

CLOUD COMPUTING SYSTEMS

Lab 2

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GOAL

In the end of this lab you should be able to:

- Create a StorageAccount + Blob Container @ Azure;
- Complete the MediaResource, by storing data at Azure Blob Storage
- Testing web apps

GOAL

In the end of this lab you should be able to:

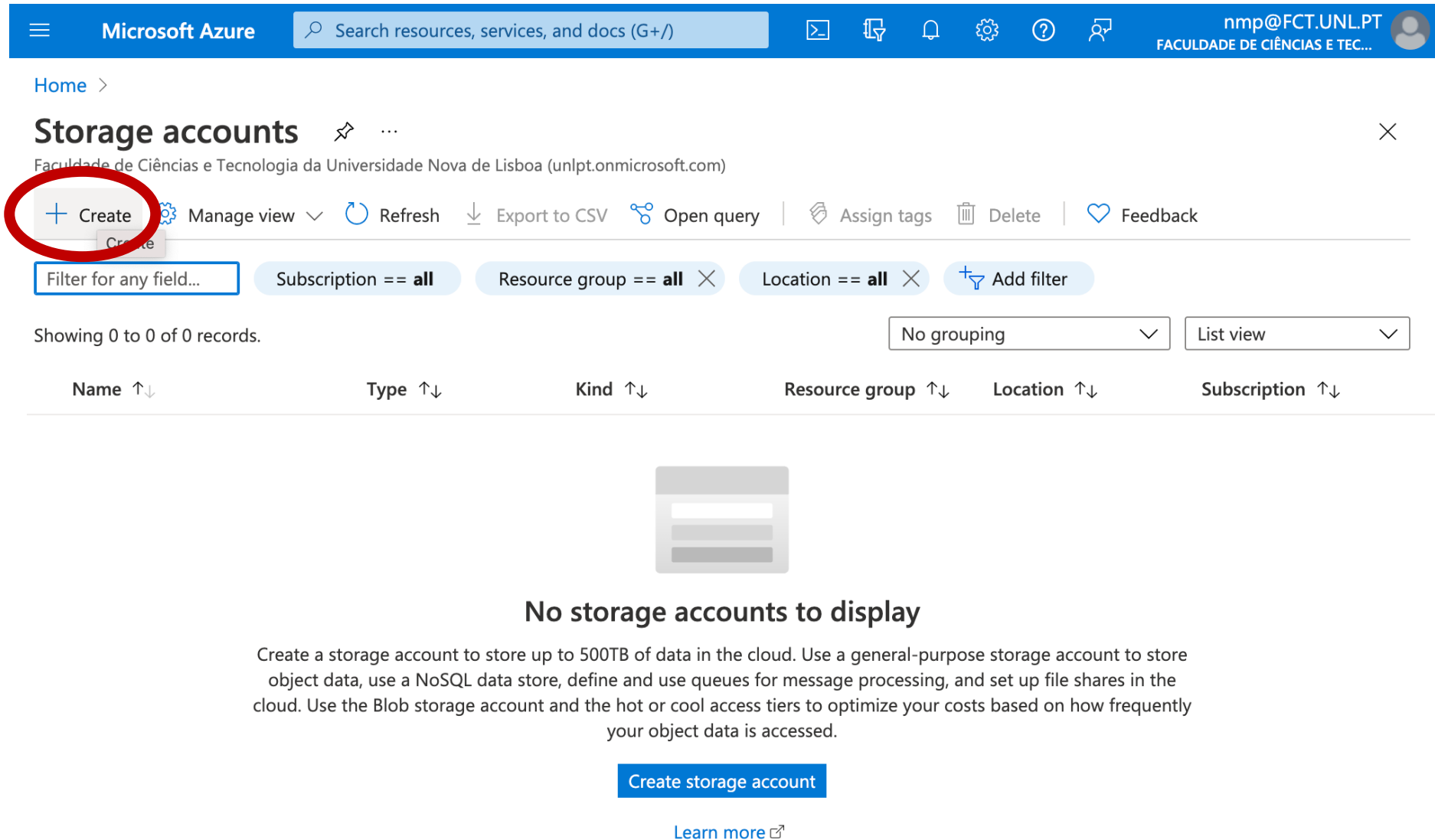
- **Create a StorageAccount + Blob Container @ Azure;**
- Complete the MediaResource, by storing data at Azure Blob Storage
- Testing web apps

CREATE STORAGE ACCOUNT (1)

The screenshot shows the Azure portal interface. On the left sidebar, the 'Storage accounts' option is highlighted with a red circle. A context menu is open over this option, displaying the 'Storage accounts' title and two actions: 'Create' (with a plus icon) and 'View' (with an eye icon). The main area of the portal shows a search bar at the top, a grid of service tiles (Sources, Subscriptions, Azure Cache for Redis, Azure Databricks, Front Doors, HDInsight clusters), and a table with columns 'Type' and 'Last Viewed'. The table contains three rows of data.

