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Use of Standards and Metadata in the Design of Adaptable Clinical Data Repositories


Chris Peck and David Sundaram
Department of Information Systems and Operations Management
University of Auckland

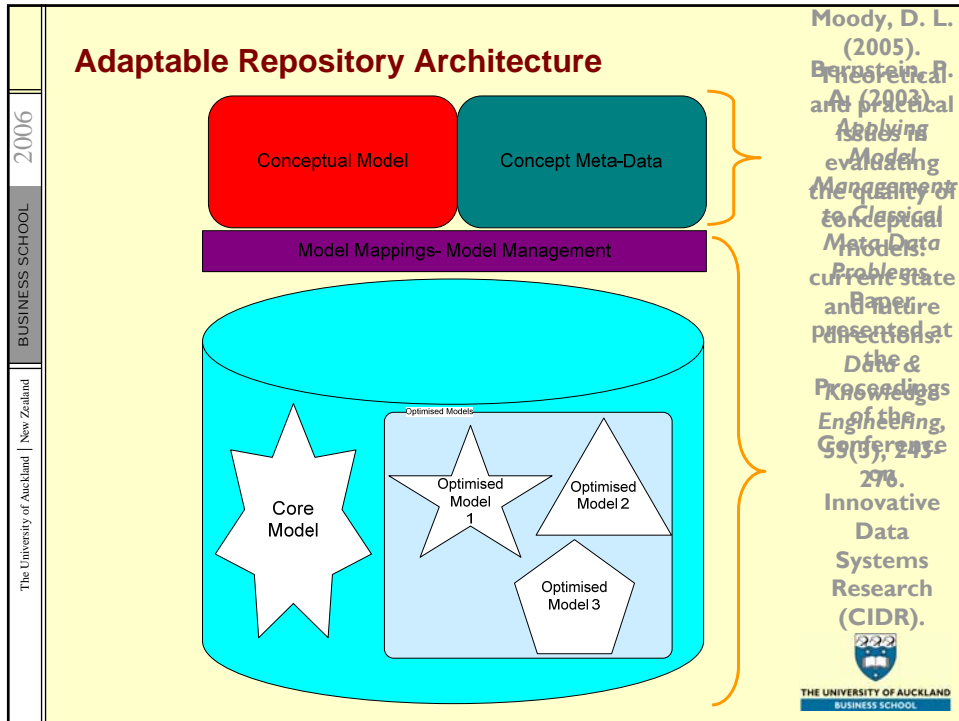
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Key Goals of this Framework

- Allow systems to accommodate new concepts at the data level
 - Model management on the data level
 - Singular/Granular concepts specified by meta-data
- Facilitate interoperability
 - Mapping at conceptual model level
 - Standards Adoption
 - Common Terminology


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What is the “right” model?

The diagram shows two boxes: a red box labeled 'Conceptual Model' and a teal box labeled 'Concept Meta-Data'.

- In order to be sufficiently extensible the conceptual model should represent business concepts with a sufficient level of abstraction
- Granular Concepts are Specified with Meta-Data
 - Coding Schemes (i.e. SNOMED, LOINC)
- Quality characteristics
 - Level of adoption
 - Domain relevance
 - Extensibility
 - Level of Abstraction


Verelst, J. (2005). "The Influence of the Level of Abstraction on the Evolvability of Conceptual Models of Information Systems." *Empirical Software Engineering* 10(4): 467-494.

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Examples that...


-meet that definition
 - HL7 RIM
 - Classes: Acts, Entities, Roles....
 - OpenEHR
 - Classes: Folders, Compositions, Observations, Evaluations....
- ... that don't
 - ASTM CCR
 - Classes: Social Security Number, Impairment, ReceivingAgencyIntakeDetail...

