Using Azurite to Run Blob Storage Tests in a Pipeline

This document determines the approach for writing automated tests with a short feedback loop (i.e. unit tests) against security considerations (private endpoints) for the Azure Blob Storage functionality.

Once private endpoints are enabled for the Azure Storage accounts, the current tests will fail when executed locally or as part of a pipeline because this connection will be blocked.

Utilize an Azure Storage Emulator - Azurite

To emulate a local Azure Blob Storage, we can use Azure Storage Emulator. The Storage Emulator currently runs only on Windows. If you need a Storage Emulator for Linux, one option is the community maintained, open-source Storage Emulator Azurite.

> *The Azure Storage Emulator is no longer being actively developed.* ***Azurite*** *is the Storage Emulator platform going forward. Azurite supersedes the Azure Storage Emulator. Azurite will continue to be updated to support the latest versions of Azure Storage APIs. For more information, see* ***Use the Azurite emulator for local Azure Storage development***.

Some differences in functionality exist between the Storage Emulator and Azure storage services. For more information about these differences, see the Differences between the Storage Emulator and Azure Storage.

There are several ways to install and run Azurite on your local system as listed here. In this document we will cover `Install and run Azurite using NPM` and `Install and run the Azurite Docker image`.

1. Install and Run Azurite

a. Using NPM

In order to run Azurite V3 you need Node.js >= 8.0 installed on your system. Azurite works cross-platform on Windows, Linux, and OS X.

After the Node.js installation, you can install Azurite simply with npm which is the Node.js package management tool included with every Node.js installation.

```
# Install Azurite
npm install -g azurite

# Create azurite directory
mkdir c:/azurite

# Launch Azurite for Windows
azurite --silent --location c:\azurite --debug c:\azurite\debug.log
```

If you want to avoid any disk persistence and destroy the test data when the Azurite process terminates, you can pass the `--inMemoryPersistence` option, as of Azurite 3.28.0.

The output will be:

```
Azurite Blob service is starting at http://127.0.0.1:10000
Azurite Blob service is successfully listening at http://127.0.0.1:10000
Azurite Queue service is starting at http://127.0.0.1:10001
Azurite Queue service is successfully listening at http://127.0.0.1:10001
```

b. Using a Docker Image

Another way to run Azurite is using docker, using default `HTTP` endpoint

```
docker run -p 10000:10000 mcr.microsoft.com/azure-storage/azurite azurite-blob --
blobHost 0.0.0.0
```

Docker Compose is another option and can run the same docker image using the `docker-compose.yml` file below.

```
version: '3.4'
services:
  azurite:
    image: mcr.microsoft.com/azure-storage/azurite
    hostname: azurite
    volumes:
      - ./cert/azurite:/data
    command: "azurite-blob --blobHost 0.0.0.0 -l /data --cert /data/127.0.0.1.pem
--key /data/127.0.0.1-key.pem --oauth basic"
    ports:
      - "10000:10000"
      - "10001:10001"
```

2. Run Tests on Your Local Machine

Python 3.8.7 is used for this, but it should be fine on other 3.x versions as well.

1. Install and run Azurite for local tests:

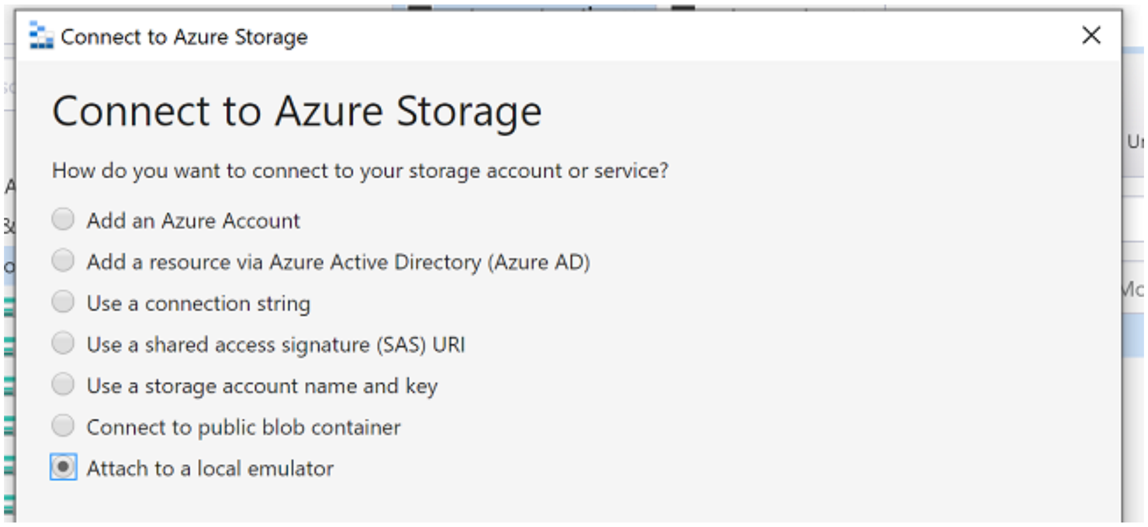
   Option 1: using npm:

