

Digital Health Webinar

openEHR: Yet Another Data Standard?

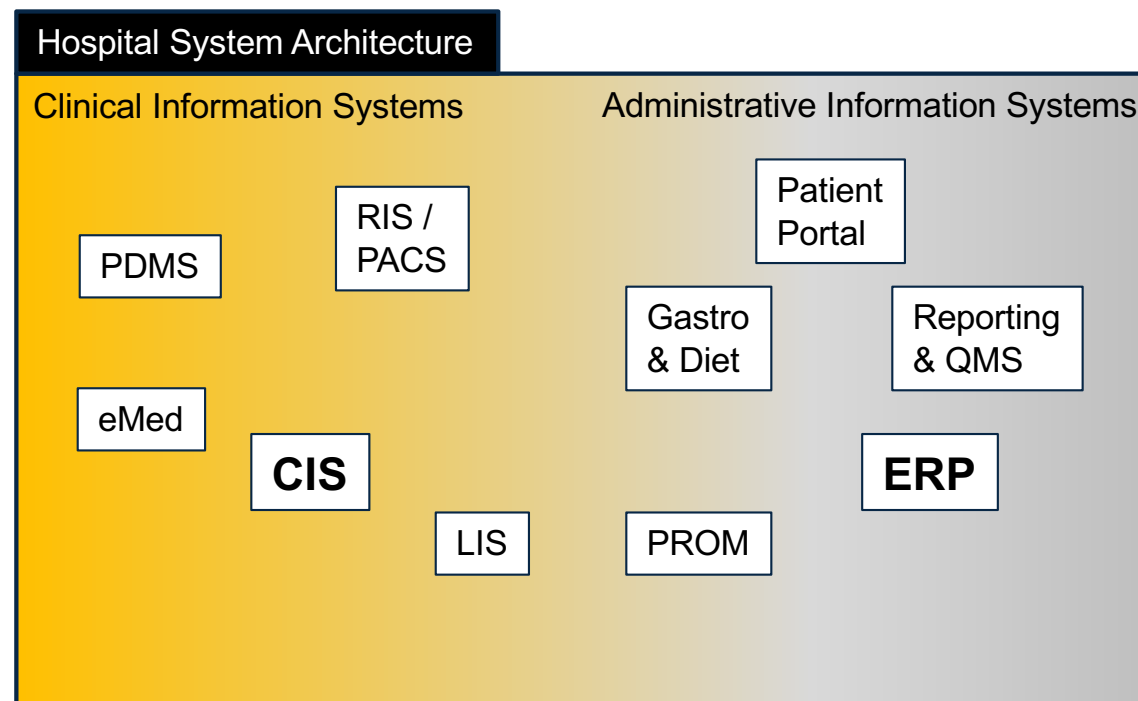
Dr. Philipp Ackermann, ZHAW SoE

What is openEHR?

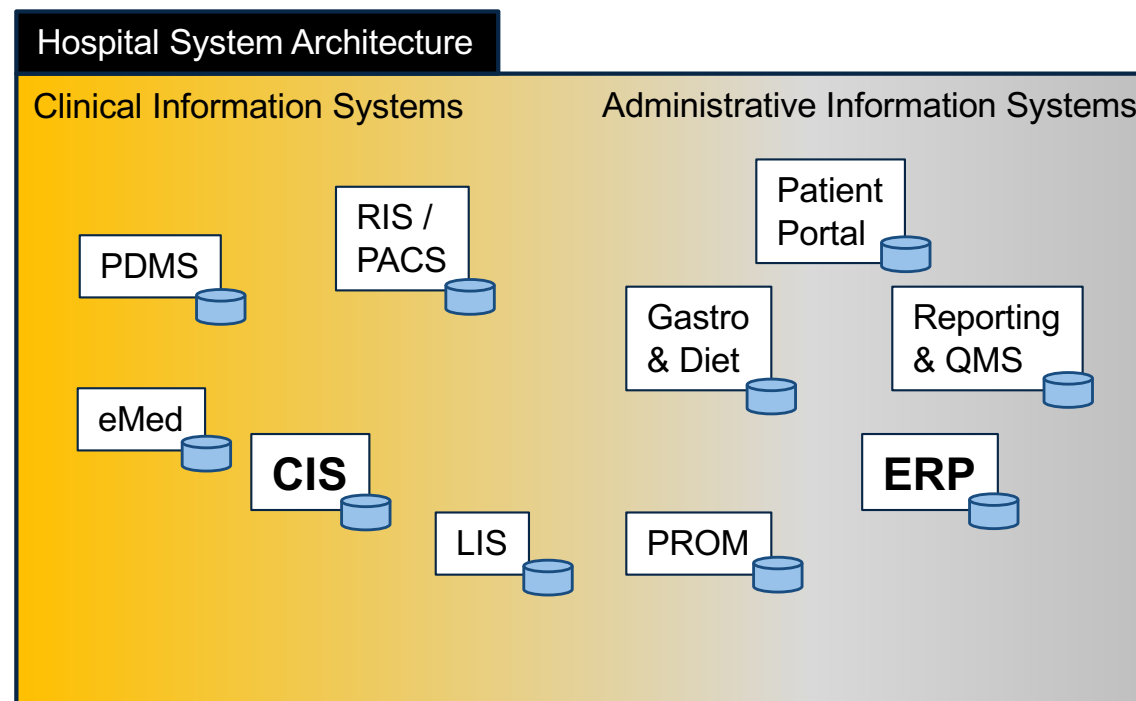
- Data exchange file format?
- Open-Source Software?
- Data-centric system architecture?
- Vision on open hospital software?
- Organisation for patient-centered health data?

