

Bringing 415VAC To The Cabinet Level

Conversion Increases Efficiency & Reduces Electrical Costs

by Curt Harler

PERHAPS THE ONLY THING BETTER than running a more efficient data center is being rewarded for doing so. According to a new study by Server Technology, switching current requirements can cut the power losses that data centers experience every time electricity passes through a power converter or transformer.

The premise is simple: Be more efficient, preserve the power that is being metered, and save money.

"With power densities continuing to rise, more efficient solutions continue to be explored, especially as power costs increase and power availability decreases," says Calvin Nicholson, director of product marketing for Server Technology (800/835-1515; www.servertech.com). He sees a move to 415VAC as one of the keys to cutting power losses. Total efficiency gains by implementing a 415VAC design are typically in the 4 to 5% range.

Simply reducing the number of power transformations and operating at higher voltages is a big step in this direction. "This can be done by converting the UPS output from 277/480VAC to 240/415VAC through an autotransformer and eliminating PDU (power distribution unit) transformers," Nicholson explains.

A 4% efficiency gain may sound trivial, but multiply it by the hundreds of boxes in a server room, and it adds up fast.

Reducing the number of transformers and operating at a higher voltage improves efficiency and reduces electrical costs. "Eliminating the PDU transformer alone gets a 2% gain in efficiency," Nicholson says.

Arnie W. Evdokimo, president and CEO of DP Air in Phoenix (www.dpair.com), is among those who like the concept of 415VAC.

He notes that there are always inductive losses on any transformer. "Even a top-rated transformer will eat up power and give off heat," he says. He figures there is a loss equivalent to a load of 3 to 4kVA on a 20kVA unit even when the unit is idling. Eliminate the transformer, he says, and you eliminate its power consumption.

The Way It Is Today

"In a perfect world, you could use 480VAC and bring it down to 277," Nicholson says. But that is not what today's equipment is designed to handle. Rather, he says, the goal is to take it to 415VAC and distribute that to the devices.

Today, most U.S. data centers get 277/480VAC, 3-phase power with voltages measured from line-to-neutral and line-to-line. Computer equipment typically operates

somewhere between 100VAC and 240VAC, single-phase. That means that the public utility's power, delivered to a data center, must be stepped down from 277VAC through isolation transformers before it can power the computer equipment. Typically, this is accomplished by taking the power through a PDU transformer. The transformer steps it down from 480VAC 3-phase to 208VAC 3-phase.

Once past that hurdle, the power goes to a server or computer. Before the power gets to the device's internal power supply, it again is converted—rectified to DC and stepped down to 12VDC.

It does not have to be that way. Although data centers in the United States and Canada are just starting to consider 415VAC power distribution systems, 415VAC already is used in the world outside of North America. In fact, Nicholson's company already provides equipment that works in Europe under just those conditions.

Back in the U.S., the Data Center Pulse group, a new organization dedicated to data center owners, operators, and users, had its first gathering in February 2009. The group posted 10 goals to boost data center efficiency. One of those is to be rid of all transformers and deliver 277/480VAC at the rack level. Among the other "name-brand" groups that are looking into ways to measure, moni-

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tor, and increase efficiencies are The Green Grid, The Uptime Institute, PG&E, and the Lawrence Berkeley National Laboratory.

"Their [DCP's] goal, right now, is more wishful thinking than reality," Nicholson admits, so he suggests that conservation-minded data centers look for the next-best thing.

There are other proposed power distribution architectures being discussed, such as rack-level and facilities-level DC power distribution and 277VAC distribution.

"I have people talking 400-cycle vs. 50-cycle power," Evdokimo says. "A lot of people are trying to go that direction."

Still, both Nicholson and Evdokimo agree that, given the right circumstances, 415VAC has potential.

Pros & Cons

Evdokimo does have some questions on the ROI (return on investment) from a

Key Points

- Changing current requirements to 415VAC can increase data center power efficiency and cut costs.
- 415VAC already is used in much of the world outside of North America.
- Return on investment from a switch to 415VAC is questionable, especially if it requires retrofitting an existing data center.

move to 415VAC, especially if it requires retrofitting an existing data center.

