



## Real Time D-SCADA and Phasor Data Processing

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## How does my substation change in the world of the Smart Grid?

### *Movement from a Static As-Designed to a Proactive Intelligent Substation Infrastructure*

#### **From:**

- Local Manual Inspection & Evaluation
- Periodic Maintenance
- Centralized Control, large footprint Protection System, Manual Switching, & Trouble Response
- General Knowledge of Environmental Conditions and Operating Status
- Physical Security

#### **To:**

- Self Monitoring, Remote Diagnosis & Reporting
- Prioritized Condition-Based Predictive Maintenance
- Compact Distributed Protection & Control with Automatic Response and Predictive Avoidance
- Time-Correlated Environment, Operational & Non-Operational Status
- Intelligent Automatic Monitoring & Detection and Cyber Security

# Smart-Substation™



## What cutting-edge technology can Siemens provide

### Non-operational

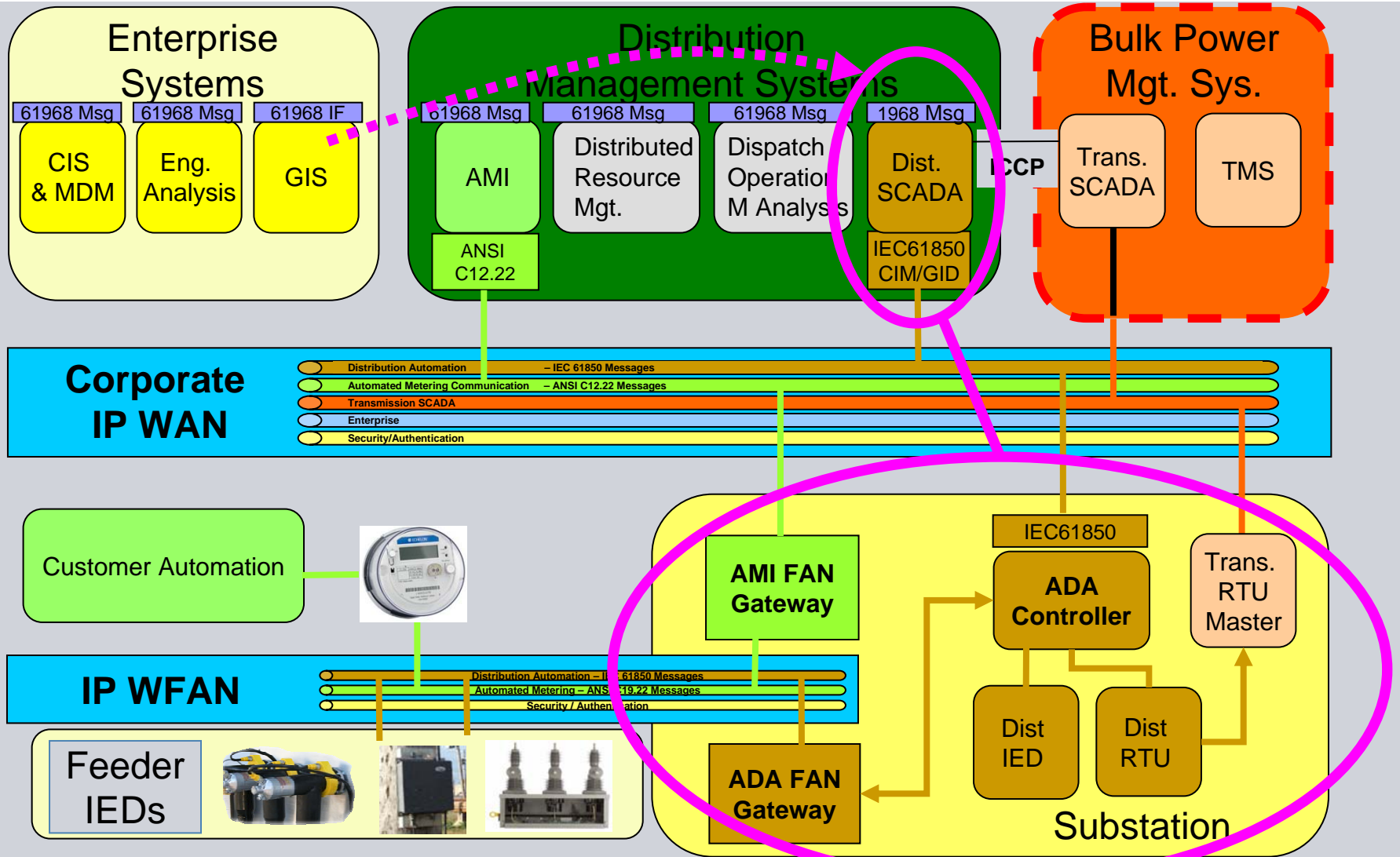
- Voltage Regulator Monitoring
- Fault Records
- Intrusion Monitoring
- Harmonics and Power Quality Monitoring
- Transformer Health Monitoring
- Circuit Breaker Health Monitoring
- Environment Monitoring
- Security Monitoring



