

# **Microsoft SQL Server**

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# **Microsoft SQL Server**

# TR-4951: Backup and Recovery for Microsoft SQL Server on AWS FSx for ONTAP

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This document covers the steps necessary to perform backup and recovery for Microsoft SQL Server on AWS FSx for ONTAP with SnapCenter. This includes the following information:

- NetApp SnapCenter configuration
- SnapCenter backup operations
- Backup operation for an FCI database
- · Backup operation for multiple databases
- · Restore and recovery

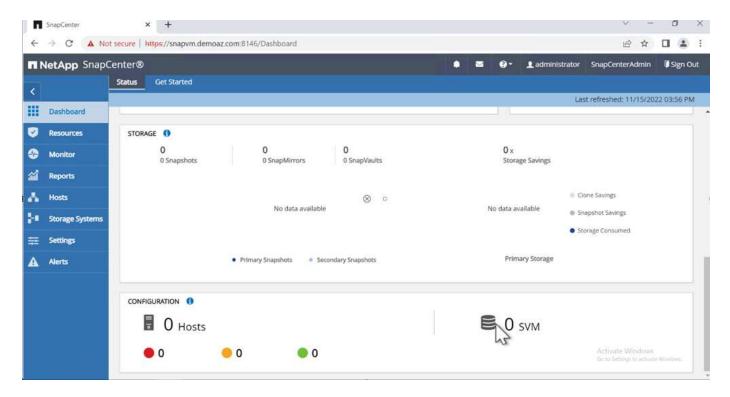
#### **SnapCenter Configuration**

The following steps must be performed for SnapCenter configuration and the protection of Microsoft SQL Server resources. Each of the following steps is detailed in the following sections.

- 1. Configure sysadmin credentials for the SQL Server backup and restore user.
- 2. Configure storage settings. Provide Amazon Web Services (AWS) management credential to access the Amazon FSx for NetApp ONTAP storage virtual machines (SVMs) from SnapCenter.
- 3. Add a SQL Server host to SnapCenter. Deploy and install the required SnapCenter Plug-ins.
- 4. Configure policies. Define the backup operation type, retention, and optional Snapshot backup replication.
- 5. Configure and protect the Microsoft SQL Server database.

#### SnapCenter newly installed user interface

Configure credentials for SQL Server backup and restore the user with sysadmin rights.



NetApp recommends using role-based access control (RBAC) to delegate data protection and management capabilities to individual users across the SnapCenter and window hosts. The user must have access to the SQL Server hosting the database. For multiple hosts, the username and password must be the same across the various hosts. Furthermore, to enable SnapCenter to deploy the required plug-in on SQL Server hosts, you must register the domain information for SnapCenter to validate your credentials and hosts.

Expand the following sections to see the detailed instructions on how to complete each step.

#### Add the credentials

Go to **Settings**, select **Credentials**, and click (+).

÷	→ C ▲ No	secure https://snapvm.demoaz.com	:8146/Administration?View	Name=RunAs			ピ ☆	
	letApp Snap(	enter®			• = 9-	1 administrator	SnapCenterAdmin	🛿 Sign Out
¢		Global Settings Policies Use	ers and Access Roles	Credential Software				
	Dashboard	Search by Credential Name		42.			11	
0	Resources	Credential Name		Authentication Mode			Details	
D	Monitor	There is no match for your search or	data is not available.					
1	Reports							
1	Hosts			⊗ ∘				
	Storage Systems							
-	Settings							
A	Alerts							

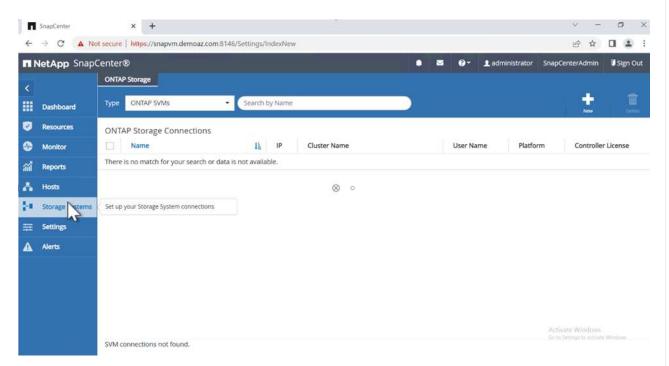
The new user must have administrator rights on the SQL Server host.

Credential Name	Demoaz	
uthentication Mode	Windows 🔹	
Username	demoaz\clusteradmin	0
Password	•••••	
	$\otimes$ $\circ$	

#### **Configure storage**

To configure storage in SnapCenter, complete the following steps:

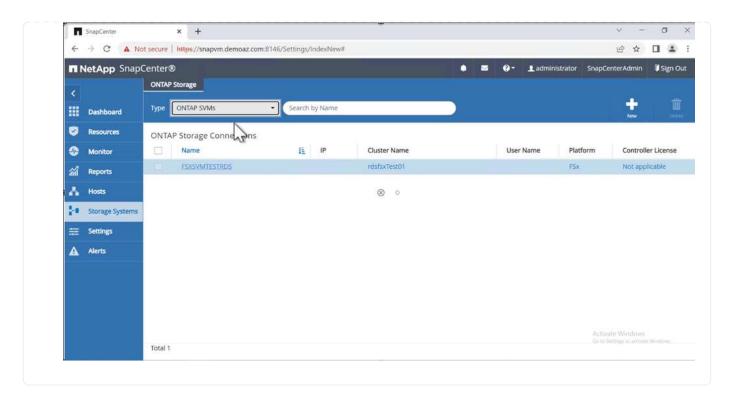
- 1. In the SnapCenter UI, select **Storage Systems**. There are two storage types, **ONTAP SVM** and **ONTAP Cluster**. By default, the storage type is **ONTAP SVM**.
- 2. Click (+) to add the storage system information.



3. Provide the FSx for ONTAP management endpoint.

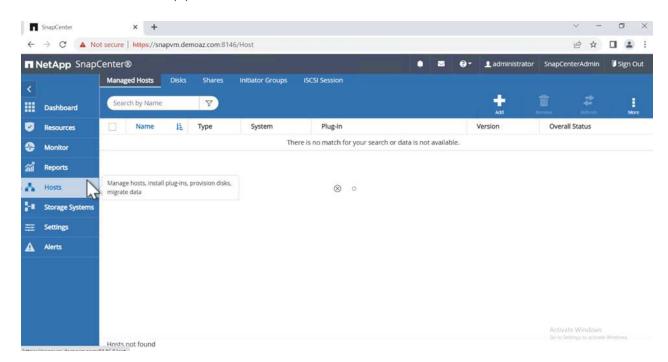
letApp SnapCenter®				•	9-	1 administrator	SnapCenterAdmin	🗊 Sign C
ONTAP Storage		Add Storage System						
		Add Storage System	0					
ONTAP Storage Connec	tions	Storage System	172.30.0,98					
Name	IL.	Username	fsxadmin					
There is no match for your se is not available.	arch or data	Password	••••					
		Event Management S	ystem (EMS) & Autoญpport Settings					
		Send AutoSuppor	t notification to storage system					
			erver events to syslog					
		More Options : Pla	tform, Protocol, Preferred IP etc					
		Submit Cancel	Reset					

4. The SVM is now configured in SnapCenter.



To add a SQL Server host, complete the following steps:

1. From the Host tab, click (+) to add the Microsoft SQL Server host.



2. Provide the fully qualified domain name (FQDN) or IP address of the remote host.



The credentials are populated by default.

3. Select the option for Microsoft windows and Microsoft SQL Server and then submit.

Ne	etApp SnapCenter®					9-	1 administrator	SnapCenterAdmin	Sign C
	Managed Hosts								
1	Search by Name	Add Host							
2	Name 1	Host Type	Windows	*					
Ð	There is no match for your search or data is not available.	Host Name	FSXCLUSTER.Demoaz.com						
1		Credentials	Demoaz	*	+				
• €		More Options ; Por	all SnapCenter Plug-Ing Package 4.7 for Window Microsoft Windows Microsoft SQL Server SAP HANA t, gMSA, Install Path, Custom Plug-Ins	vs					
		Submit Cancel							

The SQL Server packages are installed.

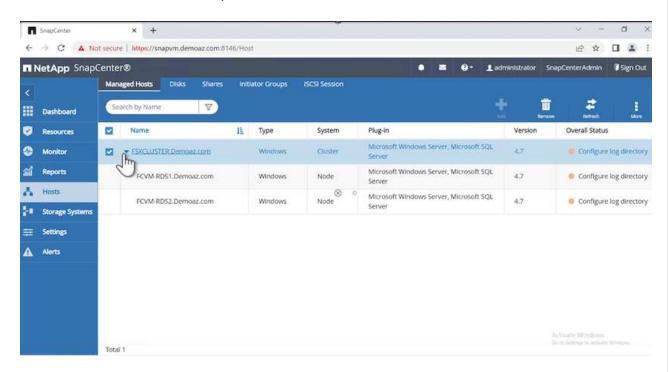
	letApp Snap	Center®							• =	 1 administrator	SnapCenterAdr	nin 🚺	Sign Out
		Managed I	Hosts Disks	Shares	1 Initi	ator Groups	ISCSI Session						
< 11	Dashboard	Search t	y Name	V							1		More
2	Resources		ame		臣	Туре	System	Plug-in		Version	Overall S		NOTE
0	Monitor	ES	XCLUSTER.Demo	az.com		Windows	Cluster				Insta	illing plug	ş-in
đ	Reports												
s.	Hosts						$\otimes$	0					
	Storage Systems												
•	Settings												
١.	Alerts												

1. After the installation is complete, go to the **Resource** tab to verify whether all FSx for ONTAP iSCSI volumes are present.

	letApp Snap(	File Sys				• =	🛛 🔹 👤 administra	tor SnapCenter/	Admin 🔋 Sign Out
< 	Dashboard	View	Path	• search	V			Referent Ref	aran New Resource Cou
0	Resources	ja	Name 11	Host	Storage Layout	Resource Groups	Policies	Last Backup	Overall Status
0	Monitor		D:\	F5XCLUSTER.Demo STER.Demoaz.com	FSXSVMTESTRDS:/ FCIDATA/FCIDATA				Not protected
<b>a</b> i	Reports		E/\	FSXCLUSTER.Demo STER.Demoaz.com	FSXSVMTESTRDS/ I/FCILOG/FCILOG				Not protected
А 34	Hosts		ΕA	FSXCLUSTER.Demo STER.Demoaz.com	FSXSVMTESTRDS:/ ACKUP/FCIBACKUP				Not protected
	Storage Systems Settings		G/\	FSXCLUSTER.Demo STER.Demoaz.com	FSXSVMTESTRDS/				Not protected
4	Alerts		H3	FSXCLUSTER.Demo STER.Demoaz.com	FSXSVMTESTRDS:/				Not protected
			К3	FSXCLUSTER.Demo STER.Demoaz.com	FSXSVMTESTRDS:/				Not protected
			վեղ						
		Total 6	0						

To configure a host log directory, complete the following steps:

1. Click the check box. A new tab opens.



2. Click the configure log directory link.

1.1	A	+							-	
4 -	C A Not secure https:	//snapvm.demo	oaz.com:8146/Host					18 ✿		1
n Ne	tApp SnapCenter®				•	. 0-	1 administrator	SnapCenterAdmin	🛛 Sign	Out
>	Managed Hosts									×
	Search by Name		Host Details							
•	Name	11.	Host Name	FSXCLUSTER.Demoaz.com		A14	erts			
•	SXCLUSTER.Demoaz.co	m	Host IP	172.30.5.143		Alt	115			
		J.	Overall Status	Configure log directory		No	Alerts			
			Host Type	Windows						
Ċ.			System	Cluster $\otimes$ o						
-			Credentials	Demoaz 🥒						
#			Plug-ins	SnapCenter Plug-Ins package 4.7.0.877 for Windows						
<b>A</b>				Microsoft Windows     Microsoft SQL Server <u>Remove</u> <u>Configure</u>						
				log directory						
			More Options : Po	ort, gMSA, Install Path, Add Plug-Ins						
			Submit Cancel	Reset						
			Concer					Activate Windows Go to Settings to activate		

3. Select the drive for the host log directory and the FCI instance log directory. Click **Save**. Repeat the same process for the second node in the cluster. Close the window.

5napCenter	× +			v - 0
← → C ▲ Not secur	e   https://snapvm.demoaz	com:8146/Host#		ie 🖈 🛛 😩
	Configure Plug	-in for SQL Server	×	
	Configure the log	backup directory for FSXCLUSTER.Demoaz.com		
	Configure host lo	g directory		
	Host	FCVM-RDS1.Demoaz.com		
	Host log directory	N:\SNAPFCVM1LOG\	🗄 Apply 🖿 Browse	
	Configure FCI ins	ance log directory		
	FCI instance	SQLHMCRDS •		
	FCI log directory	G:\SNAPLOGFCI\	Apply     Browse	
			Save Close	

The host is now in a running state.

Dashboard       Search by Name       Search by	n Ne	etApp Snap(					2/12-22-22	•		<b>?</b> ~	1 administrato	or SnapGo	enterAdmin	🛛 Sign C
Monitor Monitor Monitor Monitor Microsoft Windows Server, Microsoft SQL 4.7 Running Running Server Server	< II (	Dashboard	Managed Hosts Search by Name	Disks Shares	Initiator	Groups 154	-SI Session						*	
Monitor     • ESXCLUSTIEX.Demoa2.com     Windows     Cluster     Server     6.7     • Running       • Hosts     •     •     •     •     •     •       • Hosts     •     •     •     •     •       • Storage Systems     •     •     •     •	8	Resources	Name		1E	Туре	System	Plug-in				Version	Overa	ll Status
Hosts Hosts Storage Systems Settings	•	Monitor	ESKCLUST	R.Demoaz.com		Windows	Cluster		ndows Se	rver, Micr	osoft SQL	4.7	De Ri	unning
I Storage Systems Ξ Settings													J	
Ξ Settings	13	appres												
		nusione II												
Alerts		Hosts												
		Hosts												
	 	Hosts Storage Systems Settings												
	 	Hosts Storage Systems Settings												

1. From the **Resources** tab, we have all the servers and databases.

ш	NetApp Snap(		8 ioft SQL Server			• = •-	1 administrator	SnapCenterAdmin 🕅 Sig
< ====	Dashboard	View	Database	search by name	▽			tetes licenses www.ice
0	Resources		Name	Instance	Host	Last Backup	Overall Status	Туре
۲	Monitor		INVENTORYDB1	SQLHMCRDS	PSXCLUSTER.Demoaz. com		Not protected	User database
<b>a</b>	Reports		INVENTORYDB2	SQLHMCRDS	FSXCLUSTER.Demoaz. com		Not protected	User database
소 24	Hosts		INVENTORYDB3	SQLHMCRDS	PSXCLUSPER.Demoaz.		Not protected	User database
••• ==	Storage Systems Settings		INVENTORYD84	SQLHMCRDS	PSXCLUSTER.Demoaz. com		Not protected	User database
	Alerts		INVENTORYD85	SQLHMCRDS	PSXCLUSTER.Demoaz. com		Not protected	User database
			master	SQLHMCRDS	PSXCLUSTER.Demoaz. com		Not protected	System database
			model	SQLHMCRDS	PSXCLUSTER.Demoaz.		Not protected	System database
		Total 9						

## Configure a backup policy

A backup policy is a set of rules that govern how to manage, schedule, and retain backup. It helps with the backup type and frequency based on your company's SLA.

Expand the following sections to see the detailed instructions on how to complete each step.

To configure a backup policy for an FCI database, complete the following steps:

1. Go to **Settings** and select **Policies** on the top left. Then click **New**.

NetApp Snap	Center®							0-	1 dusteradmin	SnapCenterAdmin	Sign Out
C Dashboard	Global Settings Policies Utiers and Microsoft SQL Server			Software -				÷			
Monitor	Name		Backup Type		Schedule Type	Replication			Verification		
a Reports	There is no match for your search or data is View or export activity reports	not availabl	le.								
liosta											
Storage Systems											
E Settings											
CONTRACTOR OF A DECK											

2. Enter the policy name and a description. Click **Next**.

New SQL Serve	er Backup Policy	5		×	
1 Name	Provide a polic	/ name			
2 Backup Type	Policy name	TestDB-fullbackup-policy		0	
3 Retention	Details	TestDB-fullbackup-policy		_	
4 Replication					
5 Script		⊗ ∘			
6 Verification					
7 Summary					
			Previous	Net	

3. Select **Full backup** as the backup type.

New SQL Serve	er Backup Policy	×
1 Name	Select SQL server backup options	î
2 Backup Type	Choose backup type	
3 Retention	O Full backup and log backup	
4 Replication	Full backup	
5 Script	Copy only backup ()	
6 Verification	Maximum databases backed up per Snapshot copy: 100	
7 Summary	Availability Group Settings	

4. Select the schedule frequency (this is based on the company SLA). Click **Next**.

No. of Concession, Name				
New SQL Serve	er Backup Policy	×		
Name	Copy only backup	1		
2 Backup Type	Maximum databases backed up per Snapshot copy: 100	- 1		
3 Retention	Availability Group Settings			
4 Replication	A numerical framework and the			
5 Script	Schedule frequency 🛞 o	- II		
6 Verification	<ul> <li>Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you stagger your start times.</li> <li>O On demand</li> </ul>	1 to		
7 Summary	Hourly     Dally			
		Nhi		

5. Configure the retention settings for the backup.

×
Previous Next
Previous
Previous

New SQL Serve	r Backup Policy	
1 Name	Select secondary replication options ()	
2 Backup Type	Update SnapMirror after creating a local Snapshot copy.	
3 Retention	Update SnapVault after creating a local Snapshot copy.	
4 Replication	Secondary policy label Choose ~	0
5 Script	Error retry count 3	
6 Verification		
7 Summary		
		Previous Next

7. Specify a run script to run before and after a backup job is run (if any).

Name	Specify optional se	rrints to run be	fore performing a backup job	
			iore performing a backup job	
Backup Type	Prescript full path			
Retention	Prescript arguments	Choose option	il arguments	
Replication	Specify optional so	cripts to run af	er performing a backup job	
	Postscript full path			
Script	Postscript arguments	Choose option	il arguments	
Verification	Script timeout	60	secs	
Summary		<u>.</u>		
Juninary				
				Previous

