



## DEFINING INTEROPERABILITY REQUIREMENTS FOR G3-PLC IN UTILITY SPECIFICATIONS

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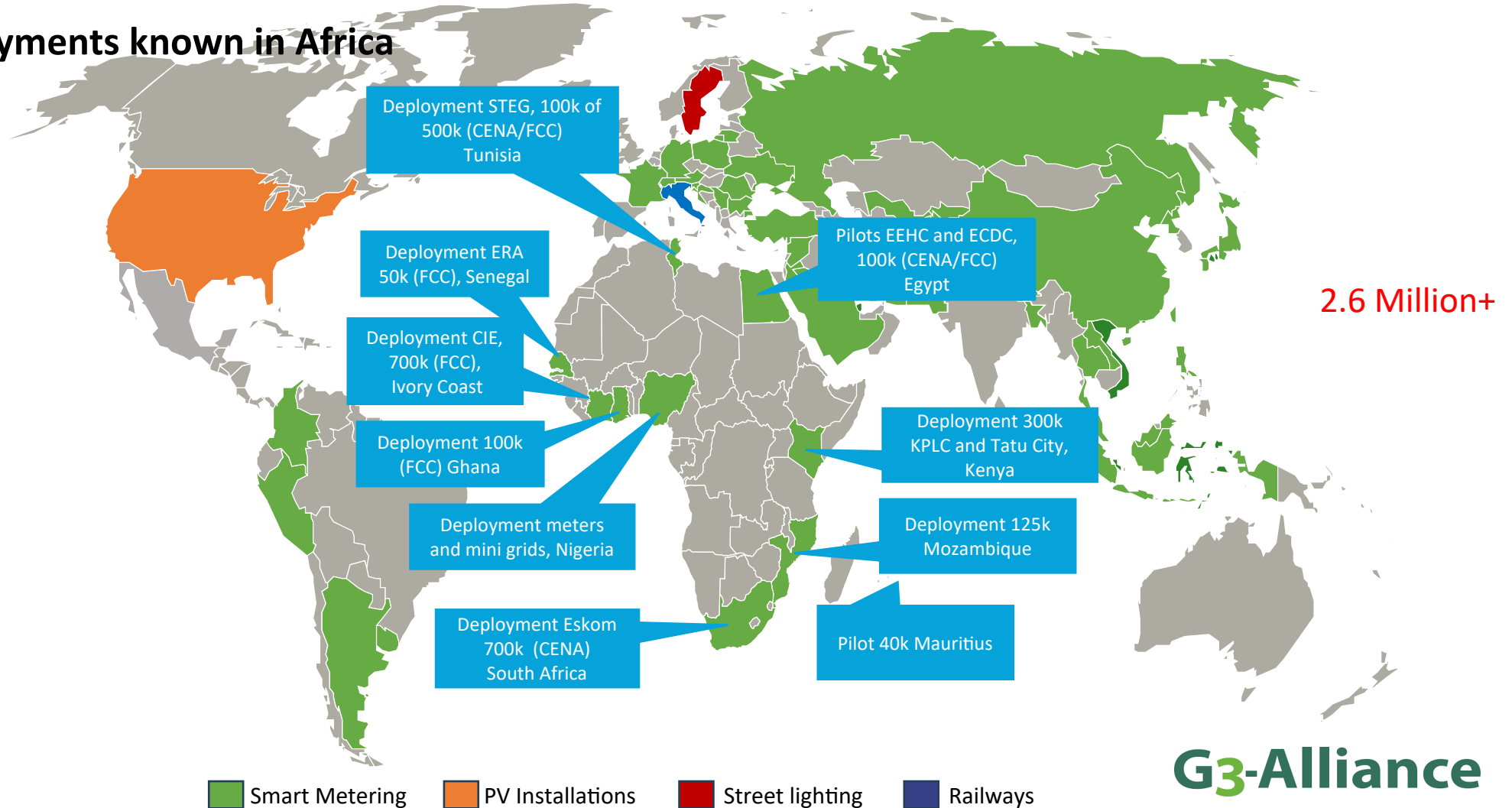
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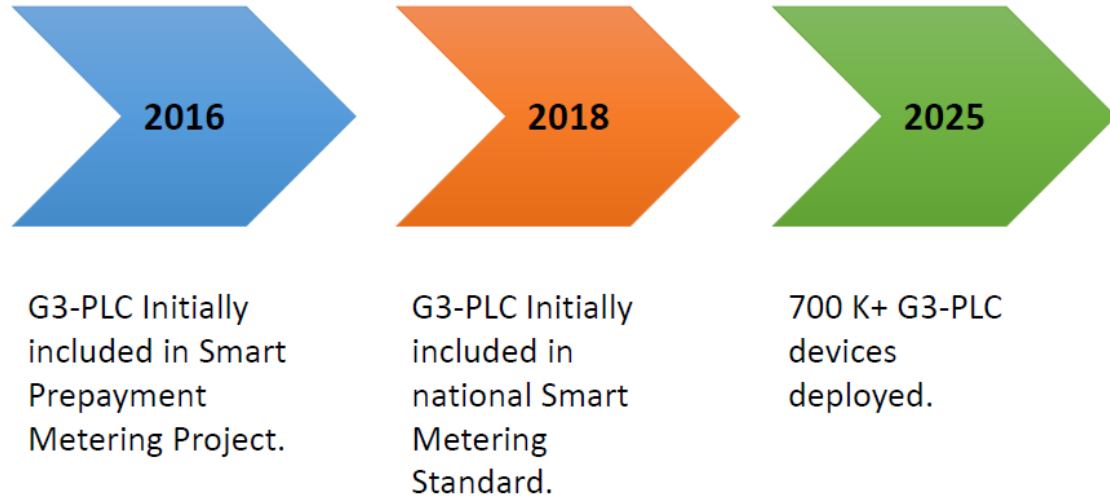
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## G3-PLC Deployments known in Africa



