

Designing For And Implementing High Speed Low Loss Parallel Optical Networks

Alastair Waite TE Connectivity

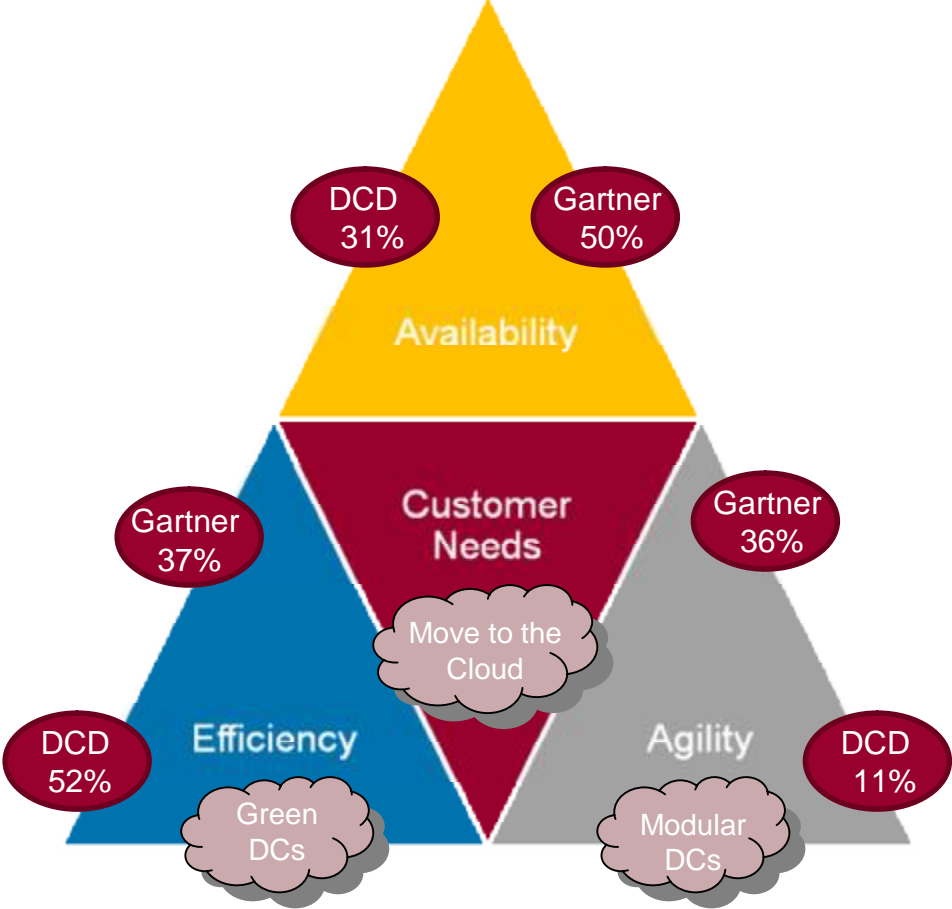


Agenda

- Business Drivers in the Data Center
- Key Technology Trends
- Transmission Standards Supporting Growth
- Physical Layer Data Center Standards Comparison
- Interface Options
- Upgrading Installed Base To 40 and 100Gb/s
- Loss Budgets
- Polarity Maintenance Methods
- Summary

Industry Trends & drivers

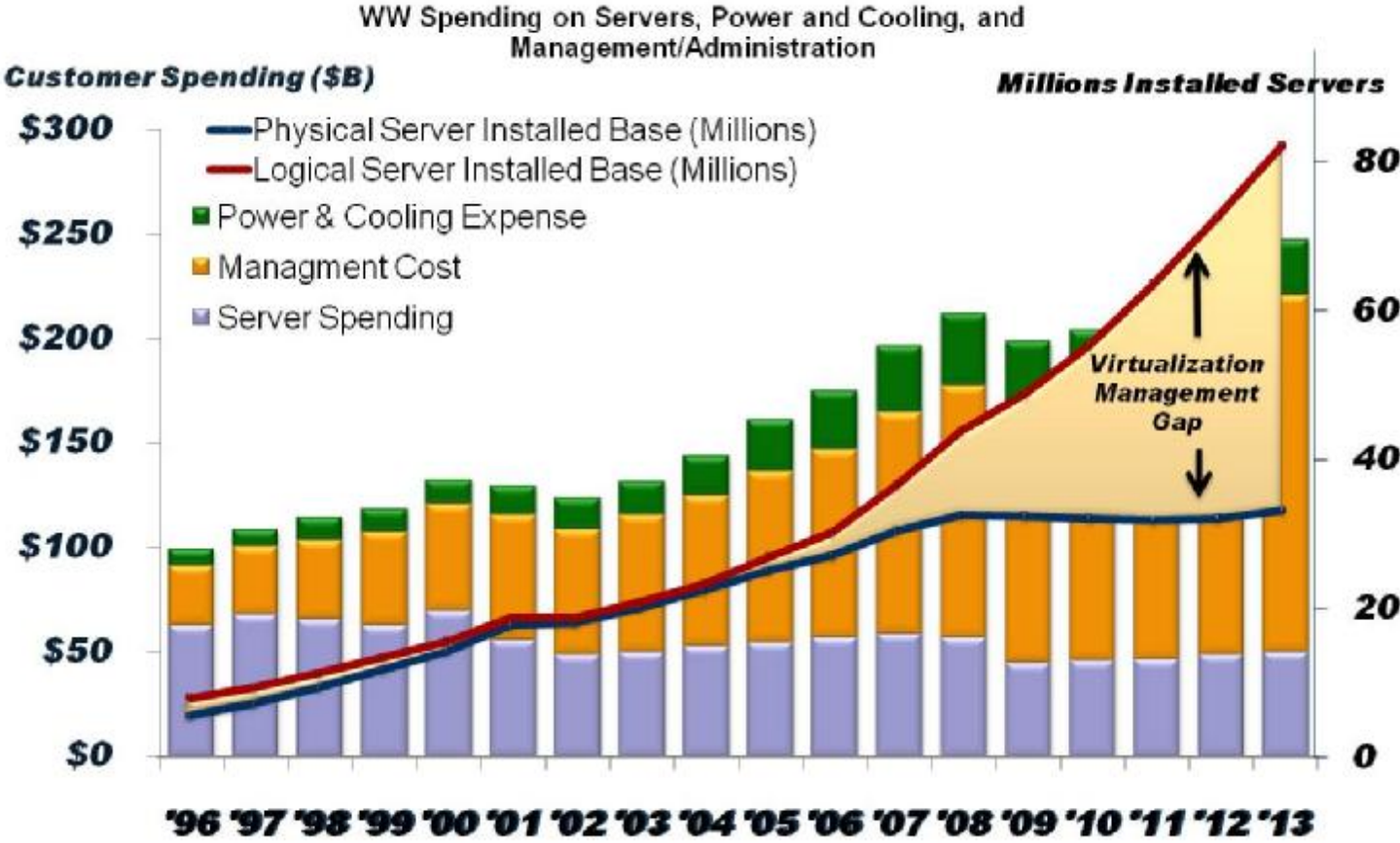
Leading market research shows that IT Managers expect the following attributes from their data center:



How Does This Translate Into Data Center Equipment?

