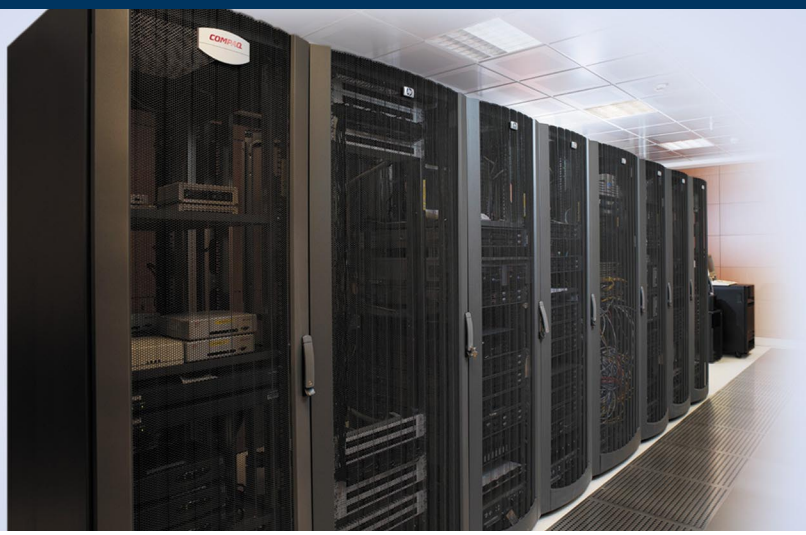
Sweating your assets off?



With server virtualization increasing, this article examines the impact upon cooling and what to do to avoid 'sweating your assets off'

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No one in their right mind would put eight three bar electric fires into a metal cabinet and not expect a lot of heat (24kW) to come out, would they? Well, increasingly some people do. The guilty party is the guy who installs the latest generation of IT Servers in a data room without due regard to the ability of the cabinet, or the room itself, to take the heat away and reject it outside. But what has driven the unwary to such suicidal tendencies?

As the server hardware OEM's produce ever faster products in ever smaller packages users demand for speed and capacity has increased even faster. The result is a rapidly increasing power density. If installed in a 42U high IT cabinet the latest 19" rack mounted hardware can fill the space at up to 600W/U - a grand total of 25kW, or the equivalent of three domestic ovens. Compare this to 7 years ago when 60W/U was considered pushing the envelope, pushing the floor power density above 2500W/m^2 during the internet dot.com boom for the first time. Turn the clock back only 10 years before that and 350W/m^2 was the state of the art data centre standard equivalent to less than 10W/U. So, in less than 20 years the power density has increased 60 times.

Despite bad press to the contrary the advent of Blade Servers (and to a lesser extent Virtualisation software) has only added fuel to accelerate and exacerbate the problem, not to cause it.

So what? I hear you cry! Well …

First, consider that the load is zero efficient and that every Watt delivered to the Server comes out as heat. If we are to believe what we read then a typical internet server handles 20% email, 20% other and 60% pornographic images (yes, yes, and the rest is wasted) and, so, does no work, hence zero efficiency.

Secondly, despite the heat ejected, the server hardware will come with operating instructions that requires the ambient cooling air to be maintained around 20-25°C. Most suck at the front and expel at the rear hence the need for cold aisle/hot aisle room layouts that you have probably heard of.

Thirdly, the server will be running some incredibly important application that requires absolutely no unforeseen interruptions and will, almost invariably, be fed from a UPS.

Now comes the point in my tale when the road works contractor down the road puts his digger bucket through the buried MV cable that feeds your building. Power fails, all mayhem breaks loose but, never fear, the UPS and its batteries are keeping up the power to your critical load and nothing will be lost. Now you have the choice between an orderly shutdown (no such thing of course) or, hopefully, you have a diesel genset installation protecting your critical and essential loads. If you do have a genset, then a minute or so later, one puff of black smoke and you are running on your own power, separated and protected from the grid supply before anything untoward can happen to your precious server.

Or so it was when (or if) the load density was (or is) less than 2500W/m^2. If you or your IT installer have been foolhardy enough to stuff your 42U high cabinets from floor to ceiling with ampere guzzling hardware and you have (worst case) managed to squeeze 25kW/m^2 into your space you have a different problem; heat, and buckets of it.

Up to around 2500W/m² the usual data room layout and cooling arrangements will cope with the heat load and the load itself will also cope with the momentary temperature rise between the time the mains fails (cooling system stops instantly) and the generator plant starts (cooling system starts to recover). In most systems there will be a time delay of 120-180 seconds whilst the cooling plant regains full capacity, during which time the air temperature will have risen several degrees but stayed below the recommended limit of around 35°C. That means that the exit temperature at the rear of the servers will be in excess of 50°C - becoming an H&S issue amongst other things.

But at 10x that power density you have only a handful of seconds before the same limit is reached (with a rather more modest 13kW/m² it takes only 20 seconds to rise from 20°C to 35°C) and your servers will be putting out over temperature alarms and, rapidly if nothing is done, shutting down.

So what happened to uninterruptible computing? You have spent all that money installing a UPS (thank you) to provide high fidelity voltage with no deviation from a tight specification lasting longer than 20ms and yet when the power fails the cooling system stops and in well under a minute your load is turning itself off. You literally are sweating your assets!

There are two ways to solve this problem:

Spread the load out, use more space, install less kit per cabinet (one blade chassis can consume 4kW in only 7U so this is a sparse deployment housing a lot of empty space). This has the added advantage of producing a potentially more reliable installation. One less system to duplicate with redundancy, pay for, install, maintain and worry about is no bad thing amongst a plethora of systems.

Feed the cooling system with a UPS system of its own. Why a separate UPS? Well, it is generally regarded as better not to mix motor loads (high starting currents and regenerative modes) with IT equipment on the same electrical bus and most cooling loads are fan and compressor motors. No doubt the increased complexity adds to running costs (UPS losses may only be 5-7% but it all adds up), adds to the maintenance requirements and detracts form the potential reliability.

So when it comes to planning server installation rack them and stack them, but don't forget to cover cooling system failure and maintenance without load shut down. Buy another UPS.

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With over 36 years experience of writing technical articles for leading companies and institutions, Ian is a world renowned author and speaker and an expert in all aspects of critical power and building services.