

Experiment No. 6

Aim: To study and Implement Storage as a Service using Own Cloud/ AWS S3, Glaciers/ Azure Storage.

Requirements: Windows/Mac/Linux O.S and AWS/Azure account.

Theory:

What Is Storage as a Service?

Storage as a service (STaaS) is a data storage business model where a provider rents storage resources to a customer through a subscription. STaaS saves you money through operating expenditure (OpEx) agility—you only pay for the storage you need, when you need it.

Why Use Storage as a Service?

Buying new storage capacity can be an expensive capital expenditure (CapEx), especially if you aren't sure how much capacity you'll need in the future. You can try to predict the growth of your business and purchase with the future in mind, but it can tie up financial resources that might have more impact elsewhere in your business.

Fortunately, there's no shortage of major tech companies with large data centers that are willing to sell their excess capacity. For these businesses, storage is just another service that's part of their expansive product offerings, and they're more than happy to absorb the expenses of managing, upgrading, and maintaining large-scale storage area networks (SANs). Amazon Web Services (AWS), Microsoft Azure, Google Cloud, and Oracle Cloud are all examples of major cloud storage providers with STaaS subscription options.

STaaS lets you treat storage as OpEx. You sign a service level agreement (SLA) with your STaaS provider and pay for storage and data transfer rates (e.g., cost per gigabyte). Best of all,

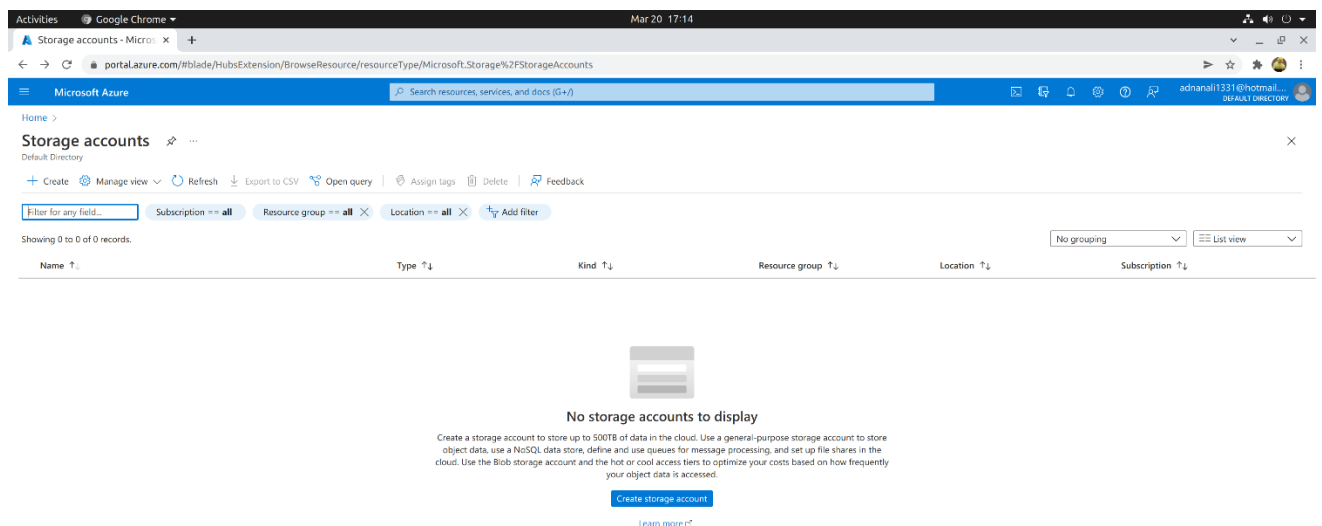
this whole process is automated, allowing you to scale your storage needs up and down as demand requires while maintaining performance and availability 24/7.

Benefits of Storage as a Service

- OpEx subscription model that lets you optimize your storage costs
- Ability to quickly scale and provision storage resources to your apps as you grow
- Always-on reliability of major cloud service providers
- Simplified storage management environment

Implementation:

1) Creating Storage Account



a) Basics

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal, specifically the 'Basics' tab. The page is titled 'Create a storage account' and includes a search bar and navigation links. The 'Project details' section requires selecting a subscription ('Azure for Students') and a resource group ('DefaultResourceGroup-CID'). The 'Instance details' section includes fields for 'Storage account name' (tempo), 'Region' (Asia Pacific Central India), 'Performance' (Standard), and 'Redundancy' (Geo-redundant storage (GRS)). A checkbox for 'Make read access to data available in the event of regional unavailability' is checked. Navigation buttons at the bottom include 'Review + create', '< Previous', and 'Next: Advanced >'.

