

DEPLOYMENT GUIDE

Autoscaling of NIOS on VMware using PowerShell

NIOS version 8.3 | October 2018

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Overview

Introduction

Auto-scaling is a way to automatically scale up or down the number of compute resources that are being allocated to your application based on its needs at any given time.

Autoscaling is useful whenever your site/application needs additional resources to satisfy the number of requests or processing jobs. Many people think about autoscaling in terms of handling sudden bursts or traffic spikes, but autoscaling is equally beneficial over the lifetime of your setup whether it's one year or ten years.

The key point is that you can now design a scalable architecture that will automatically scale-up or scale-down to meet your needs over the lifetime of your setup regardless of how fast/slow or big/small your site grows over that time.

The PowerShell script [here](#) enables you to automatically scale up or down the Infoblox grid, hosted on a VMware environment, based on DNS queries per second.

PowerShell Script

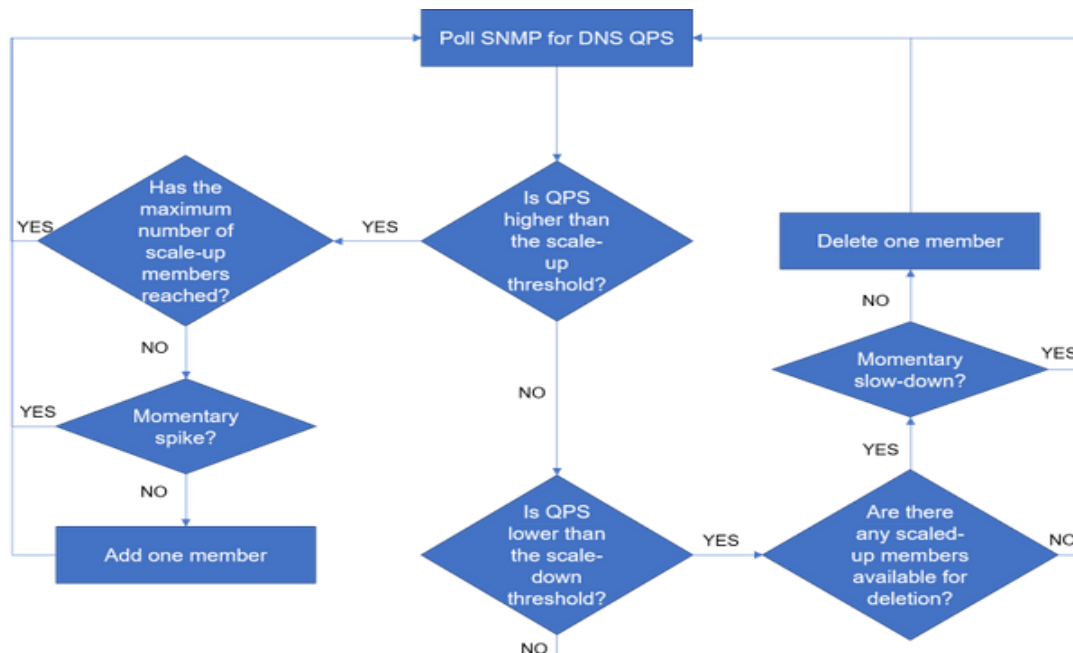
Windows PowerShell is a task automation and configuration management framework from Microsoft, consisting of a command-line shell and associated scripting language built on the .NET Framework

The PowerShell script polls the DNS queries being served by the Infoblox appliance per second, using SNMP. Based on thresholds that are set by the user, it scales up or down by adding or deleting one grid member at a time.

The PowerShell uses the SNMP module to fetch the DNS QPS information. Please note that SNMP should have been pre-configured on the Infoblox grid. It uses VMWare PowerCLI for VM related operations, and the ovftool to deploy a grid member with all the initial configuration. It also uses Infoblox REST APIs to do all the necessary configurations in the Grid

Use Cases

Let us look at how the auto scaling script can monitor the performance and do the effective management of a real time environment. The below image shows the sequence of events.



Consider an existing grid hosted on a vCenter Server that is responding to DNS queries

Scale-Up

This script constantly polls for the DNS QPS and compares it with the threshold that has been set. Once the threshold is reached, a new member is created and attached to the grid.

It first creates and initializes a member on vCenter, then adds the member to the grid, enables the DNS and DHCP services, adds the newly joined member to the nameserver group so it can start answering to the DNS queries. It also adds a fixed address entry on the grid

Scale-Down

Similarly, for scaling down, it continues to poll the DNS QPS and when the fall below a specified threshold, it deletes the newly spun up member.

First, it removes the member from the nameserver group, deletes the fixed address entry, removes the member from the grid, and finally shuts down and deletes the Virtual Machine.

