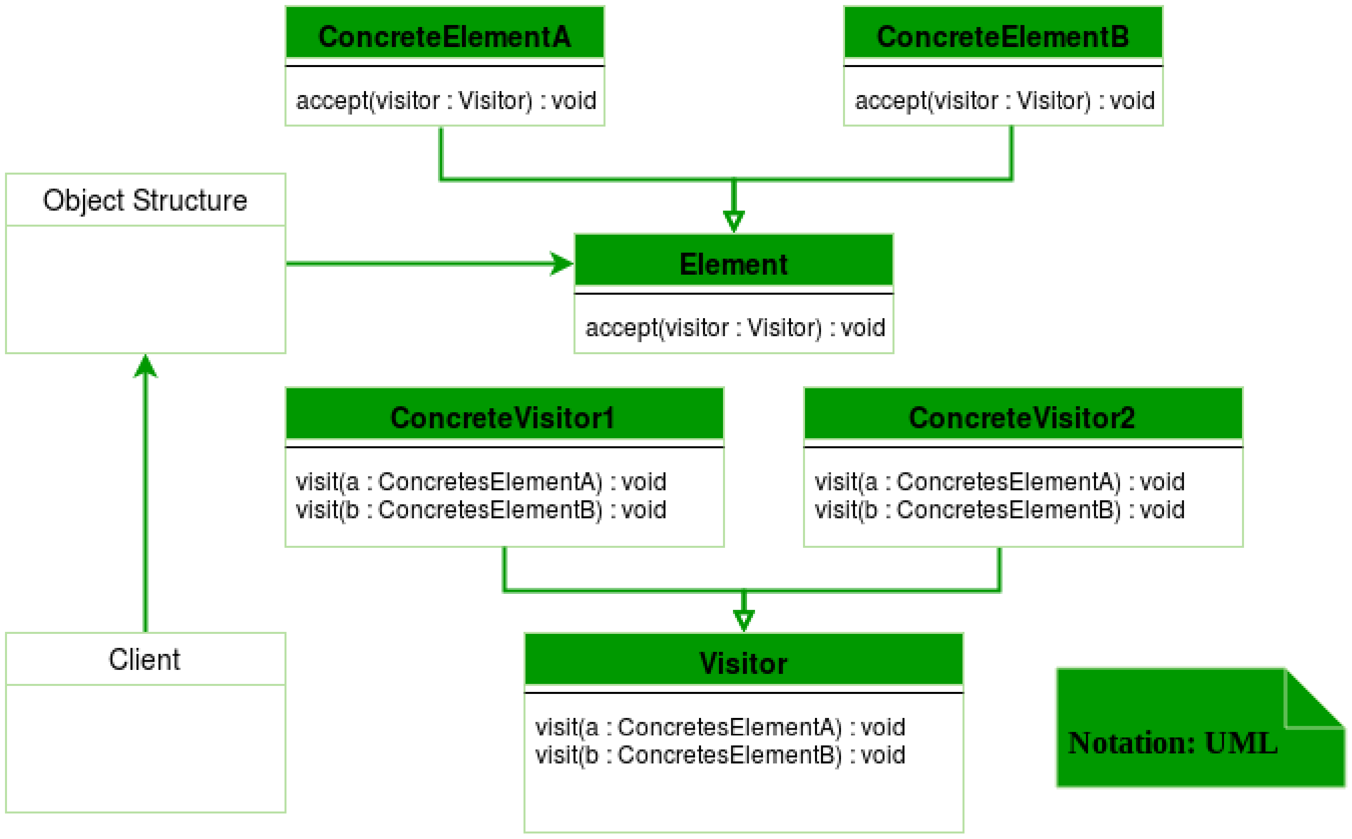
Visitor design pattern

Visitor design pattern is one of the behavioral design patterns. It is used when we have to perform an operation on a group of similar kind of Objects. With the help of visitor pattern, we can move the operational logic from the objects to another class.

