

MASTERING DATA CENTRE MODULARITY: THE CRITICAL ROLE OF CABLING

eBook by

ONNES
UNNLC





INTRODUCTION

The era of high demand is here, so data centres must become more flexible. To do this, modularity is needed – but not as we know it. To create modular data centres, operators must adopt IT infrastructure where interchangeability and connectivity are foundational.

Read on to learn the critical role that cabling will play.

READ ON



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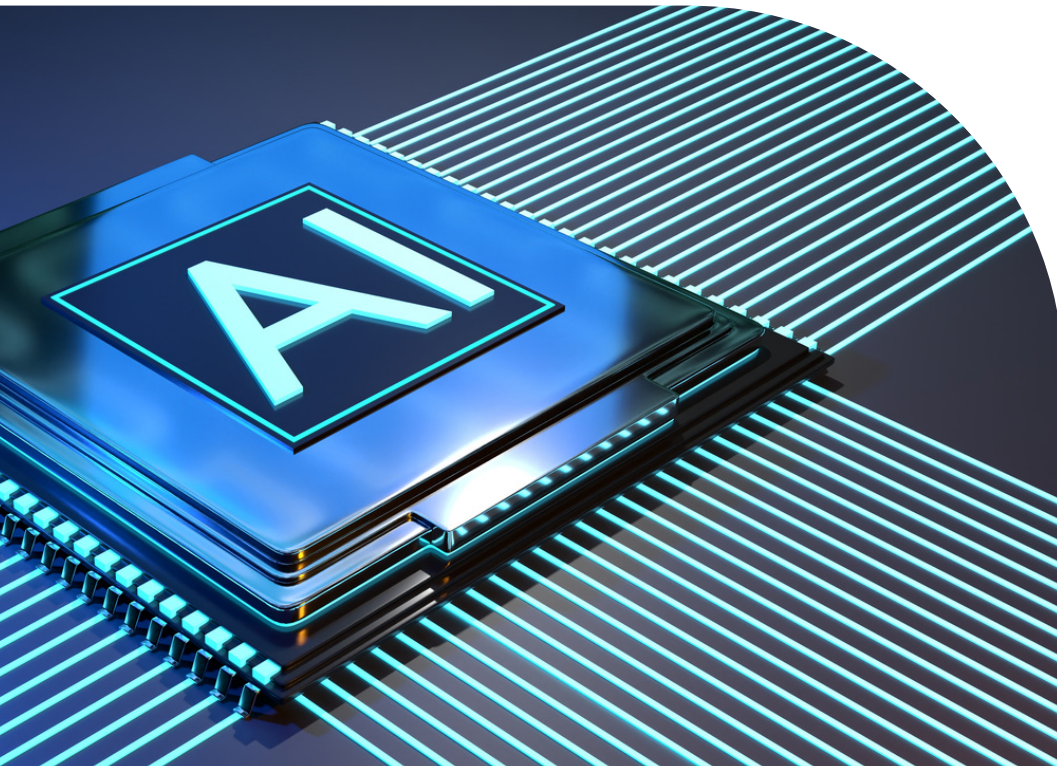
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MODULARITY IS A MUST IN AN ERA OF HIGH DEMAND

The global adoption of AI has reframed an age-old issue facing data centre operators – how to cater for rising demand. Data centres need to become more efficient to deliver the compute capacity required for AI alongside growing workloads caused by streaming and cloud-based gaming.

There are three challenges preventing data centre operators from keeping pace with increased demand:



88%

Demand is skyrocketing – 88% reported data centre capacity for AI is increasing rapidly ^[1]

83%

Construction has slowed – 83% say data centre construction struggled to meet demand in 2023 ^[2]

52%

Hardware is staying longer – 52% keep servers in operation for five years or longer ^[3]

[1] Turner and Townsend Data Centre Cost Index 2023

[2] Turner and Townsend Data Centre Cost Index 2023

[3] Uptime Institute Global Data Centre Study 2022



To keep up with customer demand, operators will need to extend the life of data centres or adapt, which will require them to replace hardware more regularly.

