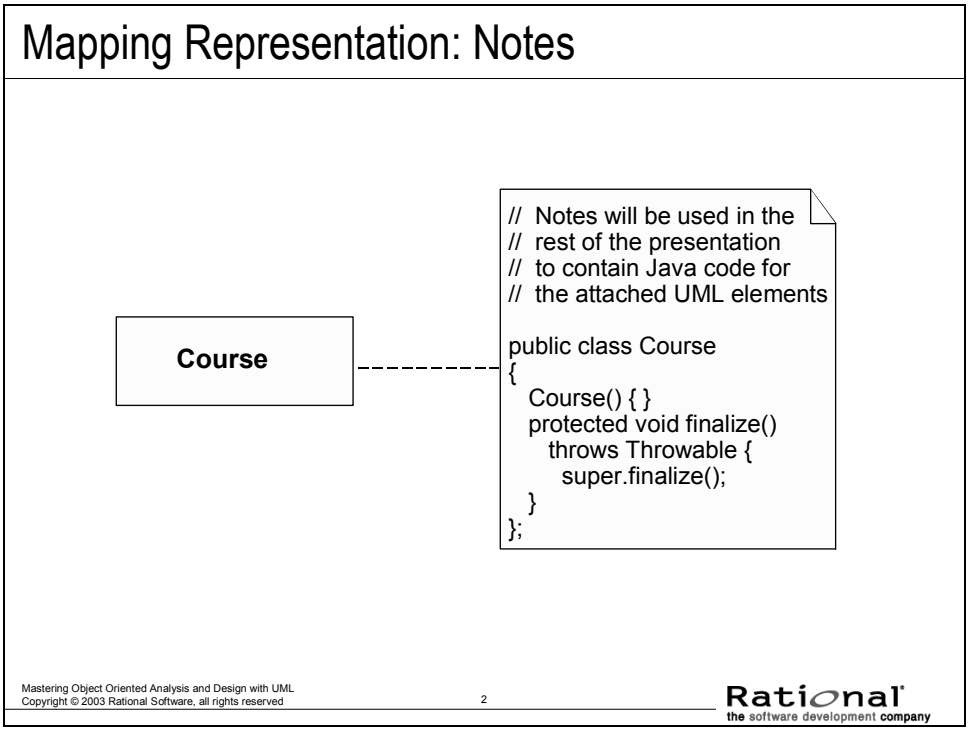
▸ ▸ ▸ Module 4
UML to Java Mapping

Mastering Object-Oriented Analysis and Design with UML

Appendix: UML to Java Mapping

Topics

Mapping Representation: Notes



If you remember from earlier in the course, a note can be added to any UML element. It is represented as a 'dog eared' rectangle. The note may be anchored to a specific element(s) with a dashed line

Visibility for Attributes and Operations

