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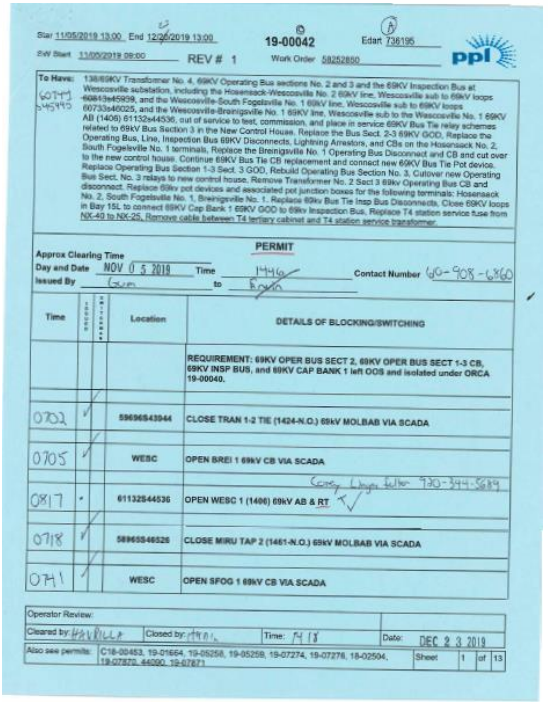
We Deliver.

Dynamic Line Ratings Strategy

Current PPL Transmission Grid



19-00042

REV # 1

PERMIT

DETAILS OF BLOCKING/SWITCHING

REQUIREMENT: 69KV OPER BUS SECT 2, 69KV OPER BUS SECT 1-3 CB, 69KV INSP BUS, and 69KV CAP BANK 1 left OOS and isolated under ORCA 19-00040.

0702 — CLOSE TRAN 1-2 TIE (1424-N.O.) 69kV MOLBAB VIA SCADA

0705 — WESC — OPEN BREI 1 69kV CB VIA SCADA

0817 — OPEN WESC 1 (1406) 69kV AB & RT

0718 — CLOSE MIRU TAP 2 (1461-N.O.) 69kV MOLBAB VIA SCADA

0741 — WESC — OPEN SFOG 1 69kV CB VIA SCADA

- Heavily rebuilt & strengthened physical plant
- ~50% penetration of microprocessor relays
- Primitive “smart” devices
- No automation
- People-dependent
  - Manual switching / paper permits
  - Reactive to failed equipment
  - Engineer calculated fault locations
  - Isolated voltage control

Business Use

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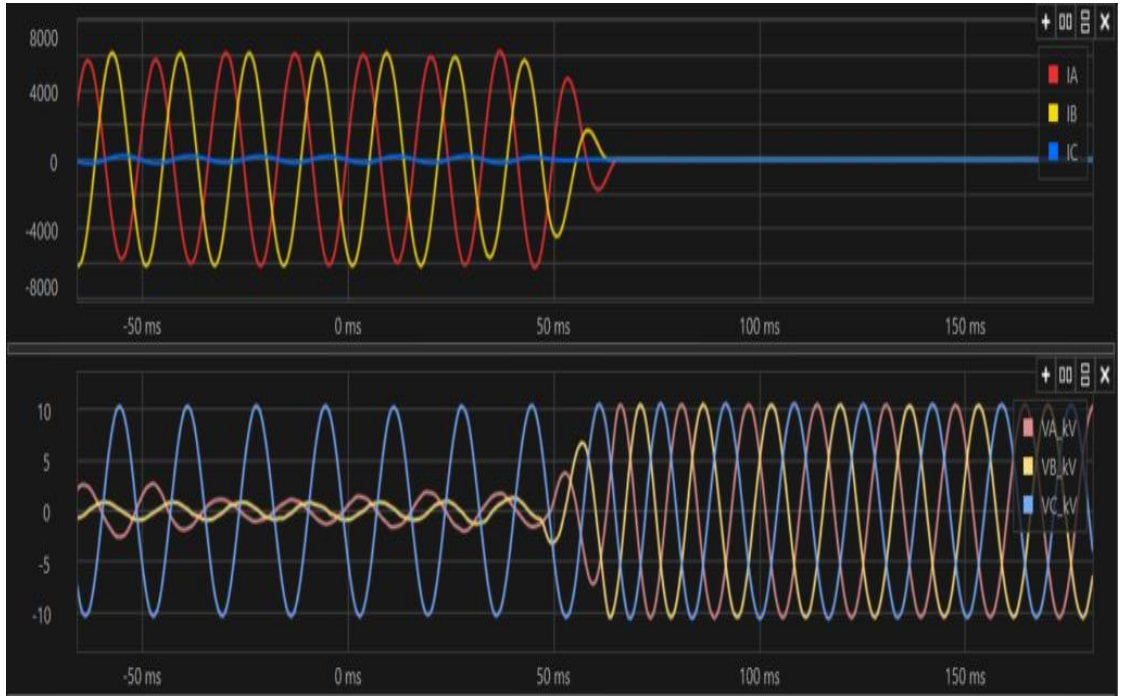
Elements of the Future Transmission Grid

