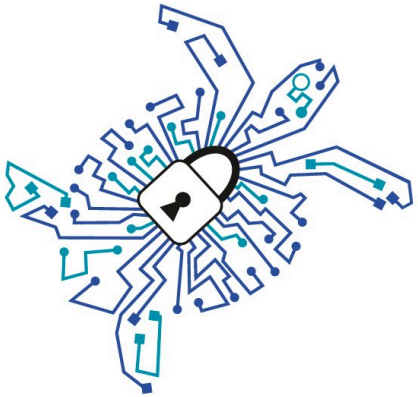
A Hackers View to ISO/SAE 21434

Or, how not to get pwned while driving 250 km/h on the Autobahn

$whoami

- Hi, I‘m Martin!
- @Fr333k

- By day: security engineer in the automotive industry
- By night: digital forensics & applied privacy
- In between: old Land Rover



$whoami

Disclaimer

- This is me, not my employer!
- I‘m not actively involved in the standarization process
- My view is biased, your mileage may vary!

Ignory my sarcasm:

- This gunna be good!

Motivation

© Andy Greenberg, wired.com


09-25-2017 Mon 01:01:55
WEST MIDLANDS POLICE
Camera 01
0:29 / 1:26

Motivation

New Vehicle Security Research by KeenLab: Experimental Security Assessment of BMW Cars

by Tencent Keen Security Lab

Vulnerability Findings

After conducting the intensive security analysis of multiple BMW cars' electronic control units, Keen Security Lab has found 14 vulnerabilities with local and remote access vectors in BMW connected cars. And 7 of these vulnerabilities were assigned CVE (Common Vulnerabilities and Exposures) numbers.
All the following vulnerabilities and CVEs have been confirmed by BMW after we submitted the full report and collaborated with them on technical details:

