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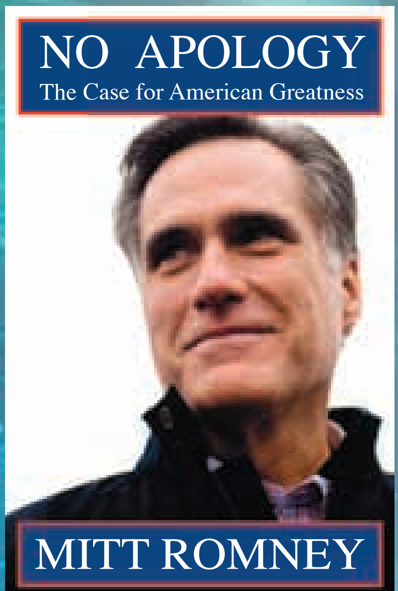
2010 SPRING CONFERENCE KEYNOTE

JUNE 6 – 9, 2010



See page 36 for more details

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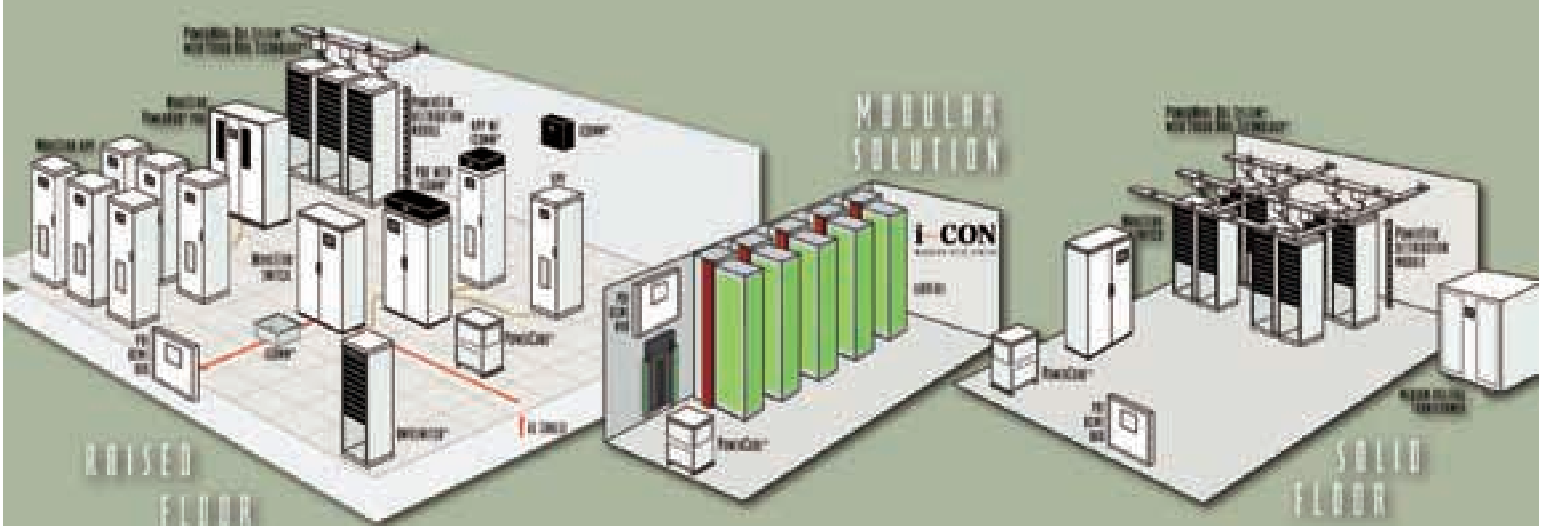

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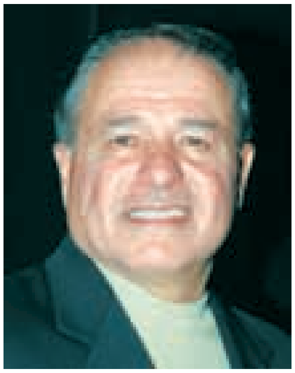

Robert J. Cassiliano

I suspect this winter has us all looking forward to spring!

The improvement in the business climate over the last several months has occurred at a gruelingly slow pace. But it has improved! Businesses, however, need to meet any opportunities with a laser focus to ensure success — and in some cases, survival — through this challenging period. This focus needs to ensure that the opportunity is real, that it makes good business sense, and that we apply our best efforts and talents to supporting the client in a superior manner. Most of our clients are challenged with delivering products and services on time — with limited resources and reduced budgets — while being energy efficient. Although these are client challenges they are shared with service providers, consultants and manufacturers. Therefore, a successful outcome is dependent on all parties understanding the business goals, executing them with precision, considering the future, and working together as a team.

The theme for the 2010 7x24 Exchange Spring Conference being held at the Boca Raton Resort and Club in Boca Raton, Florida June 6 – 9, 2010, is End to End Reliability: "The Next Generation".

Conference highlights are as follows:

- Conference Keynote: "No Apology: The Case for American Greatness" presented by Governor Mitt Romney, Former Presidential Candidate
- Keynotes by Emerson and Yahoo
- US Department of Energy (DOE) Tutorial
- Green Grid Presentation
- US Environmental Protection Agency (EPA) Update
- Exchange Tables on specific topics at all breakfasts and at Monday lunch
- An End-User Interactive Exchange Luncheon on Tuesday
- Vendor Knowledge Exchange on Tuesday afternoon
- Sponsored Intracoastal Cruise

The program content is designed to provide value to conference participants and their companies by focusing on important topics of the day. Energy efficiency is highlighted at this year's event.

I look forward to seeing you at our Spring Conference in Boca Raton!

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FIVE WAYS TO IMPROVE DATA CENTER ROI

by **Tom Freeman**

Data center operations are not just among the most mission-critical real estate in the corporate portfolio, but also consumptive (see sidebar). While the primary considerations continue to be maximum uptime, data security and reliability, there is growing pressure to operate as "lean and green" as possible while improving ROI.

At the executive level, the discussion often focuses on three questions: How can data centers best support what we want to do? Can they be more cost-effective? How can they contribute to our corporate sustainability goals? What's more, toughening federal energy requirements are rapidly making data center efficiency not just an option, but a mandate.

Jones Lang LaSalle has identified five data center best practices that organizations should follow to maximize ROI.

1. Ensure good collaboration among CRE, IT and Finance

Establish a clear process for IT, CRE and Finance to communicate data center needs with each other. The teams should be working together on new initiatives from the start. Because projects typically originate within IT, make sure IT knows to engage the CRE and finance teams at the idea stage.

An idea to consider as an incentive is to revise accounting practices so that energy costs are placed in the IT budget, not in CRE facility budgets. CRE is already sensitive to operating costs, and the transfer of energy expenses to IT can rapidly force collaboration.

Another idea to eliminate the silos between CRE and IT, is for non-IT personnel such as CRE administrators to increase their understanding and credibility among technology managers by accessing educational opportunities. Consider joining a colleague on the IT team at an industry seminar such as those conducted by Data Center Dynamics, Gartner, Tier I Research or AFCOM. The information shared at these events can be an eye-opener for CRE managers.

Facts and stats

- Data centers represent about 25 percent of total fixed corporate assets, and 50 percent of overall IT budgets.
- Demand for data center capacity is expected to grow at a 10 percent compound annual rate over the next decade.
- Facility costs are growing at 20 percent annually, compared to 6 percent growth in annual IT spending.
- A typical data center that cost about $150 million to build five years ago now requires several times that amount.
- Server utilization rarely exceeds 6 percent and facility utilization can be as low as 50 percent.
- Data centers consume almost 2 percent of world energy production, with more related carbon dioxide emissions than the entire carbon footprint of nations such as Argentina and the Netherlands. The average data center consumes as much energy as 25,000 households.
- There is potential for about 50% energy reduction in most companies through optimum IT hardware choices, operational best practices and power and cooling product efficiencies.

Sources: Jones Lang LaSalle, McKinsey & Company, Campos Research and Analysis

2. Align your data center strategy with business goals

Clarify, define and probe for business needs and risk tolerance. Developing data center capacity that guarantees uninterrupted uptime through any situation across all business lines may seem an exemplary goal, but it is a very expensive solution. Does every technology user need full-time, uninterrupted capacity? If not, what amount of support reductions and downtime are tolerable? Can some business groups be more flexible than others? These variables can dramatically impact data center costs. Also, when considering a system's resilience against shutting down under dire circumstances, weighing the costs of fail-safe technology against the consequences of a data center failure, how great a risk is the company willing to take?

Speak a common language when it comes to capacity and reliability. The Uptime Institute has established a useful four-tier system to delineate levels of data center sophistication, with basic performance expectations for each. Useful as these categories are, it is still not uncommon to hear IT administrators propose an in-between data center solution such as a "Tier II-plus," with performance somewhere between two tier definitions. It is important that technology professionals express their data center needs in very specific, understandable terms to accurately determine space needs and overall budget requirements.

Translate corporate objectives and scale for growth. How and where the company might expand? How much would that increase the need for data center support? Consult with Finance as to how much new capital is available for real estate and technology. Can the existing data centers be upgraded or redesigned to meet anticipated needs? If new land for facilities is needed, how much? Minimum capital outlay is always desirable. However, it would be shortsighted and, ultimately, costly to purchase 15 acres of non-expandable data center space if forecasts indicate that you may require 40 acres over the next ten years. An ideal data center growth plan meets—but does not exceed—the business case.

3. Evaluate current operations for efficiency

What's your PUE[1]? According to the Uptime Institute, the average data center has a PUE of 2.5, meaning that for every 2.5 watts of energy entering the meter, only 1 watt is actually being used to meet corporate computing needs. Uptime estimates that most facilities could achieve 1.6 PUE or lower, which makes this metric a worthy target. It's okay to use a different metric than PUE, but remember, you can't manage what you

Efficient sustainability: One company's LEED-ing efforts

In pursuit of LEED® Gold Certification, one large corporate data center implemented a variety of initiatives including:

- System enhancements such as a heat exchanger for free-cooling water, side economizer, variable speed drives on pumps and fans, elevated operating temperatures and enclosed hot aisles to increase free-cooling hours, upgraded building insulation and minimal windows. The result: 17 percent energy savings over new building standards required by the U.S. Department of Energy.
- Lighting and temperature that improve individual control and comfort, and adjust when a specific space is not in use
- An energy measurement and verification plan including sensors and programming to monitor and document actual building energy use
- Purchasing contracts for green power
- Low-flow fixtures and motion detection sensors to reduce potable water use by more than 30 percent
- A refrigerant management plan to reduce and eliminate greenhouse gas emissions and ozone depletion
- Ventilation systems that supply up to 30 percent more outside air, and reduce pollutants to indoor spaces

don't measure.

