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FHIR
The answer to the interoperability questions of the BMBF MI-I

Miracum Symposium
Erlangen 22-23 February 2018

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CEO, Heitmann Consulting and Services (DE)
CEO, Gefyra GmbH

Agenda

- Generations
- HL7 FHIR® Standard
  - What?
  - Coverage
  - Development, Maturity and Timelines
  - Modularity
  - Usage: FHIR and the Software Industry
  - Features
- Summary: FHIR and the MI-I

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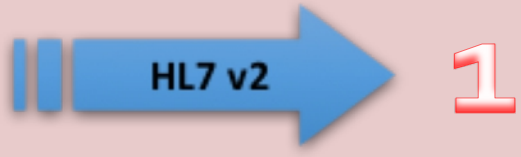
GENERATIONS

HL7 Standards Family

HL7: Generation of Standards

HL7 product line / generation	Standard	Subject and times
	**Version 2.x**	Messages (1987..) v2.xml (2003..)
	Version 3 **Clinical Document Architecture (CDA)**	Messages (1995..) and Services **Electronic Documents (Release 1 since 1999.., Release 2 since 2005..)**
	Fast Healthcare Interoperability Resources (**FHIR)**	Resources (2012..)

HL7: Generation of Standards

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- Segments
- Datentypes
  HL7 v2
- Profiles
- Z-Segments
- Machine only
- Ad-hoc coverage

- Model (V3)
- Datentypes
  HL7 R1.1
- Templates
- Informal Extensions
- Human/ Machine
- 100% coverage

- Ressources
- Datentypes
  Selected HL7 R2/ ISO 21090
- Profiles
- Featured Extensions
- Human/ Machine
- 80% coverage

Interoperability Paradigms

- RESTful
  - Core feature of FHIR: GET and POST etc.
- Documents
  - As in CDA, Composition of resources
- Messages
  - As in v2 and V3, Collection of resources
- Services
  - Service Oriented Architecture
- Also important – Formats: XML vs JSON


FHIR!
What?
Foto © Fotolia.de: adam121

FHIR! What?

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simple

mobile

modern

secure

digital

scalable

FHIR! What?

- HL7 FHIR® Standard

Good experiences

Easier to implement
Fast results

Better suited

Best perspectives

Broad support,
adaptation and use

FHIR! What?

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FHIR is a set of XML (JSON) health data resources, plus a REST API for accessing them

FHIR! What?

- Next generation of HL7 standards
- “Cherries from the cake”
- Newest web technologies
  - XML, JSON, HTTP, OAuth, etc.
- Focus on Implementation
- Modular: semantic Units → Resources
- Network of Resources / Composition
- Mobile Apps, Cloud Computing, EHR Data Sharing, ...

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Coverage in five levels

1

Level 1 Basic framework on which the specification is built

Foundation	Base Documentation, XML, JSON, REST API + Search, Data Types, Extensions

2

Level 2 Supporting Implementation, and binding to external specifications

Implementer Support	Security & Privacy	Conformance	Terminology	Linked Data
Downloads, Common Use Cases, Testing	Security, Consent Provenance AuditEvent	StructureDefinition, CapabilityStatement, ImplementationGuide, Profiling	CodeSystem, ValueSet, ConceptMap, Terminology Svc	RDF

3

Level 3 Linking to real world concepts in the healthcare system

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

4

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

Clinical	Diagnostics	Medications	Workflow	Financial
Allergy, Problem, CarePlan, DetectedIssue, RiskAssessment, etc.	Observation, Report, Specimen, ImagingStudy,Genomics,etc	Order, Dispense, Administration, Statement, Immunization, etc.	Task, Appointment, Schedule, Referral, PlanDefinition, etc.	Claim, Account, Coverage, Claim, EligibilityRequest, ExplanationOfBenefit, etc.

5

Level 5 Providing the ability to reason about the healthcare process

Clinical Reasoning	Library, ServiceDefinition & GuidanceResponse, Measure/MeasureReport, etc

