



# SQL-Integrated Storage Getting Started Guide

v1.0 – July 2020

# About This Guide

- A quick-start guide to implementing SQL-Integrated Storage for enhanced visibility, performance and management of Microsoft SQL Server databases, hosted on Virtual Machines or Physical Servers.
- Audience:
  - SQL Server Database Administrators
  - Storage Administrators
  - System Administrators

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# Prerequisites

- Tintri Global Center (TGC) version: 5.x
  - TGC 5.x Virtual Machine specs: minimum 4 vCPUs and 8GB RAM
    - NOTE: Pre-existing TGC "small" instances may be configured with 2vCPU & 4GB RAM
  - Advanced License required for each VMstore that will use SQL Integrated Storage feature set
- VMstore version: TXOS 4.6.x or newer
- Microsoft SQL Server 2016 and newer, installed on:
  - Windows Server 2016 and newer
  - VM and/or Bare-metal
- VMstore(s) and TGC operational
  - For new customers – refer to [support.tintri.com/download](https://support.tintri.com/download) for initial deployment documentation
- Active Directory administrative permissions
- Networking Familiarity

# QuickStart Overview

- Here's a high-level overview of steps needed to get up and running:
  1. Upgrade TGC & VMstores to meet minimum version & licensing requirements
  2. Join TGC & VMstores to Active Directory, if not already members
  3. Configure network connectivity from SQL Servers to Data IPs of VMstores (10Gb or higher recommended). Separate storage connectivity from client connectivity where possible. Up to 64 different IPs and VLANs can be applied per interface, giving you lots of flexibility in design
  4. Permissions: Create AD accounts and groups as needed, such as "SQL\_Servers"
  5. Create SMB shares on VMstores. Configure permissions so that SQL Server service accounts and DBAs have read/write access
  6. Register SQL Servers in TGC using SQL Accounts that have sysadmin rights
  7. Migrate Databases into the SMB shares.
  8. Observe & Protect: Each database will show up in TGC and is ready for interaction
  9. Change default locations in SQL servers to ensure all new databases benefit.
  10. Create some Service Group policies to ensure all new databases are protected by default
  11. Repeat #6 through #10 as needed



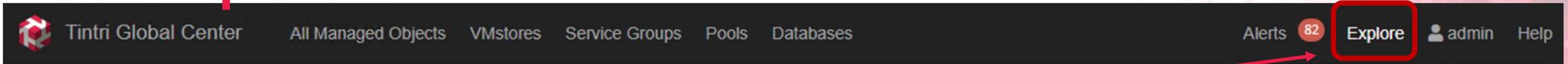
# Tintri Global Center (TGC) Settings

# Tintri Global Center (TGC)

- Verify Version
- VMstore Registrations – Add/Remove
- Time & Date
- Active Directory Membership

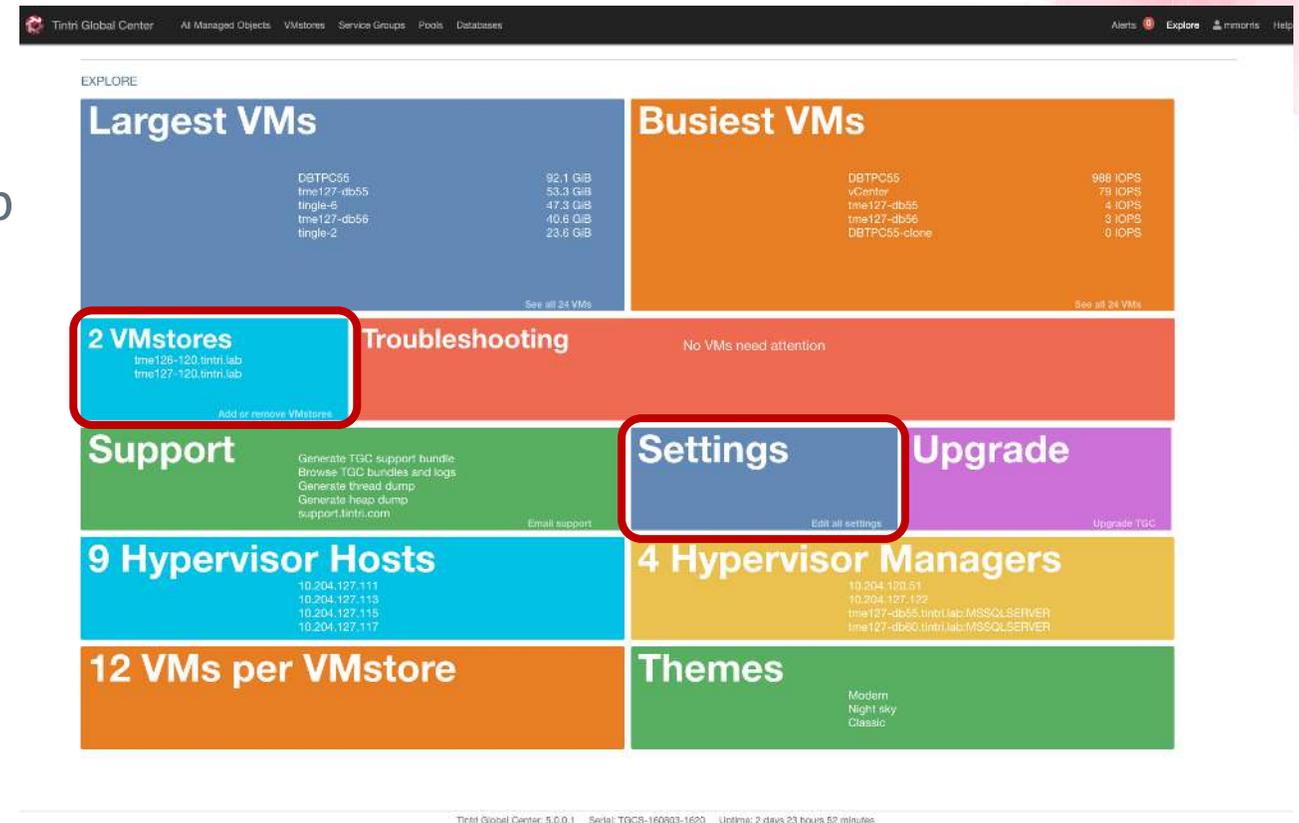


# TGC: Explore

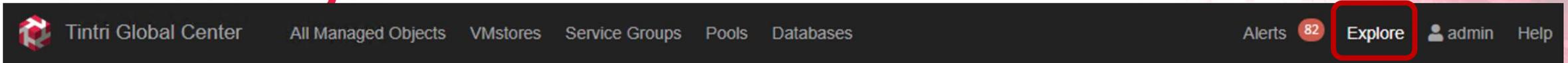


- Explore

- Provides access to a variety of high-level insight about your environment.
- Add/Remove VMstores
- Settings: SQL-Integrated Storage setup is dependent on a few elements:
  - Active Directory Membership
  - Time & Date Settings

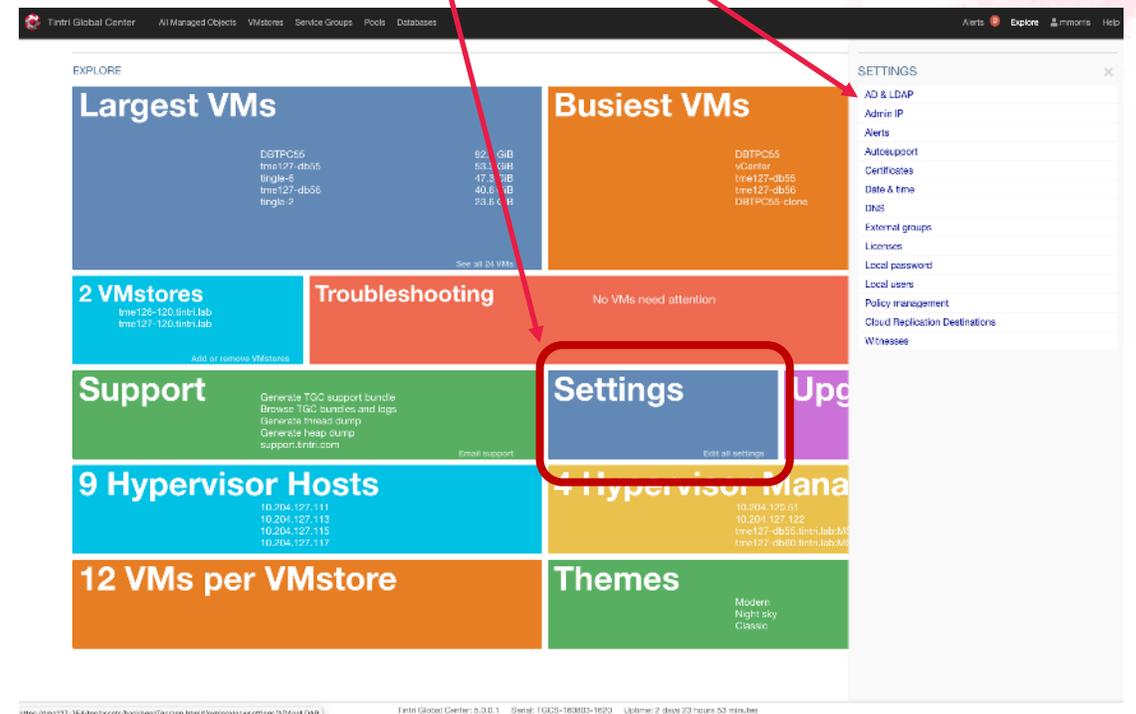


# TGC: Settings



- Active Directory
  - Make sure both TGC and VMstores are members of the same Domain.