   ```
   # Install Azurite
   npm install -g azurite
   # Create azurite directory
   mkdir c:/azurite
   # Launch Azurite for Windows
   azurite --silent --location c:\azurite --debug c:\azurite\debug.log
   ```

   Option 2: using docker

   ```
   docker run -p 10000:10000 mcr.microsoft.com/azure-storage/azurite azurite-blob
   --blobHost 0.0.0.0
   ```

2. In Azure Storage Explorer, select `Attach to a local emulator`

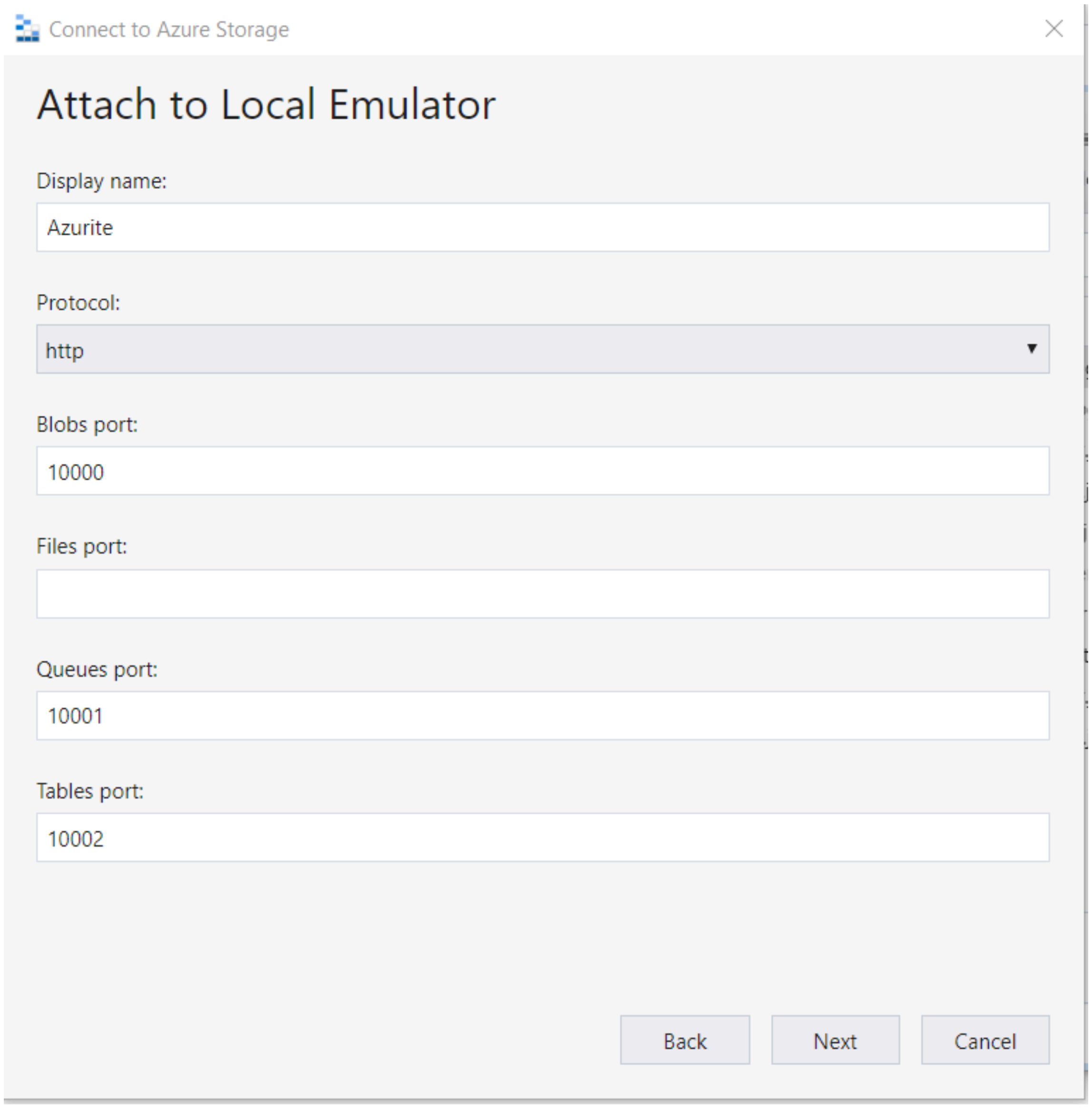
   

   Connect to Azure Storage

   How do you want to connect to your storage account or service?

   - Add an Azure Account
   - Add a resource via Azure Active Directory (Azure AD)
   - Use a connection string
   - Use a shared access signature (SAS) URI
   - Use a storage account name and key
   - Connect to public blob container
   - [✓ Attach to a local emulator]

3. Provide a Display name and port number, then your connection will be ready, and you can use Storage Explorer to manage your local blob storage.



Attach to Local Emulator

Display name: Azurite

Protocol: http

Blobs port: 10000

Files port:

Queues port: 10001

Tables port: 10002

To test and see how these endpoints are running you can attach your local blob storage to the **Azure Storage Explorer**.

4. Create a virtual python environment `python -m venv .venv`
5. Container name and initialize env variables: Use conftest.py for test integration.

```
from azure.storage.blob import BlobServiceClient
import os

def pytest_generate_tests(metafunc):
   os.environ['STORAGE_CONNECTION_STRING'] =
'DefaultEndpointsProtocol=http;AccountName=devstoreaccount1;AccountKey=Eby8vdM02
   os.environ['STORAGE_CONTAINER'] = 'test-container'

   # Crete container for Azurite for the first run
```

```
    blob_service_client =
BlobServiceClient.from_connection_string(os.environ.get("STORAGE_CONNECTION_STRI
    try:

blob_service_client.create_container(os.environ.get("STORAGE_CONTAINER"))
    except Exception as e:
        print(e)
```

