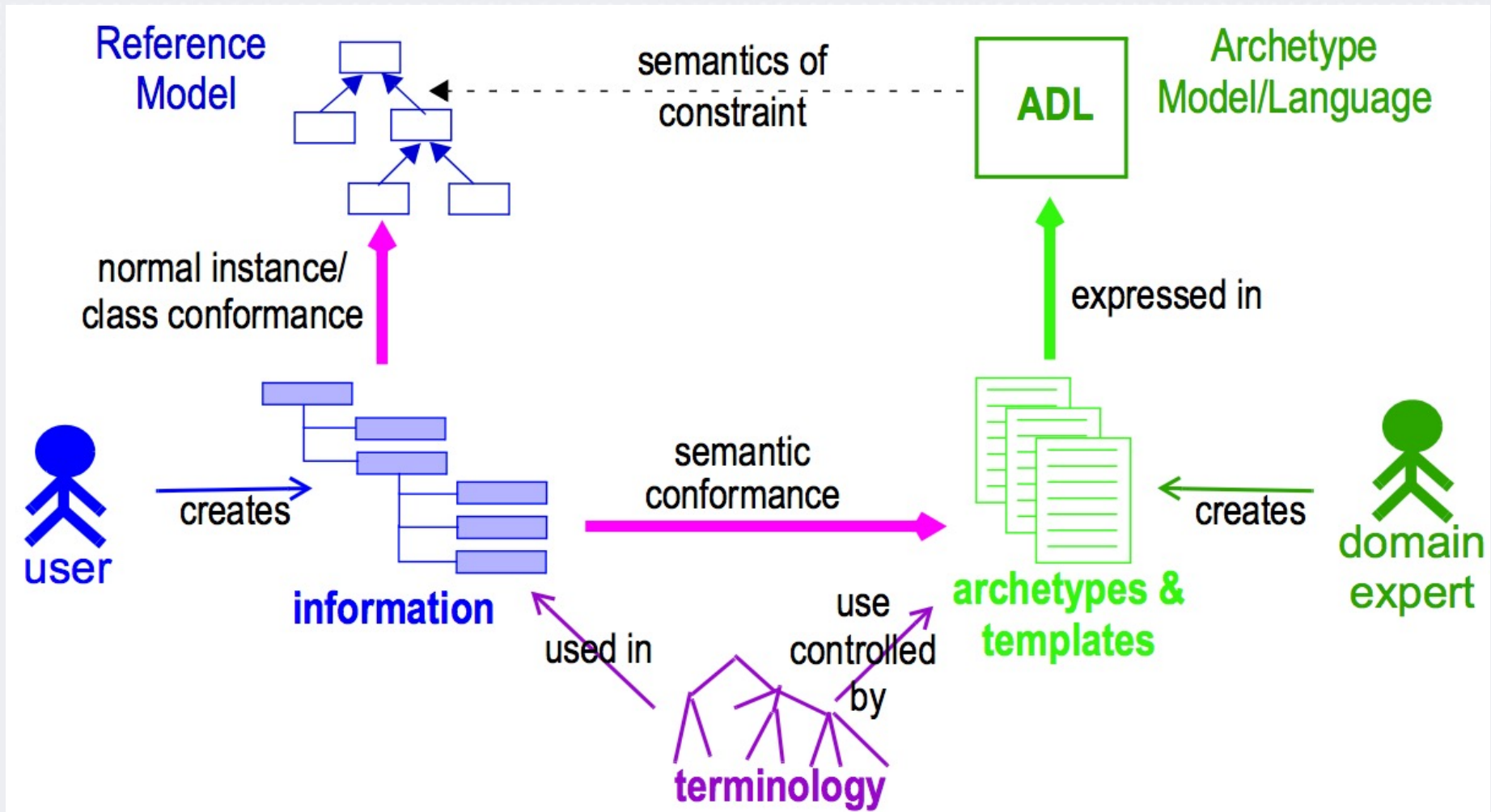# *Open*EHR
Archetype Model

2. Archetype Model

– Clinical in nature (used for representing clinical information)

– Allowing **clinician** and **domain specialists** to be involved in the development of **ontology concepts** (**archetypes**) based on domain constraints

– <u>**Archetype**</u>:

- A machine readable specification for a **single, discrete clinical concept** that is defined as a set of **Constraints** on an information model

- **Archetype key feature** ➔ complete separation of **information models** (such as database schemas) from **domain models**

- Providing a way to formally define **re-usable clinical concepts** and **group of reusable concepts** definitions

