



HAMMERSPACE

Configuring Hammerspace in Azure

Revision 1

Hammerspace Version 5.2



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Hammerspace 5.2	5
Product Features & Highlights.....	5
Solution Overview	5
Anvil.....	5
DSX.....	5
Accessing the Deployment	6
Logging into the Management GUI	6
Accessing the Command-Line Interface	7
Configuration Examples.....	8
Example 1: Changing the admin user password.....	8
Example 2: Using the Hammerspace Admin CLI to configure DNS Server Settings	8
Example 3: Using the CLI to configure NTP server settings.....	9
Example 4: Creating a Share.....	9
Example 5: Adding Azure Blob as a Storage System.....	13
Example 6: Creating Volumes	14
Example 7: Local user configuration.....	16
Example 8: Active Directory Integration.....	17
Example 9: Upgrading the System	18
Client Access.....	20
Accessing Shares from Windows	20
Accessing Shares from MacOS.....	21
Mounting NFS Exports from Linux	21
Using Parallel NFS (v4.2) for High Performance Workloads.....	21
How To Mount Anvil Using NFSv4.2	22
Appendix I: Architectural Reference Diagrams	23
Data Path: SMB and NFS v3	23
Standalone Anvil and DSX	24
High Availability Anvil and Standalone DSX	25
High Availability Anvil and DSX	26
Data Path: Parallel NFS (NFSv4.2)	27
Appendix II: Documentation and Support	28

Hammerspace 5.2

This document covers how to configure and manage a previously deployed Hammerspace cluster in Microsoft Azure.

Product Features & Highlights

- Assimilation
- Data Orchestration
- Global Namespace
- HPC Storage
- Live Data Movement
- Multiclient support: Linux, MacOS, and Windows
- Multiplatform support: Bare Metal, Cloud, and Virtual Machines
- Multiprotocol NFS, SMB, and S3
- Parallel NFS
- Persistent Volumes (Kubernetes)
- Storage Consolidation

Solution Overview

Hammerspace Global Data Environment consists of two main software components, a metadata node (Anvil) and a data services node (DSX).

Anvil

The Anvil instance(s) provides the following services:

- Management GUI & CLI
- Metadata management.
- Mount point for Parallel NFS (NFSv4.2).

DSX

The Data Services instance(s) provides the following services:

- Global Namespace.
- Global File System.
- Mount point for NFSv3 and SMBv3.

Accessing the Deployment

Logging into the Management GUI

Log into the Hammerspace Management GUI using the following steps:

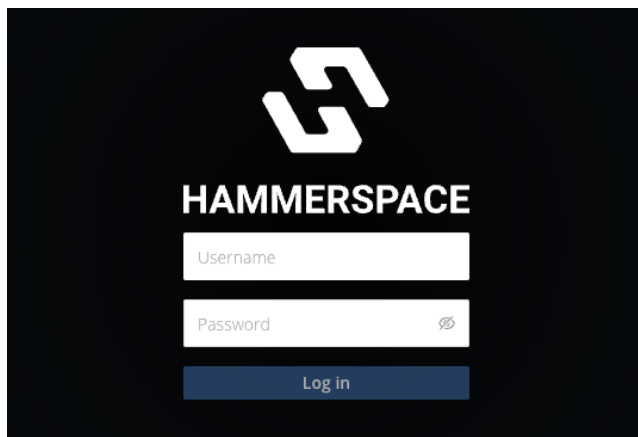
1. Open a web browser (Chrome recommended) and navigate to <https://portal.azure.com> to log in with your Azure account.
2. Navigate to **Resource Groups**.
3. Locate the Resource Group containing **Hammerspace** resources.
4. Locate the Anvil IP address, or if using HA, the frontend IP address of the Azure Load Balancer.

NOTE: The IP address is under the Networking heading. NOTE: If using a Load Balancer for Anvil HA, the IP address can be found by selecting the Load Balancer and navigating to Settings > Frontend IP configuration.

5. Point your web browser to the IP address of the Anvil or Load Balancer.

NOTE: Anvil will redirect to 8443/tcp. For example, <https://192.168.1.30:8443>.

6. Enter credentials to open the Hammerspace Management GUI:



Where:

Username: admin

Password: The password configured during Azure Marketplace deployment

Accessing the Command-Line Interface

Log in to the Hammerspace Admin CLI.

```
$ ssh admin@<anvil-node>
```

Helpful Commands	Explanation
--help	Shows how to use the CLI
?	Lists all available commands when used by itself. Append to any command for detail -ed options.
dns-list	Displays DNS configuration
node-list	Shows all Hammerspace nodes in a deployment
ntp-config	Displays how to update NTP configuration
share-list	Lists all shares and related details
system-view	Provides overview of system health
volume-list	Displays all volumes and related data

Table 1. Quick list of Hammerspace Admin CLI commands

NOTE: This is an extremely abbreviated list only to show examples. For a full explanation of all commands and options, please refer to the *Hammerspace 5.2 CLI Reference*.

Configuration Examples

This section covers various tasks by example.

Example 1: Changing the admin user password

Use the following procedure to reset the **admin** user password.

1. Navigate to Administration.
2. Select the **Users** tab.
3. Click **Reset Password**.

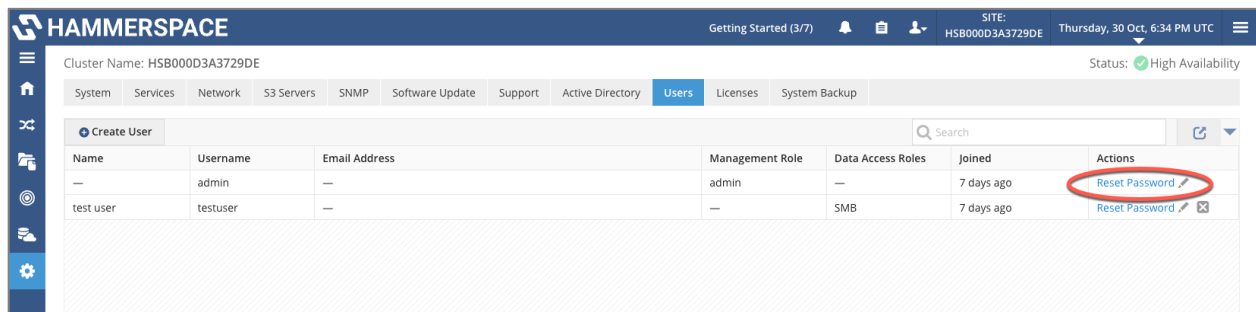


Figure 1. User management

Example 2: Using the Hammerspace Admin CLI to configure DNS Server Settings

View the DNS server settings:

```
> dns-config --view
```

Removing DNS server configuration:

```
> dns-config --servers-clear
```

Adding DNS server configuration:

```
> dns-config --servers 192.168.1.101, 192.168.2.102
```

Example 3: Using the CLI to configure NTP server settings

Viewing NTP server settings:

```
> ntp-config --view
```

Removing NTP server configuration:

```
> ntp-config --servers-clear
```

Adding NTP server configuration:

```
> ntp-config --servers 0.north-america.pool.ntp.org
```

Example 4: Creating a Share

Use the following procedure to create a share.

