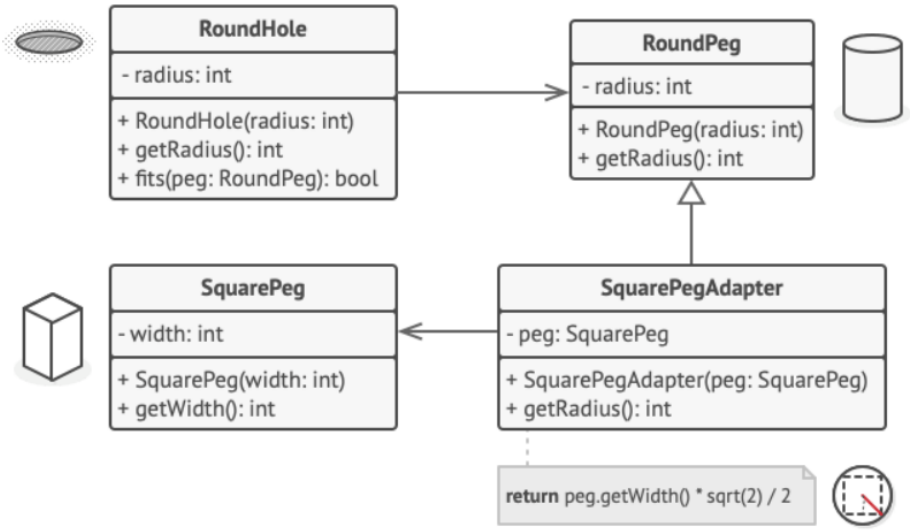
Pseudocode Example for Design Pattern

Contents

1. Adapter



Adapting square pegs to round holes.

```
// Say you have two classes with compatible interfaces:
// RoundHole and RoundPeg.
class RoundHole is
    constructor RoundHole(radius) { ... }

    method getRadius() is
        // Return the radius of the hole.

    method fits(peg: RoundPeg) is
        return this.getRadius() >= peg.getRadius()

class RoundPeg is
    constructor RoundPeg(radius) { ... }

    method getRadius() is
        // Return the radius of the peg.

// But there's an incompatible class: SquarePeg.
class SquarePeg is
    constructor SquarePeg(width) { ... }
```

```
    method getWidth() is
        // Return the square peg width.

// An adapter class lets you fit square pegs into round holes.
// It extends the RoundPeg class to let the adapter objects act
// as round pegs.
class SquarePegAdapter extends RoundPeg is
    // In reality, the adapter contains an instance of the
    // SquarePeg class.
    private field peg: SquarePeg

    constructor SquarePegAdapter(peg: SquarePeg) is
        this.peg = peg

    method getRadius() is
        // The adapter pretends that it's a round peg with a
        // radius that could fit the square peg that the adapter
        // actually wraps.
        return peg.getWidth() * Math.sqrt(2) / 2

// Somewhere in client code.
hole = new RoundHole(5)
rpeg = new RoundPeg(5)
hole.fits(rpeg) // true

small_sqpeg = new SquarePeg(5)
large_sqpeg = new SquarePeg(10)
hole.fits(small_sqpeg)// this won't compile (incompatible types)

small_sqpeg_adapter = new SquarePegAdapter(small_sqpeg)
large_sqpeg_adapter = new SquarePegAdapter(large_sqpeg)
hole.fits(small_sqpeg_adapter) // true
hole.fits(large_sqpeg_adapter) // false
```

```
public class RoundHole {
    private double radius;

    public RoundHole(double radius) {
        this.radius = radius;
    }

    public double getRadius() {
        return radius;
    }

    public boolean fits(RoundPeg peg) {
        boolean result;
        result = (this.getRadius() >= peg.getRadius());
        return result;
    }
}

public class RoundPeg {
    private double radius;
```

