

DATA CENTER INSIGHTS

Edition 1 | June 2019

MAROC TELECOM

Provides data storage to SMEs at downtown Casablanca data center

ISTANBUL AIRPORT

New airport, new infrastructure

WOLFSBURG

On the road to becoming a smart city

THE DATA CENTER GROUP

Opts for partner that thinks along with them

LENTIS

Mobile fallback data center for healthcare organization



LEGRAND DATA CENTER SOLUTIONS PRESENTS...

... THE BRAND NEW MAGAZINE "DATA CENTER INSIGHTS"!

With award-winning solutions from Legrand Data Center Solutions you benefit from optimal uptime of mission-critical operations. Our team of local specialists' design and build innovative solutions including enclosures, cooling, power, structured cabling and access management to meet your unique requirements.

You can NOW also benefit from our data center knowledge on paper! We created the brand-new Legrand Data Center Solutions magazine "*Data Center Insights*". Data Center Insights shows our view on the changes in the data center market and enables you to respond to these challenges. Every edition also contains in-depth product cases, knowledge articles and customer stories.

ENJOY READING!



Enclosures | Cooling | Power | Environmental Monitoring | Structured Cabling | KVM & Serial | Access Management

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COLOPHON

Data Center Insights is a publication of Legrand Data Center Solutions and is published twice a year.

Legrand Data Center Solutions is a reliable partner with more than 30 years of experience in the data center market with excellent service. Legrand Data Center Solutions provides flexible, proven, and scalable data center solutions.

The specialist brands of Legrand Data Center Solutions – like the strong data center players Minkels and Raritan – are part of the Legrand Group, a publicly traded company (NYSE Euronext Paris: LR) with worldwide sales in the low-voltage installation, data network and data center markets. Legrand operates in more than 180 countries and has achieved global revenues of €6 billion annually.

If you have questions or comments about the articles in this magazine, please contact the Marketing Department of Legrand Data Center Solutions:

marcom@minkels.com
+31 (0)413 31 11 00

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New magazine

DATA CENTER INSIGHTS

Offers perspective on a fast-changing market

PARTNER YOU CAN RELY ON

Our customers need a well-informed and reliable partner that is up to date on the latest developments in the increasingly complex world of the data center", says Frédéric Xerri, Executive Vice President Europe. "We want to be the partner that our customers can rely on and trust in the realization of a new data center project from design to final delivery, but also when it comes to maintenance, management, and expansion."

FROM SCALABILITY TO ENERGY EFFICIENCY

"With the introduction of the new magazine in front of you, Data Center Insights, we will be able to share our views on the changes in the data center market and how you can respond to these challenges – from maximum uptime to scalability and from modularity to energy efficiency." However, according to Frédéric Xerri, Legrand's focus on data center technology is not merely a recent phenomenon. "In the mid-1990s, we had already adapted computer and network spaces at customer locations. Then, ten years ago, we decided to make the data center market a central point of attention."

STRONG DATA CENTER PLAYER

Legrand is always looking to expand its presence with market leaders to strengthen its position. "In recent years, we have acquired several strong data center players," says Frédéric Xerri. "For example, brands such as Minkels, Raritan, Server Technology, and Modulan are now part of the Legrand

Group. Together, we have a history in the data center industry that goes back more than 30 years. This serves as an enormous source of expertise that can benefit our customers, particularly now that this knowledge and experience has been bundled into Legrand Data Center Solutions teams." Legrand Data Center Solutions therefore has a reputation to uphold. "This is reason for us to continue to invest in research and development. Stagnation is, after all, decline. And we simply want to continue to offer the best products and services: from UPSs to PDUs, from cabinets and cabling systems to data center management solutions. From micro data center solutions to complete server rooms and entire data centers."

GROWING MARKET SHARE

Legrand's focus on the data center market has been quite successful, as demonstrated by the fact that Legrand's market share is growing. "More and more customers are reaching out to our data center teams. As for us, we are continuously developing. We are currently investing in the expansion of various production locations, for example, at rack and cabinet manufacturer Minkels in Veghel (the Netherlands)." Thanks to this constant focus on the future, customers are ensured of data center solutions that continuously meet the most modern requirements in terms of reliability, safety, modularity, and continuity. "Of course, we also focus on the sustainability factor. But as far as we are concerned, that goes without saying in 2019!", Frédéric Xerri concludes. ■

The data center market is changing incredibly rapidly – driven by technologies and developments such as artificial intelligence (AI), 5G, Internet of Things (IoT), and edge computing. In addition, increasing attention is being given to the sustainable data center. To be able to serve you optimally as a customer in this changing data center world, back in 2017, we bundled our data center experience into specialist teams – Legrand Data Center Solutions teams. And in 2019, we chose to share our data center knowledge on paper with the introduction of the brand new magazine *Data Center Insights!*

Frédéric Xerri,
Executive Vice President Europe

EDITORIAL

INTRODUCING...



CHRISTIAAN VAN TERHEIJDEN
CEO Minkels

Minkels is a manufacturer and worldwide supplier of high-quality data center infrastructure solutions such as racks, enclosures & containment.



RALF PLOENES
Vice President Sales Raritan & Server
Technology Europe

Raritan is a global leader in intelligent rack PDUs, KVM switches, and other data center infrastructure monitoring and management solutions.



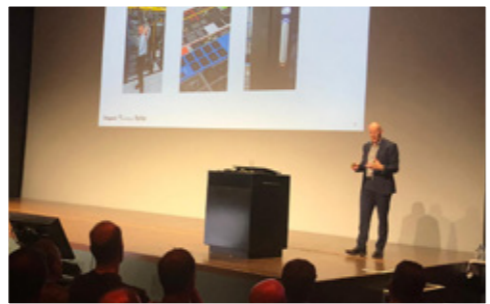
DAVID CHATELAIS
Director Business Development Legrand
UPS Europe

Legrand offers an extensive range of solutions to meet all the needs of service sector installations. The UPS range and additional functions ensure maximum continuity of service for all installations.



Events

FROM FRANCE TO DUBAI



INTERESTING DISCUSSIONS

Legrand Data Center Solutions was in attendance at several events over the past months, travelling from France to Dubai and from the UK to Switzerland! We were able to engage in many interesting discussions and get an even better feel for the demands in the data center market!

MARKET VISION

We also had the opportunity to share our market vision at events such as Datacenter Forum and Data Centre World, where we offered some insight into “the use of the EN 50600 to design an energy-efficient data center” and “the use of bonding, grounding and earthing in a data center”.

COMING MONTHS

In the coming months, we look forward to meeting you at the Finnish Data Center Forum Ry (Finland, September 18), Datacenter Forum (Denmark, September 26), Datacloud Africa (Ghana, September 26), Data Centre World (Paris, November 27 and 28) and at the FEE – IT Infrastructure Datacenters Conference (Belgium, October 24).

See you there! ■



NEWS

Award for PDU innovation of the year



The company’s power distribution units have captured three top DCS Awards in the past four years in recognition of their unique technological innovation. Winners were voted on by *Digitalisation World* readers and announced on May 16, 2019 at London’s Leonardo Royal St Paul’s Hotel.

The DCS Awards spotlight the product designers, manufacturers, suppliers, and providers operating in the data center industry. The awards recognize the achievements of the vendors and their business partners and celebrate excellence in the data center sector.

Peter Davies, Sales Manager of the Digitalisation World portfolio at Angel Business Communications, organizers of DCS Awards said, “This year’s finalists represent the very best in the industry and Server Technology’s HDOT-Cx was voted as outstanding by our readership to win the Data Center PDU Innovation of the Year category.” Read more about this product on page 20 and 21. ■

Server Technology, a Legrand brand and a leading provider of intelligent rack power distribution units (PDUs), announced that the DCS Awards has named its High Density Outlet Technology (HDOT) Cx rack-mount PDU the Data Center PDU Innovation of the Year.

Data Center Academy

During yet another successful Data Center Academy, data center knowledge was shared with other Legrand organizations, partners, and customers from all over the world.

Several “trainees” from diverse countries (from Bulgaria to Lebanon) gathered in the Netherlands for a two-day Legrand Data Center Solutions course. Various subjects were presented, ranging from the current state of the data center market to new solutions. Discussions also offered insight into new acquisitions and the correct interpretation of standards and norms.

Overall data center knowledge was brought to a higher level during these two days in May, preparing the trainees for future developments in the data center business! ■



If you would like to participate in the next Data Center Academy, please contact Etienne Rochelle for more information: etienne.rochelle@legrand.com



ISTANBUL AIRPORT

NEW AIRPORT,
NEW INFRASTRUCTURE

CUSTOMER CASE

Turkey heralds a new era in aviation with the opening of the new Istanbul Airport. The world's largest international hub is the home to Turkey's national flag carrier Turkish Airlines and establishes Istanbul as the world's central location for aviation and travel. Thanks to its strategic location at the crossroads of East and West, the airport has tremendous potential for Turkish Airlines and the global aviation industry. During this megaproject, Legrand Data Center Solutions seized the opportunity to power the world's largest airport!

