Graceful Shutdown of VMware ESXi using Network Shutdown Module

Configuring Network Shutdown Module for graceful shutdown of ESXi hosts

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2   Introduction

Network Shutdown Module 3.07 includes PowerShell scripts which allow for graceful shutdown of VMware ESXi hosts and their Virtual Machines (VMs) in the case of UPS events. This document describes how to configure your environment to enable the use of these scripts.

By default in a VMware High Availability Cluster environment the Virtual Machine Startup/Shutdown feature is disabled by design. This means that when Network Shutdown Module issues a command to shut down ESXi hosts in response to a critical UPS event the VMs running on those hosts will not be shut down cleanly.

NOTE: The scripts should be tested in a non–production environment before use on production servers.
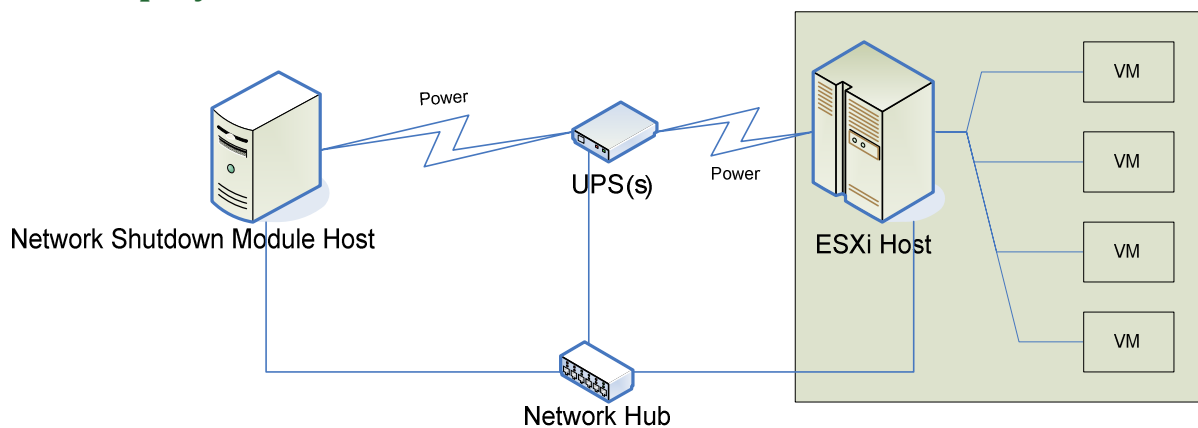
3   Deployment

Figure 1 - ESXi Deployment

An example deployment for ESXi protection is shown in Figure 1. One or more UPS units will provide power to the ESXi and the Network Shutdown Module hosts. The Network Shutdown Module host is configured to monitor the UPS(s) and when a UPS event occurs, runs the shutdown scripts to gracefully shut down the virtual machines and the ESXI host.

3.1   Prerequisites

The Network Shutdown Module Host must be running a compatible Windows Server operating system. See product documentation for a list of compatible operating systems.

The shutdown scripts require Windows PowerShell. Download and installation instructions for your operating system can be found on www.microsoft.com/powershell.