→ high-level clarification, no technical details

- Complexity of hospital requires many operated applications
 - IT operates several 100 software systems from different vendors
 - Clinical staff is confronted with many front-ends
 - See 10 of the most important hospital IT systems in the diagram

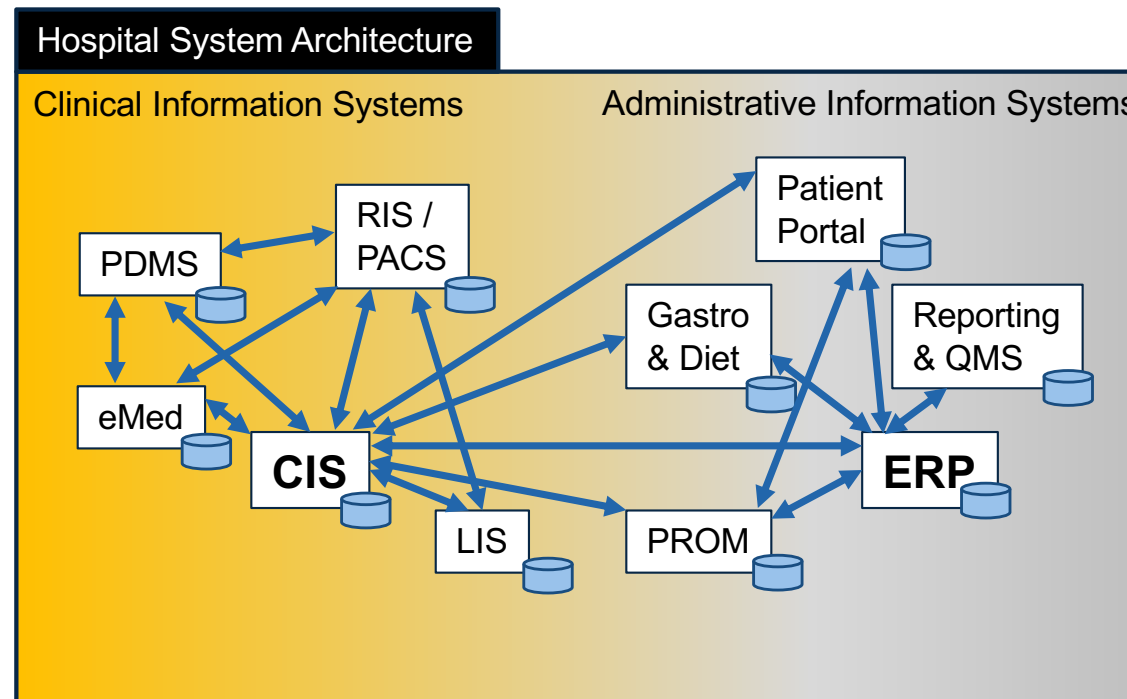


- Application-centric System Architecture
 - Each application manages its own data model
 - Each application pretends to be “master” in its main domain
 - Each application establishes its own data silo



Hospital System Architecture

- Interoperability
 - Goal: Interplay of systems without duplicated data entry
 - n applications lead to $n*(n-1)$ point-to-point connectors
 - The semantics of exchanged data is a challenge

