Software Defined Networking (SDN) in Azure Stack HCI training: Lab for Module 1: Network Controller

Microsoft Corporation
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Applies to

SDN training: Module 1: Network Controller

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Revision History

Release Date	Changes
April 05, 2024	Initial release.

Contents

SDN LAB: M1 NETWORK CONTROLLER

Overview

The Network Controller is a distributed system that runs on a Service Fabric cluster, which provides high availability, scalability, and reliability. The Service Fabric cluster consists of multiple nodes, each hosting one or more replicas of the Network Controller services. The Network Controller services are responsible for managing the network resources and policies across the SDN infrastructure, such as virtual networks, subnets, gateways, load balancers, firewall rules, etc.

In this lab, you will learn how to access and examine the Service Fabric cluster that hosts the Network Controller, using tools such as PowerShell, and REST API. You will also learn how to check the health and status of the cluster, the nodes, and the services, and how to perform some basic operations such as failover and node maintenance. By the end of this lab, you should have a better understanding of the Network Controller architecture and functionality.

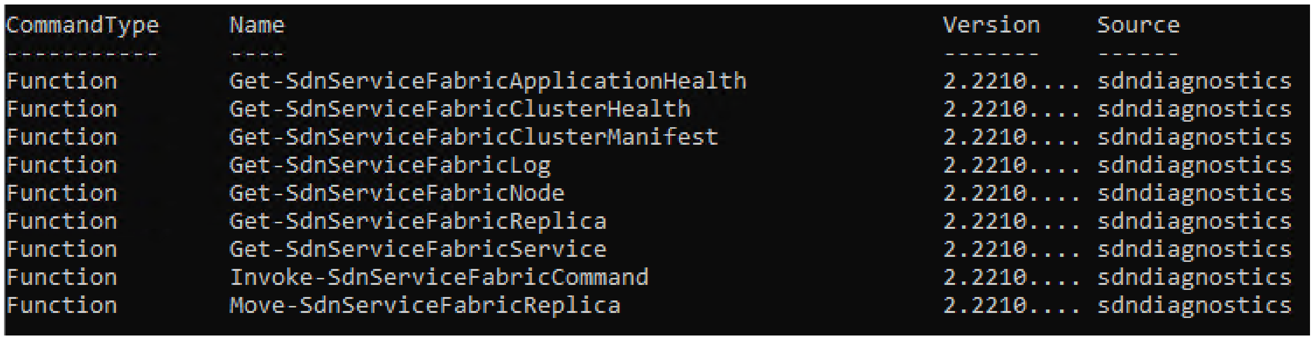
M1.1 Network Controller Architecture

As all operations are performed by the Network Controller, such as configuring SLB and GW VMs, routing, network interface operations, etc. it is critical first step to verify the health of the Network Controller as any critical issue impacting the Network Controller could cause all other behaviors/issues with the SDN infrastructure.

This section will explore validating the Service Fabric cluster health, as well as basic operations such as failover of primary replicas and disabling and enabling Service Fabric nodes.

Lab 1: Examine Service Fabric Cluster

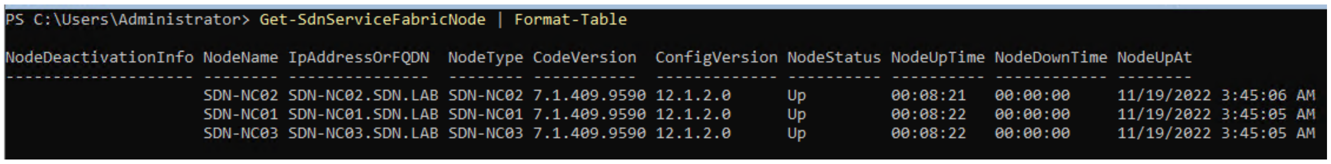
The Service Fabric cluster will be composed of one or more Network Controller nodes that are running Service Fabric, with a minimum of three Network Controllers being the minimum for production purposes to provide high availability. To examine the Service Fabric cluster, you can leverage ServiceFabric Module | Microsoft Learn. In addition, there are several functions included in the SdnDiagnostics that are commonly leveraged.



```
CommandType     Name                                               Version    Source
-----------     ----                                               -------    ------
Function        Get-SdnServiceFabricApplicationHealth              2.2210.... sdndiagnostics
Function        Get-SdnServiceFabricClusterHealth                  2.2210.... sdndiagnostics
Function        Get-SdnServiceFabricClusterManifest                2.2210.... sdndiagnostics
Function        Get-SdnServiceFabricLog                            2.2210.... sdndiagnostics
Function        Get-SdnServiceFabricNode                           2.2210.... sdndiagnostics
Function        Get-SdnServiceFabricReplica                        2.2210.... sdndiagnostics
Function        Get-SdnServiceFabricService                        2.2210.... sdndiagnostics
Function        Invoke-SdnServiceFabricCommand                     2.2210.... sdndiagnostics
Function        Move-SdnServiceFabricReplica                       2.2210.... sdndiagnostics
```

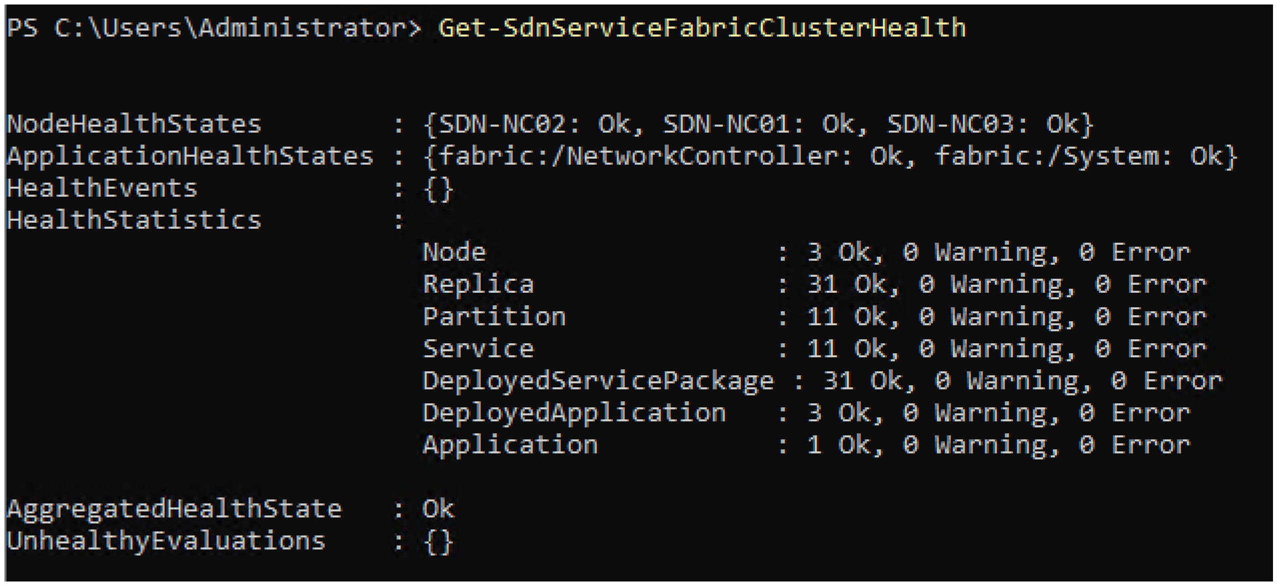
Connect into the Network Controller VM and run Get-SdnInfrastructureInfo. This will pre-populate the cache for the cmdlets below.

Examine the number of nodes within the cluster, as well as state of each node by running Get-SdnServiceFabricNode | Format-Table.



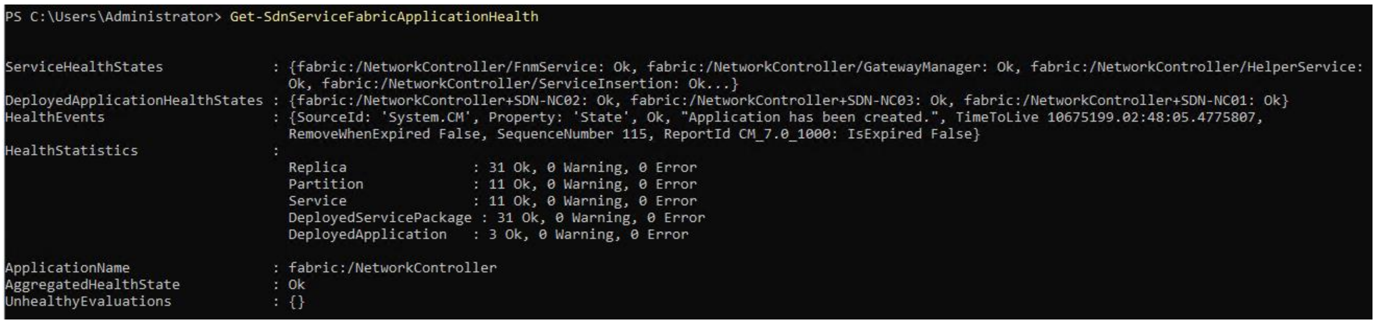
```
PS C:\Users\Administrator> Get-SdnServiceFabricNode | Format-Table

NodeDeactivationInfo NodeName IpAddressOrFQDN  NodeType CodeVersion  ConfigVersion NodeStatus NodeUpTime NodeDownTime NodeUpAt
-------------------- -------- ---------------  -------- -----------  ------------- ---------- ---------- ------------ --------
                     SDN-NC02 SDN-NC02.SDN.LAB SDN-NC02 7.1.409.9590 12.1.2.0      Up         00:08:21   00:00:00     11/19/2022 3:45:06 AM
                     SDN-NC01 SDN-NC01.SDN.LAB SDN-NC01 7.1.409.9590 12.1.2.0      Up         00:08:22   00:00:00     11/19/2022 3:45:05 AM
                     SDN-NC03 SDN-NC03.SDN.LAB SDN-NC03 7.1.409.9590 12.1.2.0      Up         00:08:22   00:00:00     11/19/2022 3:45:05 AM
```

Examine the health of the Service Fabric cluster by running Get-SdnServiceFabricClusterHealth.



```
PS C:\Users\Administrator> Get-SdnServiceFabricClusterHealth


NodeHealthStates        : {SDN-NC02: Ok, SDN-NC01: Ok, SDN-NC03: Ok}
ApplicationHealthStates : {fabric:/NetworkController: Ok, fabric:/System: Ok}
HealthEvents            : {}
HealthStatistics        :
                          Node                    : 3 Ok, 0 Warning, 0 Error
                          Replica                 : 31 Ok, 0 Warning, 0 Error
                          Partition               : 11 Ok, 0 Warning, 0 Error
                          Service                 : 11 Ok, 0 Warning, 0 Error
                          DeployedServicePackage : 31 Ok, 0 Warning, 0 Error
                          DeployedApplication     : 3 Ok, 0 Warning, 0 Error
                          Application             : 1 Ok, 0 Warning, 0 Error

AggregatedHealthState   : Ok
UnhealthyEvaluations    : {}
```

Examine the health of the applications deployed on the cluster by running Get-SdnServiceFabricApplicationHealth.



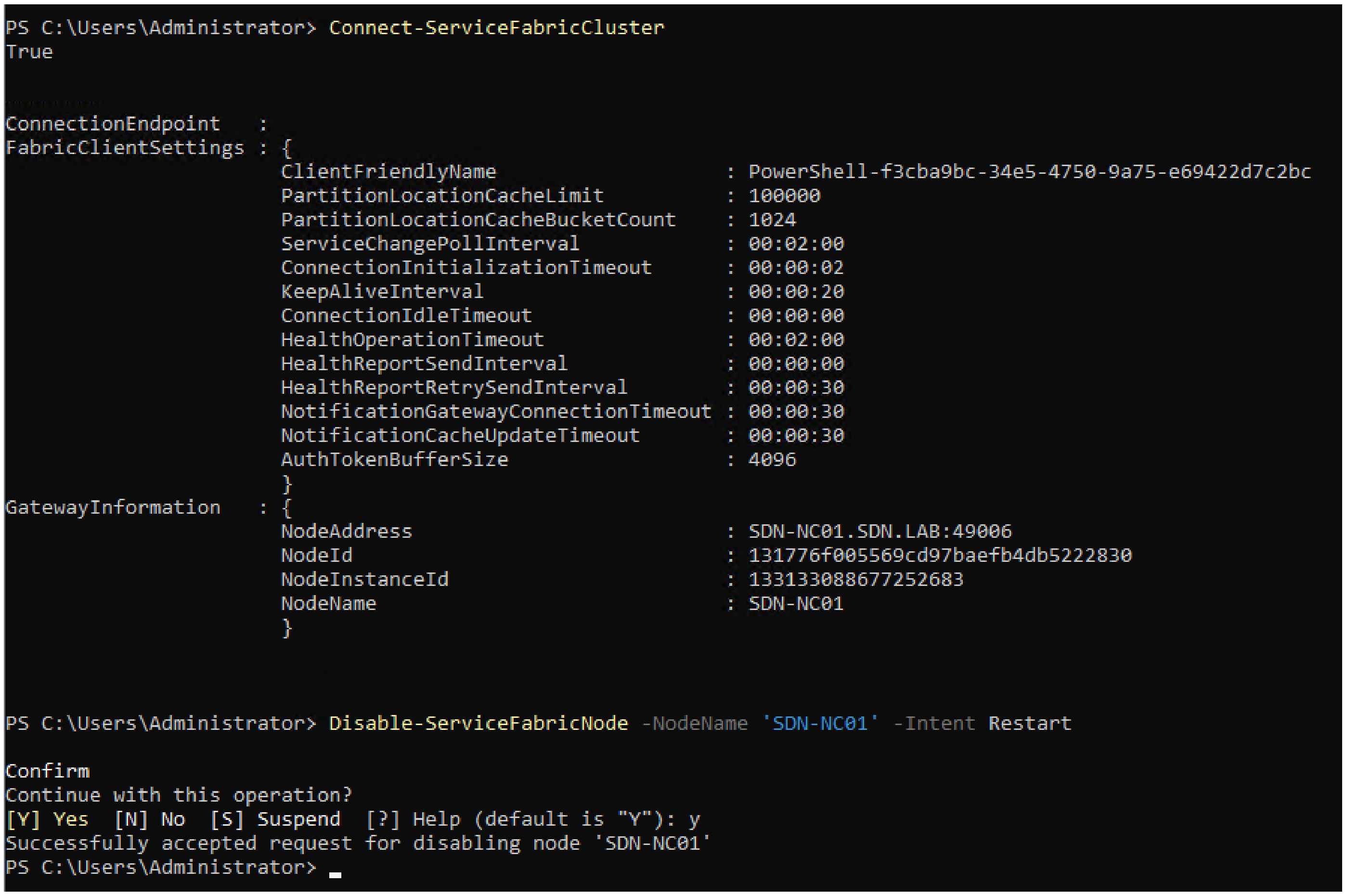
```
PS C:\Users\Administrator> Get-SdnServiceFabricApplicationHealth

ServiceHealthStates            : {fabric:/NetworkController/FnmService: Ok, fabric:/NetworkController/GatewayManager: Ok, fabric:/NetworkController/HelperService:
                                 Ok, fabric:/NetworkController/ServiceInsertion: Ok...}
DeployedApplicationHealthStates : {fabric:/NetworkController+SDN-NC02: Ok, fabric:/NetworkController+SDN-NC03: Ok, fabric:/NetworkController+SDN-NC01: Ok}
HealthEvents                   : {SourceId: 'System.CM', Property: 'State', Ok, "Application has been created.", TimeToLive 10675199.02:48:05.4775807,
                                 RemoveWhenExpired False, SequenceNumber 115, ReportId CM_7.0_1000: IsExpired False}
HealthStatistics               :
                                 Replica                : 31 Ok, 0 Warning, 0 Error
                                 Partition              : 11 Ok, 0 Warning, 0 Error
                                 Service                : 11 Ok, 0 Warning, 0 Error
                                 DeployedServicePackage : 31 Ok, 0 Warning, 0 Error
                                 DeployedApplication    : 3 Ok, 0 Warning, 0 Error

ApplicationName                : fabric:/NetworkController
AggregatedHealthState          : Ok
UnhealthyEvaluations           : {}
```

In this Service Fabric cluster, there is only a single application called fabric:/NetworkController which all services reside under. In most other Service Fabric clusters, you may see dozens of applications deployed, with numerous services deployed under each application.