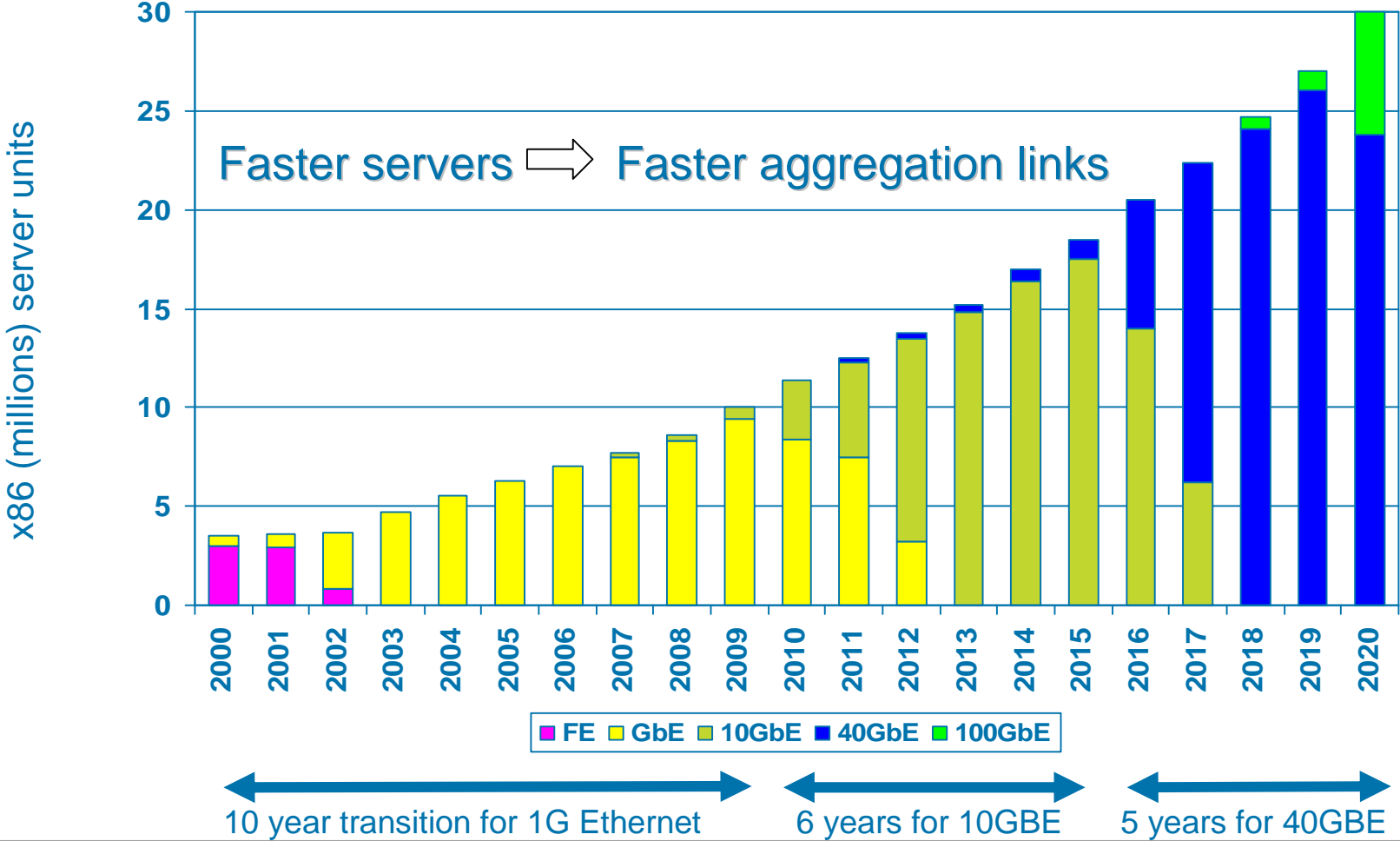


Servers Are At The Heart Of Every Design

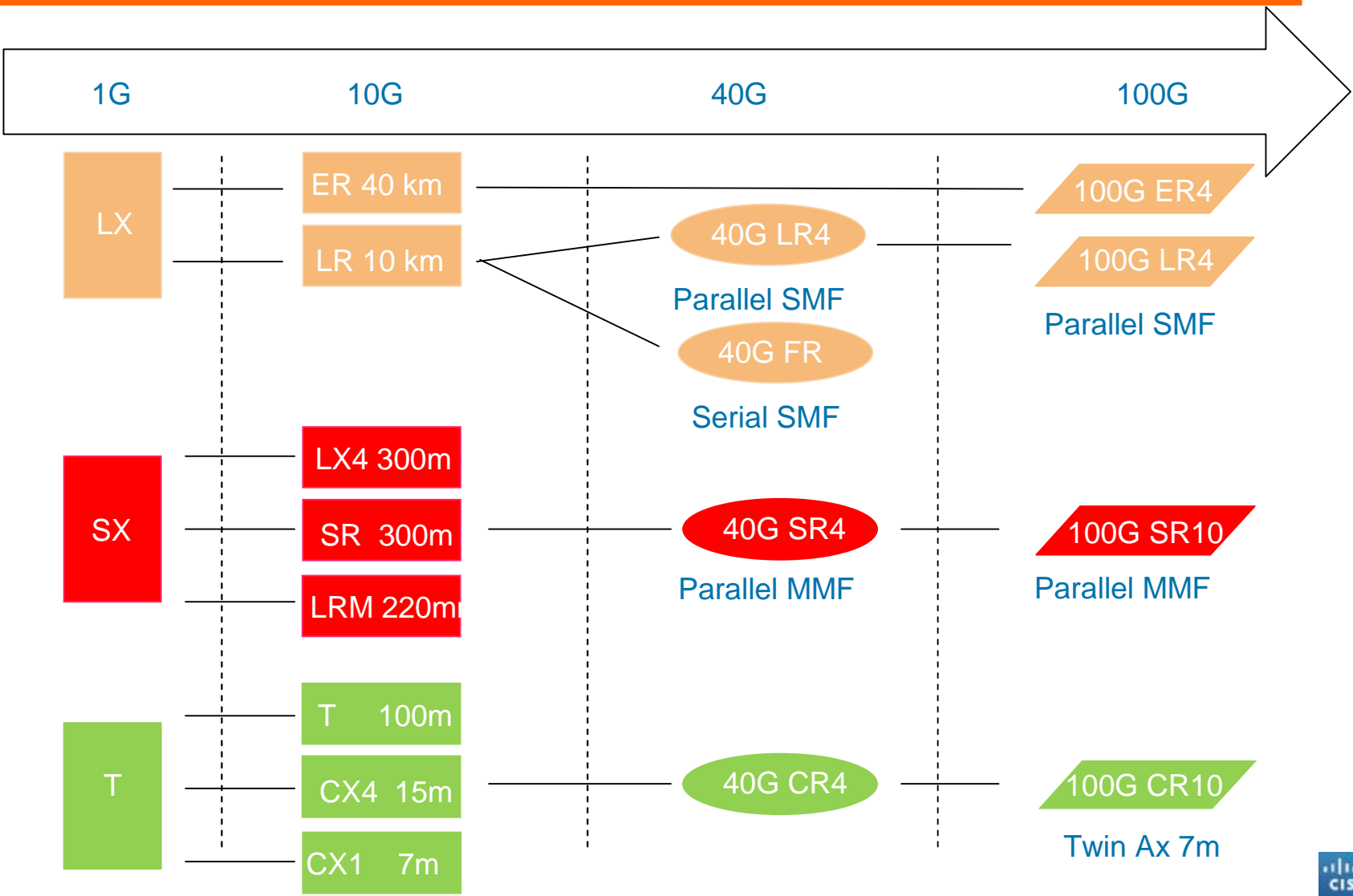


40/100 Gb/s Server Adoption

X86 Server Forecast by Ethernet Connection Type IEEE 802.3
 HSSG April 2007 Interim Meeting



High Speed Interface Standards (nBASE-x)



Choose a data center cabling standards and stick to it.

	ISO / IEC 24764	TIA-942
Copper Cabling	Category 6 _A (Minimum), 7, 7 _A	Category 3, 5e, 6 6 _A (recommended), 75Ω Coaxial Cable
Copper Channel Lengths	15 to 100 m	Up to 100 m (Twisted Pair) Up to 395 m (Coaxial)
Fibre Cabling	OS1, OM3 (minimum)	OS1, OM1, OM2, OM3 (recommended)
Fibre Channel Lengths	Up to 2000 m	Up to 300m
Fibre Connector Type	LC APC (Single Mode), LC, MPO	Not Specified
Tiers	Not Specified	I, II, III, IV

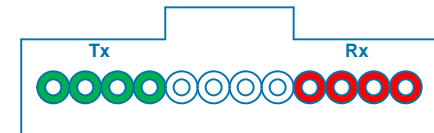
- ISO / IEC 24764 states that “For the termination of more than two optical fibers (at the equipment outlet) the interface shall be the MPO interface”

40GBASE-SR4 Parallel Optic Arrangement



4 Tx and 4
Rx parallel
channels

MPO End Face



100GBASE-SR10 Parallel Optic Arrangement

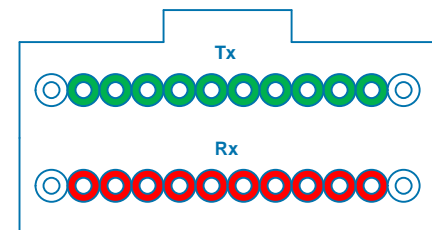
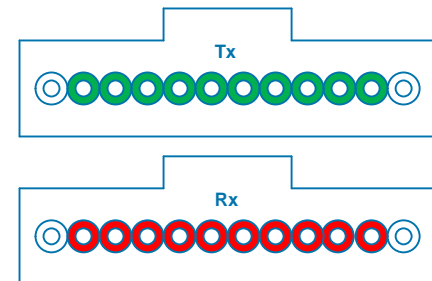


