DATA CENTER Frontier Special Report

How Four Efficiency and Density Points are Reshaping Data Center Network Architecture

In a world connected by digital infrastructure, new network considerations must be taken to ensure optimal performance, efficiency, and sustainability

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Executive Summary

As a global community, we are more connected than ever before. These past few years, we've realized a few important points. First, our ability to connect is paramount to work and life balances. Second, these digital connections grow in importance every single year. Infrastructure leaders know that uptime, resiliency, and sustainability are at the forefront of helping people stay productive and connected.

However, not every data center facility is built the same, and not every supporting architecture for those facilities is designed equally. When working with cabling and connectivity systems, it's key to reduce deployment challenges and ensure you have an intuitive design. To support emerging requirements, data center and facility leaders must look at reducing complexity, increasing density, and providing a better time-to-market pace. Most of all, this needs to be accomplished sustainably and efficiently.

This paper will explore four efficiency and density solutions that are helping data centers reshape the way they architect their critical infrastructure.

Introduction

There is no slowdown in the data center industry. A new report from Fortune Business Insights indicates that the global demand for more efficient IT technologies combined with the economic advantages of modern, consolidated connectivity applications has contributed to the exponential rise in the scale and power of data centers. As the report points out, the global data center infrastructure market size is projected to reach $142.31 billion by 2027, compared to 2019, when the global market value stood at $94.56 billion.

The rapidly evolving competitiveness in the global market and advanced technologies such as cloud computing and big data have made it simpler and cheaper for enterprises to shift their workload to self-contained data centers.

Expanding utilization of data centers by companies amid the COVID-19 pandemic is fueling the growth of this market. Furthermore, the rapidly evolving competitiveness in the global market and advanced technologies such as cloud computing and big data have made it **simpler and cheaper for enterprises to shift their workload to self-contained data centers.**

It's not always easy to shift to better designs with improved connectivity architecture. There are still real challenges facing distributed infrastructure as they work to support more users globally. Consider these emerging challenges:

- **You are trying to overcome time-to-market and supply chain issues,** and lead times for gear and equipment are slowing you down. And you're not the only one. Leaders in the digital infrastructure space are actively looking for new cabling and connectivity partners with global reach and new support capabilities.
- **Challenges with human error and inefficiency.** We'll expand on this in a minute. However, installing and re-installing wiring and cabling systems isn't only costly, it's very time-consuming. Furthermore, you introduce cabling congestion and challenges with upkeep. Modern hyperscale and colocation facilities need to be clean and well-managed.
- **You're working with non-standardized parts.** When product designs aren't craft-friendly and standardized, you'll be challenged with scaling your infrastructure. Further, you'll hit density issues as you try to support more customers.
- **You see challenges with non-scalable solutions and closed systems.** Standardization is essential to ensuring the proper deployment of critical systems. The other key factor is the ability of your cabling systems to support emerging density requirements.

In This Paper

We'll explore critical new considerations as leaders design the future of digital infrastructure. Specifically, we'll cover the following:

- ✓ **From legacy to modern: how design and components have evolved.**
- ✓ **New digital infrastructure decision points: *The four efficiency and design solutions to support critical infrastructure*.**
- ✓ **Supporting new global demands.**
- ✓ **Reducing complexity and improving time-to-market capacity.**

Finally, we'll dive into real-world use cases, design considerations, and how you can move away from legacy concepts and create a new, connected data center architecture.

Section 1: From Legacy to Digital Infrastructure: Design, Component, and Services Concepts

Change is the current constant in the modern data center landscape. It's essential to take a reflective look at the business to understand how legacy solutions might impact the overall approach to new digital trends. Other critical concerns with legacy systems are design, delivery, and operation challenges. Cabling, networking, and communication happening within a facility are much different than ever before. While we'll cover this soon, working with new solutions is critical to reducing errors and improving operational efficiency.

The only way to truly embrace a digital infrastructure is to understand the significant trends in today's data centers. Regarding data center design, consider these new and critical trends.

