

# Omnis on FHIR®

ODC 2024



HL7® FHIR®

omnis studio

# Voraussetzungen für Code Along

- Docker Desktop

<https://www.docker.com/products/docker-desktop/>

- Image

`docker pull hapiproject/hapi:latest`

- Github

<https://github.com/advancedconcepts/Omnis-FHIR>

# Über mich

- Stefan Csomor [csomor@advanced.ch](mailto:csomor@advanced.ch)
- Entwicklung mit Omnis seit 1986
- Mediziner & Ba CS
- Snomed & FHIR

# Agenda

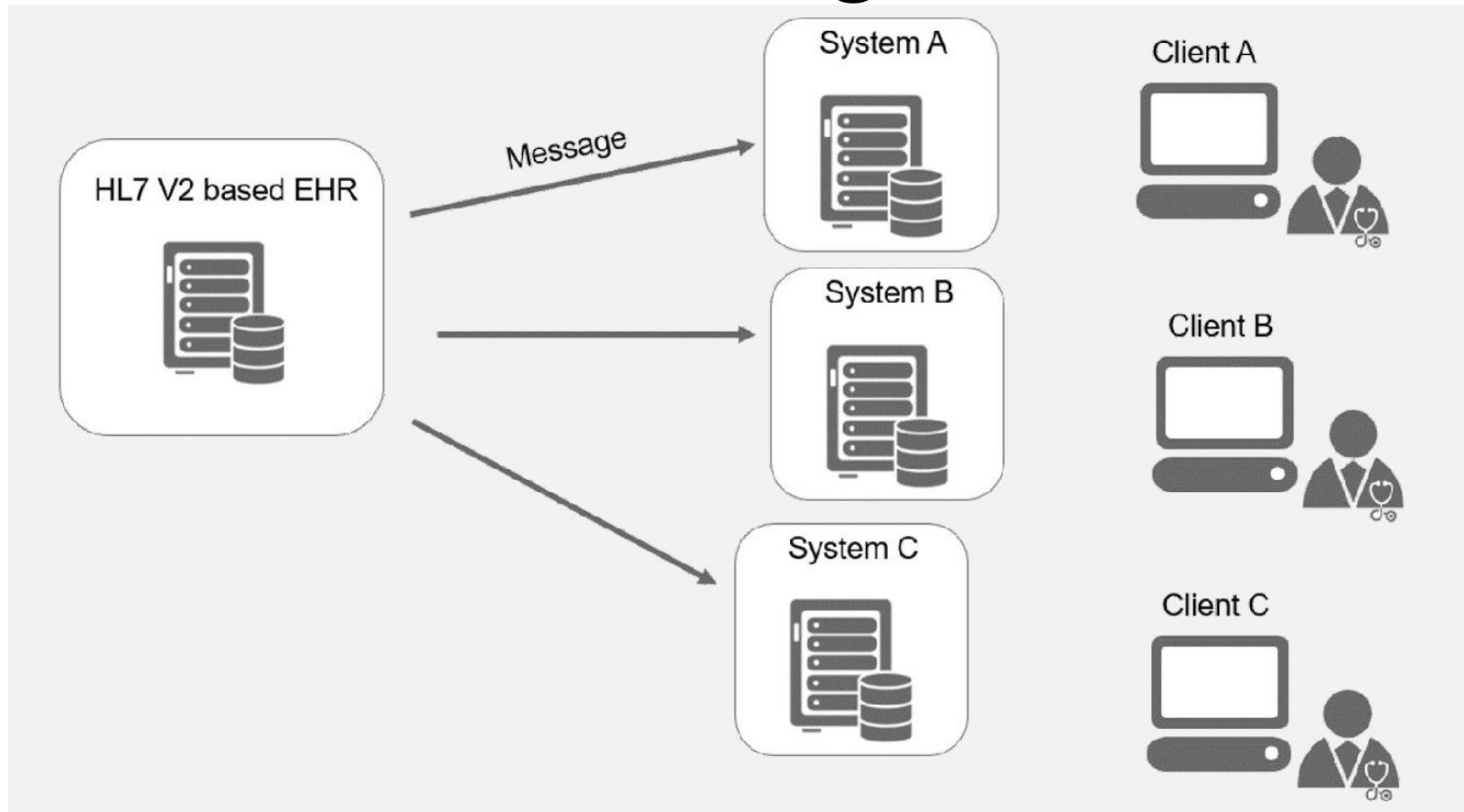
- Kurze Einführung in FHIR
- Omnis-Code mit Beispielen
- Code / Demo
- F&A

