Setting Up Apache Airflow with Docker

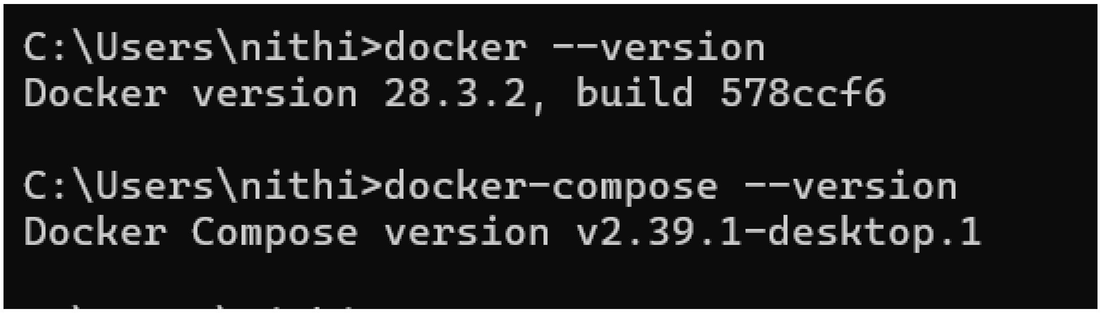
1. Install Docker Desktop

- Download and install **Docker Desktop** from:
  https://www.docker.com/products/docker-desktop

- After installation, verify Docker is working:

  ```
  docker --version
  docker-compose --version
  ```

You should see version numbers for both.



```
C:\Users\nithi>docker --version
Docker version 28.3.2, build 578ccf6

C:\Users\nithi>docker-compose --version
Docker Compose version v2.39.1-desktop.1
```

2. Create Airflow Project Directory

In PowerShell or VS Code terminal:

```
mkdir airflow
cd airflow
```

This will be the working directory for Airflow.

3. Create .env File

Inside C:\airflow create a file named .env and add:

```
AIRFLOW_IMAGE_NAME=apache/airflow:2.10.2-python3.8
AIRFLOW_UID=50000
```

- AIRFLOW_IMAGE_NAME: Specifies Airflow image version.

- AIRFLOW_UID: Ensures correct file permissions on Windows.

4. Create `docker-compose.yaml`

Inside C:\airflow, create docker-compose.yaml with the following content:

```
# Licensed to the Apache Software Foundation (ASF) under one
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# distributed with this work for additional information
# regarding copyright ownership.  The ASF licenses this file
# to you under the Apache License, Version 2.0 (the
# "License"); you may not use this file except in compliance
# with the License.  You may obtain a copy of the License at
#
#   http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing,
# software distributed under the License is distributed on an
# "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY
# KIND, either express or implied.  See the License for the
# specific language governing permissions and limitations
# under the License.
#
```

