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Postmodern EHR

Integrate. Open. Innovate.

Tomaž Gornik, CEO, Better
Co-chair, openEHR Foundation
Coordinator, Slovenian ECHA Ecosystem

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Agenda

Postmodern EHR

Health Data

OpenEHR

Use Cases

Summary

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Postmodern EHR

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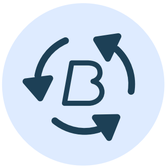
Ideal healthcare

Patient-centric

An engaged and empowered patient will be in the center as providers and the patient herself strive to improve their health and when needed, care.



Synchronised

Care will be provided to patients in a synchronised, coordinated way to maximise safety and outcomes

Data-driven

Providers, patients, researchers and policy makers will have access to data, knowledge and tools providing better care by making informed decisions

Universally **accessible**

Knowledge, best practices and procedures will be available to all

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ANNALS OF MEDICINE NOVEMBER 12, 2018 ISSUE

WHY DOCTORS HATE THEIR COMPUTERS

Digitization promises to make medical care easier and more efficient. But are screens coming between doctors and patients?

By Atul Gawande

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FORTUNE

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Death by a Thousand Clicks: Where Electronic Health Records Went Wrong

The U.S. government claimed that turning American medical charts into electronic records would make health care better, safer, and cheaper. Ten years and $36 billion later, the system is an unholy mess: Inside a digital revolution gone wrong. A joint investigation by Fortune and Kaiser Health News.

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Current Systems

- **Lack of interoperability** between vendors, technologies, applications
- **Difficult** implementation, **high cost**
- **Out-dated** interfaces, **bad design,** missing functionality, **time consuming**
- **Quality** of data, **errors**, data **difficult to find**
- **Lack of mobility**, support for devices

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Example: ERP

Gartner **MONOLITHIC SYSTEMS DESIGNED FOR NEEDS OF THE PAST**

*"Traditional **monolithic ERP** solutions using a **closed business architecture** were designed to support the process improvement **needs of the past** (such as transactional efficiency and data integrity)."*

- Gartner, 2015

Example: ERP

Gartner **MONOLITHIC SYSTEMS CAN'T COPE WITH NEW DEMANDS**

*'They **cannot enable** the **open** and **agile** needs of business to succeed in a **digital economy** that demands **new products** and services and the ability to **respond** to new **business moments.**"*

- Gartner, 2015

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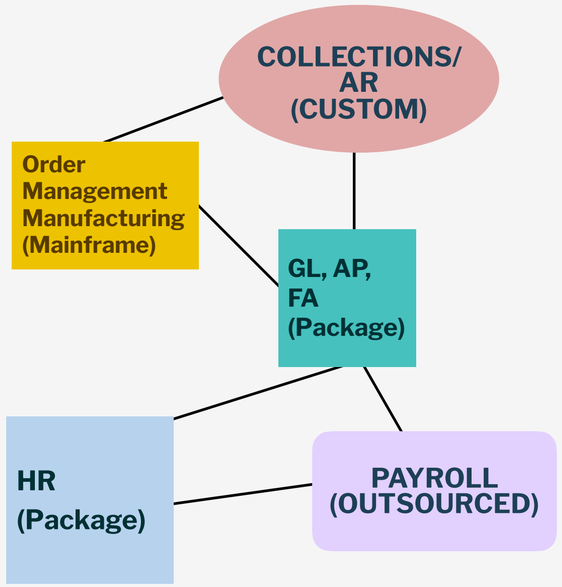
ERP Evolution: Best-of-Breed

PRE–1997
BEST-OF-BREED



NO CORE ERP
MULTI-VENDOR
FUNCTION-ORIENTED

Gartner

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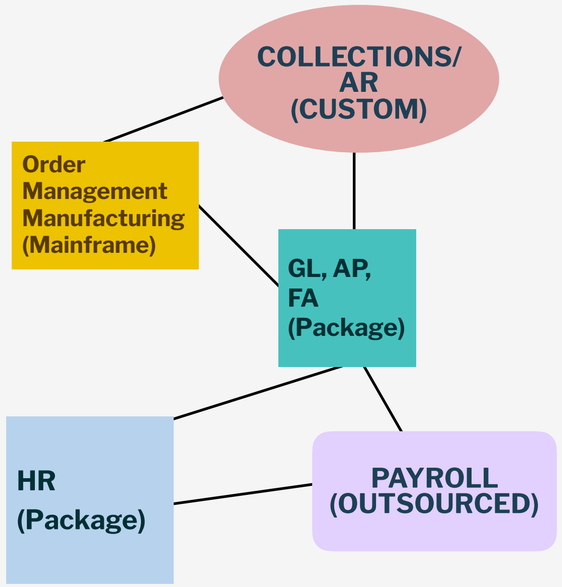
ERP Evolution: Modern

PRE–1997
BEST-OF-BREED



NO CORE ERP
MULTI-VENDOR
FUNCTION-ORIENTED

1998–2014
MODERN ERP

ERP SUITE

CRM	AP	GL
FA	Inventory	Payroll
Order Managmt	HR	Manufact-uring

CORE ERP
SINGLE VENDOR
DATA-ORIENTED

Gartner

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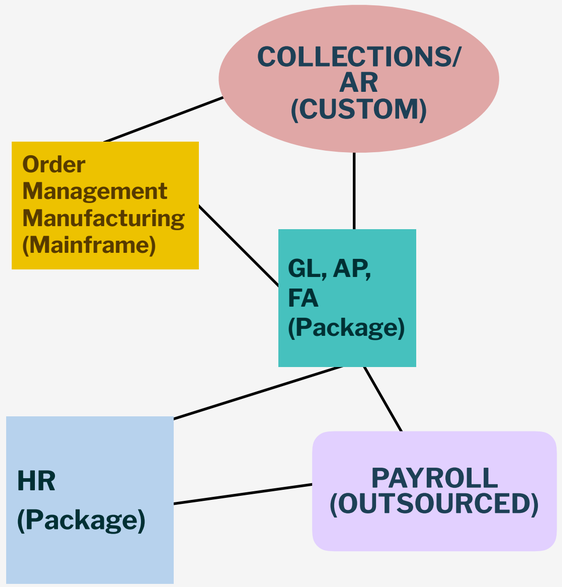
ERP Evolution: Postmodern

PRE–1997
BEST-OF-BREED



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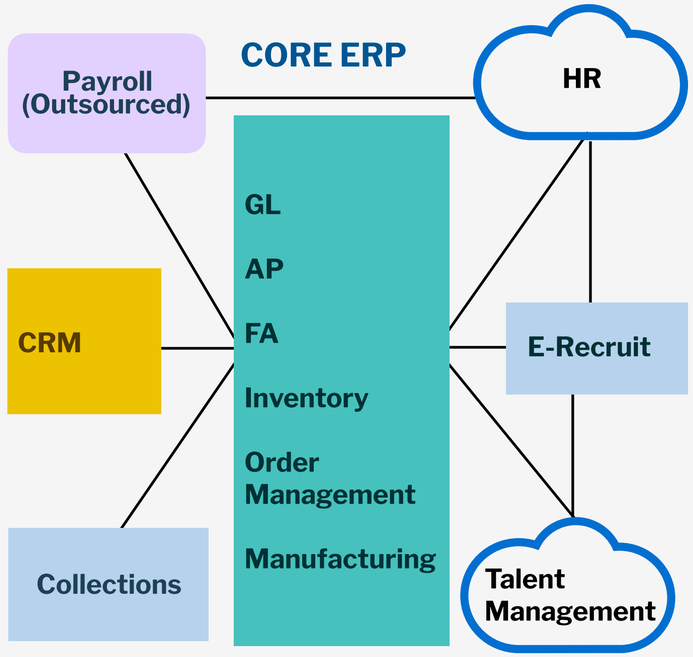
CORE ERP
SINGLE VENDOR
DATA-ORIENTED

2015–
POSTMODERN ERP



CORE ERP
MULTI-VENDOR
PROCESS-ORIENTED

Gartner

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Bi-Modal IT

Think Samurai

Mode 1		Mode 2
Reliability	**Goal**	Agility
Price for performance	**Value**	Revenue, brand, customer experience
Linear, waterfall, high-ceremony IID* & agile AD	**Approach**	Iterative, low-ceremony, nonlinear, Lean Startup, Kanban, agile AD
Plan-driven, approval-based	**Governance**	Empirical, continuous, implicit in the approach
Enterprise suppliers, long-term deals	**Sourcing**	Small, new vendors, short-term deals
Good at conventional process & projects	**Talent**	Good at new approaches & dealing with uncertainty
IT-centric, arms-length from customer	**Culture**	Business-centric, close to customer
Long (months)	**Cycle times**	Short (days, weeks)

Think Ninja

Gartner

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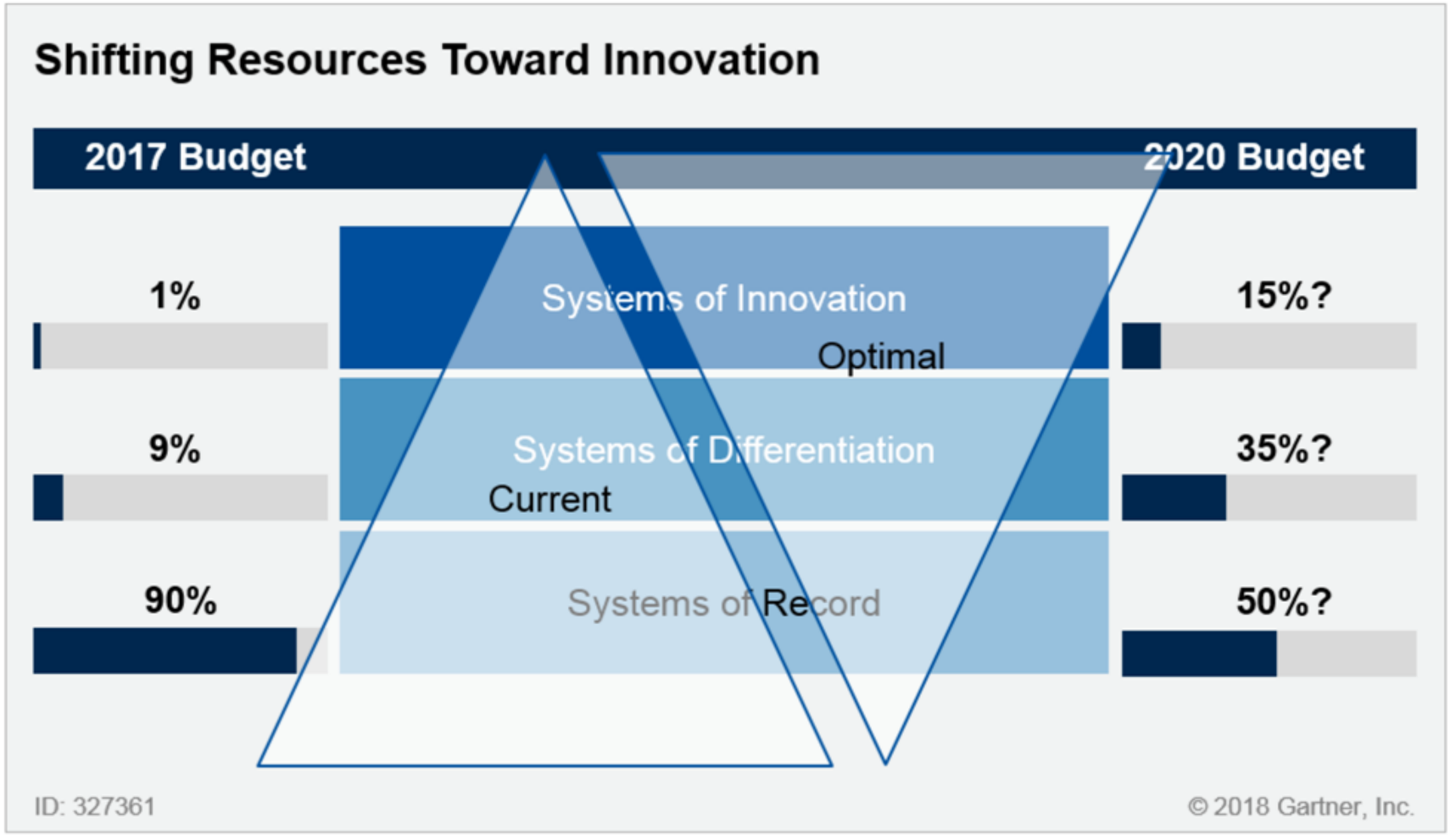
Bi-Modal IT



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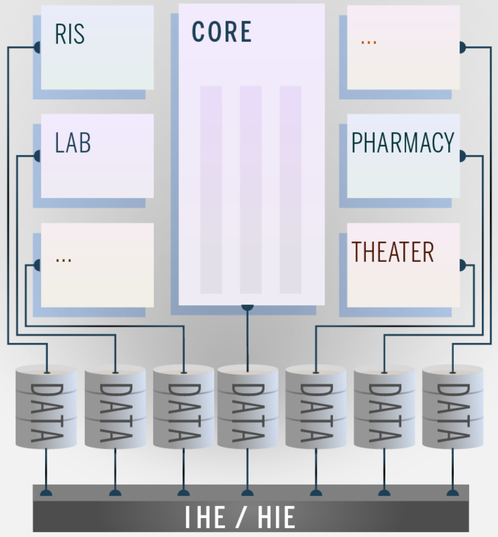
EHR Evolution



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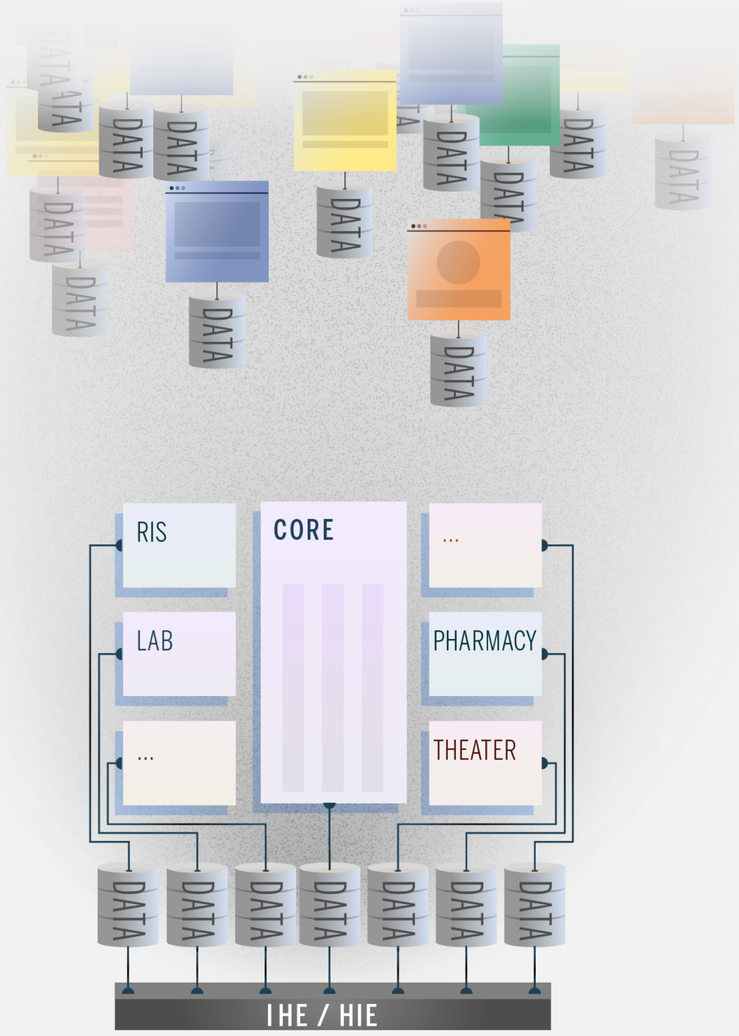