# Kurze Einführung in



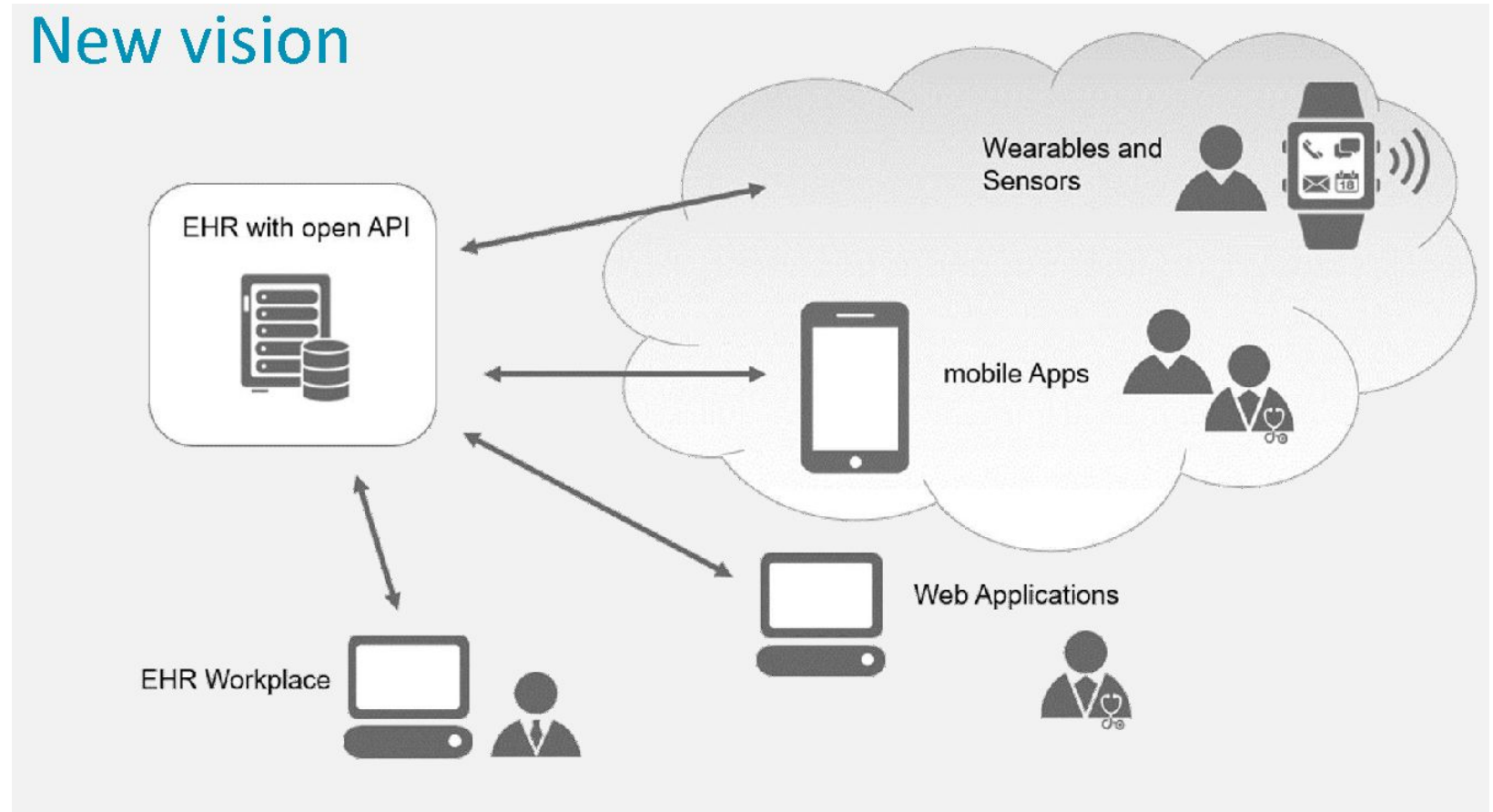
<https://www.hl7.org/fhir>

# Geschichte – Daten-Push / HL7 Messages



# Aktueller Stand der Technik

- Cloud-basiert
- Abfragegesteuert
- Open API
- JSON (+XML)
- HTTP/REST



# FHIR®

- **Schnell**
  - Niedrige Eintrittsschwelle / Umsetzer im Sinn
- **Gesundheitswesen**
  - Domain
- **Interoperabilität**
  - Nicht Modellierung, sondern Austausch
- **Ressourcen**
  - Building Blocks





# FHIR-Versionen



Mar 26, 2023	<b>Release 5</b> (Testanwendung - siehe unten)
May 28, 2022	<b>Release 4B</b> : Stufenweise Freigabe von Änderungen in bestimmten Bereichen
Dec 27, 2018	<b>Release 4</b> (1 <sup>st</sup> Normativer Inhalt + Test-Entwicklung)
Feb 21, 2017	Release 3 ( <b>STU</b> - Standard für Tests)
Oct 24, 2015	<b>DSTU2</b> (Zweiter Entwurfsstandard für Tests)
Sept 30, 2014	<b>DSTU1</b> (Erster Entwurfsstandard für Tests)

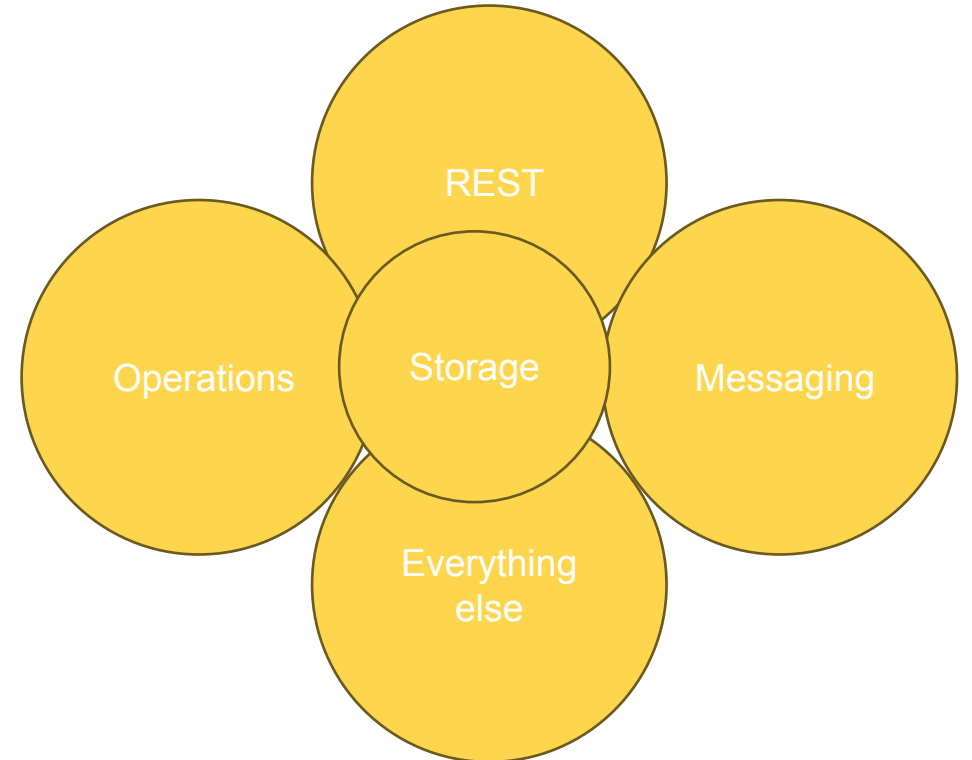


# FHIR Manifesto

- Für Durchführende
- 80/20 % Regel
- Etablierte Web-basierte Technologien
- Von Menschen lesbar(JSON zumindest ;-)
- Starke Community

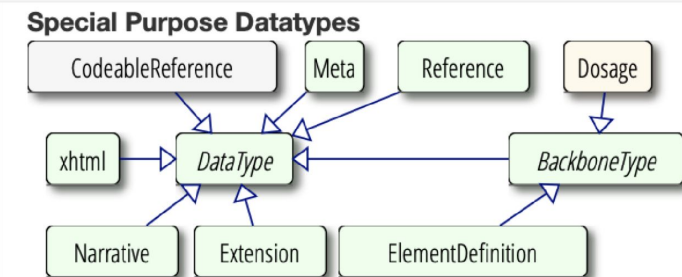
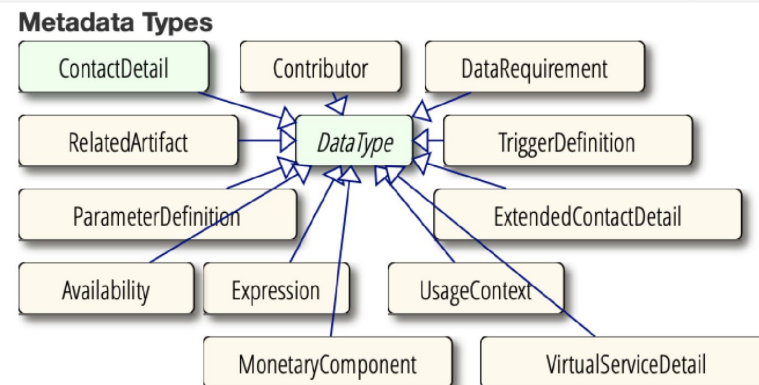
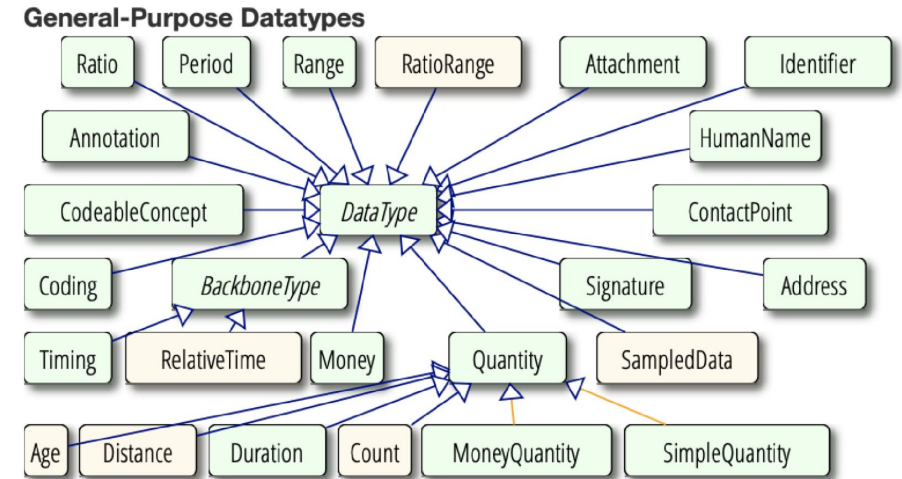
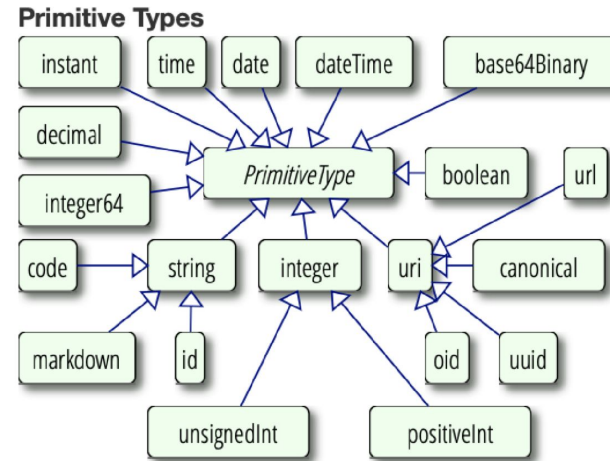
# Austausch

