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Automotive Perspective on System Design

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Four megatrends are shaping the automotive market, significantly increasing the semi content per vehicle



ADAS/Autonomous driving

- From ADAS to semi-automated and finally autonomous driving
- Every world region is striving for "0-accident"

xEV/eMobility

 Mandated CO₂ reductions make electrification of powertrain inevitable



Car Security

 Advanced connectivity is driven by making the car part of the Internet

(V2I, V2V, in-vehicle)

The car will be fully connected



- Increased connectivity and software content increase risk exposure to hackers
- Internal/external connectivity must be secured

Connectivity

Advanced security

The 5 levels of increased automation (VDA* definition)





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Building blocks of automated driving



ADAS system overview





Tomorrow's car system architecture will be much different from today



Today

 Distributed structure: Systems are connected to one another



Tomorrow

 In the future, systems will be clustered in domains and organized hierarchically



From components to heterogeneous, diverse systems



Any next level increases the requirements, Example EPS L2 -> L3





* "Hands and feet off, eyes and brain on"

Sense and Compute: Any next automation level requires more electronics



	Level of automation		
	Level 2	Level 3	Level 4/5
Application*	Parking assist		Valet Parking
	Highway assist, Traffic Jam Ass	ist Highway pilot	Urban pilot / Robot Taxi
Radar # of modules**	≥ 3	≥ 6	≥ 10
Camera # of modules**	≥ 1	≥ 2	≥ 8
Lidar # of modules**	0	C 1	■ ≥ 1
Others	Ultrasonic	Ultrasonic Interior camera	Ultrasonic Interior camera V2X

- * Source: VDA (German Association of the Automotive Industry), Society of Automotive Engineers
- ** Market assumption;

Components and systems need to be safe, secure and scalable









The connected car and move to open systems





Mapping to the functions identified by NEREID

- > Energy Autonomy, *
 - BUT: low power and efficiency are key
- Connectivity, ***
 - V2x communication; Speed; Latency; Robustness
 - 5G is required
- Sensor integration, ***
 - Diverse sensors/MEMS
 - Calibration
 - Sensor fusion



Mapping to the functions identified by NEREID

- Miniaturization, **
 - Limited space inside a car
 - Weight has to be reduced
- > Reliability & Lifecycle, **
 - Zero defect
 - Increasing operation time even for unchanged lifetime
 - Automotive requirements and environment

> Safety, Security , Privacy, ***

- Fail operational
- Redundancy
- Fault tolerance, confidentiality, integrity, authenticity
- Communication and data have to be protected for an increasing amount of scenarios



Most important challenges

- > Advanced semiconductor and assembly technologies
- > Consumer technologies for automotive
- > More than Moore
- Machine Learning and big data methods for development and application
- > IP and re-use
- > Advanced validation, verification and system design
- > Environment aware design
- > Design for safety
- Cross domain design



Summary

- Automated driving application
- Affordable, modular, scalable, evolvable, safe, trusted electronic components & systems are needed
- Design has to cope with increasing complexity & diversity, multiple constraints, safety & security requirements
- > Draft mapping to NEREID functions



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