## How to Design a Highly Reliable Fiber Optic Network

What happens if a major fiber optic cable is cut or a major hubbing location is destroyed in a fiber network? Will the whole system be brought down?

That is the subject of this article: the survivability of a well designed fiber network.

Modern fiber optic transmission systems have provided tremendous capacity for voice, video and data traffic. At the same time, the fiber network needs to be designed to take the full advantage of this economies of scale while minimizes maintenance cost.

The main design goal is to utilize cost-effective interoffice (facilities between buildings) to maximize the number of circuits remaining intact after a worst-case failure while minimizing the ongoing maintenance cost associated with this survivability.

Conventional (existing) network architecture and design methods as well as future technologies can both be used to achieve this goal to some different degrees.

**The principles in designing a survivable fiber network**

Put simply, the basic principle behind the design of efficient fiber networks is "demand aggregation". Demand aggregation makes use of facility hubbing and facility hierarchies to optimize facility networks.

**What is facility hubbing?**

Facility hubbing depends on the fact that fiber optic equipment occupies the majority cost in a fiber network. A fiber optic network's total cost is not very sensitive to the network's distance. In the mean time, fiber's capacity is too much for building to building data traffic. As a result, it is conclude that routing traffic from each building into a building selected as its "hub" is the most efficient network design.

In this way, traffic is aggregated into the largest possible bundle to take advantage of economies of scale of fiber technology.

At the hub, all traffic is sorted and properly assigned to get to its destination. Digital Cross-Connect (DCS) is used at the hub to rearrange lower rate traffic into higher rate traffic. Thus all traffic is concentrated into high capacity routes to a central location where the demands are sorted according to destination.

**What is facility hierarchy?**

Facilty hierarchy is the extension of facility hubbing. The concept of facility hubbing is brought a step further.

In this concept, buildings are grouped into "clusters", with each cluster having one hub building. This approach considers such factors as community of interest and geographic area.

The clusters can then be regrouped into "sectors", with each sector having a "gateway". The gateway is actually a hub building designated to handle inter-cluster traffic demand. A gateway can then aggregate demand from several cluster hubs to form a large demand to be routed to another gateway in much the same way as demand is aggregated to a hub building.

Actually the concept of facility hierarchy can be extended to an arbitrary number of levels.

**Conclusion**

Current fiber optic technology trends have forced a radical change in the structure of networks and the way in which networks are designed. The large capacity of fiber optic systems have resulted in efficient networks having large aggregations of demand in a few facilites.

Properly designed network architecture can increase network cost slightly but increase network survivability greatly.

## About the Author

Colin Yao is an expert on fiber optic communication technologies and products. Learn about break out kits, breakout kits, fiber optic breakout on Fiber

Optics For Sale Co. web site.

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