2024 ETHERNET ROADMAP

The Past, Present and Future of Ethernet

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INTEROPERABILITY AND CERTIFICATION

The Ethernet Alliance is committed to building industry and end user confidence in Ethernet standards through its multi-vendor interoperability demonstrations and plugfests. Our PoE Certification Program takes this mission to the next level!

Our industry-defined PoE Certification Test Plan is based on the IEEE 802.3 (Ethernet) PoE standards, and products passing this test will be granted the Ethernet Alliance PoE Certification Logo. The trademarked logo provides instant recognition for products based on these standards, and increases multi-vendor interoperability between products bearing it. The logos indicate the power class and product type providing clear guidance on which devices will work with each other.

The first generation of the program (Gen 1) certifies Type 1 and Type 2 products that use 2-Pair of wires (PoE 1). The second generation of the program (Gen 2) certifies Type 3 and Type 4 products using 2-Pair and 4-Pair of wires (PoE 2). See table below for details:

PoE Types and Classes	PoE 1 2-Pair PoE – Type 2 / PoE 1 2-Pair PoE – Type 1					PoE 2 4-Pair PoE			
Class	0	1	2	3	4	5	6	7	8
PSE Power (W)	15.4	4	7	15.4	30	45	60	75	90
PD Power (W)	13	3.84	6.49	13	25.5	40	51	62	71.3
	PoE 2 4-Pair PoE – Type 3					PoE 2 4-Pair PoE Type 4			

