

# Adapter

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- **Component designed to connect two "incompatible" devices**
- **In this scenario:**
  - A type of plug which makes it possible to connect two or more pieces of equipment (with different power plugs) to the same electrical supply



# Adapter – design pattern

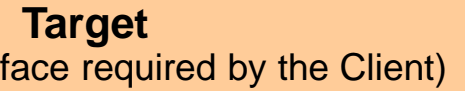
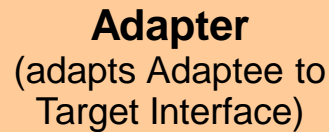
- Also called “Wrapper”
- Structural Design Pattern
  - ❑ Building simple hierarchies and relations between different classes
- Links existing classes with an incompatible interface
  - ❑ Without altering them – same underlying behaviour
  - ❑ Asymmetric - one class "connects to the other"



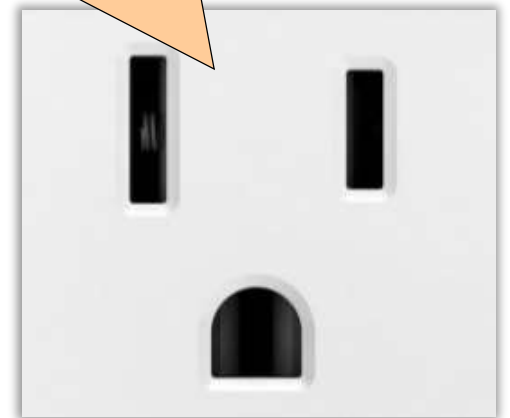


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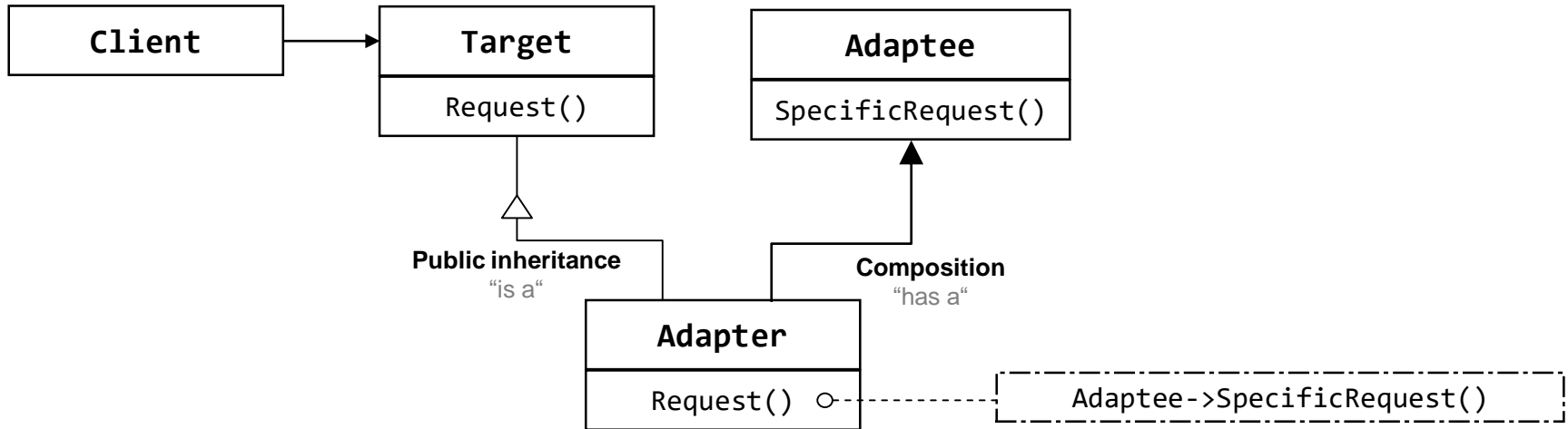
**Adaptee**  
(defines the interface the Client wants to use)



