Redefining the Grid from the Edge with Distributed AI

CURENT Industry Conference

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Utilidata

Utilidata has operated real-time machine learning software on the grid for a decade

- **2015** Real-time grid optimization software deployed at scale with utilities
- **2019** Developed first applications for meter company software platforms
- **2021** Partnered with **NVIDIA** to develop a smart grid chip
- **2023** Early adopter utilities received funding from Department of Energy
- **2024** Partnered with Aclara to embed Karman in smart meters



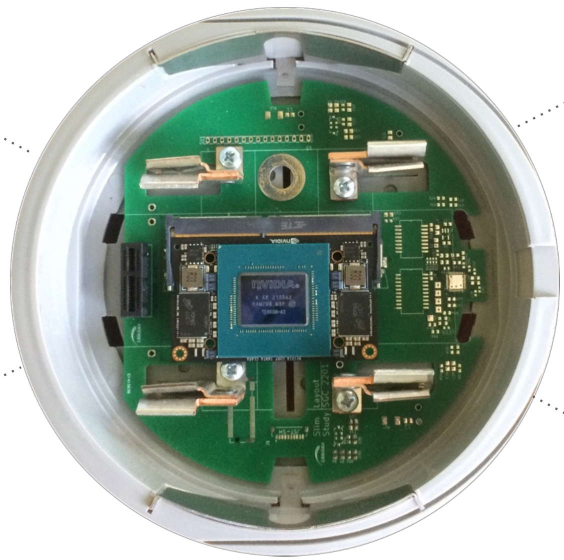

Meet Karman - a distributed AI platform powered by NVIDIA

Open, modern architecture

Software-defined data processing and communications to support unlimited applications

Advanced computation

Operates 100x faster than market solutions to enable decision-making locally at every endpoint



Robust communications

Communicates to a centralized ADMS, other Karman units, DERs, and additional devices

Easy access to data

Core services analyze millions of data points and deliver actionable insights via APIs and a user interface

Utilidata-NVIDIA custom module, powered by Karman

With 100x more processing power than current meters, our custom module will make it easier and more affordable to deploy AI and edge computing into grid edge devices

At DISTRIBUTECH International 2024, from left to right: an NVIDIA Jetson developer kit, Utilidata's meter collar, and 3D print model of Utilidata's custom module

Karman will improve nearly every aspect of utility operations

Real-time Visibility

EV Integration

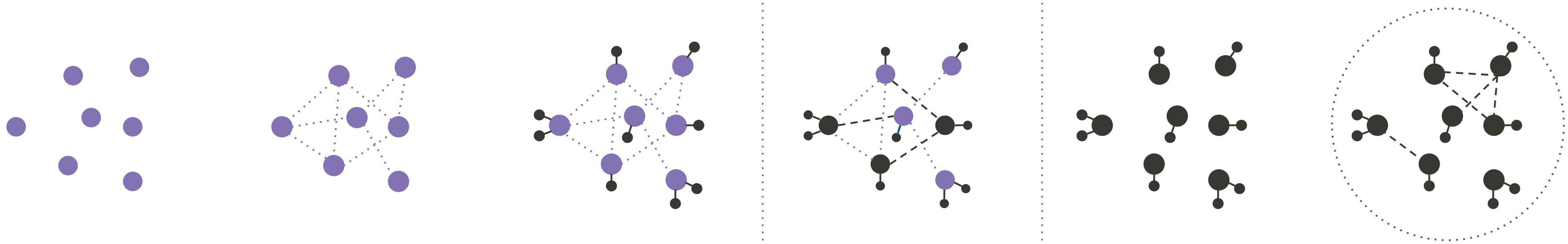
Solar Integration

Resiliency

Demand

Billing and Service

Enabling a progression to an autonomous grid



Visibility
Gather real-time data to understand grid conditions

Predictive Analysis
Use the real-time data to forecast and predict grid conditions

DER Management
Facilitate communications between DERs and the grid so DERs can operate as part of the grid

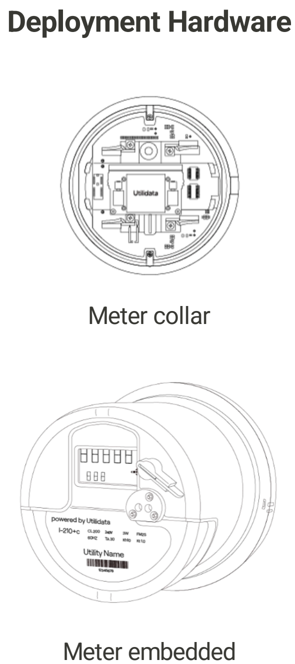
Coordination
Use real-time data and DER management to take preventative action

