

The Need for High-Speed Connectivity

By Wendy Jane Preston

Whether in the domestic market or at the edge of space, modern electronic equipment communicates at an unprecedented rate. The Internet of Things (IoT) allows devices to share data with each other, providing real-time monitoring and the ability to control remote equipment. High speed connectors and their associated cabling are the nervous system, providing pathways for the massive volume of signals.

The Evolution of High-Speed

Early experiments with high-speed transmission used coaxial cables. The first patent was in the 1880s; by the 1920s it was the backbone of the telecommunications network. It was capable of signal speeds required for voice and text communication – so as computer networks developed, coaxial cable was the obvious choice.

The continued rise of data rates and the demand for more connections sparked the move from coaxial to twisted pair cables. Ethernet networks moved to a structured wiring solution. Twisted pairs became standard; BNC connectors gave way to multi-pin modular connectors. Data transfer rates up to 100Mbps were still considered high.



Figure 1: Modern high-speed communications center in a controlled environment

Breaking the 10Gbps Barrier

In modern communications, 100Mbps is low speed. In the era of the high-speed internet, wireless communications and video streaming, data rates of 6Gbps are commonplace. 5G cellular networks enable hand-held devices to communicate more than 10Gbps.

Wireless networks are capable of the same communication speeds as traditional wired networks. Connectors within the network must deliver high-speed performance, on the devices themselves and in the data centers & base stations that are crucial to the modern communications network.

High-Speed Challenges – Signal Integrity

As higher data rates become common, the quality and accuracy of the data transmitted is vital. Connector designers work hard to ensure Signal integrity (SI) is maintained. As electrical signals are transmitted over cable and through connectors, comparing signal loss from origin to target gives a measure of SI. Many factors (internal and external) can affect SI. For instance, engineers need to be aware of the effects of electromagnetic interference (EMI) on the quality of signals carried through the connector system.

As data rates increase, there is also a need for smaller connections with higher pin counts, so a finer pitch is needed. The signal trace length on printed circuit boards and the design of the cables become a crucial issue. Increased pin counts and reduced spacing increase the risk of crosstalk – the interference of a signal within one conductor from its neighbor. Designers need connectors that are manufactured to preserve the signal integrity of high-speed signals.



Figure 2: High-speed wired communications on the factory floor

Connectors enabling high speed computing and communications

Every aspect of modern technology benefits from the high-speed revolution. Smartphones dominate the consumer world in both telecommunications and personal computing, aided by the introduction of 5G technology.

More importantly, the industrial market has embraced high-speed communications to create the smart factory and new ways to organize the manufacturing environment.

Outside the safety of the factory floor, high-speed communications systems are being deployed into the field. Automotive, aerospace and defense leverage this technology for navigation, communications, and data-sharing. The connectors required will be subject to shock, vibration, and harsh environments.

Technologies and Solutions

Many high-speed connectors employed in fixed installations such as data centers and mobile base stations are not designed with the reliability needed for field use. Creating connectors for these demanding applications requires an in-depth understanding of harsh environment conditions.

The new generation of high-speed connectors will use established features for preserving signal integrity – such as differential pairs, shielding and ground-planes – but will employ advanced manufacturing techniques. Machined contacts are common in connectors for high vibration applications, giving excellent conductivity and mechanical stability. Connector housings use high-performance polymers for superior strength.



Harwin and High-Speed Connectivity

[Harwin](#) supply multi-pole connectors of the highest quality for service in many different applications across the globe. Already well-versed in the requirements of reliable products, Harwin is applying its knowledge to a range of high-speed connection solutions for demanding applications. By leveraging expertise in high-performance products, Harwin has created a [small and lightweight high-speed connector family for the next generation of equipment](#). Further expansion in this area of connectivity is already scheduled, so keep watching for more additions to the range.

Conclusion

The recent advances in high-speed communications provide opportunities in a wide range of industries. Traditional connectivity solutions may not meet the data rate requirements found in these demanding applications, and there is a need for solutions that will provide superior performance in delivering these high-speed communications. Harwin continues to develop new products, helping design engineers in all industries to connect with confidence.