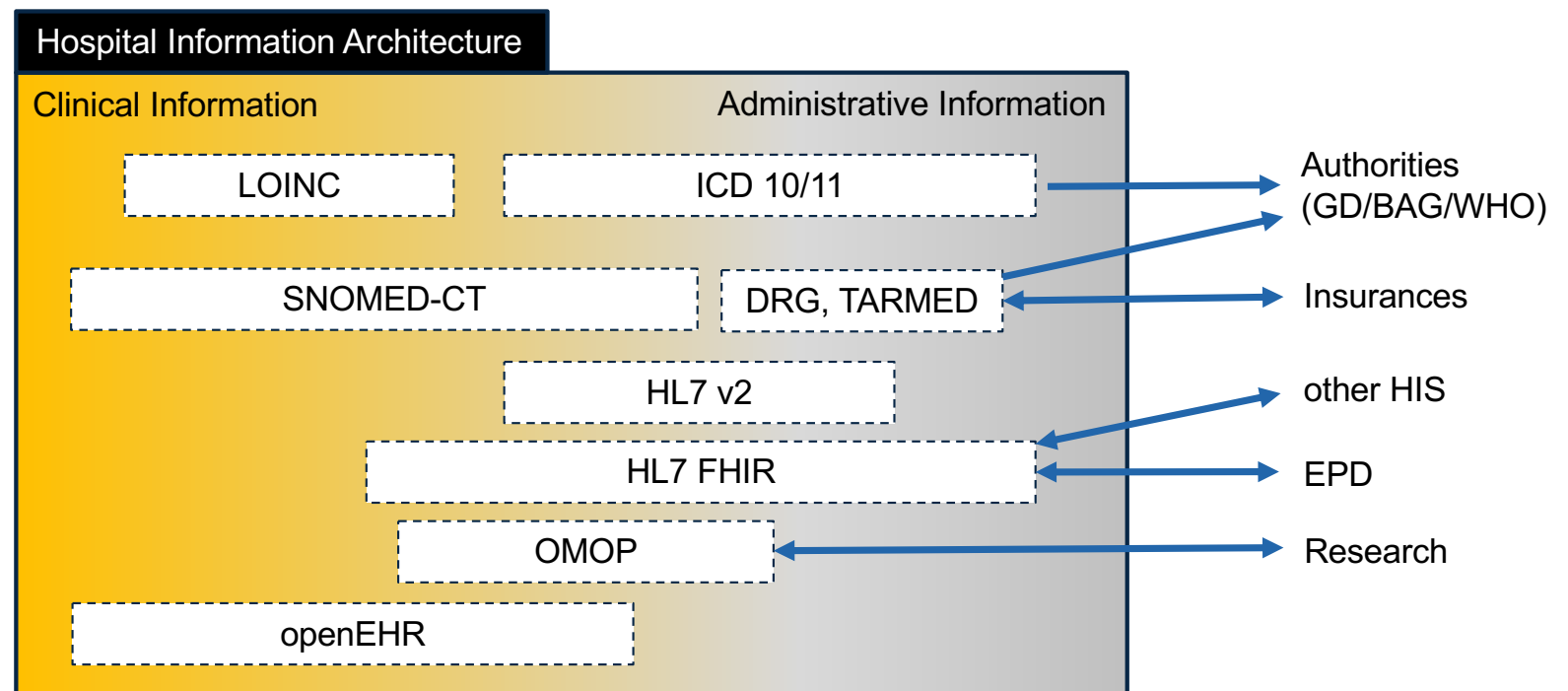


- Data Interpretation & Translation Problems
 - Need for mappings & conversions of keys, values, & units
 - height: 1.82 → body height: 182
 - birth weight: 3300g → body weight: 3,3 kg
 - BP: 135,88 → systolic: 135, diastolic: 88
 - Semantic loss and distortion due to reinterpretations
 - BP: 135,88;sitting → blood pressure: 135,88
 - Diagnosis: 25343008 | Secondary localized osteoarthritis of pelvic region → code of another classification system (e.g., SNOMED-CT → ICD10)
 - Reinterpretation impossible due to gaps, aggregations, ...
 - # cigarettes smoked per week:
0, 1-5, 6-10, 11-15, 16-30, 31+ →
0, 1-3, 4-7, 8-14, 15-28, 29-69, 70-100

- Mapping between data models
 - System A → Connector → System B
 - System A → “Standard” → System B
 - Data standards allow customization
 - 80/20 rule to gain flexibility, e.g., FHIR profiles
 - Coding & terminology often kept open
- System integration is complex and time-consuming
- Data translation is often incomplete and “messy”
(even when using health data standards)

- Health Data Standards

- Health data standards cover specific domains and roles
- See coverage of currently relevant standards in the diagram
- There is no single standard that covers the full healthcare domain

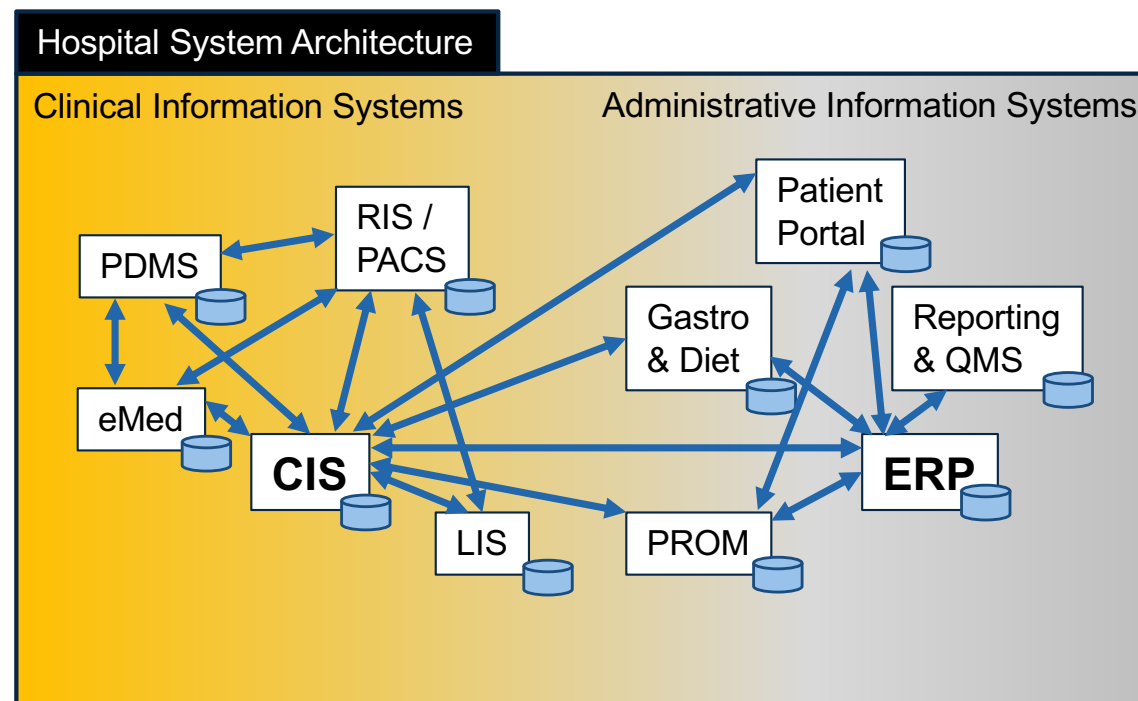


- IT Systems for Health/Healthcare
 - The same is true here as well...
 - IT systems cover specific domains and roles
 - There is no single SW system that covers the full healthcare domain
- "Single Source of Truth" is wishful thinking
 - This is due to the complexity of the medical field
 - In "simpler" industries it is not different
- Balancing "monolithic vs. best-of-breed" system architecture
 - Will be an ongoing battle