This will require the creation of modular data centres with flexibility and interchangeability built in. But badly thought-through cabling can prevent operators from adapting to changing workloads. Swapping hardware can result in existing cabling having to be replaced, leading to prolonged outages that cause operators to face fines for breaching downtime SLAs.

Problems with cabling start in the design phase, where the focus is on power, cooling and what goes into the building. Not enough thought is given to what could happen on day two and beyond. Questions that must be asked include:



- WHAT WILL FUTURE DEMAND LOOK LIKE?
- WHAT CHANGES NEED TO BE MADE IF CUSTOMERS LEAVE AND A SITE NEEDS TO PIVOT?
- HOW WILL SITES NEED TO ADAPT TO CHANGING DEMAND?
- HAVE I GIVEN ENOUGH THOUGHT & BUDGET TO MY REQUIRED INFRASTRUCTURE?

To become more flexible, modularity is needed – but not as we know it.

If you work for a data centre operator or are responsible for data centre design or operations, read on to learn why we believe the definition of modularity must change and cabling best practices that operators should follow.



READ ON 

THE PRESSURES FACING DATA CENTRE OPERATORS

New technology trends can drive significant new demand and challenges, something data centre operators witnessed with the Internet-of-Things, Bitcoin mining and more recently with Edge.



This change is evident in rack power and density trends:



Power densities per rack rose from 4–5 kW over a decade ago to 8–10 kW per rack in 2020.^[4]



JLL claims AI requirements mean operators will need to install infrastructure to accommodate densities up to 50–100kW per rack.^[5]



More than a third of operators say rack power densities have increased in the past three years.^[6]



60% of operators expect rack densities to rise over the next 12–36 months.^[7]

[4] SDXCentral: Data centre rack density – how high can it go?
[5] JLL North America Data Centre Report H1 2023
[6] Uptime Institute Global Data Centre Study 2022
[7] Data Centre Knowledge: Data Centres in 2023



As AI demand grows, data centre operators will need to conduct rapid hardware refreshes more frequently to adopt GPU-powered racks.

This will put data centres between a rock and a hard place – with power-hungry GPU racks pushing up energy usage at a time when sites are under pressure to improve Environmental, Social and Governance (ESG) metrics.

Operators must think differently about how to design data centres to be more adaptable and sustainable. This means embracing a new kind of modularity to create greener, more efficient data centres, but also get ahead of problems that limit interchangeability, such as **bad cabling**, poor installation and resource shortages. Failure to do so will put new or existing data centres at increased risk of falling into disarray and requiring early refreshes.