- **There are new solutions around distributed computing and edge.** According to Gartner, around 10% of enterprise-generated data is created and processed outside a traditional centralized data center or cloud. By 2025, Gartner predicts this figure will reach 50%, meaning that services around the edge will continue to evolve and grow. Furthermore, the edge will require a broader focus on connectivity and telecommunications for the best possible experience.
- **5G and new methods of connectivity will impact digital modernization efforts.** Gartner also noted that 5G was one of the main drivers for mobility in 2020, with the market for 5G infrastructure hitting more than $4 billion and two-thirds of companies deploying 5G in 2020. The connectivity around 5G and new telecommunication solutions are poised to revolutionize how we work, live, and stay productive. According to Ericsson, towards the end of 2020, there were already more than 92 commercial 5G networks in 38 countries, with more than 320 million 5G subscribers forecasted in the United States by the end of 2025.
- **IoT is now everywhere.** The proliferation of connected devices will not likely slow any time soon. There's a *connected revolution* going on from personal smart devices to the inside walls and ceilings of modern buildings. For example, smart buildings, where devices converge onto a shared IT infrastructure, can deliver more operational functions and improve occupant experience.

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With the mandate of "do more with less," what are leaders doing to avoid deployment fatigue where data center and business operators simply don't know where to optimize operations?

Challenges in the Digital Age

New solutions are changing the way technology leaders design critical infrastructure. New designs are helping engineers and architects create denser and more efficient solutions within data center walls.

Data center operators and managers set their sites on innovative designs. Emerging concepts are being used to gain a competitive edge, from new optical cabling solutions to renewable energy sources.

Beyond traditional designs, leaders are still asking the following questions about challenges in a persistently connected world:

- Can our digital infrastructure work smarter, better, and more sustainably?
- How can we provide more innovative solutions?
- How are downtime and outages dealt with?
- Is it possible to leverage systems to help comply with various environmental requirements, compliance regulations, and data privacy demands?
- Is it easy to find the cause and not just a resolution if a problem occurs?
- How do I effectively reduce human errors due to complexity?

The Impacts of Human Error on the Data Center

IDC estimates that human error costs organizations more than $62.4 million annually. A significant part of errors created by humans is because of tedious tasks and manual processes. Further, a recent Uptime Institute study points out that more than 70% of all data center outages are caused by human error, not by a fault in the infrastructure design. What does this cost when it all goes down? Quite a bit. Data center outages are expensive. Outages occur with and (often) without warning, leaving severe business disruption in their wake. At the same time, increasing dependency on the data center means outages and downtime are growing costlier over time. According to a 2016 Ponemon study, the average data center outage cost has steadily increased from $505,502 in 2010 to $740,357. This averages to about $9,000 per minute, and this loss can be far higher for larger data center operations.

Connectivity errors are a big part of this. Working with a good infrastructure partner that validates cables, connectivity, connectors, and more will reduce human errors and drastically improve uptime.

In the world of cabling and connectivity, new designs can allow data center professionals to quickly root cause issues within the environment. *A good connectivity architecture can also help operators become much more proactive in isolating and eliminating critical issues*.

Let's look at some emerging design and partner solutions to help you overcome the challenges we've discussed.

New Connectivity Solutions Create New Design and Partner Considerations

Sure, your current partner is doing a decent job of helping you navigate the cloud and data center waters. However, new partners take a much more macro perspective into creating a digital infrastructure capable of ensuring performance, latency control, and efficiency.

Supporting the balance between edge, cloud, various data center models (on-prem, hybrid, etc.), and emerging solutions are the partners that help us keep our digital infrastructure operating. Much like the diversity in data centers, not all partners can adequately design, implement, and maintain a digital ecosystem. When it comes to cabling and connectivity, the following brief list is a sampling of what modern data center and cloud partners are diving deeper into to help their customers compete in a digital economy:

1. Digital connectivity (including latency, resiliency, performance, and networking)
2. New types of managed services
3. Improving time-to-market and speed-to-deploy
4. Supply chain management (think locally, deploy globally)
5. Cloud services (public, private, edge, hybrid, multi-cloud)
6. Emerging data center architecture (edge and 5G, hyperscale, cloud, colocation, and more)
7. Ensuring the strategic value of the digital infrastructure
8. Simplifying critical deployments and reducing human error
9. Making troubleshooting easier and finding the root-cause faster
10. Green technology and energy consumption

Let's stay on that last point for a minute. Working with greener technology and improving energy consumption has become one of the most critical consideration points when designing digital infrastructure. It's a vital part of the cloud and data center balance. We'll touch on this again in a bit.

