Designing A Communications Cabling System for the Colocation Data Center

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It is often said that the communications cabling system is the conduit over which intelligent computing resources can share, process, store and distribute information. That being said, the communications cabling system runs 4th or 5th in the pecking order behind the architectural design, electrical engineer, mechanical engineer and the interest of the general contractor during the design and construction of a colocation data center. Our most important advice is to become very visible with your design concepts, specifications and drawings very early in the design process. Be pro-active. If you feel you need outside professional resources to assist you with the cabling design, specs and drawings, employ them early.

There are six major areas that need to be discussed as part of the communications cabling design. They are entrance facilities, MDF design, conceptual use of a "core" area for routers and primary cable distribution, the underfloor design and the IDFs. The final topic will be the design of a "super suite".

Entrance Facilities

Entrance facilities include the underground conduit delivery systems for the incoming fiber and copper services. Also included are the terminations of these cables onto racks and backboards in the MDF. Usually, the dominant local provider delivers the entrance copper but a typical colocation data center will have more than one fiber provider.

For entrance conduits, one highly overlooked fact in the rapid construction of a colocation data center is that you can build one quicker than it takes for the normal process of ordering and installing fiber entrance facilities from the carriers and having it installed. No joke here. We've actually seen the commencement of revenue in a major colo without one stand of fiber in the building. A slight bit of panic but we worked around it with the temporary use of copper T1s. To avoid this, we recommend the following:

1. Early in the design process and even before the design team assembles, determine the providers that will be supplying your fiber and copper entrance services. Identify the nearest locations from which the cables will be pulled to your site. Get to know the underground engineers for these firms, they are a great resource.
2. Work early on with the electrical engineer to design your conduit entrance system. You want your design finalized long before the trenches are dug. Dual conduit entrances are recommended. A dual entrance is not needed for copper but it is most common for fiber entrance services. Note that to be a recognized dual entrance, the conduit systems must be at least 50 feet apart.
3. Have all of the electrical requirements for all of your entrance providers ready. This includes provisions for DC power that may be required for entrance fiber racks.

4. Place your entrance vaults on your side of the property line. We recommend that you don't place them in the street or on the public side of the curb area. The primary reason for this is that if it's on your property, you control who and how the entrance cables come onto your property. If you permit the main entrance vaults to be placed in the public street or curb and one of the providers owns it, you lose control of the who and how. Further, the vendor who owns the vault may charge others to transit through it. All of this can be avoided by having your vaults on your property.
5. Carefully coordinate your design drawings with the electrical, water and other underground systems that will also be coming onto your property. The priority normally goes to the electrical and water pipes. Coordinate early to avoid excessive twists and turns in your conduits.

Also very early on, inform the design team and the general contractor that you must have access to the complete and finished entrance conduit system, MDF and the core 30-45 days before certificate of occupancy. Having such completeness in these areas early is a foreign concept to the general contractor, especially the level of completeness. You, as the building owner, must be able to get into these areas to be entirely ready for revenue commencement the day you accept the building. Note that most fiber and copper cable providers won't even consider entering your premises with cable until the conduit system is fully installed and the MDF is dust free (sanded and painted), secure and on stable power. This is often tough to do with the UPS not yet online and final commissioning of the UPS and generators systems still to come.

MDF

The MDF should be a room that is limited to the termination of all fiber and copper entrance facilities and the origination of all copper and fiber cables going to the core and the IDFs. This is room for the carriers. We recommend that routers, PBX and other IT-related systems be placed elsewhere (covered in this article).

We have three main design hints for this room. First, make sure it is large enough to hold your planned entrance facilities. Produce a CAD or Microsoft Visio drawing early to be sure. Don't forget the service clearance around electrical and HVAC systems and panels that will be in the room. Second, make sure the ceiling is high enough for the overhead cable tray or cable ladder system that will be employed. If you intend to use an overhead fiber tray system above the ladder rack, again, make sure the ceiling is high enough. Third, ensure that you have a substantial and correctly designed grounding system.

From the MDF, copper cables for voice, T1s and DS3 (coax cable) services should run directly to the IDFs. Fiber cables should run to the core.

The Core Concept

We recommend the use of a separate core area out on the floor of the colo to house the core routers and switches. This area is reserved for the IT professionals who maintain

these systems and those who perform the major cross-connects between the MDF and the core systems and switches as well as all cross-connects to the IDFs. Singlemode and multimode fiber cables arrive from the MDF. The same types of cables leave the core area and are routed to the IDFs.

