Network change

Across the globe, enterprises are responding to increased pressure to adopt greener networking strategies in their data centres. Until now, this has often resulted in increased expenditures but this is set to change. ADVA Optical Networking's Christian Illmer (below) explores new networking technologies that could actually reduce both a data centre's environmental impact and its budget

In May 2008, the U.K. suffered its worst power blackouts in over a decade. It was reported that 11 power stations and generation units experienced significant service disruptions, with some power stations shutting down completely. This resulted in over half a million homes and businesses losing power for most of the day. However, it also resulted in the cost of wholesale electricity increasing 35% to a new record high.

While the National Grid blamed the outages on coincidence, many commentators believe this was a further warning that the U.K. is unable to sustain the current demand for power. This has brought the IT industry back into focus as one of the nation's largest energy consumers. Even though IT managers may be resilient to the media attention, they are unable to ignore the continued hikes in power costs and the subsequent budgetary implications. Even more than this, IT managers must recognise that power availability is no longer a certainty and that alternative solutions must be explored.

In a recent report from the Uptime Institute, analysts found that over 42% of data centre managers expect to run out of power within two years, while 39% expect to exceed cooling capacity within the same period, rendering them unable to meet the operating requirements of their high-density servers, storage and networking equipment (see Figure 1). Gartner have found similar results, noting that over 50% of the world's data centres will run out of power by 2008. If this is true, some analysts are predicting that many of the world's largest cities, including London, will have to initiate a series of "brownouts" as early as 2009.

While continued rises in power costs have spurred some businesses into action, others have so far absorbed the additional increases. This has resulted in power costs

becoming the second largest expense in data centres after staff wages. Analysts at IDC believe that by 2010, U.S. businesses will be spending 70 cents on energy for every dollar they spend on computer hardware. This is an increase of 20 cents, from 50 cents per dollar in 2007.

However, this pattern cannot continue. The impact of the sub-prime mortgage crisis is still reverberating across the globe and as many countries sink further into recession, businesses do not have the resources to increase their IT budgets. Furthermore, new government legislation is starting to take effect. The Renewable Energy Strategy published by the U.K.'s Department of Business Enterprise and Regulatory Reform stated in June 2008 that all new commercial property, including data centres, must be zero carbon by 2019. Similar measures are also expected to affect other European countries soon.

Ultimately, the underlying network architecture, particularly the lower layers of the OSI Seven-Layer model, i.e., Layer 1 and Layer 2, are the key enablers to transforming data centres from power-hungry drains to energy-efficient resources.

Although some firms may be slow to adapt to energy-efficient and greener networking technologies, others are not. Citigroup is due to open two data centres this year designed to achieve Gold-certification in the Leadership in Energy and Environmental Design (LEED) from the U.S. Green Building Council. The data centres, located in Frankfurt, Germany and Austin, Texas are expected to reduce energy consumption by 75% and lower annual carbon dioxide emissions by over 11,000 tonnes. Fujitsu Services is also opening a new data centre in London that halves energy consumption, saving enough power to fuel over 6,000 homes for a year, and reduces carbon dioxide emissions by 10,000 tonnes. When fully loaded, the data centre will achieve a Power Usage Efficiency (PUE) of 1.6 and Data Centre infrastructure Efficiency measure (DCiE) of 62% compared to current data centres that measure PUE 3.0 and DCiE 33%.

Until now, many businesses have been reluctant to adopt greener networking methods, presuming them expensive and inefficient. But as business and economic conditions become increasingly difficult, IT managers are being forced to rethink their networking strategies. In a recent survey conducted by the U.K.'s Corporate IT Forum, 81% of businesses have deployed or are starting to deploy green IT solutions, especially in their data centres. For some companies, especially larg-

