

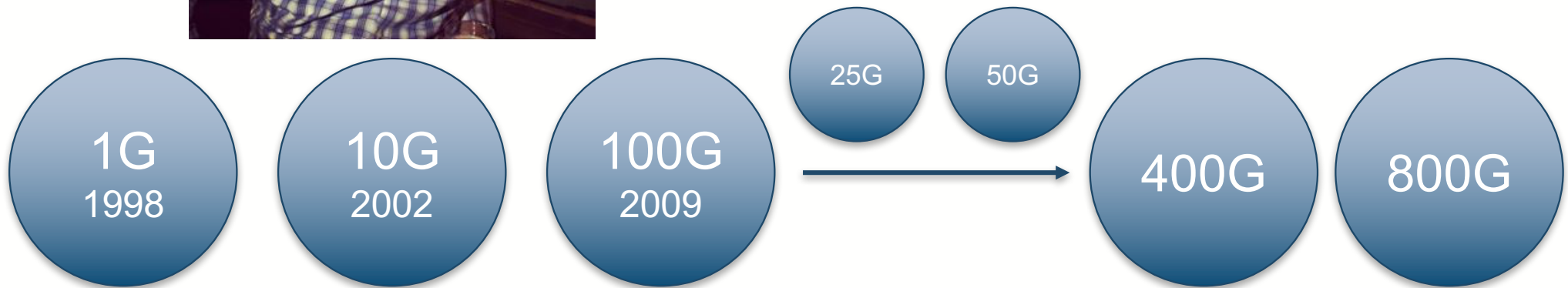
# Synopsis

- Bandwidth requirements continue to grow at an exponential pace driven by UHD Content, IOT, Serverless Compute, Machine Learning (ML) and Artificial Intelligence (AI). Both Service Providers and new Cloud operators are racing to adopt the latest technology to keep up with the bandwidth demand in a cost effective manner. With network bandwidth requirements doubling every two years, SPs and Cloud Titans will need 400GE/800GE to help them scale the cloud DC to remain competitive before 2019.
- In this vendor neutral session, we will highlight new 400GE/800GE technology, particularly OSFP and QSFP-DD, and analyse network architecture evolution options. We will also discuss the new 25G and 50G standards and demonstrate how they are the current most economic way to address bandwidth scaling today with the added benefit of providing a future proof pathway to 400G Ethernet and beyond.

# Scaling Beyond 100G With 400G and 800G

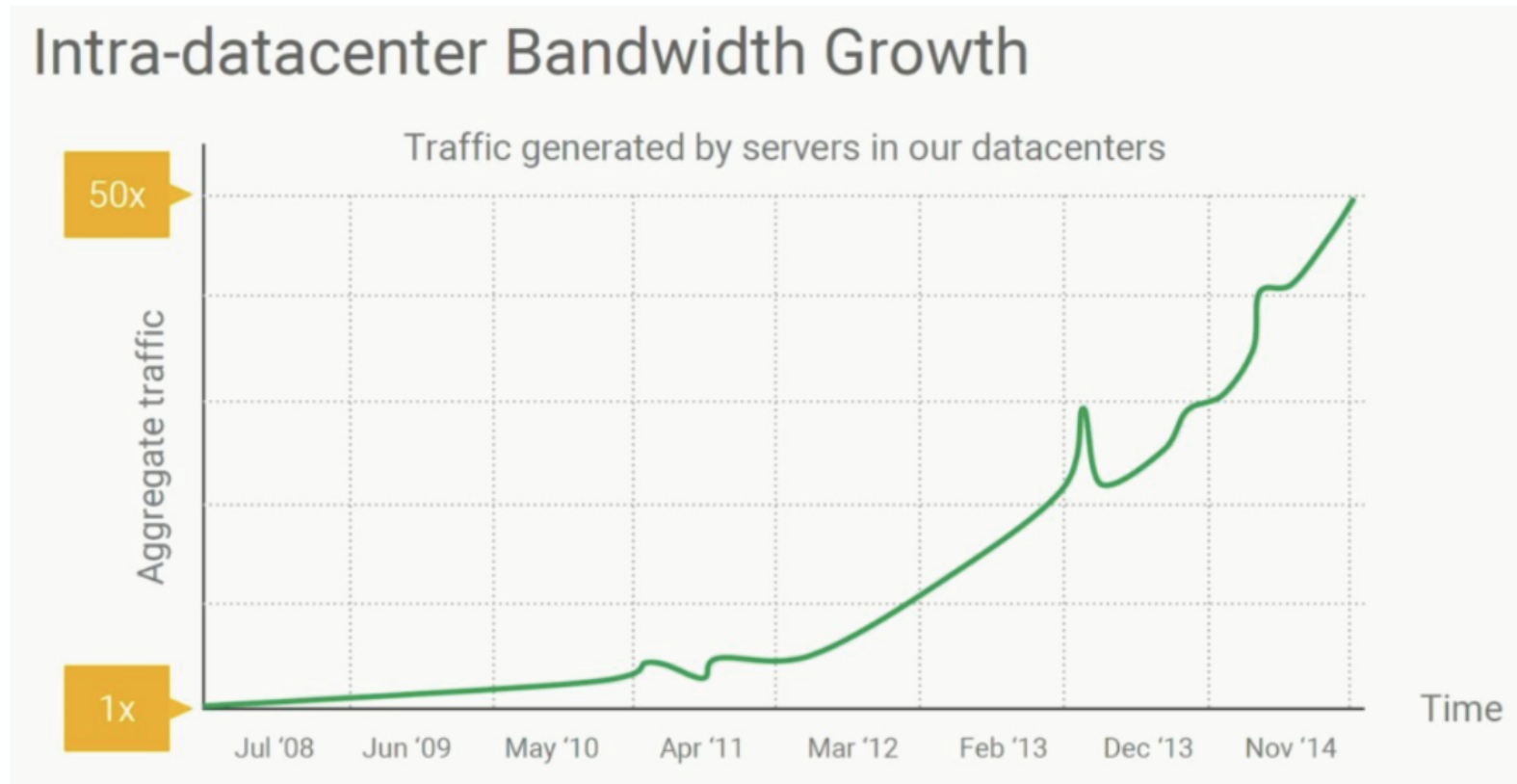
Rich Bayliss  
rbayliss@arista.com

# 400G – Really?



Source: AusNOG 2011. Tim Nagy '100GE Overview and Deployments' <http://bit.ly/2xQ4X4v>