The shutdown scripts require VMware vSphere PowerCLI. Download and installation instructions for your operating system can be found on www.vmware.com/go/powercli.
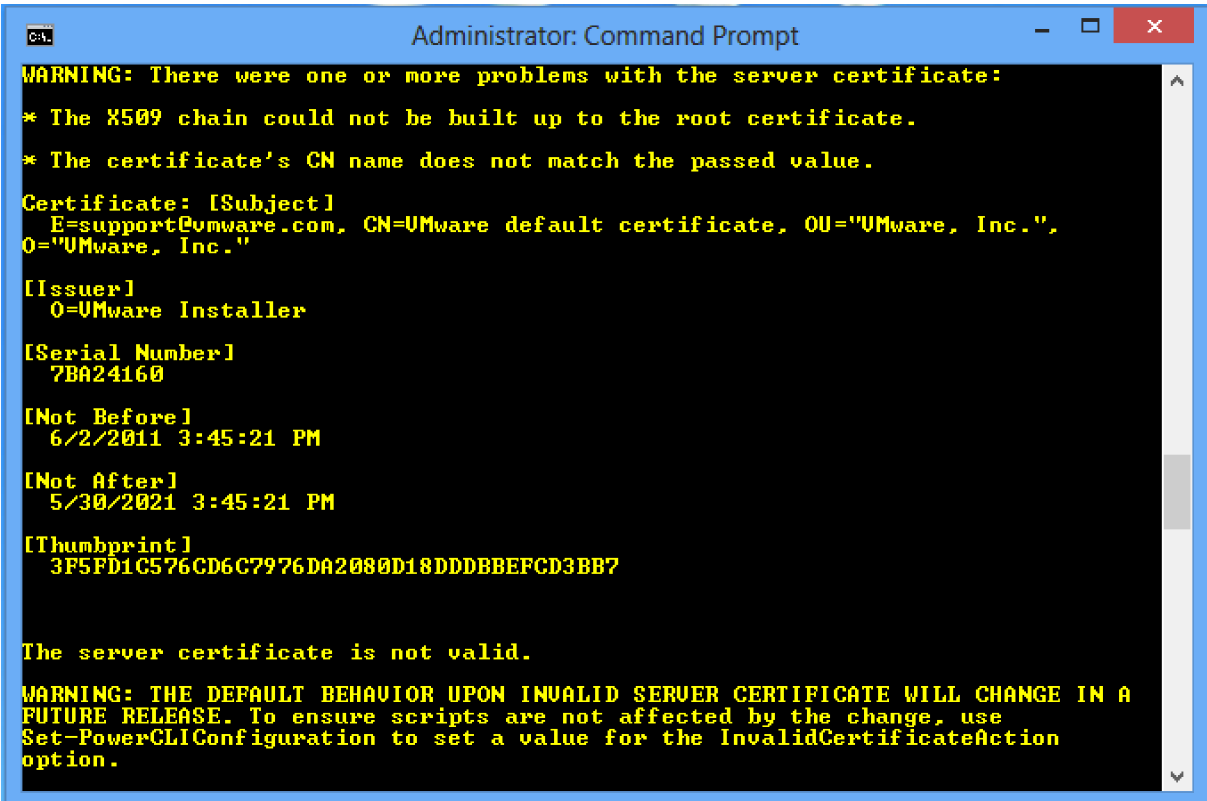
3.2 PowerShell Configuration

3.2.1 PowerShell Execution Policy

Please by aware that the provided shutdown scripts will set the execution policy for PowerShell to 'RemoteSigned'. More information on execution policies can be found in Microsoft PowerShell documentation: http:// technet.microsoft.com/en-us/library/ee176961.aspx

3.2.2 Handling Invalid Certificates

The shutdown scripts make use of the VMware PowerCLI Connect-VIServer cmdlet to connect to the target ESXi host or vCenter Server via a secure https channel. If the server presents an invalid or untrusted SSL certificate, the current implementation at the time of writing will issue a warning. An example of such a warning is given in Figure 2. This is defined in line with the InvalidCertificateAction policy. At the time of writing this guide, the default policy is 'unset', which will result in a warning being issued.

Figure 2 - Invalid Certificate Warning

In future versions of the PowerCLI, for added security, the untrusted connection may be denied. To avoid this situation, we recommend you set an InvalidCertificateAction policy to one of either 'Ignore' or 'Fail'.

If the policy is set to 'fail', the cmdlet will not establish a connection if the certificate is not valid. In this case, you must upload a valid certificate to the ESXi host or vCenter Server to ensure that shutdown protection can be provided.

With the policy is set to 'ignore', the cmdlet will establish the connection without taking into account that the certificate is invalid.

Figure 3 shows an example of setting the InvalidCertificateAction policy.