BUSIEST AIRPORT IN THE WORLD

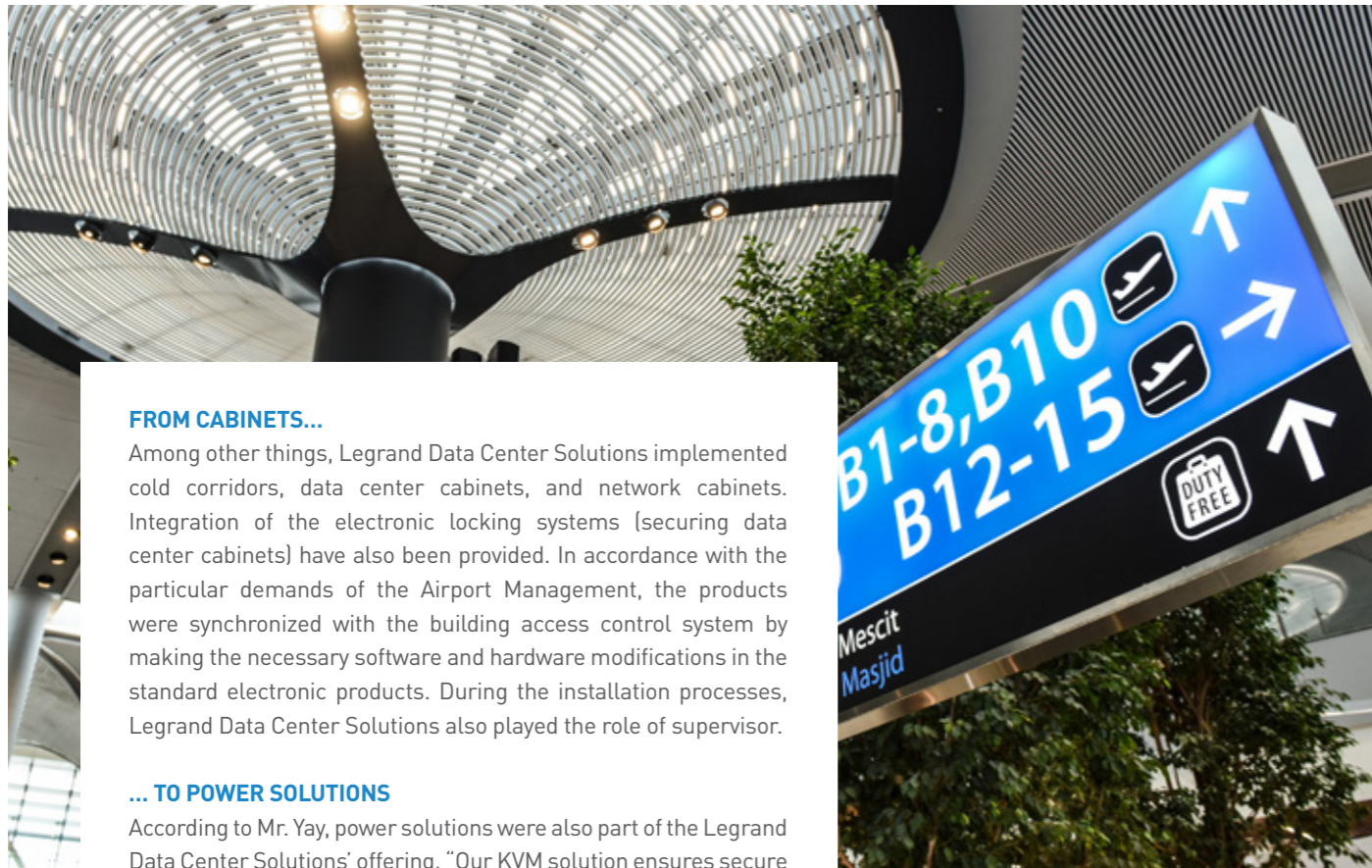
The old Atatürk airport, which processed 68 million travelers a year, was surrounded by buildings, which made expansion of the airport impossible. Which is why Atatürk Airport closed its gates in April 2019. At the same time, the new Istanbul International Airport celebrated its grand opening. Istanbul Airport will process 90 million passengers annually; a number that will rise to 200 million in seven years, at which point it will be the busiest airport in the world.

RELIABLE TECHNOLOGICAL INFRASTRUCTURE

Large airports like Istanbul Airport face numerous (data) challenges. That's where Legrand Data Center Solutions came in: providing reliable technological infrastructure. The products that were offered during the tender process included both cabinets and power solutions. Mr. Ali Yay, Sales Manager at Legrand in Turkey, is delighted that Legrand Data Center Solutions was able to play a role during this very important project for Turkey. "We were selected thanks to our previous experience on similar implementations. A visit to our factory also made a very favorable impression. Additionally, our advice and suggestions provided ease of use, both during the implementation and the actual operation."

**“We completed
a PROJECT with
an extensive
IMPLEMENTATION
SCOPE”**





FROM CABINETS...

Among other things, Legrand Data Center Solutions implemented cold corridors, data center cabinets, and network cabinets. Integration of the electronic locking systems (securing data center cabinets) have also been provided. In accordance with the particular demands of the Airport Management, the products were synchronized with the building access control system by making the necessary software and hardware modifications in the standard electronic products. During the installation processes, Legrand Data Center Solutions also played the role of supervisor.

... TO POWER SOLUTIONS

According to Mr. Yay, power solutions were also part of the Legrand Data Center Solutions' offering. "Our KVM solution ensures secure remote access to the server systems. Monitoring and reporting are carried out through our DCIM solution – the infrastructure management software. We also implemented active passive devices of more than 400 cabinets within the data center, as well as more than 500 smart PDUs, with which power consumption and load distribution of active devices within the cabinets in the data center are monitored."

EXTENSIVE IMPLEMENTATION SCOPE

Legrand Data Center Solutions made project-specific hardware and software improvements and provided R&D support for the seismic requirements of the white zones where the data center cabinets were installed. According to the needs that arose on site, special products were designed and produced. As Mr. Yay points out, "We completed a project with an extensive implementation scope – from seismic requirements to monitoring sensitivity and accuracy. To date, throughout stage one we have delivered more than 2,000 cabinets – 400 of which were data center cabinets. The construction of the airport is being implemented in four stages, expanding the airport and its facilities over time." ■

CUSTOMERCASE



CREATING INTELLIGENT DATA CENTERS

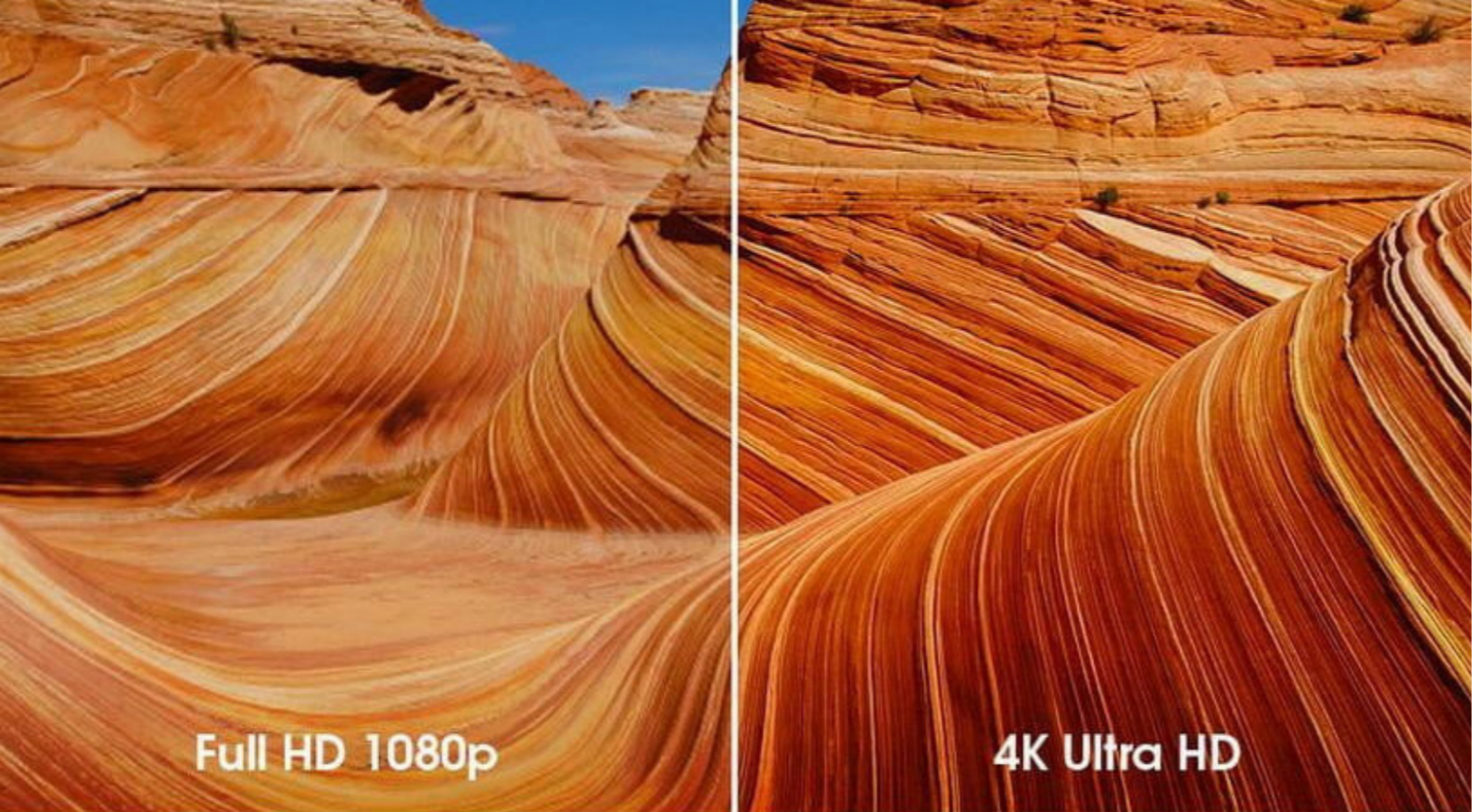
RELIABLE, EFFICIENT, AND SCALABLE DATA CENTER INFRASTRUCTURES.

We design and build innovative solutions, including enclosures, cooling, power, structured cabling, and access management for maximum uptime of mission critical operations. With 30 years of experience, Legrand Data Center Solutions is your global partner.

datacenter.legrand.com

legrand | MINKELS | Raritan.