Leaders must understand emerging design and efficiency requirements in creating a connected ecosystem to support new digital requirements. Let's dive into these new strategies.

Section 2: Design Strategies to Support Digital Infrastructure

Let's cut right to the critical point. A massive part of our digital modernization efforts revolves around our ability to connect. Further, this ability must be as efficient and low-latency as possible.

Looking back at our data center industry, we see that the most significant boom came from 1997-2000. Organizations require fast Internet connectivity, low latency, lots of computing power, and non-stop operation to deploy systems during that time. Remember, these solutions were critical as they were deployed to establish a presence on the Internet.

Since the dot-com bubble, data centers have grown in size and importance. They've also changed how they're being designed and delivered for digital solutions, new workloads, and the cloud.

Growth around distributed computing, more requirements around application resiliency, and ensuring optimal uptime have placed new stressors on data center and technology leaders. **This is all a part of the greater digital transformation effort.** A recent report indicated that Digital Transformation spending would grow to more than 53% of all information and communications technology (ICT) investment by 2023, up from 36% today. Funds continue to pour into Digital Transformation efforts as business leaders see the category as a long-term investment. As we look ahead, further spending will approach the $2 trillion mark by 2022. But where do data centers and our digital infrastructure fit in with all of this?

The latest Information Week' State of Infrastructure' report shows that 40% of respondents will spend their IT budgets on new technologies and innovation over the next 12 months. These organizations will actively look for ways to modernize their infrastructure to **support digital initiatives and connect consumers.** But there's a real challenge behind that statement.

Not all connectivity is built the same

We often get so excited about our digital infrastructure efforts that we don't always see potholes on the roads. Emerging challenges are complicating our deployment strategies.

Take a look at these key connectivity considerations:

- **Keeping things modern and efficient.** A challenge often seen within data centers is the approach to modernization as only a partial effort. Even if everything does not need to be updated, you still need to review each component in your data center. For example, are you leveraging the latest high-speed copper and fiber cabling that connects switches to servers within edge data center cabinets? Remember, these considerations help you create the right type of infrastructure balance and minimize network downtime and increase data center productivity. Keeping this modern and efficient also involves looking at processes and technology.
- **Overcoming latency and connectivity issues.** Latency, connectivity challenges, and flat-out outages are incredibly detrimental to business operations. To the network infrastructure professional, that means an ongoing effort to support exponentially increasing application speeds and bandwidth requirements with the capacity and flexibility to deliver critical network services to the enterprise efficiently. But even as network technologies advance at a breakneck pace, one thing remains constant: *The LAN is the backbone of the enterprise, and the cabling infrastructure is the backbone of the LAN.* There is a further focus on the LAN for the modern data center as systems become more converged and efficient.

  Further, LANs handle growing traffic from various solutions, including hyperconverged architecture, HPC, and more. Remember, not every cable is made the same, and not every networking solution can handle high-performance, high-density, and reliable communications. Working with network and connectivity leaders in the data center space requires good partners and the right solutions.
- **Managing an overwhelming amount of complexity and fragmentation.** The more connectivity we work with and users connecting to our infrastructure, the more complicated it can become. To reduce complexity, you need connectivity systems that are easier to deploy, support, and grow. Furthermore, a reduction in complex systems helps administrators isolate troubleshooting and reduce downtime for improved service levels.

Let's narrow our focus on connectivity as we explore digital modernization efforts. Specifically, we'll explore modern networks, cabling solutions, and how this impacts a digital infrastructure's capability to improve its time-to-market.

