smartoptics

KBC Forum 2023

WDM-Netzwerke “weiter” gedacht

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Smartoptics in short

MAIN OFFICES IN
NORWAY, SWEDEN AND USA

GLOBAL REACH: OWN SALES AND
+100 BUSINESS PARTNERS

>100 EMPLOYEES
IN 7 COUNTRIES

R&D LOCATED IN
SCANDINAVIA

PARTNERING WITH LEADING
TECHNOLOGY SOLUTION PROVIDERS

INHOUSE SUPPORT BY OUR
OWN ENGINEERS

FOUNDED
IN 2006

28% AVERAGE YEARLY GROUTH
THE LAST FIVE YEARS

TRADING AT EURONEXT
GROWTH, OSLO

Challenger of challengers…..

Smartoptics – Where we sit…

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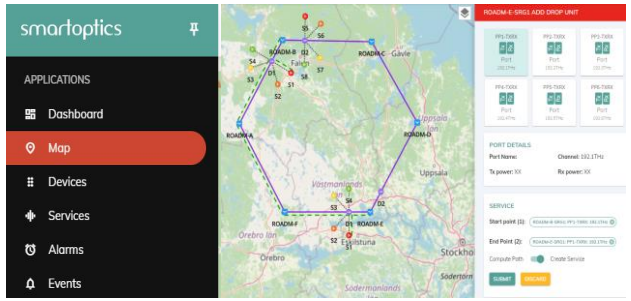
ORCHESTRATION

LightRiver | MANAGEMENT | MULTI VENDOR | FCAPS | INVENTORY | netFLEX

SoSmart

Domain control and network planning



CONTROLLER

PLANNING

MANAGEMENT

OPEN LINE SYSTEMS

DCP-M

DCI | AUTOMATION | 16 TBIT/S

METRO

DCP-F

Versatile line-system toolbox

METRO | FLEXIBILITY | 19.2 TBIT/S

EDGE

DCP-R

Ultimate network flexibility and control

METRO | FLEXIBILITY | 16 TBIT/S

REGIONAL | SDN

L1 TRANSPORT

DCP-2

L1 Transponders and Muxponders

LOW SPEED

DCP-1610

ENCRYPTION

LOW COST 100G

DCP-108 | DCP-110

LOW COST 400G

DCP-404 | DCP-1203

H-Series

CWDM / DWDM / OADM

Transceivers

Transceivers

100M up to 400G

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Major inventions, that will change “everything” if combined correctly….

- Open Line systems “reloaded”

- Pluggable coherent Transceivers “refined”

