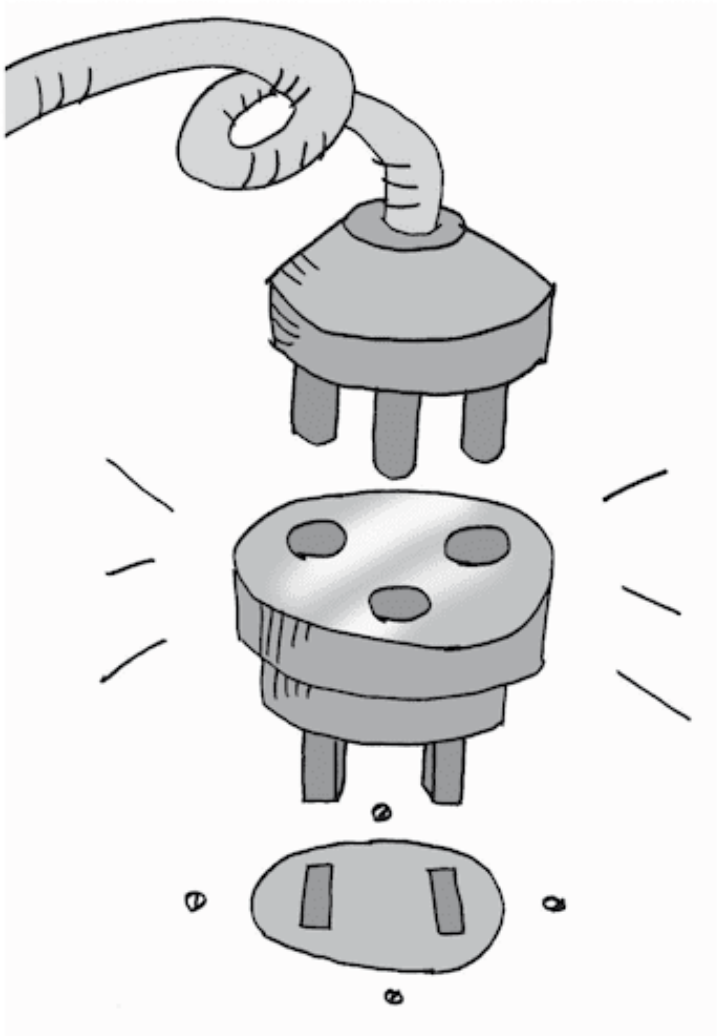
Adapter Pattern

Reuse through Adaptation



Adapter Pattern

Adapter Pattern

- **Power Adapter** → Converts U.S. 110V to EU 220V
- **HDMI to VGA** → Connects new laptop to old projector

Adapt one interface to another, making them compatible.

The Problem

- Old class: `Banner("Hello").show_with_paren()`
- New interface: `Print("Hello").print_weak()`
- Goal: Reuse old code (Banner) without rewriting to match the new interface (Print).

The challenge: how to make **incompatible interfaces** work together and **reuse existing code** without modifying it?

