PowerChute™ Network Shutdown for VMware

By David Grehan, Sarah Jane Hannon

ABSTRACT

Virtualization has transformed the IT landscape as previously underutilized servers can now run multiple virtual machines resulting in fewer physical servers, less energy consumption and less maintenance.

PowerChute™ Network Shutdown provides network-based graceful shutdown of your physical servers and virtual machines for business uptime.

This Application Note outlines how to deploy PowerChute in different VMware setups to protect your virtual as well as your physical IT infrastructure.

Applications

IT Server Rooms, Data Centers, Remote Branch Offices, Distributed Networks.

PowerChute & VMware Integration

- VMware integration supports;
  - ✓ Optional virtual machine migration
  - ✓ Graceful virtual machine shutdown
  - ✓ Graceful host shutdown
  - ✓ Virtual machine prioritization & control
- Virtual Appliance installation option
- vSphere Web/Desktop Plugin options
- Intuitive PowerChute set-up wizard
- Command file integration
- Redundant & Parallel UPS support

While Virtualization has changed the IT landscape, the need for power protection remains:

PowerChute™ Network Shutdown works in conjunction with the APC UPS Network Management Card to provide graceful physical server and virtual machine shutdown during critical events such as an extended power outages.

PowerChute provides support for High Availability (HA) and Fault Tolerant (FT) VMware Clusters. The software may be deployed as a virtual appliance while the optional vSphere Web or Desktop Plugin options enhance manageability.

This Application Note outlines sample recommended deployment options with shutdown & startup sequences for different VMware setups.

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Shutdown and Startup sequences for the following VMware Setups:

VMware HA Cluster protected by either a Single, Redundant or Parallel UPS configuration. vCenter Server is running on a virtual machine.

Recommended Deployment

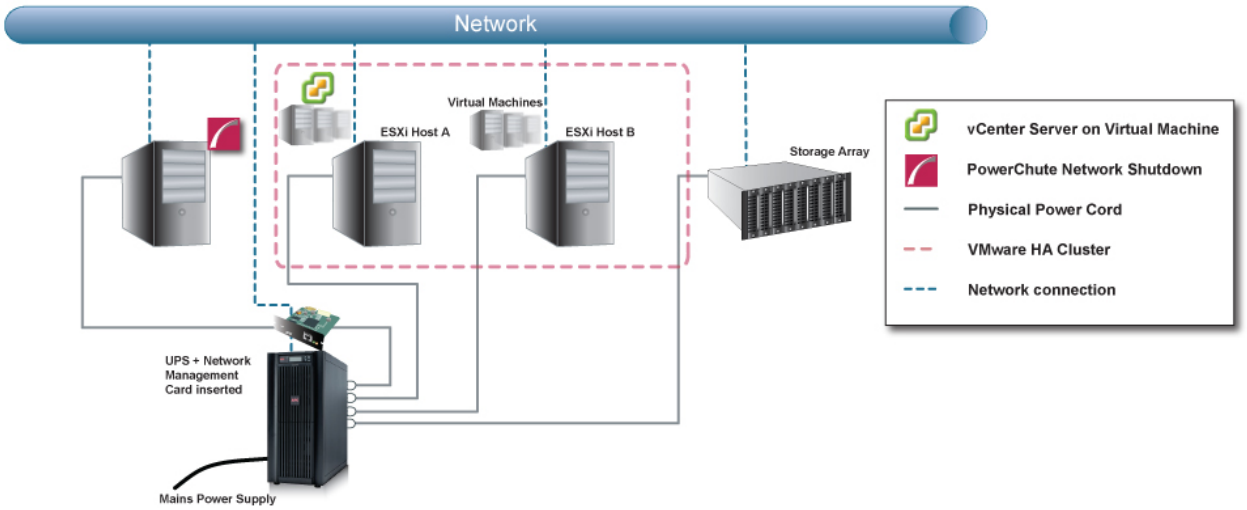
PowerChute can run on a VM in the HA cluster (either installed on the vMA or deployed as a virtual appliance) or be installed on a physical Windows machine outside the cluster. VMware Tools must be installed and running on the vCenter Server VM.

The vCenter Server account configured in PowerChute Network Shutdown must have Administrator permissions on vCenter Server and on each of the ESXi hosts being managed by PowerChute. This can be an Active Directory account or a local user account.

NOTE: The username used to connect to ESXi hosts must be in lowercase.

A) vCenter Server is running on a VM; PowerChute is installed on a physical Windows machine.

- *VM & vApp Shutdown enabled with a 120 second delay (i.e. 120 seconds allocated for each action to complete).*
- *The option to turn off the UPS or Outlet Group is enabled.*
- *A shutdown command file has been configured with a 120 second duration.*



When a critical UPS event, such as UPS on Battery occurs, the following sequence is triggered:

Shutdown Sequence

1. PowerChute reports that the UPS is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts a maintenance mode task on each Host. At the same time it sends a command to turn off the UPS or Outlet Group.
3. PowerChute starts VM shutdown followed by vApp shutdown.
4. VM/vApp shutdown durations elapse and PowerChute gracefully shuts down the vCenter Server VM.
5. vCenter VM shutdown duration elapses.
6. PowerChute starts executing the shutdown command file.
7. Shutdown command file duration elapses. PowerChute shuts down the VMware hosts using the order on the VMware Host Protection page. (The host running the vCenter VM will be shut down last in this scenario).
8. OS shutdown sequence starts on the PowerChute physical machine.
9. After a 70 second delay the OS starts to shut down.
10. UPS waits for greater of Low Battery Duration/Maximum Required Delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off Delay (initiated during step 2).
11. UPS turns off after the user-configurable Shutdown Delay time has elapsed or the Outlet Group turns off after the power off Delay elapses.

Startup Sequence

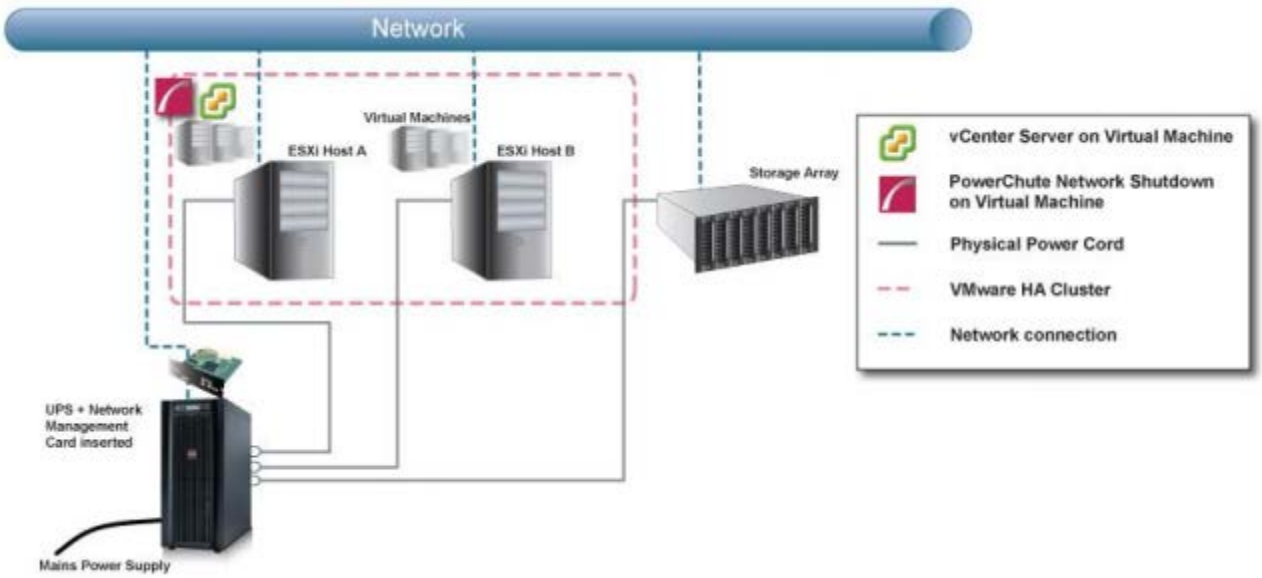
1. Input power is restored and the UPS turns on.
2. The physical Windows machine and the VMware hosts are powered on.
3. PowerChute waits until the hosts are back online before taking them out of Maintenance mode.
4. PowerChute starts the vCenter Server VM and waits until it is accessible.
5. PowerChute starts the vApp and waits until the vApp start command has completed (if there are multiple vApps they will be started in reverse order to how they were shut down).
6. PowerChute starts the VMs on each host in reverse order to how the hosts were shutdown. PowerChute uses the VM startup delay as the interval between starting VMs on each host[1].

Note

1. If vApp startup or VM startup does not work the first time on a particular host, PowerChute will attempt to start the vApp/VM again at 2 minute intervals.

B) Both vCenter Server and PowerChute are running on Virtual Machines

- VM & vApp Shutdown enabled with a 120 second delay (i.e. 120 seconds allocated for each action to complete).
- The option to turn off the UPS or Outlet Group is enabled.
- A shutdown command file has been configured with a 120 second duration.



When a critical UPS event, such as UPS on Battery occurs, the following sequence is triggered:

Shutdown Sequence

1. PowerChute reports that the UPS is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts a maintenance mode task on each Host. At the same time it sends a command to turn off the UPS or Outlet Group.
3. PowerChute starts VM shutdown followed by vApp shutdown.
4. VM/vApp shutdown durations elapse and PowerChute gracefully shuts down the vCenter Server VM.
5. vCenter VM shutdown duration elapses. PowerChute starts executing the shutdown command file.
6. Shutdown command file duration elapses.
7. PowerChute shuts down the VMware hosts using the order on the VMware Host Protection page. (The host running vCenter is shutdown second last before the host running PowerChute[1]).
8. UPS waits for greater of Low Battery Duration/Maximum Required Delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off Delay (initiated during step 2).
9. UPS turns off after the user-configurable Shutdown Delay time has elapsed or the Outlet Group turns off after the power off Delay elapses.

