Apex Design Patterns

Developers

Dennis Thong

Senior Technical Solution Architect

Richard Vanhook

Senior Technical Solution Architect

Safe Harbor

The Plan

Cover six design patterns

- Problem
- Pattern Abstract
- Code

Your participation is encouraged!

Patterns

1. ?
2. ?
3. ?
4. ?
5. ?
6. ?

Meet Billy, Your Admin

- 3+ yrs as Salesforce Admin
- Just recently started coding
- Sad because of this:

```
Trigger.AccountTrigger: line 3, column 1
System.LimitException: Too many record
type describes: 101
```

- Needs your help!

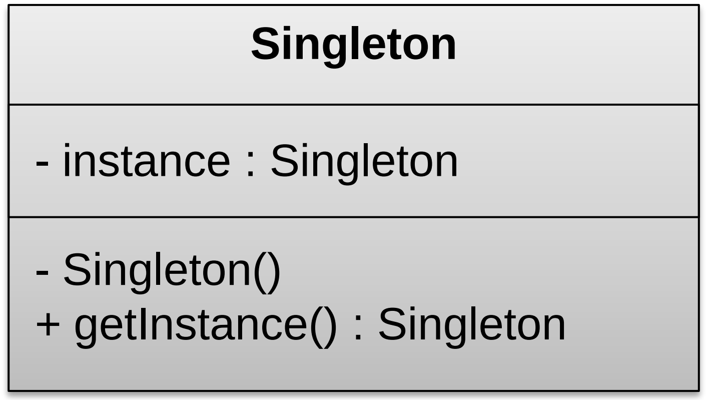
The Offending Code

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = new AccountFooRecordType();
        ....
    }
}
```

```
public class AccountFooRecordType {
    public String id {get;private set;}
    public AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
}
```

- When a single Account is inserted, what happens?
- When 200+ Accounts are inserted…?

Solution: Singleton



Let’s Code It!

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = new AccountFooRecordType();
        ....
    }
}
```

```
public class AccountFooRecordType {
    public String id {get;private set;}
    public AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
}
```

- Above is the offending code again
- Changes are highlighted in next slides

Let’s Code It!

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = (new AccountFooRecordType()).getInstance();
        ....
    }
}
```

```
public class AccountFooRecordType {
    public String id {get;private set;}
    public AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
    public AccountFooRecordType getInstance(){
       return new AccountFooRecordType();
    }
}
```

Let’s Code It!

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = AccountFooRecordType.getInstance();
        ....
    }
}
```

```
public class AccountFooRecordType {
    public String id {get;private set;}
    public AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
    public static AccountFooRecordType getInstance(){
       return new AccountFooRecordType();
    }
}
```

Static

- Can modify member variables, methods, and blocks
- Executed when?
  - When class is introduced (loaded) to runtime environment
- How long does that last in Java?
  - Life of the JVM
- In Apex?
  - Life of the **transaction**

Let’s Code It!

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = AccountFooRecordType.getInstance();
        ....
    }
}
```

```
public class AccountFooRecordType {
    public String id {get;private set;}
    public AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
    public static AccountFooRecordType getInstance(){
       return new AccountFooRecordType();
    }
}
```

Let’s Code It!

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = AccountFooRecordType.getInstance();
        ....
    }
}
```

```
public class AccountFooRecordType {
    public static AccountFooRecordType instance = null;
    public String id {get;private set;}
    public AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
    public static AccountFooRecordType getInstance(){
        if(instance == null) instance = new AccountFooRecordType();
        return instance;
    }
}
```

Let’s Code It!

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = AccountFooRecordType.getInstance();
        ....
    }
}
```

```
public class AccountFooRecordType {
    private static AccountFooRecordType instance = null;
    public String id {get;private set;}
    public AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
    public static AccountFooRecordType getInstance(){
        if(instance == null) instance = new AccountFooRecordType();
        return instance;
    }
}
```

Let’s Code It!

```
trigger AccountTrigger on Account (before insert, before update) {
    for(Account record : Trigger.new){
        AccountFooRecordType rt = AccountFooRecordType.getInstance();
        ....
    }
}
```

```
public class AccountFooRecordType {
    private static AccountFooRecordType instance = null;
    public String id {get;private set;}
    private AccountFooRecordType(){
        id = Account.sObjectType.getDescribe()
            .getRecordTypeInfosByName().get('Foo').getRecordTypeId();
    }
    public static AccountFooRecordType getInstance(){
        if(instance == null) instance = new AccountFooRecordType();
        return instance;
    }
}
```

Patterns

1. Singleton
2. ?
3. ?
4. ?
5. ?
6. ?

```
geocode('moscone center')
//=> 37.7845935,-122.3994262
```

Your Suggestion to Billy

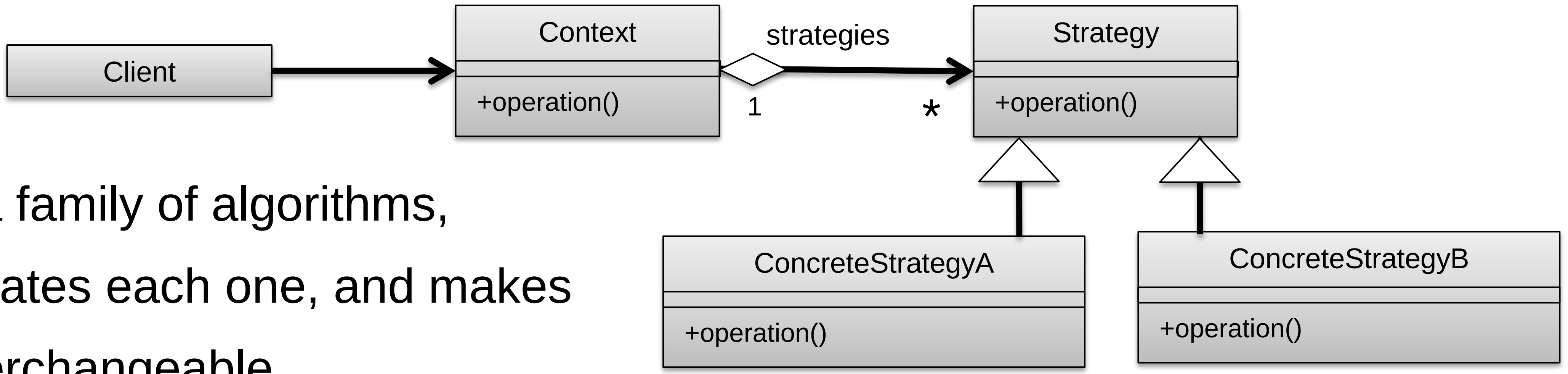
```
public class GoogleMapsGeocoder{
    public static List<Double> getLatLong(String address){
        //web service callout of some sort
        return new List<Double>{0,0};
    }
}
```

```
System.debug(GoogleMapsGeocoder.getLatLong('moscone center'));
//=> 13:56:36.029 (29225000)|USER_DEBUG|[29]|DEBUG|(0.0, 0.0)
```

<u>But then Billy mentions these requirements</u>

- Need other options besides Google Maps
- Allow client code to choose provider

Solution: Strategy



defines a family of algorithms, encapsulates each one, and makes them interchangeable

- Context => Geocoder
- operation() => getLatLong()
- Strategy => GeocodeService
- ConcreteStrategyA => GoogleMapsImpl
- ConcreteStrategyB => MapQuestImpl

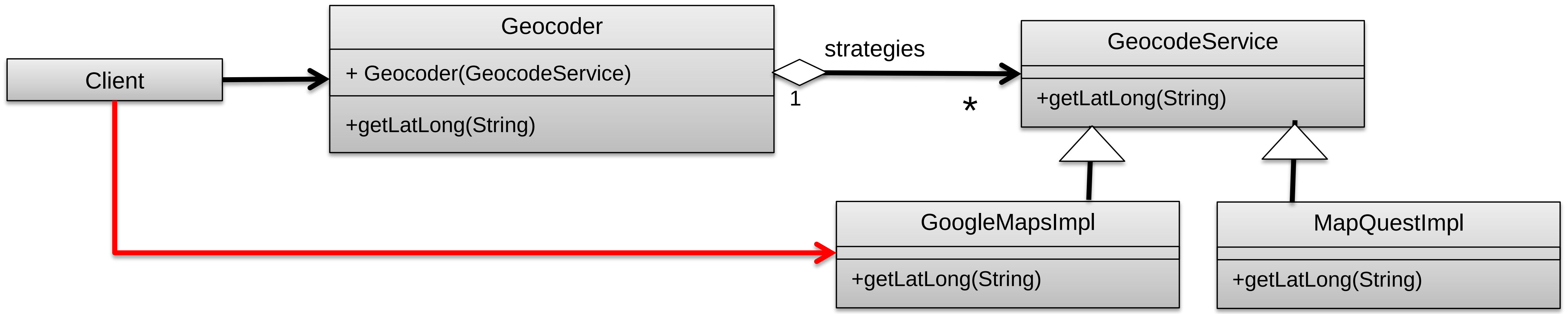
Let’s Code It!