# Need to Scale Cloud Network Bandwidth 2X/Year



Source: Urs Hoelzle, Google Cloud 2015

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Source: Urs Hoelzle, Google Cloud 2015



# Doing More With Less - Removing Artificial Limits



GIVING  
BACK TO  
MEMBERS

INTRODUCING  
UNIVERSAL  
PORT PRICING  
1GB & 10GB PORTS

\$350

PER MONTH EXC GST

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1300 653 132 | internet.asn.au

IX AUSTRALIA  
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peering@ix.asn.au  
1300 793 320 | ix.asn.au

Not for Profit | Commercially neutral | Member Driven

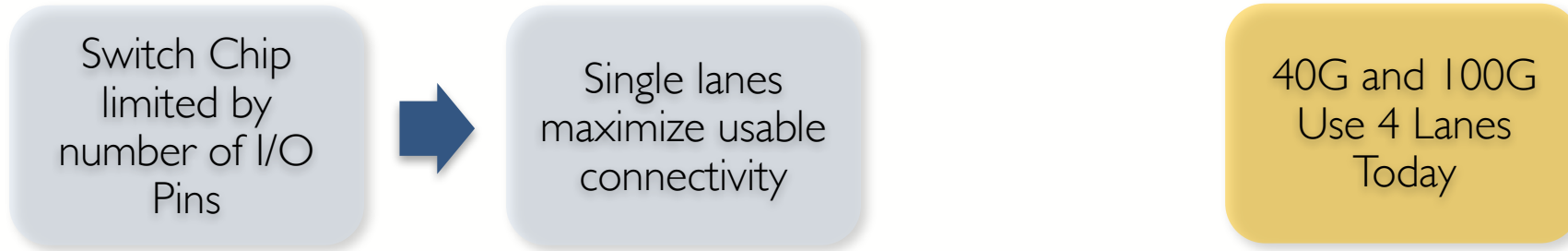
	2015	2016	2017	CAGR*	2020*
WA-IX	10Gbps	33Gbps	40Gbps	100%	320Gbps
VIC-IX	15Gbps	47Gbps	75Gbps	124%	839Gbps
SA-IX	500Mbps	1.2Gbps	7Gbps	274%	367Gbps
QLD-IX	3.5Gbps	20Gbps	28Gbps	183%	634Gbps
NSW-IX	50Gbps	80Gbps	140Gbps	67%	656Gbps

\*My Simplistic Projections

TL;DR You Already Paid For The Port – Are You Leveraging Your Investment?

Source: Internet Association of Australia, 2017 AGM

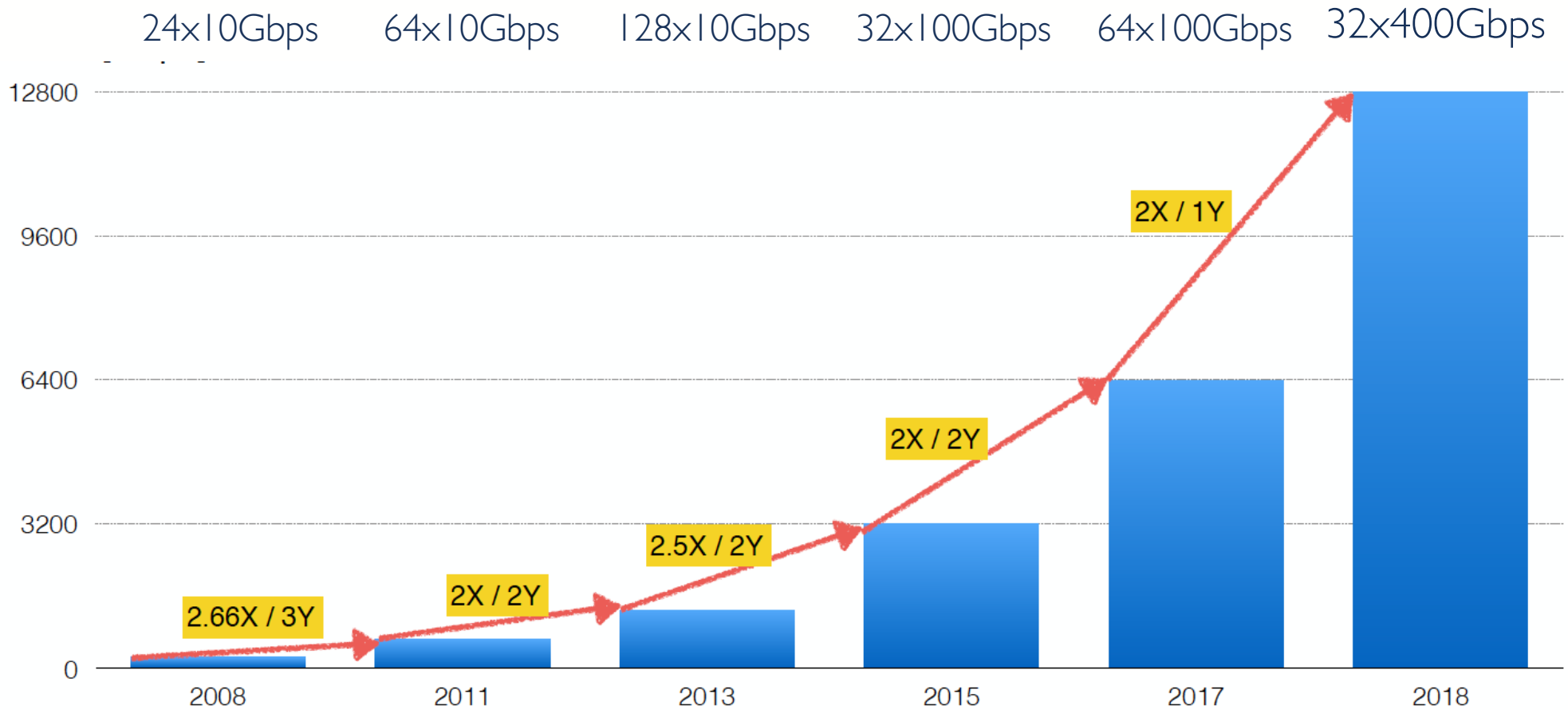
# What is Driving Switch BW? Chip I/O is Limited