## G3-PLC in Eskom



### BACKGROUND

Eskom officially adopted G3-PLC as its de facto Power Line Communication (PLC) standard in 2016, recognizing its robust communication characteristics, standardized implementation framework, and extensive ecosystem of certified smart metering devices. The G3-PLC ecosystem also offers support for diverse utility use cases and benefits from an active global community coordinated by the G3-Alliance.

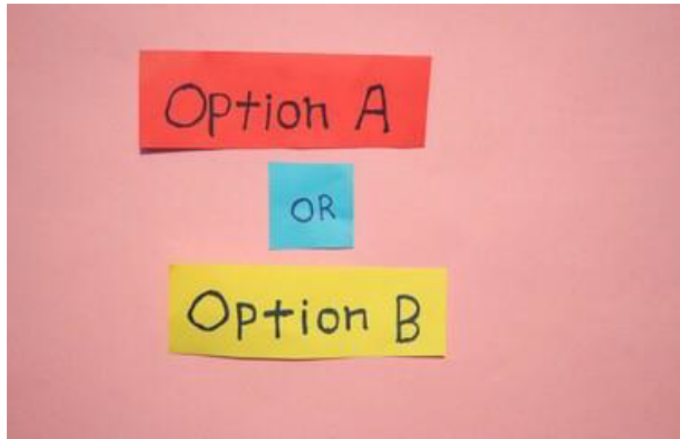
Since its adoption, Eskom's G3-PLC deployments have expanded significantly, encompassing over 700,000 smart meters.

In parallel with its deployment efforts, Eskom has developed in-house expertise and established a dedicated G3-PLC laboratory. This facility is equipped to evaluate and analyse multi-vendor G3-PLC implementations.

While initial deployments primarily involved devices from a single vendor, Eskom has always prioritized the strategic objective of achieving multi-vendor interoperability. This objective is pursued through the adoption of the DLMS/COSEM suite (IEC 62056) in conjunction with the G3-PLC protocol specifications.