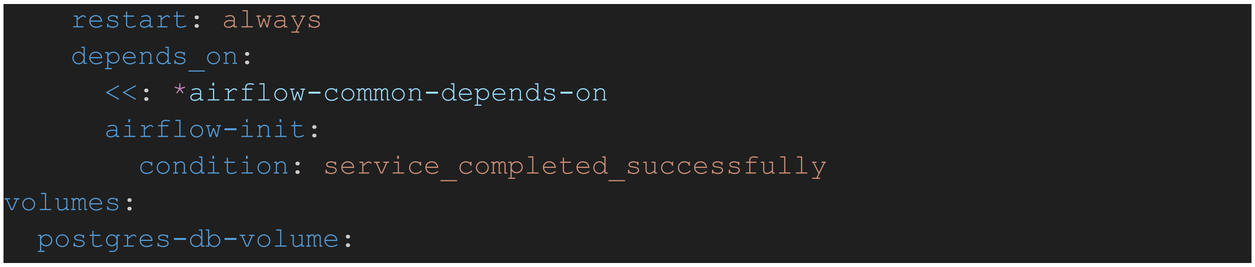
```
# Basic Airflow cluster configuration for CeleryExecutor with Redis and PostgreSQL.
#
# WARNING: This configuration is for local development. Do not use it in a production deployment.
#
# This configuration supports basic configuration using environment variables or an .env file
# The following variables are supported:
#
# AIRFLOW_IMAGE_NAME           - Docker image name used to run Airflow.
#                                Default: apache/airflow:3.0.4
# AIRFLOW_UID                  - User ID in Airflow containers
#                                Default: 50000
# AIRFLOW_PROJ_DIR             - Base path to which all the files will be volumed.
#                                Default: .
# Those configurations are useful mostly in case of standalone testing/running Airflow in test/try-out mode
#
# _AIRFLOW_WWW_USER_USERNAME   - Username for the administrator account (if requested).
#                                Default: airflow
# _AIRFLOW_WWW_USER_PASSWORD   - Password for the administrator account (if requested).
#                                Default: airflow
# _PIP_ADDITIONAL_REQUIREMENTS - Additional PIP requirements to add when starting all containers.
#                                Use this option ONLY for quick checks. Installing requirements at container
#                                startup is done EVERY TIME the service is started.
#                                A better way is to build a custom image or extend the official image
#                                as described in https://airflow.apache.org/docs/docker-stack/build.html.
#                                Default: ''
#
# Feel free to modify this file to suit your needs.
---
x-airflow-common:
  &airflow-common
  # In order to add custom dependencies or upgrade provider distributions you can use your extended image.
  # Comment the image line, place your Dockerfile in the directory where you placed the docker-compose.yaml
  # and uncomment the "build" line below, Then run `docker-compose build` to build the images.
  image: apache/airflow:2.10.2-python3.8
  # build: .
  environment:
    &airflow-common-env
    AIRFLOW__CORE__EXECUTOR: CeleryExecutor
    AIRFLOW__CORE__AUTH_MANAGER: airflow.providers.fab.auth_manager.fab_auth_manager.FabAuthManager
    AIRFLOW__DATABASE__SQL_ALCHEMY_CONN: postgresql+psycopg2://airflow:airflow@postgres/airflow
    AIRFLOW__CELERY__RESULT_BACKEND: db+postgresql://airflow:airflow@postgres/airflow
    AIRFLOW__CELERY__BROKER_URL: redis://:@redis:6379/0
    AIRFLOW__CORE__FERNET_KEY: ''
    AIRFLOW__CORE__DAGS_ARE_PAUSED_AT_CREATION: 'true'
    AIRFLOW__CORE__LOAD_EXAMPLES: 'true'
    AIRFLOW__CORE__EXECUTION_API_SERVER_URL: 'http://airflow-apiserver:8080/execution/'
    # yamllint disable rule:line-length
    # Use simple http server on scheduler for health checks
    # See https://airflow.apache.org/docs/apache-airflow/stable/administration-and-deployment/logging-monitoring/check-health.html#scheduler-health-check-server
    # yamllint enable rule:line-length
    AIRFLOW__SCHEDULER__ENABLE_HEALTH_CHECK: 'true'
    # WARNING: Use _PIP_ADDITIONAL_REQUIREMENTS option ONLY for a quick checks
    # for other purpose (development, test and especially production usage) build/extend Airflow image.
    _PIP_ADDITIONAL_REQUIREMENTS: ${_PIP_ADDITIONAL_REQUIREMENTS:-}
    # The following line can be used to set a custom config file, stored in the local config folder
    AIRFLOW_CONFIG: '/opt/airflow/config/airflow.cfg'
  volumes:
    - ${AIRFLOW_PROJ_DIR:-.}/dags:/opt/airflow/dags
    - ${AIRFLOW_PROJ_DIR:-.}/logs:/opt/airflow/logs
    - ${AIRFLOW_PROJ_DIR:-.}/config:/opt/airflow/config
    - ${AIRFLOW_PROJ_DIR:-.}/plugins:/opt/airflow/plugins
  user: "${AIRFLOW_UID:-50000}:0"
  depends_on:
    &airflow-common-depends-on
    redis:
      condition: service_healthy
    postgres:
      condition: service_healthy
services:
  postgres:
    image: postgres:13
    environment:
      POSTGRES_USER: airflow
      POSTGRES_PASSWORD: airflow
      POSTGRES_DB: airflow
    volumes:
      - postgres-db-volume:/var/lib/postgresql/data
    healthcheck:
      test: ["CMD", "pg_isready", "-U", "airflow"]
      interval: 10s
      retries: 5
      start_period: 5s
    restart: always
```

```
  redis:
    # Redis is limited to 7.2-bookworm due to licencing change
    # https://redis.io/blog/redis-adopts-dual-source-available-licensing/
    image: redis:7.2-bookworm
    expose:
      - 6379
    healthcheck:
      test: ["CMD", "redis-cli", "ping"]
      interval: 10s
      timeout: 30s
      retries: 50
      start_period: 30s
    restart: always
  airflow-webserver:
    <<: *airflow-common
    command: webserver
    ports:
      - "8080:8080"
    healthcheck:
      test: ["CMD", "curl", "--fail", "http://localhost:8080/health"]
      interval: 30s
      timeout: 10s
      retries: 5
      start_period: 30s
    restart: always
    depends_on:
      <<: *airflow-common-depends-on
      airflow-init:
        condition: service_completed_successfully
  airflow-scheduler:
    <<: *airflow-common
    command: scheduler
    healthcheck:
      test: ["CMD", "curl", "--fail", "http://localhost:8974/health"]
      interval: 30s
      timeout: 10s
      retries: 5
      start_period: 30s
    restart: always
    depends_on:
      <<: *airflow-common-depends-on
      airflow-init:
        condition: service_completed_successfully
  airflow-dag-processor:
    <<: *airflow-common
    command: dag-processor
    healthcheck:
      test: ["CMD-SHELL", 'airflow jobs check --job-type DagProcessorJob
--hostname "$${HOSTNAME}"']
      interval: 30s
      timeout: 10s
      retries: 5
      start_period: 30s
    restart: always
    depends_on:
      <<: *airflow-common-depends-on
      airflow-init:
        condition: service_completed_successfully
```

```yaml
  airflow-worker:
    <<: *airflow-common
    command: celery worker
    healthcheck:
      # yamllint disable rule:line-length
      test:
        - "CMD-SHELL"
        - 'celery --app airflow.providers.celery.executors.celery_executor.app inspect ping -d "celery@$${HOSTNAME}" || celery --app airflow.executors.celery_executor.app inspect ping -d "celery@$${HOSTNAME}"'
      interval: 30s
      timeout: 10s
      retries: 5
      start_period: 30s
    environment:
      <<: *airflow-common-env
      # Required to handle warm shutdown of the celery workers properly
      # See https://airflow.apache.org/docs/docker-stack/entrypoint.html#signal-propagation
      DUMB_INIT_SETSID: "0"
    restart: always
    depends_on:
      <<: *airflow-common-depends-on
      airflow-webserver:
        condition: service_healthy
      airflow-init:
        condition: service_completed_successfully
  airflow-triggerer:
    <<: *airflow-common
    command: triggerer
    healthcheck:
      test: ["CMD-SHELL", 'airflow jobs check --job-type TriggererJob --hostname "$${HOSTNAME}"']
      interval: 30s
      timeout: 10s
      retries: 5
      start_period: 30s
    restart: always
    depends_on:
      <<: *airflow-common-depends-on
      airflow-init:
        condition: service_completed_successfully
  airflow-init:
    <<: *airflow-common
    entrypoint: /bin/bash
    # yamllint disable rule:line-length
    command:
      - -c
      - |
        if [[ -z "${AIRFLOW_UID}" ]]; then
          echo
          echo -e "\033[1;33mWARNING!!!: AIRFLOW_UID not set!\e[0m"
          echo "If you are on Linux, you SHOULD follow the instructions below to set "
          echo "AIRFLOW_UID environment variable, otherwise files will be owned by root."
          echo "For other operating systems you can get rid of the warning with manually created .env file:"
          echo "    See: https://airflow.apache.org/docs/apache-airflow/stable/howto/docker-compose/index.html#setting-the-right-airflow-user"
          echo
          export AIRFLOW_UID=$$(id -u)