10 Tx and 10 Rx
parallel channels

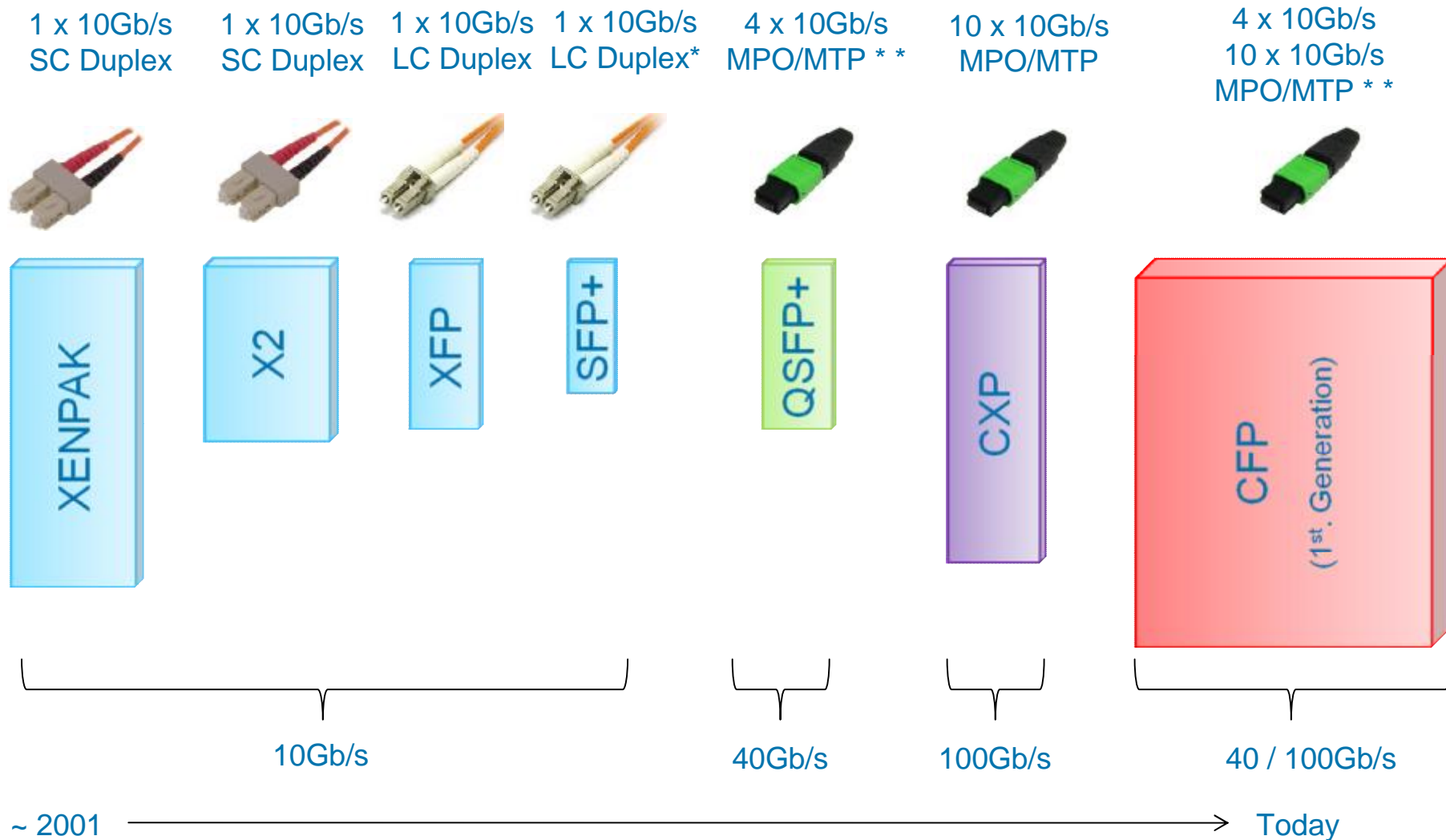


Using 10 + 10 MM
parallel fibers with
MT technology

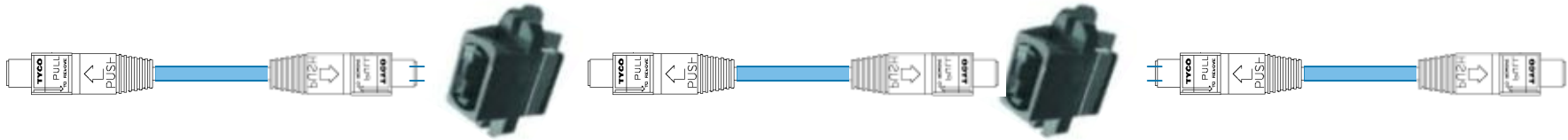
MPO End Face



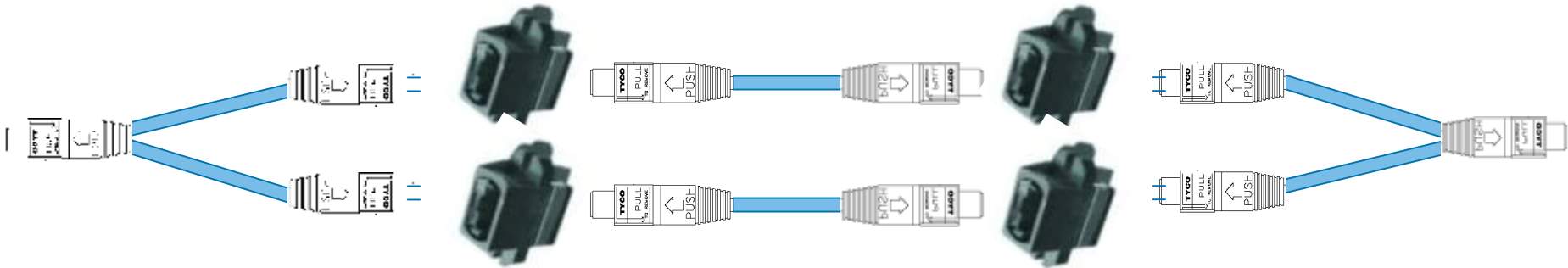
What Active Interfaces Are Being Chosen to Support Short Reach Applications?



40/100 Gb/s Systems Migration Options



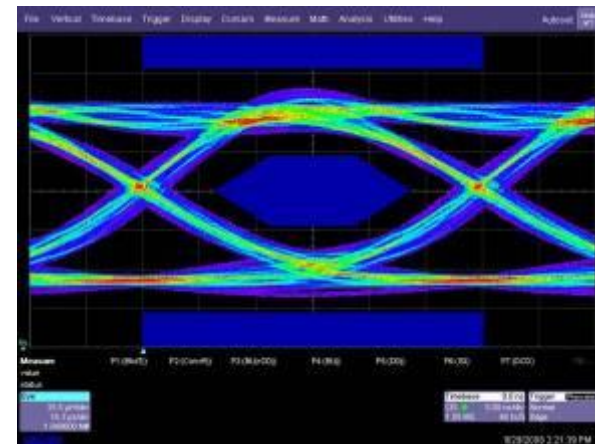