- Click on Settings
  - Then AD & LDAP



# TGC: Settings - AD & LDAP

- Check Domain Membership
  - Username / Password
  - Click the hyper-link to validate domain membership.
    - Verify saved domain join
  - After Joining the domain, you will find a computer account for TGC within your AD

AD & LDAP

Protocol:  AD  LDAP  Disabled

Domain Name: tintri.lab

Username: Administrator

Password: .....

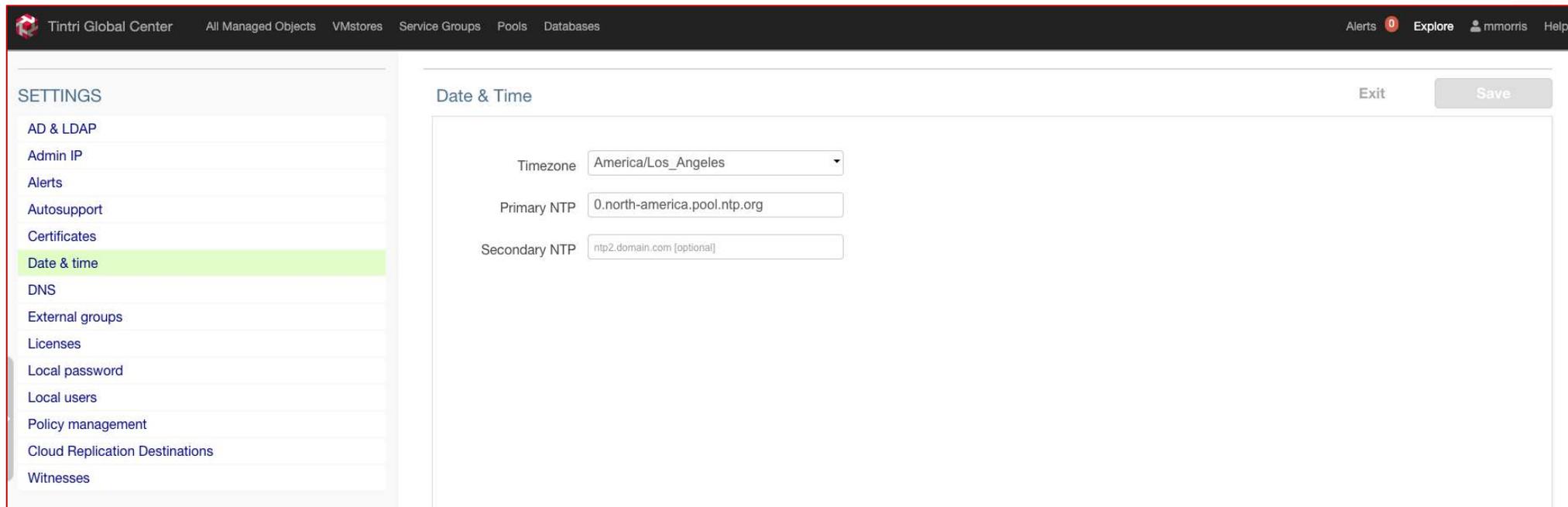
[Domain controllers](#)  
[Verify saved domain join](#)

Test Results

- Connectivity to authentication subsystem ✓
- Connectivity to internal Active Directory client ✓
- Name of currently-joined domain ✓ TINTRI.LAB (TINTRI)
- Connectivity to Active Directory domain controller(s) ✓
- Trust account credentials valid ✓
- Trusted domains ✓ Found 1 trusted domains
- Current DC Affinity ✓ tme120-50.tintri.lab
- Appliance site name ✓ Default-First-Site-Name

# TGC: Settings – Date & Time

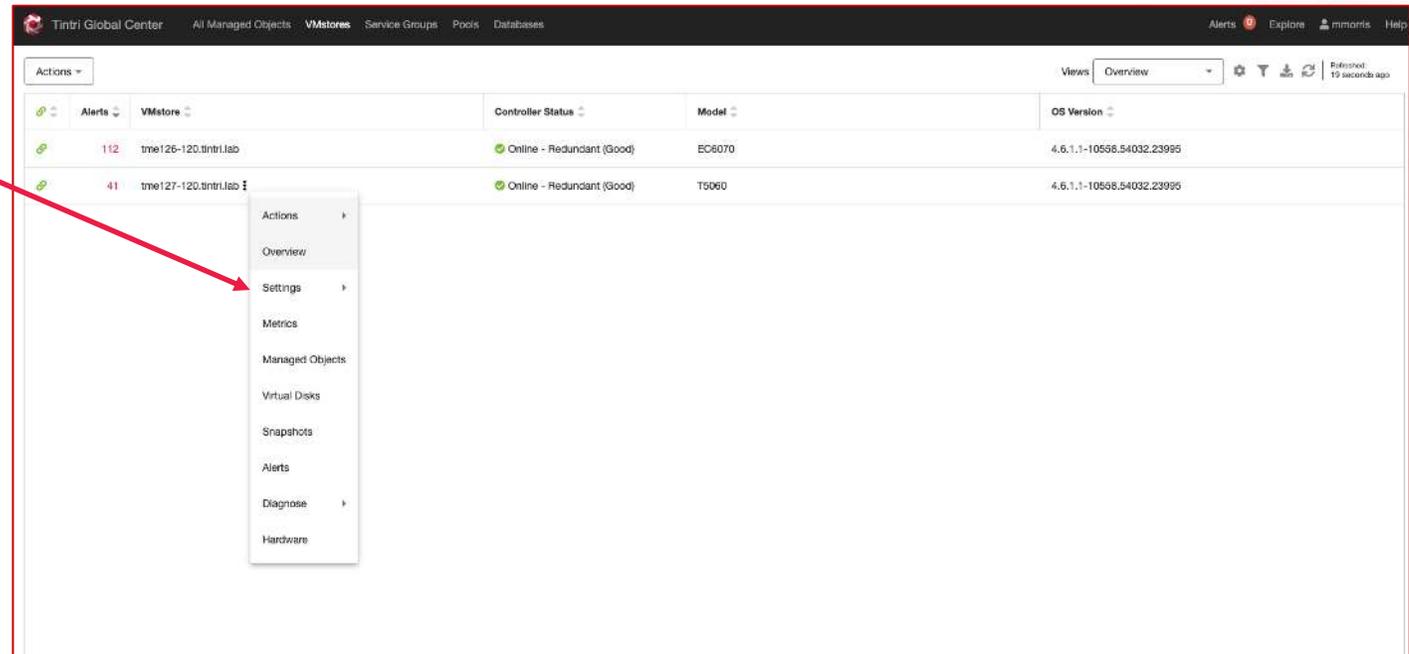
- Select Date & Time
  - Enable Network Time Protocol (NTP) to ensure all Servers, VMstores, and TGC are within a time-tolerances across the environment (required for Kerberos)



# VMstore Settings

# VMstore: Settings

- VMstore configuration
  - This section will provide access to the VMstore(s) elements
    - Overview Performance & Activity Data
    - Settings
    - Managed objects
    - Virtual Disks
    - Alerts
    - Diagnostics
    - Hardware



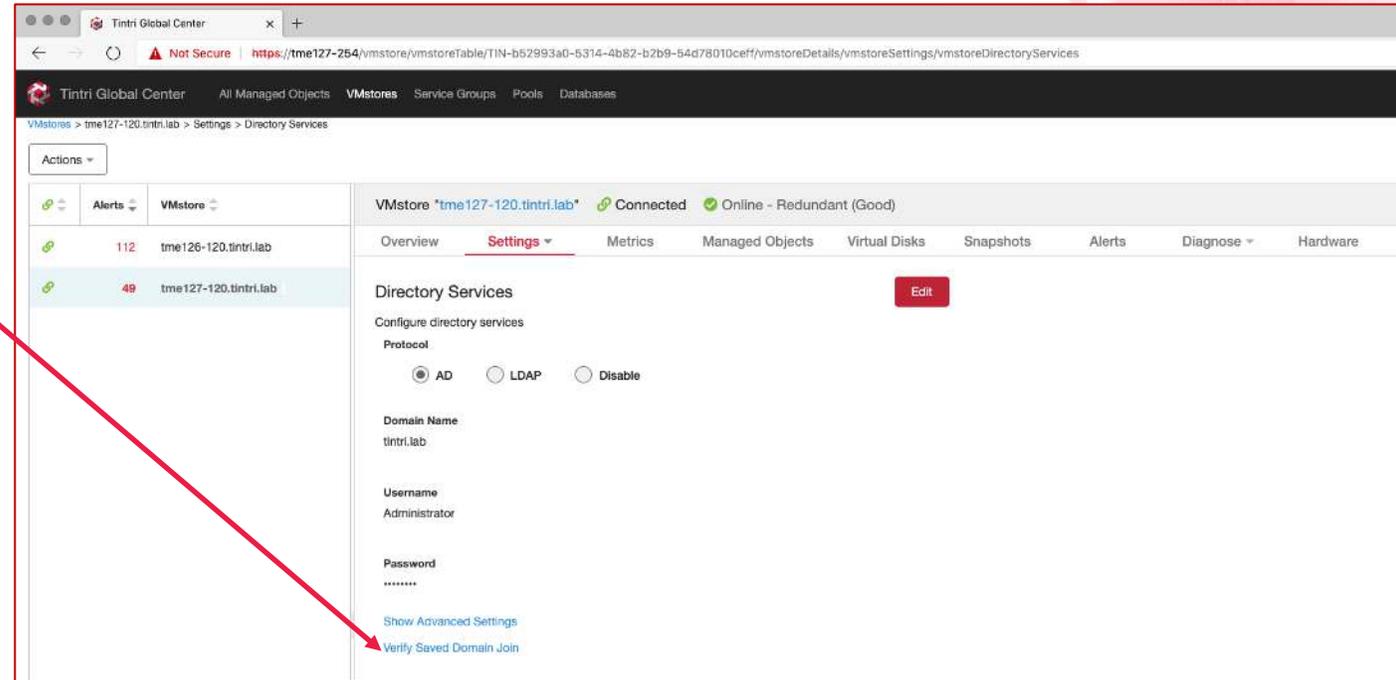
# VMstore: Settings – Directory Services

