



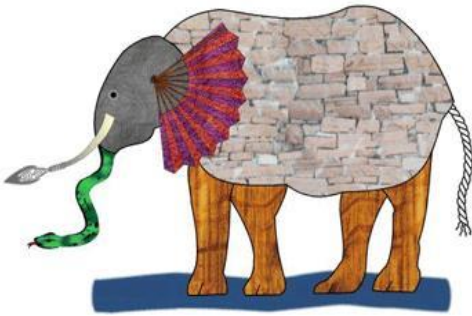
The Data Center Management “Elephant”

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EXECUTIVE SUMMARY



If you asked six data center managers to define “infrastructure management”, you are likely to get six different answers. It is similar to the ancient story of the six blind men and the elephant. When each of the men approached the elephant, they came to the conclusion that the elephant was like a wall, a spear, a snake, a tree, a fan and a rope. Who was right and who was wrong? Just as in the case of the six data center managers, each blind man was right from his own perspective, but in the end all were wrong. Just as an elephant is more than the sum of its parts, a true solution for data center managers is more than the sum of the various tool sets that fall under the area of infrastructure management. This white paper will discuss the various tool sets that make up infrastructure management.

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What is Infrastructure Management?

If you could summarize infrastructure management in one word it would be **information**. This information must be complete, accurate, have audit capability, and provide an integration layer.

Can you answer the following questions?

- How long does it take to deploy a new server?
- Who can you contact to get the accurate status for a project?
- For any given IT service, can you name all the servers on which it relies to properly operate?
- Do you have the capacity (power, cooling and space) to add 10 new blade servers?

If you can't answer the questions, it is probably because you don't have the tools you need to provide the information you need to do your job.

The following illustration shows the various infrastructure management functions, with information as the core:



- **Planning** – Translate business needs into data center requirements
- **Design** – Design proper infrastructure to meet data center requirements
- **Operations** – Consistent, repeatable processes for running the data center
- **Monitoring** – Collect data to ensure data center is operating as designed
- **Predictive Analysis** – Analyze data for input into planning process

What are the Goals of Infrastructure Management?

While all data centers are different, the primary goals of each are basically the same:

- Increase availability
- Meet service level agreements
- Reduce risk
- Reduce cost
- Increase data center efficiency
- Provide information to upper level management

Categories of Infrastructure Management Tools

Like the six “parts of an elephant”, infrastructure management tools fall into six general categories:

- Real-Time Monitoring
- Asset Management
- CFD Modeling
- Access Management
- Connectivity Management
- Maintenance Management

While many of the available tools cross over into multiple infrastructure management categories, it is important to note that no vendor today has a single tool, or even a suite of tools, that satisfies the requirements of **all** of these categories.

Real-Time Monitoring

Real-time monitoring is almost an elephant in itself because its definition is very dependent upon the perspective of the user of the information, with subsets including power and energy efficiency, environmental monitoring and security.

There are many benefits provided by real-time monitoring. For example, monitoring the intake temperature at the rack level may allow you operate your data center at a higher temperature, saving tens or hundreds of thousands of dollars in energy usage every year. Tracking power and cooling usage can help to avoid over-provisioning, which is important since right-sizing the infrastructure to the load has the greatest impact on savings in electrical consumption. Trend analysis provides data that can be used for predictive maintenance, helping identify potential catastrophic failures before they happen.

The three primary areas of real-time monitoring are:

- Network Management System (NMS)
- Building Management System (BMS)
- Data Center Monitoring System (DCMS)

Of the three, the first two areas are fairly well understood and there are a number of excellent tools available. For network management, CA **Unicenter**, Cisco **CiscoWorks**, HP **OpenView**, IBM **Tivoli**, Ipswitch **WhatsUp Gold** and Hitachi **IT Operations Analyzer** are some of the tools one would likely find running in a data center. For BMS systems, some of the familiar names are Honeywell **Excel**, Johnson Controls **Metasys**, Siemens **Apogee**, Andover **Continuum**, Liebert **SiteScan** and Tridium **Niagara^{AX}**.

The wildcard area is that of Data Center Monitoring System (DCMS) – sometimes referred to as Data Center Infrastructure Monitoring (DCIM). While BMS tools had their origin in monitoring and controlling the equipment in an entire building, with data center facilities management becoming an offshoot of the original functionality, DCMS tools were designed from their inception to monitor the data center infrastructure equipment and, in some cases, the IT equipment as well. The vendors for these crossover tools include both longtime and well-known stalwarts in the data center industry (APC and Eaton, for example) as well as a number of new players in this area. Some of the common tools include APC **ISX Central**, Eaton **Foreseer**, Modius **DCiM**, Optimum Path **Visual Data Center**, Raritan **dcTrack** and Geist **Environet**.

