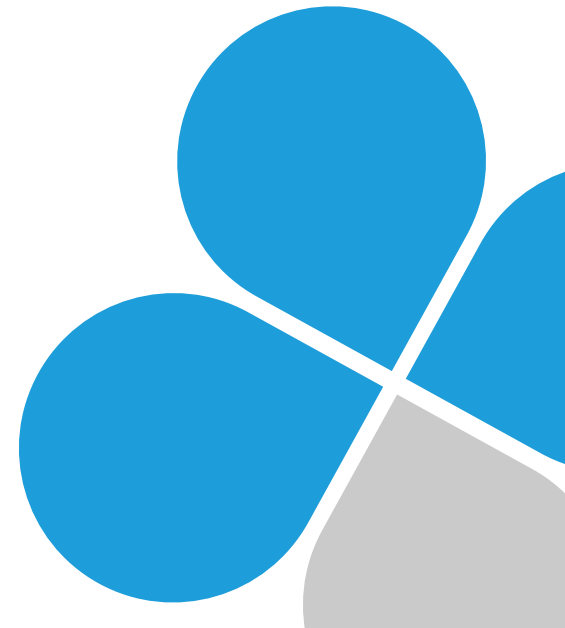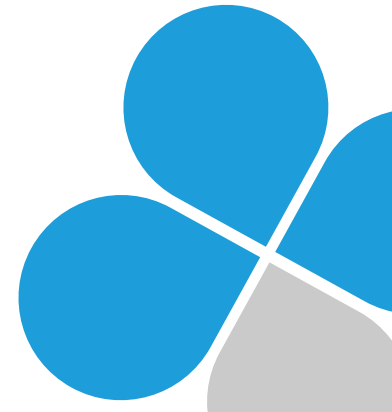# HL7 FHIR – eine Einführung

HL7 Jahrestagung 2015

Kassel

Simone Heckmann
CEO Health-Comm GmbH
simone.heckmann@health-comm.de

Paradigmenwechsel im Gesundheitswesen

- Online statt offline
- Tablet statt Desktop
- App statt Software
- Gesundheitsakte statt Krankenakte
- Cloud statt Server
- Offene API statt Datengrab
- Flexible Analysen statt statischer Reports

Health·Comm GmbH
Software für das Gesundheitswesen

FHIR Chiefs

Ein neuer Anfang

- Wie müsste Integration aussehen, wenn man ganz von vorne anfangen könnte...?
- Suche nach „Erfolgsrezepten" moderner Kommunikationsplattformen
  - Entscheidender Faktor: Größe der Datenpakete!
  - Offene, wohldokumentierte API
- Das Beste aus V2 und V3 beibehalten
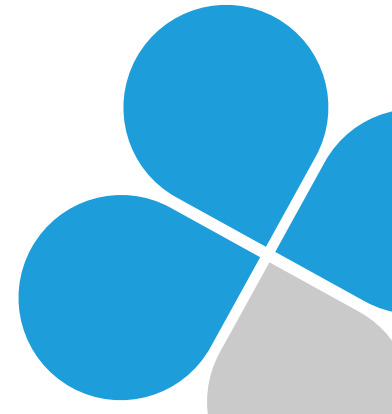- Entwurf einer API basierend auf diesen Erkenntnissen
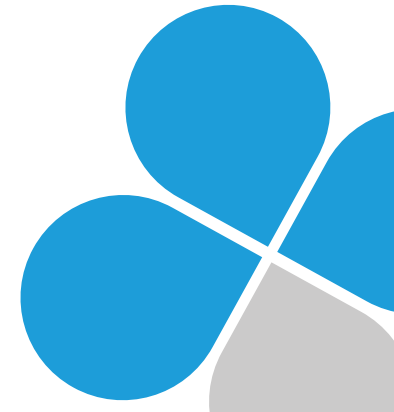
/_history