8. Run verification based on the backup schedule.

) Name	Select the options	to run backup	erification					
Backup Type	Run verifications for	or the following	backup schedu	les				
3 Retention	Select how often you enabling you to stage			policy. The speci	fic verification time	s are set at backup	job creation	
Replication	Weekly							
5 Script	Database consiste	ncy checks opti	ons					
6 Verification	<ul> <li>Limit the integrity</li> <li>Suppress all inform</li> </ul>			e database (PHY	SICAL_ONLY)			
7 Summary	<ul> <li>Display all reporte</li> <li>Do not check non-</li> </ul>	ed error messages	per object (ALL_EF	RRORMSGS)				
	C Limit the checks a	od obtain the lock		an internal data	hase Snanshot con	V (TARLOCK)		
	Uimit the checks a			an internal data	base Snapshot cop	y (TABLOCK)		
				an internal data	base Snapshot cop	y (TABLOCK)		
	Verification script : Script timeout Prescript full path	settings	s instead of using	an internal data	base Snapshot cop	y (TABLOCK)		
	Verification script	settings	s instead of using	an internal data	base Snapshot cop	y (TABLOCK)		
	Verification script : Script timeout Prescript full path Prescript arguments Postscript full path	settings 60 Choose optiona	s instead of using secs	an internal data	base Snapshot cop	y (TABLOCK)		
	Verification script : Script timeout Prescript full path Prescript arguments	settings	s instead of using secs	an internal data	base Snapshot cop	y (TABLOCK)		
	Verification script : Script timeout Prescript full path Prescript arguments Postscript full path Postscript	settings 60 Choose optiona	s instead of using secs	an internal data	base Snapshot cop	y (TABLOCK)		
	Verification script : Script timeout Prescript full path Prescript arguments Postscript full path Postscript	settings 60 Choose optiona	s instead of using secs	an internal data	base Snapshot cop	y (TABLOCK)		

9. The **Summary** page provides details of the backup policy. Any errors can be corrected here.

New SQL Serve	er Backup Policy		×	
1 Name	Summary			
2 Backup Type	Policy name	TestDB-fullbackup-policy		
3 Retention	Details	TestDB-fullbackup-policy		
Recention	Backup type	Full backup		
Replication	Availability group settings	Backup only on preferred backup replica		
0	Schedule Type	Hourly 🛞 o		
Script	UTM retention	Total backup copies to retain : 7		
6 Verification	Hourly Full backup retention	Total backup copies to retain : 7		
	Replication	none		
2 Summary	Backup prescript settings	undefined Prescript arguments:		
			Previous Finish	

### Configure and protect MSSQL Server database

1. Set up the starting date and expiration date of the backup policy.

itA	pp SnapCenter®					0-	1 administra	itor SnapCe	nterAdmin	Sign	Out
M	icrosoft SQL Server 🔽	Database - Protect Resource									
	search by name							Close Lifequite	1 Details		<b>.</b>
	Name								Statistics.		
-	DEMODB1						-				
	DEMODB2	Resource Policies Verificat	on.	Notific	ation		Summary				
	DEMODB3	Resource Product Periods		110000	00001		All thinks y				
	INVENTORYDB1	Calculation and the Calculation of		had the							
	INVENTORYDB2	Select one or more policies@nd config	sure sci	+ (							
	master	TestDB-fullbackup-policy		Ŧ							
	model	-	122								
	msdb	Configure schedules for selected polic	les			Contin	a Cabada da a				
	tempdb	Policy IE Applied Schedules			-		re Schedules				
	TestDB	TestDB- None fulbackup-				+	ſh				
		policy					6				

2. Define the schedule for the backup. To do that, click (+) to configure a schedule. Enter the **Start date** and **Expires on** date. Set the time based on the company's SLA.

SnapCenter × +					v -	σ	
← → C ▲ Not secure   https://snapvr	n.demoaz.com/8146/inventoryS	QLProtect/ProtectIndex				•	4
	Add schedules	for policy TestDB-fullba	ackup-policy ×				
	Hourly		Í				
	Start date	11/18/2022 03:42 pm	8				
	Expires on	12/18/2022 03:42 pm	=	Real Property lies			
	Repeat every	6 C hours 0	mins				
		Ø 0					
	i The schi time zor	edules are triggered in the Snap ne.	oCenter Server				
			Cancel ox				

3. Configure the verification server. From the drop- down menu, select the server.

4	e c	A Not secure https://snapvr	m.demoaz.com/8146/InventorySQLProte	ect/Protectindex					6 4		
n Ne	etApp	SnapCenter®			٠	<b>⊠ 0</b> •	administrator	SnapCer	nterAdmin	🗊 Sign Out	
>	Micro	osoft SQL Server 👻	Database - Protect Resource								×
	sea	arch by name					a	ine Lifecycle	Details	Migrate	
U		Name					L. 100				
•		DEMODB1		0 0	4		5				
		DEMODB2	Resource	Policies Verifica	tion Notific	ation	Summary				
iii		DEMODB3	Resource	roncies vernica	ion roomo	DLISH.	Summiny				
4		INVENTORYDB1	6 J								4
h.		INVENTORYDB2		ation serves o							
		master	Verification server	SQLHMCRD5(14.0.1000	)	· *					
華		model		SQLHMCRDS(14.0.1	000)						
▲		msdb	Configure verific	ation schedules							1
		tempdb	Policy JE So	chedule Type	Applied Schedu	ules	Configure	Schedules			
		TestOB	There is no match fo	or your search or data is no	t available.						
									Pres	rious Net	í

- 4. Confirm the configured schedule by clicking the plus sign and confirm.
- 5. Provide information for email notification. Click Next.

tAp	p SnapCenter®		0		0-	L clusteradmin	s SnapCe	nterAdmin	Sign Ou
	roxoft SQL Server 💽	Database - Protect Resource							
	earch by name							i	5
	Name	If you want to send notifications for scheduled or on demand jobs, an SMTP server must be configured. Continue to the summary page to save your information,	and then go to S	ettings	Global	1.4			
	master	<sup>445</sup> server.							
	model								
	msdb	0-0-0-3							
	tempdb	Resource Polices Venfication Notification Summary							
	testdb								
	master	Provide email settings							
	model	Select the service accounts or people to notify regarding protection issues.							
	madb	Email preference Never +							
	ktroa	From From email							
	tempdb	To Email to							
		Subject Nonhiston							
		C Attach job report							
				Δ	ctiv	ate Wind	Inves		
Tota	al 10				or too	Settings to a	CHUNG	VALUE Pro	neus N

The summary of the backup policy for SQL Server database is now configured.

	tAp	p SnapCenter®						•		6-	1 administrator	SnapCe	nterAdmin	Sign (
	Micr	rosoft SQL Server	Databas	e - Protect Reso	urce									
	50	earch by name										ave Lifecycle	1 Details	5
	1.	Name									t be configured. C			page to s
		DEMODB1	you	ir information, ai	na then go to se	rangs>	Global Settings+1	votilication	Server S	settings (	o configure the SN	TP server.		
_		DEMODB2									-			
l I		DEMODB3		0-	2		-0-	-6	)—	_	-03			
8		INVENTORYDB1		Resource	Policies		Verification	Notific	ation		Summary			
		INVENTORYDB2				$\otimes$	0							
		master		Database nam	e		TestDB							
8		model		Policy			TestDB-fullb	ackup polic	y: Hourly	v.				
2		msdb		Verification se	rvers		SQLHMCRDS	5						
		tempdb		Verification en	abled for policy		None							
		TestDB		Send email			No							

### SnapCenter backup operations

To create on-demand SQL Server backups, complete the following steps:

1. From the **Resource** view, select the resource and select **Backup now**.

NetAp	pp SnapCenter®				•	≅ 0·	1 administ	rator Snap	CenterAdmin	1 🛛 Sign (	Dui
M	licrosoft SQL Server	"TestD8" Topology									
	search by name		Auguste Database	Cone Lifecycle	Eenove Protection	Linck up Now	N Mary	Mertenarce	Details	Æ	
	Name	Manage Copies					hr				
	DEMODB1		-					220 77470			
	DEMODB2	0 Backu							ary Card		
	DEMODB3	Local copies	5					0 Back	100		
	INVENTORYDB1	coca copies		-				0 Clon	D.		
	INVENTORYDB2		(	8 0							
	master										
	model	Primary Backup(s)									
	msdb	search	7						1 1	44	
	tempdb	Contra	-						Annes On		
	TestDB	Backup Name				Coun	t Type	17 E	End Date	Verified	
		There is no match for your	search.								
Tel	otal 10	Backups not found									

2. In the **Backup** dialog box, click **Backup**.

← → C ▲ Not secure   https://snapvm.demoaz.com.8146/inventorySQLProtect/ProtectIndex	ß	\$	
		1000	-
Backup Screet a backup for the selected resource Resource Name TestDB Policy TestDB-fullbackup-policy Verify after backup © Cancel Bockup			

3. A confirmation screen is displayed. Click Yes to confirm.

Cont	firmation	×
	The policy selected for the on-demand backup is associated with a backup schedule and the on- demand backups will be retained based on the retention settings specified for the schedule type. Do you want to continue ?	
	Yes No	

# Monitor backup job

1. From the **Monitor** tab, click the job and select **Details** on the right to view the jobs.

Reports       TestDB-fullbackup-policy         Hosts       12       ✓       Create Resource Group 'SQLHMCRDS_TestDB'       11/18/2022 3:42:32 PM       11/18/2022 3:42:55 PM       Administration         Storage Systems       11       ✓       Create Policy TestDB-fullbackup-policy       In/18/2022 3:42:32 PM       11/18/2022 3:42:05 PM       Administration         Settings       9       ✓       Discover resources for host 'FCVM-RDS2.Demoaz.com'       11/18/2022 3:30:32 PM       11/18/2022 3:30:55 PM       Administration         Aerts       8       ✓       Discover resources for host 'FCVM-RDS1.Demoaz.com'       11/18/2022 3:39:13 PM       11/18/2022 3:39:15 PM       Administration	terribb such	Center	9		• • • •	2 administrator SnapCenter	rAdmin 🛛 Sign C
Resources       jobs - Filter       Name       Start date       End date       Owner         Reports       13			e minisce	United to the second			•
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When the backup is completed, a new entry is shown in the Topology view.

#### Backup operation for multiple databases

To configure a backup policy for multiple SQL Server databases, create resource group policies by completing the following steps:

1. In the **Resources** tab from the **View** menu, change to a resource group using the drop-down menu.

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Dechanged		ex 💙				New York Concerning Street Free
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Alerts	mullu	SQLADSHINC	PSiCU25118.DemiA2.com		Not protected	Bystern statabase
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	Ownporuhg081	Standa	STXIMS.Demo42.com(X) O		Not protected	User databate
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	ChampionshipOle105	STAVAD	STRAMS.Dem642.com		Not protected	User database
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	1004313					Go to Settings to activate Windows

2. Click (+) for a new resource group.

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NetApp Sna				• E • tadministrator SnapCenterAdmin IS	Sign O
	Microsoft SQL Server				
Deshboard	Mew Resource Group    Search by name			8 <sup>-11</sup>	J
Resources	17 💌 Name	Resource Count Tags	Policies	Last Backup Overall Status	0
Monitor	There is no match for your search or data is not available.				
Reports					
Hosts					
Storage System					
E Settings					
Alers					
		8	0		
	Resources are not found. Click Refresh Resources to discover dat	abases in the database view or create new resource group on the disco	wered databases from the resource view.	Activate Windows Go to Settings to activate Windows	
tivity The S	most recent jobs are displayed	🥪 3 Completed 🔒 0 Warnings  🗙 0 Failed 🔗 0	0 Canceled 👩 0 Running 🌀 0 Queued		

3. Provide a name and tag. Click **Next**.

App SnapCenter®								• = •- 1×	dministrator SnapCenterAdmin	n ØSign
Microsoft SQL Server	New Resource Group									
Search by name	1. To configure an SMT	P Server to send emai	I notifications for a	ichedules or on-dee	mand jobs, go to Setting	p-Gintel Semegranutic	ation Server Settings			
ty Name			-							
There is no match for your search or data is not available.	Hame	Resources	Polices	Verification	Notification	Summary				
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Resources are not found. Click Refresh Resources are not found. Click Refresh	C Use custon	name format for Sru	igano copy		0					

- 4. Add resources to the resource group:
  - Host. Select the server from the drop-down menu hosting the database.
  - **Resource type.** From the drop-down menu, select **Database**.
  - **SQL Server instance.** Select the server.

tApp SnapCenter®		🗧 🗃 🔮 🛨 admonstrator SnapCenterAdmon 🖡 Sign Out
Microsoft SQL Server	New Resource Group	
search by name		
7 Name	0-0-0-0-0	
There is no match for your search or data is not available.	Name Resources Policies Verification Notification Summary	
	Add resources to Resource Group	
	Host Resource Type SQL Server Instance	
	STAVW3.DemoAZ.com • Databases • STAVW3	
	Available Resources Selected Resources	
	(search available resources Q	
	Auto select all the resources from the same storage volume ChampionshipDB1 (STAVM3)	
	ChamponthyBB10 (STAMB) ChamponthyBB10 (STAMB) ChamponthyBB10 (STAMB) ChamponthyBB10 (STAMB) ChamponthyBB10 (STAMB) ChamponthyBB10 (STAMB) ChamponthyBB10 (STAMB) ChamponthyBB11 (STAMB)	
Resources are not found. Click Refresh Resources to discriver databases in the database view or create new resource group on the discovered databases from the resource view.		Activate Windows

The **option** Auto Selects All the Resources from the Same Storage Volume<sup>\*</sup> is selected by default. Clear the option and select only the databases you need to add to the resource group, Click the arrow to add and click **Next**.

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	Microsoft SQL Server	New Resource Group	×
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	tempdb	Add resources to Resource Group	
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•	SalwDB	rds-vm3.Demp2.com • Detabases • rds-vm3 •	
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	084	DB4 (vdsvm3)     DB5 (vdsvm3)	
	085	DBS (dd-vm3)	
	086	DB7 (rds-vm3)     DB8 (rds-vm3)	
	DB7	DB9 (ids-vm2)	
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	089	DB12 (rds-vm3)	
	08100	0813 (rds-wm3) 0814 (rds-wm3)	
	DB11	DB15(elsemb 7	
	2912		
	0813		
	0914		
	DB15		
	0819	•	Activate Windows
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5. On the policies, click (+).

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>	Microsoft SQL Server	New Resource Group	×
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III 0 2 2 4 1 I I A		Image: Point Poin	
	tempdb teidb Total 34		Activate Windows

6. Enter the resource group policy name.

Internation     Internation	New SQL Serve	r Backup Policy	1	×.	
3. Metarino       Betain         4. Medication:       5. Sirget:         5. Wethcaron:       7. Summary	1 Name	Provide a polic	y name		
A. Nellicolo   S. Strut   S. Wethorson   J. Summary	2 Backup Type	Eolicy name	FULLBACKUP_CHAMPSONSHIPD8	0	
S strat       € WethCation       2 Symmary	3. Autorition	Details	FULLBACKUP_CHAMPICIGH(#08		
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∑ Summary ⊗ ○	3 Script				
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7. Select Full backup and the schedule frequency depending on your company's SLA.

New SQL Serve	r Backup Policy ×	
	Select SQL server backup options	
2 Backup Type	Choose backup type	
3 Retention	C Full beckup and log backup	
(E) Replication	Full backup     O Log backup	
5 Surget	Capy only backup	
	Maximum databases backed up per Snapshot copy: 100	
, F. Summary	Availability Group Settings 🗸 🗸	
	Schedule frequency	
	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times.	
	On demand Mounty	
	O Daty O Weekly	
	O Monthly	
	Prevous Mf Im	
-		
	(4, Replication	Information of the backup and the backup is a strain of the backu

8. Configure the retention settings.

New SQL Serve	er Backup Policy	x
1 Name	Retention settings	
2 Backup Type	Retention settings for up-to-the-minute restore operation  🚯	
3 Retention	Keep log backups applicable to last     7     full backups	
4 Replication	O Keep log backups applicable to last	
5 Script		
6 Verification	Full backup retention settings 1 Weekly	
7 Summary	Total Snapshot copies to keep            Keep Snapshot copies for	
		Previous Next

9. Configure the replication options.

New SQL Serve	Backup Type     Update SnapMirror after creating a local Snapshot copy.       Retention     Update SnapVault after creating a local Snapshot copy.       Replication     Secondary policy label       Script     Image: Choose Image: Cho		×	
1 Name	Select secondary repl	ication options 🚯		
2 Backup Type	Update SnapMirror af	fter creating a local Snap	shot copy.	
3 Retention	🗍 Update SnapVault afte	er creating a local Snaps	hot copy.	
4 Replication			- 0	
5 Script	Error retry count	3		
6 Verification				
7 Summary				
				Previous Next

10. Configure the scripts to run before performing a backup. Click **Next**.

New SQL Serve	r Backup Policy					3
1 Name	Specify optional s	scripts to ru	before performing a bac	kup job		
2 Backup Type	Prescript full path					
3 Retention	Prescript arguments	Choose op	ional arguments			
4 Replication	Specify optional s	scripts to ru	after performing a back	doj qu		
5 Script	Postscript full path					
	Postscript arguments	Choose op	ional arguments			
6 Verification	Script timeout	60	secs			
7 Summary						
					Previous	Next
					Frevious	MEXT

11. Confirm the verification for the following backup schedules.

Name	Select the options	to run backup verification							
Backup Type		or the following backup schedules							
Retention	Select how often you		The specific verification times are set at backup job creation						
Replication	Hourly								
Script	Database consiste	ncy checks options							
5 Verification	🗹 Limit the integrity	it the integrity structure to physical structure of the database (PHYSICAL_ONLY) press all information message (NO_INFOMSGS) play all reported error messages per object (ALL_ERRORMSGS)							
- Termedian	Suppress all information message (NO_INFOMSGS)								
7 Summary	<ul> <li>Display all reported error messages per object (ALL_ERRORMSG5)</li> </ul>								
	Do not check non-clustered indexes (NOINDEX)								
	Verification script	⊗ ⊂	ernal database Snapshot copy (TABLOCK) )						
	Script timeout	60 Secs							
	Prescript full path	<scripts_path></scripts_path>							
	Prescript arguments	Choose optional arguments							
	Postscript full path	<scripts_path></scripts_path>							
	Postscript arguments	Choose optional arguments							

12. On the **Summary** page, verify the information, and click **Finish**.

Name	Summary		
Backup Type	Policy name	FULLBACKUP_CHAMPIONSHIPDB	
Detention	Details	FULLBACKUP_CHAMPIONSHIPDB	
lew SQL Sen Name Backup Type Retention Replication Script Venfication Summary	Backup type	Full backup	
Replication	Availability group settings	Backup only on preferred backup replica	
and a second	Schedule Type	Hourly	
Script	UTM retention	Total backup copies to retain : 7	
Verification	Hourly Full backup retention	Total backup copies to retain : 7	
	Replication	none	
Summary	Backup prescript settings	undefined Prescript arguments:	
	Backup postscript settings	undefiner O Postscript arguments:	
	Verification for backup schedule type	Hourty	
	Verification prescript settings	undefined Prescript arguments:	
	Verification postscript settings	undefined Postscript arguments:	

