Gridscale X Advanced Protection Assessment

Highly-detailed protection simulation for transmission and distribution networks

SIEMENS

Siemens Protection Simulation Software

The world is in the middle of transformation. Decarbonization, Decentralization and Digitalization
are challenging grid operators around the world.

Advanced Protection Assessment supports the system protection function within electric power utilities. Advanced Protection Assessment is used by major utilities in more than 50 countries on six continents worldwide due to its extensive library of more than 7,300 highly detailed relay models and extensive selection of modular protection tools that help engineers manage voluminous and complex network data, uncover potential problems, and examine alternative solutions.

Simulating short circuits and showing the responses
of protective devices is the heart of Advanced Protection Assessment. It is as simple as using a mouse to click and drag elements on a one-line diagram, and to open breakers, apply faults, and simulate protective system responses. Conducting automated fault studies and wide area coordination reviews, developing incisive custom reports, performing automatized protection system reliability studies and identifying fault locations, all become practical, efficient activities that add value
to your organization.

Highly detailed for accurate results

Advanced Protection Assessment handles networks of any size, large or small. Advanced Protection Assessment users have systems ranging from under 100 buses to 10,000 buses – including protection systems with 20,000 to 50,000 relays. Advanced Protection Assessment's ability to handle rich detail enables customers to create accurate protection models to realistically predict likely misoperations. Advanced Protection Assessment comes with a library of relays, distribution reclosers, and fuses, all ready to use out of the box. Advanced Protection Assessment facilitates automatic importing of relay settings from native relay manufacturer files, eliminating the need for manual entries which could result in errors.

Get the most from your data

Advanced Protection Assessment is built upon a true relational database, which is included with the software. The underlying DBMS is fully ODBC- and SQL-compliant; therefore, the Advanced Protection Assessment database may be accessed with programs like Oracle and Microsoft Access. All of the modules use the same Advanced Protection Assessment database data, so any data item
is entered once and may be used many times.

Advanced Protection Assessment is your all-in-one solution for maintaining, operating and protecting
your grid with its numerous features and modules.

