

Evaluating Reference Models in Healthcare - An Information System Architecture Approach -

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- Background and Motivation
- Healthcare Information Systems – An Architectural View
- Evaluation Framework
- Healthcare Reference models
- Conclusion and further Research

The adoption of standards is an essential requirement for improving the quality and usefulness of information for all stakeholder groups, and is of crucial importance in the use of the electronic healthcare record [Department of Health and Children 2004]:

- *Data standards*
- *Common indicator sets*
- *Technical standards*
- *Quality standards*

Why standards and reference models?

- enable interoperability among diverse healthcare systems
- transfer patient centered information between healthcare organizations
- integration of various knowledge sources
- improve efficiency by enabling improved co-operation and enable competition among health care vendors
- improve information quality and healthcare service

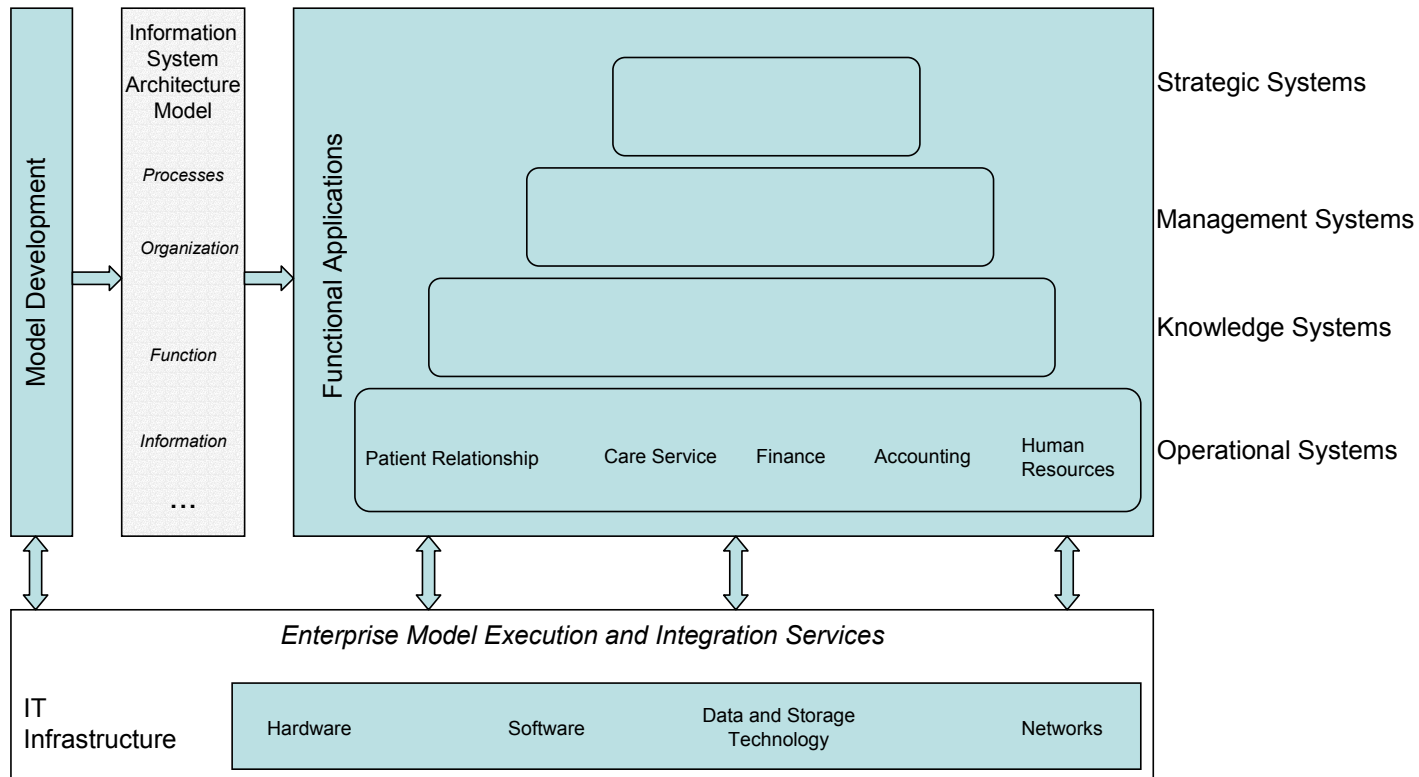


[Newsham 2004]

