

VMware vCenter Shutdown Scenarios using Dell UPS Management Software

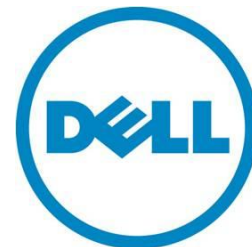
This Dell Technical Information Note provides practical examples of implementing shutdown using Dell UPS Management Software Release 2 on VMware vCenter.

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Scope of this document

This document provides a quick setup guide with practical examples for installing and using Dell Uninterruptible Power Supply (UPS) Management Software, Release 2, 01.04.0010 (A02) [*referred to as Dell UPS Management Software*], announced July 2012 with VMware® vCenter™¹.

This guide is designed for readers who have comprehensive knowledge of and experience with VMware vSphere / vCenter products. It is intended to complement the full user guide that comes with Dell UPS management software.

For full information about Dell UPS Management Software – such as hardware and software prerequisites and details about activating, configuring and using UPS monitoring and management functions – refer to the complete Users' Guides for the software components.

The two components of Dell UPS Management Software

The Dell UPS power management suite – Release 2, 01.04.0010 (A02) – is compatible with all Dell single-phase UPS products. The software suite includes two complementary and integrated offerings, both managed through a single, Web-based interface:

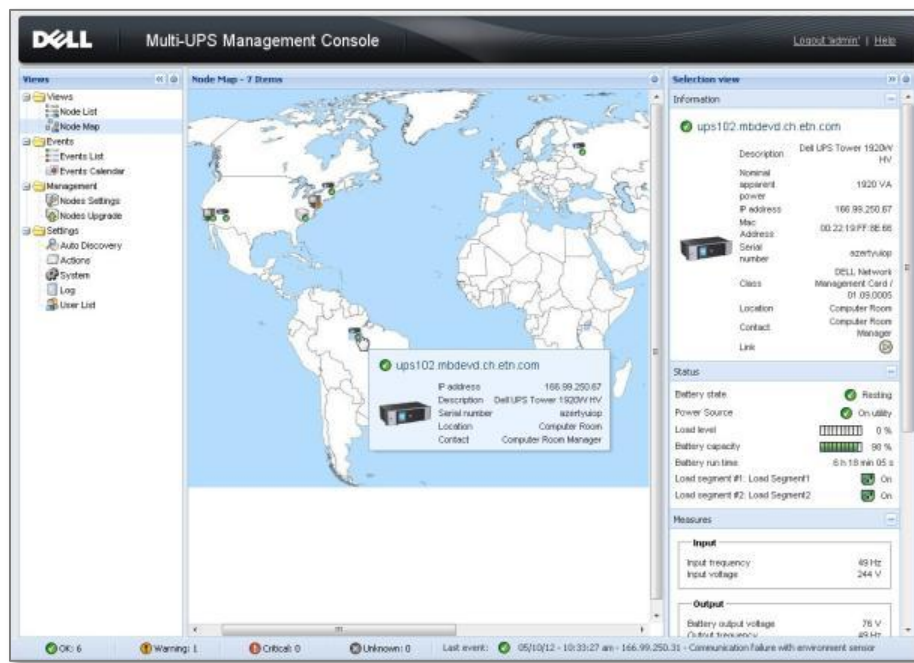
The Dell Multi-UPS Management Console (MUMC):

- Discovers and supervises Dell UPSs and Dell intelligent power distribution units (PDUs) connected to the network.
- Provides a central control point for configuring, monitoring and reporting actions relating to UPS and PDU events.

¹ For more information when installing Dell UPS Management Software on VMware vMA 5.0.0.1 or 5.0.0.2, refer to Dell Technical Information Note “Implementing shutdown using Dell UPS Management Software, Release 2 on VMware® vMA 5.0.0.1 and 5.0.0.2.” Download from http://dellups.com/support_download.asp

- Provides mass configuration and firmware update for Dell UPS NMCs. The optional NMC is recommended for remote management and required for managing UPSs in virtualized IT environments.
- Provides centralized management of Dell UPS Local Node Manager applications running on remote traditional (Windows/Linux) or virtualized servers (Microsoft®, VMware®, Citrix®, Red Hat®).
- Provides an agent-less method for managing multiple hosts in clusters using VMware vCenter™ or Citrix XenCenter®.

Figure 1: Dell's Multi-UPS Management Console (MUMC)



The Dell Multi-UPS Management Console (MUMC) does not:

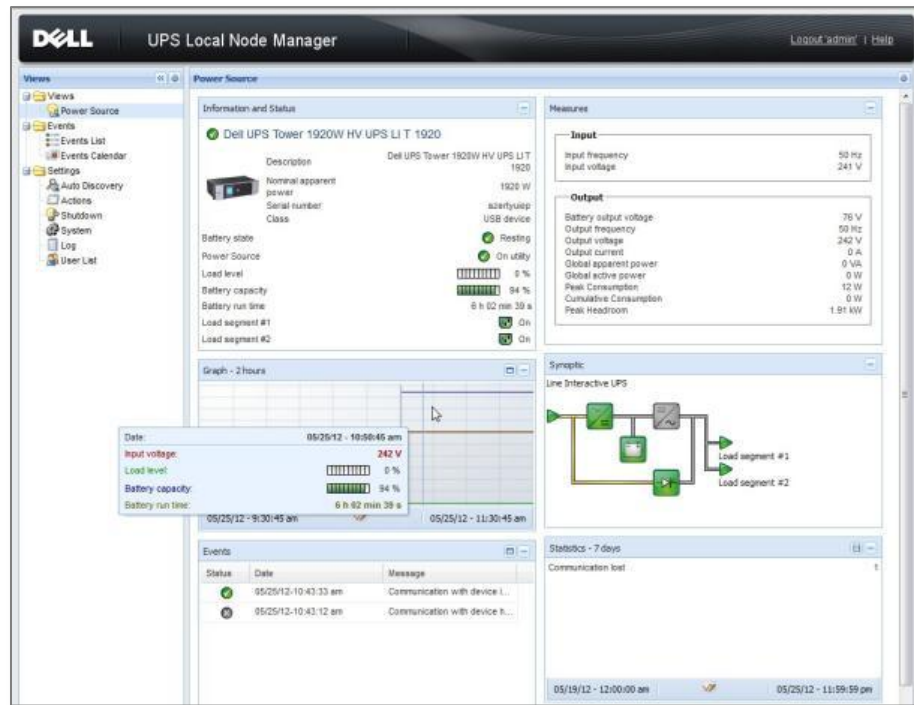
- Control virtual machine (VM) behavior. This is managed by the host and configured through vCenter or other host management interface.
- Assume responsibility for VM startup/shutdown/hibernation/VM migration. This is managed by the host management interface.
- Replace a user's need to understand VM behavior responding to a host entering maintenance mode or shutting down.
- Explain all possible scenarios according to the various virtualization vendors, license types and feature sets.

The Dell UPS Local Node Manager (ULNM):

- Acts as a local shutdown agent on local computers using traditional operating systems, for graceful, unattended UPS shutdown and restart.

- **Acts as a local shutdown agent in virtualized environments, for virtualization host Hypervisor Agent and vMA Agent type.**²
- Provides a local interface to view UPS power status, events and configurations.
- Is remotely managed by the Dell UPS supervisory console for simultaneous, centralized configuration and management of multiple ULNM agents.

Figure 2: Dell's UPS Local Node Manager (ULNM)



Both components (MUMC and ULNM) are included in the Dell UPS Management Software download bundle available from support.dell.com (and dellups.com). The focus of this document is the “Agentless” scenario shown in Figure 3.

