



GOOSE Auditor commissioning tool

IEC 61850 tool kit

GOOSE Auditor is a solution for engineers commissioning IEC-61850 substations. It consists of two components: a tap to filter and capture GOOSE packets and an application for performing protocol analysis. The laptop tap is responsible for identifying, capturing and forwarding the relevant messages to GOOSE Monitor the application that displays in real time the topology of the installation, the relationships established between IEDs and the events that may occur allowing the engineer to learn all the details at a glance.

About GOOSE

GOOSE (Generic Object Oriented Substation Event) is a fundamental protocol of the IEC 61850 standard for managing critical operations that require low latency and immediate action, such as circuit trips, fault detection or teleprotection. GOOSE is efficient and reliable; nodes interested in a particular function must register as Subscribers before receiving the corresponding messages that are sent by the Publishers in multicast mode.

Substations using GOOSE may have to deal with thousands of messages exchanged between the IEDs. Attempting to determine whether a particular sequence of messages is working properly can be

an it can be almost impossible to identify the causes of failures or malfunctions because the messages are cryptic and very difficult to decode or correlate.

GOOSE data mining

GOOSE Auditor is the solution that allows to quickly implement the GOOSE protocol, ensure the correct configuration of Publishers and Subscribers, and then confirm a reliable dialogue between IEDs, detecting faults and rogue messages that could be dangerous to the system.

Ensuring correct GOOSE installation & maintenance

GOOSE Auditor accurately and quickly identifies the information contained in the messages and displays the data structures and alarms, eliminating the need to look at tables or interpret details that are difficult to remember and are not a safe way to work in critical applications.

GOOSE Auditor does all this automatically, displaying network relationships, protocol flows and status recording the event in a log to help interpret the GOOSE protocol safely and quickly.



GOOSE Audit

The physical connections between IEDs, switchgears, circuit breakers, protection relays or bay controllers are typically located in small panels of difficult access making it difficult to connect other devices.

“Real-time GOOSE capture for analysis or troubleshooting”

This is why GOOSE Auditor requires a laptop, light and battery operatins as a tap that filters and captures the GOOSE messages, ensuring that none of them are lost or cause interference or errors to the rest of the traffic.



Filter & Capture

There is no doubt that GOOSE sniffing has become a common practice in substations that have adopted the IEC61850 standard. To do this correctly, it is necessary to use taps to capture in full duplex mode. It is important to note that conventional laptops do not have this capability, as they usually have only one port, and CPUs run software but are not capable of processing both Tx + Rx streams simultaneously (1+1Gb/s) without causing delays or errors to critical IEC61850 traffic such as SV or PTP.

Interpretation & Analysis

GOOSE Monitor is responsible for protocol analysis. It displays the IED topology, imported directly from the SCL files, which can be modified manually. It also displays the inventory of IEDs with alerts, publications, subscriptions, but engineers can select and display all the information blocks, events, logs that describe the configuration and activity of each IED. A search function allows nodes to be found using specific filters, which is very useful in complex substations.

Fig 2. GOOSE Monitor: IED List, IED Diagram, IED Details, Log.

The screenshot shows the GOOSE Monitor application window with the following components:

- IEDs List:** A table listing 11 IEDs (SGMT_01 to SGMT_11) with columns for Alerts, Publications, and Subscriptions, each represented by a green status icon.
- Publication States:** All Seen, Some Seen, None Seen, Some or All Simulated.
- Subscription States:** All Active, Some Active, None Active, No LGOS, Connection Error.
- Alert States:** No Alerts, Alerts Latched, Alerts Active, LPHD in Simulation Mode.
- Details Panel:** Shows a tree view for SGMT_01 (LGOS OK), including AP1, SGMT_01Device1, GOOSE Control Blocks (gocbG1, gocbR1), and LGOS References (LGOS1, LGOS2, LGOS3, LGOS4).
- IED Diagram:** A network graph showing connections between IEDs, with a legend for Node States (LGOS OK, LGOS Not OK, No LGOS, Connection Error, Simulation Processed) and Edge TAL (Unexpired/Expired) states.
- Log Window:** Displays system messages such as "Rogue GOOSE Detected" and "GOOSE Interface is Running", along with specific IED state changes.