- VMstore Settings

- Directory Services
- SMB

- Directory Services

- Verify Membership
- Select Edit if needed to add or make changes



# VMstore: Settings – Directory Services (con't)

- VMstore configuration

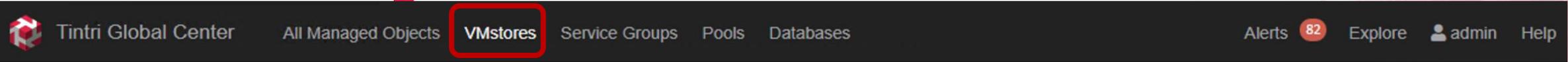
- Directory Services

- Select Edit if needed to add or make changes
    - Make Changes as needed
      - Domain Name
      - Username
      - Password

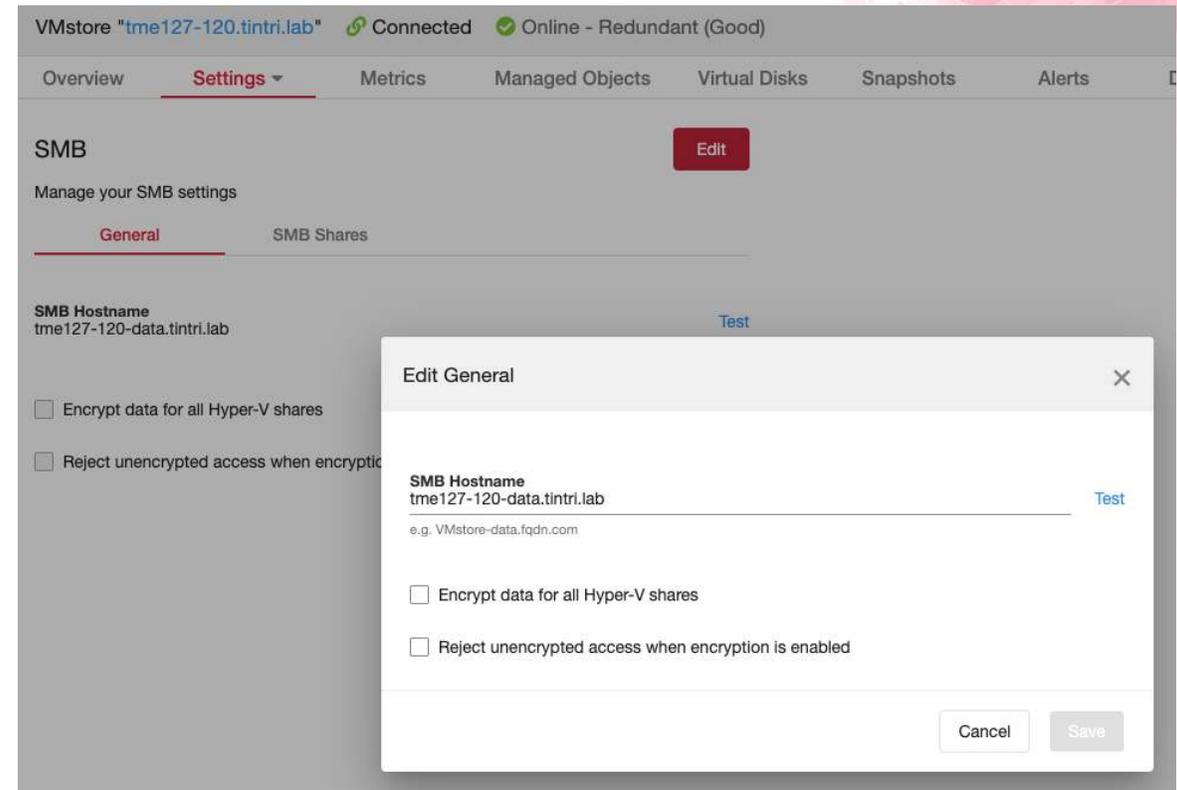
- Settings Tab Starts at the Directory Services View

The screenshot shows the 'Settings' tab for a VMstore. The 'Directory Services' section is active, displaying configuration options for Protocol (AD, LDAP, Disabled), Domain Name (tintri.lab), Username (Administrator), and Password. A red arrow points from the 'Edit' button in the 'Directory Services' section to the 'Edit Directory Services' dialog box. The dialog box contains a warning message: 'Rejoining or disabling Active Directory may disrupt management access and SMB I/O (applies to Hyper-V and SQL)'. It also shows the same configuration options as the main settings page, with 'AD' selected as the protocol. The dialog box has 'Cancel' and 'Save' buttons at the bottom.

# VMstore: Settings – SMB – General

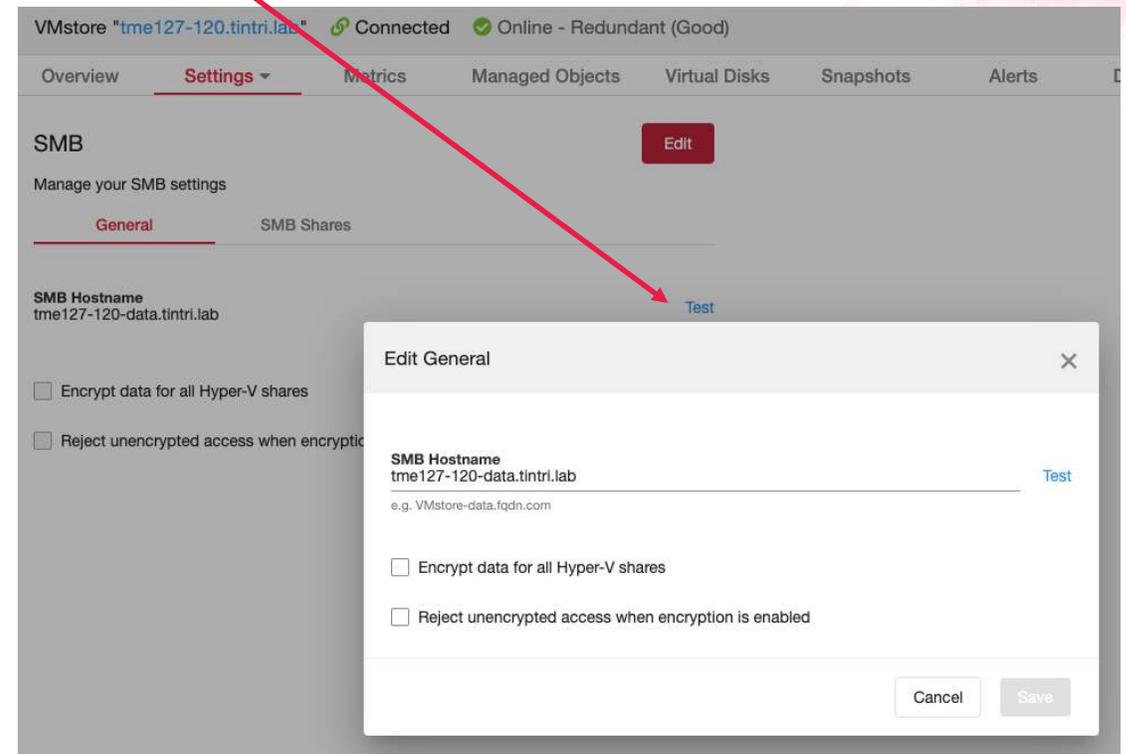


- VMstore Settings
  - Directory Services
  - SMB
- SMB Hostname
  - Create a Hostname for the Data interface
    - Create a record in DNS for this hostname, pointing to the Data IP
  - Required: Fully Qualified Domain Name
  - We recommend hostname **-data**.domain.com



# VMstore: Settings – SMB Hostname Validation

- Click Test to validate the SMB Hostname
  - This will validate Domain access, Service Principal Name, Group Membership.