Section 3: Four Key Data Center Cabling and Networking Design Considerations

In the colocation market, tenants need the ability to add capacity on demand, the capability to scale networks across the globe, and the agility to make high-speed connections with cloud and service providers as and when required. For colocation providers to compete and modernize, the physical layer should provide flexible, scalable, high-performance fiber infrastructure designed to support increasingly demanding applications and customer requirements.

As mentioned, cabling and networking systems supporting our most critical environments are essential to modernization. However, not every fiber connection or cabling system is built the same. Here are four key efficiency design considerations when working with modern networks:

1 Density

Networking and cabling carry the lifeblood of our digital infrastructure. We use these systems for critical communication. However, a significant part of this is fitting as much as possible into smaller spaces. Today, the main focus of communication technologies infrastructure is size reduction — including fiber optic cables. Higher fiber counts in smaller cable packages are in high demand. A good partner will play a significant part in creating this movement to increase fiber-dense cable concepts and participate internationally to promote the value of high-density cabling with real cost-saving opportunities. For example, AFL's MicroCore® cable family offers one of the industry's most diverse and highest fiber density product offerings. MicroCore® cabling forms the backbone of high-tech networks installed in applications ranging from the Local Area Network to the most complex data center environments.

2 Flexibility

Flexibility refers to the ability of a network to adapt to changes. An expandable network — an 864-fiber backbone versus 432 — does not necessarily solve all the problems. This is because the specific nature of network demands is hard to predict. What if a disruptive wireless service provider comes in, installs 5G nodes at certain locations, and looks for front-haul and back-haul services? Merely having those 432 dark fibers running near the sites does not help.

Fortunately, developments in splice closures, terminals, hubs, and other components provide modular and highly flexible solutions that enable the network to adapt. Does the customer need one fiber per location? 12? Two fibers, but with multiple wavelengths? With these network components, the network can be readily configured to accommodate a wide range of scenarios, ensuring that the network operator can accommodate future customers' needs — even without knowing right now what those needs will be or where.

Through partnerships with premier optical fiber manufacturing companies, a good partner must be able to offer the highest-performance optical fiber to enable the most demanding applications.

Remember, your data center must be flexible to meet your customers' needs. Flexibility becomes even more critical for multi-tenant data centers (MTDC). Design flexibility and industry-leading performance are a must when reviewing a cable offering. Through partnerships with premier optical fiber manufacturing companies, a good partner must be able to offer the highest-performance optical fiber to enable the most demanding applications.

3 Expandability

Expandability refers to the ability of a network to handle increased traffic in the future. The simplest way to do this is to deploy more fiber. There is an expense to this, though, in terms of increased cable purchasing and installation costs. Fortunately, vendors are mitigating this problem. New, compact ribbon cables enable the deployment of far more fibers than ever in the same footprint. For example, it is now possible to deploy an 864-fiber cable in the same size pathway to accommodate 432 fibers. That means network operators can deploy twice the fiber but still use the same duct, the same installation method, etc. Rather than paying 100% more for a 100% capacity increase, the total installation cost increases by a much smaller amount. New fusion splicing technology further reduces incremental installation time and costs. Your cabling partner must be able to support expandable networking and cabling solutions.

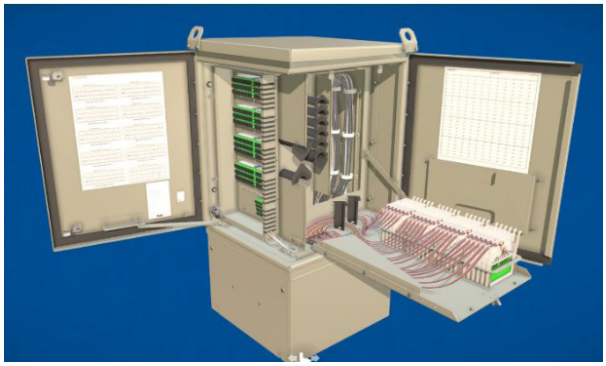
4 Accessibility

We're going to stay on this point because it's essential. Once you deploy your cabling infrastructure, it's critical to access and manage it as needed. For example, working with individual pathways gives you increased security, a more straightforward configuration around specific needs, much easier moves, adds, and changes, and you significantly minimize post-install access requirements.

