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DCIM

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Optimize your critical infrastructure

Bridge the gaps between facilities and IT

Improve reliability and sustainability

Lawrence Miller

NIyte 3rd Special Edition

About Nlyte

Nlyte software products help organizations digitally transform more efficiently and quickly by automating how they manage their critical computing infrastructure. Born out of the data center, Nlyte provides IT, facilities, and business groups with monitoring, analytics, and management capabilities from the data center, to colocation, edge, and Internet of Things (IoT) infrastructures. Nlyte DCIM delivers improved automation, efficiency, and optimization of physical, virtual, and digital assets while address several critical business needs:

- Data center critical infrastructure management
- Asset management
- Commercial and regulatory compliance
- Risk mitigation
- Security
- Sustainability

DCIM

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by Lawrence Miller

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Introduction

Data center infrastructure management (DCIM) is the mainstream practice of data center management driven by enterprise-class software. The practice adheres closely to ITIL (formerly the Information Technology Infrastructure Library) standards and is intended to enable data center operators the ability to efficiently run data center operations, improving infrastructure planning and design.

DCIM software automates labor-intensive activities such as workflow management; provides audit trails, and improves visibility across IT, building management systems (BMSs), and business systems, thereby maximizing data center utilization and efficiency. It replaces management tools such as spreadsheets, computer-aided design (CAD), and homegrown databases with enterprise-class architecture, real-time monitoring, and proactive alarms.

About This Book

DCIM For Dummies consists of six chapters that explore the following:

- The basics of DCIM (Chapter 1)
- Modern data center challenges and how DCIM addresses them (Chapter 2)
- Core capabilities in a next-generation DCIM solution (Chapter 3)
- Key DCIM implementation phases (Chapter 4)
- Ensuring enterprise sustainability with DCIM (Chapter 5)
- Important criteria to consider in a DCIM solution (Chapter 6)

Foolish Assumptions

It has been said that most assumptions have outlived their uselessness, but I assume a few things nonetheless!

Mainly, I assume you're an IT executive, data center manager, IT manager, or facilities manager. As such, I assume you're somewhat familiar with at least some of the topics discussed in this book, but you want to learn more about how DCIM is evolving to become more strategic and functional in the modern enterprise.

If that describes you, you're in the right place! If it doesn't, keep reading anyway. It's a great book, and you'll learn a few things about DCIM.

Icons Used in This Book

Throughout this book, I use icons to call attention to important information. Here's what you can expect:

REMEMBER

This icon points out information or a concept that may well be worth committing to your nonvolatile memory!

TECHNICAL STUFF

This icon explains the jargon beneath the jargon and is the stuff legends — well, nerds — are made of!

TIP

Tips are appreciated, but never expected, and I sure hope you appreciate these useful nuggets of information.

WARNING

This is the stuff your mother warned you about. Well, probably not, but these alerts do offer practical advice.

Beyond the Book

If you find yourself at the end of this book, wondering "Where can I learn more?," just go to `www.nlyte.com`.

IN THIS CHAPTER

- Understanding the different elements of DCIM
- Achieving different goals for different stakeholders
- Going beyond the data center with DCIM
- Getting strategic with your DCIM implementation

Chapter 1
DCIM 101

In this chapter, you learn the basics of data center infrastructure management (DCIM): what it is, what it does, how it supports different goals within your organization, what it can do beyond your data center, and how it plays a strategic role in an organization.

Identifying the Components of DCIM

To effectively manage today's data centers, enterprise infrastructure and operations (I&O) teams require a complete suite of tools and solutions that provide the following capabilities across building management systems (BMSs), on-premises data centers, IT service management (ITSM), public and private clouds, and finance systems, among others (see Figure 1-1):

- Asset discovery
- Asset management
- Facilities insight
- Power management
- Machine learning
- Workload insight

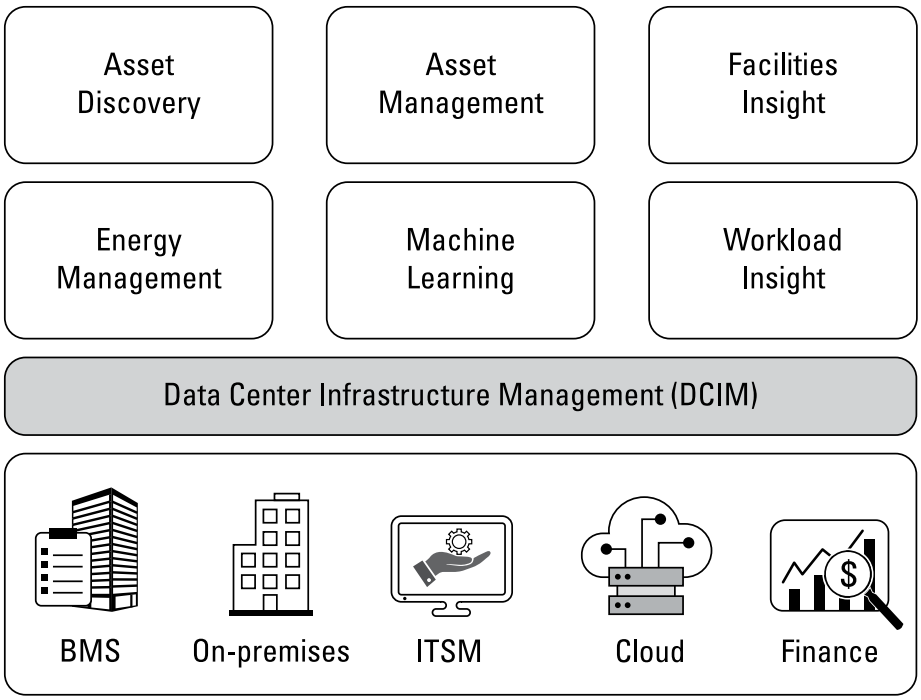

FIGURE 1-1: DCIM provides a complete suite of tools and solutions to manage data center infrastructure across different locations and systems.

REMEMBER

A BMS is a centralized, networked system of hardware and software that monitors and controls a building's facility systems including electrical systems; fire and flood safety; lighting systems; mechanical systems; security and surveillance systems; water supply and plumbing; and heating, ventilation, and air conditioning (HVAC).

Over the course of its evolution, DCIM has become a management extension to a number of other systems, including asset and service management, financial and human resource information systems (HRISs), and other core business systems. A well-designed DCIM solution quantifies the costs associated with moving, adding, or changing workloads on the data center floor or in the hybrid cloud to ensure optimal workload placement. It understands the cost and complexity of the operation of those assets and clearly identifies the value that each asset provides over its life span.

Figure 1-2 shows how DCIM stands between IT and facilities and joins them together. The physical assets of the facility — such as floor space, electrical power, environmental control, and cooling — are monitored and controlled by DCIM processes, which then interface with the virtual infrastructure overseen by

the IT function. The DCIM suite provides an overview of system health and functioning and enables drilling down to any desired level of detail for fine-grained control of operations.

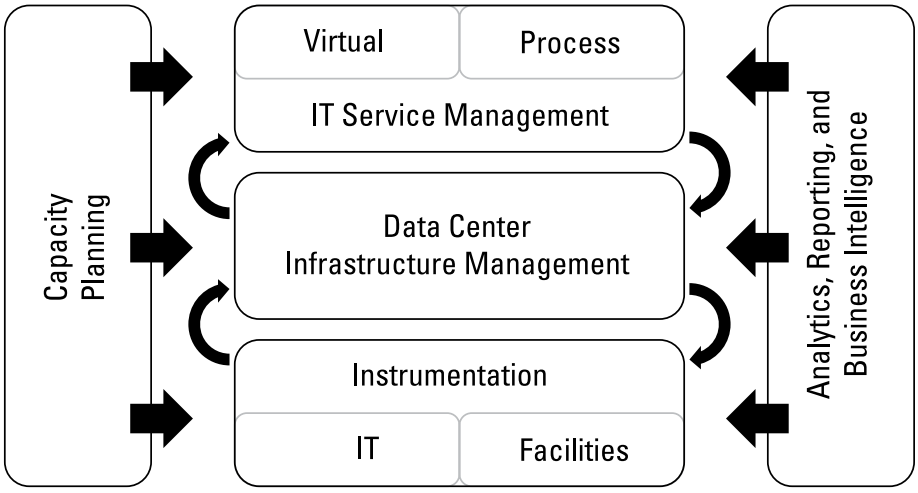

FIGURE 1-2: DCIM works with ITSM and other instrumentation to support capacity planning and analytics, reporting, and business intelligence.

