

GNSS independent synchronization solution with open and disaggregated infrastructure revolutionizes 5G rollout process

Combining forces, pioneering telecom operator Türk Telekom and synchronization expert Net Insight revolutionizes 5G networks by developing and rolling out the world's first GNSS independent overlay synchronization solution which reduces cost and time-to-market for 5G deployments.



The Company

Türk Telekom, with over 180 years of history, is the first integrated telecommunication operator in Türkiye. Having a wide service network and product range in the fields of individual and corporate services, Türk Telekom unified its mobile, internet, phone and TV products and services under the single **“Türk Telekom”** brand as of January 2016.

“Turkey’s Multiplay Provider” Türk Telekom has 17.1 million fixed access lines, 14.6 million broadband, 24.6 million mobile and 2.9 million TV subscribers as of June 30, 2022. Türk Telekom Group Companies provide services in all 81 cities of Türkiye with over 38 thousand employees with the vision of introducing new technologies to Türkiye and accelerating Türkiye’s transformation into an information society.

The Brief

Time synchronization is critical for 5G to function, and Türk Telekom early realized the cost and complexity of enabling existing PTP (Precision Time Protocol) solutions across their large national network. Türk Telekom experienced that dependence on GPS/GNSS can cause 5G services to be affected and therefore proactively decided that their 5G network must be independent of GPS or other GNSS solutions.



Türk Telekom understood the large potential to reduce cost and accelerate national 5G rollouts with the Time Transfer solution. The companies decided to combine their expertise in 5G and time synchronization to jointly develop an overlay time synchronization solution, Precision TimeNet. Precision TimeNet enables mobile operators to distribute time over

“Türk Telekom is the no. 1 lead operator in Türkiye, and it is our responsibility to shape the future and lead the digital transformation. The important collaboration with Net Insight with development of GNSS independent Precision TimeNet ensure we can deploy 5G networks with security, reliability, and a faster rollout process.”

- Ümit Önal, CEO Türk Telekom

existing underlying IP network without being forced to do costly forklift upgrades for enabling PTP, while meeting increasing regulatory requirements on GNSS independence.

The cooperation between Türk Telekom and Net Insight creates great possibilities to utilize extensive experiences from the fixed and mobile network covering all of Türkiye in the development of the synchronization solution. Being the first operator to use this technology, Türk Telekom have the advantage of early evaluation and provide feedback from an actual large nationwide synchronization network. Both companies have the intention to share their experiences in international standardization.

The Challenge

As part of the 5G/DSS rollout process Türk Telekom executed an extensive inspection of the existing network and identified a critical challenge. The recommended PTP

synchronization standard for telecom profiles requires hardware and/or software upgrades to meet the high demands for 5G, and vendors solutions might not always be compatible with each other. In addition, the cost and complexity of rolling out and operating a large-scale nationwide PTP network is significant.

The alternative to PTP is GNSS based synchronization. The awareness of GNSS disturbance is increasing even further due to the tense geopolitical situation globally. Individual country regulators e.g., the Swedish Post and Telecom Authority (PTS) have mandated GNSS independent synchronization as a requirement in all 5G build-outs. To overcome these challenges Türk Telekom initiated Net Insight to discuss on an alternative solution.

The Solution

The further development on Time Transfer resulted in Precision TimeNet (PTN), with built-in mechanisms to distribute time across existing networks.

Precision TimeNet is an overlay synchronization technique combining cutting-edge technology, decades of proven expertise and robust hardware ready for rapid field deployment within any 4G/4.5G/DSS/5G and emerging 6G networks. Türk Telekom has performed extensive network trials and PTN is now used in live 5G operation in existing IP/MPLS and DWDM networks. The Precision TimeNet solution is set up as an overlay network solution enabling distribution of time in Türk Telekom's network architecture. The sync information is transported within standard VPN connections between Precision Time Nodes and without utilizing any PTP support in intermediary nodes. This results in significant cost saving as intermediary nodes within MPLS and DWDM do not require upgrades.

