Chapter 06
Specifying Relationships

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Topics

- The Need for Relationships
- Association Relationships
- Aggregation Relationships
- Association or Aggregation?
- Naming Relationships
- Role Names

Why do we need relationships?

- All systems are made up of many classes and objects.
- System behavior is achieved through the collaborations of the objects in the system.
  - For example, a student is added to a course offering when the course offering receives the *add student* message.
  - This is often referred to as an object sending a message to another object.
  - Relationships provide the conduit for object interaction.

Types Of Relationships

- Two types of relationships discovered during analysis are:
  - Associations
  - Aggregations

Association Relationships

- An association is a bidirectional semantic connection between classes.
- It is not a data flow as defined in structured analysis and design—data may flow in either direction across the association.
- An association between classes means that there is a linkbetween objects in the associated classes.
  - For example, an association between the **Course** class and the **ProfessorCourseManager** class means that objects in the Course class are connected to objects in the ProfessorCourseManager class.

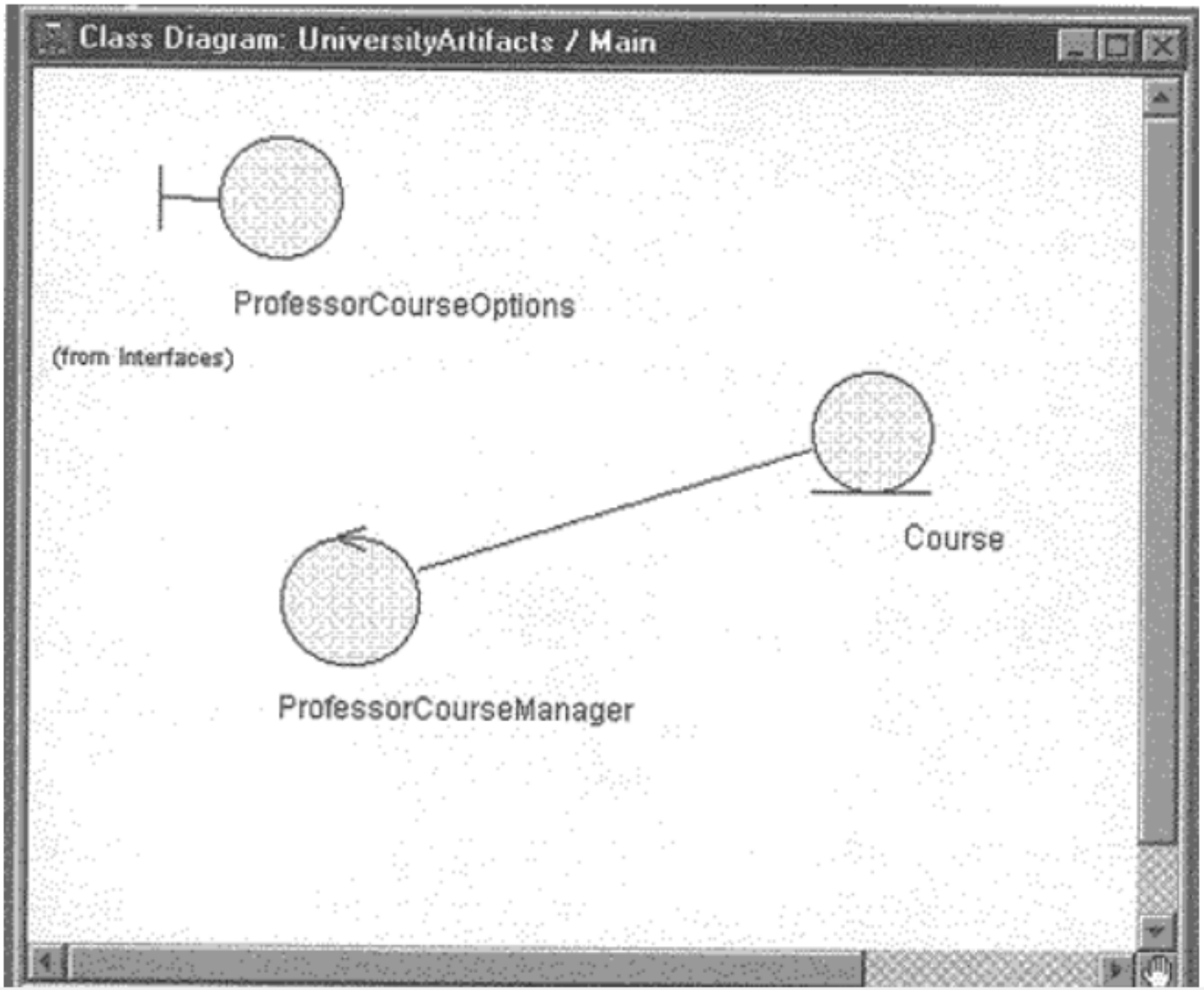
Association Relationships

- In the UML, association relationships are shown as a line connecting the associated classes, as shown in Figure 6-1.

Note

- The number of objects connected depends upon the multiplicity of the association, which is to be discussed later.

Figure 6-2. Association Relationship



Aggregation Relationships

- An aggregation relationship is a specialized form of association in which a whole is related to its part(s).
- Aggregation is known as a "part-of" or containment relationship.

Aggregation Relationships

- The UML notation for an aggregation relationship is an association with a diamond next to the class denoting the aggregate (whole), as shown in Figure 6-3.

Figure 6-3. UML Notation for an Aggregation Relationship

The “TESTS”

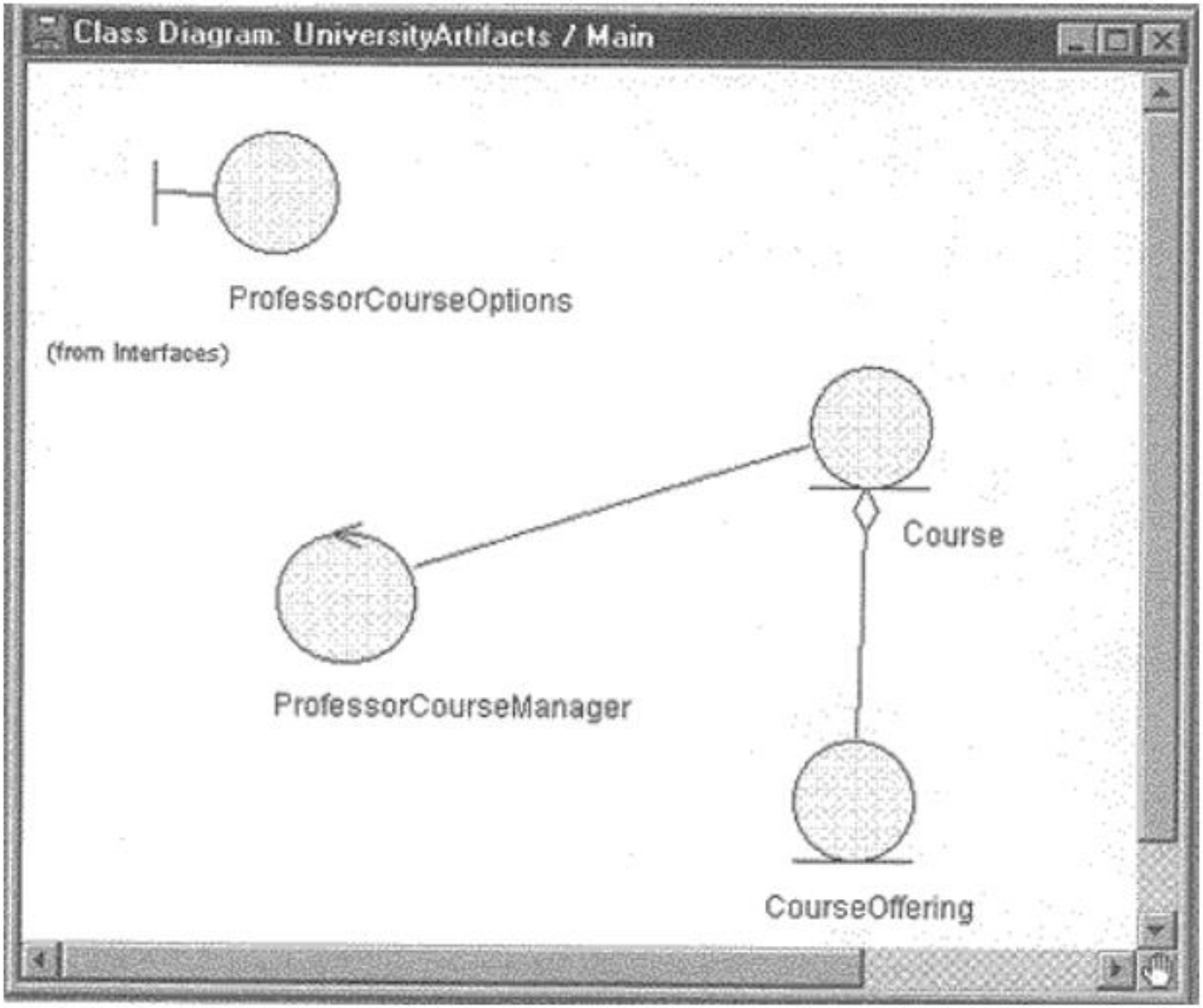
The following tests may be used to determine if an association should be an aggregation:

- Is the phrase "part of" used to describe the relationship?
- Are some operations on the whole automatically applied to its parts?
  - For example, delete a course then delete all of its course offerings.

The “TESTS”

- Is there an intrinsic asymmetry to the relationship where one class is subordinate to the other?
  - For example, a Course (Math 101) may be offered at different times during a semester.
  - Each offering is represented as a Course Offering (e.g., Math 101, Section 1, and Math 101, Section 2).
  - The relationship between a Course and a CourseOffering is modeled as an aggregation—a Course "has" CourseOfferings.

Figure 6-4. Aggregation Relationship



Association or Aggregation?

- If two classes are tightly bound by a whole-part relationship, the relationship is typically an aggregation.
  - "The decision to use aggregation is a matter of judgment and is often arbitrary. Often it is not obvious if an association should be modeled as an aggregation. If you exercise careful judgment and are consistent, the imprecise distinction between aggregation and ordinary association does not cause problems in practice."

Association or Aggregation?

- Whether a relationship is an association or an aggregation is often domain dependent.
- What type of relationship should be used to model a car with its tires?
  - If the application is a service center, and the only reason you care about the tire is because it is part of the car you are servicing, then the relationship should be an aggregation.
  - If the application is a tire store, you will care about the tire independent of a car and therefore, the relationship should be an association.