"If you have to get rid of the PDUs and get new equipment and computers that work with 415VAC, it could be more expensive than the savings," he notes. "It could take years to pay off the investment." Because most data centers cycle equipment every four or five years, he adds, there might not be enough time to recapture the cost.

"Now, if the government will give some money to do it, it would make more sense," Evdokimo says.

He adds that the game is different on a new construction project. There, the payoff could be realized more quickly because all new equipment and wiring would be used.

Cabling is another place Evdokimo sees potential for power savings. "If you use 415VAC, the requirements for your wire gauge would be much smaller," he says.

The higher the voltage, the lower the current required for the same work. The savings there could be as much as 40 to 50% over today's standard.

Evdokimo adds that there likely will be a need for tougher computer housings to separate components to prevent arcing. "The bracing inside the boxes would have to be more robust," he says. But those are concerns the European market is addressing.

On top of the cable savings, there are other savings, as well. "Operating rack-level equipment at 240VAC vs. 208VAC will provide an additional 1% to 1.5% efficiency gain," Nicholson says.

"There will be data centers (in the USA) running on 415VAC by the end of the year," Nicholson predicts. In a world where the cost of power is going up and availability is going down, anything that saves money should be on the table. ■



Microsoft To Open Two Large Data Centers

In order to house the servers needed to support its new Bing search engine, Microsoft is preparing to open the doors of two new data centers located in Chicago and Dublin, Ireland, that together will provide more than 1 million square feet of space. The new facilities indicate that Microsoft no longer intends to postpone construction projects; in January, Microsoft announced it would wait to complete the data center in Des Moines, Iowa. The new data centers will be more energy efficient, using free cooling or outside air to cool the servers and facilities. The Chicago facility is located in Northlake, Ill., and will be the size of about 16 football fields.



Study: U.S. Bandwidth Use Has Increased Drastically

According to data compiled by Entropy Economics from the Federal Communications Commission and a handful of industry and company sources, by the end of 2008, U.S. consumer bandwidth totaled almost 717 petabits per second, and U.S. consumers now use about 2.4 megabits per second of communications power on a per capita basis, compared to a mere 28 kilobits per second in 2000. The study attributes the increase to numerous factors, including Wi-Fi in smartphones, the popularity of notebook computers, ebooks (such as the Amazon Kindle), wireless video game consoles, and other mobile devices.

Gartner Studies Worldwide IT Services Revenue

According to research firm Gartner, revenue from IT services jumped 8.2% from 2007 to 2008, with revenue increasing from \$745 billion to \$806 billion. IBM continued to lead across all IT services with 7.3% of the market; HP was second with 4.8% of the market, but Gartner notes that HP's revenue grew by just 1.9% in 2008, which was well below the overall market growth rate. As for the platform space, enterprise networks grew slightly below the market average at 6.8%, but carrier networks showed a very strong growth of 14.2%. Gartner indicates that carriers are looking to transform their infrastructures and business environments to take advantage of opportunities to develop services for new revenue.

Palm Has Another Rough Quarter

Fourth-quarter financial results are in for Palm, and the figures show a \$105 million loss. Although the loss was actually less than what analysts were predicting, it still marks Palm's eighth straight quarterly deficit; however, the numbers did not include the launch of the company's new Pre smartphone, which Palm hopes will generate sufficient revenue to turn its luck around. Palm sold 351,000 smartphones for revenues of \$86.8 million for the quarter, which was lower than usual likely because buyers were waiting for the Pre's launch. Since the new smartphone's launch, Palm has sold more than 150,000 Pre units, although its success was likely hampered by the release of a new Apple iPhone days later.

Annual Energy Savings From Efficiency Gains

IT Load (kW)	1%	2%	3%	4%	5%
250	\$2,190	\$4,380	\$6,570	\$8,760	\$10,950
500	\$4,380	\$8,760	\$13,140	\$17,520	\$21,900
750	\$6,570	\$13,140	\$19,710	\$26,280	\$32,850
1,000	\$8,760	\$17,520	\$26,280	\$35,040	\$43,800
1,500	\$13,140	\$26,280	\$39,420	\$52,560	\$65,700
2,000	\$17,520	\$35,040	\$52,560	\$70,080	\$87,600