This presentation outlines key insights and lessons learned throughout Eskom's ongoing journey toward enabling multi-vendor interoperability in its G3-PLC deployments.

## Need for Clear and Complete Utility Specifications



- G3-PLC specifications include both mandatory and optional requirements – for global applicability
- Optional requirements include frequency bandplans, security suites, 6LoWPAN adaptation layer, etc.
- End users are responsible for selecting applicable optional requirements based on regulations, operations and use cases

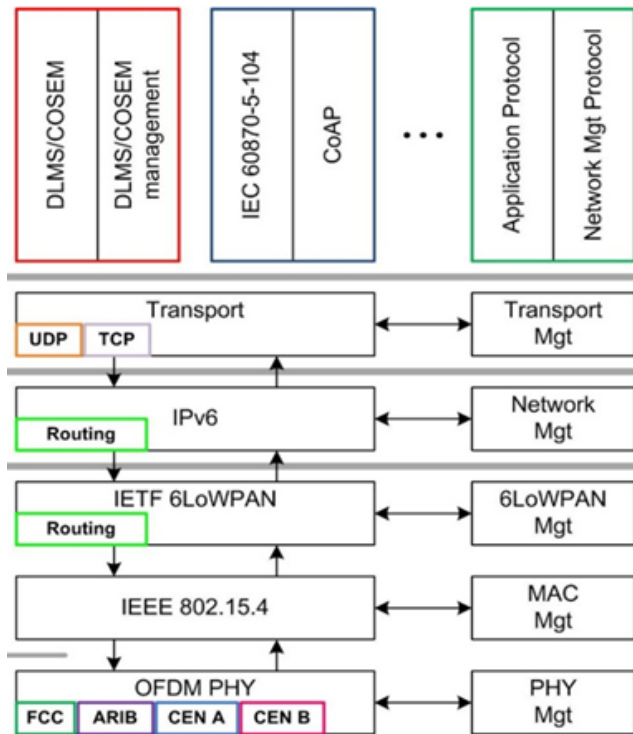
### INTRODUCTION

The G3-PLC core specifications, consistent with other internationally recognized standards, are designed for global applicability. Consequently, they include both mandatory and optional components. It is the responsibility of end users—particularly utilities—to identify and select the mandatory elements relevant to their specific regulatory environments, operational contexts, and application requirements.

Given that utilities often procure devices from multiple vendors, it is essential for them to develop detailed purchase specifications. These specifications should clearly define the optional components of the G3-PLC core standard that are applicable to their intended use cases. Such companion specifications are critical to ensuring that vendors implement uniformly structured G3-PLC protocol stacks, thereby enabling multi-vendor interoperability.

The following slides present four key optional elements of the G3-PLC specifications. These elements are discussed with the aim of assisting utilities in the formulation of precise and effective purchase specifications.

