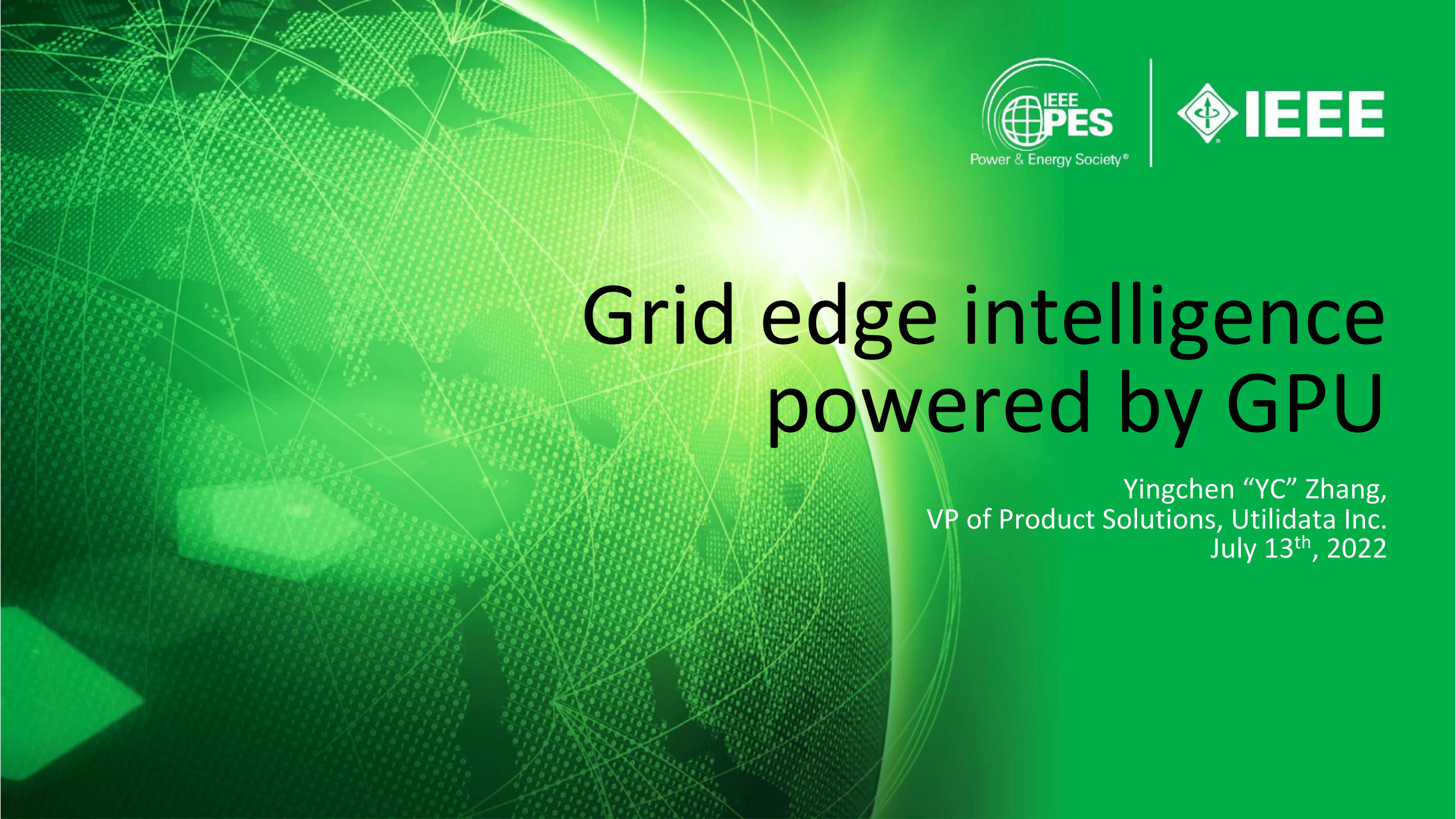


Grid edge intelligence powered by GPU

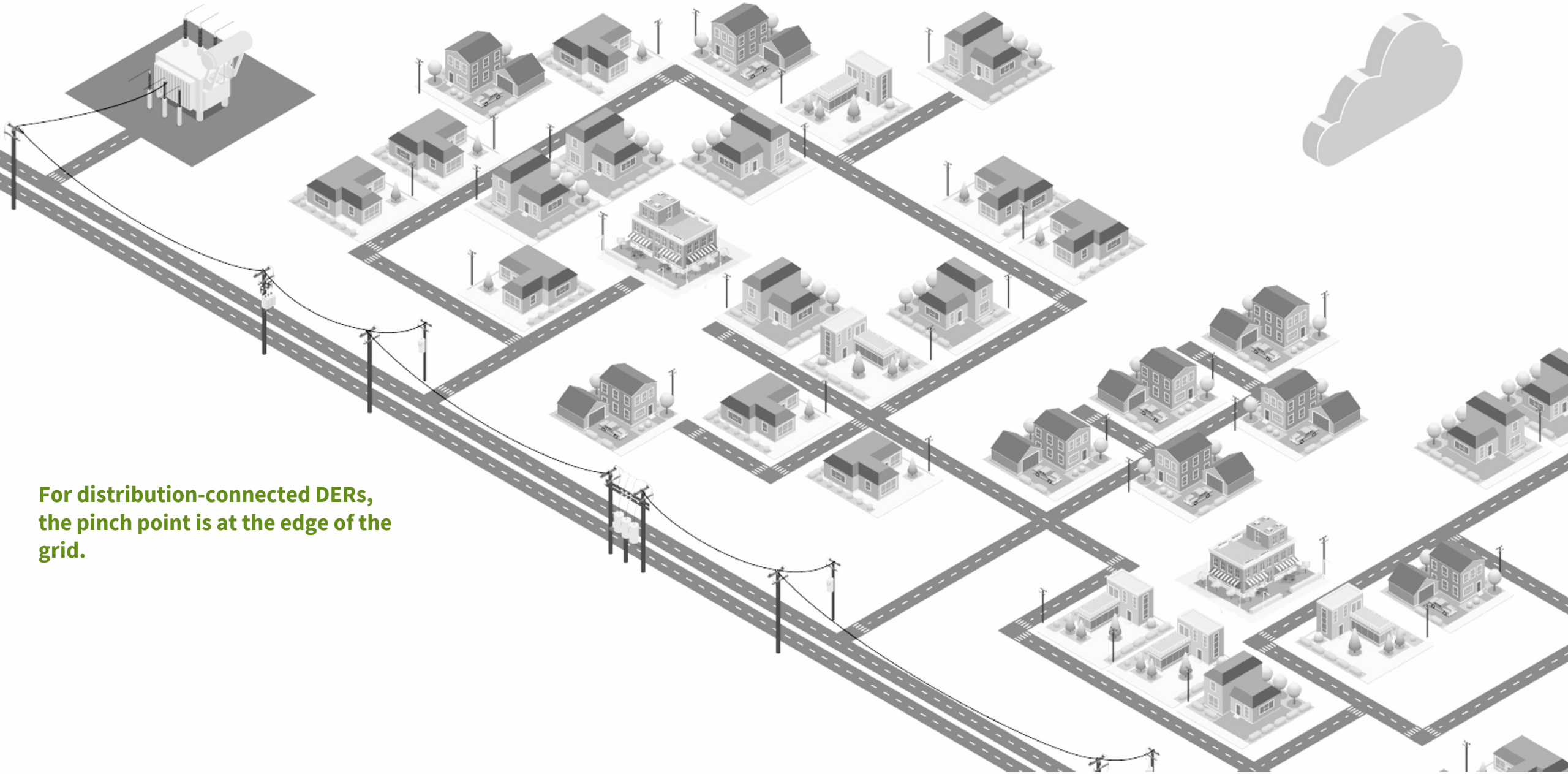
Yingchen “YC” Zhang,
VP of Product Solutions, Utilidata Inc.
July 13th, 2022

