МАСТ-ИПРА

ООО "Хартэп"

PCS of electrical substation based on software and hardware MicroSCADA solutions (ABB)

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Certificates from ABB (Finland) on MicroSCADA courses for specialists of Khartep LLC

Content

- Introduction
- Solution selection
- Solutions COM 600 – form the bottom
- SAS 605 – flexible solutions
- SAS 635 & SAS 610…690 – complete solutions
- Implementations
- Conclusion

Customers solutions

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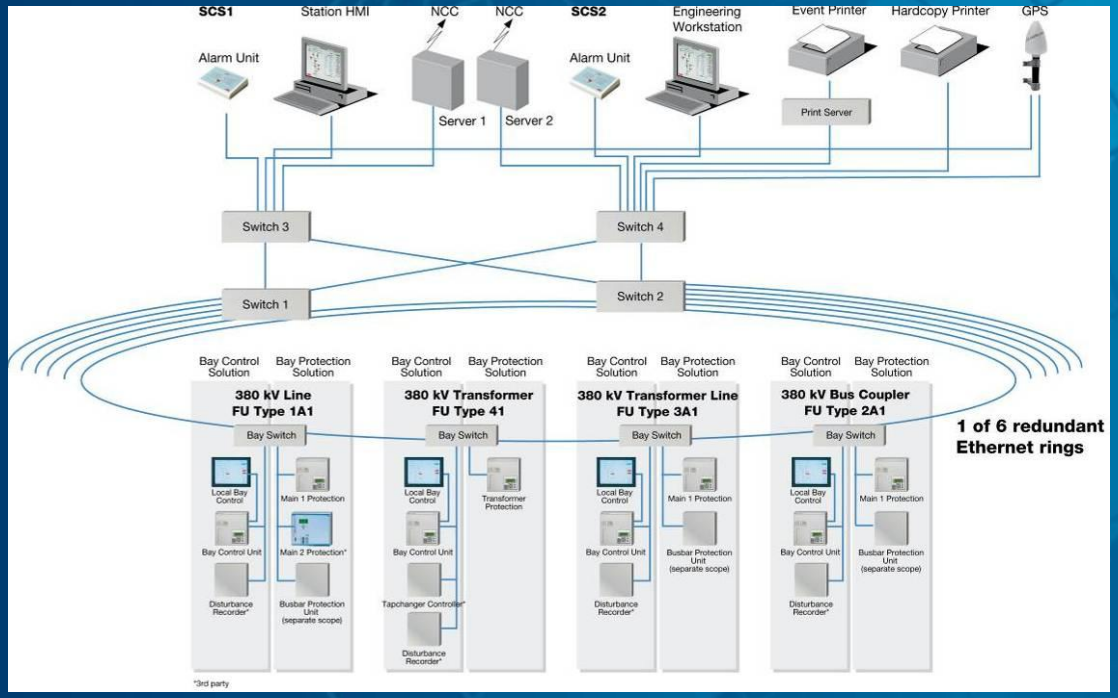
Substation level

Feeder

Process level



Функциональность

- Automation
- Monitoring
- Definition of damage
- Events, Alarms and confirmation
- Remote control

- Protection
- Control
- Monitoring
- Locks
- Data collection

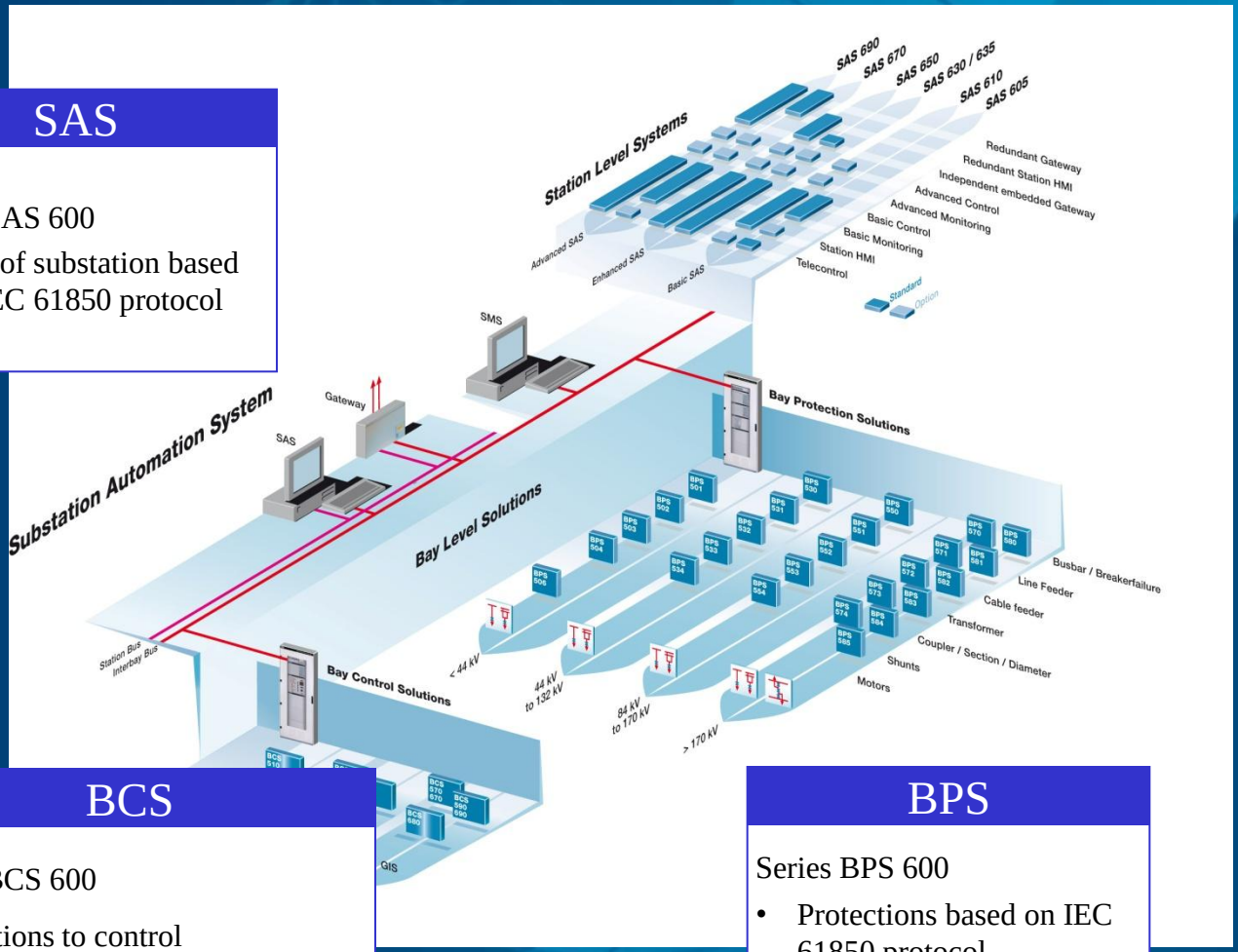
- GIS or AIS devices
- Instrument transformers
- Power transformers

ABB Proposal

SAS

Series SAS 600

- PCS of substation based on IEC 61850 protocol



BCS

Series BCS 600

- Solutions to control

feeder based on IEC 61850 protocol

BPS

Series BPS 600

- Protections based on IEC 61850 protocol

Introduction

- **In addition to the traditional requirements for management and protection of substations and more appear to have become increasingly important:**
  - Communication network for remote access;
  - The accuracy of the data;
  - Implementation of lot of work in short time
- **SAS 600 Series consists of**
  - SAS600 series (Automation of substations)
  - BCS600 series (Feeders control)
  - BPS600 series (Protections)

- **Scalable compatible with IEC 61850 solution**
- **Experience and "know-how" provide a unique combination of solutions for all types of substations**
- **Approach taking into view of the future development defines flexibility, modularity and performance**

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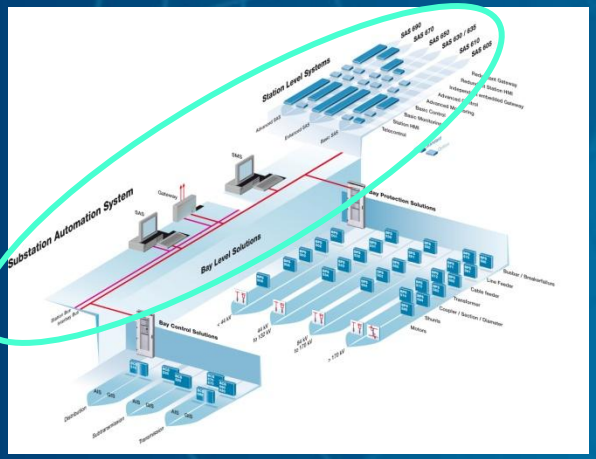
PCS for substation (SAS)



Substation Level (The components of the substation and communication)

- The integration of feeders control solutions (BCS, BPS, ...)
- Complete distributed concept
- The openness of the system (the connection to remote systems, the integration with third-party devices)

Series SAS600 – SAS solution based on IEC61850

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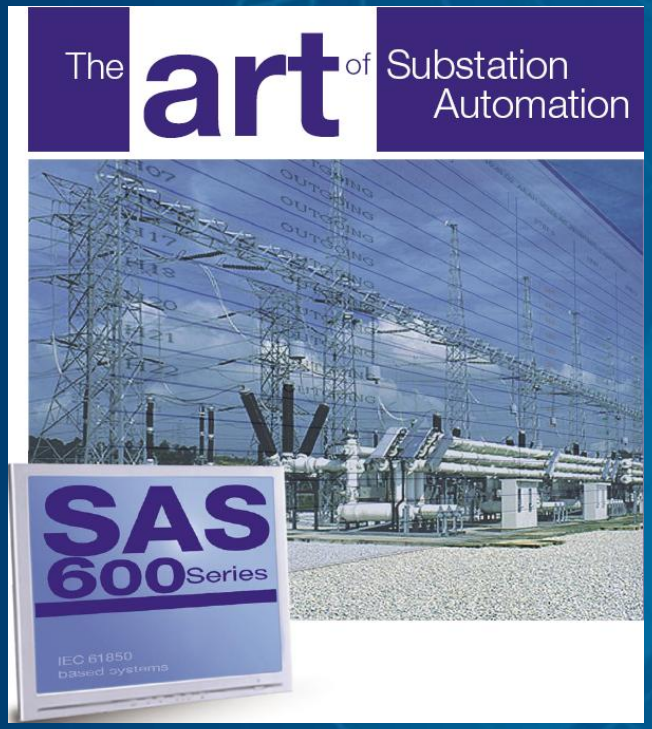
The essence of the presentation

GIS substation

AIS substation

- PCS station level for local and remote control and monitoring
- Guaranteed safe operation in different p/s
  - All levels of voltage
  - All configurations
  - All scales of PCS

Introduction



- ABB is a scalable completely compatible with IEC 61850 solution
- Experience and "know-how" provide a set of solutions for any substations
- Solutions with view to further development require flexibility and modularity

Series SAS 600 – reliable solution for networks based on experience and new technologies

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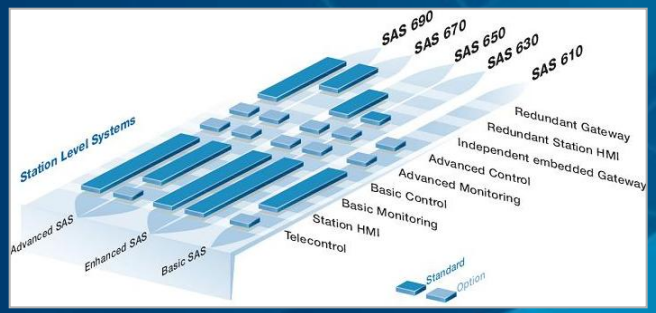
Features and benefits



Our proposal SAS 600:

- Art of substation PCS
  - High-tech solutions based on ABB's vast experience
- More than compatibility with the IEC 61850
  - Maximum safety, efficiency and reliability of local and remote control
- More than control
  - Sufficient basic functionality can be extended with additional functions
- From basic to advanced solutions
  - Satisfies all the approaches for customers to be controlled as well as for conditions of performance and functionality

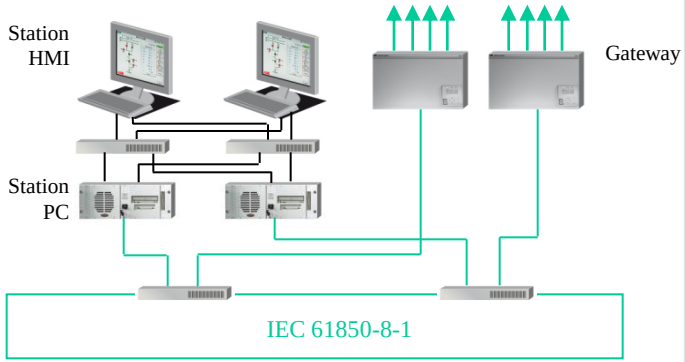
SAS solutions positioning

Efficiency

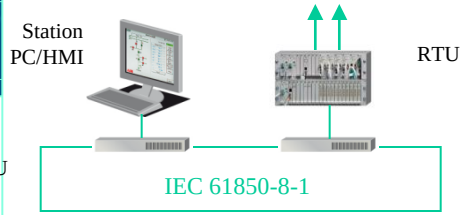
Functionality

Performance

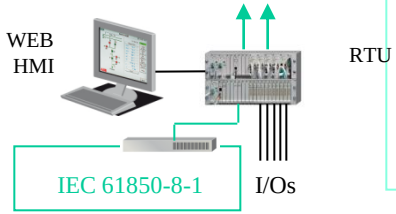
The scale of the system



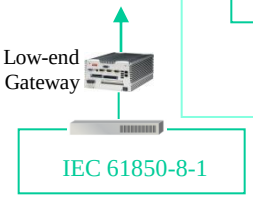
SAS 610…SAS 690



SAS 635



SAS 605



COM 600

Distribution | 110-150 kV | Transfer

Solutions based on COM600

- Lowest in solution series for small tasks of power energy distribution
- Basic Features
  - Based on the small substation workstation
  - Optimal for integrating of medium-voltage ABB relay
  - Compact installation

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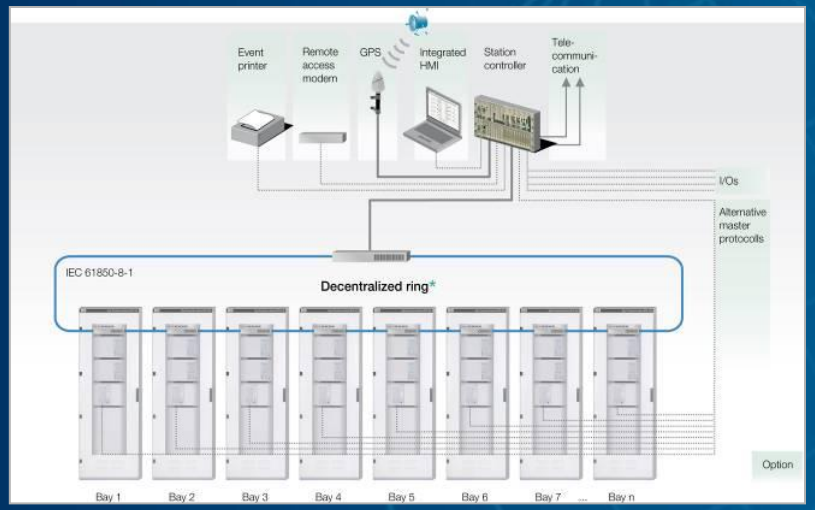
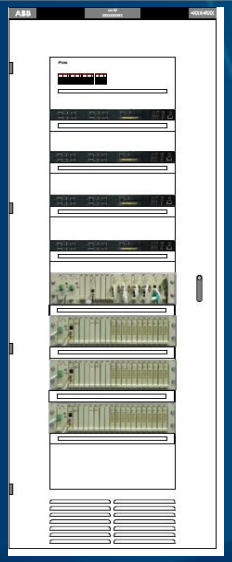
SAS605





- Flexible solution based on RTU560 for distributed applications which can be easily scaled
- Basic Features
  - Workstation based on the CPU module of RTU
  - IO modules
  - A large number of protocols with the ability to integrate various intelligent devices
  - Remote control, local control

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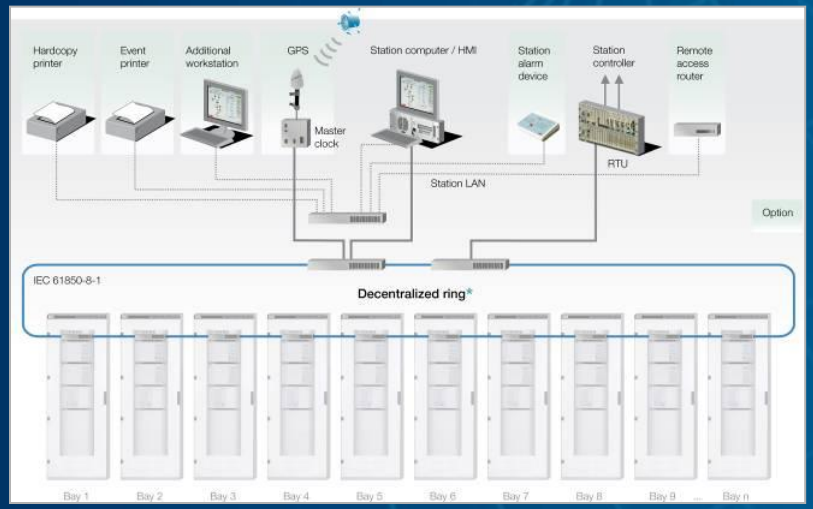
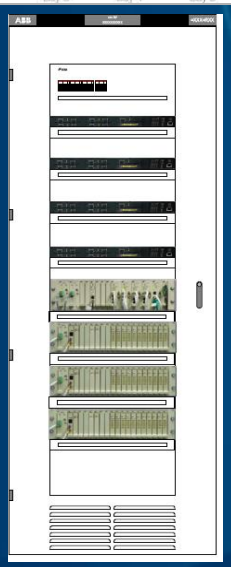
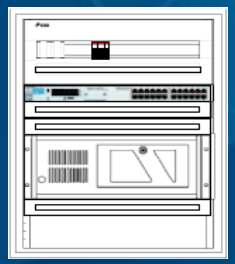
SAS635

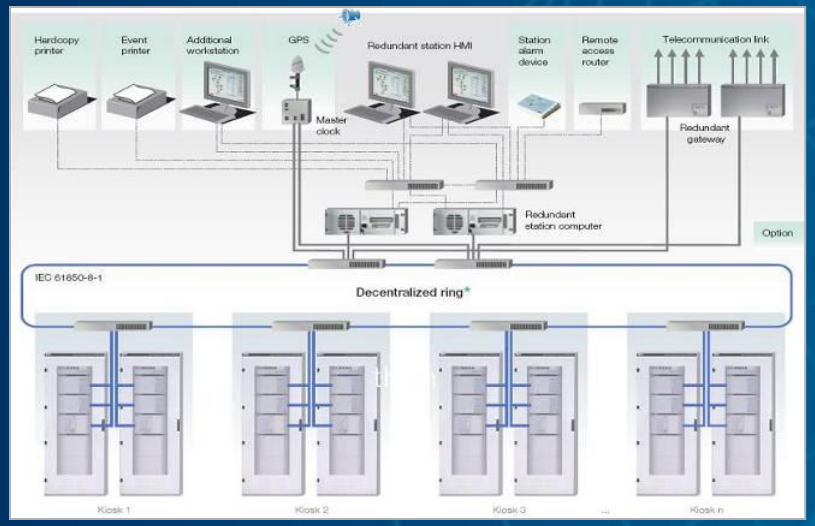


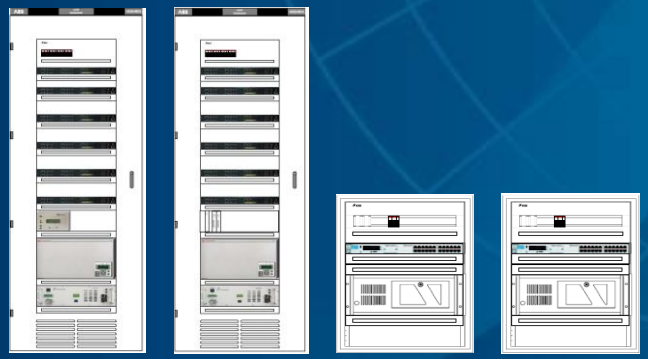




- Flexible solution based on RTU560 for distributed applications which can be easily scaled
- Basic Features
  - Distributed solution
  - Retransmission based on RTU
  - A large number of protocols with the ability to integrate various intelligent devices
  - Reliable remote control and extented local functionality

SAS610…690





High-tech solution for all types of applications
Basic Features

- Distributed architecture
- An extensible architecture and functionality:
  - From a single system to complete redundancy
  - Form basic functions to additional functions
- A large number of devices
- A large number of IEDs
  - High performance
- Large flexibility
  - Functionality
  - Communications

Idea to design of the system

Distributed functionality

- **The degradation**

Use the smallest number of components

- **More equipment - less reliable**
- **A lot of equipment - increasing maintenance costs**

Increase reliability of system components

- **Testing of the system**
- **No moving parts**

Only critical components are backed up

- **Redundant power supply of computers**
- **Higher reliability**
- **Higher performance**

The communication structure

- **Reservations are not at the port of IED**
- **Communications operate independently at the feeder**

PCS solutions Selection Table

Customer requirements	SAS 605	SAS 610	SAS 630 / 635	SAS 650	SAS 670	SAS 690
Functionality						
Control and monitoring		Option	Option	Option	Option	Option
Additional functions						
Control						
Only remote						
Only local						
Remote with local master		Option				
Local with remote master	Option					
With equal priority					Option	
Recommended system						
Substation						
Distribution power energy						
High voltage power energy						
Very high voltage power energy						
Distribution complex						

