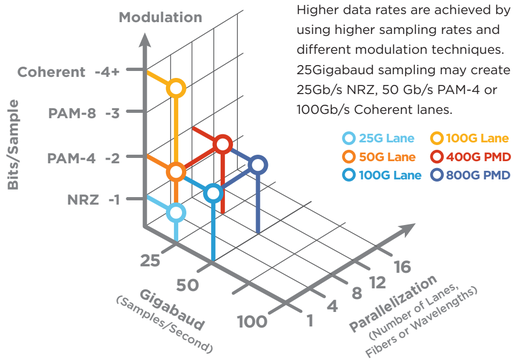
EMERGING INTERFACES AND NOMENCLATURE

	Electrical Interface	Backplane	Twinax Cable	Twisted Pair (1 Pair)	Twisted Pair (4 Pair)	MMF	500m PSM4	2km SMF	10km SMF	20km SMF	40km SMF	80km SMF
10BASE–		T1S		T1S/T1L								
100BASE–				T1								
1000BASE–				T1	T							
2.5GBASE–		KX		T1	T							
5GBASE–		KR		T1	T							
10GBASE–				T1	T				BIDI Access	BIDI Access	BIDI Access	
25GBASE–	25GAUI	KR	CR/CR-S		T	SR			LR/ EPON/ BIDI Access	EPON/ BIDI Access	ER/ BIDI Access	
40GBASE–	XLAUI	KR4	CR4		T	SR4/eSR4	PSM4	FR	LR4			
50GBASE–	LAUI-2/50GAUI-2 50GAUI-1	KR	CR			SR		FR	EPON/ BIDI Access LR	EPON/ BIDI Access	BIDI Access ER	
100GBASE–	CAUI-10 CAUI-4/100GAUI-4 100GAUI-2 100GAUI-1	KR4 KR2 KR1	CR10 CR4 CR2 CR1			SR10 SR4 SR2	PSM4 DR	10X10 CWDM4/ CLR4 100G-FR	LR4/ 4WDM-10 100G-LR	4WDM-20	ER4/ 4WDM-40	ZR
200GBASE–	200GAUI-4 200GAUI-2	KR4 KR2	CR4 CR2			SR4	DR4	FR4	LR4		ER4	
400GBASE–	400GAUI-16 400GAUI- 8 400GAUI-4	KR4	CR4			SR16 SR8/SR4.2	DR4	FR8 400G-FR4	LR8 400G-LR4		ER8	ZR

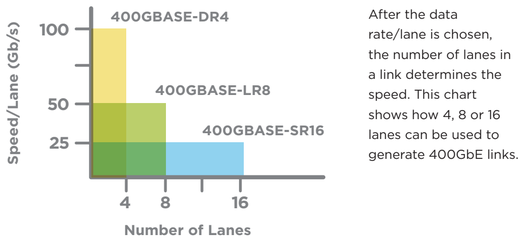
Gray Text = IEEE Standard Red Text = In Standardization Green Text = In Study Group
Blue Text = Non-IEEE standard but complies to IEEE electrical interfaces

FATTER PIPES



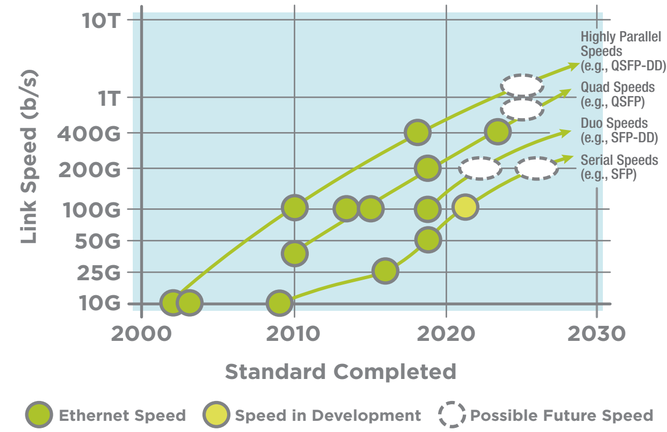
Higher data rates are achieved by using higher sampling rates and different modulation techniques. 25Gigabaud sampling may create 25Gb/s NRZ, 50 Gb/s PAM-4 or 100Gb/s Coherent lanes.

25G Lane 100G Lane
50G Lane 400G PMD
100G Lane 800G PMD



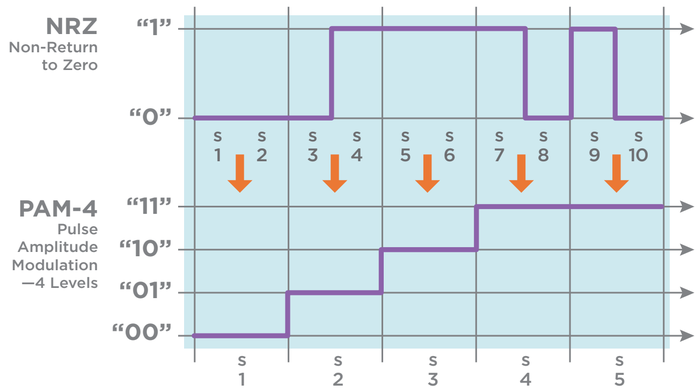
After the data rate/lane is chosen, the number of lanes in a link determines the speed. This chart shows how 4, 8 or 16 lanes can be used to generate 400GbE links.

