

Utilizing Temperature Monitoring to Increase Datacenter Cooling Efficiency

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Abstract

Looming over the heads of any environmentally conscious company, is the threat of global warming. Considerable effort has been taken to decrease the carbon footprint of the organization through various means: paperless offices, hybrid company cars, reducing waste and many more.

Now there is significant focus being placed on the IT Department to critically look at the way in which it operates. More specifically, what can be done to decrease the reliance on power, and thus help make the datacenter “go green?”

There are a number of strategies available to IT managers such as virtualization, redesign of the datacenter and exchanging power hungry servers with more energy efficient devices. Many of these strategies require a major shift from current practices, and they often carry a prohibitively high price tag.

Sensatronics is committed to making it cost effective and realistic for a company of any size to begin to effect changes in their power usage through close examination of the heating and cooling activities in the datacenter. The Senturion “Go

Green” Solution has been designed to create visibility and provide data which the IT manager can utilize to make changes, monitor the results, and continually “tweak” the datacenter to run in a highly efficient manner.

About Sensatronics

As a long term vendor to IT departments, Sensatronics has developed an understanding of temperature and its adverse effects in the datacenter. Traditionally our products have been utilized to prevent major heat, humidity and water intrusion events. Our automated monitoring and alerting solutions have been put into place in over 40% of the Fortune 100 as well as thousands of other companies.

With the current industry wide focus on green datacenters, our solutions can be implemented to help IT managers control cooling and power costs, while also serving to alert in the case of any environmental issues.



Introduction

In today's business world, there is an ever increasing reliance on information technology resources. Technology is becoming faster, denser, and more necessary. Add in the effect of remote workers and non traditional working schedules, and the load that is placed on an organization's network is vast, and almost constant. The result is an increase in pressure on the IT managers, network administrators, and C-Level personnel to deploy systems which must meet the demands of the organization. This translates to more servers, more storage, more speed, and more security.

Oftentimes, the need to fulfill these needs clashes with a company's initiatives to become more environmentally friendly. And yet, there may be a push from above to adopt a "greener" philosophy in the datacenter. The challenge is really to determine how an IT organization can become more efficient, while meeting the needs of the company as whole, and as cost effectively as possible.

What's the point?

As a busy IT practitioner, it is easy to lose sight of the larger picture. The global impact of our operations

oftentimes go overlooked, since the focus is on network efficiency and the bottom line. The folly in this line of thought is far reaching and concerns not only large organizations, but small to medium enterprises (SME's) as well.

In a November 2006 report from Gartner, Inc it is speculated that 50 percent of current datacenters will have insufficient power and cooling capacity by 2008¹. The major culprit for this trend is the increased use of high density equipment such as blade servers which require an inordinate amount of power. This translates into more heat being released into the room. Thus to simply keep IT equipment operating, the power requirement for cooling the room could potentially exceed the power requirement of the computing devices¹. It is projected that by 2009, power costs will become the second highest operating cost in 70% of the world's data centers¹. Therefore it is important for any organization to critically look at their data center to determine what can be done to increase efficiency.

Estimating datacenter efficiency

The Green Grid, a non profit organization of IT professionals, has devel-



oped a set of metrics which are useful in determining the efficiency of a datacenter. The primary metric which is used is Power Usage Effectiveness and is determined by²:

$$\text{PUE} = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}$$

IT Equipment Power is the load associated with all of the IT equipment in use within the datacenter, from servers to laptops. Conversely, Total Facility Power is the requirement of all the supporting equipment in use in the datacenter, such as PDUs, cooling systems, air handlers and others².

The PUE calculation, although not exact, helps to provide insight as to where the true power requirement is located within the room. For instance, a PUE of 3.0 indicates that the datacenter demand is 3 times higher than the energy required in powering the IT equipment². With this figure in mind, we can now implement steps to change the efficiency of the datacenter and also have the means to measure this change.

Options for optimizing efficiency

Organizations looking to become more efficient with their power usage in the datacenter have a number of options available.

1. Replace all the equipment to less dense servers, and those which employ micro cooling technologies.
2. Reconfigure the datacenter to a more efficient setup.
3. Construct a new datacenter from the ground up.

Clearly, for most companies, constructing a new datacenter from the ground up is not a feasible solution. For one thing, the time and effort required to do so is highly prohibitive, unless there are other factors necessitating this decision. It is important to keep in mind that a new green datacenter can cost an additional 3-15% upfront³. However the long term savings may more than make up for this.

Replacing high density equipment with more efficient servers is an effort that is best undertaken over time, as the equipment requires replacement. One could not argue in de-



fense of swapping out working equipment based solely on the need to be more efficient.

Thus the prudent IT manager should consider taking steps to make his/her existing infrastructure much more efficient and thus less reliant upon cooling equipment. In order to accomplish this effectively, temperature monitoring must be utilized to diagnose issues, facilitate change, and monitor the long term benefits.