## Configure and protect multiple SQL Server databases

1. Click the (+) sign to configure the start date and the expire- on date.

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II Ne	tApp SnapCenter®		9 · Ladministrator	SnapCenterAdmin	Sign Out
5	Microsoft SQL Server	New Resource Group			\$
	search by name				
0	Name :				
۲	There is no match for your search or data is not available.	Name Resources Policies Verification Hooffcation Summary			
2		Select one or more policies and configure schedules			
~		ницанскил, снимпролизнира - + 0			
20		Configure schedules for selected policies			
華		Policy IL Applied Schedules Configure Schedules			
▲		PILLEACKUP_CHAMPONSHIPDE Now			
82 - E		× •			
		Total I			
		Use Microsoft SQL Server scheduler			

2. Set the time.

Add schedules fo	r policy FULLBACKUP	_CHAMPIONSHIPDB ×
Hourly		
Start date	11/11/2022 05:30 pm	
Expires on	12/11/2022 05:27 pm	
Repeat every	a 🌲 hours o	mins
i The schede zone.	ules are triggered She Snap	Center Server time
		Cancel

I Ne	tApp SnapCenter®		🔹 🗃 🥥 • 🔒 administrator ShapCenterAdmin 🗍 Sign Out
	Microsoft SQL Server	New Ilmource Group	
	Salech by Hime		
,	7 Name	0-0-0-0-0-0	
,	There is no match for your search or data in not available.	Name Resources Policies Ventication Notification Summary	
1	COMPARING THE	- Select one or more policies and configure schedules	
		КИЦВАСКИР, СНАМРЮНИНГОВ - + 0	
		Configure schedules for selected policies Policy Is Applied Schedules Configure Schedules	
Δ		Plikt BACKUP_CHAMPIONSHPDB Houry: Appear every 8 hours:	
-			
		8 0	
		Total I	
		Use Microsoft SQC Server scheduler	
	Resources are not found. Click Refresh Resources to discover databases in the		5
	database view or create new resource group on the discovered databases from the		3
	Alsound view.		Activate Windows Previous Ne
tivi	ty The 5 most recent jobs are displayed	⊘ 3 Completed 🔒 0 Warnings 🔗 D Failed 🔗 D Canceled 💿 0 Burnsing 🔕 0 Gueund	the second of second determined

3. From the **Verification** tab, select the server, configure the schedule, and click **Next**.

	etApp SnapCenter®					• = 6	• Ladministrator SnapCenterA	dmin 🛛 Sign Ou
\$	Microsoft SQL Server	New Resource Group						
	search by name		5 mg	-				
0	7 Name	0-0-0-	-0-		۲			
0	There is no match for your search or data is not available.	Name Resources Policies	Venfcation	Notification Su	mmary			
ai i	- CALMAN SOL	Select the verification servers						
		Verification server STAVM3(13.0.5026)	•					
1		SQUEDSHMC(13.0.5020)						
<b>*</b>			chedule Type	Applied Schedules	Configure Schedules			
▲		FULLBACKUP_CHAMPIONSHIPOB	oury	hone	*			
		Total I						
	Resources are not found, Click Refresh Resources to discover databases in the database vow or create new resource group on the discovered databases from the resource view.							Previous No

4. Configure notifications to send an email.

etApp SnapCenter®		0 🛎 🛛 • 🛨 administratori SnapCenterAdmin 🖉 Sign Out
Microsoft SQL Server	New Resource Group	
search by name	4 If you want to send notifications for scheduled or on demand jobs, an SMTP server must be configured. Continue to the Summary page to save you server,	ir information, and then go to Settings-Global Settings-Notification Server Settings to configure the
T Name		
There is no match for your search or data is not available.	Lame Resources Polices Ventication Notification Summary	
	Provide email settings o Select the service accounts or people to notify regarding protection issues.	
	Email preference Never •	
	From Error emat	
	To	
	Subject Notification O	
Resources are not found. Click Refresh Resources to discover databases in the database view or create new resource group on the discovered databases from the		Activate Windows Previous ve

The policy is now configured for backing up multiple SQL Server databases.

App SnapCenter®				Ledministrator SnapCenterAdmin	Sign Du
Microsoft SQL Server					
search by name	<ul> <li>If you want to send nutifications for scheduled or on demand jobs, an SMTP berver.</li> </ul>	server must be configured. Community to the Summary page to lave you	ir information, and then go to Settings-Global	Settingic Notification Server Settings to cor	indigure the
T Name					
There is no match for your search or data is not available.	Name Resources Polices Wentcable	1 Notification Summary			
	Resource group name RE-OWARRONSHIPOR				
	Tags RE-CHAMPORSHIPOB				
	Policy PULBACIUP_C-CAMPION Plug-in ShapCenter Phile-In for M				
	Verbcation Server STAVM3				
	Verification enabled for policy IDULBACIUP_CHAMPION				
	Send entail 165	⊗ ∘			
Resources are not found, Chick Bafresh					
Resources to discover databases in the					

### Trigger on-demand backup for multiple SQL Server databases

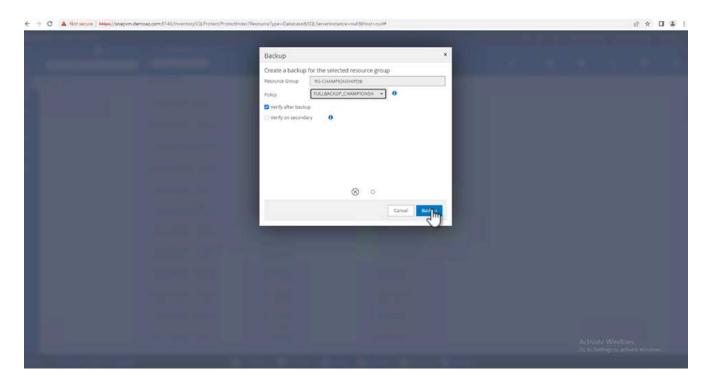
1. From the **Resource** tab, select view. From the drop-down menu, select **Resource Group**.

etApp SnapCenter®					0-1=	Immoduator SnapC	lenten Admin	Synthe
Municipal Sciences -	NE CANALORANDO DATAP							
search by risting	Smith -				<u> </u>	1 1		<u> </u>
74 Name	Resource Name	Туре	Host	Contraction of the	շիդ	Harry Andrews		
RG-DHAMPONSHPO8	Championuhg081 (STAVA3)	SQL Datallase	STAND. Demok2.com		C			
	Championalsp0810 (574/40)	SQL Detailurie	\$369M3.Demok2.com					
	ChampionshipD(\$100 (\$184145)	SOL Database	\$78yM3.DemoA2.com					
	Ownpioralsp201101 (\$144143)	SQL Dataliana	STKM/J.DemokZ.com					
	ChampionshipOB102 (STWM1)	SQL Datatiana	STAVM3.DampAZ.com					
	Championitsp08103 (554/M3)	SQL Database	118xM3.DemoA2.com					
	ChampionshipDB104(STR/M3)	SQL DataBasia	\$3WM3.Demok2.com					
	ChampionshipDB105 (ET#/M3)	SQL Database	\$78VM3.DemoA2.com					
	Champioralhsp08106 (578/WI)	SQL Database	\$78xMd1Demok2.com					
	ChampsonshipD3107 (STAVM3)	SQL Database 🛞	33MMd3.Demok2.com					
	ChampionshipDB108 (STVPM3)	SQL Database	\$30/MLDemo42.com					
	Championalsp08109(55#44/3)	SQL Dutabase	\$74x943.Demok2.com					
	Championahip0811 (37ArM3)	SQL Database	stksN3.DemoA2.com					
	Championahip08110 (CTAVMS)	SQL Database	\$350M3.DamoA2.com					
	ChampionalvgDB111 (CTx4W3)	SQL Detaltase	\$7XxM3.Demol/2.com					
	Championship08112 (STAin43)	SQL Database	\$749343.Damo42.com					
	Champion(h)p08113 (374/H2)	SQL Database	\$10483.Demok2.com					
	Champsonihydd8114 (STAVM3)	SQL Dataliase	17XVM3.Demo42.com					
	ChampionshipDi8115 (\$154Md)	SOL Detablase	STAIM3 DemokZ zom					
	Championship08116 (27#/943)	SQL Datature	\$300M3.Demoit2.com					
	Champion/hip28117 (STAVM3)	SOL Database	\$7AVM3.DemoA2.com					
	ChampionshipDE118 (\$154543)	SQL Database	STRIARS DamokZ zom					
	Olumpionalve/DB119 (STAMA9)	SQL Database	stividd Demok2.com					
Total 1	Osemanina/sp0812 (37AvM3)	SOL Database	\$13/MJ.Damo42.com					

- 2. Select the resource group name.
- 3. Click **Backup now** in the upper right.

	oment SQL Server		Mile 1 Defails						
search by name			(state)						
	Name		Resource Name	Туре	Host	the second second second			
	matter		DR1 (rds-mil)	SIQC Database	nts-smit/DemoZ.com				
	Inodel	- 1	DB10 (rds-emil)	SQL Database	rdu-vm3.DemoZ.com				
	masto	- 1	082 (109-0930	5QL Database	adsver/3.Demo2.com				
	tempdo	- 1	083(rd)-ir0)	SQL Database	Hs will DemsZ.com				
-	Neutob	- 1	0.64 (102-0103)	SQL Datatiase	nts-vm3.0emo2.com				
	54608	- 6	085(Htp-umil)	SQL Database	rds-em3.Demo2.com				
	NorthernetDill		0.04 0.01	SQL Datatuse	nds-imit Demož.com				
	081		0/67 (Hits-em/3)	SQL Dataliate	nds-ym3.DemoZ.com				
-	0618		Dist provemble	SQL Datattase	rds-vtr3.DemoZ.com				
	082		D93 () (0-m/3)	SQL batatiase	nds-ymd. Dwmod zwm				
	083		0/01/00 (cd4-vm3),	SQL Database	nts-vm3.DemoZ.com				
	064		pett intermati	SQL Database	nts-vin3.DamoZ.com				
	085		0612 (rd) vm3)	SQL Database	nts-om8.0emoZ.cum				
	066		0013 (rds-end)	SQL Database	nts-ym3.DemoZ.com				
	047		0/014 (rds-emil)	SQL Database	rdsvm3.Demo2.com				
	088		0613 (rds-emil)	SQL Database	nts-sm3.DemoZ.com				
	009		0014(mb)+m3)	SQL Database	rits vm3.0emo2.com				
	08100		Di017 pds wmity	SQL Dataliate	ntsven3.DemoZ.com				
	0811		0016 pdp-mbi	SQL Database	nts-und-DemoZ.com				
	0013		(0019(rdp-em3)	SQL Database	nty-ym3.29mo2.com				
	0813		0.020 (rds-emili)	SQL Database	rds-im8.2emo2.com				
	0814		0821 ptb-vm(8)	SQC Databate	nts-imit.Oemo2.com				
	0015		0022 (rsts-em3)	SQL Database	nds-emb DemoZ.com				
	0616		D623 indo-em/li	SOL Database	rds-sm3.com		Activate W	indows	

4. A new window opens. Click the **Verify after backup** checkbox and then click backup.



5. A confirmation message is dsiplayed. Click Yes.

Conf	irmation	×
	The policy selected for the on-demand backup is associated with a backup schedule and the on- demand backups will be retained based on the retention settings specified for the schedule type. Do you want to continue ?	
	Yes No	

#### Monitor multiple-database backup jobs

From the left navigation bar, click **Monitor**, select the backup job, and click **Details** to view job progress.

<ul> <li>C A fait service https://anapym.demoac.com/(140/100x)</li> </ul>		2 ¢ 0 3
	Job Details *	
	Backup of Resource Group: RG.CHAMPIONSHIPDB' with policy FULLBACKUP_CHAMPIONSHIPDB'	
	0 + Eacupof Resource Group 16 Convertions web program. MultiAccure, Convertion	
	✓ + StnMEDemakZeam	
	(Unit 51) Verty taxing 3G-DWMP(H)/HP08(STWM0(11-11-2022(12:2831-4332 ef 11 ebts))     STWM2/Diampon/Ap08185	
	(a)(0.31) Verdy backup 100-CAMMPORCHIPS(351940), 11-11-3022, 17.28.61-4332 (df 100)     Odd(17), 354443 (Champoning)(df 16), 514443 (Champoning)(df 17), 514448 (Champoning)(df 17),     Stav48 (Champoning)(df 16),	
	(1)() 31 VMI() Iakitap RG-CHARMONGHOR, TIMM3, 11:1-3022, 17:25.51.4357.41100 (2000) 13:14 Statuta Charge Statuta St	
	∞ ∘	
	O which we million on server to connectly unavailable, the job is powers.	
	Werrapt Structure Cove	

Click the **Resource** tab to see the time it takes for the backup to be completed.

etApp Snap	Center®					🛊 🔳 🤤 🛨 administrator SnapCenterAdmin	Usp
		QL Server 🔸					
Deshboard	View Re	source Group • search by name	V				
Resources	12.14	Name	Resource Count	Tags	Policies	Last Backup Overall Status	
Monitor	-	RS-CHAMPIONSHIPOIL	200	RS-OHAMPIONSHIPDIL	HULLIACKUP, CHAMPIONSHIPDII	11/11/2022 School Per D Consed	
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	Total 1					Activate Windows Go to Settings to activite Windo	

# Transaction log backup for multiple database backup

SnapCenter supports the full, bulked logged, and simple recovery models. The simple recovery mode does not support transactional log backup.

To perform a transaction log backup, complete the following steps:

1. From the **Resources** tab, change the view menu from **Database** to **Resource group**.

App SnapCent	ter®				• • • •	Ladministrator SnapCenterAdmin #Sign
i Mi	krosiałt SQL Server					
**	Delatase Dearth by re	m+ ▼)				
urus I	78 Database	instance	Hunt	Last Backup	Overall Status	Type
where a	Availability Group	SQUADSHINC	PSRCLUSTER Demo42.com	11/11/2022 43425 PM 🖨	Backup succeeded	Liser database
0100	2	3QUADSHINC	PSXCU/STER Demo42.com		Not protected	User database
6/56	man and an	SQURDSHIRE	PSiCuSTIX.2emol2.com		Not protected	Uter database
- C	INSIGHTON	SOURDSHIMC	FERCLUSTER.Demo42.com		Not protected	User database
age Systems	mis-GHT085	SQUADSHIRE	PSRCLUSTER Demo42.com		Not protected	Uper database
	matter	SQLROSHIAC	FORCUSTER.Semo42.com		wat protected	tyttem database
10	model	SQUADSHINC	PSRCLUSTER.Demo42.com		Not protected	System database
1971 (M	muth	SQUADSHIAC	PENCLUSTER DemokZ.com		Not protected	System database
	dogmer	SQURDSHMK;	FIRCLUSTER Demon2.com		Not available for backup	tymen database
	Oumpionship081	STAVAS	StavAlaDeniA2.com	15/102022 5:30:26 PM 🛱	Being succeeded	User database
	Championiship/D010	(DAVM)	SAVM3.DemoA2.com	11/11/2022 5:20:26 PM	Reckup succeeded	Liter database
	Championship/08100	10640	STAVM3.DemoA2.com	11/11/2022 5:30:25 PM 🛱	Backg succeeded	the dubbase
	Champonihp00151	STAUM3	STAVAS DemoA2 com	11/11/2022 5:30:26 PM 🖨	Belog succeeded	Sher dataltape
	Championship36102	STAVAD	STAVM3.DemoA2.com	10/10/2022 5:30:26 PM 🛱	Backup succeeded	Ober database
	Championship08103	35440	\$14VMLDemoA2.com	11/11/2022 5:30:26 PM 🗖	Backup successful	Uver database
	Champoniship08154	STRAMS	STAMLEHMOAZ.com	11/11/2022 \$ 30/26 PM 🖽	Backup turneeded	Uner database
	Champortship08125	32AVM3	STAVAS DemonZ.com	11/11/2022 5:00:06 PM 🗇	Backup succeeded	the database
	Ownpionship08106	156563	STAVM3.DemoA2.com	11/11/2022 5:30:25 PM	Beitup succeeded	User database
	Championship()(8107	\$54/40	STAVML DemoA2.com	11/11/2022 5:30:26 PM	Baciup succeeded	Uter database
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	Championship/0811	106/03	ETAWAI DemoAZ.com	11/11/2022/5:00:26 /M. 🛱	Backup succeeded	User database
	Champonship0011E	STAVMS	STAWAS.DemoA2.com	11/11/2022 5:00:26 PM 🛱	Bachup succentred	Ster database
	Ownoomho08111	STAVM3	STAVA3.DemoA2.com	11/11/2022 3:30:26 PM	Beckut succeeded	Autor database
TU	G(213					The fir Sectings to activate Windows.

- 2. Select the resource group backup policy created.
- 3. Select Modify Resource Group in the upper right.

etApp SnapCenter®					0. Tep	matrian Snap	CenterAdmin	150
Microsoft SQL Server	RG-CIMMPONERFORDER/IN							
inerth by form	Seet.			1		. 🔺	0	
F Name	Resource Name	Туре	Hust.	and the second	A DUM CO POTATO			
NG CHANTCHENTON	ChampionshipDB1 d3N4M3s	SQL Database	TAVM3.0emoAZ.com					
	Champonship0810 (STXVM2)	SQL Catabase	STAVAS SemiAZ com					
	Championich(pDIE1023STAVM3)	SQL Database	11AvM3.DemoA2.com					
	Championuhig0(8101 (STAVM3)	SQL Database	1TAVM3.DemoAZ.com					
	ChamponshipOlitit2 (STAyM3)	SQL Deceptere	TAVMJ.DemoAZ.com					
	Championship0(8103/STAvM3)	SQL Database	\$74/M3.Demo42.com					
	Championship08104 (STAVK3)	SQL Database	1fAVM3.DemuAZ.com					
	Champonship0@101(S73v980)	SQL Datablete	TRAVMS DemoAZ.com					
	Championuhip0@105(STAVM3)	SQL DaGidase	\$74xM3.DemoA2.com					
	ChampionshipDi8107 (STAVM3)	SQL Database	diwwi.0enok2.com					
	Championshipole (18 (572/383)	SQL Detabase	TTAVMD.DemoAZ.com					
	Championuhip0@103.6TAVM3)	SQL Database	114/43.Demo42.com					
	ChampionshipDIE11 (57K/M3)	SQL Database	11AVM3.DemoAZ.com					
	Champonuhg@8110(\$1xv93)	SQL Ownativate	STAVM3-DemoAZ.com					
	Championuhip0@111 (STAVM3)	SQL Database	11A/M3.DemiA2.com					
	ChampionshipDill112 (STAVM3)	SQL Database	11AVM3.DemoA2.com					
	Overgionshipbili112 (STWW2)	SQS OWGROUP	\$fAVM3.0emoA2.com					
	Championship0(8114(574vM3)	SQL Database	STAVAS DemoA2.com					
	Championship2(8155451AVM3)	SQL Detablate	11AVM3.0emoA2.com					
	Championship0@116.csTxv3r3)	SQL Database	STAVES Common Star Star Star Star Star Star Star Star					
	Champeniship0(8117.7 (STAVM3)	SQL Database	11AvM3.DemoAJ.com					
	Championul/sp0iii113 d514VM31	SQL Database	114VM3.0emok2.cz#					
	Oumponship@lt111GTAVM31	SQL Detetate	STAVM2.0+maA2.com					
704/1	Championshie@iii12151AvM3i	SOL Database	17AVM3.DemoA2.com					

4. The Name section defaults to the backup policy name and tag. Click Next.

The **Resources** tab highlights the bases to which the transaction backup policy is to be configured.