Figure 3 - Setting the InvalidCertificateAction

See the PowerCLI cmdlet reference for more information on both the Connect-VIServer and Set-PowerCLIConfiguration cmdlets. This is available at:

https://pubs.vmware.com/vsphere-55/topic/com.vmware.powercli.cmdletref.doc/Overview.html

4 Shutdown Configurations

4.1 Standalone ESXi Shutdown

To configure graceful shutdown of standalone ESXi hosts, use the following steps:

1. Access the vSphere Client, select your ESXi host, then the configuration tab.
2. Click on the Virtual Machine Startup/Shutdown link. Click 'properties' at the top right to display the 'Virtual Machine Startup and Shutdown' dialog, as shown in Figure 4.
3. Ensure that "Allow virtual machines to start and stop automatically with the system" is checked.
4. Use 'Move Up' to move VMs into the 'Any Order', or 'Automatic Startup' groups. VMs in the 'Manual Startup' group are not gracefully started or stopped with the ESXi host.
5. Ensure the VMs are listed in the order you want. Note that this represents the start up order of the VMs. Shutdown uses the reverse of this order, so the last on the list will be the first to shut down.
6. Change the 'Shutdown Action' to specify 'Guest Shutdown'. Click OK, to dismiss this dialog.
7. Ensure that VMware Tools are installed on each VM. This is required for graceful shutdown of the VM.

8. Ensure that the Power Controls for each VM are correct. For each VM, right click and select Edit Settings > Options Tab > VMware Tools. Under Power Controls Stop, ensure that 'Shut Down Guest' is displayed. An example is displayed in Figure 5.
9. On the Network Shutdown Module Host, install the PowerShell and PowerCLI prerequisites, as outlined in section3.1.
10. Install Schneider Electric Network Shutdown Module 3.07 on a supported Windows Server OS. Once complete the shutdown scripts can be found under C:\Program Files\SE\NetworkShutdownModule\esxi, or on the custom path chosen at install time.
