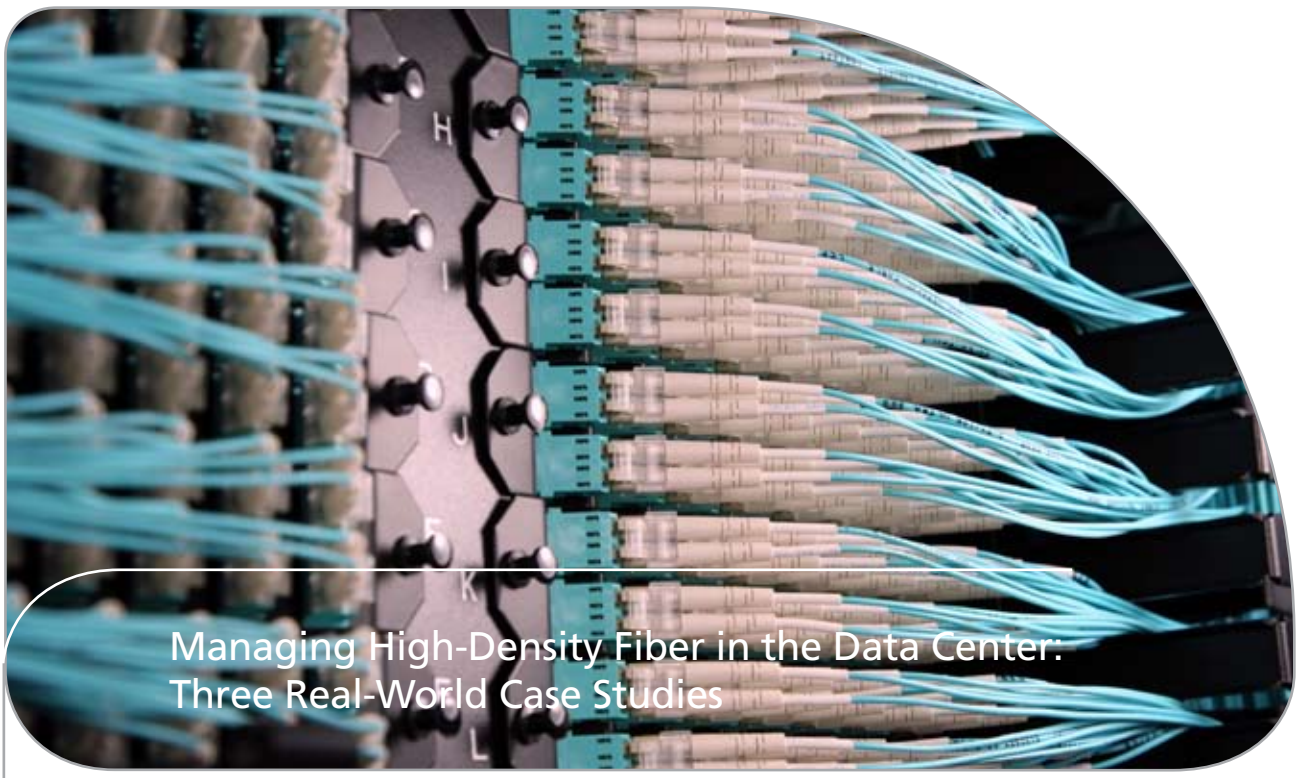


Managing High-Density Fiber in the Data Center: Three Real-World Case Studies

CASE STUDY

CHALLENGE

In today's data center, fiber optic links have become more vital than ever for transmitting data to and from a large number of sources. In recent years, the data center has experienced an upsurge in the amount of fiber optic cabling due to bandwidth and storage requirements.

As bandwidth requirements continue to evolve, data center managers are relying on fiber to transmit critical information at speeds of 10 Gbps or higher. They are also looking to fiber as they prepare for next-generation speeds like 40 Gbps and 100 Gbps, for which standards are already in the early stages of development.

Over the past decade, most data center managers and storage equipment manufacturers have adopted Fibre Channel as a means of transmitting data for storage area networks (SANs). This highly reliable, low-latency technology allows simultaneous high-speed communications among servers and data storage systems via fiber optic cabling. The amount of data needed to be stored in today's data center environment has grown tremendously and continues to grow. SANs must now offer faster backup and retrieval speeds for large amounts of data while ensuring scalability for future storage capacity. As a result, the deployment of Fibre Channel technology in the data center has grown, which has further increased the amount of fiber. Future technologies such as iSCSI and Fibre Channel over Ethernet (FCoE) will continue this trend toward higher fiber densities in the data center and SAN.