# VMstore: Settings – SMB Hostname Validation

- VMstore configuration
  - SMB Hostname Test Results
    - AD Membership, Service Principal Name verified for the SMB Hostname
    - Expect Green Checkboxes in the status column
    - Scroll down and review all tests are successful. If there are any failed tests or warnings, adjust as needed in AD or DNS in order to get all tests to pass.

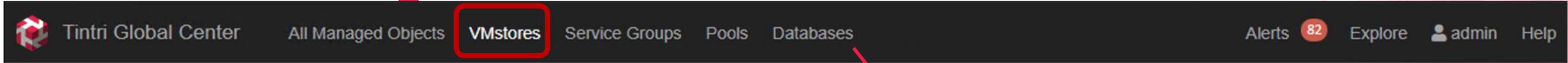
NOTE: The final test ("Delegation") is applicable to Hyper-V deployments, but not SQL Server. A status of "failed" for the delegation test is expected and can safely be ignored.

The screenshot shows the configuration page for a VMstore named "tme127-120.tintri.lab". The page is titled "SMB Shares" and displays a modal window titled "Test results for 'tme127-120-data.tintri.lab'". The modal window contains a table with the following data:

Tests	Status	Results
Resolving DNS A record for 'tme127-120-data.tintri.lab'	✓	12.2.1.120
Acquiring Kerberos ticket for tme127-120\$	✓	
Service Principal Name	✓	SPN 'cifs/tme127-120-data.tintri.lab' is set
Appliance computer account	✓	CN=tme127-120,OU=VMstore,DC=tintri,DC=lab
Total : 16		

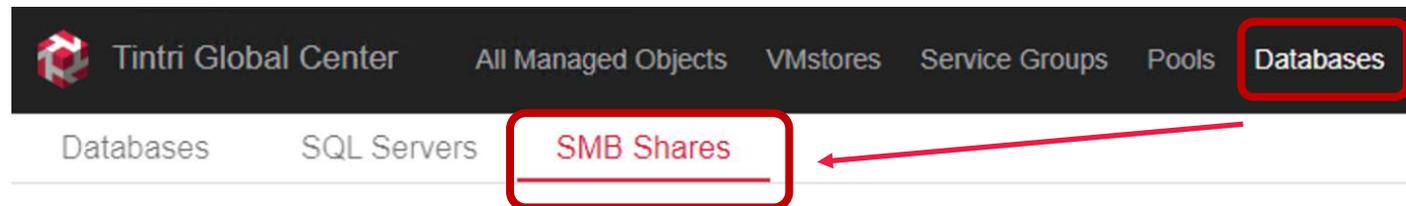
An "OK" button is located at the bottom right of the modal window.

# VMstore: Settings – SMB Shares



- Although SMB Shares can be managed from the VMstore tab, we recommend creating & managing shares for SQL Server database files from the [Databases -> SMB Shares](#) section (covered in the "SQL Integration" section)

NOTE: Although similar, the UI for "Add Share" is slightly different. Shares created under the Databases tab mask the "System Center VMM Quota" option which is only applicable to HyperV deployments and is NOT APPLICABLE TO SHARES FOR DATABASES



# VMstore: Settings – SMB Shares (con't)

- VMstore configuration
  - Existing SMB shares on each VMstore and their permissions can be viewed under **Settings – SMB – SMB Shares [tab]**
  - The builtin '*hyperv*' share acts as a root to all SMB shares created. Access to this top-level share effectively gives access to all shares (as directories)
- **STRONGLY RECOMMENDED:**
  - Edit the permissions on the '*hyperv*' share and remove "BUILTIN\Super Admins" and other BUILTIN accounts
  - Use DOMAIN groups & individual accounts on each SMB Share to control permissions

VMstore "hqtm-t850.ttucs.tm.tintri.com" Connected Online - Redundant (Good)

Overview **Settings** Metrics Managed Objects Virtual Disks Snapshots Alerts Diagnostics

### SMB

Manage your SMB settings

General **SMB Shares**

Actions

Share Name	Path	Description	Quota	Encrypt Data
hyperv	\\hqtm-t850-data.tt...		No	Off
databases	\\hqtm-t850-data.ttu...		No	Off

Total SMB Shares: 5 | 1 selected

Permissions | hyperv

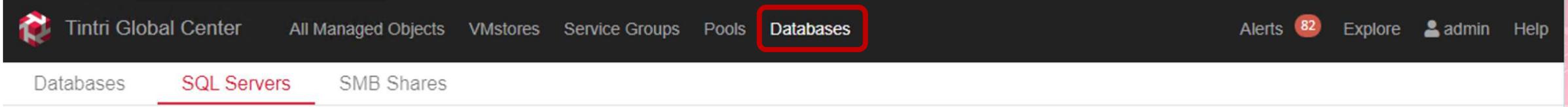
Account	Level
BUILTIN\Super Admins	Full Control



# SQL Integration

[TGC: Databases Tab]

# SQL Integration: Overview



- The Databases Tab provides a consolidated view databases and and SQL Integration components. There are three sub-tabs:
  - Databases
    - Databases discovered from the within the registered SQL Servers.
  - SQL Servers
    - Add/Remove/Manage SQL Server connections
    - View Databases within each SQL Server Instance
  - SMB Shares
    - Add/Remove/Edit SMB Shares for the selected VMstore
      - Use the dropdown to change between VMstores
      - Click on a share to view permissions

# SQL Integration: Permissions



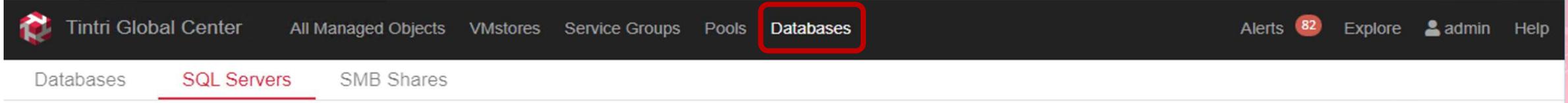
- SQL Servers -> VMstores

- SQL Servers access database files in SMB shares on Tintri VMstores using Active Directory domain accounts
- When adding permissions to SMB shares, use one or more AD group(s) to simplify adding new SQL servers later
- Ensure the domain account that the SQL Server Service logs in with is in an AD group that has permissions, or add the individual account explicitly
- If the SQL Server service runs as "Local system account" (default), apply permissions for the DOMAIN\SQL\_Server\$ computer account

- TGC -> SQL Servers

- Use a SQL Authentication with sysadmin permissions
- Account is used for:
  - Polling & Inventory
  - Attach new databases (cloning)
  - Extended Event session management
- As of the initial release of SQL Integrated Storage (TGC v5.0.0.1), only accounts using SQL Authentication provide complete feature functionality – specifically cloning
- The type of authentication used can be seen in the SQL Servers table, found under the Databases tab in TGC

# SQL Integration: Register SQL Servers



- Databases: SQL Servers

- SQL Server instances must be registered for databases to be discovered as managed objects
- Double-click a SQL Server instance to see all discovered databases within each. Only databases migrated to an SMB share on a VMstore registered in this TGC instance will show

SQL Server	Host Name	Instance Name	Port	Authentication	Username
TSIS-SA-TEST1:SQL2012	TSIS-SA-TEST1	SQL2012	53462	SQL	TintriStorage
RG-SQL2016-01.TTUCS.TM.TINTRI.COM:MSSQLSERVER	RG-SQL2016-01.TTUCS.TM.TINTRI.COM	MSSQLSERVER	1433	SQL	TintriStorage
<b>pass-prod.ttucs.tm.tintri.com:MSSQLSERVER</b>	<b>pass-prod.ttucs.tm.tintri.com</b>	<b>MSSQLSERVER</b>	<b>1433</b>	<b>SQL</b>	<b>tintristorage</b>
TSIS-LSTEST:MSSQLSERVER	TSIS-LSTEST	MSSQLSERVER	1433	Kerberos	ttucs\sql-svc
TSIS-SA-TEST1.ttucs.tm.tintri.com:MSSQLSERVER	TSIS-SA-TEST1.ttucs.tm.tintri.com	MSSQLSERVER	1433	SQL	TintriStorage
SQL-HAMDB02.TTUCS.TM.TINTRI.COM:MSSQLSERVER	SQL-HAMDB02.TTUCS.TM.TINTRI.COM	MSSQLSERVER	1433	SQL	TintriStorage
Invo-sql1.ttucs.tm.tintri.com:MSSQLSERVER	Invo-sql1.ttucs.tm.tintri.com	MSSQLSERVER	1433	SQL	sa
SQL-HAMDB01.TTUCS.TM.TINTRI.COM:MSSQLSERVER	SQL-HAMDB01.TTUCS.TM.TINTRI.COM	MSSQLSERVER	1433	SQL	TintriStorage

# SQL Integration: Register SQL Servers (con't)



Databases SQL Servers SMB Shares

- Actions -> Add SQL Server:
  - Hostname
    - Fully Qualified Domain Name recommended, needs to be accessible from TGC
  - Username
    - \* Account TGC will use to connect to SQL Server
  - Advanced
    - If your SQL Server has multiple instances installed, use this section to specify each instance
    - Custom Instance names require the SQL Browser service to be running
    - Custom fixed ports and Dynamic ports are both supported
    - Create a new SQL Server registration for every instance

### Add SQL Server

Hostname / IP / FQDN \*

tme127.db60.tintri.lab

Username \*

sqldba

e.g. sqladmin, or east\sqladmin, or sqladmin@east.company.com

Password \*

.....