ABOUT UTILIDATA

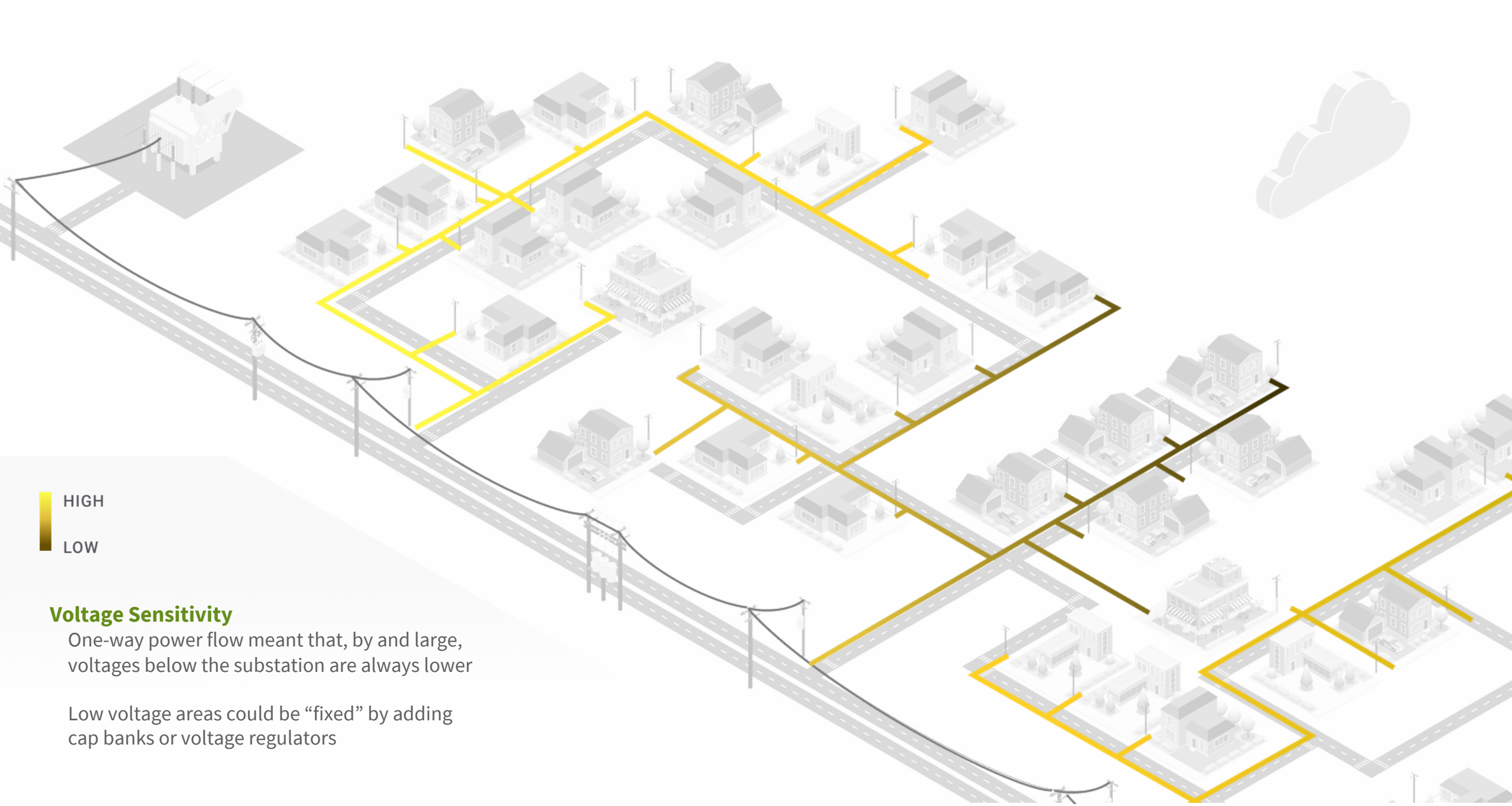
Open-source distributed AI to accelerate decarbonization

We are an industry leading grid-edge technology company with:

- A decade of experience operating and optimizing distribution grid assets
- Groundbreaking software and partnerships that unlock greater value from smart meters
- A diverse team of experts working to align commercial, technical, and regulatory outcomes