```
public interface GeocodeService{
    List<Double> getLatLong(String address);
}
```

```
public class GoogleMapsImpl implements GeocodeService{
    public List<Double> getLatLong(String address){
        return new List<Double>{0,0};
    }
}
```

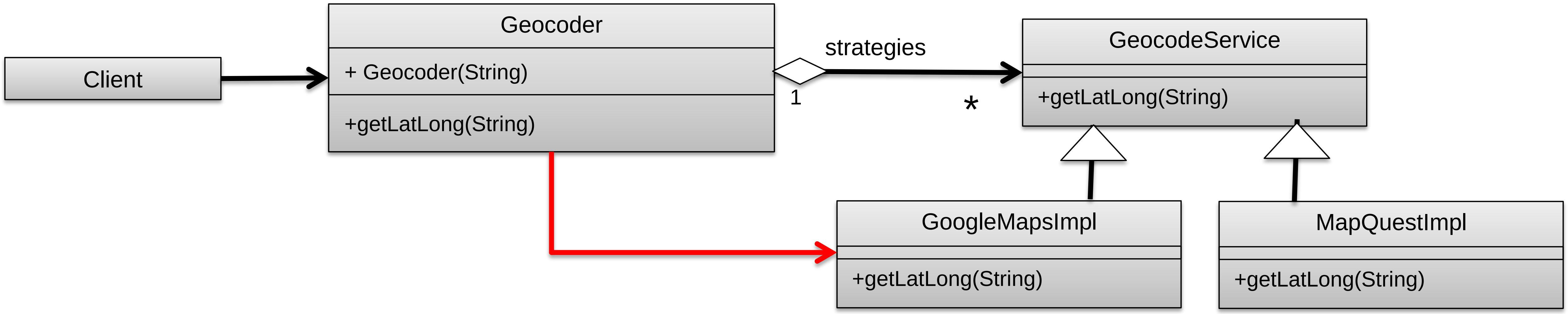
```
public class MapQuestImpl implements GeocodeService{
    public List<Double> getLatLong(String address){
        return new List<Double>{1,1};
    }
}
```

```
public class Geocoder {
    private GeocodeService strategy;
    public Geocoder(GeocodeService s){
        strategy = s;
    }
    public List<Double> getLatLong(String address){
        return strategy.getLatLong(address);
    }
}
```



```
Geocoder geocoder = new Geocoder(new GoogleMapsImpl());
System.debug(geocoder.getLatLong('moscone center'));
//=> 13:56:36.029 (29225000)|USER_DEBUG|[29]|DEBUG|(0.0, 0.0)
```

```
public class Geocoder {
    public static final Map<String,Strategy> strategies = new
        Map<String,Strategy>{'googlemaps' => new GoogleMapsImpl()
                            ,'mapquest'   => new MapQuestImpl()};
    private GeocodeService strategy;
    public Geocoder(String name){ strategy = strategies.get(name);}
    public List<Double> getLatLong(String address){
       return strategy.getLatLong(address);
    }
}
```



