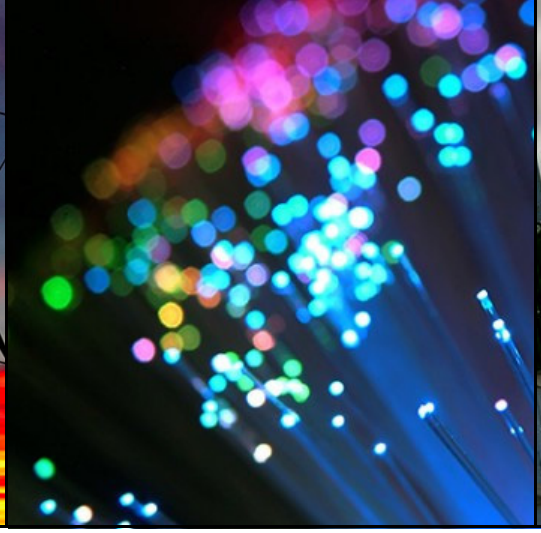




ALBEDO Telecom Catalog 2023

PROD_CATALOG_ENG v.21.0

ALBEDO delivers solutions that enable telecom infrastructures of to verify, install, monitor, troubleshoot, and migrate mission critical applications in more than 2500 customers and 110 countries.

ALBEDO's core expertise range from Test & Measurement, Synchronization, Protection, Reflectometry, GPON, WAN emulation, SIP trunking and Lawful interception. Our customers are Power Utilities, Mobile/Telecom operators, Installers, Manufacturers, R&D labs, Universities, Military, Railways, willing to install, analyze or maintain telecom infrastructures supporting critical voice, video and data applications.

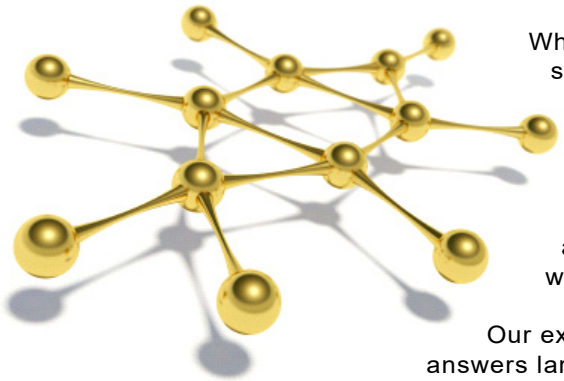
Utilities to Labs

ALBEDO products and services integrate with your business ever since the beginning, and we will work with you to get solutions to questions such as:

- Do you need a last generation PTP / NTP network clock?
- Do you test PTP, SyncE, IP, VoIP, Datacom, T1/E1, C37.94. IRIG-B?
- Do you qualify GPON, XGS-PON and NG-PON protocols, ONTs and OLTs?
- What about a WAN emulator to verify your new telecom services?
- Which type of OTDR you require?
- Do you need a GbE tap capable to capture at 100% wireline?
- Do you have to check in depth your old synchronism based on IRIG-B?

Our experts will help you to find the weak spots of your network, offer alternatives and tell you on what to do, when and why.

We understand how essential networking and telecoms are to your business. We also know that there are so many different technology solutions that it may be very difficult to decide which one better fits your requirements.



Telcos to Railways

Whether you need help with a specific network problem now, or you are still at the planning stage, ALBEDO has a solution for you. From tailored on-site monitoring systems, to any kind of telecom testers we may meet your needs.

Our experts provide customized answers large telecom operators to and small and middle size organizations. We are more than willing to share their tricks of the trade with your organization's system engineers.

ALBEDO Telecom

About **ALBEDO Telecom** (*)

ALBEDO Telecom is a manufacturer of Synchronization clocks, Telecom testers, WAN emulators, Ethernet taps and OTDRs, which core expertise range from PTP, SyncE, GbE, 10GbE, T1/E1, PPS, IRIG-B, Jitter/Wander, C37.94 and Optical technologies. Most of our customers are Utilities, Telecom operators, Railways, Air traffic control, Military and Universities that use ALBEDO solutions all over the world.

At ALBEDO Telecom, we convert ideas into tangible, manufacture worthy solutions. With our understanding of telecoms, quality monitoring systems, test and measurement, engineering, production processes and most importantly the end users -their behavior and needs- we attempt to enrich user experience at all levels. We develop projects from scratch and with special emphasis on aesthetics and ergonomics. Since its foundation ALBEDO Telecom has always been innovating in the fields of synchronization, networking and testing.

World Customers

ALBEDO has thousands of customers in the five continents. For instance: Hitachi, CISCO, Hydro-Quebec, SDG&E, UTE, ABB, Siemens, Nokia, Airbus, NASA, Meinberg, ADVA, Vodafone, Vivo, China Telecom, FT, MT, NATO, Telefonica, SEL, Orange, Claro, Disney, Wind, Bosch, MAN, Bahrat, SDG&E, Indra, REE, BSNL, Tata and many more.

Milestones:

- **1983**: ICT 2017: world first PCM analyzer with microprocessor
- **1989**: ICT 2045: portable multiplexer from 64 kbit/s up to 140 Mbit/s
- **1991**: ICT 2040: OEM to HP and then Agilent
- **1994**: Flexacom: multitechnolgy transmission platform
- **1999**: Victoria: world first hand-held tester SONET/SDH tester
- **2004**: Combo: world first stackable SONET/SDH tester
- **2009**: Net.Shark: world first hand-held tap with active filters
- **2012**: Net.Storm: world first handy wirespeed WAN emulator
- **2014**: Ether10.Genius: world smallest 10Gb/s Ethernet tester
- **2017**: Net.Sync: PTP Grand Master Clock
- **2018**: xGenius: transmission & synchronization tester
- **2019**: Zeus: Utility tester for legacy and IEC-61850 substations
- **2021**: Net.Time: first PTP/NTP over PRP boundary clock
- **2022**: World first IRIG-B jitter and wander tester
- **2023**: First OTDR made in ALBEDO

Publications

We are also authors of a lot several books:

- Triple Play: Building the converged network
- Installation & Maintenance of SONET& Synchronization Networks

*(*)**ALBEDO**, also known as reflection coefficient, is the ratio of reflected radiation from the surface to incident radiation upon it.*

since 1983

1994

1999

2006

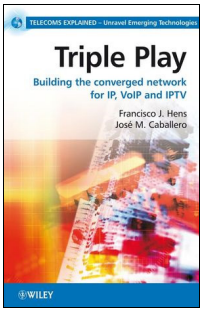
2012

2017

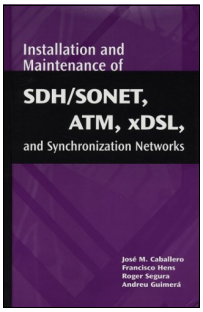
2019

2023

Wiley - Boston



ArtecHouse - London



Net.Time τ a Telecom clock

1 Gb/s clock for Telecom industry. Configurable as Master, Boundary or Slave, it supports PTP, SyncE, ToD, PPS, ToD, T1/E1, BITS and SyncE.

PTP / NTP network clock

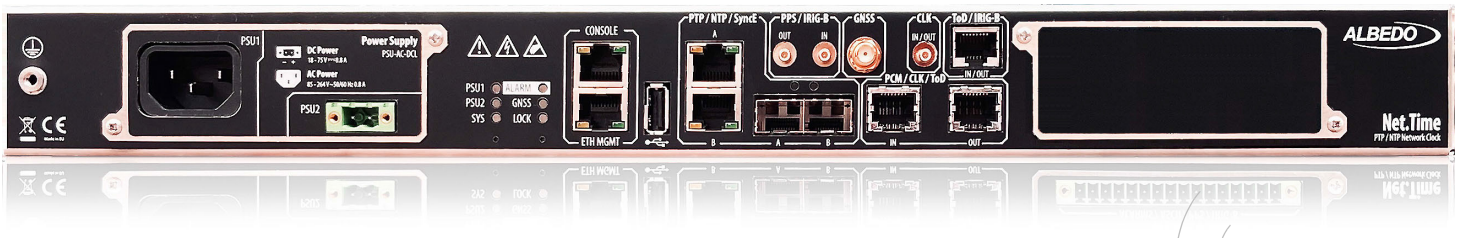
Net.Time τ is a boundary clock ideal to assure the delivery of quality time, phase and frequency across a network of base stations or micro cells. It accepts a wide variety of time refs and offers the widest range of timing signals to facilitate the integration of networks.

Net.Time τ can be configured as Master, Slave and Boundary clock and redundant in/out clock references as well. Multiple options for input (GNSS, PTP, SyncE, ToD, PPS, T1/E1, MHz) and output (PTP, SyncE, ToD, PPS, T1/E1, MHz) references make possible many combinations that facilitates the translation of timing protocols to integrate new and legacy architectures in the Telecom industry.

Net.Time τ represents the state-of-the-art in timing as it has been designed to deploy the most precise and secure synchronization networks for infrastructures used in Telecom applications. Net.Time T is fault-tolerant, has a built-in GNSS receiver, Rubidium oscillator, redundant power supply and accepts a wide variety of time references that can be used as primary or backup references. Provides compatibility between timing signals for distribution using protocol translation in all directions. Accurate and reliable synchronization is an essential resource to keep the stability and safety in Mobile Telecom as well as in other relevant sectors of the industry including the Finance, Broadcast, IoT, Automation and Air Traffic Control.

Smooth migration

The whole industry is migrating from previous timing architectures to adopt PTP for timing distribution across the existing Ethernet/IP back-haul to match the required accuracy level are especially important in these new scenarios.



