What is a Data Model?

Overview

- **What is a Data Model?**
- **Review of some Basic Concepts in Data Modeling**
- **Benefits of Data Modeling**

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What is a Data Model?

Definition: model (Merriam-Webster)

- a structural design;
- a usually miniature representation of something;
- a pattern of something to be made;
- an example for imitation or emulation;
- a description or analogy used to help visualize something (as an atom) that cannot be directly observed;

What is a Data Model?

Definition: data model

- A formal definition of the different elements required to describe those aspects of the ‘real world’ which it is designed to model and the nature of the links between these elements (indecs.org)
- A data model is typically a set of tables and columns and supporting documentation that hold information about some real world things (Cornell University);
- a collection of data structures, a collection of operators, and a collection of integrity rules (Codd, 1981)

What is a Data Model?

What is a data model?

a working definition:

A structured and comprehensible representation of:

- the information used in a purposeful enterprise, and
- the organization of that information

What is a Data Model?

Purposes of data modeling:

- Provide a precise language and syntax to represent the information and it's internal structure
- Provide a structural context for designing data repositories

What is a Data Model?

Artifacts of data modeling:

- Data Dictionary
  - a primary metadata repository
- Graphical representation(s)
  - The picture of a thousand words

Overview

- What is a Data Model?
- Review of some Basic Concepts in Data Modeling
  - Concepts
  - Notations
  - Types of models
- Benefits of Data Modeling

Basic Data Modeling

- Concepts
  - Object Class
    - Attributes
    - Identifiers
  - Association
    - Optionality
    - Cardinality
    - Composition
    - Generalization

Basic Data Modeling

- Concepts: Object Class
  - “A thing of a particular type”
  - “A kind of memorable thing”
  - “The thing about which an organization keeps data”
  - “A fundamental concept in the information domain”

Basic Data Modeling

- Concepts: Attribute
  - An elementary component or property of a class
  - A data item that serves as a descriptor of an object class

Basic Data Modeling

- Concepts: Attribute
  - Atomic vs. composite
  - Single- vs. multi-valued

Basic Data Modeling

- Concepts: Association
  - A relationship between object classes

Basic Data Modeling

- Concepts: Association
  - Optionality
    - For each X, must there be at least one Y?

Basic Data Modeling

- Concepts: Association
  - Cardinality
    - For each X, can there be more than one Y?

Basic Data Modeling

- Concepts: Generalization
  - Super-type/Sub-type relationship
  - X “Is a” type of Y

Basic Data Modeling

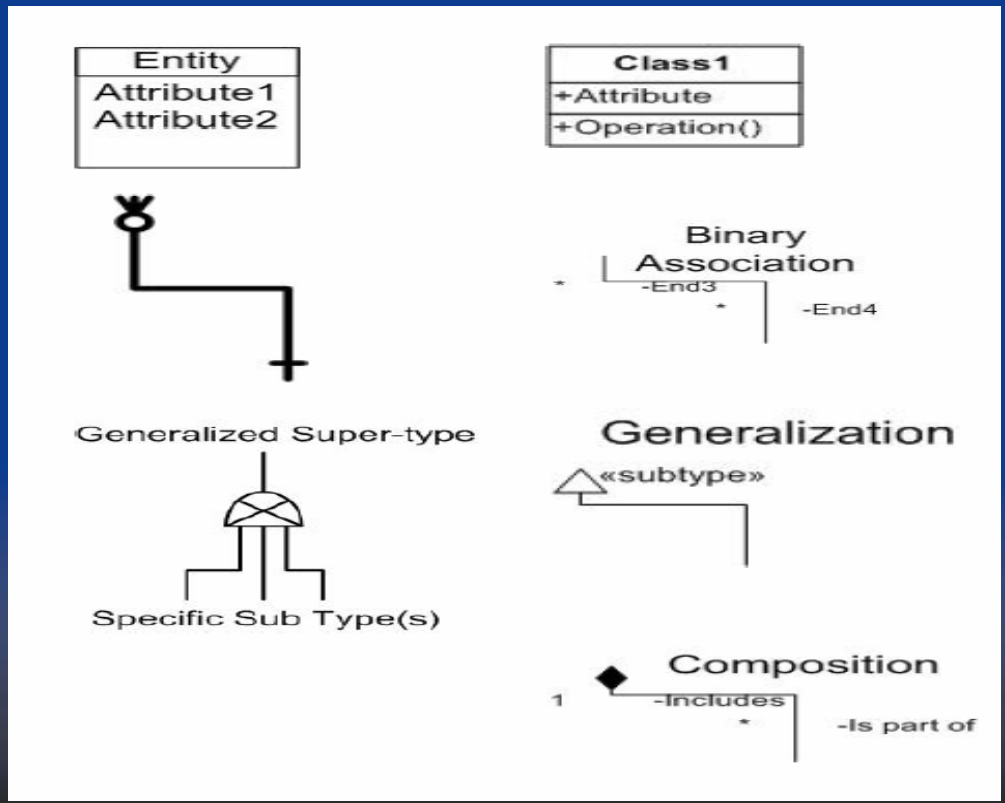
- Concepts: Composition
  - The combination of objects into an aggregate
  - X “Is part of” Y

