Database Design

7-1
Arcs
Objectives

This lesson covers the following objectives:

• Define the term "constraint" as it applies to data modeling
• Identify an exclusive OR relationship in a business scenario
• Diagram an arc constraint to represent an exclusive OR relationship
• Distinguish between the use of an arc and a subtype in the data model
Purpose

• Arcs in data modeling help designers clarify an exclusive OR across relationships.

• The more explicitly you can define the client's requirements, the more accurate your final implementation will be.
What is a Constraint?

• Every business has restrictions on which attribute values and which relationships are allowed.

• These restrictions are called constraints.

• They may refer to a single attribute of an entity, or to relationships between entities.

• We already know about several kinds of constraints; for example, every EMPLOYEE must work in one and only one DEPARTMENT.

• In this lesson, we will see another kind of constraint—an exclusive OR constraint.
Exclusive OR Relationship

• Mutually exclusive relationships sometimes exist between entities and are also known as Exclusive OR Relationships

• An Exclusive OR relationship is a relationship between one entity and two (or more) other entities where only one of the relationships can exist at a time

• In ERDs, we model this type of relationship with an Arc
Exclusive OR Relationship

• For example: a TRAINING EVENT can be hosted by either an IN HOUSE TRAINER or an external TRAINING COMPANY.
Exclusive OR Relationship

• Each TRAINING EVENT must be hosted by one and only one IN HOUSE TRAINER OR one and only one TRAINING COMPANY.
Exclusive OR Relationship

• Another Example: A billboard is an advertising space that can feature a movie, a product, or a public announcement. It may contain advertising about only one of these at a time.
Exclusive OR Relationship

• Each “feature” has its own characteristics or attributes.
• The arc tells the reader of the diagram that only one of these “features” will have a relationship with each instance of a BILLBOARD.
Representing Exclusive OR Relationships in the ERD

- Arcs are a way to represent mutually exclusive relationships in the ERD.
Representing Exclusive OR Relationships in the ERD

- This arc represents the exclusive OR relationship - each MEMBERSHIP must be held by one COMPANY or must be held by one CUSTOMER, but not both.
Representing Exclusive OR Relationships in the ERD

- An arc is represented on an ERD as a solid line with curved ends.
- A circle is drawn on the arc for every relationship that is part of the arc.
Arcs

- An arc always belongs to one entity.
- Arcs can include more than two relationships.
- Not all relationships of an entity need to be included in an arc.
- An entity may have several arcs.
- An arc should always consist of relationships of the same optionality.
Arcs

• All relationships in an arc must be mandatory or all must be optional.

• Relationships in an arc may be of different cardinality, although this is rare.
Arcs, Supertypes, and Subtypes

• Arcs and Super/subtypes both model mutual exclusiveness.
• Certain situations are best modeled as an arc, and others as supertype and subtypes.
Arcs, Supertypes, and Subtypes

- Example 1: CHECKING ACCOUNT and SAVINGS ACCOUNT are “types” of ACCOUNT.
Arcs, Supertypes, and Subtypes

• This should be modeled as supertype and subtypes

ACCOUNT
# id
* date opened
* balance
O date closed

CHECKING
# id
* overdraft Limit

SAVINGS
# id
* interest rate

OTHER
Arcs, Supertypes, and Subtypes

- Example 2: An EVENT can be held at either a PRIVATE HOME or a PUBLIC SPACE.
- If the entities that are related through the arc are similar, there may be a case for creating a super/subtype without an arc.
Arcs, Supertypes, and Subtypes

- In this case, both PRIVATE HOME and PUBLIC SPACE are types of VENUE, and they have broadly similar attributes, so they could be supertype and subtypes.
Arcs, Supertypes, and Subtypes

• Example 3: IN HOUSE TRAINER and TRAINING COMPANY are NOT types of TRAINING EVENT, and they do not share common attributes. This is best to model with an arc.

TRAINING EVENT
# id
* date
* name

IN HOUSE TRAINER
# id
* first Name
* last Name

TRAINING COMPANY
# id
* name
* address
* speciality
* contact name
Terminology

Key terms used in this lesson included:

• Arc
• Constraint
• Exclusive OR relationship
• Mutually exclusive relationship
Summary

In this lesson, you should have learned how to:

• Define the term "constraint" as it applies to data modeling
• Identify an exclusive OR relationship in a business scenario
• Diagram an arc constraint to represent an exclusive OR relationship
• Distinguish between the use of an arc and a subtype in the data model