Wireless turn-up

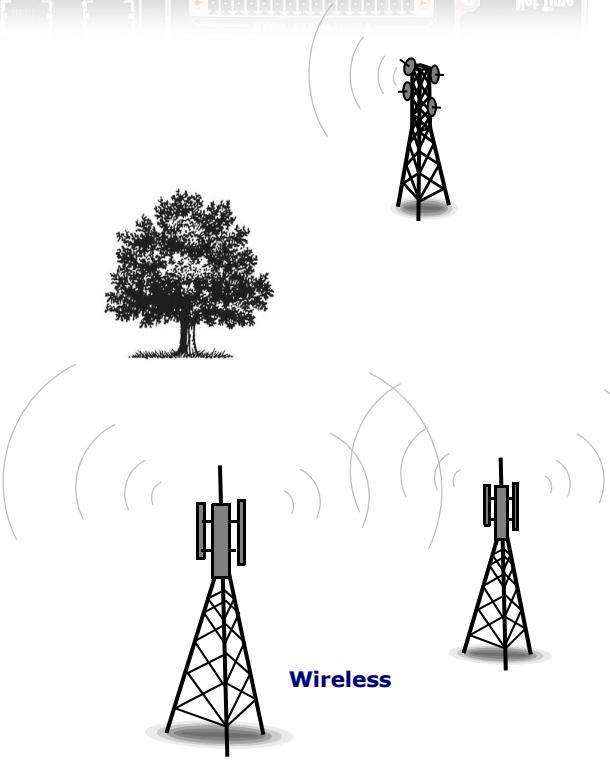
For many years the frequency synchronization requirements of mobile networks were satisfied by means of TDM signals. New deployments have strong requirements of frequency and phase to reduce the size of the cells, reusing the available frequencies, and sharing up/downstream channels to the wireless terminals. Synchronization is a critical functions in mobile networks to prevent messages from interfering with one another and enable smooth cell-to-cell transfers particularly in 5G that is increasing speeds, lower latency, and cells density.

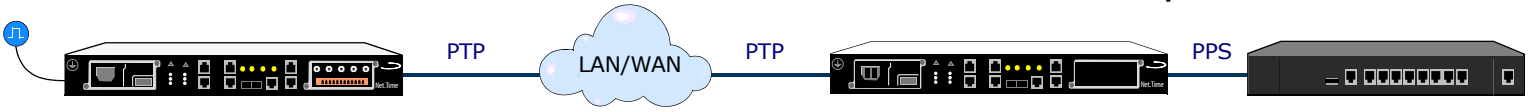
Timing services required by 5G

Synchronization enables many services including assisted navigation, location, and emergency calls. Moreover, synchronization is fundamental to every cellular technology otherwise they would not even work. Base stations must calculate permanently the distance to every single mobile operating in their cell and the neighboring cells. Base station and mobiles have to generate exactly the up/down frequencies and have to access to transmission time-slots. If radio clock loses synchronization accuracy framing will drift outside the guard period and interfere with adjacent cell-sites and will intensify interferences.

PTP telecom profile

Synchronization Technology is a fundamental building block for all wireless communication networks and with the introduction of 5G technology, we've reached a new level in terms of frequency phase and frame synchronization that can only be provided by PTP network clocks such as Net.Time to meet stricter synchronization requirements, ensure conformance to industry standards and quality of service.





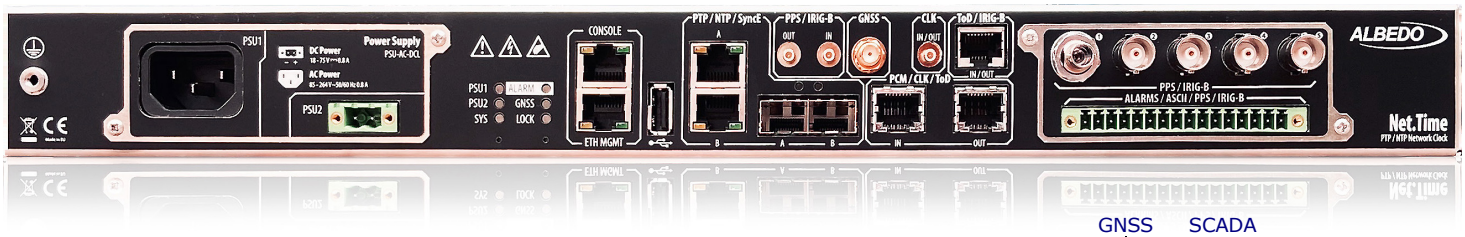
Net.Time φ a Substation clock

100 Mb/s clock for the Power industry. Configurable as Master, Boundary or Slave, it supports PTP (Power profile), NTP, IRIG-B, ToD, PPS, ToD, T1/E1, BITS and PRP.

Net.Time φ is a synchronization node, compliant with IEC 61850, that supports PTP, PRP and multiple clock options such as NTP, SyncE, 1PPS, ToD and IRIG-B to satisfy all timing needs of utility substations. It also includes Power PTP profile and Rubidium to simplify the provision of timing facilitating the integration of the installed plant for perfect control, protection and data acquisition.

PTP & NTP over PRP timing

The basic architecture of electricity distribution changed very little during the first 100 years. However, in the lasts decades, the concept of Smart Grid emerged thanks to the massive use of ICT technologies to increase the efficiency, resilience and quality of the service. Generation plants, substations and customers are now connected with telecommunication networks.

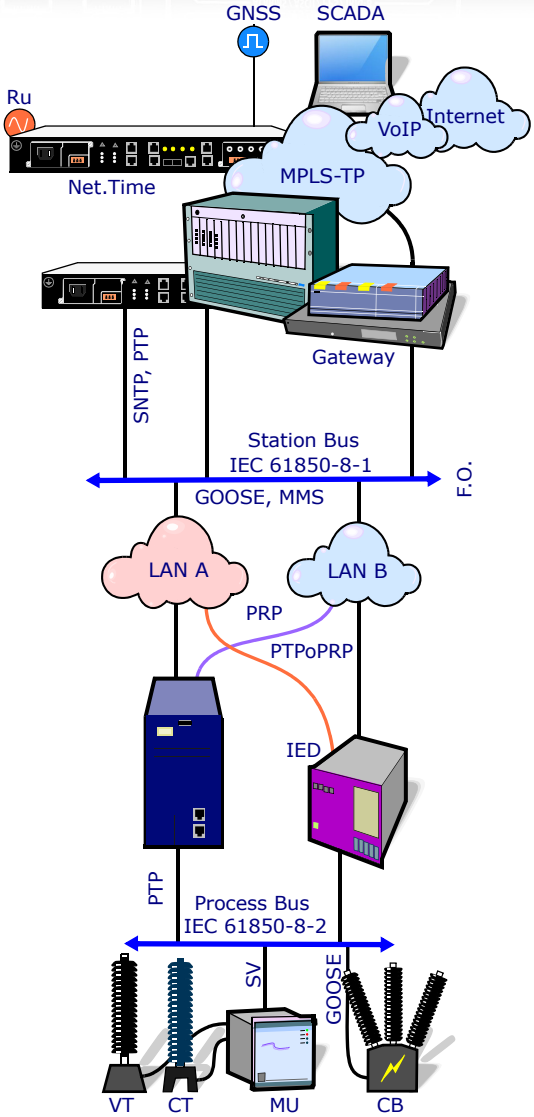


Substation automation

Substation automation refers to using data from intelligent electronic devices to enable stability, increase security and maintain the system integrity. To make it possible a new standard was released, the IEC-61850 that facilitates the intensive use of digital technologies and guarantees the interoperability between vendors, appliances and processes.

- Supports PTP Telecom and Power profiles to interconnect both type of clocks, which is a common necessity in power grids.
- It is a PRP native (DAN-P clock) with Double interface, then it does not need a Redundancy Box reducing costs and simplifying installation.
- OCXO / Rubidium are internal oscillator options to match any hold-over.
- Supports 1PPS, MHz, Mb/s, PTP and SNTP enabling features such as NTP-to-PTP translation facilitating the coexistence of legacy new equipment, and migration.
- Delivers SNTP, PTP, 1PPS and IRIG-B signals to protect all appliances.

There are partial solutions but none satisfies simultaneously all the above-mentioned requirements of the power industry as Net.Time does.



Benefits

No doubts about the advantages of the new standard that facilitates interoperation but the adoption will be a gradual process. Net.Time facilitates a smooth migration to the new and legacy protocols improving on this way the capacity to integrate any appliance of the substation. All technologies will coexist for a long time therefore the versatility is a valuable aspect offered by Net.Time Power that also has interesting advantages:

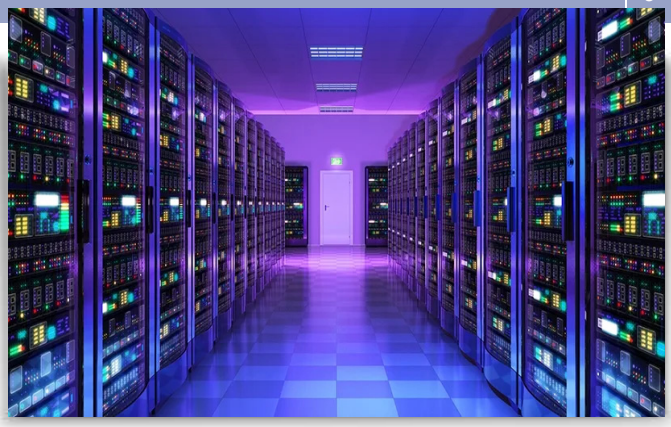
- Improves availability of NTP/PTP timing services through standard buses
- Support installed base using IRIG-B, SNTP and 1PPS
- Provides a more reliable synchronization for mission-critical infrastructures

It deserves special mention the support of PRP which requires careful considerations. Theoretically, any PTP clock could be attached to a PRP-protected network adapting a Redundancy Box (RedBox). However, this is not an optimal solution because it involves deploying a new device adding complexity and price. By implementing the PRP in the timing node the equipment is directly attached to the network. Net.Time node includes multi-protocol and redundant operation features.

It simplifies the migration to PTP by providing NTP synchronization to legacy nodes. The NTP and PTP services work concurrently so that network administrators do not need to choose which one to enable and install two or more boxes for each protocol.