- 100% smart relays & devices
- Single connectivity, geo-spatial, & engineering model
- Predict all failures before they occur
- Automated operations based on real-time data feeds into TMS
- Grid-enhancing technologies
  - Smart Wires
  - Asset Health Monitoring on every asset class
    - *Dynamic Line Monitoring*
  - Traveling Wave Relays



High Resolution Waveform Data

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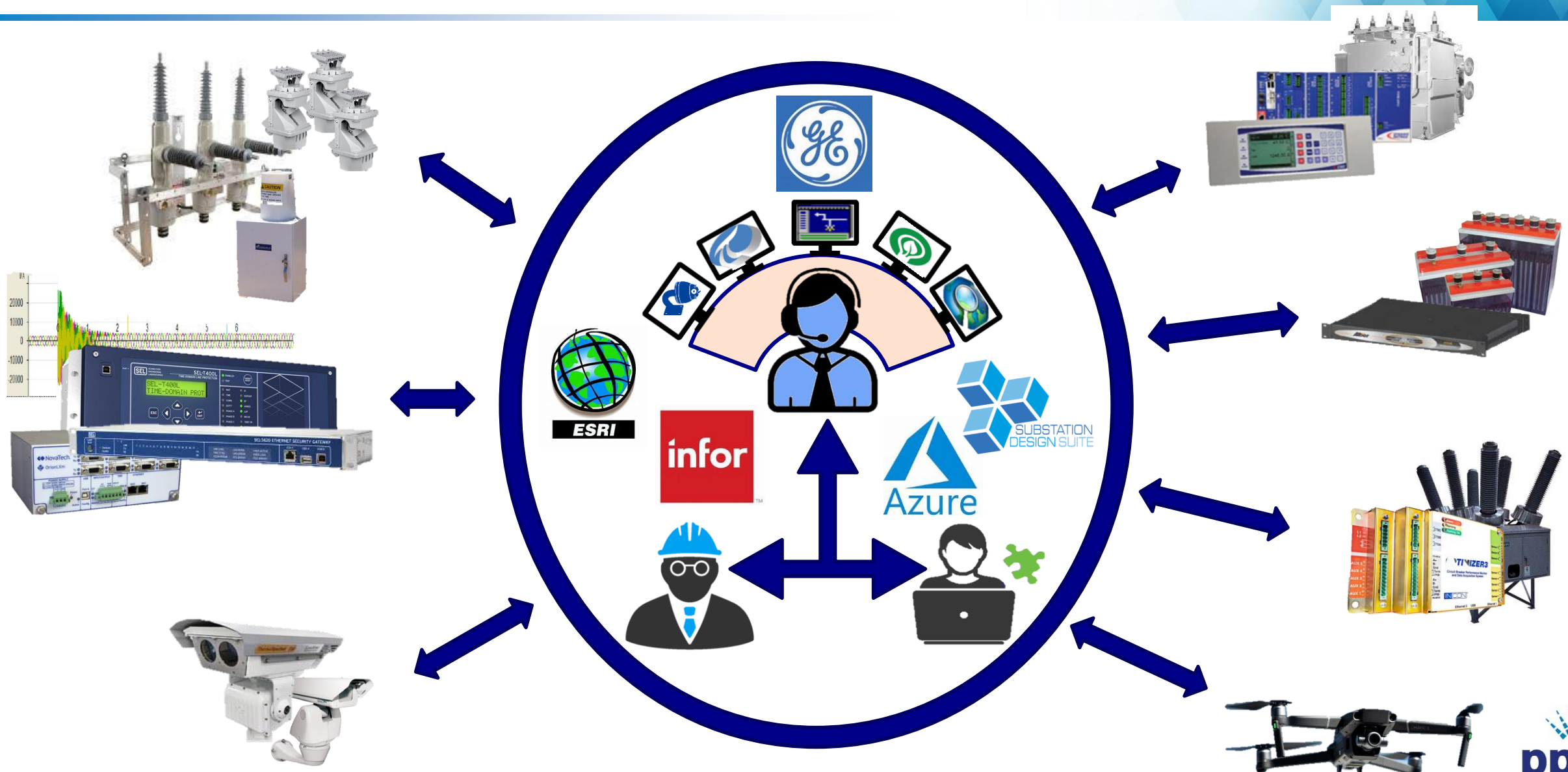
Enabler: Centralized Platforms