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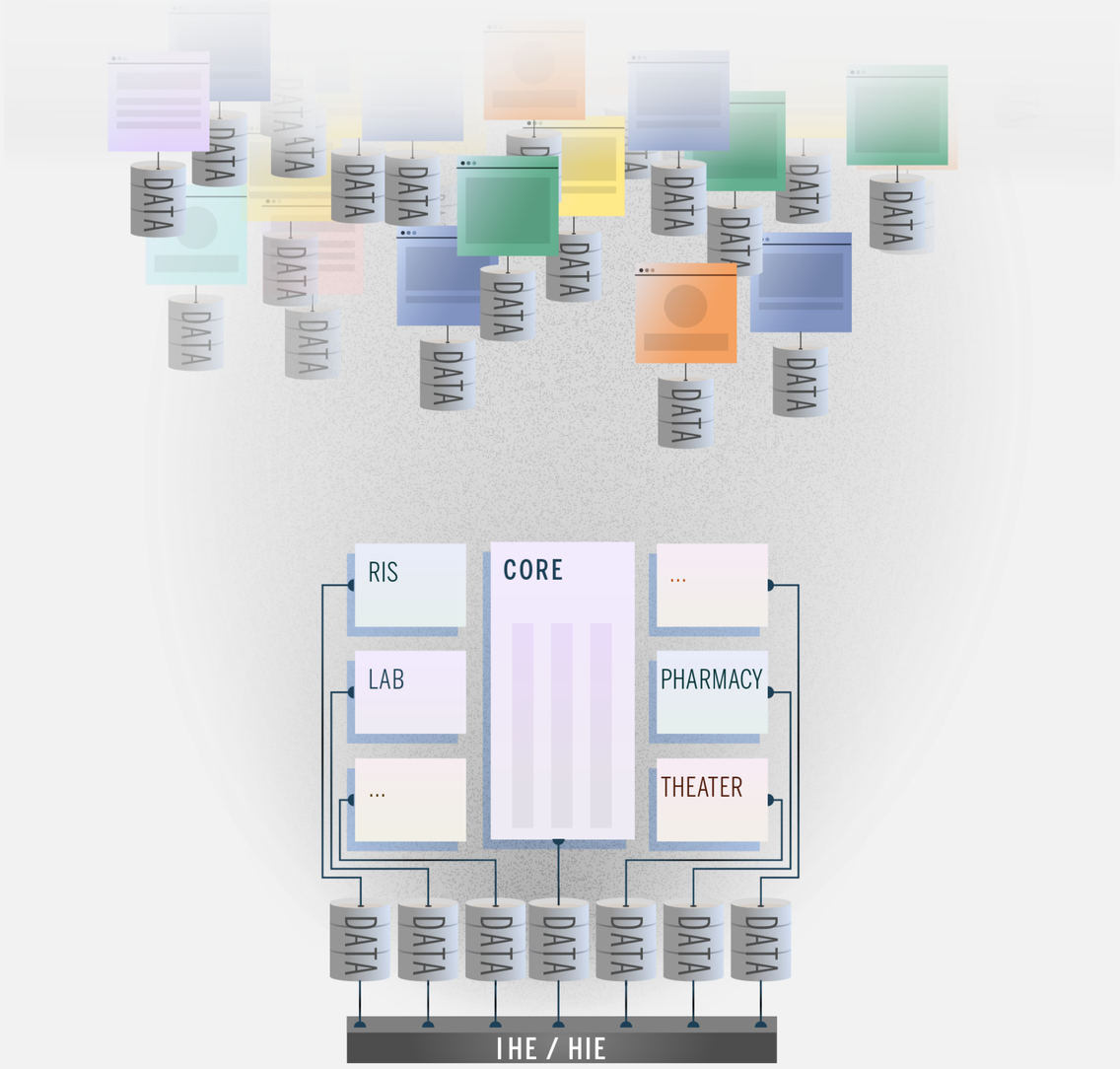

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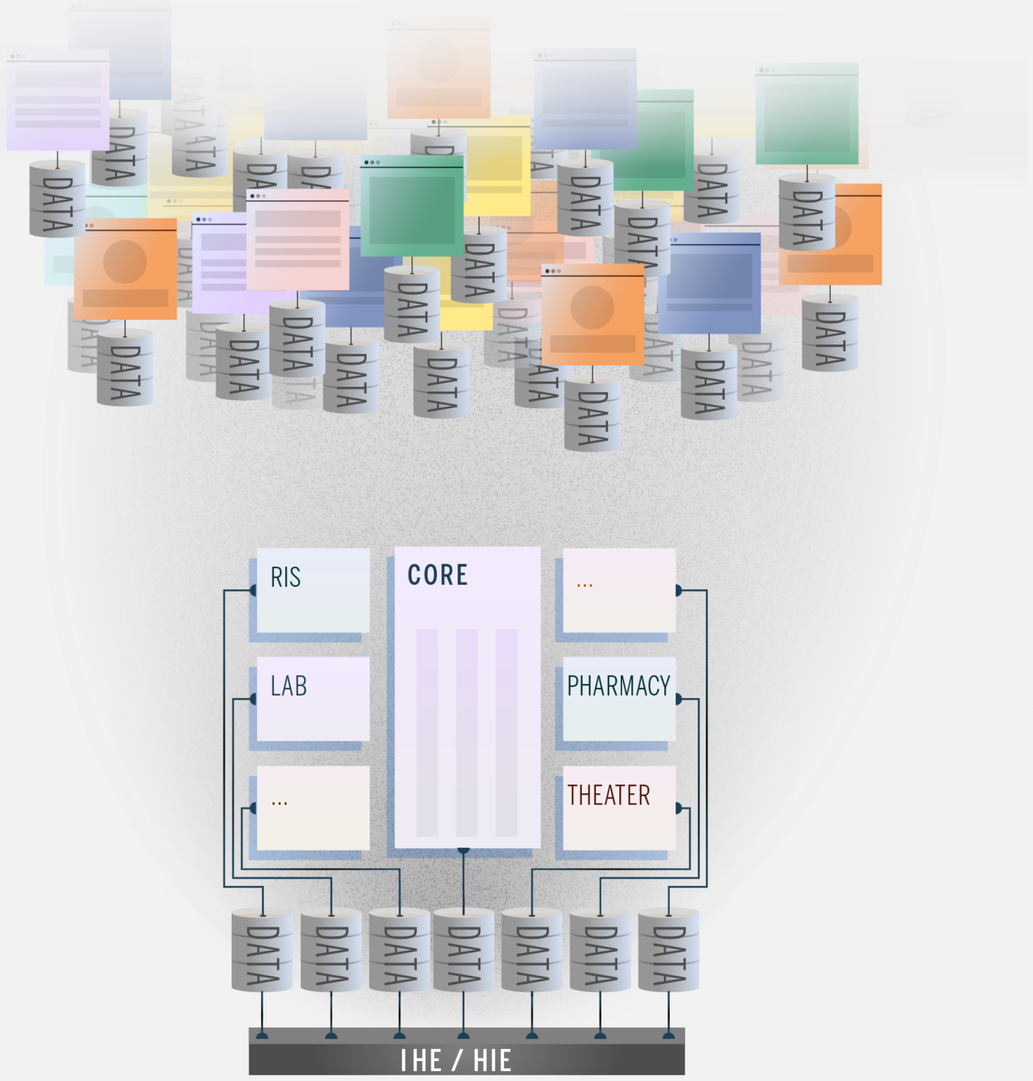

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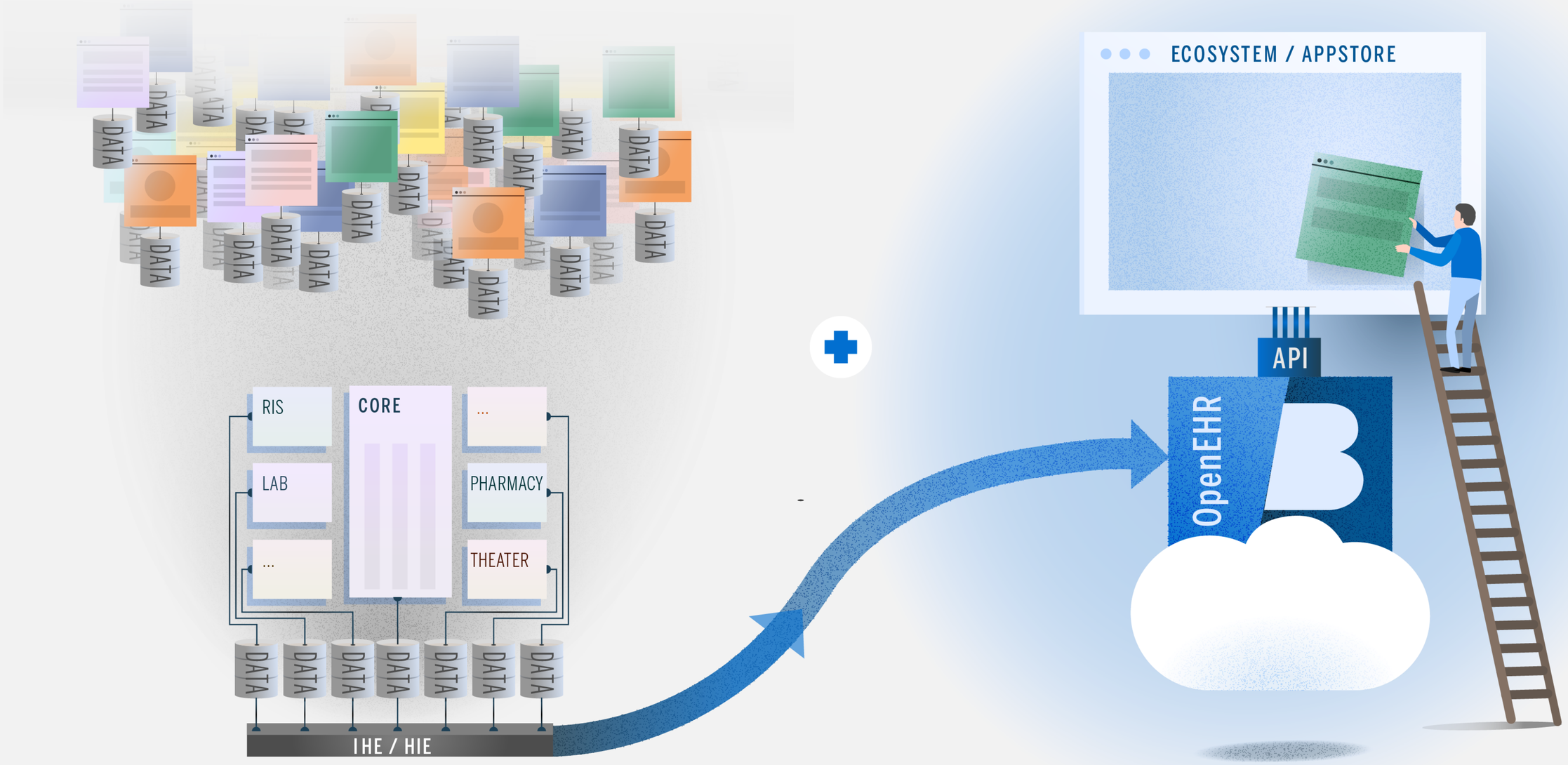
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LAB
PHARMACY
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THEATER
IHE / HIE
ECOSYSTEM / APPSTORE
API
OpenEHR

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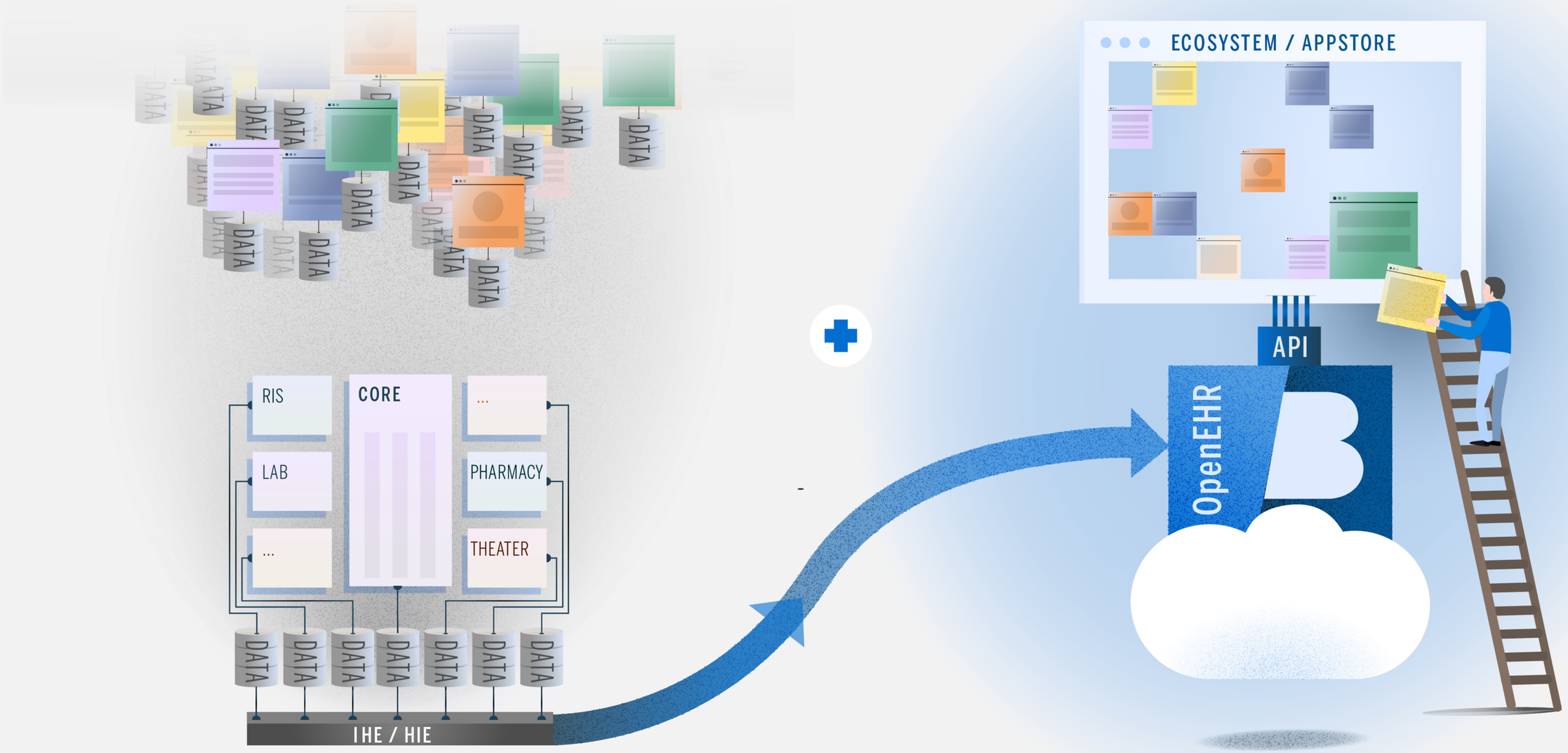
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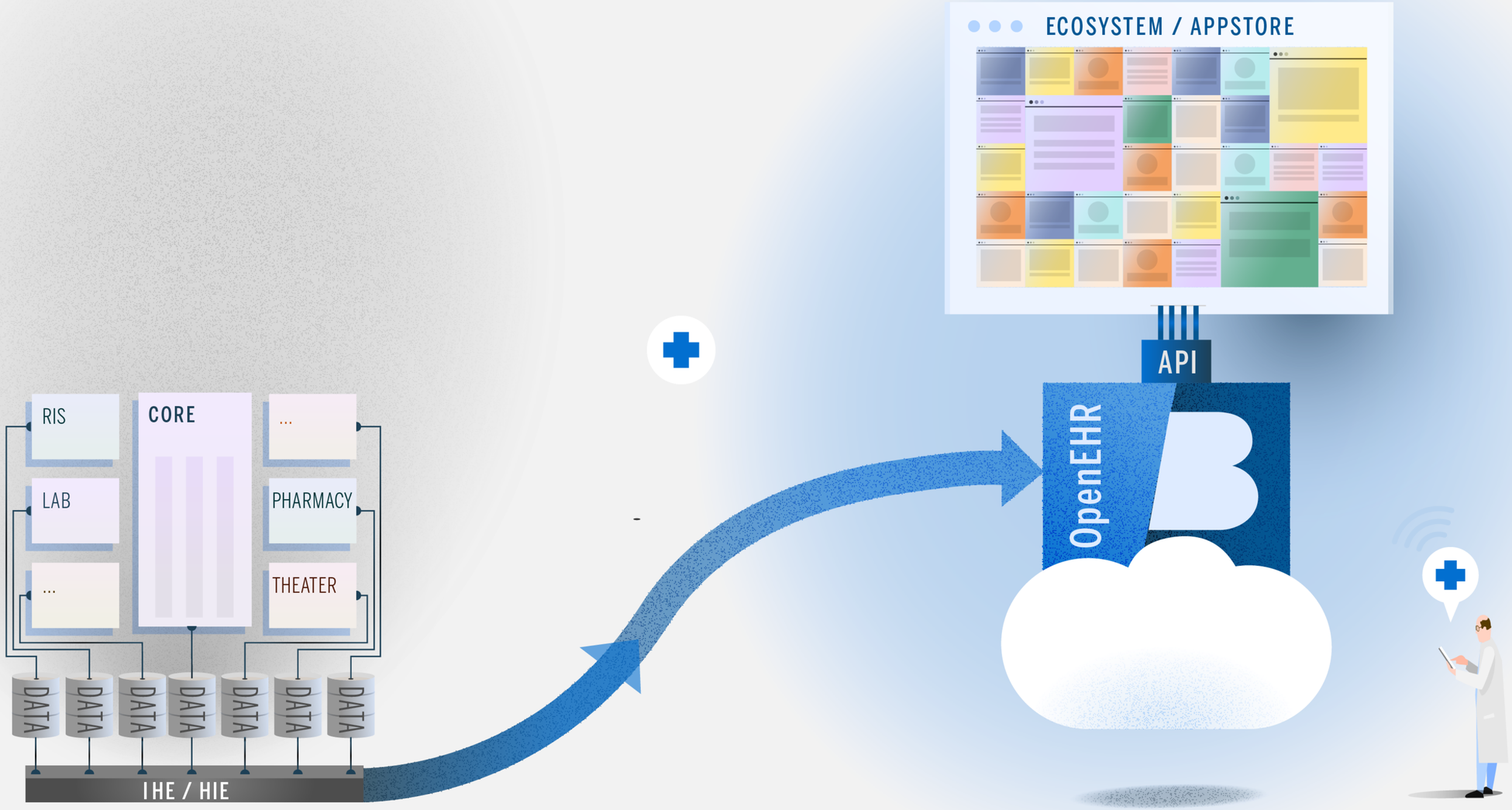

