"Towards Semantic Interoperability in eHealth"
RIDE Project Workshop, Monday 12 March 2007, Brussels, Belgium

eHealth paradigm shift from organization-focused to personalized health: challenges, solutions and supporting standards

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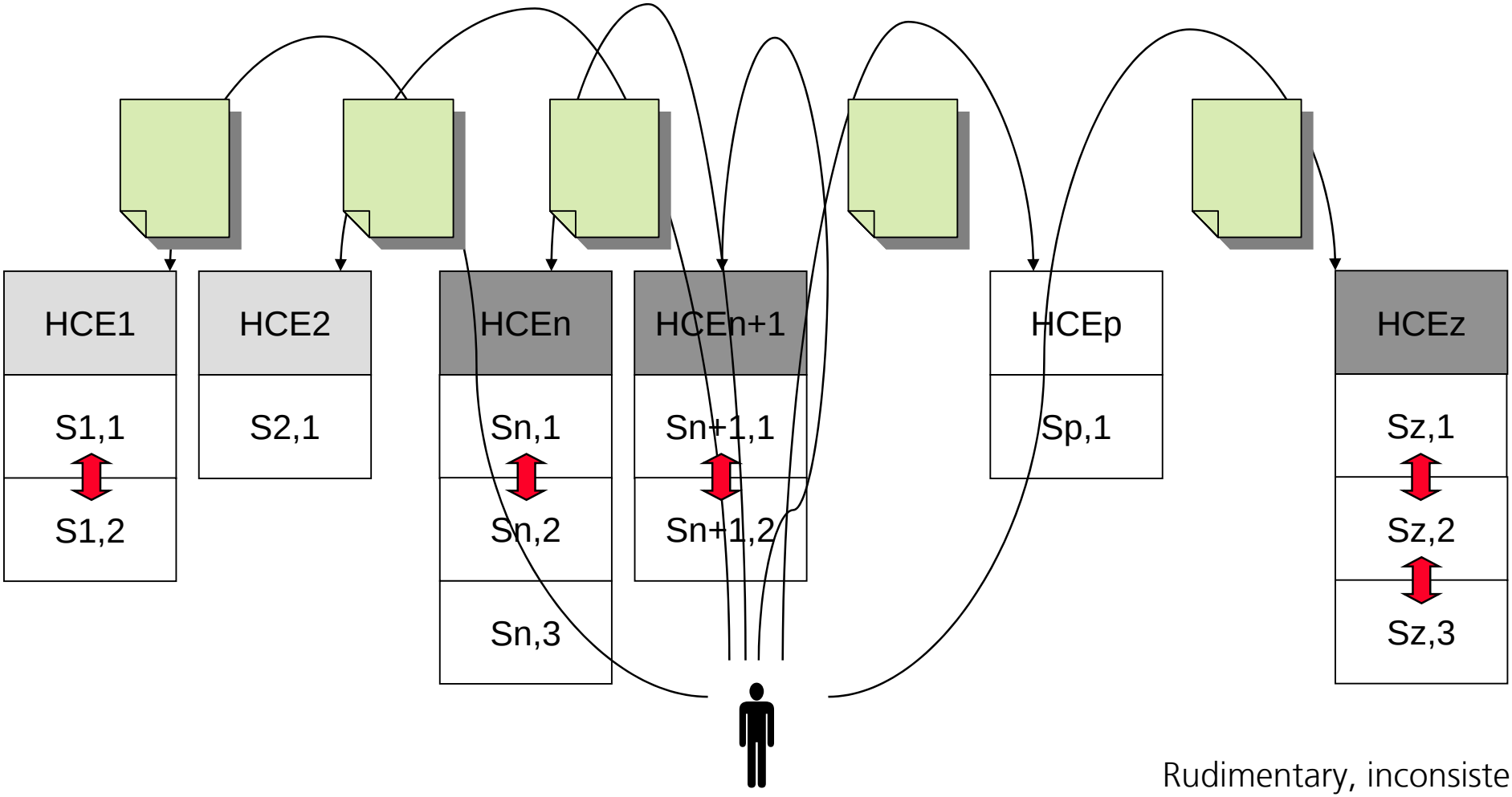