Lab 2: Disable and Enable Service Fabric Nodes

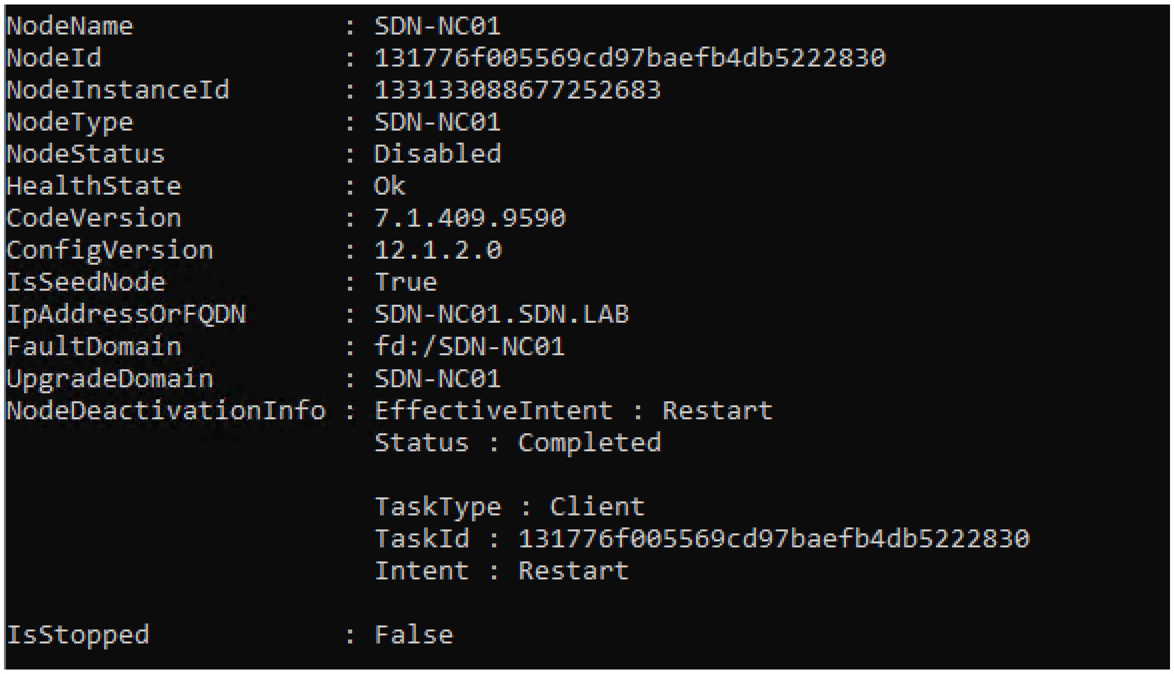
In certain instances, you may need to perform an operation against a Network Controller node where a reboot is required. To help ensure a graceful reboot, it is recommended to disable the node from within the cluster to perform a reboot. To do so, we will need to run Service Fabric cmdlets in this lab. The -NodeName is case-sensitive, so you may want to leverage Get-SdnServiceFabricNode or Get-ServiceFabricNode to make sure you grab the correct name.

```
Connect-ServiceFabricCluster
Disable-ServiceFabricNode -NodeName 'SDN-NC01' -Intent Restart
```



```
PS C:\Users\Administrator> Connect-ServiceFabricCluster
True


ConnectionEndpoint   :
FabricClientSettings : {
                       ClientFriendlyName                     : PowerShell-f3cba9bc-34e5-4750-9a75-e69422d7c2bc
                       PartitionLocationCacheLimit            : 100000
                       PartitionLocationCacheBucketCount      : 1024
                       ServiceChangePollInterval              : 00:02:00
                       ConnectionInitializationTimeout        : 00:00:02
                       KeepAliveInterval                      : 00:00:20
                       ConnectionIdleTimeout                  : 00:00:00
                       HealthOperationTimeout                 : 00:02:00
                       HealthReportSendInterval               : 00:00:00
                       HealthReportRetrySendInterval          : 00:00:30
                       NotificationGatewayConnectionTimeout : 00:00:30
                       NotificationCacheUpdateTimeout         : 00:00:30
                       AuthTokenBufferSize                    : 4096
                       }
GatewayInformation   : {
                       NodeAddress                            : SDN-NC01.SDN.LAB:49006
                       NodeId                                 : 131776f005569cd97baefb4db5222830
                       NodeInstanceId                         : 133133088677252683
                       NodeName                               : SDN-NC01
                       }


PS C:\Users\Administrator> Disable-ServiceFabricNode -NodeName 'SDN-NC01' -Intent Restart

Confirm
Continue with this operation?
[Y] Yes  [N] No  [S] Suspend  [?] Help (default is "Y"): y
Successfully accepted request for disabling node 'SDN-NC01'
PS C:\Users\Administrator>
```

Once the command has completed, run **Get-SdnServiceFabricNode** to check the state.



```
NodeName             : SDN-NC01
NodeId               : 131776f005569cd97baefb4db5222830
NodeInstanceId       : 133133088677252683
NodeType             : SDN-NC01
NodeStatus           : Disabled
HealthState          : Ok
CodeVersion          : 7.1.409.9590
ConfigVersion        : 12.1.2.0
IsSeedNode           : True
IpAddressOrFQDN      : SDN-NC01.SDN.LAB
FaultDomain          : fd:/SDN-NC01
UpgradeDomain        : SDN-NC01
NodeDeactivationInfo : EffectiveIntent : Restart
                       Status : Completed

                       TaskType : Client
                       TaskId : 131776f005569cd97baefb4db5222830
                       Intent : Restart

IsStopped            : False
```

You are now able to proceed safely rebooting the Network Controller node. Once you have completed your operations and the node is ready to be added back into the cluster, you will run **Enable-ServiceFabricNode** to get it synced back with the cluster and be an active member.

```
Enable-ServiceFabricNode -NodeName 'SDN-NC01'
```

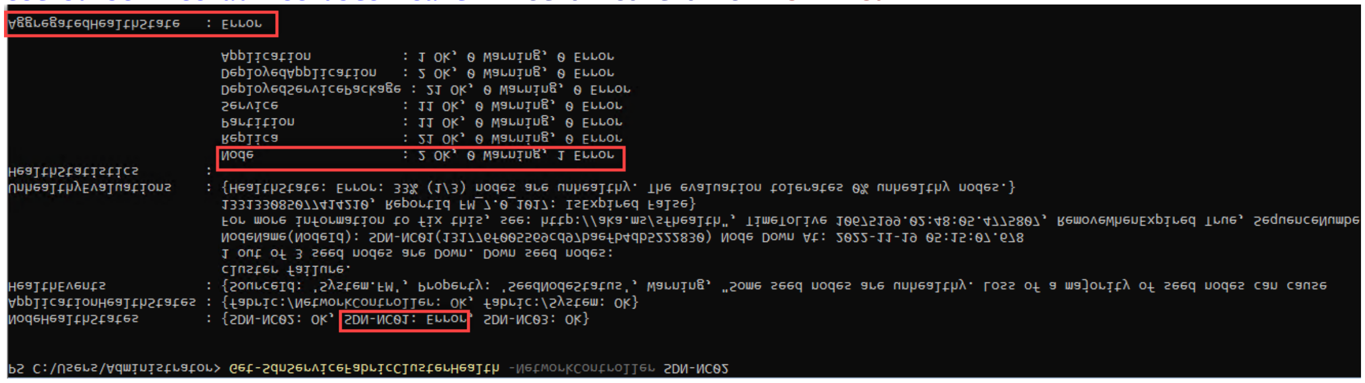
Lab 3: Examine an Unhealthy Cluster

In some situations, you may encounter where Network Controller application is reporting unhealthy. If the majority of the nodes are in a bad state, this is known as Quorum Loss and Network Controller services will be in a read-only state and will not allow any write operations. This means any NB API calls will fail, in addition if live migration happens with virtual machine(s), the policies on the dataplane will become stale, resulting in packet loss for the virtual machine(s).

Stop the FabricHostSvc using **Stop-Service -Name FabricHostSvc -Force.**

After the service has stopped, check the application and cluster health for Service Fabric.

```
Get-SdnServiceFabricClusterHealth -NetworkController 'SDN-NC02'
```



```
PS C:/Users/Administrator> Get-SdnServiceFabricClusterHealth -NetworkController SDN-NC02

NodeHealthStates          : {SDN-NC02: OK, SDN-NC01: Error, SDN-NC03: OK}
ApplicationHealthStates   : {fabric:/NetworkController: OK, fabric:/System: OK}
HealthEvents              : {SourceId: 'System.FM', Property: 'SeedNodeStatus', Warning, "Some seed nodes are unhealthy. Loss of a majority of seed nodes can cause
                            cluster failure.
                            1 out of 3 seed nodes are Down. Down seed nodes:
                            NodeName(NodeId): SDN-NC01(131776e4005209ecd97ba6fb4db5222830) Node Down At: 2022-11-19 05:15:07.978
                            For more information to fix this, see: http://aka.ms/sfhealth", TimeToLive 10675199.02:48:05.4775807, RemoveWhenExpired True, SequenceNumbe
                            133133082077414210, ReportId FM_7.0_1017; IsExpired False}
UnhealthyEvaluations      : {HealthState: Error: 33% (1/3) nodes are unhealthy. The evaluation tolerates 0% unhealthy nodes.}
HealthStatistics          :
                            Node                   : 2 OK, 0 Warning, 1 Error
                            Replica                : 21 OK, 0 Warning, 0 Error
                            Partition              : 11 OK, 0 Warning, 0 Error
                            Service                : 11 OK, 0 Warning, 0 Error
                            DeployedServicePackage : 21 OK, 0 Warning, 0 Error
                            DeployedApplication    : 2 OK, 0 Warning, 0 Error
                            Application            : 1 OK, 0 Warning, 0 Error

AggregatedHealthState     : Error
```

Once you are done examining the cluster and application health states, run **Start-Service -Name FabricHostSvc** to restore the health of the cluster.

Lab 4: Examine Cluster Authentication

Network Controller nodes will communicate with each other for the Service Fabric cluster. Communication between the nodes is secured by using X509 or Kerberos.

1. Examine the Service Fabric Cluster Manifest to determine the authentication method.

```
Get-SdnServiceFabricClusterManifest
```

2. Examine Cert:\LocalMachine\My on the Network Controller nodes to see which certificates are present.

```
Get-ChildItem -Path 'Cert:\LocalMachine\My'
```

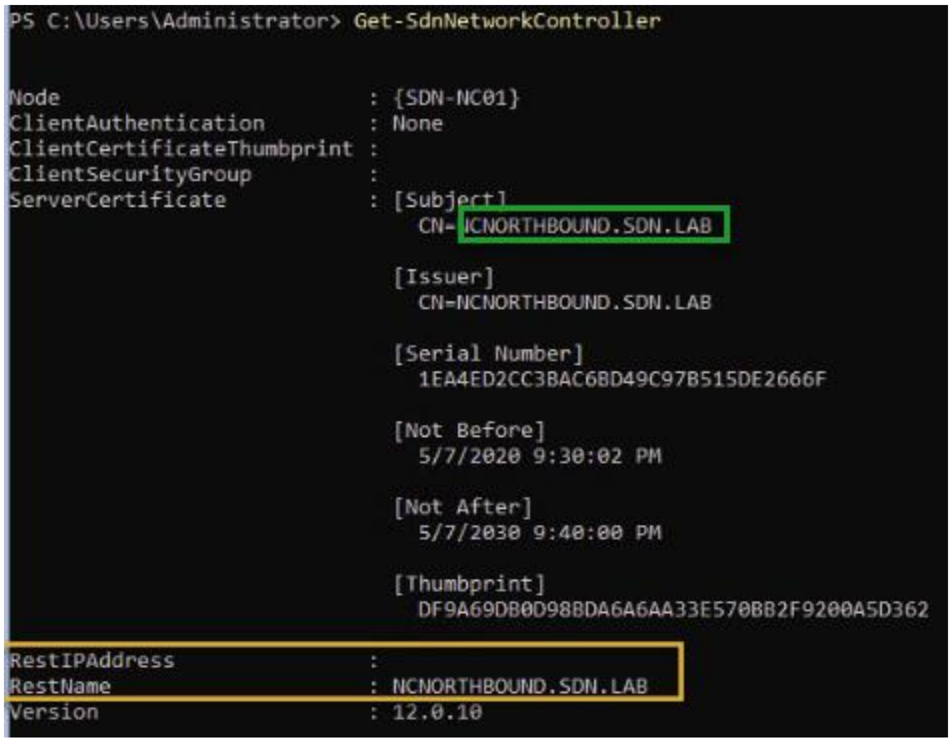
M1.2 Northbound API

There are numerous SDN resources exposed via the Northbound API. Some are related to the SDN Fabric itself, such as Servers, LoadBalancerManager/Config, LoadBalancerMuxes and Gateways. Other SDN resources may be related to the tenant dataplane configuration, such as NetworkInterfaces, VirtualNetworks, VirtualNetworkGateways, etc.

