The journey to 800G

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Sales Manager
DC Forum Stockholm 2021
2-12-2021

Market Trends

Technology Developments

Take Aways

Q & A

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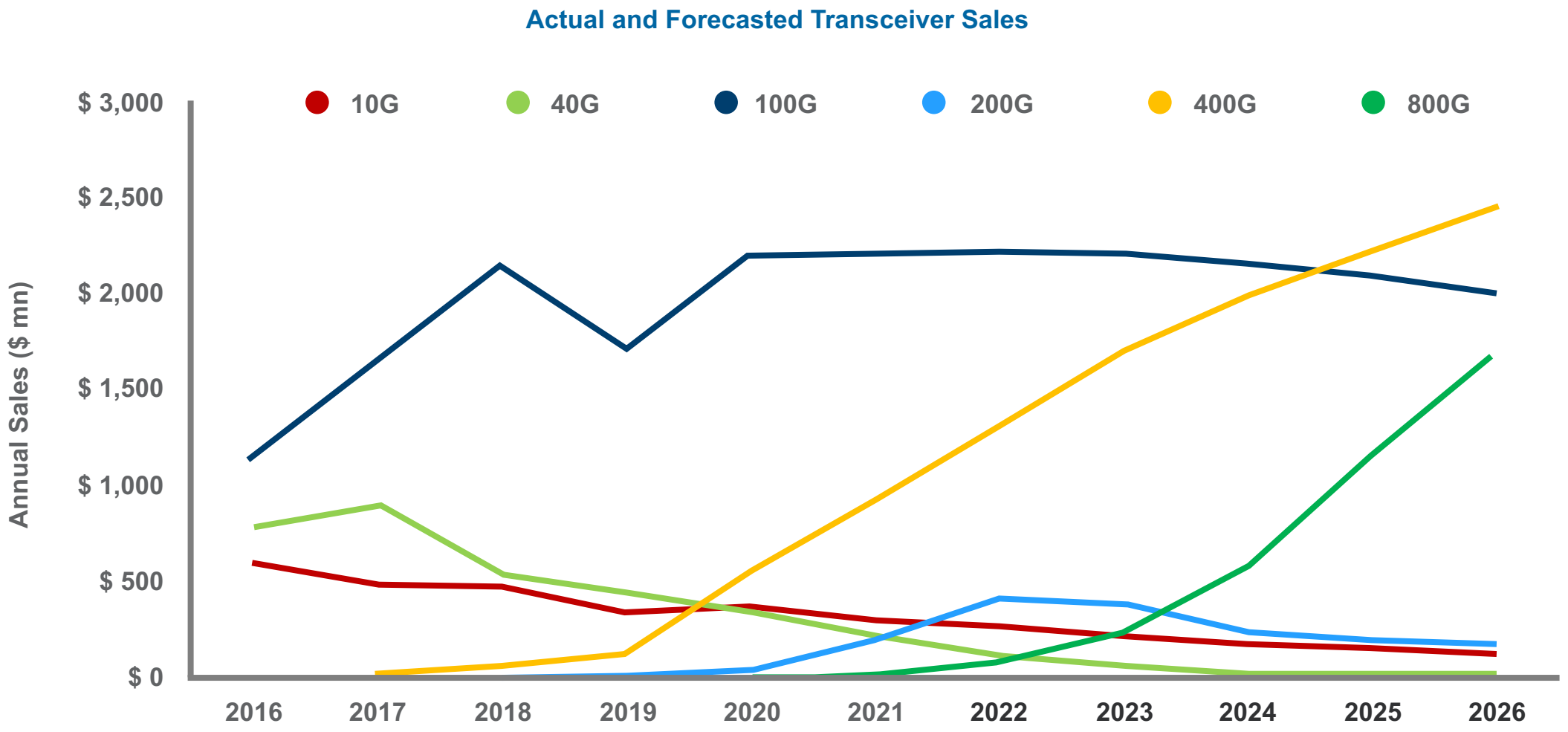
Market Trends

Technology Roadmap



Source: Lightcounting (April 2021)

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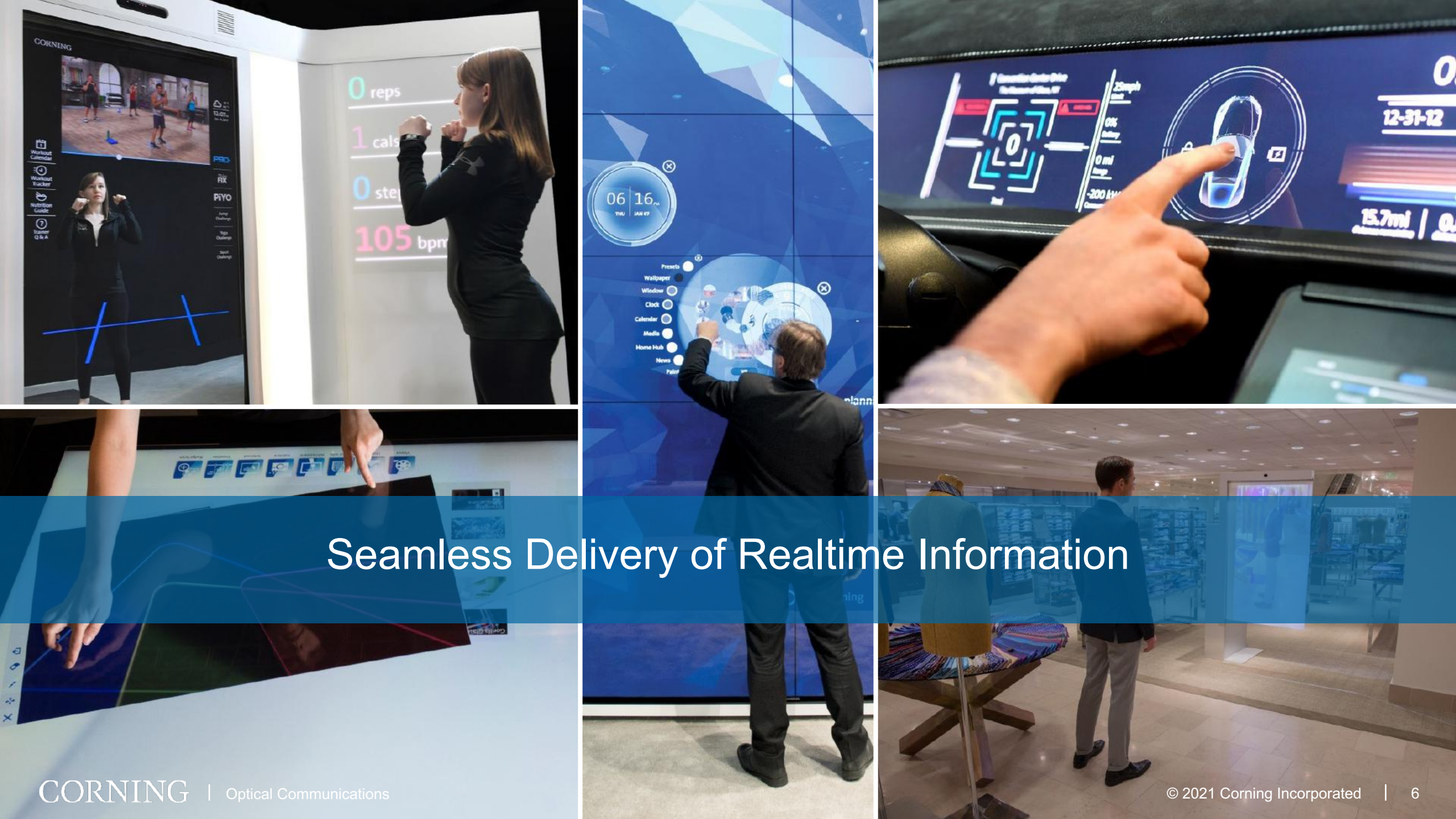

Seamless Delivery of Realtime Information

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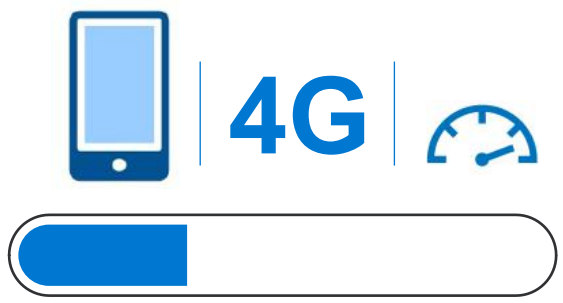
The Need for Speed!

