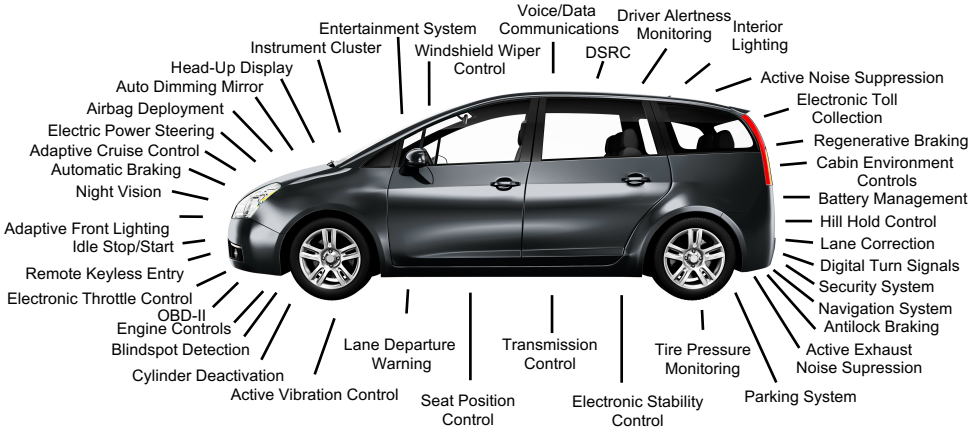
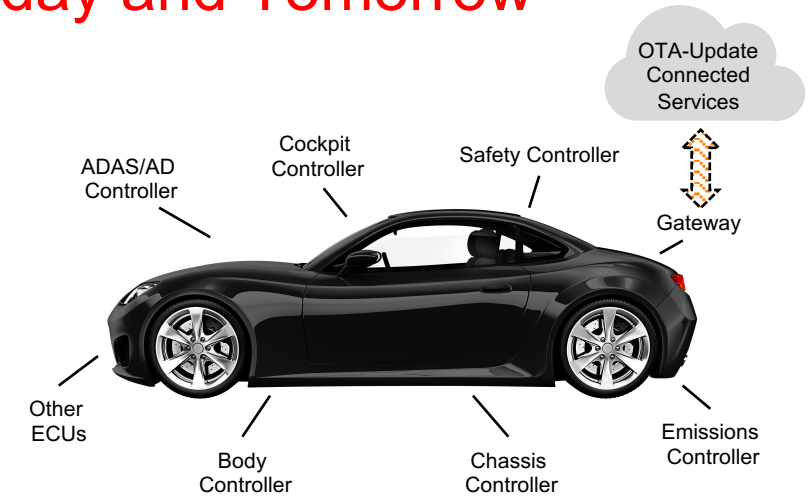
Tomorrow's Data Storage Integrity and Safety for Autonomous Cars

Dealing with Security, Safety and Reliability

Bernd Niedermeier, Tuxera Inc.

