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Conserving Valuable Floor Space in the Data Center

Application of Raised Floor Fiber Patch Panels

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Stimulation and Costs Associated with Data Center Growth

Significant legislation, recommendations and financial agreements in the United States and abroad are dictating how information must be stored, and for how long. For example, the Sarbanes-Oxley Act requires publicly held companies with a market capitalization greater than $75 million to retain documents related to financial statements for seven years and effectively requiring the organization's top management to sign for the financial accuracy of the company's annual reports, in essence holding them accountable for the practices and procedures in their IT departments. The new "Rule 17a" of the U.S. Securities & Exchange Commission (SEC) establishes strict requirements for brokerages and exchange members. Under the new rule, a 6 year retention period, has been established for transactions, e-mails and instant messages. These and many other laws and directives have fueled the growth of new and existing data centers and storage area networks. Internationally, the European Union's "Data Policy Directive" or DPD designates strict privacy requirements for any individuals, companies or other entities within EU member countries.[1]

Construction costs for first-class data centers today range from $700-$1,200 per square foot. Typical annual capacity growth rates in data centers of 50% theoretically would require equally dramatic increases in floor space requirements. However, new and dense data center processing technologies such as blade servers have reduced floor space growth requirements to the still considerable range of 30% per year. For a 10,000 ft^2 data center, these growth rates translate into spending approximately $8-12 million for capacity expansion over a three year period.[2] Clearly, it is highly desirable to carefully plan for these capacity increases as well as maximize the utilization of every available square foot of data center floor space.

The Need for Structure in Data Center/SAN Cabling Systems

Historically, data centers and storage area networks have often been constructed without full consideration of the implications of frequent capacity expansions and the resultant moves, adds, and changes that occur over the life of the data center. For example some equipment, such as storage area networks (SANs), was often installed and cabled by the SAN equipment manufacturer's technicians. Other data center equipment, such as processing elements, switches and various telecommunications systems, might be installed by their respective suppliers' technicians. While each of these crews were likely highly competent with their own individual hardware and software systems, the data center would often contain a mix of disparate technologies and cabling systems without the manageability critical for rapid maintenance, upgrades and the introduction of new products and technologies.

In the early 1980s, when AT&T divested the regional Bell Operating Companies (RBOCs), ownership of cabling systems within commercial buildings passed from the regional companies to building owners. A wide variety of proprietary cabling systems and architectures were common at the time and were addressed by the development of the TIA/EIA-568 "Commercial Building Cabling Standard". This new standard introduced the concept of structured cabling systems for these buildings and permanently changed the way telecommunication and data equipment within buildings is cabled and managed.

[1] "Recent Regulations Affecting IT", Data Center Management, AFCOM, March/April 2005
[2] Meta Group Study, August 2001

A New Standard to Simplify the Design & Management of Data Centers

The fiber and copper industries have developed and introduced many new cable and apparatus technologies and products that offer specific advantages for data center and (SAN) applications. For the past three years, subject matter experts, many of whom helped develop the TIA/EIA-568 standard and its successors, TIA/EIA-568-A, TIA/EIA-568-B, and the emerging TIA/EIA-568-C, have been working to develop a new structured cabling system standard specifically tailored to the requirements of data centers and SANs. The new standard, TIA-942, "Telecommunications Infrastructure Standard for Data Centers"[3] is expected to benefit data center and SAN design as profoundly as the TIA/EIA-568 series of standards has for commercial buildings. This new data center standard, will finally allow data center designers to incorporate the appropriate structured cabling systems to efficiently integrate disparate data center/SAN systems early in the building planning process. The standard views the data center/SAN as a fully integrated system comprising many components. As a result, it covers many other interrelated technologies such as network design, location and access as well as architectural and electrical systems and the crucial element of redundancy.

Conserving Data Center Space with the Raised Floor Fiber Patch Panel

It has been shown that real estate in the data center is costly and, as a result, its maximum utilization is highly desirable. Managers are faced with the simultaneous objectives of facilitating regular moves, adds and changes that occur in today's data centers, while, at the same time, conserving valuable floor space for other data center equipment that may require continuous access. In an effort to take advantage of underutilized installation space beneath the raised floor structure, improvised solutions have often been employed. However, a new fiber apparatus technology, the raised floor patch panel, has been developed to meet both objectives. Installing this type of apparatus in the floor has the additional effect of freeing up rack space, an important consideration for many data center designers.