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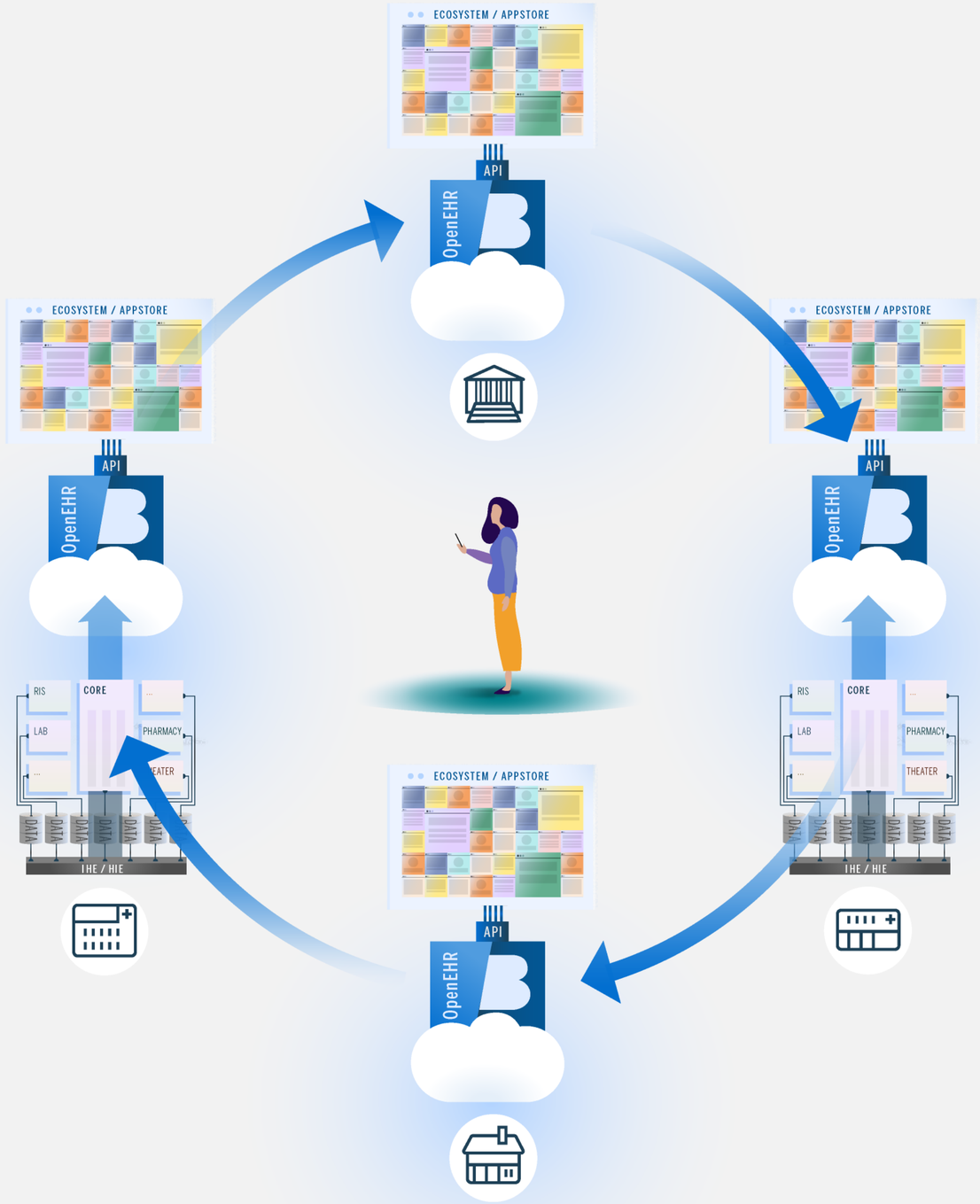
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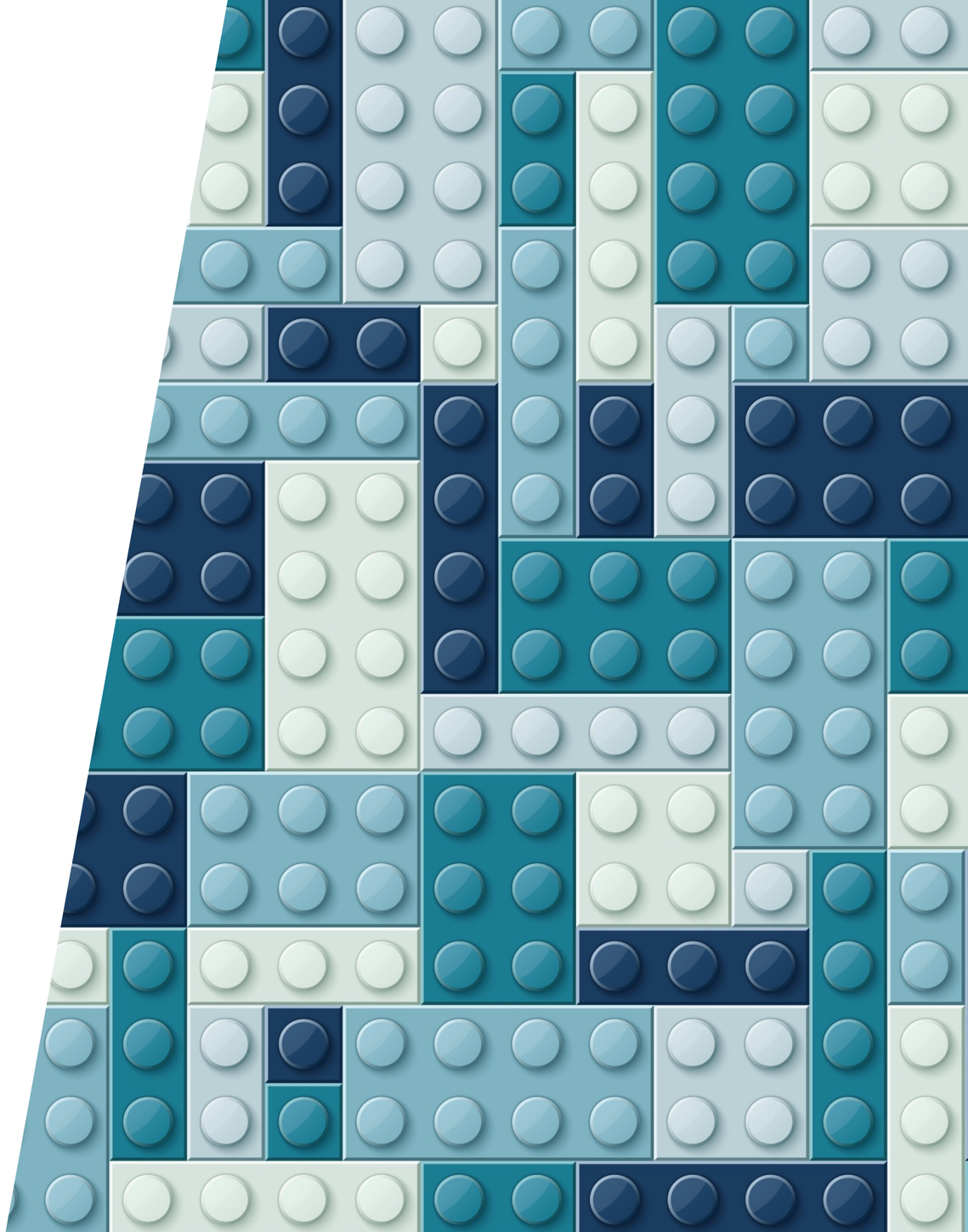
Postmodern

Uses

- **Multi-vendor** components
- New deployment models (hybrid, **cloud**)
- **New technology** (Mobile, Big Data, IoT, In-Memory, Process, Rules, AI)

Enabling

- Improved **usability** and user adoption
- **Agility** and flexibility (less lock-in)
- Cost effectiveness, **differentiation** and **innovation**
- **Standardising data** solves **interoperability!**



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Health data

Each application stores data differently

Hospital app

- Substance
  - Atenolol
- Route
  - oral
- Dose
  - 100mg
- Frequency
  - At 8am

GP app

- Medication Product name and strength
  - Atenolol 100mg tabs
- Dose and timing text
  - 1 tab in the morning

Patient app

- Medicine name
  - Atenolol 100mg tabs
- Dosage
  - 1 tab
- Frequency
  - at 8am

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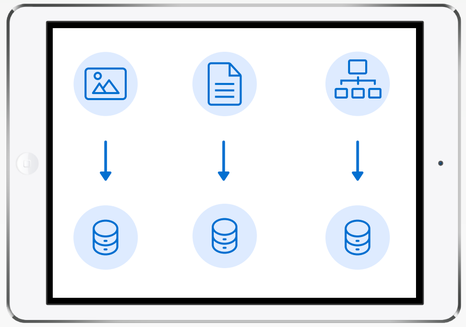
Health Data

Past: vendor dependent, proprietary data

Application A



Application B

Application C

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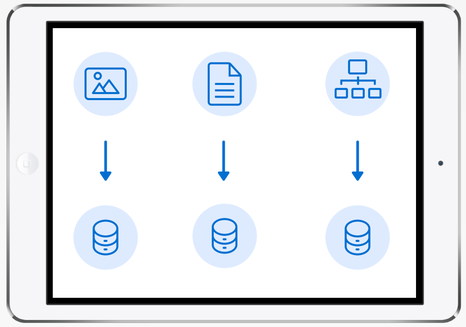
Health Data

Past: vendor dependent, proprietary data

Application A



Application B

Application C

Data migration

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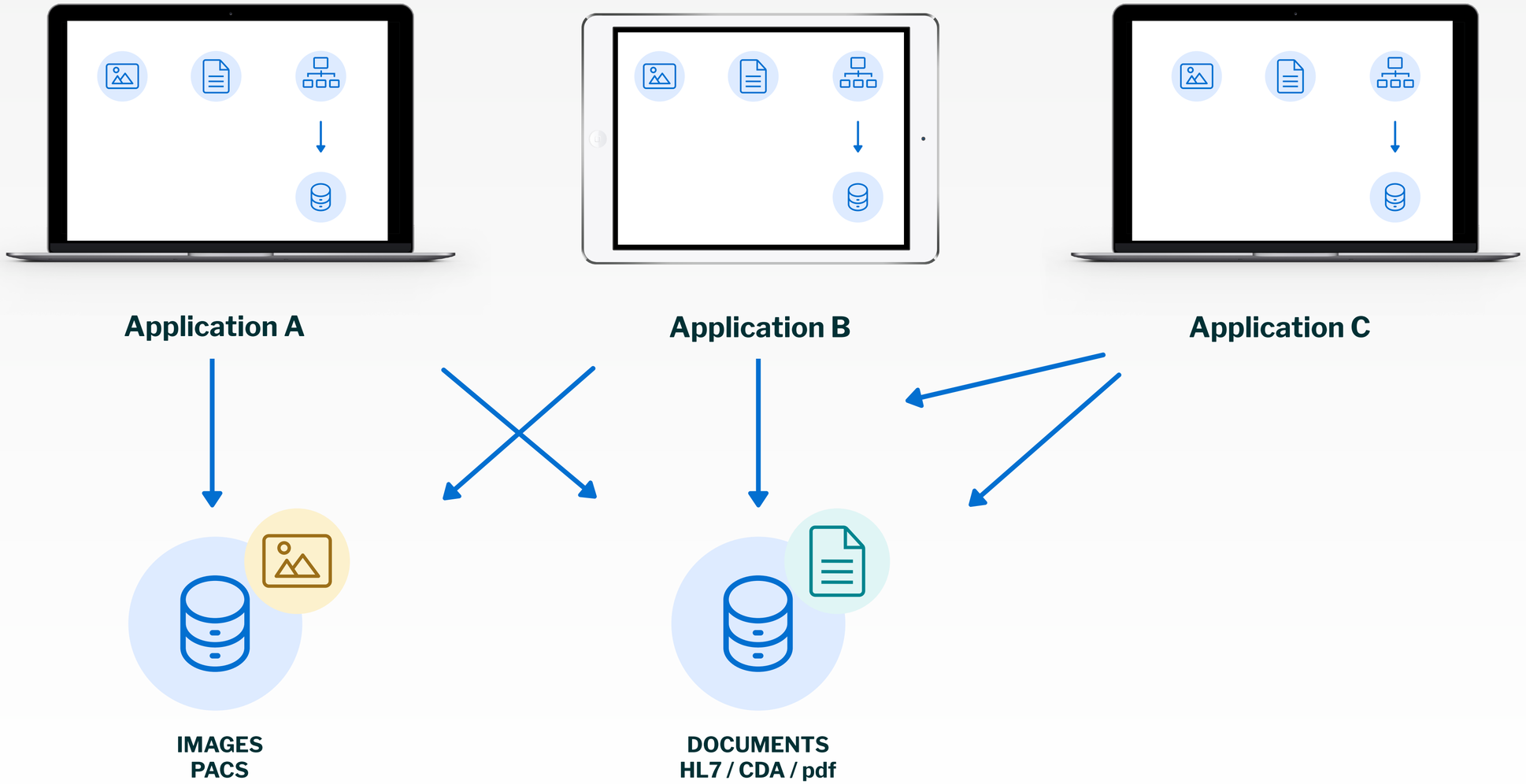
Health Data