1. From the left navigation pane, select **Data** (file folder icon).

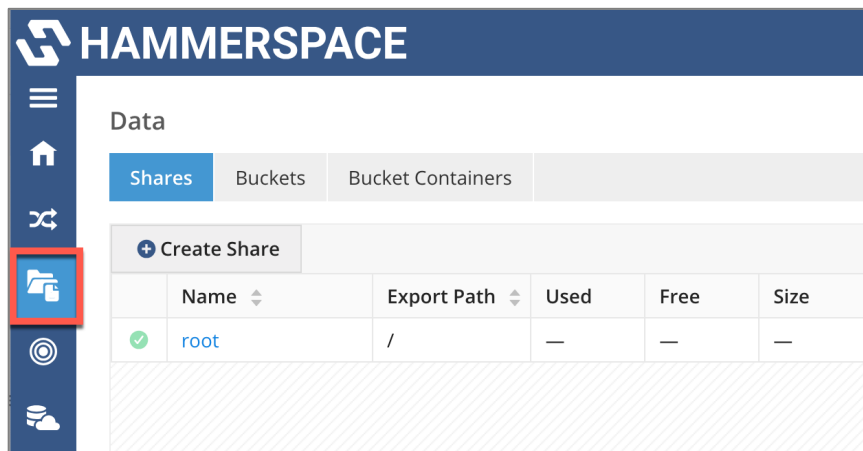
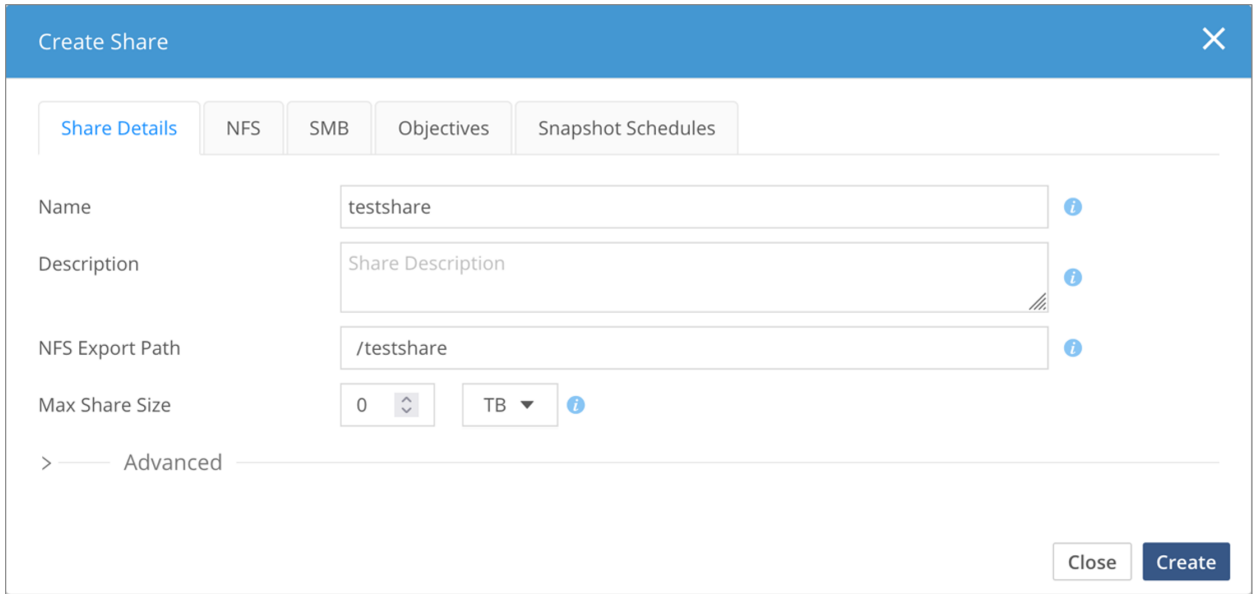


Figure 2. Create share

2. Enter share details in the Create Share wizard:



The image shows a 'Create Share' dialog box with a blue header bar containing a close button (X). Below the header is a tabbed interface with four tabs: 'Share Details' (selected), 'NFS', 'SMB', and 'Snapshot Schedules'. The 'Share Details' tab contains the following fields:

- Name:** A text input field containing 'testshare' with an information icon (i) to its right.
- Description:** A text input field containing 'Share Description' with an information icon (i) to its right.
- NFS Export Path:** A text input field containing '/testshare' with an information icon (i) to its right.
- Max Share Size:** A section containing a numeric input field with '0', a unit dropdown menu showing 'TB', and an information icon (i).

Below these fields is a link '> Advanced'. At the bottom right of the dialog are two buttons: 'Close' and 'Create'.

Figure 3. Create Share wizard



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- a. In the Share Details tab, enter the information requested. Table 2 describes the information requested in the tab.

Item	Value
Name	Name the share
Description	Optional description of the share
NFS Export Path	The NFS export path for the root of this share. Must start with /
Max Share Size	This implements a soft quota. A zero (0) denotes no quota.
Advanced (optional) – See Hammerspace Admin Guide for more information	
ABE	Lists files and directories based on the user's permissions.
Access time update	Uncheck disables A-time updates.
Retain deleted files	Check to retain deleted files across the share.
Create versioned files	Check to implement event-based file retention.
File conflict resolution	Please consult Admin Guide for more information.
WORM	Implements Write Once Read Many on the share.

Table 2. Share details

- b. If your share is an NFS share, enter the information requested in the NFS tab. Table 3 describes the information requested in the tab.

Item	Value
Client Specification	IP, CIDR Subnet, Hostname, Subdomain, @netgroup.
Permissions	Read-Only or Read-Write
Root Squash	If checked, maps NFS client 'root' (uid 0) to the anonymous uid.
Secure Port	Unselecting this option disables the requirement that NFS client connections must originate from a privileged source port < 1024

Table 3. NFS details

- c. If your share is an SMB share, enter the information requested in the SMB tab. Table 4 describes the information requested in the tab.

Item	Value
Alias	SMB Share Alias Name
Path	SMB Alias Path
Browsable	Controls whether the share is browsable by clients

Table 4. SMB details

- d. Add Objectives. Objectives provide powerful declarative control over your data throughout its lifecycle. Key aspects of data management, such as availability, durability, placement, movement, protection, workflow, and custom criteria can be controlled with ease on a file-granular level. Refer to the *Hammerspace 5.2 Administration Guide*, available in the Hammerspace Licensing and Download Portal, and the *Hammerspace Objectives Guide*, available in the Support Portal, to learn more about how to use Objectives.
- e. Add Snapshots Schedules. Snapshots can be scheduled directly upon share creation from this tab, by either creating a new schedule, adding a pre-defined schedule, or copying an existing snapshot schedule from another share, as shown below.

