Smart Grid Investment Grant Update

NASPI Working Group Meeting

October 22-24, 2013

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PRINCIPAL ENGINEER

Acknowledgement & Disclaimer

- Acknowledgment
  - This material is based upon work supported by the Department of Energy under Award Number(s) DE-OE0000372
- Disclaimer
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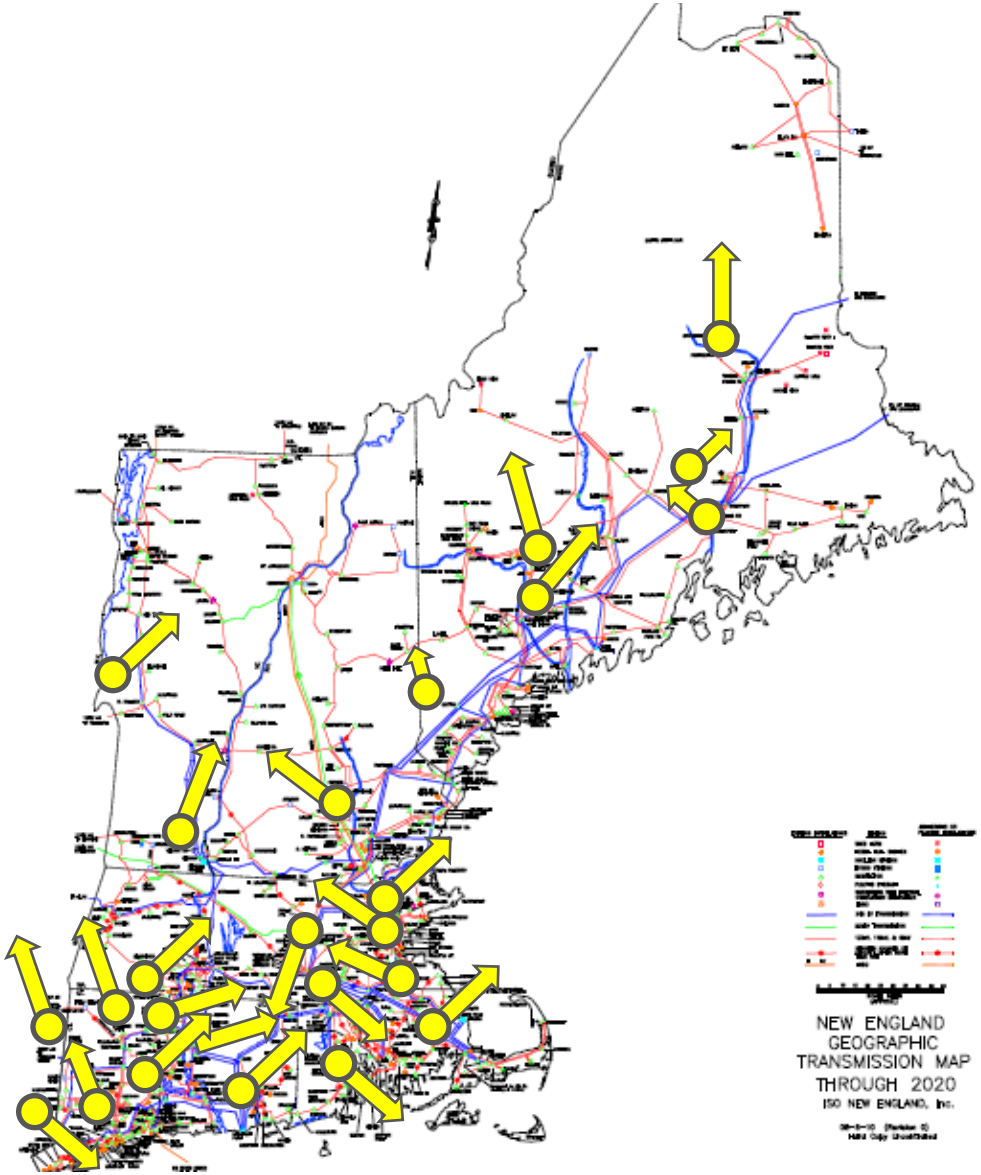
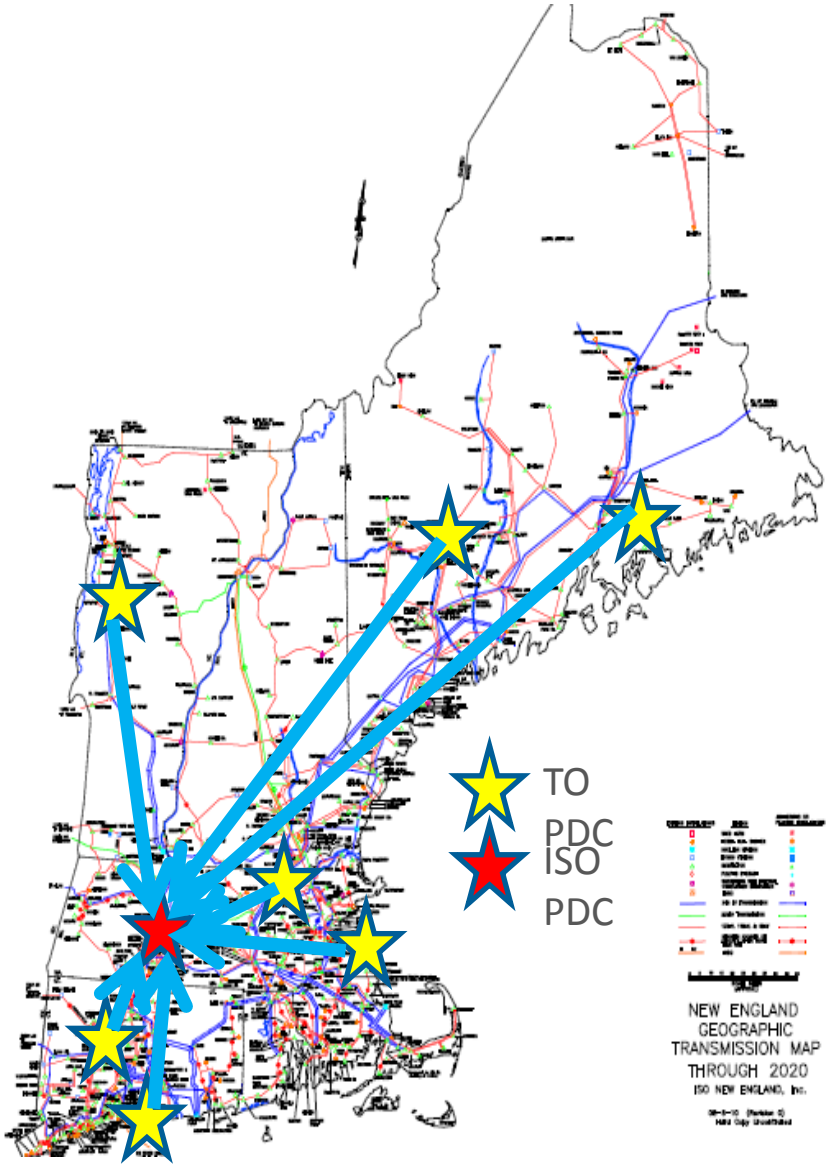
Project participants