Automotive Systems Today and Tomorrow

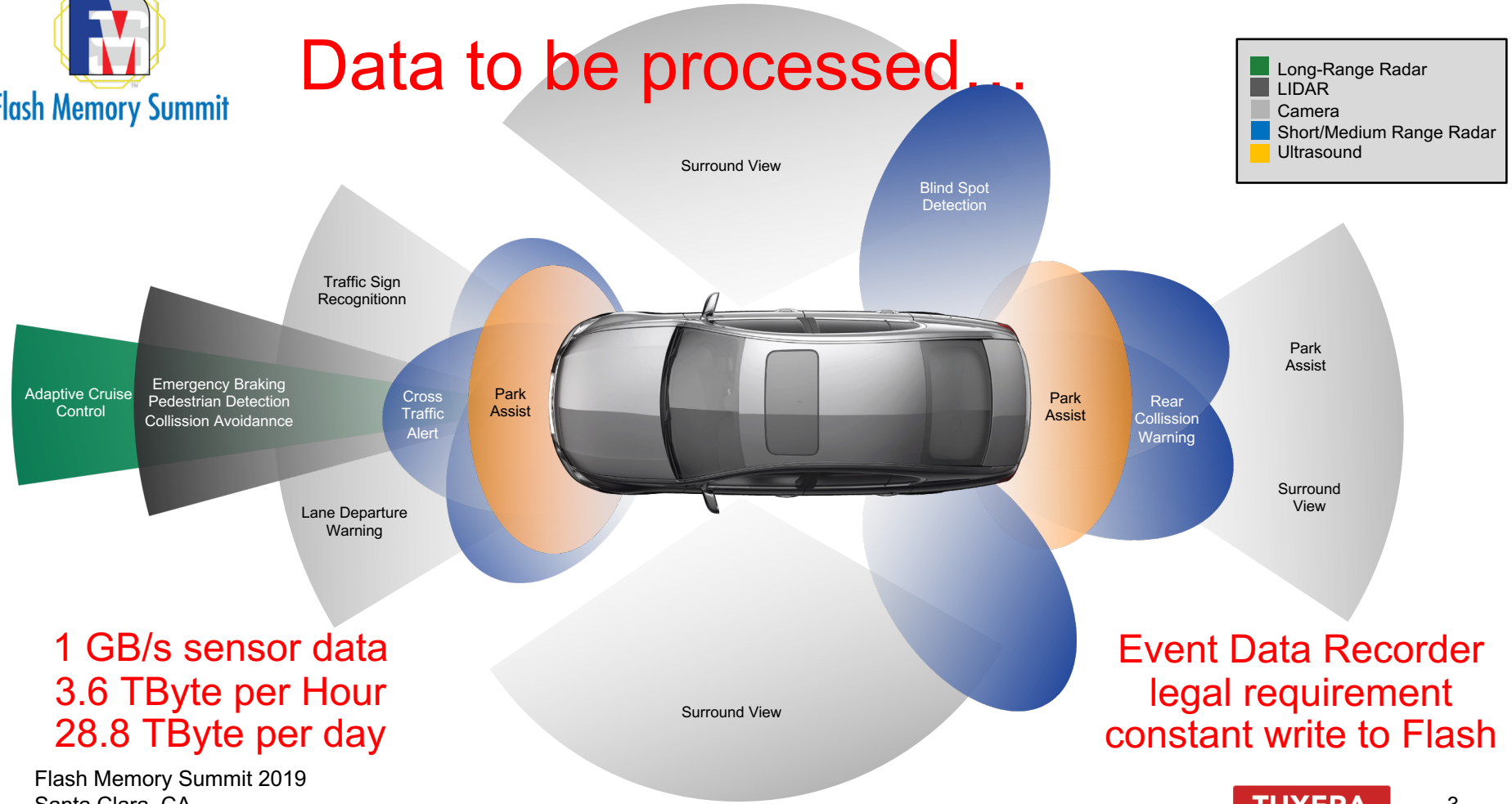




30 to 100+ ECUs	6-8 operating systems
Flashed once, minor updates	Considered read only
Predefined/fixed use case	Flash write not an issue
Closed system	Power Supply, Cost

6-10 area/domain controllers	Hypervisor + 1 - 4 (RT)OS
Separated partitions by function and tier1 / OEM	Android -> new use cases
OEM Apps / new services	Always online, OTA updates
Open system	Flash write an issue

Data to be processed…



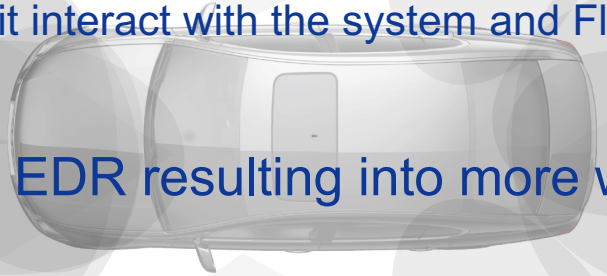
1 GB/s sensor data
3.6 TByte per Hour
28.8 TByte per day

Event Data Recorder
legal requirement
constant write to Flash

Challenge #1, Reliability over Lifetime

What app will be running in 5 years from now?

How will it interact with the system and Flash?



