routing and traffic control
	2 Data link	Frame	Transmission of data frames between two nodes connected by a physical layer
	1 Physical	Bit, Symbol	Transmission and reception of raw bit streams over a physical medium

HL7 organization

- Health Level 7 – named after OSI level 7 (Application level)

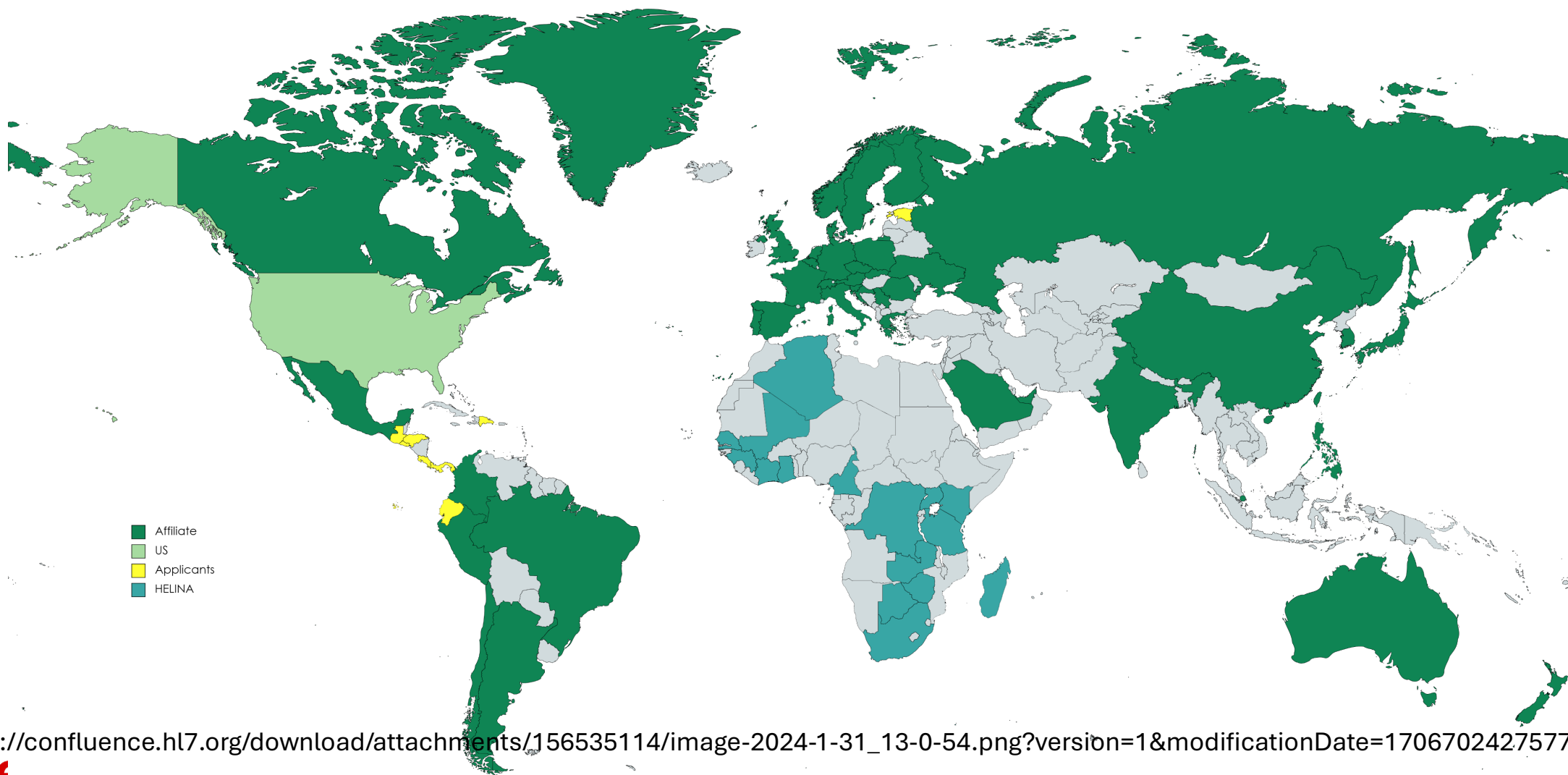
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HL7 organization

