Modern Local Network Structures

based on Intelligent Integration of Fiber Optic and Copper

Dipl.-Ing. Thomas Kwaterski

Marketing Director, MICROSENS

The Internet boom of recent years, the deployment of applications with ever-increasing demand for bandwidth, and the development of new services, have all caused a rapid evolution of telecommunications technology. Due to the increased bandwidth in local networks, the demand placed on backbones has also increased. Differentiation between the classic structures of local (LAN) and wide area networks (WAN) has become less distinct.

Observing the vitality of this development one quickly realises that a future-proof approach needs to be found for the planning of local network structures with special consideration for the scalability and upgrade capabilities of the networks.

Due to the current rate of innovation a network could become obsolete within two to three years. Hardware upgrades of active network components to the next level of technical development can usually be implemented with little effort. Higher packaging and integration density enable hardware manufacturers to produce more cost-effective components.

However, the passive wiring of a building depends on quite different innovation cycles. Here, contrary to active technology, a rapid changeover during system operation is not feasible. This means that a much longer period of time has to be considered for passive wiring at the planning stage, with the aim of achieving a life span of 10 to 15 years. The efficiency of a LAN network must be assured for a long time after its installation. This is particularly true for passive wiring technologies.

Fiber Optic as a Building´s Infrastructure

Fiber optic is the only medium ideally suited for the above requirements. One of the most important features of fiber optic is its high bandwidth in combination with long transmission distances. There are no significant limits with regard to

distance, and modern solutions using multimode fibers even enable Gigabit Ethernet transmissions up to more than 2 kilometres. Problem areas such as sensitivity to electromagnetic interference, signal emission interference, potential differences, and grounding faults, simply do not exist.

In particular, these fiber optic features cannot be matched by any other technology in dealing with the rapidly increasing capacity demands of modern data networks. In a world of changing technologies the installation of an end-to-end fiber optic network means long-term protection of investment for the operator.

However, complete migration of legacy networks to fiber optic in the real world is rather unrealistic, and in most cases hardly sensible. Very few users intend to abolish their existing copper-based hardware components such as central switches, PC network cards, and print servers. Only new installations provide the welcome opportunity to implement a complete future-proof approach. However, such an approach need not mean fiber optic and nothing but fiber optic – everywhere and at any price. Although the medium of fiber optic is steadily approaching the office environment, the equipping of all active network users with fiber optic ports would weigh heavily on the budget.

In view of this, the **intelligent combination of twisted pair and fiber optic wiring** would be the best solution. Cost-effective and future-proof investments can be achieved by means of a number of auxiliary components such as media converters and workgroup solutions, with fiber optic uplink.

Wiring Solutions

The "classically" structured wiring in accordance with EN 50173 provides for a hierarchically structured wiring tree, branching out from the primary backbone area via the secondary distribution area, through to the tertiary user ports. Fiber optic would only be used for backbone and distribution areas. The tertiary area would be implemented exclusively with copper technology.

One of the disadvantages of such a structure is its limited flexibility with regard to transition to new technologies, and the high demand from sub-distributions equipped with active components. The use of copper cables also limits the capacity of these connections.

This combination – which has been obsolete for a long time – was once created by the "copper lobby" itself. The use of optical wave-guides was mainly caused by the need to overcome the limited transmission distances over copper lines. One could call this "an afterthought caused by necessity".

Only the evolution of backbones, and in particular the rapid spread of Gigabit Ethernet technology, significantly changed the role of fiber optic. New technologies for optical components have contributed greatly to this development. Surface-emitting lasers, so-called VCSEL (Vertical Cavity Surface Emitting Laser) diodes with their advantages such as high light transmission performance, with modularity up to the gigabit range, in combination with low manufacturing costs, make the operation of multimode fiber optic with a wavelength of 850nm very attractive.

Fiber to the Office

The classic concept is confronted by a modern approach utilising the technical superiority of fiber optic. With the concept of "Fiber to the Desk" or "Fiber to the Office", fiber optic is wired end-to-end from the central building distributor right through to the end users. This is possible without intermediate distribution frames due to the characteristics of fiber optic. This means that the entire network consists of a single star design downstream from the distributor. As there is no backbone as such, but rather a backbone concentrated on one central point, this design is called "collapsed backbone" (Illustration 1).

