PowerChute™ Network Shutdown in Advanced Redundant Setups

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ABSTRACT

PowerChute™ Network Shutdown works in conjunction with the APC UPS Network Management Card to protect your physical and virtual IT environment from threats to IT availability.

The ‘Advanced Redundant’ option has been designed to provide more reliable and robust configuration options when IT equipment has a variety of power supply unit configurations.

This Application Note outlines how to deploy PowerChute for Advanced UPS setups.

Applications

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

Customer Benefits

- Graceful network-based shutdown
- Advanced Redundancy Support
- Command file integration
- Sequenced server shutdown
- Intuitive PowerChute setup wizard
- Browser accessible
- Event logging
- HTTPS communications
- IPv6 support

Introduction

In a Redundant-UPS Configuration, PowerChute Network Shutdown (PowerChute) recognizes a group of UPS’s as a single UPS.

From v4.0, PowerChute also provides an ‘Advanced’ UPS configuration option which extends Redundancy options to multiple groups of UPS’s. Each UPS group can have a different number of UPS’s and be configured with different redundancy levels (N+1, N+2, N+3…)

PowerChute will recognize that there are multiple UPS groups as well as different redundancy levels and listens to all the UPS NMCs for a shutdown command.
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<td>14</td>
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</tbody>
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How to configure Advanced Redundant UPS Configurations.

When running the PowerChute Setup Wizard:
Select ‘Advanced’ option on the UPS Configuration screen.

On the UPS Details page click the “+ Add UPS(s)” button.

Choose UPS Group and enter a UPS Setup Name. It is possible to have a mix of Single UPS’s and UPS Groups in an Advanced Configuration.
Click the “+ Add IP Address” button to enter the IP addresses of the Network Management Cards for the UPS's in each setup. A minimum of 2 IP addresses are required for each Redundant UPS Group.

Add each required UPS Setup in the same way.
Proceed to register with all the Network Management Cards.

### PowerChute Setup: Network Management Card Registration

<table>
<thead>
<tr>
<th>Blade Server #1</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.216.252.79</td>
</tr>
<tr>
<td>Communications established.</td>
</tr>
<tr>
<td>10.216.252.78</td>
</tr>
<tr>
<td>Communications established.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Blade Server #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.216.252.81</td>
</tr>
<tr>
<td>Communications established.</td>
</tr>
<tr>
<td>10.216.252.82</td>
</tr>
<tr>
<td>Communications established.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage Array #1</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.216.254.55</td>
</tr>
<tr>
<td>Communications established.</td>
</tr>
<tr>
<td>10.216.254.60</td>
</tr>
<tr>
<td>Communications established.</td>
</tr>
</tbody>
</table>

In a Virtualization Environment, link Hosts to the UPS Setups.

### PowerChute Setup: Host Protection

Please associate each Host with the UPS Setup or Outlet Group that it is being powered by. To do this, select a Host from the list on the left and drag it to the relevant UPS Setup/Outlet group on the right.

- DC6
- vSphere6
  - 10.216.254.168
  - decima.scvmmgal.net
  - jupiter.scvmmgal.net

- Blade Server #1
  - 10.216.254.168
  - jupiter.scvmmgal.net

- Blade Server #2
  - decima.scvmmgal.net

- Storage Array #1
  - Storage Array #2
For each UPS in the Group, select the Outlet Group powering the PowerChute protected equipment if the UPS supports Outlet Groups.

This page is not displayed if no UPS's have Outlet Groups.

### PowerChute Setup: Select Outlet Group

Please select the UPS Outlet Group that the server is connected to.

<table>
<thead>
<tr>
<th>Blade Server #1</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.216.252.79</td>
</tr>
<tr>
<td>Outlet Group: MOG: On</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Blade Server #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.216.252.81</td>
</tr>
<tr>
<td>Outlet Group: UPS Outlets: On</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage Array #1</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.216.254.55</td>
</tr>
<tr>
<td>Outlet Group: Main Outlets: On</td>
</tr>
</tbody>
</table>

| 10.216.254.60                          |
| Outlet Group: Select one                |
The “Configure Shutdown Conditions” page in the Setup allows you to define the Redundancy level for each UPS Setup. UPS Shutdown action and Shutdown command files can also be configured on this page.