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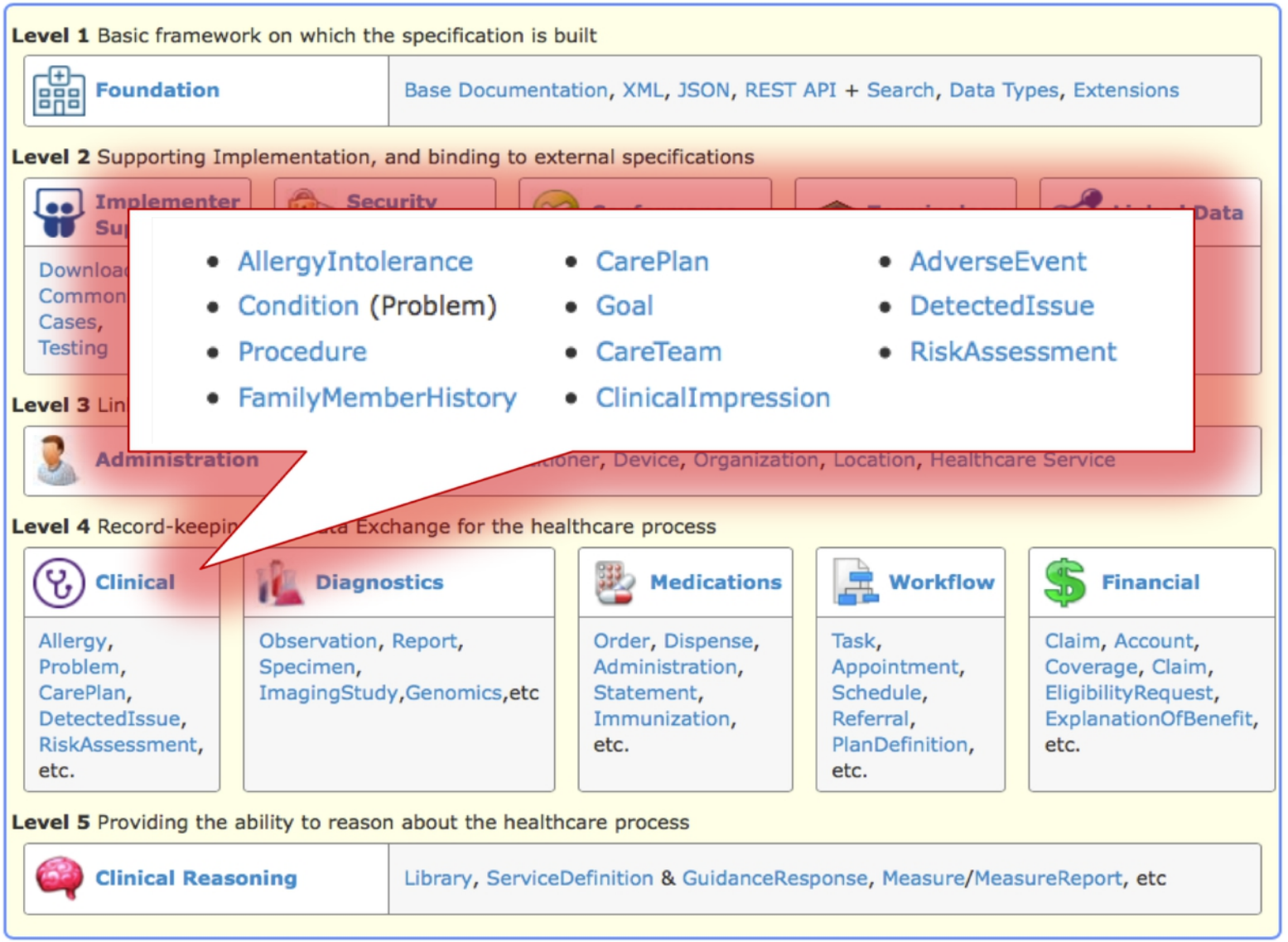
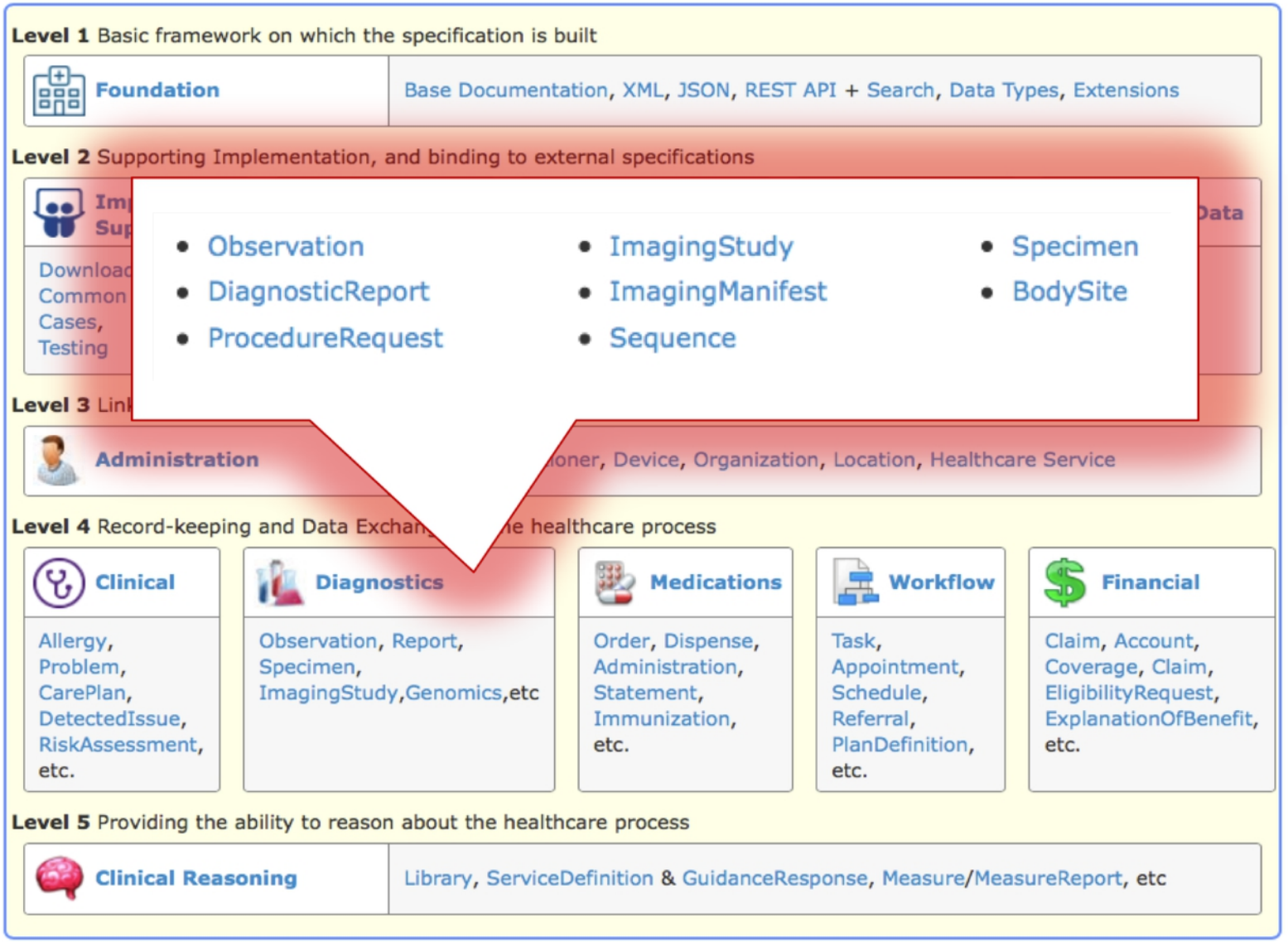
Coverage