- Cost efficient and open ROADM

Open Line Systems

Open Line System architectures for different use cases

P-t-P / DCI OLS

AUTOMATION

DCI

Metro / Edge OLS

FLEXIBILITY

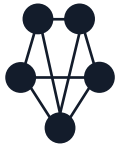
CONTROL

DCI

METRO

EDGE

Regional / Metro OLS



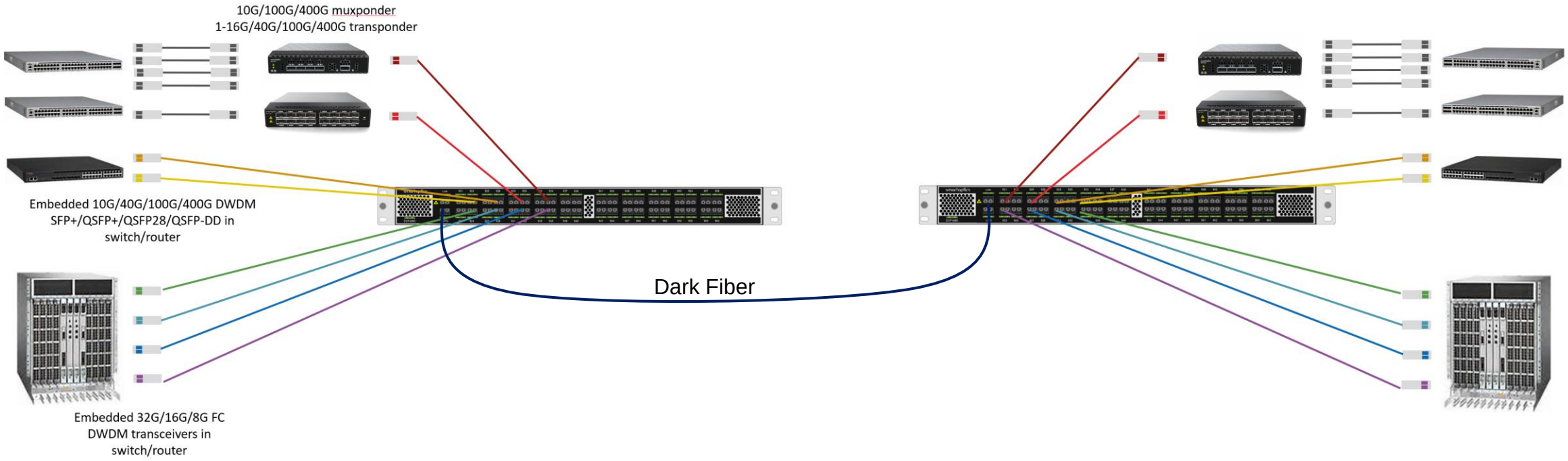
FLEXIBILITY

CONTROL

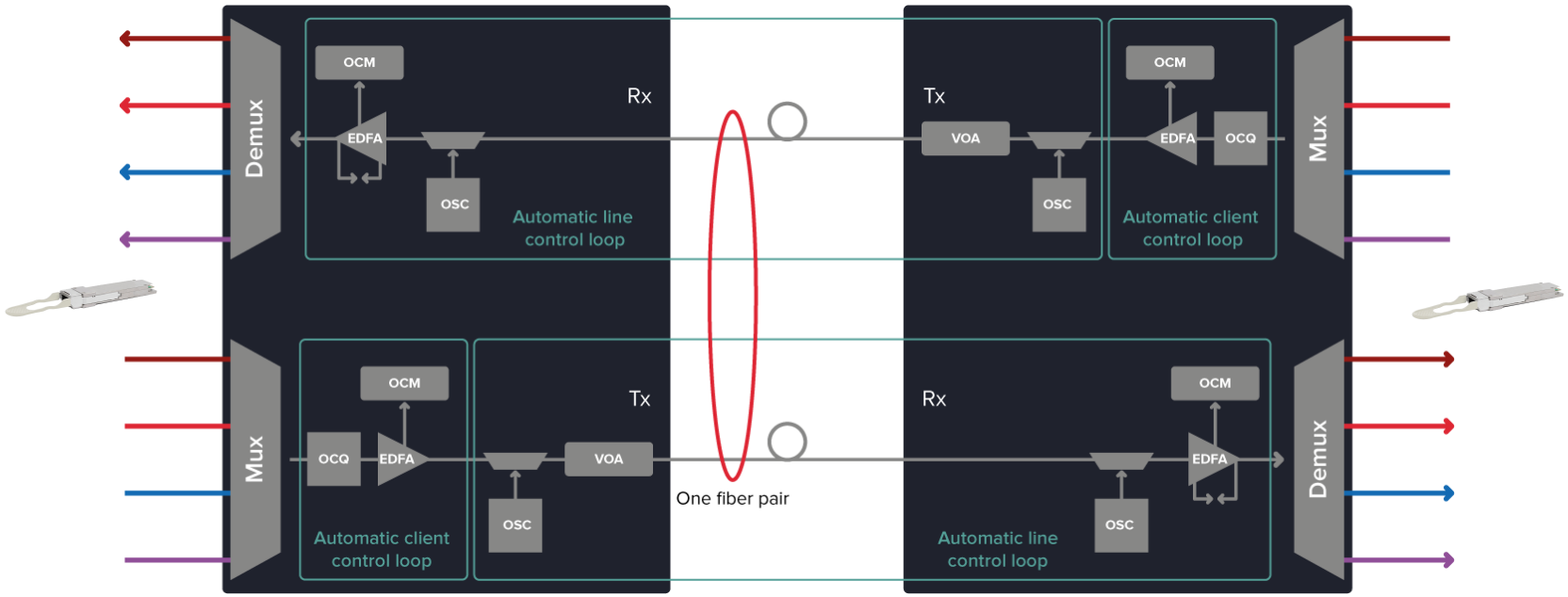
METRO

REGIONAL

Smartoptics Open Line System philosophy



How it works



OCM : Optical Channel Monitoring
OCQ : Optical Equalizer
OSC : Optical Service Channel
VOA : Variable Optical Attenuator

Client control loop

- Automatic protocol detection
- Automatic power level measurement
- Automatic power level regulation

Line control loop

- Automatic measure of fiber length
- Automatic setting of dispersion compensation
- Automatic power level regulation