Lab 1: Determine NorthBound API URI

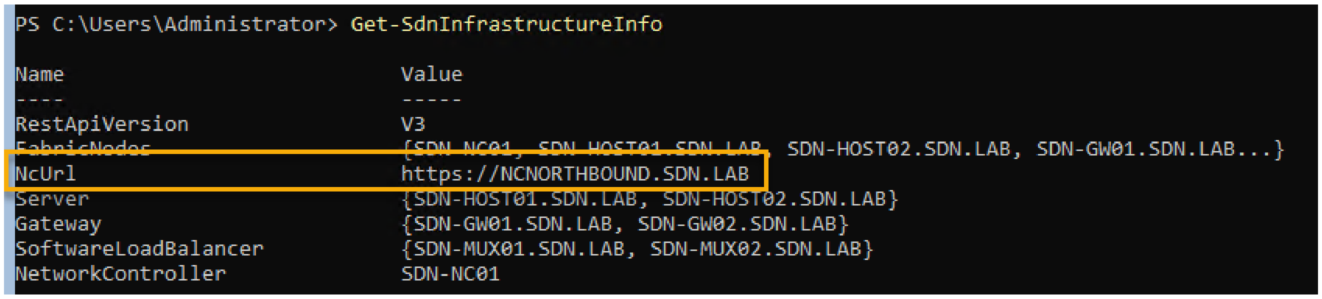
To examine the resources configured within Network Controller, you first need to determine the Northbound API endpoint that you will perform your REST operations against.

Connect to SDN-NC01 and run **Get-SdnNetworkController.** The FQDN of the NB API will match the ServerCertificate that is configured. Customers may use RestName (Dynamic) or RestIPAddress (Static IP) to define their Northbound API endpoint.



```
PS C:\Users\Administrator> Get-SdnNetworkController


Node                        : {SDN-NC01}
ClientAuthentication        : None
ClientCertificateThumbprint :
ClientSecurityGroup         :
ServerCertificate           : [Subject]
                                CN=NCNORTHBOUND.SDN.LAB

                              [Issuer]
                                CN=NCNORTHBOUND.SDN.LAB

                              [Serial Number]
                                1EA4ED2CC3BAC6BD49C97B515DE2666F

                              [Not Before]
                                5/7/2020 9:30:02 PM

                              [Not After]
                                5/7/2030 9:40:00 PM

                              [Thumbprint]
                                DF9A69DB0D98BDA6A6AA33E570BB2F9200A5D362

RestIPAddress               :
RestName                    : NCNORTHBOUND.SDN.LAB
Version                     : 12.0.10
```

You can also run **Get-SdnInfrastructureInfo**, which will also automatically determine the NB API endpoint. This information will be automatically cached as well within **Global:SdnDiagnostics** that can be referenced later. Additionally, some cmdlets within SdnDiagnostics module will automatically read from this cache, which makes working with the module simpler as required parameters will automatically be populated.



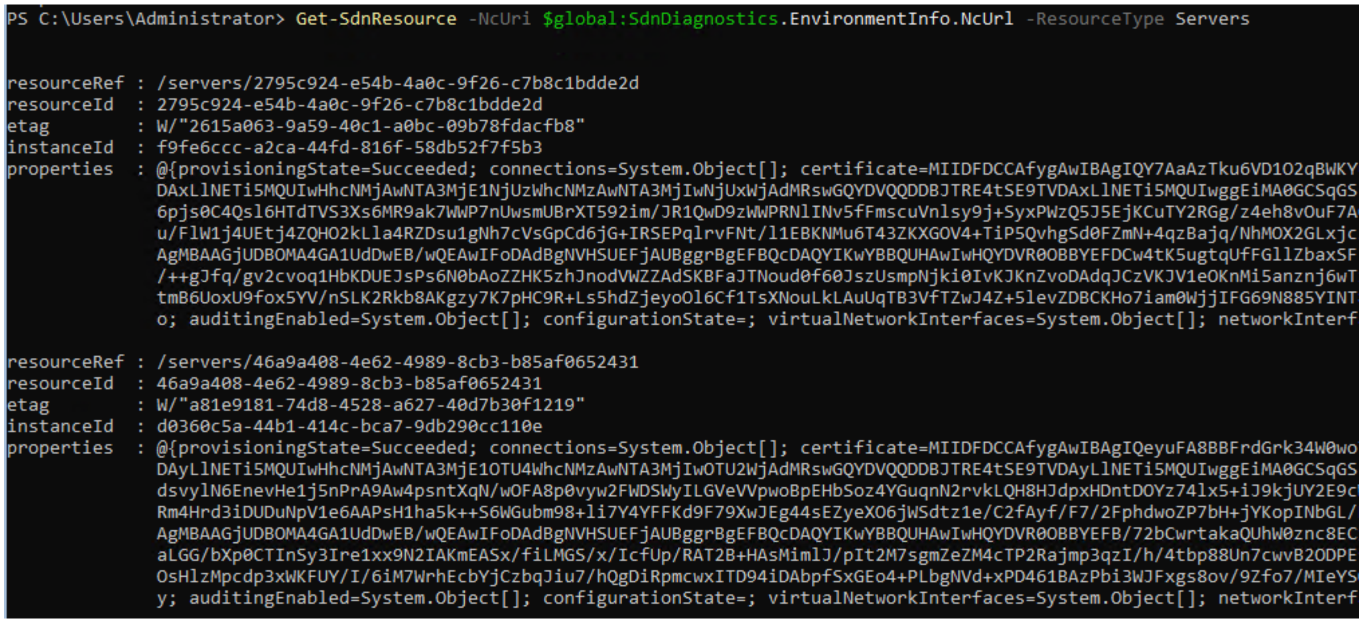
```
PS C:\Users\Administrator> Get-SdnInfrastructureInfo

Name                           Value
----                           -----
RestApiVersion                 V3
FabricNodes                    {SDN-NC01, SDN-HOST01.SDN.LAB, SDN-HOST02.SDN.LAB, SDN-GW01.SDN.LAB...}
NcUrl                          https://NCNORTHBOUND.SDN.LAB
Server                         {SDN-HOST01.SDN.LAB, SDN-HOST02.SDN.LAB}
Gateway                        {SDN-GW01.SDN.LAB, SDN-GW02.SDN.LAB}
SoftwareLoadBalancer           {SDN-MUX01.SDN.LAB, SDN-MUX02.SDN.LAB}
NetworkController              SDN-NC01
```

Lab 2: Examine SDN Fabric Resources

In this section, let's examine the Server resources by using **Get-SdnResource** cmdlet. If you have not run **Get-SdnInfrastructureInfo** already, please do so now to populate the NC URI and other environment variables.

Run **Get-SdnResource** with the -**Resource Servers** defined to return all the Server objects back from Network Controller.

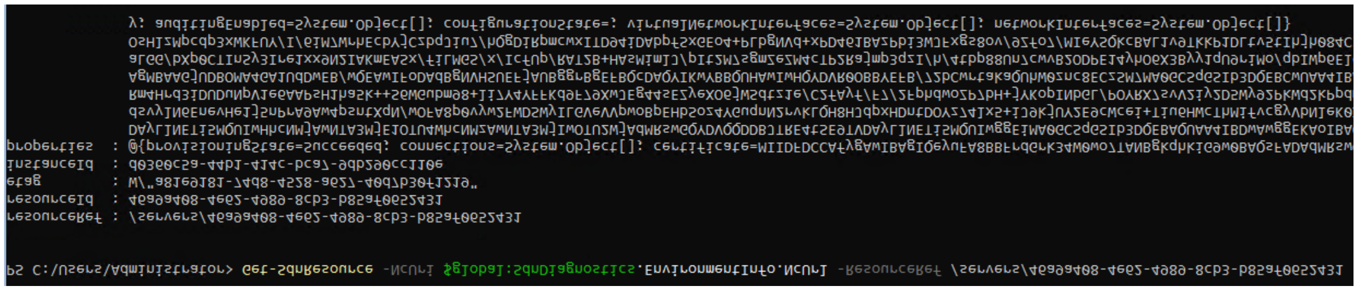
```
Get-SdnResource -NcUri $Global:SdnDiagnostics.EnvironmentInfo.NcUrl -
Resource Servers
```



```
PS C:\Users\Administrator> Get-SdnResource -NcUri $global:SdnDiagnostics.EnvironmentInfo.NcUrl -ResourceType Servers


resourceRef : /servers/2795c924-e54b-4a0c-9f26-c7b8c1bdde2d
resourceId  : 2795c924-e54b-4a0c-9f26-c7b8c1bdde2d
etag        : W/"2615a063-9a59-40c1-a0bc-09b78fdacfb8"
instanceId  : f9fe6ccc-a2ca-44fd-816f-58db52f7f5b3
properties  : @{provisioningState=Succeeded; connections=System.Object[]; certificate=MIIDFDCCAfygAwIBAgIQY7AaAzTku6VD1O2qBWKY
              DAxLlNETi5MQUIwHhcNMjAwNTA3MjE1NjUzWhcNMzAwNTA3MjIwNjUxWjAdMRswGQYDVQQDDBJTRE4tSE9TVDAxLlNETi5MQUIwggEiMA0GCSqGS
              6pjs0C4Qsl6HTdTVS3Xs6MR9ak7WWP7nUwsmUBrXT592im/JR1QwD9zWWPRNlINv5fFmscuVnlsy9j+SyxPWzQ5J5EjKCuTY2RGg/z4eh8vOuF7A
              u/FlW1j4UEtj4ZQHO2kLla4RZDsu1gNh7cVsGpCd6jG+IRSEPqlrvFNt/l1EBKNMu6T43ZKXGOV4+TiP5QvhgSd0FZmN+4qzBajq/NhMOX2GLxjc
              AgMBAAGjUDBOMA4GA1UdDwEB/wQEAwIFoDAdBgNVHSUEFjAUBggrBgEFBQcDAQYIKwYBBQUHAwIwHQYDVR0OBBYEFDCw4tK5ugtqUfFGllZbaxSF
              /++gJfq/gv2cvoq1HbKDUEJsPs6N0bAoZZHK5zhJnodVWZZAdSKBFaJTNoud0f60JszUsmpNjki0IvKJKnZvoDAdqJCzVKJV1eOKnMi5anznj6wT
              tmB6UoxU9fox5YV/nSLK2Rkb8AKgzy7K7pHC9R+Ls5hdZjeyoOl6Cf1TsXNouLkLAuUqTB3VfTZwJ4Z+5levZDBCKHo7iam0WjjIFG69N885YINT
              o; auditingEnabled=System.Object[]; configurationState=; virtualNetworkInterfaces=System.Object[]; networkInterf

resourceRef : /servers/46a9a408-4e62-4989-8cb3-b85af0652431
resourceId  : 46a9a408-4e62-4989-8cb3-b85af0652431
etag        : W/"a81e9181-74d8-4528-a627-40d7b30f1219"
instanceId  : d0360c5a-44b1-414c-bca7-9db290cc110e
properties  : @{provisioningState=Succeeded; connections=System.Object[]; certificate=MIIDFDCCAfygAwIBAgIQeyuFA8BBFrdGrk34W0wo
              DAyLlNETi5MQUIwHhcNMjAwNTA3MjE1OTU4WhcNMzAwNTA3MjIwOTU2WjAdMRswGQYDVQQDDBJTRE4tSE9TVDAyLlNETi5MQUIwggEiMA0GCSqGS
              dsvylN6EnevHe1j5nPrA9Aw4psntXqN/wOFA8p0vyw2FWDSWyILGVeVVpwoBpEHbSoz4YGuqnN2rvkLQH8HJdpxHDntDOYz74lx5+iJ9kjUY2E9c
              Rm4Hrd3iDUDuNpV1e6AAPsH1ha5k++S6WGubm98+li7Y4YFFKd9F79XwJEg44sEZyeXO6jWSdtz1e/C2fAyf/F7/2FphdwoZP7bH+jYKopINbGL/
              AgMBAAGjUDBOMA4GA1UdDwEB/wQEAwIFoDAdBgNVHSUEFjAUBggrBgEFBQcDAQYIKwYBBQUHAwIwHQYDVR0OBBYEFB/72bCwrtakaQUhW0znc8EC
              aLGG/bXp0CTInSy3Ire1xx9N2IAKmEASx/fiLMGS/x/IcfUp/RAT2B+HAsMimlJ/pIt2M7sgmZeZM4cTP2Rajmp3qzI/h/4tbp88Un7cwvB2ODPE
              OsHlzMpcdp3xWKFUY/I/6iM7WrhEcbYjCzbqJiu7/hQgDiRpmcwxITD94iDAbpfSxGEo4+PLbgNVd+xPD461BAzPbi3WJFxgs8ov/9Zfo7/MIeYS
              y; auditingEnabled=System.Object[]; configurationState=; virtualNetworkInterfaces=System.Object[]; networkInterf
```

Run **Get-SdnResource** with **-ResourceRef {resourceRef}** using one of the resource references returned in the previous result.