With that in mind, accessibility refers to the ability of technicians to go in and make critical network changes. It is one thing for a physical access network to be theoretically capable of adapting to accommodate new capacity demands, WDM, etc. But someone must go out and make those changes, preferably make them quickly, and do so without disrupting existing customers. Here, too, vendors now offer highly modular and craft-friendly network components to enable these capabilities

The best way to understand accessibility is with a real example. The image here shows a design of one network component, in this case, a fiber distribution hub, illustrating how manufacturers can enable **flexibility and accessibility** in networks. The hub can support various split ratios, WDM, a mixture of point-to-point and PON connections, etc. — all simultaneously. Its design allows technicians to quickly come in and make those changes by swapping out components, reworking splices, adding pass-through connections, or whatever else is needed.

A qualified design, engineering, and installation vendor can build a network to maximize the **flexibility and accessibility** such a component offers. Time is money, and the ability of a network operator to implement changes quickly and effectively can make a difference in whether they can capture a new opportunity or go to a competitor.



In summary, we can no longer view the physical access network as a static part of our network model. The pace of change and potential future opportunities is too great for us to ignore the dynamic nature of physical access network demands. Network operators must consider this. They need to plan for expandability, flexibility, and accessibility in their networks and seek design, engineering, installation, and hardware partners who can help them achieve this.

Before we wrap it up here, there is one more critical consideration.

- **BONUS: Sustainability.** Efficiency, modernization, and green solutions go hand-in-hand. However, too often, ensuring that your design is green or sustainable is left until the end of an architectural discussion. Going green isn't only good for the environment; it's also great for business. There have already been numerous studies indicating that going green and efficiently using energy is excellent for the company. For example, a recent study shows that S&P 500 organizations with sustainability initiatives and technologies built into their overall strategy will outperform those without. According to the report, these organizations see an 18% higher ROI because of how efficiently they manage and plan for climate change and energy utilization.

  "You will perform better financially by doing things like having a great sustainability program."

  – Jeffrey Hollender, professor of sustainability at NYU Stern

  Regarding sustainability, look for cabling and networking partners that have taken steps to become more environmentally friendly. When selecting a partner, look for, for example, voluntary partnerships with the ENERGY STAR Program. A leading partner will work to improve energy efficiency and fight climate change through a strategic, corporate energy management program that enhances the organization's financial health and help preserve the environment for future generations.

You'll see direct business and infrastructure benefits when applying these fundamental considerations. Consider the following.

Networking and data center architecture: Seeing the benefits

Once you apply the considerations above, your infrastructure will thank you. In working with a good networking and cabling solution, there are a lot of positive outcomes. This includes the following:

- **Improving time-to-market, speed-to-deployment, and reducing waste.** When working with fiber optics and cabling, it's critical to leverage the right components to get you up and running quickly. For example, solutions like Mass Fusion Splicing create time-to-market, speed-to-deployment, and waste reduction benefits. Internal studies have estimated that data center operators see up to an 89% reduction in splice time. Remember, as fiber counts increase, single fiber splicing becomes unrealistic. This is especially the case for larger colocation and MTDCs.
- **Improving performance.** Modern cabling options are designed to reduce latency and improve the performance of critical applications within a data center. For example, new cable families offer diverse and some of the industry's highest fiber-density product offerings. Through partnerships with premier Optical Fiber manufacturing companies, partners like AFL offer high-performance Optical Fiber to enable the most demanding applications. High-density horizontal trunking solutions and lightweight, high-performance vertical runs support modern data center applications and allow technicians to deploy critical infrastructure even faster.
- **Reducing complexity and reducing errors.** While we mentioned this earlier, it's critical to discuss this again. Errors and complex deployments will slow down the operations of a data center facility. Working with designs that simplify deployment and simplify operators' lives is essential. But what happens when you inspect the wiring when everything is deployed? Specifically, what if you had to conduct a connector and bulkhead inspection? In this case, work with tools that holistically simplify the inspection and remediation process.

