Assignment 4 – Database Migrations with Flyway, Ansible & CI/CD

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> Report for Question1 is created separately and named as ToolAnalysis.md and ToolAnalysis.pdf

Q2 - Implementation (12 points)

- Ansible playbooks for environment management
- Flyway migrations (initial + incremental)
- GitHub Actions CI/CD workflow
- Automated CRUD tests

Project Structure

```
PROG8850-Assignment4/
├── ansible/
│   ├── up.yml
│   └── down.yml
├── flyway/
│   ├── migrations_initial/
│   │   └── V1__create_subscribers.sql
│   └── migrations_incremental/
│       └── V2__add_status_and_index.sql
├── tests/
│   └── test_subscribers.py
├── .github/workflows/
│   └── ci.yml
└── requirements.txt
```

Running Locally

Prerequisites

- Docker Desktop
- Ansible (WSL)
- Python 3.x

Start Environment

```
cd /mnt/d/Conestoga/Course2-DevOps/Sem2/Database\ Automation/PROG8850-Assignment4
ansible-playbook ansible/up.yml
```

Verify Database

```
docker ps | grep a4-mysql
docker exec -it a4-mysql mysql -usub_user -psub_pass subscriptions -e "SHOW
TABLES;"
docker exec -it a4-mysql mysql -usub_user -psub_pass subscriptions -e "DESCRIBE
subscribers;"
```

```
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$ Run these commands to check:
Command 'Run' not found, did you mean:
  command 'bun' from snap bun-js (1.3.1)
  command 'zun' from deb python3-zunclient (4.7.0-0ubuntu1)
See 'snap info <snapname>' for additional versions.
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$ docker ps | grep a4-mysql
8e9ce864026c    mysql:8                                              "dock
er-entrypoint.s…"     15 minutes ago    Up 15 minutes               33060/
tcp, 0.0.0.0:4408->3306/tcp                          a4-mysql
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$ docker exec -it a4-mysql mysql -usub_user -psub_pas
s subscriptions -e "SHOW TABLES;"
mysql: [Warning] Using a password on the command line interface can be insec
ure.
+-------------------------+
| Tables_in_subscriptions |
+-------------------------+
| flyway_schema_history   |
| subscribers             |
+-------------------------+
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$
```

Db Created

```
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$ docker exec -it a4-mysql mysql -usub_user -psub_pas
s subscriptions -e "DESCRIBE subscribers;"
mysql: [Warning] Using a password on the command line interface can be insec
ure.
+------------+--------------+------+-----+-------------------+--------------
-----+
| Field      | Type         | Null | Key | Default           | Extra
   |
+------------+--------------+------+-----+-------------------+--------------
-----+
| id         | bigint       | NO   | PRI | NULL              | auto_incremen
t  |
| email      | varchar(255) | NO   | UNI | NULL              |
   |
| name       | varchar(120) | YES  |     | NULL              |
   |
| created_at | timestamp    | YES  |     | CURRENT_TIMESTAMP | DEFAULT_GENER
ATED |
+------------+--------------+------+-----+-------------------+--------------
-----+
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$
```

Table Structure After Initial V1 migration

```
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$ docker exec -it a4-mysql mysql -usub_user -psub_pas
s subscriptions -e "DESCRIBE subscribers;"
mysql: [Warning] Using a password on the command line interface can be insec
ure.
+------------+-------------------------+------+-----+-------------------+--
------------------+
| Field      | Type                    | Null | Key | Default           |
Extra             |
+------------+-------------------------+------+-----+-------------------+--
------------------+
| id         | bigint                  | NO   | PRI | NULL              |
auto_increment    |
| email      | varchar(255)            | NO   | UNI | NULL              |
   |
| name       | varchar(120)            | YES  |     | NULL              |
   |
| created_at | timestamp               | YES  | MUL | CURRENT_TIMESTAMP |
DEFAULT_GENERATED |
| status     | enum('active','inactive') | YES |     | active            |
   |
+------------+-------------------------+------+-----+-------------------+--
------------------+
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$ |
```

Table Structure After V2 migration

```
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$ docker exec -it a4-mysql mysql -usub_user -psub_pas
s subscriptions -e "SHOW INDEXES FROM subscribers;"
mysql: [Warning] Using a password on the command line interface can be insec
ure.
+-------------+------------+----------------+--------------+-------------+---
---------+------------+----------+--------+------+------------+---------+---
-------------+---------+------------+
| Table       | Non_unique | Key_name       | Seq_in_index | Column_name | C
ollation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | I
ndex_comment | Visible | Expression |
+-------------+------------+----------------+--------------+-------------+---
---------+------------+----------+--------+------+------------+---------+---
-------------+---------+------------+
| subscribers |          0 | PRIMARY        |            1 | id          | A
         |          0 |     NULL |   NULL |      | BTREE      |         |
             | YES     | NULL       |
| subscribers |          0 | email          |            1 | email       | A
         |          0 |     NULL |   NULL |      | BTREE      |         |
             | YES     | NULL       |
| subscribers |          1 | idx_created_at |            1 | created_at  | A
         |          0 |     NULL |   NULL | YES  | BTREE      |         |
             | YES     | NULL       |
+-------------+------------+----------------+--------------+-------------+---
---------+------------+----------+--------+------+------------+---------+---
-------------+---------+------------+
niksn@DESKTOP-BNHSP1F:/mnt/d/Conestoga/Course2-DevOps/Sem2/Database Automati
on/PROG8850-Assignment4$
```

