Duke Energy Carolinas
Smart Grid Investment Grant Update

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NASPI Work Group Meeting
October 5-6, 2010

Project participants

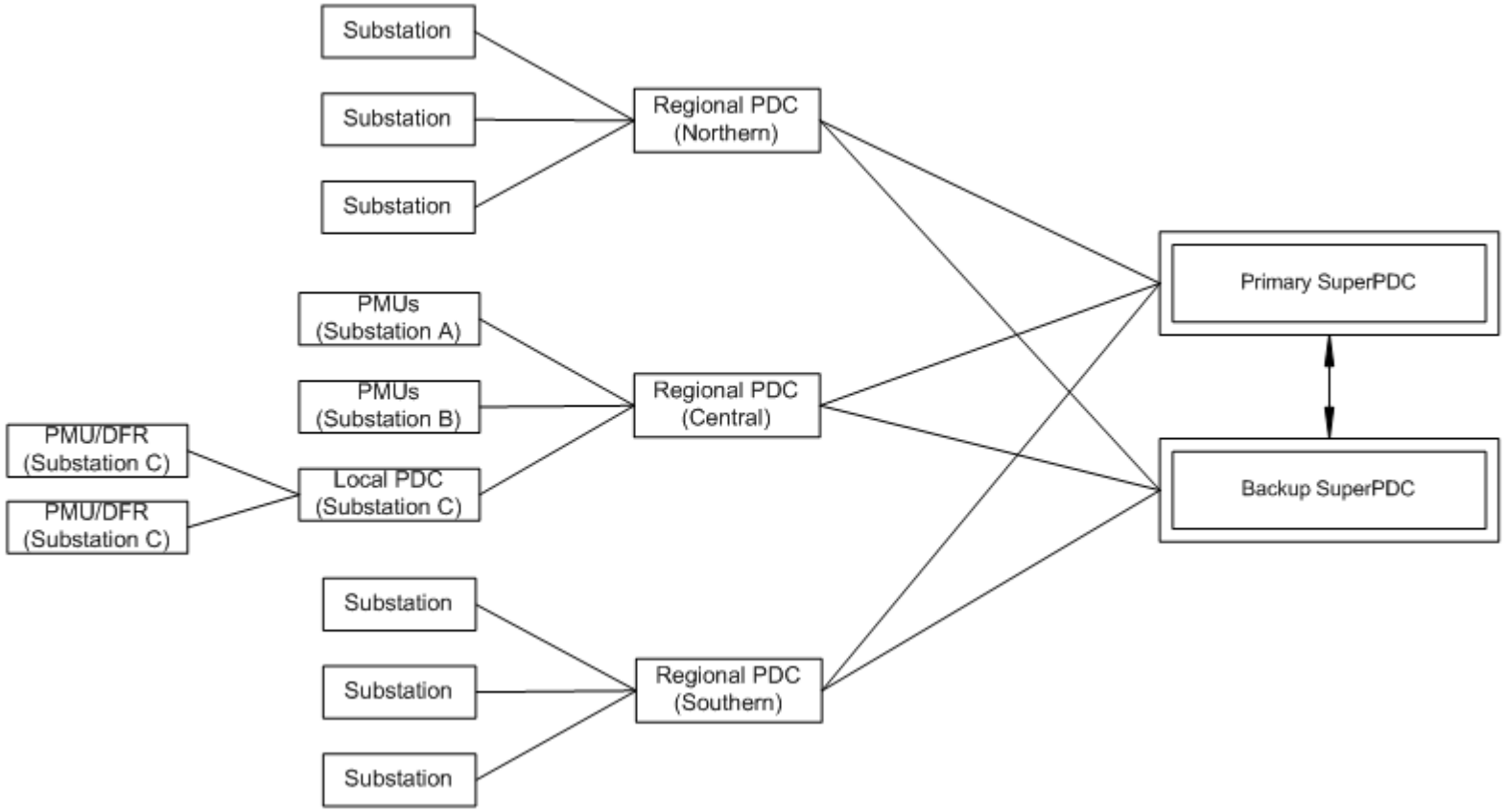
- Duke Energy Carolinas
  - Project manager
    - Tim Bradberry (Tim.Bradberry@Duke-Energy.com)
- Vendors
  - Alstom

Project Infrastructure Overview - PMUs

- Phasor Measurement Units
  - 125-150 total (usually 2 per substation)
  - SEL 351A or SEL 421
  - Sited on selected lines at all 230 & 500kV substations
  - Currently have approximately 15 PMUs installed at 6 substations
  - Total installation timeline is 3 years (completed by May 2013)

Project Infrastructure Overview - PDCs

- Phasor Data Concentrators
  - Key functionality is logging for stimulus reporting (meta-data such as performance, availability, etc)
  - OpenPDC Commercialized by Alstom



Project Infrastructure Overview - PGs

- Phasor gateways
  - Waiting for commercialized options
  - Industry-wide standards need to be finalized (NASPINet)

Most Important Synchrophasor Applications

- Improved State Estimator
  - Incorporates Phasor Measurements
  - Data inputs are SCADA (status points) and phasors
  - Provides data to EMS and other Network Applications

- Wide Area Visualization
  - Turns large amount of data into useful information for operator
  - Data inputs from EMS and phasors

- Post Event Analysis
  - Provides granularity for event analysis
  - Data inputs include phasor measurements and system models

Most Important Synchrophasor Applications

- Implementation
  - Dependent on Vendor Development
  - Expect production grade by end of 2012
  - No custom applications

- Value to Reliability/Efficiency
  - State Estimation and Wide-Area Visualization are necessary to provide a true snapshot of the system, more accurate data should lead to more reliable operation
  - Post Event Analysis helps to identify root causes, verify protections settings, and potentially reduce the number of future events

Most Important Synchrophasor Applications

- Training for Operators and Users
  - State Estimation
    - Operators should not see a change in performance, will have to be trained to interpret new data
    - Users and Support will have vendor training
  - Wide Area Visualization
    - Operators will be trained through Approved NERC System Operator Training and the Simulator
  - Post Event Analysis
    - Operators will not see this tool
    - Users and Support will have vendor training

Security Approach

- Maintain and continuously review NERC physical & cyber-security requirements
- Stand-alone PMU devices
  - Parts Availability
  - Maintenance Concerns (Human Factors Errors)
  - Cyber-Security Recommendation
- Separate communications pathways
  - Phasor data comes back on separate VLAN than SCADA data

Communications Approach

- Using standard synchrophasor protocols to ensure compatibility and interoperability with other utilities and NASPI
- Utilizing our own private network, a focus of the project is upgrading communications infrastructure from Serial to IP.
- Testing effectiveness and security through internal audits, risk assessments, etc. (details are confidential)

Project Challenges

- Overall Challenges
  - Coordination required for all internal groups (normal work continues)
  - Lack of production-grade applications and standards leave the details of the path forward somewhat obscured

- Communications Architecture and Data Flow Challenges
  - NASPINet not concrete
  - Lack of industry standardization

Other Comments

- Some issues due to new technology have not yet been discovered and resolved
  - Parts availability after scoping project
  - Device compatibility after installation

- PMUs will eventually have a positive impact in operation of the system, but sometimes have negative impacts at installation
  - Ensuring phases align across utilities and bad phasor detection for State Estimator performance
  - Determining storage requirements for data archival (a single PMU at 30x per second created performance issues for a PI server)

NASPI Support

- What can NASPI (as a community) do to support your project?
  - Drive standardization across the industry
  - Encourage development of tools and training
  - Continue to provide a forum for industry members going through the PMU installation process

Contacts

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