² Hypervisor Agent type: A host on which applications can be directly installed (such as Win2k8).

vMA Agent type: A host on which applications cannot be directly installed and instead use a management assistant to load applications (such as vMA), refer to Figure 3.

For more information on Dell ULNM and MUMC interaction with virtualized hypervisors, contact your local Dell representative or refer to the appropriate User’s Guide at dellups.com/soft-tech-doc.asp.

Figure 3: Dell UPS management software connectivity scenarios

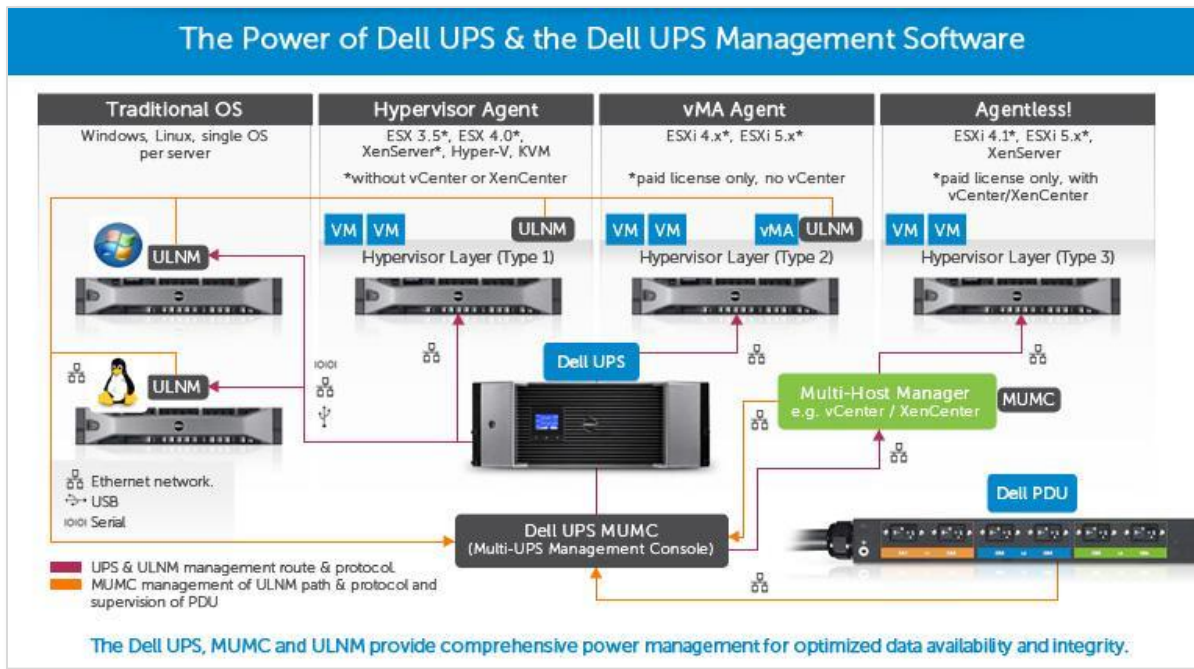
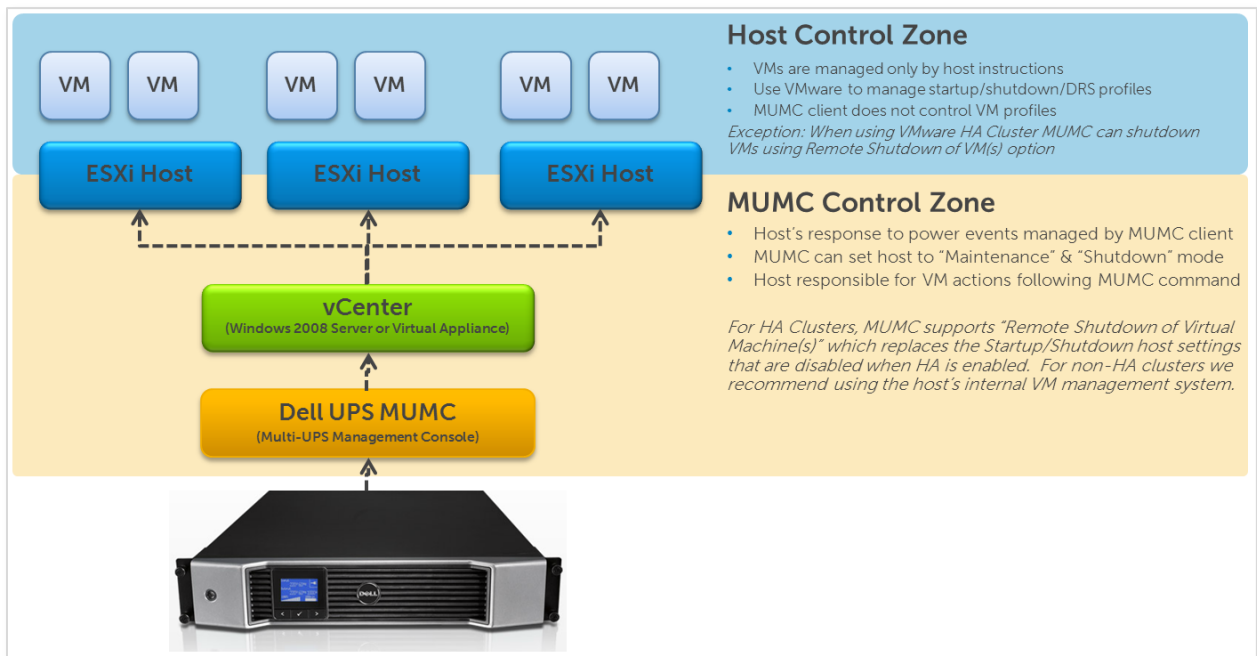


Figure 4: UPS management architecture in a virtualized environment



Prerequisites

Prerequisites: Software download from Dell

1. Get the latest version of the Dell UPS Management Software consisting of the MUMC client and ULNM from support.dell.com or from www.dellups.com:
 - Software & Technical Documentation
 - Software Downloads
 - Dell Multi-UPS Management Console and UPS Local Node Manager Software, Release 2, 01.04.0010 (A02)
2. Install the MUMC client.
3. Get the latest version of User's Guides for Dell UPS Management Software from support.dell.com or from www.dellups.com:
 - Software & Technical Documentation
 - User Manuals and Publications
 - Dell Multi-UPS Management Console User Guide [Release 2, July 2012] and Dell UPS Local Node Manager User Guide [Release 2, July 2012].

The MUMC client passes "Maintenance Mode" or "Shutdown" requests to the host at predetermined intervals after a power outage. The host response to these commands depends on the VMware features and licenses used.

Prerequisites: VMware licensing

VMware license types (Essentials, Standard, Enterprise, Enterprise Plus) can significantly affect the type of host features that can be used during a power failure event. VM behavior can vary significantly with small changes in vCenter configuration, so you must understand this aspect of the solution. The MUMC and ULNM UPS management products require pay versions of VMware vSphere / vCenter.

Prerequisites: Hardware and software

Supported operating systems: The MUMC client is installed on a Windows™ operating system (Server 2008 R2, Win7 etc). This can be either a physical machine or a virtual machine. If the MUMC client is installed on a VM, make provisions with HA/FT/DRS to ensure that this machine has a persistence priority to make certain that the MUMC client services are available for UPS instructions to be passed to the vCenter. For a full list of supported Windows™ platforms, refer to the MUMC client User's Guide.

vSphere Perl SDK: If using Dell UPS Management Software Release 1, this vSphere Perl SDK must be installed on the same operating system as the MUMC client to enable the vCenter interface and commands. (This dependency was removed in Release 2.) Check the documentation accompanying your download to confirm.