**Note: value for `STORAGE_CONNECTION_STRING` is default value for Azurite, it's not a private key*

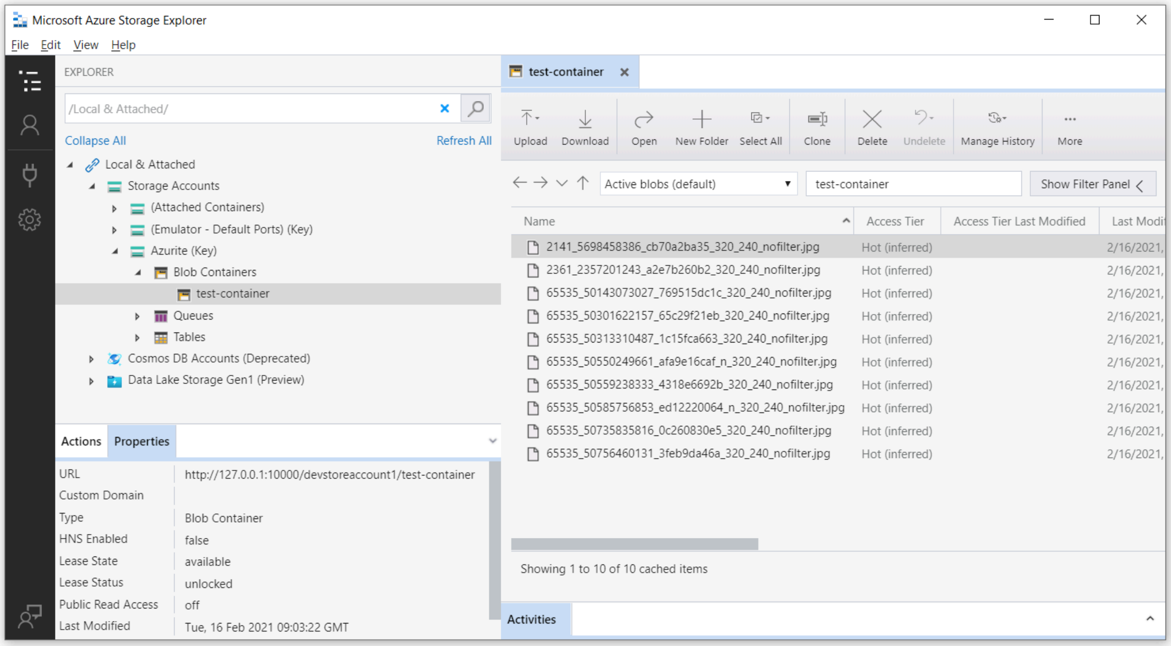
6. Install the dependencies

   `pip install -r requirements_tests.txt`

7. Run tests:

```
python -m pytest ./tests
```

After running tests, you can see the files in your local blob storage



/Local & Attached/

- Local & Attached
  - Storage Accounts
    - (Attached Containers)
    - (Emulator - Default Ports) (Key)
    - Azurite (Key)
      - Blob Containers
        - test-container
      - Queues
      - Tables
  - Cosmos DB Accounts (Deprecated)
  - Data Lake Storage Gen1 (Preview)

test-container

Active blobs (default) | test-container

Name	Access Tier	Access Tier Last Modified	Last Modi
2141_5698458386_cb70a2ba35_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