Another area to assess is chargebacks. Make sure you are using the right methodologies to determine and allocate the real costs of a data center. Traditional space allocation charges are imperfect and not ideal. Expense allocations, based on power usage, are much more realistic and accurate. Why? Many data centers are routinely upgraded with higher density servers in the same amount of square feet, using many more kilowatt hours. Whatever approach you use, it should ensure that as costs rise or fall so do the chargebacks.

Check to see if you have obsolete or comatose servers consuming valuable space and power. Effective virtualization of server designs can trigger tremendous energy reduction and cost savings.

IT groups typically roll over their hardware every three to five years, and such transitions are an ideal opportunity to utilize new architectures and advances in server technology.

4. Pursue low- and no-cost improvement opportunities

It is a mistake to assume that all operational improvements require heavy cash outlays. Besides virtualization, there are several other opportunities to reduce energy consumption, lower costs and run a greener data center, such as:

- Assess your data center configuration, which affects how hot your servers get and how much they need to be cooled. If inefficiency is found, create a design that helps servers run cooler.
- Ensure that cooling units, hardware and lighting controls are actually delivering their rated capacity by continually re-commissioning the equipment.
- Engineer indoor environmental conditions to minimize seasonal impact on temperature, humidification and dehumidification.
- Improve ventilation and cooling systems to take advantage of outdoor air and non-potable water.

See sidebar to learn how one major data center slashed costs and boosted sustainability through easy-to-implement, low-cost operational measures.

5. Anticipate restrictions and capitalize on opportunities

Prepare for unprecedented cost scrutiny. As the economy recovers, data centers will likely resume a brisk pace of new development. A Campos Research survey found that almost two-thirds of surveyed companies planned to expand their data centers in two or more locations within the next one to two years. Gone, however, is the "anything goes" attitude toward IT spending to assure adequate business support. By collaborating with IT and finance, you can develop a solid business case that links to corporate goals—and wins approval.

Avoid making assumptions about location. Less expensive, yet perfectly adequate property can be found in areas away from corporate headquarters campuses, frequently within urban cores. That said, clean energy availability and power cost should be paramount to any location decision. In a typical 20 megawatt data center, every cent per kilowatt hour increase or decrease translates to roughly $1 million in yearly data center operating expenses. Because electrical rates can vary widely across the United States, it pays immediate dividends to locate where energy costs are among the lowest. Consider areas of the country where ambient temperatures are conducive to free or low-cost cooling for much of the year.

Look beyond cheap power and the short-term. Make sure you understand and evaluate renewable energy sources such as wind, solar, hydro and nuclear power. The American Clean Energy and Security Act of 2009 (ACES) currently in Congress will likely result in higher prices, particularly for energy from non-renewable sources such as coal and natural gas. The final legislation could create a "carbon tax" on non-renewables that, passed on through rate increases, could mean that today's lowest cost utilities might not be tomorrow's, depending on their source mix.

Stay abreast of energy-related legislative developments and the regulatory environment. ACES is only the beginning of a federal push to reduce greenhouse gases and shift to renewable energy that will have a strong ripple effect on data center operation and costs.

Until now, energy emission regulation has been largely up to states and municipalities, ranging from the fairly strict laws of California to states with virtually no current sustainable requirements. Tax breaks, grants, low-cost loans and other incentives already offered for sustainable corporate initiatives will multiply in coming years.

Incentives, now and in the future

Increasingly, state and local governments are realizing the benefits of green data center investment:

- 11 states have legislated data center incentives, and legislation is pending in 10 others
- 12 states do not tax data center personal property
- 8 states provide sales tax abatement on data center related investment

The federal government, which already provides certain tax credits and other incentives for sustainable building design and operation, is raising its environmental stake in a big way. Under the new American Recovery and Reinvestment Act—commonly known as the stimulus package—states will receive $3.2 billion for energy audits and improvements to commercial buildings, with a "use it or lose it" requirement that favors shovel-ready projects. A provision of the Clean Energy and Security Act currently in Congress would help create public funding, loan guarantees, interest subsidies and other support for retrofit projects.

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[1]One of the most widely accepted metrics is Power Usage Effectiveness (PUE), created by the Green Grid, a nonprofit professional consortium dedicated to improving data center energy efficiency. PUE is determined by dividing the amount of power entering a data center by the power used to run the computer infrastructure within it, with a perfect score expressed as 1.

Tom Freeman is Managing Director of Mission Critical Solutions at Jones Lang LaSalle. He can be reached at thomas.freeman@am.jll.com.

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ADVANCED MULTILEVEL UPS

to Delivering Green and Best-in-Class Power Quality for Critical Applications

Current and future demands in critical facilities are driving power quality technologies towards greener specifications. To achieve true green power quality for critical applications, this article reports an uninterruptible power supply (UPS) that features an advanced multilevel power converter. The proposed circuit design is very suitable for UPS applications and results in unparalleled double conversion efficiency (97%) and dramatic size/weight reduction. Critical facility engineers can benefit from the multilevel UPS to reduce cost of ownership, ensure availability and optimize project design. This article provides a discussion about multilevel converters and their benefits in UPS applications. Test results using a 750kVA-prototype confirm the improvement in efficiency and the high performance of this multilevel UPS.

by **Eduardo Kazuhide Sato, Masahiro Kinoshita, Yukio Kandatsu, Tatsuaki Amboh**

I. INTRODUCTION

A critical facility requires an environmental controlled room and space to accommodate various electronics equipments as well as a high availability power supply system. To meet the current and future requirements of this type of high-level infrastructure, the online double conversion UPS is the preferred solution due to its highest level of power quality and proven reliability against all types of line disturbances (voltage spike, sag, swells, noise, frequency variation, harmonic distortion, utility voltage and so on). On the other hand, this type of UPS usually exhibits lower efficiency when compared with other configurations such as the standby and the line-interactive technology. Nowadays, with the rising cost of energy and growing environmental concerns, critical facility engineers are more concerned with the cost of ownership and hence the UPS efficiency.

Recently, online UPS has featured transformerless design to reduce the efficiency gap between this technology and others. A transformerless design also promotes significant size/weight reduction that is also an important characteristic since some UPS systems are installed in expensive facilities such as data centers.

To further improve the efficiency of UPS systems without compromising the power quality, multilevel converters have emerged as a strong candidate for future circuit topology in high efficiency uninterruptible power supplies. This article discusses and examines the design and realization of an online double conversion UPS that features an advanced multilevel power converter. In comparison with a conventional design, the proposed UPS exhibits superior double conversion efficiency (97%) and dramatic size/weight reduction. In fact, the multilevel UPS constitutes an effective contribution to critical facilities by delivering high power quality and true green efficiency at the same time.

II. CIRCUIT CONFIGURATION

A single line diagram of a double conversion UPS is shown in Figure 1. In the normal operation, the AC power from the input line is converted into DC power and then the inverter converts this DC power back to a clean AC power to the load. Because the nature of this operation ensures unmatched protection against all types of power quality problems, the online double conversion UPS is the recommended solution for powering mission-critical facilities.

The novel type multilevel UPS described in this article comprises a PWM (pulse width modulated) AC-DC converter, a PWM inverter, a bidirectional chopper circuit, a DC-link circuit and input and output LC filters. In addition, this UPS has a transformerless design, which promotes reduction of losses and hence increases the overall efficiency. Commercial implementation of three-phase double conversion transformerless UPS has been reported previously [1]. In the proposed UPS, in instead of using a conventional two-level circuit topology, a multilevel configuration is employed to achieve higher efficiency in online double conversion UPS systems. To understand the benefits of the multilevel topology in UPS systems, a comparison of these two circuit configurations is shown throughout this Section.

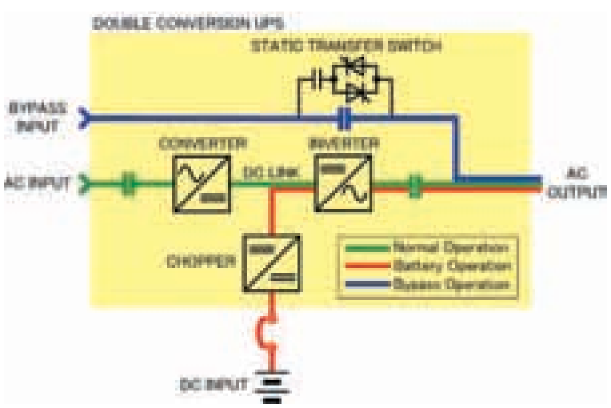

Figure 1 Single line diagram of a double conversion UPS.

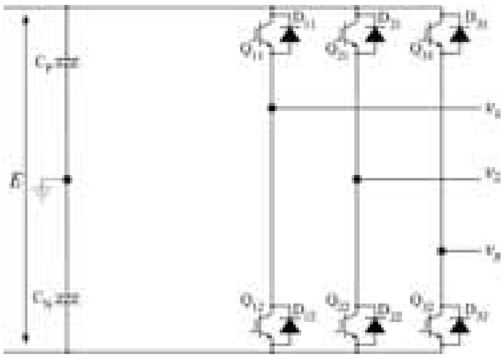

Figure 2 A two-level power converter.

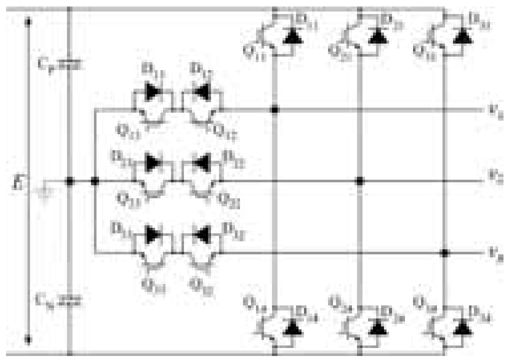

Figure 4 Advanced multilevel power converter.

Figure 3 Line-to-line voltage in a two-level converter.

Figure 5 Line-to-line voltage in a three-level converter.

