



2-Node Intel® Select Solutions For Microsoft SQL Server v2 Deployment Guide

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Microsoft Azure Stack HCI

Azure Stack HCI is an evolution of data center computing that blends Windows Server technologies with new Azure management service integration. It helps customers with large and complex IT estates and varying needs, helping them solve IT problems while being able to grow and evolve as business and IT needs change.

- **Replace aging server and storage infrastructure**, consolidate virtualized workloads, and gain cloud efficiencies on-premises with hyper-converged solutions that bring together software-defined compute, storage, and networking on industry-standard x86 servers and components, similar to technologies that Microsoft uses to run its Azure data centers.
- **Extend to Azure** quickly and easily with simplified access to cloud management and security services, including offsite backup, site recovery, and cloud-based monitoring.

Azure Stack HCI gets you up and running quickly and reliably. It features the same Hyper-V based software-defined compute, storage, and networking as Azure Stack and shares similar testing and validation criteria. It follows engineering best practices to get customers up and running without lengthy design and build times.

Built-in integration to Azure makes it easy for IT staff to start using Azure for infrastructure management services and start building cloud skills. With the Azure management services in Windows Admin Center and DataON MUST, customers can easily integrate on-premises workloads with services such as Azure Site Recovery, Azure Backup, Cloud Witness, and Azure Monitor.

Storage Spaces Direct is the software-defined storage component of a Microsoft-based hyper-converged infrastructure and is included in the Windows Server Datacenter edition.

Storage Spaces Direct

Overview

Storage Spaces Direct uses industry-standard servers with locally attached drives to create highly available, highly scalable software-defined storage at a fraction of the cost of traditional SAN or NAS arrays. Its converged or hyper-converged architecture radically simplifies procurement and deployment, while features like caching, storage tiers, and erasure coding,

together with the latest hardware innovation like RDMA networking and NVMe drives, deliver unrivaled efficiency and performance.

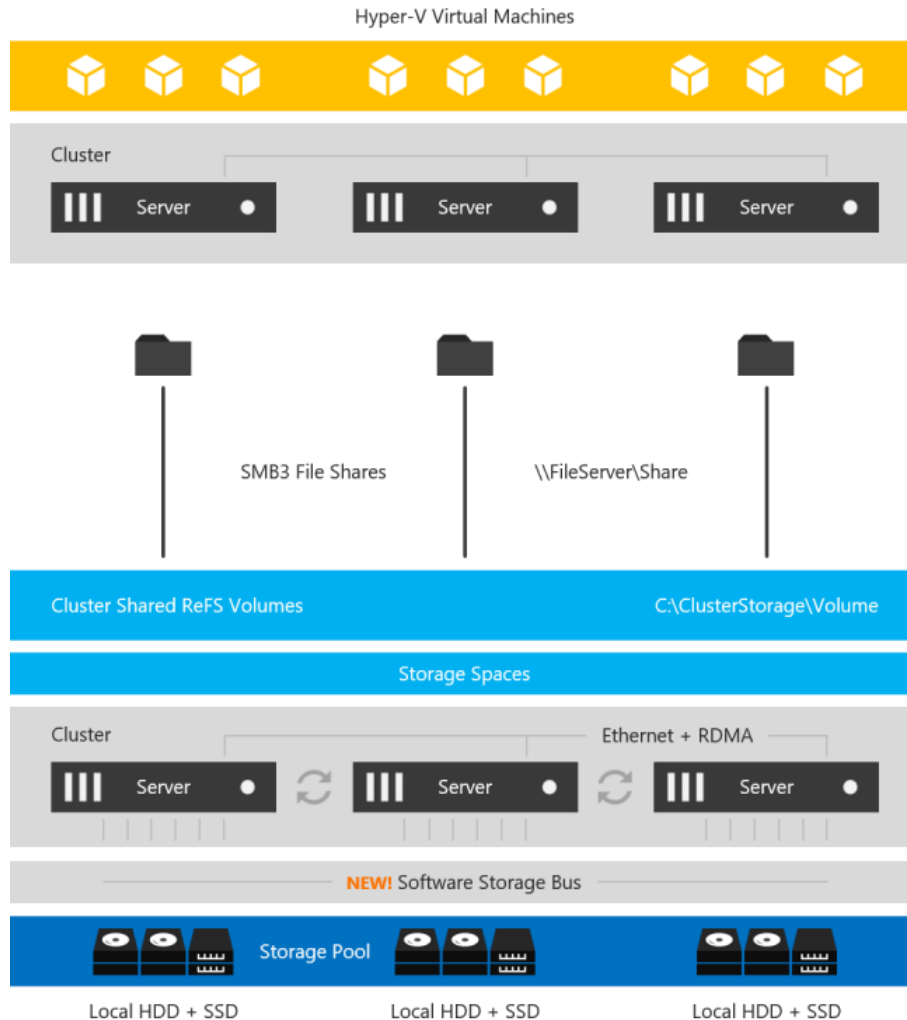
Storage Spaces Direct is included in Windows Server 2016/2019 Datacenter Edition using Full Desktop Experience (GUI) or Core.

- **High performance** – Utilizes all-flash NVMe SSDs to achieve over 2M IOPS in 2-node cluster
- **Switch-less** – Reduce cost by directly attaching 2 nodes for cluster and storage traffic
- **Supports more VMs** - Supports 40+ Hyper-V VM's per nodes, with up to 16 nodes per cluster
- **Highly scalable** – Delivers computer, networking and storage resources with near-linear scalability
- **Easy to deploy** – Simple out-of-the-box deployment and easy installation
- **Easy to manage** – Exclusive DataON MUST extension for Windows Admin Center provides infrastructure visibility and management for Storage Spaces Direct

How Storage Spaces Direct Works

Storage Spaces Direct is the evolution of Storage Spaces, first introduced in Windows Server 2012. It leverages many of the features you know today in Windows Server, such as Failover Clustering, the Cluster Shared Volume (CSV) file system, Server Message Block (SMB) 3.0, and of course Storage Spaces. It also introduces new technology, most notably the Software Storage Bus.

Here's an overview of the Storage Spaces Direct stack:



Networking hardware – Storage Spaces Direct uses SMB 3.0, including SMB Direct and SMB Multichannel, over Ethernet to communicate between servers. Microsoft strongly recommends 10GbE+ with remote-direct memory access (RDMA), either iWARP or RoCE.

Storage hardware – From 2 to 16 servers with local attached SATA, SAS, or NVMe drives. Each server must have at least 2 solid state drives, and at least 4 additional drives. The SATA and SAS devices should be behind a host bus adapter (HBA) and SAS expander. DataON platforms are fully certified for Microsoft Windows Server 2016/2019.

Failover clustering – The built-in clustering feature of Windows Server is used to connect the servers.

Software storage bus – Software storage bus is new in Storage Spaces Direct. It spans the cluster and establishes a software-defined storage fabric whereby all the servers can see all of

each other's local drives. You can think of it as replacing costly and restrictive Fibre Channel or Shared SAS cabling.

Storage Bus Layer Cache – The Software Storage Bus dynamically binds the fastest drives present (e.g. SSD) to slower drives (e.g. HDDs) to provide server-side read/write caching that accelerates I/O and boosts throughput.

Storage Pool – The collection of drives that form the basis of Storage Spaces is called the storage pool. It is automatically created, and all eligible drives are automatically discovered and added to it. We strongly recommend you use one pool per cluster, with the default settings.

Storage Spaces – Storage Spaces provides fault tolerance to virtual "disks" using mirroring, erasure coding, or both. You can think of it as distributed, software-defined RAID using the drives in the pool. In Storage Spaces Direct, these virtual disks typically have resiliency to two simultaneous drive or server failures (e.g. 3-way mirroring, with each data copy in a different server) though chassis and rack fault tolerance is also available.

Resilient File System (ReFS) – ReFS is the premier filesystem purpose-built for virtualization. It includes dramatic accelerations for .vhdx file operations such as creation, expansion, and checkpoint merging, and built-in checksums to detect and correct bit errors. It also introduces real-time tiers that rotate data between so-called "hot" and "cold" storage tiers in real-time based on usage.

Cluster Shared Volumes – The CSV file system unifies all the ReFS volumes into a single namespace accessible through any server, so that to each server, every volume looks and acts like it's mounted locally.

Scale-Out File Server (SoFS) – This final layer is necessary in converged deployments only. It provides remote file access using the SMB3 access protocol to clients, such as another cluster running Hyper-V, over the network, effectively turning Storage Spaces Direct into network-attached storage (NAS).

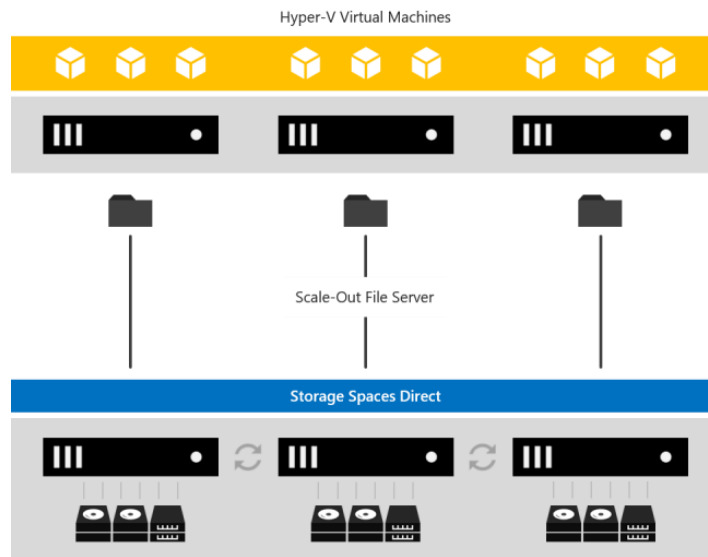
Deployment Options

Storage Spaces Direct was designed for two distinct deployment options:

Converged

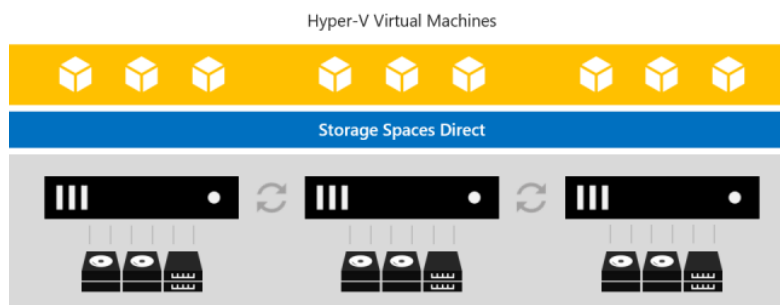
Storage and compute in separate clusters. The converged deployment option, also known as 'disaggregated', layers a Scale-out File Server (SoFS) atop Storage Spaces Direct to provide network-attached storage over SMB 3.0 file shares. This allows for

scaling compute/workload independently from the storage cluster, essential for larger-scale deployments such as Hyper-V IaaS (Infrastructure as a Service) for service providers and enterprises.



Hyper-Converged

One cluster for compute and storage. The hyper-converged deployment option runs Hyper-V virtual machines or SQL Server databases directly on the servers providing the storage, storing their files on the local volumes. This eliminates the need to configure file server access and permissions and reduces hardware costs for small-to-medium business or remote office/branch office deployments.



Deploying Storage Spaces Direct

Configuration Checklist

Use the checklist below to ensure your Storage Spaces Direct configuration is ready for production. This will make sure you meet all prerequisites before proceeding, including cabling, and switch and network configuration.

