

10GbE WWDM Interest Group Is Formed

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WWDM Interest Group

IEEE 802.3ae Plenary,
March 6-9, 2000

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WWDM PMD

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Outline Of 10GbE WWDM Specification Proposal & Status

- Motivation For LX WWDM Interface Proposal
- Proposed Equivalents For Tables 38-6, -7, -8, and -9
- GbE Jitter Budget; Table 38-10
- Example of 10GbE WWDM Jitter Budget With Hari Interface
- Other WWDM Link Alternatives
- Conclusions

Motivation For WWDM Proposal

- Four WWDM Channels Utilize The Full Specified Optical Transmission Band To Facilitate Low Cost Optical Demux
- The 4 WWDM Channels Directly Map With Four Lanes, Such As Hari, Without Electrical Translation
- The Proposed LX Interface Supports 4 Fiber Link Cases
 - 100 m & 300 m Of Either Installed 62MMF Or New/Installed 50MMF
 - 2 km & 10 km Of SMF
- The Proposed Specification Follows GbE 1000BASE-LX
- WWDM Will Have Multiple Vendors And Be Cost Competitive With Other 10GbE Proposals

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Figure 38-1 & Table 38-6 Equivalents

Figure 38-1 (equivalent for WWDM)
(This can be the same for WWDM on a per channel basis)

Table 38-6 (equivalent for WWDM)
Operating range for 10000BASE-LX WWDM over each optical fiber type

Fiber type	Modal bandwidth @ 1300 nm (min. overfilled launch) (MHz*km)	Minumum range (meters)
62.5 um MMF	500	2-300
50 um MMF	400	2-240
50 um MMF	500	2-300
10 um SMF	N/A	2-10,000

Table 38-7 Equivalent For LX WWDM

Table 38-7 (equivalent for WWDM)
10000BASE-LX WWDM transmit characteristics

Description	62.5 um MMF 50 um MMF 10 um SMF	Unit
Transmitter type	Longwave Laser	
Signaling speed per channel (range)	3.125 +/- 100 ppm	GBd
Wavelength (range), four channels	1270 to 1355	nm
Channel center wavelengths	1275.7, 1300.2, 1324.7, 1349.2 +/- 5.7 nm	nm
Channel Separation	24.5	nm
Trise/Tfall (max. 20-80% response time)	100	ps
Side-mode suppression ratio (SMSR), (min)	0.0	dB
RMS spectral width (max)	0.72	nm
Average launch power, four channels (max)	3.5	dBm
Average launch power, per channel (max)	-2.5	dBm
Average launch power per channel (min)	-7.5 *	dBm
Average launch power of OFF transmitter, per channel (max)	-30	dBm
Extinction ratio, (min)	7	dB
RIN (max)	-120	dB/Hz
* Use of mode conditioning patch cord for further study		

Table 38-8 Equivalent For LX WWDM

Table 38-8 (equivalent for WWDM)
10000BASE-LX WWDM receive characteristics

Description	62.5 um MMF	10 um SMF	Unit
	50 um MMF		
Signaling speed per channel (range)	3.125 +/- 100 ppm		GBd
Wavelength (range), four channels	1270 to 1355		nm
Channel center wavelengths	1275.7, 1300.2, 1324.7, 1349.2 +/- 5.7 nm		nm
Channel Separation	24.5		nm
Average receive power, four channels (max)	3.5		dBm
Average receive power, per channel (max)	-2.5		dBm
Return loss (min)	12		dB
Receive electrical 3 dB upper cutoff frequency (max)	3750		MHz
Receive sensitivity, per channel	-15.5	-16.5	dBm
Stressed receive sensitivity, per channel	-10.0	-15.0	dBm
Vertical eye closure penalty	3.6	0.6	dB

Table 38-9 Equivalent For LX WWDM

Table 38-9 (equivalent for WWDM)
Worst case 10000BASE-LX WWDM link power budget and penalties

