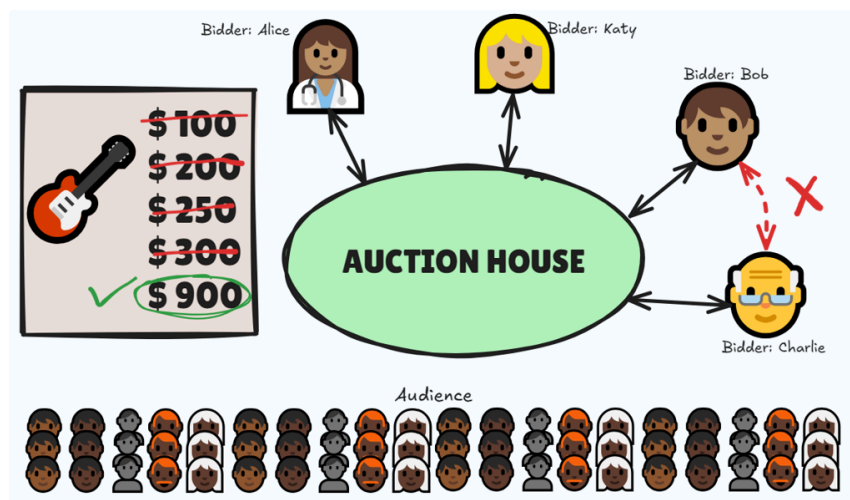# Mediator Pattern

> ∨ Resources
>
> - ▶️ 41. All Behavioral Design Patterns │ Strategy, Observer, State, Template, Command, Visitor, Memento
> - ▶️ 34. Design Online Auction System with Mediator Design Pattern │ Low Level System Design
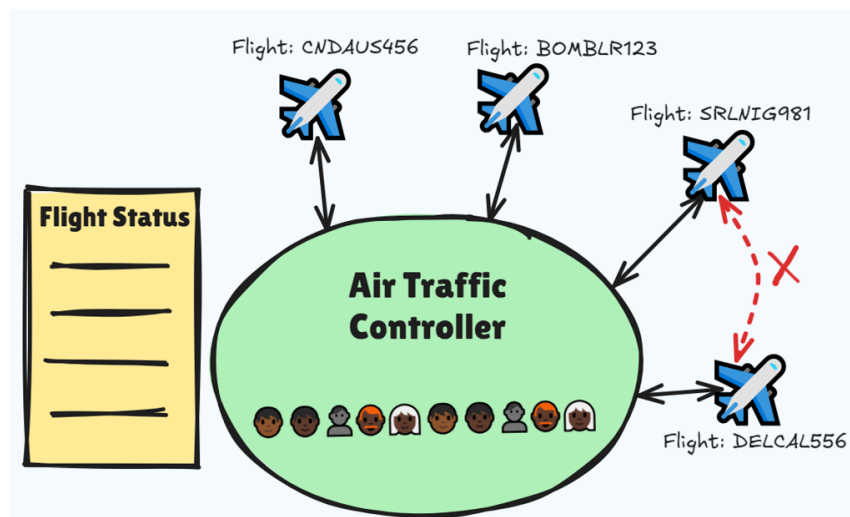
Definition

> **The Mediator design pattern is a beahvioral pattern that defines a mediator object that encapsulates the behavior of how a set of objects(components) interact. It promotes loose coupling by not allowing these objects from referring to each other explicitly but allows them to interact through mediator object upon respective state changes/updates.**
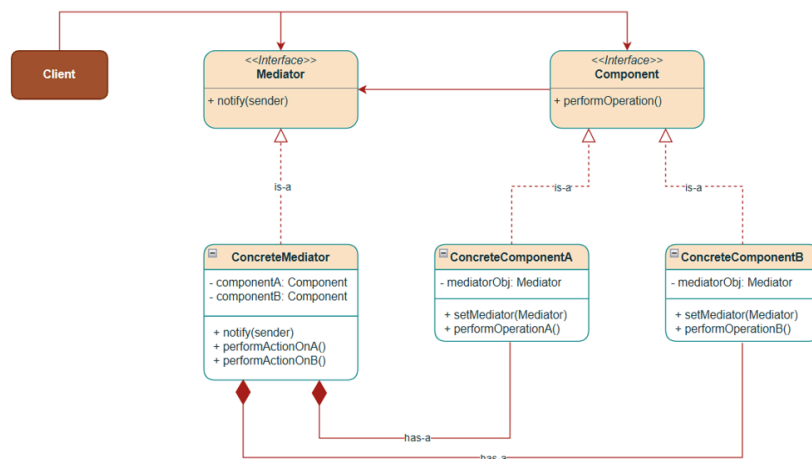
Real life Examples

