Cabling Documentation

Best Practices
PowerEdge™ Servers and
PowerApp™ Appliance Servers
PowerVault™ Switches

Contents

Safety Instructions

Use the following safety guidelines to ensure your own personal safety and to help protect your server, storage system, or appliance from potential damage. For complete safety, regulatory, and warranty information, refer to your Dell™ system's *System Information* document.

Precautions for Rack-Mountable Products

Observe the following precautions for rack stability and safety. Also refer to the rack installation documentation accompanying the system and the rack for specific warning and/or caution statements and procedures.

Servers, storage systems, and appliances are considered to be components in a rack. Thus, "component" refers to any server, storage system, or appliance, as well as to various peripherals or supporting hardware.

⚠ WARNING: Installing Dell system components in a Dell rack without the front and side stabilizers installed could cause the rack to tip over, potentially resulting in bodily injury under certain circumstances. Therefore, always install the stabilizers before installing components in the rack.

⚠ **WARNING: After installing system/components in a rack, never pull more than one component out of the rack on its slide assemblies at one time. The weight of more than one extended component could cause the rack to tip over and injure someone.**

NOTE: Dell's servers, storage systems, and appliances are certified as components for use in Dell's rack cabinet using the Dell customer rack kit. The final installation of Dell systems and rack kits in any other brand of rack cabinet has not been approved by any safety agencies. It is the customer's responsibility to have the final combination of Dell systems and rack kits for use in other brands of rack cabinets evaluated for suitability by a certified safety agency.

- System rack kits are intended to be installed in a Dell rack by trained service technicians. If you install the kit in any other rack, be sure that the rack meets the specifications of a Dell rack.
- Do not move large racks by yourself. Due to the height and weight of the rack, Dell recommends a minimum of two people to accomplish this task.
- Before working on the rack, make sure that the stabilizers are secured to the rack, extend to the floor, and that the full weight of the rack rests on the floor. Install front and side stabilizers on a single rack or front stabilizers for joined multiple racks before working on the rack.

- Always load the rack from the bottom up, and load the heaviest item in the rack first.
- Make sure that the rack is level and stable before extending a component from the rack.
- Use caution when pressing the component rail release latches and sliding a component into or out of a rack; the slide rails can pinch your fingers.
- After a component is inserted into the rack, carefully extend the rail into a locking position, and then slide the component into the rack.
- Do not overload the AC supply branch circuit that provides power to the rack. The total rack load should not exceed 80 percent of the branch circuit rating.
- Ensure that proper airflow is provided to components in the rack.
- Do not step on or stand on any system/component when servicing other systems/components in a rack.

Introduction

This document provides suggestions cabling large numbers of Dell server and storage products in a data center environment. This document is not intended to describe a single correct way to install and cable Dell equipment, but rather as a guide for the cable installer to follow when assistance is needed.

This document contains the following information:

- Naming conventions
- Equipment labeling locations
- Cable routing and tying
- Power distribution unit (PDU) placement
- Cascading switches such as KVM

Cable Routing and Tying

Cable routing and tying are a very important part of any Dell rack product installation. Incorrect and substandard cabling can lead to functionality problems.

Dell offers several types of rack mountable products. The cabling of Dell servers, storage products, switches, and PDUs is discussed in this section.

Before You Begin

Before beginning to install and cable Dell equipment, please follow all the guidelines in the *Site Planning Guide*. You should also gather all racks together and install PDU and Switches in the 0U area of each rack prior to installing the systems.

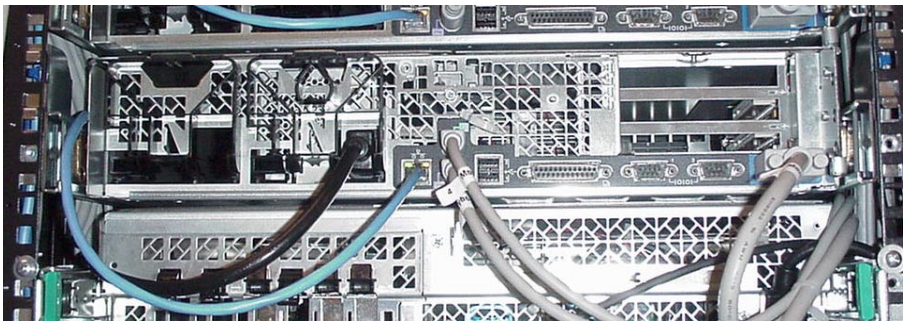
Also prior to installation, see to the current version of the *Rack Advisor Utility* at the following website:

http://support.dell.com/us/en/filelib/download/index.asp?fileid=R20652

Cabling Dell Server Products

When cabling a Dell server into any rack, first follow the *Rack Installation Guide* provided with the Dell server. Then connect the cables to the back panel of the server as shown on the server in Figure 1. Dell servers can contain a combination of the following cables: SCSI, CAT5, KVM, power, and Ethernet.

Figure 1: Cabled Dell Server



Dressing Server Cable

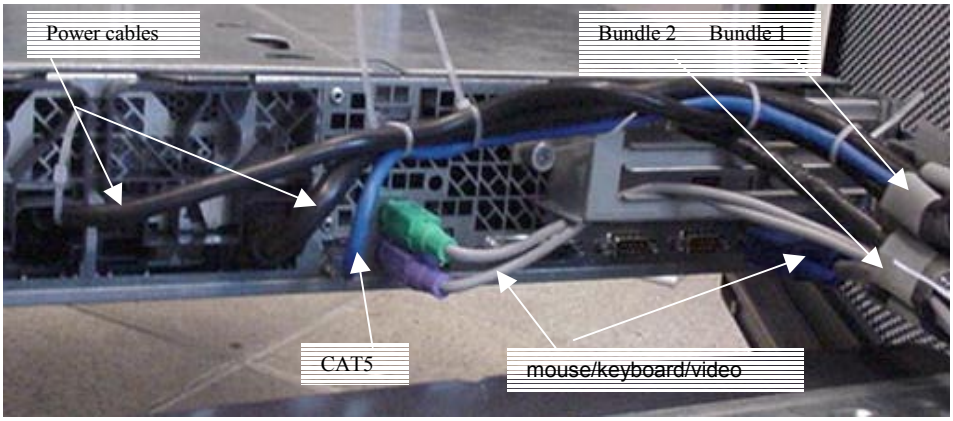
Once the cables are connected to their respective ports, the cables must be dressed toward the side of the server where the cable management arm will be attached. During this step it is important to pay close attention to the bend radii of the KVM and SCSI cables. If the bend radii of these

cables are too small, there is a high probability of signal degradation. When dressing the cables, it is imperative to use zip ties to group certain cables together in order to keep them within the height of the server. Different servers will require bundling different cables together for this initial step. Determining which cables should be bundled together depends on the proximity of one cable to other cables. Dell suggests that cables located in the same vicinity should be grouped together as shown in Figure 2. The next step is to clip the ends of the zip ties so that they do not cause interference.

In order for the server to properly slide in and out of the rack, the cable bundles must stay within the height of the server. This is achieved by attaching the cable bundles to the rear of the chassis using zip ties. The zip ties can be routed through the rear mesh of the server as shown in Figure 2.

NOTE: Different manufacturers' cables require different minimum cable radii for their products. A conservative guideline to use is to not create a bend radius less than 4 times the diameter of the cable. For example a .375-inch cable should have a minimum bend radius of 1.5-inches. Also, when zip tying cables, ensure that the tightness of the tie creates no visible indention on the cables.

Figure 2: Cable Dressing/Tying to Chassis Mesh



Cable Management Arm Installation

Once all back panel cables are dressed, mount the cable management arm (CMA) to the server rack. When you install the CMA, you first attach one end of the CMA to a rack slide, and then you attach the other end to the rack support. Be careful to support the free end of the CMA as you attach it the CMA to the rack slide. While supporting the arm, extend it out of the rear of the rack as shown in Figure 3.

NOTE: Depending on the server, you may be able to increase available space and improve cable routing by alternately installing the CMA on the right and left sides of the rack.

Figure 3: Supporting CMA

NOTE: There have been issues reported with the CMA interfering with the video cable on the PowerEdge 2450. This is due to incorrect installation of the CMA. Ensure that the tab on the CMA, shown in Figure 4, is correctly positioned behind the chassis mounting point on the PowerEdge 2450, as shown in Figure 5.