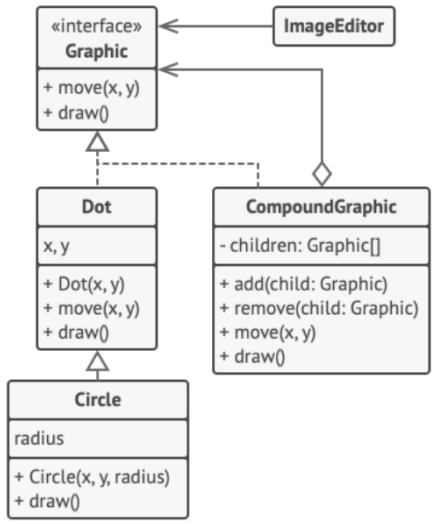
```
    public RoundPeg() {}

    public RoundPeg(double radius) {
        this.radius = radius;
    }

    public double getRadius() {
        return radius;
    }
}
```

```
/**
 * SquarePegs are not compatible with RoundHoles (they were implemented
by
 * previous development team). But we have to integrate them into our
program.
 */
public class SquarePeg {
    private double width;

    public SquarePeg(double width) {
        this.width = width;
    }

    public double getWidth() {
        return width;
    }

    public double getSquare() {
        double result;
        result = Math.pow(this.width, 2);
        return result;
    }
}
```

```
/**
 * Adapter allows fitting square pegs into round holes.
 */
public class SquarePegAdapter extends RoundPeg {
    private SquarePeg peg;

    public SquarePegAdapter(SquarePeg peg) {
        this.peg = peg;
    }

    @Override
    public double getRadius() {
        double result;
        // Calculate a minimum circle radius, which can fit this peg.
        result = (Math.sqrt(Math.pow((peg.getWidth() / 2), 2) * 2));
        return result;
    }
}
```

```
public class Demo {
    public static void main(String[] args) {
        // Round fits round, no surprise.
        RoundHole hole = new RoundHole(5);
        RoundPeg rpeg = new RoundPeg(5);
        if (hole.fits(rpeg)) {
            System.out.println("Round peg r5 fits round hole r5.");
        }

        SquarePeg smallSqPeg = new SquarePeg(2);
        SquarePeg largeSqPeg = new SquarePeg(20);
        // hole.fits(smallSqPeg); // Won't compile.

        // Adapter solves the problem.
        SquarePegAdapter smallSqPegAdapter = new
SquarePegAdapter(smallSqPeg);
        SquarePegAdapter largeSqPegAdapter = new
SquarePegAdapter(largeSqPeg);
        if (hole.fits(smallSqPegAdapter)) {
            System.out.println("Square peg w2 fits round hole r5.");
        }
        if (!hole.fits(largeSqPegAdapter)) {
            System.out.println("Square peg w20 does not fit into round
hole r5.");
        }
    }
}
```

