Structural Design Pattern

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October 27, 2021

Outline

1. Structural Pattern Overview

2. Adapter pattern

Structural Pattern Overview

How classes and objects are composed fo form larger structure.

- **Adapter**: Convert the interface of a class into another interface.
- **Bridge**: Decouple an abstraction from its implementation.
- **Composite**: Compose objects into tree structure.
- **Decorator**: Attach additional responsibilities to an object dynamically.
- **Facade**: Provide a unified interface to a set of interfaces.
- **Flyweight**: Use sharing to support large numbers of fine-grained objects efficiently.
- **Proxy**: Provide a surrogate or placeholder for another object to control access to it.

Why we need Adapter Design Pattern?

Class wrapper

The Intent of Adapter Design Pattern

Convert the interface of a class into another interface clients expect. Adapter lets classes work together that could not otherwise because of incompatible interfaces.

How to implement Adapter Design Pattern?

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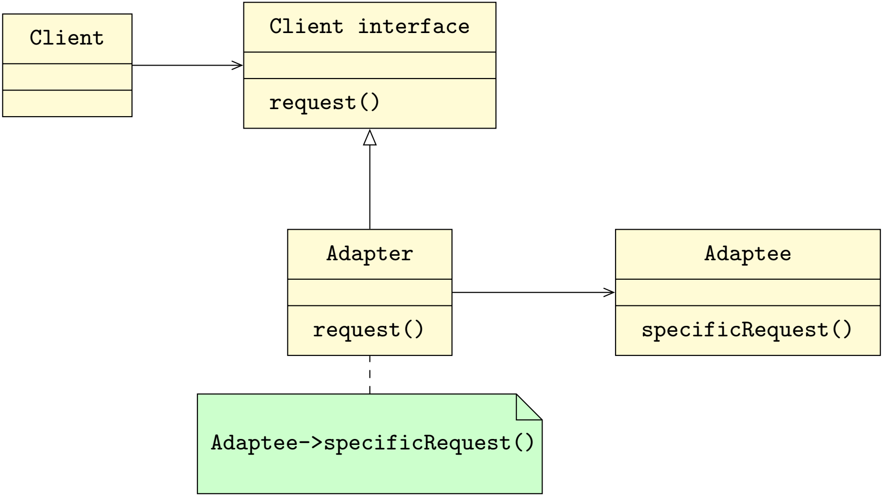
Structure of Adapter Pattern: Object adapter



Basic implementation: Rectangle class

rectangle.h

```cpp
#ifndef _RECTANGLE_H_
#define _RECTANGLE_H_
class Rectangle {
  int a;
  int b;
public:
  Rectangle();
  Rectangle(int a, int b);
  virtual int width() const;
  virtual int height() const;
  virtual int area() const;
};

#endif // _RECTANGLE_H_
```

rectangle.cpp

```cpp
#include "rectangle.h"

Rectangle::Rectangle() : a{0}, b{0} {
}

Rectangle::Rectangle(int a, int b) : a{a}, b{b} {
}

int Rectangle::width() const {
  return a;
}

int Rectangle::height() const {
  return b;
}

int Rectangle::area() const {
  return a*b;
}
```

Basic implementation: Square class

square.h

```cpp
#ifndef _SQUARE_H_
#define _SQUARE_H_
class Square {
  int a;
public:
  Square();
  Square(int a);
  int getEdge() const;
  int area() const;
};
#endif // SQUARE_H_
```

square.cpp

```cpp
#include "square.h"

Square::Square() : a{0} {
}

Square::Square(int a) : a{a} {
}

int Square::getEdge() const {
  return a;
}

int Square::area() const{
  return a*a;
}
```

Basic implementation: Adapter class

adapter.h

```cpp
#ifndef _ADAPTER_H_
#define _ADAPTER_H_
#include "rectangle.h"
#include "square.h"
class Adapter : public Rectangle{
  Square& s;
public:
  Adapter(Square& s);
  int width() const override;
  int height() const override;
  int area() const override;
};
#endif // _ADAPTER_H_
```

adapter.cpp

```cpp
#include "adapter.h"

Adapter::Adapter(Square& s) : s{s}{
}

int Adapter::width() const {
  return s.getEdge();
}

int Adapter::height() const {
  return s.getEdge();
}

int Adapter::area() const {
  return s.area();
}
```