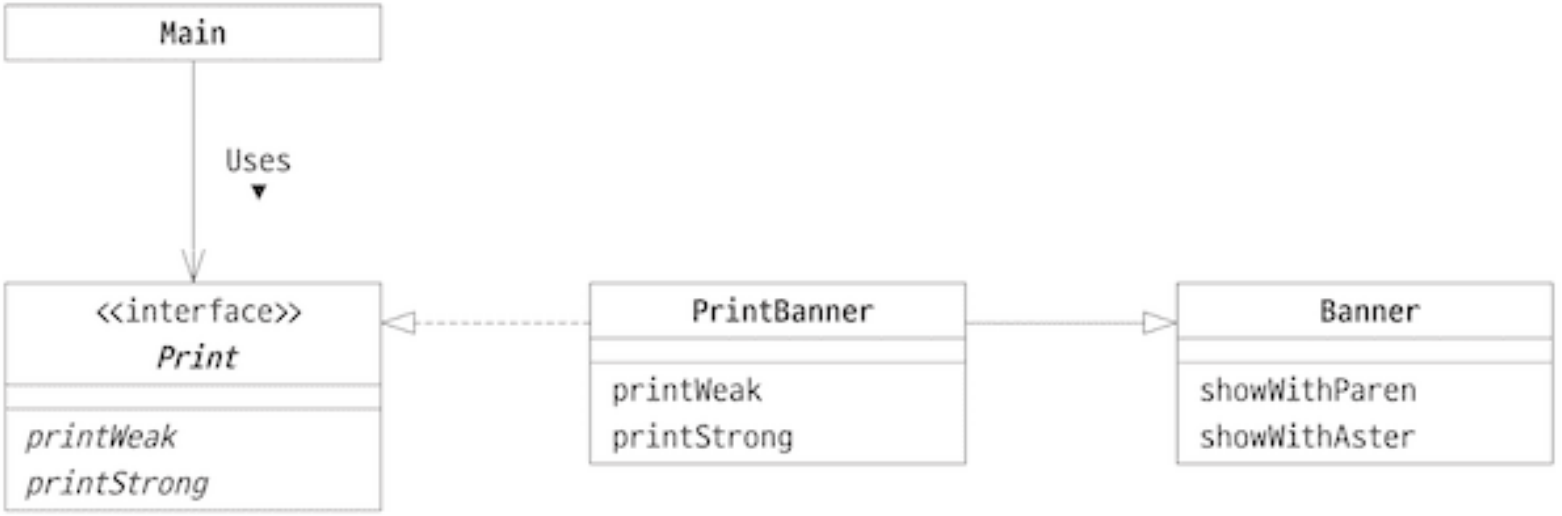
The Solution

We use the Adapter DP.

```
# We want to use the new Print interface
print_obj = PrintBanner(Banner, Print)  # Adapter
print_obj.print_weak()  # New API
```

- The **PrintBanner** is an *adapter* that allows us to use the new *print_weak* interface with the old **Banner** class.
- We can *reuse* existing code through *adaptation*.
    - For this, we should use the same *interface* with the new class, but reuse the old *code/implementation* with the old class.

The Design



- We have two interfaces: Banner (old) and Print (new).
- We need the Adator PrintBanner that knows both interfaces.
    - In this example, the adapter uses the **new interface** and old code through **inheritance**.

Example

Step 1: The Players

In this design, we have players:

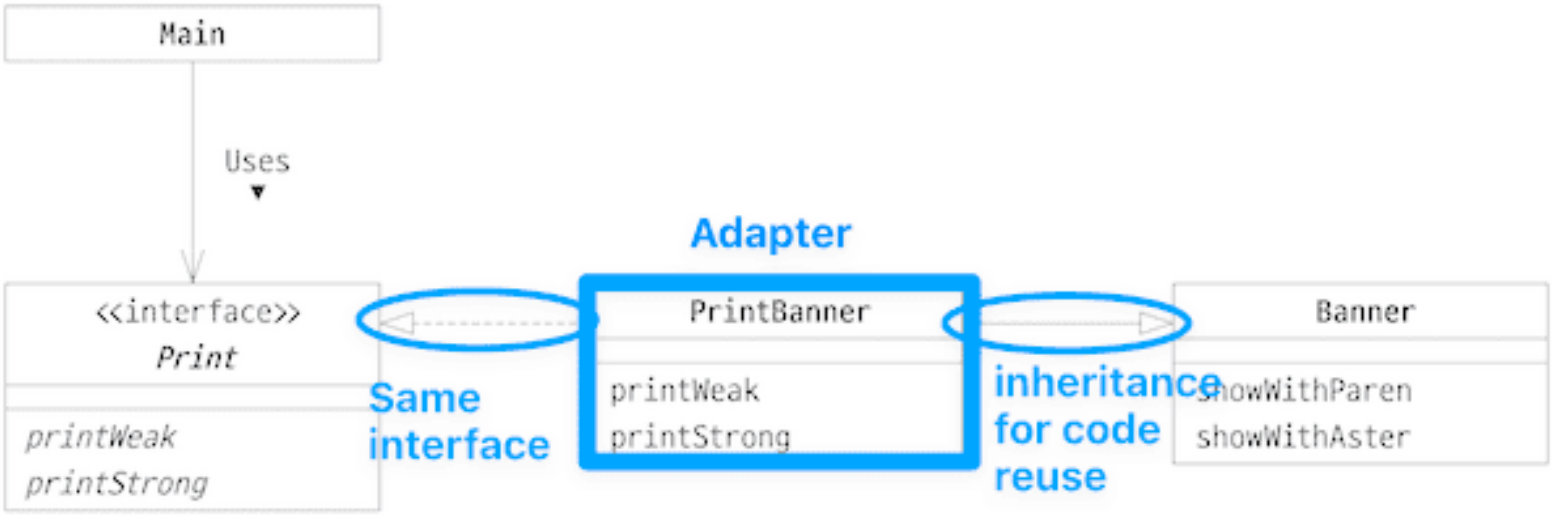
- *Target* (new interface - Print)
- **Adaptee** (old class - Banner)
- **Adapter** (bridges Target and Adaptee - PrintBanner)

The client uses the new (not old) interface with old code.