Audy Hazer Columna     Name  <	NetApp SnapCenter®		B      L administrator ShapCenterAdmin     Sign Out
Vexech by name     Vexech by n	Marosaft SQL Server	Modify linearce Group	
Image: Second and the same storage volume       Image: Second and the same storage volume         Image: Second and the same storage volume       Image: Second and the same storage volume         Image: Second and the same storage volume       Image: Second and the same storage volume         Image: Storage storage storage storage storage volume       Image: Storage storage storage storage volume         Image: Storage storage storage storage volume       Image: Storage storage storage volume         Image: Storage storage storage volume       Image: Storage storage storage volume         Image: Storage storage storage volume       Image: Storage storage storage volume         Image: Storage storage storage volume       Image: Storage storage storage volume         Image: Storage storage storage volume       Image: Storage storage storage storage volume         Image: Storage storage storage volume       Image: Storage storage storage storage volume         Image: Storage storage storage volume       Image: Storage storage storage storage volume         Image: Storage storage storage volume       Image: Storage storage storage storage storage volume         Image: Storage storage storage volume       Image: Storage			
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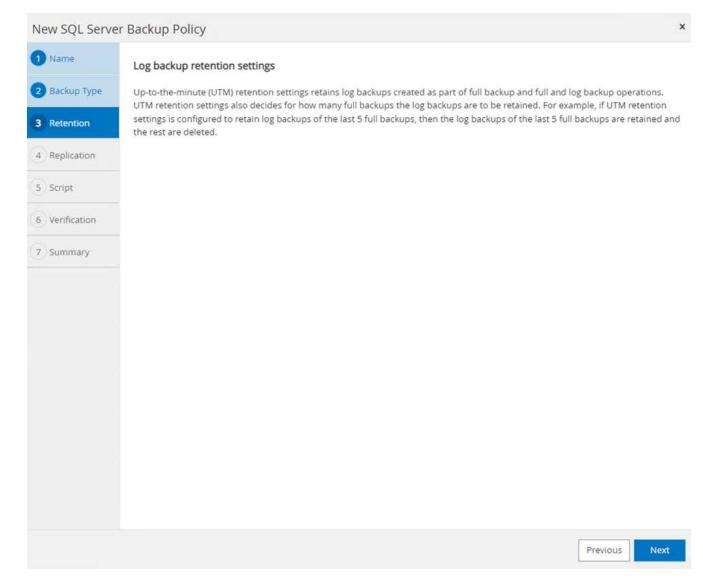
5. Enter the policy name.

azzom/8146/InventorySQUProtect/Prot	consecuence y			iff \$
New SQL Serve	er Backup Polic	Y	×	
(1) hime	Provide a poli	y name		
2 Backup type	Policy name	LOGBACKUP_CHAMPIONSHIPDB	0	
3 Retenition	Oetails	LOGBACKUP_CHAMPORSHIPDE		
4 Nephcation				
S. Script				
( 6 ) Verification				
2 Summary				
		⊗ ∘		
		0		
			Freinas Net	
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- 6. Select the SQL Server backup options.
- 7. Select log backup.
- 8. Set the schedule frequency based on your company's RTO. Click Next.

New SQL Serve	er Backup Policy
1 Name	Select SQL server backup options
2 Backup Type	Choose backup type
3 Retention	O Full backup and log backup
(4) Replication	<ul> <li>Full backup</li> <li>Log backup</li> </ul>
5 Script	Copy only backup
6 Verification	Maximum databases backed up per Snapshot copy: 100
7 Summary	Availability Group Settings
	Schedule frequency
	Select how often you want the schedules to occur in the policy. The specific times are set at backup job creation enabling you to stagger your start times.
	○ On demand
	Hourly     Delive
	O Daily Weekly
	O Monthly
	Previous Next

9. Configure the log backup retention settings. Click Next.



10. (Optional) Configure the replication options.

40

w unv service   under//surdsairgsuic	A CONTRACT OF A	ndex/ResourceType=msRbSQLServerbstance=msBbHost=ex8#	e 4
	New SQL Server	Backup Policy *	
	O Name	Select secondary replication options 0	
	🕖 Вискор Тури	Update SnaphWror after treating a local Snapshot copy.	
	() Reservan	Update SnapNault affec creating a local Snapshot copy.	
	4 Replication	Secondary policy label Dimension 0	
	( 5) Script	Errer nerry sount: 3 0	
	6 Verification		
	7. Summary		
		0.5	
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11. (Optional) Configure any scripts to run before performing a backup job.

A Horsecure / Higher proprint demo	az.com/8146/inventorySQLProtect/Prote	condex resource (yee in	and a contract of the second second second		12 ¥
	New SQL Serve	r Backup Policy			
	1 Name	Specify optional sc	ripts to run before performing a backup job 🛛 🔒		
	👩 flackup Type	Prescript full path	<\$CRPT3_Fater		
	() Patiencon	Prescript arguments	Choose optional arguments	1	
	O Replication		ripts to run after performing a backup job 0		
	5 Script	Postscript full path	<scrp15_pad+></scrp15_pad+>		
		Postscript arguments	Chicope optional arguments		
	6 Verification	Script bineput	60 INCS		
	7 Summary				
			⊗ ∘		
				Previous Netter	
	-				

12. (Optional) Configure backup verfication.

#### € → C 🔺 Not secure | Https://snapvm.demoaz.com/0146/InventorySQLProtect/Protect/Index/Resource?ype=nu/85/QLServerinstance=nu/88/foot=nu/#

the second se	and the second	
New SQL Ser	ver Backup Policy *	
O harra	Select the options to run backup verification	
1 Earling Type	Log backup	
Rutaricon	2 verifying backup. 0	
O Replication		
O segu		
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#### 13. On the **Summary** page, click **Finish**.

New SQL Serve	er Backup Policy		×	
O tame	Summary			
O Backup Type	Pibloy name	LOGBÁCKUP_CHAMPIONSHEPDIL		
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#### Configure and protect multiple MSSQL Server databases

1. Click the newly created transaction log backup policy.

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- 2. Set the **Start date** and **Expires on** date.
- 3. Enter the frequency of the log backup policy depending on the SLA, RTP, and RPO. Click OK.

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4. You can see both policies. Click **Next**.

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5. Configure the verification server.

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6. Configure email notification.

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7. On the **Summary** page, click **Finish**.

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# Triggering an on-demand transaction log backup for mutiple SQL Server databases

To trigger an on- demand backup of the transactional log for multiple SQL server databases, complete the following steps:

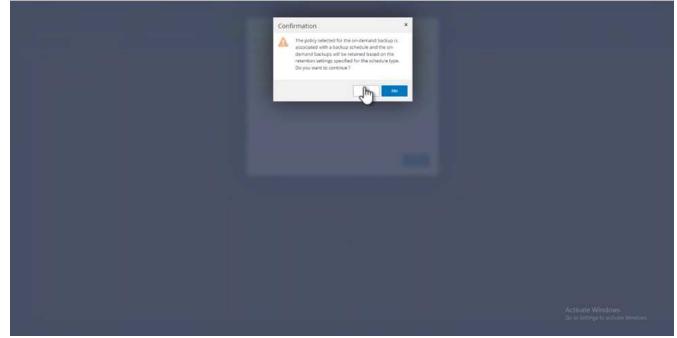
1. On the newly created policy page, select **Backup now** at the upper right of the page.

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2. From the pop-up on the **Policy** tab, select the drop-down menu, select the backup policy, and configure the transaction log backup.

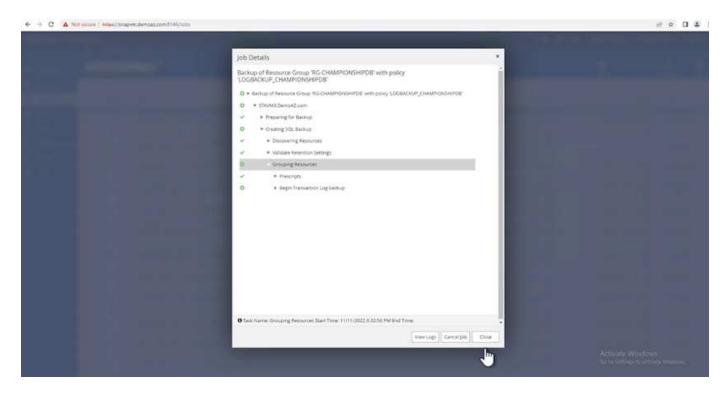
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- 3. Click **Backup**. A new window is displayed.
- 4. Click **Yes** to confirm the backup policy.



#### Monitoring

Move to the **Monitoring** tab and monitor the progress of the backup job.



#### **Restore and recovery**

See the following prerequisites necessary for restoring a SQL Server database in SnapCenter.

- The target instance must be online and running before a restore job completes.
- SnapCenter operations that are scheduled to run against the SQL Server database must be disabled,

including any jobs scheduled on remote management or remote verification servers.

- If you are restoring custom log directory backups to an alternate host, the SnapCenter server and the plugin host must have the same SnapCenter version installed.
- You can restore the system database to an alternate host.
- SnapCenter can restore a database in a Windows cluster without taking the SQL Server cluster group offline.

#### Restoring deleted tables on a SQL Server database to a point in time

To restore a SQL Server database to a point in time, complete the following steps:

1. The following screenshot shows the initial state of the SQL Server database before the deleted tables.

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The screenshot shows that 20 rows were deleted from the table.

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2. Log into SnapCenter Server. From the **Resources** tab, select the database.

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- 3. Select the most recent backup.
- 4. On the right, select **Restore**.

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- 5. A new window is displayed. Select the **Restore** option.
- 6. Restore the database to the same host where the backup was created. Click Next.

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7. For the Recovery type, select All log backups. Click Next.

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# Pre- restore options:

1. Select the option **Overwrite the database with same name during restore**. Click **Next**.

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		4 Post Ops	Specify optional	scripts to run before performing a restore joi	b 0			
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					Prevous Next			
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#### Post- restore options:

1. Select the option **Operational, but unavailable for restoring additional transaction logs**. Click **Next**.

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Script arguments Choose optional arguments	
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2. Provide the email settings. Click Next.

Restore		
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	to Settings-Global Settings-Notification Server Settings to configure the SMTP server.	
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3. On the **Summary** page, click **Finish**.

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# Monitoring the restore progress

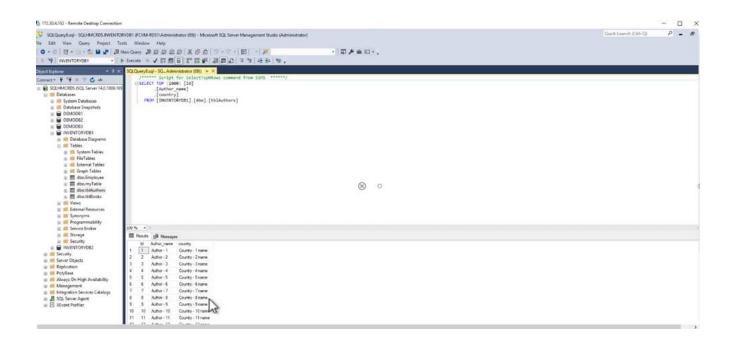
1. From the **Monitoring** tab, click the restore job details to view the progress of the restore job.

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# 2. Restore the job details.

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3. Return to SQL Server host > database > table are present.



# Where to find additional information

To learn more about the information that is described in this document, review the following documents and/or websites:

• TR-4714: Best Practices Guide for Microsoft SQL Server using NetApp SnapCenter

https://www.netapp.com/pdf.html?item=/media/12400-tr4714pdf.pdf

· Requirements for restoring a database

https://docs.netapp.com/us-en/snapcenter-45/protectscsql/concept\_requirements\_for\_restoring\_a\_database.html

· Understanding cloned database lifecycles

https://library.netapp.com/ecmdocs/ECMP1217281/html/GUID-4631AFF4-64FE-4190-931E-690FCADA5963.html

# TR-4923: SQL Server on AWS EC2 using Amazon FSx for NetApp ONTAP

This solution covers the deployment of SQL Server on AWS EC2 using Amazon FSx for NetApp ONTAP.

Authors: Pat Sinthusan and Niyaz Mohamed, NetApp

#### Introduction

Many companies that would like to migrate applications from on-premises to the cloud find that the effort is hindered by the differences in capabilities offered by on-premises storage systems and cloud storage services. That gap has made migrating enterprise applications such as Microsoft SQL Server much more problematic. In particular, gaps in the services needed to run an enterprise application such as robust snapshots, storage

efficiency capabilities, high availability, reliability, and consistent performance have forced customers to make design tradeoffs or forgo application migration. With FSx for NetApp ONTAP, customers no longer need to compromise. FSx for NetApp ONTAP is a native (1st party) AWS service sold, supported, billed, and fully managed by AWS. It uses the power of NetApp ONTAP to provide the same enterprise grade storage and data management capabilities NetApp has provided on-premises for three decades in AWS as a managed service.

With SQL Server on EC2 instances, database administrators can access and customize their database environment and the underlying operating system. A SQL Server on EC2 instance in combination with AWS FSx ONTAP to store the database files, enables high performance, data management, and a simple and easy migration path using block-level replication. Therefore, you can run your complex database on AWS VPC with an easy lift-and-shift approach, fewer clicks, and no schema conversions.

#### Benefits of using Amazon FSx for NetApp ONTAP with SQL Server

Amazon FSx for NetApp ONTAP is the ideal file storage for SQL Server deployments in AWS. Benefits include the following:

- · Consistent high performance and throughput with low latency
- · Intelligent caching with NVMe cache to improve performance
- · Flexible sizing so that you can increase or shrink capacity, throughput, and IOPs on the fly
- · Efficient on-premises-to-AWS block replication
- The use of iSCSI, a well-known protocol for the database environment
- Storage efficiency features like thin provisioning and zero-footprint clones
- · Backup time reduction from hours to mins, thereby reducing the RTO
- Granular backup and recovery of SQL databases with the intuitive NetApp SnapCenter UI
- The ability to perform multiple test migrations before actual migration
- Shorter downtime during migration and overcoming migration challenges with file-level or I/O-level copy
- Reducing MTTR by finding the root cause after a major release or patch update

Deploying SQL Server databases on FSx ONTAP with the iSCSI protocol, as is commonly used on-premises, provides an ideal database storage environment with superior performance, storage efficiency, and datamanagement capabilities. Using multiple iSCSI sessions, assuming a 5% working set size, fitting a Flash Cache delivers over 100K IOPs with the FSx ONTAP service. This configuration provides complete control over performance for the most demanding applications. SQL Server running on smaller EC2 instances connected to FSx for ONTAP can perform the same as SQL Server running on a much larger EC2 instance, because only network bandwidth limits are applied against FSx for ONTAP. Reducing the size of instances also reduces the compute cost, which provides a TCO-optimised deployment. The combination of SQL using iSCSI, SMB3.0 with multichannel, continuous availability shares on FSx for ONTAP provides great advantages for SQL workloads.

# Before you begin

The combination of Amazon FSx for NetApp ONTAP and SQL Server on EC2 instance enables the creation of enterprise-level database storage designs that can meet todays most demanding application requirements. To optimize both technologies, it is vital to understand SQL Server I/O patterns and characteristics. A well-designed storage layout for a SQL Server database supports the performance of SQL Server and the management of the SQL Server infrastructure. A good storage layout also allows the initial deployment to be successful and the environment to grow smoothly over time as your business grows.

#### Prerequisites

Before you complete the steps in this document, you should have the following prerequisites:

- An AWS account
- Appropriate IAM roles to provision EC2 and FSx for ONTAP
- A Windows Active Directory domain on EC2
- All SQL Server nodes must be able to communicate with each other
- Make sure DNS resolution works and host names can be resolved. If not, use host file entry.
- General knowledge of SQL Server installation

Also, please refer to the NetApp Best Practices for SQL Server environments to ensure the best storage configuration.

With FSx ONTAP, procuring storage is the easiest task and can be performed by updating the file system. This simple process enables dynamic cost and performance optimization as needed, it helps to balance the SQL workload, and it is also a great enabler for thin provisioning. FSx ONTAP thin provisioning is designed to present more logical storage to EC2 instances running SQL Server than what is provisioned in the file system. Instead of allocating space upfront, storage space is dynamically allocated to each volume or LUN as data is written. In most configurations, free space is also released back when data in the volume or LUN is deleted (and is not being held by any Snapshot copies). The following table provides configuration settings for dynamically allocating storage.

Setting	Configuration
Volume guarantee	None (set by default)
LUN reservation	Enabled
fractional_reserve	0% (set by default)
snap_reserve	0%
Autodelete	volume / oldest_first
Autosize	On
try_first	Autogrow
Volume tiering policy	Snapshot only
Snapshot policy	None

With this configuration, the total size of the volumes can be greater than the actual storage available in the file system. If the LUNs or Snapshot copies require more space than is available in the volume, the volumes automatically grow, taking more space from the containing file system. Autogrow allows FSx ONTAP to automatically increase the size of the volume up to a maximum size that you predetermine. There must be space available in the containing file system to support the automatic growth of the volume. Therefore, with autogrow enabled, you should monitor the free space in the containing filesystem and update the file system when needed.