Index Created after V2 migration

Run Tests

```
pip install -r requirements.txt
DB_PORT=4408 pytest tests/test_subscribers.py -v
```

Tear Down

```
ansible-playbook ansible/down.yml
```
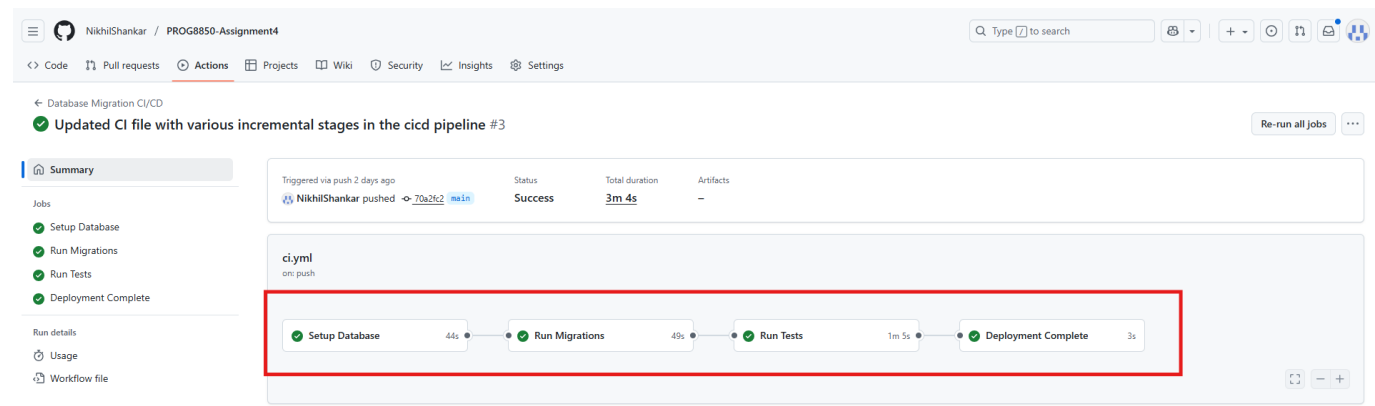
CI/CD Pipeline