Advanced ⓘ

Instance Name

MSSQLSERVER

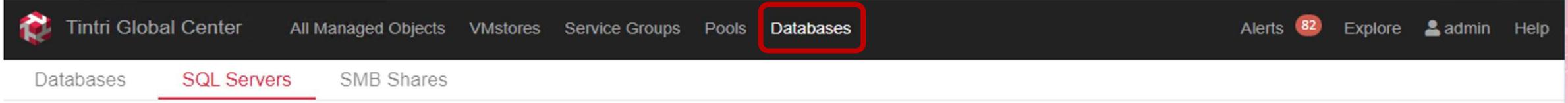
Port

1433

Cancel Add

\* In the initial release (TGC v5.0.0.1), only SQL Authentication works for full functionality, specifically cloning

# SQL Integration: SQL Servers – View Databases



- Double-click on a SQL Server in the SQL Servers table to view databases that have been migrated to SMB shares on VMstores managed by this TGC instance
  - Sort and filter columns to quickly find databases of interest

Policy Errors	Database	SQL Server	IOPS	Throughput MBps	Latency ms	VMstore	Physical Used GiB	Replication State
0	Scanner	Invo-sql1.ttu...	1193	34.85	0.7	HQTM-T5040...	220.73	
0	WDemo	Invo-sql1.ttu...	661	12.28	0.5	HQTM-T5040...	365.32	
0	tempdb	Invo-sql1.ttu...	0	0.08	0	HQTM-T5040...	0.02	
0	RobDatabase	Invo-sql1.ttu...	0	0	0	HQTM-T5040...	0	

# SQL Integration: SMB Shares

- Select VMstore
- Add/Edit/Delete Shares
  - Deleting a share does NOT remove data within it, but does make it inaccessible
  - Refer to the [appendix](#) for additional detail
- Add/Edit/Delete Permissions
  - This is where we control access to each share
    - Full Control or Read-Only

The screenshot shows the Tintri Global Center interface. The top navigation bar includes 'Tintri Global Center', 'All Managed Objects', 'VMstores', 'Service Groups', 'Pools', and 'Databases'. The 'Databases' menu is highlighted. Below the navigation bar, there are tabs for 'Databases', 'SQL Servers', and 'SMB Shares'. The 'SMB Shares' tab is active, showing a list of shares for the VMstore 'HQTM-T5040.ttucs.tm.tintri.com'. The shares listed are 'db', 'db-dev', 'db-staging', and 'Data Dev DdrInstart'. The 'db-dev' share is selected. Below the share list, there is a 'Permissions' section for the selected 'db-dev' share. The permissions table shows three accounts with 'Full Control' access: 'BUILTIN\Super Admins', 'TTUCS\SQLServers', and 'TTUCS\SQLServers-DEV'. The footer of the interface shows 'Tintri Global Center: 5.0.0.1', 'Serial: [redacted]', and 'Uptime: 40 days 12 hours 25 minutes'.

Share Name	Path	Description	Encrypt Data
db	\\hqtm-t5040-data.ttucs.tm.tintri.com\db	test	Off
db-dev	\\hqtm-t5040-data.ttucs.tm.tintri.com\db-dev	Dev	Off
db-staging	\\hqtm-t5040-data.ttucs.tm.tintri.com\db-staging	Staging	Off
Data Dev DdrInstart	\\hqtm-t5040-data.ttucs.tm.tintri.com\Data Dev DdrInstart		Off

Account	Access Level
BUILTIN\Super Admins	Full Control
TTUCS\SQLServers	Full Control
TTUCS\SQLServers-DEV	Full Control

# SQL Integration: SMB Shares – Add Share

- **Actions: Add Share**

- Share Name

- Name of the share

- Share Path

- The fully qualified path to access from your SQL Servers to store database files (.mdf, .ndf & .ldf files)

- Account to give permissions to

- AD Group or individual account
- Additional permissions added on the SMB Shares screen
- Only groups show up as you type
- Account is validated when clicking Save

Add SMB Share to "hqtm-t850.ttucs.tm.tintri.com" ✕

**SMB Share**

Share Name \*  
DevDBs  
e.g. share name can't have special characters (<, >, :, ", /, \, |, ?, \*)

Share Path  
\\hqtm-t850-data.ttucs.tm.tintri.com\DevDBs

Description  
A new share that that Dev SQL Servers can access  
48 / 255

Encrypt data

**Permission with Full Control**

Account  
ttucs\sqlservers

Cancel Save



**Tintri**

# SQL Server Settings

# SQL Server:

- SQL Server configuration

- Generally speaking, there is nothing specific that needs to be done on the SQL server other than use the SMB share you created to store the files for your databases.
- This section contains a few tips that will help make it even easier to run SQL Integrated Storage for your existing databases, as well as any new ones that get created

*\* Remember: Always register any new SQL servers within TGC before running databases on SMB shares on Tintri VMstores. Failure to do so will lead to a lack of visibility, limited feature functionality, and performance degradation*

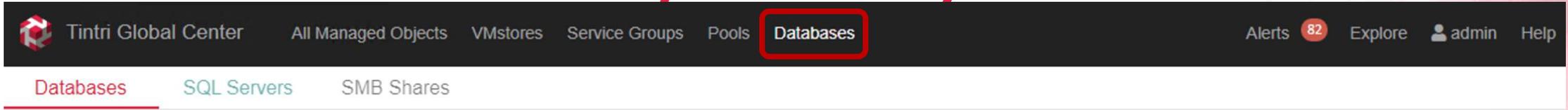




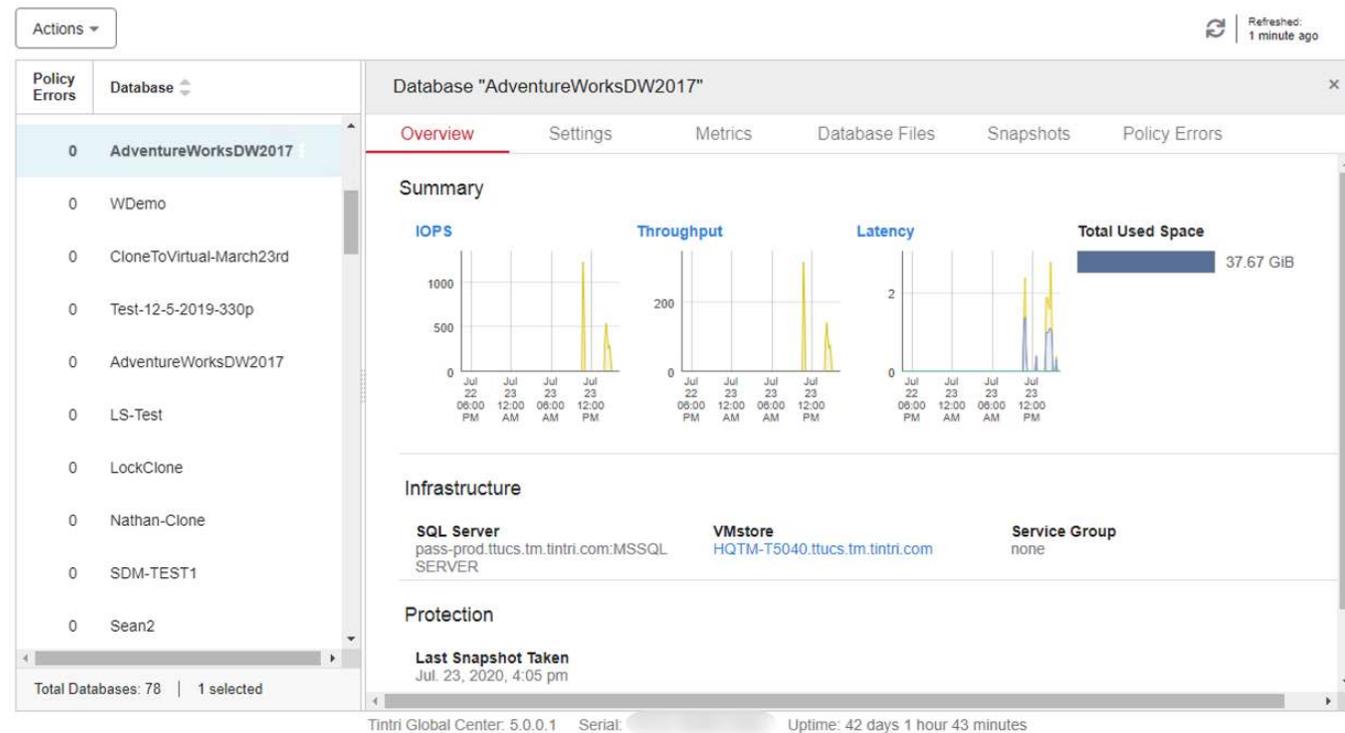


# Database Functionality

# Databases – Functionality - Visibility



- At this point, new databases added to any of your registered SQL Servers are automatically discovered and show up in the Databases tab
  - Databases will also show in the global Managed Objects list (along with VMs), in the SQL Servers tab (double-click a SQL Server to see them), and listed as top contributors when clicking on global graphs and VMstore graphs