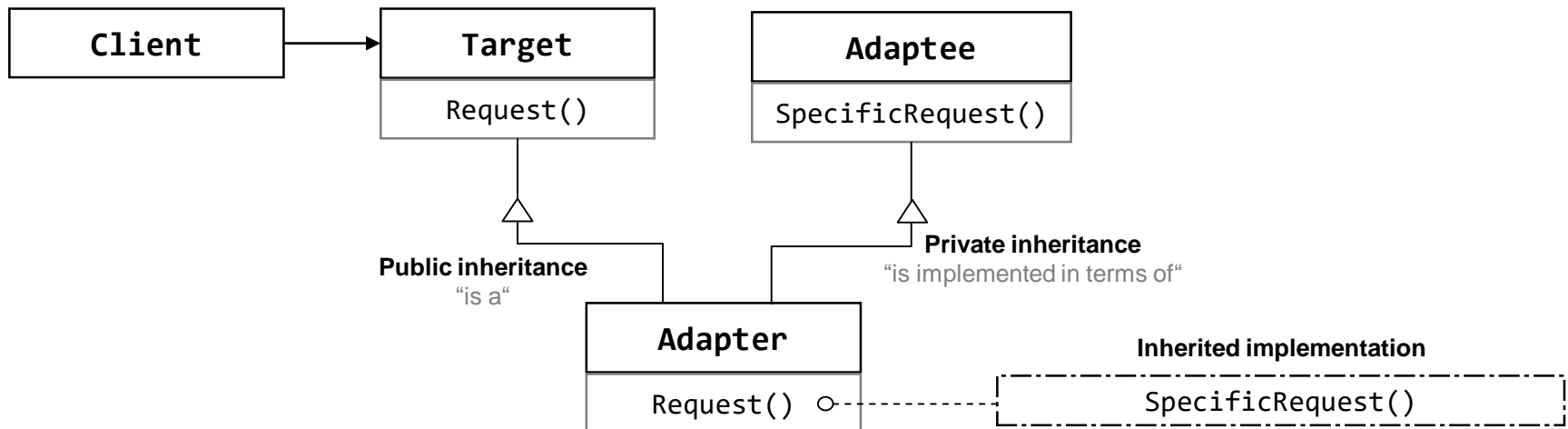


# Adapter – two connection options

## Object Adapter

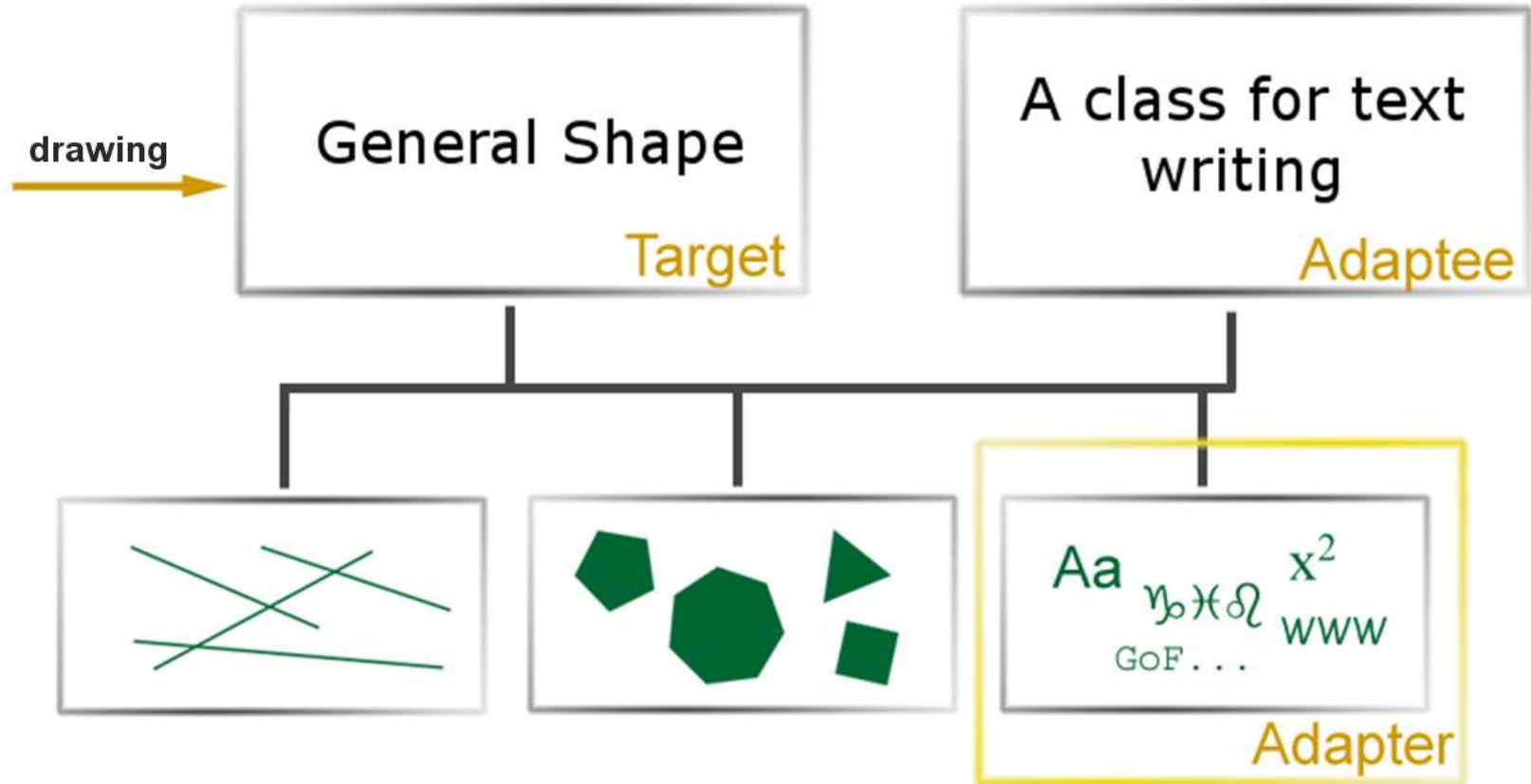


## Class Adapter





# Adapter – Drawing App example





# Adapter – example

**Target Shape**  
defines the target interface

```
class Shape
{
    virtual void BoundingBox( Point& bottomLeft, Point& topRight ) const;
    virtual Manipulator* CreateManipulator() const;
};
```

**Adaptee TextView**  
implements some methods, but  
in another interface

```
class TextView
{
    void GetOrigin( Coord& x, Coord& y );
    void GetExtent( Coord& width, Coord& height );
    virtual bool IsEmpty() const;
};
```