This approach provides significant cost benefits, as the active intermediate distribution frames are eliminated, and investment, installation, and maintenance costs are reduced. As active intermediate distributors are not required on every workgroup hub/switch with four copper ports and one fiber optic connection would reduce the number of fiber optic cables required from four to one. In addition, the number of optical ports

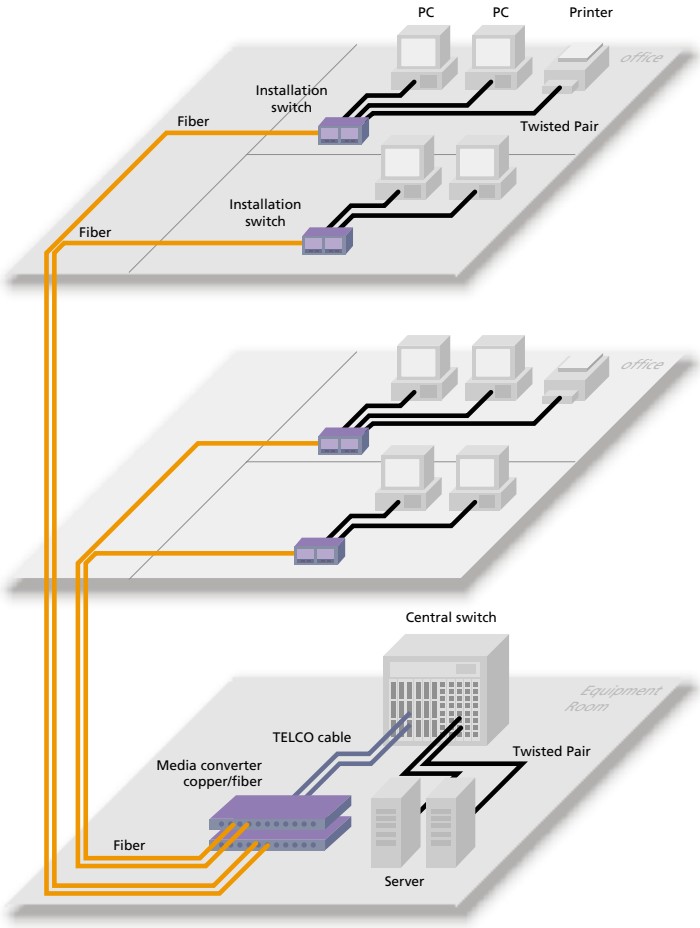

Illustration 1: Collapsed Backbone Structure

required at the central building distributor is reduced by the same factor, because the highest costs of an installation based on fiber optic are caused by the central switch with fiber optic connections.

The use of mini switches on the office level, with autonegotiation function on the copper side, offers the advantage that both 10Mbit and 100Mbit devices can be connected. Existing equipment in the end terminal area, print servers or older processors with 10Mbit/s for example, can still be used. A collision-free full duplex fiber optic link to the central switch, with a bandwidth of up to 200Mbit/s, provides sufficient performance for the work place.

Illustration 2: Office switch with fiber optic-uplink for direct installation

The "Fiber to the Office" concept, which has been popular for many years, has been experiencing a new boost with the introduction of the workgroup switching technology. The first promoters of this concept some six or seven years ago, albeit for shared 10Mbit/s Ethernet technology, were the public and the finance sectors. One of the largest projects in this area is Project Bavaria, providing more than 20,000 hub systems with fiber optic uplinks for the Bavarian Inland Revenue. Almost 70 % of all components required were supplied by MICROSENS.

This concept is now no longer limited to large projects. Smaller investments for corporate networks with around 50 users also implement the FTTO approach, with costs comparable to Cat.5 wiring. Several manufacturers have already developed suitable solutions for this specialised market – a market that, however, is dominated exclusively by German manufacturers.

Although the FTTO concept can also be realised with low-cost desktop switches and external network adapters, professional wiring concepts demand integration in standard-compliant installation systems (cable trunks and under floor systems).