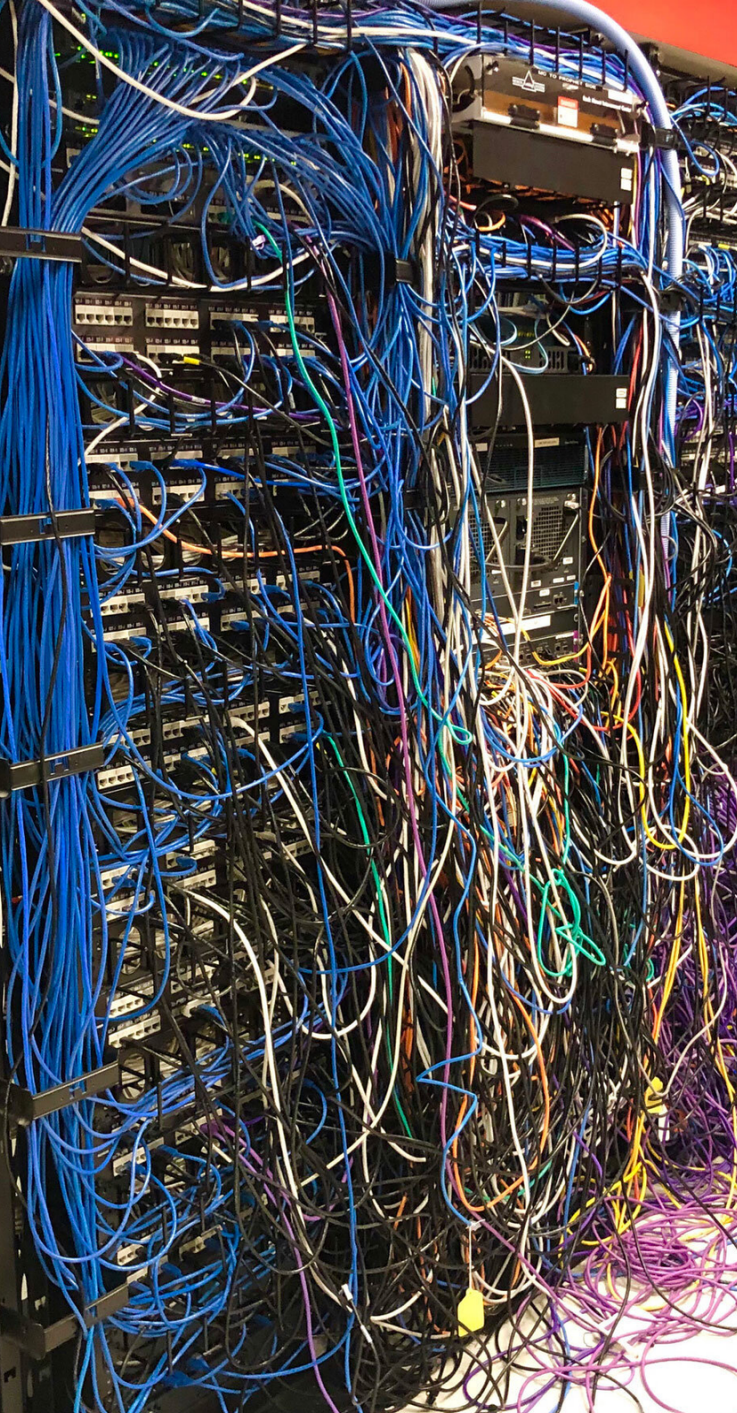
THE POWER TREND INCREASES WE ARE SEEING, AND THE NEED FOR LIQUID COOLING ADVANCES, ARE FORCING US TO THINK DIFFERENTLY ABOUT ALL ELEMENTS OF OUR PLATFORM, RACK AND POWER, AND DATA CENTER DESIGN.”

– Alexis Bjorlin, Meta Vice President for Engineering ^[8]

[8] Meta blog post: Open hardware for AI infrastructure

WHAT IS “BAD” CABLING?





WHAT IS “BAD” CABLING?

“Bad” cabling could mean many different things. Ultimately, it is cabling that leads to poor connectivity, data corruption, and troubleshooting issues. The end result is downtime.

Replacing bad cabling is very expensive compared to best-practice installation and maintenance. But too often, the cabling backbone installed cannot accelerate to meet new bandwidth needs as data centres evolve, meaning they could be replaced within 3 years, instead of the 10–15 year lifetime. Budget planning from the outset for the correct quality cabling can save in the long run.

The tell-tale signs of bad data centre cabling include:

- ✘ Poor installation quality
- ✘ Poor last-mile patching
- ✘ Low quality of last mile material e.g. patch chords
- ✘ Improper cable labelling
- ✘ Excessive cable length
- ✘ Improper bend radius
- ✘ Mixing copper and fibre cabling
- ✘ Loose connections, e.g. at jacks or patch panels
- ✘ Insufficient budgets for quality cabling
- ✘ Older cabling unsuited to required speeds or connectivity

REDEFINING MODULARITY

The data centre industry has long flirted with “modularity”. The traditional definition of modularity meant building data centres from prefabricated modules/containers that included everything from electronics to cooling. Containers were then shipped for assembly and testing on location.

