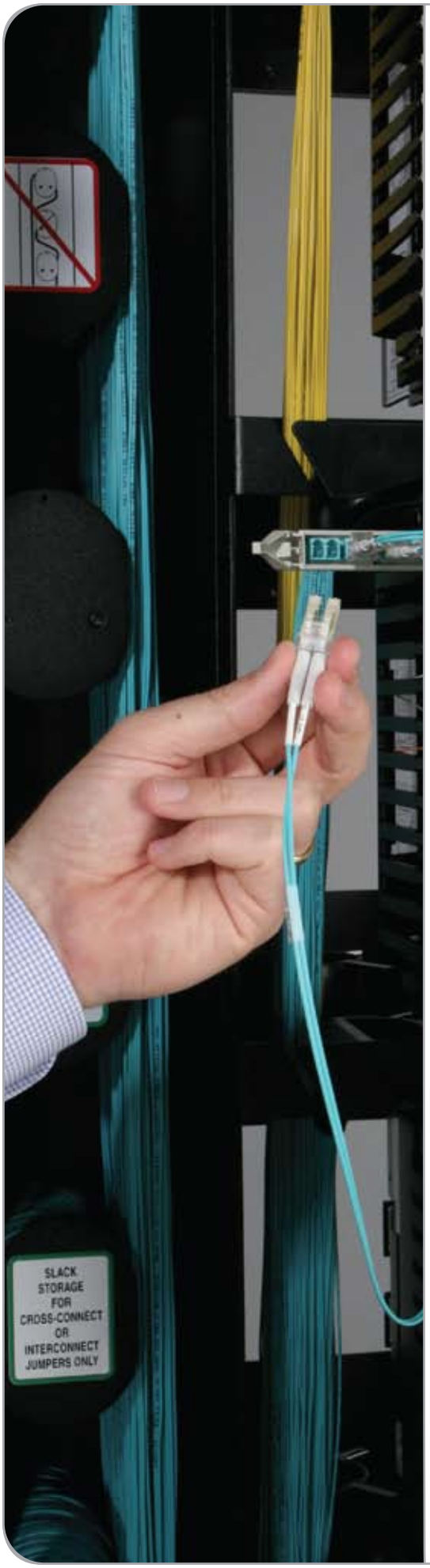

WHITE PAPER

ADC KRONE's Data Centre Optical Distribution Frame:

The Data Centre's Main Cross-Connect

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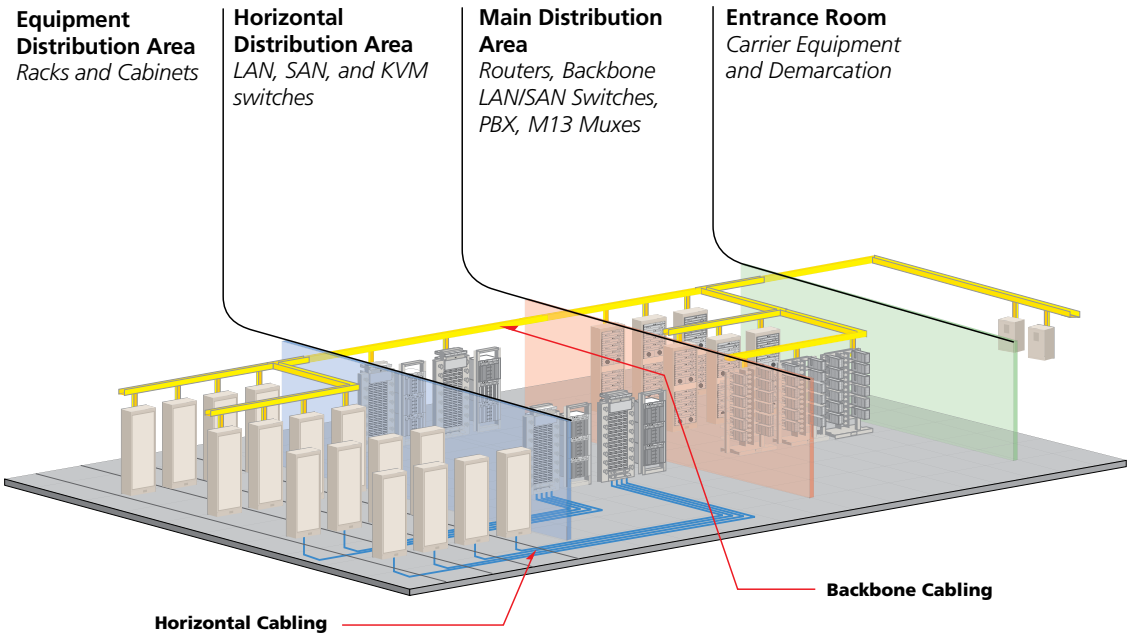
Introduction

