

Improving cooling and airflow in computer rooms

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The vast majority of computer rooms are cooled by air conditioning systems that attempt to deliver cold air to hot IT equipment placed in racks.

A few systems use cold water pumped around the rack and there are even some exotic solutions using liquid carbon dioxide and even chip level cooling. The majority however use cold air derived from direct expansion or chilled water-fed air-conditioning units.

The air-conditioning units themselves vary from 'office-grade' comfort air-conditioning units to precision controlled units specifically designed for 24/7 operation in a computer room environment.

The amount of cooling capacity delivered to an equipment rack depends upon the design of the system and how effectively it has been implemented. Although the press is full of claims and adverts about eight or even twelve kilowatts of air cooling achieved in a rack the reality is more likely to be in the order of four kilowatts in a realistic and cost effective model. Even four kilowatts depends upon a well-engineered air delivery path and optimised rack layout. Four kilowatts equates to about 16 1U rack mounted servers. Don't forget that a 16-amp supply is only going to be feeding 3.6 kW to the rack anyway.

There are many things that can be done to optimise the layout of racks, both on the floor and within the racks themselves. Following some basic rules will optimise what air conditioning power you have. It is generally considered that between 10 and 70% of cold air is wasted in computer rooms.

Rack position

- Layout racks in the hot-aisle cold-aisle format. i.e. racks face each other and cold air is introduced to them through the front. Hot air then escapes through the back to return to the air conditioning unit.
- Don't aim cold air at both sides of the rack simultaneously. The escaping hot air will be fighting against the incoming cold air if you do.
- Don't set the temperature too low on the air con units. Measure the input and output temperatures at the front and back of a rack. Input temperatures should be around 19-20 °C. If output temperatures exceed 35 °C it is a sign of big trouble ahead. But a temperature reading in the high twenties is not necessarily a problem just as long as that hot air is going back to the aircon unit and not being dragged into the input of another rack.
- Put all the racks in long parallel lines and parallel to the airflow.
- Racks should be about 1.2 m apart.
- Consider putting baffles between racks, e.g. where building columns may be, to keep the hot-aisle cold aisle concept.
- Consider putting baffles between the tops of the racks and the ceiling to prevent hot air circulating back into the inputs.
- Ensure any underfloor space, used as an air distribution plenum, is not blocked with cables or junk.
- Make sure that no air is escaping through loose or missing floor tiles.
- Ensure that there is a seal between the floor tile and the wall.

- Ensure that the underfloor plenum space is sealed e.g. there are no unblocked cable or pipe entry points.

Within the rack

- Ensure that if cables enter the bottom of the rack the air is prevented from following it by a brush grommet.
- Make sure all the equipment is the same way round. e.g. front-to-rear cooled servers all have their front air intakes in the front (cold-aisle) of the rack.
- Ensure that air doesn't escape through the rack by using blanking plates to completely fill any unused spaces.
- If the rack is very wide then use side strips to stop the air going round the inside of the walls.
- Make sure the front and rear doors are adequately ventilated, at least 60% 'open'.
- If cables pass from the front to back then use brush grommet cable organisers to stop the air from following.
- Make sure that 'side-to-side' cooled equipment e.g. some routers and switches, have adequate space around them for the air flow or ideally used a special fan unit that diverts the air flow through that kind of equipment.

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