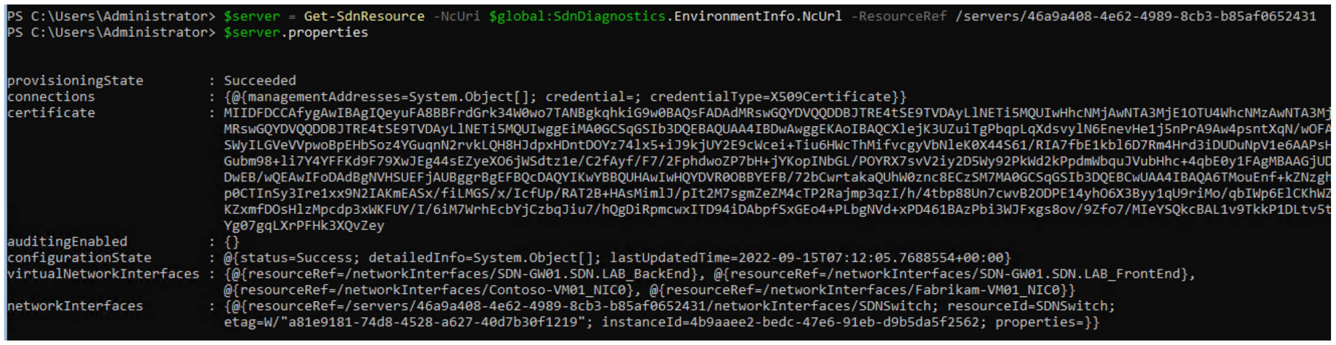
```
Get-SdnResource -NcUri $Global:SdnDiagnostics.EnvironmentInfo.NcUrl -ResourceRef
/servers/46a9a408-4e62-4989-8cb3-b85af0652431
```



```
PS C:\Users\Administrator> Get-SdnResource -NcUri $global:SdnDiagnostics.EnvironmentInfo.NcUrl -ResourceRef /servers/46a9a408-4e62-4989-8cb3-b85af0652431

resourceRef : /servers/46a9a408-4e62-4989-8cb3-b85af0652431
resourceId  : 46a9a408-4e62-4989-8cb3-b85af0652431
etag        : W/"a81e9181-74d8-4528-a627-40d7b30f1219"
instanceId  : d9360c59-44b1-414c-bc91-6db269cc1106
properties  : @{provisioningState=Succeeded; connections=System.Object[]; certificate=MIIDFDCCAfygAwIBAgIQeyuFA8BBFrdGrk34W0wo7TANBgkqhkiG9w0BAQsFADAdMRsw
              DAyLlNETi5MQUIwHhcNMjAwNTA3MjE1OTU4WhcNMzAwNTA3MjE1OTU4WjAdMRswGQYDVQQDDBJTRE4tSE9TVDAyLlNETi5MQUIwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBA
              qXdsvylN6EnevHe1j5nPrA9Aw4psntXqN/wOFA8gbAyWzFMDsMyIrGVeVVpwoBpEHbSoz4YGuqnN2rvkLQH8HJdpxHDntDOYz74lx5+iJ9kjUY2E9cWcei+Tiu6HWcThMifvcgyVbNleK0
              Rm4Hrd3iDUDuNpV1e6AAPsHIH92K++2oMGubm98+li7Y4YFFKd9F79XwJEg44sEZyeXO6jWSdtz1e/C2fAyf/F7/2FphdwoZP7bH+jYKopINbGL/POYRX7svV2iy2D5Wy92PkWd2kPpd
              VgMBAAGjUDBOMA4GA1UdDwEB/wQEAwIFoDAdBgNVHSUEFjAUBggrBgEFBQcDAQYIKwYBBQUHAwIwHQYDVR0OBBYEFB/72bCwrtakaQUhW0znc8ECzSM7MA0GCSqGSIb3DQEBCwUAA4IB
              Aee/bxpeCIInSy3Ire1xx9N2IAKmEASx/fiLMGS/x/IcfUp/RAT2B+HAsMimlJ/pIt2M7sgmZeZM4cTP2Rajmp3qzI/h/4tbp88Un7cwvB2ODPE14yhO6X3Byy1qU9riMo/qbIWpeEI
              O2HIZwpcdp3xWKFUY/I/6iM7WrhEcbYjCzbqJiu7/hQgDiRpmcwxITD94iDAbpfSxGEo4+PLbgNVd+xPD461BAzPbi3WJFxgs8ov/9Zfo7/MIeYSQkcBAL1v9TkkP1DLtv5tYg07gqLXrPFHk3XQvZe
              y; auditingEnabled=System.Object[]; configurationState=; virtualNetworkInterfaces=System.Object[]; networkInterfaces=System.Object[]}
```

View the properties of the object by assigning the value to a variable and enumerating through the PSObject properties.

```
$server = Get-SdnResource -NcUri $Global:SdnDiagnostics.EnvironmentInfo.NcUrl -
ResourceRef /servers/46a9a408-4e62-4989-8cb3-b85af0652431
$server.Properties
```



```
PS C:\Users\Administrator> $server = Get-SdnResource -NcUri $global:SdnDiagnostics.EnvironmentInfo.NcUrl -ResourceRef /servers/46a9a408-4e62-4989-8cb3-b85af0652431
PS C:\Users\Administrator> $server.properties


provisioningState        : Succeeded
connections              : {@{managementAddresses=System.Object[]; credential=; credentialType=X509Certificate}}
certificate              : MIIDFDCCAfygAwIBAgIQeyuFA8BBFrdGrk34W0wo7TANBgkqhkiG9w0BAQsFADAdMRswGQYDVQQDDBJTRE4tSE9TVDAyLlNETi5MQUIwHhcNMjAwNTA3MjE1OTU4WhcNMzAwNTA3Mj
                           MRswGQYDVQQDDBJTRE4tSE9TVDAyLlNETi5MQUIwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBAQCXlejK3UZuiTgPbqpLqXdsvylN6EnevHe1j5nPrA9Aw4psntXqN/wOFA
                           SWyILGVeVVpwoBpEHbSoz4YGuqnN2rvkLQH8HJdpxHDntDOYz74lx5+iJ9kjUY2E9cWcei+Tiu6HWcThMifvcgyVbNleK0X44S61/RIA7fbE1kbl6D7Rm4Hrd3iDUDuNpV1e6AAPsH
                           Gubm98+li7Y4YFFKd9F79XwJEg44sEZyeXO6jWSdtz1e/C2fAyf/F7/2FphdwoZP7bH+jYKopINbGL/POYRX7svV2iy2D5Wy92PkWd2kPpdmWbquJVubHhc+4qbE0y1FAgMBAAGjUD
                           DwEB/wQEAwIFoDAdBgNVHSUEFjAUBggrBgEFBQcDAQYIKwYBBQUHAwIwHQYDVR0OBBYEFB/72bCwrtakaQUhW0znc8ECzSM7MA0GCSqGSIb3DQEBCwUAA4IBAQA6TMouEnf+kZNzgh
                           p0CTInSy3Ire1xx9N2IAKmEASx/fiLMGS/x/IcfUp/RAT2B+HAsMimlJ/pIt2M7sgmZeZM4cTP2Rajmp3qzI/h/4tbp88Un7cwvB2ODPE14yhO6X3Byy1qU9riMo/qbIWp6ElCKhWZ
                           KZxmfDOsHlzMpcdp3xWKFUY/I/6iM7WrhEcbYjCzbqJiu7/hQgDiRpmcwxITD94iDAbpfSxGEo4+PLbgNVd+xPD461BAzPbi3WJFxgs8ov/9Zfo7/MIeYSQkcBAL1v9TkkP1DLtv5t
                           Yg07gqLXrPFHk3XQvZey
auditingEnabled          : {}
configurationState       : @{status=Success; detailedInfo=System.Object[]; lastUpdatedTime=2022-09-15T07:12:05.7688554+00:00}
virtualNetworkInterfaces : {@{resourceRef=/networkInterfaces/SDN-GW01.SDN.LAB_BackEnd}, @{resourceRef=/networkInterfaces/SDN-GW01.SDN.LAB_FrontEnd},
                           @{resourceRef=/networkInterfaces/Contoso-VM01_NIC0}, @{resourceRef=/networkInterfaces/Fabrikam-VM01_NIC0}}
networkInterfaces        : {@{resourceRef=/servers/46a9a408-4e62-4989-8cb3-b85af0652431/networkInterfaces/SDNSwitch; resourceId=SDNSwitch;
                           etag=W/"a81e9181-74d8-4528-a627-40d7b30f1219"; instanceId=4b9aaee2-bedc-47e6-91eb-d9b5da5f2562; properties=}}
```

Try This:

1. Can you view retrieve the resource properties for one of the networkInterface objects?
2. Try converting the properties to JSON using **| ConvertTo-Json -Depth 100** to see all the resource properties.
3. Examine other SDN fabric resources, such as Credentials, LogicalNetworks, LoadBalancerMuxes, LoadBalancerManagerConfig, Gateways

M1.3 Southbound API

Network Controller communication with Servers and MUX devices uses certificates for authentication.

Communication with the hosts is over OVSDB protocol while communication with the SLB MUX devices is over the WCF protocol. For communication with the Servers over OVSDB, Network Controller needs to present a certificate.

Lab 1: Verify Southbound Certificates

1. Examine the Southbound nodes (Servers and MUXes) to see which certificates are present under Cert:\LocalMachine\My to see which certificates are present.
2. If using self-signed certificates, examine the Cert:\LocalMachine\Root store to see which certificates are present.

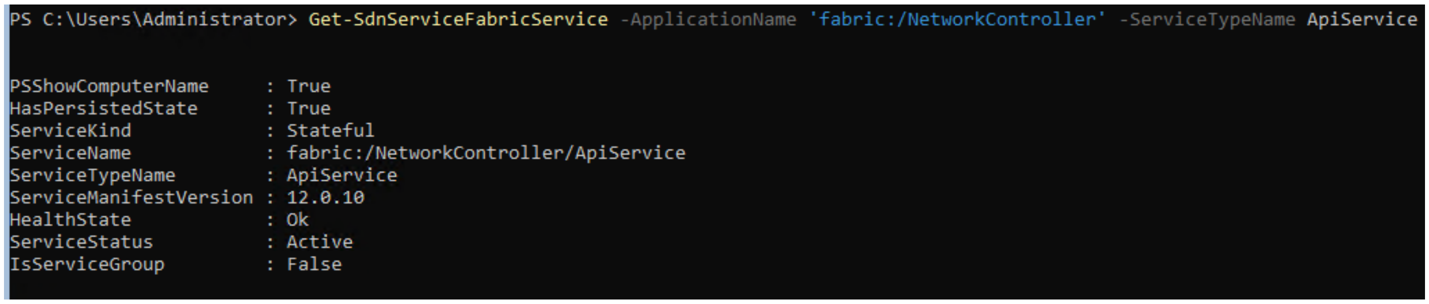
M1.4 Network Controller Services

Network Controller is an application hosted on Service Fabric, with multiple services such as vSwitchService and SlbManagerService that make up Network Controller.

Lab 1: Get Service Fabric Service

Each Service Fabric Service can be exposed by running:

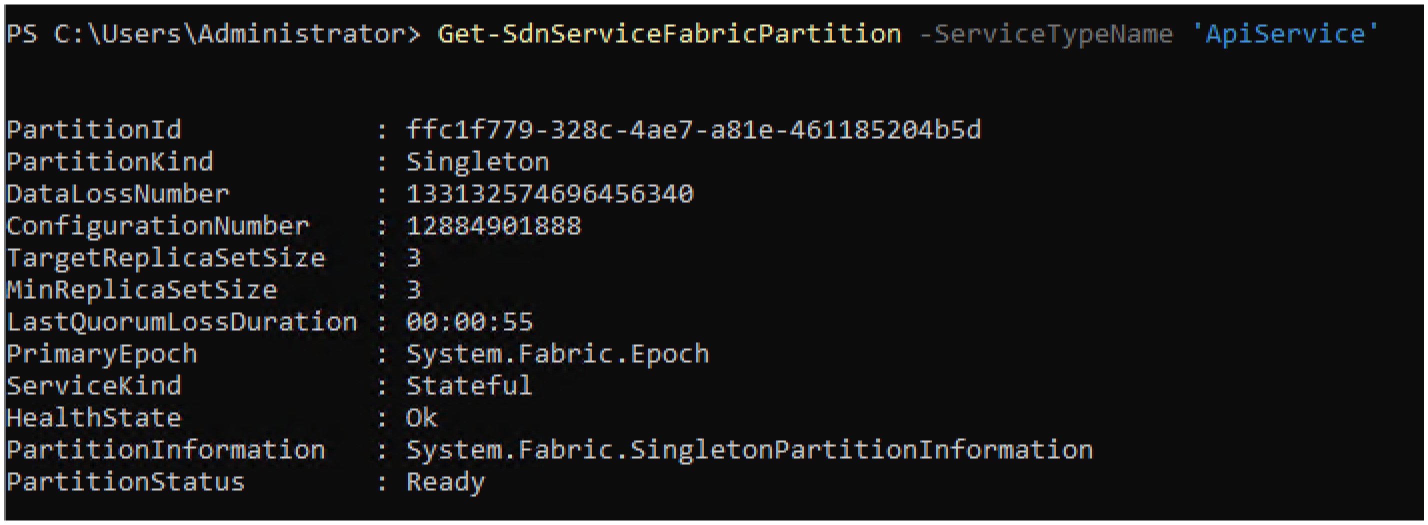
```
Get-SdnServiceFabricService -ApplicationName 'fabric:/NetworkController' -
ServiceTypeName ApiService
```



```
PS C:\Users\Administrator> Get-SdnServiceFabricService -ApplicationName 'fabric:/NetworkController' -ServiceTypeName ApiService


PSShowComputerName     : True
HasPersistedState      : True
ServiceKind            : Stateful
ServiceName            : fabric:/NetworkController/ApiService
ServiceTypeName        : ApiService
ServiceManifestVersion : 12.0.10
HealthState            : Ok
ServiceStatus          : Active
IsServiceGroup         : False
```

