# Mastering Azure Virtual Desktop

The ultimate guide to the implementation and management of Azure Virtual Desktop







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**Ryan Mangan** 



## **Mastering Azure Virtual Desktop**

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First published: March 2022 Production reference: 2290722

Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK.

ISBN 978-1-80107-502-2

www.packt.com

*Technology made large populations possible; large populations now make technology indispensable.* 

- Joseph Wood Krutch

# *Just because something doesn't do what you planned it to do doesn't mean it's useless.*

— Thomas Edison

*Be passionate and bold. Always keep learning. You stop doing useful things if you don't learn.* 

— Satya Nadella

# Contributors

# About the author

**Ryan Mangan** is an end user computing specialist. He is a speaker, presenter, and author who has helped customers and technical communities with end user computing solutions, ranging from small to global, 30,000-user enterprise deployments in various fields. Ryan is the owner and author of ryanmangansitblog, and has over 3 million visitors and over 200+ articles. Some of Ryan's community and technical awards include Microsoft **Most Valuable Professional (MVP)**, VMware vExpert 2014, 2015, 2016, 2017, 2018, 2019, 2020, & 2021, VMware vExpert EUC 2021, VMware vExpert Desktop Hypervisor 2021, **Very Important Parallels professional program (VIPP)** 2019, 20, & 21, and LoginVSI Technology Advocate 19, and 20.

Writing a book does require lots of time, energy, and dedication, especially in the midst of a pandemic where the customer demand for technology and services increased significantly. I'd like to thank my wife, Alexandra, for supporting me and providing continued motivation as well as the private time to get the book finished. Also, my daughter, Sienna, who continues to this day to ask "what are you doing on the computer, Daddy?"

## About the reviewers

**Marcel Meurer** is responsible for the professional IT services business unit at sepago GmbH in Cologne and is the founder of the development company ITProCloud GmbH. In this role, he leads a team of consultants who provide their expertise in Microsoft and Citrix technologies for customers and partners. His technical focuses are Microsoft Azure platform services, and he has been a Microsoft Azure MVP since 2016.

He loves working in the community. Besides his blog, he publishes tools that simplify working with the Azure cloud – especially in the context of Azure Virtual Desktop. His well-known tools include WVDAdmin and Hydra for Azure Virtual Desktop.

Marcel Meurer graduated as an engineer in electrical engineering from the University of Applied Science, Aachen.

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In 2021, he took care of the infrastructure, identity, security, and compliance streams for the Microsoft Partner division in Italy.

He's also the author of the free ebook *Azure Virtual Desktop (Succinctly)*, which will be published in 2022 by Synchfusion.

I'd like to thank Michel Roth and Christiaan Brinkhoff for helping me to become an Azure Virtual Desktop expert.

**Neil McLoughlin** is based in Manchester in the UK. He has worked in the IT industry for over 20 years, working across many different sectors and roles. He spent around 10 years providing Citrix consultancy for large enterprise customers. Around 5 years ago, Neil discovered the cloud and DaaS and since then has specialized in cloud-based desktop solutions, mainly Azure Virtual Desktop and M365.

Neil is very passionate about community work and runs the UK Azure Virtual Desktop User Group and the Virtual Desktops Community, which is a worldwide community of people interested in Azure Virtual Desktop.

He is currently employed as the UK Field CTO for Nerdio but has previously worked for New Signature, Computacenter, and Cap Gemini as a senior consultant and architect specializing in end user computing.

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**Toby Skerritt** is an experienced end user architect and engineer. He currently works as technology director for Foundation IT. He has been with Foundation IT for over 10 years, working mainly in the professional service and presales functions. Toby helped the organization to achieve multiple Microsoft accreditations and competencies, including Microsoft Gold Competency status for Cloud Platforms. Toby has been working in the technology space for the past 20 years, working predominantly with Windows OS deployment and virtual desktop technologies. He holds both Azure Administrator Associate and Azure Virtual Desktop Specialty accreditations and has written a number of blogs and opinion pieces on the cloud, Windows Desktop, and cloud desktop solutions.

# 5 Implementing and Managing Storage for Azure Virtual Desktop

In this chapter, we'll learn how to implement and manage storage for AVD. We'll create a storage account and configure Azure Files for FSLogix Profile Containers.

The following topics will be covered in this chapter:

- Configuring storage for FSLogix components
- Configuring storage accounts
- Creating file shares
- Configuring disks

# **Configuring storage for FSLogix components**

This chapter looks at the storage options that are available for FSLogix Profile Containers when preparing and configuring AVD. We will focus on Azure Files as the storage option of choice as this is the most commonly used storage option for AVD.

## FSLogix Profile container storage options

There are three common storage options available for **Azure Virtual Desktop** (**AVD**). This section provides a comparison of the options available to you.

#### Important Note

Microsoft recommends storing FSLogix Profile Containers in Azure Files unless there is a specific requirement not to. However, this may not meet all organization's requirements.

FSLogix is a profile solution that was acquired by Microsoft to provide Azure Virtual Desktop with roaming profiles by dynamically attaching a virtual hard disk at sign-in. The user profile that's stored on the virtual disk becomes immediately available and appears in the system like a typical user profile.

Important Note

You can use the FSLogix Profile solution outside of AVD.

Features	Azure Files	Azure NetApp Files	Storage Spaces Direct
Use case	General-purpose.	Ultra performance or migration from NetApp on-premises.	Cross-platform.
Platform service	Yes; Azure-native solution.	Yes; Azure-native solution.	No, self-managed.
Regional availability	All regions.	Select regions.	All regions.
Redundancy	Locally redundant/ zone-redundant/ geo-redundant/ geo-zone-redundant.	Locally redundant/ cross-region replication.	Locally redundant/zone- redundant/geo-redundant.
Tiers and performance	Standard (transaction optimized). Premium. Up to a maximum of 100K IOPS per share with 10 GBps per share at about 3 ms latency.	Standard. Premium. Ultra. Up to 4.5GBps per volume at about 1 ms latency. For IOPS and performance details, see the Azure NetApp Files performance considerations and the FAQ.	Standard HDD: Up to 500 IOPS per-disk limits. Standard SSD: Up to 4K IOPS per disk limits. Premium SSD: Up to 20K IOPS per-disk limits. We recommend Premium disks for Storage Spaces Direct.
Max capacity	100 TiB per share, up to 5 PiB per general-purpose account.	100 TiB per volume, up to 12.5 PiB per subscription.	Maximum 32 TiB per disk.
Required infrastructure	Minimum share size 1 GiB.	Minimum capacity pool 4 TiB, minimum volume size 100 GiB.	Two VMs on Azure IaaS (plus Cloud Witness) or at least three VMs without and costs for disks.
Protocols	SMB 3.0/2.1, NFSv4.1 (preview), REST.	NFSv3, NFSv4.1 (preview), SMB 3.x/2.x.	NFSv3, NFSv4.1, SMB 3.1.