Reclaiming underutilized floor space in the data center is desirable for all media types including UTP copper, fiber and coaxial cable. While existing copper patch panels readily support requirements for this media type, they are not well suited to fiber cabling system infrastructures. The many advantages of fiber, including broad protocol support, smaller diameter, more robust and higher bandwidth cables, increased security, noise immunity and simplified testing are leading to increased deployment of fiber in data centers and SANs. The application of raised floor fiber patch panels is not limited to data centers and SANs, however. Increasing fiber densities in various locations of commercial building cabling systems as defined in TIA/EIA-568-B may also benefit from the deployment of raised floor patch panels.

Elements of a Well-Designed Raised Floor Patch Panel

Raised floor fiber patch panel systems comprise specially designed patch panels as well as the under floor plenum-rated enclosures in which they are housed. The enclosure should be designed to minimize the obstruction of air flow in the plenum airspace and also be sealed to isolate the plenum environment and prevent creation of a turbulent air flow. The system should be designed to fit neatly under a 2' x 2' floor tile of the type typically used in data centers. An ideal design should reflect careful attention to the bend radius needs and depth issues associated with popular cassette based systems such as the Ortronics Momentum® Modular Fiber Optic System[4]. It should also be able to

[3] Available from Global Engineering Documents, www.global.ihs.com.
[4] Momentum is a registered trademark of Ortronics/Legrand.

accommodate traditional fiber connectors, whether they are field-terminated, or a component of a pre-terminated trunk cable assembly. Strain relief, both fore and aft of the patch panel should also be provided to minimize the potential for optical disconnects and resultant service interruptions. For maximum flexibility, it should be designed to support both fiber interconnections and cross-connections as specified in the TIA-942 and TIA/EIA-568-B standards. As cabling densities vary greatly among data centers, different patch panel rack unit capacities, i.e., 1U and 2U should be supported.

An important, but often overlooked element of a well-managed structured cabling system, whether it be in the data center or enterprise commercial building is accurate labeling and record keeping. The newly revised TIA/EIA-606-A "Administration Standard for Commercial Telecommunications Infrastructure" provides guidelines for documenting and maintaining telecommunications infrastructures. This new standard offers four levels of scalable administration, based on the size and scope of the data center structured cabling system. In order to insure complete and accurate records for equipment that is normally out of sight, the raised floor fiber patch panel system should include a labeling card for convenient and accurate cabling administration and record keeping, consistent with TIA/EIA-606-A.

Example of Raised Floor Patch Panel System

While there are a variety of plenum-rated under floor enclosures available[5], they are quite similar in design so that a properly designed fiber patch panel can be installed in most of them without compromising the physical requirements of the fiber cabling system infrastructure. One variation in existing under floor enclosures is the mounting rail angle in the enclosure to which the fiber patch panel is attached. The mounting rails and patch panel mounting surfaces should be designed so that the mounted patch panel is oriented vertically. With this arrangement, the patch cords are horizontal (parallel to floor tile cover) for best visibility and access. A typical enclosure has mounting rails installed at an angle of between 45 and 60 degrees with respect to the floor tile cover. However, there are also enclosures available that have mounting surfaces parallel to the cover's plane, and the raised floor patch panel may also be used in this application, albeit without full strain relief.

In order to accommodate mounting angles greater than 45º while still providing the proper fiber cable/patch cord clearances and bend radius requirements, an auxiliary stand-off mounting bracket may be utilized to provide an additional 2" of clearance between the fiber patch panel management bar and the inside of the enclosure. The fiber management bar also provides easy access to the fiber optic connectors eliminating the need to remove the patch panel. The bracket extends the mounting surface of the raised floor enclosure to accommodate the depth limitations of 2' x 2' enclosures with 56º or 60º mounting rails.

Figure 1 shows an example of a fiber patch panel designed to meet the above requirements. The patch panel is designed for installation in common 2' x 2' underfloor enclosures. The management bar maintains proper fiber bend radius requirements. It also provides a convenient point to which cables can be secured with hook and loop straps. The 1U version includes three 1U openings to accommodate standard adapter panels or cassettes while the 2U version incorporates six 1U openings to support additional adapter panels and/or 1U or 2U Momentum cassettes. For maximum flexibility, it supports both cross-connections and interconnections. Sufficient space is provided for slack storage of 900 μm buffered fiber using management clips attached directly to the floor of the enclosure. Reusable label cards are provided and hook & loop attachment points are provided to facilitate cable management within the enclosure. The cards are also easily removable to provide rear patching access.

[5] American Access Technologies, Inc. is one such provider of these enclosures.