Enclosures | Cooling | Power | Environmental Monitoring | Structured Cabling | KVM & Serial | Access Management



Full HD 1080p

4K Ultra HD



MOST POWERFUL AND FLEXIBLE

4K Ultra HD

KVM-OVER-IP

Today, we're talking with Edwin de Boer of Legrand Data Center Solutions about KVM technology and Raritan's recently launched Dominion KX IV-101 – the most powerful and flexible KVM-over-IP switch to date.

PRODUCT CASE



BEFORE WE ASK YOU ABOUT THIS NEW PRODUCT, REMIND US: WHAT DOES KVM STAND FOR?

▮▮ The abbreviation KVM stands for "Keyboard, Video, and Mouse" (not to be confused with a Kernel-based Virtual Machine) and is intended to either (remotely) access and control multiple servers from one single device with a single keyboard, video and mouse connection, or to provide multiple users remote access to a single device."

HOW DO USERS MAKE USE OF A KVM-OVER-IP SWITCH?

"KVM switches offer IT administrators

out-of-band access to servers if they no longer respond (and therefore one or more applications are no longer working), enabling them to reboot and maintain servers remotely.

There is no need to physically walk over to the server location that could be miles away, thereby saving time and expense. In addition to being ideal for data center operators, KVM technology is also deployed in control rooms, IT test labs, and broadcast environments where having high performance, high quality, and real-time video is mission critical in their day-today operations."

WHAT CAN YOU TELL US ABOUT THE DOMINION KX IV-101?

"Raritan has been at the forefront of KVM technology since 1985 and continues to invest substantially in R&D, ensuring that it continues to respond to the latest KVM technology developments and new user applications. This has led to the launch of our 4th generation and most powerful KVM-over-IP switch to date: The Dominion KXIV-101. The Dominion KX IV-101, provides a new level of 4K

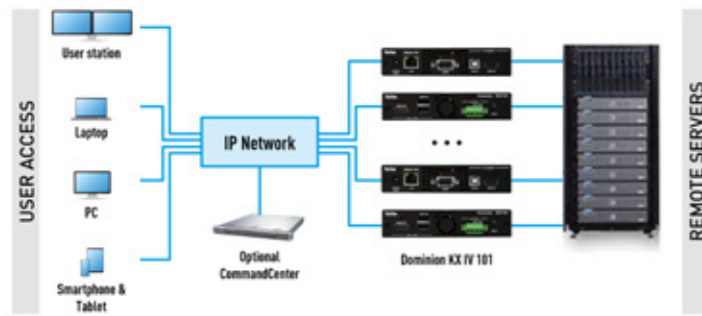
Ultra HD performance for KVM-over-IP remote management. More powerful than any other KVM-over-IP switch, the Dominion KX IV-101 supports unblocked, Java-free anytime/anywhere BIOS-level remote access of servers, PCs, and workstations. The KX IV-101 connects to a single computer, providing unblocked access to multiple users via laptop, PC, or Dominion User Station."

WHAT MAKES THIS PRODUCT STAND OUT FROM OTHER PRODUCTS IN THE MARKET?

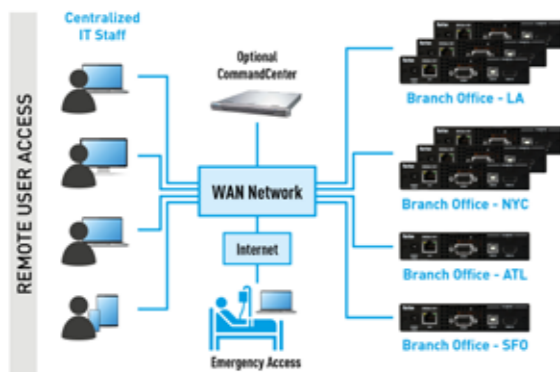
"The new Dominion KX IV-101 supports access to servers with 4K video resolution (3840 x 2160), up to 30 frames per second in combination with the new KX IV User Station (expected availability July 2019). It also supports HD resolutions up to 1920 x 1080 and 1920 x 1200 at up to 60 frames per second with high quality 4:4:4 color for high quality images and video. This rich feature set now offers applications outside the data center space that were not possible before. Using the PC-Share feature, multiple users can simultaneously access the server connected to the KX IV-101.

NUMBER OF DOMINION KX IV-101 CONFIGURATIONS

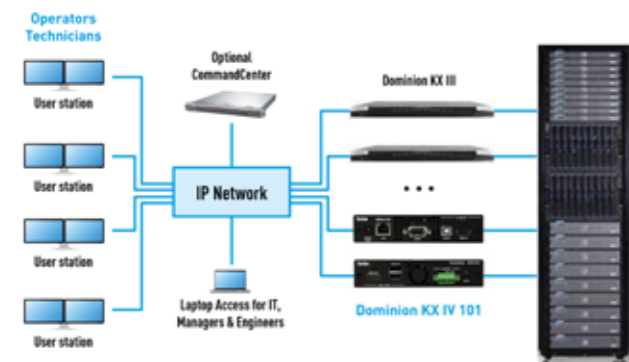
SINGLE OR MULTIPLE KX4s



REMOTE OFFICE / FACILITIES / EDGE



BROADCAST AND CONTROL ROOM SOLUTION



What's more, this switch contains enterprise-level features when it comes to security, flexibility, and has virtual media capabilities that are 3x faster than our previous generation single port KVM-over-IP switch. Another useful feature is the free iOS KVM app allowing the user to configure and administer the KX4-101!"

WHO SHOULD CONSIDER THIS NEW PRODUCT?

"This product is ideal for users that need to work with high-resolution images and/or video (4K) and/or with fast video frame rates, as well as applications that require support for remote offices, facilities, edge, color, etc. We anticipate that control room

managers, IT administrators, IT lab managers, and broadcast engineers will benefit tremendously from this new product." [Note from the editor: After conducting this interview, the Dominion KX IV-101 was awarded the prestigious NAB award in the U.S. for innovations in technology]. ■

Typical applications



Broadcast



Control Rooms



R&D Labs



Government & Military



Remote Office

PRODUCT CASE

INTELLIGENT RACK HYBRID TRANSFER SWITCHES



SAFELY BRING POWER REDUNDANCY TO SINGLE-CORDED DEVICES

HYBRID TRANSFER SWITCH

Raritan's hybrid rack-transfer switches use electromechanical relays and silicon-controlled rectifiers (SCRs) to transfer loads between two sources. The result is performance and reliability that exceeds that of standard automatic transfer switches (ATs) and at a lower cost than static transfer switches (STs).

AWARD-WINNING DESIGN

- Solid state components for fast transfers (4-8ms)
- No risk of electrical arcing
- Outlet-level monitoring & switching
- Speed of an STS at lower cost
- Fan-free design



PDVIEW - INTEGRATED TABLET DISPLAY VIA USB PORT

Turn your tablet or phone into a remote display providing the rack display of all critical data. App available for iOS and Android devices.

Free online test drive

Test drive a live installation of Raritan's hybrid rack transfer switch:
bit.ly/TestdriveTS

Raritan
A brand of **Legrand**

THE DATA CENTER GROUP

Opts for partner that thinks along with them

Photographer: Mischa Keijser



In The Datacenter Group's four ultramodern data centers in Amsterdam, Delft, Rotterdam and Utrecht, data from diverse customers is secured. The Datacenter Group forms the basis for public transport, electronic payments, medical interventions, dyke monitoring, and a portion of the Dutch Internet. In the Amsterdam data center, we spoke with Martijn Kandelaar (Project Manager) and Edwin Kennedy (Chief Commercial Officer) about the challenges that this 100% Dutch player faces.



From left to right: Edwin Kennedy and Martijn Kandelaar

EVERY SECOND COUNTS

One does not simply stroll into the data centers of The Datacenter Group. As a visitor, you must be registered in advance and you must be able to provide personal ID at the reception desk. Only then can you enter the building – and then only under the supervision of an employee. “That’s business as usual,” Kandelaar says. “We secure the data from hospitals, transport, and government institutions, among others. The reliability of IT systems is crucial in these sectors. In healthcare, even seconds count.”