The visitor pattern consists of two parts:

- a method called **Visit()** which is implemented by the visitor and is called for every element in the data structure
- visitable classes providing **Accept()** methods that accept a visitor

UML Diagram Visitor design pattern


ConcreteElementA
accept(visitor : Visitor) : void
ConcreteElementB
accept(visitor : Visitor) : void
Object Structure
Element
accept(visitor : Visitor) : void
ConcreteVisitor1
visit(a : ConcretesElementA) : void
visit(b : ConcretesElementB) : void
ConcreteVisitor2
visit(a : ConcretesElementA) : void
visit(b : ConcretesElementB) : void
Client
Visitor
visit(a : ConcretesElementA) : void
visit(b : ConcretesElementB) : void
Notation: UML

Design components

- **Client :** The Client class is a consumer of the classes of the visitor design pattern. It has access to the data structure objects and can instruct them to accept a Visitor to perform the appropriate processing.
- **Visitor :** This is an interface or an abstract class used to declare the visit operations for all the types of visitable classes.
- **ConcreteVisitor :** For each type of visitor all the visit methods, declared in abstract visitor, must be implemented. Ea Visitor will be responsible for different operations.

- **Visitable :** This is an interface which declares the accept operation. This is the entry point which enables an object to be “visited” by the visitor object.
- **ConcreteVisitable :** These classes implement the Visitable interface or class and defines the accept operation. The visitor object is passed to this object using the accept operation.

Let’s see an example of Visitor design pattern in Java.

```
interface ItemElement
{
    public int accept(ShoppingCartVisitor visitor);
}

class Book implements ItemElement
{
    private int price;
    private String isbnNumber;

    public Book(int cost, String isbn)
    {
        this.price=cost;
        this.isbnNumber=isbn;
    }

    public int getPrice()
    {
        return price;
    }

    public String getIsbnNumber()
    {
        return isbnNumber;
    }

    @Override
    public int accept(ShoppingCartVisitor visitor)
    {
        return visitor.visit(this);
    }
```

```
}

class Fruit implements ItemElement
{
    private int pricePerKg;
    private int weight;
    private String name;

    public Fruit(int priceKg, int wt, String nm)
    {
        this.pricePerKg=priceKg;
        this.weight=wt;
        this.name = nm;
    }

    public int getPricePerKg()
    {
        return pricePerKg;
    }

    public int getWeight()
    {
        return weight;
    }

    public String getName()
    {
        return this.name;
    }

    @Override
    public int accept(ShoppingCartVisitor visitor)
    {
        return visitor.visit(this);
    }

}

interface ShoppingCartVisitor
{
    int visit(Book book);
    int visit(Fruit fruit);
}

class ShoppingCartVisitorImpl implements ShoppingCartVisitor
{

    @Override
    public int visit(Book book)
    {
        int cost=0;
        //apply 5$ discount if book price is greater than 50
        if(book.getPrice() > 50)
        {
            cost = book.getPrice()-5;
        }
        else
            cost = book.getPrice();

        System.out.println("Book ISBN::"+book.getIsbnNumber() + " cost ="+cost);
        return cost;
    }

    @Override
    public int visit(Fruit fruit)
    {
        int cost = fruit.getPricePerKg()*fruit.getWeight();
        System.out.println(fruit.getName() + " cost = "+cost);
        return cost;
    }

}

class ShoppingCartClient
{

    public static void main(String[] args)
    {
        ItemElement[] items = new ItemElement[]{new Book(20, "1234"),
                              new Book(100, "5678"), new Fruit(10, 2, "Banana"),
                              new Fruit(5, 5, "Apple")};

        int total = calculatePrice(items);
        System.out.println("Total Cost = "+total);
    }

    private static int calculatePrice(ItemElement[] items)
    {
        ShoppingCartVisitor visitor = new ShoppingCartVisitorImpl();
        int sum=0;
        for(ItemElement item : items)
        {
            sum = sum + item.accept(visitor);
        }
        return sum;
    }

}
```

Output:

```
Book ISBN::1234 cost =20
Book ISBN::5678 cost =95
Banana cost = 20
Apple cost = 25
Total Cost = 160
```

Here, in the implementation if accept() method in all the items are same but it can be different. For example there can be logic to check if item is free then don't call the visit() method at all.

