Holistic Energy Efficiency

Holistic Approach Is Key to Sustainability

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There's more to "going green" than choosing eco-friendly network components – you need to commit to planning, operating and growing more flexibly and efficiently for the long term.

Data centers reportedly use one to two percent of total power consumption in the nation. The EPA's "Report to Congress on Server & Data Center Energy Efficiency" in 2007 concluded that if the demand continued, the demand for power by data centers would require an additional ten power plants in the North American power grid.

The demand did indeed continue. Even as energy costs are soaring, data center (DC) traffic continues to grow as more mission-critical business is transacted online and digital information flow becomes exponentially larger every year. Considering these findings, virtually all IT-based companies are moving towards implementing energy efficiencies and seeking ways to conserve space in their DCs. AFCOM's 2009/2010 Data Center Trends Survey revealed that over 70 percent of its members reported they were actively engaged in implementing 'green' initiatives to improve cooling efficiency and power management at the infrastructure level.

Reducing energy usage and costs is an important goal, to be sure – but it is just part of the story. This article explores how energy efficiency fits into the larger picture of overall sustainability. To be sustainable over the long term requires the holistic planning, designing, building and operating of an optimized data center infrastructure – one capable of delivering high performance and reliability, while still maintaining flexibility and scalability to meet data rate and bandwidth needs for decades to come.

PLANNING AN OPTIMIZED DATA CENTER INFRASTRUCTURE

For IT-based enterprises, the data center is the core asset that connects users to the applications they need to communicate and perform daily business transactions across the network. In other words, DC equipment and systems must be able to support all business operations.

The investment of time and materials associated with DC deployment is significant. In addition, its environment is constantly changing. New servers, storage devices, network gear and communications links are routinely moved, added or changed to maintain, expand or improve service. And, since 24/7 uptime is usually critical, the deployment of these moves, adds and changes must be accomplished quickly, with little or no disruption to existing operations.

In planning for an optimized data center infrastructure, several factors need to be considered:

- Planned growth of the network and a realistic assessment of current and future requirements for data traffic and storage
- Level of security required by the network
- Anticipated frequency of moves, adds and changes

- Life expectancy of components, including network hardware and the cabling infrastructure
- Physical space allocation (costs per square foot) and cable/connectivity installation density
- Power management and air flow (cooling) management
- Ongoing cable management and administration

While much of the network equipment is typically replaced in 3- to 5-year cycles, the cabling infrastructure is expected to serve multiple generations of devices over a 10- to 25-year period. The life expectancy of a well-planned optimized infrastructure should fall at the upper end of that scale. Detailed holistic DC planning at the front end can reap dividends down the road, especially when it comes to conserving energy, reducing energy and operating costs, and delivering lower total cost of ownership (TCO) and excellent ROI.

OPTIMIZE PERFORMANCE WHILE CONSERVING SPACE

Space allocation is a huge issue in data center planning and management. The challenge is to use available space most efficiently and effectively, since adding square footage increases a facility's overall carbon footprint. At the same time, data center owners must ensure that the network is available 24/7 and provides the robust performance, capacity and reliability users demand and expect.

In designing and planning the optimized data center infrastructure, it is highly recommended to specify high performance network cabling and connectivity components right from the start. This 'future-proofing' approach ensures that the installed system will have ample bandwidth and scalability to meet current needs and allow headroom for future growth. The longer the components last and the more product obsolescence is avoided, waste is reduced and facilities become more sustainable over the long term.

In today's DC marketplace, one can source innovative infrastructure products and solutions designed to deliver excellent transmission speed and performance in high-density, space-constrained installations. Examples include:

The 3 efficiencies: Power, Cooling, Density

- **High performance 10 gigabit Ethernet cabling systems** offer top performance and longer lifecycles to reduce obsolescence. Wall-mounted optical, high-density optical fiber and copper patching solutions and connectivity components are designed especially for use in space-constrained, high-density installations.

- **Pre-terminated cabling assemblies** are pre-bundled and tested by the manufacturer at the factory. Initially more costly, these fiber- and copper-based products offer superior electrical performance and mechanical reliability in short and long channels, while facilitating rapid 'plug-and-play' deployment by eliminating the need for field terminations. Pre-terminated cables are reusable and can be reconfigured and repurposed as needed to accommodate moves, adds and changes. In addition, pre-terminated cable assemblies require less packaging, fewer consumables with less waste, and they significantly reduce installation and labor time and costs.

