AeroSense: Phase 5 Documentation

Phase Title: Apex Programming (Developer)
Objective: To extend AeroSense functionality beyond declarative tools by using **Apex classes, triggers, SOQL, SOSL, and asynchronous processes** for real-time air quality monitoring.

1. Apex Classes & Objects

- **SensorHandler.cls** → Handles sensor logic (status updates, calibration).
- **ReadingHandler.cls** → Processes air quality readings (AQI calculation).
- **AlertService.cls** → Manages creation and notification of alerts.
- **AggregateBatch.cls** → Summarizes daily AQI values using Batch Apex.

2. Apex Trigger Example: Auto-Create Alert

Trigger on **Reading__c** to auto-generate an alert when AQI exceeds 150.

```
trigger ReadingTrigger on Reading__c (after insert) {
    for (Reading__c r : Trigger.new) {
        if (r.AQI__c > 150) {
            Alert__c alert = new Alert__c(
                Sensor__c = r.Sensor__c,
                Reading__c = r.Id,
                Severity__c = 'High',
                Message__c = 'AQI exceeds safe threshold: ' + r.AQI__c
            );
            insert alert;
        }
```

```
    }
}
```

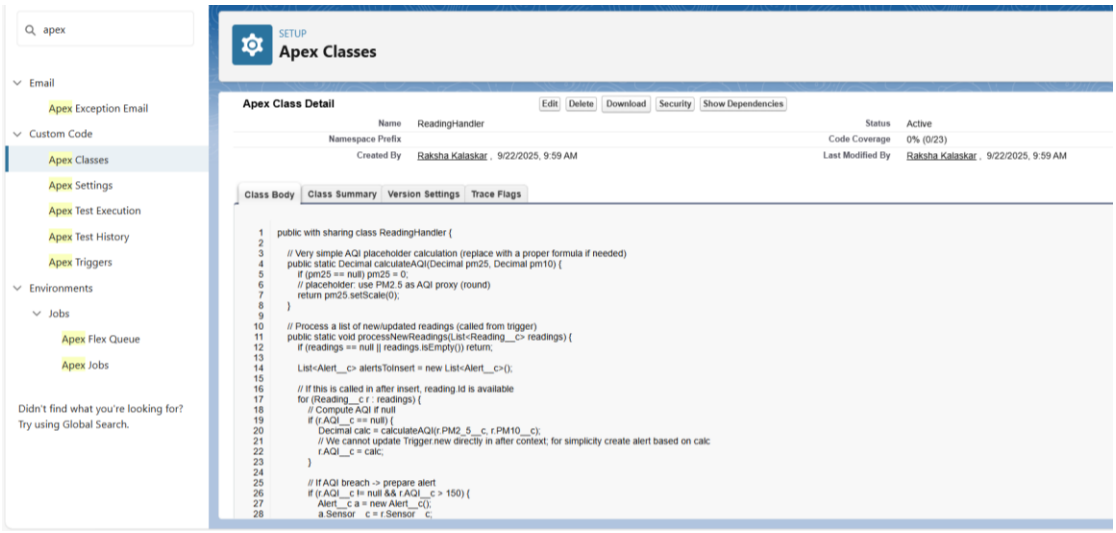
3. Trigger Design Pattern (Handler Class)

Best practice: delegate logic to a **Handler Class**.

```
trigger ReadingTrigger on Reading__c (after insert) {
    ReadingHandler.createAlerts(Trigger.new);
}


public class ReadingHandler {
    public static void createAlerts(List<Reading__c> readings) {
        List<Alert__c> alerts = new List<Alert__c>();
        for (Reading__c r : readings) {
            if (r.AQI__c > 150) {
                alerts.add(new Alert__c(
                    Sensor__c = r.Sensor__c,
                    Reading__c = r.Id,
                    Severity__c = 'High',
                    Message__c = 'Critical AQI detected: ' + r.AQI__c
                ));
            }
        }
        if (!alerts.isEmpty()) {
            insert alerts;
        }
    }
```

