Synchrowave® Operations

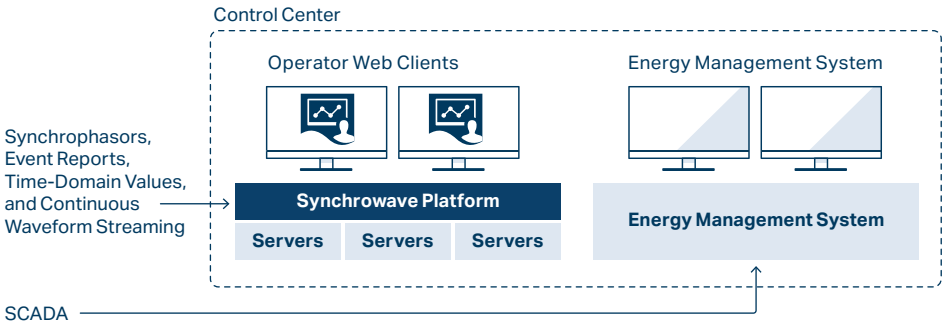
Power System Operations and Analytics Platform

Increase grid safety and reliability through situational awareness

- Gain power system insight that isn't possible with SCADA.
- Maintain power system stability by automatically detecting transients induced by renewable generation.
- Improve operator situational awareness with real-time analytics and geographic information system (GIS) location information.
- Prevent equipment failures by detecting abnormal behavior early.
- Create, integrate, and deploy new applications to address power system challenges and opportunities.

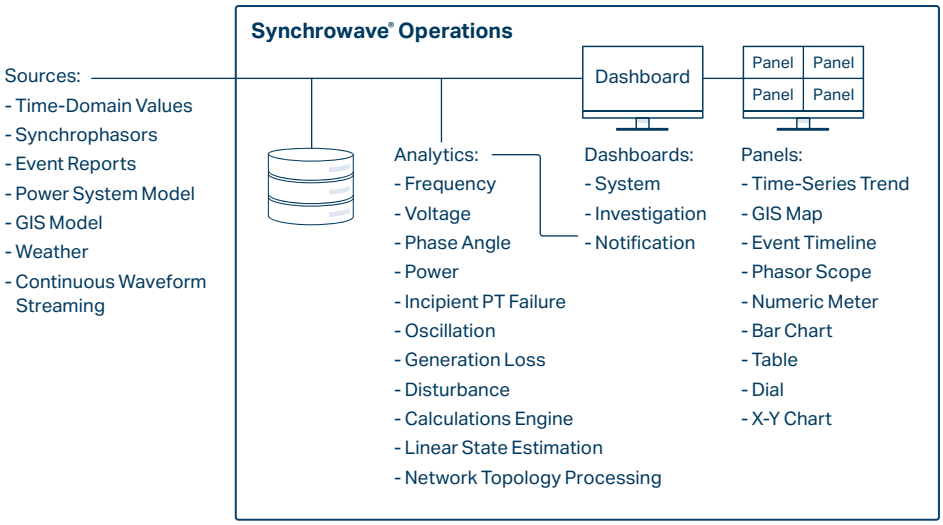
Synchrowave for Grid Operations

Improve operator situational awareness with high-resolution time-series data, real-time analytics, and GIS location information. Synchrowave Operations complements traditional SCADA systems and energy management systems (EMSs) by delivering power system insights that SCADA can't provide.



Synchrowave Operations Functional Overview

In Synchrowave Operations, time-series sources stream data to a historian, analytics applications, and dashboards. The analytics applications detect power system conditions and provide notifications. Operators then view these notifications and other types of data on custom dashboards built from a selection of panels offering different insights.



Key Benefits

See the Real-Time System State

Synchrowave Operations improves situational awareness by providing live, subsecond, and time-aligned information from across the entire power system. Waveform signatures provide additional insight into the dynamic behavior of the power system, which enhances decision making during abnormal conditions.

Get Instant Feedback

Operators will promptly see the system response after switching a line in or out of service. Unreliable behaviors, like a growing oscillation or a failed breaker reclose cycle, are visible instantaneously with subsecond resolution that enables quick identification and response before the issue impacts the power system.

Receive Intelligent Analytics and Notifications

Real-time analytics applications constantly monitor streaming data and provide notifications that give operators access to key event data, including the location and impact, with a single click.

Prevent Equipment Failures

Automatically detect an impending PT failure with high-resolution time-series measurements. Early detection gives time for crews to schedule PT maintenance before a failure occurs.