- **Client** uses the new interface

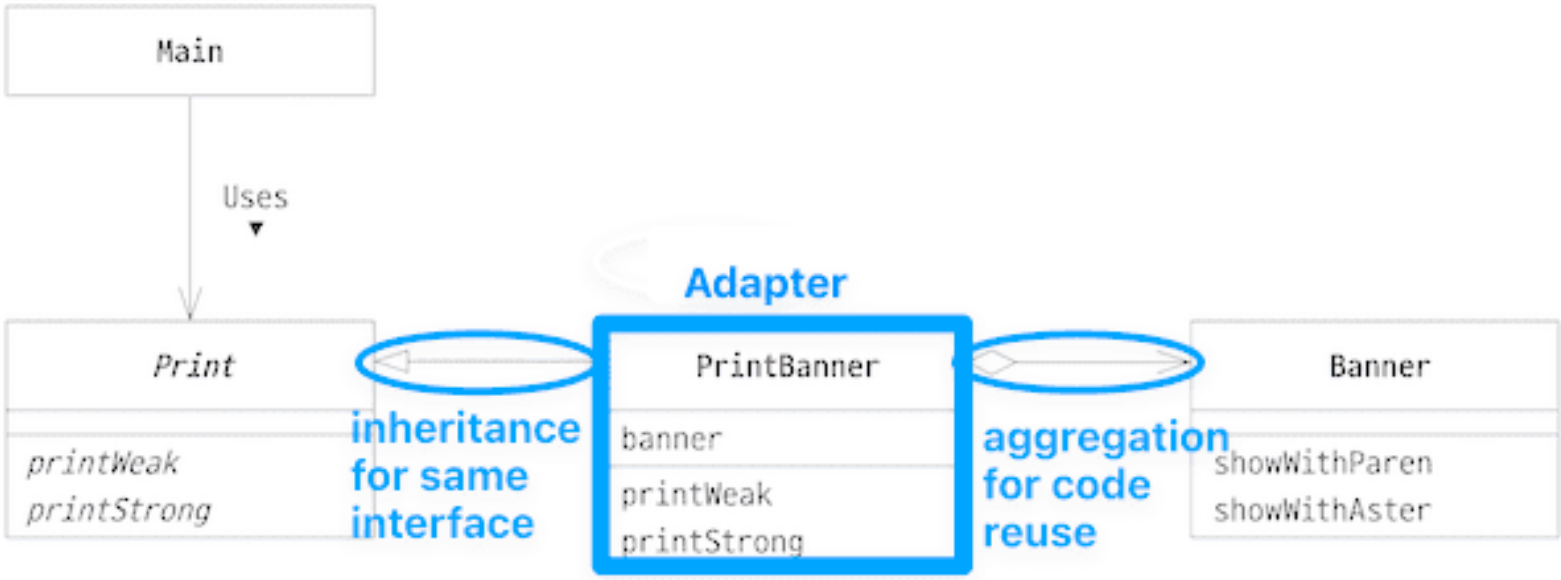
Step 2: Two Implementations

1. Inheritance-based Adapter



- **Adapter** uses the same interface of the **Target**, and use the old code from **Adaptee**.
- **Adapter** can inherit from both *Target* and **Adaptee**.

2. Delegation-based Adapter



- **Adapter** implements *Target* for reusing the interface.
- **Adapter** aggregates (owns) the **Adaptee** for code reuse.

Code

- Main Method
- Banner (Adaptee)
- Print Interface (Target)
- PrintBanner (Adapter)

Main Method

```
from print_banner import PrintBanner

def main():
    print("=== Adapter Pattern Example ===\n")

    p = PrintBanner("Hello")

    print("Client code using Print interface:")
    p.print_weak()   # Adapted to Banner's show_with_paren()
    p.print_strong() # Adapted to Banner's show_with_aster()

if __name__ == "__main__":
    main()
```

Step 1: Create adapter instance

```
p = PrintBanner("Hello")
```

- **PrintBanner** is the adapter that implements *Print* interface.
- It internally uses **Banner** functionality.

Step 2: Use the new interface

```
p.print_weak()   # Uses Banner's show_with_paren()
p.print_strong() # Uses Banner's show_with_aster()
```

- Client code uses the new *Print* interface methods.
- The adapter translates these calls to the old **Banner** methods.

Old API (Adaptee)

```
class Banner:
    def __init__(self, string: str):
        self._string = string

    def show_with_paren(self):
        print(f"({self._string})")

    def show_with_aster(self):
        print(f"*{self._string}*")
```

New API (Target)

```
from abc import ABC, abstractmethod

class Print(ABC):
    def print_weak(self): pass
    def print_strong(self): pass
```

Adapter Implementation

```python
from banner import Banner
from print_interface import Print

class PrintBanner(Banner, Print):
    def __init__(self, string: str):
        super().__init__(string)

    def print_weak(self):
        self.show_with_paren()  # Adapt to old method

    def print_strong(self):
        self.show_with_aster()  # Adapt to old method
```