```
Geocoder geocoder = new Geocoder('googlemaps');
System.debug(geocoder.getLatLong('moscone center'));
//=> 13:56:36.029 (29225000)|USER_DEBUG|[29]|DEBUG|(0.0, 0.0)
```

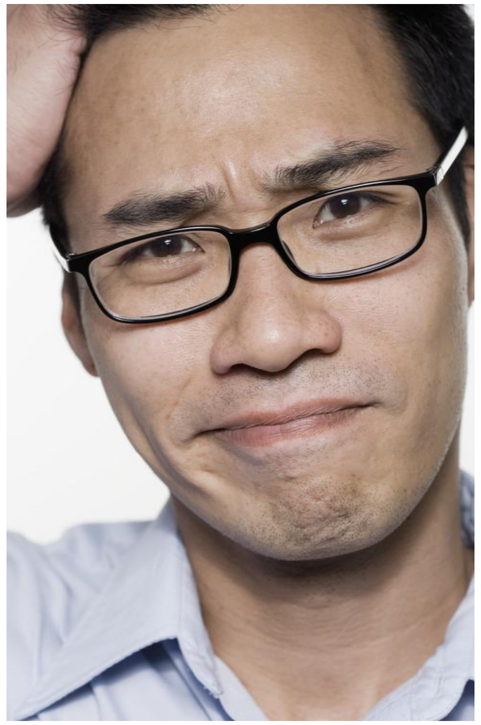
```
public class Geocoder {
    public class NameException extends Exception{}
    public static final Map<String,GeocodeService> strategies;
    static{
        GlobalVariable__c gv = GlobalVariable__c.getInstance('strategies');
        List<String> strategyNames = new List<String>();
        if(gv != null && gv.value__c != null) strategyNames = gv.value__c.split(',');
        strategies = new Map<String,GeocodeService>();
        for(String name : strategyNames){
            try{strategies.put(name,(GeocodeService)Type.forName(name+'impl').newInstance());}
            catch(Exception e){continue;} //skip bad name silently
        }
    }
    private GeocodeService strategy;
    public Geocoder(String name){
        if(!strategies.containsKey(name)) throw new NameException(name);
        strategy = strategies.get(name);
    }
    public List<Double> getLatLong(String address){
        return strategy.getLatLong(address);
    }
}
```

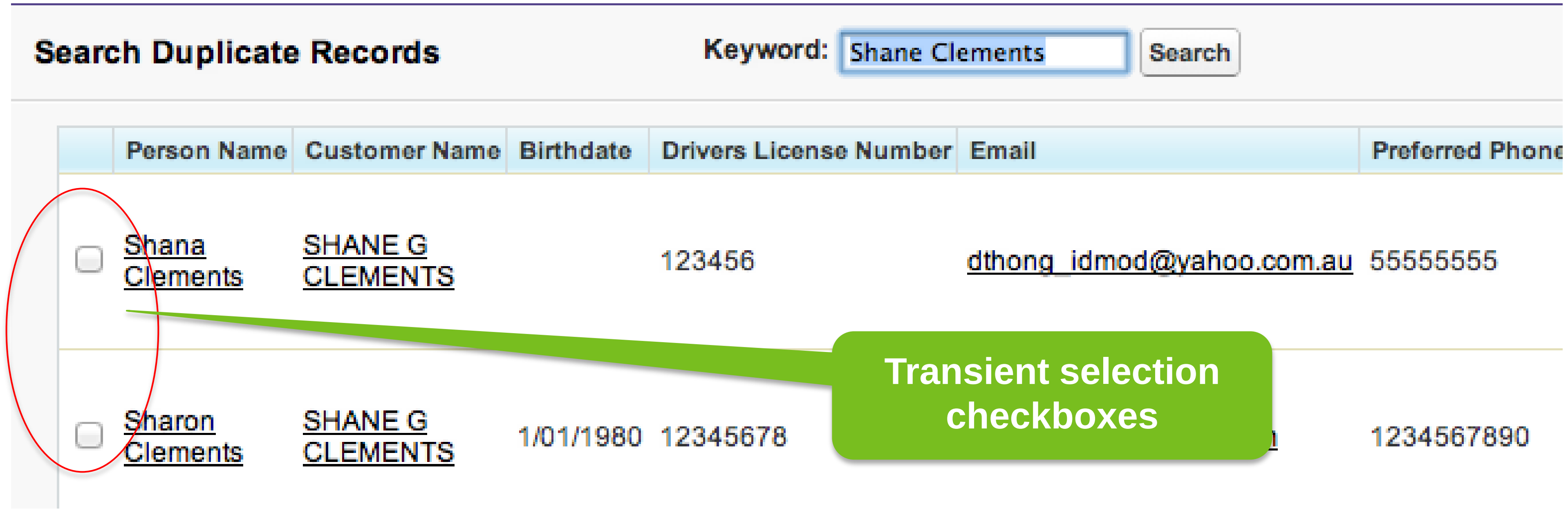
Patterns

1. Singleton
2. Strategy
3. ?
4. ?
5. ?
6. ?

Question?

How do we extend the functionality of an sObject in Apex without adding new fields?



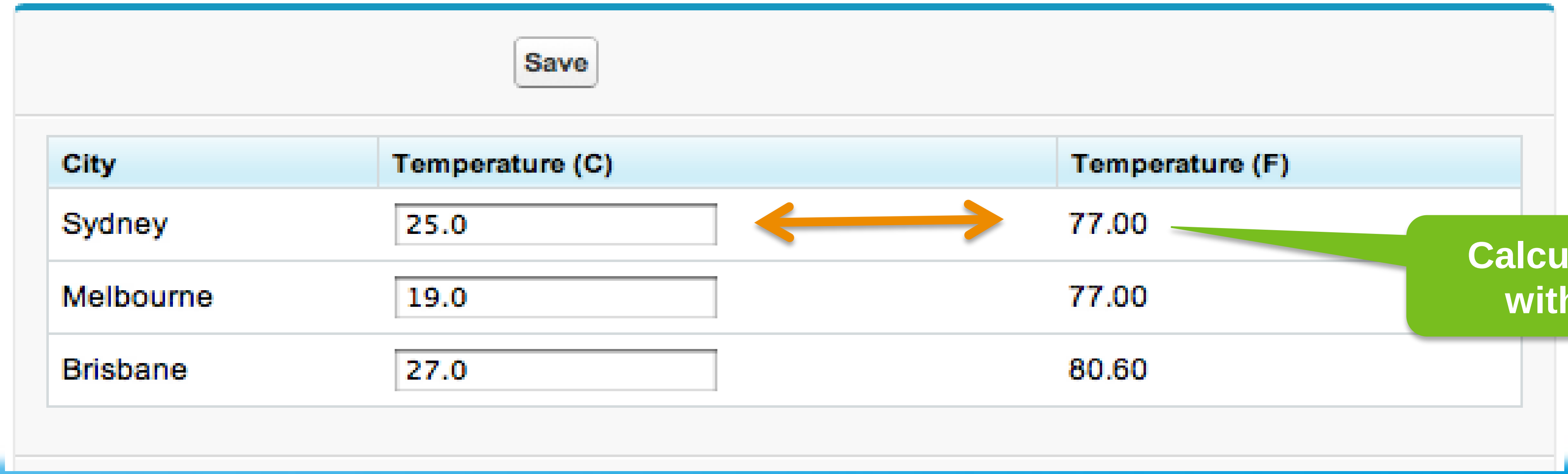


Search Duplicate Records

Keyword: Shane Clements [Search]

	Person Name	Customer Name	Birthdate	Drivers License Number	Email	Preferred Phon
☐	Shana Clements	SHANE G CLEMENTS		123456	dthong_idmod@yahoo.com.au	55555555
☐	Sharon Clements	SHANE G CLEMENTS	1/01/1980	12345678	[illegible]	1234567890

Transient selection checkboxes

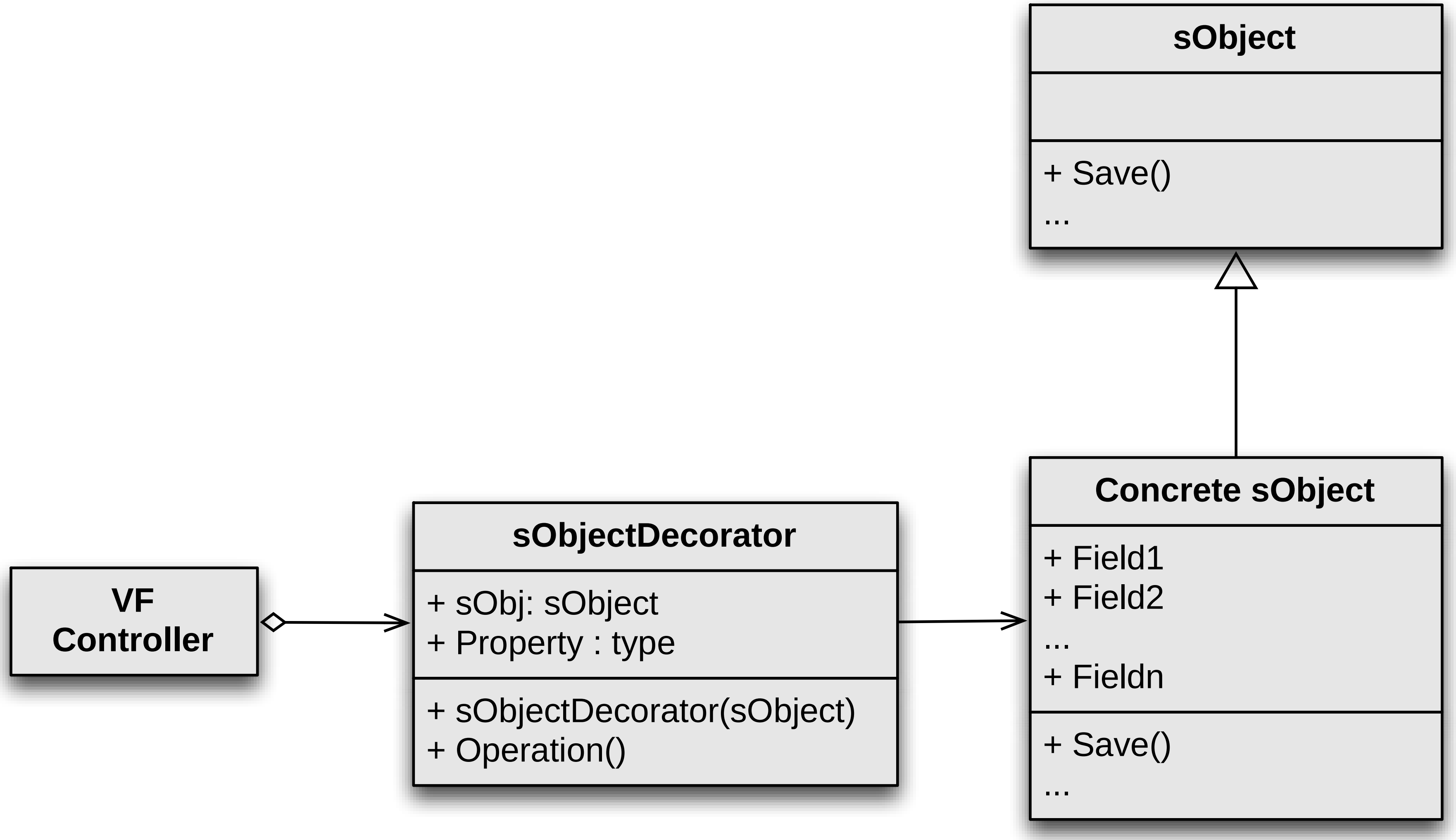


[Save]

City	Temperature (C)	Temperature (F)
Sydney	25.0	77.00
Melbourne	19.0	77.00
Brisbane	27.0	80.60

Calculated Fields with Updates

Solution – sObject Decorator



(aka Wrapper Classes)

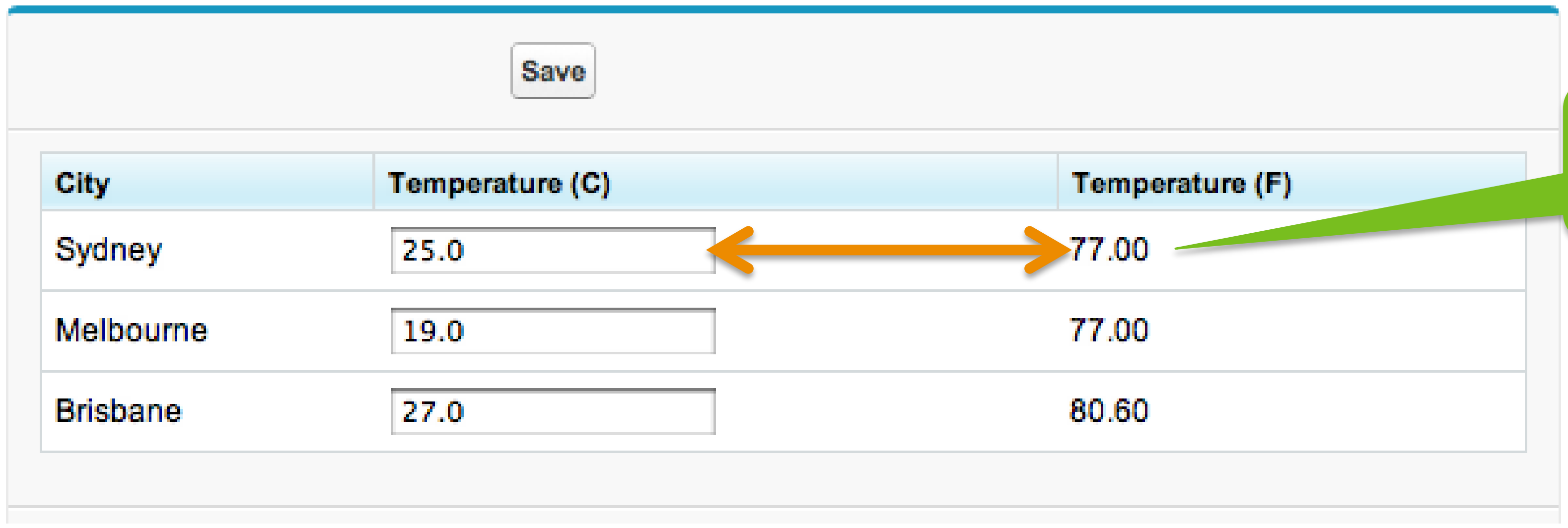
Example - Scenario

Weather sObject

- City__c
- TempInFahrenheit__c (in Fahrenheit)

VisualForce Requirements

- Stored temperature in Fahrenheit is displayed in Celcius
- User enters Temperature in Celcius and is stored to the record in Fahrenheit



City	Temperature (C)	Temperature (F)
Sydney	25.0	77.00
Melbourne	19.0	77.00
Brisbane	27.0	80.60

Bi-directional Display and Calculation

The Code – Decorated sObject Class