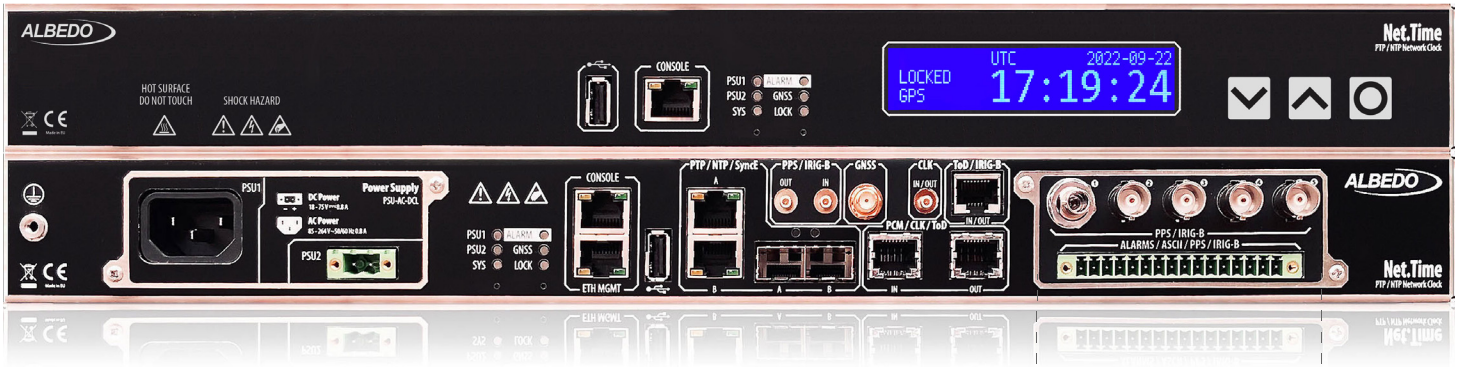
Net.Time Ω

1 Gb/s clock for Enterprise, Traffic control industry, Finance, Broadcast. Configurable as Master, Boundary or Slave, it supports PTP (Telecom + Power profiles), NTP, IRIG-B, SyncE, ToD, PPS, ToD, T1/E1, BITS and PRP.



PTP / NTP network clock

Net.Time Ω is a general purpose clock designed to supply synchronization to clients connected to Ethernet / IP networks. Once locked to the reference it delivers highly accurate synchronization to all the clients connected by optical or electrical links.



Mission Critical

Finance corporations, Manufacturing plants, Wireless operators, Power utilities, Terrestrial and Aerial transport, all are migrating to PTP protocol to satisfy the synchronization demands they have of their mission critical applications. Timing distribution across the existing Ethernet/IP back-haul is now a commodity to match the required accuracy and redundancy level of these new scenarios to manage real-time events over wide, cellular and metropolitan areas.

Finance Corporations

Financial services rely on powerful transport layer capable to provide high speed, availability, security and reliability. At the timing side PTP, NTP and GNSS has been la widely used to synchronize nodes, transactions, and to log time-stamped events in a chronological sequence.

Air Navigation

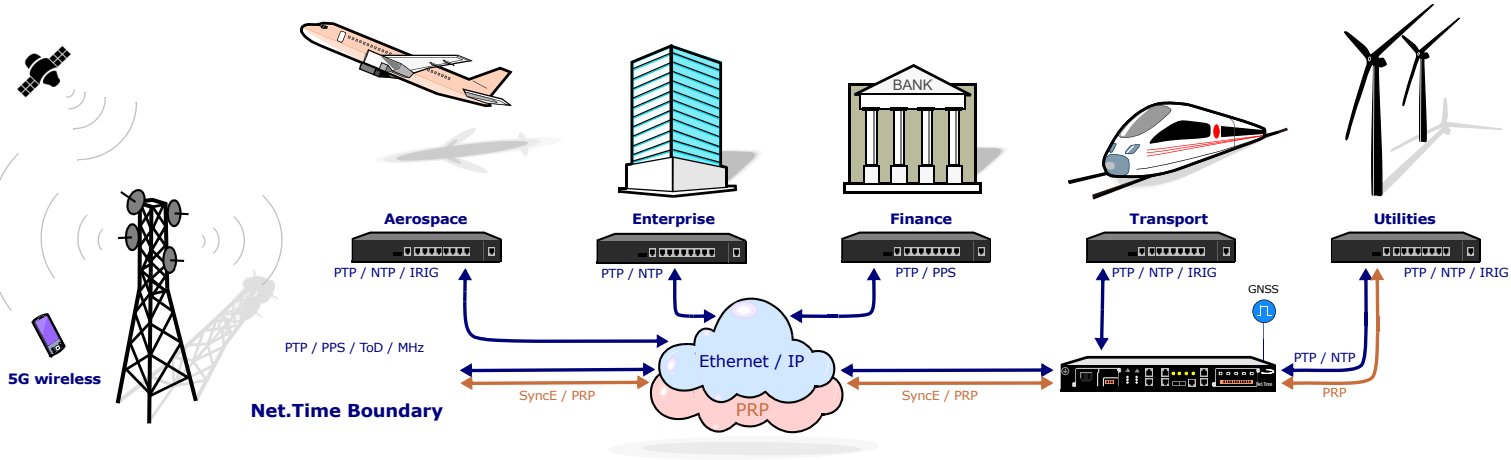
Timing is a key resource to ensure the correct operation of the Air Navigation Systems. Legacy signal --such as IRIG B, NTP and TDM-- are still on use but are being progressively substituted by PTP time stamping to provide a unique, accurate and coherent synchronization signals based on atomic clocks.

Wireless turn-up

For many years the frequency synchronization requirements of mobile networks were satisfied by means of TDM signals. New deployments have strong requirements of frequency and phase to reduce the size of the cells, reusing the available frequencies, and sharing up/downstream channels to the wireless terminals.

Power Grid

Power Grid Systems use Phasors as a source of timing for Network Monitoring while the Automatic Protection Systems require a high level of accuracy and redundancy. PTP synchronization units are deployed across remote locations of the power network with internal time references and GNSS receivers.



xGenius (timing & transmission)

ALBEDO xGenius is a multi-technology tester equipped with 8' screen and all the features you need to install and maintain telecom networks up to 10Gigabit Ethernet It supports legacy and new generation interfaces in order to verify Ethernet / IP, PTP, SyncE, ToD, IRIG-B, T1 / E1, C37.94, RS-232, G703 and check protocols such as GOOSE, SV or MMS. It is suitable for measuring legacy and next-gen networks as it has the most common interfaces. Field engineers do not need to carry any more several testers or multiple modules to turn up and monitor telecom infrastructures.

Cloud testing up to 10Gb/s

xGenius is equipped with all the advanced features you need to verify the communications in terms of performance and quality required for critical applications.

Built-in Rubidium / GPS clock

The integrated GPS/GLONASS receiver allows easy connection and use while fast acquisitions and excellent accuracy minimizing the time impairments of external devices. This an ideal solution to synchronize thanks to top performance in hold-over mode while top accuracy in a real hand-held battery operated IP tester.

Mobile 5G

Operators have different synchronization requirements. Some of them running 3G may still maintain legacyT1/E1 solely for syntonization. Those focused on LTE, see the impending need for distributing phase-synchronization and also want to avoid having to install GPS receivers at every single cell site. Alternatives are SyncE and PTP that simplify the architecture and can be turned-up with ALBEDO testers.

Power Utilities

Power utility companies must protect high voltage lines and monitor them constantly. Communication between power substations using the standard C37.94 is fundamental order to ensure correct operation while controlling every single alarm.

Platform

- A:B ports: 2 x SFP/SFP+ (100MbE, 1GbE, 10GbE, 10G WAN)
- A:B ports: 2 x RJ45 (10MbE, 100MbE, 1GbE)
- C:D ports: Balanced 2 x RJ45 (T1/E1)
- C:D ports: Unbalanced 2 x BNC (T1/E1)
- GNSS Port: SMA female
- PPS Ports: 3xSMB female (i/o)

Hot swappable modules

- C37.94 interface
- Datacom DTE/DCE: V.11/X.24, V.24/V.28, V.24/V.35, V.24/V.11 (V.36/RS449)
- VF Port
- Codirectional - G703
- IRIG-B optical and electrical
- T1/E1 additional port

Operation / Results

- Graphic and tabular wander results in standard pdf files
- Large Storage capacity, more than one week of results
- Export: results in pdf/txt/csv through USB interface or SD card
- Time stamped capture up to 10Gb/s

Ergonomics

- Size: 260 x 160 x 63 mm. Weight: 1.9 kg
- Light and easy to carry in a small bag
- Batteries: Two pack of Lipo batteries included

Internal Clocks

- Default better than ±2.0 ppm
- OCXO better than ±0.1 ppm
- Rubidium better than ±5.0e-11 (GNSS disciplined, warm- up: 600s)

SyncE and PTP testing

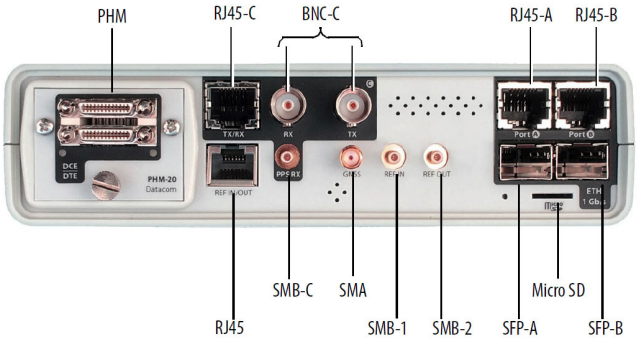
- PTP profiles: Telecom and Power
- Clock emulation: Master / Slave, Unicast/Multicast, 128 packet/s
- PDV capture, protocol analysis and correction field support

Zeus (tester for substations)

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, and it has a set of programmable filters to capture live data traffic at wire-speed.

