Cooling strategies for next generation data centres
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Data Centre Management spoke to APC on what the future will bring in terms of cooling power consumption in the data centre

The conventional legacy approach to data centre cooling using room-oriented architecture has been shown to have technical and practical limitations in next generation data centres. What’s more, with data centres which operate entirely at less than 4kW per rack position very much in the minority, a zoned approach to cooling is not only the most effective way of ensuring peak demands are met, it is also the most energy efficient and therefore least costly in terms of both finance and carbon emissions,” says Paul Tyrer, VP UK & Ireland, APC by Schneider Electric.

It was an increasing numbers of servers and power consumption which first brought the data centre sector under scrutiny for its contribution to global emissions. In 2005, Jonathan Koomey estimated that the global cost for data centre power was $7.2b. Compare and contrast this statistic with IDC’s recent estimate (October 2008) of the cost to power Europe’s data centres alone set at €4.4b for the year 2007 – a cool $6b at today’s exchange rates. And while energy demand from the sector appears to be flattening off, with threatened price hikes in the offing and uncertainty in global markets, it’s not inconceivable that Europe’s data centre energy costs alone will eclipse Koomey’s number in the coming 12 months.

There is consensus that the main areas to address in order to increase energy efficiency (with the exception of power generation) are data centre cooling and IT efficiency. Setting aside IT, one of the main barriers to increasing cooling efficiency is a legacy approach which is almost endemic. Unfortunately, high density servers create conditions that legacy cooling solutions were never intended to address and result in inefficient, unpredictable, and low power density rooms.

To reliably support high and variable power density, and to reduce electrical power consumption and other operating costs, a technological solution to the problems created by technology is demanded. Row-oriented and rack-oriented cooling architectures have therefore been developed and are emerging as the preferred solution for most next generation data centres.

Every data centre air conditioning system has two key functions: to provide bulk cooling capacity, and to distribute the air to the IT loads. The first function of providing bulk cooling capacity is the same for all cooling architectures, namely, that the bulk cooling capacity of the air conditioning system in kilowatts must exhaust the total power load (kW) of the IT equipment. The various technologies to provide this function are the same whether the cooling system is designed at the room, row, or rack level.

The major difference between cooling architectures lies in how they perform the second critical function, distribution of air to the loads. Unlike power distribution, where flow is constrained to wires and clearly visible as part of the design, airflow is only crudely constrained by the room design and the actual air flow is not visible in implementation and varies considerably between different installations. Controlling the airflow is the main objective of the different cooling system design approaches.
Industry research has demonstrated that power and cooling remains the greatest area of concern to data centre managers. With peak cooling demands approaching 30kW/ rack position in some facilities, the situation is exacerbated with the need to mitigate risk of thermal shutdown. In order to ensure sufficient cool air to server inlets, management of hot and cool air streams is key to harnessing potential savings.

One approach to increasing cooling efficiency and provisioning high density equipment is APC by Schneider Electric’s InfraStruXure with Hot Aisle Containment Solution (HACS). A good example exists in one of Fujitsu Services’ data centres. The facility in question has 5308 m2 of technical space divided into four data halls, and it has 4.5MW of power available, although only 3500kW were being utilised with an average rack power density across the facility was 750W/ m2.

Chris Flanagan, data centre development manager, Fujitsu Services said; “Originally we thought the data centre had limited opportunities for expansion – it had physical space and additional generating capacity for example, but it had reached the limits for UPS power protection and cooling capacity. So to maximise the space utilisation and exploit the generator’s spare capacity, we needed a solution which was separate from existing UPS power and chiller capacity which were already well balanced to the existing need. Also it was crucial that any proposed solution could not pose any threat to availability.”

To meet the need the company specified APC’s InfraStruXure with HACS. Chris Flanagan continued “We’ve created a data centre within our data centre which provides almost Tier IV levels of resilience as most parts are 2N. In fact the whole of the HACS installation is on UPS, including the cooling. It’s efficient because we only cool the equipment cabinets which are in use. There is free cooling on the chillers and we have much higher return air temperatures using HACS because of the segregation of air streams, increasing the number of free cooling hours we can achieve.”

The new solution has added around 20% capacity to Fujitsu Services’ data centre through 40 equipment racks at an average rack power density of 15kW – although the new install provides up to 20kW per rack where required. The installation also advances the energy efficiency of the facility.

Paul Tyrer concludes “Row and rack-oriented cooling architecture provides the flexibility, predictability, scalability, reduced electrical power consumption, reduced TCO, and optimum availability that next-generations data centres require. For users with high density server technologies, row-oriented cooling will provide the best balance of high predictability, high power density, and adaptability, at the best overall TCO. To get higher levels of efficiency requires better air management and separation of hot and cool airstreams, which raises the question of whether it’s better to enclose the hot or cool aisle. As an innovator in rack-based cooling solutions, APC by Schneider Electric will be making further announcements in this space over the coming months.”