5G CAN BE AS MUCH AS **x100** TIMES FASTER THAN 4G

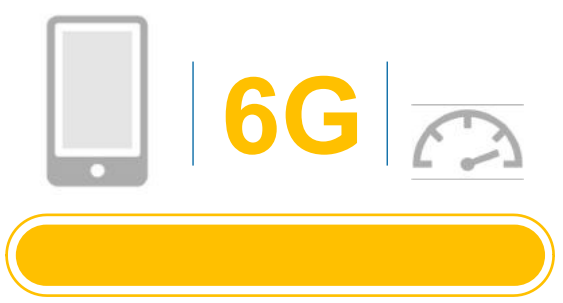
6G CAN BE AS MUCH AS **x100** TIMES FASTER THAN 5G

Total time: **26 hours**



Total time: **6 minutes**

Total time: **3.6 seconds**



Total time: **Too early to know**

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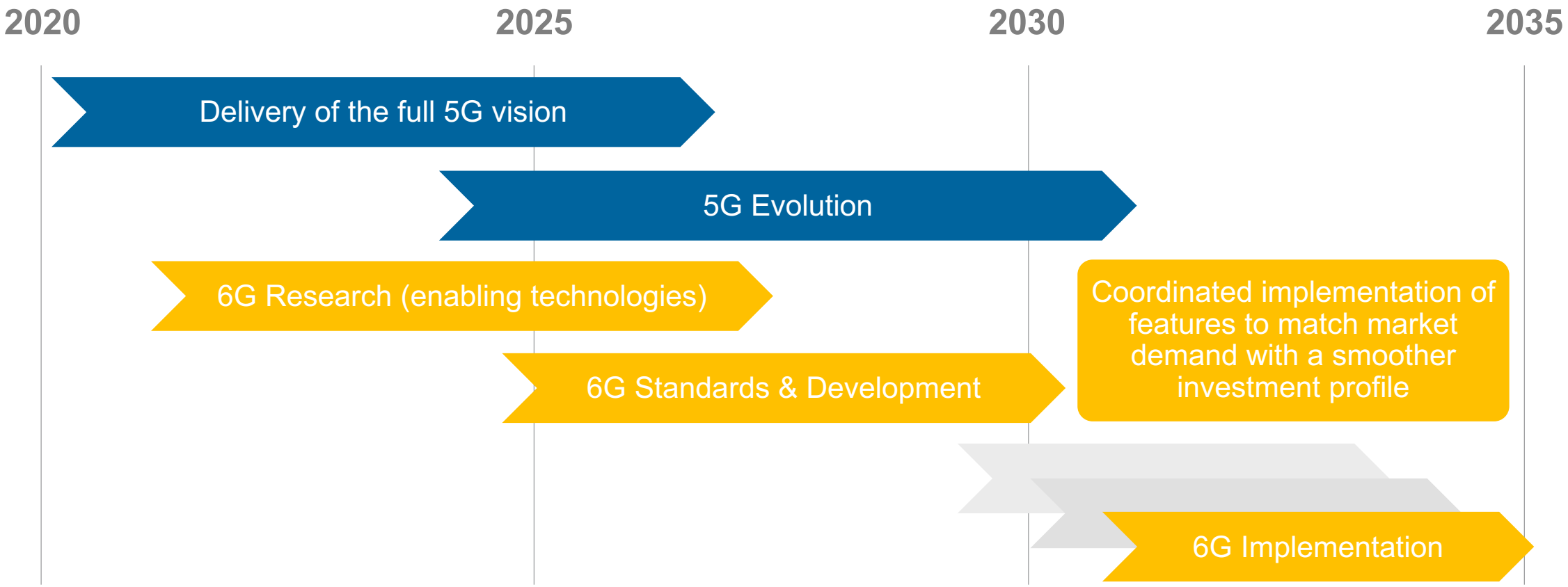
The Need for Speed!



Source: University of Surrey / www.lightreading.com November 2020

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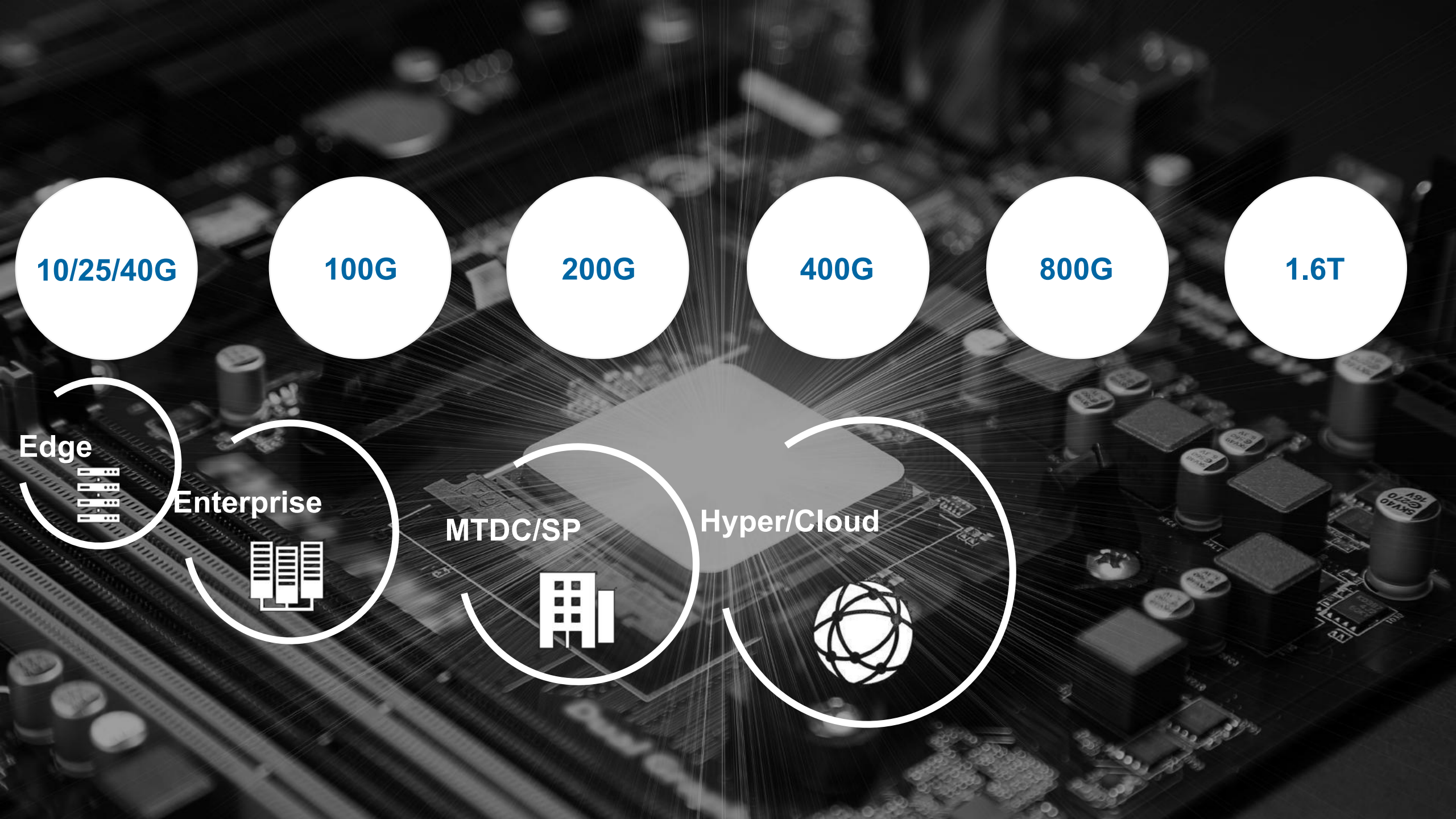
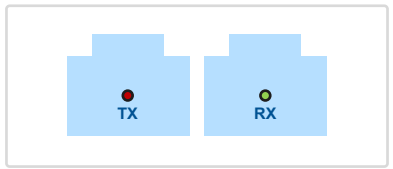
Technology Development