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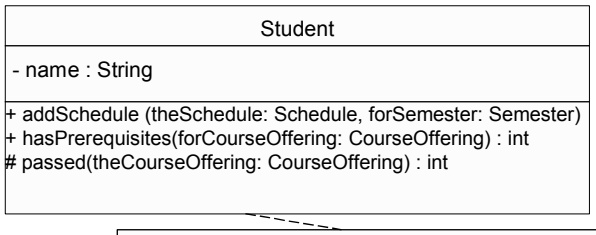
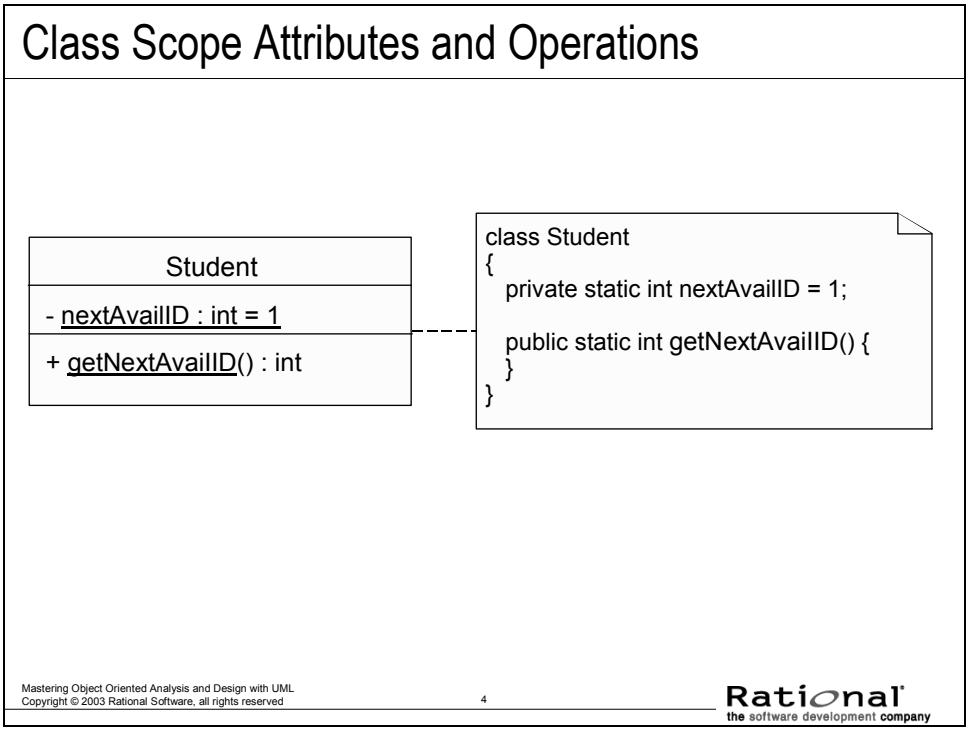
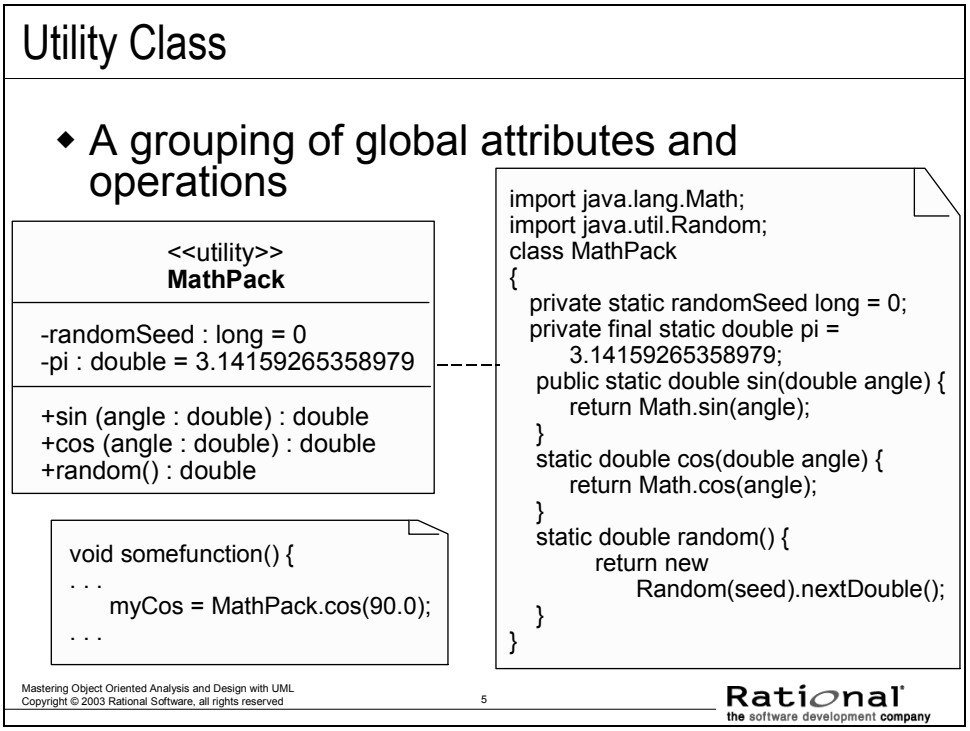



```
public class Student
{

private String name;

public void addSchedule (Schedule theSchedule; Semester forSemester) {
      }

public boolean
      hasPrerequisites(CourseOffering forCourseOffering) {
      }
protected boolean
 passed(CourseOffering theCourseOffering) {
      }
}
```

