

INFO TECH

IEC 61850 Software Library

with testing and simulation tools

Product presentation

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IEC 61850 communication standard

□ **The gossip says:**

- Terribly complex collection of models and protocols...
- Huge incomprehensive IEC documentation...
- Costly implementation...
- Expensive engineering...



□ **The truth is:**

- Easy to understand and use
- Complex only in the core implementation (like many modern technologies including Internet, GSM, GPS)
- There are ready solutions for product vendors and end-users:
 - source code and binary libraries with references from numerous deployments in products,
 - devices and systems with verified conformance to the standard,
 - user-friendly testing tools,
 - system configuration tools (though mainly vendor specific),
 - comprehensive training materials describing the essentials of the standard with easy to use training toolsets.
- **INFO TECH business in just for this truth.**



INFO TECH solutions for IEC 61850

- **INFO TECH IEC61850 Software Library:**
 - Designed in 2006 by INFO TECH based on Edition 1
 - Updates following tissue.iec61850.com and Edition 2
 - Updates following Am.1 Ed.2 (**Edition 2.1**)
 - Licenses offered to source code (for all platforms) and to binary interfacing components (for MS Windows and Linux based platforms)
 - First licensed implementations of server and client interfaces in substation automation products from the beginning of 2007
 - **As of March 2026, licensed to 59 companies** from 16 countries of Europe, Asia, North America
 - Applied by INFO TECH to build testing and simulation tools

Awards granted to INFO TECH IEC 61850 Software Library

- Awarded on the 9th of November 2015 by the quality mark „**LAUR EKSPERTA**” (“**MERIT OF EXPERT**”) and the special prize „**MEDAL NOWOCZESNOSCI**” (“**MEDAL OF INNOVATION**”) during the official gala in the Residence Belveder belonging to the President of the Republic of Poland



- Awarded on the 12th of September 2017 by the **Honorable Commendation of the International Power Industry Fair ENERGETAB 2017**

References

Our customers – licensees are e.g.

- VAMP Ltd. from Finland (now in Schneider Electric)
- Littelfuse, Inc. from USA/Canada
- Ashida Electronics Ptv. Ltd. from India
- Valmet Automation from Finland
- NSE AG from Switzerland
- Camille Bauer Metrawatt from Switzerland
- Elspec Ltd. from Israel
- Netcontrol Oy from Finland
- RTDS Technologies Inc. from Canada

and in Poland e.g.:

- Elester-PKP Sp. z o.o. (controller awarded on EXPOPOWER 2017)
- LUMEL S.A. (controller awarded on ENERGETAB 2018)
- Elektrometal Energetyka S.A. (controller awarded on ENERGETAB 2018)
- ABB Sp. z o.o.
- Computers & Control Sp. z o.o.
- Instytut Energetyki

Position on the global market

- It is hardly possible to assess the market share of protection relays and controllers with the IEC 61850 communication interfaces implemented using INFO TECH IEC61850 Software Library, but a publicly available reference is the list of products with the IEC 61850 conformance confirmed by the UCA International Users Group:
<https://redmine.ucaiug.org/projects/iec-61850-certificate/issues>
- As of March 2026 the products with the IEC 61850 interface implemented using our Library make over **3% of this global list.**
- Over 38 implementations based on INFO TECH library have been successfully tested in the accredited conformance testing labs of DNV (former KEMA), TÜV SÜD, TÜV China, Keptop, Nari Relays, Schneider Electric.

INFO TECH solutions for IEC 61850

- INFO TECH IEC61850 testing and simulation tools:
 - **61850 Avenue toolset** with IEC 61850 client, 61850 Relay Simulator, GOOSE toolset, SV toolset, File Transfer
 - **61850 SCL Runner** – simulator of server devices based on their configuration description files
 - **61850 ICD Editor** – for creating/modifying ICD/CID/IID files
 - **61850 GOOSE System Viewer** – graphical tool for GOOSE transmission supervision in the systems
 - 61850 SCD Builder – system configuration tool
 - As of March 2026 the licenses to the above software tools have been sold to over 130 companies world-wide.

- INFO TECH offers also IEC 61850 training courses:
 - for end users and integrators (basic and advanced level)
 - for companies licensing our software (implementation-oriented)
 - As of March 2026 over 120 companies attended our trainings.

