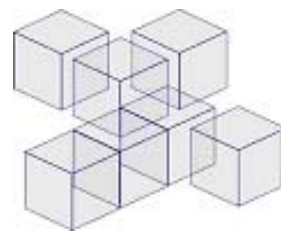


Remotely Monitoring the Data Centre Environment

A Data Centre Briefing Document



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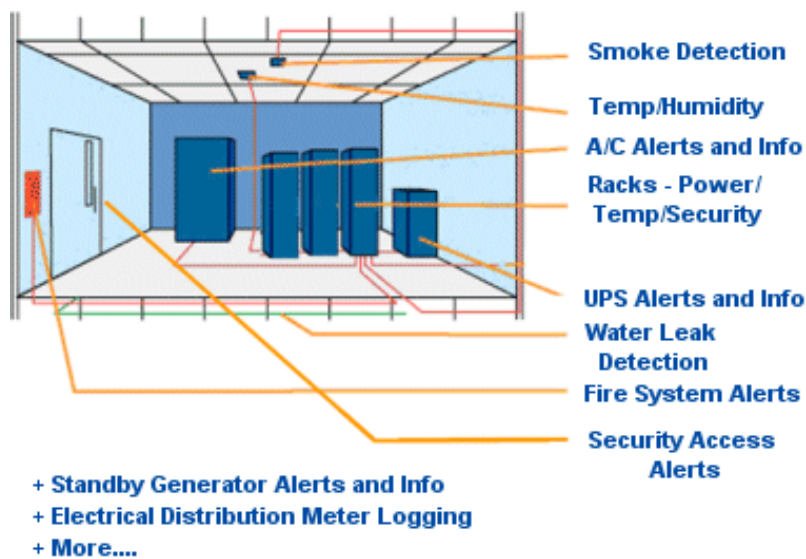
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1 Environmental Monitoring of Data Centre Infrastructures

To ensure the availability of an organisation’s IT infrastructure, a professional Data Centre is a “lights out” room with little need for access by operations staff and is environmentally controlled to keep IT Servers and network equipment operating in optimum conditions. However, environmental plant equipment (just like IT equipment) can malfunction and the effects can be catastrophic unless the right actions are taken to bring the issue under control in the shortest possible timeframe. Failure of the air conditioning, for example, can cause the temperature within the room to rise to unacceptable levels within minutes – this in turn will irrevocably damage the IT equipment. In order to fix problems, you first have to know that a problem exists and that’s where an Environmental Monitoring Solution comes into play. Monitoring can also provide data that helps the business understand and manage its capacity planning and running costs (e.g. power monitoring).

The elements that can be monitored are extensive and, therefore, it is essential to ensure that the factors monitored for any particular organisation are configured to that organisation’s exact need. The typical base set of environmental factors monitored, however, is shown in Diagram 1.



Environmental Monitoring is tailored to match both your infrastructure and your operational processes ensuring that:

- The appropriate personnel are informed of any issue (as part of an organisation’s operational processes), so that they can take the appropriate remedial actions. If the organisation has also deployed ‘Remote Management Technologies’, these can be utilised to shut down key IT equipment to prevent long term damage
- Immediate automatic actions are taken where possible to reduce any risks e.g. shutting off water isolation valve in the event of a water leak
- Data is logged and reports are produced to show trends that can enable proactive management of the Data Centre

Even if your Data Centre has a redundant (N+1) configuration with dual components (e.g. Parallel UPS Units), unless you are aware of a failure, your Data Centre is at high risk until that component is fixed. And it’s not just the Data Centre that needs monitoring. Often small Comms Rooms or local Server Rooms are just as important to an organisation’s overall operation and these are just as or more prone to such issues.

