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Advanced protection and control from ABB

Relion. Thinking beyond the box.

Designed to seamlessly consolidate functions, Relion relays are smarter, more flexible and more adaptable. Easy to integrate and with an extensive function library, the Relion family of protection and control delivers advanced functionality and improved performance.



ABB Protective Relay School Webinar Series

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ABB Protective Relay School Webinar Series

Simulation and Testing Methodologies for Digital Substation – IET600/ITT600/SDM600

Howard Self

October 29, 2015

Presenter

Howard Self, P.E.



Howard is a 1987 Graduate of Clemson University, where he received his Bachelors of Science in Electrical Engineering. He has over 28 years experience in protection, control and automation in utility transmission and distribution systems.

He spent his first 12 years of his career as a Substation Relay, Protection and Control Engineer for Santee Cooper. Howard was involved in Engineering, Operations, maintenance and Design of Transmission, Distribution, and Generation substations while there. Howard has worked the next 15 years as both an Engineering Manager for Substation Automation Systems and Product Manager for Transmission and Distribution Automation Products.

Howard has experience in delivery of systems using both DNP and IEC61850. He has been active in CUEPRA, IEEE, UCA, and DNP users groups.. Howard is presently a member of SGIP.

Howard joined ABB in 2011. He is currently the Program Manager for ABB's Distribution Automation Smart Grid Center of Excellence. Howard is responsible for helping close the product gaps through R&D and product development in ABB's DA Smart Grid Portfolio, as well as, leading the NAM Distribution Automation Verification Center(DAVC).

ABB Protective Relay School Webinar Series Contents

- IET600 - Integrated Engineering Tool main features
- ITT600 - SA Explorer main features
- SDM600 – System Data Manager
- Questions

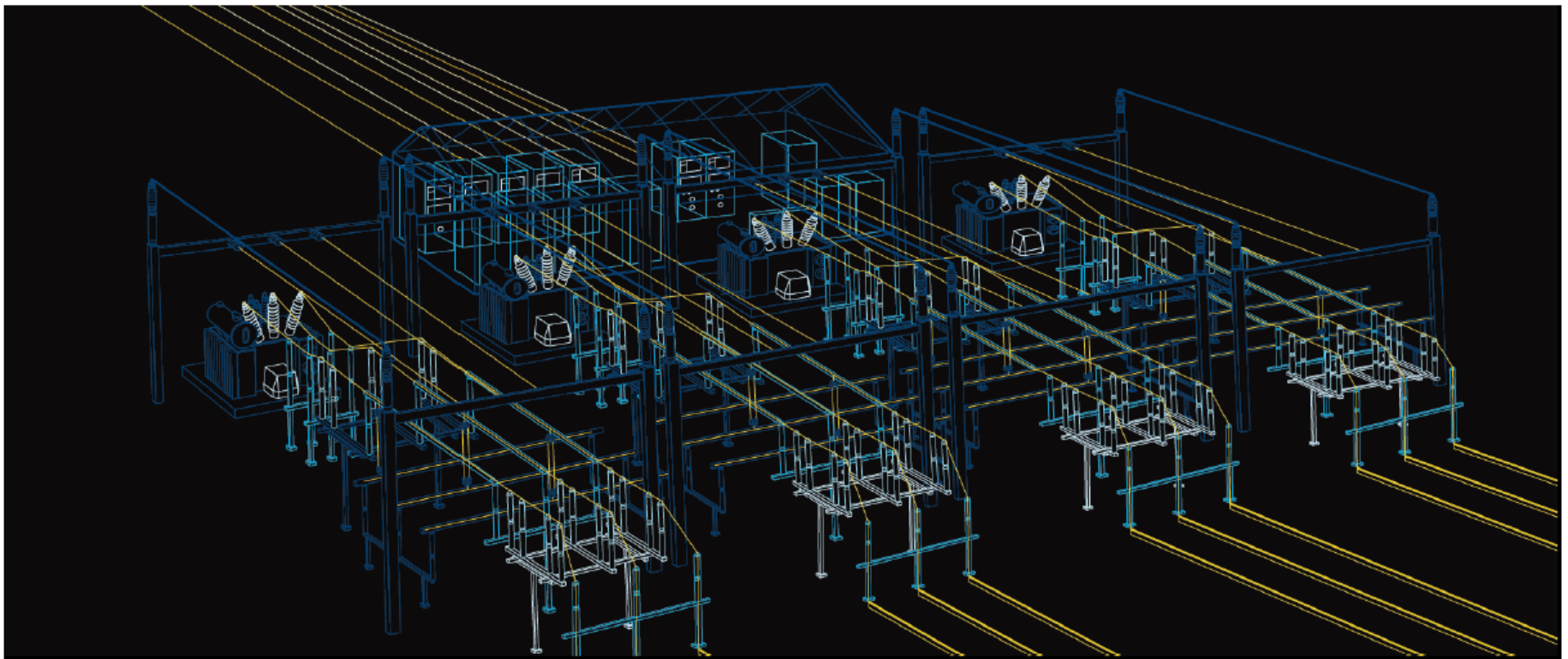


ABB Protective Relay School Webinar Series

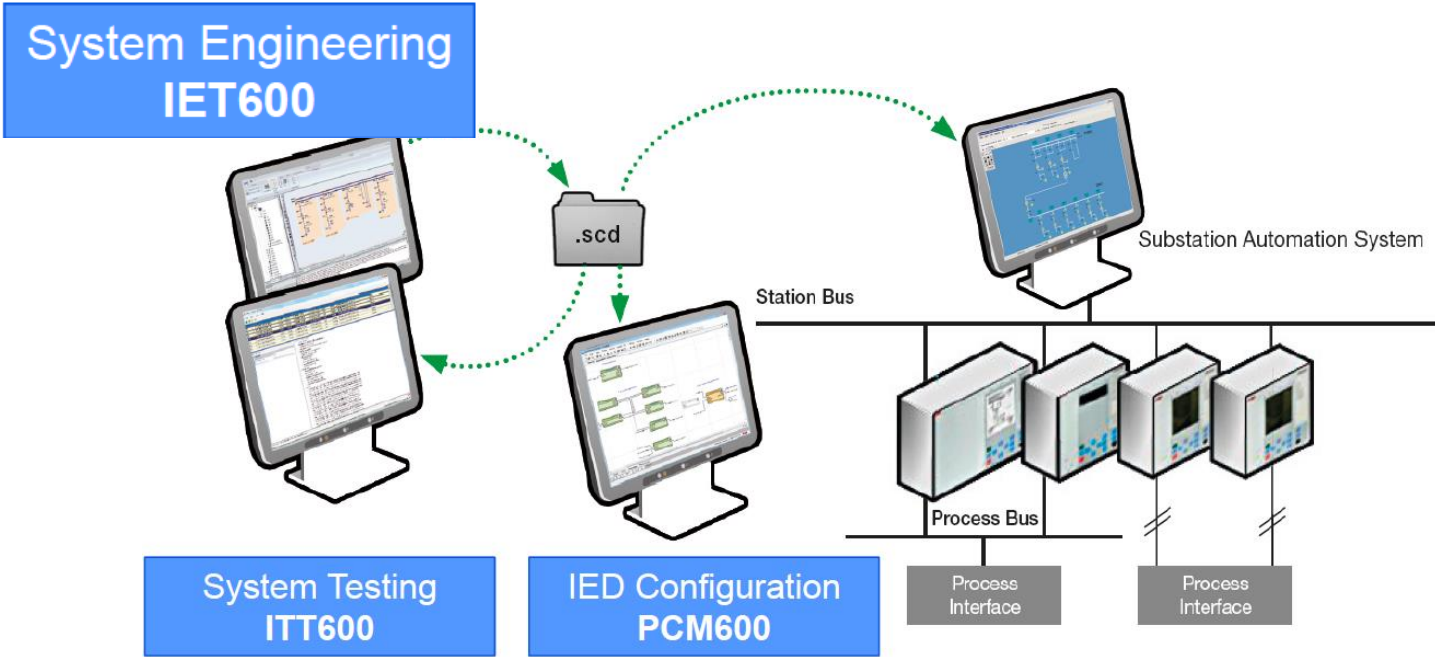
IET600

Integrated Engineering Tool

Overview

ABB's SA tool landscape

Tool suite for engineering, integration and testing



IET600 Integrated Engineering Tool

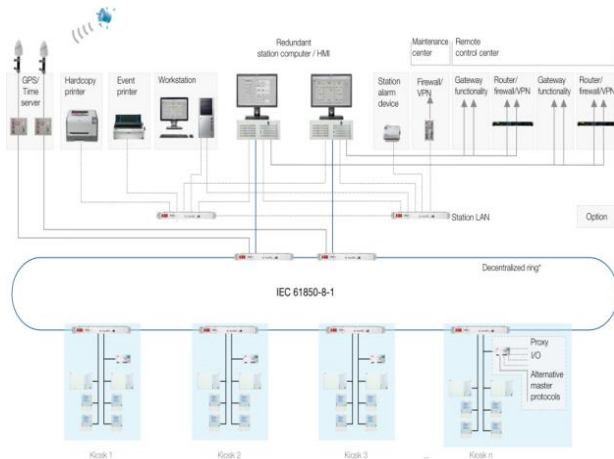


A comprehensive engineering tool to design and configure the complete IEC 61850-based substation automation system

- Graphical editor for specification of substation topology

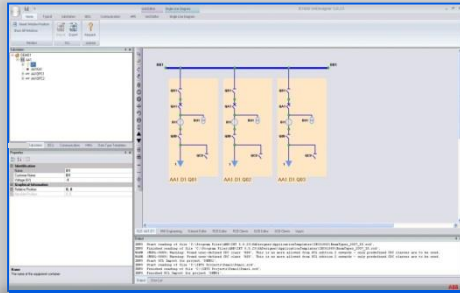
Graphical editor for specification of physical communication network topology

- Import, utilization and creation of SCL conform files
- Configuration of communication subnetworks
- Flexible configuration of datasets, Report Control Blocks (RCB) and Goose Control Blocks (GCB)
- Define dataflow and RCB/GCB clients
- Generate a complete description of the substation (SCD file)
- Generation of XLS Signallists documenting the complete IEC 61850 dataflow

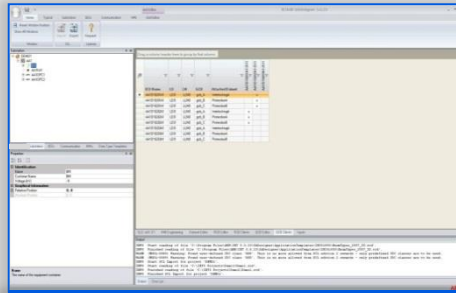


IET600

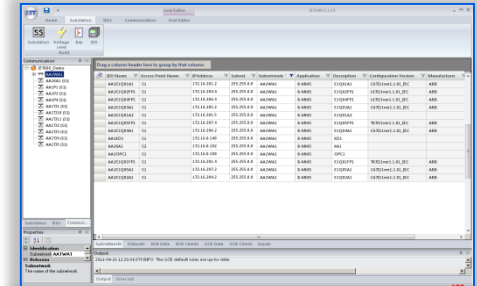
Editors for Design & Engineering of IEC 61850 SAS



