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Streamlining the Data Center with High-Density Cabling Solutions

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Enterprise data centers are undergoing a transformation driven by the need to reduce operating costs and increase performance. This can be in direct conflict with strategic business requirements reflected on the data center to increase the ability to adapt to rapid market changes. Data center growth and systems turnover driven by events such as consolidation, disaster recovery, application growth and digital data growth, increase data center cost and complexity. New technology solutions such as server virtualization, storage area networks (SANs), 10 Gigabit Ethernet and InfiniBand are being deployed throughout the data center to address business needs and meet data center requirements of reducing operating costs and increasing performance.

Information technology is increasingly becoming a strategic asset to businesses. Therefore, the need to effectively and efficiently store, protect, process, transmit and securely retrieve information is critical to overall business health. Complexity in the data center increases expense and risk, so for new technology deployments to meet business requirements they must integrate seamlessly, bear low risk and be simple to manage and maintain. Infrastructure reliability, scalability, performance and availability are essential, and trade-offs of one for the other are no longer acceptable.

In regards to the data center physical layer, new developments and practices in areas such as power distribution, cooling and structured cabling technologies are being utilized to meet the requirements of scalability, flexibility, reliability, operating cost reduction and increased performance. Examples include higher voltage power distribution systems, enhanced cabinet designs for improved air circulation and higher-bandwidth optical fibers. In particular, infrastructure managers are taking a holistic view of the data center cabling infrastructure to build in the flexibility and scalability to meet existing and future requirements.

New optical cabling solutions and deployment practices are being utilized to eliminate application-specific cabling silos that are rigid and can not easily and reliably migrate to meet future scaling, equipment and application churn. These new optical cabling solutions have built in reliability and flexibility to transmit multiple applications such as Fibre Channel, Ethernet and InfiniBand and easily scale to very high port counts. Built around a foundation of high-bandwidth laser optimized 50um - multimode optical fiber (OM3) and the high-density MTP array connector, these cabling systems also provide a migration path to higher data rates such as 100 Gigabit Ethernet.

Traditional optical cabling solutions such as duplexed patch cords and duplexed connector assemblies work well in application-specific, low-port-count environments.

But as port counts scale upwards and system equipment turnover accelerates, these solutions become unmanageable and unreliable. Also, new cabling may be pulled over decommissioned existing cable creating unused cabling in cabinets and pathways (the NEC requires abandoned cable to be removed). Continuing this practice for a period of time can lead to data center reliability issues, as cable build-up in cabinets, pathways and spaces, blocks air circulation and creates hot spots. Operational cost can increase in managing this unused cabling. Networking complexity increases as channel identification becomes difficult and port utilization at the patch panel decreases.

Deploying a modular, high-density, MTP-based structured wired cabling system in the data center will significantly increase response to data center moves, adds and changes (MACs). Implementing a centralized main distribution area patch panel and star-networked cabling throughout the data center creates a cabling backbone foundation that can be easily reconfigured at the patch panel to handle equipment and application churn. Creating this backbone cabling system with high-density optical cabling technologies such as ribbon cable reduces bulk cabling in pathways and spaces by over 50 percent. Additionally, high-density factory-terminated MTP trunk assemblies simplify and streamline network deployment with installation time savings of over 80 percent compared to traditional optical solutions. Utilization of high bandwidth laser-optimized 50µm fiber (OM3) in the optical network increases the life cycle of the cabling infrastructure by providing headroom to handle higher-data-rate applications such as 8 to 128 Gigabit Fibre Channel and 1 to 100 Gigabit Ethernet.

Another benefit to deploying an MTP-based optical network is its flexibility to transmit both serial and parallel signals. Parallel optic technologies such as InfiniBand and emerging 40/100 Gigabit Ethernet operate over the base MTP trunk infrastructure. MTP to duplexed connector transition devices such as modules and harnesses are plugged into the MTP trunk assemblies for serial communication. Modules are typically used in lower-port-count break-out applications such as in server cabinets. Harnesses provide a significant increase in cabling density and find value in high port count break-out situations such as SAN Directors (see Figure 1). The built-in modularity of the solution provides flexibility to easily configure and reconfigure the cabling infrastructure to meet current and future networking requirements. Harnesses and modules can be exchanged or completely removed from the backbone network to quickly adapt to data center MACs.

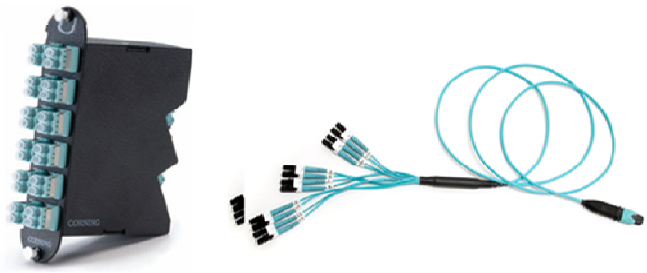

Figure 1

Break-out modules typically are placed in a housing located in the cabinet rack unit space. Here the MTP trunk cable is plugged into the back of the module. Duplexed patch cords

are plugged into the front of the module and routed to system equipment ports. Harnesses are plugged into the backbone MTP trunk assemblies through an MTP adapter panel. The MTP adapter panel is placed in a housing that is also typically located in the cabinet rack unit space.

