Implementing a Wide Area Monitoring Solution to Provide Real-Time Situational Awareness

Background

Customer:
Western Regional Load Dispatch Centre

Region:
Western India

Industry:
Power Transmission

Solutions

- SYNC 3000
- SYNC 4000

Challenge

WRLDC lacked a system to trigger alarms warning of adverse events such as large scale blackouts and cascading effects.

Business Need

The Western Regional Load Dispatch Centre (WRLDC) is responsible for ensuring integrated operation of the power system in western region of India which includes the states of Gujarat, Maharashtra, Madhya Pradesh, Chhattisgarh, Goa and the union territories of Daman and Diu, Dadra and Nagar Haveli. It covers 951,000 sq kms and serves a population of 273 million – more than 30% of the area and population of the country.

With the opening up of the Indian power sector, the western region witnessed rapid growth characterized by vast capacity additions through the rollout of independent power plants and ultra-mega power plants, and increased open access transactions across regions. As a result, several substations were established in the western region to transmit the generated power leading to complexities in the network. The spread and scale of the network adversely impacted visibility and effective monitoring of the system which could potentially result in power outages and other cascading effects. WRLDC also lacked a system to trigger alarms warning of adverse events such as large scale blackouts and cascading effects. Real-time situational awareness of the grid is key to ensuring the reliability of power supply and preventing outages. Hence, WRLDC decided to implement a wide area monitoring system (WAMS) to handle the growing scale and complexities of its network, monitor the electric grid and prevent adverse impact caused by system instabilities.

To summarize, the utility faced the following challenges:
- Increase in scale of operations due to the emergence of Ultra Mega Power Projects (UMPPs) and Independent Power Producers (IPPs) in the region
- Growing network complexities due to growth in the number of substations
- Lack of an early warning system for adverse conditions
- Lack of real time situational awareness of the electric grid

WRLDC invited tenders from solution providers with expertise in building WAMS. The ideal solution demanded proficiency in communication and automation as well as system integration and operation. With a cost effective solution that was successfully implemented on a trial basis for the Southern Regional Load Dispatch Centre, Kalkitech emerged as the winner in the tender review process.
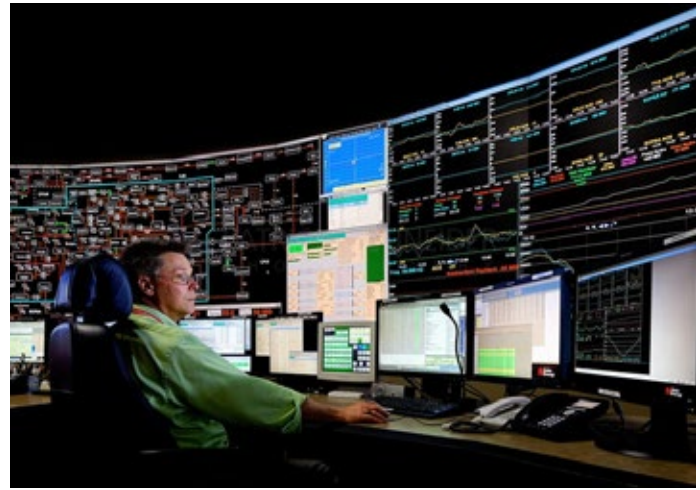
Solution

Kalkitech's solution included both products and professional services including:
- Deployment of Kalkitech SYNC 4000 Control Center Front End deployed as a wide area monitoring front end and Phasor Data Concentrator (PDC)
- Supply and installation of Phasor Measurement Units (PMUs) along with the GPS system
- Installation of eDNA Historian from INSTEP Software
- Visualization tools including oscillation monitoring system, event analysis engine and damping monitor engine

Kalkitech deployed an end-to-end WAMS solution spanning site survey, planning, design, engineering, manufacturing/integration and testing for WRLDC. It also included a general user interface for real-time situational awareness and advanced applications for wide area monitoring.

PMUs based on the IEEE C37.118 protocol were sourced from a third party vendor and installed at strategic locations across various states, along with GPS systems. Kalkitech installed its high-performance scalable SYNC 4000 PDC and protocol conversion gateway at the WRLDC control center to acquire data from up to 14 PMUs in real-time. Using INSTEP Software LLC's eDNA Historian, Kalkitech enabled collection and archival of PMU data and integrated the visualization system with the online Historian environment. The western region PDC was integrated with the northern region PDC for effective grid monitoring. The user interface provides a 360 degree view of the electric grid, allows monitoring of voltage differences and frequency instability, and helps identify regions that may be operating under stressed conditions. This helps WRLDC proactively initiate action to prevent outages.

Real time wide area measurements from PMUs provide the oscillation monitoring system (OMS) with timely identification of oscillation events that trigger alarms when deviations from normal operating conditions are detected. The OMS framework includes an event analysis engine and a damping monitor engine. The event analysis engine monitors system events in real-time. The damping monitor engine of OMS analyses ambient PMU data , scans the system and provides timely warnings when the system is operating at the brim of small signal instability.

Results

With Kalkitech's solution the WRLDC realized multiple benefits:
- Efficient and standards based data collection from PMUs for real-time situational awareness
- Timely analysis of PMU data for critical insight on grid stability and to help prevent blackouts and cascading effects
- Preventive analysis of grid variations in real-time resulting in quick identification and resolution of issues
- Enabled emergency control through real time monitoring of system events
- Increased equipment life through better grid stability
- Improved ability to monitor the grid across the region which could potentially prevent blackouts and adverse impact on the economy