Present : solved for images and documents



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Health Data

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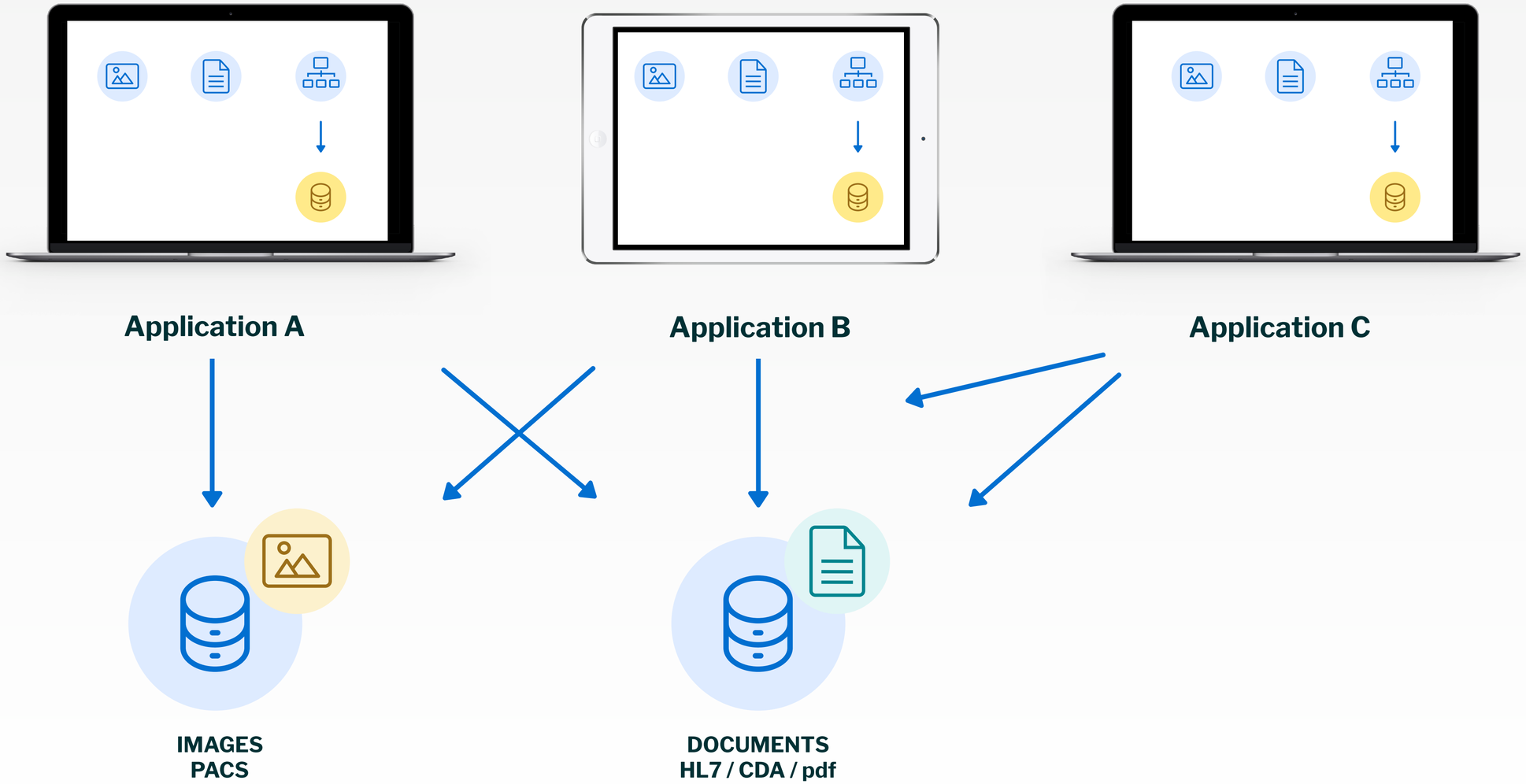

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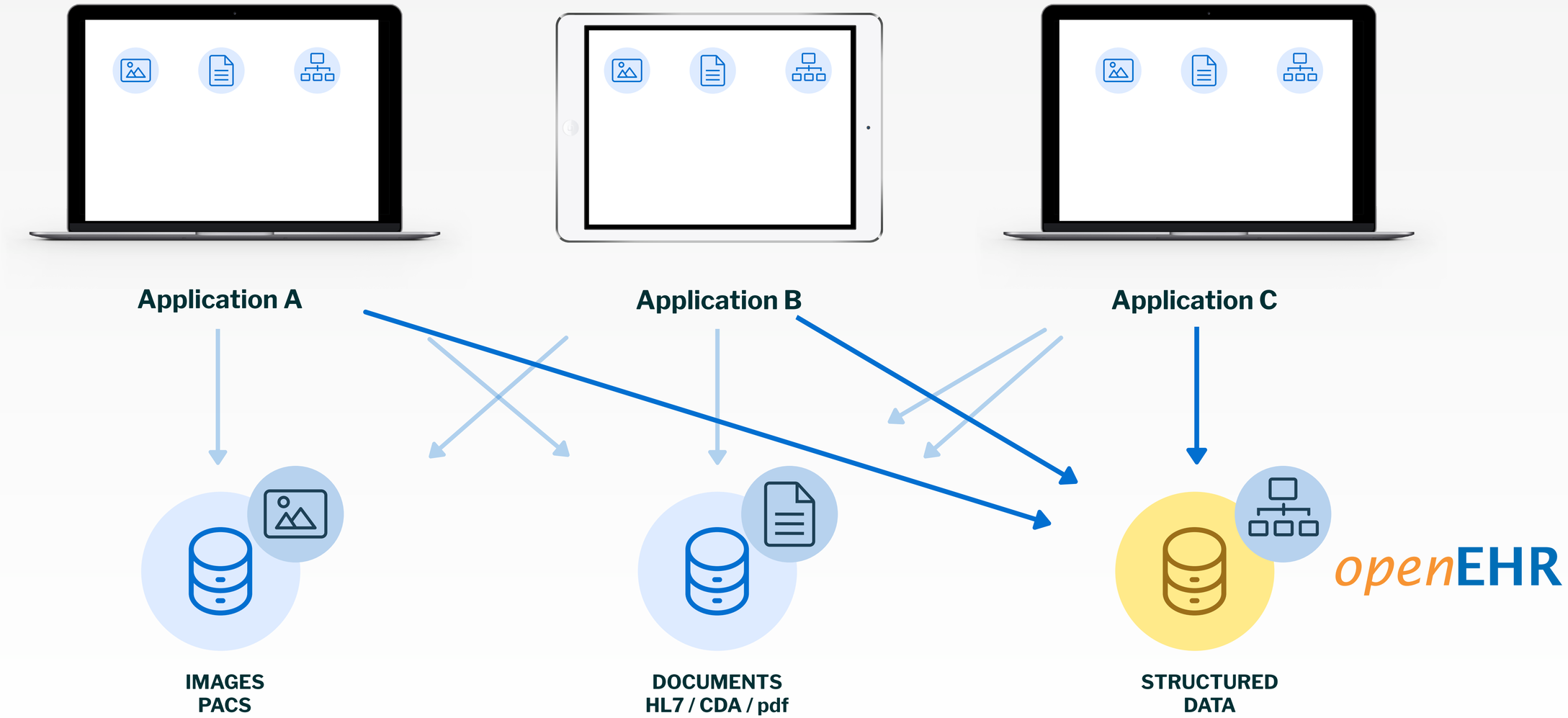
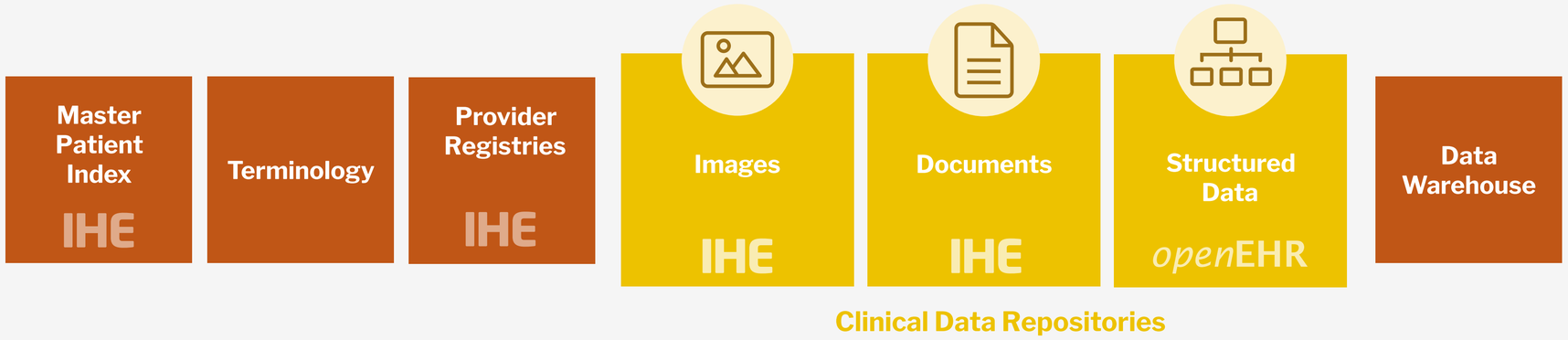
Health Data

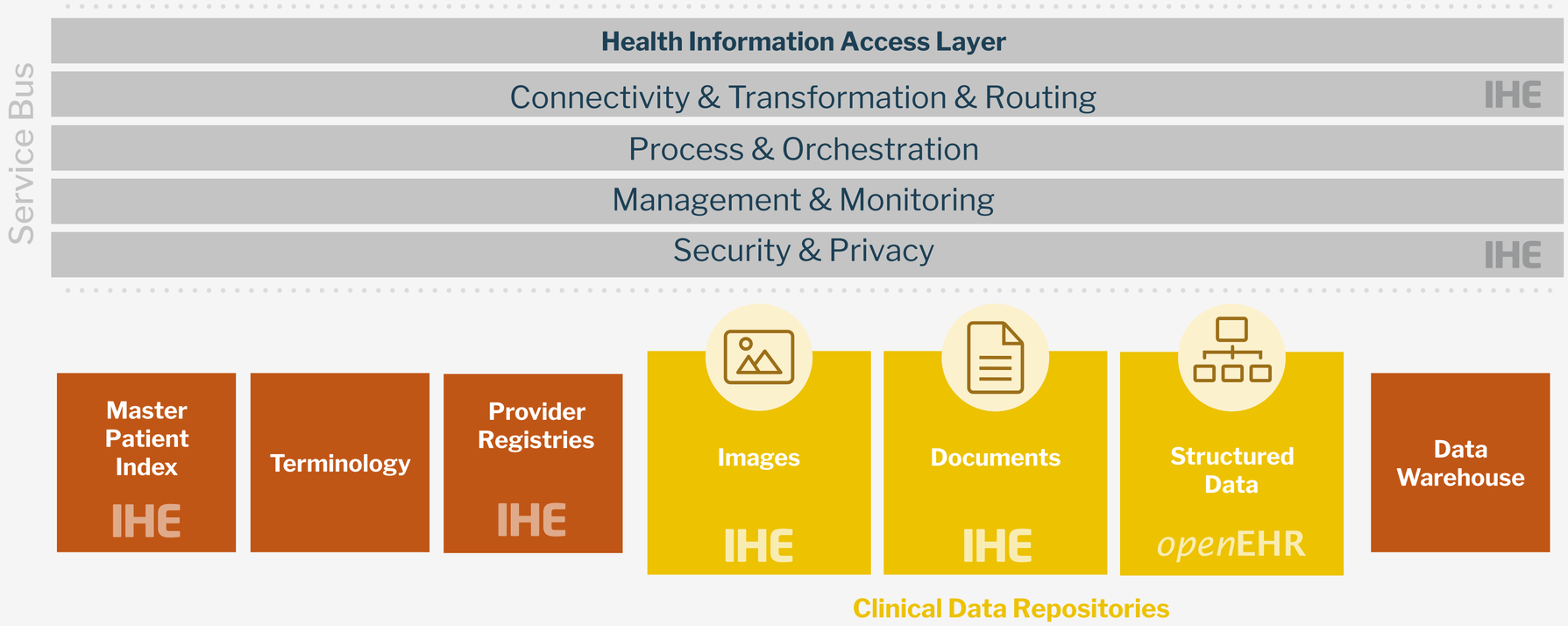
Future: vendor independent, open data



Open Architecture



Open Architecture



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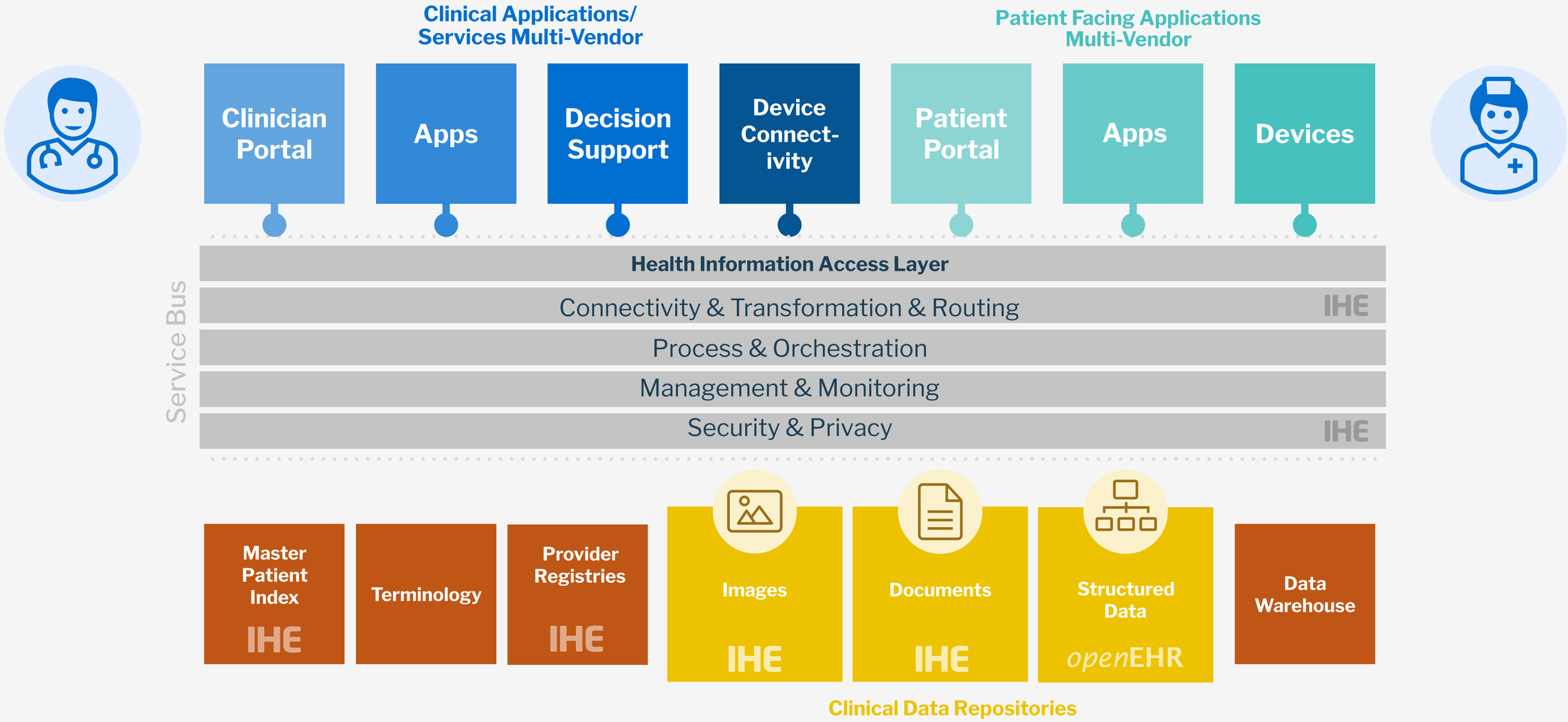
Open Architecture



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Gartner on open architecture

Gartner believes that truly effective and sustainable **open architectures** will need a capability for **vendor-neutral data persistence**, such as utilizing a common schema or set of **archetypes** and rules for managing **structured** and unstructured data (for example, a VNA, **openEHR** or IHE XDS repository). Providing open **messaging** standards (for example, FHIR, HL7) for data exchange in specific use cases will **only go so far** in meeting the architectural **challenges** of digital **citizen-centric** care delivery.