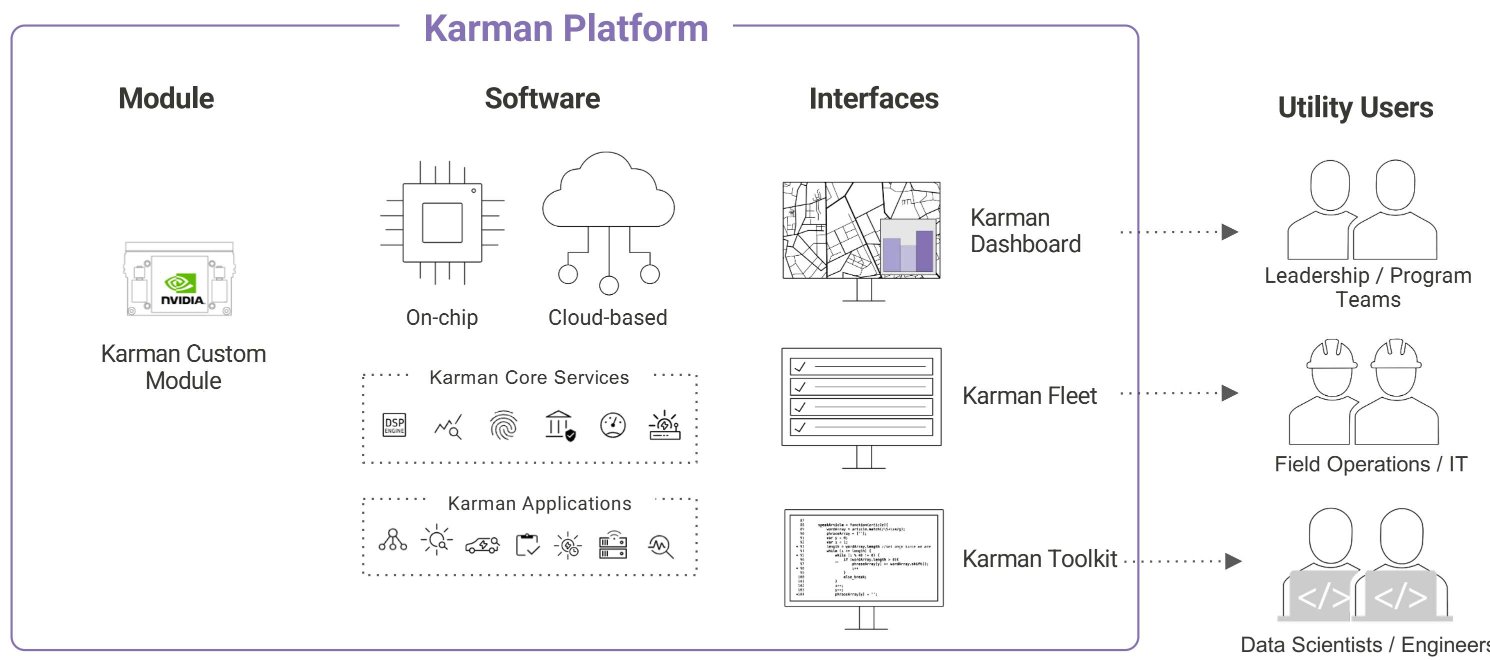
Dynamic Islanding
Use DERs to power a customer location when the grid goes down

Autonomous Microgrids
Use real-time data and DER management to recover the grid after an emergency