Rudimentary, inconsistent
Electronic Healthcare Record

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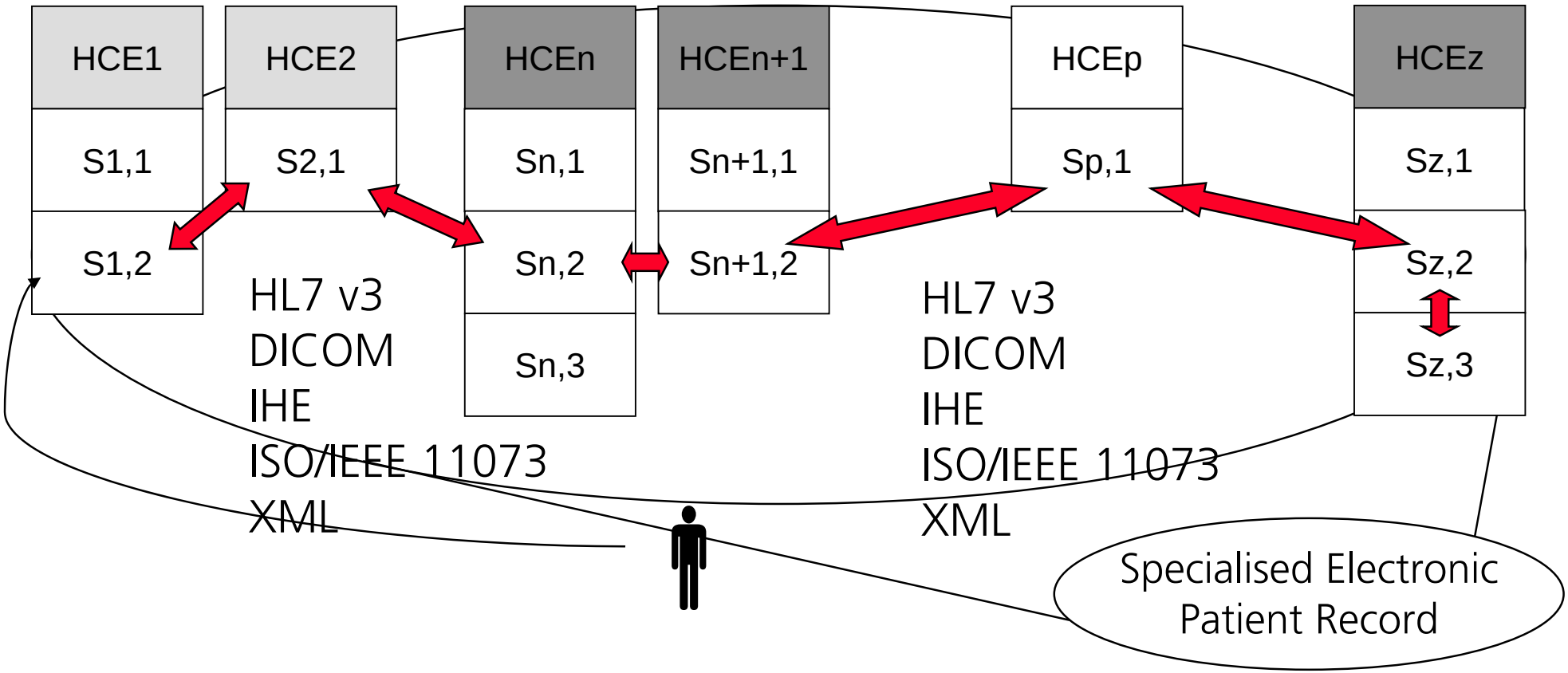

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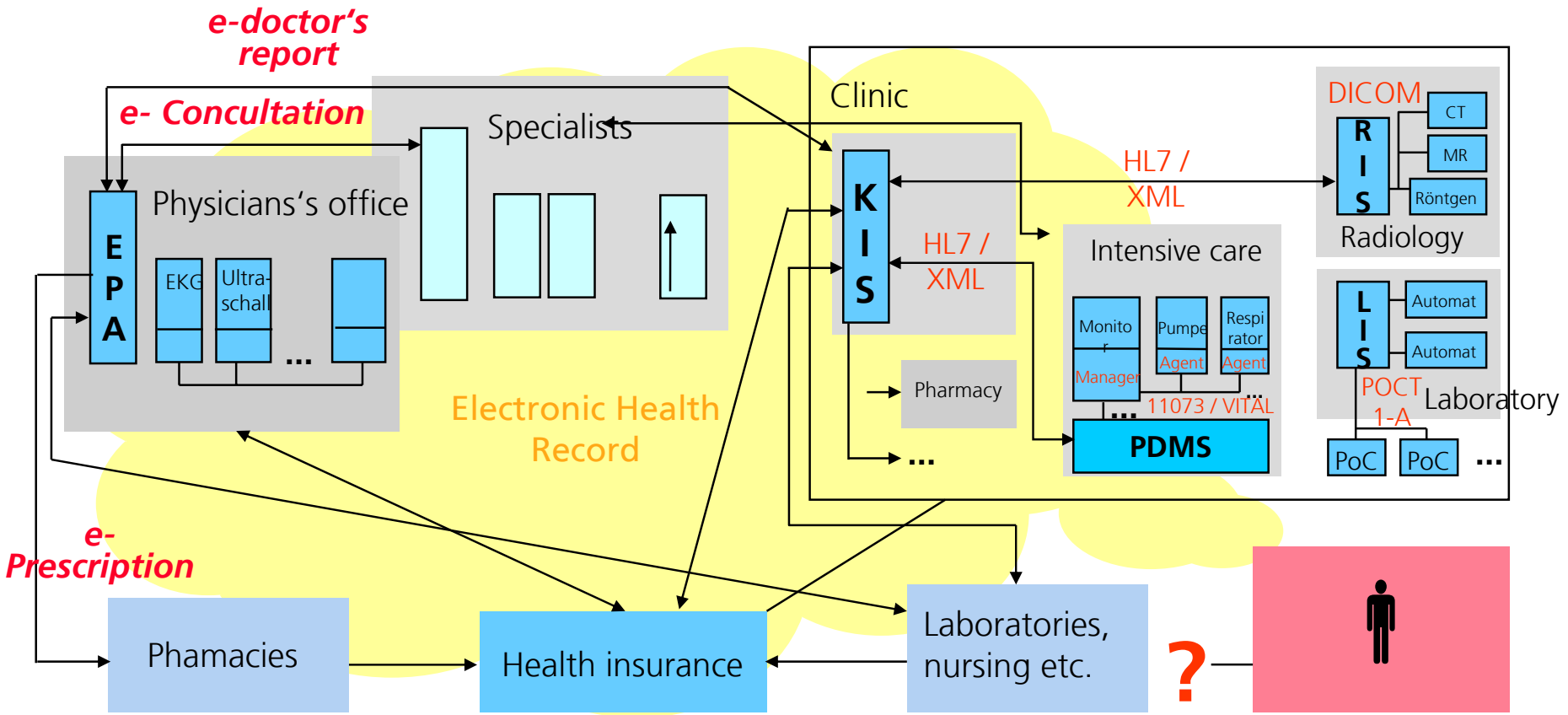
“e-health” – Interaction and integration path



