

A decorative graphic on the left side of the slide, consisting of three overlapping circular frames. The top frame shows a solar panel array in front of industrial cooling towers. The middle frame shows a helicopter performing maintenance on a high-voltage power line tower. The bottom frame shows a worker in a safety harness performing maintenance on a power line tower.

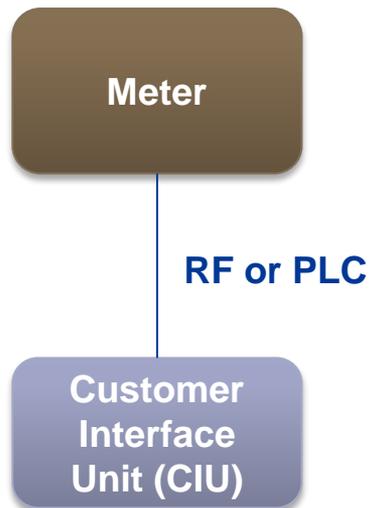
# Experiences in the standardization and use of G3-PLC

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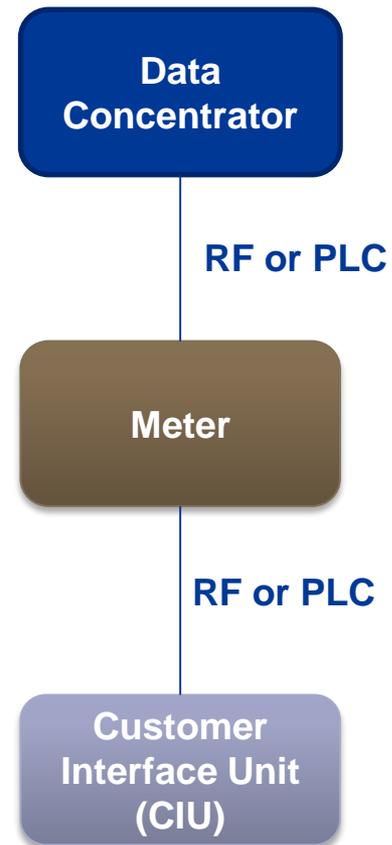
Date: 26 November 2020

- Standardization within Eskom
- Laboratory experiments and findings
- What we have learnt in the past few years...
- Adoption in NRS 049 Companion Specification

## Basic Prepayment Meter



## Smart Meter (Prepaid and Post-paid Modes)



2016

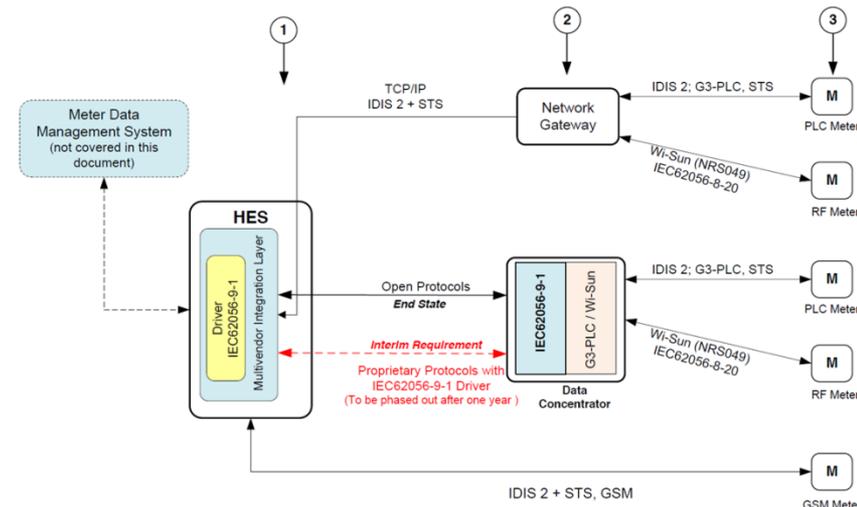
G3-PLC part of technical specifications for Eskom Smart Prepayment Project in 2016 for rolling out ~36 000 meters

2017

G3-PLC included in Eskom “Basic Prepayment Meter Standard”