The primary objective of any data centre is to deliver mission critical data in a reliable, scaleable, manageable and maintainable environment. Every standards body is working on completing standards which ensure these facilities are designed for peak performance. Standards aside, data centre designs require forward thinking. Designs need to take into account not only the current trends and strategies, but have contingencies built in for future technologies and growth. Currently, there is a move to more fibre-rich data centres, a trend that will likely continue for years to come. This is largely due to growth in Storage Area Networks (SANs) and bandwidth demands in the backbone of the network. There is a need to plan for the type of solutions that can grow as the data centre's fibre needs grow as well. ADC KRONE's Data Centre Optical Distribution Frame solution can do just that. This high density, robust solution serves as your data centre's main fibre cross-connect. An industry tested design, this solution is essential to the modern data centre, no standard fibre offering can compare.

The Standards



Data Centre according to TIA-942

In 2005, the Telecommunications Industry Association (TIA) released the TIA-942 Telecommunication Infrastructure Standards for Data Centres. TIA-942 is the first standard to specifically address data centre infrastructure. The document addresses every aspect of data centre design: space/layout, cabling infrastructure, reliability and environmental considerations.

According to TIA-942, a data centre should include the following key functional areas:

One or more Entrance Rooms

Main Distribution Area (MDA)

One or more Horizontal Distribution Areas (HDA)

Equipment Distribution Area (EDA)

An optional Zone Distribution Area (ZDA)

Backbone and Horizontal Cabling

The MDA houses the main cross-connect, the central distribution point for the data centre's structured cabling system. This area should be centrally located to prevent exceeding recommended cabling distances and may include a horizontal cross-connect for an adjacent equipment distribution area. The standard specifies separate racks for fibre, UTP and coaxial cable.

TIA-942 does present the cross-connect architecture as the best practice for the MDA. With a centralized cross-connect patching system, achieving the dual requirements of lower costs and highly reliable service is possible. In this simplified architecture, all network elements have permanent equipment cable connections that are terminated once and never handled again. Technicians isolate elements, connect new elements, route around problems, and perform maintenance and other functions using semi-permanent patch cord connections on the front of a cross-connect system. There are a few key advantages provided by a well-designed cross-connect system:

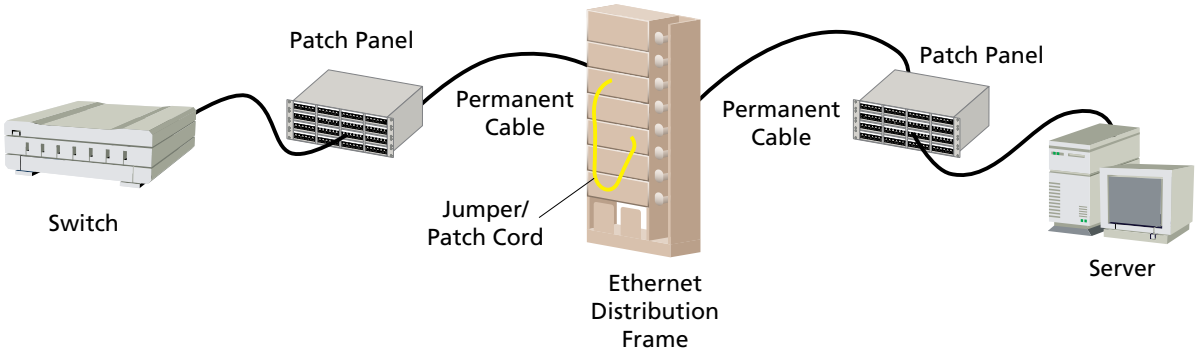
Lower operating costs: Compared to the other approaches, cross-connect greatly reduces the time it takes for adding cards, moving circuits, upgrading software, and performing maintenance.

Improved reliability and availability: Permanent connections protect equipment cables from daily activity that can damage them. Moves, adds, and changes are affected on the patching field instead of on the backplanes of sensitive routing and switching equipment, enabling changes in the network without disrupting service. With the ability to isolate network segments for troubleshooting and reroute circuits through simple patching, data centre staff gains time for making proper repairs during regular hours instead of during night or weekend shifts.