PCS solutions
Detail selection

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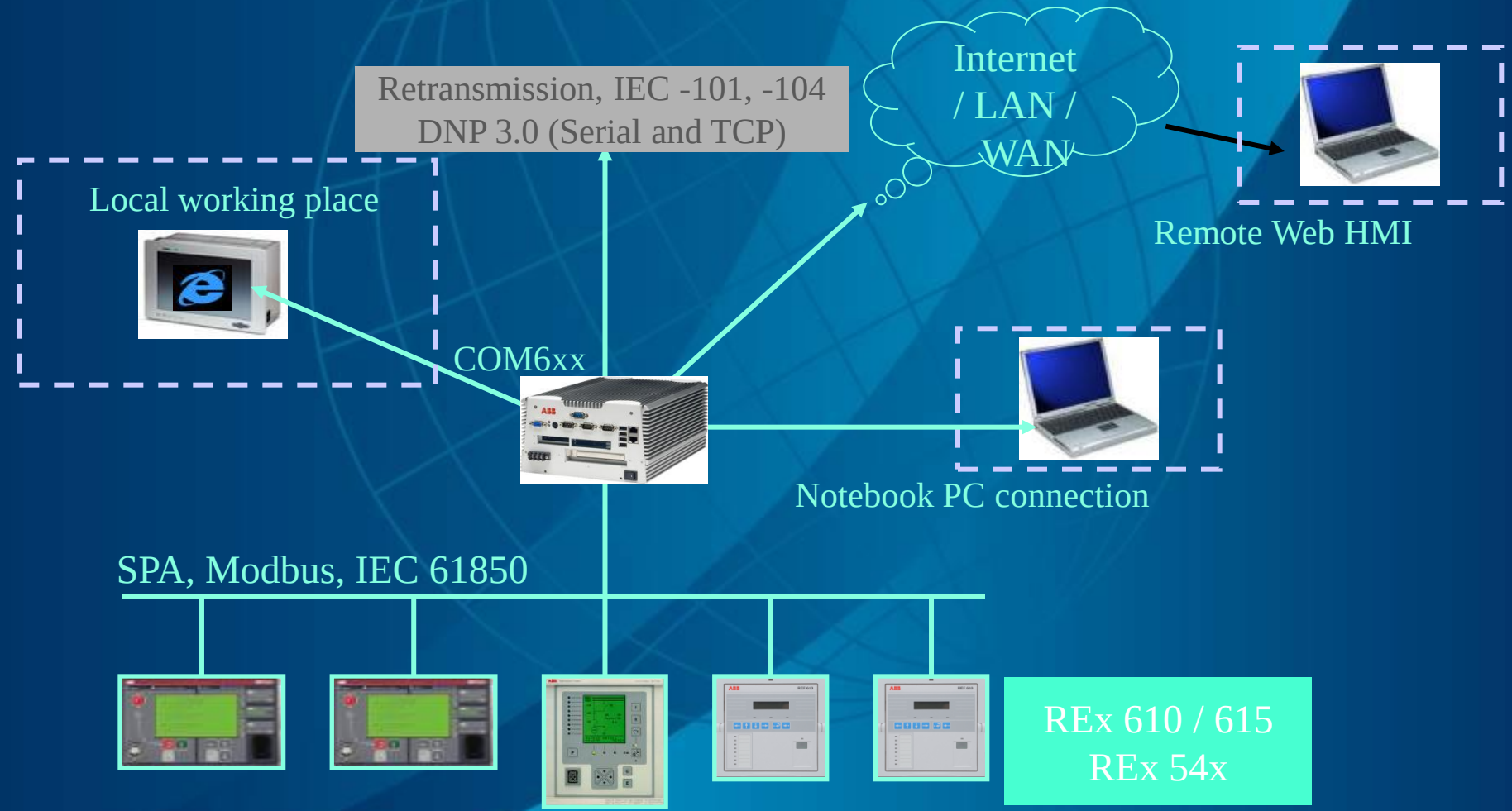
*) more according order

	COM600 based	SAS 605	SAS 635	SAS 610..690
Functions				
Time synchronization	•	•	•	•
Users roles	•	•		
Multilevel access to the system			•	•
Multilanguage with exact language for each of users			•	•
Signals and alarms groups		•	•	•
Blocks list			•	•
Zoom, drag and drop, etc.			•	•
Backup				•
Basic functions of control and monitoring				
Self-diagnosis, faults, events, telesignals, telemeasurements	•	•	•	•
Mimic schemes of the process and self-diagnosis	•	•	•	•
Control dialogs, capture function to control	•	•	•	•
Additional functions				
The settings changing	•		•	•
Waveform processing	•		•	•
Reports on measurements			•	•
Trends			•	•
Send fault events (e-mail, SMS, fax…)			•	•
Bus staining	•		•	•
Step by step operation			•	•
Recommendations for feeder IEDs				
REF541/2/3/5	•	•	•	•
IED670, REB500, REB500sys		•	•	•
Third side producers		•	•	•
Scale of the system				
Quantity of feeder	1…30	1…60	1…60	1…150 *)
Number of remote connections	0…2	1…4	1…4	0…4 *)
Number of IEC61850 buses	1	1	1	3 *)

COM 600 Basic solution

System overview



COM 600 Basic solution
Features

Communication module COM 6xx

- Embedded electronics
  - There are no moving parts – coolers, disks
  - Power supply: 19-30 VDC, 110 V AC / DC
  - Protection: IP 50
  - Temperature: -25 to +70 C
  - Store: -40 to +80 C
  - Sizes: 250 x 100 x 70 mm (W x H x D)
  - Mass: 1,2 kg
  - Interfaces:
    - 4 serial ports
    - Ethernet ports, 100Mbit / s,
    - 4 USB interfaces
    - 1 parallel port
    - VGA interface
    - Mouse and keyboard

COM 600 Basic solution

Functions

Working place

- Based on browser
- Remote and local
- Local is optionally

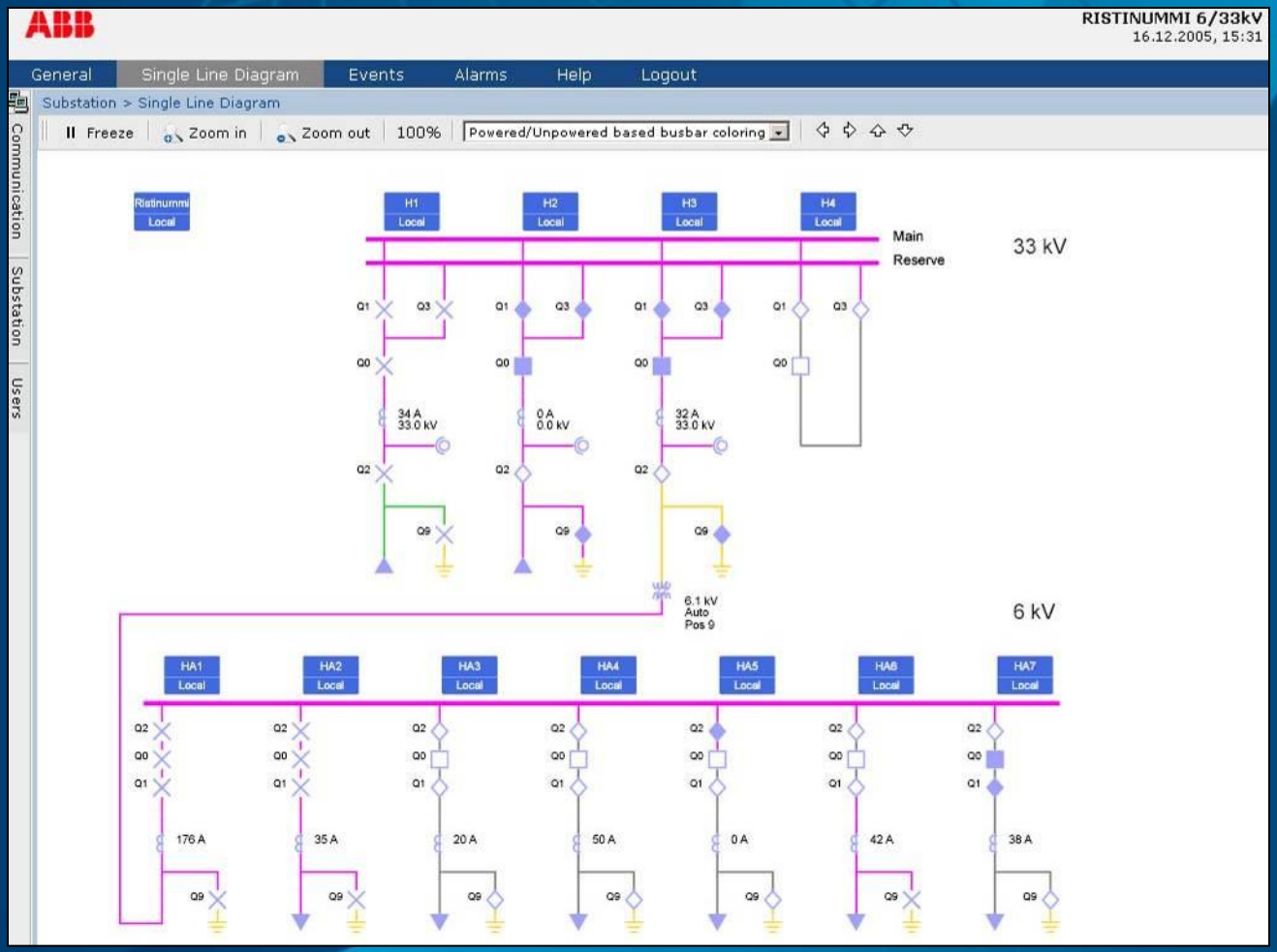
Browsing data and control

- Provide scheme
  - Objects condition
  - Bus staining
- Data and signals visualization
- Control
- Settings changing

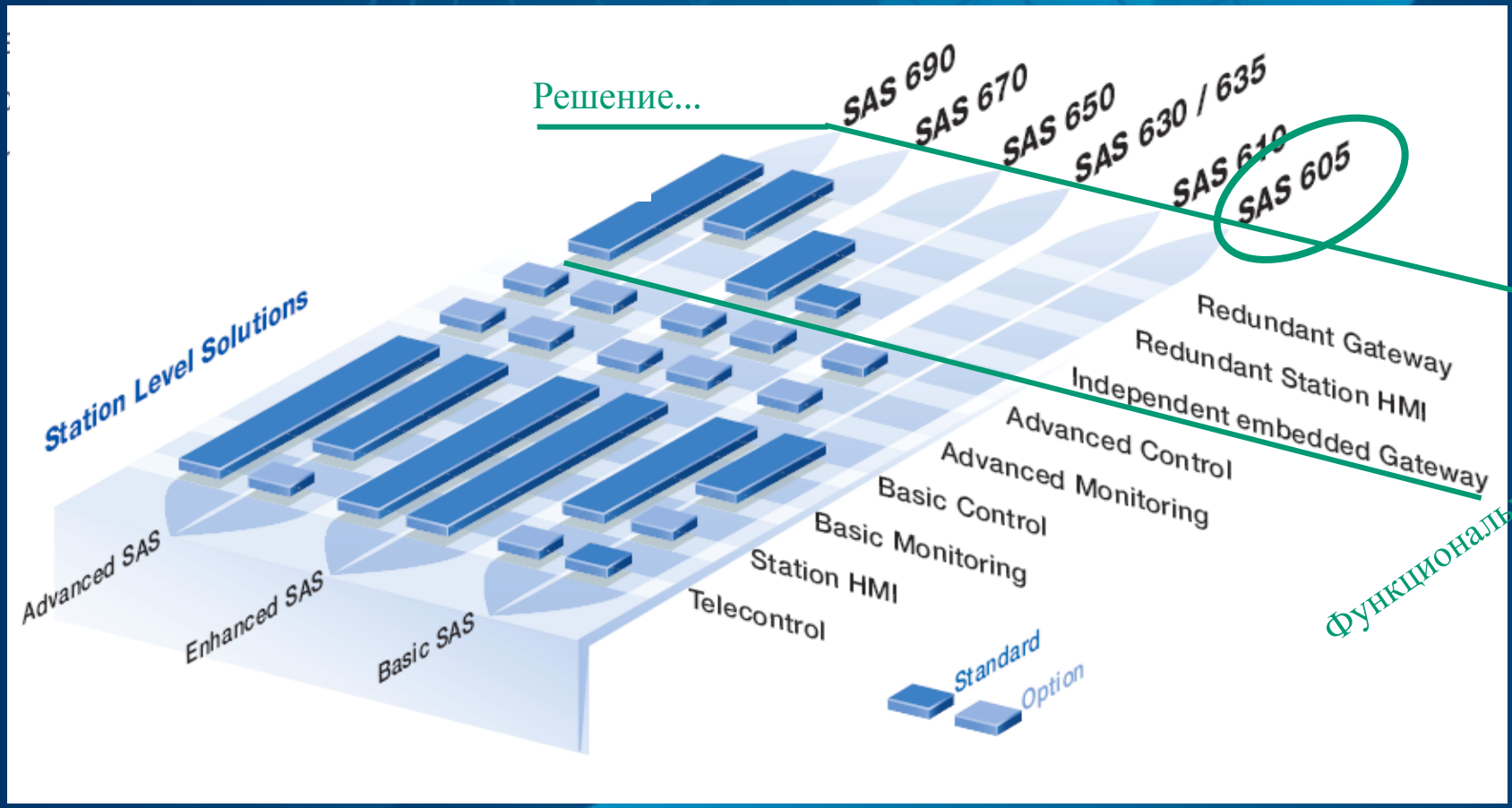
- Events list
- Alarms list
- Self-diagnostics
- Waveform processing

COM 600 Basic solution Functions

Пример: Схема



SAS 600 Series
Review solution



SAS 600 Series
Review architecture

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Advanced SAS—for extra high voltage and complex transmission substations

SAS 690		Highest availability of local and remote control through separation as well as full redundancy of gateway and station computer / HMI
SAS 670		Highest availability of local control provided by two redundant station computers in hot stand-by configuration with option for telecontrol

Enhanced SAS—for high voltage transmission substations

SAS 650		For manned substations with completely independent HMI and gateway function-ality using redundant station computers for local control and monitoring
SAS 630		For unmanned substations with completely independent station computer / HMI and a highly reliable industrial gateway for remote control
SAS 635		For unmanned substations with completely independent station computer / HMI and a RTU based station controller for remote control

Basic SAS—for distribution and sub-transmission substations

SAS 610		Compact solution featuring an industrial PC for local control and monitoring with optional remote access for telecontrol
SAS 605		Compact and flexible solution for telecontrol using a RTU based station controller with optional integrated HMI

Main components


Station computer / HMI
MicroSCADA Pro
(SYS 600)


Station computer / HMI
with integrated
gateway
MicroSCADA Pro
(SYS 600 plus COM500*i*)


Independent
gateway COM 581


Station controller
RTU 560


Integrated HMI
RTU 560

SAS 605

SAS 605
System review

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SAS 605 Basic Automation Solution

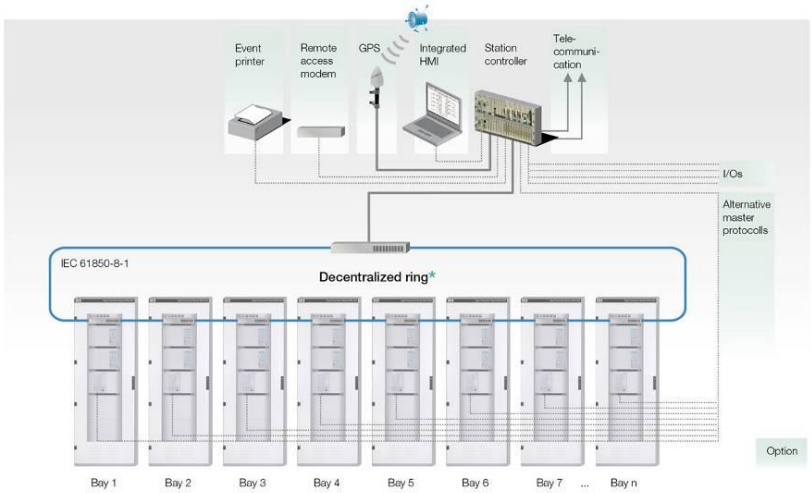
Flexible and maintenance free solution for safe remote control and monitoring. The solution with a RTU based station controller supports direct hardwired I/Os and various master protocols. Control at the substation level is available using the integrated HMI server of the station controller.

Typical applications for SAS 605

Power Utilities
Subtransmission and distribution level

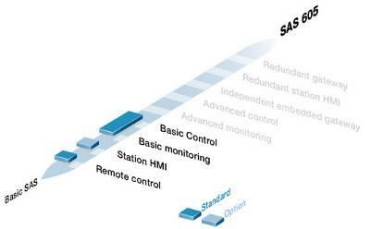
Industry
Distribution substations for power supply

Power plants
Distribution substations
for auxiliary supply



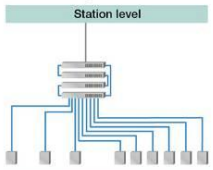
Features
- Highly reliable station controller
- Remote control
- Basic monitoring and control functions

Options
- Integrated HMI
- Different master protocols for legacy IED integration
- I/O modules for hardwired interface



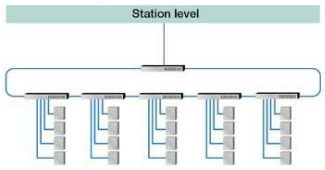
*Available Ethernet topologies

Centralized ring



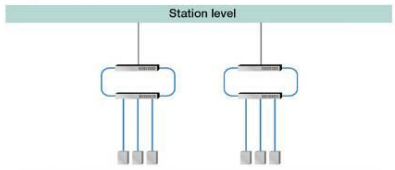
Ethernet features	Applications
Large switches in station cubicle	Short bay IED-to-station distance
High-speed Gigabit backbone	Few IEDs per cubicle/ compartment
Redundant power supply (option)	

Decentralized ring



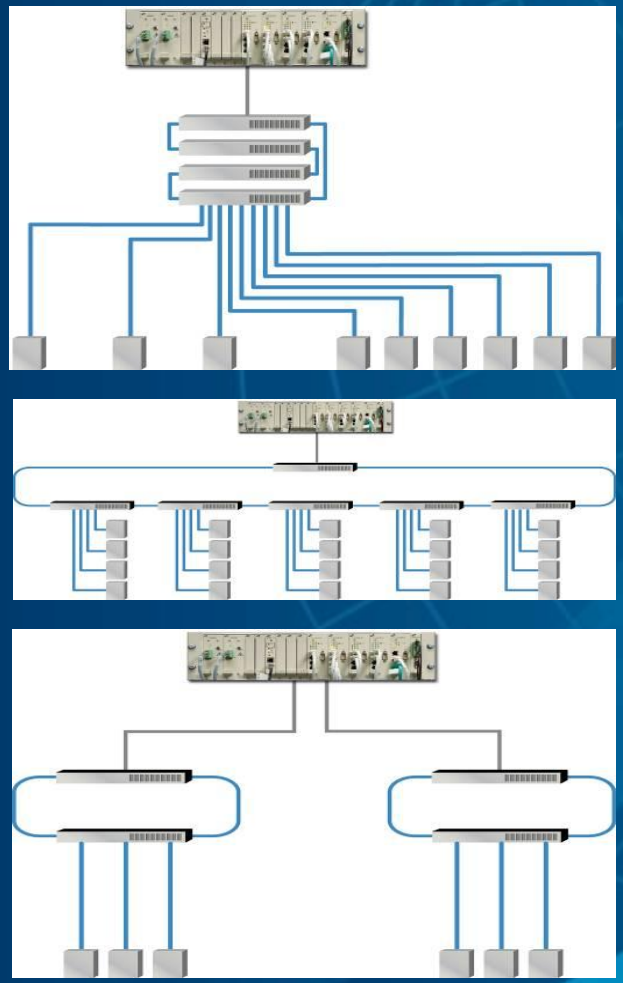
Ethernet features	Applications
Switches in bay and station cubicles	Long bay-to-station distance
Choice of large or small switches	Many IEDs per cubicle/kiosk
100 Mbit/s backbone	

Multiple networks



Ethernet features	Applications
Up to 2 physically separated networks	Large systems
Free choice of topology per network (centralized or decentralized)	Several voltage levels
	Separate control and protection systems
	Separate protection systems (Main 1, Main 2)
	High reliability requirements

SAS 605 Topology
IEC61850 Substation bus



Centralized ring

- Devices are located in the same cabinet
- Small destination between devices and router

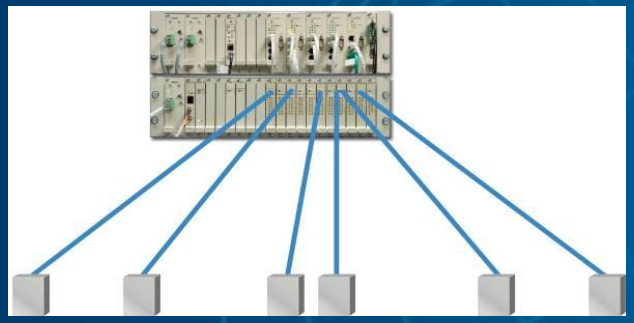
Non centralized ring

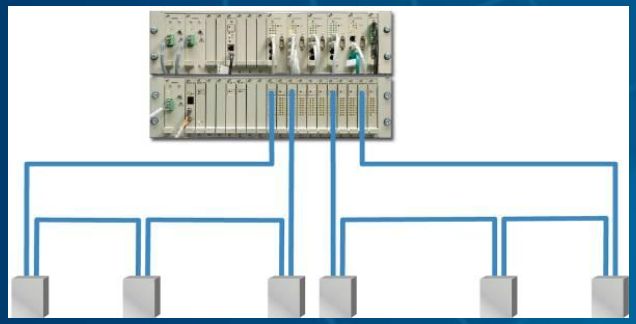
- Routers are located in different places
- Large destination between network devices and IED

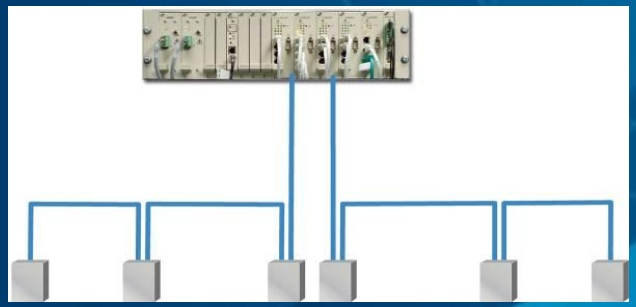
Small subnetworks

- Separated subnetworks
- This applies both to non-centralized, and for the inverse subnetworks
- They improve the reliability and usability (eg, for different voltages)

SAS 605 Topology
Master/Slave Protocols







Star

The principle of a star connection

- The router is mounted in a central cabinet
- The best way is to use master/slave protocols

Ring

- Optical connection to8 devices
- For the bus SPA

Mixed

- More cost-effective
- Based on RS485
- For protocols DNP3.0 and ModBus

SAS 605 Functions Review

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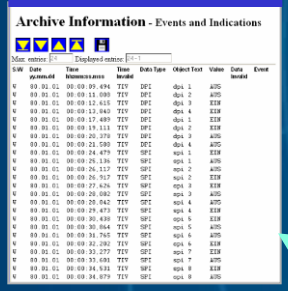
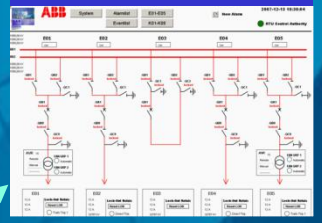
Archiving



