Is your DC ready for the journey to 400/800G?

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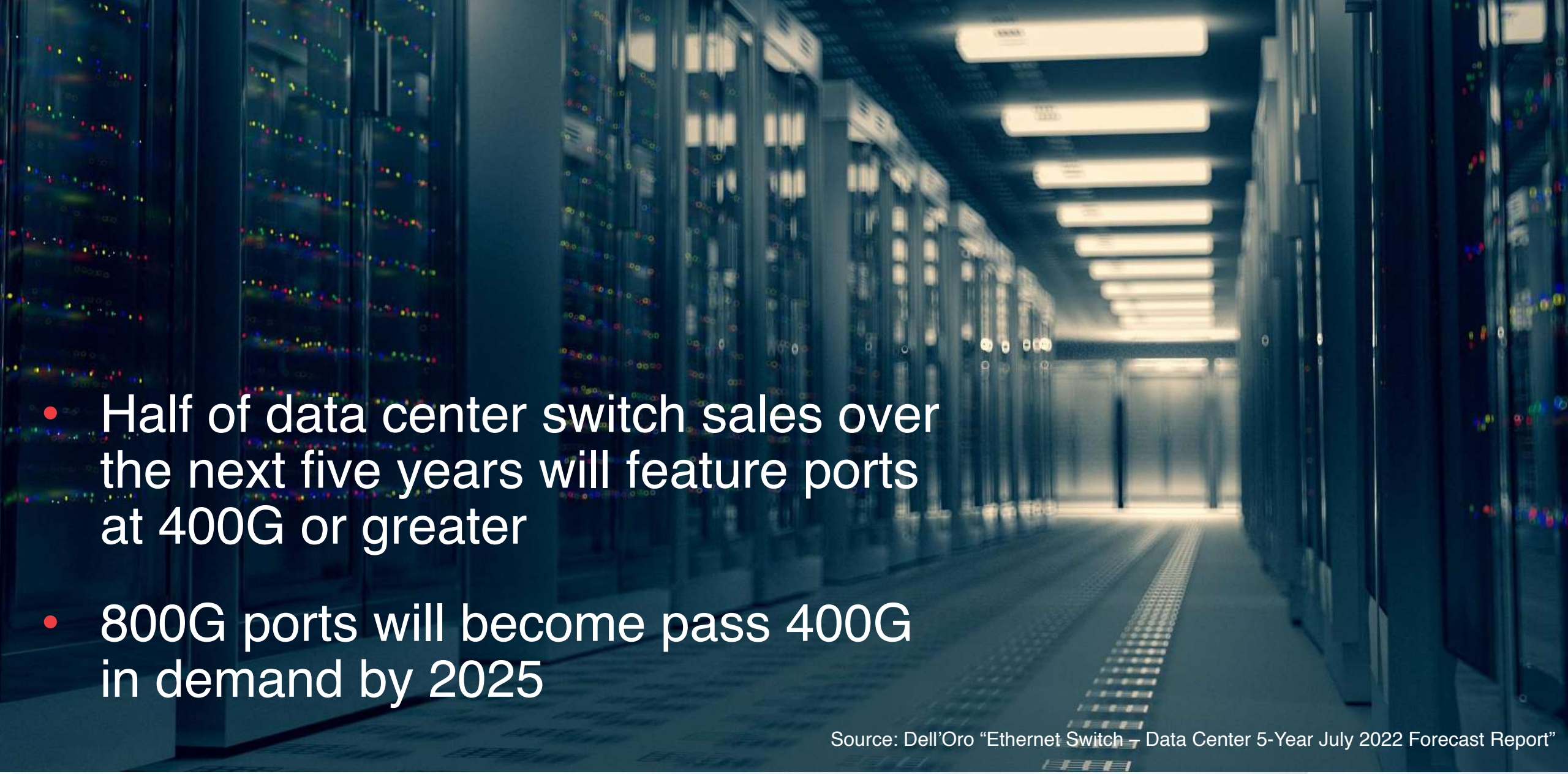
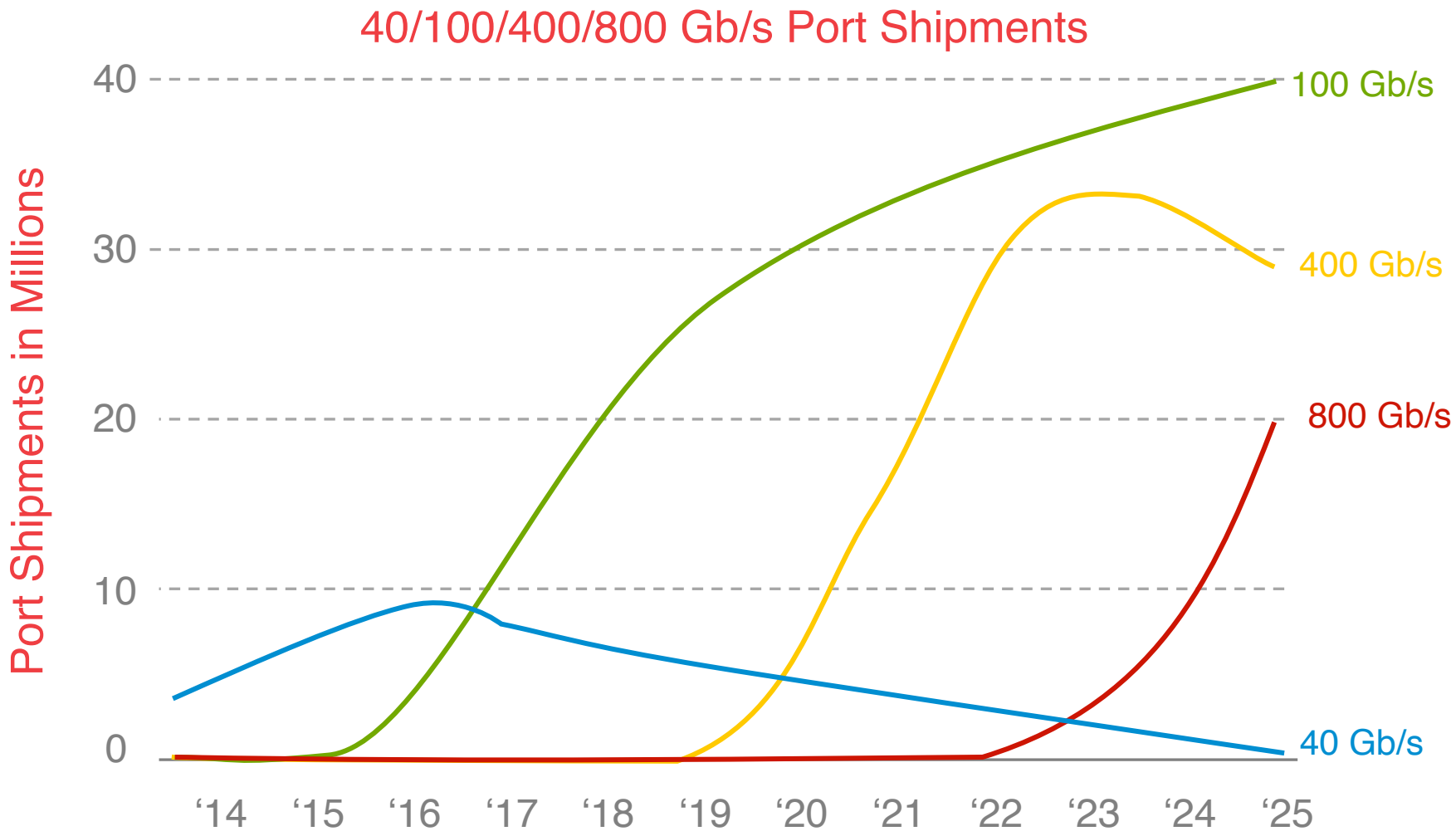