A value-add alternative to placing the housing or patch panel in the rack unit space is to integrate the solution into the side of the cabinet where vertical cable management is typically placed. (This is often referred to as a zero-U solution because it does not consume rack space.) In fact, integrating the entire MTP-based high-density cabling solution into the data center cabinet enhances the deployment and operation of the data center cabling infrastructure. As shown in Figure 2, high-density MTP trunk cables can be strategically aligned in the cabinet to maximize air circulation. Strain relief features built into the high-density MTP trunk assembly furcation plug integrate into specially designed vertical and horizontal manager brackets within the cabinet vertical manager space providing a streamlined approach to deploying and organizing trunk cabling in the data center. Cable management brackets mounted within the cabinet keep cabling cleanly routed within bend tolerances. Scaling and maintaining the cabling system is simplified through the cabinet trunk cable integration and management system.

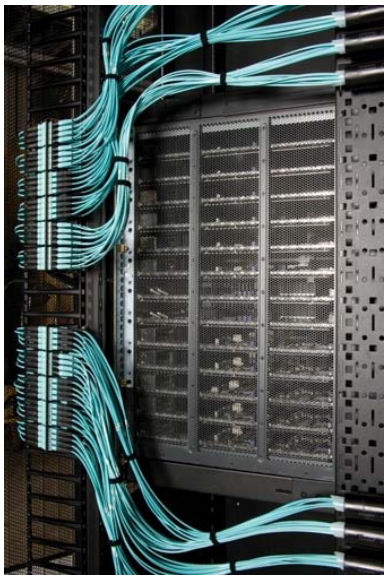

Figure 2

Figure 3

Integrating the break-out modules into the cabinet vertical manager space maximizes the rack unit space available for data center electronics. Break-out modules are moved to the cabinet sides where they snap into brackets placed between the cabinet frame and side panel. Properly engineered solutions will allow break-out modules to be aligned with low-port-count system equipment placed within the cabinet rack unit space to best facilitate patch cord routing.

The value of integrating the high-density MTP cabling system into the cabinet becomes even more evident when deploying very high port count cabling solutions such as those needed for SAN Directors. Port counts within cabinets housing SAN Directors can scale upwards of over 700 ports, requiring routing of over 1500 fibers within a single 19-inch cabinet. High-density MTP trunk cabling strategically integrates into the cabinet vertical manager promoting airflow efficiency within the cabinet. These zero-U solutions must be designed not to impede the required airflow past the cables and

connectivity, especially important for side-breathing equipment. As shown in Figure 3, the MTP trunk cabling is installed into the back of high-density MTP adapter panels mounted in the cabinet vertical manager. These MTP adapter panels feature fully identifiable and synchronized labeling to the SAN Director line cards streamlining the installation of the cabling system and promoting disciplined system management.

MTP to LC 12-fiber break-out harnesses plug into the front of the adapter panels and are routed over to the director line cards where the LC duplexed ends are plugged into the line card ports (see Figure 4). These harnesses are pre-engineered to a precise length with strict tolerances to minimize slack, while a small outside diameter allows for easy routing without preferential bend concerns. Utilization of harnesses customized for interfacing with high-port-count system electronics provides ease of installation and re-configuration in the data center. Each LC duplex connector is factory-terminated on 1.6 mm legs with staggered lengths that eliminate congestion at the director port interface. These pre-engineered harnesses integrated into the cabinet vertical manager eliminate up to 77 percent of the bulk cabling congestion in the cabinet and in the SAN Director's backplane. With a pre-engineered cabling solution, not only is installation simplified, but the time required for SAN design and documentation is greatly reduced with port mapping architecture inherent to the design.

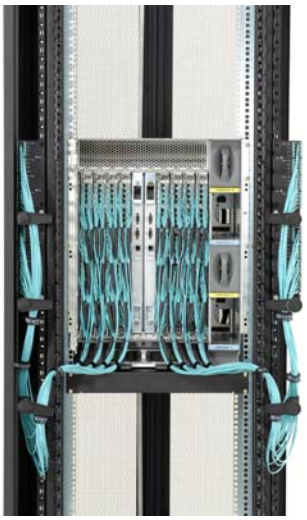

Figure 4

The move from the traditional low-density duplex patch cord or assembly cabling solution to a high-density MTP-based cabling solution integrated into the cabinet vertical manager enables the physical layer to be implemented in a manner that provides manageability, flexibility and scalability in the data center.

Features and benefits of high-density cabling solutions include:

- Zero-u space connectivity that maximizes the rack unit space available for data center electronics.
- Innovative port mapping architecture from the main distribution area to the SAN Director, reducing infrastructure design and installation time.
- Customized transition assemblies that attach to the high-density MTP backbone cabling infrastructure that simplify and improve initial speed of deployment and future MACs as well as promote airflow efficiency within the cabinet.
- Full integration of the backbone MTP cable assemblies into the cabinet providing a streamlined approach to deploying and organizing trunk cabling in the data center.
- A bulk cabling reduction in the cabinet vertical manager and SAN Director backplane of over 77 percent versus traditional patch cord cabling solutions.
- Highly modular system that can be easily reconfigured to meet future data center networking requirements.