AUTOMATIC RESTART OF HYPER-CONVERGED INFRASTRUCTURES
WHITEPAPER

Executive summary

This whitepaper discusses the innovative solution for the automatic restart of hyper-converged infrastructures (HCI), focusing on leading solutions, challenges, and how these innovations help protect and increase uptime while reducing downtime costs.
Hyper-converged infrastructure is a software-defined IT framework that combines compute, storage, and networking into a single system managed through a hypervisor. This integration simplifies management and operations, offering a streamlined, cost-effective alternative to traditional IT infrastructures.
The automatic restart feature is a transformative addition to HCI protection strategies. It ensures continuous power supply, data integrity, and a dynamic approach to managing power consumption. This innovation reduces downtime costs and enhances business uptime, providing a competitive edge in today's IT landscape.
To address these challenges, organizations should invest in reliable UPS systems ensuring continuous power supply, automated shutdown and restart processes, and robust remote management tools to protect the equipment and maintain data integrity during power outages.

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Powering Business Worldwide

Introduction

Hyper-converged infrastructure is a software-defined IT framework that combines compute, storage, and networking into a single system. This integration is managed through a hypervisor, which virtualizes all elements of conventional hardware-defined systems.

HCI simplifies data center management and operations, offering a streamlined, cost-effective alternative to traditional data centers.

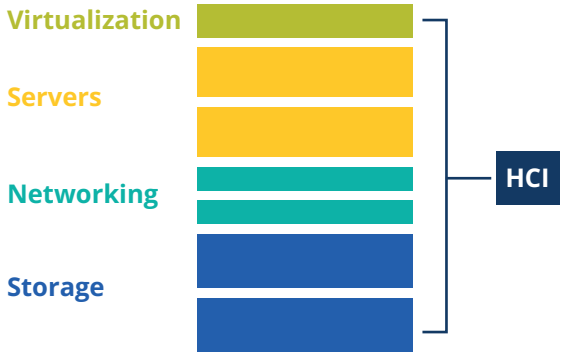
How hyper-converged infrastructure works

HCI leverages virtualization to create abstract versions of compute, storage, and networking components within industry-standard servers.

The key components of HCI include:

1. Compute: Virtual machines (VMs) run on hypervisors, providing the necessary processing power.
2. Storage: Software-defined storage pools resources from direct-attached storage devices across the HCI cluster.
3. Networking: Virtualized networking ensures seamless communication between VMs and storage resources.

The hypervisor plays a crucial role in managing these virtualized components, enabling efficient resource allocation and automation.



Advantages of hyper-converged infrastructure

HCI offers several benefits over traditional and converged infrastructures:

1. Simplified management: HCI consolidates management tasks into a single interface, reducing complexity and administrative overhead.
2. Scalability: HCI systems can easily scale out by adding more nodes to the cluster, allowing organizations to grow their infrastructure as needed.
3. Cost efficiency: By using commodity hardware and eliminating the need for specialized components, HCI reduces capital and operational expenses.
4. Improved performance: HCI optimizes resource utilization, leading to better performance and faster application deployment.
5. Enhanced data protection: Built-in data protection features, such as replication and backup, ensure high availability and disaster recovery.

VMware VSAN

VMware vSAN is a prominent HCI solution that integrates seamlessly with VMware vSphere environments. It provides a software-defined storage solution that pools resources from local storage devices across a vSAN cluster.

Key features of VMware vSAN include:

1. Storage virtualization: vSAN abstracts storage resources, creating a unified storage pool accessible by all VMs in the cluster.
2. Policy-based management: Administrators can define storage policies to automate resource allocation and ensure compliance with performance and availability requirements.
3. High availability: vSAN offers built-in redundancy and fault tolerance, ensuring data protection and minimizing downtime.
4. Scalability: vSAN clusters can scale out by adding more hosts, allowing organizations to expand their storage capacity as needed.

NUTANIX

Nutanix is another leading HCI provider, offering a comprehensive enterprise IT platform that supports various applications and workloads.