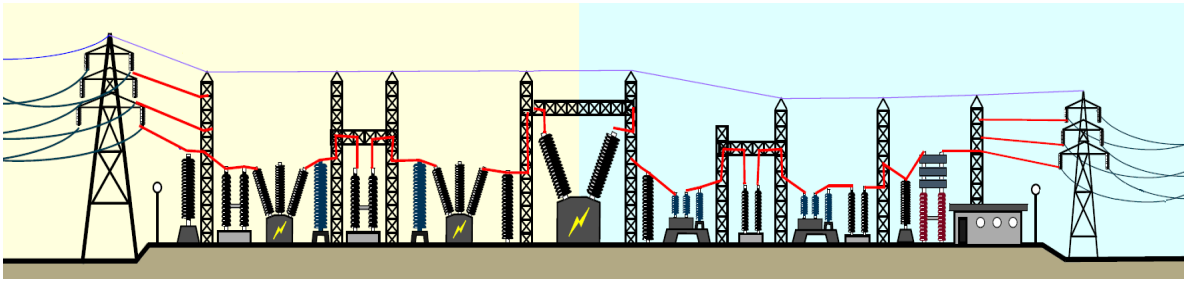
IEC 61850 support

Step-by-step proprietary architectures are being replaced by standards relaying on optical Ethernet, so there is a clear need for tools that can manage both old and new interfaces. This is Zeus, a tester capable of verifying, activating and troubleshooting all kinds of communications infrastructures including those that were installed in recent decades and the latest that will be installed in the coming years. All together are transforming substations into a more flexible, robust and scalable systems thanks to the integration and interconnectivity of different manufacturers using fibers and standardized protocols.



Applications

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



GOOSE, SV, MMS

Zeus has a set of programmable filters to capture live data traffic at wire-speed. You can now analyze GOOSE, SV, MMS and other protocols to decode and save them in PCAP format or calculate propagation delay from local or remote substations.

PTP Synchronization

Utility companies have strict timing requirements that Zeus can test and adjust by means of advanced features that allow to measure and emulate PTP, IRIG-B, 1PPS, ToD, T1/E1. The internal oscillator of the tester can be OCXO or Rubidium depending on the accuracy you need or more particularly if you need to operate in hold-over.

C37.94 Protection

A uninterrupted supply of energy requires protection functions to ensure the reliable operation of the power system. With Zeus you will fully test C37.94 systems measuring frequency, events, one way delay, and all kind of events.

Full IRIG-B testing

Verify IRIG-B signals completely including jitter & wander measurements with GPS.

Resilience

A flexible and robust network is core of intelligent substations that are capable of guaranteeing the control and operation of mission-critical applications. Therefore, it is important to have advanced instruments to verify, measure and adjust each protocol according to the strict requirements defined by IEC 61850 regarding interconnectivity, latency, symmetry and redundancy.

An additional challenge is how to design reliable and redundant networks capable of recovering data flows quickly after a failure to support applications that do not tolerate even a millisecond of network interruption without severely affecting operations that eventually could cause blackouts endangering the safety of company's employees. Consequently, an acceptance procedure is a must to verify the conditions of all mission critical systems and protections deployed across the power grid.

Ether.Genius (6-in-1 tester)

Ether.Genius is a hand–held tester suitable for labs and field operations, light and well protected. The unit is able to test Ethernet/IP networks up to 1Gb/s and supporting Sync-E/PTP protocols. It also has multiple optical/electrical interfaces interfaces for GbE/PDH/T1/E1/E0/C37.94 and Datacom as well. Operation modes include Performance and Quality tests at all interfaces and the ability to emulate PTP/SyncE, while featuring well on Frequency/Phase and PDV metrics. It is indeed the smallest test set with a built-in Rubidium clock GPS disciplined.

Timing

- Built-in atomic Rubidium clock
- Built-in GPS / GLONASS receiver
- Internal: better than ±2.0 ppm, OCXO better than ±0.1 ppm
- External: SyncE, 1544, 2048 Mb/s, 1544, 2048 10 MHz, 1 pps
- Output: 2048 kHz, 1 pps

GbE Features

- FTD, 2-way FDV, FDV, 2-way FTD, FLR, SES, PEU and PEA
- Symmetrical & Asymmetrical RFC2544 and Y.1564 (e-SAM) tests
- Multistreams for IPTV, VoIP, and Critical Data verification
- Ethernet Line frequency (MHz), offset (ppm), drift (ppm/s)

PTP / SyncE Features

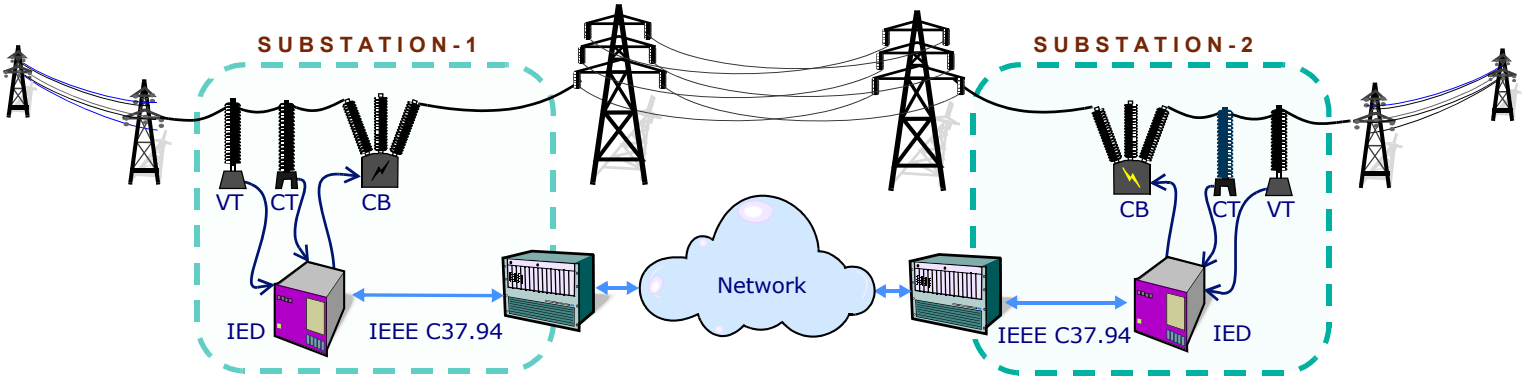
- PTP / IEEE 1588v2 support decoding
- PTP support / generation as master or slave
- Master Clock operation on each port using internal/external ref.
- Analysis / Generation ESMC messages and SSM count and rate
- Ext. clock input including 2048 kb/s, 2048 Hz, and Synchronous Ethernet
- MTIE / TDEV / TE measurement

T1, E1 and Datacom Features

- G.826, G.821, and M.2100. RTD One-way Delay (GPS accuracy)
- Jitter level/tolerance/transfer, Wander Generation and TIE, MTIE, TDEV
- V.11/X.24, V.24/V.28, V.24/V.35, V.24/V.11, V.36/RS449, EIA530(A)
- DTE, DCE emulation and monitor

C37.94 Measurement

- Rate: Nx64 kb/s, N = 1 to 12, G.821 performance: ES, SES, UAS, DM
- Round Trip Delay (ms) One-way Delay synchronized with GPS (us)
- Optical Power Meter, Frequency-MHz, offset-ppm, drift-ppm/s



C37.94 teleprotection test

Ether.Giga (Ethernet/IP tester)

Ether.Giga is a dual port tester equipped with all features to verify Ethernet including eSAM, Multistream, FCS error insertion, etc. to quickly install, validate or troubleshoot Ethernet and IP networks, while verifying the Quality of the applications.

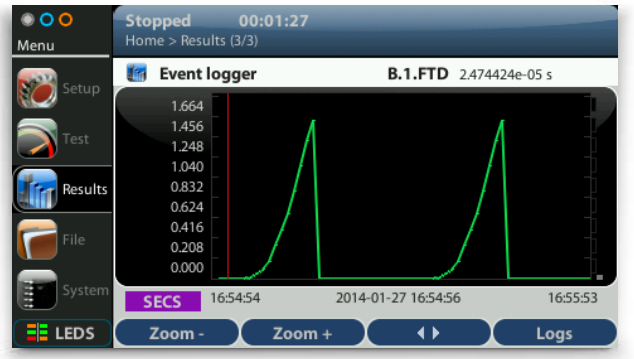
Outstanding commodity

ALBEDO Ether.Giga is an Ethernet & IP tester equipped with all the features of legacy testers such as BER and RFC2544, plus the new ones like Y.1564, Y.1731, and FCS error insertion in pass mode therefore it is capable to verify the QoS and SLA of new Multiplay services offering field technicians tools to quickly and easily validate and troubleshoot Ethernet services, including multiplay applications such as VoIP, IPTV, VoD, high-performance Computing, Virtualization Services, Data Centers and Storage that require significant levels of bandwidth.

ITU-T Y.1564 (e-SAM test)

This methodology executes multiple traffic streams in two phases:

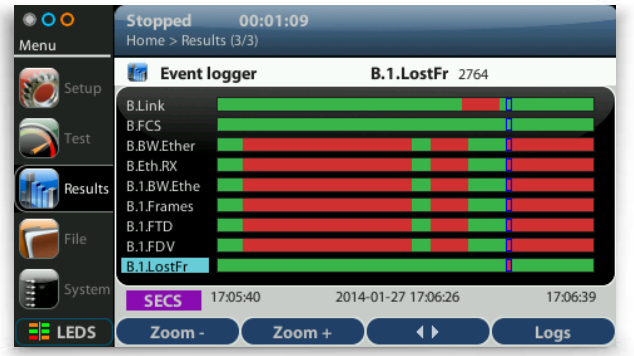
- **Service Configuration**, confirms the end-to-end set-up while quickly checking the Information Rate (IR), Frame Delay Variation (FDV), Frame Loss Ratio (FLR), Frame Loss Ratio at the Service Acceptance Criteria (FLRSAC).
- **Service Performance**, transmits all configured traffic streams at the CIR confirming all traffic is able to transverse the network under full load while checking IR, FDV, FLR and availability.



