

DATACENTER INFRASTRUCTURE MANAGEMENT SOFTWARE

Monitoring, Managing and Optimizing the Datacenter

As datacenters become bigger, denser and more complex, it is clear that the most adaptable, economically sustainable and eco-efficient facilities will be those using advanced infrastructure management software.

DCT | DATACENTER TECHNOLOGIES

4 FINDINGS

- DCIM software is multifunctional, has many components, attempts to address numerous technical and business issues, and may consist of overlapping subsystems. This has made it difficult to define. **PAGE 9**
- We believe the leading DCIM products will evolve into frameworks or suites, which handle many functions equally well, so that it is no longer possible to identify core or primary functions. **PAGE 10**
- The three main drivers of investment in DCIM software are economics (mainly through energy-related savings), improved availability, and improved manageability and flexibility. **PAGE 28**
- Overall, we provisionally believe the DCIM market is worth roughly \$240m in 2011, and will grow to \$1.2bn in 2016. **PAGE 34**

5 IMPLICATIONS

- DCIM adoption, which is generally low, varies widely across different software subsets and datacenters. Thus, overall adoption figures cited by vendors and analysts may be misleading. **PAGE 22**
- We believe it is difficult to achieve the more advanced levels of datacenter maturity, or of datacenter effectiveness generally, without extensive use of DCIM software. **PAGE 24**
- Greater use of virtualization and changes in server design will result in increased volatility in power consumption – necessitating better integration of IT and infrastructure, and new investment in management and control software. **PAGE 5**
- The 451 Group describes 15 inhibitors to DCIM adoption, all of which can be overcome in most cases. The biggest are cost, functionality issues, the difficulty of creating/maintaining asset databases and commitment to simple in-house tools. **PAGE 30**
- We expect M&A activity to increase and accelerate to the point where a group of leaders emerge, most likely offering suites of products. **PAGE 36**

1 BOTTOM LINE

- The combined effect of the many structural and technological changes sweeping through the datacenter industry is that there will be much greater use of DCIM systems in the next five years, driving strong sales growth in the space.

MAY 2011

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SECTION 1

Executive Overview

1.1 INTRODUCTION

In its relatively short history, the global datacenter industry has never been stable. For most of the time, it has been expanding rapidly, and has adapted to wave after wave of technical innovation and commercial disruption. In the decade ahead, operators of datacenters can expect more of the same – much more.

A series of major technological innovations – coupled with significant external legislative, economic and market disruptions – will increasingly dictate that managers rethink the way they plan, design and operate datacenters. These changes include a rapid increase in demand for datacenter capacity and services; the continued adoption of virtualization, dynamic provisioning and cloud computing; the deployment of modular and pre-configured datacenters; and the increasing integration of facilities and IT.

Datacenters are also more challenging than ever to manage. While business becomes ever more dependent on them, they are becoming more capital-intensive and energy-intensive, and increasingly technical. This has made datacenters more sensitive to operational management: critical, enterprise-endangering failures can be triggered by a faulty setting or a missed maintenance check, while hundreds of thousands of dollars in annual energy costs can be saved by a few small process changes and some light reconfiguration.

It is clear that the most adaptable, economically sustainable and best-managed datacenters will be those where managers have accurate and meaningful information about their datacenter's assets, resource use and status – ideally from the lowest level of infrastructure up into the middle or higher echelons of the IT stack. They can use this information for planning, forecasting and management, for real-time decision-making, and, if practical, to inform and drive automated systems.

This is the focal point and purpose of datacenter infrastructure management (DCIM) software, the subject of this report. Over the past decade, datacenters have been mostly managed using a loose collection of proprietary monitoring systems, custom-built software, and simple productivity tools such as Excel and Visio. This is all set to change with the advent and widespread adoption of new, powerful datacenter management tools.