2018

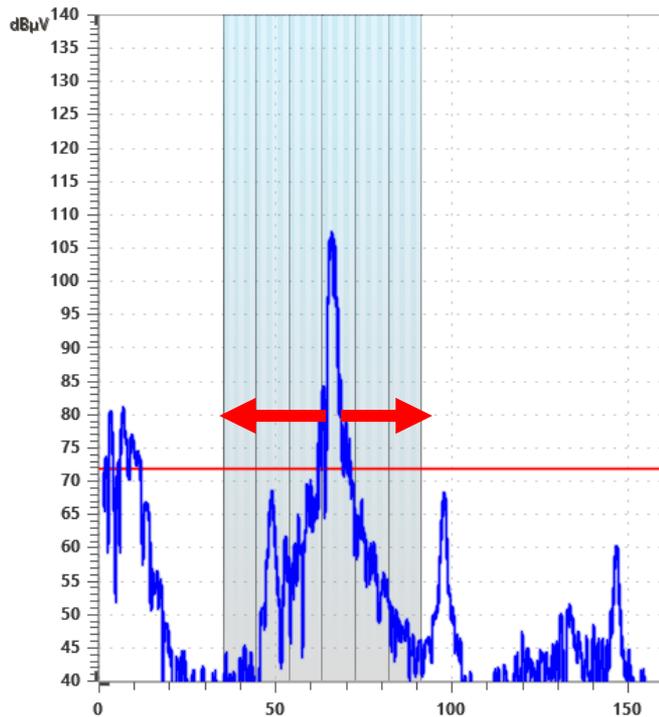
G3-PLC part of Eskom “Smart Metering Standard”



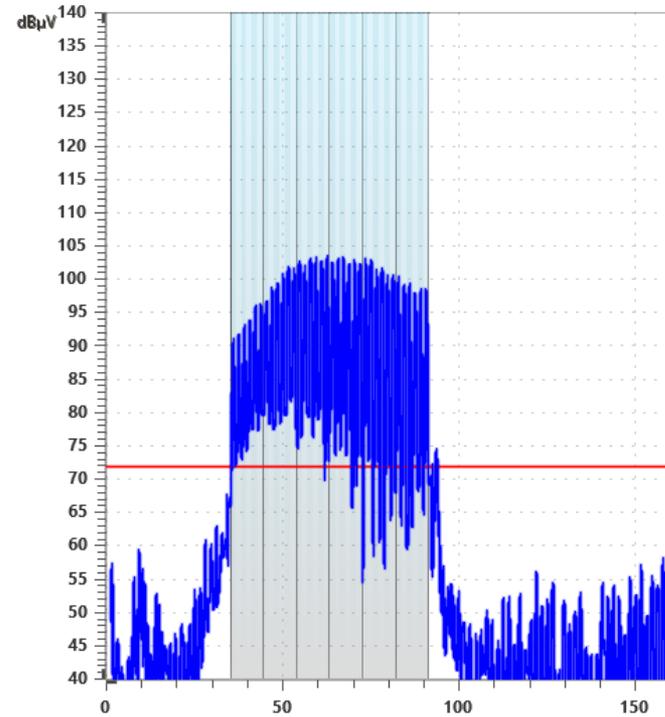
Standardization/Adoption mainly driven by:

- Robustness of G3-PLC in comparison to G1-PLC (PLAN) deployed in earlier years!
- Healthy eco-system of both smart and basic prepayment metering products from manufacturers in Africa, Asia and Europe.