- Archetype can be re-used in numerous contexts

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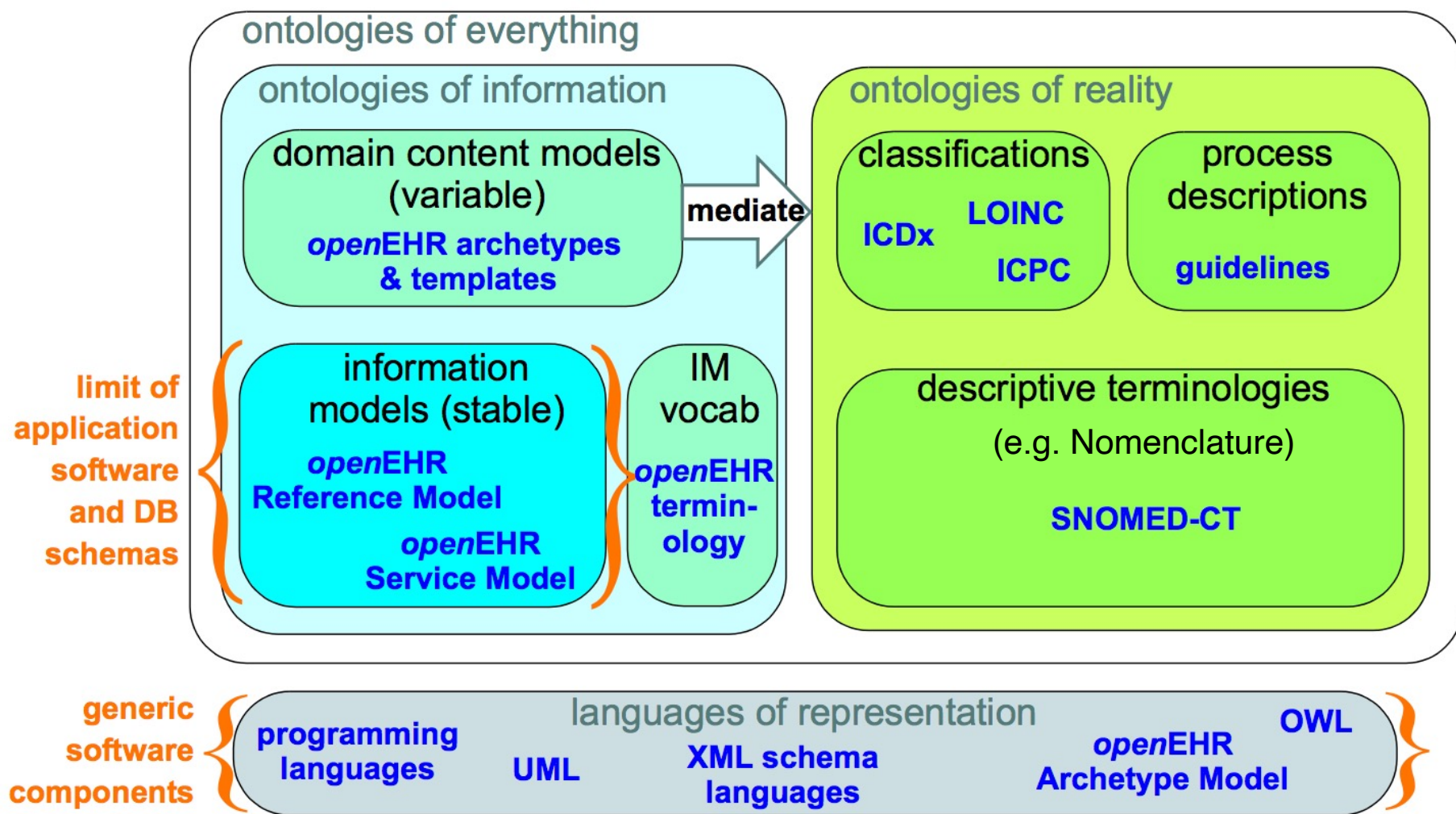
Archetype Meta Architecture

*Open*EHR
Archetype Model

- **Archetypes Functions**
  - Allowing domain experts such as **clinicians** to create a library of data element and group definitions for the data in their information systems
  - Providing runtime validation of data input via GUI or any batch process
  - Providing a basis for semantic querying of data.
- Modelling of clinical concepts using archetypes
  - **Observations** ➔ weight measurement, blood pressure, microbiology results
  - **Reports** ➔ discharge referral
  - **Orders** ➔ prescription
 - **Assessments** ➔ diagnosis

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*open*EHR Archetypes and Ontologies

ontologies of everything

ontologies of information

domain content models (variable)
*open*EHR archetypes & templates

mediate →

ontologies of reality

classifications
ICDx   LOINC   ICPC

process descriptions
guidelines

limit of application software and DB schemas

information models (stable)
*open*EHR Reference Model
*open*EHR Service Model

IM vocab
*open*EHR termin-ology

descriptive terminologies
(e.g. Nomenclature)
SNOMED-CT

generic software components

languages of representation
programming languages   **UML**   **XML schema languages**   *open*EHR Archetype Model   **OWL**