- Juli 2011 – Konzeptionierung
- September 2012 – erster Draft Ballot
- September 2012 – erster Connectathon
- September 2013 – DSTU 1
- Mai 2015 – zweiter DSTU Ballot (>1600 Kommentare)
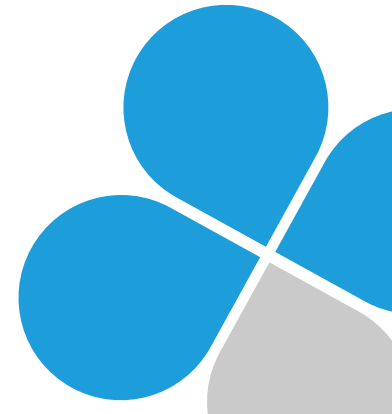- September 2015 – DSTU 2 / 10. Connectathon
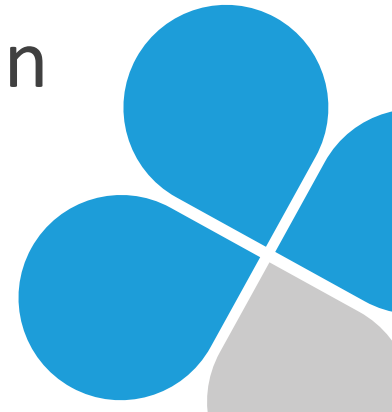
FHIR - Das Akronym

- F = Fast

- H = Healthcare

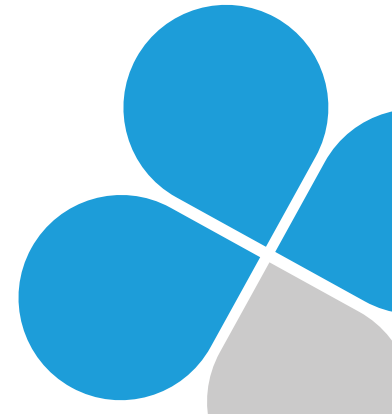- I = Interoperability

- R = Resources

Was ist FHIR?

- **Ein Bausatz**
  - bestehend aus modularen, erweiterbaren Informationseinheiten (Resourcen)

- **Ein Informations-Netzwerk**
  - bestehend aus Resourcen, die mittels URLs in Beziehung miteinander stehen

