Zinc Whiskers

By Bruce Myatt

Bruce Myatt, PE, is founder of the Critical Facilities Round Table and EVP and CTO of The Data Centers, LLC, and director, Data Center Energy Management at Glenmount Global Solutions

Holistic DCIM Solutions For Operating Data Centers

DCIM as the manager of management tools.

Over the last few years we have all read and heard about what data center infrastructure management (DCIM) is and what it should be. Here are some more thoughts about how data center operators are planning for, developing, and implementing DCIM solutions today. But first of all, what is DCIM? I believe that DCIM includes any system that collects or maintains information intended to be used for the management of the data center. That means anything from the highest level of network management software that oversees all data center infrastructure and operations to the simplest individual monitor that collects and reports real-time information.

Data center operators are striving to build holistic systems starting with software designed to oversee virtually all data center operations and infrastructure, in both the facilities and IT domains. They are able to centralize access to all information, access analytical tools for decision making, and allow for the dissemination and implementation all of command and control activities. And, they should be ready to accommodate and to communicate with virtually any conceivable program used for the monitoring, data collection and analysis, and management controls in your data center, as you see it today and tomorrow.

With so broad an objective it is important to commit an organization's time and money only to a tool that will endure the test of time. To accomplish this, it needs to be a flexible tool in the way that it stores and utilizes data, in how it accesses and shares information with subordinate computerized programs and tools, and in how it allows for the change and addition of other programs and tools. I believe that a data center organization should really scrutinize investing in a program that locks you into a vendor's approach to data center management because it may not be responsive to the needs of your organization and it may not develop at the same rate and in the same direction that your operations do.

The highest level of DCIM programs interface with subordinate tools to manage data center IT and facilities functions while utilizing real-time monitoring and high-fidelity visualization tools to coordinate and implement functions such as life-cycle asset management, capacity planning, cable and connectivity management, environmental and energy management, design and commissioning documentation, engineering predictive and root cause analysis, business and financial modeling, operations and management planning, process, and change management. They should also be capable of integrating these tools with each other and with various types of external management systems and data sources.

And finally, sometime in the future, DCIM should allow data center management domains to converge across the technological, physical, and business layers and allow us to automate functions with real-time data instead of by "trial and error, or best guess with the best information available" as we often do today. This type of converged and automated management environment should allow enterprises to use fewer resources, optimize overall performance, and coordinate the operations of many independent activities. So, if your current DCIM solutions aren't able to fit into a high-level integrated solution like this over time, you may outgrow them before you want to.

USING DCIM TO INTEGRATE IT AND FACILITIES INFRASTRUCTURE

I believe that it is inevitable that over time we will see a wide-spread adoption of DCIM that will lead to the development of intelligent planning solutions that support the real-time monitoring and management of physical and virtual infrastructures. Intelligent planning will enable the aggregation and correlation of real-time data from various infrastructures to provide data center managers with a common repository of performance and resource utilization information. It also will enable data center managers to automate the management of IT applications and facilities systems based on server capacity and environmental conditions and to optimize the performance, reliability, and efficiency of the entire data center infrastructure.

In planning for the deployment of so comprehensive a tool, it makes sense to identify the many functions to be included and to map out the functions and interactions of the system as early in the process as possible. DCIM should support data center availability and reliability requirements, identify and eliminate sources of risk used to identify interdependencies between facility and IT infrastructures, and it should assist with cost modeling of the

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implementation and maintenance of the huge accumulation of assets that form the data center.

It will take a full team of experts to effectively utilize all of its IT and facilities capabilities, to analyze data, and to interpret results. And that, of course, means a whole new approach to organizational training and change management that should be included in the DCIM system as well.

Today, large network management software providers like Hewlett-Packard, ABB, BMC, and CA Technologies are re-tooling their own products and creating DCIM alliances and partnerships with various other DCIM vendors. And, IBM recently announced a partnership to integrate its IT management software (Tivoli, NetCool, Omnibus, and Smartcloud) with Emerson facilities software (Trellis) to create a truly holistic DCIM solution. All of the largest IT providers are now defining their own data center management picture and are working to keep promises that DCIM will be part of their overall management structure.

Most of what we see advertised as DCIM programs today are integrated software suites, where a comprehensive set of life-cycle asset management features are brought together that share a common view of the data center with a common nomenclature as well as integrated data repositories and reporting and connectivity.

Subordinate vendor solutions can enhance these DCIM suites or can exist as standalone solutions. They are often referred to as "DCIM-ready" components and include over 50 components that offer sensor systems, power management solutions, analytics packages, and monitoring and are also expected to self-align their value propositions to customer needs. DCIM-ready software vendors such as APC by Schneider Electric, Cormant, FieldView, iTRACS, Modius, Nlyte, Norlinx, Rackwise, Raritan, RFCode, Romonet, Sentilla, and ServerTech are all providing such subordinate capabilities to be integrated into and to help complete the DCIM suite of software.

REAL-TIME MANAGEMENT

Several data center trends are driving the adoption of DCIM, each of which should be managed uniquely depending upon the objectives of a data center, including:

- Increased compute and power densities
- Data center consolidation
- Virtualization and cloud computing
- Increased reliance on critical IT systems
- IT and facilities energy efficiencies

And, every data center owner will have to manage each and every one of these initiatives somehow just to remain competitive, in the short term, as a data processing and storage facility.

