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infrastructure for a connected world

Improved Reliability Through Wireless Monitoring and Control

Key Points:

- Does improved reliability save costs?
- How does increased visibility affect essential data center operations?
- How can wireless monitoring improve operations?

Overview

Redundancy in electrical power components and cooling backups are the core of reliability for data centers. If an electrical or cooling component fails, it is critical that the backup takes over without human intervention and without complications. The minimum risk of repair of the failed part is dependent on an aggressive, maintainable installation that employs breakers, valves and other isolation strategies. Another critical element of reliability is capacity and the ability to conduct high density monitoring. As components reach their full capacity, they become stressed and are prone to fail. These challenges can create difficulty for the service staff to sift through data and obtain vital information quickly, concisely and accurately.

Increased Visibility

New technologies developed in recent years provide cost-effective monitoring that delves deeper into computer environments. In physical infrastructure asset management, few mature asset tracking tools currently exist, and those that do exist often lack visibility or are seriously compromised by a lack of integration with current asset management tools and techniques. This lack of visibility into the physical layer exposes data centers to significant risk, and increased operational expense.

Although this paper focuses on cooling monitoring, there are similar electrical capabilities that address the challenge in a comparable manner. While servers will alarm if a device becomes overheated, this capability is reactionary and occurs too late to create a suitable environment for the servers. To date, there are no relationships between the component temperature and the air inlet temperature. Current technologies monitor air temperature as close to the point of entry as possible, providing a significant improvement compared to "guessing" the basis for the server inlet temperatures by measuring the Computer Room Air Handler (CRAH) and/or the Computer Room Air Conditioner (CRAC) return temperature. Until recently, adding monitoring closer to the endpoint was a wired proposition – expensive and inflexible. With Panduit's SynapSense® Wireless Monitoring and Cooling Control Solution, operators can add wireless sensors strategically to measure an array of critical variables at significantly lower cost than the previous wired solution. The following variables represent a sample of the monitoring that can be added to an existing "blind operation" and create visibility not previously possible.

Temperature – Monitoring CRAH/CRAC supply or return temperatures combined with VFD speeds provide service staff the ability to calculate tonnage/BTU/kW of current cooling and perform a capacity test. The test focuses on temperatures in and out of servers:

- Cabinet inlet temperature monitoring is used to determine whether IT equipment is receiving appropriate cooling
- Server exhaust temperature monitoring is used to determine which unit is wasting energy by dumping cold air
- Chilled water in/out test provides insight on total cooling load compared to total Uninterruptible Power Supply (UPS) load to help service staff identify the percentage of the cooling system being used compared to the electrical load

Increased Visibility (continued)

Humidity – Monitoring dew-point or absolute (grains H_2O) humidity will provide the best results for operators as these variables are the most prominent when considering "humidity" and are independent of temperature.

Power – Operators achieve increased transparency to plug, power strips and cabinet loads when utilizing monitoring capabilities.

If operators intend to identify the condition of the data center environment from end-to-end, adding wireless sensors fills in the gaps. Figure 1 illustrates how a real time, LiveImaging® map, a feature of the SynapSense® Wireless Monitoring and Cooling Control Solution provides the capability to "view the entire room".

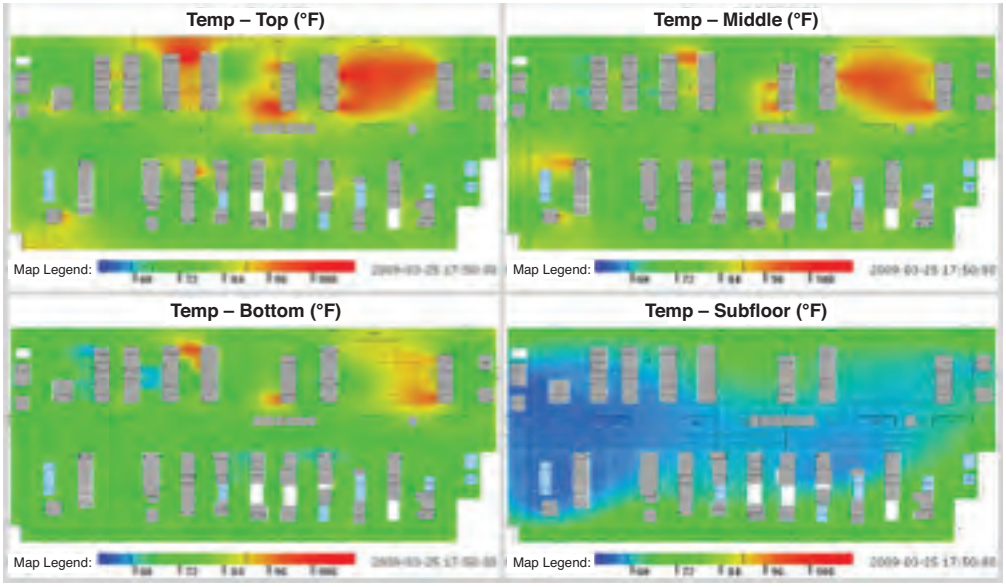
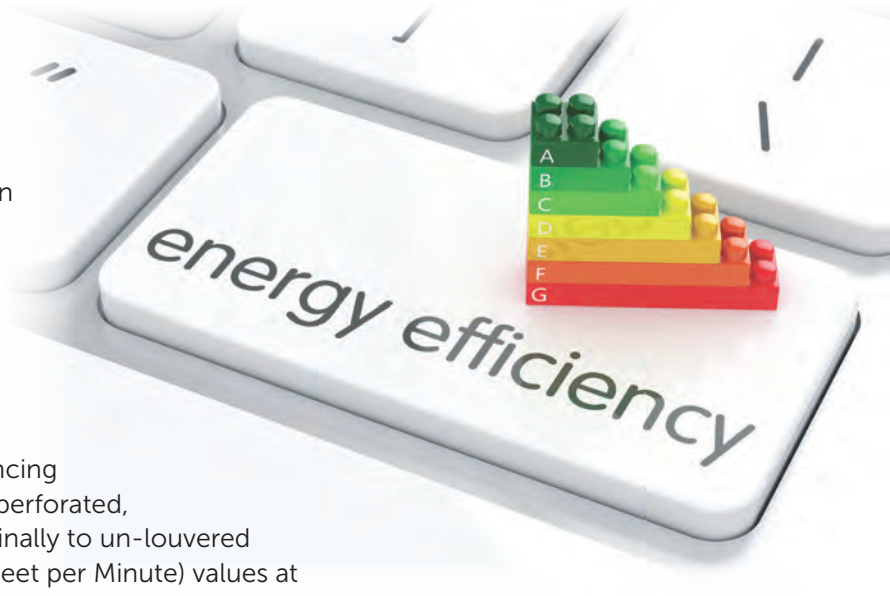


