



## THE **CONNECTED** AND **EFFICIENT** DATA CENTER

# Contents

<b>Executive summary</b>	<b>3</b>
<b>The evolving data center requires a new holistic definition of efficiency</b>	<b>3</b>
<b>Holistic command and control</b>	<b>4</b>
<b>Optimizing cabling and connectivity</b>	<b>5</b>
<b>The growing emphasis on interconnectivity</b>	<b>5</b>
<b>Optimizing CapEx with prefabricated modular data centers that are “right sized” from day one</b>	<b>6</b>
<b>Benefits of best-in-class fiber and copper</b>	<b>7</b>
<b>Conclusion: The connected and efficient data center is here</b>	<b>7</b>

**There is a growing awareness of the need to adopt holistic or whole data center approaches to data center efficiency that include both facility and IT teams**

451 Research, July 2014

## The new definition of efficiency



Then – power and cooling



Now – the whole physical ecosystem

## Executive summary

The data center has assumed a new, more prominent role as a strategic asset within the organization. Increasing capacity demands and the pressure to support the “always-on” digital business are forcing data centers to adapt, evolve, and respond at an increasingly accelerated rate. Cloud, mobility, IoT, big data – these and other interrelated trends are putting enormous pressure on the modern data center. To keep pace, today’s physical infrastructure has become vastly more complex, interconnected, and performance-driven than a decade ago.

To help manage this evolving environment, new ways of thinking about and valuing infrastructure have emerged. Designers now think of physical elements such as power, space, processing, cooling, and network connectivity as variables that can be “adjusted” to meet their specific performance goals while containing costs. Meanwhile, software-based data center infrastructure management (DCIM) solutions, automated infrastructure management (AIM) tools, and “right sized” prefabricated modular data center options now enable IT and Facilities executives to manage their data centers more holistically.

In this new paradigm, opportunities to boost performance and profitability by increasing efficiency are everywhere; not just in power and cooling, but in capacity planning, asset management, scalability, space utilization (e.g. density), and more.

Leveraging these opportunities means embracing a new definition of efficiency reflecting a more holistic approach that encompasses the entire physical ecosystem.

This is the Connected and Efficient Data Center.

## The evolving data center requires a new holistic definition of efficiency

When it comes to defining and measuring the efficiency of data center physical infrastructure, the traditional discussion has typically begun and ended with power and cooling. This focus on power usage as the primary measure of efficiency is understandable. Energy represents 25 to 40 percent of a data center’s OpEx.<sup>1</sup> In the U.S., a 40 percent reduction in data center energy consumption—about half of what is technically possible—would yield \$3.8 billion.<sup>2</sup> So power cannot and should not be ignored as a source of efficiency gains.

However, if power and cooling represent 25 to 40 percent of a data center’s monthly OpEx, then 60 to 75 percent of those operating costs lie elsewhere – in other physical resources such as space, IT assets, and connectivity. These other resources all have associated costs, not only in terms of capital, but in time, productivity, effort and opportunity costs.

Managing all of these physical resources as an interconnected whole – this is where possibilities to drive a new level of efficiency abound. Here are some examples.

**Space utilization:** Wasted floor and rack space is wasted capacity. The general consensus is that an estimated 15 percent of a data center’s servers are either unused or under-utilized – they sit on the racks without supporting any useful applications for the business (applications have long been moved). Yet they still consume power and take up valuable rack space.<sup>3</sup> In fact some reports state these “ghost” or “comatose” servers can amount to as much as 30% of the server population.<sup>4</sup> Eliminating these servers reduces energy costs and frees up additional rack space to defer expensive capacity growth investment.

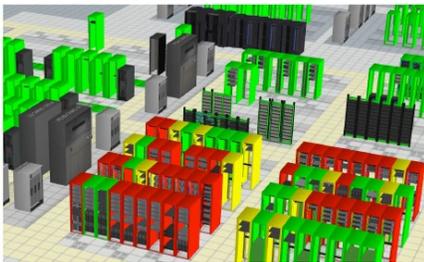
## What do we mean by efficiency?

According to the 2015 Merriam Webster dictionary, efficiency is defined as: *effective operation as measured by a comparison of production with cost (as in energy, time, and money)*. Within the data center, production and cost take many forms.

**Production** is any desired outcome: lower OpEx and CapEx, higher availability and capacity, etc.

**Cost**—in the form of dollars, time, energy or even information—this is the input required to achieve the desired outcome.

