High Efficiency technologies for Data Centre Air Conditioning

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Agenda

- High Efficiency Cooling
  - Five reasons to use DC Technology
- High Efficiency Humidication
- Integration and Services
- Conclusions

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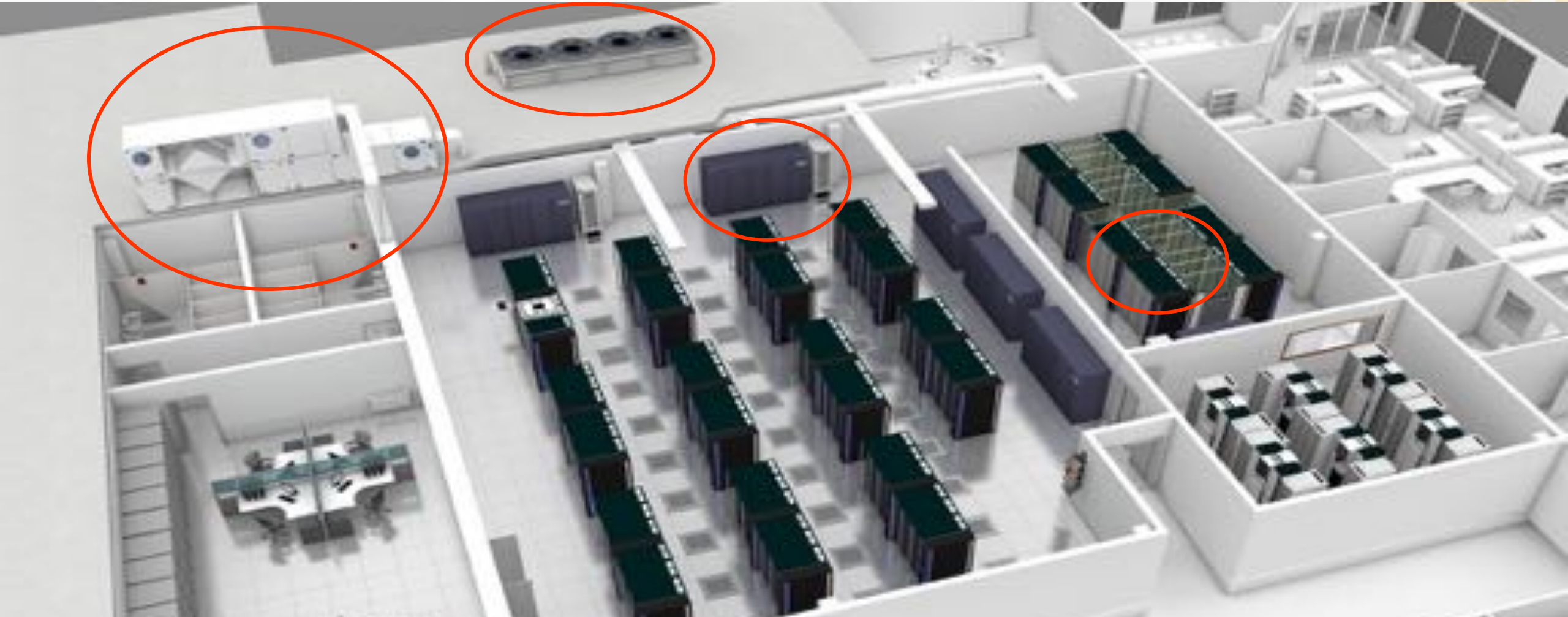
Data Centre Cooling:
Continuously evolving to save energy



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CRAC with BLDC Compressors are increasingly popular


DC
Technology

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Obtaining Energy Savings in Data Centre A/C

High Efficiency Cooling – 5 Reasons to use DC Technology

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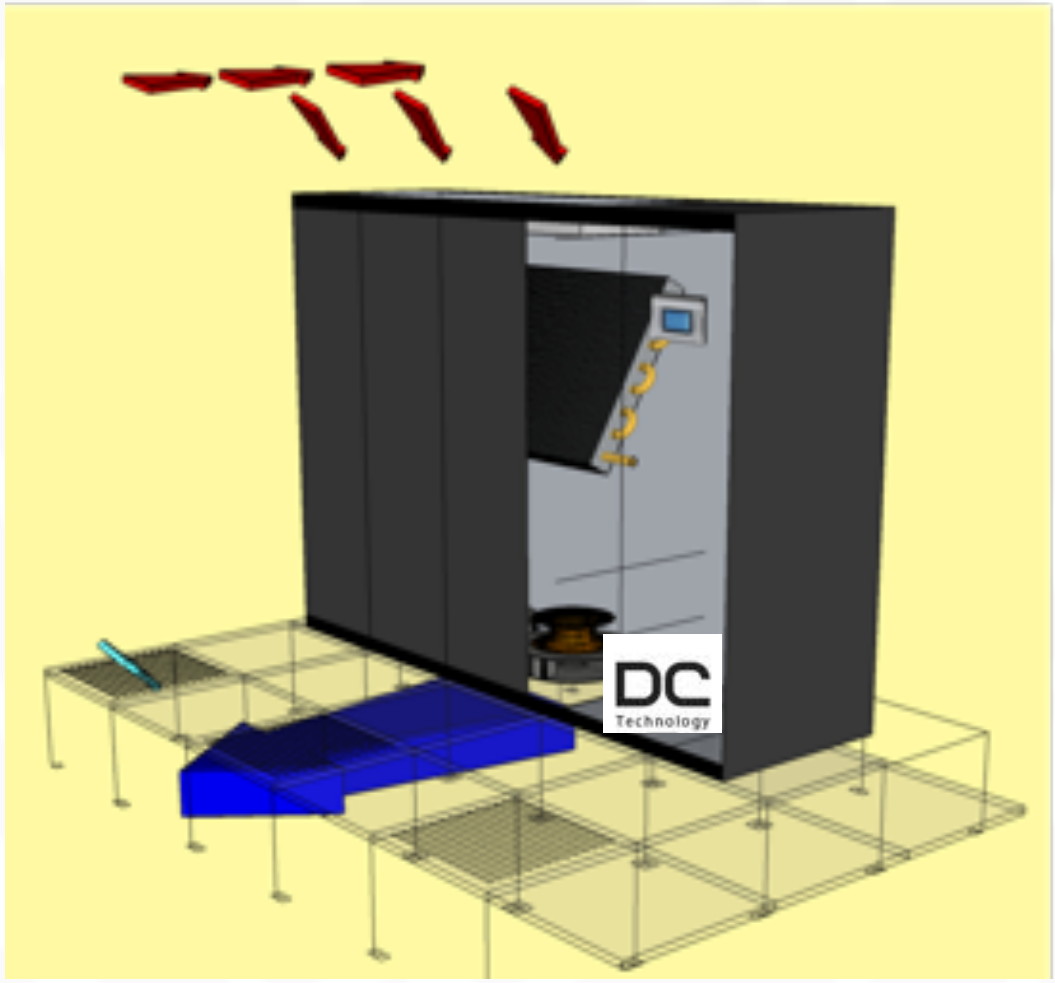
1. DC technology is energy efficient