In addition, there are a number of hardware manufacturers that offer tools to monitor and manage their own hardware products. The primary disadvantage of these products is that they are a point solution focused only on one hardware platform and, as such, may not integrate well into an overall management solution.

Real-time monitoring solutions vary greatly in how complete a solution they can offer. It is important to determine how the solution is going to fit in your environment. Questions to ask the vendor include the following:

- Can the solution manage the equipment you have deployed?
- What functionality does the solution provide?
- How customizable is the product?
- How well does the solution scale?
- Is the product delivered as an appliance or software solution?
- What communication protocols does the solution support?
- Is it a vendor-neutral solution?
- Can the solution integrate with other monitoring systems?
- What reporting and graphing capabilities are provided?

Most real-time monitoring systems rely on a number of data collection points and methods including both software and hardware. Most data center infrastructure will provide some means for retrieving data and alarms. SNMP, Modbus, OPC, LON, BACnet and IPMI are the primary communication protocols used. Environmental monitoring is an area that is growing rapidly in the data center arena. Some prominent environmental monitoring solutions include APC **NetBotz**, Geist **IT Watchdog**, RLE **Falcon**, Sinetica **Hawk-i** and SynapSense **LiveImaging**. Wireless sensors are becoming more prevalent in the data center. Solutions from SynapSense and Arch Rock are used for monitoring power and environmental conditions such as temperature, humidity and airflow.

Asset Management

Asset management and change management play important roles in the data center. It is important that management has an intimate knowledge of the equipment running in the data center. For smaller, less sophisticated organizations, this is typically accomplished through the use of spreadsheets and Visio or AutoCad drawings with coordination handled through email and infrequent change meetings. This is not necessarily bad; it really depends on the size of the data center and, most importantly, on the accuracy of the data. The decision to move to an asset management system is usually driven by the total number of assets, the frequency of moves/adds/changes, the processes involved in keeping the data accurate and the need to know the relationships between the assets.

While spreadsheets, custom databases and visual organizers are relatively inexpensive, they usually provide less functionality and require higher management. Asset management software, on the other hand, provides a much higher level of functionality but can be moderately to highly expensive.

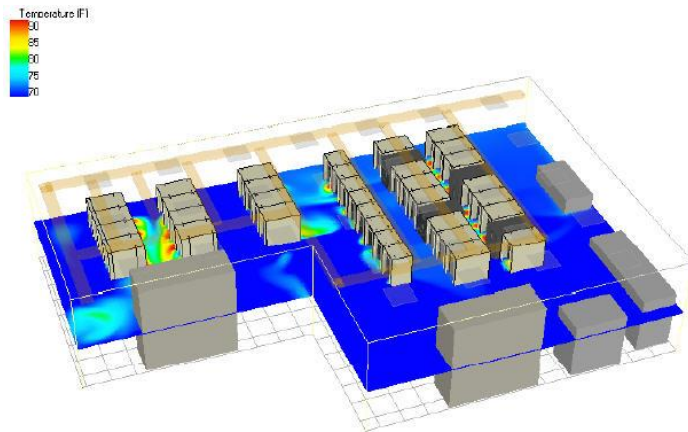
One area that is often overlooked when implementing an asset management system is the cost and time to gather the data the first time. This is a critical step in ensuring the initial data is accurate. In order to maintain accurate data, it is essential that change control processes are strictly followed. Other asset management best practices include the following:

- Get organizational buy-in
 - Ensure processes are well defined up front
 - Stakeholders should see reports on a regular basis so they continually buy into the process
- Set up a centralized CMDB-based repository
 - Avoid different groups taking their own inventory and storing it their own way
- Go deep, then go wide
 - Start inventory practice around one asset class
 - Put processes in place and test them to make sure they yield the right results
 - Once successful, implement the same process for other equipment

Some of the prominent products in the asset management arena are Align **AssetPoint**, AlphaPoint **AssetCentral**, Aperture **VISTA**, Avocent **Data Center Planner**, nlyte Software **nlyte** and Rackwise **Data Center Manager**.

Radio Frequency Identification (RFID) technology is being used to automate the tracking of assets in the data center with products such as CTI **Asset Tracking System** and RFCode **Asset Manager**.