- ISO New England (RC for the region)
- Project Transmission Owners (# PMU-substations)
  - Bangor Hydro (2)
  - Central Maine Power (5)
  - National Grid (7)
  - Northeast Utilities (16)
  - NSTAR (4)
  - United Illuminating (4)
  - Vermont Electric (2)
- Project Managers
  - Jim Graham, ISO-NE
  - Mike Gilmore, ISO-NE
- Other Partners
  - Mehta Tech Inc.
  - Alstom Grid
  - V&R Energy Systems Research

PMU & PDC Sites





Project Timeline

- PMU Installations – all 40 substations streaming
- PDC Installations – openPDC developed by GPA, supported by Alstom Grid
  - 8 openPDC sites: one at ISO, one each at 7 TOs – All in-service
  - SEL PDC used by two TO's: renames signals according to ISO-NE naming convention then forwards to ISO-NE openPDC
- Applications – none are currently used by operators
  - Alstom PhasorPoint, V&R ROSE, Mehta Tech Master Station – all completed
  - Data Quality Monitoring System (DQMS)
    - Complete – in-house enhancement continues

➢ **All Applications hosted at ISO – TOs do not have access**

PMU Data

- PMU Coverage (substations, not devices)
  - 345 kV substations – 46% (36 of 79)
  - 115 kV substations – less than 1% (4 of 688)
- Communications (PDCs)
  - Point to point circuits from ISO to each TO from telco
  - Routers at both ends managed by ISO-NE
  - Firewalls at each end (TOs manage their own Firewalls)
- Communications (PMUs)
  - Corporate WAN to PDC – mostly fiber, some telco
  - ➢ **Impact of communications from some sub-stations during lightning activity could be a concern**

PMU Data (continued)

- Data flows and speeds – all at 30 points per sec.
  - Up to 330 kbps from the largest TO (16 PMUs)
  - All data flowing to the ISO archive in real time
    - No batch data
  - ISO only receives one phase or positive sequence
    - Multiple phases were temporarily allowed for debugging but have been removed
    - Some TOs create all phases but only forward one
- Data storage
  - Data access query process is mature and workable
  - Preparing for 3 years of data readily accessible
    - Approximately 13 Tera-bytes (2 years now available)
  - At some locations PMUs are also DDRs
    - data storage in substation – ***A New England requirement***

PMU Data (continued)

- Data quality and availability
  - PMUs at all 40 substations delivering good quality data
  - All PMUs delivering data within latency limit of 3.5 sec
  - Telco failure every few months
  - ➢ **Common setup errors were addressed before PMU allowed to stream**
- Phasor data sharing:
  - No real-time data sharing outside of New England
  - Ongoing data sharing with CURENT Engineering Research Center (UTK, RPI, etc.)

Major Applications

- Visualization, event detection & analysis
  - Alstom/Psymetrix
- Data retrieval & event analysis (Mehta Tech DDR/PMUs only)
  - Mehta Tech Master Station software
- Voltage/stability analysis
  - V&R ROSE software

➢ All Applications used only by operations support engineers.

➢ PMU data enables much faster retrieval & analysis of events, so we analyze many more events!

Challenges and Lessons Learned

- Biggest technical challenges to date
  - PMU algorithmic issue
- Research needs
  - Data analysis: Identify interconnection phenomenon & data features
- Biggest programmatic or execution challenges:
  - PMU performance – addressed PMU issues during installation (calibration, etc.)
- Communications system design
  - FRAME via point-to-point T1 is adequate
- Interoperability
  - Relatively minor issues (vendor use of data quality bits, etc.)
- Data archiving – archive is not full; time will tell…

Project Priorities From Here

- Continue with observation phase and reporting to DOE through 2015.
- Utilize data to evaluate system performance and tune system models.
- Investigate additional applications:
  - integration with state estimator
- Investigate ways to introduce concepts into operator training and monitor development of operator tools.
- Refer to “Road Map” for further development:
  - Quanta, working with ISO-NE, developed a Road Map for future synchrophasor development

Success Stories

1. Identified oscillations which we were not aware of and could not be duplicated using dynamic simulations.
2. Validating and tuning models used in dynamic simulations.
3. Performing much faster post event analysis.

Synchrophasor Training

- Provided training on PhasorPoint and ROSE applications to engineers in operation support, EMS support, and planning
  - Training materials developed by vendors Alstom, V&R.
- Using synchorphasor data to calibrate and “train” the AGC simulator KERMIT.
- Conducted Synchrophasor technology workshops for non-engineering staff at ISO.

Questions