Pre-requisites

- An existing Infoblox grid Environment
- A Windows 7 machine which has connectivity to the existing Infoblox Grid and vCenter environment.
- PowerCLI module (can be installed by referring [here](#))
- OVFTOOL 4.3 (can be downloaded [here](#))

- Import SNMP package for PowerShell by running Install-Module -Name SNMP

```
PS C:\WINDOWS\system32> Install-Module -Name SNMP

NuGet provider is required to continue
PowerShellGet requires NuGet provider version '2.8.5.201' or newer to interact with NuGet-based repositories. The NuGet
provider must be available in 'C:\Program Files\PackageManagement\ProviderAssemblies' or
'C:\Users\kanandani\AppData\Local\PackageManagement\ProviderAssemblies'. You can also install the NuGet provider by
running 'Install-PackageProvider -Name NuGet -MinimumVersion 2.8.5.201 -Force'. Do you want PowerShellGet to install
and import the NuGet provider now?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y

Untrusted repository
You are installing the modules from an untrusted repository. If you trust this repository, change its
InstallationPolicy value by running the Set-PSRepository cmdlet. Are you sure you want to install the modules from
'PSGallery'?
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): Y
PS C:\WINDOWS\system32>
```

- The vNIOs image for VMware (version specific) in the ova format. (can be downloaded from [here](#))

Note – The current version of this script requires that a specific model of the vNIOs OVA (ex: [nios-8.3.1-374063-2018-08-28-22-31-51-160G-820.ova](#)) to be used. A generic DDI vNIOs OVA will not work with this script (ex: [nios-8.3.1-374063-2018-08-28-23-56-07-ddi.ova](#))

Before you begin

Launch Windows PowerShell on the Windows 7 machine and run the following commands:

- To ignore certificates while connecting to vCenter server please run the below command on PowerCLI
`set-PowerCLIConfiguration -InvalidCertificateAction Ignore -Confirm:$false`
- To run scripts in PowerShell (run as administrator)
`set-executionpolicy unrestricted`

Before invoking the script, the following variables need to be modified in the PowerShell script with values specific to your environment

Name	Description	Example
\$vmfolder	Location in the vCenter Server where the new Virtual Machine needs to be created	"\India\host\Compute\Resources\Autoscale"
\$datastore	The datastore the VM will reside on	"DS-ESX1-11B" (You can run Get-Datastore command to get a list of all the datastores in your environment)
\$dportgroup	The Distributed port group that the VM will be connected to	"Mgmt-Autoscale-Testing" (You can run Get-VDPortgroup to get a list of all the distributed port groups in your environment)
\$range	The range within which the next available IP address can be found to assign to a new member	"10.196.202.0/24"
\$memberip	The gateway and subnet mask need to be changed according to the IP address that will be assigned from the above-mentioned range	"gateway"="10.196.202.1";"netmask"="255.255.255.0"}
\$gridjoindetails	This is the details of the existing grid that the newly scaled-up member will join	@{grid_name="Infoblox" master=\$gridmaster shared_secret="test"}

\$nsname	The nameserver group that the new member will be added to	"default"
----------	---	-----------

```
PS C:\Users\kanandani\Desktop> get-datastore
```

Name	FreeSpaceGB	CapacityGB
ISOs_NFS	1,968.549	1,968.618
DS-ESX1-11	3,907.263	7,445.500
DS-ESX2-12B	5,350.570	7,452.000
DS-ESX2-12	5,036.370	7,445.500
Dell_Datastore_10TB_1	6,804.867	10,239.750
Datastore_ISO	0.000	0.000
DS-ESX1-11B	4,928.269	7,452.000
Dell_Datastore_10TB_2	8,271.275	10,239.750
datastore1	1,666.202	1,855.500
Dell_Datastore_ISO	1,757.875	2,047.750

```
PS C:\Users\kanandani\Desktop> Get-VDPortgroup
```

Name	NumPorts	PortBinding
Dswitch-Internet-DVUplinks-...	8	Static
Internet-200-24	63	Ephemeral
Dswitch-VLAN-202-DVUplinks-...	8	Static
Dswitch-VLAN-203-DVUplinks-...	4	Static

```
### NEEDS TO BE MODIFIED WITH VALUES SPECIFIC TO YOUR ENVIRONMENT ###
$vmfolder = $vcenter+"\India\host\Compute\Resources\Autoscale"
$vmlocation = "vi://"+$vusername+": "+$vpassword+"@"+$vmfolder
### The datastore the VM will reside on. You can run Get-Datastore command to get a list of
### NEEDS TO BE MODIFIED WITH VALUES SPECIFIC TO YOUR ENVIRONMENT ###
$datastore = "DS-ESX2-12B"
### the Distributed port group that the VM will be connected to. You can run Get-VDPortgroup
### NEEDS TO BE MODIFIED WITH VALUES SPECIFIC TO YOUR ENVIRONMENT ###
$dportgroup = "lab-grid-204/24"
### Details of the member: name, IP address and the licenses that will be applied during cl
### Find the next available IP address within a range in the specified subnet ###
### NEEDS TO BE MODIFIED WITH VALUES SPECIFIC TO YOUR ENVIRONMENT ###
$range = @(@{method="GET"
            object="range"
            data={network="10.196.202.0/24"}
            assign_state=@{netw_ref="_ref"}
            discard=$true},
            @{method="POST"
            object="##STATE:netw_ref:##"
            args=@{function="next_available_ip"
            enable_substitution=$true}) |ConvertTo-json
$availableip = ((Invoke-WebRequest -Uri "https://$gridmaster/wapi/v2.7/request" -Method POST

### Random string to append to the name of the new member ###
$random = RandomStringGenerator
### NEEDS TO BE MODIFIED WITH VALUES SPECIFIC TO YOUR ENVIRONMENT ###
$memberip = @{"address"=$availableip;"gateway"="10.196.202.1";"netmask"="255.255.255.0"}
$membername = "autojoin-"+$random+".autoscale.com"
$licenses = "enterprise,dns,dhcp,vnios"
```