Class Scope Attributes and Operations



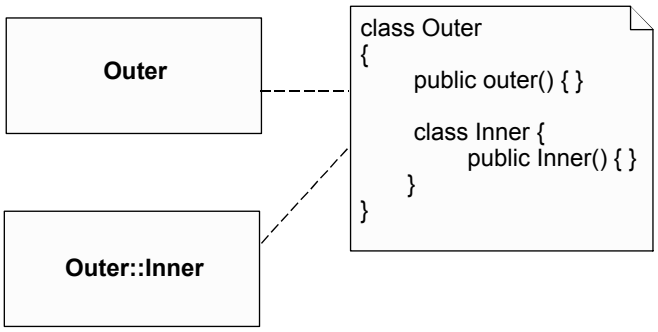
Utility Class



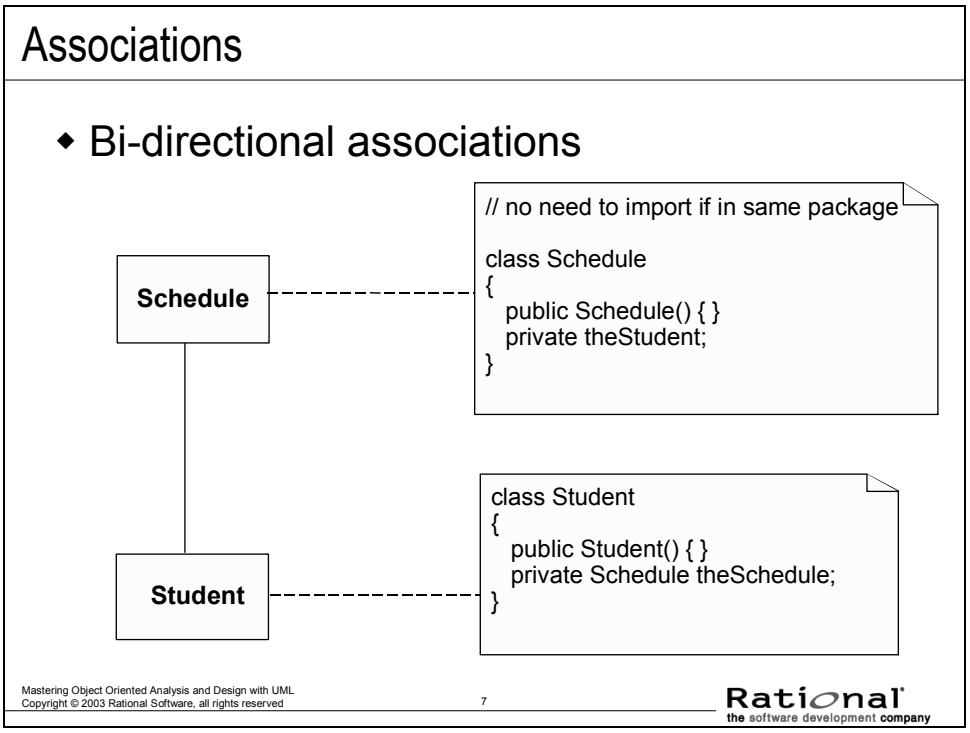
Nested Class

Nested Class

- Hide a class that is relevant only for implementation

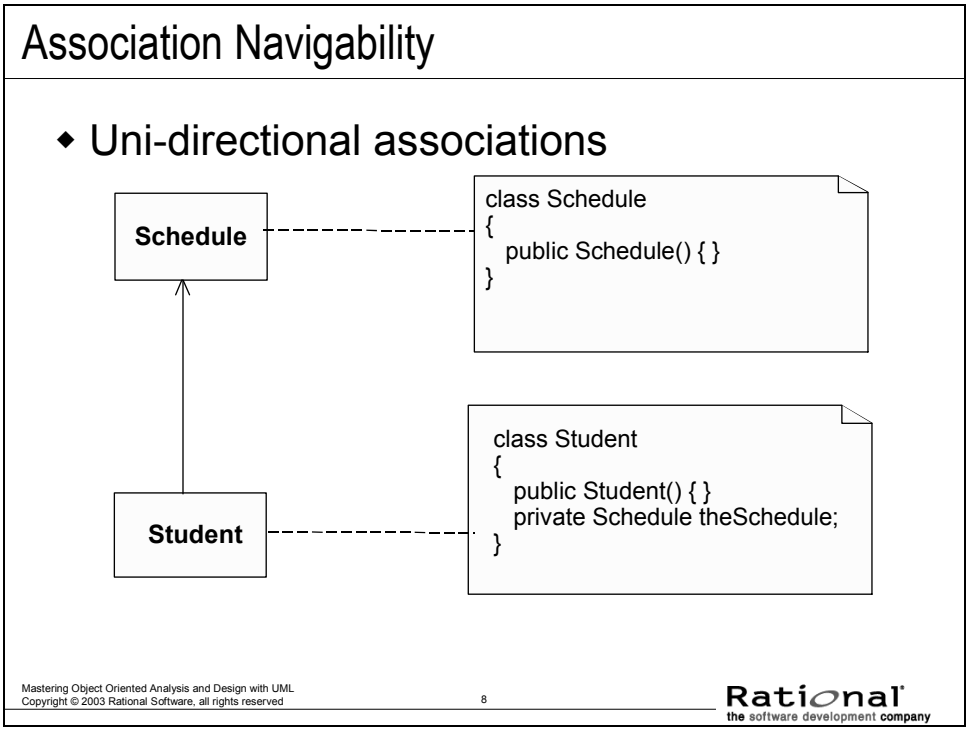


Associations

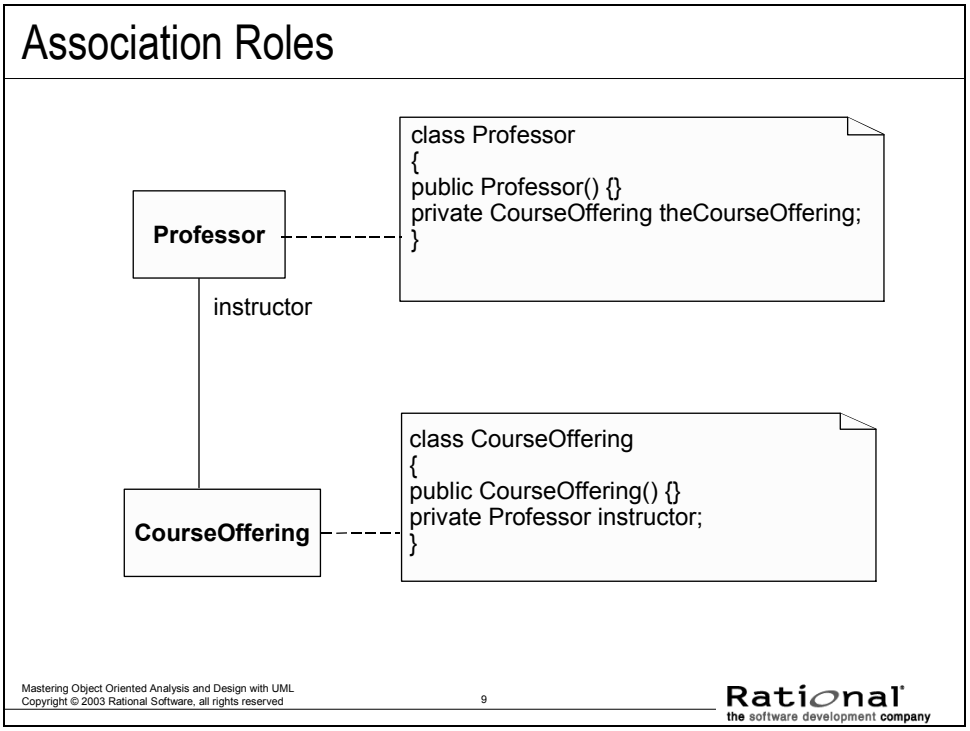


Classes declared in the same Java package can "see" one another.