- Half of data center switch sales over the next five years will feature ports at 400G or greater
- 800G ports will become pass 400G in demand by 2025

Source: Dell'Oro "Ethernet Switch – Data Center 5-Year July 2022 Forecast Report"

High Speed Ethernet Transceiver Forecast



Source: 650 Group

Primary Customer Use Cases for 400G

Hyperscale Data Centers

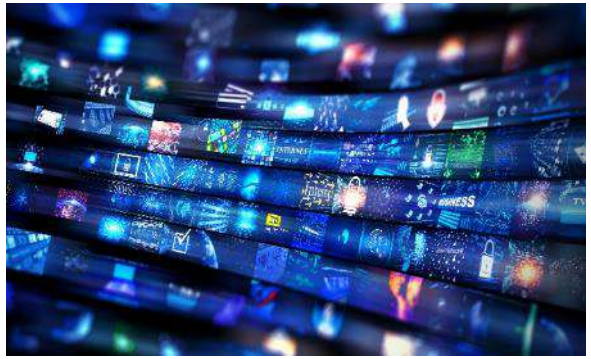
- Super-spine architecture designs
- Move to 50/100/200G NICs in servers
- Lower power per Gigabit

Telco Service Providers

- 5G Buildouts
- 100/400G fabric designs
- EDGE data centers
- Converting COs to NFV Cloud data centers

Large Enterprise Companies

- Financial and medical using high bandwidth applications
- AI and Machine Learning applications requiring 50/100G server NICs
- Supporting remote working during Covid-19



Professional Media Networks

- IP fabric for media
- Uncompressed 4K/8K/16K high resolution video
- High speed networking for computer animation and visual effects

An Increase in Cloud Repatriation

50% Public Applications Expected to Repatriate over the next 2 years.

