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Technical Article

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The costs of keeping cool

Electricity has always been a significant overhead in an environment where data processing, data transmission and data storage are the primary functions. However, typically Total Cost of Ownership (TCO) models in data centers have tended to focus on driving down the cost of the IT equipment rather than seeking to optimize the energy expended in keeping it cool. This is perhaps understandable when energy costs are low but at a time when they are not only at an all time high but also expected to double in the next ten years, a rethink in strategy which recognises the role of energy is certainly advisable. Critical to this is managing the cooling requirements given that an estimated 40 percent of a data center's overall power is used for this purpose.

The complete picture

A simplistic approach to the energy equation perhaps suggests that it should not be a focus for data centers. On average, the performance per watt of a server doubles every two years, resulting in a constantly reduced cost per performance and a constantly higher performance per unit. However, this is certainly far from the complete picture. Power capacity is increasing exponentially – almost doubling since 2000 – as data centers scale their infrastructure to keep pace with demand for processing and delivering increasing quantities of video, voice and data through a vast global network of several billion devices. Business needs continue to outstrip the improvements in server performance, meaning that every year, the number of server units is growing and the increased density of those servers brings with it challenges in terms of accumulated heat load 'hotspots'. And, as business operations become ever more reliant on data centers for business continuity, so the need increases for more expensive designs which try, as far as is possible, to prevent any interruption to the IT network. Energy costs are therefore now becoming very much a focus as data centers seek a more transparent approach to metering, monitoring and controlling their energy use.

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Metering, Monitoring & Controlling

It is a fairly obvious point but one worth making nonetheless that in order to understand its energy consumption and how that can be optimized, a data center needs to have a means of measurement. Many data centers actually run at temperatures significantly lower than that required by the IT equipment and recognising this fact can be a very useful starting point. Energy benchmarking is key to improving energy performance, providing a top level indicator of potential savings. It establishes a baseline for energy use in a typical facility, provides comparisons against similar facilities, identifies operational or maintenance problems, highlights areas for potential improvement and establishes best practice for incorporating into future designs.

Monitoring and control systems need to be put in place to keep track of how and where energy is used within a data centre. Such systems are designed to provide integrated metering and monitoring to detect and respond to a variety of events that can not only assist in reducing energy consumption but also help warn of situations that actually threaten the operation of the data center.

Cooling

As already indicated, high quality and reliable cooling systems are an important feature of any data center, helping to avoid hardware malfunction and therefore maintain the all important continuity of service on which a center's customers are reliant. If an effective cooling management strategy is not employed, the air flow will be dictated by a data center's physical layout and the characteristics and positioning of its IT and cooling equipment. The means to prevent hot air and cold air mixing, often referred to as Hot/Cold Aisle design, is a fundamental goal in data center cooling technology. This involves the effective management and control of air flow to help prevent short-circuiting of cooling systems, isolating the hot exhaust air from the cool air supply and thereby lowering the load of the cooling unit and maximizing efficiencies. In fact, the simple act of ensuring that cooling units are moved closer to IT equipment can reduce cooling costs by more than 30 percent compared with traditional approaches to cooling. The use of filler insulation panels within racks to isolate the hot air from the cold air can also reduce wasted energy in closed rack cooling while independent cooling units can be used for equipment in different function rooms to ensure that cooling capacity is distributed on an 'as required' basis, again reducing unnecessary power consumption. 'Free cooling' technology can be employed using filtered external fresh air, with the added benefit of creating a positive air pressure to effectively block dirt from the outside, ensuring a clean environment.

Active Energy Management

I have already spoken of the importance of recognising the complete picture. While cooling is a very important factor, integrated systems not only monitor cooling efficiency but also many other features which can impact on the overall energy usage. Central to this 'Active Energy

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Management' approach is the need for transparency in power flows. Current consumption and power flows need to be analyzed through power monitoring devices, E-counters and communication-capable circuit-breakers. Through communication interfaces, these devices can be integrated into high-level building automation and energy management systems that consider energy efficiency in a much more holistic way, providing monitoring and control through the integration of all data from the building control, fire safety, security, lighting and power systems. Energy reports can be generated by these building automation and control systems, with the data retrieved from the process units which record the values delivered by the system's field devices. Trends can be established from a number of different reports including energy consumption, energy costs, CO2 emissions and comfort requirements.

Cost shift

There has undoubtedly been a shift in terms of the TCO in a data center. No longer is it the cost of the IT equipment that represents the largest element but rather the means through which that equipment is powered and cooled. With energy costs only set to rise and the seemingly insatiable demand for more and more business applications requiring increased capacity from data centers, the spotlight on energy costs will become even greater.

For more information on the data center solutions from Siemens please refer to www.siemens.com/bt/datacenters

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On January 1, 2010, Rajiv Sivaraman became responsible for the setup and operation of the new Market Development Board for Data Centers. Rajiv has spent his professional life spanning over 18 years in the field of Industry, Infrastructure & Energy sectors with specialization in Project Management, Marketing & New Business/Market initiatives.

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Industry Automation, Industry Solutions, Mobility und Osram. With around 204,000 employees worldwide (September 30), Siemens Industry achieved in fiscal year 2010 total sales of approximately €34.9 billion. www.siemens.com/industry

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