

# Multi-Port Implementations of 50/100/200GbE

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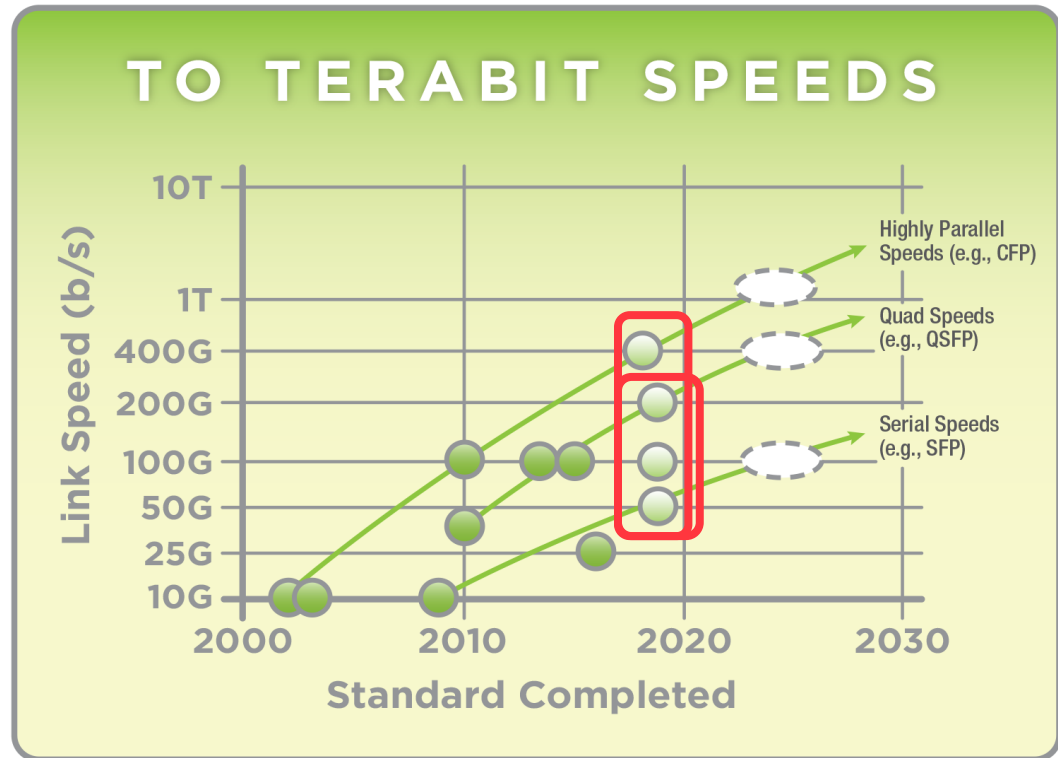
# Supporters

- Doug Coleman, Corning
- Steve Swanson, Corning
- Chris Cole, Finisar
- Jonathan King, Finisar

# The 2016 Ethernet Roadmap

- Source:

[www.ethernetalliance.org/roadmap](http://www.ethernetalliance.org/roadmap)



Ethernet Speed



Speed in Development



Possible Future Speed



ethernet alliance



- 17 (or 18) New Ethernet Interfaces Shown in Green
- At least 14 in the 802.3cd project
- Another 6 in 802.3bs

## ETHERNET INTERFACES AND NOMENCLATURE

	Electrical Interface	Backplane	Twinax Cable	Twisted Pairs	MMF	Parallel SMF	2km SMF	10km SMF	40km SMF
10BASE-				T					
100BASE-				TX	FX			LX	
1000BASE-		KX	CX	T	SX			LX	
2.5GBASE-		KX		T					
5GBASE-		KR		T					
10GBASE-	SFI, XFI	KX4, KR	CR	T	SR			LR	ER
25GBASE-	25GAUI	KR	CR	T	SR			LR	ER
40GBASE-	XLAUI	KR4	CR4	T	SR4		FR	LR4	ER4
50GBASE-	50GAUI (-2?)	KR	CR		SR		FR	LR	
100GBASE-	CAUI10	KR4, KR2	CR10,		SR10	PSM4	10X10	LR4	ER4
	CAUI4	KP4	CR4,		SR4		CWDM4	10X10	10X10
	CAUI-2		CR2		SR2		CLR4		
200GBASE-	200GAUI-4	KR4	SR4		SR4	DR4	FR4	LR4	
400GBASE-	CDAUI-16				SR16	DR4	FR8	LR8	
	CDAUI-8								