- REST am meisten verwendet
- Aber andere möglich
- FHIR-Daten ebenso



# Legosteine zum Aufbau von Ressourcen

- Simple/Primitive
  - Single Value
  - Lower Case
- Datentypen
  - Composed



# Ressourcen <http://hl7.org/fhir/resourcelist.html>

Foundation	<p><b>Conformance</b></p> <ul style="list-style-type: none"> <li>• CapabilityStatement <b>N</b></li> <li>• StructureDefinition <b>N</b></li> <li>• ImplementationGuide 4</li> <li>• SearchParameter 5</li> <li>• MessageDefinition 1</li> <li>• OperationDefinition <b>N</b></li> <li>• CompartmentDefinition 3</li> <li>• StructureMap 4</li> <li>• GraphDefinition 2</li> </ul>	<p><b>Terminology</b></p> <ul style="list-style-type: none"> <li>• CodeSystem <b>N</b></li> <li>• ValueSet <b>N</b></li> <li>• ConceptMap 3</li> <li>• NamingSystem 4</li> <li>• TerminologyCapabilities 1</li> </ul>	<p><b>Security</b></p> <ul style="list-style-type: none"> <li>• Provenance 4</li> <li>• AuditEvent 4</li> <li>• Permission 0</li> <li>• Consent 2</li> </ul>	<p><b>Documents</b></p> <ul style="list-style-type: none"> <li>• Composition 4</li> <li>• DocumentReference 4</li> </ul>	<p><b>Other</b></p> <ul style="list-style-type: none"> <li>• Basic 3</li> <li>• Binary <b>N</b></li> <li>• Bundle <b>N</b></li> <li>• Linkage 0</li> <li>• MessageHeader 4</li> <li>• OperationOutcome <b>N</b></li> <li>• Parameters <b>N</b></li> <li>• Subscription 3</li> <li>• SubscriptionStatus 2</li> <li>• SubscriptionTopic 2</li> </ul>	
	Base	<p><b>Individuals</b></p> <ul style="list-style-type: none"> <li>• Patient <b>N</b></li> <li>• Practitioner 5</li> <li>• PractitionerRole 4</li> <li>• RelatedPerson 5</li> <li>• Person 4</li> <li>• Group 3</li> </ul>	<p><b>Entities #1</b></p> <ul style="list-style-type: none"> <li>• Organization 5</li> <li>• OrganizationAffiliation 1</li> <li>• HealthcareService 4</li> <li>• Endpoint 2</li> <li>• Location 5</li> </ul>	<p><b>Entities #2</b></p> <ul style="list-style-type: none"> <li>• Substance 2</li> <li>• BiologicallyDerivedProduct 2</li> <li>• Device 2</li> <li>• DeviceMetric 1</li> <li>• NutritionProduct 1</li> </ul>	<p><b>Workflow</b></p> <ul style="list-style-type: none"> <li>• Task 3</li> <li>• Transport 1</li> <li>• Appointment 3</li> <li>• AppointmentResponse 3</li> <li>• Schedule 3</li> <li>• Slot 3</li> <li>• VerificationResult 1</li> </ul>	<p><b>Management</b></p> <ul style="list-style-type: none"> <li>• Encounter 4</li> <li>• EncounterHistory 0</li> <li>• EpisodeOfCare 2</li> <li>• Flag 1</li> <li>• List 4</li> <li>• Library 4</li> </ul>
		Clinical	<p><b>Summary</b></p> <ul style="list-style-type: none"> <li>• AllergyIntolerance 3</li> <li>• AdverseEvent 2</li> <li>• Condition (Problem) 5</li> <li>• Procedure 4</li> <li>• FamilyMemberHistory 2</li> <li>• ClinicalImpression 1</li> <li>• DetectedIssue 2</li> </ul>	<p><b>Diagnostics</b></p> <ul style="list-style-type: none"> <li>• Observation <b>N</b></li> <li>• DocumentReference 4</li> <li>• DiagnosticReport 3</li> <li>• Specimen 2</li> <li>• BodyStructure 1</li> <li>• ImagingSelection 1</li> <li>• ImagingStudy 4</li> <li>• QuestionnaireResponse 5</li> <li>• MolecularSequence 1</li> <li>• GenomicStudy 0</li> </ul>	<p><b>Medications</b></p> <ul style="list-style-type: none"> <li>• MedicationRequest 4</li> <li>• MedicationAdministration 2</li> <li>• MedicationDispense 2</li> <li>• MedicationStatement 4</li> <li>• Medication 4</li> <li>• MedicationKnowledge 1</li> <li>• Immunization 5</li> <li>• ImmunizationEvaluation 1</li> <li>• ImmunizationRecommendation 1</li> <li>• FormularyItem 0</li> </ul>	<p><b>Care Provision</b></p> <ul style="list-style-type: none"> <li>• CarePlan 2</li> <li>• CareTeam 2</li> <li>• Goal 2</li> <li>• ServiceRequest 4</li> <li>• NutritionOrder 2</li> <li>• NutritionIntake 1</li> <li>• VisionPrescription 3</li> <li>• RiskAssessment 2</li> <li>• RequestOrchestration 4</li> </ul>