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What is DLR?

System of line sensors installed to measure conductor and environmental real time data. The data can then be used for asset health algorithms and real-time operation for determining a real time rating for the line.

Static Line Ratings

Assumes:

- Wind speed
- Ambient Temp
- Solar Radiation
- 2 Seasons (Planning)
- Ambient Adjusted Ratings (Operating)

Conservatively Calculates Ratings

No way to trend field conditions or health

Dynamic Line Ratings

Measures:

- Wind Speed
- Ambient Temp
- Conductor Temp
- Conductor Sag

Provides Accurate Real Time and Forecasted Ratings

Measures Conductor Health

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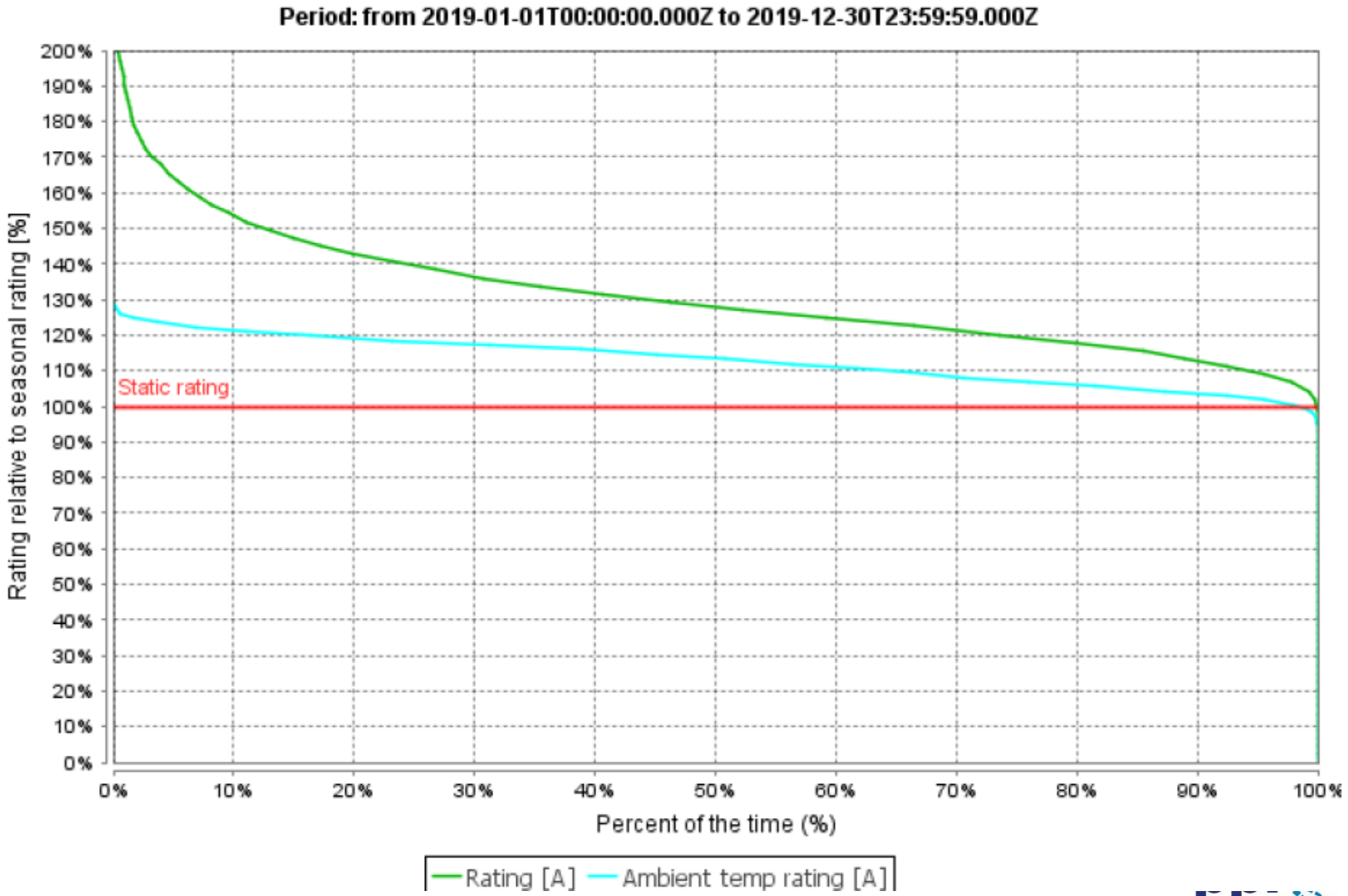
Potential Ratings Gain