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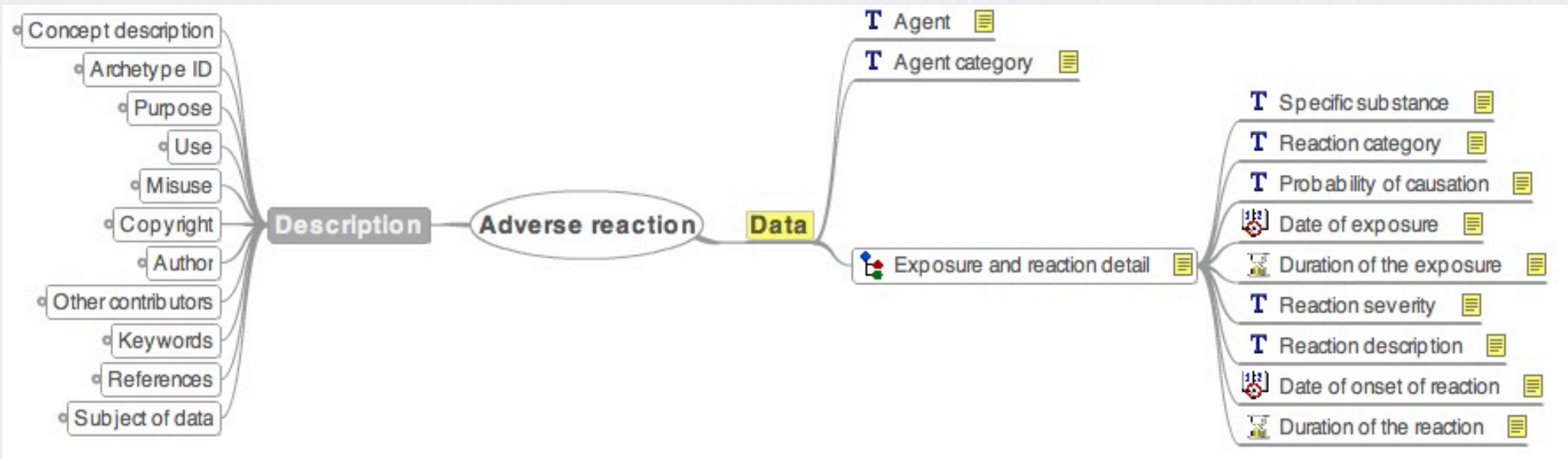
*Open*EHR
Archetype Model: Example

- Archetype example – Blood Pressure concept
  - A set of **constrains** are specified on blood pressure concept as shown in figure below
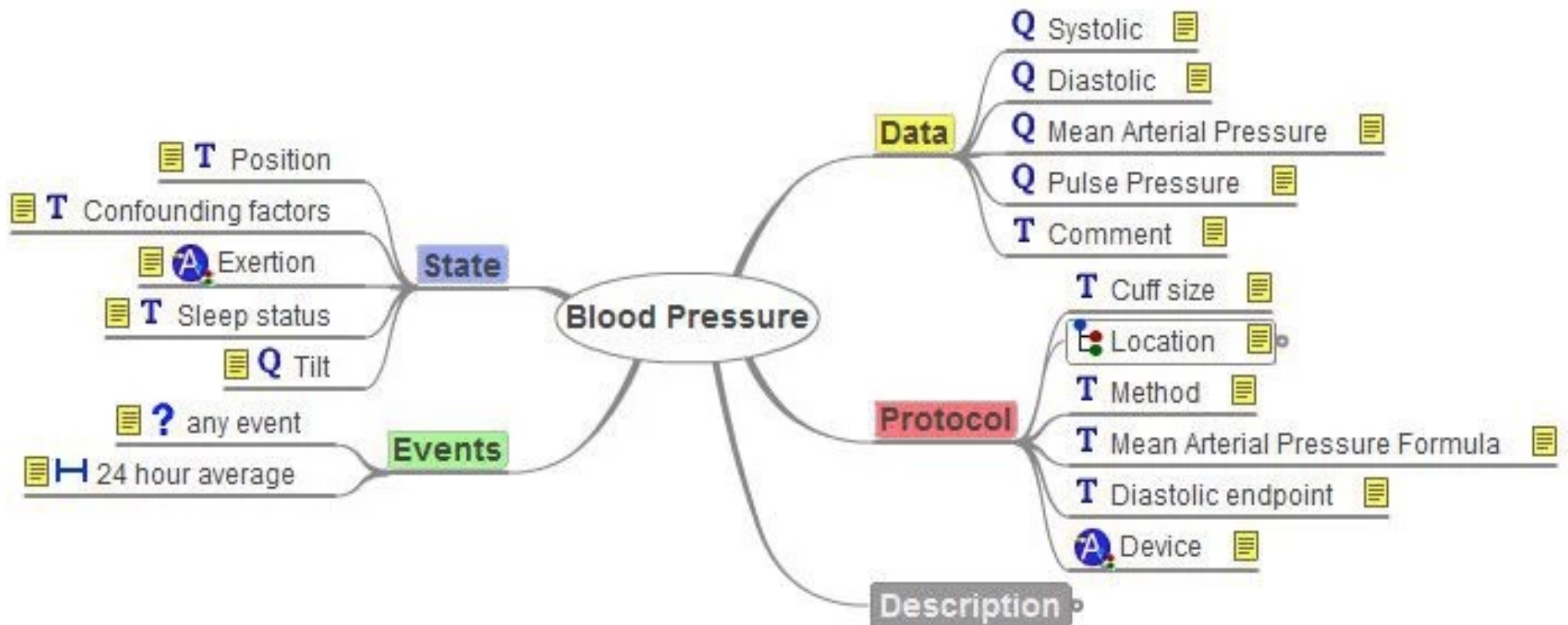
OpenEHR
Archetype Model: Example

T	**Certainty**	Degree of certainty, as assessed by a	Suspected [Possibly the causative
	Coded Text	clinician, that the specific	agent.]
	Occurrences: 0..1	Substance/Agent was the cause of the	Probable [Likely to be the causative
	(optional)	Adverse Reaction.	agent, but not confirmed by testing or
			rechallenge.]
			Confirmed [Confirmed as the
			causative agent, by testing or
			rechallenge.]

