Real-time Grid Monitoring and Controls Using Phasor Data

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Agenda

- Who is CENACE?
- Grid Stability Issues
- Proposed Solution
- Benefit
- Next Steps
- Q & A
CENACE (Centro Nacional de Control de Energía) National Energy Control Center Overview

CENACE Organization information:

- **CFE** has over 85,000 employees, including temporary and permanent
- **CENACE** has about 1,200 employees
  - **CENAL** (National Control Center)
  - 8 Control Areas
  - 34 Sub-Areas
- **779** Generation Units
- **CFE Total Capacity:** 52,945 MW
- **Peak Demand:**
  - **34,315 MW** (02/23/2011)
  - **35,870 MW** (24/08/2010)
In the past, it has been difficult to prevent grid stability issues from occurring.

It has not been possible to monitor Phase Angles in Real Time.

No visibility on Network Stability.

Fault analysis and report generation have been difficult and labor intensive.
Proposed Solution:

- **MODICOSEN** (Dynamic Monitoring & Control of the National Power System):
  - Provide the means for **Real-Time Monitoring, Analysis, and Archiving** for Synchrophasor measurements from PMUs
  - Present and visualize the dynamic behavior of the National Electrical Power system in a much faster real-time way, much better than what a SCADA system does
WAMS (Wide Area Measurement System) designed to monitor the National Electrical Power System

Prevent Future Blackouts by enabling a timely response to emerging network instabilities

Analysis and Real Time Visualization of measurements of Voltage & Current synchrophasors, Angle Differences, and the Damping Coefficient calculations for inter-area regional low frequency oscillations

Enhance the existing national electrical infrastructure to improve stability analysis, generate timely alarm notifications, and help identify differences in the network settings that will improve stability
MODICOSEN System Components
MODICOSEN Visualization

- PMU Device Monitoring
  - 25 PMUs
  - Connection Status
  - Status Updates
MODICOSEN Visualization

- PMUs Raw Data Displays

PMUs Data Analysis Frequency using SQC (Statistical Quality Control)
MODICOSEN Visualization

- Voltage Phasors
  Real & Imag Parts

- Current Phasors
  Real & Imag Parts
MODICOSEN Visualization

- Voltage and Reactive Power
- Frequency and Real Power
MODICOSEN Visualization

- Configurable MVARs Trending
- Configurable MWs Trending
MODICOSEN Visualization

- Configurable Raw PMUs Data
- Configurable Frequencies
MODICOSEN Visualization

- Configurable Frequency Worm Chart
- Configurable Angle Differences Chart
MODICOSEN Analytics - UAP (Unified Analytic Platform)

- Real-Time Calculations performed using SISCO Unified Analytic Platform

- Angle Differences. 20 times per second
- Oscillation Detection and Alarming. 5 times per second
- Damping Coefficient of Significant Harmonics. 5 times per second
MODICOSEN Analytics - PDA (Phasor Data Analyzer)

1) C37.118 Data Streams received via CFE WAN

2) Buffers phasor data for input into the archive

3) Calculates the difference in phase angle between phasors and

5) Calculates damping coefficients from FFT results as driven by the run rate of the FFT. Determines if the most significant modes of oscillation are increasing greater than a set point for longer than a setable time period.

6) Displays voltage and frequency trends as well as oscillation trends and alerts

OSIsoft FFT Interface

SISCO UAP Runtime Platform

Raw and FFT PI Archives

OSIsoft C37.118 Interface

Sharepoint Portal

SISCO UAP Scenario Player

Provides high speed simulation and playback for PDA application testing and debugging

CFE Comisión Federal de Electricidad
Cenace Centro Nacional de Control de Energía
MODICOSEN Analytics

- OSIsoft PI FFT Interface (Fast Fourier Transform)
  - Calculates the modes of oscillation (Harmonics Content)
  - Polar & Rectangular Coordinates
MODICOSEN Analytics

- OSIsoft PI FFT Interface (Real Time Water Fall Chart)
MODICOSEN Analytics

- Mexico - Guatemala Tie Line Event
MODICOSEN Analytics

- FFT Interface - Low Frequency Oscillations Detection and Alarming
Benefits

- Improved response times for data analysis
- Greater flexibility in searching, visualization and reporting
- Democratization of information through Integration
- A single source of information
- Improved “Look and Feel“ visualization
- Operators can foresee instabilities in different areas of the electrical system to implement corrective or preventive actions
- Monitoring Phase Angle 20 times per second (50ms)
- The Failure Analysis can be carried out in Real Time
- Monitoring the Network Stability in Real Time better than SCADA
MODICOSEN

Thank You