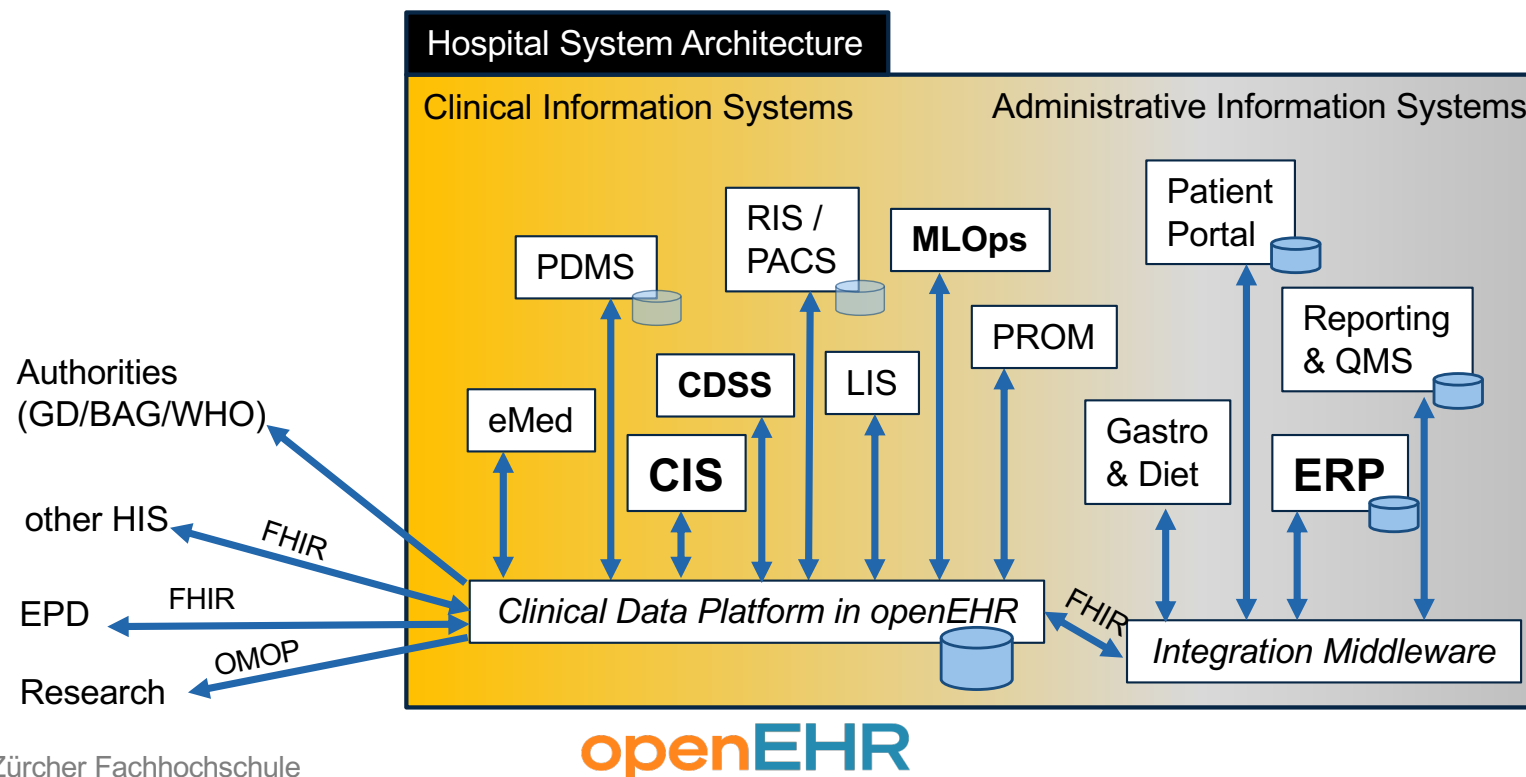
- Data is fragmented across multiple applications
- There are health data exchange formats, but integration of data across applications is time-consuming and lossy
- Free text dominates instead of structured data
- User experience is suboptimal
- Health data outlives applications, but data is bound to applications → data silos, vendor lock-in, data loss
- Siloed health data is not available for longitudinal and comprehensive analytics

