



Welcome to today's Webinar!

**Setting-up and maintaining G3-PLC networks
sharing experiences from DSO perspective**

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Today's speakers



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Agenda

- 1. Short update on G3-PLC and the G3-PLC Alliance**
2. ENEDIS Experience in Setting-up and maintaining G3-PLC networks
3. Discussion

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

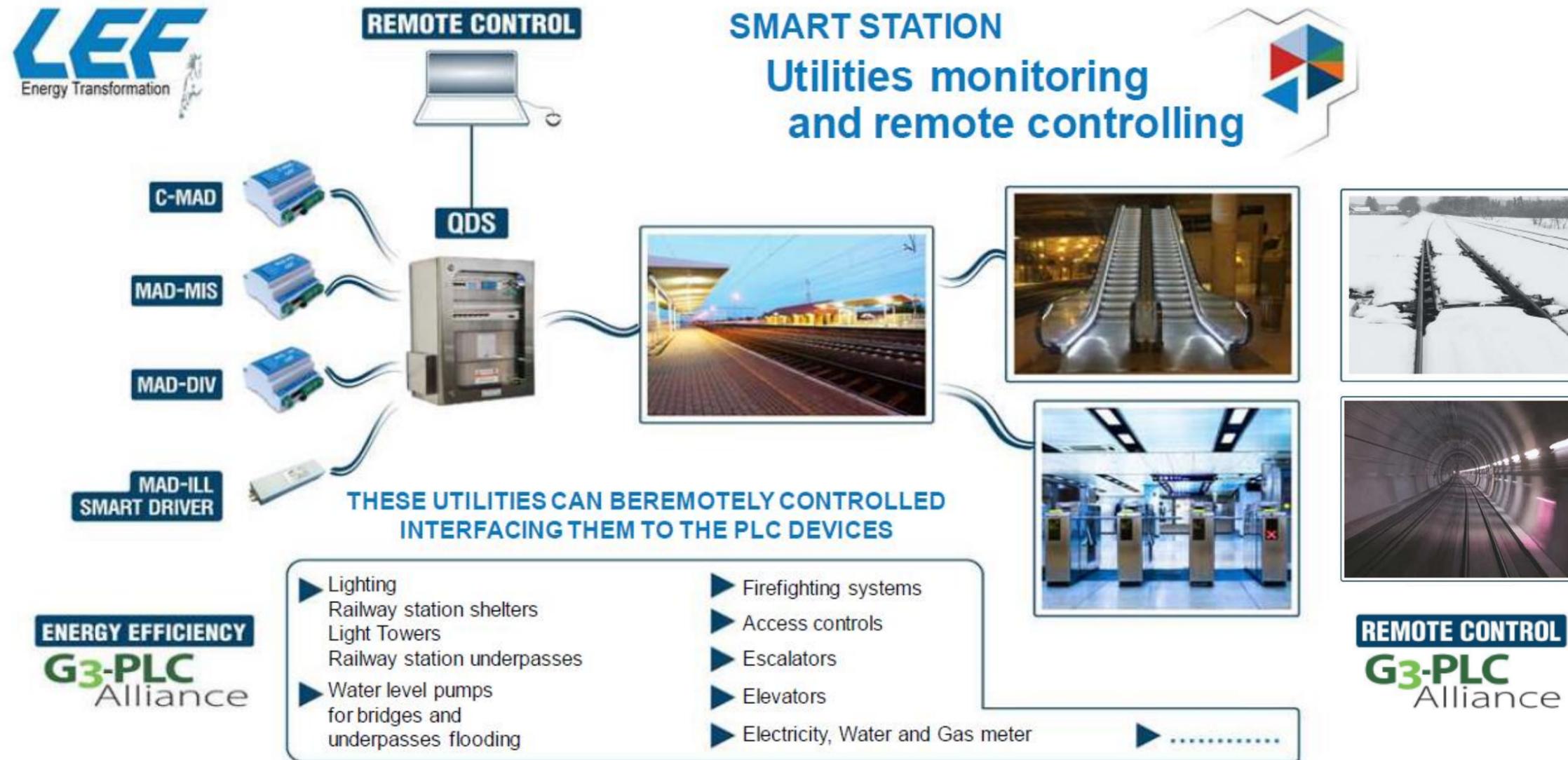
Cost effective, reliable and secure communication...

... in a wide range of applications

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



Railway use case: Monitoring and control of railway smart stations, heating of track switches and tunnel safety lights



- G3-PLC is the standard required by the Italian railway infrastructure company
- Panasonic uses G3-PLC to control lighting on railway platforms in Tokyo

G3-PLC embeds all modern features for a long term network operation and is designed for harsh network conditions

Robust communication

- Operates at very low SNR
- High indoor penetration, high-rise building, in-home applications
- Self healing

Long distance

- Easily covers several hundreds of meters
- We know of communication over 800 meters (LV in CENELEC A) and 2,4 km (MV in FCC) without branches and without repeaters

High data rate

- Complies with future needs for energy demand management and demand response policies

Strong security

- State-of-the-art Security with MAC security combined with data integrity mechanisms in higher layers

Evolutive

- End to end IP communication
- Designed to accept diverse application layers (EV, lighting, ...)



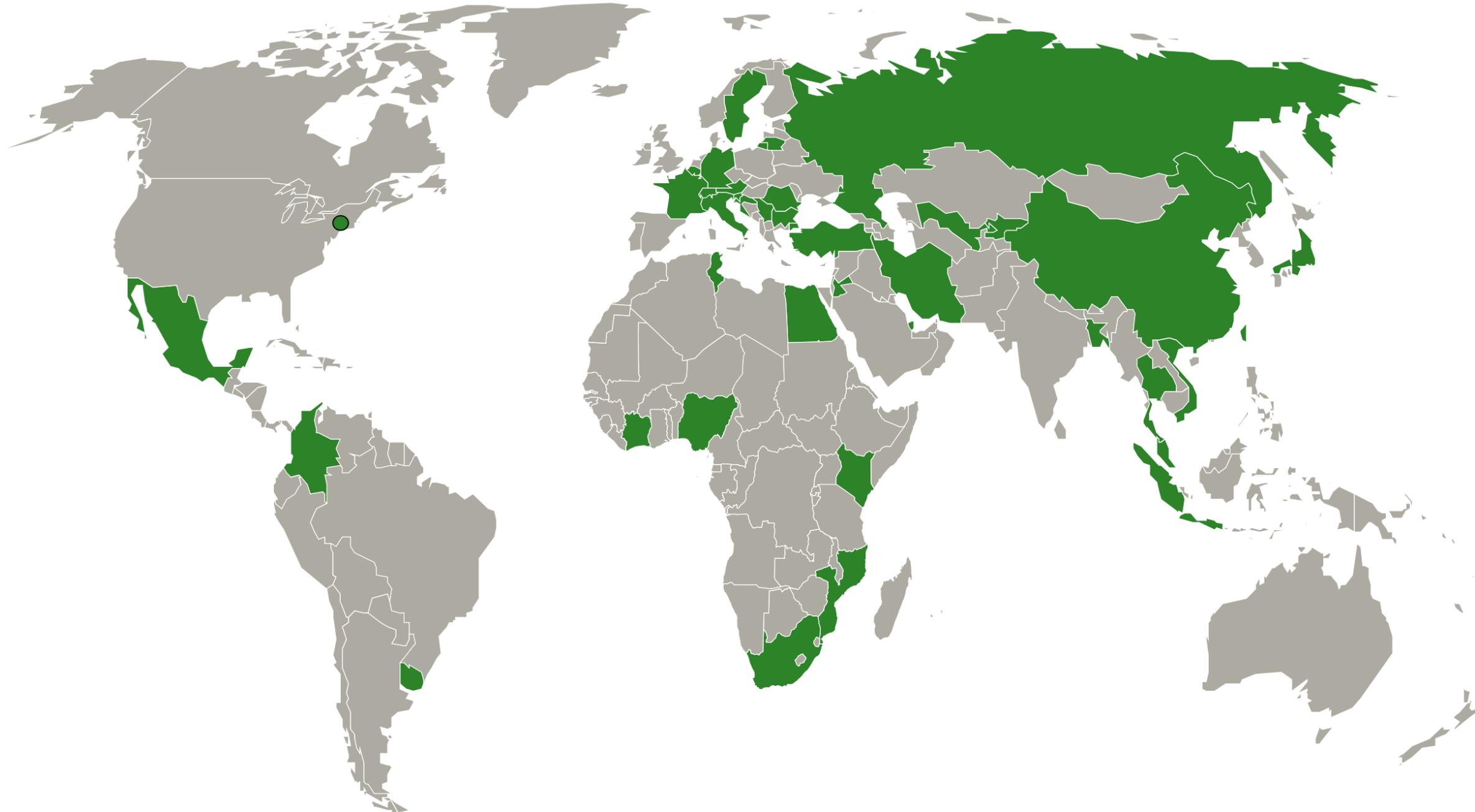
International Standard

- International open ITU standard
- Compliant with IEEE, Cenelec



G3-PLC is a mature technology with over 50 million G3-PLC products in operation in more than 30 countries worldwide

Known pilots and roll-outs of G3-PLC worldwide



Over 90 members from more than 30 countries today!

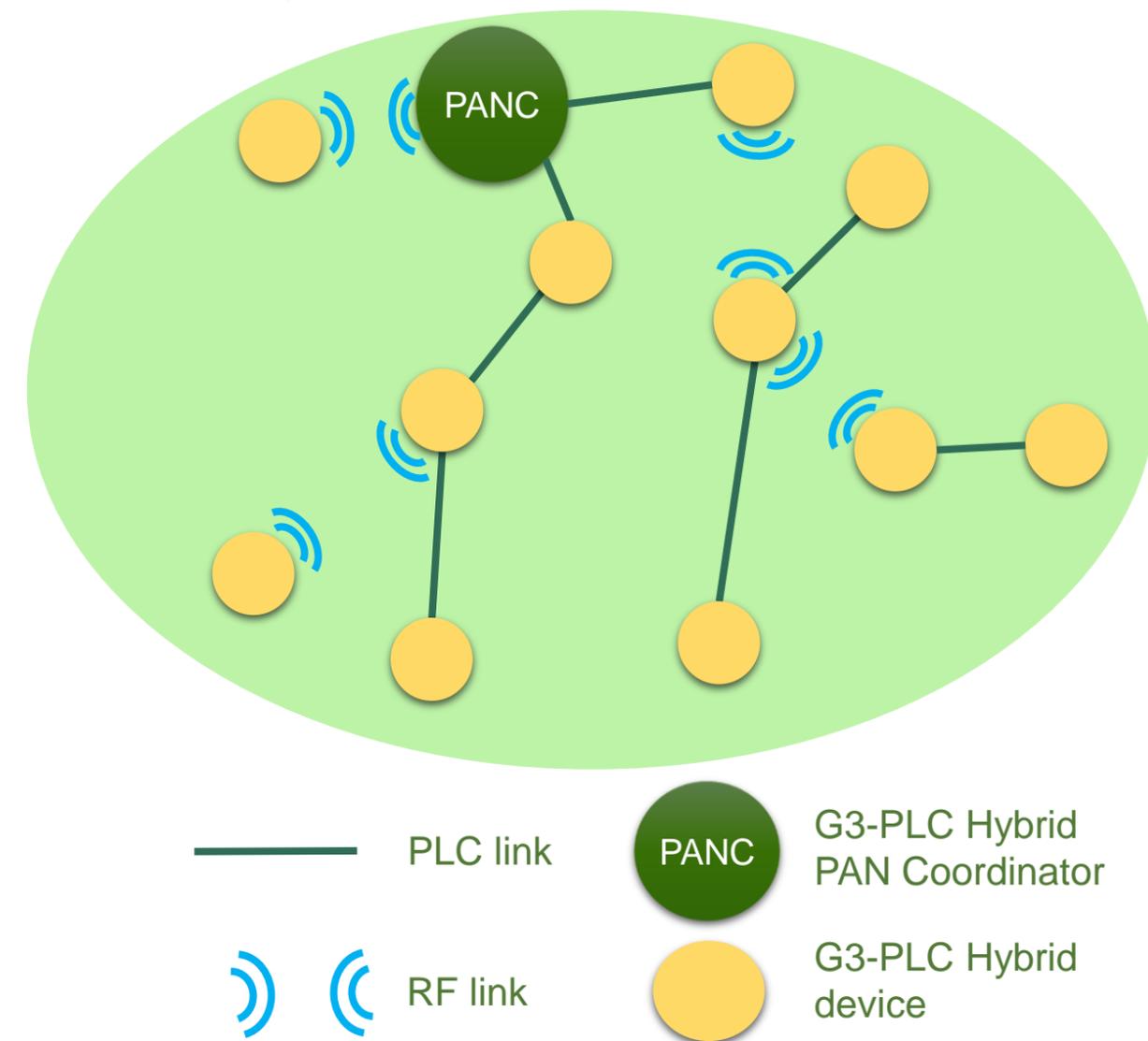


In addition to the existing PLC profiles, we introduced an extended profile with radio capabilities: G3-PLC Hybrid PLC&RF