New Apps, OTA Updates, EDR resulting into more write load for Flash

How to achieve 10-15 years lifetime for the system

How to “correctly” dimension the system

How to keep cost under control

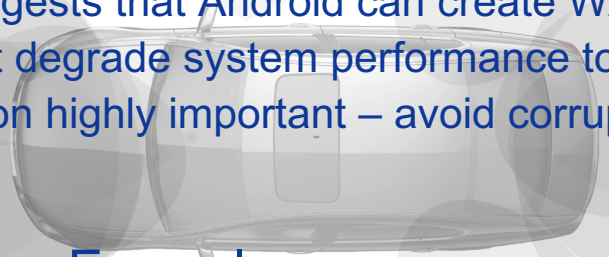
Challenge #1, Reliability over Lifetime

Filesystems do have an impact

different studies suggests that Android can create WAF of >20 (!)

Fragmentation might degrade system performance to critical point

Fail safe operation highly important – avoid corrupted data



Examples

FCA reboot loop 02/2018 in Uconnect infotainment systems

https://www.theverge.com/2018/2/15/17017946/fiat-chrysler-rebooting-screen-uconnect-problem

Spotify Bug 11/2016 – writing 5-10GB / hour into Flash

https://arstechnica.com/information-technology/2016/11/for-five-months-spotify-has-badly-abused-users-storage-drives

Challenge #2, Cyber Security

Connectivity creates attack angles

WLAN, Bluetooth, 3G/4G/LTE..

High risk for OEMs: security issue becoming functional safety issue ?

Security gaps have to be fixed via OTA updates

High focus at OEMs and tier1's

Security still a rather new area – new structures vs. legacy IP

SW vendors receiving first requests for CVE Scan results and penetration testing

Challenge #2, Cyber Security

Filesystem contribution to security

Secure boot – e.g. dm-verity

Encryption via dm-crypt, fscrypt …

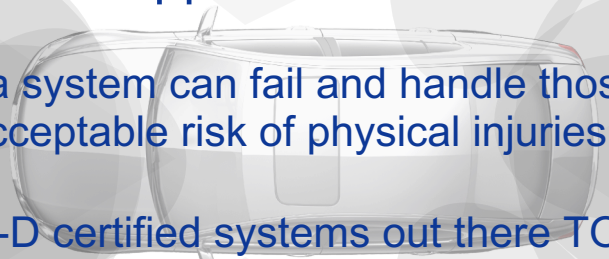
Quota setting

Hierarchical CRCs (Merkle-Trees)

Other…

Challenge #3, Functional Safety

Well established approach – ISO 26262

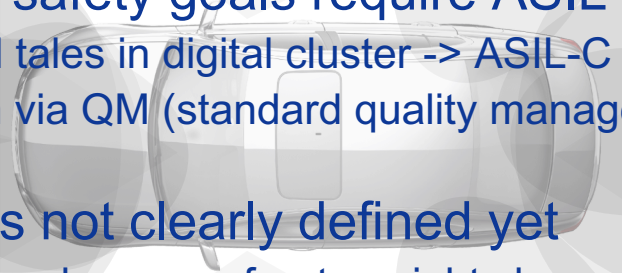


"Analyzing the different ways a system can fail and handle those cases such that there is freedom of unacceptable risk of physical injuries.. (fail safe)"

ASIL-C and ASIL-D certified systems out there TODAY
e.g. L2/3 ADAS -> ASIL-D; digital cluster -> ASIL-B/C

What about certified Flash Memory?

Challenge #3, Functional Safety



Only certain safety goals require ASIL-D

E.g. tell tales in digital cluster -> ASIL-C

Rest of system via QM (standard quality management)

Future is not clearly defined yet

Requirements not always known upfront – might change during project

Request for certified Flash?

Filesystems required to be certifiable towards ASIL-D as well?

Nice-to-have vs. mandatory?

Conclusion

Autonomous Cars and new ECU architectures creating new challenges

Reliability over Lifetime

Cyber Security

Functional Safety Requirements

Impact of filesystems and capabilities often underestimated / unknown

Filesystem companies like Tuxera open to discuss new approaches

Partner solutions, security, functional safety

Conclusion

There are standards, but not ONE single, correct approach

-> what solutions are really needed in the future?

Need for open and collaborative discussions between

Tier1's and OEMs

HW component vendors

SW vendors

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