From
Application-centric System Architecture
to
Data-centric System Architecture

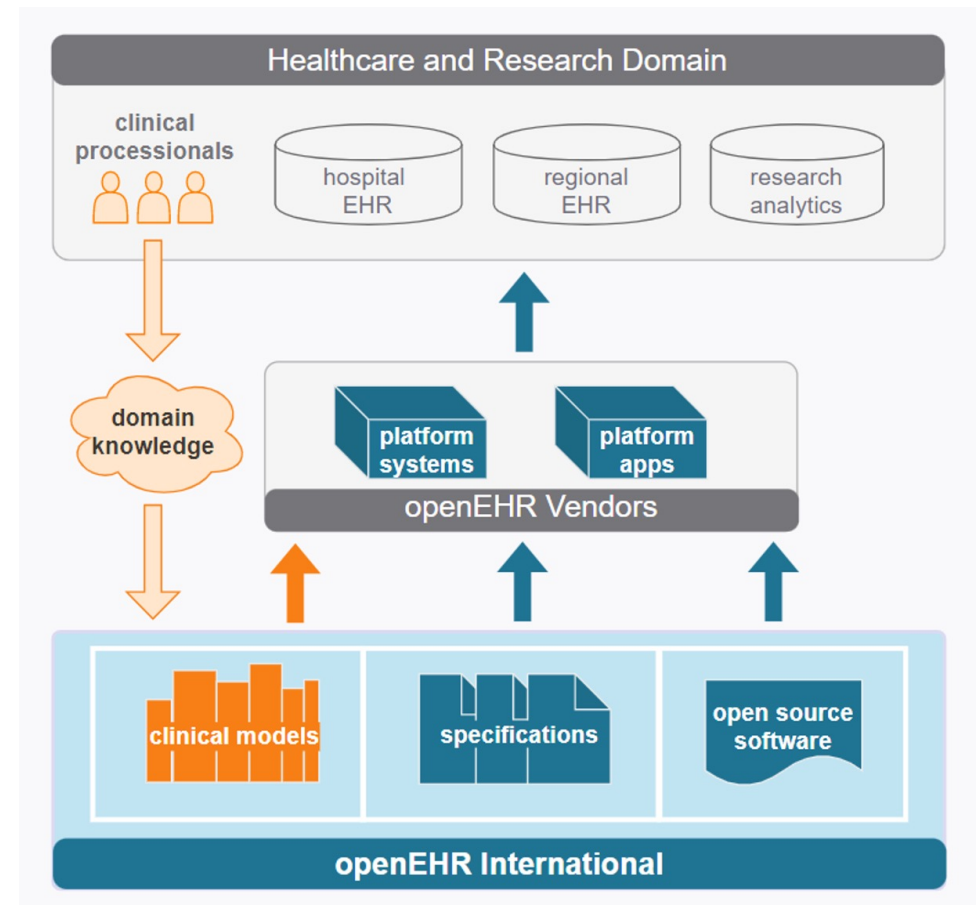
- Status quo: Application-centric System Architecture



- openEHR as Blueprint for Data-centric System Architecture
 - Clinical health data platform within hospital
 - Vendor-neutral Data Platform Standard using openEHR
 - Enables innovation in CDSS, MLOps, use-case-specific dashboards, ...