Reliably Integrate Renewable Generation Data

High-resolution data lets operators measure and track the impact of renewables. Integrating renewable energy into the power system can result in reduced system stability and new oscillatory modes. System dynamics from these generation sources change quickly—too fast to see at traditional SCADA rates.

Validate and Improve Power System Models

To accurately replicate events, power system studies rely on accurate system models. Synchrowave Operations will record the system response to system events, such as capacitor switching, generator trips, load shedding, or other events. Comparing the recording to system models lets operators validate system security and reliability.

Linear State Estimation (LSE) and Network Topology Processing

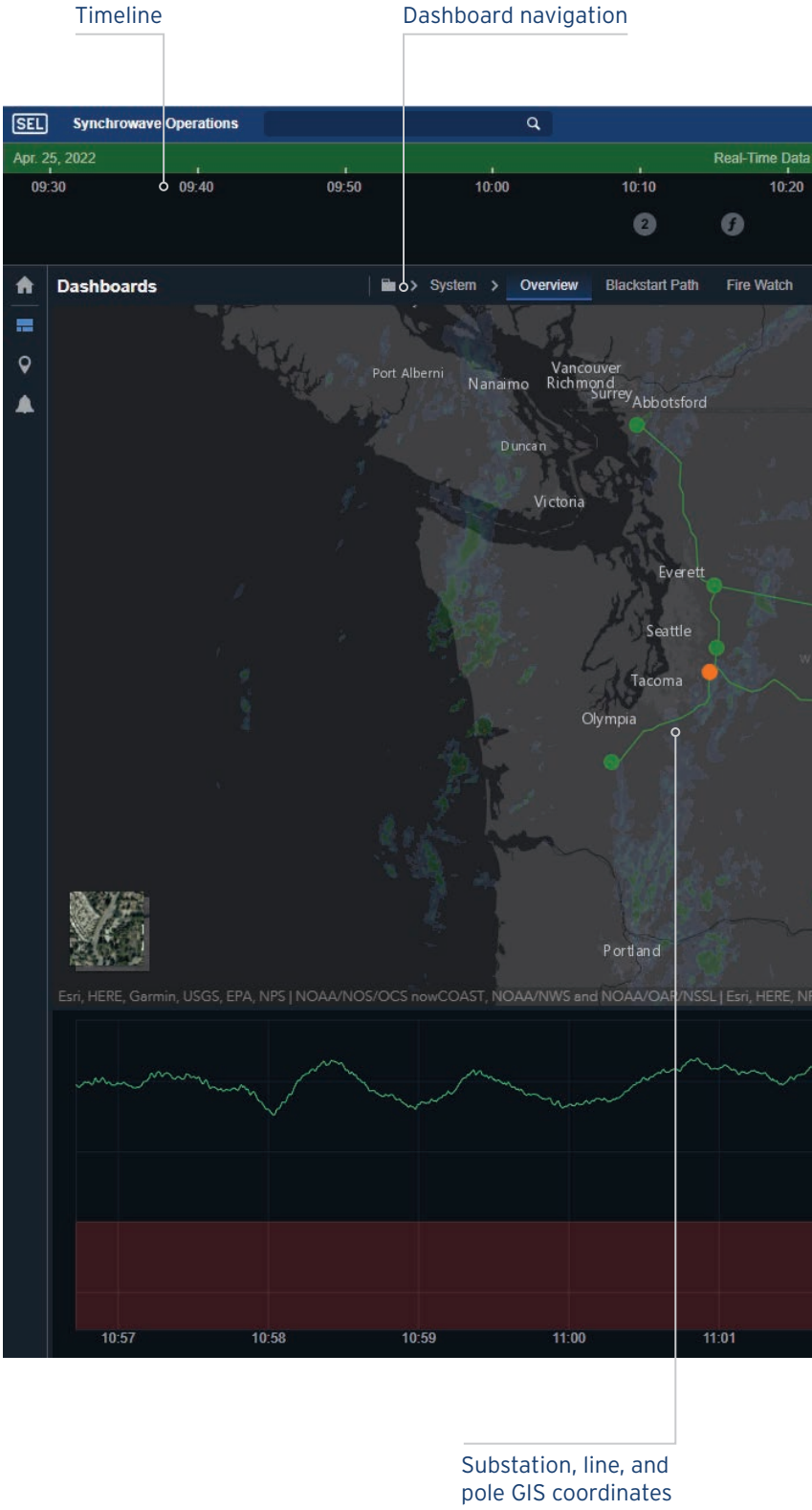
LSE improves measurement accuracy, reliability, and visibility of the power system by estimating measurements from the power system model or neighboring phasor measurement units (PMUs). Estimation is especially helpful when a PMU experiences a communication error or when a location does not have a PMU present. LSE helps mitigate the impact of a noisy measurement by comparing multiple direct measurements with estimated results. It also leverages the Network Topology Processor to correlate measurements with physical configuration changes.