## Comparison to PLAN (G1-PLC)...

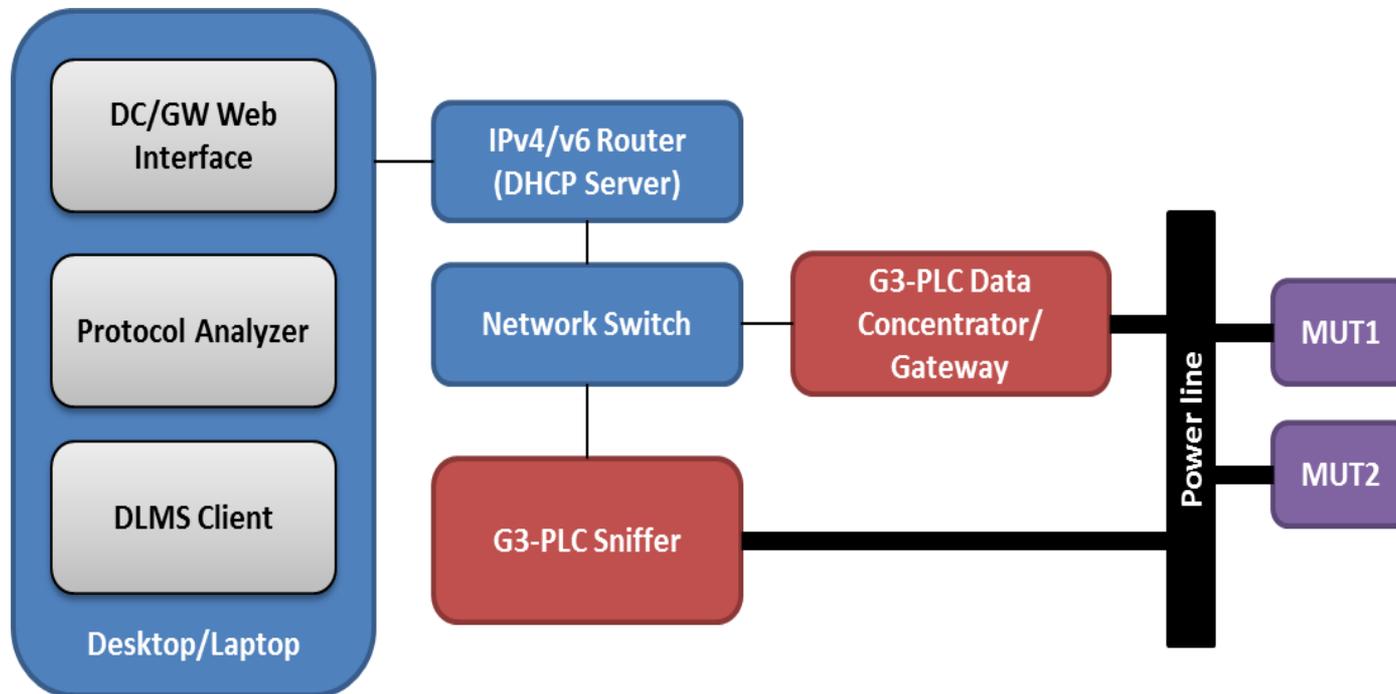


PLAN (G1-PLC)



G1-PLC  
(Cenelec A)

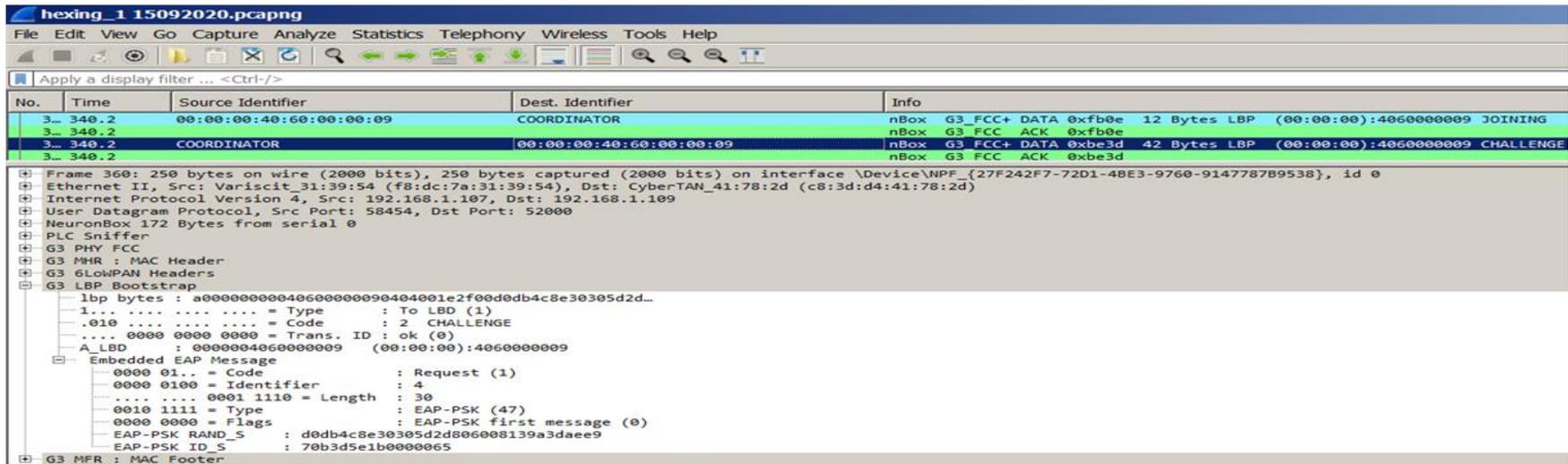
Evaluation of ease of G3-PLC level integration of devices from different manufacturers...



