Zeus

Power Utility, Substation and IEC 61850 Tester

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the Path to Excellence

ALBEDO: a **global** player of **telecom** appliances

ICT electronics (1983)

Trend Comms (2001)

ALBEDO (2009-today)

Zeus

Zeus provides deep insights to design, install, maintain, troubleshoot and engineer communications infrastructures of the Smart Grid and more particularly of the Power Substations. The unit is able to test Ethernet/IP, PTP, GbE, IRIG-B, T1/E1, G703, C37.94, GOOSE, SV and MMS protocols. One-way-delay tests, assisted by GPS, is possible at all interfaces.

It also has a set of programmable filters to capture live data traffic at wire-speed.

◆ Zeus is a tester to verify **WAN** and **Substations** communications

◆ It supports new **IEC 61850** protocols such as PTP or GOOSE and the **legacy** as well such as IRIG-B, C37.94 or G703.

With **Zeus** you will get a perfect <u>vision</u> & <u>control</u> of your infrastructures <u>improving protection</u> & <u>data acquisition</u>

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Zeus the ultimate **Power Utility Tester**

◆ Battery Operated (up to 12 hours of continuous work)

◆ Small, smart and very fast

◆ SoftLEDs © all events at a glance

◆ Landscape ergonomy / Weight: 1.9 kg

◆ Built-in clock reference inputs and outputs signals

◆ VNC remote control for centralized operation

◆ 100% compact

◆ Independent from PC or any external hardware/software

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Zeus means **connectivity**

- ◆ BNC + RJ-45: E1 / T1 balanced / unbalanced testing
- ◆ Dual SFP ports for GbE
- ◆ Built in clock reference inputs and outputs, including GNSS
- ◆ Double RJ-45 ports: 10 / 100 / 1000 Mb/s Ethernet
- ◆ Complete set of Serial Communications
- ◆ Full C37.94 support
- ◆ Round Trip and One Way Delay in all interfaces (GPS assisted)
- ◆ MicroSD card to capture and save data

Modular complements

Customizable and Hot Swapable interfaces:

◆ Datacom / Serial communications

◆ IEEE C37.94

◆ VF / Analog Port

◆ Codirectional and Contradirectional - G703
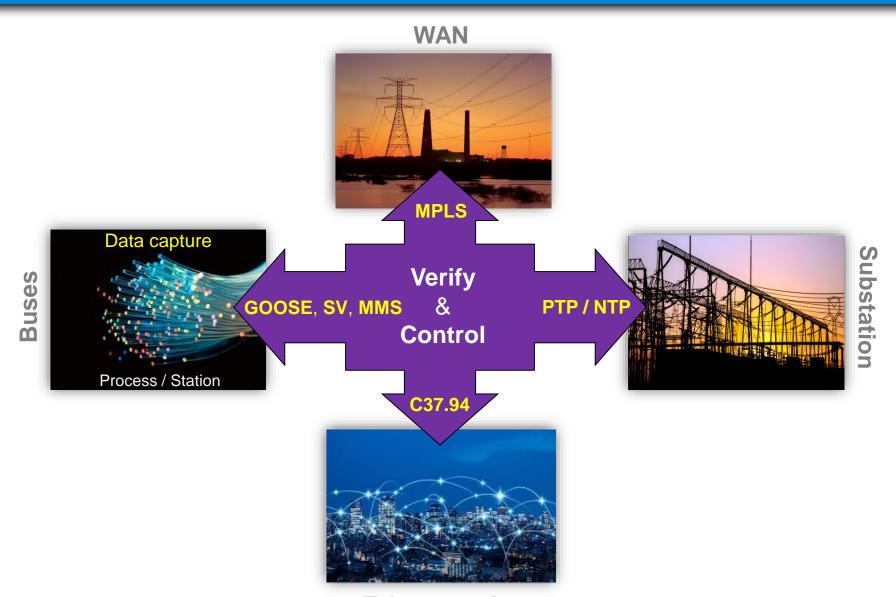
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8-inch Capacitive **Touch Screen**

- ◆ Real-time Chronographs for virtually any event measured in Zeus
- ◆ Detailed view for events such as Latency or Time error
- ◆ Vertical axis auto-scale, custom zoom and positioning functions
- ◆ Export to PNG and CSV formats

Zeus **markets**

WAN

Buses

Data capture

Process / Station

Substation

MPLS

Verify & Control

GOOSE, SV, MMS

PTP / NTP

C37.94

Teleprotection

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Zeus **applications**

- Installation tool
- Ethernet Maintenance
- IEC 61850 migration
- Protocol Analysis
- Substation maintenance
- C37.94 Teleprotection
- Serial Communications
- Troubleshooting
- PTP Clock emulation
- IRIG-B support
- GOOSE analysis
- MMS capture
- Substations Surveillance
- One-way delay
- Synchronization
- IED Acceptance and Compliance
- Substation certification
- Atomic Rubidium clock