- **“zero touch” provisioning**

ROADM based OLS

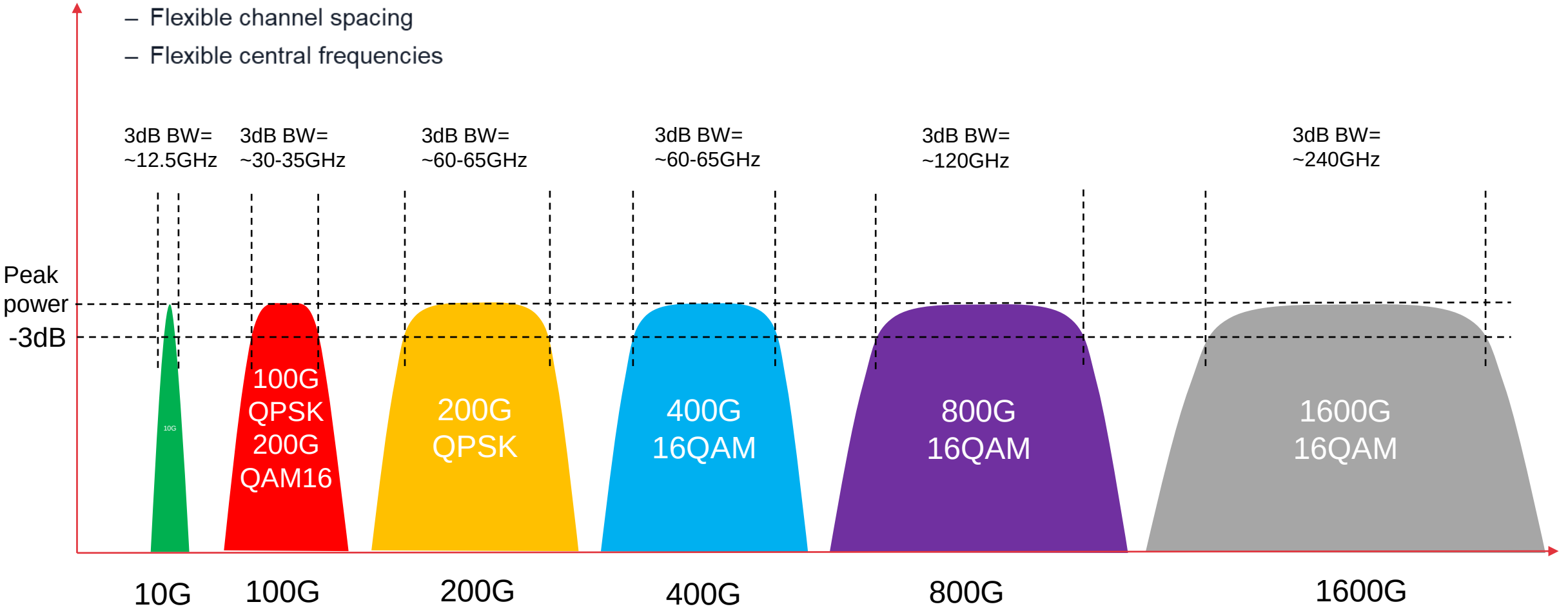

ROADM is a mature technology ! Why do we believe that this will be a market with strong growths ?

Well…

- Metro and Access market segments are opening up. Current deployment mainly in Core and Metro-Core
- Old ROADM deployments need to be upgraded/replaced:
  - Old 50 GHz fixed grid systems does not support new traffic formats
  - **FlexGrid** required to boost performance beyond 400G
- Cost advantages of openness and disaggregation (Open API:s)
- New Generation of ROADM hardware extremely cost efficient
- ROADM Networks are highly automated with “almost no” need for manual operations. They come with excellent planning tools
- Embedded optics will replace transponder based DWDM Systems over time

Why “FlexGrid” ?

- Flexgrid is needed to allow for
  - Flexible bandwidth
  - Flexible channel spacing
  - Flexible central frequencies