Coverage


Level 1 Basic framework on which the specification is built
Foundation
Base Documentation, XML, JSON, REST API + Search, Data Types, Extensions
Level 2 Supporting Implementation, and binding to external specifications
Observation
DiagnosticReport
ProcedureRequest
ImagingStudy
ImagingManifest
Sequence
Specimen
BodySite
Level 3 Link
Administration
Device, Organization, Location, Healthcare Service
Level 4 Record-keeping and Data Exchan
healthcare process
Clinical
Allergy, Problem, CarePlan, DetectedIssue, RiskAssessment, etc.
Diagnostics
Observation, Report, Specimen, ImagingStudy,Genomics,etc
Medications
Order, Dispense, Administration, Statement, Immunization, etc.
Workflow
Task, Appointment, Schedule, Referral, PlanDefinition, etc.
Financial
Claim, Account, Coverage, Claim, EligibilityRequest, ExplanationOfBenefit, etc.
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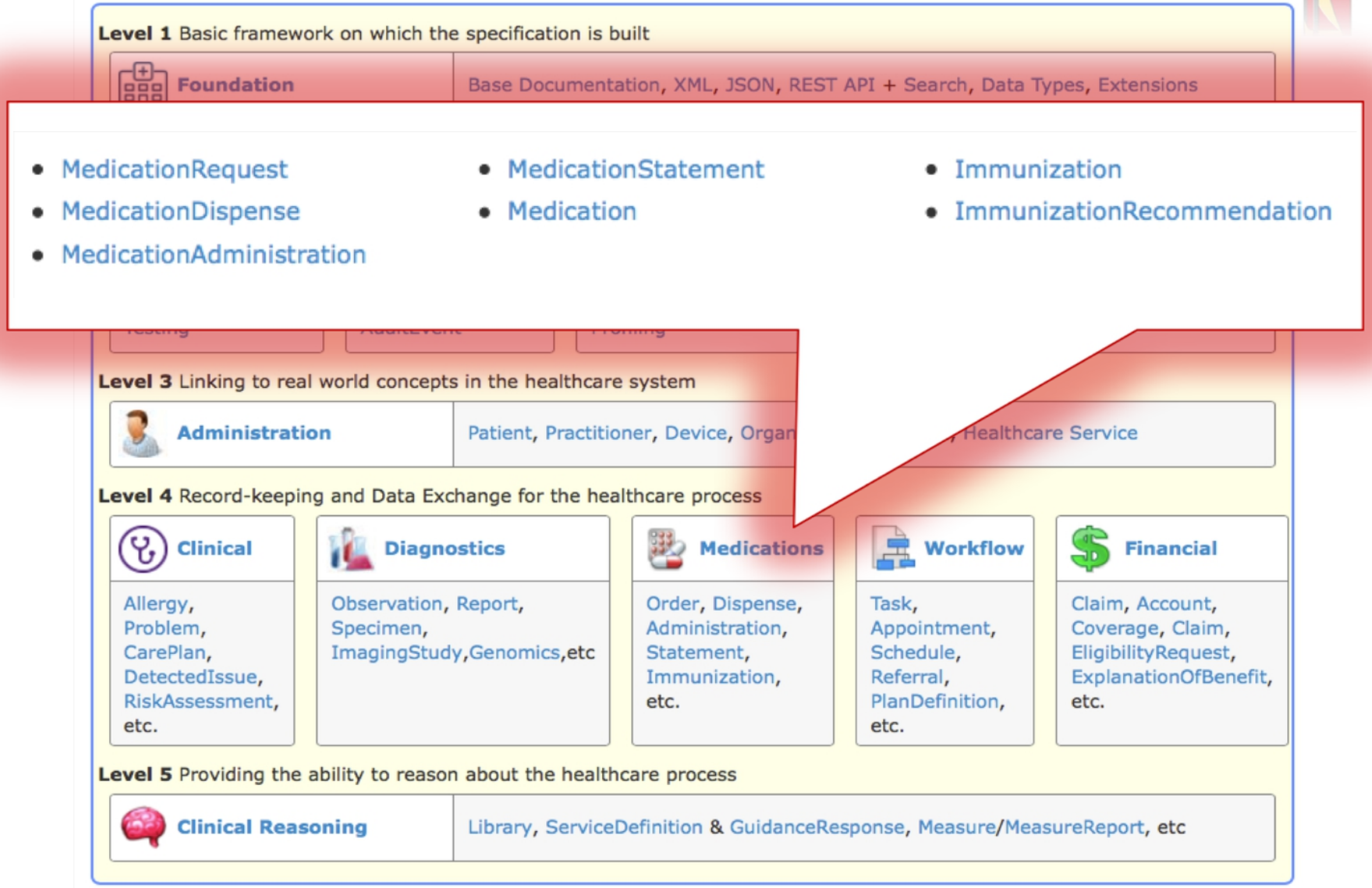
Coverage



