COMMSCOPE®

Solutions and Strategies for Improving Data Center Sustainability

When we talk about sustainability, our discussions typically revolve around our carbon footprint and how decisions today can impact our future. At the same time, the world is growing ever more data centric. Between 2010 and 2020, the volume of data generated, harvested, copied and consumed worldwide grew by almost 5,000%—and data usage increased from 1.2 trillion gigabytes[1] to 59 trillion gigabytes. As shown in Figure 1, the exponential growth in data use shows no signs of slowing; the same is true for the new technologies and network infrastructure needed to support it.

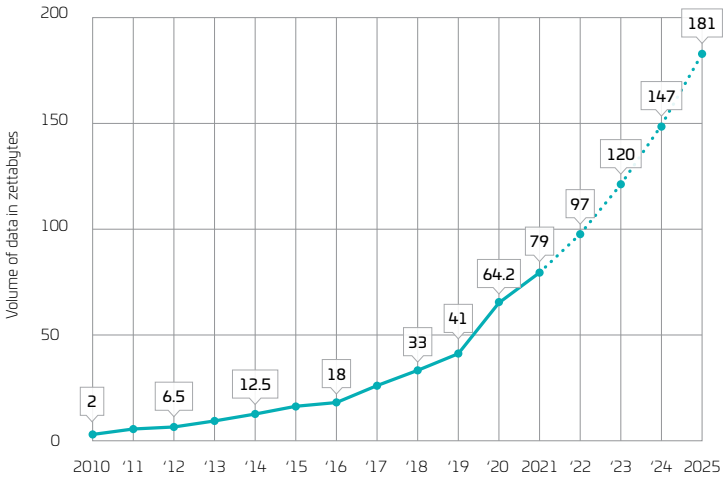

Figure 1: Global data generated, consumed, copied and stored—Source: Statista.com

Enabling the type of application connectivity, bandwidth and latency performance needed to keep pace with society's demands requires geographic diversity, capacity and accessibility on a massive scale. Service providers are responding by continuing to build out data centers of various types and sizes and investing in more interconnect networks to create more capacity and lower latency. As shown in Figure 2, the data center construction market is expected to continue its upward growth.

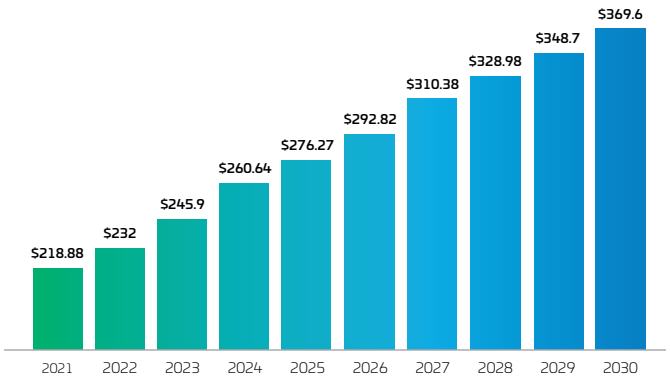

Figure 2: Data center construction market size, 2021 to 2030 (USD billion)—Source: Precedence Research

Rising to the environmental challenge

Despite its historically cautious mindset, the data center industry has taken decisive steps to address its environmental impact. 451 Research's report—Voice of the Enterprise: Datacenters, Sustainability 2023—shows the environment playing a very or somewhat important role in 76% of enterprise technology decisions, including data centers.[2] More specifically, data center providers are focused on reducing the carbon intensity of the energy consumed, with initiatives such as reducing water use and eliminating diesel generators as common topics of discussion. Other findings from the 451 Research report show that:

- 89% say data center efficiency and sustainability are very or somewhat important.
- 80% believe their data center's water consumption is a major or moderate concern.
- 36% of companies that closed a data center did so to improve their carbon footprint.

In its executive summary of the report, S&P Global Market Intelligence, which owns 451 Research, concluded, "The requirements for sustainability, as well as changes in compute infrastructure (such as higher-density chips), will push the data center industry to test and adopt innovative technology. [These include] liquid cooling, micro-modular data centers, alternatives to diesel generators, and other technical changes in data center construction and operation. Customers will continue to push for new approaches, and this could see the industry become a leader in sustainability and an example for enterprises more broadly."