  Plug-and-play cabling systems have been instrumental in speeding up and simplifying fiber network deployment, first in hyperscale and enterprise data centers and now in 5G and FTTx networks. Since contaminated connectors remain one of the primary causes of network failure, the need to rapidly inspect and validate fiber end-faces for cleanliness has become critical. To make this validation easier, look for easy-to-use tools like the FOCIS Lighting2, which features a self-contained, palm-sized design and one-button operation, making inspecting crowded fiber patch bays quick and easy. A large, high-resolution LCD touchscreen improves the visibility of MPO and single-fiber connectors for advanced analysis.
- **Supply chain improvements.** Having the best components in your data center is key to success. However, what happens when something breaks and you don't have a replacement? Partners like AFL improve the reliability of the supply of fiber optic cables to customers and provide even greater customer service by localizing supply and manufacturing. Looking for a partner that can think globally and execute locally would be best.
- **Better collaboration with general contractors.** We'll be diving into a use case on this topic specifically. You could have the best cabling system in the world. But what happens when no one knows how to service or install it? Your cabling and networking solutions are only as good as the installation. Partners like AFL have a distinct history of working with general contractors and installers. With concerns around time-to-market, it's vital to have good people capable of supporting your critical infrastructure. Working with a partner with established relationships with GCs is a significant consideration and a big benefit when you pick the right solution.

Colocation data centers represent the frontier where hyperscale, cloud, telecom, and enterprise worlds interconnect. A colocation fiber network can quickly become challenging to manage if not properly maintained, and this can be prohibitive for end-users seeking to connect to new carriers. Effective infrastructure means end-users can cross-connect quickly, save on labor costs and time, generate revenue faster, and provide the agility to offer various cost-generating services to their customers.

We've discussed all the above topics in this paper, covering deployment, density, performance, optimization, and even sustainability. One of the best ways to take this all in is through a real-world industry use case.

Section 4: The Partners That Evolve Networking and Connectivity

A noticeable shift is happening with enterprise data centers migrating many workloads to colocations or MTDCs. Today's colocation data centers deliver secure space, power, and cooling to multiple enterprises and hyperscale customers in a specific location.

Now, customers with their own data centers will often shift a considerable portion or sometimes all of their networks to a colocation provider to host and manage their requirements, leasing space by rack, cabinet, cage, or an entire data hall. This is because colocation data centers enable companies to scale and grow their business with minimum complexity, securely, and at a low cost.

The migration and modernization efforts we are seeing are essential to understand because those colocations and MTDCs that jump on emerging speed-to-market improvements are the ones that benefit the most. A data center's heart is the capability to connect, cross-connect, and access key networking services.

Reducing errors, bringing buildings online faster, and improving networking services are crucial to success in a digital economy. To put this all together, let's explore a use case covering cabling, reducing human errors, and ease of deployment.

Connect With Us: How Spligitty Leveraged AFL to Modernize Critical Infrastructure

Spligitty Fiber Optic Services, Inc. was founded in 2005 by Fiber Optic Technicians that understood fiber optic construction and wanted to provide enhanced services to a growing industry. Originally a small, privately owned company, Spligitty has grown much more. The company initially started as a splicing company with only a hand full of employees and has grown into a mid-sized multifaceted company that continues to grow.

The Challenge: Deploying Fiber in Critical Infrastructure, While Reducing Complexity

In working on several recent critical infrastructure projects, Spligitty needed a way to improve usability, decrease installation time, increase network reliability, and increase the density of fiber splices. However, with field technicians in very high demand, they also needed to do this as efficiently as possible.

The challenge for Spligitty is that their projects were growing, and they needed cabling and network deployment methods to help them pick up speed and reduce errors.

The Solution: The Next BIG (SMALL) Thing — AFL's Apex® Fiber Optic Splice Closures

To help them overcome their challenges, Spligitty looked to AFL and their Apex Fiber Optic Splice Closure to modernize operations.