CFD Modeling



Computational Fluid Dynamics (CFD) modeling is a key tool in the initial design of a data center but should also be used to evaluate proposed changes such as increased rack densities or adding, moving or removing equipment. The data center designed in 2003 may not be configured correctly for the IT equipment being used in 2010. CFD modeling allows you to compare various cooling approaches, view an airflow model of the computer room and anticipate potential hot spots based on mathematical modeling.

The primary CFD modeling products for the data center are Future Facilities **6SigmaDC**, Mentor Graphics **FloVENT**, Innovative Research **TileFlow** and Applied Math Modeling **CoolSim**.

It should be noted that CFD is not for the faint of heart. The tools are relatively expensive and require some expertise in correctly interpreting the results. As a CFD expert once told me, “CFD isn’t difficult – anyone with a PhD in thermodynamics can do it!” Before deciding whether to purchase a CFD modeling tool or to use a consultant trained in CFD modeling, consider how often you will need to run a CFD analysis and whether or not you have staff trained to correctly interpret the results.

Access Management

While KVM over IP, serial over LAN, console port servers, service processors and remote control software provide flexibility and out-of-band functionality, these access points also add management complexity. A centralized access management is important to provide centralized monitoring of servers and network hardware, real-time, out-of-band BIOS level access and control and simultaneous access by different users from different workstations (including authentication and event logging).

Products in this space include Avocent **DSView3**, Epicenter **Centerline**, Manage Operations **IT & Server Management**, Minicom **KVM.net II** and Raritan **Command Center NOC**.

Access Management is not constrained solely to KVM solutions. Most next-generation servers and blade computers have a management or service processor on the motherboard or on a plug-in card. These processors provide a connection to the server’s management processes and can be used to

monitor and control the power, provide sensor information (temperature, current, fans, etc.), redirect serial console and manage the BIOS, as well as to provide full remote control using embedded Virtual KVM over IP. Some of the more popular offerings in the market are:

- Intelligent Platform Management Interface (IPMI) – HP, IBM, Dell, Sun, and many others
- IBM Remote Supervisor Adapter (RSA)
- HP integrated LightsOut (iLO)
- Sun Advanced Lights Out Manager (ALOM)
- Dell Remote Access Controller (DRAC)

Virtual machines also have their own management consoles. Virtual systems have the added complexity of not always having the same hardware console access associated with the software console access. The major management consoles include offerings from VMWare, Citrix and Microsoft.

The focus for access management today is on merged connections that enable a user to view a unified, centralized management console which displays all of the types of access and control regardless if it is physical or virtual.

Connectivity Management

While sometimes considered a subset of asset management, connectivity management actually plays a large enough role to warrant its own data center management category. With connectivity management tools, data center management can track the relationship between assets – both power and network – and trace the connectivity path from beginning to end. This is a valuable source of information for helping to resolve issues that may actually be caused upstream from the device or to prevent issues from occurring downstream from the device.

Products in this space include iTracs **Physical Layer Manager**, Patchmanager **PatchManager** and Raritan **dcTrack**.

Automated connectivity management systems such as CTI **Connectivity Management System** can automate the tracking of connector changes using RFID tags in the cables and specialized patch panels which act as RFID antennas.

Maintenance Management

One area that has been largely neglected in the data center arena is the tracking of maintenance for critical data center equipment. While there are a number of Computerized Maintenance Management Software (CMMS) solutions on the market, none are focused on the equipment in the data center. PTS Data Center Solutions **DCMMS** does just that, providing the user with the ability to schedule and track preventive maintenance on data center infrastructure, create work orders and keep track of assets and spare parts required for maintenance. It also provides a number of reports to allow you to track costs and system downtime due to maintenance activities.

Where is Infrastructure Management Going?

Infrastructure management tools are constantly changing to fill ever-changing needs. New tools continue to emerge and current tools are enhanced to provide new functionality. Perhaps more importantly, the lines between the functional areas are becoming increasingly blurred as vendors begin to understand that data center managers are looking for a holistic tool to manage the entire infrastructure. Like opening the eyes of the blind men to see the entire elephant, infrastructure management vendors are seeing the need to open up their tools for integration with other product segments, so the data from an asset management system can be used in a CFD model or the output of a real-time monitoring tool might be used to provide information for condition-based maintenance management. The result will be more efficient, more actionable, more accurate information for the data center manager.

About No Limits Software

No Limits Software was founded in 2009 by industry experts in the field of data center monitoring and management solutions. For more information, contact info@nolimitssoftware.com or visit www.nolimitssoftware.com.