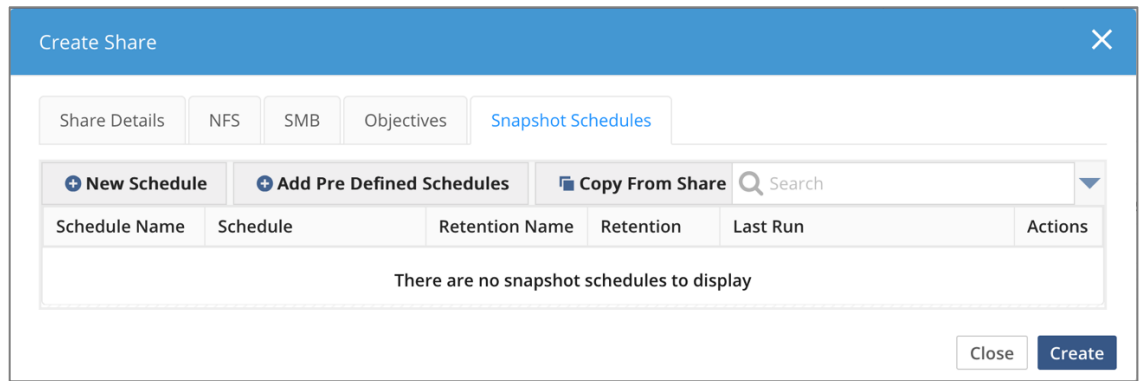


Figure 4. Adding snapshot schedule for a share

Example 5: Adding Azure Blob as a Storage System

1. Go to the **Infrastructure > Storage Systems** tab in the Hammerspace Management GUI.

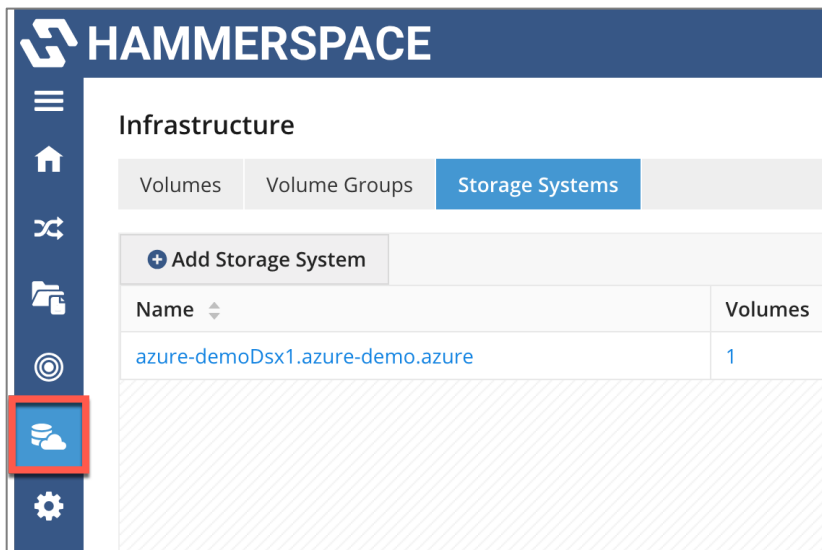


Figure 5. Storage Systems tab



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2. Select **Storage Type** and enter the requested information. Table 5 describes the information requested in the tab.

Item	Value
Storage Type	Object Storage
Type	Azure
Storage Account Name	Enter the Storage Account Name
Secret Key	Enter the Secret Key
Endpoint	Optionally, enter endpoint and port information
Proxy Host	If Proxy is used
Proxy Port	If Proxy is used
Proxy Username	If Proxy is used
Proxy Password	If Proxy is used

Table 5. Storage-type values

Example 6: Creating Volumes

1. Go to **Infrastructure > Storage Systems** tab in the Hammerspace Management GUI. Click the **+ Volume** button to open the **Add Volumes** wizard.

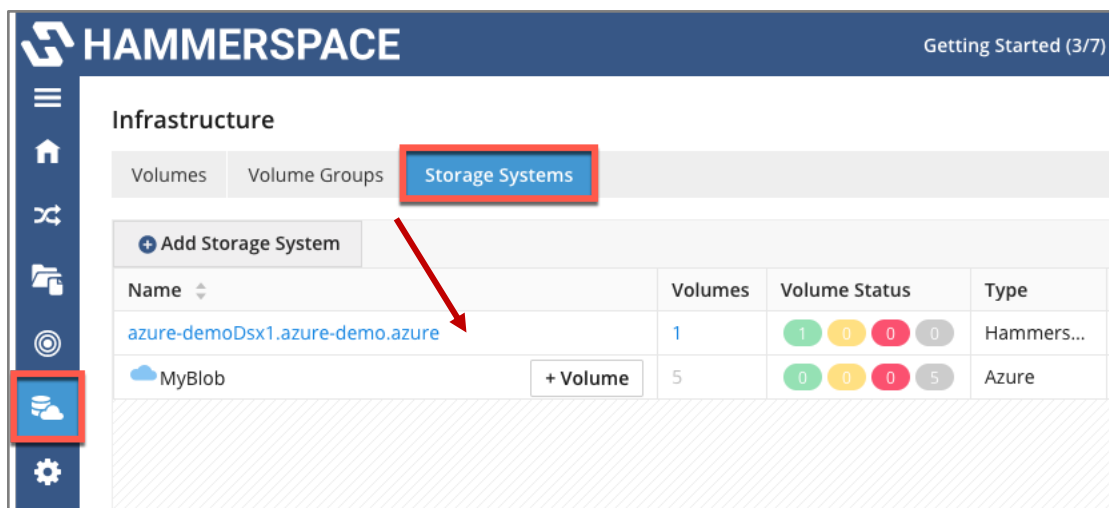


Figure 6. Location of the + Volumes button



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2. Select the Object Storage Containers you wish to add as Hammerspace volumes.

Storage System: MyBlob

Type	Name	Total	Used	Free	Percentage Used	Storage Type	Browse
☐ Volume	MyBlob::azure-blob	Add volume to view information					<
☐ Volume	MyBlob::azure-blob2	Add volume to view information					<
☐ Volume	MyBlob::azure-shared	Add volume to view information					<
☐ Volume	MyBlob::hot	Add volume to view information					<
☒ Volume	MyBlob::myblob	Add volume to view information					<

Showing 1 - 5 of 5 Storage systems

Close Previous Step Next Step

Figure 7. Select volumes

3. Click through each tab of the wizard. Use the volume-configuration settings shown in Table 6.

Item	Value
Shared Volume	Uncheck (leave checkbox empty)
Capacity	Default: Auto (choose a size to apply a quota)
Durability	Default: Auto
Availability	Default: Auto
Objectives	Check to automatically create associated Objects

Table 6. Volume configuration settings.

4. Review your selections and, if satisfied, press **Add Volume** to finalize.



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5. Navigate to the **Volumes** tab to view the newly created volume.

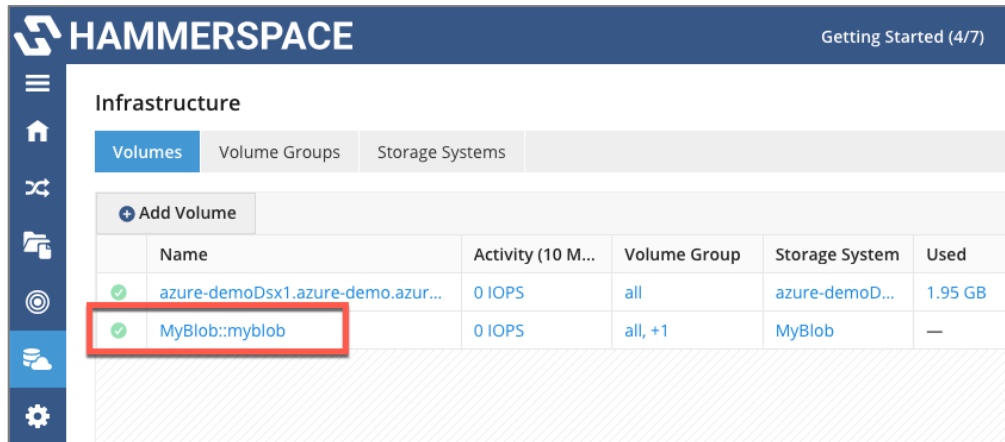


Figure 8. Your newly added volume is visible in the Volumes tab.