Now — **Next** — **Future**

Utilidata's Karman platform





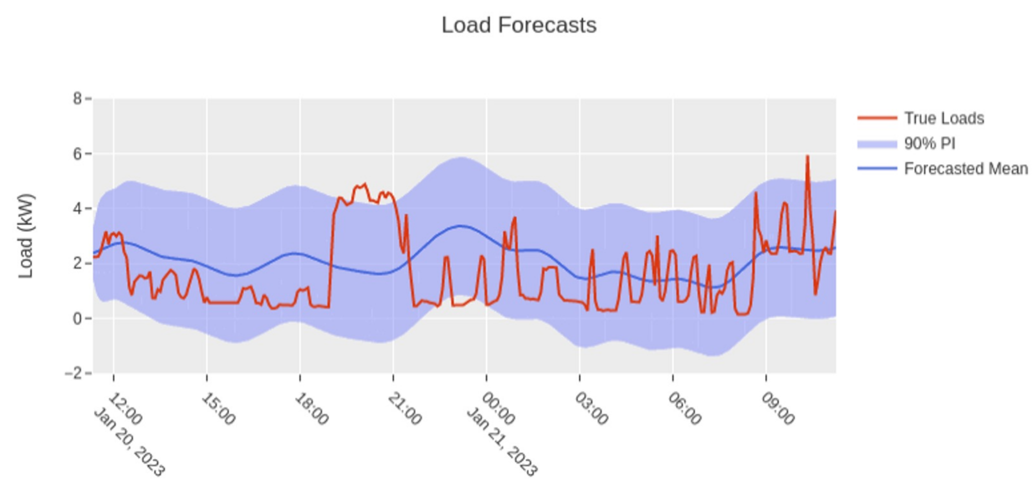
Karman core services include DSP engine, anomaly detection, digital fingerprint, data integrity, resource monitoring, DER gateway

Karman applications include topology, solar detection, EV detection, power quality evaluation, DER scheduling, real-time hosting capacity, anomaly classification

Karman continuously learns to forecast load at a single site using local AI-based algorithms

Karman can use federated learning to share critical insights between sites without sharing private information.

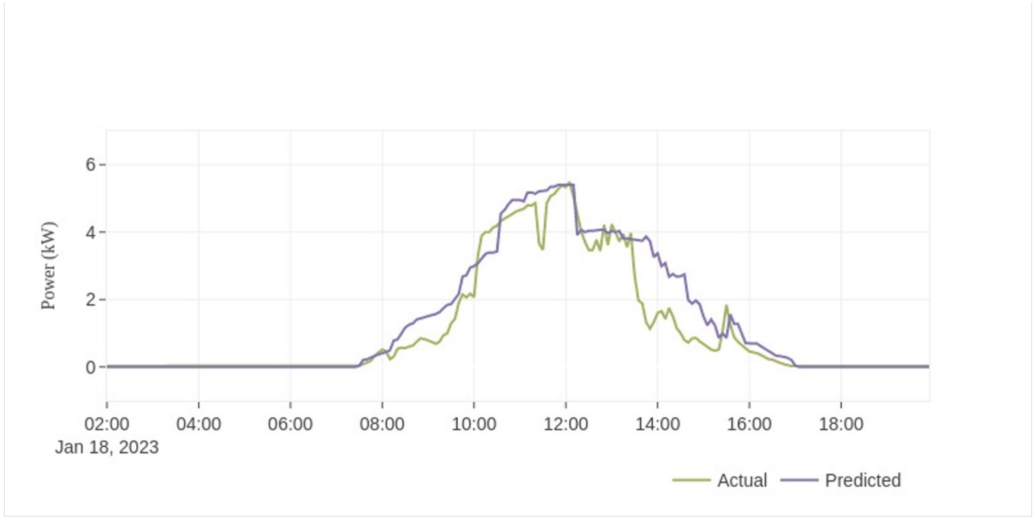
The load forecasts, which are produced on-demand, are used by other applications, such as DER scheduling.



Karman is continuously forecasting in real-time (purple).

Karman continuously identify and forecast a single site PV output using local AI-based algorithms