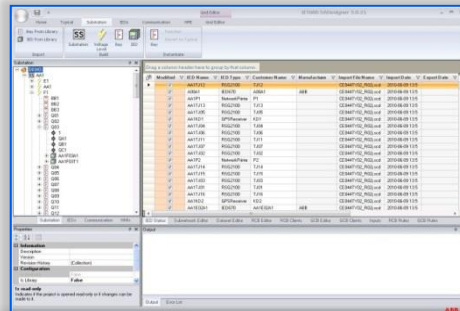
Design Substation Topology



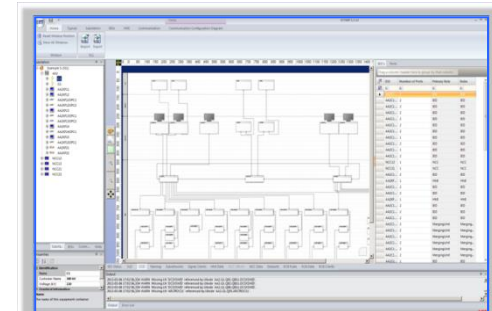
Configure IEC 61850 dataflow



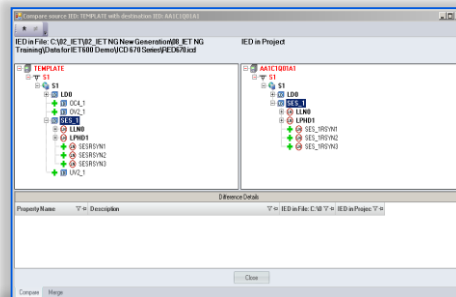
Communication Addresses



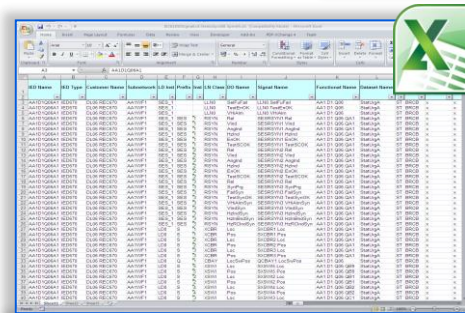
Overview of IEDs



Network Configuration

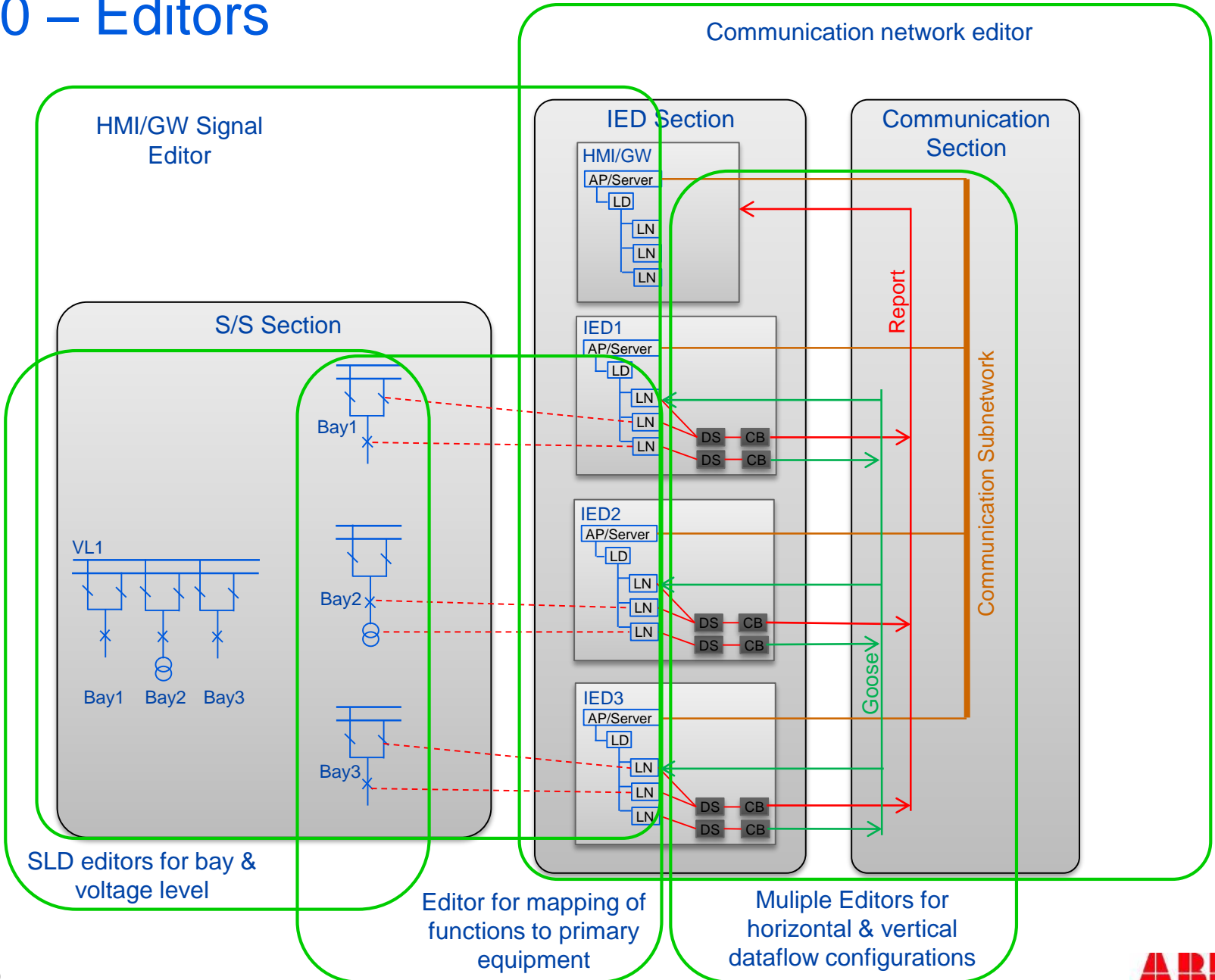


Compare & Merge SCL files



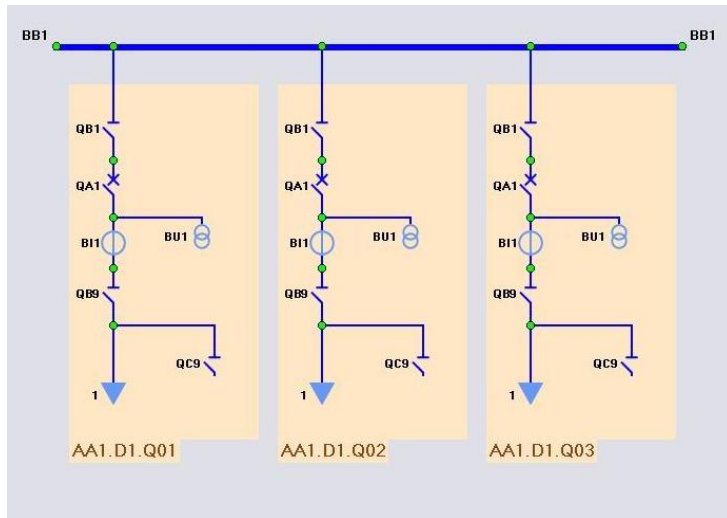
Document SA System

IET600 – Editors

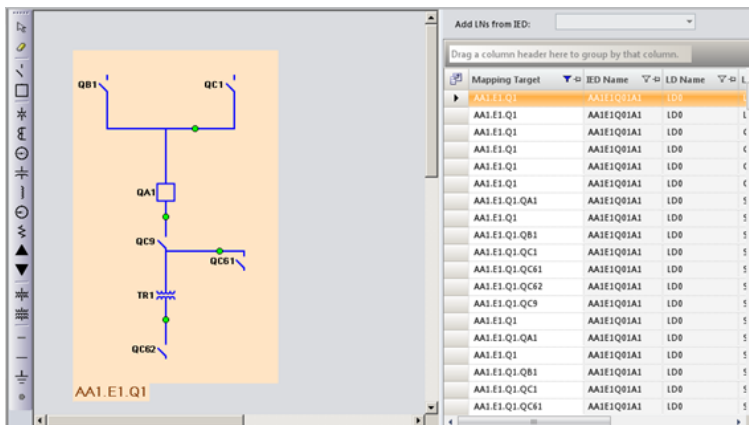


IET600

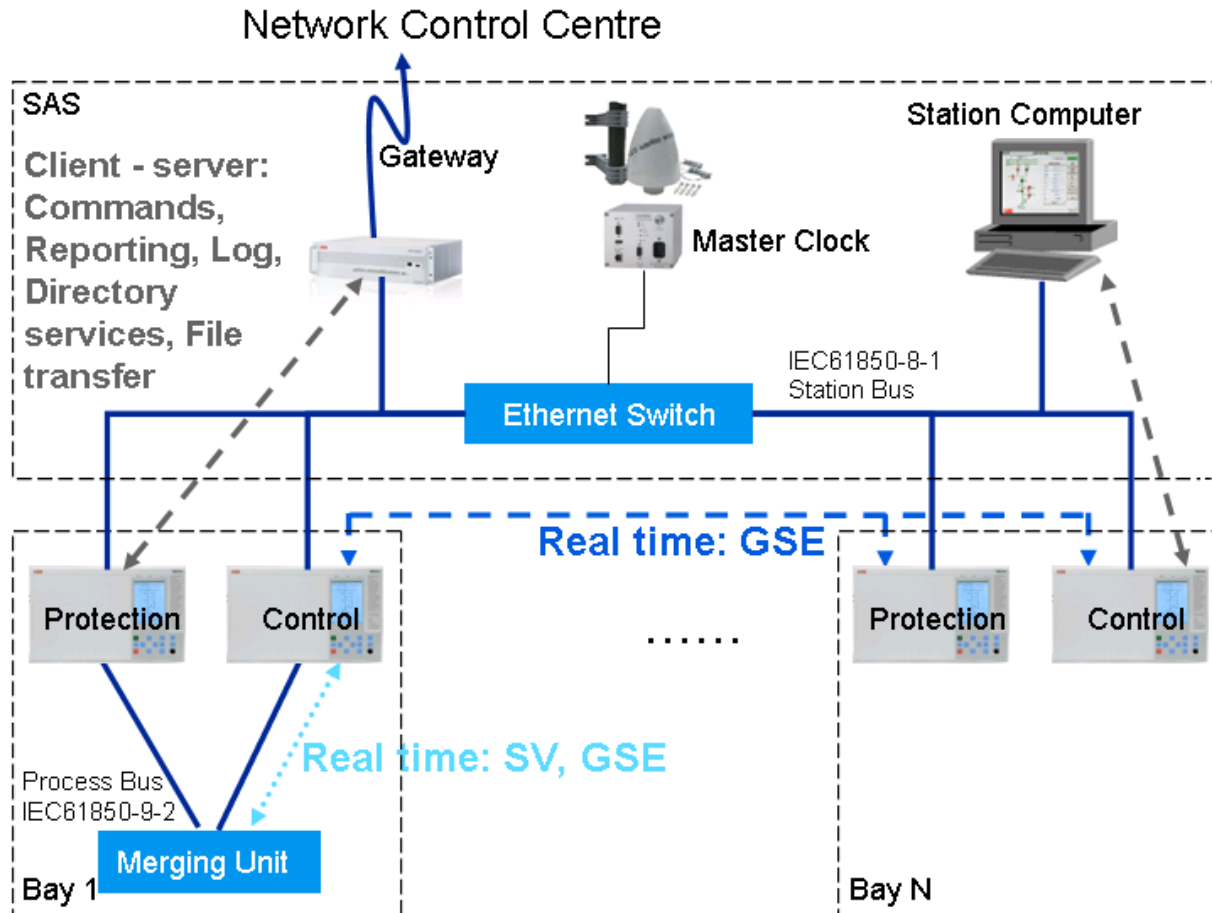
Graphical Editor to Define Substation Topology



- Easily define the substation topology, including substation, voltage level, bays and primary equipment
- Graphical single line representation of the substation
- Map primary equipment to IEDs according to IEC 61850



IET600 – Overview Engineering Tasks



Client-Server

communications are point to point

Real-time

communications are broadcast

Network traffic

performance can be optimized by using “managed Ethernet switches”

IET600

Configure Communication Networks

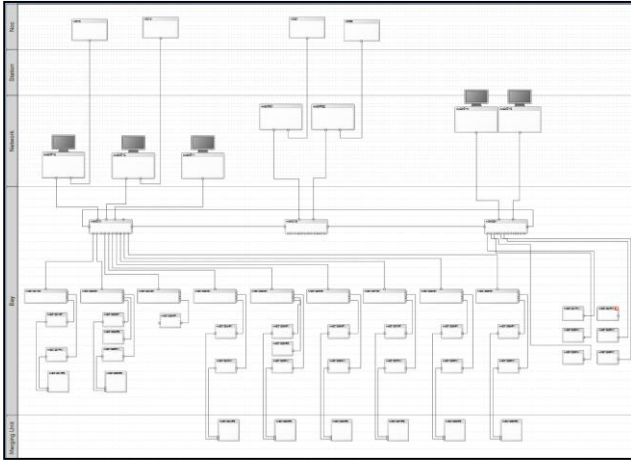


- Clear overview of communication parameters and settings
- Easily assign IEDs to subnetworks
- Versatile filtering functions to quickly navigate through parameters

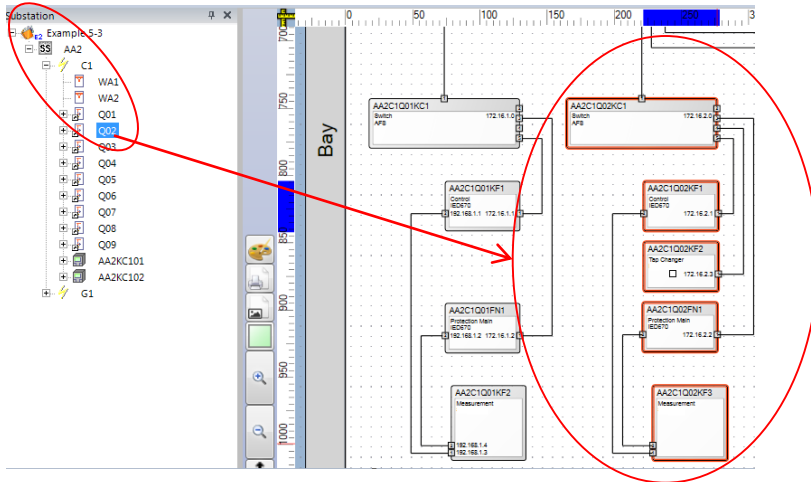
IED Name	Access Point Name	IPAddress	Subnetwork	Application
AA1D1Q02A1	S1	172.16.56.1	AA1WA1	8-MMS
AA1D1Q01A1	S1	172.16.56.3	AA1WA1	8-MMS
AA10PC1	S1	172.16.0.101	AA1WA1	8-MMS

IET600 - Overview

Graphical Editor to Define Communication Network Configuration



- Easily define the complete substation-wide communication network configuration
- Use substation tree structure to navigate/highlight the equipment that belongs to a bay
- Printout diagram for system documentation



IET600

Configure IEC 61850 Dataflow

IED Name	LD	LN	GCB	Attached Dataset	AA1D1Q01A1 IS1	AA1D1Q02A1 IS1	AA1D1Q03A1 IS1
AA1D1Q01A1	LD0	LLNO	gcb_A	InterlockingA	x		
AA1D1Q01A1	LD0	LLNO	gcb_B	ProtectionA		x	
AA1D1Q01A1	LD0	LLNO	gcb_C	ProtectionB		x	
AA1D1Q02A1	LD0	LLNO	gcb_A	InterlockingA	x		
AA1D1Q02A1	LD0	LLNO	gcb_B	ProtectionA	x		
AA1D1Q02A1	LD0	LLNO	gcb_C	ProtectionB	x		
AA1D1Q03A1	LD0	LLNO	gcb_A	InterlockingA			
AA1D1Q03A1	LD0	LLNO	gcb_B	ProtectionA			
AA1D1Q03A1	LD0	LLNO	gcb_C	ProtectionB			

- Powerful editor to easily define IEC 61850 dataflow between IEDs incl. the HMI

- Import from SCD/CID files or create manually :

IED	LD	LN	Dataset	Related Control Blocks	Status	Description
AA1D1Q01A1	LD0	LLNO	InterlockingA	gcb_A	IedDefinedConfigurable	Data required for distributed interlocking
AA1D1Q01A1	LD0	LLNO	MeasFRA	rcb_T	IedDefinedConfigurable	All dead-banded measurands used to up
AA1D1Q01A1	LD0	LLNO	ProtectionA	gcb_B	IedDefinedConfigurable	Data required for distributed protection f
AA1D1Q01A1	LD0	LLNO	ProtectionB	gcb_C	IedDefinedConfigurable	Data required for distributed protection f
AA1D1Q01A1	LD0	LLNO	StalledA	rcb_U	IedDefinedConfigurable	All IED related status data and diagnosti
AA1D1Q01A1	LD0	LLNO	StalledB	rcb_V	IedDefinedConfigurable	All IED related status data and diagnosti
AA1D1Q01A1	LD0	LLNO	StalledC	rcb_W	IedDefinedConfigurable	All IED related status data and diagnosti
AA1D1Q01A1	LD0	LLNO	StalledD	rcb_X	IedDefinedConfigurable	All IED related status data and diagnosti
AA1D1Q01A1	LD0	LLNO	StalledE	rcb_Y	IedDefinedConfigurable	All IED related status data and diagnosti
AA1D1Q01A1	LD0	LLNO	StalledF	rcb_Z	IedDefinedConfigurable	All IED related status data and diagnosti
AA1D1Q01A1	LD0	LLNO	StalledG	rcb_AA	IedDefinedConfigurable	All IED related status data and diagnosti
AA1D1Q01A1	LD0	LLNO	StaNmIA	rcb_C	IedDefinedConfigurable	Status Data used for event list entries.
AA1D1Q01A1	LD0	LLNO	StaNmIB	rcb_D	IedDefinedConfigurable	Status Data used for event list entries.
AA1D1Q01A1	LD0	LLNO	StaNmIC	rcb_E	IedDefinedConfigurable	Status Data used for event list entries.
AA1D1Q01A1	LD0	LLNO	StaNmID	rcb_F	IedDefinedConfigurable	Status Data used for event list entries.
AA1D1Q01A1	LD0	LLNO	StaNmIE	rcb_G	IedDefinedConfigurable	Status Data used for event list entries.
AA1D1Q01A1	LD0	LLNO	StaNmIF	rcb_H	IedDefinedConfigurable	Status Data used for event list entries.
AA1D1Q01A1	LD0	LLNO	StaNmIG	rcb_I	IedDefinedConfigurable	Status Data used for event list entries.

IED:	LD:	LN:	DObject:	DAttr:	FC:
AA1D1Q01A1 (S1)	OC4_1	OC4PHAR1	Mod	q [ST]	ST
	EF4_1	LLNO	Beh	ctlModel [CF]	
	LD0	LPHD1	Health	q [ST]	q
	OC4_1	OC4PHAR1	Mod	sVal [ST]	
	OV2_1	OC4PTOC1	NamPit	t [ST]	
	ROV2_1	OC4PTOC2	Str		
	SES_1	OC4PTOC3			
	UV2_1	OC4PTOC4			

- Configure communication services
 - Report Control Blocks (RCB)
 - Goose Control Blocks (GCB)
 - Sampled Value Control Block

IET600 – Communication Engineering Communication Subnetwork Editor

Grid Editor IET600 5.1.13

Home Substation IEDs Communication Grid Editor

Substation Voltage Level Build

Communication IET600_Demo

AA1WA1

AA1KA1 (S1)

AA1P1 (S1)

AA1P3 (S1)

AA1P4 (S1)

AA1D1 (S1)

AA1D10 (S1)

AA1D11 (S1)

AA1D2 (S1)

AA1D3 (S1)

AA1D4 (S1)

AA1D5 (S1)

Subnetworks Datasets RCB Data RCB Clients GCB Data GCB Clients Inputs

IED Name	Access Point Name	IPAddress	Subnet	Subnetwork	Application	Description	Configuration Version	Manufacturer
AA1E1Q01A1	S1	172.16.201.2	255.255.0.0	AA1WA1	8-MMS	E1Q01A1	C67I11ver1.1.01_IEC	ABB
AA1E1Q02FP1	S1	172.16.204.4	255.255.0.0	AA1WA1	8-MMS	E1Q02FP1	T67I11ver1.1.01_IEC	ABB
AA1E1Q04FP1	S1	172.16.206.4	255.255.0.0	AA1WA1	8-MMS	E1Q04FP1	L67I11ver1.1.01_IEC	ABB
AA1E1Q03A1	S1	172.16.205.2	255.255.0.0	AA1WA1	8-MMS	E1Q03A1	C67I11ver1.1.01_IEC	ABB
AA1E1Q01A2	S1	172.16.201.5	255.255.0.0	AA1WA1	8-MMS	E1Q01A2		
AA1E1Q05FP1	S1	172.16.207.4	255.255.0.0	AA1WA1	8-MMS	E1Q05FP1	T67I11ver1.1.01_IEC	ABB
AA1E1Q04A1	S1	172.16.206.2	255.255.0.0	AA1WA1	8-MMS	E1Q04A1	C67I11ver1.1.01_IEC	ABB
AA1KD1	S1	172.16.0.140	255.255.0.0	AA1WA1	8-MMS			
AA1KA1	S2	172.16.0.102	255.255.0.0	AA1WA1	8-MMS			
AA1OPC1	S1	172.16.0.100	255.255.0.0	AA1WA1	8-MMS			
AA1E1Q01FP1	S1	172.16.201.4	255.255.0.0	AA1WA1	8-MMS			
AA1E1Q05A1	S1	172.16.207.2	255.255.0.0	AA1WA1	8-MMS			
AA1E1Q02A1	S1	172.16.204.2	255.255.0.0	AA1WA1	8-MMS			

Drag a column header here to group by that column.

Define Subnetwork properties:

- IP Address
- Subnetwork name IP Address
- Application type
- Configuration version

Subnetwork: AA1WA1

Behavior

Subnetwork

The name of the subnetwork

Output Error List

ABB

IET600 – Communication Engineering Dataset Editor

Datasets can either be imported with an IED or created manually

The screenshot displays the IET600 5.1.13 Grid Editor interface. The main window is titled "Grid Editor" and shows a table of dataset entries. The table has columns for IED, LD, LN, Dataset, Related Control Blocks, Status, and Description. The selected node is AA1E1Q01A1, and the dataset entries below it are highlighted in orange. A red box highlights the table and the properties panel below it. The properties panel shows the IEC61850 Model to select dataset entries, with fields for IED, LD, LN, DObject, DAttr., and FC. The output window shows the message: "2011-04-18 12:28:04,079 INFO The GCB default rules are up-to-date."

Drag a column header here to group by that column.

IED	LD	LN	Dataset	Related Control Blocks	Status	Description
AA1E1Q01A1	LD0	LLN0	Interlocking	gcb_A	IedDefinedConfigura	
AA1E1Q01A1	LD0	LLN0	MeasFitA	rcb_D	IedDefinedConfigura	All deadbanded measurands used to
AA1E1Q01A1	LD0	LLN0	StatIedA	rcb_E	IedDefinedConfigura	All IED related status data and diagno
AA1E1Q01A1	LD0	LLN0	StatNormal	rcb_B	IedDefinedConfigura	Status data used for event list entries
AA1E1Q01A1	LD0	LLN0	StatNormalB	rcb_C	IedDefinedConfigura	Status data used for event list entries
AA1E1Q01A1	LD0	LLN0	StatNormalC	rcb_D	IedDefinedConfigura	Status data used for event list entries
AA1E1Q01FP1	LD0	LLN0	MeasFitA	rcb_F	IedDefinedConfigura	All deadbanded measurands used to
AA1E1Q01FP1	LD0	LLN0	StatIedA	rcb_G	IedDefinedConfigura	All IED related status data and diagno
AA1E1Q01FP1	LD0	LLN0	StatIedB	rcb_H	IedDefinedConfigura	All IED related status data and diagno
AA1E1Q01FP1	LD0	LLN0	StatNormal	rcb_B	IedDefinedConfigura	Status data used for event list entries
AA1E1Q01FP1	LD0	LLN0	StatNormalB	rcb_C	IedDefinedConfigura	Status data used for event list entries
AA1E1Q01FP1	LD0	LLN0	StatNormal	rcb_D	IedDefinedConfigura	Status data used for event list entries

Content of Selected dataset

IEC61850 Model to select dataset entries

IED:	LD:	LN:	DObject:	DAttr.:	FC:
AA1E1Q01A1 (S1)	LD0	LPHD1	PhyHealth	stVal [ST]	ST
			PhyHealth	stVal [ST]	
			PhyNormal	stVal [ST]	
			Proxy	t [ST]	

Subnetworks Datasets RCB Data RCB Clients GCB Data GCB Clients Inputs

Output

2011-04-18 12:28:04,079 INFO The GCB default rules are up-to-date.