– Gartner Group

Healthcare Provider CIOs Need to Rally Their Enterprise Architects Around Citizen-Centric Care Delivery, 07 February 2017

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An **open**, domain-driven **platform** for developing flexible e-health systems

Separation of **content** and **technology**

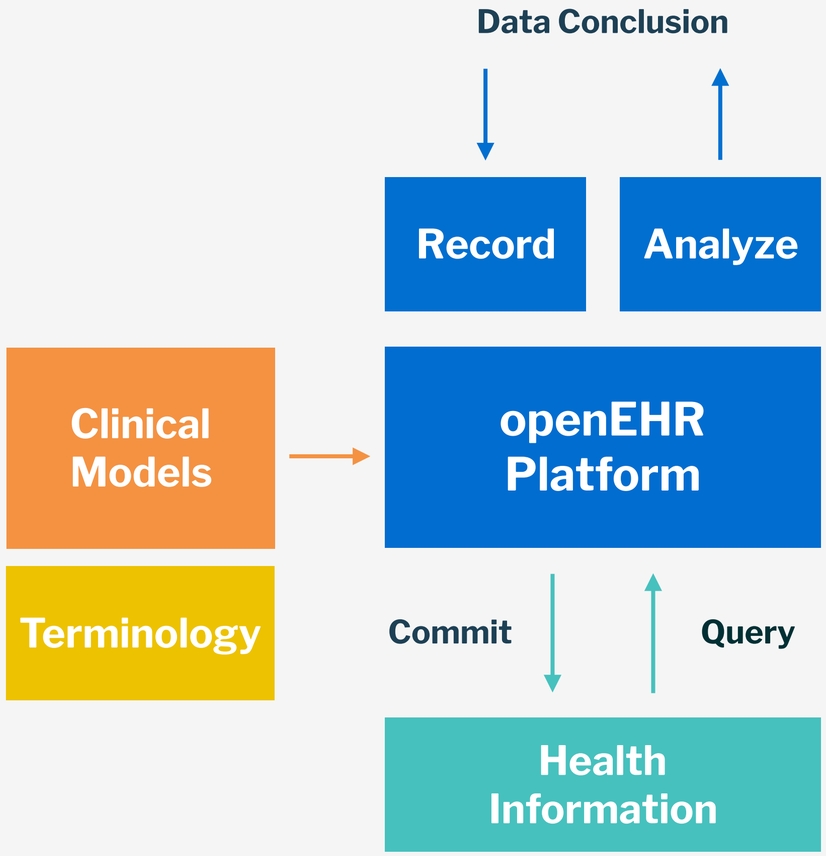
Computable data & terminologies

Two-level **modelling**

- Archetypes – **maximal** data set
- Templates - data set for **use case**

Querying

Multi-lingual



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Content / Technology

HC Professional
Domain knowledge

Domain modellers

Modelling Tool | **Modelling Tool** | **Modelling Tool**

Model Tool Platform

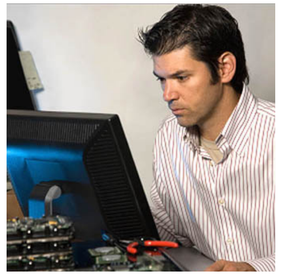
Archetypes
Templates
Ref-sets

Governance Tools

Model Repository

Operational templates

Software vendor
Technical knowledge



Software developers

App Dev Tool | **App Dev Tool** | **App Dev Tool**

App Development Framework

Programming artefacts

Deploy

APP | **APP** | **APP** | **APP**

Health Care & MGT Services

Health Data Services

Health Computing Platform

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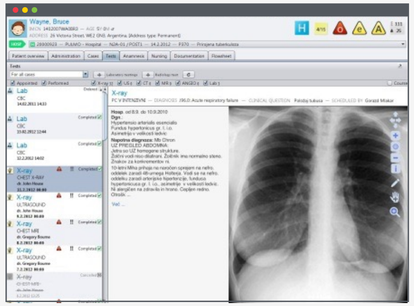
The Clinical Process

Observation
Previous results
Current observations



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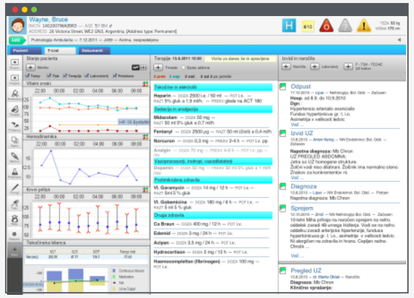
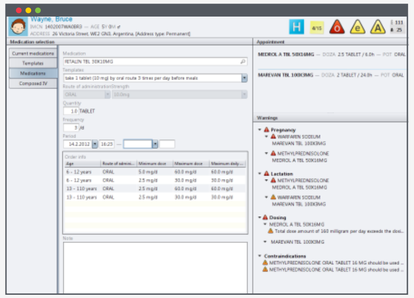


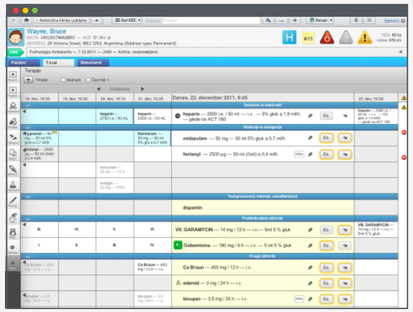
Evaluation
Domain Experts
Domain Knowledge

3



Instruction
Orders

4



Action

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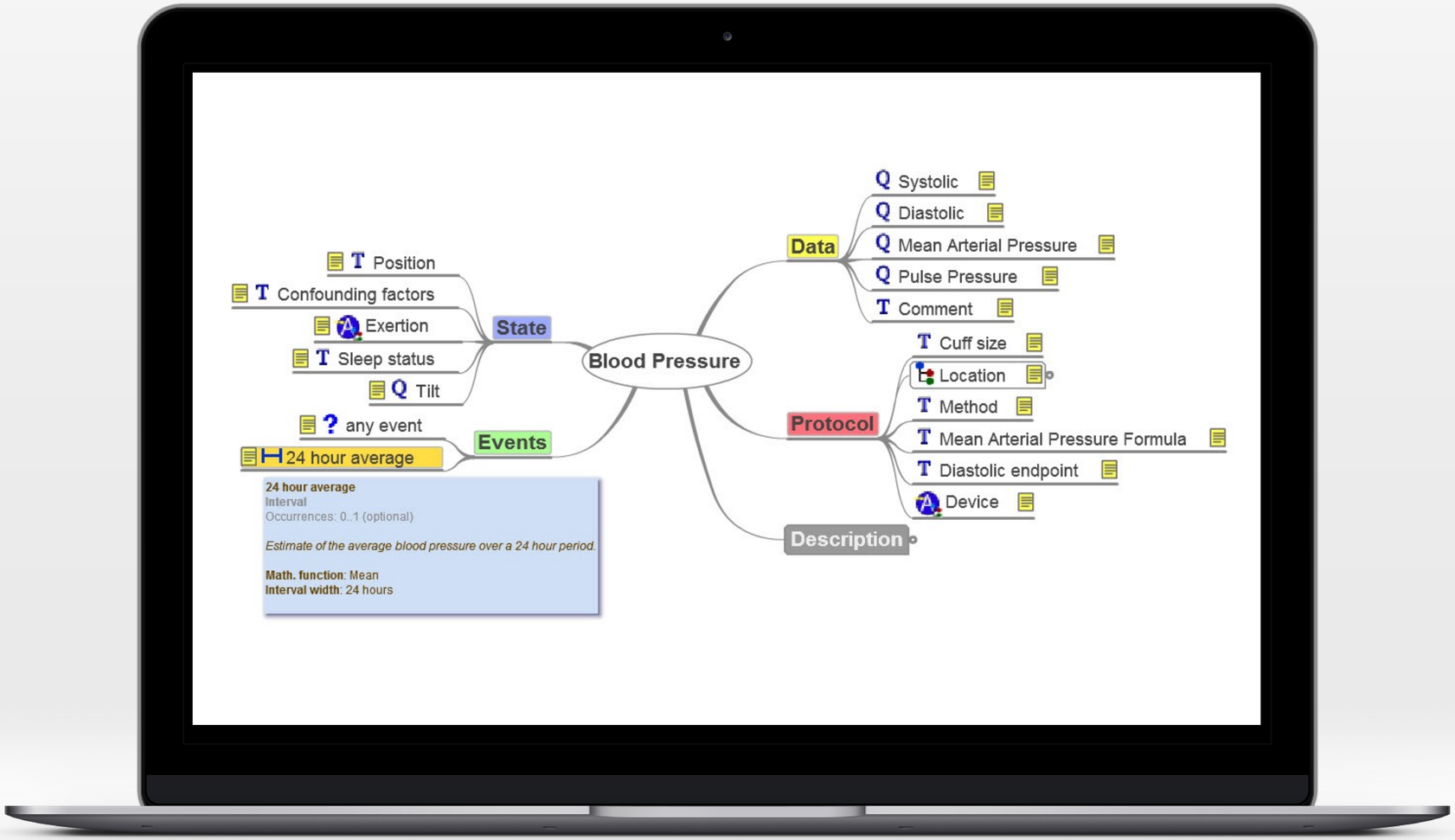
Archetypes: Universal



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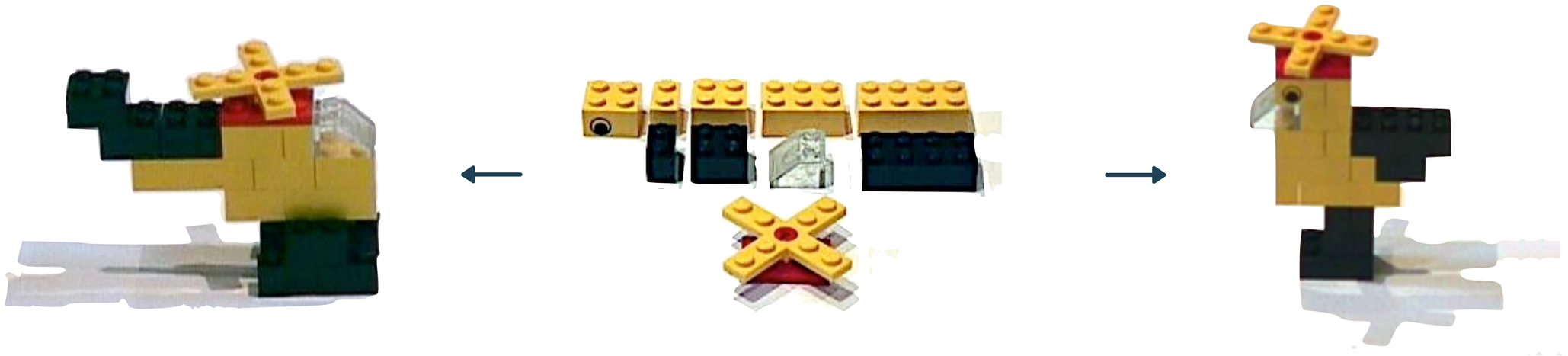
Archetypes: Brick Specifications

Elementary instructions/designs to create meaningful structures



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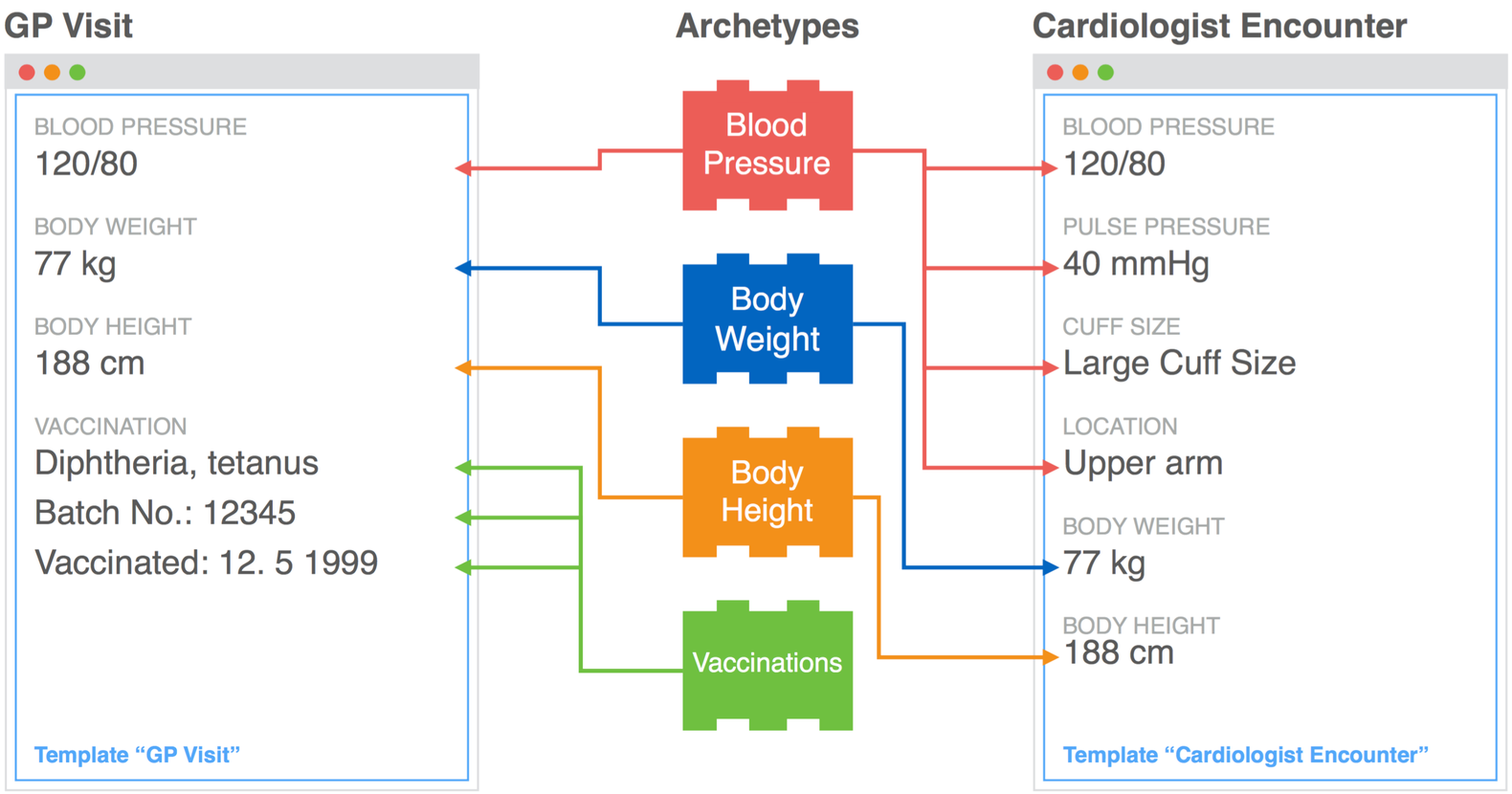
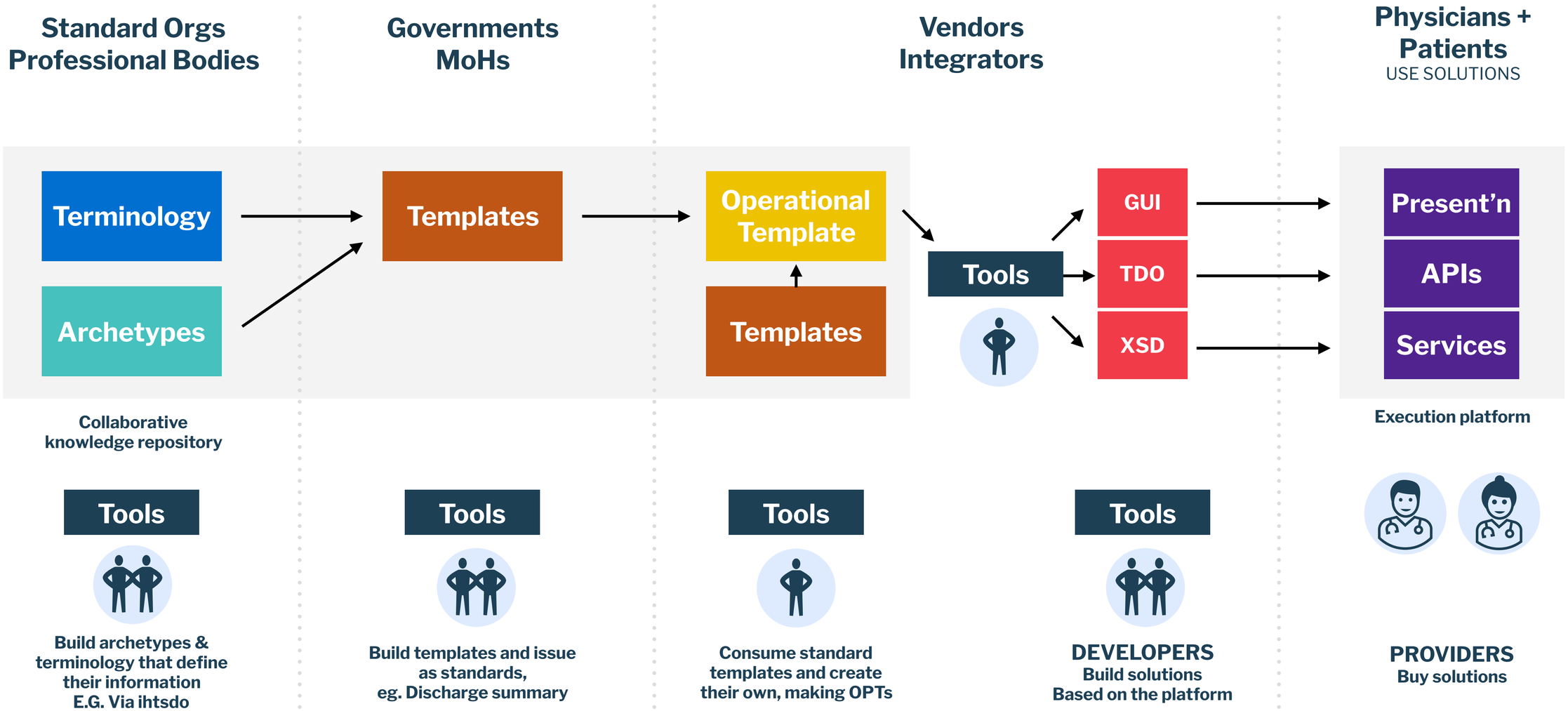
Templates: Use Case Specific