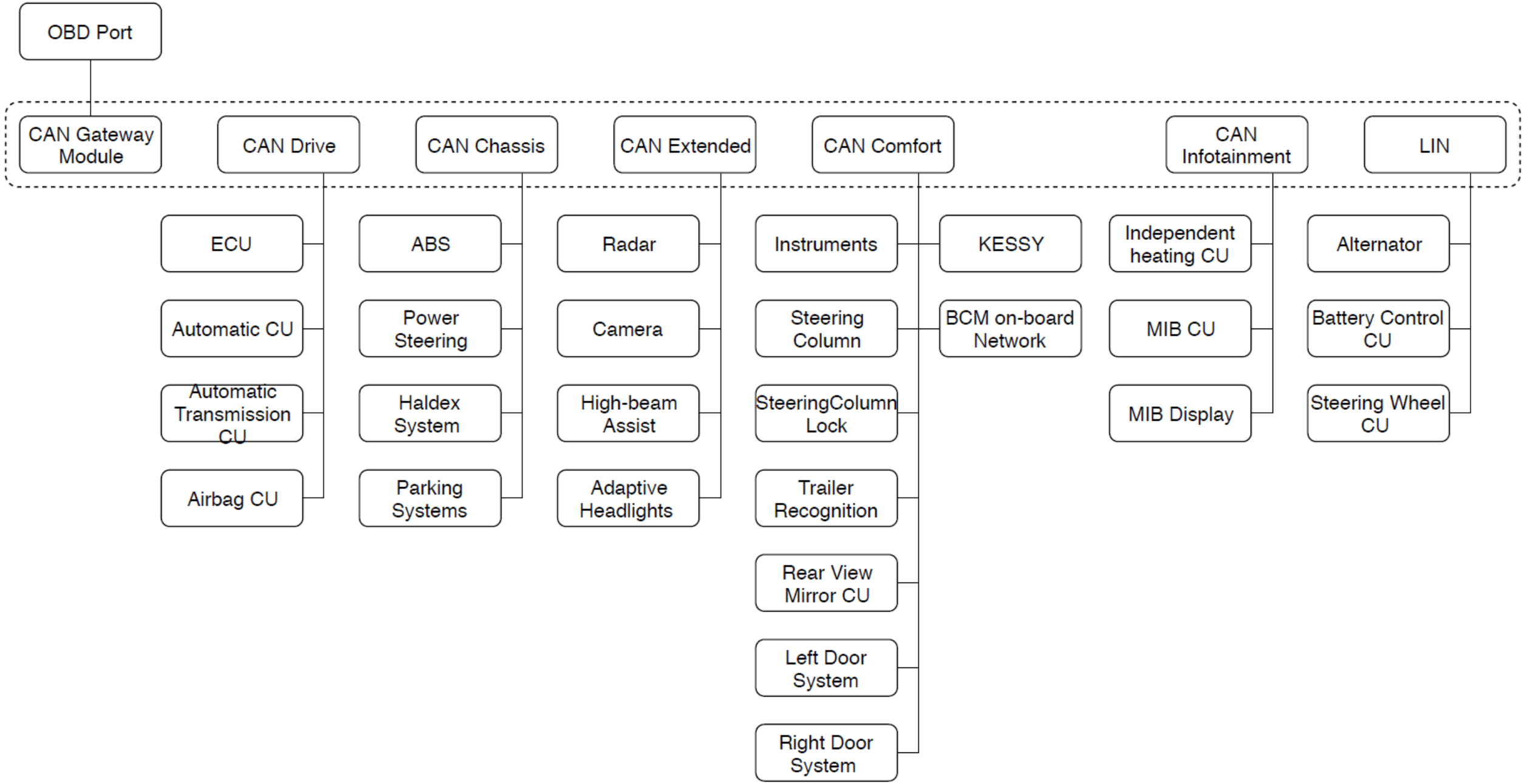
No.	Vulnerability Description	Access	Affected Components	Reference
1	All the detail information has been reserved due to security concerns.	Local (USB)	HU_NBT	CVE-2018-9322
2		Local (USB/OBD)	HU_NBT	
3		Remote	HU_NBT	Logic Issue
4		Remote	HU_NBT	Reserved
5		Local (USB)	HU_NBT	CVE-2018-9320
6		Local (USB)	HU_NBT	CVE-2018-9312
7		Remote (Bluetooth)	HU_NBT	CVE-2018-9313
8		Physical	HU_NBT	CVE-2018-9314
9		Physical	TCB	Reserved
10		Remote	TCB	Logic Issue
11		Remote	TCB	CVE-2018-9311
12		Remote	TCB	CVE-2018-9318
13		Indirect Physical	BDC/ZGW	Logic Issue
14		Indirect Physical	BDC/ZGW	Logic Issue

Table: Vulnerabilities and CVEs in Our Research Confirmed by BMW

Motivation

Vehicles are complex!

- 100+ micro controllers
- Strongly coupled, closely connected
- Real-time requirements
- Security not a priority so far!


OBD Port
CAN Gateway Module
CAN Drive
CAN Chassis
CAN Extended
CAN Comfort
CAN Infotainment
LIN
ECU
Automatic CU
Automatic Transmission CU
Airbag CU
ABS
Power Steering
Haldex System
Parking Systems
Radar
Camera
High-beam Assist
Adaptive Headlights
Instruments
Steering Column
SteeringColumn Lock
Trailer Recognition
Rear View Mirror CU
Left Door System
Right Door System
KESSY
BCM on-board Network
Independent heating CU
MIB CU
MIB Display
Alternator
Battery Control CU
Steering Wheel CU

Motivation

Software updates?