- Health Level Seven International
 - Standards Development Organization (SDO)
 - Established 1987
 - Corporate members: e.g., healthcare providers, government stakeholders, payers, pharma, vendors, and consulting firms

HL7 Affiliate Countries



https://confluence.hl7.org/download/attachments/156535114/image-2024-1-31_13-0-54.png?version=1&modificationDate=1706702427577&api=v2

HL7 Standards

- Arden Syntax
- Clinical Document Architecture (CDA)
- Clinical Quality Language (CQL)
- Messaging standard
 - HL7 v2
 - HL7 v3
 - HL7 FHIR

HL7 Standards

- Arden Syntax
- Clinical Document Architecture (CDA)
- Clinical Quality Language (CQL)
- Messaging standard
 - **HL7 v2 - EDI (Electronic Data Interchange)**
 - HL7 v3
 - HL7 FHIR

```
MSH|^~\&|EPICADT|DH|LABADT|DH|201301011226||ADT^A01|HL7MSG00001|P|2.3|
EVN|A01|201301011223||
PID|||MRN12345^5^M11||APPLESEED^JOHN^A^III||19710101|M||C|
1 DATICA STREET^^MADISON^WI^53005-1020|GL|(414)379-1212|(414)271-3434||S||
MRN12345001^2^M10|123456789|987654^NC|
NK1|1|APPLESEED^BARBARA^J|WIFE|||||NK^NEXT OF KIN
PV1|1||2000^2012^01||||004777^GOOD^SIDNEY^J.||||SUR||||ADM|A0|
```

<https://datica.com/academy/hl7-201-the-admission-discharge-transfer-adt-message>

HL7 Standards

- Arden Syntax
- Clinical Document Architecture (CDA)
- Clinical Quality Language (CQL)
- Messaging standard
 - HL7 v2
 - **HL7 v3 – Model-based**
 - HL7 FHIR

```
<observationEvent>
  <id root="2.16.840.1.113883.19.1122.4" extension="1045813"
    assigningAuthorityName="GHH LAB Filler Orders"/>
  <code code="1554-5" codeSystemName="LN"
    codeSystem="2.16.840.1.113883.6.1"
    displayName="GLUCOSE^POST 12H CFST:MCNC:PT:SER/PLAS:QN"/>
  <statusCode code="completed"/>
  <effectiveTime value="200202150730"/>
  <priorityCode code="R"/>
  <confidentialityCode code="N"
    codeSystem="2.16.840.1.113883.5.25"/>
  <value xsi:type="PQ" value="182" unit="mg/dL"/>
  <interpretationCode code="H"/>
...
```

https://wiki.hl7.org/Examples_section_of_the_v3Guide

HL7 FHIR

- **F**ast
 - **H**ealthcare
 - **I**nteroperability
 - **R**esources
- “Easy to implement”
 - “Domain”
 - “Connecting systems”
 - “Building blocks”

HL7 FHIR

- Messaging approach based on current web technology
 - REST API: **RE**presentational **ST**ate **A**pplication **P**rogramming **I**nterface
 - **Requests** are common web requests
 - **Responses** are “resources” in structured form
 - JSON – JavaScript Object Notation
 - XML – eXtensible Markup Language
 - RDF – Resource Description Framework

GET hapi.fhir.org/baseR4/Patient/596634

Response Body

```
1  {
2    "resourceType": "Patient",
3    "id": "596634",
4    "meta": {
5      "versionId": "2",
6      "lastUpdated": "2020-02-02T06:08:39.174+00:00",
7      "source": "#cusIe45SLwAkOusH"
8    },
9    "text": {
10     "status": "generated",
11     "div": "<div xmlns=\"http://www.w3.org/1999/xhtml\"><div class=\"hapiHeaderText\">Ziqi <b>ZHOU </b></div><table cla
12   },
13   "identifier": [ {
14     "value": "lzhou316"
15   } ],
16   "name": [ {
17     "family": "Zhou",
18     "given": [ "Ziqi" ]
19   } ],
20   "telecom": [ {
21     "system": "phone",
22     "value": "222-222-2222",
23     "use": "mobile"
24   }, {
25     "system": "email",
26     "value": "2222222@gmail.com",
27     "use": "work"
28   } ],
29   "gender": "male",
30   "birthDate": "1999-12-25",
31   "address": [ {
32     "line": [ "222 Park St" ],
33     "city": "Irvine",
34     "state": "TX",
35     "postalCode": "96666"
36   } ]
37 }
```