1.2 KEY FINDINGS

- The combined effect of the many structural and technological changes sweeping through the datacenter industry is that there will be much greater use of DCIM software.
- DCIM software is multifunctional, has many components, attempts to address various technical and business issues, and may consist of numerous subsystems that appear to duplicate or overlap with other systems. All of this has made it very difficult to define.
- The 451 Group believes that the leading DCIM products will evolve into frameworks or suites, which carry out many functions equally well, so that it is no longer possible to identify core or primary functions.
- Monitoring and reporting systems will likely evolve to play a major role in the emerging dynamically controlled datacenter, where data from the IT and M&E systems must not only be collected and analyzed, but must be acted upon in near-real-time.
- The 451 Group believes that a full DCIM suite will be underpinned by two closely coupled operational databases – the asset management system, which holds detailed and accurate records about all the equipment, and the (real-time and historical) status reporting database.
- We believe there are substantial opportunities in the development of automated, optimizing datacenters, but that this ‘control’ element will not begin to enjoy significant adoption until 2013 and beyond. This is largely due to product and market immaturity, issues of trust and a lack of proven reference sites.
- Most suppliers of DCIM software have up to now seen only moderate sales growth, although we believe the overall market is beginning to show more rapid growth.
- DCIM adoption varies widely across different software subsets and across different datacenters. For this reason, overall adoption figures cited by some vendors and analysts may be misleading.
- We believe it is difficult, if not impossible, to achieve the more advanced levels of the Green Grid Data Center Maturity Model – or, indeed, advanced levels of datacenter effectiveness generally – without extensive and committed use of DCIM software.
- Adoption of management products has been held back in the past because many customers have struggled to achieve effective deployment. But these products are now becoming more functional, more complete, easier to use and easier to integrate.
- Energy will rise as a proportion of overall datacenter costs. In some cases, there will also be energy scarcity. This will encourage DCIM investments that help to optimize energy use.
- Greater use of virtualization and changes in server design will result in more volatility in power consumption. This will require increased visibility into M&E by IT administrators, better integration of IT and infrastructure, and new investments in management and control software.

- Increased legislation and energy/carbon reporting are beginning to create a requirement for software and procedures to ensure compliance.
- The three main drivers of investment in DCIM software are economics – mainly through energy-related cost savings – improved availability, and improved manageability and flexibility.
- The 451 Group has identified 15 inhibitors to DCIM adoption, all of which can be overcome in most cases. The biggest of these inhibitors are cost, functionality issues, the difficulty of creating and maintaining asset databases, and commitment to simple in-house tools.
- Adoption of modular and container datacenters will have both positive and negative effects on the DCIM market. While professional, tight and dynamic management will encourage the use of more software, this software may be designed in and supplied directly to the manufacturers, reducing the market for third-party tools.
- Many datacenter software suppliers are still finding it difficult to identify potential customers, to get access to them, and, when they do, to price their products attractively.
- Overall, The 451 Group believes that the DCIM market is worth around \$240m in 2011, and will grow to \$1.2bn in 2016. These figures are provisional, and will be updated with more research.
- The 451 Group expects M&A activity in this space to increase and eventually accelerate to the point where a group of leaders emerge, most likely offering a suite of products.
- Unlocking budgets and developing a clear software market for the datacenter remains a challenge for DCIM vendors. The most successful suppliers will be those that can demonstrate a strong return on investment and make their case to senior corporate budget holders.

SECTION 3

Defining DCIM

DCIM is difficult to define precisely. It is multifunctional, has many components, attempts to address various technical and business issues, and may consist of numerous subsystems that appear to duplicate or overlap with other systems. In presentations, we have described DCIM as “a jigsaw puzzle with too many pieces,” while one supplier¹ likens DCIM to the Indian elephant, which, as the old story goes, appears to be completely different to six blind men who each felt different parts of the animal.

DCIM also goes by many names: datacenter efficiency software, operational technology, datacenter management (DCM) and datacenter operational management (DCOM). These terms are sometimes proprietary, inconsistently used, or not widely recognized. Several people have attempted to define DCIM, but for clarity in this report and for our future analysis, we apply our own definition – the first paragraph may be viewed as complete, while the following paragraphs serve to broaden the definition.

3.1 DCIM DEFINITION

A datacenter infrastructure management system collects and manages information about a datacenter’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 the datacenter’s performance.

In practice, DCIM systems may vary widely in focus, and complete DCIM offerings are likely to consist of a framework or suite of products, from one or many suppliers, that are designed to interoperate with or complement each other.

The close interworking of IT and mechanical/electrical systems will increasingly lead to the deployment of DCIM systems that span datacenter facility infrastructure, physical IT assets and virtual IT assets.

DCIM systems may be particularly effective at helping managers to adapt to technical and business change more easily; to reduce waste and unnecessary over-provisioning; to plan investments and new capacity; to reduce risk of failure; and to optimize energy consumption.

