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Going Green in the Data Center with Physical Layer Components

Selecting physical layer components with innovative "green" features offers lowers costs and increases productivity and health.

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Introduction

It's become common knowledge that green buildings offer significant benefits to their owners/users in the form of lower energy, waste and water costs; lower environmental and emissions costs; lower operation and maintenance costs and increased productivity and health. A recent study[1] also points out that "builders and building owners are starting to realize that green building isn't as expensive as they may have thought, i.e., a non-residential green building costs about 2 percent more than a traditional, comparable building." And the payback time for a green building "is about three to four years, while over a 20-year period, the payback is four to six times the investment cost."

Considering these findings, many IT companies are keeping a keen eye on data center energy efficiency, space savings and the movement to build sustainable LEED-certified facilities. However, the truth is that "green" is difficult to measure at the physical layer. As we move up the OSI model to Layer 2 (data link) and Layer 3 (network), we encounter active equipment that requires power. Here, it is much easier to calculate actual energy consumption and savings.

While it may be more difficult to determine the value of green in physical layer components, many solutions are available for all functional areas of the data center — and throughout the facility — that can enhance energy efficiency, facilitate space savings, support sustainability and minimize waste. The use of ENERGY STAR servers and high-efficiency power distribution units (PDUs) is sensible, but without the right physical layer components to provide optimal performance, density, scalability and manageability, facilities may not be able to take full advantage of today's more energy efficient equipment and deploy sustainable facilities. Today's building owners and data center managers need to take the environment into account by converging their infrastructure and selecting physical layer components with innovative "green" features.

Lowering Energy Costs

Data centers reportedly use 1-2 percent of the total power consumption in the U.S.[2] and if current trends continue, the EPA's Report to Congress on Server & Data Center Energy Efficiency[3] concludes that the demand for power by data centers would require an additional 10 power plants in the North America power grid. According to a recent study by AFCOM,[4] however, 71.3 percent of members answering their Trends Survey stated that they are actively engaged in 'greening' – with 60.8 percent responding that they have become more power efficient and 51.4 percent reporting greater cooling efficiencies. So, perhaps we are making more headway than the 2007 EPA report assumed.

Today's active equipment not only consumes more operating power, but also must be kept cool. It is estimated that cooling accounts for up to 40 percent of a data center's total energy load. What's more, the cooling process itself is accompanied by excessive energy waste as computer room air conditioner (CRAC) units attempt to compensate for hot spots. In fact, a recent study[5] advised that only 60 percent of the air delivered from air conditioning units in conventional/legacy data centers makes its way to existing IT equipment. One data center in the study[6] was found to have 25 percent of its servers running hot, yet the room cooling capacity was 10 times what it needed to be. That equates to 10 times the cooling costs – a significant and unnecessary expense when you consider that every CRAC taken out of service can save around $10,000 annually in maintenance and operation expense.

Most data centers use a hot aisle/cold aisle configuration to help contain hot air coming from the back of the equipment. However, to take full advantage of this configuration, data center managers should look for solutions that work with equipment enclosures to help maintain separation of the hot air coming out of the back of the equipment from the cold air entering the front. Solutions that accomplish this can significantly reduce the mixing of hot and cold air in the data center, which increases the differential between the inlet and outlet temperatures of a CRAC unit for better efficiency and energy savings. For example, available heat containment solutions that mount atop enclosures automatically monitor heat loads and accordingly regulate fan speeds to pull the correct amount of air out of the enclosure for return to the CRAC units via plenum spaces. This type of system can provide up to 50 percent energy savings when compared to standard hot aisle/cold aisle and enable 100 percent utilization of existing cooling infrastructure by efficiently managing airflow.

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Classifying Green in IT

In the IT industry, there are essentially three ways to look at green—from the plant level, the product level and the system level.

Plant – Green at the plant level refers to efficient, environmentally-sound manufacturing processes and practices. It's about reduced waste, recycling and energy efficient technology deployed at the facility where a product is being made. This could refer to LEAN manufacturing processes that reduce waste, ongoing recycling efforts and the use of technologies like solar panels or lighting controls, or it could be overall environmental stewardship in the surrounding community.

Product – At the product level, green can refer to the materials that make up a product. For example, RoHS-compliant components have significantly reduced levels of hazardous substances like lead, cadmium or mercury. It could refer to overall reduced amounts of packaging or material that goes into getting a product from the factory floor to the end-user.

System – At the system level, green is about products that help the actual customer reduce their impact on the environment. These are the solutions and systems that help companies and facilities enhance energy efficiency, support sustainability and minimize waste.

While going green at the plant level and product level are commendable efforts that need to be widely deployed and recognized, green at the system level is critical. Focus placed on the customer and providing systems and solutions that help many facilities across the world cut down on waste and energy consumption ultimately has the greatest impact.