2. Composite

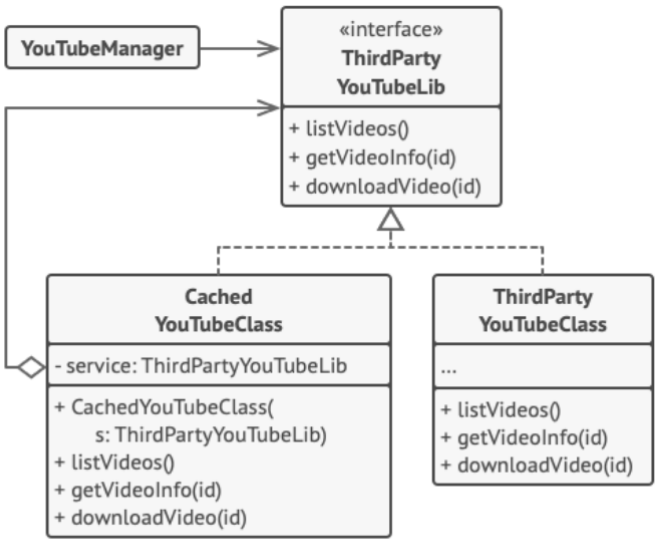



```
// The component interface declares common operations for both
// simple and complex objects of a composition.
interface Graphic is
    method move(x, y)
    method draw()

// The leaf class represents end objects of a composition. A
// leaf object can't have any sub-objects. Usually, it's leaf
```

```
// objects that do the actual work, while composite objects only
// delegate to their sub-components.
class Dot implements Graphic is
    field x, y

    constructor Dot(x, y) { ... }

    method move(x, y) is
        this.x += x, this.y += y

    method draw() is
        // Draw a dot at X and Y.

// All component classes can extend other components.
class Circle extends Dot is
    field radius

    constructor Circle(x, y, radius) { ... }

    method draw() is
        // Draw a circle at X and Y with radius R.

// The composite class represents complex components that may
// have children. Composite objects usually delegate the actual
// work to their children and then "sum up" the result.
class CompoundGraphic implements Graphic is
    field children: array of Graphic

    // A composite object can add or remove other components
    // (both simple or complex) to or from its child list.
    method add(child: Graphic) is
        // Add a child to the array of children.

    method remove(child: Graphic) is
        // Remove a child from the array of children.

    method move(x, y) is
        foreach (child in children) do
            child.move(x, y)

    // A composite executes its primary logic in a particular
    // way. It traverses recursively through all its children,
    // collecting and summing up their results. Since the
    // composite's children pass these calls to their own
    // children and so forth, the whole object tree is traversed
    // as a result.
    method draw() is
        // 1. For each child component:
        //     - Draw the component.
        //     - Update the bounding rectangle.
        // 2. Draw a dashed rectangle using the bounding
        // coordinates.


// The client code works with all the components via their base
```

```
// interface. This way the client code can support simple leaf
// components as well as complex composites.
class ImageEditor is
    field all: CompoundGraphic

    method load() is
        all = new CompoundGraphic()
        all.add(new Dot(1, 2))
        all.add(new Circle(5, 3, 10))
        // ...

    // Combine selected components into one complex composite
    // component.
    method groupSelected(components: array of Graphic) is
        group = new CompoundGraphic()
        foreach (component in components) do
            group.add(component)
            all.remove(component)
        all.add(group)
        // All components will be drawn.
        all.draw()
```