# Ressourcenbeschreibungen

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

Name	Flags	Card.	Type	Description & Constraints
Patient	<b>N</b>		DomainResource	Information about an individual or animal receiving health care services
identifier		Σ 0..*	Identifier	Elements defined in Ancestors: <a href="#">id</a> , <a href="#">meta</a> , <a href="#">implicitRules</a> , <a href="#">language</a> , <a href="#">text</a> , <a href="#">contained</a> , <a href="#">extension</a> , <a href="#">modifierExtension</a> 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 Binding: <a href="#">AdministrativeGender</a> (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 Binding: <a href="#">Marital Status Codes</a> (Extensible)






# Vererbung






 Patient

**N**

DomainResource

1

Name	Flags	Card.	Type
 DomainResource	«A» <b>N</b>		Resource
 text	<b>C</b>	0..1	Narrative
 contained	<b>C</b>	0..*	Resource
 extension		0..*	Extension
 modifierExtension	?! $\Sigma$	0..*	Extension

Name	Flags	Card.	Type
 Resource	«A» <b>N</b>		Base
 id	$\Sigma$	0..1	id
 meta	$\Sigma$	0..1	Meta
 implicitRules	?! $\Sigma$	0..1	uri
 language		0..1	code



```
{
  "resourceType": "Patient",
  "id": "example",
  "meta": {
    "profile": [
      "http://hl7.org/fhir/us/core/StructureDefinition/us-core-patient"
    ]
  },

```

```
  "text": {
    "status": "generated",
    "div": "<div xmlns=\\\"http://www.w3.org/1999/xhtml\\\"><p><b>Amy V. Baxter </b> female,DoB: 1987-02-20 ( Medical Record Number: 1032702 (USUAL))</p></div>"
  },

```

```
  "extension": [{
    "url": "http://hl7.org/fhir/us/core/StructureDefinition/us-core-genderIdentity",
    "valueCodeableConcept": {
      "coding": [{
        "system": "http://terminology.hl7.org/CodeSystem/v3-NullFlavor",
        "code": "ASKU",
        "display": "asked but unknown"
      }],
      "text": "asked but unknown"
    }
  ]
},

```

```
  "identifier": [{
    "system": "http://hospital.smarthealthit.org",
    "value": "1032702"
  }],
  "active": true,
  "name": [{
    "family": "Baxter",
    "given": [
      "Amy",
      ""
    ]
  }],

```

Metadata

Narrative

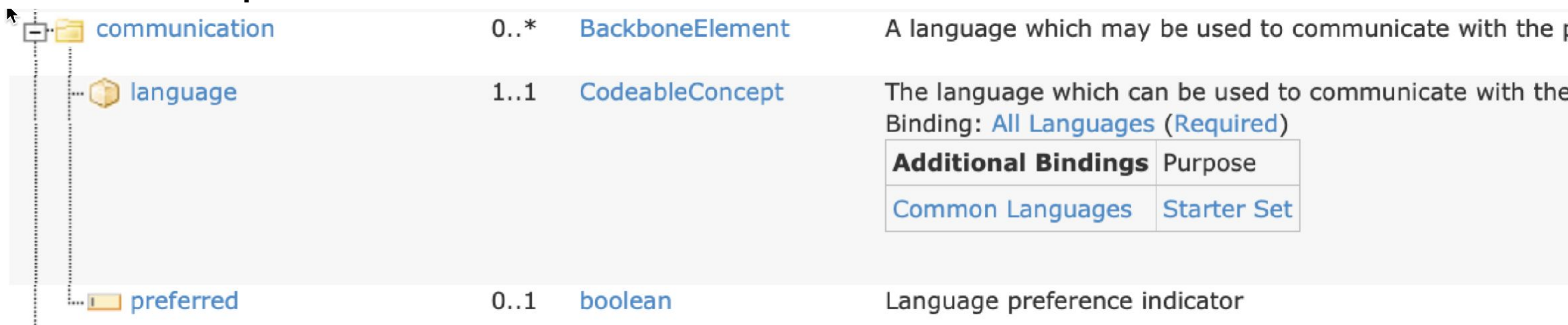
Extensions

Data elements



# Kardinalität

- 0 .. \* → Collections
- 1 .. 1 → mandatory
- 0 .. 1 → optional



- **Aber zusätzliche Constraints** in der Beschreibung

UniqueKey	Level	Location	Description	Expression
✓ pat-1	Rule	Patient.contact	SHALL at least contain a contact's details or a reference to an organization	name.exists() or telecom.exists() or address.exists() or organization.exists()

# Elemente

- Einfache Typen (lowercase, field symbol)

 `active`   0..1  Whether this patient's record is in active use

- ?! = modifier attributes (important for meaning, cannot be ignored)
- $\Sigma$  = part of summary

- Datentypen

 `maritalStatus` 0..1  Marital (civil) status of a patient  
Binding: [Marital Status Codes \(Extensible\)](#)

# Partielle Daten

- **date** und **datetime** einfache Typen können einige partielle Datenformate beinhalten
  - Nur Jahr
    - YYYY
  - Nur Jahr und Monat
    - YYYY-MM
- Andere Varianten (z. B. unbekanntes Jahr und unbekannter Monat, aber bekannter Tag) nur über Extensions
- Für die Typen **instant** und **time** sind solche partiellen Werte nicht erlaubt

# Polymorphe Elemente

- Element kann unterschiedliche Typen halten  
elementname[x] : [x] replaced by concrete type

The screenshot shows an IDE interface for an XML schema. The element 'deceased[x]' is highlighted, with a mouse cursor over the question mark icon. To its right, the cardinality '?! Σ 0..1' and the description 'Indicates if the individual is deceased or not' are visible. Below the element name, two concrete types are listed: 'deceasedBoolean' with the concrete type 'boolean', and 'deceasedDateTime' with the concrete type 'dateTime'. Both rows are highlighted in yellow.

deceased[x]	?! Σ 0..1	Indicates if the individual is deceased or not
deceasedBoolean	boolean	
deceasedDateTime	dateTime	

- sowohl in XML als auch in JSON

```
"deceasedDateTime" : "2015-02-14T13:42:00+10:00",
```

```
<deceasedDateTime value="2015-02-14T13:42:00+10:00"/>
```

# Ressourcen-Identität

- Innerhalb des Resource-Typs: **id**

Name	Flags	Card.	Type	Description & Constraints
Resource	N	n/a		Base Resource
id	Σ	0..1	id	Logical id of this artifact

- Complete URI




https://exampleserver.omnis.net/Patient/a1b2c4-d5e6

1                      2                      3  
endpoint    resource type    [logical] id

- Andere Identifikatoren ...

identifier	Σ	0..*	Identifier	An identifier for this patient
------------	---	------	------------	--------------------------------

# Verlinkung Ressourcen / Referenzen

Name	Flags	Card.	Type	Description & Constraints
 Observation	<b>N</b>		DomainResource	Measurements and simple assertions + Rule: <i>dataAbsentReason SHALL only be present if Observation.component.code is the same as Observation.component.code</i> + Rule: <i>If Observation.component.code is the same as Observation.component.code, Observation.component.value SHALL NOT be present (the Observation.component.value SHALL only be present if Observation.component.code is not the same as Observation.component.code)</i>  Elements defined in Ancestors: <a href="#">id</a> , <a href="#">meta</a> , <a href="#">implicit</a> , <a href="#">modifierExtension</a>
 identifier	$\Sigma$	0..*	Identifier	Business Identifier for observation
 subject	$\Sigma$	0..1	Reference(Patient   Group   Device   Location   Organization   Procedure   Practitioner   Medication   Substance   BiologicallyDerivedProduct   NutritionProduct)	Who and/or what the observation is about