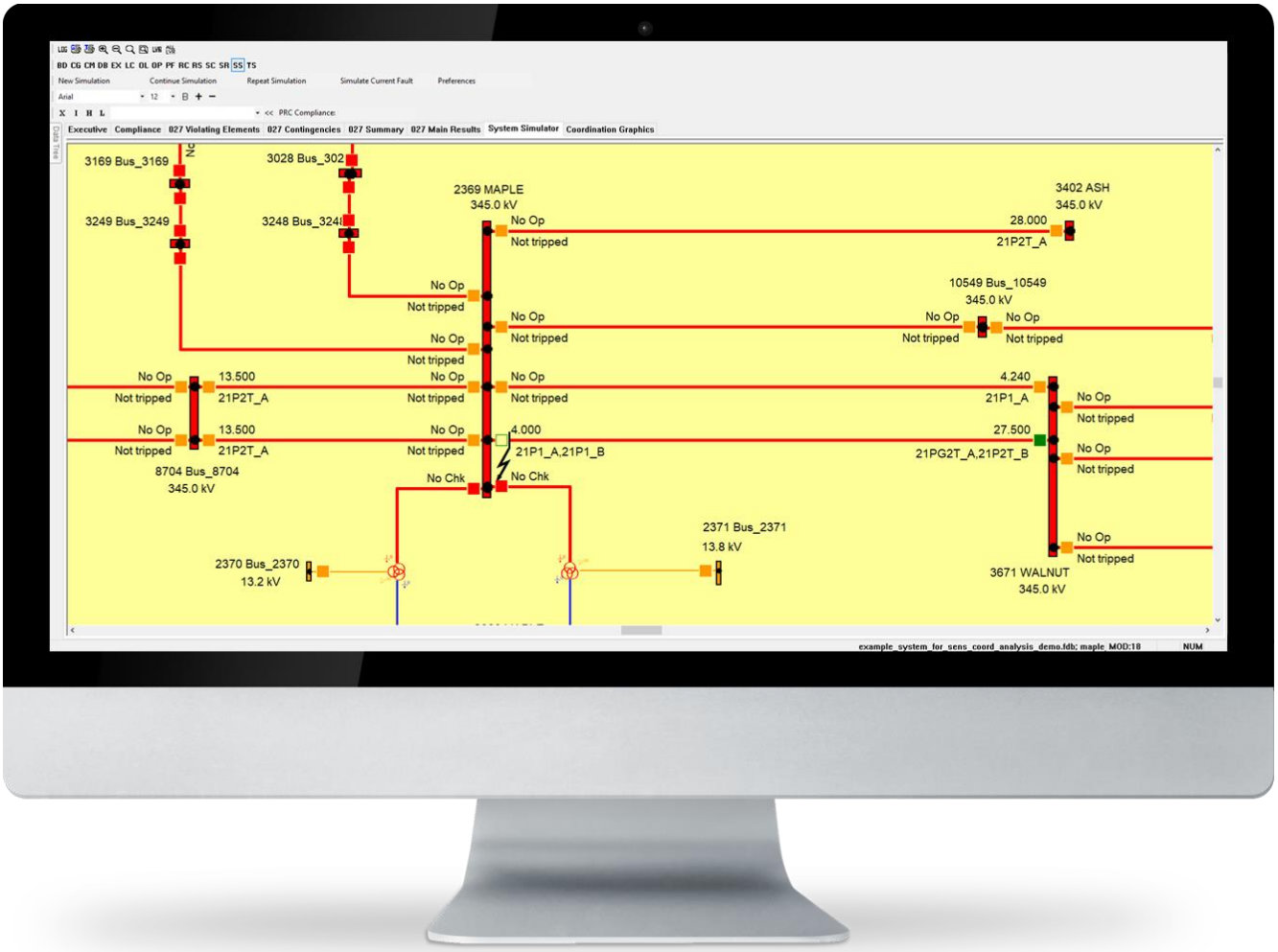

Figure 1: Easily find miscoordination and its root causes graphically and with detailed reports

Advanced Protection Assessment Pro-Standard package features: Advanced Protection Assessment

Database Editor is used to build and maintain the database of integrated network and system protection models. Special features for easy transformer model building; relay, recloser, and fuse model import; data merging, and quick entry of protection data.

Short Circuit calculates any type of fault on any size system. Supports standard and customized reporting, automated fault studies, fault location analysis, and user-defined fault conditions.

One-Line Diagram is used for building and maintaining a system one-line diagram and display of data, short circuit, and protection simulation results. Direct access for opening breakers and applying faults.

Relay Setting represents a company's relay setting procedures as user-written macros that perform fault studies, compute raw relay settings, and select actual taps. A library of "starter macros" is included. Relay Checking provides automated stepped-event simulation of the protection system in response to a variety of fault scenarios. This unique capability allows users to perform wide area evaluations of protection to uncover miscoordinations.