A. Conventional Circuit Topology in UPS Systems

The conventional topology for power converters in UPS systems is the two-level configuration as shown in Figure 2. In this configuration, note that,

- the voltage stress on each switch can be as high as the DC voltage E;
- the voltage variation (dv/dt) at the terminals (v1, v2, v3) is equal to E (between –E/2 and +E/2).

Figure 3 shows an illustrative line-to-line voltage (train of variable width pulses) at the converter terminals of a power converter using a two-level topology. To obtain a clean sinusoidal waveform as required for UPS systems, filtering using bulky reactors is required to suppress high frequency components.

B. Multilevel Circuit Topology in UPS Systems

The arrangement of the switches in a multilevel circuit topology enables the access to intermediate potentials of the DC-link voltage. Many different topologies [2] have been proposed for this purpose including the neutral-point clamped (NPC) [3]; capacitor clamped [4]; and cascaded multicell [5]. This article introduces an advanced multilevel power converter that is very suitable for UPS applications. Figure 4 shows this advanced multilevel circuit in a three-level configuration i.e., each voltage terminal can output three different potentials (+E/2, 0 and –E/2). In comparison with a two-level power converter, there is a presence of a bidirectional switch that enables the output of the middle potential of the DC link voltage E. Additionally, thanks to the bidirectional switch, note that

- the voltage stress on each switch is the half of the DC voltage E;
- the voltage variation (dv/dt) at the terminals (v1, v2, v3) is equal to E/2 (between –E/2 and 0, and 0 and +E/2).

Figure 5 shows an illustrative line-to-line voltage at the converter terminals of a three-level power converter. Note that the resulting train of pulses tracks the sinusoidal waveform closer than in the case of a two-level converter. In addition, there is a significant noise reduction (acoustic noise and electromagnetic interference) due to the lower dv/dt at the converter terminals.

III. BENEFITS OF MULTILEVEL CONVERTERS IN UPS SYSTEMS

A. Size/Weight Reduction

The improvement in waveform synthesis by using a multilevel topology results in considerable size/weight reduction of UPS systems since this configuration requires a smaller filter to obtain a clean sinusoidal waveform. Figure 6 is a simulation result showing the inverter current waveform for: a) a two-level inverter with a 0.05 p.u. filter reactor; b) a three-level inverter with a 0.05 p.u. filter reactor; and c) a two-level inverter with a 0.10 p.u. filter reactor. Harmonic spectrum of the inverter current for each case in shown in Figure 7, where fs is the switching frequency. These results show

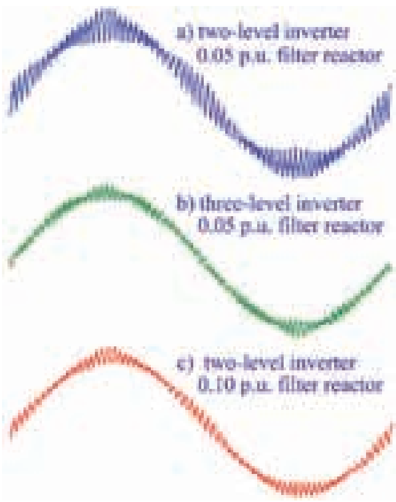

Figure 6 Inverter current for a: a) two-level circuit with a 0.05p.u. filter reactor; b) three-level circuit with a 0.05p.u. filter reactor; and c) two-level circuit with a 0.10p.u. filter reactor.

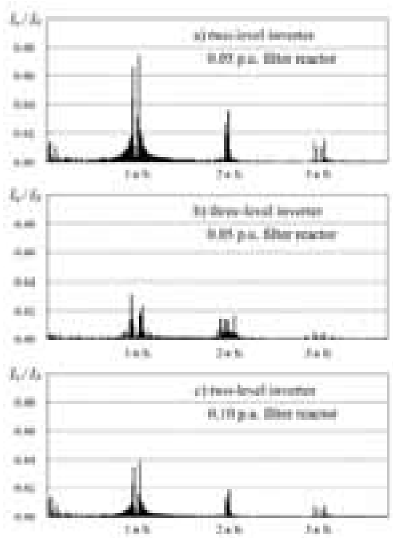

Figure 7 Harmonic spectrum of the inverter current for a: a) two-level circuit with a 0.05p.u. filter reactor; b) three-level circuit with a 0.05p.u. filter reactor; and c) two-level circuit with a 0.10p.u. filter reactor.

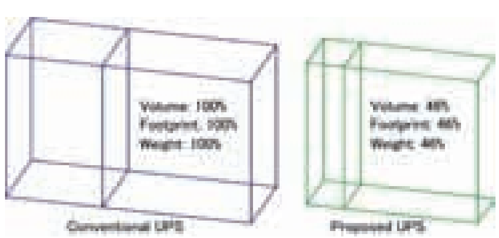

Figure 8 Dimensional comparison for a 750kVA UPS.

that a two-level converter requires a larger reactor to match the current ripple and harmonic spectrum performance of a three-level converter. In a UPS system, it implies a dramatic size/weight reduction. In fact, as shown in Fig. 8, overall volume, footprint and weight for a 750kVA unit are reduced by more than half in comparison with a conventional UPS with the same ratings. Therefore, multilevel UPS requires less space and infrastructure and ensures more room for maintenance and layout reconfiguration.

B. Higher Efficiency

Despite the fact that a three-level converter presents higher number of components, the overall UPS efficiency actually increases in comparison with the two-level topology. Since a UPS system operates at a high switching frequency, semiconductor losses are due mainly to the on/off operation of the power switches. In a semiconductor device like an IGBT, switching losses are a function of the switching frequency, the voltage across the device, the collector current, and the junction temperature. Thanks to the bidirectional switch, the voltage stress on the power switches is one half in comparison with a conventional two-level converter. Thus, for a given switching frequency, current and junction temperature, three level converters reduce the switching losses. As a result, in a typical UPS design, this advanced multilevel converter reduces the semiconductor losses about 40%. This reduction in losses contributes to the improvement in equipment reliability and long-term lifespan due to lower electrical stresses on power switches and lower heat rejection.

IV. TEST RESULTS

Typical test results of a 750kVA-prototype using the proposed multilevel converter are shown in Figures 9 and 10. The specifications of the tested UPS equipment are shown in Table I. Figure 9 shows the operation of the proposed UPS for an applied step load change. A rated load with unity power factor was switched on and off and the UPS output voltage is maintained constant. Fig. 10 shows the operation of the proposed UPS in the case of input power failure. Output voltage remains constant due to the backup provided by the DC power supply.

TABLE I. SPECIFICATIONS OF THE TESTED UPS EQUIPMENT

AC Input	Voltage	480V +15%, -20%
	Circuit configuration	3-phase, 3-wire
	Frequency	60Hz ± 10%
	Power Factor	Greater than 0.99
	Current harmonic distortion	Less than 3% at 100% load
AC Output	Voltage	480V
	Circuit configuration	3-phase, 3-wire
	Frequency	60Hz ± 0.01%
	Rated Load Power Factor	Unity
	Voltage regulation	Less than 1%
	Voltage transient response	2% (100% step load)
	Recovery time	Less than 20ms
	Voltage distortion	Less than 2% for linear loads Less than 5% at non-linear loads
	Overload capability	125% for 10 minutes 150% for 1 minute
DC Input	Voltage range	400 – 540V

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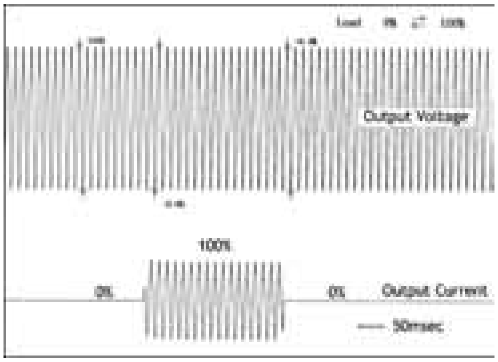

Figure 9 Output waveforms for a step load change.

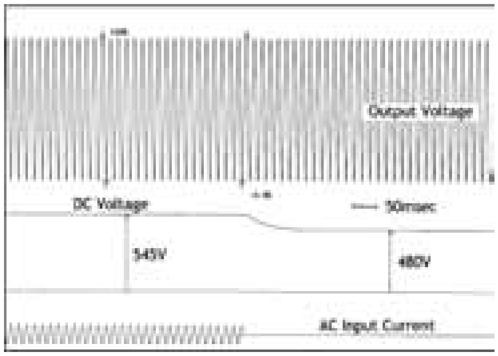

Figure 10 Output waveforms for an input power failure.

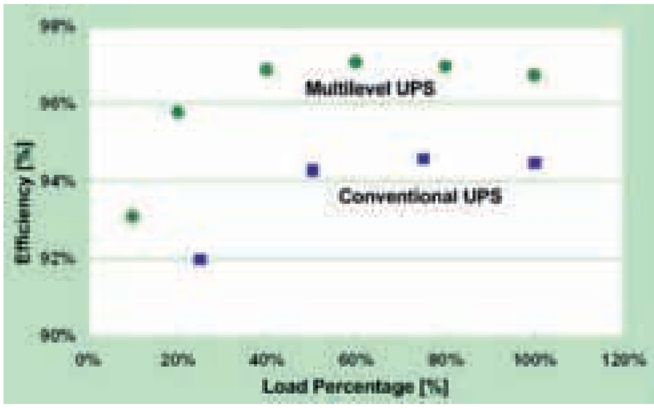

Figure 11 Efficiency curves for a 750kVA UPS.

Double conversion efficiencies of the proposed UPS are shown in Figure 11. In comparison with a conventional UPS, the proposed UPS exhibits a superior efficiency (97%) due to the circuit topology and transformerless design. Note that even for light loads (around 10%) the efficiency of the multilevel UPS is higher than 93%. Thus, the proposed UPS is also suitable for redundant multiple module system where the individual load in each UPS is below 100%.

V. CONCLUSIONS

Critical facility engineers can benefit from the green characteristics of double conversion multilevel UPS to reduce cost of ownership, ensure power availability and optimize project design. The multilevel UPS features higher efficiency due to the substantial reduction of the semiconductor losses and magnetic components. In addition, a multilevel UPS exhibits a dramatic size/weight reduction leaving more room for maintenance and layout reconfiguration Test results confirm the green energy conversion and the high performance required for mission-critical facilities.

