



NEW SOLUTIONS FOR 10 GIGABIT/S HIGHSPEED-LANS

10 Gigabit Ethernet (IEEE802.3 CSMA/CD) was standardized two years ago and represents the fastest network application available so far. At the same time, the first multimode optical fibres designed for such an extreme data throughput were launched. However, development continues to go on and once again it proves true that every two years there is a redoubling in capacity on the IT sector.

Optical fibres within LAN: Basics

From today's point of view, 10GbE is a long-distance technology mainly of interest to carriers. Well defined solutions already exist for this application. Certainly, the long-distance technology can also cover short LAN distances. The IEEE802.3ae standard soon showed that a cost-efficient solution for short LAN distances is required to make 10GbE a success. Especially with short LAN distances, multimode fibre solutions offer substantial cost advantages. Recent surveys of typical LAN installations in Europe and North America showed that 85% of premises backbones are within a 300 metres distance.

For obvious reasons, LAN carriers are mainly interested in using their legacy installations for future applications. In this respect, however, there are only limited possibilities due to physical reasons. 10GbE puts high requirements

on all network components concerned. According to IEEE802.3, existing multimode fibres are expected to cover distances of up to 300 metres (PMD 10GBASE-LX4 1310nm WDM LAN).

In order to reach the magic limit of 300 metres also at 850 nm where low-cost VCSELs are being used, extremely high requirements had to be met as to the performance of the multimode fibres. Whereas the existing 850 nm applications were supposed to cover a distance of 86 metres at a maximum, the task was to specify a new multimode fibre matching this performance level.

Optical fibre data networks: Status quo

Compared to the single-mode fibre, the fibre core of the technically more complex multimode fibre is 7times bigger which makes its application much easier. Thus, already at 1300 nm and the more so at 850 nm a huge number of „light rays“disperse within the core. It is optimized for this; however, the optimization is subject to process-related limits which result in a decline of its optical performance data compared to the single-mode fibre. For short distances of up to 2000 m it is an alternative to the single-mode fibre regarding technical aspects and an even better choice when considering costs.

New applications also imply new requirements. The new criterion of the new multimode fibre is the DMD (Differential Mode Delay). It describes

Ethernet applications at 850 nm

	OM3+ MaxCap 550 50 µm 10G / 550m	OM3 MaxCap 300 50 µm 10G / 300m	OM2 Standard 50 µm 500 / 500 MHz.km	OM1 Standard 62.5 µm 200 / 500 MHz.km
10Gb/s Serial / Laser (10GBASE-SR)	550 m	300 m	86 m	33 m
1Gb/s Serial / Laser (1000BASE-SX)	1100 m	900 m	550 m	275 m

Table 1: Ethernet applications and potential data link lengths with *MaxCap* Multimode

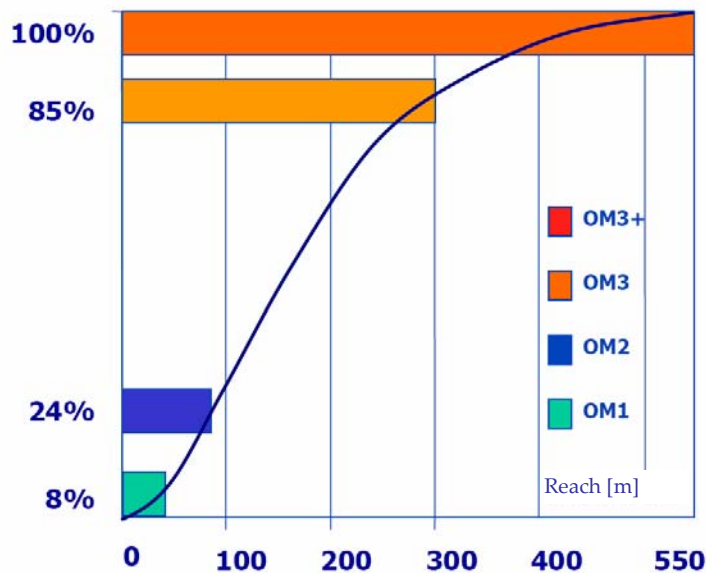
the propagation delay of the "light rays" within the fibre and thus the mode structure of the multimode fibre much more precisely than the generally determined modal bandwidth of the previous multimode fibre. This is of major importance, when the launch is effected by Laser instead of LED. The requirements of this DMD are very high. For the whole distance of 300 metres a propagation delay of only 100ps is allowed.

Although 10GBASE-SR 850nm serial LAN meant to enter new technical grounds concerning optical fibres, this "new fibre" is already found in the standard ISO/IEC 11801 (9/2002) being important for LAN installations. Under the name OM3, an optical multimode fibre is defined which is supposed to ensure an effective modal bandwidth of 2000MHz*km under laser launch.

But it is technically possible to improve the transmission by reducing the propagation delay within the fibre causing the dispersion.

The solution: MaxCap550

Under the name MaxCap550, Draka Comteq just introduced an improved multimode fibre optimized for 10GbE-laser launch at 850 nm for 550 metres applications. This fibre is the Number One among the 850 nm laser-optimized multimode fibres worldwide. MaxCap550 is a graded-index fibre with a 50µm core and 125µm cladding diameter, as specified in IEC 60793-12-10 as A1a.2 fibre. Insofar it is compatible to all existing applications and connection systems within today's LAN. For overfilled launch, this fibre is designed for a modal bandwidth of 3500 MHz*km (!). Its outstanding transmission features are due to the highly accurate and refraction index profile as is exclusively guaranteed by the PCVD process as practised by Draka. Table 1 shows the link distance achievable with MaxCap compared to the OM1 and OM2 standard fibres. The following chart demonstrates the coverage of the distances typical in LAN.



Problems in practice

The standard ISO/IEC 11801 is based on a fibre-optic building backbone of max. 500 metres. This distance sets the benchmark. In the past two years, however, time and again users felt it to be problematic that the distance of 500 metres for fibre-optic backbones as aimed at in the cabling standard could not continuously be covered by multimode fibres, although this distance is an absolutely realistic one in practice.

The limit of 300 metres certainly has not been set arbitrarily but reflected the state-of-the-art technology at that time.

A migration strategy can be directly derived from the distances shown. The migration of the high-speed components (switches etc.) as typical in LAN equally concerns the infrastructure. Whereas today 100 Mbit/s are sufficient on the floor, 1 Gbit/s will become standard in future. Where you have 1 Gbit/s in a building now, the next step will be 10Gbase-SR. The new MaxCap550 provides the basis for a future-proof infrastructure to users of series UC2000 fibre-optic cables.