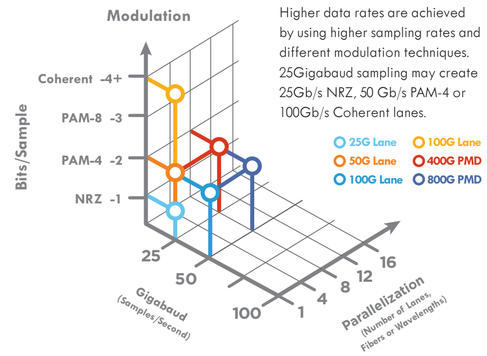
LATEST INTERFACES AND NOMENCLATURE

	Backplane	Twinax Cable	15-40m(OT) Single Twisted Pair	>100m (OT) Single Twisted Pair	100m (IT) Twisted Pair (2/4 Pair)	MMF	500m PSM4	2km SMF	10km SMF	20km SMF	40km SMF	80km SMF	Electrical Interface	Pluggable Module
10BASE–	T1S		T1S	T1L	T									
100BASE–			T1	T1L*	T									
1000BASE–			T1		T									
2.5GBASE–	KX		T1		T									
5GBASE–	KR		T1		T									
10GBASE–			T1		T				BIDI Access	BIDI Access	BIDI Access			
25GBASE–	KR1 KR	CR1 CR/CR-S	T1		T (30m)	SR			LR EPON BIDI Access	EPON BIDI Access	ER BIDI Access		25GAUI	SFP
40GBASE–	KR4	CR4			T (30m)	SR4/eSR4	PSM4	FR	LR4				XLAUI XLPPI	QSFP
50GBASE–	KR2 KR	CR2 CR	T2			SR		FR	EPON BIDI Access LxR	EPON BIDI Access	BIDI Access ER		LAUI-2/50GAUI-2 50GAUI-1	SFP/QSFP
100GBASE–	KR4 KR2 KR1	CR10 CR4 CR2 CR1	T4			SR10 SR4 SR2 VR1 SR1	PSM4 DR	CWDM4 FR1	LR4 4WDM-10 LR1	4WDM-20	ER4 4WDM-40	ZR	CAUI-10 CPPI CAUI-4/100GAUI-4 100GAUI-2 100GAUI-1	SFP QSFP/QSFP-DD OSFP
200GBASE–	KR4 KR2	CR4 CR2 CR1*				SR4 VR2 SR2	DR4 1pair*	FR4 1 pair*	LR4		ER4		200GAUI-4 200GAUI-2 200GAUI-1*	QSFP/QSFP-DD SFP-DD
400GBASE–	KR4*	CR4 CR2*				SR16 SR8/SR4.2 VR4 SR4	DR4 2 pair*	FR8 FR4 400G-FR4	LR8 LR4-6 400G-LR4-10		ER8	ZR	400GAUI-16 400GAUI-8 400GAUI-4 400GAUI-2*	QSFP/QSFP-DD OSFP
800GBASE-	ETC-KR8 KR8*	ETC-KR8 CR8* CR4*				VR8* SR8*	8 pair* 4 pair*	8 pair* 4 pair* 4 lambda*	TBD*		TBD*		800GAUI-8* 800GAUI-4*	
1.6TBASE-		CR8*					8 pair*	8 pair*					1.6TAUI-16* 1.6TAUI-8*	QSFP/QSFP-DD OSFP/OSFP-XD

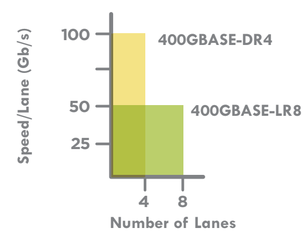
Gray Text = IEEE Standard Red Text = In Task Force Green Text = In Study Group

Blue Text = Non-IEEE standard but complies to IEEE electrical interfaces * Note: As of publication, subject to change