Gray Text = IEEE Standard

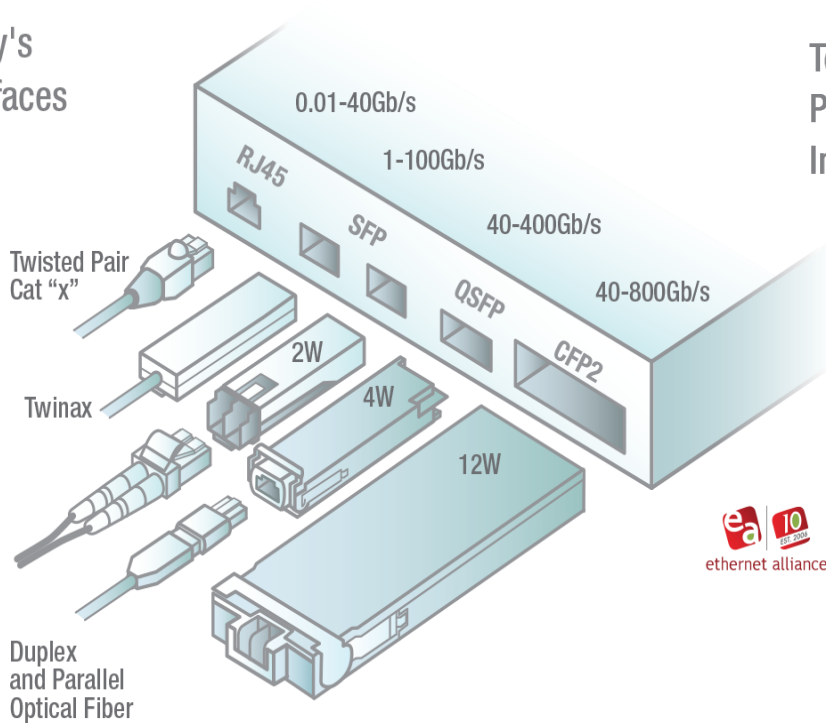
Red Text = In Standardization

Green Text = Under consideration in IEEE

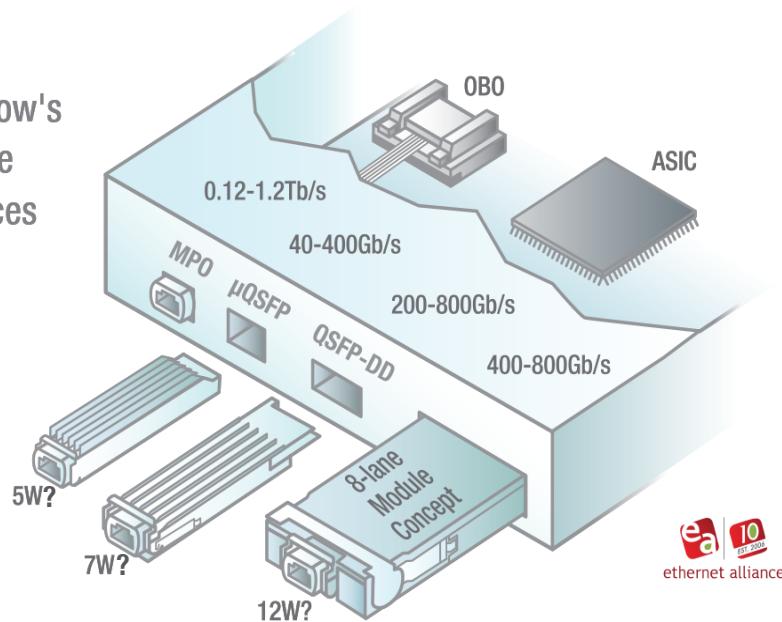
Blue Text = Non-IEEE standard but complies to IEEE electrical interfaces

# 200G and 400G Form Factors Explosion

## Today's Interfaces



## Tomorrow's Possible Interfaces



CFP8  
OSFP  
And CDFP



# Ethernet Fragmentation at 50/100/200GbE

Form Factor	CR	SR	DR	FR	LR
SFP56	50	50	50	50	50
QSFP56 and uQSFP	4 X 50 2 X 100 1 X 200	4 X 50 2 X 100 1 X 200	4 X 50 2 X 100 1 X 200	2 X 100 1 X 200	2 X 100 1 X 200
QSFP-DD and OBO-8	8 X 50 4 X 100 2 X 200	8 X 50 4 X 100 2 X 200	8 X 50 4 X 100 2 X 200	2 X 200	2 X 200

