G3-PLC Alliance

Enabling the smartest grid...together

G3-PLC and G3-Hybrid for connected lighting systems

October 2022

version 1

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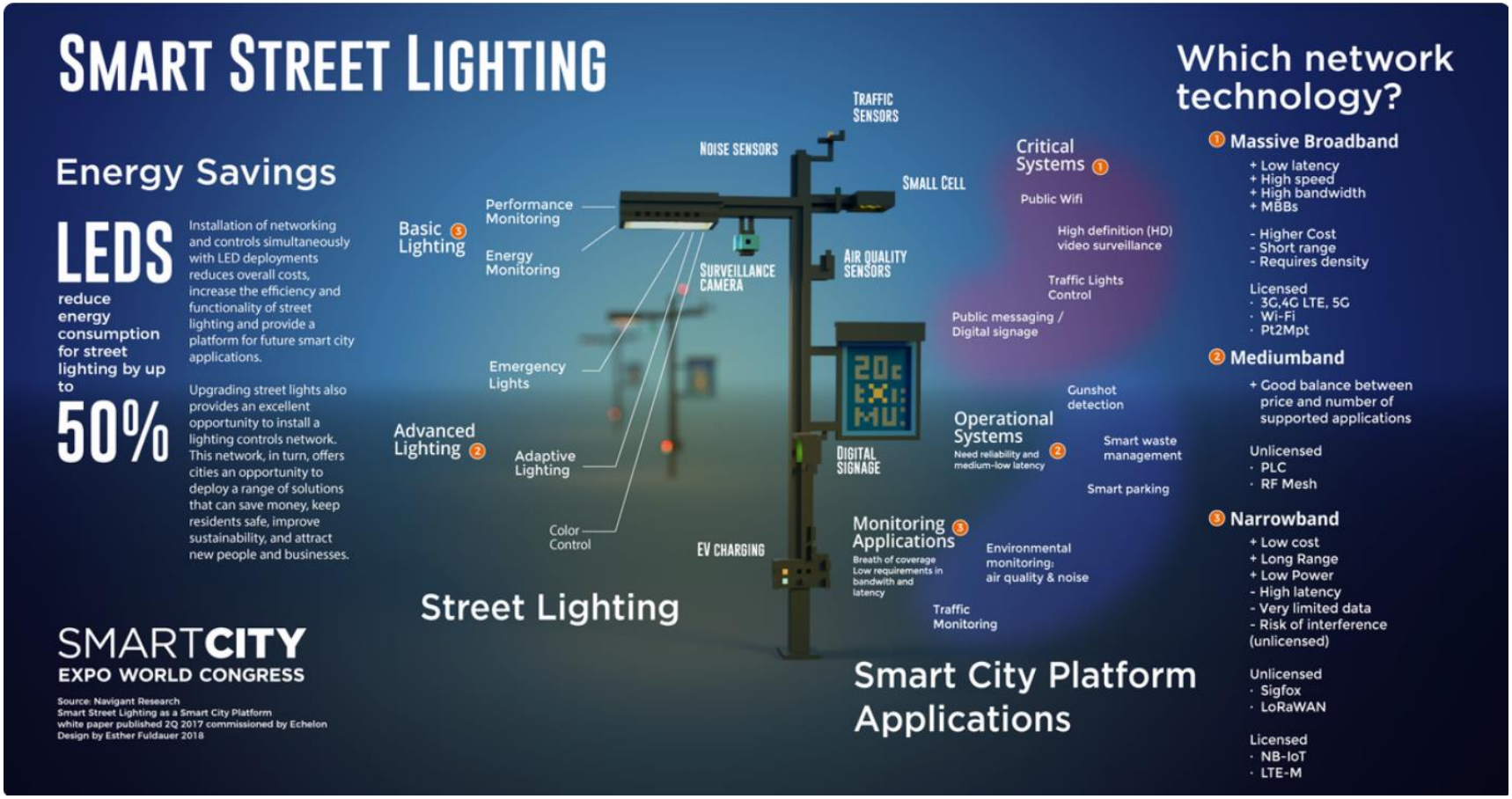
LED lighting and communication networks are transforming street lighting …