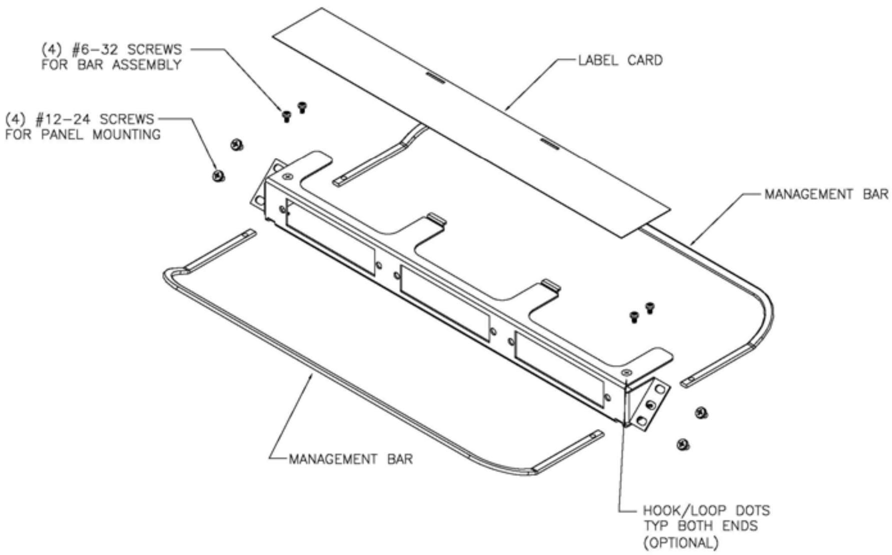

Figure 1: 1U Raised Floor Fiber Patch Panel Detail (2U Similar)

As indicated above, today's data centers and high density enterprise structured cabling systems increasingly deploy optical cassette systems to reduce installation and maintenance time as well as reduce congestion in crowded racks. With a cassette-based system, a backbone ribbon cable is terminated with a 12-fiber MTP®/MPO connector.[6] The backbone cable is connected to optical cassettes at each end of the fiber link, with each cassette supporting either one or two MTP/MPO connectors, for a total of either twelve or twenty-four fibers. Employing factory terminated connectors, such systems also offer factory-certified performance as the connector installation may be verified immediately after production with laser interferometry inspection techniques and state of the art insertion and return loss testing. Figure 2 shows a raised floor patch panel system used with an optical cassette system.

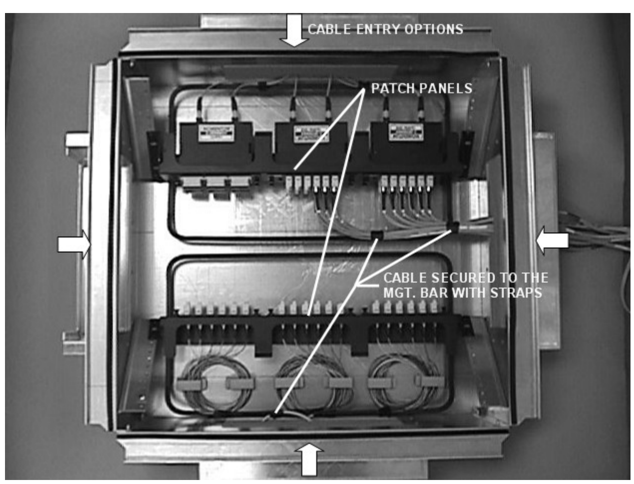

Figure 2: Raised Floor Patch Panel System for Cassette-based Application

[6] MTP is a registered trademark of US Conec.

Four cable entry points are provided in the enclosure, allowing for segregation of trunk and equipment cables. The flexibility of the system also permits it to be readily configured to support either a pre-terminated or field-terminated system. In a pre-terminated system, a backbone cable with factory installed connectors extends from the rear of an adapter panel in one rack or enclosure to the mating end of another adapter panel in another rack. With the raised floor patch panel system, either or both ends of the pre-terminated trunk cable assembly would be connected to the raised floor patch panel in the underfloor enclosure. Similarly, if it is determined that field-installed connectors are to be used for the installation, these connectors would populate the raised floor patch panel in the enclosure.