Example 7: Local user configuration

Navigate to **Administration** by clicking the gear icon at the bottom of the left-side navigation pane. Select the **Users** tab and then click **+ Create User** and enter details as shown in Table 7.

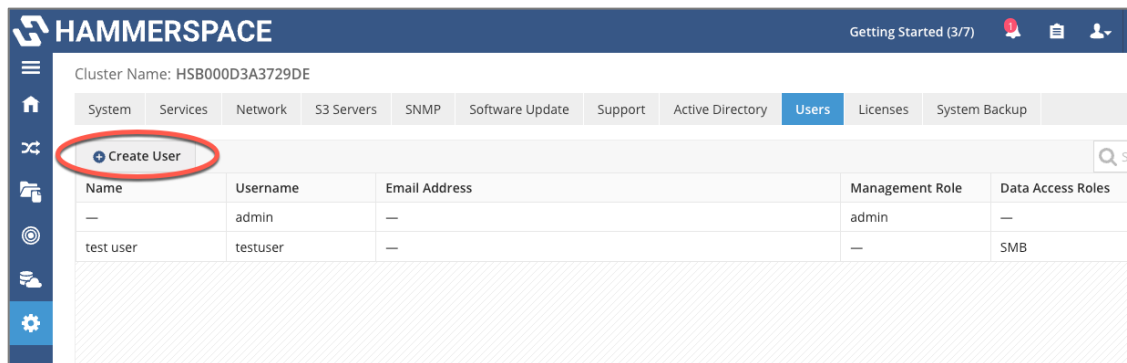


Figure 9. Location of the + Create User button in the Management GU

I

Create-user details

Item	Value
First Name	Enter the first name (optional)
Last Name	Enter the last name (optional)
Email	Enter an email address (optional)



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Username	Create a name for the user (or service)
Password	Enter a password
Confirm Password	Confirm the password
Role Type	Select the Data Access radio button
Data Access Role	Select the SMB or/and S3 checkboxes

Table 7. Create-user details

Example 8: Active Directory Integration

1. Go to **Administration** (gear icon) > **Active Directory** tab.

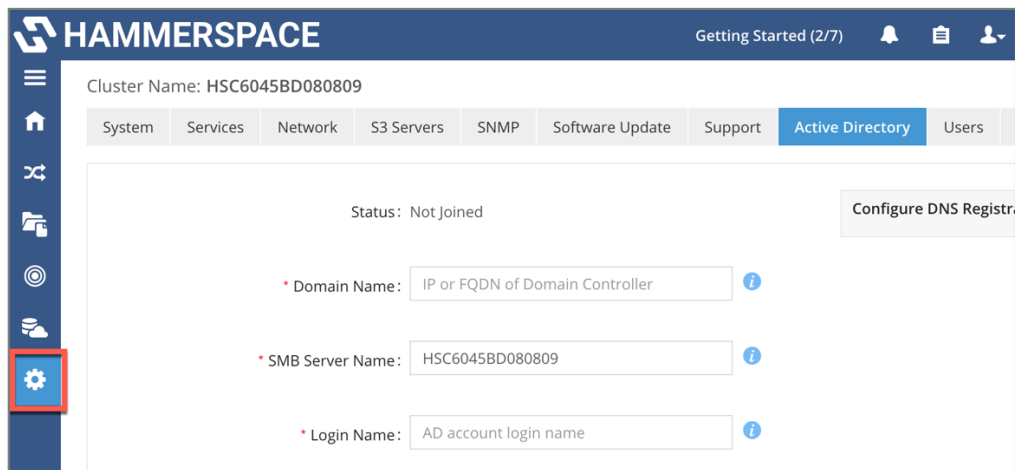


Figure 10. Location of the Active Directory tab in the Management GUI

2. Enter the requested information using Table 8 as a guide.

Item	Value
Domain Name	Enter the IP address or FQDN of Domain Controller
SMB Server Name	Enter the name desired for AD account registration
Login Name	Enter the AD account name
Password	Enter the AD account password



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Organizational Unit	Optionally add the OU to which this machine should be added
AD Servers	Select Auto or Manual discovery of AD servers
SMB – NFS User Mapping	Select the Data Access radio button

Table 8. Active Directory details

3. Optionally, add and configure Windows DNS registration.

Example 9: Upgrading the System

Step 1: Navigate to Infrastructure (gear icon) and then, select the Software Update tab.

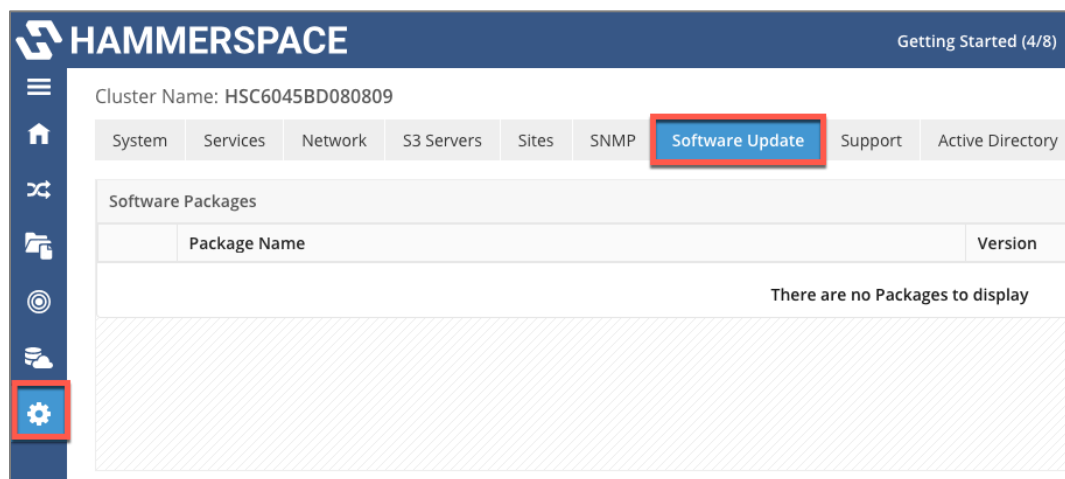


Figure 11

Step 2: Press the Upload Software Package button

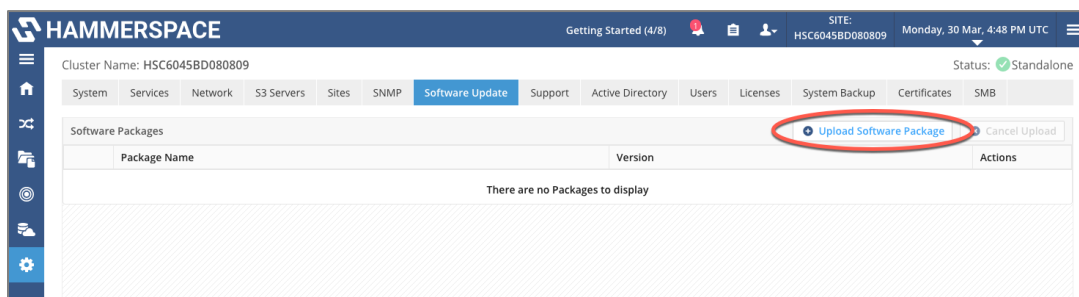


Figure 12

Step 3: Use the radio button to select how to upload the software upgrade package to the system.

