Centralized Network Administration
The Network That Pays For Itself

Centralized Network Administration -- Controlling LAN Operating Costs

With the astronomical increase in use and dependence upon LANs, has come astronomical operating costs of administrating these LANs. Centralized networking using optical fiber offers the user the ability to contain and even reduce their operating costs by providing added flexibility, control and accessibility.

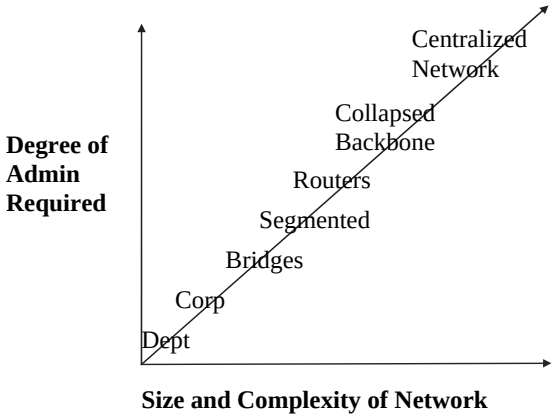
Centralized optical fiber cabling is a cost effective alternative to the optical horizontal cross-connect when deploying 62.5 µm optical fiber cable in the horizontal in support of centralized electronics and administration. While Category 5 UTP systems are limited to 100 meters total system length and require the use of distributed electronics placed in each closet, 62.5 µm optical fiber systems do not. Because of optical fiber's increased distance and bandwidth capabilities, 62.5µm optical fiber systems can technically support up to 2.5 Gbps over 300 meters. Therefore, 62.5 µm optical fiber systems do not require the use of electronics in closets on each floor and supports centralized cabling networks. Centralized network administration greatly simplifies the management of local area networks within the building, providing for more efficient use of ports on electronic hubs, and offering overall lower system cost. Centralized cabling provides direct connections from the work areas to the centralized cross-connect by allowing the use of pull-through cables, or a splice or interconnect in the telecommunications closet instead of a horizontal cross-connect.

TIA TR-41.8.1, the working subcommittee responsible for TIA/EIA-568-A Commercial Building Telecommunications Cabling Standard, approved in October 1995 TIA/EIA-TSB-72 "Centralized Optical Fiber Cabling Guidelines." This TSB (Telecommunications Systems Bulletin) provides guidelines and recommendations for the proper implementation of this modified cabling topology in support of in-building optical fiber cabling and fiber-to-the-desk. TSB-72 is a result of over a year of discussions within the Fiber Optic Task Group represented by manufacturers, consultants, and contractors and chaired by AMP.

This paper will provide an overview of the benefits and value of centralized networking and how it can reduce overall system cost. It provides guidance as to when a user should consider and select centralized networking based on specific requirements. It examines both the benefits and cost of the cabling plant and the electronic solutions under a number of situations. Lastly, it discusses some of the implementation guidelines for the physical plant to ensure the user has a cabling system that will provide long-term flexibility and usefulness.

LAN Evolution

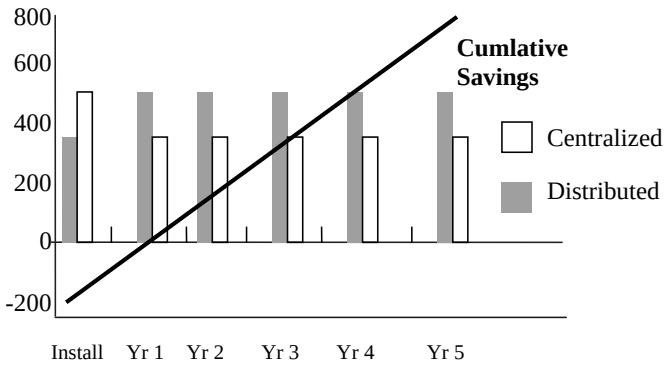
To get a better understanding of where LANs are going, let us first reflect on where LANs are at and how they got here. The LAN first was implemented to satisfy specific departmental requirements. Then it was expanded to include more and more users within the building. Initially, it was deployed with hubs in each telecommunications closet and because of limited traffic it had no bridges or routers, i.e., one big ethernet segment. However, as more and more users were added and their requirements increased the horizontal was segmented from the backbone by using simple bridges. This not last long and now each floor has to be segmented multiple times. FDDI or higher speed networks have been implemented for the backbone; and to manage the network properly the bridges are being replaced with routers. Because of the expense and capabilities of routers various manufacturers supported and many end-users elected to implement what is know as a "collapsed backbone" network. They moved their routers and bridges along with the servers to one centralized location. This was done not only to gain better control of the network but more specifically to contain the growing costs of managing LANs. However, "collapsed backbone" stops one step short of the ultimate solution for true flexibility, maintenance and administration. The concentrators or hubs along with horizontal connectivity are still distributed throughout the building's telecommunications closets. The user still has to go to the closet to make moves, adds or changes; not only to establish connectivity to the patch panel but often to put in new boards into the hubs or to change its configuration. Centralized networking delivers that ultimate flexibility and administrative solution by consolidating all LAN electronics within the building providing the lowest LAN operating costs.