- Used historical temperature and wind speed to estimate the impact of the dynamic lines ratings system
- Based on calculated conductor temperature
- Expected average ratings gain of almost 30%
- Actual rating increase incorporating the real time conductor data is expected to be greater than the estimated ratings using historical data



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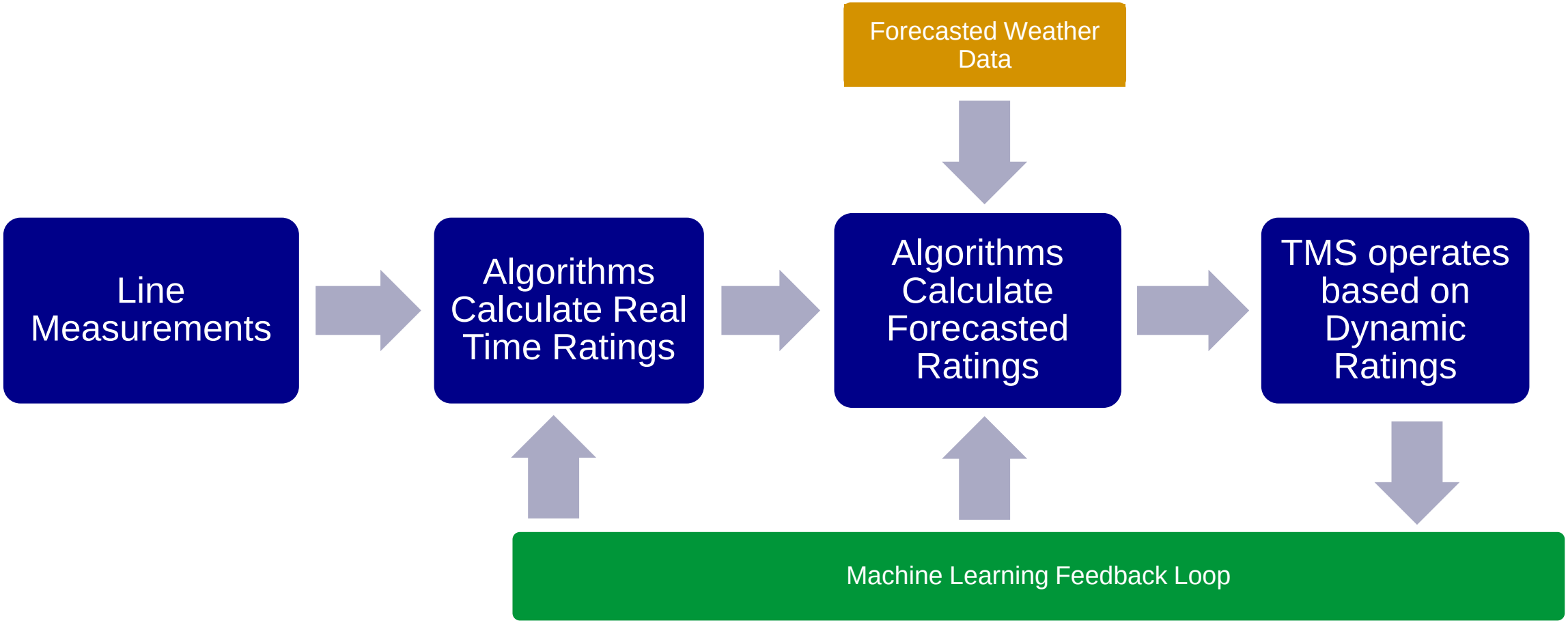
Dynamic Line Ratings Process