Startup Sequence

1. Input power is restored and the UPS turns on.
2. The VMware hosts are powered on.
3. PowerChute waits until the remaining hosts are back online before taking them out of Maintenance mode.
4. PowerChute starts the vCenter Server VM and waits until it is accessible.
5. PowerChute starts the vApp and waits until the vApp start command has completed (if there are multiple vApps they will be started in reverse order to how they were shut down).
6. PowerChute starts the VMs on each host in reverse order to how the hosts were shutdown. PowerChute uses the VM startup delay as the interval between starting VMs on each host[2].

Note

1. Once Hosts are shut down the Maintenance mode task is cancelled for the Host running PowerChute so HA can attempt to re-start the PowerChute VM when the Hosts power back on.
2. HA may not start the PowerChute VM automatically. It may need to be started manually depending on HA Admission Control Settings (see table below).
3. If vApp startup or VM startup does not work the first time on a particular host, PowerChute will attempt to start the vApp/VM again at 2 minute intervals.

Table 1 *– Deploying PowerChute as a Virtual Appliance versus installing on a Windows Physical Machine*

	Deployed as a Virtual Appliance	Installed on a Windows Machine
Machine requirements		Requires separate physical machine
If HA cluster goes down	HA may not start PowerChute VM depending on HA Admission Control settings.	Once power is restored and the UPS turns on, PowerChute is restarted

VMware setups with multiple Clusters or Datacenters

If PowerChute is deployed as a Virtual Appliance we recommend deploying one PowerChute Agent per cluster if your setup has multiple clusters.

In environments where there are multiple virtual clusters or datacenters you can use a single PowerChute Agent installed on a physical Windows machine to monitor your hosts but it may be advisable to install PowerChute on multiple machines if the datacenters are in different geographical locations.

vCenter Server is running on a VM in the cluster. Each host is protected by a separate UPS. PowerChute 'Advanced' UPS Configuration option is selected so all UPS's can be monitored by a single PowerChute Agent.

Recommended Deployment

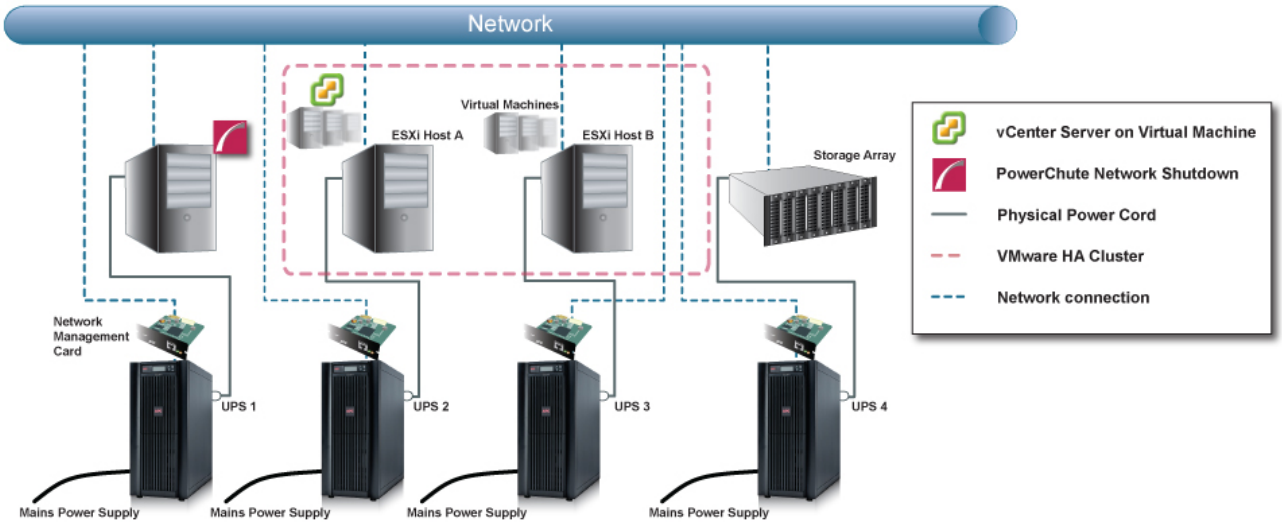
When each Host is protected by a separate UPS, select 'Advanced' UPS configuration and install PowerChute on a physical Windows machine outside the Cluster. VMware Tools must be installed and running on the vCenter Server VM.

Note

All the following scenarios could include setups of Redundant UPS groups. There is no change in the UPS Configuration option or shutdown sequence – just the number of events that are generated before shutdown begins.

vCenter Server is running on a VM; PowerChute is installed on a physical Windows machine.

- VM & vApp Shutdown enabled with a 120 second delay (i.e. 120 seconds allocated for each action to complete).
- The option to turn off the UPS or Outlet Group is enabled.
- A different shutdown command file has been configured with a 120 second duration for each UPS Setup.



Scenario A:

A UPS critical event such as On Battery occurs; but only on the UPS's that are protecting VMware Hosts.

Shutdown Sequence

1. PowerChute reports that UPS 3 is on battery, followed by UPS 2.
2. Shutdown delay for the On Battery event elapses. PowerChute starts a maintenance mode task on the affected hosts. At the same time it sends a UPS or Outlet Group turn off command to UPS 2 and UPS 3.
3. PowerChute migrates powered on VMs to other available hosts in the cluster.
4. VM migration duration elapses. PowerChute shuts down any VMs that are still powered on, followed by vApps on each Host.
5. VM/vApp shutdown duration elapses.
6. PowerChute starts executing the command file on Host B.
7. PowerChute starts vCenter Server VM shutdown on Host A.
8. Command file duration on Host B elapses. PowerChute shuts down Host B.
9. vCenter Server VM shutdown duration elapses and PowerChute starts executing shutdown command file for Host A.
10. Shutdown command duration elapses and PowerChute shuts down Host A.
11. UPS's 2 and 3 wait for the greater of Low Battery Duration/Maximum Required delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off delay (initiated during step 2).
12. UPS's turn off after the user-configurable Shutdown delay time has elapsed or the Outlet Groups turn off after the Power Off delay elapses.
13. PowerChute continues to monitor the other UPS's and protect the other hosts in the cluster.

Startup Sequence

1. Input power is restored and the UPS turns on.
2. VMware host is powered on.
3. PowerChute waits until the host is back online and takes it out of Maintenance mode.
4. PowerChute starts the vCenter Server VM if it was shut down and waits until it is accessible.
5. PowerChute starts the vApp and waits until the vApp start command has completed (if there are multiple vApps they will be started in reverse order to how they were shut down) .
6. PowerChute starts the VMs on the host.
7. If vApp startup or VM startup does not work the first time on the host, PowerChute will attempt to start the vApp/VM again at 2 minute intervals.

Note

If vCenter Server is installed on a Physical Machine:

1. **Shutdown Sequence:** Steps 7 and 9 don't apply.
2. **Startup Sequence:** Step 4 does not apply.

Scenario B:

A UPS critical event such as On Battery occurs on a UPS powering a storage array and **'Execute Virtualization Shutdown Sequence'** only has been enabled.

Shutdown Sequence

1. PowerChute reports that UPS 4 is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts a maintenance mode task on each Host. At the same time it sends a command to turn off the UPS or Outlet Group for UPS 4.
3. VM migration will not occur since all hosts are affected. VM migration duration elapses. PowerChute shuts down VMs, followed by vApps.
4. VM/vApp shutdown duration elapses.
5. PowerChute shuts down the vCenter Server VM.
6. vCenter VM shutdown duration elapses.
7. PowerChute starts executing the shutdown command file for Storage Array UPS Setup.
8. Shutdown command file duration elapses.
9. PowerChute shuts down the VMware hosts using the order on the VMware Host protection page.
10. The host running vCenter Server VM is shut down last.
11. UPS 4 waits for the greater of Low Battery Duration/Maximum Required Delay (Non-Outlet Aware UPS's or the Outlet Group Power Off Delay (initiated during step 2).
12. UPS 4 turns off after the user-configurable Shutdown delay time has elapsed or the Outlet Group turns off after the Power Off delay elapses.
13. PowerChute continues to monitor the UPS's and protect the physical machine.

Startup Sequence

1. Input power is restored and the UPS turns on.
2. The Storage Array is powered on. VMware hosts are powered on.
3. PowerChute waits until the hosts are back online. PowerChute takes the host running the vCenter Server VM out of Maintenance mode first.
4. PowerChute starts the vCenter Server VM and waits until it is accessible.
5. Remaining hosts are taken out of maintenance mode.
6. PowerChute starts the vApp and waits until the vApp start command has completed (if there are multiple vApps they will be started in reverse order to how they were shut down).
7. PowerChute starts the VMs on the hosts.
8. If vApp startup or VM startup does not work the first time on a particular host PowerChute will attempt to start the vApp/VM again at 2 minute intervals.

Note

If vCenter Server is installed on a Physical Machine:

1. **Shutdown Sequence:** Steps 5, 6 and 10 don't apply.
2. **Startup Sequence:** Steps 3 and 4 don't apply.

Scenario C:

A UPS critical event such as On Battery occurs on a UPS powering the physical Windows machine with PowerChute installed and '**Execute Virtualization Shutdown Sequence' / 'Shut down PowerChute Server'** have been enabled.