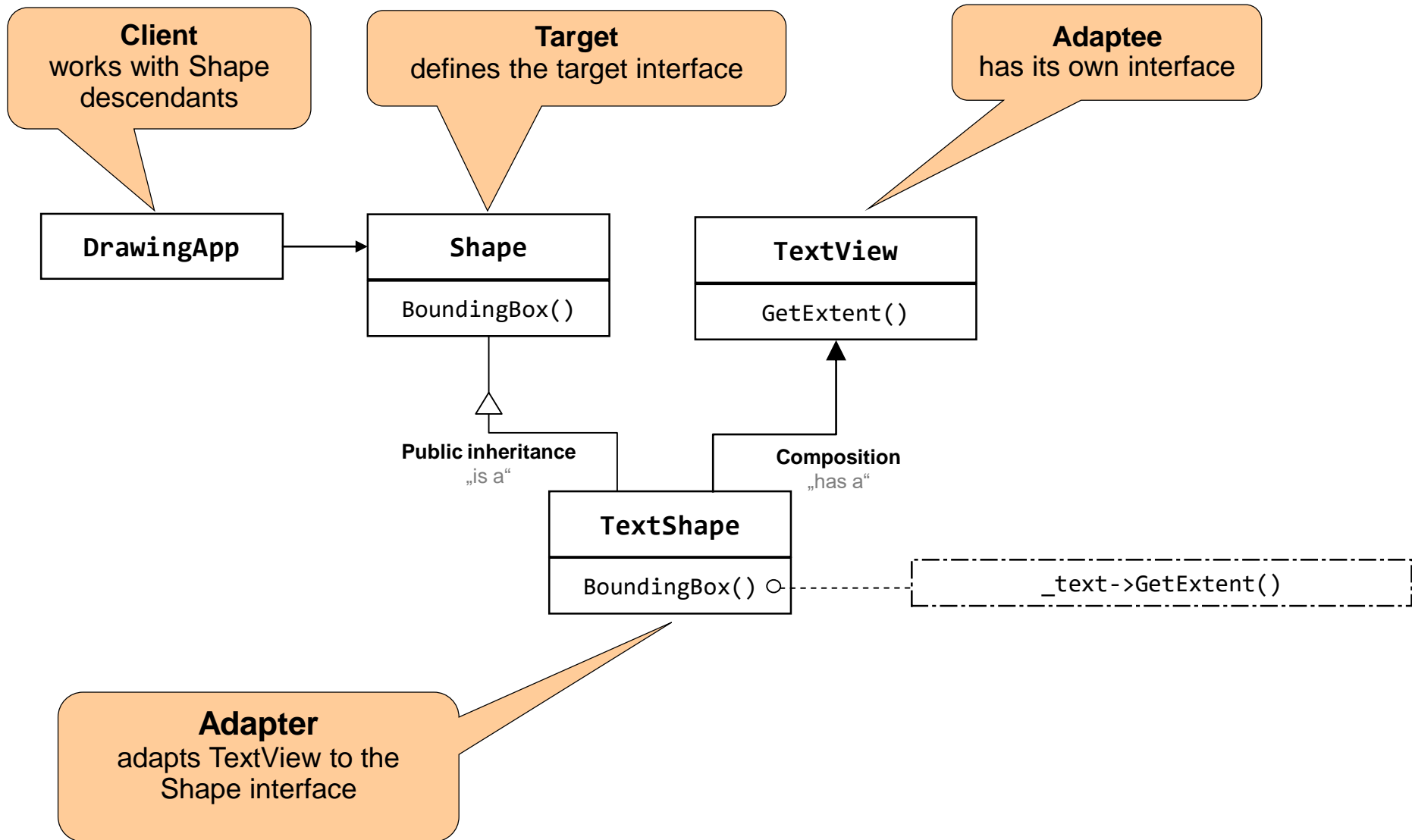


# Object Adapter





# Object Adapter – example





# Object Adapter – example

## ■ Object Adapter TextShape

**Object Adapter TextShape**  
publicly inherits from  
**Target Shape**

```
class TextShape: public Shape
{
public:
    TextShape(TextView* t);

    virtual void BoundingBox(Point& bottomLeft, Point& topRight) const;
    virtual bool IsEmpty() const;
    virtual Manipulator* CreateManipulator();

private:
    TextView* _text;
};
```

**Adaptee TextView**  
is a private member of  
**TextShape Adapter**



# Object Adapter – example

## ■ Object Adapter TextShape – implementation

```
TextShape::TextShape(TextView* t)
{
    _text = t;
}
```

the constructor requires an existing Adaptee instance

```
void TextShape::BoundingBox(Point& bottomLeft, Point& topRight) const
{
    Coord bottom, left, width, height;
    _text -> GetOrigin( bottom, left );
    _text -> GetExtent( width, height );
    topRight = Point( bottom + height, left + width );
    bottomLeft = Point( bottom, left );
}
```

```
bool TextShape::IsEmpty() const
{
    return _text->IsEmpty();
}
```

invoke Adaptee method and simply return its result

```
Manipulator* TextShape::CreateManipulator() const
{
    return new TextManipulator(this);
}
```