… and city lighting networks are becoming the platform for a wide variety of smart city innovations

Source: 2017 Navigant Research-Echelon Smart Street Lighting White Paper - Full Report

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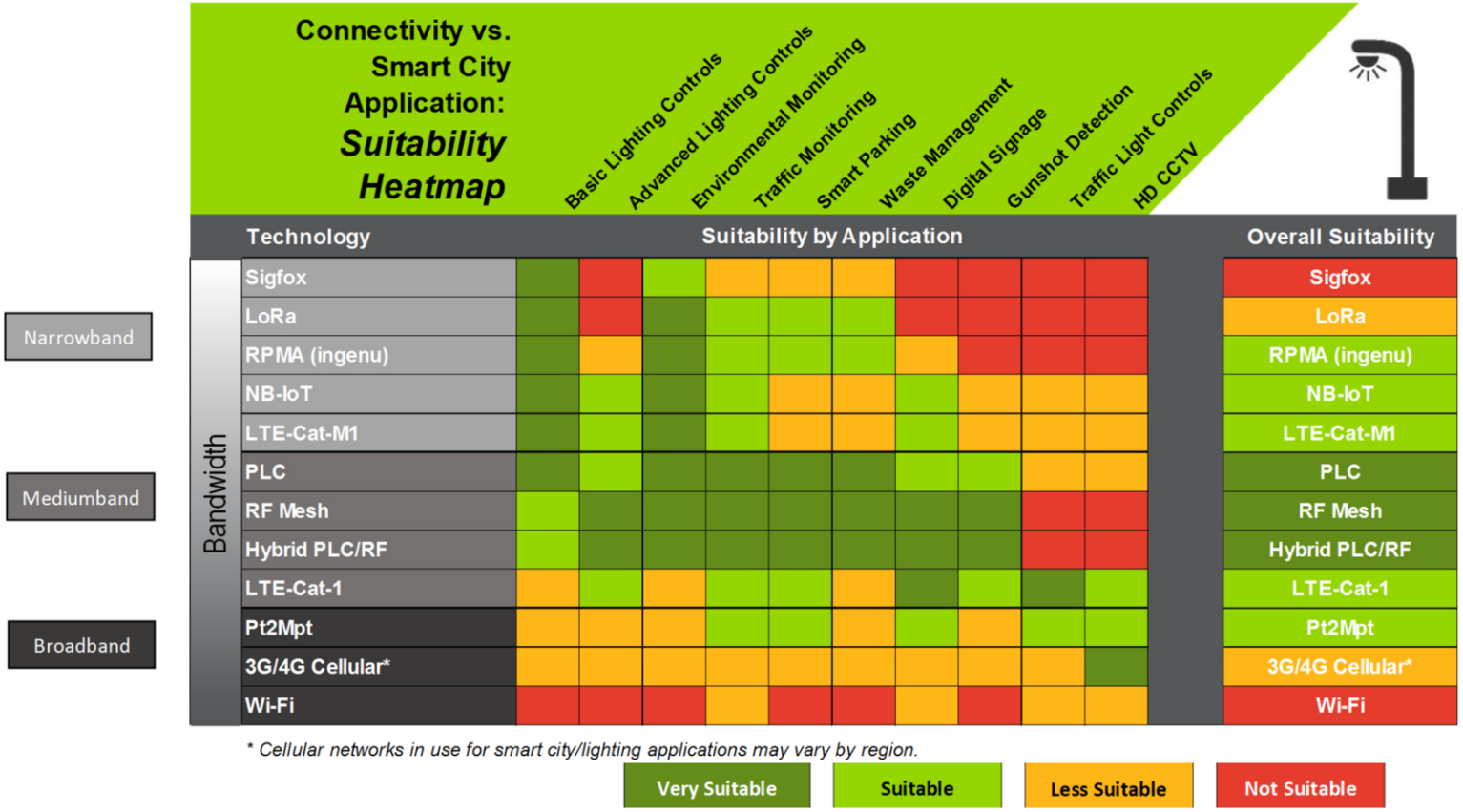
There is no simple answer to the question of which is the best street lighting network for a city

