Harness AMI data to verify the distribution network model

An accurate digital model that reflects the actual network configuration is essential for managing a safe and efficient low-voltage distribution network. It helps power system engineers more accurately predict which customers may be affected by an outage. It also reduces expensive truck rolls needed for network audits. An exact digital network model is also important for utilities as they respond to increasing numbers of renewable interconnection requests.

In addition to emergency repairs to restore power outages, new construction, line upgrades or repairs can lead to inaccuracies in the network model and what is the ground truth in the field, which also impacts other work such as:

- Phase balancing
- Transformer load management
- Demand response
- Outage impact evaluation accuracy
- Inaccurate power system models reduces the value of several utility applications such as distribution planning software, OMS, ADMS, DERMS, etc.

Eaton's Distribution Network Verification solution, using a novel phase detection method, helps utilities leverage their AMI data to align their digital models to the ground truth, improving outage management and LV capacity planning processes.
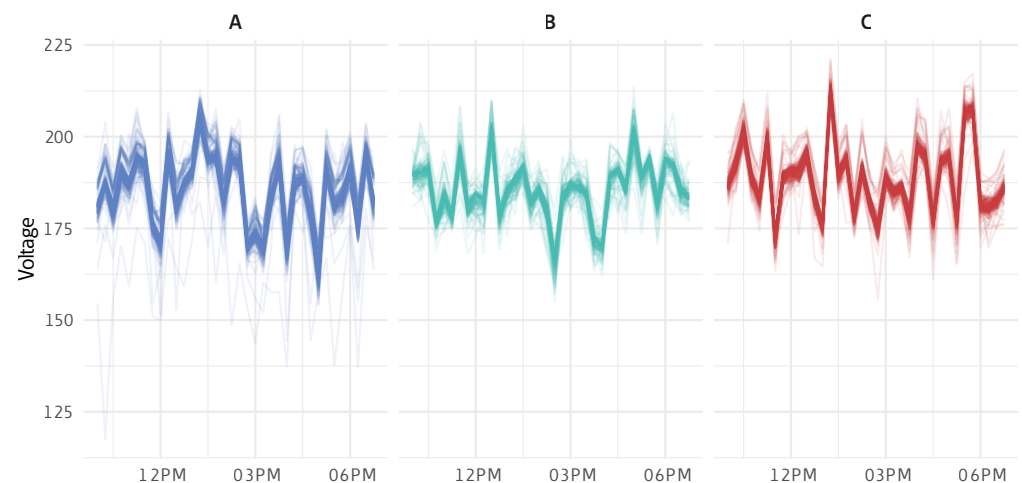
Built by Eaton's data science team and validated in the field with our customers, we are providing this new solution via the Brightlayer platform for deployment of cloud-based business intelligence. Our customers have achieved 99% phase alignment using Eaton's new phase detection method.

How does AMI-based phase detection work?

Voltages of single-phase meters on the same feeder will exhibit similar behavior if they are installed on the same phase. In a first step we find these similarities by applying feature engineering techniques to transform the voltage data in order to highlight inter-phase differences, giving a clear picture of which meters are on which phase.

Meters on a shared phase show similarities in voltage trends

Voltage over time on February 1st

Next we use machine learning techniques to identify those meters with phase assignments that are most likely to be correct at present. Our model leverages these presumed known phase labels to predict the correct phase assignments for the remaining meters. This field-validated algorithm has been developed specifically to handle difficult cases such as large groups of meters mislabeled concurrently and the presence of voltage regulators impacting the observed voltage trends.

AMI voltage data can distinguish between phases and identify mislabelled meters

Each point represents one meter. Features engineered from raw AMI voltage data

Phase label • A • B • C
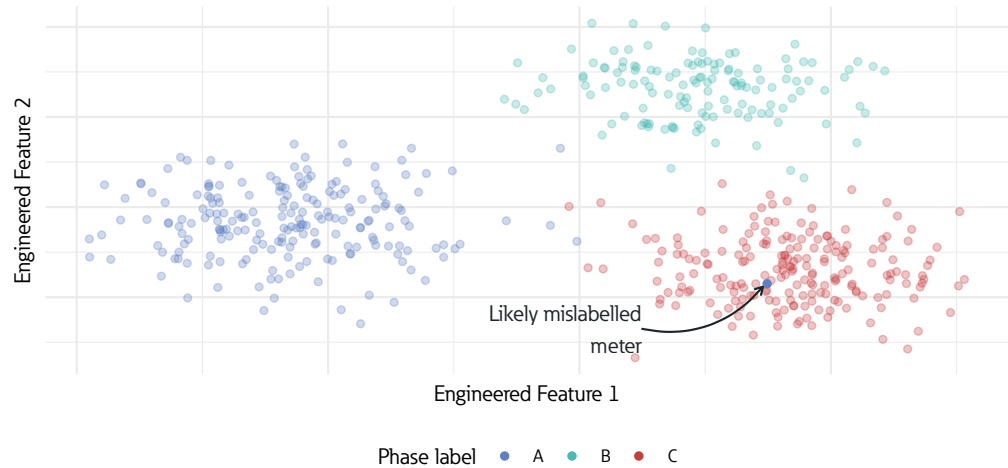
What data do you need?

This phase detection algorithm works with accurate voltage data from any AMI meter. You can achieve optimal results with six months of residential voltage data (hourly samples) together with existing single-phase meter phase labels and network model. The data is uploaded to Eaton's secure Brightlayer cloud analytics platform for immediate verification.

Understanding the phase detection insights

Phase detection insights will be delivered to you in both a narrative report and text file for ease of import into your in-house mapping tools. These insights will help you visualize any meter phase labels that are out of sync or generate work orders for investigation of possible field issues. Finally, you can use these operational insights to update the model of your distribution network to match real-world conditions.

For more information, visit
Eaton.com/phasedetection

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