

# 100GBASE-DR2: A Baseline Proposal for the 100G 500m Two Lane Objective

Brian Welch (Luxtera)

# Supporters

- Rob Stone (Broadcom)

# 100G-DR2

- Configuration: A 2x50 Gb/s parallel SMF interconnect.
  - Two fibers per direction
- Reach  $\geq 500\text{m}$
- Lane Speed: 50 Gb/s per lane using 25 GBaud-PAM4 optical signaling
- Uncorrected BER  $< 2.4\text{e-}4$
- Proposed per lane specifications are same as 200GBase-DR4

# Applications and Fit with Other Standards

## Objectives and Lane Rates

Application	50G	100G	200G	400G
Backplane	Y	Y (4x25, 2x50)	Y (4x50)	N
Twinax	Y	Y (4x25, 2x50)	Y (4x50)	N
100m MMF		Y (10x10, 4x25, 2x50)	Y (4x50)	Y (16x25)
500m PSM	N	N	Y (4x50)	Y (4x100)
2km SMF	Y	N	Y (4x50)	Y (8x50)
10km SMF	Y	Y (4x25)	Y (4x50)	Y (8x50)

P802.3cd adds  
50G variants

P802.3bs

End Users are expecting these PMDs for their datacenters

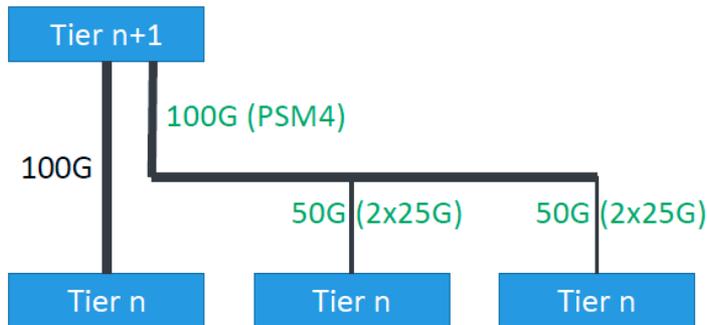
**Compatibility and interoperability are critical!!**

Target of this baseline

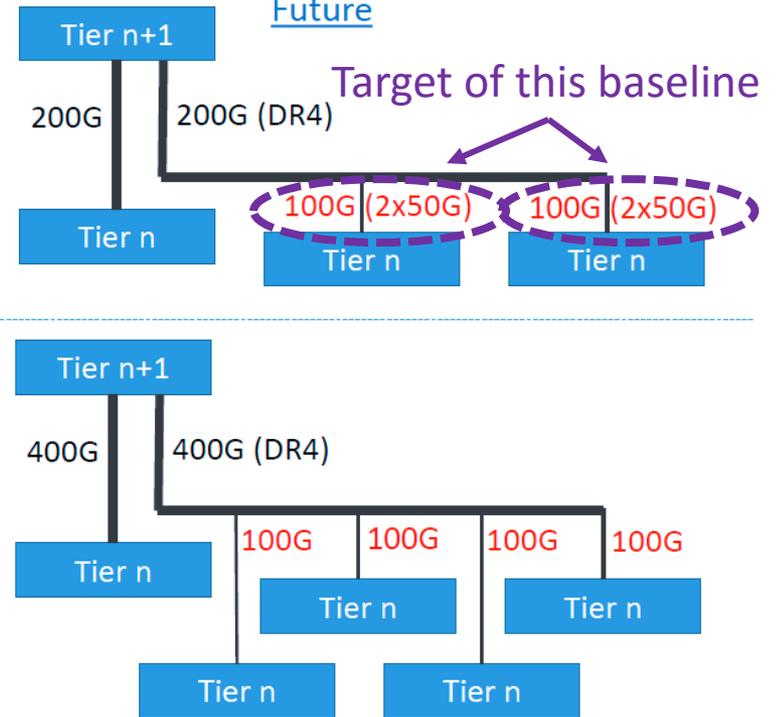
# Applications and Fit with Other Standards