Lane Speed	10Gbps	25Gbps → 50Gbps	100Gbps	
1X	10G	25G	50G	Server Interface
2X	20G	50G	100G	
4X	40G	100G	200G	Spine Interface
8X	-	200G	400G	
Availability	2011	2015	2018	2020

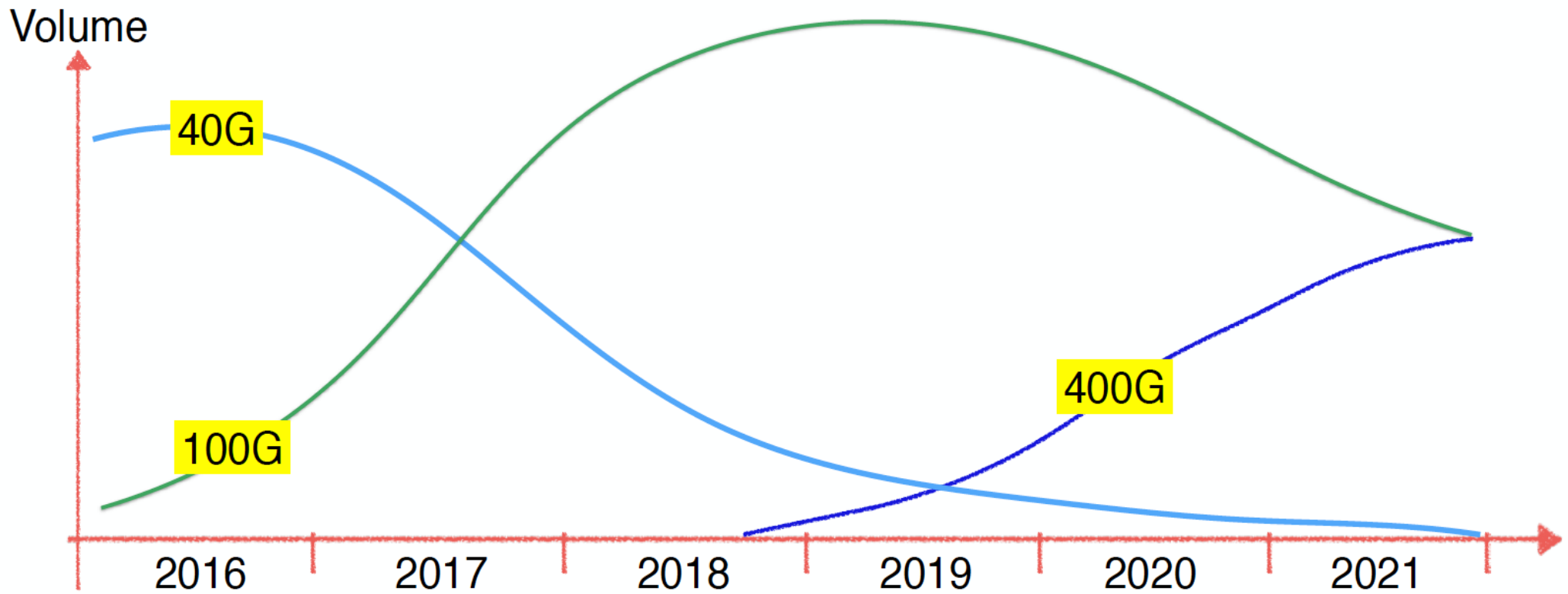


# Switch Silicon Bandwidth Growth





# 40G → 100G → 400G Switch Port Transition



# 100G In The Cloud Network Today

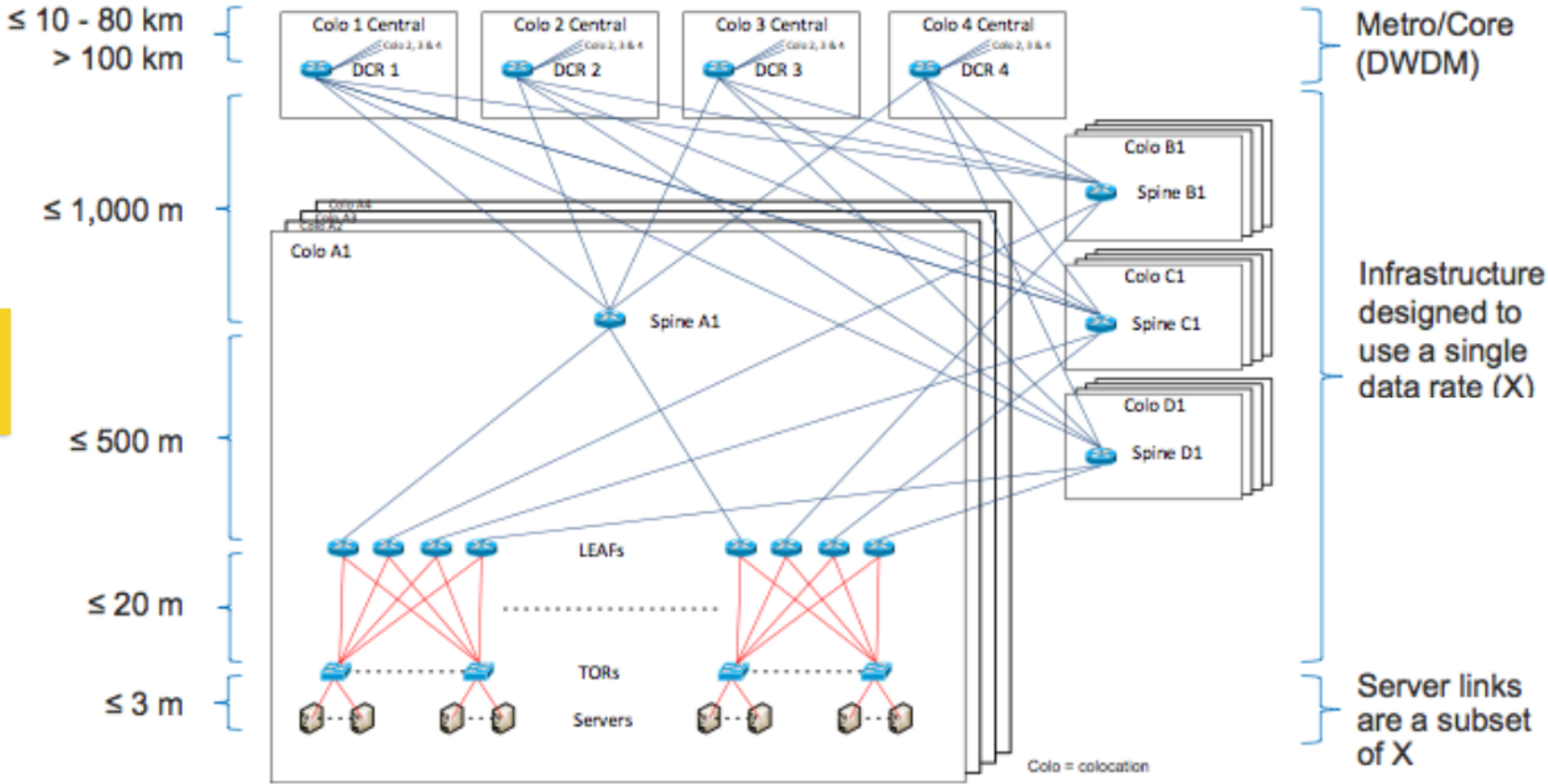
100G-DCO

100G-LR4

100G-CWDM4  
100G-PWSM4

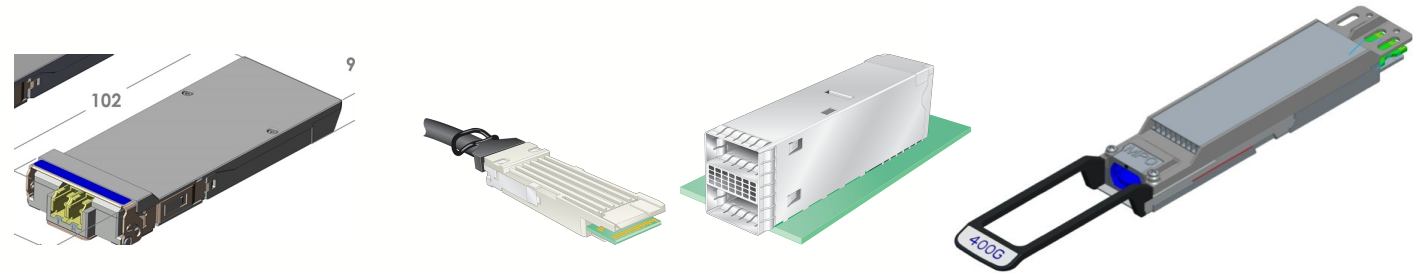
100G-AOC

100G-CR4  
4x25G-CR1



100G Ramping Fast – Estimated 5 Million Ports in 2017

# Candidate 400G Form Factors: CFP8 v QSFP-DD v OSFP



	CFP8	QSFP-DD	OSFP
Size mm (HxLxT)	41.5x107.5x9.5	18.35x89.4x8.5	22.58x107.8x13.0
Thermal Capacity	12-18W	7-12W	12-15W
Organization	<a href="http://www.cfp-msa.org/">http://www.cfp-msa.org/</a>	<a href="http://www.qsfp-dd.com/">http://www.qsfp-dd.com/</a>	<a href="http://osfpmsa.org/">http://osfpmsa.org/</a>