Some examples

- GET hapi.fhir.org/baseR4/Patient
 - Retrieve data about all patients
- GET hapi.fhir.org/baseR4/Patient/596634
 - Retrieve data about patient 596634
- GET hapi.fhir.org/baseR4/Patient?given=Ronald&_elements=birthDate,name
 - Retrieve name and birthdate for patients whose given name is “Ronald”
- POST hapi.fhir.org/baseR4/Patient (with message body)
 - Insert Patient (described in the body) – *if server allows*
- GET hapi.fhir.org/baseR4/Observation?subject=596634
 - Retrieve observations about patient 596634

FHIR Resources

FHIR

Level 1 Basic framework on which the specification is built



Foundation

Base Documentation, XML, JSON, RDF, Datatypes, Extensions

Level 2 Supporting implementation and binding to external specifications



Implementer Support

Downloads,
Version Mgmt,
Use Cases,
Testing



Security & Privacy

Security,
Consent,
Provenance,
AuditEvent



Conformance

StructureDefinition,
CapabilityStatement,
ImplementationGuide,
Profiling



Terminology

CodeSystem,
ValueSet,
ConceptMap,
Terminology Svc



Exchange

REST API + Search
Documents
Messaging
Services
Databases
Subscriptions

Level 3 Linking to real-world concepts in the healthcare system



Administration

Patient, Practitioner, CareTeam, Device, Organization, Location, Healthcare Service

Level 4 Record-keeping and Data Exchange for the healthcare process



Clinical

Allergy, Problem,
Procedure,
CarePlan/Goal,
Family History,
RiskAssessment,
etc.



Diagnostics

Observation,
Report, Specimen,
ImagingStudy,
Genomics, etc.



Medications

Medication,
Request, Dispense,
Administration,
Statement,
Immunization, etc.



Workflow

Introduction +
Task, Appointment,
Schedule, Referral,
PlanDefinition, etc.



Financial

Claim, Account,
Invoice, ChargeItem,
Coverage + Eligibility
Request & Response,
ExplanationOfBenefit,
etc.

Level 5 Providing the ability to reason about the healthcare process



Clinical Reasoning

Library, PlanDefinition & GuidanceResponse,
Measure/MeasureReport, etc.



Medication Definition

Medicinal, Packaged & Administrable product definitions,
Regulated Authorization, etc.

<https://hl7.org/fhir/>

“Patient” Resource

“Patient” Resou

- Cardinality
- Type
- Terminology binding

<https://hl7.org/fhir/patient.html>

Structure	UML	XML	JSON	Turtle	R4 Diff	All
Structure						
Name	Flags	Card.	Type	Description & Constraints		
 Patient			DomainResource	Information about an individual or animal receiving health care services		
Elements defined in Ancestors: id , meta , implicitRules , language , text , contained , extension , modifierExtension						
 identifier		0..*	Identifier	An identifier for this patient		
 active		0..1	boolean	Whether this patient's record is in active use		
 name		0..*	HumanName	A name associated with the patient		
 telecom		0..*	ContactPoint	A contact detail for the individual		
 gender		0..1	code	male female other unknown Binding: AdministrativeGender (Required)		
 birthDate		0..1	date	The date of birth for the individual		
 deceased[x]		0..1		Indicates if the individual is deceased or not		
 deceasedBoolean			boolean			
 deceasedDateTime			dateTime			
 address		0..*	Address	An address for the individual		
 maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient Binding: Marital Status Codes (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		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 Binding: 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 Binding: AdministrativeGender (Required)		
 organization		0..1	Reference(Organization)	Organization that is associated with the contact		
 period		0..1	Period	The period during which this contact person or organization is valid to be contacted relating to this patient		
 communication		0..*	BackboneElement	A language which may be used to communicate with the patient about his or her health		
 generalPractitioner		0..*	Reference(Organization Practitioner PractitionerRole)	Patient's nominated primary care provider		
 managingOrganization		0..1	Reference(Organization)	Organization that is the custodian of the patient record		
 link		0..*	BackboneElement	Link to a Patient or RelatedPerson resource that concerns the same actual individual		