ROADM based OLS - high level feature requirements

True Open Line System
No license or hidden fees

All Major Formats
Support for all major modulation formats

OpenROADM
OpenROADM API Compliant

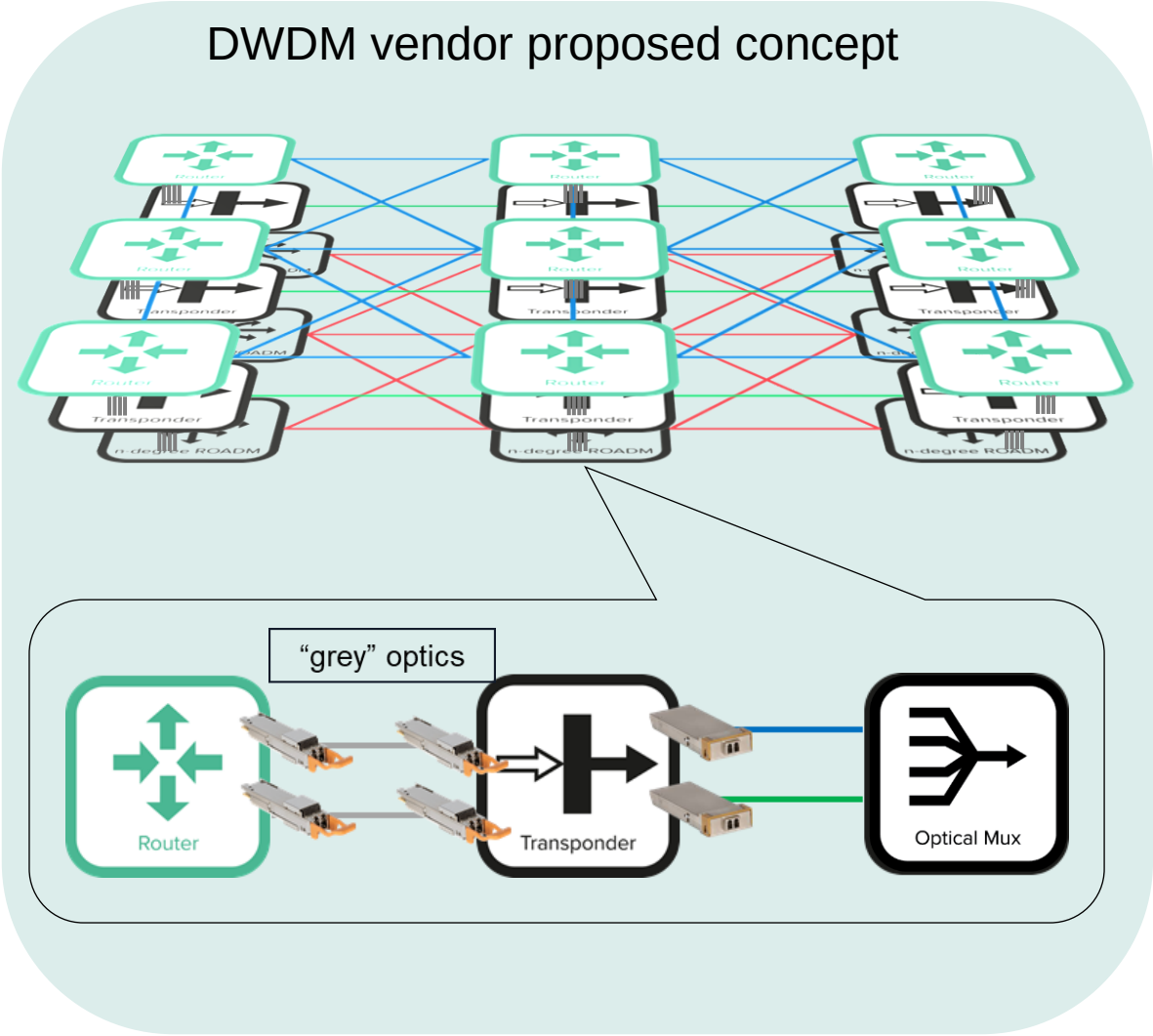
Flexgrid prepared
Future proof

High Level of Automation
Automatic fibre distance measurement

Automatic modulation format detection

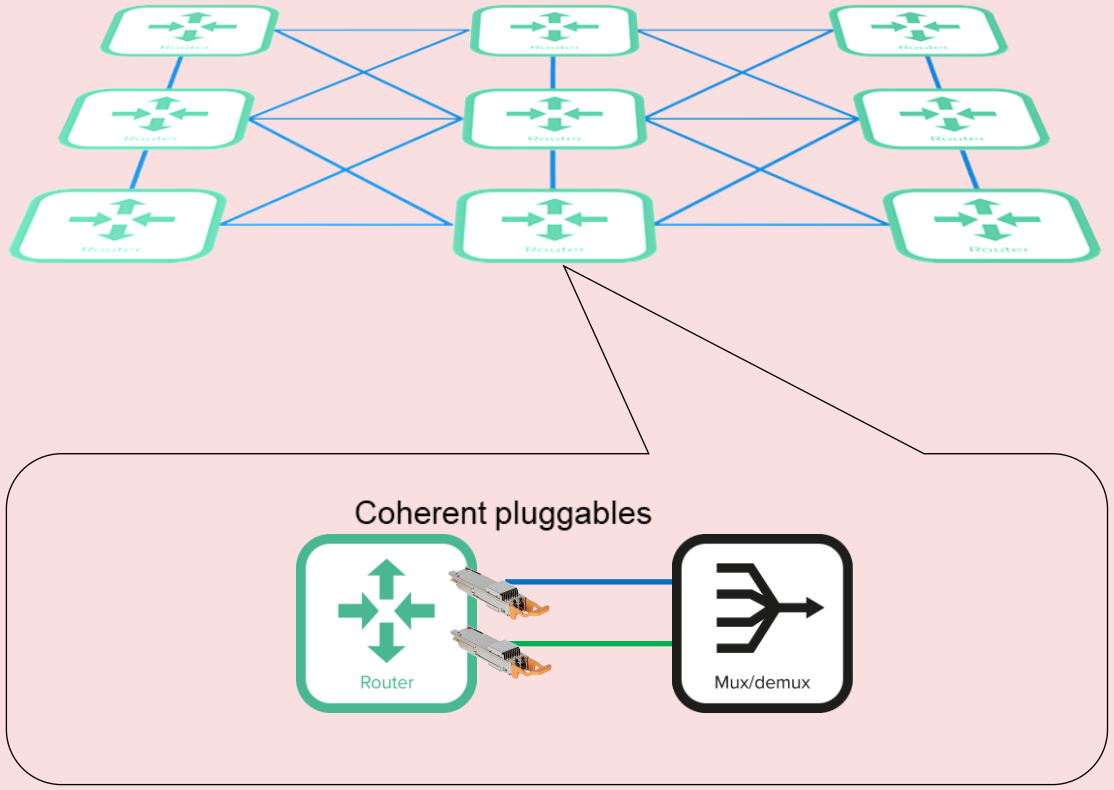
Any Network Topology
Optimized for chain, ring and meshed applications

Conventional Building Concept (dead end ?)