IN SAFE HANDS

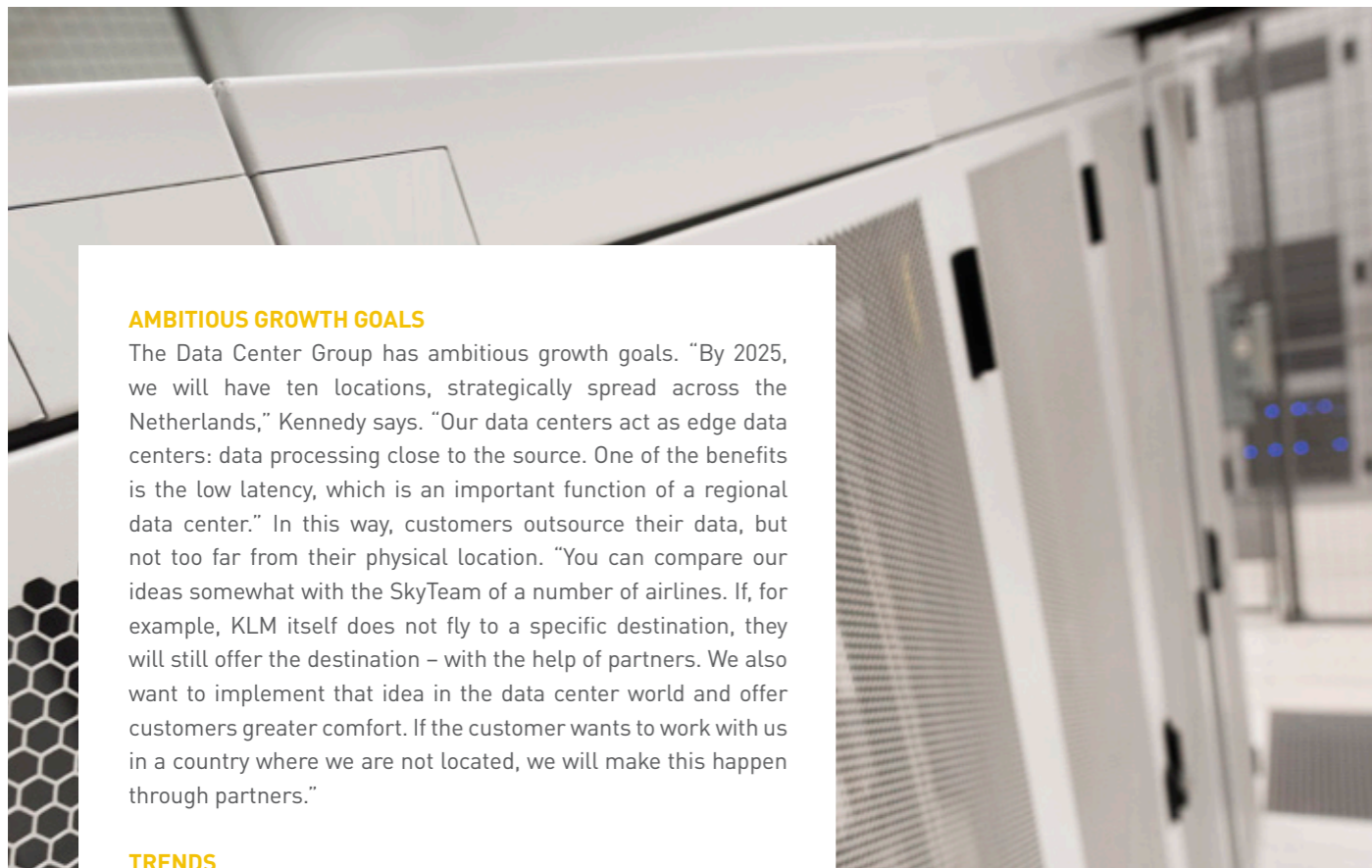
With The Datacenter Group, therefore, data is in safe hands. “Where the cloud

used to be “scary”, the idea is gradually starting to land that data is better off – more flexible, scalable, and cheaper – in a data center than at the customer location,” says Kennedy. “According to research firm Gartner, 80 to 90% of companies still have their data at their own location. In the next few years, this will decrease to 10%. We see added value of The Datacenter Group through consulting in the field of the Hybrid Cloud, and by handling migrations.”

AS GREEN AS POSSIBLE

Along with safety, social responsibility also plays an enormous role within The Datacenter Group. “Data centers are negatively associated with power consumption. Nevertheless, you can no

longer ignore data centers. That is why we operate on 100% green energy. We were the first fully green data center in the Netherlands, and we developed our own cooling system. With this cooling system, we can indirectly cool our customers’ IT equipment with outside air. Along with being highly sustainable, this also provides significant cost savings for our customers. But what really sets us apart from other data centers is the fact that we are 100% Dutch. This means that all data is stored in the Netherlands and is subject to Dutch legislation. That is very important for healthcare, education, and government institutions among others,” says Kennedy.



AMBITIOUS GROWTH GOALS

The Data Center Group has ambitious growth goals. "By 2025, we will have ten locations, strategically spread across the Netherlands," Kennedy says. "Our data centers act as edge data centers: data processing close to the source. One of the benefits is the low latency, which is an important function of a regional data center." In this way, customers outsource their data, but not too far from their physical location. "You can compare our ideas somewhat with the SkyTeam of a number of airlines. If, for example, KLM itself does not fly to a specific destination, they will still offer the destination – with the help of partners. We also want to implement that idea in the data center world and offer customers greater comfort. If the customer wants to work with us in a country where we are not located, we will make this happen through partners."

TRENDS

Additionally, The Datacenter Group keeps a close eye on trends such as ContinuousNext and Digital Twin Organization. As Kennedy explains, "Companies are constantly looking for the next development (ContinuousNext). That is why they are increasingly setting up a second IT environment focused on innovation. This "agile" environment is separate from the "normal", stable IT department that is bound by extensive rules. This means that there is room for experimentation. According to Gartner, this is the way to survive in these turbulent times. But you can imagine that such an agile environment also brings along challenges in terms of flexibility, security, computing, and storage capacity. We are happy to respond to those challenges."

LOGICAL CHOICE

A market that is constantly subject to change also requires partners that think along with them. "Legrand Data Center Solutions is just such a partner for us! We can cooperate quickly thanks to our flat organizations. This enables adjustment to be made in no time; even specials can be provided easily. The flexibility in the portfolio is also admirable. You don't see those configuration options at every supplier," says Kandelaar. The data center in Amsterdam now has cold corridors, PDUs, and approximately 700 racks. "Around 300 racks will be added in a new room. So why did we choose Legrand Data Center Solutions again? We opt for safety, flexibility and reliability – from design to implementation. Bearing that in mind, Legrand Data Center Solutions is the logical choice for us." ■

CUSTOMER CASE



ARE YOU READY FOR A REVOLUTION IN DATA CENTER INFRASTRUCTURE?






SOMETHING IS HAPPENING AT MINKELS...

Thanks to our new factory, we are able to respond more quickly and effectively to the needs of the market. But optimizing and expanding the factory was just the first step...

What's next? We created the ideal circumstances to produce high-quality data center solutions in the best possible way, leading to the development of a completely new product range...

> Coming this September!

Keep a close eye on our social media channels.

-  [Minkels.com](https://www.minkels.com)
-  [Linkedin.com/company/minkels](https://www.linkedin.com/company/minkels)
-  [Youtube.com/c/minkelshq](https://www.youtube.com/c/minkelshq)
-  [Twitter.com/Minkels_HQ](https://twitter.com/Minkels_HQ)
-  [Facebook.com/Minkels](https://www.facebook.com/Minkels)



THE PUE JOURNEY TO 1.0

“HOW LOW CAN YOU GO?”

Every data center manager knows that PUE is a metric that compares a facility's total energy usage to the amount of energy used by its IT equipment. It's also common knowledge for these same managers that a lower PUE can be achieved by implementing industry best practices such as retrofitting older facilities with off-the-shelf equipment for more efficient power distribution. Some data center managers are stuck “in between”, leveraging the most efficient power distribution devices and those that continue to use more energy than necessary. However, it's a virtual dance to see how low you can actually go with your PUE!



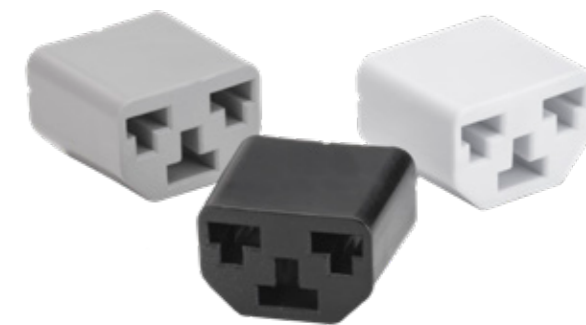
PRODUCT CASE

ACHIEVING A LOWER PUE

In terms of PUE, a perfect number is 1.0, indicating that all the power drawn by the facility is put to use. For this reason, achieving a low PUE ratio requires careful planning! If you're building a new data center, a lower PUE can be achieved by simply choosing a better location. Cooler climates require less energy consumption to keep servers running at optimal conditions. For this reason, isolating hot and cold air to maintain proper airflow while increasing the ambient temperature by just a few degrees is a no-brainer. However, other methods of achieving a low PUE, including optimization at the rack level, are a bit more elusive. After all, server-rack designs have a direct impact on a data center's PUE.

THINK SMALL FOR BIG RESULTS

The truth is, data center managers don't need to bend over backward to lower their PUE ratios. In many cases, they can reduce



power loss by using high-efficiency UPS systems that improve power distribution and eliminate unnecessary voltage conversion. Another “think small for big results” option is to use intelligent PDUs.

Intelligent PDUs are often referred to as “Network PDUs” or “IP power strips”. These are usually vertically oriented and distribute power to multiple computing devices by means of outlets situated in a narrow metal casing.

INTELLIGENT PDUS

Today, PDUs have evolved to become a more sophisticated means of power distribution.

For example, 3-Phase rack PDUs are now used in a wide variety of power configurations. These intelligent devices contain interesting PUE-lowering characteristics. They enable the power input and output to be metered at the unit (including usage, quality, and capacity) and they leverage DCIM software packages to receive and manage alerts, as well as to monitor and measure PDU devices.

Additionally, PDUs offer the option to turn power on and off (both to the individual receptacles and groups of receptacles, at the unit and remotely) and they support environmental monitoring sensors. These intelligent devices truly help control costs and improve operational efficiencies at the power distribution level while allowing for greater capacity planning and better utilization of the overall electrical systems.

FROM INFLEXIBLE...

Once the electrical infrastructure is

installed and energized, data center managers should no longer be stuck in that “in-between” phase, because the once-inflexible PDU components have now become flexible. For example, inflexible PDUs only have static C20 plugs. Therefore, if you need to change half the rack with new servers that arrived with C14 plugs: goodbye PDU! Legrand Data Center Solutions has a solution called HDOT Cx technology to overcome this dilemma. This technology recently won the award for Data Center PDU Innovation of the Year. (For information, see the news item on page 7).

... TO FLEXIBLE

Today's flexible HDOT Cx PDUs are UL-tested and offer a hybrid of the C13 and C19 outlets in a single-phase receptacle. This new version enables data center managers to plug either a C20 or C14 into the same exact spot on the PDU, introducing a great deal of flexibility while also providing the option to be outfitted with data center environmental sensors. And when intelligent PDUs are introduced, managers now have rack-based environmental monitoring at their fingertips to consolidate environmental and power system monitoring and to help improve the operational efficiency of the data center cooling system. Intelligent PDUs also offer predictive trending of environmental data and alert managers of environmental issues on a rack-by-rack basis.

