

PowerChute™ Network Shutdown in Redundant 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.

This Application Note explains the differences between Single and Redundant configurations and how PowerChute Network Shutdown works under various shutdown scenarios in a Redundant-UPS configuration.

Applications

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

Customer Benefits

- Graceful network-based shutdown
- Sequenced server shutdown
- Integration with VMware & Hyper-V
- Intuitive PowerChute setup wizard
- Browser accessible
- Command file integration
- Event logging
- HTTPS communications
- IPv6 support



Introduction

Each APC UPS in a single or redundant configuration has a UPS Network Management Card (NMC); an AP9630, AP9631 or AP9635 inserted. Each server protected by a UPS needs to have PowerChute Network Shutdown installed and registered to the NMC(s). Communication between the UPS and the server is handled over the network using the UPS NMC(s).

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 to which it may respond, by notifying administrators or users, or by gracefully shutting down the system¹. The user configures which events require action, depending on their requirements, using the PowerChute Network Shutdown "Configure Events" screen.

¹See Application Note #20 (AN-20) 'The Communications Process of PowerChute Network Shutdown'

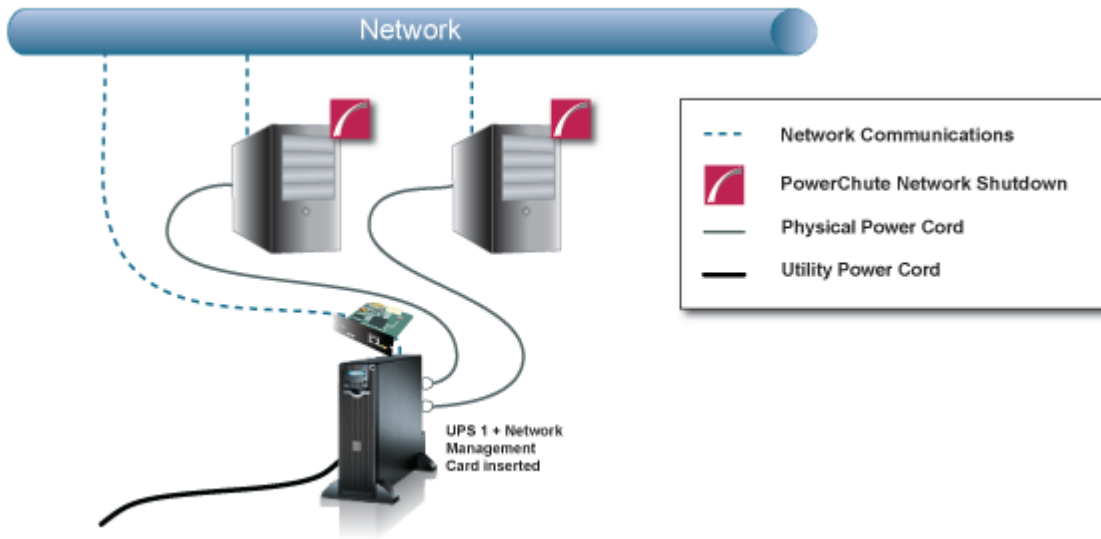
Definitions

Single UPS Configuration

Each server or group of servers is protected by a single UPS. Each server has one PowerChute Network Shutdown Agent communicating with a single NMC inserted in the UPS. This single UPS provides the full power capacity of the load for all connected servers. When an event that requires shutdown occurs, PowerChute Network Shutdown receives the notification and triggers a graceful shutdown command for all connected servers.

This application of PowerChute Network Shutdown includes all servers receiving power through the same UPS. PowerChute Network Shutdown responds to all the UPS events.

Single UPS Configuration: All servers are protected by a single UPS. The UPS Network Management Card (NMC) communicates with each server that has PowerChute installed.



Redundant UPS Configuration

PowerChute Network Shutdown recognizes a group of up to four UPS's as a single UPS. In this configuration, one PowerChute Network Shutdown Agent on a server communicates with up to four NMCs (depending on the number of UPS's in the configuration). Typically, the servers have multiple power cords. Each UPS has its own NMC, which has a unique IP address. In addition, all the NMCs use the same HTTP port and the same administrator user name and authentication phrase.