“The solution enables us to visualize the synchronization network, identify where problems lie and as a result enable us to perform data driven trouble shooting and optimization in a much efficient way. “

- Yusuf Kıraç, Chief Technology Officer Türk Telekom

Türk Telekom can therefore continually improve their networks in a better and more operatively reliable way.

“With the Precision TimeNet synchronization solution that is developed together with Net Insight providing vendor and technology independence, Türk Telekom will be able to ‘Plug and play’ while easily operating, monitoring, and troubleshooting our synchronization network. Our operational challenges are solved as the Precision TimeNet offers a ‘Time as a Service’ to existing stale alternatives on the market.”

- Yusuf Kıraç,

Chief Technology Officer Türk Telekom

Türk Telekom are now well prepared to meet existing and future synchronization requirements, e.g., imposed by new 5G RAN features such as Carrier Aggregation (CA), Fronthaul (FH) and Massive MIMO, while being flexible in choosing technology and vendors in future extensions of their network. In addition, the PTN solution is fully interoperable with and complements existing GNSS and PTP market alternatives.

The Results

Türk Telekom are currently in the phase of rolling out the PTN network and are now operational in all Turkish regions. Measurements with live 5G radio have been performed and the results have proven the capabilities of the overlay solution of accurately distributing time across Türk Telekom's national network.

“Precision TimeNet has a clear differentiation opportunity through its overlay capabilities. Ensuring right synchronization capabilities is a strategic priority for operators, while maintaining a cost-efficient rollout “

- Yusuf Kırac, Chief Technology Officer Türk Telekom

The performance of the time synchronization to the 5G access network in one of the regions is presented in Figure 1. The Time Transfer is made over about 700 km from the Primary Reference Time Clocks (PRTC) to the regional node over a complex and heterogeneous underlying network including a diverse set of both optical transport and router equipment. The results show good and robust performance within +/- 100 ns maximum Time Error as can be seen in Figure 1, which is well below

the 5G absolute phase requirements of 1,5 us. The effects from traffic load were not significantly present and showed robust stability. During the week there were several network events which changed the underlying asymmetries in the various links between the time nodes. All these network events were handled well within time error budget which demonstrates the Precision TimeNet technology’s ability to identify and compensate for network events in a robust and reliable way.

“We are impressed how fast the timing distribution was set up to the regions 5G base stations and the base station radio performance is proof of an incredibly good timing “

- Yusuf Kırac, Chief Technology Officer Türk Telekom

The innovative collaboration between Türk Telekom and Net Insight has resulted in a solution disrupting the market with continued escalating interest in the market.

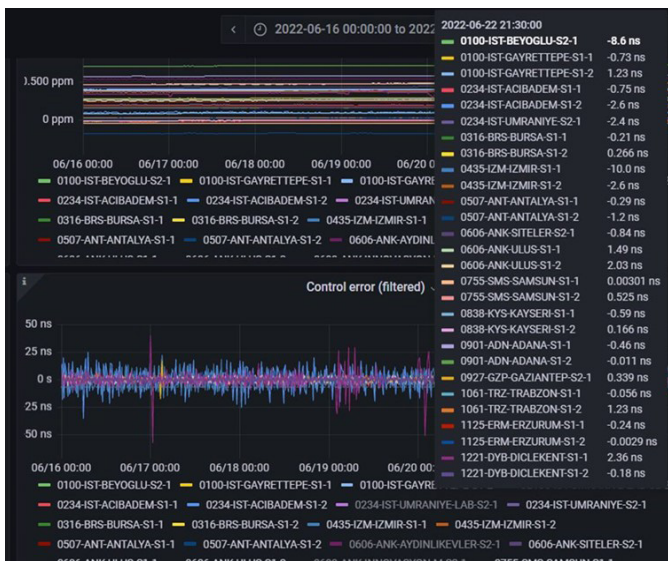


Figure 1. Measure of time error for 1 day.

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