Development process of FHIR

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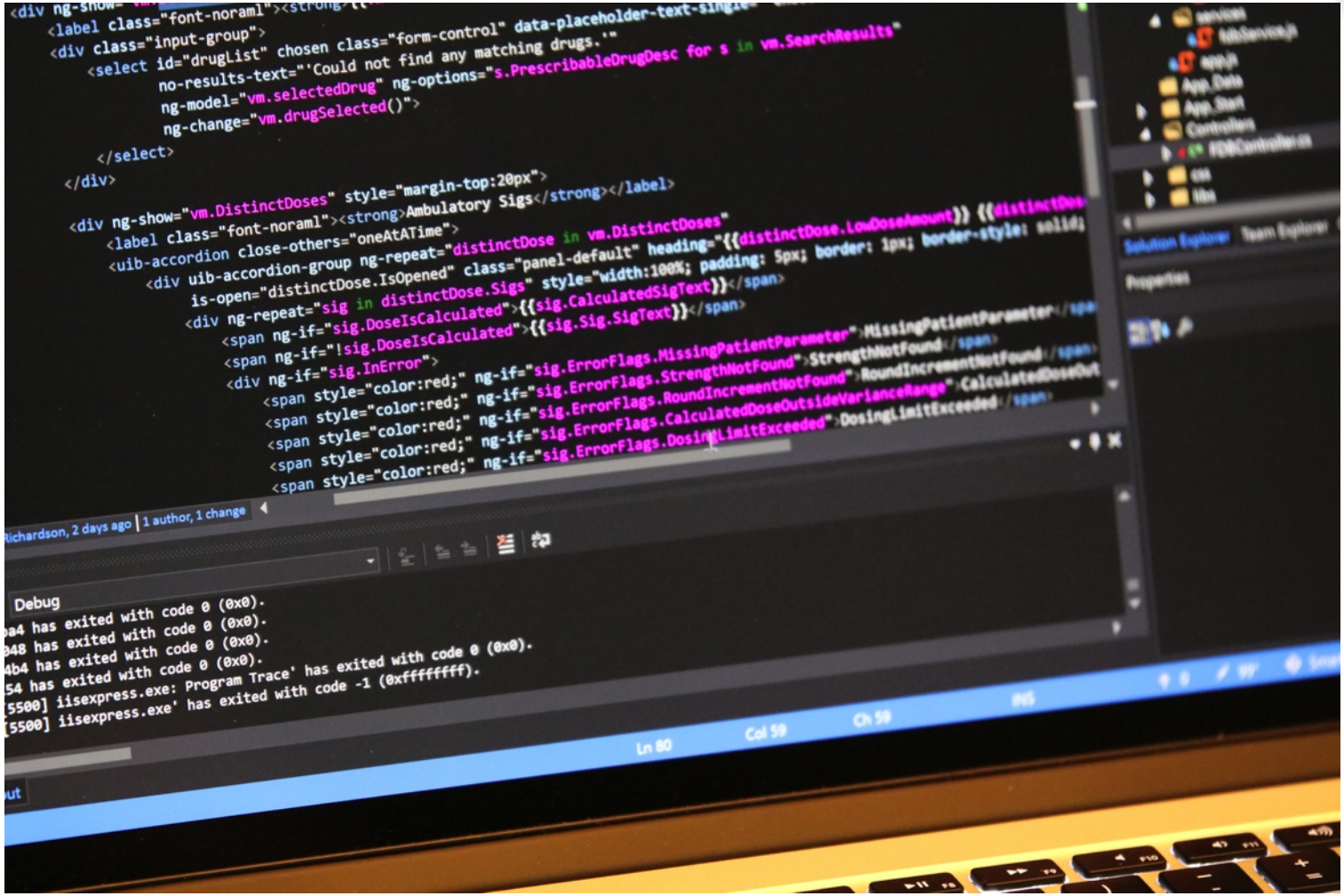
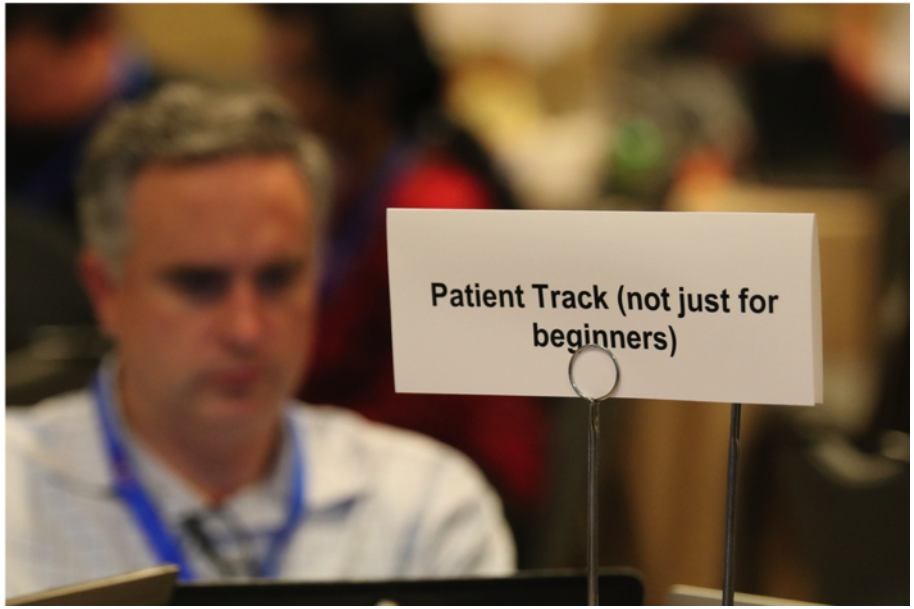
- Content proposal by domain experts
- Resource definition incl. terminology
- Maturity Levels express maturity
- Connecathons → Ballot → Normative Standard
  - in January 2018 with 250 participants

FHIR Connectathon



FHIR Connectathon

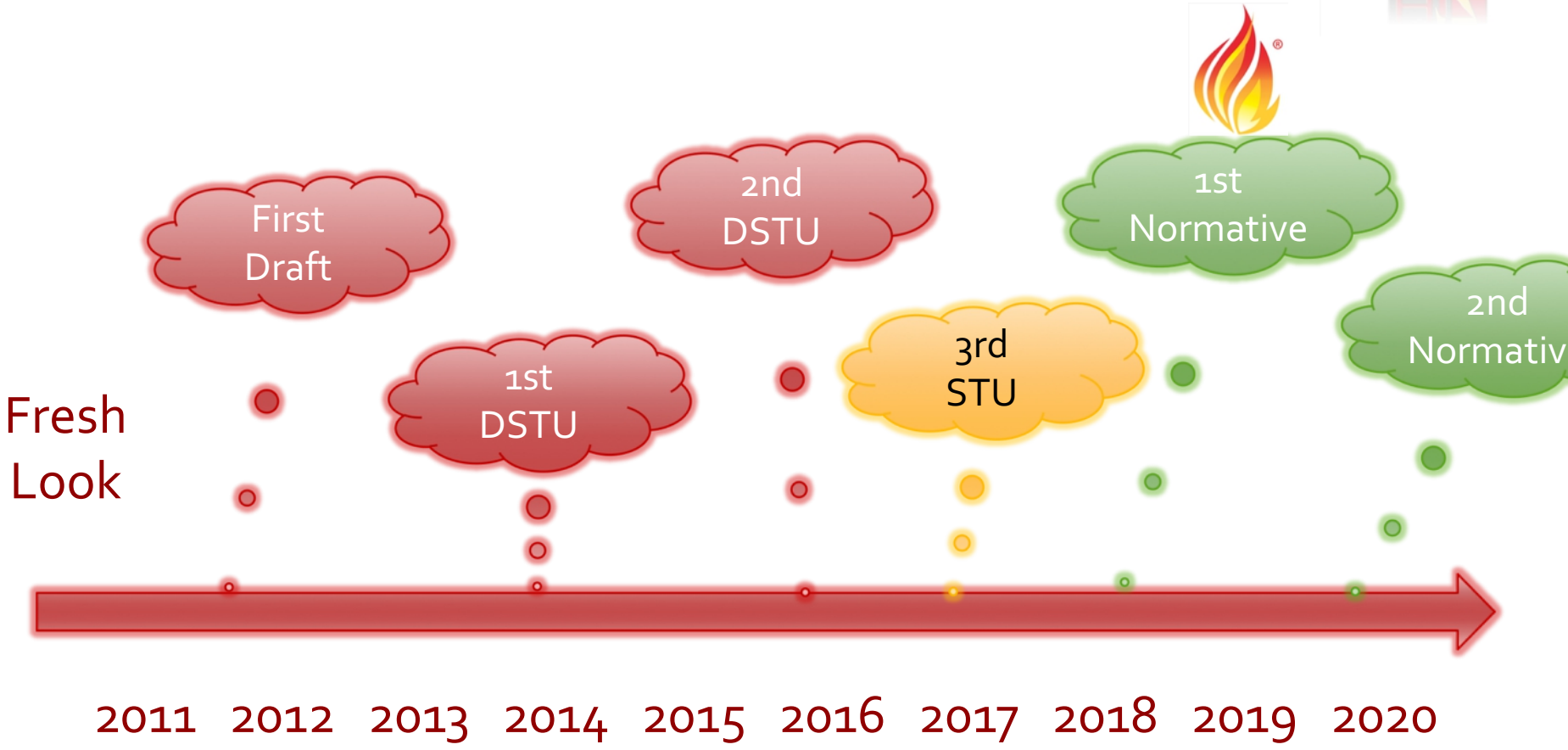
- „Hacker in the room“
- Part of maturity proof
- Grouped by topics
- Result: Experience
  - ...for yourself
  - ...for the standard