}



4. SOQL Example

Fetch sensors with their latest readings:

List<Sensor__c> sensors = [

SELECT Id, Name, Trust_Score__c,

(SELECT AQI__c, Timestamp__c FROM Readings__r ORDER BY Timestamp__c DESC LIMIT 1)

FROM Sensor__c

];

5. SOSL Example

Search for sensors or alerts with the keyword "Critical":

List<List<SObject>> results = [FIND 'Critical' IN ALL FIELDS RETURNING Alert__c(Name, Message__c), Sensor__c(Name)];

6. Collections (List, Set, Map)

List<Reading__c> readings = [SELECT AQI__c FROM Reading__c];

Set<Integer> uniqueAQI = new Set<Integer>();

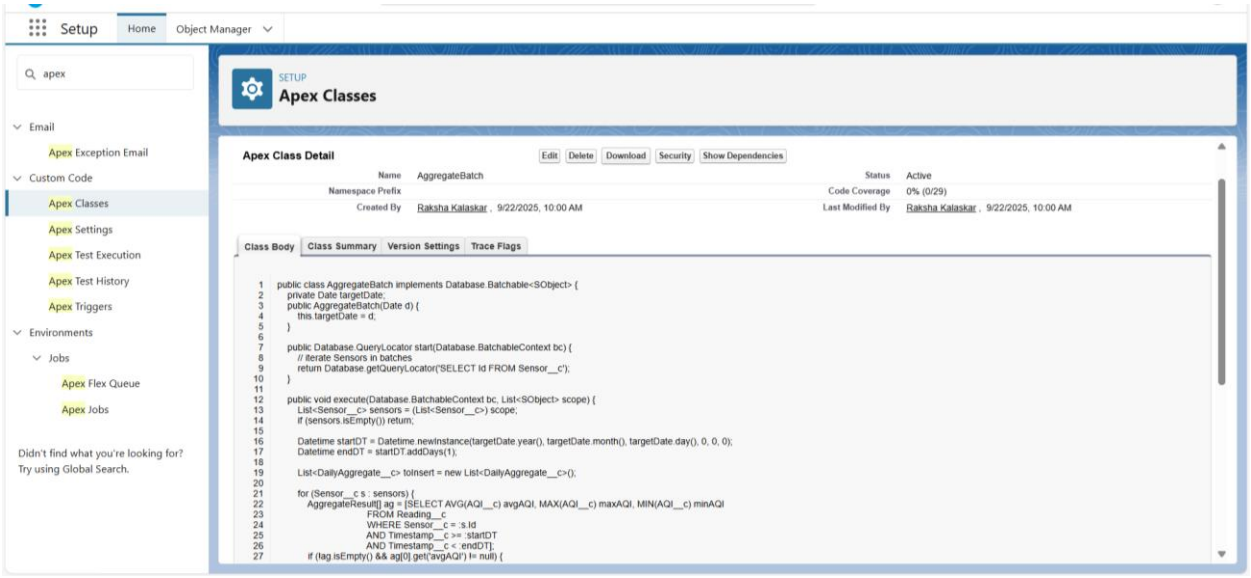
```
Map<Id, Sensor__c> sensorMap = new Map<Id, Sensor__c>([SELECT Id, Name FROM Sensor__c]);
```

