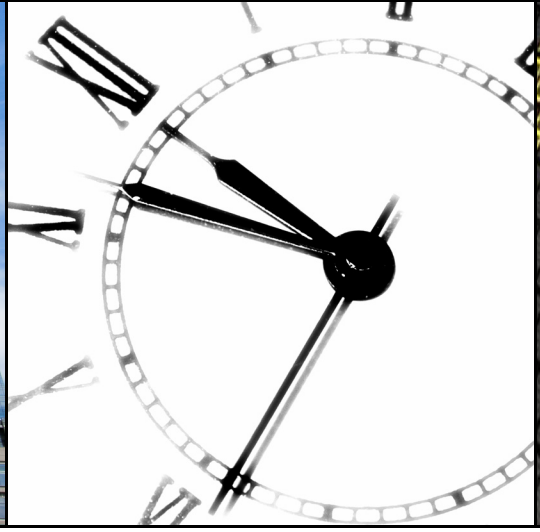

Net.Sync (just-on-time)

the Path to Excellence

Net.Sync is a synchronization appliance configurable as PTP clock while monitors the synchronization quality and time stamps packets distributed across the IP network. It can also execute verification test suites and cooperate with remote testers to verify the transmission paths followed by the PTP packets.

NET.SYNC

PTP Master & Slave

The synchronization paradigm is moving forward new timing requirements for not only frequency but phase as well. This scheme probes to be very flexible but it is necessary to provide an absolute time reference. LTE operators, Power utilities and large Corporations are adopting PTP for timing distribution across the existing Ethernet/IP packet networks.

However switches and routers cause packet lost, jitter or delays, while fibre optics generate phase impairments and bit errors. Therefore the PTP packets being distributed across suffer impairments that may degrade the synchronization.

Net.Sync has a sophisticated timing core to support both *PTP Grand-Master clock* to synchronize multiple clients, and *PTP Slave clock* to monitor de quality of the timing services and to provide host synchronization to electrical or optical interfaces up to 1Gbit/s.

Time references

Net.Sync has a built-in GNSS receiver, one internal OCXO that eventually can be upgraded to a Rubidium. Regarding references it can be selected among PTP SyncE, PPS, ToD, 1.5 / 2.0 / 10 MHz, E1 / T1 to assure the best time source.

"All-in-1: Net.Sync pre-Qualifies, Provides time & Monitors PTP synchrony"

There is no need to buy and go with testers just install Net.Sync at any point to turn up and monitor LTE.

Time SLA assurance

Net.Sync has an number of functions to track the quality, in terms of Stability and Accuracy of the timing provided. To achieve it Net.Sync is equipped with a complete set of tools that will facilitate multiple analysis and measurements:

- Frequency and phase impairments
- PTP decoding, wander, floor population
- One-way and Two-way delays with GPS

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LTE turn-up

LTE operators have to face with a number of technologies including Ethernet / IP at transmission layer, PTP and SyncE at synchronization plane.

Synchronization

LTE nodes are demanding accurate time references, particularly those architectures that consider small cells where the frequency re- utilization is a key factor of performance. The appliance can set up the synchronization network by means of a comprehensive set of features while accepting external clock ref., recovering clock from incoming data, or using the built-in OCXO and GPS.

SyncE

Complete analysis and generation of the signal, SSM and SSM protocols can be captured and decoded.

PTP Tests

During the installation of PTP connectivity problems may occur between the master and slave units. When troubleshooting these links, the appliance can be used in Terminate mode to capture PTP messaging on both the transmit and receive test ports up to 1 Gbit/s. In this mode it simultaneously generates, receives, and captures PTP messages on the circuit under test. Users can quickly identify higher layer protocol issues that may be associated with PTP messages and/or provisioning.

Jitter & Wander

Both measurements are executed in real time without the need of external devices. Jitter measurement are specific for E1 while Wander are for E1, SyncE and PTP.

One-way delay

This test is very useful in several business including Telecom and Power utilities. One-way Delay saves hours of troubleshooting by detecting asymmetric traffic delays. Accuracies 10 times greater than most common SLA can be attained, network providers to differentiate their offering and allowing network planners to understand the delay tolerances affecting their applications

Transport SLA

The Quality of the transport layer may determine the success of the syntonization. To pre-qualify those infrastructures distributing the PTP streams then Net.Sync can has a very powerful set of tools

1. Deep analysis of the transmission sublayers executing the RFC2544 to find-out of KPI such as packet throughput, loss, latency...
2. Simulation a timing service with traffic profiles and discover KPI such as frame delay, delay variation, loss ratio and availability.
3. Cooperation with remote testers as a reflector answering to BER or ICMP.