Current DCIM solutions can address the reduction of energy usage and energy efficiency. In these cases, DCIM solutions enable data center managers to measure energy use, enabling safe operation at higher densities. DCIM components such as computational flow dynamics (CFD) can be used to maximize the use of airflow and eliminate stranded resources, which further drives down infrastructure costs. DCIM software is used to benchmark power consumption through real-time feeds and equipment ratings, and then models the effects of "green" initiatives on the data center's power usage effectiveness (PUE) and data center infrastructure efficiency before committing resources to an implementation.

Modern data centers are challenged with disconnects between the facility and IT infrastructure architectures and processes. These challenges have become more critical as virtualization creates a dynamic environment within a static environment, where rapid changes in compute load translate to increased power consumption and heat dispersal. If unanticipated, rapid increases in heat densities can place additional stress on the data center's physical infrastructure, resulting in a lack of efficiency, as well as an increased risk for overloading and outages. In addition to increasing risks to availability, inefficient allocation of virtualized applications can increase power consumption and concentrate heat densities, causing unanticipated "hot spots" in server racks and areas.

These intrinsic risks, as well as the aforementioned drivers, have resulted in an increase in market demand for integrated monitoring and management solutions capable of "bridging the gap between IT and facilities" systems. In order to efficiently manage data centers and cloud computing environments, IT teams should standardize and automate virtual and physical resource provisioning activities and develop better insight into real-time resource performance and consumption.

AND WHAT WILL IT COST?

Because of the entry level investment, most DCIM implementations have been initiated in medium- to large-sized data centers. A research report prepared by the 451 Group, an independent data center research consultant, has concluded that operators are currently investing initial capital in the range of 1% to 2% of the total upfront cost of a new data center build. However, they say, for investment purposes, it makes sense to add the first five years of annual support for the software at 15% to 20% into the capital costs, which would lift this to perhaps 2.5%.

As part of 451 Group's two studies on DCIM pricing, vendors shared the cost of their initial income to help determine a median cost to operators. Outliers were $25,000 at the low end, and $6MM at the high end. The middle responses ranged from $60,000 to $250,000. Separately, as part of the annual data center survey of the Uptime Institute, operators shared their initial investment

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costs for DCIM. The results were spread, but just fewer than half said they paid less than $100,000.

IN THE MEANTIME

While we are waiting on such future tools to converge and allow us to optimize our operations, we should take care about how we use the information that we gather from our real-time facilities monitoring and measurement systems.

For example, it is customary now for data center managers and engineers to gather and analyze information that results in recommendations for changes in equipment operations to improve facilities energy utilization and performance. And, I have seen several successful change programs implemented that have apparently improved operations and saved energy. However, changes made in setpoints, equipment operating limits, and sequences of operation without fully considering the original design basis can also lead to problematic operations and even unexpected downtime.

I have seen what I believed to be part of a successful energy reduction program turn out to be somewhat careless implementations in a critical space where a variable-frequency drive (VFD) low setpoint resulted in difficulties with the operation of a computer room air conditioner (CRAC) controls system. And, on a larger scale, I have seen the operations of a complex mechanical system changed, with the intention of improving operations and reducing energy consumption that resulted in controls systems instabilities and downtime due to uncontrollable equipment operations.

For the last ten years we have acknowledged that human intervention is the number one cause of downtime in our data centers. And, I am concerned that the availability of more operating information will encourage engineers to implement changes in the name of energy efficiency and lead to more and more uncontrolled intervention.

We seem to appreciate that controls are needed during the construction and implementation process so that requested changes in design and operating conditions are strictly managed by a construction administration team and commissioning agents. And, the same strict management of changes needs to be adhered to in an operating environment, as well. Change management programs should include the close monitoring of change through a formal review and approval process.

Proposed changes in critical facility design and operating conditions should include a process similar to the following:

- Evaluation and approval of changes by the data center management team
- Evaluation and approval of changes by the engineer of record
- Evaluation and approval of changes by equipment and controls vendors
- Testing and commissioning of change by a commissioning agent qualified for the modification
- Controlled updates in design documentation, equipment specifications, sequence of operations, and controls documentation

We can more easily implement automated DCIM solutions in the original data center design and commissioning process. With the use of proven and widely used algorithms, data collected by the DCIM systems can be leveraged to change equipment operations and achieve many desired improvements in performance and efficiency with less risk, as more completely described in the "Zinc Whiskers" column that appeared in the March 2013 issue of *Mission Critical*.

However, data center operators tell me that they are apprehensive about giving up control of their critical facilities to an automated system, even if it is commissioned. I believe that commissioned automation is safer and more reliable than frequent intervention of operations and I, too, would be concerned about giving up control without a good set of industrial grade controls that are robust, responsive, and "fault tolerant." Most Tier IV data centers are driven by PLC or DCS industrial controls that are superior in many ways to the DDC commercial grade controls found in most lower-Tier data centers today.

So, along with DCIM implementations, we should expect to improve our design and operations standards, and as well as our technologies and facilities systems, as we move toward the data center of the future. Only time will tell what all that means, but you can bet that the change we have seen over the last fifteen years will be dwarfed by what is coming in the next fifteen.

CRITICAL FACILITIES ROUNDTABLE

In September of 2013, the Critical Facilities Round-Table (CFRT) met at Stanford University's SLAC Liner Accelerator campus to review the design and operations of and to tour their newest high-performance computing facility in Menlo Park, CA. CFRT is a non-profit organization based in Silicon Valley that is dedicated to the discussion and resolution of industry issues regarding mission-critical facilities, their engineering and design, and their maintenance. We provide an open forum for our members and their guests to share information and to learn about new mission-critical technologies, with the intention of helping our members improve in technical expertise and to develop solutions for the challenges of their day-to-day critical facilities operations. Please visit our website at www.cfroundtable.org or contact us at 415-748-0515 for more information. ■