7. Asynchronous Processing

Batch Apex – Daily AQI Aggregation

```
global class AggregateBatch implements Database.Batchable<SObject> {
    global Database.QueryLocator start(Database.BatchableContext bc) {
        return Database.getQueryLocator('SELECT Id FROM Sensor__c');
    }
    global void execute(Database.BatchableContext bc, List<Sensor__c> sensors) {
        List<DailyAggregate__c> aggregates = new List<DailyAggregate__c>();
        for (Sensor__c s : sensors) {
            AggregateResult[] results = [
                SELECT AVG(AQI__c) avgAQI, MAX(AQI__c) maxAQI, MIN(AQI__c) minAQI
                FROM Reading__c WHERE Sensor__c = :s.Id AND
                    DAY_ONLY(Timestamp__c) = TODAY
            ];
            if (!results.isEmpty()) {
                aggregates.add(new DailyAggregate__c(
                    Sensor__c = s.Id,
                    Date__c = Date.today(),
                    Avg_AQI__c = (Decimal)results[0].get('avgAQI'),
                    Max_AQI__c = (Decimal)results[0].get('maxAQI'),
                    Min_AQI__c = (Decimal)results[0].get('minAQI')
                ));
            }
```

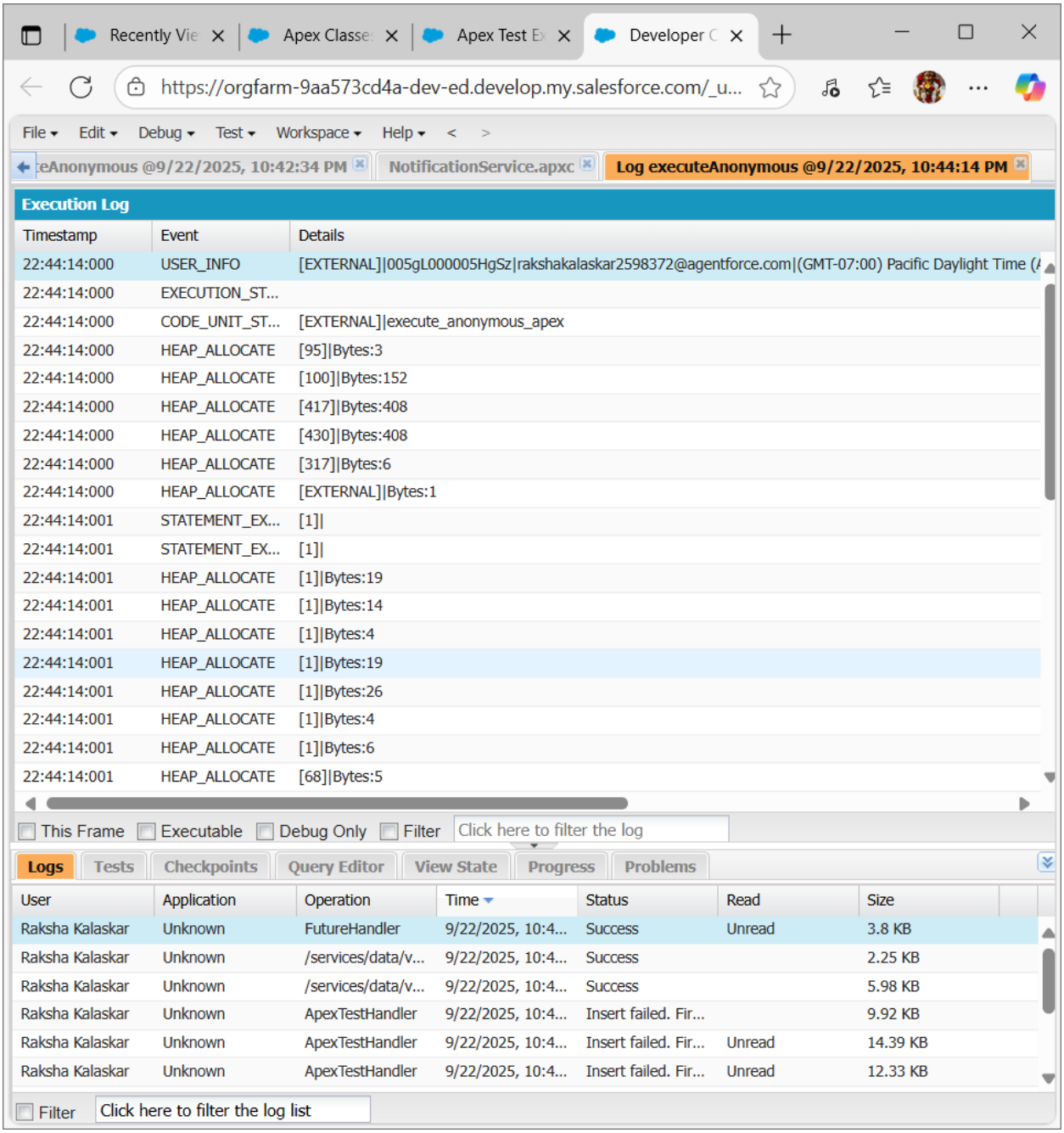
```
        }
        if (!aggregates.isEmpty()) insert aggregates;
    }
    global void finish(Database.BatchableContext bc) {}
}
```