GOOSE Monitor	
Packet Monitor & Capture	<ul style="list-style-type: none"> Filters: IED, Control Block Reference, Protocol types, DateTime, Ignored retransmissions Packet List: Time, Source, Dest, Protocol, IED, CB Ref, Interface Index/Name/IP Addr/MAC Addr, Length Settings: Duration, Direction, PCAP parameters
GOOSE Analysis	<ul style="list-style-type: none"> Ethernet GOOSE and Routable GOOSE (R-GOOSE) Filters: IED, Control Block Reference, Protocol, DateTime, Ignored retransmissions Local / Remote monitoring Subscription information from GOOSE subscription supervision logical nodes (LGOS) Rogue GOOSE Types: Unknown, Not matching, StNum missed / out of range Alerts: Expired TAL, Invalid/Missed/OoRange, Duplicate, Mismatched Gold/Dataset, Unexpected ConfRev, Needs Commissioning, Bad Data, Multiple Publishers, Duplicate Source/Destination IP or MAC Address, Non-unique Source IP
IED Inventory	<ul style="list-style-type: none"> Setup: Manual or importing IEC-61850 Substation Configuration Language (SCL) files Alert State: No Alerts, Alerts Latched, Alerts Active LPHD In Simulation Mode Publication State: All Seen, Some Seen, None Seen, Some or All Simulated Subscriptions State: All Active, Some Active, None Active, No LGOS, Connection Error
IED Status	<ul style="list-style-type: none"> GOOSE Control Block Node Status: LGOS OK, LGOS Not OK, No LGOS, Connection Error, Simulation Processed Edge Status: LGOS OK, LGOS Not OK, No LGOS, Connection Error, IED Traits: Publisher, Subscriber, Simulation Sent, Simulation Received
IED Visualization	<ul style="list-style-type: none"> Status: On, Blocked, Test, Test Blocked, Off Mode: Layered, Multidimensional, Ranking
IED Details	<ul style="list-style-type: none"> GOOSE Control Blocks: Enabled, Alerts, Subscribing IEDs, Access Point, Control Block, Header, Data Set, LGOS References: Alerts, SP [GoCBRefsetSrcRef, GoCBRefsetSrcCB], ST [BehstVal, ConfRevNumstVal LGOS: HealthstVal, LastStNumstVal, ModstVal, NdsComstVal, SimStstVal, StstVal], ST/NdsComstVal, ST/ConfRevNumstVal LGOS/ST/RxConfRevNumstVal, LGOS/ST/BehstVal, LGOS/ST/HealthstVal, LGOS/ST/ModstVal, LLNO/GO/GoEna, LLNO/RG/GoEna, LLNO/GO/NdsCom LLNO/RG/NdsCom, LLNO/ST/BehstVal, LLNO/ST/HealthstVal, LPHD/ST/SimstVal LLNO: ST [Beh Health], DC [NamPlt], EX [NamPlt], LPHDm, ST [Sim], DC [PhyNam]
Alerts	<ul style="list-style-type: none"> Expired TAL, SqNum Invalid/Missed/OoRange/Missed Error: Multiple Publishers, Duplicate Frame, Mismatched Gold/Dataset/AppID, Unexpected ConfRev, Needs Commissioning, Bad Data, IP/MAC Address: Duplicatinction, Source/Dest/Non-unique Log: Syslog client enabling TAL expirations, Rogue GOOSE messages, and other error conditions
Operation	<ul style="list-style-type: none"> Laptop / PC: equipped with at least one Ethernet adapter Local / Remote monitoring

Net.Shark	
Ports	<ul style="list-style-type: none"> Line Ports: Optical and electrical SFPs from 1 Mb/s to 1 Gb/s Mirror Ports: Dual RJ- port for electrical connection 10/100/1000BASE-T SFP support (but not only): 10BASE-T, 100BASE-TX, 100BASE-FX, 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX
Formats & Protocols	<ul style="list-style-type: none"> Ethernet frame: IEEE 8023, IEEE 8021Q, IEEE 8021ad Throughput between measurement ports: 1 Gb/s or 1,500,000 frames/s in each direction
Operation	<ul style="list-style-type: none"> 16+16 fully configurable and independent filters [Tx+Rx] defined by field contents on Ethernet, IP, UDP and TCP headers Tap & Filter: Packets are forwarded between line ports Packets are selectively copied to the mirror ports
Filters	<ul style="list-style-type: none"> Ethernet Filters MAC address: source, destination; MAC address group: subset of addresses filtered by a mask Ethertype value with selection mask VLAN-VID with selection mask, VLAN-CoS value with selection mask S-VLAN / C-VLAN with selection mask, S-VLAN / C-VLAN CoS value with selection mask, DEI IEC 61850 filters: GOOSE, SV, PTP, NTP, MMS programmable filters
Results	<ul style="list-style-type: none"> Frame counters for each configured filter, Autonegotiation results including current bit rate, duplex mode, Ethernet interface Frame counts: Ethernet, and IEEE 8021Q; Unicast / Multicast / Broadcast Basic error analysis: FCS errors, undersized frames, oversized frames, fragments, jabbers, collisions
Storage	<ul style="list-style-type: none"> Packets can be stored in an SD card in PCAP format
Performance	<ul style="list-style-type: none"> Full Duplex operation at 1 Gbit/s or 1,5 Mframes/s Accuracy better than 10⁻⁶ secs at 1 Gbit/s, Performance and accuracy 100% independent of the line bit rate Jitter-less captures in solid state hard disk and full wirespeed (full Gbit/s at Tx & Rx simultaneously)
Platform	<ul style="list-style-type: none"> Touchscreen 0 x 272 TFT, Mouse, USB & Ethernet ports, 223 x 1 x 65mm; IP-54 Rechargeable Batteries continuous working up to 12 hours continuous operation SNMP, MIB support and VNC remote control