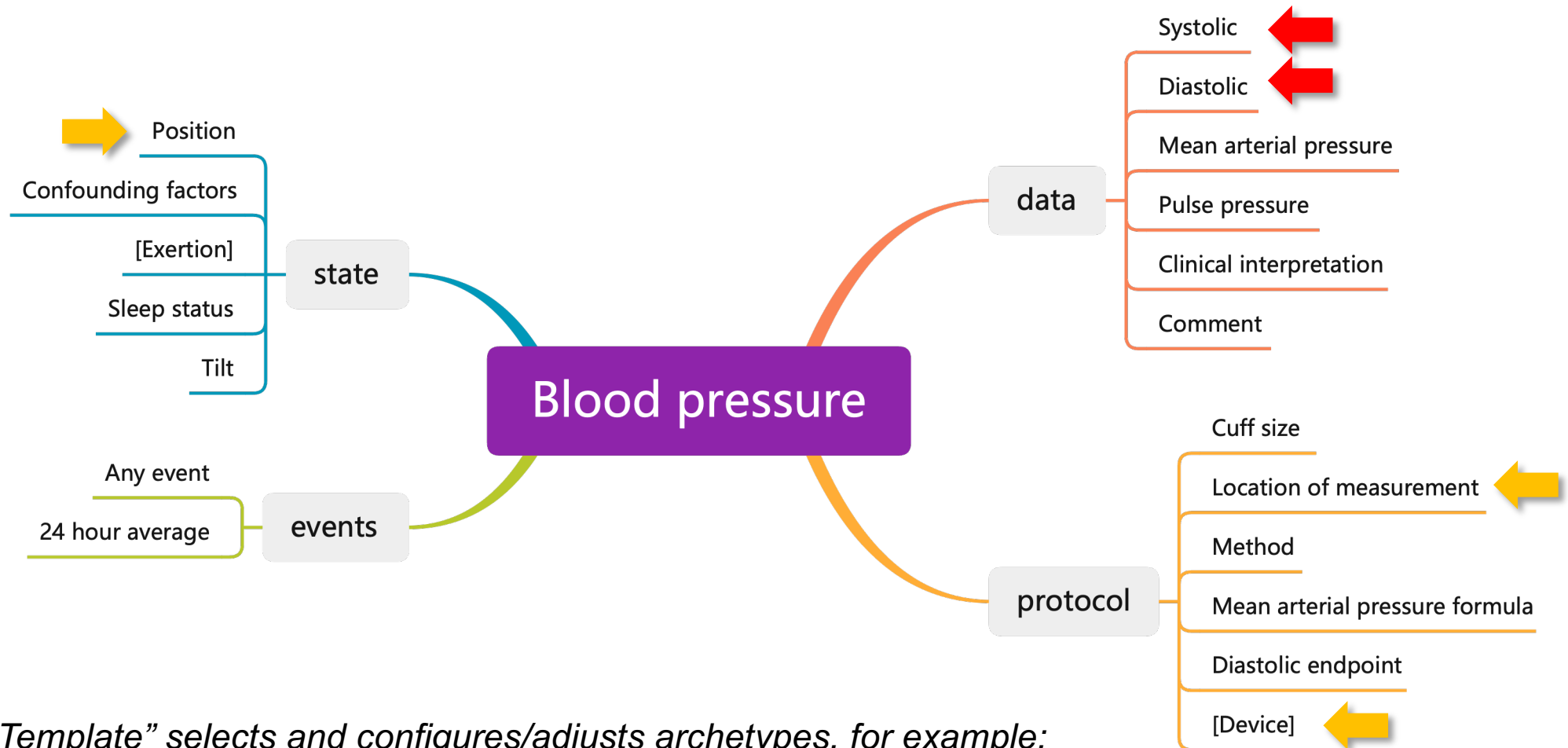


- openEHR is
 - a collaborative, non-profit organisation for patient-centered health data
 - an open specification for a “health information model”
 - capable of supporting an open platform ecosystem
 - vendor neutral
 - technology neutral
- <https://openehr.org>
- <https://openehr.ch>



- Reference Model
 - defines clinical data types and data structures
- Archetypes
 - defines medical semantic to be reused
 - description of clinical data models as maximum data set
- Templates
 - adapt and combine archetypes to your needs
 - description of use-case data set
- AQL: Archetype Query Language
 - query language operating on stored openEHR data
 - queries based on archetypes

Example of an "archetype"



"Template" selects and configures/adjusts archetypes, for example:



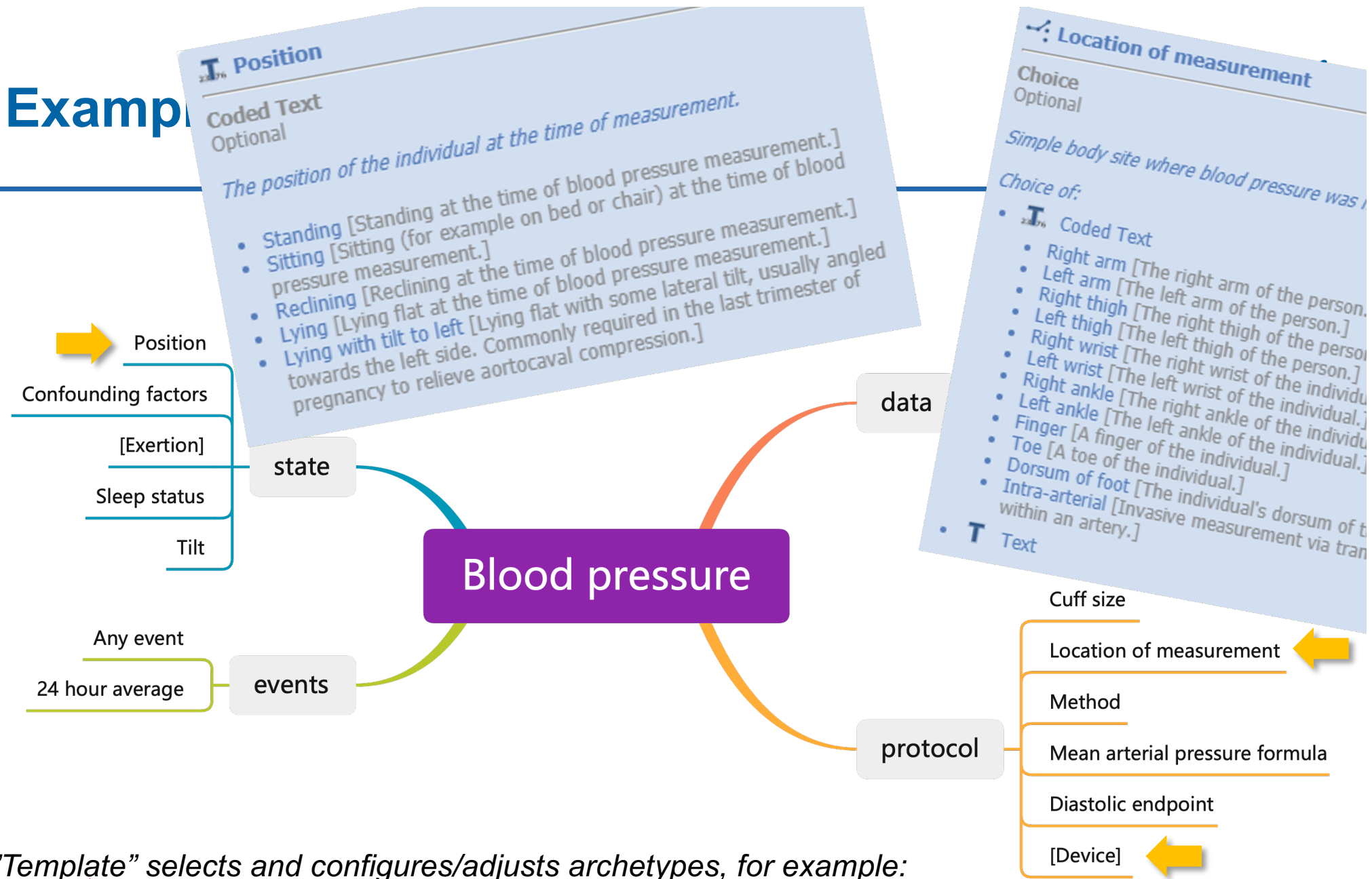
= active data capture



= sets suitable default values (that can be changed if needed)

no arrow = fields not needed in this example/use case. Thus not visible in forms etc

