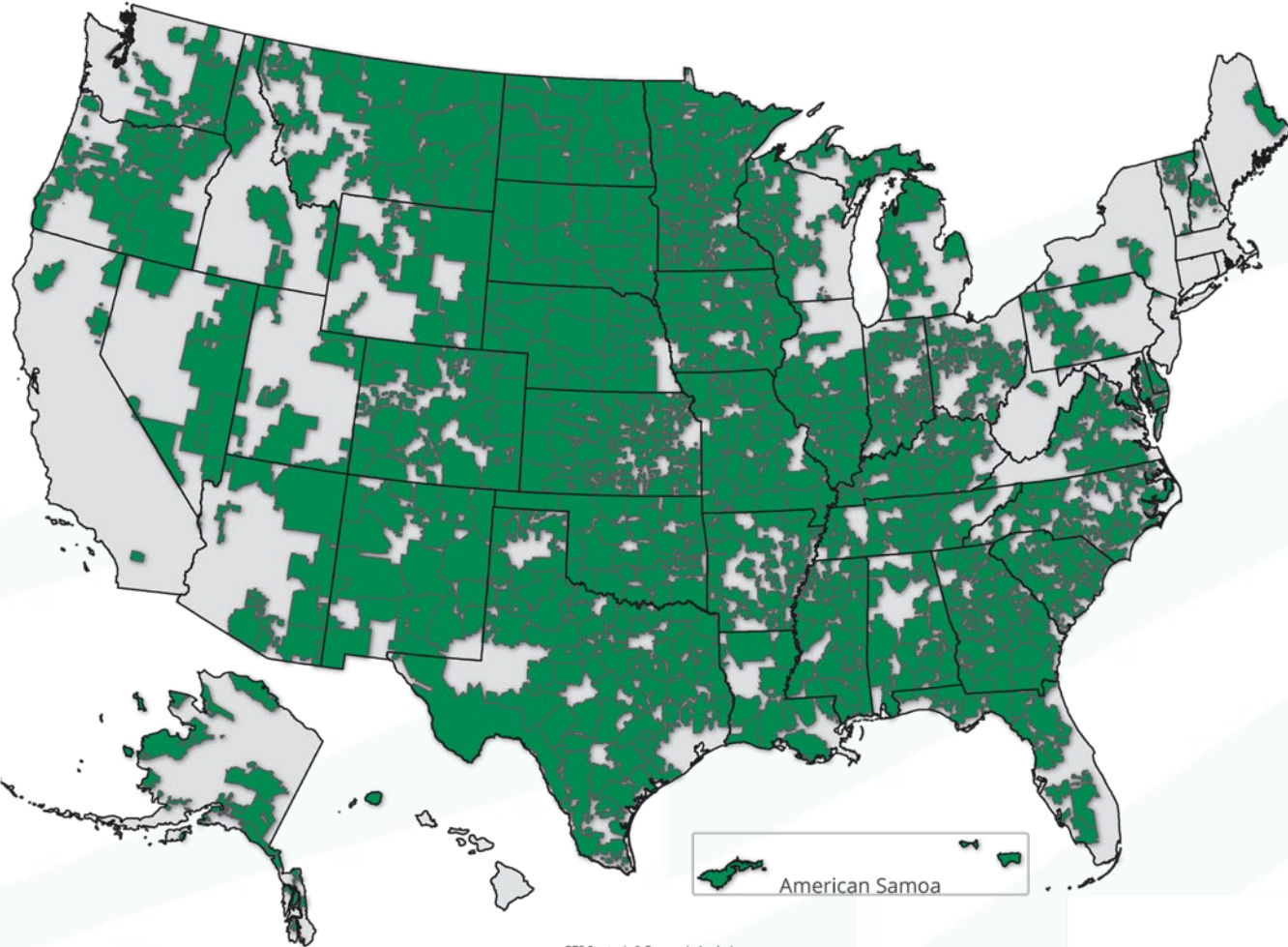


Big Data Analytics in the Utility Setting

Experiences, Barriers and Future Needs

Operators, Municipal and Cooperative Utilities

America's Electric Cooperatives



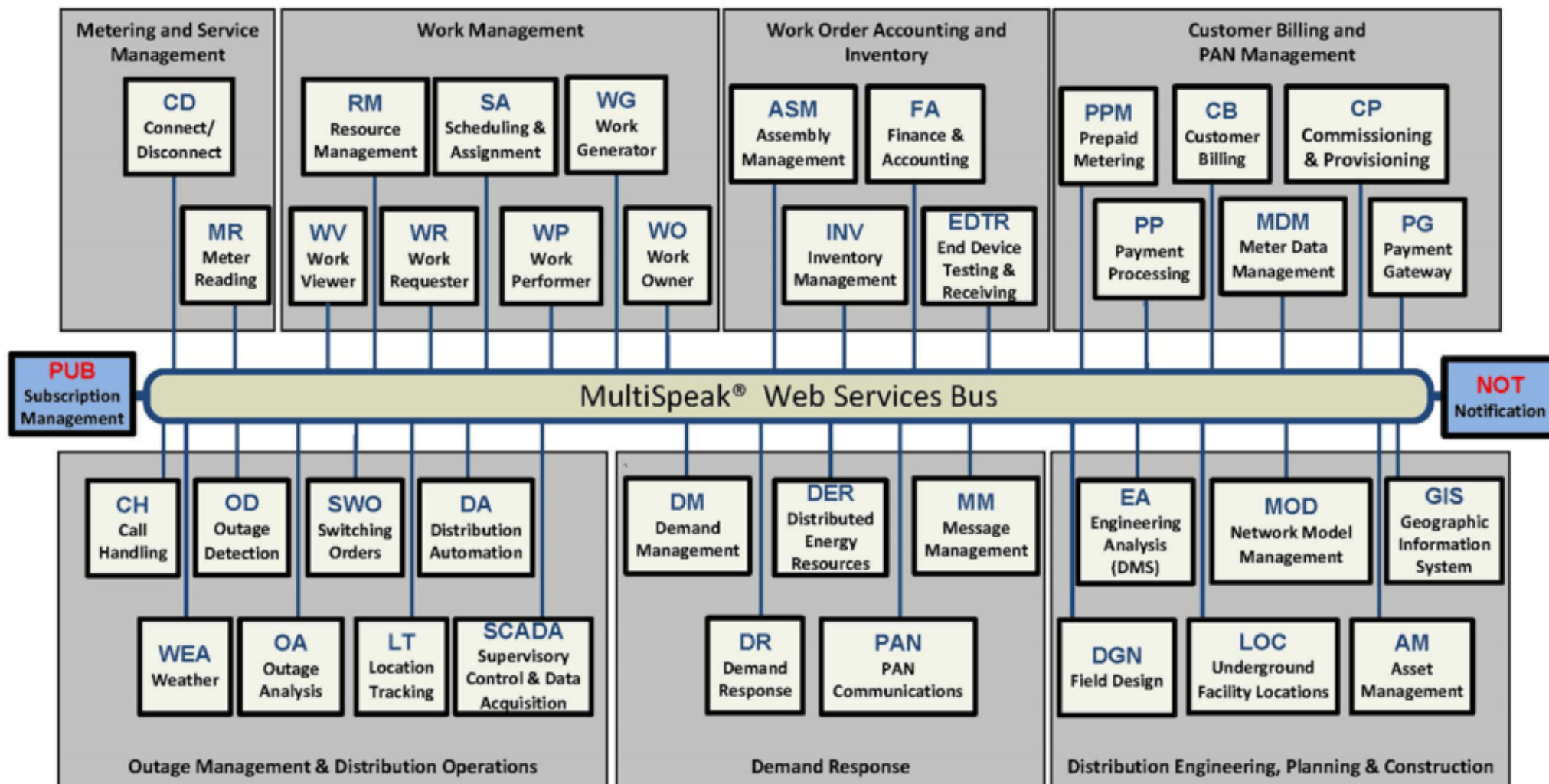
- Serve 42 million people in 47 states through 65 generation & transmission (G&T) co-ops and 840 distribution co-ops
- Own and maintain 42% of the nation's distribution lines
- Average 7.4 consumers per mile of distribution line versus 34 at IOUs, 48 at Munis.
- NRECA Research, national coordinator.