IDC

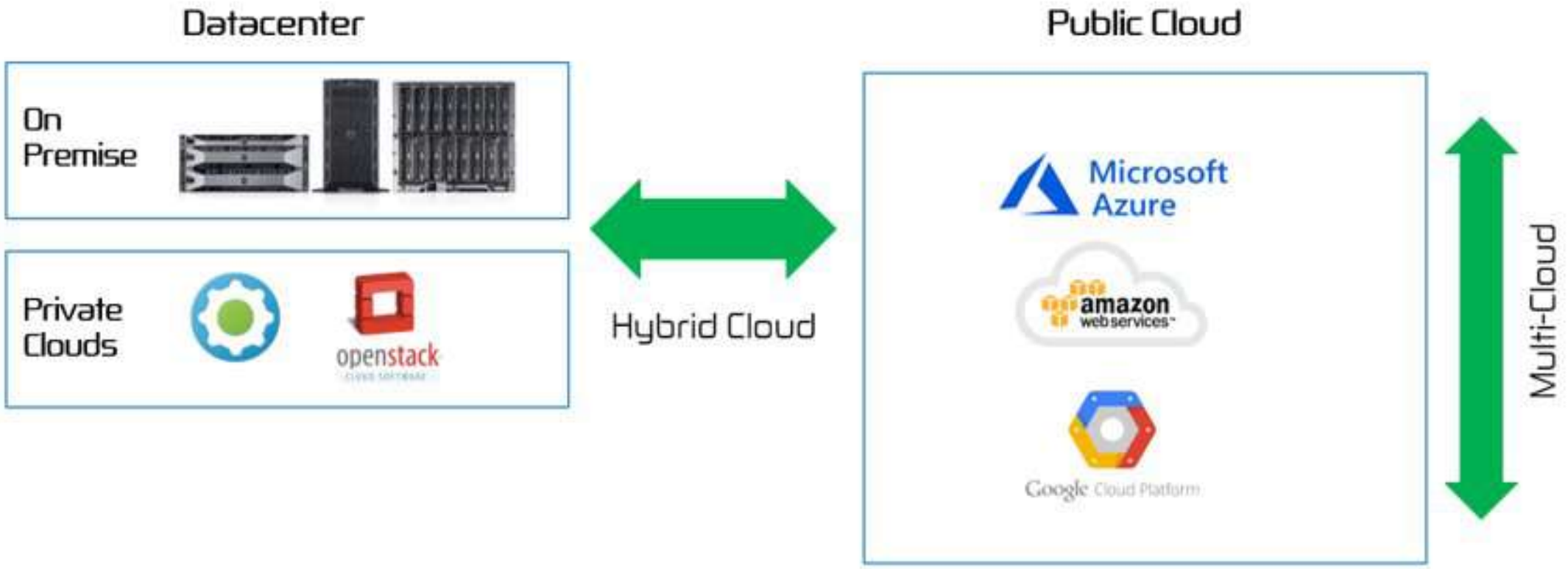
- Security
- Performance
- Costs

On-Premise

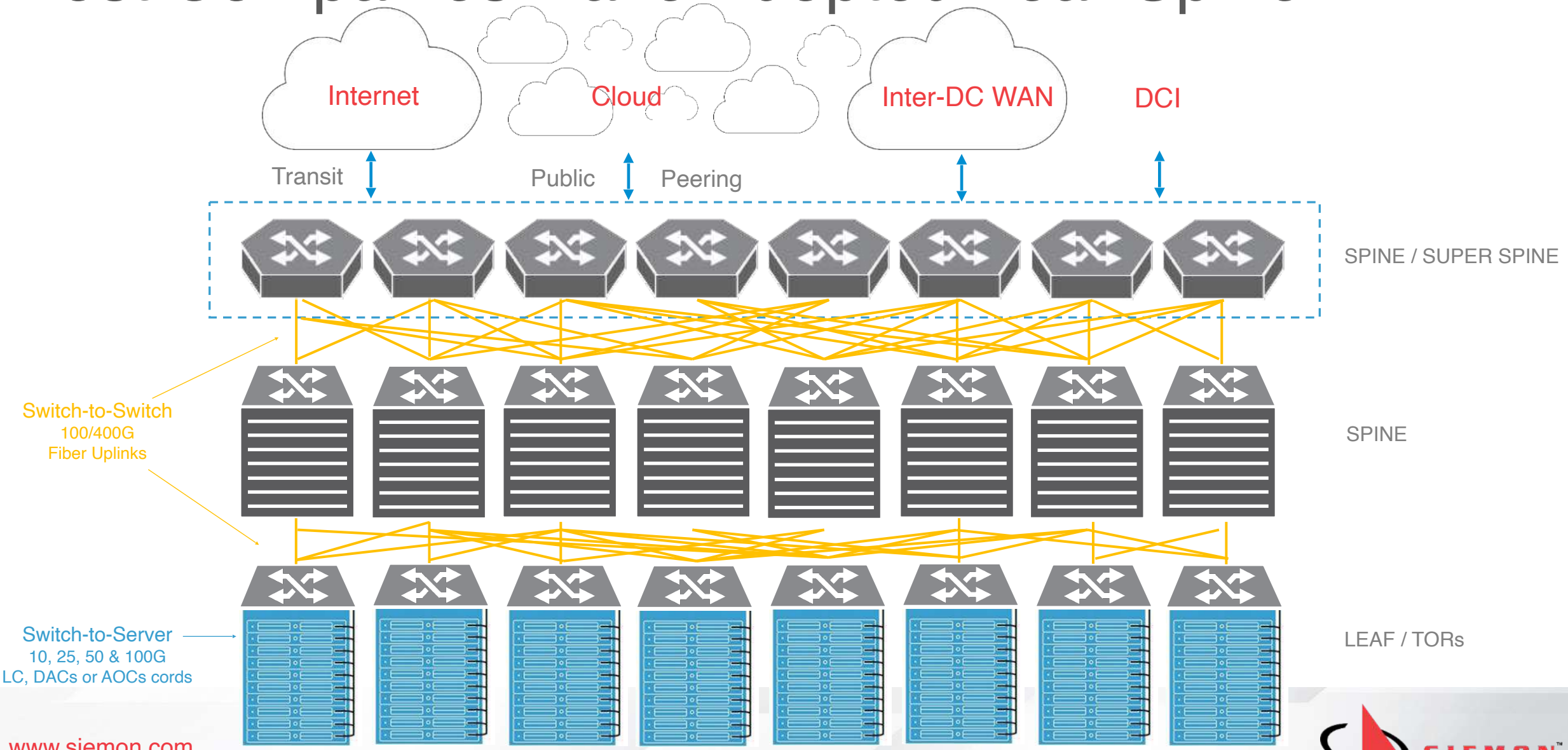
vs.