Along with this, set the space-allocation option on LUN to enabled so that FSx ONTAP notifies the EC2 host when the volume has run out of space and the LUN in the volume cannot accept writes. Also, this option enables FSx for ONTAP to reclaim space automatically when the SQL Server on EC2 host deletes data. The space-allocation option is set to disabled by default.



If a space-reserved LUN is created in a none-guaranteed volume, then the LUN behaves the same as a non-space-reserved LUN. This is because a none-guaranteed volume has no space to allocate to the LUN; the volume itself can only allocate space as it is written to due to its none guarantee.

With this configuration, FSx ONTAP administrators can generally size the volume so that they must manage and monitor the used space in the LUN on the host side and in the file system.



NetApp recommends using a separate file system for SQL server workloads. If the file system is used for multiple applications, monitor the space usage of both the file system and volumes within the file system to make sure that volumes are not competing for available space.



Snapshot copies used to create FlexClone volumes are not deleted by the autodelete option.



Overcommitment of storage must be carefully considered and managed for a missioncritical application such as SQL server for which even a minimal outage cannot be tolerated. In such a case, it is best to monitor storage consumption trends to determine how much, if any, overcommitment is acceptable.

#### **Best Practices**

- 1. For optimal storage performance, provision file-system capacity to 1.35x times the size of total database usage.
- 2. Appropriate monitoring accompanied by an effective action plan is required when using thin provisioning to avoid application downtime.
- 3. Make sure to set Cloudwatch and other monitoring tool alerts so that people are contacted with enough time to react as storage is filled.

# Configure Storage for SQL Server and deploy Snapcenter for Backup, Restore and clone operations

In order to perform SQL server operations with SnapCenter, you must first create volumes and LUNs for SQL server.

To create volumes and LUNs for SQL Server, complete the following steps:

- 1. Open the Amazon FSx console at https://console.aws.amazon.com/fsx/
- 2. Create an Amazon FSx for the NetApp ONTAP file system using the Standard Create option under Creation Method. This allows you to define FSxadmin and vsadmin credentials.

	\$
Quick create	Standard create
Use recommended best-practice configurations.	You set all of the configuration options, including
Most configuration options can be changed after	specifying performance, networking, security,
the file system is created.	backups, and maintenance.

3. Specify the password for fsxadmin.

File system administrative password	
Password for this file system's "fsxadmin" user, which you can use to access the ONTAP CLI or REST API.	÷2
O Don't specify a password	
Specify a password	

Password

Confirm password

4. Specify the password for SVMs.

SVM administrative password Password for this SVM's "vsadmin" user, which you can use to access the ONTAP CLI or REST API.	
O Don't specify a password	
<ul> <li>Specify a password</li> <li>Password</li> </ul>	
Confirm password	

5. Create volumes by following the step listed in Creating a volume on FSx for NetApp ONTAP.

#### **Best practices**

 Disable storage Snapshot copy schedules and retention policies. Instead, use NetApp SnapCenter to coordinate Snapshot copies of the SQL Server data and log volumes.

- Configure databases on individual LUNs on separate volumes to leverage fast and granular restore functionality.
- Place user data files (.mdf) on separate volumes because they are random read/write workloads. It is common to create transaction log backups more frequently than database backups. For this reason, place transaction log files (.ldf) on a separate volume from the data files so that independent backup schedules can be created for each. This separation also isolates the sequential write I/O of the log files from the random read/write I/O of data files and significantly improves SQL Server performance.
- Tempdb is a system database used by Microsoft SQL Server as a temporary workspace, especially for I/O intensive DBCC CHECKDB operations. Therefore, place this database on a dedicated volume. In large environments in which volume count is a challenge, you can consolidate tempdb into fewer volumes and store it in the same volume as other system databases after careful planning. Data protection for tempdb is not a high priority because this database is recreated every time Microsoft SQL Server is restarted.
- 6. Use the following SSH command to create volumes:

```
vol create -vserver svm001 -volume vol_awssqlprod01_data -aggregate
aggr1 -size 800GB -state online -tiering-policy snapshot-only
-percent-snapshot-space 0 -autosize-mode grow -snapshot-policy none
-security-style ntfs
volume modify -vserver svm001 -volume vol_awssqlprod01_data
-fractional-reserve 0
volume modify -vserver svm001 -volume vol_awssqlprod01_data -space
-mgmt-try-first vol_grow
volume snapshot autodelete modify -vserver svm001 -volume
vol_awssqlprod01_data -delete-order oldest first
```

7. Start the iSCSI service with PowerShell using elevated privileges in Windows Servers.

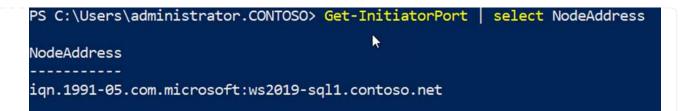
```
Start-service -Name msiscsi
Set-Service -Name msiscsi -StartupType Automatic
```

8. Install Multipath-IO with PowerShell using elevated privileges in Windows Servers.

Install-WindowsFeature -name Multipath-IO -Restart

9. Find the Windows initiator Name with PowerShell using elevated privileges in Windows Servers.

Get-InitiatorPort | select NodeAddress



10. Connect to Storage virtual machines (SVM) using putty and create an iGroup.

```
igroup create -igroup igrp_ws2019sql1 -protocol iscsi -ostype
windows -initiator iqn.1991-05.com.microsoft:ws2019-sql1.contoso.net
```

11. Use the following SSH command to create LUNs:

```
lun create -path /vol/vol_awssqlprod01_data/lun_awssqlprod01_data
-size 700GB -ostype windows_2008 -space-allocation enabled lun
create -path /vol/vol_awssqlprod01_log/lun_awssqlprod01_log -size
100GB -ostype windows_2008 -space-allocation enabled
```

```
svmsql::> lun create -path /vol/vol awssqlprod01 data/lun awssqlprod01 data -size 700GB -ostype windows 2008
Created a LUN of size 700g (751619276800)
www.sql::> lun create -path /vol/vol_awssqlprod01_log/lun_awssqlprod01_log -size 100GB -ostype windows_2008
Created a LUN of size 100g (107374182400)
svmsql::> lun show
/server Path
                                         State Mapped
                                                          Туре
         /vol/vol_awssqlprod01_data/lun_awssqlprod01_data
svmsql
                                          online unmapped windows 2008
                                                                       700GB
svmsql
         /vol/vol awssqlprod01 log/lun awssqlprod01 log
                                         online unmapped windows 2008
                                                                       100GB
 entries were displayed.
```

- 12. To achieve I/O alignment with the OS partitioning scheme, use windows\_2008 as the recommended LUN type. Refer here for additional information.
- 13. Use the following SSH command to the map igroup to the LUNs that you just created.

```
lun show
lun map -path /vol/vol_awssqlprod01_data/lun_awssqlprod01_data
-igroup igrp_awssqlprod01lun map -path
/vol/vol_awssqlprod01_log/lun_awssqlprod01_log -igroup
igrp_awssqlprod01
```

svmsq1::> Vserver	lun show Path	State	Mapped	Туре	Size
svmsql	I /vol/vol_awssqlprod01_data/lun	_awssqlpr	od01_data	·	
		online	unmapped	d windows_2	208 700gB
svmsql	/vol/vol awssqlprod01 log/lun	awssqlprc	d01 log		TOUGB
				d windows_20	800
					100GB
entries	were displayed.				
vmsql::>	lun map -path /vol/vol_awssqlp	rod01_dat	a/lun_aws	sqlprod01_0	data -igroup igrp_awssqlprod01
umcal	lun map -path /vol/vol awssqlp	nod01 100	(lup succ	alprod01 1	a igroup igro pussalprod01
ovinoq1>	Iun map -pach /voi/voi_awssqip	10001_100	/ IUI _awaa	dibrogor_r	og -igroup igrp_awssqiprodor
svmsql::>					
svmsql::>		Ctata	Mannod	WITTO O	Cino
/server	Pach	State 	Mapped	Туре	5126
svmsql	/vol/vol_awssqlprod01_data/lun	awssqlpr	cod01_data	1	
svmsql	/vol/vol_awssqlprod01_data/lun		mapped	windows_2	
		online	mapped		008 700GB
	/vol/vol_awssqlprod01_data/lun /vol/vol_awssqlprod01_log/lun_	online awssqlpro	mapped		700gb
svmsql		online awssqlpro	mapped	windows_2	700gb

- 14. For a shared disk that uses the Windows Failover Cluster, run an SSH command to map the same LUN to the igroup that belong to all servers that participate in the Windows Failover Cluster.
- 15. Connect Windows Server to an SVM with an iSCSI target. Find the target IP address from AWS Portal.

Summary		
SVM ID svm-09e98ab33a31b724a 🗇	Creation time 2021-09-21T13:19:34-07:00 Lifecycle state	
svmsql 🗇 UUID ea00ea2d-1b1d-11ec-9de1-6f9cef731025	Subtype DEFAULT	
File system ID fs-0ab4b447ebd6082aa 🗇		
Resource ARN arn:aws:fsx:us-west-2:139763910815:storage-virtual-machine/fs-0ab4b447ebd6082aa/svm- 09e98ab33a31b724a 🗗		
Endpoints		
Management DNS name svm-09e98ab33a31b724a.fs-0ab4b447ebd6082aa.fsx.us-west-2.amazonaws.com 🗗		Management IP address
NFS DNS name svm-09e98ab33a31b724a.fs-0ab4b447ebd6082aa.fsx.us-west-2.amazonaws.com 🗗		NFS IP address
iSCSI DNS name		iSCSI IP addresses

16. From Server Manager and the Tools menu, select the iSCSI Initiator. Select the Discovery tab and then select Discover Portal. Supply the iSCSI IP address from previous step and select Advanced. From Local Adapter, select Microsoft iSCSI Initiator. From Initiator IP, select the IP of the server. Then select OK to close all windows.

	perties			Discover Target Portal	
gets Discover	Y Favorite Targe	Volumes and Devices	RADIUS Configuration	Enter the IP address or DNS name a want to add.	and port number of the portal you
Target portals				To change the default settings of th	e discovery of the target portal, di
The system will	look for <u>T</u> argets o	n following portals:	Refresh	the Advanced button.	-
Address	Port	Adapter	IP address	IP address or DNS name:	Port: (Default is 3260.)
				10.2.1.167	3260
				Advanced	OK Cancel
To add a target	t portal, click Disco	ver Portal.	Discover Portal		
To remove a ta		the address above and	Advanced Settings		2
To remove a ta		the address above and	Advanced Settings General IPsec		2
To remove a ta then click Remo		the address above and			?
To remove a tai then dick Remo SNS servers	we.	the address above and ,	General IPsec	Microsoft iSCSI Initiator	?
To remove a tai then dick Remo SNS servers	we.		General IPsec	Microsoft iSCSI Initiator	
To remove a tai then click Remo SNS servers The system is re	we.		General IPsec Connect using Local adapter:		
To remove a tai then dick Remo SNS servers The system is re Name	we.	ollowing įSNS servers:	General IPsec Connect using Local adapter: Initiator IP:		

- 17. Repeat step 12 for the second iSCSI IP from the SVM.
- 18. Select the **Targets** tab, select **Connect**, and select **Enable muti-path**.

argets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration
Quick C	Connect				
		on to a target usin arget and then click	ng a basic connection, t Quick Connect.	ype the IP	address or
<u>T</u> arget	:			Qu	uick Connect
Discove	ered targets				Connect To Target
Name				Status	Target name:
ign. 19	92-08.com.r	netapp:sn.ea00ea2	2d 1b 1d 1 1ec9de 16f9	Inactive	92-08.com.netapp:sn.ea00ea2d1b1d11ec9de16f9cef731025:vs.3
					Add this connection to the list of Favorite Targets. This will make the system automatically attempt to restore the connection every time this computer restarts.
					Enable multi-path Advanced OK

19. For best performance, add more sessions; NetApp recommends creating five iSCSI sessions. Select **Properties \*> \*Add session \*> \*Advanced** and repeat step 12.

```
$TargetPortals = ('10.2.1.167', '10.2.2.12')
foreach ($TargetPortal in $TargetPortals) {New-IscsiTargetPortal
-TargetPortalAddress $TargetPortal}
```

<pre>\$TargetPortals = ('10.2 foreach (\$TargetPortal</pre>	2.1.167', '10.2.2.12') in \$TargetPortals) {New-IscsiTargetPortal -TargetPortalAddress \$TargetPortal}
Initiator InstanceName Initiator Portal Address IsDataDigest IsHeaderDigest TargetPortal Address TargetPortal PortNumber PSComputerName	: : False : False : 10.2.1.167
InitiatorInstanceName InitiatorPortalAddress IsDataDigest IsHeaderDigest TargetPortalAddress TargetPortalPortNumber PSComputerName	: : False : False : 10.2.2.12

#### **Best practices**

- Configure five iSCSI sessions per target interface for optimal performance.
- Configure a round-robin policy for the best overall iSCSI performance.
- Make sure that the allocation unit size is set to 64K for partitions when formatting the LUNs
  - 1. Run the following PowerShell command to make sure that the iSCSI session is persisted.

```
$targets = Get-IscsiTarget
foreach ($target in $targets)
{
Connect-IscsiTarget -IsMultipathEnabled $true -NodeAddress
$target.NodeAddress -IsPersistent $true
}
```

PS C:\Windows\system32>	Connect-IscsiTarget -NodeAddress (Get-IscsiTarget   select -ExpandProperty NodeAddress)
InitiatorNodeAddress InitiatorPortalAddress InitiatorSideIdentifier IsConnected IsDataDigest IsDiscovered	<pre>NONE ROOT\ISCSIPRT\0000_0 iqn.1991-05.com.microsoft:awssqlprod01.cloudheroes.dom 0.0.0.0 400001370000 True False True False True i false i True i false i True i false 2 1 ffff9988350ff010-4000013700000012 i qn.1992-08.com.netapp:sn.ea00ea2d1b1d11ec9de16f9cef731025:vs.3 0200</pre>

2. Initialize disks with the following PowerShell command.



3. Run the Create Partition and Format Disk commands with PowerShell.

```
New-Partition -DiskNumber 1 -DriveLetter F -UseMaximumSize
Format-Volume -DriveLetter F -FileSystem NTFS -AllocationUnitSize
65536
New-Partition -DiskNumber 2 -DriveLetter G -UseMaximumSize
Format-Volume -DriveLetter G -FileSystem NTFS -AllocationUnitSize
65536
```

You can automate volume and LUN creation using the PowerShell script from Appendix B. LUNs can also be created using SnapCenter.

Once the volumes and LUNs are defined, you need to set up SnapCenter to be able to perform the database operations.

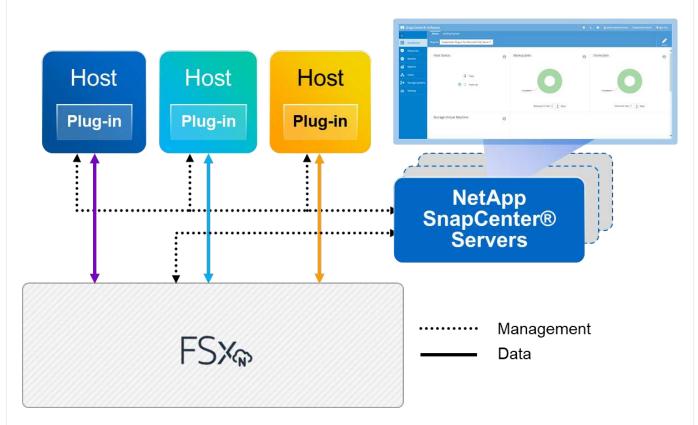
#### SnapCenter overview

NetApp SnapCenter is next-generation data protection software for tier-1 enterprise applications. SnapCenter, with its single-pane-of-glass management interface, automates and simplifies the manual, complex, and time-consuming processes associated with the backup, recovery, and cloning of multiple databases and other application workloads. SnapCenter leverages NetApp technologies, including NetApp Snapshots, NetApp SnapMirror, SnapRestore, and NetApp FlexClone. This integration allows IT organizations to scale their storage infrastructure, meet increasingly stringent SLA commitments, and improve the productivity of administrators across the enterprise. The following table lists the minimum requirements for installing the SnapCenter Server and plug-in on Microsoft Windows Server.

Requirement				
llation: 10GB sitory: 10GB				
2				
2 R2				
6				
9				
ent Framework (WMF) 4.0				
ter				
at				

For version compatibility, see the NetApp Interoperability Matrix Tool.

The following figure depicts some considerations for creating the Microsoft SQL Server database storage layout when backing up with SnapCenter.



#### **Best practices**

- 1. Place databases with I/O-intensive queries or with large database size (say 500GB or more) on a separate volume for faster recovery. This volume should also be backed up by separate jobs.
- 2. Consolidate small-to-medium size databases that are less critical or have fewer I/O requirements to a single volume. Backing up a large number of databases residing in the same volume leads to fewer Snapshot copies that need to be maintained. It is also a best practice to consolidate Microsoft SQL Server instances to use the same volumes to control the number of backup Snapshot copies taken.
- 3. Create separate LUNs to store full text-related files and file-streaming related files.
- 4. Assign separate LUNs per host to store Microsoft SQL Server log backups.
- 5. System databases that store database server metadata configuration and job details are not updated frequently. Place system databases/tempdb in separate drives or LUNs. Do not place system databases in the same volume as the user databases. User databases have a different backup policy, and the frequency of user database backup is not same for system databases.
- 6. For Microsoft SQL Server Availability Group setup, place the data and log files for replicas in an identical folder structure on all nodes.

In addition to the performance benefit of segregating the user database layout into different volumes, the database also significantly affects the time required to back up and restore. Having separate volumes for data and log files significantly improves the restore time as compared to a volume hosting multiple user data files. Similarly, user databases with a high I/O intensive application are prone to an increase in the backup time. A more detailed explanation about backup and restore practices is provided later in this document.

Starting with SQL Server 2012 (11.x), system databases (Master, Model, MSDB, and TempDB), and Database Engine user databases can be installed with an SMB file server as a storage option. This applies to both stand-alone SQL Server and SQL Server failover cluster installations. This enables you to use FSx for ONTAP with all its performance and data management capabilities, including volume capacity, performance scalability, and data protection features, which SQL Server can take advantage of. Shares used by the application servers must be configured with the continuously available property set and the volume should be created with NTFS security style. NetApp Snapcenter cannot be used with databases placed on SMB shares from FSx for ONTAP.

i

(i)

(i)

For SQL Server databases that do not use SnapCenter to perform backups, Microsoft recommends placing the data and log files on separate drives. For applications that simultaneously update and request data, the log file is write intensive, and the data file (depending on your application) is read/write intensive. For data retrieval, the log file is not needed. Therefore, requests for data can be satisfied from the data file placed on its own drive.