ADC®

With many larger data centers now supporting tens of thousands of fiber links, data center managers are demanding high-density solutions that properly manage high optical fiber counts and provide scalability to support more fiber optic cabling and future bandwidth requirements. Properly supporting and managing high-density fiber in the data center is critical for maintaining network reliability, maintenance, and operations, as well as reducing total cost of ownership.

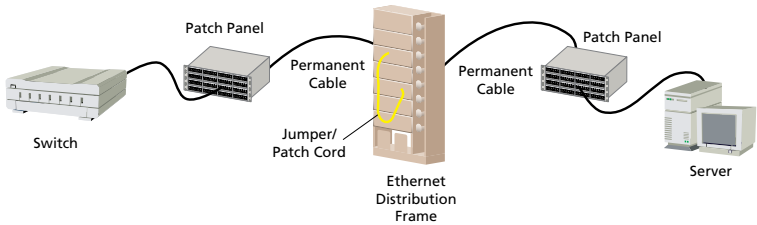
SOLUTION – ADC's TrueNet® Optical Distribution Frame

Properly supporting and managing high-density fiber in the data center starts with deploying a strategic network architecture. The use of a cross-connect scenario for connecting the main distribution area to the equipment distribution area provides a logical and easy-to-manage fiber infrastructure whereby all network elements have permanent equipment connections that once terminated, are rarely, if ever, handled again. In this scenario, all modifications, rerouting, upgrades, and maintenance activities are accomplished using patch cord connections on the front of the cross-connect. The advantage to deploying a cross-connect in your data center include:

- Lower operating costs by greatly reducing the time it takes for adding equipment, moving circuits, upgrading software, and performing maintenance.
- Improved flexibility, reliability, and availability by making changes on the patching field instead of on sensitive routing and switching equipment.
- Reduced risk of down time with the ability to isolate network segment for enabling changes in the network without disrupting service.

Supporting high-density fiber links in the data center also requires proper fiber cable management, which is critical for maintaining network reliability, maintenance, and operations. This includes:

- **Bend radius protection at all points where cable and patch cords make a bend**
  When fiber optic cabling is bent beyond the minimum bend radius, it can cause microbending or macrobending that result in signal attenuation. More severe bends can break fiber strands completely, resulting in signal loss.
- **Clearly defined and easy to follow intuitive cable routing paths**
  Pathways should enable easy deployment, separation, reduced congestion, and room for growth. This is especially important in areas that contain large volumes of cables.
- **Easy access to connectors with minimal disruption to adjacent connections**
  Accessibility should ensure that any fiber can be installed or removed without inducing a macrobend on any adjacent fiber.
- **Physical Protection to avoid damaging fiber optic cabling or connectors**
  Damage to fiber optic cabling can cause network downtime, lost money, and many headaches for enterprise IT managers.
- **Managed patch cord slack for protection and aesthetics**
  Allowing fiber to hang unprotected is unsightly and can cause exposed cables to easy to snag, which can result in damage to the connector or fiber itself.



Cross-Connect Diagram

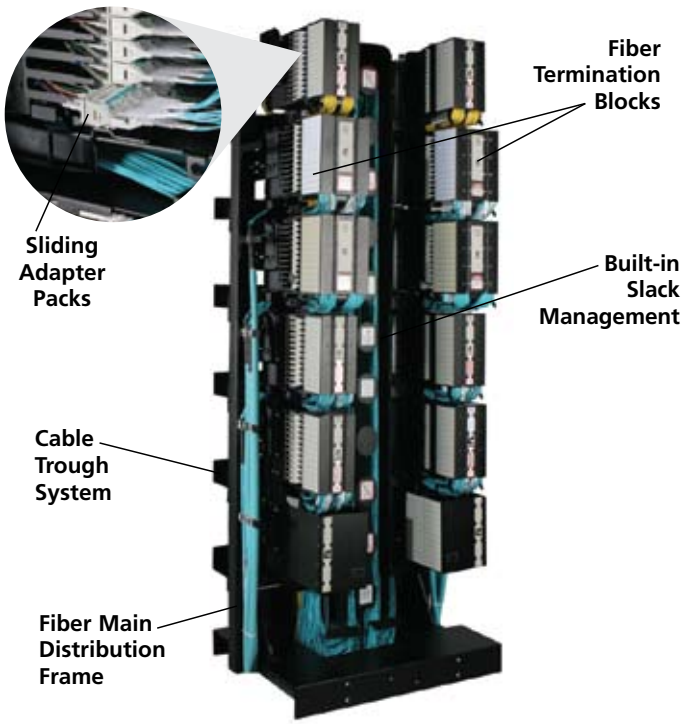
CASE STUDY

ADC's TrueNet Optical Distribution Frame (ODF) is ideally suited for properly managing high optical fiber counts in a cross-connect scenario and is designed to fit a variety of termination, splicing, and storage applications in the data center. The highest density fiber distribution frame available, the ODF's patented design minimizes congestion and incorporates the fundamentals of cable management with built-in bend radius protection, intuitive cable and jumper routing, easy access to connectors, physical protection, and closed slack management.