Key capabilities and features of DCIM software include the following:

- **Asset life-cycle management**
  - Get detailed information about your assets and environment.
  - Manage information with robust dashboards and reporting.
  - Increase flexibility to work in any environment.
  - Provide support for receiving, provisioning, making changes, doing a tech refresh, and decommissioning goods.
- **Capacity planning**
  - Visualize space, cooling, power network, connections, storage, and virtualization.
  - Enable proactive versus reactive data center management.
  - Predict data center life span with accuracy and confidence.

- **Real-time data collection**
  - Track power, cooling, CPU usage, and alarms.
  - Integrate real-time analytics leveraging artificial intelligence and machine learning.
  - Report on detailed rack, server, and workload power and cooling metrics.
  - Avert bottlenecks with global visibility of worldwide operations.
- **Automated workflow and change management**
  - Coordinate activities across independent departmental resources.
  - Ensure change management requests are compiled correctly and in a timely manner.
  - Eliminate communication gaps between facilities and IT.
- **Bidirectional systems integration**
  - Automate changes to the data center floor for physical install/move/add/change processes.
  - Deliver end-to-end visibility of time and costs.
  - Automate reconciliation of physical assets to configuration items.
  - Enable visibility of physical connectivity dependencies.
  - Validate locations.
  - Map virtual to physical dependencies.
- **Audit and reporting**
  - Log all asset changes accurately and completely.
  - Verify proper configuration was executed according to request.
  - Automate reports to reduce hundreds of man hours for manual processes.
  - Identify key performance indicator (KPI) metrics and discrepancies instantly.

Understanding the Goals of DCIM

People with different functions within an organization approach DCIM with different goals, based on their responsibilities within the organization. Fortunately, DCIM can help you achieve widely disparate goals, including the following:

- **Reducing operating costs:** One overriding goal of DCIM is to reduce the operating cost of the data center. You can't manage what you don't measure. DCIM gives you an instantaneous view of power consumption and every other critical resource in your data center, providing you the basis for performing actions that will lower costs and help you control them on an ongoing basis. Not only will you know what your power consumption is, but you'll know exactly which components of your system are consuming it and at what rate.
- **Improving capacity planning:** In addition to optimizing the use of electric power, a major goal of DCIM is to provide timely and accurate information about the available power, cooling, and space capacity of the data center to support future growth.
- **Optimizing asset management workflows:** You need to be able to identify, optimize, and manage the workflows associated with changes in the data center's physical assets. DCIM captures the processes associated with change and then enforces the steps required to make those changes across the infrastructure.
- **Creating a single source of truth:** DCIM consolidates and correlates disparate sources of real-time information into a single pane-of-glass view for assets, facilities, and compute infrastructure.
- **Extending equipment life spans:** DCIM gives predictability of space, power, and cooling capacity, increasing data center equipment life spans, as well as lowering operating costs.
- **Enabling better business decisions:** DCIM translates raw data about the data center into actionable business intelligence that can be useful to all stakeholders.

Applying DCIM at the Edge

Although many organizations are increasingly moving their application workloads from their on-premises data centers to the public cloud, most organizations today must still run at least some of their workloads in an on-premises data center or a hosted colocation facility. Many organizations are also beginning to deploy edge computing assets in micro data centers that are purpose-built to support various business use cases such as remote locations, manufacturing, oil and gas, and cell towers, as well as real-time transactions from the retail and finance sectors.

An edge computing architecture delivers several benefits to the organization, including the following:

- **Low latency:** By bringing client and server devices geographically closer together, latency is reduced significantly. The latency and bandwidth costs associated with public cloud platforms can create performance problems for various applications.
- **Increased resilience:** By having multiple small computing centers, fault tolerance is improved with an N+X factor, thus increasing failover options economically.
- **On-demand scalability and faster deployment:** Because of an edge site's reduced footprint, accessing adequate space and power resources becomes easier. They're also relatively less complex to build or even ship preassembled as a rolling data center by companies such as Dell, HPE, and IBM. Edge computing allows organizations to scale up incrementally based on demand, allowing for a more flexible and agile approach to infrastructure for rapid growth.
- **Improved security:** There are many facets to security, but the edge can reduce the amount of sensitive data transmitted across networks. Data can be anonymized closer to the source, thus protecting personally identifiable information (PII) and limiting the amount of data stored in any one location.

Extending your DCIM platform to edge computing environments provides many benefits, including mapping edge computing assets, keeping IT operations and facilities teams in sync, enabling remote maintenance and management, and monitoring and alerting on security events at the edge.

Recognizing the Fundamental and Strategic Nature of DCIM

DCIM enables an organization to make the best use of the physical resources in its data center and enables seamless integration between the data center and the organization's other business management solutions, including the following (among others):

- Asset management
- Process management
- Compute capacity and usage
- Data management
- Energy management
- Capacity planning
- Budget planning

Information is the most strategic asset and competitive differentiator that an organization has. The physical compute infrastructure is the producer of that strategic value. DCIM is the manager of that data consisting potentially of hundreds of millions of dollars in assets, as well as billions of dollars in information that flows through the compute infrastructure.

IN THIS CHAPTER

- Underestimating and overestimating energy and space needs
- Driving infrastructure costs through the (data center) ceiling
- Keeping track of your assets
- Defending against cybersecurity threats
- Reducing the data center carbon footprint
- Demonstrating regulatory compliance
- Managing risk and high availability requirements

Chapter 2
Addressing Data Center Challenges with DCIM

Modern organizations must address many difficult challenges in their data centers. These challenges become even more daunting when trying to address them manually, without the benefit of a comprehensive data center infrastructure management (DCIM) solution. In this chapter, you explore seven common data center challenges — the "Maleficent Seven."

Inaccurate and Incomplete Capacity Management

Without reliable controls and visibility into a facility's energy consumption and space requirements, serious problems can arise, causing an organization to incur unnecessary costs.

Power outages in a data center are catastrophic as all computing and communications cease, thereby inhibiting an organization's productivity. Not having available power and cooling capacity can delay the installation of new servers and other equipment to support strategic projects that are critical to the business. Additionally, inadequate power capacity stresses the physical equipment in a data center, from chillers to servers, impacting their fault tolerance and useful life span.

The other side of the coin is having too much electrical and cooling capacity. This situation not only wastes costly energy and infrastructure, but also contributes to a larger carbon footprint in the data center.

Not knowing how much physical space is available in the data center can cause under- and over-provisioning of facilities. Being under-provisioned can delay the installation of new equipment, force the acquisition of more expensive or less optimal space, and place an unacceptable burden on power and cooling capacity.

In comparison, having too much physical space results in unnecessary operating expenses for power, cooling, security, and maintenance. Energy efficiency in the data center may be less than optimal, creating hot spots and cool spots on the data center floor and in equipment racks, and shortening the life span of expensive equipment. Purchasing or leasing additional real estate also increases costs needlessly.

REMEMBER

As environmental regulations put growing pressure on organizations to reduce their carbon footprint, the need for high-performance buildings and DCIM is challenging infrastructure teams to revisit how they perform capacity planning and management to address current and future needs.

