

Using PowerChute™ Network Shutdown in Parallel Redundant or Parallel Capacity UPS Configurations

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Abstract

PowerChute™ Network Shutdown software works in conjunction with the UPS Network Management Card to provide graceful, unattended shutdown of multiple computer systems over a network. UPS's can support the load in several different physical configurations. If you wish to configure your UPS in a Parallel-UPS configuration, some consideration must be given to the system set-up. This Application Note explains how PowerChute Network Shutdown works under various scenarios in a Parallel-UPS configuration.

Introduction

During an extended power outage, if the computer system is equipped with PowerChute Network Shutdown software, it can communicate with the UPS and perform a graceful, unattended system shutdown before the UPS battery is exhausted.

Each UPS in a parallel configuration has a UPS Network Management Card (NMC); either an AP9630(CH), AP9631(CH) or AP9635(CH) inserted. Each server protected by a Parallel-UPS system needs PowerChute Network Shutdown installed and registered to the NMCs. Communication between the UPS system and server is done over the network by the NMCs. PowerChute Network Shutdown recognizes the entire configuration as a single UPS system in the case of actionable events.

PowerChute Network Shutdown receives 'PCNS packets' of data (every 25 seconds) from the UPS NMC describing the state of the UPS. PowerChute Network Shutdown then parses the 'PCNS data packet' for various events which it may respond to; by notifying administrators or users, or safely shutting down the system¹. The user configures which events require action, depending on their requirements via the PowerChute Network Shutdown "Configure Events" screen.

Definitions

Please Note: All examples (diagrammatic or otherwise) in this Application Note are for illustration purposes only as they are simplified to demonstrate PowerChute Network Shutdown behavior in various Parallel-UPS configurations and scenarios.

In a **Parallel-UPS Configuration**, two or more UPS's (up to nine depending on the model) support the load. Each UPS does not need to be capable of supporting the load on its own as the combined output of all UPS's in the configuration share the

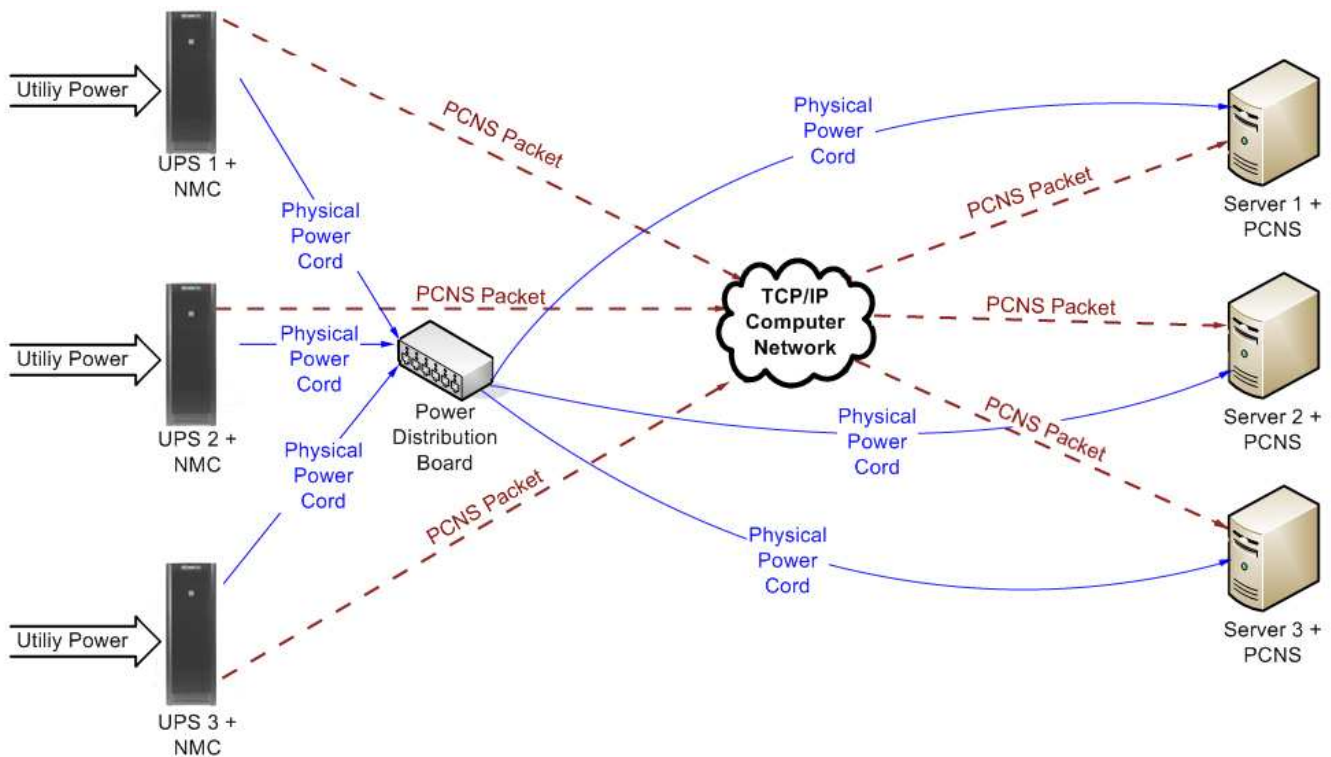
¹ Refer to Application Note #20 (AN-20) 'The Communications Process of PowerChute Network Shutdown' for a more detailed explanation of how PowerChute Network Shutdown and the UPS Network Management Card communicate.