        fi
        one_meg=1048576
        mem_available=$$(($$(getconf _PHYS_PAGES) * $$(getconf PAGE_SIZE) / one_meg))
        cpus_available=$$(grep -cE 'cpu[0-9]+' /proc/stat)
        disk_available=$$(df / | tail -1 | awk '{print $$4}')
        warning_resources="false"
        if (( mem_available < 4000 )) ; then
          echo
          echo -e "\033[1;33mWARNING!!!: Not enough memory available for Docker.\e[0m"
          echo "At least 4GB of memory required. You have $$(numfmt --to iec $$((mem_available * one_meg)))"
          echo
          warning_resources="true"
        fi
        if (( cpus_available < 2 )); then
          echo
          echo -e "\033[1;33mWARNING!!!: Not enough CPUS available for Docker.\e[0m"
          echo "At least 2 CPUs recommended. You have $${cpus_available}"
          echo
          warning_resources="true"
        fi
        if (( disk_available < one_meg * 10 )); then
          echo
          echo -e "\033[1;33mWARNING!!!: Not enough Disk space available for Docker.\e[0m"
          echo "At least 10 GBs recommended. You have $$(numfmt --to iec
$$((disk_available * 1024 )))"
          echo
          warning_resources="true"
        fi
        if [[ $${warning_resources} == "true" ]]; then
          echo
          echo -e "\033[1;33mWARNING!!!: You have not enough resources to
run Airflow (see above)!\e[0m"
          echo "Please follow the instructions to increase amount of
resources available:"
          echo "
https://airflow.apache.org/docs/apache-airflow/stable/howto/docker-compose
/index.html#before-you-begin"
          echo
        fi
        echo
        echo "Creating missing opt dirs if missing:"
        echo
        mkdir -v -p /opt/airflow/{logs,dags,plugins,config}
        echo
        echo "Airflow version:"
        /entrypoint airflow version
        echo
        echo "Files in shared volumes:"
        echo
        ls -la /opt/airflow/{logs,dags,plugins,config}
        echo
        echo "Running airflow config list to create default config file if
missing."
        echo
        /entrypoint airflow config list >/dev/null
        echo
        echo "Files in shared volumes:"
        echo
        ls -la /opt/airflow/{logs,dags,plugins,config}
        echo
        echo "Change ownership of files in /opt/airflow to
${AIRFLOW_UID}:0"
        echo
        chown -R "${AIRFLOW_UID}:0" /opt/airflow/
        echo
        echo "Change ownership of files in shared volumes to
${AIRFLOW_UID}:0"
        echo
        chown -v -R "${AIRFLOW_UID}:0"
/opt/airflow/{logs,dags,plugins,config}
```

```
        echo
        echo "Files in shared volumes:"
        echo
        ls -la /opt/airflow/{logs,dags,plugins,config}
```

```
    # yamllint enable rule:line-length
    environment:
      <<: *airflow-common-env
      _AIRFLOW_DB_MIGRATE: 'true'
      _AIRFLOW_WWW_USER_CREATE: 'true'
      _AIRFLOW_WWW_USER_USERNAME: ${_AIRFLOW_WWW_USER_USERNAME:-airflow}
      _AIRFLOW_WWW_USER_PASSWORD: ${_AIRFLOW_WWW_USER_PASSWORD:-airflow}
      _PIP_ADDITIONAL_REQUIREMENTS: ''
    user: "0:0"
  airflow-cli:
    <<: *airflow-common
    profiles:
      - debug
    environment:
      <<: *airflow-common-env
      CONNECTION_CHECK_MAX_COUNT: "0"
    # Workaround for entrypoint issue. See: https://github.com/apache/airflow/issues/16252
    command:
      - bash
      - -c
      - airflow
    depends_on:
      <<: *airflow-common-depends-on
  # You can enable flower by adding "--profile flower" option e.g. docker-compose --profile flower up
  # or by explicitly targeted on the command line e.g. docker-compose up flower.
  # See: https://docs.docker.com/compose/profiles/
  flower:
    <<: *airflow-common
    command: celery flower
    profiles:
      - flower
    ports:
      - "5555:5555"
    healthcheck:
      test: ["CMD", "curl", "--fail", "http://localhost:5555/"]
      interval: 30s
      timeout: 10s
      retries: 5
      start_period: 30s
```