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Yukio Kandatsu is a Section Manager at TMEIC.
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The End of the Low Hanging Fruit

by **Christopher M. Johnston, P.E.**

In these demanding times we always try to first pick the low-hanging fruit in our projects: the gains that are easily won with minimal cost and risk. The low-hanging fruit typically has a high return on investment (ROI) and is more likely to receive corporate funding. It also doesn't require much thought or imagination of us, and we are oftentimes lazy.

We typically pick low-hanging fruit in existing data centers that reduce operating costs with little or no capital expenditure. Projects that reduce cooling inefficiency, eliminate raised access floor air leakage at the wrong spots, and keep most of the lights normally turned off are prime examples. These opportunities will exist until we've fixed the older data centers or until they've been shut down. At the same time, we firmly resolve that we won't repeat these problems in the new data centers we design today.

Most of us today design more reliable, more energy-efficient data centers than we did a few years ago. The energy efficiency bar has been raised. RFPs in the northern United States and Canada often require an annual PUE of 1.25 or lower, requiring today's best technology and practices. Here we glimpse the end of the low-hanging fruit. When I design a data center with an annual PUE of 1.25, all of my efforts are restricted to the portion of the PUE greater than 1. At a 1.25 annual PUE, I can only affect 1/5 of the energy consumption while the 4/5 I cannot affect is the IT load. If I can reduce the non-IT energy consumption by 10%, I will reduce the annual PUE by only 2%. The energy efficiency of the IT load becomes much more important than the energy efficiency of the non-IT load. The PUE ceases to be an appropriate metric for data center energy efficiency since it doesn't consider the IT load efficiency.

We must also consider the upcoming changes in computer technology. The ASHRAE TC9.9 committee last year widened the acceptable computer equipment operating conditions to 80.6º F. entering dry bulb temperature. In many locations in the US and Canada we can satisfy these conditions using airside economizer for 8000 or more hours per year, leaving only 760 or fewer hours per year of refrigeration. Once the acceptable entering dry bulb temperature reaches 90º F., the need for refrigeration will disappear and evaporative cooling will suffice. Some owners are already operating at 90º F. and not correcting for humidity at all. Assuming 6% energy loss for air handling and 2%-6% for UPS losses, we can see a potential annual PUE reduction to 1.08-1.16. There won't be any substantial improvement past this point.

SO, WHERE DO WE GO FROM HERE?

1. We must recognize that today's low hanging fruit is mostly picked and won't be there tomorrow.

2. We must become more versed in IT so we think in terms of IT, power and cooling at the same time.

3. We must develop an easily applied metric to replace PUE and measure overall efficiency.

4. We must plan for tomorrow's technologies today.

5. We must take this opportunity to simplify our designs and make them more reliable to meet our client's needs.

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"ENERGY EFFICIENT DATA CENTERS" WITH SEPARATED HOT &

WHY THE VERY BEST COMPUTER ROOM COOLING DESIGNS USE FULL-TIME AIR ECONOMIZERS INSTEAD OF REFRIGERATION

SUMMARY

This article describes a cooling air distribution method being implemented in new and existing rooms, wherever computers are arranged vertically in tall cabinets or racks facing each other in an aisle layout. This new air distribution method is referred to as "separated hot & cold aisles" to differentiate it from the prevailing best-practice method of computer room cooling air distribution where cabinets are arranged in "open" alternating hot & cold aisles (see Figure 1.1- the alternating hot and cold aisles concept is discussed in ASHRAE TC 9.9's Thermal Guidelines for Data Processing Environments). If the goal is to increase cooling reliability in computer rooms with high power density (as measured in watts/ft^2 of floor space) this method is a must to consider.

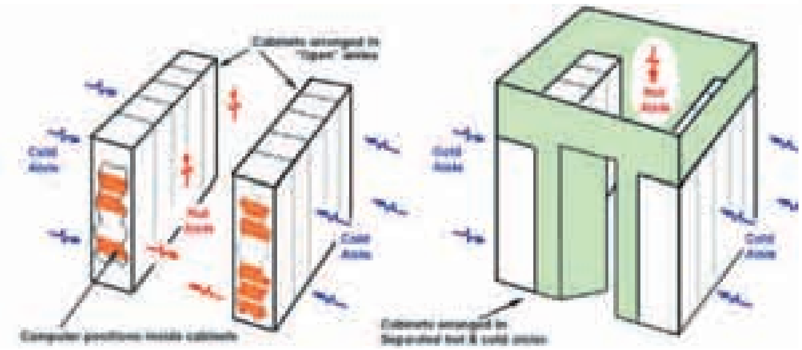

Figure 1.1 Schematic Diagrams of Hot and Cold Aisles

BACKGROUND

Deliberate placement of computers in specialized rooms where they can be efficiently cooled and provided with uninterrupted power is a practice that will continue throughout the service life of buildings being built today. Specialized buildings that house multi-megawatt server arrays connected to the internet are currently being constructed in geographically diverse areas across the globe. Optimizing the total cost of their significant investment in computer hardware causes owners to place the most powerful equipment centrally in order to more efficiently connect them into networks where they can be shared among multiple users, kept secure and have their functions maintained more reliably.

Factors that cause problems in even the most well-designed computer equipment rooms today are:

- "Hot spots" that develop when air entering some computers is much warmer or drier than intended.
- Capacity problems where the entire room becomes a hot spot and runs out of cooling airflow despite the presence of distributed electrical power and spare refrigeration tonnage.

COLD AISLE TECHNOLOGY

By **Jeff Sloan**

- High construction cost and floor space requirements for cooling systems due to desirable redundant equipment.
- High cost of energy and water used to cool computers and heat buildings can significantly increase a company's cost.

If a computer room has both "hot spots" and available cooling capacity, the problem could be undesired recirculation of hot air. Essentially, warm air is being pushed out of a computer and drawn into another computer without influence from the room's cooling capacity. In an "open" aisles room filled to capacity with computers, this problem of undesired hot air recirculation is frequently solved by either removing computers or adding cooling equipment. However, these solutions may lead to other problems as listed above.

Enter the **Separated Hot and Cold Aisles Method.** Typically, the hot aisle is the back end of **a computer cabinet and the cold aisle is the front end. This paper proposes adding a barrier to separate the hot and cold aisles so that a room's cooling capacity is directed to where it's needed most.**

METHODOLOGY

Figure 1.2

Photographs and an accompanying thermograph of computer room with raised floor cooling and "open" hot and cold aisles. Notice the large variant between the top and the bottom each cabinet. The undesired variation in cabinet temperature is caused by the computers inside the cabinets removing air from the cold aisle at a greater flow rate than the building's cooling system is supplying air to that aisle. The result is a "hot spot" between the cold aisles and the equipment, or a hot aisle. Un-cooled air is being pulled from the hot aisle, through the space above the cabinets, and below the (return air plenum) ceiling. For a flow representation of the air movement, refer to Figure 1.1.

The thermograph also shows a related cooling system problem: air supplied by the building's cooling system through the raised floor and into the cold aisle is colder than the desired temperature in the cold aisle, which is typically colder than the mixed air. The air is not mixing in a way that is intended to cool the space and the equipment. The cold aisle might be getting enough "tons" of cooling, but because the air temperature is so cool the result is too low an airflow rate for the upper computers to receive cooled supply air. If the raised floor tiles could mix the air in the cold aisle more thoroughly, there would be less variation in computer inlet temperatures. Some designers prefer overhead cooling systems for this reason, as duct grilles can be adjusted more easily to mix air in the cold aisles. However, even with better mixing of cold aisle air,

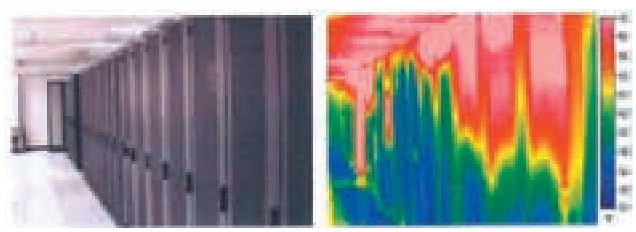

Figure 1.2 Existing Computer Room Photograph & Thermograph

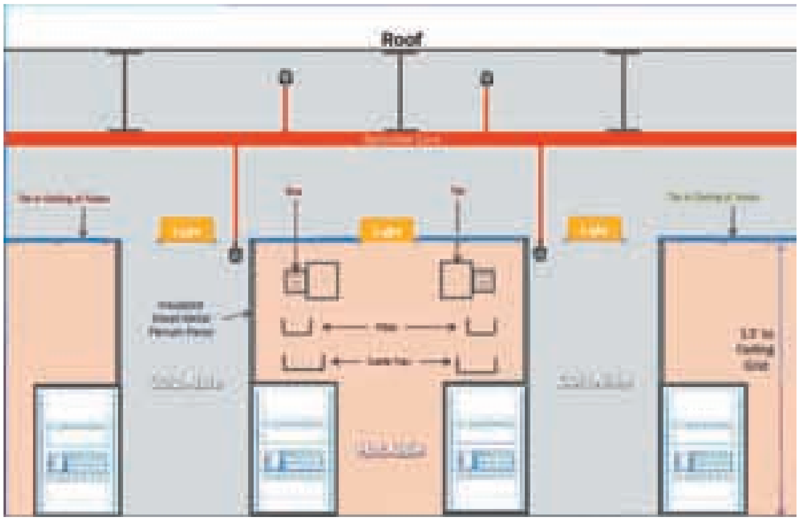

Figure 1.3 Sections of Hot & Cold Aisles

capacity mismatch is still a problem due to computer airflow and wide variation in the resulting appetite for cooled air in different parts of the room. The necessary manual adjustments to achieve the precise airflow and temperature into each cold aisle of a room as computers are moved or added, and cooling system fans switched on and off, are daunting to any facility operator. Another issue to consider is that in a humidified system, the colder air may carry in too much relative humidity for the computers.

Figure 1.3 shows how a physical barrier to contain the heat is erected around the cabinets to contain the hot aisles and the equipment. This causes all the equipment to share the same entering air temperature. In this example, a single-wall sheet metal plenum panel soffit is constructed from the top of the cabinet to the ceiling above and insulated to avoid conducting unwanted heat into the cold aisle (please refer to Figure 1.1).

The features of the barrier system are as follows:

- A variable flow system returns hot aisle air to the room's fans to maintain a near-zero pressure across each separation barrier.
- Because the temperature is routinely so warm inside the contained hot aisle, means of temporarily propping the door or opening dampers in the soffit can be provided, and the pressure temporarily adjusted to allow the room's reserve or redundant air moving capacity to flow cold aisle air into a particular hot aisle while it is occupied.