The following table provides a comparison of the different storage options and features:

This table was taken from the following site: https://docs.microsoft.com/ en-us/azure/virtual-desktop/store-fslogix-profile?WT.mc\_ id=modinfra-17152-thmaure#azure-platform-details.

As shown in the preceding table, Azure Files is the likely candidate for AVD deployments, while Azure NetApp Files offers high performance. There is also an Azure **Virtual Machine** (**VM**) option for using Storage Spaces Direct.

The following table details the features available for Azure Files, Azure NetApp Files, and Storage Spaces Direct:

Features	Azure Files	Azure NetApp Files	Storage Spaces Direct
Access	Cloud, on-premises, and hybrid (Azure File Sync)	Cloud, on-premises (via ExpressRoute)	Cloud, on-premises
Backup	Azure backup snapshot integration	Azure NetApp Files snapshots	Azure backup snapshot integration
Security and compliance	All Azure supported certificates	ISO completed	All Azure supported certificates
Azure Active Directory integration	Native Active Directory and Azure Active Directory Domain Services	Azure Active Directory Domain Services and Native Active Directory	Native Active Directory or Azure Active Directory Domain Services support only

This table was taken from the following site: https://docs.microsoft.com/ en-us/azure/virtual-desktop/store-fslogix-profile?WT.mc\_ id=modinfra-17152-thmaure#azure-management-details.

The preceding table shows the features that are available for each service, including Azure Files, Azure NetApp Files, and Storage Spaces Direct.

This section looked at the three storage options that are available when you're planning to configure FSLogix Profile Containers. In the next section, we will look at the two different Azure Files tiers.

### The different Azure Files tiers

Azure Files has two different tier types of file storage: standard and premium. The key difference between the two is performance, as premium uses **solid-state drives** (**SSDs**) and are deployed in the file storage account type. Premium file share types are helpful in larger organizations where the requirement for higher performance and low latency is required due to the number of users accessing the file share storage.

Standard file shares use **hard disk drives** (**HDDs**) and are deployed as **general-purpose version 2** (**GPv2**) storage account types. Therefore, you should expect to use standard file shares in small environments or organizations with low I/O needs.

#### Important Note

Standard file shares are only available in pay-as-you-go billing models. This means that billing is based on the total storage used, whereas when you're using premium file shares storage, you pay for the configured capacity.

The following table provides examples of when you should use standard file shares versus premium file shares:

Deployment Type	Recommended Storage Tier		
Fewer than 200 users	Standard file shares		
Greater than 200 users	Premium file shares or standard with multiple file shares		
Medium	Premium file shares		
Heavy	Premium file shares		
Power	Premium file shares		

This section explored the two different Azure files storage tiers and when to use each type. The next section looks at Azure Files integration with Azure Active Directory Domain Service.

## Best practices for Azure Files with AVD

The following are some of the best practices associated with Azure Files when you're configuring it for use with AVD:

- It is advised that you create your storage accounts in the same region as the session host VMs. This is to ensure that latency is kept to a minimum. This also applies to optimal performance when you're using FSLogix Profile Containers.
- It is recommended that you should be using Active Directory integrated file shares for security and that the following permissions should be set:

User Account	Folder	Permissions
Users	This Folder Only	Modify
Creator/Owner	Subfolders and Files Only	Modify
Administrator (optional)	This Folder, Subfolders, and Files	Full Control

• When you're storing images in Azure Files, it is advised that you store the master image in the same region as where the VMs are being provisioned.

This section looked at the different storage options available to you, including Azure Files, Azure NetApp Files, and Storage Spaces Direct. We also looked at the different storage tiers for Azure Files, Active Directory Domain Services integration, and storage best practices when configuring FSLogix Profile Containers.

Now, let's learn how to configure a storage account.

## **Configure storage accounts**

This section will look at creating a storage account and configuring data protection.

To create a storage account, you need to follow the stepwise procedure detailed in the following subsections.

#### Step 1 – create a new storage account

From the left menu within the Azure portal, select **Storage accounts** to display a list of your storage accounts. You can also search for storage accounts in the top search bar. This is shown in the following screenshot:



Figure 5.1 - Using the search bar to show the Storage accounts service in the Azure portal

Once on the **Storage accounts** page, you will see all the storage accounts and an icon to create one in the page's navigation bar. To create a new storage account, click **Create**:

	Name ↑		Type ↑↓	Kind 个	Ļ	Reso	ource group
	Showing 1 to 3	3 of 3 records.			No	grouping	
*	Filter for any	field Su	ubscription == <b>all</b>	Resource group ==	all X	Location	== all $\times$
	+ Create	🍪 Manage view 🚿	✓ 🖒 Refresh 🞍 Exp	oort to CSV 🛛 😽 (	Open query	💙 Feed	dback
٠	ryanmangansit	blog (ryanmangansitbl	log.com)				
	Storage	accounts	A				
	Home >						
Mic	rosoft Azure	, ○ Search resour	ces, services, and docs (G+	-/) 📐	Ω (	2 63	? ጽ

Figure 5.2 - Storage accounts

Once you have clicked Create, we can move on to the next section.