3. Proxy



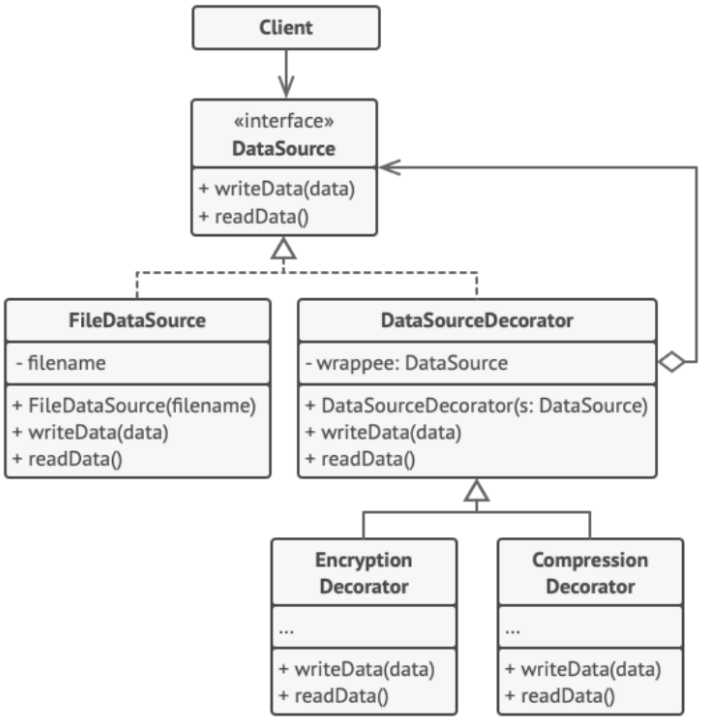
Caching results of a service with a proxy.

```
// The interface of a remote service.
interface ThirdPartyYouTubeLib is
    method listVideos()
    method getVideoInfo(id)
    method downloadVideo(id)

// The concrete implementation of a service connector. Methods
// of this class can request information from YouTube. The speed
// of the request depends on a user's internet connection as
// well as YouTube's. The application will slow down if a lot of
// requests are fired at the same time, even if they all request
// the same information.
```

```
class ThirdPartyYouTubeClass implements ThirdPartyYouTubeLib is
    method listVideos() is
        // Send an API request to YouTube.

    method getVideoInfo(id) is
        // Get metadata about some video.

    method downloadVideo(id) is
        // Download a video file from YouTube.

// To save some bandwidth, we can cache request results and keep
// them for some time. But it may be impossible to put such code
// directly into the service class. For example, it could have
// been provided as part of a third party library and/or defined
// as `final`. That's why we put the caching code into a new
// proxy class which implements the same interface as the
// service class. It delegates to the service object only when
// the real requests have to be sent.
class CachedYouTubeClass implements ThirdPartyYouTubeLib is
    private field service: ThirdPartyYouTubeLib
    private field listCache, videoCache
    field needReset

    constructor CachedYouTubeClass(service: ThirdPartyYouTubeLib) is
        this.service = service

    method listVideos() is
        if (listCache == null || needReset)
            listCache = service.listVideos()
        return listCache

    method getVideoInfo(id) is
        if (videoCache == null || needReset)
            videoCache = service.getVideoInfo(id)
        return videoCache

    method downloadVideo(id) is
        if (!downloadExists(id) || needReset)
            service.downloadVideo(id)

// The GUI class, which used to work directly with a service
// object, stays unchanged as long as it works with the service
// object through an interface. We can safely pass a proxy
// object instead of a real service object since they both
// implement the same interface.
class YouTubeManager is
    protected field service: ThirdPartyYouTubeLib

    constructor YouTubeManager(service: ThirdPartyYouTubeLib) is
        this.service = service

    method renderVideoPage(id) is
        info = service.getVideoInfo(id)
        // Render the video page.
```

```
    method renderListPanel() is
        list = service.listVideos()
        // Render the list of video thumbnails.

    method reactOnUserInput() is
        renderVideoPage()
        renderListPanel()

// The application can configure proxies on the fly.
class Application is
    method init() is
        aYouTubeService = new ThirdPartyYouTubeClass()
        aYouTubeProxy = new CachedYouTubeClass(aYouTubeService)
        manager = new YouTubeManager(aYouTubeProxy)
        manager.reactOnUserInput()
```

