Microsoft Azure

Azure Stack HCI

Monitoring and Troubleshooting – High Level

Hyperconverged Architecture

Hyperconverged Troubleshooting!

Azure Stack HCI consists of the following technologies each with their own lengthy troubleshooting methodologies.

Technologies are:

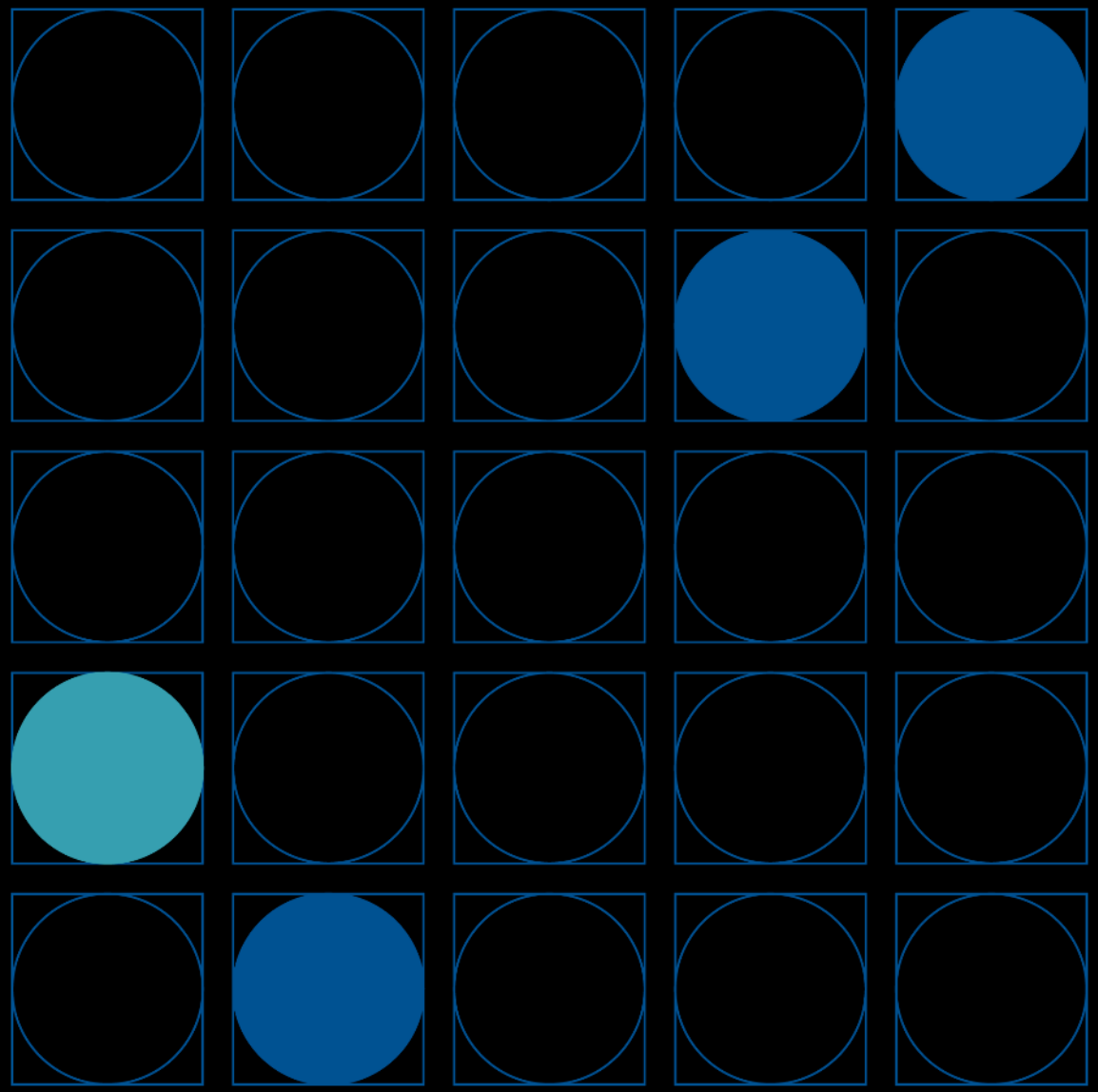
- **Hyper-V**
- **Failover Clustering**
- **Storage Spaces Direct**
- **Windows Admin Center**
- **Networking**
- **RDMA**
- **Software Defined Networking**

It would take a lot of time to cover every support situation or tools for these technologies.

So, let's look at monitoring and troubleshooting Azure Stack HCI at a high level.