Shutdown Sequence

1. PowerChute reports that UPS 1 is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts a maintenance mode task on each Host. At the same time it sends a command to turn off the UPS or Outlet Group for UPS 1 only.
3. VM migration will not occur since all hosts are affected. VM migration duration elapses. PowerChute shuts down VMs, followed by vApps.
4. VM/vApp shutdown duration elapses.
5. PowerChute shuts down the vCenter Server VM.
6. vCenter VM shutdown duration elapses.
7. PowerChute starts executing the shutdown command file.
8. Shutdown command file duration elapses.
9. PowerChute shuts down the VMware hosts using the order on the VMware Host protection page.
10. The host running vCenter Server VM is shut down last.
11. After a 70 second delay the Operating System starts to shut down.
12. UPS 1 waits for the greater of Low Battery Duration/Maximum Required delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off delay (initiated during Step 2).
13. UPS 1 turns off after the user-configurable Shutdown delay time has elapsed or the Outlet Group turns off after the Power Off delay elapses.

Startup Sequence

1. Input power is restored and the UPS turns on.
2. Physical machine is powered on if configured to do so. VMware hosts must be powered on manually.
3. PowerChute waits until the hosts are back online.
4. The host running the vCenter Server VM is taken out of Maintenance mode first.
5. PowerChute starts the vCenter Server VM and waits until it is accessible.
6. The remaining hosts are taken out of maintenance mode.
7. PowerChute starts the vApp and waits until the vApp start command has completed (if there are multiple vApps they will be started in reverse order to how they were shut down).
8. PowerChute starts the VMs on the hosts.
9. If the vApp startup or VM startup does not work the first time on a particular host PowerChute will attempt to start the vApp/VM again at 2 minute intervals.

Note

If vCenter Server is installed on a Physical Machine:

1. **Shutdown Sequence:** Steps 5, 6 and 10 don't apply.
2. **Startup Sequence:** Steps 4 & 5 don't apply.

Scenario D:

In this set-up there are three VMware hosts and a storage array. The second host is running the vCenter VM. UPS critical events such as On Battery occur on different UPS's at different times.

Shutdown Sequence

1. PowerChute reports that the UPS powering Host B is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts a maintenance mode task on Host B. At the same time it sends a command to turn off the UPS or Outlet Group for the UPS powering Host B.
3. PowerChute starts to migrate VMs.
4. On Battery event occurs on the Host A in the cluster before VM migration duration elapses. VMs that were in the process of migrating will continue to migrate.
5. PowerChute starts a maintenance mode task on Host A and starts to migrate VMs to Host C.
5. At the same time it sends a command to turn off the UPS or Outlet Group for UPS powering Host A.
6. PowerChute shuts down VMs, followed by vApps for Host B when its migration timer elapses.
7. PowerChute shuts down VMs followed by vApps for Host A when its migration timer elapses.
8. On Battery event occurs on the UPS powering the PowerChute physical machine.
9. PowerChute reports a critical event for Host C and starts the Virtualization shutdown sequence for that host.

Shutdown Sequence *(continued)*

10. PowerChute issues a UPS/Outlet group turn off command for the UPS powering the physical machine.
11. VM migration timer is counted down for the 3rd VMware host. (no migration occurs as there are no hosts available).
12. VM/vApp shutdown duration elapses on Host B.
13. PowerChute starts executing the command file for UPS Setup with Host B.
14. VM/vApp shutdown duration elapses Host A.
15. PowerChute shuts down the vCenter Server VM.
16. vCenter server goes offline.
17. VM shutdown starts on the 3rd VMware host.
18. PowerChute cannot determine if there are VMs in a vApp present on the 3rd host and will shut down any VMs that are part of a vApp during VM shutdown.
19. Command file duration for UPS Setup with Host B elapses and Host B is shut down.
20. vCenter VM shutdown duration elapses.
21. PowerChute starts executing shutdown command file for UPS Setup with Host A.
22. vApp shutdown duration is counted down on 3rd VMware host.
23. vApp shutdown duration elapses.
24. PowerChute starts executing the shutdown command file for Physical UPS Setup.
25. Shutdown command file duration elapses for UPS Setup with Host A and Host A is shut down.
26. Shutdown command file duration for Physical UPS setup elapses and Host C is shut down.
27. After a 70 second delay the OS starts to shut down.
28. UPS's wait for the greater of Low Battery Duration/Maximum Required delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off delay.
29. UPS's turns off after the user-configurable Shutdown delay time has elapsed or the Outlet group turns off after the Power Off delay elapses.

Startup Sequence

1. Input power is restored and the UPS turns on.
2. The physical machine is powered on. VMware hosts are powered on.
3. PowerChute waits until the hosts are back online and takes the host running the vCenter Server VM out of Maintenance mode first.
4. PowerChute starts the vCenter Server VM and waits until it is accessible. Other hosts are taken out of maintenance mode.
5. PowerChute starts the vApp and waits until the vApp start command has completed (if there are multiple vApps they will be started in reverse order to how they were shut down) .
6. PowerChute starts the VMs on the hosts in reverse order to how they appear on the VMware host protection page.
7. If vApp startup or VM startup does not work the first time on a particular host, PowerChute will attempt to start the vApp/VM again at 2 minute intervals.

Note

If vCenter Server is installed on a Physical Machine:

1. **Shutdown Sequence:** Steps 15, 16, 18 and 20 don't apply.

2. **Startup Sequence:** Steps 3 and 4 don't apply.

vCenter Server is running on a VM in the cluster. The physical machine running PowerChute and two Hosts are protected by the same UPS. There are two other UPS's, each powering another Host and a Storage Array. PowerChute 'Advanced' UPS Configuration option is selected so all UPS's can be monitored by a single PowerChute Agent.

Recommended Deployment

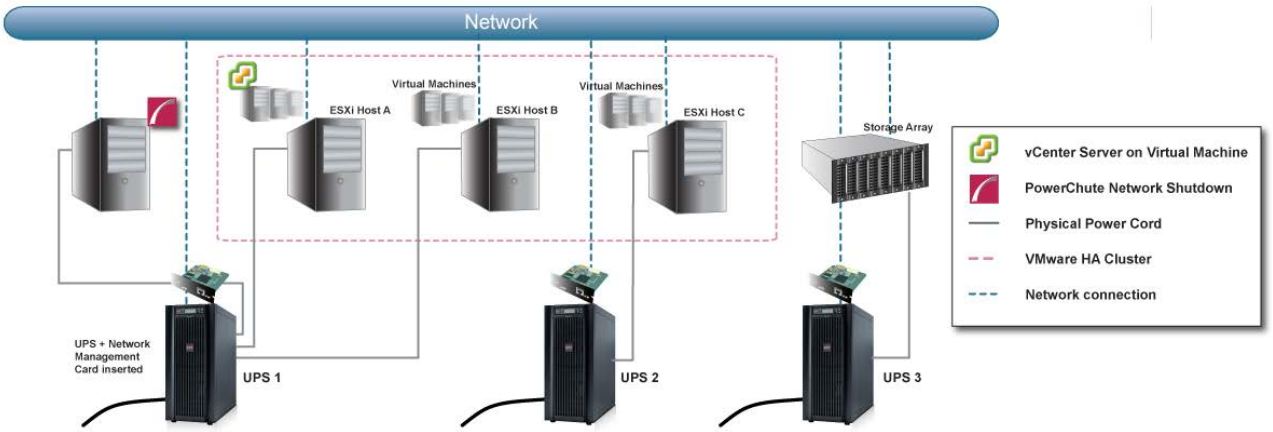
When equipment is protected by multiple separate UPS's, select 'Advanced' UPS configuration and install PowerChute on a physical Windows machine outside the Cluster. VMware Tools must be installed and running on the vCenter Server VM.

Note

All the following scenarios could include setups of Redundant UPS groups. There is no change in the UPS Configuration option or shutdown sequence – just the number of events that are generated before shutdown begins.

vCenter Server is running on a VM; PowerChute is installed on a physical Windows machine.

- VM & vApp Shutdown enabled with a 120 second delay (i.e. 120 seconds allocated for each action to complete).
- The option to turn off the UPS or Outlet Group is enabled.
- "Execute Virtualization Shutdown Sequence" and "Shutdown PowerChute Server" options are enabled for the UPS Setup which is powering both the Physical Machine and 2 VMware Hosts.



Scenario:

A UPS critical event such as "On Battery" occurs on UPS #1 which is protecting the PowerChute machine and 2 hosts.

