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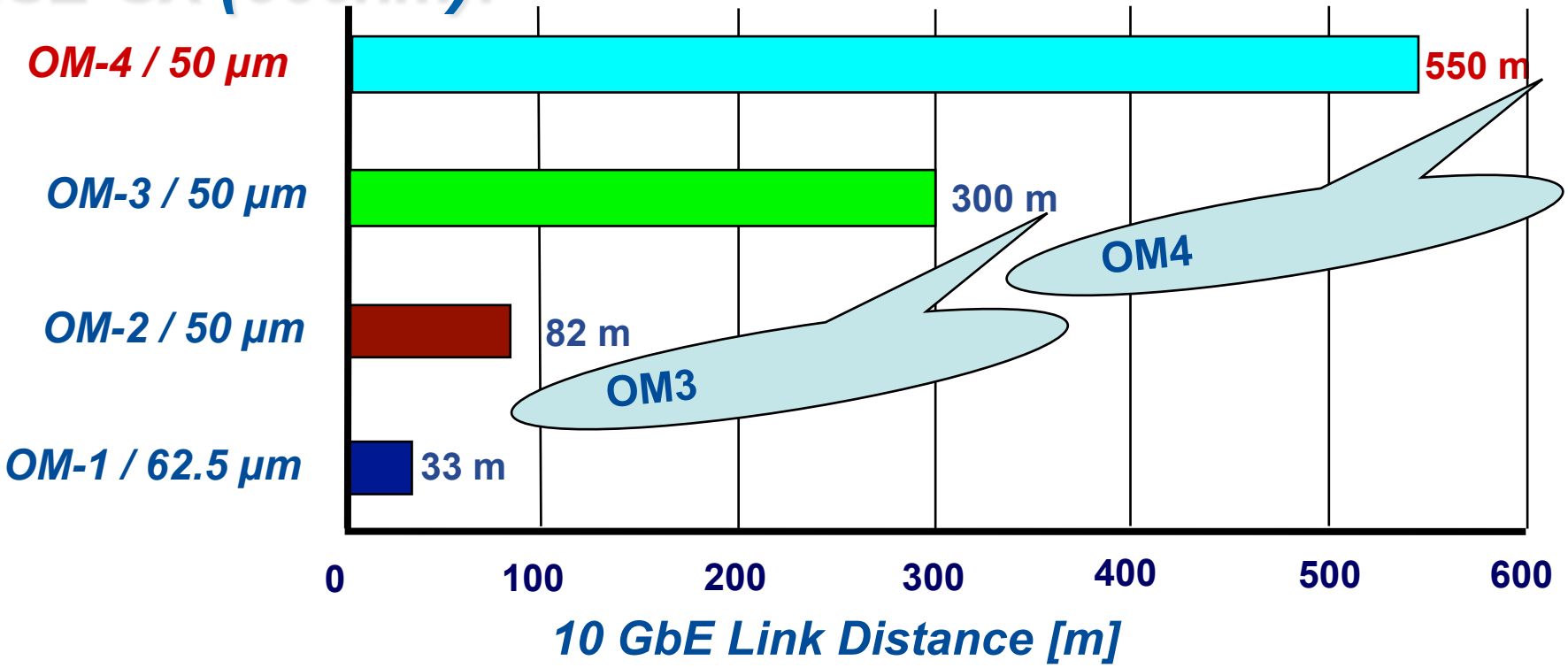
Agenda

MMF OM4

Multimode fibre solutions in IEEE 802.3 10GBASE-SX (850nm):



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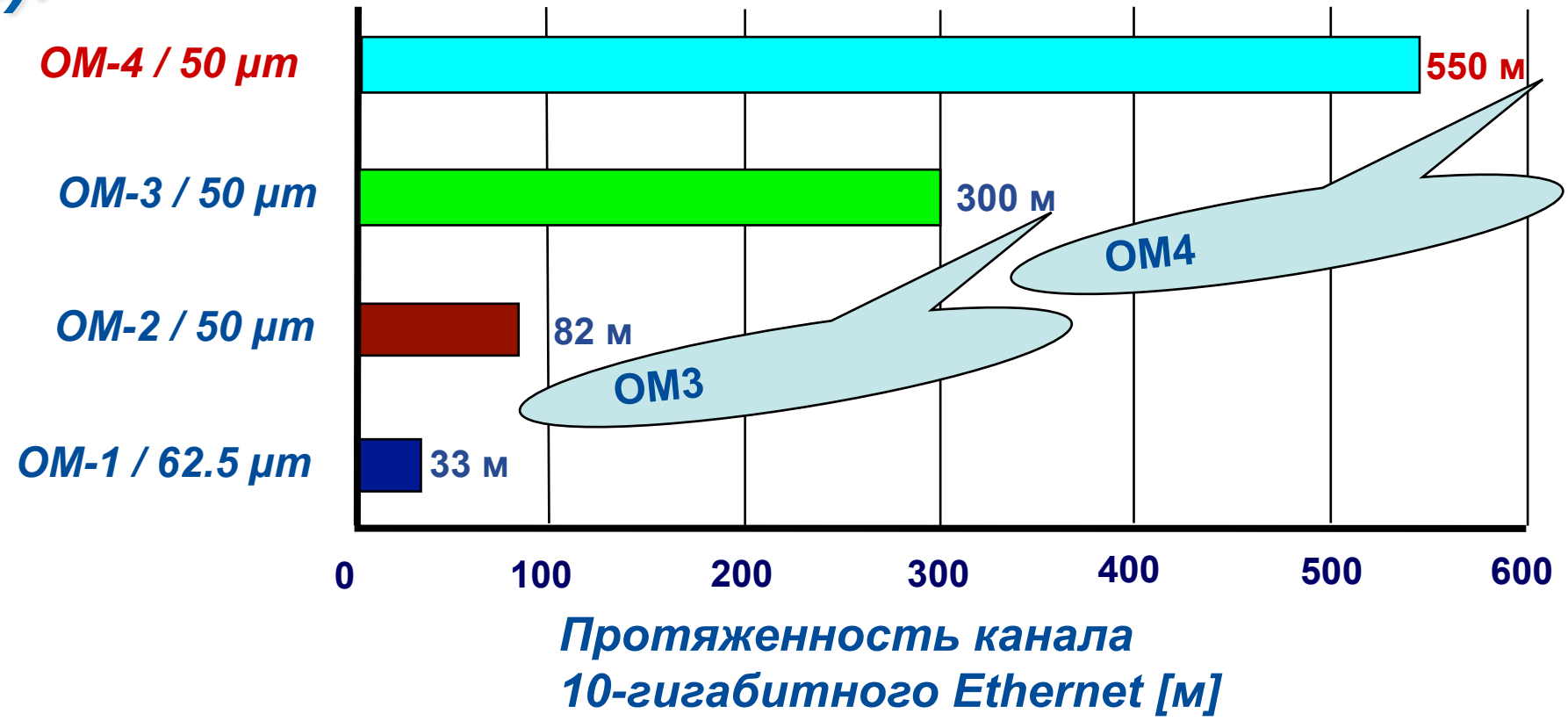
MaxCap550