- Each device can use PLC as well as RF for communication
- For each individual link the best media is selected
- Automatic channel selection during network setup and dynamic adjustment based on media status
- Maximises coverage and connectivity
- Fully backwards compatible with existing G3-PLC implementations
- Opens up new use cases as it extends the connectivity to radio-only devices

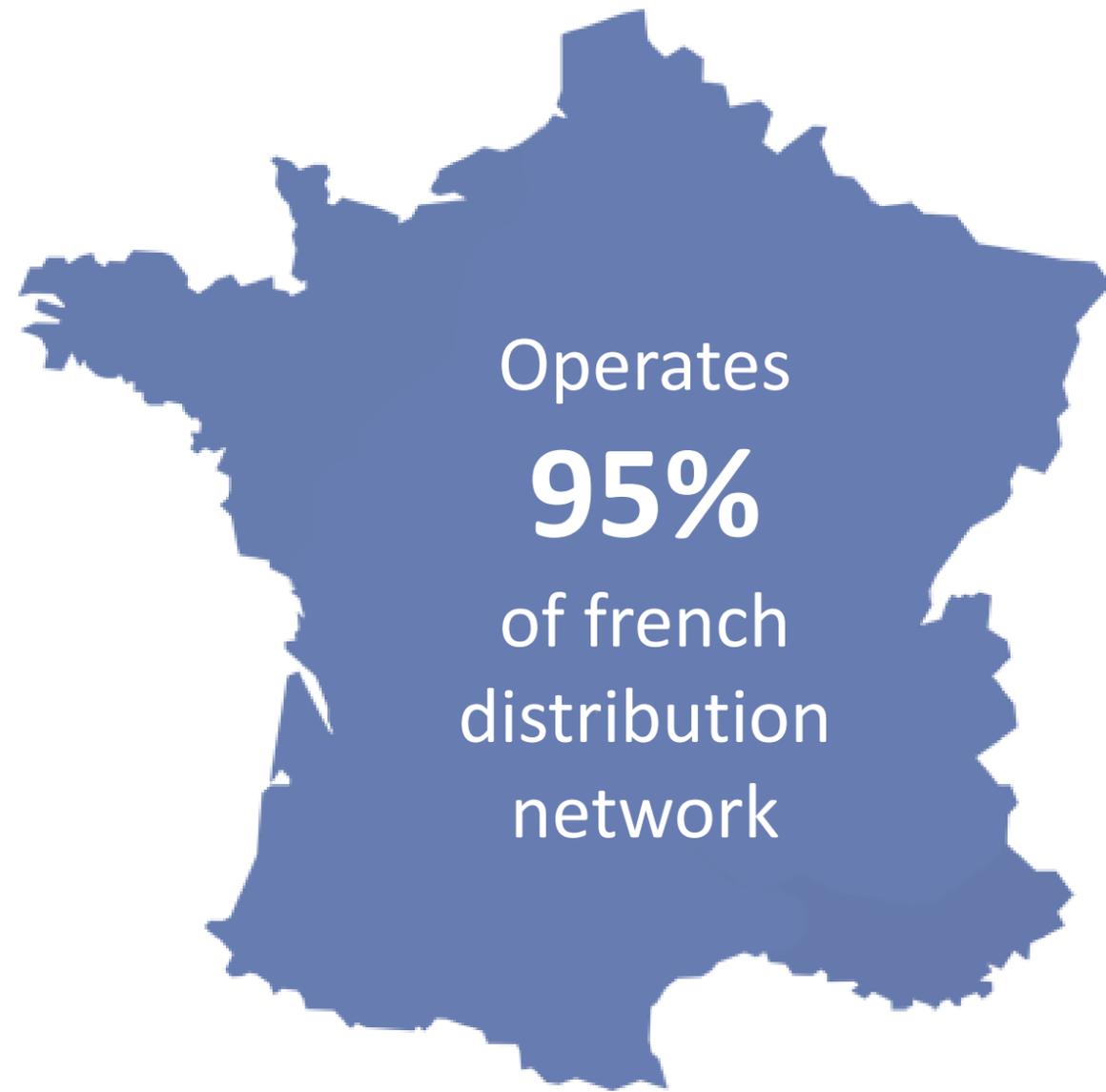


Hybrid PLC&RF mesh network



Agenda

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2. **ENEDIS Experience in Setting-up and maintaining G3-PLC networks**
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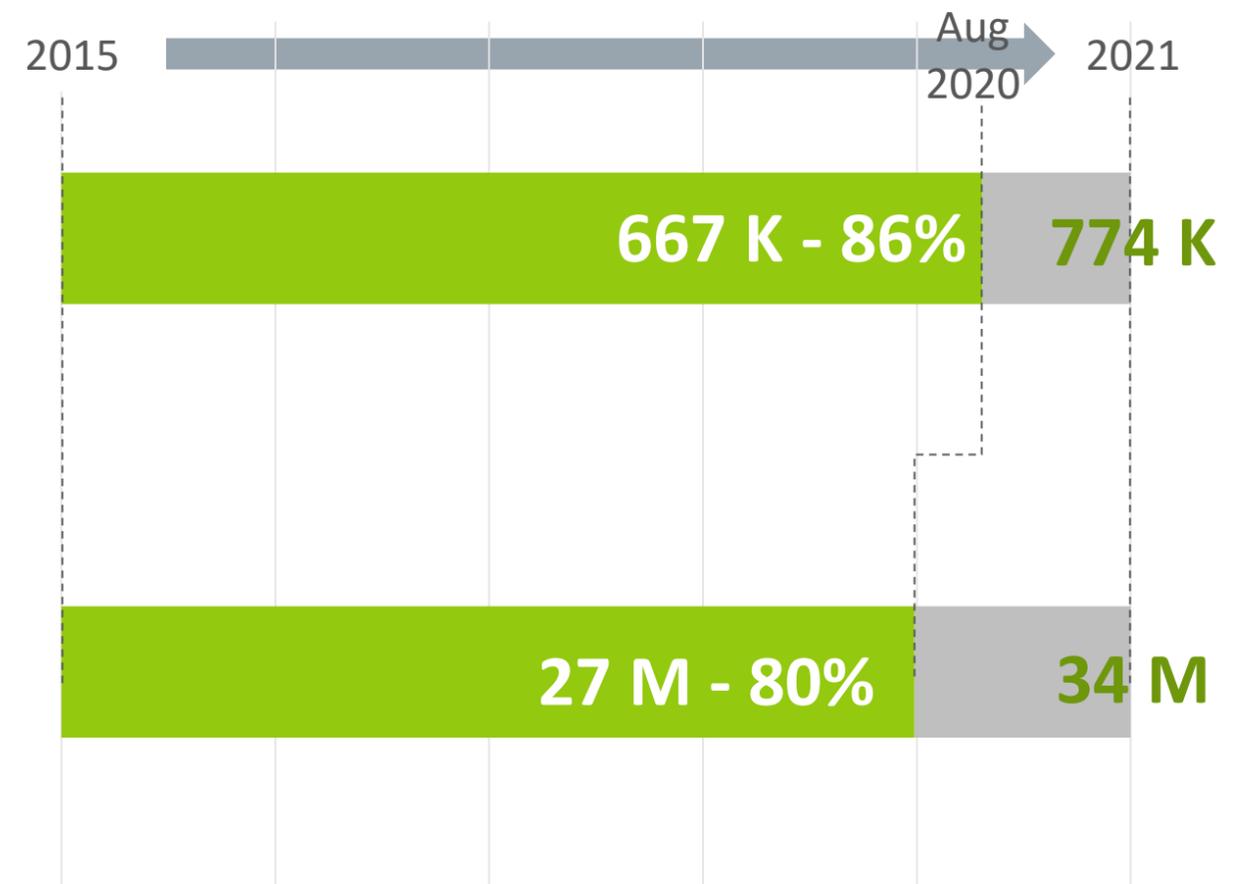
Distribution

Enedis is responsible for rolling-out, operating and maintaining the smart-grid infrastructure and system

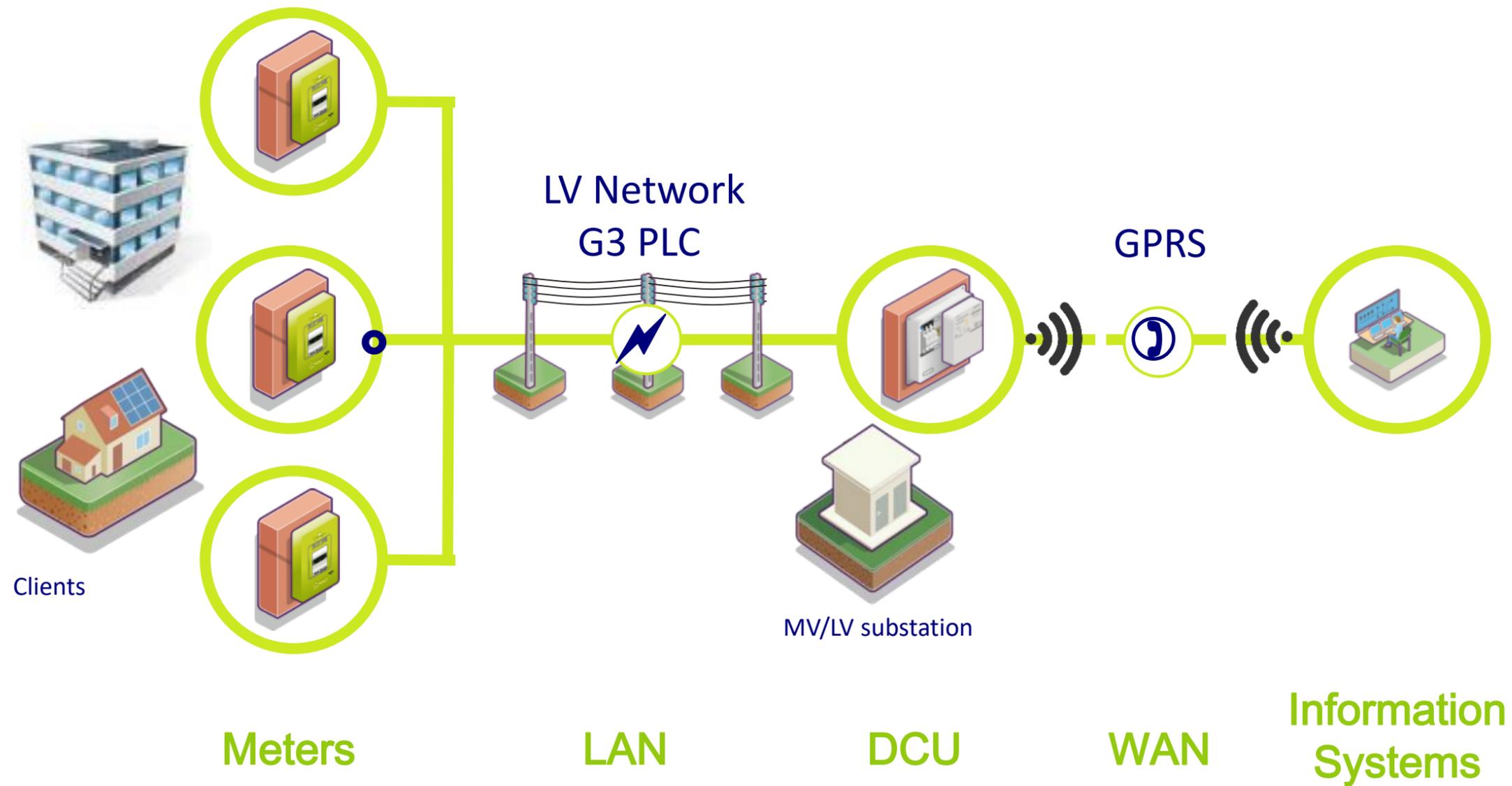
Linky



Mass roll-out



A brief introduction to the Linky Advanced Metering Infrastructure



>98% DAILY
COLLECTION RATE
(11.59 PM)