CFP8 Lacks Density. Really we need to consider QSFP-DD and OSFP

# QSFP-DD MSA Form Factor Announcement. 13 March 2017

A total of 62 companies have joined the QSFP-DD MSA to create this new standard.

## **Eight Lanes at 28 or 56Gbps**

- Supports 200G and 400Gbps

## **High Port Density: 36 per IRU**

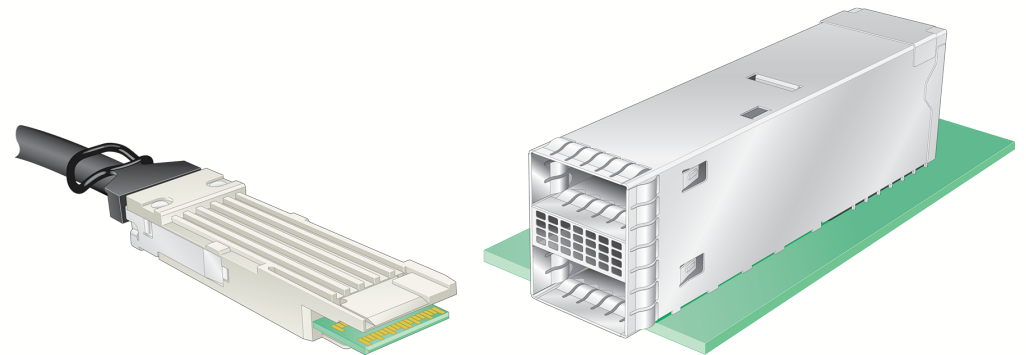
- 7.2Tbps with 200G, 14.4Tbps with 400G

## **Accommodates a Range of Optics**

- Up to 12W Thermal Capacity

## **Pluggable Module Form Factor**

- Easy to Configure and Service – \*Some backward compatibility complexities



Source: <http://www.qsfp-dd.com/qsfp-dd-msa-group-announces-form-factor-specification/>

# OSFP MSA Form Factor Announcement. 17 March 2017

A total of 80 companies have joined the OSFP MSA to create this new standard.