Features & Benefits

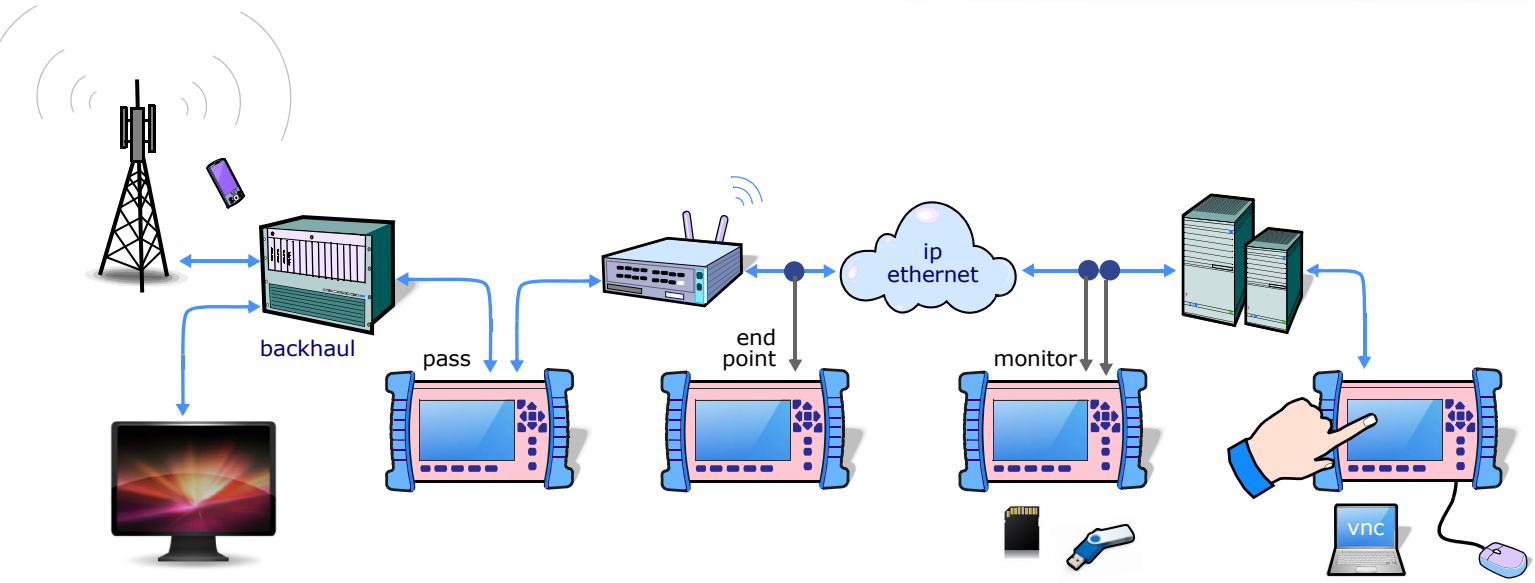
This tester supports ALL the features including the most advanced suites like asymmetric RFC2544 and eSAM.

- Y.1564 FTD, 2-way, FTD&/FDV, FLR, SES, PEU and PEA
- Y.1731 QoS statistics
- 2 x SFP + 2 x RJ45 interfaces
- Symmetrical & Asymmetrical RFC2544 test
- FCS error insertion in pass-through mode
- Multistreams for IPTV, VoIP, and Critical Data verification
- Q-in-Q for demarcation tests and MPLS support
- Scan MAC/IP/VLAN/QinQ



Applications

- QoS and SLA certification
- Automatic RFC2544, Y1464
- IPTV, VoIP, Data assurance
- VNC, LAN or wi-fi control



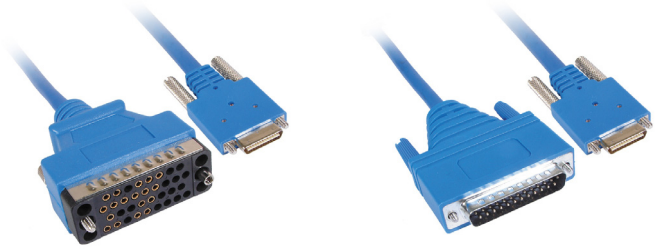
AT-One (T1 + E1 + Datacom tester)

ALBEDO Telecom is delighted to present the AT.One, the ultimate and world's most comprehensive BER analyzer / generator for T1, E1, Datacom, Jitter, Wander, Pulse mask, Frame Relay, VF, and more. The AT.One is truly rugged and is ideal for field engineers installing and maintaining T1, E1 and Datacom circuits.

Designed with the latest technology is light, fast, friendly and comprehensive. Believe or not, it is the envy of our competitors that dream to have one day a similar unit. Ideal for field engineers installing, commissioning and troubleshooting T1, E1 links, ISDN, Voice Services, Synchronization Networks, and Datacom circuits.

24h. of non-stop operation on batteries

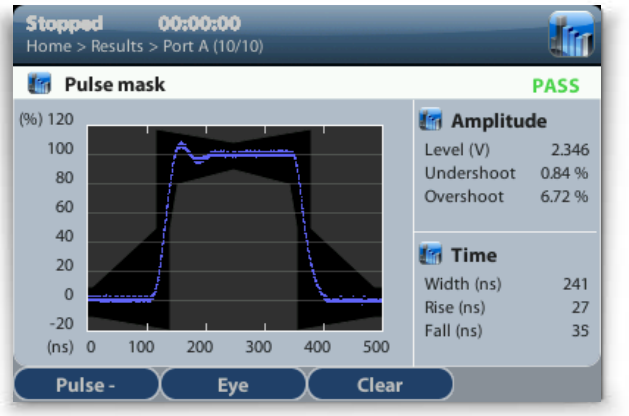
This instrument is fully designed and manufactured by ALBEDO Telecom, because we love to control the entire process to ensure first-class quality. This tester uses a brand new platform. Take a look and try this innovative and flexible tool, you will love it after discovering how the latest FPGA can overcome previous limitations in accuracy, space or performance. Honestly, nothing else can really be compared with this outstanding update for T1/E1/Datacom/Jitter/Wander testing.



The state-of-the-art in T1, E1 and Datacom testing

The AT-One is an excellent tester for network operators, contractors and enterprise users that have to manage fixed and mobile networks that are using T1, E1 and Datacom backhaul circuits.

- Latest technology: very fast!
- Based on Linux (does not hang-up)
- Double port BNC and RJ45
- Extra rugged but lightweight
- Monitor and Pass Through modes
- Jitter measurement, Wander measurement (with all masks)
- Pulse Mask
- Cisco Data Cables, 2xUSB & RJ45Ports
- VNC remote control
- Hand-held 1 kg / 2.2 lb.



Applications and Users

- Installation and Maintenance
- Jitter / Wander / Pulse Mask Measurement
- Mobile Synchronization
- Mobile, Digital Voice and Data Operators
- Laboratories and Central Office plants

Air Traffic Control, Military and Power Utilities links

AT-2048 (E1 + Datacom tester)

ALBEDO Telecom is delighted to present the AT.2048, the ultimate and world's most comprehensive BER analyzer / generator for E1, Datacom, Jitter, Wander, Pulse mask, Frame Relay, VF, and more. The AT.2048 is truly rugged and is ideal for field engineers installing and maintaining E1 and Datacom circuits.

Designed with the latest technology is light, fast, friendly and comprehensive. Believe or not, it is the envy of our competitors that dream to have one day a similar unit. Ideal for field engineers installing, commissioning and troubleshooting E1 links, ISDN, Voice Services, Synchronization Networks, and Datacom circuits.

Net.Storm (compact WAN emulator)

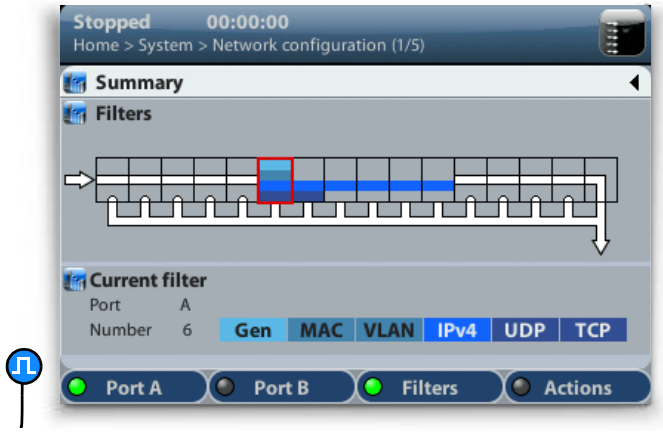
This device emulates ANY link/network based on VLAN, VPN, MPLS, etc. in terms of bandwidth & traffic impairments. Bandwidth control is done by means of Traffic Shaping & Policing specified in fr/s or bit/s, while impairments such as delay, loss, jitte, etc. are inserted in a 100% controlled way at the MAC/IP/TCP/UDP flows.