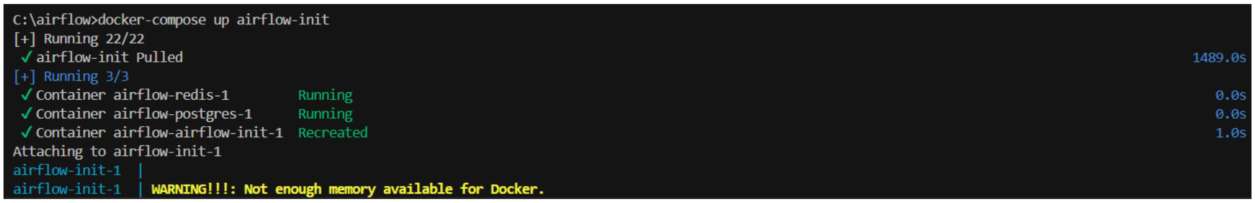


```
    restart: always
    depends_on:
      <<: *airflow-common-depends-on
      airflow-init:
        condition: service_completed_successfully
volumes:
  postgres-db-volume:
```

5. Initialize Airflow

Before starting Airflow, initialize the database:

docker-compose up airflow-init

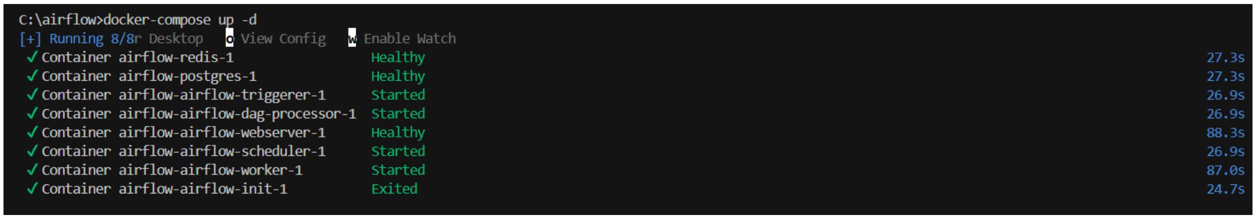


```
C:\airflow>docker-compose up airflow-init
[+] Running 22/22
 ✓airflow-init Pulled                                                                               1489.0s
[+] Running 3/3
 ✓Container airflow-redis-1         Running                                                             0.0s
 ✓Container airflow-postgres-1      Running                                                             0.0s
 ✓Container airflow-airflow-init-1  Recreated                                                           1.0s
Attaching to airflow-init-1
airflow-init-1  |
airflow-init-1  | WARNING!!!: Not enough memory available for Docker.
```

6. Start Airflow

Run containers in the background:

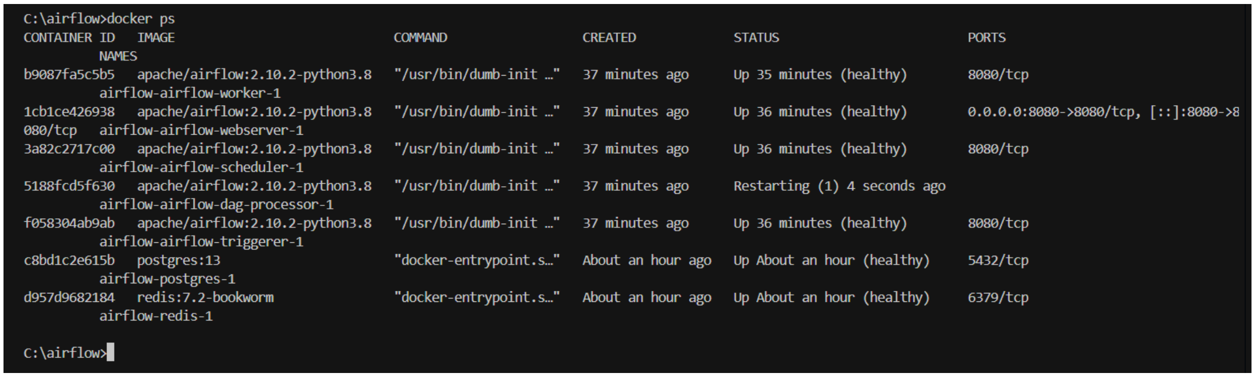
docker-compose up -d



```
C:\airflow>docker-compose up -d
[+] Running 8/8r Desktop   o View Config   w Enable Watch
 ✓Container airflow-redis-1                   Healthy                                               27.3s
 ✓Container airflow-postgres-1                Healthy                                               27.3s
 ✓Container airflow-airflow-triggerer-1       Started                                               26.9s
 ✓Container airflow-airflow-dag-processor-1   Started                                               26.9s
 ✓Container airflow-airflow-webserver-1       Healthy                                               88.3s
 ✓Container airflow-airflow-scheduler-1       Started                                               26.9s
 ✓Container airflow-airflow-worker-1          Started                                               87.0s
 ✓Container airflow-airflow-init-1            Exited                                                24.7s
```