- Weakest part are often customers

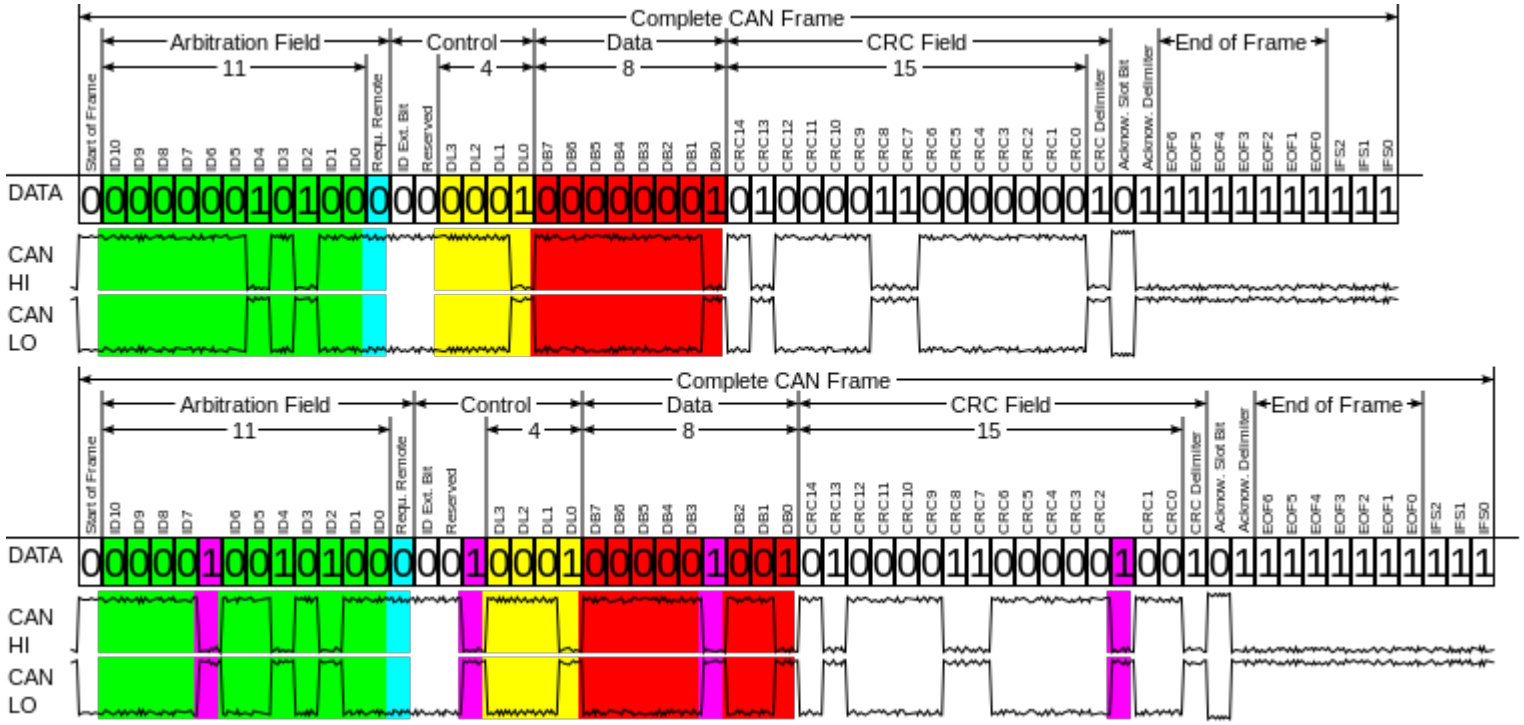
- Common fear is rise in insurance costs

Background

Common Interfaces

CAN bus:

- Differential power signal
- Very robust
- Allows arbitration
- Small payload: 64bit
- Bandwidth <= 1 Mbit/s
- No security!



Attack surface

Attack surface, traditionally:

- Physical, aka chip tuning
- Wireless protocols i.e., key fobs, tire pressure
- Infotainment system
- OBD-II port
- (Backends)

Common Interfaces

Wired/wireless:

- CAN-FD, Flexray, MOST, LIN
- BroadR-Reach
- Automotive Ethernet
- 433/868 Mhz
- NFC, Wifi, Bluetooth, …

No security, or optional!