1. No Limits Software white paper, “The Datacenter Management Elephant,” by David Cole.

3.2 DCIM FUNCTIONS AND COMPONENTS

In the descriptions below, we illustrate some of the functional components of a DCIM system. These functions are:

1. Data collection (meters, sensors)
2. Environmental monitoring and reporting
3. Asset, configuration and change management
4. Power/energy measurement and modeling
5. Power management, power scaling, power capping
6. Data management, integration and reporting
7. Capacity planning, forecasting, simulation and analytics
8. Optimization, operational BI, load management

In order to build an effective, functional DCIM system, it is necessary to have several of these functional components, and for them to interoperate. It may also be necessary for these components to integrate with other systems, notably the building management system (or facility environmental system) and one or more IT service management systems.

Of course there are various ways to divide up these functions. It is also clear that commercial software products rarely address only one of these areas – it is more common for them to serve between two and six of these functions.

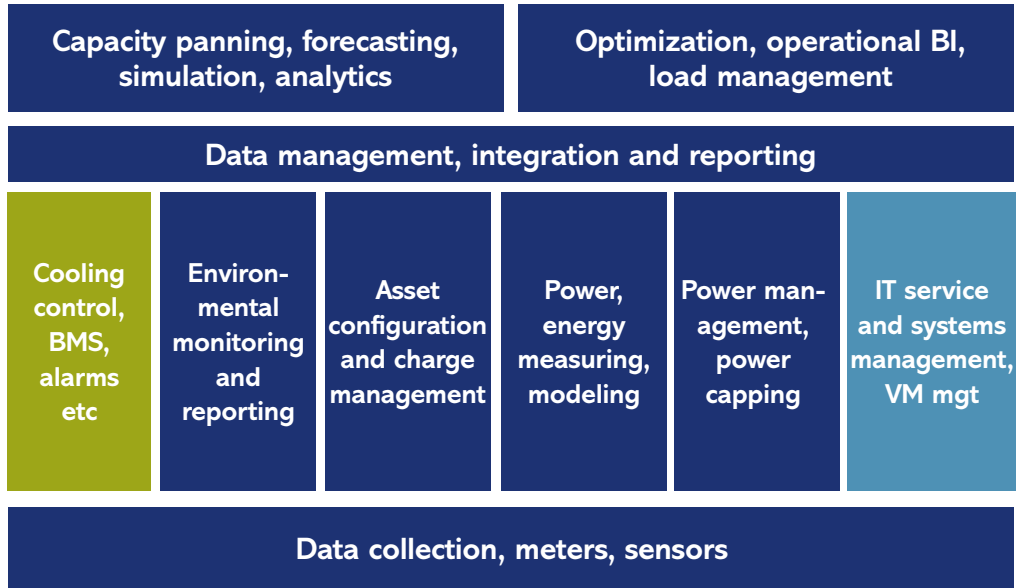
One supplier, Schneider Electric², proposes categorizing products by their primary function and their secondary function (of which there may be several). This is a good approach that reflects today's market. However, in our view, leading DCIM products will evolve into frameworks or suites, which carry out many functions equally well, so that it is no longer possible to identify core or primary functions. In this way, development will follow the example of ERP suites, which initially focused on financial and physical assets, but which are now comprehensive, organization-wide business management suites with no discernible primary or secondary functions.

3.3 THE DCIM STACK

Figure 1 lists 10 functional areas that fall into the DCIM framework. Of the 10, the two that are colored differently (BMS and IT service management) are not part of the core stack, but are likely to be very closely integrated with it. Also, there is some debate over whether power management and power capping should be included in the DCIM stack.

2. "Classification of Data Center Operations Technology Management Tools," APC Schneider Electric White Paper 104, by Kevin Brown and Dennis Bouley.

FIGURE 1: THE DCIM STACK



Source: The 451 Group

For an alternative view of the DCIM stack, with closer mapping to the datacenter layout, see the Appendix of this report.

SECTION 6

Benefits of DCIM and the ROI Conundrum

Overall, market penetration of centralized DCIM systems (as opposed to low-level tactical monitoring systems) is generally understood to be in the low single-digit percentages. Suppliers say this clearly points to the scale of the opportunity, and, of course, they are right. But it also highlights a fundamental concern: DCIM products have been available for several years, yet penetration remains low.

Furthermore, while there is some excitement about the growth opportunity in DCIM, most suppliers of DCIM software have enjoyed only moderate sales growth up to now, although we believe the overall market is beginning to show more rapid growth. This low growth rate so far may be attributed to a number of factors, which we discuss in this section. Undoubtedly, early market confusion and oversupply of products are playing their part. But it is also clear that many datacenter managers have not been able to make the case internally for the large capital investment required for integrated DCIM systems. This reluctance to invest has mystified some suppliers – they witness enormous initial capital investments for datacenters, and they believe that even on energy savings alone, DCIM investments can often justify themselves within two years.