Check status:

docker ps



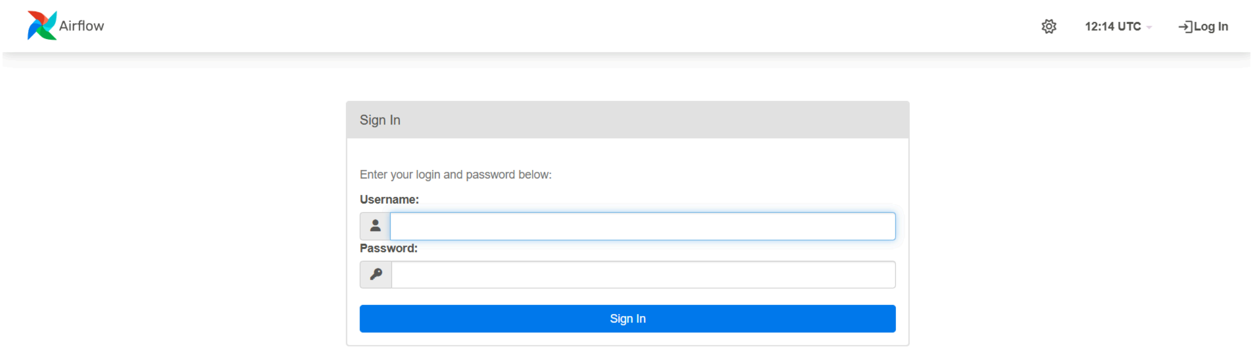
```
C:\airflow>docker ps
CONTAINER ID   IMAGE                             COMMAND                  CREATED             STATUS                         PORTS
          NAMES
b9087fa5c5b5   apache/airflow:2.10.2-python3.8   "/usr/bin/dumb-init …"   37 minutes ago      Up 35 minutes (healthy)        8080/tcp
          airflow-airflow-worker-1
1cb1ce426938   apache/airflow:2.10.2-python3.8   "/usr/bin/dumb-init …"   37 minutes ago      Up 36 minutes (healthy)        0.0.0.0:8080->8080/tcp, [::]:8080->8
080/tcp   airflow-airflow-webserver-1
3a82c2717c00   apache/airflow:2.10.2-python3.8   "/usr/bin/dumb-init …"   37 minutes ago      Up 36 minutes (healthy)        8080/tcp
          airflow-airflow-scheduler-1
5188fcd5f630   apache/airflow:2.10.2-python3.8   "/usr/bin/dumb-init …"   37 minutes ago      Restarting (1) 4 seconds ago
          airflow-airflow-dag-processor-1
f058304ab9ab   apache/airflow:2.10.2-python3.8   "/usr/bin/dumb-init …"   37 minutes ago      Up 36 minutes (healthy)        8080/tcp
          airflow-airflow-triggerer-1
c8bd1c2e615b   postgres:13                       "docker-entrypoint.s…"   About an hour ago   Up About an hour (healthy)     5432/tcp
          airflow-postgres-1
d957d9682184   redis:7.2-bookworm                "docker-entrypoint.s…"   About an hour ago   Up About an hour (healthy)     6379/tcp
          airflow-redis-1

C:\airflow>
```

You should see containers for webserver, scheduler, worker, etc.