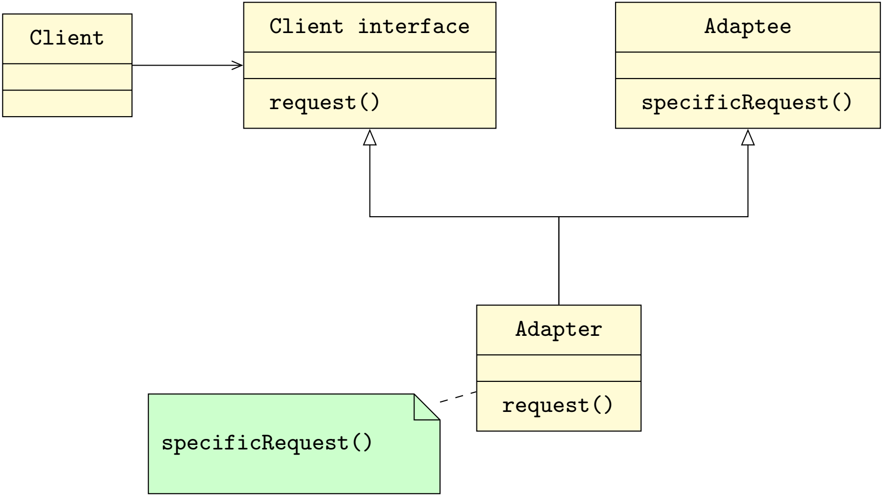
Basic implementation: client code

main.cpp

```cpp
#include "adapter.h"
#include <iostream>

// client code
void doSomething(Rectangle& r) {
  int w = r.width();
  int h = r.height();

  std::cout << "width: " << w << "\nheight: " << h << std::endl;
}

int main() {
  Square s(2);
  Rectangle r(2,3);
  doSomething(r);
  //doSomething(s);
  Adapter a(s);
  doSomething(a);
  return 0;
}
```

- Object adapter

Structure of Adapter Pattern: Class adapter



Basic implementation: Rectangle class

rectangle.h

```cpp
#ifndef _RECTANGLE_H_
#define _RECTANGLE_H_
class Rectangle {
  int a;
  int b;
public:
  Rectangle();
  Rectangle(int a, int b);
  virtual int width() const;
  virtual int height() const;
  virtual int area() const;
};

#endif // _RECTANGLE_H_
```

rectangle.cpp

```cpp
#include "rectangle.h"

Rectangle::Rectangle() : a{0}, b{0} {
}

Rectangle::Rectangle(int a, int b) : a{a}, b{b} {
}

int Rectangle::width() const {
  return a;
}

int Rectangle::height() const {
  return b;
}

int Rectangle::area() const {
  return a*b;
}
```

Basic implementation: Square class

square.h

```
#ifndef _SQUARE_H_
#define _SQUARE_H_
class Square {
  int a;
public:
  Square();
  Square(int a);
  int getEdge() const;
  int area() const;
};
#endif // _SQUARE_H_
```

square.cpp

```
#include "square.h"

Square::Square() : a{0} {
}

Square::Square(int a) : a{a} {
}

int Square::getEdge() const {
  return a;
}

int Square::area() const{
  return a*a;
}
```

Basic implementation: Adapter class

adapter.h

```cpp
#ifndef _ADAPTER_H_
#define _ADAPTER_H_
#include "rectangle.h"
#include "square.h"
class Adapter : public Rectangle, private Square{
public:
  Adapter(Square& s);
  int width() const override;
  int height() const override;
  int area() const override;
};
#endif // _ADAPTER_H_
```

adapter.cpp

```cpp
#include "adapter.h"

Adapter::Adapter(Square& s) : Square(s) {
}

int Adapter::width() const {
  return this->getEdge();
}

int Adapter::height() const {
  return this->getEdge();
}

int Adapter::area() const {
  return this->area();
}
```

Basic implementation: client code

main.cpp

```cpp
#include "adapter.h"
#include <iostream>

// client code
void doSomething(Rectangle* r) {
  int w = r->width();
  int h = r->height();

  std::cout << "width: " << w << "\nheight: " << h << std::endl;
}

int main() {
  Square s(2);
  Rectangle* r = new Rectangle(2,3);
  doSomething(r);
  //doSomething(s);
  Rectangle* a = new Adapter(s);
  doSomething(a);
  return 0;
}
```

- class adapter

Where to use?

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Thank You!