*Open*EHR Archetype Model

- Archetype Tools
  - To utilise archetype, you can:
    - Create new archetype (using **Archetype Editor**)
    - Reuse existing archetype (from Clinical Knowledge Manager (CKM))
- Archetype Editor
  - A software tool that facilitates authoring of OpenEHR **clinical and administrative archetypes** in ADL and XML format.
    - ADL ➔ Archetype Definition Language
    - XML ➔ eXtensible Markup Language
    - Download and documentation link:
      - http://www.openehr.org/downloads/archetypeeditor/home

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*Open*EHR
Archetype Editor

*Open*EHR
Archetype Model

- Archetype Template
  - Used to logically represent a **use case-specific data-set**, such as the data items making up the following use cases:
    - Patient discharge summary
    - Radiology report
    - GP referral
  - A template is constructed by referencing relevant items from a number of archetypes
    - Templates are almost always developed for local use by software developers and clinical analysts.
    - Templates are typically defined for **GUI screen forms, message definitions and document definitions**
    - **CKM** ➜ used for creating Archetype template

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*Open*EHR
Clinical Knowledge Manager (CKM))

- CKM is a Web-based system for collaborative development, management and publishing of a wide range of **clinical knowledge resources**

  – It enables the implementation of knowledge governance within and across the health enterprise.

  – Resources include archetypes, templates, term sets, artefact release sets, metadata relating to clinical models and related resources

*Open*EHR
Clinical Knowledge Manager (CKM))

*Open*EHR Service Model

3. Service Model
  - Describes the services provided within an EHR system to support its functions and data for the user (e.g. clinician)

- **Services :**
  - **A. Virtual EHR API**: facilitates users in creating
    - A new EHR artifact (through related archetype),
    - Requesting a part or a complete EHR, and
    - Modifying an existing EHR artifact locally.
  - **B. EHR Service**
    - Provides an API for inserting, accessing, and updating EHR data at server side.
    - Virtual EHR API calls this service for performing the above-mentioned operations on an EHR
  - **C. Archetype Service**
    - Provides an API for connecting to an online archetype repository for accessing archetypes for use and validation in an EHR application.
  - **D. Terminology Service**
    - Provides an API for connecting to all available coding systems, such as ICD, CPT, SNOMED CT, and so on.
  - **E. Demographic Service**
    - Provides an API for accessing, storing, and updating information of entities involved in care.