Example



"Template" selects and configures/adjusts archetypes, for example:



= active data capture



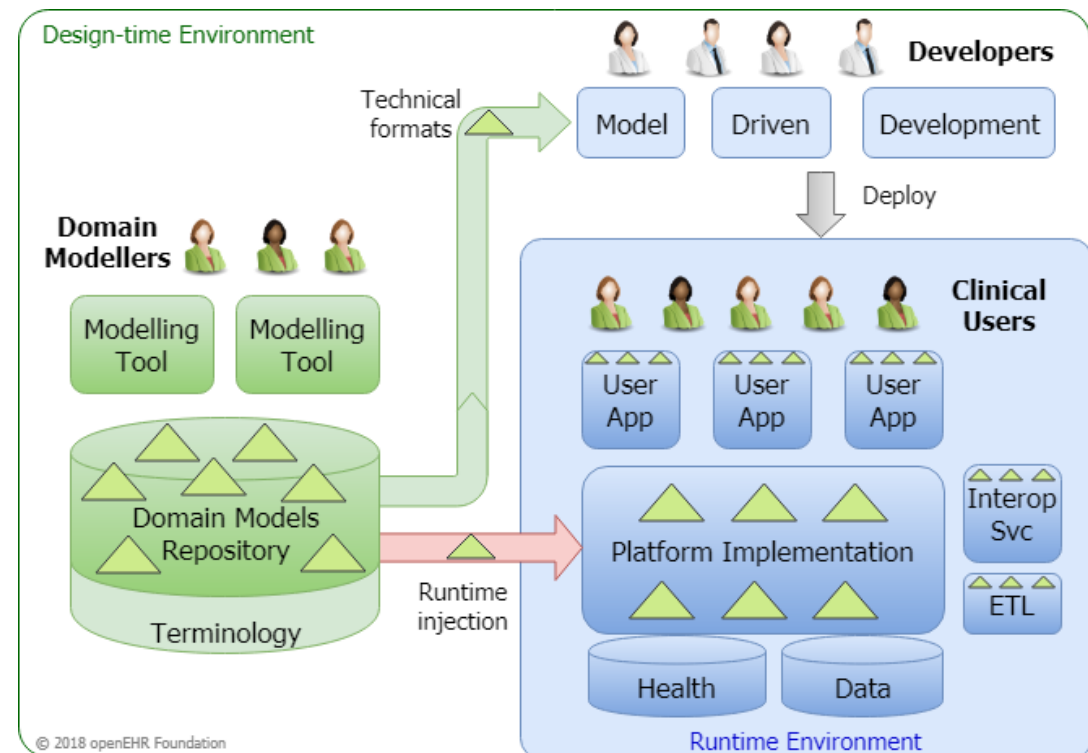
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- Clinical Knowledge Modeler
 - <https://ckm.openehr.org/ckm/>

The screenshot displays the openEHR Clinical Knowledge Manager (CKM) interface. The main content area shows a mind map for the archetype 'Pulse/Heart beat'. The central node is 'Pulse/Heart beat'. It branches into several categories: 'Position', 'Confounding factors', 'Exertion', 'Method', 'Body site', 'Data', 'Description', and 'Attribution'. The 'Data' node further branches into 'Presence', 'Rate', 'Regularity', 'Irregular type', 'Character', 'Clinical descrip', '(Clinical interp', and 'Comment'. The 'Body site' node has a detailed list of choices, including 'Coded Text' (Radial Artery - Left, Radial Artery - Right, Heart, Carotid Artery - Left, Carotid Artery - Right, Femoral Artery - Left, Femoral Artery - Right, Brachial artery - Right, Brachial artery - Left, Finger, Toe, Ear lobe) and 'Text'. The left sidebar shows a list of archetypes, with 'Pulse/Heart beat (v2)' selected. The top navigation bar includes 'Dashboard', 'Find Resources', 'Triage Assessment', and 'Pulse oximetry'.

