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Fibre to the machine is a good choice for innovative companies in the manufacturing sector

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The manufacturing sector is becoming smarter as the factory floor, and beyond, becomes increasingly digitalised. Many manufacturers are adopting multiple new technologies, such as big data analytics, artificial intelligence, and cloud services, and there is a corresponding need for companies to enhance the underlying networks that support such innovations.

Networking technologies need to adapt to this new paradigm and deliver the high performance, simplicity, and low costs that match the requirements of smart manufacturers. Fibre to the machine (FTTM) offers significant advantages over traditional copper-based LANs and other wireless alternatives such as Wi-Fi that are often used in factories. This blog lays out the benefits that can be derived in the smart manufacturing sector from deploying FTTM.

FTTM offers superior performance with higher speeds, lower latency and better reliability

In the first instance, FTTM is well suited to smart manufacturing type deployments because of the high capacity available on PON fibre networks. Smart manufacturing sites have significant bandwidth requirements for multiple applications. For instance, multiple automated production devices require central controls. One example of the high bandwidth requirements for smart manufacturing sites is Chinese automobile manufacturer First Automobile Works, which has deployed FTTM in its Technology Innovation Space. In the labs on this site, the company has multiple systems covering data collection, test and precision control, and high-speed cameras all of which can have significant bandwidth requirements, can run concurrently and generate huge volumes of data every day.

There is also a clear pathway for upgrading bandwidths on FTTM networks. FTTM networks today can use XGS-PON which provides symmetrical capacities of up to 10Gbps. Individual ONUs can then provide Gigabit or multi-Gigabit connectivity to multiple devices in a smart manufacturing location. Smart manufacturing sites could also be upgraded to 50G PON to provide up to 50Gbps of capacity and this

could be achieved by simply changing OLT and ONU hardware rather than having to replace cabling as would be the case when increasing bandwidth on a traditional copper-based LAN. This ability to easily upgrade capacity on FTTM networks is highly important for smart manufacturing sites due to the significant loss of revenue that network downtime implies.

Furthermore FTTM offers the benefit of very low and deterministic latency, which could potentially offer a ten-fold improvement over legacy networks. This is because FTTM benefits from the very low latency on PON networks. PON networks help provide deterministic latency because each data transmission is allocated a different time slot. FTTM supports hard isolation which means service channels are independent of each other. This contrasts with traditional copper-based LANs where when large numbers of terminals are connected network congestion can occur and so the network cannot provide deterministic latency.

Another area in which FTTM can deliver better performance is by offering greater predictability and reliability with low fault rates. Traditional copper-based LANs can be prone to electromagnetic interference, for instance when machines start up or shut down, and this is not the case with FTTM networks. Using Wi-Fi to connect devices on a production line can also result in difficulties because such locations can involve a lot of welding which means the environment is highly magnetic. In addition FTTM networks can deliver better reliability because fibre does not age due to oil stains which can be prevalent in production line environments.

Zero packet loss is also highly important in ensuring reliable network performance for smart manufacturing. FTTM provides dual fed and selective receiving and so in the case of link switching there is zero packet loss. In addition if a node is added or deleted, or if a single node fails, the star topology of the FTTM network means that there is zero packet loss on the other nodes.

FTTM offers flexibility and simplified network operation and maintenance

FTTM can deliver some important cost and simplicity benefits in the smart manufacturing sector. The FTTM network is capable of supporting multiple services and in the case of the Fast Group automobile manufacturer in China the supported services on its FTTM network include the management of machine control cabinets as well as the uploading of videos from the factory production line. This means that capex requirements are lower since one network can cater for multiple applications and this single FTTM network will then be easier to manage with lower opex. An additional opex benefit that can be derived from deploying FTTM is that it offers 30% lower power consumption than traditional network solutions.

FTTM also offers network operation and maintenance benefits in the sense that it allows for rapid onboarding of new devices. For example, Fast Group notes that the time required to connect new devices to the factory network is only 30 minutes with its FTTM deployment compared to 3 hours previously. The adding of new devices is likely to be important in many cases and, for instance, for First Automobile Works' Technology Innovation Space daily laboratory operations entail the addition of information points on demand and so FTTM can offer benefits in this area. An FTTM network can also use passive splitters and the reduction in active equipment simplifies network operations and maintenance. All together it is possible that the operations and maintenance of the FTTM network will require only one worker.

FTTM also has advantages in terms of locating faults. One challenge for traditional copper-based LANs is that they are only capable of delivering their maximum bandwidth to a distance of 100 metres. This then means that one communication cabinet is required every 70 metres or so and that there are huge

numbers of cables in production line environments. This then leads to significant difficulties in finding faults, which is highly important in factories where the costs of network downtime are extremely high. FTTM can help resolve these challenges because the point to multi-point PON architecture reduces the amount of cabling required. In addition FTTM offers the benefit of centralised management as well as a user friendly interface which can help in reducing fault finding time.

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