How Big?

- Largest source of new data: smart meters (AMI)
- Consider the largest coop (500k meters), highest read rates and metric volumes available: processing **1 terabyte/year of data**.
- For comparison, Google across its business processes **6,300,000 terabytes/year¹**.
- Grid not a candidate for exotic storage and processing technology.
- However, huge opportunities and challenges exist in realizing value from data.



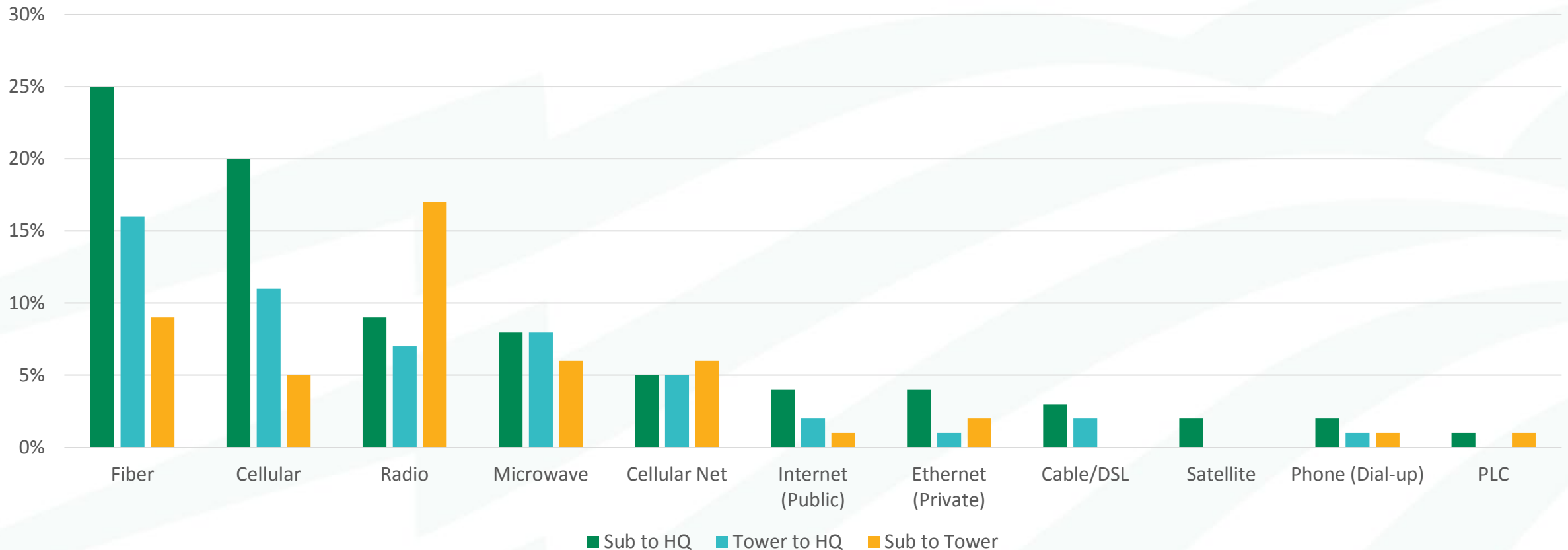
Big Integration Challenges



- Biggest IT pain point: integration
- Been chipping away at this interoperability problem for decades
- Huge opportunity for future applications