So as LAN speeds continue to increase and corporations and institutions continue to depend more and more on LANs, they have started to invest in high performance optical fiber cables implementing data networks with centralized electronics versus distributed electronics in the building. Many of the fiber-to-the-desk users are electing to implement a centralized optical fiber cabling solution to gain better control and easier management of their data networks. They are experiencing increased efficiency in the utilization of their ports and slots on their hubs, concentrators or switches by using centralized electronics resulting in lower system costs. They also report easier implementation of special work group networks, especially when members of the work group are on different floors of the building, because all user connections are located at the centralized cross-connect. All of these benefits are possible because of optical fibers increased distance capabilities, increased bandwidth and lower attenuation.

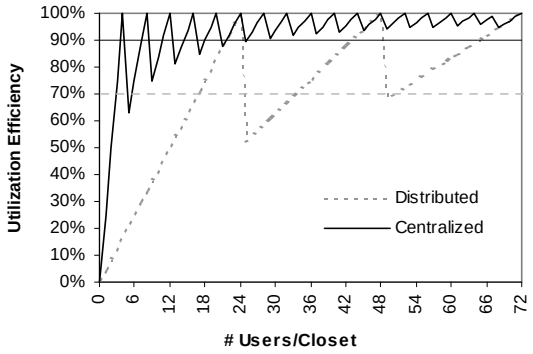
What are the Benefits?

First, let us put the various costs of LANs into proper perceptive. It is reported that the initial cost of a LAN is only 5 % cabling related and is only 12% hardware or electronics related. Even more revealing to the true cost of a LAN, reported on by Forrester Research in two separate reports, is the annual cost per individual user for LAN support and outages. Forrester Research states that the average corporation spends $280 annual per user for physical LAN support, $110 per user for bridge/router support and that the average corporation loses $160 because of outages per user. This $550 annual cost exceeds the total install cost of the cabling and electronics based on ethernet pricing. So it is quite obvious that initial first time cost of the cabling and electronics is only a small portion of the network cost and that operating and life-time costs are the significant factors.



Users are recognizing that operating and life-time costs are significant and offer the greatest potential for reducing overall-cost. For this reason many are electing to install fiber-to-the-desk and centralized cabling. While most are aware of the significant technical benefits of fiber and its ability to deliver highly reliable networks even at gigabit per second rate speeds, many have not analyzed the cost savings that can be achieved by the elimination of most of the cable related outages and the efficiency in LAN support that can be achieved with centralized networks. By using very conservative numbers that 15% of the network problems are cable related and fiber solves 80% of them and that a mere 25% efficiency can be gained in LAN support with centralized administration, then a centralized network using optical fiber would have a total annual cost of $375 versus today's $550 or annual savings of $175 per user. Just as installation costs vary from project to project, the operating and outage costs also vary. Each user should determine both his present and projected costs and determine the savings that centralized optical cabling can provide him, to do less is foolish.

Another benefit to centralized networking is increased efficiency on port and chassis utilization on the hubs, concentrators and switches. Because all LAN communication devices are located in one central equipment room, the user is able to reduce the number of ports and chassis throughout his network. The actual amount of efficiency will greatly depend on number of users per closets, the number of closets, and the port size of the electronics being utilized. As an example let us assume a building with six telecommunications closets with 72 users per closet for distributed electronics or the same building with 432 users per the centralized closet. Strictly based on mathematical probabilities, if the user was to use a 24 port hub, such as an ethernet stackable hub, the distributed electronics would provide a mean probability of 70% utilization. However, the centralized electronics would provide a mean probability of 90% utilization, or an 20% increase in utilization. Considering a $150 per user port that equates to $30.00 per user savings.



