Secure Configuration of Heterogeneous TSN and DetNet End Stations

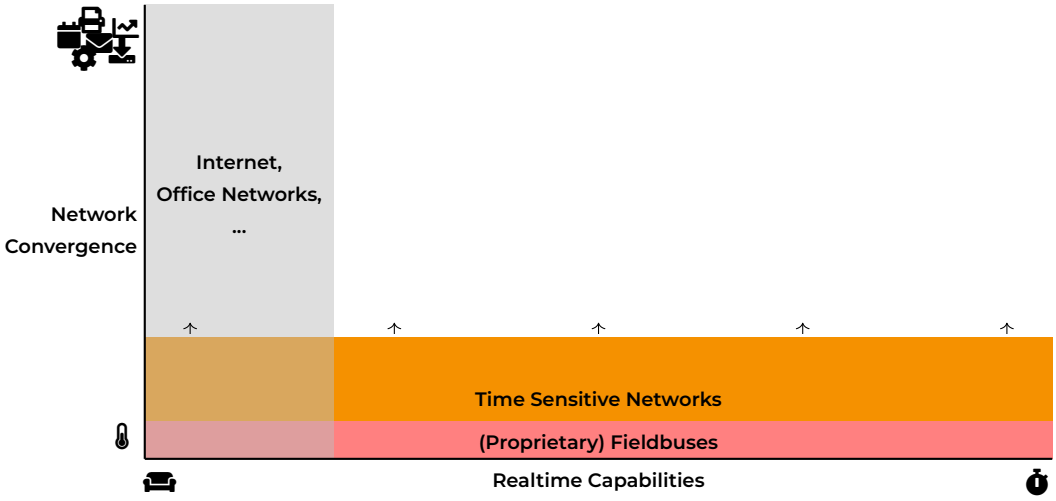
TSN/A Conference



Dr. Florian Kauer

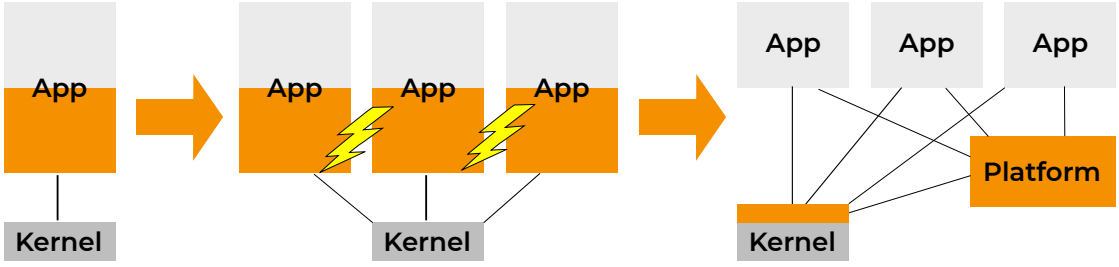
Linutronix GmbH

2023-09-28


Internet,
Office Networks,
...
Network
Convergence
Time Sensitive Networks
(Proprietary) Fieldbuses
Realtime Capabilities

LINUTRONIX

From Single Application to Platform



LINUTRONIX

Security in Conventional Cloud SDNs

Threat	Security Objective	Possible Solutions
Injection of forged application packets	Ensure packet authenticity	Message authentication codes, firewalls...
Installation of wrong network configuration	Prevent unauthorized config changes	Control plane access control
Application disrupts traffic egress of cluster node	Ensure unimpeded traffic from all applications	Fair packet scheduling
...	...	...

LINUTRONIX

Security in Conventional Cloud SDNs

Threat	Security Objective	Possible Solutions
Injection of forged application packets	Ensure packet authenticity	Message authentication codes, firewalls...
Installation of wrong network configuration	Prevent unauthorized config changes	Control plane access control
Application disrupts traffic egress of cluster node	Ensure unimpeded traffic from all applications	Fair packet scheduling
...	...	...

Fairness is not sufficient for industrial control networks!