# Wörtliche Referenzen (via URLs)

## Relative URL (Service Base URL)

```
"subject" : {  
  "reference" : "Patient/f001",  
  "display" : "P. van de Heuvel"  
},
```

## Absolute URI

```
{  
  "profile" : {  
    "reference" : "http://fhir.hl7.org/svc/StructureDefinition/c8973a22-2b5b-4e76-9c66-00639c99e61b"  
  }  
}
```

## Internal Fragment Ref (contained)

```
{  
  "resourceType" : "Condition",  
  "contained": [  
    {  
      "resourceType" : "Practitioner",  
      "id" : "p1",  
      "name" : [{  
        "family" : "Person",  
        "given" : ["Patricia"]  
      }]  
    }],  
  "participant" : [{  
    "function" : {  
      "text" : "Asserter"  
    },  
    "actor" : {  
      "reference" : "#p1"  
    }  
  }]  
}]  
}
```

# Erweiterungen

- Für die 20%, die nicht in der Ressourcenbeschreibung enthalten sind  
Nützlich oder notwendig in Ihrem Land / Ihrem Projekt / Anwendungsfall

```
{  
  "resourceType" : "Patient",  
  "id" : "FranzMuster",  
  
  "extension" : [{  
    "url" : "http://hl7.org/fhir/StructureDefinition/patient-birthPlace",  
    "valueAddress" : { "city" : "Paris", "country" : "Frankreich" }  
  },  
  {  
    "url" : "http://fhir.ch/ig/ch-core/StructureDefinition/ch-core-patient-ech-11-placeoforigin",  
    "valueAddress" : { "city" : "Köniz", "state" : "BE" }  
  }  
],  
}
```



# Profile und Implementationshinweise

- FHIR Resource/Datatype + **Extensions** + **Constraints**  
= **Profile**

```
{  
  "resourceType" : "Patient",  
  "id" : "FranzMuster",  
  "meta" : {  
    "profile" : ["http://fhir.ch/ig/ch-core/StructureDefinition/ch-core-patient"]  
  },  
}
```

- Implementationshinweise
  - Beschreiben die Verwendung in einem bestimmten Datenaustausch / wie man es richtig macht

# Suchen

- REST Standard

GET mit Query  
oder  
POST mit Parametern

POST hapi.fhir.org/baseR4/Patient/\_search

Params Authorization Headers (9) Body Pre-request Script Tests Settings Cookies

none  form-data  x-www-form-urlencoded  raw  binary  GraphQL

Key	Value	Description	...	Bulk Edit
<input checked="" type="checkbox"/> given	Joe			
<input checked="" type="checkbox"/> family	McGarret			

- Datenschutzprobleme mit GET in I

GET http://hapi.fhir.org/baseR4/Patient?given=Joe&family=McGarret

Params Authorization Headers (7) Body Pre-request Script Tests Settings Cookies

Body Cookies Headers (9) Test Results 200 OK 857 ms 2.46 KB Save as example

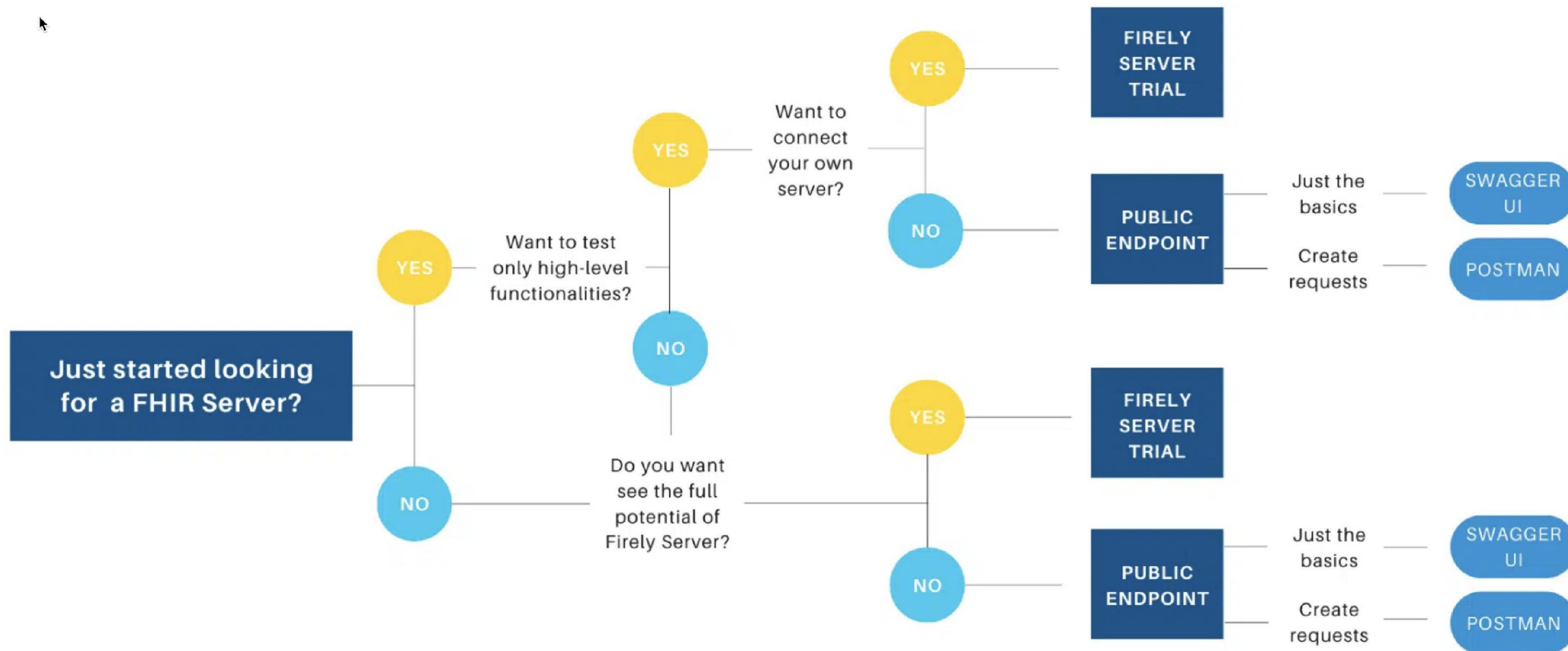
Pretty Raw Preview Visualize JSON

```
1 {
2   "resourceType": "Bundle",
3   "id": "9da52406-c66e-46fc-a270-9b8a8863ae60",
4   "meta": {
5     "lastUpdated": "2024-05-03T08:32:10.707+00:00"
6   },
7   "type": "searchset",
8   "total": 1,
9   "link": [
10    {
11      "relation": "self",
12      "url": "https://hapi.fhir.org/baseR4/Patient?family=McGarret&given=Joe"
13    }
14  ],
15  "entry": [
16    {
17      "fullUrl": "https://hapi.fhir.org/baseR4/Patient/1096829",
18      "resource": {
19        "resourceType": "Patient",
20        "id": "1096829",
21        "meta": {
22          "versionId": "4",
23          "lastUpdated": "2020-04-09T08:20:13.942+00:00",
24          "source": "#ecccR1ckxGoToCT0"
25        },
26        "text": {
27          "status": "generated",
28          "div": "<div xmlns='http://www.w3.org/1999/xhtml'><div class='hapiHeaderText'>Steven J
29        },
30        "identifier": [
31          {
32            "system": "http://fhir.de/NamingSystem/gkv/kvid-10",
33            "value": "9973299999"
34          },
35          {
36            "system": "http://starfleet-hospital.ufp/NamingSystem/patient-identifier",
37            "value": "NCC-1032"
38          }
39        ],
40        "name": [
41          {
42            "family": "McGarret",
43            "given": [
44              "Steven",
45              "Joe"
46            ]
47          }
48        ]
49      }
50    }
51  ]
52 }
```

