Real-Time Monitoring for Data Centers: Comprehensive DCIM Solution Creates Connectivity-Rich Environment

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A DIGITAL REALTY WHITE PAPER

Data center infrastructure management (DCIM). The emerging form of data center that is bridging the gap.

Data center infrastructure management (DCIM) is an emerging form of data center management that bridges the gap between traditional facilities systems and information technology (IT) systems, thereby providing operators with a consolidation of the data gleaned from each.

The sense of urgency around developing a truly comprehensive software application solution is a relatively new phenomenon.

According to 451 Research, a global analyst and data company, "a DCIM system collects and manages information about a facility's assets, resource use and operational status. This information is then distributed, integrated, analyzed and applied in ways that help managers meet business and service-oriented goals and optimize a data center's performance."[1]

With the above definition in mind, this paper will attempt to explore the challenges inherent in establishing a defensible and successful platform, and then briefly introduce Envision, Digital Realty's recently launched solution to the data consolidation conundrum.

Although the acronym "DCIM" has been part of the data center management lexicon for a few years, the sense of urgency around developing a truly comprehensive software application solution is a relatively new phenomenon. It has been fueled by an increased focus on managing efficiencies and costs related to data centers, as the footprints of these specialized facilities have been growing to meet the explosion of and heavy reliance on new technologies—including handheld devices and tablets. The advent of the cloud and virtualization has played a key role in this trend, as well.

PUE LED TO VISUAL EFFECTS: DASHBOARDS AND SPEEDOMETERS

In a 2007 study, The Green Grid[2] proposed the use of power usage effectiveness (PUE) and its reciprocal, data center efficiency (DCE) metrics, providing data center operators with a high-level benchmark pertaining to the energy efficiency of their portfolios and also allowing them to compare the results against other data centers, and therefore to determine if any energy efficiency improvements need to be implemented. Since its introduction, PUE has received broad adoption in the industry. Please see Exhibit 1 for the PUE algorithm.

Establishing PUE as a common metric led to the development of display dashboards and similar graphical elements, which are ostensibly employed in order to give data center operators critical information at a glance. The DCIM market thus far has been focused on providing these visual effects—flashy dashboards and PUE speedometers, racks shown in three-dimensional views—and while these graphics are certainly eye-catching, they have proven limited in terms of practical application, i.e., providing operators with the data points they need.

Exhibit 1 - The PUE Algorithm

$$\text{PUE} = \frac{\text{Total facility power}}{\text{IT equipment power}}$$

[1]The 451 Group, Research Presentation, "DCIM Software" Presented by Andy Lawrence.
[2]Green Grid, White Paper, "Green Grid Metrics: Describing Data Center Power Efficiency," February 2007.

While PUE and these other metrics accelerated the introduction of DCIM tools, which has been a necessary step in the evolution of data center management, I am convinced that the focus now needs to shift more toward managing data versus collecting and displaying it.

STRANDED DATA AND THE DATA CHALLENGE

The issue at the core of the DCIM puzzle is stranded data, which is part of what I refer to as the overall data challenge. Think about this from the perspective of an operator: Historically, an operator of a data center, whether on the facilities/infrastructure side (power, cooling, etc.) or the IT side, has a whole series of specialty systems that give her a variety of data points—not only separated between infrastructure and IT, but even isolated within each category.

If she walks into a modern, fully functional data center today, she will see a multitude of systems, including the building management system (BMS), the emergency power and generator control systems, the uninterruptable power system (UPS) and the electrical power management system (EPMS). But these systems do not communicate with each other and therefore it is not possible for her to view the information they provide in a meaningful way, in a truly connected sense.

Furthermore, because of their proprietary nature, these systems tend to be isolated from the operator's firm-wide network, which of course makes it difficult for her to access them remotely. There are tricks that will allow her do to so, but those are tricks versus enterprise-

appropriate solutions that grant unfettered access to information. In short, there are myriad systems that collect a significant amount of data, but the data is often stranded. Even today's most sophisticated solutions process and display data, but they generally have limited historical and predictive capabilities.

THE DATA HIERARCHY CREATES VALUE

Key to designing a comprehensive DCIM solution is recognizing the breadth and diversity of the available information, and then developing a hierarchical system that allows you to store and analyze individual data points. In fact, there is the potential to have multiple hierarchies of data across the various systems employed by a data center. Among the pieces of information that are being collected are relationships—and defining these relationships is critical to managing them.

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Think in terms of an email exchange service: An operator is running an application of some type and the application always runs on an IT device—that is a firm relationship; the IT device always sits in some type of a footprint such as a rack; that rack always sits in a pod; that pod always sits on a floor; that floor always sits in a building; that building always sits in a state; that state always sits in a region; and that region always sits somewhere on the globe (refer to Exhibit 2).

Once you build a structure around the hierarchy of data, and when it has been populated with the information a data center operator requires, you will then be able to develop a repeatable system.

DCIM IS NOT A HARDWARE PROBLEM, IT'S A DATA PROBLEM

Conventional knowledge, until recently, has determined that the deployment of a successful DCIM solution would require the implementation of specialized software, hardware and sensors—with the promise of being able to accommodate a common, real-time monitoring and management platform for all interdependent systems across IT and infrastructure. Therefore, to date, vendors have approached DCIM as a hardware problem, offering a variety of specialized devices and appliances as solutions. But DCIM is not a hardware problem, it is a data problem.