- 
- HemaFAIR**

[illegible]

“Observation” Resource

- Cardinality
- Type
- Terminology binding

<https://hl7.org/fhir/observation.html>

Structure					
Name	Flags	Card.	Type	Description & Constraints	?
Observation	N		DomainResource	Measurements and simple assertions + Rule: dataAbsentReason SHALL only be present if Observation.value[x] is not present + Rule: If Observation.component.code is the same as Observation.code, then Observation.value SHALL NOT be present (the Observation.component.value[x] holds the value). + Rule: bodyStructure SHALL only be present if Observation.bodySite is not present	
identifier	Σ	0..*	Identifier	Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension Business Identifier for observation	
instantiates[x]	Σ TU	0..1		Instantiates FHIR ObservationDefinition	
basedOn	Σ	0..*	Reference(CarePlan DeviceRequest ImmunizationRecommendation MedicationRequest NutritionOrder ServiceRequest)	Fulfills plan, proposal or order	
triggeredBy	TU	0..*	BackboneElement	Triggering observation(s)	
partOf	Σ	0..*	Reference(MedicationAdministration MedicationDispense MedicationStatement Procedure Immunization ImagingStudy GenomicStudy)	Part of referenced event	
status	?! Σ	1..1	code	registered preliminary final amended + Binding: Observation Status (Required)	
category		0..*	CodeableConcept	Classification of type of observation Binding: Observation Category Codes (Preferred)	
code	Σ C	1..1	CodeableConcept	Type of observation (code / type) Binding: LOINC Codes (Example)	
subject	Σ	0..1	Reference(Patient Group Device Location Organization Procedure Practitioner Medication Substance BiologicallyDerivedProduct NutritionProduct)	Who and/or what the observation is about	
focus	Σ TU	0..*	Reference(Any)	What the observation is about, when it is not about the subject of record	
encounter	Σ	0..1	Reference(Encounter)	Healthcare event during which this observation is made	
effective[x]	Σ	0..1		Clinically relevant time/time-period for observation	
effectiveDateTime			dateTime		
effectivePeriod			Period		
effectiveTiming			Timing		
effectiveInstant			instant		
issued	Σ	0..1	instant	Date/Time this version was made available	
performer	Σ	0..*	Reference(Practitioner PractitionerRole Organization CareTeam Patient RelatedPerson)	Who is responsible for the observation	
value[x]	Σ C	0..1		Actual result	
valueQuantity			Quantity		
valueCodeableConcept			CodeableConcept		
valueString			string		
valueBoolean			boolean		
valueInteger			integer		
valueRange			Range		
valueRatio			Ratio		
valueSampledData			SampledData		
valueTime			time		
valueDateTime			dateTime		
valuePeriod			Period		
valueAttachment			Attachment		
valueReference			Reference(MolecularSequence)		

Profiles of Resources

- Resources are deliberately defined “permissive”
 - Minimal cardinality often zero (little is mandatory)
 - Multiple options for representing information: text / codes / dates
- Profiles specify constraints on Resources
 - Making attributes mandatory (i.e., min. cardinality = 1)
 - Excluding attributes (i.e., max. cardinality = 0)
 - Adding new (optional or mandatory) attributes

Example Profile: Blood pressure

- The Profile constrains Observation
 - Code System = LOINC
 - Code = loinc:85354-9

Element	Cardinality	Constraints
code	1..	
coding	1..	
bloodPressureCode	1..1	
system	1..	Fixed Value
code	1..	Fixed Value
display	1..	
effective[x]		
comment		
bodySite		Binding
method		Binding
component	2..	
SystolicBP	1..1	
DiastolicBP	1..1	
AverageBloodPressureSNOMED	..1	
AverageBloodPressureLOINC	..1	
diastolicEndpoint	..1	
cuffTypeSNOMED	..1	
cuffTypeLOINC	..1	
positionSNOMED	..1	
positionLOINC	..1	