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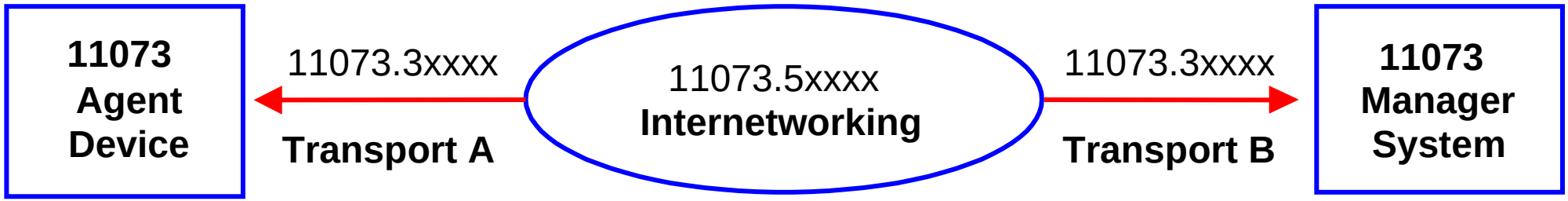
CEN ISO/IEEE 11073.5xxxx Internetworking Standards



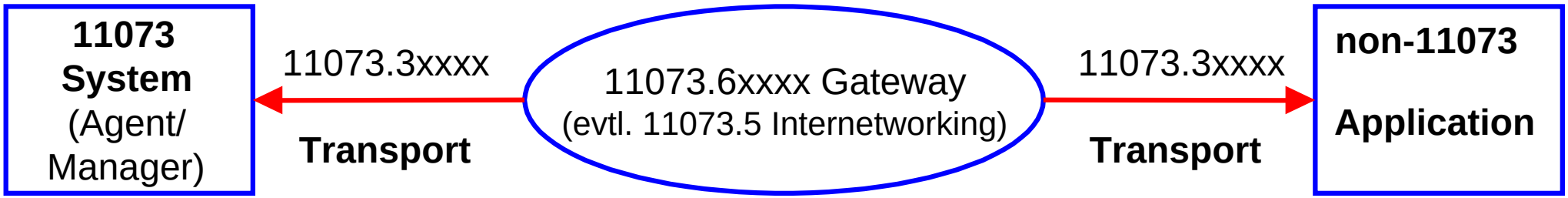
E.g. infusion pump,
respirator,
pulse oximeter

Patient monitor /
Device manager

Use of different transmission technologies (wired, IR, radio)

Examples: transition to TCP/IP-LAN,
access points for wireless and IR devices:

CEN ISO/IEEE 11073.6xxxx Application Gateways



Interoperability between application protocols

Example: **CEN ISO/IEEE 11073.60101 Application Gateway HL7, Observation Reporting Interface:** enables **i**nteroperability with HIS.

(**11073 Coding scheme** has been registered as **HL7 Coding Scheme** in 2002.)

CEN SSS-HIDE (2001) : Health Informatics-Strategies for harmonization and integration of device-level and enterprise-wide methodologies for communication as applied to HL7, LOINC and ENV 13734)

CEN ISO/IEEE 11073 Standards Family

- integrates IEEE 1073 work („Medical Information Bus“, since 1983), CEN TC 251 (ENV 13734 „VITAL“, ENV 13735 „INTERMED“, since 1993), NCCLS /CLSI (POCT1-A), HL7 (Devices SIG, since 2005), Bluetooth WG on „Medical Device Profile“, IHE etc.
- enables functional and semantic ad-hoc interoperability through:
  - object-oriented modeling of function and application area ("Domain Information Model“: devices, functionalities, measurement data, calibrations, alert information, remote control, patient information, interfaces)
  - standardized codes for naming all information elements: "Nomenclature" and "Data Dictionary“
  - optional components and profiles for different communication needs and device classes („Application Profiles“/ „Device Specializations“).
- conceptually based on ISO Systems Management (ISO/IEC 10040, 10164, 9595 : Agent/Manager - Service Model)
- considers limited hardware expenditures for „Embedded Systems“ platforms.
- defines transition between network technologies and application protocols (HL7)