INFO TECH

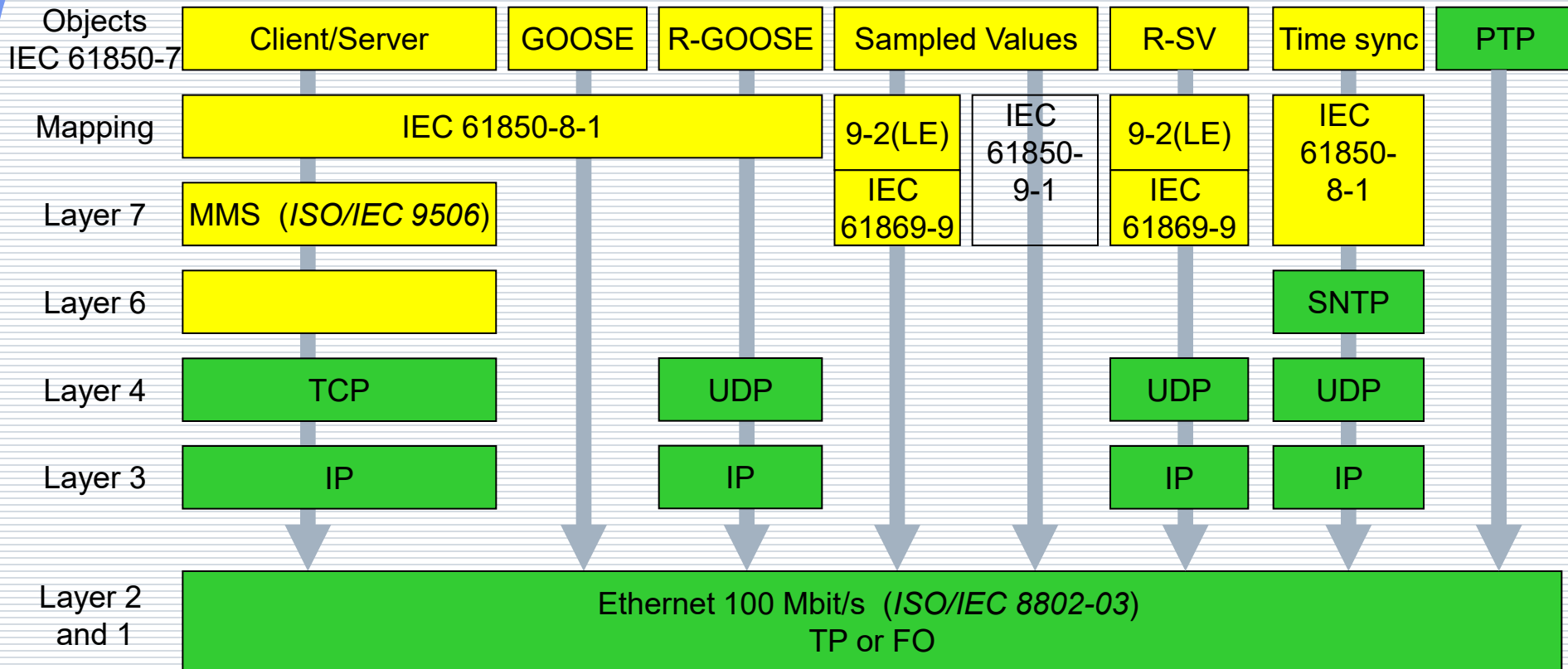
IEC61850 Software Library

- **Client part**
 - Applicable to data acquisition and control systems and substation gateways.
 - Applicable to testing and simulation tools.
- **Server part**
 - Applicable to bay level devices (protection relays, bay controllers, monitoring units etc.).
 - Applicable to testing and simulation tools.
- **GOOSE part (optional extension to Server part)**
 - Applicable to bay level devices (protection relays, bay controllers, monitoring units etc.)
 - Applicable to testing and simulation tools.
- **Sampled Values (optional extension to Server part)**
 - Applicable to process bus devices (merging units and protection relays), based on so-called **9-2LE**.
 - Applicable to testing and simulation tools.

Supported extensions

- **IEC 62351-3 – data and communications security**
 - For encrypted MMS communication (client/server).
- **IEC 62351-4 – data and communications security**
 - For authenticated MMS communication (client/server).
- **IEC 62351-6 – data and communications security**
 - For secure R-GOOSE and R-SV communication.
- **IEC 61869-9 – Sampled Values communications**
 - New specification for Process Bus.