```
public class DecoratedWeather {

	public Weather__c weather { get; private set; }

	public DecoratedWeather (Weather__c weather) {
		this.weather = weather;
	}

	public Decimal tempInCelcius {
		get {
			if (weather != null && tempInCelcius == null )
				tempInCelcius = new Temperature().FtoC(weather.TempInFahrenheit__c);

			return tempInCelcius;
		}
		set {
			if (weather != null && value != null )
				weather.TempInFahrenheit__c= new Temperature().CtoF(value);

		tempInCelcius = value;
		}
	}
}
```

The Code – Custom Controller

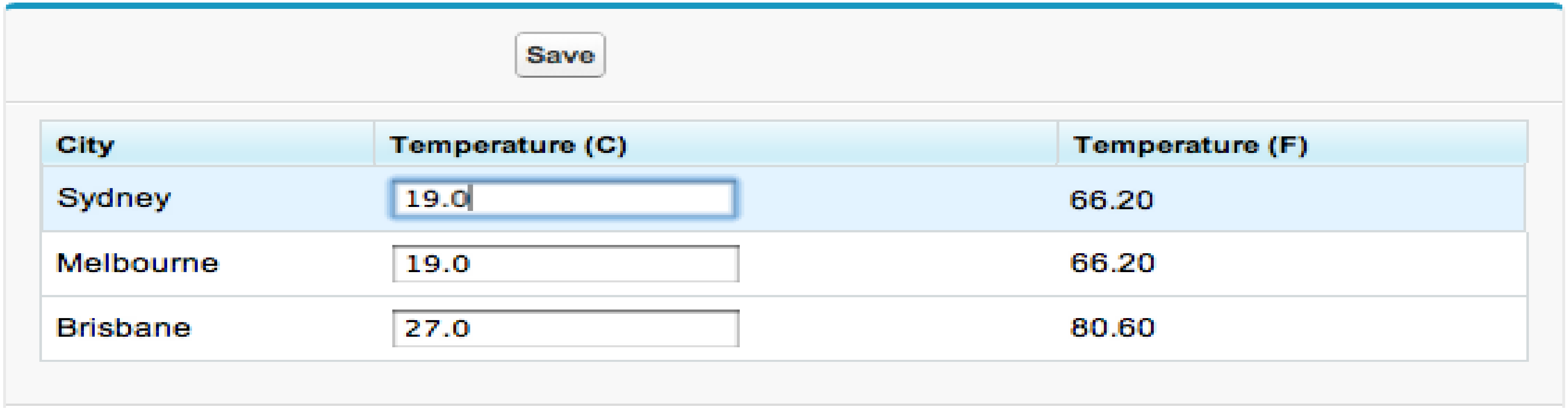
```
public class Weather_Controller {

    public List<DecoratedWeather> listOfWeather {

          get {
               if (listOfWeather == null) {
                    listOfWeather = new List<DecoratedWeather>();

               for (Weather__c weather : [select name, temperature__c from Weather__c]) {
                         listOfWeather.add(new DecoratedWeather(weather));
                    }
          }
               return listOfWeather;
          }

          private set;
     }
}
```

The Code – VisualForce Page

```
<apex:page controller="weather_controller">

    <!-- VF page to render the weather records with Ajax that only rerenders
           the page on change of the temperature
    -->
    <apex:form id="theForm">
        <apex:pageBlock id="pageBlock">
            <apex:pageBlockTable value="{!listOfWeather}" var="weather">
                <apex:column value="{!weather.weather.name}"/>
                <apex:column headerValue="Temperature (C)">
                    <apex:actionRegion >
                        <apex:inputText value="{!weather.tempInCelcius}">
                            <apex:actionSupport event="onchange"
                                            reRender="pageBlock"/>
                        </apex:inputText>
                    </apex:actionRegion>
                </apex:column>
                <apex:column headerValue="Temperature (F)"
                               value="{!weather.weather.Temper    re__c}"
                               id="tempInF"/>
            </apex:pageBlockTable>
          </apex:pageBlock>
    </apex:form>
</apex:page>
```

No client side logic!!!

Finally, on the VisualForce page

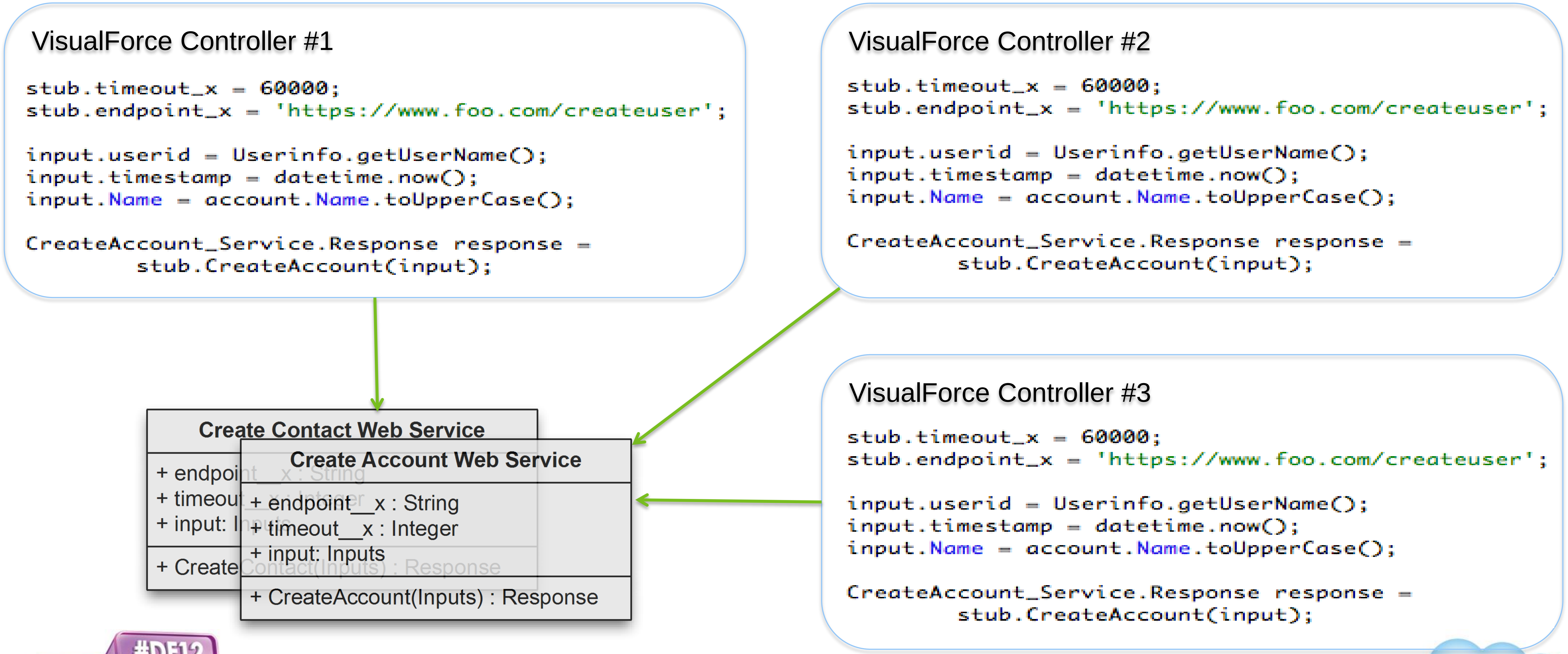


City	Temperature (C)	Temperature (F)
Sydney	19.0	66.20
Melbourne	19.0	66.20
Brisbane	27.0	80.60

Patterns

1. Singleton
2. Strategy
3. sObject Decorater
4. ?
5. ?
6. ?

What’s wrong with this?



VisualForce Controller #1