- The development of IoT networks for cities provides an exciting opportunity to improve the efficiency and quality of city services while reducing costs and energy consumption
- However, the technical landscape is complex, and it is not easy to compare alternative approaches to the needs of a specific city
- The challenge for municipalities is to balance short-, medium-, and long-term requirements against the costs and benefits of different network options
- The choice will depend on current requirements and existing investments, medium-term priorities, and the long term vision that is shaping the needs of any particular city
- Together, these requirements need to be assessed against potential connectivity solutions:
    - Do the proposed networks have the bandwidth, flexibility, and functionality to match all requirements?

PLC and Hybrid PLC&RF networking solutions score best overall according to Navigant Smart Street Lighting whitepaper

“Medium band options including PLC tend to score best overall in terms of balancing upfront and ongoing expense with flexibility and robustness to support a variety of applications.”



Source: Navigant Research-Echelon Smart Street Lighting White Paper - Full Report 2017

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Why G3-PLC and G3-Hybrid for connected street lighting?

- Powerline communication (PLC) is the natural choice for automating street lighting networks. PLC enables companies and municipalities to reduce operational costs and improve safety.
- PLC delivers a range of advantages over wireless communication systems. Like wireless, no new wires are required. But with PLC, communication is maintained even underground, through walls, and around corners. The communication channel is owned by the operator or utility, so the risks of sharing bandwidth are eliminated. PLC has no line-of-sight limitation and is not affected by weather. Additionally, since PLC uses the powerline, it can detect when there is a line break and its approximate location.
- G3-PLC is a proven and robust OFDM-based PLC standard designed for grid automation that dramatically extends the range, data rate and performance of powerline communications
- G3-PLC Hybrid PLC&RF maximises coverage and extends the connectivity of G3-PLC to RF-only devices, for example communication with environmental monitors and lighting controllers

Source: based on Powerline communications for street lighting automation
https://www.maximintegrated.com/en/design/technical-documents/app-notes/5/5347.html

Vattenfall has installed a connected lighting system in Sweden based on G3-PLC

SMART ENERGY INTERNATIONAL

IN COLLABORATION WITH SMART ENERGY INTERNATIONAL Enlit Europe PRIME EUTC

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Vattenfall presents a unique connected lighting system for municipalities

By **Guest Contributor** - Jun 17, 2022

Vattenfall, a major European energy company, presents a unique connected lighting system for municipalities based on G3-PLC powerline communication.

Making streetlights 'smart' involves more than just the possibility to control them remotely. 'Smart' in the first instance only describes introducing the ability to interchange data between various entities in a wider system. However, it paves the way to use an already existing and widespread infrastructure as an enabler for smart city applications.

In its simplest form, it allows the lamps to report lamp- or power supply failures. This

- Connected lighting system that uses the existing infrastructure for communication
- Operational in four municipalities in Sweden
- Reduces maintenance costs by report lamp- or power supply failures, detecting phase faults, faulty drivers/fittings and line breaks
- Can take a more dynamic approach to control on/off times
- Potential additional applications are traffic- or pollution monitoring, safety applications, EV charging
- G3-PLC powerline communication is the natural choice for connected lighting!

https://www.smart-energy.com/industry-sectors/smart-cities/vattenfall-presents-a-uniquely-connected-lighting-system-for-municipalities/

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Panasonic uses G3-PLC to control lighting on railway platforms in Tokyo

For more information, please visit https://www.renesas.com/br/en/about/press-center/news/2020/news20200326.html