Association Navigability

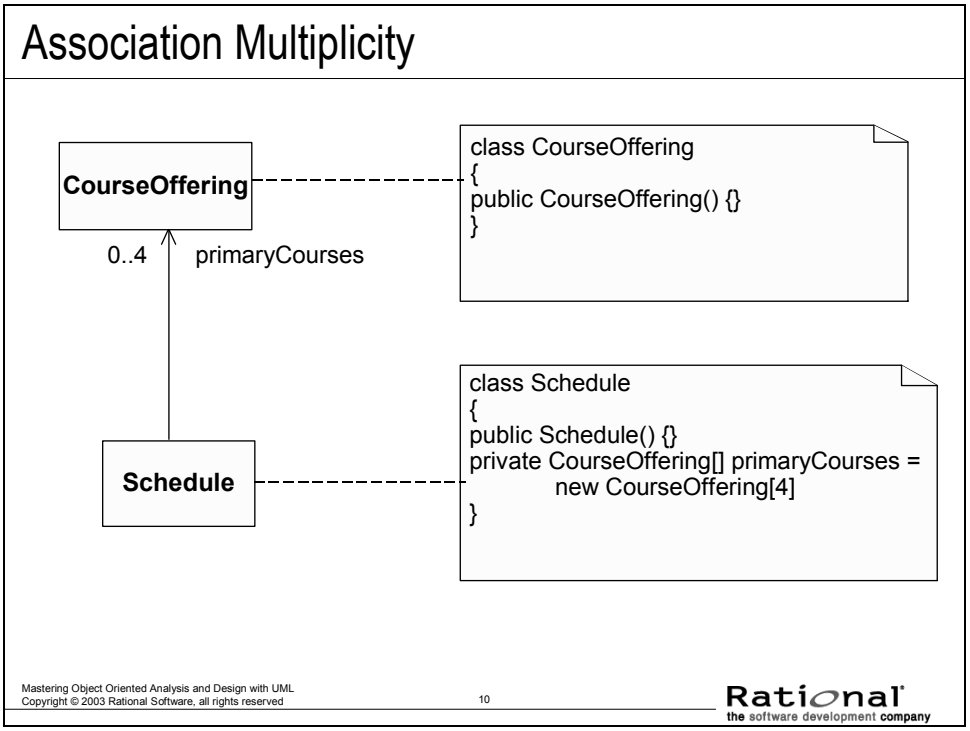


Association Roles



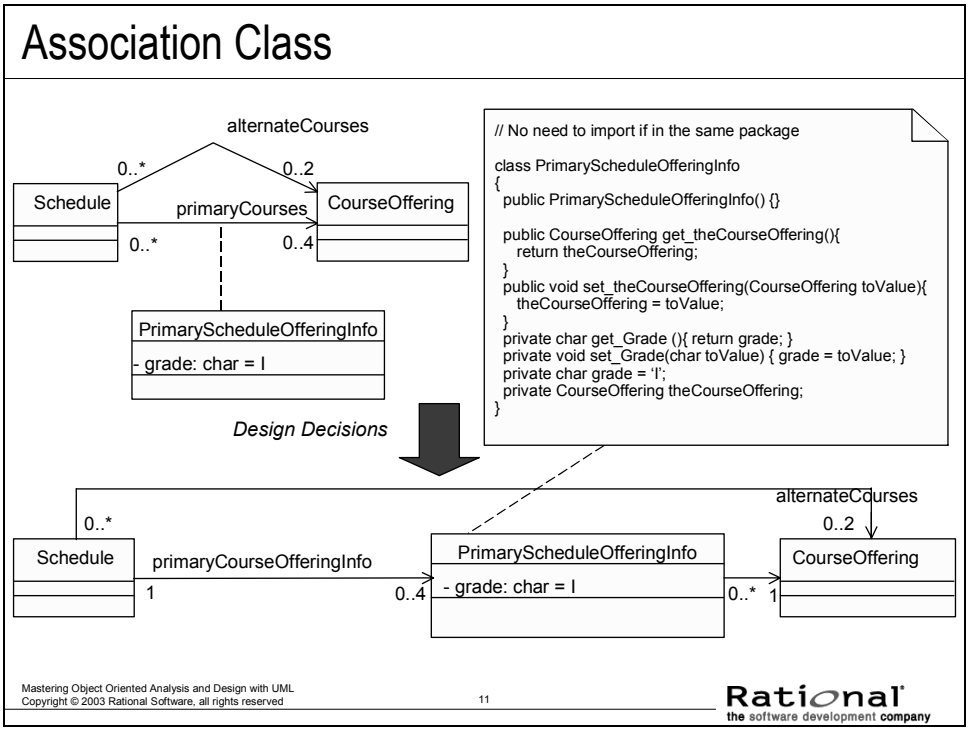
Roles on the end of the association can add clarity.

Association Multiplicity



Multiplicity is the number of instances of one class in relation to the other.

Association Class

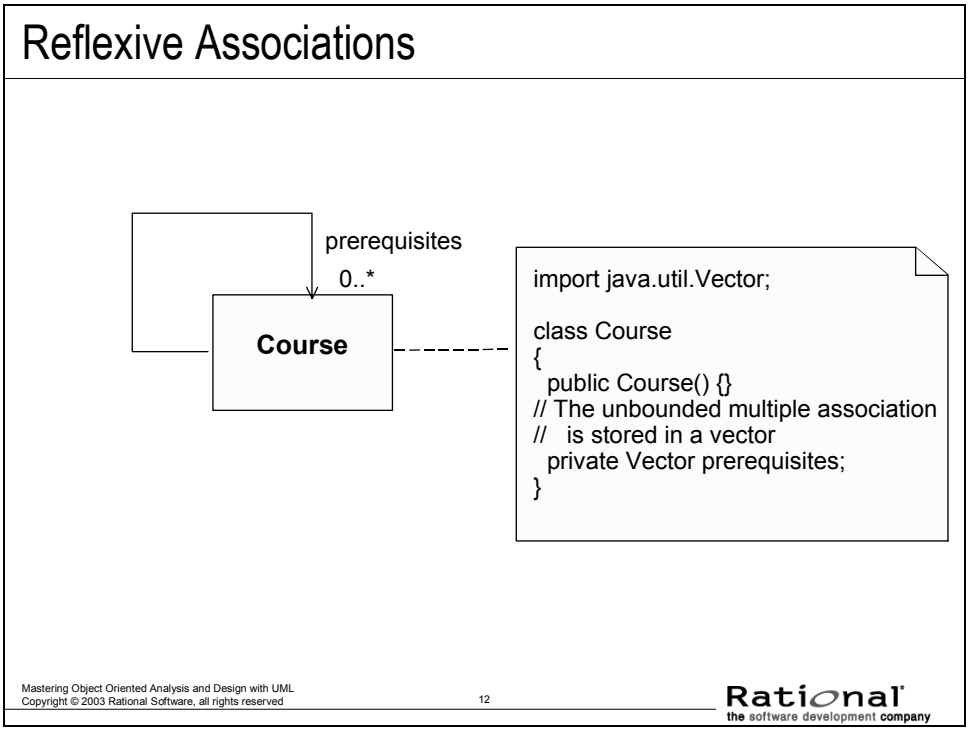


Remember, an association class is a class that is connected to an association. There is an instance of the association class for every instance of the relationship (e.g., for every link).

During design, some decisions are made regarding navigation between the involved classes.