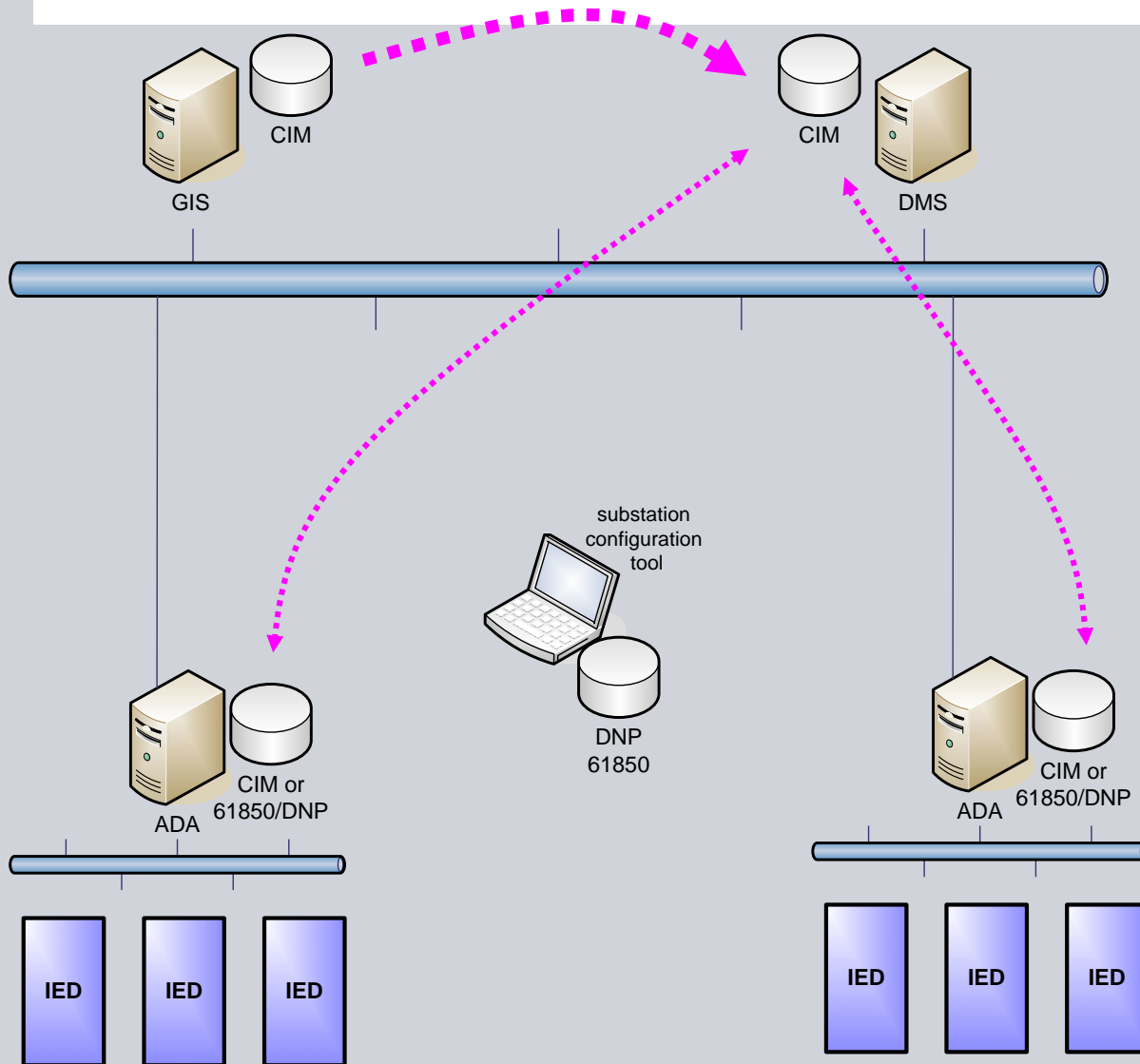
### Operational

- Monitoring, Protection and Control
- Load Shedding  
Load Transfer
- Load Tap Changer Control
- Fault Characterization,  
Location Response
- Power Factor and Cap Bank Control
- Reclosers, Switches & other Field Devices
- Data Encryption
- Phase Measurement Unit