Решения по многомодовому волокну, предусмотренные в IEEE 802.3 10GBASE-SX (850нм):



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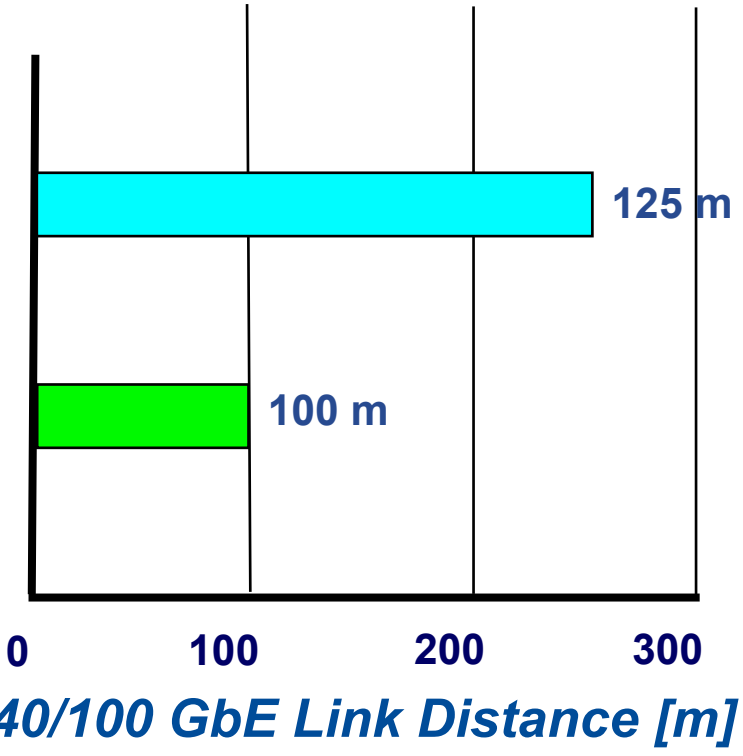
OM3 / OM4 in 40/100 GbE

Multimode fibre solutions in IEEE 802.3ba 40GBASE and 100GBASE:

Extended reach in discussion: OM-4 / (850 nm)

Agreed: OM-3 / (850 nm)



In 40/100 GBASE more relaxed transceivers are used with wider spectral width ➔ shorter distances

Datacom/LAN Market Outlook

-**Migration to high bit rates (10-100 Gigabit Base Ethernet) forces high grade MMF.**

-**Therefore the demand of high grade MMF is strongly increasing.**

-High grade MMF is available only by the big 5 players, essential is a very high **Effective Modal Bandwidth (EMB)** and a very tight **Dipersion Mode Delay (DMD).**

- Draka is market leader in this field

High quality testing OM4 MaxCap550

All MaxCap300 (OM3) and MaxCap550 (OM4) fiber are checked under the best practice known, including:

Many precautions & tight internal specifications applied to DMD test benches

All OM3 and OM4 fiber fulfill both DMD and EMBc specs

Ti:Sapp laser DMD testing for MaxCap550 fiber

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MaxCap

Tightened inner DMD mask

All Draka OM3 and OM4 products are characterised by tightened inner DMD mask:

0 – 18 um

instead of 5 – 18 um (TIA / IEC)

➔ ***Reduced Low Order DMD***

➔***Improved system margin for center-launch lasers***

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Actual OM4 specs

EMBc > 4700 MHz.km (plus DMD specs)

