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# Getting the most out of the network closet

## Executive summary

While network closets take on all shapes and sizes, they are essentially an arm of the data center and as an important component of all mission-critical environments, must be organized, protected, and managed efficiently and effectively. IT professionals are charged with keeping the technology infrastructure functioning, even in the face of constrained resources and increasing complexity. By selecting the correct rack and power infrastructure, paired with management hardware and software, organizations can keep their businesses up and running. In this white paper, we go beyond simple how-to advice for keeping IT equipment operational, and discuss how efficiently managing, organizing, and operating network closets saves time, saves money, and avoids risk utilizing the existing space and equipment.



Network Closet Rack

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## The network closet: Same components, different purpose

Whether at a small company, a mid-market organization or a large enterprise, the components that make up a typical network closet are usually the same. Essentially, a network closet includes four primary elements; network switches, servers, storage and the associated virtualization and management software. The fifth is an integrated rack and power distribution element.

What differentiates one network closet from another is its fundamental purpose. For smaller organizations, a network closet serves as a computing hub, containing all the networking, storage and computing power needed to run the business. For larger organizations, a network closet – often operates in conjunction with others – provides a connection to a centralized computing hub in the form of a server room or data center. In effect, larger organizations rely on network closets to provide a gateway to a centralized server room and then route information to a data center for storage.

When building out a new network closet or assessing an existing closet, it is best to think in terms of three essential purposes: organization, protection and management.

### Organization

Given the tight confines of a network closet, proper organization of equipment is essential for efficient operation and ongoing maintenance. Organizational equipment that can add order to a network closet includes open-air racks (two- or four-post models), accessory racks, wall cabinets for cable equipment, strain relief bars, and cable management options for organization and airflow management purposes. Equipment racks with a two-post open-frame design are most common in network closets, but for deeper and heavier equipment, consideration should be given to using a four-post adjustable depth equipment rack. Standard racks are typically 84" tall, but if space is at a premium, larger (96") racks might be a consideration for maximum space utilization. It is important to use racks that are compliant with the EIA/ECA 310E standard for 19" or 23" rack mounting to ensure uniformity and ease of installation. In addition, racks that include rack mount unit (RMU) markings permanently embossed on the rack rails make the equipment installation faster and more efficient. Last but not least in importance is the weight capacity of the equipment rack. It's recommended that the equipment rack carry at least a 1,000-lb (454kg) static weight capacity to ensure a stable support environment for expensive datacom servers, network switches, etc.

While rack design is important, when outfitting a network closet it is critical to keep servers, switches, and storage equipment safe and secure. To aid maintenance efforts as well as streamline troubleshooting, the rack area should be kept clear of cluttered data, power and network cables. For this reason, cable management is critical. A vertical cable manager should be placed on the end of each rack. One horizontal (1 RMU) cable manager is recommended for every 24 patch cables and one (2 RMU) horizontal cable manager for every 48 patch cables in a rack. Proper cable support is vital to ensure maximum performance and facilitate efficient modifications, additions or changes to network cabling systems.

### Protection

Reliability, continuous uptime and efficiency are critical with network closets, which is why protecting equipment will save time, save money and avoid common risks. Solutions that provide protection include an uninterruptible power system (UPS) to provide emergency power in the event of a utility failure, a rack power distribution unit (PDU), and hot-swap maintenance bypass units that enable power to be switched directly to equipment to perform maintenance or replace a UPS. If redundancy is a requirement, automatic transfer switches (ATSs) that automatically transfer power from a primary power source to a secondary source in the event of a power anomaly should be provided. Protection can be further enhanced by the use of intelligent rack PDUs that protect equipment within a rack by monitoring and managing power at outlet level. Integration of UPSs and intelligent rack PDUs with management software allows IT professionals to view and control the environment from any computer connected to the network server. If extended runtime is a requirement, additional battery modules can be added to the UPS.

### Management

Organizing a network closet and protecting the equipment delivers efficiency and reliability up to a point, but to truly optimize a network closet, organizations require effective management capability. Through the use of the proper hardware and software management products, IT staff can effectively manage the network environment. Management software can provide remote proactive management capabilities at both the UPS and PDU level, for intelligent PDUs up to the outlet level. Management hardware includes outlet-level current and power meters as well as temperature and humidity probes. These meters and probes enable environmental monitoring and notify IT staff when power or temperature fluctuations fall outside of the generally accepted tolerance.

### Effective management

Even though the purpose of a network closet varies depending on the size of an organization, the need to efficiently and effectively manage the assets in a closet is universal. For a small organization, all the computing capacity is contained within a closet; for larger organizations, access to the enterprise network and mission-critical applications can be compromised should any problems with the network closet occur. In both scenarios, an efficiently managed network closet is critical to ongoing operations.