Looking at the same building except now based on a 48 user chassis with 4 user port cards, such as with FDDI electronics. The distributed solution has a mean probability of 93% utilization versus 98% for the centralized solution for the cards. However, the more important savings occur with chassis utilization in that distributed electronics has only a 55% mean utilization whereas centralized electronics has a 85% utilization or a 30% gain in efficiency. Considering $150 per user for an FDDI equipped chassis and $675 per user for the card, the total saving equates to $65 per user.

The above example is based on a typical office building in which centralized electronics provides excellent savings based on port and hub utilization. However certain other building requirements provide even greater savings. The rule of thumb is as the number of closets increases and the number of users per telecommunication closets decreases, more savings will be realized from port and hub utilization. These types of conditions are commonly experienced in factories, hospitals, schools, dormitories, and libraries to mention a few. Additionally, centralized networking provides the same increased port and hub efficiencies to corporations or institutions that have multiple data network technology requirements, such as ethernet, token ring, FDDI, ATM and others, even if they have a relatively high concentration of users per closet. Users should not only consider this benefit based on initial requirements that may only involve one data network technology but more importantly their migration to higher speed technologies that will cause them to operate multiple networks in the future.

A benefit of Centralized Network Administration is the ease and cost effectiveness of being able to establish special work group networks at a moment's notice. Today, very often small work groups are formed between individuals who often are not served by the same telecommunication closets and for one reason or another they need a dedicated network to perform their task. Because all the users horizontal cables terminate in the centralized closet, it is very easy to bring in the required electronics to provide connectivity to this work group. This task is often impossible or extremely difficult with a distributed network.

The last benefit involves the telecommunications closet. A great number of projects involve recabling existing buildings in which telecommunications closets do not exist or are not suitable to house distributed electronics. Often for a number of reasons, telecommunications closets can not be built or it is cost prohibitive, therefore centralized networking provides them a solution. These types of situations are very common in schools, dormitories, factories, and many old or historical buildings. Even if you have existing closets often significant savings are possible because you do not have to outfit the closets with UPS and separate HVAC.

Who Should Consider Centralized Network Administration?

Centralized network administration is a growing implementation for fiber-to-the-desk users allowing them to exploit the potential of optical fiber by providing cost and administrative savings. With proper planning and implementation the user is ensured a network that will remain flexible and manageable and come to realize that "fiber is to high speed data as copper is to voice."

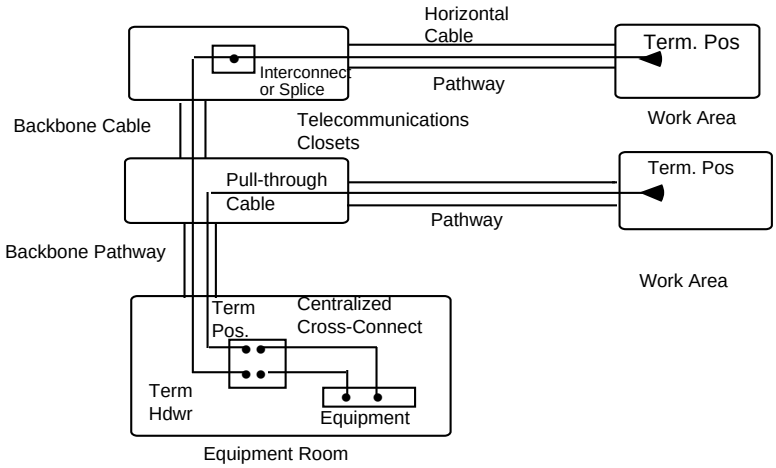
While centralized optical fiber cabling is not for everyone it should be considered by the vast majority of end-users. The driving reason for deploying centralized optical fiber cabling is the desire to experience the benefits of centralized electronics and networking. Typically, the user that will elect to deploy centralized electronics is the user that wants to gain control of the corporate network, to decrease the overall operating cost of maintaining that network and to have the ultimate flexibility of providing networking solutions to the individual users. Often this Chief Information Officer has control and responsibility for the operation of all the servers within the network versus the individual departments of the corporation or institution. Potentially, all the bridges and routers within the building have already been centralized for ease of administration and control. The centralization of data electronics, such as hubs, concentrators or switches, is just a natural progression and extension for that user who has or desires to maintain control of the network.

Secondly, the building should be a single-tenant building preferably owned or under a long term lease by the building occupant. The decision to deploy centralized electronics is much more convincing for the single-tenant owner. However, entrepreneur building owners or third-party network providers who elect not only to provide their clients cabling but also networking solutions may very well elect to install centralized networks allowing them also to experience the benefits and operating cost savings of centralized networking.