DON'T BE STUCK “IN BETWEEN”

So, when it comes to looking at a data center's PUE, don't be stuck “in between”! Remember that the options at the rack level are intended to break out those stagnant power distribution options while enabling the energy monitoring flexibility that will positively impact the PUE ratio on that journey to 1.0. ■



MAROC TELECOM

Provides data storage to SMEs at downtown Casablanca data center

CUSTOMER CASE

Maroc Telecom opened its first data center in the heart of downtown Casablanca. The data center allows the top telecoms company in Morocco to offer data storage services to the country's SMEs.

DOWNTOWN CASABLANCA

Maroc Telecom has gotten into the data center business. At a time when increasing numbers of major players are getting involved in data storage, the top telecom company in Morocco has elected to set up shop on Avenue Hassan II in downtown Casablanca, right in the middle of the company's network architecture. The data center is mainly intended to serve Moroccan SMEs. Maroc Telecom offers a hosting package for servers and other IT functions at the data center.

FACTS AND FIGURES

The data center comprises two white spaces (2,420 sq. ft. and 1,670 sq. ft., respectively) to house the servers. The spaces can hold up to 100 racks, which themselves hold the servers, cables and other data storage hardware. Maroc Telecom has a third white space (1,950 sq. ft.) ready for immediate use, as well as potential plans to make a fourth space available (5,740 sq. ft.) once technical and environmental studies have been completed.

DATA STORAGE

In these white spaces, Maroc Telecom carries out physical data storage for its clients. The service package starts at 11,000 dirhams per month and increases from there, depending on the desired storage capacity and connection speed, but also on the amount of energy consumed. The package includes infrastructure setup and the establishment of connectivity between the client and the data center via Maroc Telecom's optical cables. The data center also hosts cloud storage for Maroc Telecom's professional clients.

TIER III STANDARDS

Designed in accordance with Tier III standards, the data center is required to achieve an uptime of 99.982% and no more than 1.6 hours of downtime annually to obtain the Uptime Institute's certification – the standard-bearer in the sector. Very few Moroccan data centers have obtained this highly regarded certification. (Source: www.telquel.ma) ■



LEGRAND DATA CENTER SOLUTIONS IMPLEMENTED:

- 2 cold corridors
- 40 cabinets
- 60 x access control
- Integration of the cold corridor with fire suppression systems

Bonding, grounding,
and earthing in a

data center



New white paper!

Earthing and bonding can be quite a complex subject. The use of earthing is extensively prescribed in standards. Going through all these standards is very time-consuming and may be confusing. That is why Legrand Data Center Solutions decided to publish a clear white paper on this topic.

REQUEST WHITE PAPER 11!

Why should you read this white paper? The white paper:

- guides you through the various standards
- explains which standards to use
- indicates the best earthing system for data centers
- explains how to handle cabinets, racks, and containment
- offers a number of hands-on best practices

Go to WWW.MINKELS.COM/WHITEPAPERS to request your white paper now!

CONNECTING

The whitepaper on “Bonding, grounding, and earthing in a data center” describes how to connect to the earth (earthing) and how to connect conductors (bonding) together in a data center. This white paper not only guides you through the various standards, but also explains clearly which standards to use. Additionally, you will discover what earthing system is best for data centers and how you should handle cabinets, racks, and containment.

CLEAR AND HANDS-ON

The white paper also clarifies how the mandatory use of earthing (for safety) can seamlessly be integrated with the functional aspects of earthing in creating an optimal environment for high speed data exchange. The final section of the white paper offers you an overview of the colors and graphical symbols used in ISO and IEC Standards. The white paper concludes with a number of hands-on best practices.

CONCLUSION

This white paper solidifies the elusive subject of earthing. Follow some basic rules, incorporate the relevant standards and the result is a robust and high-performance design. In this way, safety and functionality can be achieved in a single integral design. ■

KNOWLEDGE

READ OTHER WHITE PAPERS!

Driven by the cloud, data growth, and IT cost reductions, the role of data centers is changing rapidly. This is leading to new challenges when it comes to future-proofing data center infrastructures. Legrand Data Center Solutions believes that modularity and full integration are the key to meeting these challenges. Only then can the right amount of flexibility and efficiency be offered. Legrand Data Center Solutions' experts have published a number of white papers which can be used as a guide to creating a future-proof and energy-efficient data center. The white papers are available for download from the Minkels & Raritan website:

WWW.MINKELS.COM/WHITEPAPERS
WWW.RARITAN.COM/RESOURCES/WHITE-PAPERS

Stadtwerke Wolfsburg (Germany) and its telecommunications subsidiary Wobcom have built a high-availability data center in the heart of the city for new digital infrastructure. The IT cabinets are even equipped with multiple sensors to meet the availability requirements. Central monitoring facilitates maintenance and resource management.

WOLFSBURG ON THE ROAD TO BECOMING A SMART CITY

STADTWERKE
WOLFSBURG



CUSTOMERCASE



DIGITIZATION STRATEGY

In cooperation with Volkswagen, the city of Wolfsburg has developed a digitization strategy. Wolfsburg has set for itself the goal of becoming a pioneer in electromobility. In addition, new business areas will be created for companies in the IT field. Stadtwerke Wolfsburg and its subsidiary Wobcom are responsible for setting up a broadband network and for creating an open digital platform. On this platform, initiatives, offers, and projects will be created based on the network of data from all fields of the city.

FROM FIBER TO WLAN

According to Dr. Frank Kästner (CEO of Stadtwerke Wolfsburg), all 80,000 households in the Wolfsburg area should be equipped with fiber optics by 2021. In addition, a nationwide WLAN will be created. According to Dalibor Dreznjak (head of corporate development at Stadtwerke Wolfsburg), it should become a public WLAN that can also be used, for example, for autonomous driving.

THE CORE OF THE NEW NETWORK

The core of the infrastructure is the Wobcom data center in the Nordkopf Tower in the center of Wolfsburg. That is where the Internet hub for the region is located with a fast connection to other

Internet nodes and various networks. The expansion of the broadband network will also create numerous small edge data centers distributed throughout the city. These data centers are required for fast data processing in 5G mobile transmissions and, in particular, autonomous driving. Additionally, the new central data center is connected to another data center in the city owned by Stadtwerke.

FIVE FLOORS

The new data center serves as a core for the broadband network, accommodates

regional cloud solutions, and provides hosting and colocation services to individuals, companies, and local government agencies. The data center extends across five floors in the core of the Nordkopf Tower. In fact, the building is home to five independent data centers that allow for high redundancy and provide sufficient space for hosting customers. These data centers went live in the spring of 2018 and correspond to Tier 3 requirements and the highest category D according to the Bitkom Guide for Reliable Data Centers.



CABINET MONITORING

To achieve maximum reliability, Wobcom Enterprise Architect Giovanni Coppa designed each IT cabinet redundantly and PDUs are used to monitor the connected components for power consumption. Coppa chose Raritan's PX5000 Intelligent Rack PDUs because they provide additional sensor ports to which environmental sensors can connect. Each cabinet in the Nordkopf Tower now contains two PDUs powered by different circuits. Two combined temperature/humidity sensors are connected to each cabinet, and the cabinets are equipped with a door lock with access control.

SAVING ENERGY

The monitoring of electricity consumption enables an energy-saving operation and a detailed analysis of consumers in the data center. This makes it easy to see when and which components are causing utilization peaks. This enables a targeted and more-effective distribution of the hardware in the data center. Power and voltage measurements can also increase availability. In order to detect faults early, additional measuring points at the input and the circuit breakers are therefore useful.

TEMPERATURE AND HUMIDITY

Active components must comply with the temperature and humidity requirements. For that reason, the temperature should be measured directly at the server rack. The requirements for relative humidity are also high in the data center and subject to tight tolerances. Too much air can lead to electrostatic charge and too much humidity can lead to corrosion on the installed equipment. The measurement of the air humidity should be carried out on the supply air, even before it goes through the cabinet. Wobcom works with hot- and cold-aisle enclosures and measures both at the front and in the back of the cabinet with combined temperature and humidity sensors. These measurement points can be used for climate management based on the recommendations of the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE). The PowerIQ software supports this evaluation of the climate data.

MODULAR AND EASY TO EXPAND

An administrator can remotely access, control, and read out the measurement data from their workstation in the Operations Center. This is done via LAN with the monitoring solution PowerIQ from Sunbird Software. The administrator also has the ability to enter upper and lower limits and temperature and humidity thresholds, as well as to set a role-based alert if the temperature or humidity exceeds or falls below these limits. For Giovanni Coppa, it was important for the solution to be "consistently modular and easy to expand."

SUPPORT

The installed hardware can now be clearly documented with the monitoring solution and monitored in detail. This facilitates system maintenance: faults can be identified more quickly and effectively by the operator. Maintenance measures are possible during operation. On-site PDUs with their easy-to-read LCD displays provide a quick overview of the connected components and the associated measured values. Because all of the devices, including the sensors, are connected directly to the two PDUs, the wiring remains clear. This also makes maintenance easier.

CONCLUSION

As Coppa explains, "The solution meets our exact requirements and allows us to extend the data center operations with facility management in an intuitive way." He likes the fact that the PDUs have so many sensors and modules and that they offer a variety of interfaces. The PowerIQ monitoring solution can also be modularly expanded into a comprehensive DCIM solution. "This enables us to use the PX5000 PDUs with the sensors outside of the data center and to remain fully compatible." In the medium term, the plan is to equip the other data center with this solution, as well. In addition, Coppa wants to attach differential air pressure sensors in the cold aisles to monitor the air flow there. In this way, it is once again ensured that the sensitive components actually receive sufficient cooling. ■

CUSTOMER CASE



BENEFIT FROM EXPERTISE!