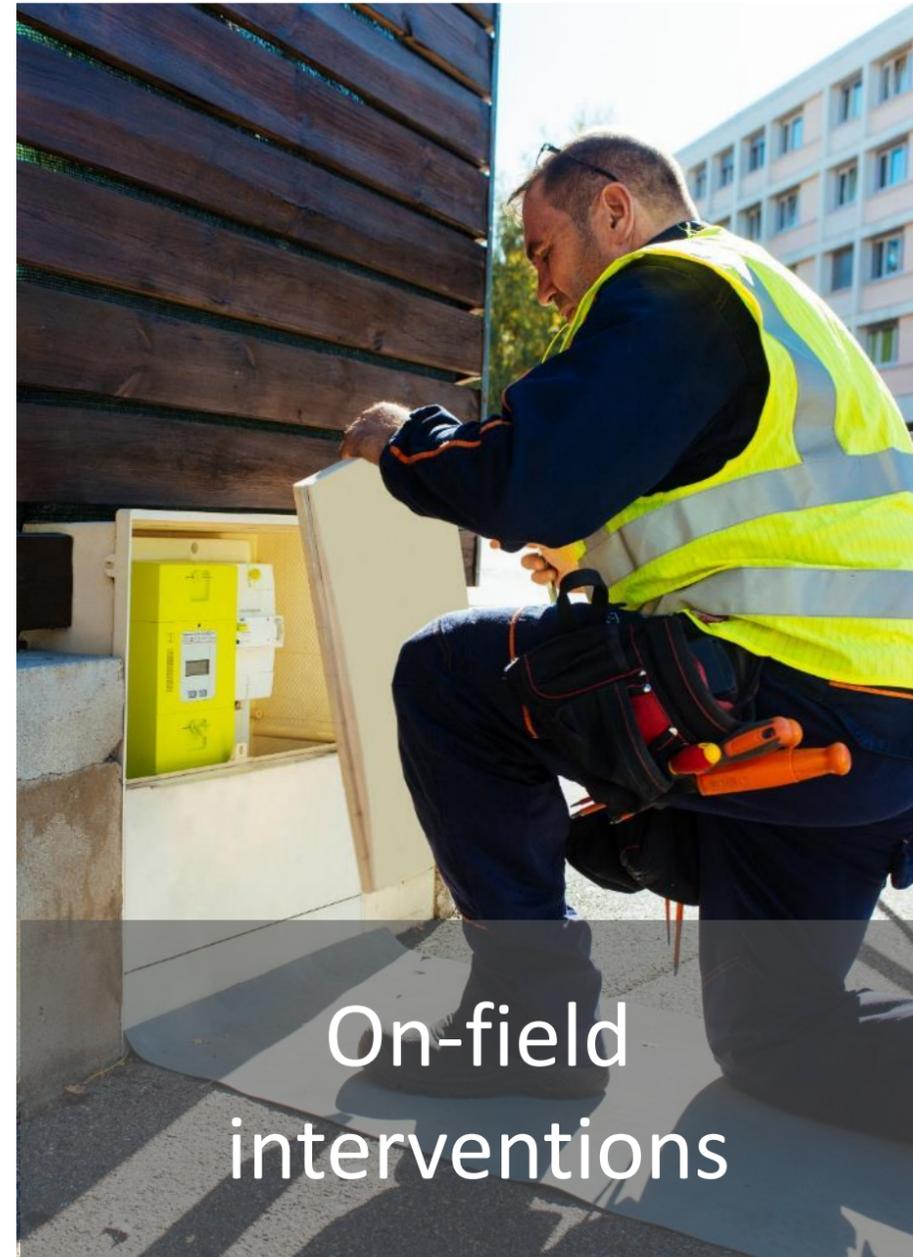


>3 billion
DATASETS
COLLECTED /
TRANSFERRED /
STORED PER DAY

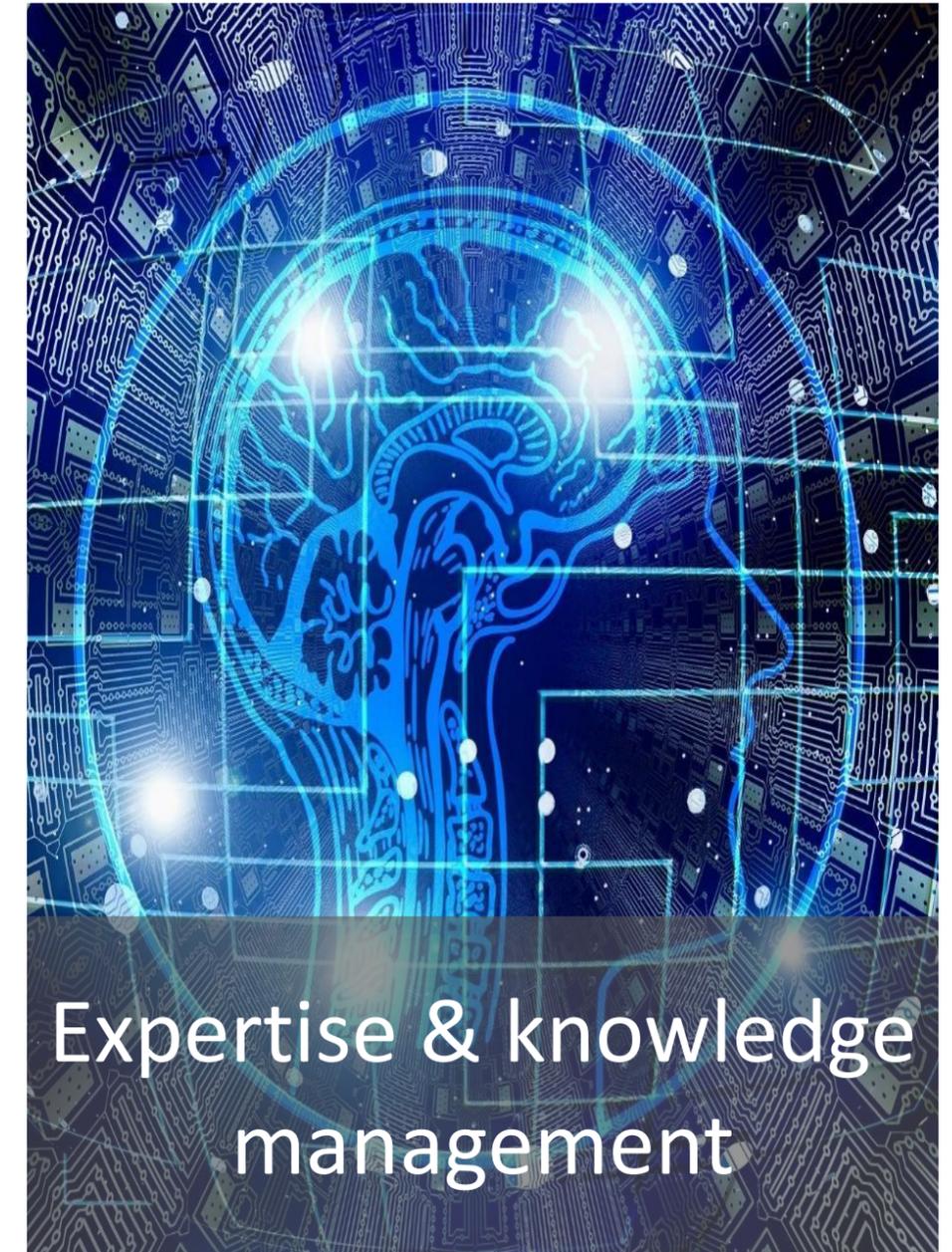
To keep an AMI infrastructure up and running, 3 items are needed



Monitoring and analysis



On-field interventions



Expertise & knowledge management



Monitoring and analysis : Network Supervision

What are we monitoring, and how ?