# Object Adapter – properties

- **Uses composition**

- ☐ **Adaptee** is a private data item of **Adapter**

- **May arise as a wrapper around an existing instance of Adaptee**

- ☐ Example – `TextShape::TextShape(TextView* t)`

- **Can adapt all descendants of Adaptee**

- ☐ Example – any descendant of `TextView`

- **Does not have access to the protected items of the Adaptee itself**

- **Cannot redefine Adaptee items**

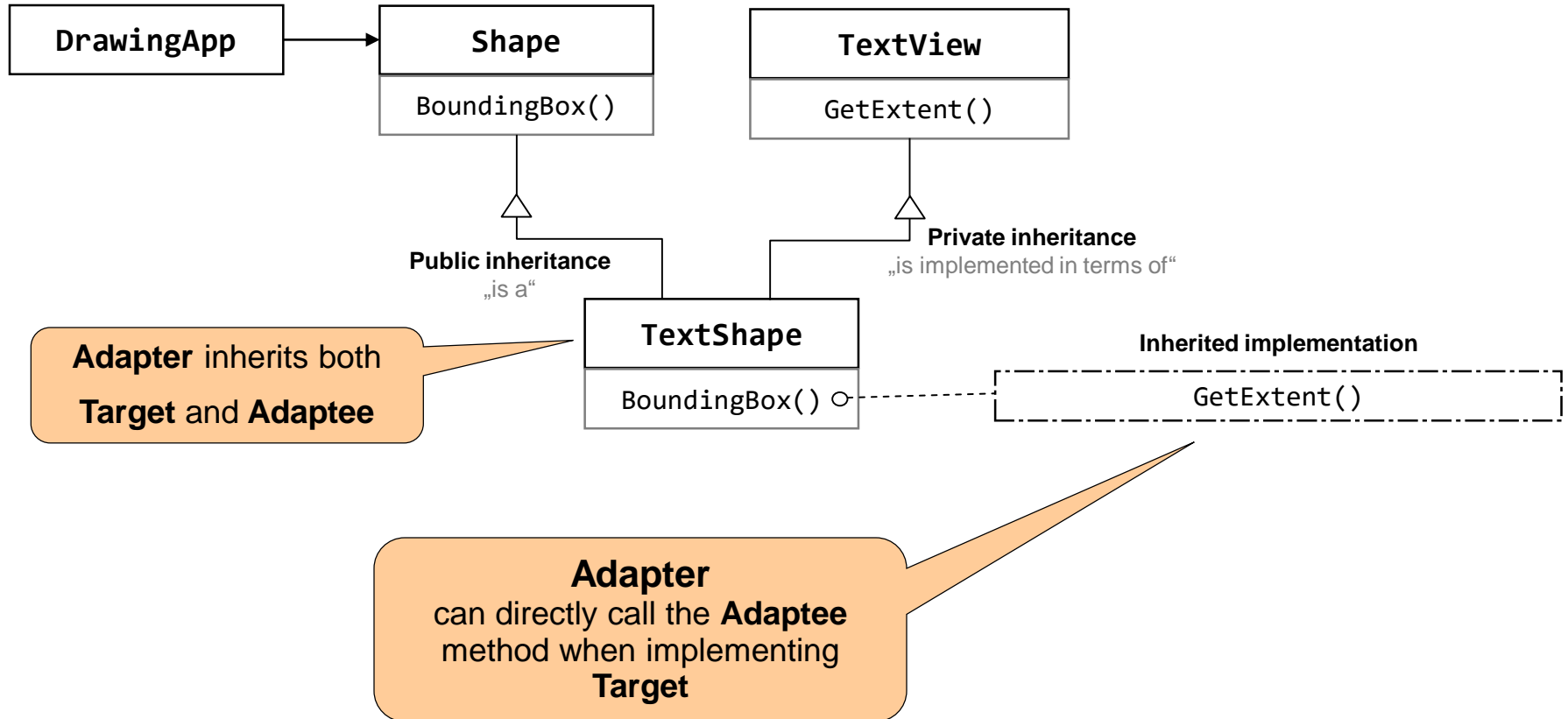
- ☐ Indirect - subclass **Adaptee**, redefined and used in **Adapter** instead of **Adaptee**