*open*EHR Package Structure
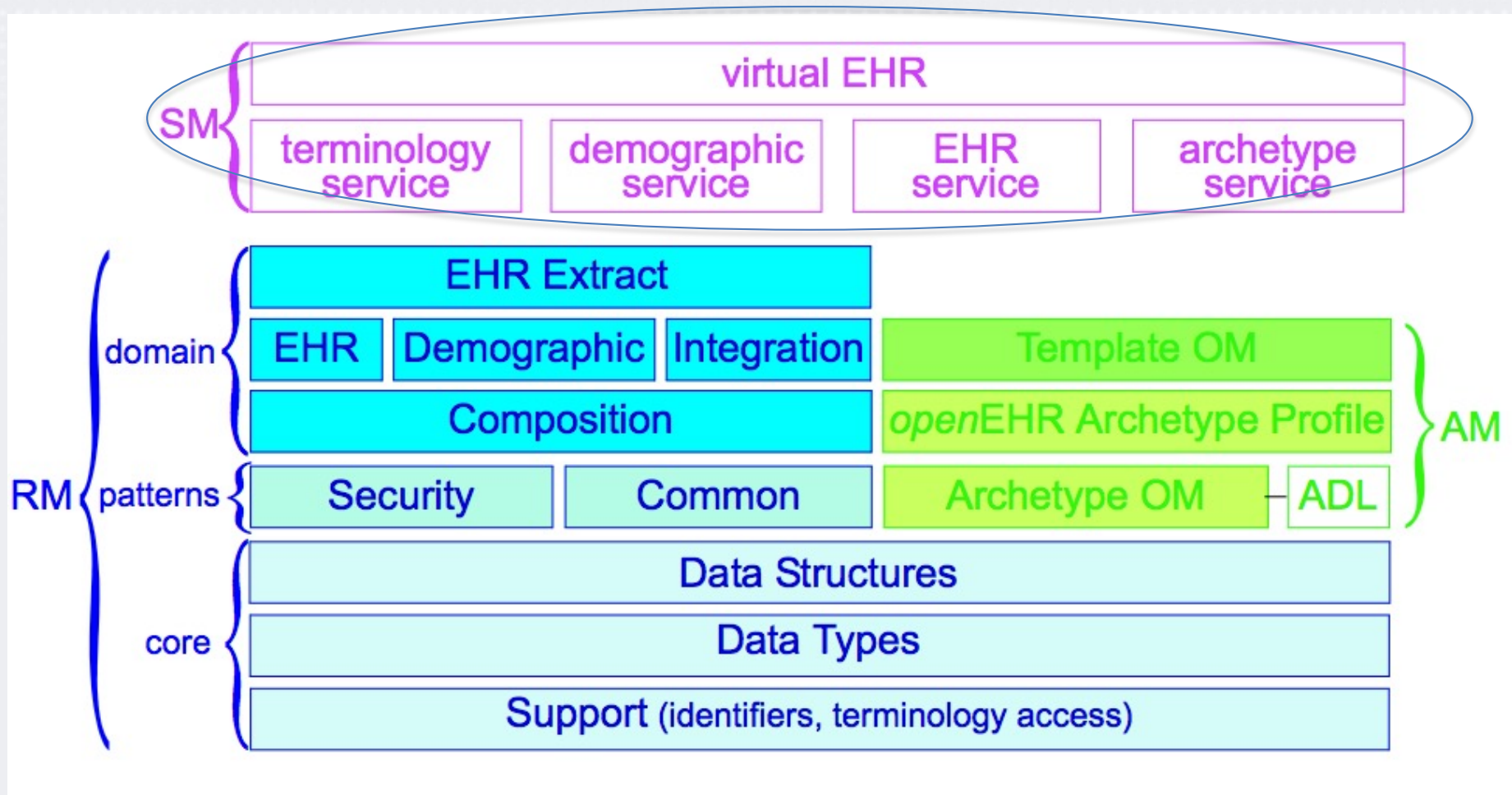
*open*EHR: Data Integration Architecture
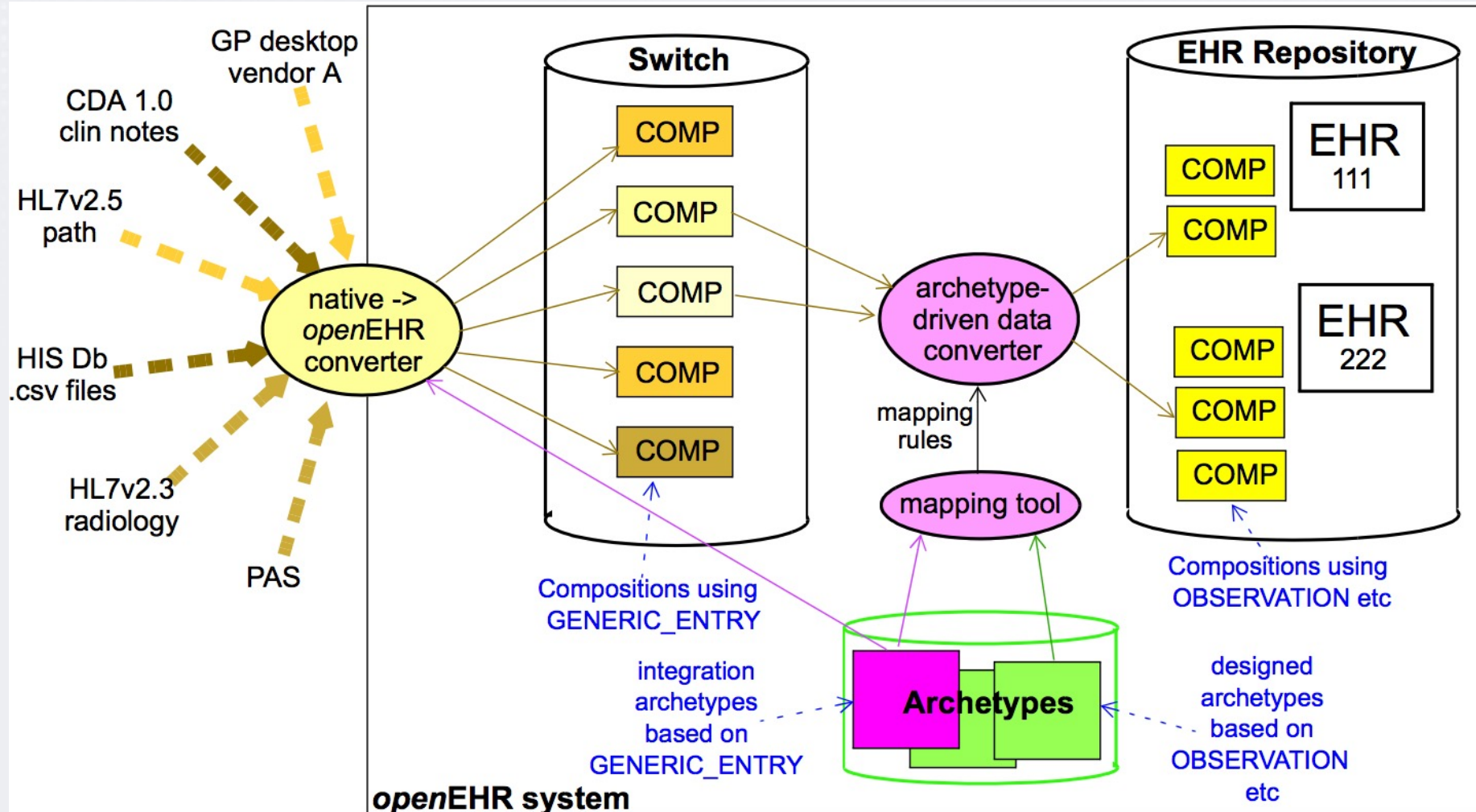