Invoking the Script

To invoke the script, enter the following in the Windows PowerShell window:

```
.\vmware_autoscale.ps1
```

After invoking the script, the following inputs need to be provided by the user:

1. The IP address of the grid master
2. The username and password that can be used to make WAPI calls to the grid master.
3. The IP address of the grid member whose DNS QPS you want to monitor
4. The SNMP community string that the script can use to get the data from the grid
5. The polling interval, that is the time interval at which the QPS is monitored
6. The scale-up limit, that is the threshold after which a new member will be spun up
7. The time interval during which the QPS is additionally monitored after the scale-up limit has reached, in order to ensure that this was not just a momentary spike.
8. The maximum number of members that can be automatically added to the grid
9. The scale-down limit, that is the threshold below which the most recently scaled up member will be deleted
10. The time interval during which the QPS is additionally monitored after the scale-down limit has reached, in order to ensure that this was not a momentary slow down.
11. The OVA file based off of which a new member will be spun up
12. The vCenter Server details

Note – While running the script for the first time, you might get a self-signed certificate warning which needs to be accepted

```
PS C:\Users\kanandani\Desktop> .\vmware_autoscale.ps1
***** Grid details *****
Grid Master IP address: 10.196.204.11 ← 1
Username for Grid Master: admin ← 2
Password for Grid Master: *****
IP address of the grid member you want to monitor: 10.196.204.12 ← 3
***** Scaling details *****
SNMP community string: public ← 4
Polling interval (in seconds): 60 ← 5
Scale-up limit for DNS QPS: 2500 ← 6
Time interval (in seconds) to monitor DNS QPS before scaling up after threshold trigger: 60 ← 7
Enter the maximum number of members that can be created while scaling up: 2 ← 8
Scale-down limit for DNS QPS: 100 ← 9
Time interval (in seconds) to monitor DNS QPS before scaling down after threshold trigger: 60 ← 10
***** vCenter details *****
The location of the OVA file to spin up new grid member from: "C:\Users\kanandani\Downloads\nios-8.2.7-372540-2018-07-18-14-22-25-160G-810.ova" ← 11
vCenter Server IP address/FQDN: vcsa65-tme.inblr.infoblox.com
Username for vCenter Server: administrator@india.local ← 12
Password for vCenter Server: *****
[INFO] Connecting to vcsa65-tme.inblr.infoblox.com as administrator@india.local
[INFO] Connected to vcsa65-tme.inblr.infoblox.com
[INFO] If the DNS QPS of 10.196.204.12 is consistently above 2500 for a period of 60 seconds, a new member will be spun up from "C:\Users\kanandani\Downloads\nios-8.2.7-372540-2018-07-18-14-22-25-160G-810.ova". A maximum of 2 member(s) will be spun up.
[INFO] If the DNS QPS of 10.196.204.12 is consistently below 100 for a period of 60 seconds, the latest scaled up member will be deleted
[INFO] DNS QPS: 0; Scale-up threshold: 2500; Scale-down threshold: 100
[WARNING] DNS QPS (0) is lesser than the threshold 100
[WARNING] No eligible members to scale down
```

As you can see above, the DNS QPS are being monitored based on the polling interval defined.

Use Cases in Action

Scale-Up

Once the DNS QPS have reached beyond the specified scale-up limit, the QPS is monitored for an additional period of time to ensure this is not just a spike.

```
[WARNING] No eligible members to scale down
[INFO] DNS QPS: 212; Scale-up threshold: 2500; Scale-down threshold: 100
[INFO] DNS QPS: 2000; Scale-up threshold: 2500; Scale-down threshold: 100
[INFO] DNS QPS: 2000; Scale-up threshold: 2500; Scale-down threshold: 100
[INFO] DNS QPS: 1857; Scale-up threshold: 2500; Scale-down threshold: 100
[INFO] DNS QPS: 2700; Scale-up threshold: 2500; Scale-down threshold: 100
[WARNING] DNS QPS (2700) has crossed the threshold 2500
[INFO] Monitoring the DNS QPS for 60 seconds to ensure this is not a temporary spike
[INFO] DNS QPS in the polling period: 2700
```