11. Open "esxi_shutdown.bat" in a text editor and edit the following script variables as required:
    a. SERVER: The IP address of the ESXi Host.
    b. USERNAME: User account with Administrator privileges for the ESXi Host.
    c. PASSWORD: Password for the user account above.
    d. OSSHUTDOWNDELAY: A delay in seconds. This delay is passed to the shut down procedure of the NSM host; to give users a warning that shut down is imminent.
12. Verify that the paths specified are correct and edit them as required. The default paths given may be different depending on your host, e.g. if you are using a 32bit or 64bit version of Windows.
    a. POWERSHELL_PATH: The path to the powershell.exe executable.
    b. VMWARE_PATH: The path to the vim.psc1 file installed as part of the VMware Power CLI.
    c. SCRIPT_PATH: The path to the shutdown.ps1 script installed with Network Shutdown Module.
    d. LOG_PATH: A path to a folder where script logs will be created. Please ensure this is a local writable location, otherwise the shutdown script will fail to create an execution log.
13. In the Network Shutdown Module user interface go to the Actions (advanced) -> System Shutdown -> Settings page.
14. Enter the full path to esxi_shutdown.bat under "Command line". If this path contains spaces, ensure the full path is within quotes.
15. Go to the Shutdown settings page, and deselect "Use central configuration provided by Network Management Card/Proxy".
16. Enter a duration value in seconds under "Shutdown duration".
        NOTE: This value must be long enough to allow all of the VMs to be shutdown cleanly followed by the ESXi and Network Shutdown Module hosts.
17. Go to the Actions (advanced) -> System Shutdown -> Events page. Select/Check a Notification Alarm to initiate the shutdown, for example, Utility Failure and Save change(s).
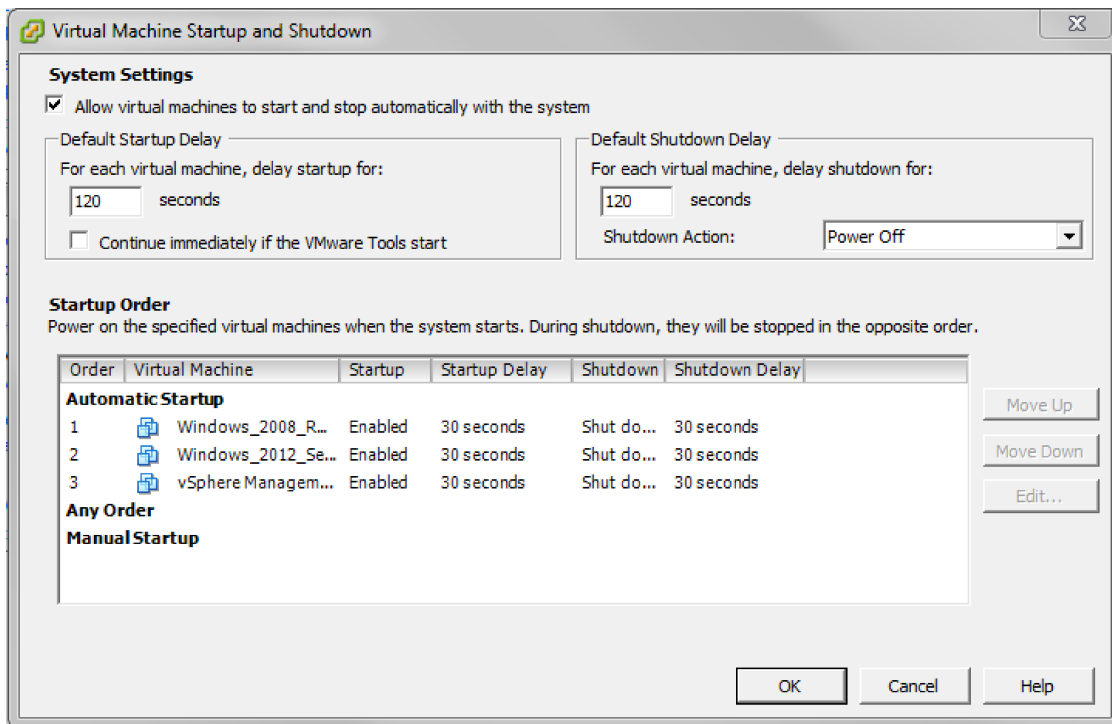
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Figure 4 - Virtual Machine Startup and Shutdown