OFL BW850nm > 3500 MHz.km

OFL BW1300nm > 500 MHz.km

Note: VAD is not appropriate for MMF production

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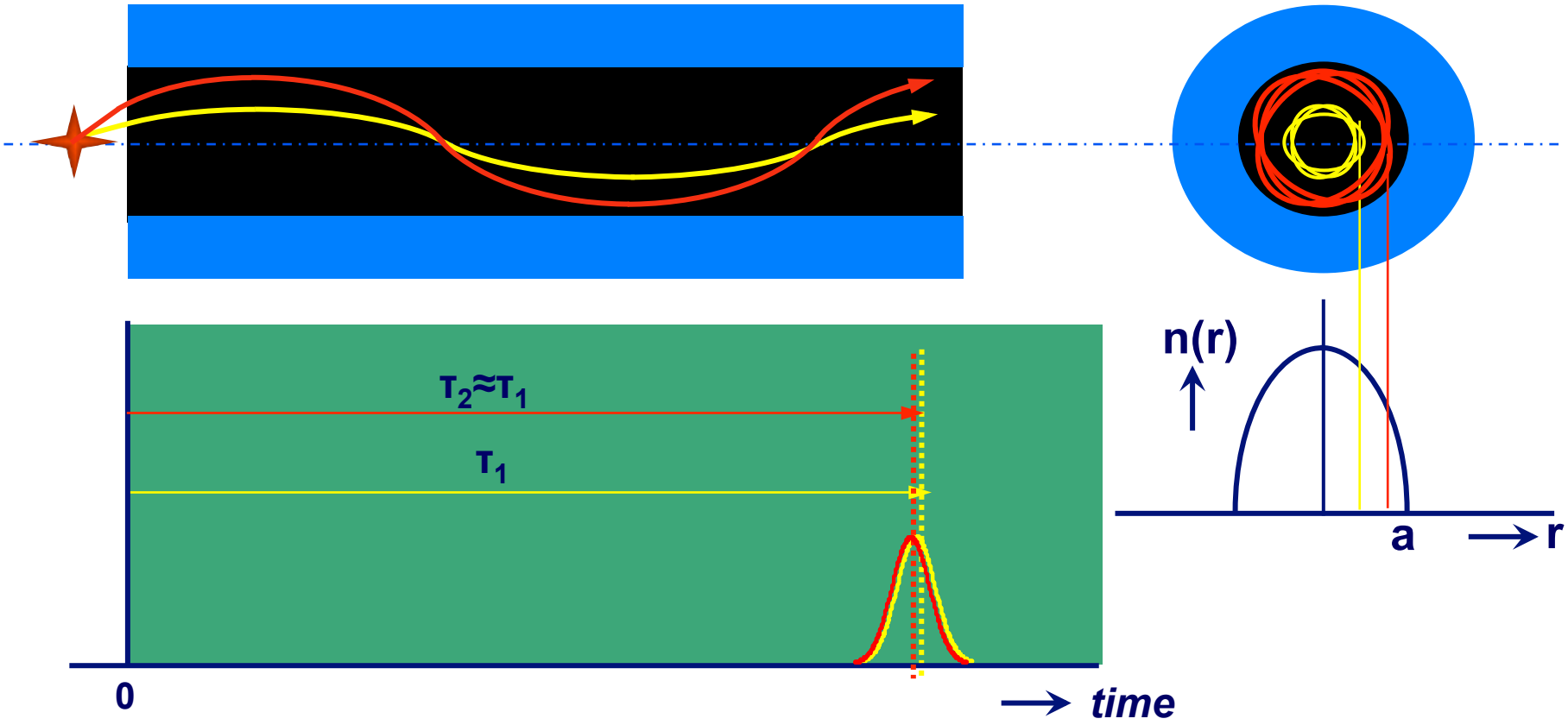
Optimize the refractive index



Reduce Differential Mode Delay (DMD)

➔ Increase bandwidth

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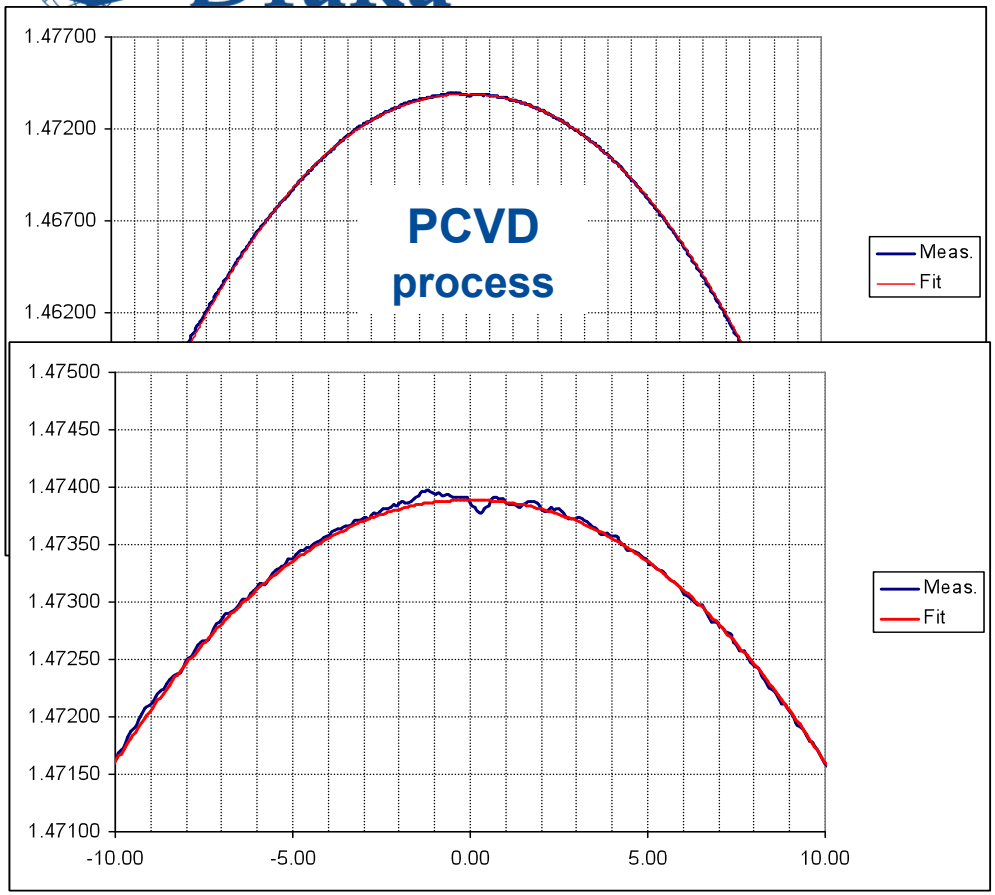
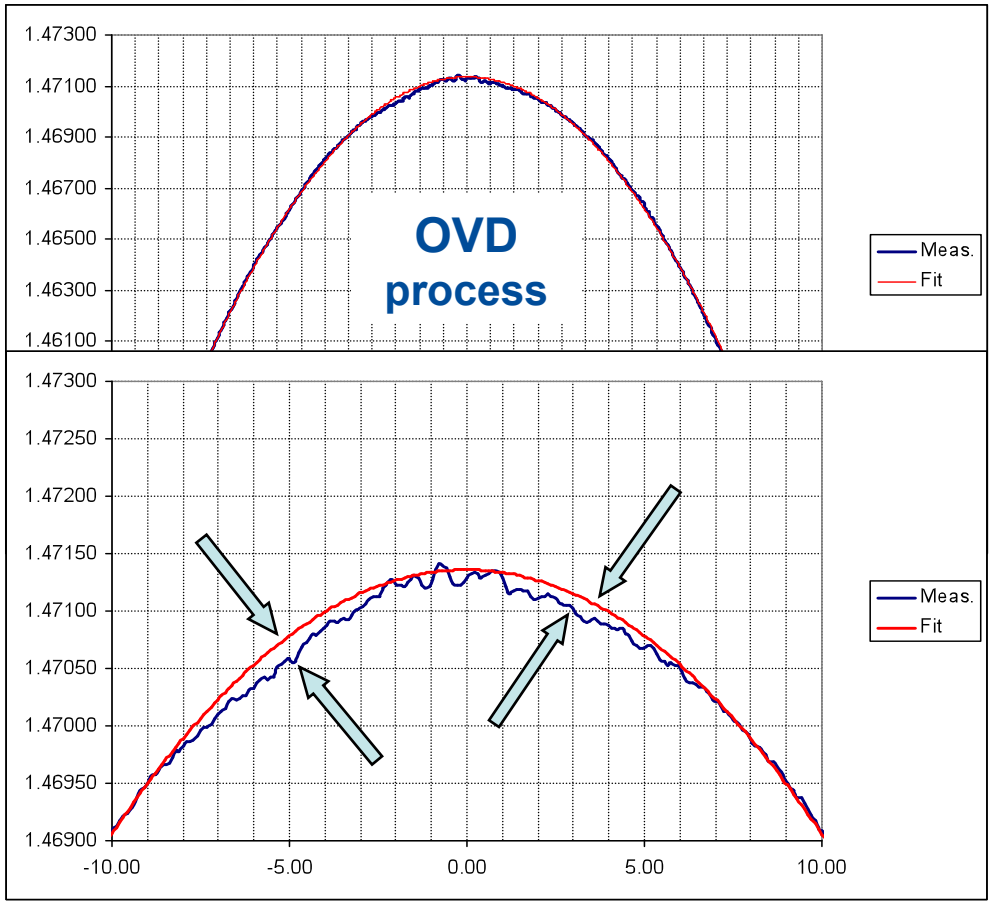
Collapsing Process