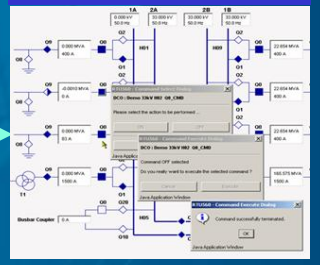
System Diagnostics

Single line

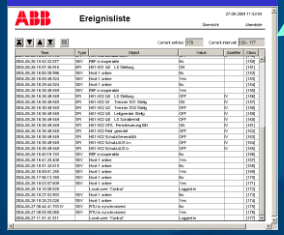


Alarm list

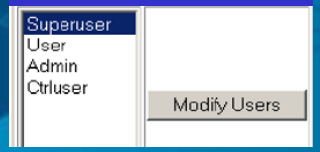
Secure operation



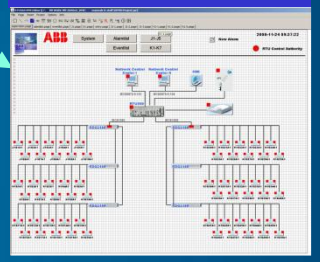
Event list



User management



System Supervision

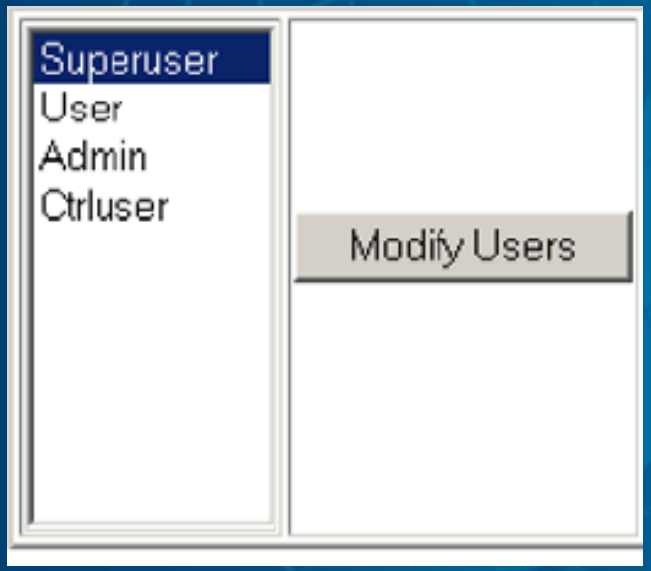


SAS 605 Functions
Working place

- User graphic interface
- Monitoring data
- Control functions
- Printing allowed
- Poor ability to configure
- Local and remote control
- Portable (Notebook) or stationary operator place

SAS 605 Functions
Users roles

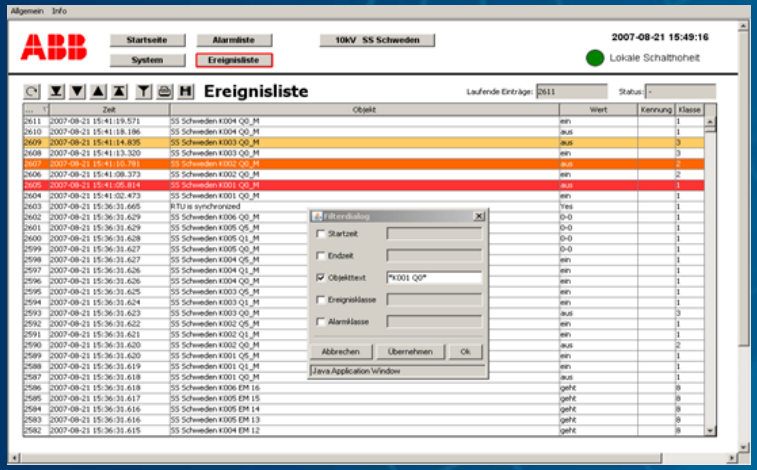
Group selection to change roles



Different groups

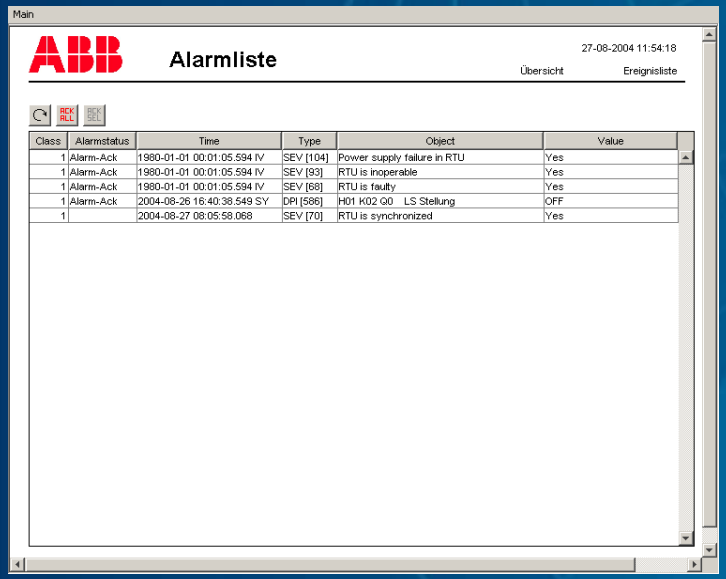
- Diagnostic, Information about condition
- Diagnostic, Information about condition, Configuration, Builds version
- Diagnostic, Information about condition, Control
- Administrator

SAS 605 Function
Events list



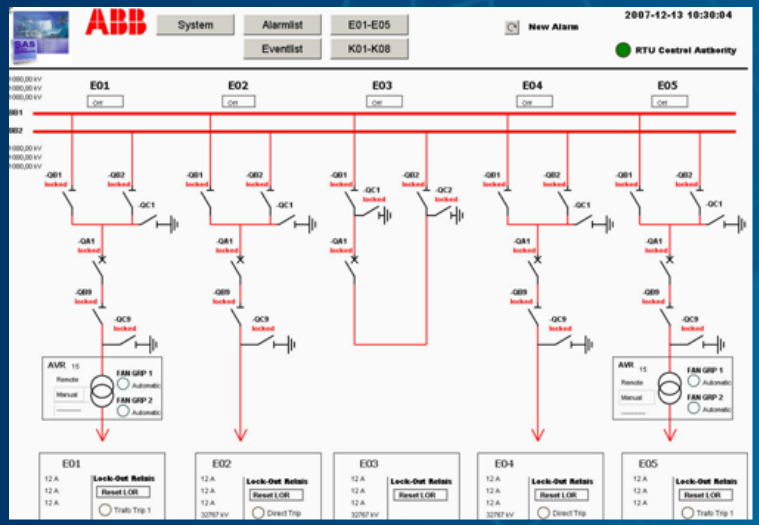
- Records structure
  - Time
  - Object name and condition
  - Object classificatory
  - Event class
- Save and filters
- Max 100.000 records
- All data objects RTU560 can be written as events
- List download to be archived

SAS 605 Functions
Faults



- Faults
  - Fault class
  - Condition
  - Time
  - Object name and condition
- Max 10 fault classes
- Individual or group confirmation
- Two types of faults
  - It requires confirmation
  - It doesn't require confirmation

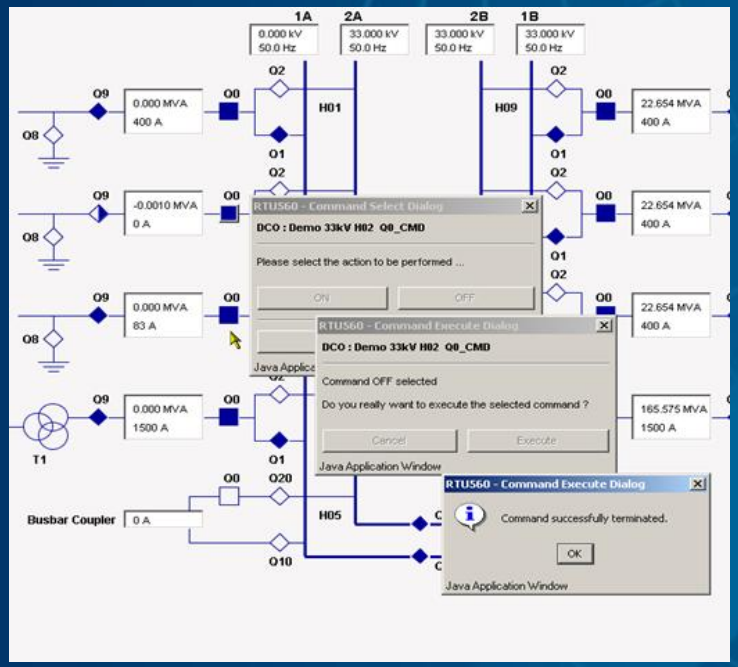
SAS 605 Functions
Scheme



- Detailed scheme
- Each level of voltage has one or some schemes
- All communication apparatus and measurements are shown
- Access to control dialogs

SAS 605 Functions

Safe control



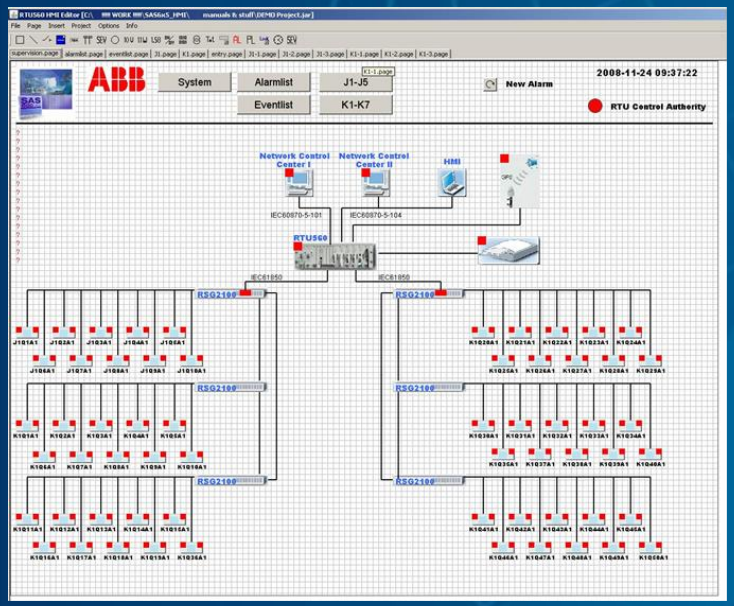
- Use roles control
- Protection by logins
- Selection before control
- Blocks (station or feeder)
- Synchronization
- Block of simultaneous commands

МАСТ-ИПРА

ООО "Хартэп"

SAS 605 Functions

Self-diagnostic



- Visualization condition of system components
- Shows features of system architecture
- Detailed condition RTU560 and slave devices
- Information about each IED

SAS 605 Basic components RTU560 Rack (1/2)

Аппаратура
• Module design • Parallel processes • Support exchange protocols • Communication cabinet for CPUs • Extension cabinet and optical modules

It’s used as a telemechanics device for data retransmission, working place and connection process signal

SAS 605 Basic components
RTU560 Cabinet (2/2)

Master protocols for IEDs

- IEC61850-8-1
- SPA
- IEC60870-5-103
- DNP3.0
- Modbus

High level protocols NCC

- IEC60870-5-101
- IEC60870-5-104
- DNP3.0
- DNP3.0 over LAN/WAN

SAS 605 Basic components
RTU560 Time module

Real Time Clock Module

- Time module
  - GPS, DCF77 or IRIG-B
  - Is installed in the cabinet
  - The antenna is connected to module directly
- Time synchronization RTU560 and all slave devices (in depend from exchange protocols)

SAS 605 Basic components
RTU560 IO Modules (1/2)

ООО "Хартэп"

Digital input	Digital output
	

- 16 inputs
- Voltage 110 or 220 V DC

- 16 relay output
- Voltage to 250 VDC/AC
- Current: 8A
- Disconnection 50W (L/R=40ms)

SAS 605 Basic Components
RTU560 IO modules (1/2)

Analog input	Analog output
	

- 8 inputs
- Current ±2 / ±5 / ±10 / ±20 / ±40mA
- Voltage ±2 VDC, 0...20 VDC

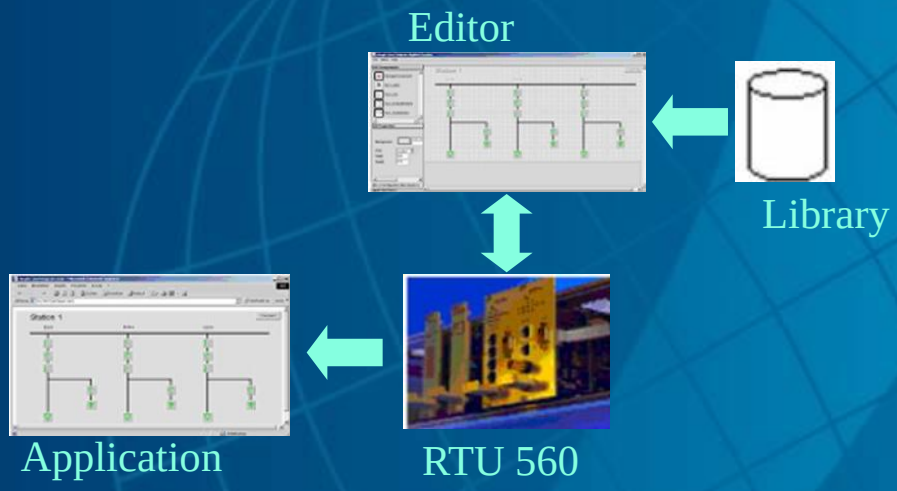
- 2 outputs/module
- ±2,5 / ±5 / ±10 / ±20 / 4..20 mA

SAS 605 Basic components
RTU560 Working place

Working place

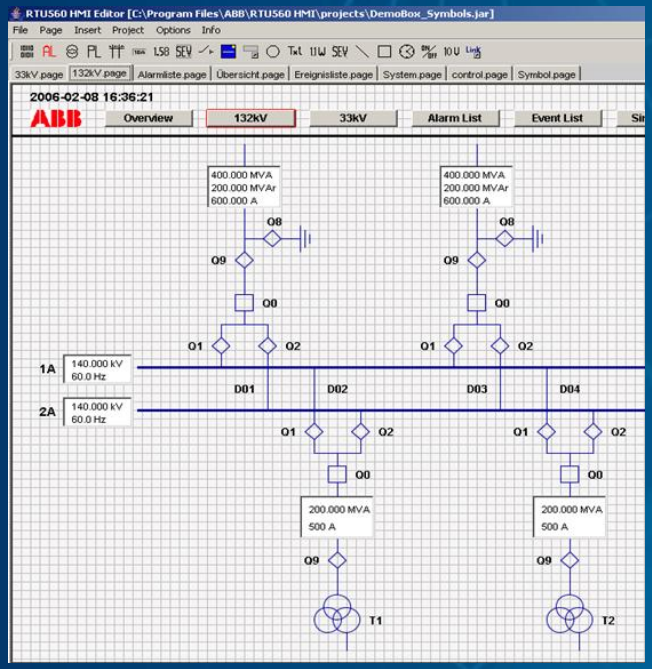
- Standard PC (separately)
- Industrial PC (separately)
- Panel PC with Touch Screen (in cabinet)
- Notebook PC (separately)

SAS 605 Software
RTU560 working place



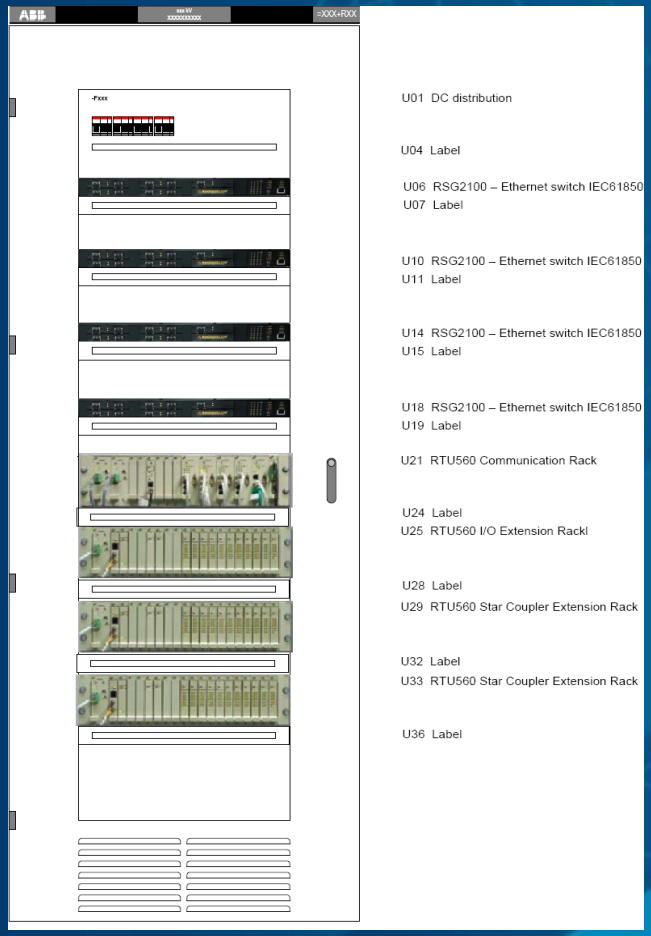
- Library components selection
- Max 20 screens
- Max 200 dynamical objects on the one screen
- Background import
- Roles control for local and remote control
- Users identification and autorization

SAS 605 Software
RTU560 Editor



- Scheme creation
  - Static elements
  - Dynamics elements
  - Different colors of components
  - Standard functions of drawing
- Easy connection of dynamic elements to data objects RTU560
- Defined forms of a list of faults and signals
- Validation (connectivity) data objects RTU560

SAS 605 Basic components
Cabinet

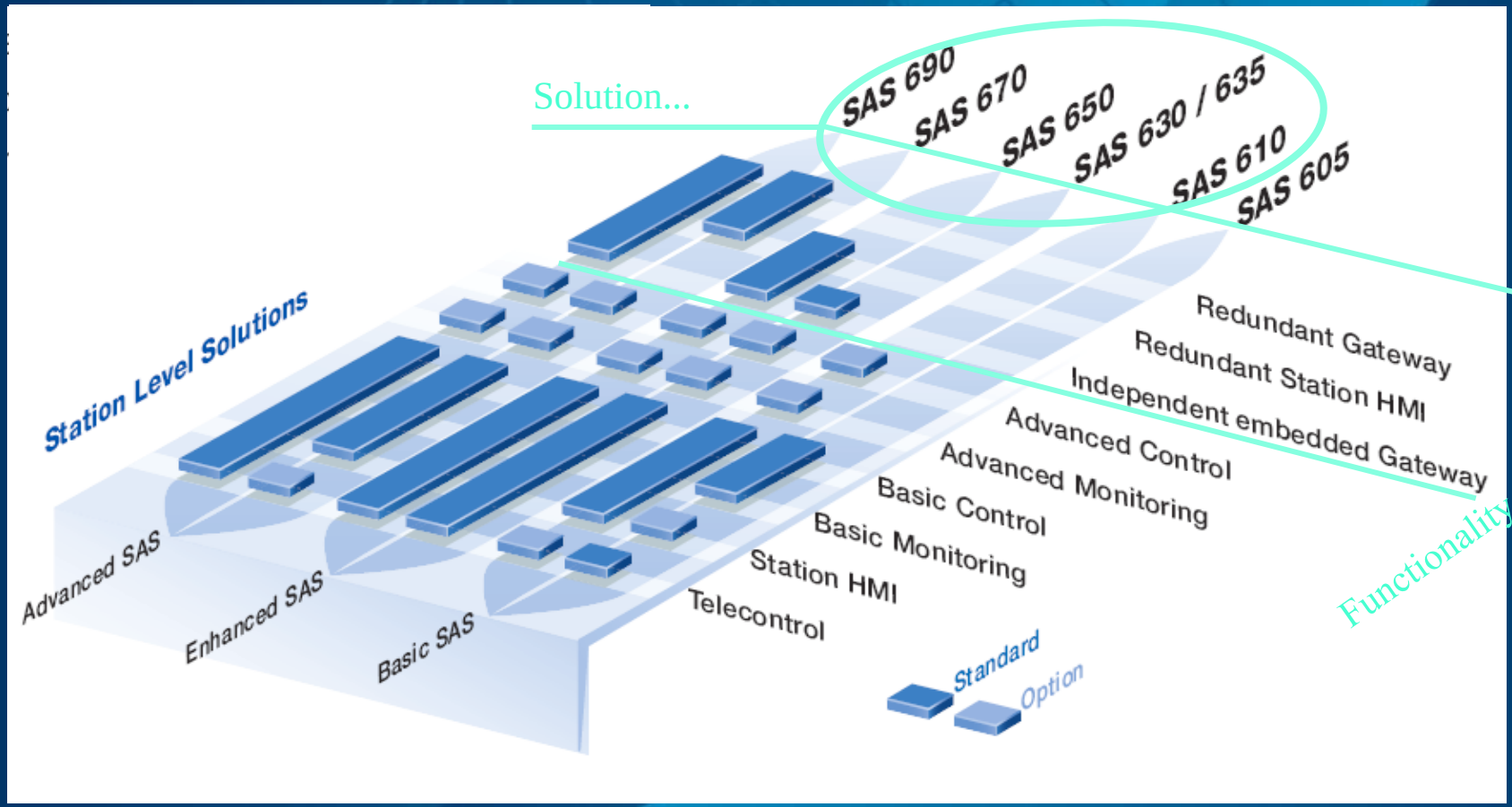


Cabinet

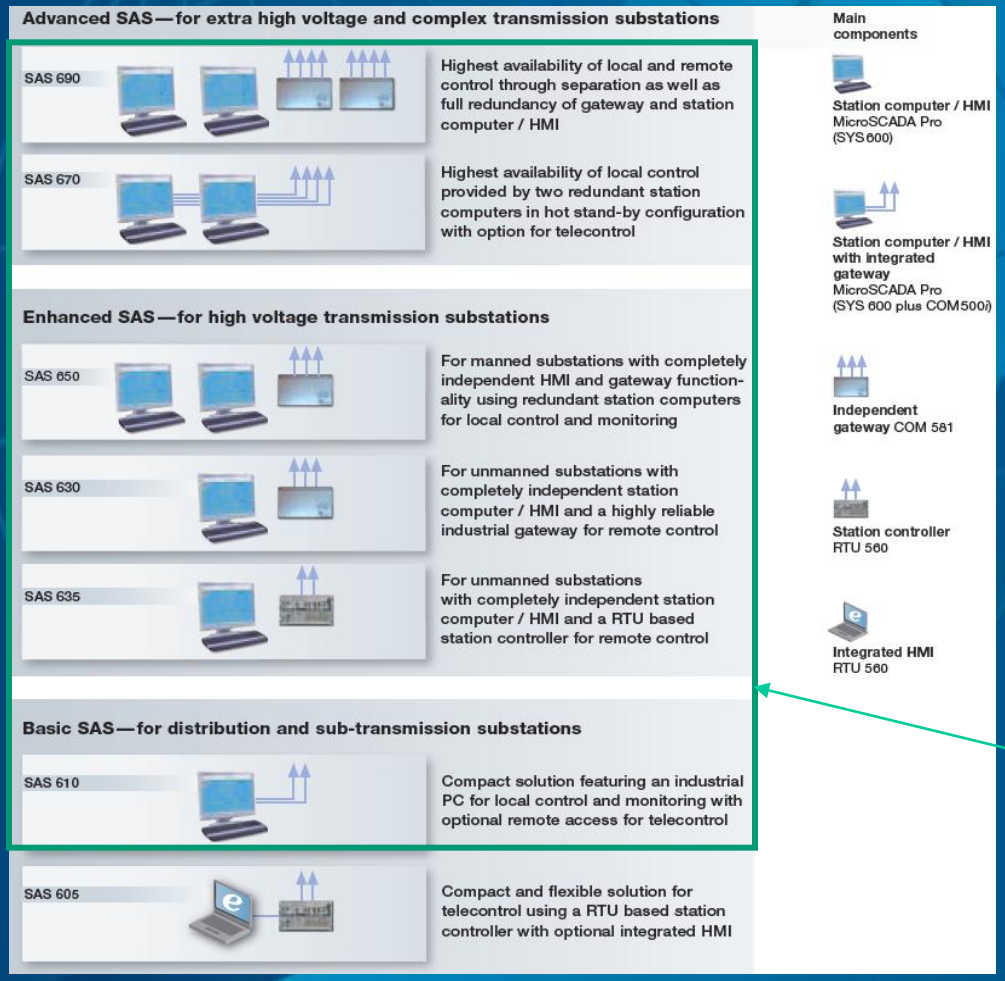
- Based on RESP07
- RTU560 communication cabinet and extension cabinets
- IO Modules 110V DC are mounted inside cabinet
- Option: Panel integration with touch-pad inside cabinet
- Option: DC/AC inverter for redundant power supply of own needs