The Underfloor

The most critical part of the underfloor design for the communications cabling system is the pathways for the cables and the underfloor cable tray. We strongly recommend the underfloor cable tray to route the cable. Further, we recommend that the underfloor cable tray be divided with a metal divider for fiber and copper cables. If done correctly, the fiber cables can be run without being enclosed in innerduct. EZ-Tray and Flex-Tray are examples of underfloor cable tray systems that we recommend. A rigid tray is not recommended.

Once the design is finalized, we recommend participating in the contractor coordination meeting where all systems under the floor are discussed. Normally, the electrical, mechanical, sprinkler, life safety meet to coordinate their underfloor drawings so that things don't bump into each other. You need to be there. As it is, you will have less priority than these other systems but at least you can achieve a very good final design. Miss this meeting and you'll end up with a design with more twists and turns than a roller coaster.

Design Hint: When finalizing your underfloor specifications, make sure you specify how the underfloor cable tray will transit over tight spots where it must cross water and/or electrical pipes and conduits. When crossing electrical conduits, we recommend requiring that a bridge be built to keep the cables at least 3"-4" away from the electrical conduits. Ideally, we recommend 6" but that is rarely possible. Avoid letting cables come in contact with the electrical conduits.

Design Hint: Avoid permitting communications cable to run close and parallel to electrical conduits for long distances.

The IDFs

Usually, multiple IDFs are required for a colocation data center. In designing the IDFs, we recommend the following:

1. Fiber cables come from the core area and not from the MDF. Fiber cables end at the IDF. Any requirement by the customer for fiber service is a cost to the customer to extend the fibers to the cage.
2. DS3 coax cable comes directly from the MDF to the IDF. These cables go no further until the customer requires DS3 service. At that time, it is usually a cost to the customer to extend to the cage.

3. Copper cables for T1 service come directly from the MDF to the IDF. T1 service is delivered to the customer cage via the copper cables that run from the IDF to the customer cages.
4. Local switches are installed in the IDFs. These switches are connected by fiber cables back to the core routers and switches.
5. The IDFs themselves are to be enclosed in their own cages and have controlled access.

The "Super Suite"

We suggest that you consider carefully the initial design of the customer cages. Early on in colocation design, rooms were filled with 5'x 10' rental areas (or areas of similar size). These areas were then enclosed in a cage structure. Each rental area had a certain amount of copper and fiber cable. All was very neat and organized. Then along came the customer that required 5, 10 and even 30 rental areas. The cage structures inside these larger boundaries were removed. Most of the communications cable went unused as the customer installed their own inter-rack cabling system. This became very expensive and the adaptation to a different method of building large rental areas was instant.

What quickly evolved was the "super suite". It could be a very large cage or it could be a separate walled room. It began as a large blank space reserved for customers with large space needs. No racks, no cages, no cable plant. Just electrical and HVAC and a few FM-200 tanks. The "super suite" worked so well, it became a marketing tool. The customer told us what was required and the space was custom designed. The customer felt special and a larger space was rented.

The super suite is a simple concept. Once the customer signs the contract and finalizes the design requirements with your qualified staff, the caged area with a complete rack and cabling system is usually installed in a very short period of time. This is our version of manufacturing's just in time system. For the larger rented spaces, this method saves time and money. And, it usually works better for the customer.

One final area that we must discuss is the aluminum relay racks that are normally called out in the communications cabling specification. In larger colocation data centers, this is the number one expense. Our last colo had 7,000+ racks, a huge expense. The rack of choice should be 8'0". An assembly of 8'0" racks provides the customer with a large amount of space into which equipment can be installed and makes the space more attractive. However, the problem that you will run into is supply. Every rack manufacturer will tell you not to worry about supply; they will make all of your tight schedules. Our direct experience with large colocation and traditional data centers is that the manufacturers ultimately fail to deliver. They want the sale. On very large projects, we have talked directly with the manufacturers and they have assured us with that we will receive the quantity of product we need when we need it. In all cases, they have failed to deliver on their promises and we constantly run short of product. Most distributors simply do not stock large quantities of 8'0" racks, 8'0" vertical wire managers and varying other components that we specify in high volume.

Our best advice is to select your communications cabling contractor early and place the orders for all materials. Do not permit the cabling contractor to delay the parts order. Most commonly, the cabling contractor will order product in stages so that components arrive shortly before installation. After 2-3 large orders and well into a tight installation schedule, you'll find that the supply dries up and you have to wait for manufacturing to produce the product. We suggest that you require the cabling contractor to order everything up front and have it delivered. You'll see very quickly how much of what you need goes onto the backorder list.

Finally, a key area for success is consistent onsite project management. Attend the weekly construction meetings and frequently observe the construction. Visit the site daily once the communications cabling begins. Resolve problems and deal with change orders promptly. For the data center and telecommunications design professional, the colocation data center is simply the most challenging and rewarding type of project in our industry.