Competitive advantage: A cross-connect system enables rapid changes to the network. Turning-up new service is accomplished by plugging in a patch cord instead of the labor-intensive task of making multiple hard-wired cable connections. As a result, cards are added to the network in minutes instead of hours, decreasing time to revenue and providing a competitive edge—faster service availability.

Increasing capacity and network applications create challenges for both the planners who design and the operations personnel who maintain the network. Following the TIA-942 standard ensures that your data centre had a long-term design that efficiently minimizes disruptions that can cause a huge drain on productivity, profits, and service availability. Successful network managers should always take into account the importance of planning and maintaining data centres to maximize density and minimize maintenance hassles.

Cross-Connect Data Centre Application



Cross-Connect Diagram

A cross-connect architecture in the data centre plays a critical role in reducing operational costs, increasing flexibility and potentially increasing revenues. This TIA-942 recognized design is critical to the vitality and long-term viability of any network.

Why commit to a cross-connect design when there are other design options that are initially less costly? Although the initial the capital expense may be less, these other designs (direct or inter-connect) have higher operating expenses. A small investment up-front can simplify procedures, reduce errors and minimize outages. Many network performance problems stem from restricted access for maintenance, cable congestion, rerouting or monitoring capabilities. Each problem can lead to longer service interruptions, operational inefficiency and frustrated customers. All of these issues can be easily averted with a cross-connect architecture in the data centre.

Cross-connection encourages seamless expansion, simple routing and quick restoration for the modern data centre. As data centres continue to expand and evolve, flexibility and reliability are more important than ever. A main cross-connect allows for nonintrusive testing, monitoring and patching point for efficient circuit rearrangement.

Flexibility

Change is inevitable in today's dynamic data centre environment. It's no longer if changes will be required, but how quickly and efficiently can changes be managed. Today's data centres require cable management that is highly reliable and modular to accommodate new bandwidth requirements and additional network elements. A central cross-connect point allows for changes to be performed with minimal re-cabling and labor costs. Changes are made quickly without the need of a massive redesign. This architecture allows your data centre to be completely modular, controlling the planning and timing of your migration plans for new network equipment.

Reliability

Cross-connections allow for moves, adds and changes to be made easily, safely and independently; minimizing the risk of service interruptions. A neutral zone is created so any problems can be identified and isolated autonomously. This provides protection to network connections and permanent circuits. In addition, a data centre's success often depends on how quickly it adapts to these changes and the simplicity of its maintenance capabilities. Cross-connection allows for complete access to any circuit, any time. Thus maintenance can be done on your network seamlessly without your customers even noticing. With the flexibility, protection and access, it is no wonder why cross-connect architecture is preferred in data centre design.

The Data Centre Main Cross-Connect Solution

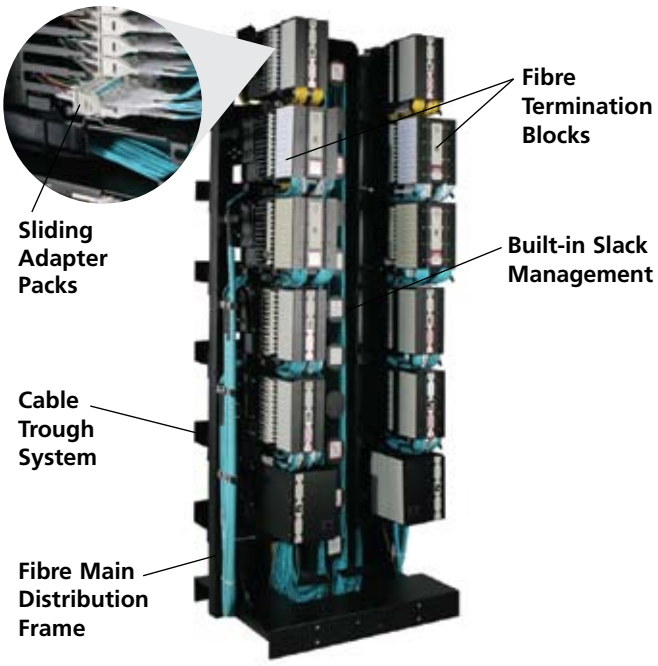
On the early 90s, ADC KRONE developed an innovative product, designed specifically for high density fibre and cross-connect applications. Working closely with the major carriers, ADC KRONE created the Next Generation (NGF) Optical Distribution Frame line to centrally patch high numbers of fibre terminations, but more importantly, manage these terminations in way that revolutionized an industry. Today, ADC KRONE's NGF is the standard in the telco market. And with the evolution of the modern data centre and the advent of more and more fibre within, ADC KRONE has taken years of cross-connect and high density fibre management expertise and translated it to the data centre.