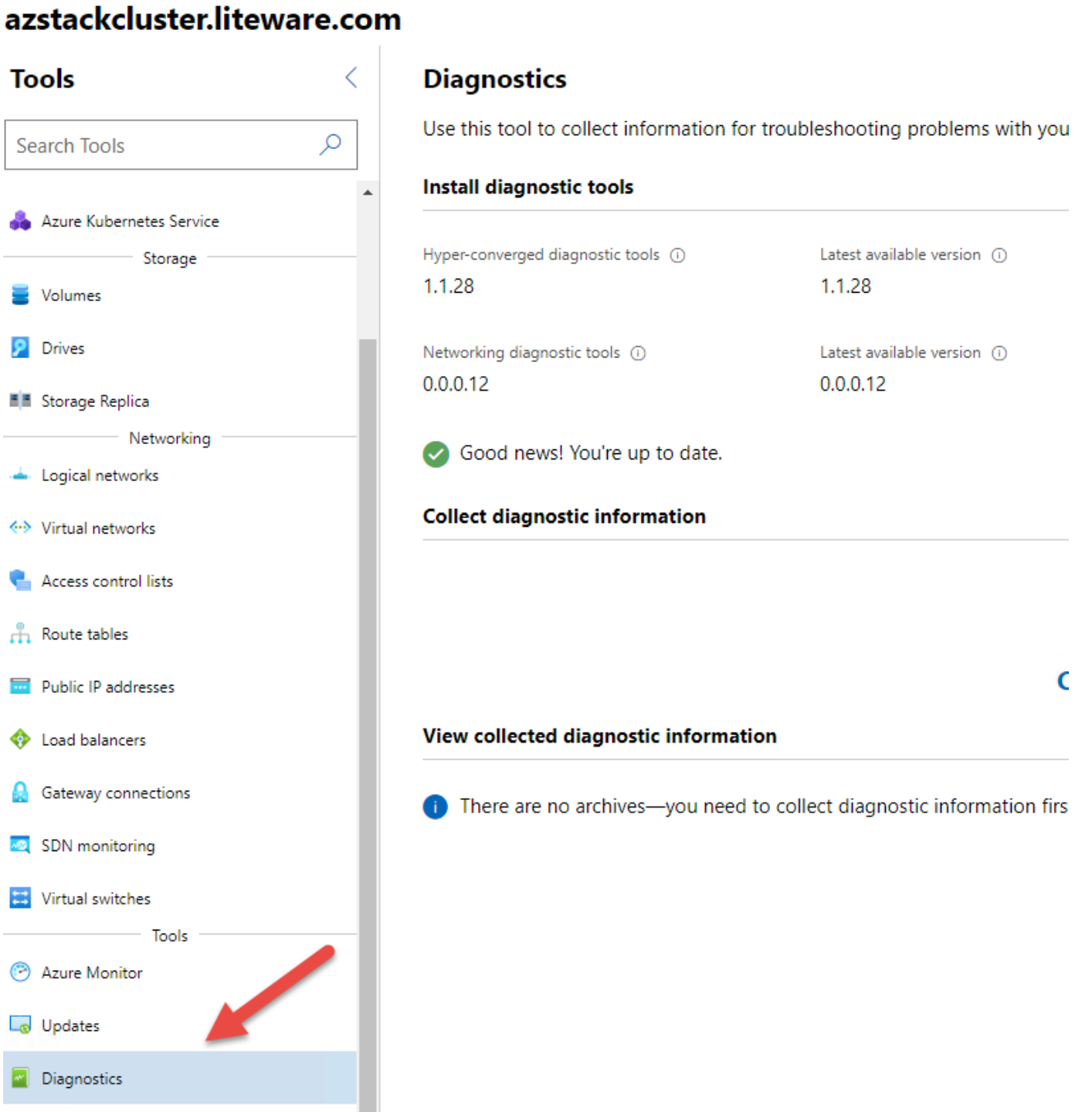
Microsoft Azure

Windows Admin Center Troubleshooting Tools

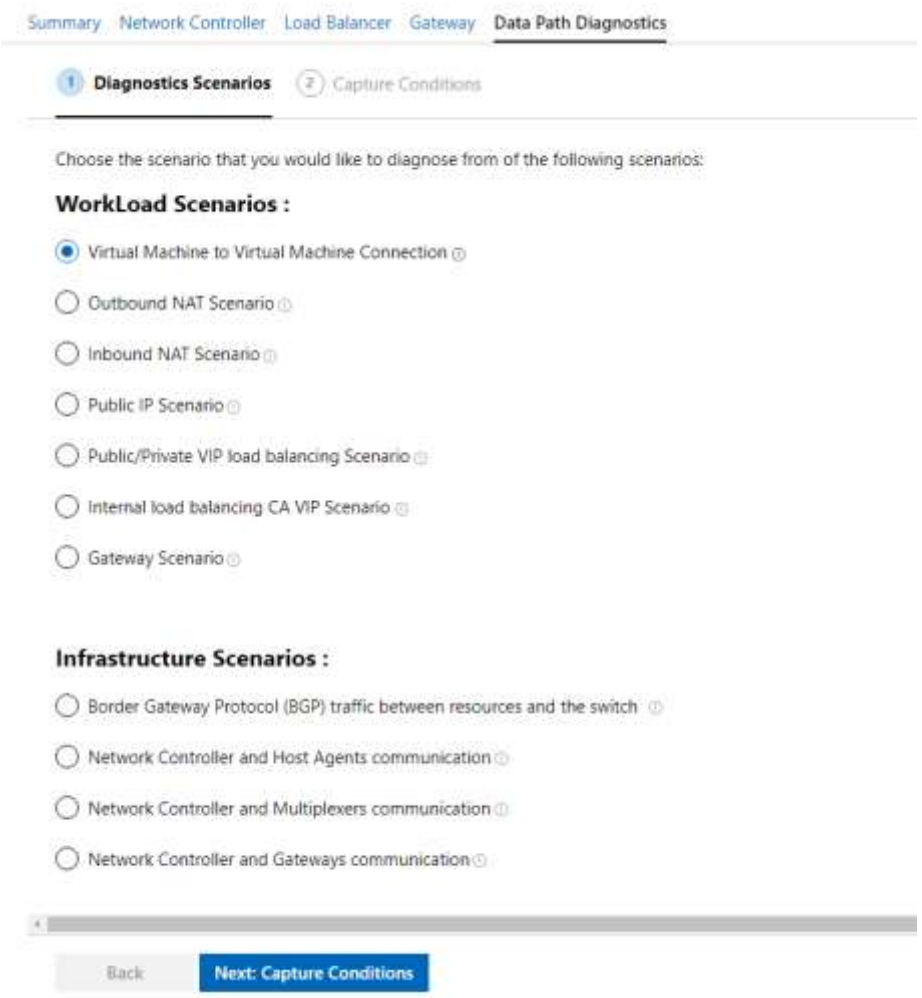


Diagnostics

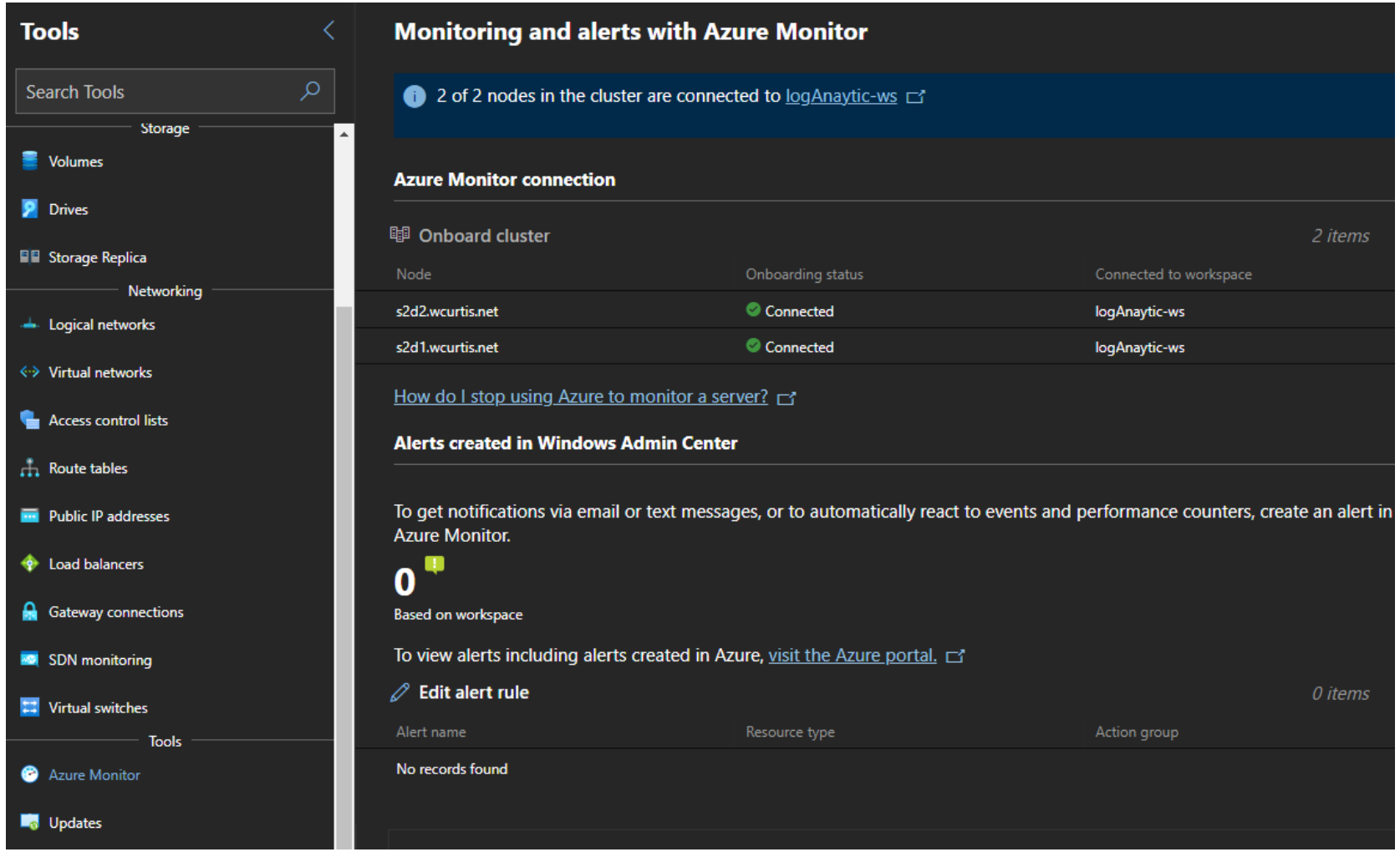
Use this tool to collect information for troubleshooting problems with your cluster. If you call Microsoft Support, they may ask for this information.



