Conceptual Modeling for XML - A Survey

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- requirements
- existing approaches

Synopsis

- introduction
- requirements for conceptual models for XML
- existing approaches

Why Conceptual Model for XML?

- recently, XML is frequently applied as a logical database model
- we have several XML schema languages
- however, these languages are unsuitable to use on the conceptual level:
  - too weak (DTD) or too complex syntax for designers (XML Schema)
  - better for use as schema languages on the logical level

Special Features of XML

- hierarchical structure
- irregular structure
- ordering
- mixed content

Requirements for conceptual models for XML

General Requirements (1)

- independence on XML schema languages
- formal foundations
- user-friendly graphical notation
- logical level mapping

General Requirements (2)

- support for hierarchical views
  - different users with different requirements accessing the modeled data
  - each of the users may require different hierarchical organization of the same data – hierarchical views
  - we need to model the hierarchical views on the conceptual level

General Requirements (3)

- integration with semantic web technologies
  - a translation from the conceptual level to the semantic web level where the structures from the conceptual level are described using OWL
  - automatic publication of internally represented data on the semantic web
  - automatic integration of data from the semantic web to the internal representation

Modeling Constructs Requirements

- classical features:
  - many-to-many rel. types
  - n-ary rel. types, attributes of rel. types
- special features:
  - hierarchical structure
  - ordering, mixed content
  - irregular structure

Approaches

Two main approaches (1)

- extension of the classical E-R model to be suitable for the modeling of special XML features
  - problem with the modeling of hierarchical structures and different hierarchical views of the same data
  - how to model ordering?
  - how to model data mixed with text values?
  - how to translate a non-hierarchical conceptual schema to a hierarchical logical schema?

Two main approaches (2)

- hierarchical approach
  - schemes are modeled as trees
  - allows to model hierarchical structures and different hierarchical views
  - problem with the modeling of many-to-many relationship types, n-ary relationship types, and attributes of relationship types

EReX -
An E-R based conceptual model for XML

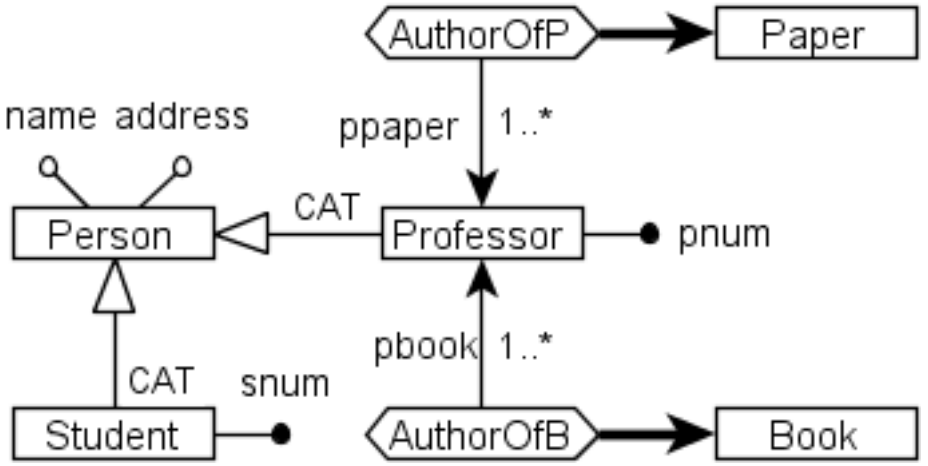
EReX (1)

- allows to model irregular structure and ordering:
  - categorization of entity types
    - similar to IS-A hierarchies in E-R
  - total/exclusive coverage constraints
    - *E1 + E2 + E3 = E*
    - *E1 | E2 | E3*

EReX (2)

- ordering specified on an entity type *E* participating in a relationship type *R*
  - for each entity *e* from *E* the set of relationships from *R* having *e* as a participant is linear ordered

EReX (3)



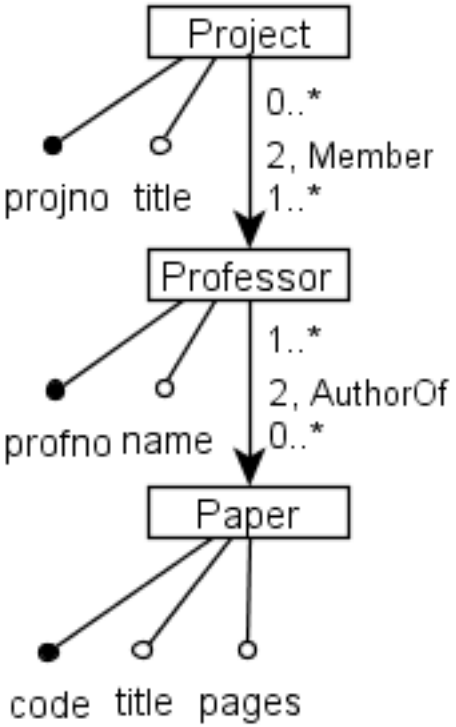
Student + Professor = Person
Student | Professor

ORA-SS - A hierarchical conceptual model for XML

ORA-SS (1)

- n-ary relationship types and attributes of relationship types
- cardinality constraints for both participants of relationship types
- ordering
- disjunction

