

10 key benefits of Industrial Ethernet

Industrial Ethernet has become big business in the last 10 years and represents a sea change in the way that industrial systems operate. For many years, communications between devices happened over an RS232 or RS485 physical layer providing slow, inflexible but reliable communications. Using Ethernet on the factory floor or in transportation systems is a relatively new concept but the move to IP based systems is growing at an exponential rate.

'Industrial Ethernet' can have several interpretations. It is a marketing concept. A phrase that can be used to describe the general shift towards Ethernet solutions in industry. It is also specifically used to describe Ethernet switches and media converters that are designed for industrial rather than home use. This is the tangible hardware part of Industrial Ethernet which we will discuss later in this article.

Industrial Ethernet is also a networking solution – a way to build distributed systems with fibre optic or copper media.

One of the main problems when making an introduction of Industrial Ethernet is that the target audience do not always have an understanding of Ethernet in the first place and the situation can become increasingly confused! For the benefit of this article, Ethernet is a general purpose communication protocol that is very fast, can be used for almost any purpose and is very cost-effective due to its mass adoption in office and home user environments. The technical team at Amplicon are a good place to start for free consultancy when taking your first steps with Ethernet technology.

Why use Industrial Ethernet?

- 1) Industrial Ethernet switches (the core building block of industrial networks) are optimised for harsh environments. Using a £30 consumer product on a production line where down-time costs £1000 a minute is a major false economy. Industrial switches have hardened enclosures, dual power inputs, shock and vibration approvals, direct DC power, DIN-rail mounting capability and high MTBFs to provide a more suitable solution for industry.
They also feature approvals for specific vertical markets such as EN50155 for rail applications and IEC-61850 for use in Substation environments.
- 2) Using Ethernet instead of serial (RS232, RS422 or RS485) communications massively increases the flexibility of the installed network. A single cable can be used for video, voice and many different types of data. Traditional fieldbus systems were limited to one task with no scope for diversification.
- 3) Power over Ethernet (PoE) allows power to be delivered over the same piece of Cat 5 or Cat 6 cable that transmits Ethernet data. This means that devices such as IP cameras, gas analysers and embedded computers can be conveniently located without the cost of installing an additional power spur. PoE is another compelling argument for using Ethernet in distributed industrial applications. In the current standard, 802.3af, the available power of 15.4W is quite limited. The new Power over Ethernet Plus standard (802.3at) promises to deliver more power whilst remaining backward compatible with the current standard.
Many customers forget or are unaware of the fact that non-PoE devices can benefit from PoE through the use of PoE splitters. In a recent application, sound level meters were networked AND powered by Ethernet by the addition of a 12Vdc PoE splitter. This allowed the meter to be located in the optimal location for sound measurements.

- 4) Fast network redundancy is a key driver for adopting Industrial Ethernet. It is possible to build a network of devices that can continue to communicate with each other even if a cable is broken or unplugged or if one of the network switches fails. Many safety critical systems must exhibit high reliability and fault tolerance. The redundancy capability of Industrial Ethernet switches is the primary method to achieve this level of reliability. A good example of where this technology has recently been adopted is the Building Automation market. Many Building Automation Controllers now have an Ethernet interface. In applications where Heating, Ventilation and Air Conditioning is considered critical (such as data centres) the network connecting the controllers must be highly reliable and able to withstand failures in network cabling or network infrastructure.
- 5) Ethernet & TCP/IP are complex subjects especially for those that have not regularly worked with them before. Consultancy and advice can be an invaluable sales tool for those entering the Industrial Ethernet space.
- 6) Most Industrial Ethernet hardware has a wide temperature range - typically -40° to +70°C and conformal coating (a protective coating for the PCB) allowing the switches to be used outdoors. This allows projects to be completed without the cost of forced cooling or heating in enclosures and offers a solution to an environmental problem that consumer Ethernet products simply do not address.
- 7) Most applications that use Ethernet use TCP/IP which happen to be the underlying protocols of the internet. Because of this it is possible to connect your industrial networks to each other allowing data sharing and remote control even if your sites are on opposite sides of the world. If the data being shared between sites is of a sensitive nature, point to point VPN (Virtual Private Network) tunnels can be established to keep data secure across the public (internet) parts of the link. Many Industrial routers are now available with firewall and VPN capabilities built in.
- 8) Another benefit that arises from Ethernet's close affiliation with IP is the ability to use mobile phone networks to communicate with industrial equipment. GPRS and 3G (UMTS) are both IP based which means a PLC in a vehicle that is travelling around the UK can stay in permanent contact with a PC or server potentially hundreds of miles away. Using cellular communications provides a data cable the length and breadth of the globe and facilitates applications that were never previously possible.
- 9) Ethernet consists of a set of well defined standards that encompass many different media types. Copper, fibre-optic and wireless Ethernet are all available to move your data through any environment as cost-effectively as possible. Fibre optic communication is especially useful in industrial applications for two of its key features.
 - a) Electromagnetic noise immunity – data is not corrupted by spikes and electrical noise. This is especially important in substations or heavy industrial plants where switchgear and high voltages can affect the surrounding environment.
 - b) Distance – whilst standard Ethernet has a range of up to 100m, fibre based variants can span distances up to 120km with off the shelf transceivers. Applications involving roads, railways and pipelines as well as any other very long linear structures often capitalise on the extended range of fibre based Ethernet.

Wireless networks can be seamlessly integrated with their wired counterparts through the use of Industrial Access Points (APs). Wireless LAN is often used where cables cannot be laid (such as Nuclear plants) or where high mobility is required such as connections to fork-lift trucks on the shop floor. Serial to Wifi converters aka wireless device servers allow RS232, RS422 and RS485 devices to be seamlessly connected to a wireless network.

- 10) Embrace it now! IP & Ethernet are going to pervade in industry. A surprising number of engineers are put off by the complexity of the subject but a little study now will stand you in good stead for years to come.

Amplicon have a wealth of experience in the design and supply of Industrial networking infrastructure and devices. If you could benefit from free consultancy on the subjects above for an upcoming project, do not hesitate to contact our technical team on 01273 570 220 or email sales@amplicon.co.uk.