Concert Control

DigiPlex's innovative Concert Control solution is the intelligence behind some of the most energyefficient data centers operating anywhere in the world.

DigiPlex's Concert Control is a procedure (algorithm) developed to optimise the performance of its highly efficient air-cooled data centers. The solution is unique in that it monitors the power being drawn by theservers to calculate exactly the quantity of conditioned air needed to remove the heat they generate.

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Ground Breaking Technology

The driver behind the development of Concert Control was to attack the energy losses resulting from cooling equipment being controlled and operated independently. To do this, Concert Control gathers dynamic information from the data hall and uses this to optimise the operation of these independent systems by enabling them to operate together in harmony.

What does the Concert Control algorithm do?

DigiPlex's Air-to-Air units supply cooled air to the data hall cold zone. This houses the rackmounted data servers in linear bays. Fans, integral to each server, pull the cooled air from the cold zone. From the servers the air, now warmed by up to 12°, is discharged into an exhaust chimney at the back of the server rack and ducted back to the Air-to-Air unit via a ceiling plenum.

Concert Control uses the direct relationship between kilowatts of electricity consumed by the servers, the kilowatts of heat given off by the servers and the volume of cooled air that needs to be delivered to the data hall. The algorithm references the server load, the specific heat capacity of the air, the temperature rise (ΔT) across the servers to calculate the mass flow rate of air delivered by the Air-to-Air units.

How does Concert Control work?

By using real-time energy consumption from the power management system as a reference point concert control varies the speed of the process side fans in the Air-to-Air units to ensure the air volume supplied precisely matches the cooling load. The algorithm references the fan curves to influence the speed controllers of the process fans to decide automatically the most economic number of Air-to-Air units to run and the fan speed at which they will operate to optimise their efficiency. A feedback loop measures the pressure differential (ΔP) between the cool zone and the hot chimney at the rear of the servers to ensure the cool zone is always maintained at a positive pressure differential of between 2Pa-4Pa relative to the hot zone.

What makes Concert Control so innovative?

Normally data center cooling systems incorporate small stand-alone controllers inside individual cooling units, each of which is controlled in isolation.

By contrast, Concert Control resolves the inherent inefficiencies of this system by controlling all of the Air-to-Air units together in an integrated cooling solution using the business specific metrics of power, server rack ΔT, external ambient cooling availability and fan curves. In fact, detailed modelling by DigiPlex has demonstrated that it is typically more energy efficient to run all the Air-to-Air units together at a low fan speed rather than fewer units at a higher fan speed, which is contrary to most operational standpoints. DigiPlex has calculated that a simple step control solution is preferable to enable or disable the Air-to-Air units at preset total power values.

Alongside the Concert Control, the Air-to-Air unit's scavenger fan controls adjust the fan speed to match the cooling available from a fall in external temperature, which further reduces power consumption and improves the data center's Power Usage Effectiveness (PUE) accordingly.

What impact does Concert Control have on operating efficiency?

A big advantage of the Concert Control system is

that it is highly efficient when operating at part server load and when total server loads are small, for example when a data center first opens. Concert Control has proved highly effective in delivering energy efficiency improvements. At DigiPlex's Stockholm data center the system delivered a PUE of 1.06 at a summer external air temperature of 15 °C. This is a highly impressive performance given that 0.03 of the PUE is attributable to losses in the uninterruptible power supply system. In other words, the data center is using just 3% of the power consumed by the data servers in keeping them cool.