Several other devices are available for reducing power consumption in the data center, such as power distribution units with remote monitoring capabilities that allow data center managers to activate and deactivate individual outlets or groups of outlets and view information about temperature, humidity, airflow and smoke. Improving airflow around equipment in racks and cabinets is also key to maintaining optimal cooling and the hot aisle/cold aisle configuration. In addition to selecting cable management solutions that facilitate keeping cables away from equipment, data center managers need to deploy common best practices to maintain neat, orderly cables with reduced slack that won't obstruct airflow.

Saving Space

Adding square footage increases a facility's overall carbon footprint and impacts the environment by requiring more materials. In the entrance room (ER) of the data center that houses access provider equipment and demarcation points, space is a significant concern. TIA-942, *Telecommunications Infrastructure Standard for Data Centers*, also recommends locating the ER outside of the data center for security purposes, which can potentially require even more space and materials. In telecommunications rooms (TRs) throughout a facility that connect the LAN to outlying areas, space is also a concern. Wall-mounted, high-density optical fiber and copper patching solutions can save space in both the ER and TR. Many of these solutions also offer user-friendly features to help manage high-density connections in less space, such as easy-to-view labels, swing-out doors for front and back access and intuitive cable routing.

Data center areas like the main and horizontal distribution areas that house power-consuming core switches include hundreds of connections at interconnects and cross connects for connecting to equipment and storage area networks. High-density solutions that take up less space while maintaining manageability also are ideal in these areas of the data center. Ultra high-density patch panels are available today that accommodate 96 fiber or 48 copper ports in just 1U of rack space for double the density of traditional panels. Angled patch panels provide left or right patch cord routing, eliminating the need for horizontal cable managers and providing up to 27 percent space savings in the rack. The racks themselves also can be designed to provide more space efficiency, and high-density vertical cable managers can effectively handle hundreds of cables routing to and from the patch panels and equipment.

Space is also a concern in cabling pathways that connect various functional areas of the data center, as well as TRs and individual workstations throughout a facility. When larger or additional pathways are needed to accommodate the growing amount of cables and connections, facilities use more material and have a higher carbon footprint. Within the data center pathways, optical fiber and copper pre-terminated solutions with bundled cable assemblies provide a smaller diameter that eases installation and cable management while requiring less space in pathways. Furthermore, pre-terminated solutions require less packaging, fewer consumables and reduced installation and labor. This means energy and waste savings throughout the manufacturing and supply chain process, all the way through to deployment. Studies show that in instances where the performance of the pre-terminated solution allows for the use of short links, this can translate to up to 40 percent material reduction in data center cabling topology by reducing slack between cabinets installed in close proximity. In outlying backbone and horizontal pathways that connect TRs and workstations, smaller diameter cables and patch cords also can save labor and significant space.

Improving Performance

As the core asset that connects users to the applications they need to communicate and perform daily business transactions, transmission performance and scalability across the data center and network are also extremely critical. But how does this impact the environment? When network components provide the highest possible performance and scalability, they not only support the very latest applications like 10 gigabit Ethernet, but they also have the potential to support future applications. The longer the network components last, the more product obsolescence is avoided, waste is reduced and facilities can be overall more sustainable.

High performance cabling components also allow data center managers to effectively take advantage of efficiency practices like server consolidation and virtualization that require more bandwidth. IT managers would be wise to deploy proven high-performance cabling components to keep up with bandwidth demands and ever-changing technology. Solutions like pre-terminated optical fiber and copper cable assemblies offer superior performance because they are factory terminated. These solutions can also be easily reused and redeployed throughout a data center to accommodate future moves, adds and changes without needing to purchase new components and unnecessarily add to the waste stream.

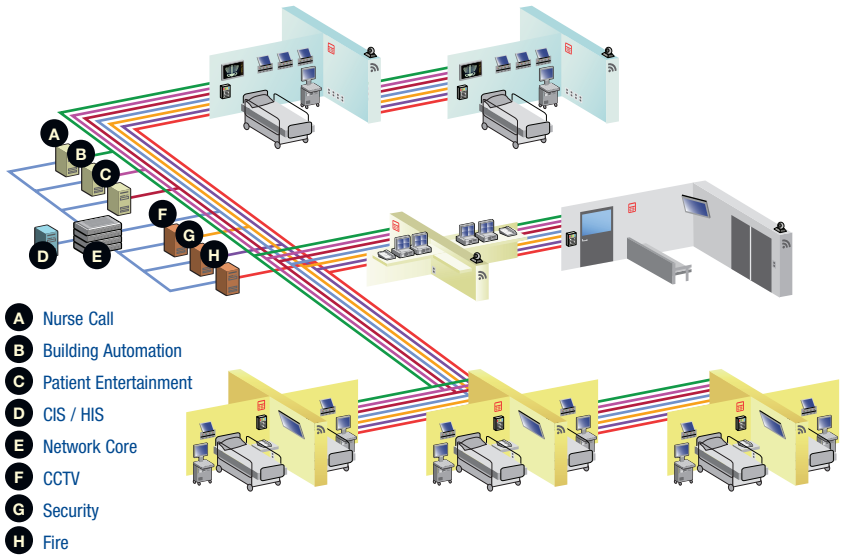
There's More to Going Green

While selecting the right network components can help reduce environmental impact and support energy efficient operations throughout the data center and LAN, there is much more to going green. Going green is about working smarter and more efficiently across all systems and operations within a facility. That's where IP convergence comes in.