Exhibit 2 - The Data Hierarchy

A typical data center, if it is fully instrumented, might have 5,000 or 10,000 data points.

In short, any DCIM solution attempts to further the alignment of information technology and facility management disciplines by centralizing monitoring, management and intelligent capacity planning of a data center's critical systems. Essentially, its goal is to provide a significantly more comprehensive view of all of the resources within a data center—from mechanical, electrical and plumbing systems that form the backbone of a facility's infrastructure to the servers and racks that compose the heart of the IT setup.

Ultimately, a great deal of intelligence will be imposed on these structures as well as highly specialized automation capabilities to create dynamic infrastructures that can actually self-adjust or tune themselves to more closely match data center resource supply with workload demand. However, the success of these systems ultimately will depend on whether the data has been organized hierarchically.

ARTICULATING THE ENVISION ADVANTAGE

Digital Realty recently launched Envision, a comprehensive DCIM solution and software as a service (SAAS) that provides: increased visibility into data center operations as well as the ability to analyze information in a manner that is digestible and actionable; a user interface, data displays (Exhibit 3) and reports that are tailored to operators; and, importantly, access to historical and predictive data. The software was developed to allow all of our customers insight into their operating environments and also offers unique features for co-location customers.

Exhibit 3 - Data Displays Tailored to Operators

As we will illustrate in the following pages, Envision provides a global perspective allowing for both high-level and granular views across sites and regions. In addition, it solves the stranded data issue by reaching across all relevant data stores on the facilities and IT sides in order to provide a comprehensive and consolidated view of data center operations.

Our solution is an enterprise-class database platform that allows for unlimited data scaling and analysis, and whose intuitive visuals and data representations, comprehensive analytics, dashboard and reporting capabilities have all been designed from an operator's perspective.

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DIGITAL REALTY HAS A DATA ADVANTAGE

Infrastructure systems are accustomed to volume—they are pushing substantial volume. But they are often very limited in terms of the ability to store and share information. IT systems also have volume, but the amount depends on the number of servers there are (10,000, 20,000, 50,000 or more). But that information doesn't change much.

For example, if we install a server in a rack, it is going to be there for a while—a lot of volume, but not a lot of transactions. A high-functioning DCIM can handle high volume (those billions and trillions of points) and also high transactions, as a facility's temperatures are constantly changing, the power readings are constantly changing—the information is continuously changing and it is in huge volumes.

A typical data center, if it is fully instrumented, might have 5,000 or 10,000 data points. If data is collected in one-minute increments, for instance, then multiply that figure by the 525,600 minutes that are in a year and we are soon in the billions of data points annually. Quite frankly, neither infrastructure nor IT systems have been designed to collect, store and churn that level of data. In fact, we would crash many of the systems available today if we attempted to collect and analyze that level of data.

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To build a DCIM platform, you have to do so from the ground up with database coding that recognizes you are going to pull in huge volumes of information and that you are going to churn that data in unbelievable volume. We developed Envision with exactly that in mind.

Importantly, Envision does not eliminate the need for building management systems. On the contrary, these systems remain necessary tools in the data center arsenal. But whereas the old command center had six screens all proprietary to their own systems, when you bring all of the data from all of the disparate systems into a common database, you have a management information system that can generate multiple reporting formats. Our data center operator can view as many screens as she wants, but they are all linked to the same database. All of the data is always aligned. It has become an integral part of a management information system.

COMPARING APPLES TO APPLES

Once you create a common database, as we have with Envision, whenever an operator asks a question of the database—at a single site or across multiple sites—she will always be comparing apples to apples. If she wants to know the power per rack, since the rack is a fixed unit and it has the same definition, she gets information from each site in the same way, so when she says, "Give me a comparative of the power per rack," the database is automatically going to determine that. Historically, solutions were developed and implemented at the building level. "You're building a new facility? We are happy to install a system for that data center. Oh, you're building another one? Sure, we can install another system."

That gets expensive, and of course, it is very inefficient. Furthermore, you cannot compare buildings if they are on isolated databases.

With Envision, on the other hand, if an operator wants a room-level report on PUE, she can go to the data center and select a request for the room, and the system will calculate the total load of the room and the IT load of the room, and then determine PUE for the room. If she selects a floor-level analysis, the software will add up all the total loads for all the data centers on the floor and all the IT loads, and give her an aggregate number. Whatever she selects, she is basically getting an aggregate number of the same point in exactly the same way.

SUMMARY

Rapid growth of technology and increased expense make the data center environment a larger part of the overall bottom line for a firm. Ten years ago a company might have had a data center that was active for 15 years and required a minimal reinvestment of X, but with the trajectory of its own internal IT growth, the same company is consuming capacity faster than ever before and investing heavily in new data centers to accommodate this growth. Fifteen years ago, data centers were complex beasts that nobody wanted to talk about—customers were not coming to us every six months saying they needed more capacity. The feeling seemed to be, "The data center is there and it is functioning, and perhaps we will need an occasional upgrade now and then."

In the new world, we are burning through capacity much faster, and all of a sudden companies may be willing to spend 10X on their data center facilities. And our customers are asking: “How do we know that the large investments our company has made in its data center(s) are yielding the desired results? Are we getting the capacity we need in order to effectively grow our business?”

We believe Envision, our newly launched DCIM solution, will offer encouraging answers to these questions by providing increased visibility into data center operations, the ability to analyze data in a manner that is digestible and actionable, a user interface and data displays/reports that are tailored to data center operators, and access to historical as well as predictive data

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