Type	Last Viewed
Subscription	a week ago
	11 months ago
	11 months ago

CREATE STORAGE ACCOUNT (2)



Microsoft Azure

Search resources, services, and docs (G+)

nmp@FCT.UNL.PT
FACULDADE DE CIÊNCIAS E TEC...

Home >

Storage accounts

Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa (unlpt.onmicrosoft.com)

+ Create Manage view Refresh Export to CSV Open query Assign tags Delete Feedback

Filter for any field... Subscription == all Resource group == all Location == all Add filter

Showing 0 to 0 of 0 records.

No grouping List view

Name ↑↓	Type ↑↓	Kind ↑↓	Resource group ↑↓	Location ↑↓	Subscription ↑↓
<div>No storage accounts to display</div> <p>Create a storage account to store up to 500TB of data in the cloud. Use a general-purpose storage account to store object data, use a NoSQL data store, define and use queues for message processing, and set up file shares in the cloud. Use the Blob storage account and the hot or cool access tiers to optimize your costs based on how frequently your object data is accessed.</p> <div>Create storage account</div> <div>Learn more</div>					

CREATE STORAGE ACCOUNT (3)

Microsoft Azure

Search resources, services, and docs (G+/)

Home > Storage accounts >

Create a storage account

Basics Advanced Networking Data protection Tags Review + create

Subscription * Azure para Estudantes

Resource group * scc-backend-rg-4204 [Create new](#)

Instance details

If you need to create a legacy storage account type, please click [here](#).

Storage account name ⓘ * scc2122

Region ⓘ * (Europe) West Europe

Performance ⓘ *

☒ **Standard:** Recommended for most scenarios (general-purpose v2 account)


☐ **Premium:** Recommended for scenarios that require low latency.

Redundancy ⓘ * Locally-redundant storage (LRS)

[Review + create](#) [< Previous](#) [Next : Advanced >](#)

Check lecture 2 for info on these options.


CREATE STORAGE ACCOUNT (4)

 Microsoft Azure

Home > Storage accounts >

Create a storage account ...

Basics Advanced Networking Data protection Tags Review + create

 Certain options have been disabled by default due to the combination of storage account performance, redundancy, and region.

Recovery

Protect your data from accidental or erroneous deletion or modification.

☐ Enable point-in-time restore for containers

Use point-in-time restore to restore one or more containers to an earlier state. If point-in-time restore is enabled, then versioning, change feed, and blob soft delete must also be enabled. [Learn more](#)

☐ Enable soft delete for blobs

Soft delete enables you to recover blobs that were previously marked for deletion, including blobs that were overwritten. [Learn more](#)

☐ Enable soft delete for containers

Soft delete enables you to recover containers that were previously marked for deletion. [Learn more](#)

☐ Enable soft delete for file shares

Soft delete enables you to recover file shares that were previously marked for deletion. [Learn more](#)

Tracking

Manage versions and keep track of changes made to your blob data.

Review + create

< Previous

Next : Tags >

We will not need nothing of this...

CREATE STORAGE ACCOUNT (5)