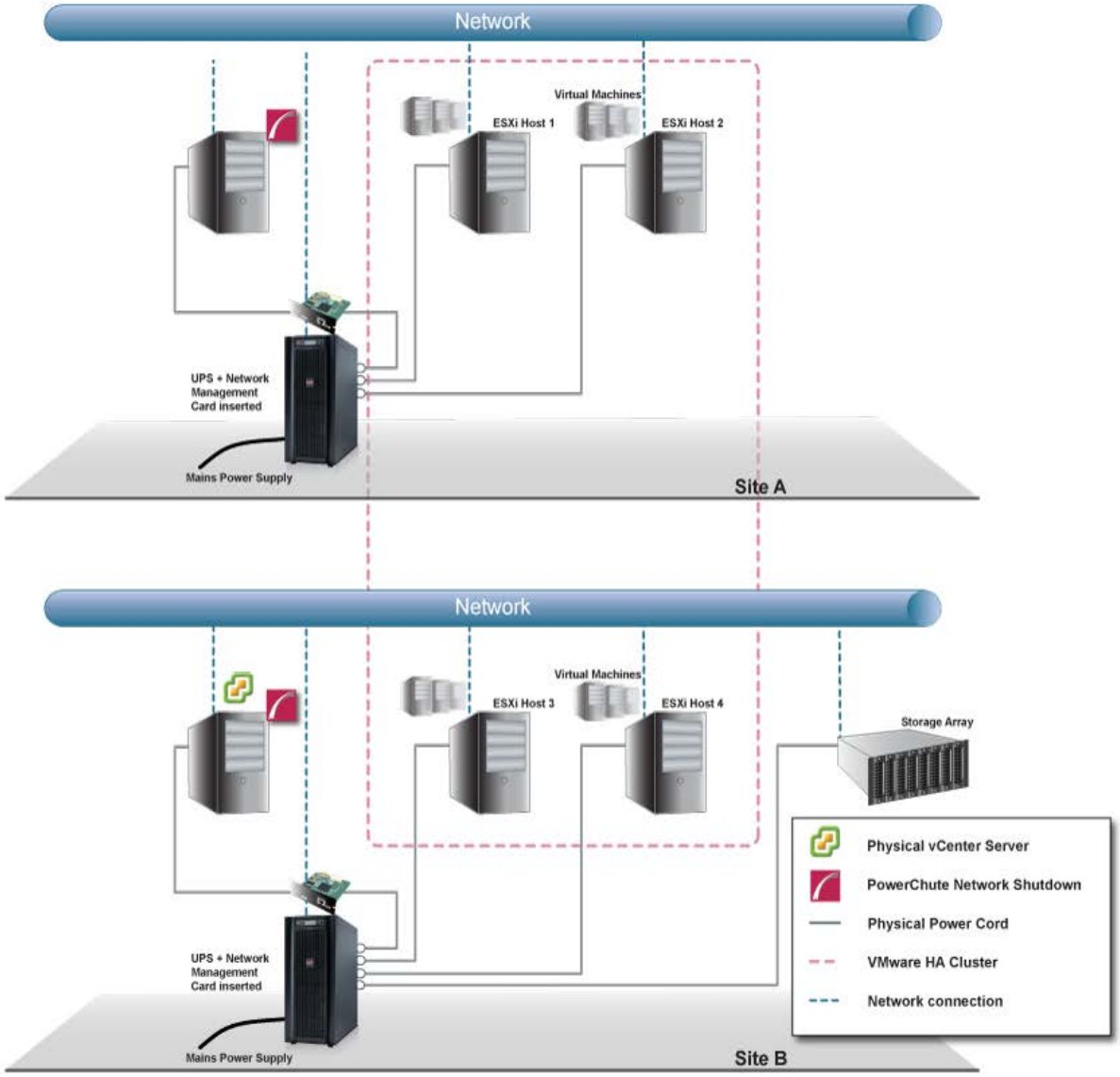
Shutdown Sequence

1. PowerChute reports that UPS 1 is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts a maintenance mode task on all hosts. At the same time it sends a UPS or Outlet Group turn off command to UPS 1.
3. PowerChute shuts down VMs on each Host , followed by vApps in the cluster.
4. VM/vApp shutdown duration elapses.
5. PowerChute starts vCenter Server VM shutdown on Host A.
6. vCenter Server VM shutdown duration elapses and PowerChute starts shutting down the ESXi hosts.
7. PowerChute shuts down the physical machine.
8. UPS 1 waits the remainder of the greater of Low Battery Duration/Maximum Required delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off delay (initiated during step 2).
9. UPS's turn off after the user-configurable Shutdown delay time has elapsed or the Outlet Groups turn off after the Power Off delay elapses.

VMware HA Cluster protected by a Single, Redundant or Parallel UPS configuration with ESXi Hosts located in different geographical locations. vCenter Server is running on a physical machine. Single Storage Array.

vCenter Server is running on a physical machine in Site B; PowerChute is installed on a physical Windows machine in Site A and Site B.

- The Storage Array is located in Site B.
- If a critical event occurs in Site A only, its VMs should be migrated to Hosts in Site B.
- If a critical event occurs in Site B, VMs in Site A and Site B should be shut down.



PowerChute Configuration Site A

1. Install PowerChute on physical machine with VMware support enabled.
2. Choose Single UPS Configuration option and register with UPS's in Site A.
3. On the VMware Host Protection page add Hosts in Site A. Do not add Hosts in Site B.
4. Enable VM migration and VM shutdown options .

PowerChute Configuration Site B

1. Install PowerChute on physical machine with VMware support enabled.
2. Choose Single UPS Configuration option and register with UPS's in Site B.
3. On the VMware Host Protection page add Hosts in Site A and Site B.
4. Enable VM shutdown option only .

Scenario A. When a critical UPS event, such as UPS on Battery, occurs on Site A, the following sequence is triggered:

Shutdown Sequence

1. PowerChute reports that the UPS is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts Maintenance mode task on Hosts in Site A.
3. At the same time it sends a command to turn off the UPS or Outlet Group.
4. PowerChute starts VM migration from Hosts in Site A to Hosts in Site B.
5. VM migration duration elapses and PowerChute gracefully shuts down any VMs that cannot be migrated.
6. VM shutdown duration elapses. PowerChute starts executing the shutdown command file.
7. Shutdown command file duration elapses. PowerChute shuts down the VMware hosts using the order on the VMware Host Protection page.
8. OS shutdown sequence starts on the PowerChute physical machine in Site A.
9. After a 70 second delay the OS starts to shut down.
10. UPS waits for greater of Low Battery Duration/Maximum Required Delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off Delay (initiated during step 3).
11. UPS turns off after the user-configurable Shutdown Delay time has elapsed or the Outlet Group turns off after the power off Delay elapses.

Scenario B. When a critical UPS event, such as UPS on Battery, occurs on Site B, the following sequence is triggered:

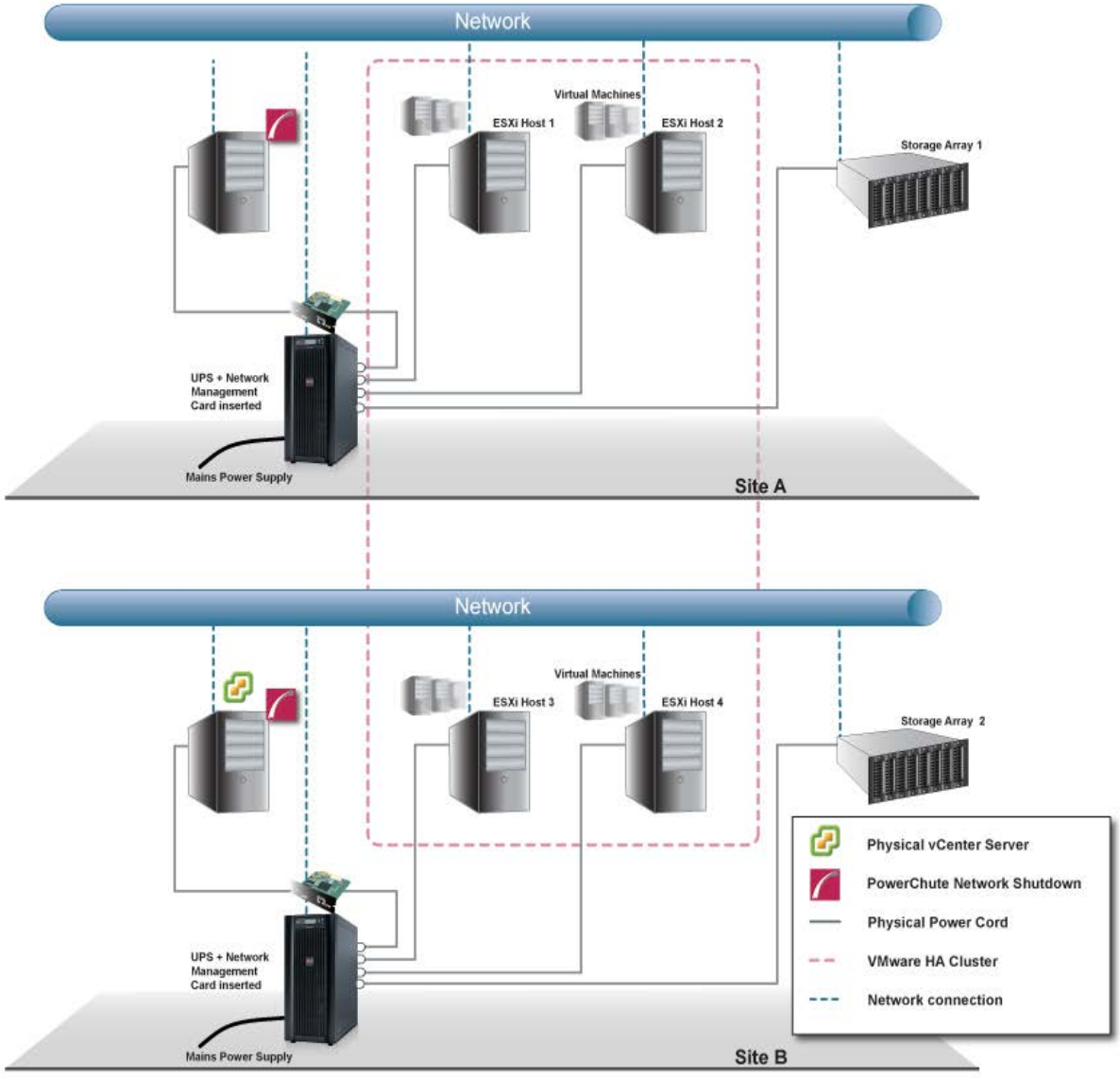
Shutdown Sequence

1. PowerChute reports that the UPS is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts Maintenance mode task on Hosts in Sites A and B.
3. At the same time it sends a command to turn off the UPS's or Outlet Groups.
4. PowerChute gracefully shuts down VMs on Hosts in Sites A and B.
5. VM shutdown duration elapses. PowerChute starts executing the shutdown command file.
6. Shutdown command file duration elapses. PowerChute shuts down the VMware hosts using the order on the VMware Host Protection page.
7. OS shutdown sequence starts on the PowerChute physical machine in Site B.
8. After a 70 second delay the OS starts to shut down.
9. UPS waits for greater of Low Battery Duration/Maximum Required Delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off Delay (initiated during step 3).
10. UPS turns off after the user-configurable Shutdown Delay time has elapsed or the Outlet Group turns off after the power off Delay elapses.