## Step 2 – configure the basics

Once you have selected **Storage accounts** and clicked **Create**, you will see the basic **Create a storage account** page:

Microsoft Azure	, P Search r	resources, se	rvices, and doc	s (G+/)		$\geq$	Ŗ	Q	©	?	ନ୍ଦି	<b>Market</b>		. 🕘
+ Create a resource		Create a storage account							×					
👚 Home				-9										
🖾 Dashboard		Basics	Advanced	Networking	Data protec	tion	Tags	Rev	view +	create				
🗮 All services														
* FAVORITES		Azure S	Azure Storage is a Microsoft-managed service providing cloud storage that is highly available, secure, durable, scalable, and redundant. Azure Storage includes Azure Blobs (objects), Azure Data Lake Storage Gen2, Azure Files, Azure Queues, and Azure Tables. The cost of your storage account depends on the usage and the options you choose below. Learn more about Azure Storage Counts							^				
All resources		Tables.												
🜔 Resource groups														
💿 App Services		Project	t details											
🍫 Function App		Select t	he subscriptior	in which to creat	e the new storage	ge accou	nt. Choo	ose a n	ew or e	xisting	resourc	e group to or	ganize and	
SQL databases		manage	e your storage	account together	with other resou	irces.								
💐 Azure Cosmos DB		1 Subscri	ption *		Azure subs	cription								
🛒 Virtual machines			Resource grou	р*	msixaa 🗸 🗸									
🚸 Load balancers		2			Create new									
📰 Storage accounts		Instan	ce details											
Virtual networks		If you need to create a legacy storage account type, please click here.												
🚸 Azure Active Director	ry				mithlaastaraaat									
🤭 Monitor		3 Storage	account name	0										
🤹 Advisor		4 Region	0 *		(Europe) U	K South							$\sim$	
Security Center	(	5 Perform	nance (i) *		Standa	rd Poco	mmond	lad for	most se	onario	r laonor	al-purpoco v	account)	
💿 Cost Management +	Billing					nu. Neco	minena	ieu ioi	moscse	enano	s (genei	ai puipose va	accounty	
🤰 Help + support					O Premiu	im: Reco	mmend	led for	scenari	os that	require	low latency.		
🧭 Azure Virtual Deskto	р 🧃	6 Redund	lancy (i) *		Geo-redun	idant sto	rage (G	RS)					~	
					🔽 Make re	ad acces	ss to dat	ta avail	able in	the ev	ent of re	gional unavai	ilability.	
		Revie	ew + create				Ne	xt : Ad	vanced	>				
		4												E F

Figure 5.3 – Creating a storage account

SN	Name	Required or Optional	Description
1	Subscription	Required	Select the subscription that's required for the storage account.
2	Resource group	Required	Select an existing resource group for this storage account, or create a new one.
3	Storage account name	Required	Choose a name for your storage account; this must be unique. Storage account name must be between 3 and 24 characters in length and contain numbers and lowercase letters only.
4	Region	Required	Select the region for your storage account.
5	Performance	Required	Select Standard performance for general-purpose v2 storage accounts; this is the default. Microsoft recommends this type of account for most scenarios. Use Premium storage for low latency.
6	Redundancy	Required	Select the required redundancy configuration. Remember, not all redundancy options are available in all regions. By selecting geo-redundant configuration (GRS or GZRS), your data is replicated to a data center in a
			different region. For read access to data in the secondary region, ensure you select Make read access to data
			available in the event of regional unavailability.

The following table details the steps shown in the preceding screenshot. You are required to complete these steps before progressing to the **Advanced** tab:

Once you have configured the **Basics** section of creating a new storage account, we can look at configuring advanced settings.

#### Important Note

Not all regions are supported for all types of storage accounts or redundancy configurations. The choice of region can also have a billing impact.

## Step 3 – configure advanced settings

Once you're in the **Advanced** tab, you will see several security and storage configuration options. You can leave these as-is or customize them as required:

Home > Storage accounts >	iome > Storage accounts >				
Create a storage accou	int 👷				
Basics Advanced Networking	Data protection Tags Review + create				
<ol> <li>Certain options have been disabled</li> </ol>	by default due to the combination of storage account performance, redundancy, and region.				
Security					
Configure security settings that impact ye	our storage account.				
Require secure transfer for REST API operations ①					
Enable infrastructure encryption ①					
Enable blob public access ①					
Enable storage account key access ①	■ 4				
Minimum TLS version (0)	Version 1.2 V				
Data Lake Storage Gen2					
The Data Lake Storage Gen2 hierarchical control lists (ACLs). Learn more	namespace accelerates big data analytics workloads and enables file-level access				
Enable hierarchical namespace					
Blob storage					
Enable network file share v3 ① 7					
	To enable NFS v3 'hierarchical namespace' must be enabled, and on the networking tab, 'public endpoint (selected networks)' must be configured with one or more subnets, or 'private endpoint' must be selected and configured with a private endpoint. Learn more about NFS v3				
Access tier ① 8	Hot: Frequently accessed data and day-to-day usage scenarios				
	Cook Infrequently accessed data and backup scenarios				
Azure Files					
Enable large file shares ①					
Tables and Queues					
Enable support for customer-managed keys ①					
Review + create	< Previous Next : Networking >				

Figure 5.4 - Advanced tab - Create a storage account

SN	Name	Required or Optional	Description
1	Enable secure transfer	Optional	Enabling secure transfer requires that incoming requests to this storage account are made only via HTTPS (default). This is recommended for optimal security.
2	Enable infrastructure encryption	Optional	Infrastructure encryption is not enabled by default. You can enable infrastructure encryption to encrypt your data at both the service level and the infrastructure level.
3	Enable blob public access	Optional	Users with the appropriate permissions can enable anonymous public access to a container in the storage account when enabling this setting. If you disable this setting, it prevents all anonymous public access to the storage account, making it private.
4	Enable storage account key access	Optional	When enabled, this setting allows clients to authorize requests to the storage account using either the account access keys or an <b>Azure Active Directory</b> ( <b>Azure AD</b> ) account. Disabling this setting prevents authorization with the account access keys.