Basic Data Modeling

- Concepts
- Notations
  - UML
  - E-R
- Types of models

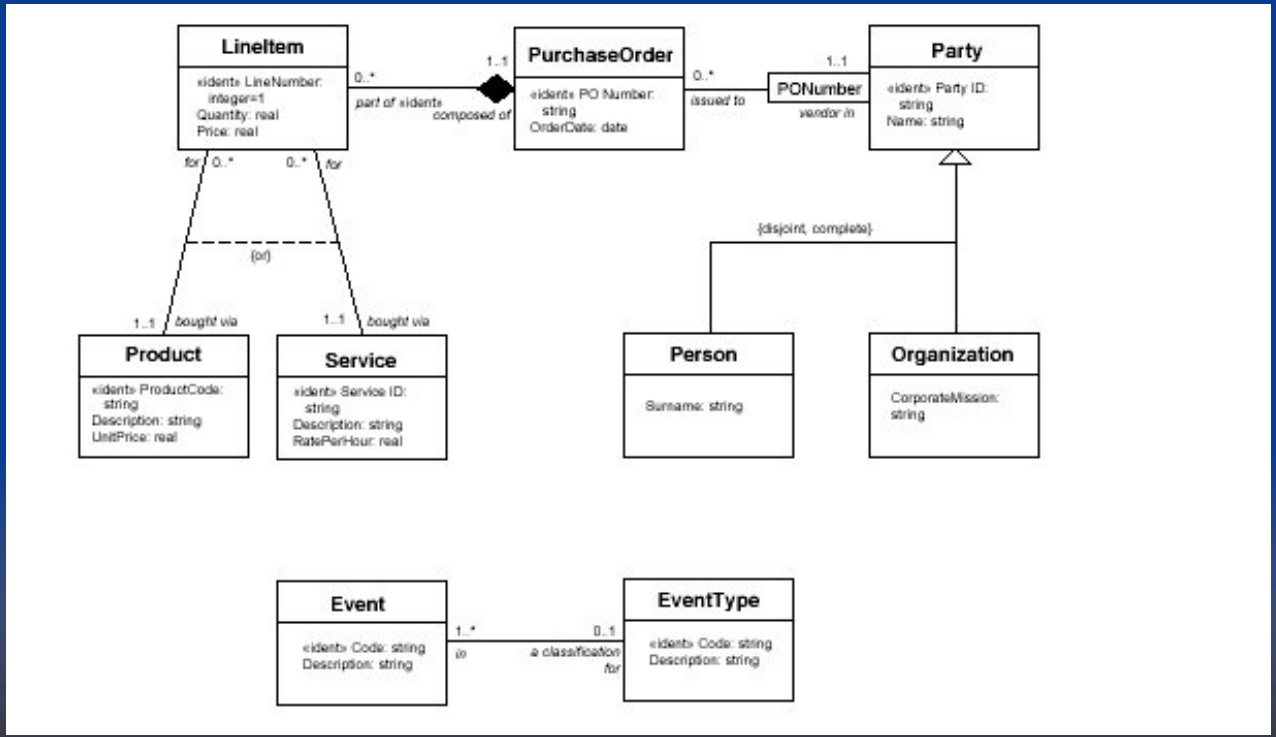
Basic Data Modeling Notations:

E-R UML



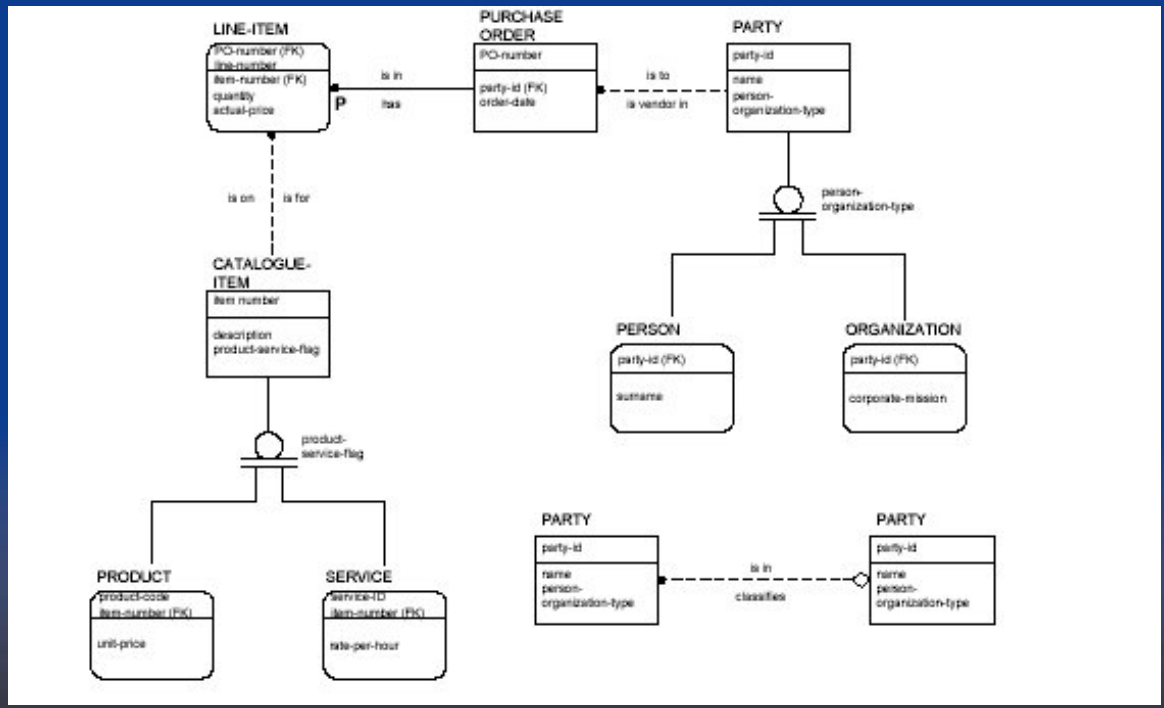
Basic Data Modeling

- Notations: UML



Basic Data Modeling

- Notations: E-R



Basic Data Modeling

- Concepts
- Notations
- Types of models
  - Degrees of detail
  - Scope

Basic Data Modeling

Each type of model can be described by its scope and degree of detail (specification).

Dimensions of Models

- **Specificity Dimension**
  Conceptual → Logical → Physical
- **Scope Dimension**
  Enterprise → Domain → Application

Specificity Dimension

- Conceptual ➔ Logical ➔ Physical
  - Conceptual Information Model
    - “The 10,000 Foot View”
  - Enterprise Logical Model
    - More Focused, More Detailed
  - Application Logical Model
    - Details the specific information requirements of the application
  - Physical Data Model
    - Fully detailed, including processing requirements

Scope Dimension

Enterprise ➔Domain ➔ Application

- **Enterprise Models address the entire set of concepts relevant to the Enterprise.**
- **Domain Models address a single subject, or a particular perspective on the Enterprise.**
- **Application Models address a specific functional area within the domain and include only those concepts needed to accomplish a particular business activity.**

Overview

- What is a Data Model?
- Review of some Basic Concepts in Data Modeling
- Benefits of Data Modeling
  - Benefits from modeling data
  - Benefits of a common conceptual &/or logical model

Benefits of Data Modeling

- **Benefits of modeling data:**
  - **Accurate and complete information.**
    - **Elimination of redundancy and therefore inconsistency**
  - **Integrity and consistency of information**
    - **Correct representation of relationships allows for determination of proper constraints**
  - **Stability**

Benefits of Data Modeling

- **Benefits of a common Conceptual &/or Logical model:**
  - **Establishment of a common semantic**
  - **Shared, consistent understanding**
  - **Facilitation of information integration**

Summary

Information Systems have their foundations in information

Data modeling provides the common language designers, developers, and users of an IT system can use to understand and discuss that information, facilitating it's proper use and management.

Questions?

Contact Information

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