Nutanix's HCI solution includes:

1. Unified platform: Nutanix integrates compute, storage, and networking into a single platform, simplifying management and operations.
2. Flexibility: Nutanix supports multiple hypervisors, including VMware vSphere, Microsoft Hyper-V, and its own AHV, providing flexibility in deployment.
3. Performance optimization: Nutanix's software-defined storage ensures efficient resource utilization and high performance for applications.
4. Data protection: Nutanix offers robust data protection features, including backup, replication, and disaster recovery.
5. Scalability: Nutanix clusters can scale out by adding nodes, allowing organizations to grow their infrastructure seamlessly.

Hyper-converged infrastructure is becoming increasingly popular due to their significant advancement in data center technology, offering simplified management, scalability, cost efficiency, improved performance, and enhanced data protection. Solutions like VMware vSAN and Nutanix provide robust HCI platforms that cater to various organizational needs, enabling efficient and flexible IT operations. However, **power outages pose significant challenges** for hyper-converged infrastructure (HCI). Here are some key issues:

1. Data corruption and loss: HCI systems integrate computing, storage, and networking into a single system. During a power outage, improper shutdowns can lead to data corruption or loss if the system isn't shut down gracefully.
2. Hardware damage: Sudden power loss can damage hardware components, especially in environments with frequent outages. This can lead to costly repairs and replacements.
3. Downtime and recovery: Power outages result in downtime, which can be particularly problematic for businesses relying on continuous operations. Recovery can be time-consuming, especially if the system needs manual intervention to restart.
4. Unattended sites: Many HCI deployments are at edge computing sites with minimal or no staff. Managing power outages remotely can be challenging, requiring robust remote management and automated recovery solutions.

To address these challenges, organizations should invest in reliable UPS systems, automated shutdown and restart processes, and robust remote management tools. This ensures that HCI systems can handle power disruptions with minimal impact on operations.

Protecting HCI with automatic graceful shutdown

The role of uninterruptible power supply (ups) in protecting HCI

UPSs provide a reliable power source that can keep critical systems running during power outages. They offer several key benefits for HCI environments:

1. Power continuity: UPSs ensure continuous power supply during outages, protecting critical equipment from sudden shutdowns.
2. Equipment protection: They safeguard against power surges and fluctuations, extending the lifespan of hardware.
3. Data integrity: By providing a stable power source, UPSs prevent data corruption and loss during unexpected power interruptions.

Software solutions for enhanced protection

In addition to UPSs, software solutions such as Eaton's Intelligent Power Manager 2 (IPM) and Brightlayer software enhance the protection of HCI systems by providing advanced monitoring, management, and automation capabilities without needing additional servers as they run withing the same HCI cluster.

Eaton's IPM2 and Brightlayer software integrates seamlessly with HCI platforms like VMware and Nutanix, offering features such as:

1. Automated shutdown: enable automated and graceful shutdown of HCI clusters experiencing unplanned power events, safeguarding data integrity.
2. Environmental monitoring: monitor environmental conditions such as temperature and humidity, triggering alerts and actions to prevent damage to equipment.
3. Remote management: allow remote monitoring and management of UPSs and other power devices, ensuring quick response to power-related issues.
4. Orchestration: improve the management of highly distributed infrastructures, enabling seamless shutdown and restart of HCI systems.
5. Automation: enhance user experience and security by providing out-of-the-box monitoring and management of Eaton UPSs and Rack PDUs
6. Edge computing: support automation at the edge, ensuring that remote and distributed environments are protected and managed effectively.

Examples of protection in VMware and Nutanix environments

VMware with IPM2

In a VMware environment, IPM2 can be configured to provide automated responses to power events. For instance, if a power outage occurs, IPM2 can initiate a graceful shutdown of virtual machines (VMs) and migrate critical workloads to a backup site. This ensures that data is preserved, and operations can continue with minimal disruption.