Customize the data model for the form, report or message



openEHR Knowledge Production Environment



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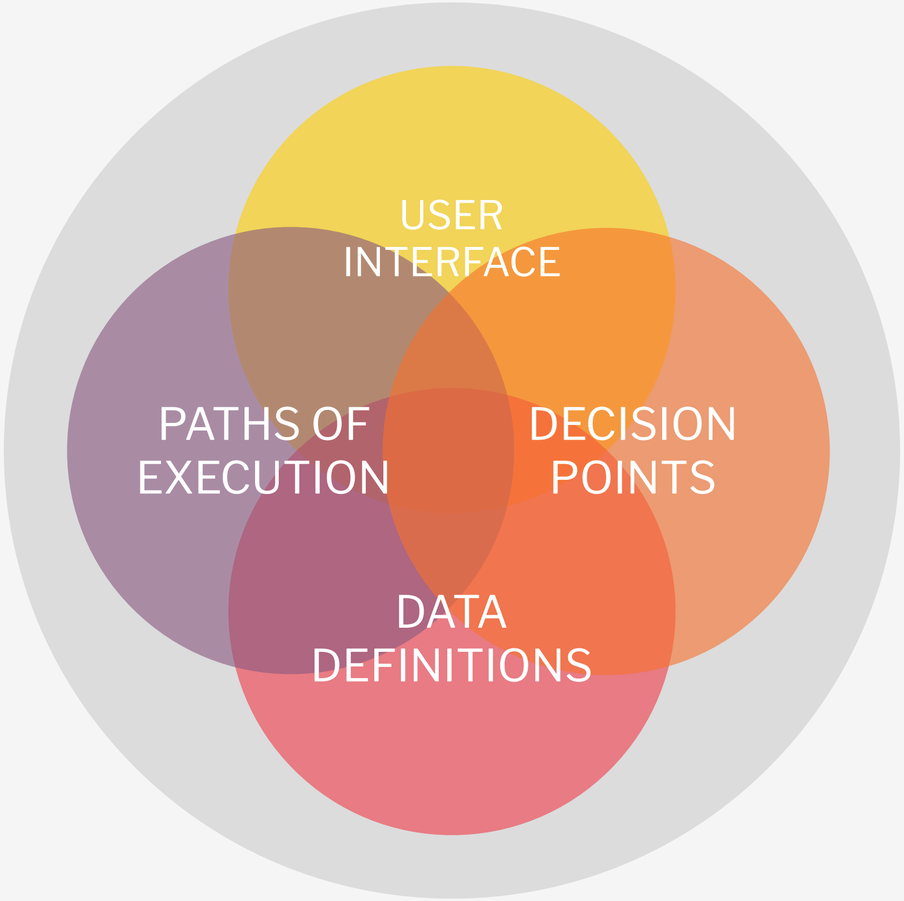
Today's Applications

Programmer Control

No Visibility

Limited Agility

Internal Control Structure



The Internals of an Application

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Next-Gen Applications

Programmer Control

No Visibility

Limited Agility

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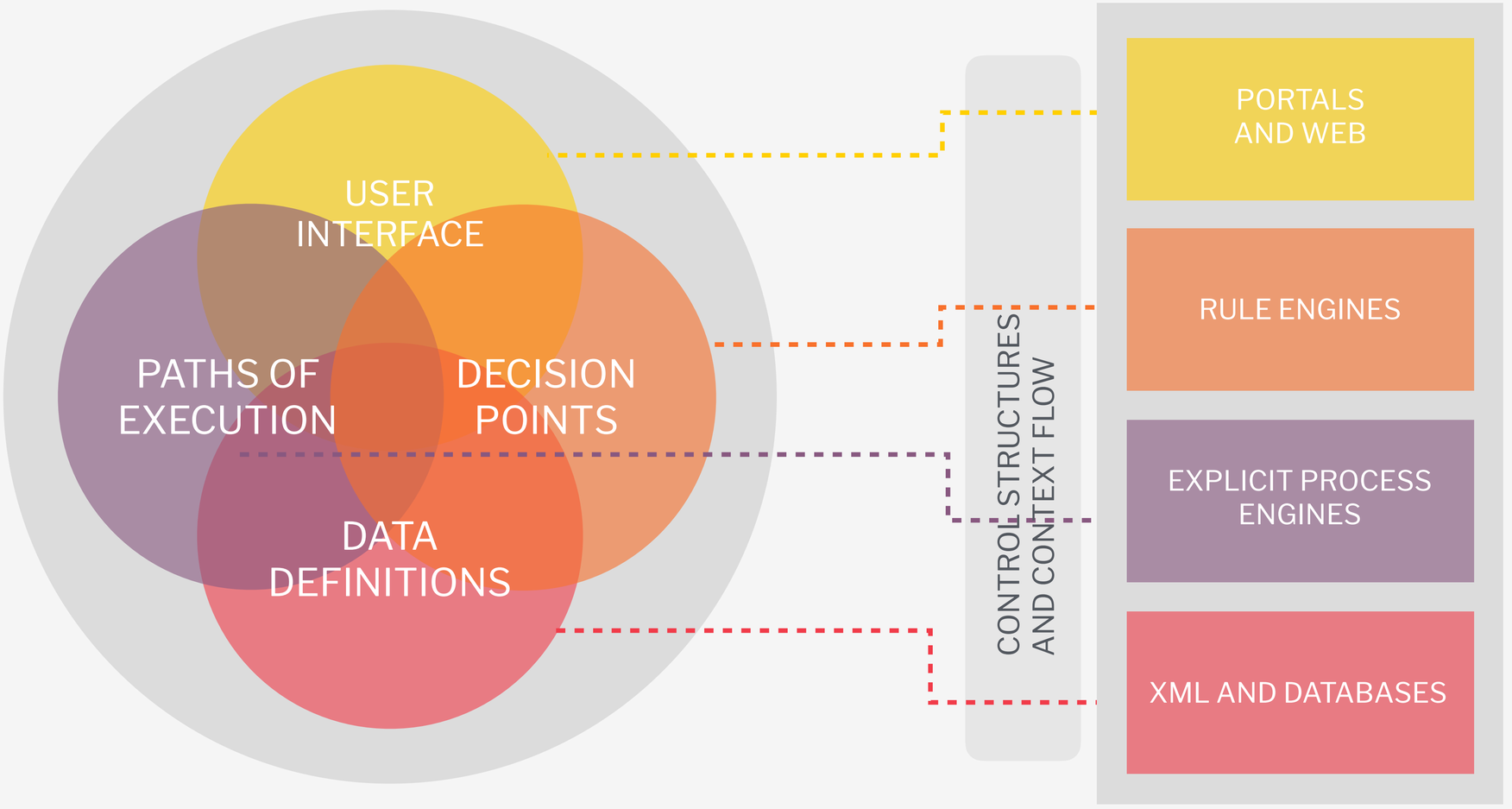

The Internals of an Application

Turning the Application Inside Out

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Next-Gen Applications

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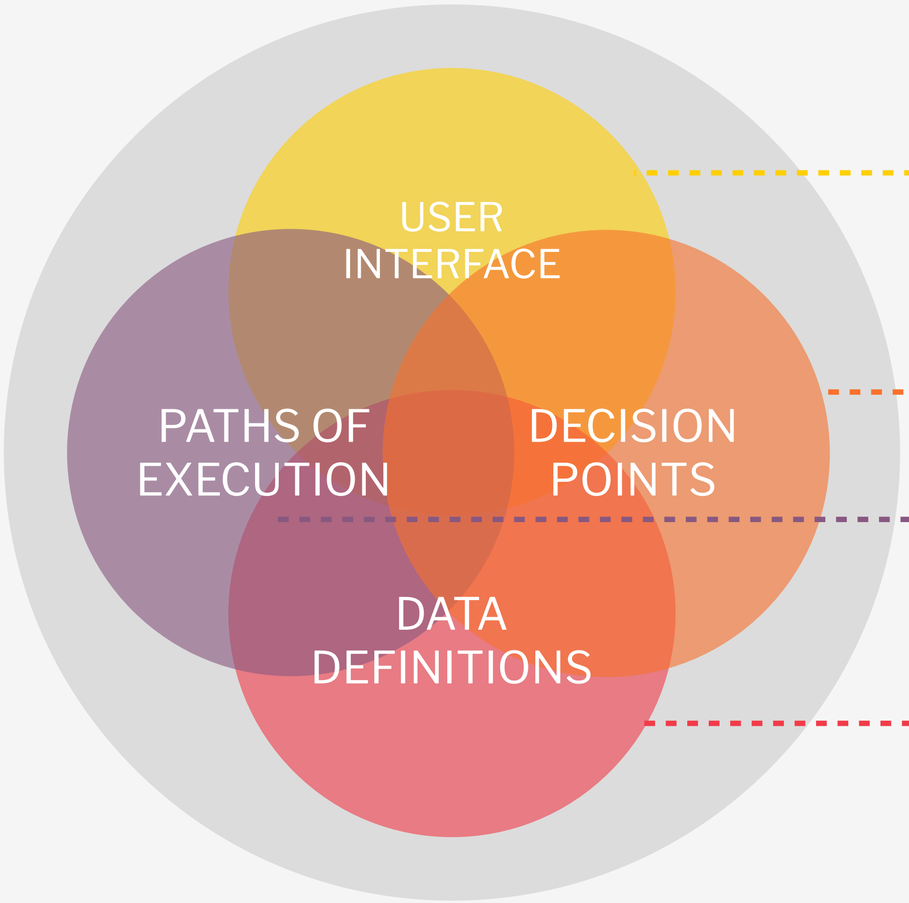

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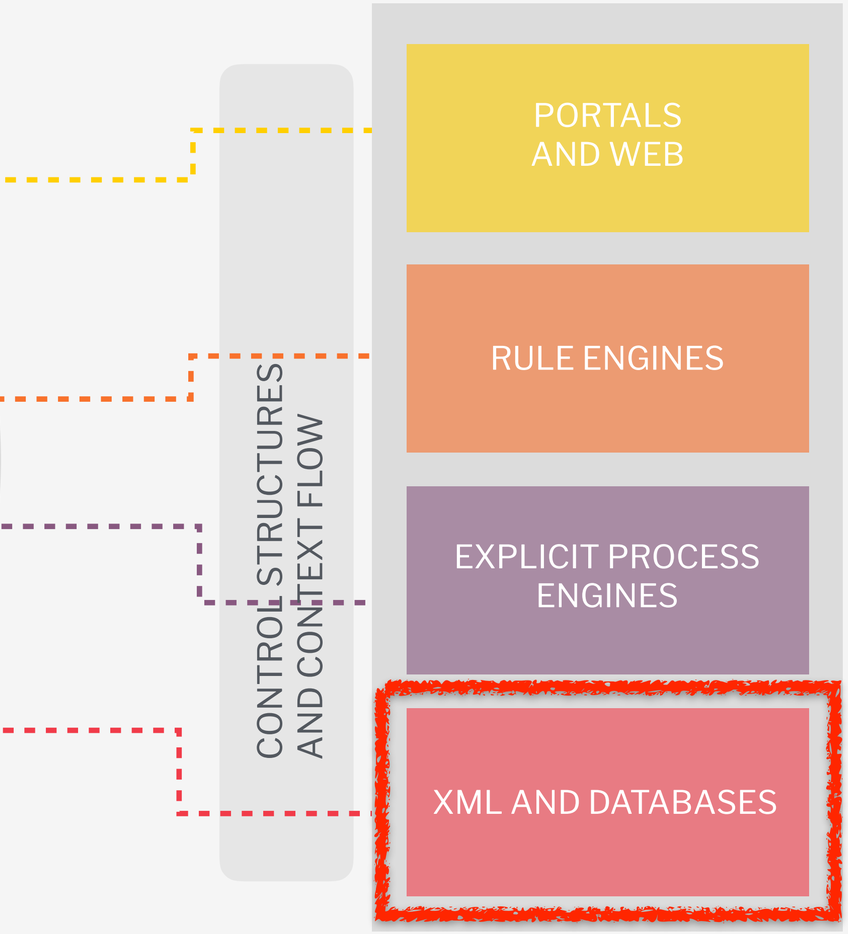

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Turning the Application Inside Out

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Next-Gen Applications

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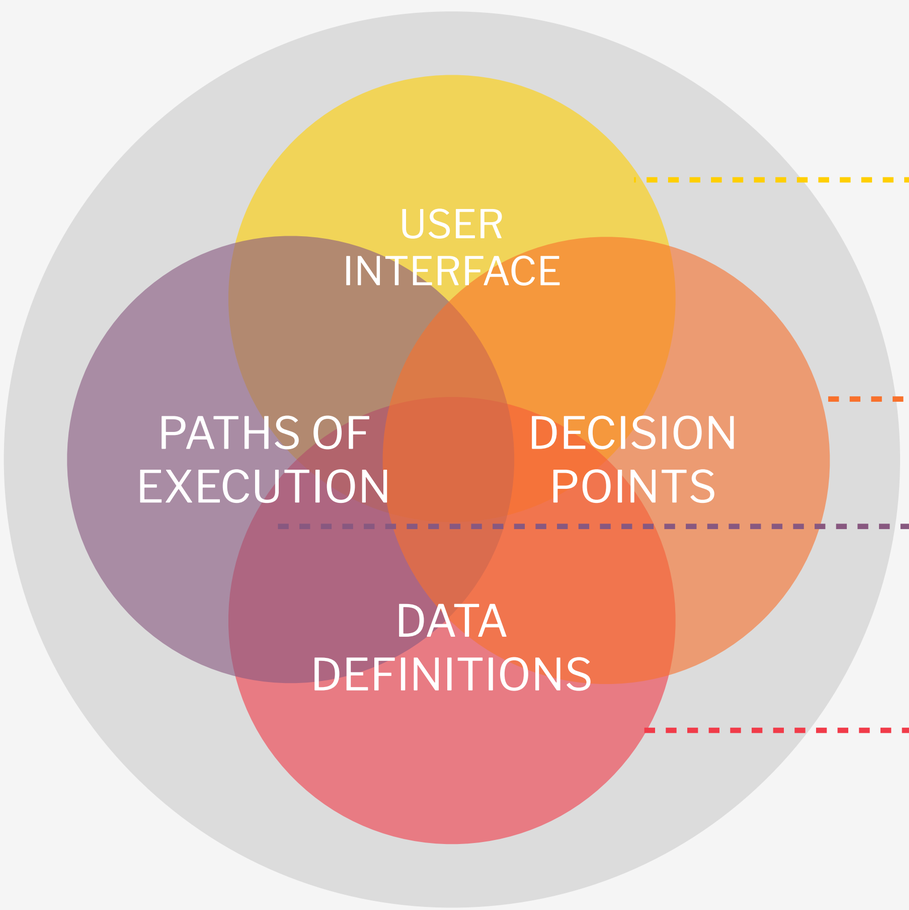

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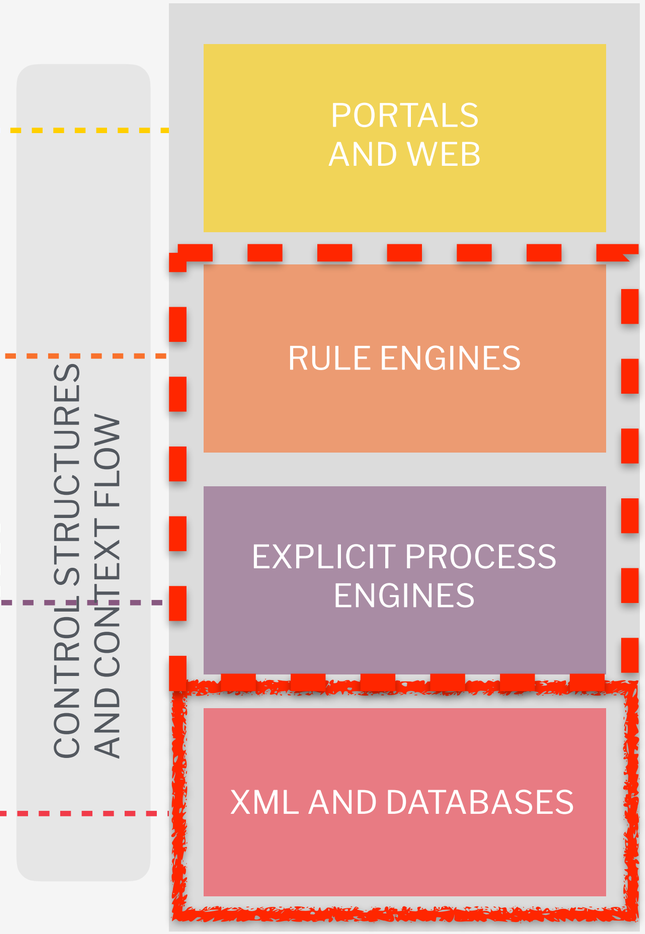