SAS 600 Series
Solution review

ООО "Хартэп"

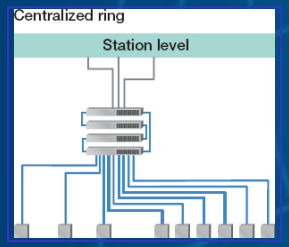


SAS 600 Series
Solutions architecture

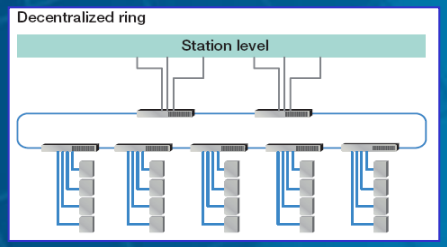


SAS 610…690

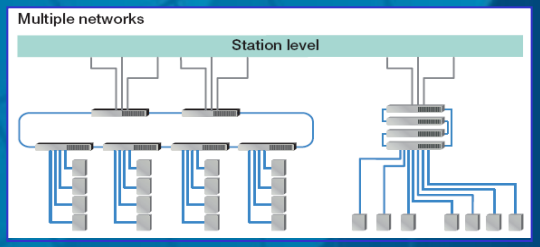
SAS 610…690
Communication topology. IEC61850 Bus



Centralized ring
- Routers in central cabinet
- Small destination to IED

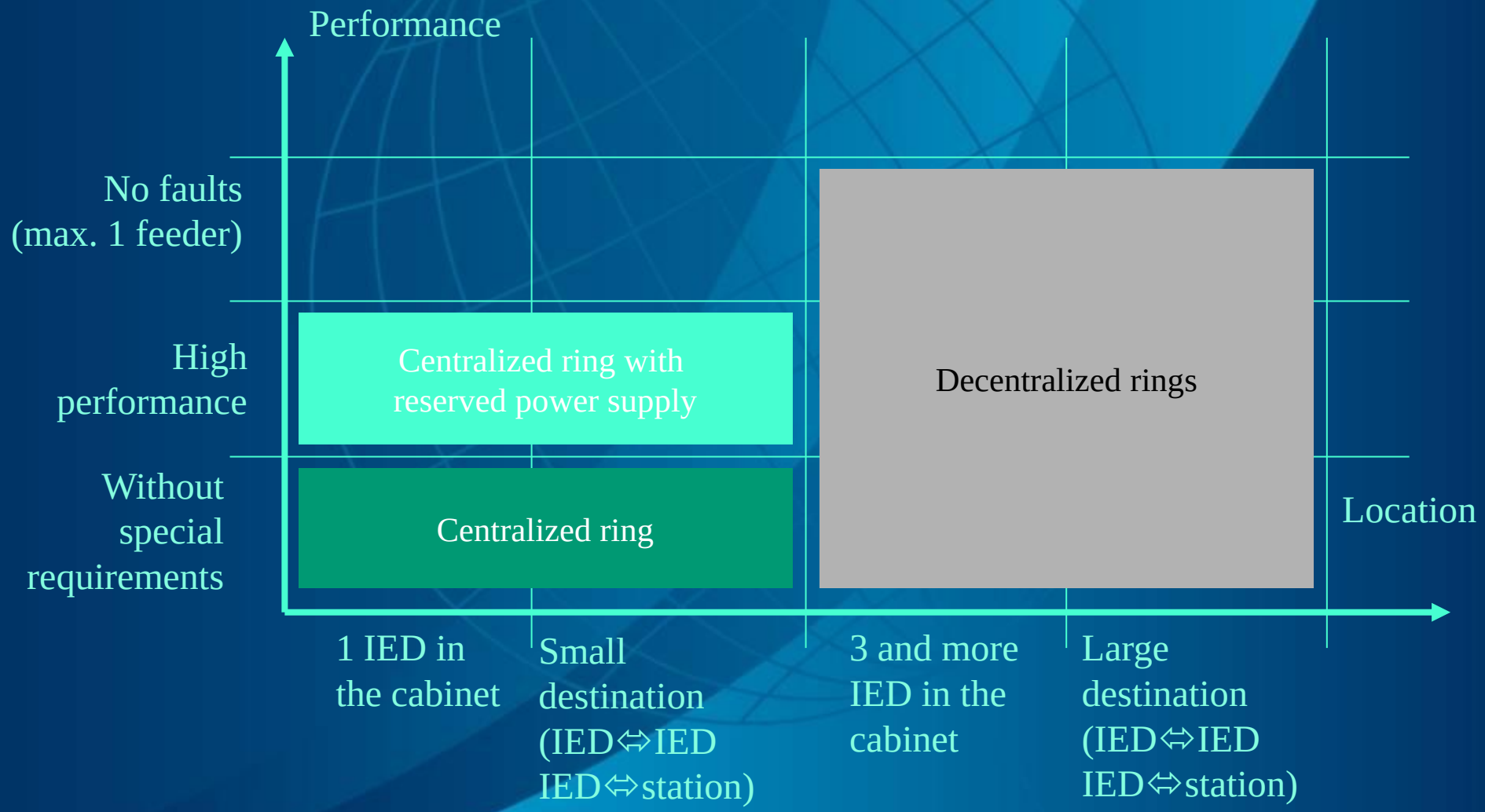


Decentralized ring
- Routers in different cabinets
- Large destination to IED

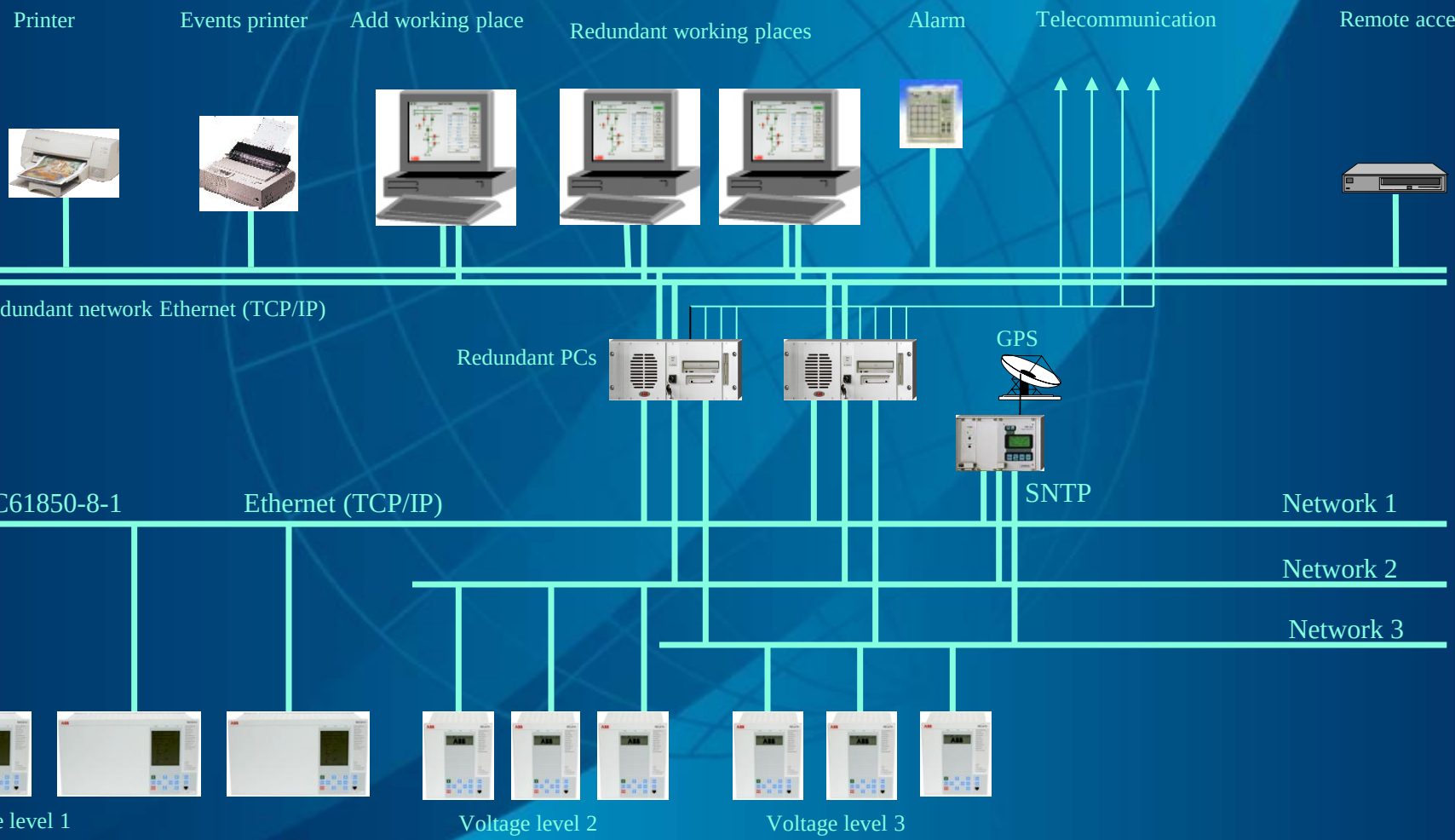


Mixed network
- Different segments of network
- Is applied for two network types
- Increase reliability
- For example, for different classes of voltages

SAS 610…690 Topology
IEC61850 diagram of network selection



SAS 610…690
IEC61850 Bus Mixed network 2

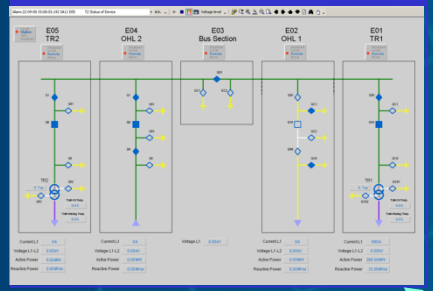


SAS 610…690 Functions
Basic functions review

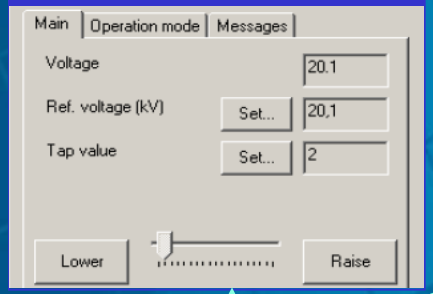
МАСТ-ИПРА

ООО "Хартэп"

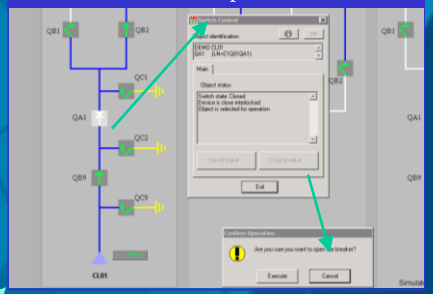
Primary equipment supervision



Control

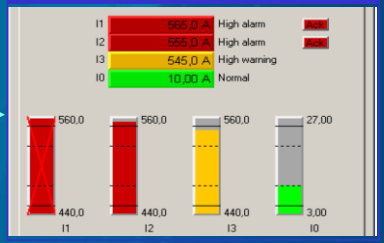


Secure Operation

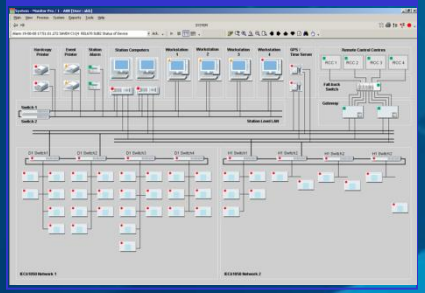


User Management

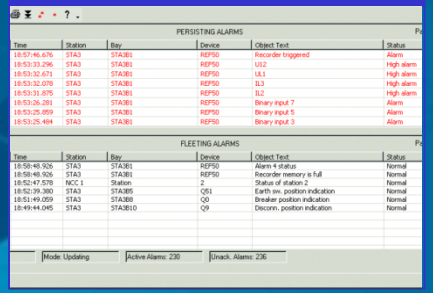
Measurements



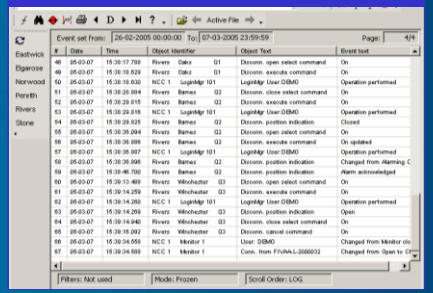
System Supervision



Alarms



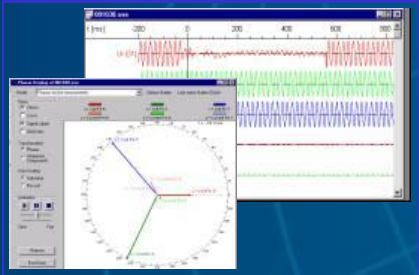
Sequences of Events



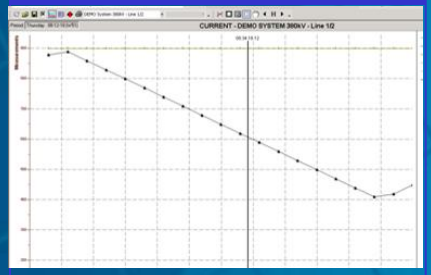
SAS 610…690 Functions
Additional functions review

ООО "Хартэп"

DR upload and Analysis



Measurement Trends and Reports



Trip Counter Table

	Trips	Current [kA]	Reset Trip Count	Set Limits
D01	0	99.00		
D02	0	0.00		
D03	0	0.00		
D04	0	0.00		
D05	0	0.00		

IED parameterization

Parameter Setting

Edit Customize IED View

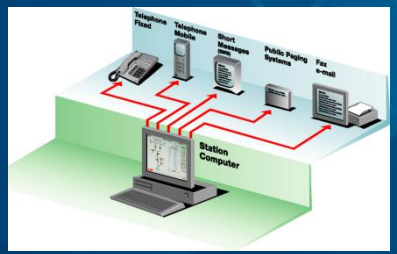
Group / Parameter Name	IED Value
LD1	
Protection	
3I > >, Three-phase directional O/C function, low-set stage I>	
Actual setting	
Operation mode	Not in use
Start current	0,05
Operate time	0,05
Time multiplier	0,05

Load Shedding

Set data to units

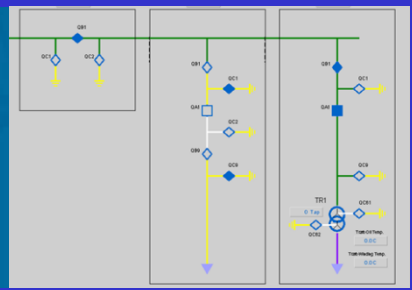
Bay Name	Actual settings	New settings	Set Stage	Status
H01	Stage 6	Stage 5		ON
H02	?	?		?
H03	?	?		?
H04	?	?		?

External Alarming

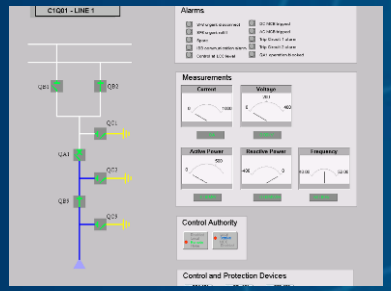


Automatic Sequences

Dynamic Busbar Coloring

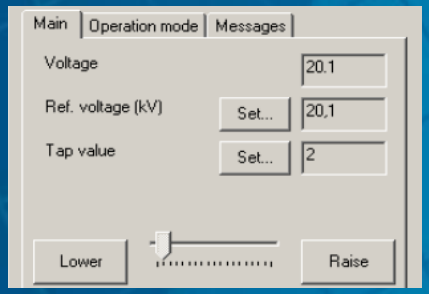


SAS 610…690 Functions
Basic functions (1/4)



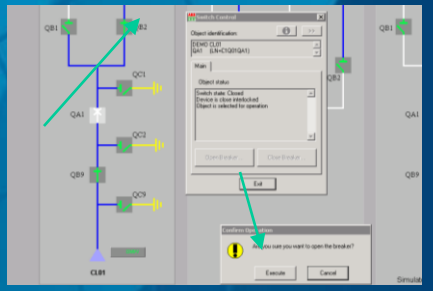
Diagnostic of basic equipment

- Permanent monitoring
- Measurements
- Access to control dialogs



Control

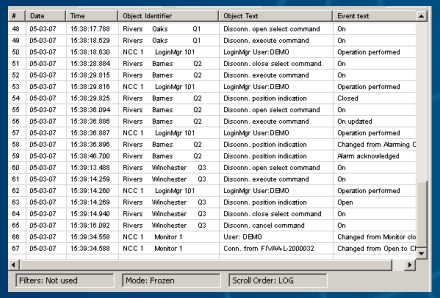
- Control dialogs
- Single and double commands
- Analog values

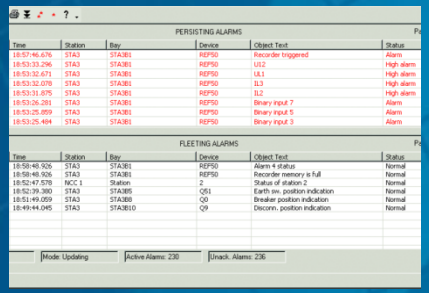


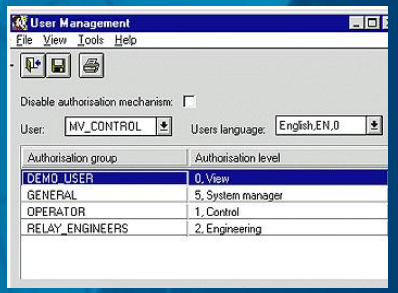
Safety

- Selection before operation
- Blocks (Feeder and substation)
- Synchronization
- Blocks of two commands

SAS 610…690 Functions
Basic functions (2/4)





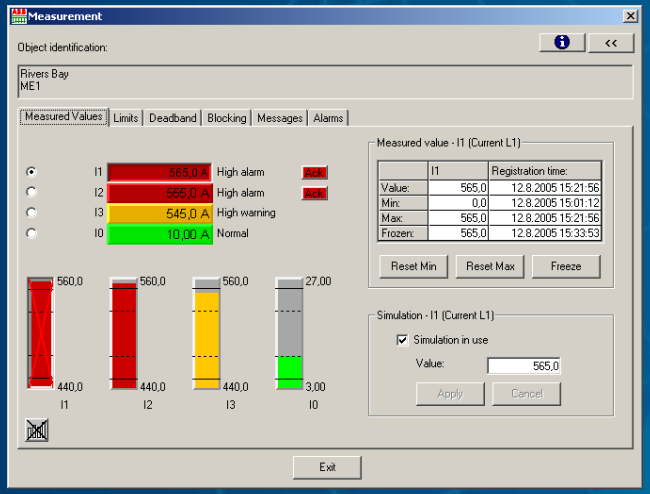


Sequences of events
- Events list
- Archive
- Functions of filters
- Export

Faults
- Faults list (pats/current)
- Confirmation
- Fault classes
- Control and sound warning

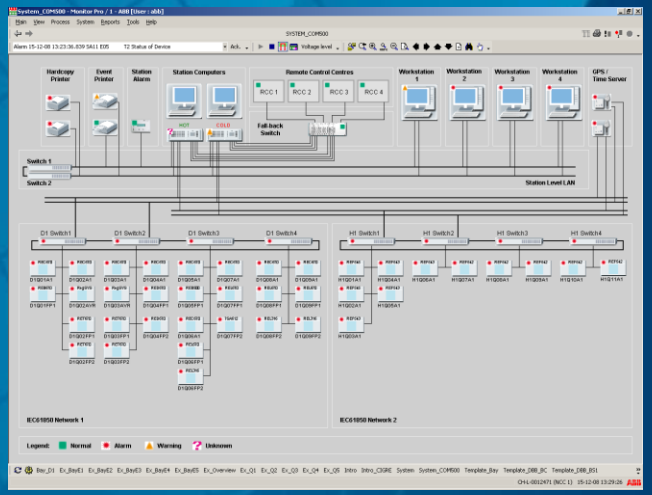
Users
- Various levels of authorization
- Defined groups have access to objects
- Authorization for each user

SAS 610…690 Functions
Basic functions (3/4)



Measurements

- Direct from current and voltage transformers
- Signals mA и V
- Time stamps form the feeder
- Statistic

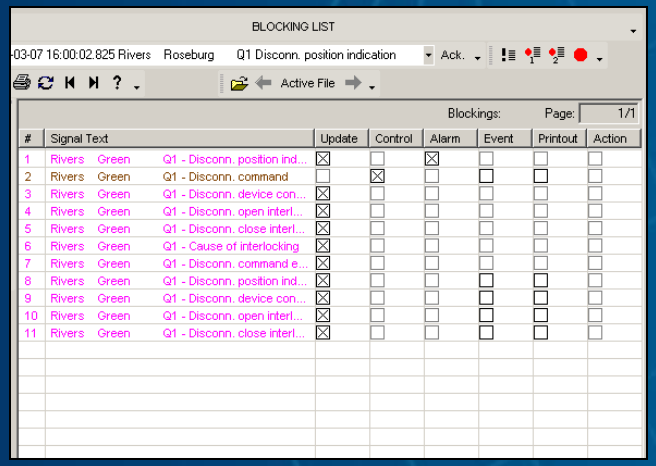


Self-diagnostic

- All IED devices
- Additional devices (printers, other)
- Networks/connections

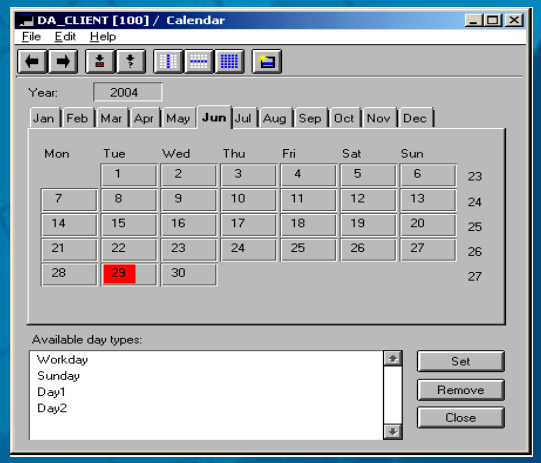
SAS 610…690 Functions
Basic functions (4/4)

ООО "Хартэп"



Blocks

- Common system table of blocks
- Blocks of events, faults, alarms, control, printing, data processing.