If it is not a momentary spike, a new VM is created based off of the template specified.

```
[INFO] Monitoring the DNS QPS for 30 seconds to ensure this is not a temporary spike
[INFO] DNS QPS in the polling period: 2700
[INFO] DNS QPS in the polling period: 2700
[INFO] DNS QPS in the polling period: 2700
[INFO] The average DNS QPS during the polling period was 2700
[INFO] Scaling up
[INFO] Spinning up a member autojoin-5i79y.autoscale.com in vc65-tme.inblr.infoblox.com\
Opening OVA source: C:\Users\kanandani\Downloads\nios-8.2.7-372540-2018-07-18-14-22-25-160
The manifest validates
Opening VI target: vi://administrator%40india.local@vc65-tme.inblr.infoblox.com:443/Indi
Deploying to VI: vi://administrator%40india.local@vc65-tme.inblr.infoblox.com:443/India/
Transfer Completed
Powering on VM: autojoin-5i79y.autoscale.com
Task Completed
Completed successfully
[INFO] Waiting for member to come online
```

Once the machine is up and running, it takes a couple of seconds for the httpd service to start.

```
Opening VI target: vi://administrator%40india.local@vc65-tme.inblr.infoblox.com:443/Indi
Deploying to VI: vi://administrator%40india.local@vc65-tme.inblr.infoblox.com:443/India/
Transfer Completed
Powering on VM: autojoin-ymuew.autoscale.com
Task Completed
Completed successfully
[INFO] Waiting for member to come online
[INFO] Waiting for member to come online
[INFO] Waiting for member to come online
[INFO] Waiting for member to come online
[INFO] Waiting for member to come online
[INFO] Waiting for member to come online
[INFO] Waiting for httpd service to start (Attempt number 1)
[INFO] Waiting for httpd service to start (Attempt number 2)
[INFO] Waiting for httpd service to start (Attempt number 3)
```


From the Console of the newly spun up virtual machine, you can see that the IP address is automatically assigned. This was picked up from the range specified earlier.

```
Note: Additional addresses configured can be viewed through "show interface" com
mand
Infoblox > [2018/10/24 10:51:38.101] System restart...
[2018/10/24 10:52:00.044] Infoblox system initializing...
[2018/10/24 10:52:00.289] LAN port IPv4 10.196.204.14, netmask 255.255.255.0, ga
teway 10.196.204.1
[2018/10/24 10:52:18.537] Contacting the grid master at 10.196.204.11....
[2018/10/24 10:52:23.262] Synchronizing database with the grid master...
[2018/10/24 10:52:24.742] vNIOS: [Model IB-UM-810]
[2018/10/24 10:52:24.818] vNIOS: CPU cores detected: 2 - [License allows: 2]
[2018/10/24 10:52:24.819] vNIOS: System memory detected: 2048MB - [License allow
s: 2048MB]
[2018/10/24 10:52:24.820] Starting services...

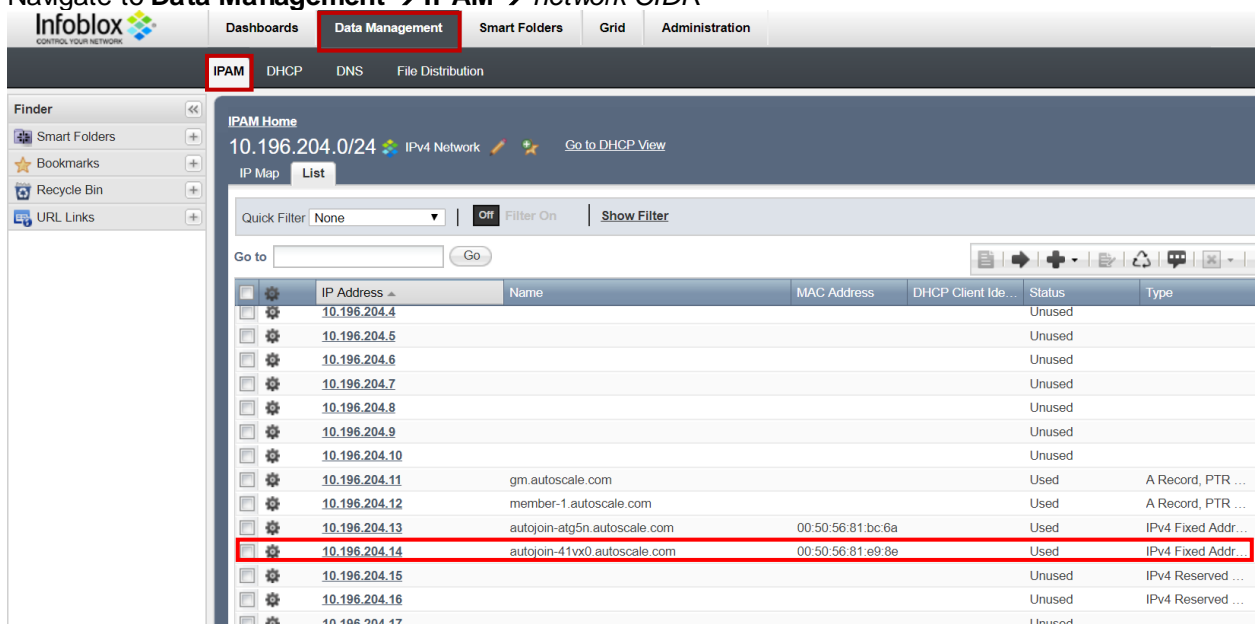
Disconnect NOW if you have not been expressly authorized to use this system.
login:
```