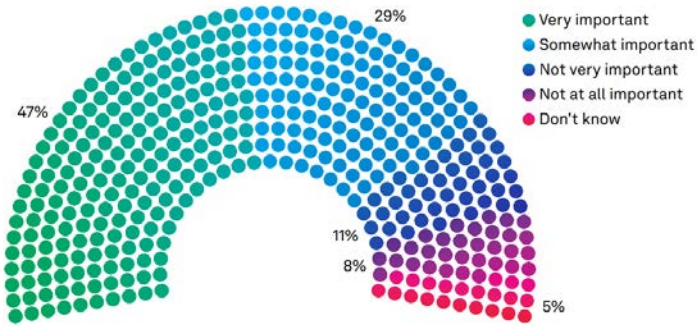

Figure 3: Role of the environment on enterprise tech decisions—Source: 451 Research

If data center operators are to successfully thread the needle between improved sustainability and increased capacity and performance, they will need help from their infrastructure technology partners—and they're getting it in a variety of forms.

New fiber-based products and portfolios can now support multiple generations of application and equipment upgrades while reducing the amount of non-recyclable packaging and installation labor. Advanced cabling configurations are also helping simplify network architectures, positively impacting space and energy consumption. New combinations of passive and active components demonstrate the potential to maximize application performance and access, benefiting customers and the environment.

Going faster while reducing consumption

Data rates have rapidly increased over the past few years, progressing beyond legacy 10G. Transceiver speeds are rapidly moving from 100G/200G to 400G, 800G, 1.6T and beyond.[3] By 2027, shipments of 100G servers are expected to dominate the market. To support a typical 1:1 subscription ratio, a leaf-and-spine data center fabric needs to run at 400G.

In the past, faster chipsets meant increased power consumption and cost. However, a single high-speed switch port can now support one, four or eight devices thanks to recent advancements in parallel optics and breakout options. This means fewer switches are required to provide the same or more capacity—with one switch now doing the work of six. Moreover, these new capabilities decrease the number of switch layers, lower the cost and power per gigabit, and reduce network complexity—all while reducing manufacturing and the amount of mined and processed minerals. These efficiencies are

driving data center operators to upgrade and migrate in advance of the traditional three-year refresh cycle.

Trending toward 8- and 16-fiber connectivity

Historically, 12- and 24-fiber-based units were the norm for fiber cable construction. However, the move to faster lane speeds has fueled a migration to 16-fiber MPO connectivity, the basic building block for 400G and higher speeds. Eight- and 16-fiber connectivity has led to more application-specific fiber configurations and modular connectivity, simplifying everything from design and installation to Day 2 operations.

Going forward, data center applications are expected to be delivered over 2, 8 or 16 fibers. To maximize switch port utilization (and minimize power consumption), trunk cabling must align with the applications being supported. All trunk options can support duplex applications, while 8- or 16-fiber applications are supported by 8- or 16-fiber trunks, with the 16-fiber option providing the most flexibility. In lieu of 16-fiber trunk cables, combining equal lengths of 8-fiber trunks can also support 16-fiber applications.

Choosing the right building blocks for data center connectivity can go a long way toward helping data centers meet their sustainability objectives. As mentioned, the 16-fiber trunk is the most flexible way to support speeds of 400G and above, allowing network managers to reduce their power draw and get the biggest bang for their cabling buck. The 16-fiber option also enables greater efficiency in onsite labor and space requirements. Thus, it can improve Day 2 operations by reducing the need for truck rolls and the associated generation of CO_2 emissions.

Rethinking fiber cabling construction

Another way in which data center operators can improve their environmental outcomes is with new and innovative fiber cabling designs. One of the best examples is rollable ribbon fiber cable. While smaller-diameter cables typically weigh less and provide benefits in pathway weight and space, the development of rollable ribbon fiber cable has enabled much higher fiber counts in much smaller jacket diameters.

Rollable ribbon fiber cable is based, in part, on the earlier development of the central tube ribbon cable. Introduced in the mid-1990s, primarily for outside plant (OSP) networks, the central tube ribbon cable featured ribbon stacks of up to 864 fibers within a single, central buffer tube. The fibers are grouped and continuously bonded down the length of the cable, which increases its rigidity. While this has little effect when deploying the cable in an OSP application, a rigid cable is undesirable in a data center where more flexible routing is required to navigate narrow and congested pathways.

In contrast, a rollable ribbon fiber cable features fibers that are attached intermittently to form a loose web (see Figure 4). This configuration makes the ribbon more flexible, allowing the fibers to flex with a degree of independence from one another. The fibers can now be "rolled" into a cylinder, making much better use of space when compared with flat ribbons.