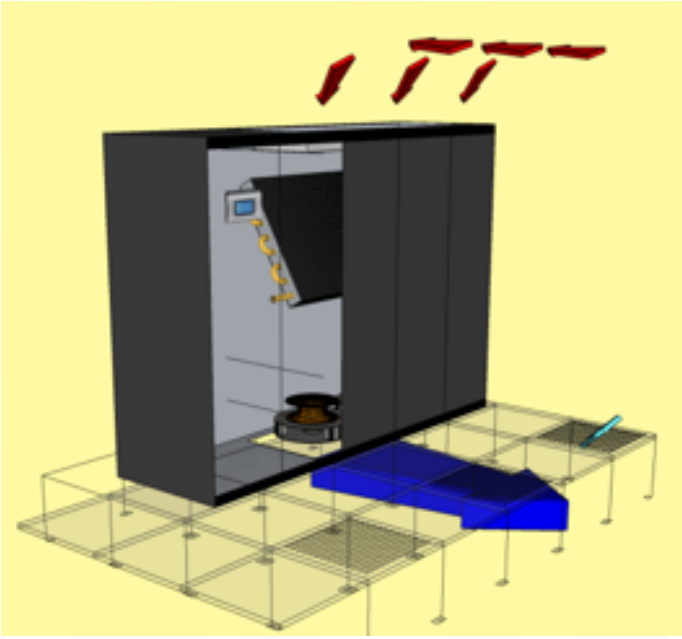
Datacenter applications have huge energy consumption and there's a constant research of technologies that are able reduce it.

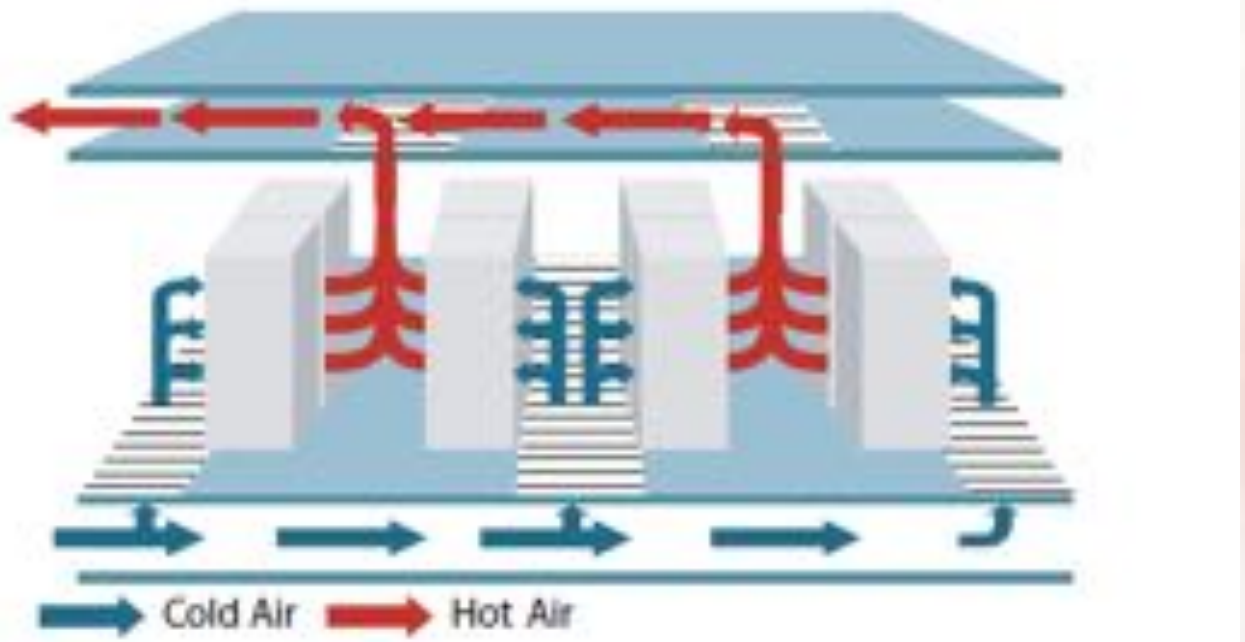
In the fans of air conditioners for datacenter the permanent magnet motors are used since a lot of time and it is proven that this technology is saving energy. In fact nowadays this technology is standard in many units of different manufacturers.

There is a huge potential of energy saving using this technology for compressors

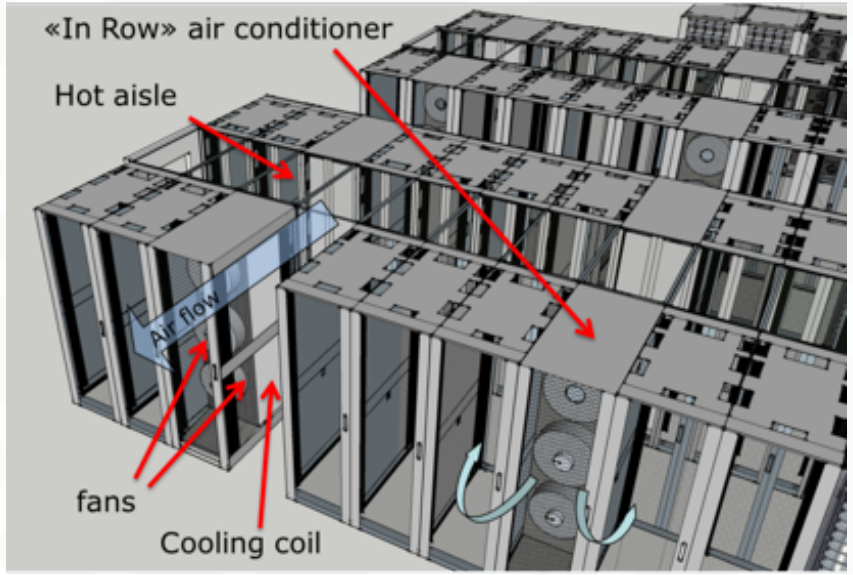
2. Modulates to control the supply air

- The new layout of data centres with hot aisle and cold aisle containment shifts the control of the unit from the return to the supply: to maintain the supply temperature of air within the required range it is very useful to use a variable speed compressor.