Comments
Please note: tl and it has bee

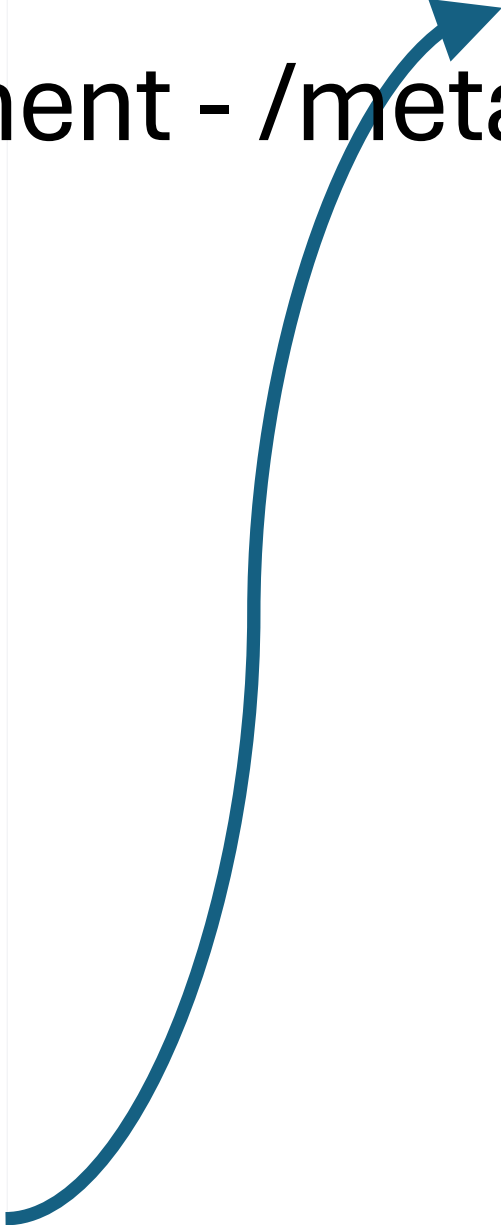
Fixed value
85354-9

Technology wrap-up

- REST-ful API
- FHIR specifies permissive Resources – common ground
- Implementations (can) specify Profiles – use-case specific
- All server **capabilities** are specified in a machine-readable way