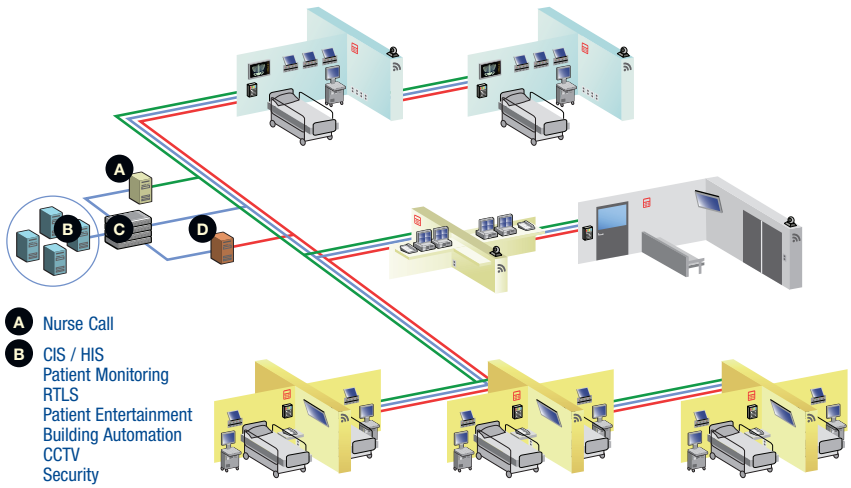
In recent years, Ethernet and IP have advanced to the point where it can now be used to transmit voice, video, security, industrial control and building management information as data signals across the network. Where facilities once had several proprietary systems running over their own cabling to their own equipment, IP convergence allows several building operating systems to run as open networks that use the same cabling media and send data signals using a common protocol. This eliminates a lot of unnecessary cabling, equipment and material. For example, many hospitals used to deploy separate coax networks for delivering TV and entertainment to patient rooms and waiting areas and another copper network for delivering Internet access and telephony. With the advent of voice over IP and video over IP, those systems can now run over the same network infrastructure.

In addition to reducing the amount of cabling and equipment, IP convergence enables facilities to improve efficiency of operations. Anytime operations are made more efficient, time, labor,

Non-converged Hospital Infrastructure



Converged Hospital Infrastructure



By converging the infrastructure in a typical hospital environment, communications flow is optimized and a significant amount of cabling, equipment and material is no longer necessary.

materials and personnel are reduced, which significantly cuts down on waste. With IP convergence, data from various systems can be centrally managed from one interface vs. separate equipment and more easily shared between applications for simplified building operations. For example, a network login can more easily interface with the security access control system to make sure the user did in fact enter the building. Security personnel can check surveillance cameras from anywhere on the network, or even wirelessly from remote locations.

Critical alarms and notifications from life-safety systems can interface with the corporate LAN and phone system to send alerts to PCs, pagers, and even cell phones of those responsible for facility management. Lights can automatically go on in an evacuation situation, and air-handling units can automatically shut down when smoke is detected. The possibilities are endless.

Total IP convergence is not yet a reality, and many systems are still deployed separately. However, as this way of designing and deploying building systems comes to fruition, it will ultimately result in overall simplified, efficient operations that significantly reduce waste and produce green, sustainable facilities.

Green Physical Layer Components

- Heat containment systems can provide up to 50 percent energy savings when compared to standard hot aisle/cold aisle and enable 100 percent utilization of existing cooling infrastructure by efficiently managing airflow and providing hot aisle/cold aisle containment.
- High-density racking systems can provide a 60 percent reduction in floor space requirements while enabling scalability and easy reconfiguration.
- Power and thermal management products save space, monitor and control temperature and deliver efficient three-phase power distribution to the cabinet for better load balancing, increased airflow and reduced material usage.
- High performance 10/40/100 gigabit Ethernet cabling systems offer top performance and longer lifecycles to reduce the occurrence of product obsolescence. Systems with smaller diameter cables enable higher densities, or space savings, and improved airflow for energy efficiency.
- Pre-terminated optical fiber and copper cabling systems significantly reduce installation and waste, provide up to 40 percent material reduction, offer high density for space savings and ensure a longer lifecycle due to performance and reusability.
- High density patch panel systems maximize space and provide scalability, while angled patch panels provide 27 percent space savings per rack and facilitate intuitive cable management and improved airflow.
- IDC systems reduce floor space and improve material usage due to cross-connect cable vs. patch cords.
- Fast, simple-to-use fiber optic field-installable connectors can significantly reduce installation labor and waste on-site.

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