Plans for the integration of new synchrophasor based information to Dominion control room environment—an operators perspective

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Presentation Outline

- Dominion PMU Project Description
- PMU applications Visualization Challenges
  - New information to be available to the operators
  - Increased granularity of the information
- Sample of Dominion’s PMU application Visualization tool
  - Monitoring of voltage imbalances in 500 kV buses
  - Monitoring the negative sequence currents in generators
- Current plans and future work
  - Training needs and adoption of the technology.
  - How the visualizations tools can capitalize the value of PMU technology?
Synchrophasor Project Summary.

- Project Participants and roles of the team
  - Dominion: PMU installation and electric power system
  - Virginia Tech: PMU Applications routines
  - Quanta Technology: PMU Application Results Visualization

- Main Applications
  - Three phase, PMU only, State estimator
  - Instrument Transformer Calibration
  - Unbalanced current flows

- Today, the focus is on visualizations of PMU application results
New information to be presented to the operator

What is the current information that operators normally have access to in the current EMS/SCADA environment?

- Trending of MW in key transmission lines
- Voltage magnitude, frequency…
- Alarms for equipment, high voltage, among others.

What is the new information that the operators will be able to see with the PMU system

- Phase angles
- Three phase Voltages: Phase A, Phase B, Phase C
- Negative sequence currents
Increased granularity of information to be accessible to the operator

- What is the **current** level of granularity of the information that operators normally have access to in the current EMS/SCADA environment?
  - State Estimator solving every 2.5 minutes
  - Faster after the occurrence of an event such as a breaker operation.

- What is the **new** level of granularity of the information that the operators will have access with the PMU system?
  - Three phase state estimator solving 30 times per second
  - New information in screens updating once a second

- The **new** level of data granularity is huge. Visualization techniques become critical for effective integration and assimilation of information.
Sample of Dominion’s PMU application Visualization tool

- How a visualization tool can help the operator better understand a concern?

  - Voltage Magnitude
  - Frequency
  - Phase Angle
  - Currents
  - Phase Sequence Domain
Monitoring of voltage imbalances in 500 kV buses

- New variables to monitor
  - Phase A, Phase B, Phase C bus voltages

- Why
  - Excessive voltage imbalance (up to 10% over-voltages) can result in insulation stress and eventually equipment failures

- Increased granularity of information
  - Monitor the phase imbalance in 500 kV buses more frequently: once a second

- Opportunities and Challenges
  - It can shed new light on voltage imbalances situation
  - Operators have not seen this information before. It can result in three times more information to the operators and more burden
  - Actionable information?
Monitoring of voltage imbalances in 500 kV buses

- Select display type “Voltage Magnitude”
- Change in real time phase A, phase B, phase C to better understand the situation
- This could also be done off-line
Full Screen in accessible in all parts of the map
Monitoring of negative sequence currents in generators

- New variable to monitor
  - Negative sequence currents in generators

- Why
  - Excessive negative sequence currents can damage the generators. Protection schemes are typically used.

- New granularity of information
  - Monitor the negative sequence current against the relay setting to monitor potential problems
  - Intention is to provide this information to operators as a “heads up” of a potential generation unit that may become offline.

- Visualization tool for is in progress.
Next Steps

- Current plans and future work
  - Visualization tools are still work in progress for the PMU applications
  - Dominion training plans for synchrophasor technology adoption are to be developed

- Visualizations tools is a great vehicle to demonstrate the value of PMU applications
  - It can shed new light on voltage/current imbalances situations
  - There is a significant amount of new information
  - The new information is of increased granularity

- Dominion, Virginia Tech, and Quanta will have a Demonstration on July 31, 2012.