Figure 1.4 shows the difference in the resulting thermograph with the air barrier and soffit in place. It can be seen that the aisle outside the isolated space is much cooler than the interior of the isolated space and the equipment benefits from a more uniform entering air temperature.

INSIDE THE CABINET

Another undesired heat circulation pattern creating the hot spots in a computer room takes place inside computer cabinets. This occurs when air inside the cabinet is isolated from the surrounding cooled room air by doors on the front and back of the cabinet. The doors can be made of perforated metal or have other openings intended to allow free exchange, but there is still resistance to the passage of air. Within the cabinet, air is circulated for cooling by fans in the individual computers. Most cabinet-mounted computer equipment is designed and installed to pull air from the front (or "cold aisle" face) and push the resulting warmed air out the back (or "hot aisle" end) of the computer. If there is space left for hot air to flow in another direction within the cabinet, air will take the path of least resistance and carry undesired heat back to the computer's front. The example temperatures in Figure 1.5 show how this undesired re-circulation and hot air "short circuit" reduces the capacity and operating efficiency of the room's cooling system.

For this reason, computer rooms with cabinets can still benefit from separated hot and cold aisles but they must be fitted with blank offs between servers and between the vertical mounting rails and

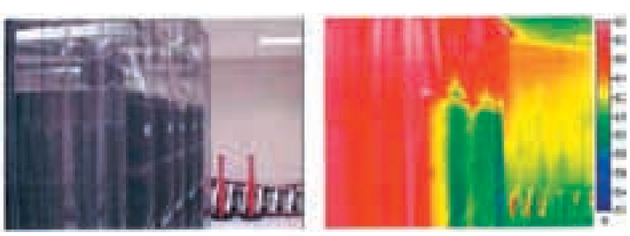

Figure 1.4 Improved Computer Room Photograph & Thermograph

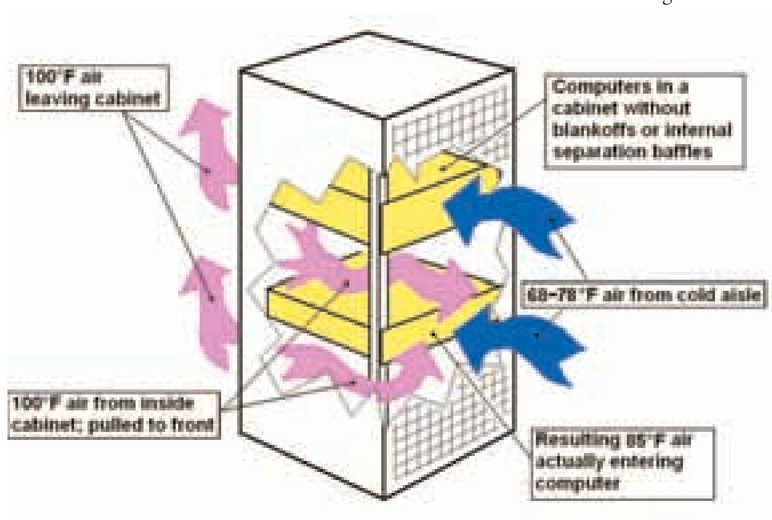

Figure 1.5 Computer Cabinets Recirculation Airflow Diagram

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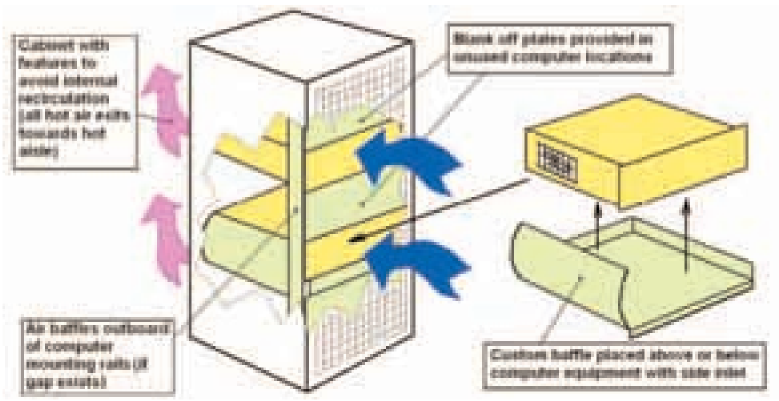

Figure 1.6 Computer Cabinet Front to Back Airflow Diagram

cabinet sides. Most computer room cabinet manufacturers suggest that all cabinets maintain these blank offs (or "air dams") in place. Some cabinet mounted heat producing equipment (such as network switches) do not have a standard air flow pattern but can benefit from creative solutions to achieve the effect of front-to-back airflow (see Figure 1.6). Even where separated hot & cold aisles are not implemented, a cabinet in an open configuration benefits when these blank offs, air dams and/or baffles are applied.

RESULTS OF SEPARATED HOT & COLD AISLES

Consider these implications of successfully conditioning rows of computer cabinets in separated hot & cold aisles, where each cabinet has a good internal separation as shown in figure 1.6:

For new construction, cost savings are possible. The cold aisles and the hot aisles themselves (from floor to slab above) become the "ducts" that allow the cooling air to travel to the computer. Note: It is important to avoid high air velocities in the immediate vicinity of the computers. Avoiding suspended ceilings and raised floors in the new room can create larger cross-sectional areas within the corridor "ducts" to allow more air flow.

Much of the horizontal ductwork within the room can also be avoided.

Wider aisles can be realized as a result of this arrangement, since dedicated floor-mounted computer room cooling equipment or shafts to deliver cooling air to a raised floor plenum are avoided. Wider aisles can result, balancing the temperature and the velocity of the air making the cold aisles more comfortable for service access.

Eliminating overhead ductwork simplifies the ceiling coordination and reduces cost of lighting and fire sprinkler systems.

Avoiding "hot spots" directly contributes to computer system reliability. "Hot spots" in the room and in each cabinet can be avoided entirely as long as the cooling system can supply air at an appropriate rate and remove air from the "hot aisles" at the same rate so that no pressure exists across the separation barrier. If the problems illustrated in Figure 1.2 and Figure 1.5 can be avoided, the cold aisle temperature can be raised without any hot spots occurring.

The rate of airflow necessary to cool the computers can be reduced. This is because most cabinet mounted computer equipment manufactured today has a greater cooling air temperature rise (25° to 60°F) than most computer cooling equipment's effective cooling temperature drop (return minus supply air temperature difference, 15° to 20°F). There are exceptions, but it is the average rise in the entire room that affects the cooling fan size. Air conditioning equipment can be adjusted to make cooler air available to the cold aisle, but that creates the mixing problem shown in Figure 1.2. So smaller cooling equipment (and smaller redundant cooling equipment) can be used to effectively to cool the same room if the cabinets and aisles are separated.

UPS installations and emergency generators can also benefit. Computer rooms that incorporate UPS power and emergency generators to continue operation through utility power outages frequently incorporate thermal storage (such as large chilled water tanks) to allow cooling while the refrigeration system goes through its reinitialization sequence. The thermal storage is considered less expensive than providing UPS power to the refrigeration system. A system that depends only on evaporative cooling of outdoor air will restart instantly when standby power is available. The low fan and pump power requirement can be economically provided with UPS power to increase overall system reliability in an outage. The generator capacity dedicated to HVAC can also be reduced.

Lower cooling system fan motor horsepower can save energy. If the room's cooling system airflow varies to match the computer's actual airflow rate, true variable air volume ("VAV") fan energy savings will occur, along with refrigeration system savings from not having to remove excessive cooling fan heat.

Reducing HVAC activities that normally lead to adding computers saves operator labor. It is possible to design a room with generously sized, separated aisles, cooled with VAV fans and never have to make manual adjustments to the air distribution system during times that computers are added, moved and removed in the space. Airflow to individual computers in a separated aisle system is automatically "balanced" by the computers themselves. If the system includes multiple cold aisles or multiple hot aisles, they can each be controlled as a VAV zone, using pressure sensing damper controls. Non-uniform distribution of computer power density in the room, including very high concentrations of power in some of the

cabinets, can be tolerated without revisions to ductwork, adjusting floor tiles, CFD modeling, or adding local in-rack cooling devices or cabinet exhausts.

Refrigeration system energy can be avoided. The supply and the return air temperatures will be higher at the room's cooling system air handler or fan coil because air is supplied at the desired cold aisle temperature while the separated hot aisles return warmer air than is possible in an "open" aisle system. At these higher air temperatures, a full air economizer can provide many more hours of reduced need for refrigeration and operating economy. For example, in Seattle WA the ASHRAE summer outdoor design dry bulb temperature is below 88°F. Since that temperature is less than the return air temperature in a separated aisle system, an air handler serving a separated hot & cold aisle room can benefit from air economizer 100% of the time. Likewise, since the Seattle outdoor wet bulb design temperature is below 68°F, it is quite possible to provide cooling airflow of 75°F all year without use of any refrigeration at all. Evaporative cooling of outdoor air can provide good cold aisle supply air all year in many West Coast climates as demonstrated in Puyallup at the South Hill Data Center. A refrigeration system may still be desired and provided (in case outdoor air quality is bad) but it might not ever be necessary to turn it on!

Evaporative and economizer cooling can be used in place of continuous refrigeration. Compared to water-cooled-water economizer refrigeration systems commonly dedicated to large computer rooms, the use of evaporative cooling and air economizer saves significant amounts of water and cost for water and wastewater. The air economizer avoids much evaporation because it is not necessary to refrigerate the cool outside air. Secondly, the cooling that is achieved adiabatically (through the evaporative process), including the removal of the sensible fan heat in a blow-through configuration, doesn't create heat of rejection — there is no compressor energy added to it requiring further evaporation.

CONCLUSION

Accepting computer dense spaces as an energy hog with no recourse is no longer a foregone conclusion. The thoughtful space and equipment layout of these rooms, combined with the introduction of separated hot and cold aisles to focus the heat removal process, can tame the energy hog and make it not only energy effective, but energy generating, creating plenty of good energy that can be utilized in a number of ways.

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VICTORIAN TIMES DOWN IN THE DATA CENTER

The shift from preventive to predictive maintenance

by **Brian Hanking**

Over the last 15 years the face of the data industry as we know it today has not only changed but actually come in to being. Way back in March of 1995, "Yahoo!" had only been heard on cowboy movies, eBay would not come into existence for another 7 months, and three whole years (a virtual eternity in this industry) would go by before Google made its debut.