10/25/40G
100G
200G
400G
800G
1.6T
Edge
Enterprise
MTDC/SP
Hyper/Cloud

SFP+ Dominated 10G in the Data Center



Data Rate	Electrical Form Factor	MMF	SMF	Optical	Connector Type
10G	**SFP+ (1x10G)**	SR (400m)	LR (10km)	1λ @ 10G	2F, LC

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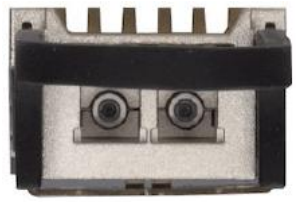
LC Connectivity

The common duplex interface in the Data Center

- LC connectivity is the leading duplex form factor for 10G through 800G
- Low Loss of 0.10 dB per mated pair MM, 0.25dB per mated pair SM
- Round 2.0 mm cable with no preferential bend
- Enhanced bend performance enabled by ClearCurve® fiber
- Uniboot design eliminates connector rotation in duplex clip designs and allow polarity changes on-site



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The optical road to higher data rates has a divergent path

1GbE, 10GbE, 25GbE

40GbE, 100GbE, 200GbE, 400GbE, 800GbE

Single channel, serial transmission

Traditionally we've been able to increase the Bitrate within a single channel (turn the light off and on more quickly).

Parallel

WDM (Duplex)

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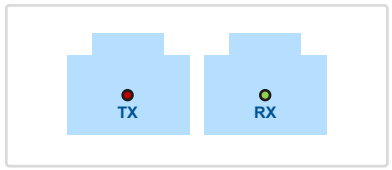
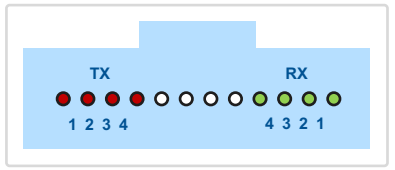
40G QSFP+ is mature





Data Rate	Electrical Form Factor	Transmission	MMF	SMF	Optical	Connector Type
40G	**QSFP+ (4x10G)**	**Duplex**	BiDi (150m)		2λ @ 20G	2F, LC
			SWDM4 (350m)	LR4 (10km) FR4 (2 km)	4λ @ 10G	2F, LC
		Parallel	SR4 (150m) eSR4 (400m)	PLR4 (10km) PLRL4 (1km)	1λ @ 10G	8F, MTP

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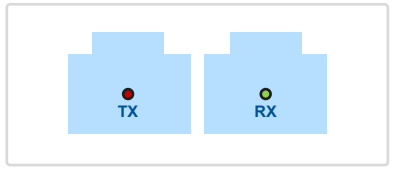
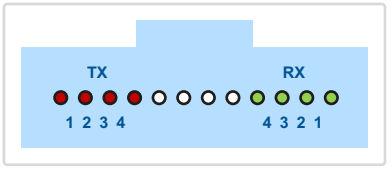
100G QSFP28 is mature





Data Rate	Electrical Form Factor	Transmission	MMF	SMF	Optical	Connector Type
100G	**QSFP28 (4x25G)**	**Duplex**	BiDi (100m)		2λ @ 50G	2F, LC
			SWDM4 (100m)	CWDM4 (2km) LR4 (10km)	4λ @ 25G	2F, LC
		Parallel	SR4 (100m) eSR4 (300m)	PSM4 (500m)	1λ @ 25G	8F, MTP

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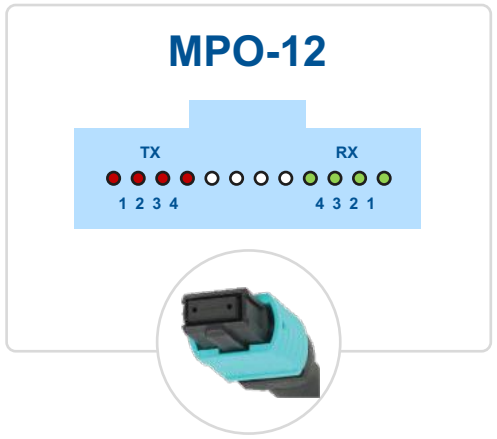
8F MTP Connectivity



The most common interface for Parallel Optics in DC

- Same form factor as 12F MTP, but only uses 8 of 12 fiber positions
- Low Loss of 0.25 dB per mated pair MM, 0.35 dB per mated pair SM
- MTP Pro allows for pinning and polarity changes in the field
- Round 2.0 mm cable with no preferential bend
- Enhanced bend performance enabled by ClearCurve® fiber

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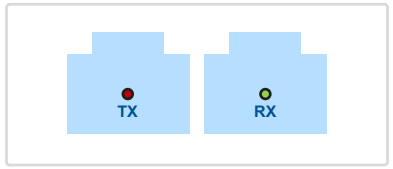
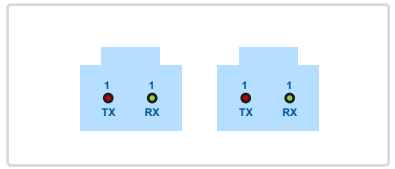
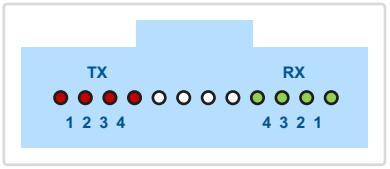
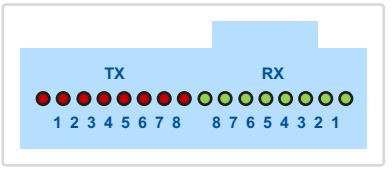
DRAFT

400G PMDs Being Introduced in the Market









Data Rate	Electrical Form Factor	Transmission	MMF	SMF	Optical	Connector Type
400G	**QSFP56-DD or OSFP56 (8x50G)**	**Duplex**		2x 200G-FR4 (2km)	4λ @ 50G	2x 2F VSFFC
		Parallel	SR4.2 (100m)		2λ @ 50G	8F, MTP
			SR8 (100m)		1λ @ 50G	16F, MTP

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400G MM introduces new 16F MTP Interface