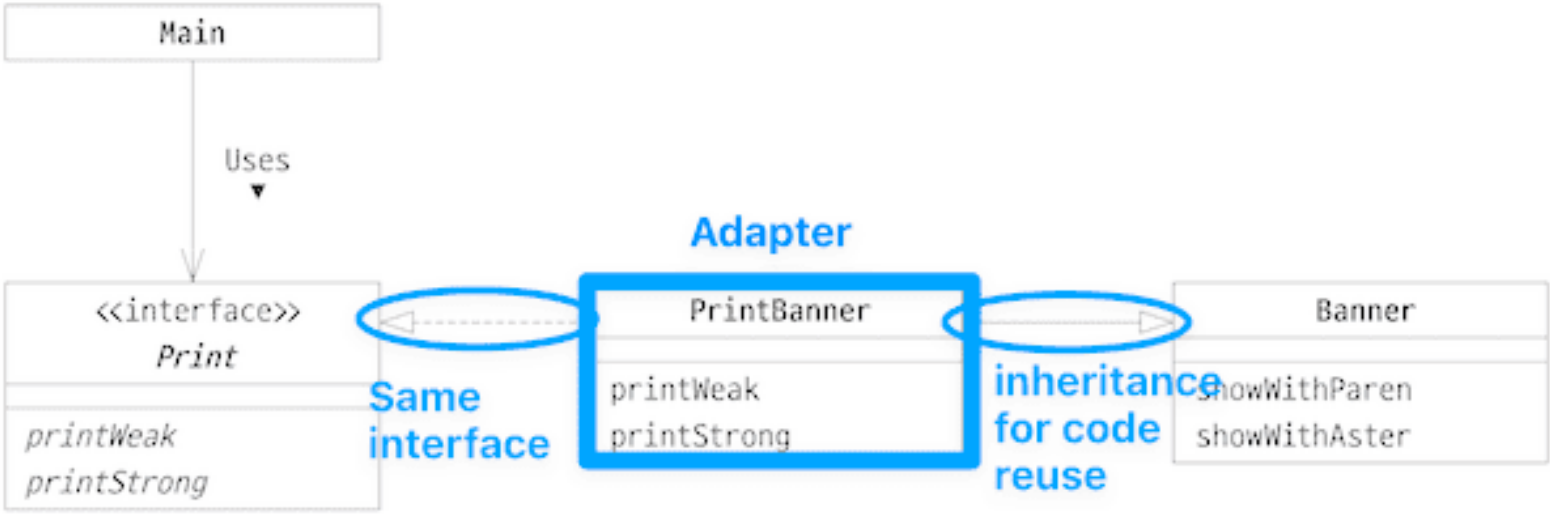
Delegation-based Alternative

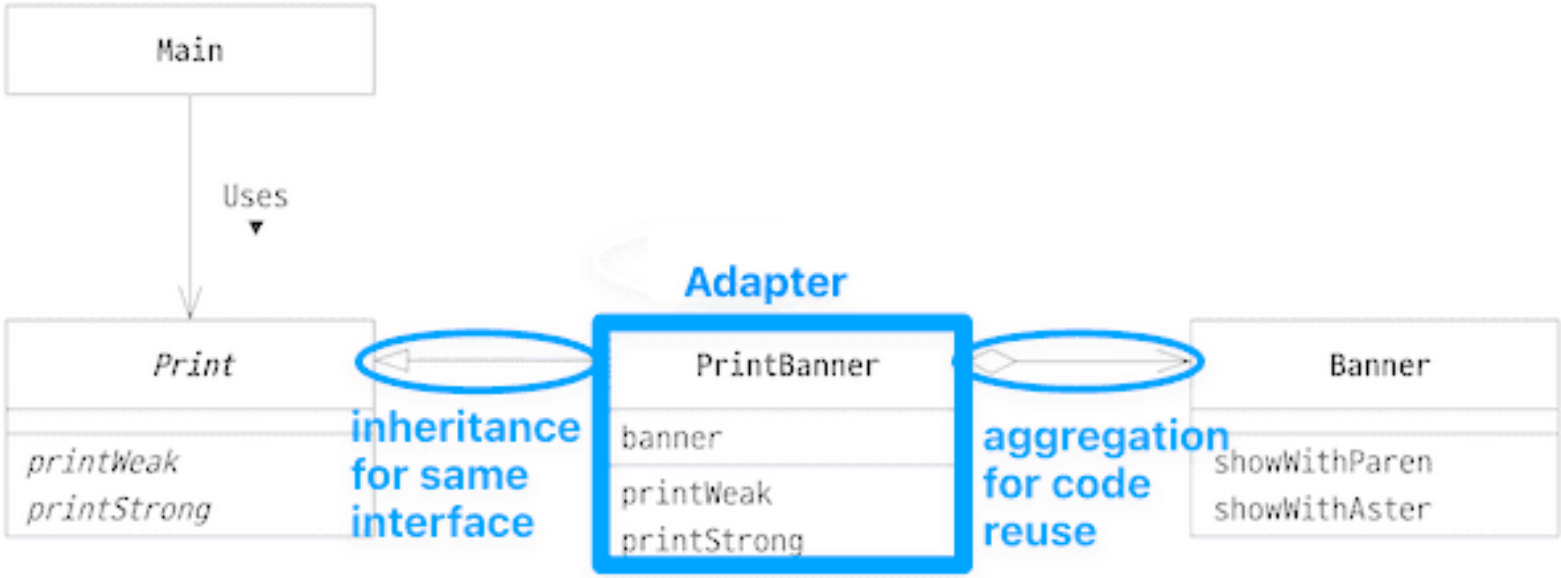
```
class PrintBanner(Print):
    def __init__(self, string: str):
        self._banner = Banner(string)  # Aggregation

    def print_weak(self):
        self._banner.show_with_paren()

    def print_strong(self):
        self._banner.show_with_aster()
```