The screenshot displays the Microsoft Azure portal interface. At the top, the header bar includes the 'Microsoft Azure' logo, a search bar with the placeholder 'Search resources, services, and docs (G+)', and a user profile icon. Below the header, the breadcrumb 'Home >' is visible. The main content area is titled 'scc2122_1633432927635 | Overview' with a 'Deployment' subtitle. A left-hand navigation pane lists 'Overview' (selected), 'Inputs', 'Outputs', and 'Template'. Above the main content, there is a search bar and a set of action buttons: 'Delete', 'Cancel', 'Redeploy', and 'Refresh'. A feedback banner reads 'We'd love your feedback!'. The central message states 'Your deployment is complete' with a green checkmark icon. Below this, deployment details are listed: 'Deployment name: scc2122_1633432927635', 'Subscription: Azure para Estudantes', 'Resource group: scc-backend-rg-4204', 'Start time: 10/5/2021, 12:22:09 PM', and 'Correlation ID: 0fa4f147-e702-446f-a6d4-0ae0e4d7f436'. There are expandable sections for 'Deployment details (Download)' and 'Next steps'. A blue button labeled 'Go to resource' is positioned below the 'Next steps' section. At the bottom, a 'Security Center' tile with a shield icon encourages securing apps and infrastructure, with a link to 'Go to Azure security center >'. The footer of the page contains the text 'Cloud Computing System 22/23 – Nuno Preguiça – DI/FCT/NOVA / 8'.

Microsoft Azure

Search resources, services, and docs (G+)

Home >

scc2122_1633432927635 | Overview

Deployment

Search (Cmd+/)

Delete Cancel Redeploy Refresh

We'd love your feedback! →

✓ Your deployment is complete

Deployment name: scc2122_1633432927635
Subscription: [Azure para Estudantes](#)
Resource group: [scc-backend-rg-4204](#)
Start time: 10/5/2021, 12:22:09 PM
Correlation ID: 0fa4f147-e702-446f-a6d4-0ae0e4d7f436

Deployment details ([Download](#))