However, not all workgroup switches are the same. Most manufacturers in the Far East focus on quantity and absolute cost savings, without much consideration for quality and reliability.

MICROSENS has been a leading supplier of FTTO solutions for many years, offering an unparalleled choice of active network components for integration in under floor systems and cable trunks.

One of the most recent solutions, shown for the first time at this year's CeBIT, is the optional Management Functionality. For the first time, all workgroup switches within the network can be

monitored from one central location. The operator can access status information via any standard browser without the need for special management software. In addition to general information on operational availability, item and serial numbers, as well as MAC and TCP/IP addresses, the status information of individual ports – active or idle, working with 10, 20, 100 or 200Mbit/s – are also displayed.

The management function integrated into the installation switch not only provides status information, but also enables adequate port configuration. This means that for the first time the complete network structure can be displayed within the network management system.

Media Conversion

The central side must provide an adequate number of active fiber optic ports. Multiport media converters are important tools in this context. These converters have emerged from a niche technology to become central components in modern wiring concepts. Media converters enable simple, flexible, and economic migration to future-proof fiber optic networks. Existing copper-based switches can continue to be used in the network design.

For new investments, the motivation for the deployment of multiport media converters is based on economic considerations caused by significant price differences between switched copper and fiber optic ports. Many manufacturers still charge high prices for the extra costs of central switched fiber optic ports. The leading manufacturers in particular charge highly differentiated prices for fiber optic and copper ports. This can be remedied by using external multiport media converters for 19-inch rack installation. In general, media converter technology is a sensible solution for reasons of economy, flexibility, and visibility, and has been very popular in practical deployment.

In many cases, optimum exploitation of the port density of central switching components can only be achieved by means of bundle connectors. These so-called TELCO cables connect 12 twisted pair ports via one plug connector for equally flexible and simple installation. Although the introduction of miniaturised fiber optic plug connectors (SFF – Small Form Factor) has increased the available port density of central components, TELCO bundle plugs still achieve the highest density. Today's multiport converter versions (figure 3) provide the opportunity to convert up to 24 ports on one height unit.

Figure 3: Multiport Media Converter for 19"-rack installation

The latest generation of multiport media converters enables integration into existing management systems (SNMP), optional connection of a redundant power supply, and automatic crossing of copper port pinout (AutoCrossing).

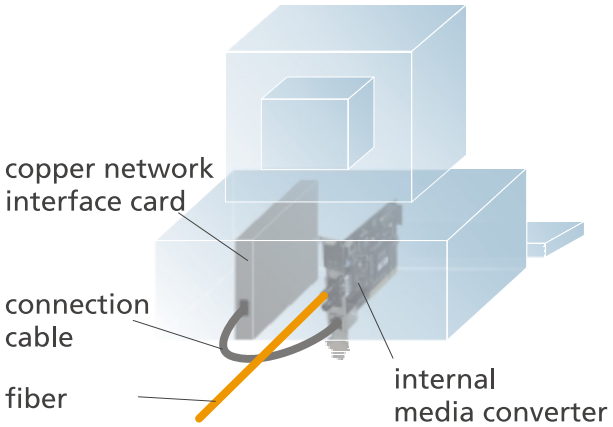

Illustration 4: PC-integrated Media Converter

Conclusion

The requirements for modern building wiring with regard to performance and future investment security have been increasing steadily. The medium of fiber optics, only used on the backbone level to date, is penetrating modern network structures and moving closer and closer to the user. The latest developments of active network components enable the smooth migration of copper-based network structures, as well as completely new designs of future-proof local fiber optic networks.

An intelligent combination of fiber optic and conventional copper technologies enables the installation of high-performance networks with significant cost benefits. Buzzwords such as "collapsed backbone" are synonymous with new concepts of structured building wiring as the basis for a more cost-effective installation of fiber optic networks, in comparison with the classical copper-based networks – even today.

Further informations you´ll will find under:
www.microsens.com

MICROSENS GmbH & Co. KG
Kueferstr. 16
59067 Hamm / Germany
Tel. +49 (0) 2381 / 9452-0
Fax +49 (0) 2381 / 9452-100