3. Suitable for new types of units (row/rack based)



- Concentrated loads with high power density (up to 20-30 kW per rack) are pushing or the development of new types of units installed near the heat source.
- These systems have small inertia because very often their load is varying continuously, and the variation can be quick: that's why it is important to have a variable speed compressor
- WITH A REDUCED MINIMUM SPEED (15%)
- Less inertia = necessary modulation of cooling power

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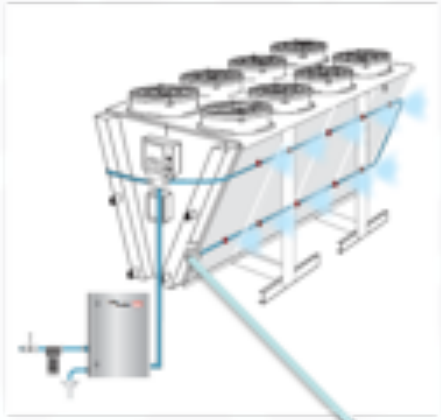
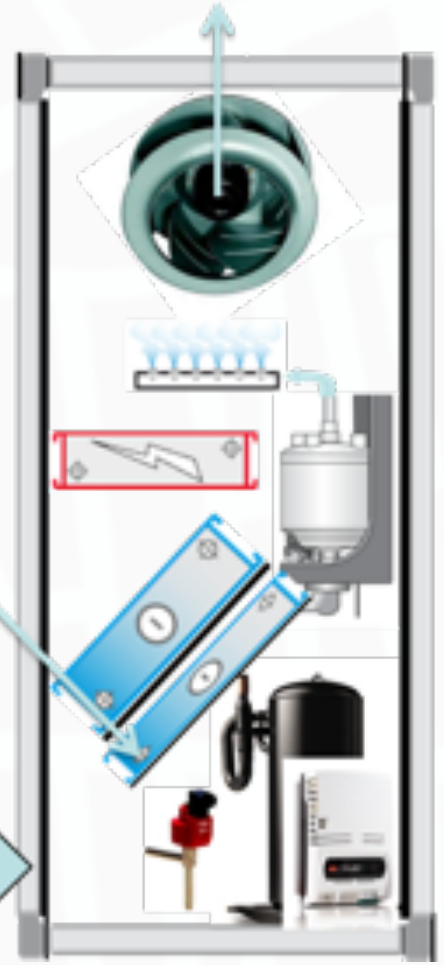
4. Co-exists with partial free cooling, modulating to provide only what is missing



The use of direct and indirect freecooling is becoming more and more popular: with an on off compressor it hard to use the freecooling combined with compressor because there can be low pressure problems.

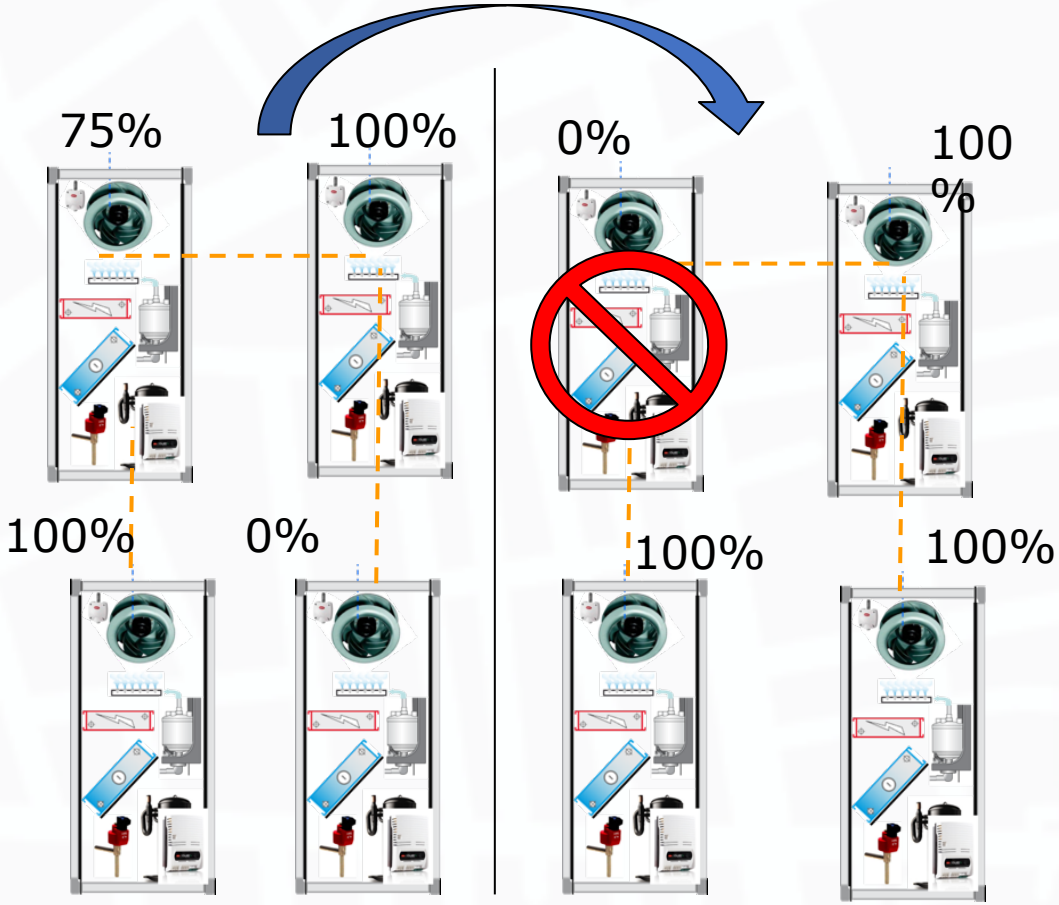
With a modulating compressor it is possible to make only the cooling power that is necessary



