Netnod Time Tech info **v.1.1 (15 November 2024)**

**[block intro]** Netnod is the leading provider of time services in the Nordics. With fully redundant clock nodes located all over Sweden, Netnod Time offers the most precise, secure and robust time available today.

**1. Introduction**
This document provides the technical overview of Netnod’s commercial time services which include our PTP service, Netnod Time Direct and Netnod Time Remote. We also provide a free Network Time Protocol (NTP) and Network Time Security (NTS) service. You can find more technical information about NTP [here](https://www.netnod.se/ntp/network-time-protocol-ntp-services) and about NTS [here](https://www.netnod.se/nts/network-time-security).

Netnod’s time services use state-of-the-art technology and redundant time nodes distributed across Sweden. Our time services, which are easy to set up and use, provide the most cost-effective way to ensure your network time is accurate, robust and avoids the risks associated with using only GNSS.

Read more about [the risks of relying on GNSS](https://www.netnod.se/knowledge-base/How-does-time-distribution-work) and [how ISO27001 compliance requires redundant time](https://www.netnod.se/blog/do-you-need-is027001-compliance-then-check-your-clocks).

**2. Netnod’s Time Services: traceable to Swedish national time**

Netnod works with RISE, the national laboratory responsible for the Swedish national timescale (UTC(SP)), and is trusted by PTS and RISE to distribute Swedish national time. Netnod’s time service is constantly monitored and checked internally and by PTS and RISE. This means that we can guarantee that Netnod's clocks are always traceable to Swedish national time.

**3. Precision time**

The Netnod Time system is designed to maintain PRTC-A accuracy (+/- 100ns from the reference) for at least 3 months of isolation. Our reference is Swedish local time, UTC(SP), provided by RISE. This time is, normally, within a couple of nanoseconds from the global time reference UTC.

Netnod’s clocks rarely differ more than +/-10ns from Swedish local time. The precision in our current calibration (static phase error compared to UTC(SP)) is better than +/- 20ns.

**4. Netnod clock nodes**

Our state-of-the-art time nodes use caesium clocks distributed in redundant pairs throughout Sweden to ensure redundancy.

There are six time nodes in different locations in Sweden, each continuously monitored and steered to follow UTC(SP). To ensure high availability, every time node is equipped with two atomic clocks generating separate time scales.

**5. Netnod’s Commercial Time Services**

**5.1 Netnod Time Direct**

Netnod Time Direct is a fully managed time service with SLA that guarantees 30µs accuracy from UTC(SP). It is delivered over a port at a Netnod Internet Exchange (IX) which makes it the perfect choice for networks already present or close to a Netnod IX. It is the most cost-effective way for your network to get accurate, secure and guaranteed time.

**5.2 Netnod Time Remote**For organisations elsewhere or with distributed sites throughout Sweden, Netnod Time Remote is a good choice. Netnod Time Remote is a fully managed time service that guarantees 1ms accuracy from UTC(SP) anywhere in Sweden

**5.3 Netnod PTP Service**
This is aimed at sectors that need the most accurate, secure and reliable time services. Netnod’s Precision Time Protocol (PTP) service provides time traceable to UTC(SP) at the level of nanoseconds.

**6. Service Description**

**6.1 Netnod Time Direct**

The Netnod Time Direct service provides a certified time signal generated by redundant clock nodes using caesium atomic clocks, delivered via our IX network to the selected data centre where it is then handed over an interface of choice. The SLA guarantees the service is accurate to within 30 microseconds of UTC(SP).

You connect to Netnod Time Direct using a data centre cross-connect. This provides a direct connection to the Netnod switch over a physical port. If you are a Netnod IX customer, you can also connect over [a separate VLAN on an existing IX port.](https://www.netnod.se/ix/netnod-one-port)

Netnod Time Direct delivers PTP using default profile, End-To-End delay measurements, multicast and adjustable message intervals. The nodes in our IX Network perform Best Master Clock Algorithm (BMCA) and will always present the best suited Grandmaster to the client.

**6.2 Netnod Time Remote**

The customer's placed equipment (CPE) is connected to Netnod’s clock nodes over a secure MPLS VPN connection.We deliver time directly to a Netnod CPE at your site using an MPLS VPN. This is a fully managed service which guarantees accuracy within 1 ms of UTC(SP). The CPE has an in-built oscillator to ensure stable, accurate time even if connectivity is disrupted.

The service is delivered over a 1Gbit/s RJ45-port. If an optical interface is required this can be offered over a port that supports SFP/SFP+. The customer has to supply cable connections (copper or fibre) and, if necessary, an SFP.

**6.2.1 How to use the service**

The equipment can deliver both NTP and PTP with equal precision.However, it is common that client equipment connected with PTP delivers a higher precision than NTP. Our experts can help determine which protocol to use based on customer needs and what is supported by the client equipment.

The customer can add a switch or use the existing network with switches and routers for both NTP and PTP. With a switch, or in an existing network, time traffic must be handled with care. A lot of traffic through the switch/network can result in long queues in the network equipment buffers and can affect the precision of the time. Some specific switches and routers can handle PTP (transparent clock alternative boundary clock).

It is also possible to use traffic prioritisation in the network to reduce the dealy for the time traffic. However, the simplest and most reliable way is to use dedicated connections for the time traffic.

**6.2.2 Security**

The customer placed equipment (CPE) for Netnod Time Remote is configured to only deliver the described service.

The time traffic is distributed over a MPLS VPN network, and all traffic, to and from the CPE, is routed through Netnod where Netnod filters it. Only necessary Netnod-services for management and monitoring are allowed.

The MPLS VPN network with necessary equipment is supplied by Netnod via partners.

Netnod Time CPE is not a router and will not allow any traffic to pass between different ports. This means that it is impossible for anyone with access to the CPE, to get access to the customer network. It is recommended to implement an ACL (Access Control List) at the customer facing side which only allows NTP/PTP.

**6.2.3 Supported Protocols**

**PTP**

* Support for multiple different profiles. G.8275.1, G.8265.1, G.8275.2
* 1-step or 2-step

**NTP**

* NTPv1, v2, v3 and v4 over both IPv4 and IPv6
* Up to 8000 transactions per second
* Automatic change of Stratum clock, based on delivered precision

**6.3 Netnod Time PTP**

Netnod Time PTP is a Precision Time Protocol (PTP) service that connects you directly to one or more of our Grandmasters within our time nodes. These nodes are designed with full redundancy and feature a pair of cross-fed time nodes, each equipped with caesium clocks.

Each PTP service has its own Grandmaster, which means we can customise the delivery to your specific requirements. We support most PTP profiles, including G.8265.1, G.8275.1, and G.8275.2. We can also provide PTP via either Multicast or Unicast, as well as with SyncE.

The PTP service is delivered over a dedicated fibre connection, supporting a wide range of interfaces. The standard option is 1GE 1270/1330 BiDi to ensure optimal accuracy, though other configurations are available.The fibre is directly connected to redundant time nodes with caesium clocks.

For maximum security and availability, we strongly recommend using our redundant PTP service. In this setup, PTP is delivered via redundant fibre connections linked to a pair of Grandmasters. These Grandmasters can be located either within the same redundant time node or across different time nodes, ensuring robust protection and continuous service.

**7. Netnod as primary or secondary time source**Our recommendation is to always use time from two sources, where Netnod can/should be the primary source and time from another source as secondary.