When you create a new database, Microsoft recommends specifying separate drives for the data and logs. To move files after the database is created, the database must be taken offline. For more Microsoft recommendations, see Place Data and Log Files on Separate Drives.

Follow the Install the SnapCenter Server and Installing SnapCenter Plug-in for Microsoft SQL Server to install and setup SnapCenter.

After Installing SnapCenter, complete the following steps to set it up.

1. To set up credentials, select **Settings** > **New** and then enter the credential information.

<		Global Settings Policies Users and Access	Roles Credential Software			
	Dashboard	Search by Credential Name				New
	Resources	Credential Name	Authentication Mode		Details	
•	Monitor	There is no match for your search or data is not availa	Die.			
ай	Reports		Credential	×		
Δ.	Hosts		I			
50 B	Storage Systems	av	Credential Name SCAdmin			
#	Settings		Authentication Mode Windows • • Username rdscustomvalVAdministrator Password ••••••	0		
			Cancel	ок		

2. Add the storage system by selecting Storage Systems > New and the provide the appropriate FSx for ONTAP storage information.

<		ONTAP Storage						
	Dashboard	Type ONTAP SVMs    Search by	Name					<u></u>
	Resources	ONTAP Storage Connections						
۲	Monitor	Name		IL IP	Cluster Name	User Name	Platform	Controller License
<b>a</b> i	Reports	There is no match for your search or data is not available						
۸	Hosts							
24	Storage Systems		Add Storage System					
			Add Storage System					
			Storage System	198.19.255.71				
			Username	fsxadmin				
			Password					
			Event Management S	stem (EMS) & Au	toSupport Settings			
			Send AutoSuppo	t notification to s	torage system			
			Log SnapCenter :					
			C More Options : Pla	form, Protocol, P	Preferred IP etc			
			Submit Cancel	Reset				

3. Add hosts by selecting **Hosts** > **Add**, and then provide the host information. SnapCenter automatically installs the Windows and SQL Server plug-in. This process might take some time.

<	Managed Hosts	Disks Shares	Initiator Groups	ISCSI Session						
Dashboard	Search Name	Y								And
Resources	Na Na	ame	📙 Туре		System	Plug-in			Version	Overall Statu
Monitor						There is no match for you	r search or data	a is not available.		
Reports			Managed Hosts							
Hosts			Search by Name	1	Add Host					
				ame	Host Type	Windows				
		•		for your search or data available.		10.0.1.85				
		<b>a</b> il	not	avenable.	Credentials	SCAdmin		+		
		Δ.			Select Plug-Ins to Inst	all SnapCenter Plug-ins Package 4.6 fe	or Windows			
		20				<ul> <li>Microsoft Windows</li> <li>Microsoft SQL Server</li> </ul>				
		=				Microsoft Exchange Server				
		A				SAP HANA t, gMSA, Install Path, Custom Plug-Ins				
					W mule options, Fo	c gwar, natairrath, custoirrriog-ing	here i			
					Submit: Cancel					

After all Plug-ins are installed, you must configure the log directory. This is the location where the transaction log backup resides. You can configure the log directory by selecting the host and then select configure the log directory.



SnapCenter uses a host log directory to store transaction log backup data. This is at the host and instance level. Each SQL Server host used by SnapCenter must have a host log directory configured to perform log backups. SnapCenter has a database repository, so metadata related to backup, restore, or cloning operations is stored in a central database repository.

The size of the host log directory is calculated as follows:

Size of host log directory = system database size + (maximum DB LDF size × daily log change rate  $\% \times$  (Snapshot copy retention) ÷ (1 – LUN overhead space %)

The host log directory sizing formula assumes the following:

- · A system database backup that does not include the tempdb database
- A 10% LUN overhead spacePlace the host log directory on a dedicated volume or LUN. The amount of data in the host log directory depends on the size of the backups and the number of days that backups are retained.

Mana	ged Hosts			
Sea	rch by Name		Host Details	
	Name	IE.	Host Name	RDSAMAZ-FFIDFMR.rdscustomval.com
	RDSAMAZ-		Host IP	10.0.1.56
	FFIDFMR.rdscustomval.com		Overall Status	Configure log directory
			Host Type	Windows
			System	Stand-alone
			Credentials	SCAdmin 🖋
			Plug-ins	SnapCenter Plug-ins package 4.6.0.6965 for Windows
				✓ Microsoft Windows
				Microsoft SQL Server <u>Remove</u> <u>Configure log directory</u>
			More Options : Po	ort, gMSA, Install Path, Add Plug-Ins
			<i>k</i> ∂	
			Submit Cancel	Reset

If the LUNs have already been provisioned, you can select the mount point to represent the host log directory.

Configure host log	directory	
Host log directory	dedicated disk directory path	Browse
Choose directory of	on NetApp Storage	
RDSAMAZ-FFIDF	MR.rdscustomval.com	
D:\FSxN\	Data\	
D:\FSxN\	HLD	
D:\FSxN\	Log\	

Now you are ready to perform backup, restore and clone operations for SQL Server.

After placing the database and log files on the FSx ONTAP LUNs, SnapCenter can be used to back up the databases. The following processes are used to create a full backup.

#### **Best Practices**

- In SnapCenter terms, RPO can be identified as the backup frequency, for example, how frequently
  you want to schedule the backup so that you can reduce the loss of data to up to few minutes.
  SnapCenter allows you to schedule backups as frequently as every five minutes. However, there
  might be a few instances in which a backup might not complete within five minutes during peak
  transaction times or when the rate of change of data is more in the given time. A best practice is to
  schedule frequent transaction log backups instead of full backups.
- There are numerous approaches to handle the RPO and RTO. One alternative to this backup approach is to have separate backup policies for data and logs with different intervals. For example, from SnapCenter, schedule log backups in 15-minute intervals and data backups in 6-hour intervals.
- Use a resource group for a backup configuration for Snapshot optimization and the number of jobs to be managed.
  - 1. Select **Resources**, and then select **Microsoft SQL Server \*on the drop-down menu on the top left. Select \*Refresh Resources**.

e .	Microsoft SQL Set	·••• 🔁					
Destand	Mey Database	e in Ceretale same	<b>V</b>				
Remoundes	17 PK 1	4artre	instance	Host	Last Galogo	Overall Status	Type
Worker		WConfiguration -	RESAMAZ FREEMR	RDSAMA2 INIDEMR.ebuseliemval.com		tein minimitie for thickup	1/ber database
		William and	Accounty Installed	Construction of the second states of		tite automotive his hardway	The distance
Augusta		Worke	REPEARANCE FREETABLE	RDSAMA2 HTIDPMS.churano-sal.com		hist available for backup	User database
1 10000 V		Naster	REISAMAZ HINDIMAR	RDSAMA2 FEIDEMR.cducummwut.com		Fort available for backup	Tyden database
1 Storage Systems		nedel	RETEARAD FIREINAR	HUSENAL RUDOWN SUCCESSION		NUT available for backup	System dalatione
		reath	RDLAMAZ #TIDEMR	RDSAMA2 TRIDPART database at 2009		(unt available for backup	System database
E Hillings		ivertariaria	RDLAWKZ FFIDERER	R050082 PDDP0R charmonal com		Teer primarities?	ther database
A Alerta	1.1	emode	RDIGAMAZ FEIDEMR	RDSAMA2 PH/DFAML/2010/05/mail.com		third available for the bar	Typero datallata

2. Select the database to be backed up, then select **Next** and (\*) to add the policy if one has not been created. Follow the \*New SQL Server Backup Policy to create a new policy.

Name									
DWConfiguration	0			4	5				
DWDiagnostics	Resource	Policies	Verification	Notification	Summary				
DWQueue	Resource	1 Oncies	venneadon	Notification	Summary				
master	Calastan			ale a shull a s					
model		Select one or more policies and configure schedules							
msdb	Full Backu	p	- + O						
SeattleRetail									
tempdb	Configure	schedules for selec	ted policies						
	Policy 🛓	Applied Schedules	Configure So	chedules					
	Full Backup	None		operations select a p policy to allow sched	olicy that has the appropriate schedule associated, or modify lules.				
	4								

3. Select the verification server if necessary. This server is the server that SnapCenter runs DBCC CHECKDB after a full backup has been created. Click **Next** for notification, and then select **Summary** to review. After reviewing, click **Finish**.

19	Name	3							
	DWConfiguration		0			4	5		
	DWDiagnostics		Resource	Policies	Verification	Notification	Summary		
	DWQueue		Resource	i olicies	verneadon	Nouncation	Summary		
	master		Select the ver	6					
	model								
	msdb		Verification serve	r Select one o	Select one or	more servers			
	SeattleRetail								
	tempdb		Configure ver	fication sched	ules				
			Policy 11	Schedule Type		Applied Schedules		Configure Schedules	
			There is no match	n for your search o	or data is not availat	le.			

4. Click **Back up Now** to test the backup. In the pop- up windows, select **Backup**.

Backup		×
Create <mark>a b</mark> ackup	for the selected resource	
Resource Name	SeattleRetail	
Policy	Full Backup	• 0
] Verify after back	qu	
		Cancel Backup

5. Select **Monitor** to verify that the backup has been completed.

	john	Schedules	henti Logi			
Determi	-	this same				
	Jobs -	Filter.				
. Martine	8	Statule	Name	Start date	End date	Dener
A Name	34	1	Rackop of Nencorce Group NDGAMAZ FEDEMIC Seattlehead with princy Yull Backup	OB/25/2012 147/30 AM	0225/2022 (1474) AM 🛱	RESCUCTORNAL Administration
Sector Contraction of the	88	10	Create Resource Group 1050442 (PCDPMI) SeattleNetal?	etaziskottaz hati de avar 🛱	10/20/2022 (-45/26 AM. 🛱	RESOUTION/ACADISIONIST
l non	32	- W	Crutic Pulicy Full Backup	BARENDER THE STATE	UMONODEL LALADAM 🖨	RESELECTION/VALUES INTER-
· Storage Systems	31	10	Discover resources for all bords	03429/2002 1138-12 AM. 🛱	101210-0002 101017 AM	RDSCUSTORVACuatrinistian

#### **Best Practices**

- Backup the transaction log backup from SnapCenter so that during the restoration process, SnapCenter can read all the backup files and restore in sequence automatically.
- If third party products are used for backup, select Copy backup in SnapCenter to avoid log sequence issues, and test the restore functionality before rolling into production.

#### Restore database with SnapCenter

One of the major benefits of using FSx ONTAP with SQL Server on EC2 is its ability to perform fast and granular restore at each database level.

Complete the following steps to restore an individual database to a specific point in time or up to the minute with SnapCenter.

1. Select Resources and then select the database that you would like to restore.

>		osoft SQL Server 🚽	SeattleRetail (RDSAMAZ-FFIDFMR) Topology								
	Sei	arch by name			<b>F</b>		Ť	<u>_</u>	1		i
					Migrate Database	Clone Lifecycle	Remove Protection	Back up Now	Modify. M	intenance I	Details
	1	Name	Manage Copies								
-		DWConfiguration	1 Backup					Su	mmary Card		
		DWDiagnostics	0 Clones								
â		DWQueue	Local copies					1 Bac			
4		master	Local copies					0 Clo	nes		
34		model									
		msdb									
		SeattleRetail	Primary Backup(s)								
A		tempdb	(search )							). Parame	- Terr
			Backup Name	Count	Туре	17			End Date	Verified	
			RDSAMAZ-FFIDFMR_SeattleRetail_RDSAMAZ-FFIDFMR_03-29-2022_01.47.31.3117	1	Full backup			03/29/20	022 1:47:37 AM 🗮	Unve	erified

- 2. Select the backup name that the database needs to be restored from and then select restore.
- 3. Follow the **Restore** pop-up windows to restore the database.
- 4. Select Monitor to verify that the restore process is successful.

	jobs	Schedules	Ivents Logi						
C Distributed	Geor	in by name	- 1 <b>7</b> 9						
liesources	Jobs	Fitter							
Mantan .	iD	Status	Natur	Start date	tist da	ir d	white		
di neoro	76	×.	Pentite #DIAMAZ4FIOEMI/Seattlefeta7	ID/29/2022 1 54(31 AM 🗖	10/29/2022 1:56:26 AM		iscutto	WW, techini	rittati=
	54	1	Backup of Resource Group NEELAMA2 Proceeds, Seattly/Heart with putry Trull Backup	DEGRAPHICE T AT 30 AM 🛤	ANY PARTY OF CONTRACT OF	<b>0</b> ×	nciarde	Mex.ubma	nhinter
A 1600	.02	. 4	Deale Residuce Group 105AW2 (FICENR) Seattlehetal?	00/26/2022 1-45/24 AM 🖽	09/09/00021145/24 AM		scusto	WWW. Ladmins	ritrator.
a Derrage Systems	18	10	Create Pulsey Pul Backage	10/29/2022 1-01:12 AM	03/29/2022 1.4140.4M		ISCUSTO	Million and Million	other .
E Sellings	9.E	4	Discover resources for all hosts	05/26/0023 1:38/12 AM 🖽	US/29/2122 1:38:17 4M	÷ .	escut to	West, wet	mbiatur
	11	14	Discoverentation for hour HDDAW2 Proprietationsmall.com	93/29/2022 10/95 17 HM 🛱	03/04/2022 10:55 18 PM		ncusto	and section	ritiatur
A Nets	87	1	Drussee resources for hold: HDGAMAD PFOHMErdousticesed aren	0000000000000000000	00/28/2022 10:41 15 PM	n 4		of philosophics	

#### Considerations for an instance with a large number of small-to-large size databases

SnapCenter can back up a large number of sizeable databases in an instance or group of instances within a resource group. The size of a database is not the major factor in backup time. The duration of a backup can vary depending on number of LUNs per volume, the load on Microsoft SQL Server, the total number of databases per instance, and, specifically, the I/O bandwidth and usage. While configuring the policy to back up databases from an instance or resource group, NetApp recommends that you restrict the maximum database backed up per Snapshot copy to 100 per host. Make sure the total number of Snapshot copies does not exceed the 1,023-copy limit.

NetApp also recommends that you limit the backup jobs running in parallel by grouping the number of databases instead of creating multiple jobs for each database or instance. For optimal performance of the backup duration, reduce the number of backup jobs to a number that can back up around 100 or fewer databases at a time.

As previously mentioned, I/O usage is an important factor in the backup process. The backup process must wait to quiesce until all the I/O operations on a database are complete. Databases with highly intensive I/O operations should be deferred to another backup time or should be isolated from other backup jobs to avoid affecting other resources within the same resource group that are to be backed up.

For an environment that has six Microsoft SQL Server hosts hosting 200 databases per instance, assuming four LUNs per host and one LUN per volume created, set the full backup policy with the maximum databases backed up per Snapshot copy to 100. Two hundred databases on each instance are laid out as 200 data files distributed equally on two LUNs, and 200 log files are distributed equally on two LUNs, which is 100 files per LUN per volume.

Schedule three backup jobs by creating three resource groups, each grouping two instances that include a total of 400 databases.

Running all three backup jobs in parallel backs up 1,200 databases simultaneously. Depending on the load on the server and I/O usage, the start and end time on each instance can vary. In this instance, a total of 24 Snapshot copies are created.

In addition to the full backup, NetApp recommends that you configure a transaction log backup for critical databases. Make sure that the database property is set to full recovery model.

#### **Best practices**

- 1. Do not include the tempdb database in a backup because the data it contains is temporary. Place tempdb on a LUN or an SMB share that is in a storage system volume in which Snapshot copies will not be created.
- 2. A Microsoft SQL Server instance with a high I/O intensive application should be isolated in a different backup job to reduce the overall backup time for other resources.
- 3. Limit the set of databases to be simultaneously backed up to approximately 100 and stagger the remaining set of database backups to avoid a simultaneous process.
- 4. Use the Microsoft SQL Server instance name in the resource group instead of multiple databases because whenever new databases are created in Microsoft SQL Server instance, SnapCenter automatically considers a new database for backup.
- 5. If you change the database configuration, such as changing the database recovery model to the full recovery model, perform a backup immediately to allow up-to-the-minute restore operations.
- 6. SnapCenter cannot restore transaction log backups created outside of SnapCenter.
- 7. When cloning FlexVol volumes, make sure that you have sufficient space for the clone metadata.

- 8. When restoring databases, make sure that sufficient space is available on the volume.
- 9. Create a separate policy to manage and back up system databases at least once a week.

#### **Cloning databases with SnapCenter**

To restore a database onto another location on a dev or test environment or to create a copy for business analysis purposes, the NetApp best practice is to leverage the cloning methodology to create a copy of the database on the same instance or an alternate instance.

The cloning of databases that are 500GB on an iSCSI disk hosted on a FSx for ONTAP environment typically takes less than five minutes. After cloning is complete, the user can then perform all the required read/write operation on the cloned database. Most of the time is consumed for disk scanning (diskpart). The NetApp cloning procedure typically take less than 2 minutes regardless of the size of the databases.

The cloning of a database can be performed with the dual method: you can create a clone from the latest backup or you can use clone life-cycle management through which the latest copy can be made available on the secondary instance.

SnapCenter allows you to mount the clone copy on the required disk to maintain the format of the folder structure on the secondary instance and continue to schedule backup jobs.

#### Clone databases to the new database name in the same instance

The following steps can be used to clone databases to the new database name in the same SQL server instance running on EC2:

- 1. Select Resources and then the database that need to be cloned.
- 2. Select the backup name that you would like to clone and select Clone.
- 3. Follow the clone instructions from the backup windows to finish the clone process.
- 4. Select Monitor to make sure that cloning is completed.

The following step are used to clone databases to the new SQL server instance running on EC2:

- 1. Create a new SQL Server on EC2 in the same VPC.
- 2. Enable the iSCSI protocol and MPIO, and then setup the iSCSI connection to FSx for ONTAP by following step 3 and 4 in the section "Create volumes and LUNs for SQL Server."
- 3. Add a new SQL Server on EC2 into SnapCenter by follow step 3 in the section "Installing and setup for SnapCenter."
- 4. Select Resource > View Instance, and then select Refresh Resource.
- 5. Select Resources, and then the database that you would like to clone.
- 6. Select the backup name that you would like to clone, and then select Clone.

