

## **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,

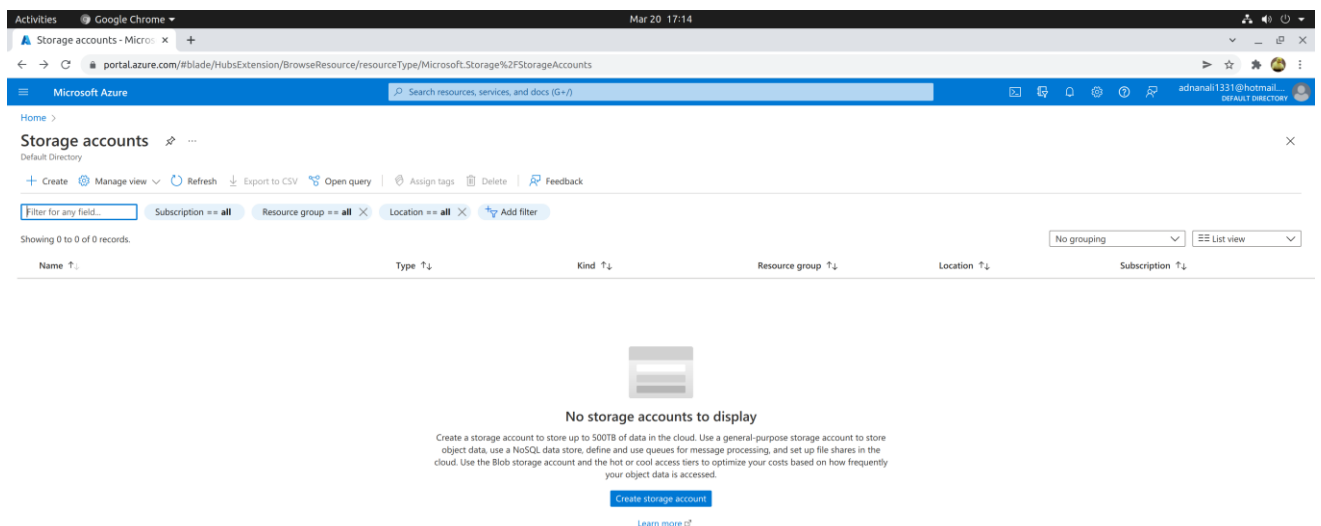
this whole process is automated, allowing you to scale your storage needs up and down as demand requires while maintaining performance and availability 24/7.

## 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 a storage account name ('tempo'), region ('(Asia Pacific) Central India'), performance type ('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', and 'Enable storage account key access', all of which are checked. There is also a checkbox for 'Default to Azure Active Directory authorization in the Azure portal' which is unchecked, and a dropdown for 'Minimum TLS version' set to 'Version 1.2'. The 'Data Lake Storage Gen2' section includes a checkbox for 'Enable hierarchical namespace' which is unchecked. The 'Blob storage' section is partially visible. 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 ⓘ Version 1.2

**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, specifically the 'Networking' tab. The page is titled 'Create a storage account' and has a breadcrumb trail: Home > Storage accounts > Create a storage account. The 'Networking' tab is selected, and the 'Connectivity method' is set to 'Public endpoint (all networks)'. 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 is also visible, with 'Microsoft network routing' selected. At the bottom, there are navigation buttons: 'Review + create', '< Previous', and 'Next: Data protection >'.

Microsoft Azure

Home > Storage accounts > Create a storage account

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

**Network connectivity**

You can connect to your storage account either publicly, via public IP addresses or service endpoints, or privately, using a private endpoint.

Connectivity method \*

- ☒ Public endpoint (all networks)
- ☐ Public endpoint (selected networks)
- ☐ Private endpoint

**Network routing**

Determine how to route your traffic as it travels from the source to its Azure endpoint. Microsoft network routing is recommended for most customers.

Routing preference ⓘ \*

- ☒ Microsoft network routing
- ☐ Internet routing

Review + create < Previous Next: Data protection >

## d) Protection

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal, specifically the 'Data protection' tab. The page is titled 'Create a storage account' and has a breadcrumb trail: Home > Storage accounts > Create a storage account. The 'Data protection' tab is selected. The 'Recovery' section is visible, with 'Enable soft delete for blobs' checked. The 'Tracking' section is also visible, with 'Enable versioning for blobs' and 'Enable blob change feed' unchecked. At the bottom, there are navigation buttons: 'Review + create', '< Previous', and 'Next: Encryption >'.

Microsoft Azure

Home > Storage accounts > Create a storage account

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

**Recovery**

Protect your data from accidental or erroneous deletion or modification.

- ☐ Enable point-in-time restore for containers
- ☒ Enable soft delete for blobs
- ☒ Enable soft delete for containers
- ☒ Enable soft delete for file shares

Days to retain deleted blobs ⓘ 7

Days to retain deleted containers ⓘ 7

Days to retain deleted file shares ⓘ 7

**Tracking**

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

- ☐ Enable versioning for blobs
- ☐ Enable blob change feed

Review + create < Previous 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 >'. The 'Encryption' tab is selected, and the 'Review + create' button is visible at the bottom. The 'Encryption type' is set to 'Microsoft-managed keys (MMK)'. The 'Enable support for customer-managed keys' option is set to 'Blobs and files only'. The 'Enable infrastructure encryption' option is set to 'Off'. The 'Review + create' button is highlighted in blue.