Output Error List

IET600 – Communication Engineering

Create new datasets

Drag a column header here to group by that column.

IED	LD	LN	Dataset	Related Control Blocks	Status	Description
AA1C1Q05A2	REGD1	ATCC1	MX	urcbMX	IedDefinedFix	
AA1C1Q05A2	REGD1	ATCC1	SP	urcbSP	IedDefinedFix	
AA1C1Q05A2	REGD1	LLN0	ST	urcbST	IedDefinedFix	
AA1C1Q05A2	REGD1	LPHD1	ST1	urcbST	IedDefinedFix	
AA1C1Q05A2	REGD1	GGIO1	ST2	urcbST	IedDefinedFix	
AA1C1Q05A2	REGD1	ATCC1	ST3	urcbST	IedDefinedFix	
AA1C1Q05A2	REGD1	GGIO2	ST4	urcbST	IedDefinedFix	
▶ AA1C1Q02A2	REGD1	LLN0	MX1		ManuallyCreated	(created on Mon, 18 Apr 2011 09:52:23 GM

Insert new row

✕ Delete row(s)

IED: AA1C1Q02A2 (P1) LD: REGD1 LN: GGIO1 DObject: Ind1 DAttr.: stVal [ST] FC: ST

REGD1 ATCC1 Beh q [ST] stVal

GGIO1 Health stVal [ST]

GGIO2 Ind1 t [ST]

LLN0 Ind10

Remove >> Add

1 attributes of 78 used.

Dataset Entries

▶ REGD1.GGIO1.Ind1.stVal

IED Status IED Capabilities Subnetworks Datasets RCB Data RCB Clients GCB Data GCB Clients Inputs

IET600 – Communication Engineering

RCB Editor

RCBs can either be either imported with an IED or created manually
Show dataset entries for each RCB

View/configure RCB properties:

- IED/LD/LN for RCB
- Status
- Name of attached dataset
- Conf. Rev.
- Buffered
- Buffer Time
- Number of Enabled Clients
- ...

IED	LD	LN	RCB	Status	Attached Dataset	Conf.Rev.	Buffered	Buffer
AA1E1Q01A1	LD0	LLN0	rcb_D	IedDefinedCo	MeasFltA	2	<input type="checkbox"/>	500			
AA1E1Q01A1	LD0	LLN0	rcb_E	IedDefinedCo	StatIedA	2	<input checked="" type="checkbox"/>	500			
AA1E1Q01A1	LD0	LLN0	rcb_B	IedDefinedCo	StatNormalA	2	<input checked="" type="checkbox"/>	500			
AA1E1Q01A1	LD0	LLN0	rcb_C	IedDefinedCo	StatNormalB	2	<input checked="" type="checkbox"/>	500			
AA1E1Q01A1	LD0	LLN0	rcb_A	IedDefinedCo	StatUrgentA	2	<input checked="" type="checkbox"/>	100	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0	rcb_F	IedDefinedCo	MeasFltA	2	<input type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0	rcb_G	IedDefinedCo	StatIedA	2	<input checked="" type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0	rcb_H	IedDefinedCo	StatIedB	2	<input checked="" type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0	rcb_B	IedDefinedCo	StatNormalA	2	<input checked="" type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0	rcb_C	IedDefinedCo	StatNormalB	2	<input checked="" type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0	rcb_D	IedDefinedCo	StatNormalC	2	<input checked="" type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0				2	<input checked="" type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q01FP	LD0	LLN0				2	<input checked="" type="checkbox"/>	100	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q02A1	LD0	LLN0				2	<input type="checkbox"/>	500	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q02A1	LD0	LLN0				2	<input checked="" type="checkbox"/>	500	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q02A1	LD0	LLN0				2	<input checked="" type="checkbox"/>	500	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q02A1	LD0	LLN0	rcb_C	IedDefinedCo	StatNormalB	2	<input checked="" type="checkbox"/>	500	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q02A1	LD0	LLN0	rcb_A	IedDefinedCo	StatUrgentA	2	<input checked="" type="checkbox"/>	100	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q02FP	LD0	LLN0	rcb_E	IedDefinedCo	MeasFltA	2	<input type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AA1E1Q02FP	LD0	LLN0	rcb_F	IedDefinedCo	StatIedA	2	<input checked="" type="checkbox"/>	500	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

IET600 – Communication Engineering

RCB Clients

Grid Editor IET600 5.1.13

Substation Voltage Bay IED Build

IEDs IET600_Demo

Drag a column header here to group by that column.

IED Name	LD	LN	RCB	Attached Dataset	AA10PC1 (S1)
AA1E1Q01A1					
AA1E1Q01A1	LD0	LLN0	rcb_D	MeasFitA	1
AA1E1Q01A1	LD0	LLN0	rcb_E	StatIedA	1
AA1E1Q01A1	LD0	LLN0	rcb_B	StatNormalA	1
AA1E1Q01A1	LD0	LLN0	rcb_C	StatNormalB	1
AA1E1Q01A1	LD0	LLN0	rcb_A	StatUrgentA	1
AA1E1Q01A2					
AA1E1Q01FP1					
AA1E1Q01FP1	LD0	LLN0	rcb_F	MeasFitA	1
AA1E1Q01FP1	LD0	LLN0	rcb_G	StatIedA	1
AA1E1Q01FP1	LD0	LLN0	rcb_H	StatIedB	1
AA1E1Q01FP1	LD0	LLN0	rcb_B	StatNormalA	1
AA1E1Q01FP1	LD0	LLN0	rcb_C	StatNormalB	1
AA1E1Q01FP1	LD0	LLN0	rcb_D	StatNormalC	1
AA1E1Q01FP1	LD0	LLN0	rcb_E	StatNormalD	1
AA1E1Q01FP1	LD0	LLN0	rcb_A	StatUrgentA	1
AA1E1Q02A1					
AA1E1Q02A1	LD0	LLN0	rcb_D	MeasFitA	1

Sender Receivers

There are Client IEDs in this project that are not connected to a subnetwork. They will not appear as columns.

Show All
 Show RCBs only

 Show IEDs only

IED Default Clients:

Clear All

Configure Empty

Configure All

RCB Clients:

Clear All

Configure Empty

Configure All

Substation IEDs Commun...

Properties

Configuration

Is Library False

Single Line ANSI

Is Library

Defines whether this Project is a Library

IED Status IED Capabilities Subnetworks Datasets RCB Data RCB Clients GCB Data GCB Clients Inputs

Output

2011-04-18 12:28:04,079 INFO The GCB default rules are up-to-date.

Output Error List

IET600 – Communication Engineering

GCB Editor

GCBs can either be imported with an IED or created manually
Show dataset entries for each RCB

The screenshot shows the IET600 GCB Editor interface. The main window displays a table of GCB configurations. A red box highlights a 'Dataset Entries' list on the left, and another red box highlights a context menu with 'Show Dataset Entries' circled. A text box on the right lists the properties that can be viewed or configured for a GCB.

IED	LD	LN	GCB	Status	Attached Dataset	t(min) (ms)	t(max) (ms)	Conf.Rev.	GCB Type	MAC Address
AA1E1Q01A1	LD0	LLN0	gcb_A	IedDefinedConfigurable	InterlockingA	0	0	1	GOOSE	
AA1E1Q02A1	LD0	LLN0	gcb_A	IedDefinedConfigurable	InterlockingA	0	0	1	GOOSE	
AA1E1Q03A1	LD0	LLN0	gcb_A	IedDefinedConfigurable	InterlockingA	0	0	1	GOOSE	
AA1E1Q04A1	LD0	LLN0	gcb_A	IedDefinedConfigurable	InterlockingA	0	0	1	GOOSE	
AA1E1Q05A1	LD0	LLN0	gcb_A	IedDefinedConfigurable	InterlockingA	0	0	1	GOOSE	

View/configure GCB properties:

- IED/LD/LN for GCB
- Status
- Name of attached dataset
- Conf. Rev.
- t(max)
- MAC Address
- APP ID
- ...

IET600 – Communication Engineering

GCB Clients

The screenshot shows the IET600 5.1.13 Grid Editor interface. The main window displays a table of GCB Clients. The table has columns for IED Name, LD, LN, GCB, Attached Dataset, and a list of 14 receiver IEDs. The 'Sender' and 'Receivers' columns are highlighted in red. The 'Sender' column contains the IED Name, LD, LN, GCB, and Attached Dataset. The 'Receivers' column contains the names of the receiver IEDs, each with a dropdown arrow. The table data is as follows:

IED Name	LD	LN	GCB	Attached Dataset	AA1E1Q01A1 (S1)	AA1E1Q01A2 (S1)	AA1E1Q01FP1 (S1)	AA1E1Q02A1 (S1)	AA1E1Q02FP1 (S1)	AA1E1Q03A1 (S1)	AA1E1Q04A1 (S1)	AA1E1Q04FP1 (S1)	AA1E1Q05A1 (S1)	AA1E1Q05FP1 (S1)	AA1KA1 (S2)	AA1KD1 (S1)
AA1E1Q01A1	LD0	LLN0	gcb_A	InterlockingA	x	x	x	x	x	x	x	x	x	x	x	x
AA1E1Q02A1	LD0	LLN0	gcb_A	InterlockingA	x	x	x		x	x	x	x	x	x	x	x
AA1E1Q03A1	LD0	LLN0	gcb_A	InterlockingA	x	x	x	x				x	x	x	x	x
AA1E1Q04A1	LD0	LLN0	gcb_A	InterlockingA	x	x	x	x	x				x	x	x	x
AA1E1Q05A1	LD0	LLN0	gcb_A	InterlockingA	x	x	x	x	x	x		x		x	x	x

The 'Sender' column is highlighted in red and labeled 'Sender'. The 'Receivers' column is highlighted in red and labeled 'Receivers'. The table is titled 'Drag a column header here to group by that column.' and has tabs for IED Status, IED Capabilities, Subnetworks, Datasets, RCB Data, RCB Clients, GCB Data, GCB Clients, and Inputs. The output window shows a message: '2011-04-18 12:42:33,240 INFO Finished update of inputs (external references) for IED 'AA1KD1'.'



Integrated Engineering Tool IET600

Feature Overview

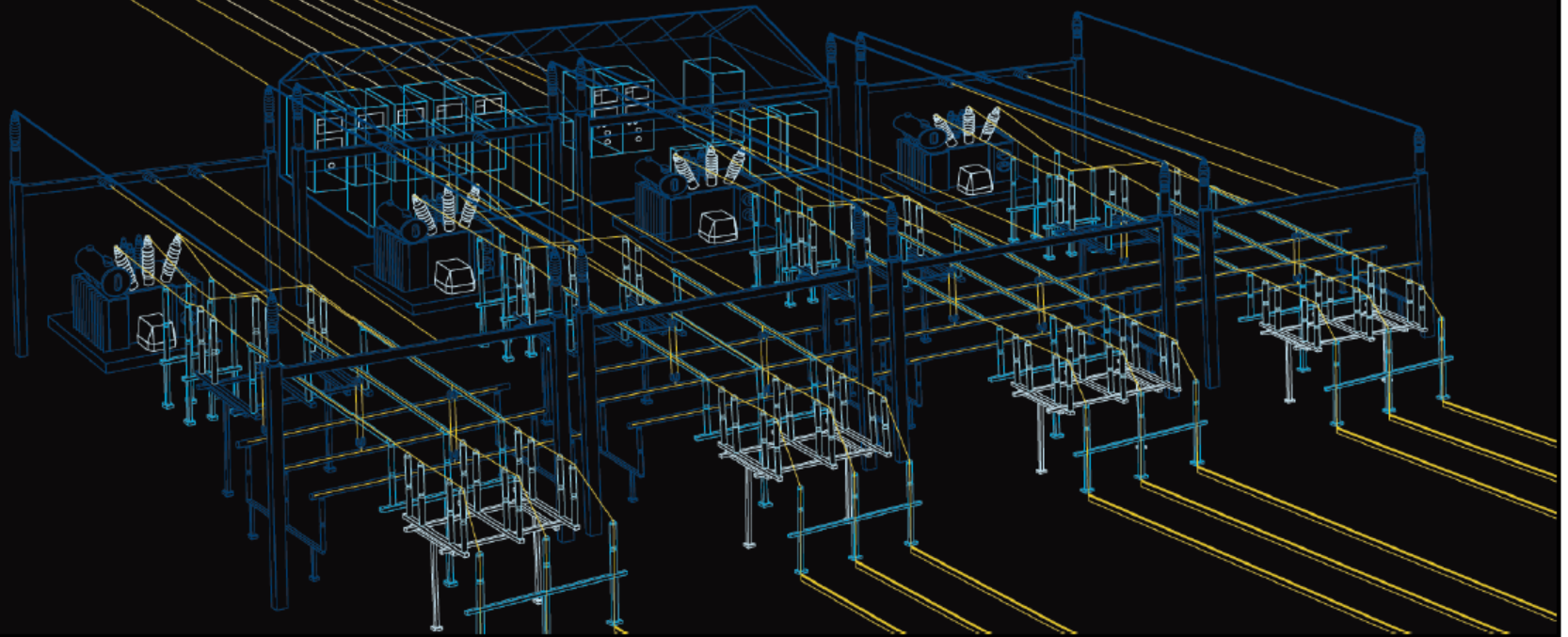
Oct.2013

Functions	IET600 v.5.2	IET600 v.5.3
IED related SCL file handling <ul style="list-style-type: none"> • ICD - import / export • IID* - import / export • CID - import / export 	<ul style="list-style-type: none"> • / • • / • • / - 	<ul style="list-style-type: none"> • / • • / • • / -
System related SCL file handling <ul style="list-style-type: none"> • SSD - import / export (optional feature acc. IEC 61850) • SCD - import / export • SED* - import / export 	<ul style="list-style-type: none"> - / - • / • - / - 	<ul style="list-style-type: none"> - / - • / • • / •
IEC 61850 Data flow engineering <ul style="list-style-type: none"> • Dataset - manual creation / import • control blocks - MMS / GOOSE / Sampled Values • Substation to substation communication 	<ul style="list-style-type: none"> • / • • / • / • - 	<ul style="list-style-type: none"> • / • • / • / • •
Define Substation section <ul style="list-style-type: none"> • Primary equipment (S/S, VL, Bay, EQ) • Functions & Sub-functions 	<ul style="list-style-type: none"> • - 	<ul style="list-style-type: none"> • •
Grafical Editors <ul style="list-style-type: none"> • Substation Single line diagram • Physical communication network 	<ul style="list-style-type: none"> • - 	<ul style="list-style-type: none"> • •
Logical Node mapping to primary objects in substation section	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •
XLS Export IEC 61850 Dataflow Signallist	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •
Supported IEC 61850 SCL versions <ul style="list-style-type: none"> • 2003 Rev.A • 2007 Rev.B* 	<ul style="list-style-type: none"> • - 	<ul style="list-style-type: none"> • •

Integrated Engineering Tool IET600 Summary



- Latest generation of ABB IEC 61850 system integration tool reflecting all experience and knowhow gathered during standardization and project execution.
- Robust tool implementation, hardened in hundreds of IEC 61850 based SA Systems engineered by ABB and partners.
- Proven system integration capabilities of various conformance tested 3rd party IEDs.
- Future proof implementation incl. preparation for upcoming standards.
- Built on state of the art software technology with support for Windows 7/8 native 64Bit and multi-core CPUs.
- Key system integration tool used in the UCA certified conformance test center – «ABB System Verification & Validation Center».



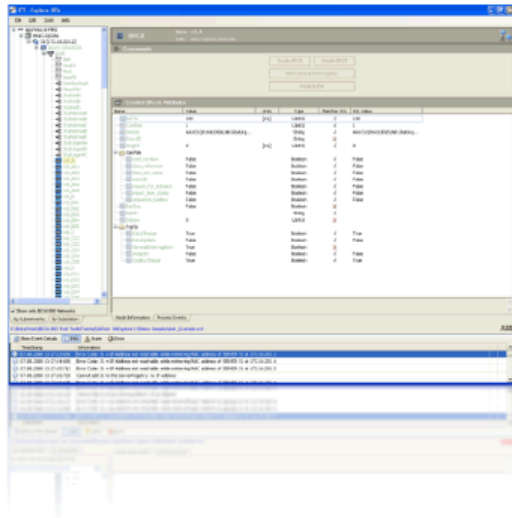
Substation Automation Products

Integrated Testing Tool ITT600 SA Explorer 2.0 Overview

ITT600 SA Explorer

Explore IEDs

- Import and visualization of SCL files
- Auto detect IEDs using online network scan
- Full fledged IEC 61850 client supporting simultaneous connection to multiple IEDs
 - IEC 61850 not only a MMS browser
 - Browsing of IEC 61850 IEDs, inspect IED data model and save to SCL file
 - Enable Report Control Blocks - receive Reports
 - Process Event list
 - SCADA like switch control dialogs for direct and select before operate commands
- IEC61850 System Consistency Checker based on SCD
 - Quick Station Overview
 - Documentation in Microsoft Excel© file
- IED simulation for 61850-8-1 based on the loaded SCD file
- Graphical Data Flow display



ITT SA Explorer

Explore Models

The interface shows a tree view of models under 'Compare other objects'. The selected model is 'AA1D109SA1LDO'. Below the tree, there are sections for 'Difference details' and 'Models to compare'.

Explore IEDs

The interface displays a list of IEDs (Intelligent Electronic Devices) with columns for Name, Type, and other attributes. A detailed view of a selected IED is shown on the right.

ITT600 SA Explorer

INTEGRATED TESTING TOOLBOX

Explore SV

The interface displays two radar charts comparing different models. To the right of each chart is a table with columns for various parameters and their values.

