RFCODE

White Paper

Best Practices for Wire-free Environmental Monitoring in the Data Center

April 2012

Introduction

Monitoring for environmental threats in the data center is not a new concept. Since the beginning of modern data centers, the temperature of servers and network equipment has been a constant concern as one of the most threatening environmental conditions.

Since then, the physical construction, physical layout, and implementation of a data center has steadily improved, optimized to accommodate the ever-changing requirements driven by advances in server and storage technology. The methods and mechanisms to monitor for physical threats in the data center have also evolved.

Environmental Threats in the Data Center

Temperature

The first and most important physical threat to the data center is temperature. There are many physical locations in the data center where temperature is critical:

- Air temperature in the plenum spaces such as raised floors, especially far away from the CRACs
- Air temperature above the plenum and in front of the racks on cold aisles (i.e., the intake air for the servers in the racks)
- Air temperature inside the IT racks themselves, especially if the racks are fully enclosed (doors front and rear as well as sides)

Humidity

Humidity is like air temperature in that it can vary throughout the data center, although it typically does not vary as much. It is not uncommon for data center humidity readings to vary with the outdoor humidity conditions. Most modern CRACs (computer room air conditioning unit) have the ability to control (increase or decrease) the humidity in the data center.

The danger of low humidity conditions in the data center is threat of electrostatic discharge (ESD), which can damage electrical components. The result of high humidity in the data center is the possibility of condensation. ASHRAE currently recommends a range of 40%-55% for data center humidity.

Water or Fluid Leaks

Water or fluid leaks in the data center are definitely a concern. The severity of this threat to a data center varies according to construction details, equipment use and water/fluid systems placement. Many systems use fluid or water for cooling from CRACs to water cooled systems to fire suppression systems. The impact to the data center from fluid or water leaks is damage to electronic systems and cabling.

Door Position

The position of rack doors and room doors is directly related to the physical threats of are air flow/ cooling and access control. Proper and efficient air flow and cooling are constructed around a known or fixed configuration, which incorporates the knowledge that doors to racks and rooms are supposed to be open or closed. Normal open and closing of a door in a short period of time typically does not impact air flow and cooling. However, doors that are propped open for extended periods of time can cause issues.

Air Handler or CRAC Failure

Understanding, even at the most basic level, the state or health of a CRAC in the data center is essential. Not all CRACs and air handlers have network monitoring and management capabilities, particularly older units and models. However, most CRACs and air handlers (as well as generators) typically do have dry contact monitoring capabilities. Dry Contact is basically a relay that makes or breaks a circuit to indicate a status change or fault with a device. So a CRAC, for example, may have one or more dry contact connection points that may indicate things such as fan status (normal or fault) and compressor status (normal or fault). Proactively monitoring the status of CRAC units, even at a basic dry contact level, can reduce the impact of a failure and increase the amount of time available to respond to the issue.

Best Practice Sensor Placement

Now let's look at the best practice methods for sensor placement to proactively monitor for physical threats in the data center.

Temperature Sensors

There is no single answer to what is the ideal placement for temperature sensors in a data center. Multiple factors influence the quantity and location of the temperature sensors needed to properly. These include data center design, load, capacity, percent utilization, and efficiency goals. The "classic" way of running a data center was to cool the data center regardless of cost and efficiency. With the new "green" way of thinking and the fact that operational costs of now outweigh the capital costs of a data center, the concept of overcooling has lost favor.

For cold aisles and hot aisles the quantity of sensors can vary, depending on your monitoring goals and budget. For closed racks with doors, it is recommended to place the sensor on the inside of the rack door. For open racks without doors, it is a matter of convenient and secure mounting location more than anything else. A good location for open racks is the left or right side of the rack but not interfering with the equipment "U" space. The following are three best practice recommendations around the placement of temperature sensors:

- Minimal temperature sensor coverage
  - One temperature sensor in the front of every rack at mid-point of the height of the rack
  - One temperature sensor in the rear of every five racks at mid-point of the height of the rack
- Typical temperature sensor coverage
  - Two temperature sensors in the front of every rack, with one mounted about sixteen inches from the bottom of the rack and one about sixteen inches from the top of the rack
  - One temperature sensor in the rear of every other rack at mid-point of the height of the rack
- Maximum temperature sensor coverage
  - Three temperature sensors in the front of every rack, with one mounted about twelve inches from the bottom, one mounted in the middle and one mount about twelve inches from the top of the rack
  - One temperature sensor in the rear of every rack at mid-point of the height of the rack

The following illustration shows proper placement of temperature sensors (assuming maximum coverage) in the front of a closed rack.

Regardless of the mounting location and quantity of temperature sensors used, always mount sensors consistently from rack to rack and row to row.