- **Ein Kommunikations-Netzwerk**
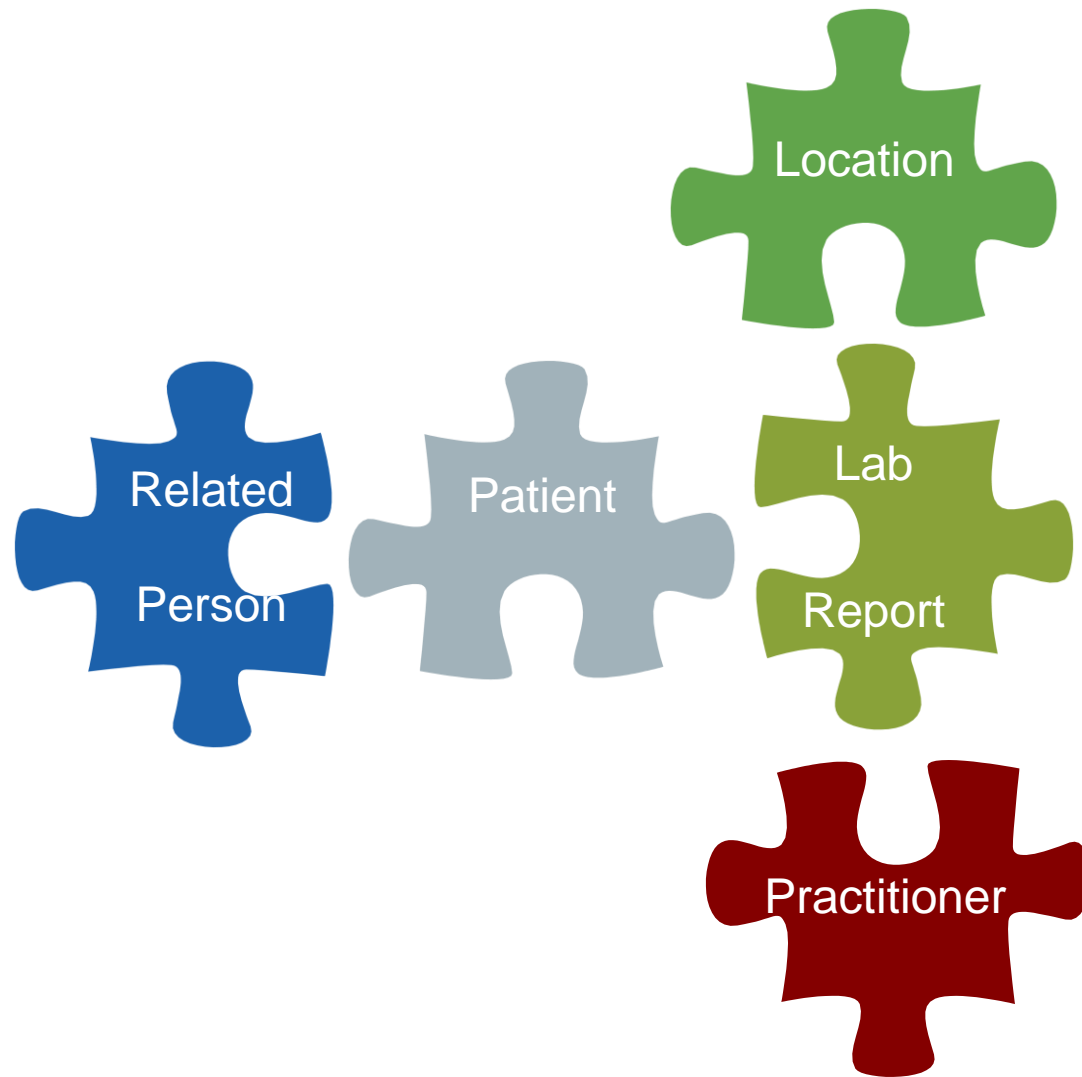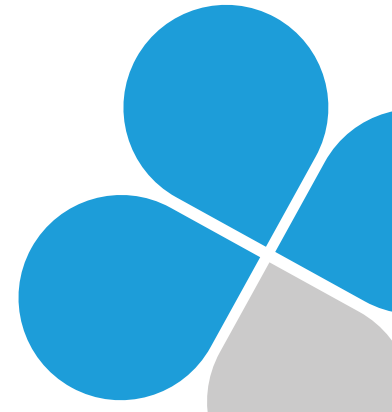 - Transport von einzelnen Resourcen bis hin zu komplexen Datenpaketen

Das FHIR Manifest

- Fokus auf Implementierer

- Fokus auf die 80%-Lösung

- Fokus auf etablierte Web-Technologien

- Fokus auf menschen-lesbare Informationen

- Fokus auf Offenheit und freie Verfügbarkeit

- Fokus auf Skalierbarkeit

Die FHIR-Resourcen

DomainResource - Die Mutter aller Resourcen

1.20.3 Resource Content 🌐

Structure	UML	XML	JSON	All

Structure

Name	Flags	Card.	Type	Description & Constraints
📦 DomainResource	I		Resource	A resource with narrative, extensions, and contained reso...
				If a resource is contained in another resource, it SHALL NO...
				meta.versionId or a meta.lastUpdated
				If the resource is contained in another resource, it SHALL ...
				from elsewhere in the resource
				If the resource is contained in another resource, it SHALL ...
				nested Resources
				If the resource is contained in another resource, it SHALL ...
				narrative
📦 text	I	0..1	Narrative	Text summary of the resource, for human interpretation
📦 contained		0..*	Resource	Contained, inline Resources
⭐ extension		0..*	Extension	Additional Content defined by implementations
⭐ modifierExtension	?!	0..*	Extension	Extensions that cannot be ignored

Clinical

General:

- AllergyIntolerance 1
- Condition (Problem) 2
- Procedure 1
- ClinicalImpression 0
- FamilyMemberHistory 1
- RiskAssessment 0
- DetectedIssue 1

Care Provision:

- CarePlan 1
- Goal 1
- ReferralRequest 1
- ProcedureRequest 1
- NutritionOrder 1
- VisionPrescription 0