Maximum infrastructure limitations: The MUMC client has been tested to >1000 nodes (UPSs, hypervisors, local UPS agents, etc.). There is no theoretical maximum to the number of nodes that can be managed by the MUMC client.

UPS network communication card. The UPSs to be remotely monitored and managed must be equipped with the optional Dell Network (Ethernet) Management Card (NMC), Dell PN H910P.

Prerequisites: Connectivity

UPS communications: The Dell UPS must be connected to an IP network using the optional Dell Network Management Card (NMC). **USB communications are not supported for the virtualized “Agentless” applications discussed in this document.**

Survivable network connectivity: The MUMC client must retain IP communications with both the UPS and vCenter at all times. Take care to ensure that network switches and other networking equipment are covered by UPS protection and suitable redundancy built into the network. If network connectivity is considered a weak link in the architecture, the optional ULNM agent can be installed on the local ESXi host to act as a local shutdown agent that can take action even when connectivity to the main MUMC client has been lost. This approach is not discussed in this document.

Network ports: The following table provides protocol, mode and port reference for Dell NMC cards. Shown for reference only are ULNM (Dell’s node manager) with a Shutdown Controller agent and Dell ULNM.

Table 1. Protocol, mode/port listing

| Protocol | Mode/Port | Dell NMC Card | Other Ethernet cards : PXGX2000, PXGX-UPS, Connect UPS BD, Connect UPS XSlot | DELL ULNM with Shutdown Controller | DELL ULNM |
|-----------------------------|-----------|---------------|--|------------------------------------|-----------|
| SMTP | TCP/25 | OUT | OUT | OUT | OUT |
| DHCP/BOOTP | UDP/67 | OUT | OUT | X | x |
| TFTP | UDP/69 | IN | x | OUT | OUT |
| http | TCP/80 | IN | IN | OUT | OUT |
| NTP | UDP/123 | OUT | OUT | X | x |
| SNMP | UDP/161 | IN | IN | OUT | OUT |
| SNMP Traps | UDP/162 | OUT | OUT | X | x |
| UNMP | UDP/200 | X | OUT | IN/OUT | IN/OUT |
| HTTPS | TCP/443 | IN | IN | OUT | OUT |
| DELL Supervision | TCP/4679 | X | x | IN/OUT | IN/OUT |
| DELL Notification Broadcast | UDP/4679 | IN/OUT | x | IN/OUT | IN/OUT |
| DELL SSL Supervision | TCP/4680 | X | x | IN/OUT | IN/OUT |
| DELL Alarms Broadcast | UDP/4680 | OUT | x | IN | IN |
| DELL Connected Alarms | TCP/5000 | IN | x | OUT | OUT |
| DELL Connected Alarms | TCP/5001 | X | x | IN | OUT |

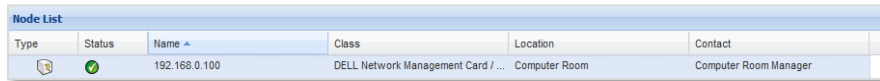
vCenter IP Ports: The MUMC Client will only communicate with vCenter through the default port 443. When installing vCenter take care to use the standard port. Future software releases may support non-standard communications ports.

Installing the software

If using Dell UPS Management Software Release 1, install vSphere Perl SDK to the Windows OS where you intend to install the MUMC client (<http://www.vmware.com/support/developer/viperltoolkit/>). This dependency was removed in Dell UPS Management Software, Release 2, 01.04.0010 (A02). Check the documentation that accompanied the download for your version. If not current, download from support.dell.com or from www.dellups.com, as described in “Prerequisites” earlier in this document.

1. Install the MUMC client to the same Windows OS.
2. Login to the MUMC client (default admin/admin).
3. Navigate to Settings ➤ Auto Discovery. Add the Dell UPS node (QuickScan or Range Scan).

Figure 5: MUMC client ➤ Settings ➤ Auto Discovery ➤ Add Node



| Type | Status | Name | Class | Location | Contact |
|------|--------|---------------|------------------------------------|---------------|-----------------------|
| | | 192.168.0.100 | DELL Network Management Card / ... | Computer Room | Computer Room Manager |

4. Right-click the UPS node and “Set Node Access Parameters” (default is admin/admin).
5. Navigate to Settings ➤ System ➤ Edit Modules Settings, and enable the Virtualization Module.

Note: Only enable the “Shutdown” module if you want the computer hosting the MUMC client to shut down in the event of a power failure. Once the computer hosting the MUMC client has shut down, it is no longer able to control hypervisor function, so care take care to ensure that the computer hosting the MUMC client is shut down in the last possible moment after all hypervisor actions have been taken.

Figure 6: MUMC client ➤ Settings ➤ System ➤ Modules Settings ➤ Edit Scan Settings

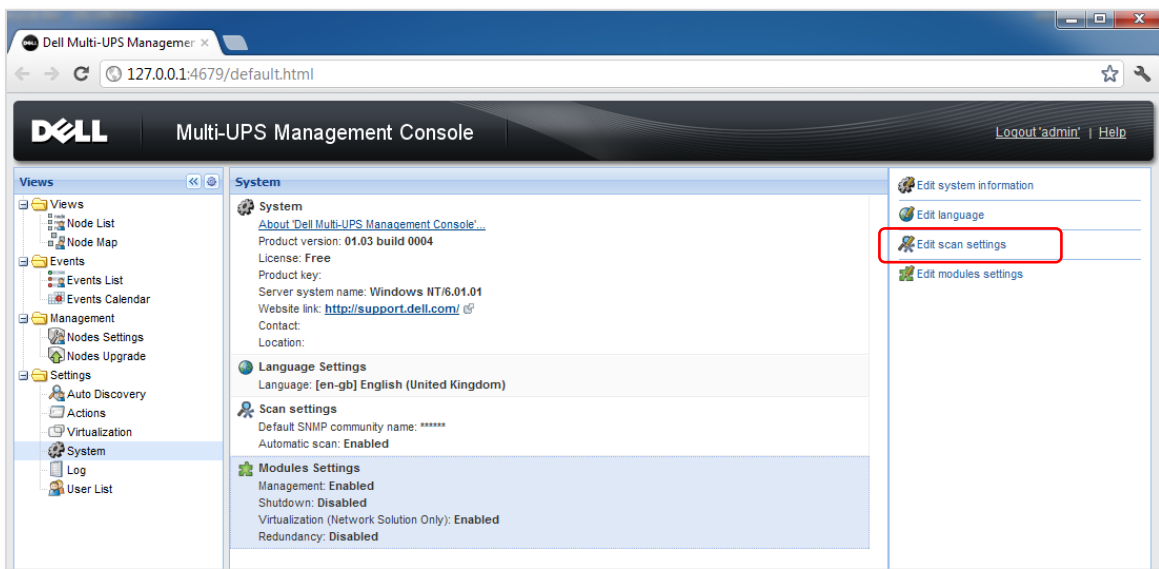
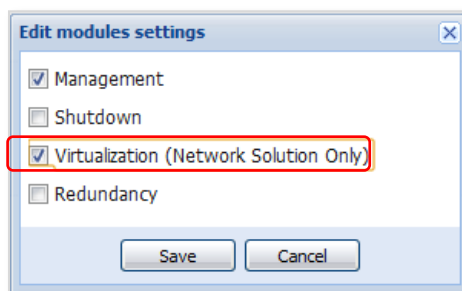
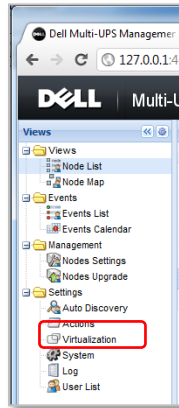


Figure 7: Edit Scan Settings ➤ Virtualization



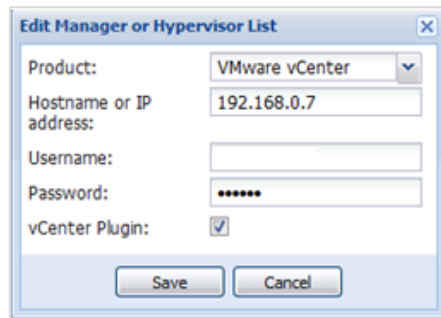
6. A new “Virtualization” menu item is now available in the Settings menu.