Nutanix with Brightlayer Software

In a Nutanix environment, Brightlayer software can be used to monitor and manage power conditions across multiple sites. For example, if environmental sensors detect high temperatures in a data center, Brightlayer software can trigger actions such as shutting down non-essential equipment to prevent overheating. This proactive approach helps maintain the stability and performance of the HCI system.

In a nutshell

UPS and related software solutions are essential components in protecting hyper-converged infrastructures from power outages and environmental conditions. By integrating UPS with advanced

software like IPM2 and Brightlayer software, organizations can ensure continuous power supply, safeguard data integrity, and maintain the reliability of their HCI systems. These solutions run inside the HCI clusters and provide the necessary tools to monitor, manage, and automate responses to power-related issues, ensuring that critical IT operations remain uninterrupted.

Increasing business uptime with automatic restart of HCI

Reducing costs associated with restart

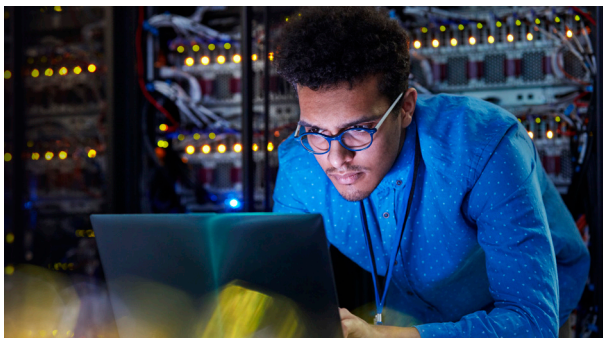
The traditional process of restarting hyper-converged infrastructures often requires manual intervention by skilled technicians, which can be time-consuming and costly. Travel costs and delays further add to the expenses. Manual intervention involves not only the direct costs of labor but also the indirect costs associated with delays and potential human errors. Technicians might need to be on-site to perform the restart, which can lead to significant travel expenses, especially for remote locations. Additionally, the time taken to diagnose and resolve issues can vary, leading to unpredictable downtime and costs.

Automation benefits

Solutions like Eaton's leverages existing datacenter hardware like UPS to automate the restart process based on external triggers such as power restoration. This automation significantly reduces the need for manual intervention, thereby cutting down on associated costs. The automation system can quickly identify and respond to external triggers, ensuring that the infrastructure is restarted efficiently and effectively. This not only reduces costs but also improves the reliability and predictability of the restart process.

Increasing customer business uptime

One of the primary goals of Eaton's solution is to increase customer business uptime without relying on additional external relays. By automating the restart process, Eaton simplifies the procedure and ensures that the infrastructure is back online as quickly as possible. The automated restart process is designed to be straightforward and easy to implement from the software user interface. It involves configuring the existing datacenter hardware to respond to specific external triggers, such as power restoration. Once configured, the system can operate independently, ensuring that the infrastructure is restarted without any manual intervention.



Enhanced efficiency

Automating the restart process not only reduces downtime but also improves the overall efficiency of the business operations. By ensuring that the infrastructure is back online quickly, businesses can avoid disruptions and maintain continuous operations. This is particularly important for industries that rely on real-time data and continuous processing, such as finance, healthcare, and manufacturing.
Eaton's solution approach not only minimizes downtime but also enhances the overall efficiency of the business operations.

Energy savings and sustainability: far beyond power outages

Solutions like Eaton's also focuses on energy savings by scheduling restarts during optimal times. This ensures that the infrastructure is not only restarted efficiently but also in a manner that maximizes business-critical operations.

What is next?

In the future, scheduling shutdowns and restarts during optimal times can significantly reduce energy consumption. By aligning those processes with periods of high or low energy demand, companies can minimize the impact on the overall energy usage of their datacenter or IT rooms. This not only reduces costs but also contributes to sustainability efforts by lowering the carbon footprint and complying with regulatory requirements.

Supporting critical operations
Automating the restart process ensures that the infrastructure is always ready to support critical business functions. By minimizing downtime and ensuring that the infrastructure is back online quickly, businesses can maintain continuous operations and avoid disruptions. This is particularly important for industries that rely on real-time data and continuous processing.