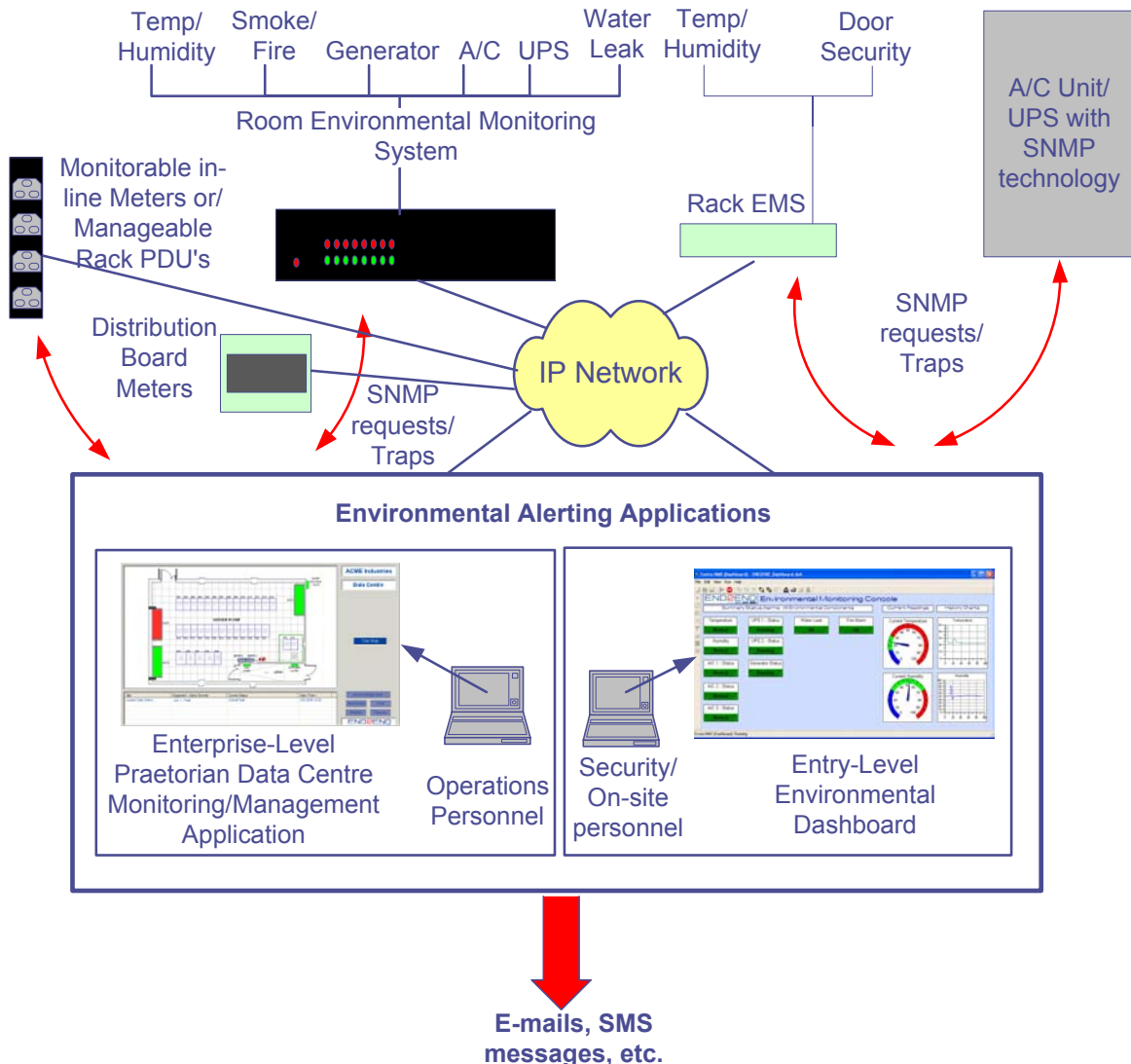
It’s all about keeping your finger on the pulse and that’s where Environmental Monitoring Solutions come into play.

2 What are the Benefits?

The benefits to an organisation are many:

- Provides alerting interfaces allowing easy visual indicators for operations personnel or out of hours personnel
- Forwards critical alerts to responsible personnel via email, SMS, etc.
- Protects investment by preventing damage to IT equipment
- Improves availability and prevents downtime
- Can be implemented at both the room and rack level
- Can reduce running costs by capacity planning and optimum management of power

3 The Environmental Monitoring/Management Overview



The Environmental Monitoring components continually monitor all of the environmental systems within the Data Centre for exception conditions and provide current status via an entry-level dashboard or a full-blown Data Centre Monitoring and Management application (such as END2END's Praetorian system). Alerts are forwarded by email or SMS to operations personnel, as dictated by your operational processes.