FATTER PIPES

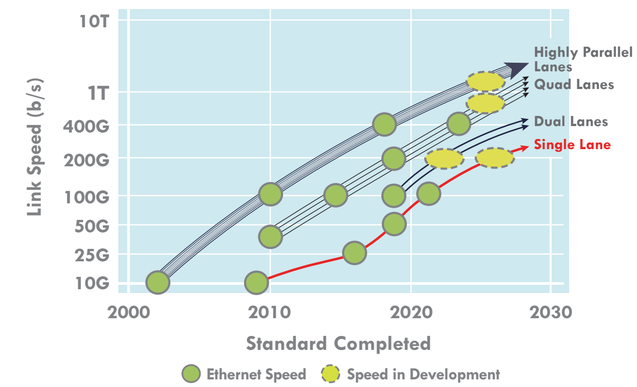


Higher data rates are achieved by using higher sampling rates and different modulation techniques. 25Gigabaud sampling may create 25Gb/s NRZ, 50 Gb/s PAM-4 or 100Gb/s Coherent lanes.



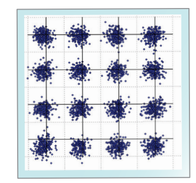
After the data rate/lane is chosen, the number of lanes in a link determines the speed. This chart shows how 4 or 8 lanes can be used to generate 400GbE links.

PATH TO SINGLE LANE

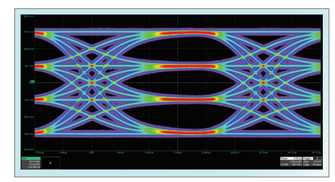


SINGLE LANE: Ethernet Alliance's "Holy Grail" Challenge

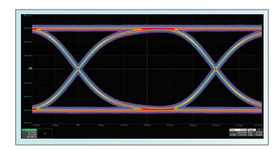
SIGNALING METHODS



Coherent



PAM-4



NRZ

Signaling for higher lane rates has transitioned from non-return-to-zero (NRZ) used for 25Gb/s per lane to four level Pulse-amplitude modulation (PAM-4) for 50 Gb/s per lane and above. Coherent Modulation uses more complex modulations for 100Gb/s per lane and above.

ETHERNET ECOSYSTEM

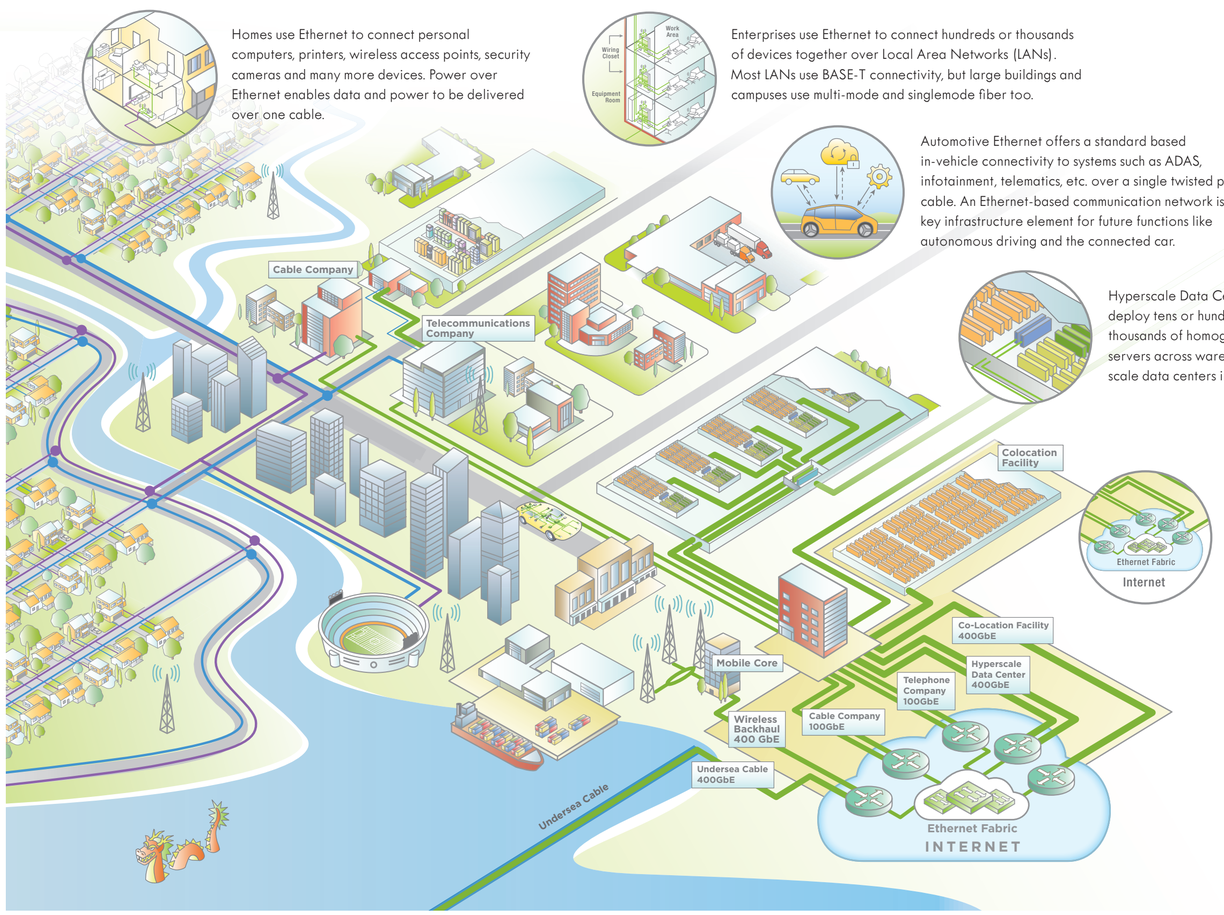
As streams turn into rivers and flow into the ocean, small Ethernet links flow into large Ethernet links and flow into the Internet. The Internet is formed at Internet Exc hange Points (IXPs) that are spread around the world. The IXPs connect Telecommunications Companies, Cable companies, Providers and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