Figure 8: MUMC client ➔ Settings ➔ Virtualization menu item added



7. Click on the new Virtualization tab.
8. Add new Supervisor, entering vCenter IP address and access credentials. Check the vCenter plugin box to enable the vCenter tab for Dell UPS Software.

Figure 9: MUMC client ➔ Settings ➔ Virtualization ➔ Add new supervisor



9. The MUMC client will poll the vCenter server and automatically add all available vSphere hypervisors to the MUMC client.
10. Switch to the vCenter management console (viewed through vSphere Client) for all further steps. Close the Web browser containing the original MUMC client.

Figure 10: vCenter → MUMC client tab

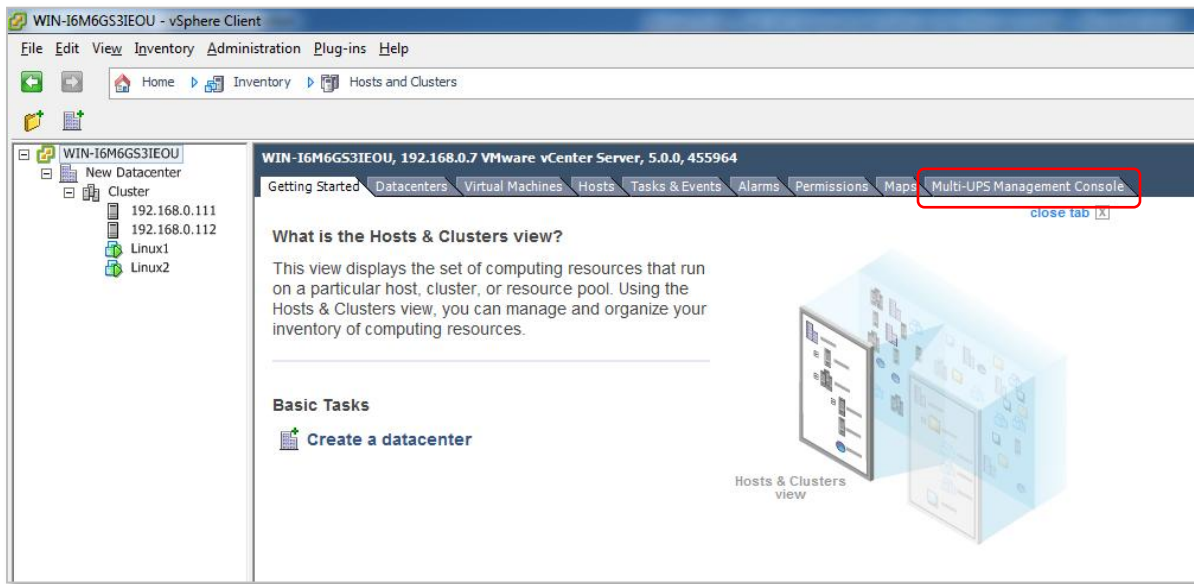
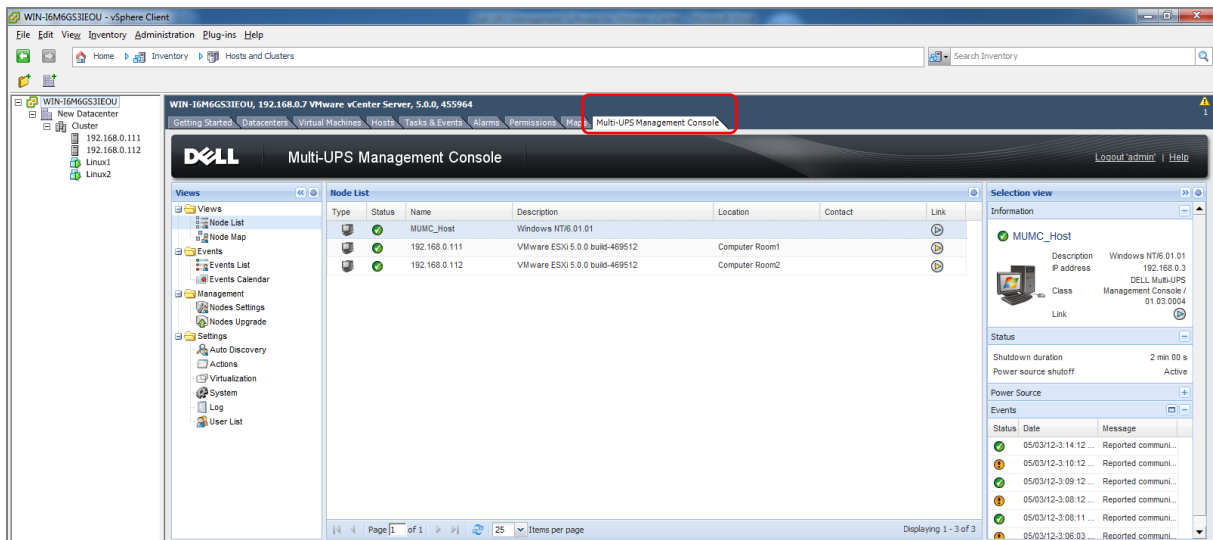
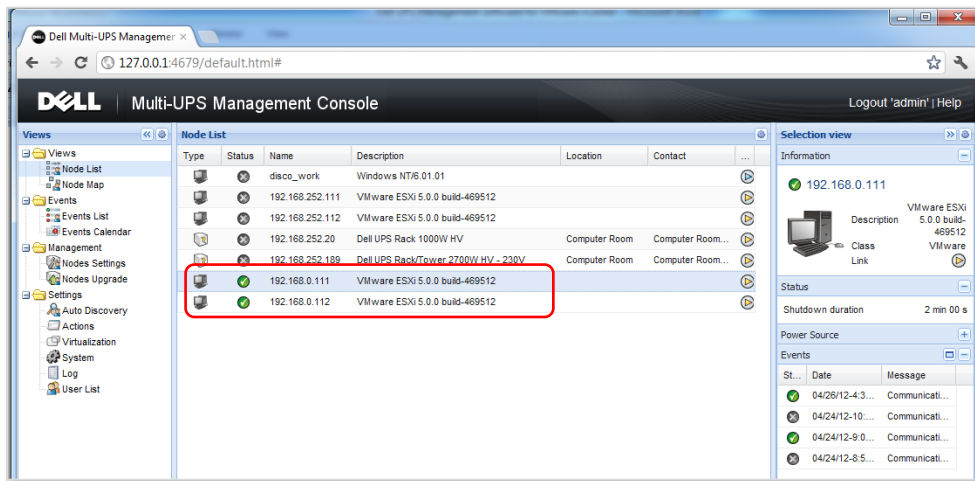


Figure 11: vCenter → MUMC client → Main menu



11. Within the MUMC client (vCenter plugin), navigate to Views → Node List and verify that all hypervisors are recognized.