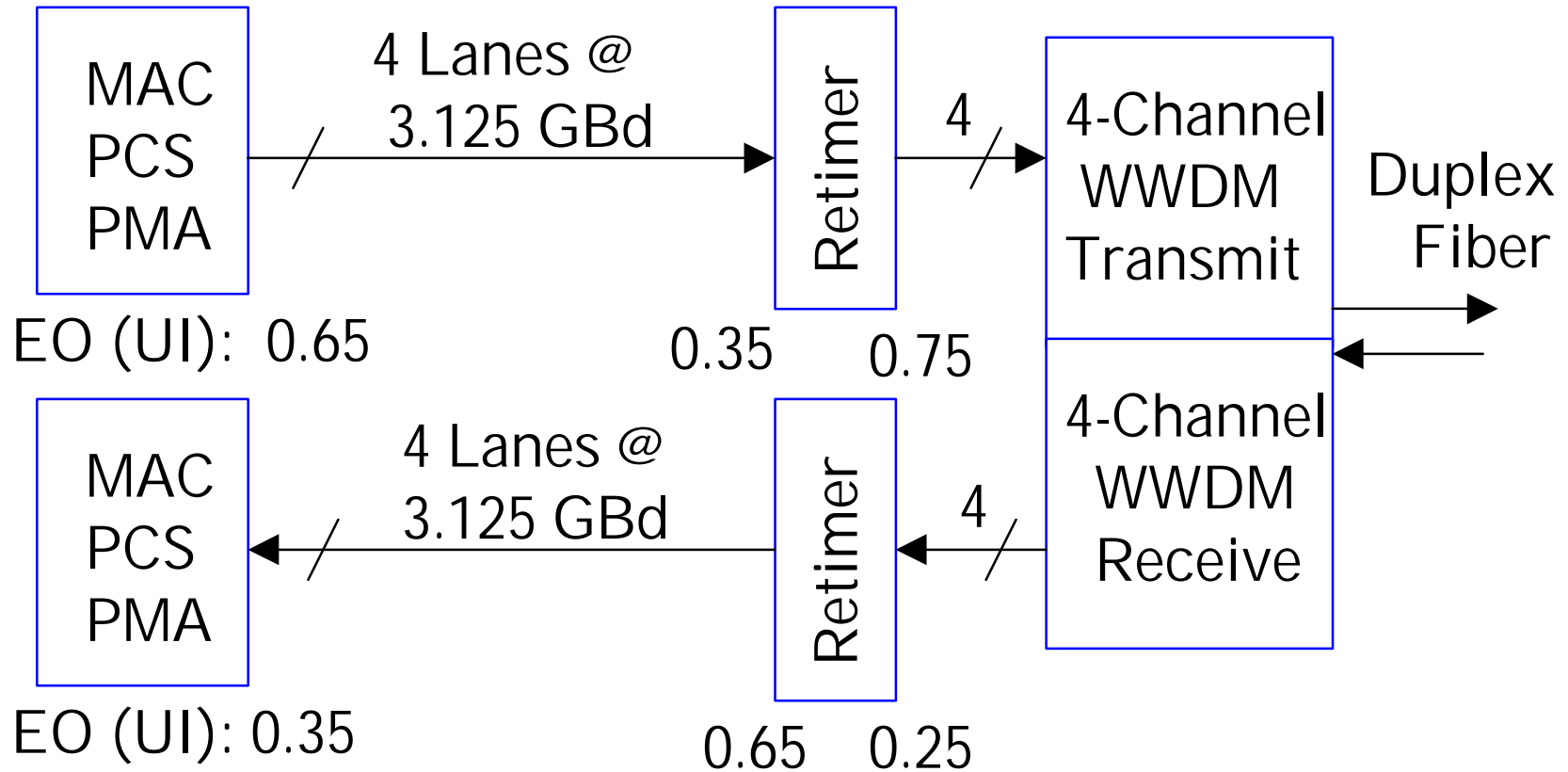
Parameter	62.5 um MMF	50 um MMF		10 um SMF	Unit
Modal bandwidth as measured at 1300 nm, (min, overfilled launch)	500	400	500	N/A	MHz* km
Link power budget	8.0	8.0	8.0	9.0	dB
Operating distance	300	240	300	10,000	m
Channel insertion loss	1.96	1.87	1.96	7.14	dB
Link power penalties	4.67	5.17	5.17	1.78	dB
Unallocated margin in link power budget	1.37	0.96	0.87	0.08	dB