The hope was that modular data centres would be quicker to build, but in reality, it didn’t always help operators to scale. This has seen high-profile hyperscalers, including Google and Microsoft, move away from using containers to scale data centre capacity.^[9]

Modularity as a containerised concept isn’t always enough to scale to meet today’s demand – both from AI and future workloads. However, modularity’s underlying principle is key to navigating the challenges of more frequent hardware refreshes. The definition of modularity must change – it’s not just about “Lego brick” containers, it’s about building modular IT infrastructure where interchangeability and connectivity are key, making plug-and-play hardware a reality.

To create modular data centres, cabling must become the critical foundation that facilitates flexibility across a site’s lifespan. This foundation will create the interchangeability needed to meet AI demand, make ongoing maintenance easier, and repurpose sites as clients leave or demand changes. Most importantly, modularity can help sites to live longer – minimising waste and maximising efficiency.



MICROSOFT HAS HAD TO EXPAND DATA CENTRE CAPACITY AROUND THE WORLD AT A PACE THAT COULDN'T BE ACHIEVED WITH CONTAINERS.”

– Kushagra Vaid, General Manager for Hardware Infrastructure, Cloud & Enterprise Division, Microsoft ^[10]

[9] Data Centre Knowledge: Microsoft moves away from data centre containers
[10] Data Centre Knowledge: Microsoft moves away from data centre containers



WHY IS HOLISTIC DESIGN IMPORTANT?

AI has torn up the data centre design rulebook. Everything from cabling and networks to power and cooling needs a rethink. Data centre design can no longer happen in siloes – taking a holistic approach is critical. This involves:

1

FOCUSING ON PURPOSE

Define the data centre's strategic direction and focus on business-driven decisions up front, not technical requirements.

2

COLLABORATING TO CREATE A SHARED VISION

Bring together teams and stakeholders to agree the shared vision and hold frequent workshops to make design decisions.

