



ENERGY

PRECISION TIME PROTOCOL (PTP) FUNCTIONAL TESTING FOR ETHERNET SWITCHES

With the introduction of IEC 61850, the demand for substation automation applications that require precise time synchronization of voltage and current measurements is growing.

These time accuracy requirements are supported by the new Precision Time Protocol (PTP, specified in IEEE 1588), which is becoming more and more widespread, because it prevents a dedicated Pulse Per Second (PPS) signal network. PTP is a protocol used to synchronize clocks throughout a computer network. In a local area network, it achieves clock accuracy in the sub-microsecond range, making it suitable for distributed protection applications, like for example a IEC 61850 process bus with sampled values transmitted by multiple merging units, distributed via Ethernet Switches and received by multiple protection relays.

A PTP verified Ethernet Switch gives network operators better trust in their power system operation as equipment performance data is more reliable. And on reliable data it is safer to steer and improve the reliability of a substation.

Time synchronization with PTP

There are specific performance requirements for Ethernet switches that are used in the substations. When an accuracy in sub-microseconds range is needed, PTP is the solution. To support utilities in selecting the correct equipment DNV GL has set up a functional testing program to verify that the equipment under test meets the IEC 61850-9-3 PTP time synchronization requirements.

We recommend that utilities and system integrators only use equipment that has passed these PTP tests.

From the vendor's point of view passing such tests gives a broader market visibility and proof of quality of their product.

Testing approach

DNV GL executes the tests accordingly to its internally developed test procedures and supported by highly specific test tools, all aligned to the need of the substation time synchronization systems implemented in conformance with IEC 61850-9-3 and IEEE 1588. These tests can be executed on Ethernet switches that integrate PTP transparent clock and boundary clock functions.

The verified aspects are: PICS statement, clock management mechanism, time sync correction 1-step and 2-step, path delay 1-step and 2-step, PTP packet contents according to the IEC 61850-9-3 standard, and the measured PTP accuracy performance.

The test steps are:

- **Preparation and configuration**
DNV GL requests the Ethernet Switch to be configured in advance and to prepare the PTP PICS document.
- **Test execution**
A DNV GL test engineer executes the applicable test procedures in our laboratory with local support from the manufacturer.
- **Test report**
The deliverable is a report stating the measured performance of the PTP device and if the device passed/failed the applicable test procedures.



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DNV GL

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In the energy industry

DNV GL delivers world-renowned testing and advisory services to the energy value chain including renewables and energy efficiency. Our expertise spans onshore and offshore wind power, solar, conventional generation, transmission and distribution, smart grids, and sustainable energy use, as well as energy markets and regulations. Our 2,500 energy experts support clients around the globe in delivering a safe, reliable, efficient, and sustainable energy supply.