Capability statement - /metadata

Capability statement - /metadata



```
33118 "type": "Patient",
33119 "profile": "http://hl7.org/fhir/StructureDefinition/Patient",
33120 "supportedProfile": [
33121   "http://berzerkistan.gov.bz/fhir/StructureDefinition/berzerkistanpatient",
33122   "http://curizent.com/fhir/StructureDefinition/BuildPatientResourceProfile",
33123   "http://example.gevko.de/fhir/schulung/StructureDefinition/VerfallPatient",
33124   "http://example.gevko.de/fhir/schulung/StructureDefinition/meinPatient",
33125   "http://example.org/fhir/StructureDefinition/BMOPatient",
33126   "http://example.org/fhir/StructureDefinition/BezPatSnapshot1",
33127   "http://example.org/fhir/StructureDefinition/BezPatSnapshot2",
33128   "http://example.org/fhir/StructureDefinition/BezPatSnapshot3",
33129   "http://example.org/fhir/StructureDefinition/BezPatSnapshot4",
33130   "http://example.org/fhir/StructureDefinition/BezPatSnapshot5",
33131   "http://example.org/fhir/StructureDefinition/BezPatSnapshot6",
33132   "http://example.org/fhir/StructureDefinition/BezPatSnapshot7",
33133   "http://example.org/fhir/StructureDefinition/BezPatSnapshot8",
33134   "http://example.org/fhir/StructureDefinition/HL7ATBerzekistanPatient",
33135   "http://example.org/fhir/StructureDefinition/MyPatient1188",
33136   "http://example.org/fhir/StructureDefinition/Patient_Exercise1",
33137   "http://example.org/fhir/StructureDefinition/TestAnns2",
33138   "http://example.org/fhir/StructureDefinition/TestAnns3",
33139   "http://example.org/fhir/StructureDefinition/TestAnns5",
33140   "http://example.org/fhir/StructureDefinition/TestPatient_MA",
33141   "http://example.org/fhir/StructureDefinition/wakanda-core-patient",
33142   "http://example.org/fhir/fish/StructureDefinition/fish-patient",
33143   "http://fhir.health.org.il/StructureDefinition/il-core-patient",
33144   "http://fhir.kids-first.io/StructureDefinition/MyPatchild2",
33145   "http://fhir.nl/fhir/StructureDefinition/nl-core-patient",
33146   "http://fhir.org/guides/who/svc-rc1/StructureDefinition/svc-patient",
33147   "http://hapi.fhir.org/fhir/StructureDefinition/MyPatient04202020A",
33148   "http://hapi.fhir.org/fhir/StructureDefinition/SidProfile",
33149   "http://hapi.fhir.org/baseR4/StructureDefinition/DemoPatient",
33150   "http://hapi.fhir.org/baseR4/StructureDefinition/FirstPatientProfileJohn",
33151   "http://hapi.fhir.org/fhir/StructureDefinition/MyPatientRehan",
33152   "http://hapi.fhir.org/fhir/StructureDefinition/SidProfile",
33153   "http://hapi.fhir.org/fhir/StructureDefinition/SidProfile/1",
33154   "http://hl7.no/fhir/StructureDefinition/no-basis-Patient",
33155   "http://hl7.org.au/fhir/StructureDefinition/au-patient",
33156   "http://hl7.org.nz/fhir/healthAlliance/StructureDefinition/HaPatient",
33157   "http://hl7.org/fhir/StructureDefinition/BMOPatient",
33158   "http://hl7.org/fhir/StructureDefinition/BMOPatientAnna1",
33159   "http://hl7.org/fhir/StructureDefinition/custom-Patient-v1",
33160   "http://hl7.org/fhir/StructureDefinition/custom-Patient-v2",
33161   "http://hl7.org/fhir/uv/ips/StructureDefinition/Patient-uv-ips",
33162   "http://hl7.org/fhir123/StructureDefinition/Patient-ibec-CodeSystem",
33163   "http://jpfhir.jp/fhir/StructureDefinition/JP_Patient",
33164   "http://jpfhir.jp/fhir/StructureDefinition/JP_Patient|0.0.1",
33165   "http://jpfhir.jp/fhir/StructureDefinition/JP_Patient|0.0.2",
33166   "http://jpfhir.jp/fhir/StructureDefinition/JP_Patient|0.8",
33167   "https://aehrc.com/fhir/StructureDefinition/AUPrimaryCarePatient",
33168   "https://corhealth-ontario.ca/fhir/StructureDefinition/corhealth-patient",
33169   "https://gematik.de/fhir/ISiK/StructureDefinition/ISiKPatient",
33170   "https://jembi.github.io/covid19-immunization-ig/StructureDefinition/covid19-
33171 patient",
33172 "https://nrces.in/ndhm/fhir/r4/StructureDefinition/Patient",
33173 "https://who-int.github.io/svc/refs/heads/rc2/StructureDefinition/shc-patient"
33174 ],
33175 "interaction": [
33176   {
33177     "code": "search-type"
33178   },
33179   {
33180     "code": "update"
33181   }
33182 ]
```

```
33172 patient",
33173 "https://nrces.in/ndhm/fhir/r4/StructureDefinition/Patient",
33174 "https://who-int.github.io/svc/refs/heads/rc2/StructureDefinition/shc-patient"
33175 ],
33176 "interaction": [
33177   {
33178     "code": "search-type"
33179   },
33180   {
33181     "code": "update"
33182   },
33183   {
33184     "code": "vread"
33185   },
33186   {
33187     "code": "read"
33188   },
33189   {
33190     "code": "patch"
33191   },
33192   {
33193     "code": "history-type"
33194   },
33195   {
33196     "code": "history-instance"
33197   },
33198   {
33199     "code": "delete"
33200   },
33201   {
33202     "code": "create"
33203   }
33204 ],
33205 "versioning": "versioned-update",
33206 "conditionalCreate": true,
33207 "conditionalUpdate": true,
33208 "conditionalDelete": "multiple",
33209 "searchInclude": [
33210   "*",
33211   "Patient:general-practitioner",
33212   "Patient:link",
33213   "Patient:organization"
33214 ],
33215 "searchRevInclude": [
33216   "Account:patient",
33217   "Account:subject",
33218   "ActivityDefinition:composed-of",
33219   "ActivityDefinition:depends-on",
33220   "ActivityDefinition:derived-from",
33221   "ActivityDefinition:predecessor",
33222   "ActivityDefinition:successor",
33223   "AdverseEvent:recorder",
33224   "AdverseEvent:subject",
33225   "AllergyIntolerance:asserter",
33226   "AllergyIntolerance:patient",
33227   "AllergyIntolerance:recorder",
33228   "Appointment:actor",
33229   "Appointment:patient",
33230   "Appointment:supporting-info",
33231   "AppointmentResponse:actor",
33232   "AppointmentResponse:patient",
33233   "AuditEvent:agent",
33234   "AuditEvent:entity",
```