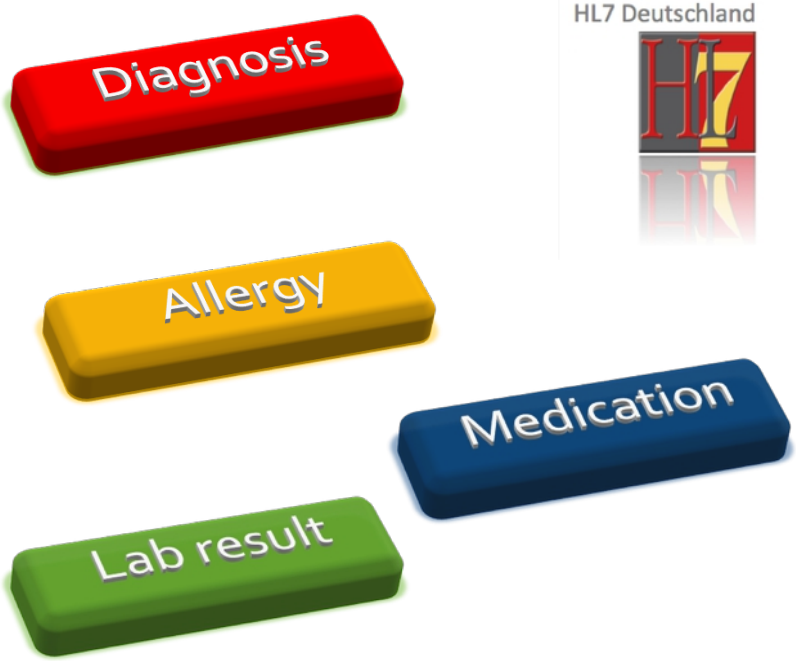
Maturity Levels

- **Maturity Levels**: Intended to indicate level of stability
  - FMM1 – Resource is “done”, no build warnings
  - FMM2 – Tested at approved Connectathon
  - FMM3 – Passes QA, has passed ballot
  - FMM4* – Tested across scope, published, prototype implementation
  - FMM5* – 5 distinct production implementations, multiple countries, 2
- Non-compatible changes at level 4 and 5 will face increased hurdles

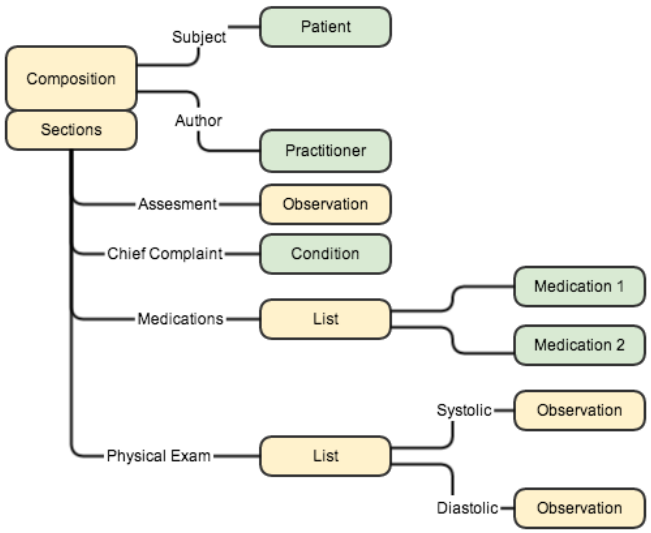
Timeline


First Draft
1st DSTU
2nd DSTU
3rd STU
1st Normative
2nd Normativ
Fresh Look
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020

FHIR! What?



- Modular:
  semantic units
  → Resources
- Network of Resources
  = Information / Data
- Use where?
  → modern applications...
  → future replacement of existing solutions...



FHIR! Used?

- Interoperability within an organization – the classic use case
- Regional Networks
- Back-end e-Business Systems
- National EHR Systems
- Social Web (Health)
- Mobile Apps + more (see Apple's announcement)

NOW
NOW

Apple announces effortless solution bringing health records to iPhone

FHIR and the software industry

- Vendors
  - Cerner
  - Dräger
  - Epic
  - GE Healthcare
  - Apple
- National Organizations
  - NHS (UK)
  - Nictiz (NL)
  - ONC (US)
- IHE
  - PDQm, IUA, MHD, ...

- Germany
  - Universities: Heilbronn, Heidelberg, Münster, Lübeck, Freiburg, Jena, Niederrhein, Köln
  - Companies: Dräger, SAP, T-Systems, Agfa, ITZ Medicom, Medatixx, Fresenius
  - Hospitals: Robert-Bosch-Krankenhaus Stuttgart, Helios Kliniken
  - Organizations: IHE-DE, bvitg,
  - + QMS, FINSOZ, EFA, KBV

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SPECIAL FEATURES!

...what makes me attractive to the MI-I...

