Africa Smart Solutions

G3 PLC Projects
Harold Hayes
AUW 2020

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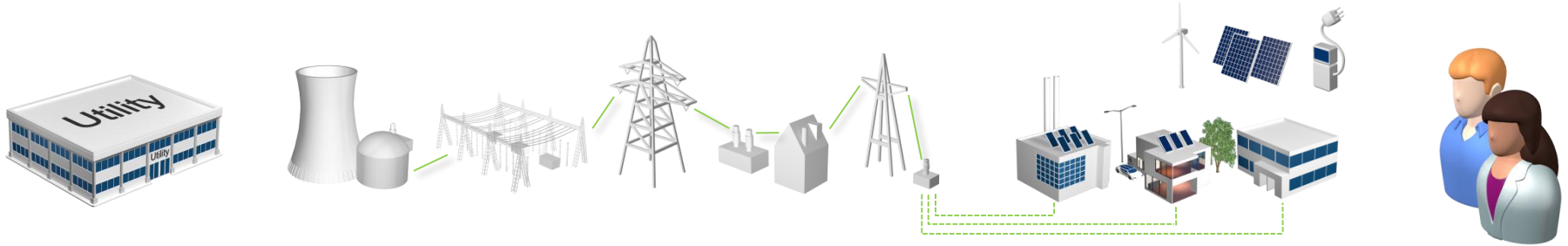
Smart Metering solution Using G3 PLC



Utility Processes → Two-way comms. → Meter Data Management & STS Prepayment Systems → Two-way comms. → Data Collection & Controls → Two-way comms. → Smart Devices → Two-way comms. → Customer

Utility Systems — STS Prepayment System

Meter Data Management Systems — Head End System (HES) — WAN

Utility Systems / 3rd party Systems

Data Concentrator

DC450 G3-PLC

G3-PLC

Smart Prepayment Meters

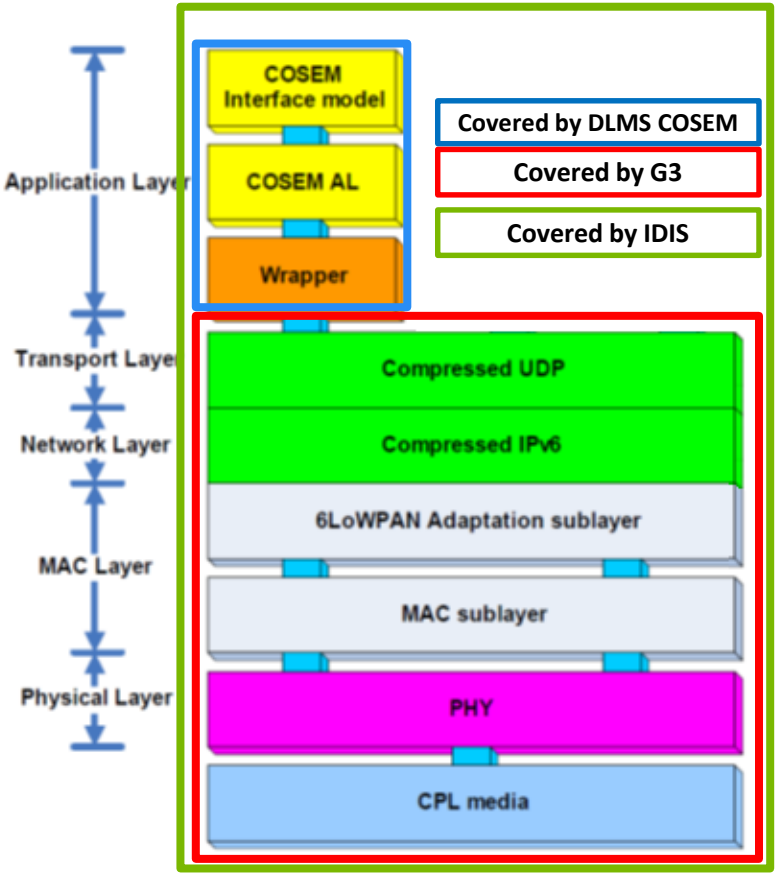
E460 G3-PLC

G3-PLC

Customer Interface Unit

P160 G3-PLC

G3-PLC and What's covered by IDIS?