Explore Ethernet

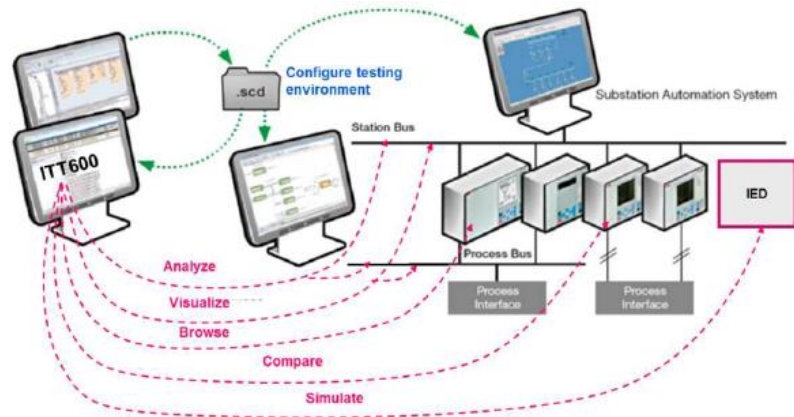
The interface shows a table of Ethernet connections with columns for ID, Name, Type, and other details. Below the table is a diagram showing the network topology.

Explore GOOSE

The interface displays a diagram of GOOSE (Generic Object Oriented Substation Event) messages, showing the flow of information between different components.

ITT600 SA Explorer

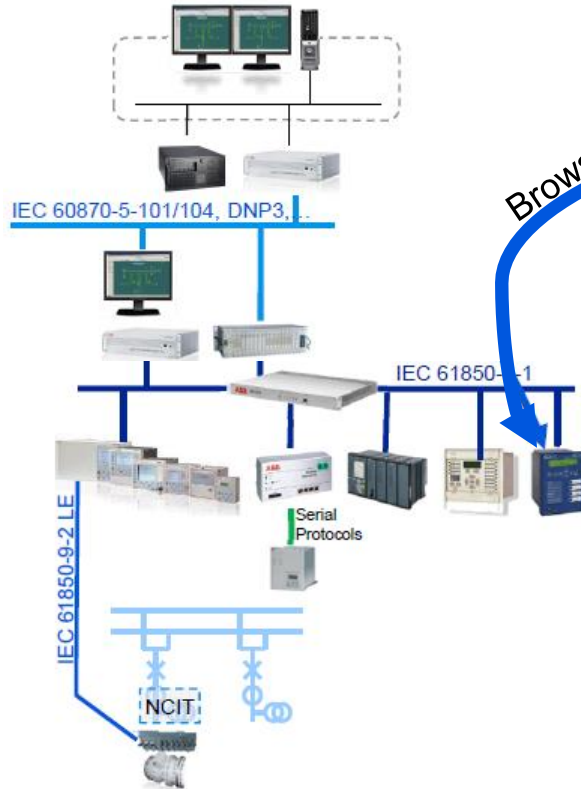
Reduce overall testing and commissioning time



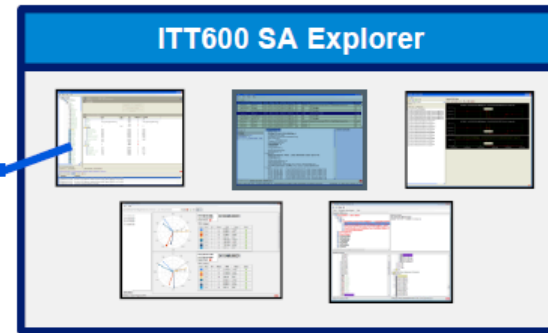
- Diagnosis and troubleshooting of IEC 61850-based substation automation systems and applications.
 - With or without SCD - Connect any IEC 61850 IED
 - System wide data consistency checks by comparing SCL file values with online value from IEDs and communication equipment.
 - Analyze and decode IEC 61850 Ethernet traffic
 - Visualize GOOSE and Sampled Value process bus data
 - IED simulation for client testing
 - Display application values in IEC 61850 language

ITT600 SA Explorer

Independent IED testing



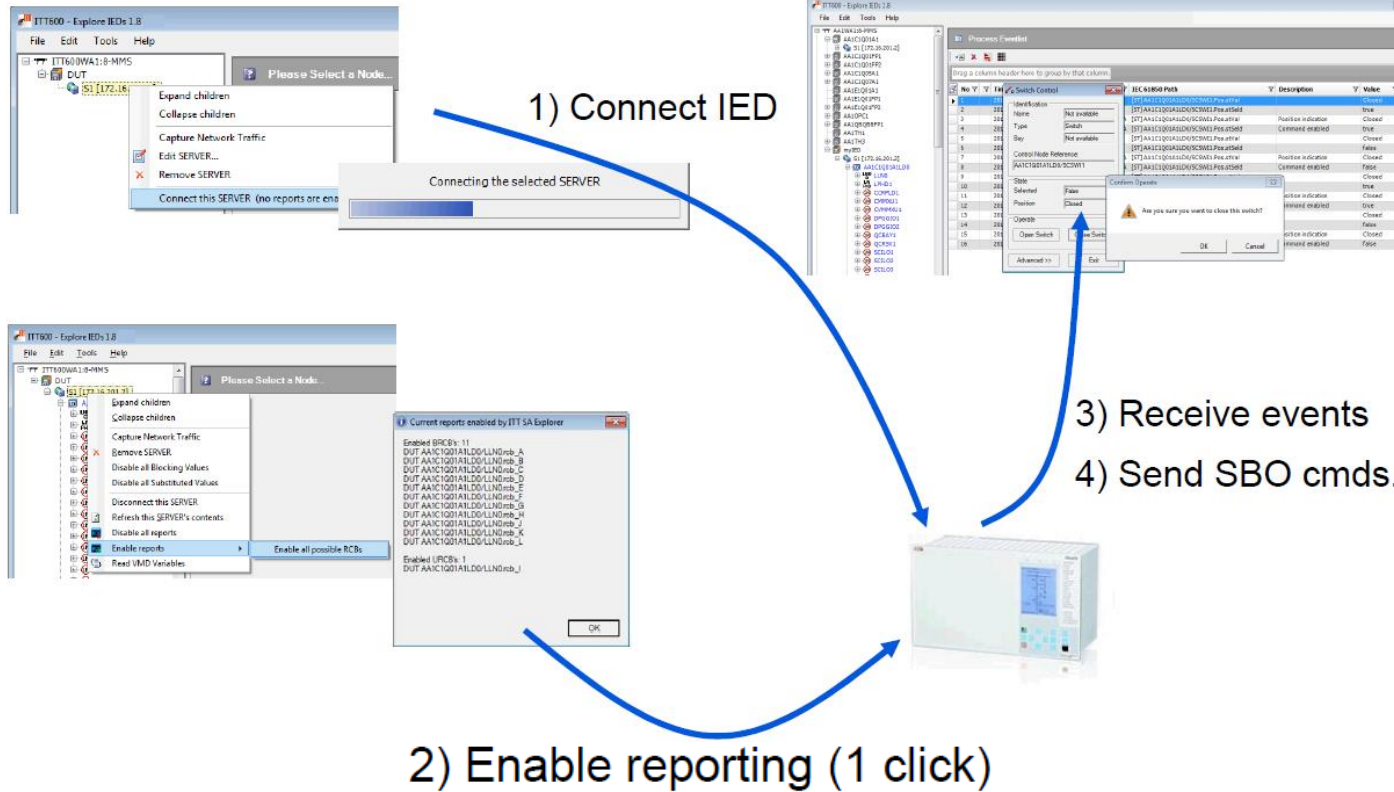
Browse



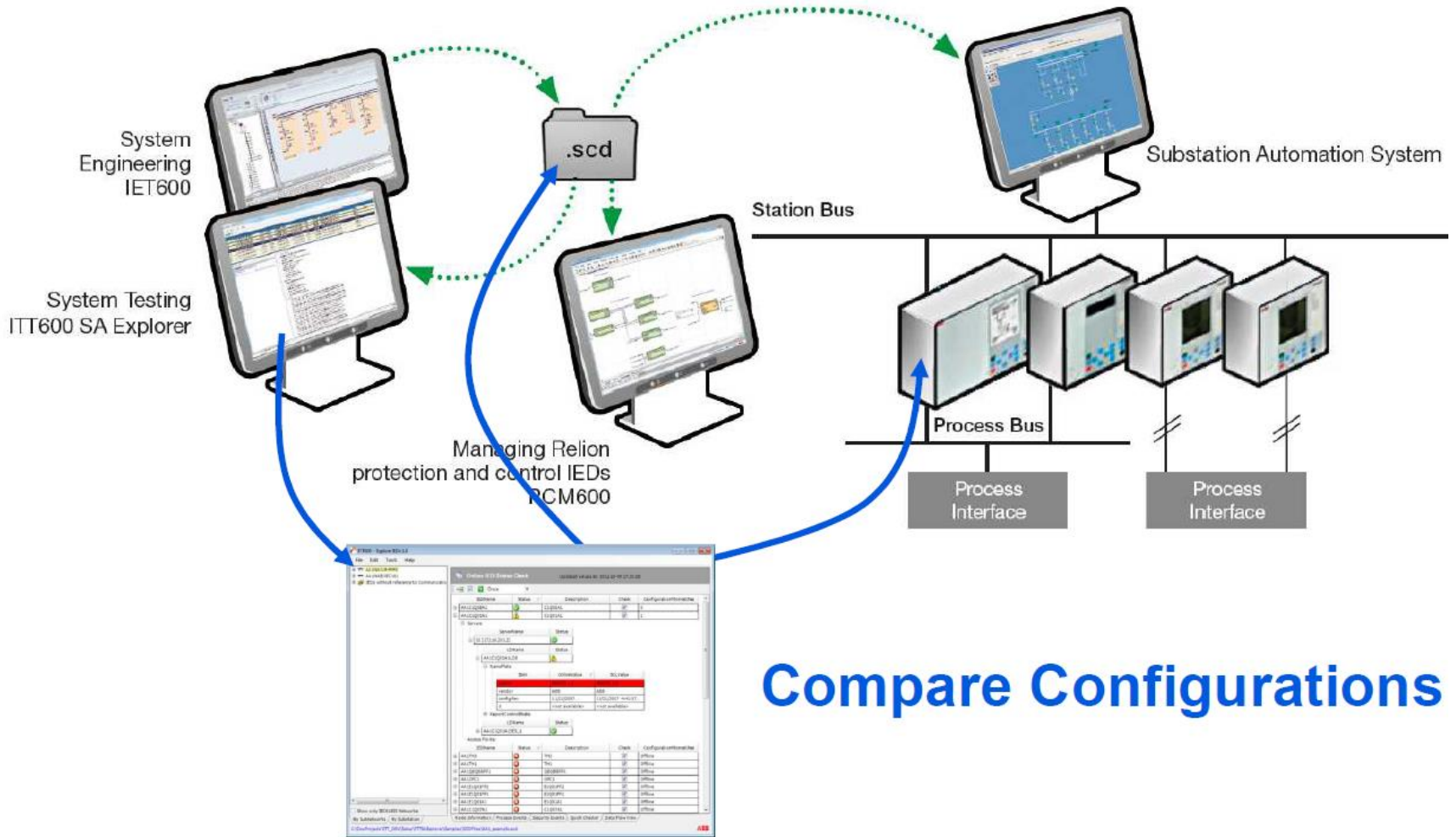
- With or without SCD - Connect any IEC 61850 IED
- Exploration of the complete IEC 61850 Data Model from multiple IEDs
- Send commands with SCADA like command dialogs
- Receive & display IEC 61850 reports in the embedded process event list
- Advanced functionalities such as
 - Editing Setting Group values
 - Creation of dynamic Datasets

ITT600 SA Explorer

Independent IED testing with Explore IEDs

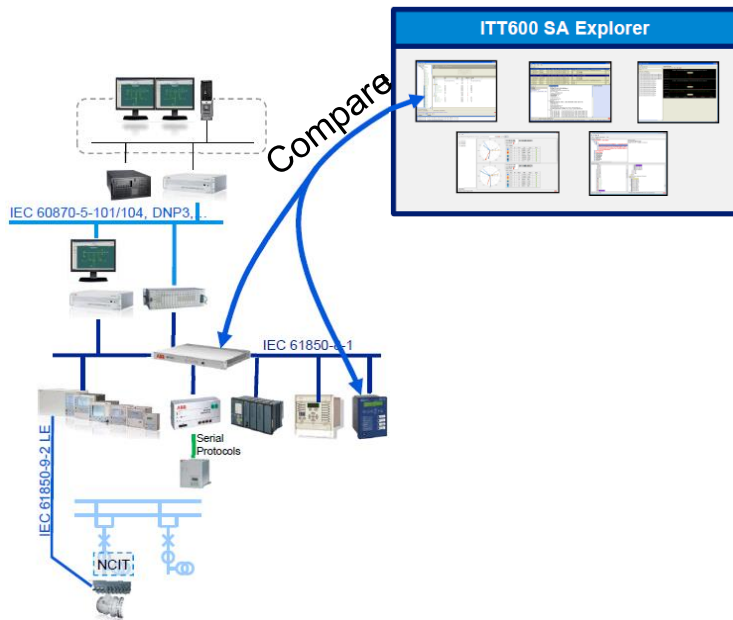


ITT600 SA Explorer



ITT600 SA Explorer

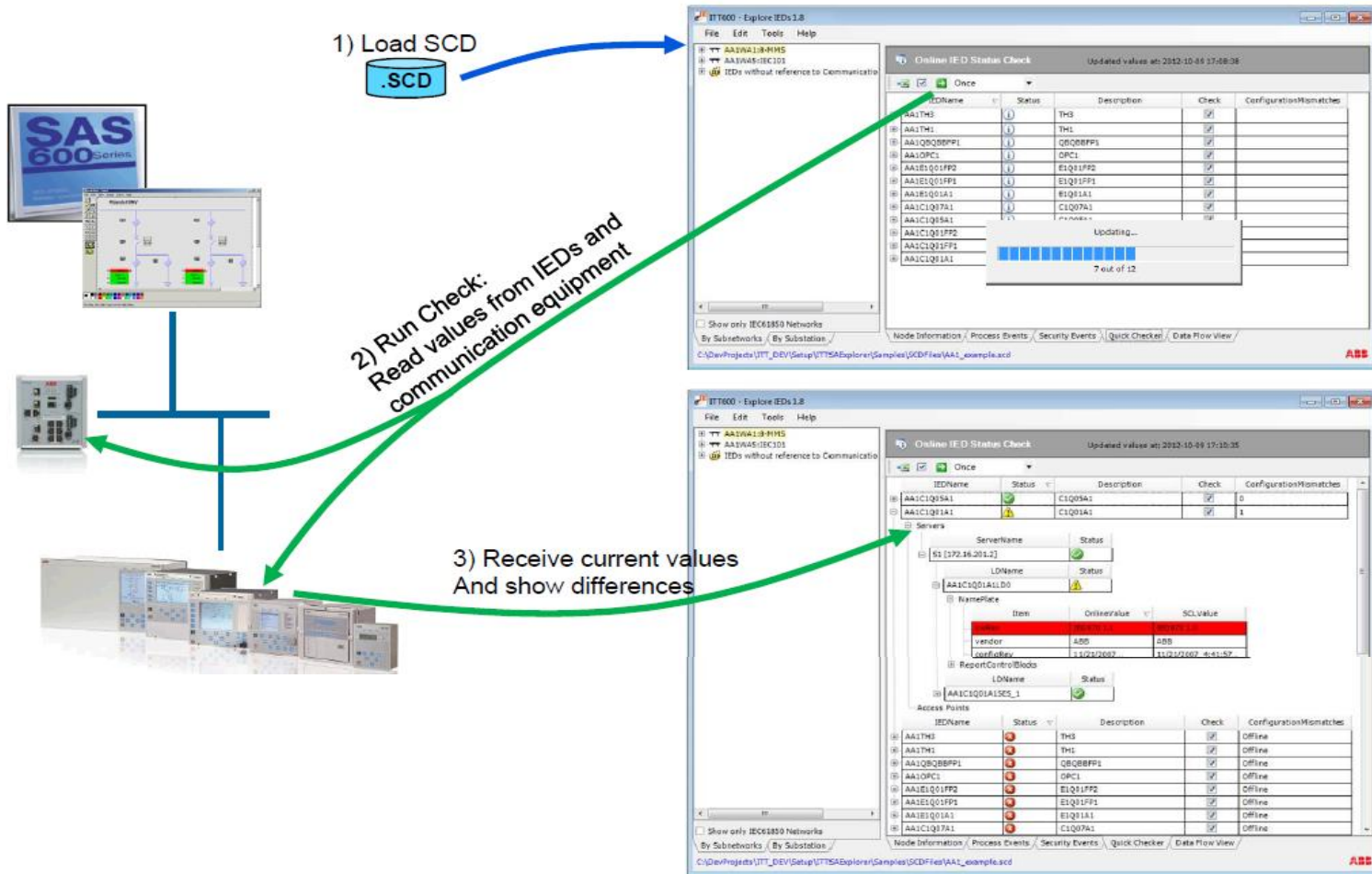
Ensure data consistency



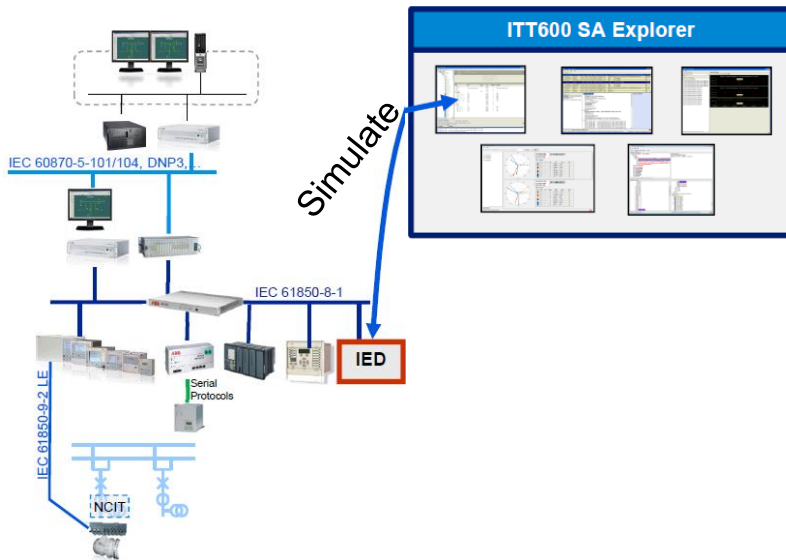
- Ensure data consistency before starting with FAT
 - System wide data consistency checks can be done by comparison of offline data (SCD file) with online data on IEDs and communication equipment.
 - Are all IEDs loaded with the same revision of the SCD file?
 - Is the communication equipment configured as designed?
 - Are the physical communication connections correct?