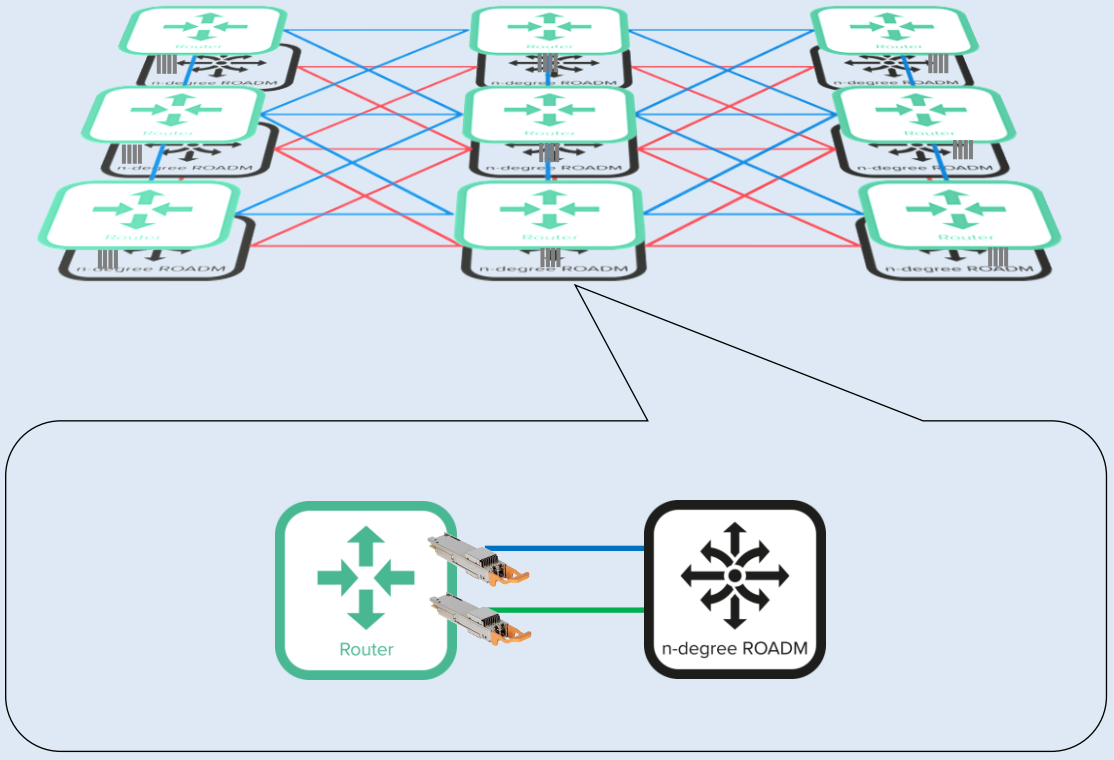
Modern network concept using IP over DWDM

IP over DWDM concept (passive) DWDM layer: P2P



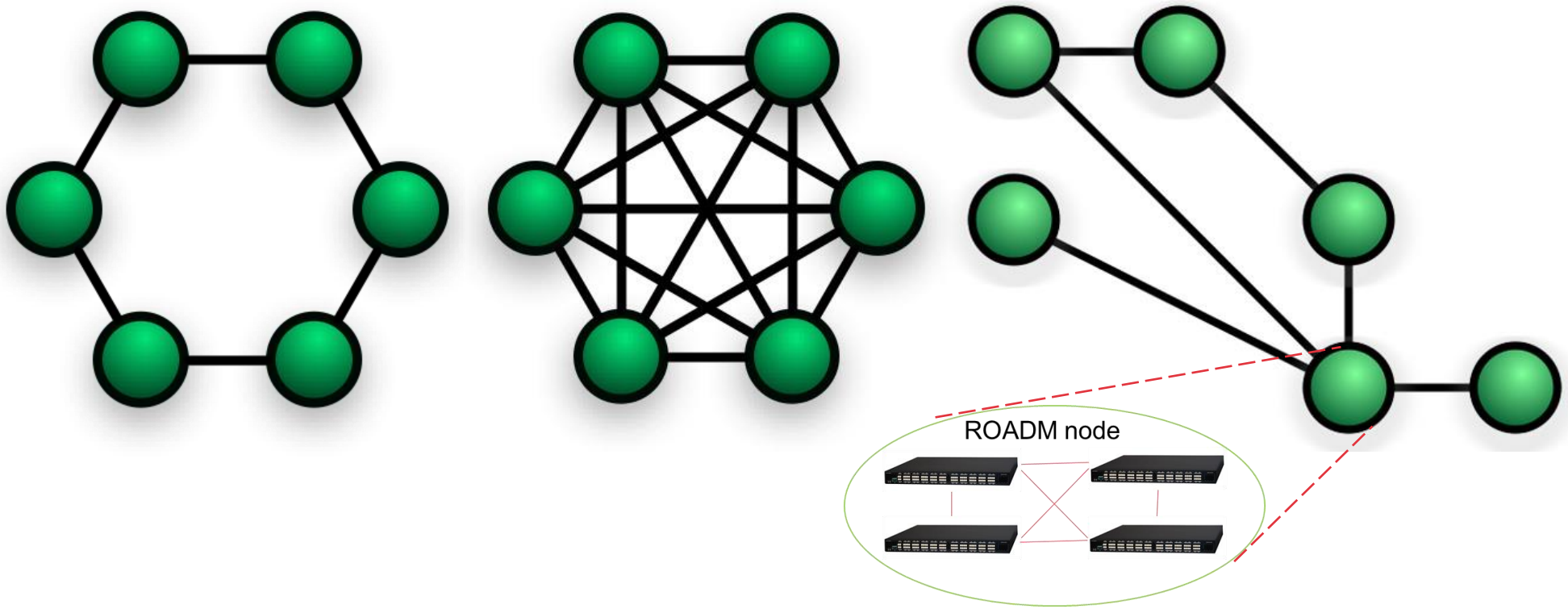
Traffic engineering on Layer 3

IP over DWDM concept with ROADM



Wavelength routing + Layer 3 traffic engineering

Network applications



With ROADM technology it is possible to build almost any type of network topology