### PowerChute Setup: Configure Shutdown Conditions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of UPS’s required to power load</td>
<td>Set this value to the minimum number of UPS’s that must be available to support the equipment that is being powered by the UPS’s in the setup.</td>
</tr>
<tr>
<td></td>
<td>The value set here will be subtracted from the total number of UPS’s in the setup and used to calculate the number of additional (redundant) UPS’s.</td>
</tr>
<tr>
<td></td>
<td>In redundancy terminology, this is the N in N+X.</td>
</tr>
<tr>
<td></td>
<td>This setting is not displayed for UPS Setups with only a Single UPS.</td>
</tr>
</tbody>
</table>

Fields that are not displayed for Non-Virtual Setups:

**Number of UPS’s required to power load**

- If using a control server, this option should be disabled for all UPS Setups except the one powering the control server itself.

**Execute Virtualization Shutdown Sequence**

This option is not displayed for Non-Virtual Setups.
### Field Description

#### Number of additional (redundant) UPS’s
This will appear in a setup with more than one UPS. It represents the number of extra UPS’s in the setup. This option is associated with the number of UPS critical events required to trigger shutdown:

<table>
<thead>
<tr>
<th>Redundancy Level</th>
<th># Critical Events for a shutdown sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>N+1</td>
<td>2</td>
</tr>
<tr>
<td>N+2</td>
<td>3</td>
</tr>
<tr>
<td>N+3</td>
<td>4</td>
</tr>
</tbody>
</table>

Multiple critical events occurring on the same UPS does not impact the above table values.

In redundancy terminology, this is the x in N+X.

This setting is not displayed for UPS Setups with a Single UPS device.

#### Total number of UPS’s in Setup
This is the total of the above two rows and is calculated automatically.

#### Run Command
When a shutdown sequence is triggered you can configure PowerChute to execute a command file.

Note: If the same command file is configured for each setup and a shutdown sequence is triggered for more than one setup at the same time, the command file is only executed once.

#### Shut down PowerChute Server
This is enabled by default and is used to gracefully shut down the physical machine running PowerChute.

This option should be disabled if the PowerChute machine is not being powered by the UPS’s in a particular setup, and if it is being used to remotely shut down other servers/equipment.

This option is not available if PowerChute is installed on the vMA or deployed as a virtual appliance.

#### Execute Virtualization Shutdown Sequence
If Virtualization Support has been enabled, selecting this option will trigger the actions enabled on the Virtualization Settings page.

This option is available only in a configuration in which a UPS setup is powering something other than a virtual host (e.g. a storage array) - it is enabled by default.
### Shut down if Redundancy lost

If this option is enabled, when the number of UPS critical events is the same as the number of additional (redundant) UPS’s, a shutdown sequence will be triggered.

This option is associated with the number of UPS critical events required to trigger shutdown:

<table>
<thead>
<tr>
<th>Redundancy Level</th>
<th># Critical Events for a shutdown sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>N+1</td>
<td>1</td>
</tr>
<tr>
<td>N+2</td>
<td>2</td>
</tr>
<tr>
<td>N+3</td>
<td>3</td>
</tr>
</tbody>
</table>

Multiple critical events occurring on the same UPS does not impact the above table values.

This option is not shown if there are no additional (redundant) UPS’s. For example, this option will not appear if the number of UPS’s required to power the load is the same as the total number of UPS’s in the group.

### UPS Shutdown

Use this option to set the required UPS behaviour after connected servers/equipment have been gracefully shut down.
Once the PowerChute Setup Wizard is complete, shutdown event actions can be enabled via the Configure Events page.
Redundancy Setup: 1 + 1 Redundancy – No Control Server
PowerChute Agents installed on multiple servers in the blade chassis.

In this setup, PowerChute will trigger a graceful shutdown if critical events occur on both UPS 1 and UPS 2 or both UPS 3 and UPS 4.

As there is no control server in this setup, multiple PowerChute Agents are installed.