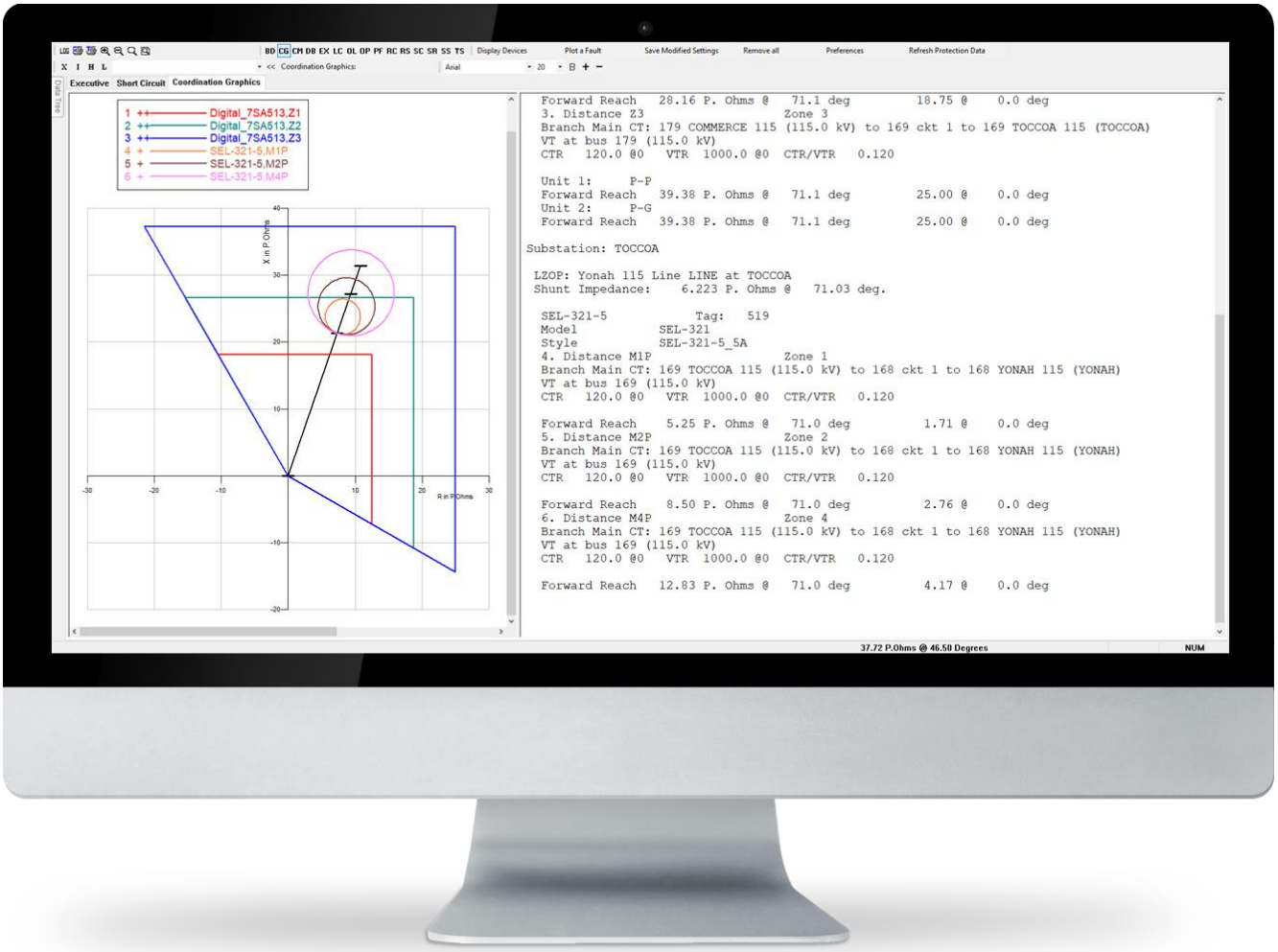

Figure 2: Easily visualize the graphical coordination of your devices

Coordination Graphics displays overcurrent and distance protective device characteristics. Supports interactive contingency and fault application, graphical relay resetting, and resetting of relay and distribution recloser taps and test points.

Coordination Graphics is an interactive facility for evaluating graphically the coordination among selected sets of protective devices, modifying tap settings or device size, evaluating the effects of the modifications, and optionally storing the new settings back into
the database.

Coordination Graphics supports the display of up to thirty (instantaneous or time delay) overcurrent or distance curves at one time, each with a different color and line style. Overcurrent curves are displayed on log-log time-current axes with user-controlled units and scales. Test points and IOC/TOC curve truncation are display options. Coordination Graphics gives you similar control over distance element curves. Your RX display can have as much contiguous network as you want, and you can display distance elements located on any part of it. They can be primary backup, facing, a combination of these, or even several transmission lines apart. Multiterminal lines are treated naturally in Advanced Protection Assessment.

Once you have displayed a set of protective device curves, you will want to specify network contingencies and faults
so that you can check the operation of those devices.
If you apply any fault on the Short Circuit one-line diagram, the fault can be immediately displayed with
the characteristics.