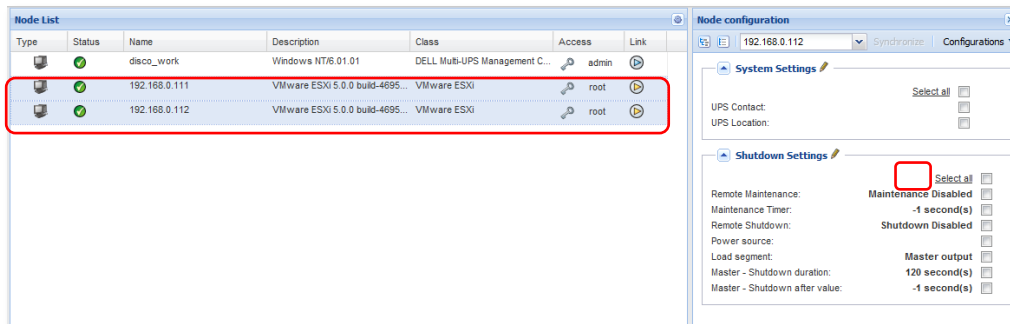
Figure 12: vCenter → MUMC Client → Views → Node List



12. Navigate to Management → Node Settings.

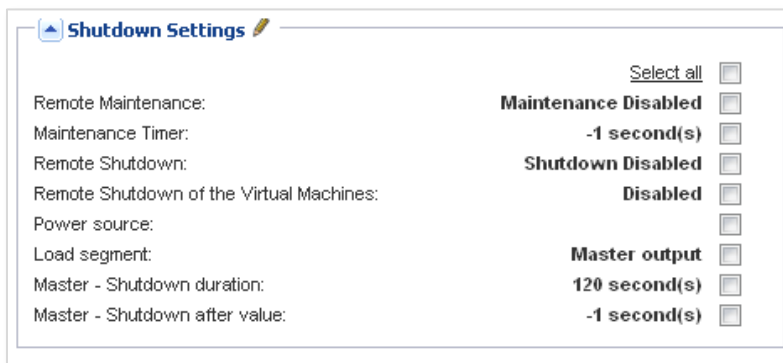
13. Left-click each ESXi instance and edit shutdown settings. To edit multiple hosts with the same configuration at the same time, select multiple hosts (Ctrl + click). Click the pencil icon to make changes.

Figure 13: vCenter → MUMC Client → Views → Node List → Node Settings



14. Click the check box next to each item that you want to edit. Not all settings must be changed. Edit the shutdown settings according to your needs.

Figure 14: vCenter → MUMC Client → Views → Node List → Node Settings → Shutdown settings



The color-coded text below corresponds to Figure 13, “UPS battery capacity over time.” The following information is from the MUMC client User’s Guide, Virtualization section ➔ Configuring Maintenance and Shutdown. Text modified to include examples of settings.

- A. **Remote Maintenance:** Choose “Enabled” to set the host(s) to “Maintenance Mode” in the event of a power outage. If your hosts have vMotion enabled then the VMs will automatically move from this host to another when power fails.
- B. **Maintenance Timer:** This is the time between power failure and the command to set the host to maintenance mode. -1 = immediate action.
- C. **Remote Shutdown:** Disabled will leave the host in maintenance mode. Enabled will shut down the hypervisor once all VMs have been evacuated.
- D. **Remote Shutdown of Virtual Machines:** Use this setting in HA clusters where the normal host VM Startup/Shutdown settings are disabled. This feature will shut down VMs with VMTools running on an HA host but will not allow preferential VM startup. The MUMC client will poll the host to check the status of VMs, and once all are shut down (no VMTools devices still running), the MUMC client will issue the shutdown command to the host.
- E. **Power Source:** Enter the IP address of your Dell UPS.
- F. **Load Segment:** Only use this variable if you are using Load Segments to preferentially control hardware startup/shutdown behaviour (e.g. servers and storage on separate profiles).
- G. **Master - Shutdown Duration:** The time (in seconds) it takes for the host to shut down (including any vMotion activities). Make sure that the time between “**Maintenance Timer**” and “**Master - Shutdown After**” gives enough time for any VM migrations to occur. Otherwise the migrations will fail and the VM will shut down on the original host location.
- H. **Master - Shutdown After:** The time (seconds) following a power failure that the shutdown command should be sent to the host.

Figure 15: UPS Battery capacity over time

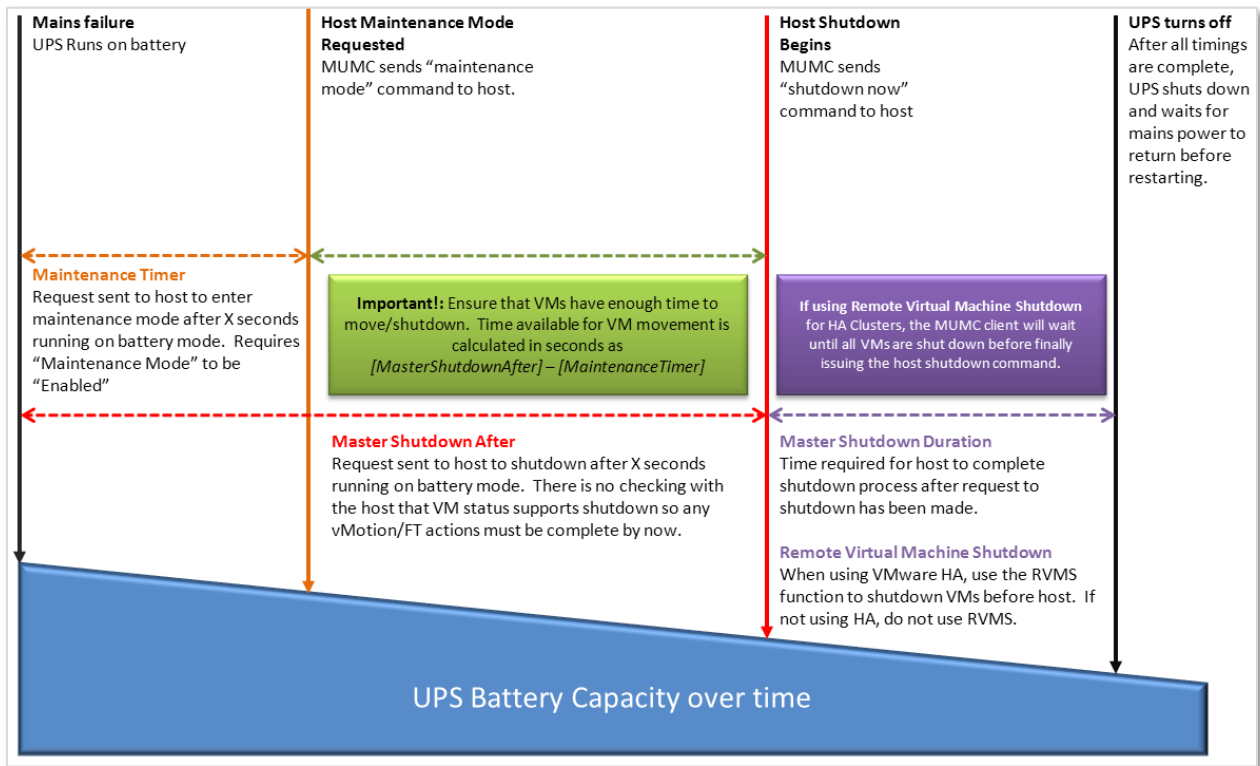
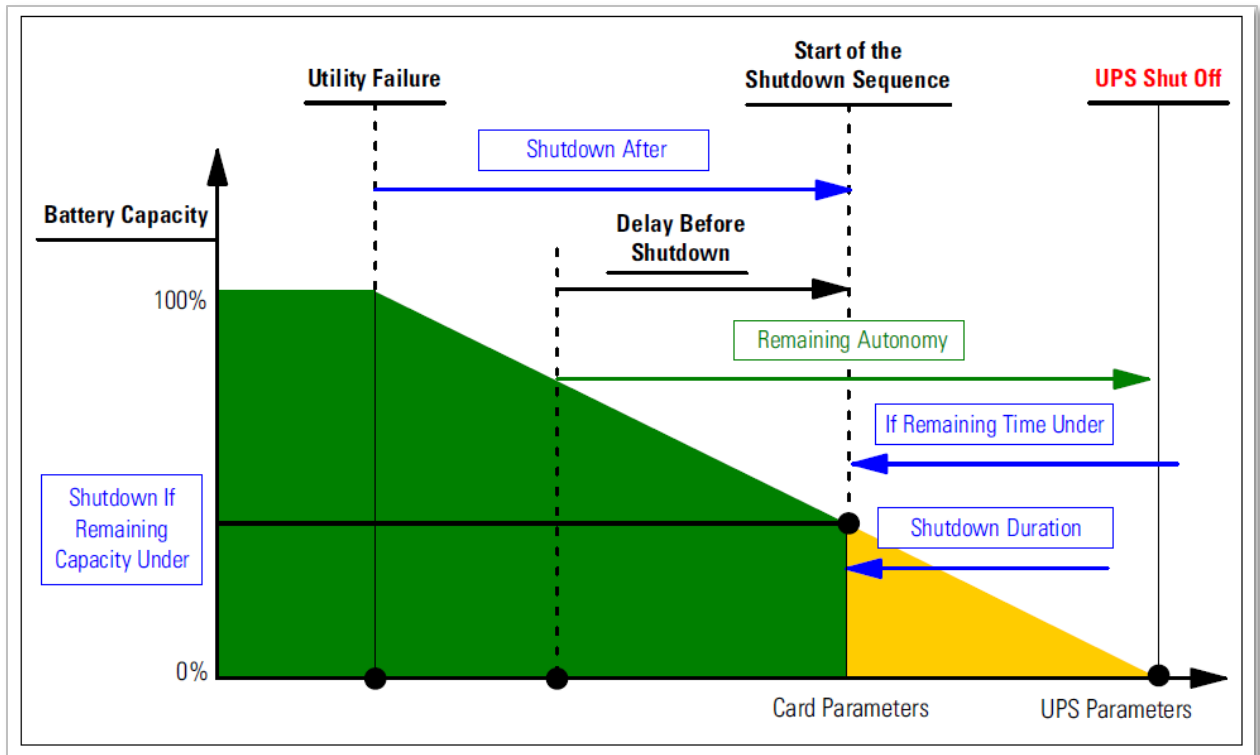