In this section, we look at the drivers for investment in DCIM, as well as the barriers. It will become clear that while the datacenter industry may be edging toward a tipping point in favor of much greater investment (what in the IT world is known as ‘crossing the chasm’), the arguments have not yet been won, and there are still several factors dragging down investment.

6.1 FACTORS DRIVING DCIM SALES

As discussed in Section 1, datacenters are changing rapidly. We believe that, one or two exceptions aside, these changes will encourage greater use of DCIM software. These developments and the implications for DCIM are summarized below.

- **Total IT under management** – The size of the server population, and to a lesser extent the number of datacenters worldwide, will continue to increase to meet strong demand for IT services. This will drive up the total market for management software.
- **Industrialization** – The productization of design and engineering expertise into pre-configured, optimized designs and integrated datacenter modules, pods and containers will have a double-edged impact on DCIM. Pre-configured systems will often incorporate management software. Some suppliers will develop and integrate their own control software at the design and manufacturing stage, while others will embed third-party DCIM at this stage under an OEM agreement. In either case, the overall market will increase. However, in both these scenarios, the opportunity for third-party sales at a later date will be much reduced.

- **Awareness** – Managers will increasingly understand the benefits of DCIM, and there will be less debate about the role and value of these systems.
- **Better management products** – Adoption of management products has been held back in the past because many customers have struggled with effective deployment. Products are becoming more functional, more complete, easier to use and easier to integrate.
- **Professionalization** – There is a drive toward greater professionalism and focus on process in the management of datacenters. While this is still far from widespread, IT managers will increasingly use standard software and systems as management tools. Organizations such as Uptime Institute, The Green Grid and the European Commission, among others, are promoting the adoption of more formal processes and professionalism in datacenter management.
- **Energy efficiency** – Energy prices will continue to rise above inflation in almost all geographies, and carbon emissions will need to be monitored and reduced. Energy will also rise as a proportion of datacenter costs. In some cases, there will also be energy scarcity. This will encourage DCIM investments that help to optimize energy use. (See energy savings table in Appendix).
- **Tighter envelopes** – There will be more widespread use of free air cooling, higher operating temperatures and chiller-less datacenters to save energy. These approaches use less energy, but there is a requirement for greater responsiveness to environmental conditions – resulting in a need for more IT and control software/technology.
- **Virtualization, load balancing and migration** – A high percentage of modern IT services already run on virtualized servers. As yet, however, there is little live migration of virtual images between machines. As this begins to happen, datacenter operators will see much greater shifts in power consumption between machines, and there will be opportunities to consolidate loads and save power. This will require greater visibility into M&E by IT administrators, greater integration of IT and infrastructure, and new investments in management and control software.
- **IT-and-M&E integration** – It is becoming increasingly accepted that the two core function areas of datacenter management – IT and facilities (M&E) – will interwork and, in some cases, be merged as managers seek to optimize their systems. As they work together, they will seek operational cost reductions using management software to match sophisticated IT management systems with facilities equivalents.
- **Capex lockdown** – Many large organizations have concluded that they cannot continue to invest in hugely expensive new datacenters to meet future demand. Some are canceling new investments, focusing instead on optimizing their existing datacenters. They will invest in software tools to achieve tighter management and eliminate waste and over-provisioning.
- **Cloud computing** – Datacenters hosting cloud services are prone to unpredictable workloads and must often provision rapidly. This means the underlying infrastructure must be integrated, monitored and optimized. The ideal datacenter configurations for

cloud services are a matter for debate, but good management reporting and control is an emerging requirement.

- **Legislation and standards** – Datacenters are becoming subject to a growing number of both regulatory and voluntary standards in planning, operation, energy use and carbon emissions. Some of these rules require ongoing monitoring and reporting, and some are finding their way into procurement documents. This is beginning to create a requirement for software and procedures to ensure compliance. (This will be the subject of a forthcoming 451 report.)