Market differentiator
The automatic restart of HCI by Eaton is already available on the market and this unique feature sets Eaton apart from competitors (patent pending) and positions Eaton's solution as a game changer in the market. This also provides assurance to customers that they are investing in a cutting-edge solution that is backed by rigorous research and development.

REFERENCE DESIGN

The reference design outlined in this whitepaper provides a comprehensive overview of three distinct infrastructure setups tailored for small and medium businesses: a 2-Node DataCore Installation, a 4-Node vSAN Installation, and an 8-Node Nutanix Installation. Each design emphasizes the integration of UPS power solutions and disaster avoidance software to ensure effective disaster recovery capabilities.

2-Node datacore installation

Server configuration:
- Model: Dell PowerEdge R740xd
- Processor: Dual Intel Xeon Scalable processors
- Memory: 128 GB DDR4 ECC
- Storage: NVMe SSDs for cache, SATA SSDs for OS, and SAS HDDs for bulk storage
- Network: Dual 10GbE NICs
- Power Consumption: Approximately 750W per server under typical load

Rack, UPS configuration, management and protection:
- Rack:
  - 25U SmartRack Standard-Depth Half-Height Server Rack Enclosure (Ref: SR25UB)
- UPS:
  - Model: Eaton 5PX 3000
  - Ref: 5PX3000IRTNG2
  - Capacity: 3000 VA
  - Backup time: Approximately 10-15 minutes at full load
  - Energy efficient: Up to 99% efficiency in energy-saving mode
  - Network card M3 is included into the UPS SKU 5PX3000IRTNG2 allowing monitoring, management and graceful shutdown and restart of DataCore cluster
- Monitoring and protection:
  - 3x Environmental monitoring probe for temperature / humidity and dry contacts monitoring in the front and back of the rack (Ref: EMPDT1H1C2)
  - Door contact sensor to monitor rack access at any time (Ref: DCS001)
  - Brightlayer software 8.0 or above or IPM2.8.3 or above for disaster avoidance protection.

4-Node VMware vSAN installation

Server configuration:
- Model: HPE ProLiant DL380 Gen10
- Processor: Dual Intel Xeon scalable processors
- Memory: 256 GB DDR4
- Storage: NVMe SSDs for cache, SSDs for capacity
- Network: Dual 10GbE NICs
- Power consumption: Approximately 900W per server under typical load

Rack, UPS configuration, management and protection:
- Rack:
  - 25U SmartRack Standard-Depth Half-Height Server Rack Enclosure (Ref: SR25UB)
- UPS:
  - Model: Eaton 9PX 6000
  - Ref: 9PX6KIRTNG2
  - Capacity: 6000 VA
  - Backup time: Approximately 10-15 minutes at full load
  - Double conversion online: Provides consistent, clean power
  - Scalability: Can add external battery modules for extended runtime
  - Network card M3 is included into the UPS SKU 9PX6KIRTNG2 allowing monitoring, management and graceful shutdown and restart of vSAN cluster
- Monitoring and protection
  - 3x Environmental monitoring probe for temperature / humidity and dry contacts monitoring in the front and back of the rack (Ref: EMPDT1H1C2)
  - Door contact sensor to monitor rack access at any time (Ref: DCS001)
  - IPM2.8.2 or Brightlayer software 7.3 or above for disaster avoidance protection.

8-Node Nutanix installation

Server configuration:
- Model: Lenovo ThinkSystem SR650
- Processor: Dual Intel Xeon Scalable processors
- Memory: 256 GB DDR4
- Storage: NVMe SSDs for cache, SSDs for capacity
- Network: Dual 10GbE NICs
- Power consumption: Approximately 850W per server under typical load