16F MTP Interfaces

- Two form factors exist on the market:
  - Single row of 16F
  - Two rows of 8F, utilizing the 24F MTP Footprint
- 8F MM solutions expected to be used for structured cabling
- 16F MM solution used to breakout 400G transceivers to 50G devices

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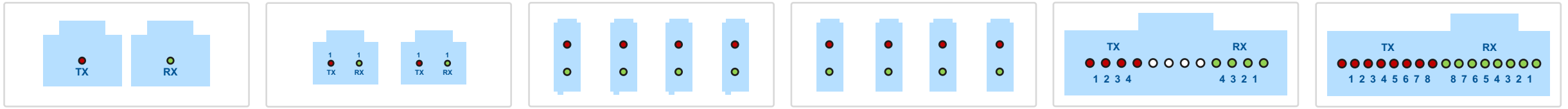
DRAFT

800G Early Stages



Data Rate	Electrical Form Factor	Transmission	MMF	SMF	Optical	Connector Type
800G	QSFP112-DD or OSFP112 (8x100G)	Duplex		2x 400G-LR4-6 (6km) 2x 400G FR4 (2km)	4λ @ 100G	2x 2F Mini LC 2x 2F VSFFC
		Parallel	2x 400G-VR4 (50m) 2x 400G-SR4 (100m)	PSM8 (500m) 2x 400G-DR4 (500m)	1λ @ 100G	16F, MTP 2x 8F, MTP 8x 2F VSFFC

Current work on development of 100G Lambda is bringing changes in 100G and 400G transceivers

Future development of a 200G Lambda could lead to implement SMF WDM 800G-LR4, 800G-FR4 and Parallel 800G-DR4 versions

800GPluggable MULTI-SOURCE AGREEMENT QSFP-DD800 OSFP

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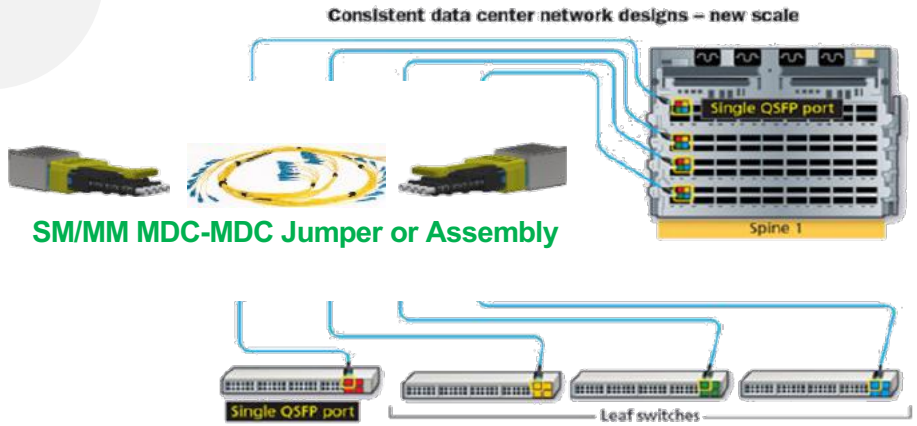
What is driving to have VSFF Connectors?

1 Breakout applications at the optics



- A smaller duplex connector can be used to **plug** the breakout fibers **directly** into a new multi-channel Tx/Rx device
- **Who drives it?**
  - Hyperscales / Carriers
- **What does it require?**
  - VSFFC transceivers, VSFFC jumpers or VSFFC trunks/assemblies

2 Higher density fiber management

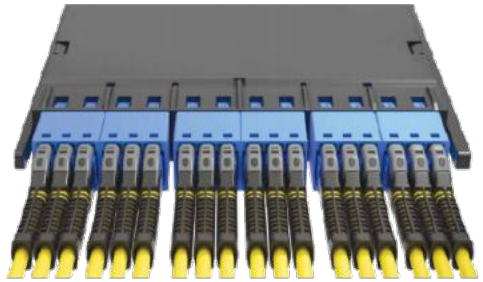


Image Source: US Conec Website

- Smaller form factor connectors would increase density by **2 to 3 times (up to 432F)**
- **Who drives it?**
  - Enterprise DC / Carriers
- **What does it require?**
  - VSFFC jumpers, VSFFC modules, Housing to handle density

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VSFFC Summary Table

	SENKO  CS (Corning Senko)	SENKO  SN	USCONEC  MDC
Transceiver breakout applications	**QSFP-DD 2:1 (2X200G)**	**QSFP-DD 4:1 (4X100G)** **SFP-DD 2:1 (2X50G)**	**QSFP-DD 4:1 (4X100G)** **SFP-DD 2:1 (2X50G)**
Are there transceivers available in the market **today**?	**Cisco / Arista**	**2021 / 2022**	**2021 / 2022**
Connector manufacturers offering components to create a new solution	**Connectors** **Adaptors** (1)	**Connectors** **Adaptors** (1)	**Connectors** **Adaptors** (1)
Who has requested these connectivity?	**Carrier Customer** (2)	**Hyperscale Customer** (2)	**Enterprise Customer** **Carrier Customer** (2)

1) *The variety of adaptors from the manufacturers will suit only specific applications and compatibility with existing hardware, meaning none of the VSFFC can provide the same Breakout application nor Density increase.*

2) *Niche application and design based on customer specification.*

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800G OSFP Optical Interfaces – Published on Aug 2nd, 2021

