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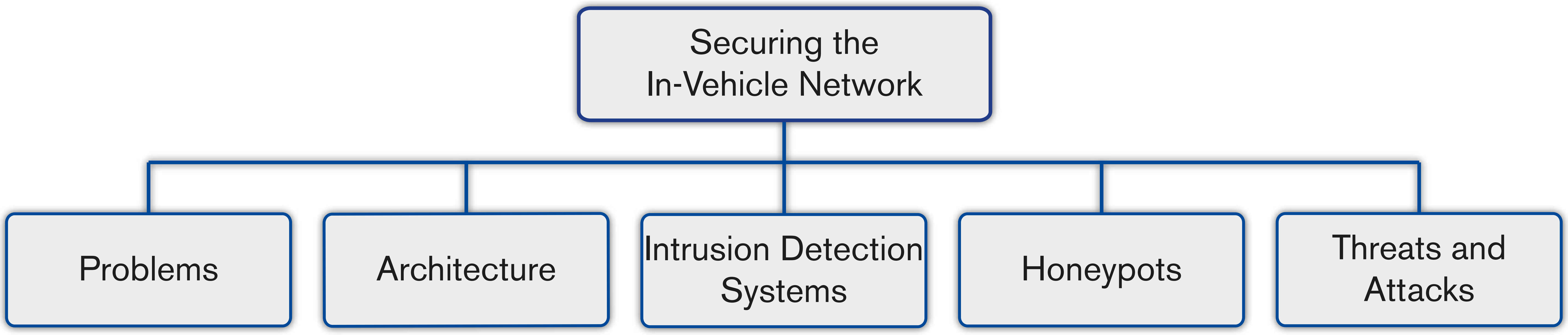
Security Aspects of the In-Vehicle Network in the Connected Car


Securing the In-Vehicle Network

Problems

Architecture

Intrusion Detection Systems

Honeypots

Threats and Attacks

Aim

To highlight the current state of the research with respect to the security of the in-vehicle network.

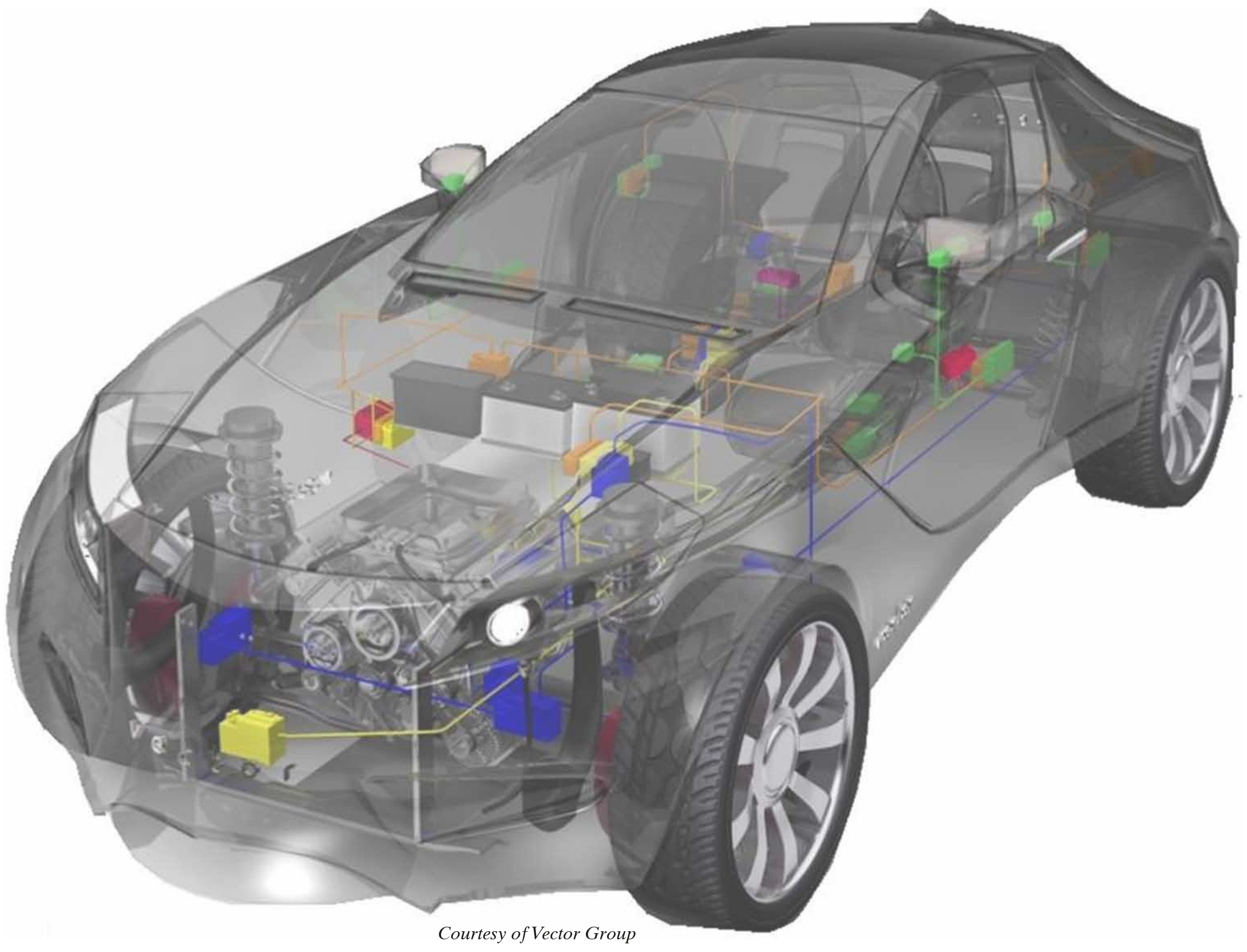
- What are the problems?
- What solutions have been proposed so far?