Rack, UPS configuration, management and protection:
- Rack :
  - SmartRack Premium 42U Server Rack Enclosure, Secure, Standard-Depth (Ref: SR42UB)
- UPS :
  - Model: 9PX G2 11kVA
  - Ref: 9PX11KIRTNG2
  - Capacity: 11,000 VA
  - Backup time: Approximately 10 minutes at full load
  - High efficiency: up to 97.2 % efficiency in double conversion mode
  - Managed Rack PDU, monitor power consumption at outlet level and control them remotely (Ref: EVMAF132A)
  - Network card M3 is included into the UPS SKU 9PX11KIRTNG2 allowing monitoring, management and graceful shutdown and restart of Nutanix cluster
- Monitoring and protection:
  - 3x Environmental monitoring probe for temperature / humidity and dry contacts monitoring in the front and back of the rack (Ref: EMPDT1H1C2)
  - Door contact sensor to monitor rack access at any time (Ref: DCS001)
  - Brightlayer software 7.3 or above or IPM2.8.3 or above for disaster avoidance protection

Technical details and examples

Eaton's software solutions (Intelligent Power Manager 2 and Brightlayer software) integrate with VMware vSAN, Nutanix and Datacore to manage virtual machines and storage. This integration allows for automated workload management and load shedding, ensuring that mission-critical VMs continue running during power disruptions. In addition to that, it allows to automate the graceful shutdown of the cluster, where IPM2 or Brightlayer software runs within, as well as the restart when the conditions are back to normal.
Eaton solutions provide a complete view of power devices, and a wizard driven automation feature that enables users to manage their virtualized environments efficiently in case of events.

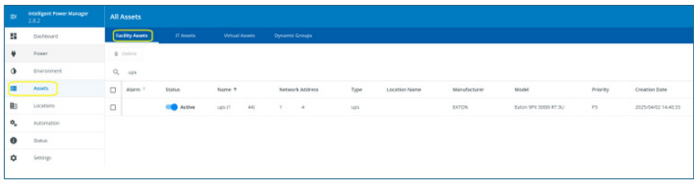
Network connectivity requirements

To ensure integration and reliable operation, the following network connectivity paths must be established and verified (refer to vendor documentation for specific configurations):

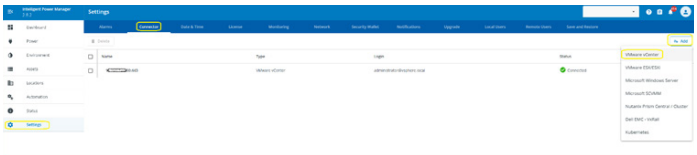
- Between the HCI management software and the UPS network interface cards.
- Between the HCI management software and the virtualized infrastructure.
- Between the UPS network interface cards and the virtualized infrastructure.

IPM2 software configuration

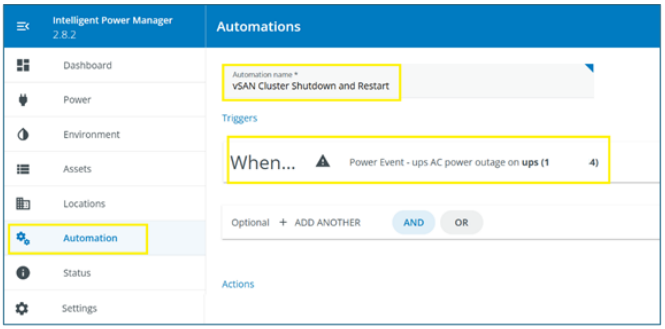
1. Make sure the UPS is monitored by IPM2 software



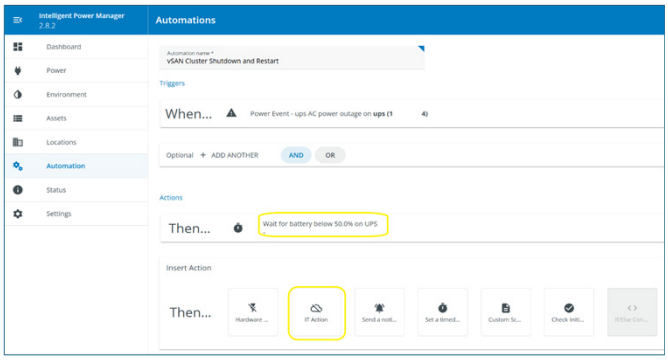
2. Connect IPM2 to VMware vCenter managing your vSAN cluster

