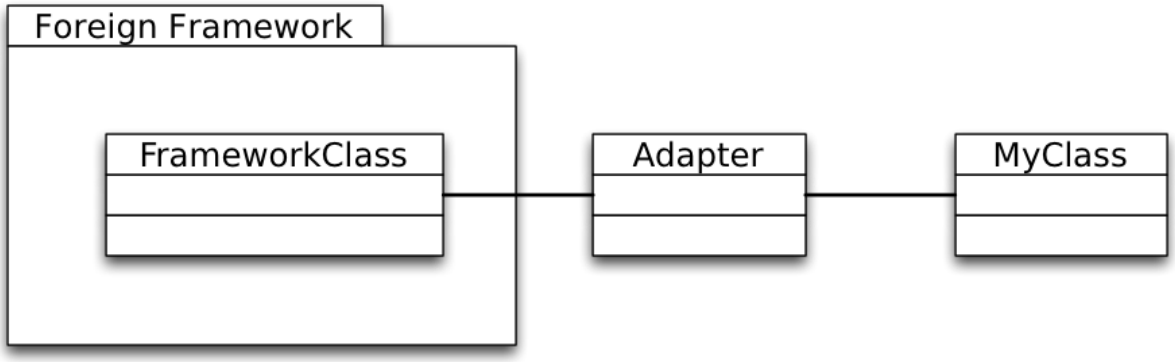
Adapter Design Pattern

Intent

The Adapter Design Pattern

Intent

Intent: Fit foreign components into an existing design.



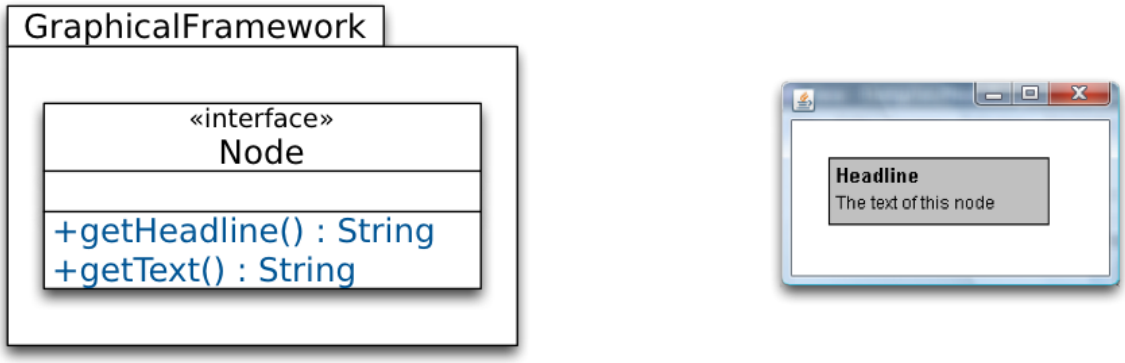
1

We want to reuse existing frameworks or libraries in our software, even if they do not match with our design.

We do not want to change our design to adhere to the structure of the reused components.

Case Study

The Adapter Design Pattern - Illustrated



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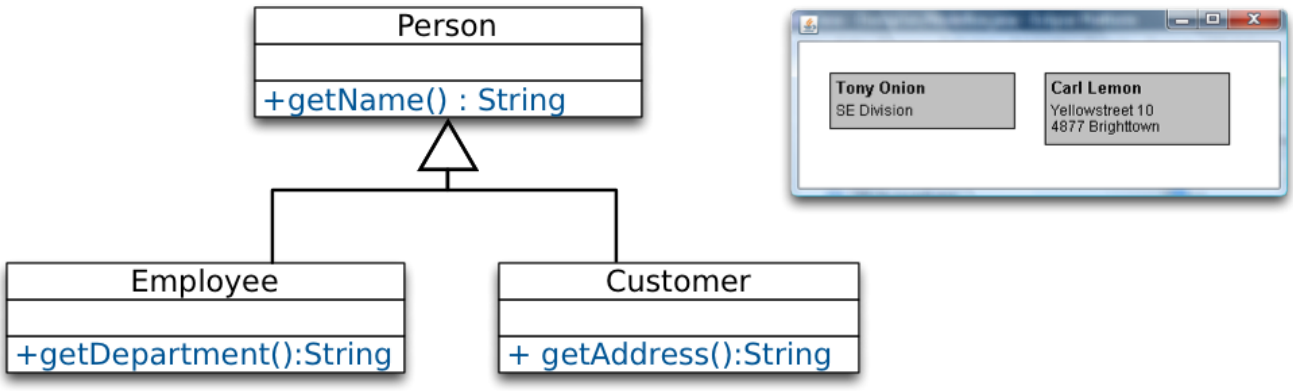
We have acquired the framework `GraphicalFramework`.