```
stub.timeout_x = 60000;
stub.endpoint_x = 'https://www.foo.com/createuser';

input.userid = Userinfo.getUserName();
input.timestamp = datetime.now();
input.Name = account.Name.toUpperCase();

CreateAccount_Service.Response response =
        stub.CreateAccount(input);
```

VisualForce Controller #2

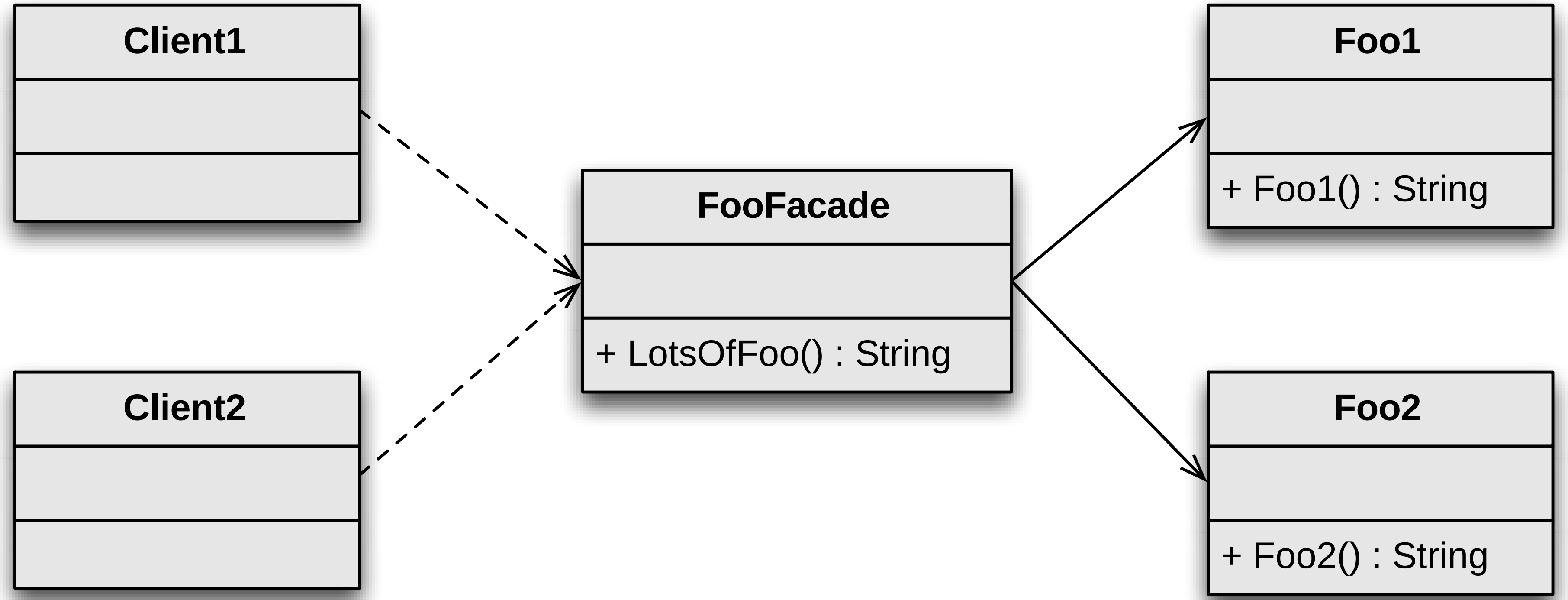
```
stub.timeout_x = 60000;
stub.endpoint_x = 'https://www.foo.com/createuser';

input.userid = Userinfo.getUserName();
input.timestamp = datetime.now();
input.Name = account.Name.toUpperCase();

CreateAccount_Service.Response response =
        stub.CreateAccount(input);
```

VisualForce Controller #3

```
stub.timeout_x = 60000;
stub.endpoint_x = 'https://www.foo.com/createuser';

input.userid = Userinfo.getUserName();
input.timestamp = datetime.now();
input.Name = account.Name.toUpperCase();

CreateAccount_Service.Response response =
        stub.CreateAccount(input);
```

Create Contact Web Service
+ endpoint__x : String
+ timeout__x : Integer
+ input: Inputs
+ CreateContact(Inputs) : Response
Create Account Web Service
+ endpoint__x : String
+ timeout__x : Integer
+ input: Inputs
+ CreateAccount(Inputs) : Response

Solution – Façade Pattern



```
public String LotsOfFoo() {
    Foo1 f1 = new Foo1();
    Foo2 f2 = new Foo2();

    return f1.Foo1() + f2.Foo2();
}
```

Example - Scenario

Composite Customer Create Transaction

- Create Account Web Service
- Create Contact Web Service

Inputs

- UserId – current user
- Timestamp – current timestamp
- Account Name (Upper case transformation)
- Last Name and First Name

Need to also set

- Timeout
- Hostname

Returns Account and Contact Number from remote system

Code – Façade Class

```
public class CreateCustomerFacade {

    public class CreateCustomerResponse {
        public String accountNumber;
        public String contactNumber;