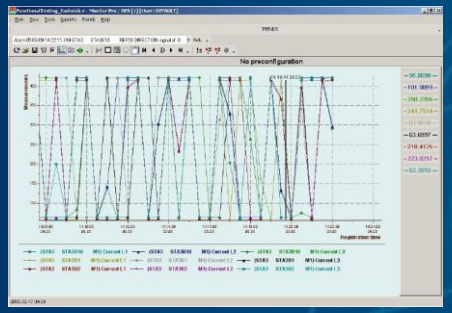


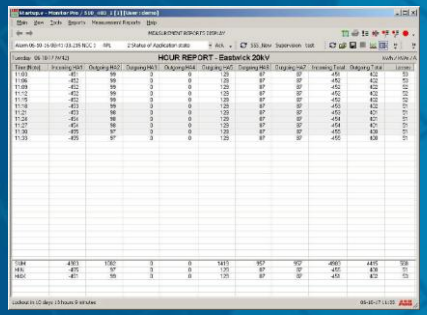
Calendar

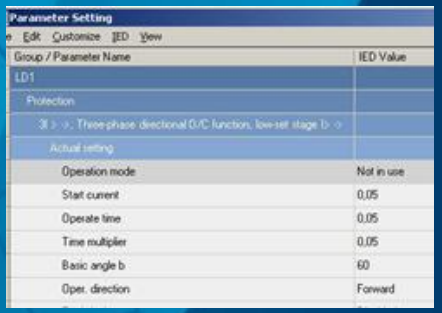
- Time of the future events
- Operation after some time
- Easy configuration, individual setting for every day

SAS 610…690 Functions
Additional functions (1/4)

ООО "Хартэп"







Trends
- For easy review and analyze
- Any values can be considered
- Graphical and tables forms
- Additional calculations

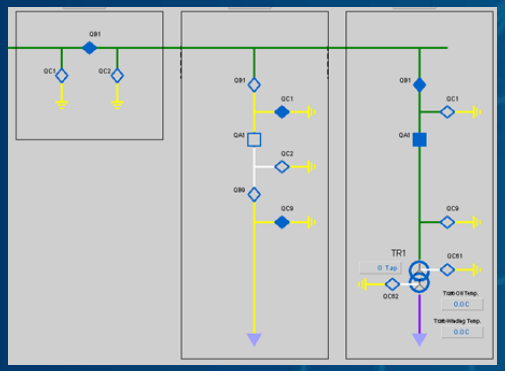
Measurement reports
- Measurements archives
- Hour/Day/Week/Month/Year report
- Table and graphical forms
- Reports in ASCII or CSV format
- Sum, min, max and etc. values

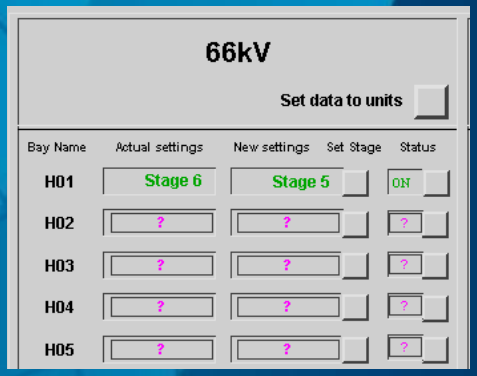
IED parameters
- Configuration/reload parameters with IED
- Parameters /setting changing
- Access to IED parameters

SAS 610…690 Functions
Additional functions (2/4)

МАСТ-ИПРА

ООО "Хартэп"





Dynamic coloring of buses

- Dynamic coloring of schemes parts
- One color for power supply
- Complex scheme visualization

Automatic sequences

- Execution of defined sequences
- Checking of switching safety
- Freely configured sequences

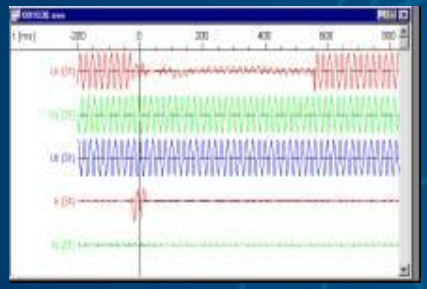
Balances

- Balance control and flows on the feeder and stations level
- Data archiving
- Control of load

SAS 610…690 Functions

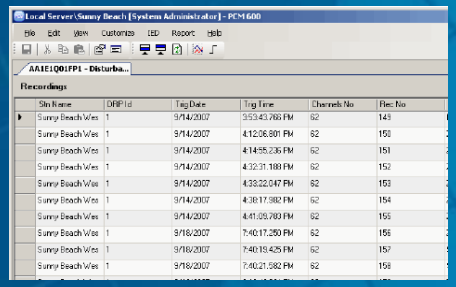
Additional functions (3/4)

ООО "Хартэп"



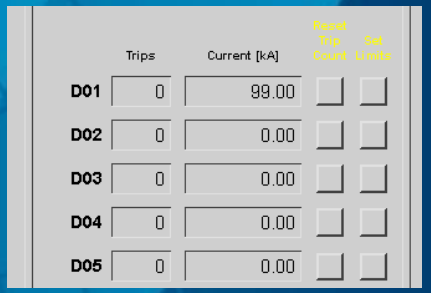
Waveforms

- Графическое отображение
- Определение мест повреждений
- Измерение частоты, параметров мощностей
- Динамический анализ



Waveforms load

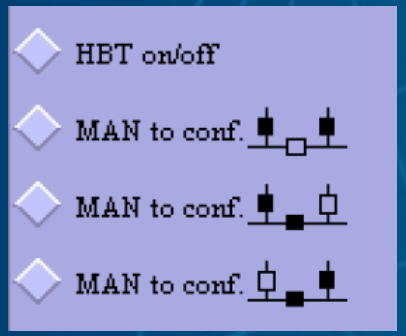
- In the manual mode
- Automatically



Switching counter

- Breakers diagnostic
- Operations quantity
- Control of summary of disconnected current

SAS 610…690 Functions
Additional functions (4/4)



Quick switching

- Feeder control, station diagnostic

Send alarm outside

- Fax, Voice messages
- SMS, Pager system
- E-mail

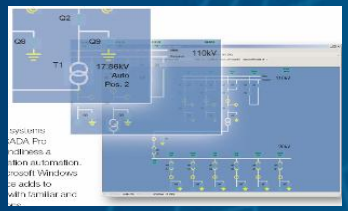
SAS 610…690 Функции

Функции системы – Рабочее место

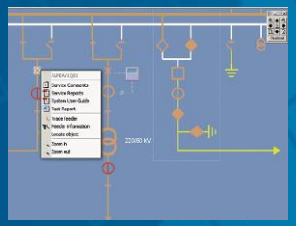
МАСТ-ИПРА

ООО "Хартэп"

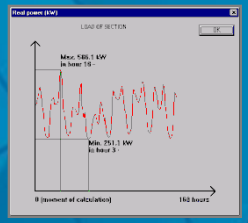
Graphical displays



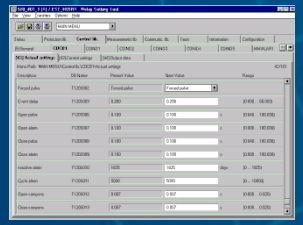
Instrumentation

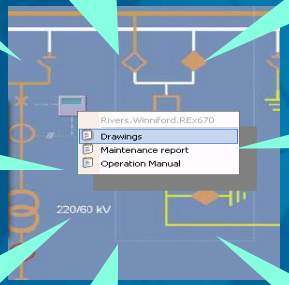


In formation analyzing

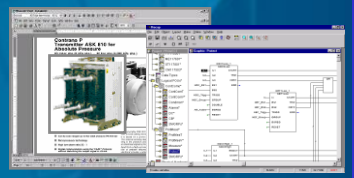


Settings



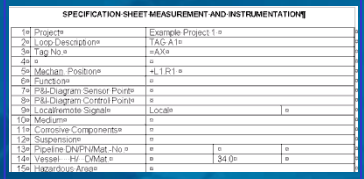


Documentation, passports

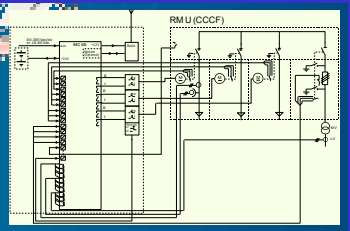


Internet

Lines descriptions



Schemes



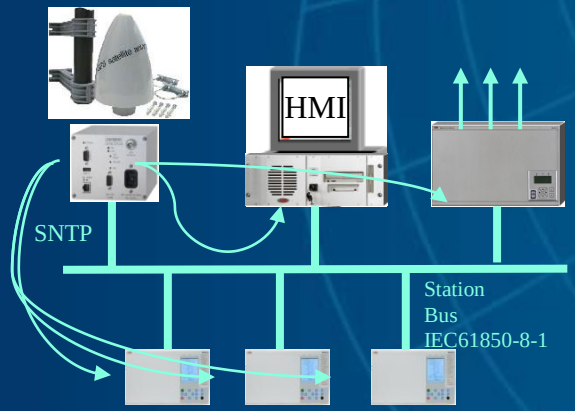
Easy navigation

SAS 610…690 Functions

System functions – Remote control

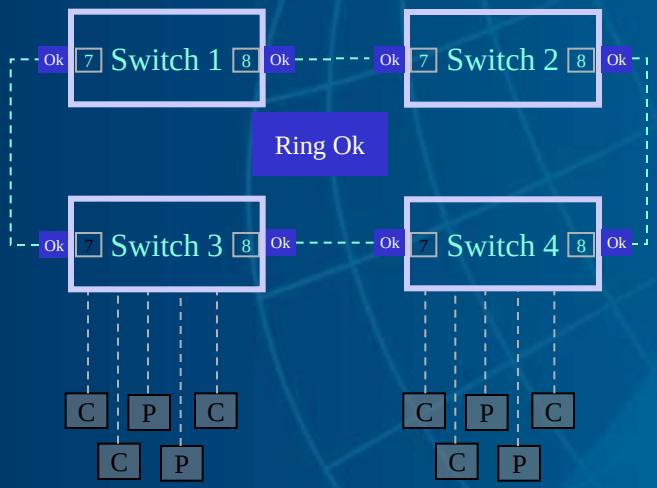
- Serial communications to the Control Centers
- Support for multiple lines with different protocols
- Diagnosis of network equipment
- Faults, measurements, commands, status
- Check the rights for commands lists
- List of faults
- Calculations based on measurements

SAS 610…690 Functions
System functions – Time synchronization



- Time comes from the master clock of computer station or control center
- Time passed on to all devices via SNTP
- Each IED has its own clock
- If the etalon clock fail, the substation computer will synchronize the time on the basis of own hours

SAS 610…690 Functions
System functions – Self-diagnostic



- Protection relays and control stations state is monitored by a computer via a bus IEC61850
- Other devices work by SNMP
  - Ethernet switches,
  - Time devices,
  - Printers
  - Additional working
- Self-diagnostic substation bus
  - The overall fault in violation of a redundant network
  - Additional faults in various locations

SAS 610…690 Functions
Functions list (1/2)

	Basic	Add.	Request
System functions			
Time synchronization	X		
User roles control	X		
Block list	X		
Group faults, signals		X	
Basic functions of monitoring			
Self-diagnostic, events and faults	X		
Conditions of communication apparatus and measurements	X		
Self-diagnostic screen	X		
Substation screen	X		
Schemes	X		
Events and faults list	X		
Basic control functions			
Switching control, breakers	X		
The principle of selection to control double-lock command and confirmation commands tap	X		
Checking of control roles	X		
Blocks, synchronization, self-diagnostic	X		

SAS 610…690 Functions
Functions list (1/2)

	Basic	Add.	Request
Additional monitoring functions			
Measurements reports		X	
Trends		X	
Remote device parameterization		X	
Waveforms reading		X	
Waveforms analyzing		X	
Faults sending (e-mail, sms, fax)		X	
Remote working place to control substations PC		X	
Additional control functions			
Coloring buses		X	
Executing of defined sequences			X
Balances and limits			X
Control of data transferring bus			X

SAS 610
System review

МАСТ-ИПРА

ООО "Хартэп"

SAS 610 Basic Automation System

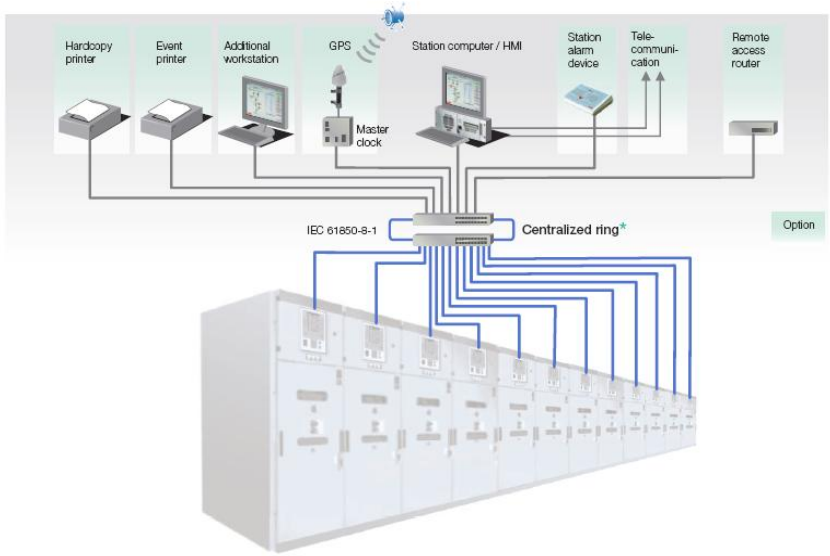
The compact solution for safe local control and monitoring. It features a single system and can be upgraded at any time. The choice is yours in terms of advanced functions and/or telecontrol.

Typical applications for SAS 610

Power Utilities
Subtransmission and distribution level

Industry
Distribution substations for power supply

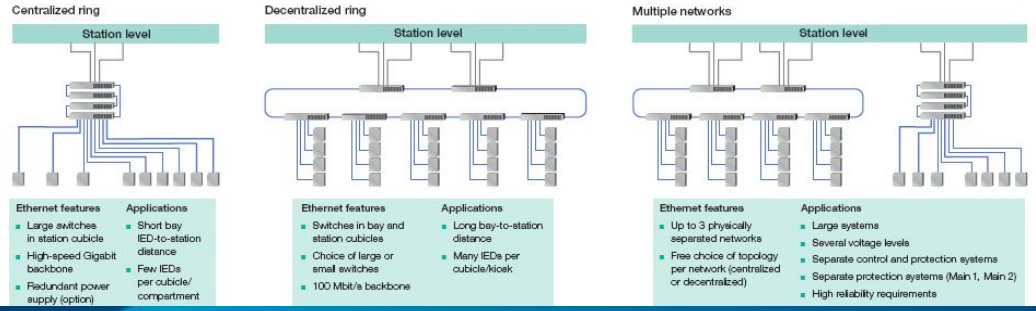
Power plants
Distribution substations
for auxiliary supply



Features
- Single industrial station computer with HMI
- Combined station LAN and Inter-bay bus
- Basic monitoring and control functions

Options
- Telecontrol
- Advanced monitoring
- Advanced control

*Available Ethernet topologies



SAS 635
System review

МАСТ-ИПРА

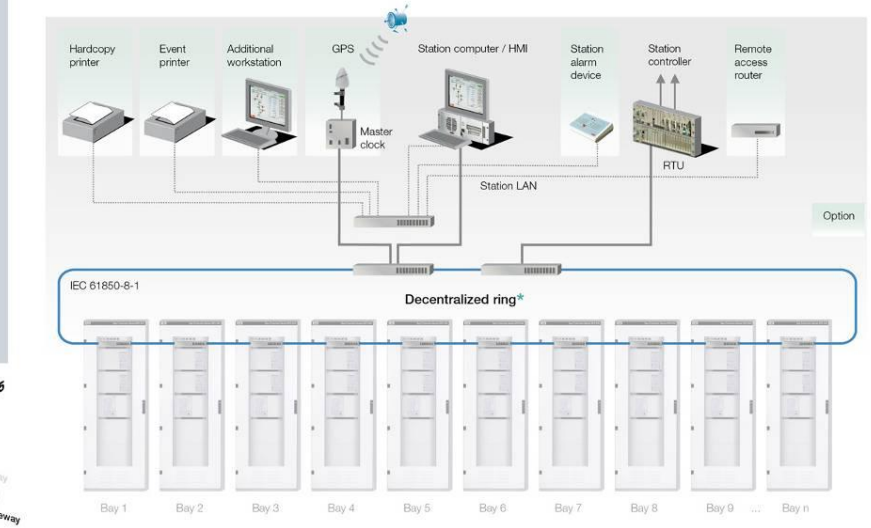
ООО "Хартэп"

SAS 635 Enhanced Automation Solution

Safe control and monitoring for usually unmanned substations. A maintenance-free RTU based station controller provides the remote control function. A dedicated computer is used for the local data acquisition and operation at the substation level.

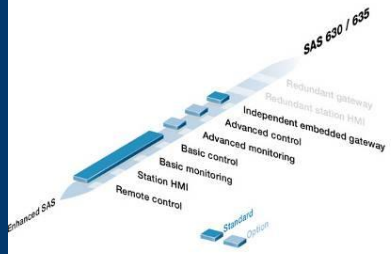
Typical applications for SAS 635

Power Utilities
Subtransmission and high voltage transmission level



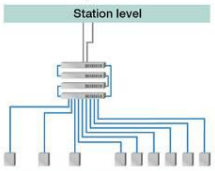
Features
- Highly reliable station controller for remote control
- Single station computer with HMI
- Basic monitoring and control functions
- Separate station LAN and IEC 61850-8 network

Options
- Advanced monitoring
- Advanced control



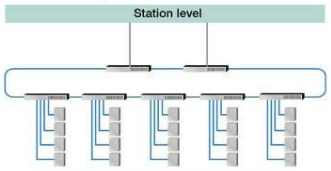
*Available Ethernet topologies

Centralized ring



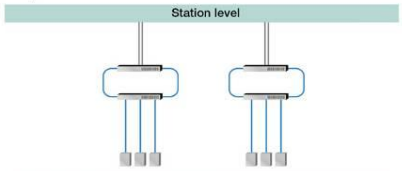
Ethernet features	Applications
Large switches in station cubicle	Short bay IED-to-station distance
High-speed Gigabit backbone	Few IEDs per cubicle/ compartment
Redundant power supply (option)	

Decentralized ring



Ethernet features	Applications
Switches in bay and station cubicles	Long bay-to-station distance
Choice of large or small switches	Many IEDs per cubicle/kiosk
100 Mbit/s backbone	

Multiple networks



Ethernet features	Applications
Up to 2 physically separated networks	Large systems
Free choice of topology per network (centralized or decentralized)	Several voltage levels
	Separate control and protection systems
	Separate protection systems (Main 1, Main 2)
	High reliability requirements

SAS 630
System review

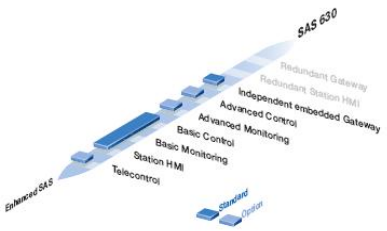
ООО "Хартэп"

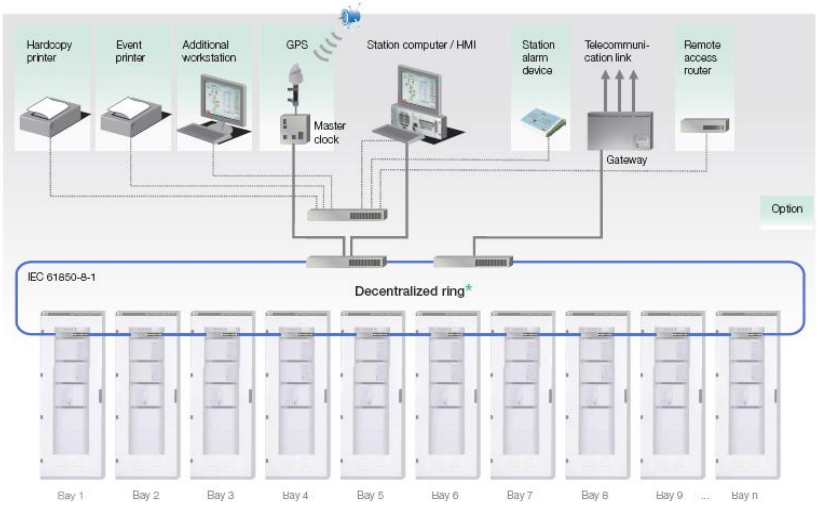
SAS 630 Enhanced Automation System

The solution for usually unmanned substations. Remote control and monitoring is combined with a local workstation. A maintenance-free industrial gateway ensures your continuous data and command access.

Typical applications for SAS 630

Power Utilities
Subtransmission and high voltage transmission level.

