OBJECTIVE

To obtain reliable information on the actual physical connection of the meter with respect to the header phases in the secondary substation

❓ Why is this information not currently available?

Low Voltage installations are usually designed arbitrarily or according to static construction criteria, and the information is not then transferred to DSOs, or is transferred incorrectly.

PRIME ALLIANCE.

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MOTIVATION
Why is this information so important?

Because it improves and facilitates **network operation** by means of load balancing per phase

Network unbalance detection
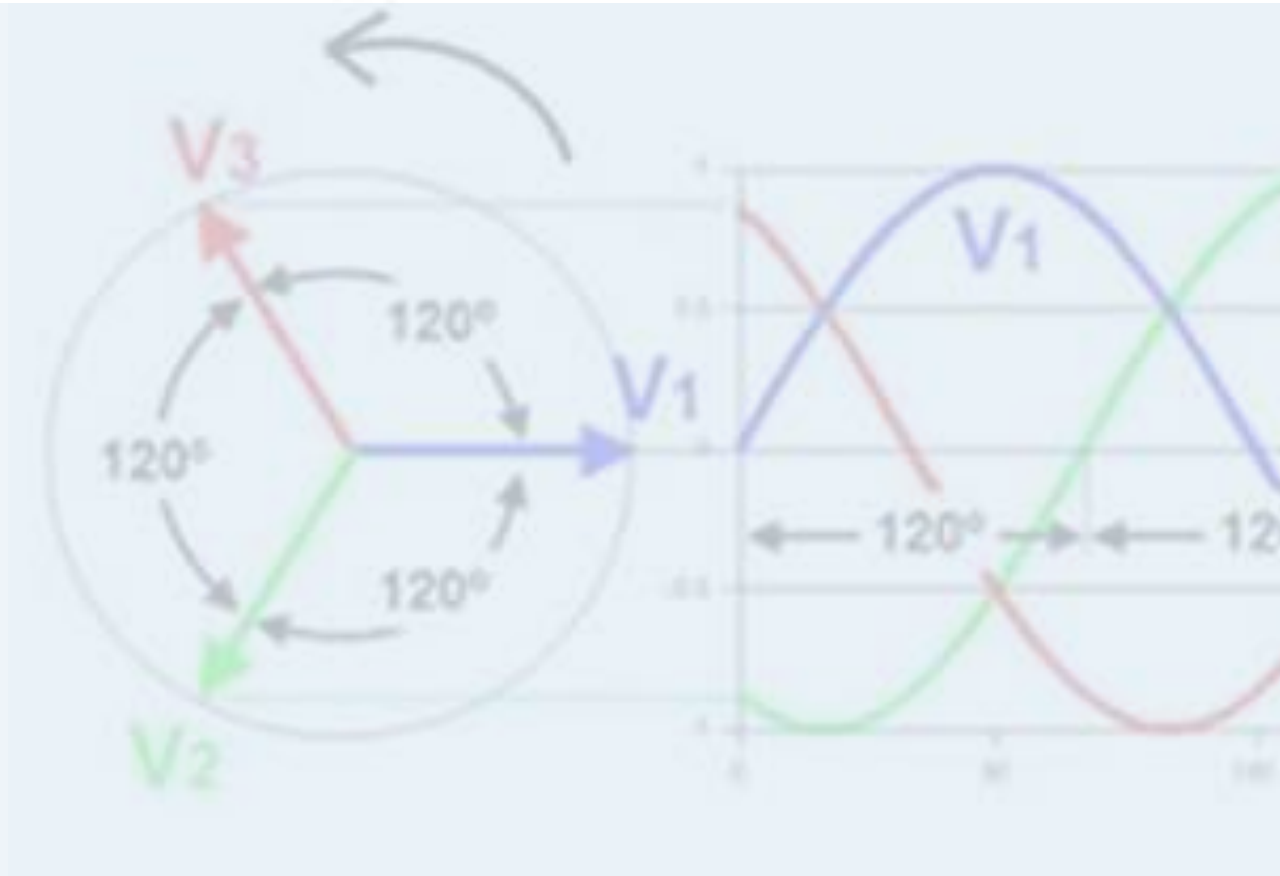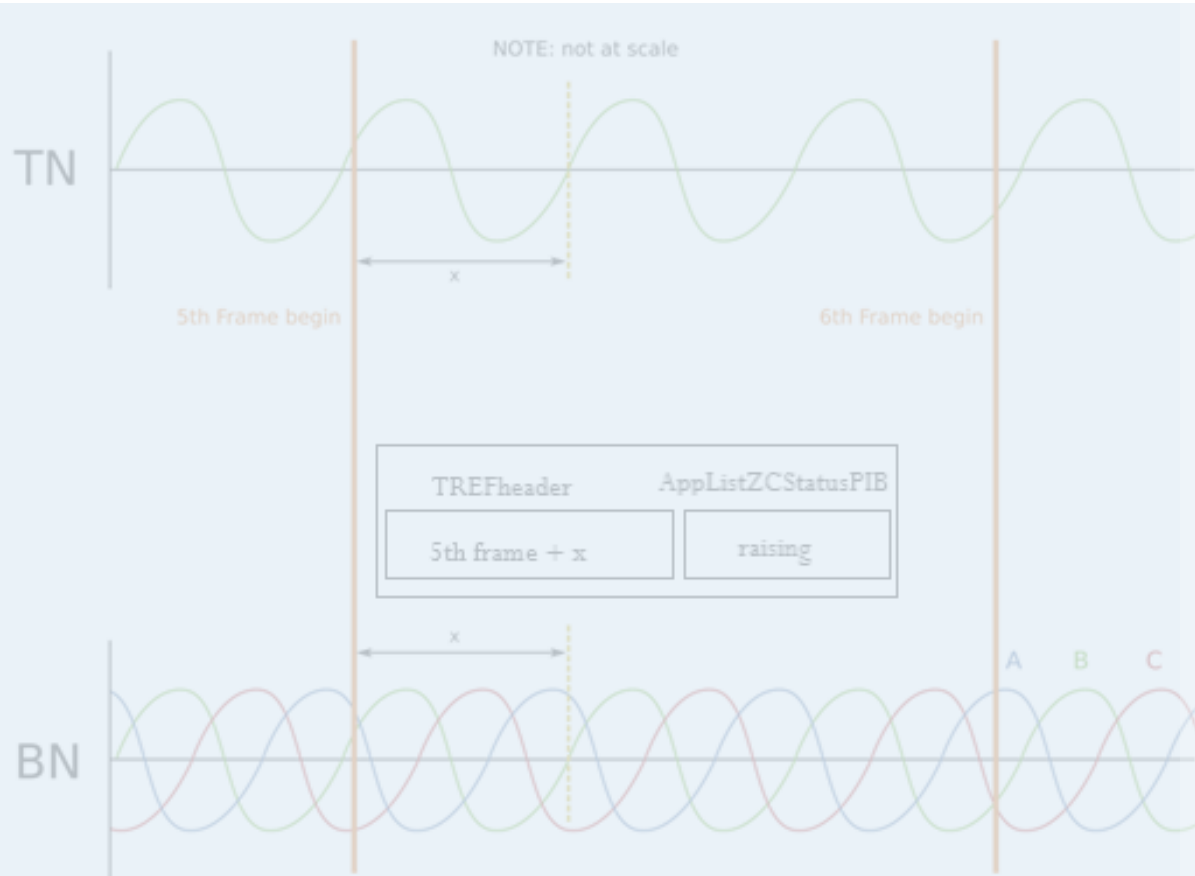
Because it improves **phase noise detection**