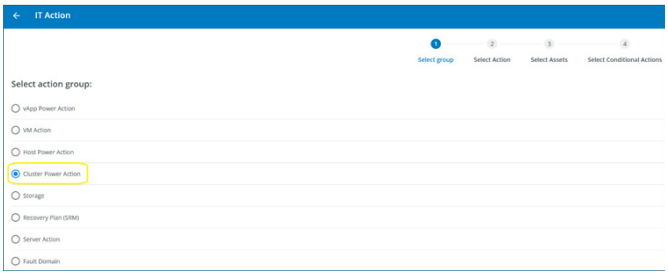


3. Define the Cluster shutdown automation using the trigger that adapts better for the needs

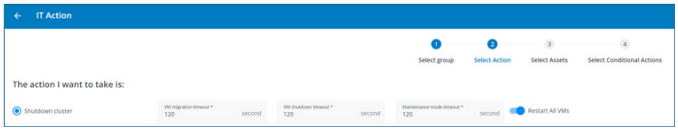


4. Additional timer can be added, for example to wait until a specific threshold is reached. Cluster shutdown action is located under IT Action menu.

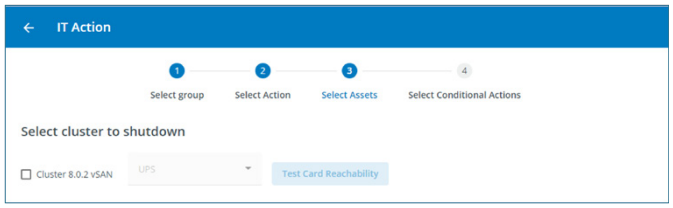




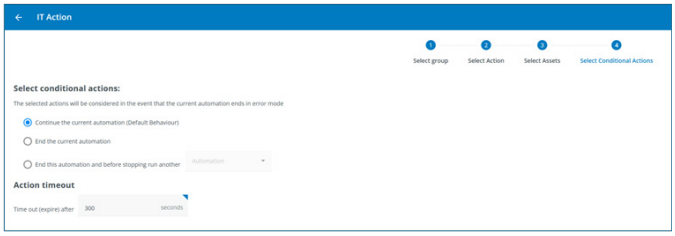
5. Select **Shutdown cluster** and set the right delays for VM migration, VM shutdown and enter into maintenance mode. Select **Restart All VMs.**



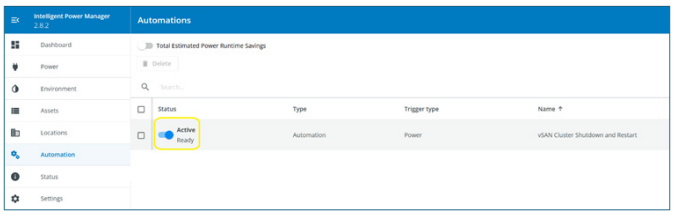
6. Select the **vSAN cluster and the UPS** in charge of the shutdown and restart operations.



7. Define the behavior to handle unexpected errors and the delay needed to complete this action and save the automation.



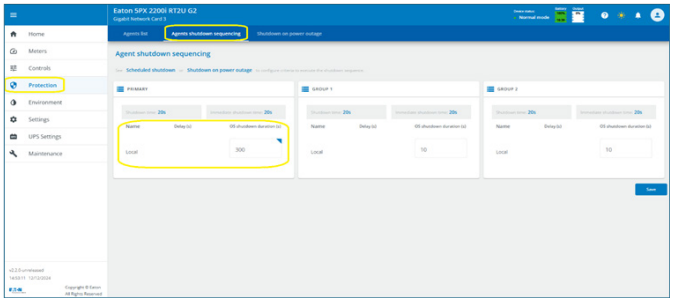
8. Make sure the automation is activated by checking the toggle.



