



# Running hot, staying cool

Dell is using the Fresh Air Hot House to demonstrate how customer data centers can use fresh-air cooling to lower costs and increase energy efficiency

## Customer profile

|           |  |
|-----------|--|
| Company   | Dell   |
| Industry  | Technology                                     |
| Country   | United States                                  |
| Employees | 110,000  |
| Website   | <a href="http://www.dell.com">www.dell.com</a> |

## Business need

Dell wanted to help its customers leverage hotter data center environmental temperatures while still providing enterprise hardware performance and reliability — possibly eliminating expensive cooling systems in the process.

## Solution

Dell created Dell Fresh Air hardware, which are off-the-shelf configurations of enterprise hardware that can operate at greater temperature ranges. The Dell Fresh Air Hot House, installed on the Dell campus in Round Rock, Texas, shows that this technology can operate year-round without the need for any expensive cooling equipment.

## Benefits

- Reduced Capital Expenses  
Data center designers can consider more efficient cooling architectures that do not require expensive chillers.
- Reduced Operational Risk  
Reliable product performance within greater temperature ranges reduces the risk of downtime.
- Support for Broader Corporate Initiatives  
IT can help organizations to meet established energy consumption and sustainability goals.

## Solutions at a glance

- Data Center



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*Jon Fitch, Senior Principal Reliability Engineer at Dell*

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For many IT departments, cool is the rule in the data center. Concerned that higher data center temperatures will cause problems for servers and other equipment, IT managers typically crank up their HVAC systems to ensure that all hardware is kept cool all year. No matter if it's summer or winter, the air conditioners keep humming.

The problem with this strategy, of course, is that it's more costly than ever to cool a data center. IT organizations first have to deal with rising energy costs to pay for the power to operate the data center, and then have to pay again to cool the heat generated by that power. On top of that, data center cooling is energy-inefficient, with too much energy being used to cool hot exhaust air. And as organizations use more kilowatts for cooling, their data centers miss out on other uses for that power.

To address these challenges, Dell sought a solution that could help customers run their hardware hotter but still reliably, potentially enabling lower data center costs. “We did some studies that showed you might spend 56 percent of your server costs on power alone over the lifetime of a server,” says Jon Fitch, senior principal reliability engineer at Dell.<sup>1</sup> “We also saw that the typical data center spends up to 40 percent of its energy on cooling alone. So we started thinking about ways to reduce these numbers, with the goal of helping customers reduce the overall costs of delivering IT.”

#### **The Dell Fresh Air solution**

As it thought about ways to enable its hardware to run hotter, Dell decided to design a new solution. “We knew we needed to build equipment that suited the climate, as opposed to designing equipment that would require an energy-inefficient building to keep it cool,” Fitch says. “We found that we could almost eliminate the energy spent on cooling a data center by developing

a solution that would allow customers to use fresh-air cooling from outside or even go completely chiller-less.”

After seven years of research and development during which Dell studied U.S. and worldwide climate zone needs, the organization developed certain enterprise hardware system configurations that are available as off-the-shelf products called Dell Fresh Air.<sup>2</sup> This Dell enterprise hardware can run at hotter temperatures and higher humidity levels in noncorrosive, clean air such as ISA-71 Class G1 environments.

Dell began offering a variety of Fresh Air–capable enterprise hardware that can operate in temperatures up to 35°C continually, with additional performance for excursionary periods of time up to 45°C. Still other Dell enterprise hardware, including configurations of 13<sup>th</sup>-generation PowerEdge servers, meet Fresh Air 2.0 conditions. They can allow operation in temperatures up to 40°C (104°F) for 100 percent of the year plus additional operation up to 45°C (113°F) with humidity up to 90 percent RH (29°C maximum dew point) for an additional 1 percent of the year. “The extra 10° of headroom allows companies to go chiller-less in most climates,” says Fitch. “It also gives them a significant amount

#### **Products & Services**

##### **Hardware**

Dell Fresh Air



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### **The Dell Fresh Air Hot House: An innovative, fresh air-cooled data center**

To demonstrate the capabilities of its Fresh Air hardware, Dell created the Fresh Air Hot House, a proof-of-concept building built on a parking lot at the Dell campus in Round Rock, Texas, where summertime temperatures can climb above 40°C (104°F).

The 8' x 10' building has no air conditioning and features a rack running Dell Fresh Air–capable hardware, including PowerEdge servers, Dell Storage and Dell Networking hardware.