- ⇒ Standards a key to interoperability [Coenen et al. 2001]
- ⇒ Which standards are required?
- ⇒ A framework to evaluate the standards and reference models in healthcare

Two different views have been emerging [Schloeffel 2002]

- “**SmallEHR**” > principally concerned with clinical information and a single subject of care
- “the EHR is everything” or the “**AIIEHR**” > includes not only clinical information but essentially the whole of what has been included in a ‘Health Information Landscape’ [Baele 2001]



- Information Systems are described through models, which are usually known as information system architectures or enterprise architectures
- The term 'architecture' is important in information system engineering and software development
- Often defined very vague
- Used inconsistent

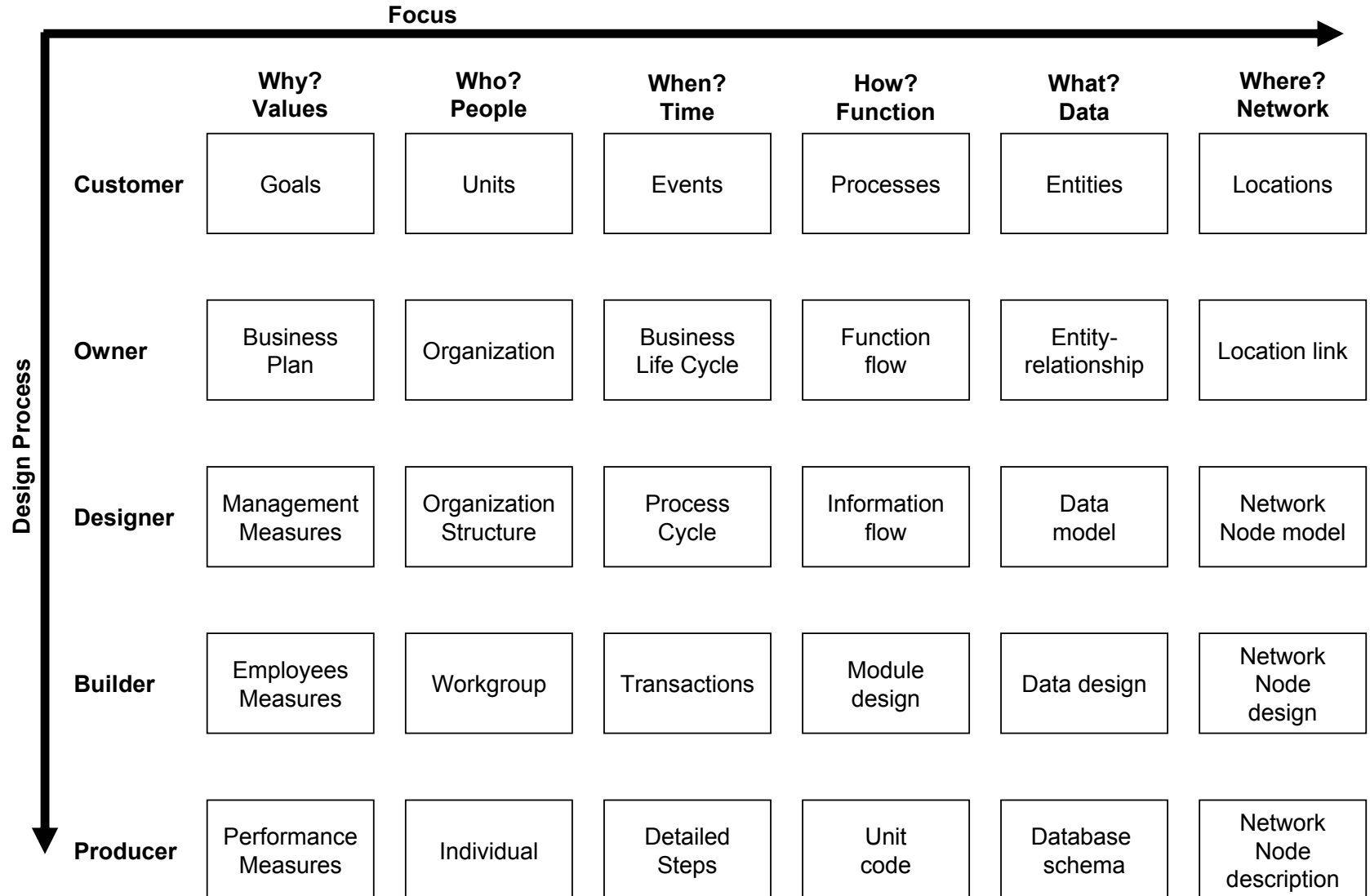
General definition:

Objects, which are representing/defining the structure of a System.