Microsoft Azure

Home > Storage accounts >

Create a storage account

Basics Advanced Networking Data protection Encryption Tags Review + create

Project details

Select the subscription in which to create the new storage account. Choose a new or existing resource group to organize and manage your storage account together with other resources.

Subscription * Azure for Students

Resource group * DefaultResourceGroup-CID [Create new](#)

Instance details

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

Storage account name * tempo

Region * (Asia Pacific) Central India

Performance * ☒ Standard: Recommended for most scenarios (general-purpose v2 account)
☐ Premium: Recommended for scenarios that require low latency.

Redundancy * Geo-redundant storage (GRS)
☒ Make read access to data available in the event of regional unavailability.

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

b) Advance

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal, specifically the 'Advanced' tab. The page is titled 'Create a storage account' and includes a search bar and navigation links. A message states: 'Certain options have been disabled by default due to the combination of storage account performance, redundancy, and region.' The 'Security' section includes checkboxes for 'Require secure transfer for REST API operations', 'Enable blob public access', 'Enable storage account key access', and 'Default to Azure Active Directory authorization in the Azure portal'. The 'Minimum TLS version' is set to 'Version 1.2'. The 'Data Lake Storage Gen2' section includes a checkbox for 'Enable hierarchical namespace'. The 'Blob storage' section is currently empty. Navigation buttons at the bottom include 'Review + create', '< Previous', and 'Next: Networking >'.

Microsoft Azure

Home > Storage accounts >

Create a storage account

Basics **Advanced** Networking Data protection Encryption Tags Review + create

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

Security

Configure security settings that impact your storage account.

Require secure transfer for REST API operations ☒

Enable blob public access ☒

Enable storage account key access ☒

Default to Azure Active Directory authorization in the Azure portal ☐

Minimum TLS version

Data Lake Storage Gen2

The Data Lake Storage Gen2 hierarchical namespace accelerates big data analytics workloads and enables file-level access control lists (ACLs). [Learn more](#)

Enable hierarchical namespace ☐

Blob storage

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

c) Network

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal. The 'Networking' tab is selected, showing options for network connectivity and routing. The 'Connectivity method' section has three radio buttons: 'Public endpoint (all networks)' (selected), 'Public endpoint (selected networks)', and 'Private endpoint'. A note states: 'All networks will be able to access this storage account. We recommend using Private endpoint for accessing this resource privately from your network. [Learn more](#)'. The 'Network routing' section has two radio buttons: 'Microsoft network routing' (selected) and 'Internet routing'. At the bottom, there are navigation buttons: 'Review + create', '< Previous', and 'Next: Data protection >'.

d) Protection

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal, with the 'Data protection' tab selected. The 'Recovery' section contains three checkboxes, all of which are checked: 'Enable point-in-time restore for containers' (unchecked), 'Enable soft delete for blobs' (checked), and 'Enable soft delete for containers' (checked). Each checked option has a 'Days to retain deleted' input field set to '7'. The 'Tracking' section contains two checkboxes, both unchecked: 'Enable versioning for blobs' and 'Enable blob change feed'. At the bottom, there are navigation buttons: 'Review + create', '< Previous', and 'Next: Encryption >'.

e) Encryption

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal, specifically the 'Encryption' tab. The page is titled 'Create a storage account' and has a breadcrumb trail: Home > Storage accounts > Create a storage account. The 'Encryption' tab is selected, and the 'Microsoft-managed keys (MMK)' option is chosen for the encryption type. The 'Enable support for customer-managed keys' option is also selected, with a warning that this option cannot be changed after the storage account is created. The 'Enable infrastructure encryption' option is not selected. At the bottom, there are buttons for 'Review + create', '< Previous', and 'Next: Tags >'. The user's profile 'adnanali1331@hotmail.com' is visible in the top right corner.

Activities Google Chrome Mar 20 17:16

Create a storage account: x +

portal.azure.com/#create/Microsoft.StorageAccount

Microsoft Azure Search resources, services, and docs (G+)

adnanali1331@hotmail.com DEFAULT DIRECTORY

Home > Storage accounts >

Create a storage account ...