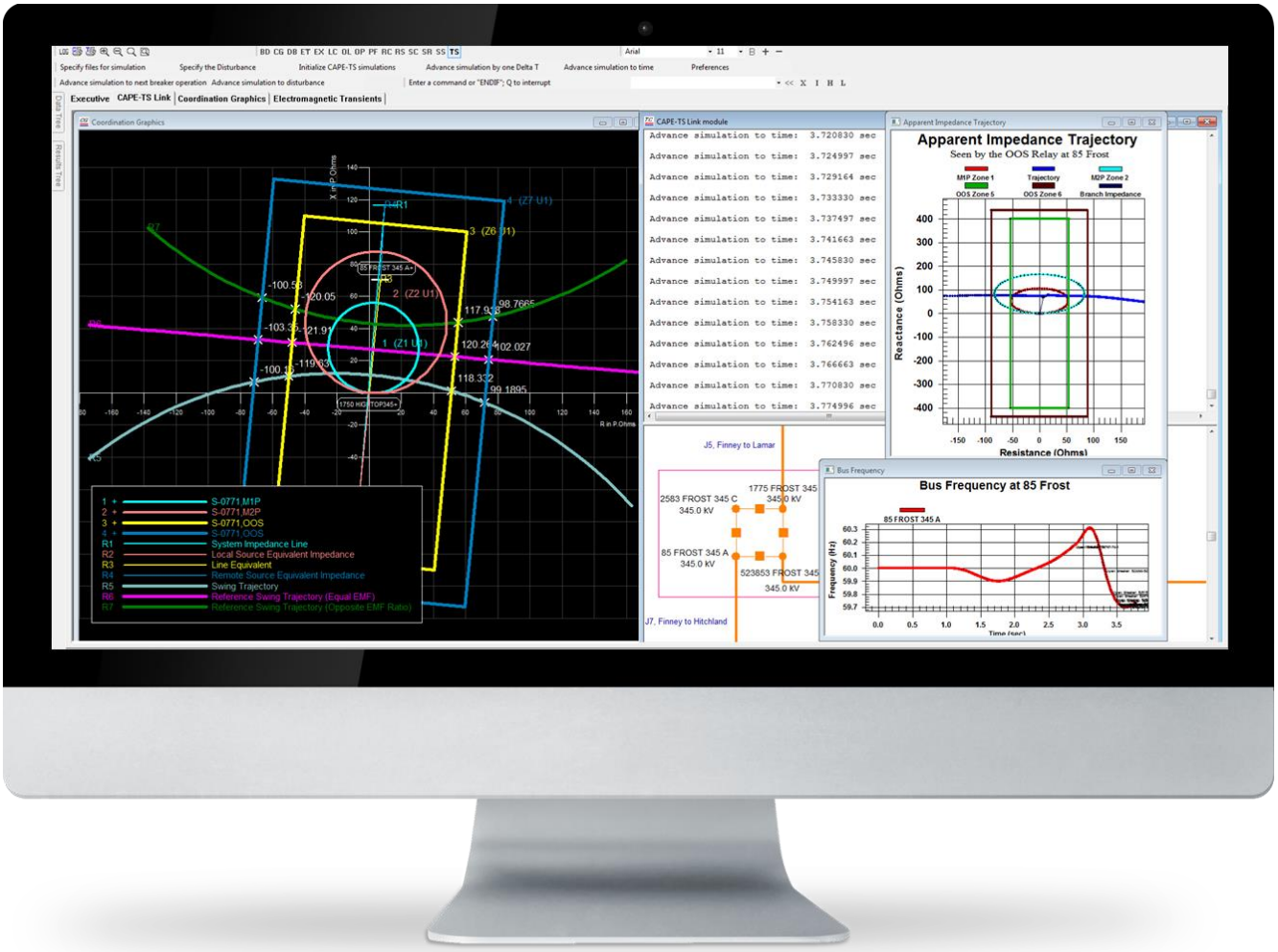

Figure 3: Evaluate the interdependency between protection action and system dynamic with Advanced Protection Assessment-TS Link simulations.

System Simulator performs stepped-event event simulations of single-scenario studies interactively with the one-line diagram, with enhanced and detailed reporting at each breaker operation.

Line Constants computes the self-positive sequence impedance and the self and mutual zero sequence impedances of overhead transmission lines based on conductor and tower data.

Order Production generates data-driven reports on paper of relay settings based on taps and test points for specific locations.

Optional Advanced Protection Assessment functions

Power Flow offers both Newton and Fast Decoupled solution methods. Control algorithms support tap and phase-shifting transformers, voltage control by reactive generation, switched capacitor bank operation, and area interchange control.

Short Circuit Reduction offers two types of network reduction; useful for providing reduced models for EMTP calculations, for other “non-Advanced Protection Assessment” programs, and for sharing data with a utility’s neighbors.