# Potential SMARTGrid Distribution Level Integration

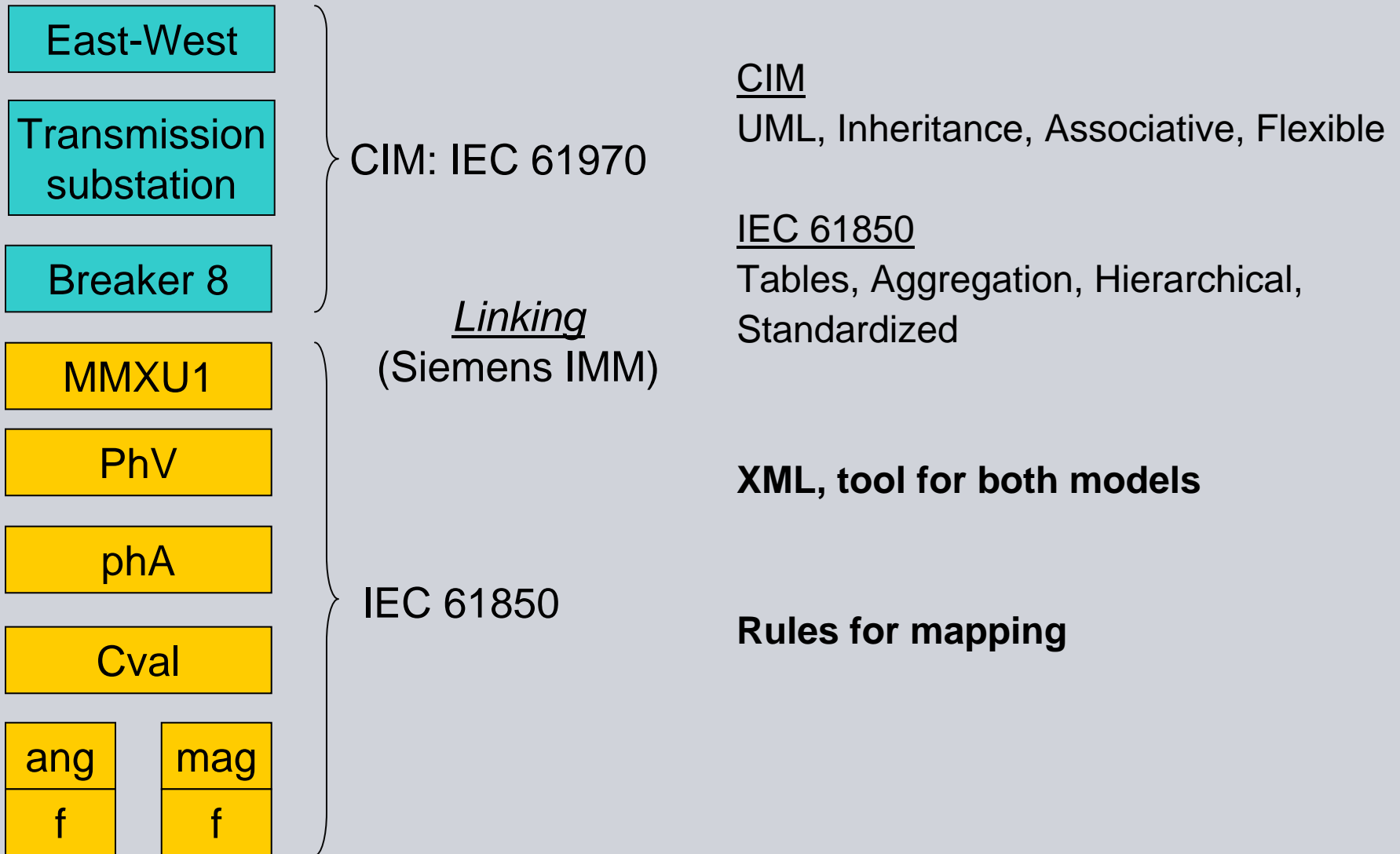


## How to push CIM model to substation



- CIM data model from GIS to DMS
- Communication between DMS and substation over different mediums and protocols
- Depending on the model in the substation, multiple solutions for the “brain” in the substation are possible

## Linking CIM and IEC 61850



# Substation SCADA

## Overview

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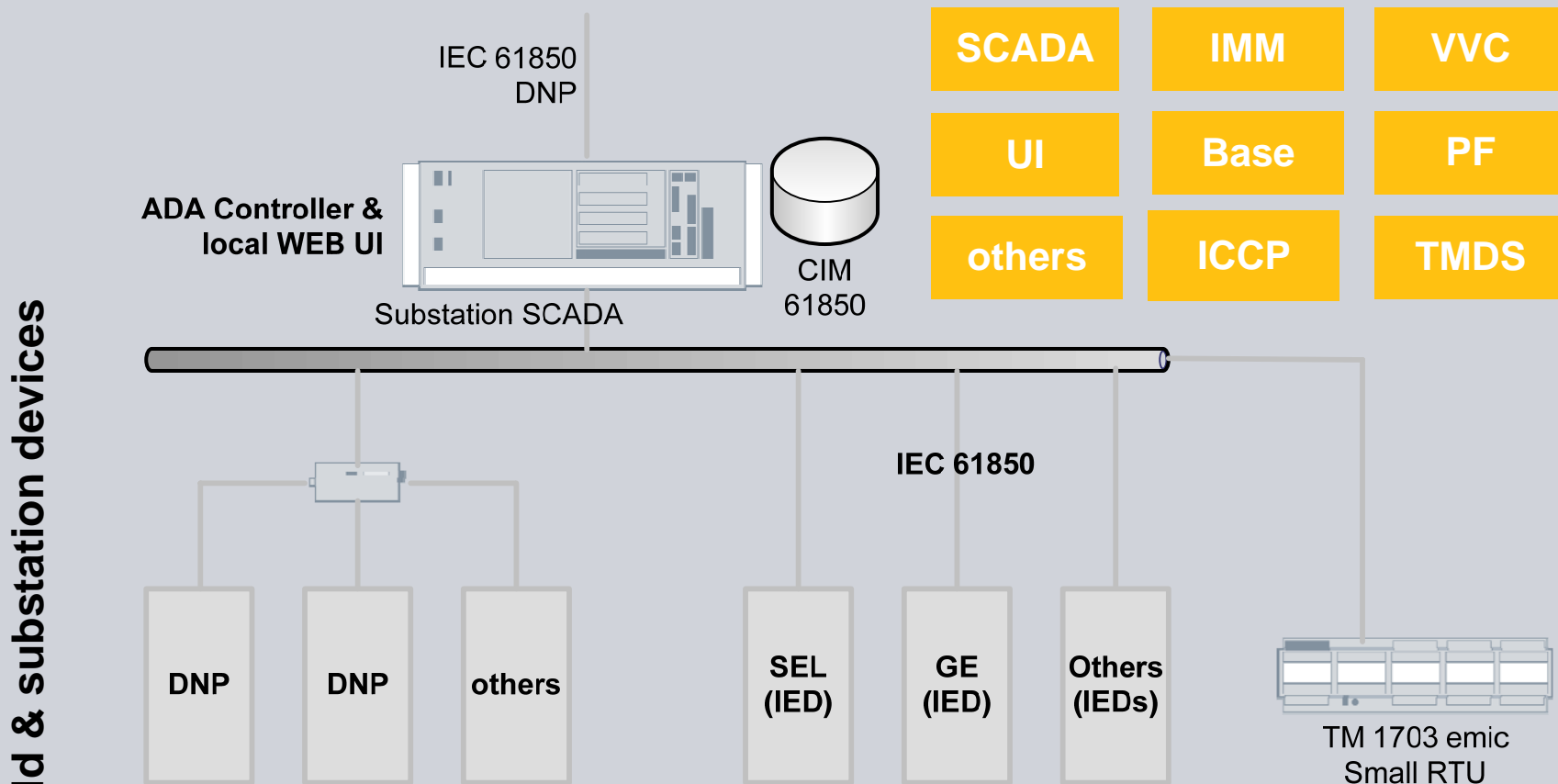
- 1** Component based modular System Architecture
- 2** Scalability in Functionality and Configuration
- 3** Modern easy-to-use Windows User Interface
- 4** Use of the Standards and “de-facto Standards”
- 5** Open, standardized Architecture and Interfaces
- 6** Web-based Architecture with mobile access to all data via Web