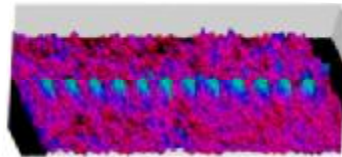
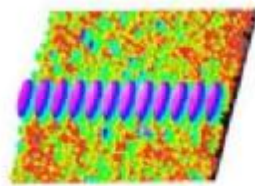
Solution for 40 or 100G using 12 fiber MPO at the equipment



Solution for 100G using 24 fiber MPO at the equipment

Parallel Optic Connector End Faces

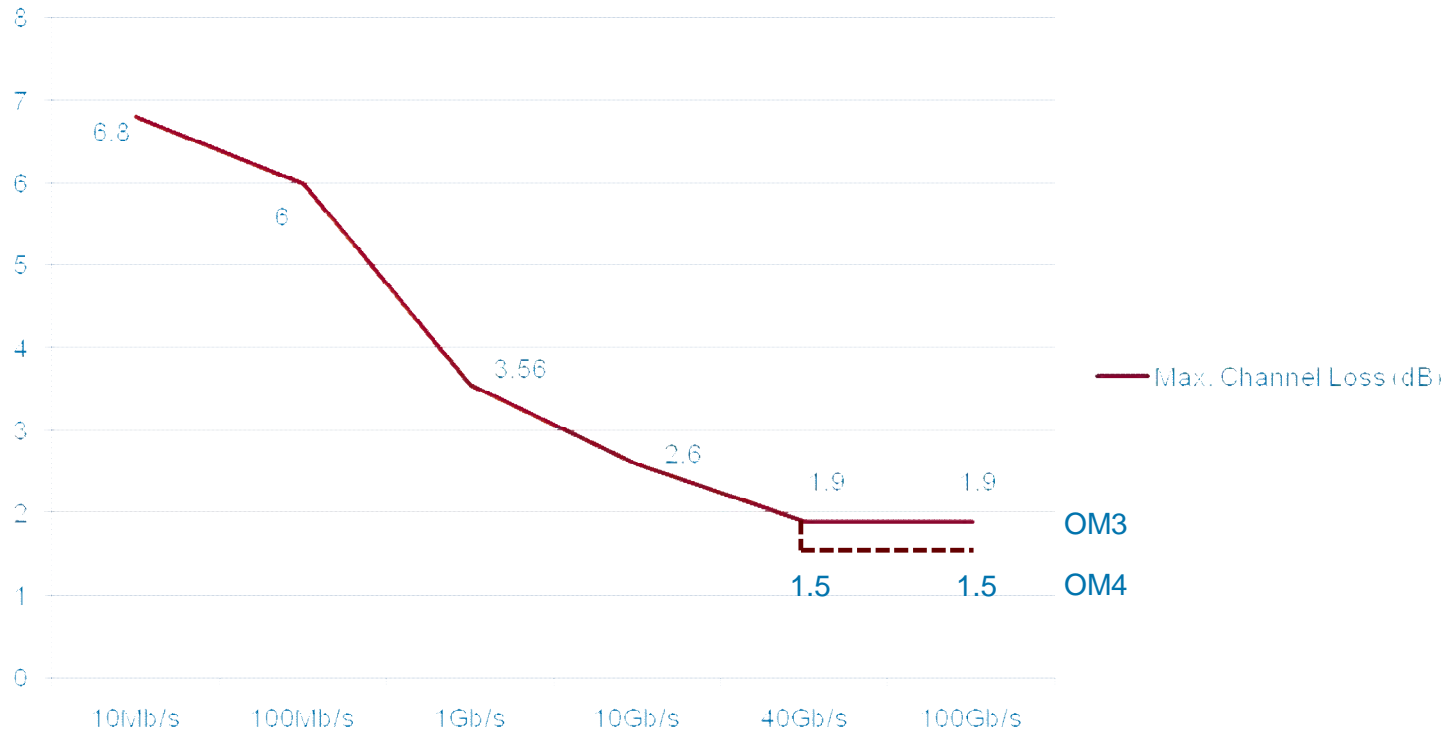
- Extremely difficult to manufacture and get the end face geometry perfect.
- Good manufacturing leads to low losses and reflections