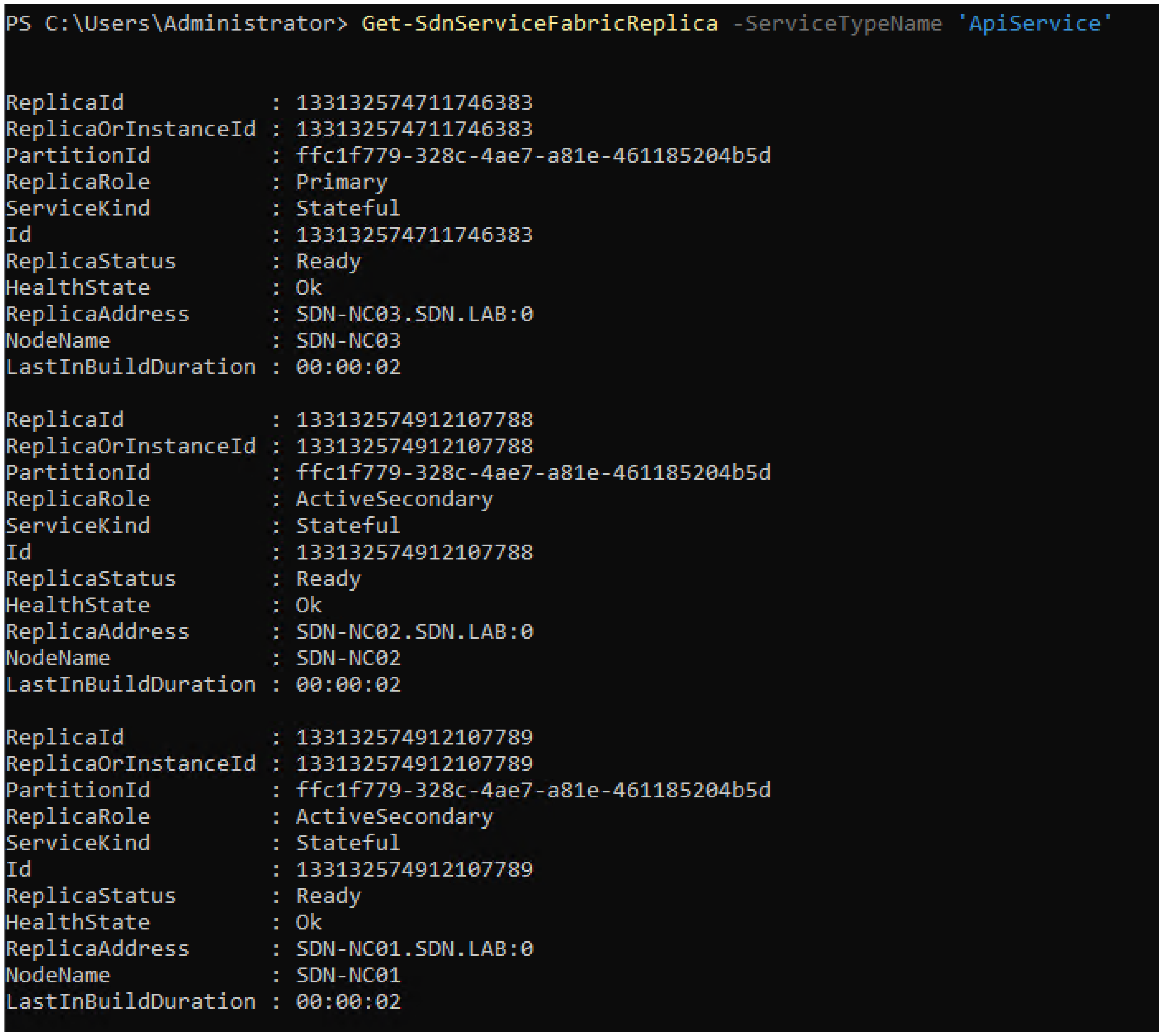
Correspondingly, you can get the Partition Database for a particular service by running:

```
Get-SdnServiceFabricPartition -ServiceTypeName ApiService
```


```
PS C:\Users\Administrator> Get-SdnServiceFabricPartition -ServiceTypeName 'ApiService'


PartitionId             : ffc1f779-328c-4ae7-a81e-461185204b5d
PartitionKind           : Singleton
DataLossNumber          : 133132574696456340
ConfigurationNumber     : 12884901888
TargetReplicaSetSize    : 3
MinReplicaSetSize       : 3
LastQuorumLossDuration  : 00:00:55
PrimaryEpoch            : System.Fabric.Epoch
ServiceKind             : Stateful
HealthState             : Ok
PartitionInformation    : System.Fabric.SingletonPartitionInformation
PartitionStatus         : Ready
```

To get the Service Fabric Replica, you can leverage Get-SdnServiceFabricReplica. You can also add -Primary switch if you want to only return the primary replica as Network Controller leverages stateful fabric services, which always use Primary and ActiveSecondary replicas.

```
Get-SdnServiceFabricReplica -ApplicationName 'fabric:/NetworkController' -
ServiceTypeName ApiService
```

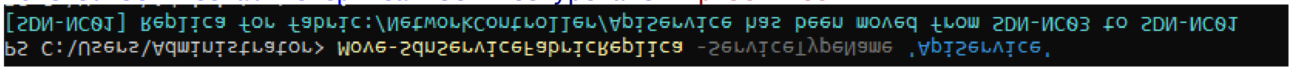


```
PS C:\Users\Administrator> Get-SdnServiceFabricReplica -ServiceTypeName 'ApiService'


ReplicaId              : 133132574711746383
ReplicaOrInstanceId    : 133132574711746383
PartitionId            : ffc1f779-328c-4ae7-a81e-461185204b5d
ReplicaRole            : Primary
ServiceKind            : Stateful
Id                     : 133132574711746383
ReplicaStatus          : Ready
HealthState            : Ok
ReplicaAddress         : SDN-NC03.SDN.LAB:0
NodeName               : SDN-NC03
LastInBuildDuration    : 00:00:02

ReplicaId              : 133132574912107788
ReplicaOrInstanceId    : 133132574912107788
PartitionId            : ffc1f779-328c-4ae7-a81e-461185204b5d
ReplicaRole            : ActiveSecondary
ServiceKind            : Stateful
Id                     : 133132574912107788
ReplicaStatus          : Ready
HealthState            : Ok
ReplicaAddress         : SDN-NC02.SDN.LAB:0
NodeName               : SDN-NC02
LastInBuildDuration    : 00:00:02

ReplicaId              : 133132574912107789
ReplicaOrInstanceId    : 133132574912107789
PartitionId            : ffc1f779-328c-4ae7-a81e-461185204b5d
ReplicaRole            : ActiveSecondary
ServiceKind            : Stateful
Id                     : 133132574912107789
ReplicaStatus          : Ready
HealthState            : Ok
ReplicaAddress         : SDN-NC01.SDN.LAB:0
NodeName               : SDN-NC01
LastInBuildDuration    : 00:00:02
```

Lab 2: Failover the Primary Replica

In some instances there may not be something working correctly where the policies you are expecting to be programmed into the southbound devices are just not happening. One of the easiest things to do if your Service Fabric cluster is not in quorum loss, is to perform a failover of the primary replica. This is only possible when you have more than 3 Network Controller nodes within your cluster.

```
Move-SdnServiceFabricReplica -ServiceTypeName 'ApiService'
```

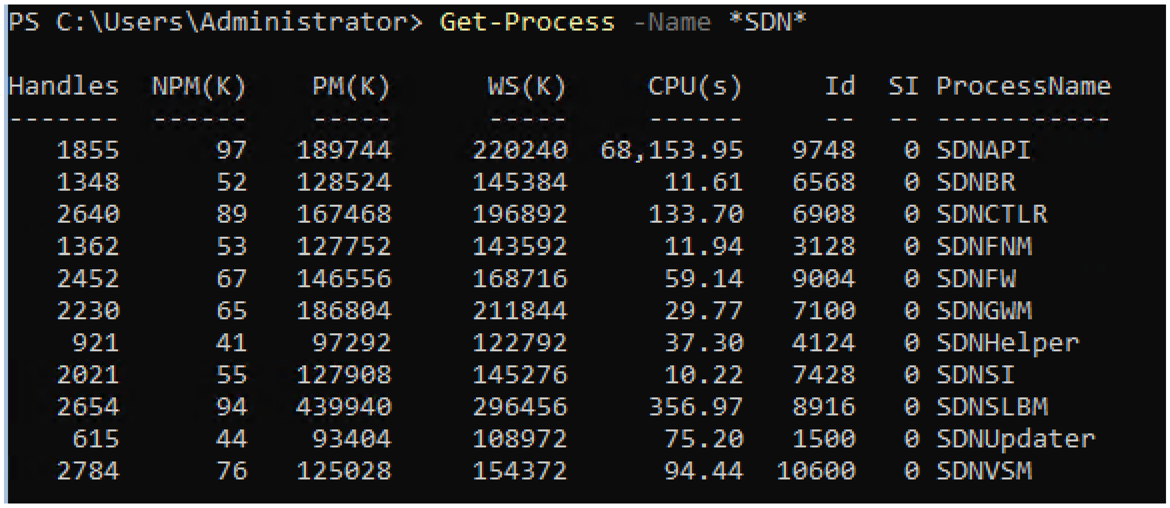


```
PS C:\Users\Administrator> Move-SdnServiceFabricReplica -ServiceTypeName 'ApiService'
[SDN-NC01] Replica for fabric:\NetworkController\ApiService has been moved from SDN-NC03 to SDN-NC01
```

Lab 3: Get Process for Service Fabric Service

Each of the Service Fabric Services has a corresponding process that is running on each of the replica nodes.

```
Get-Process -Name *SDN*
```



```
PS C:\Users\Administrator> Get-Process -Name *SDN*

Handles  NPM(K)    PM(K)      WS(K)     CPU(s)     Id  SI ProcessName
-------  ------    -----      -----     ------     --  -- -----------
   1855      97   189744     220240  68,153.95   9748   0 SDNAPI
   1348      52   128524     145384      11.61   6568   0 SDNBR
   2640      89   167468     196892     133.70   6908   0 SDNCTLR
   1362      53   127752     143592      11.94   3128   0 SDNFNM
   2452      67   146556     168716      59.14   9004   0 SDNFW
   2230      65   186804     211844      29.77   7100   0 SDNGWM
    921      41    97292     122792      37.30   4124   0 SDNHelper
   2021      55   127908     145276      10.22   7428   0 SDNSI
   2654      94   439940     296456     356.97   8916   0 SDNSLBM
    615      44    93404     108972      75.20   1500   0 SDNUpdater
   2784      76   125028     154372      94.44  10600   0 SDNVSM
```

If the processes are not running, this is an indication that something is wrong with the Service Fabric Cluster, Application or Services themselves. If they are not running, the services will not be able to push policies and rules down to NCHostAgent / OVSDB, which would directly impact accessing of resources within the dataplane.

Try This:

- Examine the SDNAPI process details. Where is the SDNAPI.exe located?
- Stop the FabricHostSvc Service. What happens to the SDN processes on that server?

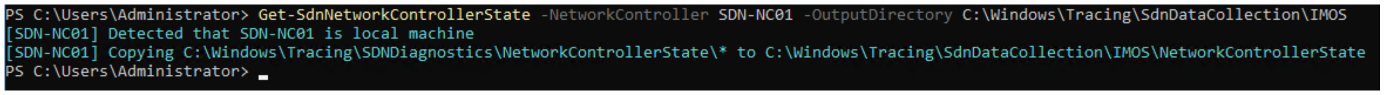
Lab 4: Examine IMOS Data

Service Fabric leverages Key Value Store (KVS) to store the configuration state date. Network Controller adds an In-Memory Object Store (IMOS) schema which provides a database-like abstraction of KVS for the services within Network Controller application. IMOS data can be gathered from Network Controller by performing a PUT request to NetworkControllerState API endpoint to trigger the configuration dump. This operation will result in the primary replicas for each service to output its current IMOS configuration to C:\Windows\Tracing\SdnDiagnostics\NetworkControllerState.

You can leverage Get-SdnNetworkControllerState which will perform the REST API operation, and then will pick up the corresponding service IMOS files from each Network Controller within the Service Fabric cluster.

```
Get-SdnNetworkControllerState -NetworkController 'SDN-NC01' -OutputDirectory
```

```
"C:\Windows\Tracing\SdnDataCollection\IMOS"
```



```
PS C:\Users\Administrator> Get-SdnNetworkControllerState -NetworkController SDN-NC01 -OutputDirectory C:\Windows\Tracing\SdnDataCollection\IMOS
[SDN-NC01] Detected that SDN-NC01 is local machine
[SDN-NC01] Copying C:\Windows\Tracing\SDNDiagnostics\NetworkControllerState\* to C:\Windows\Tracing\SdnDataCollection\IMOS\NetworkControllerState
PS C:\Users\Administrator>
```

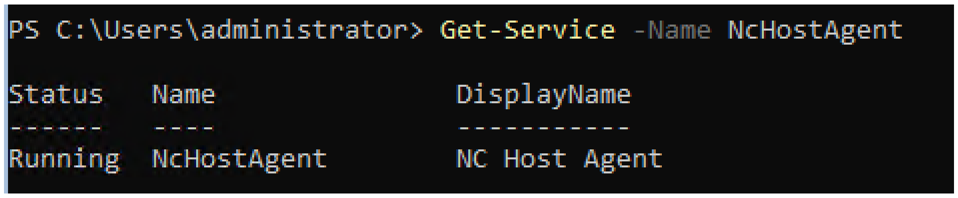
Once the command has completed, navigate to the directory (local from where command was executed from) and examine the output.

M1.5 Network Controller Host Agent

An extension of the Network Controller is the NCHostAgent that is installed on the Hyper-V hosts that are managed by the Network Controller. All policies are pushed from services hosted on Network Controller to the OVSDB tables within NCHostAgent to be programmed into the VFP in the dataplane. If for any reason the network changes do not appear to be happening and the Network Controller API is showing the correct state, then need to verify that the Network Controller can talk to the NCHostAgent.

Lab 1: Verify Southbound Connectivity

Verify that the NCHostAgent service is running by running **Get-Service -Name NcHostAgent** on one of the Hyper-V hosts.

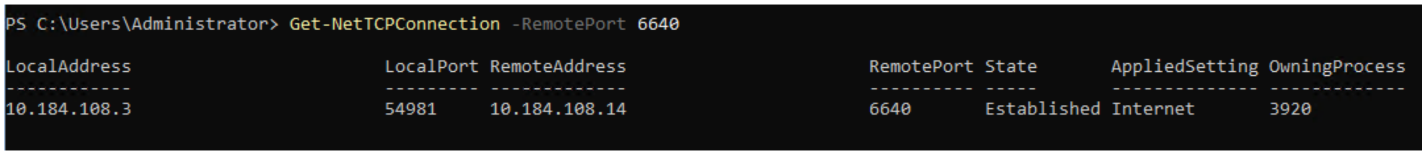


```
PS C:\Users\administrator> Get-Service -Name NcHostAgent

Status   Name               DisplayName
------   ----               -----------
Running  NcHostAgent        NC Host Agent
```

When the NCHostAgent service is running, it will create a TLS connection from the Hyper-V host to the SDN API primary replica over TCP Port 6640.

NOTE: In Azure Stack HCI 23H2 systems, this has been changed to port 6645 that NCHostAgent is listening for and receiving connections from Network Controller. Examine HKLM:\SYSTEM\CurrentControlSet\Services\NCHostAgent\Connections to verify the port.

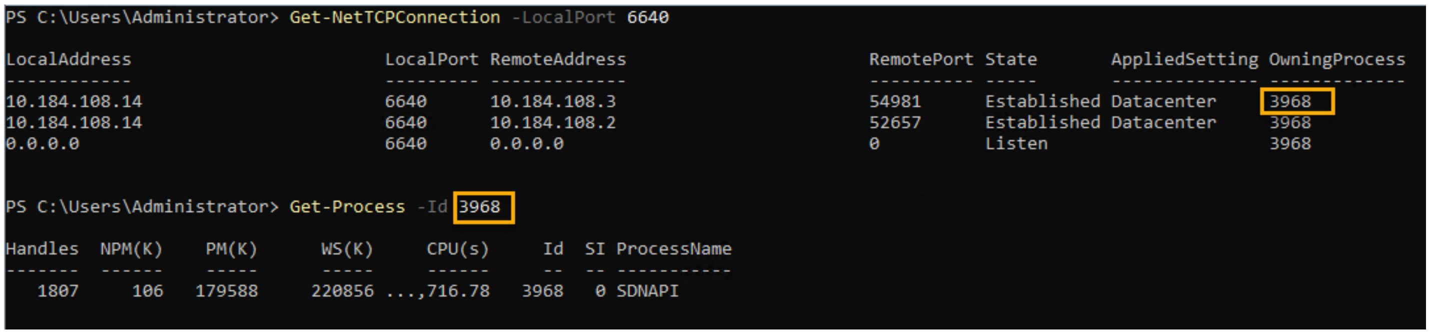
```
Get-NetTCPConnection -RemotePort 6640
```



```
PS C:\Users\Administrator> Get-NetTCPConnection -RemotePort 6640

LocalAddress                        LocalPort RemoteAddress                        RemotePort State       AppliedSetting OwningProcess
------------                        --------- -------------                        ---------- -----       -------------- -------------
10.184.108.3                        54981     10.184.108.14                        6640       Established Internet       3920
```

If you connect into the Remote Address, you can isolate the process that the TCP connection is related to by focusing on TCP Port 6640.