load. However, depending on the size of the load there may be reserve UPS(s) available. Redundancy is provided if there is at least one more UPS than is required to support the load.

- An example of a **Parallel Redundant Configuration** is if three 5kVA UPS's are supporting an 8kVA server load; one of the three UPS's can fail and the load can still be supported by the remaining two UPS's.
- A **Parallel Capacity Configuration** exists if three 5kVA UPS's are supporting a 13kVA server load. All three UPS's are required to continue supporting this load.

PowerChute Network Shutdown recognizes that the UPS's are set-up in a Parallel configuration and will monitor the changing load on the UPS'; responding depending on whether the system is Parallel Redundant or Parallel Capacity.

Parallel-UPS Configuration Set-Up



Note – The above illustration shows the set-up of a Parallel-UPS System. It can be either Parallel Redundant or Parallel Capacity depending on whether or not all UPS's are required to support the load.

Table 1 – Supported UPS's in a Parallel-UPS Configuration

UPS Families	Parallel Minimum	Parallel Maximum
Smart-UPS VT (SUMX)*	2 Minimum	4 Maximum
Galaxy 3500 (3:1 & 3:3) (SUMX)*	2 Minimum	4 Maximum
Galaxy 300 (3:1 & 3:3)	2 Minimum	2 Maximum
Galaxy 5000	2 Minimum	6 Maximum
Galaxy 7000	2 Minimum	8 Maximum
Symmetra PX 250	2 Minimum	4 Maximum
Symmetra PX 500	2 Minimum	4 Maximum

* UPS Firmware Family

Note: Smart-UPS VT units that are Parallel-Capable begin with the Part # "SUVTP...."

All UPS's must be of the same UPS family (model and firmware version).

Event Handling

PowerChute Network Shutdown always considers the following conditions as critical events:

- Low Battery
- UPS Off
- UPS Turn Off Initiated

It is possible to configure other events to be considered critical by enabling the **Shut Down System** action on the **Configure Events** screen. **[Please Note:** All references in this App Note to 'Critical Events' refer to the 3 listed Events above which PowerChute Network Shutdown initiate a safe system shutdown on. It also includes any other Event that the user configures PowerChute Network Shutdown to initiate a shutdown on].

In any Parallel-UPS configuration, PowerChute Network Shutdown always recognizes and reports the following events even if they only occur on a single UPS:

- Runtime: Exceeded and Runtime: Normal Again

- Communication lost or established between the Management Card² and the UPS
- Communication lost or established between PCNS and any of the Management Cards
- Any event generated by an Environmental Monitoring Card³

The following events are aggregated; therefore if one event occurs on a single UPS but the remaining UPS's can support the server load, PowerChute Network Shutdown does not recognize or report the event. If however, one of the following events occurs on one or more UPS's and the load is at risk, PowerChute Network Shutdown will recognize and report the event. It will also initiate any other actions configured for that particular event.

These events consist of:

- 'UPS: Overload' and 'UPS Overload: Corrected'
- 'UPS: On Battery' and 'Input Power: Restored'
- 'Battery: Discharged' and 'Battery: Recharged'
- 'Bypass: Manual Bypass' and 'Bypass Ended'
- 'Bypass: For Maintenance' and 'Bypass Ended'
- 'Bypass: Due to a Fault' and 'Bypass Ended'

Please Note: PowerChute Network Shutdown will not trigger a shutdown on the above events unless configured to do so via the Configure Events screen.

Parallel Shutdown Scenarios

In Parallel-UPS configurations – the combined output of several UPS's support the load:

PowerChute Network Shutdown automatically monitors the load as it increases and decreases to determine whether the mode of operation is 'Parallel Capacity' or 'Parallel Redundant'. For example, if you are operating in a Parallel Redundant mode (i.e. there are more UPS's available in the configuration than required to power the load) and then the load increases, PowerChute Network Shutdown will detect if the mode of operation changes to Parallel Capacity (i.e. all UPS's in the configuration are required to power the load). PowerChute Network Shutdown will respond to any event that occurs on a single UPS in this parallel system.