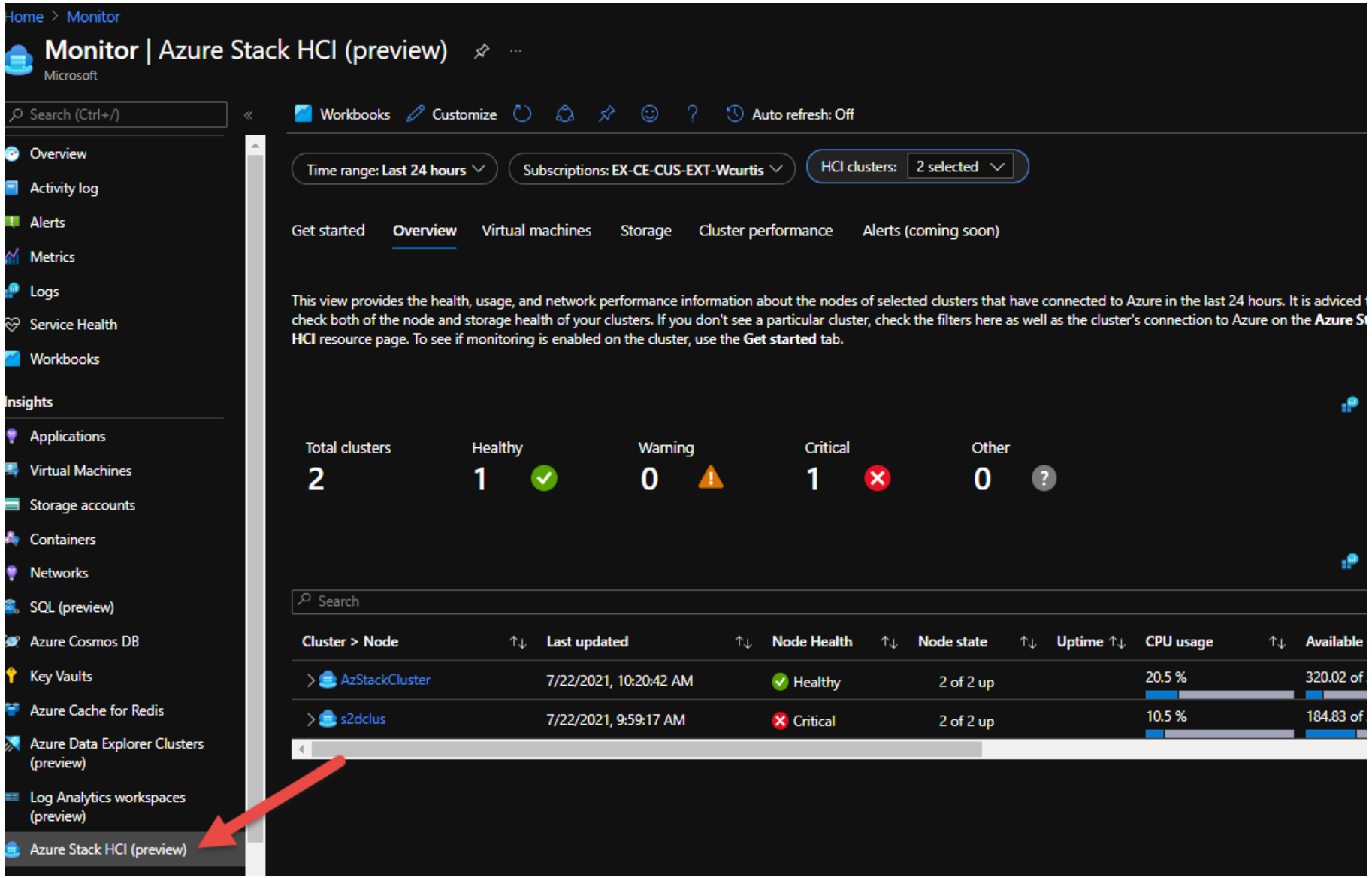
SDN Monitoring – Data Path Diagnostics



Azure Monitor in WAC

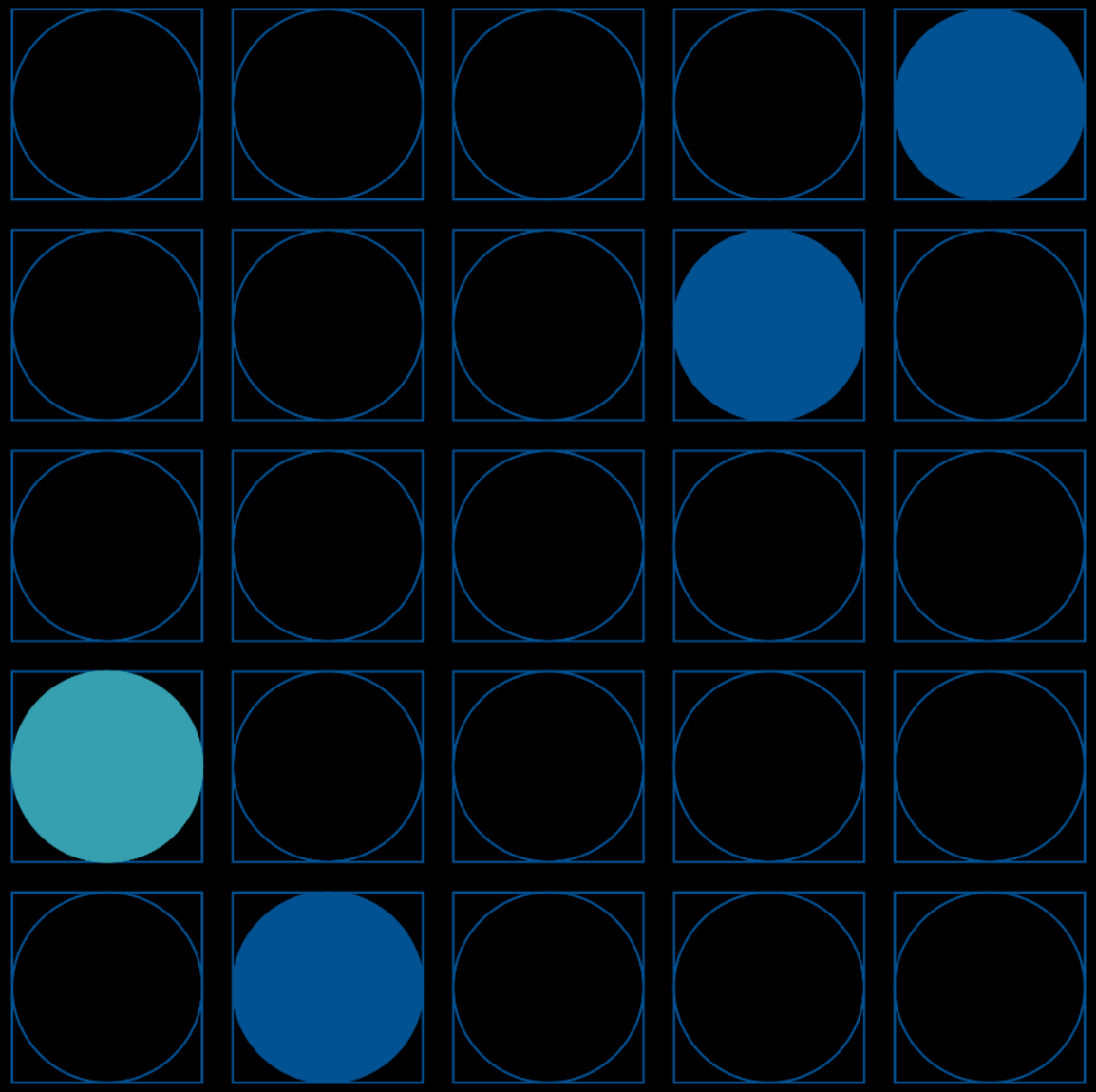


Azure Monitor – Azure Stack HCI and ARC

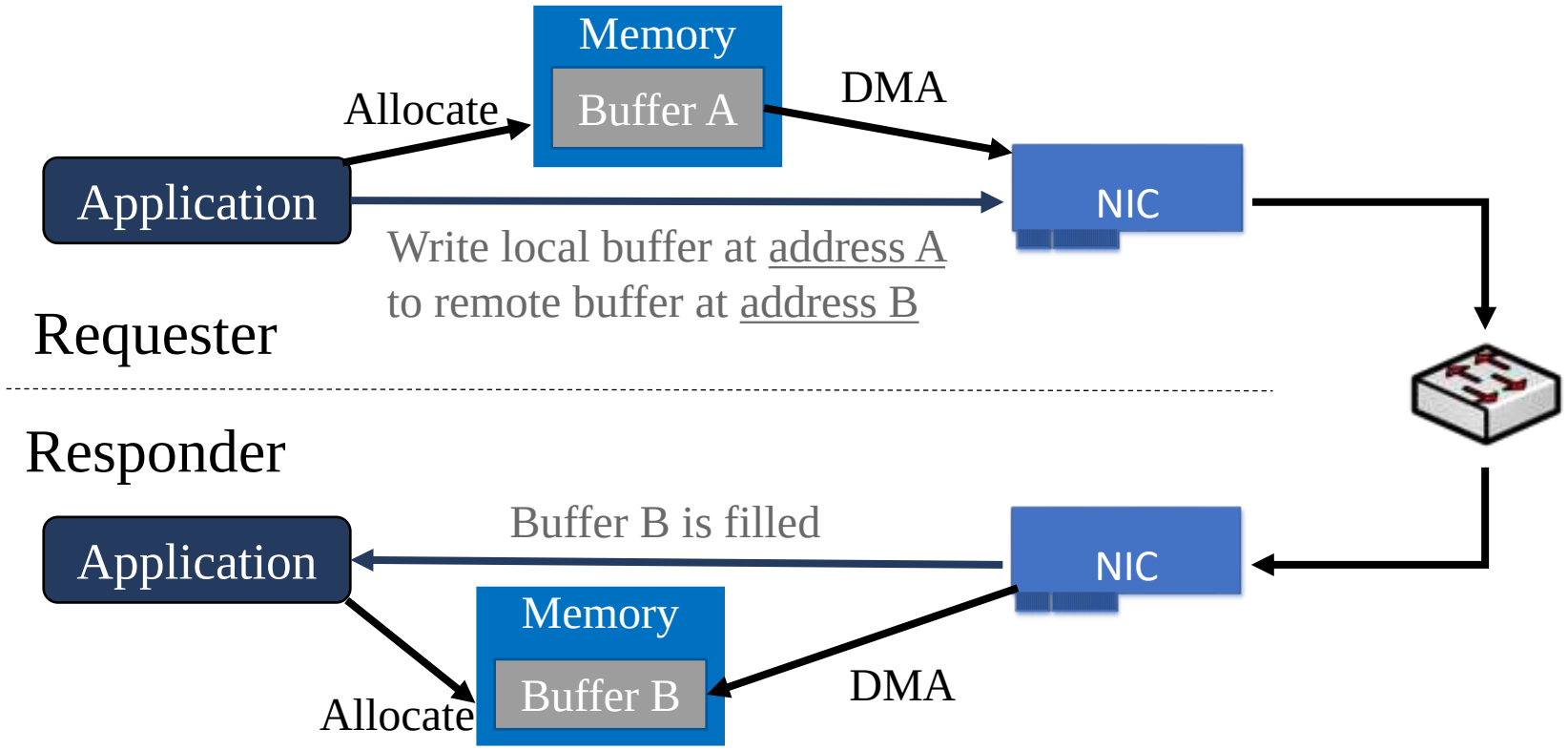


Microsoft Azure

RDMA Troubleshooting



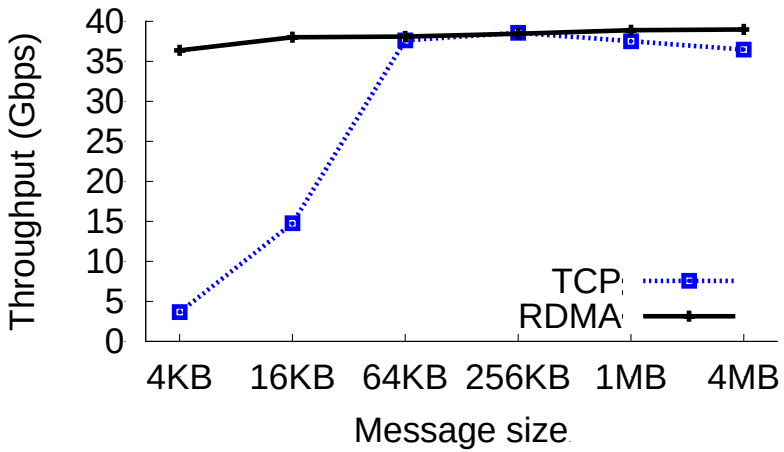
RDMA –Basic flow



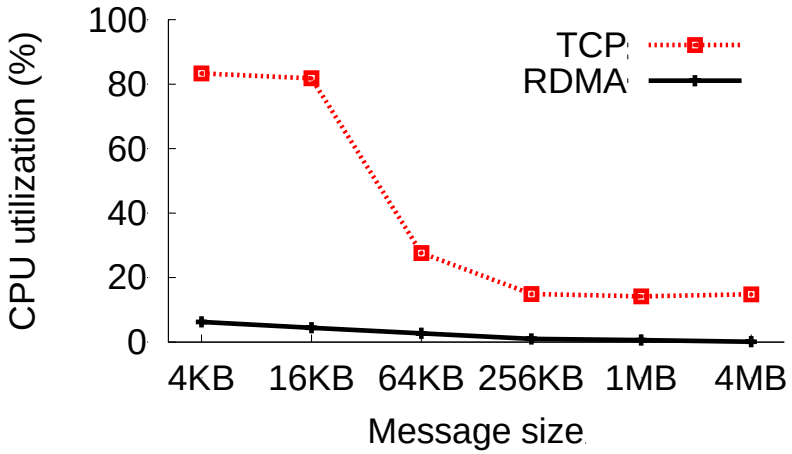
RDMA **bypasses host OS stack**
→ frees host CPU, lowers latency