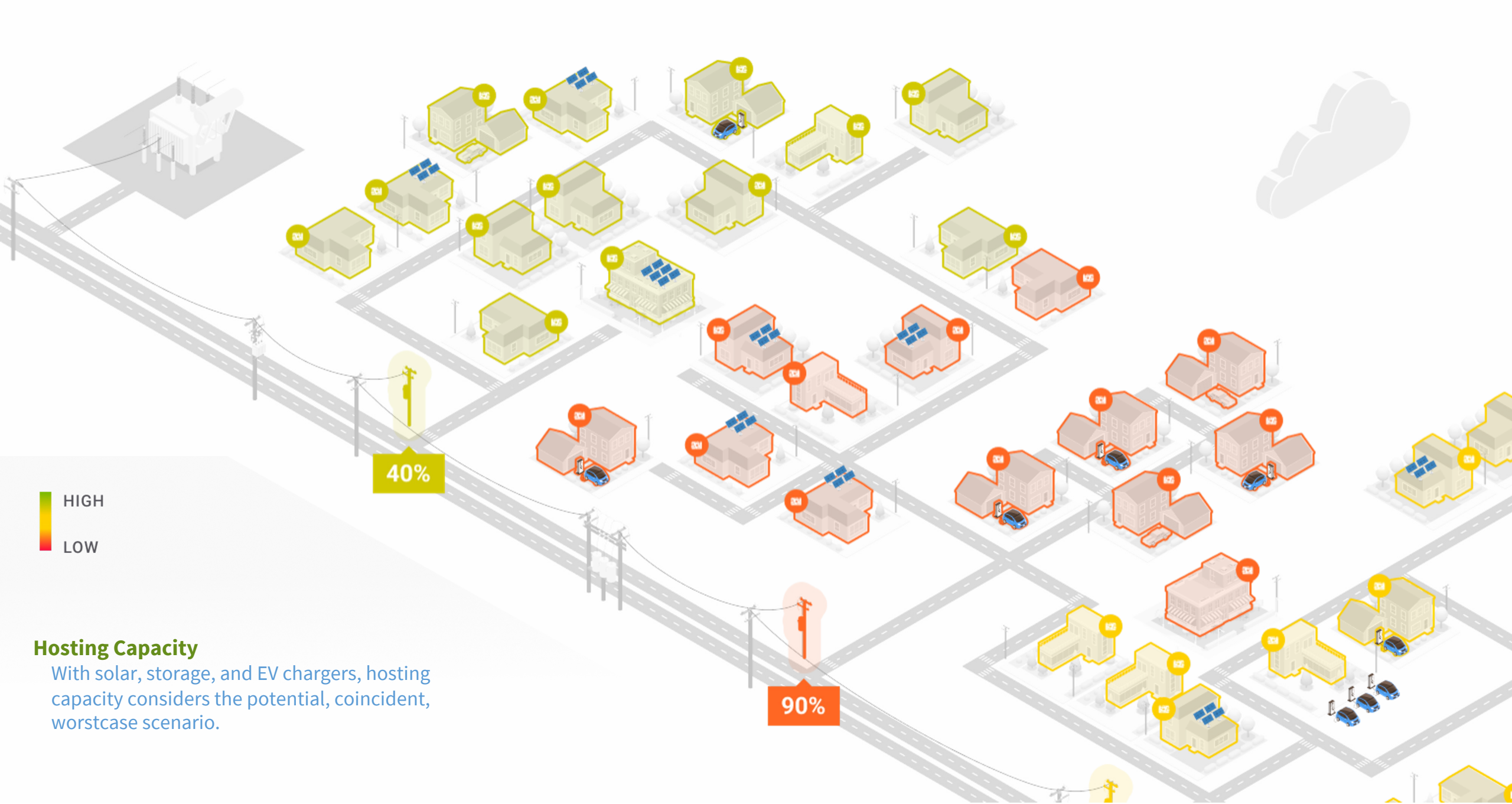
For distribution-connected DERs, the pinch point is at the edge of the grid.



Voltage Sensitivity

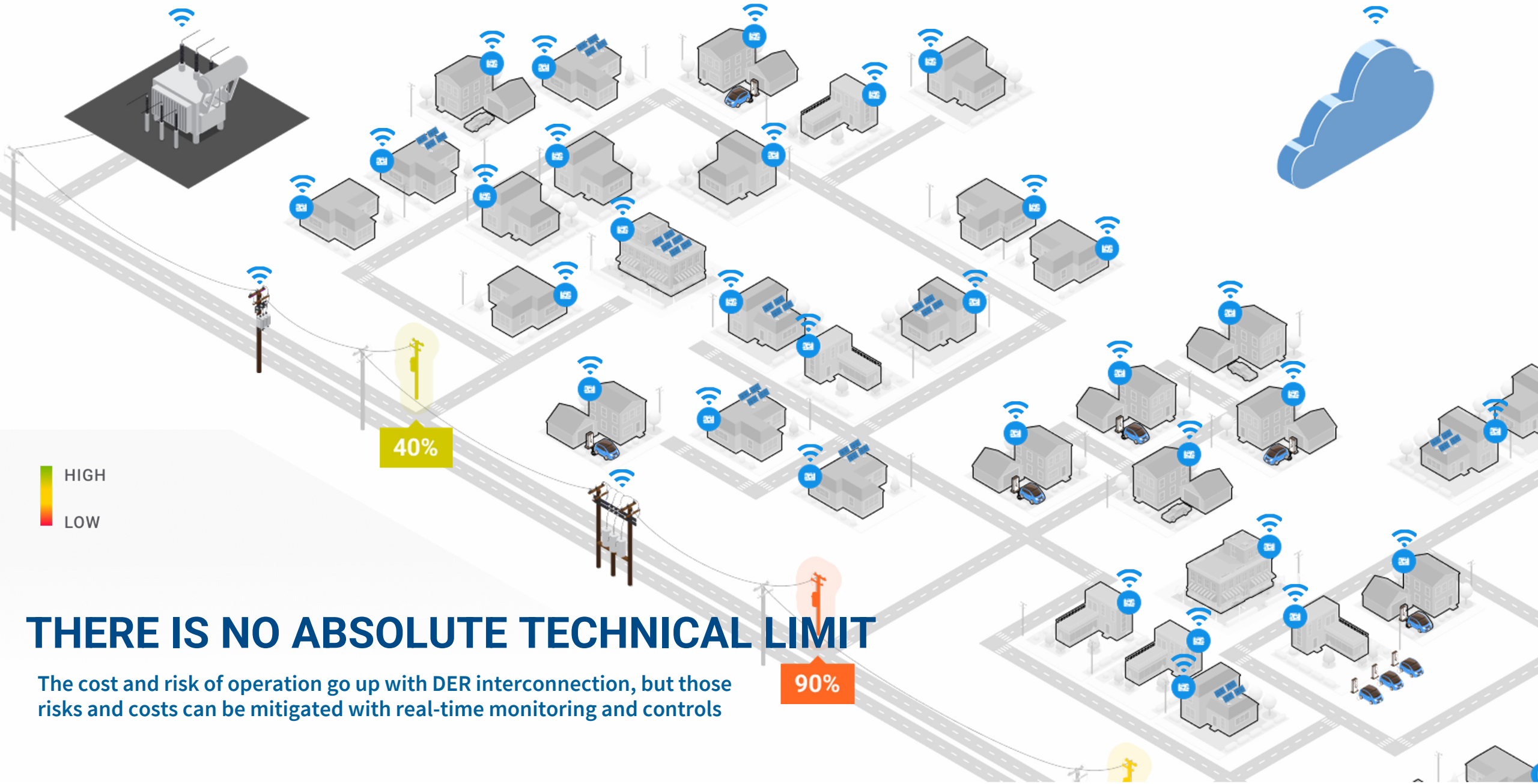
One-way power flow meant that, by and large, voltages below the substation are always lower

Low voltage areas could be “fixed” by adding cap banks or voltage regulators



Hosting Capacity

With solar, storage, and EV chargers, hosting capacity considers the potential, coincident, worstcase scenario.

