



Cable Pathways: A Data Center Design Guide and Best Practices

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Everyone has heard the saying: it's the little things that make the biggest impact. This holds true especially when designing a data center. There are many important aspects to consider—from power and cooling requirements, to servers and hardware. Good cable pathway designers know that multiple products must work together to ensure a successful pathway from point A to point B. Let's talk about a few of the key elements.

Pathways

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Pathways allow the placement of data center trunk cables and cross-connect cables between racks and cabinets. Both overhead and under floor pathways should be designed to support the weight of cables in the initial installation and it should also facilitate the addition of future cables. Planning for 90-degree bends, waterfall dropouts and other vertical support methods should be incorporated in the initial design and will allow routing of cable without damage. Pathway products come in a number of different styles:

- A ladder rack is made of tubular steel and comes in sizes from 6" to 36" wide. The installation of a ladder rack is simple and requires little trade experience. Ladder rack come with many accessories such as 90-degree bends, waterfalls and cable retaining posts. These accessories allow the routing of cable without damage.
- A cable tray is a ladder rack with sides and may be steel, aluminum or fiberglass. These sides allow for a greater amount of cable to be supported. The maximum loading depth recognized by the NEC is 6". The cable tray is designed to support both electrical and data cables and is typically more robust than a ladder rack. It requires a pre-design effort because it is not flexible to work with in the field.
- A basket tray is a cable tray designed for light duty applications. The basket tray is lightweight and easy to install; however a certain level of experience is needed to properly install. Many of the accessories that accompany ladder racks also accompany basket trays, to ensure proper bend radiuses are maintained a proper transition to the equipment rack.
- An underfloor cable tray is a product used primarily in data centers. The concept is the same as the overhead support apparatus. However, when using under floor cable tray systems, the air space may be a plenum air space, so all cable and patch cables would need to be plenum for proper air flow.

Design and Installation Considerations for Cable Support Products

In order to support existing infrastructure, and plan for future growth, there are a number of key considerations that should be made throughout the design process and installation. Some important things to keep in mind include:

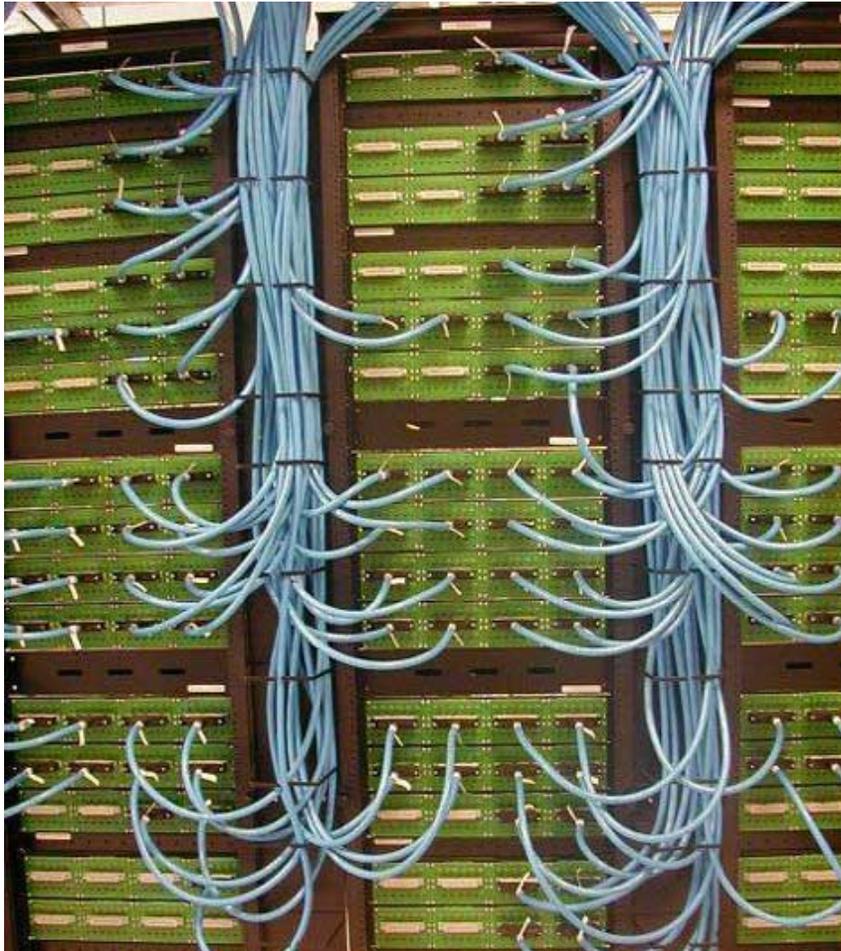
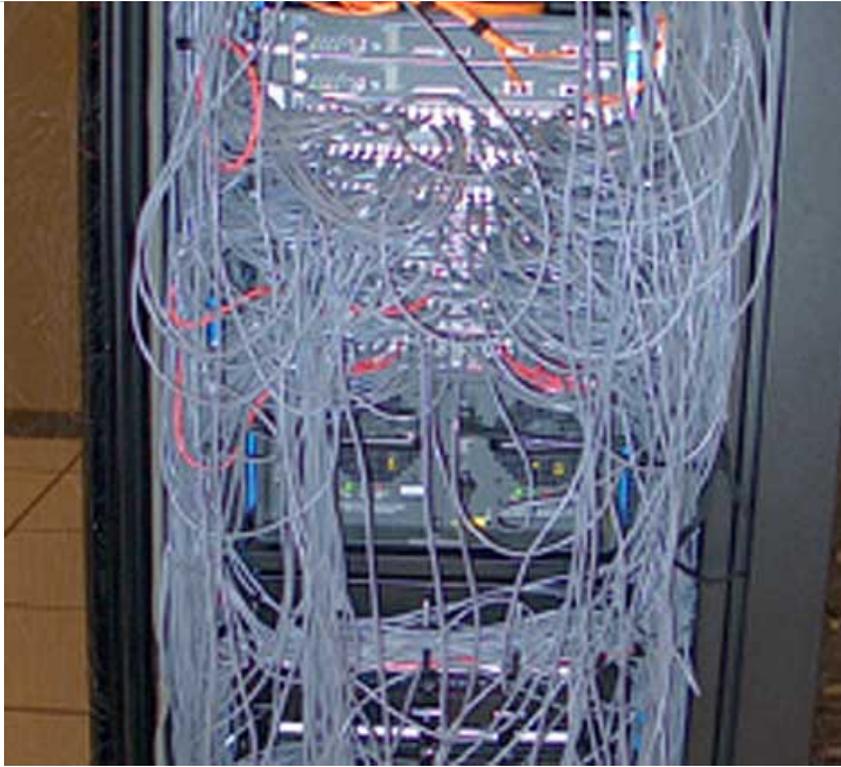
- Installation of overhead and underfloor supports should be done in a matrix type fashion that allows cables to be routed from point to point anywhere in the data center.
- Grounding and bonding is very important when installing any cabling support product. Be sure that all racks, cabinets, and pathway support products are properly bonded and the system is grounded.
- Allow room for future growth. All cable tray and ladder rack should be sized to accommodate at least 50% growth after the initial install.
- Be very careful about stressing the cable. Be sure to use sweeping 90-degree bends always when transitioning from the pathway support and the racks or around corners.
- Be sure the heaviest cable is on the bottom of the tray or separated from the lighter cables. This will prevent the heavier cable from stressing the lightweight cables.
- Separate the copper cables from the fiber cables if possible.
- Avoid mounting any cable components in locations that block access to other equipment inside and outside the racks.
- Avoid routing pathways with copper cables near equipment that may generate high levels of electromagnetic interference. Avoid areas around power cords, florescent lights, building electrical cables and fire prevention components.
- Care must be used in the engineering process when choosing Patch Cable and Pre-Terminated Fiber Cable lengths.
- When utilizing Pre-Terminated cables, slack will always be a potential problem. If it is allowed it to build up it creates many problems such as, clogged up pathways, excessive weight overloading the supports, and reduced airflow./li