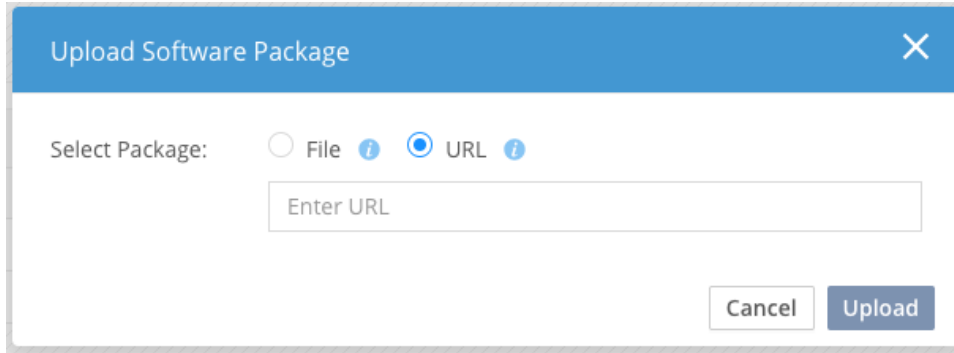


Figure 13

NOTE: Software upload packages can be obtained from Hammerspace. They can be identified by the file type extension name **.upd*.

Step 3: Once the software package has uploaded, select its radio button, and press the Update All button.

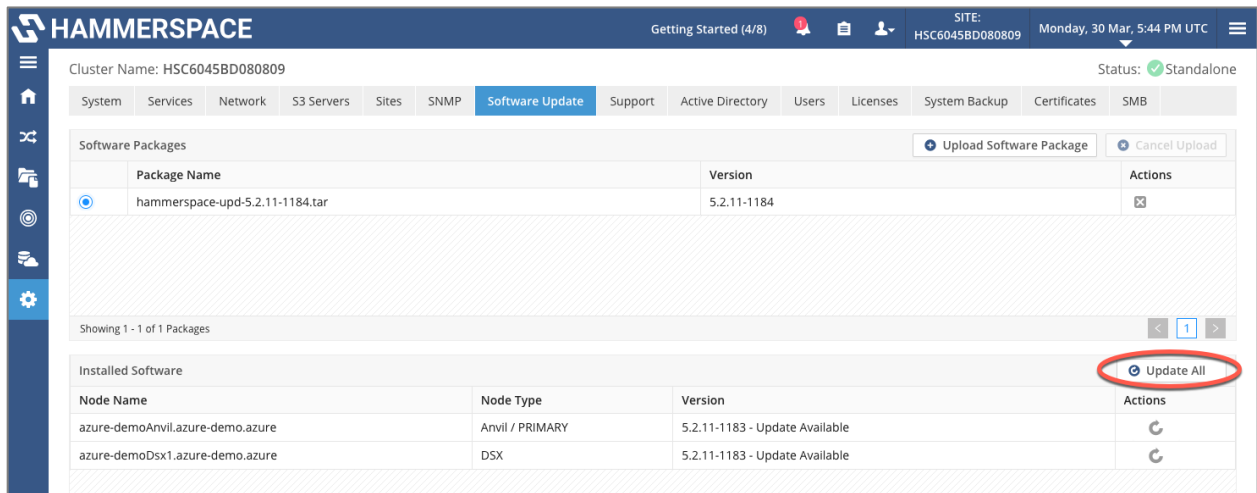


Figure 14

Client Access

The Hammerspace Global File System is fully multiprotocol. Applications and end-users can simultaneously access shares via SMB and NFS from Windows, MacOS, and Linux clients, as described below.

Accessing Shares from Windows

1. Open Windows File Explorer, right-click the computer icon, and then select **Map network drive...** as shown in Figure 15.

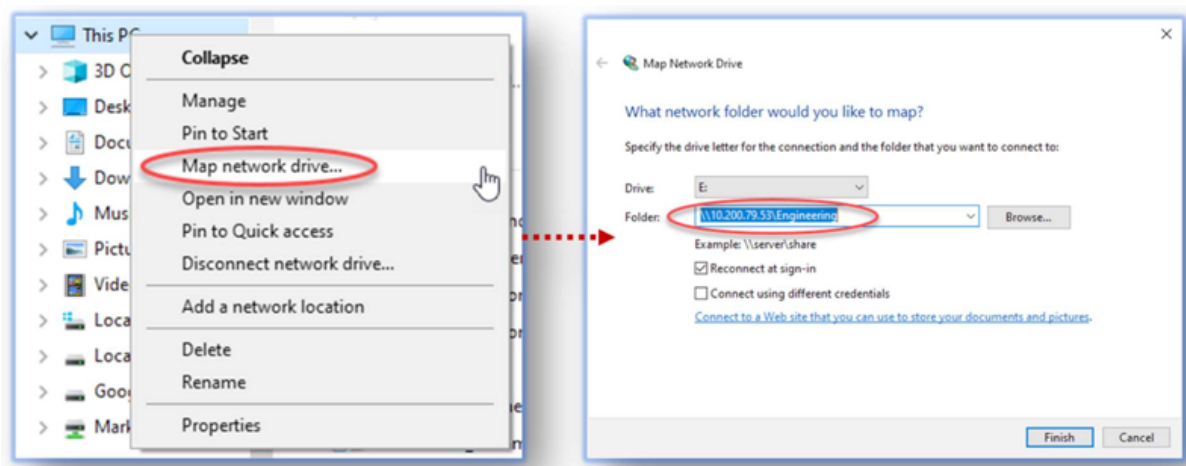


Figure 15. Location of **Map Network drive**

2. Enter the IP address or hostname followed by the share name and select the appropriate options.

Accessing Shares from MacOS

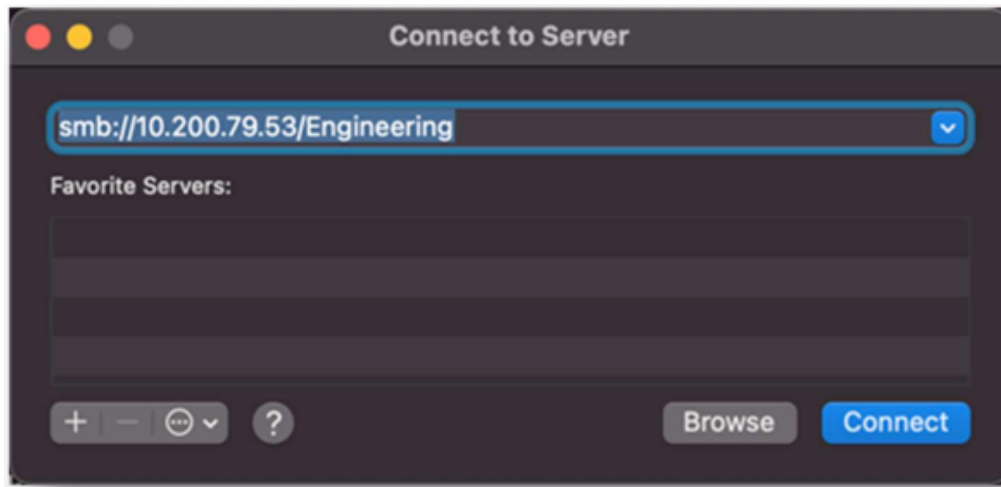


Figure 16. MacOS Connect to Server popup

Mounting NFS Exports from Linux

Depending on the Linux distribution, there may be a preference for using the **mount** command with options or the **mount.nfs** command, as shown below.

```
# mount.nfs <DSX node>:/<export path> <mount path>
```

Or...

```
# mount -t nfs -o vers=3 <DSX node>:/<export path> <mount path>
```

NOTE: Some client systems may require additional NFS options, such as ``no1ock`` and/or ``rw``. Consult the documentation for each distribution.

