AUTONOMOUS DRIVING

WHAT, WHY, WHEN ?

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AUTONOMOUS DRIVING: WHAT, WHEN, WHY ? - CONTENT

- Automotive megatrends
- The 5 levels of ADAS and AD
- Status 11/2017
- ADAS/AD from different views
- Challenges, solutions
- Q&A, discussion

AUTOMOTIVE MEGATRENDS

Emission reduction

- Electrification: EV, 48V
- Car ban in cities
- CO2 neutral mobility in 2050

41 Mio. EVs sold in 2040

Autonomous driving

- Car as office/living room
- Accident free driving
- Connectivity
- New business models
- 221 Bn US$ in 2020

Digital revolution

- Prototype free develop.
- IoT, Big data
- Deep learning
- Digital solutions

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5 LEVELS OF AUTONOMOUS DRIVING

LKA, ACC

Level 1-2

Traffic jam pilot

Level 3 -2017

Highway pilot

Level 4 - 2021

Unmanned driving

Level 5 – 202x

6 LEVELS OF AUTOMATED DRIVING FEATURES (SAE)
MOTIVATION AND INTRODUCTION SCENARIOS

Level 5 – Full Automation
all-time autonomous driving at situations, no driver required

202x

Level 4 – High Automation
handles anytime all situations in the defined use cases

2021

Level 3 – Conditional Automation
limited self driving, sufficient time margin in case of driver fallback

2017

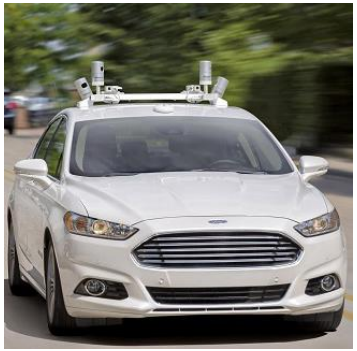
Comfort

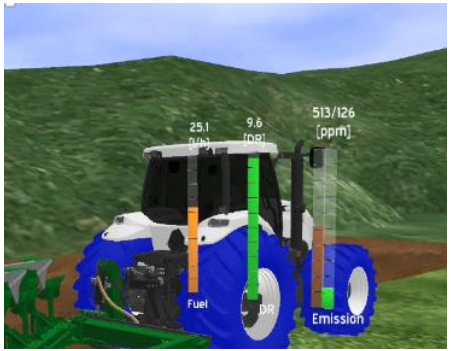
Time, money

A D

Highly Automated/ Autonomous Driving

€ € € €





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AUDI INTRODUCES FIRST LEVEL 3 SYSTEM UP TO 60KM/H

Quelle: Audi

NISSAN LEVEL 3 IN TOKYO

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CUSTOMER VIEW

Car as office, living room

Increased safety&comfort

Source: cloudfront.net

WHAT WOULD YOU DO WITH THE NEW TIME ?

Source: slideshare.net

Positive view

95% of all accidents are caused by the driver
-> AD could reduce accidents by 95%

Positive view

95% of all accidents are caused by the driver
-> AD could reduce accidents by 95%

SAFETY

Positive view

95% of all accidents are caused by the driver
-> AD could reduce accidents by 95%

Critical view

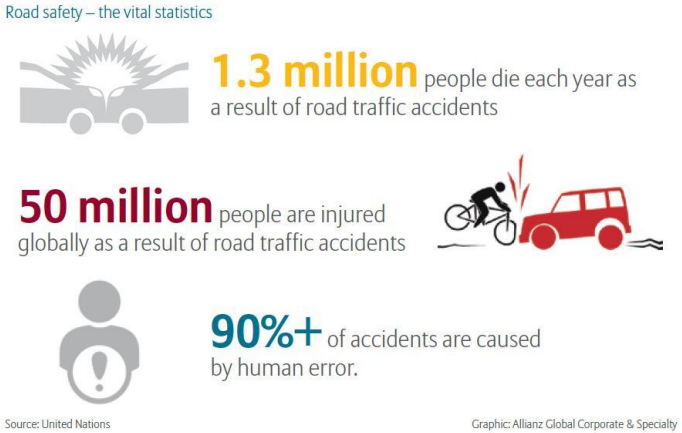
Many accidents will be caused by the AD system
-> Reduction rate not yet proven

ADAS/AD - THE CHALLENGE SAFETY

2015 – human driving

AD drives x times better than humans

	10x	100x	1.000x	10.000x	
1.3 million people die each year as a result of road traffic accidents	130.000	13.000	1.300	130	die/year
50 million people are injured globally as a result of road traffic accidents	5 Mio.	500.000	50.000	5.000	injured/ year



-> How much better must autonomous driving be ?