- **High-density racking solutions** offer a high degree of modularity and flexibility, and can provide up to 60 percent reduction in floor space requirements, while enabling scalability and easy reconfiguration. Modular racks can be tailored to specific applications and their design facilitates faster and more convenient cable routing, management and maintenance. Manufacturers of these space-efficient systems typically also offer cable management tools and techniques.

IMPROVE POWER, COOLING AND AIR FLOW MANAGEMENT

Conserving energy through efficient power management and cooling strategies is, of course, an essential part of long-term sustainability. Today's active equipment not only consumes more operating power, but also must be kept cool. In fact, cooling accounts for up to 40 percent of a DC's total energy consumption.

A Power Usage Effectiveness (PUE) ratio is used by many organizations to assess data center energy performance. PUE is calculated as the total power supplied to the DC divided by the power consumed by the IT equipment. Typical data centers have a PUE of 2.5, while best-in-class centers have a PUE of 1.6 – a goal worth striving for.

A key step toward lowering energy usage and costs is the ability to understand how power is allocated. Monitoring the power draw at the cabinet level using metered power distribution units (PDUs) with a remote monitoring feature allows a real-time assessment of static state environmental conditions and provides the opportunity to quickly remediate undesirable changes. In addition to monitoring temperature and air flow, some remote monitoring devices can also detect humidity, dew point, smoke and air pollution, and send alerts to designated cell phones and/or email addresses.

On the cooling side, deployment of high-density IT equipment can push the average enclosure heat load into the 10-15Kw range, forcing a re-thinking of the 'hot aisle/cold aisle' concept traditionally used in many data center layouts. Poor separation

between the supply (cold) and return (hot) air has caused many DCs to be oversupplied with many times the amount of cold air than is really necessary – an enormous waste of energy.

Today there are adaptive heat containment and air flow management solutions designed to help maintain separation of the hot air coming out of the back of the equipment from the cold air entering the front. These devices can significantly reduce the mixing of air flows, which in turn, increases the differential between the inlet and outlet temperatures of a CRAC (computer room air conditioner) unit for better efficiency and energy savings. For example, heat containment units that mount atop enclosures automatically monitor heat loads and regulate fan speeds accordingly to pull just the right amount of air out of the enclosure for return to the CRAC units via plenum spaces. This type of system in the data center's computer room can provide up to 50 percent energy savings when compared to standard hot aisle/cold aisle cooling. The system also enables 100 percent utilization of the existing cooling infrastructure by more efficiently managing air flow.

IP CONVERGENCE CAN STREAMLINE THE INFRASTRUCTURE

In recent years, IP (Internet Protocol)-enabled Ethernet has advanced to the point where it can help reduce environmental impact and support energy efficient operations throughout the DC and LAN (local area network). This consolidation of functional signal transmission systems – voice, data, video, security, building management and more – onto a single IT platform allows significant streamlining of the cabling infrastructure.

Where facilities once had multiple proprietary systems, each running over its own cabling and hardware, IP convergence allows systems to share and transmit signals over a common, standards-based protocol using the same physical media. This eliminates a great deal of unnecessary cabling, equipment and material, facilitates maintenance and troubleshooting, and increases overall operational efficiency. Furthermore, network command-and-control and administration through a single centralized interface helps to increase security levels, which can be reinforced using advanced security methodologies such as firewalls, authentication tools and VPNs (virtual private networks).

Any time operations are made more efficient and reliable by reducing wasted time, labor, materials and energy resources, an enterprise reduces its carbon footprint going forward. The journey towards holistic energy efficiency and sustainability need not be implemented all at once, but rather can be achieved in incremental steps, with each step leading towards a more sustainable future. ■

Pre-terminated cable assemblies, such as the Belden IBDN System 10GX shown here, are bundled and tested by the manufacturer prior to installation. Pre-terminated cabling offers "plug-and-play" convenience and are reusable and can be reconfigured quickly to accommodate network moves, adds and changes.

Well-designed high density racking systems offer a high degree of modularity and flexibility, while conserving floor space and facilitating faster, more efficient cable routing, management and maintenance.

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