# Substation SCADA



A component-based modular system architecture

## Substation SCADA – component overview

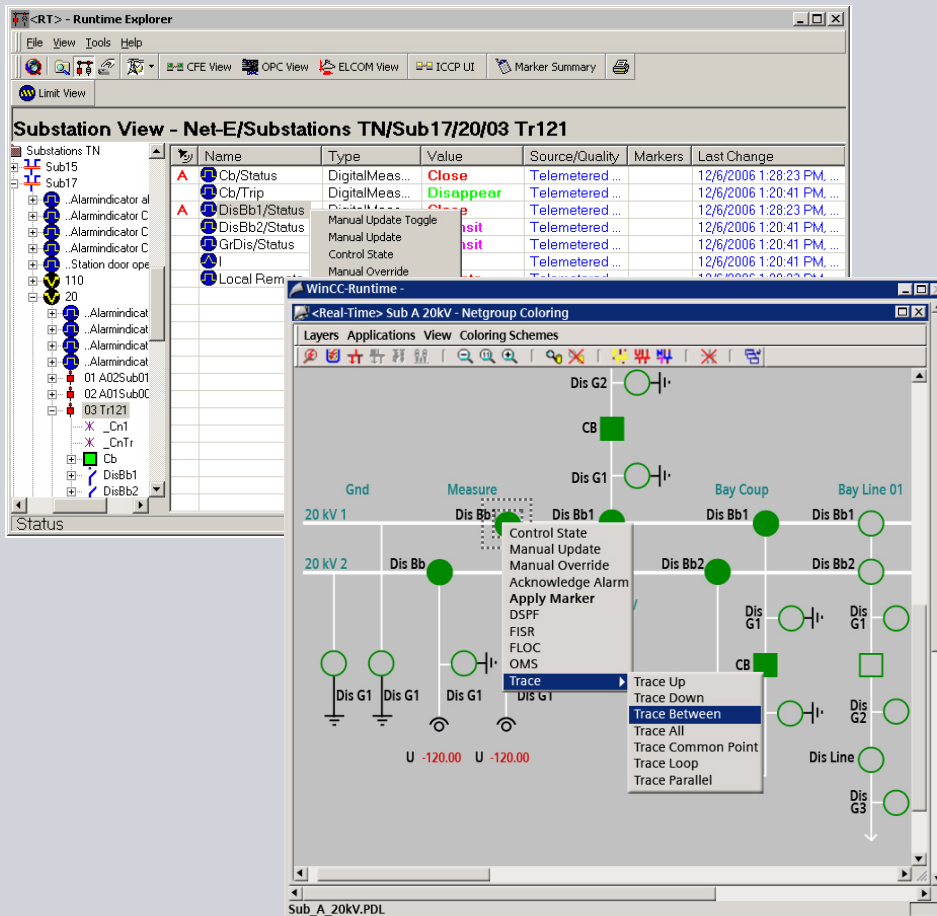


Field & substation devices

# Substation SCADA

Modern easy-to-use Windows user interface

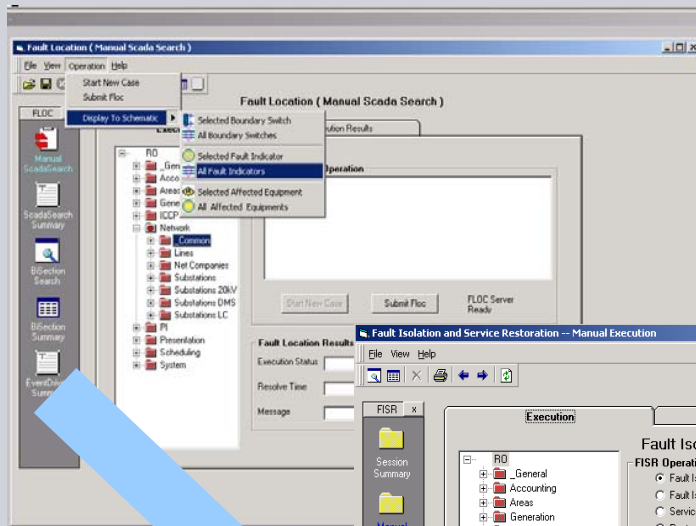
SIEMENS



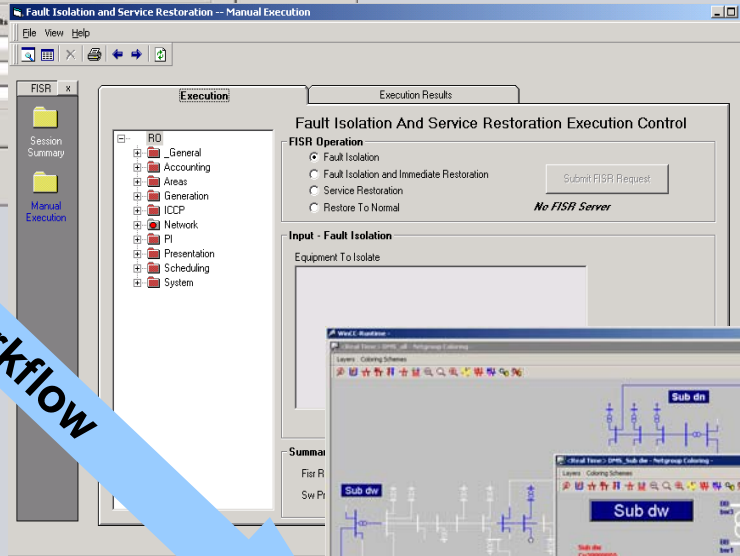
- All applications at one glance
- Local and remote viewing
- Intuitive and self-learned ergonomics' concept
- Ease to visualize and analyze the information
- Fast and secure operation
- Workflow-oriented Workspace and Navigation capabilities
- Clear distinguished presentation between Real-time and Study operations