◆ **Who**: IED Manufacturers, Installers and Utilities

◆ **Where**: Substation optical and electrical buses, MPLS WAN

◆ **What**: Synchronization, Ethernet, Teleprotection,

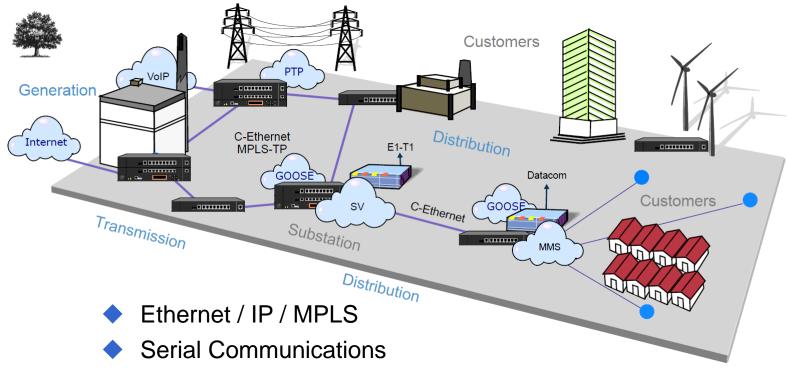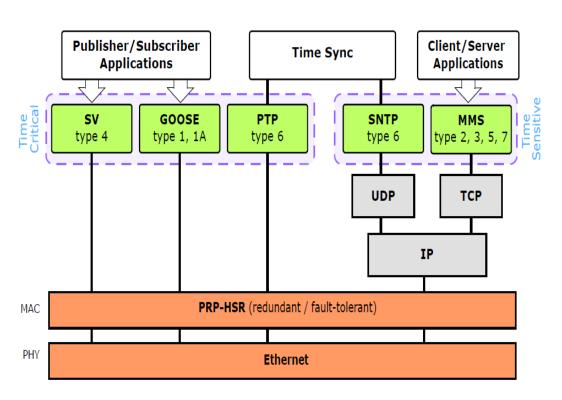◆ **When**: Acceptance, Installation, Commissioning and Maintenance

Ideal to asset **Grid Interconnectivity**

- Ethernet / IP / MPLS
- Serial Communications
- GOOSE & SV
- T1/ E1 / G703
- Synchronous Ethernet
- Voice Frequency
- C37.94

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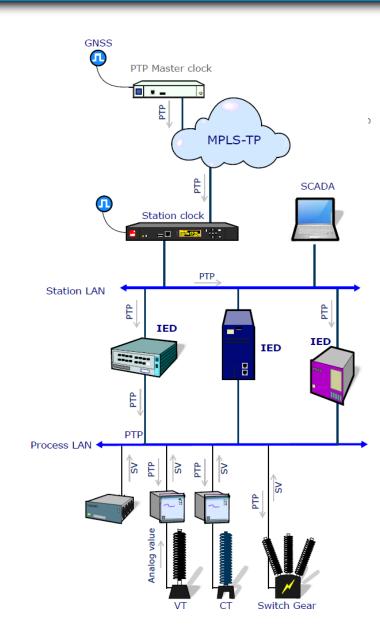# Top **testing** features (includes **IEC 61850**)

- ◆ PTP Synchronization tests
- ◆ Multiple time references
- ◆ Sync Ethernet
- ◆ IRIG-B support
- ◆ One-way / Round Trip Delay
- ◆ Built in Rubidium or OCXO
- ◆ 1PPS and clock analysis,
- ◆ VLAN, Q-in-Q MPLS and Ipv6
- ◆ Serial Communication testing
- ◆ Traffic scan: MAC / IP addr
- ◆ GOOSE, SV, MMS capture
- ◆ RTD & OWD with GNSS
- ◆ PTP master & slave emulation
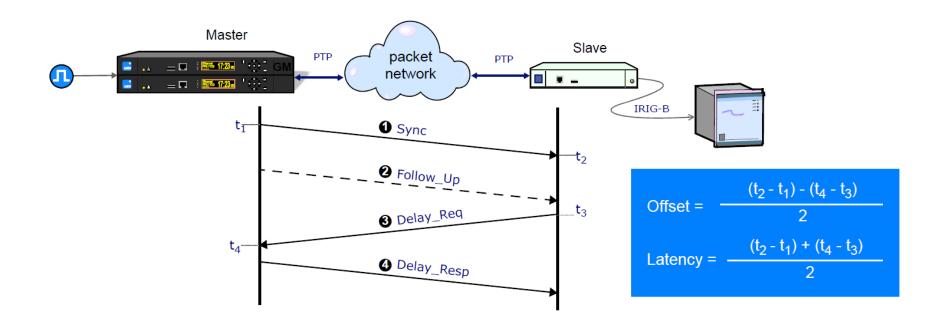- ◆ E1 / T1 mask, BER, Wander