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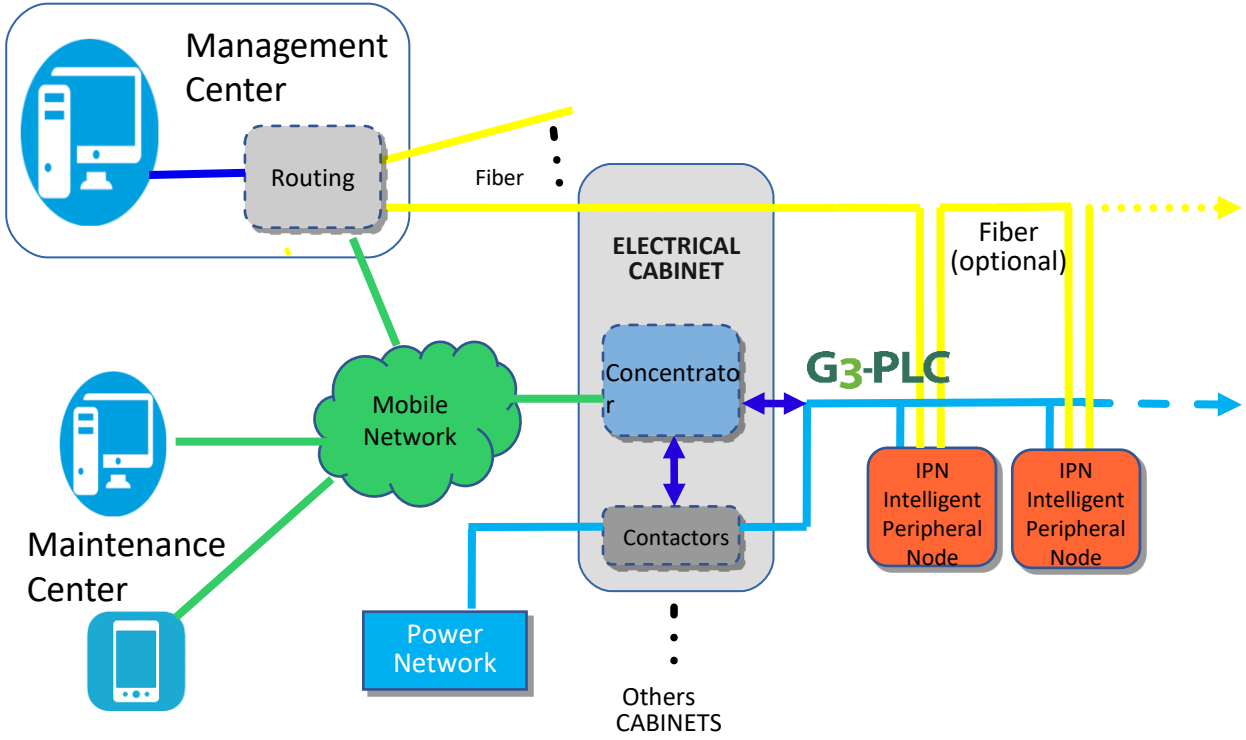
HiMarc offers an innovative public lighting system for Smart City solutions using G3-PLC for lighting control (1/2)

- HiMARC is an Italian company manufacturing products for Smart City industry
- MARC 5D – IIS products are based on the ST8500 modem with G3-PLC protocol
- An Integrated Intelligent System to transform the lighting system into the base platform to aggregate every future “smart city” service and implements the following functions:
  - predictive / pervasive security
  - traffic monitoring and control
  - environmental monitoring
  - spread public Wi-Fi
  - zero energy waste inherent in current public lighting systems
- https://himarc.it/tecnologia/

HiMarc offers an innovative public lighting system for Smart City solutions using G3-PLC for lighting control (2/2)

