

About state Design Pattern

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Goals

- Motivating Example
- Representing Different States as Objects
- Operations and State Transitions are Encapsulated by each state
- Handling Instance State

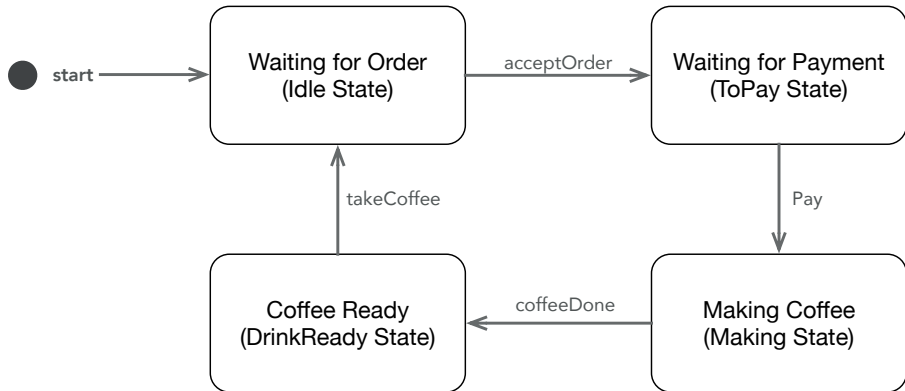


Analysing a case

- Imagine an automatic coffee machine.
- It has different states:
 - Waiting for Order
 - Waiting for Payment
 - Making Coffee
 - Coffee Ready



Our States



Our Operations

```
CoffeeMachine >> acceptOrder: anOrder  
CoffeeMachine >> howMuchIsIt  
CoffeeMachine >> pay: someMoney  
CoffeeMachine >> coffeeDone  
CoffeeMachine >> takeCoffee
```



Our Operations

- The available operations depend on the current state
- We need to add a lot of conditional code

```
CoffeeMachine >> acceptOrder: anOrder
```

```
"Checking state every time..."
```

```
machineState = #idle ifFalse: [ self error: 'Machine working...'].
```

```
"Changing state in each operation"
```

```
machineState := #toPay.
```

```
"... Do the magic to order a coffee..."
```



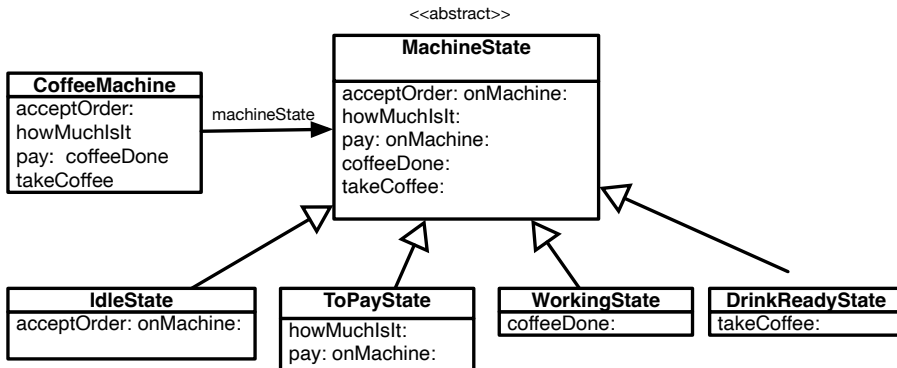
Repeated Pattern

```
CoffeeMachine >> howMuchIsIt  
"Checking state every time..."  
machineState = #toPay ifFalse: [ self error: 'Invalid State'].  
  
"Some operations do not change state"  
  
^ ourPrice
```



Proposed Idea

- Represent each state as an object
- We delegate the operations to the state



Our new Operations (1/2)

```
CoffeeMachine >> acceptOrder: anOrder  
^ machineState acceptOrder: anOrder onMachine: self
```

```
MachineState >> acceptOrder: anOrder onMachine: aMachine  
^ self error: 'Invalid State'
```

```
IdleState >> acceptOrder: anOrder onMachine: aMachine  
"The operation code"  
aMachine doTheMagicToOrder: anOrder  
"To the new State"  
aMachine machineState: ToPayState new.
```



Our new Operations (2/2)

```
CoffeeMachine >> howMuchIsIt  
^ machineState howMuchIsIt: self
```

```
MachineState >> howMuchIsIt: aMachine  
^ self error: 'Invalid State'
```

```
IdleState >> howMuchIsIt: aMachine  
^ aMachine ourPrice
```



Advantages

- Each state just implements its operations
- State transitions are implemented in each state
- Less conditional code
- Elegant solution when having many states



Where to Put the instance state? (1/3)

- Instance State as:
 - Selected coffee
 - Price
- We can put the machine instance state in:
 - The Machine Object
 - In the State object



Where to Put the instance state? (2/3)

- In the Machine Object:
 - Useful if the internal state is the same for all the machine states
 - We don't need to copy on every state change
 - Bad if each state has different instance variables



Where to Put the instance state? (3/3)

- In the State Object:
 - Useful if the internal state is different for all the machine states
 - Each state object has direct access to the instance state, we don't need accessors
 - Creating a state requires passing all instance variables that it stores



Conclusion

State pattern:

- Is useful when we have an object with many states
- Encapsulates the operations and the state transitions
- Uses delegation instead of conditional code
- It is easy to add new states and operations
- It is a more complex solution, we need to trade off the new complexity vs clarity/flexibility



Produced as part of the course on <http://www.fun-mooc.fr>

Advanced Object-Oriented Design and Development with Pharo

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