	Microsoft SQL Server	SeattleRetail (RDSAMAZ-FFIDFMR) Topology								-		
	search by name			Migrate Database	Cione Lifecycle	Remove Protection	L. Eack up Now	Modily Main	tenance	1 Decals	Ben	1
2	🛃 Name	Manage Copies										
	DWConfiguration	1 Backup					Sum	mary Card				
1	DWDiagnostics	0 Clones					1 Backu					
11	DWQueue	Local copies					0 Clones					
<b>1</b>	master						0 Clotte					
	model											
-	msdb											
≣	SeattleRetail	Primary Backup(s)										
2	tempdb	(search )							) Rename	Cone	<b>F</b> Restore	ti Del
		Backup Name	Count	Туре	17			End Date	Verified	1		
		RDSAMAZ-FFIDFMR_SeattleRetail_RDSAMAZ-FFIDFMR_03-29-2022_01.47.31.3117	1	Full backup			03/29/2022	1:47:37 AM		verified		

- 7. Follow the Clone from Backup instructions by providing the new SQL Server instance on EC2 and instance name to finish the clone process.
- 8. Select Monitor to make sure that cloning is completed.

Dashboa	ard sear	ch by name	T State Stat			
😨 Resource	es Jobs	- Filter				
Monitor	ID	Status	Name	Start date	End date	Owner
Reports	108	~	Clone from backup 'RDSAMAZ-FFIDFMR_SeattleRetail_RDSAMAZ-FFIDFMR_03-29-2022_01.47.31.3117'	3/30/2022 6:09:10 PM 🛱	3/30/2022 6:09:55 PM	rdscustomval\administrati
and reports	107	~	Discover resources for all hosts	03/30/2022 6:06:40 PM 🛱	03/30/2022 6:06:54 PM 🛱	RDSCUSTOMVAL\administ

To learn more about this process, watch the following video:

Clone databases into the new SQL Server instance running on EC2

#### **Appendices**

Appendix A: YAML file for use in Cloud Formation Template

The following .yaml file can be used with the Cloud Formation Template in AWS Console.

https://github.com/NetApp/fsxn-iscsisetup-cft

To automate ISCSI LUN creation and NetApp SnapCenter installation with PowerShell, clone the repo from this GitHub link. The following script is used to provision volumes and LUNs and also to set up iSCSI based on the instruction provided above. There are two PowerShell scripts:

```
• _EnableMPIO.ps1
```

```
Function Install MPIO ssh {
    $hostname = $env:COMPUTERNAME
    $hostname = $hostname.Replace('-',' ')
    #Add schedule action for the next step
    $path = Get-Location
    $path = $path.Path + '\2 CreateDisks.ps1'
    $arg = '-NoProfile -WindowStyle Hidden -File ' +$path
    $schAction = New-ScheduledTaskAction -Execute "Powershell.exe"
-Argument $arg
    $schTrigger = New-ScheduledTaskTrigger -AtStartup
    $schPrincipal = New-ScheduledTaskPrincipal -UserId "NT AUTHORITY
\SYSTEM" -LogonType ServiceAccount -RunLevel Highest
    $return = Register-ScheduledTask -Action $schAction -Trigger
SschTrigger -TaskName "Create Vols and LUNs" -Description "Scheduled
Task to run configuration Script At Startup" -Principal $schPrincipal
    #Install -Module Posh-SSH
    Write-host 'Enable MPIO and SSH for PowerShell' -ForegroundColor
Yellow
    $return = Find-PackageProvider -Name 'Nuget' -ForceBootstrap
-IncludeDependencies
    $return = Find-Module PoSH-SSH | Install-Module -Force
    #Install Multipath-IO with PowerShell using elevated privileges in
Windows Servers
    Write-host 'Enable MPIO' -ForegroundColor Yellow
    $return = Install-WindowsFeature -name Multipath-IO -Restart
}
Install MPIO ssh
Remove-Item -Path $MyInvocation.MyCommand.Source

    CreateDisks.ps1
```

```
#Enable MPIO and Start iSCSI Service
Function PrepISCSI {
    $return = Enable-MSDSMAutomaticClaim -BusType iSCSI
    #Start iSCSI service with PowerShell using elevated privileges in
Windows Servers
```

```
$return = Start-service -Name msiscsi
    $return = Set-Service -Name msiscsi -StartupType Automatic
}
Function Create igroup vols luns ($fsxN) {
    $hostname = $env:COMPUTERNAME
    $hostname = $hostname.Replace('-',' ')
    volsluns = Q()
    for ($i = 1;$i -lt 10;$i++) {
        if ($i -eq 9){
            $volsluns
+=(@{volname=('v '+$hostname+' log');volsize=$fsxN.loqvolsize;lunname=(
'l '+$hostname+' log');lunsize=$fsxN.loglunsize})
        } else {
            $volsluns
+=(@{volname=('v '+$hostname+' data'+[string]$i);volsize=$fsxN.datavols
ize;lunname=('l '+$hostname+' data'+[string]$i);lunsize=$fsxN.datalunsi
ze})
        }
    }
    $secStringPassword = ConvertTo-SecureString $fsxN.password
-AsPlainText -Force
    $credObject = New-Object System.Management.Automation.PSCredential
($fsxN.login, $secStringPassword)
    $igroup = 'igrp '+$hostname
    #Connect to FSx N filesystem
    $session = New-SSHSession -ComputerName $fsxN.svmip -Credential
$credObject -AcceptKey:$true
    #Create igroup
    Write-host 'Creating igroup' -ForegroundColor Yellow
    #Find Windows initiator Name with PowerShell using elevated
privileges in Windows Servers
    $initport = Get-InitiatorPort | select -ExpandProperty NodeAddress
    $sshcmd = 'igroup create -igroup ' + $igroup + ' -protocol iscsi
-ostype windows -initiator ' + $initport
    $ret = Invoke-SSHCommand -Command $sshcmd -SSHSession $session
    #Create vols
   Write-host 'Creating Volumes' -ForegroundColor Yellow
    foreach ($vollun in $volsluns) {
        $sshcmd = 'vol create ' + $vollun.volname + ' -aggregate aggr1
-size ' + $vollun.volsize #+ ' -vserver ' + $vserver
        $return = Invoke-SSHCommand -Command $sshcmd -SSHSession
$session
    }
    #Create LUNs and mapped LUN to igroup
    Write-host 'Creating LUNs and map to igroup' -ForegroundColor
Yellow
```

```
foreach ($vollun in $volsluns) {
        $sshcmd = "lun create -path /vol/" + $vollun.volname + "/" +
$vollun.lunname + " -size " + $vollun.lunsize + " -ostype Windows 2008
" #-vserver " +$vserver
        $return = Invoke-SSHCommand -Command $sshcmd -SSHSession
$session
        #map all luns to igroup
        $sshcmd = "lun map -path /vol/" + $vollun.volname + "/" +
$vollun.lunname + " -igroup " + $igroup
        $return = Invoke-SSHCommand -Command $sshcmd -SSHSession
$session
   }
}
Function Connect iSCSI to SVM ($TargetPortals) {
   Write-host 'Online, Initialize and format disks' -ForegroundColor
Yellow
    #Connect Windows Server to svm with iSCSI target.
    foreach ($TargetPortal in $TargetPortals) {
        New-IscsiTargetPortal -TargetPortalAddress $TargetPortal
        for ($i = 1; $i -lt 5; $i++) {
            $return = Connect-IscsiTarget -IsMultipathEnabled $true
-IsPersistent $true -NodeAddress (Get-iscsiTarget | select
-ExpandProperty NodeAddress)
       }
    }
Function Create Partition Format Disks{
    #Create Partion and format disk
    $disks = Get-Disk | where PartitionStyle -eq raw
    foreach ($disk in $disks) {
        $return = Initialize-Disk $disk.Number
        $partition = New-Partition -DiskNumber $disk.Number
-AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS
-AllocationUnitSize 65536 -Confirm:$false -Force
        #$return = Format-Volume -DriveLetter $partition.DriveLetter
-FileSystem NTFS -AllocationUnitSize 65536
   }
}
Function UnregisterTask {
    Unregister-ScheduledTask -TaskName "Create Vols and LUNs"
-Confirm:$false
}
Start-Sleep -s 30
$fsxN = @{svmip ='198.19.255.153';login =
'vsadmin';password='net@pp11';datavolsize='10GB';datalunsize='8GB';logv
```

```
olsize='8GB';loglunsize='6GB'}
$TargetPortals = ('10.2.1.167', '10.2.2.12')
PrepISCSI
Create_igroup_vols_luns $fsxN
Connect_iSCSI_to_SVM $TargetPortals
Create_Partition_Format_Disks
UnregisterTask
Remove-Item -Path $MyInvocation.MyCommand.Source
....
```

Run the file EnableMPIO.ps1 first and the second script executes automatically after the server has been rebooted. These PowerShell scripts can be removed after they have been executed due to credential access to the SVM.

#### Where to find additional information

Amazon FSx for NetApp ONTAP

https://docs.aws.amazon.com/fsx/latest/ONTAPGuide/what-is-fsx-ontap.html

· Getting Started with FSx for NetApp ONTAP

https://docs.aws.amazon.com/fsx/latest/ONTAPGuide/getting-started.html

Overview of the SnapCenter interface

https://www.youtube.com/watch?v=IVEBF4kV6Ag&t=0s

• Tour through SnapCenter navigation pane options

https://www.youtube.com/watch?v=\_IDKt-koySQ

• Setup SnapCenter 4.0 for SQL Server plug-in

https://www.youtube.com/watch?v=MopbUFSdHKE

· How to back up and restore databases using SnapCenter with SQL Server plug-in

https://www.youtube.com/watch?v=K343qPD5\_Ys

· How to clone a database using SnapCenter with SQL Server plug-in

https://www.youtube.com/watch?v=ogEc4DkGv1E

# TR-4897: SQL Server on Azure NetApp Files - Real Deployment View

This document covers a real-time deployment of SQL Server Always On availability group (AOAG) on Azure NetApp Files leveraging Azure Virtual Machines.

Niyaz Mohamed, NetApp

IT organizations face constant change. Gartner reports nearly 75% of all databases will require cloud-based storage by 2022. As a leading relational database management system (RDBMS), Microsoft SQL Server is the go-to choice for Windows platform-designed applications and organizations that rely on SQL Server for everything from enterprise resource planning (ERP) to analytics to content management. SQL Server has helped to revolutionize the way enterprises manage massive data sets and power their applications to meet the schema and query performance demands.

Most IT organizations follow a cloud-first approach. Customers in a transformation phase evaluate their current IT landscape and then migrate their database workloads to the cloud based on an assessment and discovery exercise. Some factors driving customers toward cloud migration include elasticity/burst, data center exit, data center consolidation, end-of-life scenarios, mergers, acquisitions, and so on. The reason for migration can vary based on each organization and their respective business priorities. When moving to the cloud, choosing the right cloud storage is very important in order to unleash the power of SQL Server database cloud deployment.

#### Use case

Moving the SQL Server estate to Azure and integrating SQL Server with Azure's vast array of platform-as-aservice (PaaS) features such as Azure Data Factory, Azure IoT Hub, and Azure Machine Learning creates tremendous business value to support digital transformation. Adopting the cloud also enables the respective business unit to focus on productivity and delivering new features and enhancements faster (DevTest use case) than relying on the CAPEX model or traditional private cloud models. This document covers a real-time deployment of SQL Server Always On availability group (AOAG) on Azure NetApp Files leveraging Azure Virtual Machines.

Azure NetApp Files provides enterprise-grade storage with continuously available file shares. Continuously available shares are required by SQL Server production databases on SMB file share to make sure that the node always has access to the database storage, including during disruptive scenarios such as controller upgrades or failures. Continuously available file shares eliminate the need to replicate data between storage nodes. Azure NetApp Files uses SMB 3.0 scale-out, persistent handles, and transparent failover to support nondisruptive operations (NDOs) for planned and unplanned downtime events, including many administrative tasks.

When planning cloud migrations, you should always evaluate the best approach to use. The most common and easiest approach for application migration is rehosting (also known as lift and shift). The example scenario provided in this document uses the rehosting method. SQL Server on Azure virtual machines with Azure NetApp Files allows you to use full versions of SQL Server in the cloud without having to manage on-premises hardware. SQL Server virtual machines (VMs) also simplify licensing costs when you pay as you go and provides elasticity and bursting capabilities for development, test, and estate refresh scenarios.

#### Factors to consider

This section describes the different issues you should consider when Azure NetApp Files with SQL Server in the cloud.

#### VM performance

Selecting the right VM size is important for optimal performance of a relational database in a public cloud. Microsoft recommends that you continue using the same database performance-tuning options that are applicable to SQL Server in on-premises server environments. Use <u>memory-optimized</u> VM sizes for the best performance of SQL Server workloads. Collect the performance data of existing deployment to identify the RAM and CPU utilization while choosing the right instances. Most deployments choose between the D, E, or M series.

#### Notes:

- For the best performance of SQL Server workloads, use memory-optimized VM sizes.
- NetApp and Microsoft recommend that you identify the storage performance requirements before choosing the instance type with the appropriate memory-to-vCore ratio. This also helps select a lower-instance type with the right network bandwidth to overcome storage throughput limits of the VM.

#### VM redundancy

To increase redundancy and high availability, SQL Server VMs should either be in the same availability set or different availability zones. When creating Azure VMs, you must choose between configuring availability sets versus availability zones; an Azure VM cannot participate in both.

#### High availability

For high availability, configuring SQL Server AOAG or Always On Failover Cluster Instance (FCI) is the best option. For AOAG, this involves multiple instances of SQL Server on Azure Virtual Machines in a virtual network. If high availability is required at the database level, consider configuring SQL Server availability groups.

#### Storage configuration

Microsoft SQL Server can be deployed with an SMB file share as the storage option. Starting with SQL Server 2012, system databases (master, model, msdb, or tempdb), and user databases can be installed with Server Message Block (SMB) file server as a storage option. This applies to both SQL Server stand-alone and SQL Server FCI.



File share storage for SQL Server databases should support continuously available property. This provides uninterrupted access to the file-share data.

Azure NetApp Files provides high performing file storage to meet any demanding workload, and it reduces SQL Server TCO as compared to block storage solutions. With block storage, VMs have imposed limits on I/O and bandwidth for disk operations; network bandwidth limits alone are applied against Azure NetApp Files. In other words, no VM-level I/O limits are applied to Azure NetApp Files. Without these I/O limits, SQL Server running on smaller VMs connected to Azure NetApp Files can perform as well as SQL Server running on much larger VMs. Azure NetApp Files reduce SQL Server deployment costs by reducing compute and software licensing costs. For detailed cost analysis and performance benefits of using Azure NetApp Files for SQL Server deployment, see the Benefits of using Azure NetApp Files for SQL Server deployment.

#### Benefits

The benefits of using Azure NetApp Files for SQL Server include the following:

- Using Azure NetApp Files allows you to use smaller instances, thus reducing compute cost.
- Azure NetApp Files also reduces software licensing costs, which reduce the overall TCO.
- Volume reshaping and dynamic service level capability optimizes cost by sizing for steady-state workloads and avoiding overprovisioning.

#### Notes:

• To increase redundancy and high availability, SQL Server VMs should either be in the same availability set or in different availability zones. Consider file path requirements if user-defined data files are required; in which case, select SQL FCI over SQL AOAG.

- The following UNC path is supported: \\ANFSMB-b4ca.anf.test\SQLDB and \\ANFSMB-b4ca.anf.test\SQLDB \.
- The loopback UNC path is not supported.
- For sizing, use historic data from your on-premises environment. For OLTP workloads, match the target IOPS with performance requirements using workloads at average and peak times along with the disk reads/sec and disk writes/sec performance counters. For data warehouse and reporting workloads, match the target throughput using workloads at average and peak times and the disk read bytes/sec and disk write bytes/sec. Average values can be used in conjunction with volume reshaping capabilities.

#### Create continuously available shares

Create continuously available shares with the Azure portal or Azure CLI. In the portal, select the Enable Continuous Availability property option. for the Azure CLI, specify the share as a continuously available share by using the az netappfiles volume create with the smb-continuously-avl option set to \$True. To learn more about creating a new, continuous availability-enabled volume, see Creating a Continuously Available Share.

#### Notes:

- Enable continuous availability for the SMB volume as shown in the following image.
- If a non-administrator domain account is used, make sure the account has the required security privilege assigned.
- Set the appropriate permissions at the share level and proper file-level permissions.
- A continuously available property cannot be enabled on existing SMB volumes. To convert an existing volume to use a continuously available share, use NetApp Snapshot technology. For more information, see Convert existing SMB volumes to use Continuous Availability.

#### Create a volume

...

Basics <b>Protocol</b> Tags	Review + create							
Configure access to your volume.								
Access								
Protocol type	O NFS	s 💿 SMB 🔵 Du	ual-protocol (NFSv3 and SMB)					
Configuration								
Active Directory * 🕡	10.0.0.	10.0.0.100 - anf.test/join						
Share name * 🕕	SQLDE	SQLDB						
Enable Continuous Availability 🤅								
Review + create	< Previous	Next : Tags >						

#### Performance

Azure NetApp Files supports three service levels: Standard (16MBps per terabyte), Premium (64MBps per terabyte), and Ultra (128MBps per terabyte). Provisioning the right volume size is important for optimal performance of the database workload. With Azure NetApp Files, volume performance and the throughput limit are based on a combination of the following factors:

- The service level of the capacity pool to which the volume belongs
- · The quota assigned to the volume
- The quality of service (QoS) type (auto or manual) of the capacity pool

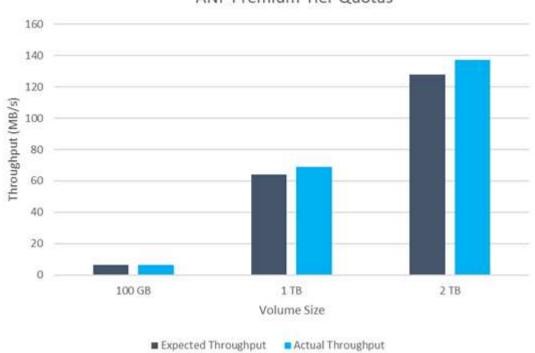
For more information, see Service levels for Azure NetApp Files.

	Service Level	Throughput				
	Ultra	128MiB/s per 1TiB quota	X	Volume	=	
	Premium	64MiB/s per 1TiB quota	Λ	Quota	_	/×
	Standard	16MiB/s per 1TiB quota				Y
E.g.	1 Premium Tier (64MiB/s per 1TiB quota)			2TiB Volume Quota		Up to 128MiB/s gross throughput
.g.	Rep.	Premium Tier iB/s per 1TiB quota)		100 GiB Volume Quota		Up to 6.25MiB/s gross throughput

#### **Performance validation**

As with any deployment, testing the VM and storage is critical. For storage validation, tools such as HammerDB, Apploader, the SQL Server storage benchmark (SB) tool, or any custom script or FIO with the appropriate read/write mix should be used. Keep in mind however that most SQL Server workloads, even busy OLTP workloads, are closer to 80%–90% read and 10%–20% write.