Now it is possible

Yes, modelling arbitrary network dynamics to verify any IP based solution, is now possible. Because Net.Storm is able to simulate any network condition to check how tolerant your services, protocols and devices are when quality / capacity degradations occur. It replicates accurately combined effects such as packet delay, errors, loss, bandwidth variations, traffic shaping and traffic policing

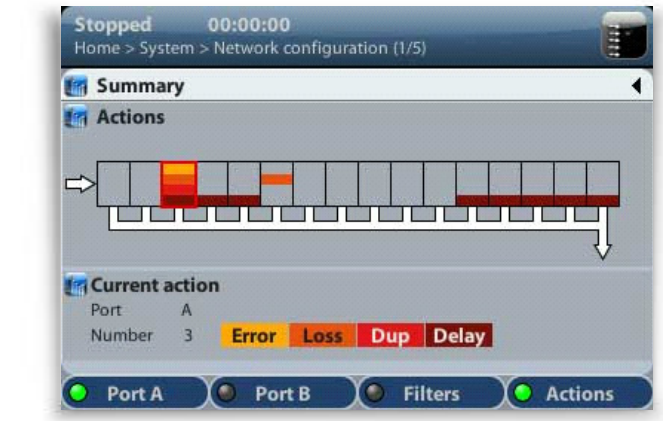
Features and Benefits

- Exact replication of any traffic condition (delay, jitter, loss, error, duplication,...)
- Multiple patterns (uniform, exponential, burst, random, two-state random,...)
- Strict bandwidth control in fr/s or bit/s
- 16+16 filters: MAC, IP, TCP, UDP...
- Wirespeed performance at full duplex
- Accuracy better than < 1µs at FDX Gbit/s
- Hand-held or rack mounted



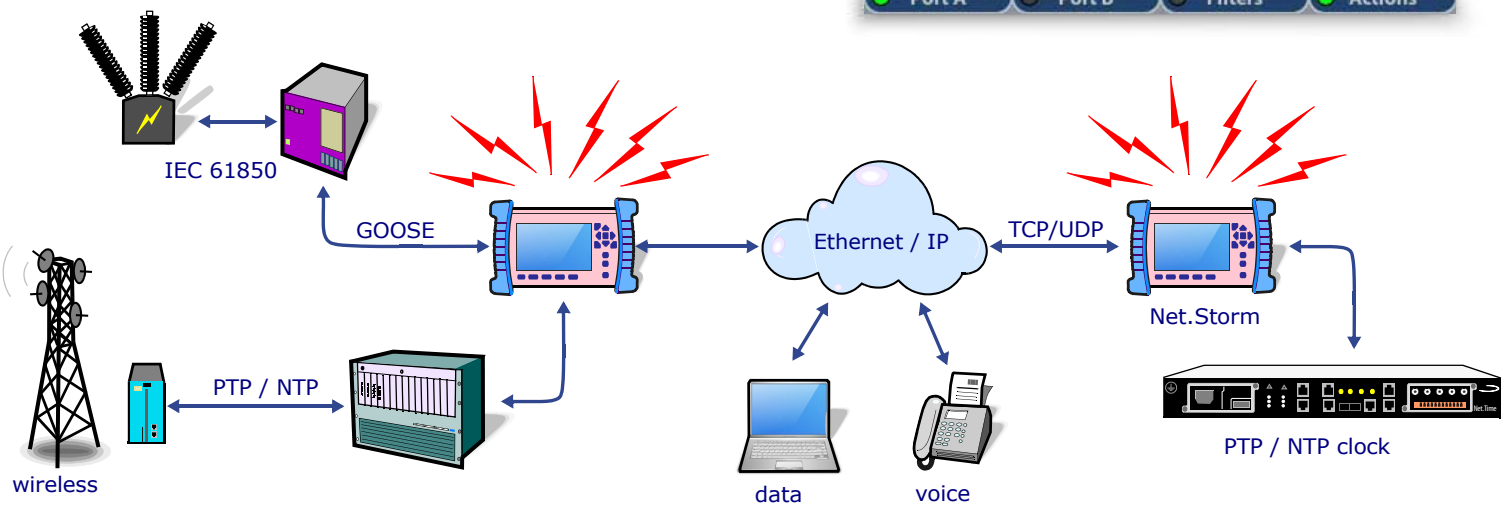
Applications

- Laboratories willing to emulate network conditions
- Deployment of IEC 61850
- Approval and Acceptance Tests of IED and MU
- Synchronization networks based on PTP, NTP and SyncE
- Verify the tolerance to one-way delays
- Check critical protocols such as GOOSE
- Check Tolerance to QoS degradation
- Identification of degraded sources



Users

- Power Utilities Labs
- Communication Dpts.
- Substation Engineers
- Control Centers
- Emulation Wireless errors and delays
- Emulation of Satellite condifitons
- Military to simulate extreme conditions



Net.Hunter (spot, capture & save)

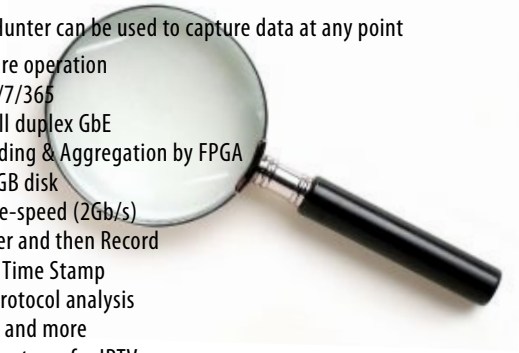
This Packet Capture Device is ideal for those experts that require real-time analysis of 100% of the IP packets transmitted through an Ethernet Link. Troubleshooting, Security and Forensic are typical applications of Net.Hunter. Interestingly it includes an embedded TAP that forwards those packets that are compliant with any of the 16+16 programmable filters.

Suspicious packets can either be saved in the internal SSD disk, or tapped to a LAN. Net.Hunter is undetectable as it has no IP or MAC address, whilst operations are executed in FDX mode [Tx+Rx], with ZERO delay and ZERO loss of customer' traffic

A tireless packet Sniffer

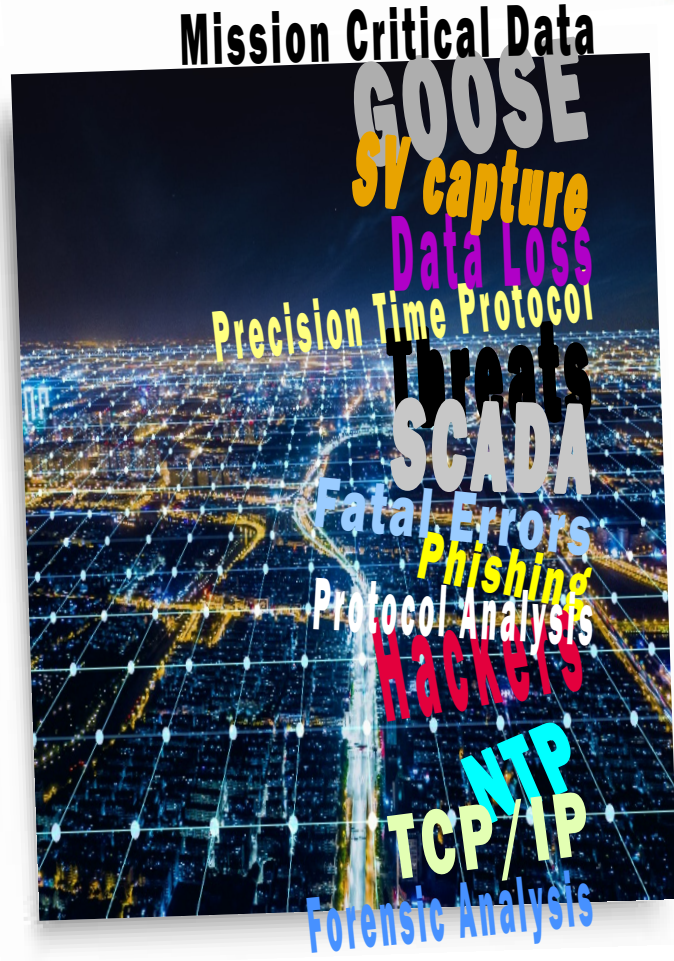
Net.Hunter filters, captures, taps & saves packets to a local SSD disk at wirespeed, wherever you are. It is a stream-to-disk device that can filter, copy, save and eventually tap packets at wire-speed to assist those who need to monitor, tap and record any data without disturbing the live traffic or generating any delay or loss.

Top Featured Appliance



Built as a field device Net.Hunter can be used to capture data at any point

- 100% firmware/hardware operation
- Non-stop packet tap 24/7/365
- Filter/Capture/Tap at full duplex GbE
- Filtering, Capture, Decoding & Aggregation by FPGA
- Storage size: up to 512 GB disk
- Capture & Record at wire-speed (2Gb/s)
- Smart Capture: first Filter and then Record
- NTP Synchronised PCAP Time Stamp
- WireShark friendly for protocol analysis
- VoIP, IPTV, Data, TCP/IP and more
- Real time Multistream captures for IPTV
- No MAC, no IP means Undetectable
- Monitor and Pass Through modes
- Captures CRC errored frames
- Built-in Tap to 1000BASE-T and Wi-Fi
- Wi-Fi Multi/Broadcast capture & record
- 16+16 Programmable Filters
- Fault tolerant to AC power loss
- 4.5h of operation on batteries
- Law applications



Net.Shark (hand-held tap)

This a genuine tap, equivalent to Net.Hunter without disk, therefore it is quite unique because it is capable of Filtering Traffic, Capture, Storage and Tap at wire-speed in an small, compact and battery operated devices. They support ALL the features of high-end taps and capture devices in a small, battery operated instrument to provide mobility and storage capacity to reach any point of the network.
Net.Shark includes ALL the features of active taps to tap connecting their favorite protocol analyzer as usually, or go anywhere to filter, capture and save packets. It includes 2x16 programmable filters to identify flows by MPLS, TCP, UDP, VLAN, IP, MAC, etc. work at wirespeed without generating any delay, lost, or jitter.

Net.Hunter & Net.Shark applications

- Power Utilities to capture GOOSE, SV, MMS, PTP, NTP protocols
- 5G operators to capture PTP, NTP and Ethernet IP protocols
- Finance and Banks organizations for security
- Enterprise Forensic Analysis
- Cyber security, Defense and Intelligence agencies
- e-Banking
- Law / Police / Intelligence applications
- Telecom Troubleshooters
- Complement to Firewalls

GPON Doctor 4k5 / 9k5

GPON Doctor 4500 model is a comprehensive tool for xGPON deployments while the 9500 model is for indicated for GPON/XGS-PON deployments. Both are is a portable, passive, chipset-less xGPON FTTH protocol sniffer and analyzer. Connected to any location within your PON distribution network (ODN), will capture downstream and upstream bit-level information providing comprehensive analysis of the GPON/XGS-PON TC layer including OAM, PLOAM and OMCI. GPON Doctor is mainly oriented for problem detection, certification and interoperability tests. It a perfect tool for lab application engineers engaged in GPON/XGS-PON deployment phase or GPON/XGS-PON active elements developers/ integrators.