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The most advanced **PTP** Testing

- ◆ 4 x Profiles: Power, Utility, Telecom, Default
- ◆ Full IEEE 1588v2 / PTP support
- ◆ PTP master/slave emulation
- ◆ 1PPS / ToD and clock analysis
- ◆ Built-in atomic Rubidium / OCXO clock and GPS receiver
- ◆ PTP / IEEE 1588v2 support decoding
- ◆ Frequency test: TIE, MTIE, TDEV
- ◆ Phase test: Time Error, max |TE|, dynamic and constant TE

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$$\text{Offset} = \frac{(t_2 - t_1) - (t_4 - t_3)}{2}$$

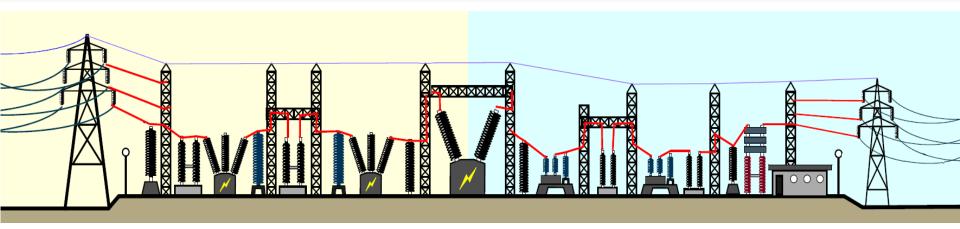$$\text{Latency} = \frac{(t_2 - t_1) + (t_4 - t_3)}{2}$$

Asymmetry generates a time offset in PTP slaves and for this reason it has to be tightly controlled

◆ Forward vs. reverse path delay

◆ Delay difference (asymmetry)

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- TE is the offset between PTP time and a ref. clock such as GPS
- Zeus includes TE results including max, constant, dynamic
  - This test tells how suitable is the network for phase time delivery

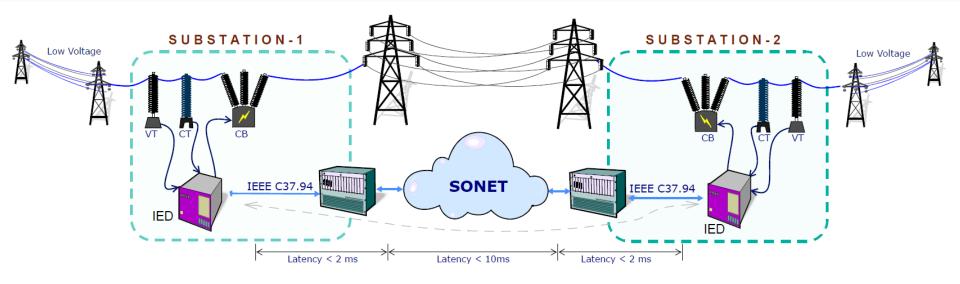| Protocol	Layer	Message	BWidth	Delay	Priority	Bus	Model	Application
SV	L2 - Multicast	4. Raw Data	High	< 208.3 ms	High	Process	Publisher	Process Bus
GOOSE	L2 - Multicast	1. Trip	Low	< 3 ms	High	Process	Publisher	Protection
GOOSE	L2 - Multicast	1A. Other	Low	< 200 ms	High	Process	Publisher	Protection
PTP	L2 - PTP	6. Timing	Low	< 3 ms	Medium High	Process & Station	Unidirectional	Synchrophasors, IED
MMS	L3 - IP/TCP	2. Medium Speed	Low	< 100 ms	Medium Low	Process & Station	Client/Server	SCADA
MMS	L3 - IP/TCP	3. Low Speed	Low	< 500 ms	Medium Low	Process & Station	Client/Server	SCADA
MMS	IP/TCP/FTP	5. File Transfer	Medium	< 1000 ms	Low	Process & Station	Client/Server	Management
MMS	L3 - IP	7. Command	Low		Medium Low	Station	Client/Server	SCADA

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IED acceptance test

IEDs are a key element in the substation running critical applications that must pass an approval test before be installed:

◆ GOOSE: protocol analysis, counts and latency analysis

◆ SV: protocol analysis, counts and latency analysis

◆ Ethernet: RFC 2544 test
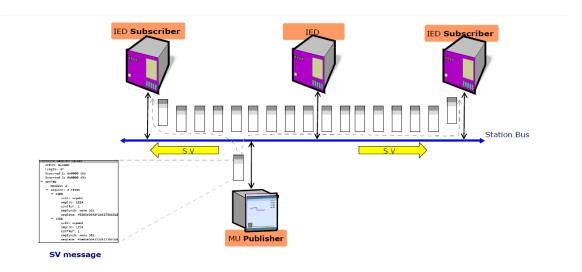
◆ PTP: synchronization support

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Check Teleprotection with **C37.94**

Field engineers can use Zeus to turn up new C37.94 deployments to troubleshoot teleprotection relays and multiplexer by means of a number of features such as:

- ◆ BERT
- ◆ G.821
- ◆ Analysis/generation of events
- ◆ Optical power meter
- ◆ One-way / round-trip delay
- ◆ Jitter and wander

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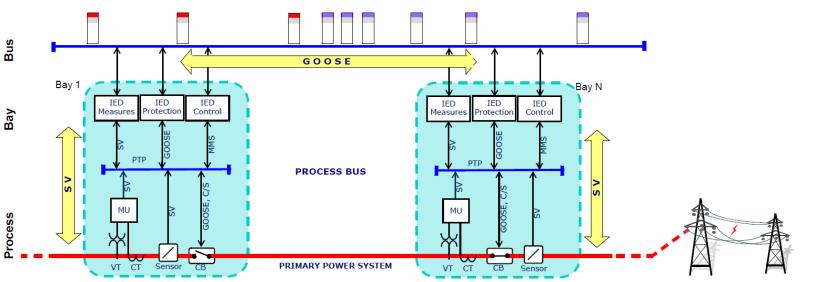
Sample Values (SV) analysis & test

Zeus can capture real-time SV data traffic and execute several tests:

◆ SV protocol scan with svID population

◆ SV frame counts

◆ Sample count and sampling rate measurement for the active flow

◆ Latency analysis: current, avrg, min, max, range, std dev.

◆ Capture and save in PCAP / PCAPNG

◆ UTC time stamps with time clock ref. input

Zeus can capture real-time GOOSE data traffic and execute several tests:

- ◆ GOOSE protocol scan with GoCBName, GoID, DatSet
- ◆ GOOSE frame counts
- ◆ Latency analysis: current, avrg, min, max, range, std dev.
- ◆ Capture and save in PCAP / PCAPNG
- ◆ UTC time stamps with time clock ref. input

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Complete **Serial** Communications
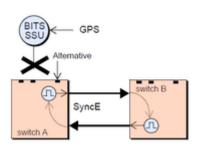

Based on Pluggable Hardware Module (PHM-20)

- ◆ V.24/V.28, X.12/V.11, X.21/V.11, V.35, V.36/RS-449, EIA-530/A
- ◆ Data, Stop, Parity, inter word gap
- ◆ DTE / DCE emulation, Full duplex monitor
- ◆ Event Insertion
  - ■ Pattern: TSE, Slip, LSS, All 0, All 1
  - ■ Asynchronous interfaces: FRM, PRTY
- ◆ Modes
  - ■ Anomalies: single, rate
  - ■ Defects: continuous
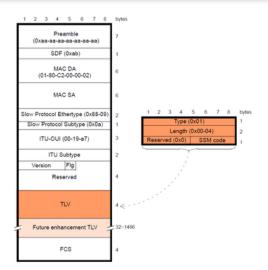- ◆ Configurable output frequency offset $\pm$25,000 ppm
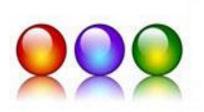
Standard CISCO cables

Zeus has a comprehensive set of features to assure the SyncE service:

- ◆ Synchronization according G8261, G8262, G8264
- ◆ Line frequency (MHz), offset (ppm), drift (ppm/s)
- ◆ Analysis / Generation ESMC and SSM messages
- ◆ SSM count & rate
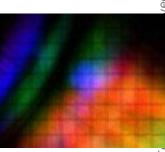- ◆ SyncE TIE, MTIE and TDEV measurement
- ◆ SyncE Wander generation

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Why **Zeus**?

◆ **LATEST ELECTRONICS**: very fast, powerful, long operation

◆ **PERFECT SYNCRONIZATION**: what else you need

◆ **FIELD OPERATION**: hand-held

◆ **ALL-IN-ONE**: multiple IEC61850 and Legacy technologies support

◆ **REMOTE CONTROL**: from any VNC platform

◆ **ACCURATE REPORTING**: for further analysis

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That's all

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