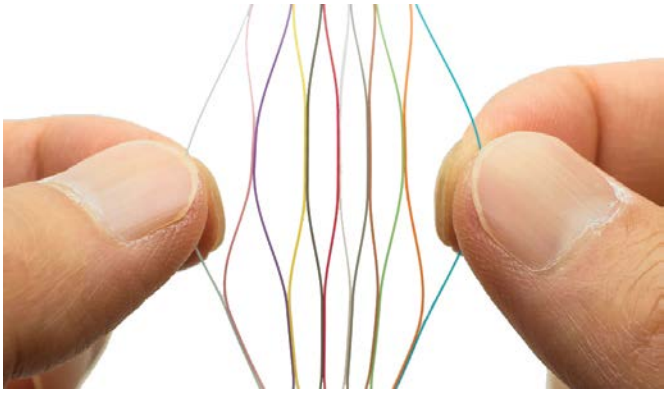

Figure 4: Intermittent bonding of rollable ribbon fibers

As many as six 3,456-rollable-ribbon-fiber cables can be loaded into one 4-in. duct, more than twice the density of conventionally packed fibers. Rollable ribbon cables use significantly less plastics and related materials while delivering more fiber protection and routing flexibility than traditional central tube ribbon cables. The design also leads to improved on-site efficiencies during installations.

Lowering the packaging impact

The type and design of the packaging of fiber cabling—or any infrastructure component—also affects a data center's carbon footprint. The challenge is how to best protect products while minimizing the environmental impact of the packaging after installation. One way to do this is to use recycled and/or recyclable packaging materials versus single-use plastics, wherever possible. Developing green-focused materials and advances in recycling have enabled much more efficient and environmentally beneficial options.

Another consideration regarding product packaging is overall weight and size, as these factors figure prominently in the fuel consumed and CO_2 emitted during transportation. Careful consideration of those materials can impact usability and efficiency on-site for the installers and data center operators.

Geographic production and supplier diversity also play a role, as highlighted by recent supply chain constraints. Sustainability planning considers the availability of the resource today and in the future. It's a small world, after all. The diversity of pre-qualified

component supply options is important in ensuring that resources are not depleted environmentally and that they are available when and where needed for capacity buildouts.

Doing our part

As an industry leader, CommScope is constantly asking ourselves tough questions:

1. Are we doing all we can to create a more sustainable industry and be a role model of corporate citizenship?
2. How can we further reduce or offset our environmental impact while continuing to improve how the world communicates and collaborates?
3. What new technologies and strategies will address the needs of our environment as well as our suppliers, partners and customers?

As part of our commitment to sustainability, CommScope developed our end-to-end, ultra-low loss, modular structured cabling fiber platform—Propel™—to be highly efficient. Propel enables 1:1 matching of module and adapter options for application-based scaling. At the same time, the entire portfolio is uniquely sustainable and designed to reduce waste, conserve space, reduce fuel use and extend the product lifecycle. For example, Propel offers:

- 4U panel packaging that is 20% smaller and 16% lighter than typical panels
- Installation with one technician, reducing CO_2e.
- Support for multiple upgrades, reducing mined materials and manufacturing impact
- Components that use conflict-free minerals

The use of 16-fiber MPO connectivity takes sustainability further, resulting in:

- 62% less plastic (fewer trunks, more links)
- 61% less steel (ultra-high-density panel)
- 57% less cardboard, 33% less packaging

As a case in point, a large social media provider realized significant improvements in their carbon footprint by upgrading to a next-generation infrastructure architecture with the Propel platform. They were able to reduce plastics, steel, cardboard and packaging materials while simplifying their architecture and enabling at least three generations of connectivity. Click here to download the full case study.

References

[1] 54 Predictions About the State of Data In 2021; Forbes, article; December 30, 2020

[2] 2023 Trends in Datacenter Services & Infrastructure; 451 Research, report; December 2022

[3] New transceivers that will use MPO16: 800G-DR8, 800G-DR8-2, 800G- SR8, 800G-VR8, 1.6T-SR8.2, 1.6T-VR8.2, 1.6T-DR8, 1.6T-DR8-2

CommScope pushes the boundaries of communications technology with game-changing ideas and ground-breaking discoveries that spark profound human achievement. We collaborate with our customers and partners to design, create and build the world's most advanced networks. It is our passion and commitment to identify the next opportunity and realize a better tomorrow. Discover more at commscope.com.

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