Which all impacts the agility of the network design.....

Data Rate  Channel Loss 

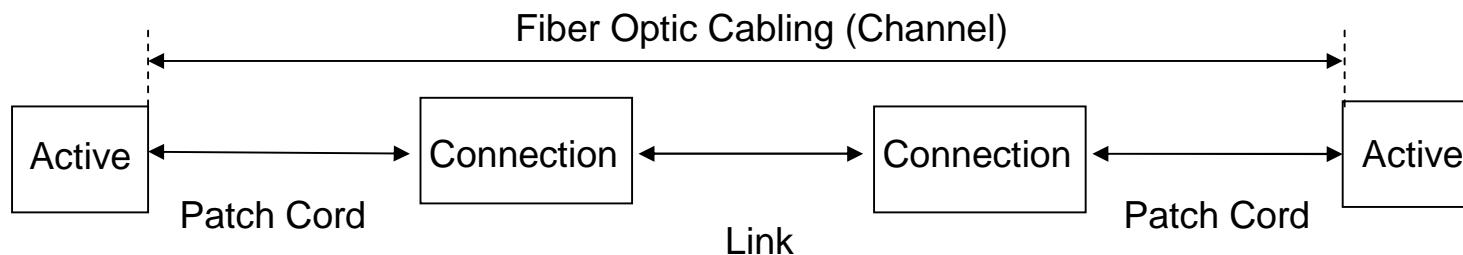
Total Channel Loss Allowed for 850nm Ethernet Transmission



- As data rates are increasing, loss budgets are reducing.
- Are channel lengths decreasing?

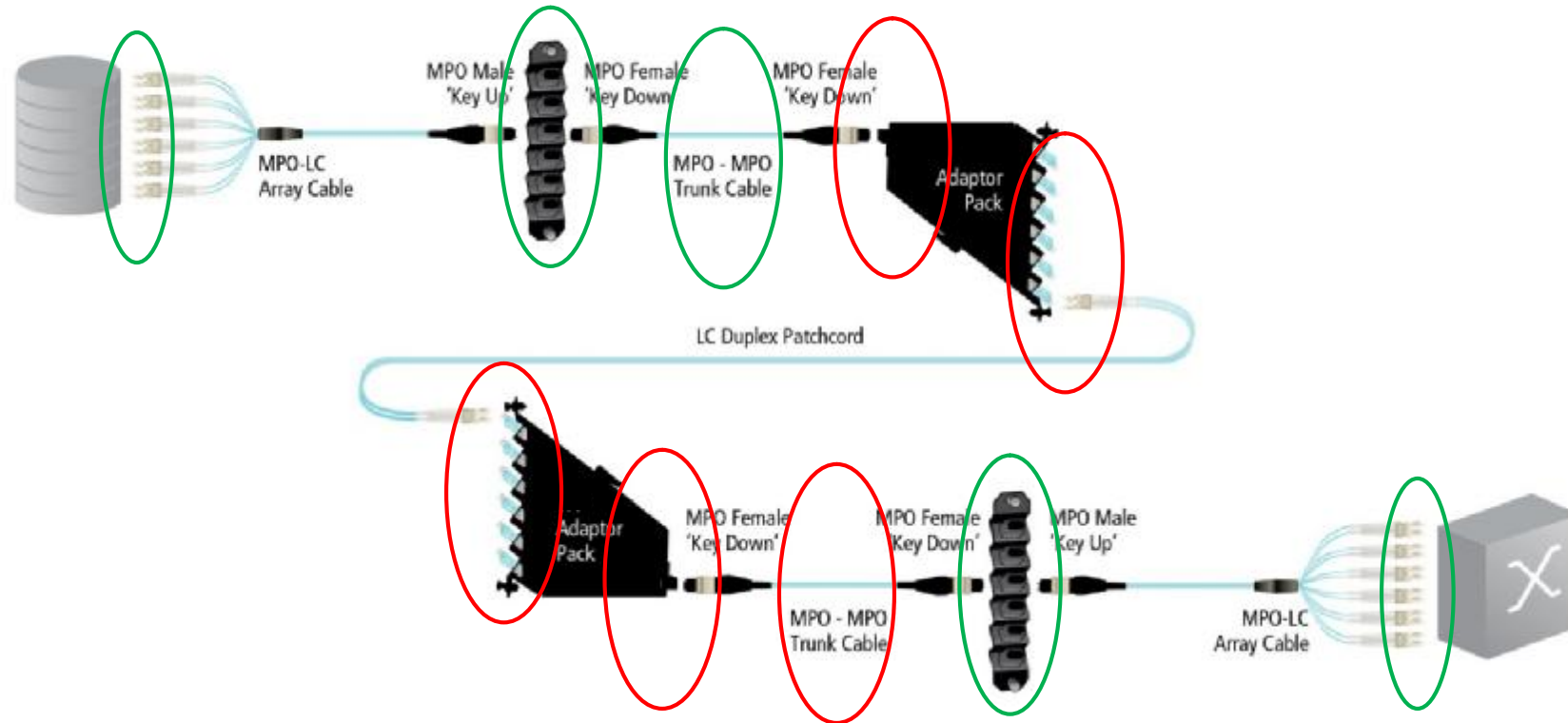
IEEE802.3ba Loss Budget

- IEEE 802.3ba (40G and 100G) standard states that:
 - An OM3 Channel can be 100m long and have up to 1.9dB of channel loss, of which only 1.5dB can be connection and splice loss.
 - An OM4 Channel can be 150m long and have up to 1.5db of channel loss, of which only 1.0dB can be connection and splice loss.
 - Typical MPO/MTP connector losses available on the market could support two connections, as below, but may run out of head room for a more complex channel design.