The ODF includes 12 mounting positions for fiber termination blocks (FTBs), which are equally divided by vertical and horizontal cable managers. The front of the ODF also includes slack management for the cross-connect patch cords. Extremely scalable, a single ODF can efficiently manage up to 1,728 fiber terminations using 144-position blocks or 2,304 using 192-position blocks (LC style only).

Sliding adapter packs available with SC, ST, or LC connector styles can be mounted in FTBs to provide easy access to connectors. Preterminated FTBs are also available with plug-and-play 12-fiber MPO trunks or ribbon, stranded, or loose tube configurations. Preterminated blocks make installation quick and easy to reduce labor costs, and they are 100 percent factory tested to guarantee continuity and reliable connections. Fiber Combination Blocks (FCBs) that provide termination and on-frame splicing capabilities in one block are also available.

ADC's TrueNet ODF was recently deployed in a fiber cross-connect scenario in Tier III/ Tier IV high-density data centers. Each of these leading customers has deployed the ODF using a slightly different approach, demonstrating the product's ability to meet a variety of data center applications.



TrueNet Data Center ODF

CASE STUDY

Case Study Number 1: Large Internet Service Provider

A large Internet service provider was experiencing rapid growth and delivering more applications to users than ever before. This required consolidation and higher bandwidth for a variety of network equipment and storage systems, resulting in the build-out of extremely large, fiber-intensive data centers with singlemode fiber optic links connecting every server and switch. With over 100,000 servers and tens of thousands of fiber connections located in their data centers, the customer was looking for a better approach to managing high-density fiber in their data centers.

In this case study, the customer chose to deploy one ADC TrueNet ODF for a specific number of equipment cabinets in the equipment distribution area, for a total of 16 ODFs at each site. Singlemode fiber optic cabling from the core switches and routers in the main distribution area is terminated on the back of the ODF. Fiber ports that mirror the switch ports on the front of the ODF are then cross-connected to a second ODF using SC-style connectors and singlemode patch cords. Fiber optic cabling from the back of the second ODF connects to the equipment distribution area. This approach enables the customer to make all moves, adds, and changes on the front of the ODF without having to touch sensitive switch ports. Additional ODFs and blocks can be easily added for scalability.

At the cross-connect location, the customer chose to deploy preterminated blocks in the ODF. From the back of the ODF, the preterminated fiber trunk cable is cut to length and spliced to another trunk cable that is preterminated in rack-mounted FL2000 Series fiber optic panels in the equipment distribution area. All of the fiber optic splices are housed in ADC's OMX™ 600 All-Splice Cabinet, a high-density splice solution able to house up to 1440 splices in 12-fiber splice trays, complete with proper cable management. Using preterminated solutions and splicing in conjunction with the ODF in a centralized cross-connect provides the following benefits to this Internet service provider:

- Better cable management for reliability and availability
- Better flexibility because once the spliced backbone is in place, all changes are performed at the front of the ODF via individual patch cords for each port.
- Overall reduced material cost.
- Reduced insertion loss (splice has very low loss).
- Reduced slack storage requirements with trunk cables cut to length before splicing.

OMX™ 600 All-Splice Cabinet

- Easier cable pulling with no connectors on the ends of the trunk cables.
- Superior performance with factory terminated and tested connectors at the patching field and equipment panels.
- Faster lead-time with specific lengths of backbone trunks not required.

CASE STUDY

Case Study Number 2:
Large Financial Services Provider

As a global company supporting many financial institutions, a large financial services provider decided to consolidate multiple data centers into fewer larger locations. In the past, network administration had been a daunting task for this customer with over 200,000 fiber optic terminations, and consequently they were looking for an easier solution.

In this case study, the customer chose to deploy ODFs in a cross-connect scenario for connecting the main distribution area to the equipment distribution area, providing a total capacity of 237,000 fiber terminations. For easier management and rapid installation, the customer selected all plug-and-play MPO solutions where each ODF is loaded with either 144-position or 192-position blocks. The blocks include either twelve or sixteen 12-fiber MPO connectors on the back broken out to 144 or 192 individual LC connectors on the front. The cross-connect is performed on the front of the ODF from one block to another using individual LC patch cords.