# Class Adapter



# Class Adapter – example





# Class Adapter – example

## ■ Class Adapter TextShape

**Multiple Inheritance**  
public from **Target**  
private from **Adaptee**

```
class TextShape: public Shape, private TextView
{
    public:
        TextShape();

        virtual void BoundingBox( Point& bottomLeft, Point& topRight ) const;
        virtual bool IsEmpty() const;
        virtual Manipulator* CreateManipulator()
};
```



# Class Adapter – example

## ■ Class Adapter TextShape – implementation method

```
void BoundingBox( Point& bottomLeft, Point& topRight ) const
{
    Coord bottom, left, width, height;
    GetOrigin( bottom, left );
    GetExtent( width, height );

    topRight    = Point( bottom + height, left + width );
    bottomLeft  = Point( bottom, left );
}

bool TextShape::IsEmpty() const
{
    return TextView::IsEmpty();
}

Manipulator* TextShape::CreateManipulator() const
{
    return new TextManipulator( this );
}
```

Direct calling  
methods of the  
ancestor





## Class Adapter – properties

- **There is no indirection when delegating methods**
  - ❑ Methods are called directly, not using pointers
- **Uses multiple inheritance**
  - ❑ Access to protected **Adaptee** items can be redefined
  - ❑ Can override some **Adaptee** behaviour
- **Multiple (class) inheritance is not supported by many languages**
  - ❑ But we can inherit from multiple interfaces
- **Cannot adapt subclasses of Adaptee**



# Implementation notes

## ■ How much work needs to be done by the Adapter itself?

- ❑ Simple conversion between differently named methods

```
bool TextShape::IsEmpty() const
{
    return TextView::IsEmpty();
}
```

- ❑ Operation not supported by **Adaptee** - Processing logic
- ❑ Sometimes it implements the **Adapter** without the help of **Adaptee**

```
Manipulator* TextShape::CreateManipulator() const
{
    return new TextManipulator(this);
}
```

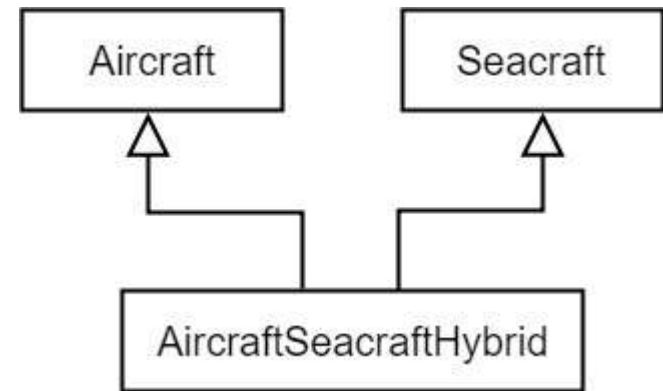
## ■ Adapter does not necessarily have to adapt only one class



# Some other variations of implementation

## ■ Two-way Adapter

- ❑ Interchangeability of the **Adapter** behind **Adaptee** objects
- ❑ It behaves like **Target** and **Adaptee**
- ❑ Typical implementation with **multiple public inheritance**