EA Certified™ EA Certified 2.0™

https://ethernetalliance.org/poecert/

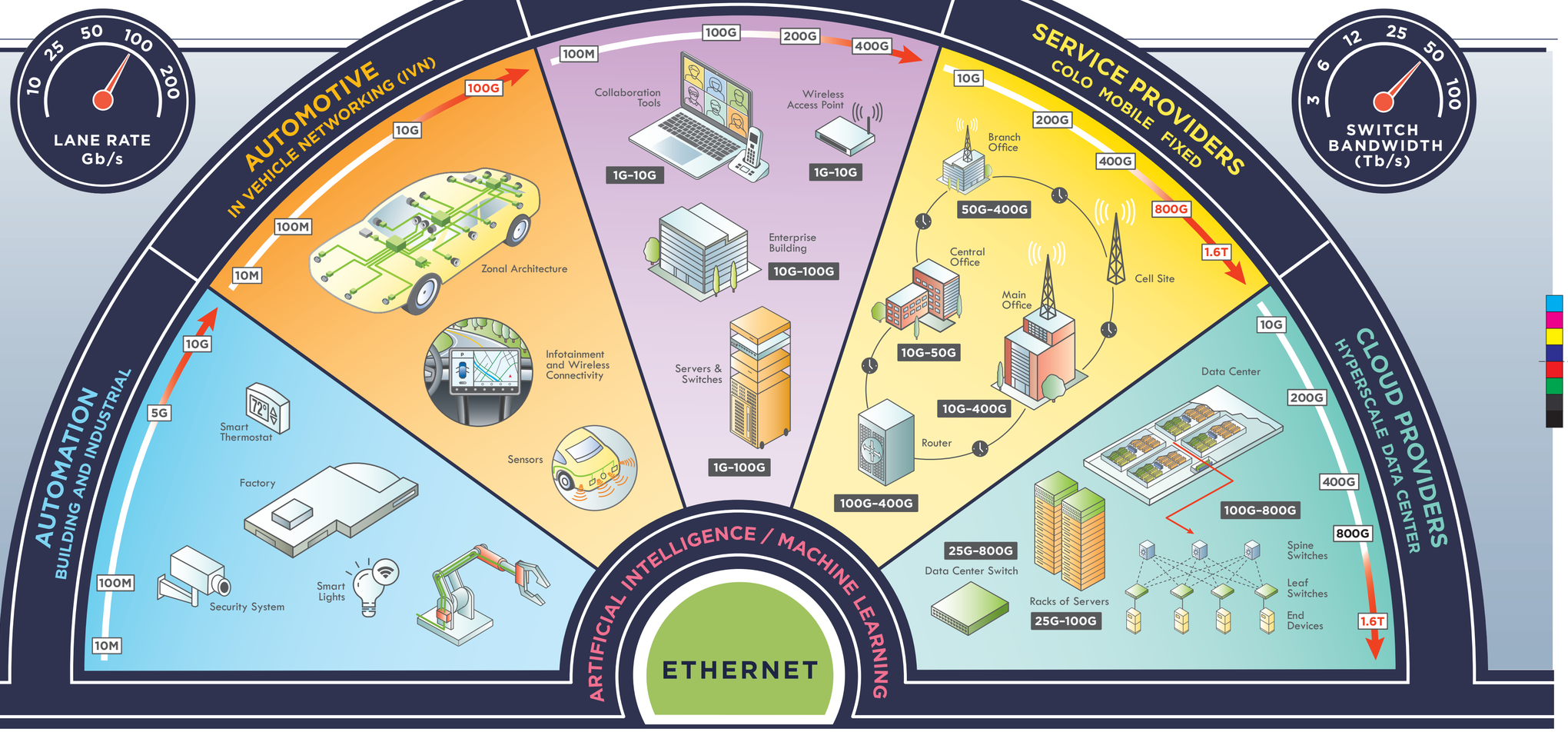
ETHERNET APPLICATIONS

AUTOMOTIVE is one of Ethernet's latest success stories. Ethernet links within cars provide data using Single-Pair Ethernet (SPE) to reduce the cost while providing economies of scale and interoperability. Richer multimedia experience, autonomous driver assistance systems (ADAS), roll-out of autonomous vehicles and convergence of legacy in-vehicle networking (IVN) technologies towards Ethernet are the big drivers for Ethernet adoption in cars. Meanwhile, Ethernet is reducing the weight of the vehicle of tomorrow by enabling the consolidation of multiple electrical systems into a unified zonal architecture similar to other converged networks.

ENTERPRISE and Campus applications are a huge market for Ethernet with over a billion ports shipping per year. Most of these ports are BASE-T at the access layer, with both multi-mode and single-mode fiber links (MMF/SMF) further into the network.

The changing needs of Wi-Fi access points and Enterprise class client devices are driving technology transitions. BASE-T ports are making the transition from 1000BASE-T to 2.5G/5G/10GBASE-T, and optical ports are moving from 10G/40G to 25/100G.

SERVICE PROVIDERS have driven higher speed Ethernet solutions for decades, including router connections, EPON, client side optics for optical transport network (OTN) equipment, and wired and wireless backhaul. In particular, the 5G mobile deployment is driving dramatic increases in both fronthaul and backhaul applications and continues to push Ethernet to higher rates and longer distances. With global demand by consumers for video, this shows no signs of changing. The aggregated bandwidth seen in service provider networks continues to push for increased Ethernet speeds, currently reaching for 1.6 Tb/s. SyncE (Synchronous Ethernet) has become a critical technology used in the Telco rollout of 5G networks and services, a massive adoption of this technology is expected over the next few years.



BUILDING & INDUSTRIAL AUTOMATION applications are moving from older fieldbus style networks to Ethernet. This move has been accelerating over the last decade, with Ethernet as a key enabling technology for the Fourth Industrial Revolution aka Industry 4.0. The main themes of Industry 4.0 are Interconnection, Information Transparency, Technical Assistance and Decentralized Decisions [1]. Adopting Ethernet provides these applications access to all the networking technology that IT has developed over the last 40 years, as well as physical layers developed specifically for harsh OT environments, e.g., 10BASE-T1L. Ethernet, in conjunction with IEEE. Time Sensitive Networking (TSN) is revolutionizing industrial automation. In turn, automation applications are seeing Ethernet development return to its roots such as 10 and 100 Mb/s speeds and shared media using new technology.

[1] M. Hermann, T. Pentek and B. Otto, "Design Principles for Industrie 4.0 Scenarios," 2016 49th Hawaii International Conference on System Sciences (HICSS), 2016, pp. 3928-3937, doi: 10.1109/HICSS.2016.488

ARTIFICIAL INTELLIGENCE (AI) is harnessing the power of higher 200G and 400G Ethernet speeds to support the training and inference of large language models (LLMs). AI and Machine Learning (ML) is driving the roadmap extending Ethernet speeds to 800G and beyond. The architecture within AI-driven data centers is evolving, leveraging a blend of copper and fiber solutions to meet AI's soaring bandwidth demands. Ethernet's progression towards higher speed interfaces, the widening variety of interconnect options, and advancements in power efficiency bodes well for ensuring longer term viability to meet market demands for AI and ML services.

CLOUD PROVIDERS adopted 10G servers on a large scale in 2010 for hyperscale data centers. In the 2020's, the appetites for AI and Machine Learning applications required faster connections and hyperscale moved to 25G/lane speeds and are now transitioning to 50G, 100G and beyond. Unique networking architectures within these warehouse scale data centers have driven a mix of both active and passive copper cables, traditional multi-mode fiber and single-mode optics and fiber solutions, and the new Linear Pluggable Optics for 100G, 200G, 400G and 800G. The bandwidth demands of both hyperscalers and service providers coupled with the need to reduce energy consumption and improve cooling are driving innovative interconnect technologies.

The gap in products and requirements of the Telecom and cloud services providers has rapidly closed over the last decade, and it's even more aligned than ever with the global rollout of 5G services. Historically, the telcos drive technology to keep pace with the end-users and equipment demands. Cloud and hyperscale companies require greater density and high-speed and energy efficient inter-connections in the data center to support the application demands. The result is a more collaborative and cohesive relationship between cloud and service providers to rapidly define and deploy more ubiquitous solutions meeting both their market needs.

For digital version of the roadmap and for latest Ethernet industry resources, please visit: www.ethernetalliance.org