# Sicherheit

- Authentication
  - für Web oAuth2
- Authorisierung/Zugriffskontrolle mit Sicherheits-Labeln
- Audit Log
- Ausführliche Details auf <https://www.hl7.org/fhir/security.html>

# Test Server: Public oder Local



# Public

- Liste auf <https://confluence.hl7.org/display/FHIR/Public+Test+Servers>

Auswahl nach benötigten Funktionen, z. B. Authentifizierung über Smart on FHIR

- <https://server.fire.ly/r4> (/r5 etc ...)
- <http://hapi.fhir.org> (Web UI)

# Local

- <https://github.com/hapifhir/hapi-fhir-jpaserver-starter>

Oder

- <https://hub.docker.com/r/hapiproject/hapi>

```
docker pull hapiproject/hapi:latest  
docker run -p 8080:8080 hapiproject/hapi:latest
```

<http://localhost:8080> (jetzt in Version 4.0.1)

Omnis on FHIR®

# Reale Verwendung

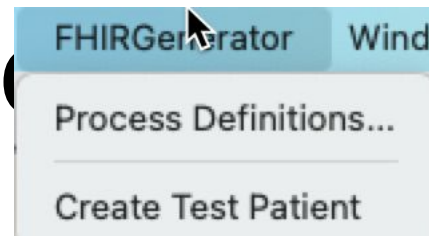
- Bis 2020 zunächst nur aus persönlichem Interesse  
<https://github.com/advancedconcepts/Omnis-FHIR>
- 2021 bietet das Swiss Covid-19 Vaccination Portal eine FHIR API  
(obwohl sie Adressen falsch behandeln!)
- Seit 2023 Anbindung des eigenen Praxisinformationssystems an die elektronische Patientenakte über FHIR



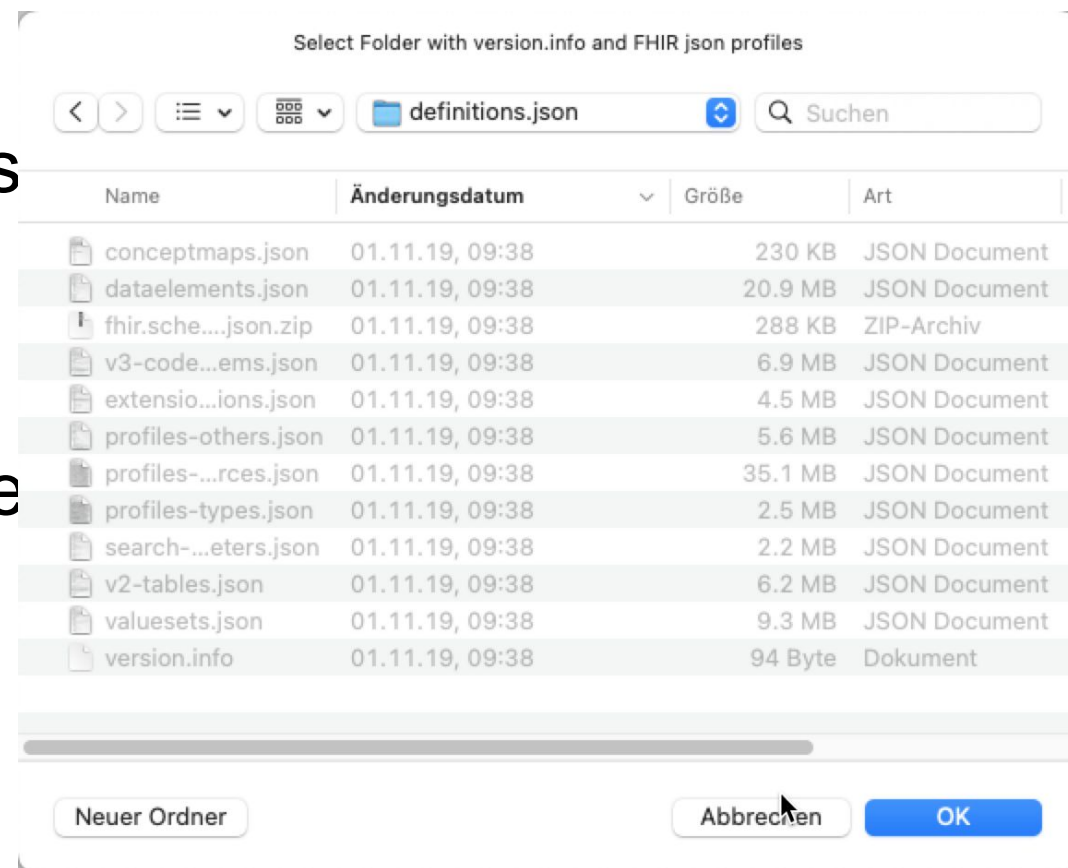
# Unterstützende Klassen in fhir.lbs

- **oFHIRContext**  
(halten konkrete FHIR-Version, Komfortmethoden)
- **oFHIRClientEndpoint**  
(REST Client)
- **oFHIRBridge**  
(Übersetzung ‚native‘ ↔ FHIR Repräsentation)
- **oFHIRServerEndpoint**  
(REST Server) nicht im Rahmen dieser Präsentation enthalten

# Generierter Code für FHIR-Type



- **fhir\_tools.lbs** generiert eine **fhir\_xx.lbs** aus JSON FHIR Definitionsdateien jedes Releases
- Vorgeneriert für STU3, R4, R5
- Also nur für zukünftige Versionen oder wenn die Handhabung geändert wird



# Omnis FHIR Type System

- Viele einfache/primitive Typen
  - Als Elemente, die auf native Omnis-Typen abgebildet werden

FHIR Type	Omnis Type
instant, time	kDate / kTime
date, datetime ( <i>partial dates</i> )	kCharacter, \$assign "polymorph"
base64binary	kBinary
integer, unsignedInt, positiveInt	kInteger/k32bitint
Integer64	kInteger/k64bitint
decimal	kNumber/kFloatdp
uri, oid, uuid, canonical, code, markdown, xhtml, id	kCharacter

# Omnis FHIR Type System (Forts.)

- Modelliert nach FHIR Standard -> oFHIRBaseElement in FHIR.LBS
- Für alle (einschl. einfacher Typen als Objekte):
  - FHIR Name bleibt (inklusive Casing), mit vorangestelltem ,o‘
    - Patient -> oPatient, boolean -> oboolean
  - Objekt-Referenzen durchgängig verwendet
    - Gibt Type an mit einer festen Version in Omnis IDE für Autovervollständigung
- Für CodeSystems werden Code-Klassen mit vorangestelltem ,cs‘ benutzt
  - Do code method `csGenderIdentity/$male ...`