Cloud

What is the Best Data Center Strategy?



Most Companies Have Adopted Leaf-Spine



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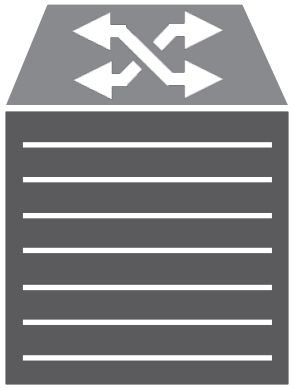
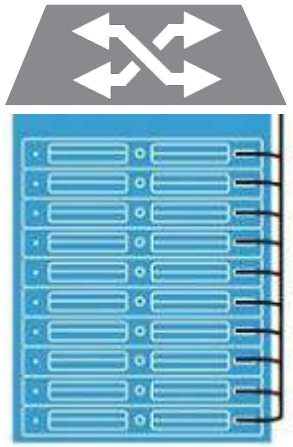


SPINE

100/400G Uplinks



LEAF / TOR

LCs, DACs or AOCs
10, 25, 50 & 100G connections

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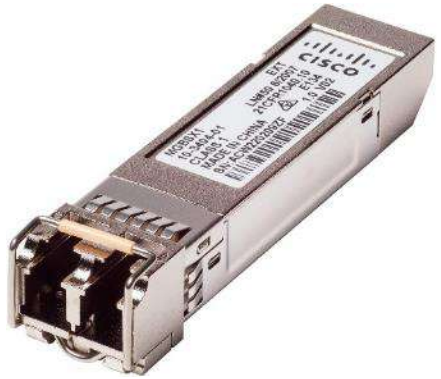
Transceiver Form Factor Evolution



SFP+	SFP28	SFP56	QSFP+	QSFP28	QSFP56	QSFP-DD/ OSFP
10G	25G	50G	40G	100G	200G	400G

New Ethernet Terminologies for 200/400G

SR8 I 100m reach

- 8 x optical channels (16 total MM fibers-MPO)
- Each channel operates at 50Gb/s

DR4 I 500m reach

- 4 x optical channels (8 total SM fibers-MPO)
- Each channel operates at 100Gb/s

FR4 I 2km reach

- 4 x optical channels multiplexed onto 1 pair (2 total SM fibers-LC)
- Each channel operates at 100Gb/s

400G Optical Transceivers (Q1 2022)

	400G Transceiver	STD	MFR	Form Factor	Breakout Option	Fiber Type	Distance (meters)	# of Fibers	Connector
1	400G-FR4	IEEE/MSA	All	QSFP-DD,OSFP	No	OS2	2,000	2	LC
2	400G-DR4	IEEE	All	QSFP-DD,OSFP	Yes	OS2	500	8	12F MTP
3	400G-XDR4 (DR4+)	Prop.	Arista, Juniper, Cisco	QSFP-DD,OSFP	Yes	OS2	2,000	8	12F MTP
4	400G-SR8	IEEE	Arista	QSFP-DD,OSFP	Yes	OM3/OM4	70/100	16	16F/24F MTP
5	400G-SR4.2(BD)‡	IEEE/MSA	Cisco	QSFP-DD	Yes	OM3/OM4/OM5	70/100/150	8	12F MTP
6	400G-2FR4	Prop.	Arista	OSFP	Yes	OS2	2,000	4	CS
7	COMING:400G-VR4	802.3db*	N/A	TBD	Yes	OM3/OM4	30/50	8	12F MTP
8	COMING:400G-SR4	802.3db*	N/A	TBD	Yes	OM3/OM4	70/100	8	**12F MTP**
9	COMING:400G-DR2	802.3df^	N/A	TBD	No	OS2	500	4	LC/CS/SN/ MDC?

Expected High Volume Options

Notes:
Does not include long reach 10km options. “SR16” or “FR8” options not available on the marke
All OM4 & OM5 distances are the same, with only exceptions listed above

‡ : Plan to be commercially available in Q1-2022
*IEEE 802.3db estimated publication in Q2-2022
^ IEEE 802.3df estimated publication in Q3-2025