As such, it is possible to measure the efficiency of any process, operation or resource.



**Asset management:** A significant amount of money is related to the management and maintenance of data center assets – specifically, the lifecycle management of IT assets that include switches, servers, and storage. The on-going cost of tech refreshes, inventory management and auditing are measured in dollars, time, availability and capacity. Data centers cannot afford to keep managing complex IT asset populations using outdated, cumbersome excel spreadsheets.

**Connectivity:** Increasing rack densities and accelerating fiber adoption are creating a perfect storm within the data center's structured cabling and connectivity network. The need to better manage this complex environment makes connectivity a prime candidate for efficiency initiatives that can drive increased savings.

The bottom line?

While the decision-makers cannot ignore the impact of power and cooling, they must take a more holistic approach in defining, measuring and managing “efficiency” across all physical resources in the data center.

## Holistic command and control

Higher availability requirements, more mission-critical applications and rising throughput demands have led to greater fiber density, more assets in smaller footprints, and a physical layer that is becoming increasingly difficult to manage.

Indeed, the growing complexities of the modern data center – and the need to address efficiency at a broader scale – have given rise to new faster, more efficient ways more of constructing data centers as well as tools for managing them more efficiently. For example new prefabricated modular data center designs as well as tools like data center infrastructure management (DCIM) and automated infrastructure management (AIM) now provide data center managers with significant efficiency gains across all areas of the data center.

Today's DCIM solutions, such as CommScope's iTRACS® DCIM software suite, can monitor and manage IT and facility systems simultaneously, providing a wealth of granular and accurate information of how all systems are operating, both historically and in real-time. As a result, there are multiple opportunities to increase efficiency through better use of time, space, labor, and dollars:

- **Capacity utilization:** DCIM helps data center managers discover, reclaim and redeploy stranded capacity including rack space, stranded power, switch ports, servers, and other equipment. This helps defer CapEx while making the most of the existing data center footprint.
- **CPU efficiency:** Tracking and mapping CPU utilization and power usage enables managers to improve transactions per watt and match the right server to the right application.
- **Space density:** Data centers are currently using DCIM to safely maximize the use of cabinets and enclosures to increase server densities without jeopardizing the environment. As a result, managers are able to generate higher revenues and productivity per rack.
- **Availability:** Real-time visibility across the entire interconnected physical ecosystem – with user-friendly capabilities like root cause analysis and predictive modeling – can help today's data center operators maintain desired availability levels and avert potential service issues.

## The benefits of a holistic approach

There are many benefits associated with using the latest technologies to holistically manage the physical ecosystem, but most decision makers agree that the greatest value can be found in these three areas:

**Efficient to operate.** Today's software-based solutions can help speed decision making and minimize manual tasks. For example, AIM solutions can accelerate time to market for new IT assets and simplify diagnostic issues related to connectivity—one of the trickiest areas of infrastructure management.

**Simple to manage.** A comprehensive DCIM software suite makes it easier to manage today's complex interconnected environments. All resources—both IT and facilities—are visualized, managed, and optimized within a single pane of glass.

**Easy to scale.** New prefabricated modular data centers can help organizations scale capacity at will, going live within weeks—not years. Meanwhile, fiber solutions can now easily scale from 40/100/400G to keep pace with the insatiable demand for speed and performance.



## Optimizing cabling and connectivity

In today's complex mission-critical data center environments, uptime is mandatory – there's no room for error. This means the IT team must be able to swiftly identify, diagnose, and resolve potential issues that can affect IT services delivered to the business. Yet this is easier said than done. According to a recent survey by ZK Research, 90% of mean-time-to-resolution (MTTR) is spent identifying the problem; in fact, 75% of problems are first identified by end users, NOT by the IT department that must fix them.<sup>5</sup> Much of the problem can be attributed to a lack of visibility into the data center's cabling and connectivity network. Until recently, inventory and management of this environment was handled manually or semi-manually, using tools such as spreadsheets and Visio graphics.

Fortunately, today's automated infrastructure management (AIM) solutions are providing data center professionals with deeper insight and control over their structured and unstructured cabling. AIM solutions such as CommScope's imVision® consolidate all network cabling and patching information into a single database offering real-time intelligence and visibility into every patch and switch port. Data center managers can understand and proactively manage this environment with granularity and insight, creating opportunities to drive efficiency in a number of areas:

**Capacity:** Managers are using AIM systems to locate and recover stranded switch ports – switch ports that appear to be in use but are in fact stranded, as the server has been moved yet the patch itself is still in place. This helps to increase efficiency while freeing up switch ports for re-use, eliminating the need to spend CapEx on new switch ports.