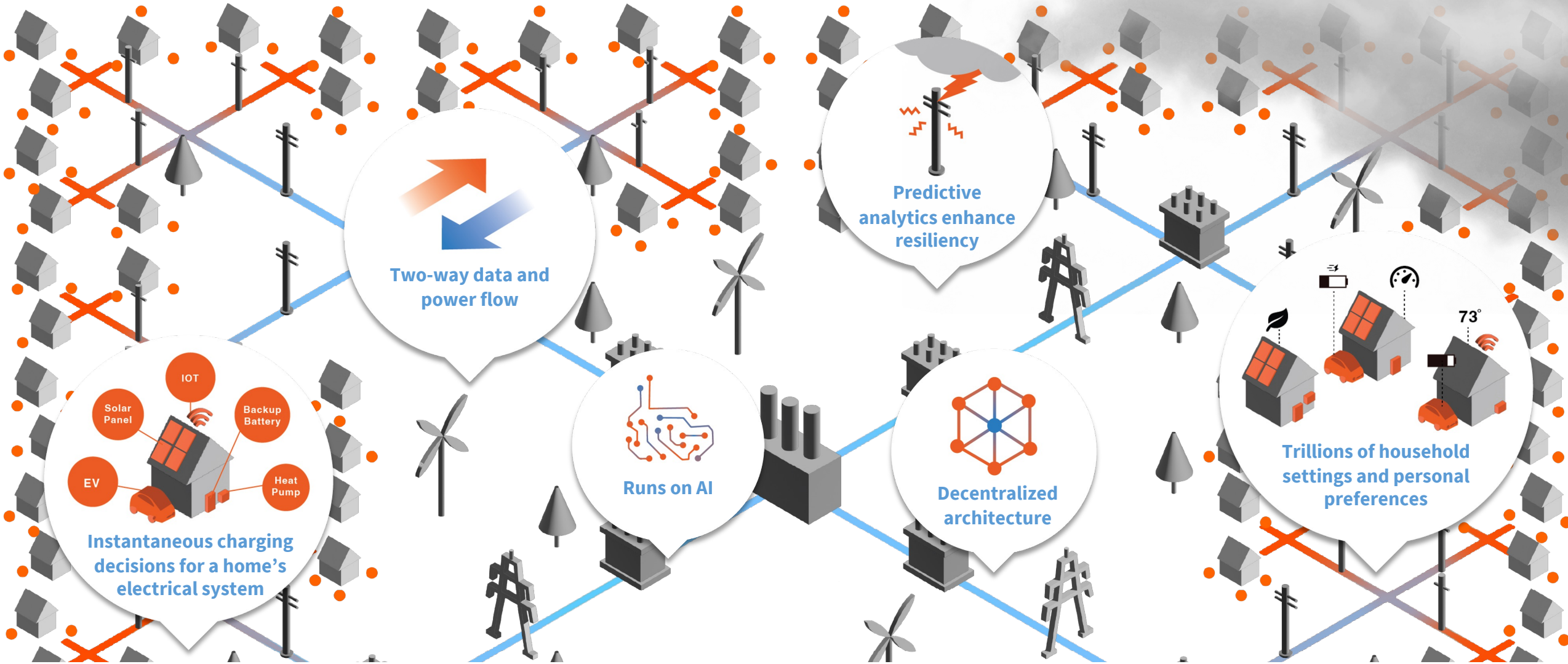


THERE IS NO ABSOLUTE TECHNICAL LIMIT

The cost and risk of operation go up with DER interconnection, but those risks and costs can be mitigated with real-time monitoring and controls

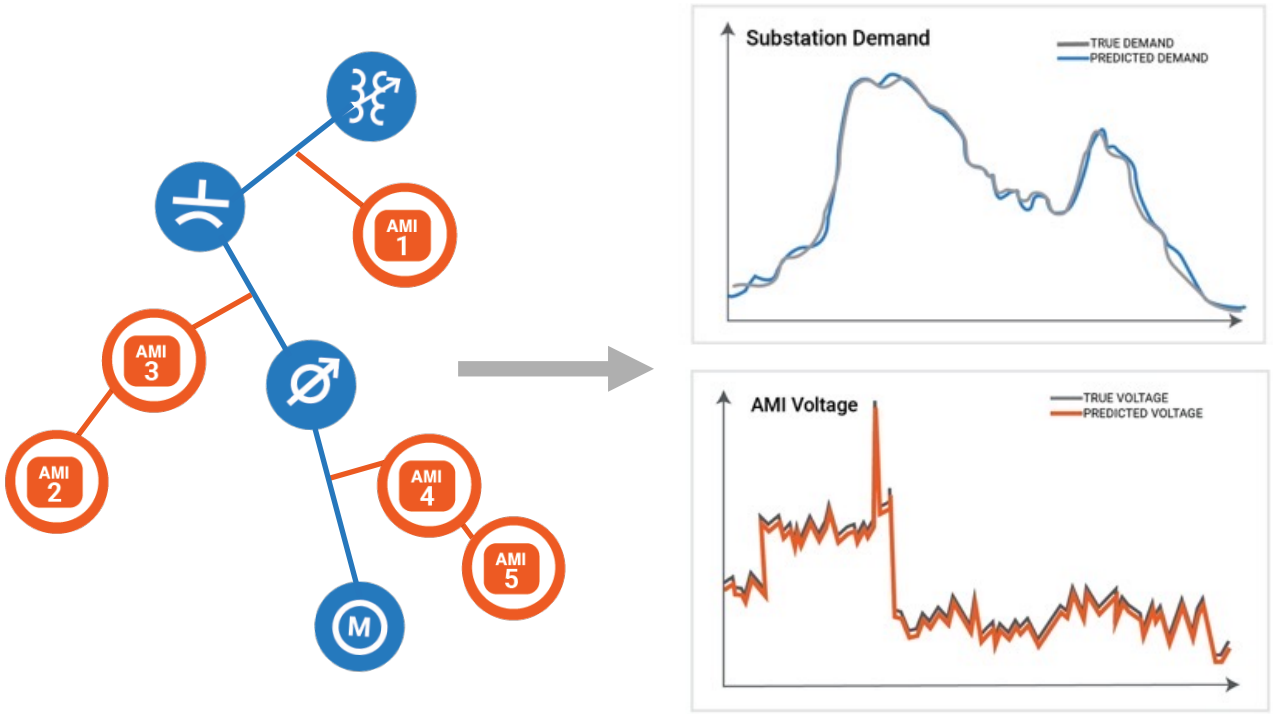
TOMORROW

Before 2030, we will need a software-defined grid.