Evaluation of ease of G3-PLC level integration of devices from different manufacturers...

Some learnings...

- One device found to be transmitting un-encrypted G3-PLC messages and thus these were ignored by the G3-PLC Gateway
- Some devices, meant for the Japanese market, use an *EAP ID\_P* field different from the EUI-64 format
- Due to split metering format deployed in SA – meter may need to be both PAN coordinator and PAN device, thus PAN bootstrap procedure needs to be clearly defined



The screenshot shows a Wireshark capture of G3-PLC traffic. The main pane displays a list of packets with columns for No., Time, Source Identifier, Dest. Identifier, and Info. Packet 360 is expanded to show the following details:

- Frame 360: 250 bytes on wire (2000 bits), 250 bytes captured (2000 bits) on interface \Device\NPF\_{27F242F7-72D1-4BE3-9760-9147787B9538}, id 0
- Ethernet II, Src: Variscit\_31:39:54 (f8:dc:7a:31:39:54), Dst: CyberTAN\_41:78:2d (c8:3d:d4:41:78:2d)
- Internet Protocol Version 4, Src: 192.168.1.107, Dst: 192.168.1.109
- User Datagram Protocol, Src Port: 58454, Dst Port: 52000
- NeuronBox 172 Bytes from serial 0
- PLC Sniffer
- G3 PHY FCC
- G3 MFR : MAC Header
- G3 GLOWPAN Headers
- G3 LBP Bootstrap
  - lbp bytes : a000000004060000090404001e2f0d0db4c8e30305d2d...
  - 1... .. = Type : To LBD (1)
  - .010 .. = Code : 2 CHALLENGE
  - ... 0000 0000 0000 = Trans. ID : ok (0)
  - A\_LBD : 0000004060000009 (00:00:00):4060000009
  - Embedded EAP Message
    - 0000 01.. = Code : Request (1)
    - 0000 0100 = Identifier : 4
    - ... .. 0001 1110 = Length : 30
    - 0010 1111 = Type : EAP-PSK (47)
    - 0000 0000 = Flags : EAP-PSK first message (0)
    - EAP-PSK RAND\_S : d0db4c8e30305d2d806008139a3daee9
    - EAP-PSK ID\_S : 70b3d5e1b0000065
- G3 MFR : MAC Footer

- G3-PLC has a broad ecosystem of metering products manufactured in Africa, Asia and Europe covering both basic prepayment meters and smart meters
- A solid certification program reduces the burden of product assurance on utilities or end-users
- ITU-T G.9903 is freely available – provides an excellent base for knowledge development in the utility space
- Openness of G3-PLC enables the availability of test tools – Eskom has leveraged this aspect for experiments and knowledge development!
- G3-PLC is a telecommunications network and traditional metering technicians need to be provided with telecommunication tools to enable efficient troubleshooting and maintenance
- G3-PLC is an international standard and naturally, contains a number of optional elements and these should be carefully considered when G3-PLC is adopted in utility specifications

- NRS 049 is a collaborative effort between Eskom and SA municipalities to develop smart technical specifications
- NRS 049 protocol aspects based open international standards and in particular IEC 62056-1-0
- Based on learnings from the past few years, G3-PLC has recommended for adoption in NRS 046
  - ❑ NRS 049 to reference **IEC 62056-8-5 (DLMS over G3-PLC profile)** and include G3-PLC interface classes in its object model
- A number of questions still to be addressed:
  - ❑ G3-PLC FCC or Cenelec A or both? (In anticipation of wide deployment of solar inverters)
  - ❑ What is the standard bootstrap procedure for CIU and meters is one PAN?

Thank you!