        public CreateCustomerResponse(String accountNumber,
                                      String contactNumber) {
            this.accountNumber = accountNumber;
            this.contactNumber = contactNumber;
        }
    }
    ...
```

Code – Façade Class

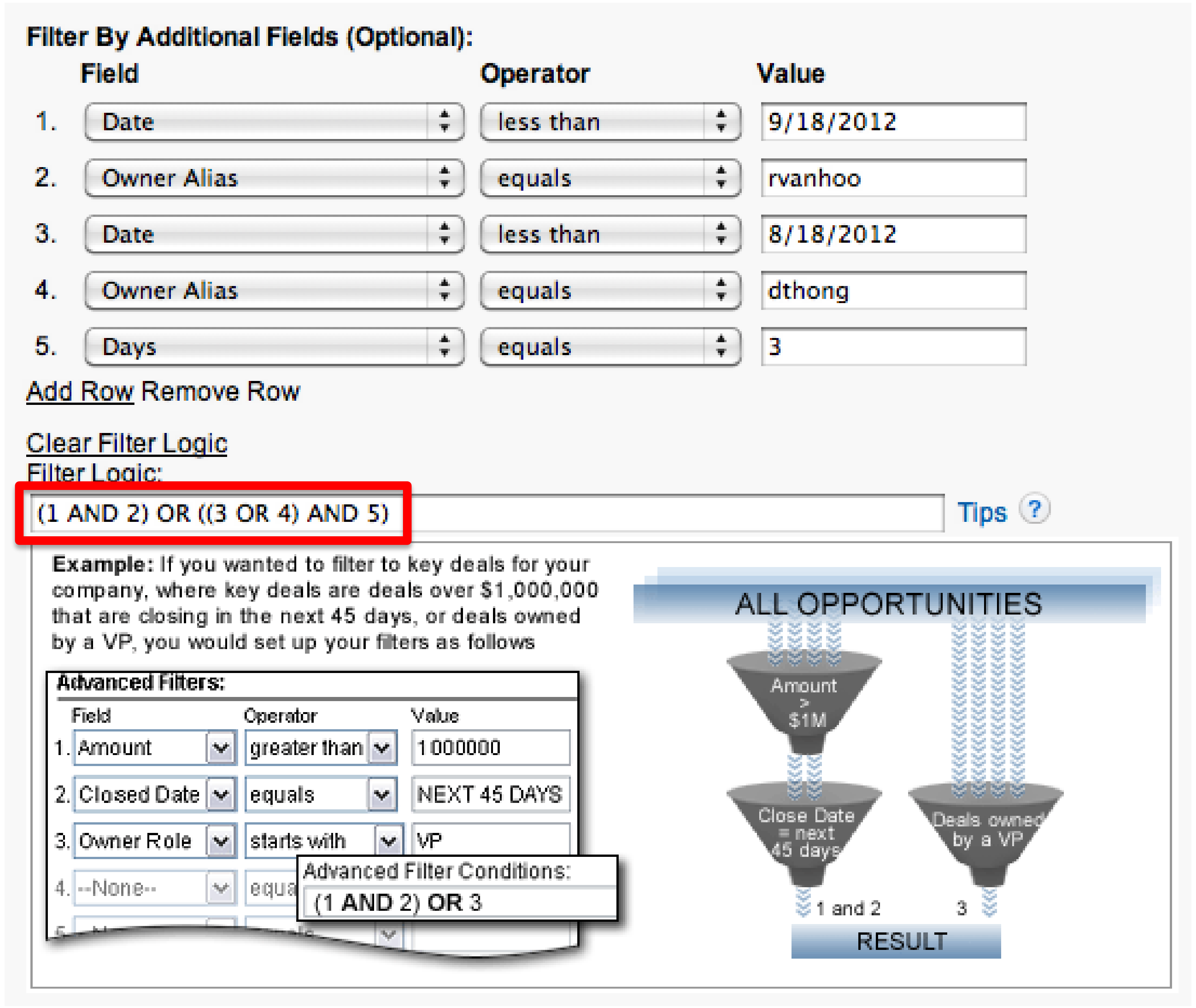
```
    ...
    public String CreateCustomerExternal(String Name,
                      String LastName, String FirstName) {
        CreateAccount_Service.CreateAccount stubCA =
                            new CreateAccount_Service.CreateAccount();
        CreateAccount_Service.Inputs inputCA =
                            new CreateAccount_Service.Inputs();

        stubCA.timeout_x = 60000;
        stubCA.endpoint_x = 'https://www.foo.com/ca';

        inputCA.userid = Userinfo.getUserName();
        inputCA.timestamp = datetime.now();
        inputCA.Name = name.toUpperCase();

        String accountNumber = inputCA.CreateAccount(input);

        /* REPEAT FOR CONTACT */

        return new CreateCustomerResponse (
                            accountNumber, contactNumber);
    }
```

Code – The Client

```
public class FooController{

    public Account account { get; set; }
    public Contact contact { get; set; }
    …
    public void CallCreateCustomerWS() {
        CreateCustomerFacade ca =
              new CreateCustomerFacade();

        CreateCustomerFacade.CreateCustomerResponse resp =
       ca.CreateCustomerExternal(account.name, contact.LastName,
contact.FirstName);

       account.accountNumber = resp.accountNumber;
       contact.contactNumber__c = resp.contactNumber;
    }
}
```

Patterns

1. Singleton
2. Strategy
3. sObject Decorater
4. Façade
5. ?
6. ?



Filter By Additional Fields (Optional):

	Field	Operator	Value
1.	Date	less than	9/18/2012
2.	Owner Alias	equals	rvanhoo
3.	Date	less than	8/18/2012
4.	Owner Alias	equals	dthong
5.	Days	equals	3

Add Row Remove Row

Clear Filter Logic

Filter Logic:

(1 AND 2) OR ((3 OR 4) AND 5)

Tips ?

Example: If you wanted to filter to key deals for your company, where key deals are deals over $1,000,000 that are closing in the next 45 days, or deals owned by a VP, you would set up your filters as follows

Advanced Filters:

	Field	Operator	Value
1.	Amount	greater than	1000000
2.	Closed Date	equals	NEXT 45 DAYS
3.	Owner Role	starts with	VP
4.	--None--	equa	

Advanced Filter Conditions:

(1 **AND** 2) **OR** 3

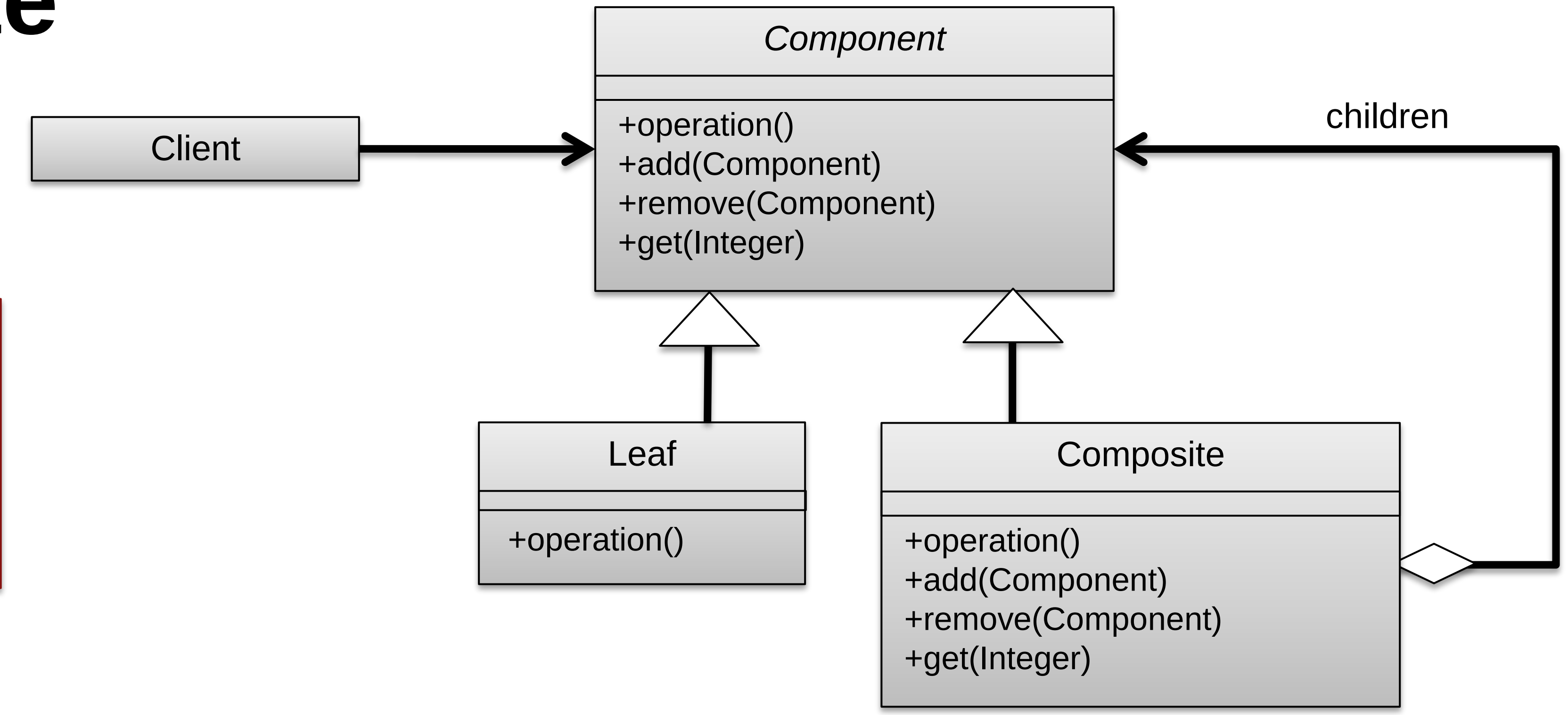
How do you represent expressions?

1 AND 2

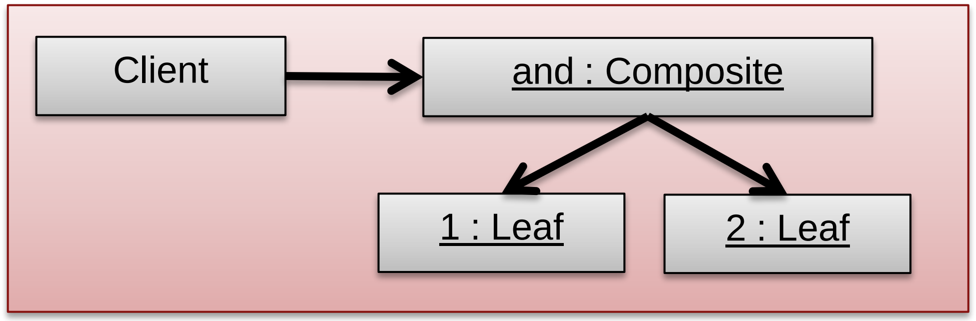
1 OR (2 AND 3)

(1 AND 2) OR ((3 OR 4) AND 5)

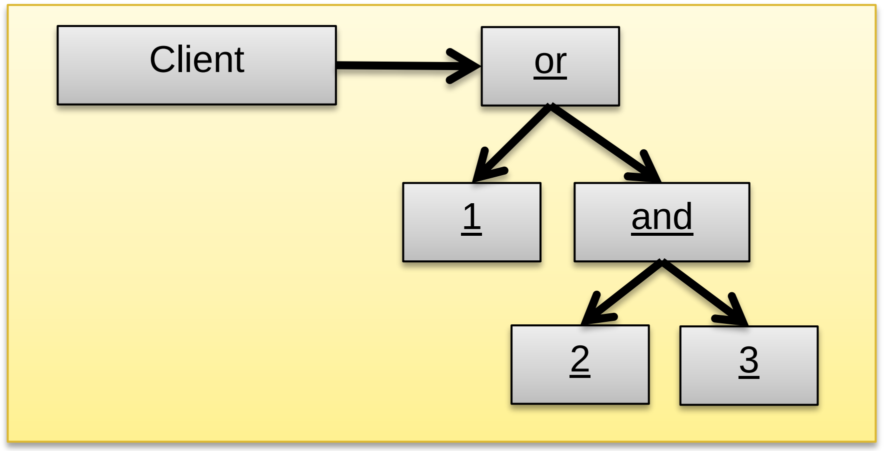
Solution: Composite



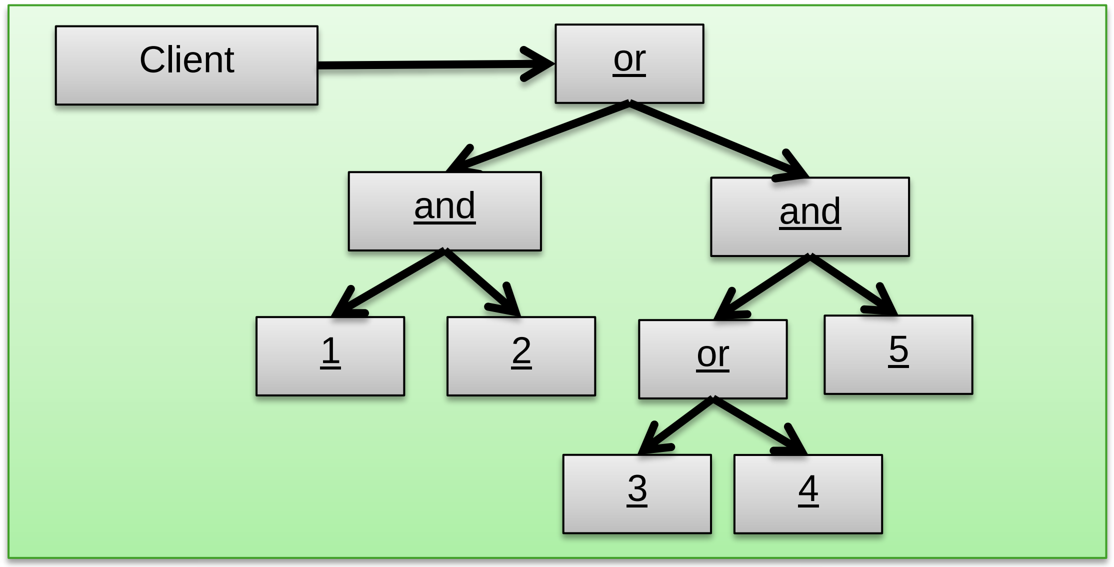
1 AND 2



1 OR (2 AND 3)



(1 AND 2) OR ((3 OR 4) AND 5)



Let’s Code It!