Using Parallel NFS (v4.2) for High Performance Workloads

Mounting shares using NFS v4.2 is slightly different from NFS v3 and SMB. NFS v4.2 exports are available from the Hammerspace Metadata Server (Anvil) while NFS v3/SMB exports/shares are available from any of the DSX nodes.



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How To Mount Anvil Using NFSv4.2

```
# mount -t nfs -o vers=4.2 <anvil node>:<export path> <mount path>
```

NFS v4.2 is a more modern protocol with significant performance improvements. This means that only relatively recent Linux versions (for example, RHEL/CentOS 7.5 and later) have the most recent fixes. For some older Red Hat/CentOS Linux versions, Hammerspace has done the work to backport the upstream fixes.

NOTE: Most Linux versions available in the cloud are capable of mounting NFS v4.2. For more information, refer to [RFC 5661](#) and [RFC 8434](#), or contact Hammerspace at support@hammerspace.com.

Appendix I: Architectural Reference Diagrams

Data Path: SMB and NFS v3

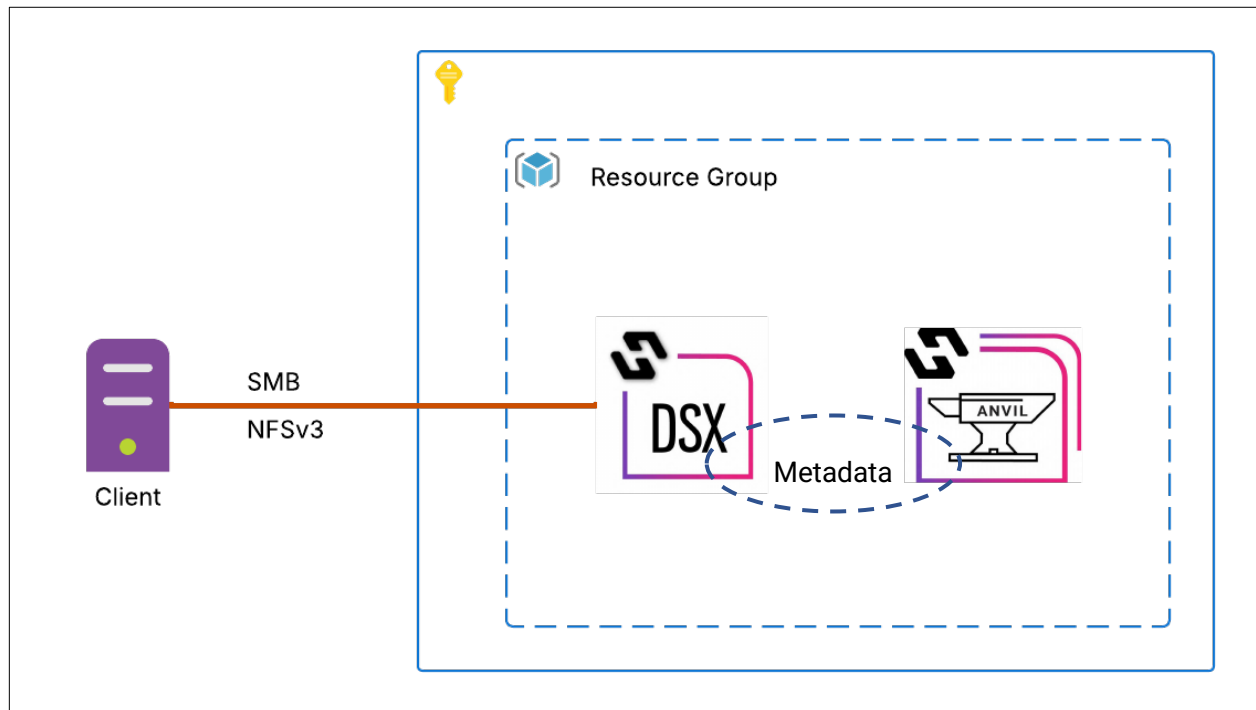


Figure 17. Diagram of the data path from SMB/NFS v3 to the client

SMB and NFS v3 clients mount DSX while metadata is managed by Anvil.