PCVD process shows excellent core refractive index profiles

OVD process shows systematic core refractive index profile distortions near core center due to consolidation of soot preform

This profile distortion is not visible as sharp center dip, but more as an extended profile deviation, causing larger DMD (double pulses) and lower bandwidth

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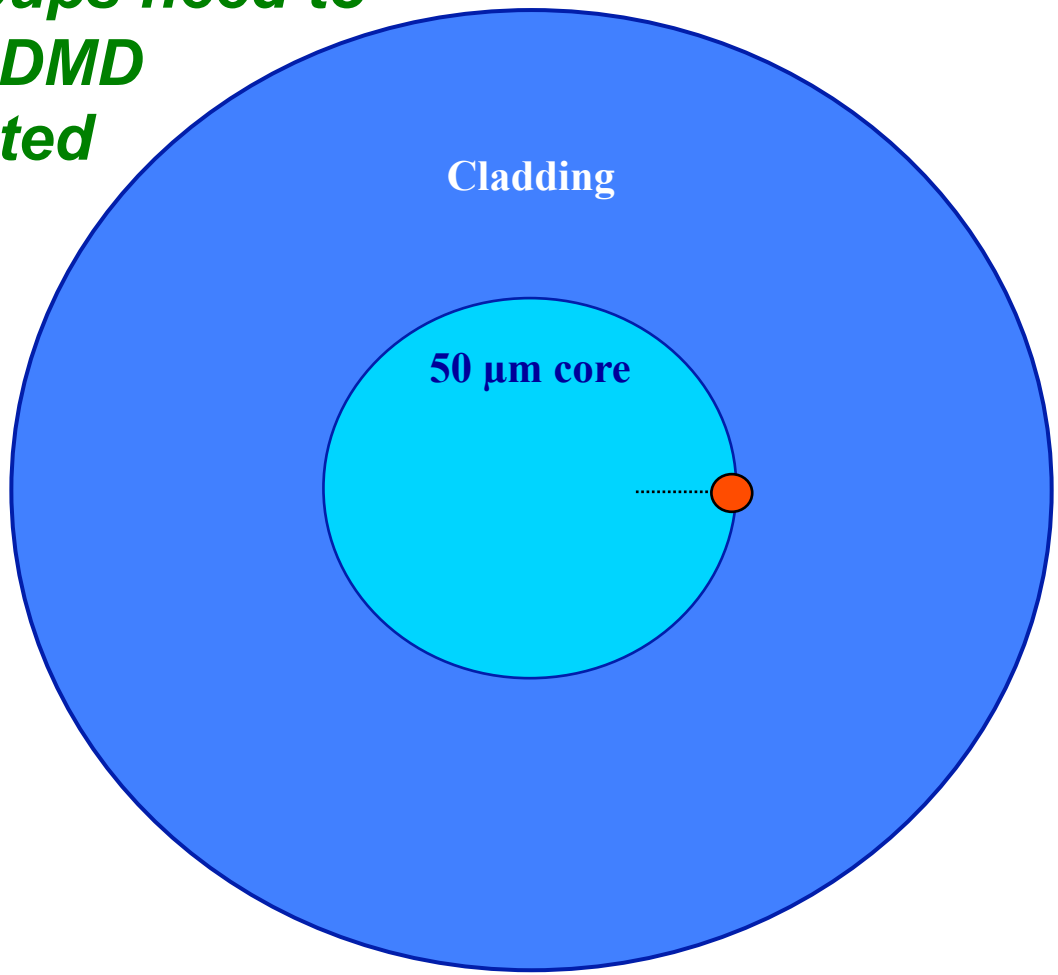
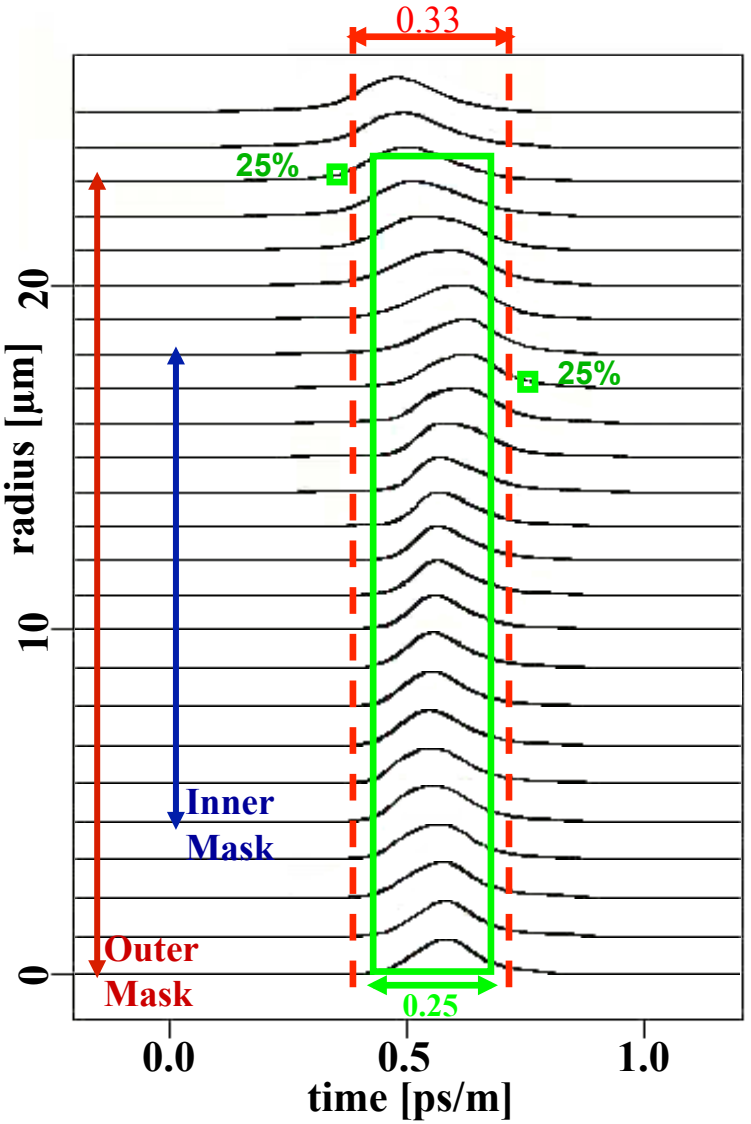
Diff. Mode Delay testing