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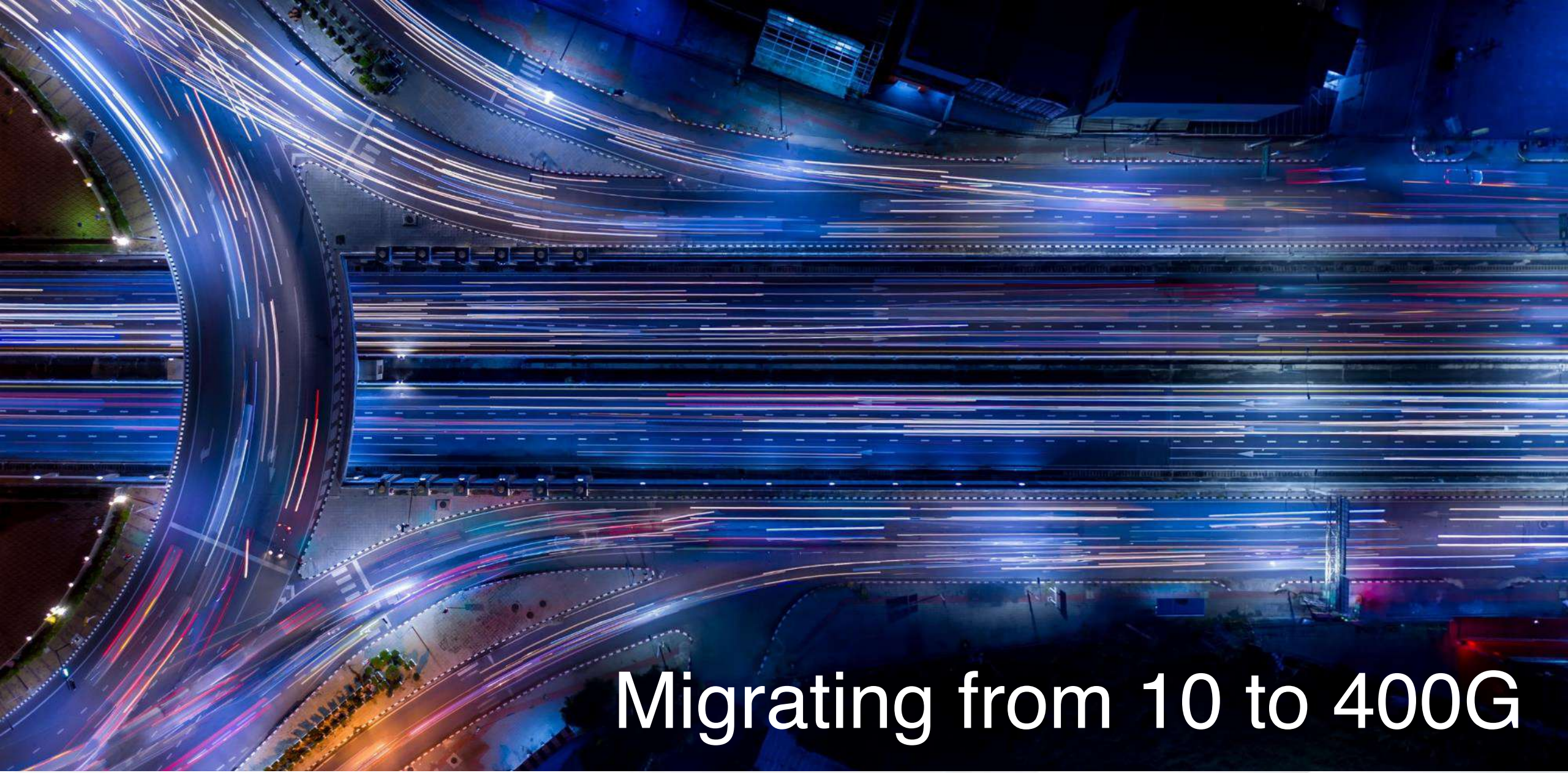
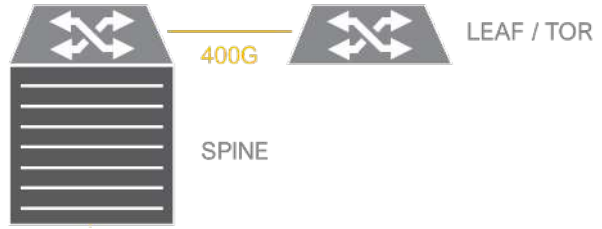


Migrating from 10 to 400G

100G-DR4 or 400G-FR4 Channel

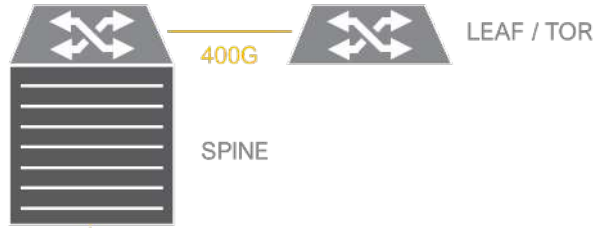
2-fiber Singlemode Channel will support 10G, 40G, 100G & 400G



- Base-8 Singlemode cabling
- Provides duplex LC connections at equipment

100G-PSM4 or 400G-FR4 Channel

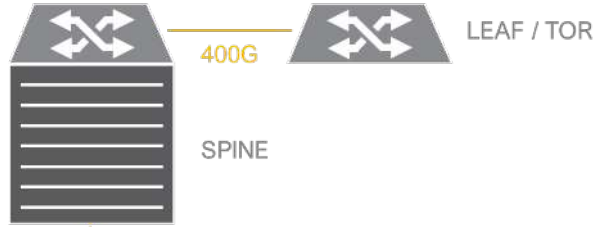
8-fiber Singlemode Channel



- Base-8 Singlemode cabling
- Provides parallel (8-fiber) connections at equipment