A Real World Example

Simplified SAN Deployment



○ Components of the channel that the IEEE802.3ba model shows

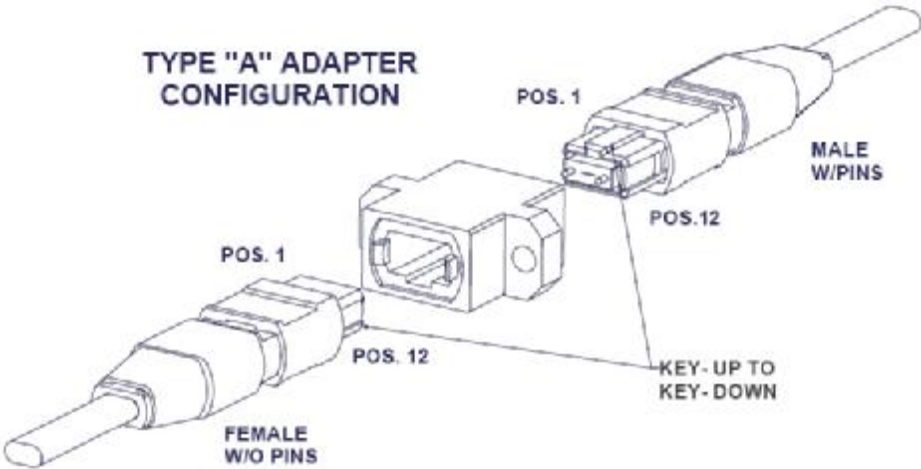
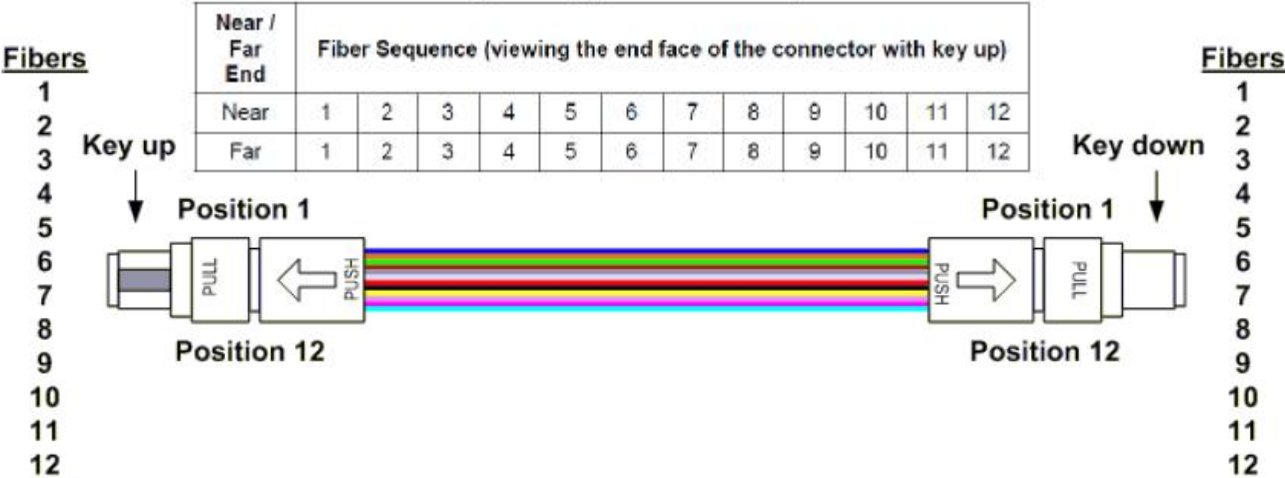
○ Components in addition to those shown in the IEEE802.3ba model

Polarity Maintenance

- TIA/EIA-568-B-1 describes 3 different methods of maintaining Tx-Rx polarity
 - Methods A, B and C
 - Other methods of maintaining polarity are not excluded
 - Never Ever Mix Schemes. Your network won't work.
 - Here's why.....