Securely Access Data and Applications

Synchrowave Platform brings the latest in software technology to a secure private network. Applications and all dependencies run self-contained, resulting in reduced attack surfaces. Access to the platform is restricted to authorized users via Lightweight Directory Access Protocol (LDAP) authentication.

User Interface

Synchrowave Operations uses a modern, intuitive interface with color-coded notifications to help operators quickly detect and mitigate system events in real time. Dashboards are customized with GIS, trend, dial, bar chart, and table panels to ensure operators always have the information needed.



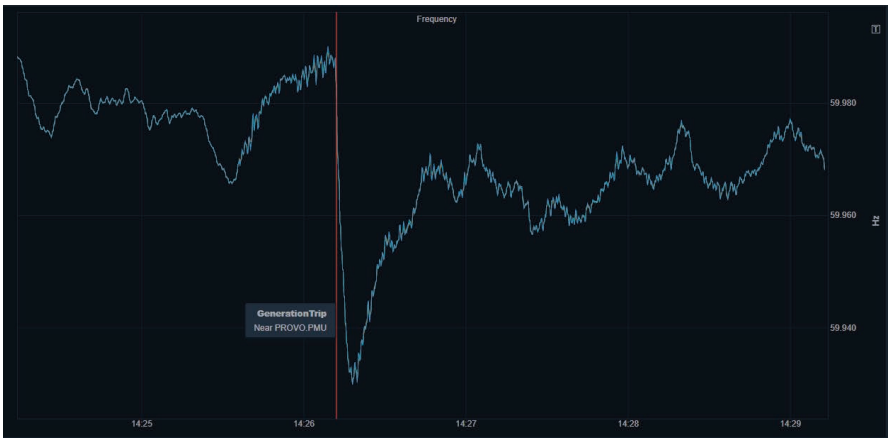
Real-time mode
Notifications
Notification summary
jarebest
11:06:43
04/25/2022
10m
Minute Chart Range
User
Frequency
Angle
Power
General
Oscillation
Voltage
All
Notifications
One-Line Diagram
Phase Angle
System MVA
System Voltage
Panel
Dashboard
Penticton
Nelson
Cranbrook
Fernie
Grand Forks
Trail
Kalispell
Spokane
Wenatchee
Missoula
Yakima
Lewiston
Kennewick
Powered by Esri
Frequency
GC.BUS230
59.903 Hz
Phase1 Voltage Angle
90°
120°
60°
150°
30°
180°
0°
-150°
-30°
-120°
-60°
-90°
Frequency
60.000
59.950
59.900
59.850
Hz
11:02
11:03
11:04
11:05
11:06
LL Voltage Magnitude
231.228 kV
230.945 kV
232.195 kV
231.042 kV
230.510 kV
230.324 kV
232.185 kV
231.191 kV
231.770 kV
Time-series trend panel
Numeric, phasor scope, and bar chart panels

Real-Time Analytics

Real-time applications continuously analyze data to identify power system conditions. When a condition is detected, a notification is sent to the operator. Notifications include critical information about the condition, such as the state, impact, and location.

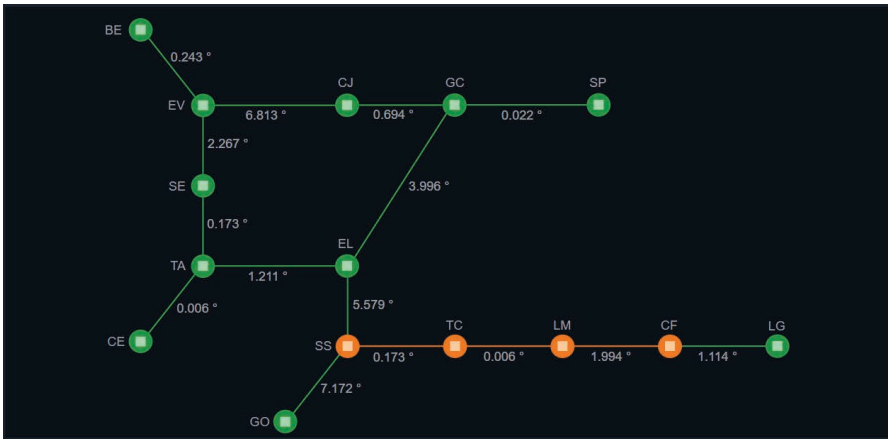
Frequency Monitor

The frequency monitor application intelligently generates just one notification for each system frequency event. By reducing the number of alarms, displaying the propagation of events on the GIS map, and overlaying generation loss information directly on the trend, this application allows operators to quickly determine the source of events and take appropriate action.