8. Future Method Example (Async Call)

```
public class NotificationService {
    @future
    public static void sendAsyncEmail(String email, String message) {
        Messaging.SingleEmailMessage mail = new Messaging.SingleEmailMessage();
        mail.setToAddresses(new String[]{email});
        mail.setSubject('AeroSense Alert');
        mail.setPlainTextBody(message);
        Messaging.sendEmail(new Messaging.SingleEmailMessage[]{mail});
    }
```

}



9. Exception Handling Example

```
try {
    insert new Alert__c(Name='Test');
```

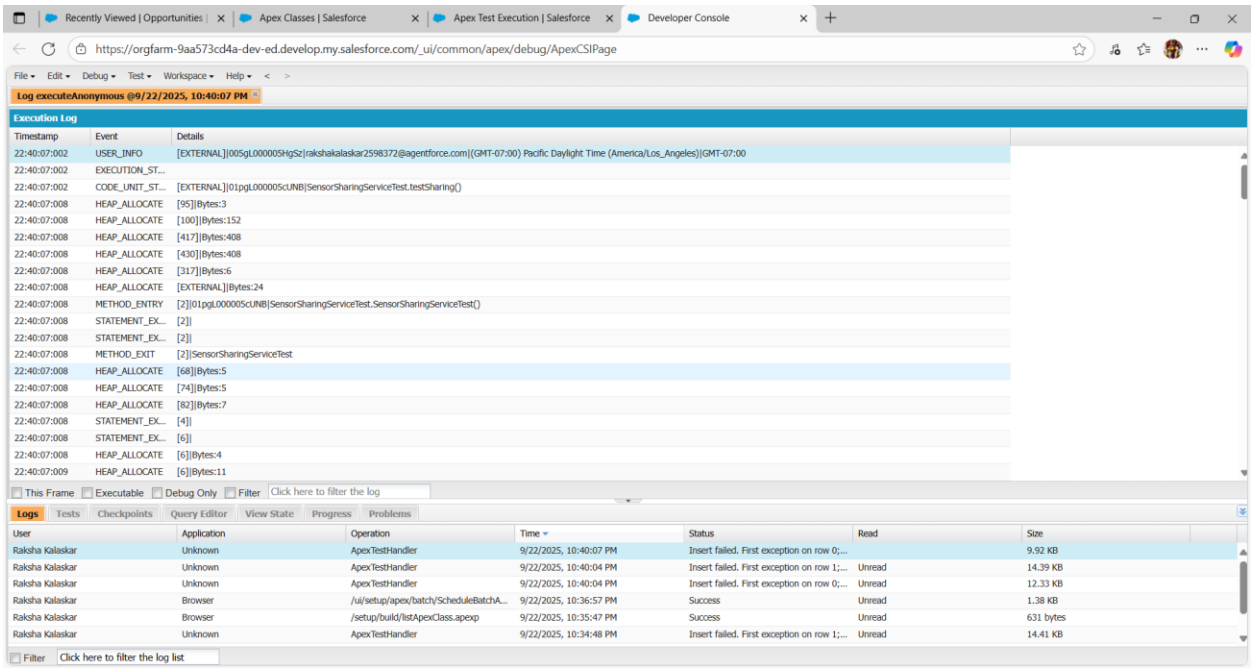
```
} catch (DmlException e) {
    System.debug('Error creating alert: ' + e.getMessage());
}
```