Data Centre Optical Distribution Frame (ODF) System

With the unprecedented growth of optical fibre counts seen within the data centre and the increased demand to optimize floor space, fibre cable management has become a critical element in providing a robust and reliable fibre network. Simply adding additional fibre frames to existing line-ups or increasing the termination density of a traditional fibre system is not enough, as the horizontal and vertical cable troughs become too congested and difficult to manage.

As the number of fibre terminations in the data centre increase, the need for strong cable management within the fibre distribution frame is even more important. Bend radius protection, easy connector access and clear, easy to follow fibre routing paths are key aspects of fibre cable management. High density/high capacity fibre distribution frame systems need to focus on these key cable management aspects. The system needs to ensure that all fibres have full bend radius protection throughout the entire system. This complete bend radius protection is critical in ensuring the optical performance and long term reliability of the fibre network. In order to achieve high density in a fibre distribution frame, the adapter ports must be placed closer together. The system must allow for easy access to the connectors on the front and rear of those ports for insertion and removal. When gaining access to ports, the technician cannot be forced to move other installed fibres out of the way or be required to use a tool. Cable routing paths are critical in ensuring that jumpers are routed correctly and are accessible for easy future tracing and removal. The routing paths in the system should be such that they are easy for a technician to follow and limit the number of choices to make during jumper routing. These cable management features must all be designed to make the frame system as technician friendly as possible.

ADC KRONE has taken the innovation and functionality found in our NGF product, adapted it for the new surge in data centres and led us to introduce the Data Centre Optical Distribution Frame (ODF). Designed for high density cross-connect applications, the Data Centre ODF system provides the highest fibre termination capacity within a line-up while offering the best cable management features possible. The system's design ensures it can accommodate these higher fibre counts while incorporating ADC KRONE's four fundamental elements of fibre cable management: Bend Radius Protection, Cable and Connector Access, Intuitive Cable Routing Paths and Physical Protection. Conventional fibre distribution systems typically allocate only about 20% of the space within the frame for cable management. The rest of the space is dedicated to the housing of fibre terminations. Built-in cable management is truly the hallmark of this solution. The Data Centre ODF system dedicates the majority of the space within the frame system for jumper routing and cable management access ensuring the manageability of your fibre.



The Data Centre ODF system itself is modular. As the fibre needs of your data centre increase, you have the ability to add more blocks to an existing frame and over time, add more frames to your line-up. Up to fifteen ODF frames can be lined up and patched between each other, a standard fibre frame cannot accommodate this sort of design. This sort of modularity can be key as you plan for the future and when your data centre actually does expand.

The ODF system is designed with the management and protection of your data centre's critical fibre backbone in mind. The system is comprised of various innovative products that together create the Data Centre ODF. Each component is designed to ensure proper bend radius protection, proper cable management and ease of moves, adds and changes.

Sliding Adapter Packs

The most basic building blocks of the Data Centre ODF are the sliding adapter packs. These packs are the cornerstone of what makes the Data Centre ODF the ideal solution for cross-connect applications. Sliding adapter packs house groups of fibre optic adapters and are mounted in Fibre Termination Blocks to provide easy access to connectors, both the front and the rear connector at the same time. Sliding Adapter Packs are available with SC and LC adapters. The adapters come in packs of six and eight depending on the adapter type and the desired termination density. To access each adapter, the pack slides neatly out of the block, still ensuring proper cable management, routing and protection.

Sliding Adapter Packs

Fibre Termination Blocks (FTBs)

Fibre Termination Blocks (FTBs) house the Sliding Adapter Packs and mount directly of the frame. These blocks are designed to ensure maximum fibre density while leaving maximum space for fibre cable management. FTBs are available with SC adapters in block configurations of 144-positions, and with LC adapters in 144- and 192-positions. FTBs utilize sliding adapter packs to gain easy access to both the front and rear connectors. FTBs can be ordered with adapters only, with factory terminated IFC stubs, or as Plug-and-Play cassettes.

Fibre Termination Block

Fibre Main Distribution Frame

The foundation of the Data Centre ODF system is the Fibre Main Distribution Frame (FMDF). This innovative fibre distribution frame, designed to make installation and maintenance easier, provides extensive fibre cable management, horizontal troughing and slack storage to allow easy management of fibres in a high density system. The FMDF provides mounting locations for 12 FTB's, plus the routing paths and troughs for fibre jumpers. Individual frame sections consist of 2 verticals (left and right) on which the FTB's are mounted. Between the verticals is the slack storage panel for storing up to 3.5 meters (12 feet) of excess slack in the cross connect or interconnect jumpers. Each FMDF frame section also includes extensive horizontal and vertical troughing for routing jumpers within the frame and six rear horizontal cable troughs for a total of 30 inches of horizontal trough space. This abundant trough space minimizes fibre pile up and congestion leading to easier moves, adds and changes. The FMDF frame sections can accommodate overhead or under floor cabling.