`GraphicalFramework` provides the interface `Node` to draw rectangles with a headline and text to the screen.

Drawing is done by the framework, we just need to provide the data via the interface `Node`.

Desired Usage of the Framework



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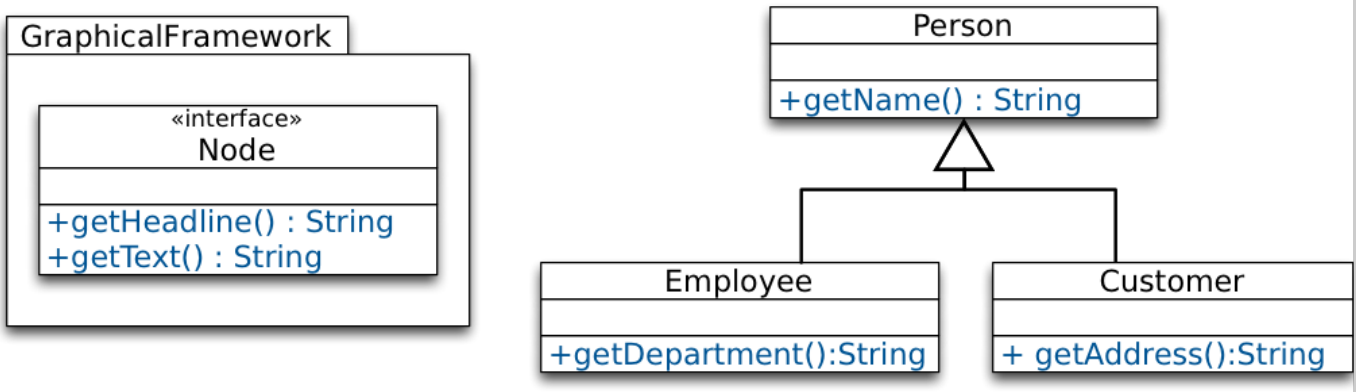
Our own design represents different kinds of persons. We want to draw our data to the screen:

- Name and department of `Employee`.
- Name and address of `Customer`.

Adapting the Framework



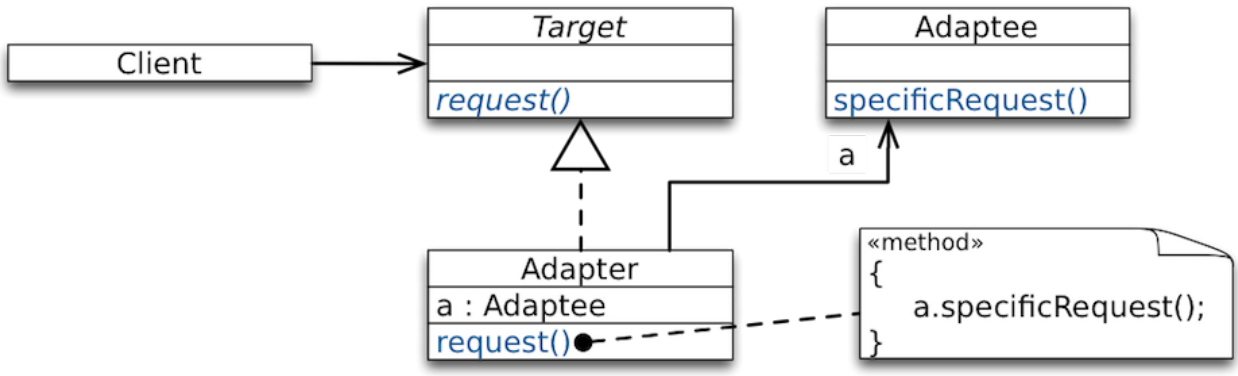
We will create adapters to use the functionality of `GraphicalFramework` for our classes.