High Infrastructure Costs

The costs associated with running data center infrastructure are high and are constantly being scrutinized by organizations. The usual suspects contributing to high infrastructure costs include the following:

- **Inefficient power consumption:** Electricity is one of the highest costs in a data center. Without tools to determine the most efficient time to run specific processes and take advantage of lower rates or cleaner energy, operating costs go unchecked.
- **Abandoned servers (ghosts and zombies) and outdated servers:** Servers and other equipment that are no longer needed but are not promptly decommissioned are often forgotten and continue to use power — and potentially expose security vulnerabilities — needlessly. Old, outdated equipment runs less efficiently than newer technologies, but understanding the optimal life cycle can be very complex.
- **Random placement of servers and workloads:** Without proper planning, servers and workloads that are just deployed wherever there is rack space and a power outlet potentially introduce further inefficiency and hot spots that burden power and cooling systems. A lack of communication and coordination between facilities and data center personnel often leads to inefficient management of power consumption.
- **Limited space for growth:** As the need for additional growth puts a strain on existing facilities, executive management may start to reconsider the cost and value of owning data centers. Acquisition costs, ongoing operating costs, real estate taxes, budget priorities, different locations, and alternative platforms (such as the public cloud or a colocation provider) must all be considered.
- **Poor communication and collaboration across teams:** A major waste of time and money comes from multiple cross-organization teams performing redundant tasks and activities due to mistimed work order responses, disparate workflows and reporting systems, and insufficient information across multiple business intelligence systems including configuration management databases (CMDBs), building management systems (BMSs), and DCIMs.

WARNING

Many organizations are migrating their data center workloads to the public cloud to reduce costs. However, the cloud isn't always less expensive. The cost savings in the cloud aren't linear and can quickly exceed the costs of an owned or leased data center. There may also be pressure to reuse or repurpose physical equipment in the data center that hasn't yet fully depreciated.

Other business and IT priorities may lead to unused equipment not being properly decommissioned and being forgotten in the data center. Finally, many workloads require a data center or edge location for optimal application performance and to meet security and compliance requirements. The bottom line when it comes to your company's bottom line is that the fixed costs and amortized investment in owned data center real estate can sometimes provide a better financial investment overall — particularly if the data center infrastructure is properly managed.

Inaccurate and Incomplete Asset Management

Keeping an accurate and complete inventory of your data center assets should be easy, right? Unfortunately, it's easier said than done. Typical challenges include the following:

- **Asset inventory management and control:** Knowing what assets are in production and what equipment is in inventory, such as spares or equipment waiting for deployment, is a daunting task when relying on a spreadsheet to manage these assets. More important, you need to know where your assets are physically located. Ticketing systems generally rely on a CMDB for asset information, but if the CMDB relies on individuals to update it manually, it can quickly become out of date, inaccurate, and useless. Without a total grasp on your assets, you may overbuy or miss commitments in your service-level agreements (SLAs) when a repair is needed. Financial accountability and theft control also become concerns for many organizations without accurate inventory and traceable accounting for equipment.
- **Life-cycle management:** Tracing an asset from the time it reaches the data center to the time it's retired and disposed of requires discipline. Knowing where an asset is in its useful life span is critical to avoiding outages, maintaining support and security patches, and ensuring efficient compute and power utilization. A manual process that relies on multiple individuals to sustain a disaggregated tracking and planning system creates a management "black hole" in the data center.

- **Workflow management:** Manually keeping track of who's working on a work order and where an asset is requires lots of emails and phone calls. Things get further complicated when you're relying on other departments or remote locations. Getting notified of when equipment arrives on the dock, where it's stored, and when it has been installed without an automated workflow tracking system is chaotic. If you have to trace items for audit or billing reasons, your answers may be less than ideal.
- **Business intelligence systems integration:** A help-desk ticket is created, the CMDB is checked, and a work order is sent to the data center operations team. The operations team needs a power-run, so they open a ticket with the facilities team, and the phone calls and emails begin. Each team works from disparate systems with no centralized system of record and no single-pane-of-glass management console. The CMDB says a server is in one spot, the DCIM database knows it's somewhere else, and the BMS system has no clue! SLAs are not met, service is degraded, and frustration mounts.

Infrastructure Cybersecurity Risks

Cybersecurity threats are everywhere, and the data center is a metaphorical bank vault to cybercriminals. Infrastructure cybersecurity risks include the following:

- **Physical access:** The challenge with physical security systems such as keypads and keyed locks in a data center or other facility is that they can be compromised. They can also delay entrance to authorized third-party personnel, such as a vendor service technician. Access and keys are often managed by various people and teams within an organization, making quick access challenging. Furthermore, keeping a log of who has been in a room or cabinet or who has been servicing a system may prove challenging without an automated system for tracking and logging access.
- **Devices attached to the network:** Processes are only as good as the people who follow them. Servers and applications get added and removed regularly, and not all of them

will be properly documented. Not only does this put a burden on power and cooling management, but it introduces risk, whether it's a redundant path server or an improperly patched application. Manually identifying these out-of-compliance adds, moves, and changes is an impossible task in a busy data center or at a remote edge site, even with a physical audit.

- **Patch-level reporting:** Patch management tools, like Microsoft Endpoint Configuration Manager (formerly System Center Configuration Manager, or SCCM) may do the bulk of the work for your patch management, but they can't help with systems whose agents have been removed, are powered off, or are running another operating system (such as Linux) or hypervisor (such as VMware). This coverage gap may leave a significant number of systems unmanaged and unprotected in your data center.

Lack of Tracking and Reporting on Sustainability

For many years, corporate sustainability programs ("green" initiatives) were treated as soft goals with no real objective measurement of progress or success. It was more about public perception than actual results. All that has changed, and corporate boardrooms are now being held accountable for achieving measurable results with respect to sustainability. Some key challenges include the following:

- **Environmental, social, and governance (ESG) management:** ESG management is not a new concept, but it has been slow to take a front seat in enterprise IT. Standards and initiatives like the European Union (EU) Code of Conduct for Data Center Efficiency and the U.S. Data Center Optimization Initiative (DCOI) for federal data centers are bringing this subject to the forefront. Climate change and resource management are becoming an ever-greater social concern and, given the placement of ESG officers in larger organizations, it's very evidently now a corporate (shareholder) concern. With data centers consuming more than 4 percent of the planet's generated power, they'll quickly become "in scope."

- **Return on investment (ROI) on automation tools:** When automation tools are first implemented, many efficiency improvements and error/risk reductions are relatively obvious. The challenge is showing how these improvements affect operating expenses and translate into carbon reduction for the ESG officer. The primary challenge in showing energy improvements is the complexity of the data center and the tens of thousands of data points needed to be collected. Calculating all this data is impossible for humans to do manually with any real meaning in the results.

TIP

Download a free copy of *DCOI For Dummies* at `www.nlyte.com/resource/dcoi-for-dummies` to learn more about the DCOI.

Inability to Demonstrate Compliance

When most people think about security and privacy mandates such as the U.S. Health Insurance Portability and Accountability Act (HIPAA), Payment Card Industry Data Security Standards (PCI DSS), and EU General Data Protection Regulation (GDPR), they think about securing the systems and data, but not necessarily about where it's processed and the network path it travels. However, practically all current data security and privacy regulations require the ability to audit and show secure physical access to compute, storage, and network devices. Spreadsheets, Visio diagrams, and IT support tickets can't provide a comprehensive or collective view of this information and your compliance posture. In addition to data security and privacy regulations, there are financial and environmental regulations that organizations must comply with, including the following:

- **Financial:** Organizations rely upon systems of record and human accuracy (and integrity) to keep track of data center assets and efficiency. After doing a physical audit of the data center to show compliance, inventory accuracy, and power and space efficiency, you may discover there are a lot of "hidden gems." In recent years, the U.S. federal government implemented the DCOI after realizing the tremendous amount of waste, redundancy, and inefficiency across its data centers. Federal agencies are being called to the carpet to demonstrate that they're running financially responsible computing environments, from data centers to field

operations and out to the public cloud. In the corporate world, shareholders demand to see how their money is being spent and what efforts to eliminate waste are being taken.

- **Environmental:** No organization wants to waste money on extra energy costs, but playing the "carbon neutral" game has been just that for many years. However, with the growing interest in the EU to regulate the carbon footprint of data centers and global organizations appointing ESG officers to appease shareholders, the focus on sustainability efforts is becoming more intense.

Existing Infrastructure Risk and Potential Loss of Availability

The power goes out; it's a fact of life. There are generators, battery backups, redundant systems, and failover sites, but sometimes all that fails, too. The lifeblood of any modern organization is the applications that drive their business. How do you apply a "belt and suspenders" approach to ensuring those applications stay up and running or recover as quickly as possible in the event of an outage in your data center?