Once the httpd service starts, an entry for the member is added on the grid, and a grid join is initiated from the member. It then adds a fixed address entry on the grid, enables the DNS and DHCP services, and adds the newly joined member to the nameserver group so it can start answering to the DNS queries.

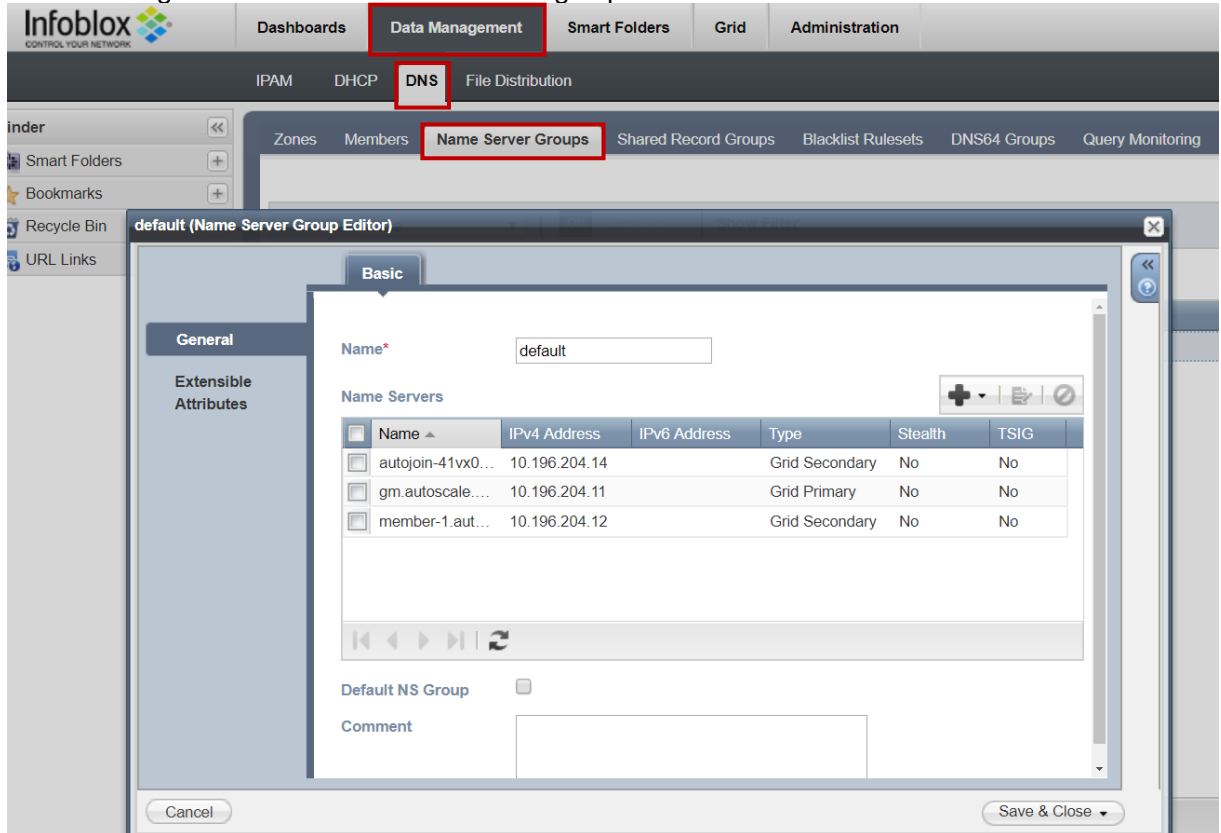
```
[INFO] Entry for 10.196.204.14 has been added to the grid 10.196.204.11
[INFO] Joining the member to the master
[INFO] 10.196.204.14 has joined the grid with Grid Master at 10.196.204.11
[INFO] Adding a fixed address entry to the Grid
[INFO] Fixed address entry for 10.196.204.14 with MAC address 00:50:56:81:74:37 has been added to the grid
[INFO] Enabling DNS and DHCP services
[INFO] DNS service is enabled
[INFO] DHCP service is enabled
[INFO] Adding member autojoin-ymuew.autoscale.com to nameserver group default
[INFO] Member autojoin-ymuew.autoscale.com is added to nameserver group default
[INFO] Auto scale-up complete
```