## **Eight Lanes at 56 or 112Gbps**

- Supports 400G and 800G (2x400G)

## **High Port Density: 36 per IRU**

- 14.4Tbps with 400G, 28.8Tbps with 800G (72x400G Dual Optics)

## **High Thermal Capacity**

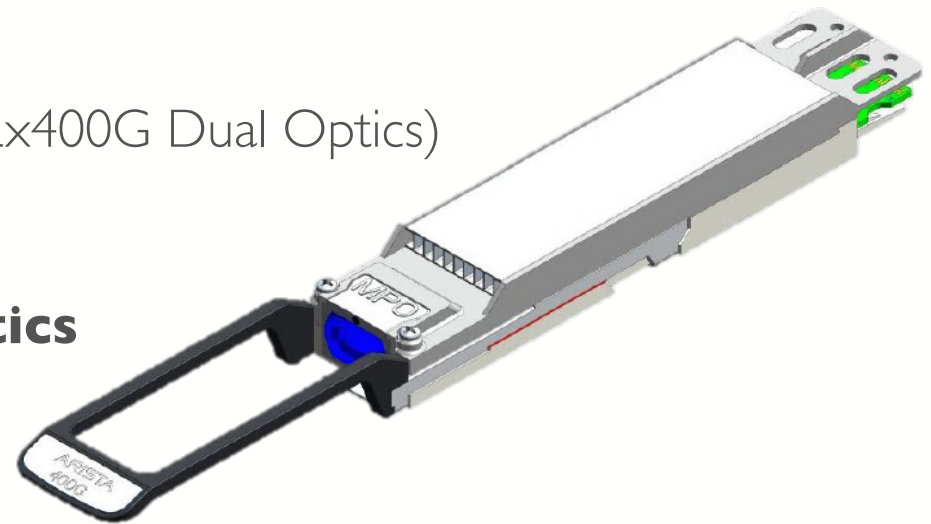
- Demonstrated 15W Power Capability

## **Accommodates A Wider Range of Optics**

- Datacenter, Metro and Long Reach

## **Pluggable Module Form Factor**

- Easy to Configure and Service – New Size



Source: <http://osfpmsa.org/press-releases/pr-20170317.html>

# IEEE 802.3bs 200 Gb/s and 400 Gb/s Ethernet Task Force

Standard	Speed	Technology	Distance
200GBASE-DR4	200Gbps	4 lanes SMF	500m
200GBASE-FR4	200Gbps	4 WDM lanes	2km
200GBASE-LR4	200Gbps	4 lanes WDM	10km
400GBASE-SR16	400Gbps	16 lanes MMF	100m
400GBASE-DR4	400Gbps	4 lanes SMF	500m
400GBASE-FR8	400Gbps	8 WDM lanes	2km
400GBASE-LR8	400Gbps	8 WDM lanes	10km

2017: IEEE will complete 802.3bs (400G), 2018: First 400G platforms Expected to Land



# 400G OSFP Use Cases



## **Supports all 400G use cases up to Metro and Long Reach**

- No single 400G optics technology addresses all market requirements

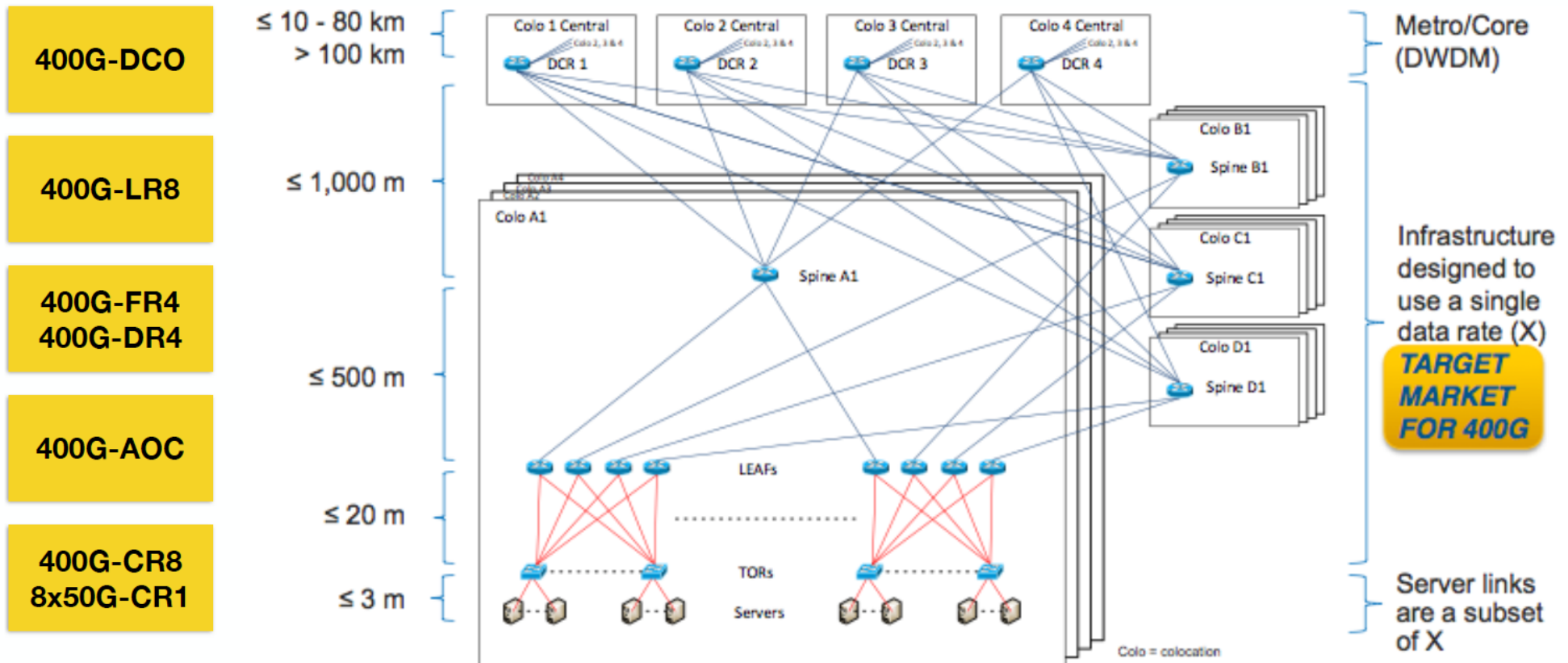
## **OSFP Supports Future Dual 400G and 800G Optics**