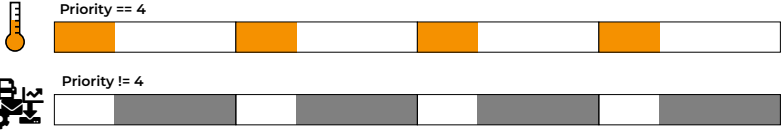
→ Disturbing traffic shall not even reach the wrong queue!

LINUTRONIX

The Scenario



Photo by Joeb07, CC BY 3.0, https://commons.wikimedia.org/wiki/File:Schkopau_Buna-Werke.jpg

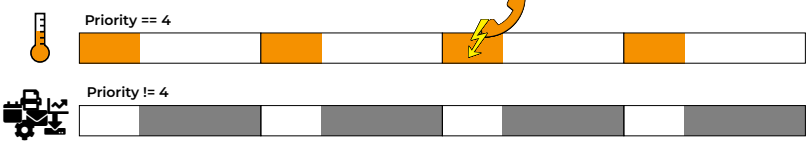


LINUTRONIX

The Problem



Photo by Joeb07, CC BY 3.0, https://commons.wikimedia.org/wiki/File:Schkopau_Buna-Werke.jpg



LINUTRONIX

Virtual PLC Use Case



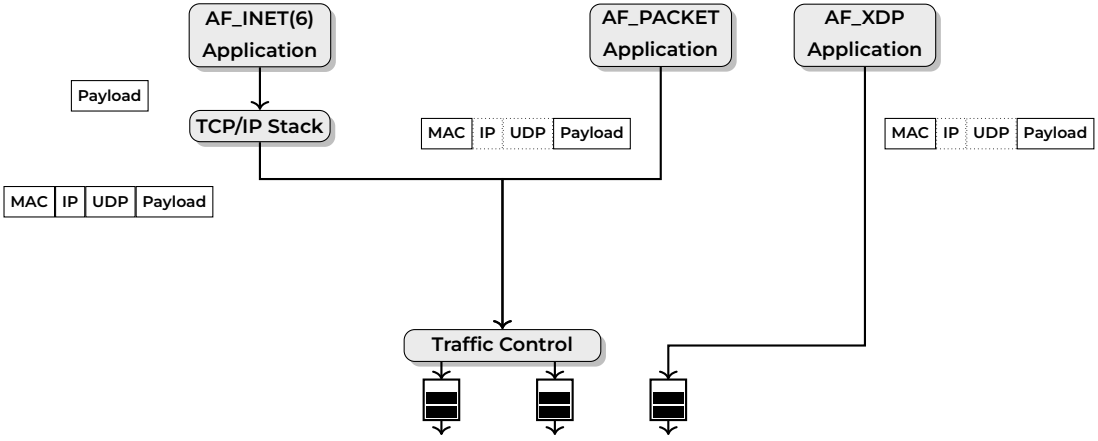
AI impression of a central data center in an industrial park

Virtual PLCs...

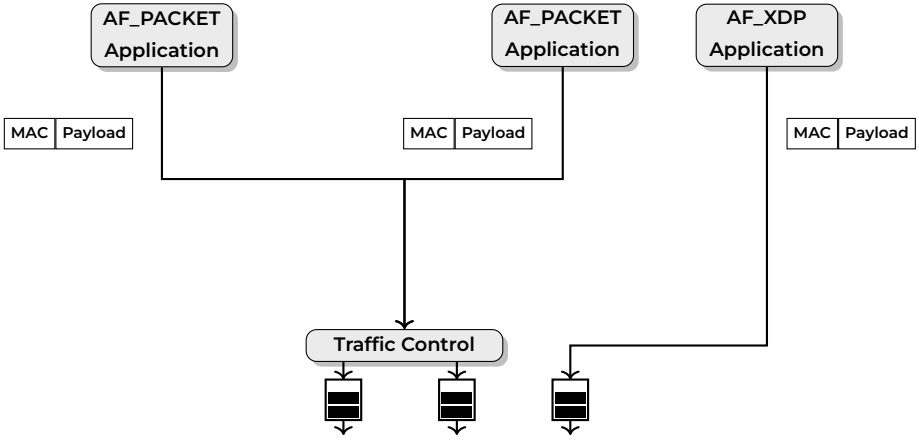
- ... for different applications
- ... with different realtime and security requirements
- ... developed by different vendors
- ... for different factory floors
- ... for different customers