Example architecture for Smart Street Lighting



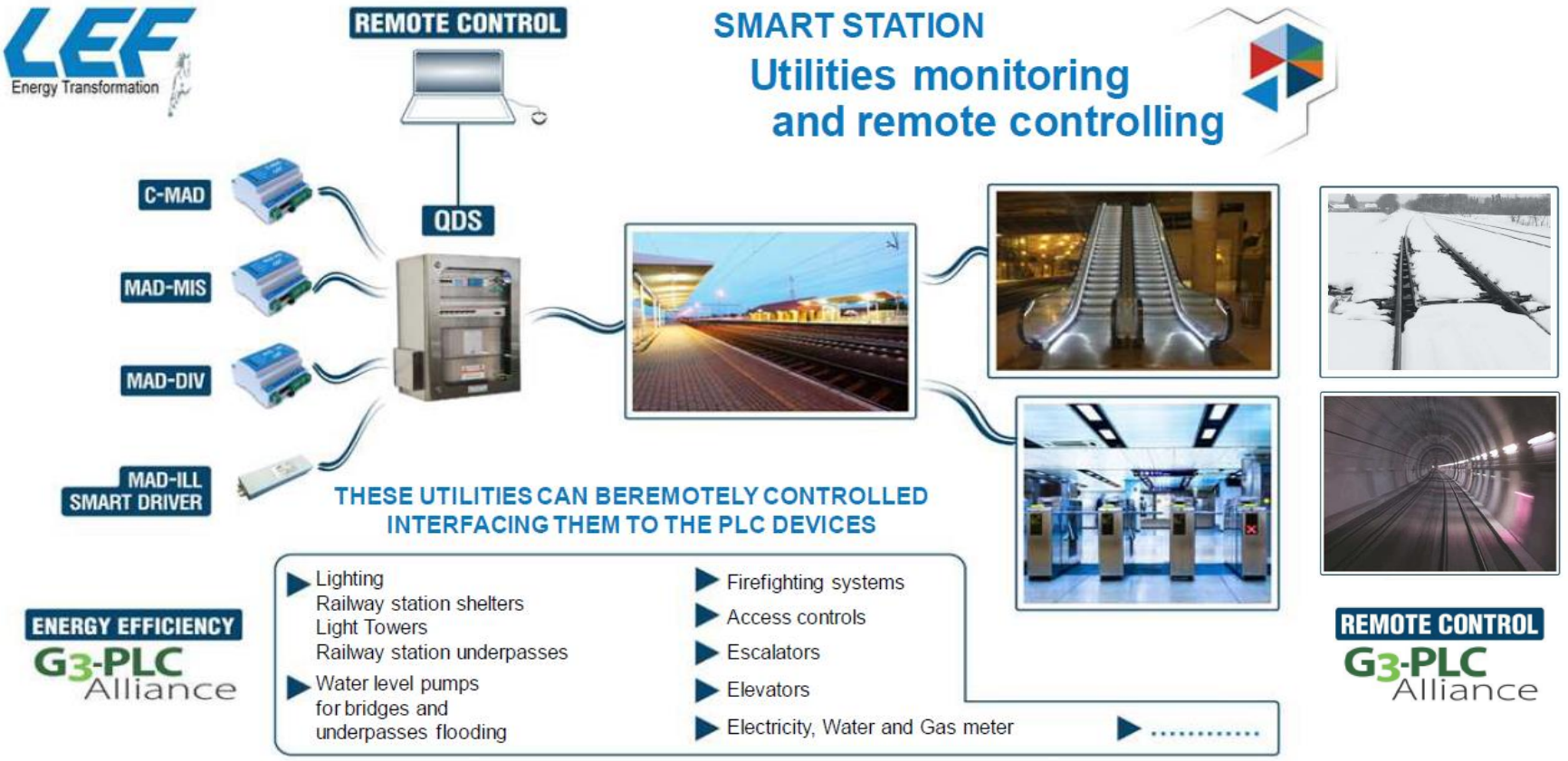
Concentrator for Street Lighting With G3-PLC modems

LED lamp with G3-PLC modem for remote control

- **PLC Communication success rate ~99%**
- **PLC Application request/ response RTT: ~250ms**

➢ G3-PLC in FCC band has the high throughput and low latency required for smart city/smart industry automation

Control of tunnel safety lights in Italy as well as monitoring and control of smart railway stations and heating of track switches



- G3-PLC is the standard required by the Italian railway infrastructure company

Enedis together with Neuron developed an end-to-end solution for street lighting based on G3-PLC embedding the DALI protocol