During your configuration, use the built-in validation tests to confirm your RDMA connections and validate the cluster. Once configuration is complete, test the solution for resiliency and performance using DataON's MUST application.

DataON's Deployment Package

Your DataON & Storage Spaces Direct solution includes a customized deployment package provided to you by the technician who built and tested your cluster. This package will include:

- **Storage Spaces Direct deployment PowerShell script** – To be opened and run in PowerShell ISE to build your cluster
- **DataON scripts folder** – Supplemental scripts to rename NICs, clean drives and check volume information
- **MUST folder** – Link to download Windows Admin Center
- **Rail kit installation guide** – Steps on how to install the rail kit and rack the servers
- **Firmware and drivers spreadsheet** – List of components and the driver version installed for your cluster. Please check with us if you have a business or technical requirement to update any of these in case there are known issues with the updated version.
- **VM Fleet benchmark report** – Synthetic tests performed on your cluster prior to shipment to ensure Storage Spaces Direct is performing properly. If desired, we can make the testing tools available to perform your own testing.
- **Troubleshooting Storage Spaces Direct guide from Windows Docs** – Microsoft's guide on various Storage Spaces Direct states and status
- **A deployment document** which contains:
 - Hardware configuration
 - Server front & rear view
 - Network connections diagram
 - Firmware and drivers installed
 - Storage Spaces Direct stack
 - Example on how to run the deployment script
 - VM Fleet performance benchmarks

- DataON MUST for Windows Admin Center
- Storage Spaces Direct troubleshooting guide
- Resources for DataON servers (documents, tools, BIOS/drivers and O/S RAID information)
- Intel BMC KVM information

The information provided in this document will be based on our deployment package. Some items may not be specific for your deployment.

Physical Setup

After receiving the server hardware, follow the rack installation guide to properly rack the servers into the cabinet.

Hardware View

Below are front and rear views of 1U and 2U server nodes used in S2D cluster and its associated network ports.

K2N-108 Front and Rear View – Consists of two DataON S2D-5108i 1U servers each with eight bays for NVMe drives. Connectivity between the two nodes will be two 25GbE connections.

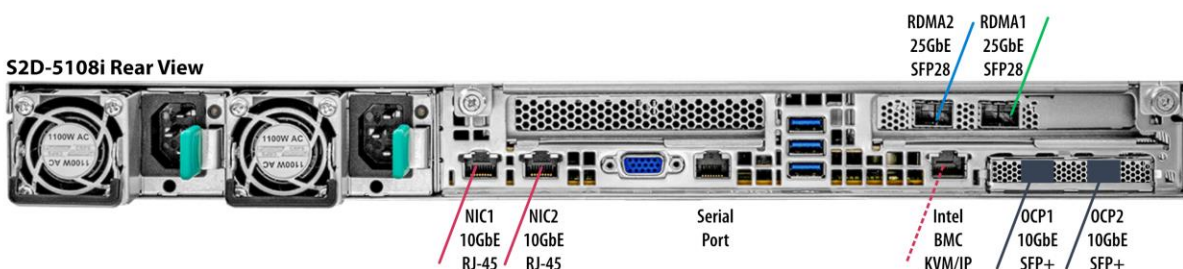
DataON K2N-108

K2N-108 consists of (2) S2D-5108i server nodes direct-attached

S2D-5108i Front View



S2D-5108i Rear View



- 10GbE - RJ-45 | On-board NIC 1 & 2 - North-South Client/Management Traffic (option 1)
- 10GbE - SFP+ | OCP 1 & 2 - North-South Client/Management Traffic (option 2)
- 25GbE - SFP28 | RDMA 1 - East-West Cluster and Storage Traffic
- 25GbE - SFP28 | RDMA 2 - East-West Cluster and Storage Traffic
- RJ-45 | Intel BMC/IPMI RJ-45 for KVM/IP

Note on SFP+ and SFP28

Our dual-port 25GbE RDMA adapters have ports in the form factor of SFP+. To achieve the following speeds, please select the appropriate cables:

- For 25Gb/s, select SFP28 cables
- For 10Gb/s, select SFP+ cables

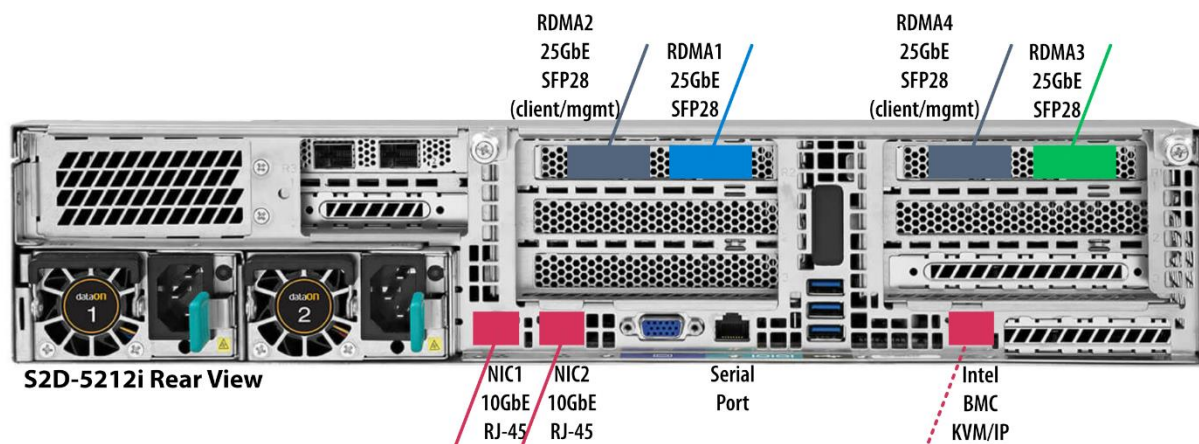
K2N-212 Front and Rear View – Consists of two DataON S2D-5212i 2U servers with two bays for NVMe and 10 bays for SATA/SAS drives. Connectivity between the two nodes will be two 25GbE connections.

DataON K2N-212

K2N-212 consists of (2) S2D-5212i server nodes direct-attached



S2D-5212i Front View



S2D-5212i Rear View

10GbE - RJ-45	On-board NIC 1 & 2 - North-South Client/Management Traffic (option 1)
25GbE - SFP28	RDMA 2 & 4 - North-South Client/Management Traffic (option 2)
25GbE - SFP28	RDMA 1 - East-West Cluster and Storage Traffic
25GbE - SFP28	RDMA 3 - East-West Cluster and Storage Traffic
Intel BMC KVM/IP RJ-45	Intel BMC/IPMI RJ-45 for KVM/IP

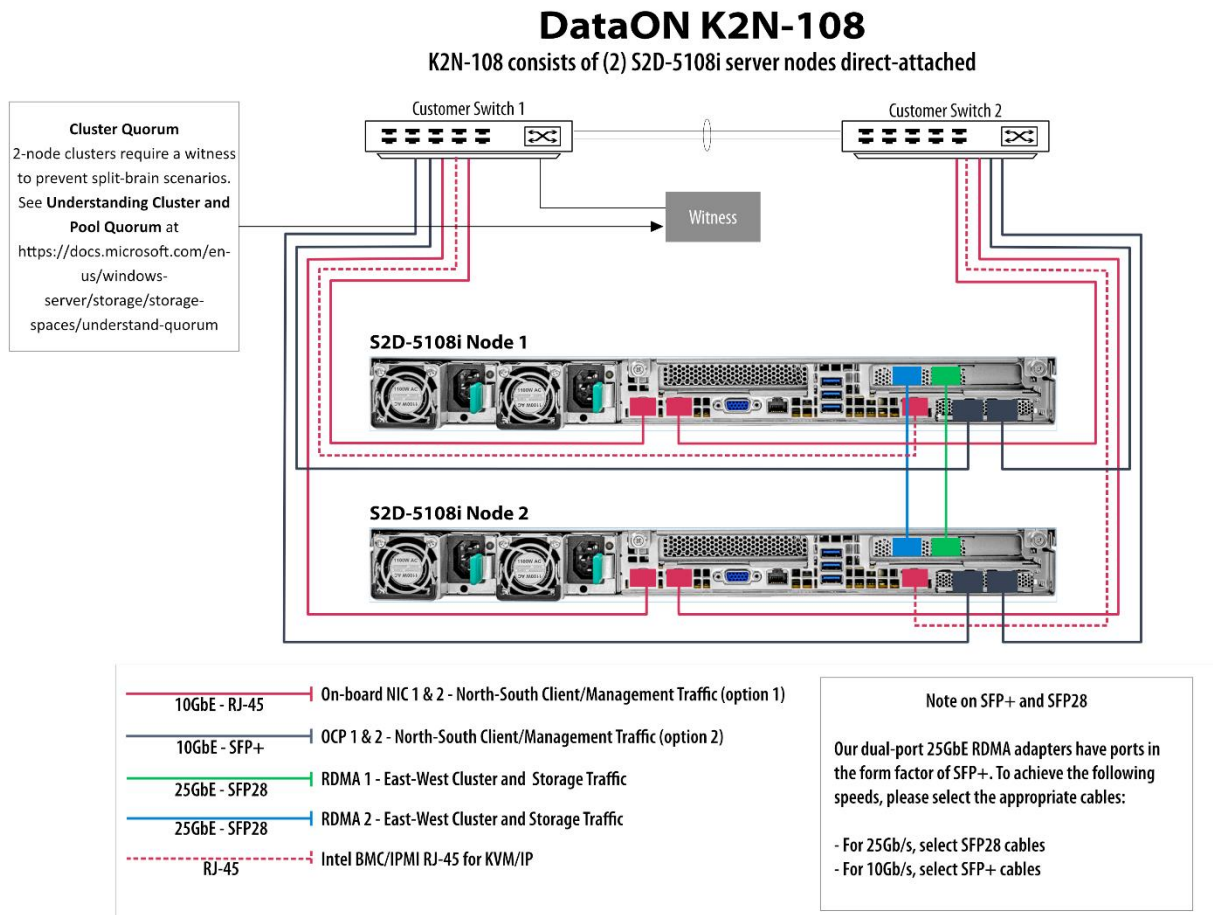
Note on SFP+ and SFP28

Our dual-port 25GbE RDMA adapters have ports in the form factor of SFP+. To achieve the following speeds, please select the appropriate cables:

- For 25Gb/s, select SFP28 cables
- For 10Gb/s, select SFP+ cables

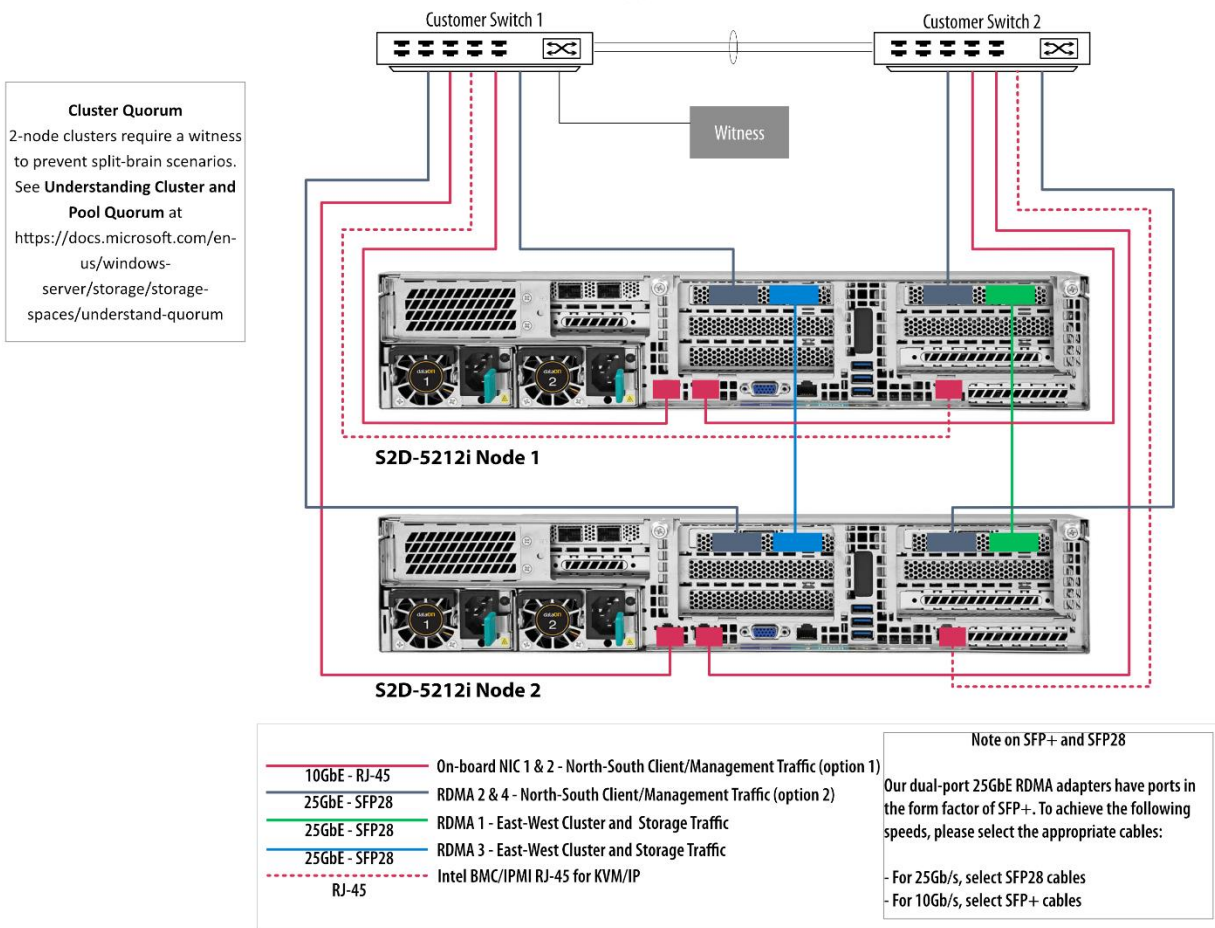
Cabling Diagram and Cluster Witness

Proper connectivity for the cluster-to-cluster traffic is essential for the storage and cluster traffic to function properly. In addition, a 2-node cluster requires a [quorum witness](#) to prevent a split-brain scenario.



DataON K2N-212

K2N-212 consists of (2) S2D-5212i server nodes direct-attached



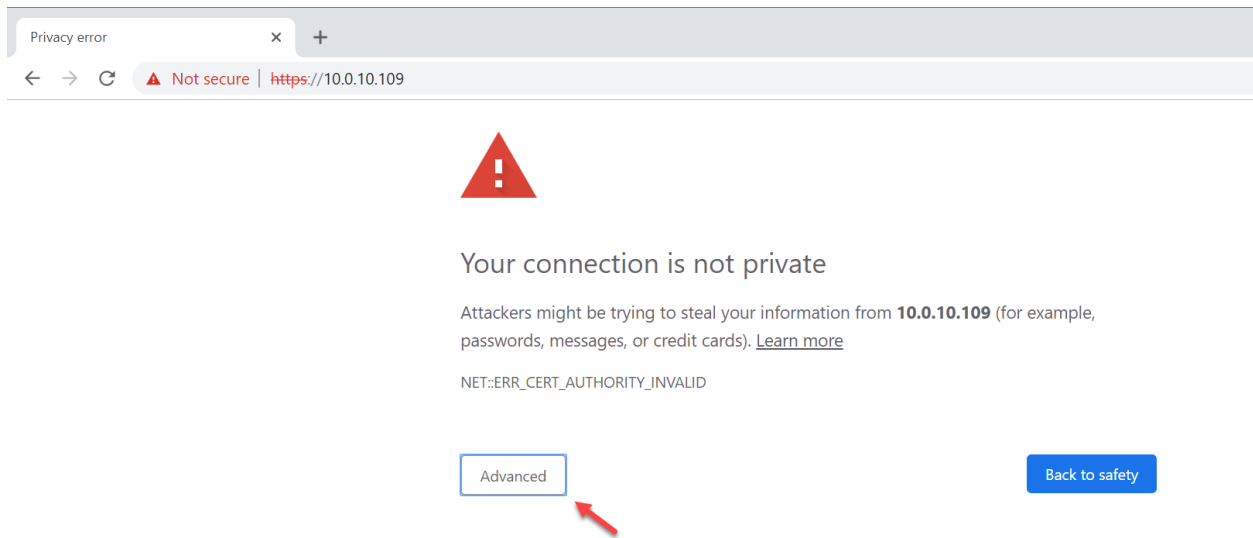
Note: For brevity, only the S2D-5212i is shown above as a representative of the 2U 2-node cluster. Other 2U 2-node S2D models are available from DataON and will have the similar network connections.

Logical Configuration

BMC

Your DataON servers will either have a static BMC IP address you provided to us during the testing phase or a dynamic address using DHCP. With BMC access, you can remote console into the system using KVM/IP.

Note: Your browser will indicate there is a lack of a SSL certificate for this https connection. This is normal. Click **Advanced**.



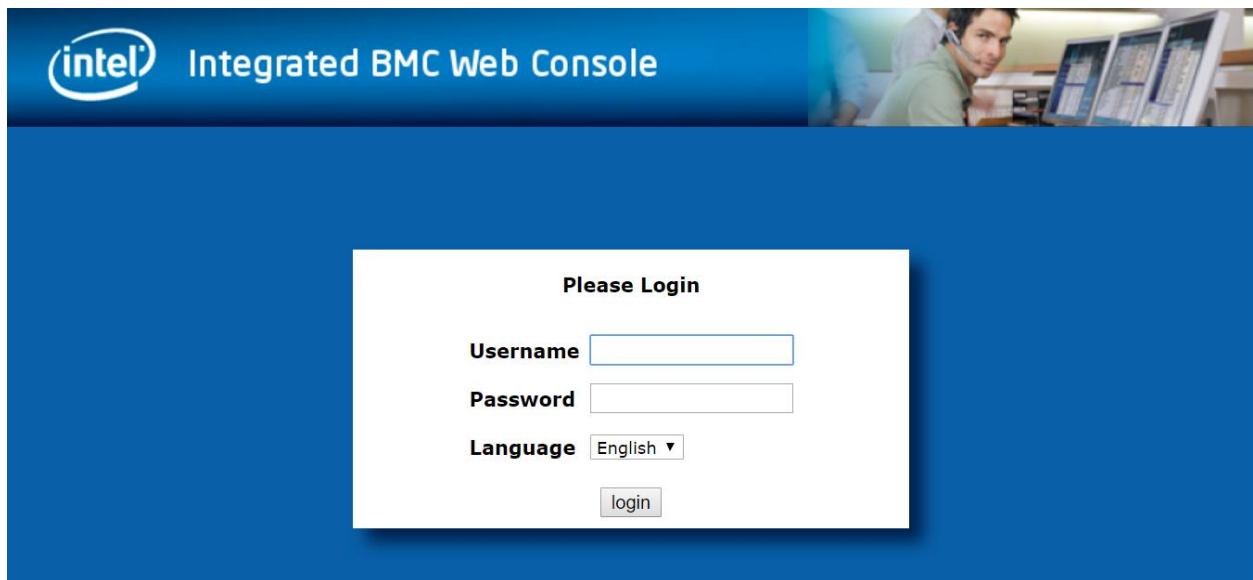
After clicking advanced, click on **Proceed** to <your IP address>.

This server could not prove that it is **10.0.10.109**; its security certificate is not trusted by your computer's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection.

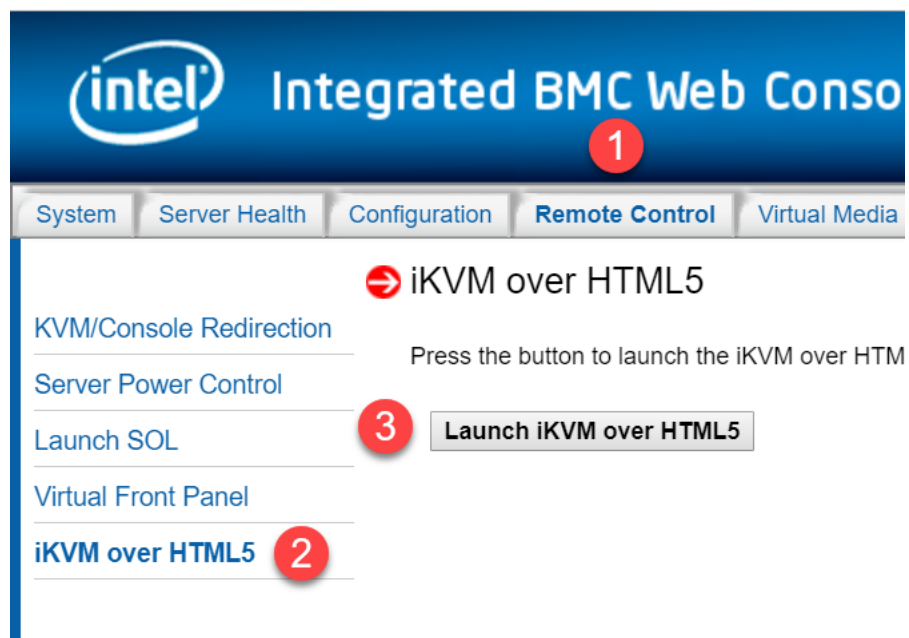
[Proceed to 10.0.10.109 \(unsafe\)](#)



You will be presented with the login screen for BMC. Enter the credentials provided by DataON.



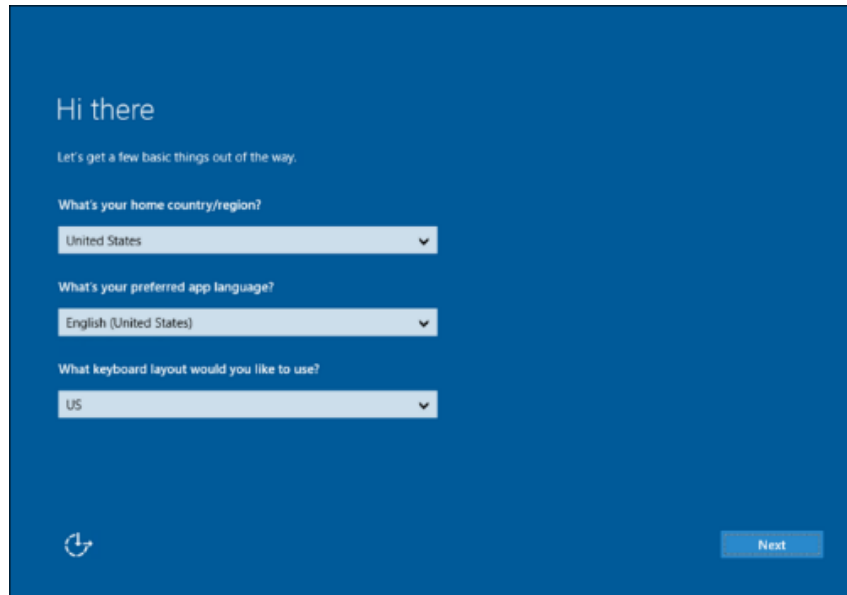
Select the **Remote Control** tab then **iKVM over HTML5** (other option is KVM/Console Redirection using Java) then click on **Launch iKVM over HTML5**. You will then have remote console access to the system.



