Research Internship / Master Thesis:
Secure Time Synchronization in Modern Networks

Context

High-precision time synchronization is a vital prerequisite for many modern applications and technologies, including Smart Grids, Time-Sensitive Networking (TSN), and 5G networks. Although the Precision Time Protocol (PTP) can accomplish this requirement in trusted environments, it becomes unreliable in the presence of specific cyber-attacks. Time delay attacks mainly pose the highest threat to the protocol, enabling attackers to diverge targeted clocks undetected. While redundant paths have been identified as effective countermeasures to such attacks, they create new challenges regarding network design and configuration.

The student should get familiar with secure time synchronization and focus on redundant path strategies for PTP. Afterward, the main task of this work is to find solutions for the aforementioned challenges and evaluate them regarding multiple criteria (performance, cost, security, applicability, etc.). The theoretical analysis should be complemented with a small proof-of-concept implementation, preferably on real hardware.

Tasks

1. Get familiar with PTP (aka IEEE 1588), the threat of time delay attacks, and countermeasures based on path redundancy.
2. Develop solutions to efficiently design, configure, and maintain multi-path networks while ensuring the security for precise time synchronization.
3. Set up a test environment to evaluate the performance of your solution.

Requirements

- High motivation, structured and independent approach to work
- Strong background in computer networks and graph theory
- Good programming skills (preferably C/C++, Python)
- Basic knowledge of time synchronization and/or security is beneficial

The topic could be targeted in either a research internship or a master's thesis. However, the latter is preferred.

Contact

If you are interested in this position, please send your full application (CV, transcript of records, possible start dates) to Andreas Finkenzeller (**andreas.finkenzeller@tum.de**).

Associate Professorship of Embedded Systems and Internet of Things
School of Computation, Information and Technology
Technical University of Munich
Arcisstraße 21, 80333 München
www.ce.cit.tum.de/esi