Demonstration of a Novel Synchrophasor-based Situational Awareness System

Wide Area Power System Visualization, On-line Event Replay and Early Warning of Grid Problems

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Guorui Zhang, EPRI
gzhang@epri.com
DOE SynchroPhasor Demonstration Project Objectives

• Develop and demonstrate a synchrophasor-based comprehensive situational awareness system

• Improve operator situational awareness to
  – Perform wide area power system visualization using real-time synchrophasor measurements
  – Provide early warning of potential system problems
  – Perform power system event replay for post event analysis
DOE SynchroPhasor Demonstration
Roles of Project Teams

• EPRI Team:
  – Project Management
  – Research, development, integration and demonstration

• TVA Team:
  – Work with EPRI on technology development for efficient data processing and transfer
  – Integration with openPDC, demonstration and technical support

• University of Tennessee at Knoxville (UTK) Team:
  – Enhance location of disturbance application
  – Provide technical support for LOD integration and demonstration

• HTC Tech:
  – Research, development, integration, demonstration and technical support
Scope of Demonstration Using Real-time and Historical SynchroPhasor Measurements

- Real-time reliability monitoring using real-time synchrophasor measurements
- On-line event detection and location of disturbance
- Near real-time event replay
- Post event analysis
- Early warning of potential system problems (TVA area)
Main Application Modules

- Real-time Synchrophasor Measurements
- Online Event Detection
- Location of Disturbance
- Near Real-Time Event Replay
- Early Warning of Grid Problems
- Wide-Area Visualization & Reliability Monitoring

Operators
Project Phases and Technical Tasks

• Phase 1 - Analytical Study
  – Task 1: Technology development for early warning of potential system problems
  – Task 2: Technology development for efficient data processing

• Phase 2 - Pilot Study
  – Task 3: Functional specification
  – Task 4: Software development, integration and testing
  – Task 5: System integration and testing

• Phase 3 - Large Schedule Demonstration
  – Task 6: System installation and demonstration
  – Task 7: Technical training and technical workshop
  – Task 8: Technical support for 6 month
System Architecture Overview

Data Transfer

Visualization Web Service

WA PS Visualization Application Via Internet or Intranet

Application Service with Memory Residence DB

Event Oriented Application Database

On-line Event Trigger

Location of Disturbance

Application Server

OpenPDC Data Servers

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Early Indication of Potential Grid Problems Using Real-Time Synchrophasor Measurements

Event Detection

Synchrophasor Data

Event Visualization

Indication of Potential Grid Problems

- Safe
- Alert
- Unsafe

Time

Risk

Operators

Early warning
Special Features of this DOE Demo Project

• Integrate with distributed openPDC
• Provide high performance wide area power system visualization
• Replay new sequence of events in near real-time with full resolution
• Integrate location of disturbance application
• Perform post event analysis
• Provide early warning of potential system problems