Note: iKVM over HTML5 is available starting with Intel BIOS v15. Prior to this version, the only option is Java-based KVM/IP option.

Initial Windows Configuration

1. Our standard deployment uses an out-of-box experience so that our users can set the basic Windows Server configuration.



2. After clicking 'Next', enter your own password for the built-in Administrator account. Then log into the Administrator account to proceed.



Windows Server 2016/2019 License Key

Every DataON S2D server node has Windows Server 2016/2019 Datacenter Evaluation version pre-installed for your convenience. This version is provided for proof-of-concept only. Please apply your own license before official deployment using the command lines below to apply the license.

Note: The eval license is good for approximately 180 days from the day DataON installed the OS. After 180 days, the server will automatically reboot on an hourly basis.

Open PowerShell window as Administrator

```
# To view the current edition installed
dism /online /get-currentedition

# To view the possible target editions available
dism /online /get-targeteditions

# To input the retail or KMS Windows License Key
dism /online /set-edition:ServerDatacenter /AcceptEula /ProductKey:<input your product key or KMS key>
```

Update Windows with the latest patches

Prior to shipment, DataON makes every effort to load the latest Windows cumulative patch available. However, there will be cases where you will need to run Windows updates again to ensure your OS is up-to-date prior to building the cluster.

DataON S2D Server Node Configuration

Your Windows Server 2016/19 OS image has the drivers pre-installed with the DataON S2D server node. After entering the license information, you will need to rename the servers and join it to your domain. Once complete, you're ready to build the DataON S2D cluster.

With the exception of Step 1 (rename server), the boxes below are the PowerShell commands to run on **One** of the hosts. Open a PowerShell ISE window as Administration to execute the commands.

System Pre-Setup

Step 1: Rename the Server

(Optional) Rename the server using the convention of "[Node 1 name]-N1". For example, if we have two DataON S2D-5108's, so we could rename the server name to S2D-2108-N1 and N2 and join it to your own domain.

```
Rename-Computer <Host Name>
Add-Computer -DomainName <Domain Name>
Restart-Computer
```

Step 2: Assign hostnames to \$nodes

Once all the nodes boot up, run the command below with your hostnames. The \$nodes variable will be used in subsequent commands.

```
$S1 = "<host name 1>"
$S2 = "<host name 2>"

$nodes = ($S1, $S2)
```

Step 3: Enable the Remote Desktop Connection

(Optional) Enable the remote desktop connection.

Note: make sure the entire block of commands starting from Invoke-Command to the "}" at the bottom.

```
Invoke-Command -ComputerName $nodes -ScriptBlock {
    Set-ItemProperty -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server'-Name
    "fDenyTSConnections" -Value 0
    Set-ItemProperty -Path 'HKLM:\System\CurrentControlSet\Control\Terminal
    Server\WinStations\RDP-Tcp' -Name "UserAuthentication" -Value 0
    Enable-NetFirewallRule -DisplayGroup "Remote Desktop"
    Get-NetFirewallRule -DisplayGroup "Remote Desktop" | ft Name,Enabled,Profile
}
```

Step 4: Enable Ping for Every Node

Allow the firewall to receive pings.

Note: make sure the entire block of commands starting from Invoke-Command to the "}" at the bottom.

```
Invoke-Command -ComputerName $nodes -ScriptBlock {
    Enable-NetFirewallRule -Name 'FPS-ICMP4-ERQ-In'
}
```

Step 5: Disable the Firewall

(optional) Disable the firewall.

```
Invoke-Command -ComputerName $nodes -ScriptBlock {
    Set-NetFirewallProfile -Profile Domain,Private,Public -Enabled False
}
```

Step 6: Clear All the Disks

Clear all the disks in the current configuration before setting up the DataON S2D server node.

```
Invoke-Command -ComputerName $nodes -ScriptBlock {
    Set-ExecutionPolicy Unrestricted
    cd C:\DataON\script
    .\Clear-SdsConfig.ps1
}
```

Step 7: Display the Number of Clean Disks

Display the number of clean disks that are available to be in the DataON S2D storage pool for the entire cluster.

```
Invoke-Command -ComputerName $nodes -ScriptBlock {  
    Get-PhysicalDisk -CanPool $true  
} | measure
```

In this example, we have four disks on each node that are available: Intel® P3700 800GB NVMe SSDs and eight Intel® P3520 2TB NVMe SSDs per server. With four DataON S2D servers, we should see 40 clean disks during setup.

```
PS C:\VMfleet\control> Invoke-Command -ComputerName (get-clusternode) -ScriptBlock {  
    Get-PhysicalDisk -CanPool $true  
} | measure  
  
Count      : 8  
Average    :  
Sum        :  
Maximum    :  
Minimum    :  
Property   :
```

Networking Setup

Step 1: Rename the NICs across all nodes

```
Invoke-Command -ComputerName $nodes -ScriptBlock {  
    Set-ExecutionPolicy Unrestricted  
    C:\DataON\script\NicConfig.ps1 C:\DataON\script\nic.config Rename  
}
```

Step 2: Check the Network Status.

Check the status of the network (NIC).

```
Invoke-Command -ComputerName $nodes -ScriptBlock {  
    Get-NetAdapter | where Status -Like Up | ft ifAlias, Status, LinkSpeed  
}
```

Step 3: Get the Disconnected NIC.

Get the disconnected / disabled NIC.

```
Invoke-Command -ComputerName $nodes -ScriptBlock {  
    Get-NetAdapter | where Status -Like "Disconnected" | ft Name, Status  
    Get-NetAdapter | where Status -Like "Disabled" | ft Name, Status  
}
```

Step 4: Disable the disconnected NIC.

Disable the disconnected NIC.

```
Invoke-Command -ComputerName $nodes -ScriptBlock {  
    $nics = Get-NetAdapter | Where-Object Status -NE "Up" | Select-Object -ExpandProperty Name  
    foreach( $nic in $nics) {  
        Write-Verbose 'Disable $nic'  
        Disable-NetAdapter $nic -Confirm:$false  
    }  
}
```

Step 5: Configure static IPs on NIC 1

This assumes you haven't already configured the IPs on NIC 1 (which is defined in Step 1).
Ignore if this was completed manually.

You can set the **IP address, prefix length, default gateway and server address** for node 1.

```
Invoke-Command -ComputerName $S1 -ScriptBlock {  
    Set-NetIPInterface -InterfaceAlias "NIC1" -DHCP Disabled  
    Remove-NetIPAddress -InterfaceAlias "NIC1" -Confirm:$false  
    New-NetIPAddress -InterfaceAlias "NIC1" -IPAddress <IP Address> -PrefixLength <subnet  
prefix> -DefaultGateway <gateway IP>  
    Set-DnsClientServerAddress -InterfaceAlias "NIC1" -ServerAddresses <DNS IP separated by  
comma for multiple IPs>  
}
```

Set Node 2 - NIC 1 as static IP.

You can set the **IP address, prefix length, default gateway and server address** for node 2.

```
Invoke-Command -ComputerName $S2 -ScriptBlock {  
    Set-NetIPInterface -InterfaceAlias "NIC1" -DHCP Disabled  
    Remove-NetIPAddress -InterfaceAlias "NIC1" -Confirm:$false  
    New-NetIPAddress -InterfaceAlias "NIC1" -IPAddress <IP Address> -PrefixLength <subnet  
prefix> -DefaultGateway <gateway IP>  
    Set-DnsClientServerAddress -InterfaceAlias "NIC1" -ServerAddresses <DNS IP separated by  
comma for multiple IPs>  
}
```

Step 6

Confirm NIC 1 on the servers can ping.

```
ipconfig.exe /flushdns  
ping $S1  
ping $S2
```

Step 7

Configure RDMA 1 and 2. These will be the ports for server-to-server cluster, storage and live migration communication. You will use the same steps as above but for InterfaceAlias RDMA 1 and 2.

You can set the **IP address, prefix length and server address** for node 1. These connections will not have a DNS nor gateway as they're direct connections. RDMA 1 and 2 will be on separate subnets.

Node 1

```
Invoke-Command -ComputerName $S1 -ScriptBlock {  
    Set-NetIPInterface -InterfaceAlias "RDMA1" -DHCP Disabled  
    Remove-NetIPAddress -InterfaceAlias "RDMA1" -Confirm:$false  
    New-NetIPAddress -InterfaceAlias "RDMA1" -IPAddress 192.168.101.11 -PrefixLength 24  
}  
  
Invoke-Command -ComputerName $S1 -ScriptBlock {  
    Set-NetIPInterface -InterfaceAlias "RDMA2" -DHCP Disabled  
    Remove-NetIPAddress -InterfaceAlias "RDMA2" -Confirm:$false  
    New-NetIPAddress -InterfaceAlias "RDMA2" -IPAddress 192.168.102.11 -PrefixLength 24  
}
```

Node 2

```
Invoke-Command -ComputerName $S2 -ScriptBlock {  
    Set-NetIPInterface -InterfaceAlias "RDMA1" -DHCP Disabled  
    Remove-NetIPAddress -InterfaceAlias "RDMA1" -Confirm:$false  
    New-NetIPAddress -InterfaceAlias "RDMA1" -IPAddress 192.168.101.12 -PrefixLength 24  
}  
  
Invoke-Command -ComputerName $S2 -ScriptBlock {  
    Set-NetIPInterface -InterfaceAlias "RDMA2" -DHCP Disabled  
    Remove-NetIPAddress -InterfaceAlias "RDMA2" -Confirm:$false  
    New-NetIPAddress -InterfaceAlias "RDMA2" -IPAddress 192.168.102.12 -PrefixLength 24  
}
```

Install Windows Features

Install Hyper-V, Failover Clustering and File Services. You will need to reboot afterwards.

```
icm $nodes {Install-WindowsFeature Failover-Clustering -IncludeAllSubFeature -  
IncludeManagementTools}  
icm $nodes {Install-WindowsFeature -Name Hyper-V, File-Services -IncludeManagementTools}  
icm $nodes {Restart-Computer -Force}
```

Cluster Validation and Creation

Step 1: Validate that nodes are ready for cluster creation

Run the following command to test \$S1 and \$S2 are ready to be a cluster. A report will be generated. Open the report using Internet Explorer to address any issues.

```
Test-Cluster -node $nodes -Include "Storage Spaces Direct",Inventory,Network, "System  
Configuration" -ReportName C:\Windows\cluster\Reports\report
```

Step 2: Check the cluster report.

```
& 'C:\Program Files (x86)\Internet Explorer\iexplore.exe'  
C:\Windows\cluster\Reports\report.htm
```


Step 3: Create a failover cluster with a name and a static IP

```
New-Cluster -Name <cluster name> -Node $nodes -NoStorage -StaticAddress <IP Address>
```

Step 4: Review the cluster creation log to ensure there are no errors

```
Invoke-Item C:\Windows\cluster\Reports\
```

Storage Spaces Direct Creation

Enable and Configure Storage Spaces Direct with disk volumes

Step 1: Enable Storage Spaces Direct – This will depend on whether you have cache drives or not.

