PANDUIT®

White Paper

# Server Cabinet Connectivity Evolution

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# Table of Contents

## Introduction

With the explosion of data over the last handful of years, the need to quickly scale compute systems to meet that need has forced the data center industry to find innovative products to help service this growth. The growth has also highlighted that application need drives changes to design and connectivity methods mainly around supporting higher bandwidth requirements.

## Evolving Connectivity in the Cabinet

As the need for additional bandwidth and power savings in the data center became evident, there was an infrastructure switch from using RJ45 based copper/GBIC's to Direct Attach Copper (DAC) cabling. This shift shrank the power output per port in watts from 2W-5W per link, to about .15W per link, as defined by the average power draw of a DAC cable. While this worked well for most customers, the distance limitations of passive or even active DAC still handicapped the design considerations to force Top of Rack (ToR) switching. And since DAC isn't a patchable system, it could only be used as in-cabinet or near-cabinet connectivity. In addition to design challenges, newer switches, cabling updates (SFP+ to QSFP to QSFP+), as well as NIC hardware changes were necessary to bump up speeds as bandwidth requirements were exponentially growing each year. To realize economies of scale, many server farms when servicing this growth standardized on a single cable length in cabinet, which creates cable management difficulty when using thick, inflexible, and overly long DAC copper cables. A better connectivity method was needed.

## New Applications Drive Change

With each progression of connectivity, power, and bandwidth requirements, network designers may have to make architectural changes to cabling design. This comes with substantial cost and effort. And as the available square footage of data center space decreases, cabinet density needs to increase, magnifying the need to save space and costs yearly.

Applications such as Base-8 technology, that easily breaks out an 8-Fiber array to multiple Base-2 Duplex LC connectors has pushed switch manufacturers to ensure their switches are capable of 4:1 breakout to be a viable vendor of switch-to-server infrastructure.

This is where fiber to the server makes sense. While fiber is a decades old technology, it was traditionally used for point-to-point or switch-to-switch applications where high bandwidth and/or longer distances were a requirement. These updated bandwidth and distances needed to run today's applications such as Artificial Intelligence (AI) or Machine Learning (ML) are highlighting to the data center industry that the emergence of fiber to the server will be necessary for more scenarios moving forward. While there is a power penalty of using fiber-based optics vs direct attach copper, the gains in manageability, design flexibility, and most importantly bandwidth capabilities outweigh the detractors of using DAC.

## How Does Fiber to the Server Futureproof You?

Using fiber to the server solves many of the limitations in data center server farm/POD designs today.

- **Extended Distance –** Using Multimode (MMF) or Singlemode (SMF) fiber can extend connectivity design limitations from 100m to 300m (MMF) or 2km or beyond (SMF). This allows flexibility in design to change from ToR to EoR designs.

- **Rack Unit/Space Utilization –** A 1 RU or 2 RU panel/enclosure can support a very dense server cabinet with out-of-cabinet uplinks. In addition to the rack unit savings, the opportunity to use bend insensitive, single-jacketed fiber with Uniboot/Push Pull connectors allows flexibility in vertical cable routing and minimizes cable bundling, which also enables better server and switch airflow.
- **Speed to Deploy –** Customers deploying full rack systems can prewire cabinets at their integration point, roll to location, and deploy minimal fiber uplinks or preterm assemblies back to the leaf switches. Minimal "structured cabling" is required.
- **Upgrade Path –** Customers today using 10G to the server with fiber can use the same MPO/LC breakout connectivity to go from 10G <-> 25G <-> 40G <-> 50G <-> 100G over the same duplex LC cassette based (BiDi-based), or parallel MPO (SR-based) fiber adapter panel based solutions. The NIC, transceiver, or leaf may need a refresh, but that same fiber cabling infrastructure can support any of those bandwidth needs.
- **CapEx Savings –** With eliminating the limitation of ToR switching in server farms that are using copper or DAC, customers can use higher port count chassis-based switches in an End of Row (EoR) or Middle of Row (MoR) design along with front access cassettes, which minimizes the cost per port with fewer switches needed, and in turn fewer support contracts. Additional savings can be realized with re-using fiber distribution at the cabinet as bandwidth upgrade changes are made.

## The Benefit of Using Panduit Products for Fiber to the Server

Panduit listened to the leading data center designers and installers pain points regarding the usage of traditional rear access cassette based cabling for high density server cabinets. Working within a full server cabinet leaves little room for network infrastructure, even if it's only a rack unit or two.

To aide in cabinet integration, a front-access cassette based solution was needed.

A front-access cassette enables all fiber cabling to be hand accessible and on the same plane on the cabinet, which allows for easy uplinks during cabinet integration. This can be completed using our existing form factor fiber enclosures and panels that our customers trust to run their mission-critical applications today.

An added benefit of a front-access cassette application is the speed to integrate and deploy a fully cabled system is significantly increased. Installers can roll the cabinet to the end location in the data center and simply run a pre-terminated trunk or small bundle of single uplinks, pull them to the fiber demarcation point in the cabinet, and clean/patch the uplinks. No need to fumble on a ladder to attempt rear hand access, or pull a cassette out to patch, disturbing pre-cabled fiber to the server patches done in integration. Panduit offers these front access cassettes in all three of our form factors as well.

# Front-Access Cassettes

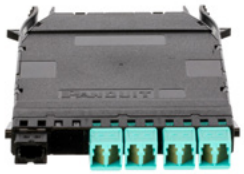
## Opticom®

| Part Number | Description |
|---|---|
| FCF39N-16-10* | OS2 Opticom 4:1 Conversion Cassette, (2) 8-FIBER MPO to (8) Duplex LC, Standard |
| FCF3ZO-16-10* | OM4 Opticom 4:1 Conversion Cassette, (2) 8-FIBER MPO to (8) Duplex LC, Optimized Loss |

## SFQ QuickNet™

| Part Number | Description |
|---|---|
| FQF39N-08-10* | OS2 QuickNet SFQ 4:1 Conversion Cassette, 8-Fiber MPO to (4) Duplex LC, Standard, |
| FQF3ZO-08-10* | OM4 QuickNet SFQ 4:1 Conversion Cassette, 8-Fiber MPO to (4) Duplex LC, Standard |

## HD Flex™



| Part Number | Description |
|---|---|
| FHCF9N-08-10* | OS2 HD Flex 4:1 Conversion Cassette, 8-Fiber MPO to (4) Duplex LC Standard |
| FHCFZO-08-10* | OM4 HD Flex 4:1 Conversion Cassette, 8-Fiber MPO to (4) Duplex LC Optimized |

*Method U and U2 options available. See **www.panduit.com** for additional info.

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