Minimal *open*EHR EHR System
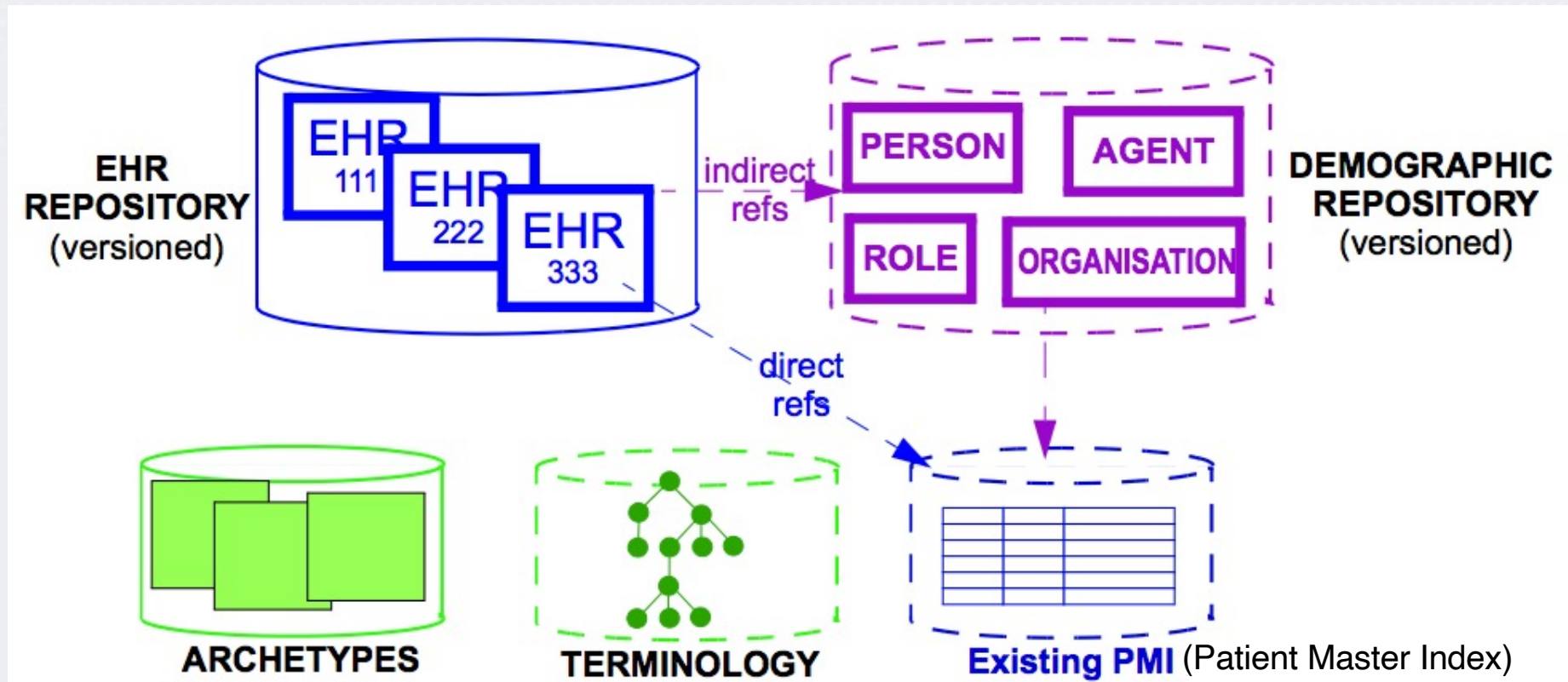
Enterprise EHR System Architecture
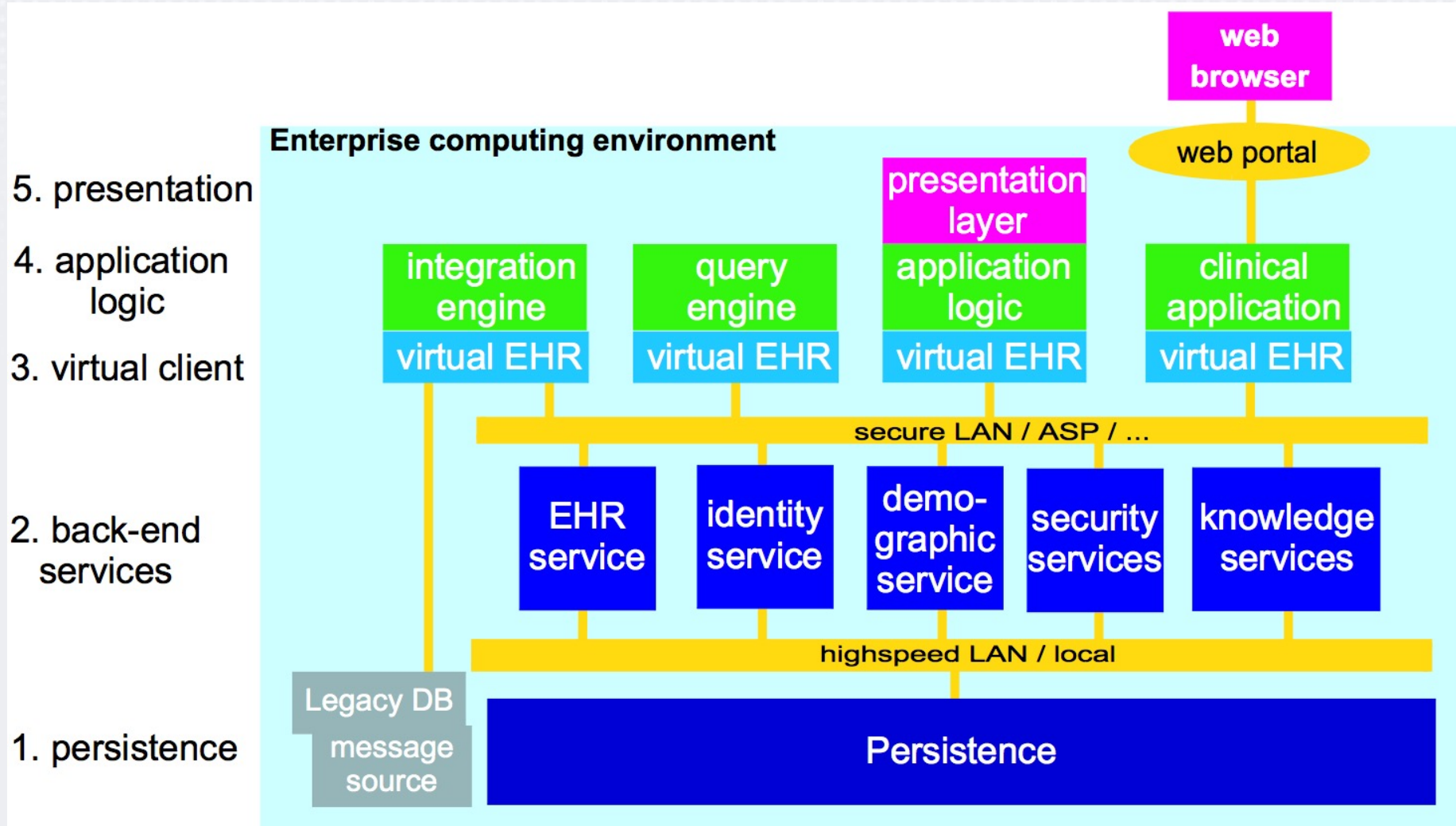
EHR and knowledge integration