Application Layer

Compliant ANSI C12.19/C12.22, IEC 62056-61/62 (DLMS/COSEM)or other standards used world-wide

Transport and Network Layer

IPv6 enables potential services: SNMP, TFPT, etc

Adaptation layer 6LowPan associates the MAC Layer 802.15.4 to IPV6 (Compression of IP header, fragmentation, routing, authentication)

MAC layer

Plug and play network management to choose "Best Path" (Full Mesh Support)
Time domain and collision management
MAC Layer IEEE 802.15.4-2006
CSMA/ARQ

Physical Layer

Support of internationally accepted bands from 10kHz - 490kHz (G3-500, CENELEC, ARIB)
Multi-layer error encoding/decoding (Viterbi, Convolution, Reed Solomon and CRC16)
8psk,QPSK, BPSK, Robo, Messaging Mode
Adaptive Tone mapping, notching and modulation

G3-PLC, OFDM Open Standard PLC

Open, Interoperable and future proof

Designed to meet present and future advanced networking and application layer needs. The world's only CENELEC / FCC PLC solution supporting true IPv6 (Internet protocols) addressing

Benefits

- Highly-reliable & suitable for harsh, noisy environments
- Future proof , standards based, IPv6, G3-PLC technology
- Supports frequency bands worldwide
- Support load switches, sensors and home area networks
- Includes high security mechanisms to protect grid assets
- Coexists with older technologies such as FSK & S-FSK

ESKOM Main use cases successfully implemented

SYSTEM OPERATION USE CASES

1. Meter reading process*
   Automatic/manual reading, comm. supervision
2. Validation, Estimation, Editing (VEE)*
   Validate data acc.to predefined rules, re-read missing values
3. Profile and tariff calculation*
   Aggregation of profiles, tariff calculation
4. Data collection supervision
   Device status and comm quality supervision (Operator Data panel)
5. *Meter supervision*
   PQI, Device Status
6. Power quality supervision
   PQI, voltage supervision, outages (Operator Data panel)
7. Alarm and Event management
   Alarm/ Event handling (Operator Data panel)
8. Customer service
   Customer enquiries, ad-hoc reading, disconnect/ reconnect