## Application Layer Protocol + Profile Specification



### APPLICATION LAYER REQUIREMENTS

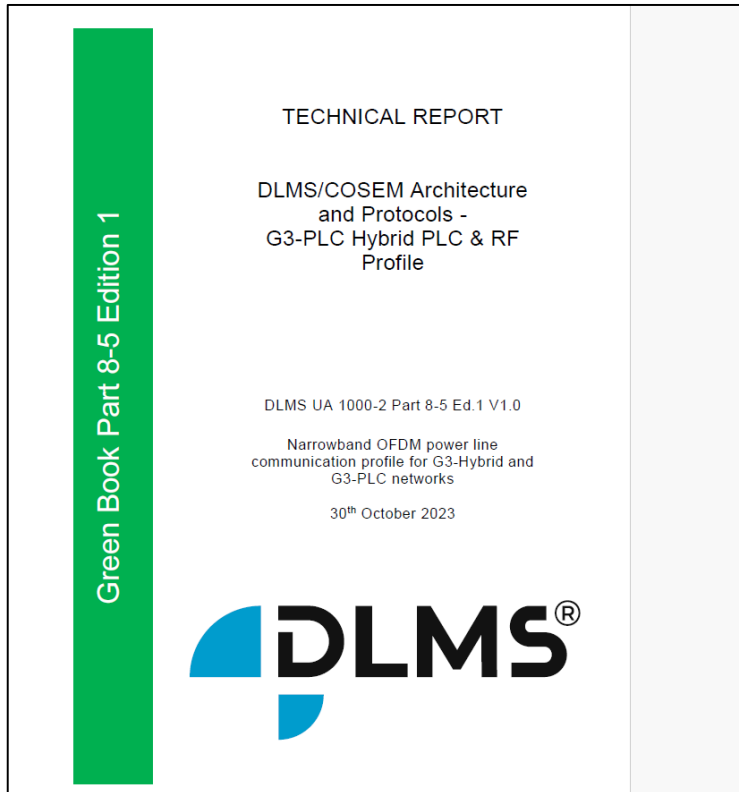
The G3-PLC protocol supports a broad spectrum of application domains, including smart metering, electric mobility (e-mobility), building and industrial automation, railway systems, smart cities and street lighting, as well as grid control and monitoring (see: [G3-Alliance Applications](#)). Owing to this versatility, the G3-PLC core specification does not prescribe a specific application layer protocol. Accordingly, certification under G3-PLC is confined to ensuring conformance from the network layer down to the physical layer. The evaluation of application layer protocols is thus excluded from the scope of G3-PLC certification and is instead delegated to utility-specific requirements.

Technical details at the application layer, such as the IP addressing scheme and UDP port numbers, are not standardized under the G3-PLC certification process. These parameters must be defined within application layer profile specifications, such as IEC 62056-8-5, which outlines the implementation of the DLMS/COSEM protocol over G3-PLC in smart metering contexts. This profile stipulates critical interoperability requirements, including the use of standardized UDP port numbers. It is therefore imperative that utilities explicitly include such parameters in their purchase specifications to ensure interoperability between DLMS/COSEM servers utilizing G3-PLC communication.

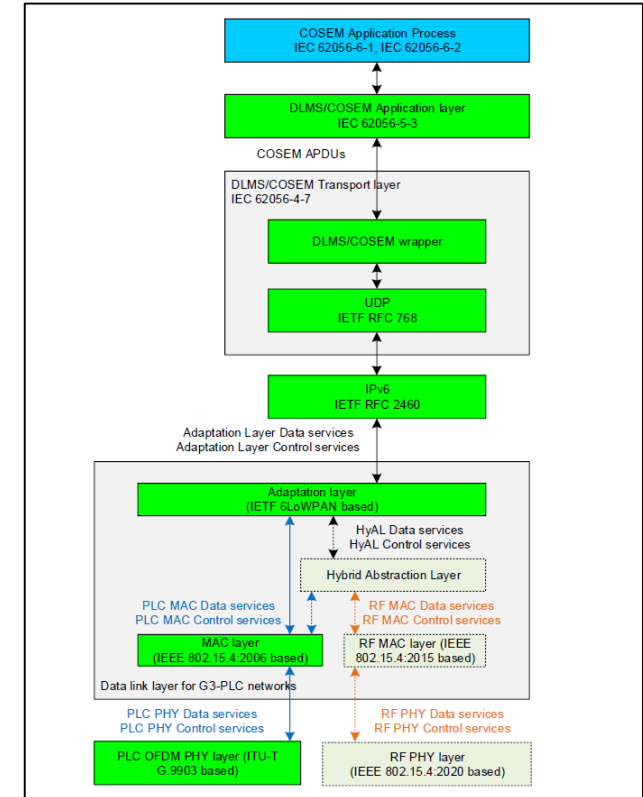
Beyond certification of lower-layer protocol conformance by the G3-Alliance, utilities are advised to advocate for comprehensive compatibility certification, as developed by the DLMS User Association (DLMS UA). This advanced certification assesses the full protocol stack—encompassing both DLMS/COSEM and G3-PLC—using devices that have already achieved G3-PLC certification. This approach ensures end-to-end compatibility and reinforces multi-vendor interoperability objectives.