Advantages :

- If the logic of operation changes, then we need to make change only in the visitor implementation rather than doing it in all the item classes.
- Adding a new item to the system is easy, it will require change only in visitor interface and implementation and existing item classes will not be affected.

Disadvantages :

- We should know the return type of visit() methods at the time of designing otherwise we will have to change the interface and all of its implementations.
- If there are too many implementations of visitor interface, it makes it hard to extend.

Another example of visitor pattern in C++

```
//Write CPP code here

#include <iostream>
using namespace std;

class Stock
{
  public:
    virtual void accept(class Visitor *) = 0;

};

class Apple : public Stock
{
  public:
    /*virtual*/ void accept(Visitor *);
    void buy()
    {
        cout << "Apple::buy\n";
    }
    void sell()
    {
        cout << "Apple::sell\n";
    }

};
class Google : public Stock
{
  public:
    /*virtual*/ void accept(Visitor *);
```

```
        void buy()
        {
            cout << "Google::buy\n";
        }

        void sell()
        {
            cout << "Google::sell\n";
        }
    };

    class Visitor
    {
      public:
        virtual void visit(Apple *) = 0;
        virtual void visit(Google *) = 0;
        //private:
        static int m_num_apple, m_num_google;
        void total_stocks()
        {
            cout << "m_num_apple " << m_num_apple
                 << ", m_num_google " << m_num_google << '\n';
        }
    };
    int Visitor::m_num_apple = 0;
    int Visitor::m_num_google = 0;
    class BuyVisitor : public Visitor
    {
      public:
        BuyVisitor()
        {
            m_num_apple = m_num_google = 0;
        }
        /*virtual*/ void visit(Apple *r)
        {
            ++m_num_apple;
            r->buy();
            cout << "m_num_apple " << m_num_apple << endl;
        }
        /*virtual*/ void visit(Google *b)
        {
            ++m_num_google;
            b->buy();
            cout << " m_num_google " << m_num_google << '\n';
        }
    };

    class SellVisitor : public Visitor
    {
      public:
        /*virtual*/ void visit(Apple *a)
        {

            --m_num_apple;
            a->sell();
            cout << "m_num_apple " << m_num_apple << endl;
        }
        /*virtual*/ void visit(Google *g)
        {
            --m_num_google;
            g->sell();
            cout << "m_num_google " << m_num_google << endl;
        }
    };

    void Apple::accept(Visitor *v)
    {
        v->visit(this);
    }

    void Google::accept(Visitor *v)
    {
        v->visit(this);
    }

    int main()
    {
        Stock *set[] = { new Apple, new Google, new Google,
                         new Apple, new Apple, 0 };

        BuyVisitor buy_operation;
        SellVisitor sell_operation;
        for (int i = 0; set[i]; i++)
        {
            set[i]->accept(&buy_operation);
        }
        buy_operation.total_stocks();

        for (int i = 0; set[i]; i++)
        {

            set[i]->accept(&sell_operation);
        }
        sell_operation.total_stocks();
    }
```

Output:

```
Apple::buy
m_num_apple 1
Google::buy
 m_num_google 1
Google::buy
 m_num_google 2
Apple::buy
m_num_apple 2
Apple::buy
m_num_apple 3
m_num_apple 3, m_num_google 2
Apple::sell
m_num_apple 2
Google::sell
m_num_google 1
Google::sell
m_num_google 0
Apple::sell
m_num_apple 1
```

```
Apple::sell
m_num_apple 0
m_num_apple 0, m_num_google 0
```

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