Version with economizer damper

5. Helps create redundancy

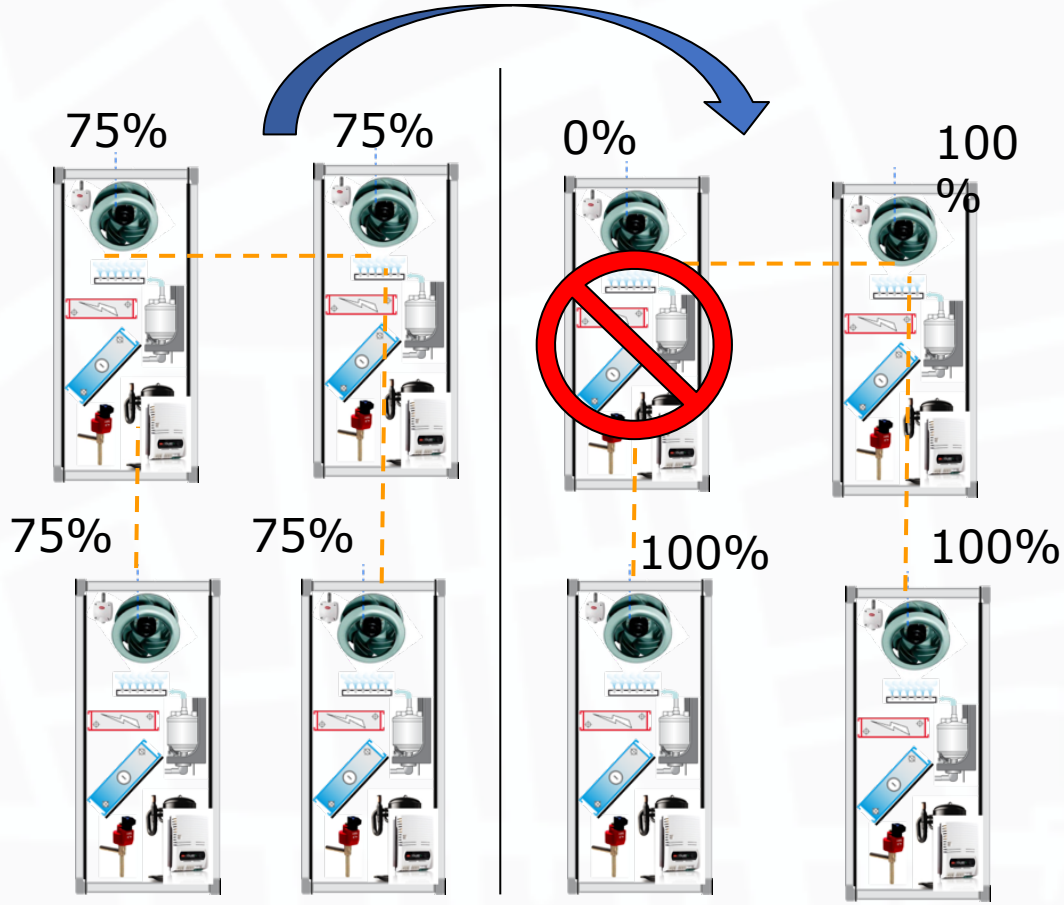
- With on/off compressors, units in stand-by are set in ON mode to backup the cooling power of a unit that has a fault
- This requires rotation of stand-by units to make sure they are working and to have an equal wear of components
- The air distribution may be uneven



5. Helps create redundancy

Using DC Technology

- Designing units for 75% of the load where the efficiency is best with even air distribution
- When one unit is faulty the other ones speed up
- The alternative would have been having 3 ON/OFF units working and 1 in stand-by