Everything to make sure that the Ethernet/IP network transmission SLA distributing the PTP messages is preserved.

Network verification

These features will help to quickly identify higher layer protocol issues that may be associated with PTP messages with tools to set up and modify any IP/Ethernet or PTP header.

Improved RFC

The RFC 2544 verifies the performance of the network testing throughput, frame loss, latency, jitter and burst, that can be executed as symmetric and asymmetric. The unit can also be setup in loop back mode or peer-to-peer mode.

e-SAM test

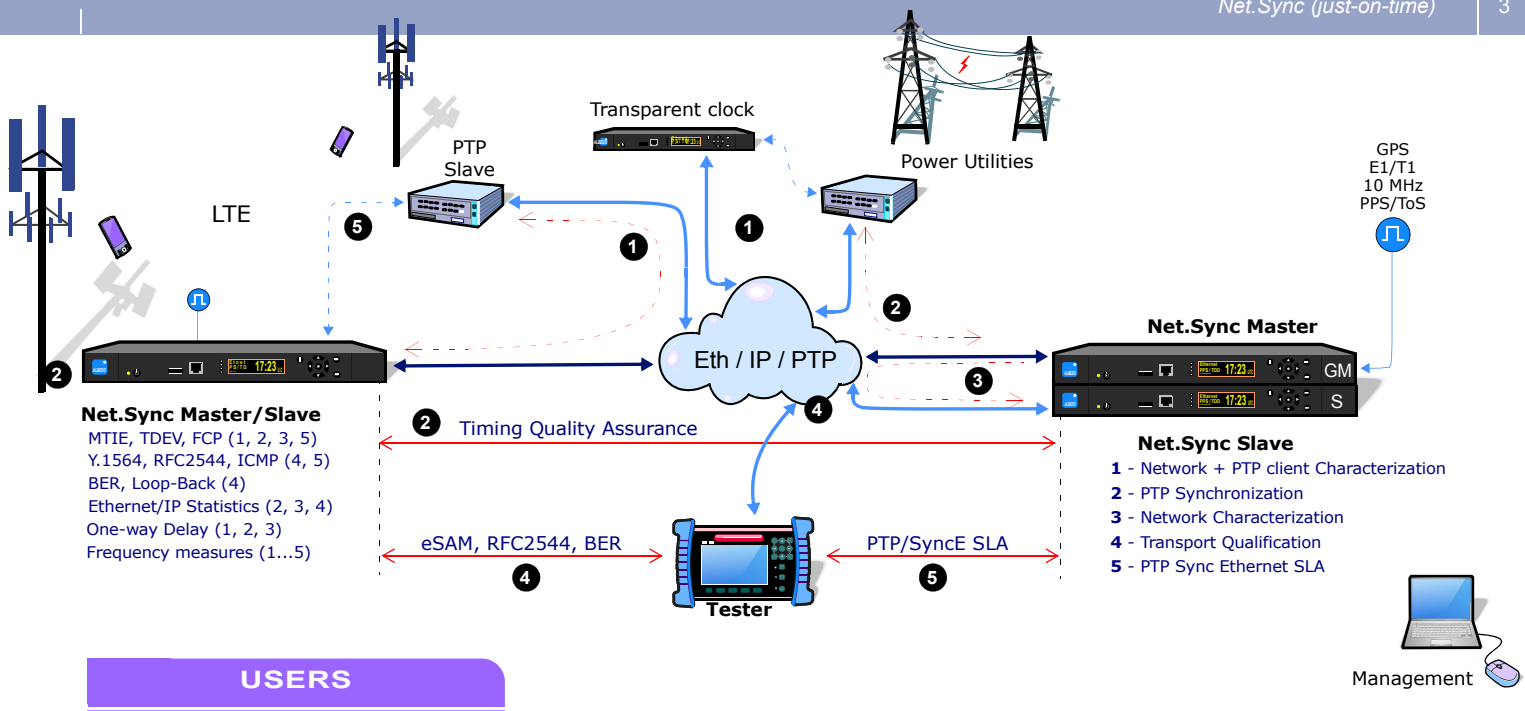
This Ethernet service activation test methodology for turning up, installing and troubleshooting Ethernet-based services allowing the complete validation of Ethernet service-level agreement (SLA) in a single test executed in two phases:

Q-in-Q

This appliance has the ability to test QoS by means of the VLAN CoS bits used for VLAN stacking by carriers and operators.