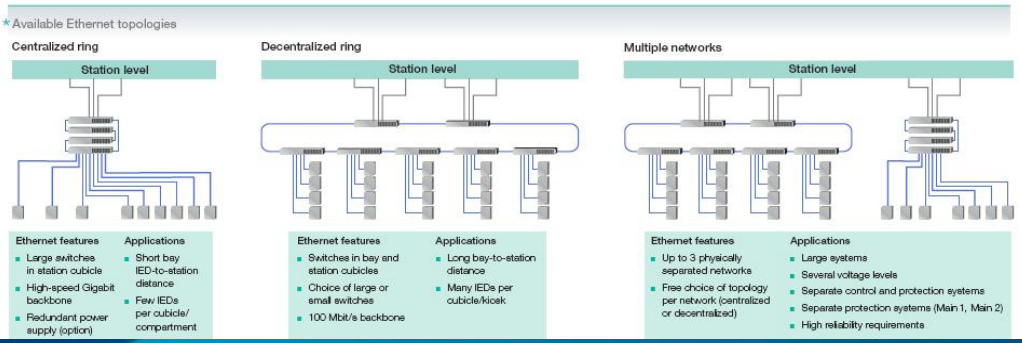




Features
- Highly reliable embedded industrial gateway for telecontrol
- Single industrial station computer with HMI indepedent of gateway
- Separate station LAN and interbay bus
- Basic monitoring and control

Options
- Telecontrol
- Advanced monitoring
- Advanced control

*Available Ethernet topologies

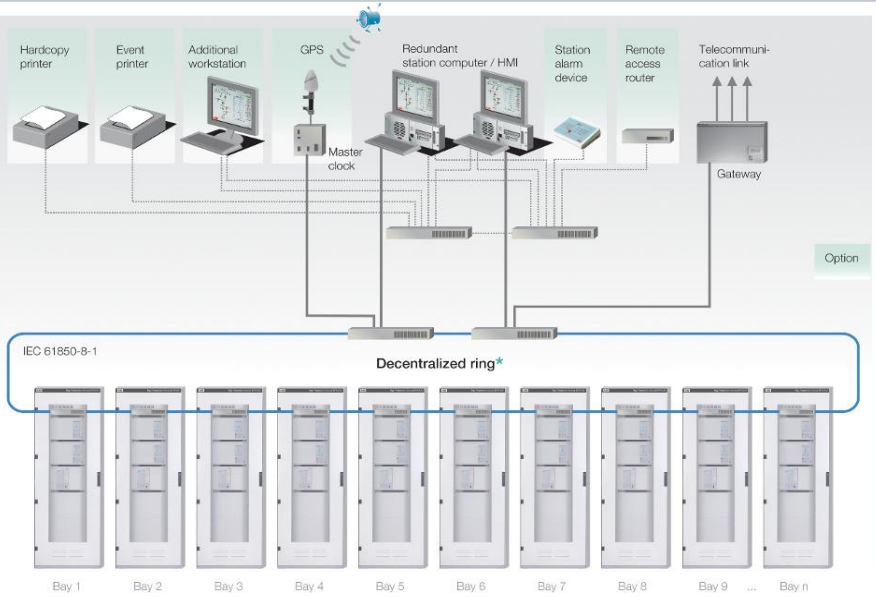


SAS 650
System review

ООО "Хартэп"

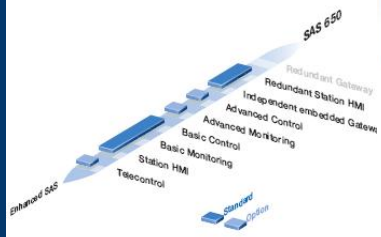
SAS 650 Enhanced Automation System

The solution for the manned substation. Redundant Station HMIs on a separate LAN are supplemented with an independent industrial gateway for telecontrol.



Typical applications for SAS 650

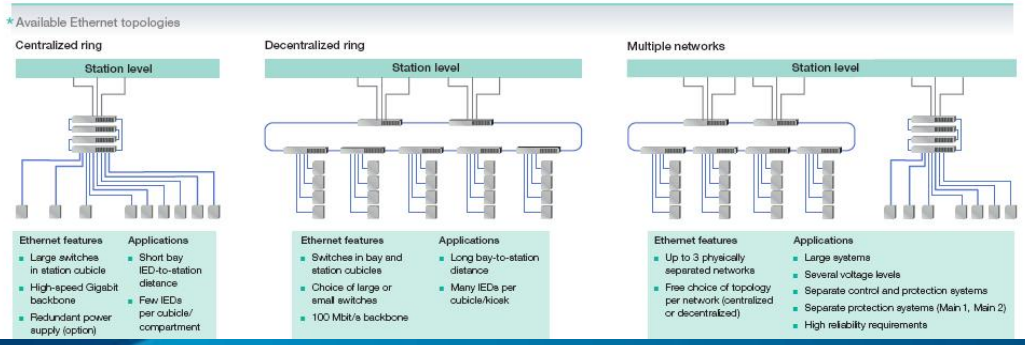
Power Utilities
Subtransmission and high voltage transmission level.



Features
- Highly reliable embedded industrial gateway for telecontrol function
- Redundant industrial station computer with HMI independent of gateway
- Separate station LAN and interbay bus
- Redundant station level LAN
- Basic monitoring and control

Options
- Telecontrol
- Advanced monitoring
- Advanced control

*Available Ethernet topologies



SAS 670
System review

МАСТ-ИПРА

ООО "Хартэп"

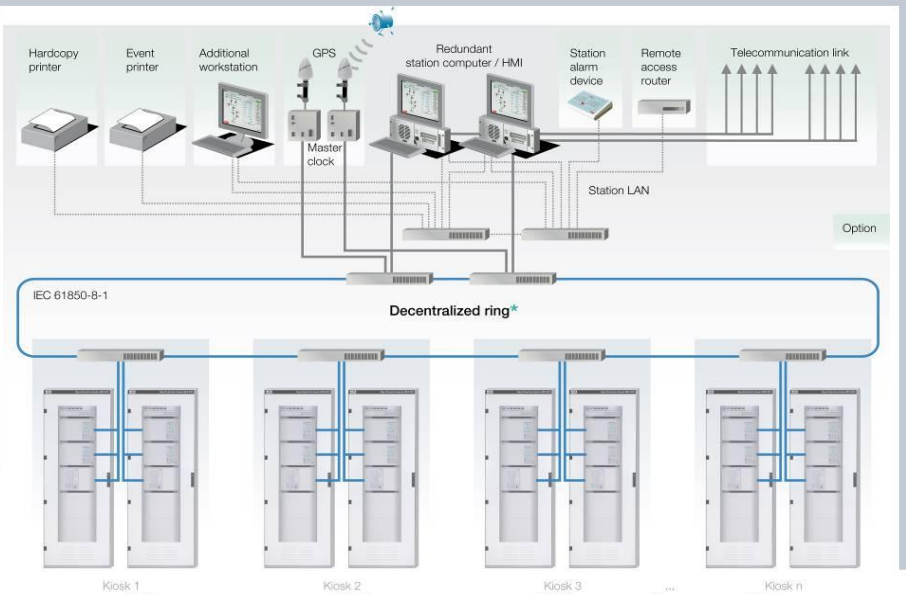
SAS 670 Advanced Automation System

The solution for highest availability of local control. Redundant Station computers and HMIs leave no room for single points of failure. Complementing these with integrated gateway functionality for telecontrol gives you additional peace of mind.

Typical applications for SAS 670

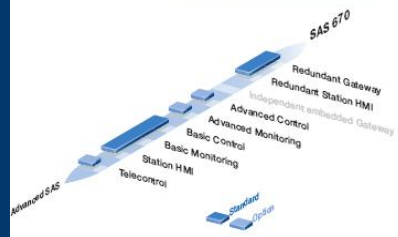
Power Utilities
Extra-high voltage transmission substations

Industry
Complex distribution substation of high importance



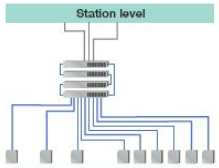
Features
- Redundant industrial station computer/HMI
- Separate station LAN and interbay bus
- Redundant station level LAN
- Basic monitoring and control

Options
- Advanced monitoring and control
- Integrated redundant gateway



*Available Ethernet topologies

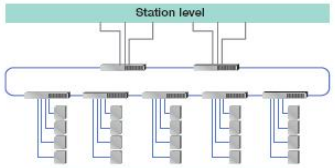
Centralized ring



Ethernet features
- Large switches in station cubicle
- High-speed Gigabit backbone
- Redundant power supply (option)

Applications
- Short bay IED-to-station distance
- Few IEDs per cubicle/ compartment

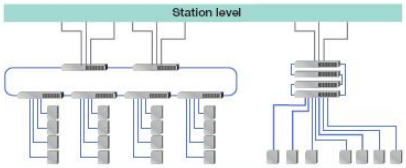
Decentralized ring



Ethernet features
- Switchee in bay and station cubicles
- Choice of large or small switches
- 100 Mbit/s backbone

Applications
- Long bay-to-station distance
- Many IEDs per cubicle/kiosk

Multiple networks



Ethernet features
- Up to 3 physically separated networks
- Free choice of topology per network (centralized or decentralized)

Applications
- Large systems
- Several voltage levels
- Separate control and protection systems
- Separate protection systems (Main 1, Main 2)
- High reliability requirements

SAS 690
System review

ООО "Хартэп"

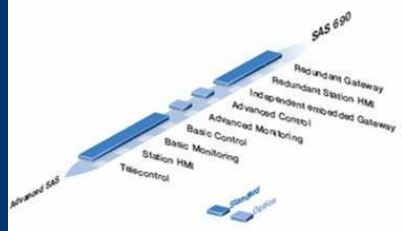
SAS 690 Advanced Automation System

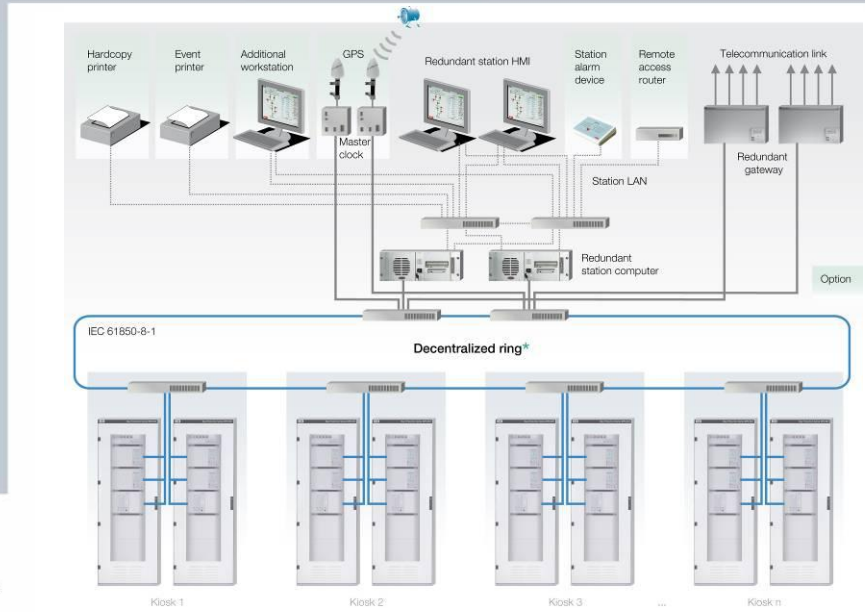
The fully redundant local and remote control solution meets even the highest availability requirements. You are assured of the continuous controllability of your substation. After all, it is of prime importance.

Typical applications for SAS 690
Highly demanding applications where no single point of failure and the highest level of availability are a necessity

Power Utilities
Extra-high voltage transmission substations

Industry
Complex distribution substation of high importance



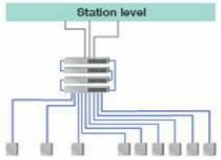


Features
- Redundant, highly reliable embedded industrial gateway for telecontrol
- Independent redundant industrial station computer with HMI
- Separate station LAN and interbay bus
- Redundant station level LAN
- Basic monitoring and control

Options
- Advanced monitoring
- Advanced control

*Available Ethernet topologies

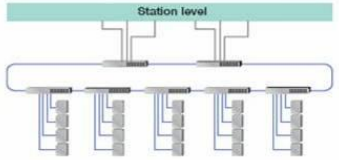
Centralized ring



Ethernet features
- Large switches in station cubicle
- High-speed Gigabit backbone
- Redundant power supply (option)

Applications
- Short bay IED-to-station distance
- Few IEDs per cubicle/ compartment

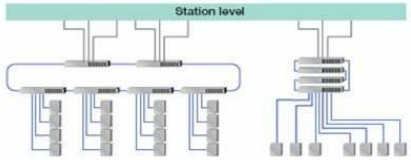
Decentralized ring



Ethernet features
- Switches in bay and station cubicles
- Choice of large or small switches
- 100 Mbit/s backbone

Applications
- Long bay-to-station distance
- Many IEDs per cubicle/kiosk

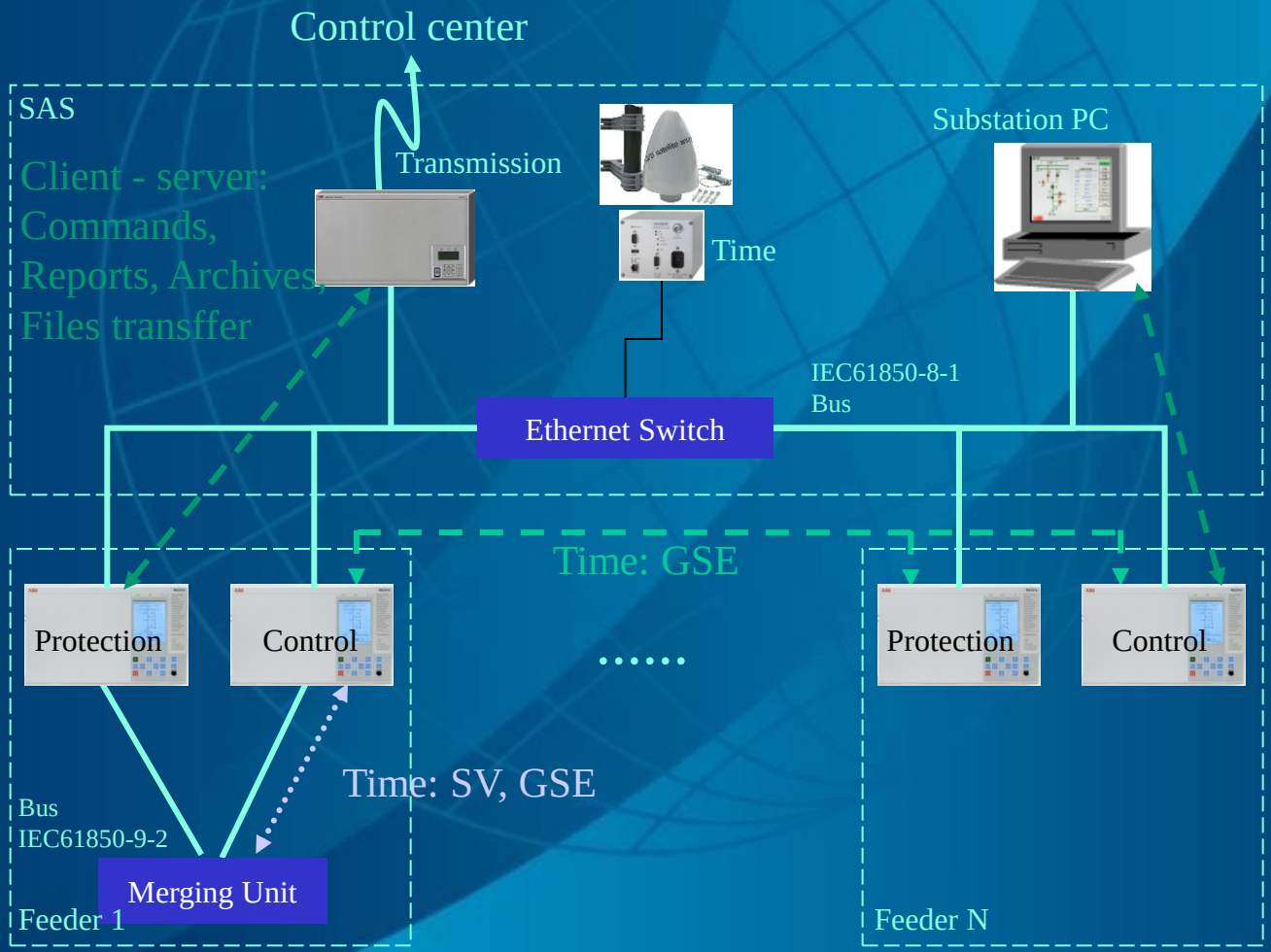
Multiple networks



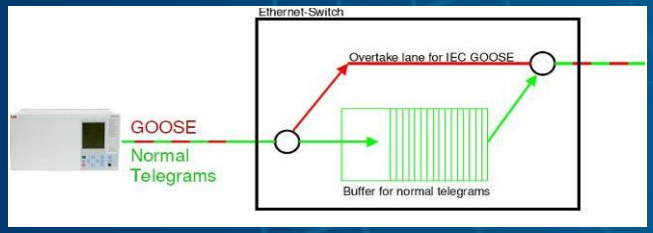
Ethernet features
- Up to 3 physically separated networks
- Free choice of topology per network (centralized or decentralized)

Applications
- Large systems
- Several voltage levels
- Separate control and protection systems
- Separate protection systems (Main 1, Main 2)
- High reliability requirements

SAS 600 Basic components
IEC61850 communication

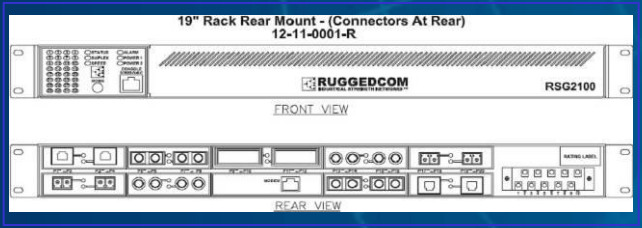


SAS 600
Basic components
Ethernet Switches for the bus IEC61850 (1/3)



- IEC 61850 uses Ethernet
- IEC 61850 has all Ethernet advantages
- Requirements to Ethernet Switches
  - Priorities processing
  - SNMP for diagnostic
  - Power 110…220V DC
  - Temperature 0..+55°C
  - Electromagnetic compatibility

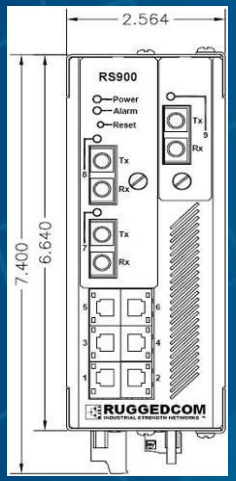
SAS 600
Basic components
Ethernet Switches for the bus IEC61850 (2/3)



Big modular Ethernet Switch

- In the cabinet 19”
- Devices connections
  - To 14x ports 100Mbit/s
  - Electrical ports (RJ45) or optical (ST, MTRJ, and etc.)
- Ring
  - Centralized topology:
    - 2 electrical ports 1Gbit/s (RJ45)
  - Decentralized topology :
    - 2x optical ports 100Mbit/s (ST) or
    - 2x optical ports 1Gbit/s (LC)
- Additional power supply

SAS 600
Basic components
Ethernet Switches for the bus IEC61850 (3/3)

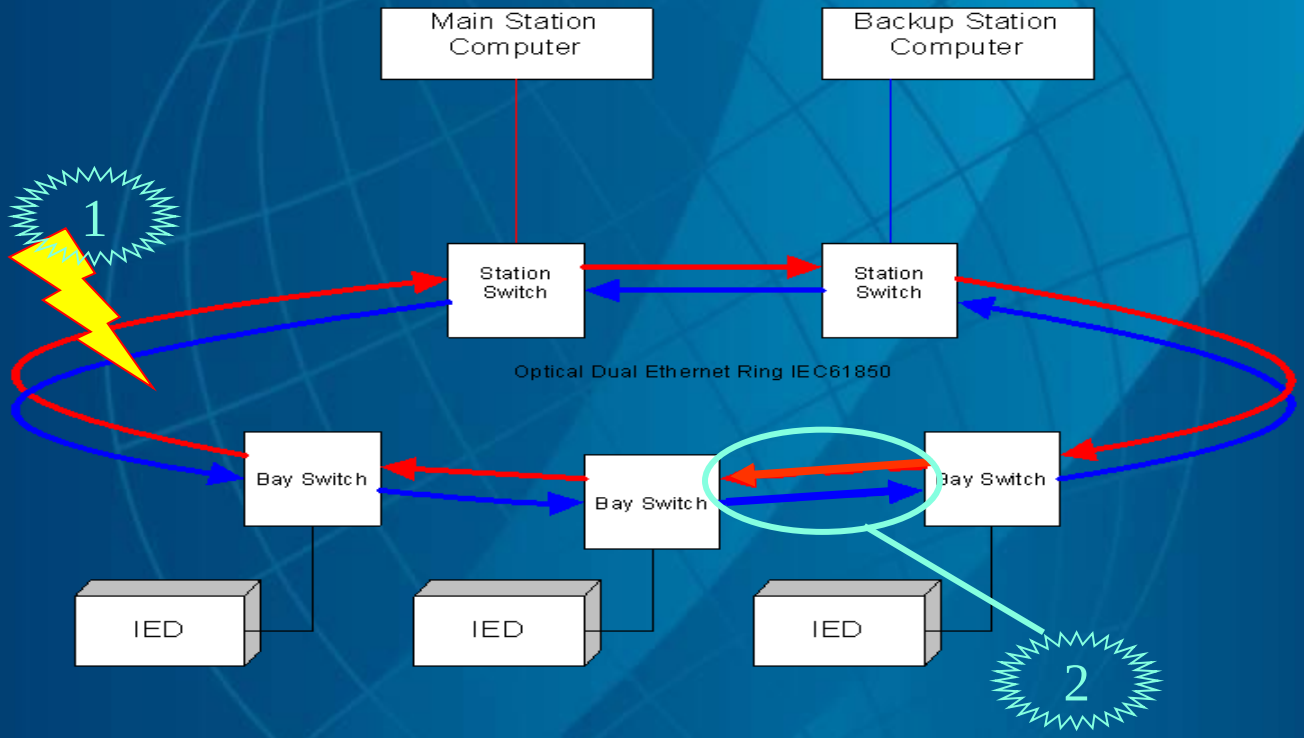


Small Ethernet Switch

- DIN Rack
- Devices connections
  - 6x electrical ports 100Mbit/s (RJ45)
  - 1x optical ports 100Mbit/s