Certainly, the financial industry had always known the necessity of storing all of our details and transactions, but the concept that a profitable business could not just rely on but actually consist solely of data and data storage was science fiction back then.

The level of operating hardware and software grew with the demand. The hardware grew at turns faster, larger and more power hungry than the software it ran. While capabilities grew by leaps and bounds, the intricacies of both hardware and software meant merely rebooting the computer at the first sign of a problem was often no longer an option. Even a minor "glitch" could result in a catastrophic loss of data, which began to mean a catastrophic loss of business.

A multitude of industries enjoyed growth over this period, all reliant on the idea that a computer must be closed down in a controlled fashion. Many companies learned the potential for data loss the hard way and the subsequent market for backup storage devices grew exponentially with data center space being dominated by huge tape storage machines of enormous complexity and cost.

While backup is still important, the cost of business downtime while backup is instigated has become so expensive to these new companies in terms of loss of revenue and customers, that the emphasis over the last 8 or so years has been to avoid using these behemoths wherever possible by preventing power loss to the computers in the first place.

Power loss has always been notoriously difficult to predict (One Fortune 500 company I visited several years back concluded with their historical data that 98% of unplanned power outages were as a result of personnel being in the battery room). Dual redundancy became the flavor of the day and is still used today. Even with dual redundancy there are still some areas of this critical power feed that are the Cinderella of this critical power continuity: the batteries.

Arguably the only piece of Victorian technology to be found in any data center, the humble lead acid battery still stands virtually unchallenged in its ability to provide the instantaneous power required when the AC feed drops out and the uninterruptible power supply needs to draw from somewhere to allow it to continue supporting its all-important computers.

Hi-tech data centers spend untold millions on multiple UPS systems and multiple generators that are maintained at start temperature, 24x7, to be ready the instant they are required. Typically the generators are started once a month to make sure they will work when required, but what about the batteries? Very often they are lucky to get a quarterly or even a semi-annual test or inspection to validate their integrity. This weak link is an area that needs improvement in over 90% of critical power sites in the US today. Regular servicing of batteries is perceived as preventive but it is not. Batteries are not like generators, batteries are chemical devices and their state can change virtually overnight. Testing a battery one week does not prevent it from failing the next week, no more than a personal medical exam one week prevents illness the next. Having a fixed battery monitoring system is essential for the reliable uptime of a data center.

So having established that UPS backup batteries are critical to data security and knowing that battery monitoring needs to be part of the power chain security system is a big step and kudos for getting this far. But as always, there is more to know.

What do you need to consider when looking for a proper and effective battery monitoring system?

Battery monitoring has come as far as the machines it now supports. In the 80s there was much debate about whether measuring the internal resistance of a battery told anything about its state of health and whether it would or could perform. Over the last 20 years it has been categorically proven that it is possible to detect many of the failure mechanisms of a lead acid battery using measurement techniques involving the "ohmic value" of a battery.

There are several companies that have specialized in the techniques for measuring lead acid battery state of health and despite different techniques, most of these companies' products work by informing the user about battery state of health. There are many factors to consider, so how do you know which one to pick?

Price: As always this is going to be a factor but what is the cost compared to one unplanned power outage?

An expensive battery with no monitoring is not as good as a low cost battery with monitoring and, if well chosen, your monitor will last over the life of many batteries so consider carefully where you spend your money.

Ease of installation: This is extremely important and leads to two other critical factors when choosing a monitoring system for your UPS batteries.

(a) **The downtime:** It can be difficult to schedule downtime and the costs involved are very real, not to mention, the potential risks involved both to personnel as well as the infrastructure being supported by the batteries remaining online; assuming that the user can switch strings out while installation is going on. Due to the way a lead acid battery behaves, having a two string system provide 15 minutes of run time will not give the user 7.5 minutes if he only has one string operational. In many cases it may provide less than one minute. Obviously, the disruption and time it takes for installation can have a significant impact on the overall operation of the business.

(b) **The complexity:** The more complex a system and the more wires it has, the more likely it is to go wrong and the more maintenance and inspections it will require in order to keep it running. A battery monitoring system needs to be more reliable than the battery system it is monitoring otherwise it becomes an annoyance of false alarms which very quickly get ignored. Make sure the system uses fiber optics wherever possible rather than cumbersome wiring harnesses.

Expandability: A good battery monitoring system is going to last over the lifetime of many batteries and during these lifetimes the expandability of the system will become an important consideration. Make sure that the system chosen can expand with minimum expense. Systems requiring entirely new control boxes and without adequate connectivity should be avoided. Look for systems with modularity that will only require adding a few components to the present system and where the addition of these components is simple and quick.

Backwards compatibility: Make sure that the system you choose has backwards compatibility. This may not be important or evident in the beginning, but if the system is to last over the life of several batteries then this is an important factor and when you come to add several more strings of batteries to your 30 cabinets of 12 jars then you will be glad you considered this.

Versatility: Ensure that the system you choose can cope with differing voltages of jars in your strings of batteries rather than having to buy a completely separate system just because you want to add a couple of strings of 12 volt jars to your 4 strings of 240 2 volt wet cells. A well thought out battery monitoring system should be able to cope with all voltages of jars on one system. Your chosen battery monitoring system should last years and for the life of many battery banks so don't "put yourself into a corner" on day one.

The less current a system uses to test the ohmic value of a battery the more often it can test. Be careful with this however as once a day is quite adequate for this crucial measurement.

Technical support: However good a battery monitoring system is, technical support from the manufacturer may become important, not only during the initial stages but also later on when staff members move on or if further training is required. A battery monitoring system is a long-term decision; make sure the company chosen is in it for the long haul as well.

Measurement frequency: If you are considering a battery monitoring system then you already know that quarterly maintenance is not going to give you the nine 9s of reliability your business is most likely demanding. So an "ohmic" test every three months won't do it, but what will?

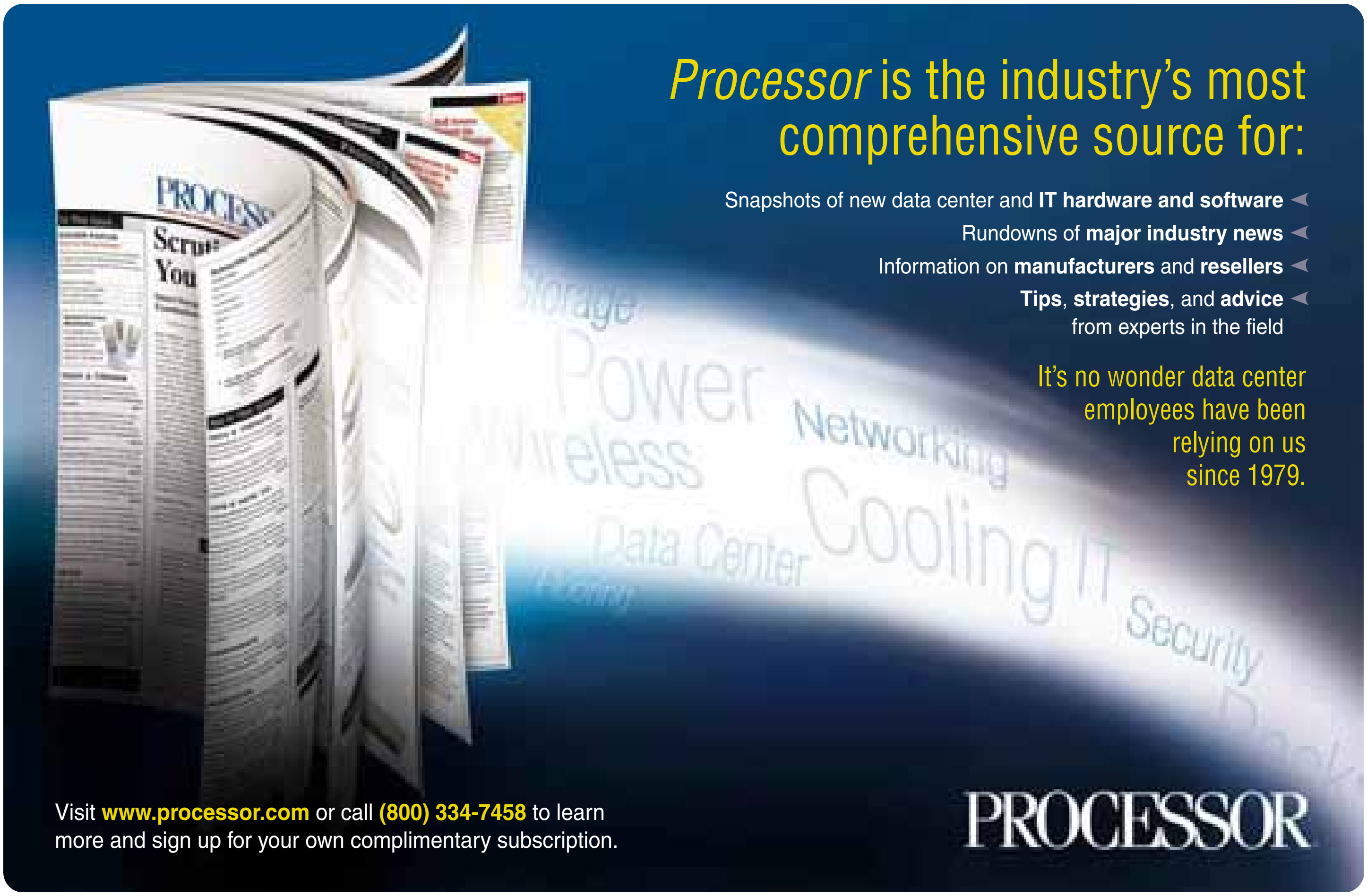
It has consistently been shown that since their introduction, valve regulated lead acid batteries can double their ohmic value in as little as two or three days. A quarterly maintenance schedule may assure your battery health for around two weeks each as an absolute maximum giving you a total of 8 weeks of possible "safe" time, but leaving you totally vulnerable for the remaining 44 weeks of the year.

From this then it can be seen that a battery monitoring system recommending measuring ohmic value every two weeks, or worse every month is going to fall way short of ensuring the nine 9's of reliability that you require. Make sure the system you choose measures daily for optimum reliability.

Global coverage: Your choice of system at your site may become part of a larger requirement for your company. Make sure that the company you choose has reasonable global presence, not only for ordering and shipping of new orders, but also so that unwanted or damaged product does not have to be shipped halfway around the world in order to get a replacement.