Duplex LC Optical Interface

MPO-12 Optical Interface

MPO-16 Optical Interface

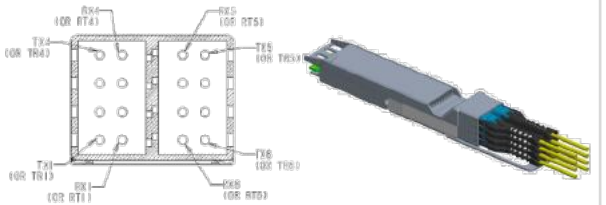
Quad SN Optical Interface

Dual Duplex LC Optical Interface

Dual MPO-12 Optical Interface

MPO-12 Two Row Optical Interface

8x MDC Optical Interface

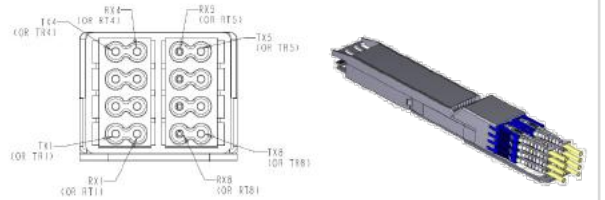


Dual Mini-LC Optical Interface

Dual CS Optical Interface

Quad MDC Optical Interface

8x SN Optical Interface



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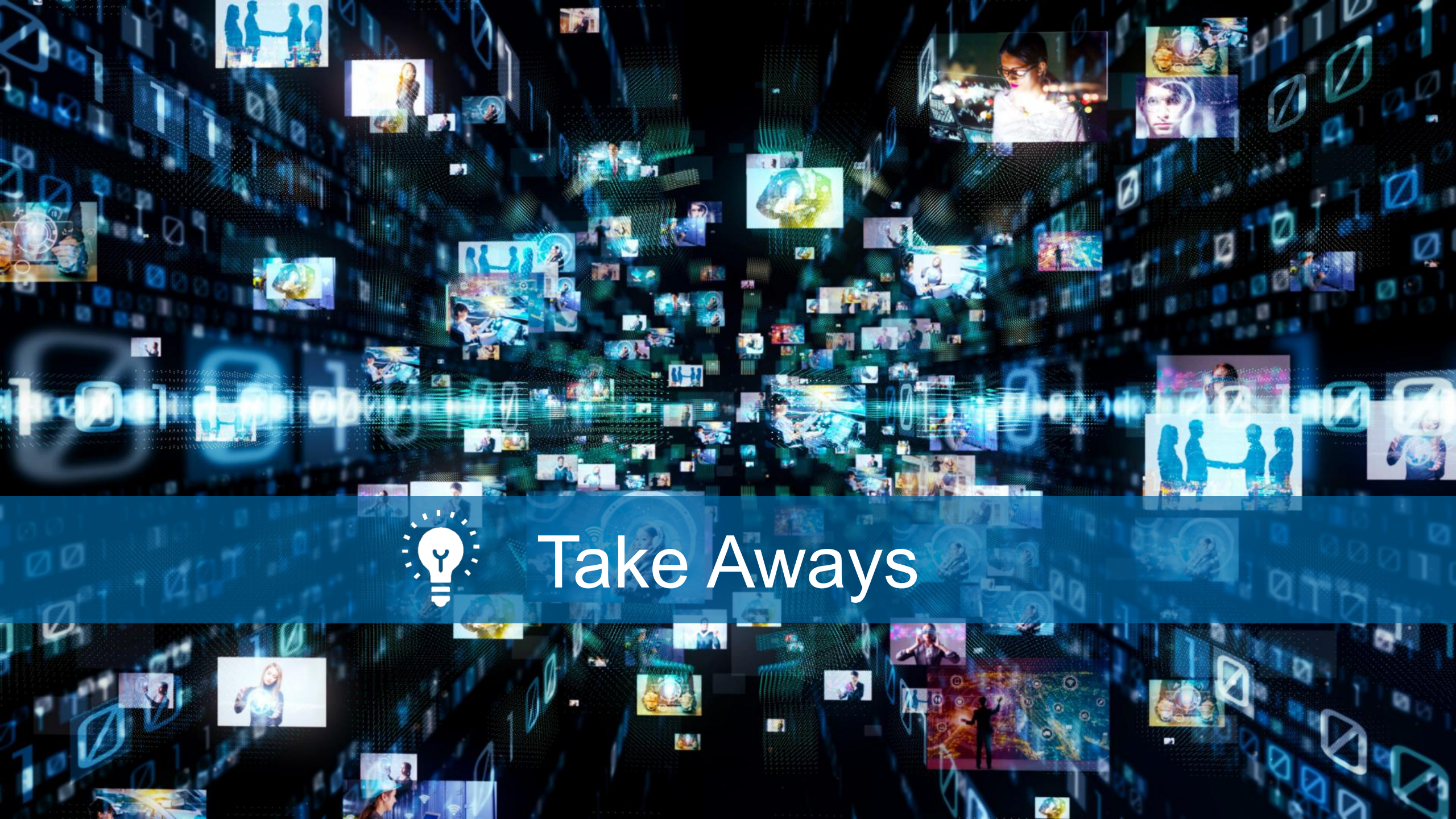
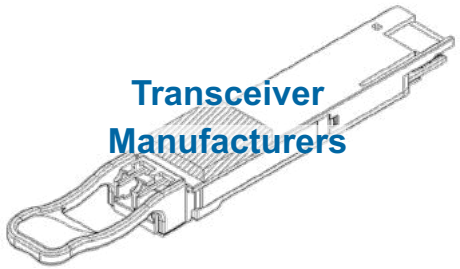


Take Aways

Technology Roadmap

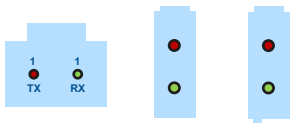


Transceiver Manufacturers

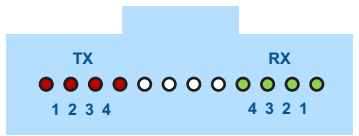
Voice of Technology

10G 40G 100G 200G 400G 800G

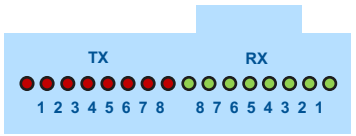
2 Fiber Connectivity

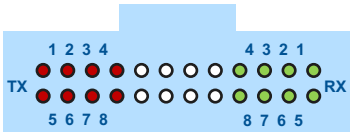


8 Fiber Connectivity



16 Fiber Connectivity





Deployment can be supported with Base-8

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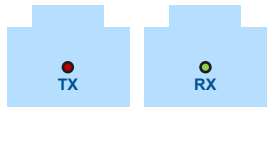
EDGE8® Solutions

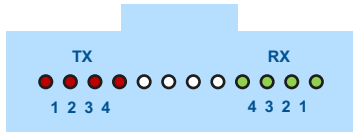
Budget & Cost | Space & Density | Deployment | Migration | New Tech | MACs | ISO / IEC11801 EN 50173-1 Standards