# oFHIRContext

- Herausforderung: Handling verschiedener FHIR-Versionen (fhir\_XXX.lbs)
- Version hängt vom Zielsystem(en) ab
  - Mehrere Versionen im Einsatz zur Laufzeit
- Indirektion durch Instanzen oFHIRContext
  - Verwendet Version String oder Versionsnummer als Constructor-Argument
- Komfortable Methoden zur Ressourcenerstellung

Code / Demo

# Open fhir\_sample\_client.lbs

- Open oSampleClientEndpoint.\$createPatientOnServer1

# Set up FHIR Context


- In \$createPatientOnServer1
  - Set up FHIR Context (base class methods)  
eg. to „r4“  
Calculate \$cinst.\$context as 'r4'
  - Verify context  
If \$cinst.\$context().\$isvalid()  
  
End If



# Create Resource

- Setup

- Add local variable nativePatient (Row, sSamplePatient)
- Add local variable patient (Object Reference, fhir\_r4.oPatient)

1	nativePatient	Row	sSamplePatient
2	patient	Object refer	 fhir_r4.oPatient

- Setup nativePatient data
  - Do method `setupNativePatient` (**nativePatient**)
- In the `$isvalid()` branch
  - Create Resource by FHIR Typename
    - Calculate **patient** as `$cinst.$context().$createResource('Patient')`

# Set Attributes

- In the `$createPatientOnServer1`
  - Do `$cinst.$patientToResource($cinst.$context(),nativePatient.$ref,patient)`
- In der `$patientToResource` Methode
  - Wir kopieren alle Attribute aus der nativen Repräsentation **pNativePatient** (Item Reference) in die FHIR Resource **pFHIRPatient** (Object Reference)
  - Da wir neue Ressourcen erstellen müssen, haben wir auch **pContext** (Object Reference)

# Einfache Attribute

Name	Flags	Card.	Type	Description & Constraints
Patient	<b>N</b>		DomainResource	Information about an individual or animal resource
identifier	$\Sigma$	0..*	Identifier	Elements defined in Ancestors: <a href="#">id</a> , <a href="#">meta</a> , <a href="#">imp</a> An identifier for this patient
active	?! $\Sigma$	0..1	boolean	Whether this patient's record is in active use
name	$\Sigma$	0..*	HumanName	A name associated with the patient
telecom	$\Sigma$	0..*	ContactPoint	A contact detail for the individual
gender	$\Sigma$	0..1	code	male   female   other   unknown Binding: <a href="#">AdministrativeGender (Required)</a>
birthDate	$\Sigma$	0..1	date	The date of birth for the individual

# Assignment: **id**

Calculate **pFHIRPatient.id** as **pNativePatient.sampleID**

# Assignment: **birth**

Calculate **pFHIRPatient.\$birthDate** as **pNativePatient.sampleBirth**

# Switch matching codes: **gender**

Switch **pNativePatient.sampleSex**

Case 'M'

Do code method **fhir\_r4.csGenderIdentity/\$male** Returns **pFHIRPatient.\$gender**

Case 'F'

Do code method **fhir\_r4.csGenderIdentity/\$female** Returns **pFHIRPatient.\$gender**

Default

# if we do not know, we do not set

End Switch

# Komplexe Attribute (Card ..1)

Name	Flags	Card.	Type	Description & Constraints
Patient	<b>N</b>		DomainResource	Information about an individual or an organization Elements defined in Ancestors: <a href="#">id</a> , <a href="#">meta</a>
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 <a href="#">AdministrativeGender</a> (Required)
birthDate	Σ	0..1	date	The date of birth for the individual
deceased[x]	?! Σ	0..1		Indicates if the individual is deceased
deceasedBoolean			boolean	
deceasedDateTime			dateTime	
address	Σ	0..*	Address	An address for the individual
maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient <a href="#">MaritalStatus</a> (Extensible)

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

- if not set, a new instance gets created automatically upon accessing

Calculate `codeableConcept` as `pFHIRPatient.$maritalStatus`

Switch `pNativePatient.sampleMaritalStatus`

Case 'U'

Calculate `codeableConcept.text` as "unmarried"

...

Default

# all other cases should be handled as well

End Switch

# Hinzufügen zu Collections (Card ... >1)

1	codeableConce	Object refer	fhir_r4.oCodeableConcept
2	coding	Object refer	fhir_r4.oCoding

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

Name	Flags	Card.	Type	Description & Constraints
Coding	Σ <b>N</b>		Element	A reference to a code defined by a terminology system Elements defined in Ancestors: <a href="#">id</a> , <a href="#">extension</a>
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

- Create Element, then use the add ... method

Calculate **coding** as `pContext.$createResource("Coding")`

Calculate **coding.code** as `U`

Calculate **coding.system** as `'http://terminology.hl7.org/CodeSystem/v3-MaritalStatus'`

Calculate **coding.display** as `'unmarried'`

Do `codeableConcept.$addcoding(coding)`

- Convenience method

Calculate **coding** as `pContext.$createcoding('http://terminology.hl7.org/CodeSystem/v3-MaritalStatus','U','unmarried')`

# Hinzufügen zu Collections (Forts.)

Name	Flags	Card.	Type	Description & Constraints
Patient	<b>N</b>		DomainResource	Information about an individual or animal resource
identifier	Σ	0..*	Identifier	Elements defined in Ancestors: id, meta, im 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

Name	Flags	Card.	Type	Description & Constraints
HumanName	Σ <b>N</b>		Element	Name of a human or other living entity - parts and usage
use	?! Σ	0..1	code	Elements defined in Ancestors: id, extension usual   official   temp   nickname   anonymous   old   maiden Binding: NameUse (Required)
text	Σ	0..1	string	Text representation of the full name
family	Σ	0..1	string	Family name (often called 'Surname')
given	Σ	0..*	string	Given names (not always 'first'). Includes middle names This repeating element order: Given Names appear in the correct order

	Variable	Type	Subtype
1	name	Object reference	fhir_r4.oHumanName

- Or use the add ... method without param  
→ creates new instance

```
# calling add... to get a new instance (object ref)
Calculate name as pFHIRPatient.$addname()
Calculate name.$use as 'official'
Calculate name.$family as pNativePatient.sampleLastname
```

- For simple types direct add

```
# direct parameter (especially elegant for primitive types)
Do name.$addgiven(pNativePatient.sampleFirstname)
```

# Identifiers (nicht das id Element)

Name	Flags	Card.	Type	Description & Constraints
Patient	N		DomainResource	Information about an individual or animal rec
identifier	Σ	0..*	Identifier	Elements defined in Ancestors: id, meta, impl An identifier for this patient

2	adrestext	Character	100000000			
3	codeableConce	Object refer	fhir_r4.oCodeableConcept			
4	coding	Object refer	fhir_r4.oCoding			
5	identifier	Object refer	fhir_r4.oIdentifier			
6	name	Object refer	fhir_r4.oHumanName			
	Task	Class	Instance	Local	Parameter	Documentation