*Automatic, configurable processes running in background

METER DATA ANALYTICS **

9. Meter data analytics (AGA)
   Analytics based on meter load profile and PQI data

ROLLOUT-, DEVICE-, LOAD MANAGEMENT

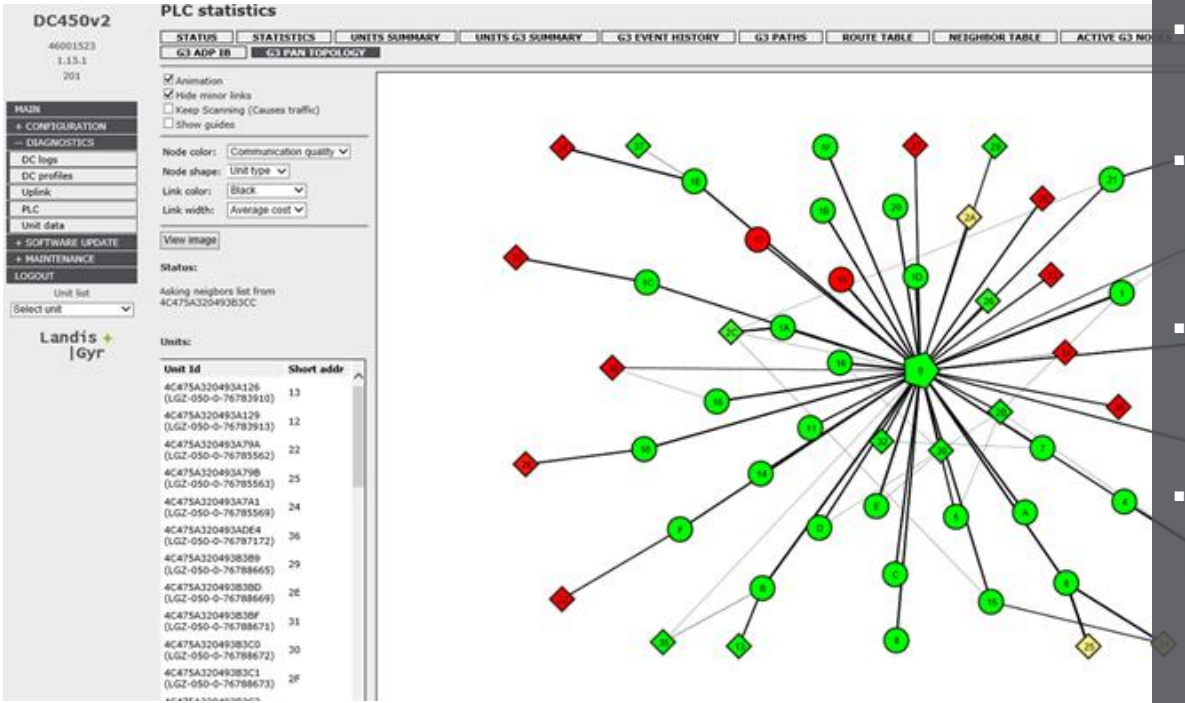
10. Installation- and rollout process **
    Create metering point, FOM: planning, exec. and reporting install.
11. Remote Device management
    FW upgrade/ Remote Configuration (LP Interval, Disable LP, CII)
12. Load Management, Time of use
    TOU tables, TOU or remote/ local command based Load Control

SYSTEM- AND DEVICE-CONFIGURATION, SECURITY

13. System setup and -configuration
    Basic System setup, control and superv. tasks, AIMIA Interfaces
14. Device configuration (-meter, DC, LS, multi-energy)
    Data import (csv, xml), register-, configure-, exchange device
15. User Access Management and Security
    Import credentials, security setup, exchange credentials