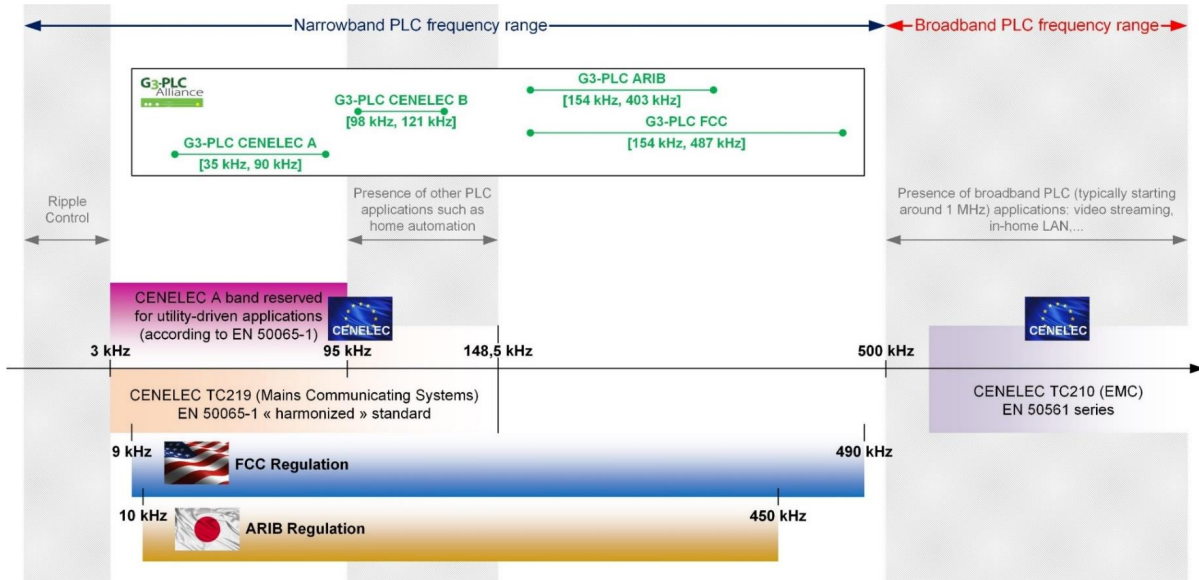
## Application Layer Protocol + Profile Specification



- Targeted communication environments
- Communication layers
- Identification and addressing schemes
- Application layer services
- Communication configuration and management
- COSEM application process



## Frequency Bandplan



## SELECTION OF APPLICABLE FREQUENCY BAND

The G3-PLC core specifications encompass a variety of frequency bands—including CENELEC, FCC, and ARIB—to accommodate global deployment across diverse regulatory regions. However, utility operations are inherently situated within specific national contexts governed by distinct regulatory frameworks, and their use cases are shaped by strategic priorities and operational requirements. Additionally, device manufacturers often favor particular frequency bands as a means of product differentiation within the competitive landscape.

Given these factors, it is essential for utilities to select and mandate a single frequency band within their technical procurement specifications. This band must align with both national regulatory constraints and the performance requirements of the intended use cases. For example, CENELEC A is predominantly allocated for utility use in Europe, while the FCC frequency range is designated for similar purposes within the United States.

Certain applications—such as grid monitoring and control—may necessitate higher data throughput, thereby requiring a frequency band that supports greater bandwidth. In such cases, utilities should ensure that their specifications reflect these performance demands.

Crucially, the deployment of G3-PLC devices across multiple, non-compatible frequency bands within the same network will undermine interoperability. To preserve interoperability and ensure consistent network performance, utilities must enforce the use of a standardized frequency band across all vendor equipment deployed in a given region or network segment.

### Factors to consider:

- Local EMC regulations?
- Required data rates for utility use cases?
- Severity or prevalence of EMI emissions in the operational environment?