Medication & Immunization:

- Medication 1
- MedicationOrder 1
- MedicationAdministration 1
- MedicationDispense 1
- MedicationStatement 1
- Immunization 1
- ImmunizationRecommendation 1

Diagnostics:

- Observation 1
- DiagnosticReport 1
- DiagnosticOrder 1
- Specimen 1
- BodySite 0
- ImagingStudy 2
- ImagingObjectSelection 1

Identification

Individuals:

- Patient 3
- Practitioner 1
- RelatedPerson 1

Groups:

- Organization 1
- HealthcareService 1
- Group 1

Entities:

- Location 1
- Substance 1
- Person 1

Devices:

- Device 1
- DeviceComponent 1
- DeviceMetric 1

Workflow

Patient Management:

- Encounter 1
- EpisodeOfCare 1
- Communication 1
- Flag 1

Scheduling:

- Appointment 1
- AppointmentResponse 1
- Schedule 1
- Slot 1

Workflow #1:

- Order 0
- OrderResponse 0
- CommunicationRequest 1
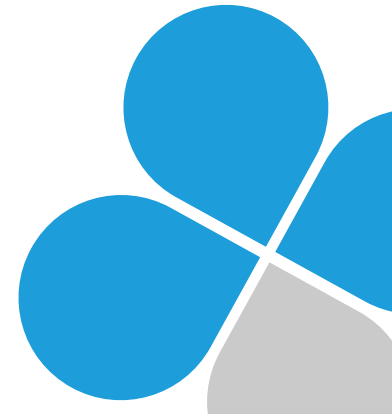- DeviceUseRequest 0
- DeviceUseStatement 0

Workflow #2:

- ProcessRequest 0
- ProcessResponse 0
- SupplyRequest 0
- SupplyDelivery 0

Structure

Name	Flags	Card.	Type	Description & Constraints
Patient			DomainResource	Information about an individual or animal receiving health care services
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	Addresses for the individual
maritalStatus		0..1	CodeableConcept	Marital (civil) status of a patient Marital Status Codes (Required)
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 *SHALL at least contain a contact's details or a reference to an organization*
relationship		0..*	CodeableConcept	The kind of relationship PatientContactRelationship (Extensible)
name		0..1	HumanName	A name associated with the contact person
telecom		0..*	ContactPoint	A contact detail for the person

Die 80%-Regel

- Datenelemente werden nur dann ein Teil der Kernspezifikation, wenn es wahrscheinlich ist, dass die meisten Implementierungen dieses Datenelement nutzen werden.

- Alles andere wird über Extensions abgebildet

- Die Resourcen der Kernspezifikation sollen möglichst einfach und unveränderlich sein

```xml
<Patient xmlns="http://hl7.org/fhir">
 <id value="us01"/>
 <text>
   <status value="generated"/>
   <div xmlns="http://www.w3.org/1999/xhtml">
     <table>
       <tbody>
         <tr>
           <td>Name</td>
           <td>Peter James
             <b>Chalmers</b>
           </td>
           ...
       </table>
   </div>
 </text>
 <extension url="http://hl7.org/fhir/StructureDefinition/us-core-race">
   <valueCodeableConcept>
     <coding>
       <system value="http://hl7.org/fhir/v3/Race"/>
       <code value="1096-7"/>
     </coding>
   </valueCodeableConcept>
 </extension>
 <active value="true"/>
 <name>
   <use value="official"/>
   <family value="Chalmers"/>
   <given value="Peter"/>
   <given value="James"/>
 </name>
 <telecom>
```

Narrative

Extensions

Elemente

Das Bundle – eine Resource voller Resourcen

- Eine Bündelung von Resourcen in gemeinsamem Kontext, z.B.:
  - Batch
  - Transaktion
  - Suchergebnisse
  - Nachricht
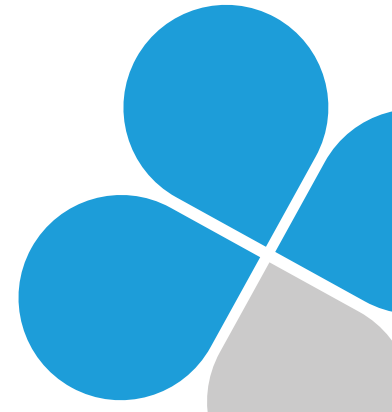 - Dokument