Research

Epidemiology

Clinical outcomes

Evidence on treatment effectiveness

Clinical audit

Care plans

Medical Knowledge

Bio-sciences

Pathological processes

Diseases and treatments

Health Records

Descriptions, findings, intentions

Prompts, reminders

Professionalism and accountability
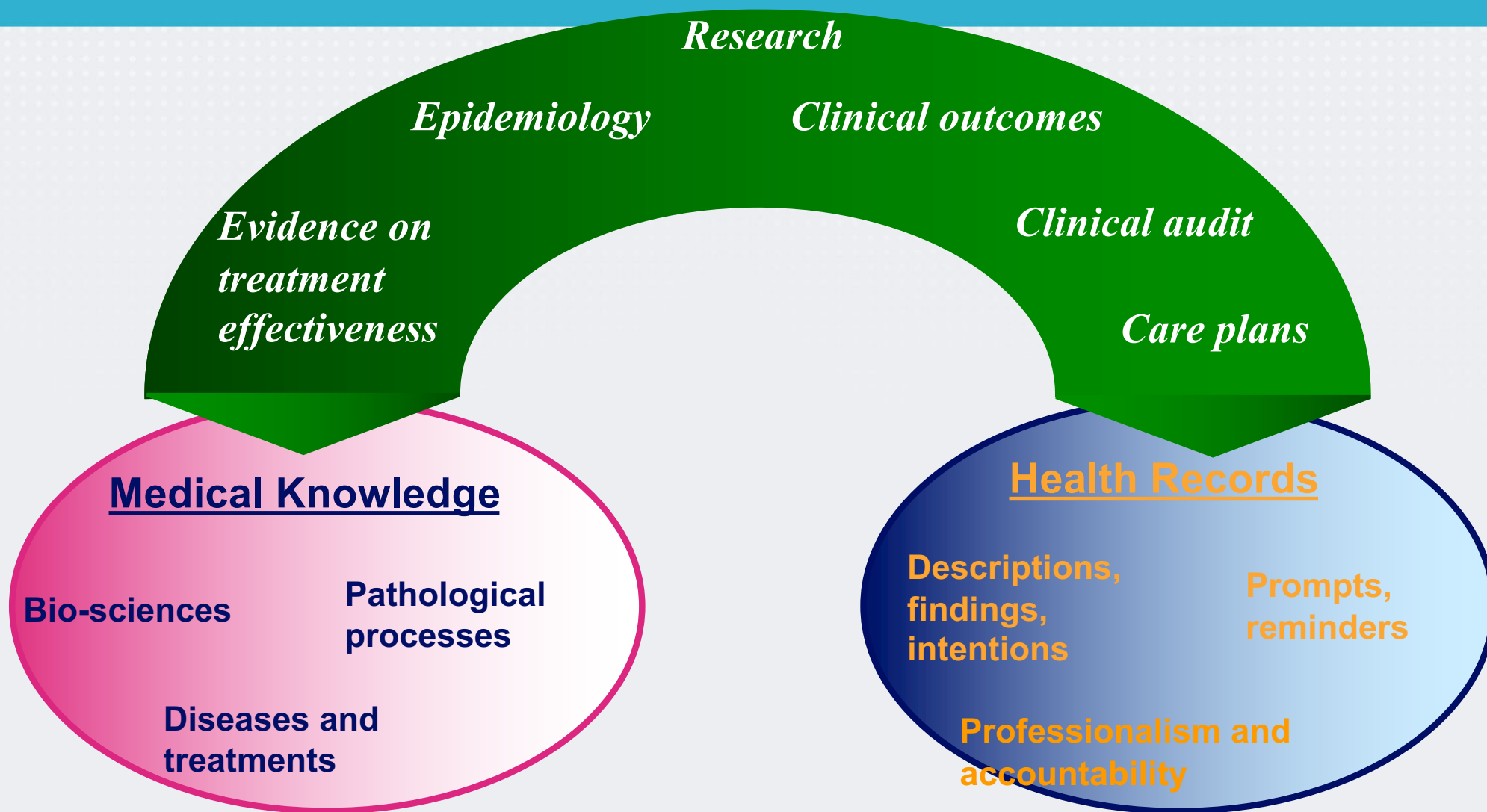
These areas need to be represented consistently to deliver meaningful and safe interoperability