Driven by factors such as the cloud, data growth, and IT cost reduction, the role of data centers is changing rapidly. This creates new challenges when it comes to the design and build to future-proof the data center infrastructure.

We believe that modularity and total integration of the infrastructure's components is key to addressing these challenges. Only then can the right level of flexibility and efficiency be obtained to ensure a consistent optimal performance throughout the infrastructure's life span and at the lowest possible cost of ownership.

To share our accumulated data center knowledge with customers, our experts have published a variety of white papers on various topics.

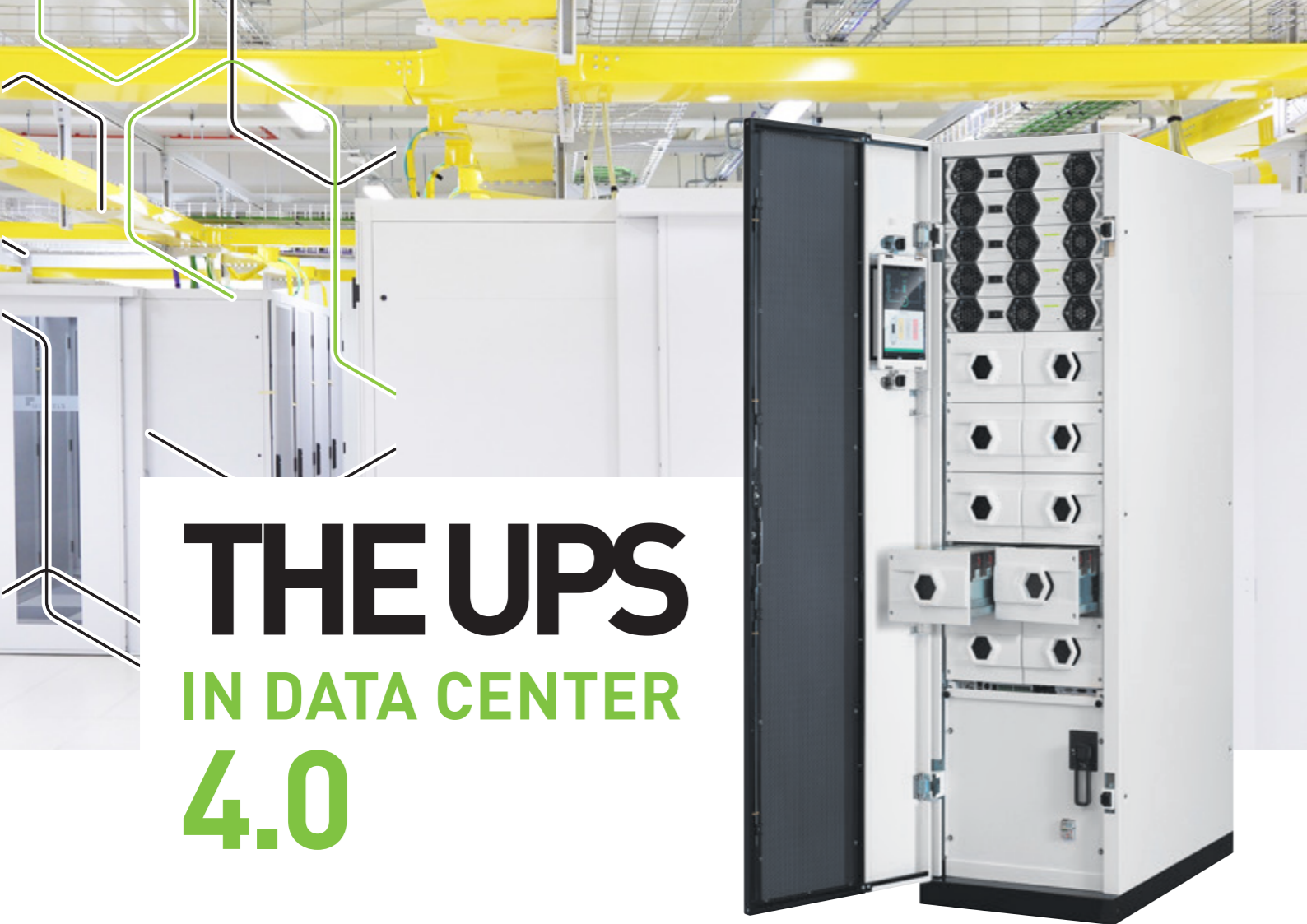
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Enclosures | Cooling | Power | Environmental Monitoring | Structured Cabling | KVM & Serial | Access Management



THE UPS IN DATA CENTER 4.0

The speed at which modern data centers are evolving has exceeded all expectations.

The rapid growth in the volume of data driven by services – both consumer (social media, streaming services, etc.) and corporate services (Industry 4.0) – requires solutions to respond just as quickly and flexibly, and also at low costs if possible.

FACTORS

Not just the data management and storage equipment, but the entire data center infrastructure is called upon to respond to this imminent growth. There are a number of factors that characterize the data center and the entire infrastructure of tomorrow.

THE SPACE FACTOR

Modern technologies used in the servers to increase the calculation speed – greater storage capacities combined with virtualization and the cloud – can considerably

reduce the required data center space. This will allow the UPS, for example, to be placed in the same room as other equipment. This in turn will enable a drastic reduction in costs due to the smaller number of square feet occupied by the entire infrastructure, the simplification of the electrical system, and the reduction in air conditioning. IT Managers are therefore putting in place some possible options to reduce the costs associated with their IT infrastructure. By adopting high-power-density UPS solutions, combined with high efficiency enclosed in small spaces, a mutual advantage will be obtained: the reduction of the physical dimension of the entire infrastructure of the data center.

PRODUCT CASE

THE RELIABILITY FACTOR

As with data equipment, a minimum level of redundancy is achieved by completely duplicating the servers. In the event of a hardware failure in a machine, its equivalent is ready to replace it immediately, even to the plant or power supply. Therefore, the UPS is requested the same service. In fact, only the modular solutions are able to offer this feature and this level of reliability. In a modular UPS, we try to avoid (or at least minimize) the single point of failure by dividing the total power supplied between the various power modules that together make up the system. In the event of failure, the damaged module is simply switched off and/or replaced by a new one that is always available to be removed in the subsequent hours or even days.

THE SIMPLICITY FACTOR

The direction that companies will take is to implement intelligent systems and machine learning to simplify operational processes, to support services, and to simplify maintenance, making data centers more predictive and efficient. In this way, the standardization of the infrastructure components is taking on remarkable relevance. The possibility of using the same elements for the UPS simply by combining them in different quantities is becoming a fundamental and strategic factor in reaching the targeted goals. The objective is to reduce infrastructure costs and speed up the implementation and provision of services, while also simplifying assistance and maintenance procedures.

THE FLEXIBILITY AND TIME FACTOR

The speed with which the data center is evolving has definitely increased as compared to just a few years ago. The time factor is certainly decisive to the success of your project or application. In the past, increasing the size of the infrastructure and expanding the data center could take a long time. These days, there is a serious need for flexibility, and above all to reduce the time required for each individual activity. The increase in absorbed electrical power directly impacts the UPS, which must be able to adapt to the new situation. A modular UPS represents the ideal solution to these needs. A modular UPS enables scalability (both in terms of power and in extremely simple autonomy) without the necessity to adapt the electrical system. This operation is easily accomplished by adding new power modules or battery modules to systems already present in the infrastructure.

THE GREEN FACTOR

Along with the previous four factors, there is a fifth factor that is quite recurrent and still considered fundamental: the green factor. The theme of energy saving is present in every area, required for every element of the infrastructure. The reason why the efficiency requirements for equipment are increasing is not only out of respect for the environment. Achieving a significant economic saving is also a very important reason – the shared linked to the consumption of electricity is the largest factor in the total costs. The UPS

manufacturers are therefore constantly in search of increasingly efficient solutions, even from the perspective of energy saving. The latest generation of UPSs has reached very high levels of efficiency, thus minimizing the losses deriving from self-consumption. A further contribution to the energy saving of the UPS can be provided indirectly by the color of the cabinet. The light surfaces of the structures are more reflective with a consequent decrease in the lighting elements inside the data center.

THE LAST FACTOR

The last factor, but certainly not a negligible one, is the aesthetics. Even the formal aspect, or rather the design, is becoming increasingly important. Data centers have become the flagship of every company: beautiful to look at, clean, tidy, and very bright. All the devices that compose the data centers must reflect the same beauty, refinement in details, materials, and aesthetic aspects. The new UPSs on the market, as well as innovative technological features, must add an aesthetic value that respects the current trends and the convenience that we already find in other more commonly used objects. The use of large touch displays, the simplicity of the Human/Machine Interface (HMI), and the intuitiveness of an “iconic” language to allow quick access to the machine functions are the ingredients that simplify the ordinary and extraordinary activities of the internal infrastructure. ■



For more information check the website: ups.legrand.com/en



Healthcare organization Lentis wanted a number of components of their IT infrastructure to be no more than three hundred meters apart. To achieve that, they were looking for an IT solution that they could make operational as quickly as possible at their location in the city of Groningen (the Netherlands) in the event of a disaster at the site in Zuidlaren (the Netherlands). When considering this type of fallback option, they came up with the idea of a mobile solution...