One more thing...

FHIR

Level 1 Basic framework on which the specification is built



Foundation

Base Documentation, XML, JSON, RDF, Datatypes, Extensions

Level 2 Supporting implementation and binding to external specifications



Implementer Support

Downloads,
Version Mgmt,
Use Cases,
Testing



Security & Privacy

Security,
Consent,
Provenance,
AuditEvent



Conformance

StructureDefinition,
CapabilityStatement,
ImplementationGuide,
Profiling



Terminology

CodeSystem,
ValueSet,
ConceptMap,
Terminology Svc



Exchange

REST API + Search
Documents
Messaging
Services
Databases
Subscriptions

Level 3 Linking to real-world concepts in the healthcare system



Administration

Patient, Practitioner, CareTeam, Device, Organization, Location, Healthcare Service

Level 4 Record-keeping and Data Exchange for the healthcare process



Clinical

Allergy, Problem,
Procedure,
CarePlan/Goal,
Family History,
RiskAssessment,
etc.



Diagnostics

Observation,
Report, Specimen,
ImagingStudy,
Genomics, etc.



Medications

Medication,
Request, Dispense,
Administration,
Statement,
Immunization, etc.



Workflow

Introduction +
Task, Appointment,
Schedule, Referral,
PlanDefinition, etc.



Financial

Claim, Account,
Invoice, ChargeItem,
Coverage + Eligibility
Request & Response,
ExplanationOfBenefit,
etc.

Level 5 Providing the ability to reason about the healthcare process



Clinical Reasoning

Library, PlanDefinition & GuidanceResponse,
Measure/MeasureReport, etc.



Medication Definition

Medicinal, Packaged & Administrable product definitions,
Regulated Authorization, etc.