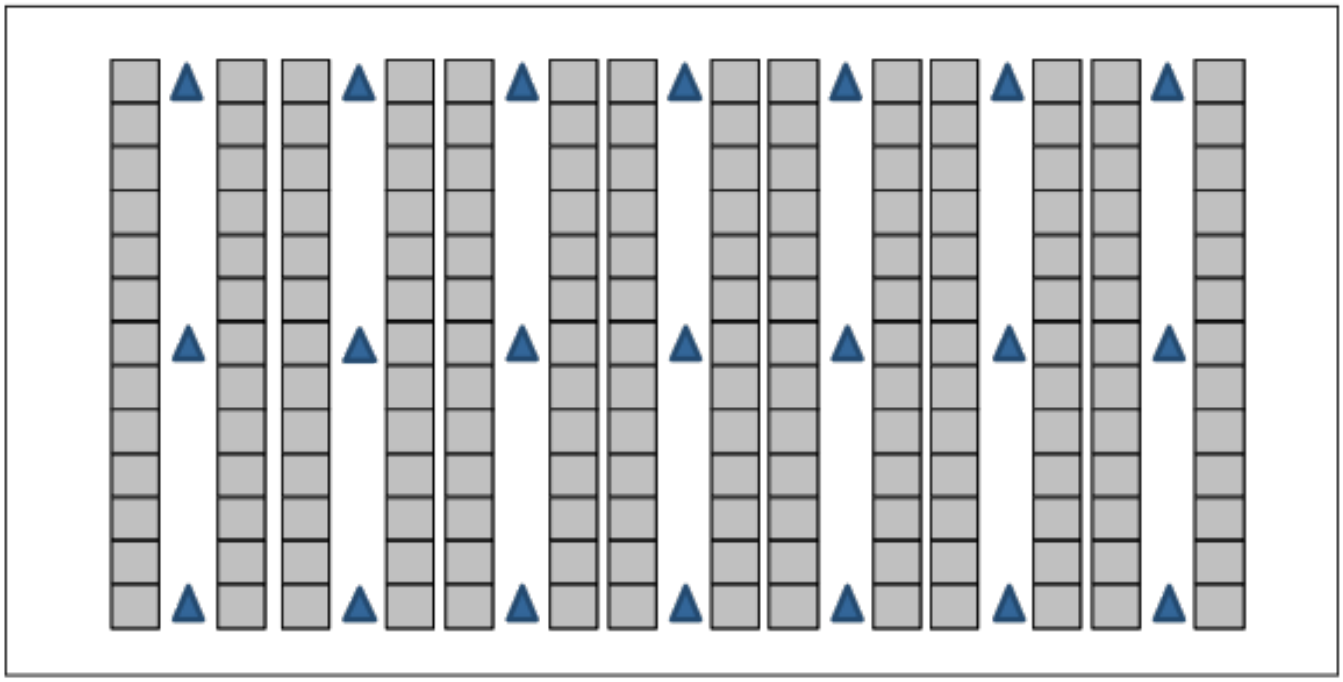
To better understand the environment in the plenum, additional temperature sensors may be placed in plenum spaces such as below raised floors.

Humidity Sensors

Humidity does not vary as quickly in a data center as temperature. Therefore, fewer humidity sensors are needed. Humidity sensors are typically placed on cold aisles and spaced fairly far apart. The following are three best practice recommendations around the placement of humidity sensors:

- Minimal humidity sensor coverage
  - One humidity sensor per row placed in the front of a rack in the middle of the row
- Typical humidity sensor coverage
  - One humidity sensor for every five racks placed in the front of a rack
- Maximum humidity sensor coverage
  - One humidity sensor for every three racks placed in the front of a rack

As with temperature sensors, humidity sensors should always be mounted consistently throughout the data center.



Liquid Sensors

Liquid or leak sensors should be placed near the potential sources of the liquid. The most common fluid source in the data center is the CRACs. However, more sources may be present in your data center. So it is best to involve the facilities manager who can indentify pipes that may be hidden behind walls as well. Additional sensors may be needed if your data center is in the basement level of building (or even partially below ground level) because of potential water seepage from outside walls.

Door Position Sensors

At a minimum, door sensors should be placed on all doors that provide access to the data center, even if an access control system is installed. In addition, door sensors may be installed on the front and rear of IT racks.

