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Enhancing Industrial IoT and Smart City Networks with G.hn

By: **Livia Rosu**

The Industrial Internet of Things (IIoT) and smart cities are already transforming the way we live and work, offering more efficient, sustainable, and connected environments. These systems rely on quality and reliable data communication, without which they simply cannot function.

This is where gigabit home networking (G.hn) technology comes in—G.hn is a global telecommunications standardization sector (ITU-T) standard for wired connectivity that provides high-speed data transmission over any existing wiring, including powerlines, coaxial cables, and telephone wires. This means that IIoT and smart cities can take advantage of existing infrastructure to transmit data, while delivering a cost-effective, secure, and reliable solution to the data communication challenges that operators face.

Both IIoT and smart city applications rely on the collection, analysis, and use of large amounts of data, and this means the communication networks must be robust and reliable to function effectively. Without these networks, the data generated by the devices and machines cannot be collected, analyzed, and used to drive improvements.

The growing technology of choice

G.hn offers not only a solution to overcome the challenges of digitalization, but also eases and accelerates the digital transition by filling the gap between technologies, extending the connectivity of previously installed technologies. Thanks to its ability to connect devices and operate efficiently with multiple types of networks over any wire (such as coax, phone lines,

powerlines, and optical fiber) it is not only a fast alternative but also a reliable backbone for other technologies and networks.

This aspect of interoperability with other devices already on the market is fundamental for any technology to reach its full potential. HomeGrid Forum made significant headway in validating the interoperability of G.hn systems with certification programs for a variety of applications and markets, ensuring an ecosystem of highly performant, standard-compliant, and interoperable products ready for accelerated service deployments.

This is why G.hn is a key player in the fully digitalized world, providing the high-speed, reliable, and cost-effective connectivity needed to support the growth of IIoT and smart cities. As the market for IIoT continues to grow, we can expect to see even greater adoption of G.hn in the years to come.

The G.hn standard is constantly being maintained by ITU, with periodic updates to address the increasing bandwidth requirements from the industry. G.hn devices currently support up to 2 gigabit per second (Gbps) speeds and ITU is already working on a new amendment of the standard that is delivering data rates up to 10 Gbps, including full-duplex support.

New use cases for G.hn

While G.hn use cases started with purely home networking and smart-grid services, the evolution of IoT systems—requiring network-enabled devices of all sorts to intercommunicate reliably—has driven the need for a robust backbone that can support all networked devices reliably and for a standard that can govern interoperability for industrial applications. G.hn can utilize the existing cables in industrial environments to reliably deliver high-speed, multigigabit data to Local Area Networks(LANs) which are in turn connected to IIoT endpoint devices through common industrial interfaces, including Ethernet, RS-485/232, and USB. New research recently released by HomeGrid Forum has proven G.hn can help such industrial networks overcome traditional digitalization challenges by ensuring reliable connectivity and maintaining the functionality of existing infrastructure.

Key benefits of the G.hn for IIoT applications include:

Increased network reliability

Within IIoT and smart city networks, data is transmitted from various sources and devices to central control systems, where it is processed and analyzed. G.hn technology provides this highly reliable and secure data communication channel that ensures the accurate and timely transmission of the data.

Enhanced network efficiency

Data communication must be fast and efficient to support real-time decision-making. Through its ability to offer high-speed data transmission, G.hn makes it possible to process and analyze the data in real-time. This results in enhanced network efficiency and enables faster, more accurate decision-making.

Easy deployment and scalability

As G.hn uses existing wiring within the network, it eliminates the need for new cabling and reduces installation costs. Furthermore, G.hn networks are highly scalable, allowing them to accommodate growth and changing network requirements as they evolve over time, which is particularly relevant to IIoT and smart city networks.

Interoperability and compatibility

G.hn systems are tested and certified for interoperability and compliance with the ITU-T standard. This means that G.hn networks can be easily integrated into existing IIoT and smart city networks, improving overall system performance and functionality.