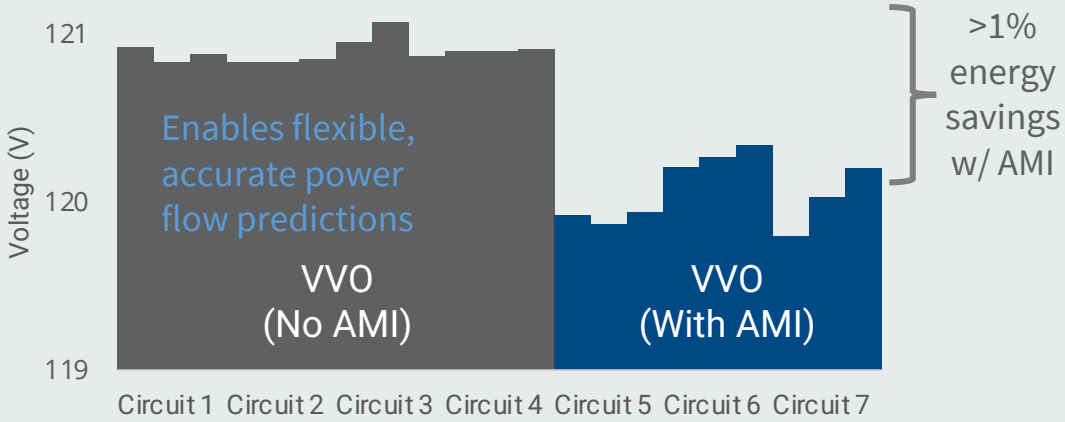
REAL-TIME AMI-BASED VOLTAGE OPTIMIZATION

Our unique solution leverages AMI data to deliver real-time operational results from the substation to the meter.



- AI and machine learning establish electrical connectivity relationships
- Grid-edge data and apps build topology from substation to meter
- Enables flexible, accurate power flow predictions

Using meter data, customers save 33% more (3% → 4% EE) with real-time VVO

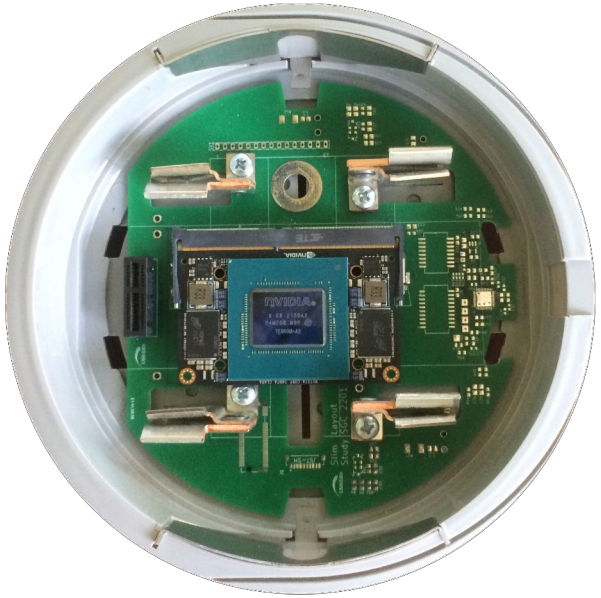


OUR SOLUTION: THE SMART GRID CHIP

Utilidata is partnering with NVIDIA to bring distributed AI to the grid edge

Utilidata

Industry leader in real-time, machine learning grid operations software and more experience developing grid-edge apps than any other company.

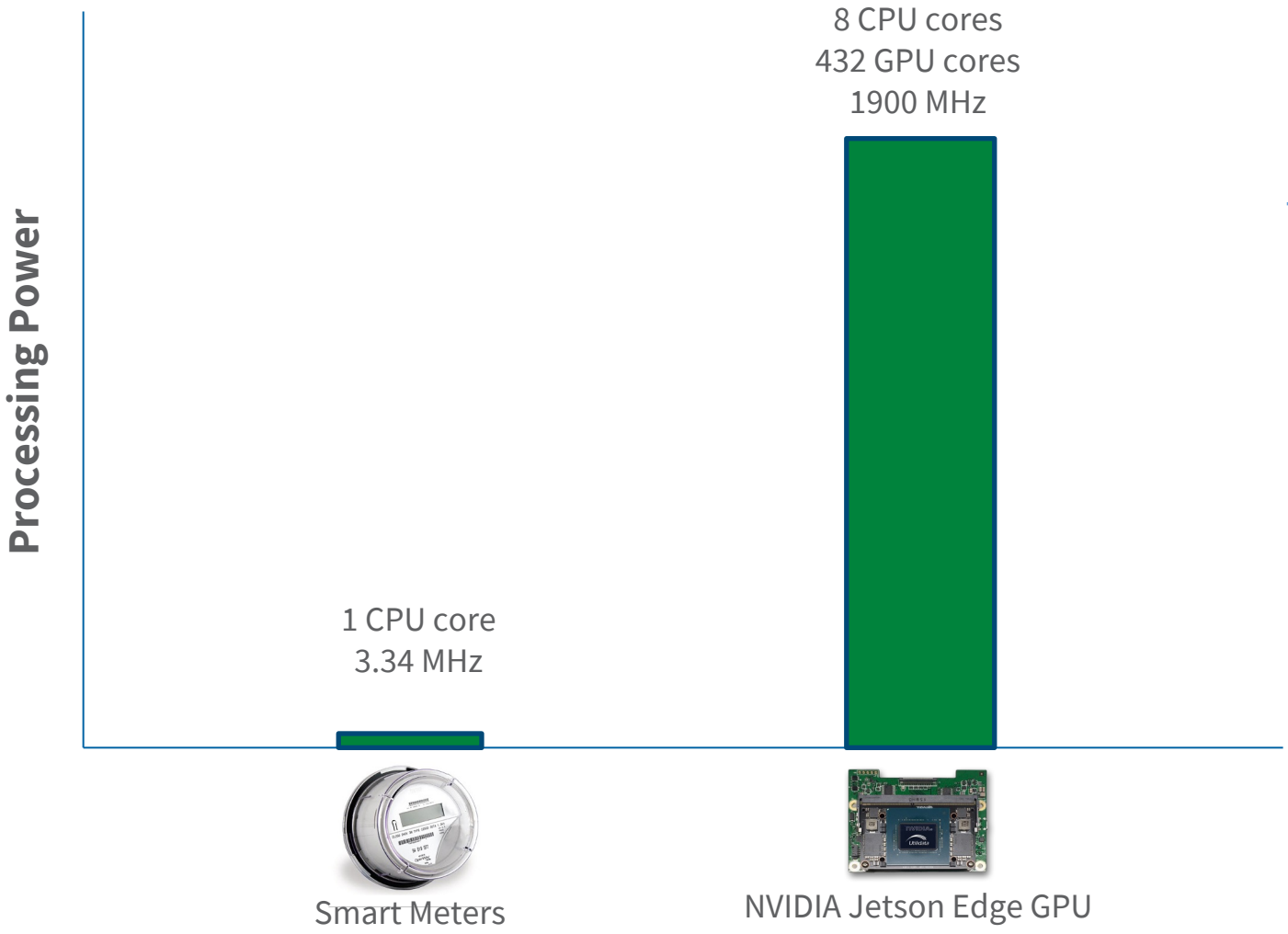


NVIDIA

Global leader in accelerated computing, transforming industries with artificial intelligence, supercomputers, scientific simulation, and edge computing.