LC Duplex

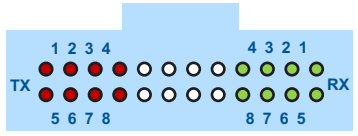


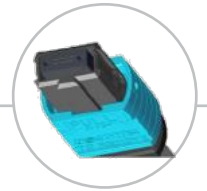
CS Duplex

MPO-12

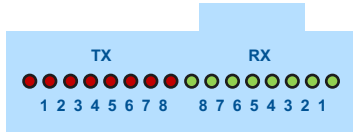


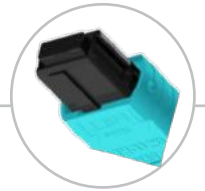
MPO-12 Two Row

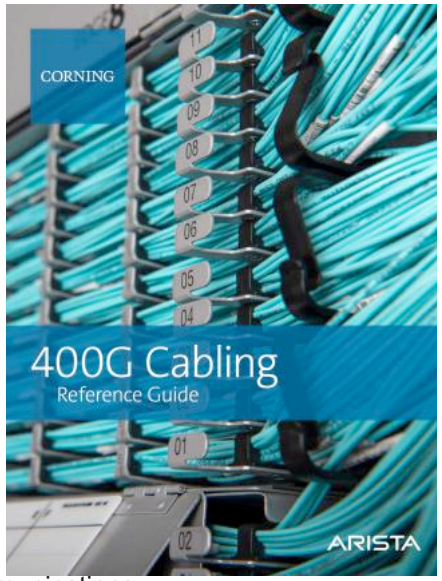


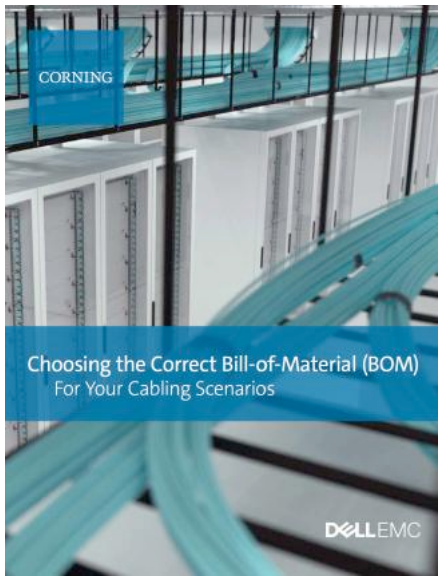


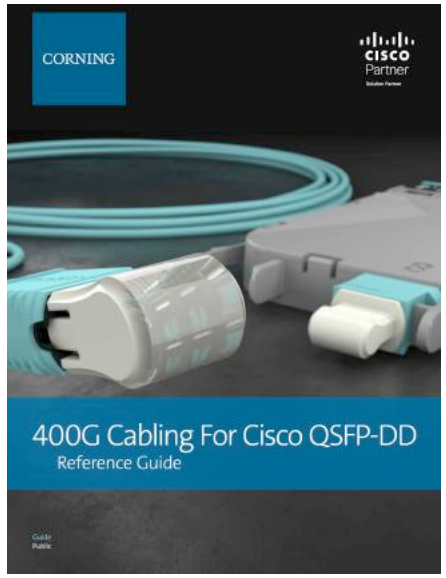
MPO-16 One Row











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SUPPORT MATERIAL

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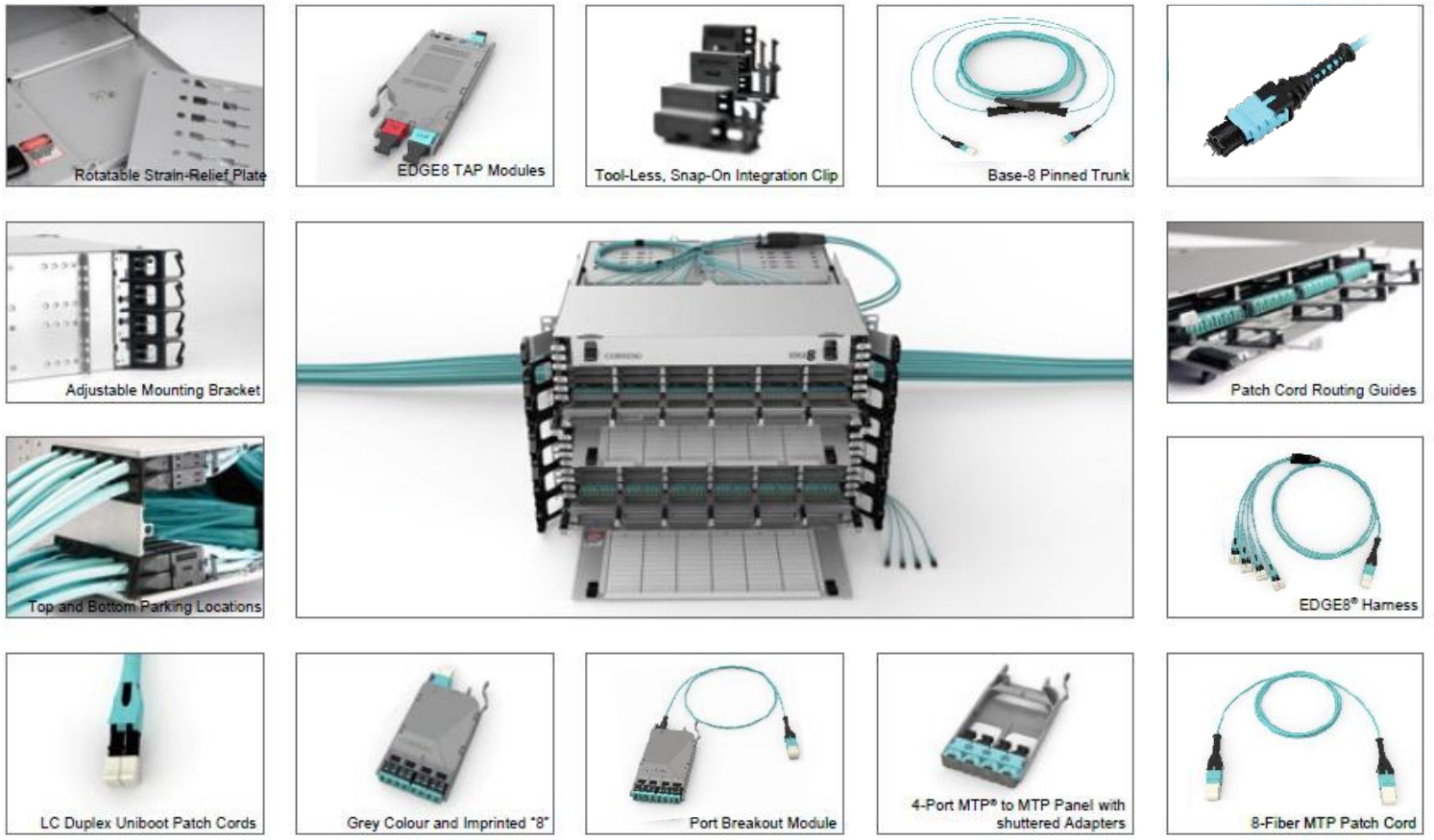
EDGE8 Solutions

Best in class

- The EDGE/EDGE8 Platform is the world's **most versatile Switch-to-Switch data center solution**.
- **B2ca a1 s1 d1 trunks** rated under CPR requirements
- **MTP-Pro** connectors with **Push-Pull-Boot** allowing superior finger access and polarity changes in the field
- Utilizes Corning fiber providing **enhanced bend performance**
- LC Uniboot and MTP **Low Loss connectors** available for MMF and SMF connections
- **Match the transceiver technology connectivity** with 100% fiber utilization



Value-Prop

- The best option supporting **migration** from 10G to 800G
- Supports Base-2, Base-8 and Base-16 connectivity with **duplex and parallel architecture**
- Supports port **breakout solutions** to save space, power and cooling
- Supports **network monitoring** without adding separate space consuming hardware
- Supports keyed connectivity for **Secure Solutions**

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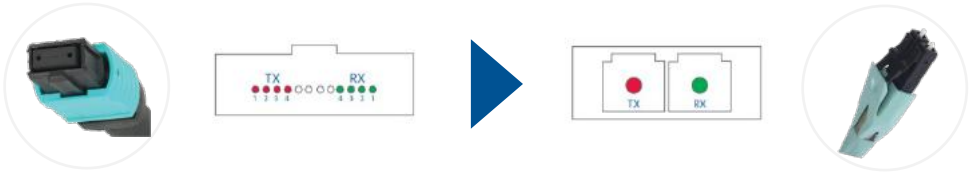
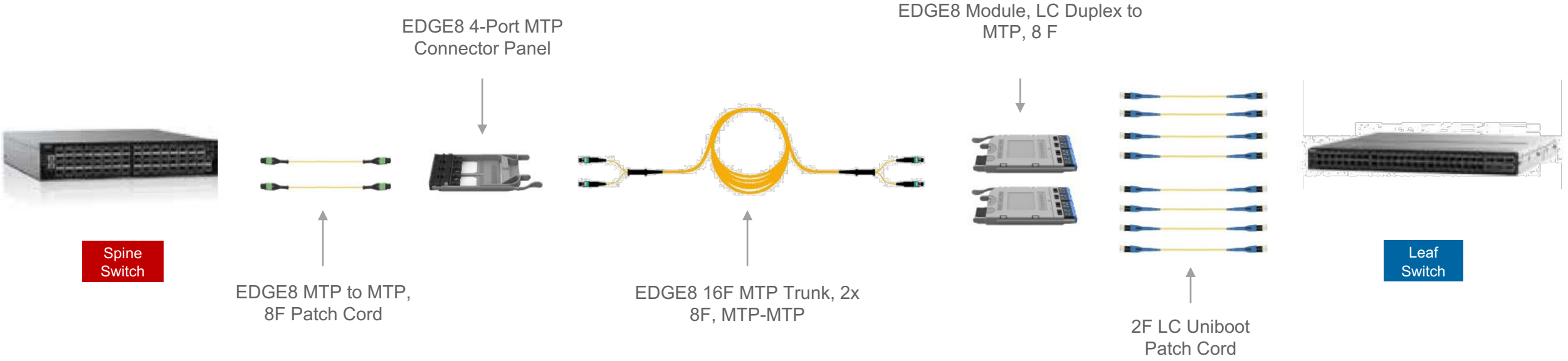
Interconnecting MDA to EDA with EDGE8