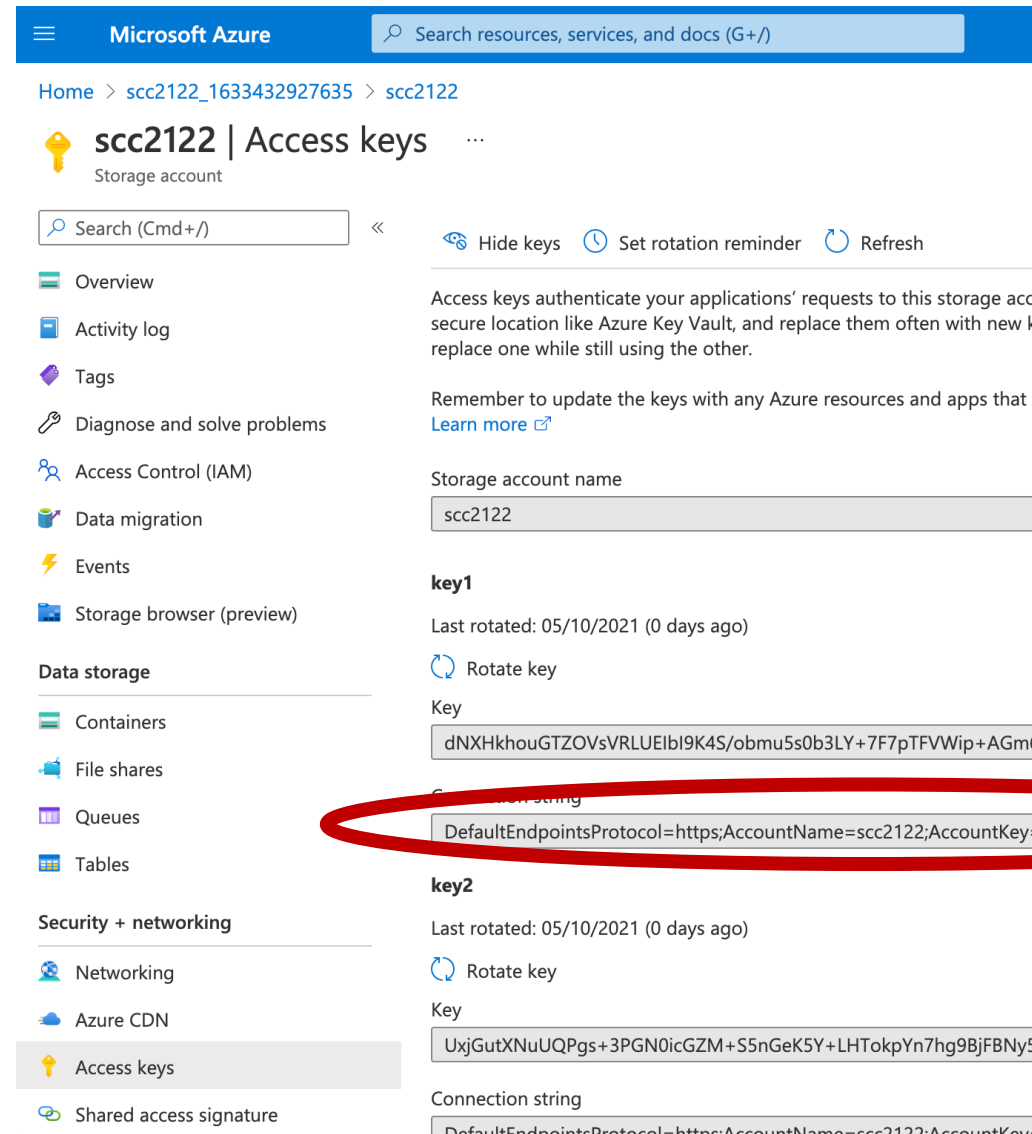
Next steps

[Go to resource](#)

Security Center
Secure your apps and infrastructure
[Go to Azure security center >](#)

Cloud Computing System 22/23 – Nuno Preguiça – DI/FCT/NOVA / 8

STORAGE ACCOUNT: ACCESS KEYS (FOR CODE)



Microsoft Azure

Search resources, services, and docs (G+)

Home > scc2122_1633432927635 > scc2122

scc2122 | Access keys

Storage account

Search (Cmd+)

Hide keys Set rotation reminder Refresh

Access keys authenticate your applications' requests to this storage account from a secure location like Azure Key Vault, and replace them often with new keys to replace one while still using the other.

Remember to update the keys with any Azure resources and apps that use the keys. [Learn more](#)

Storage account name

scc2122

key1

Last rotated: 05/10/2021 (0 days ago)

Rotate key

Key

dNXHkhouGTZOVsVRLUEIbI9K4S/obmu5s0b3LY+7F7pTFVWip+AGm6

Connection string

DefaultEndpointsProtocol=https;AccountName=scc2122;AccountKey=

key2

Last rotated: 05/10/2021 (0 days ago)

Rotate key

Key

UxjGutXNuUQPgs+3PGN0icGZM+S5nGeK5Y+LHTokpYn7hg9BjFBNy5

Connection string

DefaultEndpointsProtocol=https;AccountName=scc2122;AccountKey=

Overview

Activity log

Tags

Diagnose and solve problems

Access Control (IAM)

Data migration

Events

Storage browser (preview)

Data storage

Containers

File shares

Queues

Tables

Security + networking

Networking

Azure CDN

Access keys

Shared access signature

CREATE BLOB STORAGE CONTAINER (1)

The screenshot displays the Microsoft Azure portal interface for a storage account named 'sc2021'. The left sidebar contains navigation options: Overview, Activity log, Tags, Diagnose and solve problems, Access Control (IAM), Data transfer, Events, Storage Explorer (preview), Settings, Access keys, Geo-replication, CORS, Configuration, Encryption, Shared access signature, and Firewalls and virtual networks. The main content area shows the 'Essentials' section with details about the resource group, status, location, subscription, and tags. Below this, there are three cards: 'Containers' (highlighted with a red circle), 'File shares', and 'Tables'. The 'Containers' card describes it as 'Scalable, cost-effective storage for unstructured data' and includes a 'Learn more' link. The 'File shares' card describes it as 'Serverless SMB and NFS file shares' and includes a 'Learn more' link. The 'Tables' card describes it as 'Tabular data storage' and includes a 'Learn more' link. A notification banner at the top right states: 'Classic alerts in Azure Monitor is announced to retire in 2021, it is recommended that you upgrade your classic alert rules to retain alerting functionality with the new alerting platform. For more information, see Continue alerting with ARM storage accounts.'

Microsoft Azure

Search resources, services, and docs (G+)

Home > Microsoft.StorageAccount-20201006214246 >

sc2021
Storage account

Search (Cmd+/) << Open in Explorer → Move ↕ Refresh | Delete | Feedback

Overview

Activity log

Tags

Diagnose and solve problems

Access Control (IAM)

Data transfer

Events

Storage Explorer (preview)

Settings

Access keys

Geo-replication

CORS

Configuration

Encryption

Shared access signature

Firewalls and virtual networks

Classic alerts in Azure Monitor is announced to retire in 2021, it is recommended that you upgrade your classic alert rules to retain alerting functionality with the new alerting platform. For more information, see [Continue alerting with ARM storage accounts](#).