Apex is a modern solution for modern critical infrastructure problems. A smaller closure with higher density means it's easier to maximize available space when space is at a premium. If you've been following the data center industry, you'll know that vacancy rates are at all-time lows, and density is critical to creating competitive advantages.

To help bring critical infrastructure up, cabling and networking solutions must be deployed quickly, safely, and efficiently. AFL's wedge-based sealing system with cable strain relief allows a cable to be installed into the closure and sealed in seconds, thus reducing overall installation time. The universal splice holder module eliminates the need to stock different splice trays or splice holders for other jobs.

The other key point is that the Apex Fiber Optic Splice Closures were far easier to work with than previous solutions.

"The first thing we noticed was the simplicity of how easy it was to put together. Our previous closures that we used to work with had many moving pieces and parts. And with moving pieces and parts come errors and broken parts."

– Sydney Timberlake, Fiber Technician, Spligitty

For Spligitty, this was a game-changer in their work with critical infrastructure. Their technicians found that the Apex case was straightforward to assemble, and they also saw that they could deploy projects faster and with fewer errors.

Let's look at some critical benefits mentioned by Spligitty:

- **Re-entry and maintenance.** The Spligitty team specifically said that working on the Apex closures was far easier than others. "When we need to do work, re-entry is very easy. Every port is independent, so you can work on the specific port without disrupting the rest when you re-enter.
- **Setup and configuration.** The Apex case comes with a holder, "Which makes our job so much easier," added Sydney Timberlake. "It simplifies getting cables and key components in and out. It's a little thing but makes such a big difference by allowing us easier access to critical parts while holding the closure in place."
- **Double the productivity.** The Spligitty team could deploy twice as many cases working the same hours as before. This was the most significant difference noticed by business leaders and technicians in the field. "We have doubled our productivity with these closures," states Sydney Timberlake. "Because they're so simple, we've been able to service and work on more critical infrastructure projects."

The network requirements inside the customer area usually mean tenants have other considerations, such as maximizing density while maintaining ease of use and the flexibility to grow.

Capabilities of a Colocation Connectivity Partner

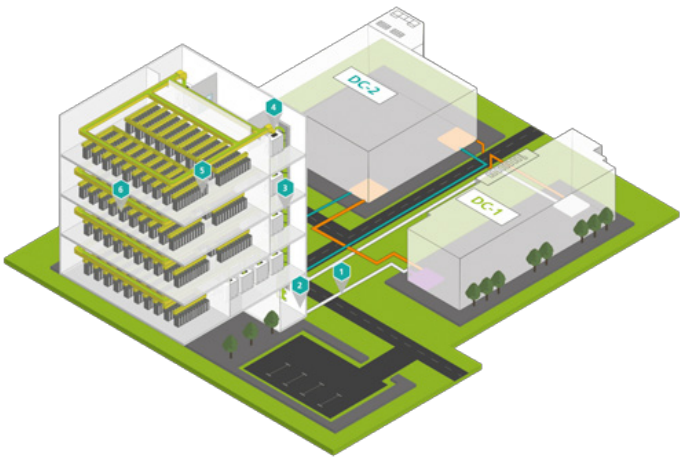
We've covered quite a bit in this paper, including a use case that discussed how cabling and closures could make a difference in critical infrastructure deployments.

However, as we look deeper into hyperscale and colocation data center architecture, we see that there is much more to consider. A good networking and cabling partner must be able to help with several key pieces of your critical infrastructure. This includes high-density cabling and networking solutions, structured cabling, and even operating in harsh environments.

The physical layer of the colocation network (from outside plant cable to the customer cage) calls for redundant and structured cabling architecture, which can add capacity and scale quickly and reliably. This is often made up of high-fiber-count cable and easy-to-use, fast-to-install, modular, and scalable connectivity infrastructure. The network requirements inside the customer area usually mean tenants have other considerations, such as maximizing density while maintaining ease of use and the flexibility to grow.