4 The Environmental Monitoring Infrastructure Components

The solution consists of a large number of discrete components integrated into the final solution. The configuration of those components is bespoke to meet the needs of the customer and more importantly the room being monitored. No two solutions are exactly the same. All of the following components can be integrated and communicate to a single Monitoring Application

In summary, the components and applications are:

□ Alert/Capacity Monitoring technologies

- **Room Environmental Monitoring System** – This is the central unit generally located in the Data centre and consists of a chassis with plug in sensors, depending on the types of monitoring required. It can be linked to the majority of the room's environmental sensors and equipment (e.g. Room temperature/humidity, A/C's, UPS's, Generators, Fire Panels, Intruder systems, Vesda Systems, etc.)
- **Environmental equipment with SNMP**– Most A/C units and UPS's have SNMP capability, which enables a high level of detail to be ascertained. This detail can be used for capacity planning purposes or to enable correct scheduling of engineers and parts for issues experienced.
- **Rack Environmental Monitoring Systems** - For the monitoring of individual racks (temperature, security (doors), etc.) within the Data Centre. Even in a well designed room individual racks can be overloaded.
- **Distribution Board Meters** – These are fitted into the Electrical Distribution boards and provide detailed information on the electrical supply to the Data Centre. This can help you understand, for example, the usage of power in the Data Centre, as part of any 'green' initiative
- **In-Line Rack Meters/Clamp Meters** – These sit between the power socket under the floor and your Rack PDU's and measure the Amps and kWh. This can prevent rack overloading and help understand how best to install kit across the Data Centre (also used by Hosting Organisations to bill clients). The Clamps can be added without the need to power off the rack
- **Intelligent Rack PDU's** – These provide the monitoring capability of the Rack Meters, but also enable intelligent control of sockets (e.g. you could remote switch off ports)

The next subsections provide more detailed information on the components.

4.1 Monitoring Technologies- Room Environmental Monitoring System



The Room Environmental Monitoring System comes in a number of sizes depending on the number of alerts to be monitored. The model above is the entry-level 8 port system, but these go up to 60 port versions. All can be fitted into standard 19" racks. The installation of all of the components including sensors and linkage to existing A/C, UPS and other units is carried out by END2END, providing a single, fully delivered solution.

The table below defines the types of sensors/connections that are typically included.

Sensor Descriptions		
Sensor Type	Typical Monitoring Conditions	Notes
UPS	Mains Failure Low Battery UPS Fault/Bypass	<input type="checkbox"/> The UPS's are monitored for a number of faults (the exact amount and type may depend on the UPS manufacturer)
Water Leak	Water Leak	<input type="checkbox"/> Detection cables are located in key areas around the room (e.g. base of A/C systems) and instantly detect any water leaks <input type="checkbox"/> This can also be used to activate an isolation valve
Fire Panel	Fire Alert	<input type="checkbox"/> Forwards 1 st or 2 nd stage alert signals to monitoring subsystem
Fire/Smoke	Fire/Smoke	<input type="checkbox"/> Sensors are located within the room to detect smoke independently of any other detection system
Temperature/ Humidity	High Temperature Critical Temperature Low Humidity High Humidity	<input type="checkbox"/> Sensors are located in key areas of the room. Alerts are produced if the readings are out of normal range
Air Conditioning	Failure/Fault	<input type="checkbox"/> Links to the A/C units for reporting of critical faults or maintenance alerts (e.g. dirty filter)
Generator Set	Unit Running Unit Failed to start Unit failed under load Fuel Low	<input type="checkbox"/> The generator is monitored for status and possible faults

4.2 Integrating with Imbedded Technologies

The environmental monitoring infrastructure can be further extended by the use of imbedded technologies. Today's environmental plant equipment (e.g. UPS's, A/C's, etc) can be equipped with SNMP cards, allowing in-depth information to be provided back to alerting applications. This provides:

- The ability to assess fully the implication of an issue (e.g. an A/C alert could be a small humidifier bottle problem or a compressor fault). This helps to ensure that maintenance engineers come when required and with the right parts, which in turn helps to reduce overall maintenance costs
- Planning information. e.g. Understanding UPS current loads allows IT organisations to understand when they may be overloading the total available power in the room or be suffering from phase imbalance – both are common problems