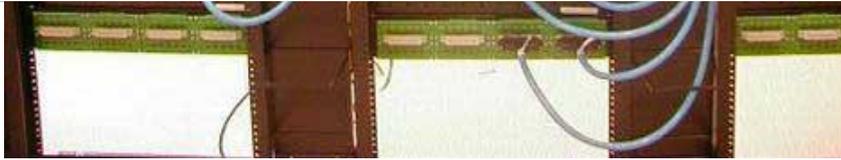
Design and Installation of Horizontal and Vertical Wire Managers

Now that we have considered everything we need to support our cabling above and below the equipment racks and cabinets, we need to consider our cabling pathways in and around the cabinet and or rack.

- Horizontal wire managers allow the neat and proper routing of patch and equipment cords from the switch/server to a patch panel. Density is very important in data center cabinets and racks so keep in mind how many rack spaces are being utilized with horizontal wire managers. Horizontal wire managers are available in many sizes from 1U to 4U. 1U and 2U heights are the most prevalent. They also come in depths from 1.75" to 6" deep. Cable management can be accomplished in both the front and rear of the rack with double-sided organizers. Depending on how much you want to hide the cables, horizontal wire managers can also come with or without doors/covers. They come in metal and plastic.
- A vertical wire manager provides a vertical pathway for cable within the rack or cabinet. It allows multiple horizontal wire managers to feed into a larger vertical pathway for the entire height of the rack. There can be as many as 20 horizontal wire managers feeding into one large vertical manager. Therefore, these vertical managers need to be large, with depth sizes from 4 to 10 inches deep and up to 10 inches wide. These managers can come with waterfalls and spools to help manage multiple cables and to help with maintaining proper bend radius on copper and fiber cables.
- It's important to make sure there is enough space to accommodate all the patch cords to avoid overfilling the wire managers. Overfilling wire managers will cause kinking in the patch cords make it very difficult for moves, adds or changes. You should allow a minimum 30 percent space in the wire manager for growth.







Cable Selection

Outside diameter is the key to reducing cable fill in your cable tray and your cable management. Let's look at the options available.

- Copper cables are more difficult due to their weight and large OD compared to fiber optic cables. Copper cables are typically used for inter and intra rack communications.
- Fiber optic cables offer options to reduce cable fill and can provide much greater bandwidth than copper.
- There are many types of fiber optic cables designed for data centers that will dramatically reduce cable fill in cable trays.
- Pre-Terminated fiber optic cables are also prevalent in data centers. They are used for many reasons including quality, dependability, and reduced installation time. Cable slack is hard to accommodate in data centers no matter where it is located—cable trays, vertical or horizontal

cable managers. Every effort should be made to get the lengths right before they are installed.

Other Considerations

Cable management in the racks is as important as in the pathways. Waterfalls from the overhead cable supports into the vertical wire managers provide necessary strain relief. Spools that can be attached in the vertical wire manager help maintain bend radius for both copper and fiber cable. Also, Velcro cable supports are reusable and a safe way to secure the cable without damaging it.

There are many things that need to be considered when it comes to cables and pathways in a data center. One thing is for sure: data centers will continue to grow as technology continues to advance the way we live.

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