Basics Advanced Networking Data protection Encryption Tags Review + create

Encryption type ⓘ +

☒ Microsoft-managed keys (MMK)

☐ Customer-managed keys (CMK)

Enable support for customer-managed keys ⓘ

☒ Blobs and files only

☐ All service types (blobs, files, tables, and queues)

⚠ This option cannot be changed after this storage account is created.

Enable infrastructure encryption ⓘ ☐

Review + create < Previous Next: Tags >

d) Tags

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal, specifically the 'Tags' tab. The page is titled 'Create a storage account' and has a breadcrumb trail: Home > Storage accounts > Create a storage account. The 'Tags' tab is selected, and the page explains that tags are name/value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups. A note states that if you create tags and then change resource settings on other tabs, your tags will be automatically updated. Below the text, there is a table with three columns: Name, Value, and Resource. The first row shows 'cd' as the Name, 'temp' as the Value, and 'All resources selected' as the Resource. The second row is empty. At the bottom, there are buttons for 'Review + create', '< Previous', and 'Next: Review + create >'. The user's profile 'adnanali1331@hotmail.com' is visible in the top right corner.

Activities Google Chrome Mar 20 17:16

Create a storage account: x +

portal.azure.com/#create/Microsoft.StorageAccount

Microsoft Azure Search resources, services, and docs (G+)

adnanali1331@hotmail.com DEFAULT DIRECTORY

Home > Storage accounts >

Create a storage account ...

Basics Advanced Networking Data protection Encryption Tags Review + create

Tags are name/value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups. [Learn more about tags](#)

Note that if you create tags and then change resource settings on other tabs, your tags will be automatically updated.

Name	Value	Resource
cd	temp	All resources selected
		All resources selected

Review + create < Previous Next: Review + create >

e) Reviewing and creating

Activities Google Chrome Mar 20 17:16

Create a storage account: x

portal.azure.com/#create/Microsoft.StorageAccount

Microsoft Azure Search resources, services, and docs (G+)

Home > Storage accounts >

Create a storage account

Validation passed

Basics Advanced Networking Data protection Encryption Tags Review + create

Basics

Subscription	Azure for Students
Resource Group	DefaultResourceGroup-CID
Location	centralindia
Storage account name	tempo
Deployment model	Resource manager
Performance	Standard
Replication	Read-access geo-redundant storage (RA-GRS)

Advanced

Secure transfer	Enabled
Allow storage account key access	Enabled
Allow cross-tenant replication	Enabled
Default to Azure Active Directory authorization in the Azure portal	Disabled
Blob public access	Enabled
Minimum TLS version	Version 1.2
Enable hierarchical namespace	Disabled
Enable network file system v3	Disabled
Access tier	Hot
Enable SFTP	Disabled
Large file shares	Disabled

Networking

Create < Previous Next > Download a template for automation

d) Successful deployment

Activities Google Chrome Mar 20 17:17

tempo_1647776814124 x

portal.azure.com/#blade/HubsExtension/DeploymentDetailsBlade/overview/id/%2Fsubscriptions%2F8cb997f8-3dec-4107-a690-e8159e8a5d22%2FresourceGroups%2FDefaultResourceGroup-CID%2Fproviders%2FMicrosoft.Resources%2Fdeployments...

Microsoft Azure Search resources, services, and docs (G+)

Home >

tempo_1647776814124 | Overview

Deployment

Search (Ctrl+J)

Delete Cancel Redeploy Refresh

We'd love your feedback! →

Your deployment is complete

Deployment name: tempo_1647776814124
Subscription: Azure for Students
Resource group: DefaultResourceGroup-CID

Start time: 3/20/2022, 5:16:58 PM
Correlation ID: d551fcb8-6444-4dc5-8b42-982565c39763

Deployment details (Download)

Next steps

Go to resource

Deployment succeeded
Deployment 'tempo_1647776814124' to resource group 'DefaultResourceGroup-CID' was successful.
Go to resource Pin to dashboard