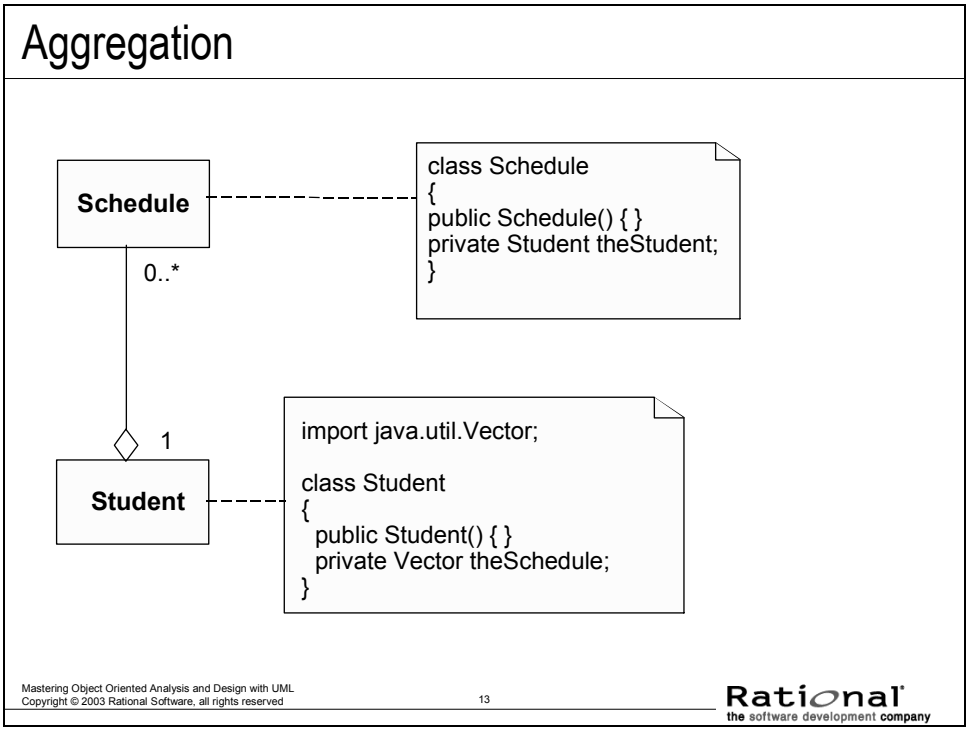
A subset of the class operations and attributes are shown above. For this example, we included a subset to demonstrate the UML construct we are emphasizing.

Reflexive Associations



A class may have an association with objects of the same type.

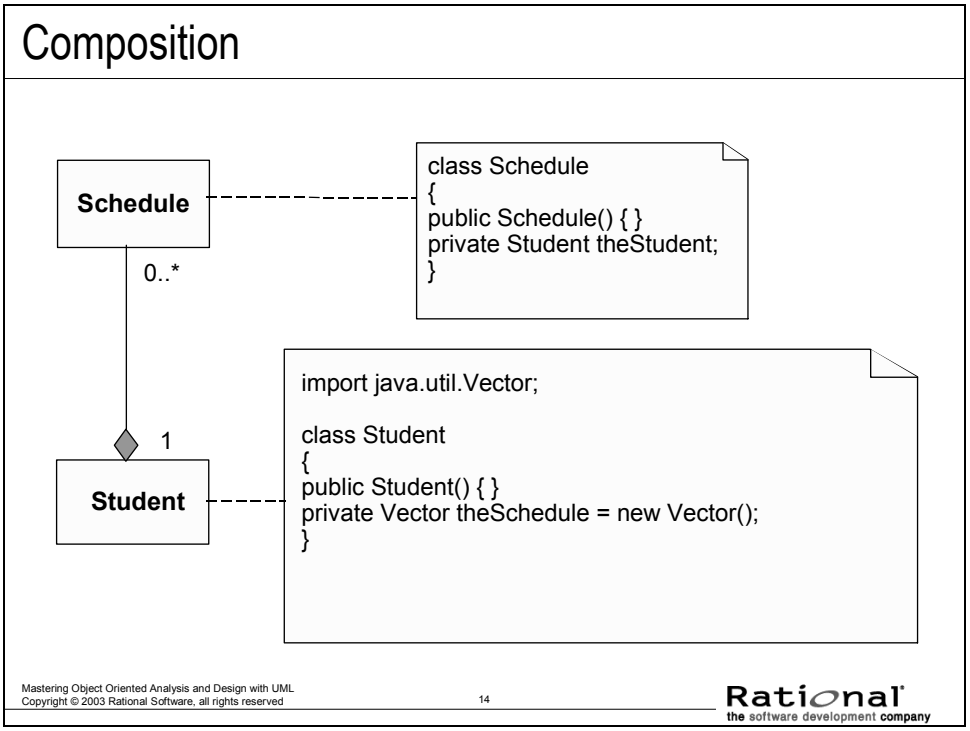
Aggregation



Vector is a reusable list class available in the Java programming environment. It could be replaced by any other available list class.