# Advanced Applications in Substation SCADA

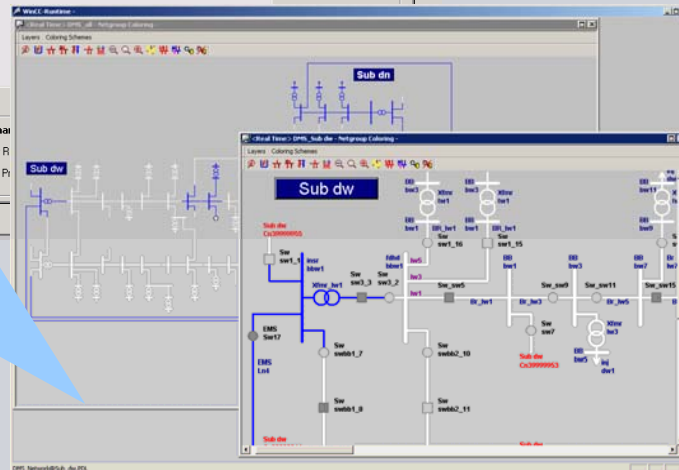
... optimizes the efficiency



- Fault Location  
Fault Indicators / Short Circuit



- Fault Isolation &  
Service Restoration



- Power Flow  
Calculation
- VVC

Local  
Interaction



Workflow

# Substation SCADA

## Web based architecture - user interface



### Web based and mobile operation

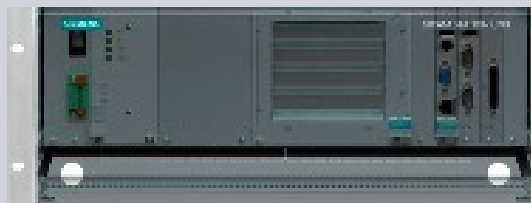
#### Secure information access ... ... at any time and any place

- From mobile workplaces, e.g. from car
- From multi-screen consoles in the control center
- From remote standby shift location and at home
- From standard PC in the office
- Alarming via wireless devices, e.g. mobile phone and SMS



## Features and functions of Substation SCADA

- Substation SCADA as the D-SCADA Controller
- Interfaces to existing devices (DNP, Modbus, ..)
- Downloadable logical CIM model
- Fully IEC 61850 compliant
- Integrated Web UI
- Fault location, isolation & restoration based on logical model
- Advanced intelligent calculations on CIM model → functions



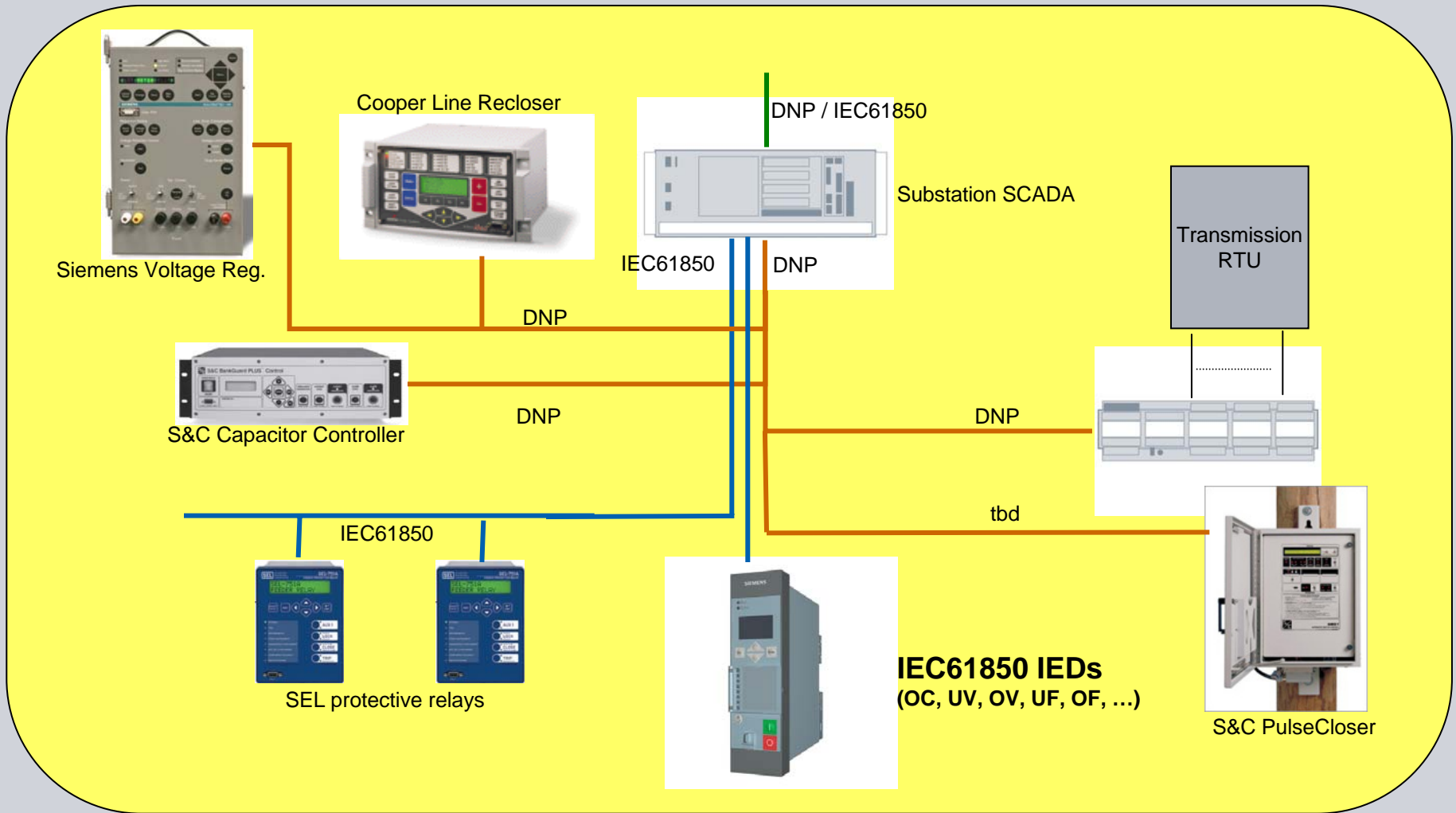
IEDs  
IEC61850, DNP, ..

The screenshot displays the WinCC-RTU interface for a substation. The main window shows a network diagram with various components like Dis G1, Dis Bb1, Dis Bb2, Dis G2, Dis G3, Bay Coup, and Bay Line 01. A context menu is open over a component, listing actions such as Trace Up, Trace Down, Trace Between, Trace All, Trace Common Point, Trace Loop, and Trace Parallel. To the right, a 'Fault Location (Event Driven Summary)' window is open, showing a table of fault records.