Lastly, centralized optical fiber cabling provides the greatest benefits to those corporations or institutions that have or will have multiple data network technology requirements, such as ethernet, token ring, FDDI, ATM and others, or who have a small density of users per telecommunications closets.

What is Centralized Optical Fiber Cabling?

Centralized optical fiber cabling is designed as a cost effective alternative to the optical horizontal cross-connect when deploying 62.5 µm optical fiber cable in the horizontal in support of centralized electronics and management. Centralized cabling, as depicted below, provides direct connections from the work areas to the centralized cross-connect by allowing the use of pull-through cables, or a splice or interconnect in the telecommunications closet instead of a horizontal cross-connect. Centralized optical fiber cabling is not intended to replace or supersede the requirements for the horizontal cross-connect within ANSI/TIA/EIA-568-A but merely to offer a more cost-effective option for those users desiring to employ centralized electronics.



One should view centralized optical fiber cabling as fibers equivalent to the traditional 110 punch down blocks for voice networks. Just like with voice a user is not best served by modular patch panels for his voice (centralized electronics) network, the user desiring to deploy centralized data electronics is not best served by a horizontal cross-connect equipped with optical fiber connectors.

Centralized cabling implementations shall be contained within a single building. The administration of moves and changes shall be performed at the centralized cross-connect. The administration of adding and removing horizontal links should be performed at the telecommunications closet. TSB-72 "Centralized Optical Fiber Cabling Guideline" provides guidance on the proper implementation of this network, to include distance limitations, migration path planning, management, and optical fiber cable sizing. A number of the requirements deal with how to properly plan the centralized cabling network to ensure the ability to migrate to a horizontal cross-connect in the future, if required. Requirements and functionality of the connecting hardware, along with proper installation practices and testing procedures are provided. These guidelines plus the benefits and selection of the various options, pull-through, interconnect and splice, available when implementing a centralized network follow along with guidance on the proper sizing (fiber count) of the intrabuilding backbone.

What are pull-through cables?

Pull-through cables are continuous sheath horizontal cables, the traditional 2 or 4 fiber cable, which are pull-through the telecommunication closet, i.e., not cut, from the outlet to the centralized cross-connect. TSB-72 states that the pull-through cables shall not be greater than 90 meters (295 ft) long. Pull-through cables are typically used in smaller building, such as a 2 or 3 story office building. Why limit pull-through cables to 90 meters? While there are a number of reasons the most valid is for ease of installation. At some increased distance the installation would become too difficult and it would be better to install a high-fiber count backbone and splice on the horizontal cables. Additionally, by using high-fiber count backbone cables the riser shaft pathways are better utilized, especially in high rise buildings.

Are there any other distance recommendations?

The TSB recommends that the total passive link (horizontal and backbone) shall not exceed 300 meters (985 feet). The base for this recommendation is future-proofing the infrastructure. Presently, the draft ATM specification for 622 Mbps ATM specifies a minimum operating distance of 300 meters over standard grade 62.5 µm fiber using a new technology transceiver the VCSEL (Vertical Cavity Surface Emitting Lasers). This new, low cost technology holds promise to provide extremely high bandwidth over multimode fiber Additionally, it is technically possible to support up to 2.5 Gbps ATM on 62.5 µm fiber for 300 meters. By limiting the distance to 300 meters we are providing the best guidance possible to ensure a user will not have to go back to distributed electronics because of bandwidth requirements.

Splice or Interconnect?

Typically, the splice will be the most cost-effective solution of the two and will require less space in the closet. The interconnect will allow some increased flexibility for the end-user, specifically those who feel more comfortable with connectors. Remember that the centralized cross-connect is intended to be the location where all moves and changes are administered. Only adding or deleting horizontal and/or backbone links would occur in the telecommunications closet.

How does this relate to Open Office (Zone) Cabling?

Centralized optical fiber cabling can be implemented with zone cabling just as it with traditional single-user cabling and receives the same benefits of centralized networking. The primary difference is that the horizontal distribution cable is typically a 12 to 24 fiber count cable versus the normal 2 or 4 fiber count cable in single-user cabling. If using the splice or interconnect option the backbone cable remains the same and the multi-user cable is simply spliced or connected to the backbone cable. For ease of administration the connecting or splice hardware in the telecommunications closet and the connecting hardware in the centralized closet should allow for organization and administration of the fibers per multi-user cable.