## Example: Core/Fabric Transition – PSM

Today



Future

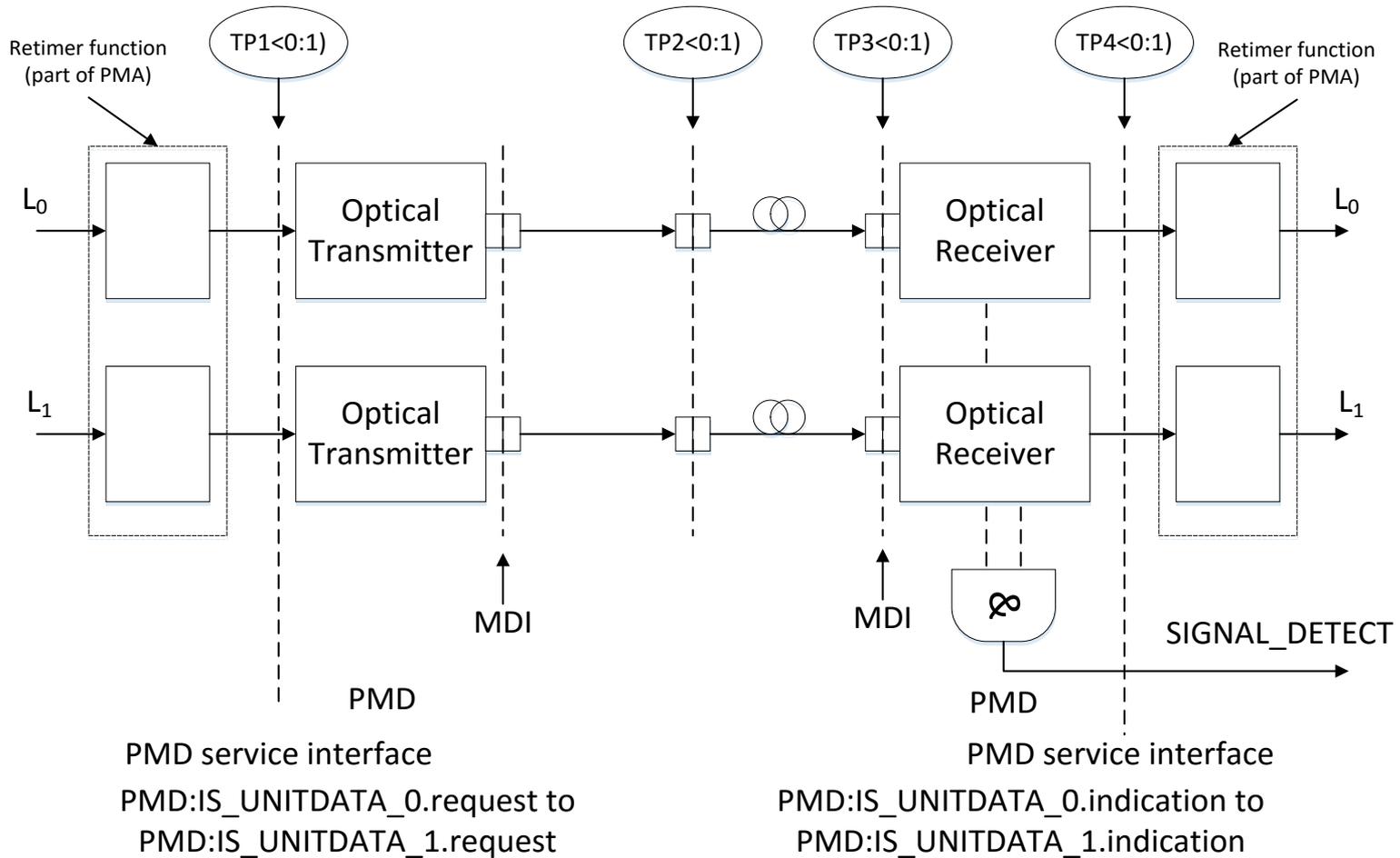


Consortium/MSA  
No Supporting SMF PMDs

IEEE P802.3cd May 2016 Interim Meeting

8

# 100G-DR2 Block Diagram



# 100G-DR2: Transmitter Specifications (TP2)

Description	Value	Unit
Signaling rate, each lane (Range)	26.5625 ± 100 ppm	GBd
Modulation Format	PAM4	
Lane wavelengths (range)	1304.5 to 1317.5	nm
Side-mode suppression ratio (SMSR), (min)	30	dB
Average launch power, each lane (max)	3	dBm
Average launch power, each lane (min)	-4.6	dBm
Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ), each lane(max)	2.8	dBm
Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ), each lane(min)	-2.5	dBm
Launch power in OMA <sub>outer</sub> minus TDECQ, each lane (min)	-3.5	dBm
Transmitter and dispersion eye closure (TDECQ), each lane (max)	2.5	dB
Average launch power of OFF transmitter, each lane (max)	-30	dBm
Extinction ratio, each lane, (min)	4.5	dB
RIN <sub>25</sub> OMA (max)	-142	dB/Hz
Optical return loss tolerance (max)	24.7	dB
Transmitter reflectance (max)	-26	dB

# 100G-DR2: Receiver Specifications (TP3)

Description	Value	Unit
Signaling rate, each lane (Range)	26.5625 ± 100 ppm	GBd
Modulation Format	PAM4	
Lane wavelengths (range)	1304.5 to 1317.5 nm	nm
Damage threshold, each lane	6.5	dBm
Average receive power, each lane (max)	3.0	dBm
Average receive power, each lane (min)	-7.6	dBm
Receive power, each lane ( $OMA_{outer}$ ) (max)	2.8	dBm
Receiver reflectance (max)	-26	dB
Receiver sensitivity ( $OMA_{inner}$ ), each lane (max)	-11.4	dBm
Stressed receiver sensitivity ( $OMA_{outer}$ ), each lane (max) <sup>†</sup>	-4.1	dBm
Conditions of stressed receiver sensitivity test:		
SECQ <sup>†</sup>	2.5	dB
$OMA_{outer}$ of each aggressor lane	2.8	dBm

<sup>†</sup> Links with lower OMA and TDEQ values must not have BER > 2.4e-4