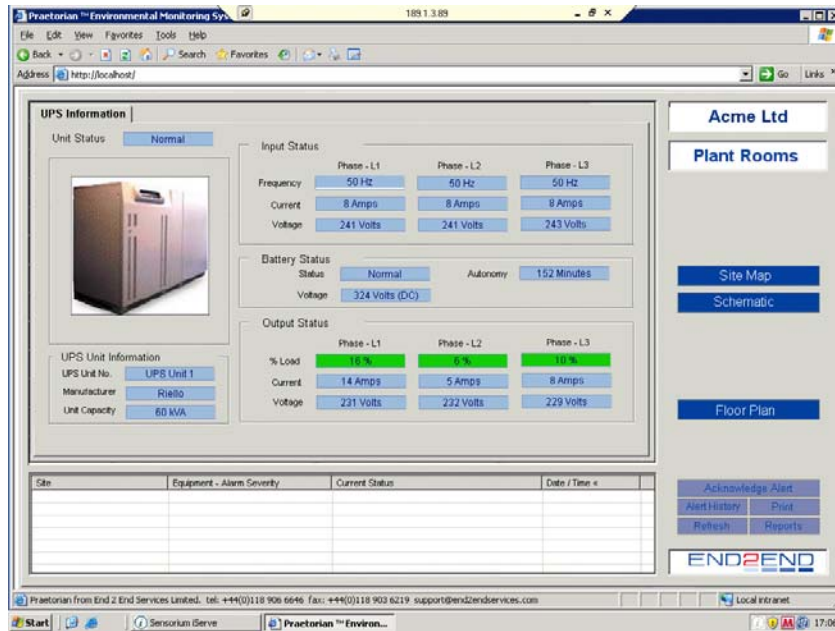


Diagram showing detailed information on a UPS displayed on 'Praetorian'

4.3 Monitoring Technologies- Rack Environmental Monitoring System

For internal monitoring of individual racks, the Rack EMS provides temperature and humidity, as well as contacts for checking on such items as rack security (door contacts). This can be extremely useful in ensuring that intra-rack layouts are not adversely affecting the overall room environment.



These come in individual units or above or larger units providing sensors for numerous racks

4.4 Electrical Distribution Board Meters

These meters can provide a wealth of information on the power usage within the Data Centre, including power loads (i.e. Amps, Kilowatts, kVA), running costs (i.e. kWh or kVAh) and much more. They provide a visual display and the data can be remotely accessed by monitoring applications such as Praetorian. Used in combination with Rack in-line meters or clamps, they provide a full view of the power usage in the Data Centre. Essential in these 'Green' times.



4.5 Rack in-line Meters/Clamps

These meters enable you to monitor the power usage per IT rack (i.e. Amps, volts and kWh), whilst still keeping your existing rack PDU's. They provide a visual display and the data can be remotely accessed by monitoring applications such as Praetorian. This helps the Data Centre Manager to ensure that racks are not overloaded, preventing possible downtime. One unit can support 2 rack PDU's (as shown in picture below). The Clamp (on the right) can be added on to existing power cables without the need to power off the rack.



4.6 Intelligent Rack PDU's

These give the Data Centre Manager full control over the power within the IT Racks. They provide the monitoring functionality of the in-line meters, whilst also providing temperature and humidity monitoring and allowing control over individual or groups of power sockets. This means that power can be re-cycled remotely if necessary, without the need for anyone to enter the Data Centre. They are especially useful where operations personnel have to manage remote sites or comms rooms.



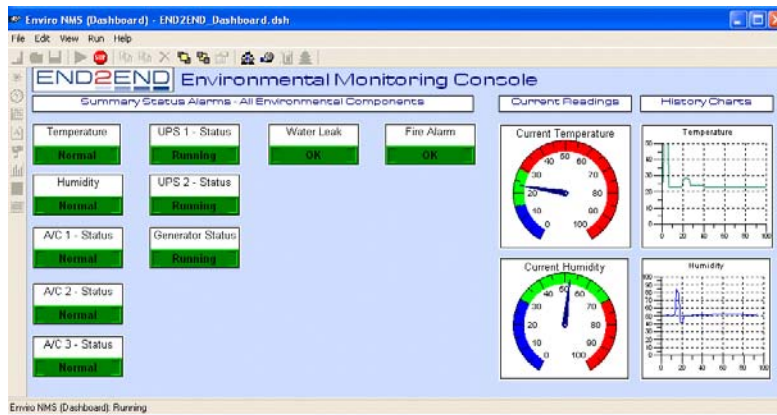
They come in a variety of models – the above shows a 0u model with 24/C13 outlets. Two PDU's in a single rack only require a single IP address.