Standalone Anvil and DSX

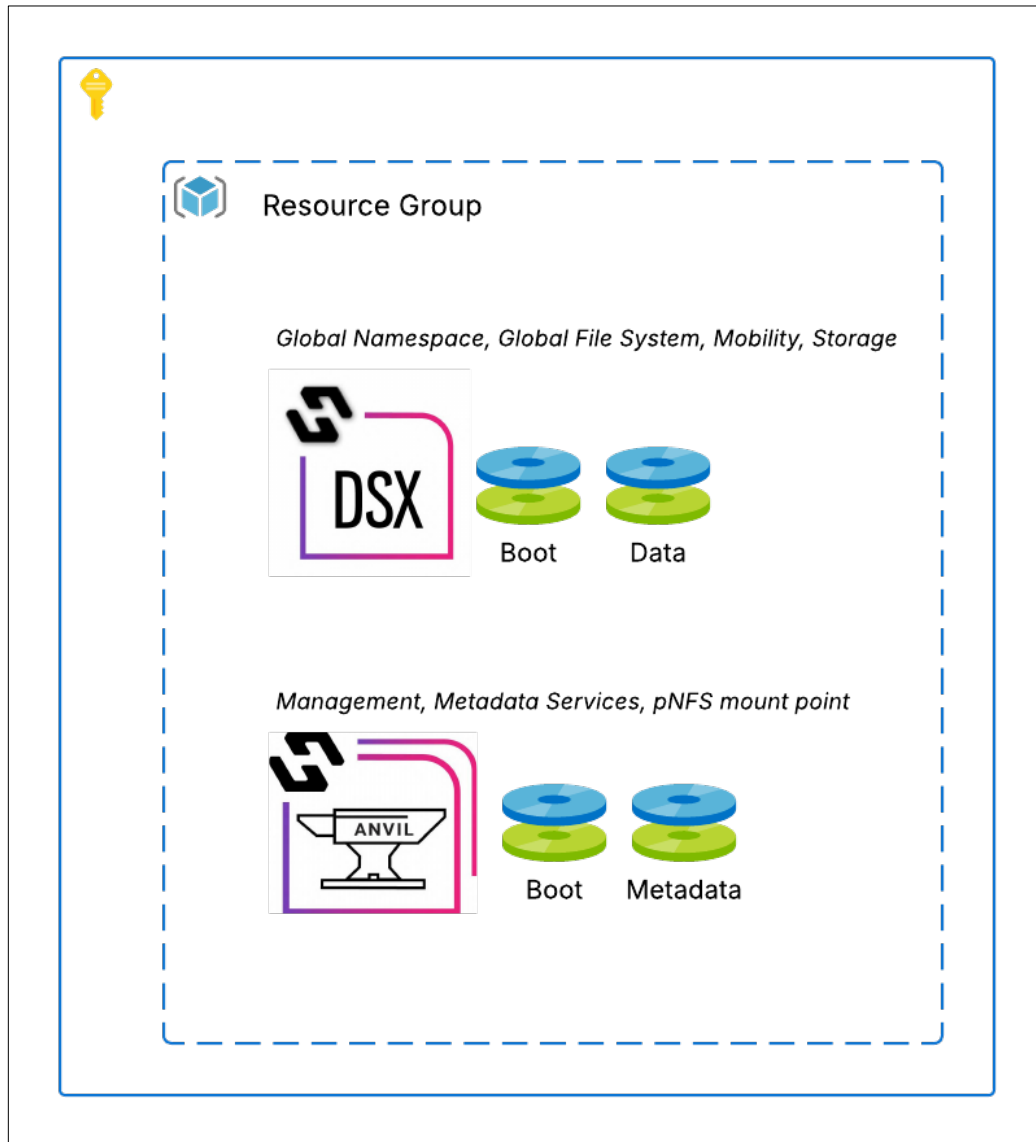


Figure 13. Diagram of a single Anvil/single DSX cluster

The minimum configuration of a Hammerspace solution consists of a single Anvil and a single DSX. Each instance requires, at a minimum of two disks: one for the boot partition and the second to hold data or metadata, respectively.



High Availability Anvil and Standalone DSX

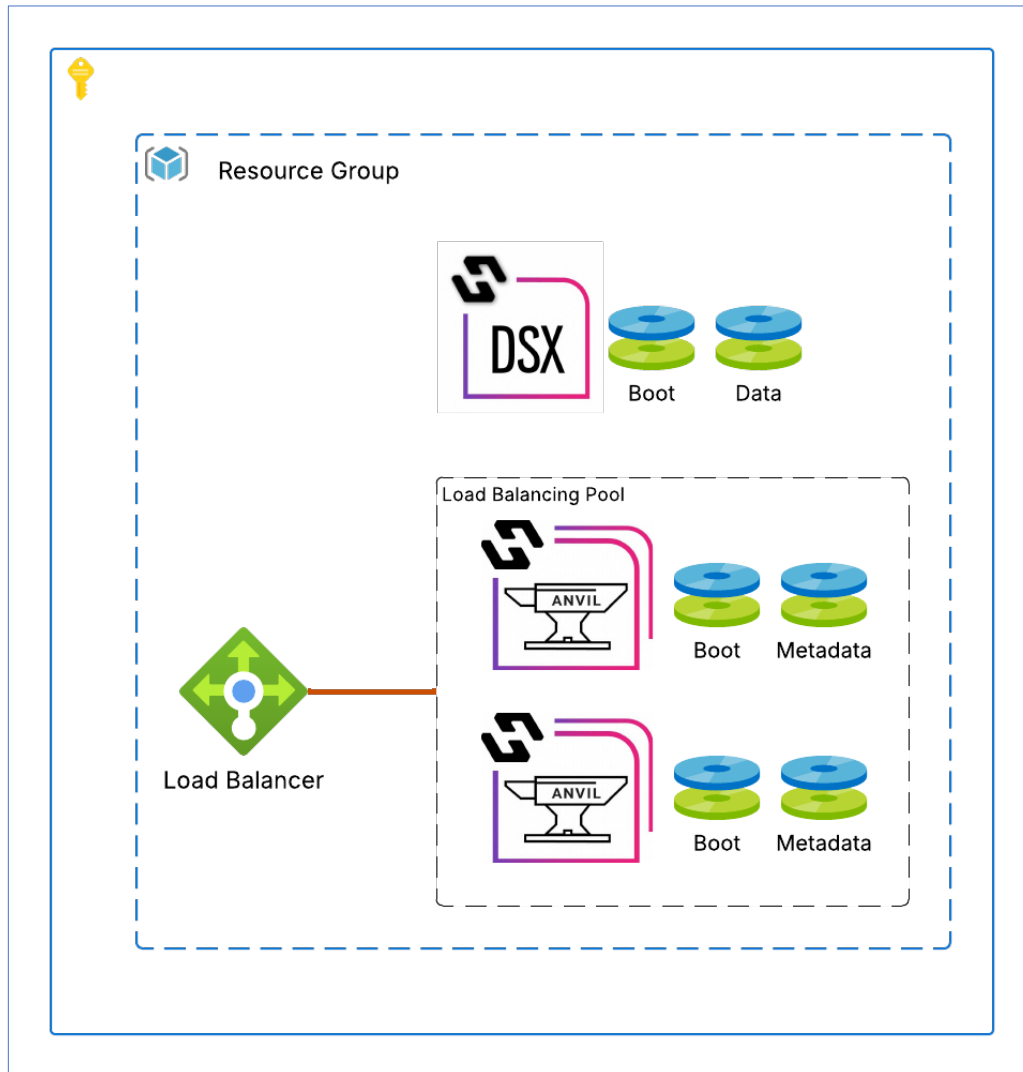


Figure 18. Diagram of an HA-Anvil and standalone-DSX architecture

Figure 18 illustrates a single DSX and a highly available configuration of Anvil nodes. Microsoft Azure requires configuring an Azure Load Balancer to support high availability using Floating IP addresses.