# 100G-DR2 : Link Parameters

Description	Value	Unit
Operating distance	500	m
Signaling rate, each lane (Range)	26.5625 ± 100 ppm GBd	
Encoding type	PAM4	
Lane wavelength (range)	1304.5 to 1317.5 nm	nm
Uncorrected BER	< 2.4e-4	
Channel insertion loss (max)	3	dB
Channel insertion loss (min)	0	dB
Allocation for penalties, at max TDECQ (dB) <sup>†</sup>	2.6	dB
MPI Penalty	0.1	dB
Maximum discrete reflectance	-45	dB
Max number of -45 dB reflections	4	
Positive dispersion (max)	0.8	ps/nm
Negative dispersion (min)	-0.93	ps/nm
DGD_max	2.24	ps
Optical return loss (min)	39	dB

# 100G-DR2 : Link Parameters (continued)

Description	Value	Unit
Nominal fiber specification wavelength	1310	nm
Cabled optical fiber attenuation (max)	0.5	dB/km
Zero dispersion wavelength ( $\lambda_0$ )	$1300 \leq \lambda_0 \leq 1324$	nm
Dispersion slope (max) ( $S_0$ )	0.093	ps/nm <sup>2</sup> km

PMD type	Dispersion (ps/nm)		Insertion Loss	Optical Return Loss	Max mean DGD
	Minimum	Maximum			
100GBase-DR2	$0.0011625 \times \lambda \times [1 - (1324/\lambda)^4]$	$0.0011625 \times \lambda \times [1 - (1300/\lambda)^4]$	Minimum	24.7	0.5 ps

# Compatibility

- Compatible with 50GE and 200GE Optical Interface standards
  - Breakout to 50GBase-FR and 50GBase-LR (over reduced loss budget)
  - Breakout from 200GBase-DR4
- Compatible with 50GE and 100GE Electrical Interface Standards
  - CAUI-2
  - 50GAUI-2
  - 50GAUI-1

# 100G-DR2

- Configuration: A 2x50 Gb/s parallel SMF interconnect.
  - Two fibers per direction
- Reach  $\geq 500\text{m}$
- Lane Speed: 50 Gb/s per lane using 25 GBaud-PAM4 optical signaling
- Uncorrected BER  $< 2.4\text{e-}4$
- Proposed per lane specifications are same as 200GBase-DR4

100GBASE-DR2: A Baseline Proposal for  
the 100G 500m Two Lane Objective

**Thank You**