<https://hl7.org/fhir/>

FHIR Terminology server

- GET .../CodeSystem

```
2838 {
2839   "fullUrl": "https://browser.ihtsdotools.org/fhir/CodeSystem/sct_11000146104_20250228",
2840   "resource": {
2841     "resourceType": "CodeSystem",
2842     "id": "sct_11000146104_20250228",
2843     "url": "http://snomed.info/sct",
2844     "version": "http://snomed.info/sct/11000146104/version/20250228",
2845     "name": "SNOMED CT",
2846     "title": "Netherlands Edition",
2847     "status": "active",
2848     "date": "2025-02-28T00:00:00+00:00",
2849     "publisher": "Nictiz",
2850     "hierarchyMeaning": "is-a",
2851     "compositional": true,
2852     "content": "complete"
2853   }
2854 },
2855 {
2856   "fullUrl": "https://browser.ihtsdotools.org/fhir/CodeSystem/sct_11000146104_20250131",
2857   "resource": {
2858     "resourceType": "CodeSystem",
2859     "id": "sct_11000146104_20250131",
2860     "url": "http://snomed.info/sct",
2861     "version": "http://snomed.info/sct/11000146104/version/20250131",
2862     "name": "SNOMED CT",
2863     "title": "Netherlands Edition",
2864     "status": "active",
2865     "date": "2025-01-31T00:00:00+00:00",
2866     "publisher": "Nictiz",
2867     "hierarchyMeaning": "is-a",
2868     "compositional": true,
2869     "content": "complete"
2870   }
2871 },
2872 {
2873   "fullUrl": "https://browser.ihtsdotools.org/fhir/CodeSystem/sct_11000146104_20241130",
2874   "resource": {
2875     "resourceType": "CodeSystem",
2876     "id": "sct_11000146104_20241130",
2877     "url": "http://snomed.info/sct",
2878     "version": "http://snomed.info/sct/11000146104/version/20241130",
2879     "name": "SNOMED CT",
2880     "title": "Netherlands Edition",
2881     "status": "active",
2882     "date": "2024-11-30T00:00:00+00:00",
2883     "publisher": "Nictiz",
2884     "hierarchyMeaning": "is-a",
2885     "compositional": true,
2886     "content": "complete"
2887   }
2888 },
2889 {
2890   "fullUrl": "https://browser.ihtsdotools.org/fhir/CodeSystem/sct_11000146104_20241031",
2891   "resource": {
2892     "resourceType": "CodeSystem",
2893     "id": "sct_11000146104_20241031",
2894     "url": "http://snomed.info/sct",
2895     "version": "http://snomed.info/sct/11000146104/version/20241031",
2896     "name": "SNOMED CT",
2897     "title": "Netherlands Edition",
2898     "status": "active",
2899     "date": "2024-10-31T00:00:00+00:00",
2900     "publisher": "Nictiz",
```


FHIR Terminology server

- Query CodeSystem for a Subset
 - “Hereditary hemoglobinopathies”

```
22  "contains": [  
23    {  
24      "system": "http://snomed.info/sct",  
25      "code": "16371831000119108",  
26      "display": "Delta beta thalassaemia trait"  
27    },  
28    {  
29      "system": "http://snomed.info/sct",  
30      "code": "10806241000119108",  
31      "display": "Thalassaemia in mother complicating childbirth"  
32    },  
33    {  
34      "system": "http://snomed.info/sct",  
35      "code": "10759401000119105",  
36      "display": "Sickle cell trait in mother complicating childbirth"  
37    },  
38    {  
39      "system": "http://snomed.info/sct",  
40      "code": "10759351000119103",  
41      "display": "Sickle cell anaemia in mother complicating childbirth"  
42    },  
43    {  
44      "system": "http://snomed.info/sct",  
45      "code": "685111000119109",  
46      "display": "Haemoglobin E beta zero thalassaemia"  
47    },  
48    {  
49      "system": "http://snomed.info/sct"
```

[https://browser.ihtsdotools.org/fhir/ValueSet/\\$expand?url=http://snomed.info/sct?fhir_vs=isa/235862008](https://browser.ihtsdotools.org/fhir/ValueSet/$expand?url=http://snomed.info/sct?fhir_vs=isa/235862008)

HL7 FHIR – Status

- Broad uptake by industry
 - EHR vendors, Google, Apple, Microsoft, Amazon
- Part of US and (likely) EU legislations / regulations
- Large and active community
- Broad range of tooling
- Many initiatives “on FHIR”

Conclusion - HL7 FHIR

- provides web-based service architecture
- specifies Resources
- enables use-case specific Profiles
- supports patient data AND terminologies

Sources

- HL7 FHIR <https://hl7.org/fhir/>
- HAPI FHIR - Open Source FHIR API <https://hapifhir.io/>
- Demo servers:
 - HAPI-FHIR <https://hapi.fhir.org/>
 - MELD <https://gw.interop.community/Test02Open/open/>
- Terminology servers:
 - SNOMED browser.ihtsdotools.org/fhir/CodeSystem
 - ValueSets <https://nzhts.digital.health.nz/fhir/ValueSet>
- Playground for REST API:
 - <https://hoppscotch.io/>



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