Figure 4: CMA Installation Tab

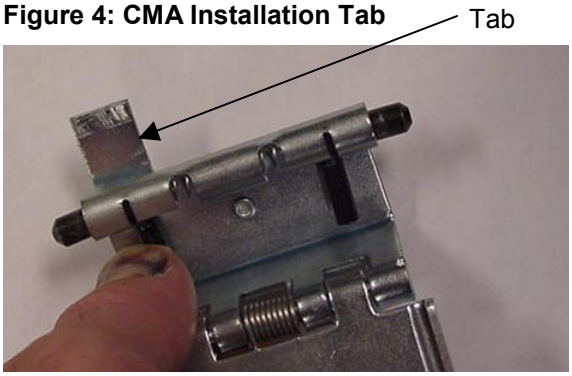
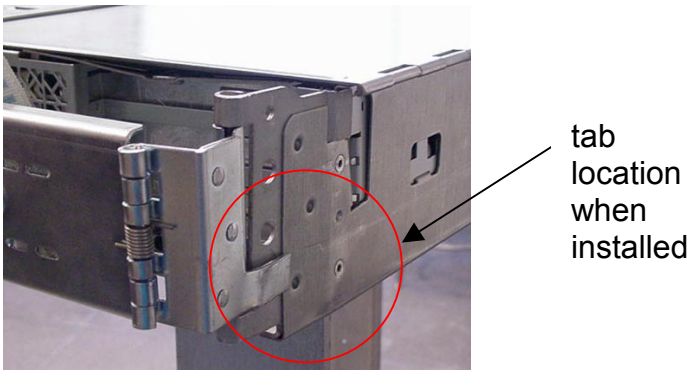


Figure 5: Correct Installation of CMA on PowerEdge 2450

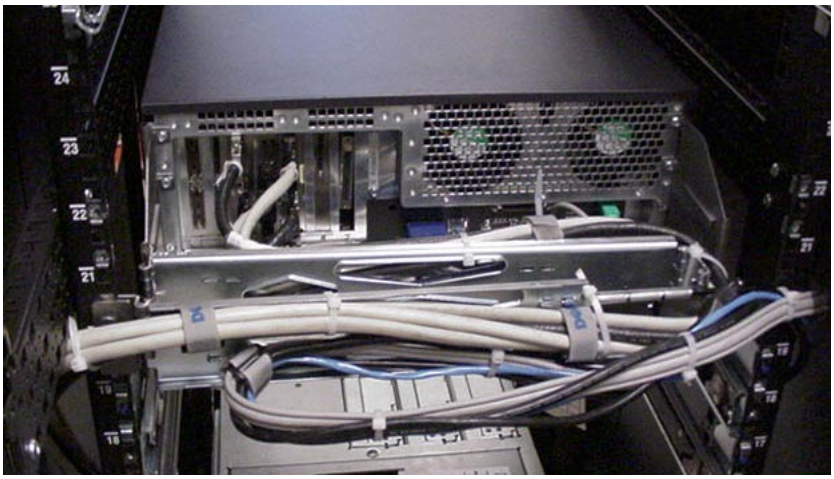


Cabling the Cable Management Arm

Route the cables along the trough of the cable management arm, paying close attention the tightness of the cable bundles. Loose cable bundles may cause obstruction with systems above and below in the rack. Attach the

bundles to the CAM with the provided Velcro straps. You can also use additional zip ties to attach cables to the arm as shown in Figure 6. A guideline to use is to place a zip tie every 3 inches along the arm.

Figure 6: Zip Tying Cables to CMA



Complete CMA Installation and Cycle Server

After the bundles are attached to the cable management arm, bend the arm to ensure that there is no binding of the cables. If binding is seen, adjust the cables within the arm until the binding ceases. Attach the rear end of the CMA to its position on the rack support as indicated in the rack installation guide. Slide the server in and out of the rack. If binding is present, adjust the cables to alleviate the problem.