10. Test Class Example

```
@isTest
public class ReadingHandlerTest {
    @isTest
    static void testCreateAlert() {
        Sensor__c s = new Sensor__c(Name='Test Sensor');
        insert s;

        Reading__c r = new Reading__c(Sensor__c = s.Id, AQI__c = 200);
        insert r;

        List<Alert__c> alerts = [SELECT Id FROM Alert__c WHERE Sensor__c = :s.Id];
        System.assertEquals(1, alerts.size());
    }
}
```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Developer Console
https://orgfarm-9aa573cd4a-dev-ed.develop.my.salesforce.com/_ui/common/apex/debug/ApexCSIPage
File Edit Debug Test Workspace Help
Log executeAnonymous @9/22/2025, 10:40:07 PM
Execution Log
Timestamp Event Details
22:40:07:002 USER_INFO [EXTERNAL]|005gL000005HgSz|rakshakalaskar2598372@agentforce.com|(GMT-07:00) Pacific Daylight Time (America/Los_Angeles)|GMT-07:00
22:40:07:002 EXECUTION_ST...
22:40:07:002 CODE_UNIT_ST... [EXTERNAL]|01pgL000005cUNB|SensorSharingServiceTest.testSharing()
22:40:07:008 HEAP_ALLOCATE [95]|Bytes:3
22:40:07:008 HEAP_ALLOCATE [100]|Bytes:152
22:40:07:008 HEAP_ALLOCATE [417]|Bytes:408
22:40:07:008 HEAP_ALLOCATE [430]|Bytes:408
22:40:07:008 HEAP_ALLOCATE [317]|Bytes:6
22:40:07:008 HEAP_ALLOCATE [EXTERNAL]|Bytes:24
22:40:07:008 METHOD_ENTRY [2]|01pgL000005cUNB|SensorSharingServiceTest.SensorSharingServiceTest()
22:40:07:008 STATEMENT_EX... [2]|
22:40:07:008 STATEMENT_EX... [2]|
22:40:07:008 METHOD_EXIT [2]|SensorSharingServiceTest
22:40:07:008 HEAP_ALLOCATE [68]|Bytes:5
22:40:07:008 HEAP_ALLOCATE [74]|Bytes:5
22:40:07:008 HEAP_ALLOCATE [82]|Bytes:7
22:40:07:008 STATEMENT_EX... [4]|
22:40:07:008 STATEMENT_EX... [6]|
22:40:07:008 HEAP_ALLOCATE [6]|Bytes:4
22:40:07:009 HEAP_ALLOCATE [6]|Bytes:11
This Frame Executable Debug Only Filter Click here to filter the log
Logs Tests Checkpoints Query Editor View State Progress Problems
User Application Operation Time Status Read Size
Raksha Kalaskar Unknown ApexTestHandler 9/22/2025, 10:40:07 PM Insert failed. First exception on row 0;... 9.92 KB