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Dynamic Line Rating Next Steps

- Establishing a data stream from the sensors installed on Juniata-Cumberland & Harwood-Susquehanna lines to PPL Operations.
- Work with PJM to fully utilize available line capacity, by operating to real-time ratings and using forecasted ratings in the day ahead market.
- Continue to seek additional lines to install the technology on
- Looking at using accumulated historical DLR over time to justify improving static line ratings methodology

Business Use
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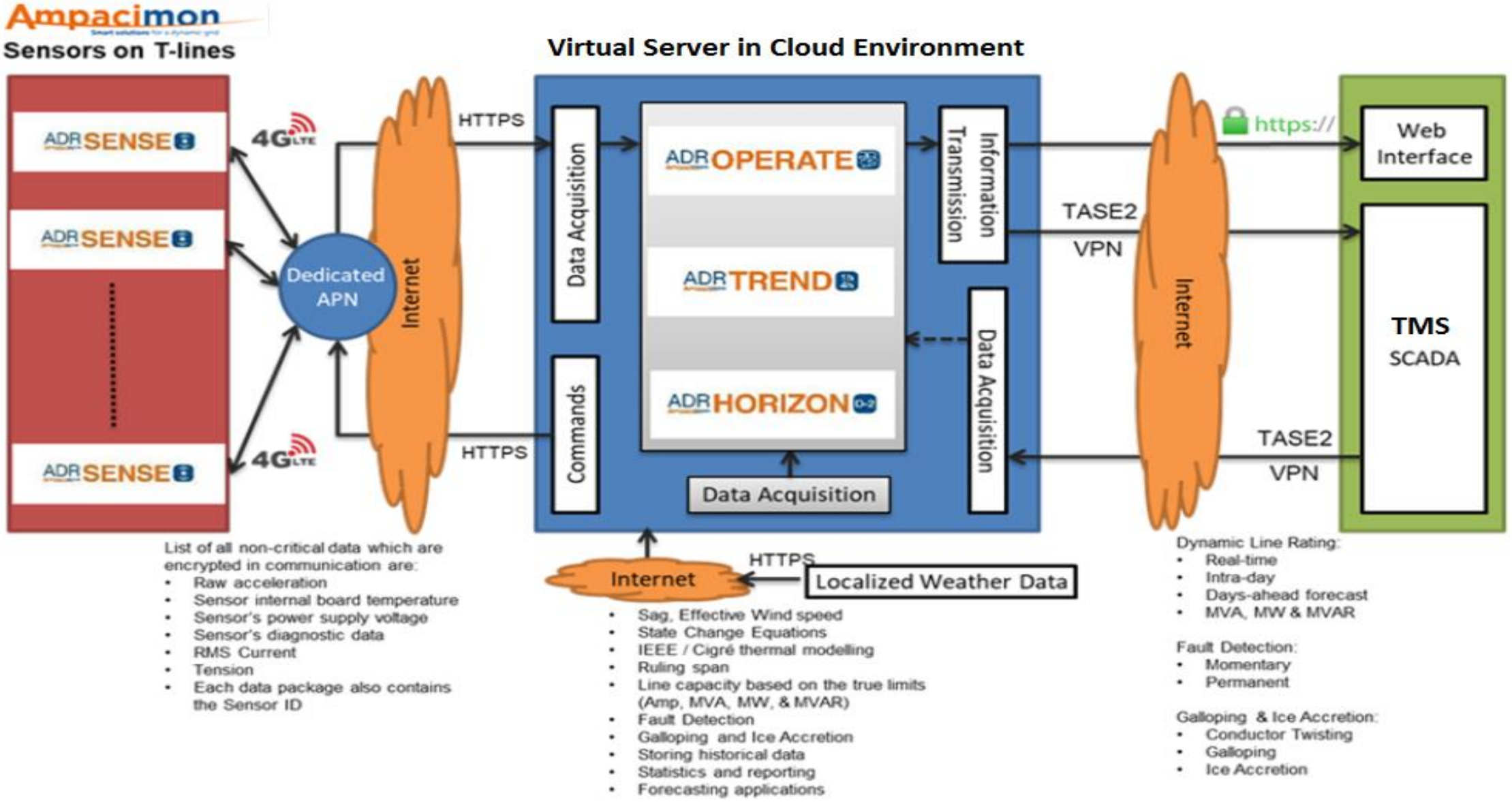
System Overview



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