# Databases – Functionality - Actions

- **Double-Click** or **Right-click** a Database to explore all the functionality available, similar to what's possible with VMs
- Cloning actions can also be performed on snapshots of database, enabling quick recoveries to any share on any SQL Server
- Refer to the TGC Admin Guide for a complete list of functionality

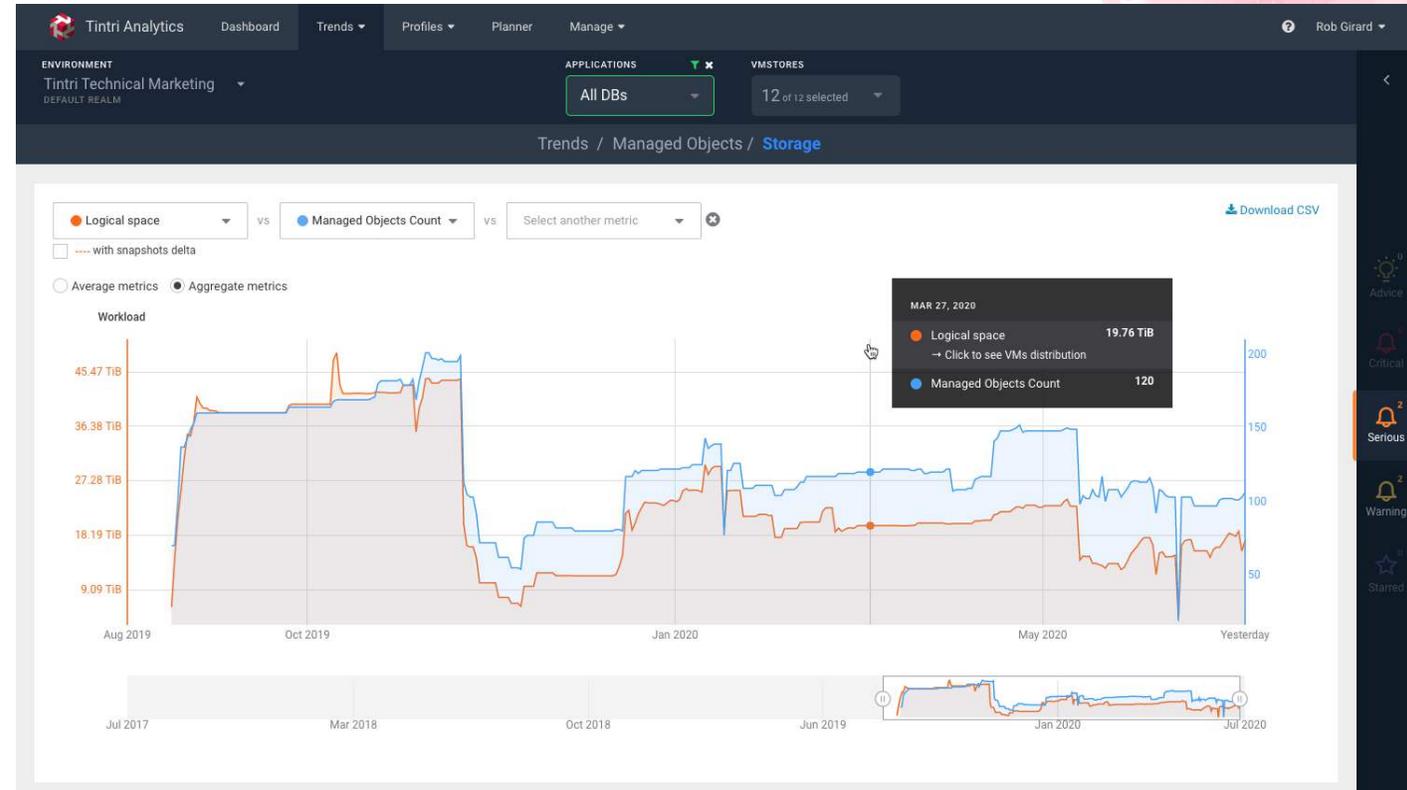
The screenshot shows the Tintri Databases interface. At the top, there's a navigation bar with 'Databases' highlighted. Below it, there's a sub-navigation bar with 'Databases', 'SQL Servers', and 'SMB Shares'. The main content area displays a table of databases. The first row is selected, and an 'Actions' menu is open over it. The menu options are: Actions, Overview, Settings, Metrics, Database Files, Snapshots, and Policy Errors. The 'Actions' menu is further expanded to show 'Take Snapshot' and 'Clone'. The background shows a detailed view of the 'AdventureWorks2017' database, including a 'Database "AdventureWorks2017"' header, 'Overview' and 'Settings' tabs, a bar chart showing metrics over time, and 'Infrastructure' details for the SQL Server.

Policy Errors	Database
0	AdventureWorks2017
0	AdventureWorksDW2017
0	AW2017Log
0	BACKupTest
0	ETS
0	Gus-Test-deleteme
0	Hybrid
0	LocalTest2
0	LogShipTest

# Databases – Tintri Analytics



- Database trending and planning is available at <https://analytics.tintri.com>
- A built-in group “All DBs” has been created to view only database managed objects



# Databases – Tintri Analytics



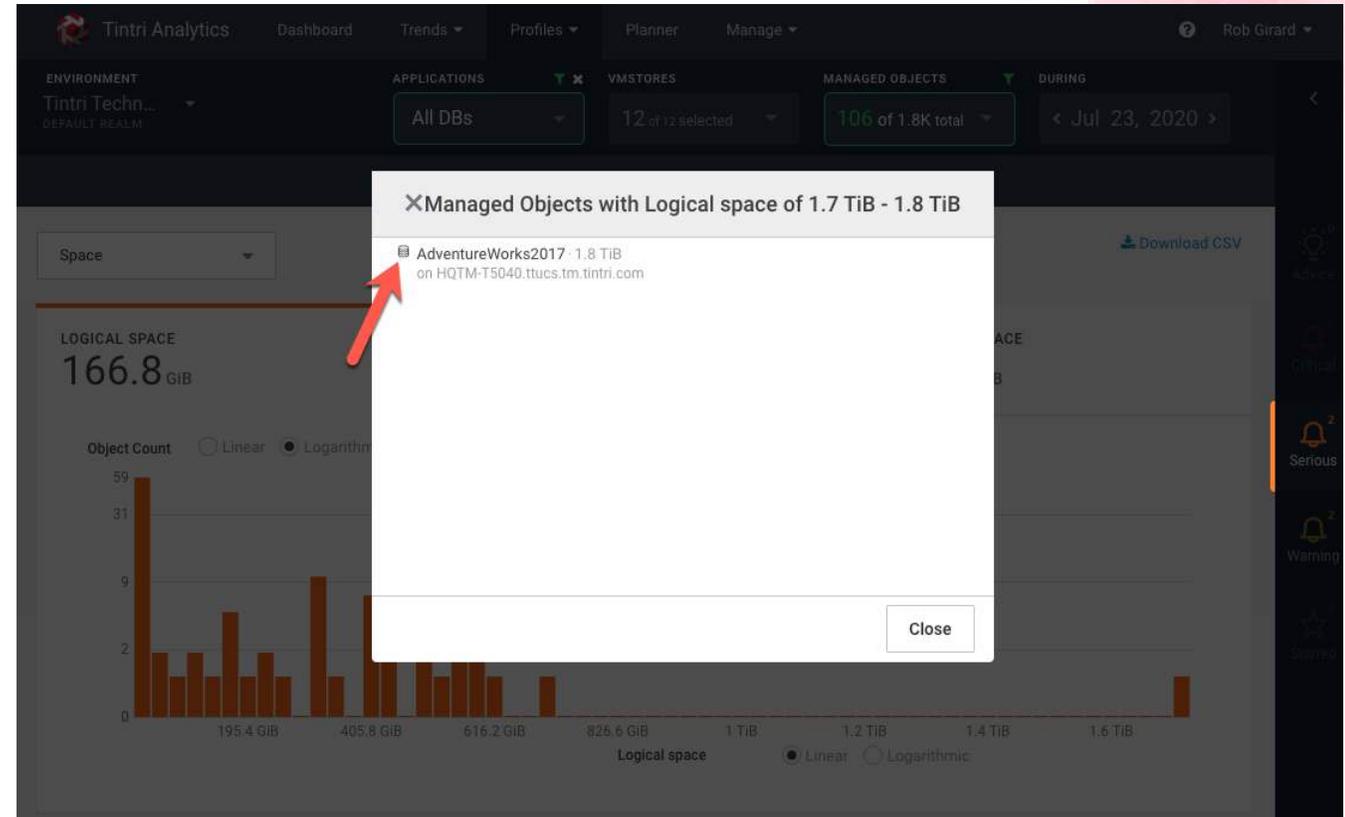
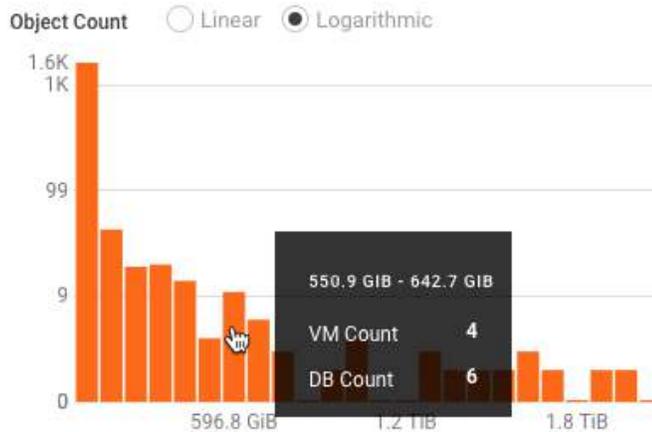
- Custom application groups can use *Object Type = Databases* as criteria to include only DBs and can be combined with other criteria, such as naming patterns to trend & model specific sets of databases