Homes use Ethernet to connect personal computers, printers, wireless access points, security cameras and many more devices. Power over Ethernet enables data and power to be delivered over one cable.

Enterprises use Ethernet to connect hundreds or thousands of devices together over Local Area Networks (LANs). Most LANs use BASE-T connectivity, but large buildings and campuses use multi-mode and singlemode fiber too.

Automotive Ethernet offers a standard based in-vehicle connectivity to systems such as ADAS, infotainment, telematics, etc. over a single twisted pair cable. An Ethernet-based communication network is a key infrastructure element for future functions like autonomous driving and the connected car.

Hyperscale Data Centers deploy tens or hundreds of thousands of homogeneous servers across warehouse scale data centers in pods.



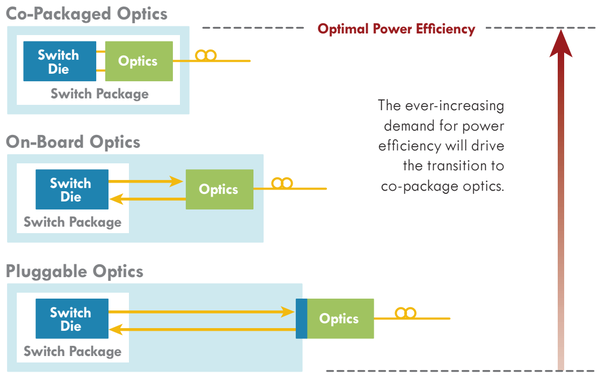
The Internet Exchange Point (IXP) is where the Internet is made when various networks are interconnected via Ethernet. Co-location facilities are usually near the IXP so that they have excellent access to the Internet and long haul connections. 5G's next-generation network architecture is changing our connected world. It has the potential to support thousands of new applications in both industrial and consumer segments, and with speeds and throughput exponentially higher than current networks, the possibilities for 5G appear to be almost limitless.

- Server Racks
- Ethernet Switch And Router Racks
- Patch Panels
- Storage Racks
- Storage Network Equipment
- Transport Equipment
- Telecom Networks
- Cable Networks

ETHERNET SPEEDS

- 10–100M
- 1–5G
- 10G
- 25–50G
- 100–200G
- 400G

OPTICAL EVOLUTION



The ever-increasing demand for power efficiency will drive the transition to co-package optics.