-> How many AD caused accidents are acceptable?

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ADAS/AD CHALLENGES

Functional safety

- Increased road safety
- No failures, bugs
- No accidents
- Hacker resistancy

Customer expectations

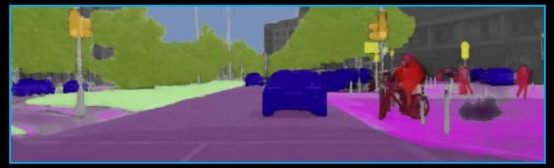
- OEM brand feeling
- High quality, safety & security
- Perceived safety
- Fun to be driven

Development time Testing, validation

- 100 Mio. km and 55.000 years with standard validation methods for level 4

PRINCIPAL STRUCTURE

Sensors

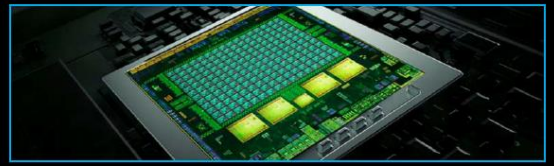


What an autonomous vehicle does not "see",
it is likely to drive into

Actuators

Anything a driver would do
needs to be controlled electronically

Autonomous Vehicle "Brain"



Deciding which course of action is right
depending on the situation

Backend

Data provisioning and collection
as well as operator commands

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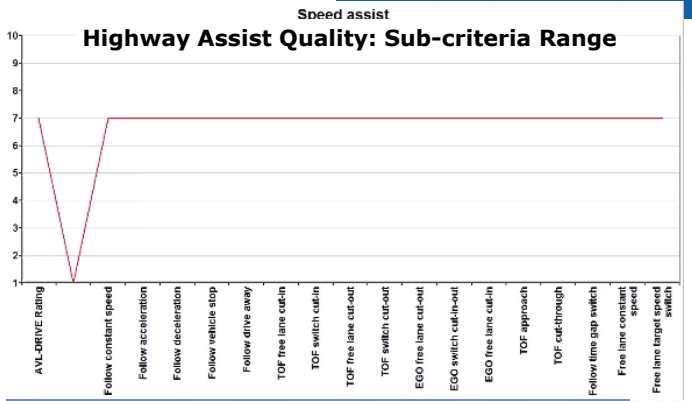
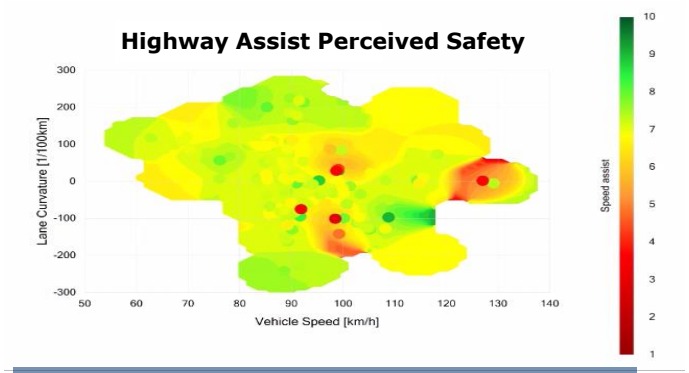
LKA / ACC ON
How would you feel in this situation?
MOVE

EVALUATION OF PERCEIVED SAFETY

Infrastructure: Styria Test Region, Alp.Lab, AVL test track **Tool**: AVL-DRIVE™ ADAS