ITT600 SA Explorer

Check system wide data consistency with Explore IEDs



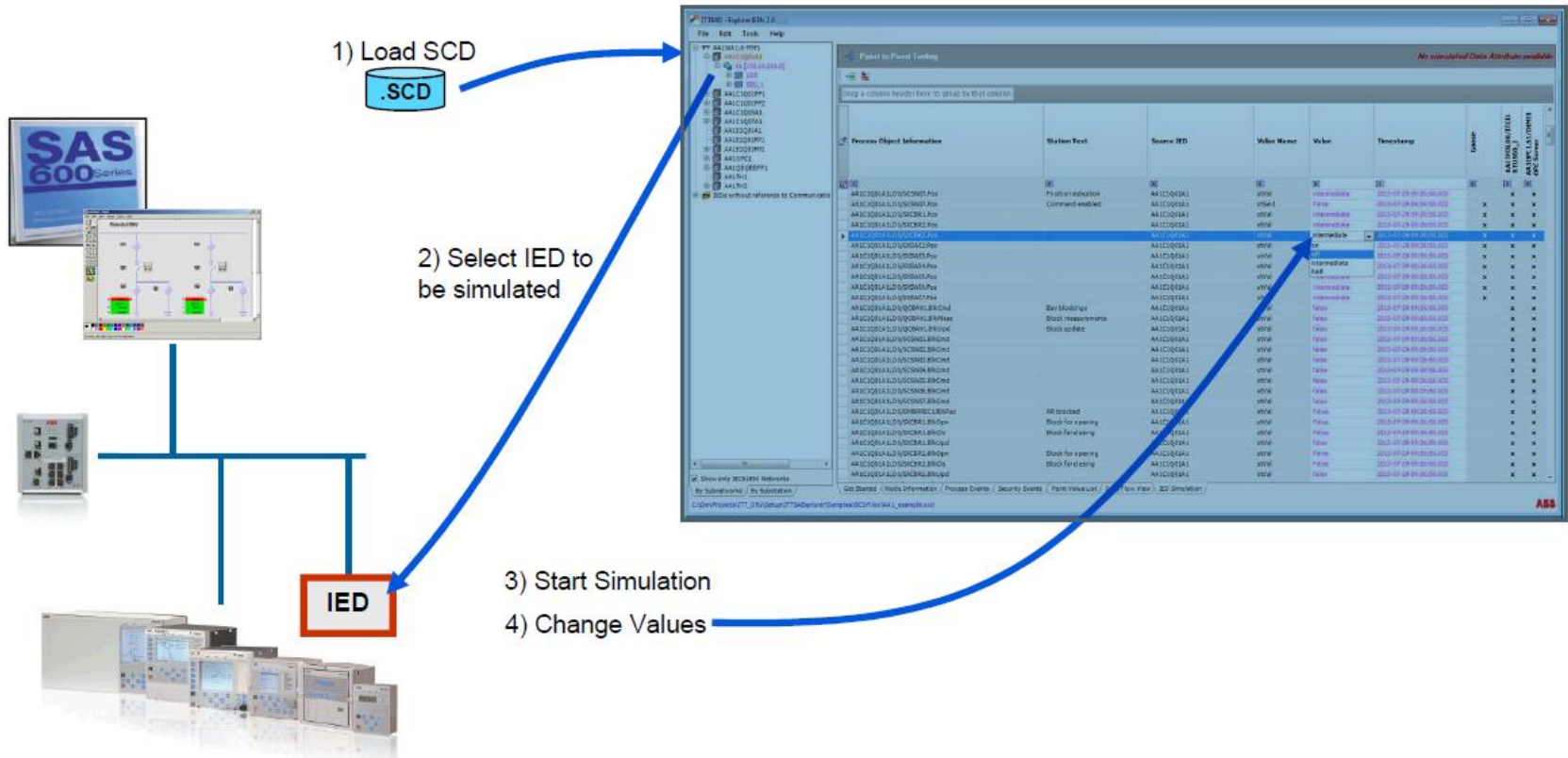
ITT600 SA Explorer Simulate IED



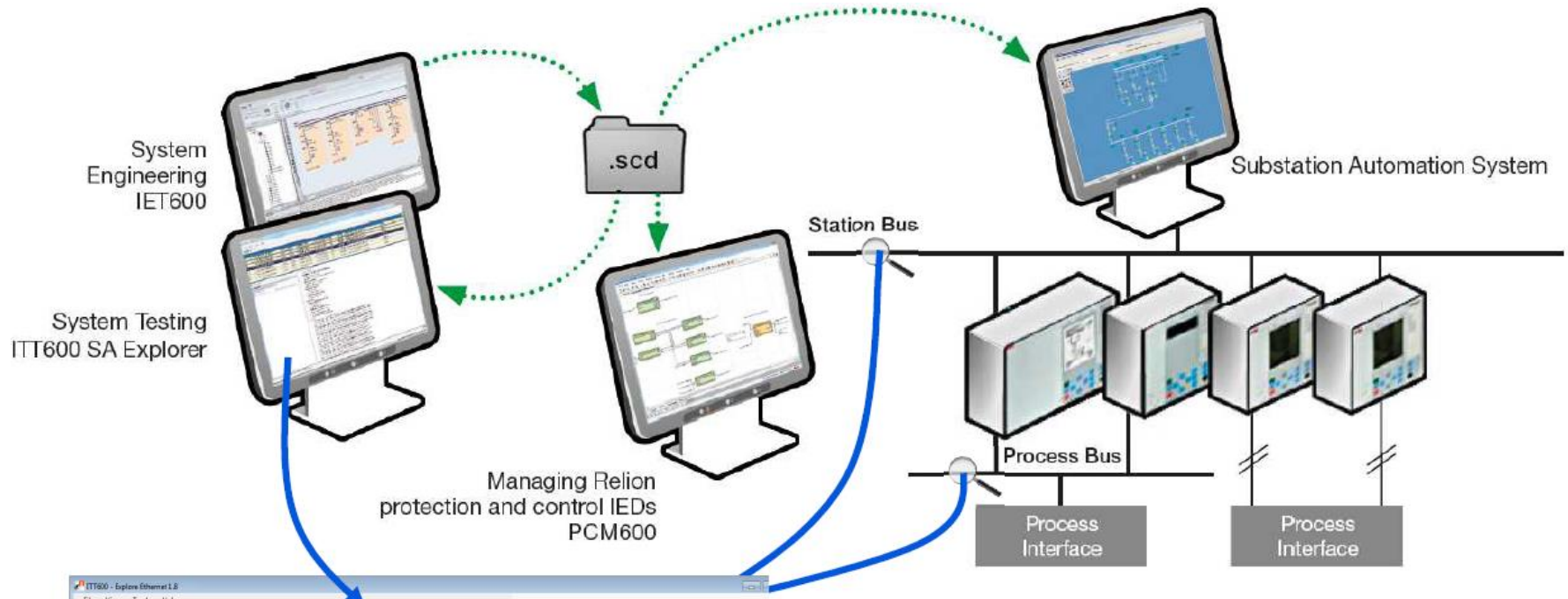
- Independently test an IEC 61850 device
 - **One** IED of the loaded SCD file can be simulated
 - GOOSE messages are sent and received
 - Full MMS simulation including support for Reports
 - Generic application logic to process commands
- Test GOOSE reception of an IED
- All Values of a simulated IEDs are changeable (also Quality attributes)

ITT600 SA Explorer

Simulate an IED with Explore IEDs



ITT600 SA Explorer



ITT600 - Explorer Ethernet 1.8

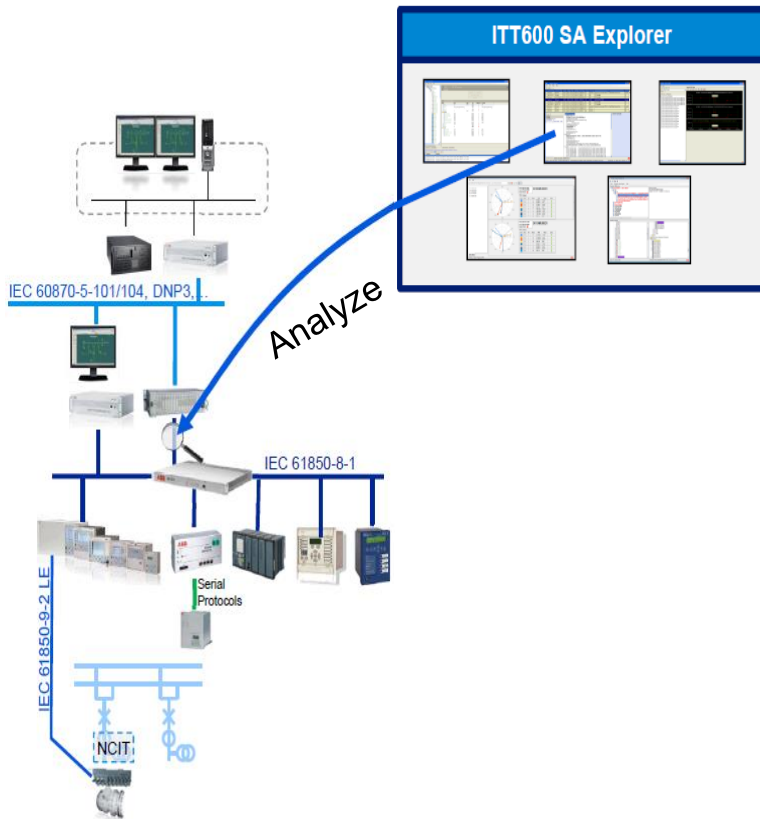
No.	Source/Server	Destination/Server	SrcPort	SourceIP	DestinationIP	Gateway	Application	Details
19	Not found	Not found	2008-07-18 14:36:58.2963	255.255.255.255	255.255.255.255	240	GOOSE	GOOSE:APRD:0x3001 Checks: NOT Ok
20	Not found	Not found	2008-07-18 14:36:58.2737	255.255.255.255	255.255.255.255	240	GOOSE	GOOSE:APRD:0x3001 Checks: NOT Ok
21	Not found	Not found	2008-07-18 14:36:58.3036	255.255.255.255	255.255.255.255	240	GOOSE	GOOSE:APRD:0x3001 Checks: NOT Ok
22	Not found	Not found	2008-07-18 14:36:58.6336	255.255.255.255	255.255.255.255	240	GOOSE	GOOSE:APRD:0x3001 Checks: NOT Ok
23	Not found	AA1C1Q01A1S1	2008-07-18 14:36:58.4407	172.16.255.254	172.16.201.2	54	MMS	TCP keep alive
24	AA1C1Q01A1S1	Not found	2008-07-18 14:36:58.6500	172.16.201.2	172.16.209.254	152	MMS	MMS report
25	Not found	AA1C1Q01A1S1	2008-07-18 14:36:58.6510	172.16.255.254	172.16.201.2	54	MMS	TCP keep alive
26	AA1C1Q01A1S1	Not found	2008-07-18 14:36:58.6510	172.16.201.2	172.16.209.254	149	MMS	MMS report

General	MMS
<p>General</p> <p>Source/Server: True</p> <p>Message/Client: 1</p> <p>Message/Description: MMS report</p>	<p>MMS PDU: MMSpollCHOICE</p> <p>AA1C1Q01A1S1 - (QA1) - (BT) AA1C1Q01A1LDASCSW1 Pos: aVal (Position indication) : 10 - Closed</p> <p>AA1C1Q01A1S1 - (QA1) - (BT) AA1C1Q01A1LDASCSW1 Pos: s : 000000000000 - Good</p> <p>AA1C1Q01A1S1 - (QA1) - (BT) AA1C1Q01A1LDASCSW1 Pos: s : 2008-07-18 12:36:26.80000</p> <p>AA1C1Q01A1S1 - (QA1) - (BT) AA1C1Q01A1LDASCSW1 Pos: aVal (Comment enabled) : True</p> <p>Report operation</p> <p>RCB Reference: AA1C1Q01A1LDASCSW1 hb: A</p>

Analyze SA Protocols

ITT600 SA Explorer

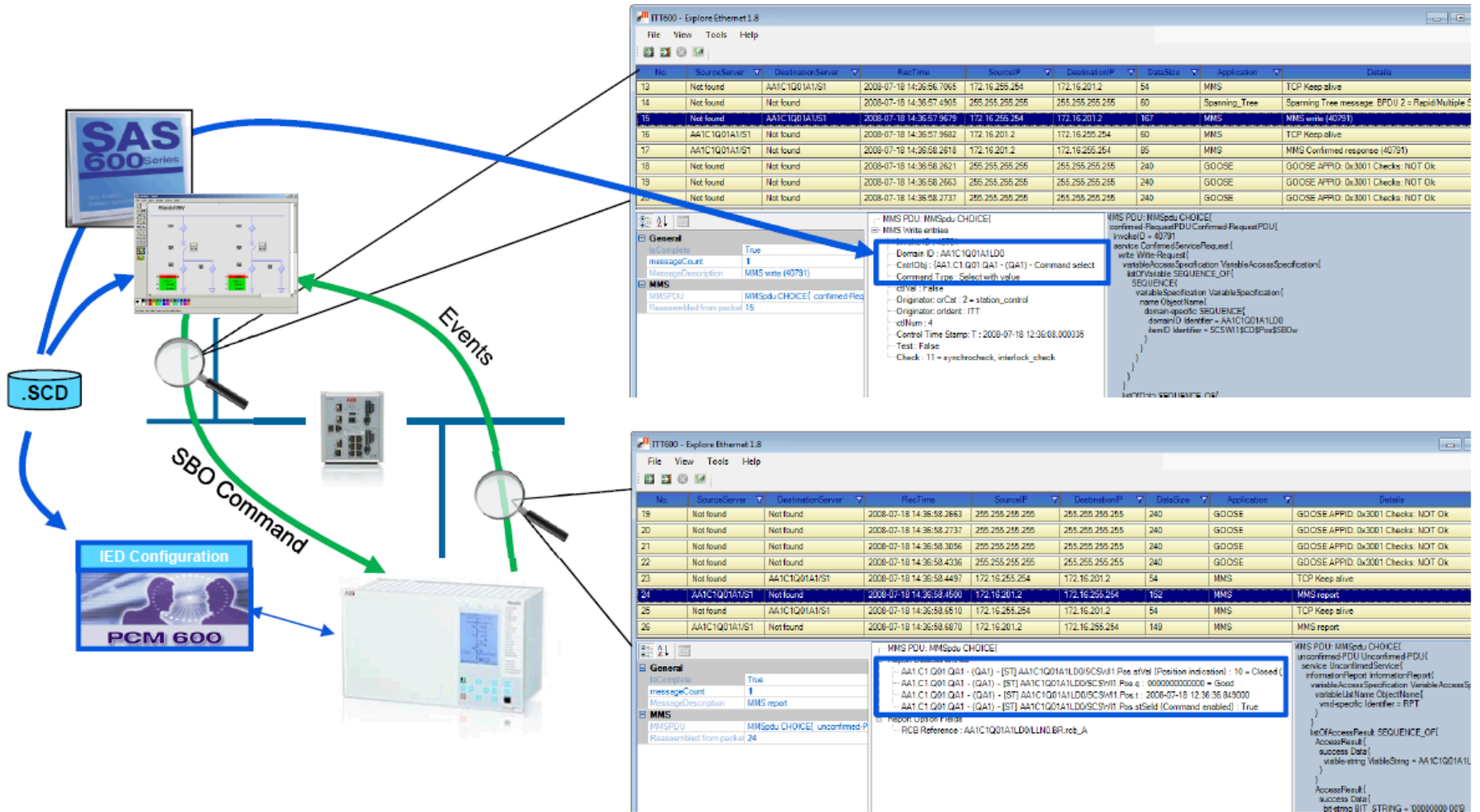
Inspect SA Ethernet traffic



- Identify the root cause of application problems
 - Updated value not shown in the SCADA?
 - Is it sent by the IED?
 - Is it a configuration issue in the SCADA?
- Analyze Substation Automation related network traffic
 - Concentrate on the application and not the communication protocol details
 - Unique built in consistency checks

ITT600 SA Explorer

Inspect SA Ethernet traffic with Explore Ethernet



Inspect SA Ethernet traffic MMS Report in Wireshark

Sample_MMS_Cmds_Reports_GOOSE.acp [Wireshark 1.6.7 (SVN Rev 41973 from /trunk-1.6)]

Filter: Expression... Clear Apply

No.	Time	Source	Destination	Protocol	Length	Info
17	6.771830	172.16.201.2	172.16.255.254	MMS	80	confirmed-response+PDU
18	6.771898	AbbIndus_06:30:fe	Iec-Tc57_01:00:00	GOOSE	240	
19	6.776129	AbbIndus_06:30:fe	Iec-Tc57_01:00:00	GOOSE	240	
20	6.783461	AbbIndus_06:30:fe	Iec-Tc57_01:00:00	GOOSE	240	
21	6.815415	AbbIndus_06:30:fe	Iec-Tc57_01:00:00	GOOSE	240	
22	6.943423	AbbIndus_06:30:fe	Iec-Tc57_01:00:00	GOOSE	240	
23	6.959467	172.16.255.254	172.16.201.2	TCP	54	gds-db > iso-tsap [ACK] Seq=114 Ack=33 win=65409 Len=0
24	6.959776	172.16.201.2	172.16.255.254	MMS	152	unconfirmed-PDU
25	6.160827	172.16.255.254	172.16.201.2	TCP	54	gds-db > iso-tsap [ACK] Seq=114 Ack=131 win=65311 Len=0
26	7.196822	172.16.201.2	172.16.255.254	MMS	149	unconfirmed-PDU
27	7.257970	0a:bb:fe:10:c9:06	Iec-Tc57_01:00:00	GOOSE	245	