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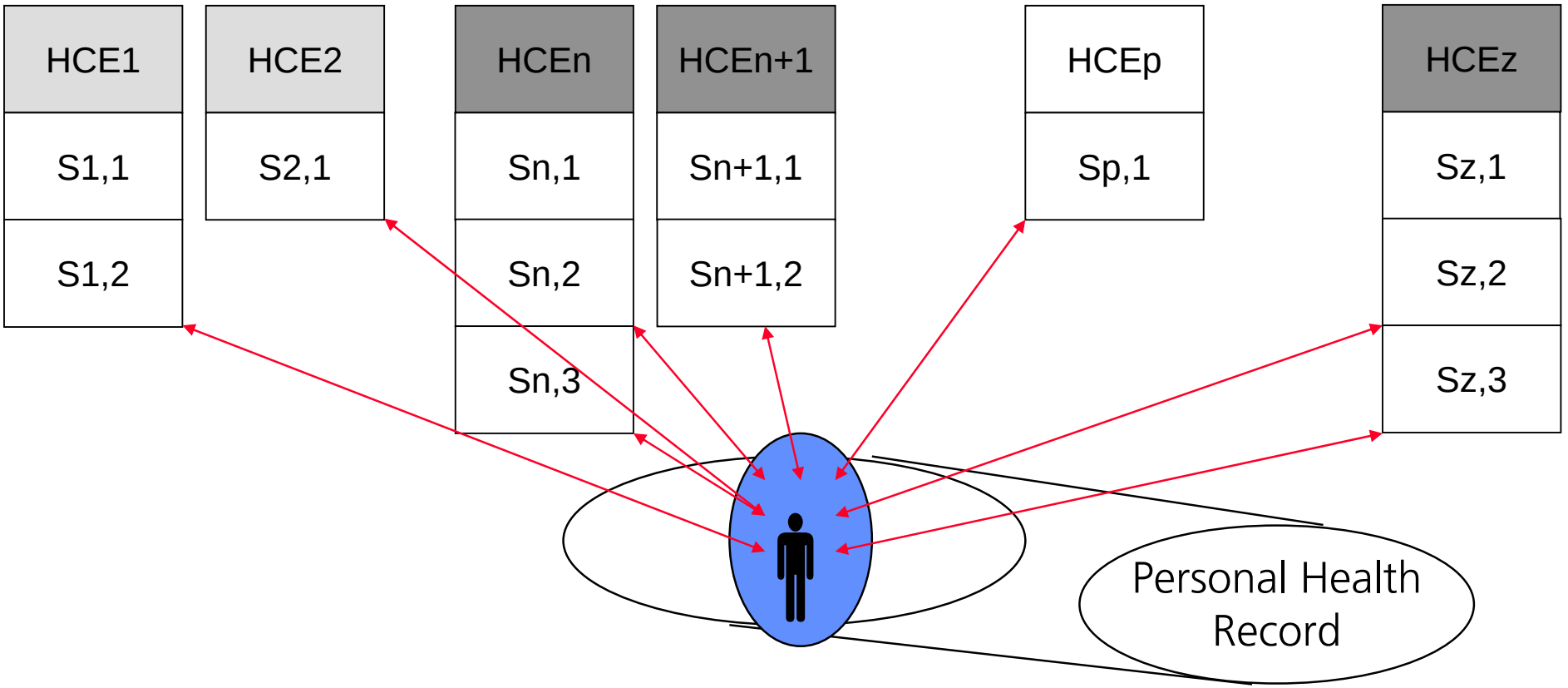

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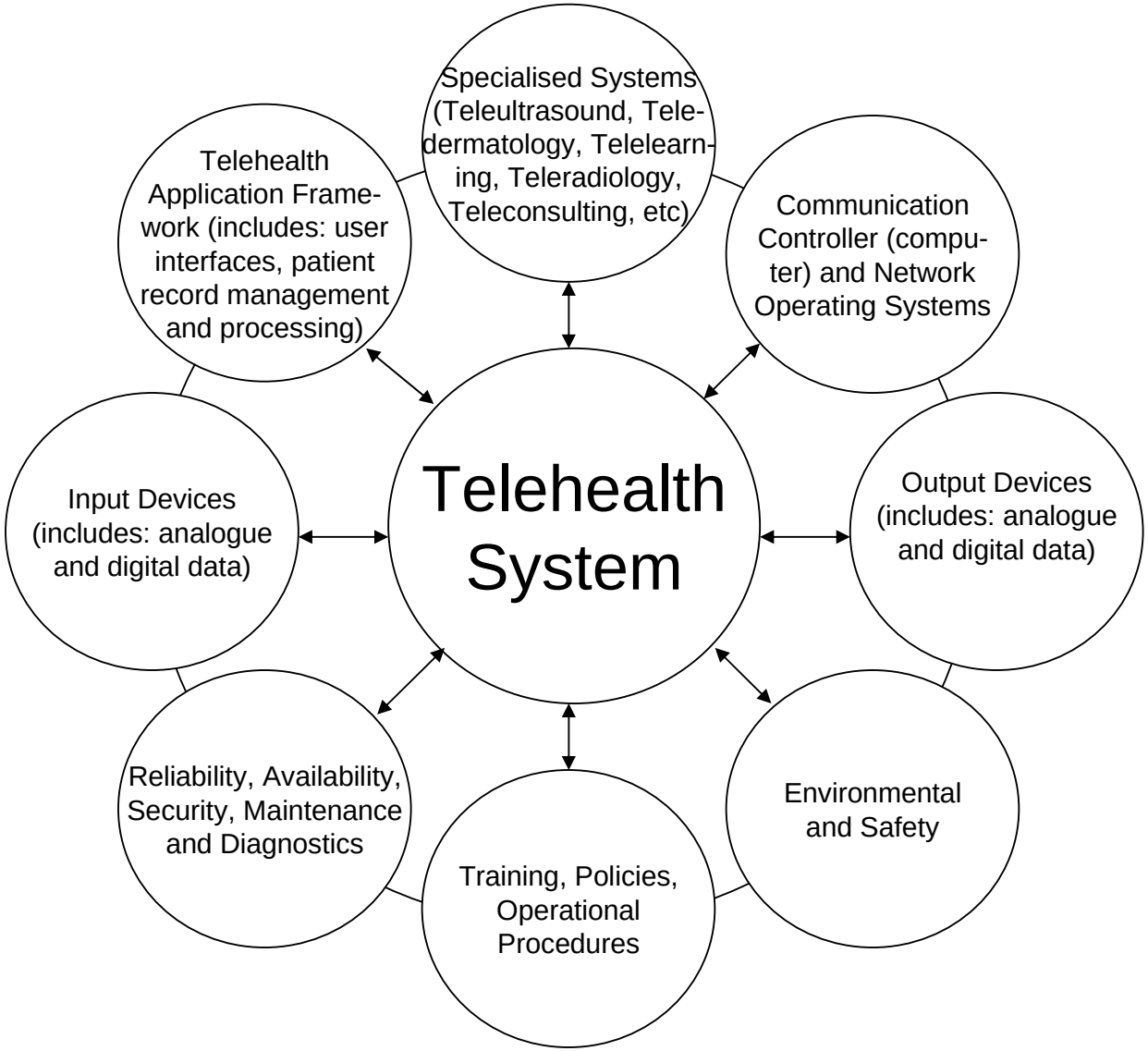