Configuration

1. Select ‘Advanced’ Option under ‘UPS Configuration’ and add 2 UPS Groups on the ‘UPS Details’ page.
2. Set up UPS Groups - A (UPS 1 & 2) and Group B (UPS 3 & 4) for each PowerChute Agent.
3. Each PowerChute Agent monitors UPS Groups A & B
4. Set Redundancy level to 1+1 for each UPS Group.
5. ‘Shutdown PowerChute Server’ option must be enabled for each UPS Group.
6. Storage/Network devices are shut down via Outlet Group turn off. No command file is configured for the Groups.
7. Shutdown action is enabled for the On Battery event.

Shutdown Sequence

1. Power Outage on Mains Supply 1 - UPS1 and UPS 3 on battery. No shutdown sequence is triggered.
2. Power Outage then occurs on Mains Supply 2 – all UPS’s are on battery.
3. Shutdown delay for On Battery event elapses – shutdown sequence is triggered on all blade servers.
4. UPS/Outlet group turn off command is issued once the OS shutdown sequence starts.
5. UPS waits for the greater of Low Battery Duration/Maximum Required Delay for Non-Outlet Aware UPS’s or the Outlet Group Power Off Delay.
6. UPS’s/Outlet Groups turn off after the user-configurable Shutdown delay time has elapsed or the Outlet Group turns off after the Power Off delay elapses.
Redundancy Setup: 1 + 1 Redundancy – Control Server

PowerChute Agent installed on single Physical Machine (Control Server).

In this setup, PowerChute will trigger a graceful shutdown if critical events occur on both UPS 1 and UPS 2 or both UPS 3 and UPS 4 or both UPS 5 and 6.

Configuration

1. Select ‘Advanced Redundant’ Option under ‘UPS Configuration’ and add 2 UPS Groups on the ‘UPS Details’ page.
2. Set up UPS Groups - A (UPS 1 & 2), Group B (UPS 3 & 4) and Group C (UPS 5 & 6).
3. PowerChute Agent installed on the Control Server monitors UPS Groups A, B and C.
4. Set Redundancy level to 1+1 for each UPS Group.

PowerChute is installed on a Single Control Server and is configured to trigger remote shutdown of Blade Servers via shutdown command file for each UPS Setup.

5. ‘Shutdown PowerChute Server’ option is only enabled for Group C.
6. Storage/Network devices can be shut down via command file.
7. Shutdown action is enabled for the On Battery event.

Shutdown Sequence

1. Power Outage on Mains Supply 1 – UPS1, 3 and 5 on Battery. No shutdown sequence is triggered.
2. Power Outage then occurs on Mains Supply 2 – all UPS’s are on battery.
3. Shutdown delay for On Battery event elapses – shutdown sequence is triggered.
4. Shutdown command file is executed for each UPS Setup.
5. UPS/Outlet group turn off command is issued once the command files start executing.
6. Shutdown command file delay elapses for each UPS Setup.

7. 70 seconds later OS shutdown starts on the Control Server.
8. UPS’s wait for the greater of Low Battery Duration/Maximum Required Delay for Non-Outlet Aware UPS’s or the Outlet Group Power Off Delay.
9. UPS’s/Outlet Groups turn off after the user-configurable Shutdown delay time has elapsed or the Outlet Group turns off after the Power Off delay elapses.
Redundancy Setup: 3 + 1 Redundancy – Control Server

PowerChute Agent installed on single Physical Machine (Control Server).

In this setup, PowerChute will trigger a graceful shutdown if critical events occur on any two of UPS 1, 2, 3 or 4 or both UPS 5 and 6 or both UPS 7 and 8 or both UPS 9 and 10.

Configuration

1. Select ‘Advanced Redundant’ Option under ‘UPS Configuration’ and add 4 UPS Groups on the ‘UPS Details’ page.
2. Set up UPS Setups - A (UPS 1, 2, 3 and 4), B (UPS 5 & 6), C (UPS 7 & 8) and D (UPS 9 & 10).
3. Set Redundancy level to 3+1 for UPS Setup A.
4. Set Redundancy Level to 1+1 for the other Setups

PowerChute is installed on a Single Control Server and is configured to trigger remote shutdown of Blade Servers via a shutdown command file for each UPS Setup.