Frame 24: 152 bytes on wire (1216 bits), 152 bytes captured (1216 bits) on interface 0

- Ethernet II, Src: AbbIndus_06:30:fe (00:00:23:06:30:fe), Dst: Intel
- Internet Protocol Version 4, Src: 172.16.201.2 (172.16.201.2), Dst: 172.16.255.254
- Transmission Control Protocol, Src Port: iso-tsap (102), Dst Port: iso-tsap (102)
- TPKT, Version: 3, Length: 98
- ISO 8073 COTP Connection-Oriented Transport Protocol
- ISO 8327-1 OSI Session Protocol
- ISO 8327-1 OSI Session Protocol
- ISO 8823 OSI Presentation Protocol
- MMS
 - unconfirmed-PDU
 - unconfirmedService: informationReport (0)
 - informationReport
 - variableAccessSpecification: variableListName (1)
 - MicroAccessResult: 4 items
 - AccessResult: success (1)
 - success: visible-string (10)
 - visible-string: AA1C1Q01ALLD0/LLN0\$BR\$rcb_A
 - AccessResult: success (1)
 - success: bit-string (4)
 - Padding: 6
 - bit-string: 0000
 - AccessResult: success (1)
 - success: bit-string (4)
 - Padding: 1
 - bit-string: 8000000
 - AccessResult: success (1)
 - success: structure (2)
 - structure: 4 items
 - Data: bit-string (4)
 - Padding: 6
 - bit-string: 80
 - Data: bit-string (4)
 - Padding: 3
 - bit-string: 0000
 - Data: utc-time (17)
 - utc-time: Jul 18, 2008 12:36:36.849000036 UTC
 - Data: boolean (3)
 - boolean: True

Pure Protocol Analysis

- No semantics
- For experts only

Inspect SA Ethernet traffic

See the difference in Explore Ethernet

The screenshot displays the ITT600 - Explore Ethernet 1.8 interface. The main window shows a table of network traffic with columns for No., SourceServer, DestinationServer, RecTime, SourceIP, DestinationIP, SourceMAC, DestinationMAC, DataSize, Application, Details, Network, and Transport. Row 24 is highlighted, showing an MMS report from source IP 172.16.201.2 to destination IP 172.16.255.254.

The detailed view for row 24 shows the following information:

- General:** IsComplete: True, messageCount: 1, MessageDescription: MMS report
- MMS:** MMSpdu: MMSpdu CHOICE{ unconfirmed-PDU, Reassembled from packets: 24
- Report Data Set entries:**
 - AA1.C1.Q01.QA1 - (QA1) - [ST] AA1C1Q01A1LD0/SCSW1.Pos.stVal (Position indication) : 10 = Closed (on)
 - AA1.C1.Q01.QA1 - (QA1) - [ST] AA1C1Q01A1LD0/SCSW1.Pos.q : 00000000000000 = Good
 - AA1.C1.Q01.QA1 - (QA1) - [ST] AA1C1Q01A1LD0/SCSW1.Pos.t : 2008-07-18 12:36:36.849000
 - AA1.C1.Q01.QA1 - (QA1) - [ST] AA1C1Q01A1LD0/SCSW1.Pos.stSeld (Command enabled) : True
- Report Option Fields:** RCB Reference: AA1C1Q01A1LD0/LLN0.BR.rcb_A

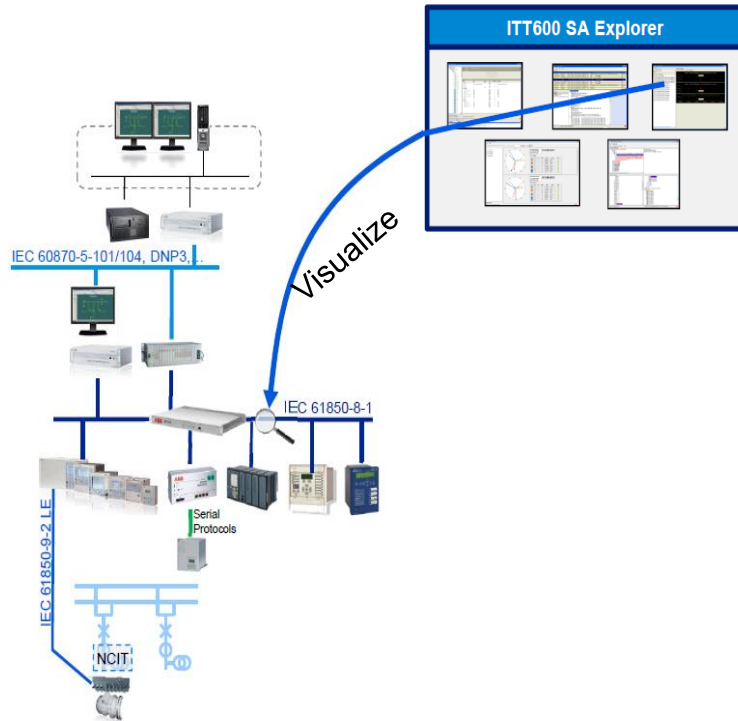
The right-hand pane shows the raw MMS PDU structure in XML format, including fields like `variableAccessSpecification`, `variableListName`, and `listOfAccessResult`.

Three callout boxes provide context for the data:

- Substation Section Info Station / Voltage Level / Bay...** (points to the RCB Reference field)
- Automatic mapping of the values to the IEC 61850 attributes** (points to the Report Data Set entries)
- Values with a meaning and description text from SCD** (points to the Report Data Set entries)

ITT600 SA Explorer

Analyze distributed applications



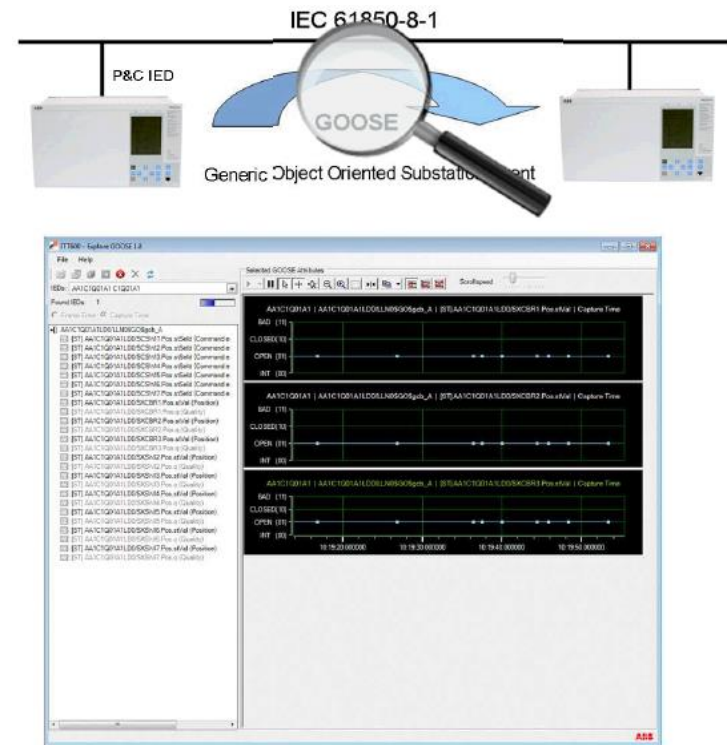
- Analyze distributed applications using GOOSE
 - With or without SCD - display any GOOSE message graphically
 - Debug distributed applications using GOOSE communications
 - Check time & performance
 - Online and offline
 - Visualize correlations

ITT600 SA Explorer

Analyze applications with ITT600 – Explore GOOSE

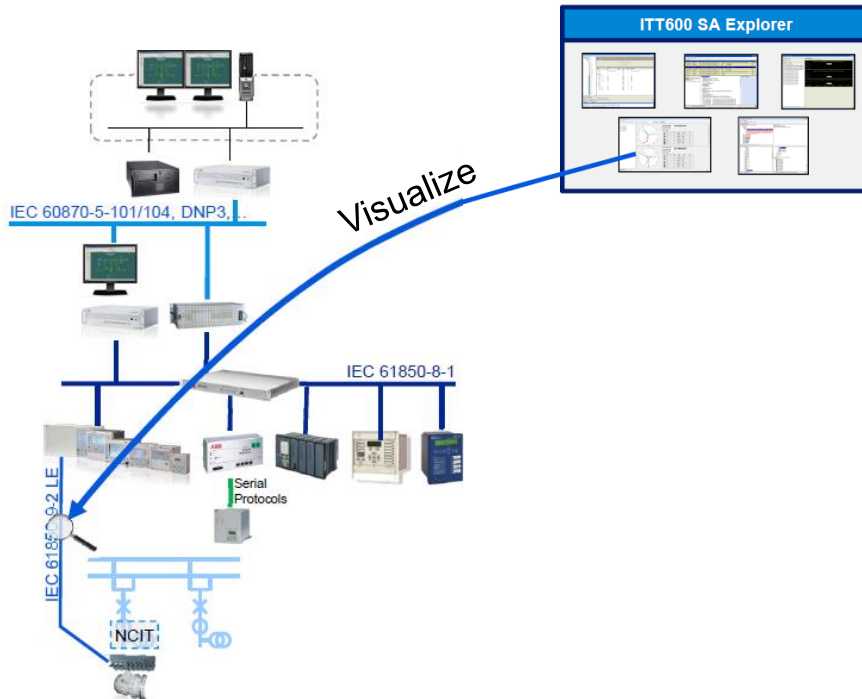


Multimeter or oscilloscope for conventional hard wired solutions



ITT600 – Explore GOOSE

ITT600 SA Explorer Visualize Process Bus



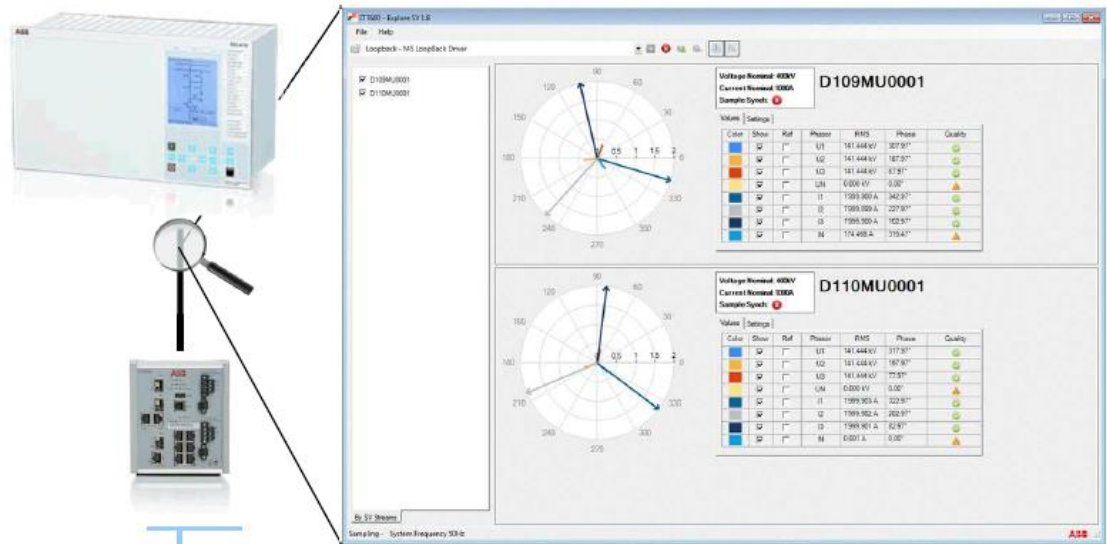
- Visualize your analog process bus values.
 - Display up to two IEC 61850 9-2 (LE) streams simultaneously in a phasor display
 - Compare phase shift between two streams
 - Analyze waveforms in offline mode
 - Log process bus data into a file

ITT600 SA Explorer

Visualize Process Bus with ITT600 – Explore SV



Conventional



IEC61850-9-2 (LE) tools on a PC

ITT600 SA Explorer

Features and customer benefits

- IEC 61850 troubleshooting made easy
 - Isolating the root cause of the problem.
 - Significantly reduce overall testing and commissioning time
- Ensure system consistency
 - Make sure all individual components of the system are configured with the same revisions
 - Do not start testing if different versions are used.
- Standalone IED testing
 - Individually test components before they are connected together
 - Pre-test individual work



ITT600 SA Explorer

Features and customer benefits cont'd



- IEC 61850 intelligence
 - Translating the complex communication protocols into substation automation system terms
 - Anybody can use the same tool regardless of their level of knowledge of IEC 61850 communication.
- IEC 61850 Visualization
 - Show GOOSE and SV graphically
 - Focus on the application behavior not protocols
- One tool not many
 - The ITT 600 SA Explorer toolbox provides everything you need to effectively troubleshoot your SA applications.
 - No reason to have several individual tools with own licenses and updates

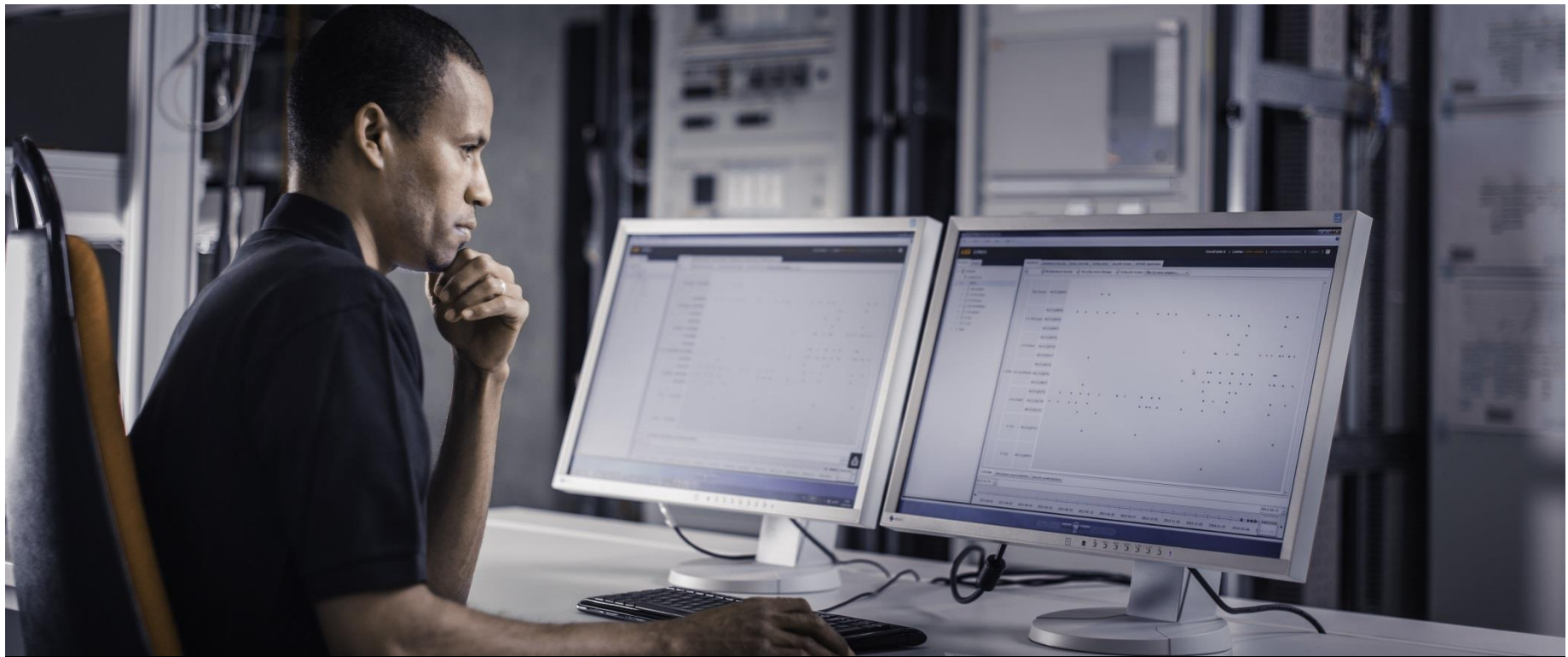


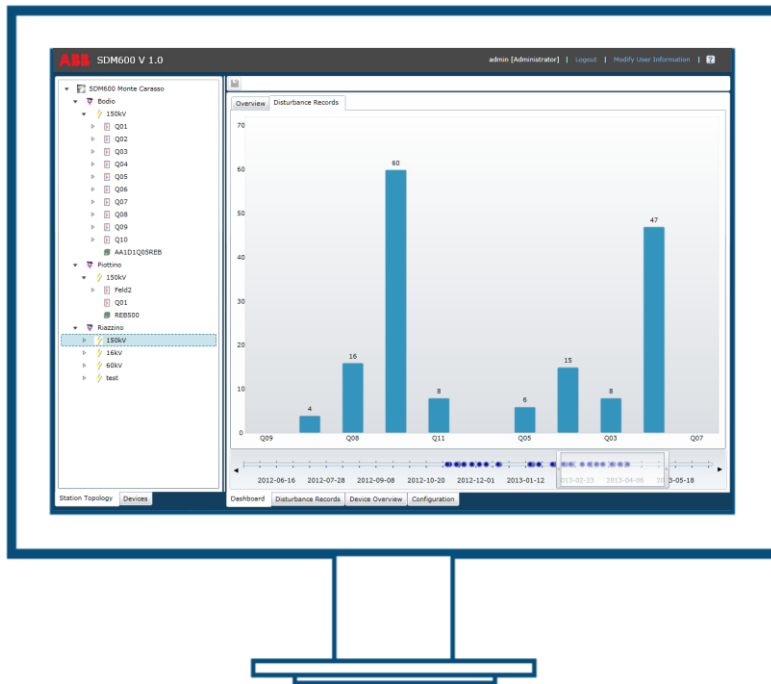
ABB Protective Relay School Webinar Series

System Data Manager SDM600

See the unseen from a new perspective

System Data Manager – SDM600

See the unseen from a new perspective



A comprehensive software solution for automatic management of service and cyber security relevant data across your substations

System Data Manager – SDM600

Product overview

Data Management

Disturbance
Recorder Data
Management

Disturbance
Recorder Data
Evaluation

Automatically collect, store and provide evaluation for disturbance recorder files.