[Foegen; Battenfeld 2001]

includes:

- Static aspects as for example components, interfaces and relationships
- Dynamic aspects as for example the communication between components.



	Why (Motivation)	When (Time)	Who (People)	What (Content)	How (Function)	Where (Network)
Vision (Guidelines)						
Scope (Contextual)	1. Personal and public health impact, and care delivery business case.	2. Identification of significant health care and care delivery events.	3. Essential health service organizations and their functions.	4. Description of important health service and care delivery information.	5. Important health care and care delivery services.	6. Identification and description of organization and individual locations.
Design (Standards)						
Enterprise and Environment (Conceptual)	7. Personal health benefit and care delivery business objectives.	8. Sequence and timelines of health care services.	9. Healthcare information system workflow.	10. Semantic description of health care processes.	11. Conceptual activity model of health care delivery.	12. Structure and interrelationship of health care facilities.
Health Information System (Logical Design)	13. System functional requirements.	14. Health care event phases and process components.	15. Health care information system human-system interface architecture.	16. Logical data model for health care information.	17. Application architecture with function and user views.	18. Connectivity and distributed system architecture.
Implementation (Standards)						
Health Information Technology (Physical Design)	19. System operational requirements.	20. Health care information system control structures.	21. Health care information system human-system interface description.	22. Physical data model for health care information.	23. System design, language specification, and structure charts.	24. Health system information network detailed architecture.
Health Information Components (Modules and subsystems)	25. Technical requirements.	26. Health care information system component timing descriptions.	27. System security architecture and operations.	28. Health care information metadata, and DBMS scripts.	29. Code statements, control blocks, DBMS stored procedures, etc.	30. Physical data network components, addresses and communication protocols.
Operation (Standards)						
Functioning Health Information System	31. Technology operational requirements.	32. Health care information system operation schedules.	33. IS participant description.	34. Functioning database, knowledgebase.	35. User procedural and system documentation.	36. Operating health system communication network.

- ISO – TC 215 Health Informatics
 - CEN – TC 251: European Committee for Standardization (→ ENV 13606: Information architecture for communicating the EHR)
 - HL7 – Health Level 7 (→ RIM – Reference Information Model)
 - openEHR (“two-level” and distributed modeling approach)
 - ...
- ⇒ Recently collaboration between CEN, ISO TC215, HL7 and openEHR

- Pre-standard based on experience and the dual model approach
- Uses ISO Requirements (18308) for EHR Architecture standards

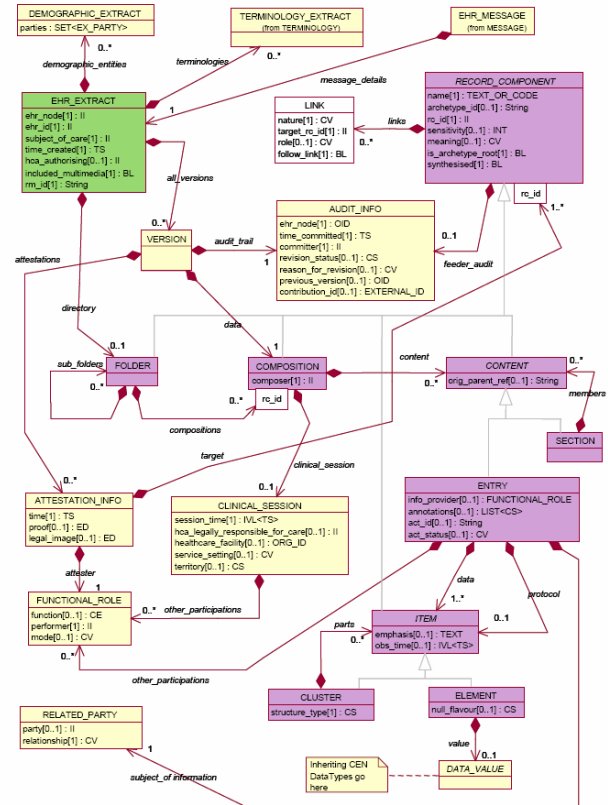
Generic reference information model

Generic properties of health record information
 Domain constrains / archetype for specific use
 Comprises a set of classes and attributes in UML