850 nm

For 10 GbE individual mode groups need to be DMD tested



= Measurement laser spot



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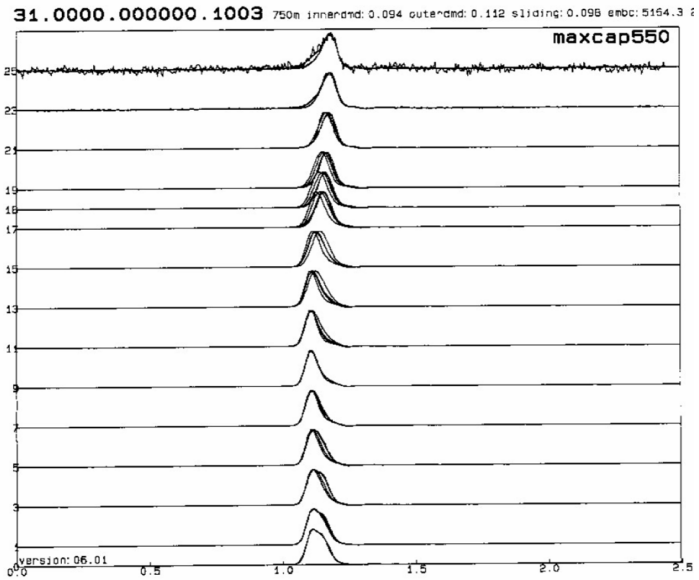
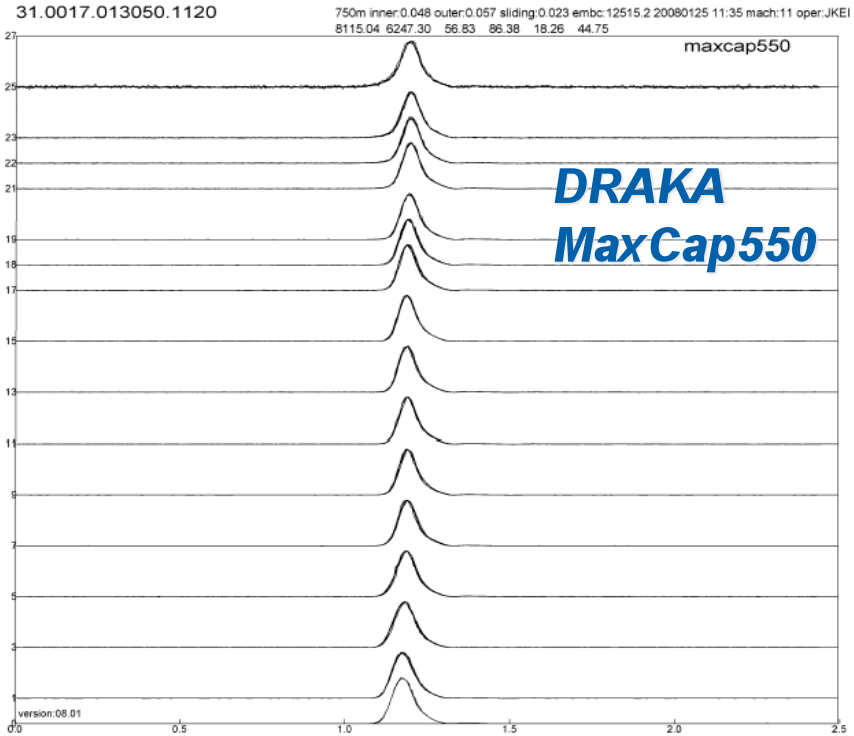
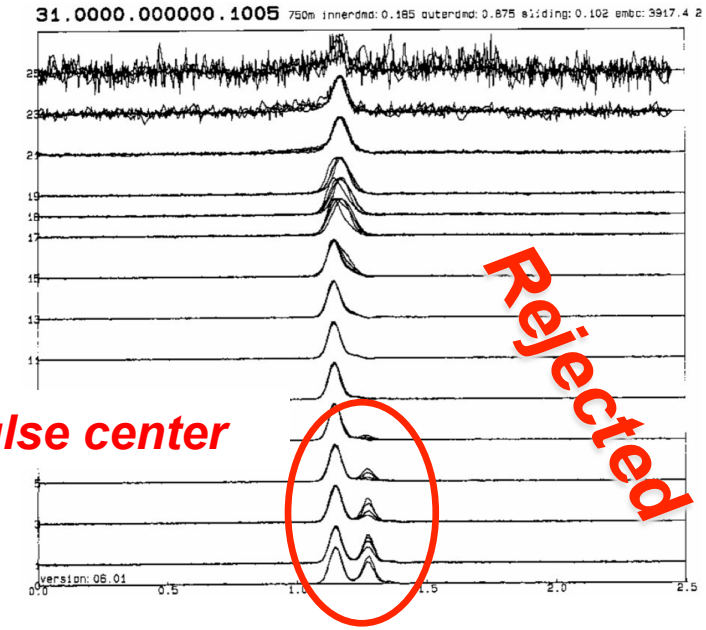
Competition
DMD testing