High Availability Anvil and DSX

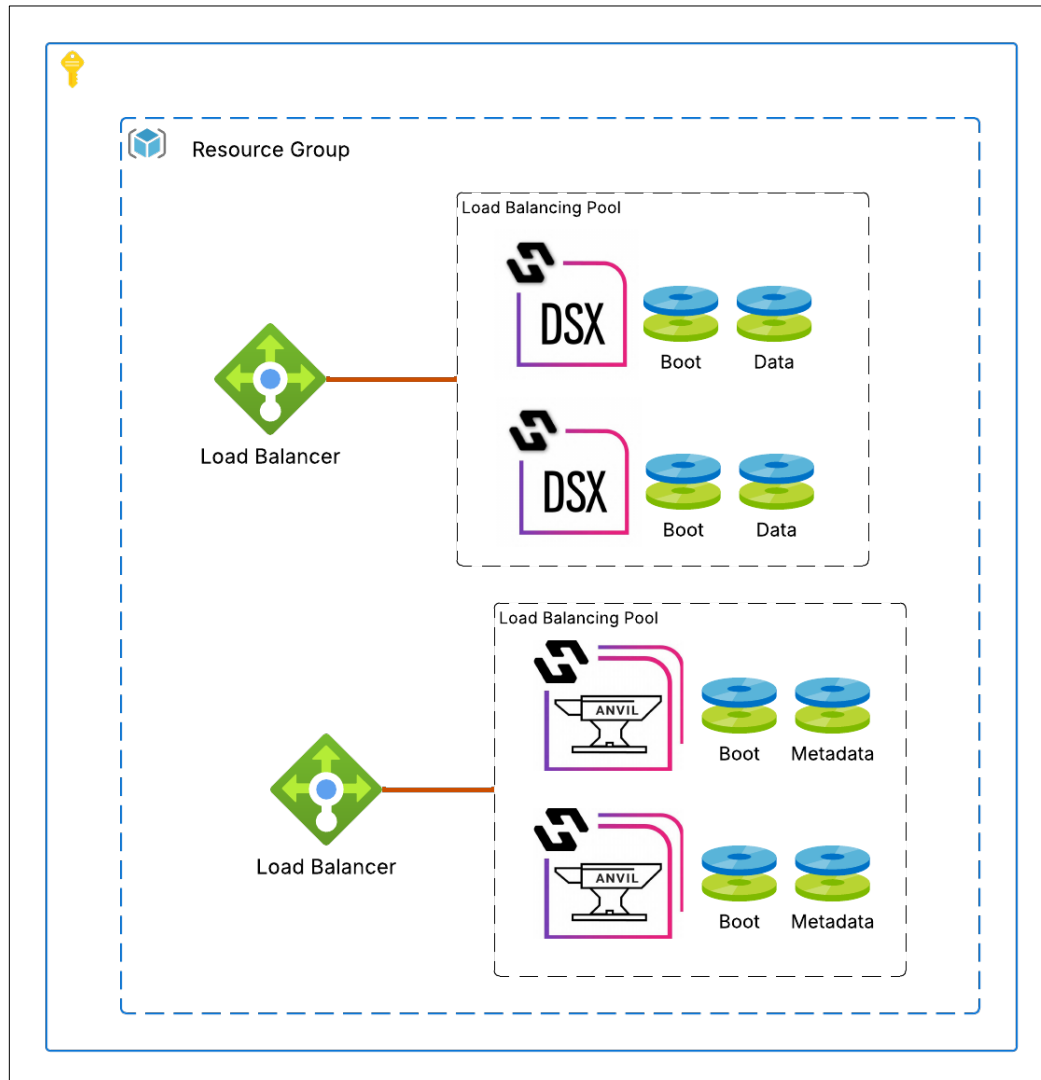


Figure 19. Diagram of HA architecture with 2 Anvils and 2 DSX nodes

NOTE: Azure Load Balancer(s) are used as a substitute to Floating IP addresses for Anvil and/or DSX highly available scenarios. It is possible to use either a single load balancer with separate pools or two separate load balancers.

Data Path: Parallel NFS (NFSv4.2)

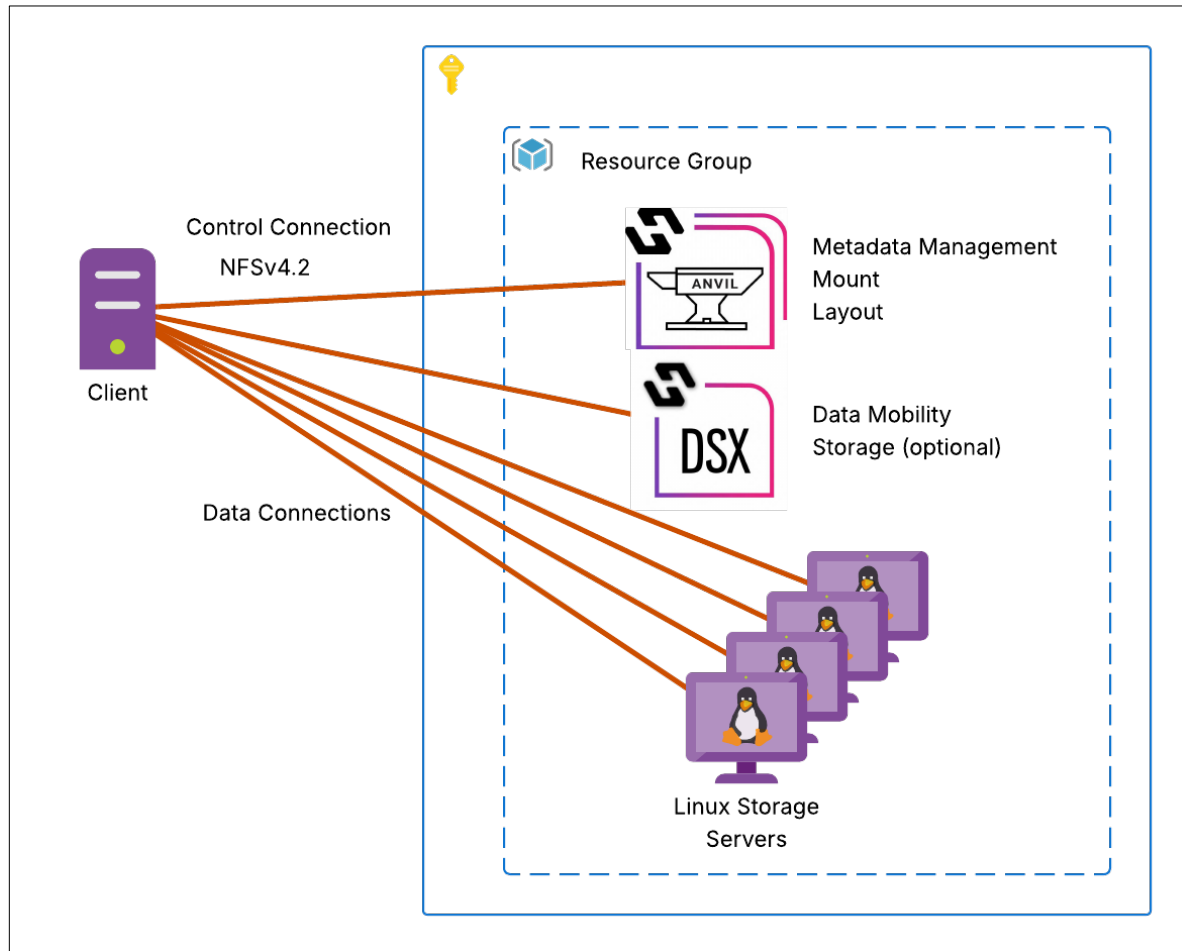


Figure 20. Diagram of a Parallel NFS (v4.2) architecture

NFSv4.2 is used for the highest performance requirements, including AI/ML workloads. Connections are parallelized from client to multiple backend Linux Servers. For more information on Parallel NFS, refer to the following documentation:

- [RFC 5661](#)
- [RFC 8434](#)

Appendix II: Documentation and Support

Azure References

<https://azure.microsoft.com/en-us/get-started>

<https://learn.microsoft.com/en-us/azure/networking/>

<https://learn.microsoft.com/en-us/azure/?product=compute>

<https://learn.microsoft.com/en-us/azure/virtual-machines/>

<https://learn.microsoft.com/en-us/azure/?product=storage>

<https://learn.microsoft.com/en-us/azure/?product=security>

<https://learn.microsoft.com/en-us/azure/load-balancer/>

<https://learn.microsoft.com/en-us/azure/load-balancer/quickstart-load-balancer-standard-internal-portal>

Hammerspace References

<https://hammerspace.com/azure/>

<https://hammerspace.com/resources/>

<https://hammerspace.com/support/>

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