IP Services test

Often it is required to test IP features to verify end-to-end connectivity by means of Ping and Trace Route with ICMP echo request and analysis fully supported.



USERS

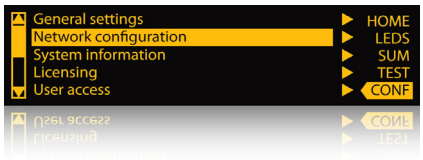
- LTE roll-out & maintenance
- Power Utilities
- Large factories
- PTP vendors
- R+D centers

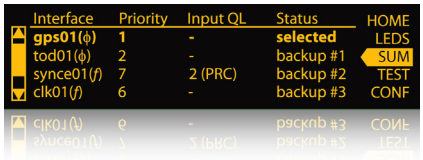
KEY FEATURES

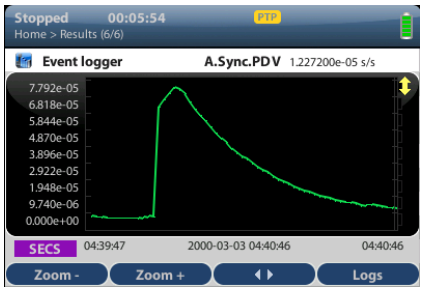
- Built-in GNSS and OCXO
- TRef. SyncE, PTP, PPS, ToD, E1, T1, 1.5/2/10MHz
- SyncE / PTP wander analysis and Generation
- Floor Delay Population
- One-way delay measure
- RFC 2544
- L1/L2/L3/L4 loopback
- One-way-delay with GPS
- ESMC/SSM analysis/capture
- Y.1564 (e-SAM)
- Y.1731 QoS statistics
- Sym/Asym RFC2544
- MPLS support
- SNMP support

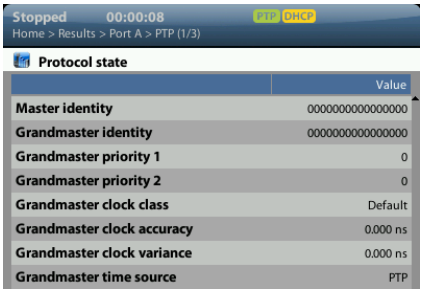
BENEFITS

- Built-in GPS receiver
- Upgradable by software
- Up to 4h. on batteries
- Enhanced holdover
- Q-in-Q for demarcation tests









Syntonize perfectly

Net.Sync can also measure the frequency and phase impairments caused by the network elements including lasers, fibre optics, packet switches and routers. It is also able to verify the transmission layer used by LTE and cooperate with remote instruments executing standard test suites.

Timing Characterization

Net.Sync samples of synchronization provider and care services:

1. **Network and PTP client.** Characterization of network delay and delay variation measurements, timing accuracy:
2. **PTP Synchronisation.** Multiple references ie. GPS, BITS, SyncE for perfect master-slave packet stream generation.
3. **PTP Network.** Characterization by means of timing accuracy measurements and packet statistics.
4. **Transport layer.** Qualification, troubleshooting, performance and quality tests.
5. **Synchronization SLA.** Permanent monitorization in terms of frequency and phase impairments control.

For technicians responsible of PTP installation, commissioning and maintenance Net.Sync provides valuable insight and simplifies complex issues by illustrating the full network picture. Experts will quickly characterize those resources that are in a good shape and which ones require intervention.