One of the foundations to learning how to manage a network closet effectively is monitoring and managing the equipment on a granular level. UPS-level monitoring and management can enable network administrators to keep close tabs on power supply and consumption throughout the rack. For larger organizations with multiple network closets, remote monitoring and management capabilities provide a comprehensive view of the networking environment. Intelligently managing power with software can help administrators respond effectively and efficiently in the event of power disruptions. Intelligent rack PDUs allow IT professionals to monitor and control outlet-level current and power metering – both necessary to ensure efficient operations. Also necessary is the ability to gauge environmental conditions through remote temperature and humidity monitoring.

Remote management of environmental conditions from a central location is especially important for those organizations that have added network closets to scale up or scale out their existing environments. Integration of UPSs and rack PDUs with management software allows IT professionals to view and control the environment from any computer connected to the network server. For example, a typical college may have network closets located in various buildings throughout the campus. It is not unusual for many of the network closets to be in converted spaces not initially designed for computing. Such environments are unfriendly from a temperature and humidity standpoint; if no extra cooling is devoted to the network closet space, remote management helps avoid risk due to running too hot.

For larger organizations, it is particularly important to back up the network closet; as a gateway to the server room or data center, a network closet outage can leave mission-critical applications such as corporate email systems inaccessible. Also important is the ability to migrate and shut down virtual machines (VMs). In the event of a power outage, critical VMs can be kept online while those that run non-essential applications can be automatically shut down. This process, known as load shedding, is a critical component of effective VM migration. By turning off less critical VMs through load-shedding capability, administrators can preserve and extend battery power for their more critical applications. To perform load shedding effectively, we suggest UPS management software that integrates into the virtualized platform, therefore effectively providing these capabilities in a way that doesn't jeopardize mission-critical IT operations.

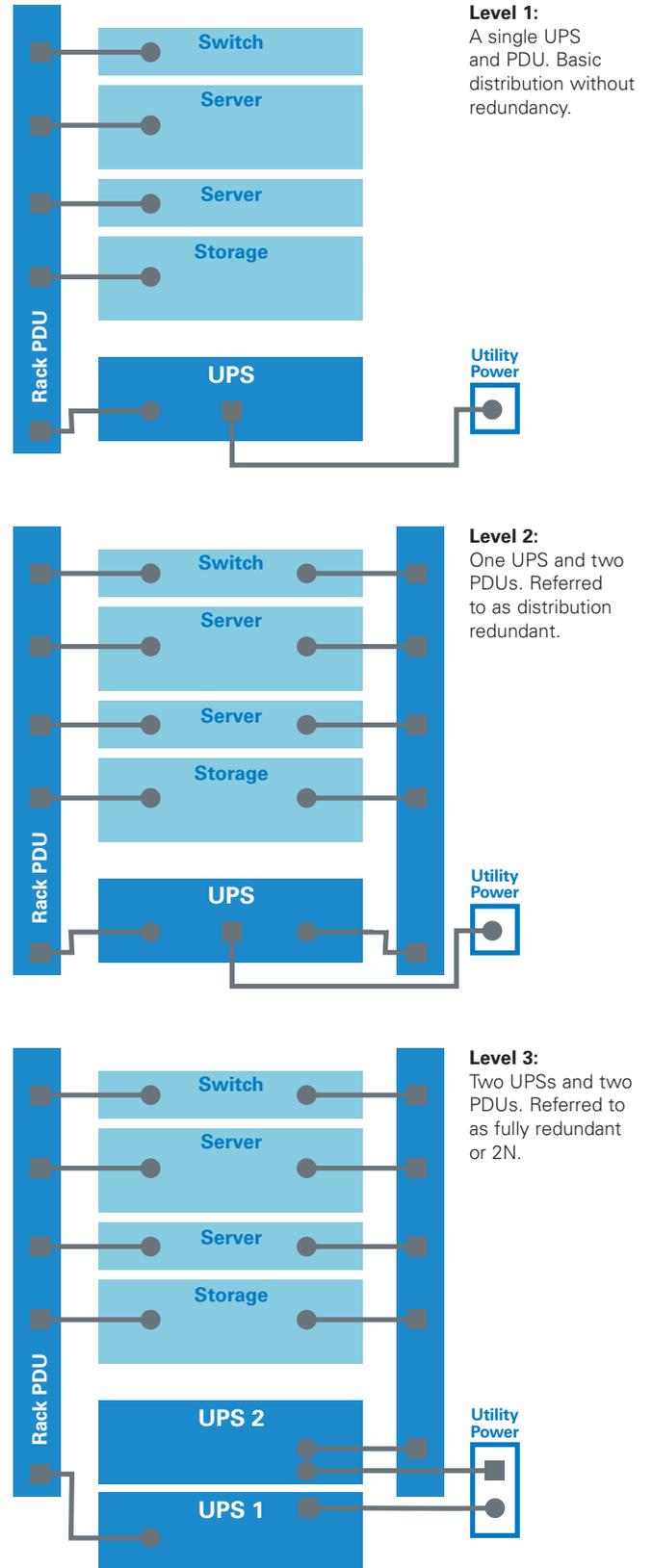
### Rack hygiene: Maximizing uptime and increasing reliability