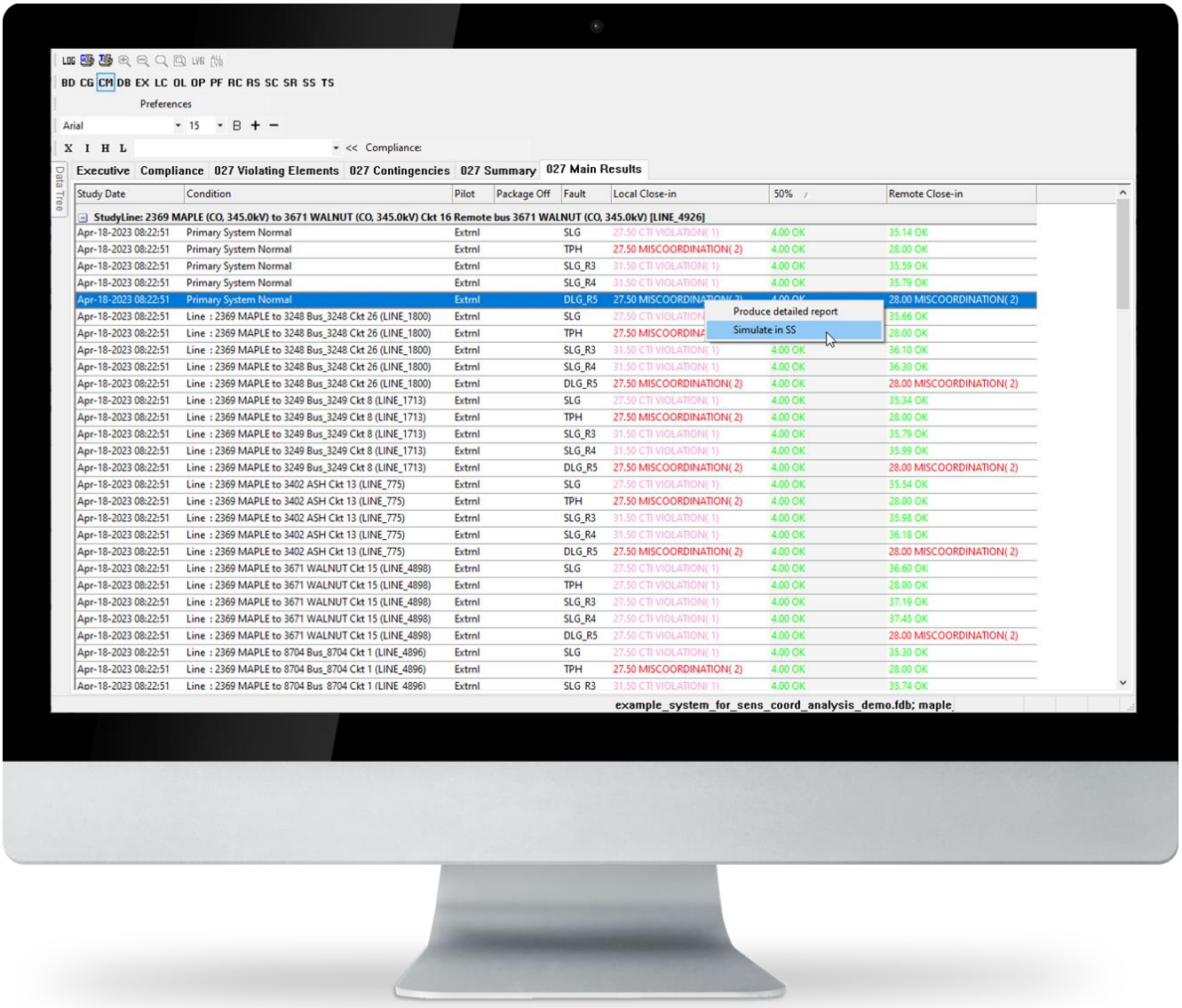

Figure 4: Wide-area coordination reviews results are easily identified using traffic light-colors in the automized Compliance Module.

Breaker Duty automates the evaluation of breaker interrupting duty following approved procedures of either the IEC or ANSI standards. Streamlines the evaluation of new and existing breakers.

Advanced Protection Assessment Bridge Module provides two-way data exchange of network and protection data with asset management systems.

Advanced Protection Assessment – TS Link integrates the highly detailed protection models and data from Advanced Protection Assessment with the PSS®E time-domain transient stability program to evaluate the interdependency of system dynamic and protection action. Protection directly affected by power swings, such as Out-of-Step, Power Swing Blocking, Underfrequency Load, Shedding Schemes, ROCOF, Remedial Action Schemes, for example, are easily analyzed using this module.