- Electrical and thermal performances support eight lanes of 100G

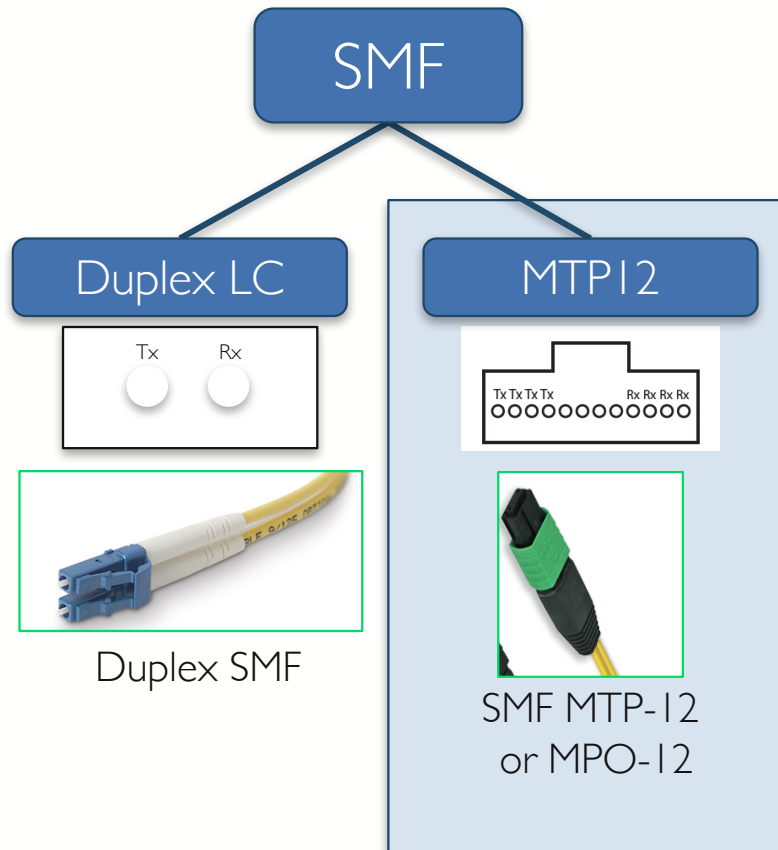
## **Bulk of 400G Volume will use 100G electrical interfaces**

- Switches with 100G lane switch silicon expected in 2020

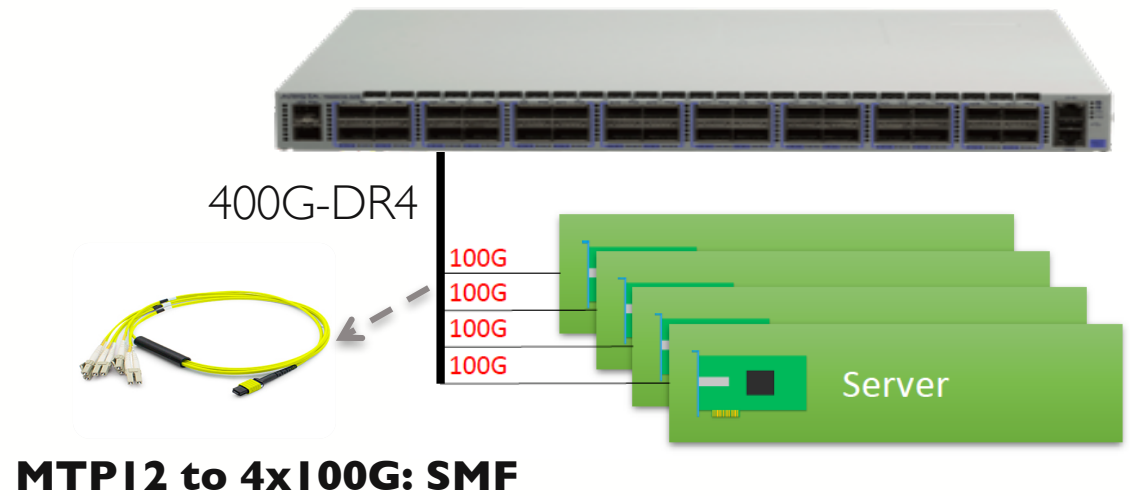
# 400G In the Cloud Network (2018+)



# Future High Density 100G – 400G-DR4



- 400G-DR4 with 8 x SMF
- 4x100G-DR1 breakout
- 500m to 2km reach
- 128 x 100GE ports per RU
- 100GE to compute/storage

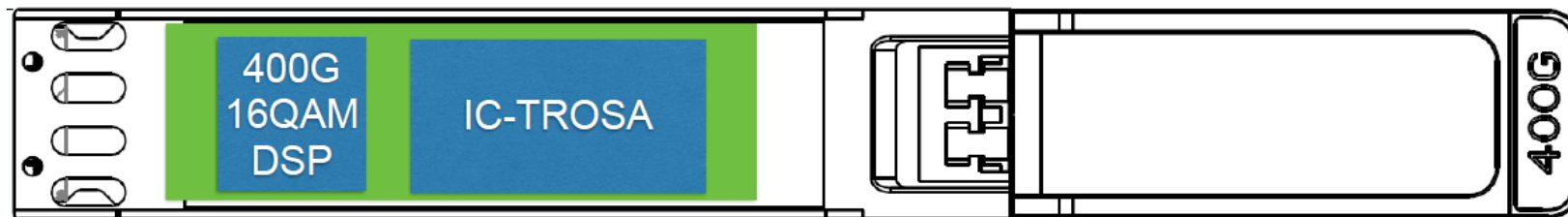
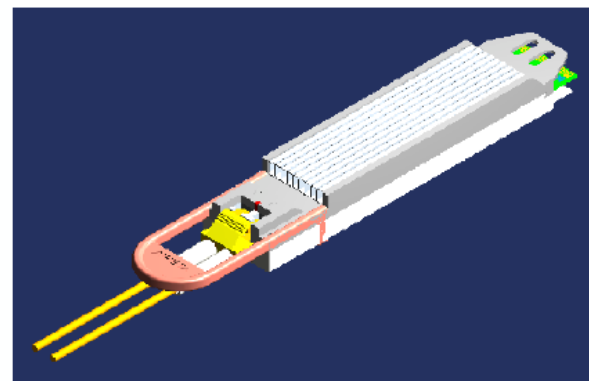