We have to adapt `Employee` and `Customer` to fit with `Node`.

Two Kinds of Adapters

Object Adapter

Object Adapter



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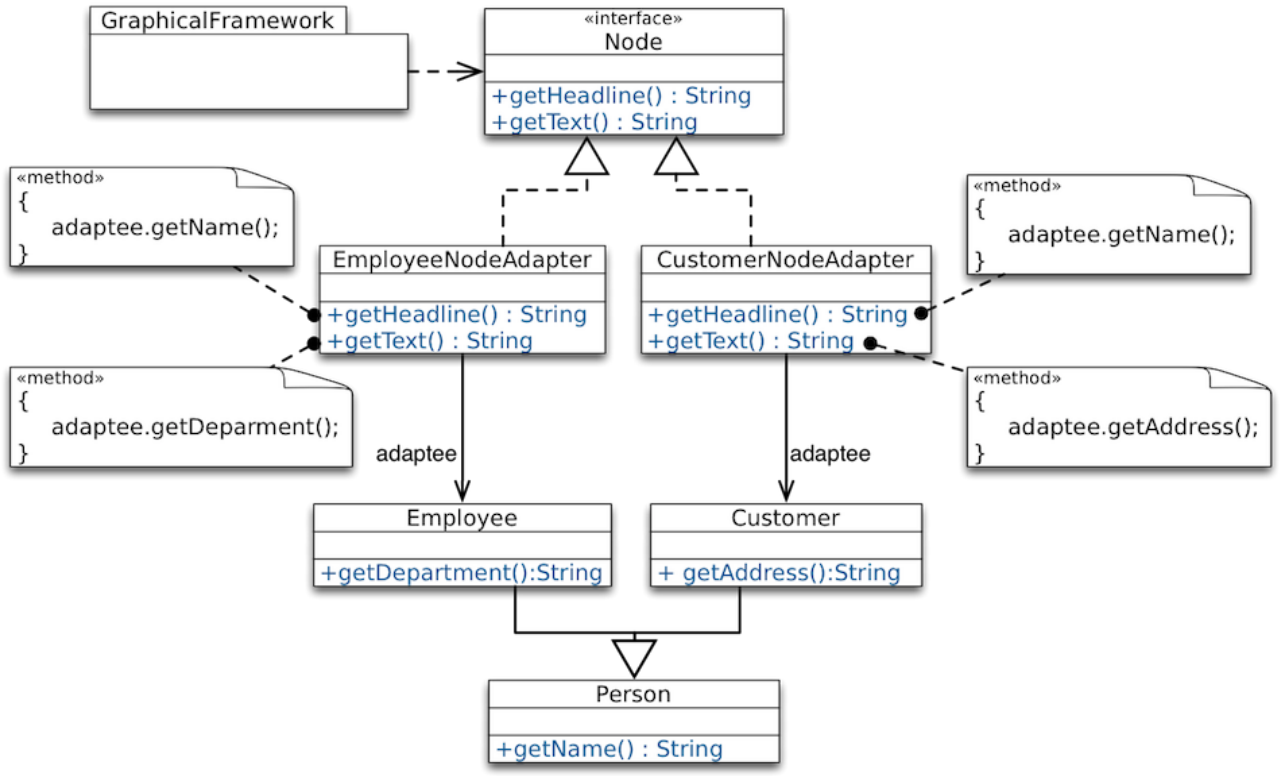
- `Adaptee` is wrapped by `Adapter` to fit in the interface of `Target`.
- `Adapter` forwards calls of `Client` to `request()` to the specific methods of `Adaptee` (e.g, `specificRequest()`).