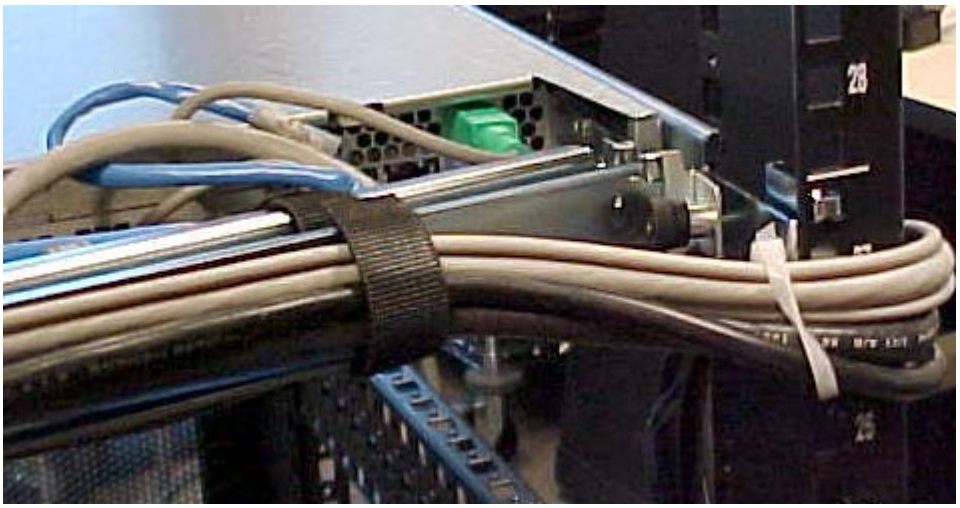
At this point in the cabling procedure, all of the server's cables should be neatly routed through the CMA. To lessen the cable volume on one side of the rack, you should divide the cables into two groups: power and signal.

Cable Division

All power cables should exit one side of the rack and all signal cables should exit the other side. This is not mandatory; however, it is a recommendation. For different racks, there are different locations to route the cables into the 0U space where the racks PDUs and switches are mounted. Routing locations for cables into the 0U space for the current three Dell racks are shown in Figure 7, Figure 8, and Figure 9.

Figure 7: Routing Location for Dell PowerEdge 4200 42U Rack

Figure 8: Routing Location for Dell PowerEdge 4210 42U Rack and PowerEdge 2400 24U Racks



Routing Cables to the Opposite side of the Rack

When routing cables to the side of the rack opposite from where the CMA is attached, the cable bundles must extend to the Electronic Industries Association (EIA) flange and then to the other side of the rack, attaching to the other EIA flange. Ensure that this cable bundle is tight and does not interfere with systems install above or below in the rack. This is shown in Figure 9. Figure 10 shows where the cables go when placed in the 0U space.

Figure 9: Cable Routing to the Other Side

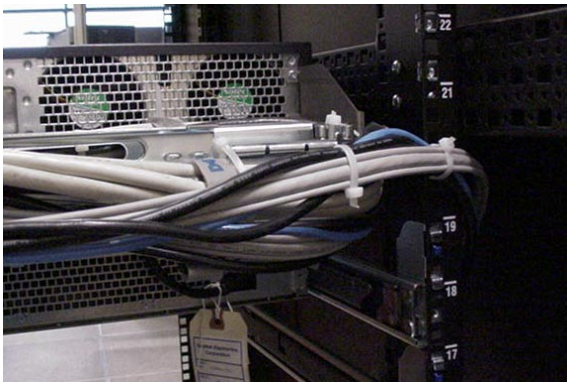
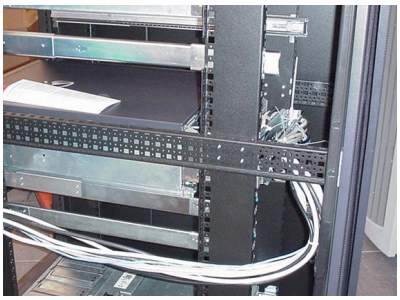


Figure 10: Routing Into the 0U Area



Issues with Server Cable Routing

With Dell's focus on targeting the Internet Service Provider (ISP) market segment, cable density per U has increased drastically. The cause of this increase in density is due to the smaller U envelope, or height, of the ISP products. The current ISP-targeted servers are the PowerEdge 2450 (2U), PowerApp 100 systems (1U) and the PowerEdge 1550 (1U). There is an inherent problem of cable routing with these units in a Dell 4200 rack because of the rack's limited depth.