Compliance Module comprises automatic protection system reliability studies, including revision of protection coordination in wide network areas, evaluation of the behavior of transmission and generation protection upon overload conditions, the coordination of generator controls and its protection, as well as other protection reliability checks. For North American users, these reliability studies support compliance with NERC PRC standards PRC-027, PRC-023, PRC-026, PRC-019, PRC-024, and PRC-025 standards.

Figure 5: Generator protection coordination with generator controls is automatically evaluated with the Compliance Module.

Flexible Licensing Options

Licensing of the Advanced Protection Assessment software is very flexible as it offers three methods for licensing, including individual user licenses, network licenses for a server and network licenses for
a virtual server.

In addition, a “borrowable” option allows an engineer to “check out” or borrow a license from a network license to use the Advanced Protection Assessment license when not connected to the office network.

Advanced Protection Assessment community

Advanced Protection Assessment users are part of an active network of protection engineering expertise, worldwide.

An annual User Group Meeting & Conference in North America and User Group Meetings and Summits in other regions provide content-rich opportunities to make connections in person.

Ready to get started?

Siemens makes the transition easy for you including the license acquisition, training, implementation, consulting and ongoing software updates and support. Siemens is uniquely qualified to provide a complete and comprehensive offering to our customers.

For further information about all Advanced Protection Assessment products, visit our website:
http://www.siemens.com/apa

Accelerating Digital Transformation

Large transmission grid operators around the world are tackling the energy transition head-on by implementing a digital twin of its entire transmission network.

By breaking down data silos, utilities will have one common network model that all departments work from to ensure reliable planning, operation, and protection of the power grid.

Data is at the center of the power grid. It is exchanged between many different departments, stakeholders, and systems, enabling utilities to properly plan, operate, and maintain their grid.

With trends like decentralization, digitalization, and renewables, this data has become increasingly complex to manage and exchange.

As grid planning and operations becomes more complex, traditional, siloed, manual practices for sharing model data across departments are no longer optimal.

The Siemens Network Model Management solution provides a single source of truth for model data across planning, protection, and operations departments.
By leveraging a complete digital model of the physical grid, grid operators can quickly adapt to grid changes while increasing renewable capacity efficiently, safely, and reliably.

Breaking down silos with a unified network model

Our Network Model Management system leverages Siemens consulting expertise and our interoperable, open, and scalable software to break down the data silos between traditionally separate departments.

Powered by the CIM-based network model management software PSS®ODMS, the system enables seamless data exchange between various software tools, including Gridscale X Advanced Protection Assessment – highly- detailed protection simulation software, PSS®E – high-performance transmission planning and analysis software, and additional 3rd party tools.

