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Intel: Servers Do Fine With Outside Air

Rich Miller | Sep 18, 2008

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Do servers really need a cool, sterile environment to be reliable? New research from Intel suggests that in favorable climates, servers may perform well with almost no management of the environment, creating huge savings in power and cooling with negligible equipment failure.

Intel's findings are detailed in a new white paper reviewing a proof-of-concept using outside air to cool servers in the data center - a technique known as air-side economization. Intel conducted a 10-month test to evaluate the impact of using only outside air to cool a high-density data center, even as temperatures ranged between 64 and 92 degrees and the servers were covered with dust.

Intel's result: "We observed no consistent increase in server failure rates as a result of the greater variation in temperature and humidity, and the decrease in air quality," Intel's Don Atwood and John Miner write in their white paper. "This suggests that existing

assumptions about the need to closely regulate these factors bear further scrutiny."

Intel set up a proof-of-concept using 900 production servers in a 1,000 square foot trailer in New Mexico, which it divided into two equal sections using low-cost direct-expansion (DX) air conditioning equipment. Recirculated air was used to cool servers in one half of the facility, while the other used air-side economization, expelling all hot waste air outside the data center, and drawing in exterior air to cool the servers. It ran the experiment over a 10-month period, from October 2007 to August 2008.

The temperature of the outside air ranged between 64 and 92 degrees, and Intel made no attempt to control humidity, and applied only minimal filtering for particulates, using "a standard household air filter that removed only large particles from the incoming air but permitted fine dust to pass through." As a result, humidity in the data center ranged from 4 percent to more than 90 percent, and the servers became covered with a fine layer of dust.

Despite the dust and variation in humidity and temperature, the failure rate in the test area using air-side economizers was 4.46 percent, not much different from the 3.83 percent failure rate in Intel's main data center at the site over the same period. Interestingly, the trailer compartment with recirculated DX cooling had the lowest failure rate at just 2.45 percent, even lower than Intel's main data center.

While the reliability trade-off in the proof-of-concept was small, the energy benefit was huge. Using air-side economizers resulted in a 74 percent decrease in power consumption compared to recirculated air. Based on temperatures in its New Mexico test

locale, Intel estimates that it could use economization 91 percent of the time, translating into potential savings of 3,500 kilowatt hours.

That works out to considerable savings in larger data centers. That energy savings template could create annual savings of $143,000 for a small 500 kilowatt data center, or annual savings of $2.87 million for a 10 megawatt data center.

There are limitations to Intel's experiment, which would work primarily in areas with warm temperatures and low humidity (we've previously noted the advantages this climate profile has provided for Switch Communications in Las Vegas). But the results of Intel's research provide some meaningful new data points on the reliability of servers in a broader band of heat and humidity conditions.

There's been much discussion in recent years of raising the cooling set point in data centers. Sun Microsystems say data center managers can save 4 percent in energy costs for every degree of upward change in the set point. The HVAC industry group ASHRAE has also examined the issue, widening its recommendations on operating ranges for data centers. In practice, many data center managers are wary of trying expanded ranges of heat and humidity in production facilities.

Intel says it will likely repeat the proof-of-concept with a 1 megawatt data center, and could include air-side economizers in future data center designs.