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Data in a Resource

- ID
- Metadata
- Narrative
- Body (granular data)
- Instantiated in XML or JSON

XML Resource

```
<Patient xmlns="http://hl7.org/fhir">
```

Resource ID

```
  <id value="example01"/>
```

Metadata

```
  <meta>
    <versionId value="1"/>
    <lastUpdated value="2017-07-01T02:22:06.586-04:00"/>
    <tag>
      <system value="http://projectcrucible.org"/>
      <code value="testdata"/>
    </tag>
  </meta>
```

Narrative

```
  <text>
    <status value="generated"/>
    <div xmlns="http://www.w3.org/1999/xhtml">
      Peter James CHALMERS
    </div>
  </text>
```

Body

```
  <identifier>
```

Body

```
  "identifier": [
    {
      "system": "urn:oid:1.2.36.146.595.217.0.1",
      "value": "12345"
    }
  ],
  "active": true,
  "name": [
    {
      "family": "Chalmers",
      "given": [
        "Peter",
        "James"
      ]
    }
  ],
  "gender": "male",
  "birthDate": "1974-12-25",
  "address": [
    {
      "line": [
        "534 Erewhon St"
```

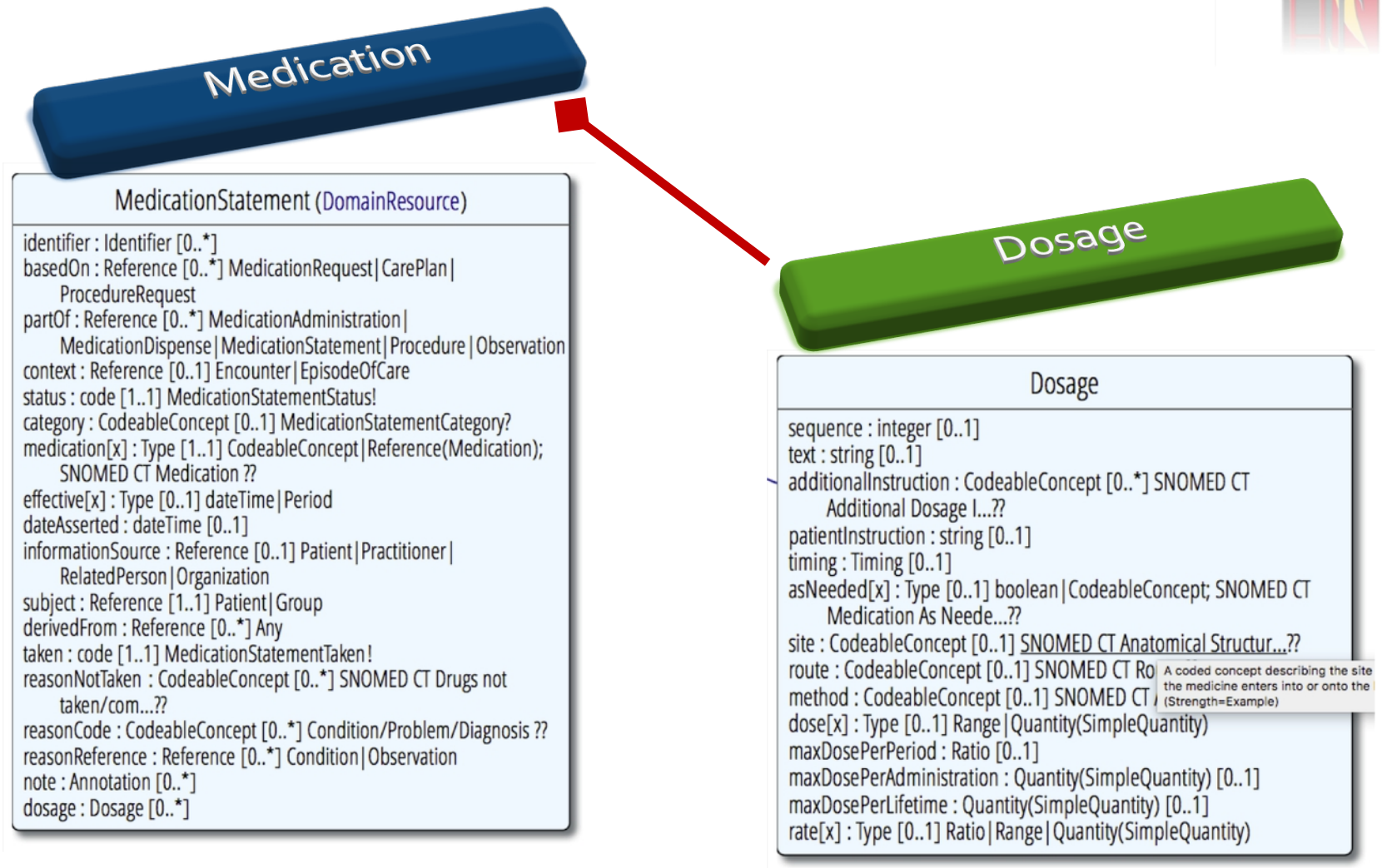
Resource Definition

- Patient, and more (150)