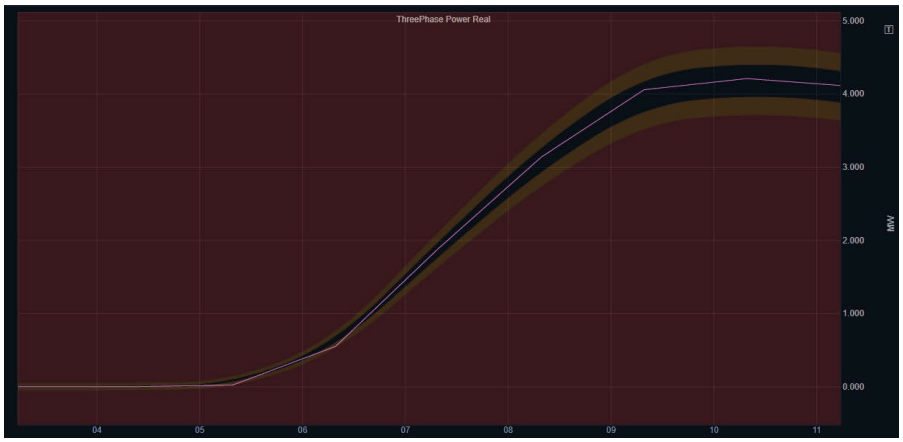
Phase-Angle Monitor

The phase-angle monitor automatically computes the phase-angle difference (PAD) across transmission lines and generates a notification when the PAD for a transmission line exceeds its limit. A phase-angle overview diagram displays phase angles across the system in real time and historically.



Power Monitor

The power monitor automatically computes real, reactive, and apparent power for power system assets. The power monitor compares power measurements to their limits and provides an indication of the amount of power being transferred by an asset. Dynamic limits are also shown in the application, allowing operators to see how asset limits change in real time. Power flow measurements are available as layers on the GIS map for visual representation.



Additional Real-Time Applications	Available
Voltage monitor	Yes
Oscillation detection and location	Yes
Disturbance detection	Yes
Incipient PT failure detection	Yes
Linear state estimation and network topology processing	Yes
Fault detection and location	Coming soon

Powerful and Intuitive Dashboards

Dashboards provide real-time visualization of power system data and information through a collection of panels. Dashboards are dynamic and customizable, and they provide actionable intelligence so operators can efficiently manage the power system. System monitoring, asset investigation, and notification analysis dashboards are available.

System Monitoring

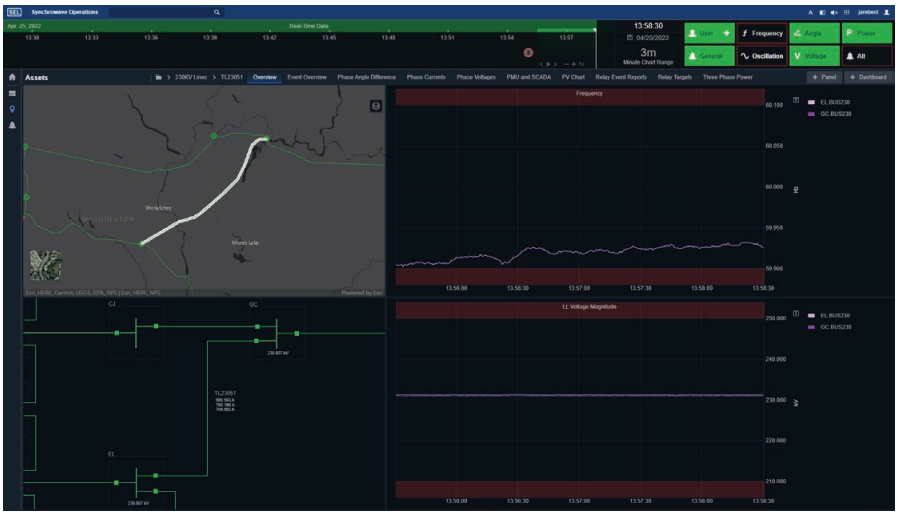
System monitoring dashboards provide visibility across the entire power system for applications such as path flow analysis, phase-angle stress detection, and voltage monitoring.