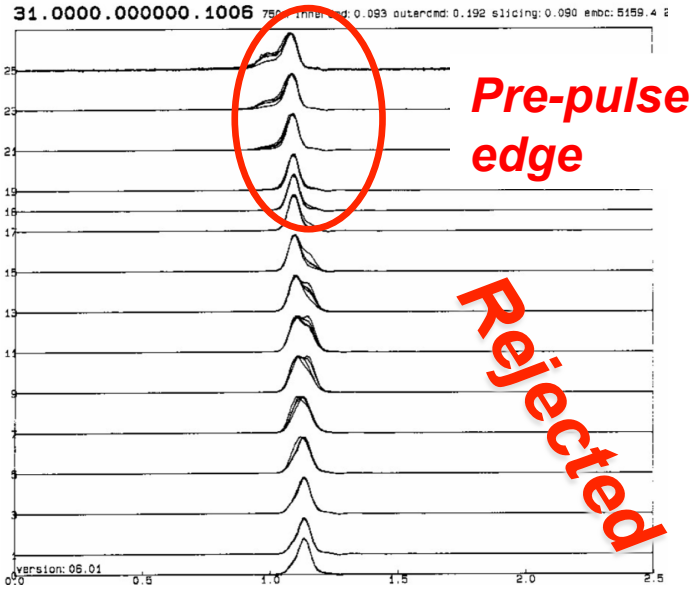


DRAKA MaxCap550



Pre-pulse center

Rejected



Pre-pulse core-edge

Rejected

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Agenda

MMF BIF

MaxCap-BB-OM3/4
Macrobending specification

Macrobending specification of regular 50µm multimode fibers is still based on very old applications:

100 turns R = 37.5mm ➔ ≤ 0.5 dB (850nm + 1300nm)

MaxCap-BB-OM3 / OM4 macrobending specification is defined on much smaller bend radii, as can be found in practical Datacenter and LAN environment:

Macrobend loss: 2 turns	850nm	1300nm
R = 7.5mm	≤ 0.2 dB	≤ 0.5 dB
R = 15mm	≤ 0.1 dB	≤ 0.3 dB

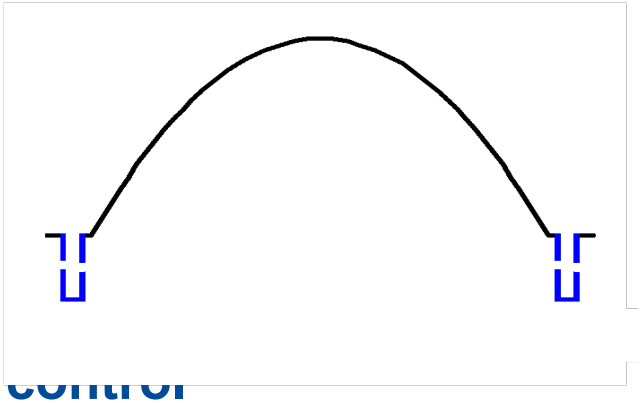
Note: MaxCap-BB-OM3 / OM4 offers lower bend loss than regular MaxCap fibers and up to 10 times lower bend loss than regular 50µm MMF: ITU-T Rec. G.651.1 (MMF: 2007) states:

2 turns R=15mm ➔ ≤ 1 dB (850nm + 1300nm)

MaxCap-BB-OM3/4
Introduction

Draka combined 2009 MaxCap and BendBright technology, bringing Bend-Insensitivity to the multimode fiber world !!!

➔ **MaxCap-BB-OM3 / OM4: combining high bandwidth with low bend loss**



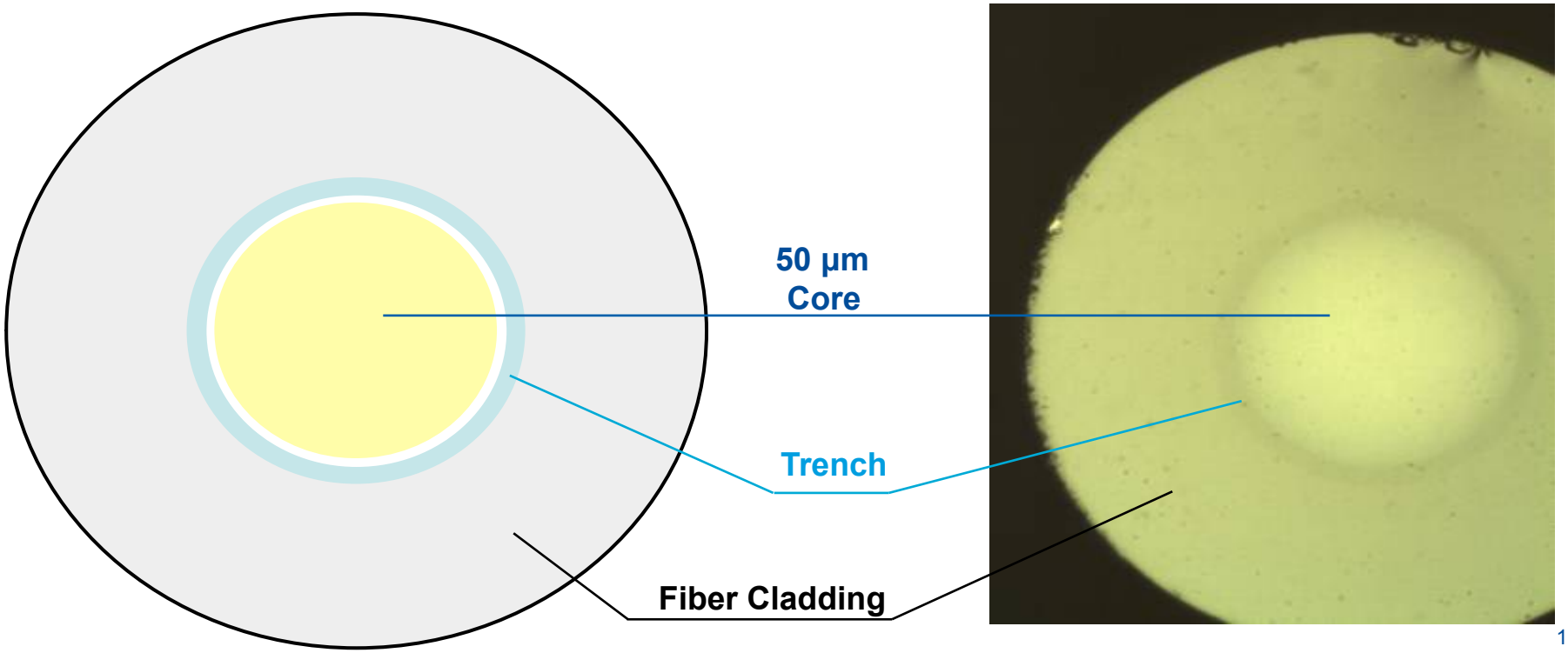
➔ ➔ **using special refractive index profile control**
➔ **only feasible with Draka PCVD process**