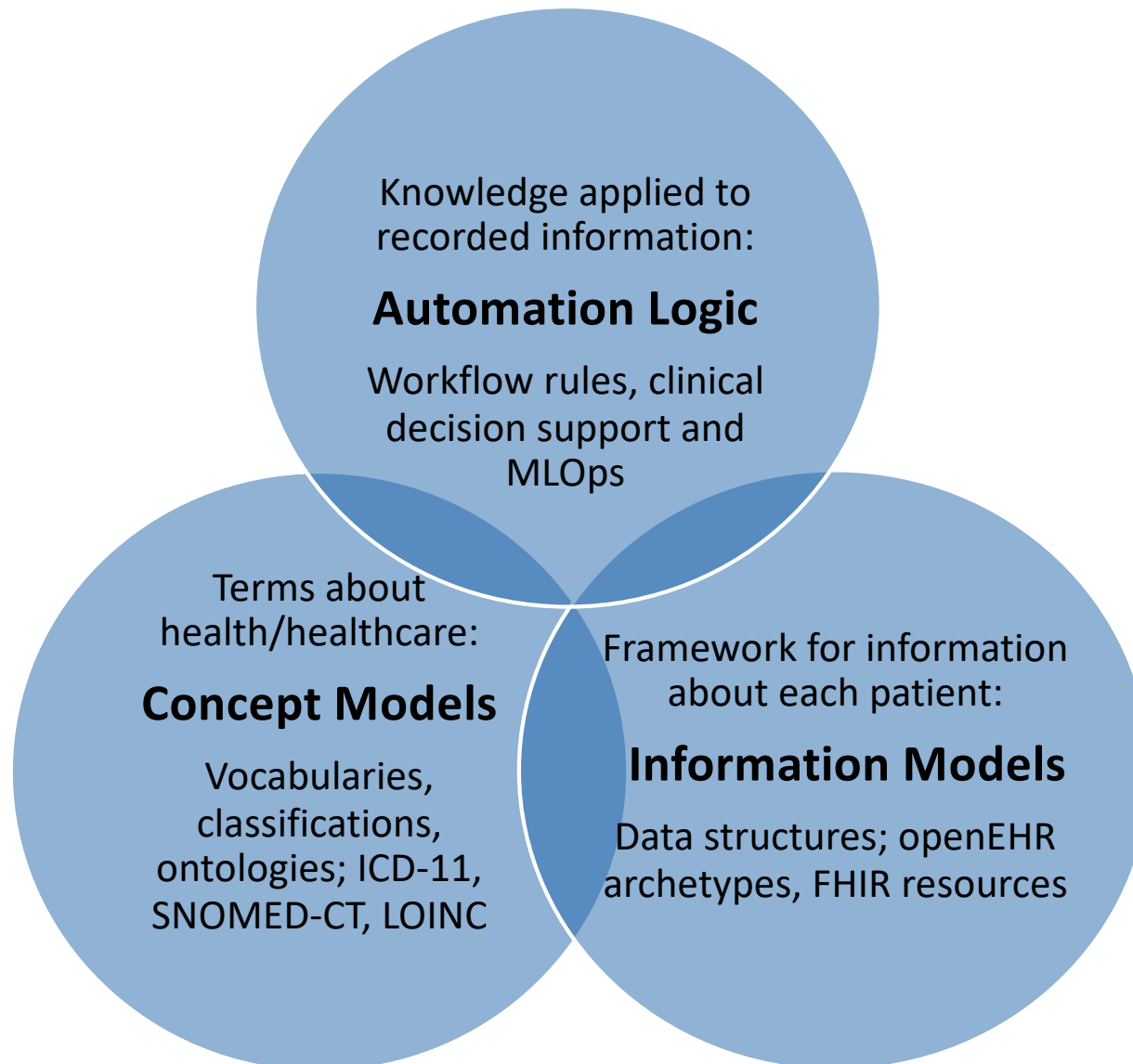
- Clinical Knowledge Modeler
 - CKM is a library of clinical knowledge artefacts defined by the medical community as archetypes and templates
 - Managed through a governance-controlled review and publication process
 - Validated data and knowledge structures
- Model-Driven Dev
 - Compose archetypes
 - Inject models



The model-driven openEHR technology ecosystem

- Should be called “Model-centric System Architecture”
- Clinical Data Model
 - Starting point of design
 - Developed by medical experts (not IT specialists)
 - Editors for modelling medical knowledge are used
 - Community-driven approval of clinical data models
- Model-Driven Development (MDD)
 - Clinical Data Model is input to development process
 - Automatic generation of Data Platform representations
 - Objects with their persistency (in DB) and corresponding APIs
 - Add application logic and user interface (semi-automatic)

Interplay of Health Data Standards



What is openEHR good for?

- Building standards-based clinical data repositories (CDRs)
- Modelling and standardising clinical concept models (archetypes)
- Creating complex data sets as information models using combinations of standardised models (templates)
- Building applications on data schemas generated from templates (MDD)
- Persisting clinical data in a standardised way (compositions)
- Predictably retrieving clinical data:
Archetype Query Language (AQL)

So, what is openEHR?

- Data exchange file format?
→ Not really, but interplays well with HL7 FHIR
- Open-Source Software?
→ Only partially, but open tech standard & toolchain
- Data-centric system architecture?
→ Even better: Model-centric, MDD
- Vision on open hospital software?
→ Yes: get rid of vendor lock-in; life-long health data
- Organisation for patient-centered health data?
→ International community: openehr.org / openehr.ch

- Health Data Platform within hospital
 - Integrating (and migrating?) clinical data between systems
- Development Platform for any healthcare orga
 - Reuse of clinical models
 - Modelling by medical experts with domain knowledge
 - Model-driven development for iterative prototyping
- Supporting life-long, patient-centric health data
 - Share data among smart apps that improve over time
- Innovation Platform for academic research
 - Mirroring hospital platform and medical data schemes
 - Improve transfer from research to clinical applications