Using Object Adapter



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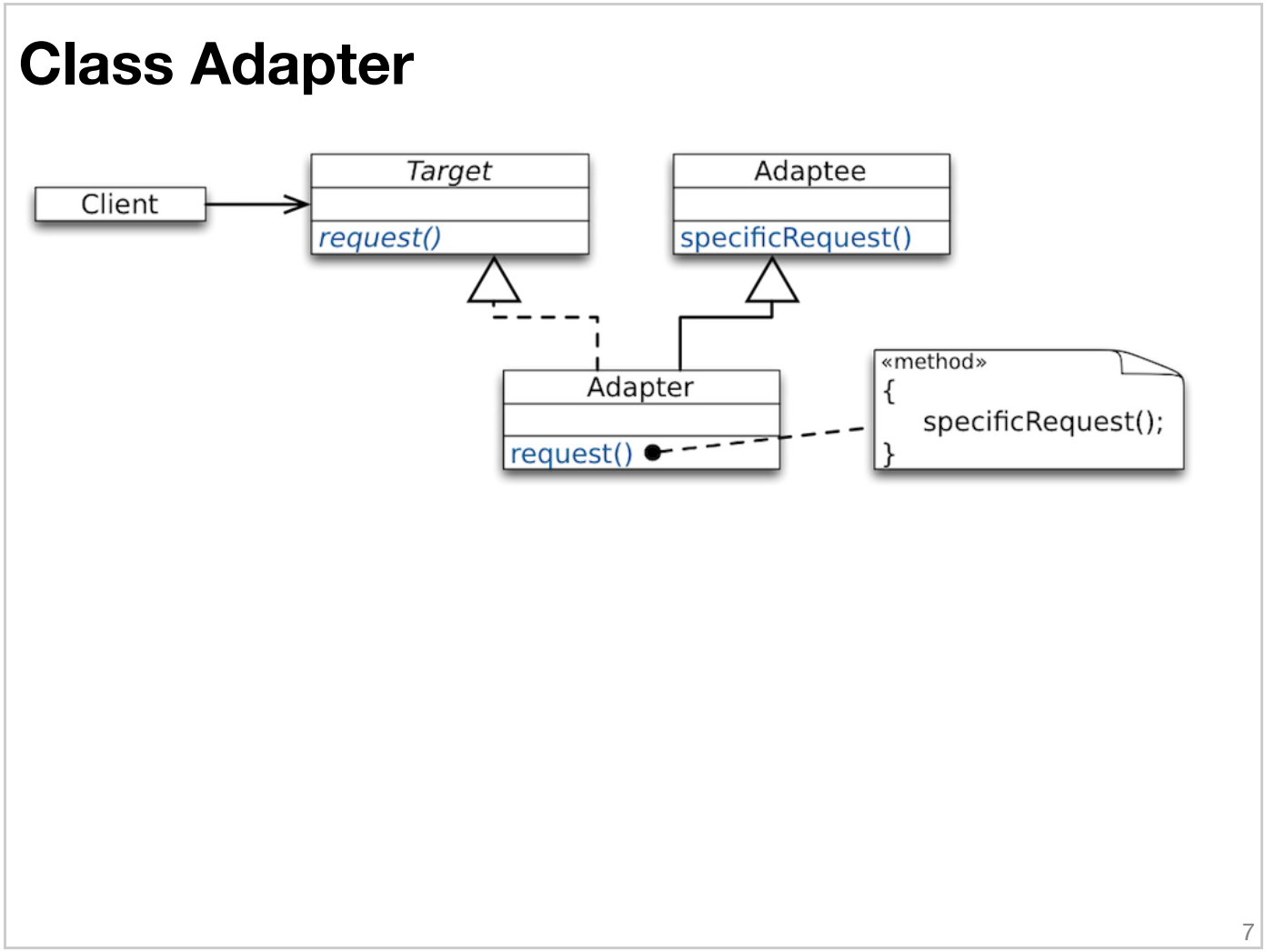
Advantages:

- `Adapter` works with `Adaptee` and any subclass of it.
- `Adapter` can add functionality to `Adaptee` and its subclasses.