VMware HA Cluster protected by a Single, Redundant or Parallel UPS configuration. vCenter Server is running on a physical machine. ESXi hosts in the HA Cluster are located in different geographical locations. Site A VMs are on Storage Array 1 and Site B VMs are on Storage Array 2.

vCenter Server is running on a physical machine in Site B; PowerChute is installed on a physical Windows machine in Site A and Site B.

- There are Storage Arrays on Site A and Site B.
- If a critical event occurs in Site A only, its VMs should be migrated to Hosts and Storage Array in Site B.
- If a critical event occurs in Site B only, its VMs should be migrated to Hosts and Storage Array in Site A.
- If a critical event occurs in Sites A and B, all VMs and Hosts should be shut down.



PowerChute Configuration Site A

1. Install PowerChute on physical machine with VMware support enabled.
2. Choose Single UPS Configuration option and register with UPS's in Site A.
3. On the VMware Host Protection page add Hosts in Site A. Do not add Hosts in Site B.
4. Enable VM migration and VM shutdown options .
5. Configure Shutdown command file to execute Storage vMotion of VMs in Storage Array on Site A to Storage Array on Site B.

PowerChute Configuration Site B

1. Install PowerChute on physical machine with VMware support enabled.
2. Choose Single UPS Configuration option and register with UPS's in Site B.
3. On the VMware Host Protection page add Hosts in Site B. Do not add Hosts in Site A.
4. Enable VM migration and VM shutdown options .
5. Configure Shutdown command file to execute Storage vMotion of VMs in Storage Array on Site B to Storage Array on Site A.

Scenario A: When a critical UPS event, such as UPS on Battery, occurs on Site A, the following sequence is triggered:

Shutdown Sequence

1. PowerChute reports that the UPS is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts Maintenance mode task on Hosts in Site A.
3. At the same time it sends a command to turn off the UPS or Outlet Group.
4. PowerChute starts VM migration from Hosts in Site A to Hosts in Site B.
5. VM migration duration elapses and PowerChute gracefully shuts down any VMs that cannot be migrated.
6. VM shutdown duration elapses. PowerChute starts executing the shutdown command file to trigger Storage vMotion of VMs in Site A to Storage Array in Site B.
7. Shutdown command file duration elapses. PowerChute shuts down the VMware hosts using the order on the VMware Host Protection page.
8. OS shutdown sequence starts on the PowerChute physical machine in Site A.
9. After a 70 second delay the OS starts to shut down.
10. UPS waits for greater of Low Battery Duration/Maximum Required Delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off Delay (initiated during step 3).
11. UPS turns off after the user-configurable Shutdown Delay time has elapsed or the Outlet Group turns off after the power off Delay elapses.

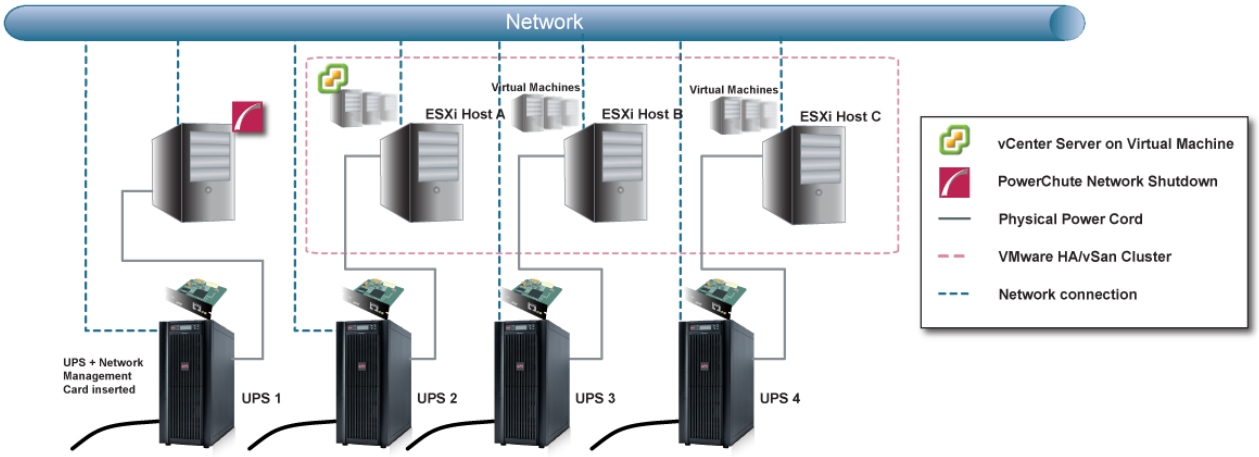
Scenario B: When a critical UPS event, such as UPS on Battery, occurs on Site B, the following sequence is triggered:

Shutdown Sequence

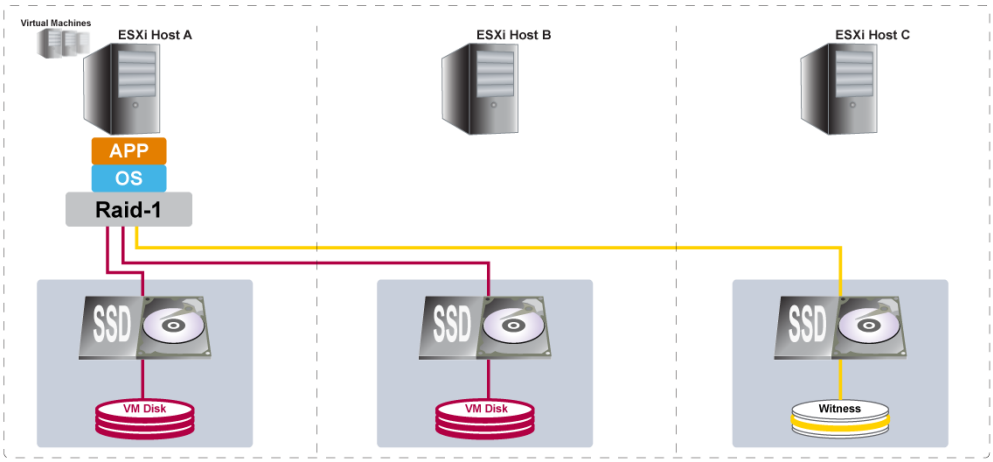
1. PowerChute reports that the UPS is on battery.
2. Shutdown delay for the On Battery event elapses. PowerChute starts Maintenance mode task on Hosts in Site B.
3. At the same time it sends a command to turn off the UPS's or Outlet Groups.
4. PowerChute starts VM migration from Hosts in Site B to Hosts in Site A.
5. VM migration duration elapses and PowerChute gracefully shuts down any VMs that cannot be migrated.
6. VM shutdown duration elapses. PowerChute starts executing the shutdown command file to trigger Storage vMotion of VMs in Site B to Storage Array in Site A.
7. Shutdown command file duration elapses. PowerChute shuts down the VMware hosts using the order on the VMware Host Protection page.
8. OS shutdown sequence starts on the PowerChute physical machine in Site B.
9. After a 70 second delay the OS starts to shut down.
10. UPS waits for greater of Low Battery Duration/Maximum Required Delay (Non-Outlet Aware UPS's) or the Outlet Group Power Off Delay (initiated during step 3).
11. UPS turns off after the user-configurable Shutdown Delay time has elapsed or the Outlet Group turns off after the power off Delay elapses.

VMware vSAN Cluster in an Advanced UPS Configuration

In a vSAN cluster with 3 Hosts (minimum) we do not support an Advanced UPS Configuration where each host is protected by a separate UPS as shown below.



The reason for this is that a vSAN Cluster with 3 Hosts will only tolerate 1 Host Failure using the default vSAN policy. When a Virtual Machine is created, vSAN will create 2 mirror copies of the virtual disk and a witness as shown below.

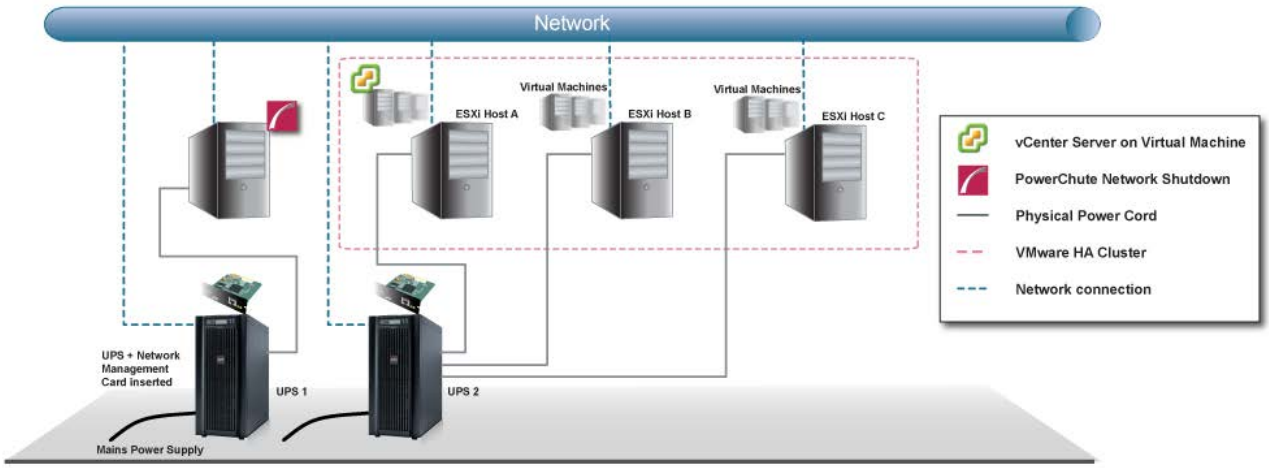


If UPS 2 has a critical event and Host A is shutdown, the VMs which have VMDKs running on the disks on Host A and Host B will still be accessible. However, if UPS 3 also has a critical event and Host B also needs to shutdown then these VMDKs will be inaccessible and prevent the VMs from working properly.