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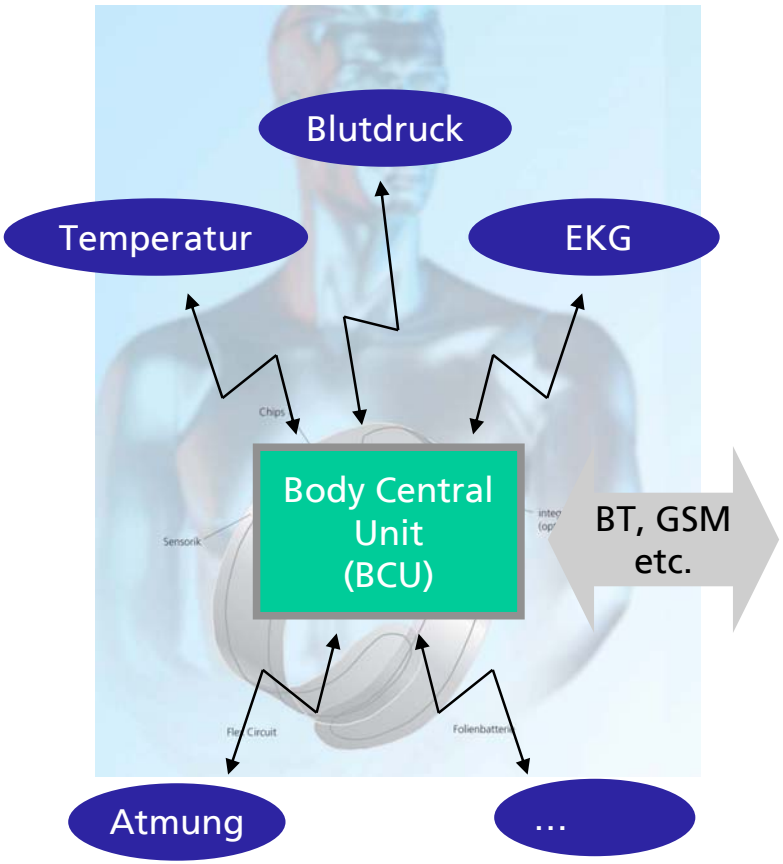
Body Area Network (BAN):



Body Sensor Units (BSU):

data entry and (pre-)processing
comfortable, being „invisibly“ worn
minimal size and weight

Body Central Unit (BCU):

personal user interface
management of several BSUs
data concentration, processing, etc.
event recognition and management
wireless connection to external networks
(BT, DECT, WLAN, GSM, UMTS,..)

Ad-hoc interoperability
→ *„(un)plug & play“*

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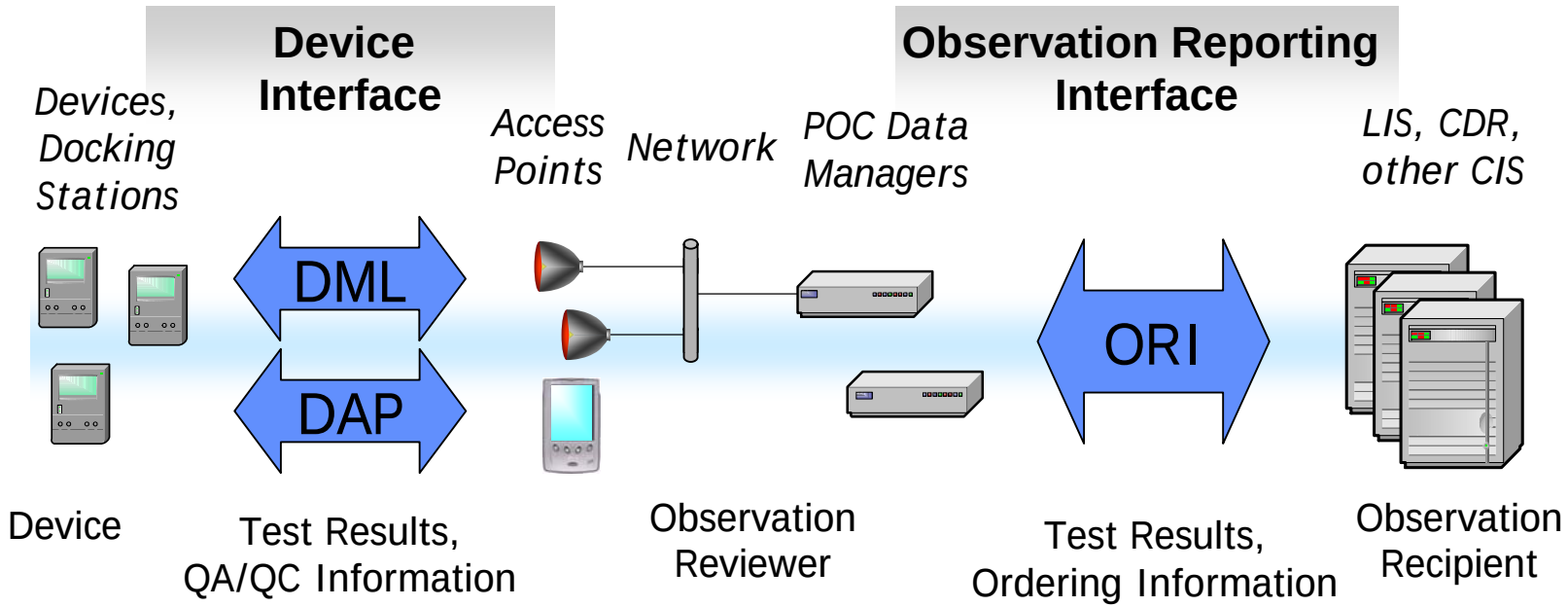
POCCIC/(NCCLS/) CLSI POCT-1A ⇨ CEN ISO/IEEE 11073.90100