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Coherent Pluggable Optics

Innovations around Coherent Pluggable Optics

- **High Tx power 400G QSFP-DD**

- In accordance with OpenZR+ but with 0 dBm output power
- Supported is already existing ROADM based networks
- Support for 200G 16QAM to work in 50GHz networks

- Improved Optical Performance

- Probabilistic shaping
- Sub-carrier technology
- Additional modulation formats

- OTN and Encryption support in **400G QSFP-DD**

- OpenROADM compliant
- Layer-1 encryption
- In-band management via GCC

- Additional line rates

- **100G QSFP28 coherent DWDM “soon”**
- 800G pluggable coherent DWDM modules mid next year
- 1,6T during 2025

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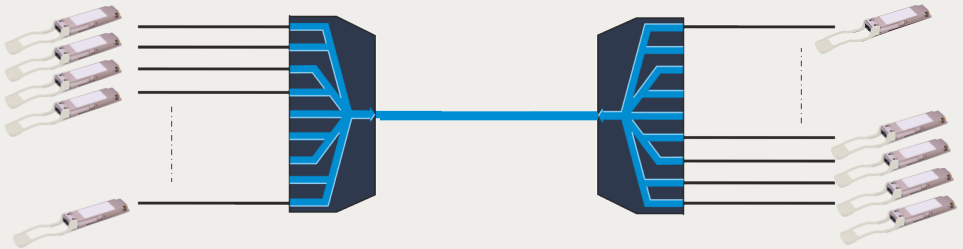
100G Coherent QSFP28

QSFP28 Transceiver

- Power budget: 22dB (Tx= -8dBm, (0dBm later) Rx= -30dBm)
- Host interface: CAUI-4 or OTL4.4
- 100Gbps DP-DQPSK (25Gbaud)
- Full C-band tuneable
- Up to 80km unamplified, 120km amplified
- Optional extended reach up to 300km amplified
- SC-FEC or RS(255,239)
- Power dissipation <5.0W (C-temp) <5.5W (I-temp)



High Tx power 400G QSFP-DD

QSFP-DD Transceiver

OpenZR+ MULTI-SOURCE AGREEMENT

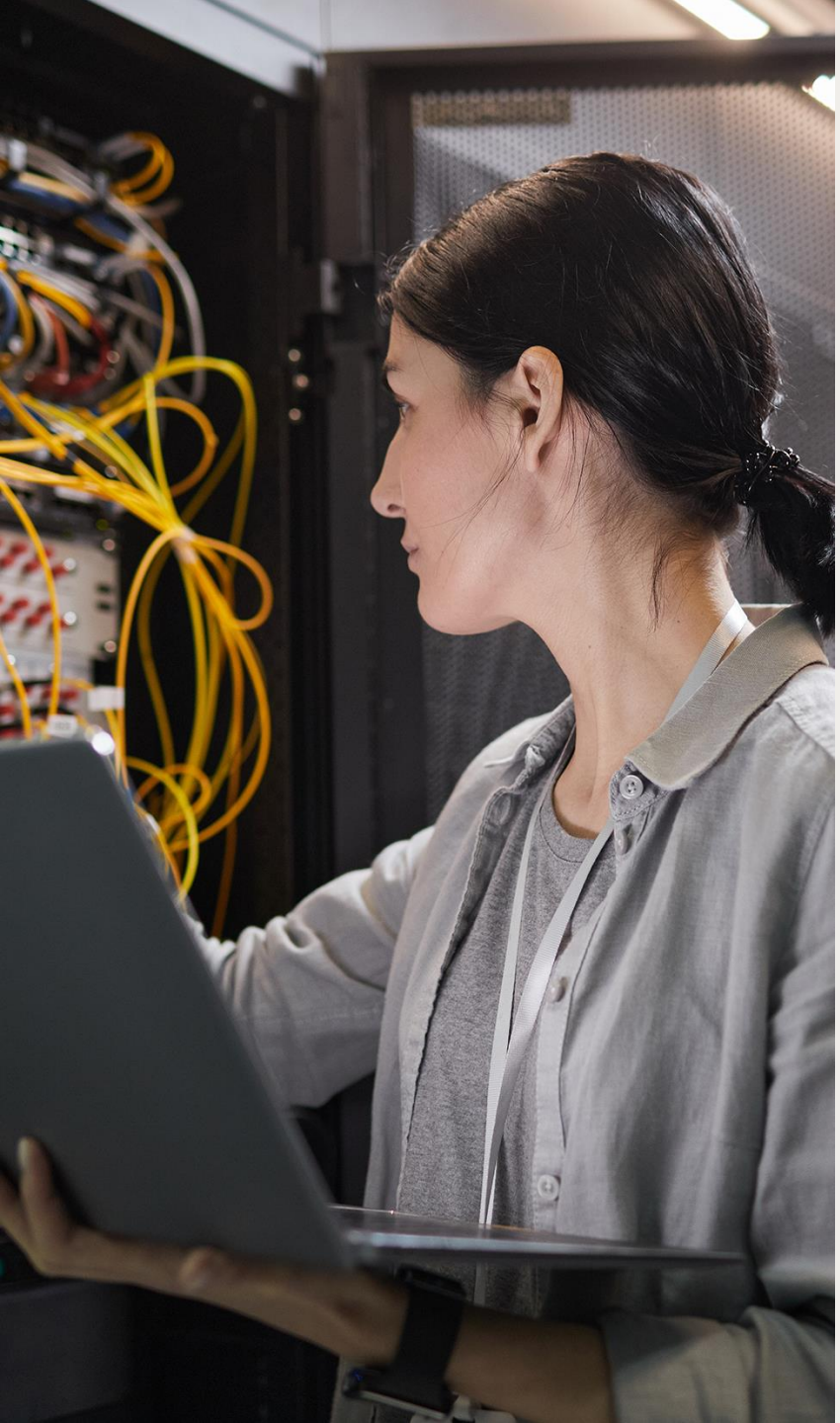
In accordance with OpenZR+ but with higher output power to support already existing ROADM based networks.

