

building OPERATING management

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GSA's Kevin Kampschroer on evaluating new building technologies

Good as New

Repositioning a dated property is a big investment. Here's why owners are deciding it's worth the money

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Reducing Human Error —
and Data Center Downtime

critical facilities

Preventing Human Error

Addressing the biggest source of downtime risk takes disciplined follow-through by alan hart and david boston

MOST PROFESSIONALS in the data center industry have come to recognize that human error is the most common cause of downtime. A review of thousands of facilities system incident reports collected over more than a decade demonstrates risk is highest when computer hardware is installed or removed. This continues to be the case today. Though “dual power” provides a more forgiving environment and a greatly enhanced potential for continuous operation, the reality is management of computer room electrical distribution is more complex now than during the single-power-path era. Some organizations have been more successful than others in adeptly managing this challenge.

A major financial services organization based in Texas has realized significant success by addressing that challenge. The firm identified the opportunities for failure in a dual-power path environment, then presented a convincing business case for needed change to the

managers of each department that shares the installation and de-installation process. It was also essential to get buy-in and consistent support from senior management. In addition to implementing recommended changes, the firm consistently applied these new processes through written documentation, training, and continued monitoring.

This organization operates multiple data centers nationally. Included are two at their Texas headquarters campus, one that occupies 62,000 square feet of raised floor space (2,400 kW) and another at 15,000 square feet of raised floor space (1,060 kW). UPS systems are 2(N+1). Dual power paths are provided to each device and cabinet.

The computer hardware profile is varied, ranging from mainframe and storage devices to servers and network devices in cabinets. A few devices are single corded; any of these deemed critical are connected to automatic transfer switches (ATS). Thousands of individual devices occupy the computer

rooms, and the average number of installations or removals is 100 per month. This is a relatively high churn rate for a data center business, presenting a greater challenge than a more static facility has in trying to accomplish continuous operation.

This company has deployed 90 dual-input power distribution units (PDUs) across the two data centers referenced above for more than a decade. They conduct preventive maintenance on each of these on a three-year cycle, with a staggered schedule, so several PDU preventive maintenance

activities occur monthly. As with most data center owners, they traditionally spread the responsibilities of installing and removing computer devices, network cables, and power cords across multiple departments, with multiple individuals involved in each group.

Although this arrangement provided for a successful operation most of the time, it did result in several surprise power interruptions to computer hardware devices over time, before the necessity for change resonated with some involved in the process. In addition to discoveries of misconnected devices when a rare single power path failure occurred, there were a few surprises when a power path was purposely shut down for preventive maintenance or



Red tape identifies the B side of the two cords supplying power to dual-corded devices. No tape is placed on the cord that is fed from the A side. In addition, blue tape is placed on each power feed to a single-corded device.

repair to a PDU. In general, these were found to involve someone who attempted to install or remove a device without proper authorization, training, and understanding of the configuration.

In this organization's effort to reduce the risk of additional surprise interruptions, the facilities department successfully articulated to managers in each of the involved departments the problem with continuing to operate as they had. Several issues created unnecessary risk. For one thing, too many departments were involved, including outside vendors who pre-configure some of the racks. On top of that, there was a lack of written, site-specific, repetitive processes. What's more, training was insufficient.

DETAILED CHANGES IMPLEMENTED

With buy-in from the senior managers in each department involved in computer hardware

Under a new policy, facilities is solely responsible for all network cable, fiber, and power cord installation and removal in the data centers.

installations and removals, the facilities department implemented a series of changes roughly eight years ago.

Today, each device installation or removal must be submitted to the facilities department online via a specific request form. The person making the request must indicate the model number, serial number, device name, and desired location within the data center for any new device. The facilities department uses this information to determine projected power draw, heat load, and available capacity of the PDUs, remote power panels, and ATS within the desired location to support the new device or devices. The request is accepted or rejected based on available capacity.

Under the new policy, the facilities department is the sole owner of all network cable, fiber, and power cord installation and removal in the data centers. No other individuals physically touch a cord. The number of people with access to the computer rooms was methodically reduced.

Other elements of the new process include:

- PDUs and RPPs are never loaded more than 40 percent and loads are always balanced between PDUs or RPPs, within a pair.