Raksha Kalaskar Unknown ApexTestHandler 9/22/2025, 10:40:04 PM Insert failed. First exception on row 1;... Unread 14.39 KB
Raksha Kalaskar Unknown ApexTestHandler 9/22/2025, 10:40:04 PM Insert failed. First exception on row 0;... Unread 12.33 KB
Raksha Kalaskar Browser /ui/setup/apex/batch/ScheduleBatchA... 9/22/2025, 10:36:57 PM Success Unread 1.38 KB
Raksha Kalaskar Browser /setup/build/listApexClass.apexp 9/22/2025, 10:35:47 PM Success Unread 631 bytes
Raksha Kalaskar Unknown ApexTestHandler 9/22/2025, 10:34:48 PM Insert failed. First exception on row 1;... Unread 14.41 KB
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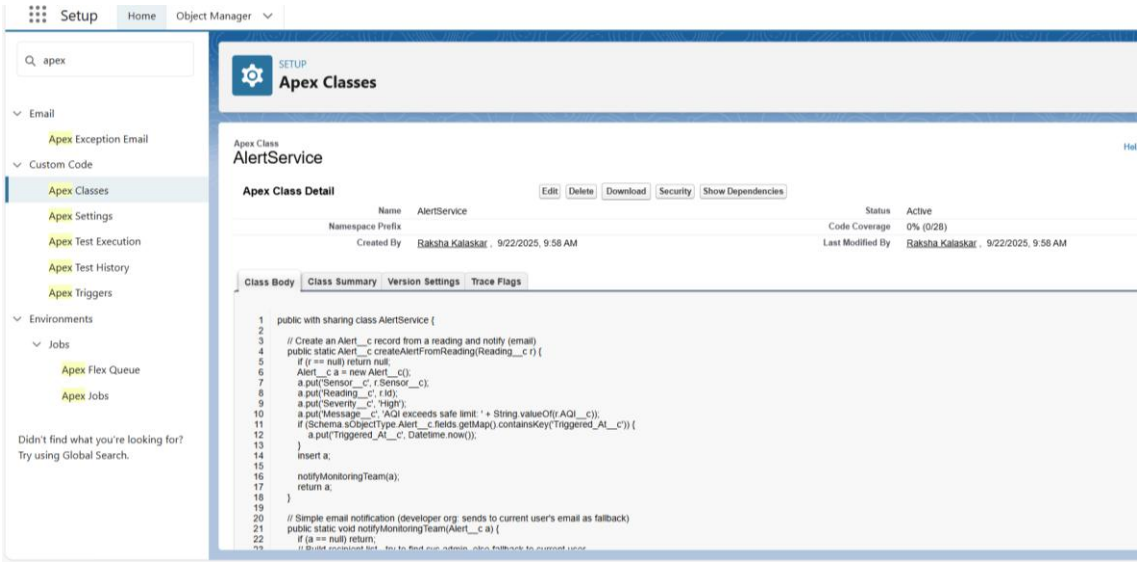
Setup
Home
Object Manager
apex
Email
Apex Exception Email
Custom Code
Apex Classes
Apex Settings
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Apex Test History
Apex Triggers
Environments
Jobs
Apex Flex Queue
Apex Jobs
Didn't find what you're looking for?
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SETUP
Apex Classes
Apex Class
AlertService
Apex Class Detail
Edit Delete Download Security Show Dependencies
Name AlertService
Namespace Prefix
Created By Raksha Kalaskar, 9/22/2025, 9:58 AM
Status Active
Code Coverage 0% (0/28)
Last Modified By Raksha Kalaskar, 9/22/2025, 9:58 AM
Class Body Class Summary Version Settings Trace Flags
1 public with sharing class AlertService {
2
3 // Create an Alert__c record from a reading and notify (email)
4 public static Alert__c createAlertFromReading(Reading__c r) {
5 if (r == null) return null;
6 Alert__c a = new Alert__c();
7 a.put('Sensor__c', r.Sensor__c);
8 a.put('Reading__c', r.Id);
9 a.put('Severity__c', 'High');
10 a.put('Message__c', 'AQI exceeds safe limit: ' + String.valueOf(r.AQI__c));
11 if (Schema.sObjectType.Alert__c.fields.getMap().containsKey('Triggered_At__c')) {
12 a.put('Triggered_At__c', Datetime.now());
13 }
14 insert a;
15
16 notifyMonitoringTeam(a);
17 return a;
18 }
19
20 // Simple email notification (developer org: sends to current user's email as fallback)
21 public static void notifyMonitoringTeam(Alert__c a) {
22 if (a == null) return;