

Wireless sensor network enables data centre environmental monitoring

In data centres avoiding downtime is critical. Temperature and humidity fluctuations and hot spots can wreak havoc on server hardware and cause costly breakdowns.

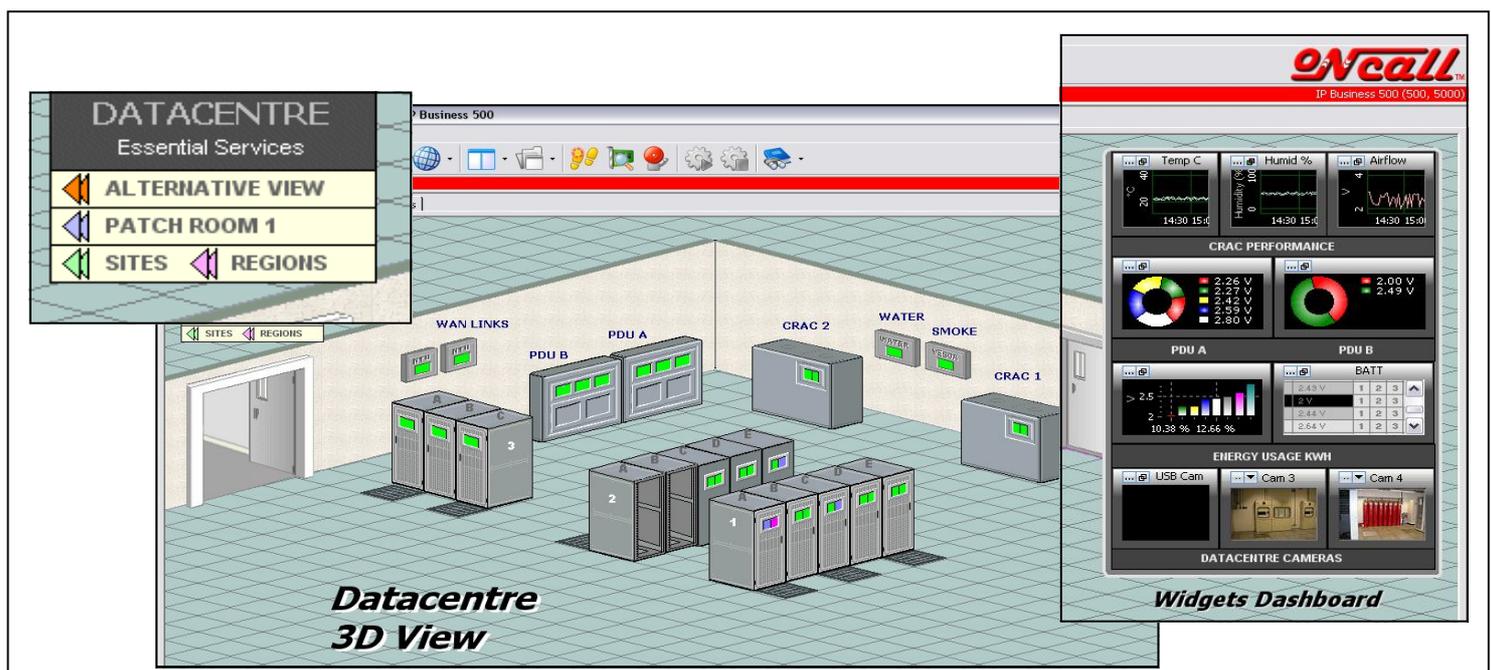
Also with increased concern over environmental issues the energy consumed in data centres has become a very high priority for management.

Only by continuously monitoring conditions in the data centre can one hope to control these threats and balance the need to give maximum service to users whilst limiting the impact on the environment and costs to the organisation.

This paper describes an application using a wireless sensor network at a major natural resources company in one of their mission critical data centres. A wireless mesh network solution was chosen as it provided the best combination of reliability, flexibility and data granularity that the customer was seeking.