October 23, 2019

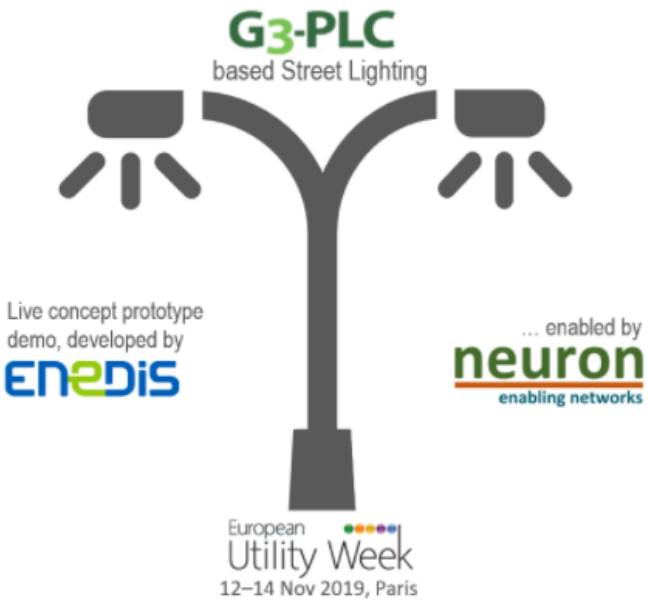
Street Lighting over G3-plc

Following the joint work between Enedis and Neuron, which was announced during 2018, G3-PLC experts at Enedis have developed an end-to-end solution for Street Lighting using G3-plc technology. Leveraging on the experience acquired through the roll out of more than 20 million of G3-PLC smart meters, and as a G3-PLC Alliance founding member, ENEDIS wanted to promote the usage of the G3-PLC protocol as an open, secured and standard IP connector over any device connected to the electrical grid, regardless of the application.

The solution integrates G3-plc with two of the most prevelant Street light protocols interfaces, DALI and MODBUS.

Running on Neuron's devices, the application bridge developed by Enedis works as G3-plc device on one side and interfaces with a DALI or MODBUS device on the other. The APIs made available as part of our Developer License of both, nBox-Gateway have been used for this purpose. The application is centrally controlled over the G3-plc Coordinator (nBox-Gateway) through a mobile interface. Extended application functions like for eg. dimming are also supported in the application.

The solution underlining G3-plc's suitability as a general purpose IoT technology will be available for live demonstration at G3-plc's booth during the upcoming European Utility Week show in Paris



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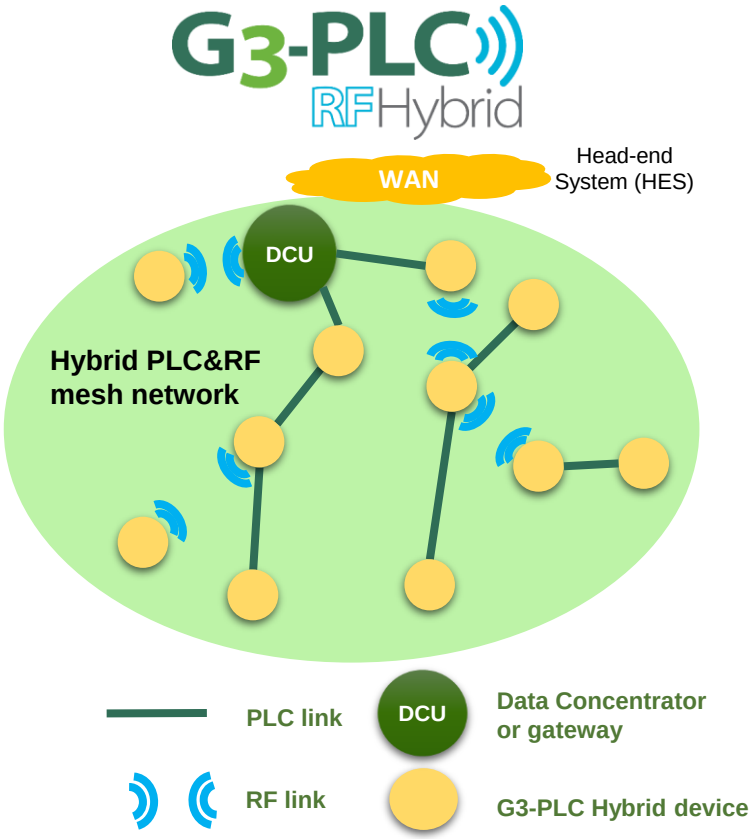
What is G3-Hybrid PLC&RF communication?