² The term Management Card referenced in PowerChute Network Shutdown Events refers to the UPS NMC.

³ PowerChute Network Shutdown does not support environmental events for all UPS models (e.g. Symmetra PX250/PX500).

Scenario 1: Three 5kVA UPS's supporting an 8kVA Server Load (Parallel Redundant)

In this Parallel Redundant configuration, one critical event will not trigger a graceful server shutdown. **See Figure 1.**



Figure 1 – One critical event will not trigger a graceful shutdown of the server(s) on which PowerChute Network Shutdown is running.

If two or more critical events occur, PowerChute Network Shutdown will trigger a graceful server shutdown. **See Figure 2.**

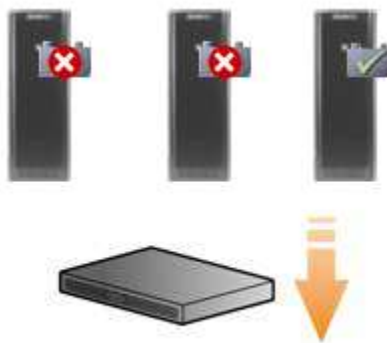


Figure 2 – In this same parallel redundant configuration scenario, if two or more critical events occur, PowerChute Network Shutdown will trigger a graceful shutdown of the server.

The critical event type and combination will impact the shutdown delays (if any) that are counted.

- 2 identical critical events such as **Low Battery** occurring on 2 UPS devices will cause a shutdown; the shutdown will be immediate and no configured delay is counted down.

- 2 identical *configured* critical events such as **UPS: On Battery** occurring on 2 UPS devices will cause a shutdown; any configured delay time will be counted down first.
- 2 different critical events (may or may not have been configured by the user) such as **Low Battery** and **PowerChute cannot communicate with the Management Card** occurring on 2 UPS devices will cause the event called **Multiple Critical Events occurred** which always leads to a shutdown. A 10 second delay prior to the PCNS shutdown process starting will be counted. No additional configured delay time for the events themselves is counted down.

Scenario 2: Three 5kVA UPS's supporting a 13kVA Server Load (Parallel Capacity)

In this Parallel Capacity configuration one critical event will trigger a graceful shutdown of the server(s).

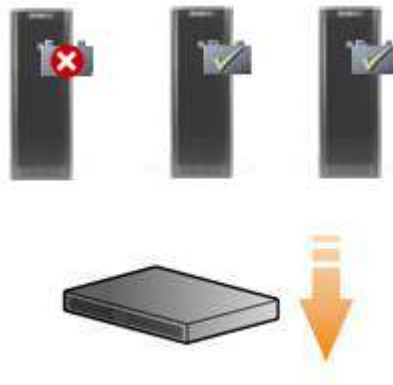


Figure 3 –In this Parallel Capacity configuration one critical event will trigger a graceful shutdown of the server(s).

If two identical critical events occur in a Parallel Capacity configuration, then the event is only reported once and any configured delay is counted down. If different critical events occur, then both events are reported separately and the shortest shutdown delay will be counted down.

Conclusion

In Parallel-UPS configurations, where the combined output of several UPS's support the load, the behavior of PowerChute Network Shutdown depends on whether the configuration is Parallel Redundant or Parallel Capacity (whether or not more UPS's are available than are required to support the load).

In a Parallel Redundant configuration there is sufficient capacity to support the load even if one UPS becomes unavailable.

In a Parallel Capacity configuration, the load is shared between all UPS's in the configuration. As all UPS's are required, if the load is at risk due to some critical event, then PowerChute Network Shutdown can initiate a safe system shutdown.

Events such as Lost Communications and Runtime Exceeded are always reported in any Parallel-UPS configuration. However, when PowerChute Network Shutdown combines critical events from the UPS's, it only reports an event if the systems' ability to support the load is at risk. This means that in a Parallel-UPS configuration, PowerChute Network Shutdown will monitor the load on the system to determine the level of redundancy provided; only reporting the event when the load is at risk.

About the Author:

Sarah Jane Hannon is Product Line Manager for the PowerChute UPS Management software range. Prior to joining APC in November 2007, she worked for over five years in Product Management and Strategic Planning in the Telecommunications industry. Sarah Jane holds a Bachelor's degree in Business and French from the University of Limerick and a Masters in Marketing Management from University College Dublin.