Blue Text = No current IEEE objective

# 50/100/200GbE Potential

Demonstrated at  
Ethernet Alliance  
booth at OFC

- 200G Port and OBO should support:

Electrical Interfaces:

50GAUI

100GAUI-2

200GAUI-4

Modules:

QSFP

microQSFP

QSFP-DD

OBO

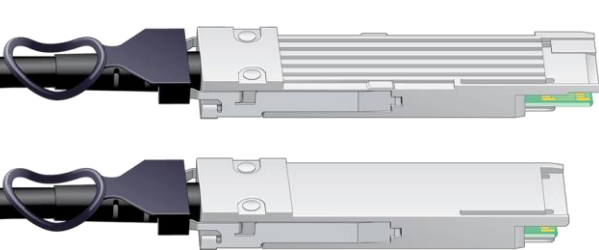
Network Interfaces:

50GBASE-CR/SR/DR/LR

100GBASE-CR2/SR2/DR2/LR2

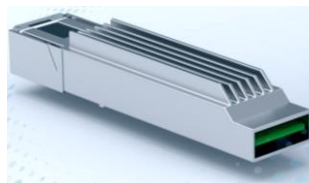
200GBASE-CR4/SR4/DR4

200GBASE-FR4/LR4



QSFP-DD

QSFP



microQSFP

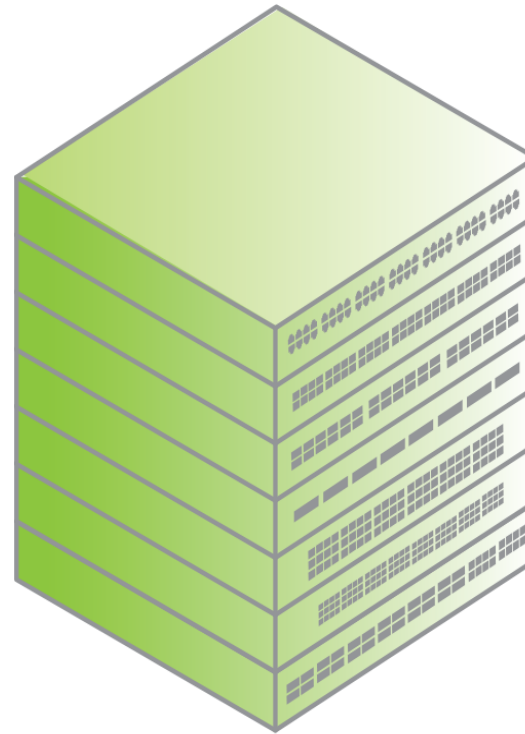


On Board Optics (OBO)

Blue Text = No current IEEE objective

# Switch/Router Configurations

- Each switch vendor needs to select between module form factors and switch configurations
- This shows 1U switches while module switches and routers have more flexibility
- QSFP-DD same as QSFP



## Port Density Comparison

- ← 56 RJ45s/1U
- ← 56 SFP/1U
- ← 36 QSFP/1U
- ← 8 CFP2/1U
- ← 72  $\mu$ QSFP/1U
- ← 100 OB0/1U
- ← 24QSFP +16 OB0

OB0 = On Board Optics

GRAPHICS AVAILABLE AT  
[WWW.ETHERNETALLIANCE.ORG/ROADMAP](http://WWW.ETHERNETALLIANCE.ORG/ROADMAP)

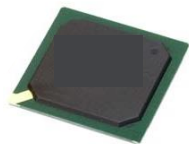


ethernet alliance



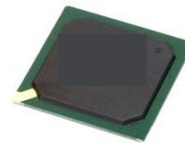
# Possible Next Generation Switches

128 Port 50G Switch ASIC



6.4Tb/s ASIC

256 Port 50G Switch ASIC



12.8Tb/s ASIC

32 200G QSFP56 Port Switch



1X4  
Copper Breakout

Optical Breakout



 2X50GbE SFP56 Server

32 400G QSFP-DD Port Switch



1X8  
Copper Breakout

Optical Breakout



 2X50GbE SFP56 Server

# Multi-Port Copper Breakout

25GbE Consortium already has a 50GbE (2X25G) Interface Defined

- Breakout to single Lanes

QSFPxx capable of running at 4X 10GbE, 25GbE or 50GbE  
– xx = +, 28 or 56



To 10GbE, 25GbE or 50GbE SFP Ports

- Breakout to Dual Lanes

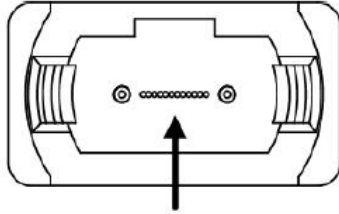
QSFPxx capable of running at 2X50GbE, or 100GbE  
– xx = +, 28 or 56