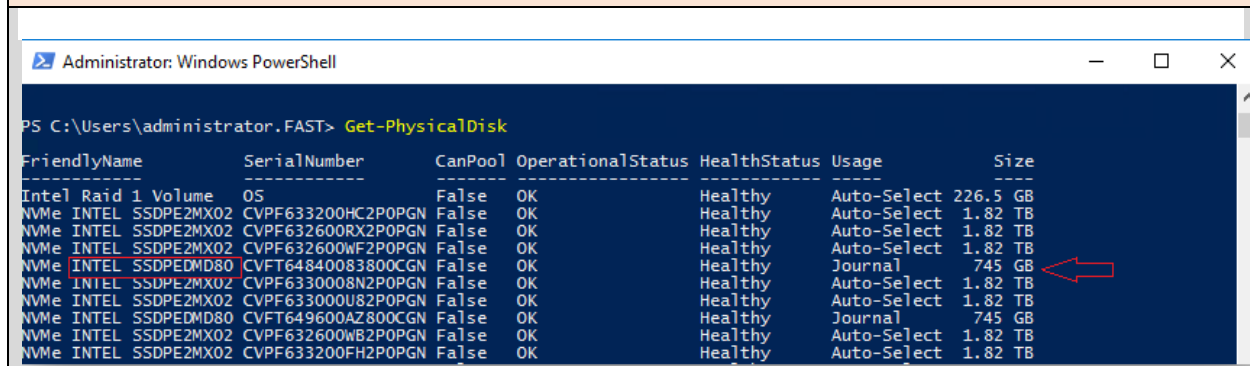
Step 1a. Storage Spaces Direct with cache drives

If you have cache drives, use the following example

Configure Storage Spaces Direct's cache tier with performance devices, such as NVMe SSDs. Use this command to identify the friend name of the highest performance device.

As administrator, run:

```
Get-PhysicalDisk
```



```
PS C:\Users\administrator.FAST> Get-PhysicalDisk
```

FriendlyName	SerialNumber	CanPool	OperationalStatus	HealthStatus	Usage	Size
Intel RAID 1 Volume	05	False	OK	Healthy	Auto-Select	226.5 GB
NVMe INTEL SSDPE2MX02	CVPF633200HC2P0PGN	False	OK	Healthy	Auto-Select	1.82 TB
NVMe INTEL SSDPE2MX02	CVPF632600RX2P0PGN	False	OK	Healthy	Auto-Select	1.82 TB
NVMe INTEL SSDPE2MX02	CVPF632600WF2P0PGN	False	OK	Healthy	Auto-Select	1.82 TB
NVMe INTEL SSDPEDMD80	CVFT64840083800CGN	False	OK	Healthy	Journal	745 GB
NVMe INTEL SSDPE2MX02	CVPF6330008N2P0PGN	False	OK	Healthy	Auto-Select	1.82 TB
NVMe INTEL SSDPE2MX02	CVPF633000U82P0PGN	False	OK	Healthy	Auto-Select	1.82 TB
NVMe INTEL SSDPEDMD80	CVFT649600AZ800CGN	False	OK	Healthy	Journal	745 GB
NVMe INTEL SSDPE2MX02	CVPF632600WB2P0PGN	False	OK	Healthy	Auto-Select	1.82 TB
NVMe INTEL SSDPE2MX02	CVPF633200FH2P0PGN	False	OK	Healthy	Auto-Select	1.82 TB

Change the **CacheDeviceModel** and enable it as journal cache.

```
Enable-ClusterS2D -CacheDeviceModel 'INTEL SSDPE2MD80'
```

Continue to Step 2.

Step 1b. Storage Spaces Direct without Cache Drives

For clusters with all SSDs as capacity (with no cache drives), run:

```
Enable-ClusterS2D -CacheState Disabled
```

Step 2: Check the enable cache report

```
Invoke-Item C:\Windows\cluster\Reports\
```

Step 3: Check the storage pool size in TB or GB (single pool)

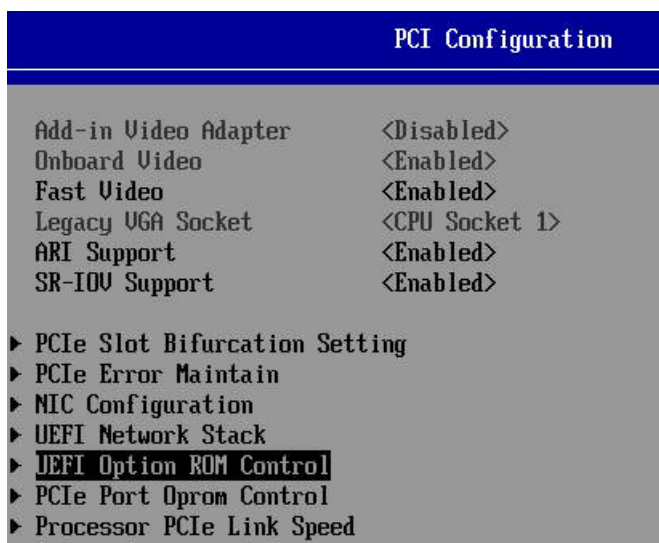
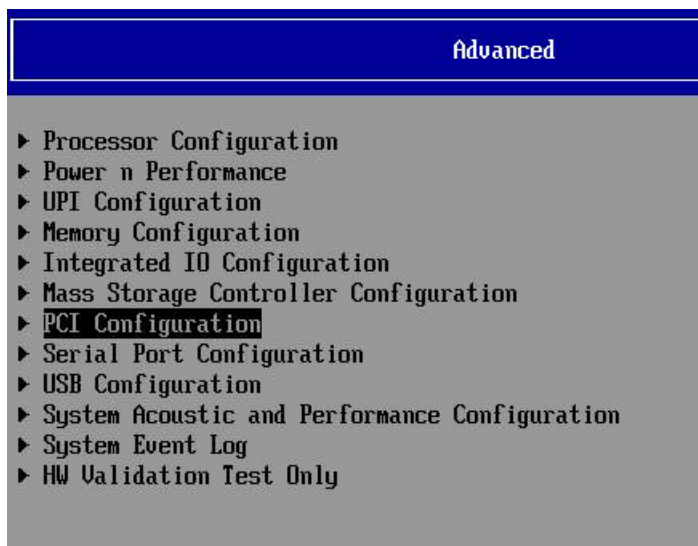
```
Get-StoragePool S2* | ft FriendlyName, @{n='Size in TB';e={$_.Size / 1TB}}  
Get-StoragePool S2* | ft FriendlyName, @{n='Size in GB';e={$_.Size / 1GB}}
```

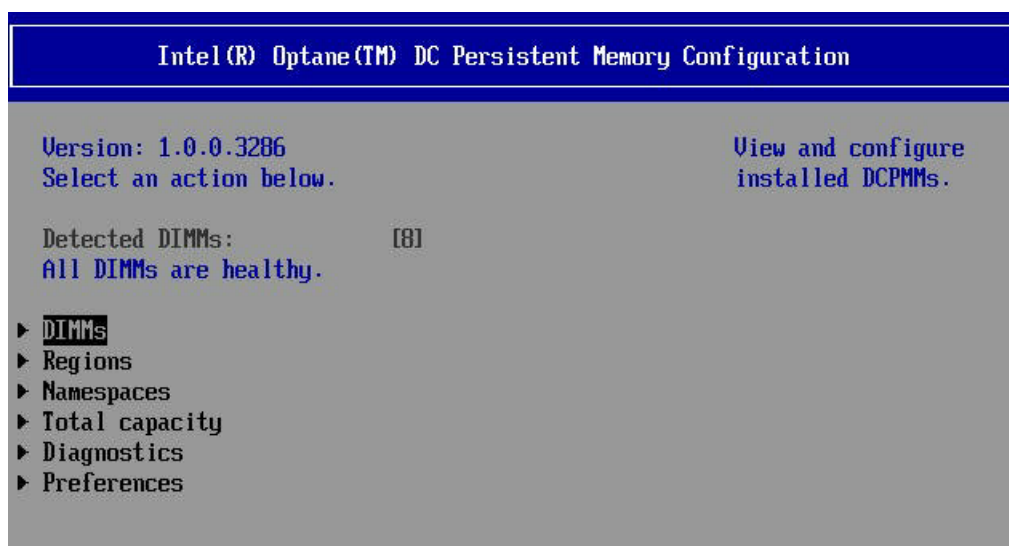
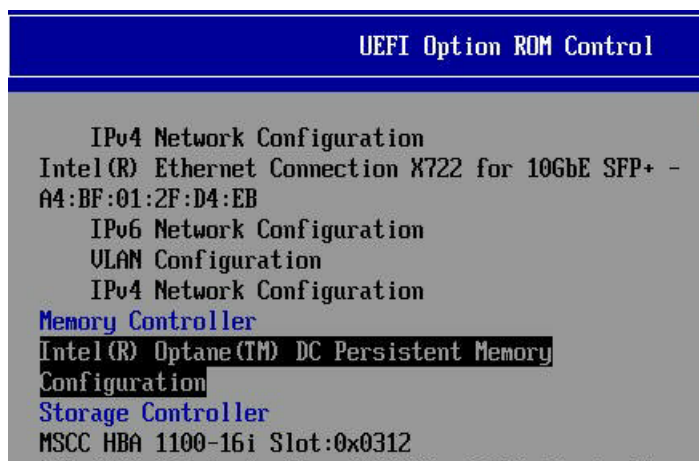
Step 4: Create 2-way mirror volume, one volume per node

```
Get-ClusterNode |% { New-Volume -StoragePoolFriendlyName S2D* -FriendlyName $_ -FileSystem  
CSVFS_ReFS -Size <size>TB -ResiliencySettingName "Mirror" -PhysicalDiskRedundancy 1 }
```

Persistent Memory BIOS Configuration for Memory Mode

1. Advanced > PCI Configuration > UEFI Option ROM Control > Intel® Optane™ DC Persistent Memory Configuration > Regions > Create goal config