Disadvantages:

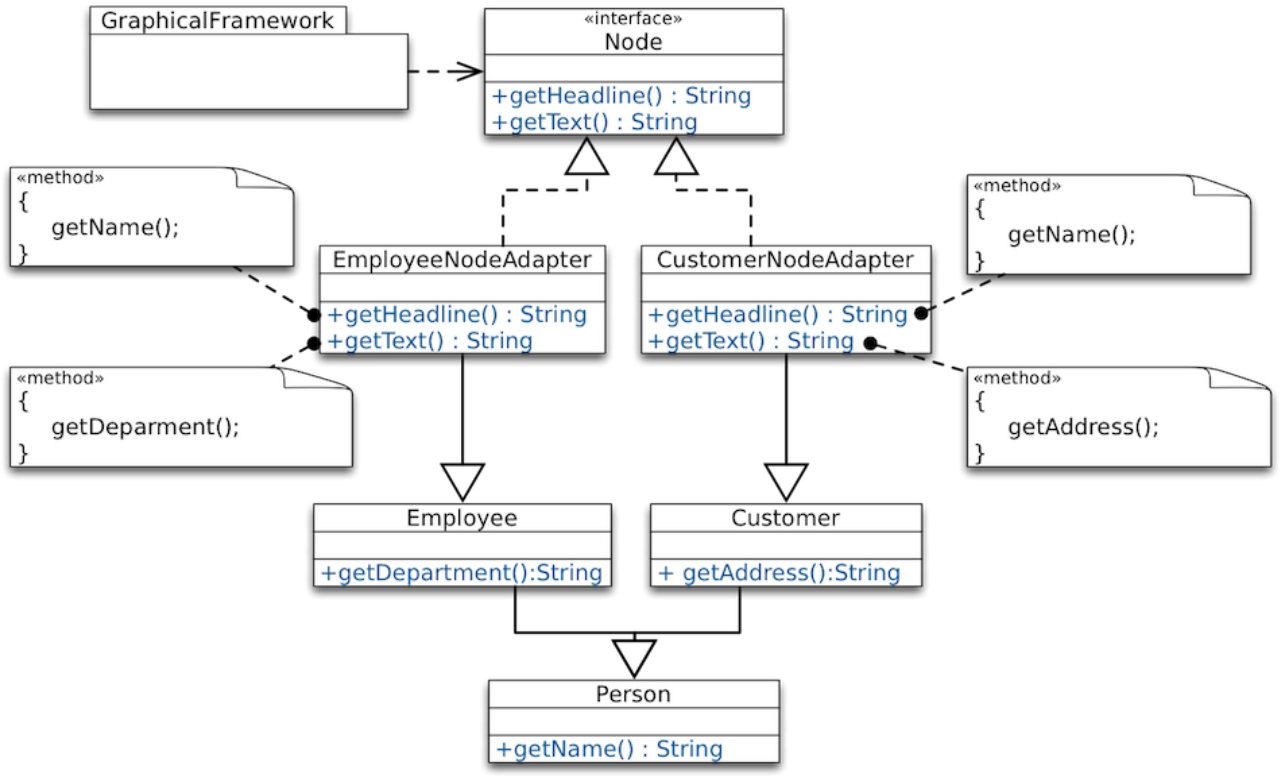
- Cannot override methods in `Adaptee`.
- Cannot reuse `Adapter` with subclasses of `Target`.
- `Adapter` and `Adaptee` are different objects.
  (Need to maintain relation between `Adaptee` and his `Adapter`)

Class Adapter



Instead of having `Adaptee` as an attribute, `Adapter` inherits from `Adaptee`.