Technical
architecture



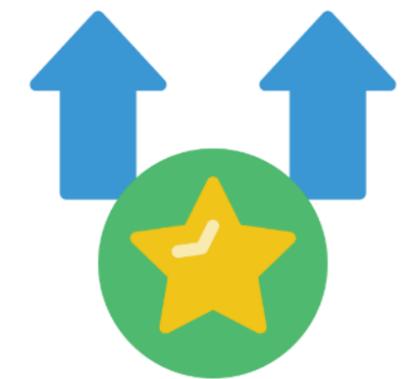
Services



Quality
monitoring and
analysis

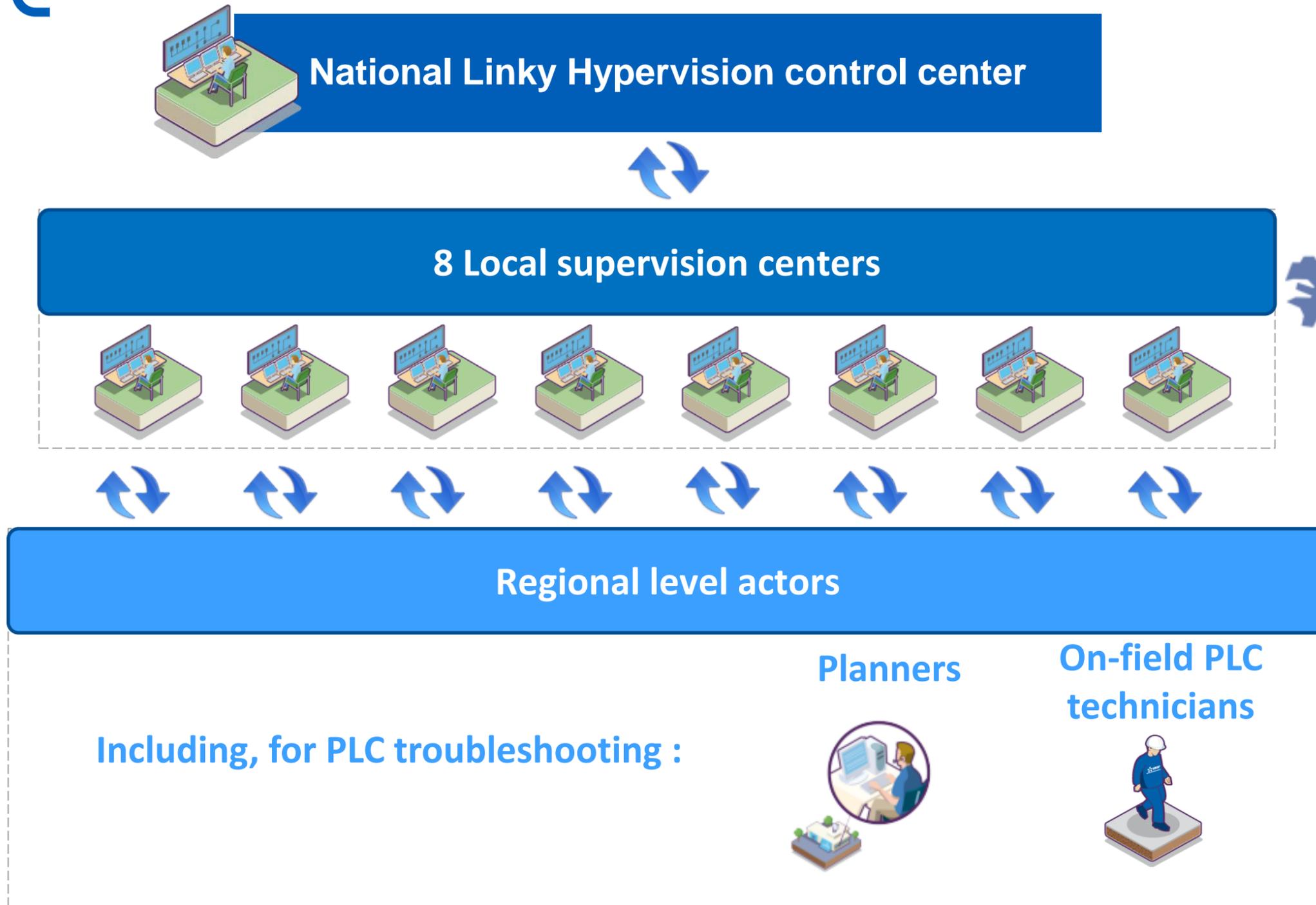


Incidents
resolution



Continuous
improvement

How is the network supervision organised ?



Linky Sup : a dedicated tool to detect and treat incidents

The screenshot displays the Linky Sup software interface, which is used for monitoring and managing incidents. The interface is divided into several sections:

- Tableaux de bord (Dashboards):** Located at the top left, it shows key performance indicators such as "Performance de collecte" (95.23%) and "Dossiers d'analyse" (65%).
- Historique des actions (2):** A central panel showing the status of an analysis dossier (DA150131000029) as "En cours" (In progress). It includes details like creation date (31/01/2015 16:09) and criticality (Grave).
- Carte (Map):** A map view showing the geographical location of the incident, with a legend for "Taux de collecte" (Collection rate) ranging from 0% to 100%.
- Données (14):** A table listing 14 data points, including PRM, ID PDC, N° série C, Constructeur, PDK_Mercator, PDK_Com, Statut C, Date de pose, Date de découverte, Date de dernière déc., Date de récon., and Date de dernière collect... The table is filtered to show 14 elements.
- Indicateurs (Indicators):** A section on the right showing "Dysfonctionnements en cours (1)" and "Réseau LAN (14 C)" with a small chart for "Collecte primaire" (Primary collection).
- Causes probables (Probable causes):** A section listing various causes such as "CR de pose K non transmis", "K sans CR (perdu ou non saisi)", and "Cause indéterminée K".



On-field interventions

A fleet of PLC-trained technicians



~60 local technicians
not full-time / 38 700 employees

Enedis workforce
not Telco specialists



In-house
Training

Theory and practice
experimental network



3 days
training

Training started in
2016





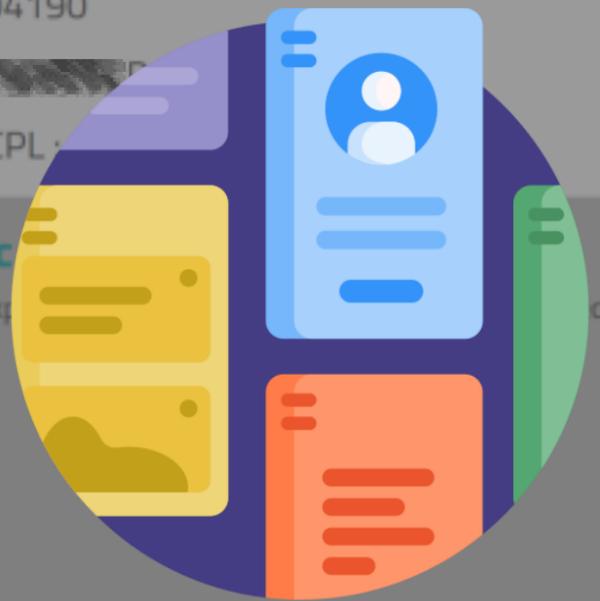
Dossier d'expertise : DE1511250097

Informations

Informations de Supervision



Measure



Information



Intervention

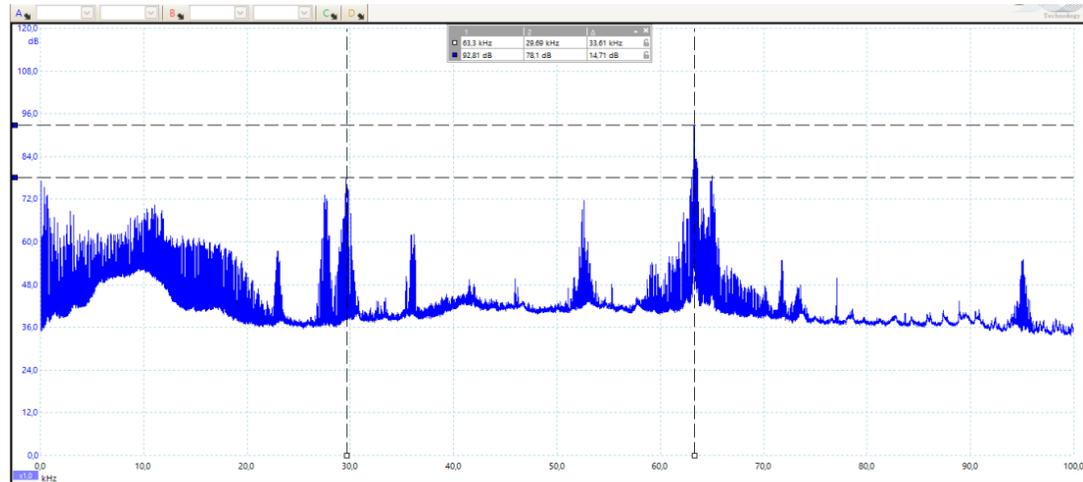


Traceability

An all-in-one toolcase to facilitate field interventions

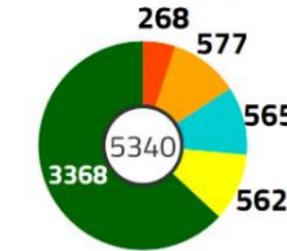


Oscilloscopes

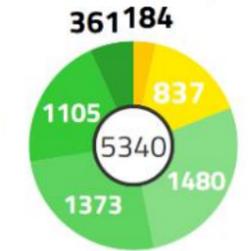


PLC Sniffer

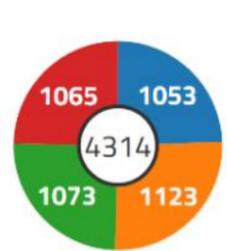
Types de paquets reçus



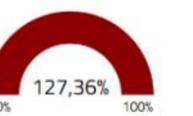
LQI des paquets reçus



Modulation



Occupation du canal



Renvoi de trames



Erreurs de reception



| | | | | | |
|-----------------------------|--------|----------|--------|-----------|--------|
| Beacon requests | 5,02% | [0-31] | 0,00% | [112-127] | 25,71% |
| Beacons | 10,81% | [32-47] | 0,00% | [128-143] | 20,69% |
| Bootstrapping messages | 10,58% | [48-63] | 0,00% | [144-255] | 6,76% |
| Bootstrapping fail messages | 0,00% | [64-79] | 3,45% | | |
| Tonemap responses | 10,52% | [80-95] | 15,67% | | |
| Data messages | 0,00% | [96-111] | 27,72% | | |
| Encrypted data messages | 63,07% | | | | |
| | | | | ROBO | 24,41% |
| | | | | DBPSK | 26,03% |
| | | | | DQPSK | 24,87% |
| | | | | DBPSK | 24,69% |



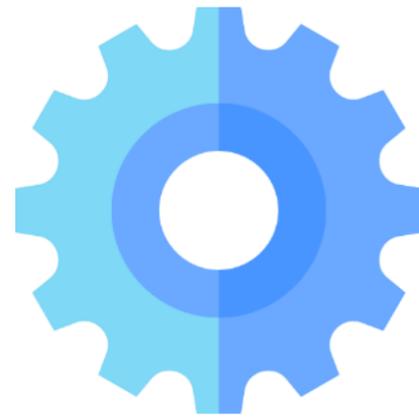
Expertise and knowledge management

Thanks to our feedback loop and team of experts, we improve



Performances

Noise, transmission power...



