**ETHERNET APPLICATIONS**

**AUTOMOTIVE** is one of Ethernet’s latest success stories. Forecasts predicted up to 700 million ports of Ethernet will ship by end of 2023, Ethernet will be in cars. Meanwhile, Ethernet is reducing the weight of the vehicle to enable 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 10G-100G of 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 data center devices are driving technology transitions. Base 2 and optical pairs are making the transition from 10GBASE-T to 25G/50G/100G BASE-T, and optical pairs are moving from 10G/40G to 25/100G.

**SERVICE PROVIDERS** have driven higher-speed Ethernet solutions for decades, including router connections, PoE, 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 broadband and backhaul applications and continues to push Ethernet to higher rates and longer distances. With global demand by consumers for video, there’s no sign of slowing. The aggregated bandwidth seen in service provider networks continues to push for increased Ethernet speeds, currently reaching for 40 and 50G. Ethernet has become a critical technology used in the Tactile Internet 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 drivers 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 IOT environments, e.g., 10G-Base-T, Ethernet in conjunction with IEEE 802.1 time-division Synchronous Networking (TSN) is revolutionizing automation. In turn, automation applications are driving Ethernet development return to its roots such as 10 and 100 Mbit/s speeds and shared media using new technology.

**CLOUD PROVIDERS** were the first to adopt 10GBase-T servers on a large scale in 2010 for hyperscale data centers. In the 2020’s, with voracious appetite for applications like AI and Machine-learning, hyper-scale servers have moved to 25G/40G and are transitioning to 50G/100G and beyond. Unique networking architecture within these warehouse-scale data centers have driven a mix of copper cables, multi-mode fiber and single-mode fiber solutions at 100G/200G/400G/800G. The bandwidth demands of both hyperscale data centers and service providers continue to grow exponentially and they are adopting similar technologies.

The gap in product requirements and the requirements of the Telecom and Cloud services providers has rapidly closed over the last decade, and it’s never been more aligned than it has become with the global rollout of 5G services. On the telco side, they are driving technology to keep pace with the demands of their end-users and appliances. Cloud and hyperscale companies are increasingly requiring greater density and lighting fast connections in the data centers to support the applications. This results in more collaboration and coexistence between Cloud and service providers to rapidly define and deploy more ubiquitous solutions meeting both their market needs.

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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 PlugFest Certification Program takes this vision to the next level.

Our industry-defined PlugFest 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 logo indicates 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 products and Type 2 products that are 2-Pair and 4-Pair of wires (PoE 2), PoE 1 products and 2-Pair PoE – Type 1, Type 2 products. See table below for details.

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For digital versions of the roadmap and for latest Ethernet industry resources, please visit: [www.ethernetalliance.org](http://www.ethernetalliance.org)
LATEST INTERFACES AND NOMENCLATURE

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The Internet of Things is the Internet of Other Things, a concept where everything is connected. This includes everything from cars to houses to appliances to medical devices. By connecting all of these devices via Ethernet, we can create a world where everything is always connected and always available.

- **Optical Evolution**
  - Co-Packaged Optics
  - On-Board Optics
  - Pluggable Optics

**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 spread around the world. The IXPs connect telecommunications companies, cable companies, providers, and content delivery networks over Ethernet in their data centers.

Hyperscale Data Centers deploy hort or hortands of thousands of homogenous servers across warehouse scale data centers in pods.

- **Path to Single Lane**
  - Single Ends
  - Dual Speeds
  - Quad Speeds
  - Octal Speeds

**Signalizing Methods**

- NRZ
- PAM4

**Optical Speeds**

- 16–100G
- 1–50G
- 32–56G
- 100–1000G
- 400G

**Co-Packaged Optics**

- Optics

**On-Board Optics**

- Optics

**Pluggable Optics**

- Optics

**Single lane: Ethernet Alliance’s “Holy Grail” Challenge**

- Optics

**Transport Equipment**

- And Router Racks
- Cable Networks

**Optical Power Efficiency**

- The ever-increasing demand for power efficiency in the data center is driving the transition to co-packaged optics.