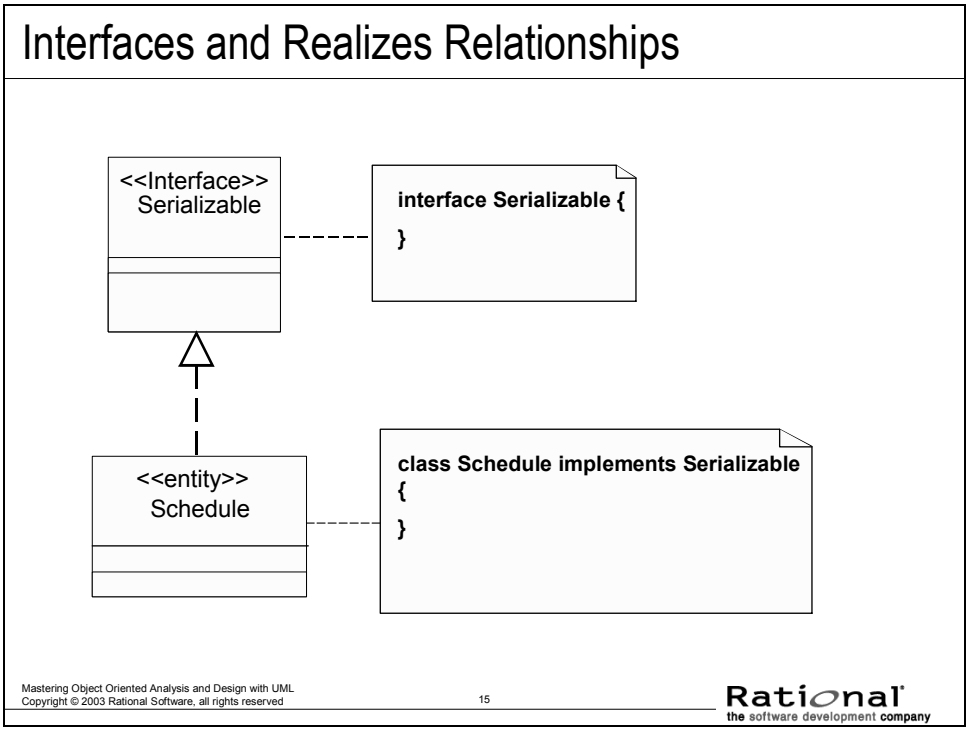
Java has no explicit construct for aggregation. In Java, the code for aggregation looks the same as it does for "vanilla" association.

Composition



Java does not support containment by value.

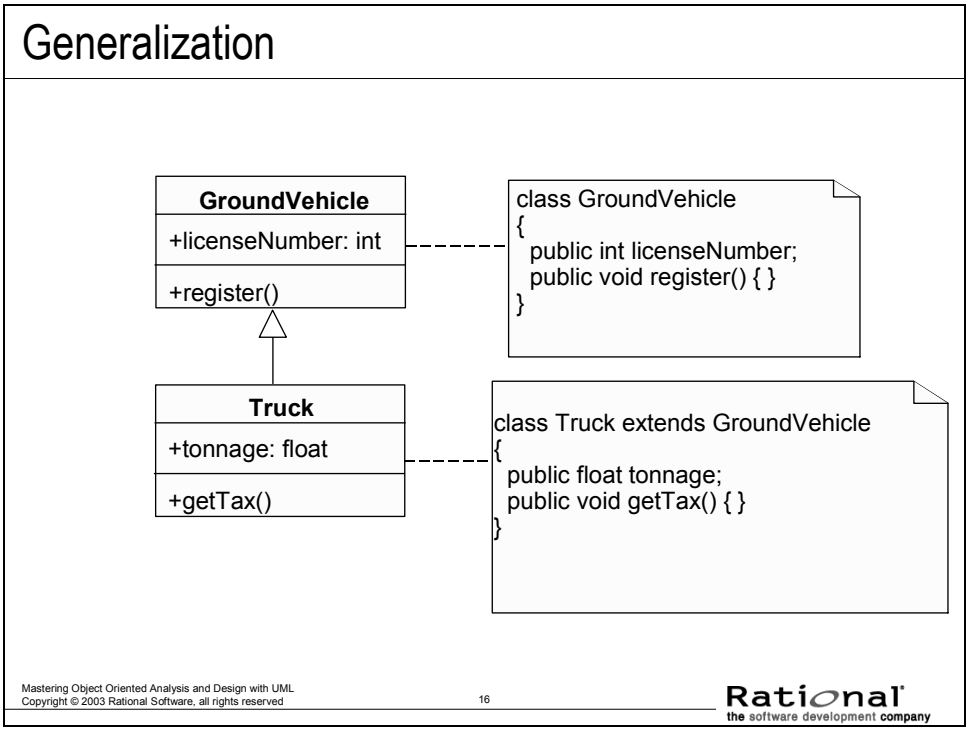
Interfaces and Realizes Relationships



Java has the notion of "implements" which translates to the realizes relationship in the UML. Java classes implement interfaces and they can implement as many interfaces as they see fit. Interfaces can extend other interfaces.

In Java, interfaces may have attributes defined for them. This differs from the pure UML definition of interface which states: (UML 1.1): "An interface is a declaration of a collection of operations that may be used for defining a service offered by an instance. Interfaces may not have Attributes, Associations, or Methods."

Generalization

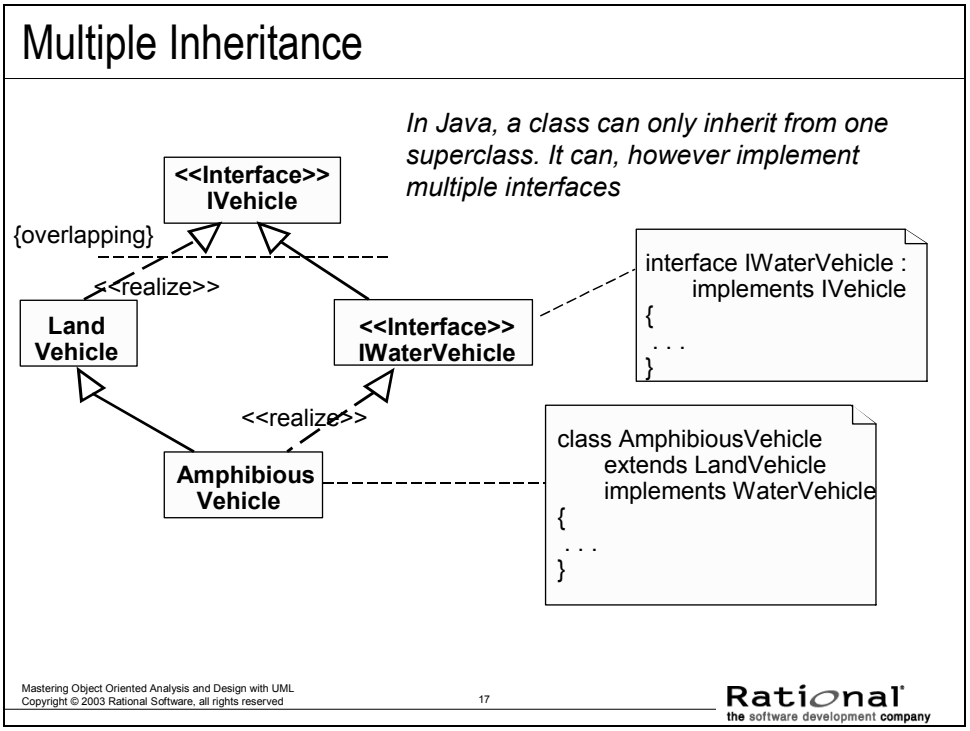


Remember generalization is a "is-a" or "kind-of" association. It is used to represent generalization / specialization.