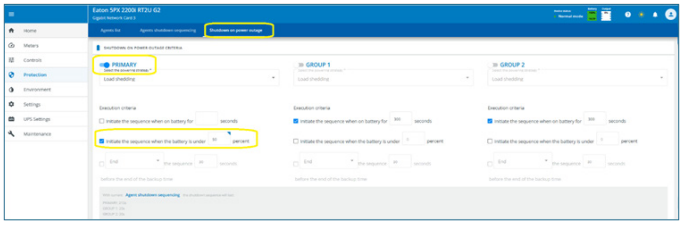
NETWORK-M3 CARD CONFIGURATION

Make sure the configuration for cluster restart with Eaton Network-M3 card is correct. This configuration should be consistent with the automation configuration on the software.

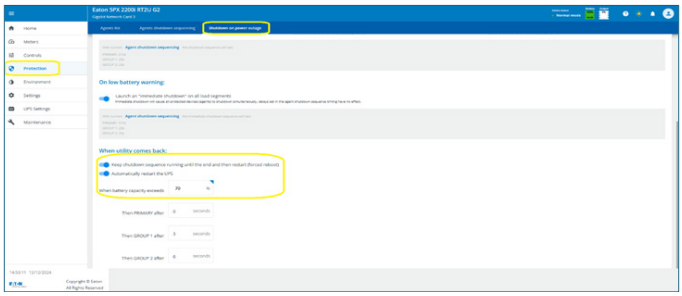
1. Under the protection settings, go to the Agent shutdown sequencing tab. Notice there is a Local OS shutdown duration for the PRIMARY. Set that value to the amount of time needed to gracefully shutdown your infrastructure. Notice the UPS output will be power off once this time has elapsed.



2. Now under the Shutdown on Power Outage tab, set the PRIMARY criteria to replicate the one configured on the software. Based on the above software configuration, the Network-M3 card configuration should be as follows:



3. Make sure the Forced Reboot option is enabled allowing the UPS to power cycle the output in case power is back during the shutdown sequence.
   Set the restart configuration as per your needs and make sure the restart capacity exceeds the one defined as triggered for the shutdown. This is key to give enough time to your infrastructure to shut down gracefully in case of a recurrent power outage.



Summary

The automatic restart feature in UPS and related software solutions is a game changer for protecting Hyperconverged Infrastructures from power outages and environmental conditions. This innovative capability offers several significant advantages:

Cost reduction: By automating the shutdown and restart processes, organizations can significantly reduce the costs associated with manual interventions and minimize downtime. This ensures that critical operations can resume quickly without incurring additional expenses.

Leveraging existing devices: The automatic restart feature leverages existing devices, such as network cards on UPS, to enhance the overall efficiency and reliability of the power management system. This integration maximizes the utility of current infrastructure investments.

Versatility beyond power events: This feature is not limited to responding to power or environmental events. It can also be scheduled to save power outside working hours or linked to grid stability conditions. This flexibility allows organizations to optimize energy usage and contribute to broader sustainability goals.

Dynamic arbitration: The ability to dynamically arbitrate the shutdown or restart of systems based on previously measured power consumption is a key advantage. This ensures that energy is saved while maximizing the performance of business-critical operations. By analyzing power consumption patterns, the system can make informed decisions to balance energy efficiency and operational effectiveness.

Market differentiator: The automatic restart feature sets organizations apart in the market by offering a unique combination of cost savings, enhanced reliability, and energy efficiency. This capability demonstrates a commitment to innovation and sustainability, making it a compelling value proposition for customers and stakeholders.

In conclusion, the automatic restart feature is a transformative addition to HCI protection strategies. It not only ensures continuous power supply and data integrity but also provides a versatile and dynamic approach to managing power consumption. This feature is a clear market differentiator, offering organizations a competitive edge in today's rapidly evolving IT landscape.

Ready to learn more?
If you want to learn more about Eaton solutions, contact your Eaton representative and visit Eaton.com/Network-M3

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