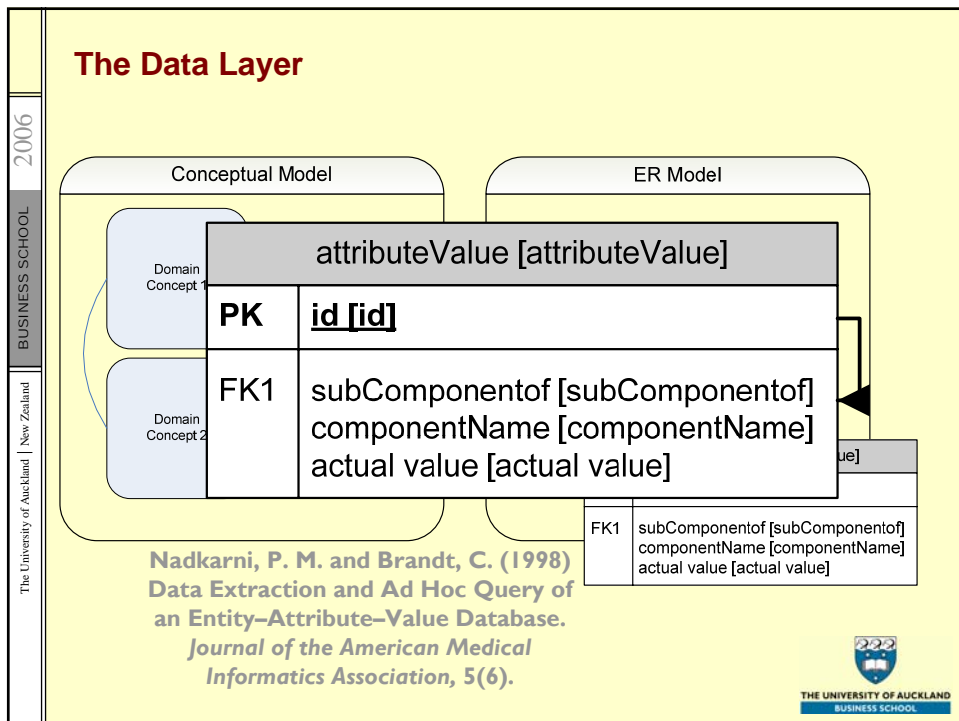
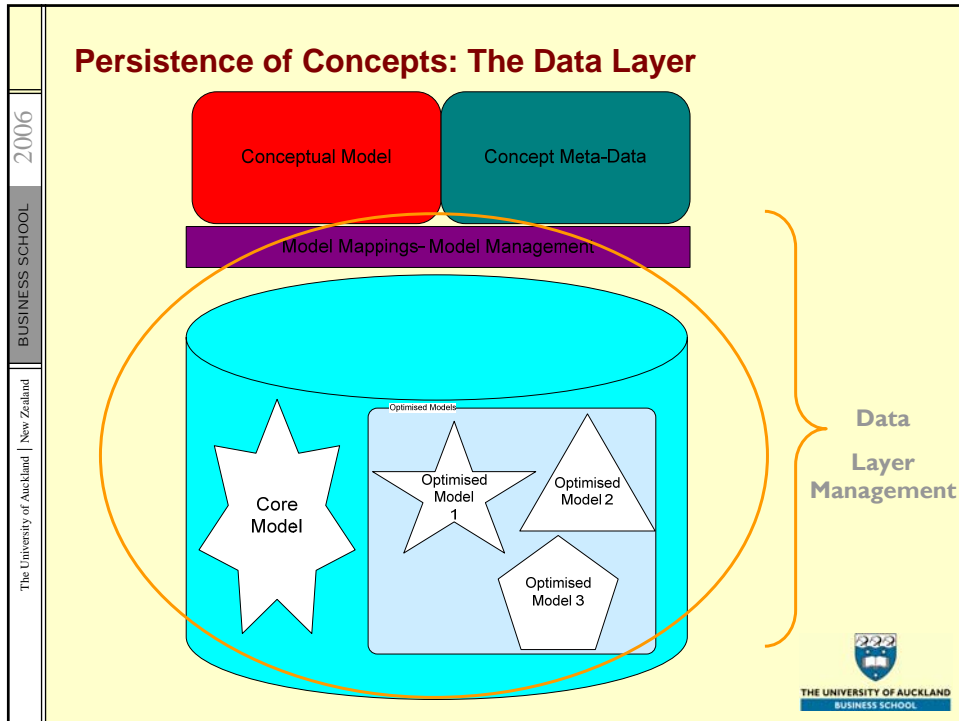