Figure 16: Shutdown sequence (from ULNM UG)



If there is a ULNM agent (Dell's node manager) installed on the server that is hosting the Hypervisor (VM Host), the shutdown is done by the ULNM agent. NOTE: The ULNM agent shutdown scenario (reference Figure 1: Dell UPS Management Software Connectivity Scenarios, "Hypervisor Agent" and "vMA Agent" columns) is not discussed in this document. Reference ULNM User's Guide for more information.


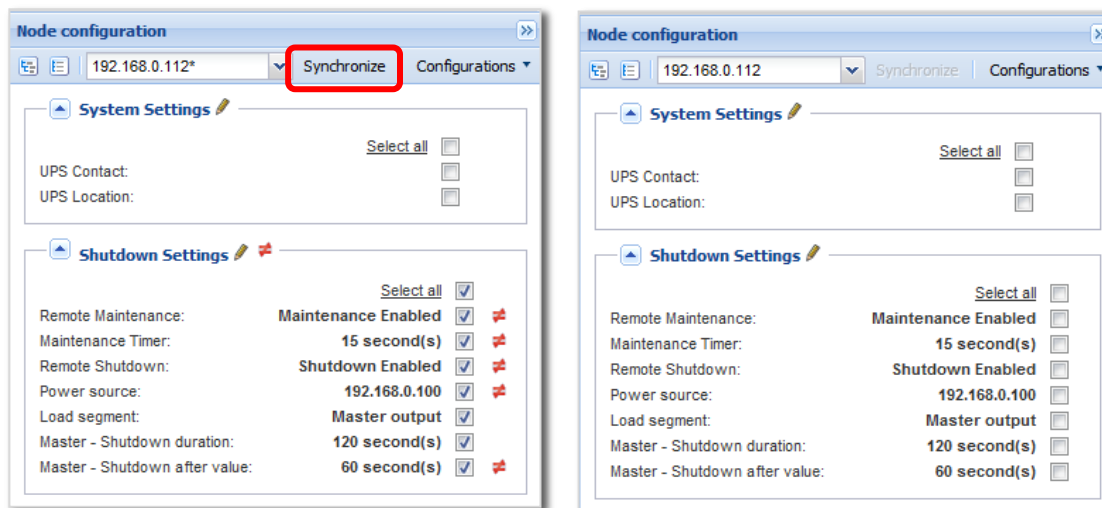
15. Click "Synchronize" to send the new settings to the hypervisor. Once synchronization is complete the red  will disappear.

Figure 17: Node Settings  Shutdown Settings  Node configuration synchronize before and after



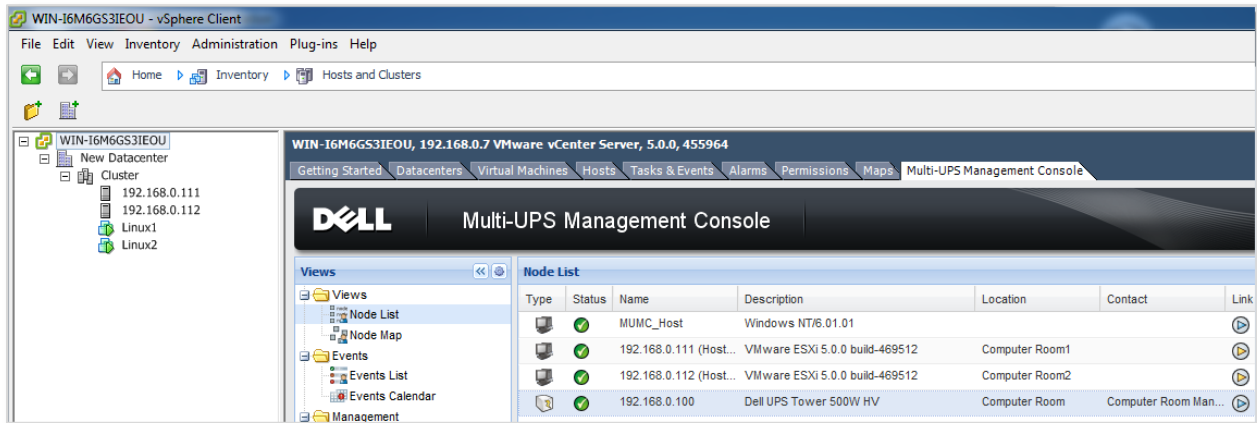
At this point, the MUMC client configuration and setup are completed!