Using Class Adapter



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Advantages:

- Behavior of `Adaptee` can be overridden.
- Adapter and `Adaptee` are the same object, no forwarding.

Disadvantages:

- `Adapter` cannot be used with subclasses of `Adaptee` or `Target`.
- `Multiple` inheritance may be required.
  In Java: At least one of `Target` and `Adaptee` must be an Interface.

Takeaway

Adapter is an effective means to adapt existing behavior to the expected interfaces of a reusable component or framework.

Two variants: **Object and Class Adapter**

- Both have their trade-offs.
- Both have problems with the reusability of the adapter.

Pimp-my-Library Idiom/Pattern (Scala)

Goal

Solve the problem that you can change or extend your own code, but if you use other libraries you have to take them as they are.

Solution Idea

Define a conversion function to convert your object into the required object and make this conversion `implicit` to let the compiler automatically perform the conversion when needed. (*Transparent* generation of object adapters.)

Example Scenario

We want to be able to repeat a certain operation multiple times and want to store the result in some given mutable store.

But, Scala's (2.10) mutable collections do not define a common method to add an element to them.

In the following we develop a generalization of the previously shown `repeat` method. This variant enables the developer to specify the target data store.

Implementing a `repeatAndStore` method **(naïve approach)**.

```
object ControlFlowStatements {
  import scala.collection.mutable.Set

  abstract class MutableCollection[T, C[T]](val underlying: C[T]) {
    def +=(elem: T): Unit
  }

  implicit def setToMutableCollection[T](set: Set[T]) =
    new MutableCollection(set) { def +=(elem: T) = set += (elem) }

  def repeatAndStore[T, C[T]]
      (times: Int)(f: ⇒ T)(collection: MutableCollection[T, C]): C[T] = {
    var i = 0; while (i < times) { collection += f; i += 1 }
    collection.underlying
  }

}
```



```
object CFSDemo extends App {
  import ControlFlowStatements._

  val nanos =
    repeatAndStore(5) {
      System.nanoTime()
    }(new scala.collection.mutable.HashSet[Long]())

}
```

What is the type of `nanos`?

The previous solution has two issues:

1. The `repeatAndStore` method requires a `MutableCollection` which is basically an implementation-internal type.

2. It returns the original collection to make the usage easier, but important type information is lost (the `HashSet` has become a `Set`).

Implementing a `repeatAndStore` method.

```
object ControlFlowStatementsBase {
  trait Mutable[-C[_]] {
    def add[T](collection: C[T], elem: T): Unit
  }

  implicit object Set extends Mutable[Set] {
    def add[T](collection: Set[T], elem: T) { collection += elem }
  }

  implicit object MutableBuffer extends Mutable[Buffer] {
    def add[T](collection: Buffer[T], elem: T) { collection += elem }
  }

  def repeatWithContextBound[T, X[T] <: AnyRef: Mutable]
  (times: Int)
      (f: ⇒ T)(collection: X[T]): collection.type = {
    var i = 0
    while (i < times) {
            implicitly[Mutable[X]].add(collection, f); i += 1
    }
    collection
  }
}
```



```
object CFSDemo extends App {
  import ControlFlowStatements._

  val nanos_1: HashSet[Long] =
    repeatWithContextBound(5){ System.nanoTime() }(new HashSet[Long]())

  val nanos_2: ArrayBuffer[Long] =
    repeatWithContextBound(5){ System.nanoTime() }(new ArrayBuffer[Long]())

  val nanos_3: nanos_1.type =
    repeatWithContextBound(5) {System.nanoTime() }(nanos_1)

  def stricterEquals[X <: AnyRef](a: X)(b: a.type) = a == b
  stricterEquals(nanos_1)(nanos_3)
  // /* correctly won't compile */ stricterEquals(nanos_2)(nanos_3)
}
```