Chapter 4: The Enhanced E-R Model and Business Rules

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Supertypes and Subtypes

- Subtype: A subgrouping of the entities in an entity type which has attributes that are distinct from those in other subgroupings
- Supertype: An generic entity type that has a relationship with one or more subtypes
- Juneritance:
 - Subtype entities inherit values of all attributes of the supertype
 - An instance of a subtype is also an instance of the supertype



Figure 4-1 Basic notation for supertype/subtype relationships

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Figure 4-2 -- Employee supertype with three subtypes



Relationships and Subtypes

Relationships at the *supertype* level indicate that all subtypes will participate in the relationship

The instances of a *subtype* may participate in a relationship unique to that subtype. In this situation, the relationship is shown at the subtype level

Figure 4-3 -- Supertype/subtype relationships in a hospital



Generalization and Specialization

Generalization: The process of defining a more general entity type from a set of more specialized entity types. BOTTOM-UP **Specialization:** The process of defining one or more subtypes of the supertype, and forming supertype/subtype relationships. **TOP-DOWN**

Figure 4-4 – Example of generalization (a) Three entity types: CAR, TRUCK, and MOTORCYCLE



Figure 4-4(b) – Generalization to VEHICLE supertype



Note: no subtype for motorcycle, since it has no unique attributes Chapter 4 © Prentice Hall, 2002

Figure 4-5 – Example of specialization

(a) Entity type PART



Figure 4-5(b) – Specialization to MANUFACTURED PART and PURCHASED PART



Note: multivalued attribute was replaced by a relationship to another entity

Constraints in Supertype/ Completeness Constraint

Completeness Constraints: Whether an instance of a supertype *must* also be a member of at least one subtype
– Total Specialization Rule: Yes (double line)
– Partial Specialization Rule: No (single line)

Figure 4-6 – Examples of completeness constraints (a) Total specialization rule



Figure 4-6(b) – Partial specialization rule



Constraints in Supertype/ Disjointness constraint Disjointness Constraints: Whether an instance of a supertype may simultaneously be a member of two (or more) subtypes.

- Disjoint Rule: An instance of the supertype can be only ONE of the subtypes
- Overlap Rule: An instance of the supertype could be more than one of the subtypes

Figure 4-7 – Examples of disjointness constraints (a) Disjoint rule



Figure 4-7(b) Overlap rule



Constraints in Supertype/ Subtype Discriminators

Subtype Discriminator: An attribute of the supertype whose values determine the target subtype(s)

- Disjoint a *simple* attribute with alternative values to indicate the possible subtypes
- Overlapping a *composite* attribute whose subparts pertain to different subtypes. Each subpart contains a boolean value to indicate whether or not the instance belongs to the associated subtype

Figure 4-8 – Introducing a subtype discriminator (*disjoint* rule)



Figure 4-9 – Subtype discriminator (**overlap** rule)



Figure 4-10 – Example of supertype/subtype hierarchy



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Entity Clusters

EER diagrams are difficult to read when there are too many entities and relationships Solution: group entities and relationships into entity clusters **Entity cluster:** set of one or more entity types and associated relationships grouped into a single abstract entity type

Figure 4-13(a) – Possible entity clusters for Pine Valley Furniture



Figure 4-13(b) – EER diagram of PVF entity clusters



¹A relationship diamond and name (e.g., Ordered_on) could be inserted here, although none is on Figure 4-13a.

Business rules

Statements that *define* or *constrain* some aspect of the business.

- Constraints can impact:
 - Structure (definition, domain, relationship)
 - Behavior (operational constraints)
- **Classification of business rules:**
 - Derivation rule derived from other knowledge
 - Structural assertion rule expressing static structure
 - Action assertion rule expressing constraints/control of organizational actions

Figure 4-15 – EER depiction of business rules classification



Source: adapted from GUIDE Business Rules Project, 1997.

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Action Assertion Classifications

Result

- Condition IF/THEN rule
- Integrity constraint must always be true
- Authorization privilege statement

Form

- Enabler if true, leads to creation of new object
- Timer allows or disallows an action
- Executive executes one or more actions

Rigor

- Controlling something must or must not happen
- Influencing guideline for which a notification must occur

Stating an Action Assertion

Anchor Object – an object on which actions are limited
Action – creation, deletion, update, or read
Corresponding Objects – an object influencing the ability to perform an action on another business rule

Action assertion will identify corresponding objects that constrain the ability to perform actions on anchor objects

Figure 4-16 – Data model segment for class scheduling



Figure 4-17 – Business Rule 1: For a faculty member to be assigned to teach a section of a course, the faculty member must be qualified to teach the course for which that section is scheduled



Figure 4-18 –Business Rule 2: For a faculty member to be assigned to teach a section of a course, the faculty member must not be assigned to teach a total of more than three course sections



In this case, the action assertion is an *Upper LIM*it

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