3

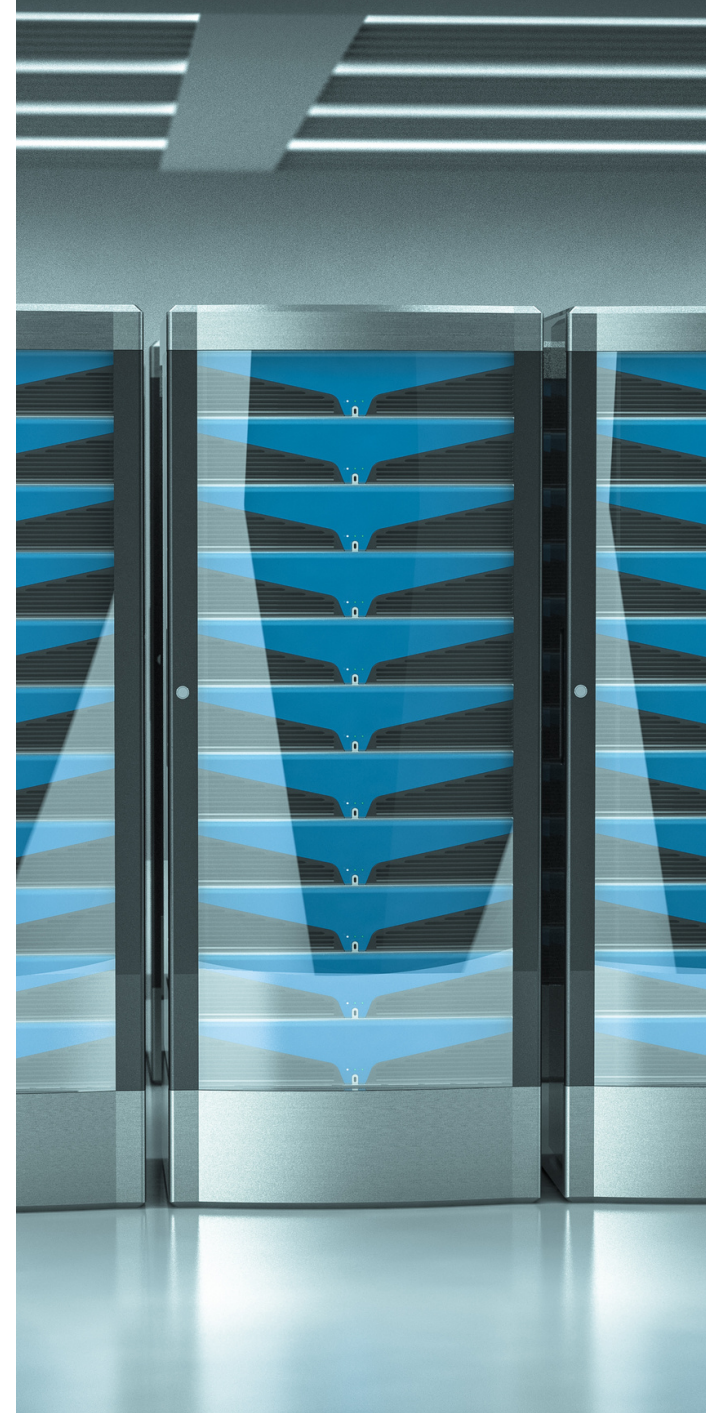
USING THE AI ADVANTAGE

Consider how AI can help the on-site team to optimise data centre operations.

4

BEWARE OF FALSE ECONOMIES

Invest the right amount of capital in the early design stages and aim for long term efficiencies over short-term cost savings.



CABLING IS CRITICAL FOR EMBRACING MODULARITY – 5 BEST PRACTICE TIPS

Building modular data centres will become increasingly necessary as AI workloads ramp up. Operators must take a more holistic approach to planning, and ensure cabling best practice is followed.

1

CHANGE THEIR MINDSET ABOUT DATA CENTRE BUILDS

- Operators must think about sites as integrated engineering purpose built projects, rather than just another commercial property developments.
- Sites will have intricate dependencies between power, cooling, or network routing, so an integrated engineering view will consider and understand how systems and technologies work together, and the role of cabling.
- Operators should identify what services the site will be providing to customers. This will ensure designs optimise offerings, instead of building a rigid facility that's hard to change as new innovations emerge.
- This mindset shift helps operators consider how the data centre could evolve as workloads change and develop cabling infrastructure that supports interchangeability.





2

CHOOSE CABLING SUPPLIERS WISELY

- Operators should avoid the temptation to find multiple suppliers to get the cheapest options for each type of cable they need.
- Operators must benchmark suppliers to minimise the number of suppliers used to standardise installations and maintain high quality cabling best practices.
- A consistent approach to cabling keeps operators focused on the data centre vision, creating a standardised architecture that enables seamless interchange of hardware to achieve modularity.

AS A RESULT, OPERATORS WILL BE ABLE TO



Make support and maintenance easier.



Create tight alignment between operator and vendor plans.



Leverage economies of scale to secure competitive prices on quality cabling.



Improve inventory management with cabling that meets the same standards.



3

BUILD A PIPELINE OF SKILLS THAT CATER FOR TODAY, AND THE FUTURE

To make modular data centres a reality, operators must ensure they have the right skillsets to install, maintain and replace equipment. Teams should have a mix of competencies, such as:

- **Technical** – knowledge of cabling standards, cable testing and troubleshooting, reading network infrastructure plans, familiarity with cable labelling.
- **Installation** – attention to detail when pulling, securing or dressing cables, ability to work in tight enclosures mixed with other infrastructure, expertise using installation hardware, e.g. conduits.
- **Maintenance** – cable tracing, understanding test parameters to identify diagnose and fix cabling faults.
- **General outlook** – problem-solving, high attention to detail, being process-driven and having documentation discipline.