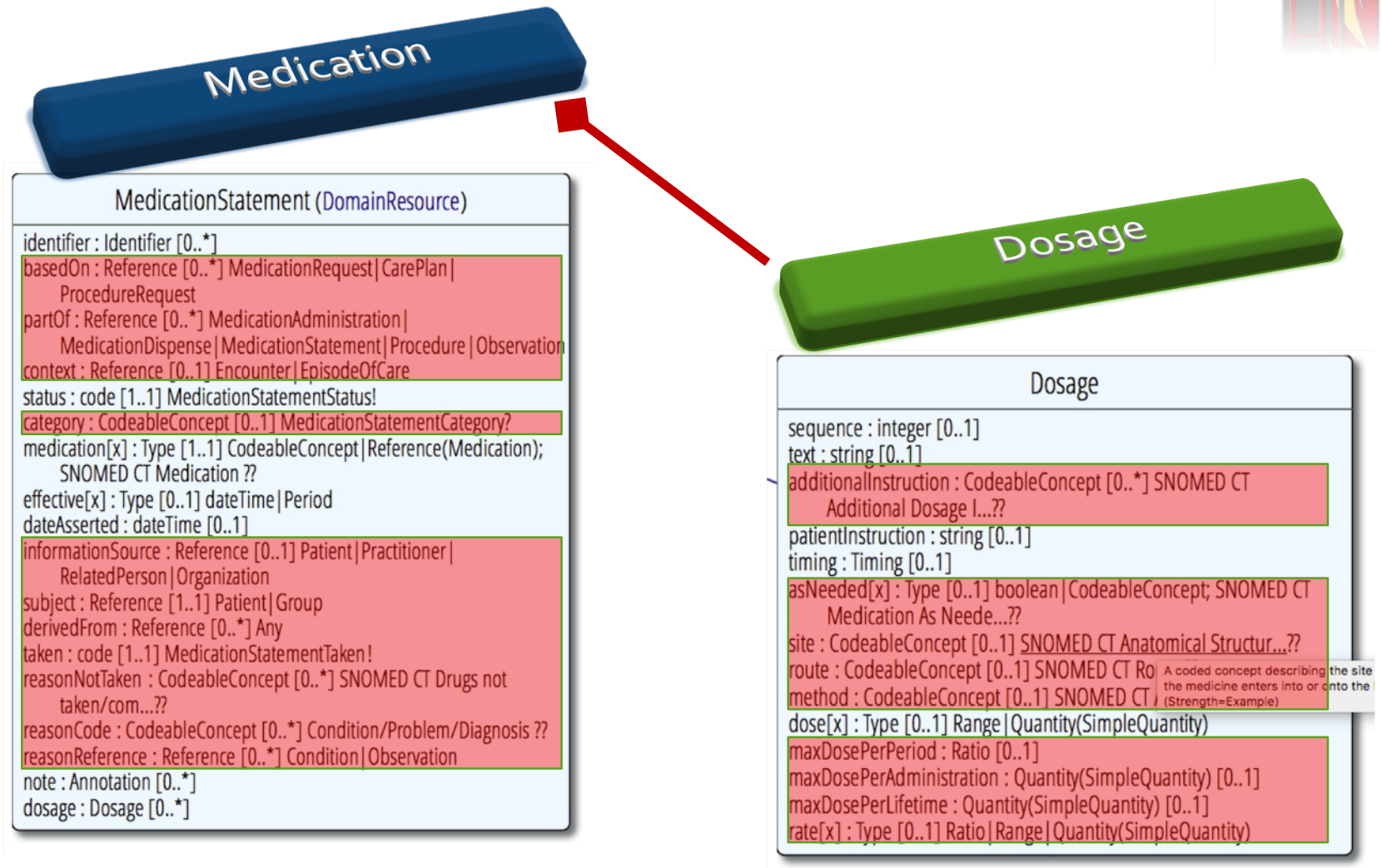
Structure

Name	Flags	Card.	Type	Description & Constraints
Patient			DomainResource	Information about an individual or animal rec Elements defined in Ancestors: id, meta, impl
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)