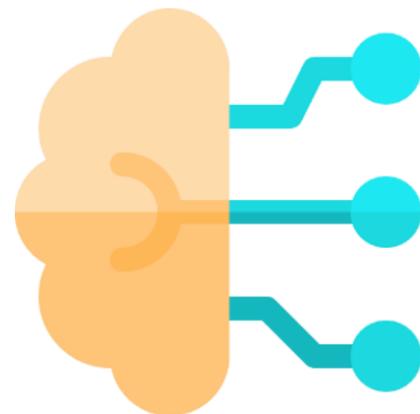
Parameters

tuning



Grid

services



Automated

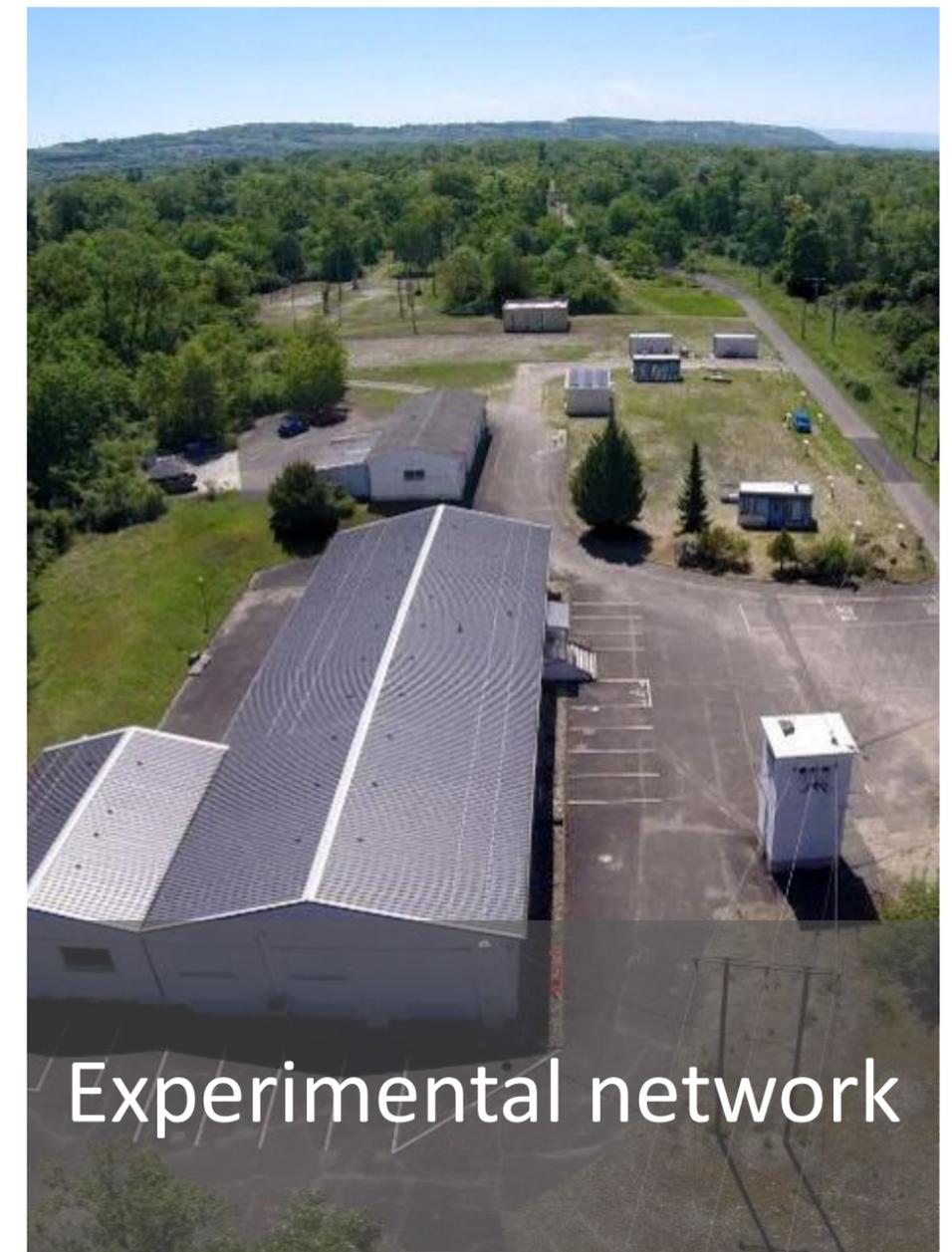
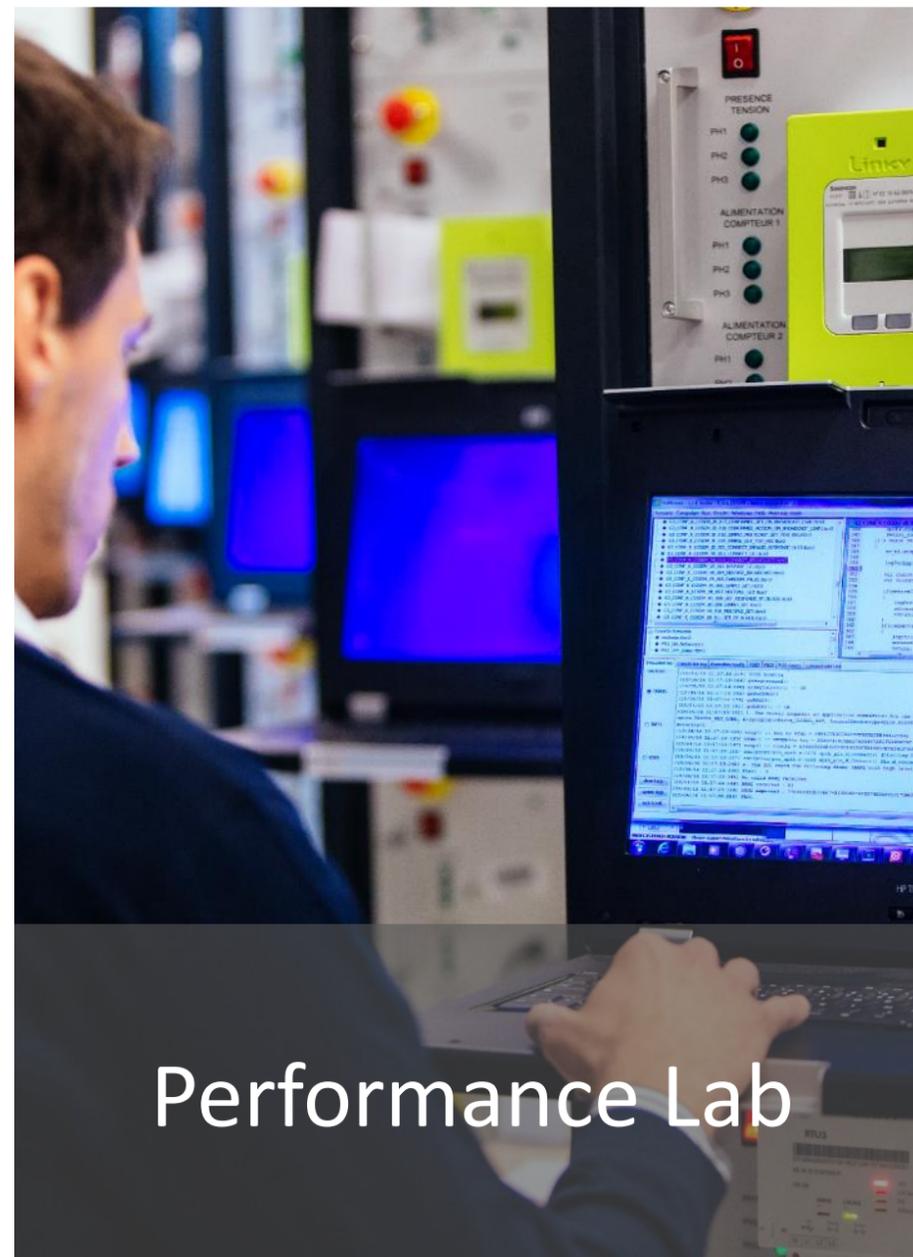
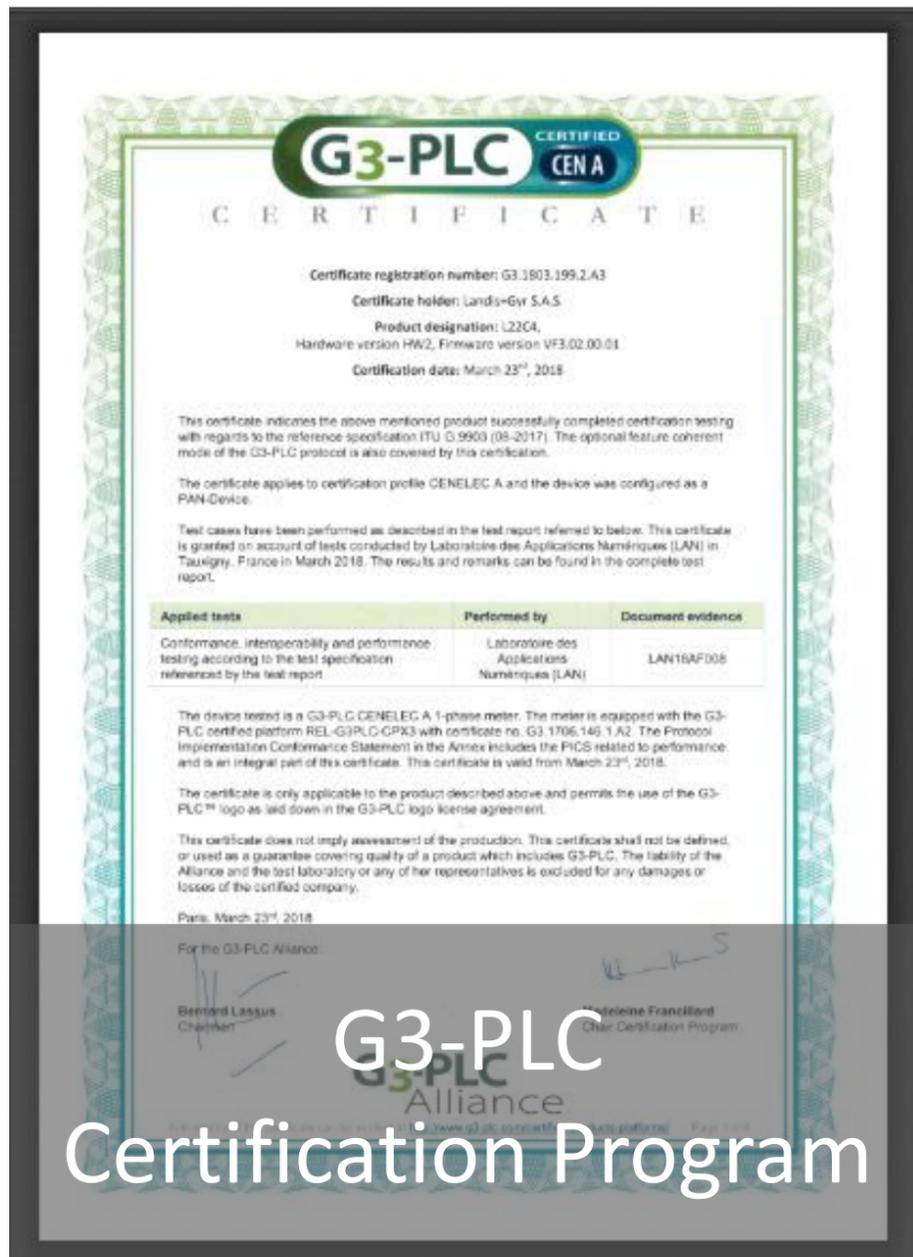
detection and analysis



Trainings

for our team

G3-PLC devices performances



Parameters and system performances

G3-PLC Alliance
G3-PLC User Guidelines
Attribute usage (version 1.0, 06/2020)

Executive Summary

G3-PLC provides a significant number of attributes which may be used to tweak the G3-PLC protocol stack behaviour to better fulfill specific use cases or to better match local particularities. Yet changing the value of an attribute or doing so for a combination of attributes can lead to sub-optimal performance and even malfunction.

This document provides guidelines for the configuration of G3-PLC attributes covering physical, MAC and adaptation layers.

About G3-PLC

G3-PLC facilitates high-speed, highly-reliable, long-range communication over the existing powerline grid. The features and capabilities of G3-PLC have been developed to address the difficult challenges of powerline communications. While earlier approaches were a step in the right direction, they fall short of meeting the technical and reliability requirements necessary in the hostile environment of PLC.

G3-PLC meets these requirements because of its unique features such as a mesh routing protocol to determine the best path between remote network nodes, a "robust" mode to improve communication under noisy channel conditions and channel estimation to select the optimal modulation scheme between neighbouring nodes. Furthermore, its support of IPv6, enabling easy integration of various application profiles, adds high versatility and carries G3-PLC well into the future.