INFO TECH Library – supplied layers and required software platform



Client part - characteristics

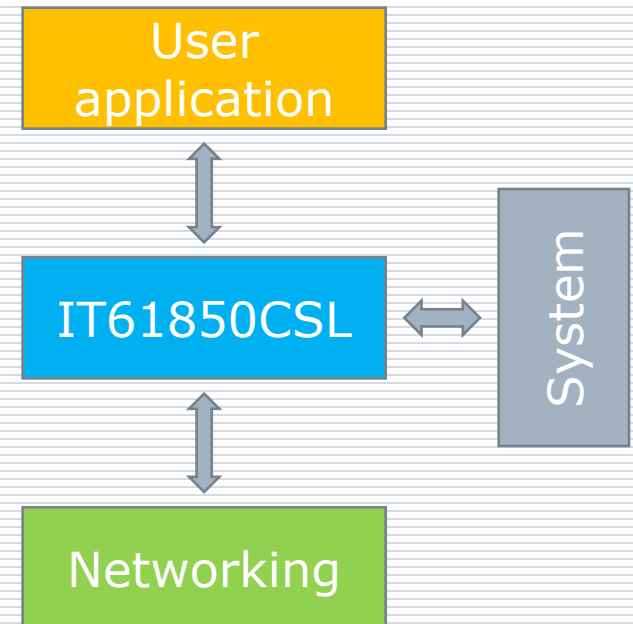
- Implemented in C++
 - API in C++ for the library in source code
 - API in C++ and C# for the library in compiled version (binary)
- Portable to common OS, e.g.
 - MS Windows
 - Linux
- Ready to use build scripts
 - MS Visual Studio family
 - CMake and gcc (native build system or cross-compilation)
- Documentation in source code
 - Help, Intellisense
- Access to data (server model replica)
 - Abstract communication service layer
 - Direct access to MMS objects and lower layers (source code)

Client part - supported features

- Connection establishing and closing
- Learning server IED data model
 - By exploring in on-line mode (after connecting)
 - By using SCL files in off-line mode (before connecting)
- Reading and writing data
- Reading and writing datasets with management
- Control services
- Reporting (buffered and unbuffered)
- Setting groups and parameters
- Access to control blocks for GOOSE and SV
- File transfer

Client part - portability

- ❑ Library is ready to use for Linux and MS Windows operating systems
- ❑ C/C++ memory management
- ❑ All non-portable services are indirect
 - Multitasking
 - Networking
 - Time and clock services
 - Non-standard C++/C runtime library
 - Useful utilities
- ❑ Only common basic types in use



Server part - characteristics

- ❑ Implemented in ANSI C
- ❑ Small footprint
- ❑ Short startup time
- ❑ Easy to use (only 3 API functions need to be implemented)
- ❑ Ready to use for Linux and Windows environment
- ❑ Easily portable to other OS
- ❑ Optional extensions to Server part:
 - **GOOSE part** - services implementing publisher and subscriber functionality of horizontal communication
 - **Sampled Values part** – for Process Bus communication, services implementing publisher and subscriber functionality for merging unit and signal processing unit

Server part – implemented abstract service layer over MMS

- Connection establishing and closing
- Read/write data access
- Buffered and unbuffered reporting
- Preconfigured and dynamic datasets (persistent and non-persistent)
- Control services (one and two step, with normal and with enhanced security)
- Setting groups and parameters
- Service tracking
- File transfer
- GOOSE (optional part)
- Sampled Values (optional part)

Server part – application data model

Supported two options of creating server data model:

- Option 1: static data model
 - Data model and device application to IEC 61850 mapping defined in spreadsheet files.
 - Automated generation of C-code and ICD file from spreadsheet files.
 - Compilation time definition of the data model.
 - Possibility of removing unused LNs at the server start-up.
- Option 2: dynamic data model
 - Server data structure created in run-time from the supplied ICD/CID file.
 - Application to IEC 61850 mapping is defined in a separate XML file.
 - This option is available for devices with development environment supporting C++ compiler and libxml2 library (e.g. Linux, Windows).