This can be verified from the Infoblox Grid as specified below

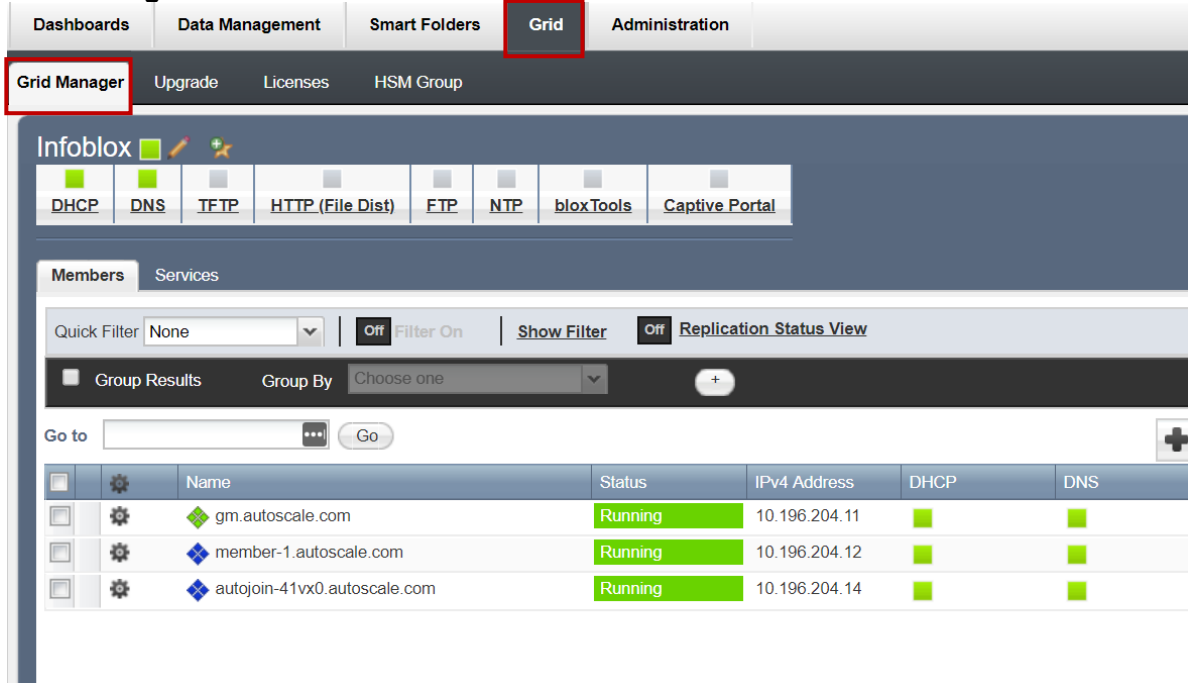
1. Navigate to **Data Management** → **IPAM** → *network CIDR*



2. To verify that the nameserver group is updated with the new member as a grid secondary, navigate to **Data Management** → **DNS** → **Name server groups**. Click on the gear icon next to the nameserver group name and select edit.