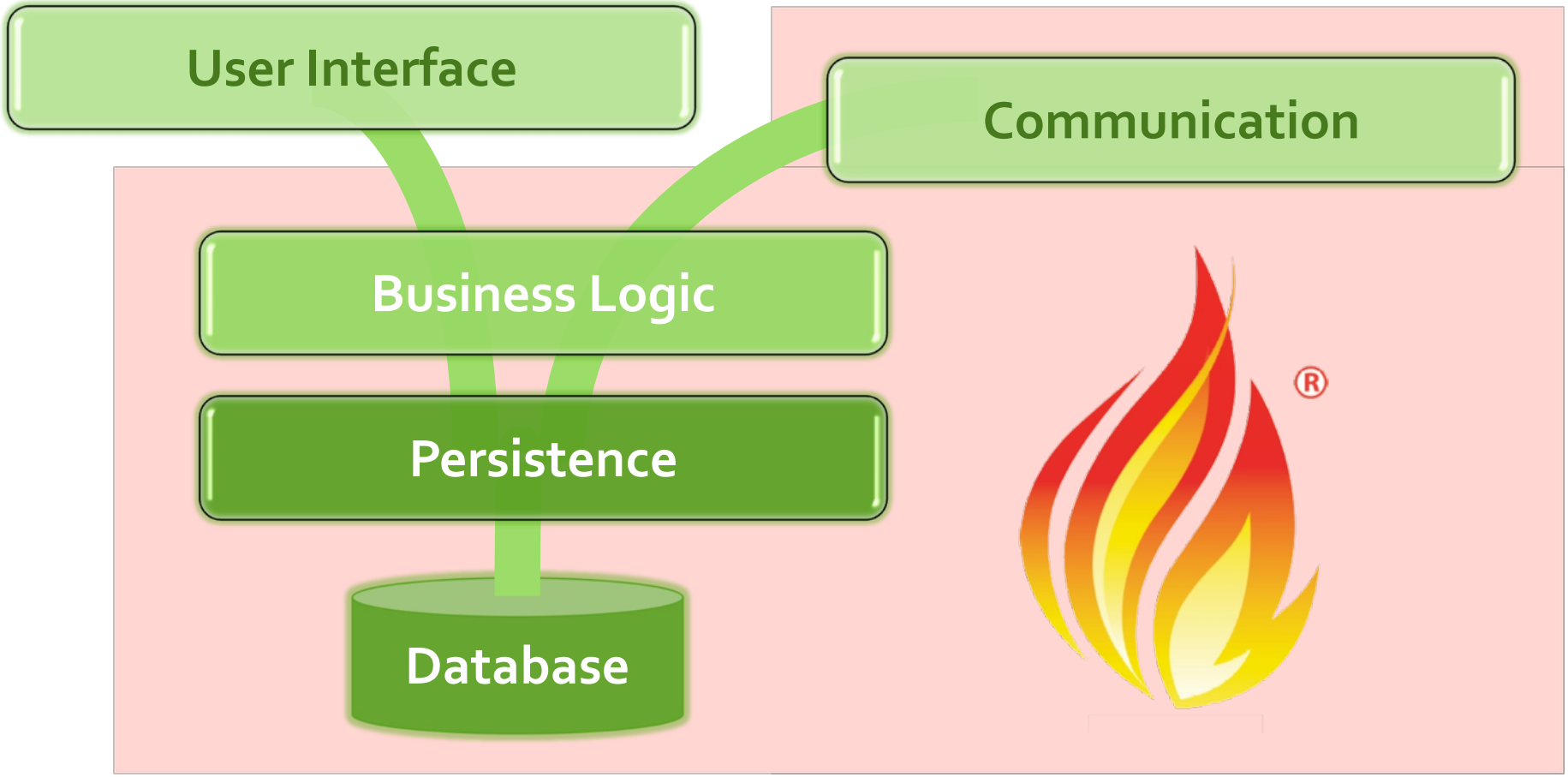
Resource Definition Example



Resource Profiling Example

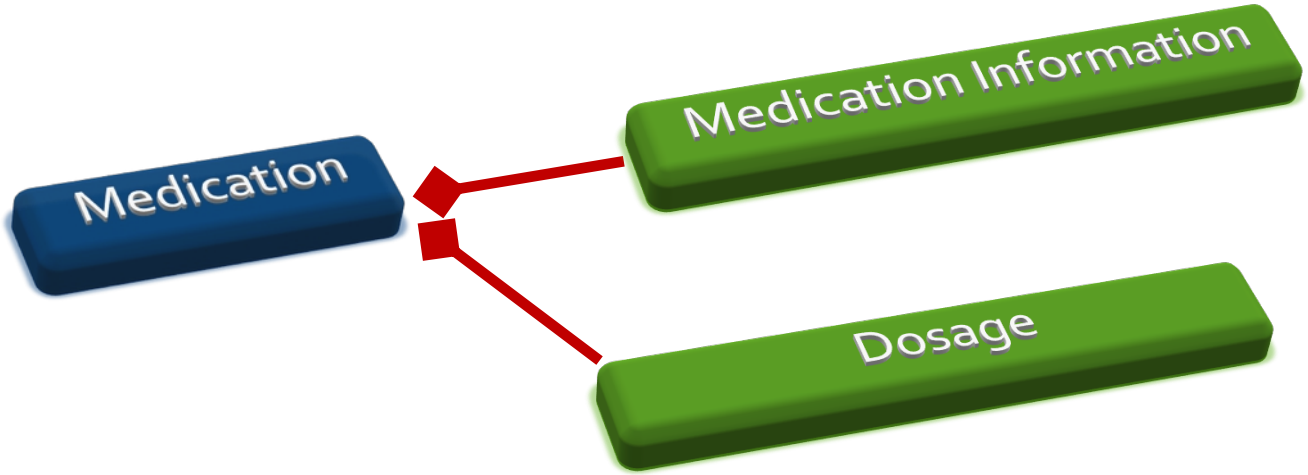


Tiers: FHIR‘s architecural contributions



Tiers: FHIR‘s architecural contributions

- Communication! FHIR!
- Business logic
- Persistence: don’t forget it!
- Modeling: consult the FHIR models!



Querying

Patient

https://fhir.de/Patient?name=smith&gender=male

GET Patient?birthdate=1941-11-19

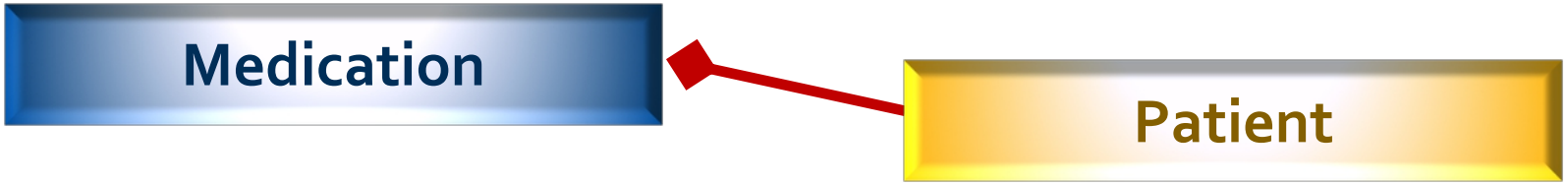
Lab Result

GET Observation?code=http://loinc.org|6298-4

GET Observation?code=http://loinc.org|6298-4 &
value-quantity=lt4.0|http://unitsofmeasure.org/|mmol/L

Querying

GET Condition?_content=diabetes



GET Medication?subject:Patient=234

GET Patient?_has:Medication:patient:code=01234567

GET MedicationRequest?_include=MedicationRequest:patient

Querying

Medication

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11.4.4 Search Parameters

Search parameters for this resource. The common parameters also apply. See Searching for more information about

Name	Type	Description	Expression
category	token	Returns statements of this category of medicationstatement	MedicationStatement.category
code	token	Return statements of this medication code	MedicationStatement.medicati
context	reference	Returns statements for a specific context (episode or episode of Care).	MedicationStatement.context (EpisodeOfCare, Encounter)
effective	date	Date when patient was taking (or not taking) the medication	MedicationStatement.effective
identifier	token	Return statements with this external identifier	MedicationStatement.identifier
medication	reference	Return statements of this medication reference	MedicationStatement.medicati (Medication)
part-of	reference	Returns statements that are part of another event.	MedicationStatement.partOf (MedicationDispense, Observa MedicationStatement)
patient	reference	Returns statements for a specific patient.	MedicationStatement.subject (Patient)
source	reference	Who or where the information in the statement came from	MedicationStatement.informat

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MORE INFORMATION!

...about FHIR...

FHIR®

More Info and References

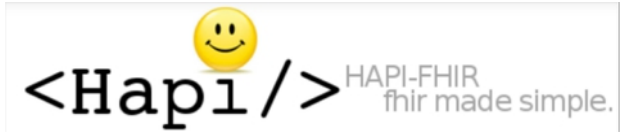
- FHIR Community of HL7 Germany!
  - Mailing list fhir@hl7.de
  - www.hl7.de/fhir und
- Additionally
  - Current specification, tool lists, numerous examples under http://build.fhir.org
  - FHIR Developer Days in November (Furore/fire.ly)
- International FHIR Community

More Info and References

- onfhir.hl7.org FHIR Product Director Blog
- FHIR → hl7.org/fhir
  - Executive summary
  - Developer's introduction
  - Clinical introduction
  - Architect's introduction

Tools (partially commercial)

- Resources profiling
  - Forge (Furore/Fire.ly)
  - ClinFHIR (Orion)
- Manage, maintain and publish profiles
  - Simplifier.net (Furore)
- Data in FHIR: FHIR-Server
  - VONK (Furore/Fire.ly)
  - FHIR .NET API
  - HAPI-FHIR (Kanada), Java
  - SmileCDR



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SUMMARY

FHIR and the MI-I

FHIR®

Summary (1): FHIR and the MI-I

- Recommendations from a FHIR perspective
- Good experiences
  - *When modeling any of the use cases for any purpose (e.g. persistence, database) learn deeply from what FHIR has learned from over 30 years of clinical modeling*
  - *Let data items be influenced by the FHIR elements*
  - *The closer the data model is to the communication model, the easier and earlier interoperability appears*

Summary (2): FHIR and the MI-I

- Better suited
  - *The ease of implementation will lead to early results with less efforts*
  - *Communicate using FHIR: it's easy – what else…?*
  - *The build-in querying capabilities helps to analyze data directly or create extract for further analysis in other tools*
  - *Solid FHIR server availability can act as the backbone of any Data Integration Center*

Summary (3): FHIR and the MI-I

- Best perspectives
  - *Assume that FHIR is broadly used soon*
  - *FHIR got a broad industry awareness and important industry commitments*
  - *FHIR has broad support for implementers through HL7 around the world, the FHIR Foundation and the international FHIR community*
  - *Communicate using FHIR: everybody will do*

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THANK YOU!

Questions?

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