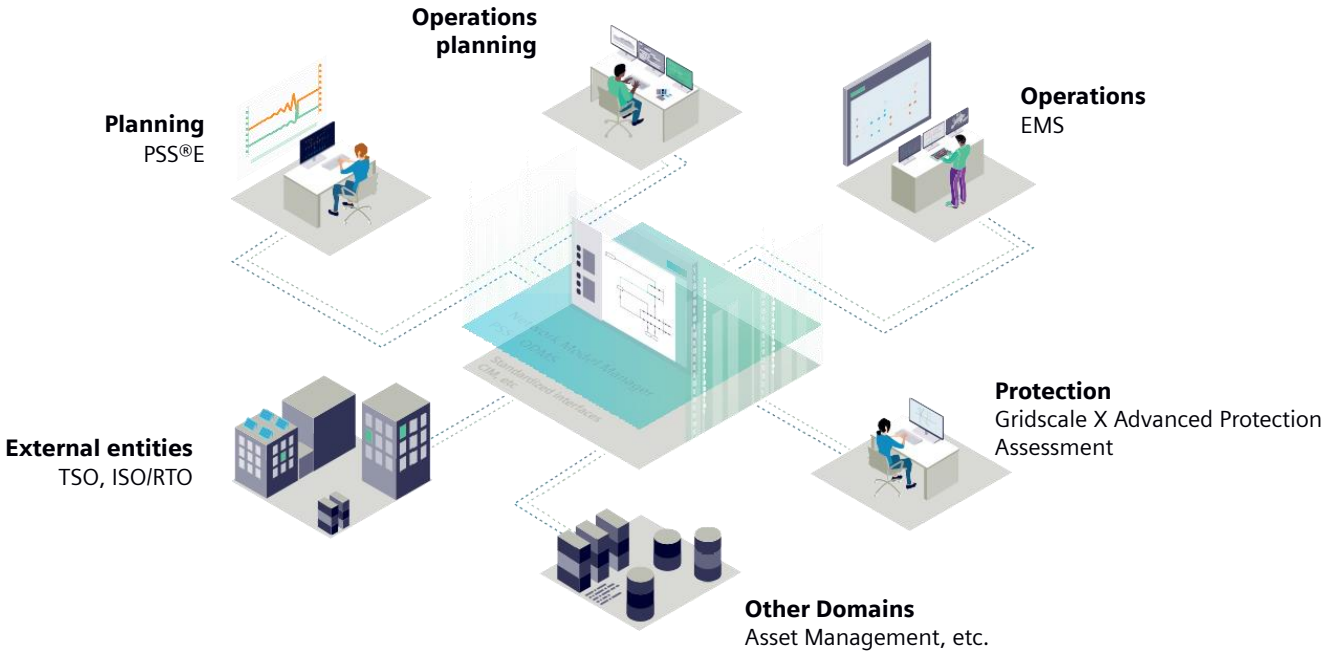

Figure 6: Accelerating Digital Transformation

Gridscale X Protection Data Manager

The energy transition increases the need that protection systems and their relays are continuously well configured. Protection engineers need to create and maintain high accuracy and up-to-date data for their protection equipment in the field, including the device information, and protection settings.

Gridscale X Protection Data Manager is the newest addition to the Siemens Gridscale X portfolio. Is a powerful and convenient solution to significantly reduce your workload on protection data management. Using Protection Data Manager will lower your costs, reduce handling time, improve data quality, avoid outages which entail penalties, loss of operation and reputational damage and create a single source of truth for all your protection data.

Protection Data Manager provides the confidence to handle your protection studies based on accurate and up-to-date data and can automatically import and manage protection data in end-to-end, seamlessly integrated workflows. However, when it comes to managing protection relay data, protection engineers are facing challenges, barriers, and difficulties in their day-to-day work.

- Discrepancies in the central protection data may lead to wrong simulations and assessment results and entail avoidable maloperations.
- Manual tracking of changes and updates of data e.g. after site inspections is time consuming and requires extreme discipline by all involved engineers and risk to be missed in practice.

More frequent operational changes and higher load flow (e.g. from DER infeed) increase the need for accuracy and efficiency of protection data handling.