The screenshot displays the 'Applications' page in Tintri Analytics. At the top, there are filters for 'ENVIRONMENT' (Tintri Techn...), 'VMSTORES' (12 of 12 selected), 'HOSTS' (47 of 47 selected), and 'DURING' (Jul 23, 2020). The main content area is titled 'Adventure DBs' and shows 'Average workload on Jul 23, 2020'. It features five performance metrics: LOGICAL SPACE (366 GiB), IO PERFORMANCE (5.9K units), WORKING SET (14.2 GiB), CPU (0 GHz), and MEMORY (0 GB). Each metric has a 'See Manage Objects Distribution' link. There are also buttons for 'Edit Definition' and 'Simulate Deployment'. Below the metrics, there are expandable sections for 'All databases' and 'Nothing'. A right-hand sidebar contains navigation icons for Advice, Critical, Serious, Warning, and Starred.

# Databases – Tintri Analytics



- When viewing distribution graphs (profiles), SQL Server databases are denoted with an icon
- Mouse-over bars to see separate counts for VMs and DBs:

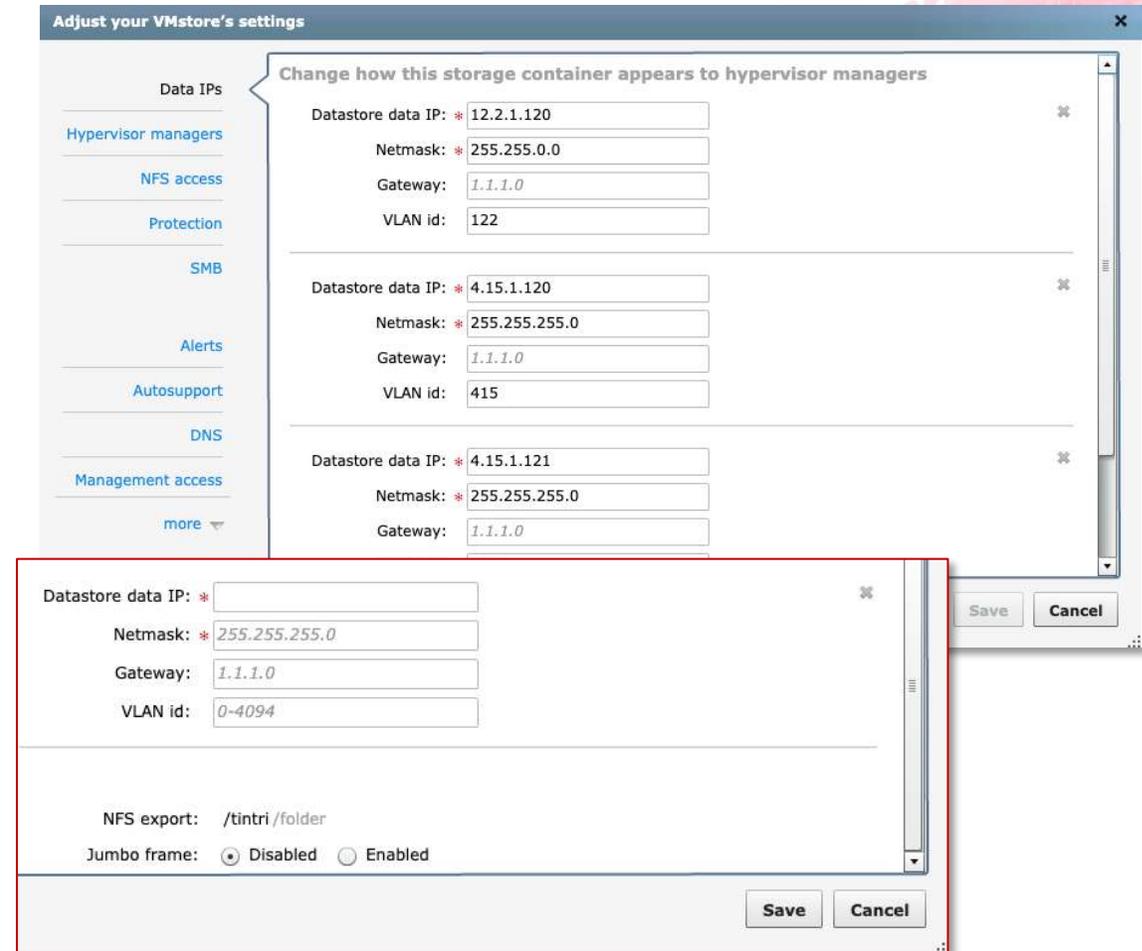




# Appendix

# VMstore Configuration - Networking

- Data IP (VMstore local UI – Settings)
  - Press the **+** and create up to 64 IPs and VLAN IDs
  - Separate SMB storage traffic from SQL client traffic by multihoming SQL Servers for best performance
  - Configure additional VMstore Data IP addresses in the same subnet as SQL Server IPs, on the same VLAN and don't use a gateway for better performance
  - If Network latency shows up on your databases, further isolation of traffic may be required. On SQL Server VMs, investigate VMNIC usage on the hosts. Additional port groups and physical NICs may help



# VMstore Configuration – Date & Time

- Date & Time
  - Kerberos is time-sensitive and too much of a time delta between VMstores, TGC, SQL Servers, Hypervisors and AD Controllers may interfere with authentication
  - Configure NTP in order to keep time consistent throughout your infrastructure

Adjust your VMstore's settings

Set the time and date

Time zone: \* **America/Los\_Angeles**

Primary NTP: \* 0.north-america.pool.ntp.org **OK**

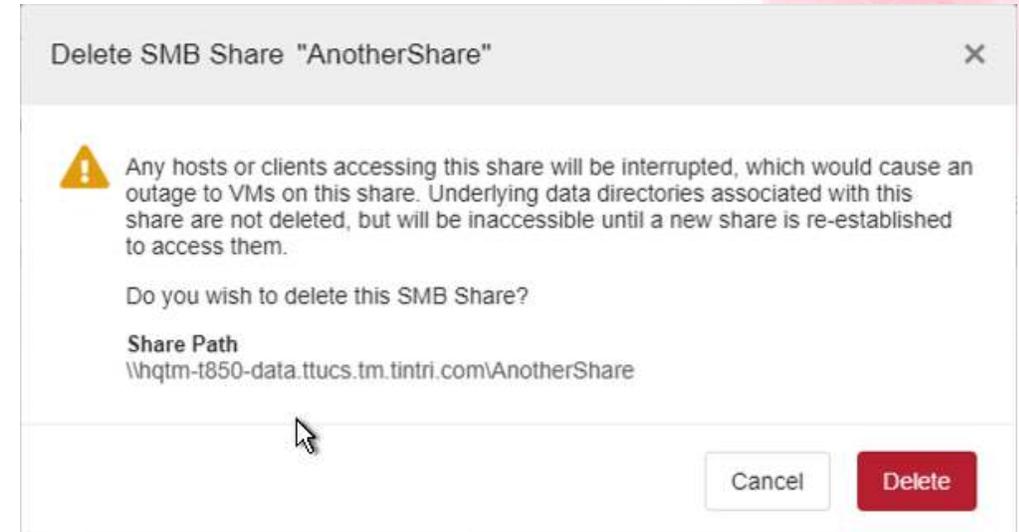
Secondary NTP: 10.204.120.50

[Set the clock manually.](#)

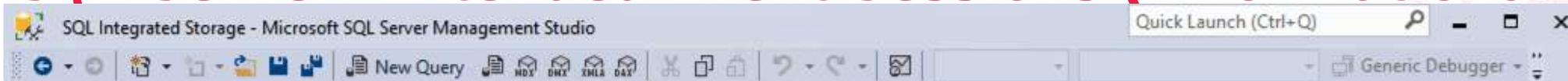
Save Cancel

# SQL Integration: Deleted SMB Shares

- **Oops! You deleted the wrong SMB share!**
  - You were warned, but proceeded anyway
  - SQL Servers with databases in the deleted SMB share lose connectivity and are denoted with "In Recovery" in SSMS
  - If your databases are still trying to find the missing share, simply re-create the share using the same name and the same directory will be re-used.
  - If you no longer want the share, but it contained data, that data is no longer recognized as Managed Objects and becomes "other" data. Browse the 'hyperv' share (SMB root) and a directory will persist with the same name as the SMB share that was deleted. Delete or more the data to clean up