REST

- Einzelne Resourcen mittels HTTP-Verben lesen, erzeugen, aktualisieren oder löschen (CRUD)
  - GET http://myfhirserver.com/Patient/123
  - POST http://myfhirserver.com/Patient {Resource}
- Suche nach Resourcen mittels Query-URL
  - GET http://myfhirserver.com/Patient?name=John
  - GET http://myfhirserver.com/Encounter? subject:Patient=23
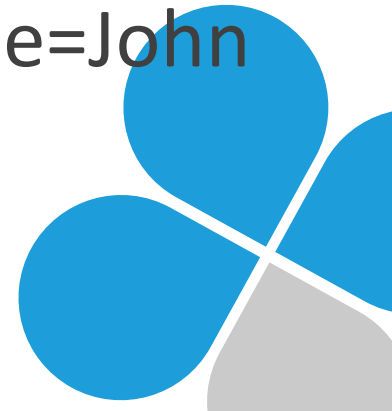
Services

- Ausführen spezifischer Operationen, z.B.

  - Validieren von Resourcen
    POST http://myfhirserver.com/Patient/$validate
    {Resource}

  - Erzeugen von Dokumenten
    GET http://myfhirserver.com/Composition/$document

  - Validieren von Codes

  - Abrufen aller gültigen Codes eines ValueSets
    GET http://myfhirserver.com/ValueSet/$expand

Extensions

- Sind unverzichtbar aber problematisch
  - Was bedeutet "ZFX|ja|5|vorgestern" ???
- Kommen auf unterschiedlichen Ebenen vor
  - Standard (Randfälle von internationaler Relevanz)
  - Domäne (z.B. Kardiologie, Pädiatrie...)
  - National (z.B. spezielle Identifier, Versicherungsdaten...)
  - Lokal (herstellerspezifisch, organisationsintern...)
- Werden in FHIR maschinenlesbar spezifiziert

5.1.15 Patient HL7 Extensions 🌐

Defines common extensions used with or related to the Patient resource

5.1.15.1 Content 🌐

Extensions:

patient-mothersMaidenName	**Mother's Maiden name :** Mother's maiden (unmarried) name, commonly collected to help verify patient identity.
patient-birthTime	**Time of day of birth :** The time of day that the Patient was born. This includes the date to ensure that the timezone information can be communicated effectively.
patient-nationality	**Nationality :** The nationality of the subject.
patient-citizenship	**Nation(s) where the patient claims citizenship :** The patient's legal status as citizen of a country.
patient-cadavericDonor	**Post-mortem donor status :** Flag indicating whether the patient authorized the donation of body parts after death.
patient-congregation	**A group of place of religious practice :** A group or place of religious practice that may provide services to the patient.
patient-adoptionInfo	**The adoption status of the patient :** Code indication the adoption status of the patient.
patient-disability	**Condition(s) limiting movement, senses, or activities :** Value(s) identifying physical or mental condition(s) that limits a person's movements, senses, or activities.
patient-importance	**Special status given the patient :** The importance of the patient (e.g. VIP).
patient-clinicalTrial	**The patient's participation in clinical trials :** The clinical trials this patient has or is participating in.

Extension: Time of day of birth

URL for this extension:

> http://hl7.org/fhir/StructureDefinition/patient-birthTime

Status: draft. Extension maintained by: HL7

The time of day that the Patient was born. This includes the date to ens[...] effectively.