VMware vCenter example

Here is an example of a VMware configuration. The setup includes:

- Two ESXi5 hosts running in a cluster environment
- A Linux OS running on each ESXi5 host (Linux1 and Linux2)
- Virtual machines stored in an iSCSI shared storage device (required for vMotion)

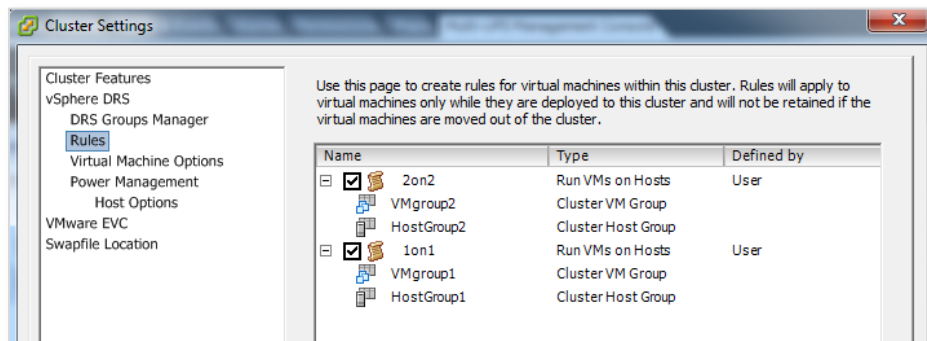
Figure 18: vCenter → MUMC client tab example



Cluster settings:

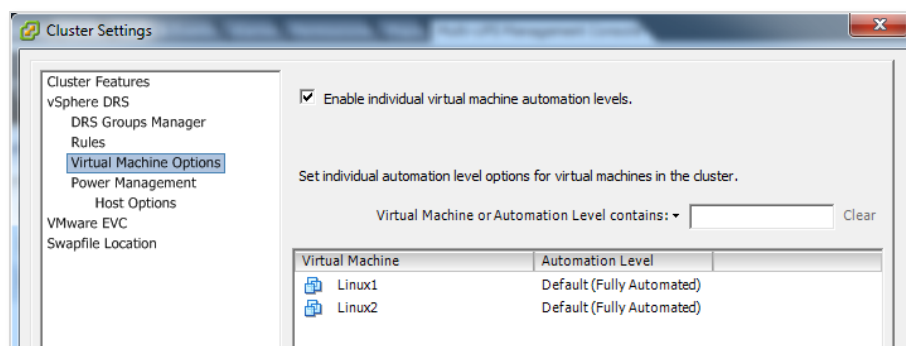
- DRS: Fully automated (to allow VMs to move under maintenance mode request)
- DRS Group Manager: Linux1 is set to prefer ESXi hostA. Linux2 to prefer hostB.
- DRS Rules: Basic rules are set up so that when exiting maintenance mode, each Linux VM will move back to its original host.

Figure 19: vCenter → Cluster Settings → Rules



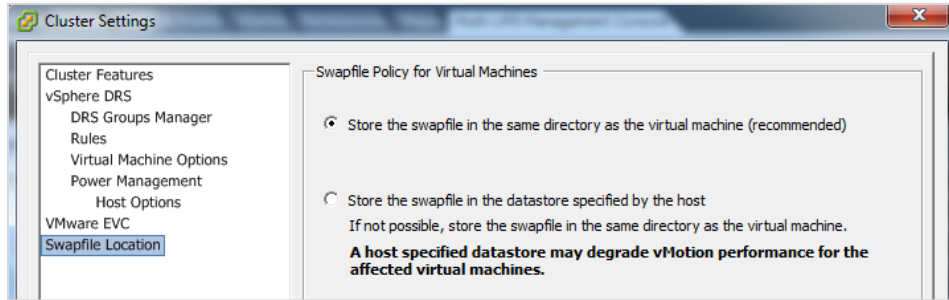
- Virtual Machine Options: Each machine is set to fully automatic.

Figure 20: vCenter → Cluster Settings → Virtual Machine Options



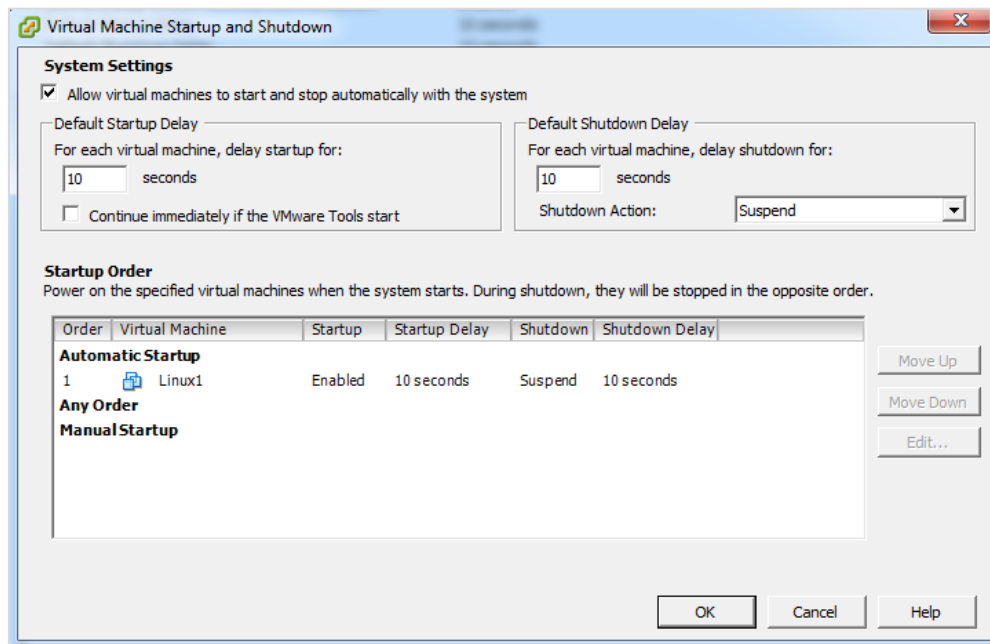
- Power Management is set to “off.”
- EVC is not used.
- Swapfile is set to the same directory as the virtual machine.

Figure 21: vCenter → Cluster Settings → Swapfile Location



VM startup/shutdown profiles: Virtual machines were set to automatically start and stop with the host so that if the power failure extends longer than battery life, the host can shut down the VMs before finally shutting itself down.

Figure 22: vCenter → VM Startup and Shutdown

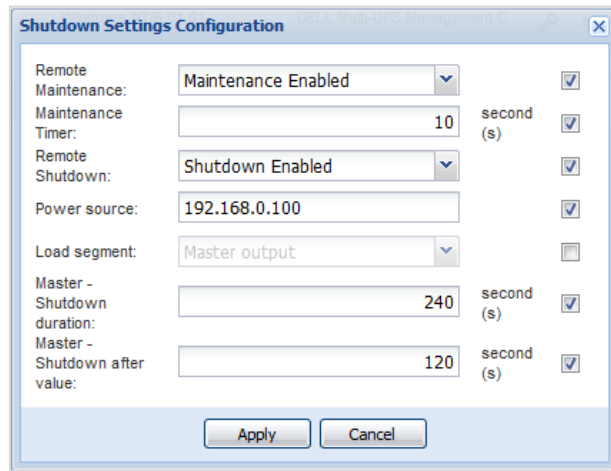


MUMC Settings for ESXi5 HostB:

- Remote Maintenance: Enabled (will provoke VM move to HostA)
- Maintenance Timer: 10 seconds
- Remote Shutdown: Enabled (we want the HostB to power off gracefully to save battery runtime for HostA)
- PowerSource: IP address of Dell UPS

- Master Shutdown Duration: Time taken for HostB to shut down after VMs are evacuated
- Master Shutdown after value: 120seconds. This is the time after Maintenance Mode has been requested that the hypervisor should begin shutdown. This value must be large enough that all VMs have moved before host shutdown begins. If VM migration has not completed before the hypervisor shutdown begins, then the vMotion will fail and the VM will remain on the original host and shut down. There will be no data loss, but there will be a loss in service (the VM will be off).