Naming Relationships

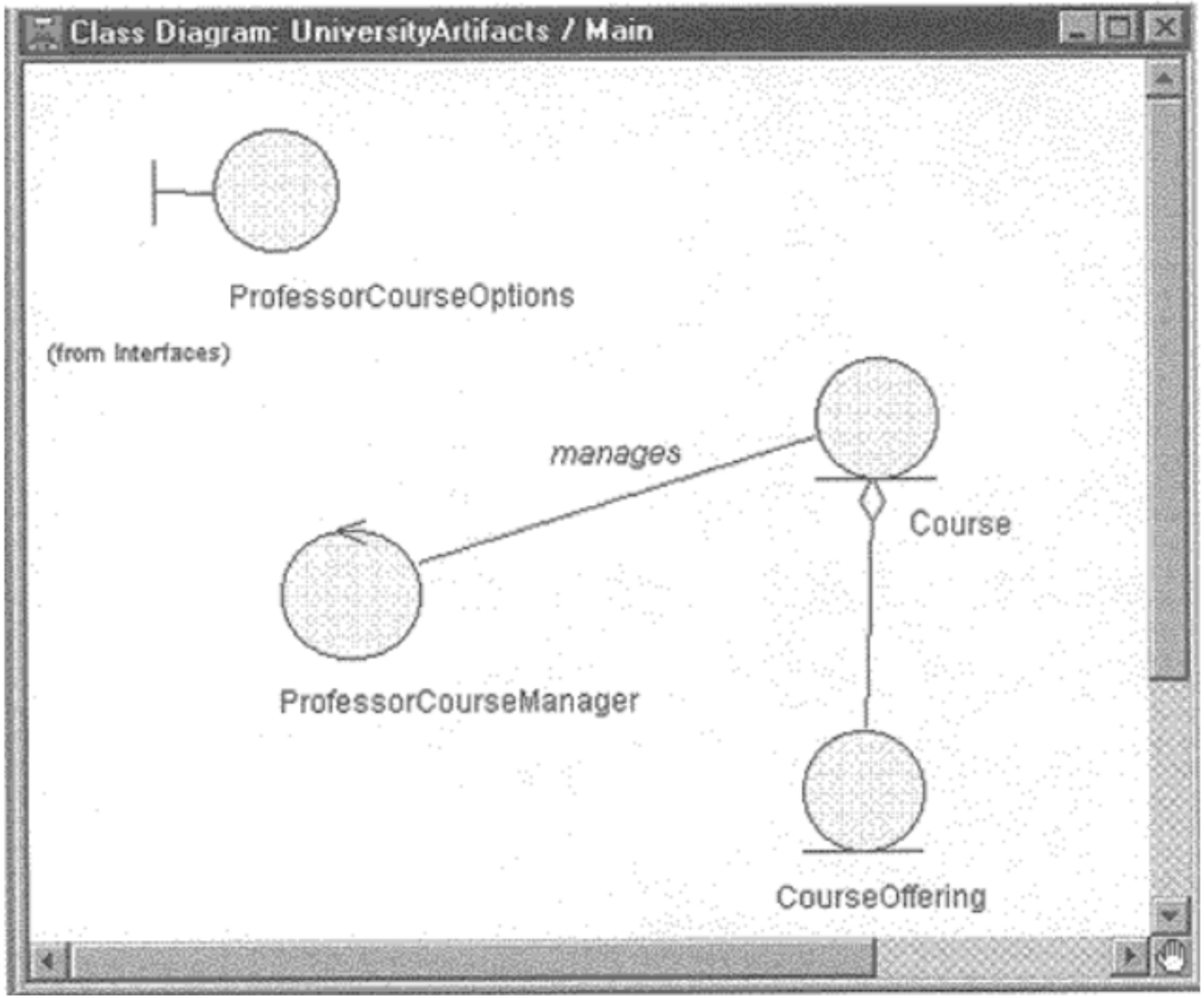
- An association may be named.
- Usually the name is an active verb or verb phrase that communicates the meaning of the relationship.
- Since the verb phrase typically implies a reading direction, it is desirable to name the association so it reads correctly from left to right or top to bottom.
- The words may have to be changed to read the association in the other direction (e.g., a Professor *teaches* a Course, a Course *is taught by* a Professor).
- It is important to note that the name of the association is optional.

Naming Relationships

- Names are added if they are needed to add clarity to the model.
- Aggregation relationships typically are not named since they are read using the words "has" or "contains."

A named relationship is shown in Figure 6-5.