The following table details the 10 configuration options. Eight are optional, while two are mandatory. These configuration settings are cross-referenced in the preceding screenshot:

SN	Name Required or Optional		Description
5	Minimum TLS version	Required	Select the minimum version of <b>Transport</b> <b>Layer Security</b> ( <b>TLS</b> ) for incoming requests to the storage account. The default value is TLS version 1.2. When set to the default value, incoming requests made using TLS 1.0 or TLS 1.1 are rejected.
6	Enable hierarchical namespace	Optional	You need to configure a hierarchical namespace to use this storage account for Azure Data Lake Storage Gen2 workloads.
7	Enable <b>network file</b> <b>system (NFS)</b> v3 (preview)	Optional	NFS v3 provides Linux filesystem compatibility at object storage scale and enables Linux clients to mount a container in Blob storage from an Azure VM or a computer on-premises.
8	Access tier	Required	Blob access tiers enable you to store blob data cost-effectively, based on usage.
9	Enable large file shares	Optional	This is only available for premium storage accounts for file shares.
10	Enable support for customer-managed keys	Optional	To enable support for customer-managed keys for tables and queues, it is advised that you ensure this setting is enabled while creating the storage account.

Once you have chosen the required advanced settings, you can start configuring the **Networking** section.

## Step 4 – configure networking

This step is where you configure specific network connectivity requirements, including public and private endpoints. You can also specify the required routing option:

Home >	Storage accour	its >				
Crea	Create a storage account					
Basics	Advanced	Networking	Data protection	Tags	Review + create	
Netwo	rk connectivity	1				
You can private	n connect to you endpoint.	r storage account	either publicly, via put	olic IP add	resses or service endpoints, or privately, using a	
Connec	tivity method *		Public endpoir	it (all netw	vorks)	
			O Public endpoir	nt (selected	d networks)	
			O Private endpoi	nt		
			All networks will     Private endpoint     more	be able to for accessi	access this storage account. We recommend using ing this resource privately from your network. Learn	
Network routing 2 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 netw	ork routir	ng	
			O Internet routin	g		

Figure 5.5 – The Networking tab

The preceding screenshot is numbered to reference the **Connectivity method** and **Routing preference** areas shown in the following table:

SN	Name	Required or Optional	Description
1	Connectivity method	Required	Incoming network traffic is routed to the public endpoint for your storage account by default. You can specify that traffic must be routed to the public endpoint through an Azure virtual network. You can also configure private endpoints for private network communication to the storage account.
2	Routing preference	Required	This setting specifies how network traffic is routed to the public endpoint of your storage account from clients over the internet. A new storage account uses Microsoft network routing by default. However, you can also configure how network traffic is routed through the <b>point of presence</b> ( <b>POP</b> ) closest to the storage account, which may lower networking costs.

Now that you have configured the networking section of the *Creating a storage account*, we can move on to step five, where we will configure the data protection settings for the storage account.

#### Step 5 - configure data protection

Within this tab, you can configure the various recovery and tracking options for your storage account. The following screenshot, whose numbers are referenced in the following table, shows several options that are available to you:



Figure 5.6 - The Data protection tab

The preceding screenshot is annotated with numbers one to six; this correlates with the following table, which shows the options for configuring data protection for the new storage account:

SN	Name	Required or Optional	Description
1	Enable point-in- time restore for containers	Optional	Point-in-time restore protects against accidental deletion or corruption by enabling you to restore block blob data to an earlier state.
			Enabling point-in-time restore enables blob versioning, blob soft delete, and blob change feed. These prerequisite features have a cost impact, so be sure to check their pricing first.
2	Enable soft delete for blobs	Optional	Blob soft delete protects an individual blob, snapshot, or version from accidental deletes or overwrites by maintaining the deleted data in the system for a specified retention period.
			During the retention period, you can restore a soft-deleted object to its state when it was deleted.
3	Enable soft delete for containers	Optional	Container soft delete protects a container and its contents from accidental deletes by maintaining the deleted data in the system for a specified retention period.
			During the retention period, you can restore a soft-deleted container to its state at the time it was deleted.
4	Enable soft delete for file shares	Optional	Soft delete for file shares protects a file share and its contents from accidental deletion by maintaining the deleted data in the system for a specified retention period.
			During the retention period, you can restore a soft-deleted file share to its state at the time it was deleted.

SN	Name	Required or Optional	Description
5	Enable versioning for blobs	Optional	Blob versioning automatically saves the state of a blob in a previous version when the blob is overwritten.
			It is recommended that you enable blob versioning for optimal data protection for the storage account.
6	Enable blob change feed	Optional	The blob change feed provides transaction logs of all the changes that have been made to all the blobs in your storage account, as well as their metadata.

Once you have selected the required options for data protection, you can set **Tags** or proceed to the **Review + create** tab.

Within the **Review + create** tab, check if all the settings are as you require, then proceed to create the storage account:

Microsoft Azure	$\mathcal P$ Search resources, services, and docs (G+/)	🔲 🖸 🕼 🗘 🐡 ? 🖉 📩 🛃 🔍
+ Create a resource	Home > Storage accounts >     Create a storage acco	unt ··· ×
Dashboard	⊘ Validation passed	
	Basics Advanced Networking	Data protection Tags <b>Review + create</b>
All resources Resource groups	 Basics	Î
🇔 App Services	Subscription	Azure subscription 1
nterion App	Resource Group	msixaa
SQL databases	Location	uksouth
Zzure Cosmos DB	Storage account name	rmitblogstorage1
Virtual machiner	Deployment model	Resource manager
	Performance	Read-access neo-redundant storane (RA-GRS)
Load balancers	Replication	
Storage accounts	Advanced	
Virtual networks	Secure transfer	Enabled
litector Active Director	Allow storage account key access	Enabled
Monitor		
Advisor	Create <	Previous Next > Download a template for automation
Security Center	<b>▼</b> (	

Figure 5.7 – The Review + create tab

Once the storage account has been created, you will see it appear on the **Storage accounts** page. In the next section, we will look at configuring an Azure file share.

# **Configuring file shares**

Once you have created your storage account, you need to create a file share for FSLogix Profile Containers. This section will look at configuring a file share in a storage account ready for use with FSLogix.