7. Access Airflow UI

Open browser and go to:
http://localhost:8080



Sign In

Enter your login and password below:

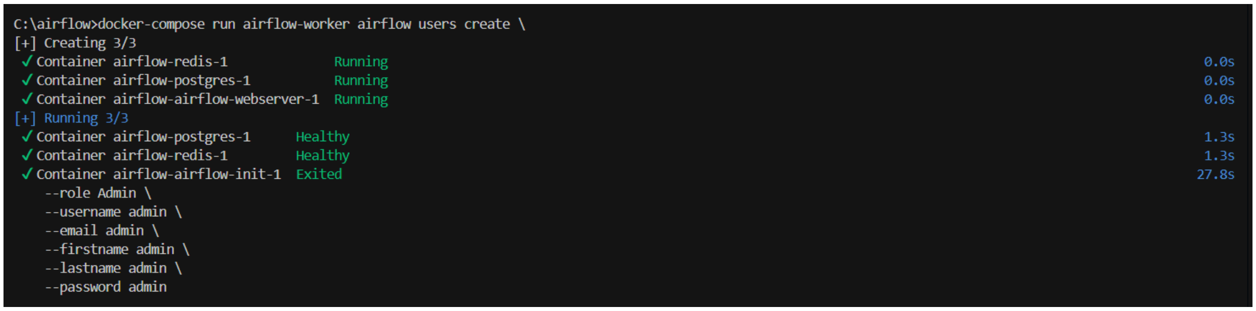
Username:

Password:

8. Create Admin User

Run the following command to create an **Admin user**:

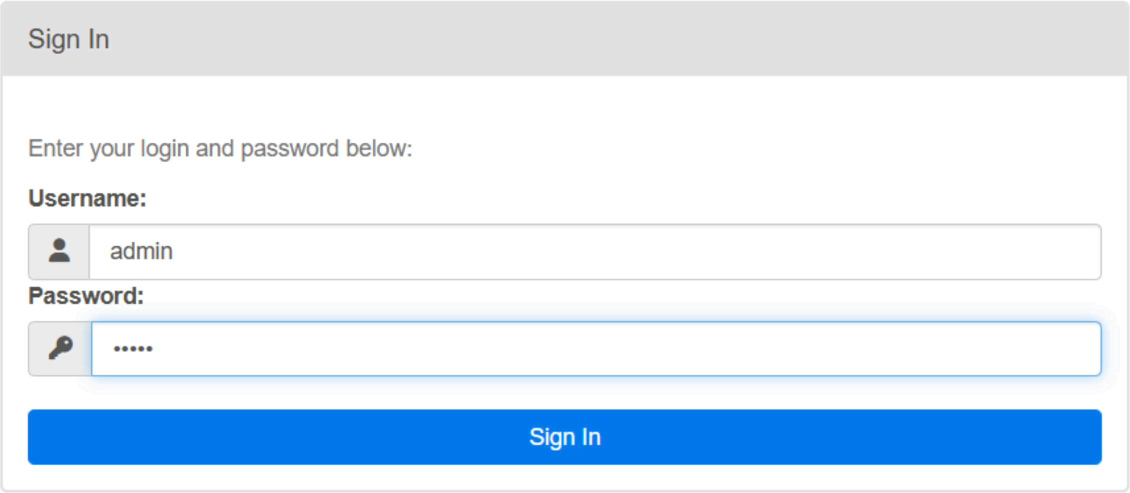
docker-compose run airflow-worker airflow users create \
    --role Admin \
    --username admin \
    --email admin \
    --firstname admin \
    --lastname admin \
    --password admin



```
C:\airflow>docker-compose run airflow-worker airflow users create \
[+] Creating 3/3
 ✓Container airflow-redis-1            Running                                                          0.0s
 ✓Container airflow-postgres-1         Running                                                          0.0s
 ✓Container airflow-airflow-webserver-1  Running                                                        0.0s
[+] Running 3/3
 ✓Container airflow-postgres-1      Healthy                                                             1.3s
 ✓Container airflow-redis-1         Healthy                                                             1.3s
 ✓Container airflow-airflow-init-1  Exited                                                             27.8s
    --role Admin \
    --username admin \
    --email admin \
    --firstname admin \
    --lastname admin \
    --password admin
```