- 1999-2001 developed by an industry consortium with IEEE und HL7 input
- defines two interfaces: - Device Interface (DAP: **IEEE 1073**, DML: **HL7** V2.3 + XML)
  - Observation Reporting Interface (ORI: **TCP / IP** + **HL7** V.2.3)



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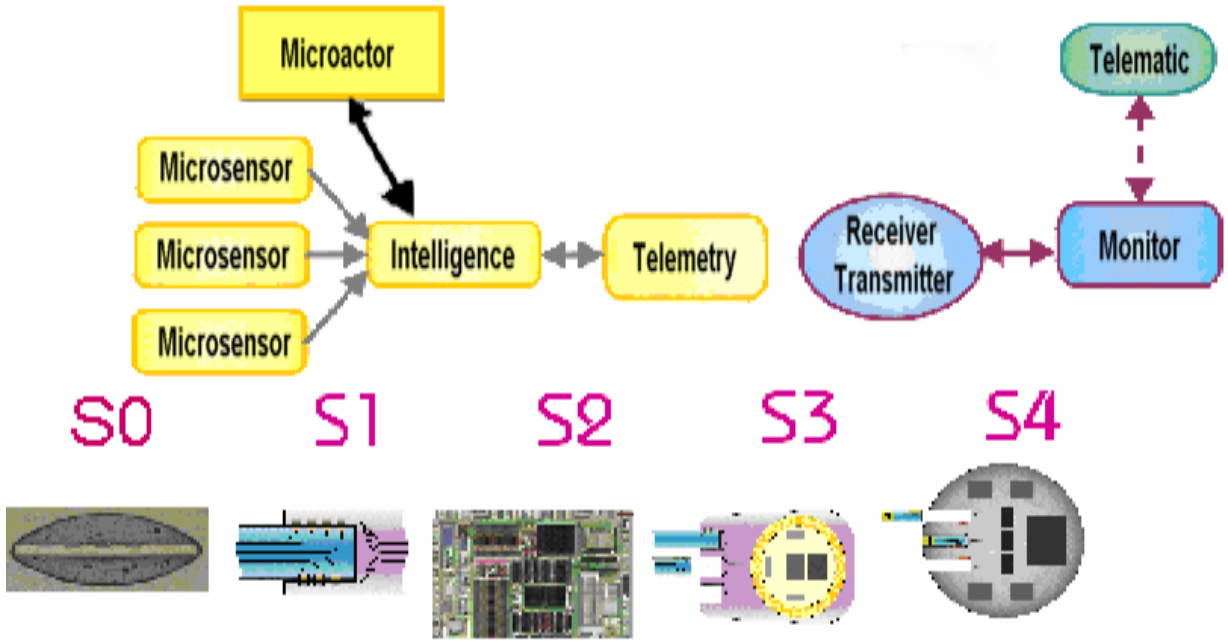
Smart Microsystems – the other end of the interoperability chain



⇨ **IMEX* IEC standard draft for cross-vendor micro-system interoperability**

*German VDE / BMBF IMEX Project: „Implantierbare und extrakorporale modulare Mikrosystemtechnikplattform“

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Requirements for achieving interoperability and harmonisation (1/2)

- Openness, Scalability, Flexibility, Portability
- Distribution at Internet level
- Standard conformance
- Service-oriented semantic interoperability
- Consideration of timing aspects of data and information exchanged
- Lawfulness
- Appropriate security and privacy services