100 to 4x25G or 400 to 4x100G Breakouts

8-fiber Singlemode Channel with 400G-DR4 or 100G-PSM4



QSFP-DD
or QSFP28

8F MTP Jumper

MTP Adapters

Base-8 MTP-MTP Trunk

MTP Adapters

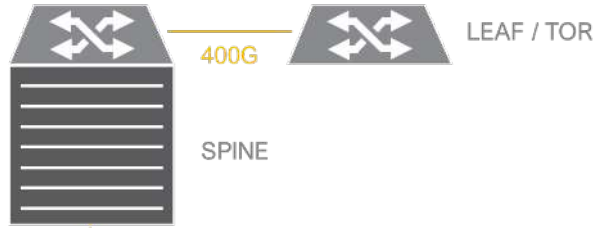
MTP-LC Cord

QSFP28
or SFP28

- Base-8 Singlemode cabling
- Convert 8-fiber channel to 4 x duplex channels
- Creates up to 128 x 100G channels per 1U switch

100G-SR4 or 400G-SR4.2 Channel

8-fiber Multimode Channel will support 40, 100 & 400G

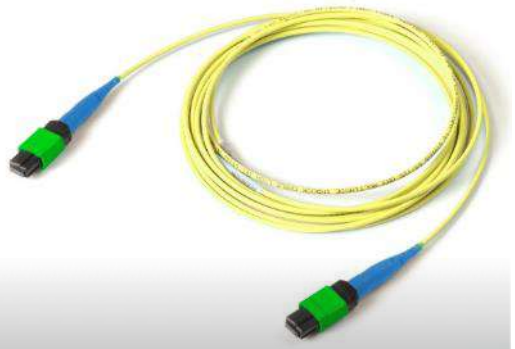


- Base-8 OM4 cabling
- Provides parallel (8-fiber) connections at equipment

Ultra Low Loss Base-8 Cabling Solutions

Singlemode and Multimode

High Density Enclosures



MTP Jumpers

Pre-Terminated Assemblies

High Density Modules

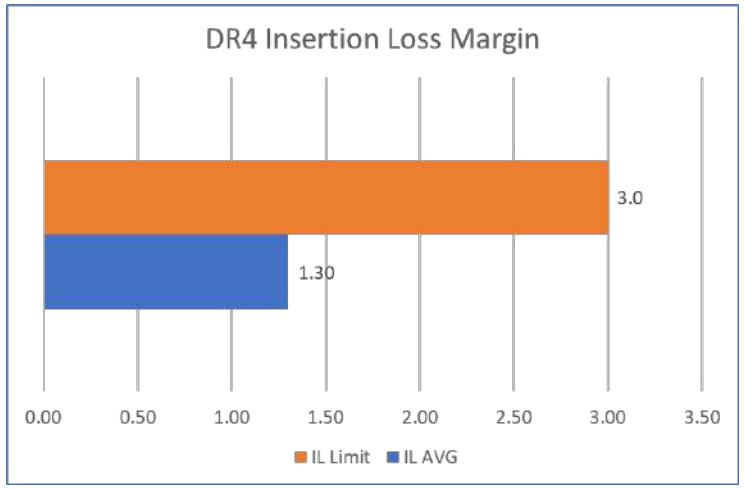
Singlemode Ultra Low Loss MTP System

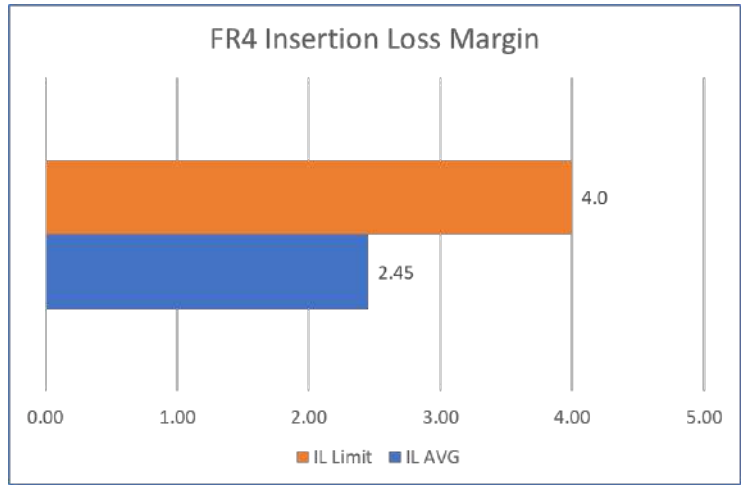
- Siemon is the 1st company to have 3rd party testing to 400G Ethernet
- 8 x MTP mated pairs tested to 400G-DR4 channel limits
- 5 x MTP-LC modules tested to 400G-FR4 channel limits

intertek
Total Quality. Assured.

The best Singlemode performance in the industry!