Before we get started with Azure file shares, let's have a look at the different tiers that are available per share:

- **Premium** file shares use SSDs, which provide higher constant performance and lower latency than standard storage. This file share tier type is beneficial for larger shares or high I/O workload requirements.
- **Transaction** optimized file shares, similar to standard storage, use HDDs. This is suitable for heavy workloads but does not provide the required latency that premium file shares offer.
- Hot file shares provide storage optimized for general-purpose file sharing for items such as department shares. Hot files use HDDs.
- **Cool** file shares provide cost-effective storage for archive storage requirements. This type of storage tier uses HDDs.

#### Important Note

For larger organizations and high I/O workloads, it is recommended that you use the premium storage tier for Azure file shares.

Creating an azure file share is quite simple. You need to make sure you have created a storage account before proceeding. Within the storage account, you need to navigate to the **File Shares** icon within the table of contents for the storage account:



Figure 5.8 - The File shares link within the storage account

On the File shares page, click the File share button, as shown in the following screenshot:

Micr	osoft Azure	𝒫 Search resources	s, services, and docs (G+/)	⊾ Ç	⊉ 🕸	? &	minanti	. 🕘
»	Home > rm	hitblogstorage1_16236	90391749 > rmitblogstor	age1				
+	🛁 rmi	tblogstorage	1   File shares	\$				$\times$
٠	Storag	e account						
	P Search (	Ctrl+/)	« 🕂 File share	💛 Refresh				
	Poto mic	aration	File share setting	s				
-*-	Evonto	Jiauon	Active Directory:	Not configured	Soft delete	: 7 days	Share capacity: 5 TiB	
		Evoloror (proviou)	Court flasher					
	Je Stolage	explorer (preview)	Search file share	s by prefix (case-s leted shares	ensitive)			
۲	Data storage	<b>;</b>						
	Containe	ers	100000000				<u></u>	
~			Name		M	odified	Tier	
2	📫 File shar	es	You don't have a	any file shares yet.	M Click '+ File st	odified	Tier started.	
» 8	File shar	es	Name You don't have a	any file shares yet.	M Click '+ File sł	odified	Tier started.	•
<ul> <li>Image: Second sec</li></ul>	File shar Queues Tables	es	Name You don't have a	any file shares yet.	M Click '+ File sł	odified	Tier tarted.	Þ
<ul> <li>12</li> <li>12</li> <li>13</li> <li>14</li> <li>1</li></ul>	File shar Queues Tables Security + no	es etworking	Name You don't have a	any file shares yet.	M Click '+ File sł	odified	Tier	•
🚺 🚸 🛃 🕱 🖉	File share Queues Tables Security + no Network	es etworking ing	Vou don't have a	any file shares yet.	M Click '+ File sł	odified	Tier	×
<ul> <li>•••</li> <li>•••</li></ul>	Pile share     Queues     Tables     Security + ne     Network     Azure CE	es etworking ing DN	Vame You don't have a	any file shares yet.	M Click '+ File sł	odified	Tier	Þ
> 00 N I A	File share     Queues     Tables     Security + ne     Network     Azure Cl     Access k	es etworking ing DN eys	Vou don't have a	any file shares yet.	M Click '+ File sł	odified hare' to get s	Tier	•
> 💀 🕺 📑 🗇 🚺 🔅 🔶 🕐	File share     Queues     Tables     Security + ne     Security + ne     Azure Cl     Access k     Shared a	es etworking ing DN eys eccess signature	Vou don't have a	any file shares yet.	M Click '+ File sł	odified hare' to get s	Tier	Þ
» (* (* (* (* (* (* (* (* (* (* (* (* (*	File share     File share     Queues     Tables     Security + ne     Network     Azure CC     Access k     Shared a     Encryptia	es etworking ing DN eys eccess signature on	You don't have a	any file shares yet.	M Click '+ File sł	odined	Tier	÷

Figure 5.9 – The File share button

Once you have clicked the **File share** button, you will see the **New file share** blade appear. Fill in the following fields in this blade to create a new file share:



Figure 5.10 – The New file share blade

You will need to enter a **Name** for the share, a **Quota** size, and choose the tier you would like.

Once you have entered the required details, click Create to finish creating the new share:

Micro	osoft Azure	$\mathcal P$ Search resources, servi	ices, and docs (G+/)	r 🖓 🕸	? &	uniterreratie. 🔍	
		itblogstorage1_1623690391	749 > rmitblogstorage1				
	🛁 rmi	tblogstorage1	File shares 🛷 …			×	
٠	Storage	e account					
	P Search (C	Ctrl+/) «	🕂 File share 💍 Refresh				
	🍧 Data mig	gration	File share settings				
	🗲 Events		Active Directory: Not configu	red Soft delet	e: 7 days S	Share capacity: 5 TiB	
	🚡 Storage I	Explorer (preview)	Search file shares by prefix (	case-sensitive)			
	Data storage		Show deleted shares				
4>	🗖 Containe	ers	Name	N	lodified	Tier	
					01010040121000		
2	📫 File share	25	📫 test	6	/14/2021. 6:31:33	3 PM Transaction optimized	
2	File share	25	📫 test	6	/14/2021, 6:31:33	3 PM Transaction optimized	
8 8	File share Queues	25	📫 test	6	/14/2021, 6:31:3:	3 PM Transaction optimized	
	File share     Queues     Tables     Security + ne	es etworking	-≓ test ∢	6	/14/2021, 6:31:3:	3 PM Transaction optimized	
12	File share Queues Tables Security + ne	es etworking		6	/14/2021, 6:31:33	3 PM Transaction optimized	
III ♦	File share Queues Tables Security + ne Network	etworking ing DN		6	/14/2021, 6:31:33	3 PM Transaction optimized ▶	
	File share     Queues     Tables     Security + ne     Network     Azure CE     Access ke	es etworking ing DN eys	.щ test ∢	6	/14/2021, 6:31:33	3 PM Transaction optimized	
	File share     Queues     Tables     Security + ne     Network     Azure CC     Access k     Shared a	etworking ing DN eys cccess signature		6	/14/2021, 6:31:33	3 PM Transaction optimized	
	File share     Queues     Tables     Security + ne     Network     Azure CC     Access k     Shared a     Encryptice	etworking ing DN eys cccess signature on		6	/14/2021, 6:31:33	3 PM Transaction optimized	

Figure 5.11 – The newly created file share

Note that the experience within a storage account using premium storage for file storage has a slightly different UI experience, as shown in the following screenshot:

New file share	$\times$
Name *	
A premium file share is billed by provisioned share size, regardless of the used capacity. Learn more	
<ul> <li>The minimum share size is 100 GiB.</li> <li>Provision more capacity to get more performance.</li> </ul>	
Provisioned capacity * ①	
1024	
Set to maximum	GiB
Performance	
Maximum IO/s ① 1424	
Burst IO/s ① 4000	
Throughput rate ① 163.0 MiBytes / s	
Protocol * ① SMB O NFS	
To use the SMB protocol with this share, check if you can communicate over port 445. Th scripts for Windows clients and Linux clients can help. Learn how to circumvent port 445 issues.	nese

Figure 5.12 – Configuring premium file shares

This section summarized the different Azure file share storage tier options and how to create a new Azure file share. In the next section, we will look at Azure Managed Disks, ephemeral OS disks, and learn how to prepare a custom image.