Online Auction System

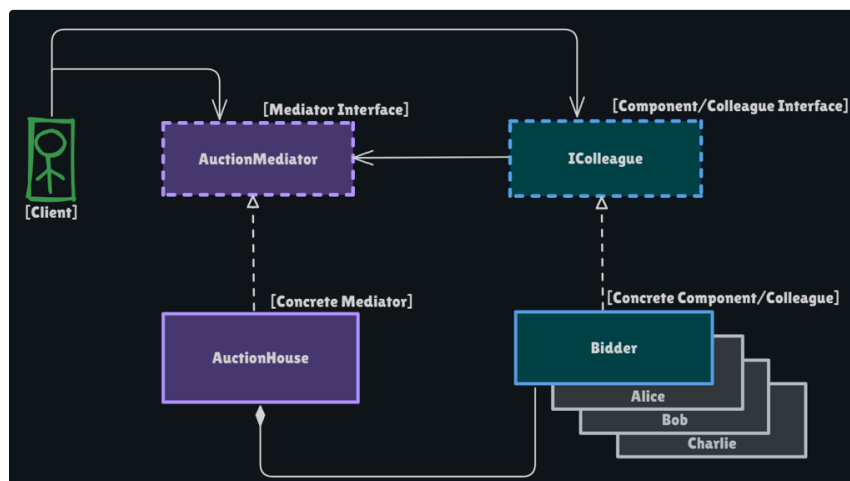## Airline Management System

Class Diagram

Structure of Mediator Pattern

Let's understand the Online Auction System using Online Auction System Example

1. **Mediator Interface (** `AuctionMediator` **):** Defines the contract for communication between bidders. Methods include:
   - `registerBidder()` - Add bidders to the auction
   - `placeBid()` - Process bids from bidders
   - `closeAuction()` - End the auction and announce winner

2. **Concrete Mediator (** `AuctionHouse` **):** Implements Mediator Interface behaviors and maintains references to all bidders.
   - Tracks the highest bid and bidder and encapsulates the core bidding logic of interaction.
   - Validates bids and notifies all participants upon appropriate state changes in bidders(components).

3. **Colleague/Component Interface (** `IColleague` **):** Abstract class or Interface representing the components (colleagues/bidders/auction participants) that vary independently.
   - Holds reference to the mediator (not to other bidders).
   - Declares contracts for performing operations (placing bids and receiving notifications).

4. **Concrete Colleague/Component (** `Bidder` **)**
   - Defines methods for performing operations (actual bidder implementation).
   - This class communicates only with the mediator.
   - Receives notifications about updates/state changes.