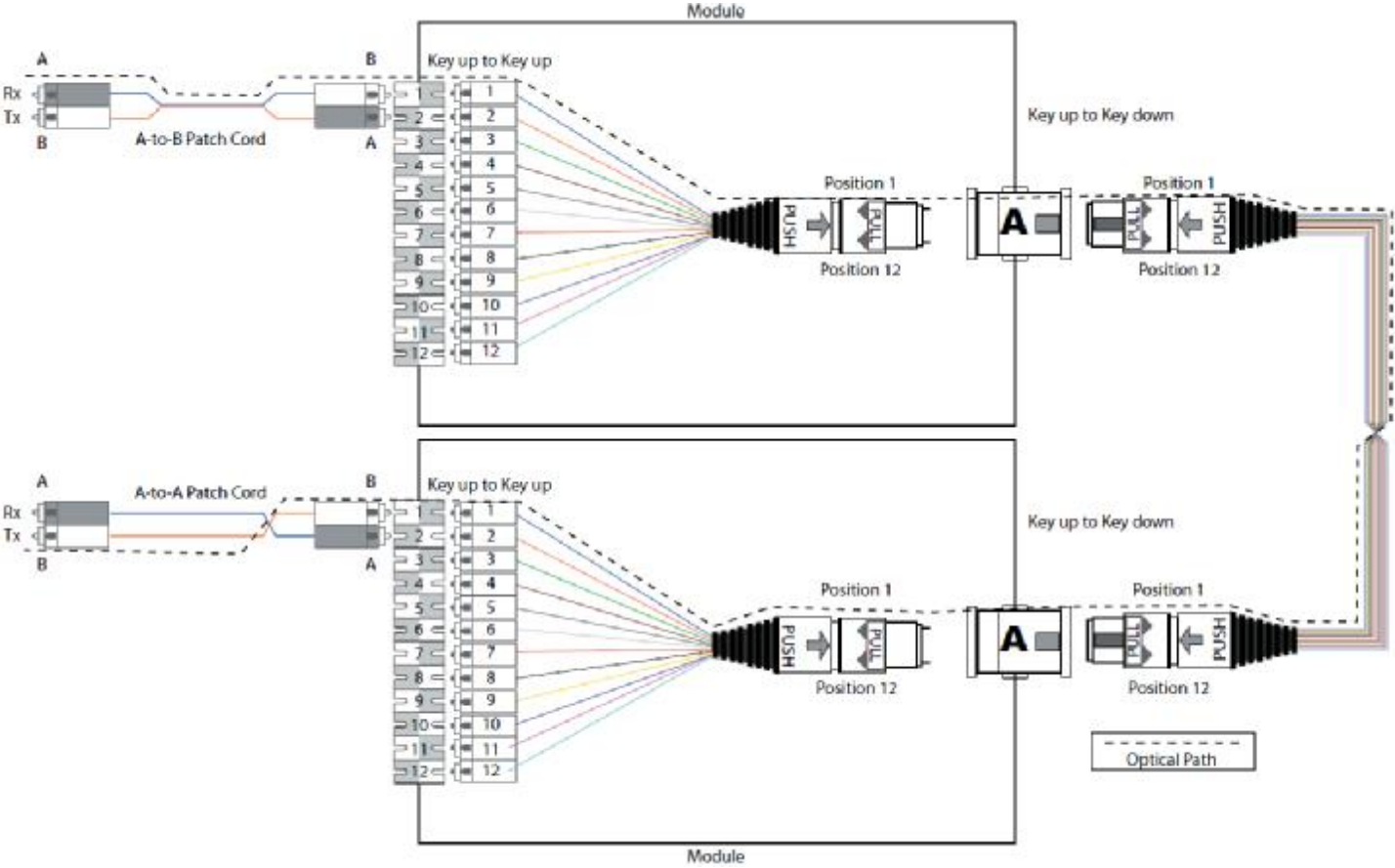
MPO Connectivity

Type A Array Patch Cords



MPO Connectivity

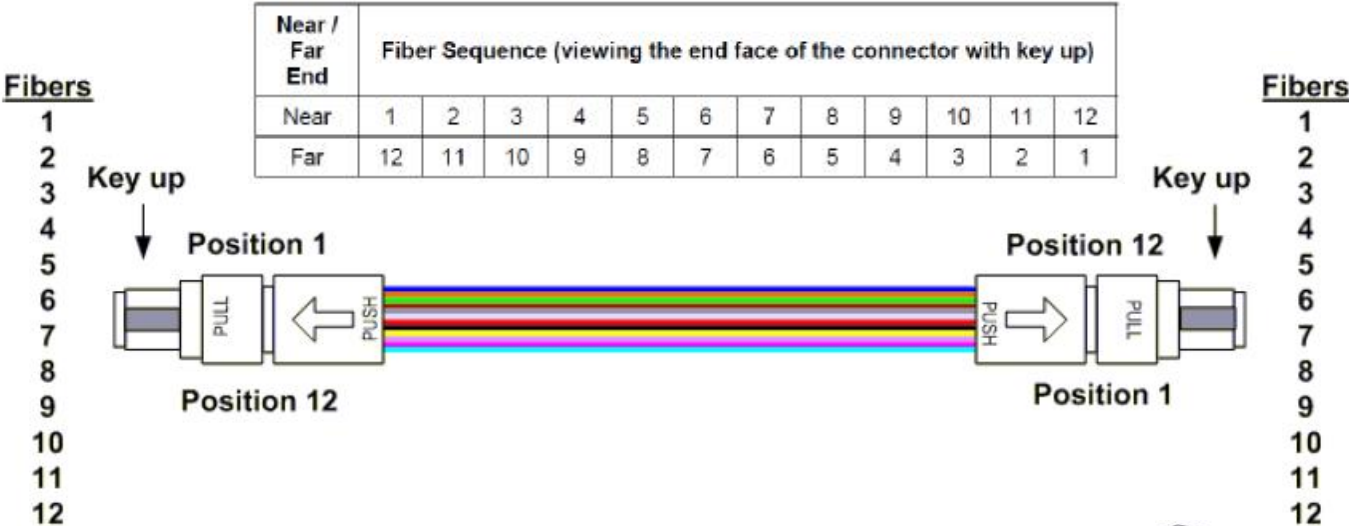
Type A Method



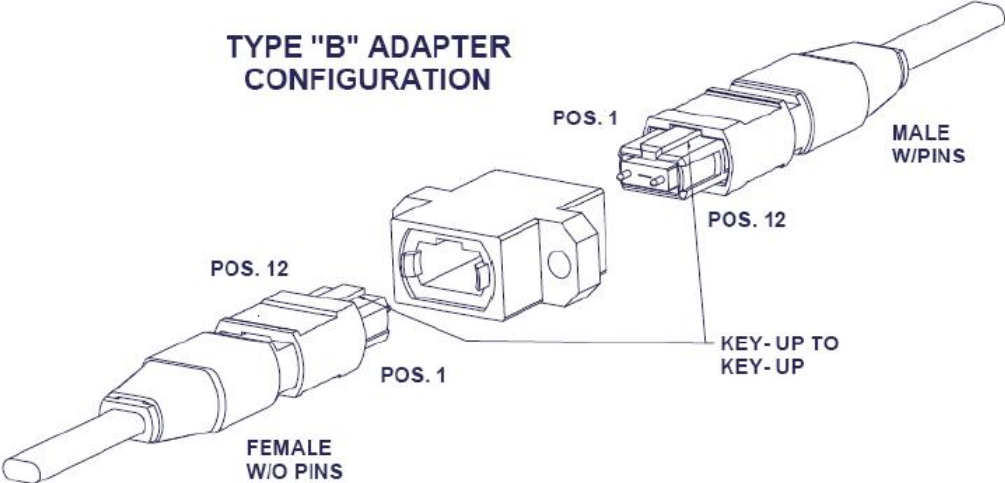
- Requires two different patch cords – one flipped, one straight.
- Flip performed in the trunk cable