Server part – portability

- The Library is ready to use for Linux and MS Windows operating systems.
- The Library was successfully ported to Windows CE, MQX4.0, NetOS7.0 and several proprietary RTOS'es.
- To port the Library to other OS the following functionality has to be implemented or modified:
 - Access to TCP/IP stack
 - Ethernet chip access (for GOOSE and SV only) – in Linux and Windows the Pcap library is used for that
 - Access to system clock (for time-stamping)
 - Access to local file system (if file transfer services will be used)
 - Access to non-volatile memory for storing control block parameters and persistent dynamic dataset contents

Proof of conformance

- **20 devices** with IEC 61850 server+GOOSE interfaces based on INFO TECH library passed conformance tests to receive **UCA conformance certificates for Edition 1**
- **15 devices** with IEC 61850 server+GOOSE interfaces based on INFO TECH library passed conformance tests to receive **UCA conformance certificate for Edition 2**
- **3 devices** with IEC 61850 client interfaces based on INFO TECH library passed conformance tests to receive **UCA conformance certificate for Edition 2**
- The following UCA accredited laboratories tested implementations based on INFO TECH library:
 - DNV GL from the Netherlands (former KEMA),
 - TÜV SÜD from Germany,
 - TÜV SÜD from China,
 - Central Power Research Institute of India (CPRI),
 - Ketop Lab from China,
 - Schneider Electric corporate test laboratory,
 - Nari Relays laboratory from China.

INFO TECH IEC 61850 testing and simulation tools – built on our Library



61850 Avenue: Client tool for testing server devices (e.g. protection relays)

Easy to use.

Able to connect and browse server devices.

Able to import SCL file and connect to the described server device.

Allows to read and write data values, configure control blocks, receive reports with data model update, perform control commands.

Optional support of secure client-server communication (TLS & ACSE).

The screenshot displays the 61850 Avenue software interface. The main window is titled "61850 Avenue - New IEC-61850 server [127.0.0.1]". It features a menu bar (Server, Connection, Window, Help) and a toolbar. The interface is divided into several panes:

- Servers:** A tree view showing the connection to "New IEC-61850 server [127.0.0.1]". Below it, a list of server devices is shown: VAMP 211 [192.168.0.211], Demo [127.0.0.1], V 218 [192.168.0.218], TEMPLATE [172.19.21.88], and JYLJ6.2A1 [110.121.21.12].
- Main:** A table with the following data:

Name	New IEC-61850 server
Address	127.0.0.1
Port	102
- Remote OSI Parameters:** A table with the following data:

Parameter	Value
AE Qualifier	12
Application ID	1.1.1.999.1
OSI Presentation Selector	00000001
OSI Session Selector	0001
- Data Model Tree:** A tree view showing the data model structure for "New IEC-61850 server [127.0.0.1]". The tree includes nodes for LN (LN0, LN1, LN2, LN3), D (D1, D2, D3, D4, D5, D6, D7, D8, D9, D10), and Obj (Obj1, Obj2, Obj3).
- Data Table:** A table showing the current state of the data model. The table has columns for Name, FC, and Value.

Name	FC	Value
Mod		{stVal=on, q=000000000000 (Good, Process), t=2018-...
Beh		{stVal=on, q=000000000000 (Good, Process), t=2018-...
Health		{stVal=Ok, q=000000000000 (Good, Process), t=2018-...
NamPlt		{vendor=INFO TECH, swRev=1.0, d=Remote control of ...
Loc		{stVal=false, q=000000000000 (Good, Process), t=201-...
OpCntRs		{stVal=0, q=010000000000 (Invalid, Process), t=2018-...
Pos		{Oper=ctlVal=false, origin=orCat=remote-control, orde...
Oper	CO	{ctlVal=false, origin=orCat=remote-control, orIdent=C0...
stVal	ST	01 (off)
q	ST	00000000000000 (Good, Process)
t	ST	2018-05-04 09:43:19.305 [Leap Second Known][Time A...
ctlModel	CF	direct-with-enhanced-security
- Log:** A table showing the history of operations. The table has columns for Time, Server, and Message.

Time	Server	Message
11:43:19.295	New IEC-61850...	OperateReq (invokeId:54 reference:DemoProtCtrl/Obj1CSWI1.Pos) ctlVal="false"; origin.orCat="3"; origin.orIdent="COA80016"; ctlNum="0"; T="2018-05-04 11:43:14"; T...
11:43:19.306	New IEC-61850...	OperateRes+ (invokeId:54 reference:DemoProtCtrl/Obj1CSWI1.Pos)
11:43:19.322	New IEC-61850...	CommandTermination+ (reference:DemoProtCtrl/Obj1CSWI1.Pos) ctlVal="false"; orCat="3"; orIdent="COA80016"; ctlNum="0"; T="2018-05-04 11:43:14.000"; Test="false";
11:43:20.367	New IEC-61850...	Report (RptID:DemoProtCtrl/LLN0\$BR\$brcb02 OptFlds:[SequenceNumber, ReportTimeStamp, ReasonForInclusion, DataSetName, DataReference, BufferOverflow, EntryId, C...
11:43:20.367	New IEC-61850...	Report values: DemoProtCtrl/Obj1CSWI1.Pos.stVal[ST]="01"; DemoProtCtrl/Obj1CSWI1.Pos.q[ST]="00000000000000"; DemoProtCtrl/Obj1CSWI1.Pos.t[ST]="2018-05-04 09...
11:43:20.367	New IEC-61850...	Report reason codes: DemoProtCtrl/Obj1CSWI1.Pos[ST]="010000"; DemoProtCtrl/Obj1XCBR1.Pos[ST]="010000"