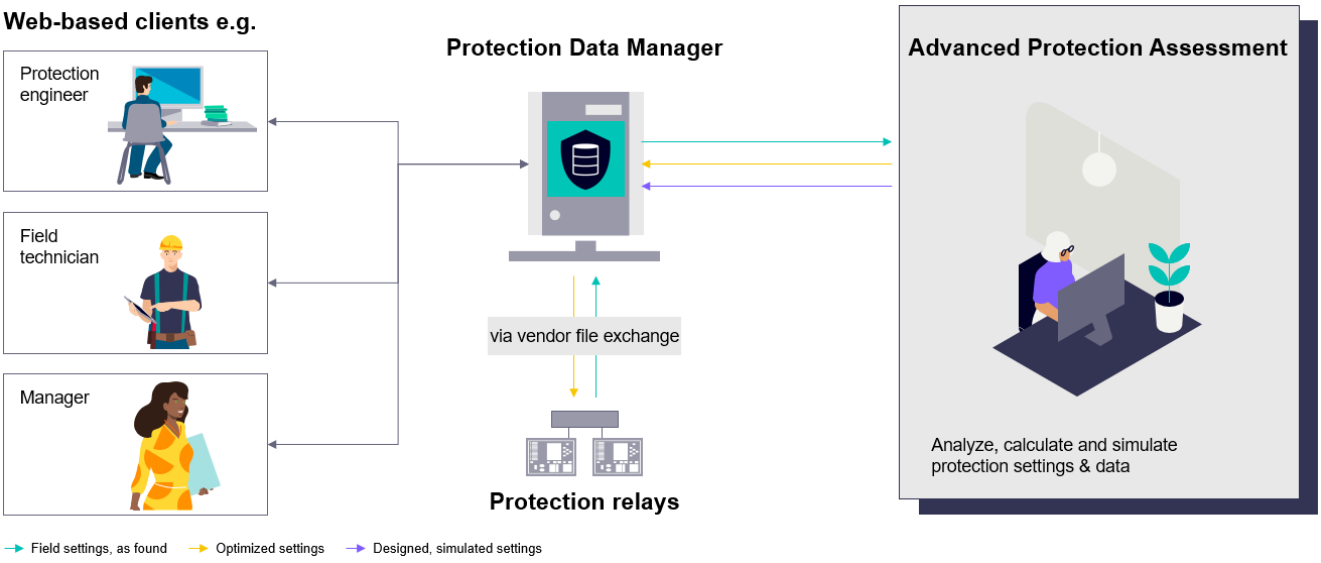

Figure 7: Gridscale X Production Data Manager

Take advantage of over 7,300 existing relay templates to store and manage the relays including their settings and ranges, plus the option to edit or configure the templates for your needs.

Import and store setting groups via the respective configuration files from multiple vendors for further analysis, or to compare and trigger changes in setting parameters.

Exchange setting parameter values with SIEMENS simulation tools for a variety of simulation scenarios and variants and acquire target values to be applied to the devices in the field.

Track your protection relay history, analyze and report changes to support audit relevant tasks.

Manage multiple setting groups for each relay, including data like status, personas, date, comments etc.

For more information about Protection Data Manager, please visit our website: http://www.siemens.com/protection-dm.

Gridscale X Advanced Protection Assessment – Implementation Service Offering:

New Advanced Protection Assessment users are faced with the challenge of how to quickly become productive with Advanced Protection Assessment while at the same time continuing to meet existing workflow and job demands of their department.

It has been estimated that as many as 20 – 25% of protection engineers currently working for utilities may retire in the next three to five years leaving utilities with a deficit in experience and industry knowledge that must be filled. Siemens is uniquely poised to help you implement Advanced Protection Assessment whether you are starting to use protection software for the first time or converting from another solution.

We offer various ways to support you to get the best out of Advanced Protection Assessment for your grid!

Our services include:

- Advanced Protection Assessment Training – Basic, Advanced and Refresher
- Training & Implementation – Find Picture in DAM
- Advanced Protection Assessment Database Quality Check and Cleanup
- Advanced Protection Assessment Network and Protection Systems Modeling Services
- Relay Settings Macro Development
- Automation Support
- Regulatory Compliance Studies (NERC PRC Standards)
- Wide-Area Protection Coordination Studies and Compliance with NERC PRC-027-1 (Protection System Coordination for Performance During Faults
- Transient Stability and Protection Simulation

Gridscale X Advanced Protection Assessment Team: Expertise, stability, and responsiveness … when you need us

We are dedicated to serving the utility industry and protection engineering. Whether it is through one of the capabilities listed in this brochure, or something else that we can support, when you use Advanced Protections Assessment, we become an active partner in your success.

Our implementation and services team gets your team started quickly and confidently. We are known for our ongoing technical support: Expert, thoughtful, and very responsive.

How can Advanced Protections Assessment's power help you?

Contact us any time. Our dedicated staff is happy to answer your questions about putting Advanced Protections Assessment to work to improve the effectiveness of your protection engineering function.
For further information about all Advanced Protection Assessment products and services visit our website: http://www.siemens.com/apa

Expert Power System Advisory

Siemens PTI Consulting Offering

We are offering additional services and products for an all-in-one package

Expert advisory for profound decisions in grid infrastructure

Power System Consulting is the global expert team of PTI specializing in optimizing electrical grids, from planning to operations, over the entire life cycle. Our services cover the full spectrum of technical power system issues in the entire energy landscape: from high voltage to low voltage, from generation to consumption, for public and private networks.

Discover our consulting services:

- Grid Analysis and Design
- Power-quality-related System Studies
- System Dynamics and Transients
- System Interconnected and Grid Code Compliance
- Protection and Control System Studies
- Real-time Protection Simulation and Testing
- Power System Modeling and Grid Data Consulting

For further information about Siemens PTI:
http://siemens.com/power-technologies

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