CURRENT GRID EDGE SOLUTIONS ARE INADEQUATE

Existing smart meters are not designed to support clean energy integration, resilience or modern operations.



Today's hardware-centric smart meters lack:

- Processing power
- Grid operational software
- A truly open architecture for open data and third-party innovation

SMART GRID CHIP PLATFORM

APPLICATIONS

GRID OPERATION SERVICES

PLATFORM TOOLS

NVIDIA

dmlc XGBoost
RAPIDS

AI & DATA ANALYTICS

DATA BUS COMMS & API MANAGEMENT

PYTORCH
TensorFlow
mxnet

COMPUTE UTILIZATION

CUDA-X
NVIDIA HPC SDK
JETPACK

RENDERING & VISUALIZATION

INDEX
CLOUDXR
OPTIX
MDL

SECURITY & APPLICATION MANAGEMENT

FLEET MANAGER
MORPHEUS

SMART GRID CHIP PLATFORM

APPLICATIONS

GRID OPERATION SERVICES

Utilidata

DSP ENGINE

ANOMALY DETECTION

LOAD FORECASTING

METER FINGERPRINT

REQUEST HIERARCHY

P2P COMMS

DER COMMS

DISPATCH RESOLUTION

GATEKEEPER PERMISSIONS

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SMART GRID CHIP PLATFORM

APPLICATIONS

- Customer Energy Use Analysis
- Autonomous Microgrid Optimization
- Surgical Load Shedding
- Vegetation Management
- Rooftop Solar / Battery Management
- Fault Location & Isolation
- Autonomous Vehicle Power Management
- Customer Service Kyc, Call Center, Nlp
- Security & Outage Management
- Dynamic Load Planning & Balancing
- And More

GRID OPERATION SERVICES

Utilidata

- DSP ENGINE
- ANOMALY DETECTION
- LOAD FORECASTING
- METER FINGERPRINT
- REQUEST HIERARCHY
- P2P COMMS
- DER COMMS
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SMART GRID CHIP PLATFORM

CONNECT + MANAGE | **COORDINATE + PROTECT**

APPLICATIONS

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Utilidata

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SMART GRID CHIP: TWO SOLUTIONS TO PROGRESS TOWARD AN AUTONOMOUS GRID

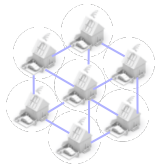
Connect + Manage

Operation of a **single node** during normal operations

1 Visibility
2 Predictive Analysis
3 Tuned DER Settings
4 Local DER Management
5 Real Time Autonomous DER Management

Coordinate + Protect

Communication between **nodes** to protect wide-area network



1 Network Visibility
2 Network Anomaly Prediction
6 Coordination
Autonomous Grid
7 Single Point Resilience
8 Recovery
Resilient Grid

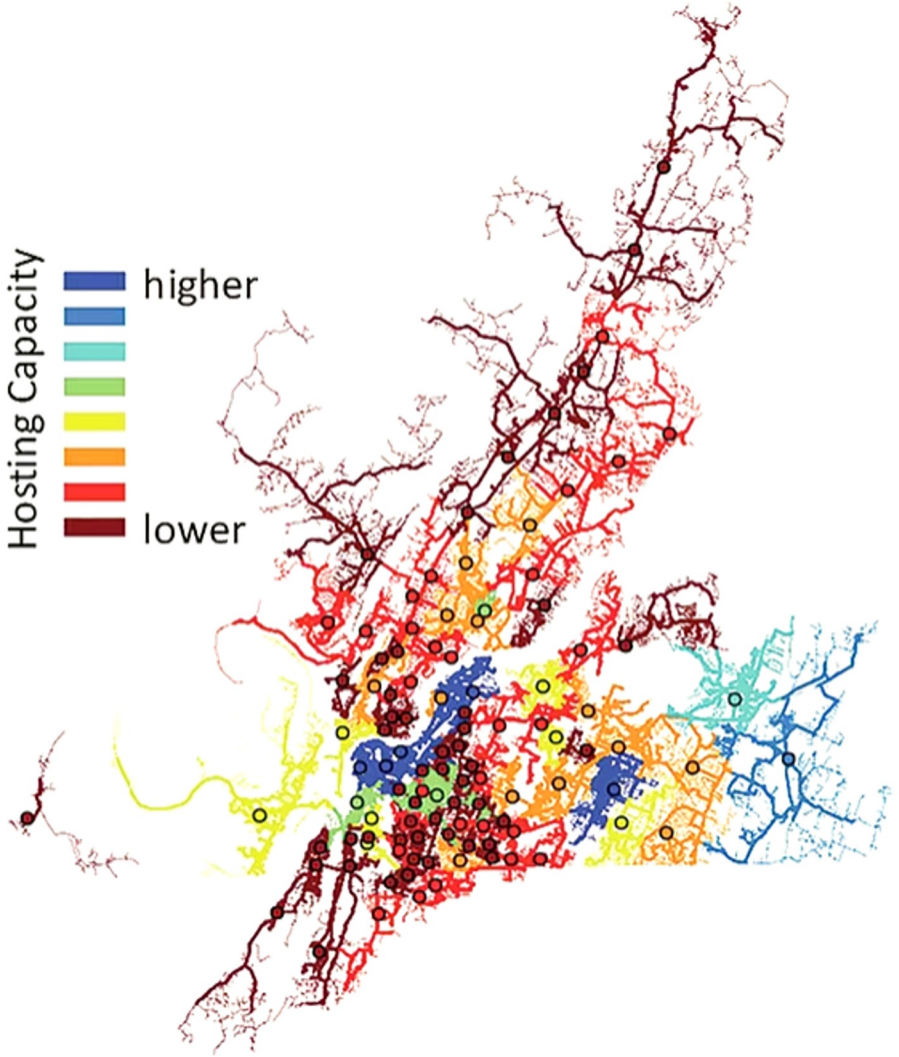
CONNECT + MANAGE

A solution that makes each node on the grid autonomous, allowing utilities and customers to manage and optimize DERs in real time, by comparing information against forecasts.