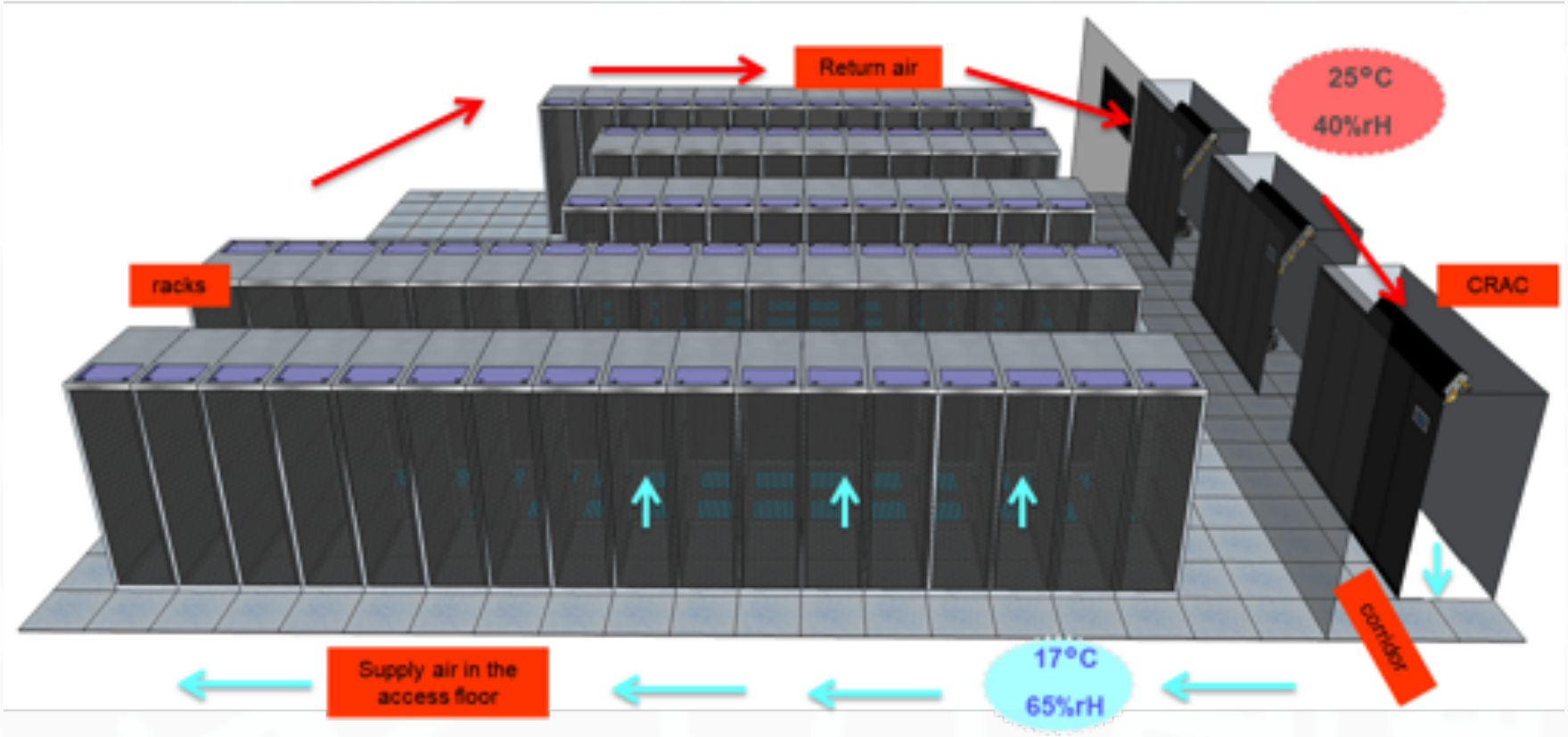


Obtaining Energy Savings in Data Centre A/C

High Efficiency Humidification

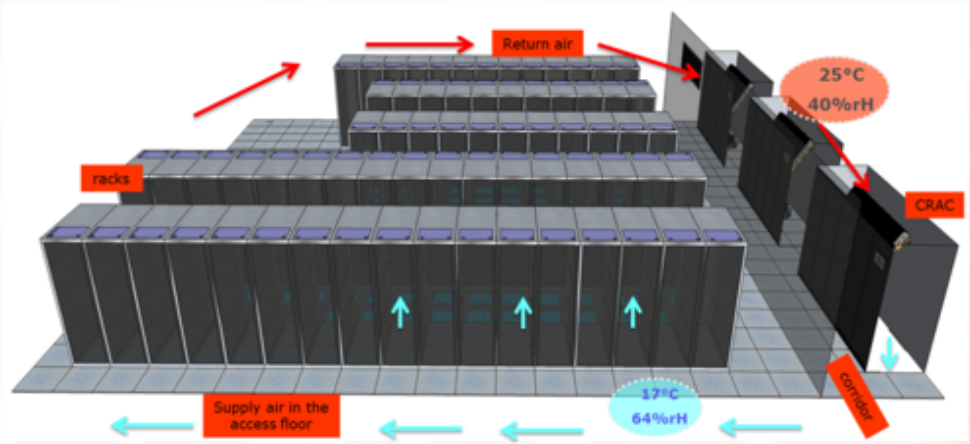
Legacy Data Centres

- Humidifiers sizing based on CRAC dehumidification
- Use of **steam humidification** (1kg/h requires 750 W)



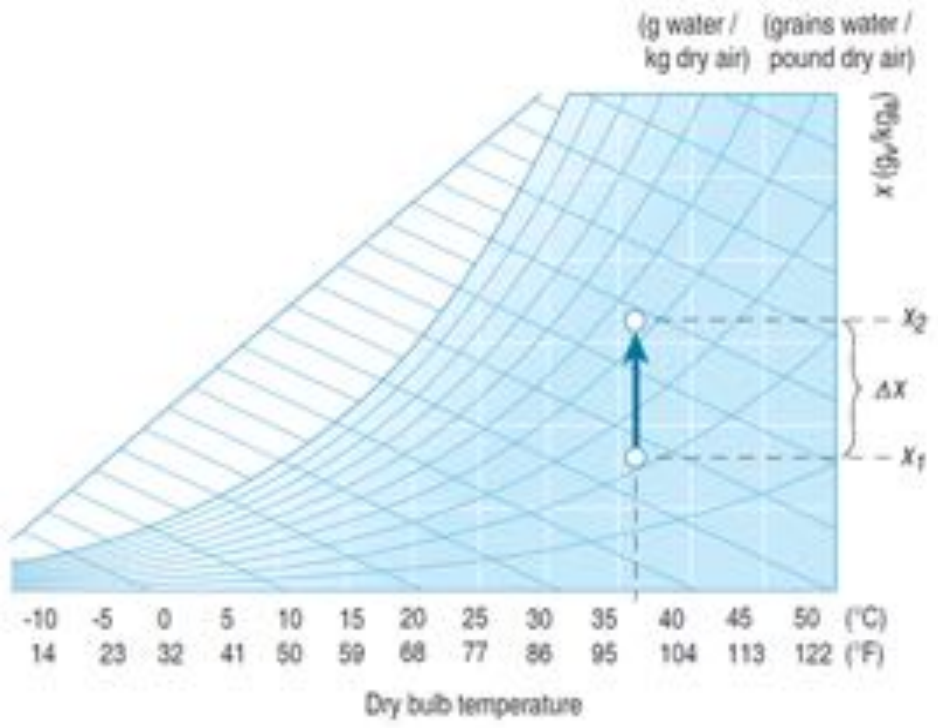
Legacy Data Centres:
Find an energy saving alternative

- Total Cooling Load 1,17 MW
- 135 kg/h humidifiers for humidity control based on dehumidification
- Power of humidifiers is 105 kW compared to approx. 400 kW
- Finding an alternative technology could save 20% of total electrical power used for cooling
- Reducing installed power offers great opportunity if running out of capacity
- With higher room temperatures it is easier to use adiabatic technologies