GPONDoctor is a complete and autonomous solution: Composed by a GPON/XGS-PON capture + evaluator card, a "state of the art" chassis and a processing software capable of analyzing and evaluating the captured data. Based on our own implementation, the capture hardware includes last generation optical modules and great processing power. Capable of synchronizing with the downstream and upstream data flow of the PON fiber, performing automatic calibration, and allowing long length captures. It also extracts and decrypts in real-time Ethernet traffic from the upper layer ,allowing to regenerate services like video or VoIP.

Troubleshooting in xPON

With the aim of reducing the ONTs price it is important that any OLT is capable to interact with any ONT regardless its manufacturer. However, GPON/XGS-PON has a number of intrinsic characteristics that could make difficult the interoperability:

- Commercial implementations from earlier versions of the standard
- Problems during the activation process
- Misinterpretation of the standard
- OMCI, a very broad standard open to interpretations
- Heterogeneity among operators
- Attenuation in a GPON / XGS-PON path can be very high due to the sum of fibre splitting, connections (Insertion loss), fusion splice, and distance in the fiber.

All these factors imply a great challenge in the deployment of PON networks.

Non-invasive Capture

GPONDoctor solutions transparently analyse traffic within a FTTH network. Moreover, its automatic calibration and built in touch screen, makes it possible with just one click to have a full capture of network traffic. The capture can be very long and allows captured data export to XML format for later analysis.

Smart Network analysis

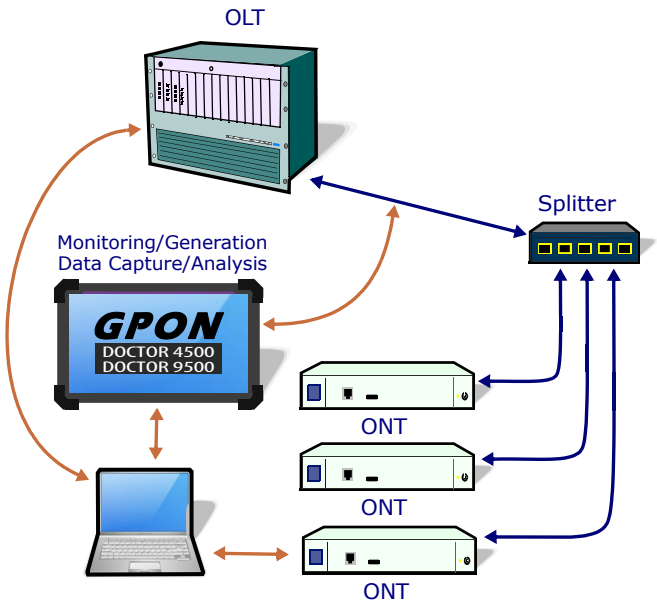
The smart analysis software interprets the captured data and translates it into a graphical and categorized format that can be easily used for in-depth analysis of GPON/XGS-PON protocol conformance, interoperability evaluation, bandwidth assignments and field deployment troubleshooting.

The data captured by the GPONDoctor are analyzed to enable the view of:

- GPON/XGS-PON topology: ONTs detected, ONTs and OLT status, data established
- Entities created and relationships including errors and alarms generated
- Bandwidth assignment plots per ONT and TCONT and its evolution in time
- Degree of compliance with the standard, by applying an evaluation system for the ITU-T G.984.x, G.9807.x/G.987.2/G.989.3/G.988 based on dynamic rules.

Real time Ethernet traffic extraction

GPONDoctor 4500 and GPONDoctor 4500/9500 allow clear-text traffic extraction in real-time for both upstream and downstream. The traffic is extracted at Ethernet layer. This traffic can be further analyzed by upper layer protocol analyzers.



Users and Applications

- GPON/XGS-PON networks deployment, equipments, and certification
- Interoperability troubleshooting among different vendors
- Diagnosis and Analysis of events and deviations for already deployed xPON
- Compliance during the development of OLTs and ONTs
- Analysis of user traffic and evaluation of quality of services in the xPON Network
- GPON/XGS-PON Auditing and Optimization
- Real time supervision of the Network state and all its active elements (ONTs).

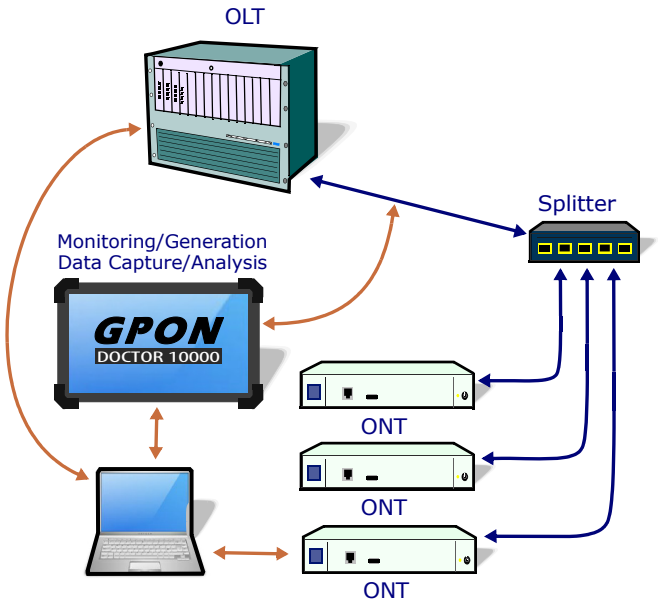
GPON Doctor 10K

GPONDoctor 10000 is a chipset-less passive portable dual analyzer of FTTH XGS-GPON and GPON protocols. Once connected to a point in the distribution fiber of the network it captures data at the downstream and upstream bit-level, interpreting all the control information at PLOAM and OMCI levels.

The analyzer is oriented to the detection of problems, certification and analysis of interoperability, being ideal for operators and installers of XGS-GPON / GPON deployment as well as manufacturers of equipment. It is a complete and autonomous solution: composed of an XGS-GPON and GPON data capture hardware board, a high-performance chassis / equipment and analysis and evaluation software for the captured data.

The capture hardware is self-implemented with the latest generation optical modules and high processing capacity. Capable of synchronizing with the upstream and downstream link at any point in the XGS-GPON or GPON network and of being automatically calibrated, allowing long-term captures. Optionally, it also extracts and decrypts traffic in real time from the upper layer, allowing regeneration of services such as Video or VoIP.

The software for analysis interprets the captured data and allows you to review the trace from the first to the last control frame. It is able to create an estimate of the XGS-PON / GPON network topology: ONTs, status of the state machines of the ONTs and OLTs, established data channels, exchanged configuration, E / R OMCI diagrams, analysis and graphs of bandwidth for each ONT per T-CONT.



Features

Capture + Analyze + Evaluate in 1 single click

From the data captured, GPONDoctor 10000 deduces the network topology and applies a series of rules to certify if the ITU-T G.9807.x or ITU-T G.984.x recommendation is met. Its automatic adaptive timing and calibration and intuitive interface make it easy to use from day one. Dual equipment: XGS-PON or GPON analyzer (selectable in app) Portable ruggedized equipment that allows, in the same device, to select the analysis mode: XGS-PON or GPON protocol. Accurate detection of problems in an XGS-GPON or GPON network. It evaluates and detects problems identifying the devices that may cause them and the failure.

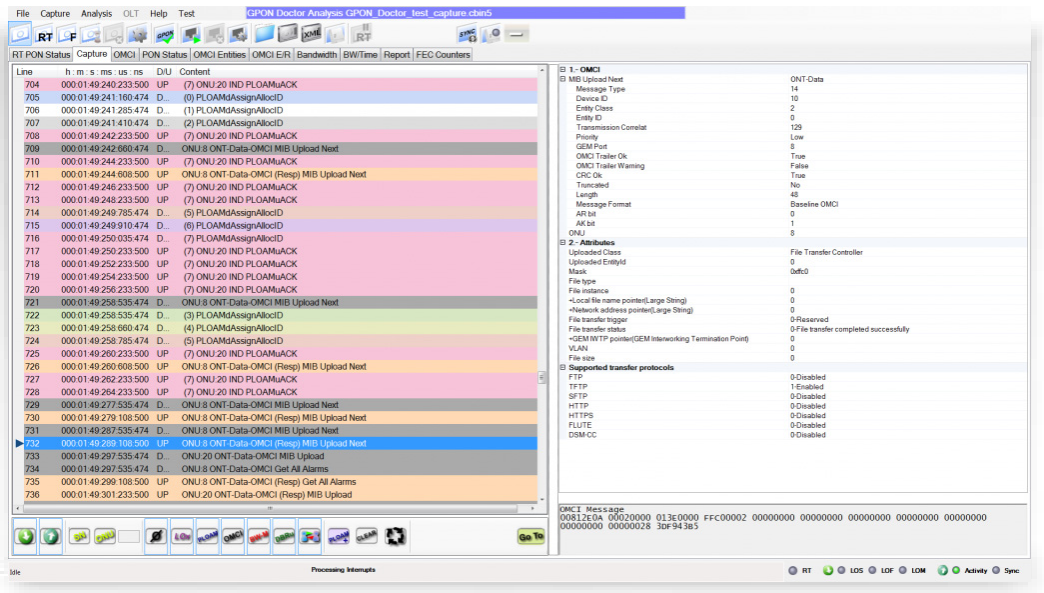
Capture XGS-GPON or GPON in real time

GPONDoctor 10000 captures OMCI and XGS-TC / GTC messages on the fiber in real time to facilitate the monitoring of negotiation processes and configurations, showing in real time the status of ONTs, XGEM / GEM ports and T-CONTs. Extraction of upper layer (Ethernet) traffic in real time allowing the extraction and decryption in real time of user traffic for its monitoring and external analysis. The decoding hardware implements fully automatic AES decryption combined with FEC encoding.

Service regeneration and QoS evaluation

It is possible to regenerate the services established in a PON network. For example, you can extract and reassemble multicast video in real time to be displayed on the GPONDoctor screen. This feature is perfect for evaluating the QoS and QoE of the services configured on a PON.