2361_2357201243_a2e7b260b2_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50143073027_769515dc1c_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50301622157_65c29f21eb_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50313310487_1c15fca663_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50550249661_afa9e16caf_n_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50559238333_4318e6692b_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50585756853_ed12220064_n_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50735835816_0c260830e5_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,
65535_50756460131_3feb9da46a_320_240_nofilter.jpg	Hot (inferred)		2/16/2021,

Showing 1 to 10 of 10 cached items

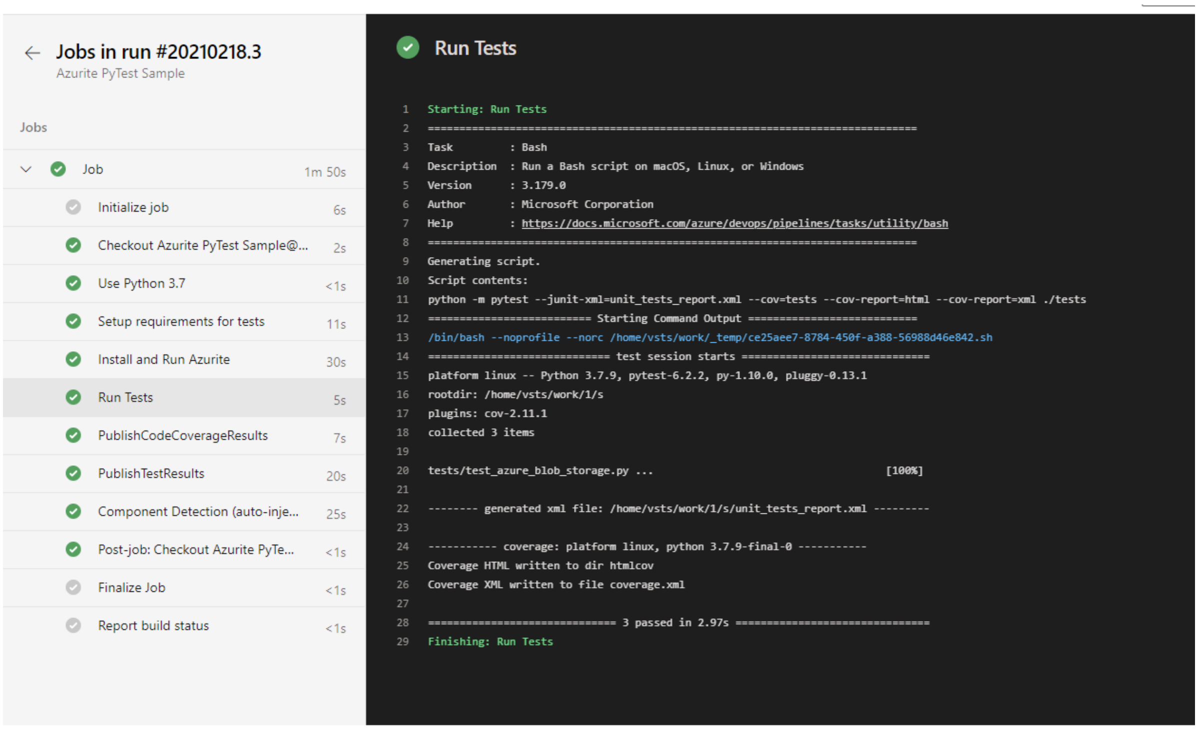
URL	http://127.0.0.1:10000/devstoreaccount1/test-container
Custom Domain	
Type	Blob Container
HNS Enabled	false
Lease State	available
Lease Status	unlocked
Public Read Access	off
Last Modified	Tue, 16 Feb 2021 09:03:22 GMT