5 The Environmental Monitoring Applications

Whilst it is possible to utilise a Network Management Application (such as HPOpenview), these are not really designed for environmental usage and so END2END supply 2 specifically designed monitoring applications:

- Entry-level – The Environmental Dashboard – for simple easy to read display of current conditions for a small environment
- Enterprise-level - Praetorian – The Data Centre Monitoring and Management Application – A centralised system for the full monitoring and management of the Data Centre environment

5.1 Monitoring/Management Stations - Entry-level Display Dashboard



The Dashboard provides a single screen view of the key indicators. It is a standalone application that can be run on any workstation. This is extremely useful for Operations Bridges and Security Guard Stations (OOH), providing a simple traffic light approach with easy to read analogue-style dials. (Note: To run on more than one workstation extra copies have to be purchased)

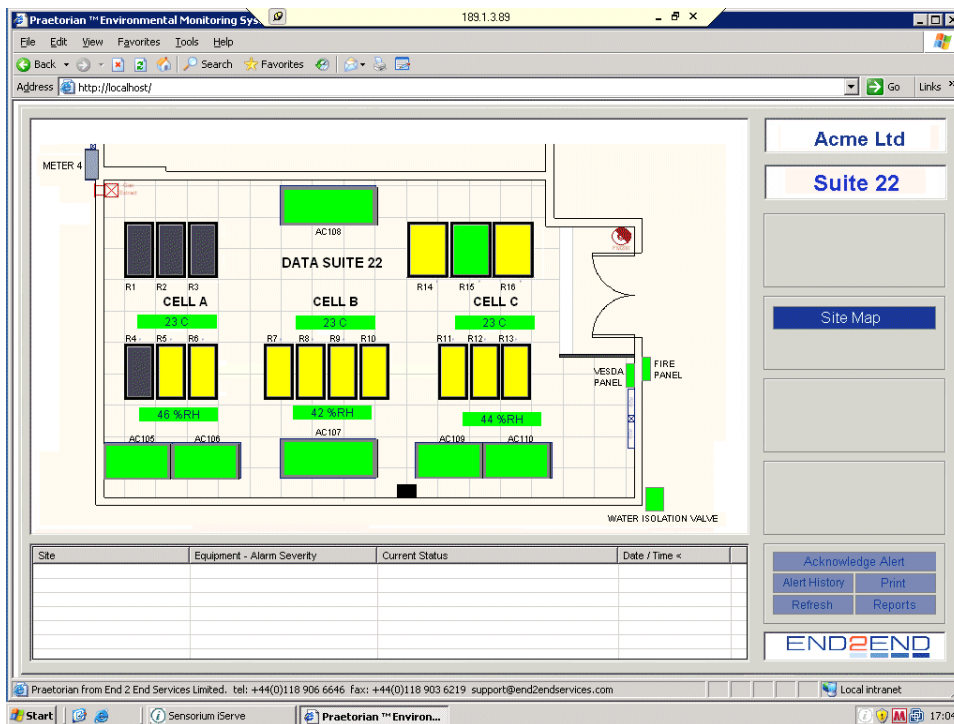
5.2 Praetorian Data Centre Monitoring and Management – Enterprise-Level Application

For most organisations, a full Data Centre Monitoring and Management Application is the preferred choice. It is tailored to each customer’s need (and monitoring infrastructure) and provides a high level of detailed information from all of the installed monitoring components.

The application runs on a dedicated server and continually communicates with the Monitoring Infrastructure. Users can access the system by use of a standard IE browser (Praetorian allows multiple user access)

Praetorian provides a host of different functions and views – the following are just some of the key examples that show the power of the system:

- ❑ High-level floor plans of the site with the status of environmental components for easy viewing of full Data Centre Status – with instant Alarm indications on issues – to enable initiation of the maintenance cycle. This helps to show exactly where failed units reside (engineers have been known to try and fix the wrong component)



- Detailed information on key devices (e.g. A/C Units, UPS's, PDU's, etc) by clicking on the component on the floorplan. This means that engineers can be provided with all of the information necessary to ascertain exactly the nature of the problem. This can save on both time and cost of unnecessary or ill-timed call outs

The screenshot displays two views of the Praetorian Environmental Monitoring System web interface. The top view shows the 'UPS Information' page for 'Acme Ltd Plant Rooms'. The bottom view shows the 'General Information' page for 'Acme Ltd Data Centre 01'.

UPS Information (Acme Ltd Plant Rooms)

Unit Status: Normal

Input Status:

	Phase - L1	Phase - L2	Phase - L3
Frequency	50 Hz	50 Hz	50 Hz
Current	8 Amps	8 Amps	8 Amps
Voltage	241 Volts	241 Volts	243 Volts

Battery Status: Status: Normal, Autonomy: 152 Minutes, Voltage: 324 Volts (DC)

Output Status:

	Phase - L1	Phase - L2	Phase - L3
% Load	16 %	6 %	10 %
Current	14 Amps	5 Amps	8 Amps
Voltage	231 Volts	232 Volts	229 Volts

UPS Unit Information: UPS Unit No. UPS Unit 1, Manufacturer: Riello, Unit Capacity: 60 kVA