To showcase performance, a quick test was performed against a volume using premium service levels. In this test, the volume size was increased from 100GB to 2TB on the fly without any disruption to application access and zero data migration.



ANF Premium Tier Quotas

Here is another example of real time performance testing with HammerDB performed for the deployment covered in this paper. For this testing, we used a small instance with eight vCPUs, a 500GB Premium SSD, and a 500GB SMB Azure NetApp Files volume. HammerDB was configured with 80 warehouses and eight

users.

The following chart shows that Azure NetApp Files was able to deliver 2.6x the number of transactions per minute at 4x lower latency when using a comparable sized volume (500GB).

An additional test was performed by resizing to a larger instance with 32x vCPUs and a 16TB Azure NetApp Files volume. There was a significant increase in transactions per minute with consistent 1ms latency. HammerDB was configured with 80 warehouses and 64 users for this test.



#### **Cost optimization**

Azure NetApp Files allows nondisruptive, transparent volume resizing and the ability to change the service levels with zero downtime and no effect on applications. This is a unique capability allowing dynamic cost management that avoids the need to perform database sizing with peak metrics. Rather, you can use steady state workloads, which avoids upfront costs. The volume reshaping and dynamic service-level change allows you to adjust the bandwidth and service level of Azure NetApp Files volumes on demand almost instantaneously without pausing I/O, while retaining data access.

Azure PaaS offerings such as LogicApp or Functions can be used to easily resize the volume based on a specific webhook or alert rule trigger to meet the workload demands while dynamically handling the cost.

For example, consider a database that needs 250MBps for steady state operation; however, it also requires a peak throughput of 400MBps. In this case, the deployment should be performed with a 4TB volume within the Premium service level to meet the steady-state performance requirements. To handle the peak workload, increase the volume size using Azure functions to 7TB for that specific period, and then downsize the volume to make the deployment cost effective. This configuration avoids overprovisioning of the storage.

#### Real-time, high-level reference design

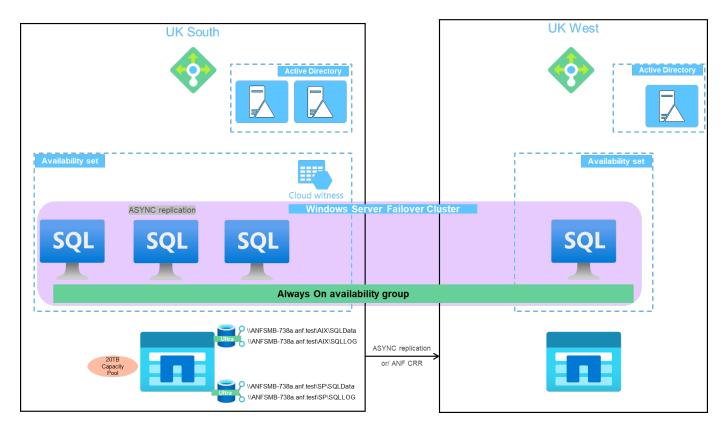
This section covers a real-time deployment of a SQL database estate in an AOAG configuration using an Azure NetApp Files SMB volume.

- Number of nodes: 4
- Number of databases: 21

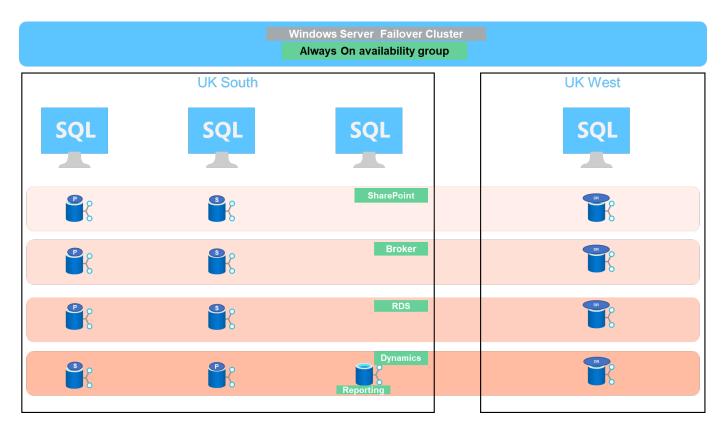
- Number of availability groups: 4
- Backup retention: 7 days
- Backup archive: 365 days



Deploying FCI with SQL Server on Azure virtual machines with an Azure NetApp Files share provides a cost-efficient model with a single copy of the data. This solution can prevent add-file operation issues if the file path differs from the secondary replica.



The following image shows the databases within AOAG spread across the nodes.



#### Data layout

The user database files (.mdf) and user database transaction log files (.ldf) along with tempDB are stored on the same volume. The service level is Ultra.

The configuration consists of four nodes and four AGs. All 21 databases (part of Dynamic AX, SharePoint, RDS connection broker, and indexing services) are stored on the Azure NetApp Files volumes. The databases are balanced between the AOAG nodes to use the resources on the nodes effectively. Four D32 v3 instances are added in the WSFC, which participates in the AOAG configuration. These four nodes are provisioned in the Azure virtual network and are not migrated from on-premises.

#### Notes:

- If the logs require more performance and throughput depending on the nature of the application and the queries executed, the database files can be placed on the Premium service level, and the logs can be stored at the Ultra service level.
- If the tempdb files have been placed on Azure NetApp Files, then the Azure NetApp Files volume should be separated from the user database files. Here is an example distribution of the database files in AOAG.

#### Notes:

- To retain the benefits of Snapshot copy-based data protection, NetApp recommends not combining data and log data into the same volume.
- An add-file operation performed on the primary replica might fail on the secondary databases if the file path of a secondary database differs from the path of the corresponding primary database. This can happen if the share path is different on primary and secondary nodes (due to different computer accounts). This failure could cause the secondary databases to be suspended. If the growth or performance pattern cannot be predicted and the plan is to add files later, a SQL Server failover cluster with Azure NetApp Files is an acceptable solution. For most deployments, Azure NetApp Files meets the performance requirements.

#### Migration

There are several ways to migrate an on-premises SQL Server user database to SQL Server in an Azure virtual machine. The migration can be either online or offline. The options chosen depend on the SQL Server version, business requirements, and the SLAs defined within the organization. To minimize downtime during the database migration process, NetApp recommends using either the AlwaysOn option or the transactional replication option. If it is not possible to use these methods, you can migrate the database manually.

The simplest and most thoroughly tested approach for moving databases across machines is backup and restore. Typically, you can start with a database backup followed by a copy of the database backup into Azure. You can then restore the database. For the best data transfer performance, migrate the database files into the Azure VM using a compressed backup file. The high-level design referenced in this document uses the backup approach to Azure file storage with Azure file sync and then restore to Azure NetApp files.



Azure Migrate can be used to discover, assess, and migrate SQL Server workloads.

To perform a migration, complete the following high-level steps:

- 1. Based on your requirements, set up connectivity.
- 2. Perform a full database backup to an on-premises file-share location.
- 3. Copy the backup files to an Azure file share with Azure file sync.
- 4. Provision the VM with the desired version of SQL Server.
- 5. Copy the backup files to the VM by using the copy command from a command prompt.
- 6. Restore the full databases to SQL Server on Azure virtual machines.



To restore 21 databases, it took approximately nine hours. This approach is specific to this scenario. However, other migration techniques listed below can be used based on your situation and requirements.

Other migration options to move data from an on-premises SQL Server to Azure NetApp Files include the following:

- Detach the data and log files, copy them to Azure Blob storage, and then attach them to SQL Server in the Azure VM with an ANF file share mounted from the URL.
- If you are using Always On availability group deployment on-premises, use the Add Azure Replica Wizard to create a replica in Azure and then perform failover.
- Use SQL Server transactional replication to configure the Azure SQL Server instance as a subscriber, disable replication, and point users to the Azure database instance.
- Ship the hard drive using the Windows Import/Export Service.

#### Backup and recovery

Backup and recovery are an important aspect of any SQL Server deployment. It is mandatory to have the appropriate safety net to quickly recover from various data failure and loss scenarios in conjunction with high availability solutions such as AOAG. SQL Server Database Quiesce Tool, Azure Backup (streaming), or any third-party backup tool such as Commvault can be used to perform an application- consistent backup of the databases,

Azure NetApp Files Snapshot technology allows you to easily create a point-in-time (PiT) copy of the user databases without affecting performance or network utilization. This technology also allows you to restore a

Snapshot copy to a new volume or quickly revert the affected volume to the state it was in when that Snapshot copy was created by using the revert volume function. The Azure NetApp Files snapshot process is very quick and efficient, which allows for multiple daily backups, unlike the streaming backup offered by Azure backup. With multiple Snapshot copies possible in a given day, the RPO and RTO times can be significantly reduced. To add application consistency so that data is intact and properly flushed to the disk before the Snapshot copy is taken, use the SQL Server database quiesce tool (SCSQLAPI tool; access to this link requires NetApp SSO login credentials). This tool can be executed from within PowerShell, which quiesces the SQL Server database and in turn can take the application-consistent storage Snapshot copy for backups.

\*Notes: \*

- The SCSQLAPI tool only supports the 2016 and 2017 versions of SQL Server.
- The SCSQLAPI tool only works with one database at a time.
- Isolate the files from each database by placing them onto a separate Azure NetApp Files volume.

Because of SCSQL API's vast limitations, Azure Backup was used for data protection in order to meet the SLA requirements. It offers a stream-based backup of SQL Server running in Azure Virtual Machines and Azure NetApp Files. Azure Backup allows a 15-minute RPO with frequent log backups and PiT recovery up to one second.

#### Monitoring

Azure NetApp Files is integrated with Azure Monitor for the time series data and provides metrics on allocated storage, actual storage usage, volume IOPS, throughput, disk read bytes/sec, disk write bytes/sec, disk reads/sec and disk writes/sec, and associated latency. This data can be used to identify bottlenecks with alerting and to perform health checks to verify that your SQL Server deployment is running in an optimal configuration.

In this HLD, ScienceLogic is used to monitor Azure NetApp Files by exposing the metrics using the appropriate service principal. The following image is an example of the Azure NetApp Files Metric option.

Scope	Metric Namespace	Metric	Aggregation	
volume1	NetApp Volumes stand 🗸	Total throughput	✓ Avg	~ •
DB/s		Percentage Volume Cor		•
		Read iops		
DB/s		Read throughput		
DB/s		Total throughput		
DB/s		Volume allocated size		

### DevTest using thick clones

With Azure NetApp Files, you can create instantaneous copies of databases to test functionality that should be implemented by using the current database structure and content during the application development cycles, to use the data extraction and manipulation tools when populating data warehouses, or to even recover data that was mistakenly deleted or changed. This process does not involve copying data from Azure Blob containers, which makes it very efficient. After the volume is restored, it can be used for read/write operations, which significantly reduces validation and time to market. This needs to be used in conjunction with SCSQLAPI for application consistency. This approach provides yet another continuous cost optimization technique along with Azure NetApp Files leveraging the Restore to New volume option.

#### Notes:

- The volume created from the Snapshot copy using the Restore New Volume option consumes capacity from the capacity pool.
- You can delete the cloned volumes by using REST or Azure CLI to avoid additional costs (in case the capacity pool must be increased).

#### Hybrid storage options

Although NetApp recommends using the same storage for all the nodes in SQL Server availability groups, there are scenarios in which multiple storage options can be used. This scenario is possible for Azure NetApp Files in which a node in AOAG is connected with an Azure NetApp Files SMB file share and the second node is connected with an Azure Premium disk. In these instances, make sure that the Azure NetApp Files SMB share is holding the primary copy of the user databases and the Premium disk is used as the secondary copy.

#### Notes:

- In such deployments, to avoid any failover issues, make sure that continuous availability is enabled on the SMB volume. With no continuously available attribute, the database can fail if there is any background maintenance at the storage layer.
- Keep the primary copy of the database on the Azure NetApp Files SMB file share.

#### **Business continuity**

Disaster recovery is generally an afterthought in any deployment. However, disaster recovery must be addressed during the initial design and deployment phase to avoid any impact to your business. With Azure NetApp Files, the cross-region replication (CRR) functionality can be used to replicate the volume data at the block level to the paired region to handle any unexpected regional outage. The CRR-enabled destination volume can be used for read operations, which makes it an ideal candidate for disaster recovery simulations. In addition, the CRR destination can be assigned with the lowest service level (for instance, Standard) to reduce the overall TCO. In the event of a failover, replication can be broken, which makes the respective volume read/write capable. Also, the service level of the volume can be changed by using the dynamic service level functionality to significantly reduce disaster recovery cost. This is another unique feature of Azure NetApp Files with block replication within Azure.

#### Long-term Snapshot copy archive

Many organizations must perform long-term retention of snapshot data from database files as a mandatory compliance requirement. Although this process is not used in this HLD, it can be easily accomplished by using a simple batch script using AzCopy to copy the snapshot directory to the Azure Blob container. The batch script can be triggered based on a specific schedule by using scheduled tasks. The process is straightforward—it includes the following steps:

- 1. Download the AzCopy V10 executable file. There is nothing to install because it is an exe file.
- 2. Authorize AzCopy by using a SAS token at the container level with the appropriate permissions.
- 3. After AzCopy is authorized, the data transfer begins.

#### Notes:

- In batch files, make sure to escape the % characters that appear in SAS tokens. This can be done by adding an additional % character next to existing % characters in the SAS token string.
- The Secure Transfer Required setting of a storage account determines whether the connection to a storage account is secured with Transport Layer Security (TLS). This setting is enabled by default. The

following batch script example recursively copies data from the Snapshot copy directory to a designated Blob container:

```
SET source="Z:\~snapshot"
echo %source%
SET
dest="https://testanfacct.blob.core.windows.net/azcoptst?sp=racwdl&st=2020
-10-21T18:41:35Z&se=2021-10-22T18:41:00Z&sv=2019-12
-12&sr=c&sig=ZxRUJwFlLXgHS8As7HzXJOaDXXVJ7PxxIX3ACpx56XY%%3D"
echo %dest%
```

The following example cmd is executed in PowerShell:

-recursive

```
INFO: Scanning...
INFO: Any empty folders will not be processed, because source and/or
destination doesn't have full folder support
Job b3731dd8-da61-9441-7281-17a4db09ce30 has started
Log file is located at: C:\Users\niyaz\.azcopy\b3731dd8-da61-9441-7281-
17a4db09ce30.log
0.0 %, 0 Done, 0 Failed, 2 Pending, 0 Skipped, 2 Total,
INFO: azcopy.exe: A newer version 10.10.0 is available to download
0.0 %, 0 Done, 0 Failed, 2 Pending, 0 Skipped, 2 Total,
Job b3731dd8-da61-9441-7281-17a4db09ce30 summary
Elapsed Time (Minutes): 0.0333
Number of File Transfers: 2
Number of Folder Property Transfers: 0
Total Number of Transfers: 2
Number of Transfers Completed: 2
Number of Transfers Failed: 0
Number of Transfers Skipped: 0
TotalBytesTransferred: 5
Final Job Status: Completed
```

#### Notes:

- A similar backup feature for long-term retention will soon be available in Azure NetApp Files.
- The batch script can be used in any scenario that requires data to copied to Blob container of any region.

#### **Cost optimization**

With volume reshaping and dynamic service level change, which is completely transparent to the database, Azure NetApp Files allows continuous cost optimizations in Azure. This capability is used in this HLD extensively to avoid overprovisioning of additional storage to handle workload spikes.

Resizing the volume can be easily accomplished by creating an Azure function in conjunction with the Azure alert logs.

#### Conclusion

Whether you are targeting an all-cloud or hybrid cloud with stretch databases, Azure NetApp Files provides excellent options to deploy and manage the database workloads while reducing your TCO by making data requirements seamless to the application layer.

This document covers recommendations for planning, designing, optimizing, and scaling Microsoft SQL Server deployments with Azure NetApp Files, which can vary greatly between implementations. The right solution depends on both the technical details of the implementation and the business requirements driving the project.

#### Takeaways

The key points of this document include:

- You can now use Azure NetApp Files to host the database and file share witness for SQL Server cluster.
- You can boost the application response times and deliver 99.9999% availability to provide access to SQL Server data when and where it is needed.
- You can simplify the overall complexity of the SQL Server deployment and ongoing management, such as raid striping, with simple and instant resizing.
- You can rely on intelligent operations features to help you deploy SQL Server databases in minutes and speed development cycles.
- If Azure Cloud is the destination, Azure NetApp Files is the right storage solution for optimized deployment.

#### Where to find additional information

To learn more about the information described in this document, refer to the following website links:

• Solution architectures using Azure NetApp Files

https://docs.microsoft.com/en-us/azure/azure-netapp-files/azure-netapp-files-solution-architectures

· Benefits of using Azure NetApp Files for SQL Server deployment

https://docs.microsoft.com/en-us/azure/azure-netapp-files/solutions-benefits-azure-netapp-files-sql-server

• SQL Server on Azure Deployment Guide Using Azure NetApp Files

https://www.netapp.com/pdf.html?item=/media/27154-tr-4888.pdf

• Fault tolerance, high availability, and resilience with Azure NetApp Files

https://cloud.netapp.com/blog/azure-anf-blg-fault-tolerance-high-availability-and-resilience-with-azure-netapp-files

# TR-4467: SAP with Microsoft SQL Server on Windows - Best practices using NetApp Clustered Data ONTAP and SnapCenter

Marco Schoen, NetApp

TR-4467 provides customers and partners with best practices for deploying clustered NetApp Data ONTAP in support of SAP Business Suite solutions running in a Microsoft SQL Server on Windows environment.

TR-4467: SAP with Microsoft SQL Server on Windows - Best practices using NetApp Clustered Data ONTAP and SnapCenter

### Modernizing your Microsoft SQL Server environment

Optimize operations and unleash the power of your data - on the premises or in the cloud.

Modernizing your Microsoft SQL Server environment

# TR-4590: Best practice guide for Microsoft SQL Server with ONTAP

Manohar Kulkarni and Pat Sinthusan, NetApp

This document describes best practices and offers insight into design considerations for deploying SQL Server on NetApp storage systems running NetApp ONTAP® software, with the goal of achieving effective and efficient storage deployment and end-to-end data protection and retention planning.

TR-4590: Best practices guide for Microsoft SQL Server with ONTAP

# TR-4764: Best practices for Microsoft SQL Server with NetApp EF-Series

Mitch Blackburn, Pat Sinthusan, NetApp

This best practices guide is intended to help storage administrators and database administrators successfully deploy Microsoft SQL Server on NetApp EF-Series storage.

TR-4764: Best practices for Microsoft SQL Server with NetApp EF-Series

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