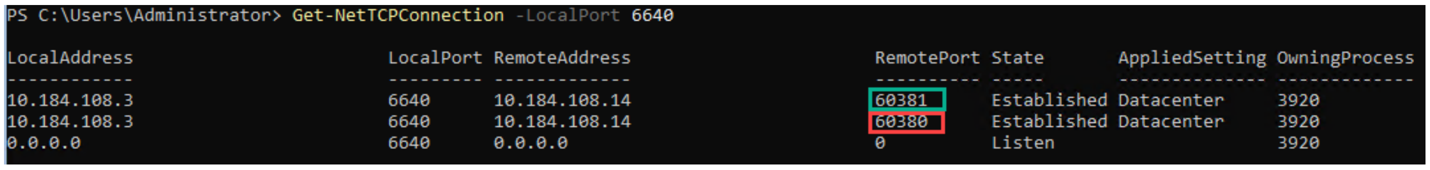
```
Get-NetTCPConnection -LocalPort 6640
Get-Process -Id 3968
```



```
PS C:\Users\Administrator> Get-NetTCPConnection -LocalPort 6640

LocalAddress                        LocalPort RemoteAddress                        RemotePort State       AppliedSetting OwningProcess
------------                        --------- -------------                        ---------- -----       -------------- -------------
10.184.108.14                       6640      10.184.108.3                         54981      Established Datacenter     3968
10.184.108.14                       6640      10.184.108.2                         52657      Established Datacenter     3968
0.0.0.0                             6640      0.0.0.0                              0          Listen                     3968

PS C:\Users\Administrator> Get-Process -Id 3968

Handles  NPM(K)    PM(K)      WS(K)     CPU(s)     Id  SI ProcessName
-------  ------    -----      -----     ------     --  -- -----------
   1807     106   179588     220856 ...,716.78   3968   0 SDNAPI
```

After NCHostAgent establishes a TCP connection with SDN API, Virtual Switch Manager and Firewall Service will create southbound connections to NCHostAgent as well. If there are no tenant workloads that have been deployed, then there will not be a southbound connection from SDN vSwitch Manager service.

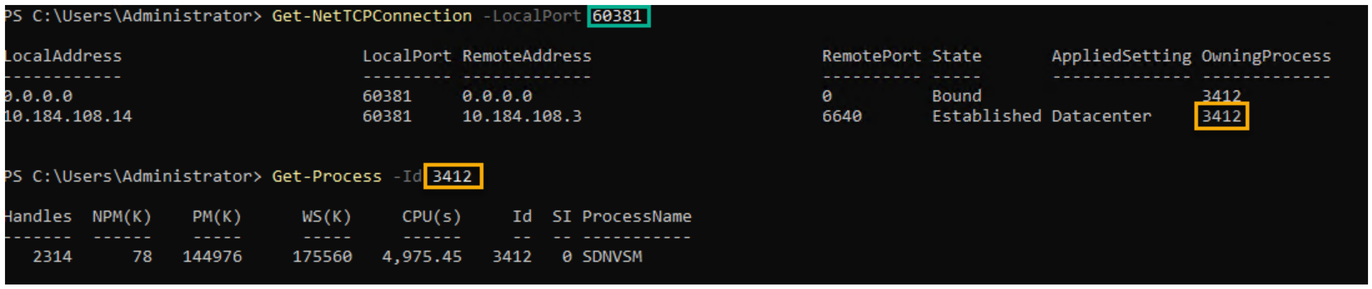
```
Get-NetTCPConnection -LocalPort 6640
```



```
PS C:\Users\Administrator> Get-NetTCPConnection -LocalPort 6640

LocalAddress                        LocalPort RemoteAddress                        RemotePort State       AppliedSetting OwningProcess
------------                        --------- -------------                        ---------- -----       -------------- -------------
10.184.108.3                        6640      10.184.108.14                        60381      Established Datacenter     3920
10.184.108.3                        6640      10.184.108.14                        60380      Established Datacenter     3920
0.0.0.0                             6640      0.0.0.0                              0          Listen                     3920
```

If you connect into the Remote Address, you can isolate the process that the TCP connection is related to by identifying the OwningProcess for the TCP connection and comparing it with current running processes.

```
Get-NetTCPConnection -LocalPort 6640
Get-Process -Id ####
```



```
PS C:\Users\Administrator> Get-NetTCPConnection -LocalPort 60381

LocalAddress                        LocalPort RemoteAddress                        RemotePort State       AppliedSetting OwningProcess
------------                        --------- -------------                        ---------- -----       -------------- -------------
0.0.0.0                             60381     0.0.0.0                              0          Bound                      3412
10.184.108.14                       60381     10.184.108.3                         6640       Established Datacenter     3412

PS C:\Users\Administrator> Get-Process -Id 3412

Handles  NPM(K)    PM(K)      WS(K)     CPU(s)     Id  SI ProcessName
-------  ------    -----      -----     ------     --  -- -----------
   2314      78   144976     175560   4,975.45   3412   0 SDNVSM
```

Try this:

- Failover the vSwitchService (SDNVSM) or FirewallService (SDNFW) primary replica on NC multi-node environment. What has happened with the TCP connections to the Hypervisor hosts?

Lab 2: Open vSwitch Database (OVSDB)

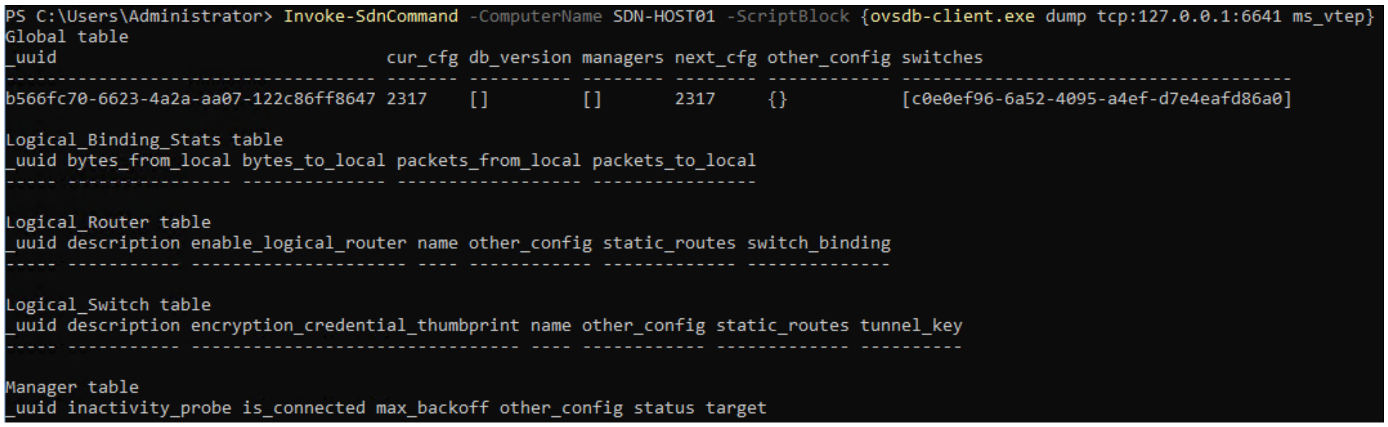
Microsoft's Network Controller pushes policies down to the NC Host Agent running on each hypervisor host using Open vSwitch Database (OVSDB) Management Protocol via the Southbound Interface (SBI). These policies are represented in schemas that are persisted in the host agent's database. A local ARP responder on the host is then able to catch and respond to all ARP requests from the VMs to provide the destination MAC address of the remote VM. The Host Agent database also contains the VTEP IP address of all hosts attached to the virtual subnet. The Host Agent programs mapping rules into the VFP extension of the Hyper-V Virtual Switch to correctly encapsulate and send the VM packet based on the destination VM.

For more information about OVSDB, see RFC 7047. For more information about Microsoft's use of OVSDB, see What's New in Hyper-V Network Virtualization in Windows Server 2016 or Network Virtualization in the Windows Server 2016 Software Defined Networking (SDN) Stack.

The data represented in the tables is also stored in configuration files under %ProgramData%\Microsoft\Windows\NCHostAgent on each compute host. By default, there is a ms_vtep, Firewall, and ServiceInsertion configuration file. You can view the configuration on any of the hosts by opening an administrative command prompt and running **ovsdb-client.exe dump tcp:127.0.0.1:6641 database_name**.

Try running the command either locally on SDN-HOST01 or SDN-HOST02, or leveraging SdnDiagnostics module, from any computer.

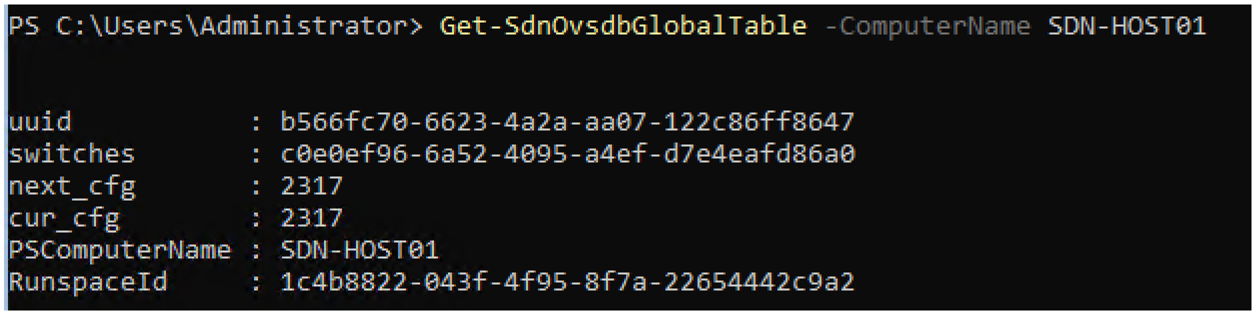
```
Invoke-SdnCommand -ComputerName SDN-HOST01 -ScriptBlock {ovsdb-client.exe dump
tcp:127.0.0.1:6641 ms_vtep}
```



```
PS C:\Users\Administrator> Invoke-SdnCommand -ComputerName SDN-HOST01 -ScriptBlock {ovsdb-client.exe dump tcp:127.0.0.1:6641 ms_vtep}
Global table
_uuid                                cur_cfg db_version managers next_cfg other_config switches
------------------------------------ ------- ---------- -------- -------- ------------ --------------------------------------
b566fc70-6623-4a2a-aa07-122c86ff8647 2317    []         []       2317     {}           [c0e0ef96-6a52-4095-a4ef-d7e4eafd86a0]

Logical_Binding_Stats table
_uuid bytes_from_local bytes_to_local packets_from_local packets_to_local
----- ---------------- -------------- ------------------ ----------------

Logical_Router table
_uuid description enable_logical_router name other_config static_routes switch_binding
----- ----------- --------------------- ---- ------------ ------------- --------------

Logical_Switch table
_uuid description encryption_credential_thumbprint name other_config static_routes tunnel_key
----- ----------- -------------------------------- ---- ------------ ------------- ----------

Manager table
_uuid inactivity_probe is_connected max_backoff other_config status target
```

Alternatively, SdnDiagnostics has several functions available that automatically take the raw database output to create a PSObject that can be more easily worked with.

```
Get-SdnOvsdbGlobalTable -ComputerName SDN-HOST01
```



```
PS C:\Users\Administrator> Get-SdnOvsdbGlobalTable -ComputerName SDN-HOST01


uuid           : b566fc70-6623-4a2a-aa07-122c86ff8647
switches       : c0e0ef96-6a52-4095-a4ef-d7e4eafd86a0
next_cfg       : 2317
cur_cfg        : 2317
PSComputerName : SDN-HOST01
RunspaceId     : 1c4b8822-043f-4f95-8f7a-22654442c9a2
```

To see which functions are available for enumerating the OVSDB data, run:

```
Get-Command -Module SdnDiagnostics -Name *OVSDB*
```

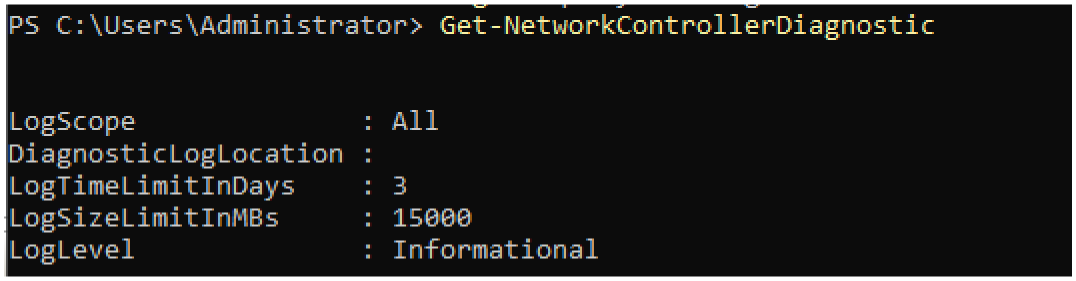
Try this:

- Stop NCHostAgent service on SDN-HOST01 or SDN-HOST02. Try to run OVSDB commands against the MS_VTEP or MS_Firewall database.