Notification Analysis

Notification analysis dashboards provide visibility into active and historic power system conditions by dynamically displaying information like limits, location, and time with one click.

Asset Investigation

Asset investigation dashboards let operators and engineers drill down into any power system asset (transmission line, substation bus, transformer, generator, feeder, etc.) to see its current state. When an EMS/SCADA alarm doesn't provide all the information needed, asset investigation dashboards quickly provide high-resolution information.

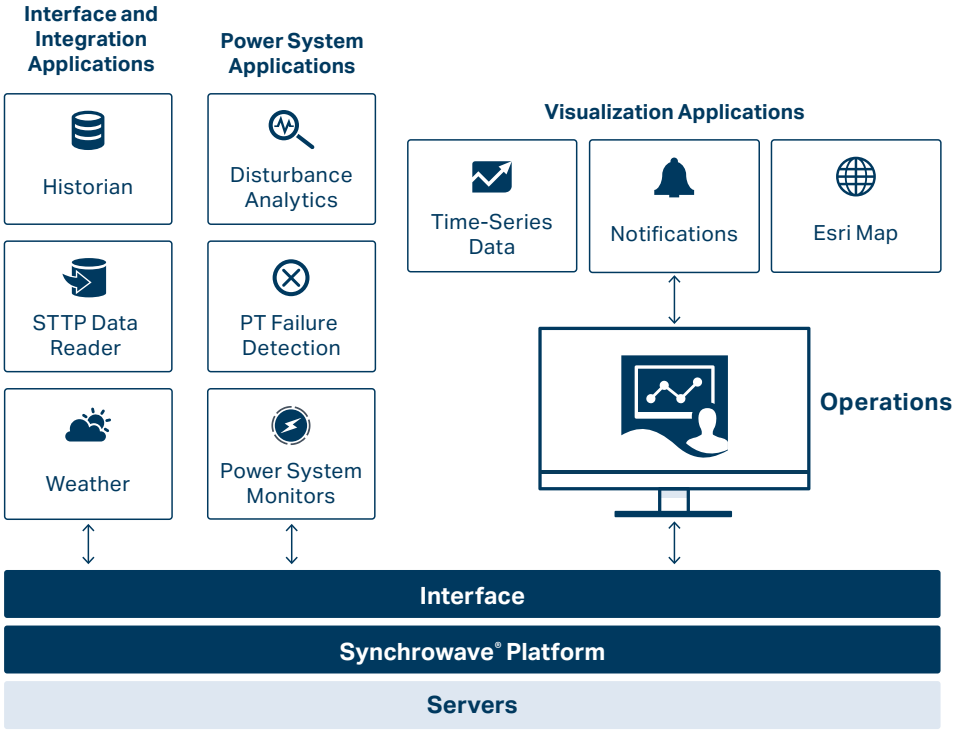


High-Performance Platform

Synchrowave Operations is built on Synchrowave Platform, a scalable, resilient, and secure application platform for real-time power system operations and analytics. Synchrowave Platform brings state-of-the-art software technology to a secure private network. The platform is designed from the ground up with microservice and container technology, providing a robust and scalable solution for future growth.