- Installation and removal of devices is only conducted during a nightly window between midnight and 6 a.m. All cords are traced before device removal. All cords connected to a PDU are traced prior to each planned preventive maintenance activity on the PDU (one power path will be shut down). The B-side cord in each dual-cord installation is identified with red tape affixed to the cord above the plug at each end. Single-corded devices are identified with a piece of blue tape affixed above the plug on the cord at each end. A comprehensive PDU circuit survey procedure and form is employed during each device installation and removal activity. (See "Step-by-Step: PDU Circuit Survey" on this page.)

- Third-party vendors, which sometimes pre-configure a rack when many devices are added at once, must adhere to a detailed process developed by the data center owner. Facilities technicians inspect the pre-configured rack prior to applying power.

- A defined process is used for tracing circuits, requiring each cord to be followed by hand within a designated cabinet from the ATS or power strip to the device, in order to confirm that it is connected as recorded. A defined process is also followed for shutting down a PDU during a preventive maintenance or repair activity. Facilities technicians verify that the second PDU in the pair is loaded less than 40 percent and infrared-scan the second PDU in the pair to identify

Step-by-Step: PDU Circuit Survey

HERE IS AN EXAMPLE from the PDU circuit survey procedure and form used during device installation and removal:

- F. Verify that the power cords connected to the device have proper redundancy and have the associated color representation.
- ___ 1. Make sure the connections between an automatic transfer switch (ATS) and the IT equipment maintain an "A" and "B" bus configuration in order to ensure redundancy.
 - ___ 2. Make sure all dual corded devices have two power cords.
 - ___ 3. Ensure that the power cord between the IT device and the "A" bus ATS is a black cord.
 - ___ 4. Ensure that the power cord between the IT device and the "B" bus ATS is a black cord with red tape on both ends of the cord.
 - ___ 5. The power cord connections between a single-corded IT device and an ATS must be wrapped with blue tape on both ends of the cord.

—David Boston and Alan Hart

any loose connections or hot spots. Then the feeder breakers on the PDU to be maintained are opened. The technician infrared-scans the second PDU in the pair for 30 minutes to observe whether there is any excessive heat rise. The facilities technician backs out and re-powers the other PDU if any breaker in the second PDU begins to overheat. A defined process is also employed for powering a PDU following a preventive maintenance or repair activity: The facilities technician leaves panel board mains off, energizes feeder to the PDU, and verifies closed

Gaining support from multiple departments that share a common objective is extremely valuable and important.

transition, panel board mains on, and loads accepted.

BENEFITS REALIZED

Since these changes were executed, the organization has eliminated surprise power interruptions related to device installation and removal. The circuit tracing process has proven its value by exposing a few devices over the years that were incorrectly connected. However, the other components of the new process have ensured that these discoveries are rare. This record of continuous power availability within the computer rooms at this organization is exceptional, particularly in light

of the high frequency of device installations and removals.

This project illustrates the value of clearly articulating a problem and proposed solution; gaining support from multiple departments that share a common objective; and consistently deploying a substantial change in process. As one of the owner's facilities senior technicians likes to point out: "Poor power cord management will ensure disappointment with the best designed critical power systems. Management of the process is the key to success, as well as the most economical means of achieving the desired reliability record." ■

Data Center Specialists Earn More, Survey Shows

THE NEWLY RELEASED Data Center Facility Staff Salary Survey shows that facility staff whose primary responsibility is data center facility infrastructure typically earn higher salaries than facility professionals whose responsibilities include data centers, but not as the position's primary responsibility.

For the survey, facility managers reported the salary ranges for eight facility staff positions. Half of those positions were focused strictly on data centers; the other half were generalist positions with some data center responsibility. The positions are:

- Data center facility manager
- Data center chief engineer
- Data center engineer
- Data center technician
- Facility manager with some data center responsibility
- Chief engineer with some data center responsibility
- Engineer with some data center responsibility
- Technician with some data center responsibility

The report includes salary information for the overall market as well as data broken down by different redundancy levels and data center sizes. For the overall market, and in most subcategories, data center specialists earn higher salaries, the survey shows. For example, when the critical load of the largest data center is from 2 MW to 10 MW, the median salary range for a data center facility manager is \$80,000 to \$120,000. By contrast, the median range for a facility manager who has some responsibility for data centers is between \$80,000 and \$100,000.

Similarly, when looking at the overall market, a data center technician typically earns between \$50,000 and \$65,000, compared to a range of \$45,000 to \$60,000 for technicians whose primary responsibility is not data centers.

For complete survey results, go to www.facilitiesnet.com/16363BOM.

— Edward Sullivan, editor

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