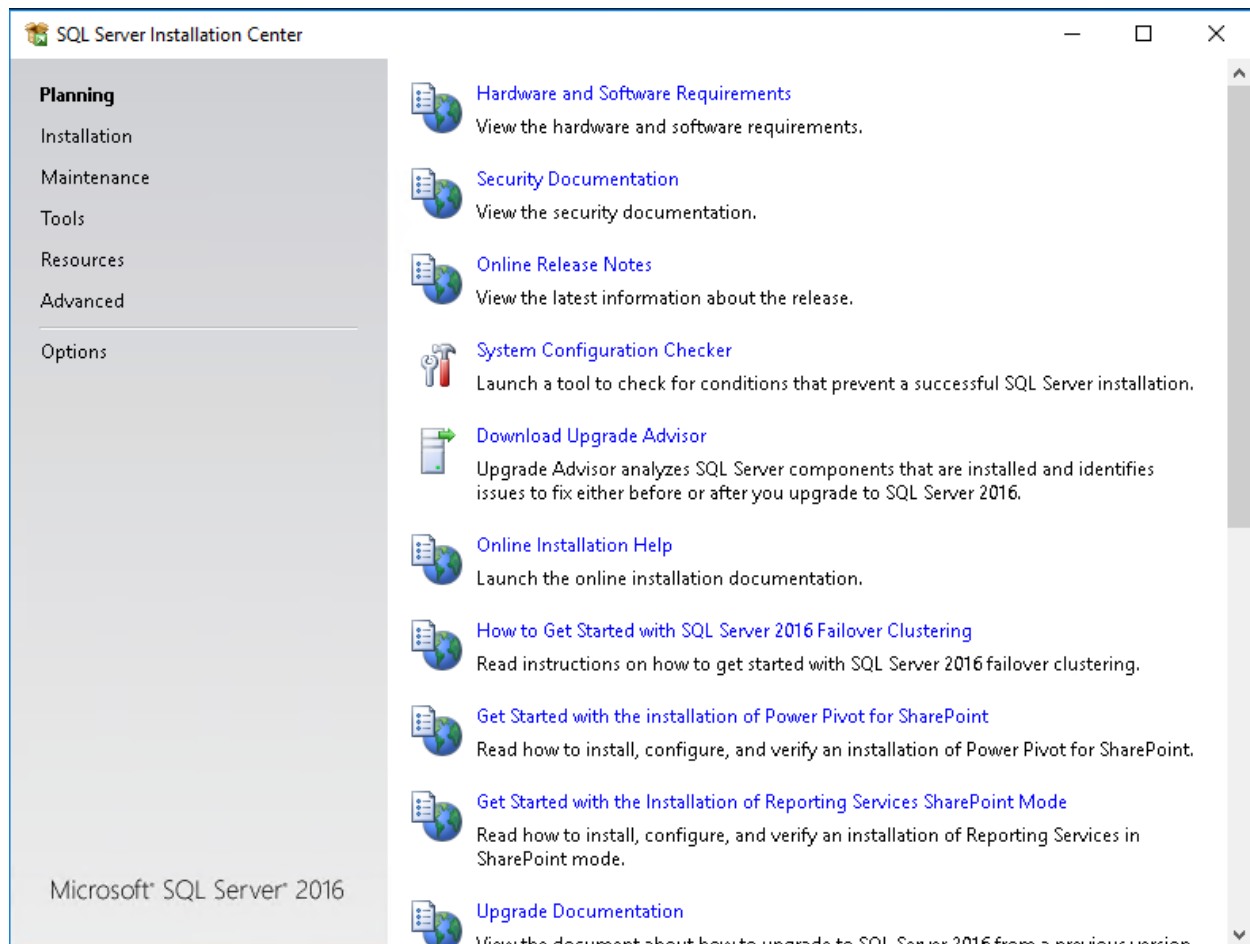
Create Goal Config	
Select the scope of the new region then set the desired sizes.	Select target to create goal config.
Create goal config for:	<Platform>
Reserved [%]:	[0]
Memory Mode [%]:	[0]
Persistent memory type:	<App Direct>
Namespace Label version:	<1.2>
<ul style="list-style-type: none">▶ Create goal config▶ Back to Regions menu▶ Back to main menu	

2. Change the Memory % from [0] to [100]
3. Select Create goal config
4. Save change and reboot

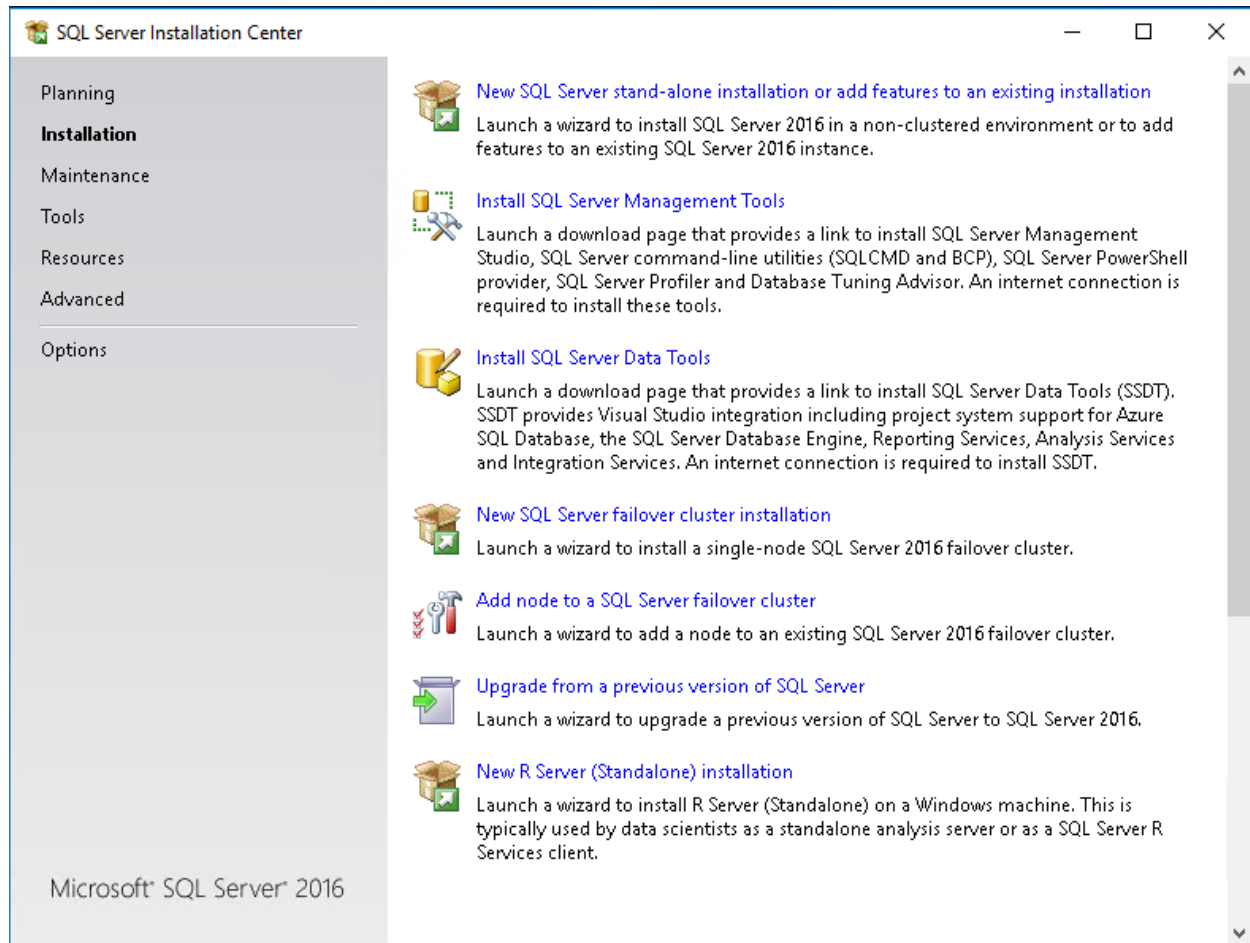
Installing Microsoft SQL Server

Install SQL Server 2017 Enterprise Edition by following these steps. Next listed is a generic process for installing Microsoft SQL Server 2017. Refer to Microsoft collateral for details on specific installation requirements.

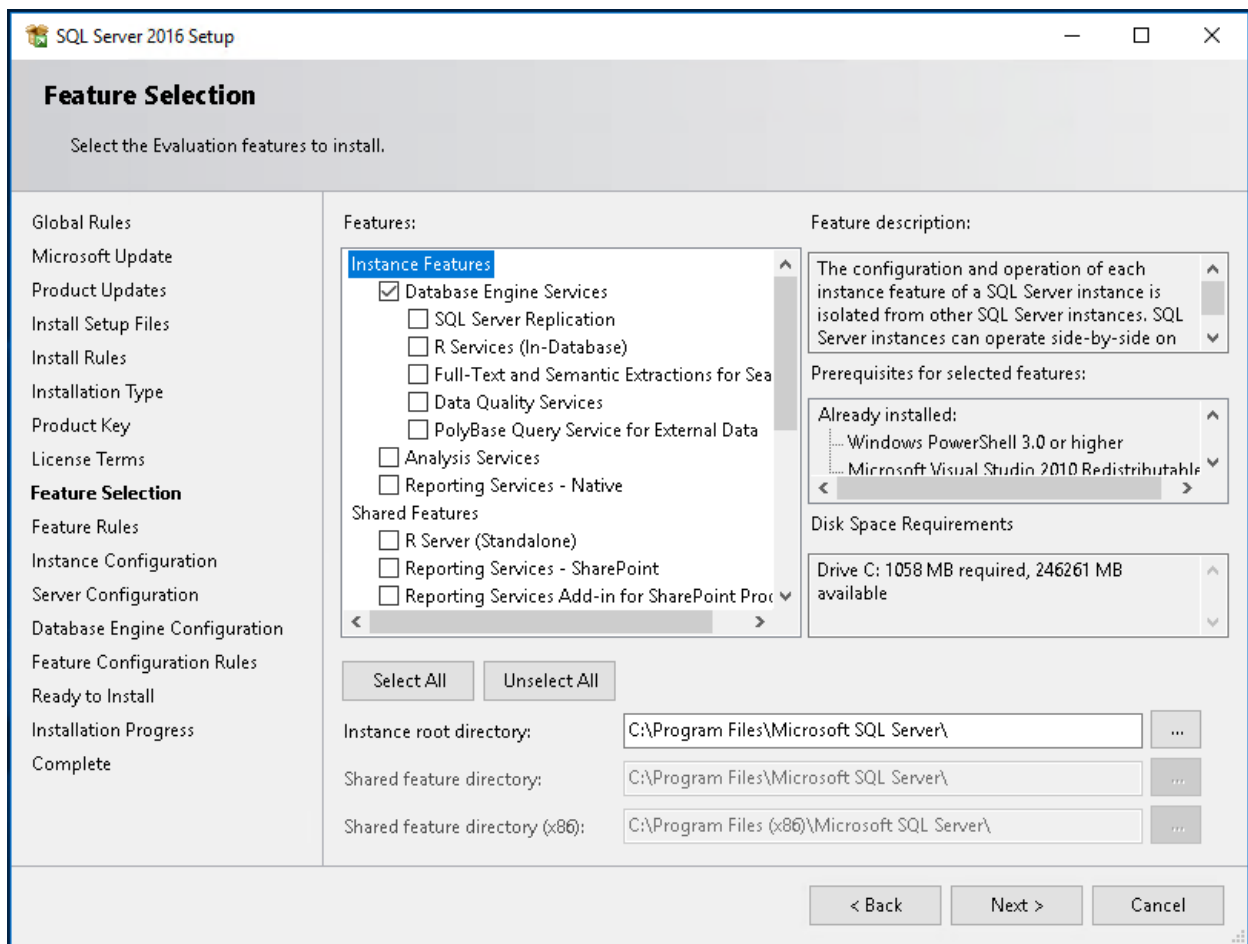
1. Download SQL Server 2017 installables from the Microsoft web site onto the server.
2. Click "Setup.exe" to open "SQL Server Installation Center".



3. Go to the "Installation" section and select "New SQL Server stand-alone or add features to an existing installation". Then "SQL Server 2016 Setup" will open



4. On the "Feature Selection" page, select "Database Engine Services"



5. Select "Default Instance" on the Instance Configuration.

SQL Server 2016 Setup

Instance Configuration

Specify the name and instance ID for the instance of SQL Server. Instance ID becomes part of the installation path.

☒ Default instance

☐ Named instance:

Instance ID:

SQL Server directory: C:\Program Files\Microsoft SQL Server\MSSQL13.MSSQLSERVER

Analysis Services directory: C:\Program Files\Microsoft SQL Server\MSAS13.MSSQLSERVER

Reporting Services directory: C:\Program Files\Microsoft SQL Server\MSRS13.MSSQLSERVER

Installed instances:

Instance Name	Instance ID	Features	Edition	Version
---------------	-------------	----------	---------	---------

< Back Next > Cancel

6. On the "Server Configuration" page, check "Grant Perform Volume Maintenance Task privilege to SQL Server Database Engine Service" check box.

Server Configuration

Specify the service accounts and collation configuration.

Global Rules
Microsoft Update
Install Setup Files
Install Rules
Product Key
License Terms
Feature Selection
Feature Rules
Instance Configuration
Server Configuration
Database Engine Configuration
Feature Configuration Rules
Ready to Install
Installation Progress
Complete

Service Accounts Collation

Microsoft recommends that you use a separate account for each SQL Server service.