- Ring
  - 2x optical ports 100Mbit/s

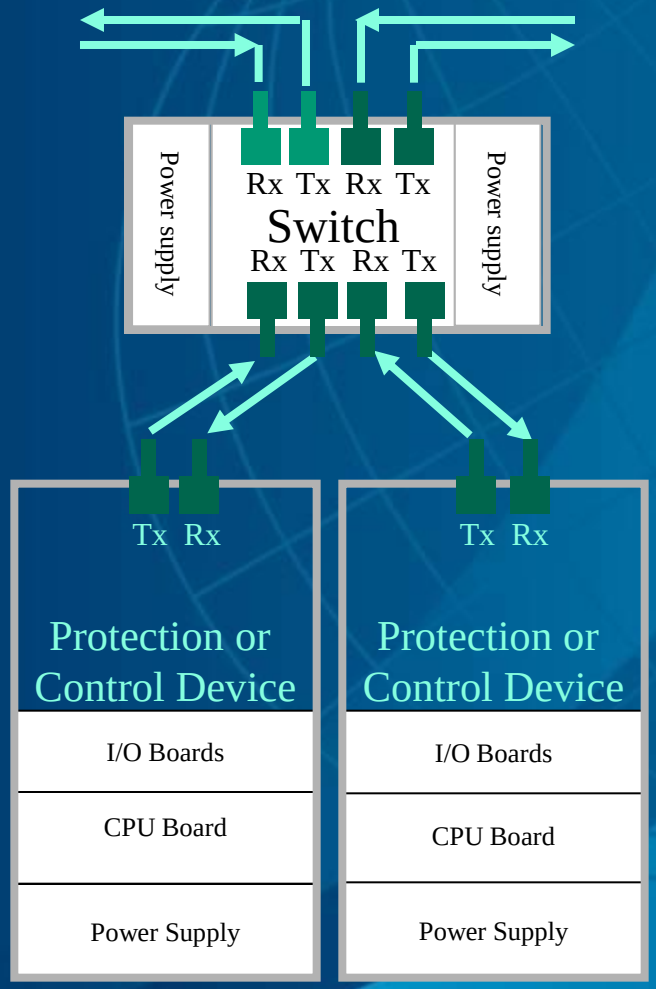
SAS 600
Basic equipment
Ethernet ring functions

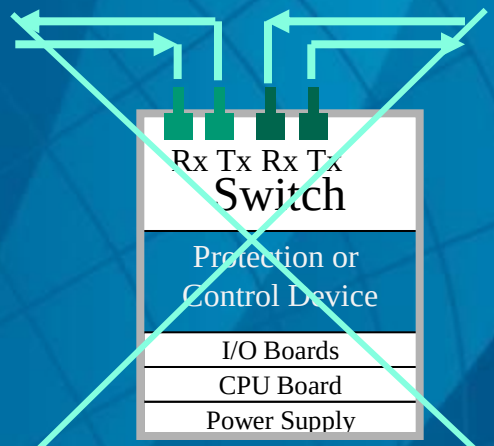


The function of the optical ring is when a ring is damaged then parcels are served by redundant devices

SAS 600 Basic equipment
The use of external switches

ООО "Хартэп"

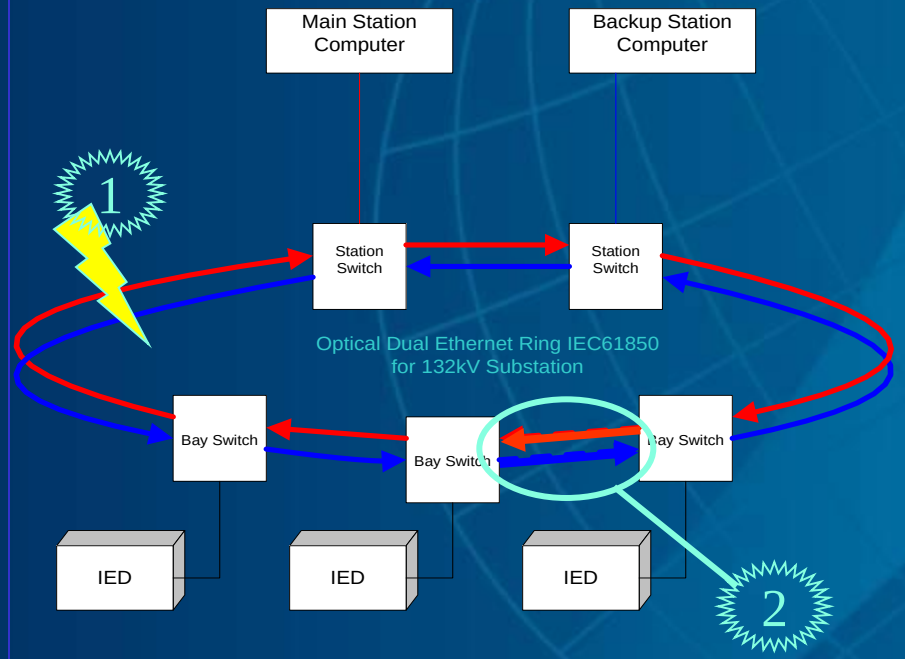




- The external switches are needed to improve reliability
  - Works with all IED
  - Highly reliable network of up to 1 Gbit/s
  - Highly reliable switches with power reservation
  - The solution does not depend on the manufacturer IED
  - Communication does not depend on IEDs
  - Easy to use

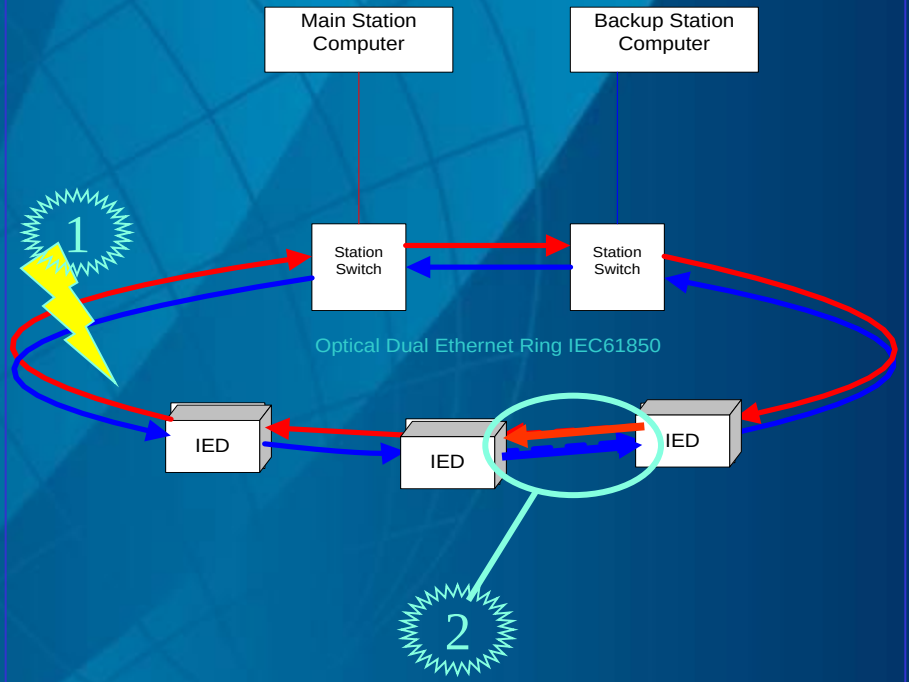
External Ethernet Switch
Loss of optics between the two switches

External Ethernet Switch



Full functionality is achieved using redundant Switch

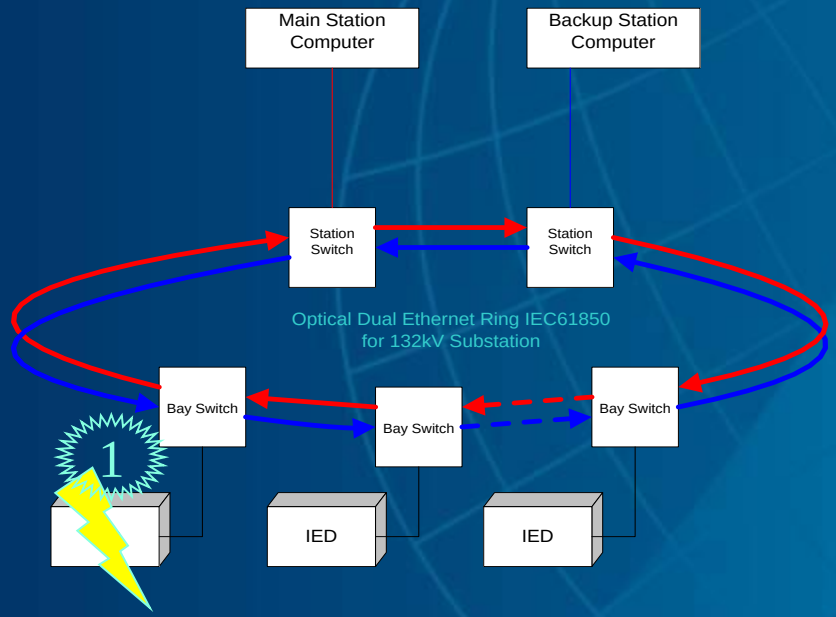
Integrated Ethernet Switch



Full functionality is achieved using redundant Switch

External Ethernet Switch
Failure of a BCU

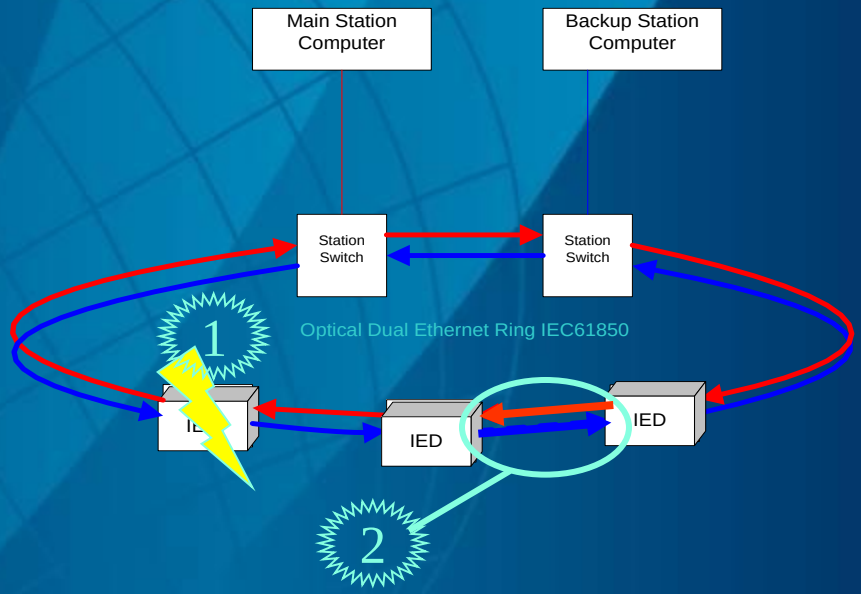
External Ethernet Switch



Does not affect any other IEDs, no communications

It does not require reconfiguring of the network

Integrated Ethernet Switch



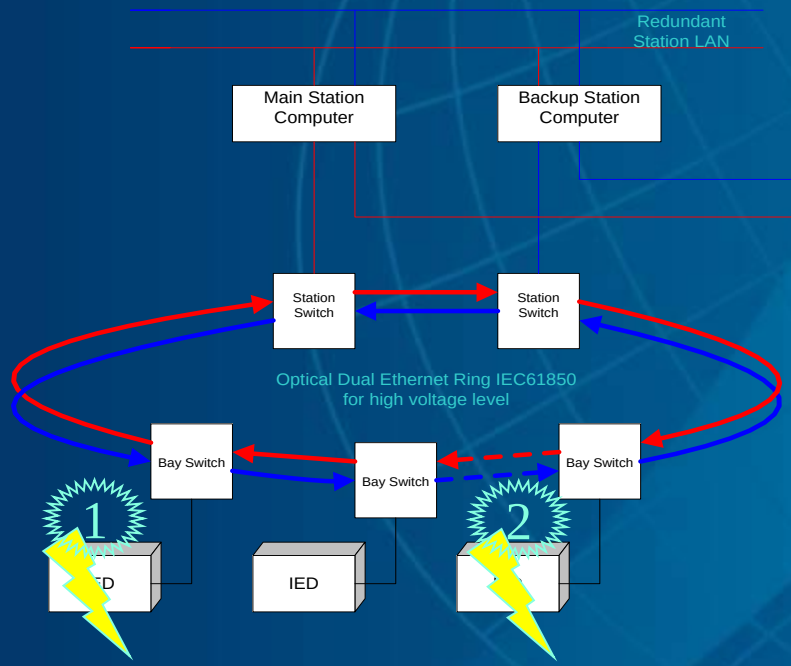
Reconfiguration of the network

Loss of communication with the protection relay device

External Ethernet Switch
Failure of one or more BCUs

ООО "Хартэп"

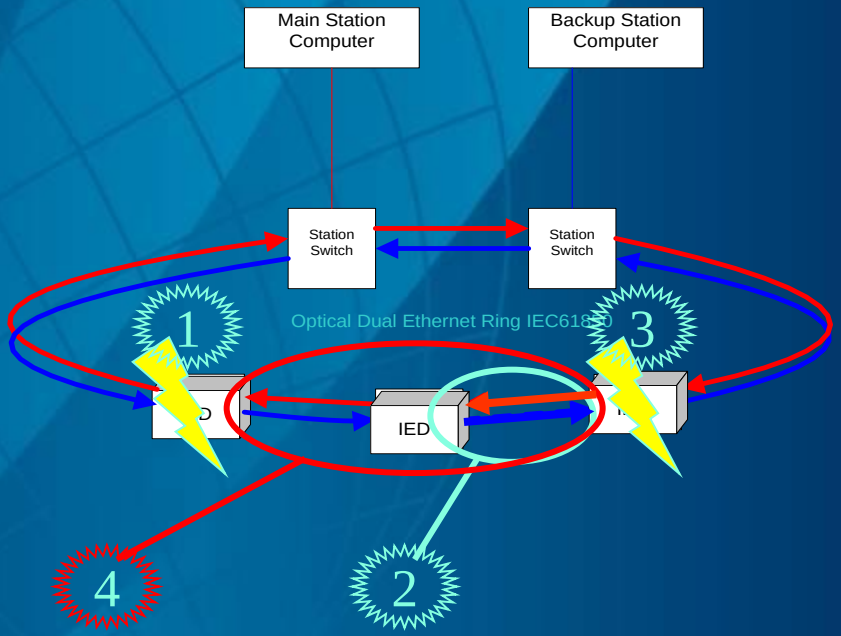
External Ethernet Switch



No network reconfiguration

No loss of network performance

Integrated Ethernet Switch



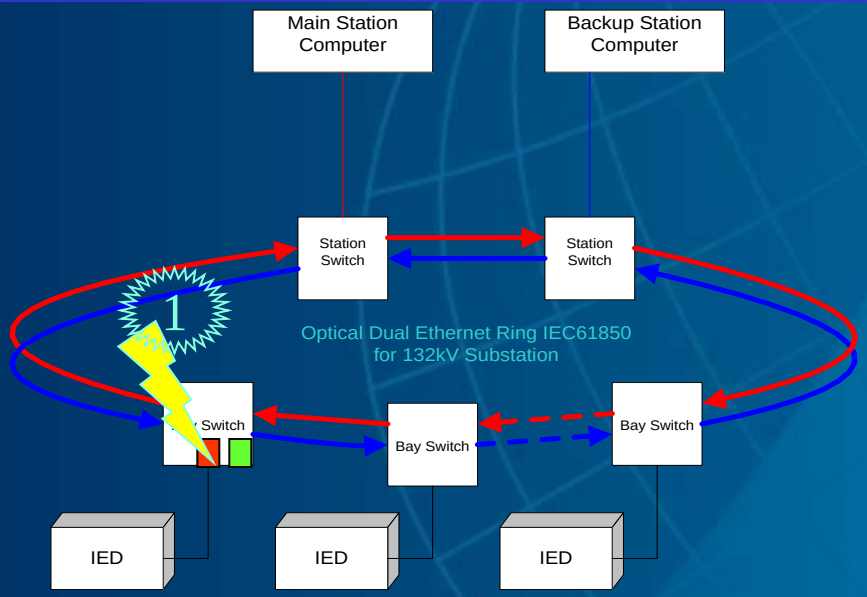
Reconfiguration of the network

All of the devices between faulty BCUs are lost

External Ethernet Switch
The failure of a switch

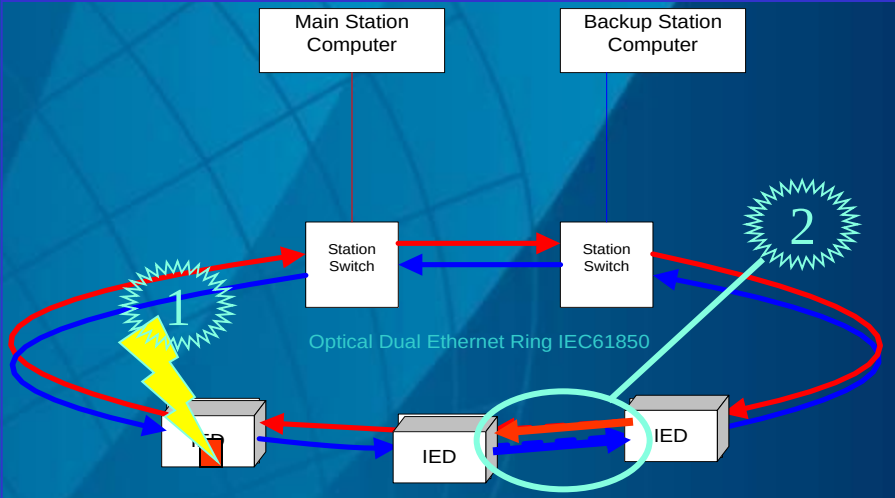
ООО "Хартэп"

External Ethernet Switch



Connection with 1 or 2 IEDs is lost
The ring is not lost
IEDs can be connected to a spare port

Integrated Ethernet Switch

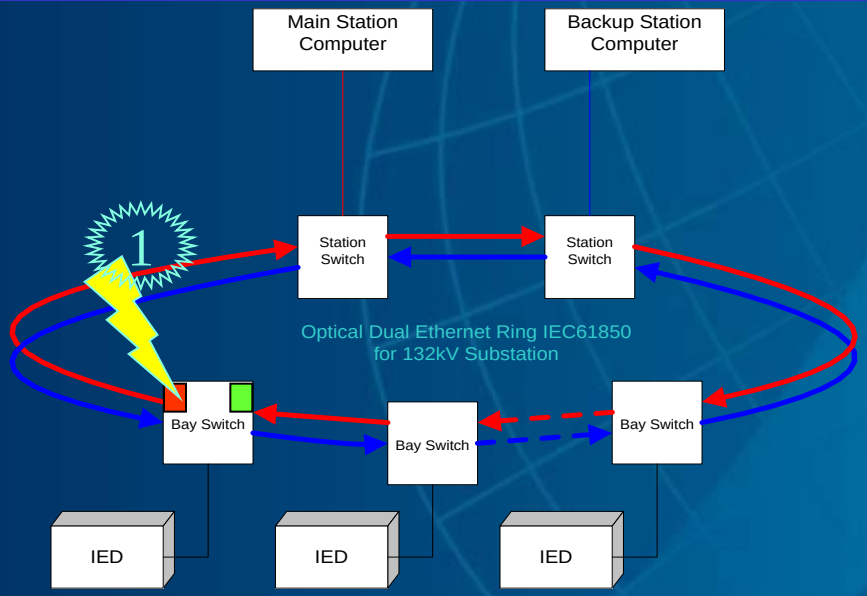


Connection with a damaged IED with a built-port lost
Reconfiguration of the ring
IED must be switched off from the network with a switch jointly

External Ethernet Switch
Failure of power supply

ООО "Хартэп"

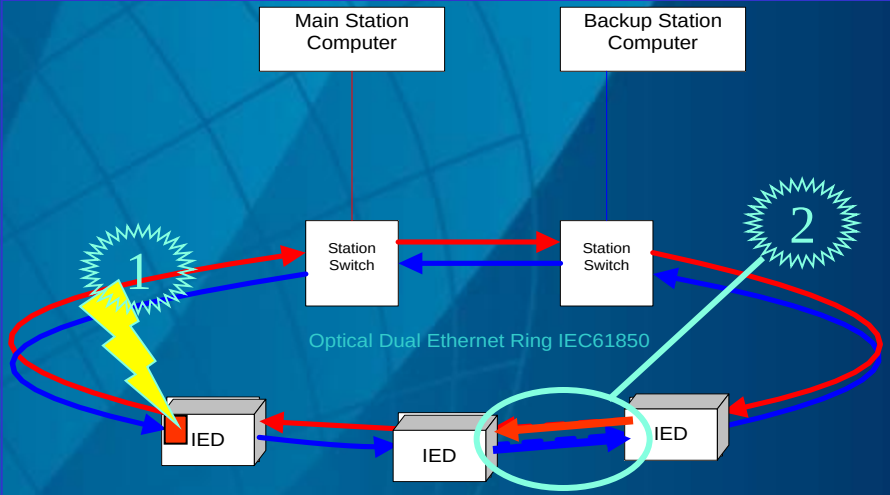
External Ethernet Switch



No loss of connection

Replacing the backup power supply in the least

Integrated Ethernet Switch



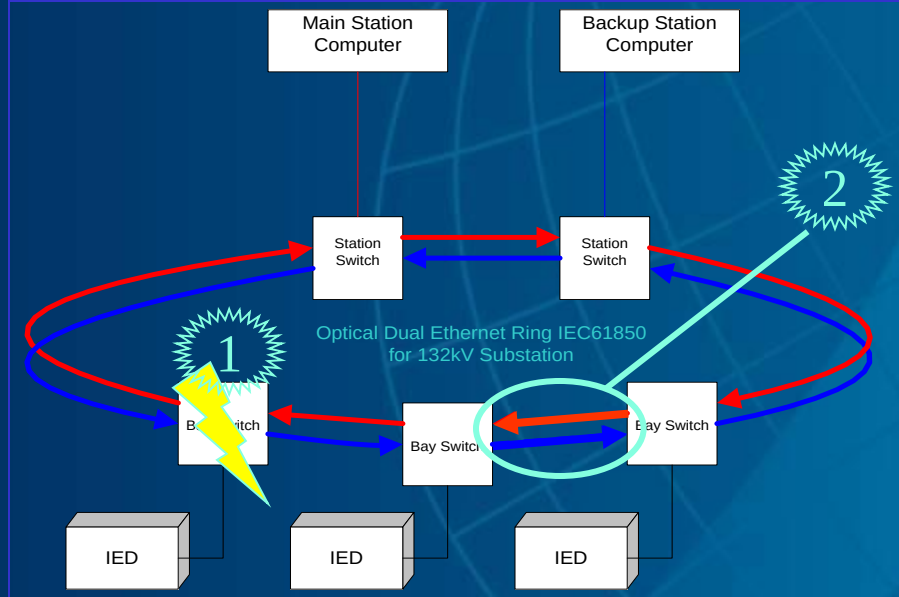
Communication with IED-damaged power supply is lost