# 400G-DCO: 100km Reach

## 400G-16QAM DSP + Coherent Laser

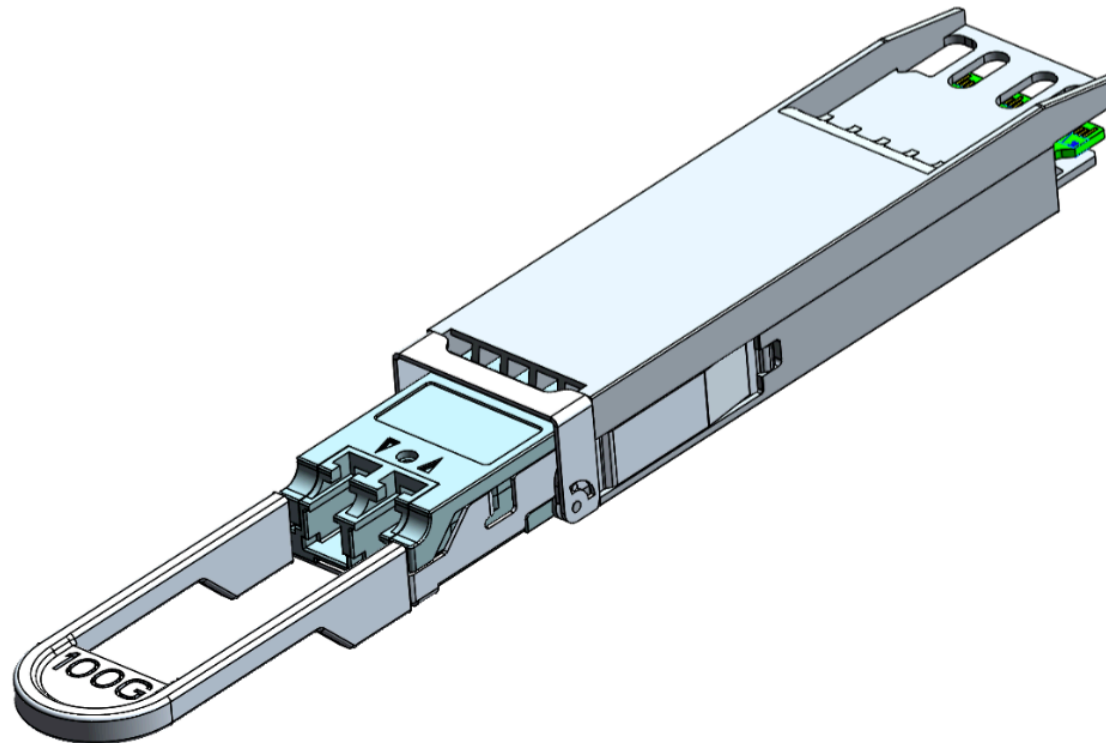
Up to 20 Terabits bandwidth per dark Fiber

Power Target < 15W



400G Coherent at the same port density as other datacenter Optics

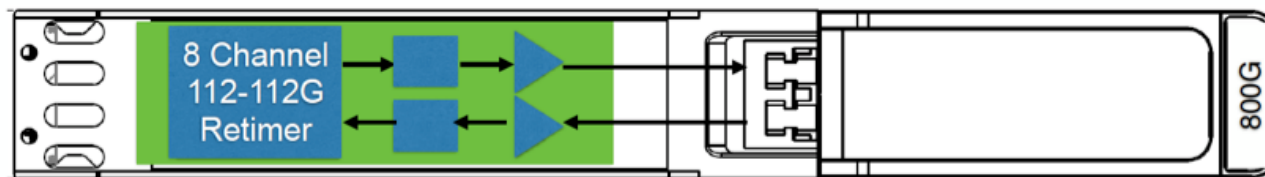
# Backwards Compatibility - OSFP to QSFP Adapter



Both QFSP-DD and OSFP Can Provide Backward Compatibility\*

## Other 400G/800G OSFP Transceivers

Type	Distance	Cable	Lane Speed	Power
400G-DR4	2km	8 SMF	4 x 100G	10W
400G-FR4	500m-2km	2 SMF	4 x 100G	10W
Dual 400G-DR4	2km	16 SMF	8 x 112G	12W
Dual 400G-FR4	500m-2km	4 SMF	8 x 112G	12W
800G-FR8	2km	2 SMF	8 x 112G	12W
800G-LR8	10km	2 SMF	8 x 112G	12W