** Additional modules

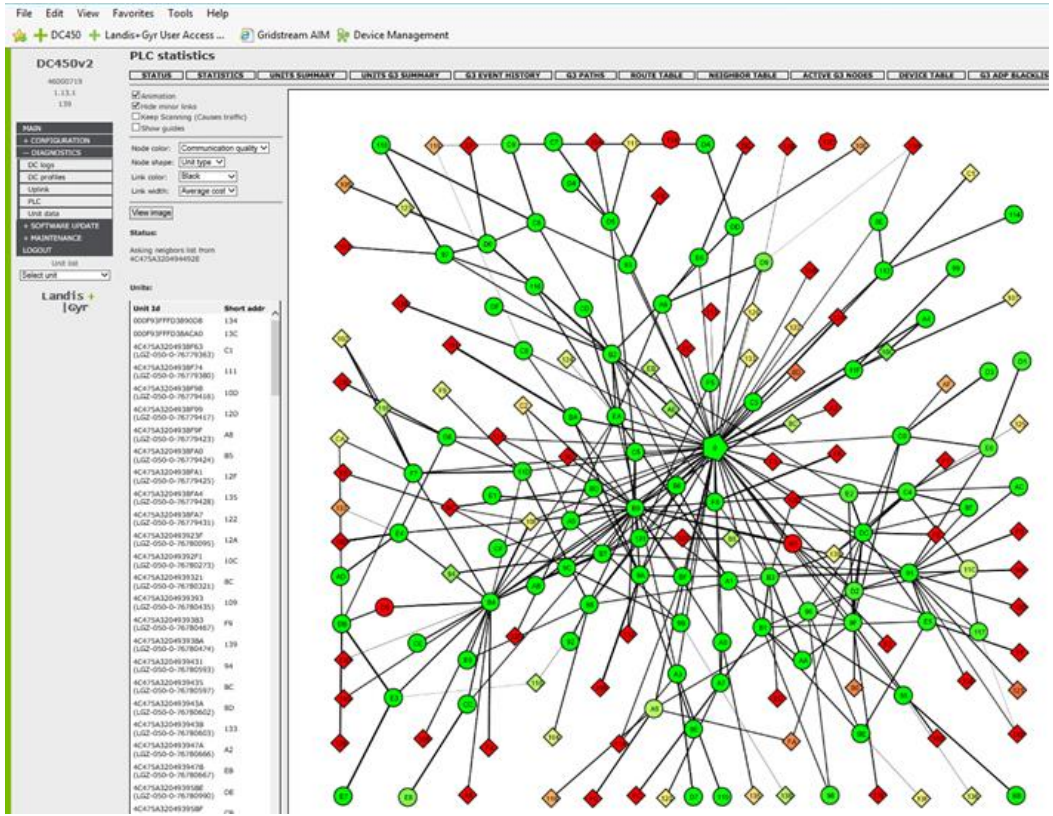
ESKOM G3 PLC



G3-PLC PAN Topology

- *At the centre is the Data Concentrator and the view shows G3 smart meter devices in GREEN that have the best communications quality*
- *The view also shows some meters in yellow or lighter shade of green that have a lower quality of communications (Possibly due to a noise source in the area or distance from the DC)*
- *In the case an additional device has been located but it is not able to join the G3 PAN, this is shown in RED (or In Home displays not plugged in)*
- *Meter and CIU count confirmed*

ESKOM learnings, increased G3 PLC Traffic

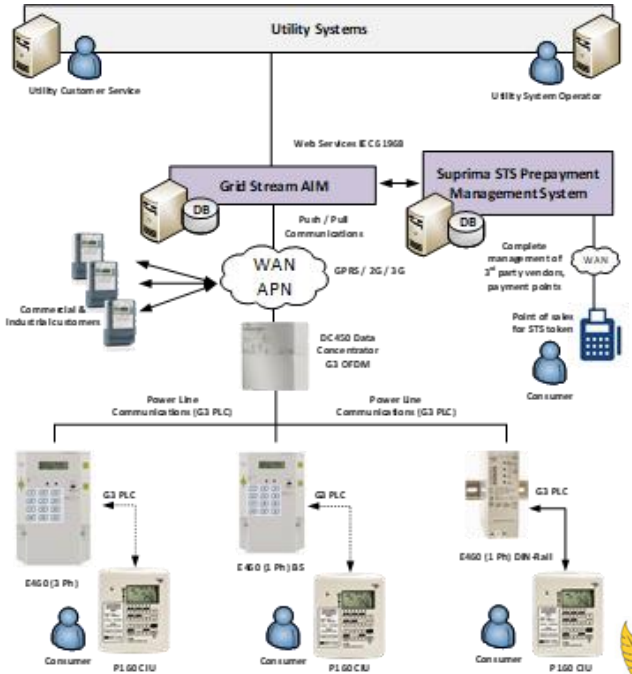


Increased G3 PLC Traffic

- *Utility Quality of Supply*
- *Outages, Load Shedding etc*
- *Events, under and over voltages specifically*
- *Customers, tend to leave in-home displays unplugged*
- *Power Failures, In-home display joining times*
- *Joining times, managing times between Meters – In-Home displays and Concentrators (customer must come first)*

Key elements relating Meter role out

- Test various **communication mediums**
  - Point to Point (P2P) GSM (2G/3G/4G/LTE)
  - PLC G3
- **Basic Meter requirements that will be read over G3 PLC**
  - Post Paid / Prepayment conversions
  - Quality of supply Measurement (power failures, voltage and current dips, swells etc.)
  - Revenue protection (Tamper, reversal, Magnetic, etc)
  - Load profiles 30 minute values (Minimum +kWh, -kWh, remaining Credit)
  - 12 months billing history
- **Data concentrators (DC) G3 PLC**
  - Communication mediums (GSM & Ethernet)
  - DC placements in the field (number of customers per transformer)