TO TERABIT SPEEDS



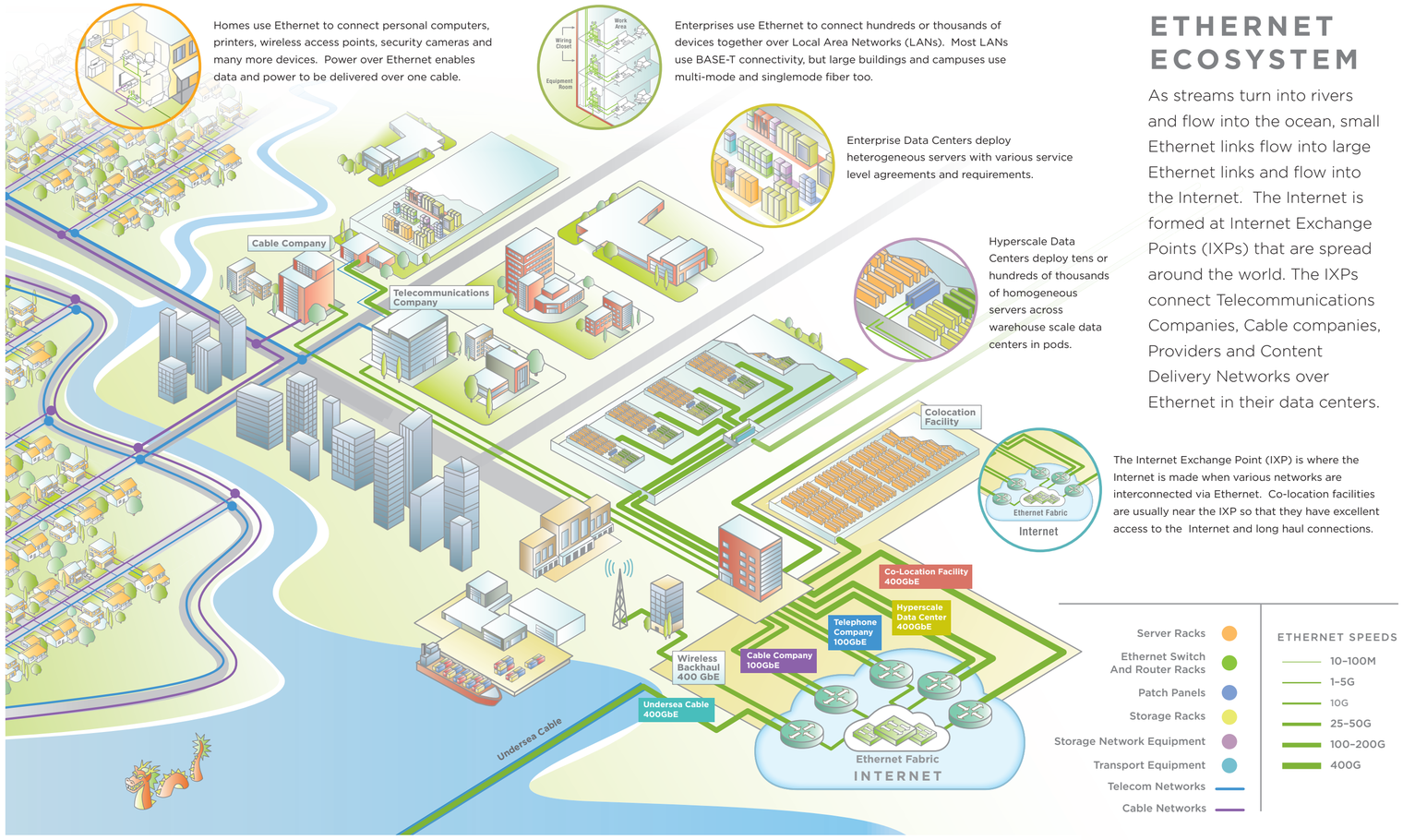
SIGNALING METHODS

Most high speed Ethernet signaling has been Non Return to Zero (NRZ), but Pulse Amplitude Modulation 4 Level (PAM-4) signaling delivers twice as many bits per sample.



ETHERNET ECOSYSTEM

As streams turn into rivers and flow into the ocean, small Ethernet links flow into large Ethernet links and flow into the Internet. The Internet is formed at Internet Exchange Points (IXPs) that are spread around the world. The IXPs connect Telecommunications Companies, Cable companies, Providers and Content Delivery Networks over Ethernet in their data centers.

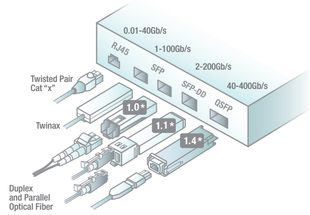


FORM FACTORS

This diagram shows the most common form factors used in Ethernet ports. Hundreds of millions of RJ45 ports are sold a year while tens of millions of SFP and millions of QSFP ports ship a year.

This diagram shows new form factors initially designed for 100GbE and 400GbE Ethernet ports. All have 4 or 8 lanes and the OBO has up to 16 lanes. The power consumption of the modules is proportional to the surface area of the module.

1–4 Lane Interfaces



*Square inches of top surface of the module

4-16 Lane Interfaces