Outgoing feeder bay simulator (61850 Relay)

Feeder bay model with circuit breaker and disconnecter.

Simple overcurrent protection relay with IEC61850 server interface (fixed but representative data model).

Remote and local monitoring.

Remote and local control (DO control model).

Additional line with circuit breaker for demonstration of an alternative control model (SBO).

Optional support of secure client-server communication (TLS & ACSE).

INFO TECH IEC61850 Server

Simulation of protection relay with IEC61850 server
Now with GOOSE, file transfer and cybersecurity!

INFO TECH

IED Name: Demo
Server IP: 0.0.0.0
Server Port: 102
MAC: 00:50:B6:1A:D6:94
Edition: 2.1
ResvTms attribute: yes
Owner attribute: yes
Use TLS: no
ACSE authentication: no

Overcurrent protection >

0 50 100

IL1 = 46
IL2 = 57
IL3 = 47

UL1 = 13620
UL2 = 13290
UL3 = 13590

DI1
DI2
DI3
DI4
DI5

Disable sound

Drag to change IL2 current

Connections: 0

GOOSE toolset:

GOOSE Sender and GOOSE Receiver

Idx	Type	Value	Formula	Data reference
0	STRUCT	3 element(s)		P3U_101Relay/VI1GGIO137.SPSCO [ST]
0.0	BOOL	TRUE		P3U_101Relay/VI1GGIO137.SPSCO.stVal [ST]
0.1	QUALITY	00000000000000		P3U_101Relay/VI1GGIO137.SPSCO.q [ST]
0.2	TIME	2020-05-27 14:48:44.126		P3U_101Relay/VI1GGIO137.SPSCO.t [ST]
1	STRUCT	3 element(s)		P3U_101Relay/VI2GGIO138.SPSCO [ST]
1.0	BOOL	TRUE		P3U_101Relay/VI2GGIO138.SPSCO.stVal [ST]
1.1	QUALITY	00000000000000		P3U_101Relay/VI2GGIO138.SPSCO.q [ST]
1.2	TIME	2020-05-27 14:48:44.126		P3U_101Relay/VI2GGIO138.SPSCO.t [ST]
2	STRUCT	3 element(s)		P3U_101Relay/Obj1CSWI1.Pos [ST]
2.0	BS2	00		P3U_101Relay/Obj1CSWI1.Pos.stVal [ST]
2.1	QUALITY	00000000000000		P3U_101Relay/Obj1CSWI1.Pos.q [ST]
2.2	TIME	2020-05-27 14:48:44.126		P3U_101Relay/Obj1CSWI1.Pos.t [ST]
3	STRUCT	3 element(s)		P3U_101Relay/Io1MMXU11.A.neut [MX]
3.0	STRUCT	1 element(s)		P3U_101Relay/Io1MMXU11.A.neut.cVal [MX]
3.0.0	STRUCT	1 element(s)		P3U_101Relay/Io1MMXU11.A.neut.cVal.mag [MX]
3.0.0.0	FLOAT	0		P3U_101Relay/Io1MMXU11.A.neut.cVal.mag.f [MX]
3.1	QUALITY	00000000000000		P3U_101Relay/Io1MMXU11.A.neut.q [MX]
3.2	TIME	2020-05-27 14:48:44.126		P3U_101Relay/Io1MMXU11.A.neut.t [MX]

Idx	Type	Value	Data reference
0	STRUCT	3 element(s)	
0.0	BOOL	TRUE	
0.1	QUALITY	00000000000000	
0.2	TIME	2020-05-27 14:48:44.126	
1	STRUCT	3 element(s)	
1.0	BOOL	TRUE	
1.1	QUALITY	00000000000000	
1.2	TIME	2020-05-27 14:48:44.126	
2	STRUCT	3 element(s)	
2.0	BS2	00	
2.1	QUALITY	00000000000000	
2.2	TIME	2020-05-27 14:48:44.126	
3	STRUCT	3 element(s)	
3.0	STRUCT	1 element(s)	
3.0.0	STRUCT	1 element(s)	
3.0.0.0	FLOAT	0	
3.1	QUALITY	00000000000000	
3.2	TIME	2020-05-27 14:48:44.126	

Sender: Publisher simulation (configuration: manual or from SCL file).