- C-band tunable
- Supports OpenZR+ application modes
- 0dBm Tx output power (vs. -10dBm for regular ZR+)
- 20dB optical power budget @400G
- 400G/16QAM, 300G/8QAM, 200G/QPSK-8QAM/16QAM, 100G/QPSK
- Supported by Smartoptics DCP-404 Muxponder

DCP-404

Target release: Q2 2023

SmartConnect



400G QSFP-DD with Encryption

QSFP-DD Transceiver

In accordance with OpenZR+ and OpenROADM

- C-band tunable
- Supports OpenZR+ and OpenROADM application modes
- 0dBm Tx output power
- 20dB optical power budget @400G
- 400G/16QAM, 300G/8QAM, 200G/QPSK-8QAM/16QAM, 100G/QPSK
- *AES256 encryption for all line rates in OpenROADM modes*
- Supported by Smartoptics DCP-404 Muxponder

DCP-404

Target release: Q4 2023

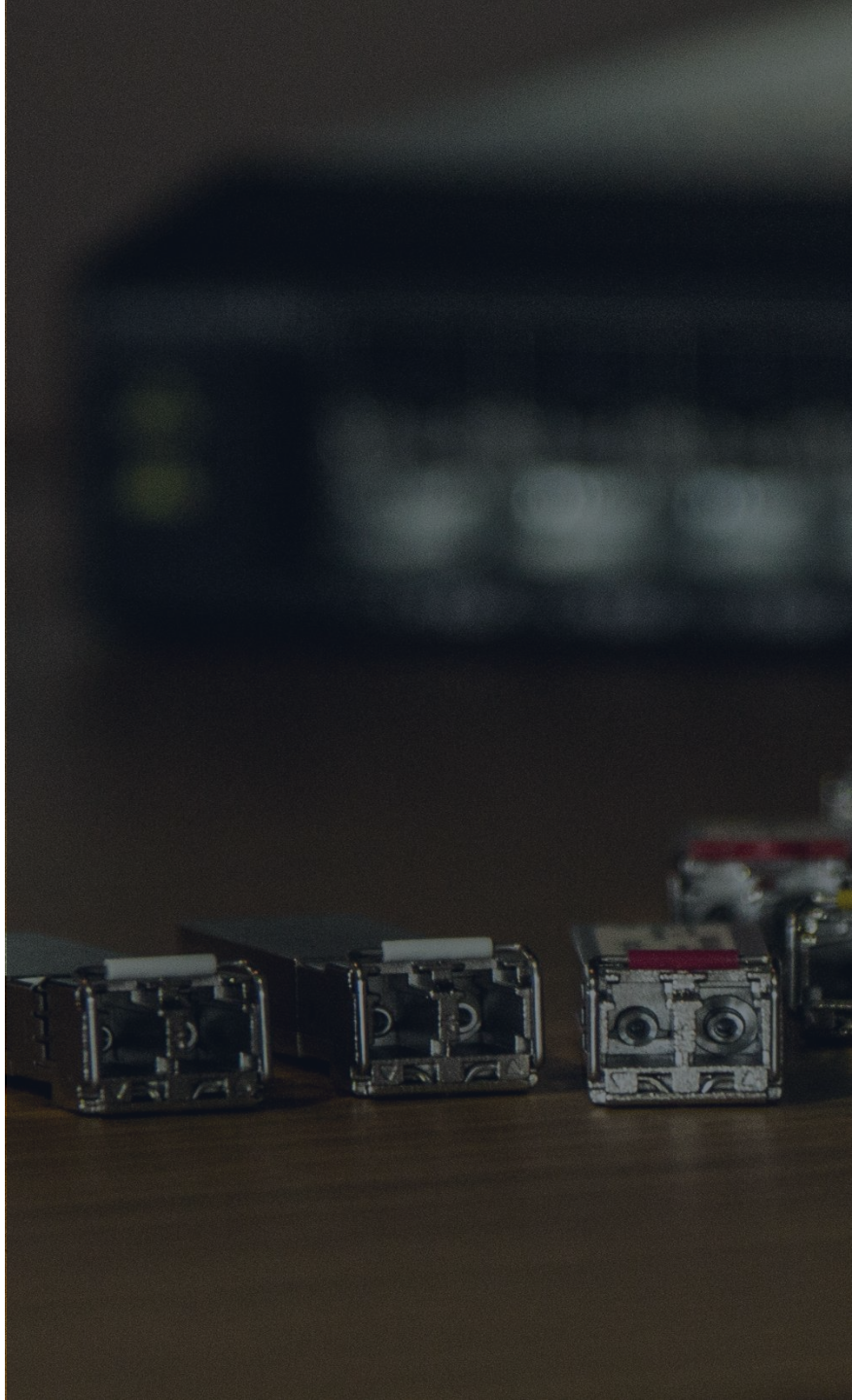
Optical Transceivers

The past, the present…..

Optical Transceivers

10G	40G	100G	400G
XFP • Grey, SR, LR, ER, ZR • CWDM, DWDM • Tunable	**QSFP** • SR4, LR4 • PAM4 DWDM	**CFP, CFP2, CFP4** • SR4, LR4, ER4 • ER4-DWDM • Coherent DWDM	**OSFP** • Coherent DWDM 400G ZR and ZR+
SFP • Grey, SR, LR, ER, ZR • CWDM, DWDM • Tunable	**CFP** • 40G Base • SR4, LR4, LR4-40	**QSFP28** • SR4, LR4, ER4 • PSM4, CWDM4 • PAM4 DWDM	**QSFPDD** • Coherent DWDM 400G ZR and ZR+

- All form factors
- Speeds from 1G to 400G