You can't solve every conceivable (or inconceivable) situation, but a solid game plan, tools to monitor, and advanced warning technology can considerably lower the risk. Additional challenges come from maintaining "lights out" and remote/edge sites where personnel may be relatively unskilled or access is limited.

Everyone wishes for a crystal ball to see into the future. The ability to determine when a planned or unplanned disruption will occur and what systems and application workloads will be affected eludes many data center managers. It's also frustrating that millions of sensor and telemetry points could shed light on the inevitable. Still, the ability to consume and process the data in a meaningful manner is daunting for a mere mortal (human).

IN THIS CHAPTER

- Optimizing your data center workloads
- Ensuring the integrity of your data center assets
- Leveraging artificial intelligence and machine learning
- Getting real with augmented reality
- Integrating critical third-party systems with DCIM

Chapter 3
Exploring Next-Generation DCIM

In this chapter, I describe several next-generation data center integration management (DCIM) capabilities and modules that you should look for in your DCIM solution.

Workload Optimization

As data centers grow in scale and complexity, it's no longer sufficient to only monitor space, power, and cooling. System utilization, or the lack of it, is increasingly being scrutinized as enterprises routinely discover that upwards of 20 percent of the servers in their data center are "ghost servers" that idly consume energy but serve no business function.

Effective monitoring enables organizations to optimize workload performance within their data center based on a variety of considerations, including performance, latency, security, cost, and more. Optimum workload placement can be determined, and migration can be automated across different virtualized servers, physical data centers, public clouds, and edge computing environments.

Critical components to help you truly optimize an application's full workload include (see Figure 3-1):

- Power and cooling management
- Space planning
- Asset life-cycle management
- Automated workflow management
- Management of remote location resources for colocation and edge computing

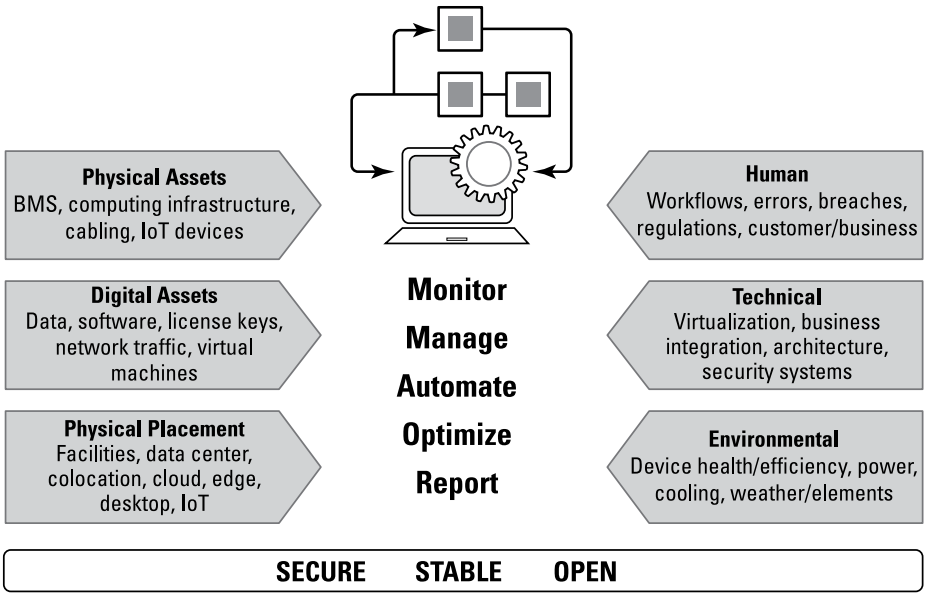

FIGURE 3-1: Critical components in a workload optimization solution.

Asset Integrity Monitoring

Asset integrity monitoring offers a streamlined system that creates a baseline for all the critical assets you need to manage, enabling you to harden your physical compute environment by proactively evaluating the resilience of your asset tracking and management.

Asset integrity monitoring identifies versions of software and firmware that are unauthorized or have known vulnerabilities so you can head off security issues before they occur. It brings awareness of all devices attached to your networks, monitors for changes and compliance, and provides the ability to report and respond to unauthorized assets, software, and changes.

Ultimately, all the applications and data your organization manages depend on a stable and secure physical infrastructure. Whether this infrastructure is located in your own data centers, in a hosted colocation facility, or at the edge, you must be certain these resources are not intentionally or unintentionally compromised.

Resources can become compromised when personnel make unplanned and/or unrecorded changes to assets. They may add or remove assets, such as servers or server blades, without approval or without recording the information centrally, which can then leave your organization open to cyberattacks or to costly outages. Devices can be installed that don't meet security or safety standards.

Additionally, new security threats are constantly being identified and require the latest firmware and software patches to be applied to hardware to close these vulnerabilities. Yet many organizations don't have a comprehensive list of all hardware and the versions of firmware and software running on assets throughout their network, which results in these systems being vulnerable to cyberattacks.

Asset integrity monitoring includes the following:

- **Discovery:** Asset integrity monitoring starts with a baseline of assets. This consists of your DCIM inventory database augmented by a thorough discovery scan across your network. This compiled asset list becomes the single source of truth including, power, compute, software and firmware, network connections, edge, and Internet of Things (IoT) devices.
- **Change management:** Change management practices and protocols are established, based on U.S. National Institute of Standards and Technologies (NIST) best practices, an ITIL (formerly the Information Technology Infrastructure Library) framework, and integration with an IT service management (ITSM) configuration management database (CMDB) and other systems. To reduce human error and risk from repetitive tasks, adopt a DCIM solution that automates standardized infrastructure change management workflows. Lastly, define reporting and enforcement procedures across IT operations, security, finance, and human resources systems.

- **Monitoring:** Inspect what you expect, rinse, and repeat. Proactively scan to determine changes made to the physical compute infrastructure. Compare against the single source of truth and change management protocols. Inspect, record, and report any changes that are outside the baseline or set of expected changes. Update the DCIM source of truth asset database.
- **Alerting and reporting:** Share the knowledge. Correlating changes to the physical compute environment and reporting them to concerned groups provides many benefits. IT operations can see repeat offenders making unauthorized or undocumented changes. This can help you avoid unexpected changes to power or the introduction of potentially harmful equipment and software, leading to disruptions or catastrophic events. Security teams can monitor for vulnerabilities introduced by unauthorized devices, applications, and network connections. Finance can accurately audit and validate inventory to ensure support, maintenance, and license expenses are accurately accounted for.

Machine Learning

The scale, complexity, and required optimization of modern data centers requires "management by artificial intelligence (AI)" because data centers increasingly cannot be planned and managed with traditional rules and heuristics. Several use cases lend themselves especially well to AI and machine learning:

- **Predictive power and thermal:** Optimize thermal performance by predicting application and underlying power behavior.
- **Workload/hybrid cloud optimization:** Use critical infrastructure data as a new source of insight to optimally place workloads within and across data centers for enhanced availability and performance.
- **Placement optimization:** Optimally place equipment based on thermal, power, communications, and application vectors.

- **Multi-variate maintenance and failure prediction:** Use granular information, such as component detail within equipment or application history, to enhance preventive maintenance routines and refine failure prediction.
- **Alarm and alert management:** Intelligently filter and prioritize significant events, either stand-alone or in complex chains.

Augmented Reality

Whether you're managing a massive data center, supporting remote locations, responsible for a lights-out facility, or contending with the challenge of limited trained support staff, augmented reality (AR) delivers skilled hands no matter how far away.

An AR module in a next-generation DCIM platform delivers a new level of remote management across the entire compute infrastructure. It will find and guide a user to a specific workloads rack and server. The user will see an overlay of the DCIM user interface over the work environment using the AR goggles (such as Microsoft HoloLens or Oculus), tablet, or smartphone. They can see reports, workload and asset dependency maps, room, isle, or cabinet hot spots, associated alarms, and more.