4.1.1   Standalone ESXi Shutdown Procedure

The shut down sequence occurs as follows:

1. UPS goes on Battery.
2. The configured bat file is executed (esxi_shutdown.bat), which calls the associated PowerShell script (shutdown.ps1).
3. This script attaches to the ESXi host, and triggers a Power Off action.
4. The script saves a log of running VMs to vmlist.csv in the log directory. A log of actions performed by the script is also saved here.
5. The ESXi host reacts as it is configured to, and suspends or powers off the VMs.
6. The ESXi host then shuts down.
7. After OSSHUTDOWNDELAY seconds, the Network Shutdown Module host will shut down.
8. Once all computers connected to the UPS have been shut down, the UPS shuts off (interrupts the supply of power to the loads) to protect the battery.
    NOTE: This function is not authorised on some UPSs.
9. Assuming the UPS shut off function is available, when power is restored, the UPS will restart providing power to attached equipment. Using BIOS settings on the ESXI hosts you may be able to initiate a system start when power is restored.
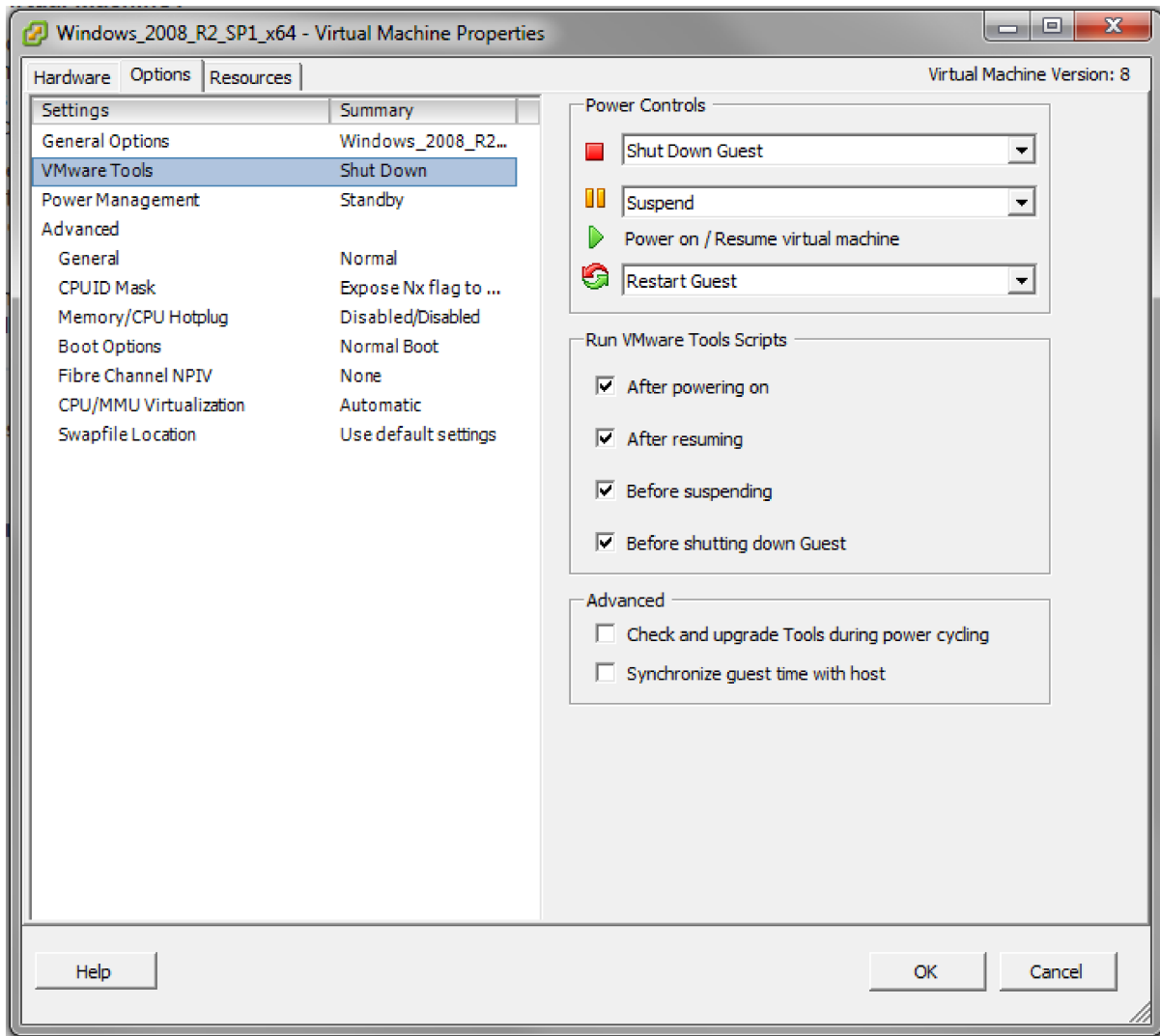
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Figure 5 - VMware Tools Settings

4.2 ESXi Cluster Shutdown

To configure shutdown for an ESXi Cluster environment, use the following steps:

1. Install the PowerShell and PowerCLI prerequisites, as outlined in section3.1.

2. Install Schneider Electric Network Shutdown Module 3.07 on a supported Windows Server OS. Once complete the shutdown scripts can be found under C:\Program Files\SE\NetworkShutdownModule\esxi, or on the custom path chosen at install time.