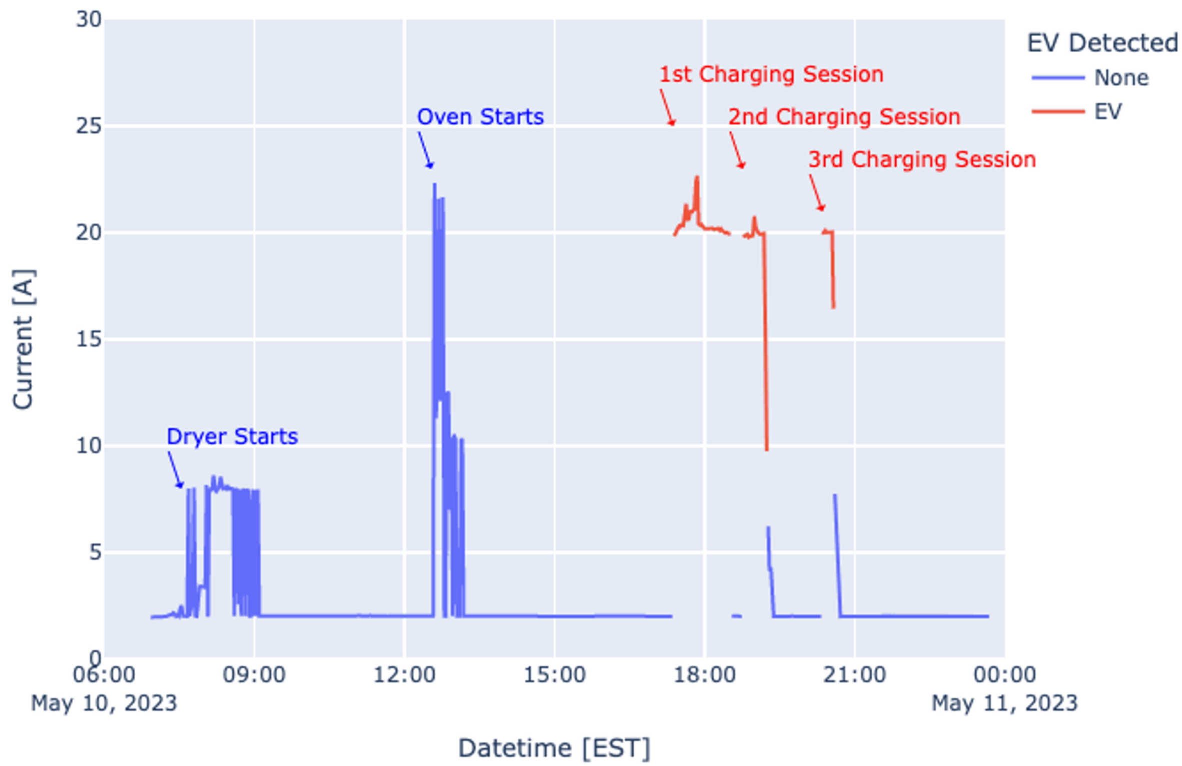
Local AI algorithms identify patterns in large volumes of data and make predictions like forecasting behind-the-meter PV production at resolutions not seen to date



Karman detects EV charging and distinguishes it from other loads at the house

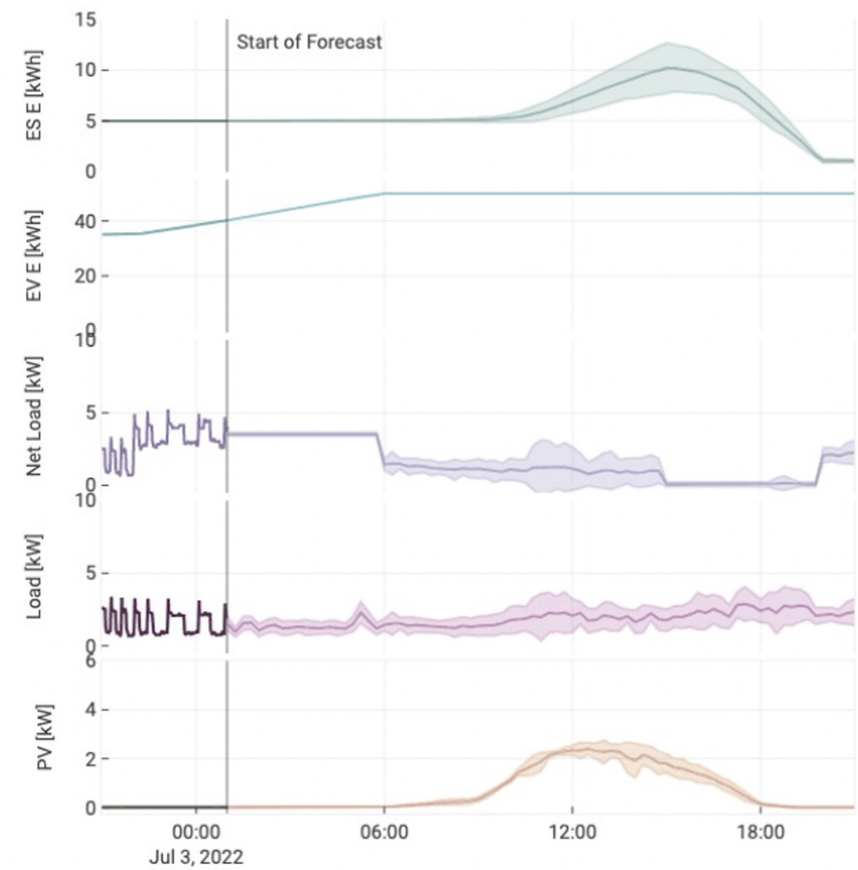
Karman uses on-chip algorithms to detect the start time of EV charging within seconds and instantly makes those events known to other applications, such as DER scheduling.