4. Decorator



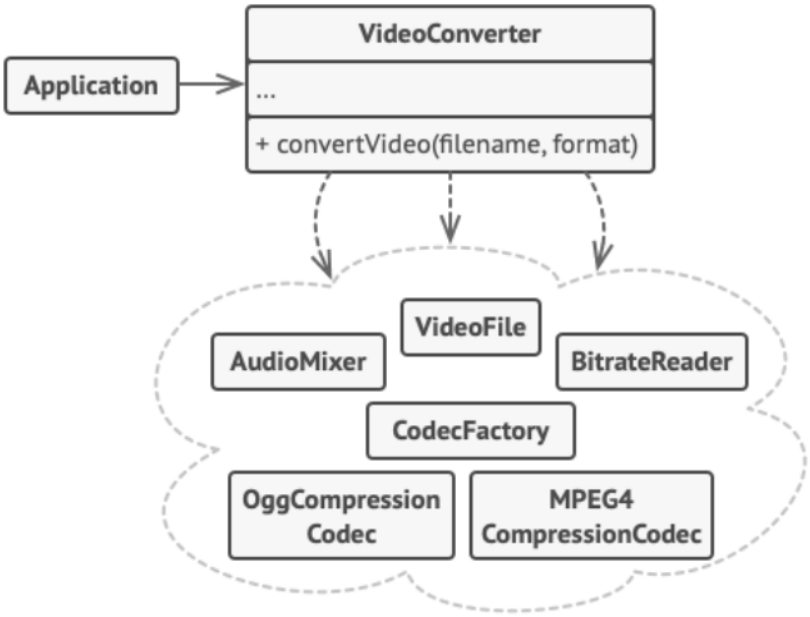
The encryption and compression decorators example.

```
// The component interface defines operations that can be
// altered by decorators.
interface DataSource is
    method writeData(data)
    method readData():data

// Concrete components provide default implementations for the
// operations. There might be several variations of these
// classes in a program.
class FileDataSource implements DataSource is
    constructor FileDataSource(filename) { ... }

    method writeData(data) is
```

```
        // Write data to file.

    method readData():data is
        // Read data from file.

// The base decorator class follows the same interface as the
// other components. The primary purpose of this class is to
// define the wrapping interface for all concrete decorators.
// The default implementation of the wrapping code might include
// a field for storing a wrapped component and the means to
// initialize it.
class DataSourceDecorator implements DataSource is
    protected field wrappee: DataSource

    constructor DataSourceDecorator(source: DataSource) is
        wrappee = source

    // The base decorator simply delegates all work to the
    // wrapped component. Extra behaviors can be added in
    // concrete decorators.
    method writeData(data) is
        wrappee.writeData(data)

    // Concrete decorators may call the parent implementation of
    // the operation instead of calling the wrapped object
    // directly. This approach simplifies extension of decorator
    // classes.
    method readData():data is
        return wrappee.readData()

// Concrete decorators must call methods on the wrapped object,
// but may add something of their own to the result. Decorators
// can execute the added behavior either before or after the
// call to a wrapped object.
class EncryptionDecorator extends DataSourceDecorator is
    method writeData(data) is
        // 1. Encrypt passed data.
        // 2. Pass encrypted data to the wrappee's writeData
        // method.

    method readData():data is
        // 1. Get data from the wrappee's readData method.
        // 2. Try to decrypt it if it's encrypted.
        // 3. Return the result.

// You can wrap objects in several layers of decorators.
class CompressionDecorator extends DataSourceDecorator is
    method writeData(data) is
        // 1. Compress passed data.
        // 2. Pass compressed data to the wrappee's writeData
        // method.

    method readData():data is
        // 1. Get data from the wrappee's readData method.
        // 2. Try to decompress it if it's compressed.
```

```
        // 3. Return the result.


// Option 1. A simple example of a decorator assembly.
class Application is
    method dumbUsageExample() is
        source = new FileDataSource("somefile.dat")
        source.writeData(salaryRecords)
        // The target file has been written with plain data.

        source = new CompressionDecorator(source)
        source.writeData(salaryRecords)
        // The target file has been written with compressed
        // data.

        source = new EncryptionDecorator(source)
        // The source variable now contains this:
        // Encryption > Compression > FileDataSource
        source.writeData(salaryRecords)
        // The file has been written with compressed and
        // encrypted data.


// Option 2. Client code that uses an external data source.
// SalaryManager objects neither know nor care about data
// storage specifics. They work with a pre-configured data
// source received from the app configurator.
class SalaryManager is
    field source: DataSource

    constructor SalaryManager(source: DataSource) { ... }

    method load() is
        return source.readData()

    method save() is
        source.writeData(salaryRecords)
    // ...Other useful methods...


// The app can assemble different stacks of decorators at
// runtime, depending on the configuration or environment.
class ApplicationConfigurator is
    method configurationExample() is
        source = new FileDataSource("salary.dat")
        if (enabledEncryption)
            source = new EncryptionDecorator(source)
        if (enabledCompression)
            source = new CompressionDecorator(source)

        logger = new SalaryManager(source)
        salary = logger.load()
    // ...
```