Essentials

Resource group (change) : scc-backend-rg-4204

Status : Primary: Available

Location : West Europe

Subscription (change) : Azure para Estudantes

Subscription ID : 83abecdf-8b40-49a0-bcae-b5fba4011353

Tags (change) : [Click here to add tags](#)

Performance/Access tier : Standard/Hot

Replication : Locally-redundant storage (LRS)

Account kind : StorageV2 (general purpose v2)

Containers
Scalable, cost-effective storage for unstructured data
[Learn more](#)

File shares
Serverless SMB and NFS file shares
[Learn more](#)

Tables
Tabular data storage
[Learn more](#)

Queues
Effectively scale apps according to traffic

CREATE BLOB STORAGE CONTAINER (2)

The screenshot shows the Microsoft Azure portal interface. At the top, the navigation bar includes the Microsoft Azure logo, a search bar, and user information (nmp@FCT.UNL.PT). The breadcrumb trail indicates the path: Home > Microsoft.StorageAccount-20201006214246 > sc2021. The main heading is 'sc2021 | Containers', with 'Storage account' below it. A search bar is present. A red circle highlights the '+ Container' button. To the right of this button are links for 'Change access level', 'Restore containers', 'Refresh', and 'Delete'. Below these is a search bar for containers and a toggle for 'Show deleted containers'. A table with columns 'Name', 'Last modified', 'Public access level', and 'Lease state' is shown, containing the message: 'You don't have any containers yet. Click '+ Container' to get started.' The left sidebar lists various options: Overview, Activity log, Tags, Diagnose and solve problems, Access Control (IAM), Data transfer, Events, Storage Explorer (preview), and a Settings section with Access keys, Geo-replication, CORS, and Configuration.

Microsoft Azure

Search resources, services, and docs (G+)

Home > Microsoft.StorageAccount-20201006214246 > sc2021

sc2021 | Containers

Storage account

Search (Cmd+)

+ Container

Change access level

Restore containers

Refresh

Delete

Search containers by prefix

Show deleted containers

Name	Last modified	Public access level	Lease state
You don't have any containers yet. Click '+ Container' to get started.			

Overview

Activity log

Tags

Diagnose and solve problems

Access Control (IAM)

Data transfer

Events

Storage Explorer (preview)

Settings

Access keys

Geo-replication

CORS

Configuration

CREATE BLOB STORAGE CONTAINER (3)

Microsoft Azure

Search resources, services, and docs (G+)

Home > Microsoft.StorageAccount-20201006214246 > sc2021

sc2021 | Containers

Storage account

Search (Cmd+)

« + Container Change access level Restore containers v Refresh | D

Search containers by prefix

Name	Last modified
You don't have any containers yet. Click '+ Container' to get started.	

New container

Name *
images

Public access level ⓘ
Blob (anonymous read access for blobs only) v

Blobs within the container can be read by anonymous request, but container data is not available. Anonymous clients cannot enumerate the blobs within the container.