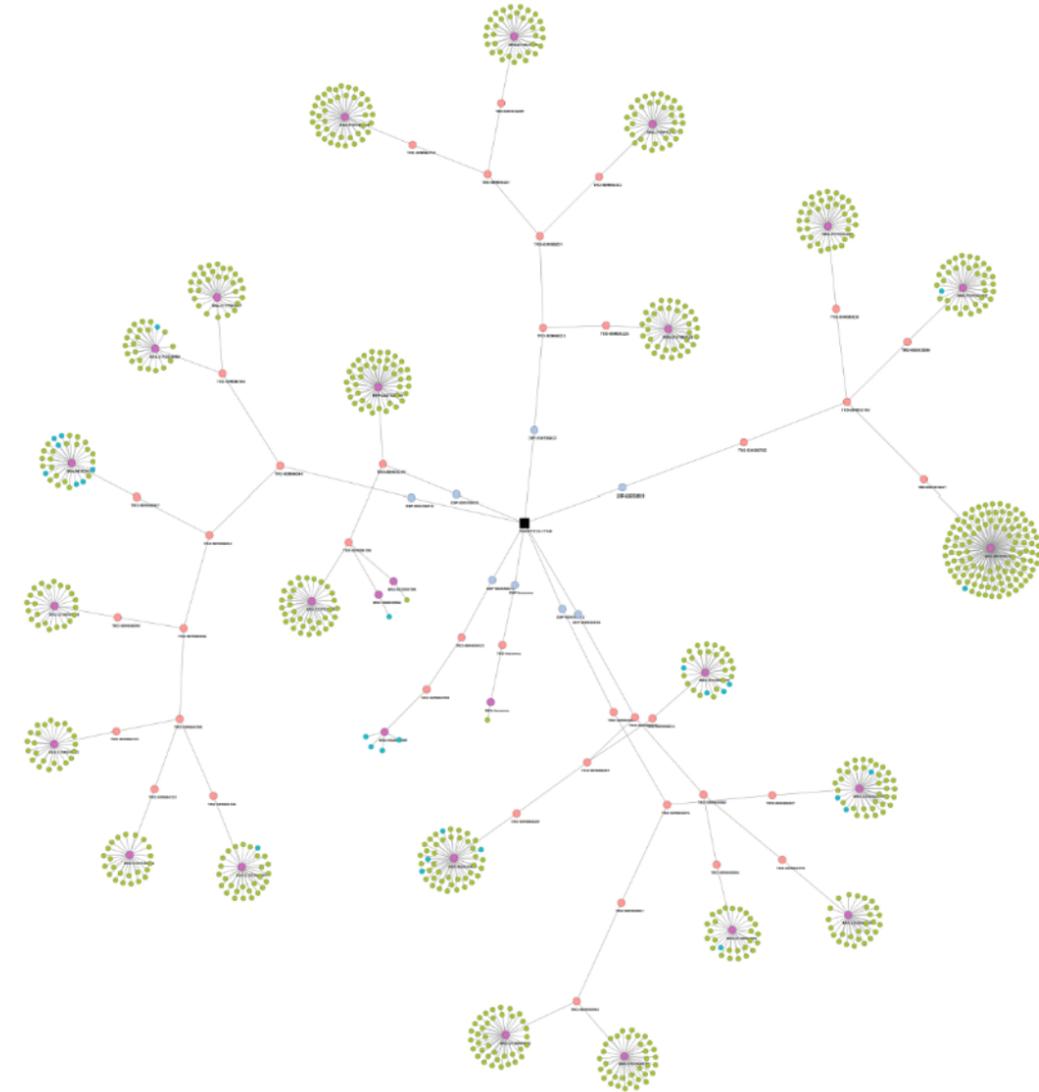
G3-PLC is an open, international standard published by ITU: <https://www.itu.int/rec/T-REC-G.9903>.

To help adopters properly integrate the G3-PLC protocol stack in products and systems we have developed a set of user guidelines. All user guidelines can be found on the G3-PLC Alliance website: <http://www.g3-plc.com/what-is-g3-plc/userguidelines>

For more information: www.g3-plc.com

Attribute usage version 1.0, 06/2020 1

or



One size fits all

Tailor made ?

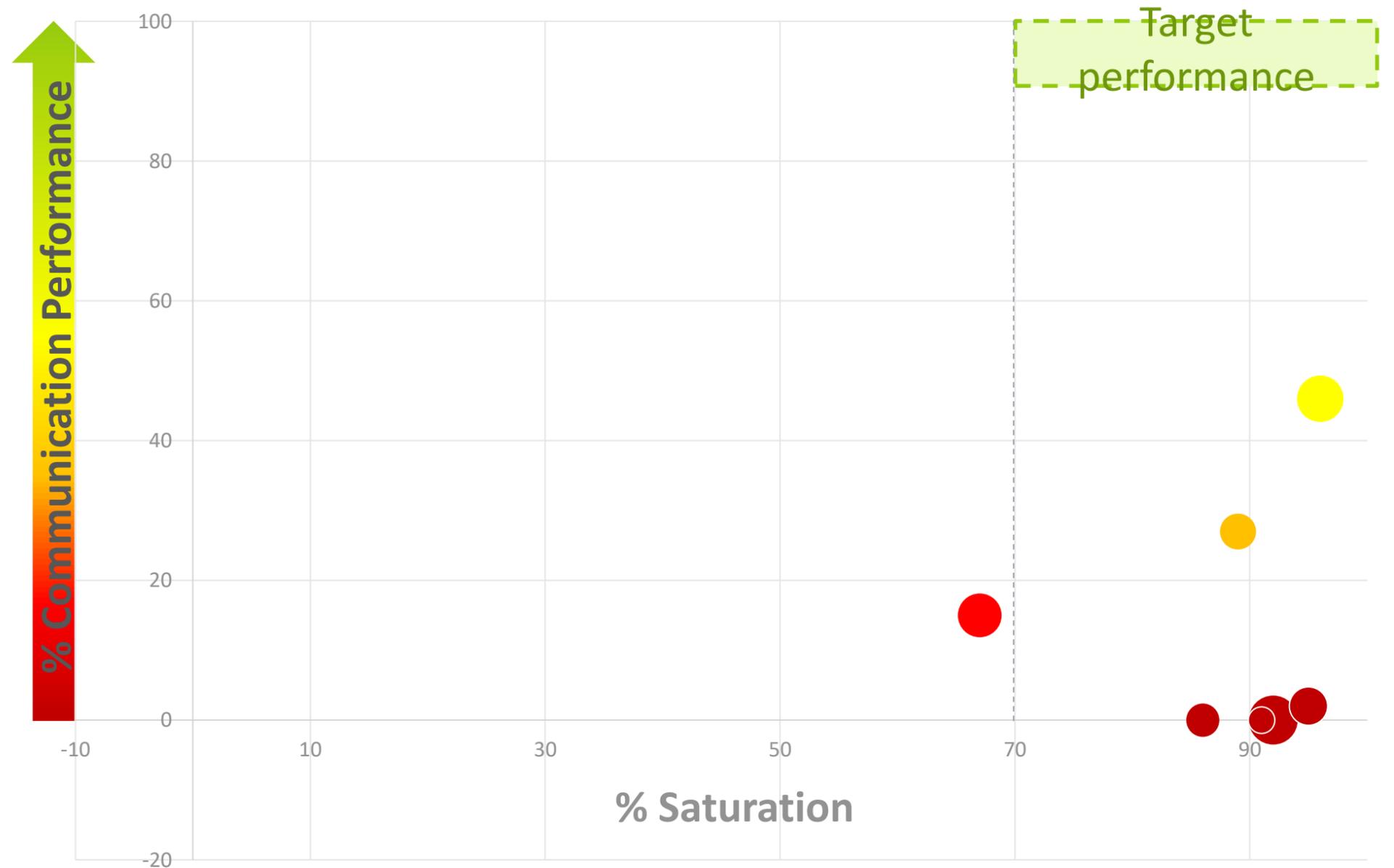
Once upon a time

Case studies

Crowded and noisy : Silence the neighbours !



7 substations with low performances detected



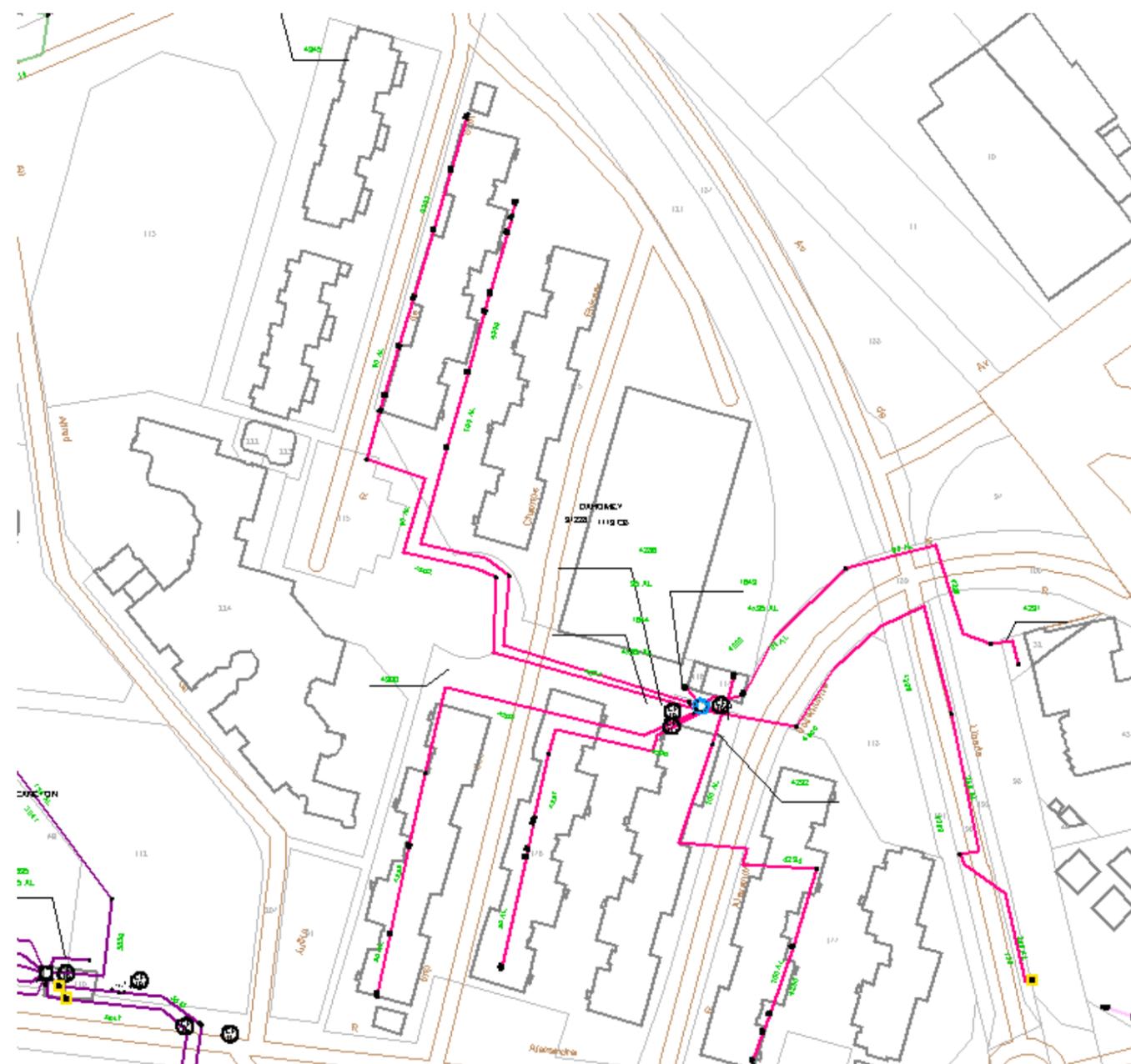
Crowded and noisy : Silence the neighbours !

In-room analysis

- DCUs are reachable, connected
- Collective Housing (urban development in the 70's / 80's)



Noisy neighbour (s) ?
District heating ?



Crowded and noisy : Silence the neighbours !