High security

Data transmitted over IIoT and smart city networks can be sensitive and critical. G.hn technology provides robust encryption and authentication mechanisms to ensure the privacy and security of the data transmitted over the network with protection against unauthorized access and tampering.

A well-suited match for a range of IoT use cases

The recent work revealed by HomeGrid Forum's IIoT Task Force states that G.hn is well-suited for a range of IIoT networks including smart lighting control, smart elevators, smart traffic lights, charging stations, industrial plants, airport navigation systems, and fire alarms, among others. The list of industrial IoT use cases covers building and cities automation, factory automation, transportation, and energy-focused case studies. Proving suitable in both brownfield and greenfield scenarios, the use of G.hn means the functionality of existing installations can be easily extended, allowing them to reliably transport multi-gigabit-per-second Internet protocol (IP) data on any existing wire. G.hn stands out by providing secure, low latency, high speed, real-time connection for environmental sensors and video surveillance operations. Combiningthis with its high quality of service—especially on control and information-level industrial applications—it is particularly of benefit where new cables and infrastructure are challenging due to budget limitations and safety regulations. As it operates efficiently with any wire, it offers a cost-effective and reliable backbone for other technologies and networks, including Wi-Fi, LiFi, 5G, NarrowBand Powerline, RF, and ZigBee.

For example, imagine a situation where a city was to convert to a smart network. In this scenario, almost every product can be connected to the Internet or network to boost efficiency, productivity, and user experience. This can range from factories using G.hn within their machine sensors to monitor performance and maintenance needs, to shops and malls utilizing G.hn over their existing wiring to enhance their data communication networks for both the businesses and the visitors within.

Delving deeper into the likes of a smart lighting network within a city, the system is becoming increasingly interactive to communicate with the surrounding environment and the lives of its inhabitants. This can include in-building lighting in buildings, shops, and factories, as well as

streetlights. The system aims to have an efficient operation by adjusting the light intensity, monitoring power consumption, controlling the lighting schedule, and setting failure alarms.

With as many as 90 million lampposts in the EU, and 75 percent over 25 years old, now is the time to update the lighting to a fully interactive and interoperable system. This is proven by the multiple aspirations to implement smart lighting networks across cities globally. An example is the Smart Cities Marketplace Humble Lamppost project set out by the EU in which ten million smart lampposts are to be installed as part of the EU's aim to give a new lease on life to a long-neglected resource by making lampposts an integral part of the development of smart cities.

The use of G.hn in sensors within the lamppost can control a range of activities such as street signs, light control, water level, humidity and temperature sensors, pedestrian push-talk system, vehicle charging, image sensing units, speakers, Wi-Fi access points, and monitoring of containers for smart waste collection. To achieve this, the application requires broadband communication and a high data rate, sufficient reach, and a self-adaptive network with plug-and-play functionality—G.hn delivers exactly that.

G.hn technology for a fully digitalized industrial world

G.hn allows for fast installation and works seamlessly through existing wiring to provide low latency and long-reach connectivity upon which industrial applications rely. The technology is naturally well-suited as a backbone for smart sensors, video surveillance, and safety panels, thanks to its real-time, two-way traffic handling and high bandwidth.

The ever-increasing dependency for high-speed reliable data communication networks, along with the need for these networks to be efficient and futureproof, ultimately fuels the demand for solutions like G.hn. G.hn is a future-proof technology with its capability to deliver a fully interoperable network. Networks don't need to depend on one single technology, so energy network operators and connectivity service providers can look at a blended approach. G.hn can reach where other technologies may not reach or may not be economical to deploy or using existing infrastructure along with serving as a backbone for other protocols and technologies. G.hn helps extend the connectivity, contributing to reducing the cost of adapting technology and improving efficiency of smart network deployments in all fields. Industry players already anticipate an accelerated market adoption to this ever-evolving technology across a wider range of use cases in the 2024 to 2025 timeframe.