Common Interfaces

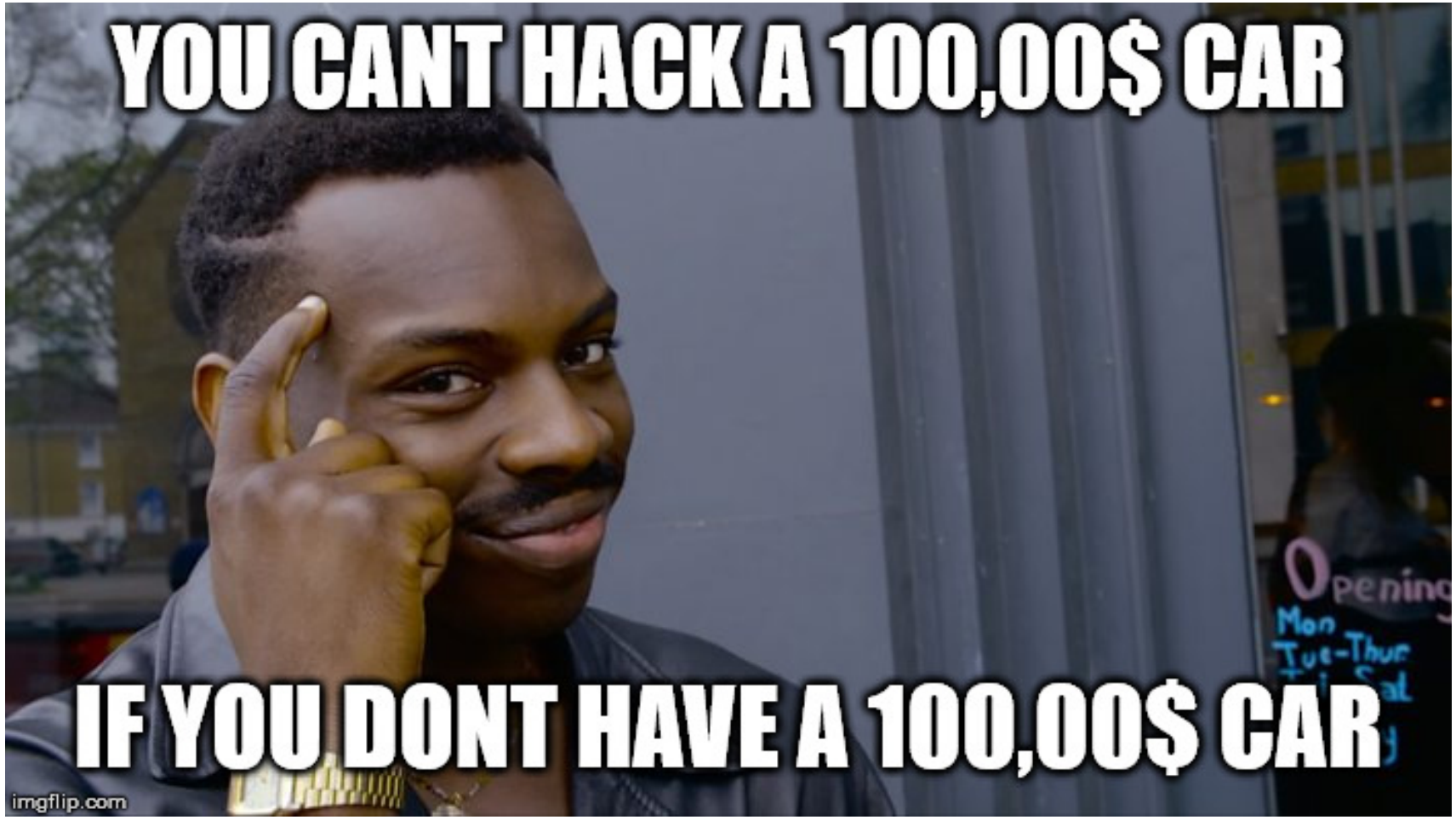
GSM/LTE:

- Mandatory, for eCall
- Not only once, but multiple times

V2X in the future:

- C-V2X, based on LTE
- IST-5G, based on 802.11p

Best security measure so far:



Doomed?

ISO/SAE 21434

Basics of ISO/SAE 21434

Current status:

- Committee draft, summer baseline
- About 120 pages
- International collaboration: DIN, VDA, ISO, SAE, …
- Publication sometime 2020

Basics of ISO/SAE 21434

Some fun facts:

- V-model development process is still a thing!