```
public interface Expression {
    Expression add(Expression expr);
    Expression set(String name, Boolean value);
    Boolean evaluate();
}
```

```
public abstract class Composite implements Expression{
    public List<Expression> children {get; private set;}
    public Composite(){ this.children = new List<Expression>(); }
    public Expression add(Expression expr){
        children.add(expr); return this;
    }
    public Expression set(String name, Boolean value){
        for(Expression expr : children) expr.set(name,value);
        return this;
    }
    public abstract Boolean evaluate();
    public Boolean hasChildren{get{ return !children.isEmpty(); }}
}
```

```
public class AndComposite extends Composite{
    public override Boolean evaluate(){
        for(Expression expr : children) if(!expr.evaluate()) return false;
        return true;
    }
}
```

```
public class OrComposite extends Composite{
    public override Boolean evaluate(){
        for(Expression expr : children) if(expr.evaluate()) return true;
        return false;
    }
}
```

```
public class Variable implements Expression{
    public String  name  {get;private set;}
    public Boolean value {get;private set;}
    public Variable(String name){ this.name = name; }
    public Expression add(Expression expr){ return this; }
    public Expression set(String name, Boolean value){
        if(this.name != null && this.name.equalsIgnoreCase(name))
            this.value = value;
        return this;
    }
    public Boolean evaluate(){ return value; }
}
```

Building Expressions

```
//1 AND 2
Expression expr = new AndComposite();
expr.add(new Variable('1'));
expr.add(new Variable('2'));
```

```
//1 OR (2 AND 3)
Expression expr = new OrComposite();
expr.add(new Variable('1'));
Expression expr2 = new AndComposite();
expr.add(expr2);
expr2.add(new Variable('2'));
expr2.add(new Variable('3'));
```

```
//no need for expr2 var if using "method chaining"
//last line of add method: return this;
Expression expr = (new OrComposite())
    .add(new Variable('1'))
    .add((new AndComposite())
        .add(new Variable('2'))
        .add(new Variable('3'))
    );
```

Use Case

```
//1 OR (2 AND 3)
Expression expr = (new OrComposite())
    .add(new Variable('1'))
    .add((new AndComposite())
        .add(new Variable('2'))
        .add(new Variable('3'))
    )
    .set('1',false)
    .set('2',true)
    .set('3',false);

System.debug(expr.evaluate());
//FALSE OR (TRUE AND FALSE) => FALSE

expr.set('3',true);