Navigation: Site Map, Schematic, Floor Plan, Acknowledge Alert, Alert History, Print, Refresh, Reports

General Information (Acme Ltd Data Centre 01)

Unit Status: Unit Standby

Current Status: Return Temp. 15.7 C, Return Hum. 55.1 %RH, Cooling Off, Dehumidification Off, Heating Off, Humidification Off

Critical Alarms: Critical Indicator OK, Airflow Failure OK, Compressor 1 Trip OK, Overheat Cut Out OK, Compressor 2 Trip OK, A/C LAN error OK

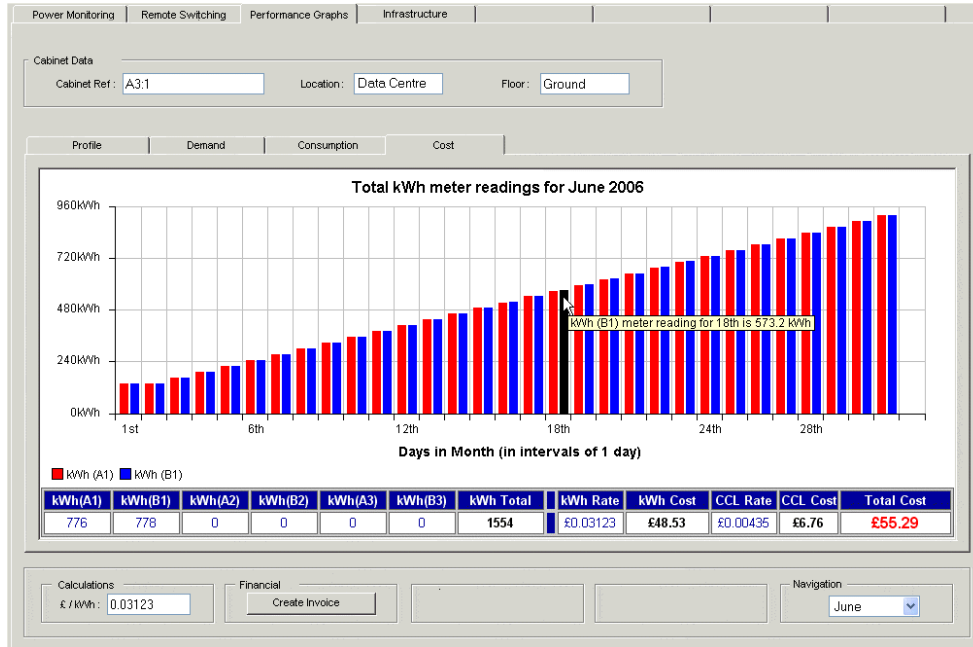
Non-Critical Alarms: Non-Critical Indicator OK, Air Filter Change OK, Common Humidifier OK, Hum. Bottle Change OK

Unit Configuration: Temp. Setpoint 20 C, Hum. Setpoint 45 %RH

A/C Unit Information: A/C Unit No. AC Unit 1, Manufacturer: Airedale, Model: Alphacool DF65, U No. []

Navigation: Site Map, Floor Plan, Acknowledge Alert, Alert History, Print, Refresh, Reports

- Logging and Reporting of key environmental indicators (e.g. Power consumption, cost of power, UPS loads, etc.) – this allows the Data Centre Manager to plan based on known loadings and capacities to ensure that the Data Centre can keep up with demand



6 Building an effective Monitoring Infrastructure– The END2END Approach

So, how do you go about implementing an effective Environmental Monitoring Infrastructure?

The following are the 5 key steps that END2END undertake:

1. Brief the customer on the benefits and functionality of Environmental Monitoring (this document). This provides the customer with an overall knowledge of the concept and possibilities, allowing them to jointly work with END2END to map their requirements to a final solution
2. Assess the Operational Profile of the site to create the optimum, cost effective Environmental Monitoring solution – this results in a Solution Proposal being delivered for the customer's evaluation and acceptance, detailing the required components to be utilised and the choice of application required
3. END2END carry out the Installation Planning process for the solution – this includes hardware installation, cabling requirements, sensor placements, etc.
4. END2END Install and Test the Environmental Infrastructure, including:
 - ⇒ Installation of all of the all EMS components
 - ⇒ Cabling of all components including connection to key environmental plant equipment (i.e. UPS's, A/C's, etc.)
 - ⇒ Full Testing of the environmental monitoring infrastructure
5. Configuration, installation and testing of chosen Monitoring/Management Application