Wordly occurences:

- „cybersecurity“: 822
- „cyber security“: 1
- „risk“: 180
- „agile“: 1
- „Lorem ipsum“: none

Basics of ISO/SAE 21434

What is it all about:

- Risk management!
- Development process & beyond!
- Vulnerability management

Scope:

- Automotive componentes
- E/E (electrical and electronic) architecture

Basics of ISO/SAE 21434

Related documents:

- ISO 26262: Functional safety
- SAE J3061, Cybersecurity Guidebook for Cyber-Physical Vehicle Systems

SURFACE VEHICLE RECOMMENDED PRACTICE	J3061™	JAN2016
	Issued 2016-01	
Cybersecurity Guidebook for Cyber-Physical Vehicle Systems		

Basics of ISO/SAE 21434

Also relevant:

- ISO 31000: Risk management
- 2016: NHTSA Cybersecurity Best Practices for Modern Vehicles
- 2018: UNECE World Forum for Harmonization of Vehicle Regulations (WP.29)
- 2018: California IoT Security Law

Basics of ISO/SAE 21434

Whats inside:

- Assets
- Vulnerabilities
- Threats
- Risk = Impact * Feasibility
- Security goals: Confidentiality, Integrity, Availability

Standard risk management!

Basics of ISO/SAE 21434

Example:

- Asset = software on specific ECU, say engine control unit
- Goal = integrity
- Impact = severe
- Feasibility = high

Outcome:

- Better do something about it!

Basics of ISO/SAE 21434

Example:

- Asset = Infotainment
- Goal = availability
- Impact = low
- Feasibility = high

Outcome:

- Could be ok, but is probably not

Basics of ISO/SAE 21434

Next step: security concept

- Define security measures & mitigations
- Can be requirements, or recommendations

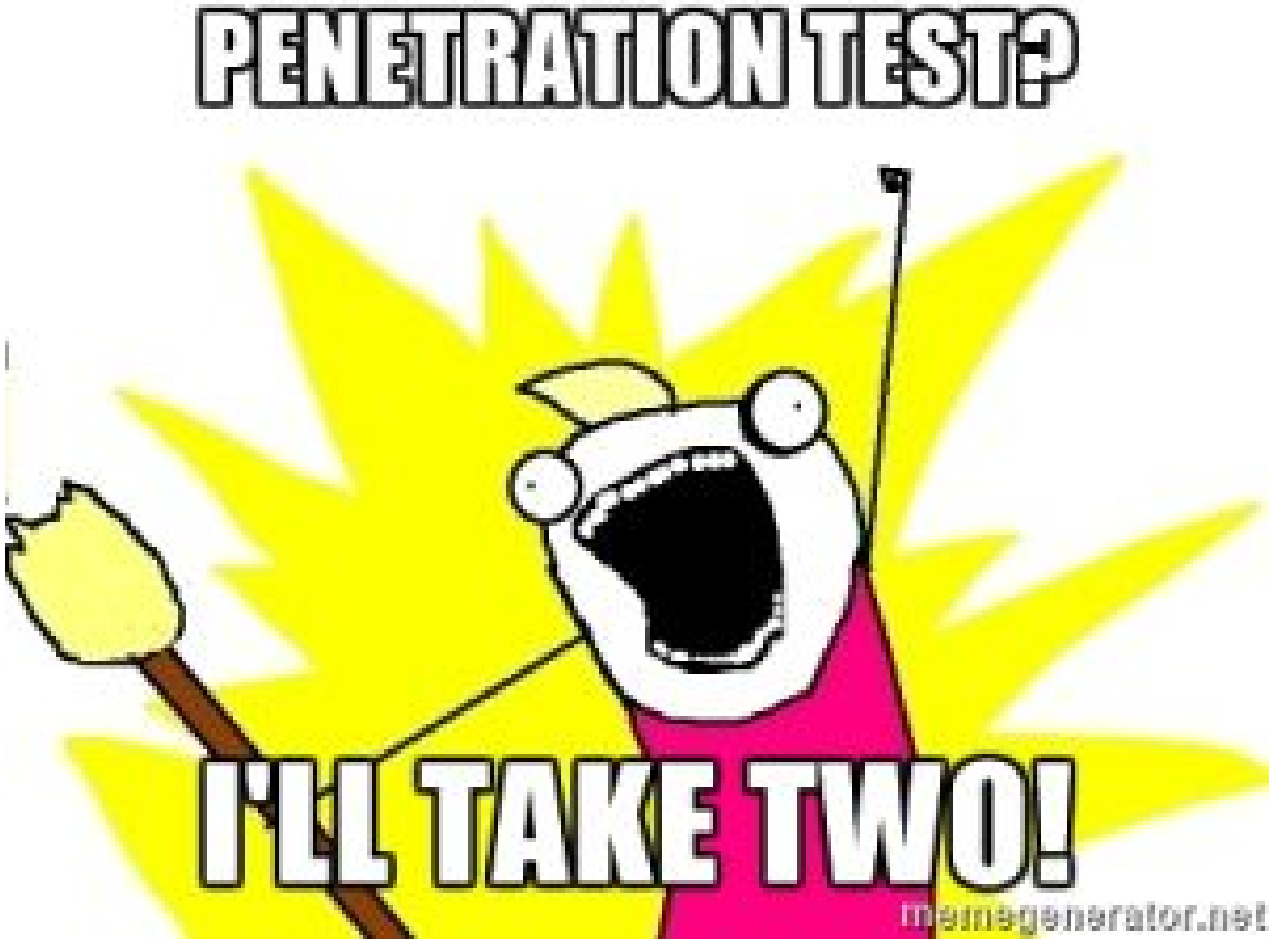
Can be things like:

- MISRA C
- Fuzzing
- Proper training of developers

Basics of ISO/SAE 21434

Going forward:

- Develop
- Verify
- Validate e.g., pentest



Basics of ISO/SAE 21434

Post-development:

- Residual risks should be clear

Production!

- Some aspects can be surprisingly hard
- Like key management: Individual keys, certificates, signatures, …
- Usually not a one-shot

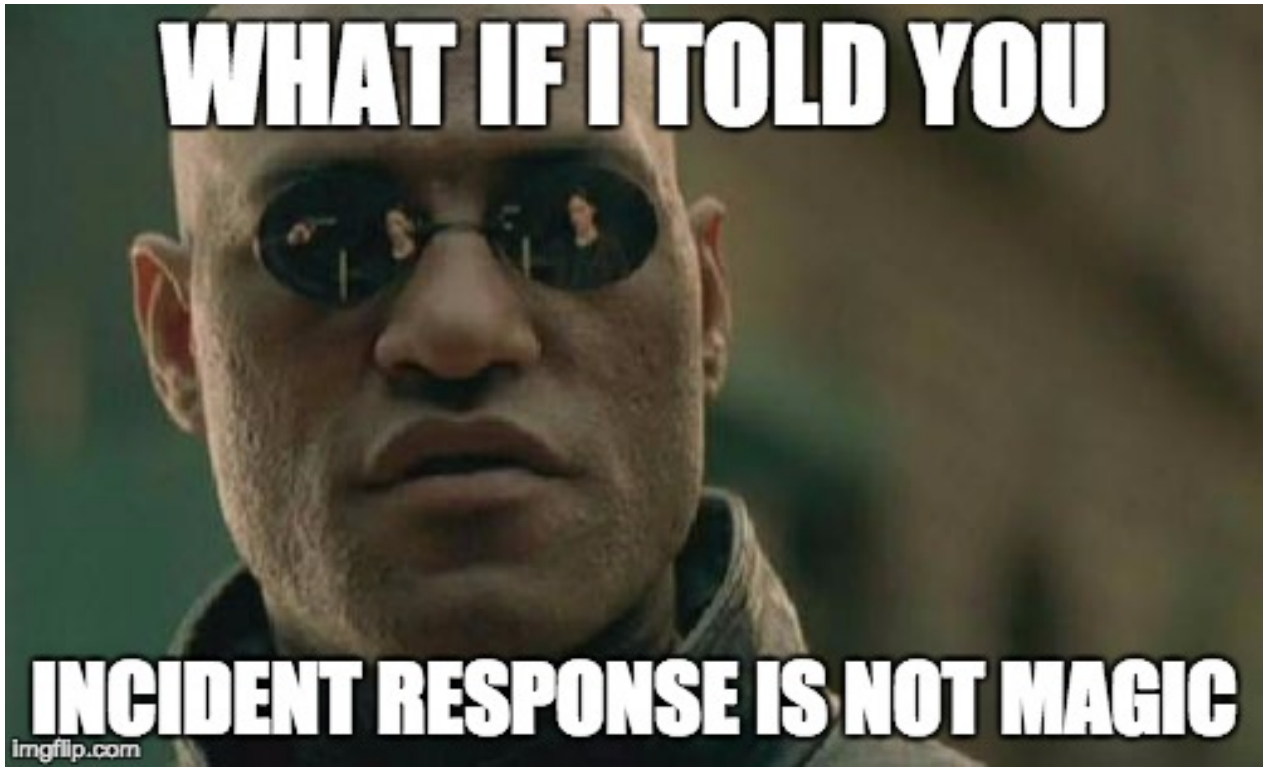
Basics of ISO/SAE 21434

Operations & maintenance:

- Monitoring
- Triage
- Incident response

But for how long?

- End of support?
- End of production?
- End of expected lifetime?



Basics of ISO/SAE 21434

What it boils down to:

- Updates!
- What about supply chain?

FIN:

- Decommission

So, whats my take?