PowerEdge 2450

Currently it is possible to route cables when installing a PowerEdge 2450. The cables are routed just above the slide as shown in Figure 11 and then into the 0U space.

Figure 11: PowerEdge 2450 Cabling to the 0U Space

PowerApp 100 Systems

On the PowerApp 100, cable routing can be somewhat difficult. When installing more than two PowerApp 100 systems, there is no place for the cables to get to the 0U space. In this situation the cables are routed in the space behind the server and against the side of the rear rail brackets, as shown in Figure 12. When space is available, route the cables into the 0U space. Ensure that power cables and signal cables are routed to opposite sides, as discussed above.

Figure 12: PowerApp 100 System Cabling to 0U Space

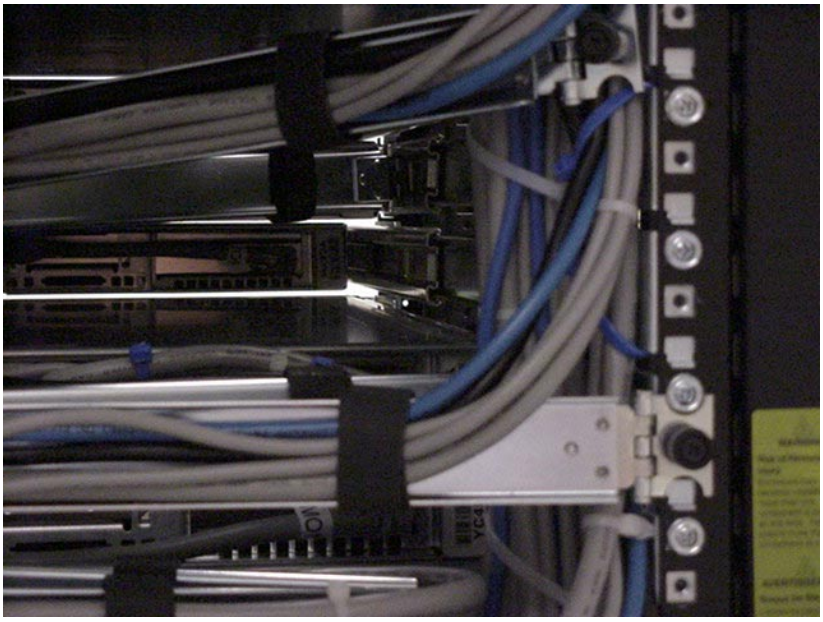
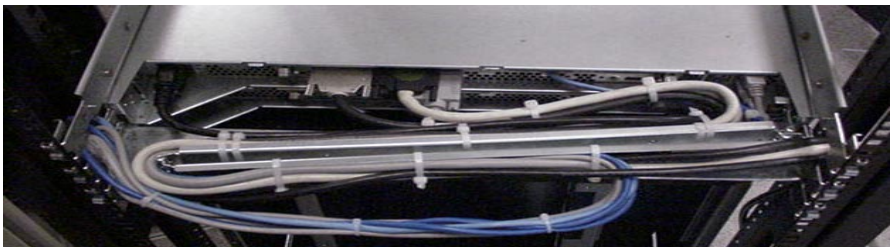


Figure 13: PowerApp 100 System Cabling to 0U Space Through Bracket Cutouts



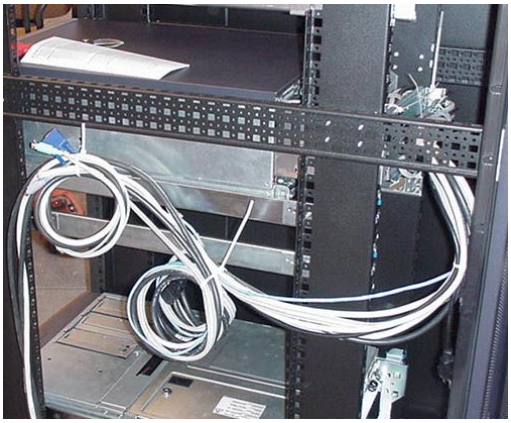
PowerEdge 1550

When installing multiple PowerEdge 1550 servers, Dell suggests installing the first server and fully routing the cables before installing the next PowerEdge 1550 above. Ensure that the power and signal cables are separated from each other. There are cutouts on the PowerEdge 1550 rail brackets provided for routing as shown in Figure 13.