Activities Google Chrome Mar 20 17:16

Create a storage account portal.azure.com/#create/Microsoft.StorageAccount

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

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 >'. The 'Tags' tab is selected, and the 'Review + create' button is visible at the bottom. 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. It also notes that if you create tags and then change resource settings on other tabs, your tags will be automatically updated. The 'Name' field is set to 'cd', the 'Value' field is set to 'temp', and the 'Resource' field is set to 'All resources selected'. The 'Review + create' button is highlighted in blue.

Activities Google Chrome Mar 20 17:16

Create a storage account portal.azure.com/#create/Microsoft.StorageAccount

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

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

The screenshot shows the 'Create a storage account' page in the Microsoft Azure portal. The 'Review + create' tab is selected, displaying a summary of the configuration. A green banner at the top indicates 'Validation passed'. The configuration is divided into 'Basics' and 'Advanced' sections.

Section	Property	Value
Basics	Subscription	Azure for Students
	Resource Group	DefaultResourceGroup-CID
	Location	centralindia
	Storage account name	tempo
	Deployment model	Resource manager
	Performance	Standard
Basics	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

At the bottom, there are buttons for 'Create', '< Previous', 'Next >', and 'Download a template for automation'.

## d) Successful deployment

The screenshot shows the 'tempo\_1647776814124 | Overview' page in the Microsoft Azure portal. The page displays a 'Deployment succeeded' notification and a 'Your deployment is complete' message. The deployment details are as follows:

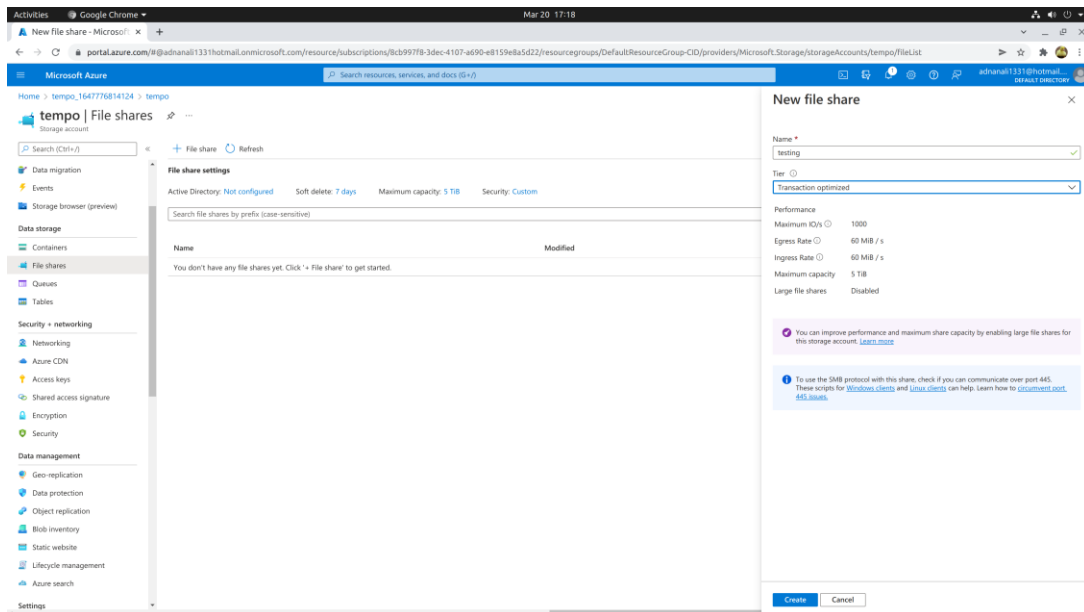
Property	Value
Deployment name	tempo_1647776814124
Subscription	Azure for Students
Resource group	DefaultResourceGroup-CID

The deployment was completed on 3/20/2022 at 5:16:58 PM. The correlation ID is d551fcb8-6444-4dc5-8b42-982565c39763. The page also includes a 'Go to resource' button and a 'Next steps' section with a 'Go to resource' button.

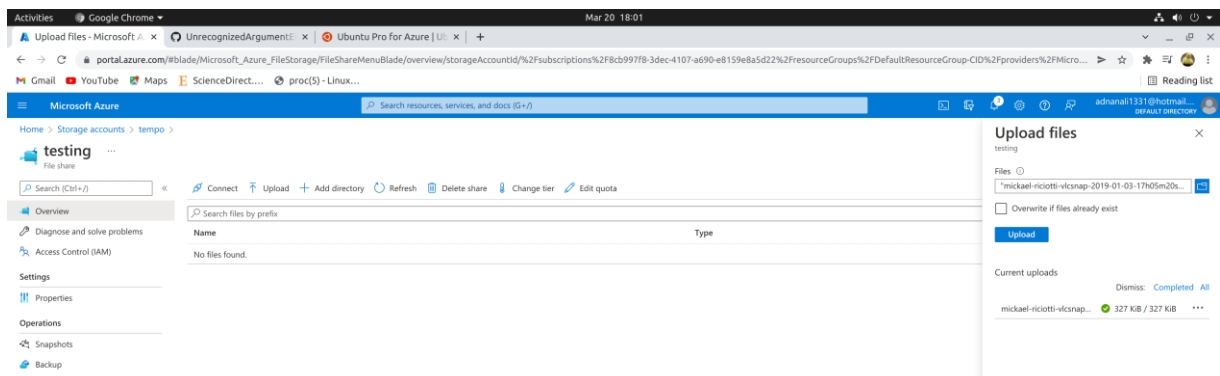
On the right side, there are several recommendations:

- 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  tempo.cred
```

## 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 area displays a table of files with columns for Name, Type, and Size.

Name	Type	Size
mickael-riciotti-vlcsnap-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.