Challenges

(1) resource constrains of the ECU
(2) severe cost restrictions
(3) lifetime of the solution

Problems in In-Vehicle Networks

- *lack of sufficient bus protection*: Messages on the CAN-bus can be read by all nodes, have no sender or receiver address, and are not authenticated [1].
- *weak authentication*: Due to weak authentication in obtaining privilege mode in ECUs, it is possible to illicitly reprogram ECUs with new firmware [2].
- *misuse of protocols*: Attacks towards the in-vehicle network can be performed by misusing well chosen mechanisms in the protocols [3].
- *poor protocol implementation*: In some cases the protocol implementation is such that it does not properly reflect the protocol standard [2]. In some implementations it is indeed possible to launch a command that would disable the CAN communication and put the ECU into programming mode even if the vehicle is moving.
- *information leakage*: An information leakage from the vehicle can be triggered by manipulating the diagnostic protocol, creating a potential privacy violation [4].



Courtesy of Vector Group

Architectural Security Features

Ref.	Confidentiality	Integrity	Authentication	Communication	Timing
[5]	✓			-	Real-Time
[6]		✓	✓	End-to-End	Delayed
[7]	✓		✓[1]	Group	Real-Time
[8]	✓	✓	✓	End-to-End	Real-Time
[9]		✓	✓	Group	Delayed[2]

[1] Authentication of ECUs within group, not individual message
[2] Uses Time-Triggered Protocol (TTP)

Some Open Research Issues

- *problems in in-vehicle networks*. The CAN- and FlexRay-protocols still lack sufficient protection. If external communication is to be forwarded to these buses, appropriate security mechanisms need to be applied.
- *architectural security features*. Some of the proposed approaches still have to be evaluated considering the limited resources of the in-vehicle network.
- *intrusion detection systems*. Both anomaly-based and specification-based IDSs have been suggested, but so far only addressing the CAN-protocol.
- *honeypots*. The hardest problem in implementing a honeypot is to make it separate from the real in-vehicle network and still make it as realistic as possible.
- *threats and attacks*. We note that steps have been taken to adapt the CERT Taxonomy [10] to also classify attacks towards the connected car.

References

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