## ■ Pluggable Adapter

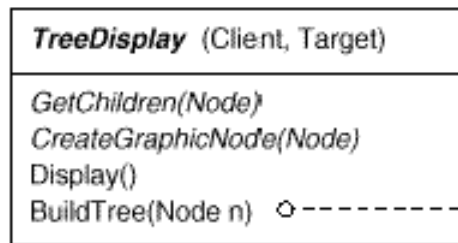
- ❑ Up to now - one **Client**, one **Adaptee**
- ❑ Many **Adapters** for Many Adjusted Classes
- ❑ An adapter that isn't hard-coded against a specific **Adaptee**
- ❑ Can adapt to different Adaptees with different interfaces
- ❑ **Unified interface** for adapting all representations
- ❑ Minimal – “**narrow interface**”
- ❑ Implementation types:
  - Abstract methods
  - Delegate



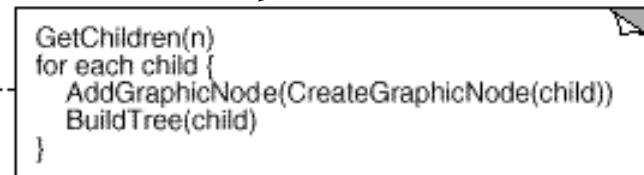
# Pluggable Adapter – Abstract methods

## Abstract methods

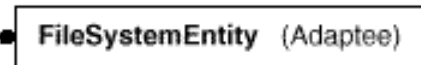
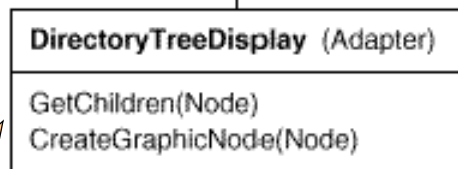
**Narrow interface** part  
TreeDisplay – abstract  
methods



Default implementation of tree  
view



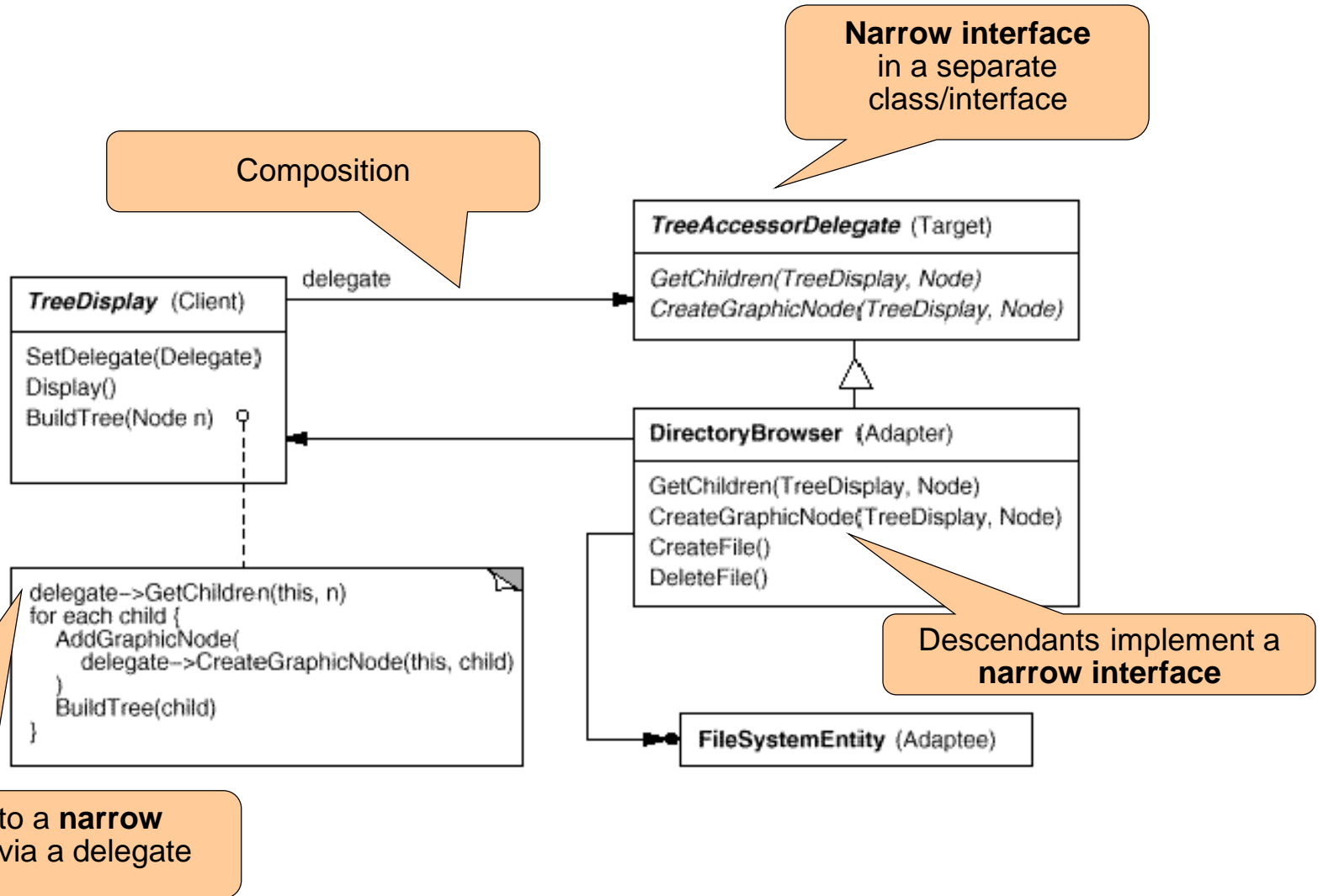
**Descendants**  
implement a narrow  
interface