M1.6 Component-Level Tracing

Lab 1: Examine Diagnostic Log Settings

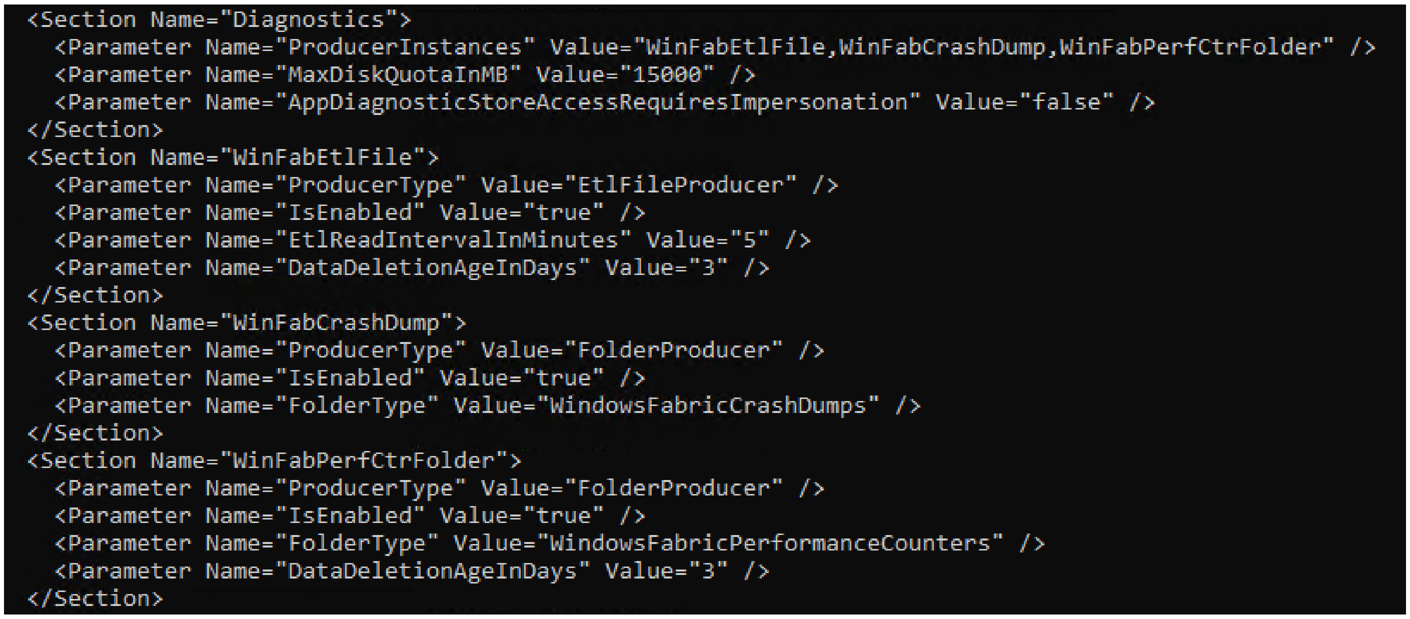
Diagnostic logging is configured using Get-NetworkControllerDiagnostic and Set-NetworkControllerDiagnostic cmdlets. To see the current diagnostics configuration, run Get-NetworkControllerDiagnostic.



```
PS C:\Users\Administrator> Get-NetworkControllerDiagnostic


LogScope              : All
DiagnosticLogLocation :
LogTimeLimitInDays    : 3
LogSizeLimitInMBs     : 15000
LogLevel              : Informational
```

When using the Set-NetworkControllerDiagnostic cmdlet, it is actually pushing the configuration into Service Fabric and forcing a cluster upgrade of the application to take the new log configuration settings. You can also see these log settings by examining the cluster manifest directly using Get-SdnServiceFabricClusterManifest.

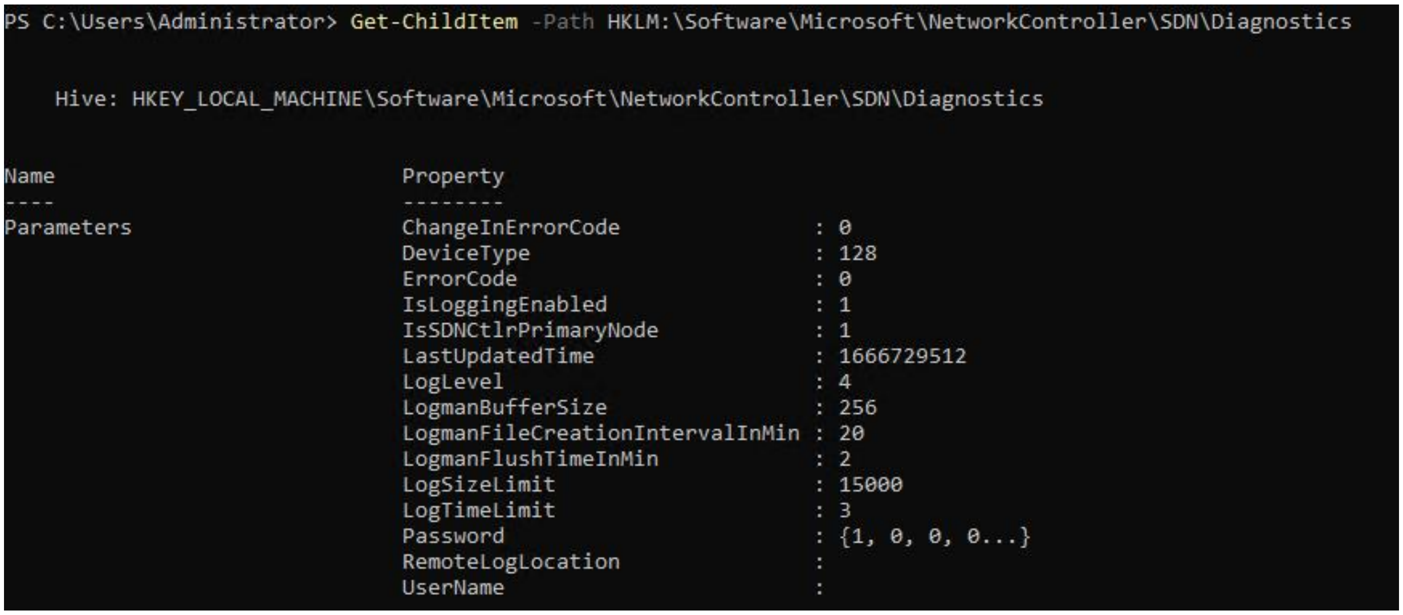
```
<Section Name="Trace/Etw">
  <Parameter Name="Level" Value="4" />
</Section>
```



```
<Section Name="Diagnostics">
  <Parameter Name="ProducerInstances" Value="WinFabEtlFile,WinFabCrashDump,WinFabPerfCtrFolder" />
  <Parameter Name="MaxDiskQuotaInMB" Value="15000" />
  <Parameter Name="AppDiagnosticStoreAccessRequiresImpersonation" Value="false" />
</Section>
<Section Name="WinFabEtlFile">
  <Parameter Name="ProducerType" Value="EtlFileProducer" />
  <Parameter Name="IsEnabled" Value="true" />
  <Parameter Name="EtlReadIntervalInMinutes" Value="5" />
  <Parameter Name="DataDeletionAgeInDays" Value="3" />
</Section>
<Section Name="WinFabCrashDump">
  <Parameter Name="ProducerType" Value="FolderProducer" />
  <Parameter Name="IsEnabled" Value="true" />
  <Parameter Name="FolderType" Value="WindowsFabricCrashDumps" />
</Section>
<Section Name="WinFabPerfCtrFolder">
  <Parameter Name="ProducerType" Value="FolderProducer" />
  <Parameter Name="IsEnabled" Value="true" />
  <Parameter Name="FolderType" Value="WindowsFabricPerformanceCounters" />
  <Parameter Name="DataDeletionAgeInDays" Value="3" />
</Section>
```

These global configuration settings are pushed down to each SDN fabric node into respective registry location.

```
Get-ChildItem -Path HKLM:\Software\Microsoft\NetworkController\SDN\Diagnostics
```

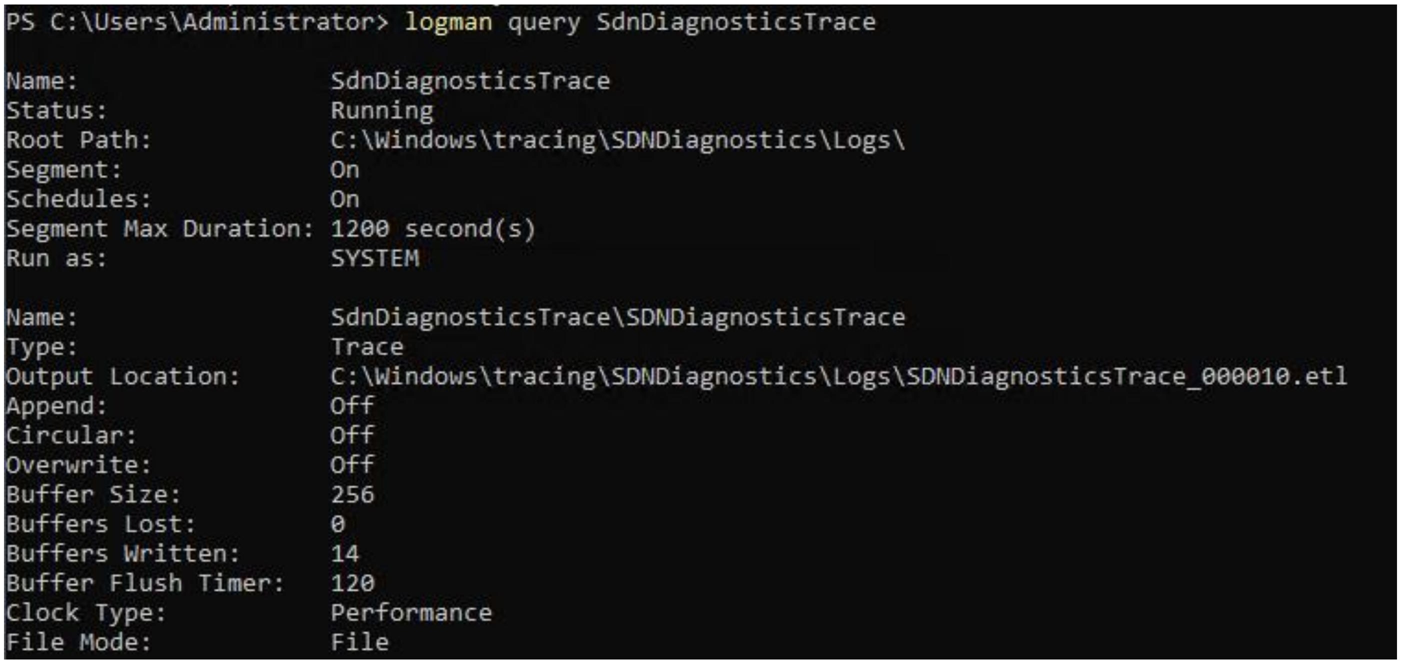


```
PS C:\Users\Administrator> Get-ChildItem -Path HKLM:\Software\Microsoft\NetworkController\SDN\Diagnostics


    Hive: HKEY_LOCAL_MACHINE\Software\Microsoft\NetworkController\SDN\Diagnostics


Name                           Property
----                           --------
Parameters                     ChangeInErrorCode            : 0
                               DeviceType                   : 128
                               ErrorCode                    : 0
                               IsLoggingEnabled             : 1
                               IsSDNCtlrPrimaryNode         : 1
                               LastUpdatedTime              : 1666729512
                               LogLevel                     : 4
                               LogmanBufferSize             : 256
                               LogmanFileCreationIntervalInMin : 20
                               LogmanFlushTimeInMin         : 2
                               LogSizeLimit                 : 15000
                               LogTimeLimit                 : 3
                               Password                     : {1, 0, 0, 0...}
                               RemoteLogLocation            :
                               UserName                     :
```

Lab 2: Examine Logman Trace Settings

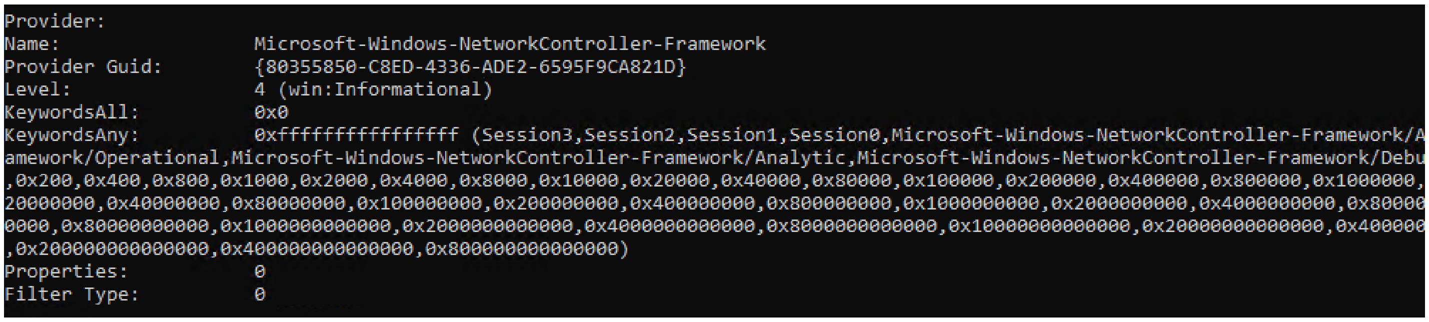
By default, ETW trace logging is enabled on any SDN fabric node. Each role will have its own unique ETW providers that tracing is enabled for.

```
logman query SdnDiagnosticsTrace
```



```
PS C:\Users\Administrator> logman query SdnDiagnosticsTrace

Name:                     SdnDiagnosticsTrace
Status:                   Running
Root Path:                C:\Windows\tracing\SDNDiagnostics\Logs\
Segment:                  On
Schedules:                On
Segment Max Duration: 1200 second(s)
Run as:                   SYSTEM

Name:                     SdnDiagnosticsTrace\SDNDiagnosticsTrace
Type:                     Trace
Output Location:          C:\Windows\tracing\SDNDiagnostics\Logs\SDNDiagnosticsTrace_000010.etl
Append:                   Off
Circular:                 Off
Overwrite:                Off
Buffer Size:              256
Buffers Lost:             0
Buffers Written:          14
Buffer Flush Timer:       120
Clock Type:               Performance
File Mode:                File
```

In addition to the information above, there will be several other properties related to the unique ETW providers that tracing is enabled for.



```
Provider:
Name:                     Microsoft-Windows-NetworkController-Framework
Provider Guid:            {80355850-C8ED-4336-ADE2-6595F9CA821D}
Level:                    4 (win:Informational)
KeywordsAll:              0x0
KeywordsAny:              0xffffffffffffffff (Session3,Session2,Session1,Session0,Microsoft-Windows-NetworkController-Framework/A
amework/Operational,Microsoft-Windows-NetworkController-Framework/Analytic,Microsoft-Windows-NetworkController-Framework/Debu
,0x200,0x400,0x800,0x1000,0x2000,0x4000,0x8000,0x10000,0x20000,0x40000,0x80000,0x100000,0x200000,0x400000,0x800000,0x1000000,
20000000,0x40000000,0x80000000,0x100000000,0x200000000,0x400000000,0x800000000,0x1000000000,0x2000000000,0x4000000000,0x80000
0000,0x80000000000,0x1000000000000,0x2000000000000,0x4000000000000,0x8000000000000,0x10000000000000,0x20000000000000,0x400000
,0x200000000000000,0x400000000000000,0x800000000000000)
Properties:               0
Filter Type:              0
```

Try this:

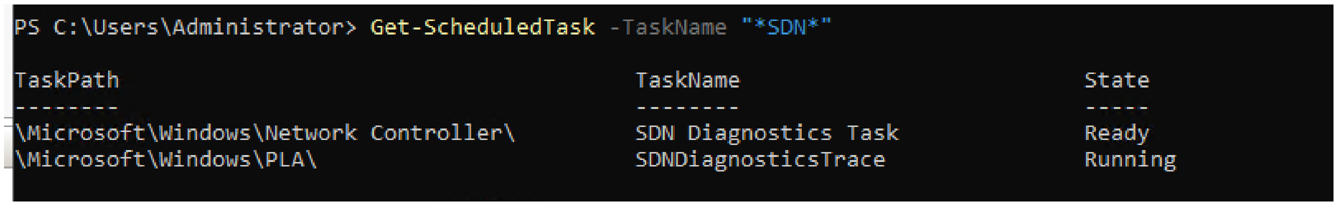
- Examine logman trace settings for other SDN roles to identify which providers are enabled by default.