GbE Table 38-10; With Analysis

Line Rate (MBd)=	1250		Input	BOLD	UI Parameters				
Baud Period (ps)=	800								
	Table 38-10								
	Total		DJ		DCD		RJ		
	TJ(UI)	TJ(ps)	DJ(UI)	DJ(ps)	rms, (ps)	% of DJ	RJ(UI)	RJ(ps)	
SerDes Tx, TP1	0.240	192.0	0.100	80.0			0.140	112.0	
FO Tx Added	0.284	227.2	0.100	80.0			0.184	147.2	
FO Tx Out, TP2	0.431	345.0	0.200	160.0	46.0	29	0.231	185.0	
Fiber Added	0.170	136.0	0.050	40.0			0.120	96.0	
Fiber Out, TP3	0.510	408.4	0.250	200.0	65.1	33	0.260	208.4	
FO Rx Added	0.332	265.6	0.212	169.6			0.120	96.0	
FO Rx Out, TP4	0.749	599.0	0.462	369.6	79.7	22	0.287	229.4	
SerDes Rx Window	0.251	201.0							

Example of Jitter Interface Assuming Hari-To-WWDM Optics

← Hari Interface →



EO: Eye Opening (Unit Interval)



Table 38-10 Equivalent For WWDM Assuming Hari to WWDM Optics

Line Rate (MBd)=	3125	Input	BOLD	UI Parameters							
Baud Period (ps)=	320										
	Total		DJ		DCD		RJ				
	TJ(UI)	TJ(ps)	DJ(UI)	DJ(ps)	rms, (ps)	% of DJ	RJ(UI)	RJ(ps)			
SerDes Tx, TP1	0.240	76.8	0.100	32.0			0.140	44.8			
FO Tx Added	0.284	90.9	0.100	32.0			0.184	58.9			
FO Tx Out, TP2	0.431	138.0	0.200	64.0	18.4	29	0.231	74.0			
Fiber Added	0.170	54.4	0.050	16.0			0.120	38.4			
Fiber Out, TP3	0.510	163.4	0.250	80.0	26.0	33	0.260	83.4			
FO Rx Added	0.332	106.2	0.212	67.8			0.120	38.4			
FO Rx Out, TP4	0.749	239.6	0.462	147.8	31.9	22	0.287	91.8			
SerDes Rx Window	0.251	80.4									

Other 4-Channel WWDM LAN Link Alternatives for Further Study

- Short Reach 850 nm VCSEL WWDM Interface
 - Support For 100 m Of Installed 62MMF Or 50MMF
 - Support For 300 m Of New, Higher Bandwidth 50MMF
- Long Reach 1310 nm or 1550 nm DFB Laser WWDM Interface
 - Support For 40 km SMF
 - Add ~15 dB To Proposed LX Optical Power Budget
 - Utilize Isolated DFB Lasers
 - Utilize Avalanche Photo Diode Detectors
 - Modify Proposed LX Specification Parameters

WIG Conclusions For 4-Ch WWDM

- The Four-Channel WWDM Interface Facilitates A Direct Connection To Four-Lane Interfaces
- The Single Proposed LX Interface Specification Supports Four Of The Five 10GbE Fiber Optic Link Cases
- The Specification Process Will Follow 1000BASE-LX
- Multiple Vendors Will Supply The Proposed LX WWDM Transceivers; Prototypes Will Be Available in 2H2000
- Cost Will Be Competitive With Other 10GbE Proposals
- The WIG Will Study Specifications for Proposed New High BW MMF
- Other Short & Long Reach WWDM LAN Alternatives Will Be Considered By The WIG
- Next WIG Meetings Planned In Conjunction with 10GEA IN March/May