Fault Record	Event Time	Tripped Circuit Breaker(s)
20	10/13/2006 11:23:57 AM	NetE:\Substations\DMS\Sub.dn\Feder2\Fsw.dn\l1_m07
25	10/13/2006 11:23:57 AM	NetE:\Substations\DMS\Sub.dn\Fsw.dn\l2_m0b1_8
35	10/13/2006 11:23:57 AM	NetE:\Substations\DMS\Sub.dn\Fsw.dn\l2_m0b2_11
36	10/13/2006 11:23:57 AM	NetE:\Substations\DMS\Sub.dn\Feder2\Fsw.dn\l1_m07
36	10/13/2006 11:23:57 AM	NetE:\Substations\DMS\Sub.dn\Fsw.dn\l2_m0b1_8

Below the table, there are sections for 'Affected Equipment' and 'Affected equipment' with columns for 'Equipment Type' and 'Number of Customers'. A legend indicates 'Load' with checkboxes for Switch, Transformer, and Busbar. At the bottom, there are checkboxes for 'Fault indicator' and 'Affected equipment', and buttons for 'Highlight' and 'Clear Record'.

# Possible solution D-SCADA Controller



## Smart-Substation™



### What is the value of Siemens Smart-Substation™?

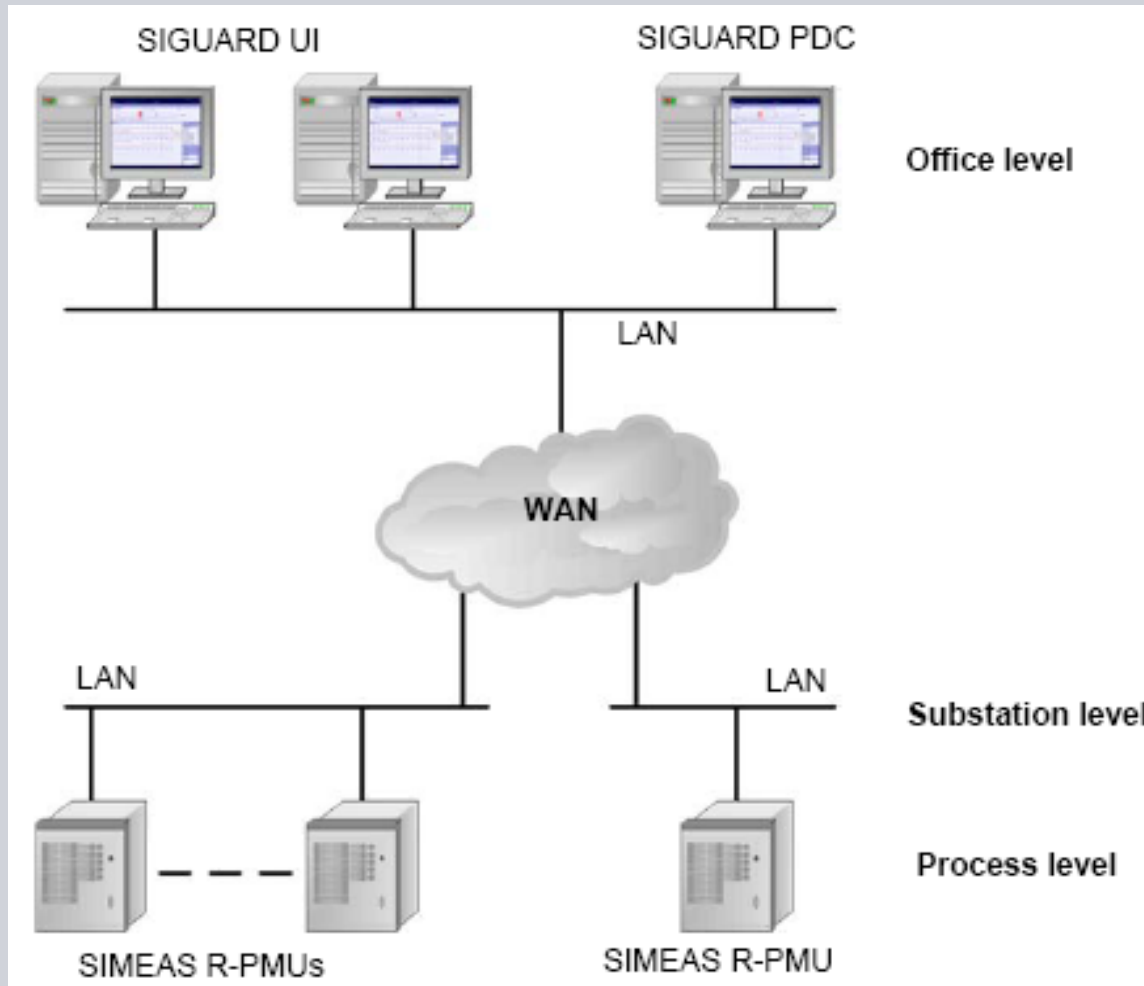
- Automation and decentralized logic improves power factor and helps to reduce outage times
- Substation design becomes standardized and repeatable
- Minimal engineering for commissioning reduces cost
- Integration of expert applications is the step towards Smart Grid
- Expert applications reduce information overload at the control center
- Better utilization of equipment reduces substation visits and improves fleet management
- Field proven system with extreme scalability high reliability
- Siemens expertise helps to manage the complexity of substation design
- Security helps to operate the substation with more reliability

**SIGUARD System for Phasor Data Processing**  
**Real Time Visualization and Disturbance Recording**

Siemens Energy, Inc.