v Advanced

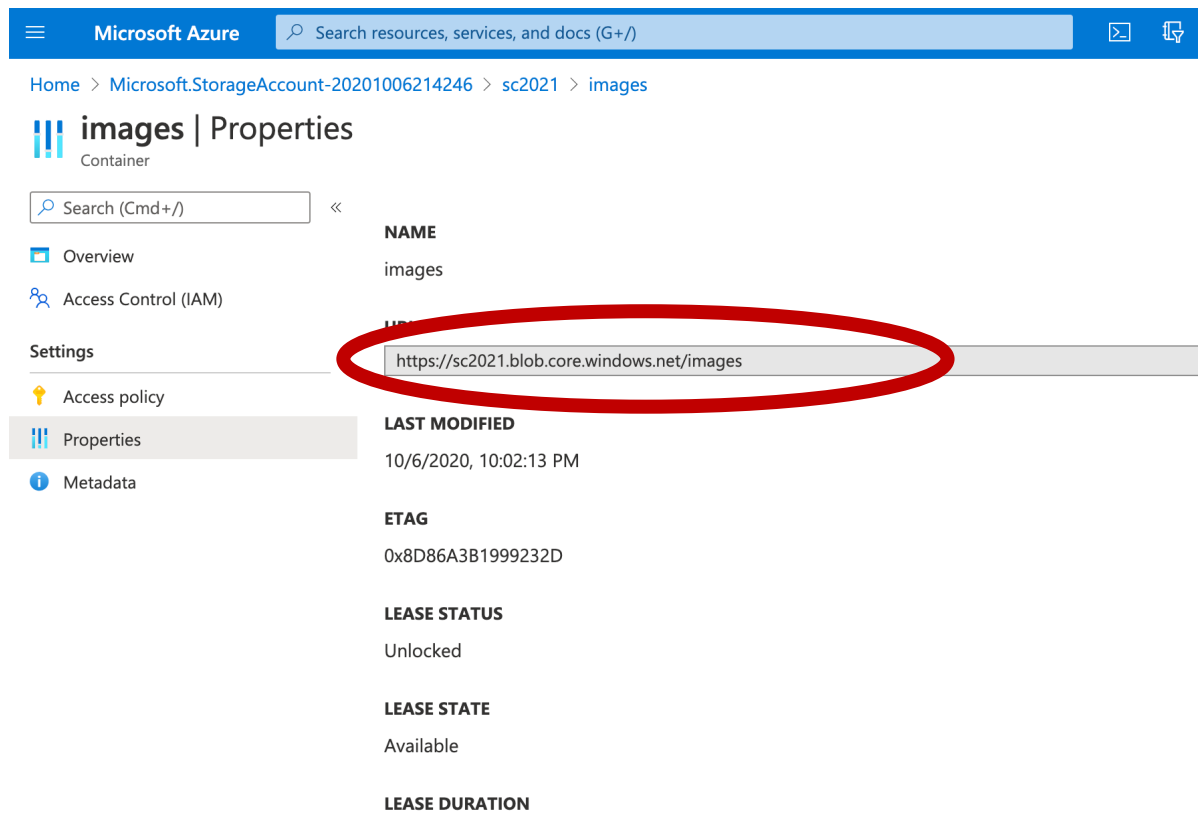
Create Discard

Set anonymous read access for blobs if you plan to allow applications to retrieve blobs directly from Blob Storage.

CONTAINER BASE URL

The base URL allows direct access to the blob by clients.

Try uploading a file (in Azure interface) and downloading it in the browser using this URL.



The screenshot shows the Microsoft Azure portal interface. The breadcrumb navigation at the top indicates the path: Home > Microsoft.StorageAccount-20201006214246 > sc2021 > images. The main heading is 'images | Properties' with a sub-label 'Container'. On the left, there is a sidebar with 'Settings' expanded, showing options like 'Access policy', 'Properties', and 'Metadata'. The 'Properties' section is active, displaying a table of container properties. The 'URL' property is highlighted with a red oval, showing the value 'https://sc2021.blob.core.windows.net/images'. Other properties listed include 'NAME' (images), 'LAST MODIFIED' (10/6/2020, 10:02:13 PM), 'ETAG' (0x8D86A3B1999232D), 'LEASE STATUS' (Unlocked), 'LEASE STATE' (Available), and 'LEASE DURATION' (-).

NAME
images
URL
https://sc2021.blob.core.windows.net/images
LAST MODIFIED
10/6/2020, 10:02:13 PM
ETAG
0x8D86A3B1999232D
LEASE STATUS
Unlocked
LEASE STATE
Available
LEASE DURATION
-

GOAL

In the end of this lab you should be able to:

- Create a StorageAccount + Blob Container @ Azure;
- **Complete the MediaResource, by storing data at Azure Blob Storage**
- Testing web apps

ACCESSING AZURE (BLOB) STORAGE

We will use the library provided by Microsoft.

Java Docs available at:

<https://javadoc.io/doc/com.microsoft.azure/azure-storage-blob/latest/index.html>

Example available at:

<https://docs.microsoft.com/en-us/azure/storage/blobs/storage-quickstart-blobs-java?tabs=powershell>

MAVEN DEPENDENCIES

<dependency>

 <groupId>com.azure</groupId>

 <artifactId>azure-storage-blob</artifactId>

 <version>12.19.1</version>

</dependency>

STEP 1: CREATE CLIENT TO BLOB STORAGE

```
// Get connection string in the storage access keys page
```

```
String storageConnectionString = ...
```

```
// Get container client
```

```
BlobContainerClient containerClient = new BlobContainerClientBuilder()  
    .connectionString(storageConnectionString)  
    .containerName("images")  
    .buildClient();
```