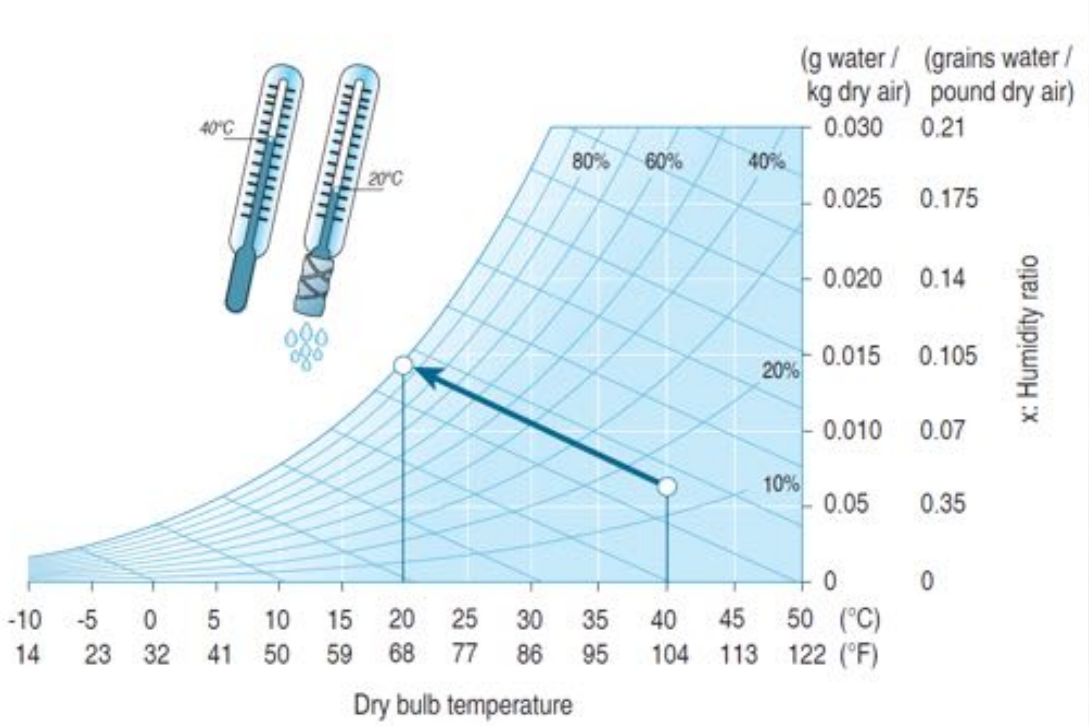
Adiabatic vs Steam Humidification

STEAM



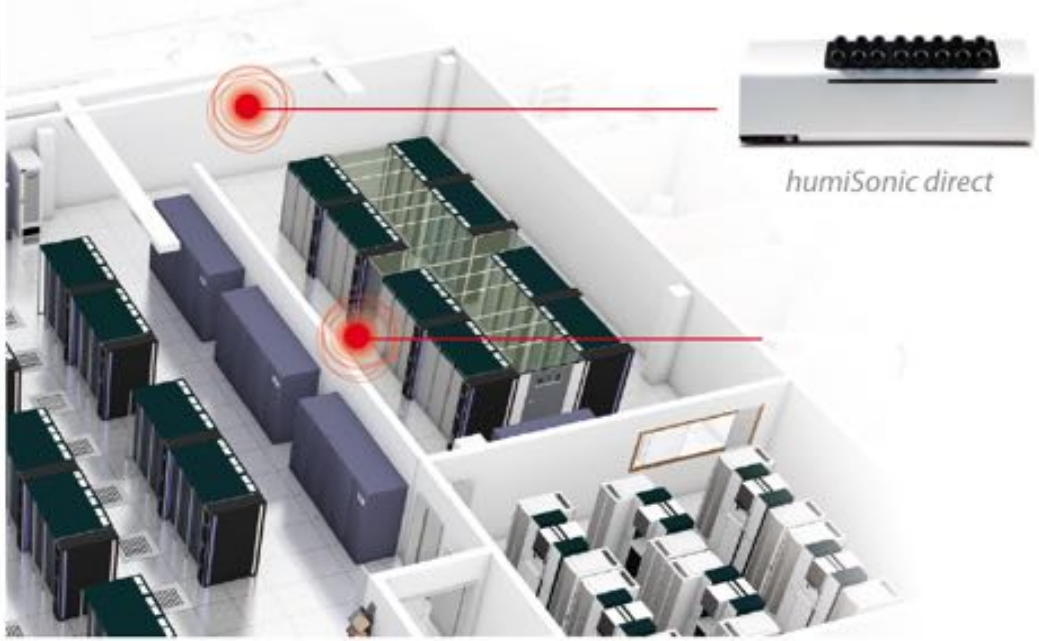
750 W/kg

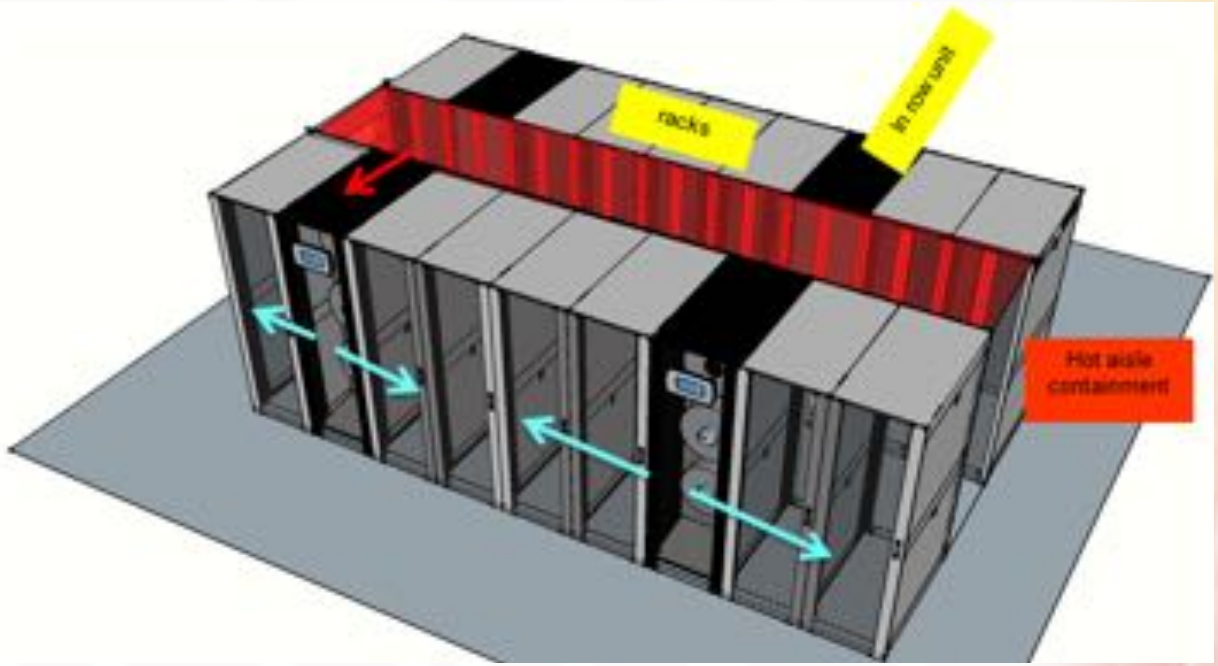
ADIABATIC



4 W/kg

Example: Ultrasonic Humidifiers

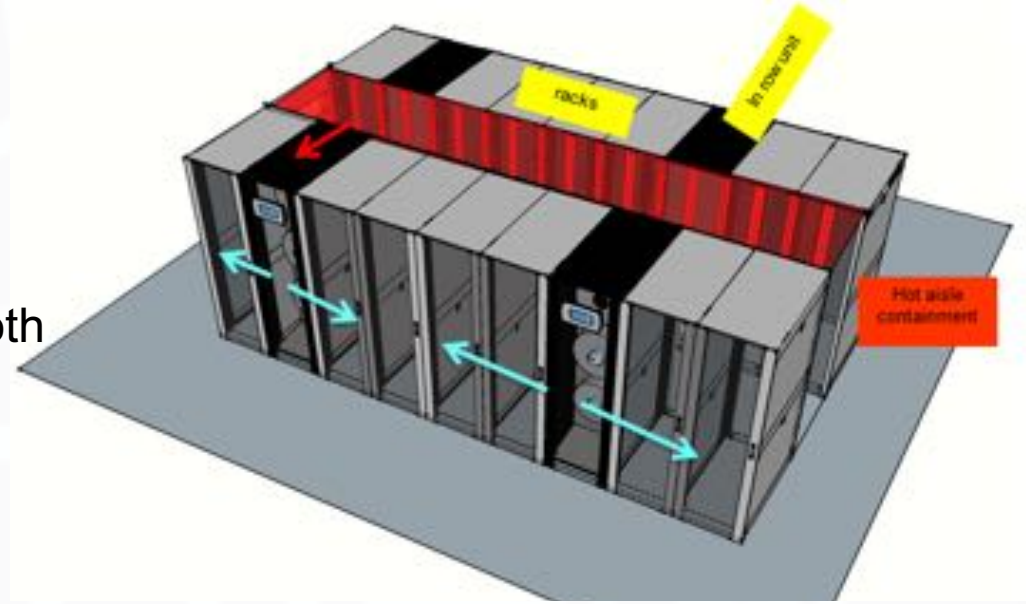




Example: Ultrasonic Nebulizers

→ **1 µm** droplet **diameter**
→ Only **10%** of **power** consumption compared to steam humidifiers
→ **10.000** guaranteed working hours

Ultrasonic nebulizer uses ultrasonic transducers to nebulize water in extremely small droplets that spontaneously evaporate in the surrounding air both humidifying and cooling it