# Pluggable Adapter – Delegate

## Delegate





# Pluggable Adapter – Delegate (C# example)

```
class Cat //Adaptee 1
{public static void Meow() { Console.WriteLine("Meow!"); }}
```

```
class Dog //Adaptee 2
{public static void Bark() { Console.WriteLine("Woof!"); }}
```

```
class Adapter
{
    public Action MakeSound { get; private set;} // "pluggable" adapter

    public Adapter(Action makeSoundAction)
    {
        MakeSound = makeSoundAction;
    }
}
```

```
class SoundMaker //Client
{
    static void Main(string[] args)
    {
        (new Adapter(Cat.Meow)).MakeSound();
        (new Adapter(Dog.Bark)).MakeSound();
    }
}
```

**Action Delegate**  
encapsulate some  
method



# Pluggable Adapter – properties

## ■ Abstract methods

- ❑ **Client** is also **Target**, inheriting directly from it
- ❑ The **Adaptee** interface is only suitable for the object-adapter
  - **Target** is not just an interface - multiple inheritance required

## ■ Delegate

- ❑ Delegating a narrow interface to a delegated class
  - Access methods through a pointer
  - A pointer back to the **Client**
- ❑ Possible object and class adapter
- ❑ Two objects – **Client** and **Adapter**



# Adapter – usage

## ■ When to use

- ❑ Use an existing class with an incompatible interface
- ❑ Creating a reusable class that uses classes with a potentially incompatible interface

## ■ Known uses

- ❑ C# – ADO.NET
  - **DataAdapter** – data queries independent of the data source
  - Usage in **DataSet**
- ❑ Java I/O
  - **StringBufferInputStream** – adapts **StringBuffer** as **InputStream**
- ❑ Pluggable Adapter in Swing
  - `javax.swing.tree.TreeModel` – **JTree** component viewing interface





# Adapter – related design patterns

## ■ Related DPs

### □ Bridge

- Decouple interface from implementation
- Does not change the interface
- Used at design time

### □ Decorator

- Does not change the interface of the object
- Adds functionality
- Support recursive composition

### □ Proxy

- Does not change the interface
- Hides the actual location of the object (e.g. object on disk, on another computer)

### □ Facade

- Provides a simplified interface
- Hides the complexities of a larger system