

Real-Time Deterministic Networking for Virtualized Industrial Applications in a Datacenter Infrastructure

Bachelor's Thesis/Master's Thesis

Project

In production environments, real-time deterministic communication is essential to guarantee the exchange of time-critical traffic. In an era where hardware functions are increasingly virtualized into datacenter-like infrastructures, the question arises whether deadlines and determinism can be guaranteed on Custom Off-The-Shelf (COTS) platforms typically designed for best-effort traffic. The additional virtualization layer further accentuates this challenge.

This thesis will focus on the architecture stretching from the virtualized environment to the Network Card (NIC). The goal is to find a combination of network driver, packet processing techniques and time synchronization method that will enable deterministic and low-latency communication to and from the virtualized industrial application.

The work will be remunerated with a monthly salary and located at the Research Campus of SEW-Eurodrive (Campus 3, 76646 Bruchsal). The total duration would be 6 months.

Tasks

1. Analysis of time synchronization and networking options for given virtualization technologies and network cards
2. Implementation of 2 to 3 retained architectures
3. Setup of a reproducible test environment and empirical evaluation of the proposed solutions

Requirements

- ✓ Understanding the network stack and virtual machines/containers will help a lot
- ✓ Programming experience and basic knowledge of Linux-based systems
- ✓ First contact with real-time systems, Time Sensitive Networking (TSN), and NICs are advantageous

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