IED should withdraw to repair the power supply

External Ethernet Switch
Switch damage

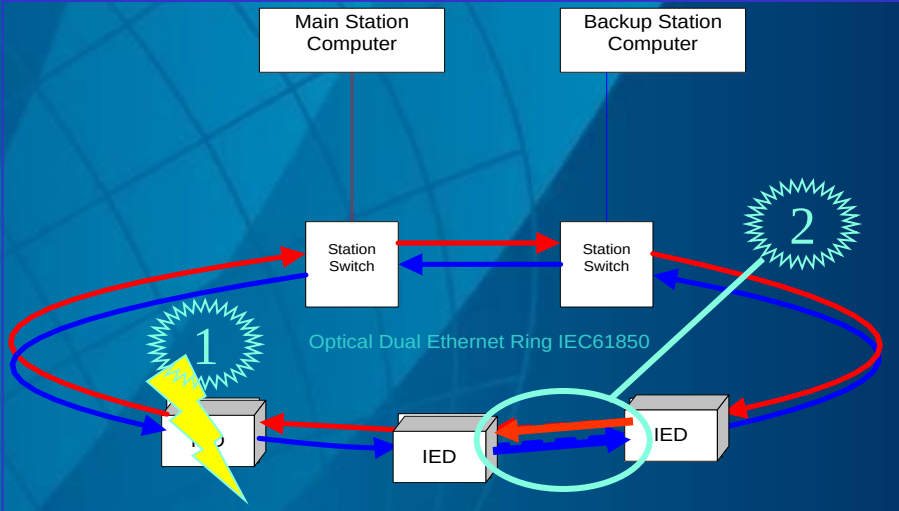
ООО "Хартэп"

External Ethernet Switch



Communication with IED lost
Replacing the external switch without replacing the IED

External Ethernet Switch



Communication with an integrated switch
IED is lost
IED should be removed to repair the communications module

SAS 610…690
Basic components
Substation industrial PC

Key Features MicroSCADA Pro

- Graphical interface for local staff
- Compatibility IEC61850
- Option: Hot standby SYS600 using double PC
- Option : COM500*i* program package for remote control

Application

- Working place of substation
- Option: Retransmission of information
- SAS650-V11: Industrial PC with redundant hard disk and power supply

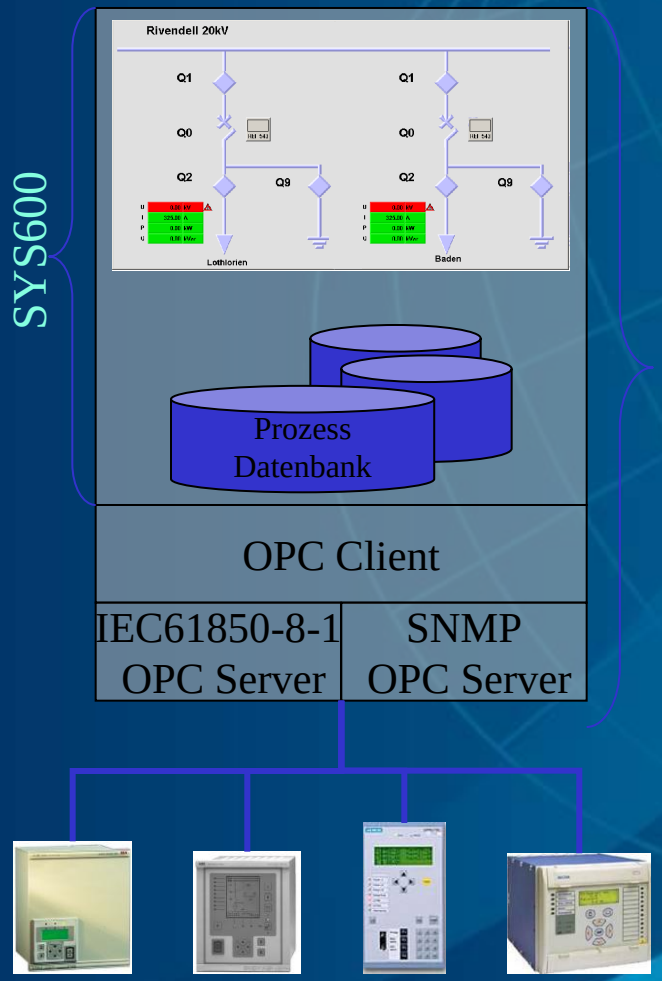
Standard configuration

- Windows XP или 2003 Server
- MicroSCADA Pro
- LAN платы для IEC61850 Communication

Options

- The serial ports for communication
- Redundant video
- Windows Terminal Services

SAS 610…690
Basic components
MicroSCADA Pro



SYS 600
- Real time database
- A new interface for information visualization for staff
- Means to control the system

MicroSCADA OPC DA client
- Separated node MicroSCADA for TCP/IP
- Simple OPC names and process databases

IEC61850-8-1 OPC Server
- Stack implementation of MMS protocol
- Name in accordance with the data model of IEC61850-7-x standard
- Time synchronization : SNTP client
- Devices description SCL to import signal list

SAS 610…690
Basic components
RTU560 – Retransmission based on RTU

Supported slave protocols
- IEC60870-5-101
- IEC60870-5-104
- DNP3.0
- DNP3.0 over LAN/WAN

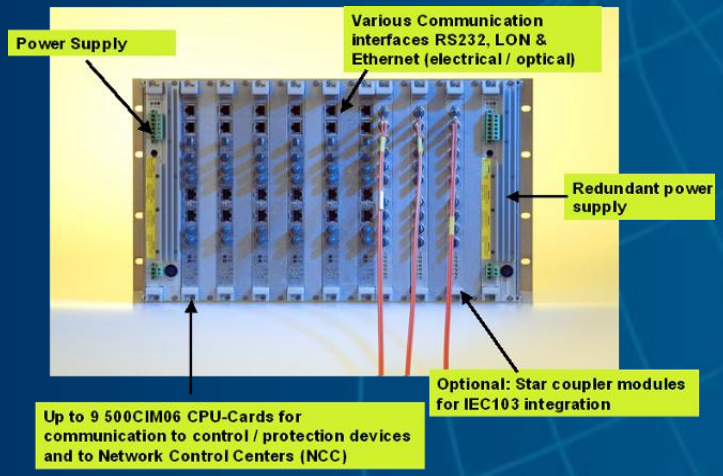
Application
- Teleinformation retransmission

Solution
- SAS635

Basic features
- Modular implementation
- Parallel processes architecture
- Support of big number protocols
- CPU communication racks

Functionality
- Retransmission
- Data conversion
- Faults groups

SAS 610…690
Basic component
COM581 – Protocol converter



Supported slave protocols
- IEC60870-5-101
- IEC60870-5-104
- DNP3.0 serial

Application
- Receiver
- Converter for IED of the third producers

Solution
- SAS630, SAS650, SAS690

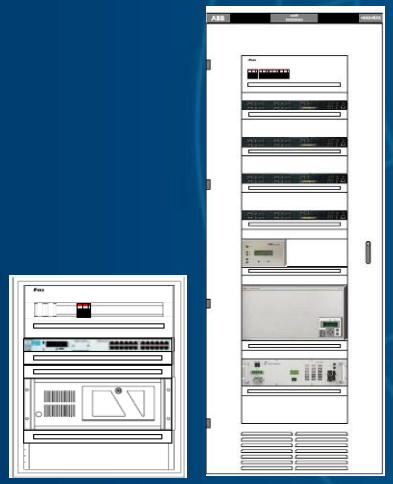
Basic features
- Large operation term
- (certificated and industrial) without moving parts
- Redundant power supply as option

Functionality
- Retransmission
- Data conversion
- Faults groups
- Access roles processing
- Redundant configuration COM581

SAS 610…690
Basic component
Time source

- Exact time module
  - GPS, DCF-77 or IRIG-B receiver
  - SNTP Time server
  - 3 LAN ports
  - SNMP diagnostic protocol
- Substation bus clock synchronization directly from the source of accurate time
- Time synchronization IED as well as in server, retransmission means

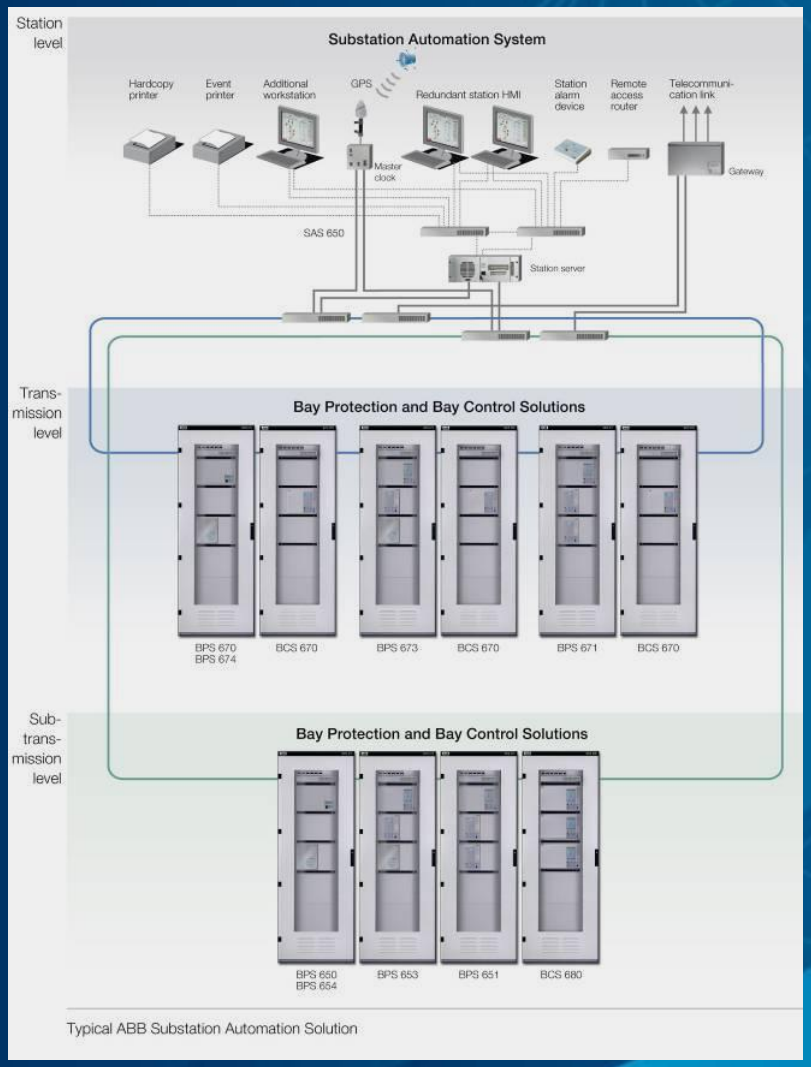
SAS 610…690
Basic components
Scope of supply



The whole system

- All equipment, including cabinet of servers and communications
- Engineering
- Documentation set
- Option: Test of acceptance at the factory
- Option: Test facility operation

Example of complete substation PCS



Developed a model standard solution for substation control system for rapid deployment

- According to the model IEC61850-8-1
- Predefined functionality

SAS 600 joint with BCS 600 feeder control and BPS 600 for feeder protection is a optimal solution for substation PCS

Implementations examples

МАСТ-ИПРА

ООО "Хартэп"

ABB solutions based on IEC 61850 worldwide

TERNA SICAS Program for 380/220/150kV S/Ss, Italy

Large-scale standardization of IEC 61850-compliant solutions

Creation, homologation and supply of:

- 40 type-tested bay control and protection solutions
- High-quality user interface, standard logics and sequencer
- Incorporation of 3rd party IEDs and units with IEC 61850 communication interfaces

Efficient project implementation

EGL 380 kV Laufenburg Substation, Switzerland

The world's first HV substation with IEC 61850-compliant SA

Stepwise retrofit of seven out of 17 bays:

- New control and redundant protection
- Gateway to existing station HMI
- Integration of 3rd party Main 2 IEDs with IEC 61850 communication interfaces

Sustainable concept for easy migration of remaining bays/station HMI.

DEWA Frame contract, Dubai

Supply of 20 IEC 61850-based SA systems

State-of-the-art systems for new 132/11 kV S/Ss:

- Short lead times realized by highly qualified project team
- Redundancy concept, independent key components and physically separated communication networks
- Proven technology and functionality

Safeguarded investment into interoperable systems for any make of switchgear.

NEK refurbishes its HV S/Ss Dobrudja & Varna, Bulgaria

The first 400/220/110 kV S/Ss to be refurbished obtain IEC 61850-compliant SA

- Different configurations: double busbar, 1½ c.b., ring
- Redundant station servers and operator workstations in hot standby mode
- Integration of some 70 new REx670 IEDs and four REB500 numerical busbar protection systems
- Integration of 110 kV signals via RTU as well as existing REL521 line protection

Optimal life cycle management through future-proof retrofit concept

Senelec's Hann 90/30kV S/S, Senegal

Refurbishment of Senelec's most important substation

- New IEC 61850-compliant bay control and protection
- Redundant station level system
- Integration with Network Control and Dispatching Centers

Future-proof solution for existing 90kV AIS as well as new 30kV GIS

ENELVEN's and ENELCO's Soler & Médanos S/Ss, Venezuela

IEC 61850 is key to the utilities' strategy for SA throughout their grids

- Uniform system architecture with redundant station level for high availability
- Redundant Ethernet ring with switches for direct connection of all control & protection IEDs with IEC 61850 communication interface
- High-quality operator interface with proven applications for control and monitoring of the entire 138/24 kV & 115/13.8 kV S/Ss

Enhanced efficiency with harmonized SA systems for new and retrofit substations

MEW's Financial Harbour, Sitra & Buquwwah S/Ss, Bahrain

The three 220/66/11 kV GIS substations will strengthen the grid and increase the reliability of the power supply

- Redundant Station HMI with redundant, independent gateways
- One product family, REx670, for Control and Protection
- Bay/Section control unit REC670 for all three voltage levels
- REB500 busbar and breaker failure protection (220 kV) with IEC 61850 communication interface
- Integration of 3rd party protection IEDs via IEC-103/IEC 61850 converter

IEC 61850 introduced in ABB's first substations for MEW Bahrain

Six new HV substations for PGCIL, India

400/220 kV GIS S/S at Maharanibagh, 400/220 kV AIS S/Ss at Bhatapara, Fatehbad, Raigarh and Rajagarh, 400 kV AIS S/S at Bina

PGCIL's new substations will be controlled and monitored by IEC 61850-based SA systems featuring:

- Redundant Station HMI using MicroSCADA Pro
- One product family, REx670, for Control and Protection
- REC670 bay control unit for all voltage levels
- REB500 numerical busbar protection system with IEC 61850 communication interface
- Integration of 3rd party Main 2 IEDs on IEC 61850 platform
- Redundant gateways for integration with Network Control and Dispatching Centers

The customer's philosophy as well as requirements for functionality and availability are being met

220/132/33kV S/S for Sohar Industrial Area, Oman

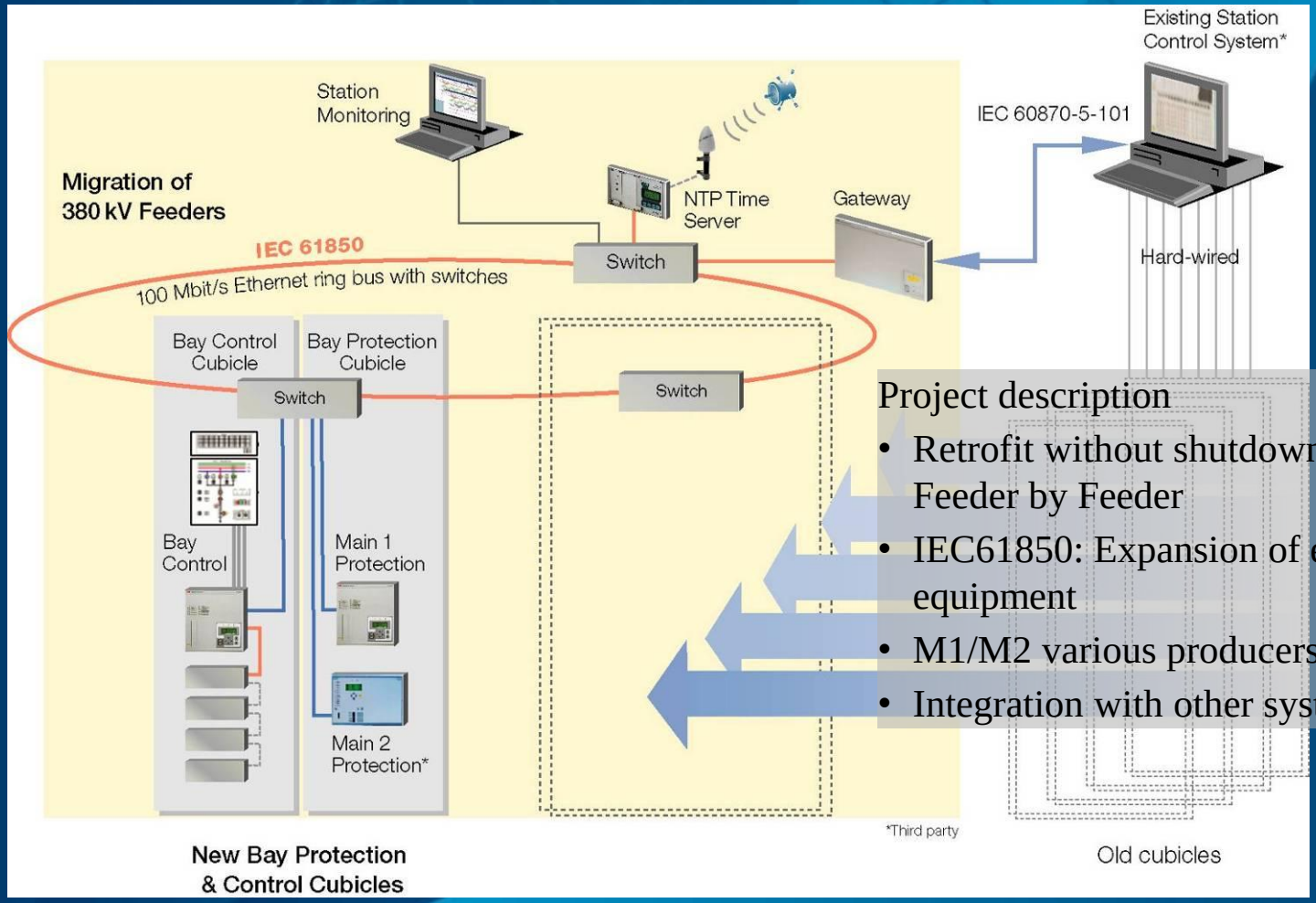
Automation with verified IEC 61850 implementation for new GIS substation

- Redundant Station HMI
- Scaleable bay control unit REC670 for all three voltage levels

Enhanced operational efficiency and safety through optimized solution

- New installation
- Retrofit/migration

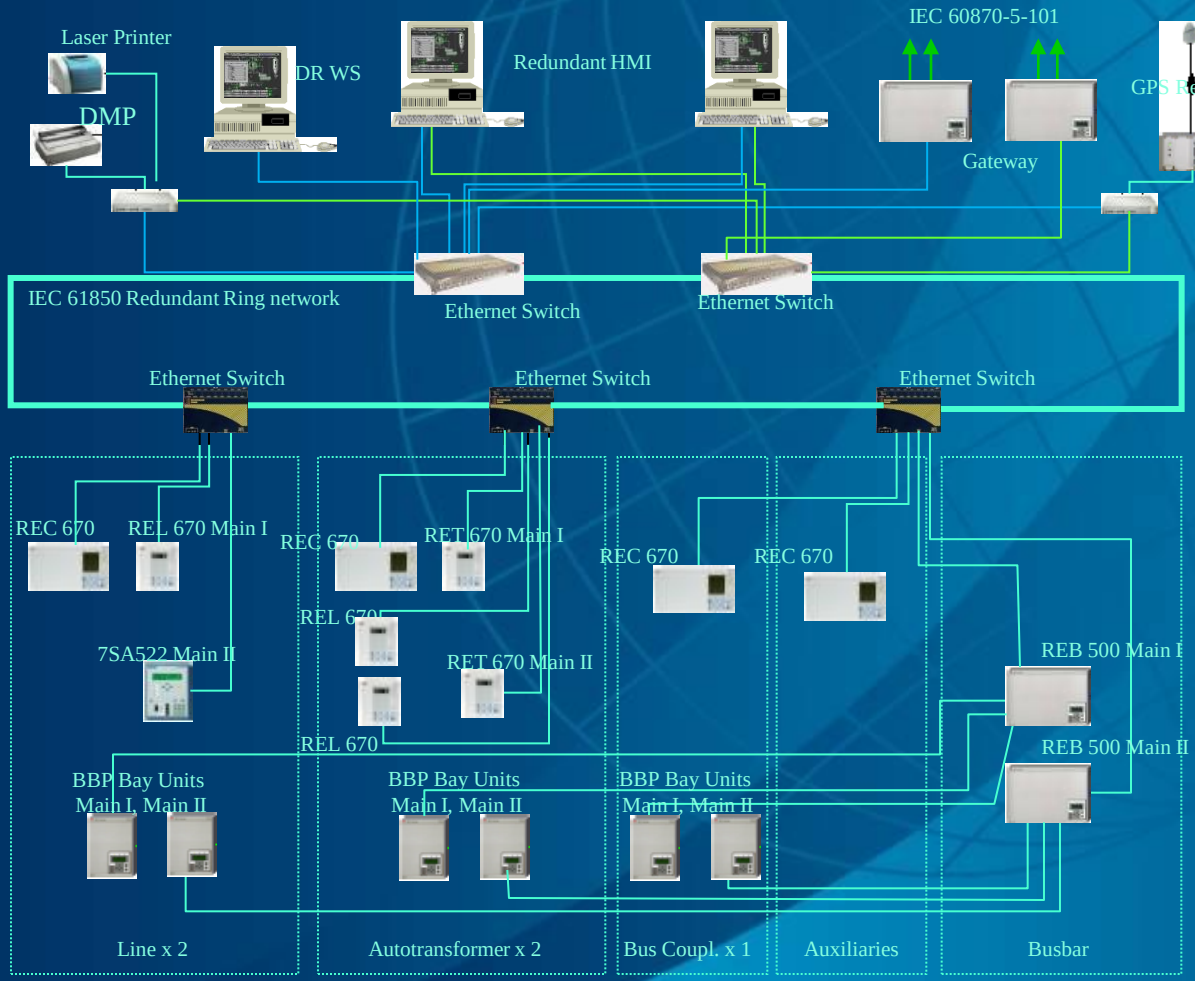
Implementations examples
EGL – Laufenburg 380kV Substations



Project description

- Retrofit without shutdown: Feeder by Feeder
- IEC61850: Expansion of existing equipment
- M1/M2 various producers
- Integration with other systems

Implementations examples PGCIL Maharanibagh



Project description

- PGCIL new substation, where PCS was built based on IEC 61850
- IED670 Single database for protection and control
- PLC integration 2 IED third producers based on IEC 61850

Conclusion

Substation PCS based on ABB solutions

- High-tech solution based on ABB experience in substations construction and control system solutions based on IEC61850
- Designed for the most safe, effective solutions for local and remote substation control
- An extensible architecture, ranging from basic to advanced functionality, from simple to redundant configuration
- Ready-made solution, designed, documented, tested

МАСТ-ИПРА

ООО "Хартэп"

Thank you very much!

Questions?