## **ID\_P and ID\_S Fields in G3-PLC Networking Joining Process**

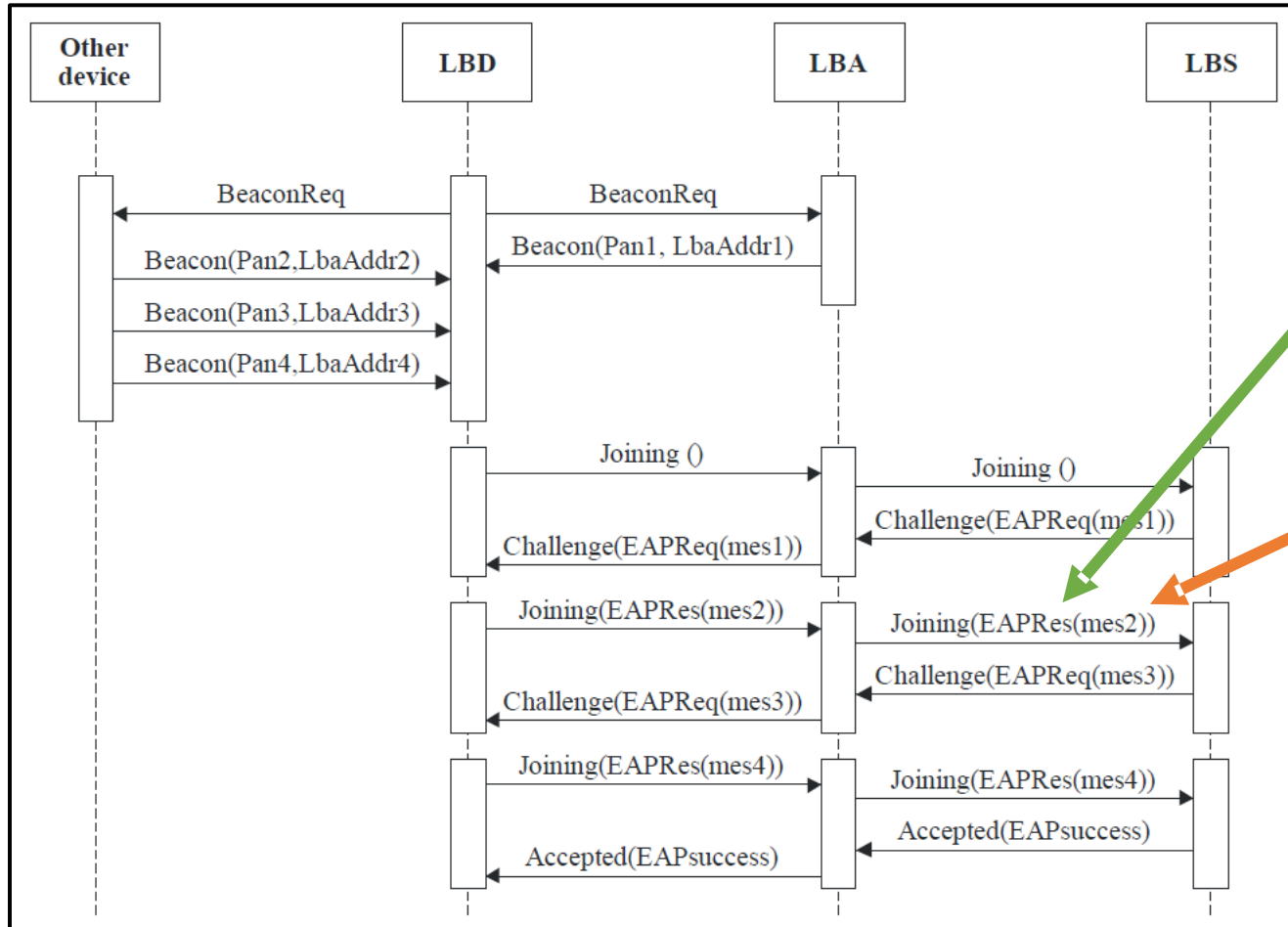
### STANDARDIZATION OF ID\_P AND ID\_S FIELDS

The ID\_P and ID\_S fields are critical components of the Link Beacon Process (LBP) joining procedure as defined in the G3-PLC core specifications. This secure mechanism is used by all G3-PLC devices to establish a connection to a G3-PLC network through a data concentrator or gateway. According to the specifications, these fields may be formatted either as a 64-bit Extended Unique Identifier (EUI) or as a variable-length, user-defined ASCII identifier of up to 36 bytes. Both configurations are compliant with G3-PLC standards and are thus eligible for certification.