Now login at http://localhost:8080 with:

- **Username**: admin
- **Password**: admin

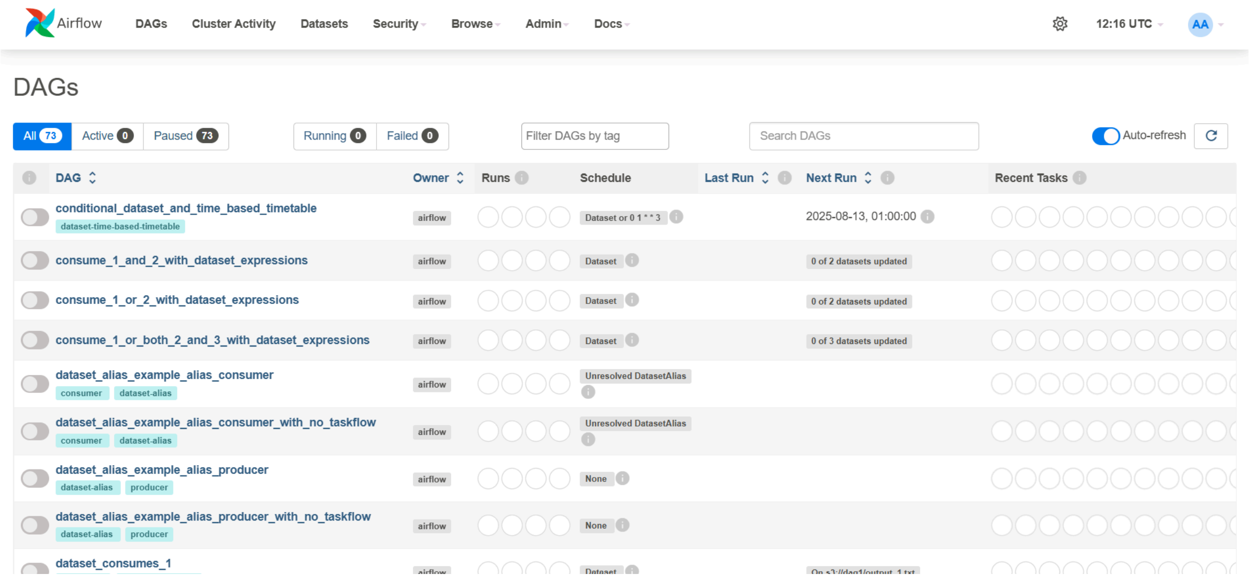


Sign In

Enter your login and password below:

Username: admin

Password: •••••



DAGs

All 73 | Active 0 | Paused 73 | Running 0 | Failed 0 | Filter DAGs by tag | Search DAGs | Auto-refresh

DAG	Owner	Runs	Schedule	Last Run	Next Run	Recent Tasks
conditional_dataset_and_time_based_timetable dataset-time-based-timetable	airflow		Dataset or 0 1 * * 3		2025-08-13, 01:00:00	
consume_1_and_2_with_dataset_expressions	airflow		Dataset		0 of 2 datasets updated	
consume_1_or_2_with_dataset_expressions	airflow		Dataset		0 of 2 datasets updated	
consume_1_or_both_2_and_3_with_dataset_expressions	airflow		Dataset		0 of 3 datasets updated	
dataset_alias_example_alias_consumer consumer dataset-alias	airflow		Unresolved DatasetAlias			
dataset_alias_example_alias_consumer_with_no_taskflow consumer dataset-alias	airflow		Unresolved DatasetAlias			
dataset_alias_example_alias_producer dataset-alias producer	airflow		None			
dataset_alias_example_alias_producer_with_no_taskflow dataset-alias producer	airflow		None			
dataset_consumes_1	airflow		Dataset		On s3://dag1/output_1.txt	