Mobile fallback data center for healthcare organization LENTIS

CUSTOMER CASE

RUNNING FLAWLESSLY

“The mobile data center is running flawlessly. You don’t really notice it’s there.” That’s how Automation Manager Eppe Wolfis of the healthcare organization Lentis responds when asked how he likes the “ENGIE Mobile Data Center – powered by Legrand” (EMDC), now that it has been running for more than a year. The EMDC is the fallback data center that was delivered to Lentis in Zuidlaren. The EMDC is housed in a humble shipping container and holds a fully-fledged data center that runs synchronously with the existing data center that is located within two hundred meters of the EMDC.

THE SOLUTION: A CONTAINER

Wolfis went in search of a concept to make his idea a reality. The search brought him to a school in the city of Groningen where a completely new mobile data center had been set up on the roof of the temporary school in a shipping container after a fire. “That’s the solution,” Wolfis thought, and he tracked down the supplier of the mobile data center, which turned out to be ENGIE. According to Wolfis, it soon became clear that ENGIE had a great deal of knowledge and experience in the field of data centers, for example, with a complete Mobile Data Centers program –

LEARN MORE ABOUT THE EMDC

Since the Lentis implementation, the container has been further optimized. The tools in the EMDC have also been professionalized. Have a closer look at the EMDC on ENGIE’s website:

www.engie-services.nl/markten/datacenters/emdc/mobiledatacenter/

in cooperation with Legrand Data Center Solutions. ENGIE was therefore one of the two parties with which Lentis entered into discussions.

DECISIVE FACTORS

According to the Automation Manager, the decisive factors in choosing the EMDC included the conceptual solution and the favorable maintenance scenario for a period of five years, combined with the purchase price and the focus on “Green IT”. According to Wolfis, “Green IT” means, for example, the solution for cooling the EMDC. Rather than using air conditioners, the cooling capacity of the outside air is used. “Two hundred days a year, the outside temperature is lower than what you need in a data center. That results in considerable energy savings,” he explains.

“In addition, the modular cooling solution ensures optimum availability and scalability. The cooling solution is scalable to such an extent that when IT demands extra capacity, the cooling capacity is automatically scaled up. That way, there is never any unnecessary use of cooling capacity. So, that is also a saving.”

A RESOUNDING “YES”

“If you ask me if I would recommend the EMDC, my answer is undoubtedly YES,” Wolfis continues. “In case of an IT failure, you have only one chance to get it right. And we have every confidence in this mobile solution in the event of a disaster. For example, we have practiced moving the 8x3 meter container together several times. The container can be in place in Groningen in under four hours.” Everything is correct, down to the last detail, summarizes the Automation Manager. “And that inspires the necessary confidence. After all, when it comes to choosing an IT fallback solution, you don’t want to make a rash decision. The continuity of your organization stands or falls with it. In our case, fifty locations are linked to the EMDC and we still have quite a bit of capacity remaining. The container is now half full. In that way, the solution is scalable, and therefore we are ready for the future.” ■

New range of intelligent PDUs with

RESIDUAL CURRENT MONITORING



VARIOUS TYPES OF RESIDUAL CURRENT MONITORING

Legrand Data Center Solutions offers the following types of residual current monitoring on Raritan PX PDU models with RCM option:

- RCM Type A: Detecting AC and pulsating DC leakage
- RCM Type B single channel: Detecting both AC and DC leakage for all lines
- RCM Type B three channel: Detecting both AC and DC leakage on each line

Residual current monitoring is offered on the most part of the PX range. Do you need help selecting the most suitable data center power infrastructure? If so, please contact us via your Raritan PDU expert.

RESIDUAL CURRENT MONITORING

According to Michael Suchoff, chief engineer and inventor of the self-test patent for Raritan, "We wanted to simplify the way users deploy Residual Current Monitoring at the rack level by making it easier to test and maintain the circuitry, and ultimately comply with electrical standards. Adding RCM to the Rack PDUs is the most efficient way to manage potential leakage current risks from the IT equipment."

DATA CENTER INSPECTIONS

Not surprisingly, some European countries such as Germany and France have made periodic inspection of data centers compulsory to protect its workers and facilities. The expectation in the IT industry is that an increasing number of countries across Europe and beyond will follow RCM standards to monitor Residual Current in data centers to improve efficiency, better protect workers and IT equipment, and ultimately prevent electrocution and fires.

EUROPEAN DATA CENTER STANDARDS

In parallel to RCM, European data center standards such as EN 50600 are also defining the need for neutral current monitoring. EN 50600-2-2:2014 8.2.1 defines the need for neutral current monitoring as a means to prevent overloading and overheating of the neutral wire. According to Nicolas Sagnes, Global Product Marketing for Raritan, "It's our continuous mission to launch products that improve efficiency and uptime, whilst lowering operational cost in the data center. With this philosophy in mind, our engineers designed three types of RCM sensors, as well as a neutral conductor monitoring solution to provide customers with a more reliable infrastructure, and to keep the data center a safe working environment."

Legrand Data Center Solutions offers a new range of Residual Current Monitoring (RCM Type B) options for Raritan intelligent PX PDUs. These new RCM models include a patented self-test functionality designed to avoid the need for manual RCM testing by electricians in the data center and to avoid potential downtime of IT equipment.



Protect against electrical shock caused by residual current.



Reduce the risk of fire caused by leakage and fault current by alerting in time.

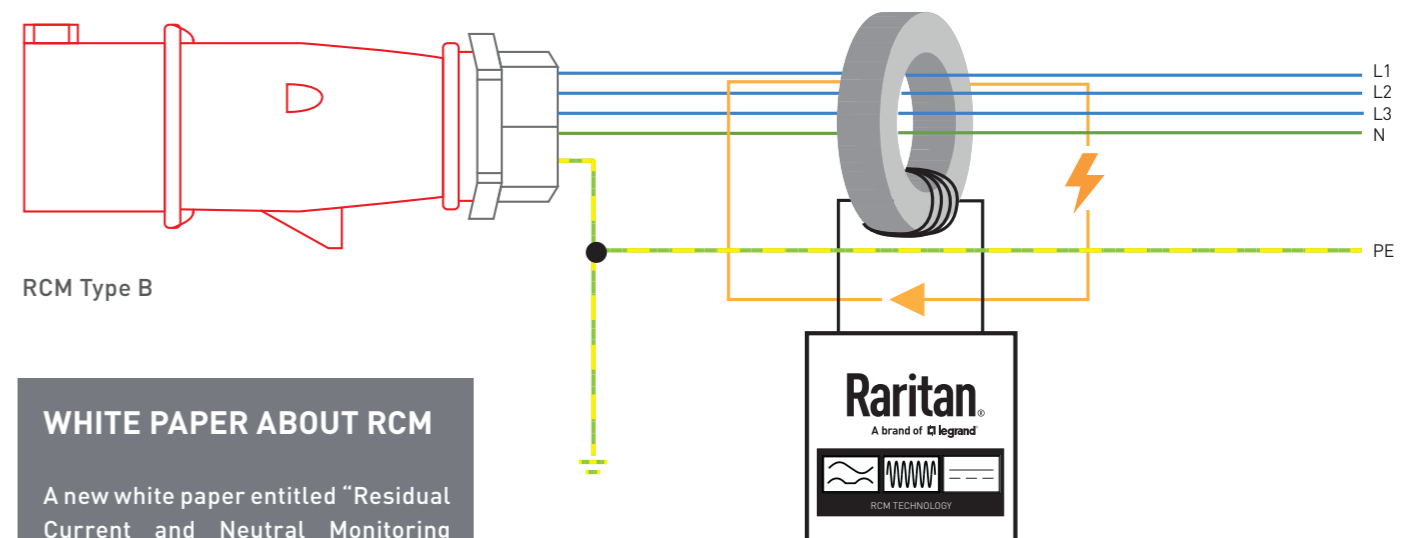


Facilitate preventative maintenance and detect insulation errors.



Increase overall performance of the data center.

KNOWLEDGE



RCM Type B

WHITE PAPER ABOUT RCM

A new white paper entitled "Residual Current and Neutral Monitoring in the Data Center" provides detailed insight into why data center managers should seriously consider deploying residual current monitoring, the various types of RCM, and neutral current metering. This white paper is available for download on Raritan's website: <http://bit.ly/300EC5l>

PREVENTING DOWNTIME

All PX PDUs with the highly accurate RCM sensor embedded enable users in data center environments to set configurable RCM thresholds for optimal efficiency and early detection of critical conditions. Alerts can be configured through Xerus firmware and be sent to a dedicated maintenance contact by e-mail, SMS, and SNMP traps for quick intervention to prevent downtime. ■

THE CASE FOR OM5 FIBER

in the data center

Typical LAN cabling involves a copper and/or fiber backbone (generally 2 km maximum distance) and horizontal copper cabling (maximum distance 100 m, including cords). The devices are usually connected using speeds of 1 Gigabit per second (Gbps), although most require far less than this level of performance (although a few may need up to 10 Gbps). The typical data center has far shorter distances, generally 30 m between server and network racks, while backbone cabling is generally also far shorter than for LAN. Nevertheless, the performance is far superior with servers requiring between 10 and 100 Gbps, leading backbone to offer 100 to 400 Gbps capacity. In this article, Gautier Humbert, BICSI District Chair Mainland Europe, shares his knowledge about using fiber in a data center.



DATA CENTER CABLING VERSUS LAN CABLING

Copper solutions are perfectly suited for short distances because they generally cost less than fiber. The best copper solution today is Category 8, which provides up to 40 Gbps for 30 m. This means that for most high-performance data centers, copper offers insufficient capacity and distance.