Augmented reality enables the following:

- Remote user interaction with
  - Voice instructions sent from a user to another user wearing AR glasses
  - Sharing what the user wearing AR glasses is seeing with another user
  - Providing two-way communication so that remote users can be guided through the data center, thereby saving the cost of sending people to the site
  - Finding and guiding a user to a workload running within a data center, rack, or server
- Visualizing DCIM overlay reports against real data center assets and racks, hot spots, electro-optical (EO) alarms, and so on

- Reviewing and updating workflow actions using hand gestures
- Updating data center assets in the DCIM and CMDB asset databases

Integration with ITSM, BMSs, and Security Systems

Data centers have never been more vital or central to business operations, yet they need to be more efficient, resilient, and flexible. These goals are best achieved by tightly integrating the critical infrastructure (power, cooling, monitoring, and the building itself) with IT equipment and applications. Data centers are unlike other building types in that they're greatly and dynamically influenced by the behavior of the systems running within them. Next-generation DCIM integrates these numerous systems, from buildings to virtualization, to provide greater efficiency, streamlined management, and improved insight.

Integrating multiple systems — such as IT service management (ITSM), building management systems (BMSs), and security systems — from different vendors can be a daunting task. Any integration between two enterprise systems must be cost effective, highly functional, supportable, and defendable.

A major choice arises between end-user hardcoded and off-the-shelf prebuilt integration. The former becomes increasingly cumbersome to manage and adapt when business processes change, which they invariably will. In contrast, a mature off-the-shelf integration will make connections to external systems that are created and maintained by the manufacturer of the DCIM solution, along with all the business logic, workflows, and data mapping and transformations that have been deployed, without any end-user hard coding. Regardless of the integration approach, be sure to factor in the total cost of ownership versus the one-time acquisition cost.

TIP

By integrating the critical infrastructure and workload end points in a data center, next-generation DCIM provides numerous benefits, including the following:

- Improved efficiency of power and cooling utilization by enabling critical infrastructure to track with application behavior, such as idle periods or reduced loads
- Improved productivity of facility and IT personnel as the effects of changes or maintenance are predicted and proactively addressed within the computing environment
- Reduced risk of outages or breaches due to poor capacity or asset management processes
- Improved resiliency and efficiency by including critical infrastructure in simulation software for planning, operations optimization, and failure scenarios

IN THIS CHAPTER

- Mapping your starting point in the DCIM maturity model
- Stepping through DCIM implementation

Chapter 4
Getting Started with DCIM Implementation

The key to success in beginning a data center infrastructure management (DCIM) implementation journey is to know where your organization is starting and set realistic goals regarding your capabilities, timing, investment, and the business value you can achieve. In this chapter, I introduce the DCIM maturity model and explain how you can successfully implement DCIM in your organization.

Assessing Your Organization's DCIM Maturity Level

Initially, for most organizations, applications like computerized maintenance management systems (CMMSs), building management systems (BMSs), and DCIM are viewed as merely a tactical management tool, but they soon realize that they're stepping-stones to a more strategic way to manage and operate their technology infrastructure.

The strategic value realized from your DCIM implementation is directly related to the discipline with which it's used across different groups and across the entire organization. This means facilities, IT, business processes, and applications need to be tightly integrated and communicate bilaterally.

As with any journey, to know where you're going, you have to know where you're starting. The DCIM maturity model (see Figure 4-1) will help you assess where you are in your organization's DCIM journey. Your end goal may be to reach Phase 5 (Workload Asset Management), but you don't need to have a fully mature deployment to get tremendous value out of DCIM right away. Smart facilities, strategic facilities planning, workload asset management, and machine learning are great aspirational goals, but just taking the first step — consolidating spreadsheets and floor plan diagrams into a single source of truth — can be achieved affordably and return huge benefits.

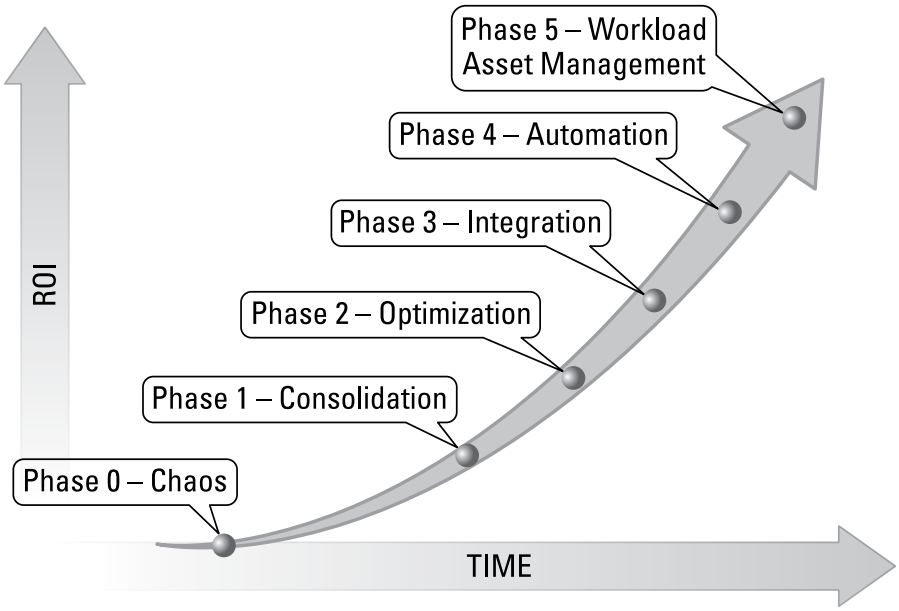

FIGURE 4-1: The DCIM maturity model.

REMEMBER

Don't be overwhelmed by the end-game promise of DCIM. Focus on the small advancements and wins. Your DCIM solution can grow with your organization — in scale, functionality, reach, and integration.

Phase 0 (Chaos)

Despite technology management solutions such as DCIM having been on the market for several years, many organizations are still in Phase 0 (Chaos) of DCIM maturity and are just focused on "keeping the lights on."

Asset management at this stage often consists of multiple spreadsheets created and maintained by different groups, each with a different type of information collected for a different purpose. The accuracy of this data is usually highly suspect and grows worse over time. Multiple copies of these spreadsheets may be created and shared, which means they quickly become out of sync with each other and with what's actually on the data center floor. Ultimately, there is no single source of truth — and no idea of what the truth actually is.

WARNING

Mismanaged work orders, manual processes, multiple/disparate/siloed systems and data, conflicting workflows between organizations, and costly human error are the hallmarks of chaos and the harbingers of inefficiency and impending catastrophe in the data center.

Phase 1 (Consolidation)

Consolidation is the first step on the road to DCIM in which you consolidate your various spreadsheets and diagrams into a single application. A modern DCIM solution can import bulk data from spreadsheets and other electronic documents directly into the asset database. From there, the application allows users to visualize the facility floor in various ways, including space and power availability. Simple reports and dashboards may exist, along with support for fundamental asset changes. As a result, infrastructure managers can make better decisions and reduce the number of human errors. Making the jump from spreadsheets and diagrams to Phase 1 of the DCIM maturity model is an excellent starting point, which demonstrates a commitment to proactive planning rather than reactive action.

Phase 2 (Optimization)

The next phase of DCIM maturity requires a more significant commitment to examining and prospectively changing the processes you use in managing your facility infrastructure. This

phase is where optimized facilities processes are programmed into the DCIM software and where the DCIM software is used to enable and enforce associated workflow processes. This level is also where the utilization rates of facilities and systems over time can begin to be tracked, thus allowing for better forecasting based on historical results. Some organizations at this phase choose to inject real-time metric information into their DCIM solution from automated discovery tools, power management and monitoring applications, and/or advanced analytics from machine learning.

Phase 3 (Integration)

In this phase, infrastructure teams begin performing multiple "what if" planning scenarios with large numbers of servers, using the DCIM solution to identify potential failure points in the power chain and using predictive analytics to optimize the use of power, cooling, and space. This phase is also where physical to logical reconciliation technologies are deployed, such as modern automated discovery or older radio-frequency identification (RFID). This technology can be used to continuously audit devices across the facility and identify potential errors in the CMMS, BMS, DCIM, configuration management database (CMDB), and even in fixed asset systems.


TIP

Integration with other IT solutions and processes often happens in Phase 2 (Consolidation), but at Phase 3 the DCIM solution should be tightly integrated with the other available facilities management, BMS, and business intelligence systems, most notably change management systems and CMDBs.