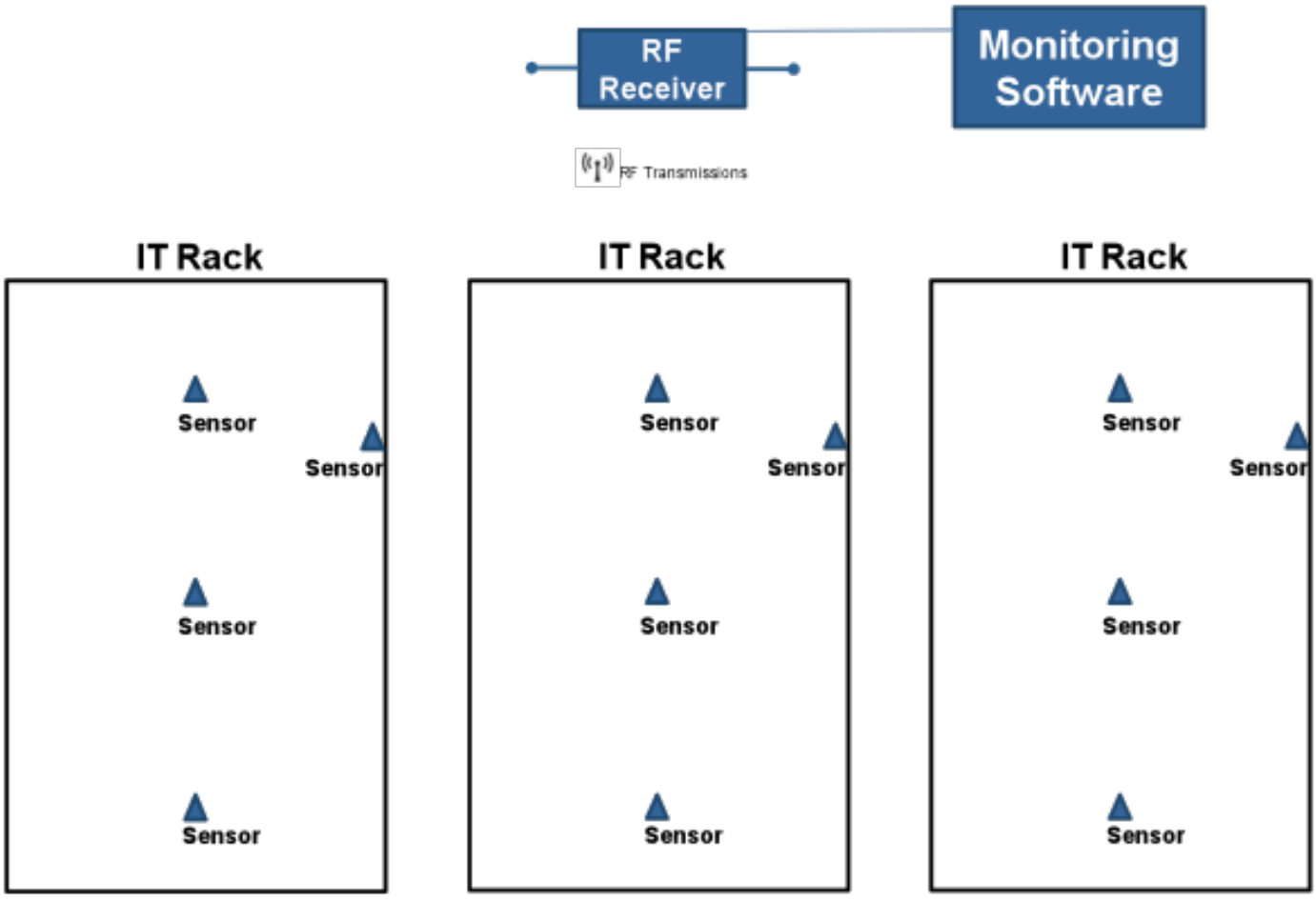
Dry Contact Sensors

Any CRAC or air handler not monitored via SNMP should have a dry contact sensor attached. Note that outdoor generators as well as UPS systems usually have dry contact connection points as well.

Advantages of Wire-free Environmental Monitoring Solutions

1. They typically cost much less than wired solutions.
2. There are no wires to install and manage with wire-free solutions.
3. Wire-free monitoring solutions do not consume any valuable rack space because the RF readers are typically mounted to the data center ceiling.
4. Properly designed wire-free solutions have a very high sensor- to-RF receiver ratio that allows for massive scalability. New sensors can be added without worrying about wiring connections and cabling restrictions.
5. In most wire-free sensor solutions, more than one RF receiver can receive the RF broadcast from each tag. Having multiple RF receivers with the same coverage zone eliminates the single point of failure of aggregation appliances.
6. Lastly, the cost to deploy a wire-free environmental monitoring solution is substantially less than a traditional wired solution.

For more information, see http://www.rfcode.com/Wire-Free-Environmental-Monitoring-Solutions.html.



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