To 50GbE (2X25G) or 100GbE (2X50GbE) QSFP Ports

# Multi-port Optics to 10/25/50GbE

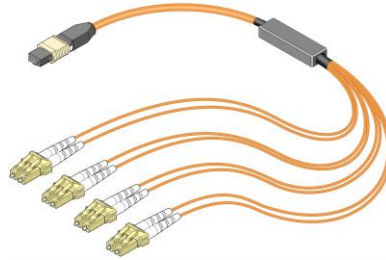
Figure 20 — QSFP Optical Receptacle and Channel Orientation



Fiber Number: 12 11 10 9 ..... 4 3 2 1

Transmit Channels: 1 2 3 4

Receive Channels: 4 3 2 1



QSFP56 running at 10,  
25 and 50GbE per lane



25GbE Server



50GbE Server



10GbE Server

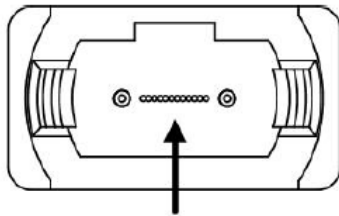


50GbE Switch

# Multi-Ports to 50GbE and 100GbE

## Optical Breakout

Figure 20 — QSFP Optical Receptacle and Channel Orientation



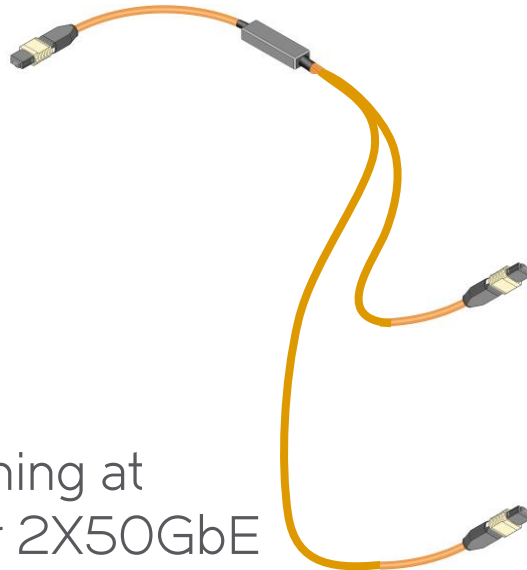
Fiber Number: 12 11 10 9 ..... 4 3 2 1

Transmit Channels: 1 2 3 4

Receive Channels: 4 3 2 1



QSFP56 running at  
2X100GbE or 2X50GbE



100GbE Server  
(2X50G)

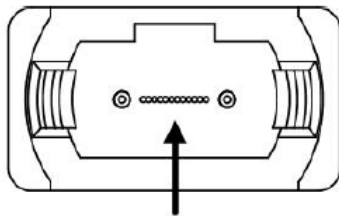


50GbE Server  
(2X25G) – Not  
IEEE Standard

# One Port of 200GbE or 100GbE

## Optical Breakout

Figure 20 — QSFP Optical Receptacle and Channel Orientation



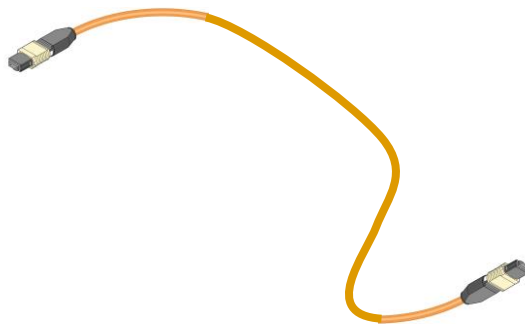
Fiber Number: 12 11 10 9 ..... 4 3 2 1

Transmit Channels: 1 2 3 4

Receive Channels: 4 3 2 1



QSFP56 running at  
1X100GbE or 1X200GbE



200GbE Module  
(4X50G)



Possibly  
100GbE Module  
(4X25G) at  
reduced speed

# Parallel Port and Module Highly Flexible

One Module – 3 Cabling Configurations

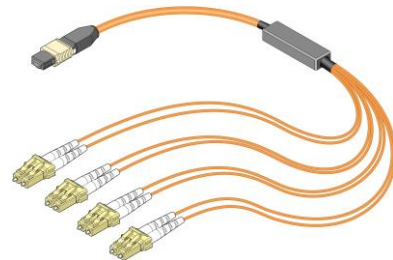
- Industry can reach high volume by using 1 module with different cabling
  - Applies to parallel solutions like CR, SR and DR
- Higher volume equals lower cost



