



**Systems
Automation**

SAGE is a powerful SCADA/EMS that offers a complete solution to real time operational processes of electric power systems. SAGE, which was developed by Cepel (Electrical Energy Research Center), an organization in the Eletrobras system, is widely used within the Brazilian electric power network. Also, SAGE is the core of the real-time solution REGER, the new supervision and control structure of the ONS (Operator of the National Electricity System, the Brazilian ISO).

SAGE enables the acquisition, storage and analysis in real time of all data-flow from multiple sources of an electric power system, be it local, regional or even on a national level, producing user friendly information, in the form of alarms, graphs, reports, trends and simulation results.

Advanced features provide early warning of potential problems in the system and assistance to the operator's decisions, in what is known as "situational awareness" to stabilize the network or to bring it to a more secure and economic operational state. Cepel has a long standing tradition of developing network simulation software, ensuring state-of-the-art tools for SAGE EMS.

SAGE has unique features that guarantee its effectiveness in managing the processes of power generation, transmission and distribution:

- Unparalleled scalability - from the supervision of a small distribution substation to the management of the entire National Interconnected System (SIN).
- Performance and reliability - advanced architecture allows dynamic reallocation of tasks among multiple servers.
- Business continuity - stability and unique capabilities for managing redundancies, from a single function to an entire Control Center.
- Maximum connectivity - extensive library of native communication protocols, including the ICCP (Inter-Control Center Communications Protocol) and IEC 61850.
- Readiness for future challenges - open system, close adherence of standards, support of key interoperability technologies such as CIM (Common Information Model) and SOA (Service Oriented Architecture). Policy of continuous evolution: the evergreen concept in the real world.



The basic platform for the development, testing and demonstration of SAGE is the Advanced Supervision and Control Laboratory (LASC) at CEPEL.

Established in 1996 and through continuous modernizations it remains a state-of-the-art laboratory. LASC reproduces the environment of modern operational control centers



About REGER

REGER was launched by a CEPEL and Siemens consortium in 2009. REGER has implemented a set of supervisory and control systems (SCSs) that are highly integrated, distributed geographically and redundant, and it is ready to perform all the functions required by the ONS. REGER is based on the development, integration and configuration of two major systems: SAGE, from CEPEL, which

implements all real time solutions of the system, and Spectrum PowerCC - IMM, from Siemens.

REGER enhances the ONS security and efficiency in the execution of its critical activities. The unique architecture of the system ensures full continuity in supervising and controlling the electrical system, even following extreme contingencies such as the loss of an entire control center.

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SINAPE.Net is a computational system for the management and analysis of digital fault recordings. It is designed to increase the productivity of the fault analysis processes in electrical power utilities. The system has advanced computational resources to automatically extract the most relevant information from fault recordings, helping the user to define the set of files best elucidating the fault event.

Some of the main features of SINAPE.Net are:

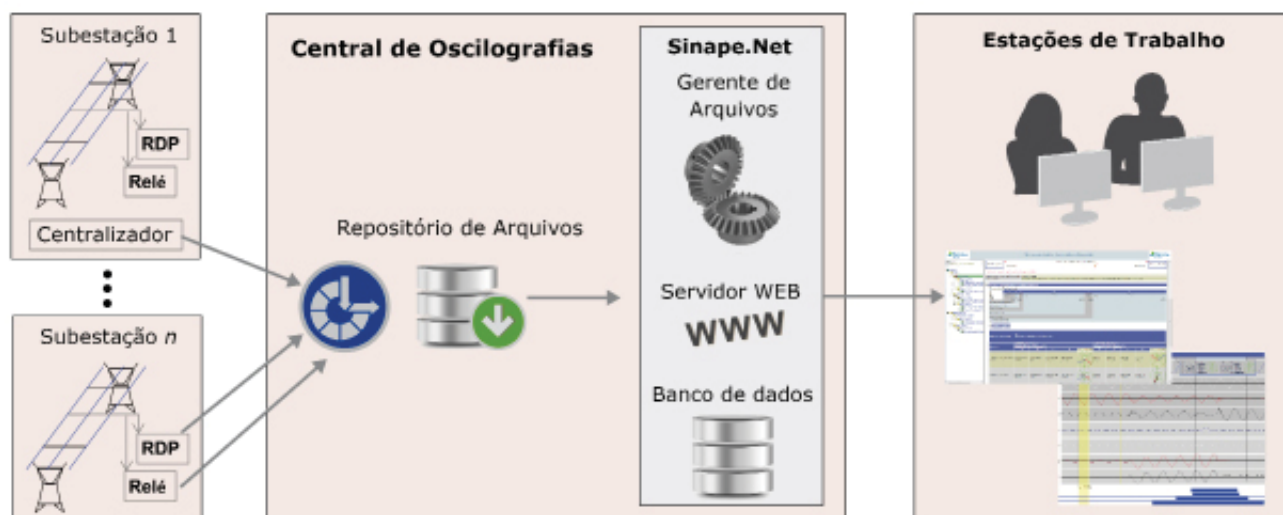
- Access to the central fault recording repository in the utility through a Web interface.
- Link between the fault recording files and the power system equipment being monitored.
- Automated fault analysis resulting in disturbance identification, aiding the user to focus on the most important recording.
- Fault reports that include results from analysis of analog and digital channels as well as the basic topology of the system stored in the database.
- Automated fault distance location in transmission lines using one or two line terminals.
- Flexible file storage options adaptable to pre-defined practices of the fault analysis team.

- Waveform display with advanced features for manually scrutinizing the recording.
- Flexible parameterized features to tailor the system for distinct architectures.

The automated disturbance analysis software and the fault location algorithm created by Cepel have been refined through their daily use at some of the largest Brazilian electrical utilities.

The SINAPE.Net system has the following components:

- File repository: dedicated area of a file system bearing fault recording files in COMTRADE format (IEEE Std C37.111).
- File manager: an operational system service software that runs most of the automated actions.
- File backup: enables cleaning up the repository by moving older files to a backup.
- Automated disturbance analysis: executes algorithms to diagnose the recorded events.
- Database server: runs the DBMS services.
- Web interface: provides visualization of the results on the company intranet.



A synoptic view of the results are exhibited on a web page where events can be filtered by monitoring equipment, disturbance type, time of

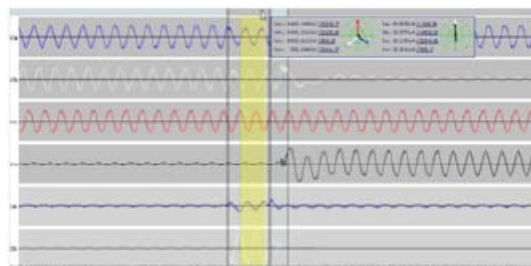
the trigger, time of file reception and time of the event analysis.



The system automatically relates files recorded simultaneously in a given region to a single event. When synchronization to an absolute time source is not available in the fault recorder, this link can be performed manually. This feature is used in the fault location algorithm to improve the estimated results, which can be published on a control center console using simplified views designed for this purpose.

The system has an administrative interface designed to access and edit the topology of the electrical power system (e.g. transmission lines, busbars, substations), manage the registration of file recorders and their connections, deal with files in quarantine (those that could not be processed due to an unexpected error in the original files) and adjust system settings.

SINAPE.Net system can depict voltage and current waveforms, as well as the contents of digital channels in a browser window. It includes resources like zoom, cursor lines for time measurement and the visualization of phasor values in a given segment.



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