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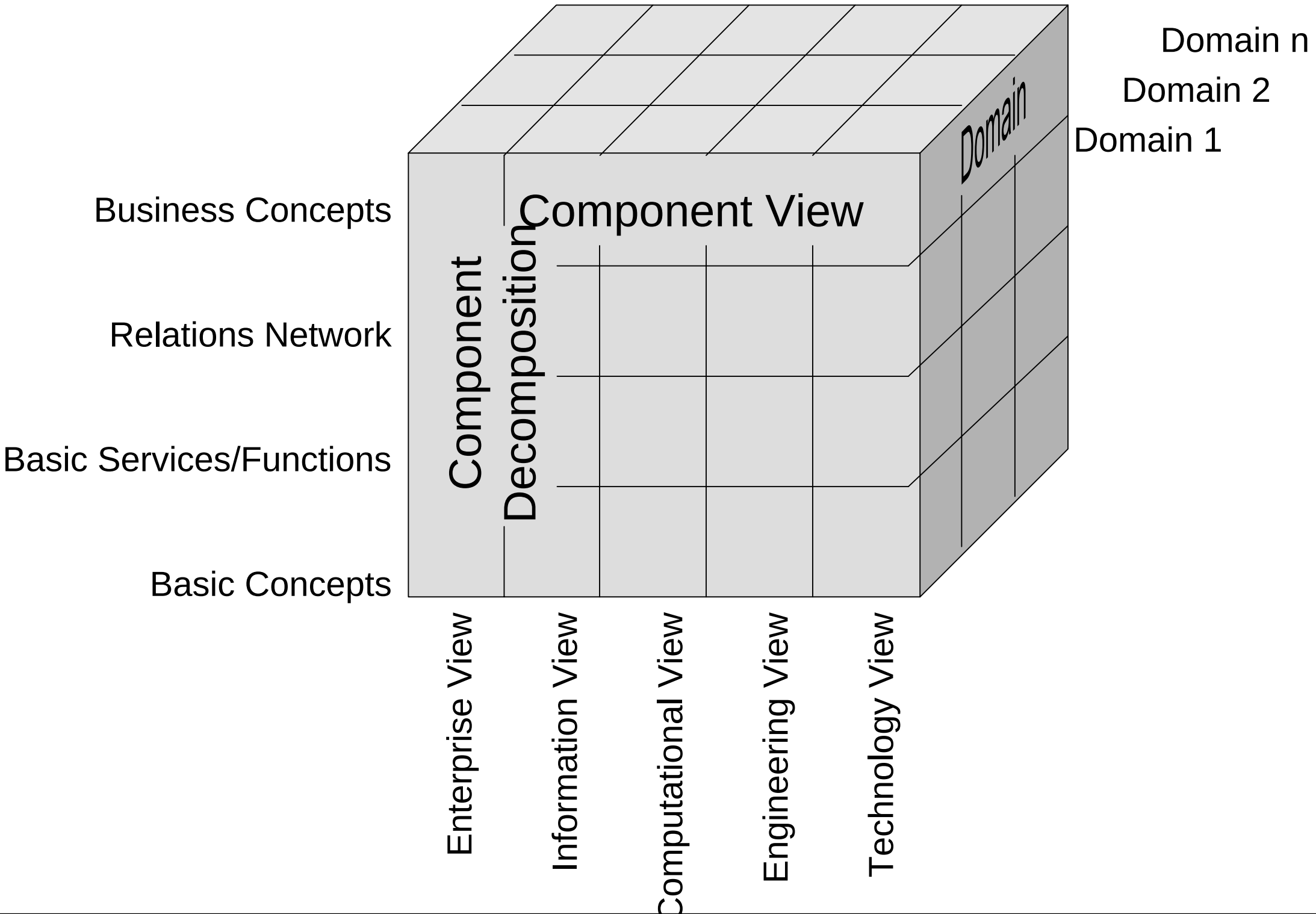
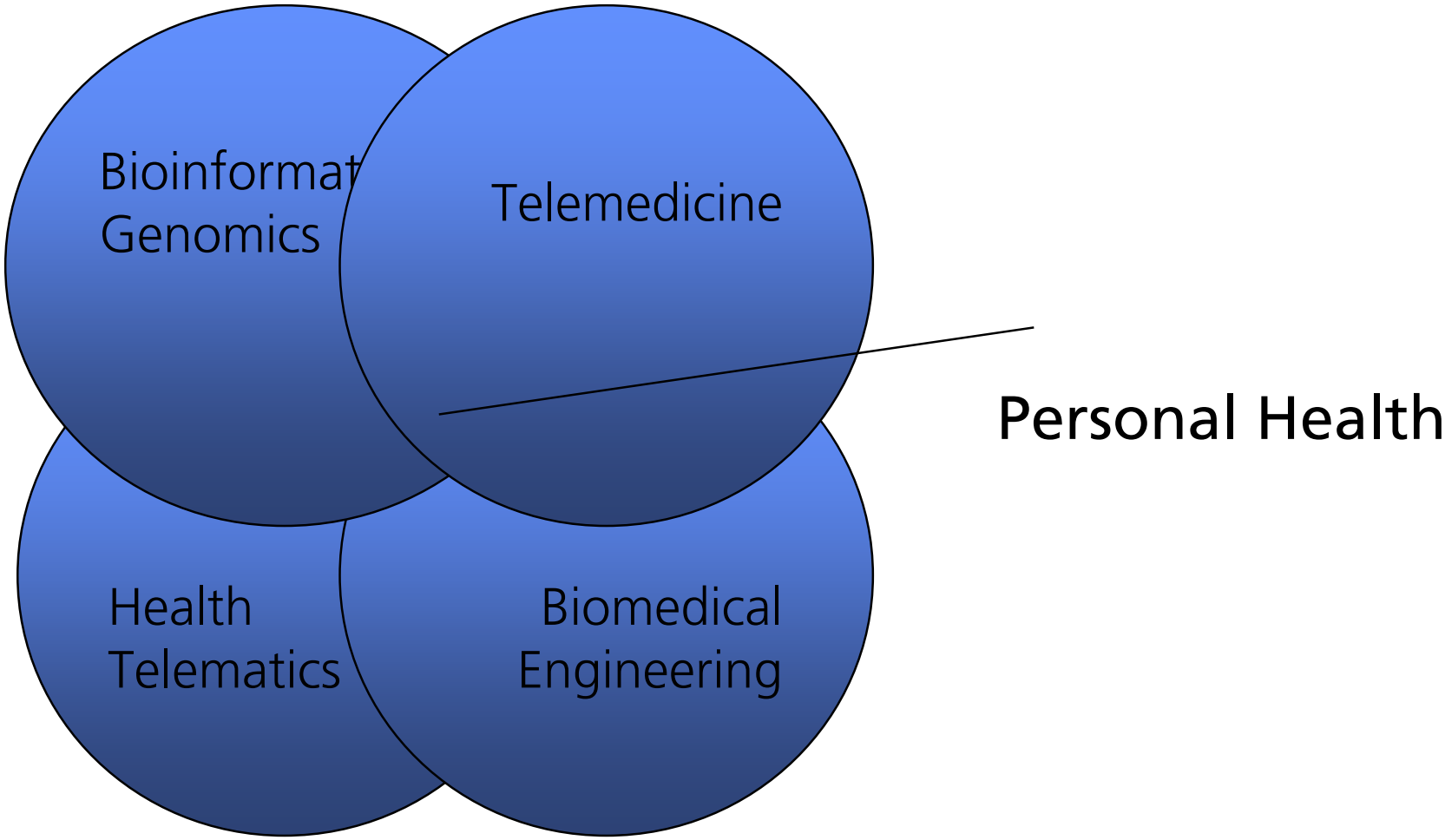
Requirements for achieving interoperability and harmonisation (2/2)