# **Configuring disks**

This section will look at Azure Managed Disks, the different available options, and how to prepare a custom VHD image.

An Azure managed disk is essentially a virtual disk (block-level storage volume) in conjunction with Azure VMs. Managed disks are designed to provide an availability of 99.999%. This is achieved by providing three replica copies of your data, which provides high durability.

Detail	Ultra Disk	Premium SSD	Standard SSD	Standard HDD	
Disk type	SSD	SSD	SSD	HDD	
Scenario I/O-intensive workloads such as SAP HANA, top tier databases (for example, SQL, Oracle), and other transaction-heavy workloads		Production and performance- sensitive workloads	Web servers, lightly used enterprise applications, and dev/test	Backup, non-critical, and infrequent access	
Max disk size	65,536 gibibytes (GiB)	32,767 GiB	32,767 GiB	32,767 GiB	
Max throughput	2,000 MB/s	900 MB/s	750 MB/s	500 MB/s	
Max IOPS	160,000	20,000	6,000	2,000	

The following table details the different types of managed disks that are available:

This table was taken from the following site: https://docs.microsoft.com/ en-us/azure/virtual-machines/disks-types.

As shown in the preceding table, each type of disk has a specific use case. For AVD multi-session deployments, it is recommended that you use premium SSDs to avoid any IOPs bottlenecks. You can use standard SSDs for personal desktop deployments. It is not recommended to use standard HDD disks for AVD deployments as performance could be degraded:

```
Important Note
```

It is recommended that premium SSDs be used for session hosts.

Premium SSD Sizes	P10	P15	P20	P30	P40	P50	P60	P70	P80
Disk size in GiB	128	256	512	1,024	2,048	4,096	8,192	16,384	32,767
Provisioned IOPS per disk	500	1,100	2,300	5,000	7,500	7,500	16,000	18,000	20,000
Provisioned Throughput per disk	100 MB/ sec	125 MB/ sec	150 MB/ sec	200 MB/sec	250 MB/ sec	250 MB/ sec	500 MB/ sec	750 MB/ sec	900 MB/sec
Max burst IOPS per disk	3,500	3,500	3,500	30,000*	30,000*	30,000*	30,000*	30,000*	30,000*
Max burst throughput per disk	170 MB/ sec	170 MB/ sec	170 MB/ sec	1,000 MB/ sec*					
Max burst duration	30 min	30 min	30 min	Unlimited*	Unlimited*	Unlimited*	Unlimited*	Unlimited*	Unlimited*
Eligible for reservation	No	No	No	Yes, up to 1 year	Yes, up to 1 year	Yes, up to 1 year	Yes, up to 1 year	Yes, up to 1 year	Yes, up to 1 year

This table was taken from Microsoft's documentation site: https://docs. microsoft.com/en-us/azure/virtual-machines/diskstypes#premium-ssd-size.

Typically, Azure Managed Disks are **locally redundant storage** (**LRS**). This means that the storage is replicated three times within a single data center in the region where you deployed the VM.

You can also configure **zone-redundant storage** (**ZRS**) for managed disks. ZRS replicates Azure Managed Disks synchronously across three Azure availability zones within a selected Azure region. Each zone is a separate physical location with independent networking, cooling, and power.

There is no difference in latency or performance; the only improvement when using ZRS is the improved data protection.

## **Ephemeral OS disks**

Ephemeral OS disks, also known as stateless disk storage, are created on the Azure Hypervisor's local storage as part of the VM cache. One benefit of using ephemeral disks over Azure Managed Disks is that ephemeral disks are free. This allows the stateless disk storage to provide lower latency and faster reads and writes. The following table details the differences between Azure Managed Disks and ephemeral disks:

	Azure Managed Disks	Ephemeral OS Disks
Size limit for OS disk	2 TiB.	Cache size for the VM size or 2 TiB, whichever is smaller. For the cache size in GiB, see DS, ES, M, FS, and GS.
VM sizes supported	All.	VM sizes that support (cache disk) premium storage such as DSv1, DSv2, DSv3, Esv3, Fs, FsV2, GS, and M.
Disk type support	Managed and unmanaged OS disk.	Managed OS disk only.
Region support	All regions.	All regions.
Data persistence	OS disk data that's written to OS disks is stored in Azure Storage.	Data written to OS disk is stored in the local Hypervisor storage and is not persisted to Azure Storage.
Stop-deallocated state	VMs and scale set instances can be stop-deallocated and restarted from the stop-deallocated state.	VMs and scale set instances cannot be stop-deallocated.
Specialized OS disk support	Yes.	No.
OS disk resize	Supported during VM creation and after the VM is stop-deallocated	Supported during VM creation only.
Resizing to a new VM size	OS disk data is preserved.	Data on the OS disk is deleted, OS is re-provisioned.
Page file placement	For Windows, the page file is stored on the resource disk.	For Windows, the page file is stored on the OS disk.

This table was taken from the following Microsoft site: https://docs.microsoft.com/en-us/azure/virtual-machines/ephemeral-os-disks.

Note that you cannot start and stop/deallocate an Azure VM that's been configured with an ephemeral OS disk (OS cache). The only options that are available to you are to restart or reimage.

#### Important Note

If you want to use ephemeral disks, you need to use a custom ARM template or third-party tooling and PowerShell.