3. Open "hashutdown.bat" in a text editor and edit the following script variables as required:

   a. SERVER: The IP address of the ESXi host or vCenter Server.
   b. USERNAME: User account with Administrator privileges for the ESXi host or vCenter Server.
   c. PASSWORD: Password for the user account above.
   d. DATACENTER: Name of the data centre container that contains the CLUSTER.

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e. CLUSTER: Name of the cluster that contains the ESXi hosts to be shut down.

f. VMSHUTDOWNDELAY: A VM shut down delay, specified in seconds. After requesting a Shut Down for the VM, the script will wait this long to allow time for the VM shutdown procedure to complete. Once this delay has elapsed, a Power Off command is given. The value for this field should be sufficiently long to allow graceful shutdown of your VMs.

g. OSSHUTDOWNDELAY: A delay in seconds. This delay is passed to the shut down procedure of the NSM host; to give users a warning that shut down is imminent.

4. Verify that the paths specified are correct and edit them as required. The default paths given may be different depending on your host, e.g. if you are using a 32bit or 64bit version of Windows.

a. POWERSHELL_PATH: The path to the powershell.exe executable.

b. VMWARE_PATH: The path to the vim.psc1 file installed as part of the VMware Power CLI.

c. SCRIPT_PATH: The path to the shutdown.ps1 script installed with Network Shutdown Module.

d. LOG_PATH: A path to a folder where script logs will be created. Please ensure this is a local writable location, otherwise the shutdown script will fail to create an execution log.

5. In the Network Shutdown Module user interface go to the Actions (advanced) -> System Shutdown -> Settings page.

6. Enter the full path to hashutdown.bat under "Command line". If this path contains spaces, ensure the full path is within quotes. Click "Save Changes" to apply.

7. Go to the Shutdown settings page, and deselect "Use central configuration provided by Network Management Card/Proxy".

8. Enter a duration value in seconds under "Shutdown duration". Click "Save Changes" to apply.

   NOTE: This value must be long enough to allow all of the VMs to be shutdown cleanly followed by the ESXi and Network Shutdown Module hosts.

9. Go to the Actions (advanced) -> System Shutdown -> Events page. Select/Check a Notification Alarm to initiate the shutdown, for example, Utility Failure and Save change(s).

4.2.1 Cluster Shutdown Procedure

The shut down sequence occurs as follows:

1. UPS goes on Battery.

2. The configured bat file is executed (hashutdown.bat), which calls the associated PowerShell script (hashutdown.ps1).

3. This script attaches to the ESXi host or vCenter Server, and enumerates the powered on VMs in the cluster. These VMs are saved to the vmlist.csv file in the log directory.

   a. Please Note: Only those VMs which are associated with hosts which are in the "Connected" or "Maintenance" states are enumerated. VMs associated with hosts in the "Disconnected" or "NotResponding" states cannot be enumerated, and their hosts can not be safely shut down by this script.

4. The script attempts to shut down each virtual machine in the cluster.

NOTE: VMware tools must be installed on each VM, otherwise a Power Off command is sent.

5. After VMSHUTDOWNDELAY seconds, the script checks for any remaining VMs that are powered on and issues a power off command to those that are still running. This is necessary to allow the ESXi host(s) to enter maintenance mode.

6. If the ESXi host is in the "Connected" state, the script will then command the ESXi host(s) to enter maintenance mode.

7. Then the ESXi hosts are shut down.

8. After OSSHUTDOWNDELAY seconds, the Network Shutdown Module host will shut down. The Network Shutdown Module host will always shut down after all ESXi hosts have shut down.

9. Once all computers connected to the UPS have been shut down, the UPS shuts off (interrupts the supply of power to the loads) to protect the battery.

    NOTE: This function is not authorised on some UPSs.

10. Assuming the UPS shut off function is available, when power is restored, the UPS will restart providing power to attached equipment. Using BIOS settings on the ESXi hosts you may be able to initiate a system start when power is restored.

    NOTE: ESXi hosts will power up in maintenance mode.

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