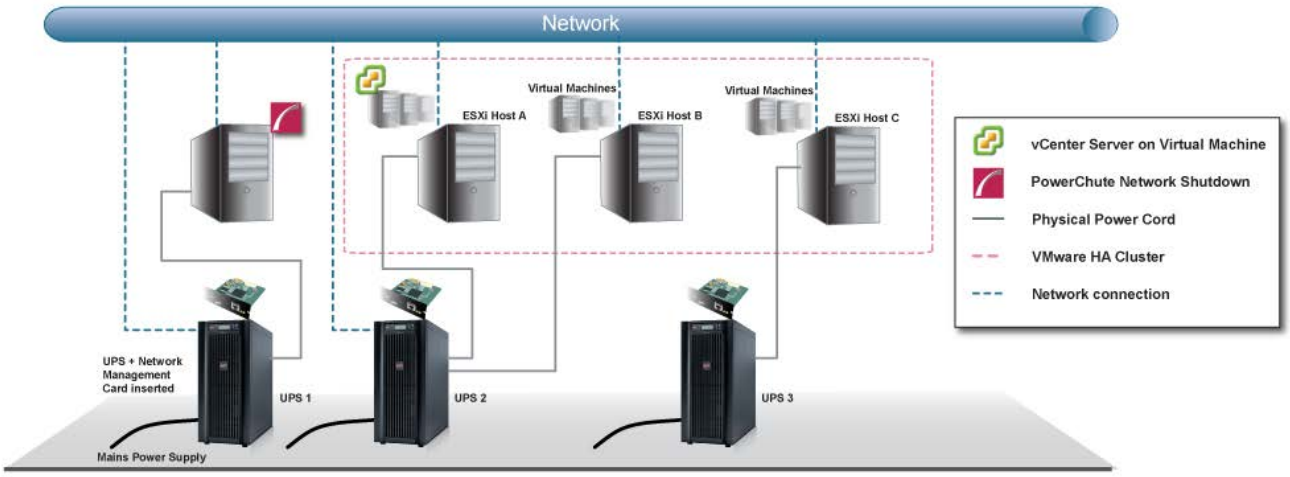
VMware vSAN Cluster in an Advanced UPS Configuration

Supported Advanced UPS Configurations where Hosts are part of vSAN Cluster.

Scenario A: All Hosts in the vSAN Cluster are shut down when a critical event occurs on either UPS 1 or 2.

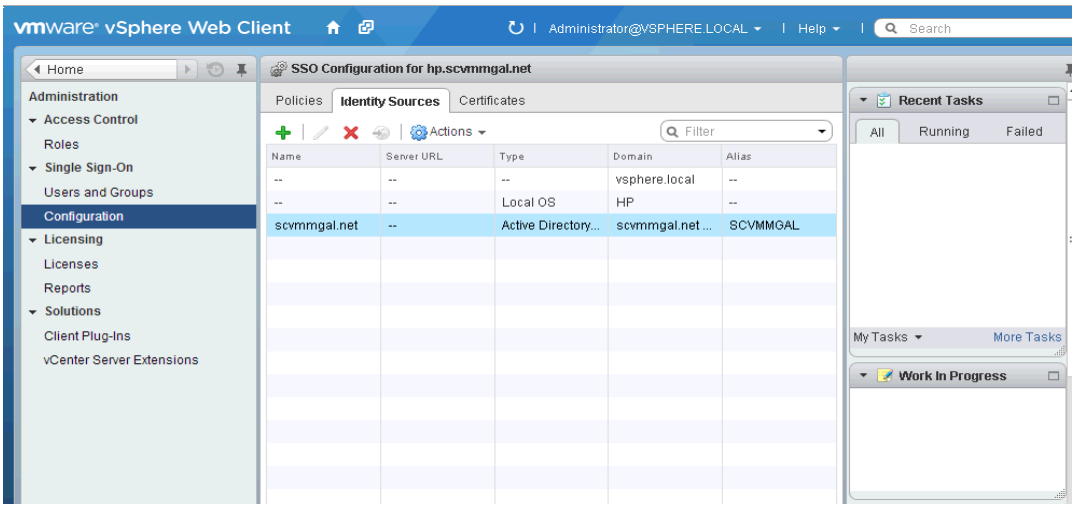


Scenario B: If a critical UPS event occurs on UPS 3 only VMs from Host C can be migrated to Hosts A or B. If a critical event occurs on UPS 1 or 2 all 3 ESXi hosts will be shut down.

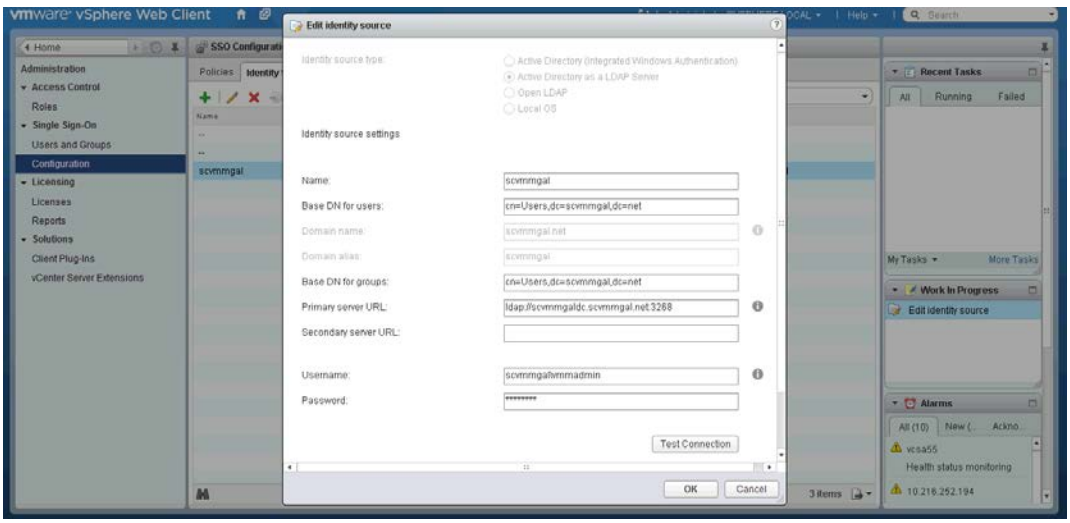


Active Directory / VMware Single Sign-On Configuration

1. In the event that vCenter Server is unavailable we recommend configuring an Active Directory account that can be used to connect directly to the VMware hosts to perform shutdown actions.
2. In Active Directory Users and Groups create a group called "ESX Admins"[1] and add your user(s) to the group.
3. Add Active Directory as an Identity Source in VMware Single Sign On
4. Log in to vCenter Server using the vSphere Web Client via a browser - https://<your_vcenter_ip>:9443 - using default vCenter Server administrator account – administrator@vsphere.local.
5. Click on Administration – Single Sign On – Configuration and then on the Identity Sources tab.

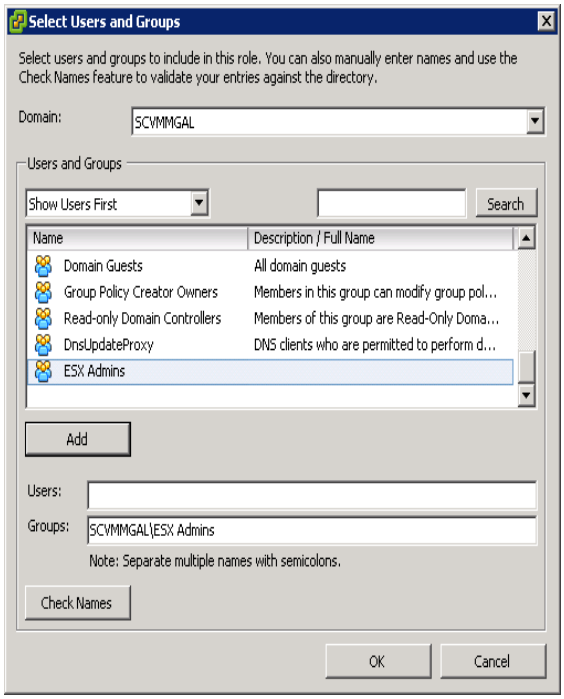


6. Click on the plus symbol to add a new identity source.
7. Select "Active Directory as a LDAP Server". **Note:** If using vSphere 5.5 and vCenter is installed on a Windows machine that is part of the Active Directory domain choose "Active Directory (Integrated Windows Authentication)".
8. Enter the domain details; e.g. - testdomain.com
   a) Name: testdomain
   b) Base DN for Users: CN=Users, DC=testdomain, DC=com
   c) Domain Name: testdomain.com
   d) Alias: testdomain
   e) Base DN for Groups: CN=Users, DC=testdomain, DC=com
   f) Primary Server URL: domaincontroller.testdomain.com
   g) Username: testdomain\domainuser

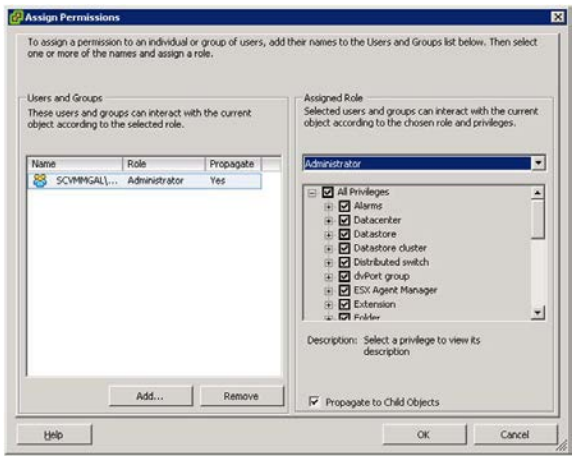


Active Directory / VMware Single Sign-On Configuration *(continued)*

9. Click Ok.
10. Click on “Set as default domain”
11. Log into vCenter using the vSphere client and select the root folder.
12. Next click on the Permissions tab, right click in the right hand pane and select “Add permission”. Change the Assigned Role to Administrator. Click “Add” under Users and Groups. Select your Active Directory domain from the dropdown list. Select the group “ESX Admins” and click Add.
13. Click Ok.