Implementation(Example: Online Auction System)

```java
// Mediator Interface
public interface AuctionMediator {
    void registerBidder(IColleague bidder);

    void placeBid(IColleague bidder, double bidAmount);

    void closeAuction();
}
```

```java
// Concrete Mediator
public class AuctionHouse implements AuctionMediator {
    private List<IColleague> bidders;
    private String itemName;
    private double currentHighestBid;
    private IColleague currentHighestBidder;

    public AuctionHouse(String itemName, double startingPrice) {
        this.itemName = itemName;
        this.currentHighestBid = startingPrice;
        this.bidders = new ArrayList<>();
        System.out.println("[+] Auction House created for item: " +
itemName +
                          " with initial bid of $" + startingPrice);
    }

    @Override
    public void registerBidder(IColleague bidder) {
        bidders.add(bidder);
        System.out.println("[+] " + bidder.getName() + " has joined
the auction
                          for " + itemName);
    }

    @Override
    public void placeBid(IColleague bidder, double bidAmount) {
        // Check if the bid is valid
```

```java
26          if (bidAmount <= currentHighestBid) {
27              System.out.println(bidder.getName() + " bid of $" +
    bidAmount +
28                                  " is too low. Current highest bid is $"
29                                  + currentHighestBid);
30              // Colleagues are not notified about the bid
31              return;
32          }
33
34          // Update the highest bid
35          currentHighestBid = bidAmount;
36          currentHighestBidder = bidder;
37          System.out.println("\n===> [New Bid Accepted]" + " Info:
    {Bidder: "
38                              + bidder.getName() + ", Bid Amount: " +
    bidAmount + "}");
39          for (IColleague colleague : bidders) {
40              if (!colleague.getName().equals(bidder.getName())) {
41                  // Notify other bidders about the new bid
42                  colleague.receiveBidNotification(bidAmount);
43              }
44          }
45      }
46
47      @Override
48      public void closeAuction() {
49          if (currentHighestBidder != null) {
50              System.out.println("\n===> [AUCTION UPDATE]");
51              System.out.println("[+] Auction closed! Winner is "
52                                  + currentHighestBidder.getName() +
53                          " with a bid of $" + currentHighestBid + " for " +
    itemName);
54          } else {
55              System.out.println("Auction closed with no bids.");
56          }
57      }
58
59 }
```

```java
1  // Colleague Interface(aka Component Interface)
2  public interface IColleague {
3      void placeBid(double amount);
4
5      void receiveBidNotification(double bidAmount);
6
7      String getName();
8  }
```

```java
1  // Concrete Colleague/Component
2  public class Bidder implements IColleague {
3      protected String name;
4      protected AuctionMediator mediator;
5
6      public Bidder(String name, AuctionMediator mediator) {
7          this.name = name;
8          this.mediator = mediator;
9          mediator.registerBidder(this);
10     }
11
12     @Override
13     public void placeBid(double amount) {
14         System.out.println("\n===> [Placing Bid] " + name
15                             + " is attempting to bid $" + amount);
16         mediator.placeBid(this, amount);
17     }
18
19     @Override
20     public void receiveBidNotification(double bidAmount) {
21         System.out.println("[+] Bidder " + name +
22                             " has received a new bid notification of: "
    + bidAmount);
```

```java
23         }
24
25         @Override
26         public String getName() {
27             return name;
28         }
29 }
```

```java
1  // Client
2  public class AuctionDemo {
3      public static void main(String[] args) {
4          System.out.println("\n###### Mediator Design Pattern ######");
5          System.out.println("\n===> Welcome to the Auction House!\n");
6
7          // Create a Mediator
8          AuctionMediator auctionHouse = new AuctionHouse("Vintage
   Guitar", 100.0);
9
10         // Create Colleagues/Components
11         IColleague alice = new Bidder("Alice", auctionHouse);
12         IColleague bob = new Bidder("Bob", auctionHouse);
13         IColleague charlie = new Bidder("Charlie", auctionHouse);
14
15         // Register Colleagues/Components with Mediator - AuctionHouse
   Constructor
16
17         // Use Colleagues/Components
18         alice.placeBid(150.0);
19         bob.placeBid(250.0);
20         charlie.placeBid(300.0);
21         alice.placeBid(300.0); // Will not be accepted
22         bob.placeBid(900.0); // Winner
23
24         // Admin closes the auction
25         auctionHouse.closeAuction();
26
27     }
28
29 }
```

Output

```
###### Mediator Design Pattern ######

===> Welcome to the Auction House!

[+] Auction House created for item: Vintage Guitar with initial bid of $100.0
[+] Alice has joined the auction for Vintage Guitar
[+] Bob has joined the auction for Vintage Guitar
[+] Charlie has joined the auction for Vintage Guitar
```

```
===> [Placing Bid] Alice is attempting to bid $150.0

===> [New Bid Accepted] Info: {Bidder: Alice, Bid Amount: 150.0}
[+] Bidder Bob has received a new bid notification of: 150.0
[+] Bidder Charlie has received a new bid notification of: 150.0


===> [Placing Bid] Bob is attempting to bid $250.0

===> [New Bid Accepted] Info: {Bidder: Bob, Bid Amount: 250.0}
[+] Bidder Alice has received a new bid notification of: 250.0
[+] Bidder Charlie has received a new bid notification of: 250.0


===> [Placing Bid] Charlie is attempting to bid $300.0

===> [New Bid Accepted] Info: {Bidder: Charlie, Bid Amount: 300.0}
[+] Bidder Alice has received a new bid notification of: 300.0
[+] Bidder Bob has received a new bid notification of: 300.0


===> [Placing Bid] Alice is attempting to bid $300.0
Alice bid of $300.0 is too low. Current highest bid is $300.0  ✗


===> [Placing Bid] Bob is attempting to bid $900.0

===> [New Bid Accepted] Info: {Bidder: Bob, Bid Amount: 900.0}
[+] Bidder Alice has received a new bid notification of: 900.0
[+] Bidder Charlie has received a new bid notification of: 900.0


===> [AUCTION UPDATE]  ✓
[+] Auction closed! Winner is Bob with a bid of $900.0 for Vintage Guitar
```