This solution maximizes capacity utilization and removes the need for interconnection studies.

THE CHALLENGE

- Interconnection processes are time consuming and frustrating for customers and utilities.
- Utilities lack real-time visibility and two-way communication between DERs and the grid.
- Customers cannot predict where interconnection costs are going to spike.

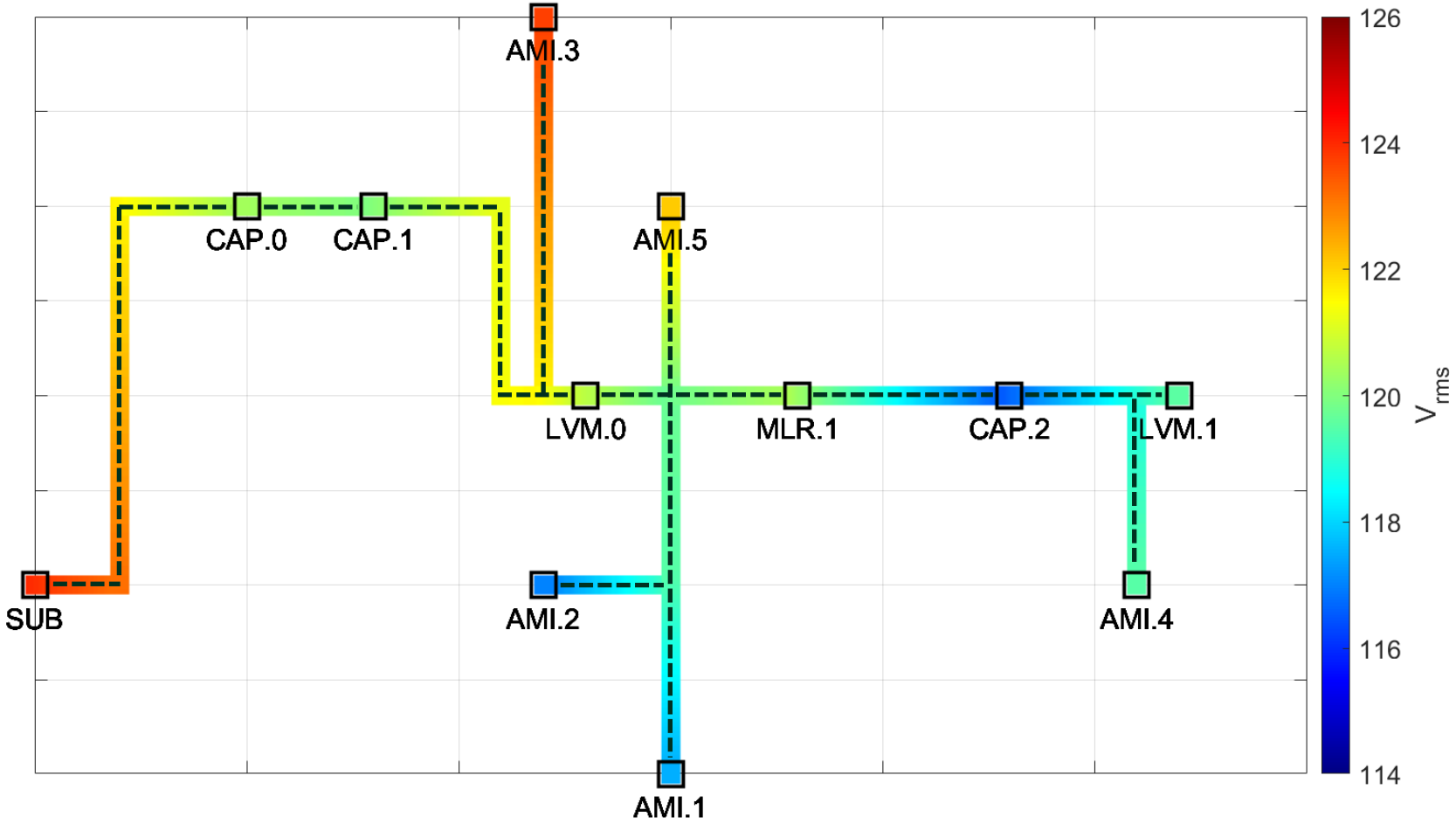


COORDINATE + PROTECT

A solution that provides visibility to a network of nodes on the grid and is able to see anomalies, prevent outages before they happen, and recover when emergencies occur.

OUR MODEL WITH NEXT-GENERATION AMI

With next-generation AMI with on-meter computing, we can deliver full visibility to the edge of the grid.