Automated events detection



Perceived safety assessment

THE CHALLENGE TESTING AND VALIDATION

2015 – people drive

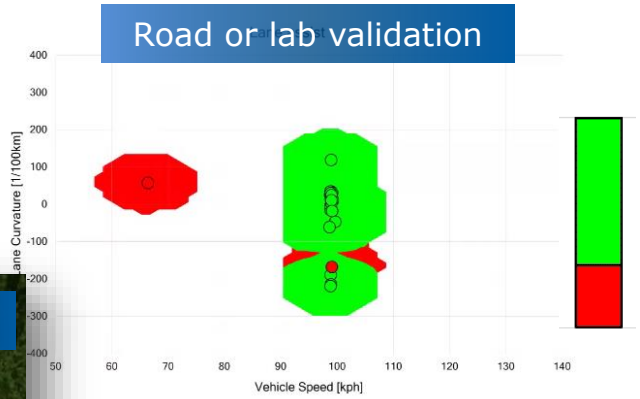
AD drives n times better	10x	100x	1000x	10.000x	
	130.000	13.000	1.300	130	died people
	5 Mio.	500.000	50.000	5.000	injured

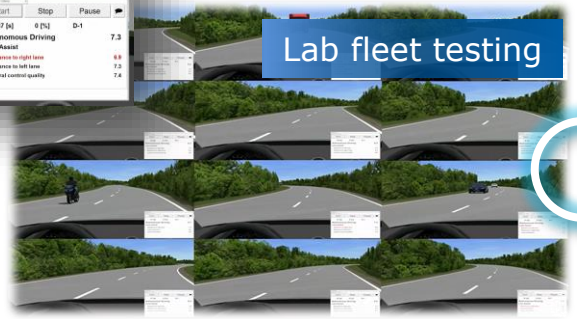
Human drivers drive very safe, statistically 1 died person per 12 Mio. km in Germany

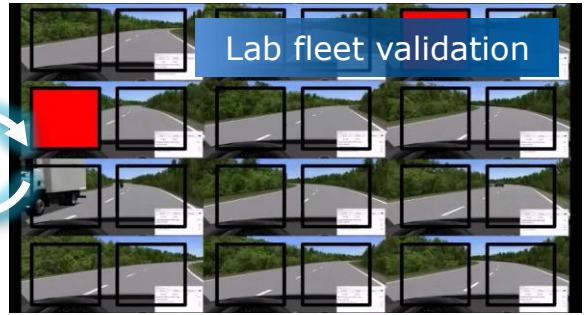
Necessary AD testing	120 Mio.	1,2 Bio.	12 Bio.	120 Bio.km
Testing duration: 100 cars, $1*10^5$km/car/year:	12	120	1.200	12.000 years

-> New solutions required !

VIRTUAL VALIDATION OF AUTONOMOUS DRIVING







Virtual validated testing:
2017: 7,5 Mio.km/week
2018: 50 Mio.km/week
2019: 100 Mio. km/week

USP: Fully automated validation of virtual scenarios based on unique AVL assessment technology

OTHER AD CHALLENGES

Level 3 Level 4 Level 5

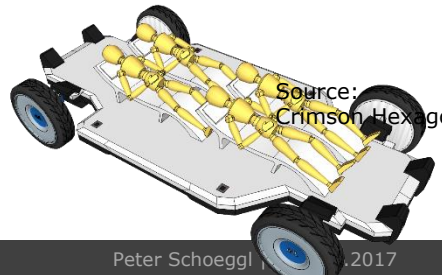
Development

1. SW and hardware development
   - New procedures, e.g. agile development, Scram
   - New methods: Self learning, machine learning, N.N., C2C learning
2. Testing
   - New procedures, e.g. agile development, Scram
3. Validation – 1 Bio. Km
   - Virtual validation

Insurance: Who is responsible for SW errors
Legisations: What is allowed where and when
Customer acceptance: Increase public attentation

CONCLUSION

- **ADAS&AD will come: Level 3 in 2018, Level 4 21, level 5 202x**
- **Main reasons are safety, comfort, profit**
- **Many people have still a lot of fear**
- **Still several development challenges:**
  - Object detection, functional safety, validation time
- **New development and optimization methods will come up**
- **The new solutions will also be applied to other areas**



Thank you for your attention !