Cabling Dell Storage Products

Storage products are typically easier to cable than servers because most storage products are not moved in and out of the rack. They are also significantly shorter in depth than the servers. However, as with servers, cable routing must be neat. Install all the storage products' cables, and identify which cables will and will not stay within the rack. Cables that are staying within the rack and will be attached to another Dell product should be neatly bundled, routed along the cable troughs of the rack, and then attached to the other product. If there is a surplus of cable, Dell suggests that the bundles be coiled up neatly and attached to the rack or to the storage product in a location that doesn't interfere with the operation of other products. Attach the coils of surplus cables as shown in Figure 14.

Figure 14: Surplus Cable Coils



Cabling KVM Switches and Routers

The following are sample KVM cabling configurations.

1U Configuration

For products that mount in the 1U configuration, Dell suggests that the product be mounted at the top of the rack allowing a 1U space above for cabling. Depending on what product is being used, this may not be necessary. If it is necessary, the cables will be routed along the side troughs of the rack and into the open 1U space above the product. The cables will then connect to their respective ports on the product. The cable bundles must be tied off to the EIA flange so that the weight of the cables does not cause the connectors to pull out of their ports.

0U Configuration

For products that mount in a 0U configuration, the cables from the product will already be routed into the 0U space. All that is required is to dress the

cable bundles, take up any surplus cable as described above, and secure the bundle to the rack to prevent cables from being disconnected.

PowerVault™ 35F and PowerVault 50F/51F Switches

Dell suggests that customers not use the cable management arms shipped by Dell for the PowerVault 35F or PowerVault 50F/51F switches. This is because the visibility of the operating lights on the switches is critical. All work on a switch is performed from the back of the rack. Thus, the switch is not pulled out towards the front like a server. Tie wraps can be used to secure switch cables directly to vertical rack posts.

NOTE: When replacing cables in a cabled system, it may be necessary to cut the zip ties to free the cable that needs replacing. Inspect all cables for accidental cuts prior to placing the equipment back into operation.

Locating and Cabling Dell PDUs

Each of the three current Dell racks support the use of Dell PDUs. Within each rack, there are different locations for this equipment. Each rack allows for the PDUs to be mounted in a 1U or 0U configuration. When there is space available, Dell always recommends using the 0U space before consuming the 1U space. Figure 15 through Figure 18 show the different locations for PDUs on the different racks.

PowerEdge 4200 42U

The 1U PDUs can be mounted on the vertical frame members as shown in Figure 15. They can also be mounted in the floor of the rack with the 2U PDU. This mounting configuration is shown in Figure 16.

PowerEdge 4210 42U

The 1U PDU can be mounted on the vertical frame members as well as the top, bottom, and middle system chassis as shown in Figure 16. The 2U PDU can be mounted only in a 2U configuration because there is no space in the floor of the rack. Figure 18 shows the various placements of the PDU(s).

PowerEdge 2400 24U

The 1U PDU can be mounted on the vertical frame members as shown in Figure 17. The 2U PDU can be mounted only in a 2U configuration.