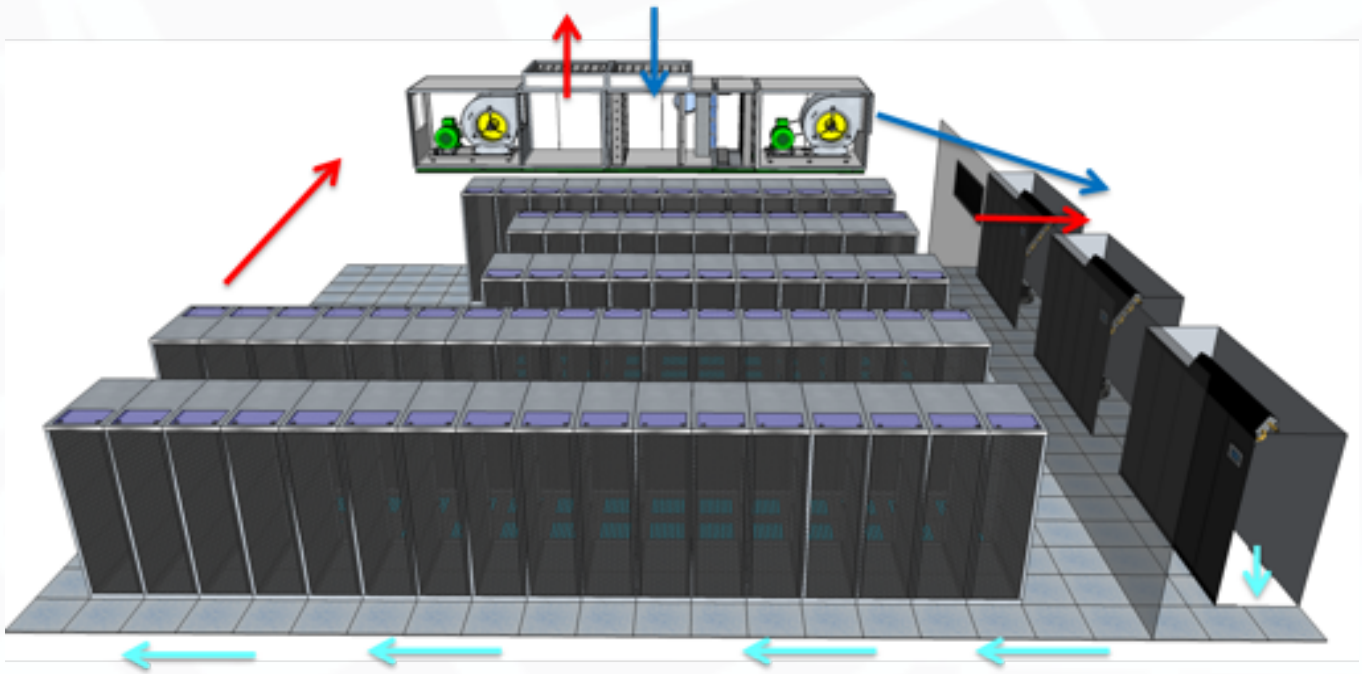


Obtaining Energy Savings in Data Centre A/C

Integration and Services

Integration of solutions: optimisation needed

Example: integration of direct free cooling and CRAC units.



Centralised control using DCIM?

- Best solution: **unit controller** tested by the manufacturer for reduced commissioning and redundancy of controls
- Use of **communication** to optimise controllers (temperature set points, air flow set points,..)
- Specific **HVAC skills** are needed for design and implementation of control