- PLC and RF technology in one *single* solution
- Automatic channel selection
- Fully backwards compatible
- Standards based solution adopted by ITU
- Certified platforms and products available



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PLC&RF Hybrid communication benefits

Cost of Ownership

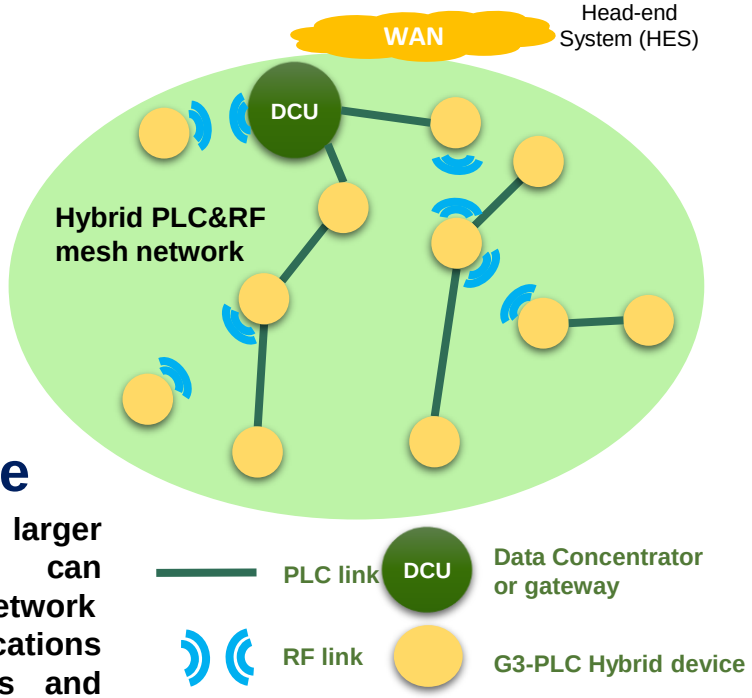
- Avoids high cost of last 1% connectivity
- Reduces complexity of the roll-out
- No OPEX for using the network

Flexiblity

PLC and RF work hand-in-hand to and complement each other, maximising coverage and connectivity

Performance

- Higher data rate with larger number of nodes can communicate within a network
- Opens other IoT applications such as sensors, gas and water meters



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G3-Hybrid communication: a global standard solution and certified

- The G3-PLC Hybrid is available for CENELEC, FCC and ARIB PLC bandplans

- An extensive range of RF frequencies is already included in the hybrid solution:

RF frequencies included in the G3-PLC specification		
863 MHz (Europe) 866 MHz (India) 870 MHz (Europe)	915 MHz (US, Canada, Mexico, Colombia) 915-a MHz (US, Canada, Mexico) 915-b MHz (Brazil) 915-c MHz (Argentina, Australia, NZ)	919 MHz (Malaysia) 920 MHz (Japan) 920-b MHz (Indonesia, Thailand, Vietnam, Singapore)

- Incorporates dedicated mechanisms addressing regional regulatory requirements such as Frequency Hopping
- Platforms and products certified by G3-PLC Alliance

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G3-PLC is a proven Powerline Communication technology offering lowest total cost of ownership and independency on telco operators

Cost effective, reliable and secure communication…

Cost-effective		Long range communi-cation	Real-time communi-cation
ITU standard	Supports IPv6	Secure	
	High robustness	High data rate	Future proof
Routing		Plug and play	

… in a wide range of applications

- Mature technology with >80 million products in >30 countries worldwide
- Supported by international group of nearly 100 DSO's and industrial players

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G3-PLC is supported by a international group of nearly 100 DSO's and industrial players from more then 30 countries worldwide!