Why use RDMA? RDMA Outperforms TCP

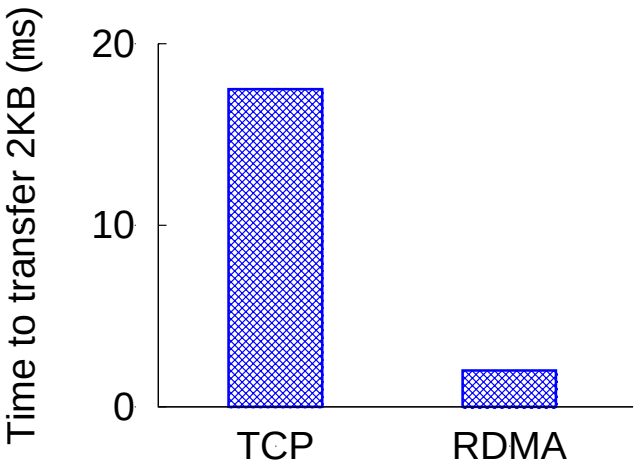
Micro Benchmarks:



RDMA single thread ~40Gbps



RDMA CPU ~0%



RDMA latency 1~2 μs

So, what do you do when Storage is Faster with RDMA Disabled?

- Check RDMA Activity Performance Counters
- Check your Switch Configuration (PFC Settings)
- Check your DCB settings on your Hyper-V Host (Validate DCB)
- If possible, switch out RDMA technologies (RoCE to iWARP).