Discussion

- The Adapter pattern can be used even when we do not have the source code: we just call the old method to implement the new interface.
- The Adapter pattern is used for supporting legacy code by making the legacy code the Target and the new code the Adaptee.
- When the Adaptee and Target are too different, we can't use this pattern.

UML


Main
Uses
Adapter
<<interface>>
Print
printWeak
printStrong
Same
interface
PrintBanner
printWeak
printStrong
inheritance
for code
reuse
Banner
showWithParen
showWithAster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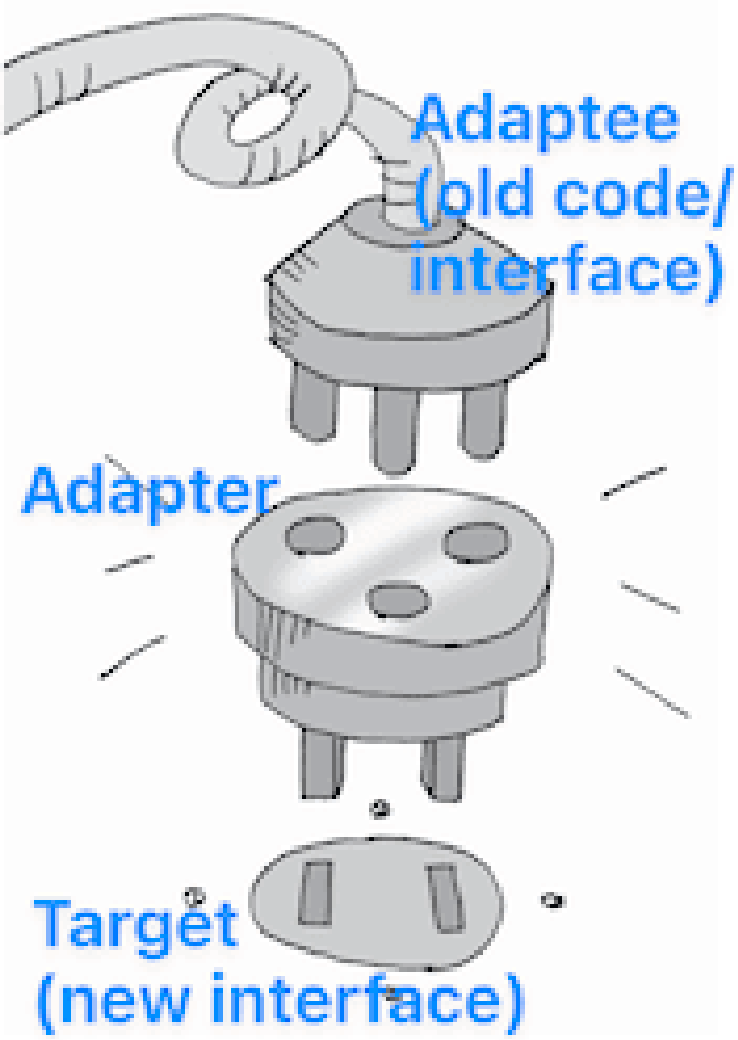
Adaptee
(old code/
interface)
Adapter
Target
(new interface)