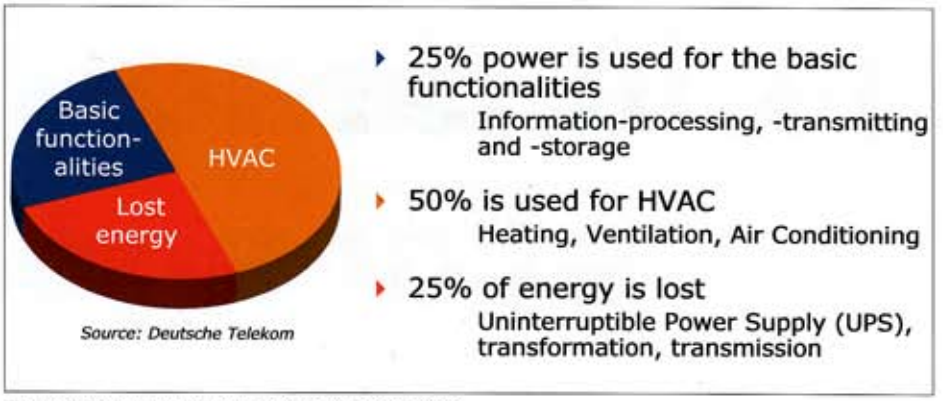

Figure 1: How power is used in current data centres

er organisations such as Google and Microsoft, this means relocating data centres out of cities and closer to sources of renewable energy, e.g., rivers for hydropower. Of course, data centre relocation not only reduces power costs but also lowers operating expenses, e.g., rent. However, for other businesses green IT means restructuring their current data centres to develop a streamlined and scalable IT infrastructure that reduces server sprawl, eliminates unnecessary equipment and simplifies the number of technologies being used.

The effects of streamlining a data centre's IT inventory, both on budget and on the environment, can be immense. Until now, green I.T. has been focused primarily on servers and storage, where trends including virtualization and Information-Lifecycle-Management (ILM) have helped to increase energy efficiency and simplify operations. Many analysts believe that these applications, which encourage shared resources and increase server utilization, are the simplest route to greener data centres. However, to successfully deploy these applications, IT managers need to reassess their network infrastructure.

Ultimately, the underlying network architecture, particularly the lower layers of the OSI Seven-Layer model, i.e., Layer 1 and Layer 2, are the key enablers to transforming data centres from power-hungry drains to energy-efficient resources. Current data centres are composed of a number of individual Layer 2 network fabrics, each requiring its own specific network protocol, including Fibre Channel (FC), InfiniBand (IB), Ethernet and SONET/SDH. Managing multiple technology platforms and converting/bridging protocols from one into the other, across a range of applications, is not only labour-intensive but also highly ineffective and power-intensive.

To enable a power-efficient and simplified network infrastructure, IT managers need to deploy a unified data centre Layer 2 fabric that not only meets the reliability, latency and performance requirements of today's storage needs but also encourages broader data centre connectivity. Of the fabrics available, Fibre Channel over Ethernet (FCoE) is currently the most promising solution. Together with an optimized Layer 2 Ethernet fabric, known as Data-Centre-Ethernet (DCE) or Converged-Enhanced-Ethernet (CEE), it is targeted to offer the throughput and loss-less transport that FC and IB offer while maintaining the simplicity of well-known Ethernet technology. Supported by an impressive coalition of vendors, including IBM, Brocade, Intel, Cisco and SUN, FCoE could provide the long-awaited step to eliminating the need for a separate transport and switching technology for storage and networking (see Figure 2).

Removing unnecessary technology from the data centre by simplifying the network protocol used on Layer 2 and above significantly impacts and lowers energy costs. However, when IT managers discuss greener networking, it is often from a perspective of Layer 3 and above. Yet the easiest and often most significant route to lowering power consumption starts, as one may expect, at the bottom - Layer 1, the physical layer .

While we have seen that FCoE is capable of simplifying Layer 2 transport and switching, it is also important to understand developments in Layer 1. Until now, the preferred media for data transport within the data centre was copper, which was easy to handle and deploy. Nevertheless, any data transmission on copper consumes much more power than the same amount of data running over a fibre-optic cable (at the same or even higher distance). This difference in power is even more evident in next-generation optical transport devices that have replaced their power-hungry legacy Layer 1 counterparts. Possessing a much smaller footprint, today's Layer 1 optical transponders, including Small-Form Factor pluggables (SFPs), require much less cooling and use much less power. However, when placed within a Wavelength Division Multiplexing (WDM) device, they are capable of transporting almost unlimited bandwidth.

In many respects, greener networking requires IT managers to view their data centres (including server networks and attached Storage Area Networks) as fast-adapting, almost organic organisms that need an underlying transport infrastructure that enables rapid and simple changes while being power-efficient itself. Reducing the complexity and dependency on Layer 2 and 3 processing and routing devices is the only way to achieve this.

With an intelligent, simplified and scalable Layer 1 and Layer 2 transport infrastructure, businesses are able to rapidly adopt green technologies within their data centres. From this efficient foundation, IT managers can build a flexible infrastructure that can utilise the latest resource-sharing applications to ensure the mix of servers and other computer hardware is being fully exploited. This will result in drastically less equipment, lower cooling requirements and lower power consumption. Only when IT managers start to view their data centres as a unified whole as opposed to individual components will the industry start to reduce its inefficiency and ultimately its budget.

Figure 2: A converged foundation for data and storage networking