It's not just about building for today; operators must also engineer for tomorrow. This means hiring AI, analytics and predictive skills to anticipate shifting demand and deliver installation projects sustainably.

[11] Gartner Says Four Trends Are Shaping the Future of Cloud, Data Center and Edge Infrastructure



LACK OF SKILLS REMAINS THE BIGGEST BARRIER TO INFRASTRUCTURE MODERNISATION INITIATIVES, WITH MANY ORGANISATIONS FINDING THEY CANNOT HIRE OUTSIDE TALENT TO FILL THESE SKILLS GAPS.”

- Gartner ^[11]

OPERATORS SHOULD



- ✓ Partner with local vocational establishments to create education pathways and apprenticeships for those leaving school.
- ✓ Collaborate with educational institutions to promote cabling as a career path for underrepresented communities.
- ✓ Create programmes that offer retraining and on-the-job shadowing – such programmes could be targeted at veterans or other job seekers looking for a new career.
- ✓ Build excitement and passion for working in the data centre industry – showcasing career paths, opportunities and skills learned.





4

MAP OUT THE CABLING STRATEGY

- Before operators think about installation, they must create a detailed cabling project plan outlining when materials will be delivered. This plan will lay the foundations for the infrastructure required in modular data centres.
- Data centres are typically built to a “just-in-time” delivery model – planning mistakes can be costly and delay construction. Operators must prepare as much as possible to eliminate installation delays.

THIS PLAN SHOULD



- ✓ Consider the unique requirements of the data centre vision to ensure the structured cabling is futureproofed – for example, installing the capacity for 100G or 800G or higher bandwidth needs.
- ✓ Include a detailed design plan calculating the entire cabling system; cable lengths, cable trays – to achieve optimum performance, minimise clutter and streamline installation and troubleshooting.
- ✓ Set aside preparation time to ensure cables are properly labelled and prepared so they are installed correctly.
- ✓ Outline when cabling is due to be delivered on site to plan and ensure resources are available and ready to install.

5

CREATE A METICULOUS INSTALLATION GUIDE

- The project plan will ensure everything is in place but won't cover how cabling should be installed once in the building.
- The installation guide must clearly outline guidelines for how ALL cabling should look, be dressed, labelled, as well as the minimum requirements and standards to meet. It must include every step for employees to follow – confusing or incomplete instructions could lead to costly refits.
- With this guide, operators have a working plan for their modular data centre, with detailed instructions to seamlessly interchange hardware.

THIS GUIDE SHOULD



- ✓ Detail every cable and connector type and provide connection instructions.
- ✓ Explain how to validate the compatibility of each connection.
- ✓ Show how to accurately measure cable lengths to ensure the site is free of loose cables.
- ✓ Provide accurate patch cabling documentation to provision new services, maintain equipment and troubleshoot connectivity problems.



HOW DIGITAL TWINS CAN HELP EXISTING DATA CENTRES BECOME INTERCHANGEABLE

For existing sites, it can be difficult to create interchangeable infrastructure.

A good starting point is creating a digital twin of the data centre to understand your space and the required infrastructure, cabling, cable trays, bus bars, power boxes, cooling pipes and more. This digital twin will help operators review infrastructure to see how to standardise and reduce complexity by introducing shorter cabling and a lower number of connections.

This will allow operators to:



Improve ease of hardware upgrades and reduce implementation errors.



Make technical teams more efficient.



Make audits easier as cabling and documentation have been standardised.



Scale and adapt to changing demand.

SUMMARY

Cabling is the critical connection to enable modern modularity. As AI workloads continue, data centres seeking to keep pace must adopt a modern approach to building modular IT infrastructure where interchangeability and connectivity are foundational.