- MTP connectors: 0.3 dB max IL
- MTP-LC modules: 0.5 dB max IL
- LC BladePatch cords: 0.2 dB max IL





Come and see our 400G-ready LightVerse® solutions on our stand

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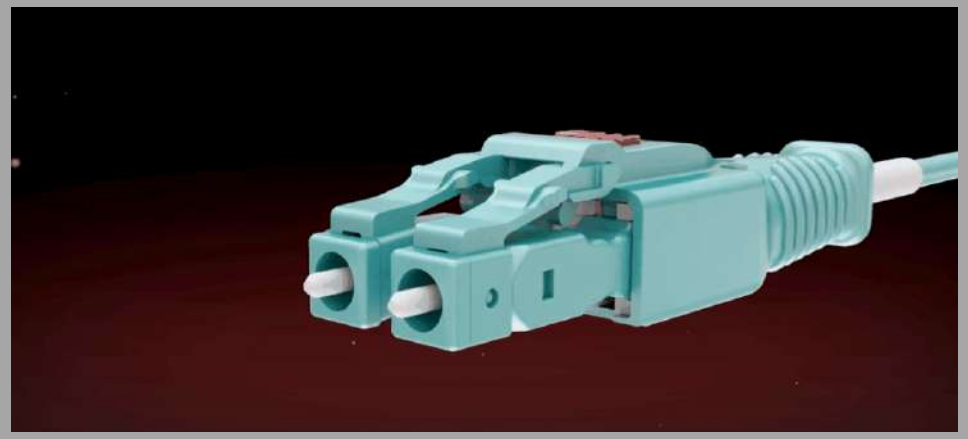
Patented LC BladePatch® Patch Cords

- Polarity Changes
- Smaller Footprint
- Simple Management
- Improved Airflow
- High Performance
- Various Options



DACs and AOCs

- Simplified Channels
- Factory Tested
- Interoperability
- Fast Lead Times
- Length & Diameter
- Color Options

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800G on the Horizon

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800G MSAs and Industry Activities

QSFP-DD800

- Specification is 8 x 100G lanes
- Will be backwards compatible to QSFP-DD, QSFP
- Will use Singlemode fiber
- Expect to use 24W of power

BROADCOM
CISCO
FINISAR
JUNIPER NETWORKS
molex
intel
MARVELL
samtec

800GPluggable MULTI-SOURCE AGREEMENT

- Specification might include 8 x 100G & 4 x 200G lanes
- Will use Singlemode fiber

Accelink
AOI
Baidu 百度
CIG
TTL
FUJITSU
H3C
Hisense
HUAWEI
Inphi
LUMENTUM
LUXSHARE ICT
SUMITOMO ELECTRIC
Tencent
YAMAICHI ELECTRONICS

Ethernet Technology Consortium

- Specification is 8 x 100G lanes
- Could use 2 x 400G-DR4
- Will use Singlemode fiber

ARISTA
BROADCOM
CISCO
DELL
Google
Microsoft
NVIDIA

SIEMON

Potential 800G Optical Transceivers (Q1 2022)

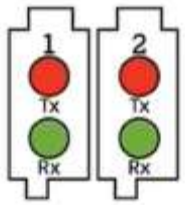
	800G Transceiver	STD	MFR	Form Factor	Breakout Option	Fiber Type	Distance (meters)	# of Fibers	Connector
1	800G-PSM8	MSA	N/A	QSFP-DD/OSFP	Yes	OS2	100	16	16F MTP
2	800G-FR4	MSA	N/A	QSFP-DD/OSFP	No	OS2	2,000	2	LC
3	800G-DR4/FR4	802.3df^	N/A	TBD	Yes	OS2	500/2,000	8	12F MTP
4	800G-DR8/FR8	802.3df^	N/A	TBD	Yes	OS2	500/2,000	16	16F MTP/24F MTP
5	800G-VR8	802.3df^	N/A	TBD	Yes	OM3/OM4	30/50	16	16F MTP
6	800G-SR8	802.3df^	N/A	TBD	Yes	OM3/OM4	50/100	16	16F MTP
7	800G-SRm.n	802.3df^	N/A	TBD	Yes	OM3/OM4	100?	4/8?	TBD

Note:
^ IEEE 802.3df estimated publication in Q3-2025

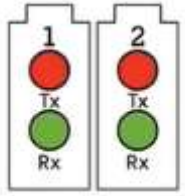
Very Small Form Factor (VSFF) Connectors