Finally: As with all technologies there is more to battery monitoring than first meets the eye, so choose a company that is not new to the technology it uses but one that is not stuck in the dark ages either. Make sure there are plenty of the systems out there and avoid being the "guinea pig" testing new products on your valuable site(s). Make sure the technology is up-to-date but established.

Brian Hanking is the Director of Sales and Marketing of NDSL. He can be reached at bhanking@cellwatch.com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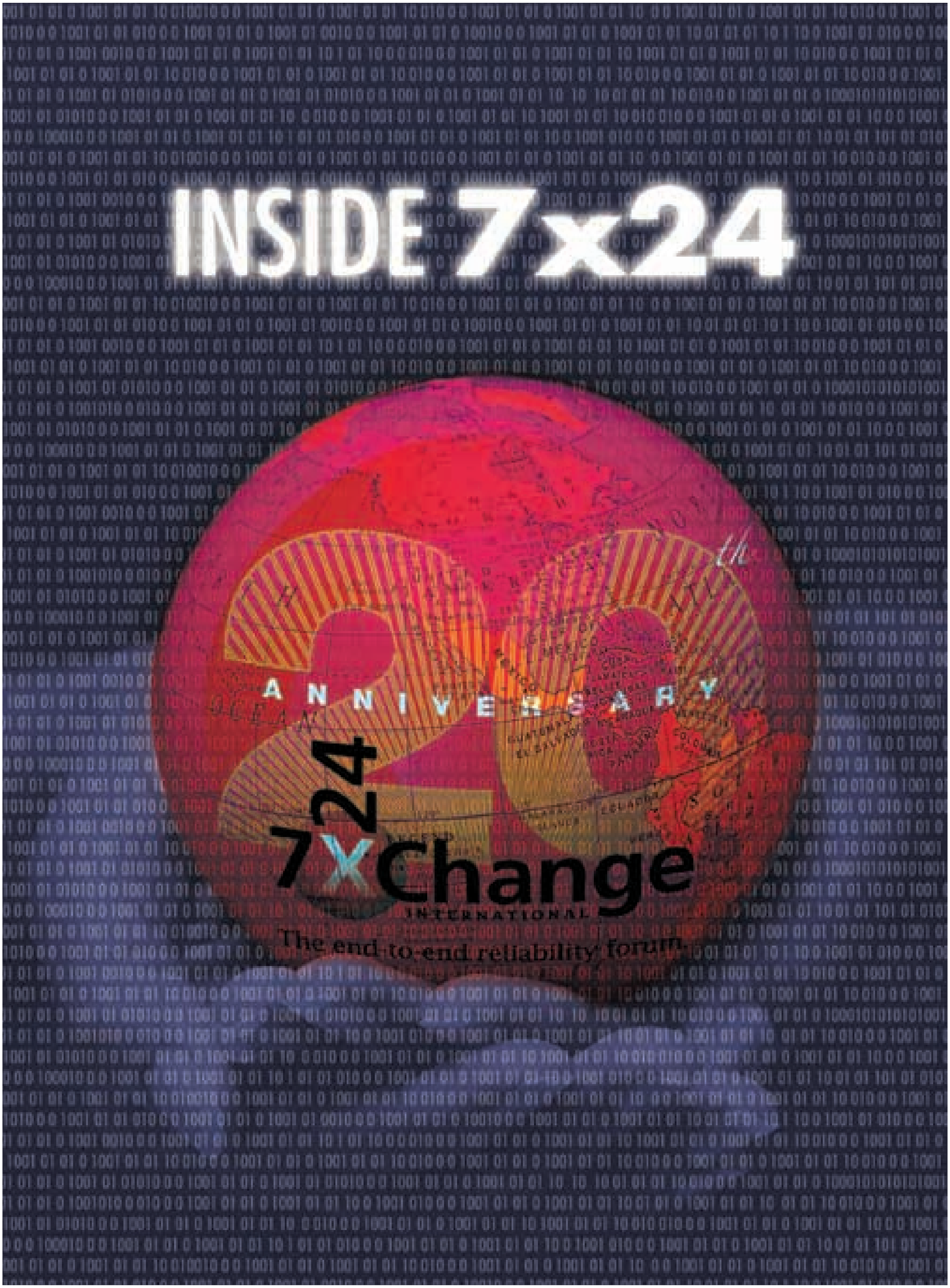
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Commander of the USS Cole, Kirk S. Lippold, kicked off the conference with a keynote address "Leadership and Accountability When It Matters" In his riveting recount of the Cole story, he detailed how leaders must act in the now yet plan ahead, to help organizations cope with complex environments while operating under adverse conditions. Lippold's Five Pillars of Leadership explained his crew's ability to focus and execute as a dynamic team.

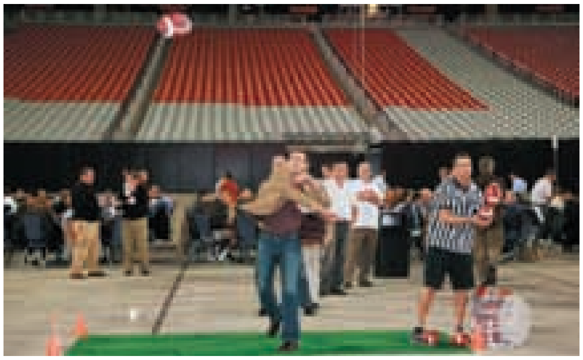
Conference Keynote Kirk Lippold, Commander of the USS Cole, opens the 7x24 Fall Conference in Phoenix, Arizona.

At the 2009 Fall Conference the Keynote Speaker, Commander Kirk Lippold, US Navy (ret.) accepted a donation from 7x24 Exchange International Chairman, Bob Cassilano, to Families United. Through Families United, military families receive support, resources, and opportunities that they need to cope with the absence of a loved one.

Pre Conference workshops included a session from the Department of Energy and ASHRAE on how to achieve energy efficiency in a data center. 7x24 Exchange also partnered with Data Center Pulse to host an exclusive End User summit embodying the conference theme, "The Changing Landscape of the Data Centers".

Steve Sams, Vice President of Global Site and Facilities Services for IBM kicked off Tuesday with a keynote entitled "Achieving Data Center Availability and Energy Efficiency".

The 20th Anniversary celebration continued at the Punt Pass & Kick event at the University of Phoenix Stadium closing with a colorful array of fireworks. Don Beaty, President of DLB Associates, closed the conference on Wednesday with a keynote entitled "The Global Impact on Data Centers".



Attendees participate in the Punt, Pass & Kick event at the Arizona Cardinals stadium.

Members enjoy the vendor sponsored event at the Arizona Cardinals stadium.

From left to right, John Oyhagaray; Paul Fox; John Jackson; Bob Cassiliano; Frank Gialanella; Dennis Cronin and Dave Sjogren.

At the 20th Anniversary Conference 7x24 Exchange recognized its founders, visionaries and long term board members for their contribution of time and talent to the organization.

7x24 Exchange celebrates its 20th Anniversary at the 2009 Fall Conference.

2010 SPRING CONFERENCE HIGHLIGHTS

The Spring Conference themed **"Mission Critical Facilities: The Next Generation"** will be held June 6-9 at the Boca Raton Resort & Club in Boca Raton, FL. It will feature compelling keynotes, a full day pre-conference workshop, concurrent breakout sessions, endless networking opportunities, a spectacular vendor event, and more...

Governor Mitt Romney, will kick off the conference with a keynote entitled **"No Apology: The Case for American Greatness"**. All conference attendees will received a complimentary signed copy of his new book. Bob Bauer, Group Vice President of Emerson & President of Liebert will kick off Tuesday with a keynote entitled "Data Center Evolution". Scott Noteboom, Head of Global DC Infrastructure will close the conference with a keynote entitled "Lower Cost, Higher Performance and Faster to Build - Timing is Right to Have it All" In keeping with the theme, additional presentations on the next generation of mission critical facilities will be offered with topics such as:

- **Real Time PUE Reporting at Digital Realty Trust**
- **By the Numbers: Energy Analytics for Data Centers**
- **Next Generation Data Centers and the Realities of Virtualization**
- **Cooling: A Vendor Neutral Overview**
- **Management Tools for Data Center Physical Infrastructure**
- **Tier 4 EPA Emission Will Impact the Data Center**
- **The Green Grid**
- **Data Center Pulse – EPA**
- **Air + Evaporation = No Chillers!**
- **Virtualization: It's a Networking Problem**
- **Incorporating Next Generation Technologies into our New Data Centers**

In addition to enhanced programming 7x24 Exchange International presents the Monte Carlo Nights Intracoastal Yacht Cruise. Join 7x24 attendees for a delicious dinner on shore followed by a cruise on the Intracoastal waterway. Attendees will cruise in style with a floating casino atmosphere. So wear your gambling attire. If gambling is not your thing, sit back and relax while you sip your favorite cocktail and enjoy the musical entertainment and surrounding views of Southern Florida.

Attendees enjoy the Fall Conference.

Chairman Bob Cassiliano, left, thanks outgoing board member Roy Chapman, right, for his dedication to the association.

THIS EVENT HAS BEEN MADE POSSIBLE THANKS TO THE FOLLOWING PARTNERS:

Chloride, Data Aire, Eaton, FieldView, GE, HP, idGroup, KBD, Klingstubbins, Kohler, Mitsubishi, MTU, PDI, Russelectric, S&C, Simens, Starline, Stulz, Synapsense, Syska Hennessy, Virginia, Walker Engineering, Wrightline.

For the complete Spring Conference program and registration information please visit 7x24exchange.org or call (646) 486-3818.

SAVE THE DATE!!!

FALL 2010
November 14 – 17, 2010
JW Marriott Desert Ridge
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SPRING 2011
June 12 – 15, 2011
Hilton Orlando Bonnet Creek
Boca Raton, FL

For information about sponsoring a 7x24 Exchange event please contact Brandon Dolci, CMP at (646) 486-3818 x108

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Data Center Industry Leaders Reach Agreement on Guiding Principles for Energy Efficiency Metrics

As business demands and energy costs for data centers rise, owners and operators have focused on the energy efficiency of the data center as a whole, frequently using energy efficiency metrics. However, the metrics are not always applied clearly and consistently. To address these inconsistencies, a group of leaders from across the industry met on January 13, 2010 to agree on data center energy efficiency measurements, metrics, and reporting conventions. Organizations represented were the 7x24 Exchange, ASHRAE, The Green Grid, Silicon Valley Leadership Group, U.S. Department of Energy's Save Energy Now and Federal Energy Management Programs, U.S. Environmental Protection Agency's ENERGY STAR Program, U.S. Green Building Council, and Uptime Institute.