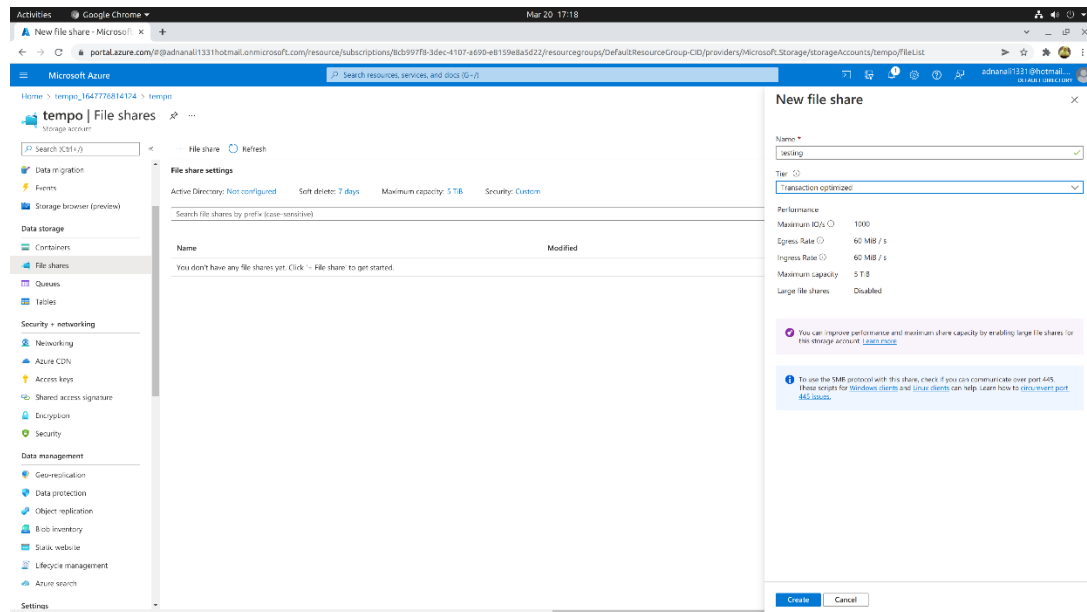
Cost Management
Get notified to stay within your budget and prevent unexpected charges on your bill.
Set up cost alerts >

Microsoft Defender for Cloud
Secure your apps and infrastructure
Go to Microsoft Defender for Cloud >

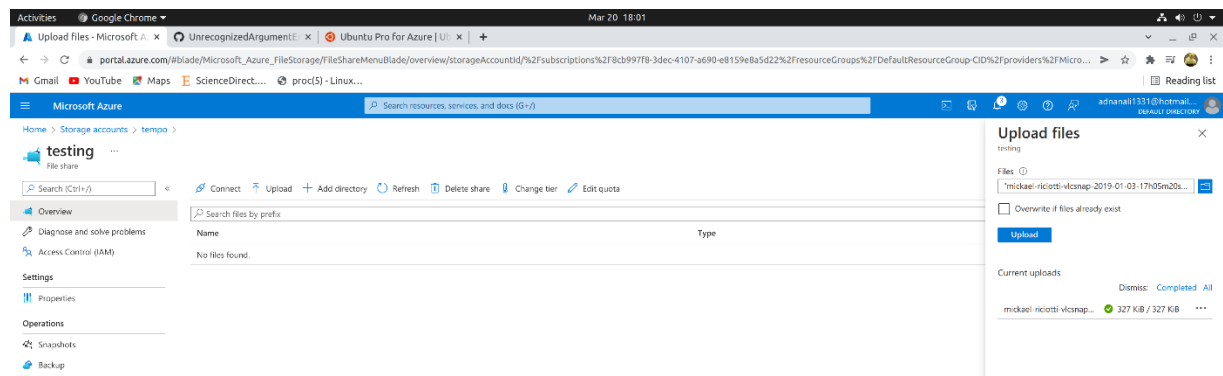
Free Microsoft tutorials
Start learning today >

Work with an expert
Azure experts are service provider partners who can help manage your assets on Azure and be your first line of support.
Find an Azure expert >