- Distribution, Component-orientation (flexibility, scalability)
- Model-driven and service-oriented design
- Separation of platform-independent and platform-specific modelling → separation of logical and technological views (portability)
- Specification of reference and domain models at meta-level
- Interoperability at service level (concepts, contexts, knowledge)
- Unified Process
- Common terminology and ontology (semantic interoperability)
- Advanced security, safety and privacy services


Domain n
Domain 2
Domain 1
Domain
Business Concepts
Component View
Component Decomposition
Relations Network
Basic Services/Functions
Basic Concepts
Enterprise View
Information View
Computational View
Engineering View
Technology View

The Personal Health Paradigm



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Standards Classification Health Informatics (1/2)

- Architecture standards
  - HL7 versions 2.x/3, CORBA, MDA, HISA
- Modelling standards
  - UML, CEN 15300: “CEN Report: Framework for formal modelling of healthcare security policies”
- Communication standards
  - CEN 13608: “Security for healthcare communication”, CEN 13606: “Electronic healthcare record communication”
- Infrastructure standards
  - ISO 17090: “Public key infrastructure”, ETSI TS 101733: “Electronic Signature Formats”

Standards Classification Health Informatics (2/2)

- Privacy standards
  - ASTM E1987-98: “Standard guide for individual rights regarding health information”, CEN 13729: “Secure user identification - Strong authentication using microprocessor cards”; ISO/IEC PDTS Pseudonymisation Practices for the Protection of Personal Health Information and Health Related Services
- Safety standards
  - CEN 13694: “CEN Report: Safety and security related software quality standards for healthcare”; ISO/DTS 25238 Classification of Safety Risks
- Terminology and ontology standards
  - UMLS, SNOMED
- Identifier and identification schemes
  - LOINC, ASTM E1714-00: “Standard guide for properties of a Universal Healthcare Identifier”

Personal Health Characteristics

Personalization of

- Process design
- Workflow management
- Concept representation
- Concept aggregation
- Terminology/Ontology
- Result compilation

- Diagnostic methods
- Therapeutic means

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Conclusions (1/3)

- Health telematics and telemedicine necessitate requirements on interoperability between clinical and health policy processes as well as stakeholders.
- "Personal Care" and personal ubiquitous health services extend "e-Health" and require the integration of personal, body worn or implanted mobile systems as part of the health telematics infrastructure.
- Mobile Body Area Networks are an essential platform for future personal ubiquitous health services.
- Interoperability implies different concepts ranging from functional interoperability up to the comprehensive semantic interoperability.
- For essential function areas, international standards are available or established, resp.
- Interoperability of personal mobile systems includes all 7 layers of the ISO / OSI Reference Model including terminology, knowledge concepts, coding aspects, etc.
- The CEN ISO/ IEEE 11073 standard family contains corresponding profiles for all 7 ISO/OSI layers, which can be used for personal systems too.
- Micro-systems are essential components for such structures, requiring the extension of existing approaches and interoperability chains.

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Conclusions (2/3)

- Crucial demand for simplified, standardised methods to access healthcare information and services → making healthcare safe and available to all
- Appropriate standards for healthcare information and systems → cornerstone to achieving a reasonable healthcare infrastructure
- Many health informatics standards exist, emerge, or are under adaptation to meet requirements
- Obstacles: existence is not well known, not used enough, interoperability often not proven, and some conflicts
- Conformance statements needed; testing and certification must be performed → achieving interoperability is a considerable challenge

Conclusions (2/3)

- Real need for formal and informal co-ordination of standardisation efforts
  - to leverage the synergy of the various efforts,
  - to harmonise vocabularies,
  - to enable interoperability, and
  - to promote consistent testing and certification programs across and within organisations

- Develop tools and prototypes to promote consistent definitions and artefact reuse, and facilitate interoperability for healthcare systems
- Spread acceptance of management of health information standards across the whole eHealth community
- Achieve full and appropriate integration into all information flows
- Privilege management infrastructure standard addresses complexities of RBAC and management of user privileges
- Effort will establish consistent means for protecting personal health information within and across enterprises

Questions?

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