Stages: Setup → Migrate → Test → Deploy

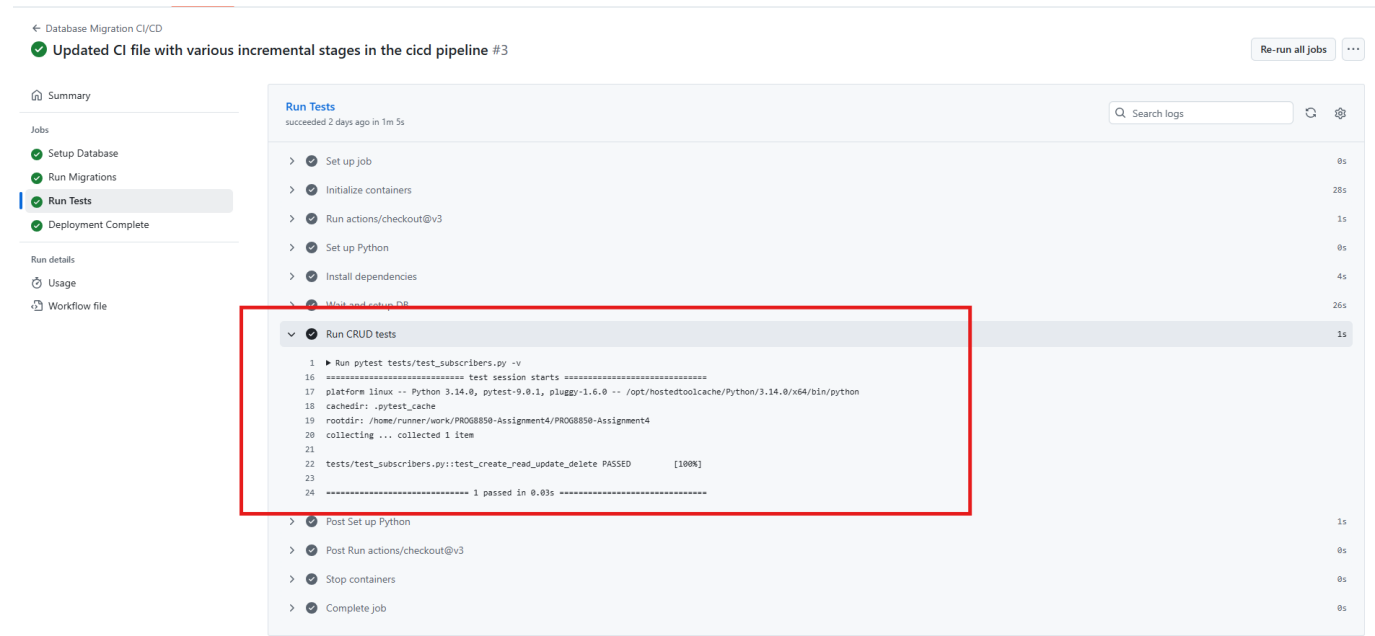**Trigger:** Push to main/master

Configuration:

- MySQL 8 on port 4408
- Database: subscriptions
- User: sub_user / sub_pass
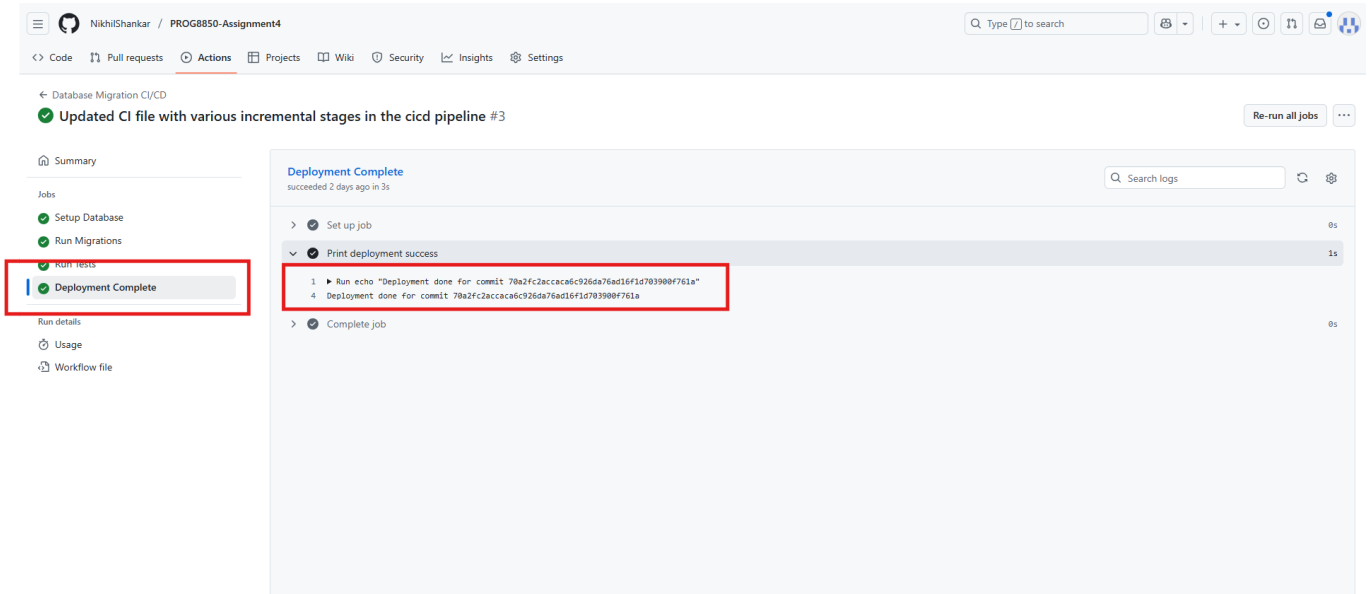
- Flyway 10

All 4 stages in the pipeline getting passed

Python test cases running and passing in CICD workflow

Deployment Complete Once all stages in workflow is completed ie Deploy, migration and testing we print deployment completed for the appropriate commit.

Deployment Completed Status after succesful completion of all stages in pipeline

Database Schema

V1 - Initial Schema

- id (BIGINT, PK, auto_increment)
- email (VARCHAR(255), UNIQUE)
- name (VARCHAR(120))
- created_at (TIMESTAMP)

V2 - Incremental Updates

- status (ENUM: active/inactive, default active)
- Index on created_at

CRUD Tests

Coverage:

- CREATE: Insert subscriber
- READ: Retrieve by ID
- UPDATE: Modify name
- DELETE: Remove subscriber

Environment Variables:

- DB_HOST (default: 127.0.0.1)
- DB_PORT (default: 3306, use 4408 locally)
- DB_USER (default: root)
- DB_PASSWORD (default: rootpass)
- DB_NAME (default: subscriptions)

Dependencies

Python:

- pymysql
- pytest

Docker:

- mysql:8
- flyway/flyway:10