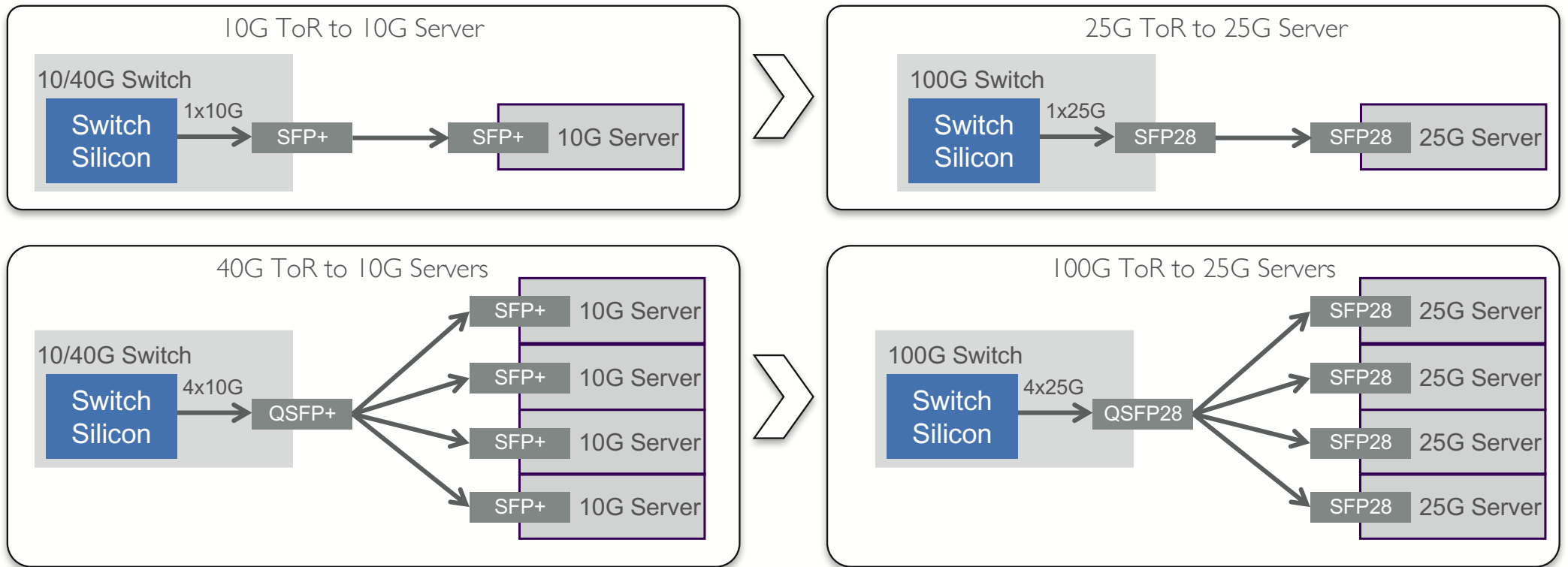


# Let's Not Get Carried Away.



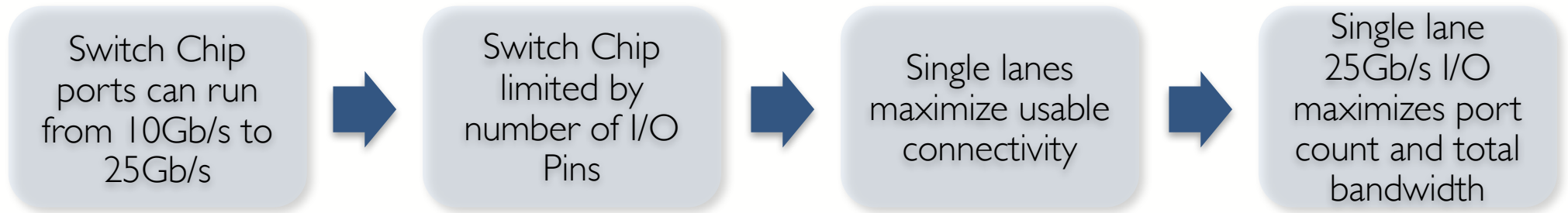
What Do We Do This Year? How Can We Prepare For The Future?

# Migration to 25Gbps / SFP28



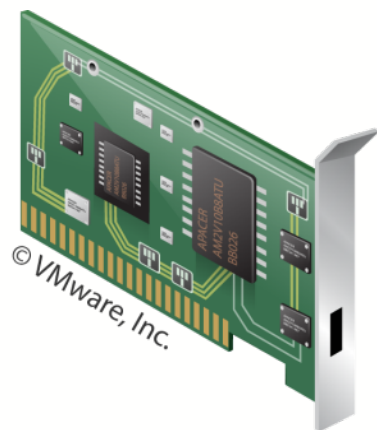
25GE / SFP28 Can Reuse Existing Cable Infrastructure. Est. >2.5x 25G ports than 40G in 2018

# What is Driving Switch BW? Chip I/O is Limited



Port Speed	Lane Speed (Gb/s)	Lanes / Port	Usable Ports	Total BW
10GbE	10	1	128	1280
25GbE	25	1	128	3200
40GbE	10	4	32	1280
50GbE	25	2	64	3200
100GbE	25	4	32	3200

# PCIe 3.0 and Network interfaces



Interface	Lane Requirement	Bandwidth Utilization
10GE	2	62.5%
25GE	4	78.1%
40GE	8	62.5%
100GE	16	78.1%

- PCI-Express 3.0 supports 8 GigaTransfers per second (GT/s) per lane
- 25Gbps / SFP28 is more bandwidth efficient than 10GE or 40G
- PCIe 3.0 x 8 is widely shipping (dual port SFP28)
- First 25/50/100 Plugfest – Jan 2017 by 25GE Consortium at UNH-IOL

# 2017: Leverage 25G and 100G Investments

## Compute

10GbE to 25GbE

- 25GbE uses same copper or fiber as 10GbE
- No changes to cable plant\*

2.5X  
Higher Server  
Bandwidth

## Storage

40GbE to 50GbE

- 50GbE uses half the lanes compared to 40GbE
- 2X more nodes per switch

100%  
More Storage  
Nodes

## Leaf - Spine

40GbE to 100GbE

- 2.5X performance increase for every link
- Better load distribution and lower latency

2.5X  
Higher Network  
Capacity





Thank You

[www.arista.com](http://www.arista.com)



## 25G Transceiver and cable

Standard	Distance support
25GBASE-SR	Up to 70m over Parallel OM3 Multi-mode fiber and 100m over parallel OM4 Multi-mode fiber
25GBASE-LR	Up to 10km over Single-mode fiber
25GBASE-AOC	Up to 30m pre-terminated 25GbESFP Active optical cable
25GBASE-CR	Up to 3m pre-terminated 25GbESFP twinax copper cable