all potentially running on
the same hypervisor / cluster node

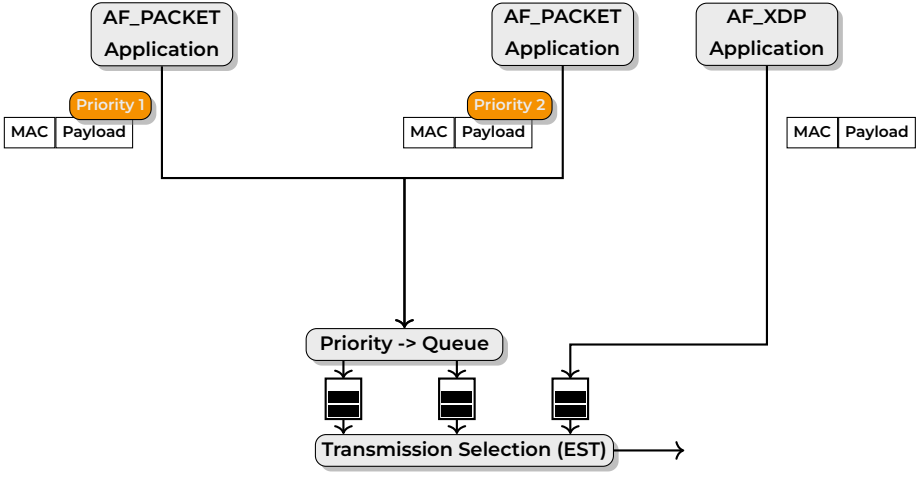
Linux Socket Types



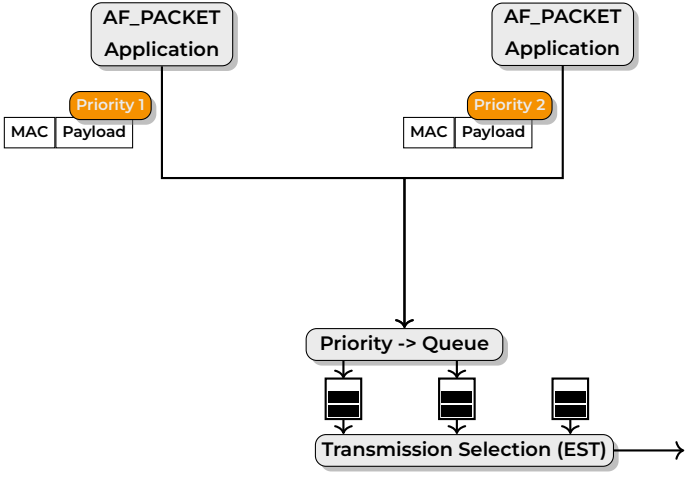
Linux Socket Types - Ethernet only



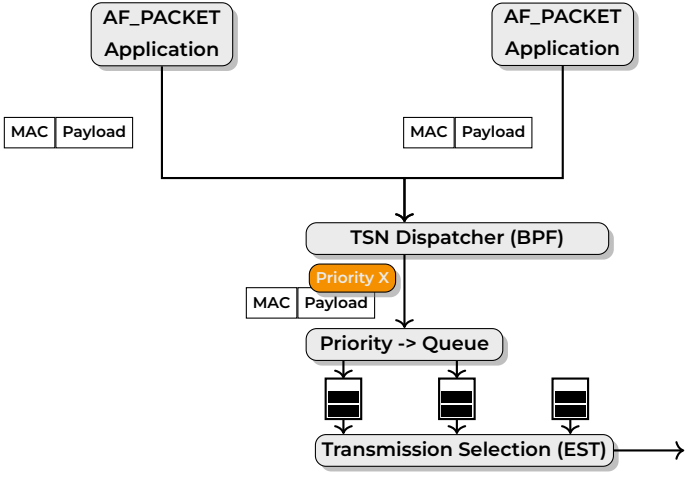
TSN Linux Endpoint today



TSN Linux Endpoint today

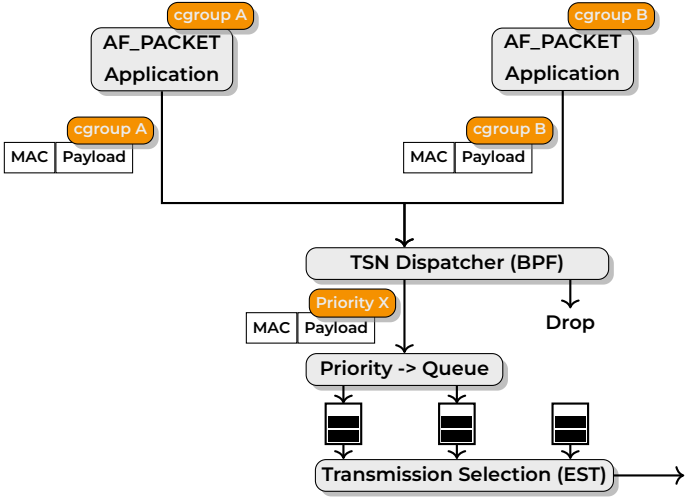


TSN Linux Endpoint with Dispatcher



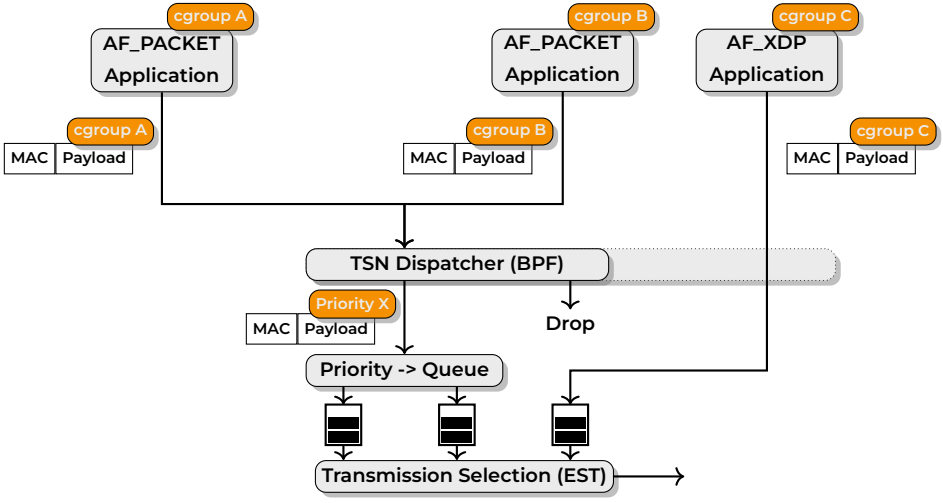
LINUTRONIX

TSN Linux Endpoint with Dispatcher