Traditional and inefficient methods look at energy use trends over time and retrospectively select the times that EV charging is likely to occur.



Karman uses local insights to increase the value of energy management for customers

Karman can forecast premise level loads at resolutions not seen to date through existing solutions and optimizes schedules for energy storage, EVs, and solar



We partnered with the University of Michigan to study EV charging behavior and its impact on the grid

Karman collected real-time waveform resolution voltage, current, and power data at the edge of the grid, allowing researchers to analyze and detect EV charging patterns and better understand how to manage EV demand

UMTRI TRANSPORTATION RESEARCH INSTITUTE UNIVERSITY OF MICHIGAN

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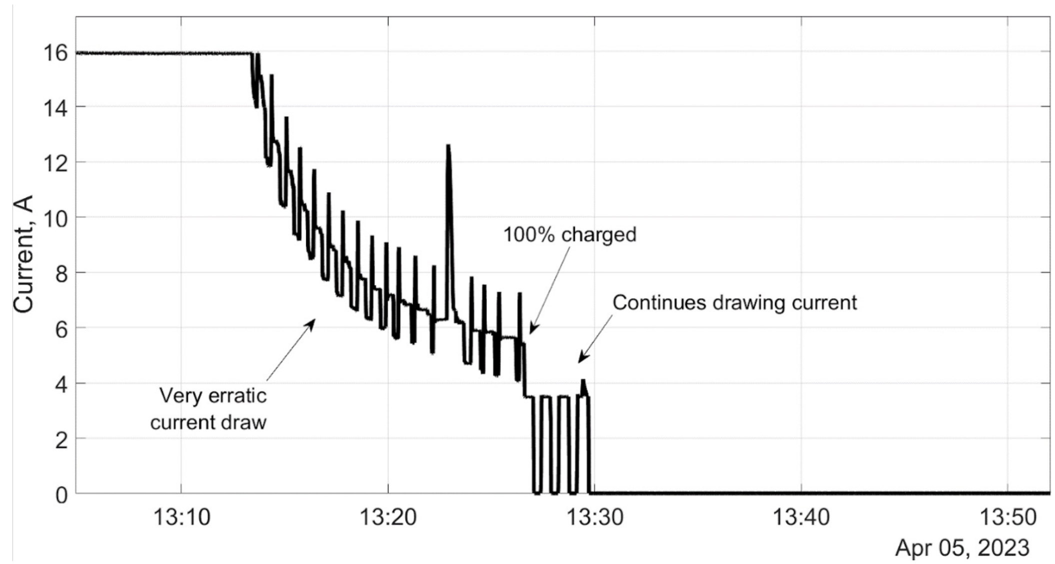
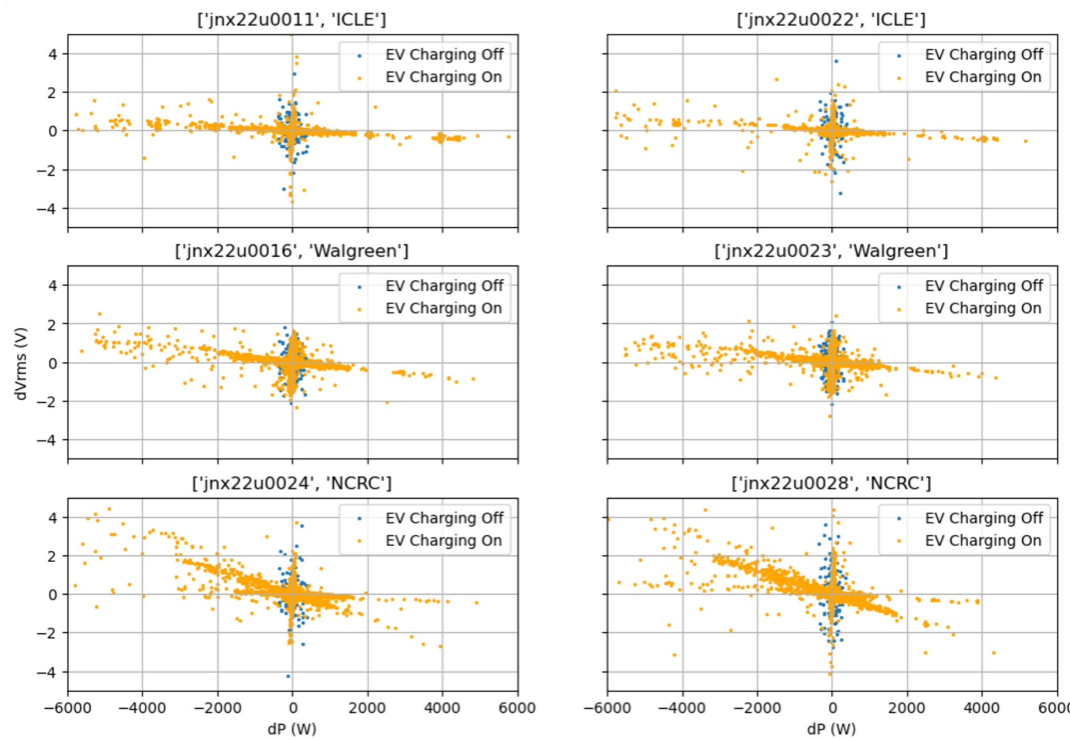
EV charging caused large, rapid swings in current draw