Each UPS has the capacity to supply power to the load on its own. The first UPS provides all the power for the load, the additional UPS(s) act as reserve. When the first UPS is unable to supply power, the server switches over to take power from the next UPS. As a result, if one of the UPS's goes down, for whatever reason, the other UPS(s) can continue to supply power to the load and therefore provide redundancy between UPS's. PowerChute Network Shutdown recognizes that the UPS's are set-up in a Redundant-UPS configuration and listens to all the UPS NMCs for a shutdown command.

Redundant UPS Configuration: Two or more UPS's protect each server. Each UPS can support the server load on its own. All NMC's communicate with each server that has PowerChute installed.

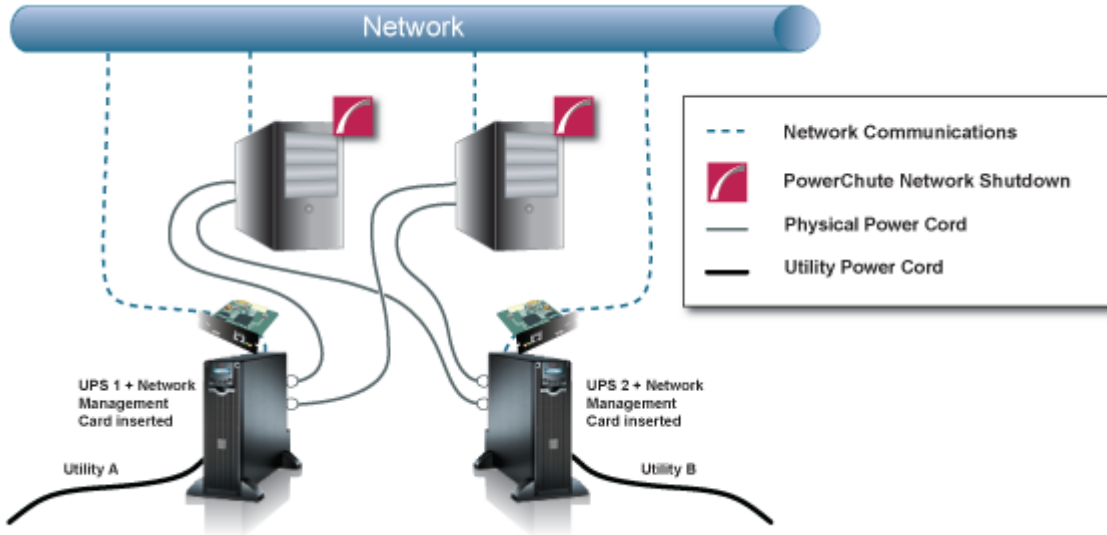


Table 1 – Supported UPS's in a Redundant-UPS Configuration

	Redundant (Minimum)	Redundant (Maximum)
Smart-UPS	2 Minimum	4 Maximum
Smart-UPS VT	2 Minimum	4 Maximum
Galaxy 3500 (3:1 & 3:3)	2 Minimum	4 Maximum
Symmetra 1-Phase	2 Minimum	4 Maximum
Symmetra 3-Phase	2 Minimum	4 Maximum

All UPS's in a Redundant-UPS configuration must be from the same UPS Family as opposed to the same UPS model. For example; SMX, SMT or SUA Smart-UPS can be mixed together but an SMX Smart-UPS cannot be mixed with an SURT or SRT model which belongs to the Smart-UPS On-Line Family.

Each UPS must have enough battery power to support the entire load in the event of a power outage.

While up to four UPSs can be supported, the Redundancy level is set so that if two UPS's in the configuration have a critical UPS event, then a graceful shutdown will be triggered.

Event Handling

PowerChute Network Shutdown aggregates the events from all the UPS's in the Redundant configuration to form one 'virtual' UPS System.

These events are always considered critical:

- Low Battery
- UPS Off
- UPS Turn off Initiated

It is possible to configure other events to be considered critical by enabling the Shutdown action on the Configure Events screen. The critical event type and combination will impact the shutdown delays (if any) that are counted.