2) Creating Share File storage



3) Uploading file



4) Creating Linux VM to access this File shares

```
adnan@Azure:~$ group=azure-files-temp
adnan@Azure:~$ name=linux-vm
```

```
adnan@Azure:~$ az vm create \
> --name $name \
> --resource-group $group \
> --image UbuntuLTS \
> --generate-ssh-keys \
> --admin-username adnan
SSH key files '/home/adnan/.ssh/id_rsa' and '/home/adnan/.ssh/id_rsa.pub' have been generated under ~/.ssh to allow SSH access to the VM. If using m
to a safe location.
It is recommended to use parameter "--public-ip-sku Standard" to create new VM with Standard public IP. Please note that the default public IP used
rd in the future.
{
  "fqdns": "",
  "id": "/subscriptions/8cb997f8-3dec-4107-a690-e8159e8a5d22/resourceGroups/azure-files-temp/providers/Microsoft.Compute/virtualMachines/linux-vm",
  "location": "centralindia",
  "macAddress": "60-45-BD-AD-0C-53",
  "powerState": "VM_running",
  "privateIpAddress": "10.0.0.4",
  "publicIpAddress": "20.193.242.50",
  "resourceGroup": "azure-files-temp",
  "zones": ""
}
```

Terminal container button

5) Accessing storage account through SSH

```

adnan@Azure:~$ az vm show -g $group -n $name -d --query "{name:name,publicIps:publicIps,user:osProfile.adminUsername}" -o jsonc > clouddrive/$name.json
adnan@Azure:~$ cat clouddrive/$name.json
{
  "name": "linux-vm",
  "publicIps": "20.193.242.50",
  "user": "adnan"
}
adnan@Azure:~$ ssh adnan@20.193.242.50
The authenticity of host '20.193.242.50 (20.193.242.50)' can't be established.
ECDSA key fingerprint is SHA256:WK8ibA5raWQc3uF9nZQey6tS78EvA+ma4ByQ+y1Umog.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '20.193.242.50' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-1072-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

System information as of Sun Mar 20 12:29:05 UTC 2022

System load:  0.0          Processes:      108
Usage of /:   4.8% of 28.90GB Users logged in: 0
Memory usage: 5%          IP address for eth0: 10.0.0.4
Swap usage:   0%

0 updates can be applied immediately.

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

adnan@linux-vm:~$

```

6) Connecting VM to File Share storage:

```

adnan@linux-vm:~$ sudo mkdir /mnt/testing
adnan@linux-vm:~$ if [ ! -d "/etc/smbcredentials" ]; then
> sudo mkdir /etc/smbcredentials
> fi
adnan@linux-vm:~$ if [ ! -f "/etc/smbcredentials/tempo.cred" ]; then
> sudo bash -c 'echo "username=tempo" >> /etc/smbcredentials/tempo.cred'
> sudo bash -c 'echo "password=d3TC0pwze0TqhQHr1GsFYmgfE0tRkDBUYUE/0sn5q9rYnbgbb9seduIq/5Q+AYtcYIEPN18g+DAXMosnZadihg==" >> /etc/smbcredentials/tempo.cred'
> fi
adnan@linux-vm:~$ sudo chmod 600 /etc/smbcredentials/tempo.cred
adnan@linux-vm:~$
adnan@linux-vm:~$ sudo bash -c 'echo "//tempo.file.core.windows.net/testing /mnt/testing cifs nofail,vers=3.0,credentials=/etc/smbcredentials/tempo.cred,dir_mode=0777,
/fstab'
adnan@linux-vm:~$ sudo mount -t cifs //tempo.file.core.windows.net/testing /mnt/testing -o vers=3.0,credentials=/etc/smbcredentials/tempo.cred,dir_mode=0777,
adnan@linux-vm:~$ ls /mnt/
DATALOSS WARNING README.txt  lost+found  temp

```

7) Reading and writing files to File Share storage

```

adnan@linux-vm:~$ ls /mnt/testing/
mickael-riciotti-vlcsnap-2019-01-03-17h05m20s138.jpg
adnan@linux-vm:~$ echo "hello world" > /mnt/testing/temp.txt
adnan@linux-vm:~$

```


8) Result

Microsoft Azure portal interface showing the 'testing' storage account overview. The interface includes a sidebar with navigation options like Overview, Diagnose and solve problems, Access Control (IAM), Settings, Properties, Operations, Snapshots, and Backup. The main content area displays a table of files with columns for Name, Type, and Size. Two files are listed: 'mickael-riciotti-vksnap-2019-01-03-17h05m20s138.jpg' (327.3 KiB) and 'temp.txt' (12 B). The user's profile 'adnanal1331@hotmail...' is visible in the top right corner.

Name	Type	Size
mickael-riciotti-vksnap-2019-01-03-17h05m20s138.jpg	File	327.3 KiB
temp.txt	File	12 B

Conclusion: We have successfully implemented Storage as a Service using Azure.