STEP 2: UPLOAD BYTE ARRAY

```
// Get client to blob
```

```
BlobClient blob = containerClient.getBlobClient( filename);
```

```
// Upload contents from BinaryData (check documentation for  
other alternatives)
```

```
// This will throw an exception if blob exists !!
```

```
blob.upload(data);
```

STEP 3: DOWNLOAD TO BYTE ARRAY

```
// Get client to blob
```

```
BlobClient blob = containerClient.getBlobClient(  
filename);
```

```
// Download contents to BinaryData (check documentation  
for other alternatives)
```

```
BinaryData data = blob.downloadContent();
```

```
byte[] arr = data.toBytes();
```

SOME NOTES

- Is it possible to create containers, etc. from the code?

Yes. Check documentation.

We will see that later.

CODE PROVIDED

The code provided (lab2.zip) is a Maven project with a single class that uploads a file to the Blob store (directly).

For testing it in the command line, just run:

```
mvn compile assembly:single
```

to compile and create a single file with all compiled classes and dependencies.

Run the program as follows:

```
java -cp target/scc2223-lab2-1.0-jar-with-dependencies.jar  
scc.utils.UploadToStorage cats.jpeg
```

TO DO

Complete the media resource of lab 1, by storing data on a BLOB storage.

- Test your server with some simple tests.
E.g. use the client provided to upload files; access the contents using your browser (or Postman).

Use the example scripts to benchmark your server.

- Code is on CLIP (lab2-test.zip)

GOAL

In the end of this lab you should be able to:

- Create a StorageAccount + Blob Container @ Azure;
- Complete the MediaResource, by storing data at Azure Blob Storage
- **Testing web apps**

ARTILLERY

<https://artillery.io/docs/guides/overview/welcome.html>

Specific docs for HTTP/REST testing.

<https://artillery.io/docs/guides/guides/http-reference.html>

TEST-IMAGES.YML (1)

config:

target: 'https://scc-backend-4204.azurewebsites.net/rest'

Defines the base URL

plugins:

metrics-by-endpoint: {}

processor: "./test-utils.js"

Specifies the file with auxiliary functions

variables:

metricsProcessEndpoint : "myProcessEndpoint"

phases:

- name: "Warm up"

duration: 10

arrivalRate: 1

rampTo: 5

- name: "Main test"

duration: 20

arrivalRate: 5

Specifies the phases of the tests:

Warm up, for 10 sec, with a new client per second, up to 5 clients.

Main Test, for 20 seconds, with 5 new clients per second.

TEST-IMAGES.YML (2)

scenarios:

- name: 'Upload image'

weight: 1

flow:

- post:

url: "/media"

headers:

Content-Type: application/octet-stream

Accept: application/json

beforeRequest: "uploadImageBody"

afterResponse: "processUploadReply"

Scenarios specify the sequence of operations to be executed.

Weight: relative weight of this scenario in the tests

url, header: to be used in the HTTP request
beforeRequest: function called before the request is performed.
afterResponse: function called after the response is received.

TEST-UTILS.JS (1)

Adds an image to the request body.

```
/** Sets the body to an image, when using images. */  
function uploadImageBody(requestParams, context, ee, next) {  
    requestParams.body = images.sample()  
    return next()  
}
```

Store the result id in a list of image ids.

```
/** Process reply of the download of an image.  
 * Update the next image to read. */  
function processUploadReply(requestParams, response, context, ee, next) {  
    if( typeof response.body !== 'undefined' && response.body.length > 0) {  
        imagesIds.push(response.body)  
    }  
    return next()  
}
```

TEST-IMAGES.YML (3)

- name: 'Download image'
 - weight: 5
 - flow:
 - function: "selectImageToDownload"
 - get:
 - url: "/media/{{ imageId }}"
 - headers:
 - Accept: application/octet-stream
 - ifTrue: "imageId"

function: allows to call a function at any point in the test. In this case, before executing the HTTP request.

{{ imageId }}: this will be replaced by the value of variable imageId.

ifTrue: allows to make a call conditionally to the value of a variable.

TEST-UTILS.JS (2)

```
/** Select an image to download. */  
function selectImageToDownload(context, events, done) {  
    if( imagesIds.length > 0) {  
        context.vars.imageId = imagesIds.sample()  
    } else {  
        delete context.vars.imageId  
    }  
    return done()  
}
```

If we already have image ids in the list of image ids, select one; otherwise delete the variable.