Measure
In the substation



Measure
Close to the boiler room



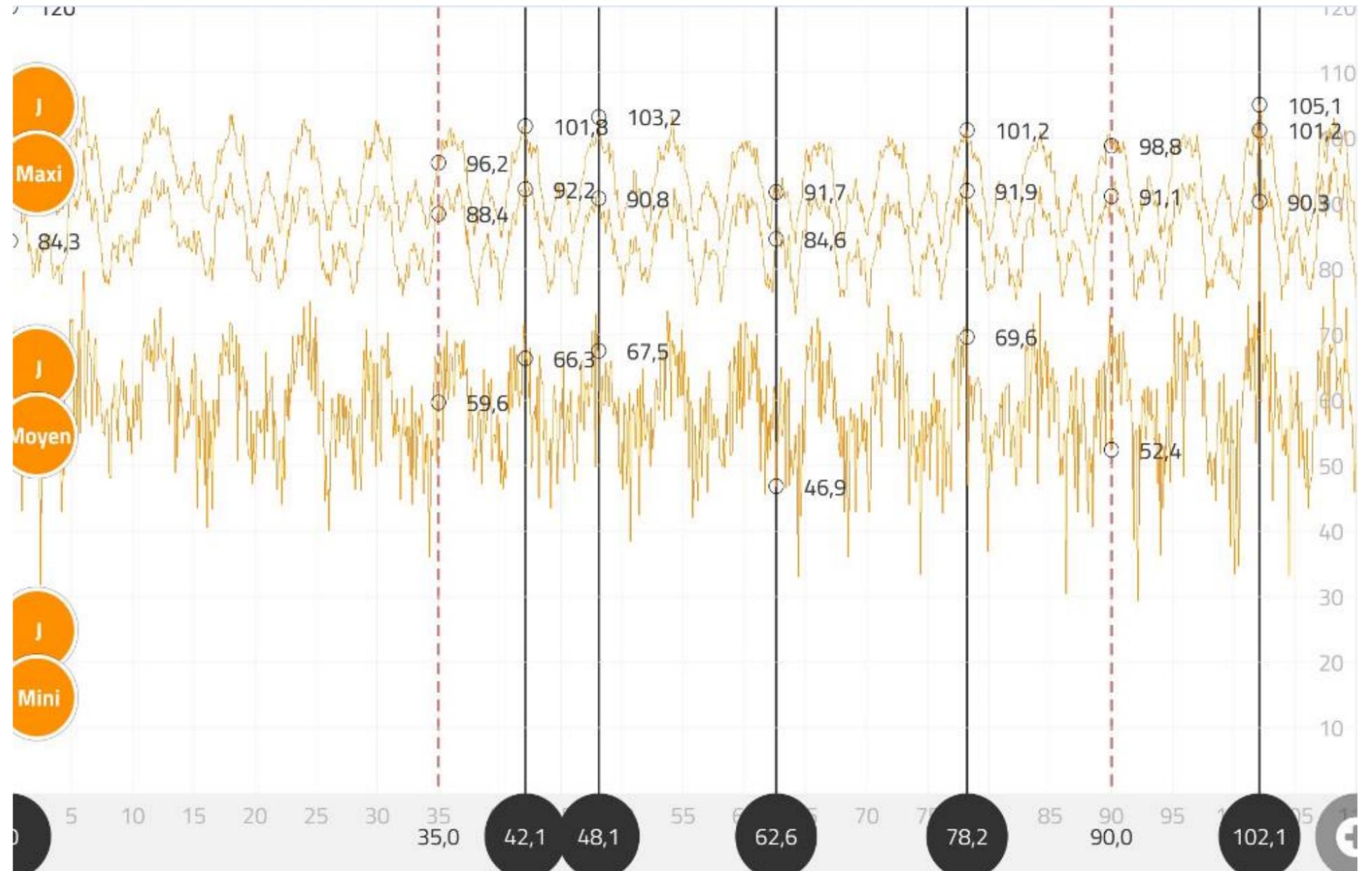
Measure
Disconnecting the boiler
room



Ask the operator
to filter the noise



Performances
went up



A story of allies and enemies



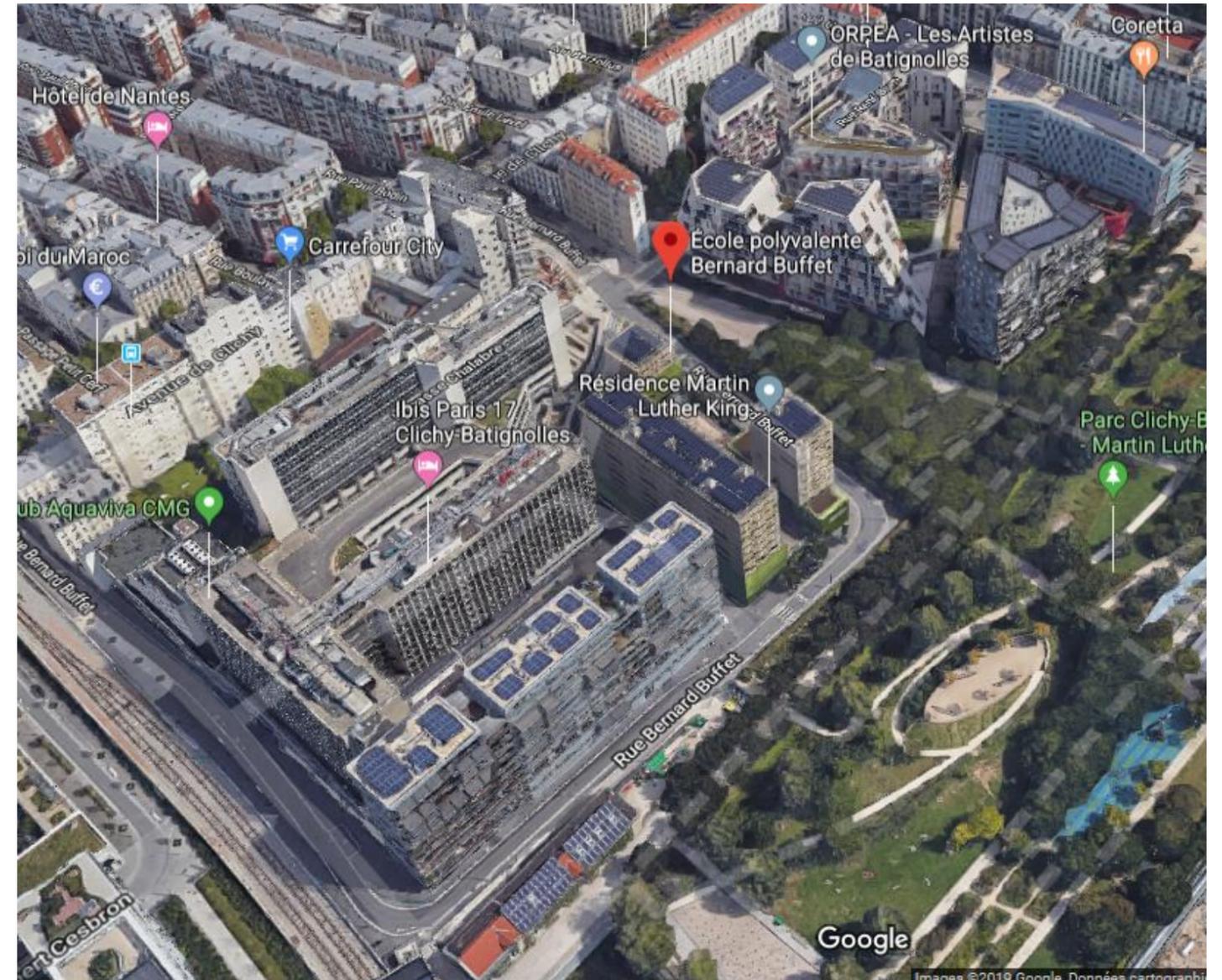
A story of allies and enemies

In-room analysis

- Massive roll-out not over yet: low saturation ratio
- Recent urban development with solar panels