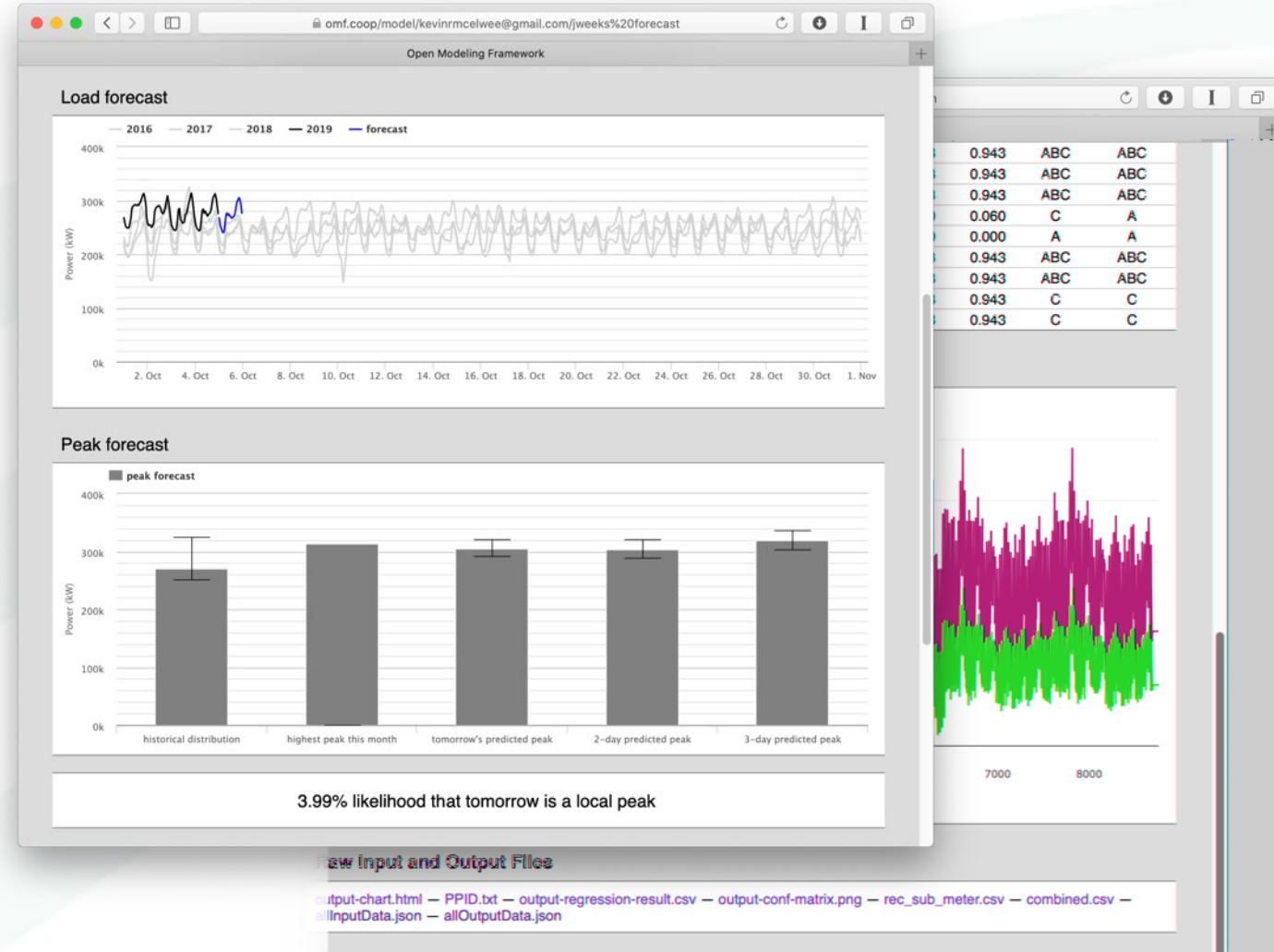
Big Communication Challenges

AMI Communications Methods

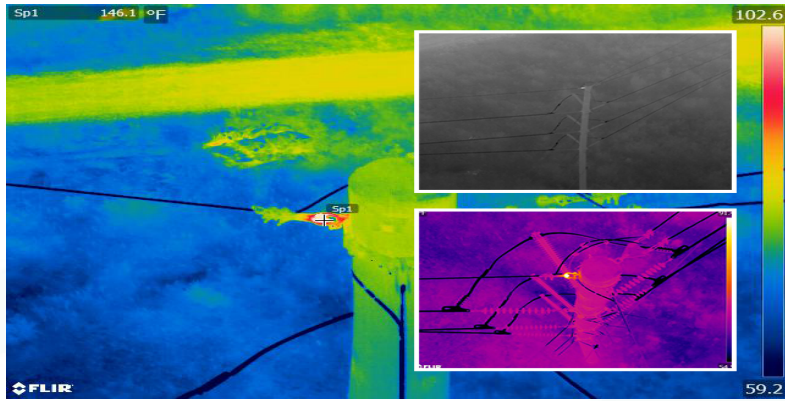


Big Opportunities in Machine Learning Pt. 1

- Emerging ML Tools:
 - Load forecast and storage control
 - Load, PV disaggregation
 - Equipment anomaly detection
 - Phase identification
- Initial deployments with coops, seeking more.



Big Opportunities in More Data



Drone Flights



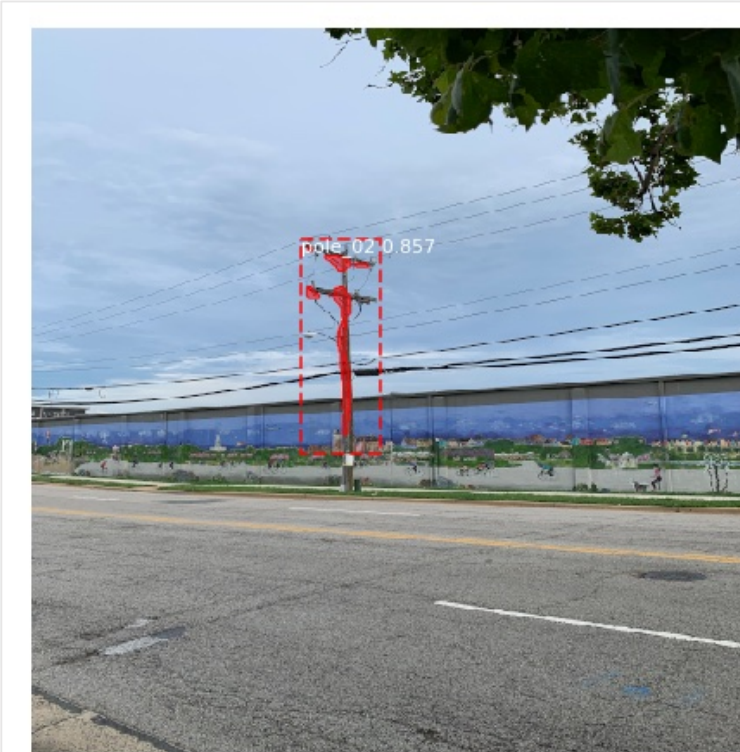
μPMUs



3D Asset Scans

Big Opportunities in Machine Learning Pt. 2

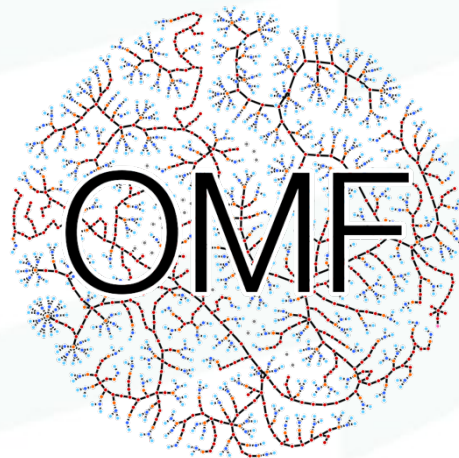
- 23% of coops fly drones, and 13% are planning to soon
- Initial analytical prototype: apply computer vision techniques to drone imagery to flag assets and/or problems
- DOE efforts just starting up
- Building a database of drone imagery



Big Opportunities in Planning/Ops Integration

Grid Configuration

Network Models
Future Scenarios
Utility ICS Topology



Configuration
And Analysis



Calibration Data,
Physics Problems



Grid Telemetry

AMI/AMR
SCADA
Distribution PMUs



Conclusions

- Utility data volumes are modest but difficult to integrate, and collected over diverse networks.
- Challenges will continue to increase with new sensor deployments.
- Huge opportunities in machine learning applications.

Feedback?

David.Pinney@nreca.coop