Cyber Security Management

Central User Account
Management

Central Cyber
Security Logging

Provide centralized User Account Management and security logging

Service and Maintenance

Tracking IED
Software Versions

Tracking IED
Configuration
Revisions

Documentation of Firmware and configuration revisions of the supervised IEC 61850 IEDs

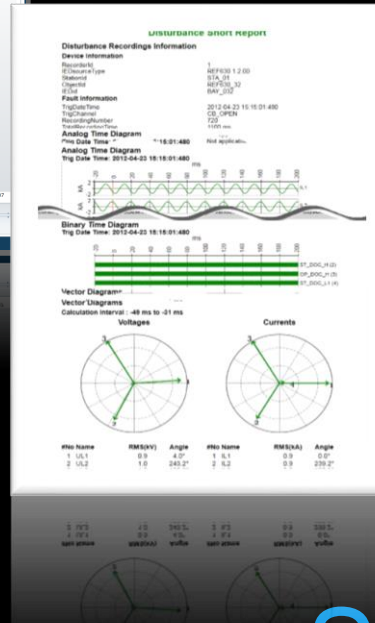
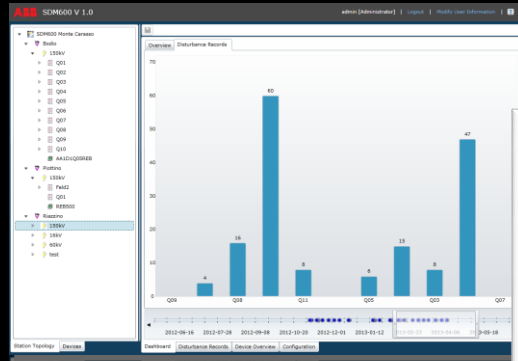
System Data Manager – SDM600

Application areas



Optimal product functionalities for:

- Substation Automation
- Transmission and distribution management

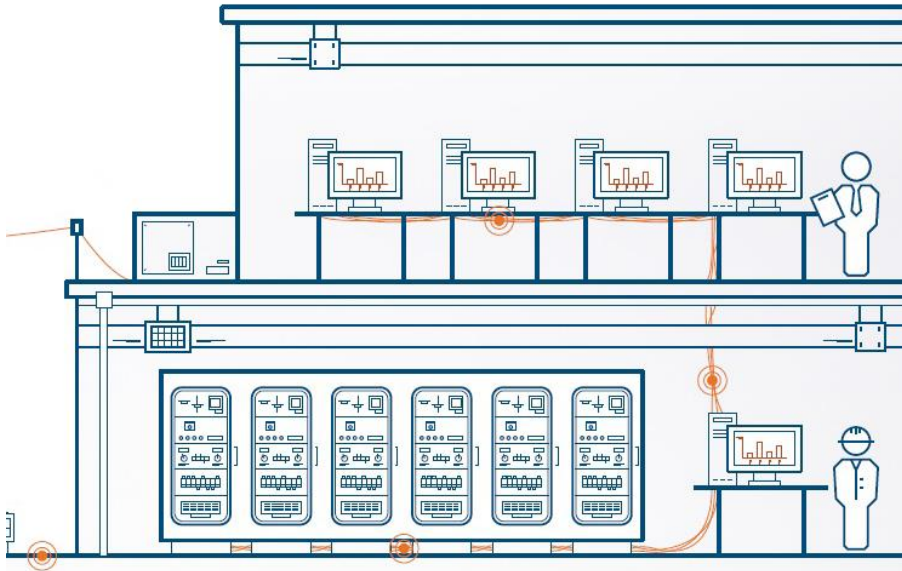


System Data Manager – SDM600 Disturbance recorder data



System Data Manager – SDM600

Management of disturbance recorder data



Independent and automatic

- Automatic upload of disturbance recorder (DR) files from IEDs
- Supported protocols: IEC 61850 (MMS), FTP and Windows File System access
- Polling the IEDs for new files
- No IEC 61850 engineering required
- No Interaction with an existing SAS system
- Seamless integration also into existing substation automation system
- Visualization of DR Data

System Data Manager – SDM600

Disturbance recorder data management features

Collect

- Automatic IED vendor independent DR file collector for
- IEC 61850-8-1 (MMS)
- FTP
- Windows File System

Analyze

- Short Report for any DR file
- Embedded ABB WaveWin application for DR Analysis
- Alternative application can be configured by the user

Notify

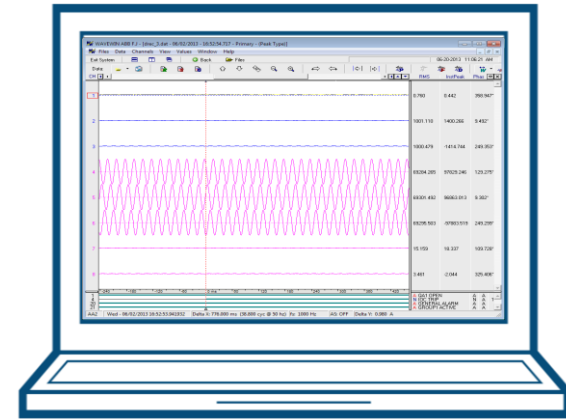
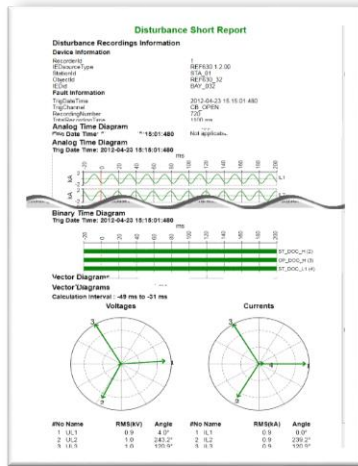
- Send DR info and Short Report via email

Interface

- Export DR files to file system for integration into another system

System Data Manager – SDM600

Disturbance recorder data visualization



Short report

- For any uploaded DR file
- Fast evaluation of disturbances
- PDF format - easy to annotate, email etc.

Evaluation software

- For any uploaded DR file
- Detailed analysis using integrated ABB WaveWin application.

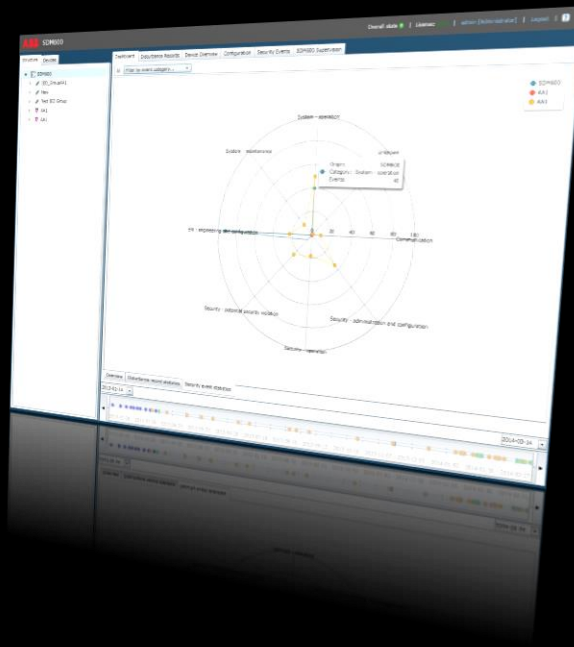


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System Data Manager – SDM600

Cyber security



System Data Manager – SDM600

The cyber security process

Protect



Is my system protected against an attack?

Active protection includes physical security, virus scan, etc.



Manage



Can I sustain the security of my system?

SDM600 centrally manages your user accounts

Monitor

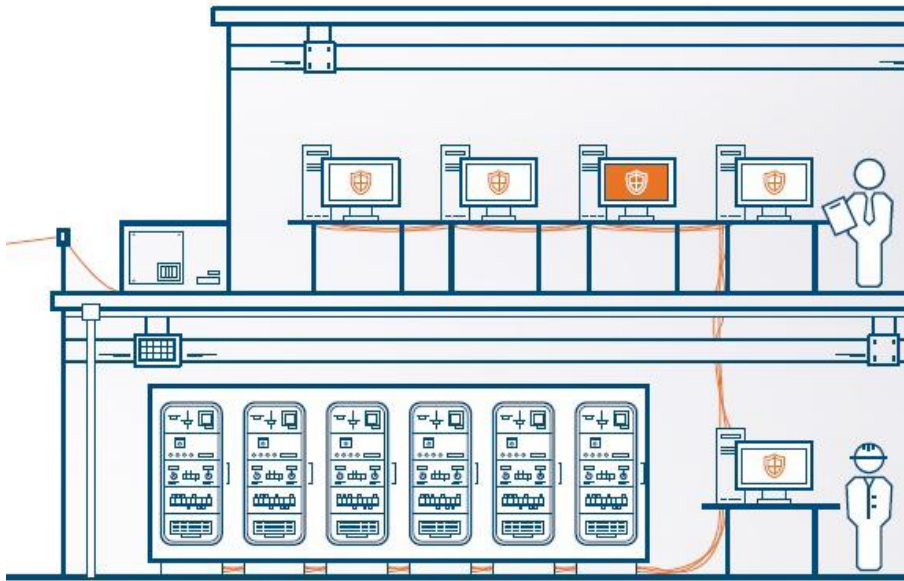


Do I know what happens on my system?

SDM600 monitors the security related events of the system

System Data Manager – SDM600

System wide cyber security event logging

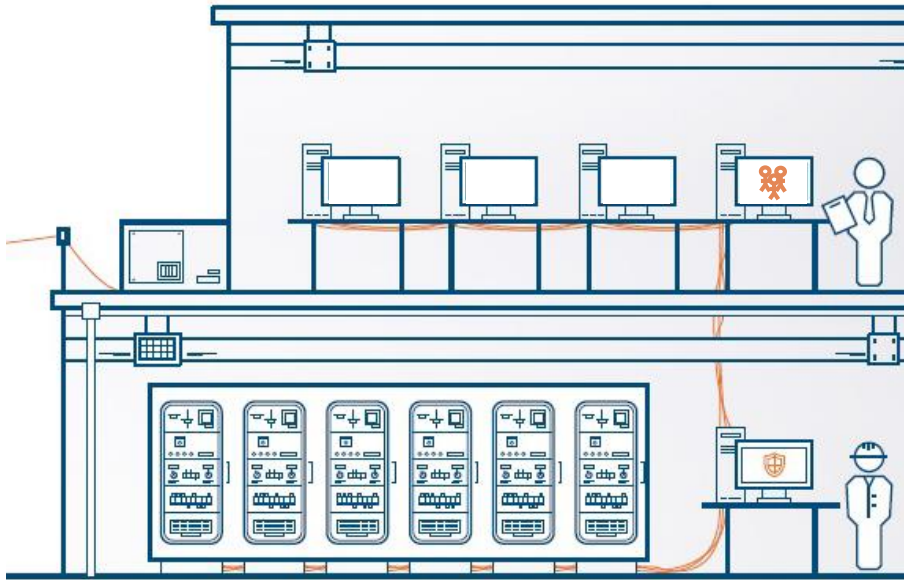


Monitor your system

- Securely store all user activities and other security events from IEDs or system level components
- Integration of devices using Syslog protocol (UDP and TCP)
- Built in visualization and reporting
- Integrate SDM600 into an existing event logging system

System Data Manager – SDM600

Central user account management



Manage your users

- System wide user management
- Role based access control (RBAC) according IEC 62351-8
- Enforce password policies
- For Windows PCs, MicroSCADA Pro and RADIUS or LDAP enabled devices.
- In accordance with NERC CIP and BDEW whitepaper requirements

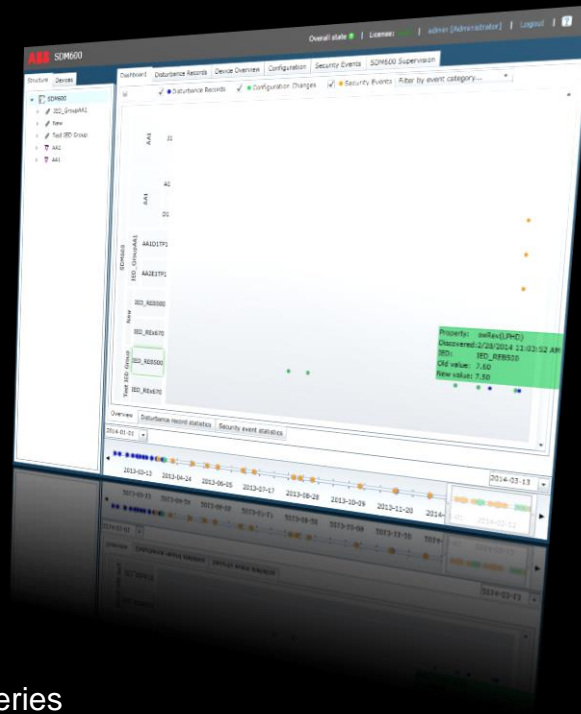


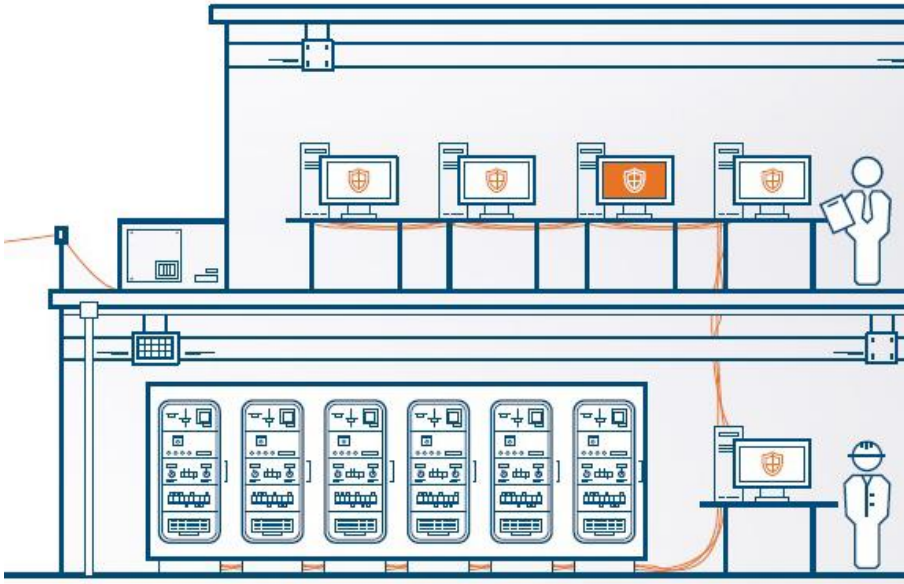
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System Data Manager – SDM600 Service data



System Data Manager – SDM600

Track service relevant data



Collect service data

- Reading of service relevant data from supervised IEC 61850 IEDs
- Monitor deployed IED software versions and serial numbers*
- Track IED firmware versions
- Track IEC 61850 configuration revision information

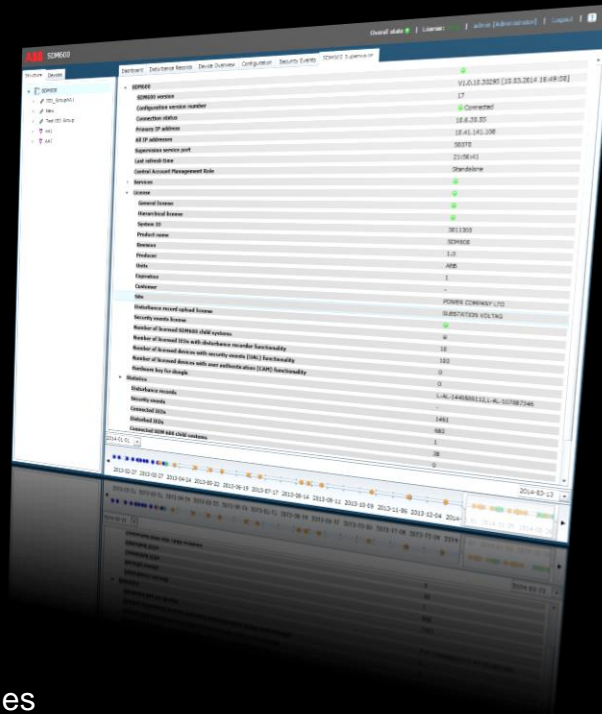


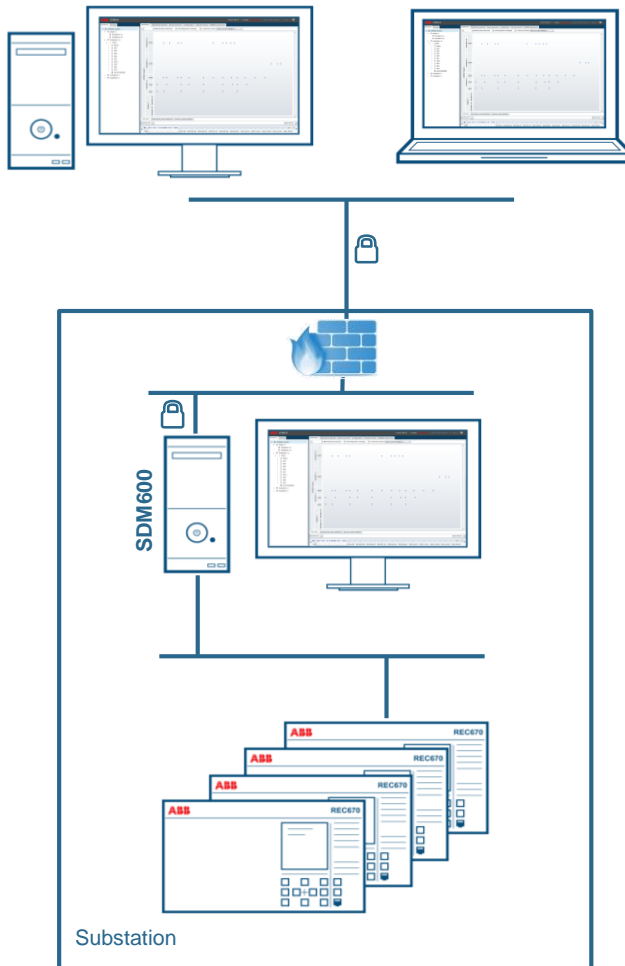
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System Data Manager – SDM600 Technical solution