Areas for Improvement

Due in part to the way in which IT has evolved there is most likely room for improving cooling efficiency in any size datacenter. In order to combat this inefficiency, there are a number of areas which require careful examination to determine the effectiveness of a greening strategy.

Datacenter Design

When setting up a datacenter it is important to intelligently place devices within racks such that the overall cooling load is distributed. Simply taking the time to determine the best possible placement of the devices can have a considerable impact on the power requirement for the room. For example, two datacenters

with the same equipment may have entirely different cooling needs, based solely on the setup design⁴. Once a datacenter is installed, it then becomes prudent to monitor the heating and cooling activities in order to respond to increasing demands on the equipment. Higher user demand is directly related to the amount of heat produced.

Overall Layout

It is important to create a logical flow of air throughout the datacenter that also separates the warm and cold air. An ideal arrangement would utilize a hot-aisle/cold-aisle methodology⁴. Through doing this air segregation is obtained.

A secondary benefit of this configuration is the ability to monitor the temperatures of the exhausted air compared to the inbound cold air. Fluid dynamics tells us that no matter how much cold air you flood into the rack, the change in the exhausted air remains almost constant⁵. Thus by analyzing the change in temperature between the air intake, the middle of the rack and the exhaust, you will be able to determine if the air-flow is being choked off within the rack.



Floor Vented Tile Location

Vented floor tiles are an excellent way to distribute cool air into the datacenter. However, in many rooms, tiles are either placed inappropriately or an insufficient or excessive number are installed⁴. Therefore it is important for the practitioner to utilize a temperature monitoring system at the point(s) of air entry into the rack to ensure optimal vented tile placement.

Server Software Configuration

Oftentimes little thought is given to the configuration of server software. It is important to utilize power economizer modes⁴ or explore virtualization to increase the operating efficiency of datacenter devices.

Closely Coupled Cooling

The datacenter manager or designer should give serious thought to breaking the paradigm of large scale cooling. In a typical datacenter, CRAC units are employed to cool the ambient air, with the hope of keeping all IT equipment within specifications. However, this concept of simply flooding the room with cold air causes the heat and cold to mix, making it nearly impossible to spe-

cifically target the high heat sources in the datacenter⁴. By employing a closely coupled cooling approach, the cold air can be delivered to the high need areas, and drawn away from less heat generating devices.

Be Lighting Efficient

Lights in the datacenter also produce a considerable amount of heat. It is important to not ignore this heat source in an overall green strategy. The IT manager should be cognizant of the times in which the lights need to be on, and either install motion sensors or automatic controls for the lights to help reduce costs.

Senturion “Go Green” Solution

The majority of low cost strategies to transform a “traditional” datacenter into a greener datacenter can be primarily focused around understanding the heat requirements of the room.

Sensatronics has devised a solution catered to the IT practitioner seeking a means to cost effectively reduce power requirements in the datacenter. The purpose of the Senturion “Go Green” Solution is to assist with the diagnosis of temperature abnormalities within the rack. Through analysis of the collected data, the IT



manager will be able to identify areas of improvement as it relates to the physical configuration of the racks, floor tiles, cooling delivery system and lighting. In addition, once improvements have been enacted, the system can be utilized to monitor the effectiveness of this change.

Benefits of the Senturion “Go Green” Solution

This solution is comprised of three primary components:

1. Senturion Rack Mount Environmental Monitor
2. Three temperature probes for placement at the cool air intake, the center of the rack, and the exhaust vent/area
3. INM software for data collection, analysis and report generation

Upon installation of the hardware components, data is immediately gathered in the Senturion unit for real time examination. Once the software is up and running, however, users gain access to automated reporting and graphical representations of the three temperature points. By

comparing these values the IT manager will be able to determine if the rack is being cooled correctly. From there, experimentation is required to find the optimal efficiency for the cooling system for that rack.

It is recommended that multiple instances of the Senturion “Go Green” Solution be utilized in multiple racks. All of this data can be aggregated into the same software, thus allowing the datacenter manager to compare one set of equipment to another. Again, through experimentation, an optimal configuration can be achieved.

Senturion “Go Green” Solution Goals

In order to take the first steps towards maximizing efficiency of the cooling system in the datacenter, the “Go Green” Solution can be employed to:

- Identify inefficiencies in the CRAC system
- Provide actionable data for datacenter reconfiguration
- Test the effectiveness of equipment reconfiguration activities



- Monitor hot/cold aisles
- Detect any unwarranted changes in the cooling system
- Immediately notify the appropriate personnel if an unexpected rapid increase in temperature occurs

Conclusion

With the threat of global warming, compacted with the economic requirement of larger and faster datacenters, it is important to strike a balance between these forces. Soon enough, there will be a need for all organizations to adopt a “go green” attitude.

By critically looking at the way in which a datacenter operates and utilizes the cooling system, SME’s and large organizations can efficiently reconfigure these devices to considerably cut costs and create a lasting impact environment. That is why the Senturion “Go Green” Solution has been developed, to allow the IT manager to take the first critical leap into operating an efficient and cost effective datacenter.

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