➔ **Without sacrifice or trade-off on bandwidth or other performance specifications**

MaxCap-BB-OM3/4
Principle

MaxCap-BB-OM3 / OM4 is based on similar Trench-Assisted technology as highly successful BendBright-XS SMF

- *Trench (reduced refractive index ring) just outside core/cladding interface confines especially higher order modes (in the outer core region) to the core, preventing them from escaping in strong bends*
  ➔ *higher order modes normally most sensitive for bending !!*

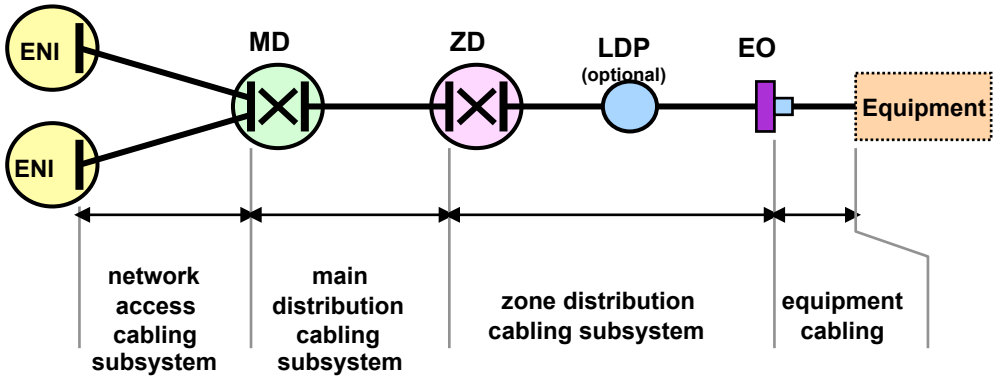


MaxCap-BB-OM3/4
Need for BI-MMF

All 850nm data systems show reduced system margins with increasing system speeds

➔ Bend-Insensitive MaxCap-BB-OM3 / OM4 fibers can relax such reduced system margins in current and future networks:

- In practical Datacenter designs often more connectors are applied than foreseen in basic lay outs (e.g. in local distribution points), putting pressure on the total connection insertion loss



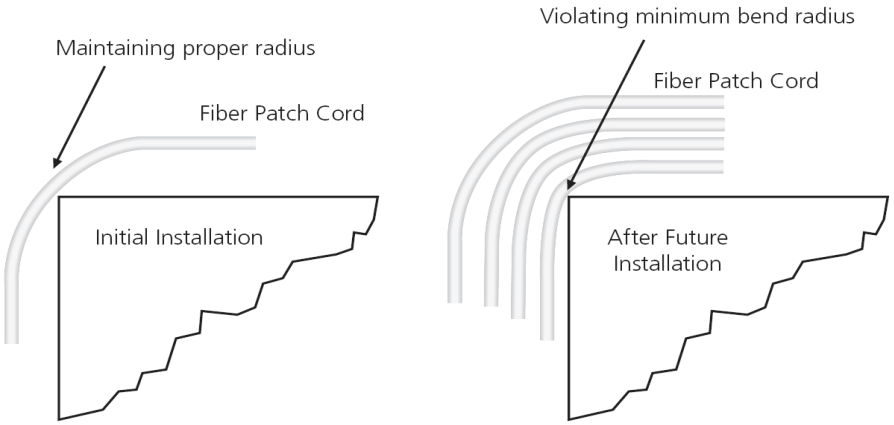
ENI = Equipment Network Interface
MD = Main Distributor
ZD = Zone Distributor
LDP = Local Distribution Point
EO = Equipment Outlet

➔ MaxCap-BB-OM4 offers additional system margin on top of extra margin by high OM4 bandwidth

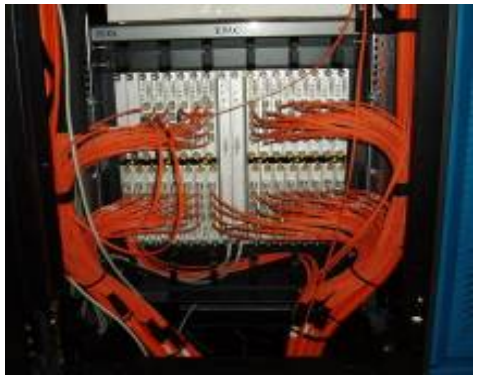
MaxCap-BB-OM3/4
Need for BI-MMF

Bend-Insensitive MaxCap-BB-OM3 / OM4 fibers can relax limited margins in current and future high speed Datacom links:

- **Massive optical cabling in Datacenters set pressure on installation practices with inherent chance of increasing macro- and microbending loss**



- **Bend-insensitive multimode fibers offer reduced size cable cabinets, reducing ownership costs**



Photos: Brand-Rex

MaxCap-BB-OM3/4
Bend test examples

MaxCap-BB-OM3 / OM4 fiber compared in practical bend testing to regular OM3 / OM 4 multimode fiber:

4 turns on 4mm diam. mandrel

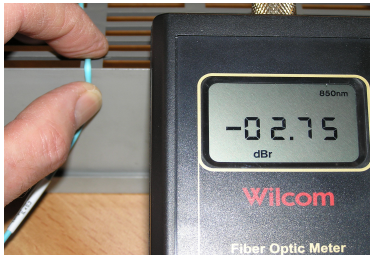
Regular OM3
➔ 3.37 dB

MaxCap-BB-OM3
➔ 0.14dB

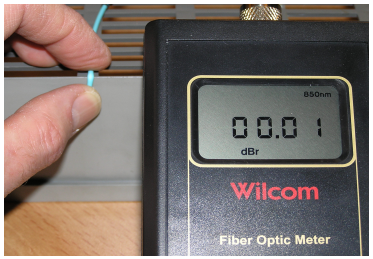
➔ 4 turns around 4mm mandrel

Sharp 90 degree kink test (pinched fiber) ➔

2mm indoor cable tested in sharp 90 degree angle



Regular OM3:
➔ 2.75dB



BI-OM3:
➔ 0.01dB

MaxCap-BB-OM3/4

Applications at network level

MaxCap-BB-OM3 / OM4 is recommended for:

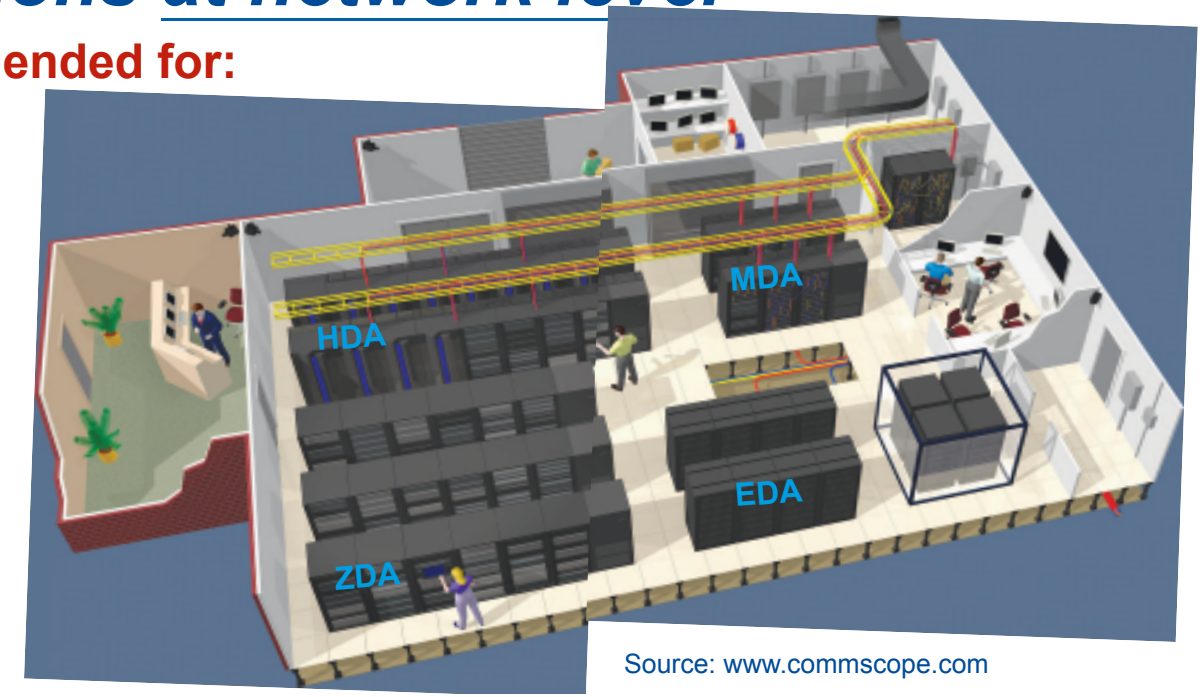
Dense cabling of Datacenter backbone and horizontal cabling (10G – 40G – 100G)

Many bends in racks

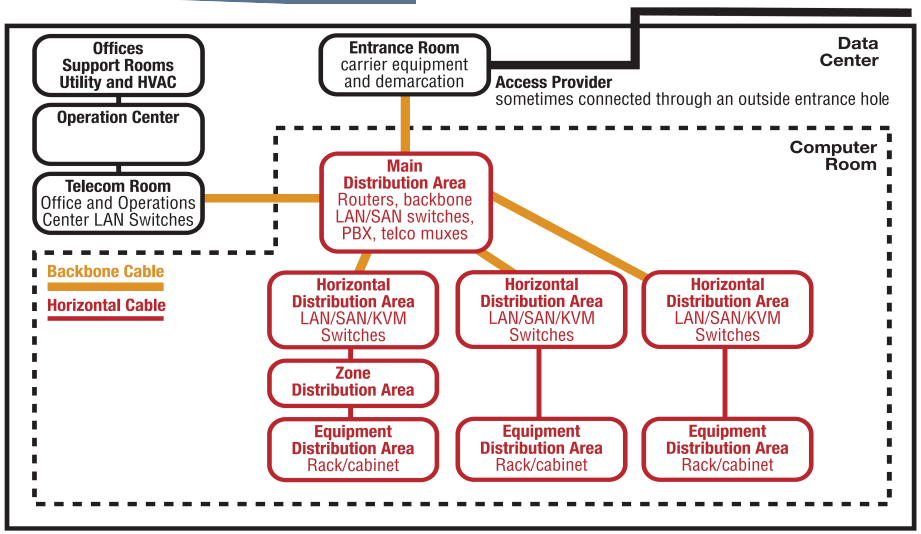
Future proof

➔ Moves, adds and changes (MACs) can disturb over time an initially well installed structured cabling system; yet no problem using Draka's new BI-OM3 / OM4 MMF

➔ Max. lifecycle & reduced CAPEX + OPEX



Source: www.commscope.com



MaxCap-BB-OM3/4

Applications at product level

MaxCap-BB-OM3 / OM4 is recommended for:

Compact high fiber count cables
Flexible cable designs

Example:

Parallel Active Optical Cable in a variety of data capacities

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Thank you for your attention