Name	Flags	Card.	Type	Description & Constraints
Identifier	Σ N		Element	An identifier intended for computation + Warning: Identifier with no value has limited utility. If communicating the value element SHOULD be present with an extension indicating the
use	?! Σ	0..1	code	Elements defined in Ancestors: id, extension usual   official   temp   secondary   old (If known) Binding: IdentifierUse (Required)
type	Σ	0..1	CodeableConcept	Description of identifier Binding: Identifier Type Codes (Extensible)
system	Σ	0..1	uri	The namespace for the identifier value
value	Σ C	0..1	string	The value that is unique
period	Σ	0..1	Period	Time period when id is/was valid for use
assigner	Σ	0..1	Reference(Organization)	Organization that issued id (may be just text)

- Eg MR (Medical Record Number) is mandatory in many situations

Calculate **identifier** as **pFHIRPatient**.\$addidentifier()

Calculate **identifier**.\$use as 'usual'

Calculate **identifier**.\$system as "http://www.myomnisfhirsample.org/"

Calculate **identifier**.\$value as **pNativePatient**.sampleUUID

Calculate **codeableConcept** as **identifier**.\$::type()


Calculate **coding** as **codeableConcept**.\$addcoding()

Calculate **coding**.\$system as "http://terminology.hl7.org/CodeSystem/v2-0203"

Calculate **coding**.\$code as "MR"

# Profile

- Profile zeigen den „Vertrag“ an, dem eine Ressource entspricht

5	meta	Object refer	 fhir_r4.oMeta
---	------	--------------	-------------------------------------------------------------------------------------------------

Do **meta**.\$addprofile("http://fhir.ch/ig/ch-core/StructureDefinition/ch-core-patient")

Do **meta**.\$addprofile("http://fhir.ch/ig/ch-core/StructureDefinition/ch-core-patient-epr")



# Polymorphe Elemente

Name	Flags	Card.	Type	Description & Constraints
Patient	<b>N</b>		DomainResource	Information about an individual or animal receiving health care services Elements defined in Ancestors: <a href="#">id</a> , <a href="#">meta</a> , <a href="#">implicitRules</a> , <a href="#">language</a> , <a href="#">text</a> , <a href="#">contains</a>
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 <a href="#">AdministrativeGender (Required)</a>
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	

If `pNativePatient.sampleDeathdate<>'`

- create either a boolean

Calculate `polymorph` as `pContext.$createSimpleType('boolean')`

Calculate `polymorph.$value` as `pNativePatient.sampleDeathdate<>'`

- or a date

Calculate `polymorph` as `pContext.$createSimpleType('date')`

Calculate `polymorph.$value` as `pNativePatient.sampleDeathdate`

- which is assigned to the element 'deceased'

Calculate `pFHIRPatient.$deceased` as `polymorph`

End If

# Extensions

1	address	Object reference	 fhir_r4.oAddress
4	extension	Object reference	 fhir_r4.oExtension

Calculate **extension** as **pFHIRPatient**.\$addextension()

Calculate **address** as **pContext**.\$createResource('Address')

Calculate **address.city** as **pNativePatient**.samplePlaceOfOriginCity

Calculate **address.state** as **pNativePatient**.samplePlaceOfOriginState

Calculate **extension.url** as 'http://fhir.ch/ig/ch-core/StructureDefinition/ch-core-patient-ech-11-placeoforigin'

Calculate **extension.value** as **address**

# Umgang mit Referenzen

- Erstellen von Referenzen

(... practitioner resource setup)

Calculate **pFHIRPatient**.\$generalPractitioner as **pContext**.\$createReference(**practitioner**)

- Erstellen Interner Referenzen

(enthaltene Resource, außerhalb des Rahmens dieser Präsentation)

Do **docRef**.\$addcontained(**pSubSetAuthor**)

Do **docRef**.\$addauthor(**pContext**.\$createInternalReference(**pSubSetAuthor**))

# Daten aus einer Ressource abrufen

- `$asxml/$asjson()` gibt einen Text im entsprechenden Format zurück
- `$astext(format)` als generische Methode

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <Patient xmlns="http://hl7.org/fhir">
3   <name>
4     <use value="official"/>
5     <family value="Doe"/>
6     <given value="John"/>
7   </name>
8   <gender value="male"/>
9   <birthDate value="1989-02-01"/>
10  <maritalStatus>
```

Calculate `res`

```
1 {
2   "resourceType": "Patient",
3   "name": [
4     {
5       "use": "official",
6       "family": "Doe",
7       "given": [
8         "John"
9       ] /given
10    } /name[0]
11  ], /name
12  "gender": "male",
13  "birthDate": "1989-02-01",
```

# Kommunikation mit einem REST Server

- Setup Authentication
  - Meistens OAuth2 (nichts Besonderes hier)
- Setup FHIR Server Base URL

Calculate `$cinst.$baseURL` as `'http://localhost:8080/fhir'`

# Daten auf einen REST-Server übertragen

- Komfortable Methode

```
Calculate format as 'json'  
Do $cinst.$POSTResource('Patient', patient, format) Returns response
```

- Oder noch etwas komfortabler

```
Do $cinst.$POSTPatient(patient,format) Returns response
```

```
If left(response.$statusCode(),1)='2'  
  OK message Success {Resource Createds Call returned [response.$statusCode()]}  
Else  
  OK message Error {HTTP Call returned [response.$statusText()] ([response.$statusCode()]})  
End If
```

- Testen mit dem Browser

<http://localhost:8080/fhir/Patient?family=Muster>

# Abfragen eines REST-Servers

- Komfortable Methode

Do `$cinst.$GETResource('Patient?family=Muster',format)` Returns `response`

If `left(response.$statusCode(),1)='2'`

    Calculate `content` as `utf8tochar(response.$content())`

    Calculate `bundle` as `$cinst.$context().$createFromText(content,format)`

    OK message Success {Search Query returned [`bundle.total`] Elements}

Else

    OK message Error {HTTP Call returned [`response.$statusText()`] ([`response.$statusCode()`])}



End If

Vielleicht ein wenig  
Refactoring ...



# Übersetzung

- Zutat: Subclassed **oFHIRBridge**
- Verschieben von Methoden in Ihre Unterklasse  
**\$patientToResource(pContextRef, pNativeResourceRef, pFHIRResourceRef)**

	Variable	Type	Subtype
1	pContext	Object refer	 fhir.FHIRContext
2	pNativePatient	Item referen	medical.TPatient
3	pFHIRPatient	Object refer	 fhir_r4.oPatient

Task | Class | Instance | Local | Parameter | Documentation

This is called eg from oFHIRClientEndpoint's

**\$createPatientResourceFromNative**

# POST für die Erstellung

Do `$cinst.$createPatientResourceFromNative(iCurrentPat.$ref)` Returns **patientResource**

...

Do `$cinst.$POSTResource('Patient',patientResource,format)` Returns **response**

# Setting up Resources

- Zutat: Subclassed **oFHIRBridge**

(Übersetzen zwischen „nativer“ und „FHIR“-Darstellung, siehe nächste Folien)

- Subclass **oFHIRClientEndpoint**

- Call Translation

```
Do iBridge.$patientToResource(iContext,pNativePatient.$ref,patient)
```

# Fragen & Antworten