Phase 4 (Automation)

At some point, your organization will begin to leverage all the instrumentation, control, and analytics deployed in the previous phases to enable a self-managing, continuously aware facility infrastructure. Supply and demand will be more closely aligned, with feedback-based control mechanisms dynamically adjusting the supply of computing based on the demands being placed upon it over time. Thus, as demands change, so too will the required compute capacity, the cooling capacity, and even the network and storage configurations. This state is highly desirable, but this advanced phase typically requires a few years of practical production level DCIM deployment and usage.

Phase 5 (Workload Asset Management)

At this phase, the highly strategic aspects of DCIM spread across your entire compute infrastructure to achieve accurate workload asset management. Real workload asset management is the ability to understand real-time and future demands to decide where critical applications need to be running for the most optimal performance and reliability. The DCIM solution leverages asset management, automated discovery, inventory tracking, application usage monitoring, and advanced intelligence from machine learning capabilities to achieve workload asset management.

Planning Your DCIM Implementation

After you've assessed your organization's maturity level and you know where you're beginning your DCIM journey, you can plan the steps for a successful implementation:

1. **Do your research.**

   Read. Talk to your peers at other companies that have already invested in a modern DCIM solution. Recruit your fellow stakeholders and solicit their ideas and support. Together, define a vision for DCIM in your organization. Then think about it, test it, and refine it. Create a three-year plan, but don't try to boil the ocean — make it realistic. Be sure to identify today's scope and needs. Appropriately scoping your plan for your current and future needs will yield a rough order-of-magnitude budget, so keep that in mind for the remainder of these steps.

2. **Get buy-in from all the stakeholders.**

   Many groups and individuals will be affected by a DCIM implementation. Spend some time gaining consensus on the concept and what they need out of it. Work together to resolve any objections. Not knowing all the key players and understanding and addressing their concerns is a huge risk.

3. **Be realistic when establishing your scope and rollout timing.**

   Consider your answers to the following questions:

   - How much can you do now?
   - Who are your peers that will help?

- How much time do you and your peers have?
- What other priorities and initiatives do you have on your plate?
- What other resources do you need?
- How does this impact other existing projects?
- What is the missed opportunity if you do nothing?

4. **Document your existing processes and tools.**

   This will be an eye-opener! Many companies at this point find themselves maintaining many random processes, dealing with numerous inconsistencies, and lacking adequate documentation. In today's facilities operations, you'll likely find a great deal of individual and surprisingly unique approaches to the same everyday tasks.

5. **Inventory and audit the capital assets that you already have installed.**

   With the cost of a typical rack of modern IT equipment approaching $100,000, you've likely spent much more than anyone imagines on IT over the past three years. Most concerning, there is limited documentation for these capital expenditures (CapEx), and the documentation that does exist is often inaccurate and woefully inadequate. Like many Fortune 500 companies, you'll likely find yourself gathering spreadsheets, Visio drawings, and even composition notebooks and Post-it notes to find it all.

6. **Determine your integration and reporting requirements.**

   What will the new DCIM platform do when plumbed into your world? Integration and reporting are all about defining how your DCIM solution will interact with your other systems — your accounting systems, your building systems, your ticketing systems, and so on. It's also about how simply users can pull reports relevant to their needs without having to be a database programming wizard.

7. **Establish a roster of users and associated security policies.**

   Who can use the system and what is the span of their access and control? If done right, there will probably be more than you think. As a general rule of thumb, the more users of the DCIM platform there are, the more strategic the adoption will need to be.

8. **Determine each stakeholder's required outputs (dashboards, reports, and so on).**

   This output is the business intelligence that aligns IT physical structures with the needs of the business. It's this critical requirement that transforms raw data into actionable information. Knowing the temperature of any given point in space is data; knowing what the thermal trends are across a facility to balance cooling chillers more efficiently is information. Knowing that the supply of computing resources is meeting the needs of the workload transactions being generated throughout each day is your business.

9. **Select a focused and comprehensive partner that you can trust.**

   You've probably just spent three to six months working on the preceding steps, so it's the culmination of that work that must be used to select a DCIM partner. You'll be holding your chosen partner accountable to deliver what you've articulated. Be more objective versus subjective in this process. The selected partner will work with you for years to come to help you succeed, so take this selection process seriously and don't minimize how much of your needs are shared with each partner candidate. The more they know about your needs, the better they'll be able to determine their ability to satisfy those requirements. They should understand the breadth and depth of your organization's business. Their solutions must be complete and out of the box. However, they also need to provide tools and services that can help you enhance and tailor the implementation to your unique needs, quickly and cost-effectively.

10. **Implement.**

    This is where tangible change begins to happen in your DCIM journey. There will be prerequisites that need to be accommodated, various components that will need to be installed, existing structure detail that will need to be migrated to the new DCIM repository, and acceptance testing that will need to be completed. This process could take weeks or months, so plan accordingly. Implementation of a DCIM solution should be treated as any other mission-critical enterprise application. After it's deployed, validate the deployment:

    - Is the data all there?
    - Are the integrations working?
    - Does the model match the reality?

11. **Train your users.**

    Show them how to make the system work for them. Too many people have been given a login to business intelligence applications, skipped the user training, and then found themselves not understanding how to use the system, let alone use it to its fullest value. Your DCIM solution will never be strategic if your users don't understand it or, even worse, if they feel compelled to work around it. Encourage them to learn it and see how it can enhance their world of work.

12. **Celebrate your success! Also, continue to evolve, grow, and enhance capabilities.**

    Make sure your company and all the stakeholders are aware of the new business value through your DCIM solution. Continue to test your growing needs, assess your organization's maturity level, and go back to the first step every year. No matter what you implemented up front, the value you can extract will grow over time when done right. There is a tremendous opportunity to use this new source of knowledge to streamline your compute infrastructure, reduce risk, manage compliance, and ultimately optimize your workloads and customer experience. Keep testing and challenging the processes and the system to do more.

Are there other steps? Sure. The order may even be slightly different in each case, but these are the critically important steps seen in the most successful DCIM implementations. In general, the more strategic that people feel the solution is, the more likely they'll be to work the system into their daily routine and won't only replace old processes but begin to enhance and streamline those processes — which, in turn, saves tremendous time and money while ensuring broad adoption and significant benefits.

IN THIS CHAPTER

- Understanding the key role of DCIM
- Managing a hybrid digital infrastructure
- Learning about integrated data center management
- Going green in your data center

Chapter 5
Leveraging DCIM for Facilities and Hybrid Cloud Sustainability

In this chapter, you learn how data center infrastructure management (DCIM) serves as the foundation for hybrid digital infrastructure management (HDIM) and integrated data center management (IDCM). You also discover how DCIM helps organizations achieve their sustainability goals to help protect and conserve the planet's nonrenewable resources.

Understanding Why DCIM Is a Cornerstone Technology

Most organizations today use comprehensive, integrated core business software suites to oversee and manage key aspects of their business, such as sales, finance, manufacturing, and shipping. An organization's digital infrastructure requires this same type of comprehensive, integrated control to ensure the most effective and efficient use of these assets and to deliver maximum business value from its data center.

In simple terms, DCIM is the strategic business management solution for the data center. DCIM is the structured approach to managing change, purpose-built for the modern compute infrastructure — whether physical or virtual, on-premises or in the cloud. Thus, DCIM is a foundational technology in solutions such as HDIM and IDCM, discussed in the following sections.

Learning about HDIM

Modern organizations — whether long established or newly created — tend to use a large mix of information technology to power their business operations. These technologies often extend from the on-premises environment and hosted data centers to multiple public and private clouds. In the public cloud alone, most organizations today leverage numerous software as a service (SaaS) offerings — such as Microsoft 365, Salesforce, and Workday — and platform as a service (PaaS) and infrastructure as a service (IaaS) offerings from providers such as Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure, and Oracle Cloud.

This hybrid digital infrastructure has evolved because organizations understand that placing the right workloads in the right place to address the unique requirements of their business is critical to successful digital transformation. Strategically, this is the right approach, but it inevitably adds complexity and creates new challenges for the teams that manage the competing demands of heterogeneous hardware and software platforms.