Provided by APC, the Hot House rack is optimized for cooling, power distribution, cable management and environmental monitoring. The Uninterruptible Power Supply (UPS), Power Distribution Units (PDUs), and environmental monitoring products from Dell featuring the designs of APC, include:

- Dell NetShelter SX rack enclosure engineered for APC by Schneider Electric™
- Dell Smart-UPS On-Line engineered for APC by Schneider Electric and developed to withstand the harshest power conditions in the world
- APC Metered PDUs for real-time remote monitoring of connected loads and environmental conditions
- Netbotz Rack Monitor for remote monitoring and reporting of physical and environmental conditions with user-defined alerts

APC features Dell Fresh Air–enabled hardware, with the UPS having an environmental operating range of 0–40°C (32–104°F) and the PDUs featuring an environmental operating range of -5–45°C (23–113°F). Additionally, the Netbotz monitor provides graphs and reporting of environmental conditions, as well as an alerting mechanism to show if user-set thresholds are exceeded.

Dell PowerEdge servers have Dell OpenManage™ Power Center, which provides visibility to power consumption, anomalies, and utilization as well as policy-based power capping. This enables increased control, improved rack density, fast response times, improved accuracy, and broad decision-making intelligence.

Also included is iDRAC, which leverages Intel® Node Manager technology for platform-level power reporting and capping of Intel® chipsets, and used to optimize and manage power resources.

The Dell Fresh Air Hot House uses 100 percent air-side economization and no chiller by pulling outdoor air into the structure and passing the hot air out with simple blowers. And the Fresh Air Hot House does not sacrifice reliability using this alternative air-cooling method. “In the Fresh Air Hot House, we’re seeing that our hardware continues to function and perform at a very high level, regardless of the temperature inside,” says Fitch.

### **Use Fresh Air cooling at the height of summer**

The Fresh Air Hot House is a proof of concept, showing that Dell customers can use fresh-air cooling even during very hot months of the year, which could translate to real-world HVAC use reductions to cool a data center. These reductions could result in significant cost savings. “If you go chiller-less, you will have an energy cost for your data center fans and air movers, but you can still significantly reduce energy costs,” Fitch says. “Or you might choose to economize for only part of the year and use much less air conditioning, so you’re spending less in power to cool the data center.”

As an example, for eBay, Dell Data Center Solutions custom-designed servers for its data center and custom-designed an ultra-efficient highly scalable Modular Data Center for the roof that relies heavily on fresh air cooling. “IT is our business,” notes

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Dean Nelson, vice president of Global Foundation Services (GFS) for eBay. “That’s because our 100+ million active users depend on our site 24x7 by forever.” In a test of the Modular Data Center conducted in August 2011, Nelson and his team saw firsthand what they had accomplished from a cooling standpoint. They tested the Modular Data Center, and its 1,920 servers, under maximum-load conditions on a sweltering day in the desert sun. “It was 115°F, measured outside — 115 degrees Fahrenheit — on the roof, exposed to the sun, in the desert. We were sustaining 26 kilowatts per cabinet, and we were getting free cooling,” Nelson says. “Let that sink in for a second: We were getting free cooling at 115°F in the desert.”

### Boosting energy efficiency and powering research

Dell Fresh Air solutions also demonstrate impressive energy efficiency, with an average power usage effectiveness (PUE) measured at 1.043, according to The Green Grid standards. A perfect PUE is 1.00, which indicates that all of the power being used by the data center is going to actual work.

Breaking out the numbers specifically for servers, the energy efficiency is even more impressive: Dell Fresh Air solutions have offered customers approximately a 50 percent reduction in energy intensity over the past two years.

But the energy efficiency of Dell Fresh Air solutions isn’t just about energy savings. It’s also about what the efficiency is enabling Dell customers to do. For instance, a Dell installation at the University of Cambridge in the United Kingdom is using a Dell Fresh Air high-performance computing cluster to crunch data for the Square Kilometer Array radio telescope.

### Helping meet sustainability goals

Dell can also better meet its sustainability goals by using findings from the Fresh Air Hot House. In fact, the Hot House’s energy efficiency supports the Dell 2020 Legacy of Good Plan, which lists 21 strategic goals, including the reduction of energy intensity in Dell products by 80 percent by the year 2020. “From a sustainability point of view, we take seriously the footprint our customers see as a result of using our products,” says John Pflueger, principal environmental strategist at Dell. “We understand that it’s part of our footprint as well, and the Hot House is an example of what we’re doing to try and improve our efficiency and demonstrate it to our customers.”

1. Results based on 2011 white paper published by Schneider Electric, *Data Center Science Center: An Improved Architecture for High-Efficiency, High-Density Data Centers: White Paper 126*, authored by Neil Rasmussen. [http://www.apcmedia.com/salestools/NRAN-6V5QAA/NRAN-6V5QAA\\_R1\\_EN.pdf](http://www.apcmedia.com/salestools/NRAN-6V5QAA/NRAN-6V5QAA_R1_EN.pdf)
2. Fresh Air capability is limited to certain system configurations.

View all Dell case studies at [Dell.com/CustomerStories](http://Dell.com/CustomerStories)