Figure 15: PDUs in a PowerEdge 4200 42U Rack

Figure 16: PDUs in a PowerEdge 4210 42U Rack

Figure 17: PDUs in a PowerEdge 2400 24U Rack

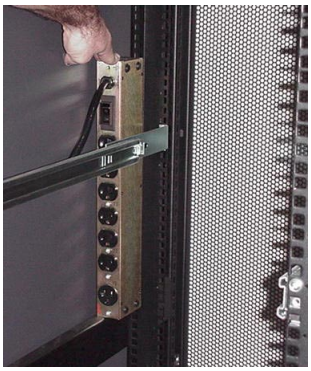
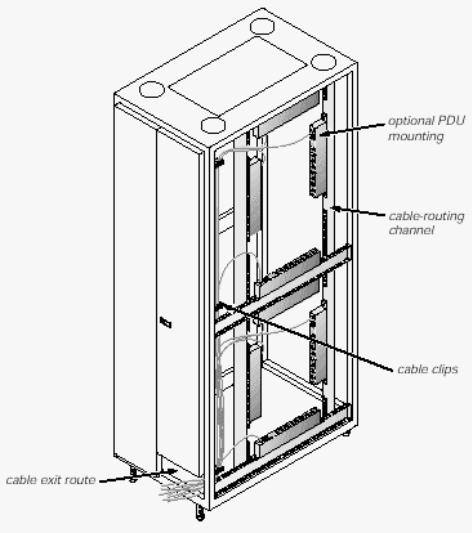
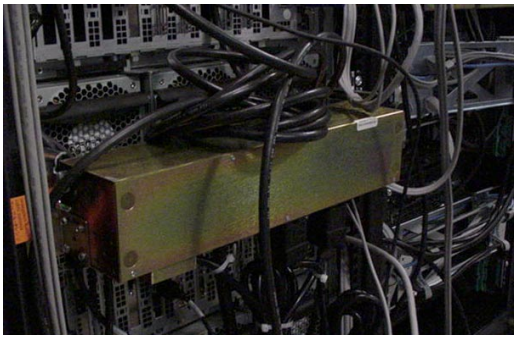


Figure 18: PDU Locations in a PowerEdge 4210 Rack



NOTE: The 2U PDU can be mounted behind some products that are shallow in depth. Installation personnel can install the PDU behind equipment where space is available as seen in Figure 19.

Figure 19: 2U PDU in the Rear of the Equipment



Cascading KVM Switches

As mentioned in *Cabling KVM Switches and Routers*, a KVM switch can be mounted in either a 0U or 1U configuration. These configurations will determine how cascading occurs. Cascading KVM switches is the procedure by which you control two or more switches by input from a single KVM. The switches are cascaded by connecting the KVM to the input port of the first switch, and then connecting last output port of the first switch and to the input port of the second switch.

0U Configuration

On the PowerEdge 4200 and PowerEdge 4210 racks, a maximum of four KVM switches can be mounted per side, two per vertical frame member. The order in which the switches are cascaded is not critical; however, the surplus cascading cable will need to be coiled and tied to maximize available space within the sidewalls of the rack. On the PowerEdge 2400 24U rack, a maximum of two switches can be mounted per side along the vertical frame members. When cascading switches in the 0U configuration of all current Dell racks, use the same techniques.

1U Configuration

When KVM switches are mounted in the U space of the rack, a maximum of 42 switches can be mounted in both of the Dell 42U racks, and 24 in the 24U rack. However, it is highly unlikely that this will ever be the case since it would be physically impossible provide enough space within the rack to accommodate that many cables. The process of cascading switches in the 1U configuration is very similar to that in the 0U configuration. The inputs and outputs are placed in the same locations; however, the KVM cables from the servers can be routed through the side walls of the rack, from rear to front, and then brought around to the front of the rack and plugged into the switches as discussed in the prior section *Cabling KVM Switches and Routers.*

NOTE: Dell suggests switches be mounted in a 0U configuration whenever there is 0U space available.

Miscellaneous Cabling Tips

The following are tips to help improve expedite the cabling process:

- Start by installing cables in the servers before attaching CMAs.
- Use zip ties to tie cables together.
- To reduce strain on connectors, use the server chassis, and rack frame or EIA flanges to attach cables.
- Cut all excess zip tie ends prior to completing the cabling process.
- Slide servers in and out of the rack to ensure that there is no interference between cables and other equipment mounted in the rack.
- Install PDUs and switches in the 0U space when available.
- Label all cables for easy identification.
- When routing cables, keep bundles clear of warning lamps on rear of chassis.
- When installing PowerEdge 1550 servers, install one at a time and fully cable it before installing the next.
- When installing the PowerEdge 4200 42U rack, route the PDU cables down the sides and through the floor of the rack.
- When using the PowerEdge 4210 rack, route the cables behind the rear EIA flanges and then into the 0U space.