Figure 1. LiveImaging® sample of raised floor temperatures

Benefits

High density monitoring provides substantial short and long-term benefits.

Air and Temperature Optimization – Minimizing the air used and maximizing the air temperature saves energy, significantly decreasing operational expenses for the data center, and recovers stranded capacity with the elimination of waste. This translates into increased reliability because the cooling delivery system is capable of handling added servers until the capacity is reached, at which point a notification will be sent to alert the staff long before issues arise. Recovered capacity translates into higher reliability because a failed unit can be compensated by the surrounding unit's ability to deliver the recovered capacity. Reliability is also enhanced because capacity stressed areas can be addressed proactively before issues become critical due to related server issues.



Benefits (continued)

Pressure Optimization – There is a misconception in the industry that an approach to control the environment is to raise and lower underfloor pressure. This approach can cause a great penalty because any pressure increase requires higher fan speeds, which results in energy usage proportional to the cube of the speed (RPM^3). A best practice is to maintain a constant, minimum underfloor pressure. Sequencing grates on a timed rotation from solid to louvered perforated, then to un-louvered perforated to louvered, and finally to un-louvered allows transitioning of the following CFM (Cubic Feet per Minute) values at 0.03" H_2O pressure (constant): 0, 200, 400, 800, 1600 CFM. A 4' cold aisle can accommodate 200w/S.F. and 10kW/cabinet. Switching to a 6' cold aisle allows operators to successfully condition 300w/S.F. and +15kW/cabinet. Reducing the cost of operation and maintaining the current space is beneficial to the planning team, which should strongly consider utilizing Variable Frequency Drives (VFD) control of underfloor pressure using wireless sensors. The programming includes "areas of influence" where CRAH (CRAC) unit speeds are raised slightly and the sensors that detect the change are mapped to the self-adjusting control.

CRAH (CRAC) Function – By adding temperature supply/return and recognizing CFM at different VFD speeds, the system can detect in real time the load vs. capacity of each cooling element. Panduit has used this capability to detect malfunctioning chilled water (CHW) valves on units that otherwise appeared to be functioning properly. Because the cooling side is generally over-provisioned, one or two units that are less than optimal can "hide" in the space. As time goes on, this condition could become critical if allowed to progress. With the ability to measure real-time actual cooling vs. capacity and a programmable capacity test, the staff can service units as challenges arise, ensuring reliability is maintained. This is equivalent to performing a CRAH load bank test as often as desired with no risk to the data center operation and elevates the condition assessment from assumption to verified knowledge.

Teamwork – The industry has had a natural division between the IT and facility staff. While many try to collaborate, there is a natural language barrier due to the nature of each group's focus. The LiveImaging® map presents members of both groups with a common point of discussion where neither has difficulty understanding that the cold areas represent waste and the hot areas require attention.

Resource Optimization – Providing higher level visibility of the data center environment produces a more informed staff, resulting in better decisions. Problem solving is at a much higher level, which creates a more efficient troubleshooting resolution process, allowing for better use of the data center's staff to attend to previously ignored challenges.

Conclusion

The SynapSense® Wireless Monitoring and Cooling Control Solution delivers unprecedented energy savings through enhancing performance and reliability. This platform is designed to meet today and future environmental monitoring demands around power and cooling optimization for mission critical facilities. By deploying this fine-grain wireless sensing technology and cooling automation platform, data centers realize benefits such as:

- Savings up to 50% of their cooling costs (on average, up to 20% of total energy) per year
- Gain valuable data that enables fast adjustments and management of server inlet temperature closer to the A1 class allowable range (per ASHRAE is 59° up to 80.6°) resulting in increased cooling capacity
- Improved visibility increases operational efficiency
- Highly flexible system accommodates the data center equipment as it expands or contracts
- Capacity recovery and reliability improvements to enhance energy savings without increasing risk of thermal issues

PANDUIT®

Since 1955, Panduit's culture of curiosity and passion for problem solving have enabled more meaningful connections between companies' business goals and their marketplace success. Panduit creates leading-edge physical, electrical, and network infrastructure solutions for enterprise-wide environments, from the data center to the telecom room, from the desktop to the plant floor. Headquartered in Tinley Park, IL, USA and operating in 112 global locations, Panduit's proven reputation for quality and technology leadership, coupled with a robust partner ecosystem, help support, sustain, and empower business growth in a connected world.

For more information

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