Generalization is modeled as an open triangular arrowhead pointing to the base on the base class end.

Java has the notion of "extends" which translates to the generalization relationship in the UML. Java classes can extend ONE other class. Interfaces can extend other interfaces. Java interfaces are discussed on a later slide.

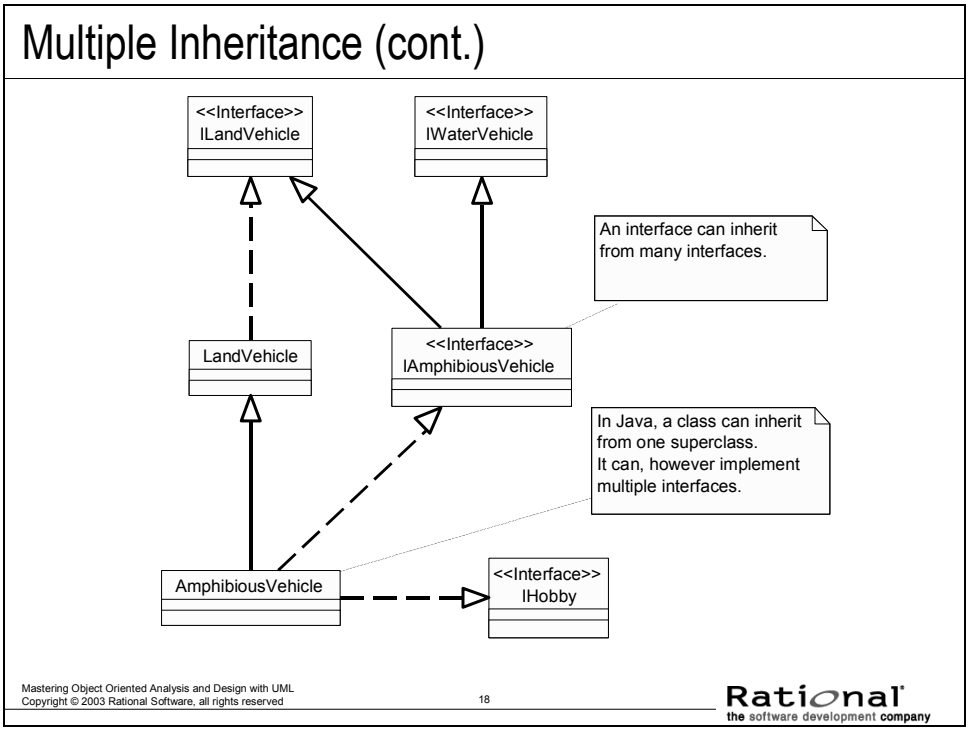
Multiple Inheritance



In Java, a class can only inherit from ONE superclass. However, a class can realize multiple interfaces.

Remember, subclasses that are not mutually exclusive can be annotated with the UML {overlapping} constraint. This supports multiple inheritance.

Multiple Inheritance (cont.)

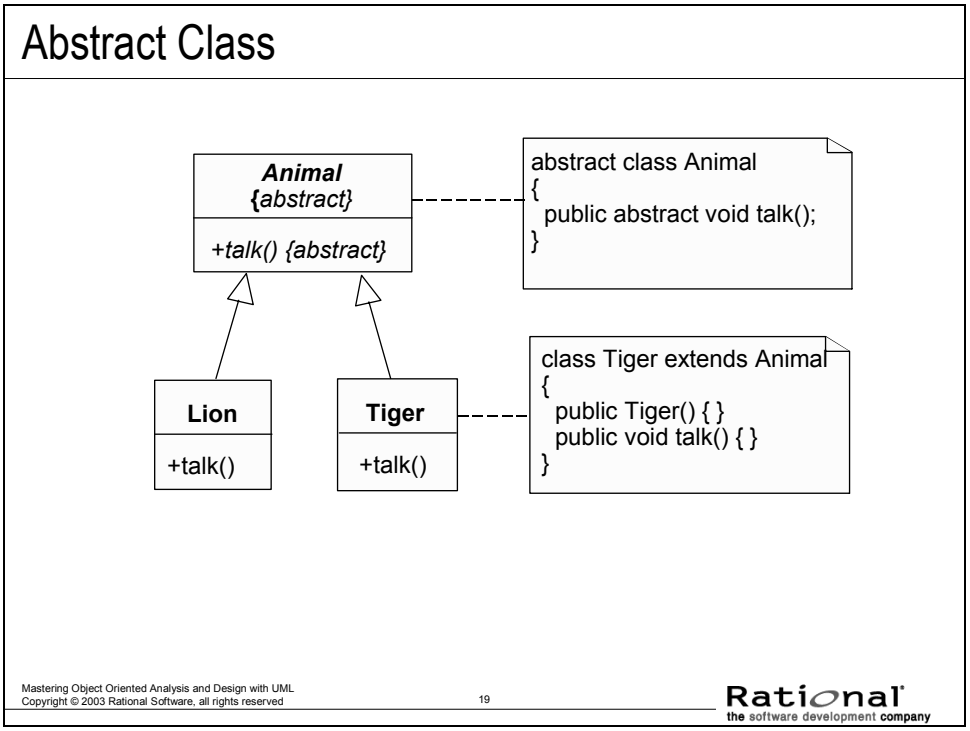


Java supports multiple inheritance between interfaces.

In Java, an interface CAN inherit from multiple interfaces.