Receiver: For tracking transmission from selected publisher (configuration: manual, 22 from captured message stream or from SCL file).

SV toolset: SV Sender (simulator of Merging Unit) and SV Receiver (signal processing unit)

Transmission of SV message stream for given signal characteristics.

Calculation of signal characteristics based on received SV message stream.

61850 SCL Runner – simulator of server devices based on SCL files

Force data change event flow by one click:
 a) Change of all subscribed data
 b) Change of all data from data sets

IP address as in the SCL file

Enables testing access to all data and simulation of events, reports, controls and control results.

The screenshot displays the 61850 SCL Runner software interface. It features a main control panel at the top with a menu (File, Server, Help) and various control buttons (GO, STOP, Refresh, Help, Power). Below this is a table listing IEDs (Intelligent Electronic Devices) with columns for IED Name, IP address, IP mask, RCB Indexing, Boot time [ms], Manufacturer, Type, and Status. The 'VAMP57' device is selected and running.

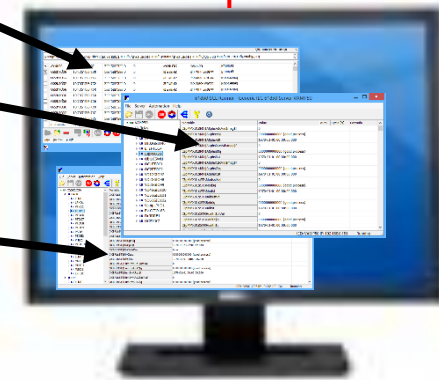
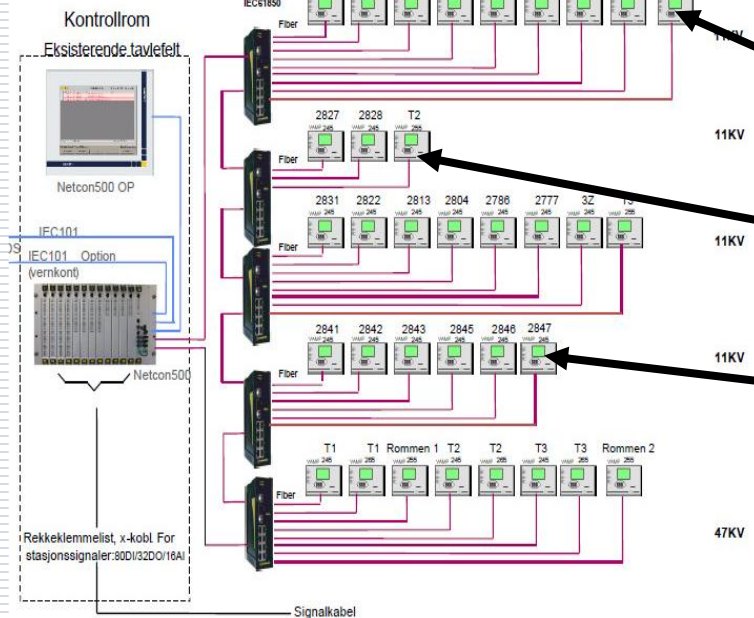
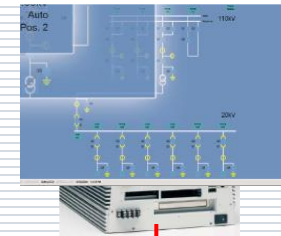
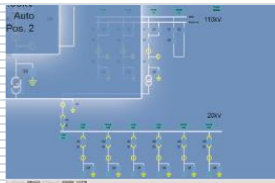
Below the main control panel, there are three overlapping windows showing the configuration and variable monitoring for different IEDs:

- 61850 SCL Runner - Generic IEC 61850 Server OSSK1Q32:** Shows a tree view of the IED structure with folders for LD PROT, LD MEAS, and LD DR. A table of variables is visible, including XCBR.1\$ST\$Loc\$stVal (false).
- 61850 SCL Runner - Generic IEC 61850 Server VAMP57:** Shows a tree view of the IED structure with folders for LD Relay and LD IED. A table of variables is visible, including ST\$Mod\$stVal (on), ST\$Beh\$stVal (on), and ST\$Op\$general (true).
- 61850 SCL Runner - Control Panel:** Shows the main control panel with the 'VAMP57' device selected and running.