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Conceptual Model Summary

- Conceptual models must be able to accommodate new concepts in the domain
- Highly abstract models can accommodate more concepts, but are more difficult to use consistently
- Issues in choosing the "right" model
 - Proliferation of Proposals
 - Lack of Empirical Evidence or Adoption
 - Different Levels of Generality or Abstraction
 - Lack of Measurement and Evaluation Procedures





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Evolve and Adapt

Match takes two models as input and returns a mapping between them


Compose – takes a mapping between models A and B and a mapping between models B and C, and returns a mapping between A and C

Diff – takes a model A and mapping between A and some model B, and returns the sub-model of A that does not participate in the mapping

ModelGen – takes a model A, and returns a new model B based on A (typically in a different data model than A's) and a mapping between A and B

Merge – takes two models A and B and a mapping between them, and returns the union C of A and B along with mappings between C and A, and C and B”


From:
Bernstein, P. A. (2003). Applying Model Management to Classical Meta Data Problems. Proceedings of the Conference on Innovative Data Systems Research (CIDR).

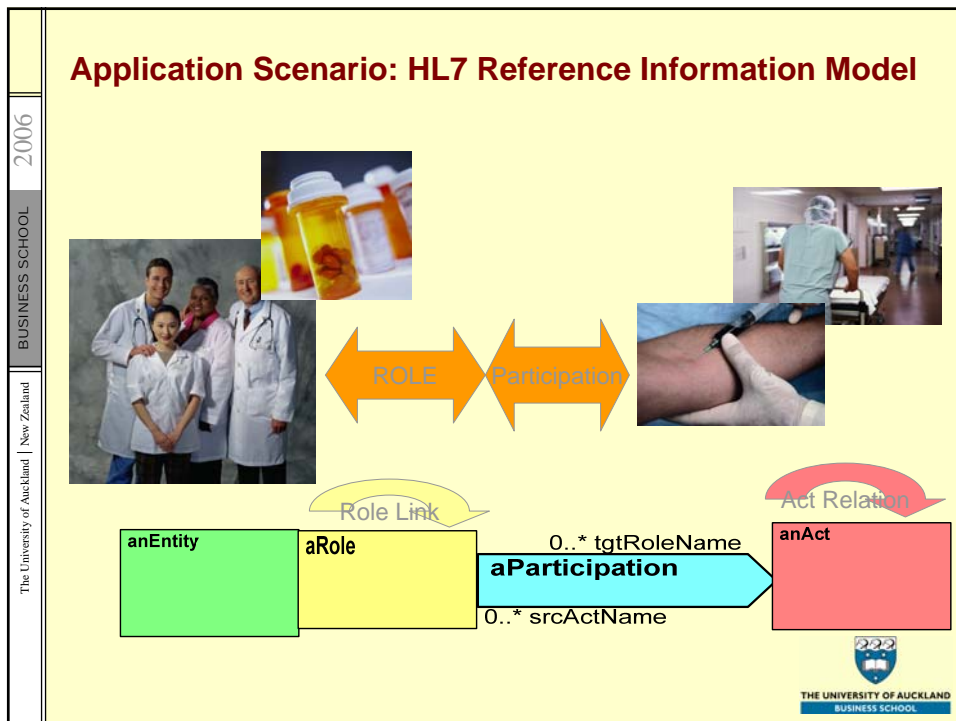
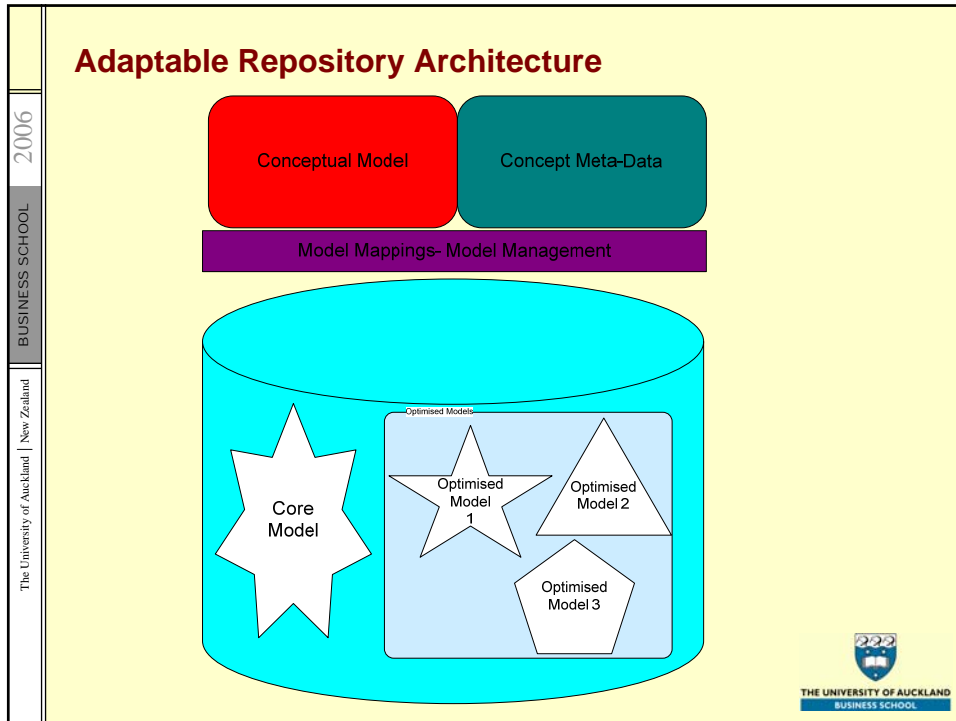