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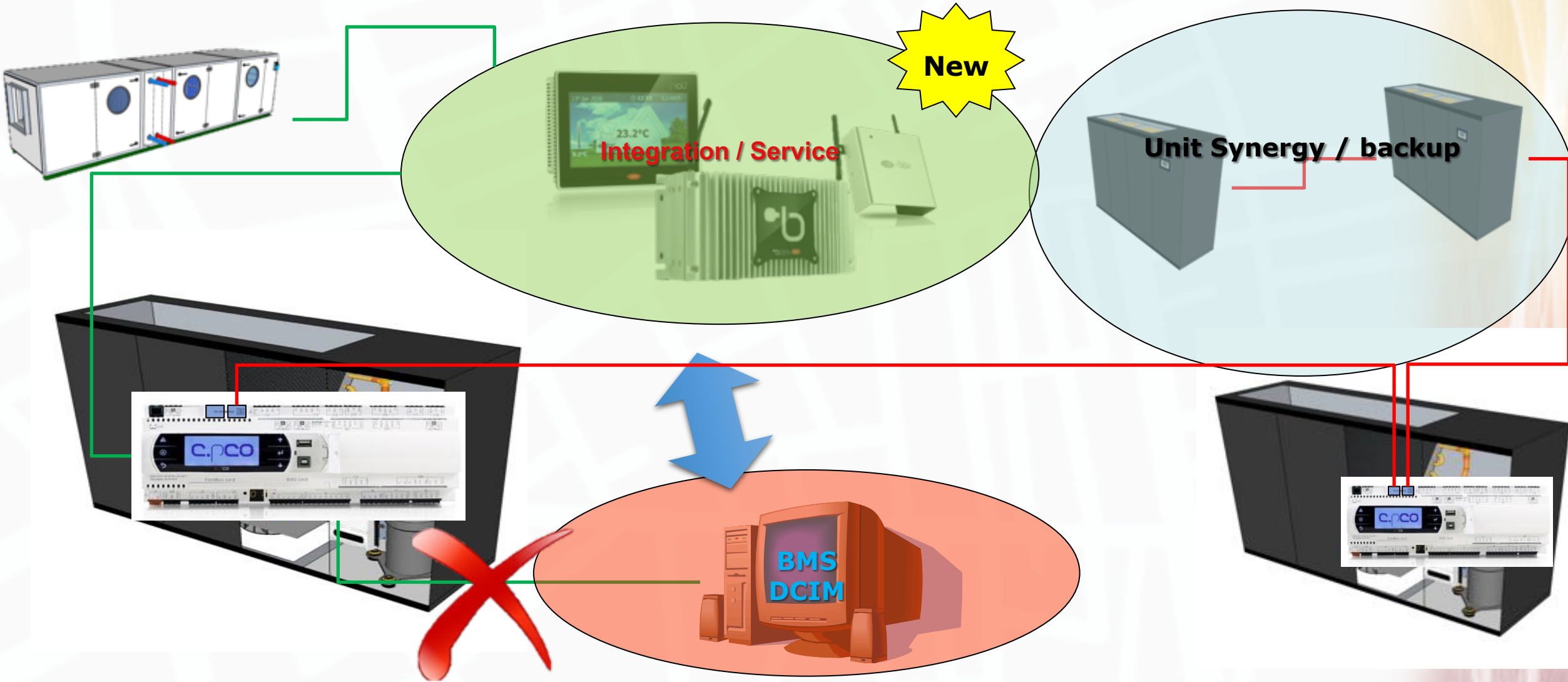
Distributed intelligence: Different layers



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Data Centre Cooling Integration and Services

- Data **collection** (additional probes, power facilities)
- Data **presentation** (graphic user inteface)
- Data **sharing** (i.e. with DCIM) and notification
- Additional **HVAC logic** for cooling optimization
- Interacting with local/remote controls for **Services** (maintenance)

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Example: Medium data centre integration with a PC based system

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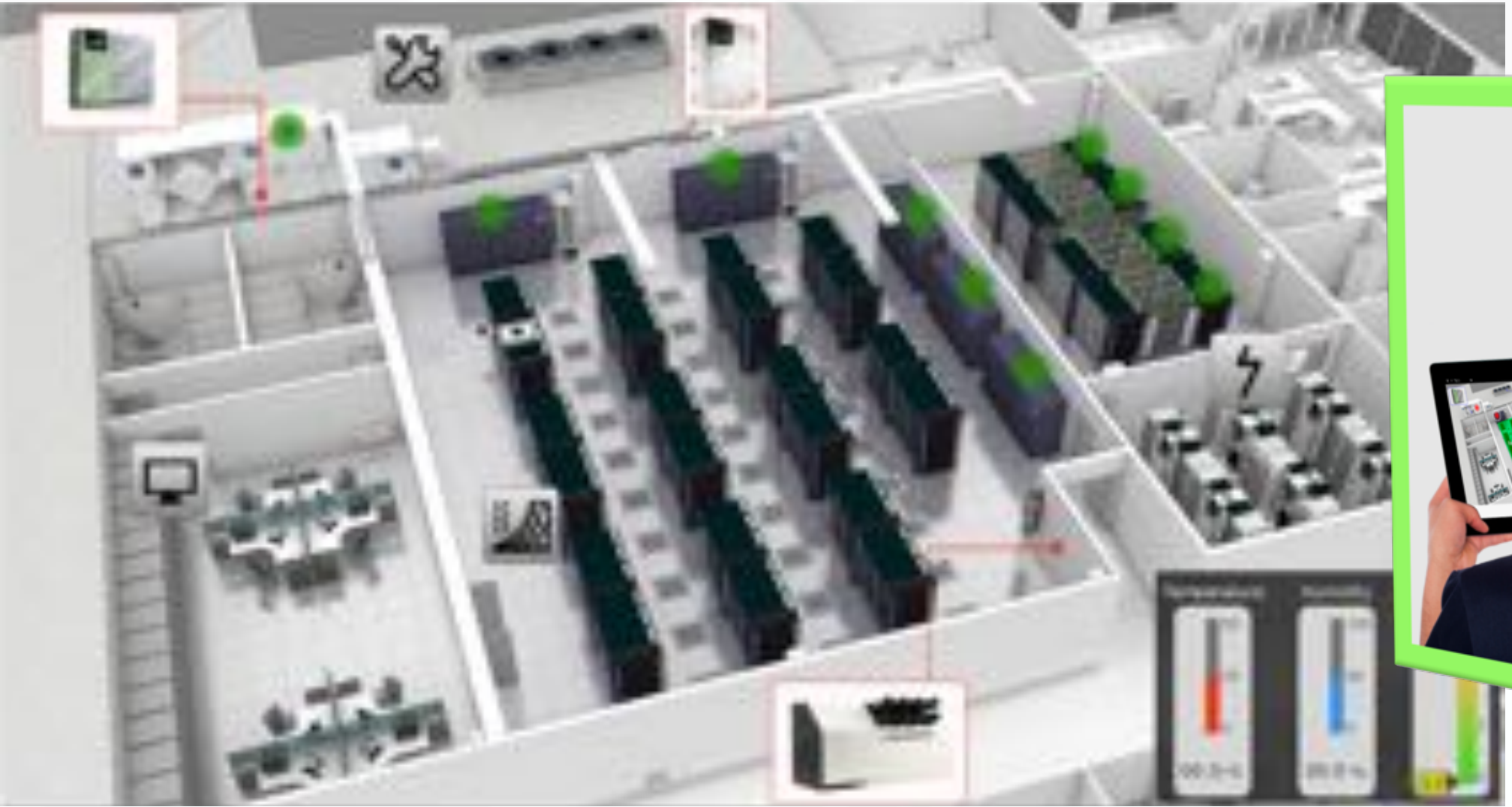
Customised visualisation and easy access



Conclusions

- Data centers are rapidly growing as their energy consumption: there are several technologies that might help achieve Energy Savings
- Switching to high efficiency components has beneficial returns on the retrofitting investment
- Retrofitting is still representing a strong market driver as capacity of existing data centers is growing
- The role of integrated systems will be fundamental to efficiently manage different technologies.
- Flexibility, Compatibility, Adaptability: key aspects to integrate existing units and new technologies.

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