# SIGUARD Phasor Data Processing System System Architecture

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- Install on single PC or multiple PCs
- Supports multiple User Interfaces (UI)
- Works with all PMUs strictly conforming to IEEE C37.118 Standard

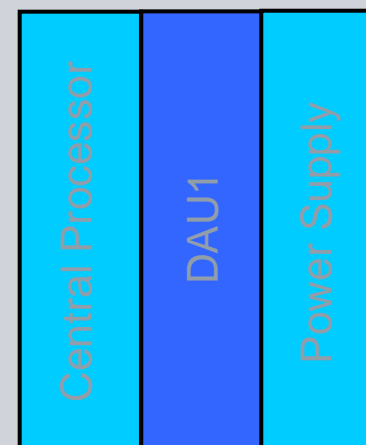
## SIMEAS R - PMU Hardware



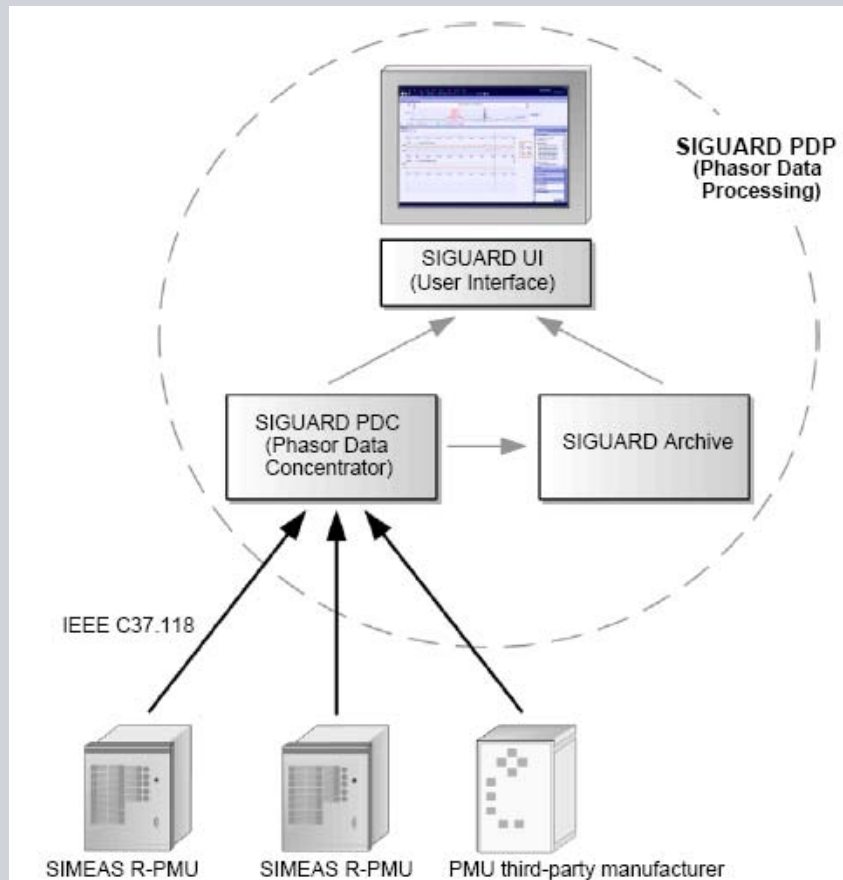
19-inch  
System  
6 slots  
up to  
32 analog and  
64 binary inputs