Figure 6-5. A Named Association

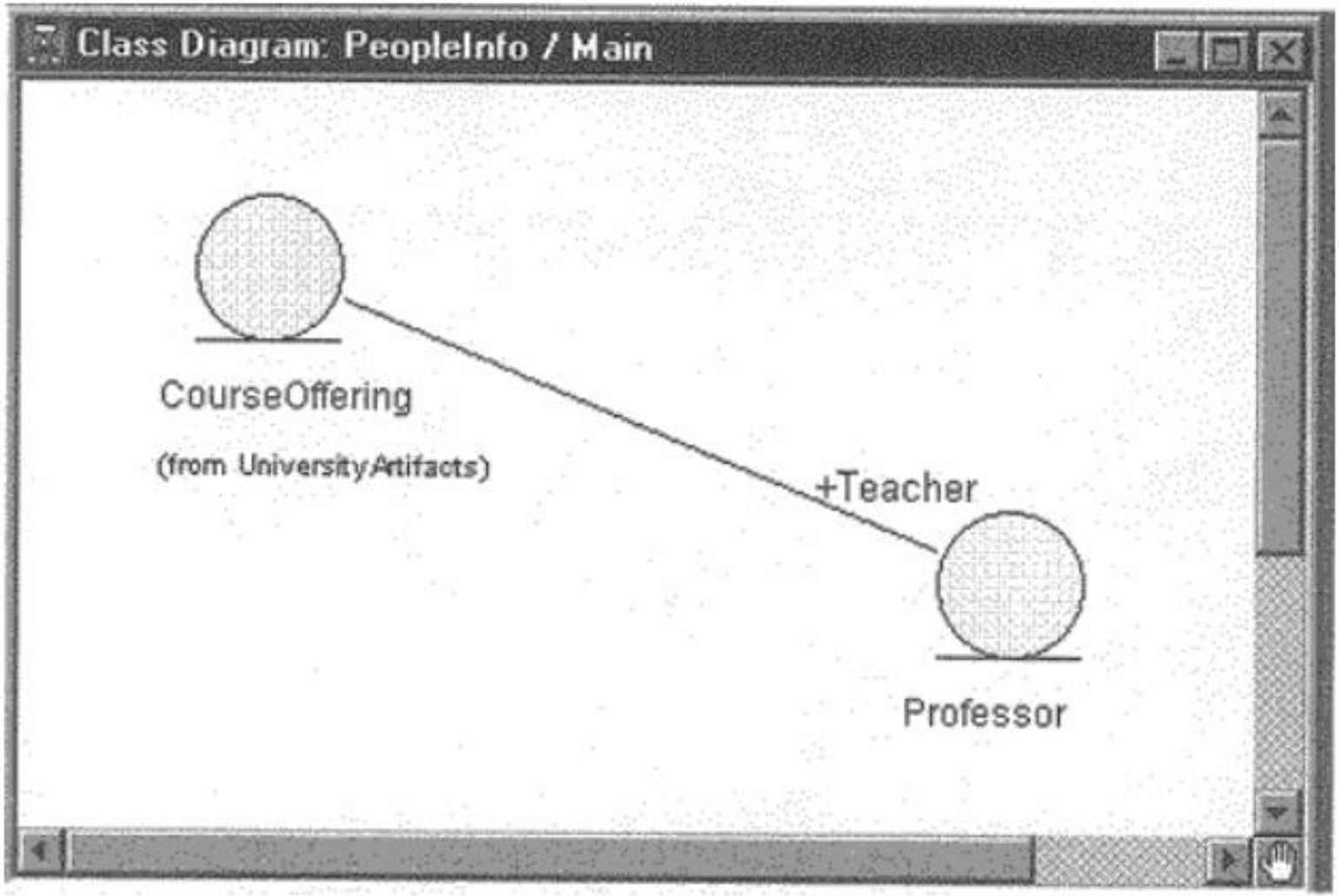


Role Names

- The end of an association where it connects to a class is called an association role.
- Role names can be used instead of association names.
- A role name is a noun that denotes the purpose or capacity wherein one class associates with another.
- The role name is placed on the association near the class that it modifies, and may be placed on one or both ends of an association line.
- It is not necessary to have both a role name and an association name.

Figure 6-6 shows an association with a role name.

Figure 6-6. Role Name



Role Names

- The relationship shown in Figure 6-6 is read in both directions.
  - A Professor playing the role of the Teacher is related to the CourseOffering.
  - A CourseOffering is related to a Professor playing the role of a Teacher.

Role Names

- There is no standard as to whether you should use association names or role names.
- However, most people today tend to use role names instead of association names since it is easier to convey the meaning of the relationship.
- This is especially true in a bidirectional relationship since it is very hard to find a verb phrase that reads correctly in both directions.
- What verb phrase could be used to name the association in Figure 6-6?
- By using a role name, the meaning is clear in both directions .

Role Names

- Associations are named or role names are used only when the names are needed for clarity.
- If you have a relationship between Company and Person then you could use an association name called "employs" or the role names of "Employer" and "Employee" to convey an employment relationship.
- If the classes were named Employer and Employee, no name would be necessary since the meaning of the relationship is clear based on the names of the classes.