3. Run Tests on Azure Pipelines

After running tests locally we need to make sure these tests pass on Azure Pipelines too. We have 2 options here, we can use docker image as hosted agent on Azure or install an npm package in the Pipeline steps.

```yaml
trigger:
- master

steps:
- task: UsePythonVersion@0
  displayName: 'Use Python 3.7'
  inputs:
    versionSpec: 3.7

- bash: |
    pip install -r requirements_tests.txt
  displayName: 'Setup requirements for tests'

- bash: |
    sudo npm install -g azurite
    sudo mkdir azurite
    sudo azurite --silent --location azurite --debug azurite\debug.log &
  displayName: 'Install and Run Azurite'

- bash: |
    python -m pytest --junit-xml=unit_tests_report.xml --cov=tests --cov-
report=html --cov-report=xml ./tests
  displayName: 'Run Tests'

- task: PublishCodeCoverageResults@1
  inputs:
    codeCoverageTool: Cobertura
    summaryFileLocation: '$(System.DefaultWorkingDirectory)/**/coverage.xml'
    reportDirectory: '$(System.DefaultWorkingDirectory)/**/htmlcov'

- task: PublishTestResults@2
  inputs:
    testResultsFormat: 'JUnit'
    testResultsFiles: '**/*_tests_report.xml'
    failTaskOnFailedTests: true
```

Once we set up our pipeline in Azure Pipelines, result will be like below



Jobs in run #20210218.3
Azurite PyTest Sample

Jobs

Job	1m 50s
Initialize job	6s
Checkout Azurite PyTest Sample@...	2s
Use Python 3.7	<1s
Setup requirements for tests	11s
Install and Run Azurite	30s
Run Tests	5s
PublishCodeCoverageResults	7s
PublishTestResults	20s
Component Detection (auto-inje...	25s
Post-job: Checkout Azurite PyTe...	<1s
Finalize Job	<1s
Report build status	<1s

Run Tests

```
Starting: Run Tests
==============================================================================
Task         : Bash
Description  : Run a Bash script on macOS, Linux, or Windows
Version      : 3.179.0
Author       : Microsoft Corporation
Help         : https://docs.microsoft.com/azure/devops/pipelines/tasks/utility/bash
==============================================================================
Generating script.
Script contents:
python -m pytest --junit-xml=unit_tests_report.xml --cov=tests --cov-report=html --cov-report=xml ./tests
========================== Starting Command Output ===========================
/bin/bash --noprofile --norc /home/vsts/work/_temp/ce25aee7-8784-450f-a388-56988d46e842.sh
============================= test session starts ==============================
platform linux -- Python 3.7.9, pytest-6.2.2, py-1.10.0, pluggy-0.13.1
rootdir: /home/vsts/work/1/s
plugins: cov-2.11.1
collected 3 items

tests/test_azure_blob_storage.py ...                                     [100%]

-------- generated xml file: /home/vsts/work/1/s/unit_tests_report.xml ---------

---------- coverage: platform linux, python 3.7.9-final-0 -----------
Coverage HTML written to dir htmlcov
Coverage XML written to file coverage.xml

============================== 3 passed in 2.97s ===============================
Finishing: Run Tests
```

Last update: August 26, 2024