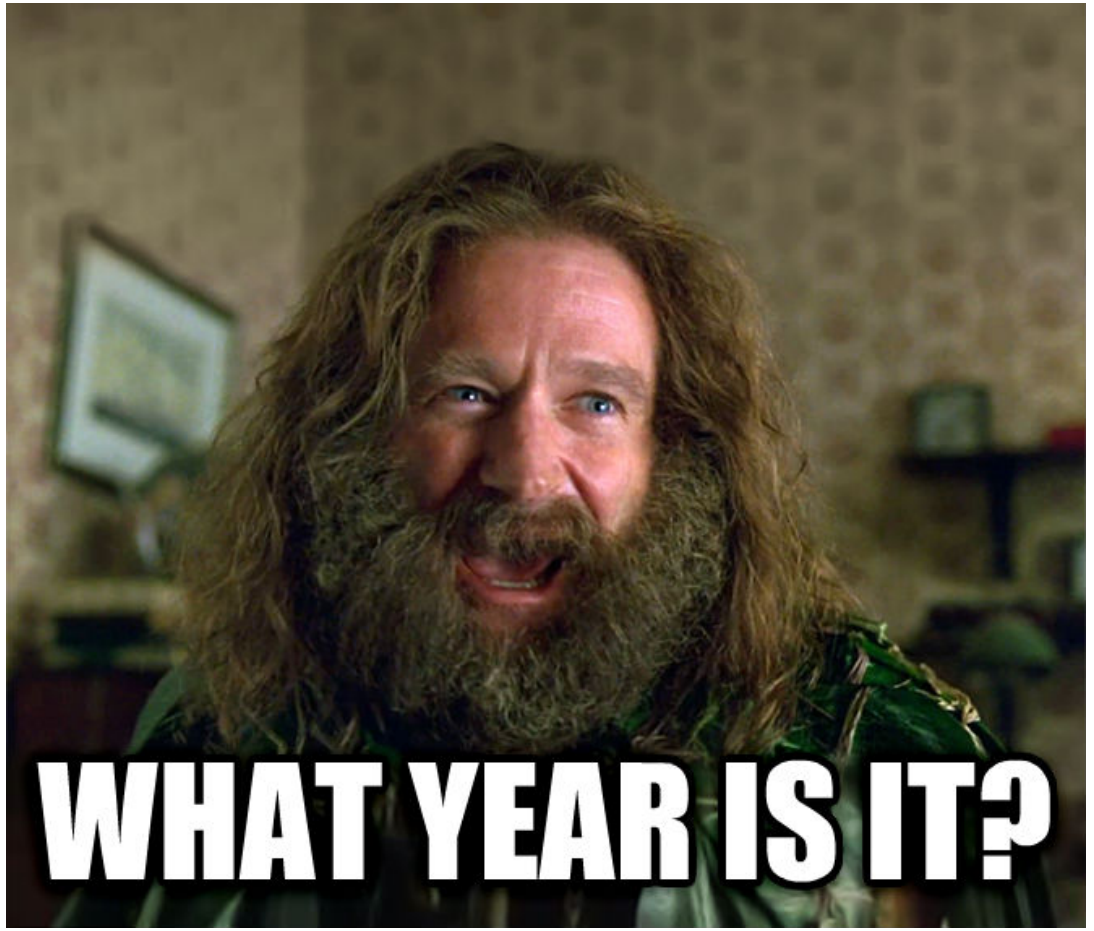
My take on ISO/SAE 21434

On the standarization process

My take on ISO/SAE 21434

My 2 cents:

- Closed standardization process?
- NDAs? Really???
- I thought we are over this!



My take on ISO/SAE 21434

To quote Kenny Paterson:

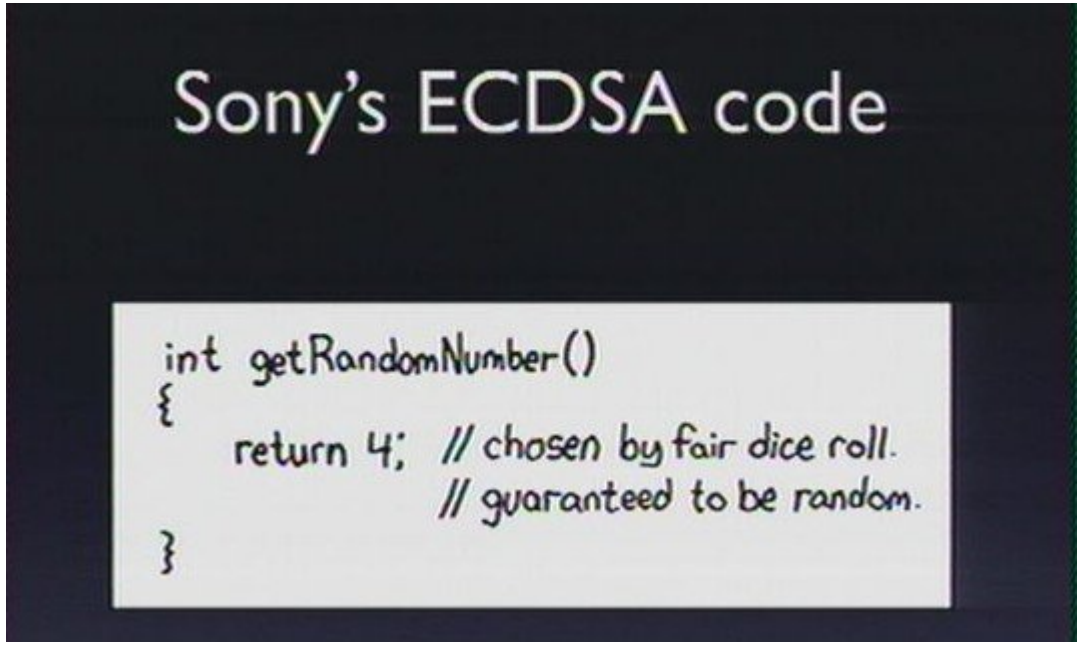
- “You're a bit late to the party. We're metaphorically speaking at the stage of emptying the ash trays and hunting for the not quite empty beer cans.“

I would love to see
more openness here!

My take on ISO/SAE 21434

Devil is in the details:

- “Sure we use secure boot”
  (but we store the key in unprotected memory)
- “Sure we use TLS”
  (but we don’t pin on CA, or certificate)
- “Sure we have individual keys”
  (but no TRNG)



My take on ISO/SAE 21434

Don’t wanna jinx it, but:

- This could be good!
- Move in the right direction

Possible issues:

- Vehicles as a whole are soooooooo complex
- Details, details, details …

Questions?

Contact me: @Fr333k