Service	Account Name	Password	Startup Type
SQL Server Agent	NT Service\SQLSERVERA...		Manual
SQL Server Database Engine	NT Service\MSSQLSERVER		Automatic
SQL Server Browser	NT AUTHORITY\LOCAL ...		Disabled

☒ **Grant Perform Volume Maintenance Task privilege to SQL Server Database Engine Service**

This privilege enables instant file initialization by avoiding zeroing of data pages. This may lead to information disclosure by allowing deleted content to be accessed.

[Click here for details](#)

< Back Next > Cancel

7. On the "Database Engine Configuration" page, select "Mixed authentication Mode" , chose a password for SA and "Add current user"

SQL Server 2016 Setup

Database Engine Configuration

Specify Database Engine authentication security mode, administrators, data directories and TempDB settings.

Product Key
License Terms
Global Rules
Microsoft Update
Product Updates
Install Setup Files
Install Rules
Feature Selection
Feature Rules
Instance Configuration
PolyBase Configuration
Server Configuration
Database Engine Configuration
Analysis Services Configuration
Reporting Services Configuration
Distributed Replay Controller
Distributed Replay Client
Consent to install Microsoft R ...
Feature Configuration Rules

Server Configuration | Data Directories | TempDB | FILESTREAM

Specify the authentication mode and administrators for the Database Engine.

Authentication Mode

☐ Windows authentication mode

☒ Mixed Mode (SQL Server authentication and Windows authentication)

Specify the password for the SQL Server system administrator (sa) account.

Enter password: [password field]

Confirm password: [password field]

Specify SQL Server administrators

WIN-O9MRIH19CBV\Administrator (Administrator)

SQL Server administrators have unrestricted access to the Database Engine.

Add Current User | Add... | Remove

< Back | Next > | Cancel

8. Select "TempDB"

SQL Server 2017 Setup

Database Engine Configuration

Specify Database Engine authentication security mode, administrators, data directories and TempDB settings.

Product Key
License Terms
Global Rules
Microsoft Update
Product Updates
Install Setup Files
Install Rules
Feature Selection
Feature Rules
Instance Configuration
Server Configuration
Database Engine Configuration
Feature Configuration Rules
Ready to Install
Installation Progress
Complete

Server Configuration | Data Directories | TempDB | FILESTREAM

Specify the authentication mode and administrators for the Database Engine.

Authentication Mode

☐ Windows authentication mode

☒ Mixed Mode (SQL Server authentication and Windows authentication)

Specify the password for the SQL Server system administrator (sa) account.

Enter password:

Confirm password:

Specify SQL Server administrators

WIN-F7FE0NPAN14\Administrator (Administrator)

SQL Server administrators have unrestricted access to the Database Engine.

Add Current User Add... Remove

< Back Next > Cancel

1. For Plus configurations, change "Number of files" to 24
2. For Base configuration, change "Number of files" to 6
3. Log directory: Change to the Log Pool create at Section 7.1.1
4. DataON directories: add all disks for the temp DB

Database Engine Configuration

Specify Database Engine authentication security mode, administrators, data directories and TempDB settings.

Product Key
License Terms
Global Rules
Microsoft Update
Product Updates
Install Setup Files
Install Rules
Feature Selection
Feature Rules
Instance Configuration
Server Configuration
Database Engine Configuration
Feature Configuration Rules
Ready to Install
Installation Progress
Complete

Server Configuration Data Directories TempDB FILESTREAM

TempDB data files: tempdb.mdf, tempdb_mssql_#.ndf

Number of files: 24

Initial size (MB): 8 Total initial size (MB): 192

Autogrowth (MB): 64 Total autogrowth (MB): 1536

Data directories:

- D:\mssql2017\temp
- E:\mssql2017\temp
- F:\mssql2017\temp
- G:\mssql2017\temp
- H:\mssql2017\temp
- I:\mssql2017\temp

Add... Remove

TempDB log file: templog.ldf

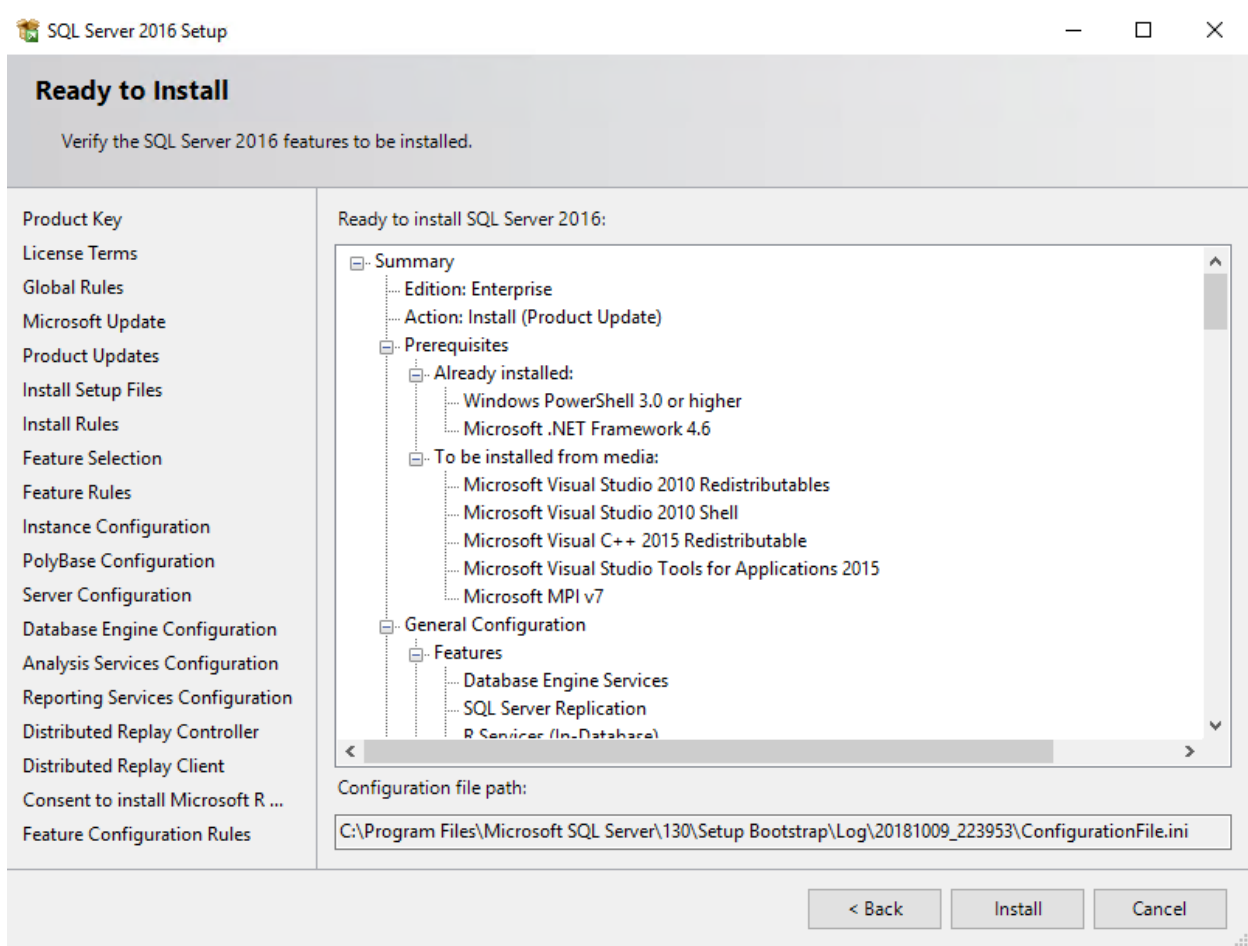
Initial size (MB): 8 Setup could take longer with large initial size.