PTP Prequalification, Synchronization and Surveillance	
Operation Modes	• PTP Clock: PTP Grandmaster (IEEE 1588v2) • PTP Slave (IEEE 1588v2) • GNSS Receiver, Synchronization input to timing output • Service Activation Methodology (ITU-T Y.1544) • PTP / Ethernet appliance: Performance test (IEEE RFC2544) • L1/L2/L3/L4 loop-back
PTP profiles	• Default (IEEE 1588v2) • Frequency Delivery (ITU-T G.8265.1) • Power Profile (IEEE C37.238-2011)
Timing Inputs (time references)	• Built-in GNSS receiver over SMA-F connector (GPS and GLONASS support) • Built-in quartz crystal OCXO; short term stability: 0.5 ppb over 0.1 to 30 seconds; typical stability: 0,05 ppb over 1 second • 1xPPS, 1xToD with NMEA format over RJ45 and BNC connectors • SyncE: ESMC and SSM decoding, double Port 1000BASE-T and 1000BASE-X • PTP (IEEE 1588v2): double Port 1000BASE-T and 1000BASE-X • E1, 2048 kbit/s, 2048 kHz, T1, 1544 kbit/s, 1544 kHz, and 10 MHz over RJ45 and BNC connectors
Timing Outputs	• PTP Clock IEEE 1588v2 (over RJ45 and SFP) • Synchronous Ethernet (over RJ45 and SFP) • E1, 2048 kbit/s, 2048 kHz (over RJ45 and BNC) • T1, 1544 kbit/s, 1544 kHz (over RJ45 and BNC) • 1 x PPS (over RJ45)
Timing Accuracy	• Locked to GPS: timestamp ± 100 ns • Holdover mode from PPS to OCXO: Phase<±1.5ms then 1h; Freq.<16 ppb 1month • Holdover mode from PPS to Rubidium: Phase<±1.5ms then 24h; Freq.<16 ppb 5year
Timing Quality and Assurance	• Operation: Generation / Decoding of PTP • PTP Master / Slave operation • Transparent in pass-through mode • Protocol state: Port state, best master, identity, BMC priorities, clock class, accuracy, clock variance, time source • PTP Counts & statistics: Sync, Delay req, Delay resp, Peer delay req, Peer delay res, Follow up, Peer delay res. follow up, Announce • PTP Sync Floor Delay Population: FPC, FPR, FPP min and current; Configurable Pass / Fail threshold • PTP Wander analysis: TIE, MTIE, TDEV according to ITU-T G.8260 • SyncE Analysis: Line frequency, offset, drift • Wander TIE / MTIE / TDEV (ITU-T O.172) • Wander generation, QL in SSM decoding (G.781) • Asymmetric Delay Analysis: Two-way delay measurement • One-way delay measurement (Assisted by GNSS)
Automatic Transport Tests	• RFC 2544: Throughput, Frame-loss, Latency, Back-to-back, Recovery, Asymmetric RFC based on Ethernet and IP RMP • Y.1564: Ethernet service activation, Eight / four services (color / not) CIR, EIR, max, throughput, FTD, FDV, FLR, availability objectives • Loopback: Layer 1-4 loopback with Filtering conditions • MPLS loop control, Loop controls for broadcast • ICMP support
Ethernet/IP Statistics	• Top 16 talkers: Sour/Dest MAC / IPv4 / IPv6 addresses, VID (VLAN), C-VID (Q_in_Q), S-VID (MPLS) • Ethernet Frame Counts (RFC 2819): VLAN, Q-in-Q, Priority, Control, Pause, BPDUs • Tx/Rx Uni-Multi-Broadcast, Errors, Undersized, Oversized, Fragments, Jabbers, Runts, (Late) Collisions, Sizes, MPLS stack length • Bandwidth Statistics: (in bit/s, frame/s,%) Rate, Max, Min, Aver, Occupancy, Unicast, Multicast, Broadcast • IPv4 & IPv6 counts: (in bit/s, frame/s,%) Unicast, Multicast, Broadcast, Errors, TCP, UDP, ICMP
Interfaces	• 2 x SFP / SFP+ ports: 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX, 100BASE-FX, 100BASE-TX, 10BASE-T • 2 x RJ-45 port for electrical connection 10/100/1000BASE-T; PoE detection and PoE transparency • SMA-F: GNSS (GPS, GLONASS) • RJ45 and BNC: PPT, SyncE, PPS, ToD, E1, 2MHz, T1, 1.5MHz, 10MHz

Platform	
Rack mounted (1U)	• Management: SNMP, SSH, VNCSNMP, MIB and VNC remote control • Front Panel: Display: OLED 256 x 64 pixels, LEDs: Power, System, Alarm, Clock • Keypad: Power On/Off, Up, Down, Left, Right, Page Up, Page Down, Esc • Console: RJ45, USB: upgrades, configuration, results, user files • Back Panel: Network and Time interfaces, • Redundant Power Supply: (AC+AC / AC+DC / DC+DC) • VDC: -40 to 60V / VAC: 110 to 240V • Lipo Batteries: Fault tolerant 2.15h of continuous operation without power supply • Mechanical: Fanless, Size: 1¾"x10"x19" (ETSI 1U rack mount), • Weight: 4.2 kg / 8.7 lb • Operation Temperature: -10°C to +50°C • Operation Humidity: 10% to 90%

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in Test we trust