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Turning the Application Inside Out

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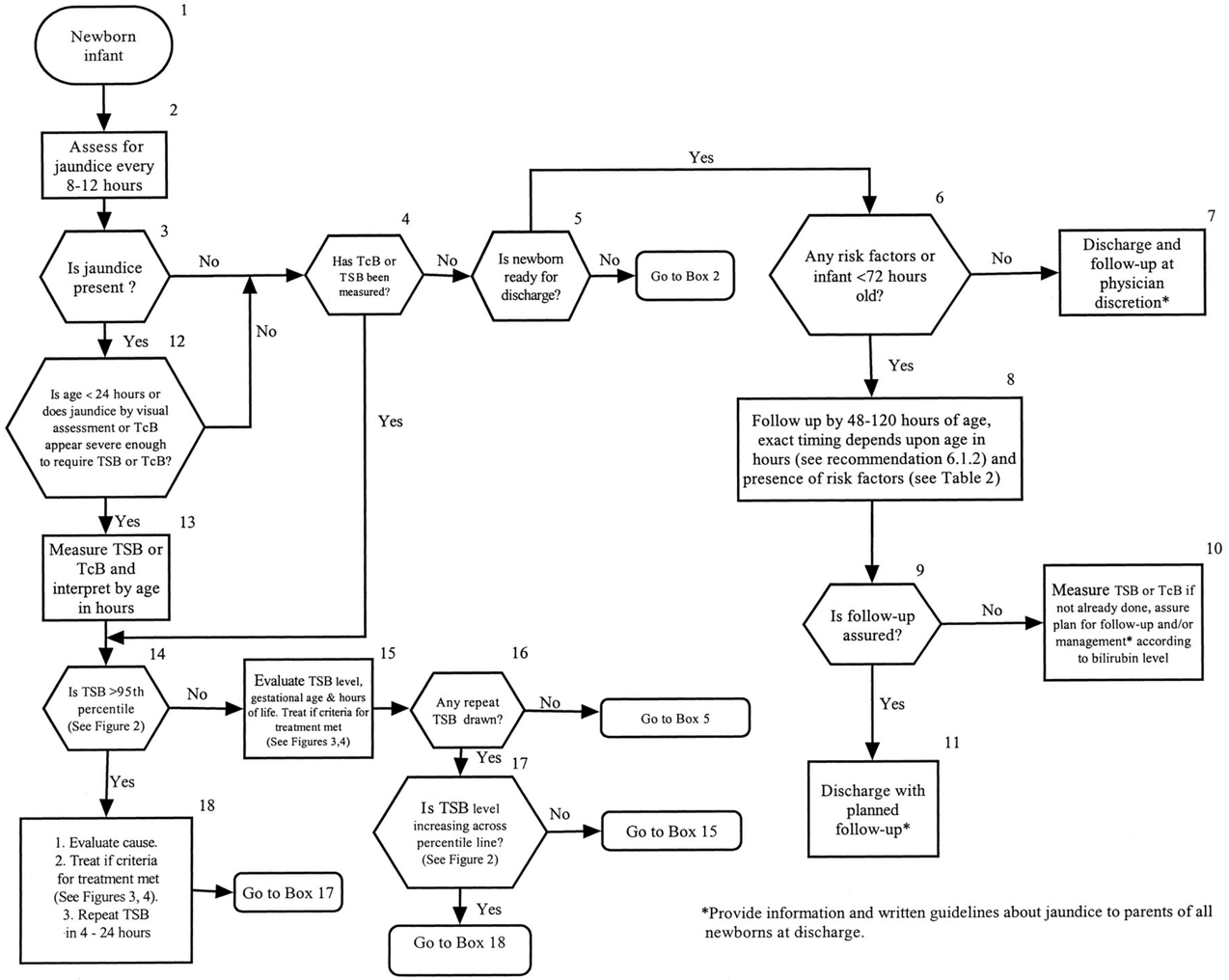
Today



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Future

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- **Semantic coherence** in the application stack (all layers of software know what the data mean)
- A high level of **re-use** of artefacts A single, **stable reference model** for sharing clinical and related information
- A standardised query language for writing **portable queries**
- A standardised, re-usable way of connecting to **terminology**
- **Next**: Vendor-neutral **clinical workflow**

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Use Cases

openEHR

Global Presence

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Use Case 4 - Chinese Army EHR-S

- Switching technical framework to openEHR since 2018, by Academy of Military Sciences PLA China and ZJU
- Collecting data from over 200 hospitals and 1400 clinics, and provide EHR data services for improving management and medical services

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References

Unimed

MALTA MINISTRY OF HEALTH

tieto

UniversitätsKlinikum Heidelberg

Genomics england

Region Östergötland

inpeco

CGI

Eurotransplant

ihu STRASBOURG

MOSCOW CITY

Pasient Sky™

Medtronic

AyalaHealth

Salford Royal NHS
NHS Foundation Trust

openEHR

CDR for governments and eHealth programs

Health data platform for EHR, applications, apps and CDS

ecosystems of healthcare apps and services

CDR for research and clinical decisions support

openEHR

Framework for clinical registries

openEHR

CDR for governments and eHealth programs

Health data platform for EHR, applications, apps and CDS

ecosystems of healthcare apps and services

CDR for research and clinical decisions support

openEHR

Framework for clinical registries

openEHR

MOSCOW CITY City-wide Electronic Health Record

Clinical and analytical infrastructure providing a centralised, vendor-neutral EHR

openEHR

MOSCOW CITY City-wide Electronic Health Record

Clinical and analytical infrastructure providing a centralised, vendor-neutral EHR

Scope

- 428 policlinic institutions
- 76 healthcare centres
- **12 million patients**
- 161 millions visits/year
- 130.000 system users
- 45.000 physicians
- 1B documents, 25 TB of data

Challenges

- **Complex** environment
- Multi-vendor software development
- Vendor **lock-in and risk**
- **Lack** of interoperability

Solutions

- Think!EHR PlatformTM as **clinical data repository**
- Platform APIs for all development
- **openEHR** and **IHE** XDS
- IHE XDS for electronic document sharing

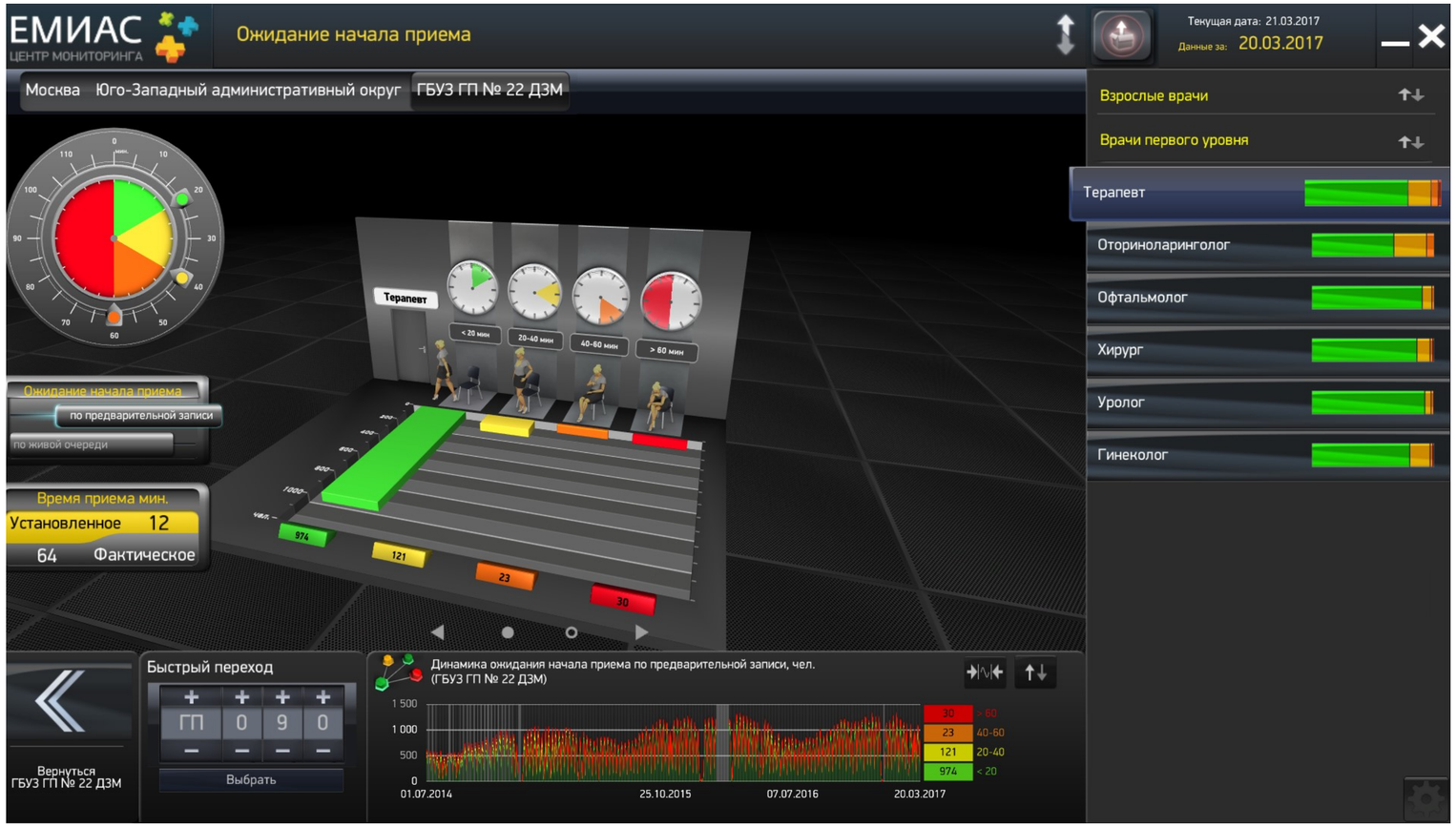
Benefits

- **Common data platform** for all applications
- All clinical data in an **open**, structured format
- Technology and **vendor neutral**, **less lock-in**
- Powerful querying and analytics
- Deployed in a private **cloud**

openEHR


Москва
Взрослые врачи
Терапевт
% 10 20 30 40 50 60 70 80 90 100
Быстрый переход
ГП 0 0 0
Выбрать
Обеспеченность медицинской помощью с временем ожидания, чел
(Москва)
60000
40000
20000
0
28.05.2013
06.11.2013
14.03.2014
20.07.2014
25.11.2014
02.04.2015
160
620 от 4 до 15 дней
1314 от 2 до 3 дней
33213 от 0 до 1 дней

openEHR


ЕМИАС
ЦЕНТР МОНИТОРИНГА
Ожидание начала приема
Текущая дата: 21.03.2017
Данные за: 20.03.2017
Москва
Юго-Западный административный округ
ГБУЗ ГП № 22 ДЗМ
Взрослые врачи
Врачи первого уровня
Терапевт
Оториноларинголог
Офтальмолог
Хирург
Уролог
Гинеколог
Терапевт
< 20 мин
20-40 мин
40-60 мин
> 60 мин
974
121
23
30
Ожидание начала приема
по предварительной записи
по живой очереди
Время приема мин.
Установленное 12
64 Фактическое
Быстрый переход
ГП 0 9 0
Выбрать
Вернуться
ГБУЗ ГП № 22 ДЗМ
Динамика ожидания начала приема по предварительной записи, чел.
(ГБУЗ ГП № 22 ДЗМ)
1 500
1 000
500
0
01.07.2014
25.10.2015
07.07.2016
20.03.2017
30 > 60
23 40-60
121 20-40
974 < 20

openEHR


ЕМИАС
ЦЕНТР МОНИТОРИНГА
Время ожидания к врачам - терапевтам
Текущая дата: 21.03.2017
Данные за: 20.03.2017
Быстрый переход
ГП 0 9 0
Выбрать
Вернуться
ГБУЗ ГП № 22 ДЗМ
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(ГП № 90)
26.06.2014
25.10.2015
07.07.2016
20.03.2017
неудовлетворенный спрос
от 4 до 15 дней
от 2 до 3 дней
от 0 до 1 дней

openEHR

HIMSS Analytics STAGE 6

EMRAM

CHILDREN'S HOSPITAL University Medical Center, Ljubljana, Slovenia

Think!Clinical - Electronic Health Record solution to manage clinical processes and data

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OPENeP

- Medication Reconciliation and Summary
- Inpatient and outpatient ePrescribing
- Medication Administration
- Clinical pharmacist review
- Medication Adherence
- Analytics

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AYALA HEALTH Philippines Primary Care Provider

Centralised and structured vendor-neutral data repository for primary care EHR - 150 clinics

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UNA - NATIONWIDE PROGRAM TO REFORM SOCIAL AND HEALTH CARE ICT ECOSYSTEM Finland

Centralised and structured vendor-neutral data repository to enable implementation of modular ecosystem

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OPEN PLATFORM BASED PERSON HELD RECORD
Leeds City Council, Leeds, UK

Open platform based PHR

openEHR

DIGITALISATION PLATFORM Region Östergötlands Sweden

Digital platform to develop innovative apps and services

openEHR

OPEN PLATFORM BASED HEALTH RECORD

Sardinia, Italy

inpeco

openEHR

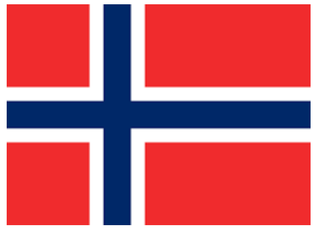
NASJONAL IKT Norway

National level standardisation of clinical information: modelling and data governance

openEHR

NASJONAL IKT
Norway

National level standardisation of clinical information: modelling and data governance



openEHR

- Clinical use in DIPS Arena
- DIPS Arena EHR currently replacing legacy system in 3 of 4 regions
- 4th region currently in procurement
- Several GP system vendors are implementing openEHR
- Clinical registries are looking at harmonising information models
- 600 clinicians and health informaticians
- all published on arketyper.no

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GENOMICS ENGLAND
100,000 Genomes Project

Centralised and structured vendor-neutral Phenotype data repository

Genomics england

Great Ormond Street Hospital for Children NHS Foundation Trust

University College London Hospitals NHS Foundation Trust

Moorfields Eye Hospital NHS Foundation Trust

Royal Free London NHS Foundation Trust

London North West Healthcare NHS Trust

Barts Health NHS Trust

openEHR

HiGHmed - PLATFORM FOR INTEGRATING DATA FOR RESEARCH Germany

generic and scalable platform architecture for integrating data from care, research, and external sources to facilitate the development of new solutions for medical data analytics

openEHR

HiGHmed Consortium

UniversitätsKlinikum Heidelberg

Medizinische Hochschule Hannover

UNIVERSITÄTSMEDIZIN GÖTTINGEN : UMG

dkfz. DEUTSCHES KREBSFORSCHUNGSZENTRUM

UKSH UNIVERSITÄTSKLINIKUM Schleswig-Holstein

CHARITÉ UNIVERSITÄTSMEDIZIN BERLIN

Universitätsklinikum Würzburg

UKM Universitätsklinikum Münster

UNIKLINIK KÖLN

HiGHmed Medical Informatics

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

openEHR

Highmed Platform

- **Open Service Models**: all specifications of the APIs are openly accessible to everybody. Specifications include data security and privacy, electronic health record management, and database queries.
- **Open Information Models**: All clinical models (e.g. lab values) are well defined based on established open standards. Data based on these models can be reliably processed and computed in local and distributed environments.
- **Open System Specifications**: All system components and protocols are openly specified using licenses feasible for commercial and non-commercial use. I.e., every component in the system can be replaced by software from multiple vendors or by an open source project.