While monitoring and managing the infrastructure is critical to effective network management, these activities alone are not enough to optimize network closet operations. Network administrators must also consider rack hygiene – the practice of organizing cables and efficiently managing power so a racked environment is properly controlled and maintained. The right cable management solution saves time and money by increasing airflow and ease of accessibility to closet hardware for additions or changes. It also avoids risk by preventing against hardware failures due to accidental/inadvertent power cable removal. Cable management – through color-coding and the use of vertical and horizontal cable organizers, cable spools and outlet plug retention – enables network administrators to maintain proper cable connections and streamline problem resolution. Efficient cable management through the use of vertical and side cable management channels can increase airflow in the network closet; it can also ease any moves, adds and changes made to the rack, thereby reducing the chance for disruptions due to issues with the environmental temperature or accidental dislodging of a cable. A rack PDU with IEC plug retention prevents the accidental dislodgment of a plug and can greatly enhance reliability. Essential to cable management best practice is the ability to organize like cables – blue data cables, for example – to improve troubleshooting, eliminate clutter and reduce the potential for interference between different kinds of cables. Using dividers, it is possible to store power and networking cables within a single organizer and still maintain cable performance.



**Figure 1.** Rack PDUs with IEC outlet grips can reduce the risk of plugs getting bumped loose and leading to server shutdown.

In addition to cable management, power is also another component of rack hygiene, which is where UPSs and PDUs come in. To ensure maximum uptime and improve reliability, network closets should ideally contain redundant UPSs and PDUs to protect both primary and redundant equipment power supplies. However, not all network closets require fully redundant protection; by mixing and matching UPSs with PDUs, administrators can devise the right level of protection to suit their network closet needs. Typically, there are three levels of protection:



## Looking for additional protection options?

Consider using ATSS and a maintenance bypass switch. For protecting single-corded equipment, an ATS is particularly useful as it maintains redundant power distribution to equipment in a rack with one or two power supplies. An ATS transfers power from a primary source to a secondary source when problems occur, and subsequently transfers it back once the primary source is restored. In addition, a maintenance bypass switch can be highly effective as well. The maintenance bypass switch enhances power availability to the rack by routing utility power around the UPS and into the PDU. If a UPS needs maintenance or replacement, the maintenance bypass switch allows power to be switched directly to the network closet equipment, eliminating the need to shut down the equipment during any repair or maintenance procedures.

Need additional backup runtime? Organizations that have stringent service level agreements should opt for an extended battery module to ensure more runtime during a power outage or to ensure sufficient time to migrate data in a virtualized environment. Ideally, an extended battery module designed to pair specifically with a UPS can ensure an installation that is trouble-free, while delivering a reliable backup solution.

In summary, when choosing a rack and power management and distribution solution for a network closet, keep in mind the various aspects related to return on investment (ROI). Achieving efficiency and effectiveness can be compromised over the long term by selecting UPS and PDU options that do not create value by saving time, money and risk avoidance. To make the most appropriate choice, consider the following factors that affect overall ROI:

- **Rack organization** – Keep equipment secure and in its place to optimize the time and money spent on maintenance as well as any future planning.
- **Power rating** – Pay attention to wattage measurements, as these reveal real power.
- **Network card** – Determine whether the UPS price includes a network card.
- **Output receptacles** – Be sure the UPS and PDU have enough output receptacles to accommodate the power cords of servers and other network closet equipment.
- **Input plug** – Some UPSs and PDUs have input plugs that fit into a standard wall socket. If not, an electrician may be needed to install a new wall outlet.
- **Batteries** – Consider the cost of additional battery packs, as well as the cost and frequency of servicing UPS batteries.
- **Software** – Make sure UPS and PDU software can integrate with existing virtualization management software.
- **User interface** – An intuitive LCD can streamline troubleshooting and save maintenance costs.

- **Mounting hardware** – For mounting a UPS in a two-post rack, look for mounting hardware that is included. Also be sure to pay attention to mounting bracket requirements for PDU installation.
- **Maintenance bypass** – Purchasing this switch can save money and avoid risk by allowing IT equipment to stay up and running in the event of a UPS failure.
- **Voltage** – From an energy utilization standpoint, a 208-volt UPS costs less than a standard 120-volt UPS, so make sure the proper voltage required is considered upfront.
- **Warranty** – Factor in the duration of the warranty and whether it covers batteries.

## Conclusion

No matter how big or small an organization, the network closet is an important element that keeps the business running. With reliability and redundancy paramount, organizations can equip their network closets with the right hardware and software to maximize uptime, improve efficiency and reduce operating costs – goals that, when achieved, deliver the highest ROI. By selecting a rack and equipment with organization, protection and management top of mind, a network closet can deliver the reliability and performance demanded by today's computing environments.

## About Eaton

Eaton's electrical business is a global leader with expertise in power distribution and circuit protection; backup power protection; control and automation; lighting and security; structural solutions and wiring devices; solutions for harsh and hazardous environments; and engineering services. Eaton® is positioned through its global solutions to answer today's most critical electrical power management challenges.

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