Chapter 3
Entity-Relationship Data Modeling: Process and Examples

A Data Modeling Process
- Steps in the data modeling process
  - Plan project
  - Determine requirements
  - Specify entities
  - Specify relationships
  - Determine identifiers
  - Specify attributes
  - Specify domains
  - Validate model

Planning the Project
- Obtaining project authorization and budget
- Building the project team
- Planning the team’s activities
- Establishing tools, techniques, and standards for consistent results
- Defining the project’s scope

Determining System Requirements
- Sources for data modeling requirements
  - User interviews and user activity observations
  - Existing forms and reports
  - New forms and reports
  - Existing manual files
  - Existing computer files/databases
  - Formally defined interfaces (XML)
  - Domain expertise
- The result of the requirements determination will be a repository of notes, diagrams, forms reports, files, etc., that can be used to develop the data model

Specifying Entities
- An entity is something that the users want to track; something the users want to keep data about
- Entities
  - can be physical things or logical concepts
  - are identifiable; you can tell one from another
  - are things described by nouns, not characteristics described by adjectives

Specifying Relationships
- Includes:
  - Identity of the parent and child entities
  - Relationship type
  - Minimum and maximum cardinalities
  - Name of the relationships
- Two techniques:
  - Examine whether a relationship exists between every combination of two entities
  - Locate relationships from requirement documents
- A combination of the two approaches may be used
Determining Identifiers

- Identifier is an attribute or group of attributes that uniquely identifies an entity instance.
- If there is difficulty specifying an identifier, maybe:
  - it should be part of a different entity
  - it is a subtype or category of a common entity
  - it needs one or more identifying relationships

Specifying Attributes and Domains

- Find attributes on forms, reports, existing files, etc., and add them to entities.
- Determine whether the attribute has already defined a domain.
- If so, the attribute is based upon that domain.
- If not, a new domain is defined.
- Review the domains and make adjustments as necessary.
- Domain properties change when the domain properties change, affecting all attributes.
- Domains may be used to enforce data standards promoting compatible data types and systems.
- Once all attributes have been specified, the model should be reviewed for missing entities.

Validating Model

- Data model is a model of humans’ models, not a model of reality.
- A data model is wrong if it does not accurately reflect the ways the users think about their world.
- Data models are validated through a series of reviews:
  - Normally, a team review is followed by user reviews.
- E-R model as well as prototypes of forms and reports may be used to communicate features of the data model.

Creating Data Models From Forms and Reports

- Example: Single entities.

Example: Identifying Connection Relationships

Example: Repeating Groups
Example: Repeating Groups

Example: Nested Groups

Example: Non-Identifying Connection Relationships

Example: Non-Identifying Connection Relationships

Example: 1:N

Example: 1:N
Example: Category Relationship

Figure 3.15: Example Category Relationship — One Category Has Additional Subcategory.

Example: Sales Order

Figure 3.16a: Sales Order Example — Sample Document.

Figure 3.16b: Sales Order Example — Sale Order.

Figure 3.16c: Sales Order Example — Sale Order with One Identifying Relationship.

Figure 3.16d: Sales Order Example — Sale Order with One Identifying Relationship.

Sales-Order Model

Figure 3.16e: Sales-Order Model — Example Document.

Example: Sales Order

Figure 3.16f: Sales Order Example — Sale Order with One Identifying Relationship.

Figure 3.16g: Sales Order Example — Sale Order with One Identifying Relationship.

Example: University System

Figure 3.25: Final Data Model.

Example: University System With Domain Names

Figure 3.27: Model with Domain Names.
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