Example: MPO-12 to LC Duplex Across the Data Center With Trunk



Near End Optic (Left)		Far End Optic (Right)		Reach
OSFP-400G-DR4	single-mode	4x QSFP-100G-DR	single-mode	500 m
OSFP-400G-XDR4	single-mode	4x QSFP-100G-FR	single-mode	2 km
QDD-400G-DR4	single-mode	4x QSFP-100G-DR	single-mode	500 m
QDD-400G-XDR4	single-mode	4x QSFP-100G-FR	single-mode	2 km
QSFP-100G-PSM4	single-mode	4x SFP-25G-LR	single-mode	500 m
QSFP-40G-PLRL4	single-mode	4x SFP-10G-LRL	single-mode	1 km
QSFP-40G-PLR4	single-mode	4x SFP-10G-LR	single-mode	10 km

Near End Optic (Left)		Far End Optic (Right)		Reach
QSFP-100G-SR4	multimode	4x SFP-25G-SR	multimode	100 m
QSFP-100G-XSR4	multimode	4x SFP-25G-SR	multimode	100 m
QSFP-40G-SR4	multimode	4x SFP-10G-SR	multimode	150m
QSFP-40G-XSR4	multimode	4x SFP-10G-SR	multimode	150m



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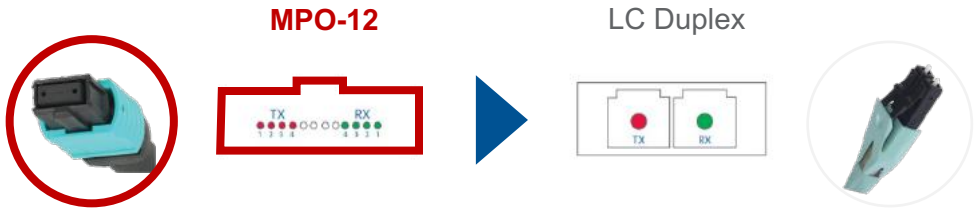
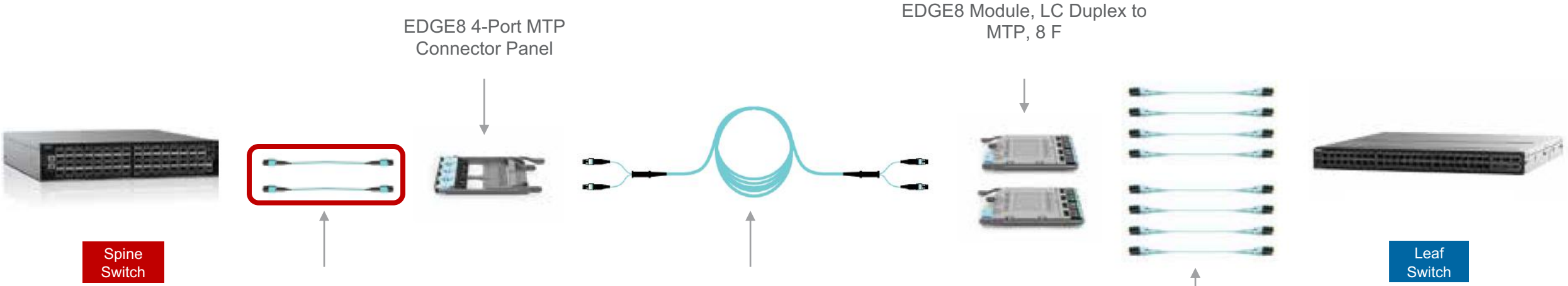
Interconnecting MDA to EDA with EDGE8

Example: MPO-12 to LC Duplex Across the Data Center With Trunk



Near End Optic (Left)		Far End Optic (Right)		Reach
QSFP-100G-SR4	multimode	4x SFP-25G-SR	multimode	100 m

Near End Optic (Left)		Far End Optic (Right)		Reach
OSFP-400G-SR8*	multimode	8x SFP-50G-SR	multimode	100 m
OSFP-400G-SR8'	multimode	8x SFP-25G-SR	multimode	100 m
QDD-400G-SR8*	multimode	8x SFP-50G-SR	multimode	100 m
QDD-400G-SR8'	multimode	8x SFP-25G-SR	multimode	100 m



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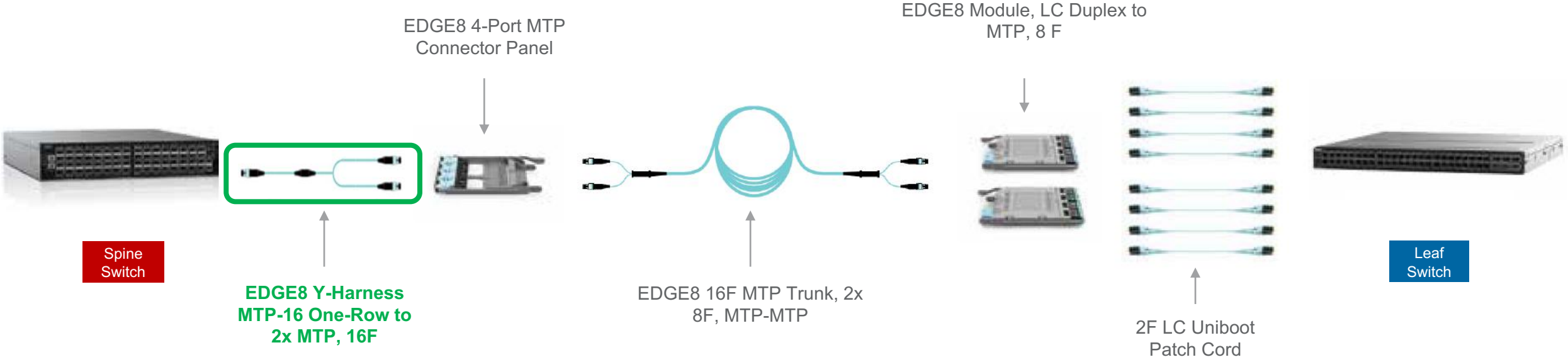
Interconnecting MDA to EDA with EDGE8

Example: MPO-16 APC One-Row to LC Duplex Across the Data Center With Trunk

Near End Optic (Left)		Far End Optic (Right)		Reach
OSFP-400G-SR8*	multimode	8x SFP-50G-SR	multimode	100 m
OSFP-400G-SR8'	multimode	8x SFP-25G-SR	multimode	100 m
QDD-400G-SR8*	multimode	8x SFP-50G-SR	multimode	100 m
QDD-400G-SR8'	multimode	8x SFP-25G-SR	multimode	100 m

*Refer to Arista 400G FAQ for supported breakout modes.
'Configured to work as 2x 100G. Refer to Arista 400G FAQ for supported breakout modes.