INSTALLATION

- Install nodejs
- Install the following packages

```
npm install -g artillery
```

```
npm install -g faker
```

```
npm install -g node-fetch -save
```

```
npm install -g https://github.com/preguica/artillery-plugin-metrics-by-endpoint.git
```

RUNNING

- Run with:

```
artillery run test-images.yml
```

Do not forget to replace the base URL.

- Debug options
- http -> print HTTP request
http:request / http:response -> prints request/response info;
http* ->all information

- Mac/Linux

```
DEBUG=http artillery run test-images.yml
```

- Windows

```
SET DEBUG=http
```

```
artillery run test-images.yml
```

OUTPUT OF ARTILLERY

```
lab2-test — -bash — 119x35
All virtual users finished
Summary report @ 09:54:23(+0100) 2021-10-12
  Scenarios launched: 330
  Scenarios completed: 279
  Requests completed: 281
  Mean response/sec: 7.19
  Response time (msec):
    min: 57
    max: 2906
    median: 81
    p95: 1395
    p99: 2324.7
  Scenario counts:
    Download image: 281 (85.152%)
    Upload image: 49 (14.848%)
  Codes:
    200: 281
  Errors:
    ETIMEDOUT: 51
  POST:/rest/media:
    min: 183
    max: 9601
    median: 219
    p95: 9383.9
    p99: 9601
  GET:/rest/media/:
    min: 183
    max: 9969
    median: 230
    p95: 8121.8
    p99: 9660.6
  code 200 on POST:/rest/media: 41
  code 200 on GET:/rest/media/: 235
```

Information on launched scenarios.

Information on individual REST requests.

GETs of all images are shown under
/rest/media

Remove the plugin metrics-by-endpoint from
YML to have information on individual
requests.

CONTENTS OF BLOB CONTAINER

You can check that the BLOB container has the images POSTed using Azure portal.

The screenshot shows the Microsoft Azure portal interface. At the top, there's a navigation bar with the Microsoft Azure logo, a search bar, and user information (nmp@FCT.UNL.PT). Below the navigation bar, the breadcrumb path is 'Home > scc21224204 > images'. The 'images' container is selected, and its overview is shown. On the left, there's a sidebar with options: Overview (selected), Diagnose and solve problems, Access Control (IAM), Settings, Shared access tokens, Access policy, Properties, and Metadata. The main area displays the container's details: Authentication method (Access key), Location (images), and a search bar for blobs. Below this, there's a table listing the blobs in the container.

Name	Modified	Access tier	Blob type	Size	Lease state
<input type="checkbox"/> 34A61FCDBFACBEF...	10/12/2021, 9:53:53 ...	Hot (Inferred)	Block blob	11.63 KiB	Available ...
<input type="checkbox"/> 39363F1A472827A1...	10/12/2021, 9:53:58 ...	Hot (Inferred)	Block blob	35.07 KiB	Available ...
<input type="checkbox"/> 4150E36CF723C031...	10/12/2021, 9:53:59 ...	Hot (Inferred)	Block blob	3.47 KiB	Available ...
<input type="checkbox"/> 41939794BF5D5F47...	10/12/2021, 9:53:38 ...	Hot (Inferred)	Block blob	10.93 KiB	Available ...
<input type="checkbox"/> 4AA7BE6B6232BA3...	10/12/2021, 9:54:02 ...	Hot (Inferred)	Block blob	17.13 KiB	Available ...
<input type="checkbox"/> 60C4FAD1F0FC0BB...	10/12/2021, 9:53:51 ...	Hot (Inferred)	Block blob	4.4 KiB	Available ...
<input type="checkbox"/> 750CC8A3B2F3C47...	10/12/2021, 9:53:43 ...	Hot (Inferred)	Block blob	3.73 KiB	Available ...
<input type="checkbox"/> 78B1EC35B245A041...	10/12/2021, 9:54:21 ...	Hot (Inferred)	Block blob	6.22 KiB	Available ...
<input type="checkbox"/> 7A98BB21762890C1...	10/12/2021, 9:54:20 ...	Hot (Inferred)	Block blob	4.05 KiB	Available ...

TO DO

Complete the media resource.

- Test your server with some simple tests. E.g. using postman or a similar tool to submit REST requests.

Use the example scripts to benchmark your server.

- Code is on CLIP (lab2.zip)