\\s2d1

RDMA Activity	Mellanox ConnectX-3 Ethernet Adapter	Mellanox ConnectX-3 Ethernet Adapter #2
RDMA Accepted Connections	430.000	430.000
RDMA Active Connections	8.000	8.000
RDMA Completion Queue Errors	0.000	0.000
RDMA Connection Errors	0.000	0.000
RDMA Failed Connection Attempts	0.000	0.000
RDMA Inbound Bytes/sec	213,144.457	22,262.655
RDMA Inbound Frames/sec	262.834	41.131
RDMA Initiated Connections	4.000	4.000
RDMA Outbound Bytes/sec	301,813.867	80,130.310
RDMA Outbound Frames/sec	333.057	90.287

\\s2d2

RDMA Activity	Mellanox ConnectX-3 Ethernet Adapter	Mellanox ConnectX-3 Ethernet Adapter #2
RDMA Accepted Connections	4.000	4.000
RDMA Active Connections	8.000	8.000
RDMA Completion Queue Errors	0.000	0.000
RDMA Connection Errors	0.000	0.000
RDMA Failed Connection Attempts	0.000	0.000
RDMA Inbound Bytes/sec	321,163.236	76,312.522
RDMA Inbound Frames/sec	365.036	90.256
RDMA Initiated Connections	430.000	430.000
RDMA Outbound Bytes/sec	224,256.282	23,982.044
RDMA Outbound Frames/sec	264.751	41.117

Validate DCB

- Validate-DCB is a module that validates the RDMA and Data Center Bridging (DCB) configuration best practices on Windows.

- Validate-DCB v2.1 is a PowerShell-based unit test tool that allows you to:

  ✔ Validate the expected configuration on one to N number of systems or clusters

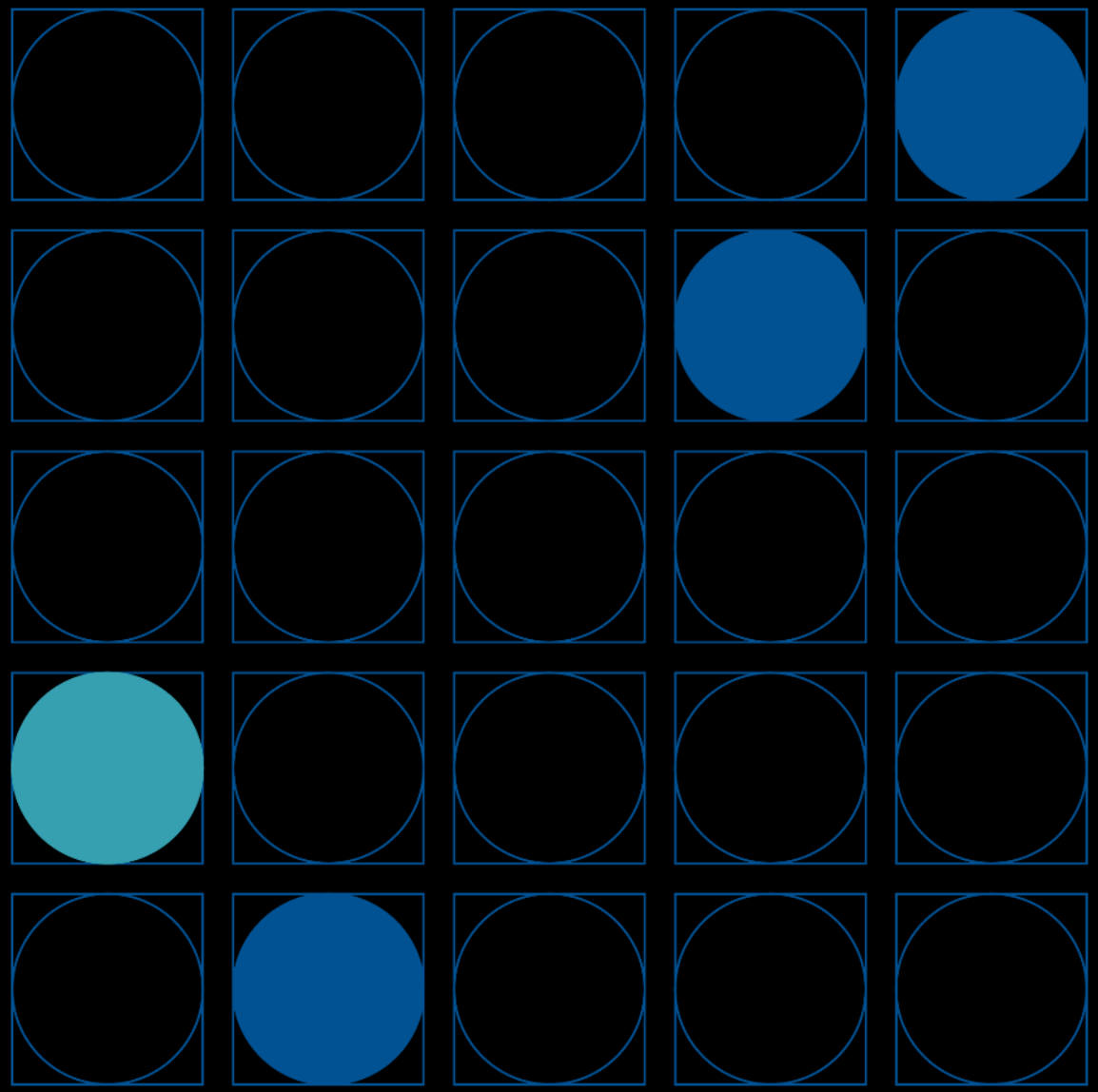
  ✔ Validate the configuration meets best practices

Test-RDMA

- Runs diskspd over network and tests performance
- Located at: SDN/Diagnostics at master · microsoft/SDN (github.com)
- To test RDMA with this script, schedule maintenance or use test-clusterhealth from DISKSPD VM Fleet, here
- Example: .\Test-RDMA.ps1 –IfIndex 6 –RemoteIpAddress ‘192.168.1.2’ –PathToDiskspd ‘c:\temp\dispd\amd64fre’

Microsoft Azure

Troubleshooting Tools



Test-ClusterHealth.PS1

- https://github.com/Microsoft/diskspd/blob/master/Frameworks/VMFleet/test-clusterhealth.ps1
- Checks Volumes health, SMB Connectivity errors, cluster symmetry.
- Recommended to run even in production environment

Copy/paste to PowerShell ISE to run or import as PS CMDlet

Needs to run from cluster node.

```
PS C:\windows\system32> C:\Users\stevenek\Documents\test-clusterhealth.ps1
******************** Basic Health Checks (23.0s)
All cluster nodes Up
All operational pools Healthy
******************** Clusport Device Symmetry Check (24.8s)
********** Total
Pass with 9 per node
********** Disk Type
Pass with 6 per node
********** Solid/Non-Rotational Media
Pass with 3 per node
********** Enclosure Type
Pass with 3 per node
********** Virtual
Pass with 3 per node
******************** Enclosure View Symmetry Check (26.5s)
********** Total
Pass with 3 per node
******************** Operational Issues and Storage Jobs (29.9s)
No storage rebuild or regeneration jobs are active
******************** Physical Disk Health (22.7s)
All physical disks are in normal auto-select or journal state
```

Get-ClusterDiagnosticInfo

- You can specify –verbose to reveal more info
- This command collects all necessary cluster info from each node
  - Event log
  - Cluster log
  - Systeminfo
  - Basic info in XML files
- Result is stored in ZIP