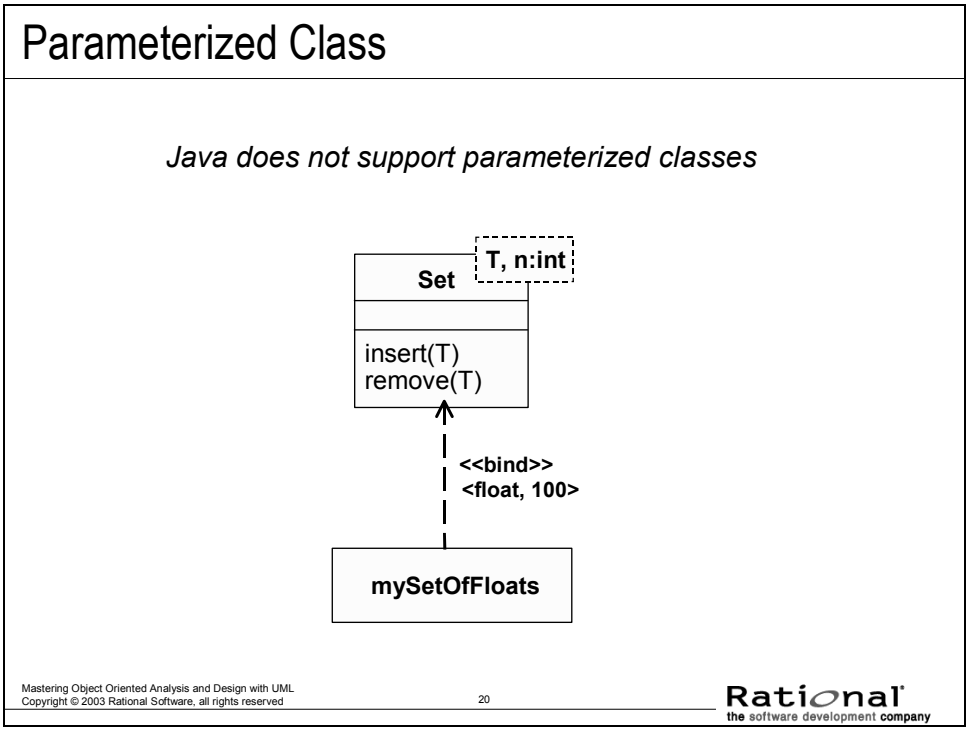
Multiple inheritance of interfaces overcomes the “weakness” of Java regarding true multiple inheritance.

Abstract Class



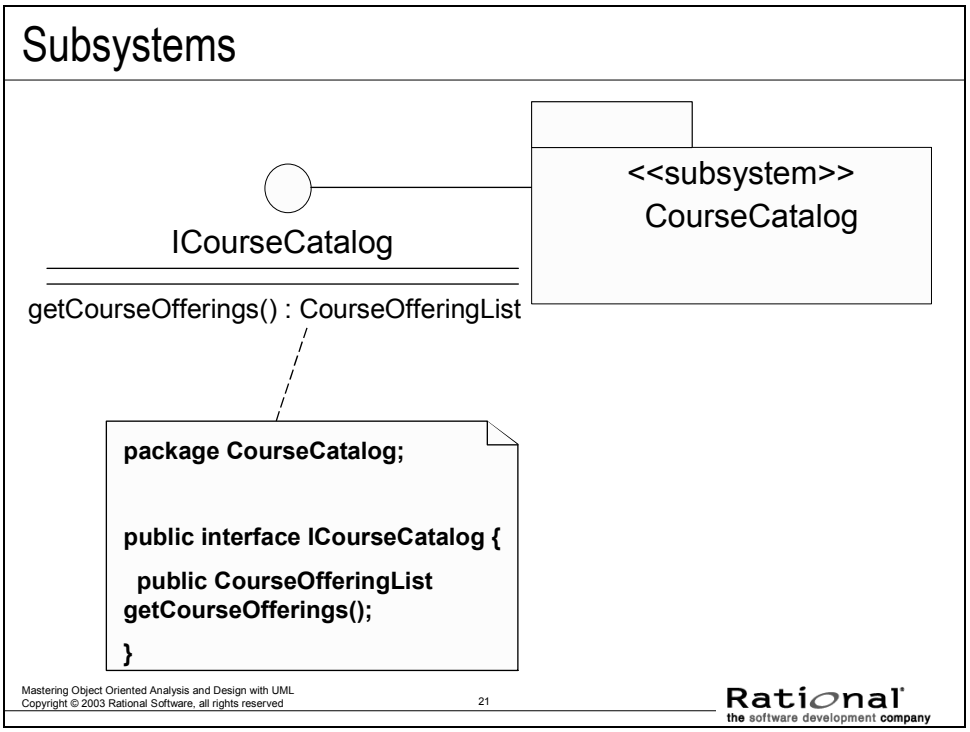
Remember, an abstract class is a class for which no instances are created.

Parameterized Class



Java does not provide support for parameterized classes.

Subsystems



As discussed within the OOAD course, subsystems are the Design Model representation for components.

Some aspects of UML subsystems can be implemented using Java packages. Java packages have a one-to-one correspondence to UML packages. Packages in Java also correspond to directories.

Packages are declared at the top of the file. All classes defined within the file are considered part of the specified package. All classes defined within the same package can “see” each other automatically. If the package statement is omitted (i.e., no package is specified), the file contents are considered to be in the "default package" (e.g., the root package), and all other classes for which a package was not specified can “see” the classes defined within the file.

There can be only 1 public class per file. (you can have inner classes in the file as well, but only 1 "top level" class). The name of the file must be the same as the name of the public class.

These restriction are what hinder Java’s support for subsystems. In the UML, the mapping between interfaces and subsystems is many-to-many (subsystems can realize one or more interfaces; interfaces can be realized by one or more subsystems). In Java, the mapping is always one-to-one.

Note: CourseOfferingList is assumed to exist in a separate common package. The import statement has been excluded from the code fragment.