This paper discusses the following issues :

- Limitations of existing monitoring solutions
- How a wireless sensor network solution solves many of those limitations
- A typical installation and the benefits achieved



Traditional monitoring solutions

Manual collection of environmental data becomes almost impossible to maintain as the pressure grows on staff time and, even if records are kept, errors soon creep in and reduce the reliability of the data. Wired monitoring systems are expensive and unrealistic in challenging physical environments due to cost and the pace of change within the data centre.

There a number of traditional wireless solutions which are either point-to-point or point-to-multipoint. The reliability of these networks is set by the quality of the RF link between the central access point and each endpoint. In data centre settings it can be hard to find a location for an access point that provides dependable communications with each endpoint. Moving an access point to improve communications with one endpoint will often degrade communications with others.

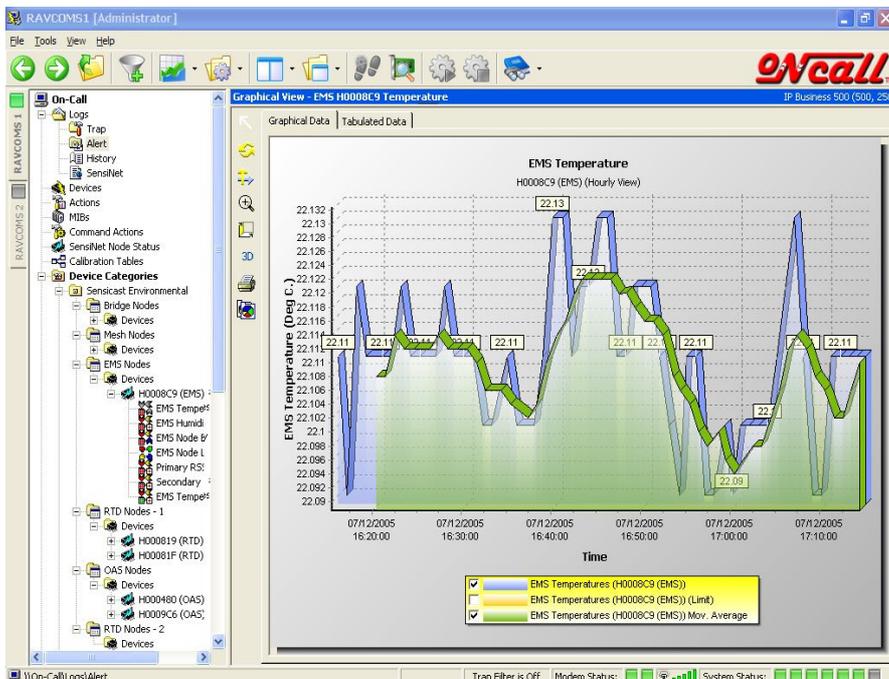
Benefits of a wireless mesh network

A **wireless sensor network** (WSN) is a wireless network consisting of distributed devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations.

In addition to one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery.

A sensor network normally constitutes a wireless ad-hoc (mesh) network, meaning that each sensor supports a multi-hop routing algorithm (data may travel along various paths through the network to its desired destination). The network also uses wireless mesh routers to form a robust network backbone and a gateway which is used to collect data and configure the network.

In a typical data centre wireless sensors can be deployed in various locations to monitor environmental factors including temperature, humidity and power consumption. Because of the unique capabilities of the mesh architecture the addition of extra sensor nodes or movement of existing nodes is simple and does not require specialist support to reconfigure the network..



Case history : Mission-critical company data centre

Background

The company had been using a system based on manually managed data loggers which were manually deployed and then regularly recovered for transferring data to a pc. This was time-consuming, labour intensive, slow, incomplete in terms of coverage and data became available usually at least a week after the data was first logged. To move towards their goal of a more responsive environment management at the company needed to move to a real-time monitoring solution with increased completeness of coverage, whilst retaining the flexibility of manually placed mobile devices.