Inconsistent power draw results in inefficient energy consumption, which could lead to overheating lines, power loss, and outages



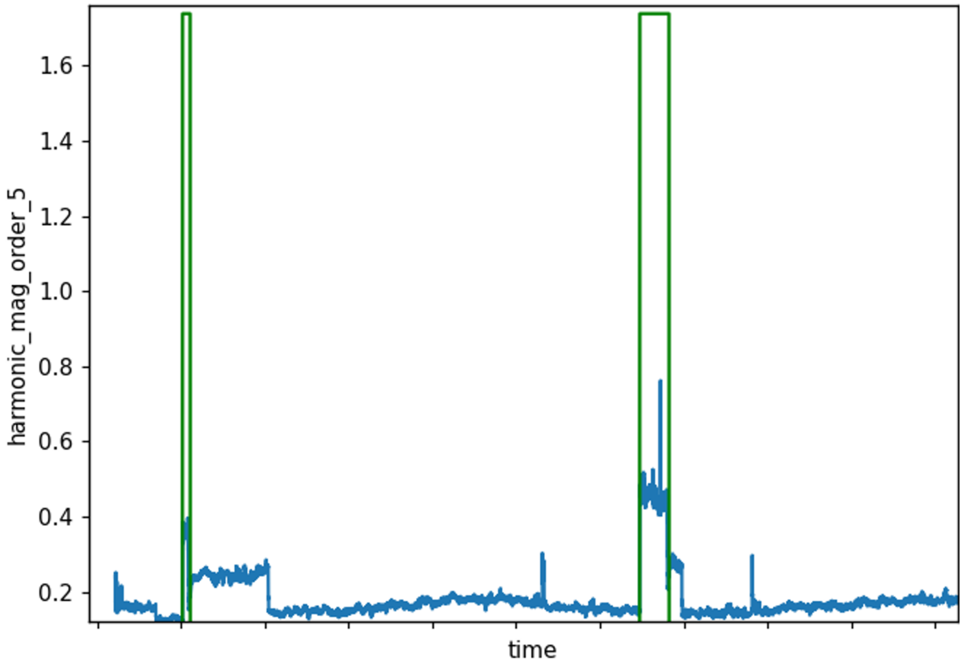
EV charging causes variability in local voltage

The ability to measure these changes with edge computing allows utilities to understand which locations can accommodate EV charging



EV charging lowers power quality by introducing current harmonics generated from the conversion of AC to DC power

Low power quality causes equipment degradation and failure for both utilities and consumers (flickering lights, excessive motor wear and tear, and premature failure of home appliances)



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Thank you