For the backbone cabling, laser-optimized multimode trunk cables with MPO connectors on both ends run from the back of the ODFs out to MPO-to-LC cassettes or MPO-to-MPO bulkhead adapters located in ADC's TrueNet Fiber Panels. The TrueNet Fiber Panels combine vertical cable guides and patented angle-left/angle-right adapters with bend radius protection, intuitive routing, and easy connector access.

From the MPO-to-MPO bulkhead adapters deployed for high port count switches, the customer chose to use ADC's array cables with an MPO connector on one end and a fan-out to individual LC connectors closer to the switch. This made cable management significantly easier with just 6 MPO array cables (3mm OD) per bulkhead adapter pack to manage from each side of the patch panel versus the need to route 72 individual LC patch cords. This solution enabled 288 LC connections in a 2RU TrueNet Fiber Panel.

Data Center ODF, MPO Block and Sliding Adapter Pack

Ultimately, the use of plug-and-play MPO solutions made the most sense for this large financial services provider because it was quick and easy to install, and they were able to avoid field termination and splicing. Because MPO solutions provide an additional mated pair, there is a higher insertion loss to consider (typically 0.25 db per cassette). However, in this case study, the customer was able to design their network with an optical loss that was within budget to ensure reliability. Using plug-and-play MPO solutions in conjunction with the ODF in a centralized cross-connect provided the following benefits to this financial services provider:

- Better cable management for reliability and availability
- Better flexibility because all changes are performed at the front of the ODF via individual patch cords for each port.
- Reduced labor costs with less installation time and expertise required with plug-and-play solutions.
- High-quality terminations with preterminated MPO connectors that are factory terminated and tested.

- Easy cable pulling through pathways with one MPO connector for 12 fibers.
- More readily prepared for 40 Gbps or 100 Gbps using parallel optics.

Case Study Number 3: Large Co-Location Provider

A large co-location data center wanted to implement a system that could accommodate the comings and goings of clients without having to deploy new systems and cabling. They knew that a centralized cross-connect was the best approach but they demanded a higher-density solution to accommodate over 24,000 fibers. They also desired a more aesthetically pleasing solution and better patch cord management than provided by typical fiber patch panels.

In this case study, the co-location provider decided to implement 14 ODFs in a cross-connect layout using 144-position blocks with LC-style adapters. A 144-count laser optimized multimode single end fiber was run from each core switch and client server TrueNet Fiber Panel to the ODF. The 144-count stub end was spliced to LC pigtails at the TFP and the pre-terminated end was connected to LC adapters packs at rear of the ODF. All cross-connect is now performed on the front of the ODF from one block to another using LC LOMM patch cords. Now if a customer requires a connection to a different switch, that change is easily made on the front of the ODF without touching sensitive switch ports or the client equipment.

The TrueNet Fiber Panels offer a variety of adapter packs with or without pigtails, as well as convenient storage and sliding access to splices.

5 RU TrueNet Fiber Panel (TFP)

A key reason for deploying the ODF in this co-location environment was the higher return on investment. If a client pulls their equipment out of the co-location center, the co-location provider can easily reallocate the ODF to new customer equipment. Additional cost savings is gained because patch cord slack is easily stored in the ODF's vertical cable manager, which ultimately enables the co-location provider to stock just a few standard patch cord lengths. Using the ODF in a centralized cross-connect provided the following benefits to this large co-location center:

- Superior density and cable management over patch panels.
- Better reliability and flexibility because all changes are performed at the front of the ODF and not at the network element.
- Easy pulling of bulk cable with connectors at only one end
- No slack storage required for bulk cable cut to length.
- Easy access to each fiber connector

SUMMARY

As shown in the three case study examples, ADC's TrueNet ODF is the ideal solution for managing high-density fiber in the data center. It provides the flexibility and reliability of cross-connect scenario for connecting the main distribution and equipment distribution areas, and it is easily adapted to fit a variety of fiber termination types and customer needs. Whether its factory terminated solutions with splicing, plug-and-play MPO solutions, or field terminations, the ODF offers the best fiber optic cable management, scalability, and highest density available on the market. For more information, refer to the following:

- The Three Principles of Data Center Design – 102261AE
- TIA-942 Data Center Standards Overview – 102264AE
- Managing Density in the Data Center – 105455AE
- Understanding the Pros and Cons of Fiber Termination Methods – 106988AE

CASE STUDY

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