3. To verify if the DNS and DHCP services have been automatically enabled, navigate to **Grid** → **Grid Manager**



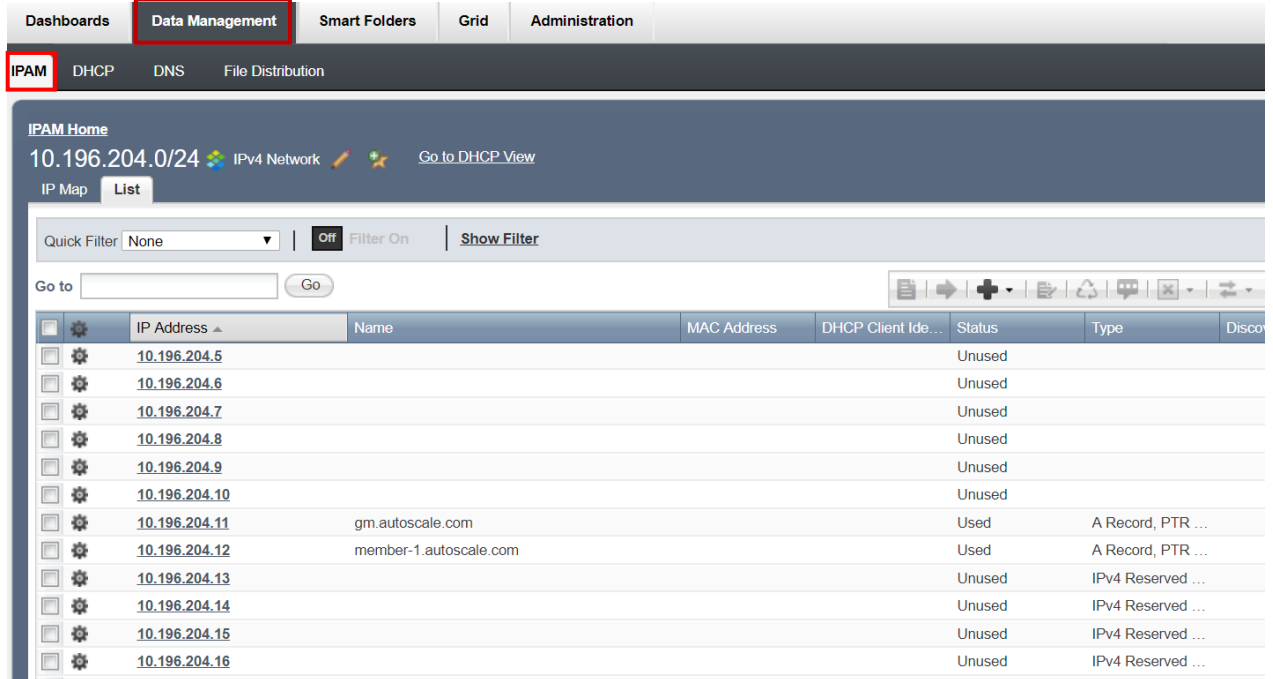
Scale-Down

Once the DNS QPS have fallen below the specified scale-down limit, the QPS is monitored for an additional period to ensure this is not just a momentary slowdown. It then removes the most recently scaled up member from the nameserver group, deletes the fixed address entry, and removes the member from the grid.

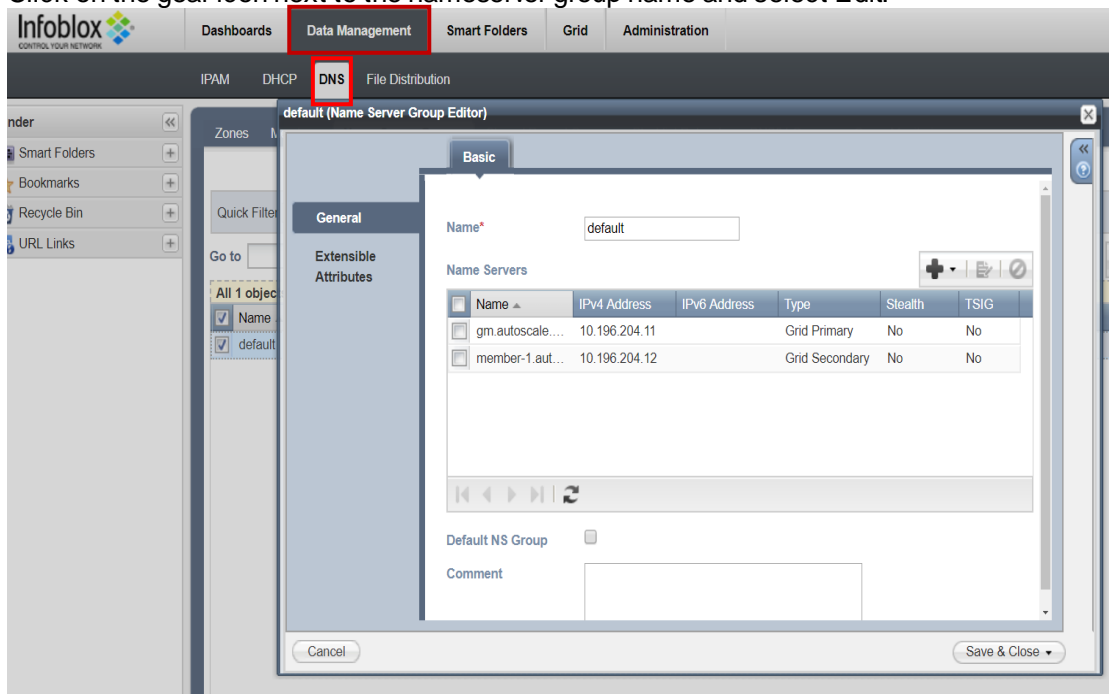
```
[INFO] DNS QPS: 1400; Scale-up threshold: 1500; Scale-down threshold: 1200
[INFO] DNS QPS: 1400; Scale-up threshold: 1500; Scale-down threshold: 1200
[INFO] DNS QPS: 1400; Scale-up threshold: 1500; Scale-down threshold: 1200
[INFO] DNS QPS: 1400; Scale-up threshold: 1500; Scale-down threshold: 1200
[INFO] DNS QPS: 1304; Scale-up threshold: 1500; Scale-down threshold: 1200
[INFO] DNS QPS: 0; Scale-up threshold: 1500; Scale-down threshold: 1200
[WARNING] DNS QPS (0) is lesser than the threshold 1200
[INFO] Monitoring the DNS QPS for a cooldown period of 60 seconds
[INFO] DNS QPS in the polling period: 0
[INFO] DNS QPS in the polling period: 0
[INFO] DNS QPS in the polling period: 0
[INFO] DNS QPS in the polling period: 0
[INFO] DNS QPS in the polling period: 0
[INFO] DNS QPS in the polling period: 0
[INFO] The average DNS QPS during the cool-down period was 0
[INFO] Scaling down
[INFO] Removing member autojoin-41vx0.autoscale.com from nameserver group default
[INFO] Member autojoin-41vx0.autoscale.com is removed from nameserver group default
[INFO] Removing member autojoin-41vx0.autoscale.com from the grid
[INFO] Member autojoin-41vx0.autoscale.com is removed from the grid
[INFO] Removing the fixed address entry from the Grid
[INFO] Fixed address entry for 10.196.204.14 has been deleted from the grid
[INFO] Shutting down and deleting the VM autojoin-41vx0.autoscale.com from vCenter
[INFO] The VM autojoin-41vx0.autoscale.com has been shut down
```