Migration to 400G/800G

- Currently listed in the QSFP-DD and SFP-DD MSAs
- Two-fiber, push-pull designs

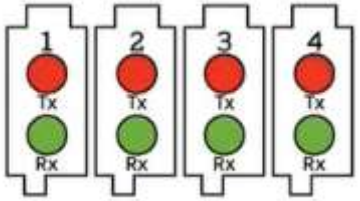


SN-Dual

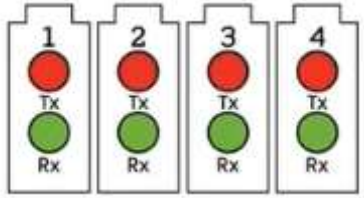


MDC-Dual

SFP-DD Interfaces

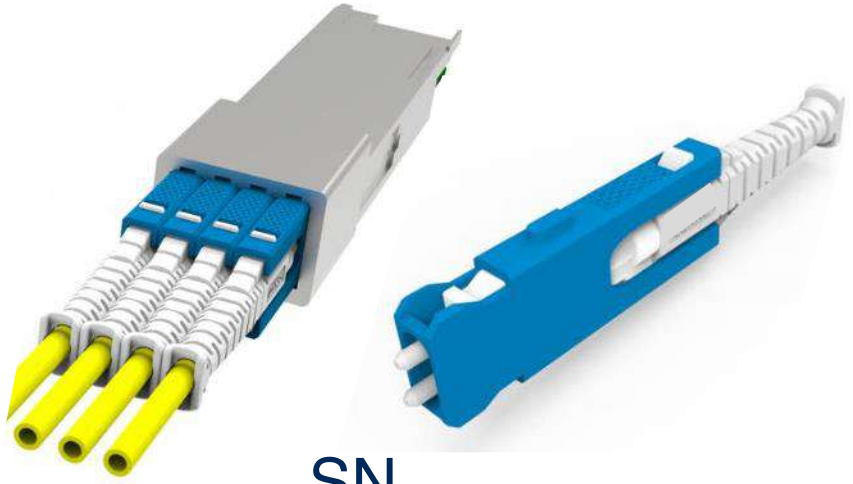


SN-Quad



MDC-Quad

QSFP-DD Interfaces



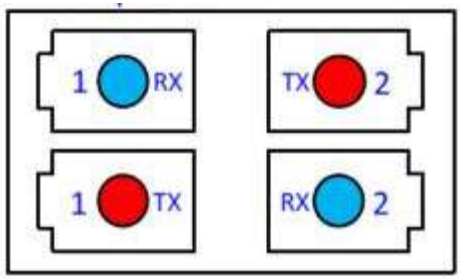
SN

MDC

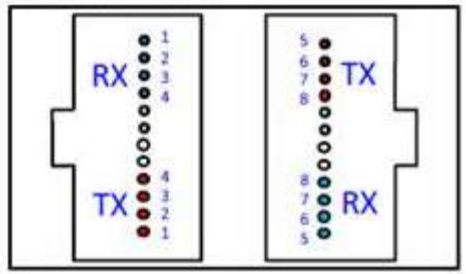
Other Potential Options for 800G Connections

Migration to 400G/800G

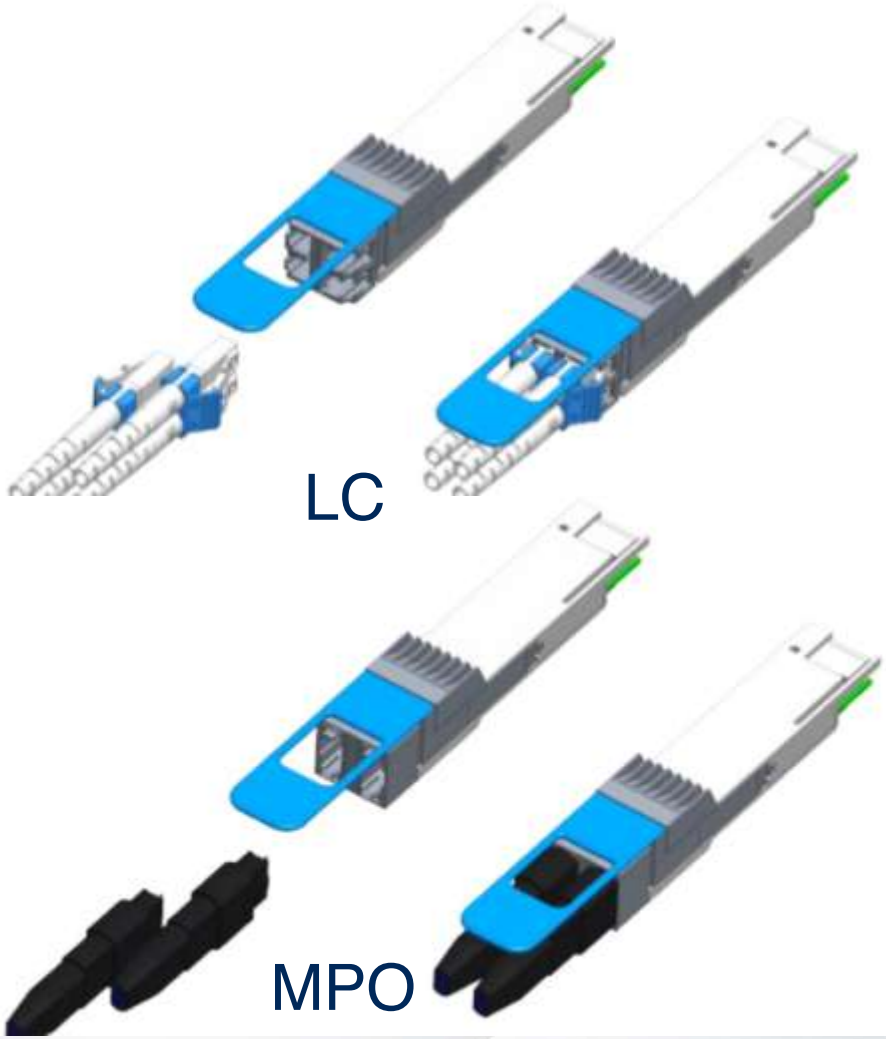
- Recently added as option to draft QSFP-DD800 MSA
- Sideways orientation of standard LC and MPO12
- Would fit into a new Type 2B QSFP-DD Module



Dual Duplex LC



Dual MPO-12



Summary

- Many trends and applications are driving the need for 400G bandwidth
- A variety of different use cases
- 400G equipment is here today
- Many transceiver options for 100, 200 & 400G
- Several different breakout use cases
- Siemon can be a trusted advisor and help you understand the technologies & potential solutions

Thanks for your time

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