5. Façade

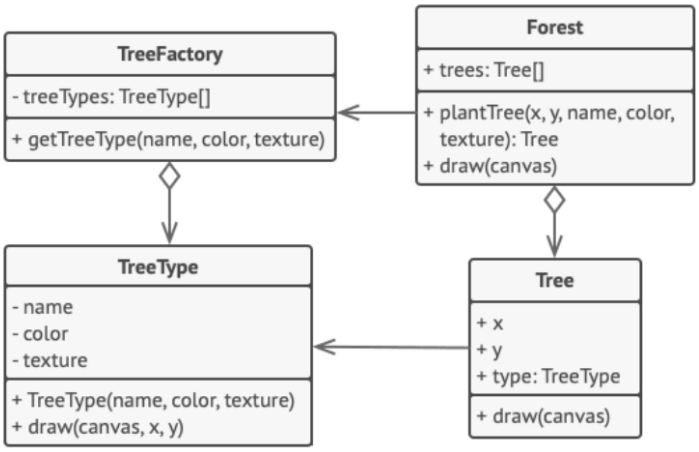


An example of isolating multiple dependencies within a single facade class.

```
// These are some of the classes of a complex 3rd-party video
// conversion framework. We don't control that code, therefore
// can't simplify it.

class VideoFile
// ...

class OggCompressionCodec
// ...

class MPEG4CompressionCodec
// ...

class CodecFactory
// ...

class BitrateReader
// ...

class AudioMixer
// ...


// We create a facade class to hide the framework's complexity
// behind a simple interface. It's a trade-off between
// functionality and simplicity.
class VideoConverter is
    method convert(filename, format):File is
        file = new VideoFile(filename)
        sourceCodec = new CodecFactory.extract(file)
        if (format == "mp4")
            destinationCodec = new MPEG4CompressionCodec()
```

```
        else
            destinationCodec = new OggCompressionCodec()
        buffer = BitrateReader.read(filename, sourceCodec)
        result = BitrateReader.convert(buffer, destinationCodec)
        result = (new AudioMixer()).fix(result)
        return new File(result)

// Application classes don't depend on a billion classes
// provided by the complex framework. Also, if you decide to
// switch frameworks, you only need to rewrite the facade class.
class Application is
    method main() is
        convertor = new VideoConverter()
        mp4 = convertor.convert("funny-cats-video.ogg", "mp4")
        mp4.save()
```

6. Flyweight




```
// The flyweight class contains a portion of the state of a
// tree. These fields store values that are unique for each
// particular tree. For instance, you won't find here the tree
// coordinates. But the texture and colors shared between many
// trees are here. Since this data is usually BIG, you'd waste a
// lot of memory by keeping it in each tree object. Instead, we
// can extract texture, color and other repeating data into a
// separate object which lots of individual tree objects can
// reference.
class TreeType is
    field name
    field color
    field texture
    constructor TreeType(name, color, texture) { ... }
    method draw(canvas, x, y) is
        // 1. Create a bitmap of a given type, color & texture.
        // 2. Draw the bitmap on the canvas at X and Y coords.

// Flyweight factory decides whether to re-use existing
// flyweight or to create a new object.
class TreeFactory is
    static field treeTypes: collection of tree types
```

```
    static method getTreeType(name, color, texture) is
        type = treeTypes.find(name, color, texture)
        if (type == null)
            type = new TreeType(name, color, texture)
            treeTypes.add(type)
        return type

// The contextual object contains the extrinsic part of the tree
// state. An application can create billions of these since they
// are pretty small: just two integer coordinates and one
// reference field.
class Tree is
    field x,y
    field type: TreeType
    constructor Tree(x, y, type) { ... }
    method draw(canvas) is
        type.draw(canvas, this.x, this.y)

// The Tree and the Forest classes are the flyweight's clients.
// You can merge them if you don't plan to develop the Tree
// class any further.
class Forest is
    field trees: collection of Trees

    method plantTree(x, y, name, color, texture) is
        type = TreeFactory.getTreeType(name, color, texture)
        tree = new Tree(x, y, type)
        trees.add(tree)

    method draw(canvas) is
        foreach (tree in trees) do
            tree.draw(canvas)
```