**Speed:** Better intelligence is leading to improved practices in cable routing and faster time-to-live for new servers. "Guided confirmation" makes it easy for installers to quickly and accurately patch in new servers.

**Availability:** By some estimates, AIM systems can result in reduction of downtime by 30 to 50 percent<sup>6</sup> by offering rapid identification of issues that can affect network service.

## The growing emphasis on interconnectivity

Infrastructure management solutions like DCIM and AIM are enabling data center professionals to take a step back and view their physical infrastructure from a bigger perspective. What they are seeing is a single interconnected and highly dynamic physical ecosystem – power, space, assets, cooling, cabling and systems (both IT and Facilities systems) existing in close relationship with one another. A change in one resource invariably produces intended and unintended changes in others – with often direct or indirect impacts on overall performance and efficiency. This suggests that the key to increasing efficiency is being able to holistically see and manage this vast expanse of interconnectivity.

For example, changing the location of a single asset will alter the power requirements of the former and new rack locations, alter the asset database, create changes in the structured cabling, etc. If the data center team is not comprehensive in how they monitor and log all the associated effects of the change – and if they are not using software to gain visibility into both intended and unintended impacts – then they may unintentionally and unknowingly compromise availability levels or affect actual capacity levels. All of this impacts efficiency in some way.

A holistic framework approach enables awareness of the effect of changes made to the data center specific to the various efficiency metrics. For example, an improvement targeted to improve a specific performance metric could have the result of making another metric look worse. A holistic framework helps the operator keep in mind the effects on all metrics simultaneously.

*Green Grid, Harmonizing Global Metrics for Data Center Energy Efficiency, 2013*



Here's another example: thanks to DCIM, data center managers are now becoming keenly aware of the close association between structured cabling management and cooling efficiencies. Optimizing the cabling network for greater availability, for example, may have an adverse effect on cooling and power efficiencies. A holistic understanding of the various interdependencies is essential in order to achieve higher overall efficiency.

By understanding and being able to manage the intended and unintended consequences of moves, adds, and changes, data center managers are better able to achieve higher business output from the IT investment, optimize availability, maximize IT capacity, contain OpEx budgets and make the best possible use of their IT staff.

## Optimizing CapEx with prefabricated modular data centers that are "right sized" from day one

While the industry tends to think of efficiency in terms of OpEx, there are also significant gains to be made in CapEx. This is especially true when adding data center capacity with a traditional, cost-intensive brick-and-mortar facility. As many decision-makers readily admit, the conventional brick-and-mortar build is typically costly, time-consuming, imprecise, and is plagued by a tendency to overbuild based on projected usage levels that may never be reached.

Much of the problem is due to the fact that a new brick-and-mortar data center must be designed today to serve the organization's anticipated needs 10-20 years into the future. Often, in an effort to get the greatest ROI on the construction investment, managers build based on projected capacity demands that may not be realized for years – if ever.

Brick-and-mortar infrastructure can cost from \$10M to \$20M per megawatt, depending on the design and construction of the data center,<sup>7</sup> and can require as much as 4-5 years to deploy. Research suggests that at the typical start-up of a brick-and-mortar facility:

- The data center is typically five times larger than the immediate capacity needs of the organization
- With respect to the 80 percent that is idle on day one, large portions may remain empty and unused throughout the lifecycle of the facility

Due to inefficiencies like these, decision makers often have lingering questions as to whether their brick-and-mortar strategies represent the best use of the organization's resources.

Fortunately, a new class of prefabricated modular data centers is available today that enables organizations to augment their brick-and-mortar facilities in a scalable and efficient fashion. CommScope's Data Center on Demand (DCoD) is pre-built, pre-tested, and then delivered to site. It is right-sized to the customer's capacity needs from day one, with all power, electrical, and cooling systems pre-configured. The customer buys only what they need today, then deploys additional capacity (scales the modular deployment) as their needs expand.