Loads of enemies and few allies



A story of allies and enemies



Measure
In the substation



Measure close to a
feeder



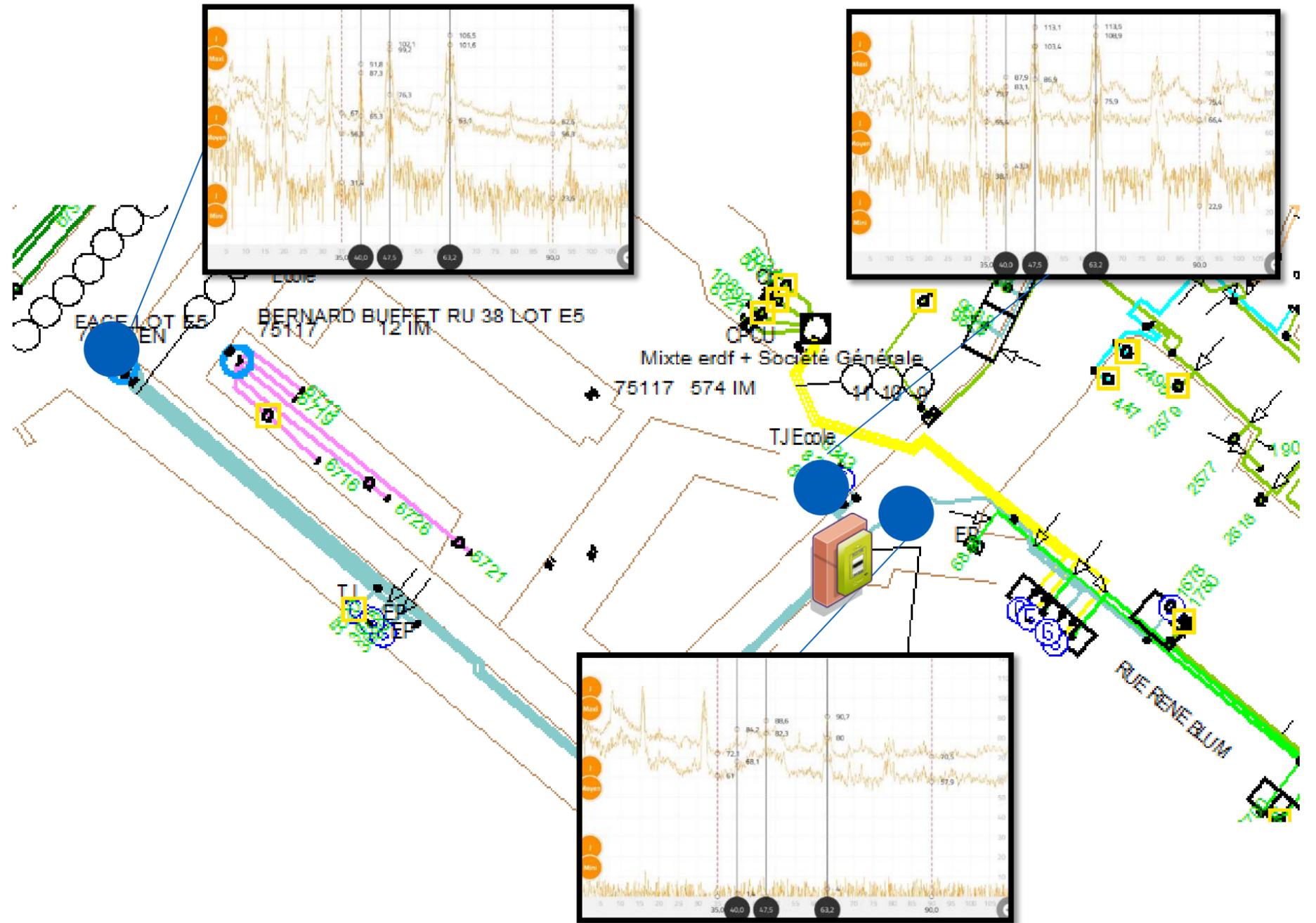
Measure close to a
feeder



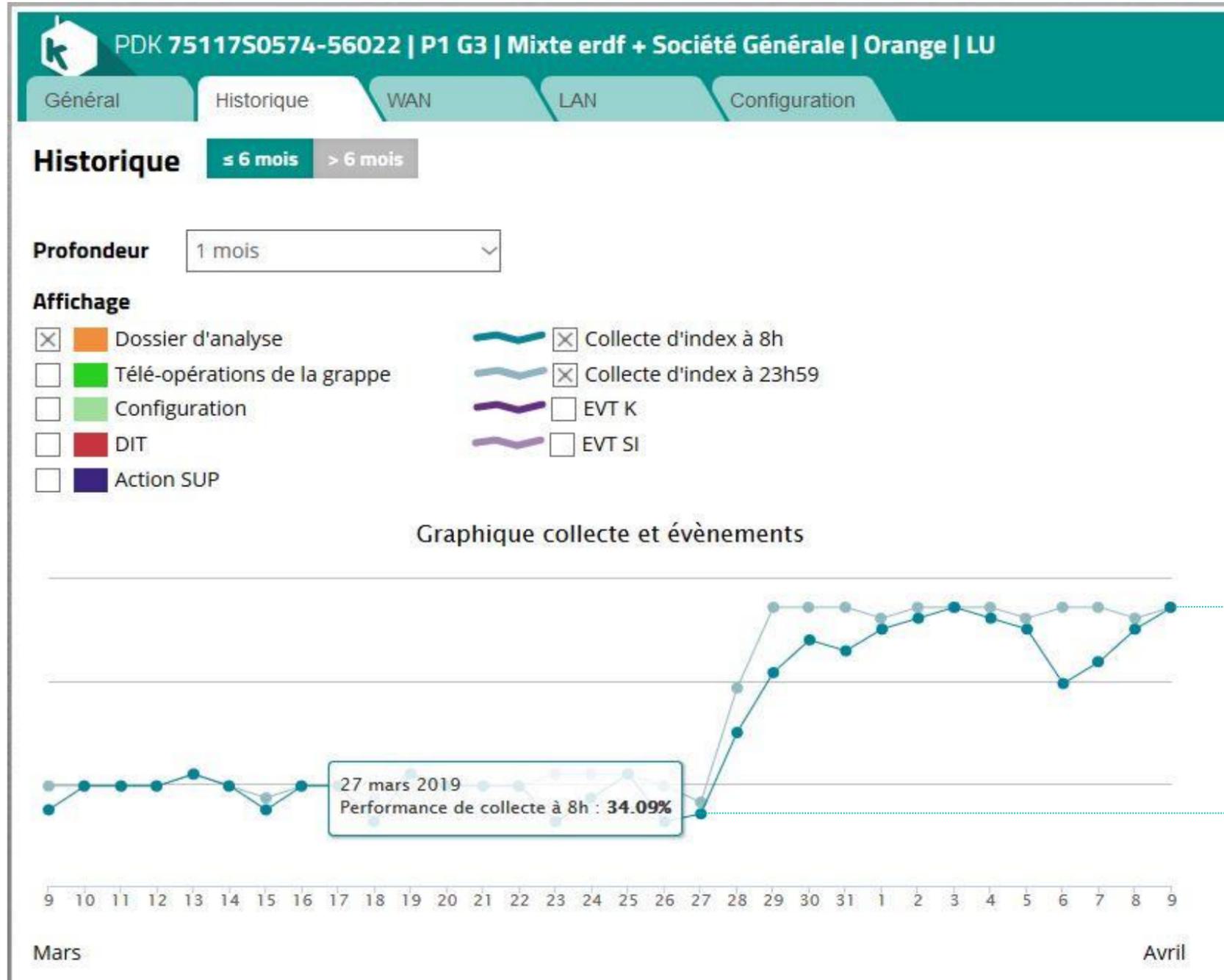
Install new meter



Performances
went up

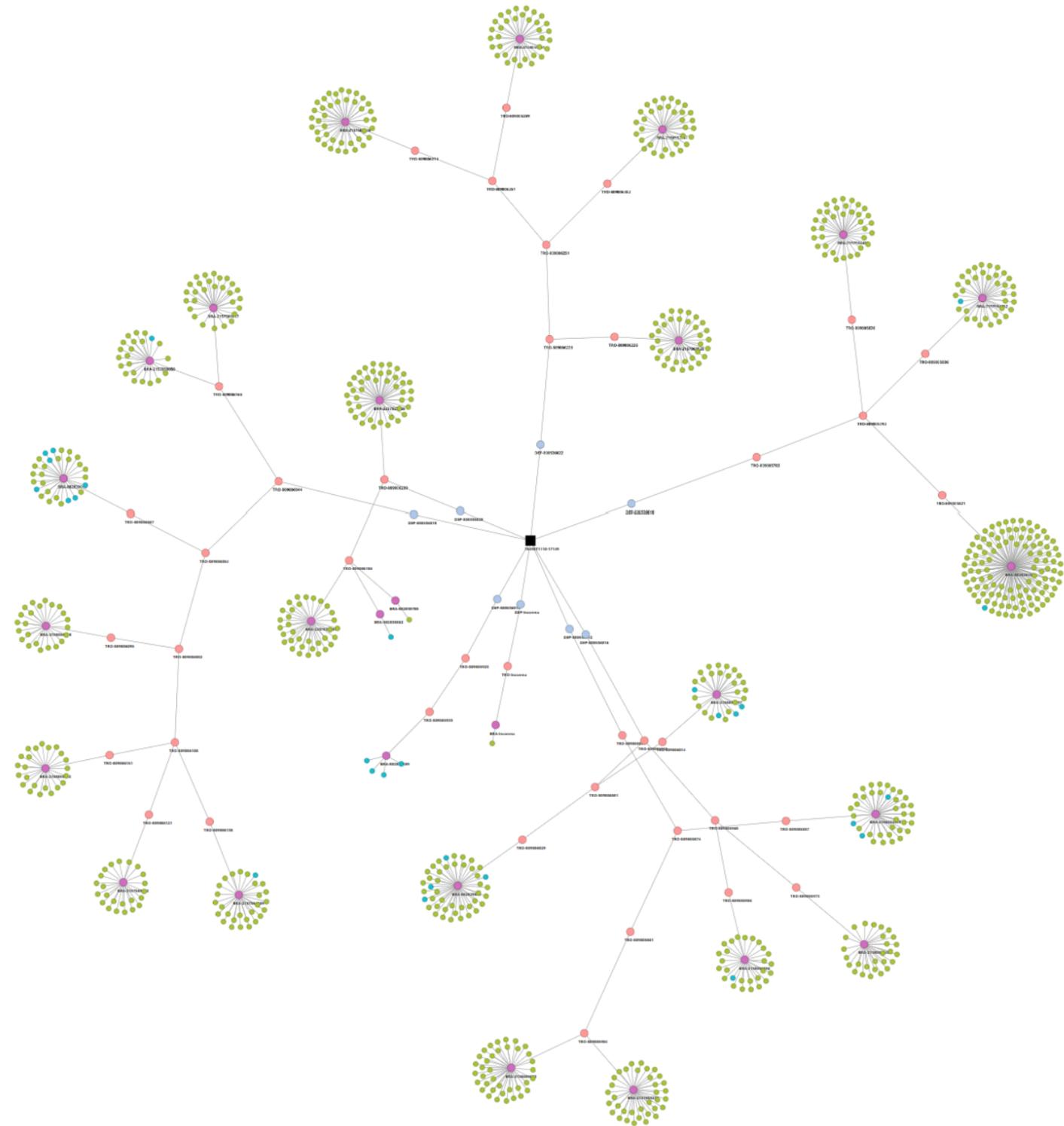


A story of allies and enemies



1 meter installed
+41 points
performance

Collecting 800 meters with 1 DC



Specific situations may require specific parameters



G3-PLC network analysis
with PLC sniffer



DC logs analysis



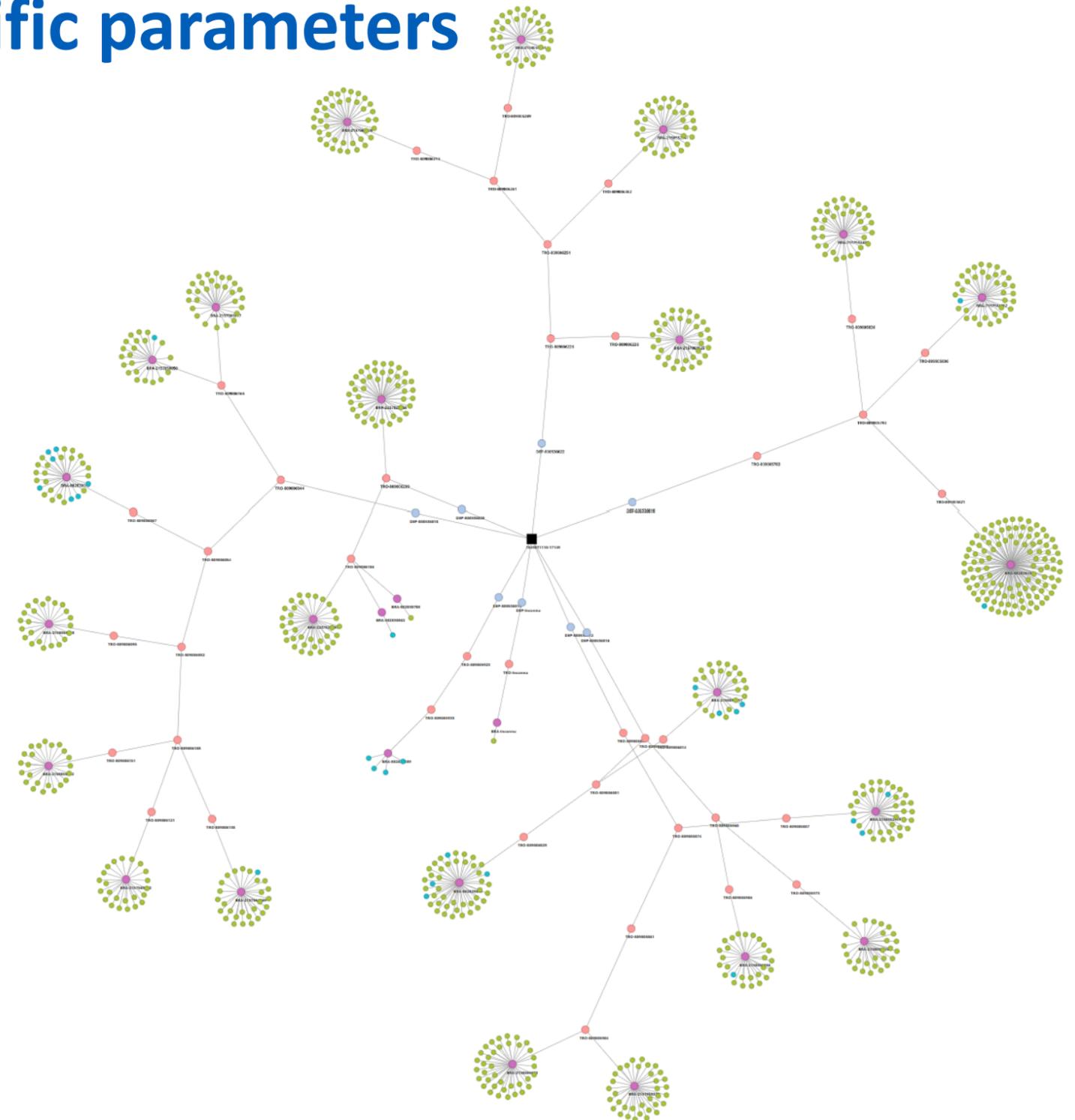
Collective work with technician,
supervision and G3-PLC experts



Parameter and software
optimisation



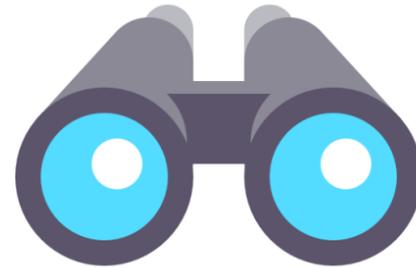
Performances went up
From 20% to 90% data collection rate !



To sum up, in our experience, PLC troubleshooting



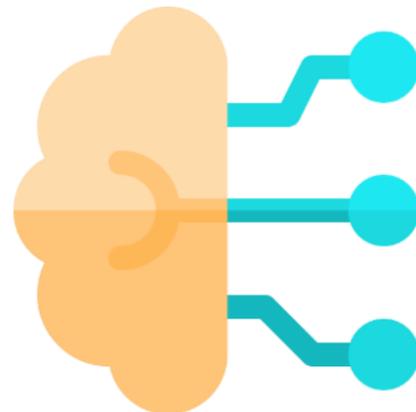
is
Vital



requires
observation & analysis



fuels
feedback loop



can be
automated



can be
outsourced



Thanks for attending this webinar today ! Do not hesitate to get in touch:



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