Context of Use: Use on element: Patient.birthDate

usage info: insert a list of places where this extension is used

1.17.0.1 Extension Element

Every element in a resource or data type includes an optional "exten[...] is the content model of the extension as it appears in each resource:

Structure | UML | XML | JSON | All

Structure

Name	Flags	Card.	Type	Description & Constra[...]
📁 Extension			Element	
└─ 📁 url		1..1	uri	identifies the meaning of
└─ ⬡ value[x]		0..1	*	Value of extension

Extension Content

Summary | **Full Structure** | **XML** | **JSON** | **All**

Fulle Structure

Name	Flags	Card.	Type	Description & Constraints	❓
⭐ extension		0..1	Extension	URL = http://hl7.org/fhir/StructureDefinition/patient-birthTime Time of day of birth: The time of day that the Patient was born. This includes the date to ensure that the timezone information can be communicated effectively. Use on element: Patient.birthDate	
⭐ ~~extension~~		~~0..0~~			
url		1..1	uri	"http://hl7.org/fhir/StructureDefinition/patient-birthTime"	
valueDateTime		1..1	dateTime	Value of extension	

StructureDefinition

- "Bauplan" einer Resource, einer Extension, eines Datentyps oder eines Profils
- "Werkzeug" zur Erstellung von Profilen
- StructureDefinitions
  - sind maschinenlesbar
  - in Repositories online abrufbar
  - die Basis für Validierung, Code- und UI-Generierung
  - die Basis für die Erzeugung der Spezifikation

Tooling: Profile erstellen

Tooling: Profile erstellen

Tooling: Profile veröffentlichen

SIMPLIFIER.NET

Search   SIGN UP   LOG IN

FHIR REGISTRY

Find and publish FHIR resources.

This registry is based on **FHIR DSTU2 1.0.1**. Need to update your profiles? We might be able to transform them.

Projects

Showcases

SMART on FHIR	👍
Data Access Framework	👍
QiCore	👍
Structured Data Capture	👍
HSPC	👍

Popular

ZorgInformatieBouwstenen	★	3
QiCore	★	2
Structured Data Capture	★	1
SMART on FHIR	★	1
US Laboratory	★	1
Data Access Framework	★	1
sqlonfhir	★	1

FHIR Core

- 🔥 FHIR Core Base Resources
- 🔥 FHIR Core Datatypes
- 🔥 FHIR Core ValueSets
- 🔥 FHIR Core SearchParameters
- 🔥 FHIR Core Extensions
- 🔥 FHIR Core v2 Tables
- 🔥 FHIR Core v3 Codesystems

Resources

Popular

core-base-resources Patient	3
core-base-resources Organization	1
smart-on-fhir OAuth Endpoint	

StructureDefinitions

Account	1
Address	1
AllergyIntolerance	5

Examples

AllergyIntolerance	1
Basic	1
Communication	1

D.17.1 StructureDefinition: DAF-Patient 🌐

The official URL for this profile is:

> http://hl7.org/fhir/StructureDefinition/daf-patient

Defines constraints and extensions on the patient resource for use in querying and retrieving patient demographic information.

This profile was published on Thu, Aug 21, 2014 00:00+1000 as a draft by Health Level Seven International (Infrastructure and Messaging - Data Access Framework).

D.17.1.1 Formal Views of Profile Content 🌐

Description of Profiles, Differentials, Snapshots, and how the XML and JSON presentations work.

Text Summary	**Differential Table**	Snapshot Table	XML Template	JSON Template	All

This structure is derived from Patient.

Name	Flags	Card.	Type	Description & Constraints	?
Patient		0..*	Patient		
identifier	S	1..*	Identifier		
type	S	0..1	CodeableConcept	Description of identifier	
system	S	1..1	uri		
value	S	1..1	string	The value that is unique within the system.	
active	S	0..1	boolean		
name	S	0..*	HumanName		
telecom	S	0..*	ContactPoint		
system	S	1..1	code		
value	S	1..1	string		