Because it allows to have a complete, accurate and updated **inventory of loads** in real time

Network unbalances cause serious network problems:

- Circuit overload, short-circuits, overheating

SOLUTION DESCRIPTION

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## Introduction to PRIME Technology

- [PHY] OFDM modulation robust against impulsive and frequency-selective noise

- [PHY] 96 subcarriers per channel (8 channels up to 500 kHz)

- [MAC] node discovery and network convergence automatic mechanism

- The base node (in the secondary substation) is the central element of the network and manages the topology.

- The service nodes (embedded in the Smart Meters) are registered in the base node and can automatically behave as repeaters (switches)

- **SYNCHRONOUS PROTOCOL-> The start time and duration of the frames are propagated through the network by means of "beacons" which are transmitted at fixed and known intervals, keeping the network synchronized with an unique time reference.**

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SOLUTION DESCRIPTION
Event transmission

All nodes can reference and transmit time information relative to the frame start instant , a "network time" that all nodes understand and interpret.

Time event: zero-crossing time of the 50Hz signal, relative to the frame start instant
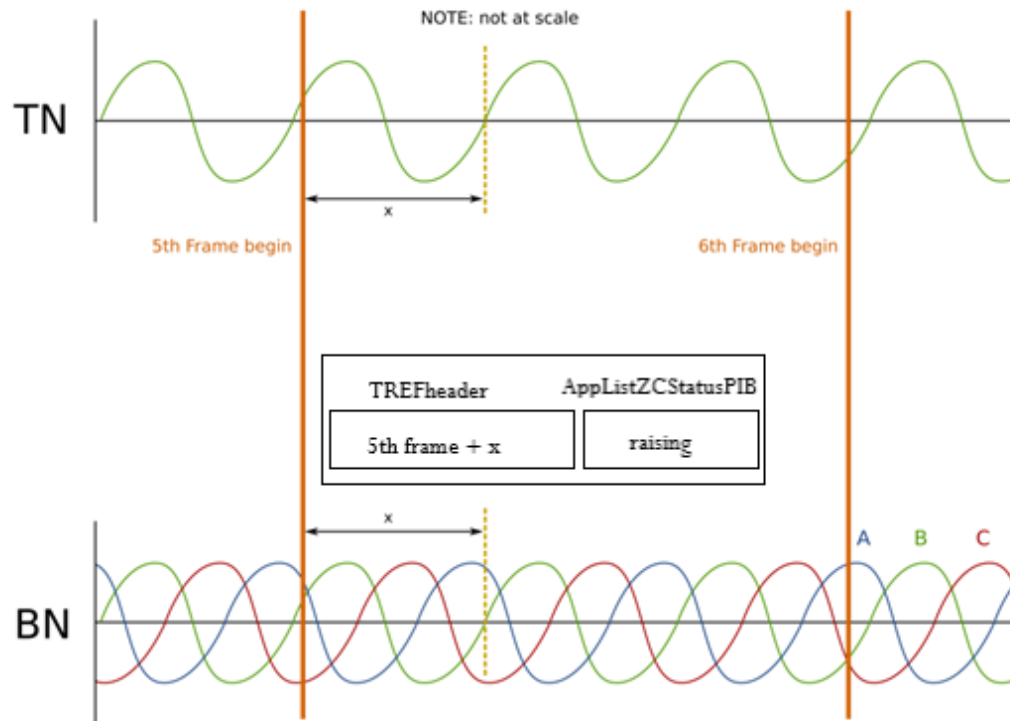
PRIME v1.4: The MAC subheader "Time Reference" is introduced, which allows nodes to exchange any temporal information (relative to the start of the frame)
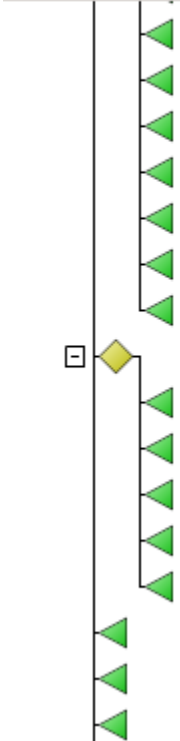
Phase Identification

The response of each service node to the AppListZCStantus attribute of the PIB includes in TREF the time reference of the zero crossing of its 50 Hz signal.

With this information, the base node knows the phase difference between the service node and its R-phase (considered as 0º).

The base node can transmit the phase difference for each registered service node. The phase difference is transmitted in angle units (between 0º and 359,99º) with respect to its phase and **it is possible to associate the phase of the node when the phase difference is close to 0º, 120º or 240º.**

EUI48	Location	Line	Quality	Phase	SID	LNID	State	SSID
40:40:22:42:53:52	Unknown			B 236.40º	1	5471	Terminal	None
40:40:22:42:53:54	Unknown			C 114.30º	1	4396	Terminal	None
40:40:22:42:53:5a	Unknown			A 359.82º	1	4978	Terminal	None
40:40:22:42:53:5b	Unknown			A 0.54º	1	4684	Terminal	None
40:40:22:42:53:5c	Unknown			C 117.36º	1	5302	Terminal	None
40:40:22:42:53:5d	Unknown			C 123.36º	1	5335	Terminal	None
40:40:22:42:53:5f	Unknown			C 122.82º	1	5389	Terminal	None
40:40:22:42:52:a0	Unknown			B 238.86º	0	5607	Switch	2
40:40:22:42:52:04	Unknown			B 238.14º	2	5355	Terminal	None
40:40:22:42:52:34	Unknown			C 116.64º	2	4666	Terminal	None
40:40:22:42:52:64	Unknown			A 5.22º	2	4973	Terminal	None
40:40:22:42:52:75	Unknown			B 237.96º	2	4887	Terminal	None
40:40:22:42:53:61	Unknown			A 4.86º	2	5324	Terminal	None
40:40:22:42:51:fd	Unknown			A 1.44º	0	5401	Terminal	None
40:40:22:42:52:01	Unknown			B 239.94º	0	4616	Terminal	None
40:40:22:42:52:11	Unknown			A 0.36º	0	5693	Terminal	None
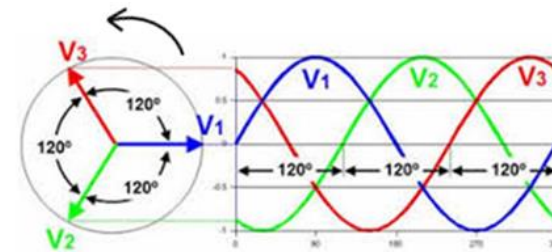
CONCLUSIONS

Native   **Reliable**   **Accurate**   **Instantaneous**   **Interoperable**:

CONCLUSIONS
NATIVE + RELIABLE + ACCURATE + INSTANTANEOUS + INTEROPERABLE method

Native
The information is obtained directly from the PRIME nodes, it does note require any other type of sensor or algorithm.

Reliable and deterministic
Phases calculated correctly in 100% of meters

Accurate
The maximum deviation obtained in angle is very small, far from the uncertainty limit

Instantaneous
On demand. As another meter reading

Interoperable:
All PRIME 1.4 nodes incorporates this functionality

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¡Thank you!

Phase mapping in PLC PRIME Networks

¿Questions?

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