In this section, we looked at what ephemeral disks are, the pros and cons, and the differences between Azure Managed Disks and ephemeral disks. In the next section, we will create a custom master VHD image.

### Creating a VHD image

In this section, you will learn how to prepare a master **virtual hard disk** (**VHD**) image for Azure. Note that Microsoft recommends that you use an image from the Azure image gallery. However, this section covers both options, giving you the ability to customize an image offline and upload it to Azure when you're finished. You can also use Microsoft Deployment Toolkit and SCCM to create images for AVD. To upload these images, you can use the following tools:

- Azure portal: Use the upload feature within the storage account.
- Azure Storage Explorer: https://azure.microsoft.com/features/ storage-explorer/
- Az copy: https://docs.microsoft.com/azure/storage/common/ storage-ref-azcopy

#### Important Note

Ensure your image does not have the AVD agent installed on the VM. The agent can cause issues, including blocking registration and preventing user session connections.

### Creating a VM

There are two options for creating a VM. First, you can provision the VM in Azure, and then customize and install the required software. Alternatively, you can create an image locally using Hyper-V and customize it to your requirements.

First, let's look at deploying a VM in Azure:

1. Within the Azure search bar, type virtual; the **Virtual machines** page link will be shown. Click on **Virtual machines**:

Micro	osoft Azure	𝒫 virtual	X D 🛱 🖓 🎯 🧭 ryan@ry	yanmangansitbl IGANSITBLOG (RYANM
»	Home >	Services See all	Marketplace	See all
+	Virtual r	📮 Virtual machines	🖄 Virtual network	×
1	ryanmangansit	Virtual networks	🖄 Virtual Card 360	
<b>21</b>	$+$ Create $\vee$	📕 Virtual clusters	a eCare21 Virtual Care Platform	
⊨	Filter for any f	💀 Virtual WANs	Red Hat Enterprise Linux 7.5	
*	Filter for any I	🔒 Virtual network gateways	Documentation	See all
	Showing 1 to 4	Virtual networks (classic)	Virtual networks and virtual machines in Azure   Microsoft	$\sim$
	✓ Name ↑↓	🎭 Virtual machine scale sets	Azure Virtual Desktop session host autoscale preview	, Size ↑↓
	200-0	Virtual machines (classic)	Get started with the Azure Virtual Desktop Agent	Standard B2s
		🕎 SQL virtual machines	Built-in policy definitions for Azure Virtual Machines	Standard_025
~	app-1	🧭 Azure Virtual Desktop	Resource Groups	Standard_B2S
<b>801</b>	VDTE	Resources	No results were found	Standard_D2s
<u>8</u>	🔽 早 DC-01	No results were found.	no real since round.	Standard_B2s
•				
-		Didn't find what you were looking for?		
$\equiv$		Try searching in Azure Active Directory		
		Searching 1 of 2 subscriptions.	📌 Give fer	edback
-				
<b>(</b>	4			•
	< Previous	Page 1 v of 1 Next >		

Figure 5.13 – Search bar displaying the Virtual machines page link in the Azure portal

2. Within the **Virtual machines** page, click **Create** and select **Virtual Machine**. This will open the **Create a virtual machine** page:

Micro	osoft Azure 👂 Search resour	ces, services, and docs (G+,	)		G 🖉 🖗 Ø	ryan@ryanman RYANMANGANSITEL	jansitbl SG (RYANM_
» +	Home >						
<b>^</b>	ryanmangansitblog (ryanmangansitbl	log.com)					×
20	+ Create $\lor \rightleftharpoons$ Switch to cla	assic 🕓 Reservations 🗸	🔕 Manage view 🗸	🖒 Refresh 🞍 Exp	ort to CSV 🛛 😤 Open o	uery 🛛 🦁 Assign tags	
=	+ Virtual machine	ption == Azure sub:	cription 1 Resour	rce group == all $ imes$	Location == all $\times$	⁺Ҿ Add filter	
	+ Start with a preset configurat snowing 1 to 4 of 4 records.	tion			No grouping	✓ List view	$\sim$
[]	🗹 Name ᡝ	Subscription ↑↓	Resource group $\uparrow_\downarrow$	Location $\uparrow\downarrow$	Status ↑↓	Operating system 1	Size ↑↓
۲	🔽 🖳 app-0	Azure subscription 1	msixaa01-avd	UK South	Running	Windows	Standard_B2s
🤣	🔽 🖳 app-1	Azure subscription 1	msixaa01-avd	UK South	Running	Windows	Standard_B2s
	AVDTECHFEST-0	Azure subscription 1	msixaa01-avd	UK South	Running	Windows	Standard_D2s
32	🔽 🖳 DC-01	Azure subscription 1	RMITBLOG_AD	UK South	Running	Windows	Standard_B2s
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	< Previous Page 1 V o	of 1 Next >					

Figure 5.14 - Creating a VM within the Virtual machines page in the Azure portal

- 3. Within the **Create a virtual machine** page, you will need to fill in all the required fields:
  - Under the **Subscription** section, select the required subscription and select an existing **Resource group** or create a new one.
  - Under the **Instance details** section, provide a **Virtual machine name**, select a **Region**, select an **Image**, and specify a **Size**. This will be a VM skew:

*...* 

#### Create a virtual machine



Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. Learn more C<sup>3</sup>

Review + create

#### **Project details**

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * 🛈	Azure subscription 1				
Resource group * 🛈	(New) image-example				
	Create new				
Instance details					
Virtual machine name * 🛈	Testimage 🗸				
Region * 🛈	(Europe) UK South				
Availability options ①	No infrastructure redundancy required $\checkmark$				
Security type 🕕	Standard V				
Image * 🕕	Windows 10 Enterprise multi-session, version 21H1 + Microsoft 365 App V				
Azura Spat instance					
Azure spot instance ()					
Size * 🛈	Standard_B2s - 2 vcpus, 4 GiB memory (£25.68/month)				

Figure 5.15 - The Basics tab within the Create a virtual machine page

- 4. Within the same tab, provide an administrator username and password.
- 5. Set the inbound port rules if required.
- 6. Check the **Licensing** check box to confirm that you have the correct licensing rights:

Administrator account	
Username * 🛈	sysadmin 🗸
Password * ①	······ ✓
Confirm password * ①	······ ✓
Inbound port rules	
Select which virtual machine network ports network access on the Networking tab.	are accessible from the public internet. You can specify more limited or granular
Public inbound ports * 🛈	O None
	Allow selected ports
Select inbound ports *	RDP (3389)
	This will allow all IP addresses to access your virtual machine. This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.