System.debug(expr.evaluate());
//FALSE OR (TRUE AND TRUE) => TRUE
```

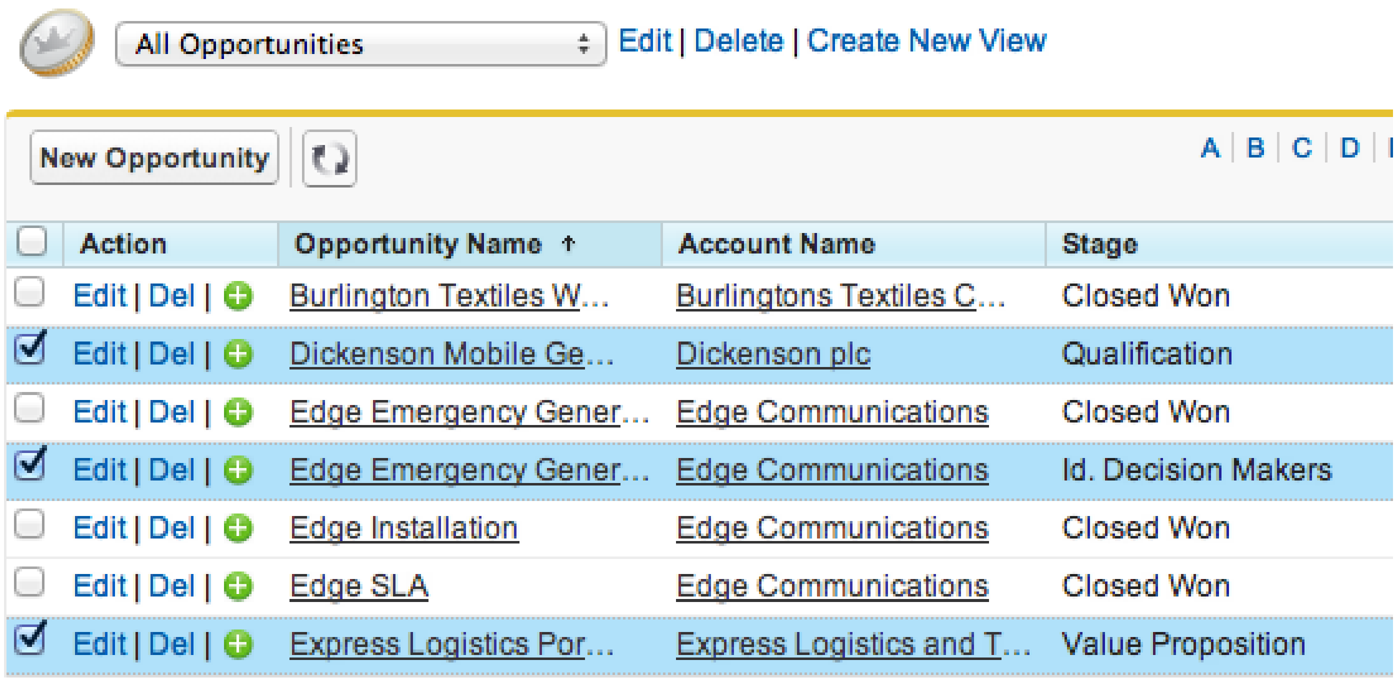
Patterns

1. Singleton
2. Strategy
3. sObject Decorater
4. Façade
5. Composite
6. ?

Billy Has a New Problem!

Billy wrote a trigger to create an order on close of an opportunity, however:

- It always creates a new order every time the closed opportunity is updated
- When loading via Data Loader, not all closed opportunities result in an order



	Action	Opportunity Name ↑	Account Name	Stage
☐	Edit | Del | ⊕	Burlington Textiles W...	Burlingtons Textiles C...	Closed Won
☑	Edit | Del | ⊕	Dickenson Mobile Ge...	Dickenson plc	Qualification
☐	Edit | Del | ⊕	Edge Emergency Gener...	Edge Communications	Closed Won
☑	Edit | Del | ⊕	Edge Emergency Gener...	Edge Communications	Id. Decision Makers
☐	Edit | Del | ⊕	Edge Installation	Edge Communications	Closed Won
☐	Edit | Del | ⊕	Edge SLA	Edge Communications	Closed Won
☑	Edit | Del | ⊕	Express Logistics Por...	Express Logistics and T...	Value Proposition

The Offending Code

```
trigger OpptyTrigger on Opportunity (after insert, after update) {

    if (trigger.new[0].isClosed) {
        Order__c order = new Order__c();
        …
        insert order
    }
}
```

Occurs regardless of prior state

No Bulk Handling

Poor reusability

Any Better?

```
trigger OpptyTrigger on Opportunity (after insert, after update) {

    new OrderClass().CreateOrder(trigger.new);

}
```

```
public class OrderClass {

    public void CreateOrder(List<Opportunity> opptyList) {
        for (Opportunity oppty : opptyList) {
            if (oppty.isClosed) {
                Order__c order = new Order__c();
                ...
                insert order;
            }
        }

    }
}
```

Occurs regardless of prior state

Not bulkified

How’s this?

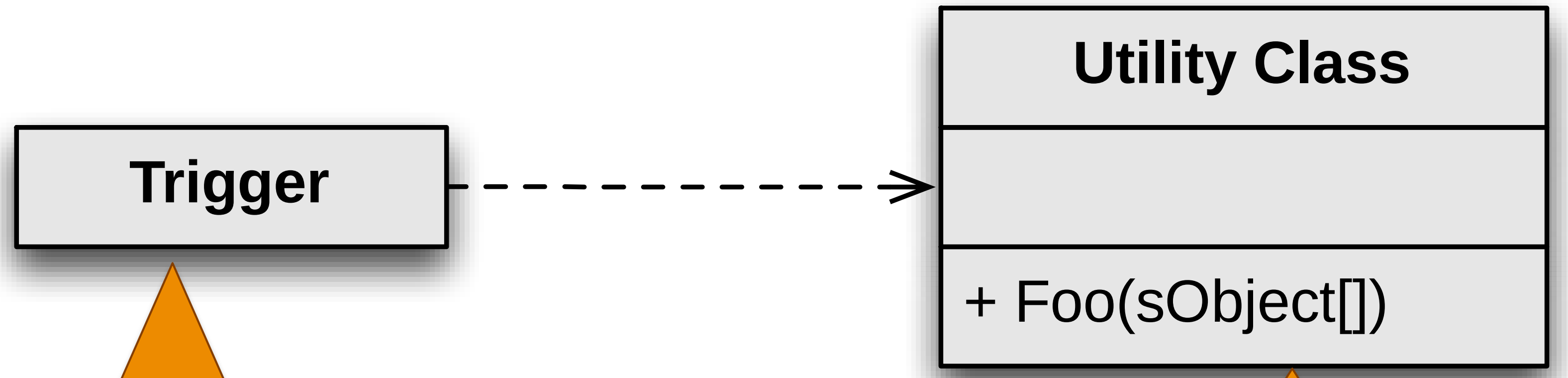
```
trigger OpptyTrigger on Opportunity (before insert, before update) {
    if (trigger.isInsert) {
        new OrderClass().CreateOrder(trigger.newMap, null);
    else
        new OrderClass().CreateOrder(trigger.newMap, trigger.oldMap);
```

```
public class OrderClass {

    public void CreateOrder(Map<Opportunity> opptyMapNew
                            Map<Opportunity> opptyMapOld) {
        List<Order__c> orderList = new List<Order__c>();
        for (Opportunity oppty : opptyMapNew.values()) {
            if (oppty.isClosed && (opptyMapOld == null ||
                    !opptyMapOld.get(oppty.id).isClosed)) {
                Order__c order = new Order__c();
                ...
                orderList.add(order);
            }
        }
        insert orderList ;
    }
```

At least it’s bulkified

This code is highly coupled and not reusable

Solution – Bulk Transition



- Checks for eligible records that have changed state and match criteria
- Calls utility class method to perform the work
- Only eligible records are passed in

- Generic utility class method that can be called from any context

At Last!!!

```
trigger OpptyTrigger on Opportunity (after insert, after update) {
    if (trigger.isAfter && (trigger.isInsert || trigger.isUpdate)) {
        List<Opportunity> closedOpptyList = new List<Opportunity>();
        for (Opportunity oppty : trigger.new) {
            if (oppty.isClosed && (trigger.isInsert ||
                    (trigger.isUpdate &&
                    !trigger.oldMap.get(oppty.id).isClosed)))
                closedOpptyList.add(oppty);
        }
        if (!closedOpptyList.isEmpty())
            new OrderClass().CreateOrderFromOpptys(closedOpptyList)
```

Trigger handles state transition

```
public class OrderClass {
    public void CreateOrdersFromOpptys(List<Opportunity> opptyList) {
        List<Order__c> orderList = new List<Order__c>();
        for (Opportunity oppty : opptyList) {
            Order__c order = new Order__c();
            ...
            orderList.add(order);
        }
        insert orderList ;
```

This method is now a lot more reusable and is bulk-safe

Patterns

1. Singleton
2. Strategy
3. sObject Decorater
4. Façade
5. Composite
6. Bulk State Transition

Resources

Wrapper Classes - http://wiki.developerforce.com/page/Wrapper_Class

Apex Code Best Practices - http://wiki.developerforce.com/page/Apex_Code_Best_Practices

Apex Web Services and Callouts - http://wiki.developerforce.com/page/Apex_Web_Services_and_Callouts

Sample Code - https://github.com/richardvanhook/Force.com-Patterns

More at #DF12

Hands-on Training: Introduction to Apex Patterns

Tuesday 3:30pm-6:00pm, Hilton Union Square, Continental Parlor 5

Thursday 12:00pm-2:30pm, Hilton Union Square, Continental Parlor 1/2/3

Q&A

Dennis Thong

Senior Technical Solution Architect

Richard Vanhook

Senior Technical Solution Architect

Thank You