What are the requirements for the connecting/splice hardware in the TC?

Listed below are the requirements of the connecting hardware used to join the horizontal cables to the intrabuilding backbone cables in a centralized cabling network as stated in TSB-72. They specifically deal with ensuring that the connecting or splice hardware provides the capabilities to properly administer this location by allowing for fiber identification and the ability to add or delete fiber circuits. Additionally, the hardware must have provision to migrate to a horizontal cross-connect in the future, if required. As you can tell the typical outside plant splice closures, that most people associate with splicing, will not meet these requirements and would not be considered acceptable.

Provide a means of joining the fibers from the backbone and horizontal cables by either using splices or re-mateable connectors. It is recommended that only one method be used at a facility.

Provide joining technology that allows fiber circuits to be joined as single fibers or as fiber pairs, but organizes and manages the fiber circuits by fiber pairs.

Provide a means to identify the connected fiber circuits. As a minimum the connecting hardware shall provide the ability to uniquely identify each joining position.

Allow for both removal of existing horizontal connections, and the addition of new horizontal connections.

Provide a means to store and identify non-connected fibers either from the backbone or the horizontal cables.

Provide a means for growth from the addition of backbone and/or horizontal cables.

Provide a means for migration from a splice or interconnect to a horizontal cross-connect.

Provide a means of access to test optical fiber cabling from the connecting hardware.

What about backbone cable sizing?

The intrabuilding backbone subsystem should be designed with sufficient spare capacity to permit additional horizontal circuits to be routed to the centralized cross-connect without the need to pull additional intrabuilding backbone cables. The intrabuilding backbone fiber count should be sized to deliver present and future applications to the maximum work area density within the area served by the TC. Generally two fibers are required for each application delivered to a work area.

The most straight forward situation is a building in which the horizontal work area is fully cabled with two fibers per user and the building is close to 100% occupancy upon move-in. In this situation the number of fibers in the backbone cable equals the number of fibers in the horizontal for that closet.

Sometimes users decide to install four fibers to each outlet because of concern that some users may have two separate data network requirements. Unless the majority of the users are expected to have two applications the number of fibers in the backbone does not have to equate to the number of fibers in the horizontal. For example, a closet serves 100 users and it is believed that no more than 25% of the users at any one time would require two applications. In this situation the backbone cable(s) should have a total of 250 fibers or 125 drops.

Lastly while a user may elect to completely cable the horizontal before move-in, they may initially and for the future have a low occupancy rate. In this situation the required number of fibers in the backbone may be based upon the initial occupancy rate. Of course this approach is best implemented when the portions of the floor that will be occupied can be accurately identified.

What administration requirements are stated?

Comment [AMP1]:

The design shall support the labeling requirements of TIA/EIA-606. In addition, TC splice and interconnect hardware shall be labeled with unique identifiers on each termination position. Field color coding is not used at the splice or interconnect. The centralized cross-connect termination positions connected to TOs shall be labeled as a blue field.

The centralized cabling shall be implemented to ensure the correct fiber polarity as specified in 12.7.1 of ANSI/TIA/EIA-568A, i.e., A-B orientation at the telecommunications outlet and B-A orientation at the centralized cross-connect.

Summary

As LAN speeds increase and users invest in high performance optical fiber cables, many users are implementing data networks with centralized electronics versus distributed electronics in the building. Many of the fiber-to-the-desk users are electing to implement a centralized optical fiber network solution to gain better control and easier management of their data networks. They are experiencing increased efficiency in the utilization of their ports and slots on their hubs, concentrators or switches by using centralized electronics resulting in lower system costs. They also report easier implementation of special work group networks, especially when members of the work group are on different floors of the building, because all user connections are located at the centralized cross-connect. All of these benefits are possible because of optical fibers increased distance capabilities, increased bandwidth and lower attenuation.

Centralized optical fiber networking, cabling and electronics, offers excellent management and administration capabilities to the end-user, resulting in lower operating cost and overall lowest life-time cost. To support centralized networking, TIA has approved TIA/EIA TSB-72 “Centralized Optical Fiber Cabling Guidelines." Centralized optical fiber cabling is a cost effective alternative to the optical horizontal cross-connect when deploying 62.5 µm optical fiber cable in the horizontal in support of centralized electronics and management. By following these guidelines not only will a highly reliable data network be established but also who that can be easy managed and administered to the required level.