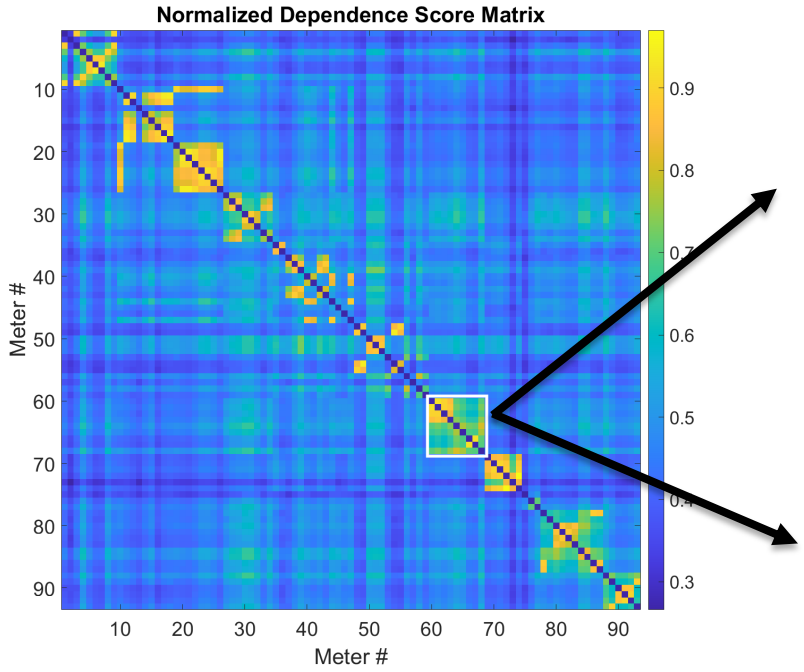


VARIOUS METHODS FOR AMI METER FINGERPRINTING

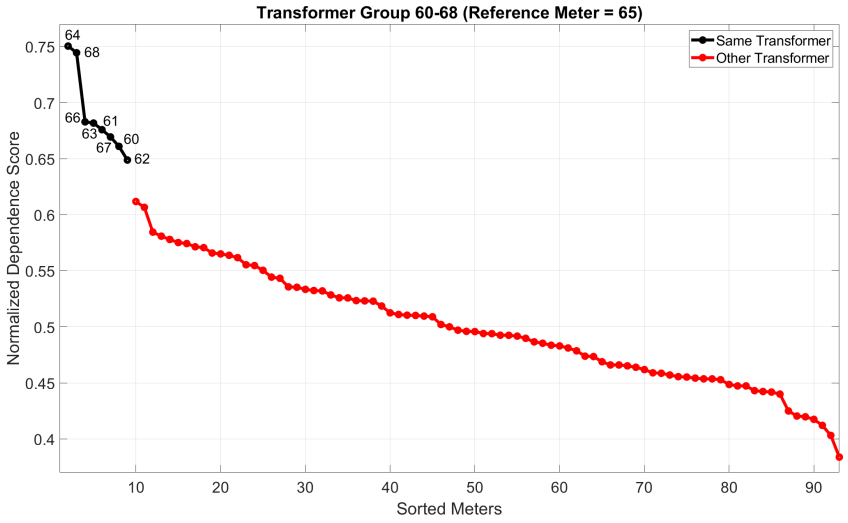
For a given dependence matrix, 2 types of meter sorting were tested:

- Maximum Rand Index
- Spanning Tree

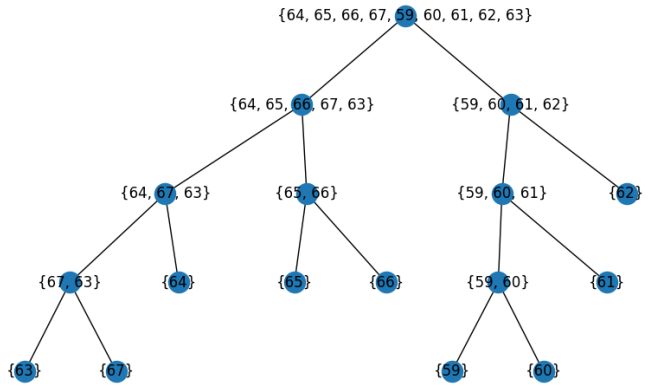
» Best results obtained by intelligently combining results from both methods



Max Rand Index sorting

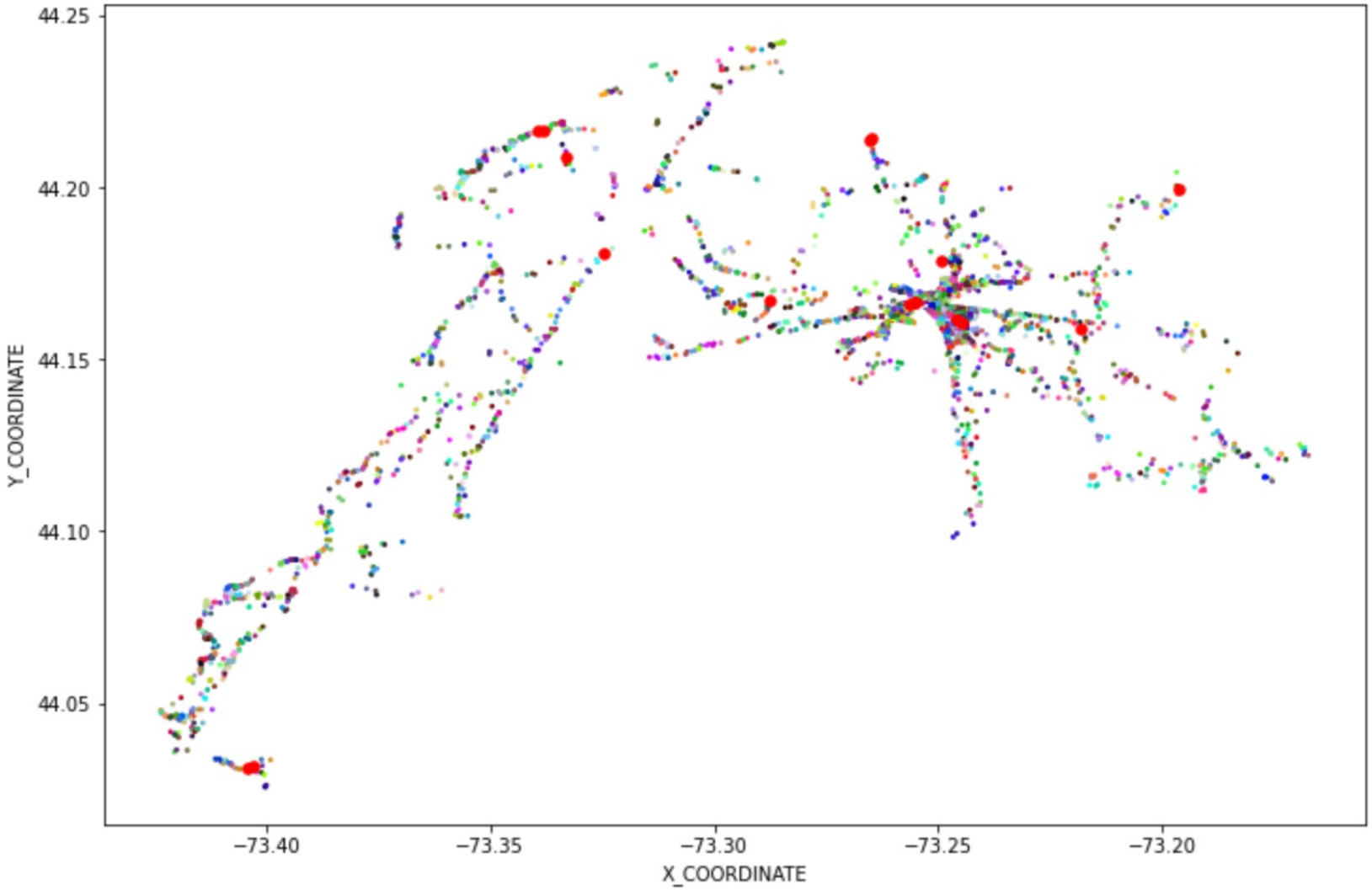


Spanning tree sorting



PRELIMINARY RESULTS

- Using the initial dataset and down-selected hyperparameters, an example mapping is shown overlaid on a street map.
- The results are 91% accurate, with true groups separated by color, and predicted groups enclosed by a polygon.



GPU in Edge Intelligence

Advanced hardware necessary for advanced processing

The GPU parallelizes operations:

- Enables fast response for time-critical operations, e.g., DER control
- Allows for many different processes to run simultaneously