6.2 MANAGEMENT BENEFITS OF DCIM

Global trends in datacenters will not necessarily get datacenter managers to adopt DCIM software. They will need to have a clear reason to invest in DCIM today. Because DCIM components can vary widely in function and purpose, the proposed benefits will also vary widely. We group them in three main categories:

- **Economics** – Most investments in DCIM software are made because there is a clear financial case. DCIM tools can pay for themselves in less than two years where there is a clear energy- or labor-saving element, although the manager making the decision to buy may allow for a longer period of time in this regard if there is an element of strategic asset management. The key savings achieved are likely to be in three areas:
 - Reducing over-provisioning and redundancy in IT and infrastructure hardware.
 - Extending or optimizing existing datacenter capacity (space, cooling, power).
 - Reducing operating costs, especially energy.
- **Availability** – A substantial proportion of datacenter spending is focused on reducing or eliminating downtime. DCIM tools, such as environmental monitoring systems, are critical components in meeting this goal. Higher-level, integrated and analytical systems build on these components to help improve overall visibility and availability by:
 - Collecting critical status data, alerting managers to emerging issues and analyzing data over time.
 - Storing optimal measurements and building accurate models that real data can be compared to.
 - Providing clear visibility into asset status, location and configuration for easy or rapid maintenance.
- **Manageability** – Many of the newer DCIM tools focus on the business management as well as the technical management of the datacenter. Effective use of assets is increasingly important, as is long-term capacity management, forecasting and legislative reporting. DCIM systems can provide:

- Clarity on power, space, cooling – present and future.
- Ability to report PUE, energy, carbon and other metrics.
- The visibility and data to help managers respond more quickly to business changes.

Figure 5 summarizes some of the problems that datacenter managers face, and how DCIM can help solve them.

FIGURE 5: DATACENTER PROBLEMS AND DCIM SOLUTIONS

PROBLEM	WHY?	HOW DCIM CAN HELP	BENEFITS
Managers over-provision for power and cooling.	They must allow for inaccurate estimates, spikes and growth.	Accurate modeling or monitoring reduces waste.	Frees up unused power; reduces over-spending on equipment.
Managers aren't always sure where to place servers.	Power availability and demand is not understood at the device level.	Software identifies optimal placing of servers.	Time saved in planning; waste reduced; space/power better utilized.
Managers can't account for energy use, or map energy or carbon use against servers, services and workload.	IT workload data not associated with energy-use data.	Measures and links utilization and power use.	Opportunity for energy charge-back, carbon accounting. Workloads moved to maximize efficiency.
Managers don't know how well they are doing; performance metrics are inaccurate or difficult.	Measurements are inaccurate or lacking granularity.	Can create instant metrics.	Datacenter efficiency can be tracked and compared.
Managers don't always know what all power-drawing devices are doing – if anything.	There is usually no means for tracking power consumption by devices.	Identifies all power-drawing devices and monitors behavior.	Expensive unused 'zombie' servers can be eliminated.
Hotspots and other problems detected late, or by staff in aisles.	Lack of central system leaves discovering some problems to chance.	Potential problems identified before they occur.	Downtime and equipment failure avoided. IT load may be spread to avoid hotspots.
Managers can't see solutions to problems despite wealth of data. Often uncertain about best option.	Monitoring, reporting, planning data kept in several disparate applications or databases.	Key data available in one integrated (possibly Web-based) application.	Improved decision-making, efficiency; inaccuracies, inconsistencies avoided.
Available power, space and cooling are unused, despite shortage where it's needed. ('Stranded capacity')	Managers cannot clearly see where there is over- or under-capacity.	Mismatches in availability and demand of power, space and cooling are identified.	Datacenters are less constrained by power limits.
Raising of temperature set points, use of free air and other energy-saving innovations deemed risky.	New systems and procedures introduce potential instability in temperatures, environment, power, etc.	Changing environmental and energy use quickly picked up and acted on.	Innovations that save money and energy may be more safely introduced.
Executive and legal requests for power, carbon and efficiency data cannot be met easily.	Key performance data is not collected, or not aggregated.	Detailed reports of power use/carbon and cost available to executives.	Higher visibility for executive decision-making, legal compliance.
Managers can't always see emerging equipment or configuration problems.	Unless specifically monitored, equipment failures or inefficient configurations go unnoticed.	Software can map power-consumption patterns against ideal or normal patterns and spot anomalies.	Configuration errors and failures in equipment can be foreseen.

SECTION 10

Players and Entrants

10.1 SUPPLIERS TO WATCH

nlyte Software

Nlyte Software was set up in the UK in 2003 as Global DataCenter Management (GDCM) to provide software to help datacenter managers get visibility into their assets. Later, it changed its name to nlyte, its main product, moved to Menlo Park, California, and raised substantial venture capital. Nlyte has built out its software aggressively and brought in a management team with deep experience with growing software companies. The core of nlyte is the asset management database, but it has a full DCIM suite that includes monitoring, analytics and the ability to read IT utilization data. The company is now regarded as one of a small group of clear leaders in DCIM. It has grown dramatically since 2008.