Lab 3: Examine Scheduled Tasks

Scheduled tasks enable default logging on the respective SDN fabric in addition to preventing the logs from consuming an unlimited amount of space.

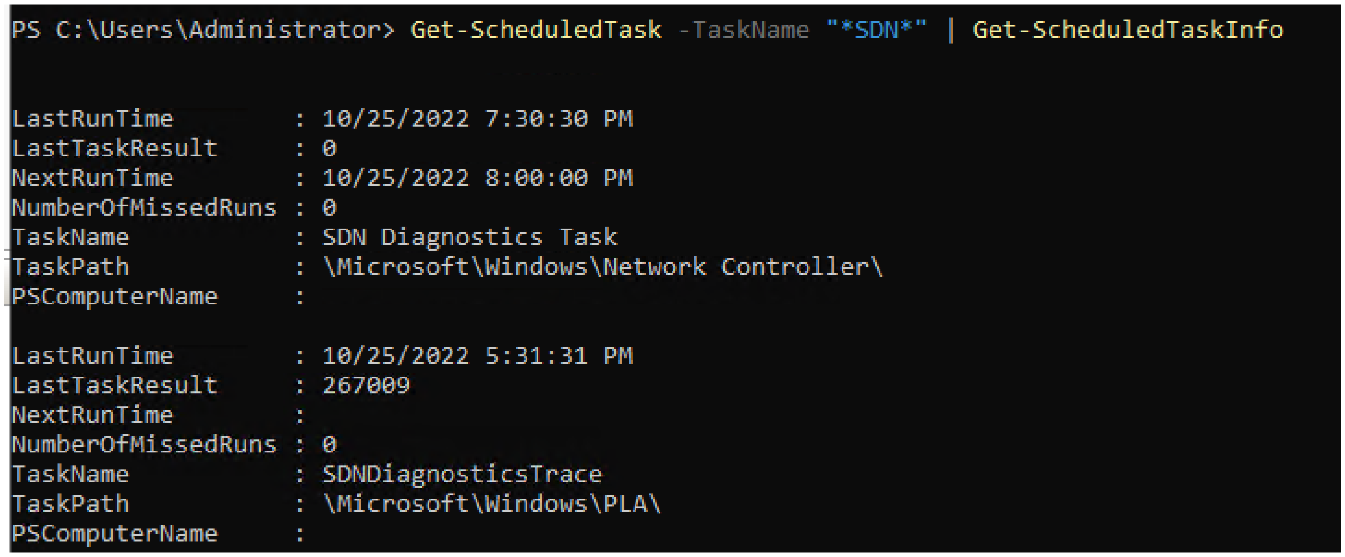
Enumerate current scheduled tasks on SDN-NC01

```
Get-ScheduledTask -TaskName "*SDN*"
```



```
PS C:\Users\Administrator> Get-ScheduledTask -TaskName "*SDN*"

TaskPath                                       TaskName                          State
--------                                       --------                          -----
\Microsoft\Windows\Network Controller\         SDN Diagnostics Task              Ready
\Microsoft\Windows\PLA\                        SDNDiagnosticsTrace               Running
```

To get more details regarding the task itself, you can pipe the output from above to **| Get-ScheduledTaskInfo**



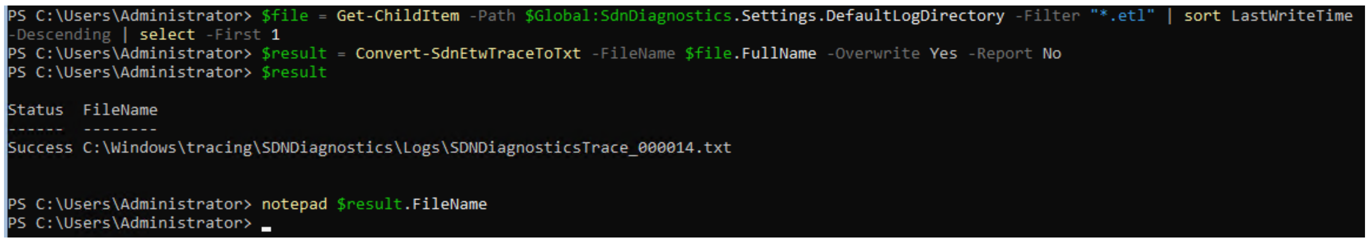
```
PS C:\Users\Administrator> Get-ScheduledTask -TaskName "*SDN*" | Get-ScheduledTaskInfo


LastRunTime        : 10/25/2022 7:30:30 PM
LastTaskResult     : 0
NextRunTime        : 10/25/2022 8:00:00 PM
NumberOfMissedRuns : 0
TaskName           : SDN Diagnostics Task
TaskPath           : \Microsoft\Windows\Network Controller\
PSComputerName     :

LastRunTime        : 10/25/2022 5:31:31 PM
LastTaskResult     : 267009
NextRunTime        :
NumberOfMissedRuns : 0
TaskName           : SDNDiagnosticsTrace
TaskPath           : \Microsoft\Windows\PLA\
PSComputerName     :
```

Lab 4: Convert and View an ETW Trace

There are multiple methods within Microsoft to decode the .etl files into human readable format, however, customers and partners can decode these .etl traces gathered from SDN fabric as these ETW events are manifest based and can be decoded on the systems with the appropriate features and roles installed.

Connect to SDN-NC0# node, and convert one of the .etl trace files and examine the output.

```
$file = Get-ChildItem -Path $Global:SdnDiagnostics.Settings.DefaultLogDirectory -
Filter "*.etl" | sort LastWriteTime -Descending | select -First 1
$result = Convert-SdnEtwTraceToTxt -FileName $file.FullName -Overwrite Yes -Report No
$result

notepad $result.FileName
```



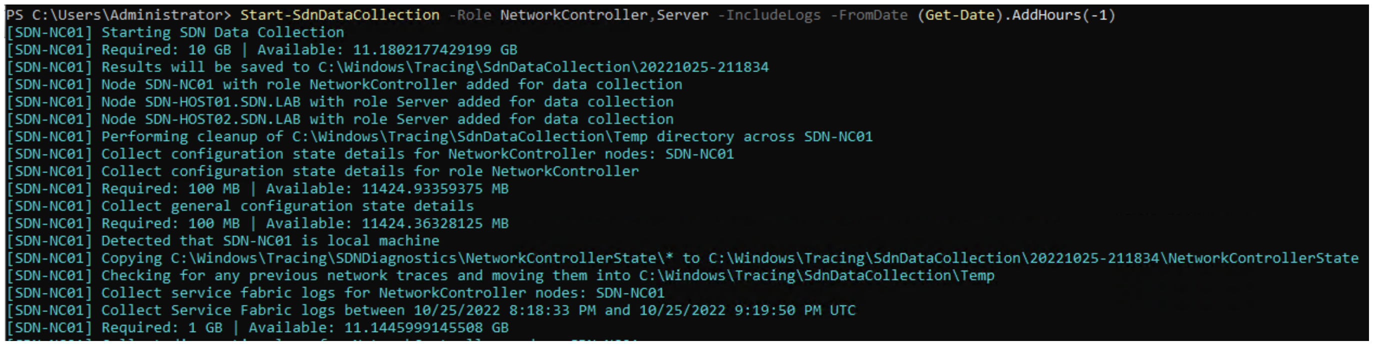
```
PS C:\Users\Administrator> $file = Get-ChildItem -Path $Global:SdnDiagnostics.Settings.DefaultLogDirectory -Filter "*.etl" | sort LastWriteTime
-Descending | select -First 1
PS C:\Users\Administrator> $result = Convert-SdnEtwTraceToTxt -FileName $file.FullName -Overwrite Yes -Report No
PS C:\Users\Administrator> $result

Status  FileName
------  --------
Success C:\Windows\tracing\SDNDiagnostics\Logs\SDNDiagnosticsTrace_000014.txt


PS C:\Users\Administrator> notepad $result.FileName
PS C:\Users\Administrator> _
```

Alternatively, if you are not actively on the system and need to decode the files, you can leverage netsh trace convert which is native Windows command that will decode these files.

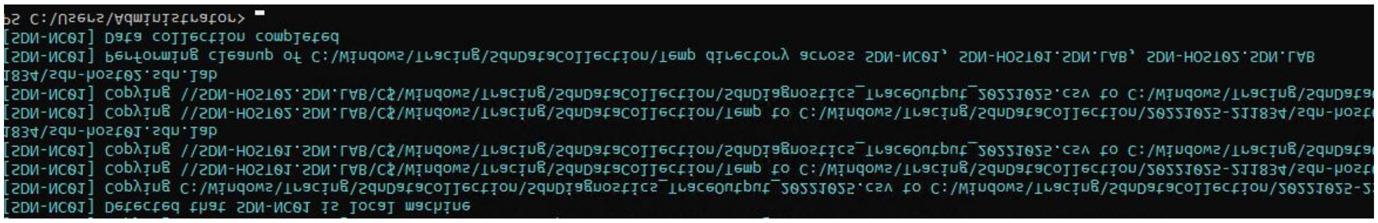
Lab 5: Perform Data Collection

In some instances, we cannot always get to the root cause of customer issues during a single troubleshooting session or may have reached a technical roadblock. In these instances, it is recommended to use Start-SdnDataCollection to gather a comprehensive set of data from the SDN fabric that can be analyzed. SdnDiagnostics module itself can be executed from any location if the user has appropriate permissions to access the Network Controller NB API and SDN fabric nodes.

```
Start-SdnDataCollection -Role NetworkController,Server -IncludeLogs -FromDate (Get-
Date).AddHours(-1)
```



```
PS C:\Users\Administrator> Start-SdnDataCollection -Role NetworkController,Server -IncludeLogs -FromDate (Get-Date).AddHours(-1)
[SDN-NC01] Starting SDN Data Collection
[SDN-NC01] Required: 10 GB | Available: 11.1802177429199 GB
[SDN-NC01] Results will be saved to C:\Windows\Tracing\SdnDataCollection\20221025-211834
[SDN-NC01] Node SDN-NC01 with role NetworkController added for data collection
[SDN-NC01] Node SDN-HOST01.SDN.LAB with role Server added for data collection
[SDN-NC01] Node SDN-HOST02.SDN.LAB with role Server added for data collection
[SDN-NC01] Performing cleanup of C:\Windows\Tracing\SdnDataCollection\Temp directory across SDN-NC01
[SDN-NC01] Collect configuration state details for NetworkController nodes: SDN-NC01
[SDN-NC01] Collect configuration state details for role NetworkController
[SDN-NC01] Required: 100 MB | Available: 11424.93359375 MB
[SDN-NC01] Collect general configuration state details
[SDN-NC01] Required: 100 MB | Available: 11424.36328125 MB
[SDN-NC01] Detected that SDN-NC01 is local machine
[SDN-NC01] Copying C:\Windows\Tracing\SDNDiagnostics\NetworkControllerState\* to C:\Windows\Tracing\SdnDataCollection\20221025-211834\NetworkControllerState
[SDN-NC01] Checking for any previous network traces and moving them into C:\Windows\Tracing\SdnDataCollection\Temp
[SDN-NC01] Collect service fabric logs for NetworkController nodes: SDN-NC01
[SDN-NC01] Collect Service Fabric logs between 10/25/2022 8:18:33 PM and 10/25/2022 9:19:50 PM UTC
[SDN-NC01] Required: 1 GB | Available: 11.1445999145508 GB
```



```
PS C:\Users\Administrator> _
[SDN-NC01] Data collection completed
[SDN-NC01] Performing cleanup of C:\Windows\Tracing\SdnDataCollection\Temp directory across SDN-NC01, SDN-HOST01.SDN.LAB, SDN-HOST02.SDN.LAB
1834\sdn-host02.sdn.lab
[SDN-NC01] Copying \\SDN-HOST02.SDN.LAB\C$\Windows\Tracing\SdnDataCollection\SdnDiagnostics_TraceOutput_20221025.csv to C:\Windows\Tracing\SdnData
[SDN-NC01] Copying \\SDN-HOST02.SDN.LAB\C$\Windows\Tracing\SdnDataCollection\Temp to C:\Windows\Tracing\SdnDataCollection\20221025-211834\sdn-host
1834\sdn-host01.sdn.lab
[SDN-NC01] Copying \\SDN-HOST01.SDN.LAB\C$\Windows\Tracing\SdnDataCollection\SdnDiagnostics_TraceOutput_20221025.csv to C:\Windows\Tracing\SdnData
[SDN-NC01] Copying \\SDN-HOST01.SDN.LAB\C$\Windows\Tracing\SdnDataCollection\Temp to C:\Windows\Tracing\SdnDataCollection\20221025-211834\sdn-host
[SDN-NC01] Copying C:\Windows\Tracing\SdnDataCollection\SdnDiagnostics_TraceOutput_20221025.csv to C:\Windows\Tracing\SdnDataCollection\20221025-2
[SDN-NC01] Detected that SDN-NC01 is local machine
```

Logs by default will be saved under C:\Windows\Tracing\SdnDiag\SdnDataCollection_{date-timestamp}. The data collected will depend on which parameters were defined and what roles were collected. Take some time to explore the dataset that was collected to get a feel for the content that is collected. Visual Studio Code is useful for this scenario as it allows you to open the parent directory and examine the resources. Extensive marketplace extensions make viewing certain file types much easier.