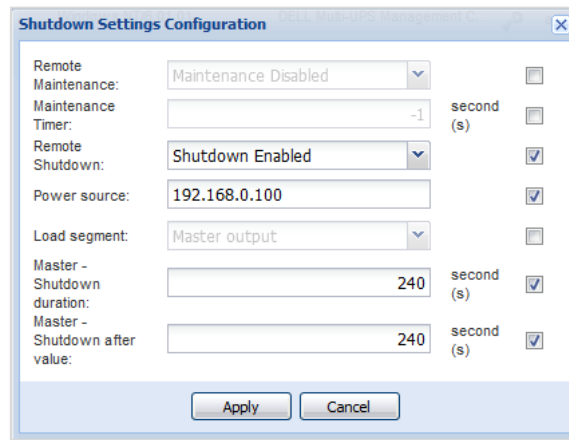
Figure 23: MUMC client → Shutdown Settings → Shutdown Enabled



MUMC Settings for ESXi5 HostA:

- Remote Maintenance: Disabled (there will be no other failover hosts available)
- Maintenance Timer: -1 (not relevant as maintenance is disabled in point1)
- Remote Shutdown: Enabled (since we want the host to shut down VMs and power itself down when UPS battery gets low)
- PowerSource: IP Address of Dell UPS
- Master Shutdown Duration: 240 seconds
- Master Shutdown After Value: 240 seconds (the time since power failed when the hypervisor should begin the shutdown process. Normally you would match this value to your UPS battery runtime, but for testing we used 240 seconds).

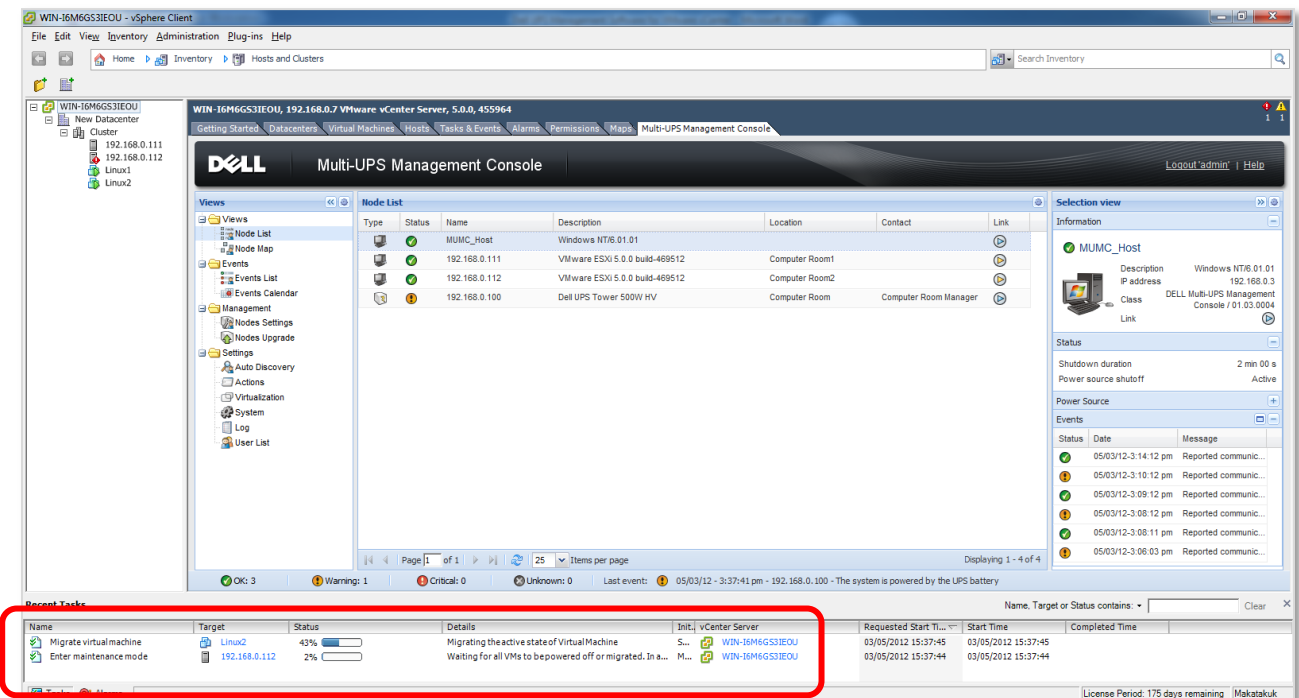
Figure 24: MUMC client → Shutdown Settings → Shutdown Value of 240 seconds



In a simulated power failure:

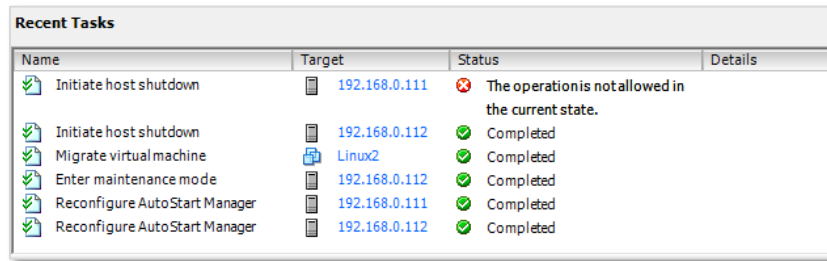
- Host B receives “Maintenance Mode” Command from MUMC and moves Linux2 to HostA.
- Host B has completed shutdown.
- Host A is running Linux1 and Linux2.
- Host A receives shutdown command from the MUMC client. Based on VM/Host/Cluster settings the host will shutdown/suspend VMs before shutting down as well.







Figure 25: vCenter → MUMC client → Shutdown/suspend VMs task



Note: Host Shutdown Failure: In previous versions of the MUMC client, there was an issue that allowed the shutdown of a host with active VMs to fail, as shown in the screenshot below.

Figure 26: vCenter Recent Tasks



| Name | Target | Status | Details |
|-------------------------------|---------------|--|---------|
| Initiate host shutdown | 192.168.0.111 |  The operation is not allowed in the current state. | |
| Initiate host shutdown | 192.168.0.112 |  Completed | |
| Migrate virtual machine | Linux2 |  Completed | |
| Enter maintenance mode | 192.168.0.112 |  Completed | |
| Reconfigure AutoStart Manager | 192.168.0.111 |  Completed | |
| Reconfigure AutoStart Manager | 192.168.0.112 |  Completed | |

An effective work-around is to set Maintenance Mode to “Enabled.” This will set the host to maintenance mode and then request shutdown and complete the process. Example screenshot of the failure is below. The problem has been resolved with Dell UPS Management Software, Release 2, 01.04.0010 (A02).

Summary

Using Dell’s console, MUMC, as an agentless plug-in with VMware vCenter provides integrated power management, visibility and control.

References

Dell Technical Information Notes:

Available at dellups.com ➔ Software & Technical Documentation ➔ Support FAQ

- Activating Redundancy and Virtualization Modules
- Implementing Shutdown on VMware vMA 5.0.0.1 and 5.0.0.2
- Common Software Installation Scenarios
- Understanding Windows ® Event Log Scripts

Dell Publications:

Available at dellups.com ➔ Software & Technical Documentation ➔ User Manuals and Publications

- Dell Multi-UPS Management Console Installation and Configuration User’s Guide
- Dell UPS Local Node Manager Installation and Configuration User’s Guide