Synchrophasors at ComEd Today (and Tomorrow)

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ComEd PMU Installations

- 12 PMUs
  - Initial PMU installations were part of PJM’s DOE ARRA effort
- All PMUs send data to a single PDC which forwards the data to PJM
  - All data is sent to a second PC running SEL SynchroWave
- PMU installations:
  - 7 substations
  - 9 345kV
  - 3 138kV
Now What

• By late 2012, we had PMU data, but no good way to do anything with it

• The first sets of data were provided to universities (IIT, UIUC) for research and teaching
  o University of Illinois at Urbana-Champaign (UIUC)
    ▪ Data provided for graduate student research
    ▪ This effort will restart soon
  o Illinois Institute of Technology
    ▪ PMU data is being used to support research projects and to develop a short course as part of DOE funded Synchrophasor Engineering Research and Training (SERT) project

• Internal use was limited
  o “What do we do with these things?”
  o Initial work to do comparisons between state-estimator phase angles and PMU data
    ▪ Calculated SE phase angles are archived for comparisons with PMU data

• Collaborative effort with Argonne National Laboratory
  o More information later today

• We needed some bling!
SynchroWAVE

• Installed SynchroWAVE in August 2014
• SynchroWAVE is web based, so it can be readily available to other users
• Useful for real-time and historical analysis
  o Graphical display of PMU data
  o Modal analysis
• Held introductory session with ComEd’s real-time analysis group shortly after installations
  o They found interesting things…
Easy Application

- Digital Fault Recorder with Continuous Storage
- Do not underestimate how useful this is!
- What we learned:
  - PMUs can make better DFRs than DFRs
Bad Squirrel

• A squirrel got onto a 12kV bus where it didn’t belong…
• What we learned:
  o The squirrel caused a transient seen on the transmission system
Hourly Oscillations

- Oscillations with 1-hour period
  - Verified in state estimator
  - Due to flows through ComEd

- What we learned:
  - Stuff happens
Going Forward

• Planning for significant increase in the number of PMUs
  o Roadmapping with Quanta is in progress
    ▪ How best to move forward from what we currently have
  o Upgraded PDC and other infrastructure
    ▪ PDC redundancy
    ▪ Data storage
    ▪ Improved access to data
  o Many, many more PMUs
    ▪ Will make sure we get the right data from the right locations on the system
    ▪ Processes to be put into place to simplify PMU installation
    ▪ Eliminate limits to the number of PMUs, for the next few years at least

• Will be putting PMUs on the distribution system
  o This is a natural progression of ComEd’s Smart Grid efforts
  o Distribution PMU effort being coordinated with ComEd Smart Grid organization

• Continued collaboration with universities and national laboratories