For colocation providers and tenants alike, partners like AFL provide agility and sustainability to improve your network performance, lower colocation costs, and grow MTDC business. When it comes to holistic capabilities. Look for the following solutions:

1. **Outside Plant (OSP) Cabling.** As colocation clusters can range from being next door to one another to being hundreds of miles apart, careful consideration is needed regarding the cable that links them together. To ensure adequate future bandwidth, fiber density, fiber type, cable construction, distance, and installation method must be considered.
2. **Meet-Me Room (MMR)/ External Network Interface (ENI).** A Meet-Me Room (MMR), otherwise known as External Network Interface (ENI), is where outside plant cable transitions to inside plant cable. All sorts of optical cables converge here, from other colocation data centers in the cluster to internet service providers, telecommunications carriers, and cable companies.
3. **Backbone Cabling.** To create the data center backbone from the MMR to the MDA (or, for network resilience, another MDA), there are many considerations — primarily, the fiber density required and the cable route.



4. **Main Distribution Area (MDA).** The MDA is the central distribution point for the data center's structured cabling system. It is where horizontal cabling cross-connects to active equipment (switches, servers, and storage) or the customer area.
5. **Horizontal Cabling.** The MDA connections to the customer area and equipment racks are referred to as horizontal cabling. In colocation data centers, these links must offer maximum flexibility for deploying connectivity to the customer area as and when needed. The architecture needs to accommodate very low-density fiber deployments and very high-fiber-count deployments in the same space.
6. **Customer Area / Customer Cage.** The customer area is where the tenant houses their infrastructure — this can be in a cage or in a cabinet.

With all this in mind, why is it more critical than ever to examine your networking and cabling architecture? The *colocation market has seen a rapid rise in the volume of data centers,* with acquisition after acquisition now commonplace as larger operators seek to grow regional footprints and improve customer connection capabilities.

Different colocation providers will often have used other manufacturers for their physical layer, meaning it can be challenging to standardize on one or a handful of manufacturers after acquisition.

Standardization on a global level can be challenging to achieve, but the benefits are enormous: network designs can be utilized and adapted anywhere in the world; network spending can be leveraged to drive manufacturing costs down and product availability up; and site engineers can all follow consistent product training and installation programs. As a manufacturer with a global presence, partners like AFL can provide the expertise and infrastructure to ensure consistency for your networks wherever they are in the world.

The other key point is that the colocation market is in a state of growth, which means either building up or building out. Building out means acquiring or leasing land where development space is often limited or expanding into new countries or continents — this requires expert knowledge and local support. AFL works to make this easier with supply chain and business support being done locally and globally.

On that note, and as a final point before we wrap up, the rapid growth of colocation data centers depends on the strength of their supply chain and the ability to effectively provide tenants with what they need. From global standardization and intermittent demand to the need for rapid technological innovation, partners like AFL understand the opportunities and challenges for colocation data centers. They are dedicated to helping them deliver their services and create a more connected world.

As colocation and hyperscale data centers grow in volume and size, it'll be critical to work with a partner that can help bring connectivity together.

Final Thoughts and Getting Started

We've covered a lot in this paper. Our connected world is fueling growth around critical infrastructure, and our reliance on digital systems only continues to grow.

At the heart of all of this is the data center. As colocation and hyperscale data centers grow in volume and size, it'll be critical to work with a partner that can help bring connectivity together. Our paper covered five crucial topics related to connectivity and networking. Specifically:

- ✓ Density
- ✓ Flexibility
- ✓ Expandability
- ✓ Accessibility
- ✓ Sustainability

Think about these five points. As you consider this all, take a moment to reflect on your critical infrastructure. Expand your thinking beyond just cabling. Think about your networking architecture and how you manage essential connectivity pieces. Is it challenging? Are there too many errors or rework that's being done? Learning more about your ecosystem will help gauge where you can improve directly. To get started, have that reflective conversation with your technicians and reach out to a partner that can support your emerging needs.

Remember, there's no slowdown in the connectivity we'll all be experiencing. It'll be up to you to ensure your cabling, networks, and connectivity systems can keep up with digital demand.