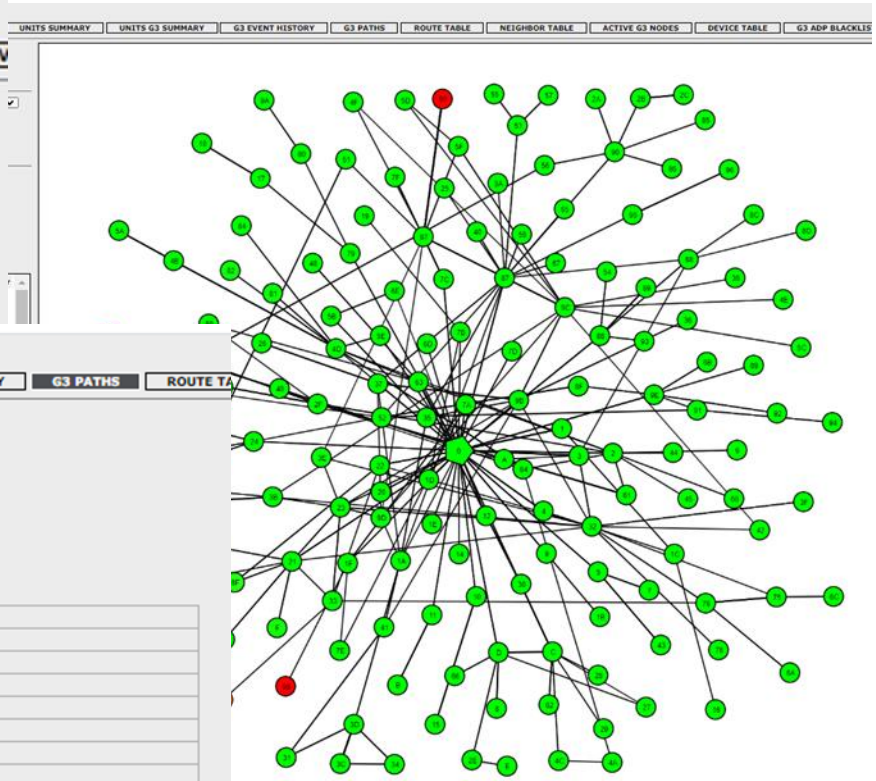
LEC DC Web Interface – G3 PAN Topology “meter count”

PLC statistics

STATUS | STATISTICS | UNITS SUMMARY | UNITS G3 SUMMARY | G3 EV

Units summary

Total amount of units	158
Communication quality (last 24h)	97.5 %
Amount of accessible units	156
Communication quality of accessible units (last 24h)	98.7 %



DC450v2

48004463
1.15.0
LEC PILOT DC

- MAIN
- + CONFIGURATION
- -- DIAGNOSTICS
- DC logs
- DC profiles
- Uplink
- PLC
- Unit data
- + SOFTWARE UPDATE
- + MAINTENANCE
- LOGOUT

Unit list
Select unit

Landis + Gyr

PLC statistics

STATUS | STATISTICS | UNITS SUMMARY | UNITS G3 SUMMARY | G3 EVENT HISTORY | G3 PATHS | ROUTE TA

csv export

Path statistics

Count of paths:	158
Maximum path length:	10
Average path length:	4.6
Average path cost:	49.7

Path length distribution

Hop count	Units (%)	Units
2	20.9 %	33
3	2.5 %	4
4	33.5 %	53
5	8.9 %	14
6	19.0 %	30
7	5.1 %	8
8	7.0 %	11
9	1.9 %	3
10	1.3 %	2

Case Study – Kenya / Integrators of Systems Tech. IST

Tatu City requirements

- Tatu Connect is a private entity, therefore requiring **modern smart technology** for the new Tatu City development (Outside of Nairobi)
- **No manual meter** reading or estimations
- Online metering solution, reducing the loss of revenue
- **On time Billing**
- Eliminate the **high cost of disconnection** and reconnection
- **Load Management** and monitoring
- Aligned with Kenya's desire to **reduce carbon footprint**, Tatu Connect are implementing smart technology