#### Licensing

 I confirm I have an eligible Windows 10 license with multi-tenant hosting rights. \*

Figure 5.16 – The Administrator account section within the Basics tab of the Create a virtual machine page within the Azure portal

7. On the **Disks** tab, select the required disk. As we mentioned previously, a premium SSD is recommended:

#### Create a virtual machine

Basics Disks Networking Mana	agement Advanced Tags Review + create			
Azure VMs have one operating system disk and a temporary disk for short-term storage. You can attach additional data disks. The size of the VM determines the type of storage you can use and the number of data disks allowed. Learn more 🖻				
Disk options				
OS disk type * 🛈	Premium SSD (locally-redundant storage)			
Encryption type *	Locally-redundant storage (data is replicated within a single datacenter)			
Enable Ultra Disk compatibility ①	Premium SSD Best for production and performance sensitive workloads			
	Standard SSD Best for web servers, lightly used enterprise applications and dev/test			
Data disks	Standard HDD			
You can add and configure additional data ( Best for backup, non-critical, and infrequent access temporary disk.				
LUN Name	Size (GiB) Disk type Host caching			

Create and attach a new disk Attach an existing disk

Figure 5.17 – The Disks tab within the Create a virtual machine page of the Azure portal

8. Once you have finished choosing the required disk and settings within the **Disks** tab, click the **Networking** tab and configure the required networking.

- 9. Under the **Networking** tab, configure the following:
  - Select the required Virtual network.
  - Select the required **Subnet**.
  - Set a public VM, if required.
  - Set the network security groups, if required:

Basics	Disks	Networking	Management	Advanced	Tags	Review + create
Define n	atwork co	nnectivity for your	virtual machine by	/ configuring ne	twork int	orface card (NIC) settings. V

Define network connectivity for your virtual machine by configuring network interface card (NIC) settings. You can control ports, inbound and outbound connectivity with security group rules, or place behind an existing load balancing solution. Learn more 3

#### Network interface

When creating a virtual machine, a network interface will be created for you.

Virtual network * ①	WVD_test01 V Create new
Subnet * 🛈	default (10.0.0.0/24)          ✓        Manage subnet configuration
Public IP 🕕	None V Create new
NIC network security group ①	<ul> <li>None</li> <li>Basic</li> <li>Advanced</li> <li>The selected subnet 'default (10.0.0.0/24)' is already associated to a network security group 'Network'. We recommend managing connectivity to this virtual machine via the existing network security group instead of creating a new one here.</li> </ul>
Accelerated networking ①	The selected VM size does not support accelerated networking.
Load balancing	
You can place this virtual machine in the b	ackend pool of an existing Azure load balancing solution. Learn more 🗗
Place this virtual machine behind an existing load balancing solution?	



If you require specific settings under the Management, Advanced, and Tags tabs, complete the required settings and progress to the Review + create tab. If you do not require specific settings under these tabs, skip to the Review + create tab:



Figure 5.19 - The Review + create tab of the Create a virtual machine page within the Azure portal

This section showed you how to deploy a VM image template for AVD in the Azure portal. Next, we will learn how to create a local image on Hyper-V.

## Creating a local image

First, you will need to download the required OS image. Then, using Hyper-V, you must create a VM using the downloaded VHD. You need to ensure that you complete the following steps:

1. Specify the generation as Generation 1:

🖳 New Virtual Machine Wizar	× b
Specify Gene	ration
Before You Begin Specify Name and Location	Choose the generation of this virtual machine.
Specify Generation Assign Memory	This virtual machine generation supports 32-bit and 64-bit guest operating systems and provides virtual hardware which has been available in all previous versions of Hyper-V.

Figure 5.20 - Choosing Generation 1 in Hyper-V

2. Disable the checkpoints for the VM:

Ċ	Checkpoints
You	a can configure options for checkpoints for this virtual machine.
C	heckpoint Type
[	Enable checkpoints
	Select the type of checkpoint that will be created when users choose to checkpoint this virtual machine.

Figure 5.21 – Disabling the Enable checkpoints box

The following PowerShell cmdlet allows you to disable checkpoints:

Set-VM -Name <VMNAME> -CheckpointType Disabled

Now, let's look at the difference between dynamic and fixed disks since Azure only supports the fixed disk format.

### Dynamic disks versus fixed disks

When creating a VM from an existing VHD, it creates a dynamic disk by default. However, you can change this by selecting the **Edit Disk...** option within Hyper-V. You can also use PowerShell to change a dynamic disk to a fixed disk, as follows:

```
Convert-VHD -Path c:\test\MY-VM.vhdx -DestinationPath c:\test\
MY-NEW-VM.vhd -VHDType Fixed
```

This section detailed the options available to you when creating an image. We also covered some of the requirements for if you decide to customize an image outside of AVD using Hyper-V.

## Summary

In this chapter, we looked at implementing and managing storage for AVD. First, we explored the requirements for storing FSLogix Profile Containers, storage account tiers, Azure Files storage tiers, and Azure Files integration with Active Directory Domain Services. Next, we looked at creating a new storage account and configuring Azure File Shares. Then, we reviewed the differences between Azure Managed Disks and ephemeral Operating System disks and finished by looking at the options available for creating a VM with Azure.

In the next chapter, we will look at creating and configuring host pools and session hosts.

# Questions

Here are a few questions to test your understanding of this chapter:

- 1. What is the recommended storage solution for FSLogix Profile Containers?
- 2. Do all regions support all types of storage accounts and redundancy configurations?
- 3. When it comes to storage accounts for larger organizations and high I/O workloads, what is the recommended storage tier?
- 4. What is the recommended disk type for session hosts?
- 5. What disk format does a virtual hard disk need to be to upload and function correctly within Azure?