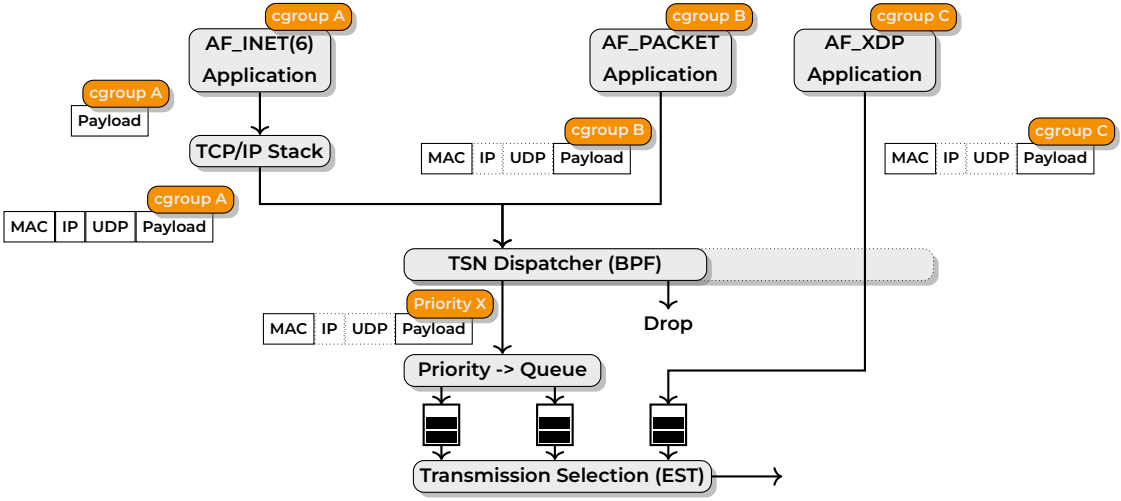
LINUTRONIX

TSN Linux Endpoint with Dispatcher



LINUTRONIX

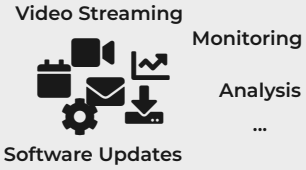
DetNet/TSN Linux Endpoint with Dispatcher



LINUTRONIX

Why DetNet on top of TSN?

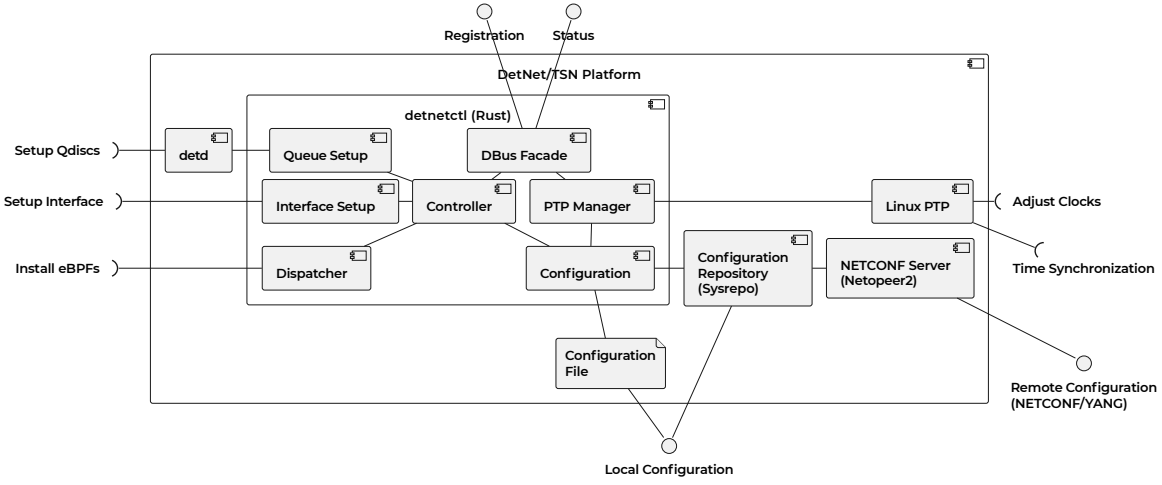
Easier integration of TSN-unaware applications



Support of large heterogenous networks



DetNet Platform Agent Demonstrator



LINUTRONIX

Demo

Next Steps

- Support for managing AF_XDP sockets
- Dynamic configuration changes without traffic disruption
- Fully integrated system → OpenCNC and OpenCUC
- Discussions about further steps and possible use cases
- Try it out and participate in the development at GitHub:
  github.com/linutronix/detnetctl



Contact

Linutronix GmbH

Dr. Florian Kauer

florian.kauer@linutronix.de

+49 7556 25 999 0

www.linutronix.de



Working Draft Overall Configuration Architecture