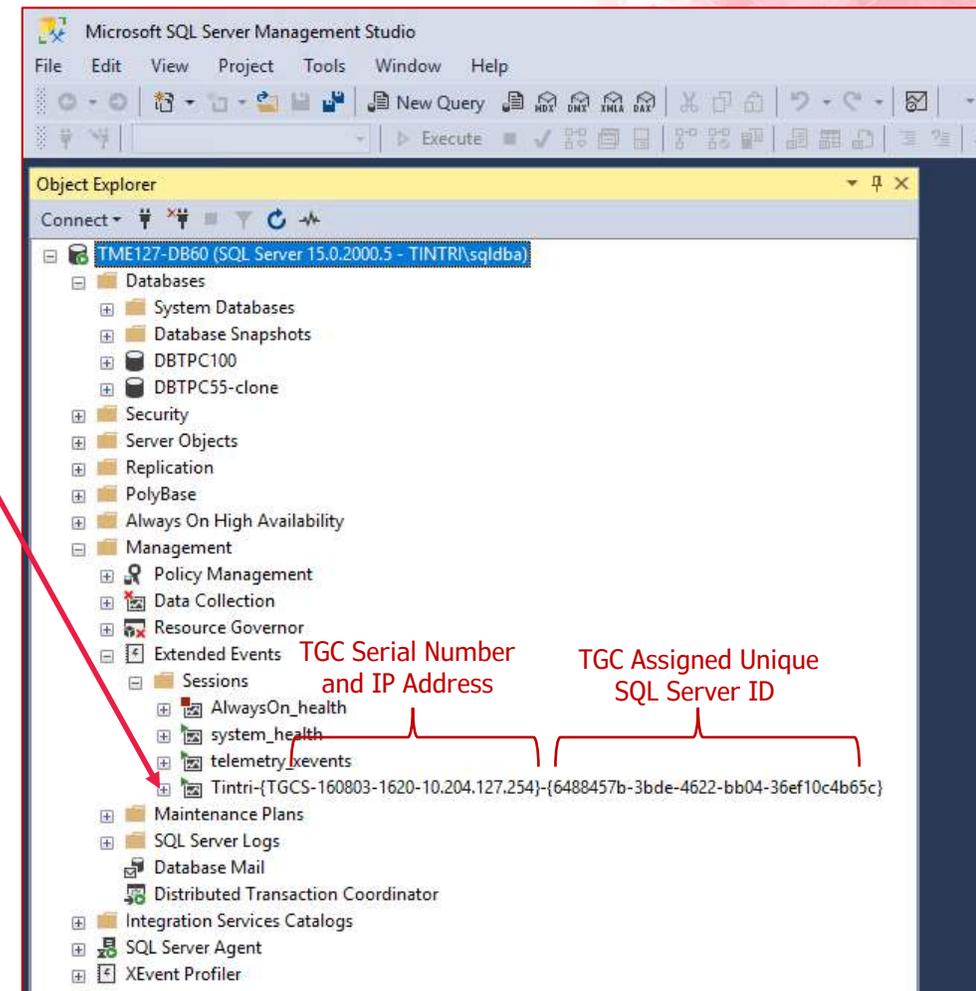


# SQL Server: Extended Event Sessions (Informational Only)



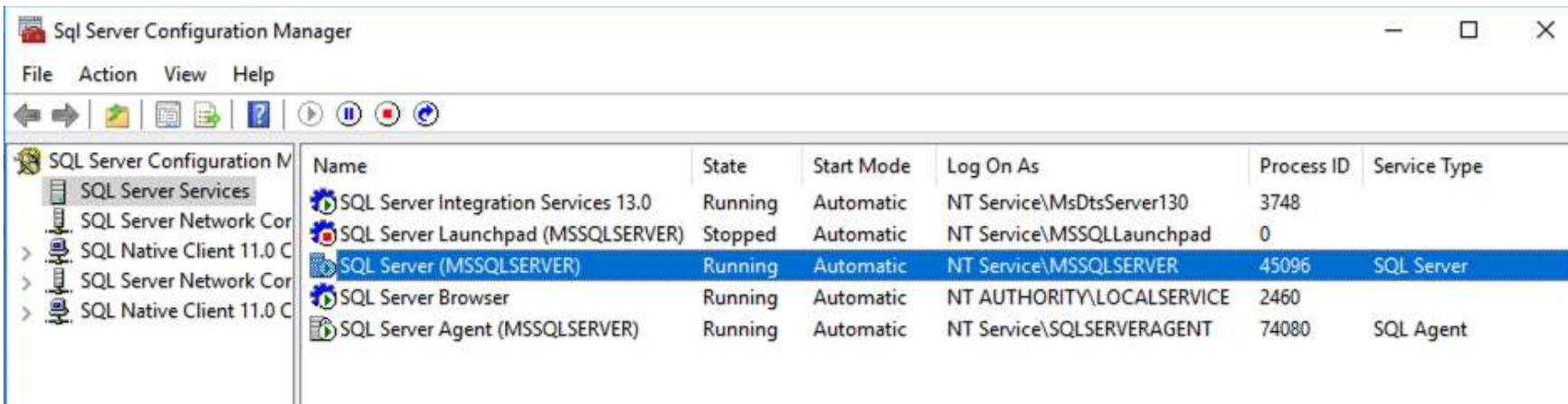
- When a SQL Server instance is registered in TGC, an Extended Event Session is created
  - Enables a lightweight polling process for TGC to detect changes in inventory
  - A watchdog service on TGC will restart the session if stopped and recreate it if missing
  - When a SQL Server registration is removed from TGC, the extended event session is stopped and left behind to reuse the unique SQL Server ID in case the instance is re-added. This prevents duplicate objects from being created

NOTE: If cloning a SQL Server VM, delete this session ID before attempting to register the new SQL Server in TGC. This will allow a new unique ID to be created for the cloned SQL server

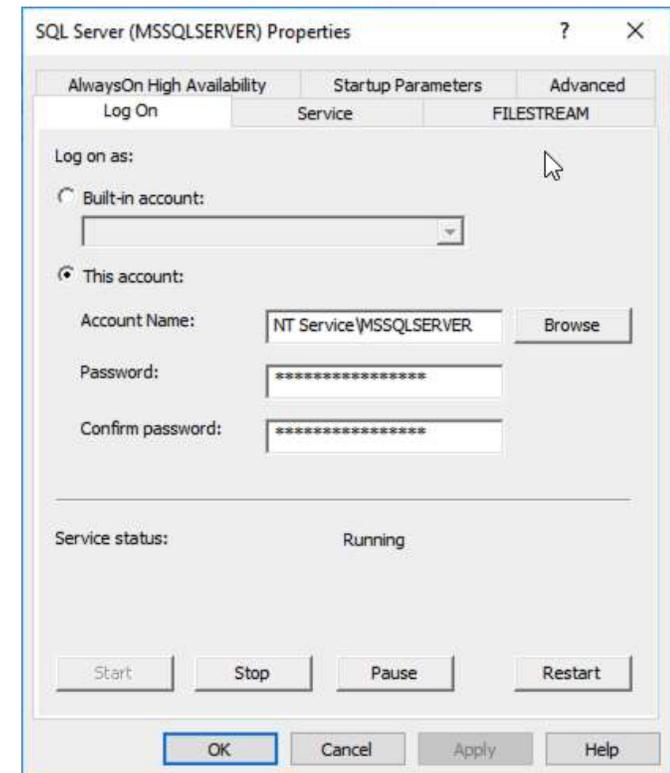


# SQL Server: Configuration Manager

- Confirm that the “Log on As” account for the SQL Server service has permissions to the SMB share
  - If your server is using the default NT Server\MSSQLSERVER account, the domain account requiring permissions on the SMB share will be the **DOMAIN\SQL\_SERVER\$** computer account
  - Alternatively, if you’re using a domain service account, ensure that account has permissions to the SMB share
  - If you encounter access issues, check to ensure the Service Principal Name (SPN) is configured correctly on the AD account for Kerberos to function properly



Name	State	Start Mode	Log On As	Process ID	Service Type
SQL Server Integration Services 13.0	Running	Automatic	NT Service\MsDtsServer130	3748	
SQL Server Launchpad (MSSQLSERVER)	Stopped	Automatic	NT Service\MSSQLLaunchpad	0	
<b>SQL Server (MSSQLSERVER)</b>	<b>Running</b>	<b>Automatic</b>	<b>NT Service\MSSQLSERVER</b>	<b>45096</b>	<b>SQL Server</b>
SQL Server Browser	Running	Automatic	NT AUTHORITY\LOCALSERVICE	2460	
SQL Server Agent (MSSQLSERVER)	Running	Automatic	NT Service\SQLSERVERAGENT	74080	SQL Agent



# Additional Resources

- Tintri Support: <https://tintri.com/company/support/vmstore-support/>
- Additional Information on Tintri SQL-Integrated Storage: <https://tintri.com/sql>

## Revision History

Version	Date	Author	Notes
1.0	July 2020	Matt Morris & Rob Girard	Initial release