To effectively manage this growing complexity, organizations need a complete suite of HDIM tools and solutions that work together to ensure they can drive the best business value from their infrastructure and operations (I&O) platform.

HDIM is the next step in the evolution of DCIM. HDIM extends the monitoring, management, automation, optimization, and reporting capabilities of DCIM to the entire hybrid digital infrastructure, which includes on-premises data centers, public clouds, private clouds, and edge clouds (micro data centers). By leveraging a secure, scalable, and open platform, DCIM can

manage your entire digital estate including physical assets, digital assets, physical workload placement, human resources, environmental systems, and technical systems (see Figure 5-1).

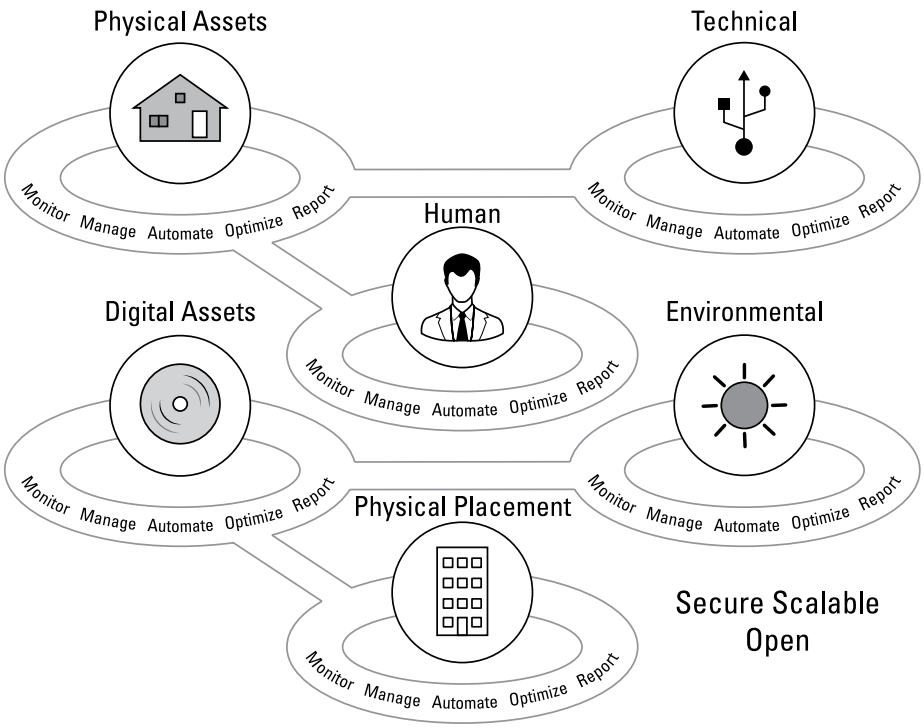

FIGURE 5-1: HDIM is the next step in the evolution of DCIM.

HDIM involves the integration of tools designed to monitor hybrid environments and includes devices, subnets, domains, data centers, and/or service providers. Its focus is on discovery, monitoring, key performance indicator (KPI) metrics, optimization, dependency mapping, and location of both physical and logical assets.

TIP

Download a free copy of *HDIM For Dummies* at `www.nlyte.com/resource/hdim-for-dummies` to learn more about HDIM.

Discovering IDCM

The challenges faced by today's data center operators demonstrate the need for an advanced management solution that provides visibility and control of the data center building infrastructure and the critical elements and systems within the data center — an IDCM solution.

At its highest level, an IDCM solution provides deep integration between data-center-critical facilities infrastructure, the resources within the data center (such as servers, storage, network switches, and so on), and the application workloads running on those resources. Simply put, IDCM is a complete suite that brings together the capabilities and features of building management systems (BMSs), DCIM, and IT operations (see Figure 5-2).

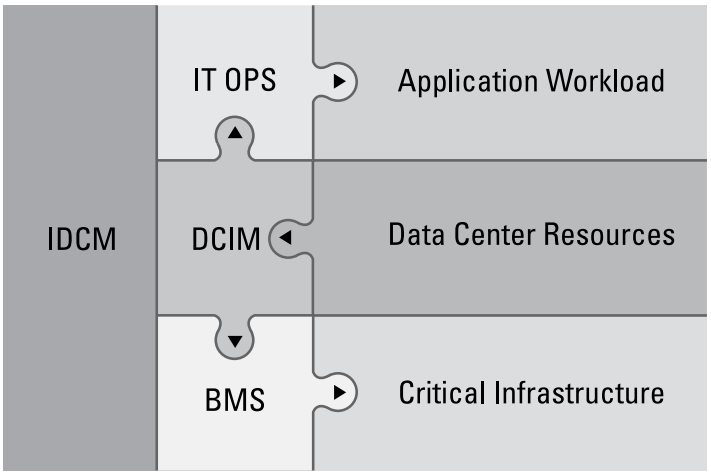

FIGURE 5-2: IDCM brings together the capabilities and features of BMS, DCIM, and IT operations.

Ultimately, the vision of IDCM is focused on integrating and providing transparency between all the elements, assets, layers, and devices in and around the data center. In this way, components and systems can be managed with awareness and insight into how those elements affect the efficiency and service levels of the application workloads being supported.

Through this more in-depth integration, data center operators and facilities managers can make better decisions about maintenance, operations, and critical events in the data center. IDCM provides complete visibility of where servers are running and what devices, systems, and critical infrastructure support those workloads. With this data, organizations can perform better capacity management, increase the efficiency of existing resources, and perform more streamlined workflows and operations across all layers of the IT stack.

REMEMBER

With expertise in IT asset management, critical power, and thermal management, as well as how that ecosystem affects application workloads, Nlyte is partnering with several building infrastructure vendors to bring IDCM to market and take data centers to the next level of efficiency, resiliency, and flexibility.

Here are the four primary goals of IDCM:

- To increase efficiency of power, cooling, and space by allowing critical infrastructure to reflect application behavior, such as idle periods or reduced loads
- To improve effectiveness of facility and IT personnel by pinpointing change or maintenance effects throughout the computing environment
- To reduce risk of outages or breaches due to poor capacity or asset management processes
- To improve uptime and efficiency by simulating critical infrastructure in software for planning, operations optimization, and failure scenarios

TIP

Download a free copy of *IDCM For Dummies* at `www.nlyte.com/resource/idcm-for-dummies` to learn more about IDCM.

Ensuring Sustainability with DCIM

Sustainability has to do with preserving the planet's nonrenewable resources to the greatest extent possible. These nonrenewable resources include the fossil fuels that are used in the production of most of today's electricity. An organization can do many things to improve its environmental greenness, but the three big targets focus on the following:

- **Power consumption:** Data centers account for 4 percent of the global power consumption per year, which contributes to 2 percent of the planet's carbon dioxide emissions. U.S. data centers alone consumed approximately 73 thousand megawatts in 2020.

- **Water conservation:** In the United States alone, 660 billion liters of water were consumed in 2020 to cool cabinets, buildings, and generate power. In FY18, Google used nearly 16 billion liters of water and Microsoft used 3.5 billion liters, with the majority going to data centers.
- **Waste management:** Two percent of all trash generated in the United States comes from e-waste, which represents 70 percent of the overall toxic waste generated in the United States.

REMEMBER

Terms like *NetZero* and *carbon neutral* are frequently used interchangeably. NetZero is about achieving a balance between the greenhouse gases put into the atmosphere and those taken out. Carbon neutral is about offsetting carbon emissions with a balancing factor, such as planting trees.

Data centers are among the largest consumers of electricity in an organization with requirements for robust 24/7/365 power and cooling capabilities. Consequently, data centers are frequently prime candidates for targeted cost recovery and improved energy utilization. However, it's no simple task to change temperature setpoints without end-to-end visibility into how a temperature change will affect the equipment that is processing critical workloads. To safely change thermal equipment's energy consumption, an operator must have a granular level of transparency into how any proposed change in temperature will affect the environment and the applications being run within it.