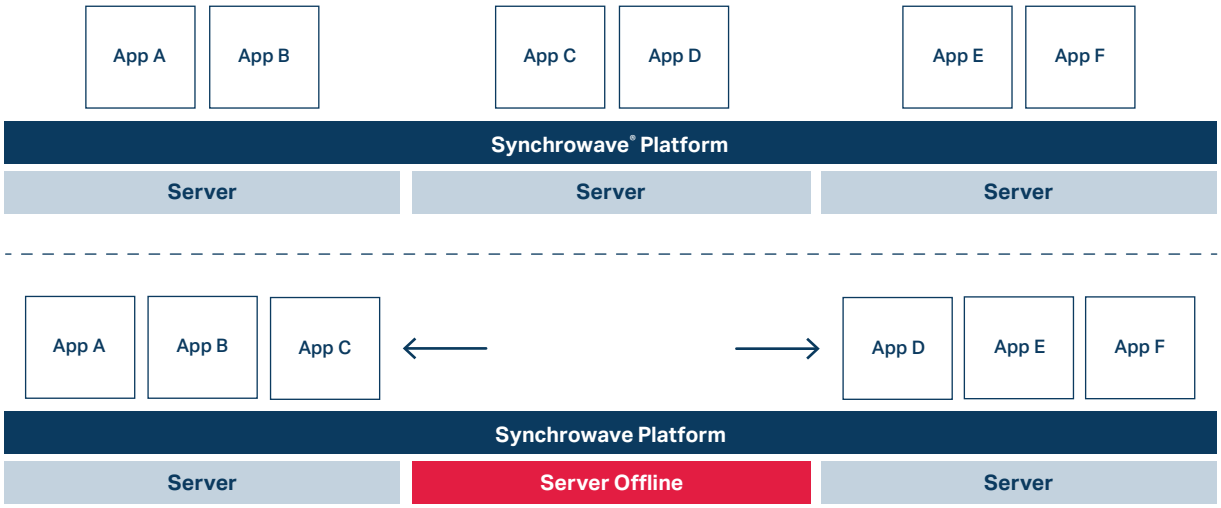
Simple and Fast Application Deployment

Install, manage, and update applications quickly and independently. When a new application is released or an existing application is enhanced, that application is simply uploaded to the platform. The underlying container technology ensures the software suite is scalable, resilient, and secure.



Resiliency and Availability for Grid Operations

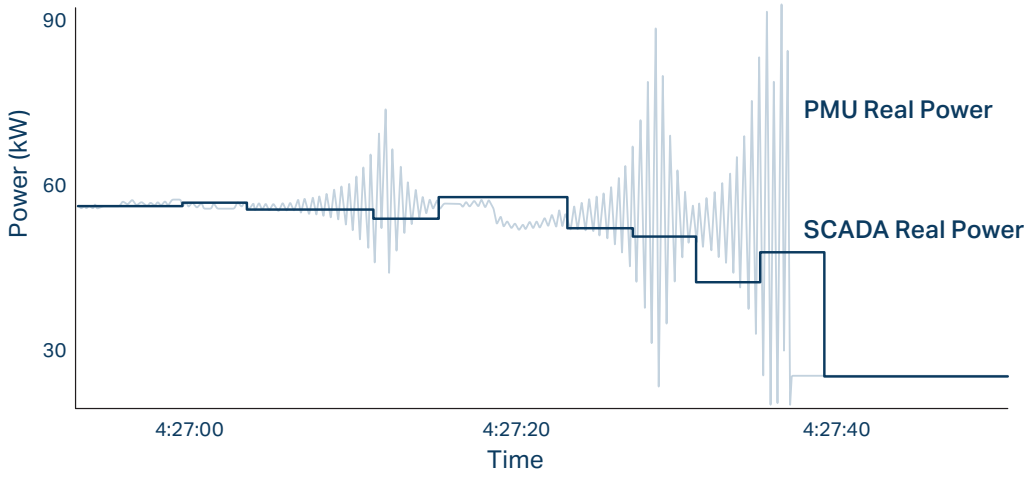
During a server failure or maintenance, applications automatically rebalance and move to healthy servers in the platform's cluster, ensuring critical applications are always operational.



Applications automatically rebalance during a hardware failure.

Know What's Happening With High-Speed Time-Series Data

The dynamics of the power system are changing because of increased renewable energy integration. Traditional SCADA data rates fail to capture important information needed to maintain grid stability. Synchrowave Platform supports high-speed time-synchronized measurements, ensuring the operators know what is happening on the grid at all times and can make timely decisions.



SCADA data versus high-resolution synchrophasor (PMU) data.

Specifications

General	
Data Rates	1—14,400 samples per second
Data Formats	Synchrophasors, relay event reports, streaming point-on-wave data
Database	Time series—contact SEL for hard drive sizing requirements.

Minimum System Requirements	
File System	NFS Version 3 (recommended for cluster deployment) Local drive or external network file system (single-server installation)
Web Browser	Google Chrome Version 73
GIS Server	Esri GIS server connection
Server	2.1 GHz processor with >16 cores, 16 GB RAM, two 10 Gb network cards See instruction manual for minimum and high-performance recommendations.
Operating System	Red Hat Enterprise Linux, Ubuntu Server, and Microsoft Windows. See instruction manual for supported versions.
Network	100 Mbps, 1 Gbps recommended

Fault detection and location is coming soon.

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PF00644 • 20250409