Arrows point from the text 'Force data change event flow by one click' to the 'GO' and 'STOP' buttons in the control panels. Another arrow points from the text 'IP address as in the SCL file' to the IP address '192.168.0.219' in the table.

Which way of testing is easier? Real system vs simulated system

Building a lab version of the target system
or simulation?
Cost, complexity, time ...



INFO TECH
61850 SCL Runner
toolset

Problem to solve: How to prepare and verify the configuration of the control system?

- One possible approach for the test lab:
 - Acquire all devices to be installed in the target place.
 - Find and implement the way how process data changes and parameter data changes can be stimulated and how controls can be traced.
 - Build a test network together with the control system to be configured.
 - Configure/reconfigure the devices and the control system and test all configured communication exchanges (can be thousands of signals and data points).
 - Iterate the previous step until all obtained test results are correct.

- Is there any more economic and less laborious approach?
INFO TECH 61850 SCL Runner - with excellent references
from integrators from over 15 countries

61850 SCL Runner – what can it do

- ❑ Collected ICD/CID/SCD files can be used to setup an IEC 61850 server device simulator running on MS Windows PC.
- ❑ One or more server devices (IEDs) can be simulated using different IP addresses and different network adapters.
- ❑ Data models exactly as in real IEDs.
- ❑ Data changes can be defined by the user using formulas: either as fixed values or variable and time dependent.
- ❑ The simulator supports data sets and the reporting function with BRCBs and URCBs: data and quality changes, integrity period and GI trigger reports.
- ❑ All available and all actually subscribed data flows can be tested by one click.
- ❑ The simulator supports control functions with proper behavior and responses dependent on the control model.
- ❑ The simulator supports GOOSE publish function, GOOSE subscribe function (Inputs) and SV publish function.
- ❑ IED start, stop and communication break-down situations can be easily tested by one click.
- ❑ The simulator can be also driven from an external program using telnet protocol for sending commands.

61850 ICD Editor

– tool to create/modify SCL files

The screenshot displays the 61850 ICD Editor software interface. The main window shows a tree view of the logical device structure under 'TEMPLATE' > 'LD LD0'. The tree includes nodes for 'LN LLNO', 'LN LPHD1', 'LN Obj1CSWI1', and 'LN St1PTOC1'. Under 'LN St1PTOC1', there are several 'DO' (Data Object) nodes: 'Mod', 'Beh', 'Health', and 'NamPlt', each with associated 'DA' (Data Attribute) nodes.

Three dialog boxes are overlaid on the main window:

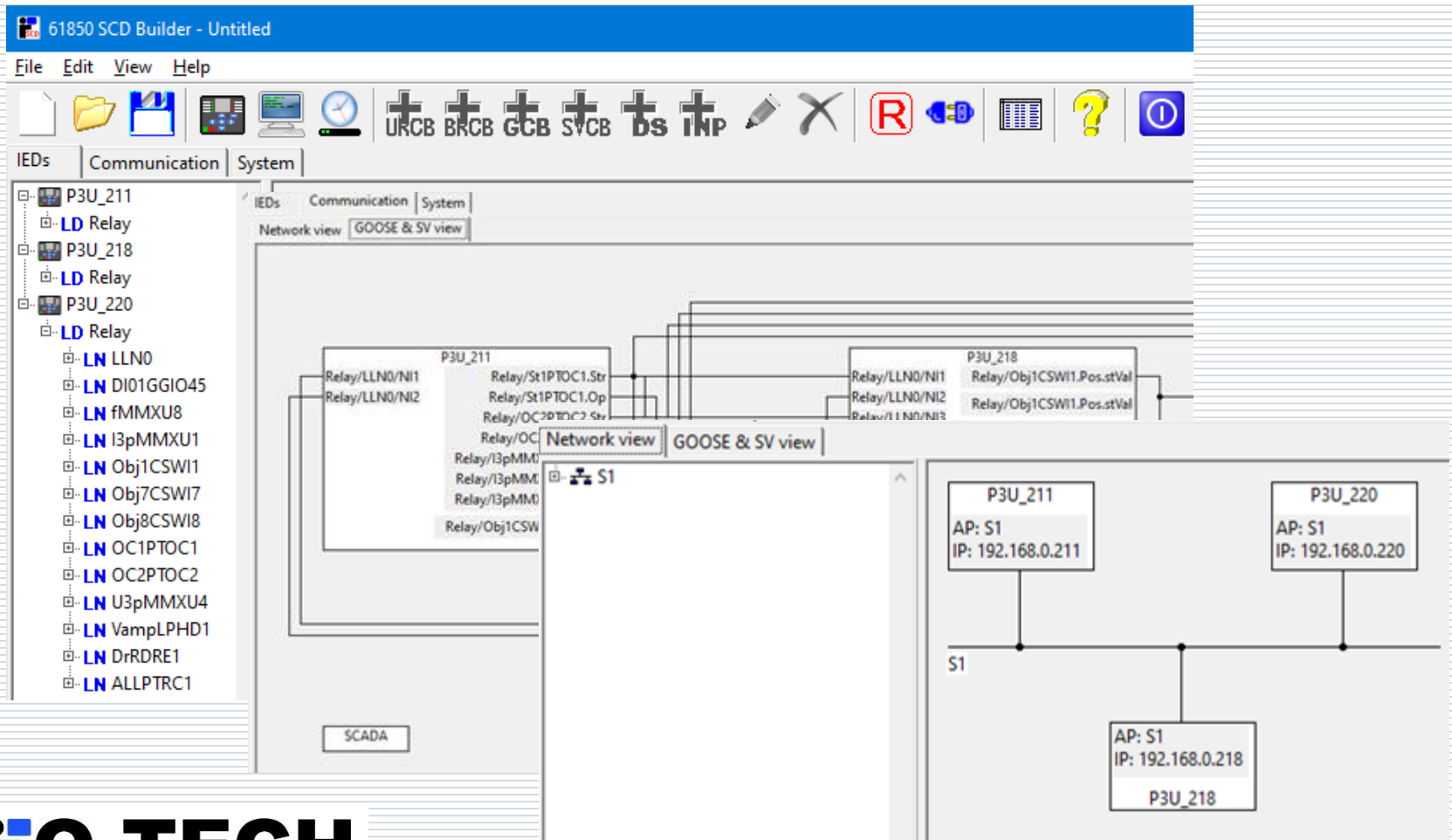
- Create new Logical Device:** A dialog for creating a new logical device. The 'Name' field is set to 'LD0'. The 'Type' field is set to '61850-7-4'. The 'Logical Device' field is set to '61850-7-4'. The 'OK' button is visible.
- Add new Logical Node:** A dialog for adding a new logical node. The 'Class' is set to 'XCBR'. The 'Prefix' is 'Obj1' and the 'Instance' is '1'. The 'LN name' list includes 'XCBR', 'XSUI', 'TCTR', and 'TVTR'. The 'OK' button is visible.
- Control Block Editor:** A dialog for editing a control block. The 'Control block type' is set to 'Buffered Report CB'. The 'Name' is 'brcb0'. The 'DataSet' is empty. The 'Report ID' is empty. The 'Buffering time' is '1000' and the 'Integrity period' is '0'. The 'Config revision' is '1' and the 'Instances' is '1'. The 'Option fields' section includes checkboxes for 'Sequence number', 'Time stamp', 'DataSet reference', 'Reason code', 'Data reference', 'Entry ID', 'Configuration revision', and 'Buffer overflow'. The 'Triggering options' section includes checkboxes for 'Control block is indexed', 'Data change', 'Quality change', 'Data update', 'Integrity scan', and 'General interrogation'. The 'OK' and 'Cancel' buttons are visible.

61850 SCD Builder

- ❑ **System Configuration Tool** allowing to create SCD files (System Configuration Description) from ICD files (IED Capability Description) of components using the bottom-up approach of system engineering in accordance with the IEC 61850-6 standard.
- ❑ 61850 SCD Builder tool supports the SCD creation process in accordance with **Edition 1, Edition 2 and Amendment 1 to Edition 2 (Ed. 2.1)** of the IEC 61850 standard.
- ❑ The produced SCD file is fully conformant with SCL scheme of the chosen standard edition.
- ❑ 61850 SCD Builder is IED vendor independent. The IEC 61850 standard is the reference and the common denominator for interoperability.

61850 SCD Builder

– system configuration tool



For more information including licensing conditions and license prices

please contact

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