



Dispersion and Skew

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*How much dispersion and skew
does MultiPHY Ethernet need to
support?*

WDM Dispersion and Skew Issues

- What type of fiber will be used?
- What wavelengths and wavelength spacing will be used?
- What maximum distance will be supported?
- How is dispersion compensation done?
 - **Broadband (per-band) mechanisms**
 - E.g. DCF brings entire band back within dispersion tolerance of each individual receiver, or approximately zero skew
 - DCF is prevailing standard in network today
 - New FBG-based broadband dispersion compensation beginning deployment in new networks
 - Dispersion tolerance of each OEO location adds up
 - **Narrowband (per-channel) mechanisms**
 - E.g. receiver dispersion tolerance, EDC, individual channel FBGs, micro-ring resonators, etc.
 - Mostly relatively recent and undeployed inventions
- Will all channels follow the same route?

Dispersion and Skew Over Fiber

– Assumes narrowband dispersion compensation)

Channel	Wavelength (nm)	Band	Dispersion (psec/nm-km)		n(eff)		Speed of Wavelength (km/s)		Propagation Delay @ 100 km (us)		Propagation Delay @ 10,000 km (us)	
			G.655	G.652	G.655	G.652	G.655	G.652	G.655	G.652	G.655	G.652
1	1270	O	-20.1	-3.8	1.464500	1.467617	204,706	204,272	488.505	489.544	48,850.462	48,954.423
2	1290	O	-18.4	-2.2	1.464750	1.467658	204,671	204,266	488.588	489.558	48,858.801	48,955.812
3	1310	O	-16.7	-0.6	1.465000	1.467700	204,636	204,260	488.671	489.572	48,867.140	48,957.202
4	1330	O	-15.1	1.0	1.465250	1.467742	204,602	204,254	488.755	489.586	48,875.479	48,958.592
5	1350	O	-13.3	2.6	1.465500	1.467783	204,567	204,248	488.838	489.600	48,883.818	48,959.982
6	1370	E	-11.6	4.2	1.465750	1.467825	204,532	204,243	488.922	489.614	48,892.157	48,961.372
7	1390	E	-9.9	5.8	1.466000	1.467867	204,497	204,237	489.005	489.628	48,900.496	48,962.762
8	1410	E	-8.2	7.4	1.466250	1.467908	204,462	204,231	489.088	489.642	48,908.835	48,964.152
9	1430	E	-6.5	9.0	1.466500	1.467950	204,427	204,225	489.172	489.655	48,917.175	48,965.541
10	1450	E	-4.8	10.6	1.466750	1.467992	204,392	204,219	489.255	489.669	48,925.514	48,966.931
11	1470	S	-3.1	12.2	1.467000	1.468033	204,358	204,214	489.339	489.683	48,933.853	48,968.321
12	1490	S	-1.4	13.8	1.467250	1.468075	204,323	204,208	489.422	489.697	48,942.192	48,969.711
13	1510	S	0.3	15.4	1.467500	1.468117	204,288	204,202	489.505	489.711	48,950.531	48,971.101
14	1530	C	2.0	17.0	1.467750	1.468158	204,253	204,196	489.589	489.725	48,958.870	48,972.491
15	1550	C	3.6	18.6	1.468000	1.468200	204,218	204,190	489.672	489.739	48,967.209	48,973.880
16	1570	L	5.4	20.2	1.468250	1.468242	204,184	204,185	489.755	489.753	48,975.548	48,975.270
17	1590	L	7.0	21.8	1.468500	1.468283	204,149	204,179	489.839	489.767	48,983.887	48,976.660
18	1610	L	8.8	23.4	1.468750	1.468325	204,114	204,173	489.922	489.781	48,992.226	48,978.050
	1630				1.469000		204,079					

Skew (us) Scenario

- 1.2 1500 octet Ethernet packet at 10 Gb/s
- 0.1 10λ CWDM (1430-1610 nm @ 20 nm) @ 100 km on G.652
- 0.8 10λ CWDM (1430-1610 nm @ 20 nm) @ 100 km on G.655
- 16.7 10λ DWDM (C Band) @ 10,000 km on G.652
- 2.8 10λ DWDM (C Band) @ 10,000 km on G.655



Thanks!

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