1. Power Outage on Mains Supply 1 - UPS’s 1, 2, 5, 7 and 9 on Battery.
2. Shutdown delay for On Battery event elapses.
3. Shutdown command file for UPS Group A starts executing and issues remote OS shutdown command to Blade Servers.
4. No shutdown sequence is initiated for UPS Setups B, C or D.
5. UPS/Outlet group turn off command is issued to UPS 1 and 2.
6. Power Outage on Mains Supply 2 – All UPS’s on Battery.
7. Shutdown command files are executed for UPS Setups B, C and D.
8. UPS/Outlet group turn off command is issued to UPS’s in Setups B, C and D. UPS’s 3 and 4 in Setup A are not shut down. Shutdown command file is not executed a 2nd time for Setup A.
9. Shutdown command file delay elapses for Setups B, C and D.
10. 70 seconds later, OS shutdown starts on the Control Server. UPS waits for the greater of Low Battery Duration/Maximum Required Delay for Non-Outlet Aware UPS’s or the Outlet Group Power Off Delay.
11. UPS’s/Outlet Groups turn off after the user-configurable Shutdown delay time has elapsed or the Outlet Group turns off after the Power Off delay elapses.

Shutdown Sequence

- Power Outage on Mains Supply 1 - UPS’s 1, 2, 5, 7 and 9 on Battery.
- Shutdown delay for On Battery event elapses.
- Shutdown command file for UPS Group A starts executing and issues remote OS shutdown command to Blade Servers.
- No shutdown sequence is initiated for UPS Setups B, C or D.
- UPS/Outlet group turn off command is issued to UPS 1 and 2.
- Power Outage on Mains Supply 2 – All UPS’s on Battery.
- Shutdown command files are executed for UPS Setups B, C and D.
- UPS/Outlet group turn off command is issued to UPS’s in Setups B, C and D. UPS’s 3 and 4 in Setup A are not shut down. Shutdown command file is not executed a 2nd time for Setup A.
- Shutdown command file delay elapses for Setups B, C and D.
- 70 seconds later, OS shutdown starts on the Control Server. UPS waits for the greater of Low Battery Duration/Maximum Required Delay for Non-Outlet Aware UPS’s or the Outlet Group Power Off Delay.
- UPS’s/Outlet Groups turn off after the user-configurable Shutdown delay time has elapsed or the Outlet Group turns off after the Power Off delay elapses.
Redundancy Setup: 2 + 2 Redundancy – Control Server
PowerChute Agent installed on single Physical Machine (Control Server).

In this setup, PowerChute will trigger a graceful shutdown if critical events occur on any three of UPS 1, 2, 3 or 4 or both UPS 5 and 6 or both UPS 7 and 8 or both UPS 9 and 10.

**Configuration**

1. Select ‘Advanced Redundant’ Option under ‘UPS Configuration’ and add 4 UPS Groups on the ‘UPS Details’ page.
2. Set up UPS Groups - A (UPS 1,2,3 and 4), B (UPS 5 & 6) , C ( UPS 7 & 8) and D (UPS 9 & 10).
3. Set Redundancy level to 2+2 for UPS Group A.

4. Set Redundancy Level to 1+1 for the other Groups
5. ‘Shutdown PowerChute Server’ option is only enabled for Group D.
6. Storage/Network devices can be shutdown via command file.
7. Shutdown action is enabled for the On Battery event.

**Shutdown Sequence**

1. Power Outage on Mains Supply 1 – UPS’s 1,2, 5, 7 and 9 are on Battery.
2. No shut down sequence is triggered.
3. Power Outage on Mains Supply 2 – all UPS’s on battery.
4. Shutdown delay for On Battery event elapses – shutdown sequence is triggered for all UPS Setups.
5. Shutdown command file is executed for all UPS Setups. Blade Servers and Storage Arrays are remotely shut down via the command files.
6. At the same time, UPS/Outlet groups turn off command is issued.
7. Shutdown command file delay elapses.
8. 70 seconds later OS shutdown starts on the Control Server.
9. UPS waits for the greater of Low Battery Duration/Maximum Required Delay for Non-Outlet Aware UPS’s or the Outlet Group Power Off Delay.
10. UPS’s/Outlet Groups turn off after the user-configurable Shutdown delay time has elapsed or the Outlet Group turns off after the Power Off delay elapses.