ORA-SS (2)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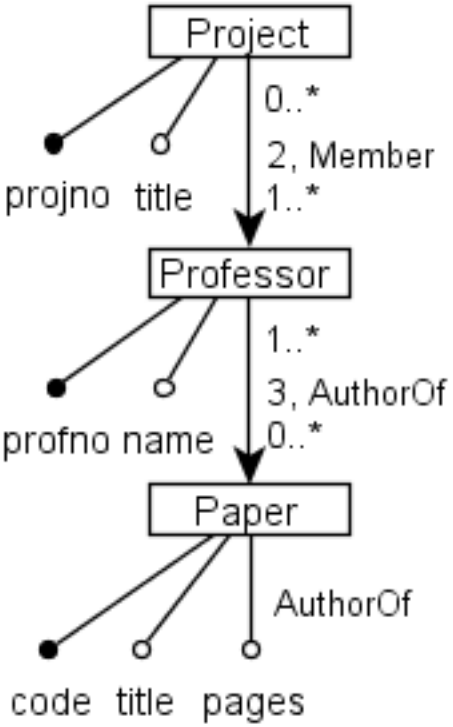
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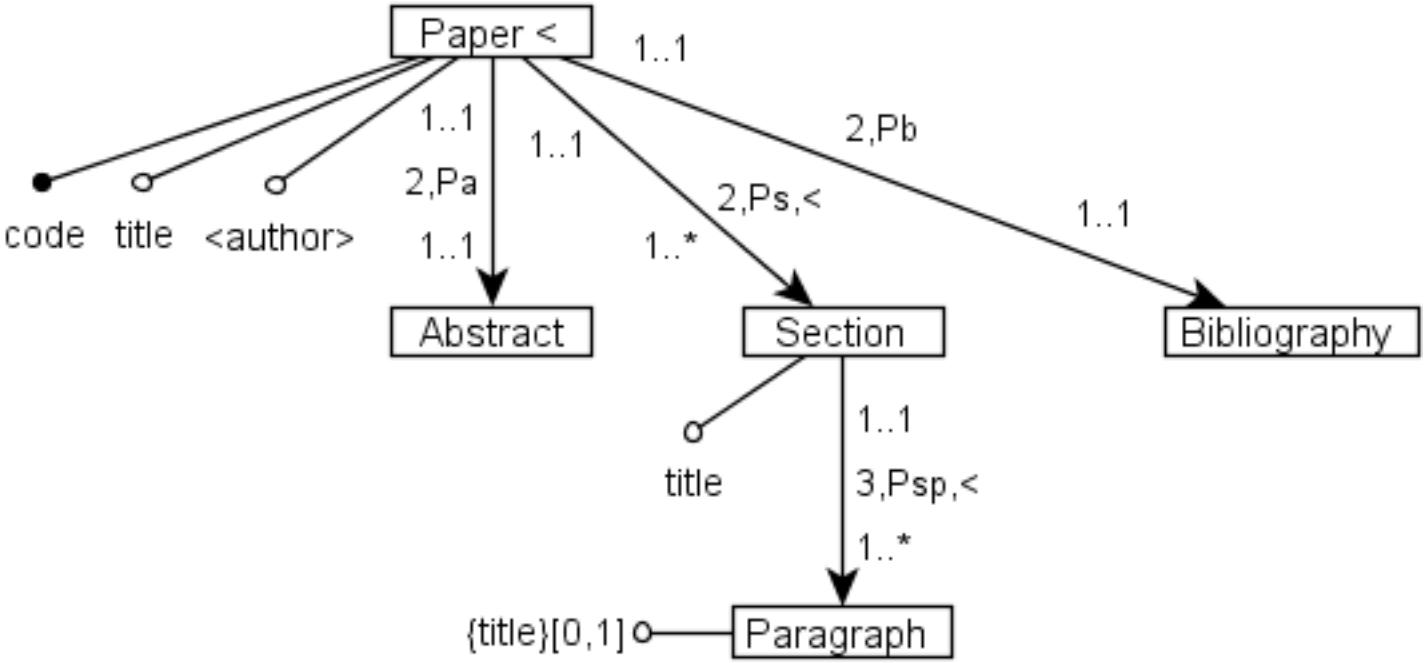
ORA-SS (3)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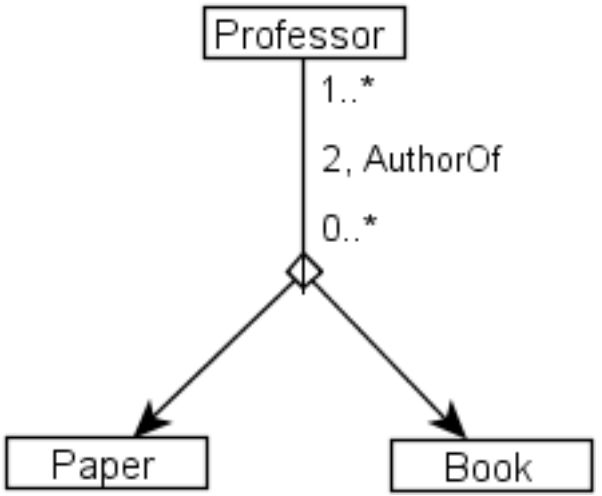
ORA-SS (4)



Conclusion

- poor support of the specific XML features
- utilization of conceptual models for the data integration and for the integration with the semantic web has not been studied enough yet
- there is no conceptual model combining the advantages of the both approaches (E-R and hierarchical)
- open space for research

Thank you for your attention!