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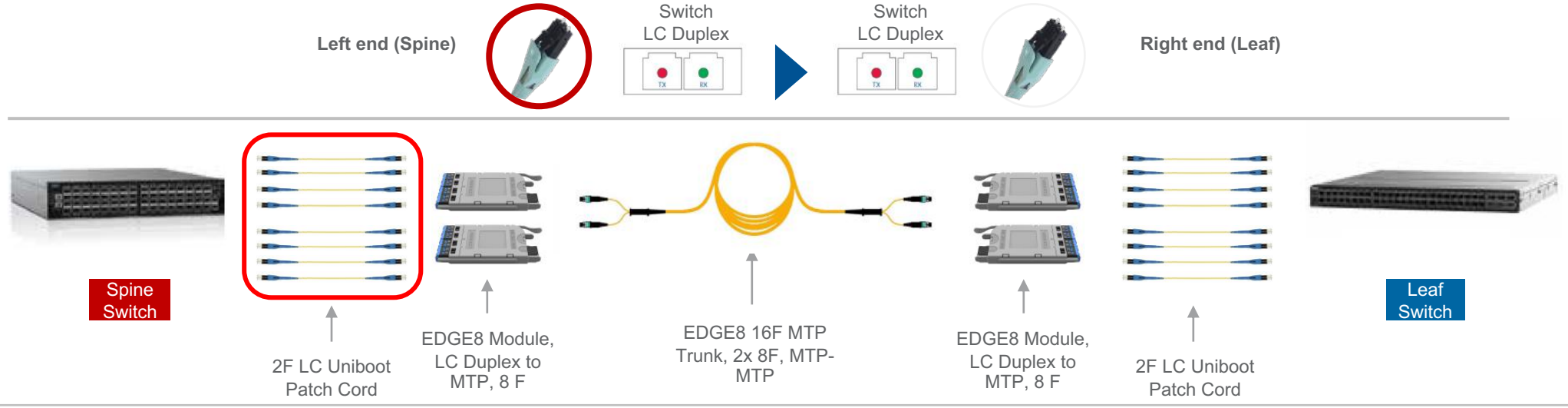
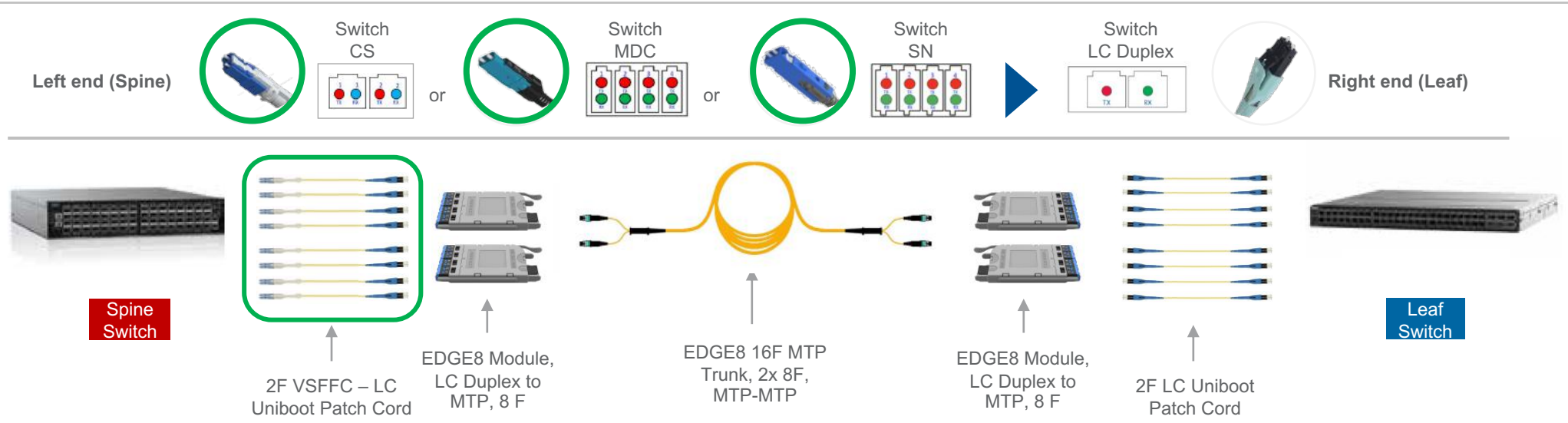
Example of cabling infrastructure migration from LC-LC optics footprint to VSFFC-LC footprint utilizing the existing EDGE8 infrastructure



Migration to higher data rate utilizing VSFFC



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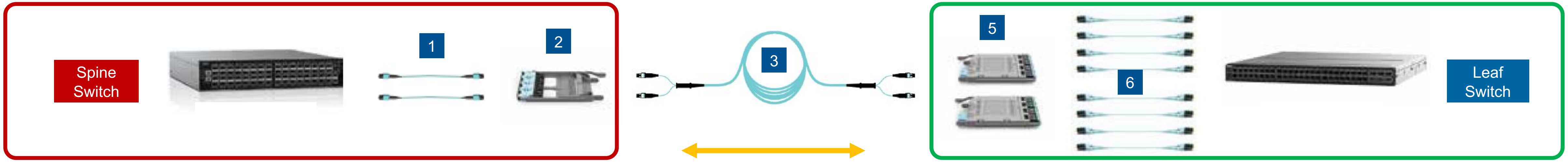
Interconnecting MDA to EDA with EDGE8

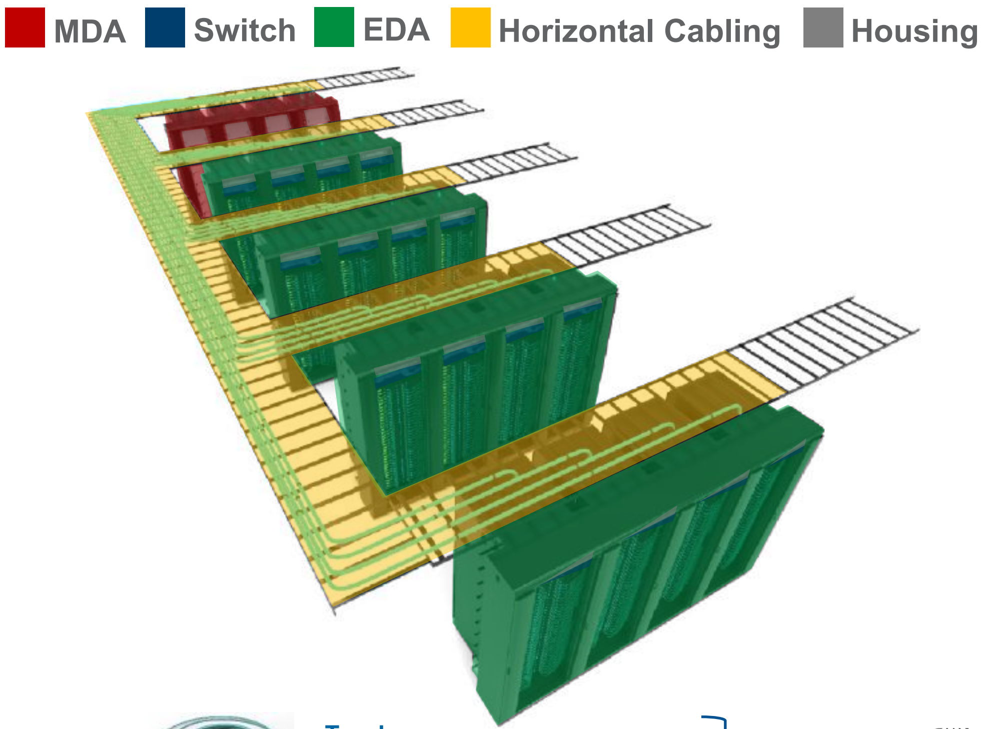


1 

MTP Patch Cords
MTP patch cords with MTP PRO to allow field management of pinning and polarity. MTP patch cords support parallel optics like QSFP, QSFP-DD and OSFP

2 

MTP Adapter Panel
Reverse polarity adapter for field polarity management



5 

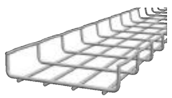
Module
MTP-LC cassette to support port breakout functionality

6 

LC Uniboot Patch Cords
Reverse polarity uniboot patch cords minimize patch cord density and optimize routing

3 

Trunk
MTP trunk with 100 lb pulling grip to simplify installation



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