This agile, buy-as-you-go approach offers a new level of efficiency in how capacity is delivered and managed, starting with an accelerated time to market. In fact, the University of Montana recently reported that it took just 9 weeks to build out a 20-rack modular unit.<sup>8</sup>



These prefabricated modular solutions highlight opportunities to put CapEx dollars to more efficient use by ensuring the data center is “right sized” from day one. According to 451 Research, organizations deploying modular are able to lower their construction costs by between 10-30 percent<sup>9</sup> as compared to brick-and-mortar. It’s no wonder the analysts at 451 are projecting rapid growth for the modular market – a 30% CAGR between 2013 and the year 2018, when the market will hit nearly \$4B. “We expect PFM data centers will become the new benchmark to beat for virtually all use cases, from SMEs to hyperscale operators,” writes 451 Research.<sup>10</sup>

## Benefits of best-in-class fiber and copper

In addition to software-based intelligent connectivity management like AIM and DCIM, there is untapped efficiency that can be realized in the fiber and copper cabling network itself. Deploying pre-terminated copper and fiber cabling, for example, offers up to 8x faster deployment speeds than terminating cable on site. The process speeds installation, minimizes potential mistakes, and reduces the time that installation crews are on site.

Increasing fiber density also leads to more efficient ways of deploying the structured cabling network. By taking advantage of conversion fiber modules, data center managers can achieve 100 percent fiber utilization when migrating to 40G and 100G over multimode fiber. As a result, they are able to reduce the inefficiencies caused by unused or “dark” fiber strands. And to increase space and CapEx savings, many data centers are evaluating wideband multimode fiber, which can handle four times more information with the same number of fiber strands over practical distances.

## Conclusion: The connected and efficient data center is here

In today’s fast-moving data centers, the conventional definition of efficiency is rapidly evolving and expanding. With every dollar being critical, data centers can no longer afford to focus their efficiency initiatives solely on power and cooling. Today’s connected and efficient data centers must drive efficiency across all of their physical resources—including space, network connectivity, and IT assets—to unlock the true value of their data center infrastructure.

Fortunately, a wide range of DCIM, AIM, prefabricated modular data center solutions, and other innovations are available today to help decision-makers pursue this challenge. Today’s connected and efficient data centers can be managed as strategic business assets with financial metrics that transcend purchase price or utility bills. New ways of measuring efficiency can be explored including availability, space utilization, workflow optimization, deferred and/or reduced CapEx, and more.

Within the connected and efficient data center, there is no shortage of opportunities to unleash the strategic value of physical infrastructure.

**So where do we go from here? Let’s continue the conversation.**

### Sources

- 1 Improved Efficiency & Reliability for Data Center Servers Using Immersion Oil Cooling; IPC presentation; 2013
- 2 Data centers are the new polluters; ComputerWorld; August 26, 2014
- 3 The IT Monster in the Closet: Ghost Servers; BizTech Magazine; October 31, 2013
- 4 [http://www.koomey.com/post/120611632473/Stanford University and Anthesis Group, research study; June, 2015](http://www.koomey.com/post/120611632473/Stanford%20University%20and%20Anthesis%20Group,%20research%20study,%20June,%202015)
- 5 The Need for Active Visibility; Gigamon, white paper; September 2014
- 6 Automated Infrastructure Management: A Much Needed Revolution for the Cabling Industry; InfoTech Spotlight; August 26, 2013
- 7 Optimizing Data Center Capital Costs with Intelligent IT; Data Center Knowledge; April 2012
- 8 CommScope case study: University of Montana; 2015
- 9 Uptime Institute: Modular Design Offers CapEx Savings; Data Center Knowledge; May 17, 2012
- 10 Prefabricated Modular Data Centers Are Coming of Age; 451 Research report; October 9, 2015

**CommScope** (NASDAQ: COMM) helps companies around the world design, build and manage their wired and wireless networks. Our network infrastructure solutions help customers increase bandwidth; maximize existing capacity; improve network performance and availability; increase energy efficiency; and simplify technology migration. You will find our solutions in the largest buildings, venues and outdoor spaces; in data centers and buildings of all shapes, sizes and complexity; at wireless cell sites and in cable headends; and in airports, trains, and tunnels. Vital networks around the world run on CommScope solutions.



---

[www.commscope.com](http://www.commscope.com)

Visit our website or contact your local CommScope representative for more information.

© 2016 CommScope, Inc. All rights reserved.

All trademarks identified by ® or ™ are registered trademarks or trademarks, respectively, of CommScope, Inc.

This document is for planning purposes only and is not intended to modify or supplement any specifications or warranties relating to CommScope products or services.

WP-109245-EN (01/16)