Autogrowth (MB): 64

Log directory: L:\mssql2017\temp_log

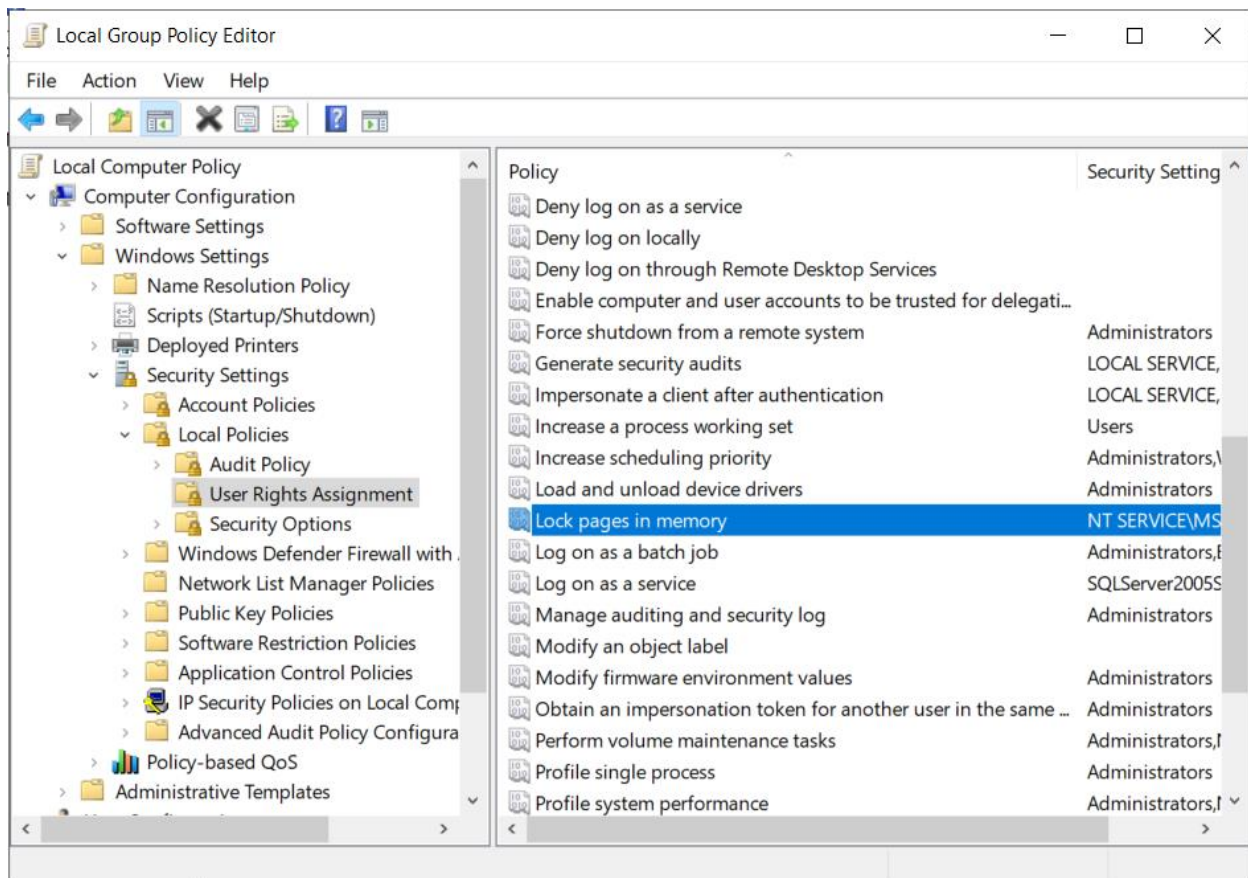
< Back Next > Cancel

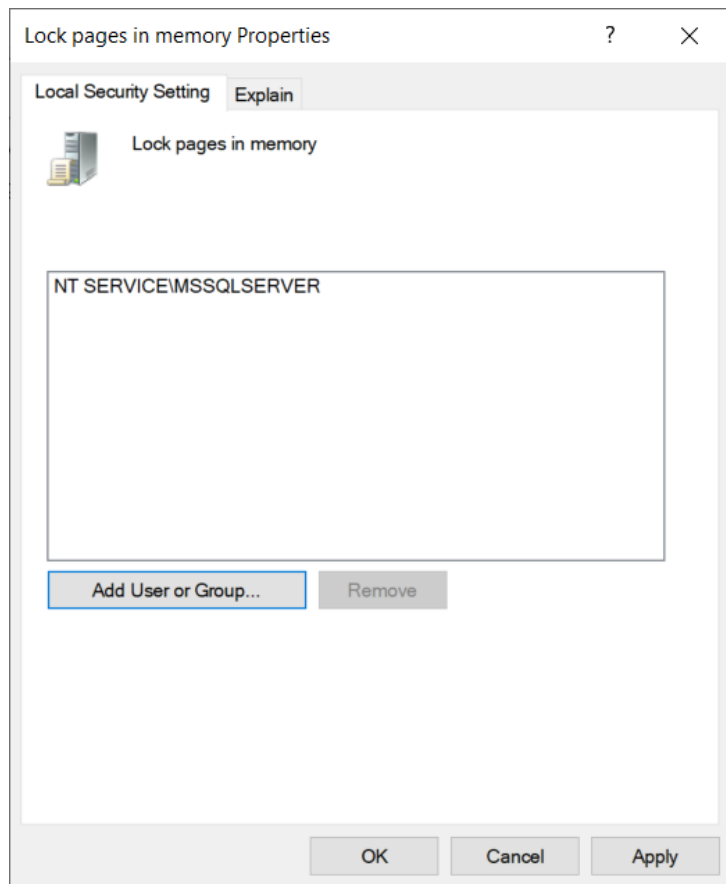
8. On the "Ready to Install" page, click "Install"



9. Configure 'Lock pages in memory'

1. Run gpedit.msc
2. Go to > Computer Configuration > Windows Settings > Security Settings > Local Policies > User Rights Assignment > right click "Lock pages in memory" select "properties"
3. Click Add User or Group
4. Add the SQL Server user to Lock pages in memory





10. Once SQL server is installed, you may also apply latest cumulative patches released by Microsoft on top of SQL Server 2017.

11. Install SQL Server Management Studio by following the next steps.

1. Download SQL Server Management Studio from this web site.
<https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-2017>
2. Double click the file "SSMS-Setup-ENU.exe" to install SQL Server Management Studio.

SQL Server installation

Title	Description
Install SQL Server on Server Core	Review this article to install SQL Server on Windows Server Core.
Check Parameters for the System Configuration Checker	Discusses the function of the System Configuration Checker (SCC).
Install SQL Server from the Installation Wizard (Setup)	Procedural article for a typical SQL Server installation by using the Installation Wizard.
Install SQL Server from the Command Prompt	Procedural article that provides sample syntax and installation parameters for running unattended Setup.
Install SQL Server Using a Configuration File	Procedural article that provides sample syntax and installation parameters for running Setup through a configuration file.
Install SQL Server Using SysPrep	Procedural article that provides sample syntax and installation parameters for running Setup through SysPrep.
Add Features to an Instance of SQL Server (Setup)	Procedural article for updating components of an existing instance of SQL Server.
Repair a Failed SQL Server Installation	Procedural article for repairing a corrupt SQL Server installation.
Rename a Computer that Hosts a Stand-Alone Instance of SQL Server	Procedural article for updating system metadata that is stored in sys.servers.
Install SQL Server Servicing Updates	Procedural article for installing updates for SQL Server.
View and Read SQL Server Setup Log Files	Procedural article for checking errors in setup log files.
Validate a SQL Server Installation	Review the use of the SQL Discovery report to verify the version of SQL Server and the SQL Server features installed on the computer.

How to install individual components

Title	Description
Install SQL Server Database Engine	Describes how to install and configure the SQL Server Database Engine.
Install SQL Server Replication	Describes how to install and configure SQL Server Replication.
Install Distributed Replay - Overview	Lists down the articles to install the Distributed Replay feature.
Install SQL Server Management Tools with SSMS	Describes how to install and configure SQL Server management tools.
Install SQL Server PowerShell	Describes the considerations for installing SQL Server PowerShell components.

How to configure SQL Server

Title	Description
Configure the Windows Firewall to Allow SQL Server Access	This article provides an overview of firewall configuration and how to configure the Windows firewall.
Configure a Multi-Homed Computer for SQL Server Access	This article describes how to configure SQL Server and Windows Firewall with Advanced Security to provide for network connections to an instance of SQL Server in a multi-homed environment.
Configure the Windows Firewall to Allow Analysis Services Access	You can follow the steps provided in this article to configure both port and firewall settings to allow access to Analysis Services or Power Pivot for SharePoint.

DataON MUST for Windows Admin Center

SerialNumber	Slot	Health Status	Model name	Type	Size	Used For	Usage
v17698-N1.fast.dataonstorage.com							
CVPF634200DPA50...	0	Healthy	INTEL SSDPE2MX45	NVMe	419.19 GB	Capacity	40.74%
CVPF634600KD450...	1	Healthy	INTEL SSDPE2MX45	NVMe	419.19 GB	Capacity	40.98%
CVPF634600G6R450R...	2	Healthy	INTEL SSDPE2MX45	NVMe	419.19 GB	Capacity	40.98%
CVPF634600G6N450...	3	Healthy	INTEL SSDPE2MX45	NVMe	419.19 GB	Capacity	40.74%
CVPF634600G26450R...	4	Healthy	INTEL SSDPE2MX45	NVMe	419.19 GB	Capacity	40.98%
CVPF634200AT450R...	5	Healthy	INTEL SSDPE2MX45	NVMe	419.19 GB	Capacity	40.74%
v17698-N3.fast.dataonstorage.com							
CVPF633300D2450...	0	Healthy	INTEL SSDPE2MX45	NVMe	419.19 GB	Capacity	48.37%

DataON MUST™ (Management Utility Software Tool) provides a high level of infrastructure visibility, monitoring, and management for Windows Server-based hyper-converged systems, networking and storage. Built to support Microsoft's suite of software-defined storage technologies, including Storage Spaces Direct, Storage Replica and Storage Quality-of-Service (QoS), MUST simplifies data center management and helps enterprise customers transition from traditional SANs to a Windows Server-based hyper-converged infrastructure.

MUST can be used through its standalone console or can be used within Windows Admin Center, allowing customers to use both Windows Admin Center and MUST through a single pane of glass.

Window Admin Center is an evolution of Windows Server management tools that complements but does not replace, System Center and Operations Management Suite. It gives you full control over all aspects of your server infrastructure from a locally deployed, browser-based management experience. MUST enhance the Windows Admin Center experience with expanded functionality:

- **Historic Data Reporting** – Provides real-time and monthly dashboards of your system performance data including IOPS, latency, throughput on your cluster, storage pool, volume, and nodes.

- **Disk Mapping** – MUST displays the device types and components in each of the nodes, providing a clear disk map of your entire node. It shows the number of disks, disk type, location and slot of each drive, and disk health status.
- **System Alerts** – Leverages Windows Health Service faults to identify hardware failures, configuration issues, and resource saturation. It also provides a multi-level assessment of specific locations, fault descriptions, and recovery actions. You can also leverage third-party SNMP monitoring traps to alert you when you need disk or hardware replacements.
- **SAN-like Call Home Service** – Prompted by system alerts, administrators can have automated email alerts sent to key contacts.

Installing the DataON MUST extension

To utilize DataON's MUST extension, you will first need to [download and install Windows Admin Center](#).

Step 1: Download Windows Admin Center

Look for the **Get it Here** link at the top. Windows Admin Center can be installed on Windows 10 or Windows Server 2016/2019.

Step 2: Add cluster to Windows Admin Center

After installing Windows Admin Center, add the HCI cluster using the following steps:

Click the **+ Add** to add your cluster. Select **Hyper-converged Cluster Connection**

Input the cluster name or the hostname of one of the server cluster nodes (Windows Admin Center will find the rest).

Select the cluster by the cluster name that you've just added. In the type column, it should be listed as a **Hyper-Converged Cluster**. Select that link to see the default HCI dashboard components in Windows Admin Center.

Step 3: Install DataON's MUST extension for Windows Admin Center:

Click on the upper right gear icon.

Select **Extensions** on the left side bar

Select **DataON MUST** from the list then click **Install**. Windows Admin Center will ask for a confirmation to continue.

Click on **Windows Admin Center** on the upper left corner to return to the Windows Admin Center's homepage

Return to the HCI cluster you previously added. You should now see **DataON MUST** near the bottom on the left side under **Extensions**.

MUST will automatically detect the DataON server model then collect the disk information. It will then display the disk mapping. This may take a few minutes.

After the mapping completes, you can visit the **Alerts** tab to request for a code from DataON to setup alerts for HCI events.

Once you receive the code from DataON, you can input it into the extension to setup your SMTP server information and individual users who will receive alerts generated by Windows Server's Health Service.

Intel® Select Solutions

Intel® Select Solutions are workload-optimized data center solutions that simplify and accelerate the process of selecting and deploying the hardware and software needed for today's workloads and applications.

Intel® Select Solutions:

- Simplify evaluation and eliminate guesswork via tightly specified hardware and software components
- Have pre-defined settings and system-wide tuning enabling smooth deployment
- Are designed and benchmarked to perform optimally for specific workloads

Based on 2nd Generation Intel® Xeon™ Scalable processors, Intel® Select Solutions enable enterprises to make confident choices in deploying data center infrastructure.

Intel® Select Solutions are rigorously tested and benchmarked at a system-wide level. Well-known third party and industry benchmarking tools that simulate real-world loads are used to identify and eliminate pressure points.

DataON and Intel have collaborated to create an Intel® Select Solution for Microsoft Azure Stack HCI and Intel® Select Solutions for Microsoft SQL Server* Business Operations.

Component		Required/ Recommended	Quantity
Description	1-Tier storage configuration capacity / Throughput optimized 2-node minimum (1LM config)	N/A	2
Platform	Intel® Server Board S2600WFT qual	N/A	1
CPU	2x Intel® Xeon® Gold 8260 Y CPU; 2.40GHz, 24 Cores, 2 processors per node	Required	2
Memory (min.)	384GB (16x 16GB 2666MHz 288-pin DDR4 RDIMM)	Required	16
Boot Drive	1x Intel® SSD D3-S4510 Series (480GB, 2.5" SATA 6Gb/s, 3D2, TLC)	Recommended	1
Cache Tier (NUMA balanced)	NVMe single tier (see below)		
Capacity Tier (NUMA balanced)	Intel® SSD DC P4610 Series (1.6TB, 2.5" PCIe 3.1 x4, 3D2, TLC) (1-tier)	Required	8
Data Network	10GbE Data network (x-over to 2 nd node)	Required	1
Mgmt. Network	Intel® Ethernet Connection X722	Recommended	1

Intel® Select Solution Edge Base Configuration (6.4TB RAW)

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Appendix

Collateral

[Microsoft Windows – Compare Features in Windows Server versions](#)

[DataON MUST datasheet](#)

Videos

[Hyper-Converged Infrastructure Deployment with Windows Server](#)

[Storage Spaces Direct in Windows Server 2016 presentation](#)

[Windows 2019 Deep Dive](#)

[Windows Admin Center](#)

[HCI Management with Windows Admin Center](#)

[DataON MUST demo video](#)

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