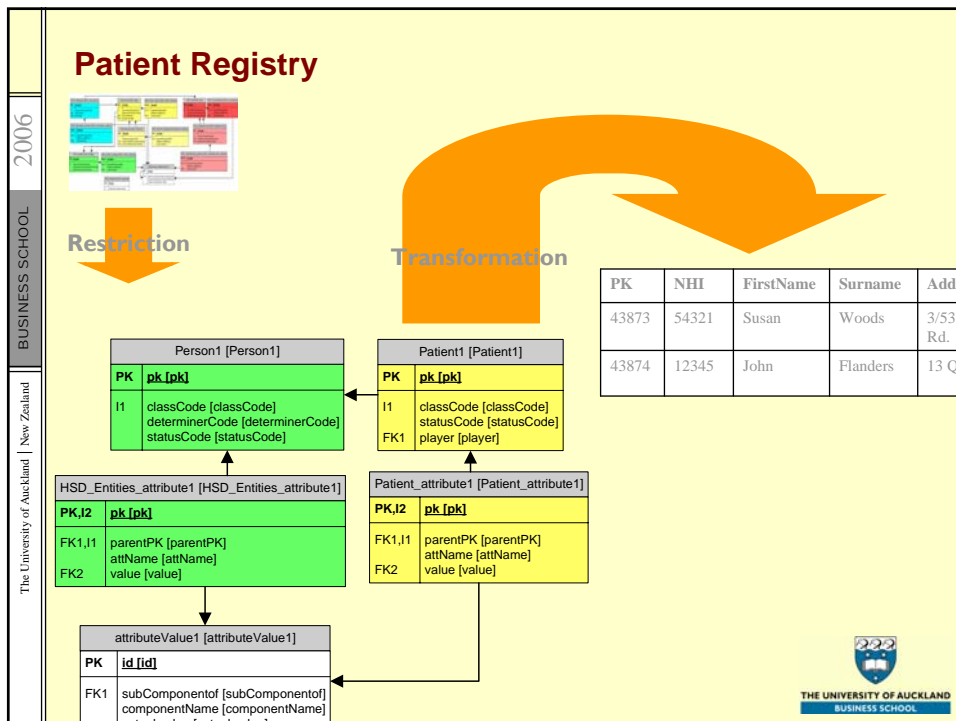
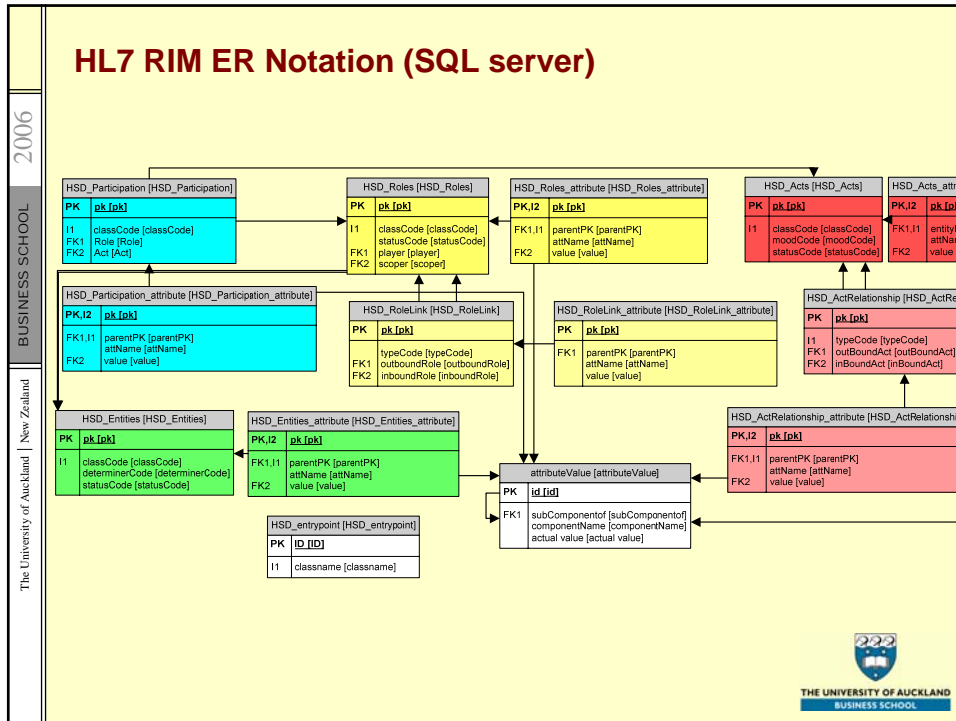
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Model Management