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Long-term View

Clinical Care | **Clinical Research**

incident monitoring & detection

outcome analysis

retrieval of similar patient history

care management patients at risk

re-admission prevention

diagnosis & treatment assistance

System biology

Lead identification

Biomarker definition

Clinical trial Execution

Market Access

Ongoing safety tracking

Data Collection

Clinical Data

Data integration

Information

Information

Clinical Workflow

Research Workflow

Decision support

Knowledge

Medical Knowledge

Knowledge

Data exploration

openEMR

An example EHR system that implements openEHR standards (or part of)

OpenEMR
Free & Open Source Web Application

- Free
  - Anyone is freely licensed to **use, copy, study, and change** the software in any way

- Open source
  - The source code is **openly shared** so that people are encouraged to improve the design of the software voluntarily

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OpenEMR
Free & Open Source Web Application

– OpenEMR Based on **3-tier client–server Web architecture**:

1. **Application/process layer**
   - OpenEMR processes and services are built using **PHP programming language** (called Application server)

2. **Data layer**
   - OpenEMR data are stored using MySQL database management system

3. **Presentation layer**
   - Users (Clients) can access OpenEMR processes and services via **internet** (or local computer network) using a **Web browser** and via **HTTP** protocol.

OpenEMR
3-Tier Client-Server Web Architecture
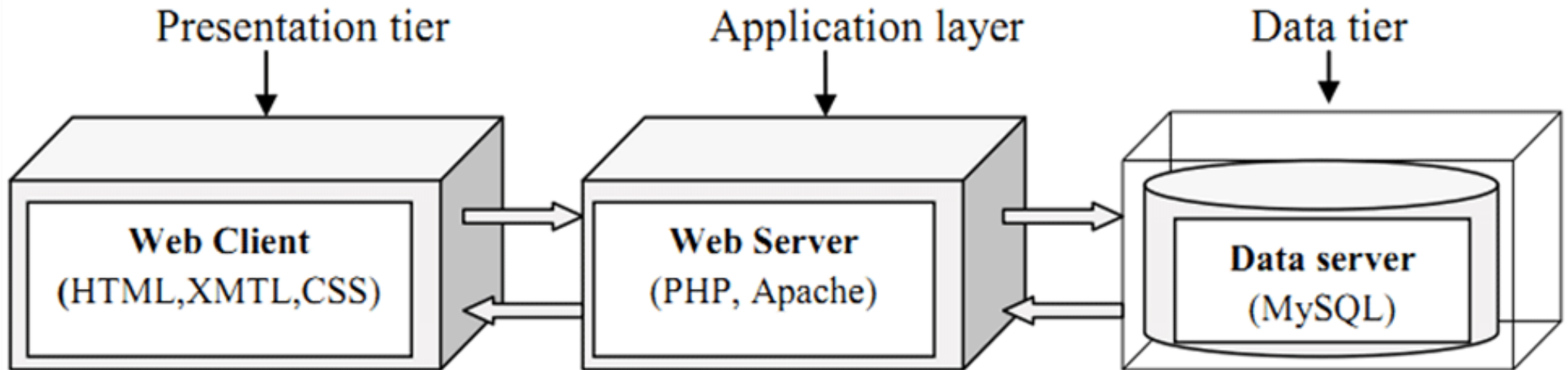
OpenEMR
Medical Practice Management Software

- Deals with the **day-to-day operations** of a medical practice
  - Management and tracking of **Patient Demographics**
  - Patient **appointments and Scheduling**
  - **Prescriptions** management and tracking
  - Medical **billing support**
  - **Clinical decision** rules
  - **Medical and managements** reporting

OpenEMR
Supports Electronic Health Record

- OpenEMR facilitates **management and sharing** of patients' health information
  - Patient's **encounters** data collection and management
  - Patient's **medical issues and clinical notes**
  - Patient's **medications and immunizations**
  - Patient's **Lab reports and radiology images**
  - Clinical **messaging and referrals**
  - Electronic Syndrome Surveillance reporting
  - Other EHR-related data/information

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OpenEMR Reference Architecture

Providers Hospitals Regional Clinics

Business Analytics & Optimization / **Security**

Presentation Layer
- Web
- Mobile
- Patient Portal
- Role-based Portal Access
- PHPGACL
- Reports

Process Layer
- **Patient**: Patient Demographics, Patient Scheduling
- **Medical Practice Mgmt**: Electronic Medical Records, Clinical Decision Rules, Prescription
- **Billing**: Medical Billing
- **Medical Imaging**: Imaging Records

Data Layer
- Patient Data
- Practice Mgmt. Data
- Billing Data
- Document Mgmt
- Imaging Data

Integration Layer
- HL7 Engine

LIS PACS/RIS PIS HIS Financial System

LEGEND: Other Systems | Not in OpenEMR

1

Reference: http://www.open-emr.org/wiki/, 05/08/2017

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OpenEHR & OpenEMR

- OpenEMR manage Patient using two process modules:

  1. Patient module
     - Responsible for managing patient demographic data and patient scheduling

  2. Medical practice management module
     - Responsible for managing **patient medical record (encounters)**, **clinical decision rules, and prescription**

- This separation enhance facilitate patient's privacy (e.g., **anonymization and pseudonymization**)

- Also, it is compatible with OpenEHR architecture

References

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Thanks!

Any questions?

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