- Extract package
- Demographics package
- Terminology package
- Set of data type packages
- Message package

General purpose Information Components (GPICS)

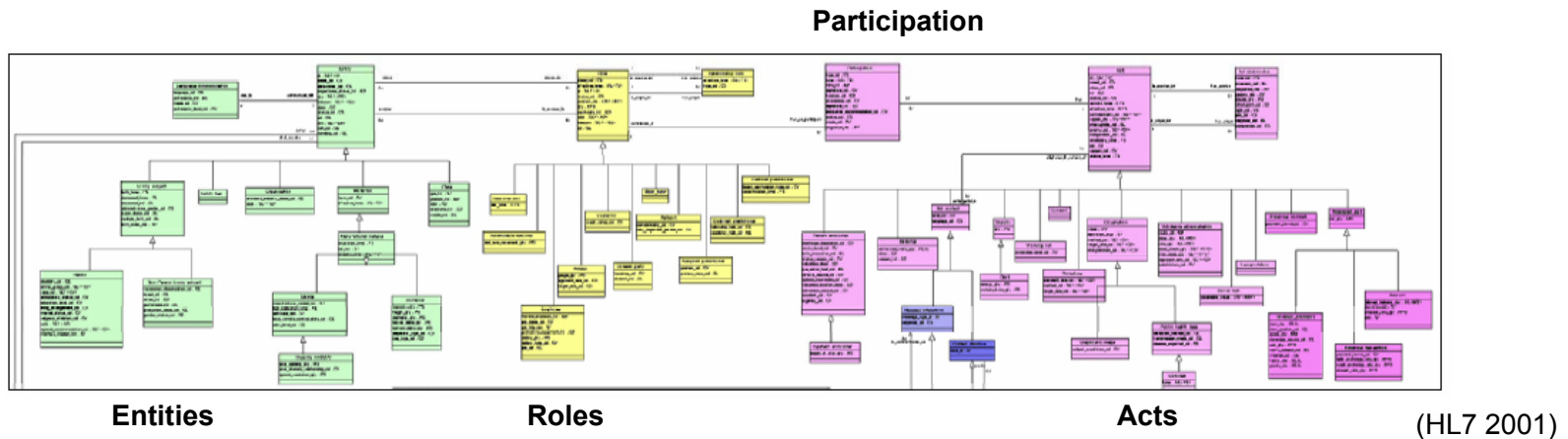
- re-usable information model fragments (such as demographics or address components, Acquisition procedure, patient preparation procedure,...) (derived from the HL7 RIM).



⇒ The focus is EHR communication and distributed access, not the internal model of an EHR system.

- Provides a static view of the information needs
- Using the Unified Modeling Language (UML)
- Standard set of structures with standard names / structured terminology

- Every happening is an **Act** (procedures, observations, medications, supply, registration etc.)
- Acts are related through an **Act_Relationship** (composition, preconditions, revisions, support etc.).
- **Participation** defines the concept for an Act (Author, performer, subject, location etc.).
- The participants have **Roles** (patient, provider, practitioner, etc.).
- Roles are played by **Entities** (Persons, organizations, material, places etc.)
- Episodes: “Workflow archetypes”



- Standards and Reference models are important for interoperability and help to improve Information Quality (accuracy, completeness, timeliness, relevancy, accessibility,...)
- Need for evaluation Frameworks for standards and reference models
- Information System architecture provides various perspectives along the system development process
- Focus on healthcare process models
- Harmonization and consistent Meta-model from an information system perspective (archetype modeling, dialogue sub-system that structures the terminology system, reconciliation and converting of various models and standards)
- Further refinement and inclusion of other standards (e.g. Performance indicators, terminologies and classification standards)