- Match, Compose, Diff, Model Gen, Merge
 - Prototypes
 - Artemis Tool Environment
 - SERF Schema Matching
 - Niranjin Shared Data Services (IEEE)
 - Products
 - Adeptia Data Mapper
 - Oracle 10g RDF/RDFS support modules
 - Pantero Semantic Technologies
- Not a single technology or approach but a combination







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PK	NHI	FirstName	Surname	Address	...
43873	54321	Susan	Woods	3/53 Park Rd.	
43874	12345	John	Flanders	13 Queen St.	...

Ad Hoc Addition

PK	NHI	FirstName	Surname	Address	Emergency Contact Person	...
43873	54321	Susan	Woods	3/53 Park Rd.	Joe Walsh Mob: 021-121234	
43874	12345	John	Flanders	13 Queen St.	Jane Flanders Mob: 027-1230343	...

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Person [Person]

PK pk [pk]

I1 classCode [classCode]
determinerCode [determinerCode]
statusCode [statusCode]

Patient [Patient]

PK pk [pk]

I1 classCode [classCode]
statusCode [statusCode]
FK1 player [player]

HSD_Entities_attribute [HSD_Entities_attribute]

PK,I2 pk [pk]

FK1,I1 parentPK [parentPK]
attName [attName]
FK2 value [value]

Patient_attribute [Patient_attribute]

PK,I2 pk [pk]

FK1,I1 parentPK [parentPK]
attName [attName]
FK2 value [value]

attributeValue [attributeValue]

PK id [id]

FK1 subComponentof [subComponentof]
componentName [componentName]
actual value [actual value]

HSD_RoleLink1 [HSD_RoleLink1]

PK pk [pk]

typeCode [typeCode]
outboundRole [outboundRole]
FK1,FK2 inboundRole [inboundRole]

Realignment


PK	NHI	FirstName	Surname	Address	Emergency Contact Person	...
43873	54321	Susan	Woods	3/53 Park Rd.	Joe Walsh Mob: 021-121234	
43874	12345	John	Flanders	13 Queen St.	Jane Flanders	...

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Summary

- **Framework for Adaptable / Evolvable Clinical Data Repository**
 - Abstract Conceptual (or Domain) Model
 - Granular Domain Concepts Specified with Meta-Data, not with classes
 - Mirror of Conceptual Model Created in the Data Layer
 - Model Management techniques used to evolve and adapt data layer
- **Application Scenario: HL7 Reference Information Model**
- **Limitations**
 - Static Model Focus
 - Tools for model management immature



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Key References

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