📁 contact	S	0..*	BackboneElement	
🔶 relationship	S	0..*	CodeableConcept	**Binding:** PatientContactRelationship (required)
🔶 name	S	0..1	HumanName	
🔶 telecom	S	0..*	ContactPoint	
🔶 address	S	0..1	Address	
📁 use	S	0..1	code	
📁 line	S	0..*	string	
📁 city	S	0..1	string	
📁 state	S	0..1	string	**Binding:** USPS Two Letter Alphabetic Codes (required)
📁 postalCode	S I	0..1	string	**inv-2:** (Zip or Postal Code) SHALL be formatted as 99999[-9999] for US Zip or ZIP +4 codes or as A9A9A9 for Canadian postal codes.
📁 country	S	0..1	string	ISO 3166 2 or 3 letter Country Code **Binding:** ISO Country Codes ↗ (required)
📁 ~~animal~~		~~0..0~~		
📁 communication	S	0..*	BackboneElement	
🔶 language	S	1..1	CodeableConcept	
↗ careProvider	S	0..*	Reference(DAF-Organization | DAF-Pract)	
↗ managingOrganization	S	0..1	Reference(DAF-Organization)	
⭐ us-core-race	S	0..1	CodeableConcept	A category of humans sharing history, origin or nationality **URL:** http://hl7.org/fhir/StructureDefinition/us-core-race **Slice:** Unordered, Open, by url **Binding:** MU Race Value Set (required)
⭐ us-core-ethnicity	S	0..1	CodeableConcept	A category of human sharing heritage **URL:** http://hl7.org/fhir/StructureDefinition/us-core-ethnicity **Binding:** Ethnicity group (required)

Conformance

- Die Resource dokumentiert die Konformität eines Systems zum FHIR-Standard ("Conformance-Statement")

- Um "FHIR-konform" zu sein, *muss* ein Server eine Conformance-Resource publizieren (http://fhir-dev.healthintersections.com.au/open/metadata)

- Maschinenlesbar

  - Client kann sich anpassen

  - automatischer Abgleich möglich

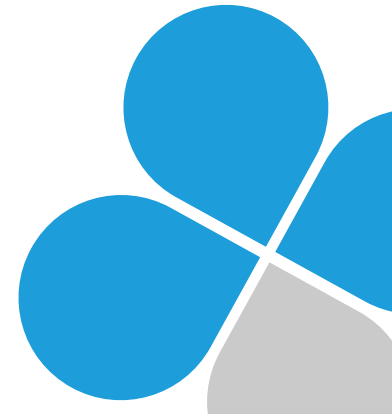 - kann automatisch erstellt werden

Implementierung
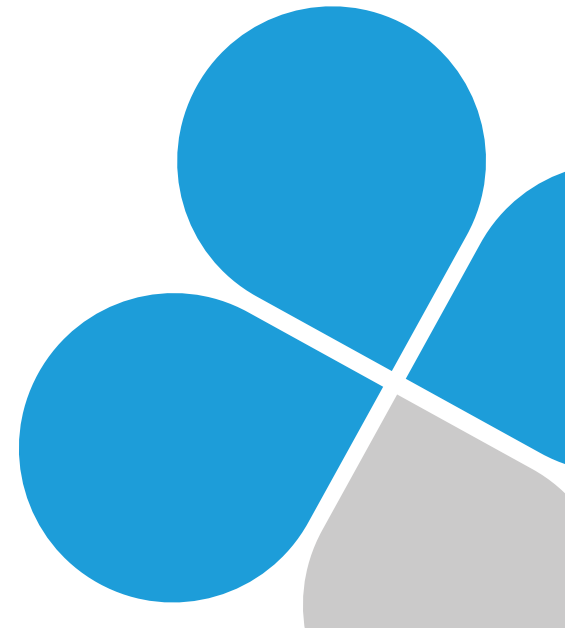
Einsatzbereiche

- Einrichtungs-interne Interoperabilität
- eBusiness-Systeme
- Einrichtungsübergreifende Kommunikation
- Regionale und nationale Netzwerke
- **Social Web (Patienten-Interaktion)**
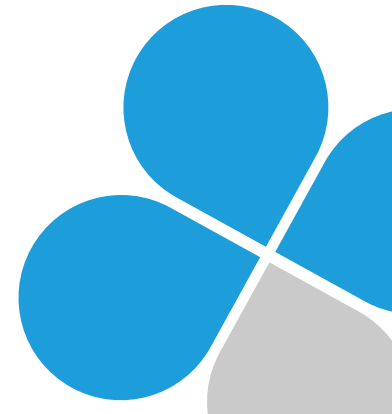- **Mobile Applikationen**

Interested Parties (Auswahl!)