HiGHmed Medical Informatics

IHE Integrating the Healthcare Enterprise

openEHR

HL7® FHIR®

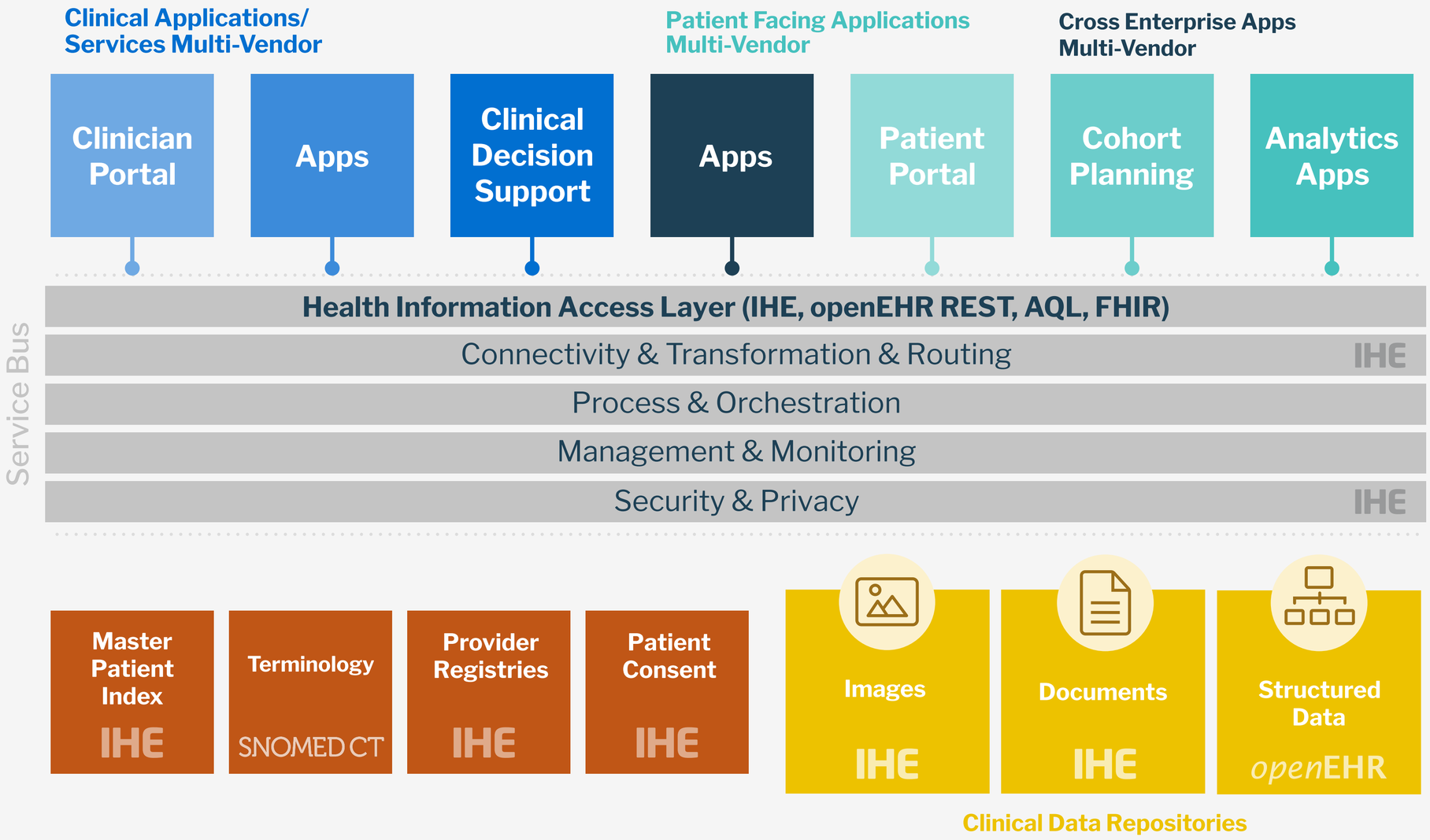
SNOMED CT The global language of healthcare

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

openEHR

HiGHmed Platform



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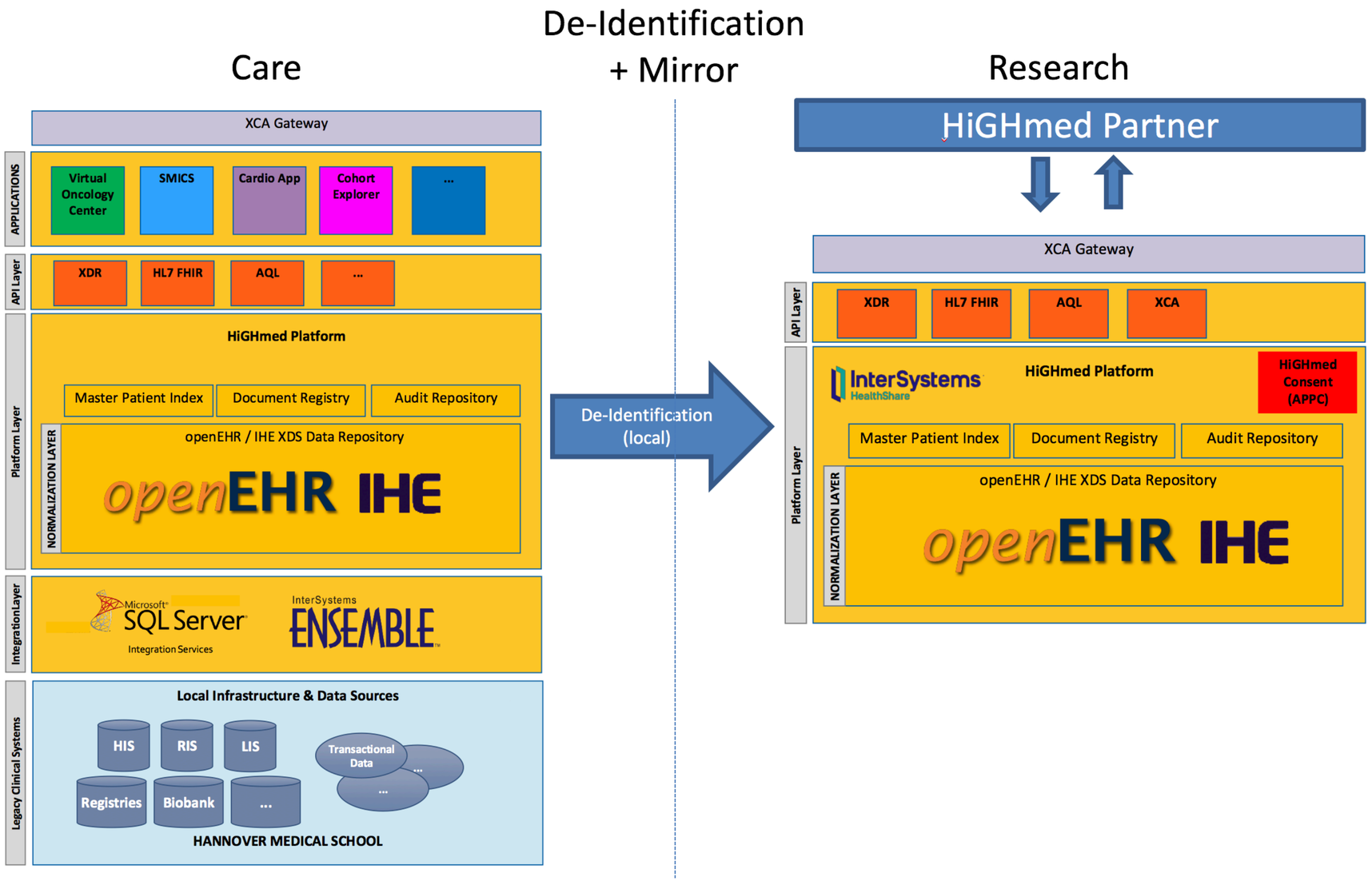
Medic - Hannover (MHH)



HiGHmed
Medical Informatics

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und Forschung

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SALFORD ROYAL NHS FOUNDATION TRUST MANCHESTER 800+ bed acute GDE

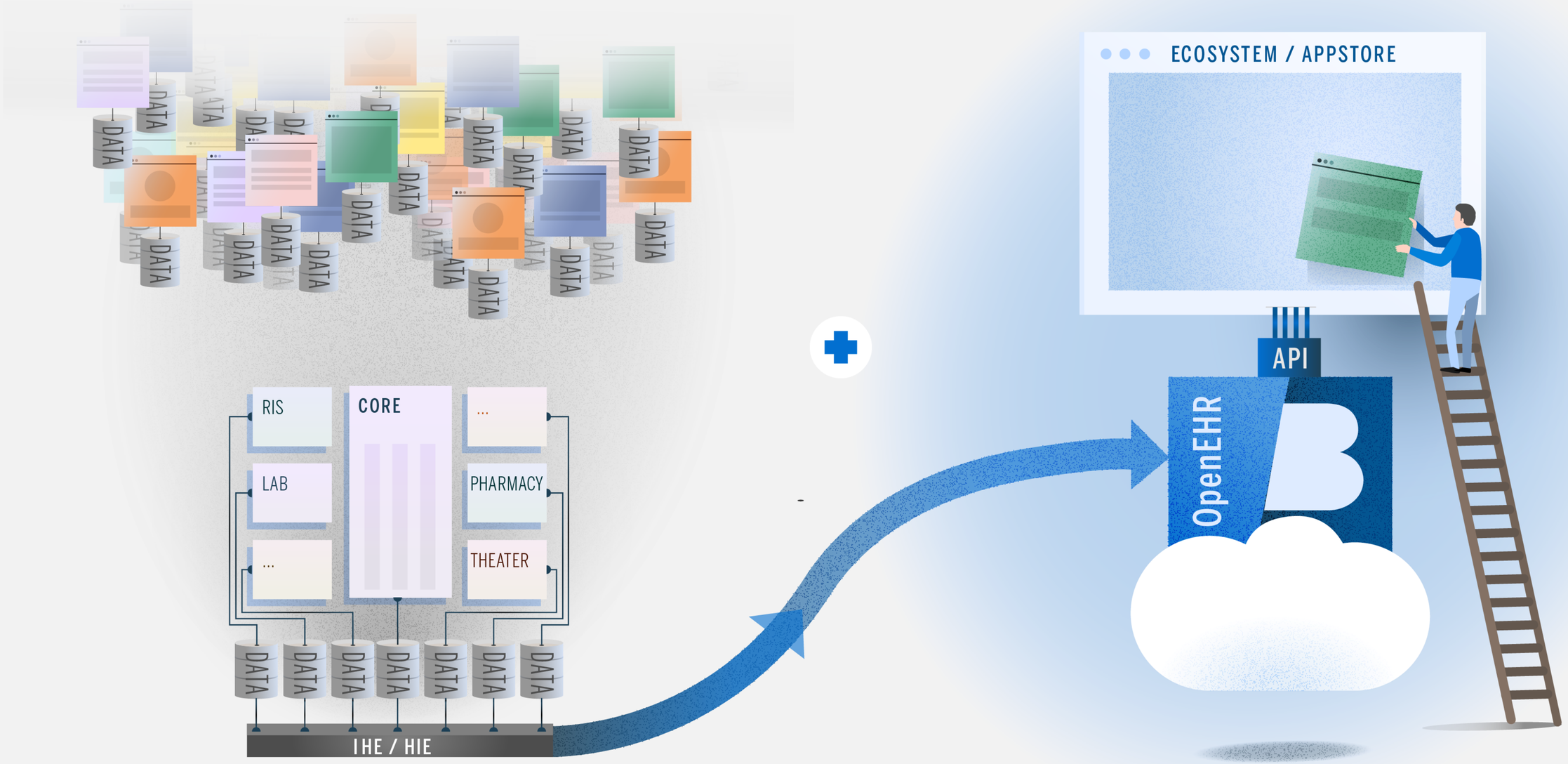
App Ecosystem Platform
to develop innovative apps and services

openEHR

PLYMOUTH HOSPITALS NHS TRUST
1,000+ bed acute trust

OPENeP - An Open Standards Approach to an Integrated Digital Care Record

openEHR


DATA
RIS
CORE
...
LAB
PHARMACY
...
THEATER
IHE / HIE
ECOSYSTEM / APPSTORE
API
OpenEHR

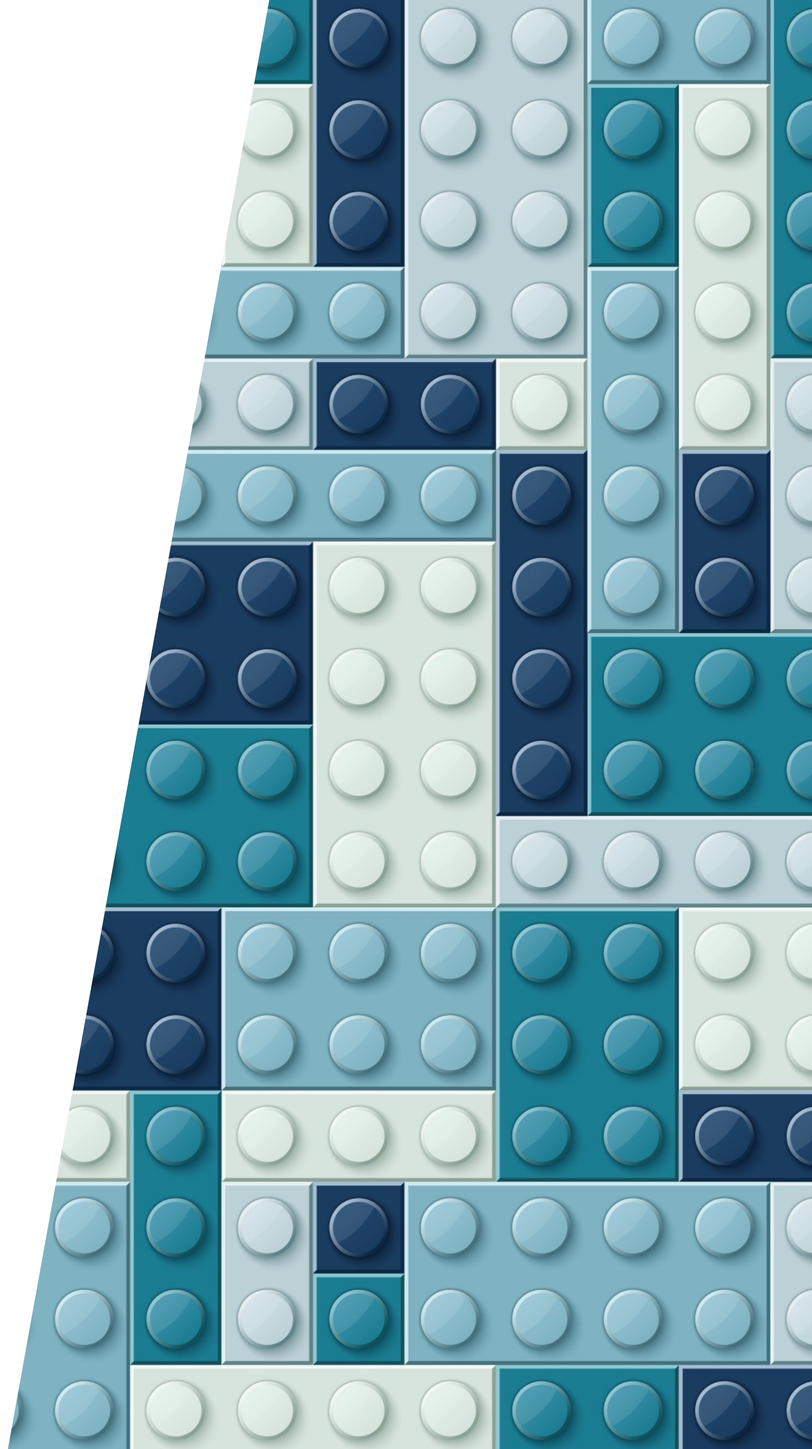
openEHR

Summary

openEHR

Summary

- Healthcare is **changing** and today's monolithic applications can't cope
- ERP went from B-o-B to Megasuite to **Postmodern**
- The same will happen with **healthcare** applications
- The **lifecycle** of applications and data is **different**, so we need to **separate** data from applications
- The future is **multi-vendor** so **vendor-neutral** health **data** is a **key asset**
- **openEHR** provides a **proven platform** to build **new innovative applications**



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Thank You!

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