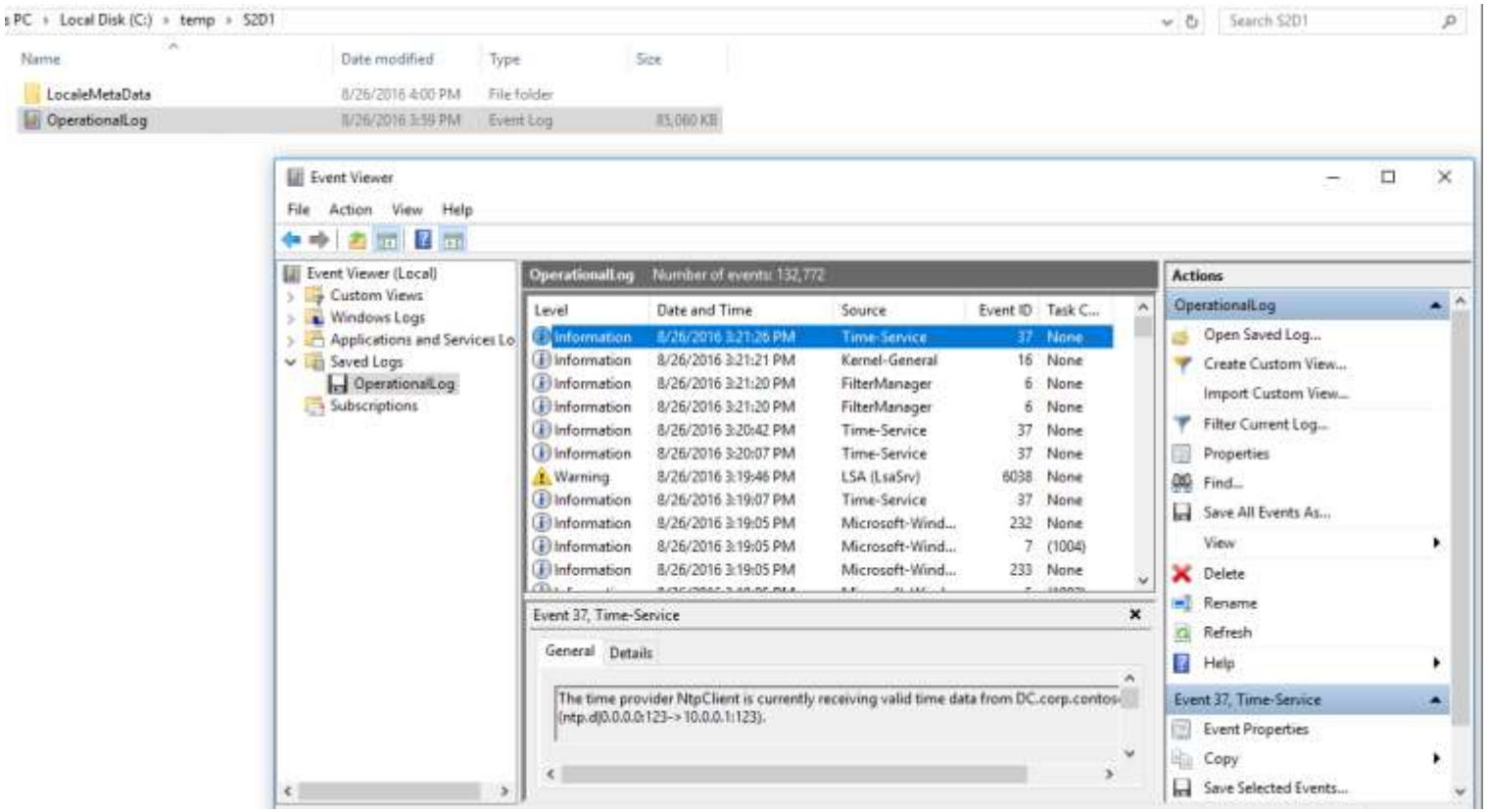
HealthTest-S2D-Cluster-20160826-1551	8/26/2016 3:54 PM	Compressed (zipp...	10,934 KB

- Usage:
  - `Get-ClusterDiagnosticInfo –Cluster $ClusterName`

Administrator: C:\Windows\system32\cmd.exe

```
PS C:\> Get-ClusterDiagnosticInfo
Writing to path : C:\Users\wcurtis\HealthTest\
Script Version : 0.1
Date of capture : 07/22/2021 07:33:42

<<< Phase 1 - Cluster Overview >>>

 Examining each VM
    VM 6 of 7
    [oooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo

Got remainder cluster objects & exporting groups resources

Exporting remaining objects

Getting cluster properties

Getting VMs

Exporting vms
The states and counts of vms are

state   count
-----   -----
Running     7
```

Get-StorageDiagnosticInfo



Generates log for each node

Log consists of all storage related info

Usage

- Get-StorageSubSystem -FriendlyName *$ClusterName | Get-StorageDiagnosticInfo -DestinationPath c:\temp

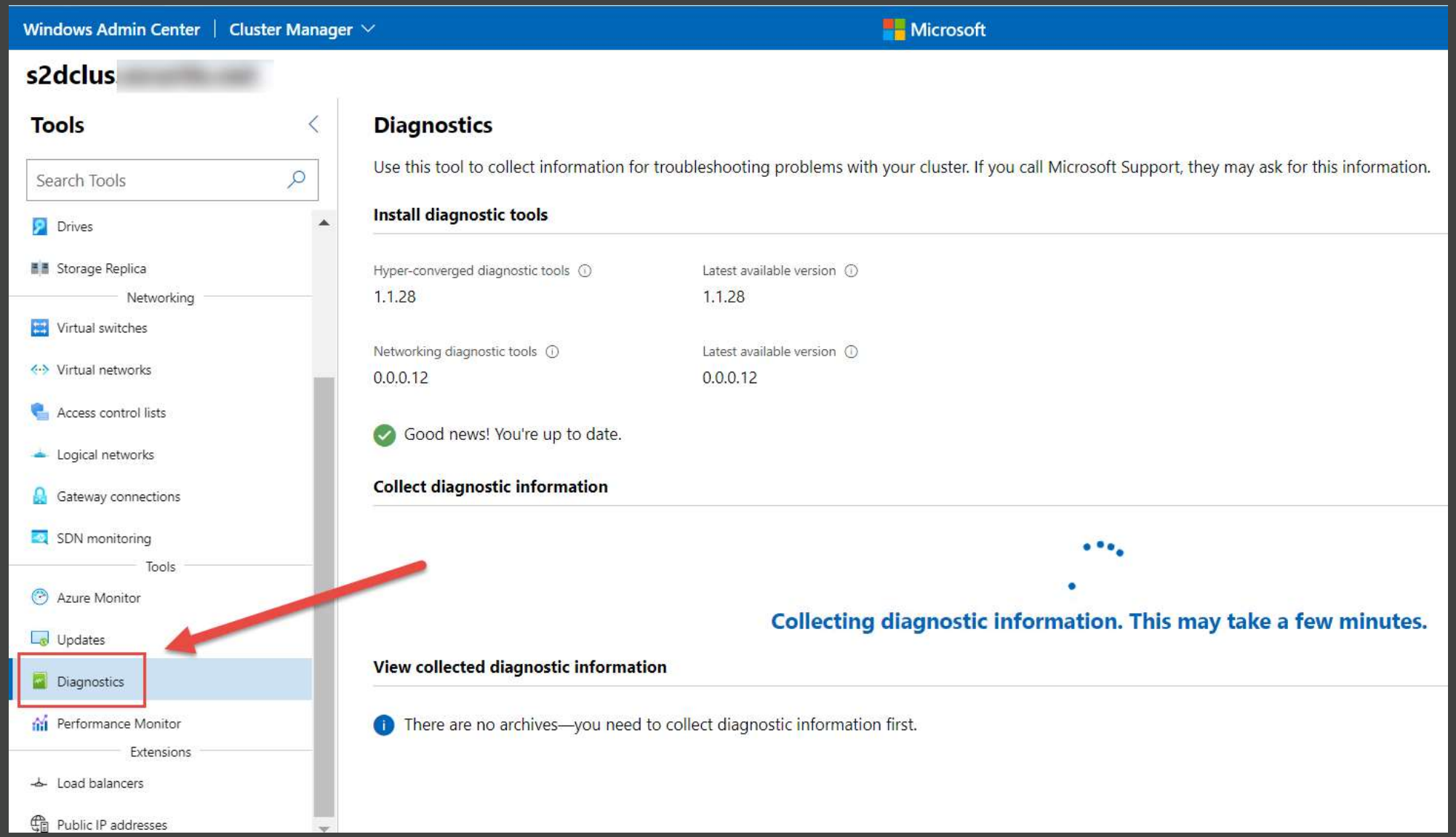
Get-SddcDiagnosticInfo

```
Select Administrator: C:\Windows\system32\cmd.exe
PS C:\> Get-SddcDiagnosticInfo
Transcript started, output file is C:\Users\wcurtis\HealthTest\0_CloudHealthGatherTranscript.log
2021-07-22T07:39:08 : Temporary write path : C:\Users\wcurtis\HealthTest\
2021-07-22T07:39:08 : PrivateCloud.DiagnosticInfo v 1.1.28
2021-07-22T07:39:08 : <<< Phase 1 - Data Gather >>>

Cluster name                : s2dclus.wcurtis.net
Accessible Node List        : s2d1, s2d2
Access node                 : s2d1

2021-07-22T07:39:18 : Start gather of Sddc Diagnostic Archives ...
2021-07-22T07:39:29 : Start gather of cluster configuration ...
2021-07-22T07:39:30 : Start gather of driver information ...
2021-07-22T07:39:30 : Start gather of verifier ...
2021-07-22T07:39:40 : Start gather of filesystem filter status ...
2021-07-22T07:39:50 : Start gather of system info, cluster/health logs, reports and dump files ...
2021-07-22T07:40:10 : Starting export diagnostic log and live dump ...
2021-07-22T07:40:19 : Starting export of events ...
2021-07-22T07:40:28 : SMB Shares
2021-07-22T07:40:28 : SMB Share Open Files
2021-07-22T07:40:28 : SMB Share Witness
2021-07-22T07:40:28 : Clustered Subsystem
2021-07-22T07:40:28 : Volumes & Virtual Disks
2021-07-22T07:40:29 : Dedup Volume Status
2021-07-22T07:40:30 : Storage Pool & Tiers
2021-07-22T07:40:31 : Storage Jobs
2021-07-22T07:40:33 : Clustered PhysicalDisks and SNV
2021-07-22T07:40:35 : Storage Enclosures
2021-07-22T07:40:35 : Pooled Disks
2021-07-22T07:40:35 : Storage Scale Units
```