Wireless flexibility

A wireless system was required due to the cost and inflexibility of a wired solution (whether an Ethernet-based or dedicated wired system). The wireless project had been proposed for several years prior to installation and other vendors had made proposals to meet the company requirements but were found to be unsuitable for technical and/or commercial reasons.

Custom sensors

Adaptive Wireless Solutions submitted a proposal and following a visit to site for testing and performance validation was the selected solution. Adaptive was also, uniquely, able to supply a very neat and compact integrated wireless temperature and humidity sensor, which is ideal for ambient data centre monitoring applications, and a variant with the sensor on a 50 cm wire, which proved ideal for rack monitoring

The primary reason for needing the system is real-time continuous monitoring to ensure that the environment is within operating specifications for the installed computing equipment so that problems can be detected early and dealt with before becoming critical.

Rapid installation with minimal disruption

Although involving more than a hundred sensors in the first phase, the installation of the wireless gateways and sensors was completed in only a few business days. Subsequent expansions have been similarly quick and trouble-free.

System description

The main data centre is on 4 floors and there are two separate remote facilities for business continuity and disaster recovery, and more than a dozen separate critical network infrastructure rooms.

Even though it is possible for the wireless signals to penetrate between floors of the main data centre, for operational reasons it was decided to install a logically separate wireless mesh network on each floor and in each of the two separate remote areas. This is possible due to network configuration features with the system. Each separate wireless 'sub-net' is connected via the data centre wired LAN to one of two blade servers running the network management software and the OnCall alarming and alerting application. Two servers were required for failover capability so that either server could monitor the entire facility if required.

The company determines the required interval for readings from the wireless temperature and humidity sensors. This is configured at will within the software. Wireless sensors are placed both on ceilings and in the sub-floor for background readings but the majority are placed on racks and moved around as required both within and between floors. To date there are well over 250 sensors installed. The total raised floor area is of the order of 7,500 sq. metres.

The wireless mesh network transmits the data to the gateway for that area of the building and the data is passed through the LAN into the server. The OnCall application displays temperature and humidity data on floor plans and presents alerts and alarms in numerous ways that are configurable by the user. Several installed OnCall client applications can be connected to either or both monitoring engines to view status and acknowledge alarms.

In this case, while also being used at the desktop by key staff with overall system responsibility, the primary OnCall floor plan views created by the client were also deployed on large screens on the data centre control room 'video wall'. OnCall is used as the primary alerting system for 24x7x365 critical environmental temperature and humidity monitoring.

Benefits

The wireless system has allowed the Control Room and Facilities staff to monitor critical environmental data in real time rather than relying on manual data collection which suffers from delays and inaccuracies.

The nature of the wireless mesh network means additional monitoring points have been easy to add and relocating existing sensors has allowed staff to focus on suspected trouble spots or experiment with sensor location to optimise measurement accuracy and usefulness.

Specific benefits noted during more than two years that the system has been installed have been numerous and include:

- Early warning of hot spots caused by CRAC unit malfunctions such as sticking chilled water valves
- Provision of real-time temperature records to support equipment warranty claims in cases of SAN and server failure
- Provision of real-time temperature records to verify service-level agreements between Facilities and IT groups
- Provision of detailed temperature and humidity records to aid in retrospective analysis of specific problems
- Use of temperature and humidity survey data to better understand and optimise the data centre CRAC management and cold air distribution

Conclusions

This paper has shown how the use of wireless mesh sensor networks can provide real time data collection and analysis in mission critical IT facilities.

Such real time data, coupled with the flexibility and speed of wireless deployment, introduces the possibility of new paradigms for data centre management and demonstrates real business benefit.

Ongoing efforts to control spiralling energy costs whilst maintaining required availability and reliability will increasingly rely on the ability to make detailed measurements with a cost, implementation and flexibility profile that only a wireless sensor network solution can offer.