1/2 - 19-inch  
System  
3 slots  
8 analog and  
16 binary inputs



## PDC Concepts



### SIGUARD is a software-based

- Phasor Data Concentrator
- Data Archive
- User Interface

### Users

- System operators
- Power system analysts

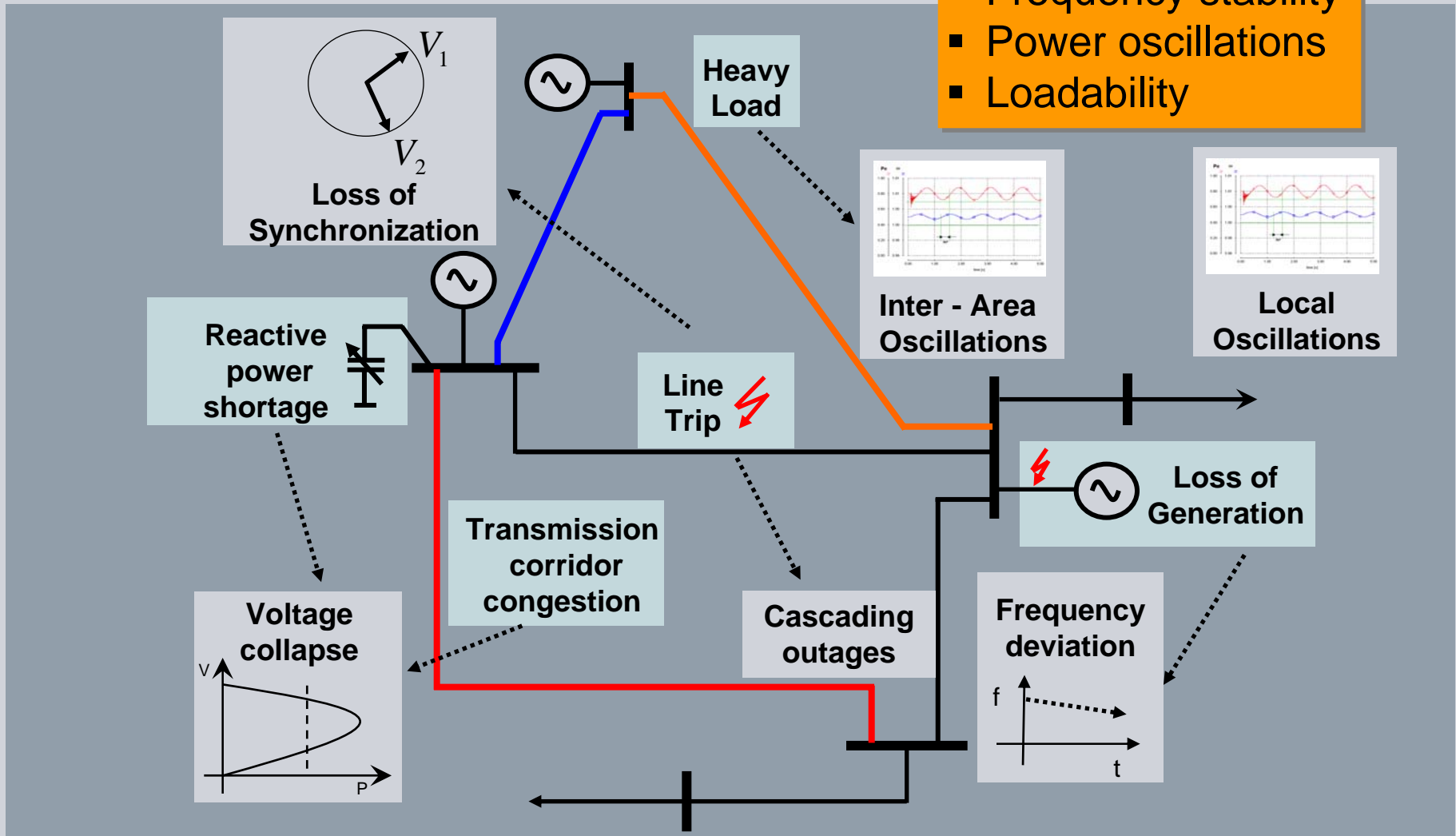
### Modes of Operation

- Online: Real-time operation
- Offline: Post event analysis

# SIGUARD Phasor Data Processing System Application Areas

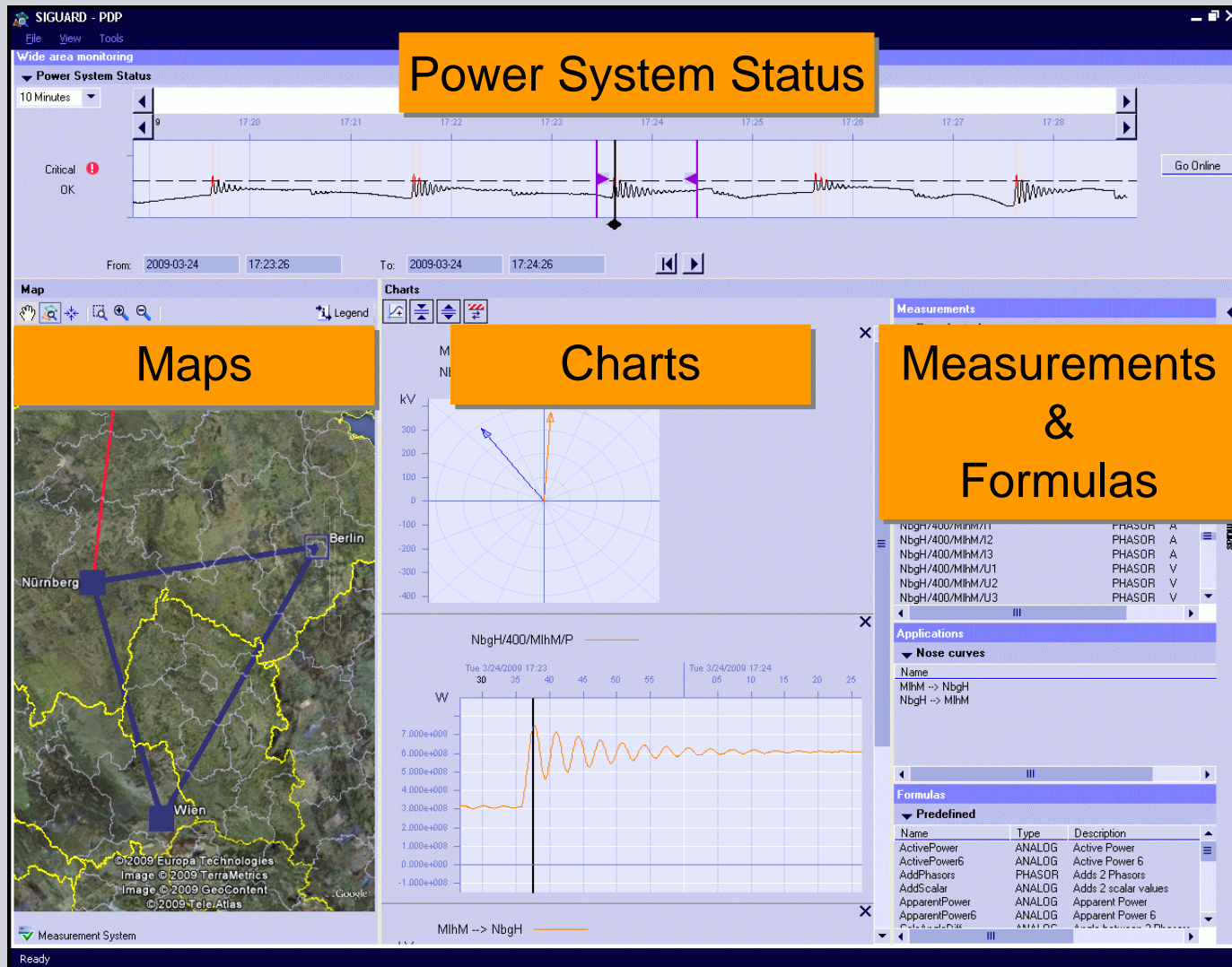
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- Voltage stability
- Frequency stability
- Power oscillations
- Loadability



# SIGUARD Phasor Data Processing System User Interface

SIEMENS



# **SIGUARD Phasor Data Processing System Conclusion**



## **Primary Application Areas**

- Voltage stability
- Frequency stability
- Power oscillations
- Loadability

## **Customer Benefits**

- Operational support for preventing blackouts
- Close information gap between protection & SCADA measurements
- Greater loading of transmission lines while maintaining stability
- Fast analysis of power swings; quickly generate disturbance reports

## **Phasor measurement technology leads to future Smart Grid app's**

- System integrity protection schemes (SIPS)
- Power oscillation damping devices (FACTS, fast valving)
- Real time state estimator

# Discussion