Copper is only adapted for server connections in specific designs. These days, there is a clear trend to implement fiber wherever possible – to provide the right distances and high data rates. The table on the adjoining page provides an example of the achievable distances for

KNOWLEDGE

Maximum Distance (m)	30	100	150	400	> 10 000
Category 6a 10G	Yes	Yes	No	No	No
Category 6a 40G	No	No	No	No	No
Category 8 10G	Yes	Yes	No	No	No
Category 8 40G	No	No	No	No	No
Multimode 10G	Yes	Yes	Yes	Yes	No
Multimode 40G	No	No	No	No	No
Singlemode 10G	Yes	Yes	Yes	Yes	Yes
Singlemode 40G	No	No	No	No	No

10 Gbps and 40 Gbps for various cabling types.

PARALLEL AND MULTIPLEXING

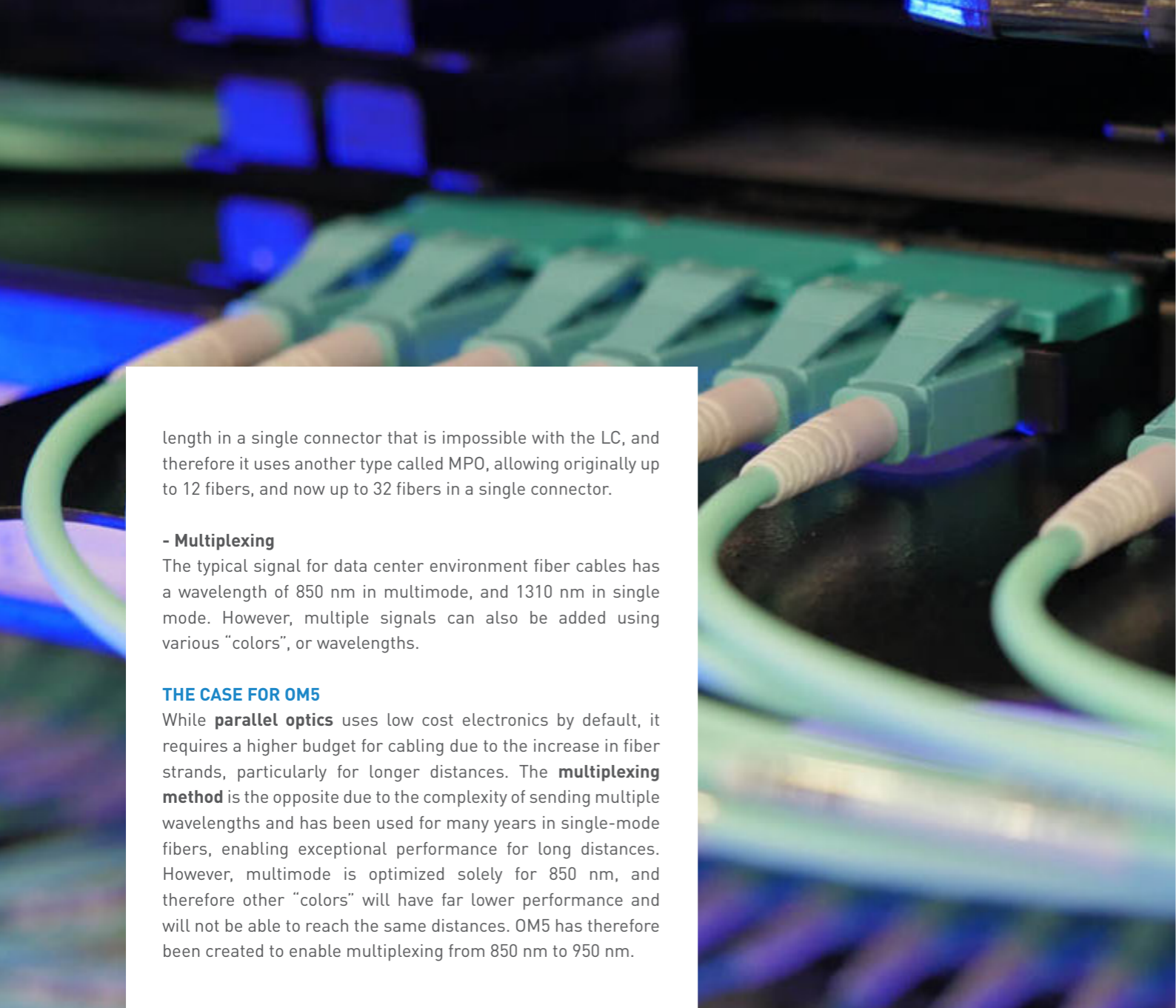
In fiber, the traditional communication method involves sending a signal on one

fiber strand and receiving on another over a duplex connection, generally with an LC type connector. Today, the highest data rate available per channel is 50 Gbps on multimode and 100 Gbps on single mode, limited by the technology

of the light source, as well as the transmission capacity of the fiber cable. To provide the higher rates that today's equipment requires, two main technologies are available: **parallel optics** and **multiplexing**.

- Parallel optics

To multiply the number of channels, the number of fibers must also be multiplied. The first application ratified using this technology was 40Gbase-SR, sending on 4 fibers and receiving in 4 fibers - in fact, simply 4 signals of 10Gbps. This requires multiple fibers of identical



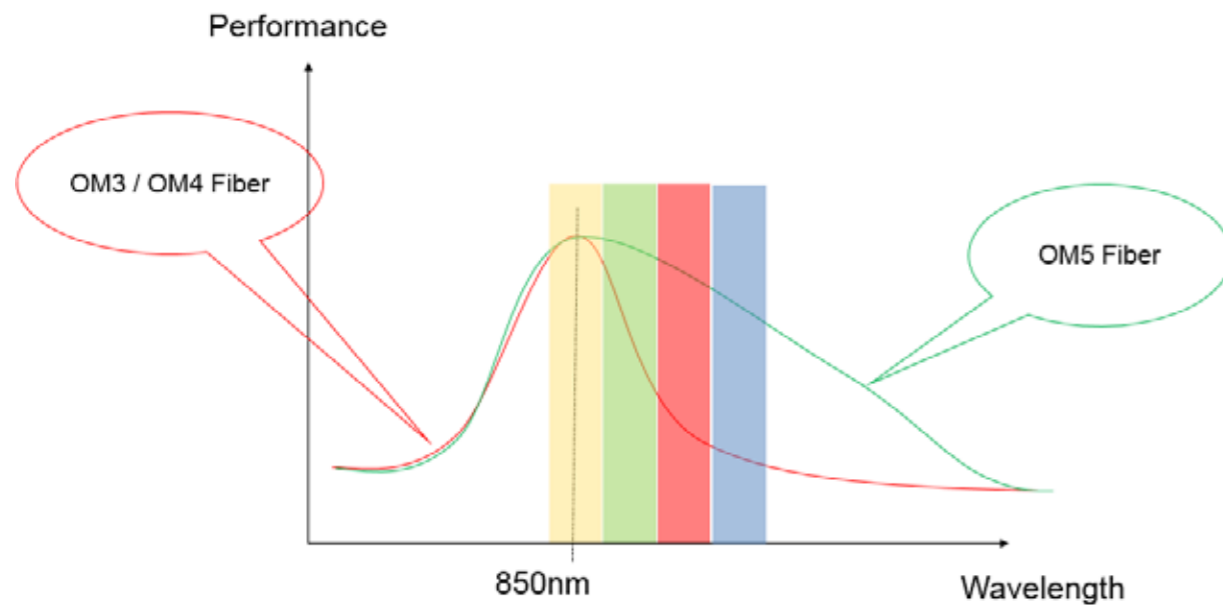
length in a single connector that is impossible with the LC, and therefore it uses another type called MPO, allowing originally up to 12 fibers, and now up to 32 fibers in a single connector.

- Multiplexing

The typical signal for data center environment fiber cables has a wavelength of 850 nm in multimode, and 1310 nm in single mode. However, multiple signals can also be added using various "colors", or wavelengths.

THE CASE FOR OM5

While **parallel optics** uses low cost electronics by default, it requires a higher budget for cabling due to the increase in fiber strands, particularly for longer distances. The **multiplexing method** is the opposite due to the complexity of sending multiple wavelengths and has been used for many years in single-mode fibers, enabling exceptional performance for long distances. However, multimode is optimized solely for 850 nm, and therefore other "colors" will have far lower performance and will not be able to reach the same distances. OM5 has therefore been created to enable multiplexing from 850 nm to 950 nm.



AVAILABLE SOLUTIONS

The single-mode options are generally used for longer distances, 10 km or even more, so they are generally based on the traditional duplex channel. Multimode fibers are generally used for distances of around 100 m, and are available in both multi-strand for parallel optic and duplex for wavelength multiplexing. In the table of applications below, the colored circles indicate the applications that will achieve improved distances with OM5 fiber.

Fiber	Data Rate (Gbps)	IEEE Standard Status	Fiber Pairs	Wavelengths	
Singlemode	25	Ratified	1	1	
	40	Ratified	1	4	
	50	Draft	1	1	
	100	Ratified	1	4	
			2	1	
		Draft	1	2	
	200	Ratified	1	1	
			4	1	
	400	Ratified	1	4	
			4	1	
Multimode	25	Ratified	1	1	
	40	Ratified	4	1	
		Non-Standard	1	2	🌈
	50	Draft	1	4	🌈
			1	1	
	100	Ratified	10	1	
			4	1	
		Non-Standard	1	4	🌈
	400	Draft	1	2	🌈
			4	2	🌈
Ratified		4	4	🌈	
		16	1		
800	Draft	4	4	🌈	

HOW TO CHOOSE

For long distances, single-mode cables are usually the only option. However, due to the cost of electronics, single-mode cables are less suited to short links. When using multimode, there are two possible strategies: more fiber strands or more wavelengths. The reason why there are so many solutions is that each project is different and it is impossible to claim that one solution is better than another. The current Ethernet applications available do not effectively take advantage of the OM5 wavelength multiplexing capability, but the non-standard and future applications can provide greater performance on OM5 than on other multimode cables. ■



**ARE YOU
READY?**

SOMETHING IS COMING...

...THIS SEPTEMBER!