Raised Floor Patch Panel System Application in the Data Center

The new TIA-942 Telecommunication Infrastructure Standard for Data Centers defines seven “spaces” and two “cabling subsystems” within the data center. The spaces include the (1) Computer Room, (2) the Telecommunications Room; (3) the Entrance Room, (4) the Main distribution area (MDA), (5) the Horizontal Distribution Area (HDA), the Zone Distribution Area (ZDA), and the Equipment Distribution Area (EDA). The cabling subsystems defined by TIA-942 include the backbone cabling subsystem and the horizontal cabling subsystem. Figure 3 shows the relationship of the spaces and cabling subsystems in a typical data center. The first five “spaces” defined in the standard generally involve many connections and are often best supported with high capacity, high density patch panels and racks. It is in the ZDA and the EDA that the raised floor patch panel system is optimally deployed. The equipment distribution area or EDA is the space allocated for end equipment, including computer systems and telecommunications equipment. Because the EDA is the lowest level of the hierarchical architecture supported in a data center, there are generally fewer cables connected to this area than to others. This makes the raised floor patch panel a good fit for this area.

The TIA-942 standard also supports the ZDA which is an optional interconnection point within the horizontal cabling subsystem. It is located between the HDA and the EDA. ZDAs are particularly useful in a data center where the need exists for frequent reconfiguration and flexibility. The ZDA is analogous to a consolidation point (CP) in a traditional commercial building structured cabling system. Here too, because the expected cable and connection density is often lower at the ZDA than other areas of the data center, the raised floor patch panel system is often an appropriate choice.

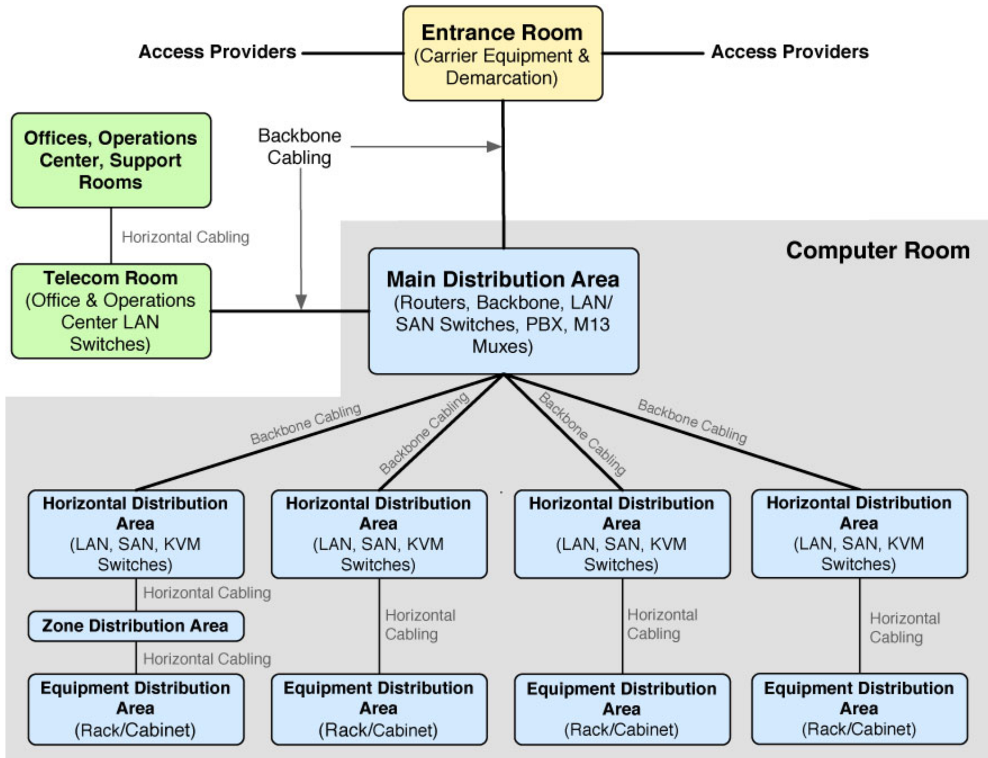

Figure 3: Example of Data Center Hierarchical Star Data Center Architecture

Summary

Clearly there is a need for a systematic and space efficient method of establishing cross-connections and interconnections at all levels of the hierarchical star or centralized architectures supported in the data center. Traditional high density, high capacity fiber optic patch panels serve most applications in the primary "spaces", i.e., the Entrance room, the Main distribution area, the Telecom room and the Horizontal distribution area. However, the requirements of less "equipment dense" areas within the data center such as the Equipment distribution area and the Zone distribution area are also key elements of the data center structured cabling system. The high cost of data center floor space requires the most efficient space utilization. The raised floor patch panel meets all of these requirements providing greater flexibility in structured cabling system design while at the same time maximizing usage of premium data center floor space.