TIP

DCIM provides the information that enables organizations to optimize energy utilization in their data centers. Look for the following capabilities and features in a DCIM solution's energy optimization/efficiency module:

- **Power monitoring:** Real-time power monitoring enables facility power systems to react in a timely manner to throttle up or down as demand changes.
- **Cooling monitoring:** Real-time visualization down to the server and workload ensures that room-level data is not masking over- or under-cooling supply.

- **Energy optimization (workload alignment):** Historical analysis makes it easy to place workloads in the most optimal location or run applications at optimal times.
- **Cooling prediction/optimization (rack white space level):** Provides thermal details inside racks to augment and fine-tune floor and ceiling sensors and enhance time-based temperature mapping.
- **Power usage effectiveness (PUE) prediction/calculation:** Simplifies the PUE calculations while adding additional layers of sensor and workload data.
- **Dashboards and reports:** See historical trends and predictive analysis in real time to determine optimal placement of workloads and application processing both immediately and in the future.

TECHNICAL STUFF

PUE is a measure of what proportion of a data center's electric power usage is going into powering the IT infrastructure:

$$PUE = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}$$

For example, Table 5-1 shows that a PUE of 1.2 is indicative of a very efficient data center with 83 percent data center infrastructure efficiency (DCiE).

TABLE 5-1 PUE Ratings Based on Level of Efficiency and DCiE

PUE	Level of Efficiency	DCiE
3.0	Very inefficient	33 percent
2.5	Inefficient	40 percent
2.0	Average	50 percent
1.5	Efficient	67 percent
1.2	Very efficient	83 percent

NLYTE ENERGY OPTIMIZER

Nlyte Energy Optimizer (NEO) can help your organization achieve its sustainability goals by driving real-time analytics into IT service management (ITSM) ecosystems. The breadth and depth of Nlyte's offerings provide unmatched visibility, insight, and solutions into all aspects of your monitoring and alarming needs.

NEO allows for different types of devices to be monitored by the application through industry-standard protocols such as the following:

- Simple Network Management Protocol (SNMP)
- Modbus remote terminal unit (RTU)
- Modbus Transmission Control Protocol (TCP)
- Building automation and control network (BACnet)
- Object Linking & Embedding (OLE) for Process Control (OPC)
- Extensible Markup Language (XML)

Each device, based on the communications protocol, can be configured within NEO to monitor functions or "points." A *point* is any value or status from a device or other object being polled by the application that is being monitored and trended within the NEO application. Depending on the protocol, the combination of an Internet Protocol (IP) address, object identifier (OID), or slave ID is assigned to each device so that a network connection can be made and the selected points can be captured by the polling engine.

Devices typically monitored with NEO include the following:

- Uninterruptible power supply (UPS)
- Computer room air conditioning (CRAC) and computer room air handlers (CRAHs)
- Power meters
- In-rack power strips
- Floor-standing power distribution units (PDUs)
- Environmental sensors
- Branch circuit monitoring
- Any device using a supported protocol

IN THIS CHAPTER

- Ensuring security
- Enabling out-of-the box integrations in an open platform
- Providing low-code/no-code customizations
- Leveraging artificial intelligence
- Scaling to support growth
- Addressing cost management challenges
- Supporting different protocols and standards
- Creating customizable dashboards in a single management console

Chapter 6
Ten Criteria for Selecting a DCIM Vendor

Here are some important criteria to consider when selecting a vendor for your DCIM solution:

- **Secure:** A complete DCIM solution connects to critical devices and equipment in your data center and integrates with many important systems such as building management systems (BMSs), IT service management (ITSM), and more. Don't let DCIM become an attack vector for bad actors to gain access to valuable data. Ensure your DCIM solution offers robust security features such as role-based access control (RBAC), data encryption (in transit and at rest), and more.

- **Out-of-the-box integration:** Your DCIM solution needs to be able to exchange information easily with your existing (or planned) systems, including BMS, ITSM, cloud management, finance, and business intelligence (BI). Make sure the integration capabilities that you need will be available.
- **Open platform:** Your DCIM solution needs to be built on an open platform to enable out-of-the-box integration with a broad ecosystem of third-party vendor and partner solutions, as well as an open application programming interface (API) to support custom integrations, when needed. A DCIM that is limited to closed, proprietary technologies can't support an ever-growing hybrid digital infrastructure composed of numerous systems from different vendors.
- **Easy customization:** You'll inevitably need to develop some custom integrations, build your own workflow automation scripts, and otherwise modify your DCIM solution to support new technologies, processes, workflows, and other requirements. Your DCIM vendor should provide an open API and a web-based interface that supports low-code/no-code custom development so you don't have to engage costly professional services every time you need to make a change to your DCIM solution.
- **Artificial intelligence (AI):** Data centers present an ideal use case for machine learning and industrial AI: complex, energy-intensive, and critical, with a very large set of inputs and control points that can only be properly managed through an automated system. With ever-evolving innovations in the data center, from application performance management (APM) linked with physical infrastructure to closely linked virtualization and multi-data-center topologies, the need for and benefit of AI will only increase. Look for a DCIM solution that leverages AI and machine learning capabilities to provide big data analytics such as impact analysis and "what if" scenario planning for various business continuity, disaster recovery, workload placement, and capacity planning scenarios.
- **Growth:** Your data center infrastructure will inevitably grow — whether on-premises, across multiple clouds, or both — to support the needs of your business. Be sure your DCIM solution can scale to address the needs of your business today and in the future.

- **End-to-end cost management:** According to the *Flexera 2020 State of the Cloud Report,* optimizing the existing use of cloud (cost savings) is the top initiative for 73 percent of enterprises and assessing on-premises versus cloud costs is one of the top-three cloud migration challenges for 44 percent of enterprises. Make sure you have complete insight into your on-premises data centers and hosted facilities costs, including space and power. If you're a cloud service provider, look for a DCIM solution that provides you the necessary information to effectively manage your costs across potentially thousands of data centers around the world.
- **Broad support for different protocols and standards:** You need a DCIM solution that is protocol-agnostic and supports a variety of protocols and standards such as Simple Network Management Protocol (SNMP), Modbus remote terminal unit (RTU), Modbus Transmission Control Protocol (TCP), building automation and control networks (BACnet), Object Linking & Embedding (OLE) for Process Control (OPC), and Extensible Markup Language (XML). Look for a DCIM solution that supports a variety of protocols and standards, as well as agent-based, discovery, management, and reporting capabilities.


REMEMBER

Many systems and devices in your data center may have proprietary operating systems, strict control requirements, or limited memory and storage capacity that precludes installation of a management agent.

- **Intuitive dashboards:** Your DCIM platform needs to not only collect and analyze a lot of disparate data across your data center infrastructure, but also be able to support a broad variety of users and use cases. Look for intuitive and customizable dashboards, RBACs, robust auditing and reporting capabilities, and extensive automation capabilities in your DCIM platform.
- **Single console:** DCIM provides you with a single source of truth for your data center infrastructure. It should likewise provide you with a single pane of glass for management. Having to log in to different systems and consoles to manage potentially thousands of systems is inefficient and makes it challenging, if not impossible, to correlate data and make key real-time decisions to support your business.

Integrate and Automate Everything

From Data Center to Edge

Leading DCIM solutions focus on integrating systems, from buildings to servers to applications, wherever they are located.

This leads to greater efficiency, improved insight, and streamlined management.

Unify your entire data center ecosystem with Nlyte DCIM!

Nlyte® Software

Take control of your data center!

Your data center is probably expanding quickly to meet the business needs of your growing organization. And old management tools and approaches may struggle with the significant amount of ongoing change required to deliver IT services cost effectively. Data center infrastructure management (DCIM) provides a comprehensive view and streamlined operations, which enable improved decision making and cost efficiencies within your data center.

Inside...

- Lower operating costs
- Increase asset utilization
- Streamline capacity planning
- Reduce your data center carbon footprint
- Address cybersecurity risks
- Improve resilience and availability
- Choose the right DCIM partner

NIyte Software

Lawrence Miller has worked in information technology in various industries for more than 25 years. He is the co-author of *CISSP For Dummies* and has written more than 200 *For Dummies* books on numerous technology and security topics.

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