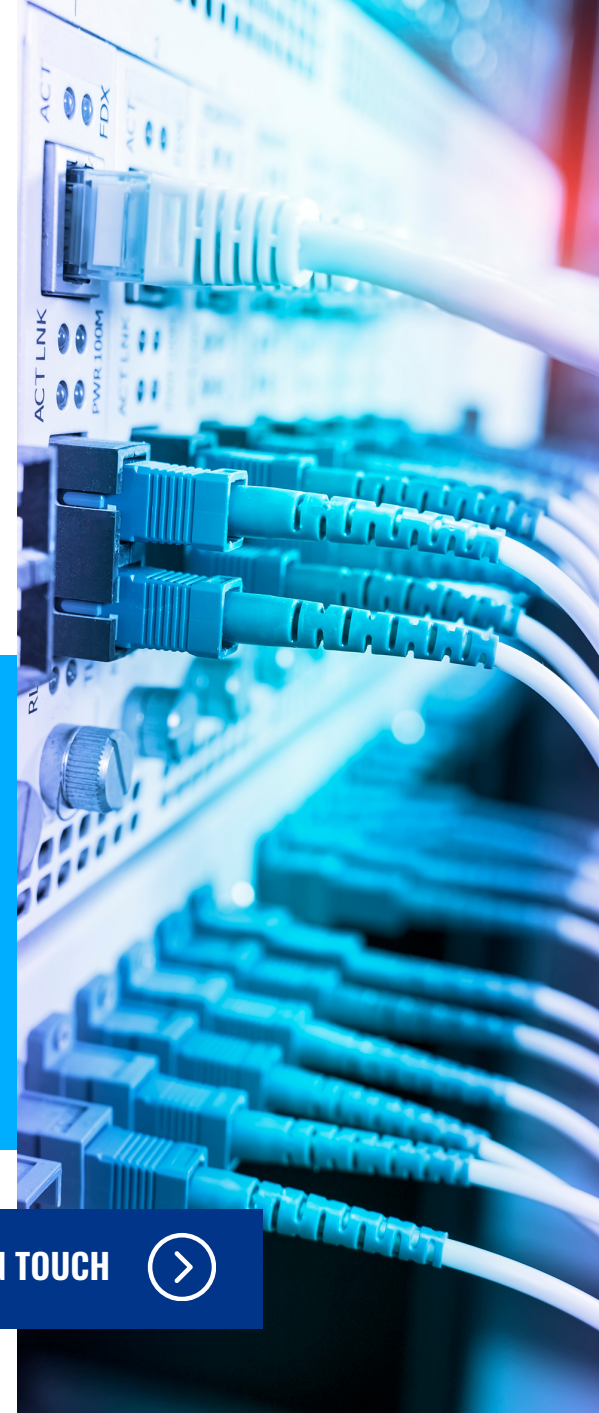
Cabling has a major role to play. By following these cabling best practices and adopting the holistic approach needed to build and operate a modern data centre, operators can seamlessly upgrade hardware as required so they can deliver AI-compute and cater to future workloads.

As a result, operators will be able to:

- ✓ Offer a greater range of services to a wider variety of customers.
- ✓ Easily scale and adapt to new demands and workloads.
- ✓ Avoid costly and time-consuming refits.
- ✓ Ensure uptime and meet customer SLAs.

IF YOU'D LIKE TO LEARN MORE ABOUT THE CRITICAL IMPORTANCE OF CABLING IN HELPING TO CREATE MODULAR DATA CENTRES, SPEAK WITH ONNEC TODAY.

GET IN TOUCH



ABOUT ONNEC

Onnec sits at the centre of connections. We're a single provider of multi-layered data centre solutions – our expertise spans data centre environments, and we support customers with:



Infrastructure and containment holistic design.



Network hardware installations, changes and support.



Installation of cabling, ODFs, PDUs and containment solutions.



Connectivity and equipment upgrades and changes.



Fully managed support service.

Onnec helps to lay the foundations today that can support your data centre for years to come. Connect with us to learn how we help to deliver business growth and certainty in your data centre.

Email: info@onnecgroup.com

Visit: www.onnecgroup.com





Learn more about the unique capabilities we've built over 30 years, delivering cabling and networking at scale, in multiple locations across the globe.



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