Best Tool to gather Azure Stack HCI Cluster Information.

Can be downloaded and run manually or run from Windows Admin Center.

....or just use Windows Admin Center!



Connecting remote storage subsystem

Useful when working with remote storage.Debug-StorageSubsystem and Get-StorageDiagnosticInfo benefit from this

```
 #register storage subsystem
Get-StorageProvider | Register-StorageSubsystem -ComputerName $ClusterName

#unregister storage subsystem
$ss=Get-StorageSubSystem -FriendlyName *$ClusterName
Unregister-StorageSubsystem -ProviderName "Windows Storage Management Provider"
-StorageSubSystemUniqueId $ss.UniqueId
```

Get-StorageReliabilityCounter

Administrator: Windows PowerShell

```
PS C:\Windows\system32> Get-PhysicalDisk | Get-StorageReliabilityCounter | fl *


ObjectId                : {1}\\JAROMIRK-WIN10\root/Microsoft/Windows/Storage/Providers_v2\SPACES_StorageReliabilityCoun
                          ter.ObjectId="{f6973183-510b-11e6-933f-806e6f6e6963}:RC:{2885aeb2-bd05-d0f3-7866-8a2145915eae
                          }"
PassThroughClass        :
PassThroughIds          :
PassThroughNamespace    :
PassThroughServer       :
UniqueId                : {f6973183-510b-11e6-933f-806e6f6e6963}:RC:{2885aeb2-bd05-d0f3-7866-8a2145915eae}
DeviceId                : 0
FlushLatencyMax         : 106
LoadUnloadCycleCount    :
LoadUnloadCycleCountMax :
ManufactureDate         :
PowerOnHours            : 4372
ReadErrorsCorrected     : 0
ReadErrorsTotal         : 0
ReadErrorsUncorrected   :
ReadLatencyMax          : 6133
StartStopCycleCount     :
StartStopCycleCountMax  :
Temperature             : 0
TemperatureMax          : 0
Wear                    : 0
WriteErrorsCorrected    :
WriteErrorsTotal        :
WriteErrorsUncorrected  :
WriteLatencyMax         : 6119
PSComputerName          :
CimClass                : ROOT/Microsoft/Windows/Storage:MSFT_StorageReliabilityCounter
CimInstanceProperties   : {ObjectId, PassThroughClass, PassThroughIds, PassThroughNamespace...}
CimSystemProperties     : Microsoft.Management.Infrastructure.CimSystemProperties


PS C:\Windows\system32>
```

- Displays SCSI Primary Commands 4 (SPC-4).
- Can display data even with Storage Spaces enabled (unlike SMART)
- Counters
  - Wear
    - SSD Wear level
    - Some disks report 0 as healthy
    - Some disks report 100 as healthy
  - Temperature
  - Errors
  - PowerOnHours

Looking for a Bad Disk

```
#Look for bad disks (OperationalStatus Not Equal OK)
Get-StorageSubSystem -CimSession $Cluster -FriendlyName "Clustered
Windows Storage*" | Get-PhysicalDisk | where OperationalStatus -NE OK
```

```
PS C:\Users\administrator.WSSDCORP> Get-StorageSubSystem -CimSession $Cluster -FriendlyName "Clustered Windows Storage*" | Get-PhysicalDisk | ? OperationalStatus -NE OK

FriendlyName    SerialNumber       CanPool OperationalStatus   HealthStatus Usage          Size PSComputerName
------------    ------------       ------- ----------------   ------------ -----          ---- --------------
ATA MB6000GEBTP 1EK4Y4WJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4W41H           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4V0XJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MK1200GEYKF BTHV611401U31P2PGN False   In Maintenance Mode Warning      Journal     1.09 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4WMJJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4Y3YJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MK1200GEYKF BTHV611402J11P2PGN False   In Maintenance Mode Warning      Journal     1.09 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4Y6NJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4VV4J           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4WPMJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MK1200GEYKF BTHV611402Q01P2PGN False   In Maintenance Mode Warning      Journal     1.09 TB QP-HPR01Cluster
ATA MK1200GEYKF BTHV611402Q81P2PGN False   In Maintenance Mode Warning      Journal     1.09 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4Y2RJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
ATA MB6000GEBTP 1EK4VLDJ           False   In Maintenance Mode Warning      Auto-Select 5.46 TB QP-HPR01Cluster
```