System Data Manager – SDM600

Web based application



Web based client server application

- Installation of SDM600 Server
- User Interface via Web browser

Multiple users can access SDM600 at the same time

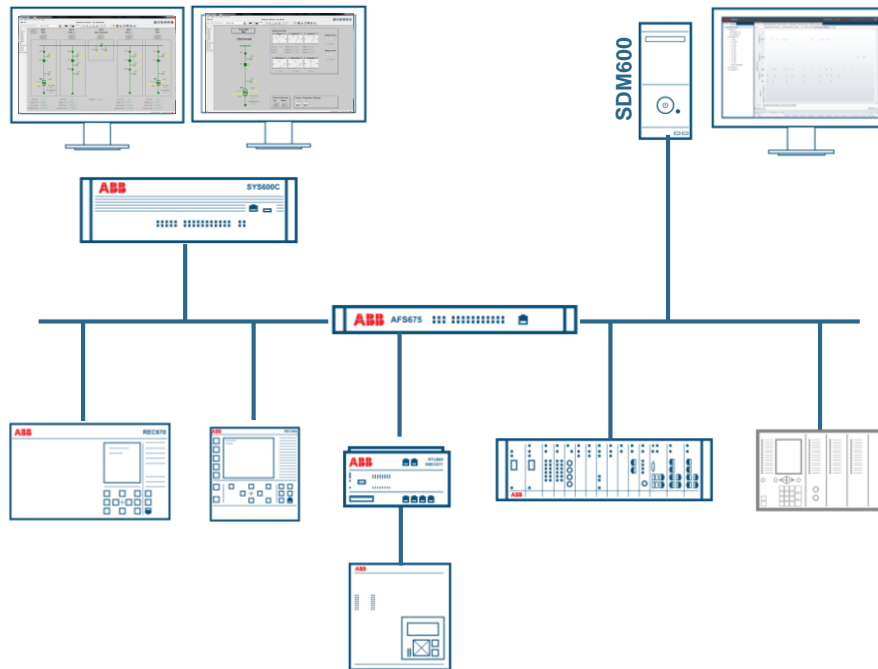
Encrypted communication between web browser and SDM600 server

System Data Manager – SDM600

Standalone installation within a station

Station
Level

Bay/Feeder
Level



No interaction with
operational SAS

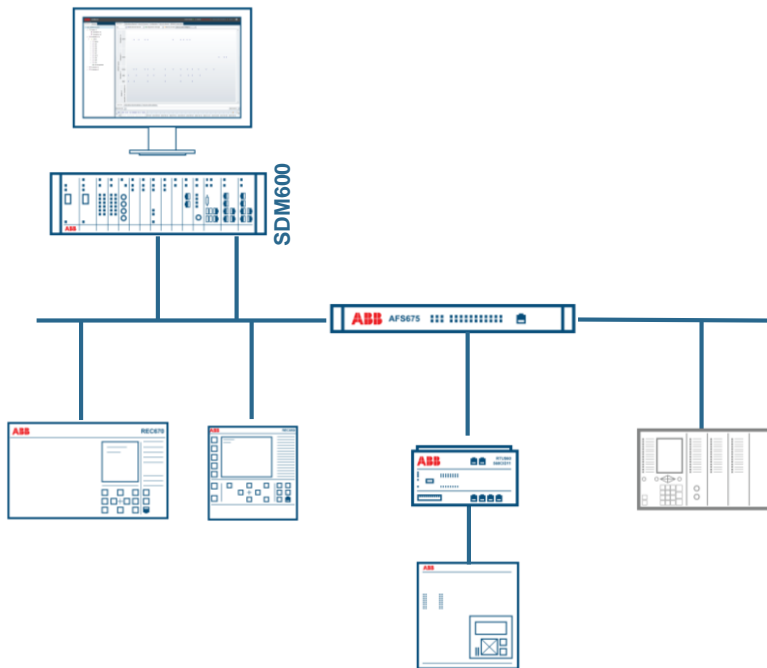
Direct access to IEDs

System Data Manager – SDM600

Installation within RTU500 series based systems

Station
Level

Bay/Feeder
Level



Available on the RTU560
PC board 560HMR01
running Windows
Embedded Standard 7

SDM600 functionality for
RTU560 based Solutions*

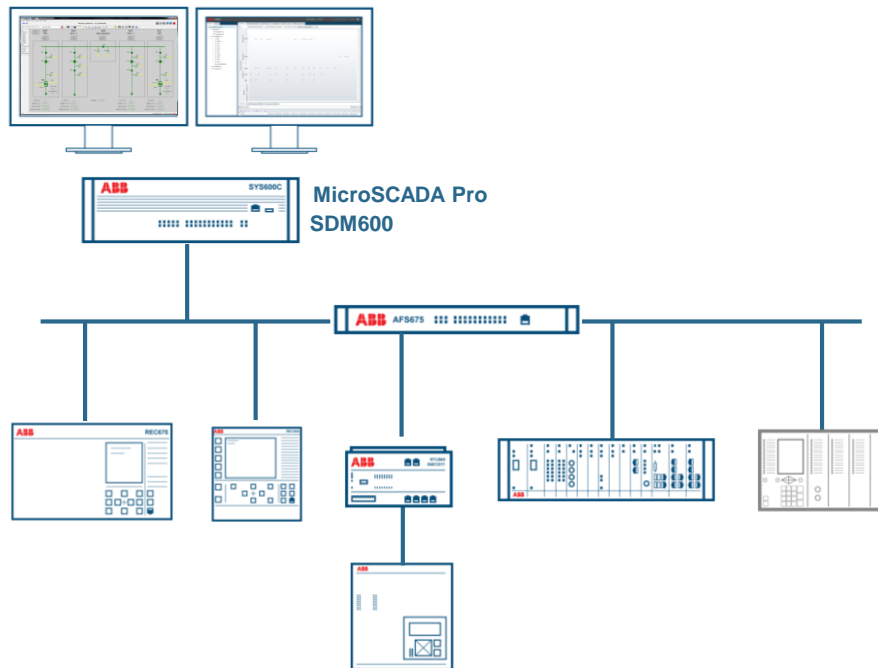
Direct access from
560HMR01 to IEDs
required.

System Data Manager – SDM600

Side by side installation with MicroSCADA Pro

Station
Level

Bay/Feeder
Level



Running on
MicroSCADA Pro
SYS600 or SYS600C
installations

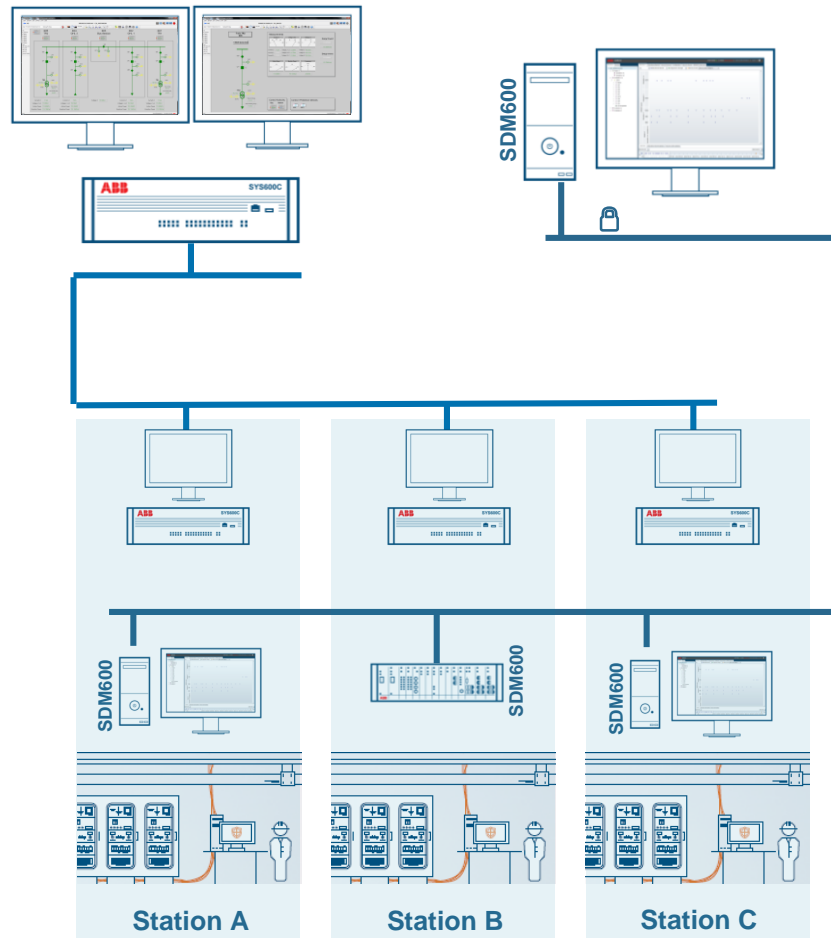
Shared hardware
resources

System Data Manager – SDM600

Hierarchical installation

Upper Level

Station Level



Consolidate data from several SDM600 installations at a central point

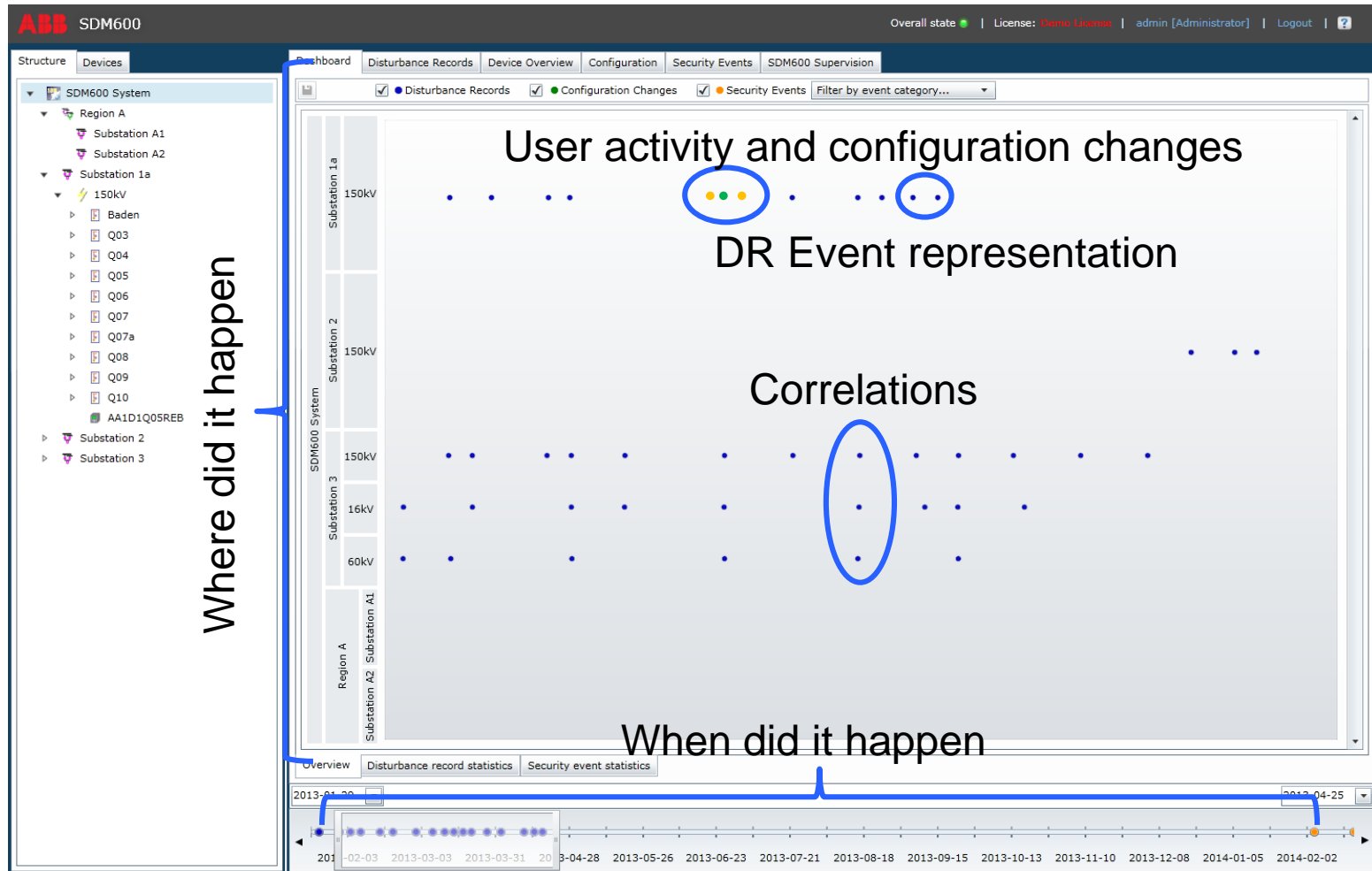
Clear overview

Central data and user management

Encrypted communication

System Data Manager – SDM600

User interface



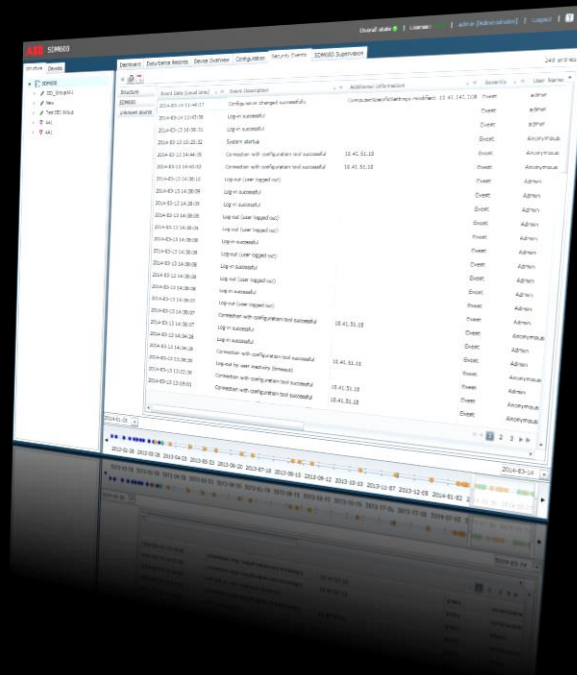


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System Data Manager – SDM600 Benefits and summary



System Data Manager – SDM600

Your benefits



- Vendor independent
 - Based on international standards (IEC 61850, IEC 62351)
 - Every compliant device is supported
- Efficiency improvement in disturbance recorder management
 - Automatic DR file collection, representation, and evaluation
- Monitoring IEC 61850 configuration changes
 - Tracking and visualization of IED configuration and HW information parameters
- Efficient monitoring of user activity and cyber security events
 - System wide security event logging

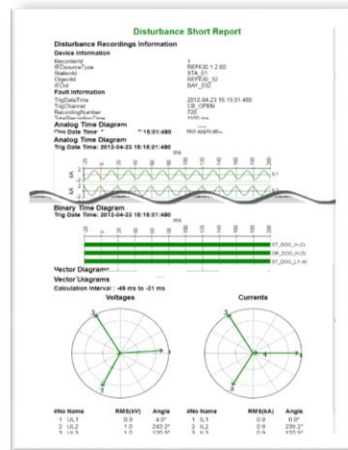
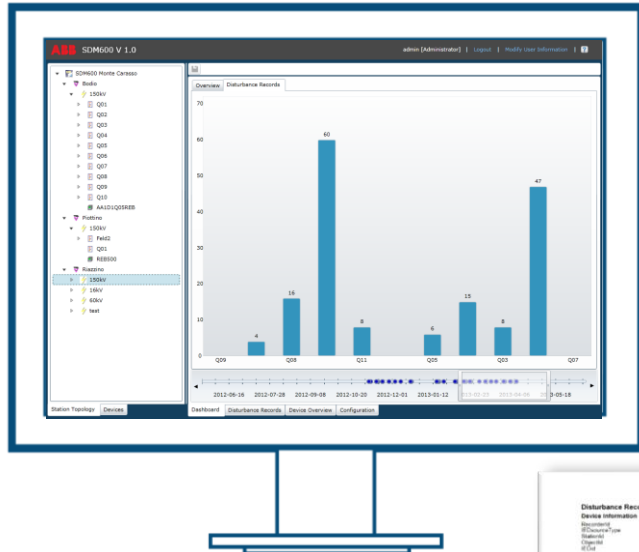
System Data Manager – SDM600

Your benefits



- Optimized user management
 - Coherent users in the SA system
 - System wide role based user account management
- Automatic and intuitive graphical event correlation
 - Unique visualization of events in the dashboard
- Minimal configuration effort
 - Re-use of already engineered data by IEC 61850 configuration file import
- Flexible and remotely accessible system architecture
 - Hierarchical SDM600 using lean, web based technology
- Scalable product
 - Functionality controlled only with the license key

System Data Manager – SDM600 Summary



Features

- Automatic disturbance recorder file handling & report creation
- Centralized user account management and security logging for station and bay level products
- Monitor service data from IEDs
- Scalable system with hierarchical data collection
- Minimal configuration effort
- Lean, web-based technology

Thank you for your participation

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