This frame, built for density, allows for the termination of 1728 fibres in a single frame when installed in conjunction with (12) 144-position FTB's. When used with (12) 192-position FTB's, the fibre termination count increases to 2304.

Fibre Main Distribution Frame

Slack Storage System

Each FMDF frame section includes a built in system for storing excess lengths of cross connect jumpers that are routed to the front of the frame. In most fibre frame systems, this storage function requires additional hardware that is attached to the side of the frame, increasing the width of the frame system. In the Data Centre ODF system this functionality is built into the frame and does not require any additional hardware or add additional width to the frame. This user-friendly system can easily store up to 3.5 meters of excess jumper slack allowing for a single length patchcord to be used to connect any two ports within a single frame. This reduces the number of different length cords required for use within a frame line-up.

The enclosed system eliminates any crossing of jumpers, which make tracing functions much easier. The slack storage system is also designed such that stored jumpers always have positive bend radius protection to ensure signal integrity and long term network reliability. Abundant labeling on the frame and slack storage system provide guidance on cable routing dos and don'ts.

Slack Storage System

Whether patching within one frame or within a line-up of frames, the ODF design is intended to minimize patch cord lengths required in the system. A single patch cord length can be used, allowing the user to stock this specific length and avoid waiting for a custom length to be ordered to turn up service.

Cross-Connect Patchcord Length

Number of Frame Sections	Patchcord Length
Within Single Frame	6 meters
Adjacent Frames	7 meters
3-4	8 meters
5-6	9 meters
7-8	11 meters
9-10	12 meters

Cable Routing Troughs

The FMDF frame sections are designed to ensure that all fibre jumpers are easy to route and are always protected with proper bend radius protection and physical protection. Each FMDF block mounting position includes a dedicated troughing system that incorporates complete bend radius protection at every turn and is sized to ensure easy access to fibres, even when the frame is at maximum capacity. The horizontal and vertical cable troughing within the FMDF makes the job of routing and tracing patchcords much easier by providing a clear easy to follow routing path. This easy to follow routing path reduces the number of decisions a technician has to make when routing a jumper, thus reducing the amount of time required and reducing the possibility of errors. Also, the vertical cable ways are designed with the best possible access for the technician, producing safe and easy jumper tracing.

Six Rear Horizontal Cable Troughs

Rear Horizontal Cable Troughs

One of the biggest issues with traditional fibre distribution frame systems is their inability to support large fibre count frame line-ups. When routing cross-connect jumpers between frames, a horizontal cable trough is required. Most fibre distribution frame systems incorporate a single 5" deep lower cable trough or possibly a combination of 5" deep front upper and lower cable troughs. The single 5" deep front lower cable trough only provides ten square inches of horizontal trough space for routing jumpers between frames. This trough is typically used, even when jumpers are only routed within a single frame. Systems that utilize the upper and lower horizontal trough combinations provide double the trough space of a single lower trough system, but these systems tend to be very confusing for installers and lead to multiple routing errors. The FMDF frame sections incorporate six 5" deep rear horizontal troughs

for routing cross connect jumpers. When additional frames are added, these rear troughs become continuous throughout the line-up. Jumpers can immediately and easily be routed between frames using these troughs.

The FMDF system provides 57 square inches of horizontal trough space in the 6 rear troughs. This large amount of horizontal trough space allows the Data Centre ODF system to accommodate more than twice the number of terminations that other systems do. This also reduces the jumper pileup and congestion in the rear troughing system allowing for faster and easier jumper routing and tracing.

The Data Centre Optical Distribution Frame

When you combine all of these elements together, you get ADC KRONE's Data Centre ODF System. The ODF is the most comprehensive fibre distribution frame, fine-tuned for the data centre from years of industry deployments. This flexible system allows it to grow as your need for fibre increases and your data centre expands. When planning and building your data centre for the next generation, it is important to do it right. Planning for increased bandwidths and more fibre can be challenging, especially when space is typically at a premium. The Data Centre ODF is a complete cross-connect solution that allows you room to grow and ease of expansion without sacrificing cable management or density.

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