secVI

Security for Vehicular Information

HAW HAMBURG

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Introduction

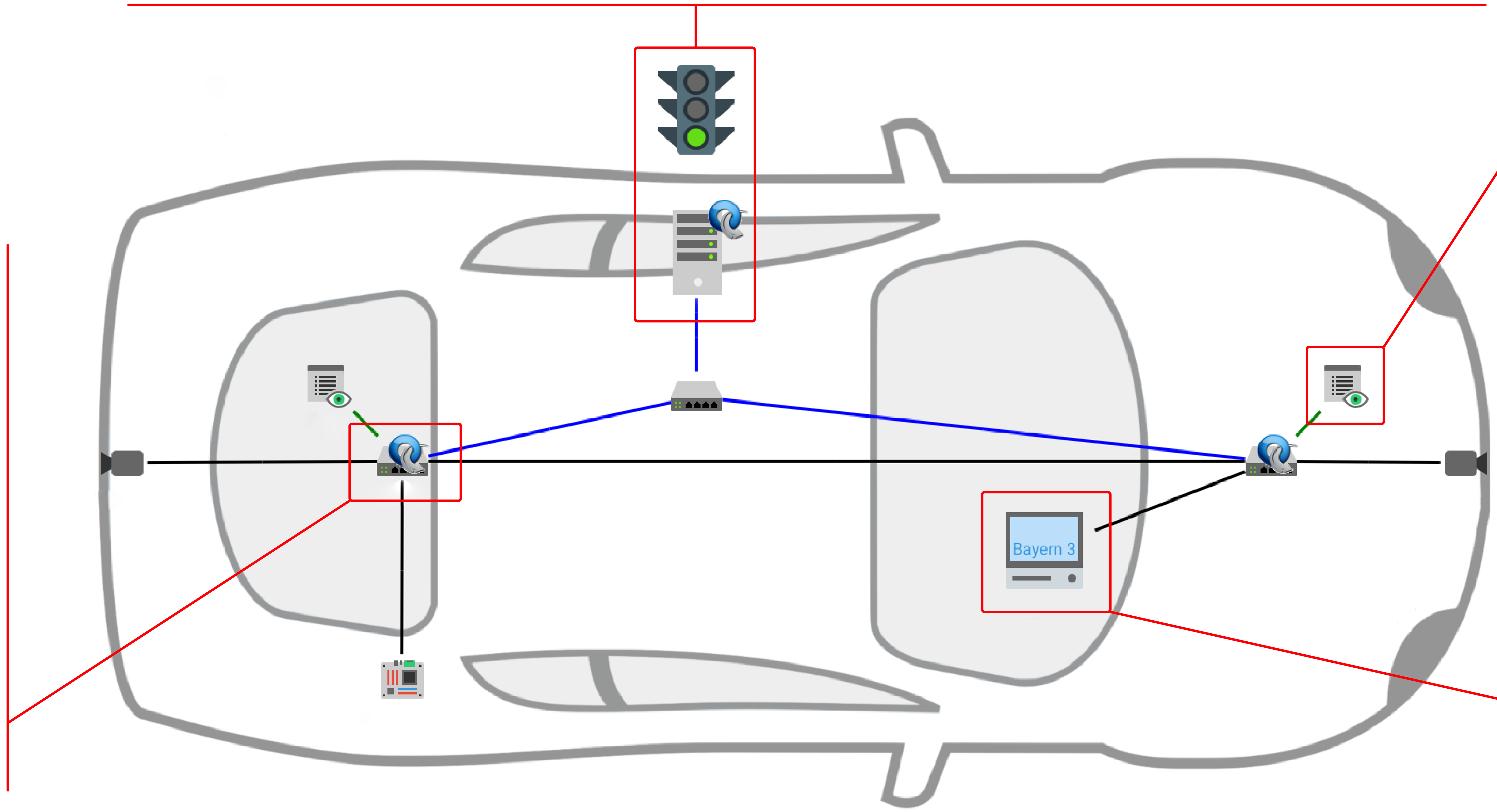
SecVI designs and analyses network security architectures that are flexible, robust, and of reduced complexity to protect the entire communication system of a vehicle. Work includes the verification of online updates as well as continuous monitoring of flows between ECUs and network components. Flow monitoring is a good technique to prevent cyber-attacks on the vehicle in a robust way while keeping most existing components of the vehicle unchanged.

Software-Defined Networking

- The control plane of network devices is separated from the data plane.
- An SDN-Controller is introduced to program the network devices.
- The flow based forwarding devices of the data plane are connected to the SDN controller via the OpenFlow protocol.
- This allows for a central management of all flows with comprehensive control functionality, management applications and security functions.

Security Cluster

- The Security Cluster monitors the security state of the in-vehicular network.
- It hosts the SDN-Controller and is connected to the forwarding devices in a separate control network.
- Has knowledge about all implemented flows and is able to add, modify and delete flows.
- Collects the reported anomalies of NADS's and flow table misses of forwarding devices.
- The Security Cluster initiates adequate countermeasures if possible.
- Defence mechanisms range from adding or removing flows to disconnecting certain nodes at the forwarding devices.



Network Anomaly Detection System

- An NADS is connected to each switch.
- NADS analyses network metrics such as the utilised bandwidth and average frame size per flow.
- Machine learning with the K-means clustering algorithm is used to learn the flow behaviour.
- Outliers of the learned clusters are recognised as anomalies and reported to the Security Cluster.

Attack Scenarios

Simple Message Attack

- Messages do not match any existing flows.
- First switch on the path reports a flow table miss to the Security Cluster.

Flow Hijack Attack

- Messages match an existing flow and are forwarded along the programmed path.
- The NADS detects misbehaviour and reports it to the Security Cluster.

In both scenarios the Security Cluster can execute countermeasures.

Website: https://secvi.inet.haw-hamburg.de