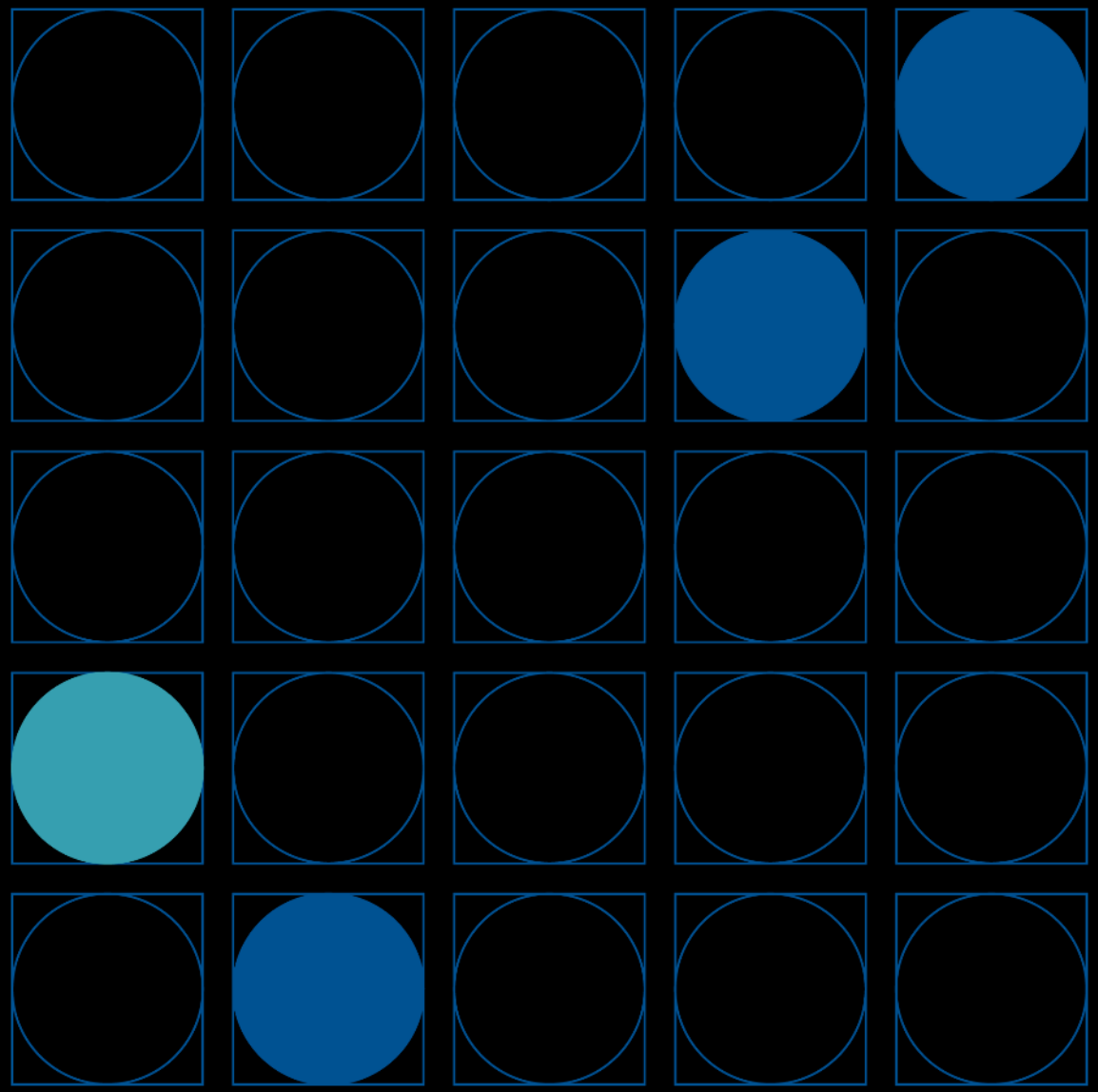
See drives within specific server

Administrator: Windows PowerShell

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\> Get-ClusterNode

Name           State Type
----           ----- ----
261193E04-19-1 Up    Node
261193E04-19-2 Up    Node
261193E04-19-3 Up    Node
261193E04-19-4 Up    Node


PS C:\> Get-StorageSubSystem Cluster* | Get-StorageNode

Name                                    Manufacturer                 Model                 SerialNumber   OperationalStatus
----                                    ------------                 -----                 ------------   -----------------
261193E04-19-1.cfdev.nttest.microsoft.com Quanta Cloud Technology Inc. QuantaPlex T41SP-2U QTFCKJ60500010 Up
261193E04-19-2.cfdev.nttest.microsoft.com Quanta Cloud Technology Inc. QuantaPlex T41SP-2U QTFCKJ60500010 Up
261193E04-19-3.cfdev.nttest.microsoft.com Quanta Cloud Technology Inc. QuantaPlex T41SP-2U QTFCKJ60500010 Up
261193E04-19-4.cfdev.nttest.microsoft.com Quanta Cloud Technology Inc. QuantaPlex T41SP-2U QTFCKJ60500010 Up


PS C:\> Get-StorageNode 261193E04-19-3.cfdev.nttest.microsoft.com | Get-PhysicalDisk -PhysicallyConnected

FriendlyName         SerialNumber         MediaType CanPool OperationalStatus HealthStatus Usage          Size
------------         ------------         --------- ------- ----------------- ------------ -----          ----
ATA SAMSUNG MZ7KM1T9 S2HNNYAG800111       SSD       False   OK                Healthy      Auto-Select 1.75 TB
ATA SAMSUNG MZ7KM1T9 S2HNNYAG800105       SSD       False   OK                Healthy      Auto-Select 1.75 TB
ATA SAMSUNG MZ7KM1T9 S2HNNYAG800110       SSD       False   OK                Healthy      Auto-Select 1.75 TB
ATA SAMSUNG MZ7KM1T9 S2HNNYAG800093       SSD       False   OK                Healthy      Auto-Select 1.75 TB
INTEL SSDPE2MD800G4  0000_0000_0000_0000. SSD       False   OK                Healthy      Journal      745 GB
INTEL SSDPE2MD800G4  0000_0000_0000_0000. SSD       False   OK                Healthy      Journal      745 GB


PS C:\> _
```

Microsoft Azure

Disk Performance



VMFleet

- Tool for orchestrating diskspd in multiple VMs in multiple Volumes
- Simulates real workload
- Creates volumes and VMs
- Designed to do tests before going into production
- https://github.com/Microsoft/WSLab/tree/master/Scenarios/VMFleet

File copy to CSV as a Benchmark….

Always use \\<ClusterName>\ClusterStorage$

If you use \\<NodeName>\c$\ClusterStorage , it might fail

All IO to a VHD is unbuffered IO, and that is what CSV is optimized for.

With a file copy, you are performing buffered IO

doing a file copy (especially with Explorer) is the worst way to evaluate the performance of the system

XCopy with the /J switch to do unbuffered IO

Diskspd “on CSV” vs “inside VM”

- on the CSV - **5,915 IOPS**

diskspd.exe -Z20M -Z -h -t1 -o8 -b4k -r4k -w0 -W30 -C30 -d300 -D -L c:\ClusterStorage\collect\testfile1.dat

```
Total IO
thread |       bytes     |     I/Os     |     MB/s   |  I/O per s |  AvgLat  | IopsStdDev | LatStdDev |  file
------------------------------------------------------------------------------------------------------------------
     0 |      7268605952 |      1774562 |      23.11 |    5915.01 |    1.351 |    3906.49 |     3.856 | c:\ClusterStorage\collect\testfile1.dat (10240MB)
------------------------------------------------------------------------------------------------------------------
total:        7268605952 |      1774562 |      23.11 |    5915.01 |    1.351 |    3906.49 |     3.856
```

- **Inside VM - 84,204 IOPS**

diskspd.exe -Z20M -Z -h -t1 -o8 -b4k -r4k -w0 -W30 -C30 -d300 -D -L e:\shares\testfile1.dat

```
Total IO
thread |       bytes     |     I/Os     |     MB/s   |  I/O per s |  AvgLat  | IopsStdDev | LatStdDev |  file
------------------------------------------------------------------------------------------------------------------
     0 |    103470358528 |     25261318 |     328.92 |   84204.40 |    0.094 |   13324.50 |     0.304 | e:\shares\testfile1.dat (10240MB)
------------------------------------------------------------------------------------------------------------------
total:      103470358528 |     25261318 |     328.92 |   84204.40 |    0.094 |   13324.50 |     0.304
```

S2D Cache performance counters

- How much S2D cache writes to cache devices*:
- Cluster Storage Cache Stores\Update Bytes
- Cluster Storage Hybrid Disks\Cache Populate Bytes
- Cluster Storage Hybrid Disks\Cache Write Bytes

- How much S2D cache writes to capacity devices:
- Cluster Storage Hybrid Disks\Destage Bytes
- Cluster Storage Hybrid Disks\Direct Write Bytes
- *does not contain write amplification for resiliency (3x) and updating the read cache as workload churns …

Microsoft