The following guiding principles were agreed to:

- Power Usage Effectiveness (PUE) using source energy consumption is the preferred energy efficiency metric for data centers. PUE is a measurement of the total energy of the data center divided by the IT energy consumption.
- When calculating PUE, IT energy consumption should, at a minimum, be measured at the output of the uninterruptible power supply (UPS). However, the industry should progressively improve measurement capabilities over time so that measurement of IT energy consumption directly at the IT load (i.e. servers) becomes the common practice.
- For a dedicated data center, the total energy in the PUE equation will include all energy sources at the point of utility handoff to the data center owner or operator. For a data center in a mixed-use building, the total energy will be all energy required to operate the data center, similar to a dedicated data center, and should include IT energy, cooling, lighting, and support infrastructure for the data center operations.

This guidance is meant to help the industry have a common understanding of energy efficiency metrics that can generate dialogue to improve data center efficiencies and reduce energy consumption. Member organizations are committed to applying and promoting these guidelines to their programs.

A task force, consisting of the organizations listed below, has been created to further refine these metrics and to identify a roadmap for the future. The group also aspires to address IT productivity and carbon accounting in the future.

If you are a member of one of groups listed below, please contact them directly for further details.

7x24 Exchange: eemetrics@7x24exchange.org

ASHRAE: http://tc99.ashraetcs.org

The Green Grid: gdcmetrics@lists.thegreengrid.org

Silicon Valley Leadership Group: tim.crawford@datacenterpulse.org

U.S. Department of Energy Save Energy Now Program:
http://www1.eere.energy.gov/industry/datacenters/contacts.html

U.S. Environmental Protection Agency's ENERGY STAR Program:
ENERGYSTARdatacenters@icfi.com

U.S. Green Building Council: leedinfo@usgbc.org

Uptime Institute: http://www.uptimeinstitute.org

In Retrospect

Gary P. Rackow, P.E.
Vice President of Sales
Active Power
1954 - 2010

Gary Rackow, a dedicated member and supporter of 7x24 Exchange International, passed away unexpectedly Tuesday, March 16th from natural causes. Gary touched many lives throughout his life and career.

"Active Power has lost a kind, talented and inspirational leader. We are deeply saddened by his death," said Jim Clishem, president and CEO, Active Power. "He was a distinguished member of the engineering community, a team player, a committed boss, a devoted husband and a good friend. Our thoughts and prayers are with his family during this very difficult time."

CHAPTER UPDATE
SPRING 2010

After some diligent background work and discussion, we have finally established the new 7x24 Exchange Carolinas Chapter and held our first board meeting.

In addition to select board members, we were pleased to have Bill Leedecke, President of the 7x24 Exchange national organization as well as Dennis Cronin, a founding national member and sponsor of our chapter attend this first meeting.

The 7x24 Exchange national organization has just celebrated its 20th Anniversary at this past Fall Conference in Phoenix. The not for profit organization was first founded as the Uninterruptible Uptime Users Group (UUUG) with a goal to "promote dialog among industry professionals and address the many challenges facing owners and operators of mission crucial enterprise infrastructure". The 7x24 Exchange Carolinas chapter joins other 7x24 Exchange chapters to bring this dialog to a regional level.

It is an exciting time in the Carolinas as we are continuing to enjoy some of the nation's highest profile data center construction projects. Members of the 7x24 Carolinas chapter will discover ways to promote best practices and identify the resources that will facilitate the adoption into their own organizations.

From left to right: John Geib, Andy Ebert, David Knight, Robin Aron, Ellis Zaytoun, Jeff Farlow, Jeremy Zupp. Members not pictured: Dennis Cronin, David Farlow, Peter Holst, Craig Saunders, Marcus Hassen, Dave Soldat, Bob Verdink, Brandon Harris.

Several of the 7x24 Carolinas members attended the national Fall Conference in Phoenix Arizona, where they listened and participated in discussions regarding increasing power and cooling densities in existing enterprise environments. Leading server manufacturers openly discussed where the Mission Critical Industry was going, and the resources and technologies that they rely on to support new trends. All of this information is important to the decision making process not only for new server environments but for sustainable and confident operations of existing facilities.

We are looking forward to using the 7x24 Carolinas Chapter as a conduit for informed discussion throughout the Carolinas. Initial interest in this chapter has come from an exciting mix of end users, governmental representatives, consultants and vendors. Members will provide informed discussion on the broad view of challenges and direction in this important industry.

With the chores of organization now behind us, we are excited about what the future holds, not only for our organization, but also for the industry in the Carolinas. We want to make sure that we do all that we can do to promote an environment that supports future mission critical development regionally.

Our website at www.7x24carolinas.org is an important resource for news and links to activities of the national organization. We suggest that you check back frequently for updates and information about topics and local events.

I am greatly honored to be a part of this chapter and look forward to the opportunity to improve and grow our industry throughout the Carolinas.

Jeff Farlow
Executive Director
7x24 Exchange Carolinas Chapter

GREATER WASHINGTON DC CHAPTER CONDUCTS ITS FIRST MEETING!

From L) to R), back row: Jonathan Litvany – Digital Realty Trust, David Ruppe – Power Loft, Derrick Millard – GEICO, Brian Brobst – Truland Systems, Dennis Cronin – Gilbane Company, Jerry Corbin – VISA

Front row: Ross Rebraca – Hitt Contracting, Melanie Naugle – EDG2, David DiQuinzio – RTKL, Don Miller – Holder Construction, Kenn Stipcak – Mark G. Anderson, Peter Holst – Gilbane Company

Not pictured: John Becker – Freddie Mac, Frank Butler – Fannie Mae

2010 SPRING CONFERENCE

Corporate Leadership Program Partners

(at press time)

Silver Partners

ABB, Active Power, Caterpillar, Cummins Power Generation, Cyberex, DA Data Aire Inc., E1 Dynamics, Eaton – Powering Business Worldwide, PDI – creating the perfect wave, S&C, Schneider Electric, Siemens, Syska Hennessy Group

Key Partners

Chloride, FieldView patent pending, GE Digital Energy Power Quality, hp, idGroup, KBD Group – Kajima Building & Design Group, Kling Stubbins, Kohler, mtu onsite energy, Mitsubishi Electric UPS Division, Russelectric, Skanska Mission Critical, Starline, Stulz Air Technology Systems, Inc., SynapSense – Wireless Instrumentation Solutions, Virginia – YesVirginia.org – Best State for Business, Walker Engineering, Inc – Electrical Contractors & Engineers, wright · line – data center containment solutions

Contributor Partners

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The Data Center Journal, Mission Critical, Processor

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1/3 Page	600	550	500
1/4 Page	500	450	400

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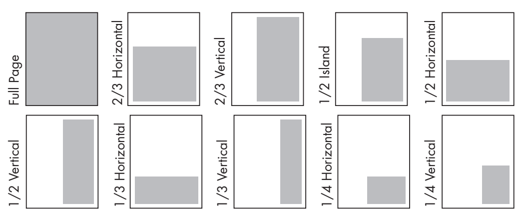

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1/2 Horizontal	7.5″	4.875″
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1/4 Vertical	3.25″	4.5″

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Bylines: All articles should include a brief (1-2 sentence) author biographical sketch at the end of the article, that includes the author’s name, title, affiliation, address, and phone number. Photos of authors are never used. We do not pay authors for contributions.

Visuals: Authors are encouraged to submit photographs and charts, graphs, or other illustration that will help readers understand the process being described, though it does not guarantee that visuals will be used with the article. Submit all charts, graphs, and other artwork separately; do not incorporate them in the body of the article. Indicate caption material separately. We reserve the right to publish submitted visuals.

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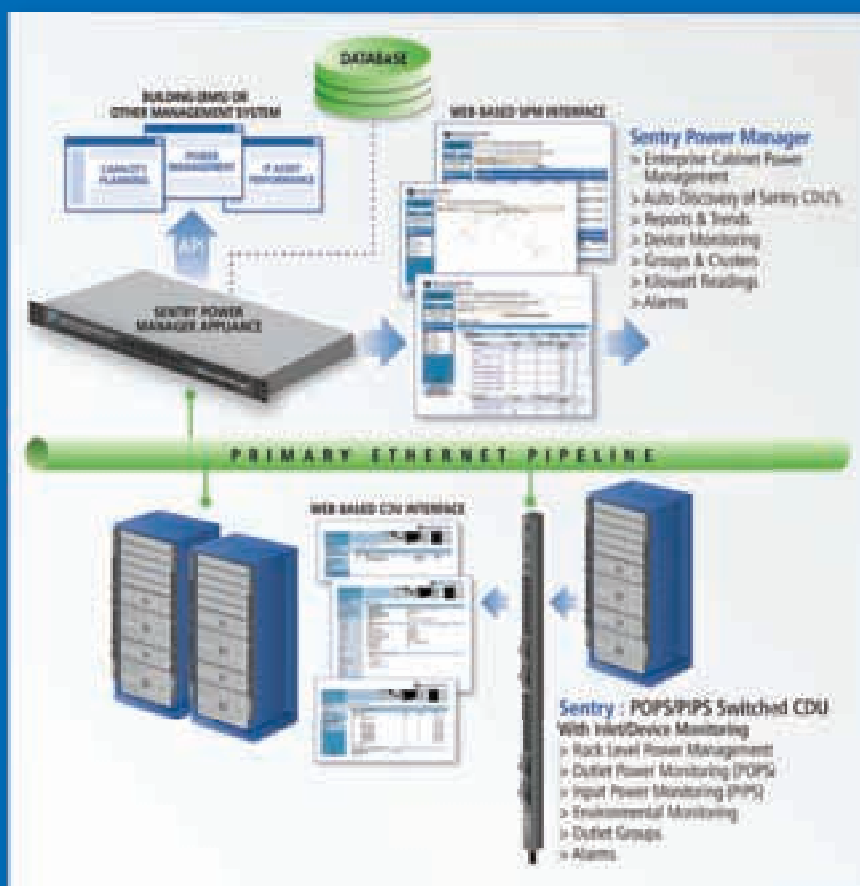

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