Solution

IST AMI/AMR system

G3-PLC Alliance

dlms device language message specification

DC450v3 Data Concentrator

E460 3ph

E460 1ph BS

Water meter

- 500 meter installations
- Initially, 20 Data Concentrator installations
- IST system integration with Landis+Gyr DC450v3 and E460 smart meters

TATU CITY

Benefits and Impact for Tatu City

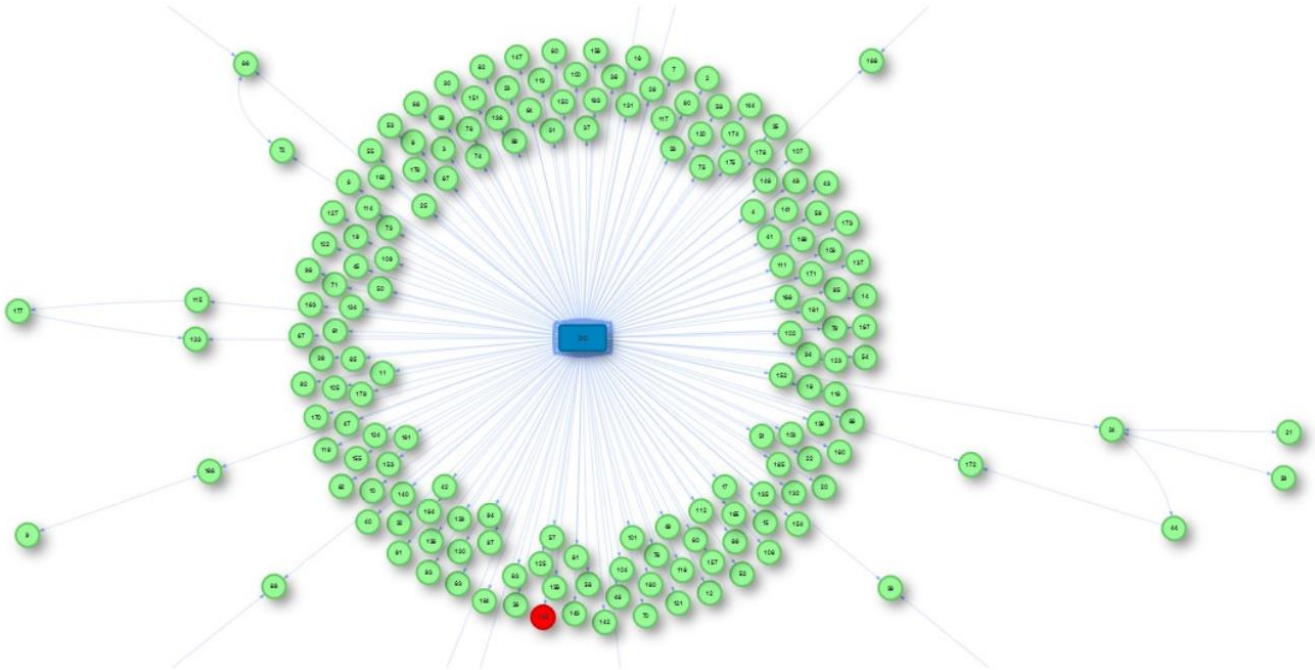
- Solution integration **partnership** with IST and Landis+Gyr
- **Remote meter readings**, IST back office prepayment / wallet system
- **Water meters** provide pulse inputs to the E460 meters
- **Remote disconnect** and reconnect
- Remote meter **monitoring** for improved revenue protection
- **Visibility of devices** on the network, using the DC450's web admin interface

DC Web Interface – G3 PAN Topology

- Meters
- CIUs
- Neighbour Table
- Path Table
- Topology
- Route Table
- Blacklist
- Profile Data
- Readout Data

Topology

☐ Show neighbours data



Summary

G3 PLC Technology has proven to be

- Highly-**reliable & suitable** for harsh, noisy environments
- **Future proof** , standards based, IPv6, G3-PLC technology
- Supports **frequency bands worldwide**
- Includes high security mechanisms to protect grid assets
- Coexists with older technologies such as FSK & S-FSK

Thank you for your attention

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