OMCI entity / relationship diagrams and bandwidth analysis Displays a detailed OMCI entity / relationship diagram including alarms and errors, bandwidth allocation diagrams by ONT and T-CONT, and optional diagrams of the evolution over time of the allocation of bandwidth.



Optical Power and Error Detection / Reporting

GPONDoctor 10000 offers two new licensed functionalities with the possibility to act as an optical power meter and it allows the detection and generation of online error reports.

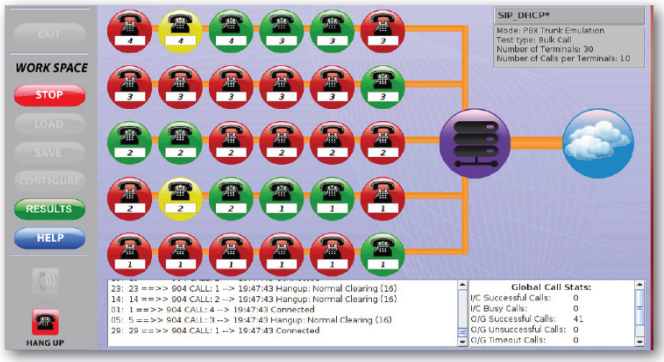
Chipset-Less Implementation

Capture hardware manufactured exclusively for this equipment. The results are independent of the proprietary implementation of the XGS-GPON and GPON equipment manufacturer.

VoIP.Master (SIP trunk & VoIP turn up)

VoIP.Master helps organizations accelerate revenue generation through quick and effective testing of SIP Trunks, VoIP services and VoIP equipment. Designed to meet the needs of VoIP technicians, USB-VoIP.Master has one of the simplest user interfaces on the market. With a powerful feature set USB-VoIP.Master provides a comprehensive test capability required for next generation voice environments. Based on a USB memory device, USB-VoIP.Master is a self-contained live software environment that can be run on most x86/X64 based laptops or computers. By using a live USB memory device users are able to turn existing laptop or computer assets into a powerful VoIP tester without the concern of anti-virus or other corporate lock-down issues that may be present when using the device in a native Windows mode.

USB-VoIP.Master offers the most comprehensive support for VoIP turn-up and maintenance testing through its unique functional testing approach. By providing this capability USB-VoIP.Master can emulate key VoIP/UC infrastructure elements allowing users to quickly test and ensure the correct operation and performance of VoIP networks and equipment. Users can for example connect USB-VoIP.Master to SIP trunks and networks emulating an IPBX, making multiple VoIP calls ensuring the trunk is operational and performing to pre-agreed Service Level Agreements. USB-VoIP.Master can also emulate a SIP VoIP network allowing VoIP equipment to be tested without the need for an operational SIP trunk or network, ideal for pre-staging prior to deployment



Turn-up and Maintenance tester

VoIP.Master can support up to 30 simultaneous VoIP calls using 'Virtual Terminals' in PBX and Network emulation mode. Any combination of outgoing/incoming calls is supported, incoming calls on answer are presented with an auto-attendant capability providing users the ability to select the required mode of operation for call.

Powerful Emulation Workspace

- Support for IP-PBX and Network emulation modes.
- Up to 30 simultaneous VoIP calls
- Real-time quality indicator of the of SIP Trunks and VoIP circuits
- Single Call, Sequential Call and Bulk Call modes
- Multiple codec support

Call Quality Metrics

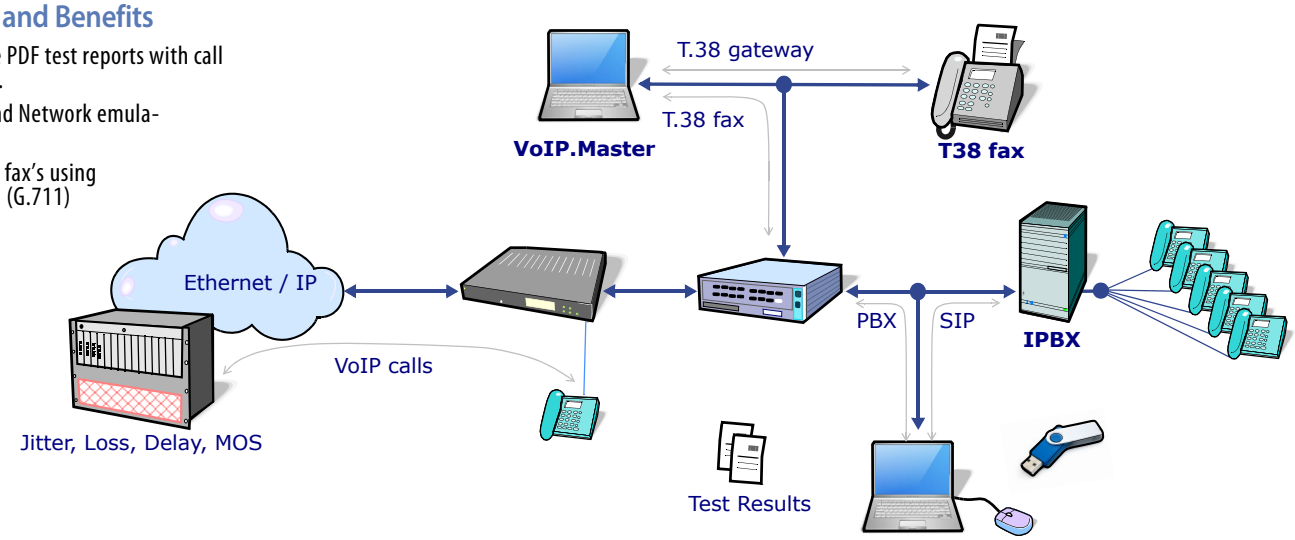
- Call quality metrics using ITU-T E-Model
- Real-time coloured coded MOS indication for each terminal (call).
- Detailed media (RTP) statistics for each call
- Pass/Fail thresholds can be set for MOS or RTP metrics (Jitter/Delay/Loss).

Mass Call Mode

- Emulation of up to 200 simultaneous calls (incoming/outgoing)
- Support for Equipment and Network emulation modes
- Comprehensive PDF test reports with call quality metrics

Key Features and Benefits

- Comprehensive PDF test reports with call quality metrics.
- T.38 Fax CPE and Network emulation
- Send or receive fax's using T.38 or in-band (G.711)



2023 Buyer' Guide

by protocol

	10GE	OWD	T1/E1	IP	PRP	SyncE	PTP	NTP	Tap	VoIP	Serial	Cntrdir	IRIG-B	Goose	SV	C37.94	GPON	NGPON	XGSPON
AT-One			★								★	★							
AT-2048			★								★	★							
Ether.Genius		★	★	✓		★	★	★			★					★			
Ether.Giga				★															
GPONDtr 4.5k																	★		
GPONDtr 9.5k																	★	★	
GPONDtr 10k									○								★	★	★
Net.Hunter				✓			○	○	✓					○	○				
Net.Shark				✓			○	○	★					○	○				
Net.Storm				○			○	○						○	○				
Net.Time Ω			★	★	★	★	★	★					★						
Net.Time ϕ			★	★	★	★	★	★					★						
Net.Time τ			★	★	★	★	★	★											
VoIP.Master																			
xGenius	★	★	★	★		★	★	★	✓	○	★	★	★	○	○	★			
Zeus		★	★	★		★	★	★	✓	○	★	★	★	★	★	★			

★ Best
✓ Good
○ Partial

Tap: Packet Capture Cntrdir: Codirectional /Contradirectional SV: Sampled Values Serial: Serial data / Datacom

by application

	10GE	OWD	T1/E1	IP	PRP	SyncE	PTP	NTP	Tap	VoIP	Serial	Contra	IRIG-B	Goose	SV	C37.94	GPON	NGPON	XGSPON
AT-One			M,R,U								M,R,S,U	R							
AT-2048			M,R,U								M,R,S,U	R							
Ether.Genius		U, W	R,U	all		S,U	all	all			R,S,U					S,U			
Ether.Giga				all															
GPONDtr 4.5k																	T		
GPONDtr 9.5k																	T	T	
GPONDtr 10k																	T	T	T
Net.Hunter				S,L			S,L	E,M,S,L	S,L	E,L				S,L	S,L				
Net.Shark				S,L			S,L	S,L	S,L	E,L				S,L	S,L				
Net.Storm				S,L			S,L	E,M,S,L		E,L				S,L	S,L				
Net.Time ω			A,M	all	S	T	all	all					A,M,S						
Net.Time φ			S	S	S	U,S	S	all					A,M,S						
Net.Time τ			T,E,D	T,E,D		T	T,E,D	E,S											
VoIP.Master				E			E			E									
xGenius	T,U,W	U	R,S	all		T,U,W	all	all	S,U		R,S,U	R	A,M,S	S	S	S,U			
Zeus		U	R,S	S,U		U	S,U	S,U	S		R,S,U	R	A,M,S	S	S	S,U			

A: Aerospacial D: Data Centers E: Enterprise F: Finance L: Labs M: Military R: Railways S: Substation T: Telecom U: Utilities W: Wireles

ALBEDO is an ISO9001 certified company. ALBEDO aim is to be the best technological partner of our customers offering them products to install, synchronize, monitor and troubleshoot transmission resources. ALBEDO designs and markets products that contain a high degree of sophistication and offer a great added value where accuracy and reliability is fundamental in a changing technological environment. Customer satisfaction is our objective and the main driver of our improvement.

3 Years WARRANTY

Each ALBEDO Telecom product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is three years for the Unit and its Accessories except batteries that only have a six months that begins on the date of shipment. This warranty extends only to the original buyer or end-user customer of an ALBEDO Telecom authorized reseller, and does not apply to batteries or to any product which, in ALBEDO Telecom's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling. ALBEDO Telecom warrants that software will operate substantially in accordance with its functional specifications for six months. ALBEDO Telecom does not warrant that software will be error free or operate without interruption.

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