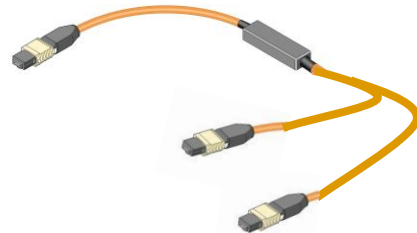
One Module

3 Cabling Configurations

1. 4X50GbE Breakout



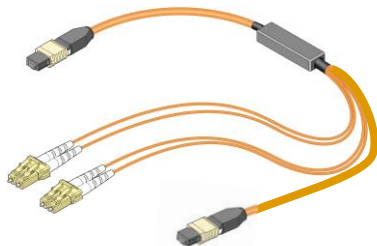
2. 2X100GbE Breakout



3. 1X200GbE



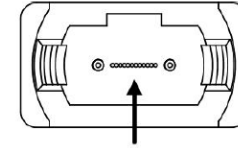
Could even do this:  
4. 1X100GbE and  
2X50GbE



# Cabling and Fiber Lanes Summary

## 3 Configurations

- Duplex LC – 2 fibers



- New Quadplex MPO – 4 fibers



- Octalplex MPO – 8 fibers



QUADPLEX AND OCTALPLEX  
ARE NAMES I MADE UP

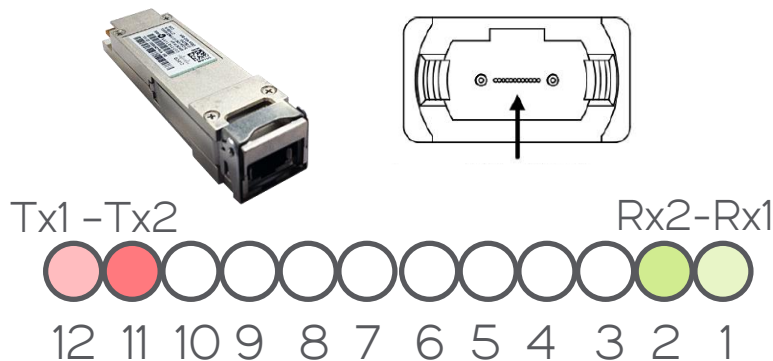
○ =Dark or Removed fibers

# 100GBASE-SWDM2 and LR2 Limitations

100GBASE-SWDM2 or CWDM2 has two wavelengths over one fiber

- $\mu$ QSFP, QSFP56 and QSFP-DD can't support two Dual LC connectors without compromising density, so it will probably use MPO
  - Solution may be forthcoming
- MPO would be in Quadplex configuration and would only connect to similar modules – No SFPs

- Quadplex MPO – 4 fibers



○ = Dark or Removed fibers



# 100GBASE-SWDM2 and LR2 Limitations

100GBASE-SWDM2 has two wavelengths over one MMF

- If the task force develops 100GBASE-SWDM2 instead of 100GBASE-SR2, then the solution will have less configurability – It can only be SWDM2
- A server with a QSFP56 that only uses two lanes is suboptimal (only uses 2 or 4 lanes) or a new depopulated module
- New breakout cables will be needed with 2 dual LCs or fiber will be wasted
- SWDM2 is only supported in a multi-port module like QSFP56 (2X100GbE) or QSFP-DD (4X100GbE) – No SFP56



THE ORANGE FIBERS SHOULD BE  
AQUA TO REPRESENT OM3/4 OR SMF

# 100GBASE-SWDM2 vs 100GBASE-SR2

	Pros	Cons
100GBASE-SWDM2	Requires half the fiber	Requires new module types in fractured market Less Configurable Requires mux and demux – higher power lasers
100GBASE-SR2	Highly configurable Higher volumes and lower cost	Requires double the fiber

# Conclusion – Configurability Key to Success

Multi-Port Switch Implementations will be widely deployed

- With ASIC port counts rising, switch designs are changing
- CR/SR/DR multi-lane modules can support multiple configurations of 50/100/200G by changing the cabling
- Module configurability leads to higher volume and thus lower cost
- WDM Ports can't be broken out
- New Quadplex (4-fiber instead of 8 or 12) cabling infrastructure is needed for either MMF solution
- Multi-Port implementations do need different cabling and this could affect the MDI
  - MPO has different characteristics than LC connectors

Thank you!