14. Confirm ‘Propagate to child objects’ is selected.



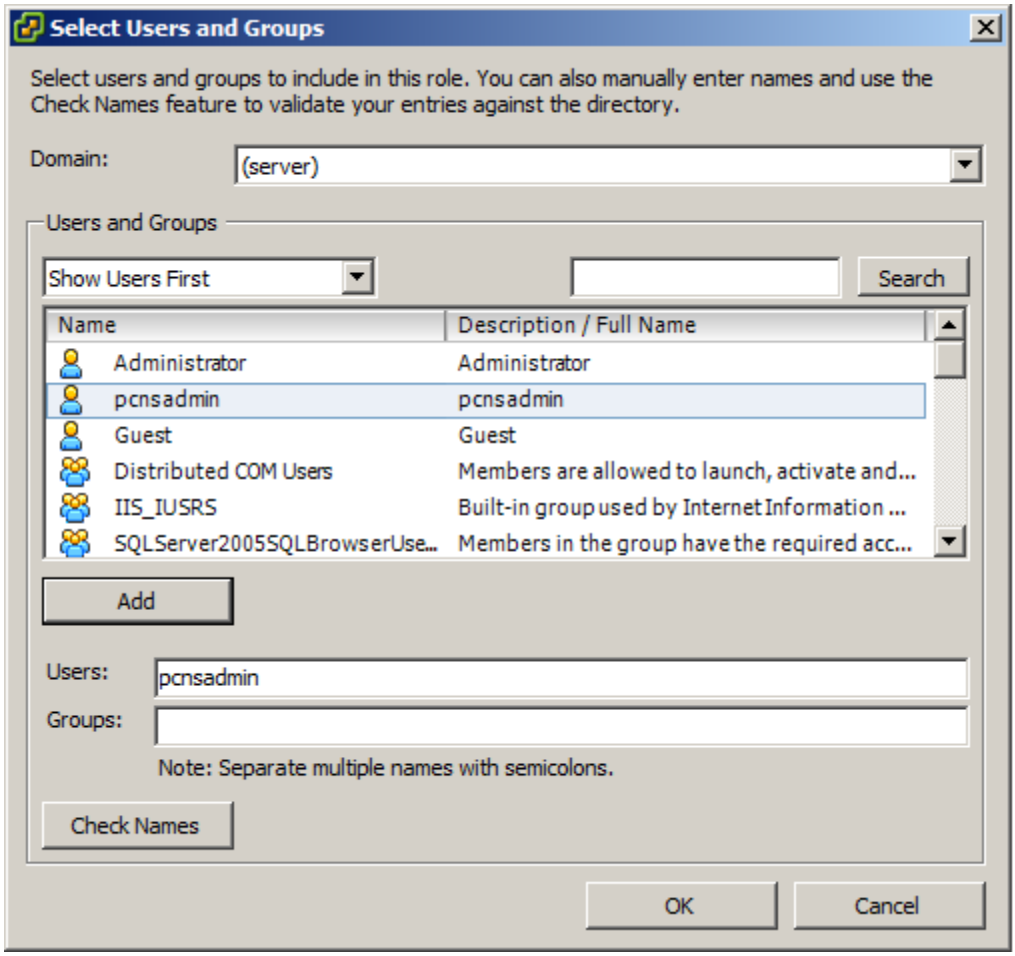
15. Click Ok again.
16. Select each host in the Inventory and go to Configuration – Authentication Services under Software. Click on properties and join the host to your Active Directory Domain.
17. When entering the vCenter Server details in the PowerChute Setup Wizard enter a domain user account that is a member of the “ESX Admins” Active Directory User group.
18. More information on VMware Single Sign On Configuration is available from the VMware site at: http://www.vmware.com/support/pubs/

Note

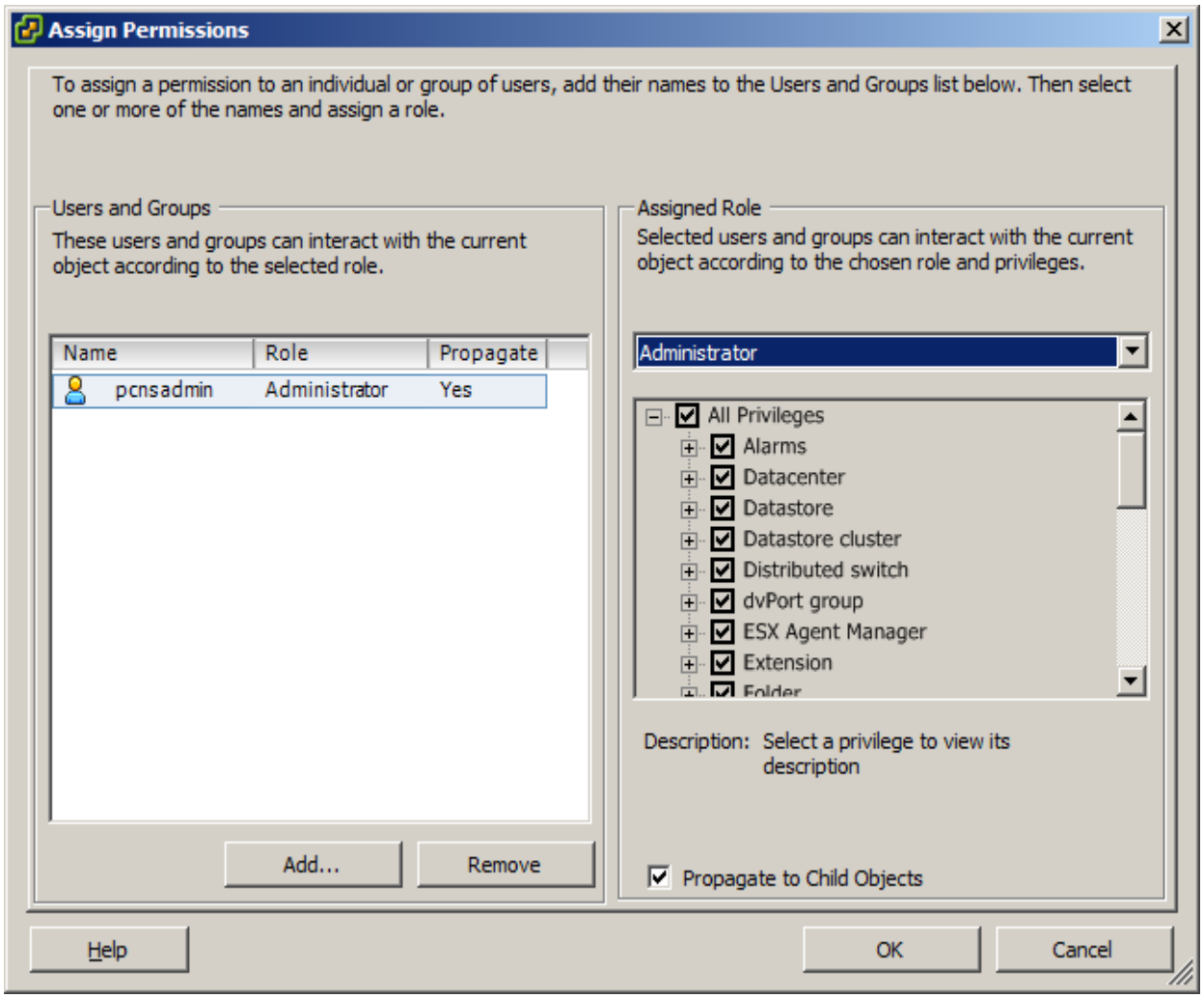
1. When using Active Directory, VMware provides a default AD Group account called "ESX Admins". This group is automatically added to each ESXi host joined to the domain and is granted administrator rights by default.

Shared Local Account for vCenter Server and VMware hosts.

1. In the event that vCenter Server is unavailable, a shared account needs to be configured that can be used to connect directly to the VMware hosts to perform shutdown actions.
2. If Active Directory is not available then a local user account can be added to vCenter Server.
3. An account with the same name and password then needs to be added to each ESXi host.
4. Log in to the vCenter Server machine and add a user via Computer Management -> Local Users and Groups for Windows. On Linux/vCenter Server Appliance use the terminal commands “useradd” and “passwd”.
5. Log in to vCenter Server using the vSphere Client and click on the Permissions tab at the root inventory level.
6. Right click and select Add Permission.
7. In the Assign Permissions dialog click Add.
8. Select (server) under domain, select the User that was added in step 4 and click Add.
9. Click OK.
10. Change the Assigned role to Administrator.
11. Select “Propagate to Child Objects” and Click OK.



Shared Local Account for vCenter Server and ESXi hosts *(continued)*



1. Log in to each ESXi host using the vSphere client and click on Local Users and Groups tab.
2. Right click and select Add…
3. Enter the same username and password that was used when adding the local user to vCenter Server.
4. Click on the Permissions tab.
5. Right click and select Add Permission.
6. In the Assign Permissions dialog click Add.
7. Select (server) under domain, select the User that was added in step 3 and click Add.
8. Click OK.
9. Change the Assigned role to Administrator.
10. Select “Propagate to Child Objects” and Click OK.

Note

1. A shared local account should be used when vCenter Server is running on a VM and Active Directory is unavailable.
2. A shared local account can also be used if the Active Directory Domain Controller is running on a VM and will be shut down.
3. With vCenter 5.5 SSO the local user account may need to be entered in the format **user@localos** or **localos\user** in PowerChute in order to connect to vCenter Server depending on which Identity Source has been set as the Default Domain in SSO. When connecting directly to ESXi hosts PowerChute just uses **user** as the account name since ESXi will not allow @localos for a username.