- Hersteller
  - Cerner
  - Dräger
  - Epic
  - GE Healthcare
- Nationale Organisationen
  - NHS (England)
  - Nictiz (Niederlande)
  - ONC (USA)
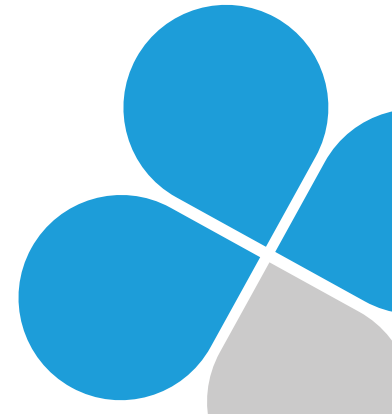- IHE
  - PDQm-, IUA-, MHD- Profile
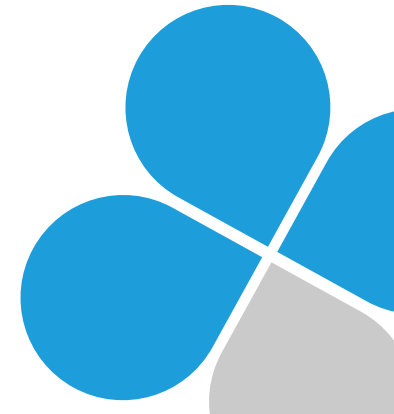
Implementationsunterstützung

- Tools, APIs, Parser, Validator, Serializers...
- Schema, Schematron, Validation Packs...
- Beispiele, Beispiele, Beispiele...
- Live Server zum Testen
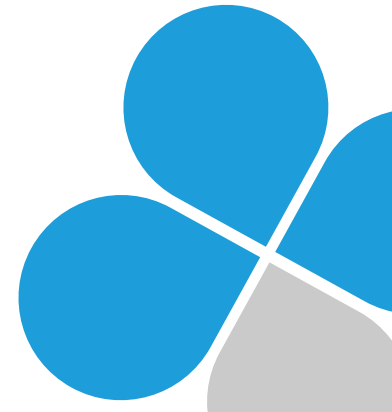- Mail, Chat, Wiki, Stackoverflow...
- Connectathons

Connectathon

- Wichtiger Bestandteil des FHIR-Entwicklungszyklus

- Hat bisher 10x stattgefunden

- Ist eigentlich ein "Hackathon"

- Hat unterschiedliche "Tracks"

- Gibt es für Implementierer und Kliniker

- Dient der Weiterentwicklung des Standards

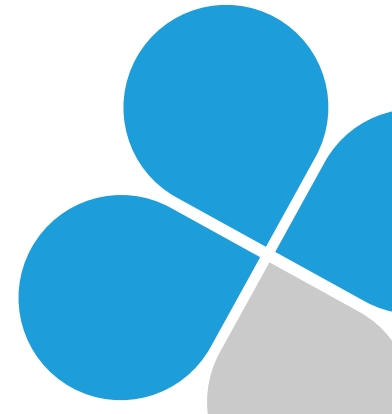- Gekoppelt mit AID WGM und Tutorials

Nächste Termine

- Hackathon heute Nachmittag ☺

- DevDays Amsterdam November 2015
mit Student Track!

- WGM / Connectathon Orlando Januar 2016

- DSTU 2.1 im Sommer 2016 (Nachlieferung)

- Normativ 2017 (teilweise)

- Sukzessive Release weiterer Resourcen und
Funktionen

Aktuelle Baustellen

- Resourcen für „Financial" und „Workflow"

- Definition von „Operations" und Messaging

- Tooling für Conformance & Conformance-Test

- Tooling für Profiling & Publikation

- Aufbau von Terminologie-Servern und –Diensten

Links

- FHIR:
  http://hl7.org/fhir

- Development team wiki home:
  http://wiki.hl7.org/index.php?title=FHIR

- Twitter:
  https://twitter.com/search?q=%23FHIR

- Stack Overflow:
  http://stackoverflow.com/questions/tagged/hl7-fhir

- Watchblog:
  http://www.fhirabend.de