- 2 identical critical events such as Low Battery OR UPS Turn Off Initiated occurring in succession 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 in succession on 2 UPS devices will cause a shutdown; any configured delay time will be counted down first.
- 2 different critical events such as Low Battery and PowerChute cannot communicate with the Management Card occurring in succession 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 PowerChute shutdown process starting will be counted. No additional configured delay time for the events themselves is counted down.

Additionally, in a Redundant-UPS configuration, PowerChute Network Shutdown will always recognize and report the following events even if they occur on only one UPS:

- Runtime exceeded.
- Any event generated by an Environmental Monitoring Card.

As the above events are not aggregated, if for example an environment threshold exceeded event is configured for shutdown, it will initiate a shutdown even if only 1 UPS has that threshold exceeded.

All other events are aggregated (read in combination from all the UPS's) and need to occur on at least two UPS's before they are recognized and reported.

Shutdown Scenarios

(Note: Same rules apply if there are 2, 3 or 4 UPS's in a Redundant UPS Configuration)

Scenario 1: Two UPS's supporting a load – the same critical events occur on each UPS:

UPS 1 reaches a critical event such as Low Battery; the UPS Network Management Card in that UPS will log the shutdown notification - no event is logged, no shutdown occurs. The same critical event occurs on UPS 2 and its UPS Network Management Card sends the shutdown notification – the event is logged and an immediate shutdown occurs. No shutdown delay is counted.



Figure 1 – Two identical critical events, one in each UPS will trigger a graceful shutdown of the server with no shutdown delay counted.

Shutdown Scenarios

Scenario 2: Two UPS's supporting a load – the same configured critical events occur on each UPS:

UPS 1 reaches a configured critical event such as UPS: On Battery; the UPS Network Management Card in that UPS will log the shutdown notification. However, no event is logged and no shutdown occurs.

The same configured critical event occurs on UPS 2 and its UPS Network Management Card sends the shutdown notification – the event is logged and shutdown occurs. Any configured delay time will be counted down first.



Figure 2 – Two identical configured critical events, one in each UPS will trigger a graceful shutdown of the server with any configured delay time counted down first.

Scenario 3: Two UPS's supporting a load – Different critical events occur on each UPS:

UPS 1 reaches an event such as UPS: On Battery or Low Battery (may or may not be a configured critical event). The UPS Network Management Card in that UPS will log the shutdown notification - no event is logged, no shutdown occurs.

A different critical event (such as UPS Turn Off Initiated) occurs on UPS 2, its UPS Network Management Card sends the shutdown notification – the event is logged and shutdown occurs. As the critical events are different for both UPS's, a 10 second shutdown delay is counted. No other shutdown delays are counted down.



Figure 3 – Two different critical events (whether configured or not), one in each UPS will trigger a graceful shutdown of the server. A 10 second shutdown delay is counted down first.

Scenario 4: Two UPS's supporting a load – A critical event only occurs on one of the UPS's:

If UPS 1 reaches Low Battery and eventually turns off but no events occur on UPS 2 and the UPS stays online, PowerChute Network Shutdown will not begin a shutdown as the second UPS is capable of supporting the entire load itself.



Figure 4 – Critical events in one UPS will not trigger a graceful shutdown of the server if no critical events occur on the second UPS.

Conclusion

In a Redundant-UPS configuration, each UPS must be able to support the entire load itself. A critical event must occur on two of the UPS's to trigger PowerChute Network Shutdown to initiate a graceful server shutdown.

When PowerChute Network Shutdown combines or aggregates critical events from the UPS's, it only reports an event if the systems' ability to support the load is at risk.

In a Redundant-UPS system, this means that two UPS's must report the issue before PowerChute Network Shutdown will report the event and initiate the required safe server shutdown actions.

While PowerChute Network Shutdown supports up to four UPS's of the same UPS Family in a Redundant-UPS configuration, PowerChute will trigger a graceful shutdown if a critical event occurs on two or more UPS's.