- Grey wavelengths
- CWDM and DWDM Fixed and Tunable



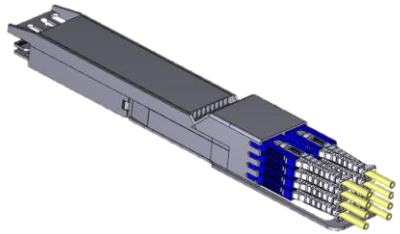
Optical Transceivers

The future and beyond….

800G : Battle of the form-factors

OSFP (Octal Small Form-Factor Pluggable)

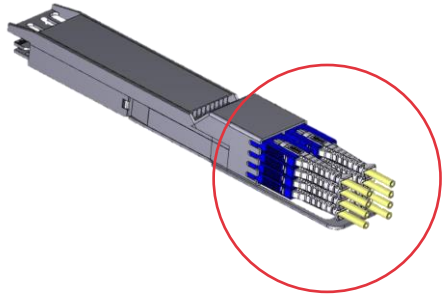
- Enables speed up to 800G
  - 8x100G electrical lanes
- Compared to QSFP-DD800
  - Physically larger form-factor
  - Improved heat sink, better thermal cooling properties
  - A “brand new” form-factor
    - No backwards compatibility with current form-factors (w/o converter)



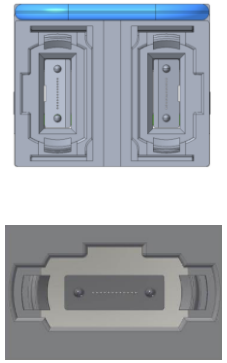
QSFP-DD800 (Quad Small Form-Factor Pluggable – Double Density-800G)

- Enables speed up to 800G
  - 8x100G electrical lanes
- Compared to OSFP
  - Physically smaller form-factor, increased port density
  - Less surface area than OSFP, gets warmer
  - Provides interface provides backwards compatibility with the QSFP form factor

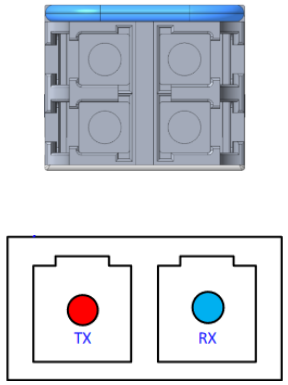
800G : Battle of connectors



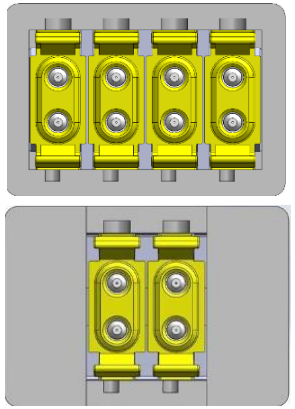
MPO-x



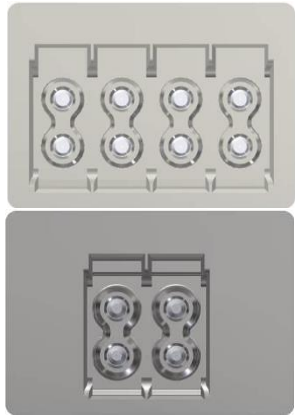
Dual LC



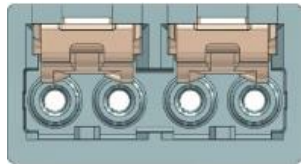
SN connectors



MDC connectors



CS connectors



Why so many? Depends...

…und natürlich gibt es das auch billiger, aber ;-)