However, to ensure interoperability within a heterogeneous device environment, utility procurement specifications must mandate a standardized format for the ID\_P and ID\_S fields. If different devices adopt inconsistent formats—some using the 64-bit EUI and others employing variable-length ASCII strings—they may fail to successfully complete the LBP joining process, resulting in interoperability failures.

As an alternative approach, utilities may specify the deployment of data concentrators or gateways capable of supporting both formats. This dual-format compatibility would enable devices, regardless of the ID\_P and ID\_S format employed, to successfully join the G3-PLC network and operate in an interoperable manner. Nonetheless, such decisions should be clearly articulated in technical and purchase specifications to avoid fragmentation and ensure seamless integration across multi-vendor environments.

## ID\_P and ID\_S Fields in G3-PLC Networking Joining Process



64-bit EUI

ID\_P: 000F93FFFE12FE

Variable-length ASCII ID (up to 36 bytes)

ID\_P: 000F93FFFE12FE0000000000000000

- Inconsistent formats across devices can cause join process failures.
- Standardize ID\_S / ID\_P format

## Customer Interface Units

### REQUIREMENTS FOR G3-PLC CUSTOMER INTERFACE UNITS

The Customer Interface Unit (CIU) is a critical component of the "split metering" architecture, also referred to as multi-device metering hardware architecture. This system is widely implemented in various African countries to address meter tampering and to support prepayment metering functionalities. Within this architecture, the Energy Measurement and Control Unit (MCU), which is located outside the customer's premises, communicates with the CIU over the G3-PLC network. Typically, the CIU is situated within the customer's premises, enabling users to monitor their energy consumption and input prepayment tokens as necessary.

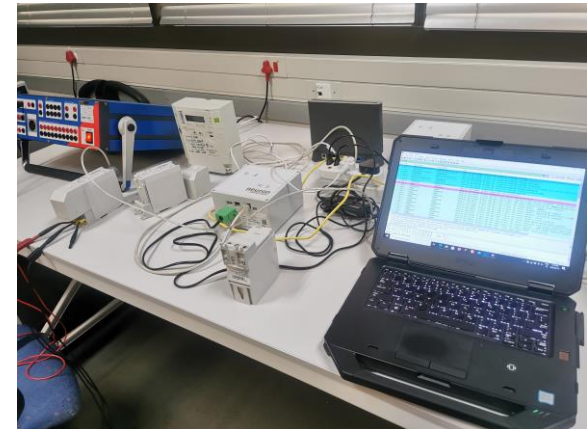
The utility procurement specifications often lack detailed guidance on the integration of CIUs into the G3-PLC network, leading to varied implementation approaches by different vendors regarding the manner in which CIUs connect to the network. The G3-PLC core specification provides two potential methods for device integration into the network: either through the Data Concentrator (PAN coordinator) or via a direct peer-to-peer connection, where the CIU attaches directly to the MCU without involving the PAN coordinator.

Given these options, it is essential for utility procurement specifications to clearly define the required attachment method for all vendors. This ensures uniform participation of CIUs in the G3-PLC network, thereby promoting interoperability across different devices and vendors.

## Additional Considerations



- Gain a solid understanding of the G3-PLC protocol and its key characteristics.
- Develop skills to diagnose and troubleshoot G3-PLC network issues.
- Where feasible, establish a G3-PLC laboratory to build internal utility expertise and support full-stack protocol validation.



**Thank You**