MPO Connectivity

Type B Array Patch Cords

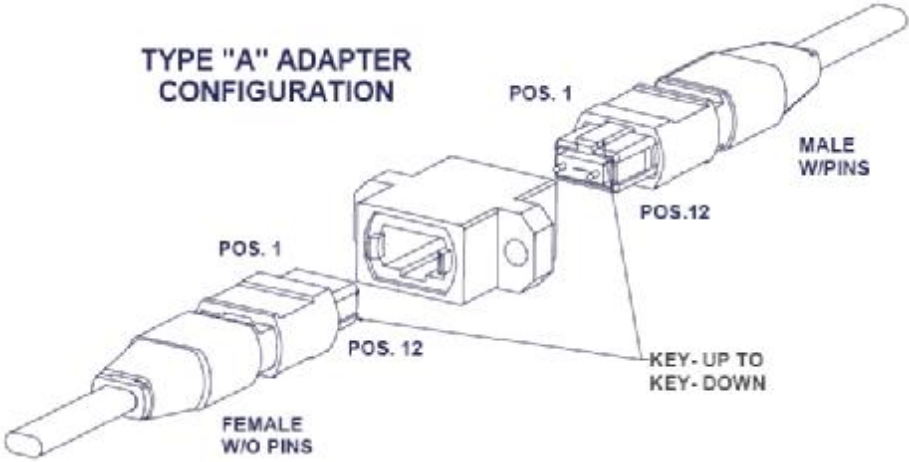
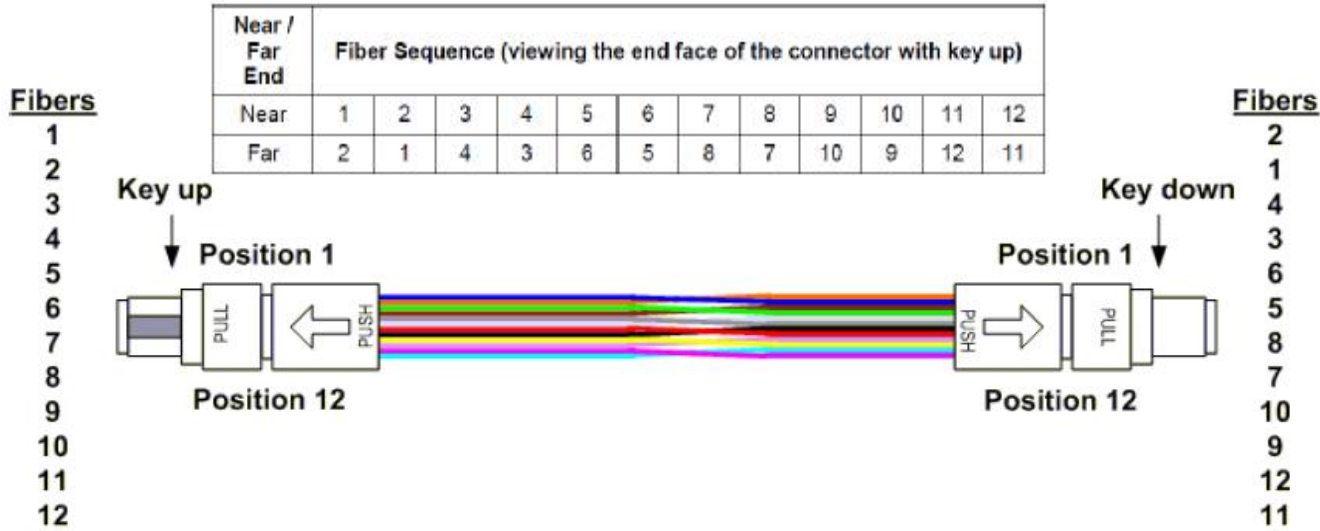


TYPE "B" ADAPTER CONFIGURATION



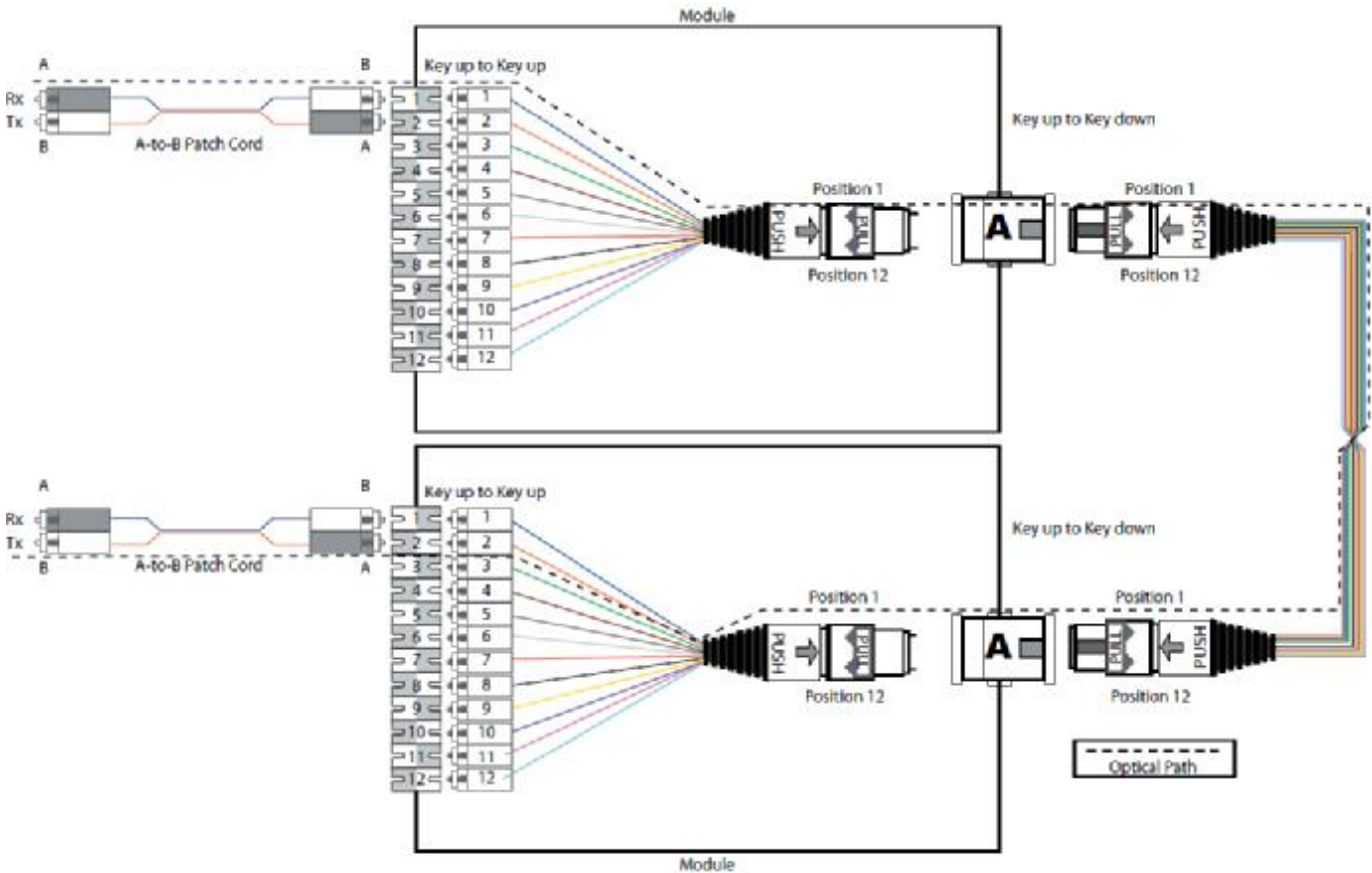
MPO Connectivity

Type C Array Patch Cords



MPO Connectivity

Type C Method



- Twisted pair flip within the trunk, plus a flip performed by the trunk.
- Patch cords are straight through

Finally.....

- *A number of the high speed standards call out the use of parallel optics.
– Remember that its not the only choice available to you*
- *Understand which standard you are working to*
- *If you plan for parallel optics deploy a single polarity method for parallel optics, and stick to it!*
- *Next generation channel budgets are low, use good products from reputable manufacturers to give sufficient headroom for network flexibility.*

Following the above points should help you deploy an Agile, Available and Efficient Infrastructure For Your Data Center