This can be verified from the Infoblox Grid as specified below

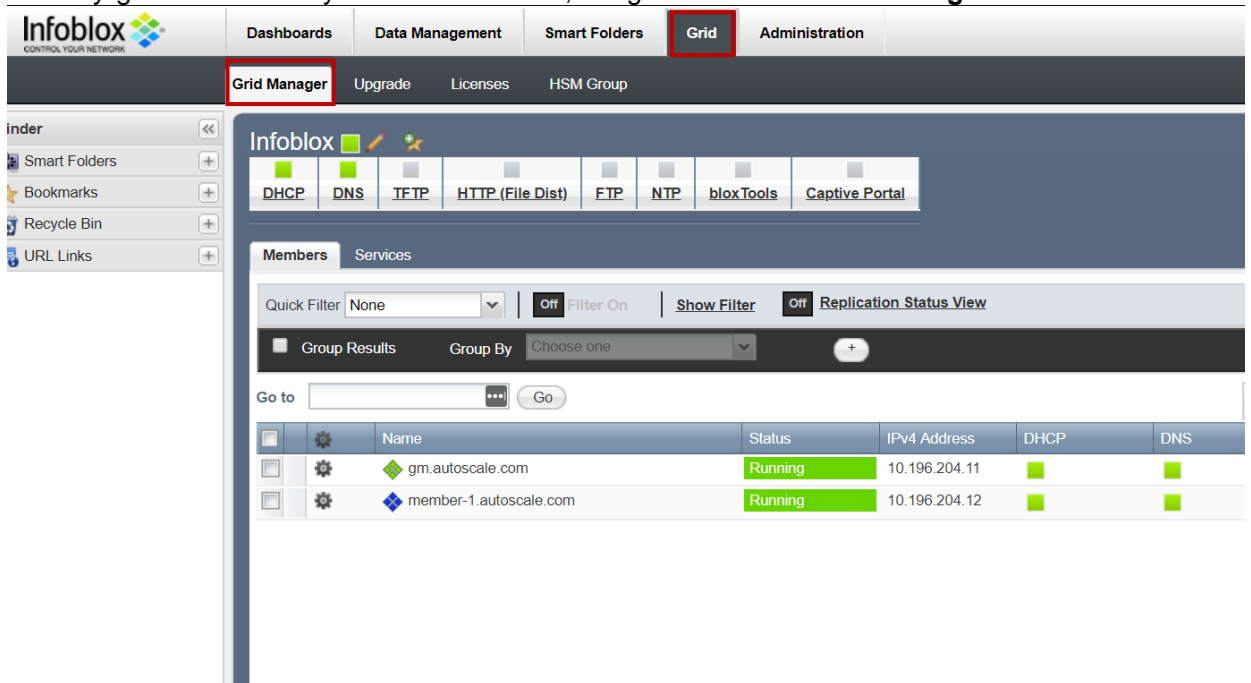
1. To verify fixed address entry has been removed, navigate to **Data Management** → **IPAM** → *network CIDR*



- To verify name server group, navigate to **Data Management** → **DNS** → **Name server groups**. Click on the gear icon next to the nameserver group name and select Edit.



- To verify grid member entry has been removed, navigate to **Grid** → **Grid Manager**



4. Once the grid has been cleaned up, it shuts down and deletes the VM from the vCenter Server.

Recent Tasks							
Task Name	Target	Status	Initiator	Queued For	Start Time	Completion Time	Server
Delete virtual machine	autojoin-41vx0.auto...	✓ Completed	INDIA.LOCAL\Admi...	3 ms	10/24/2018 4:30:41 ...	10/24/2018 4:30:48 ...	vcsa65-tme.inblr.infoblox.com
Power Off virtual machine	autojoin-41vx0.auto...	✓ Completed	INDIA.LOCAL\Admi...	5 ms	10/24/2018 4:30:39 ...	10/24/2018 4:30:40 ...	vcsa65-tme.inblr.infoblox.com

Demo Video

To see the script in action, you can watch the demo video [here](#).