Appendix A

Sample Storage vMotion PowerCLI Script

> **Note**
> This script has been tested in a controlled environment by APC by Schneider Electric. This is a sample script to be used at your own risk after first testing it in your own test environment before production use.

PowerCLI Installation

VMware PowerCLI can be obtained here: https://www.vmware.com/support/developer/PowerCLI/

Install VMware PowerCLI on each Windows machine running PowerChute in Site A and B per the scenario on page 12.

PowerShell 2.0 or higher is required.

Storage vMotion Command File

1. C:\Windows\SysWOW64\WindowsPowerShell\v1.0\powershell.exe -command get-executionpolicy
2. C:\Windows\SysWOW64\WindowsPowerShell\v1.0\powershell.exe -command set-executionpolicy RemoteSigned
3. C:\Windows\SysWOW64\WindowsPowerShell\v1.0\powershell.exe -psc "C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI\vim.psc1" -noe -c ". \"C:\SVMOTION\svmotion.ps1\"

Create a .cmd file with the content above on each PowerChute machine and configure PowerChute to execute this using Command File option on Shutdown Settings page.

1. This line checks the Powershell execution policy.
2. This line sets the execution policy to RemoteSigned to allow the Powershell script to execute.
3. This line imports the VMware PowerCLI Powershell modules and executes the **svmotion** Powershell script which is stored in folder C:\SVMOTION.

Appendix A - Sample Storage vMotion PowerCLI *(continued)*

sVMotion Powershell Script

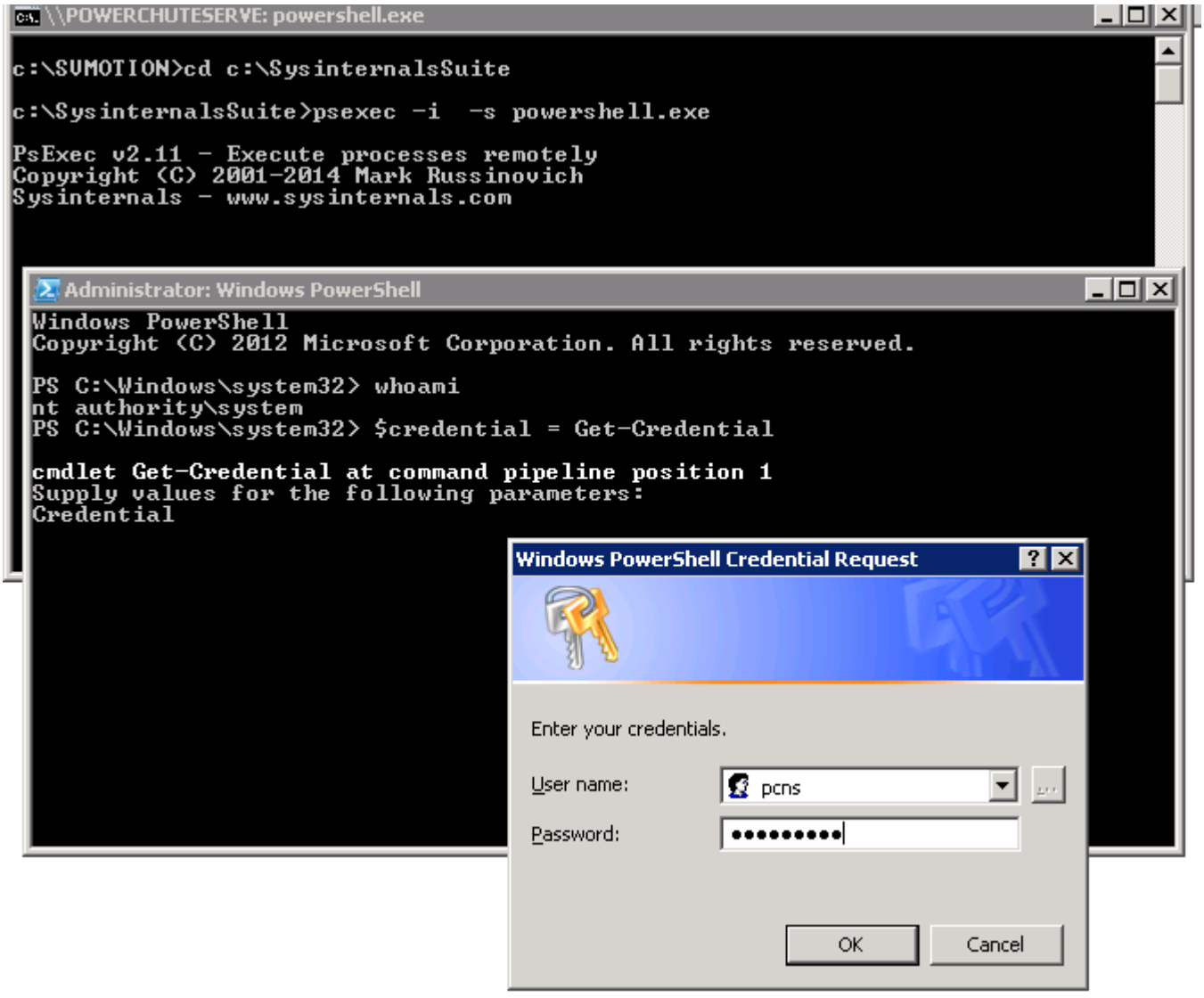
In order to store vCenter Server credentials in a PSCredential object, rather than as plain text in the script file, follow the instructions below.

Download psexec.exe from https://technet.microsoft.com/en-us/sysinternals/bb842062.aspx

From a command prompt run: **psexec –i –s powershell.exe**

Since PowerChute runs using the Local System account, it is necessary to generate and store the credentials in a PowerShell session, also using the Local System account. The command above, using **psexec**, allows for this.

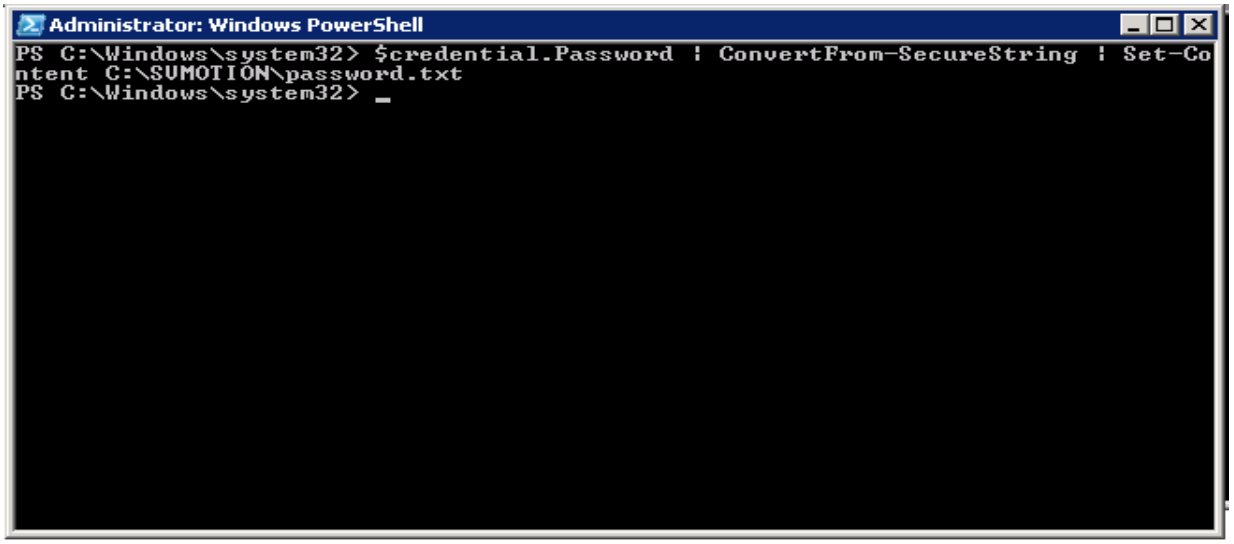
Run the following command to store the vCenter Server Username and Password in a credential object.
$credential = Get-Credential
Enter the vCenter Server Username and Password and click OK.



Appendix A - Sample Storage vMotion PowerCLI Script *(continued)*

Run the following command to write the password to a text file:

$credential.Password | ConvertFrom-SecureString | Set-Content C:\SVMOTION\password.txt




```
1.  $server = "10.216.254.72"
2.  $protocol = "https"
3.  $username = "pcns"
4.  $password = Get-Content C:\SVMOTION\password.txt | ConvertTo-SecureString
5.  $mycred = New-Object System.Management.Automation.PSCredential($username,$password)
6.  $sourceds = "pcnslab1"
7.  $targetds = "pcnslab2"

8.  Connect-VIServer -Server $server -Protocol $protocol -Credential $mycred
9.  $VMs = (Get-Datastore -Name $sourceds).Extensiondata.Vm|%{(Get-View -Id $_.toString()).name}
10. ForEach ($VM in $VMs)  {   Get-VM $VM | Move-VM -Datastore (Get-Datastore $targetds) }
11. Disconnect-VIServer -Server $server -Confirm:$false -Force
```

Create a .ps1 file with the content above on each PowerChute machine.

1. This is the IP address of the vCenter Server machine.
2. Default protocol for connecting to vCenter Server Web Services API.
3. vCenter Server username – this account must be assigned the vSphere Administrator role.
4. vCenter Server password is retrieved from C:\SVMOTION\password.txt.
5. Creates a PSCredential object **"$mycred"** that can be passed to **Connect-VIServer** cmdlet to authenticate with the vCenter Server.
6. The name of the source Datastore on Storage Array in Site A or Site B.
7. The name of the target Datastore on Storage Array in Site A or B.
8. Connect to vCenter Server.
9. Retrieves a list of all VMs on the Source Datastore.
10. Process each VM on the Source Datastore and move it to the Target Datastore.
11. Disconnect from vCenter Server.