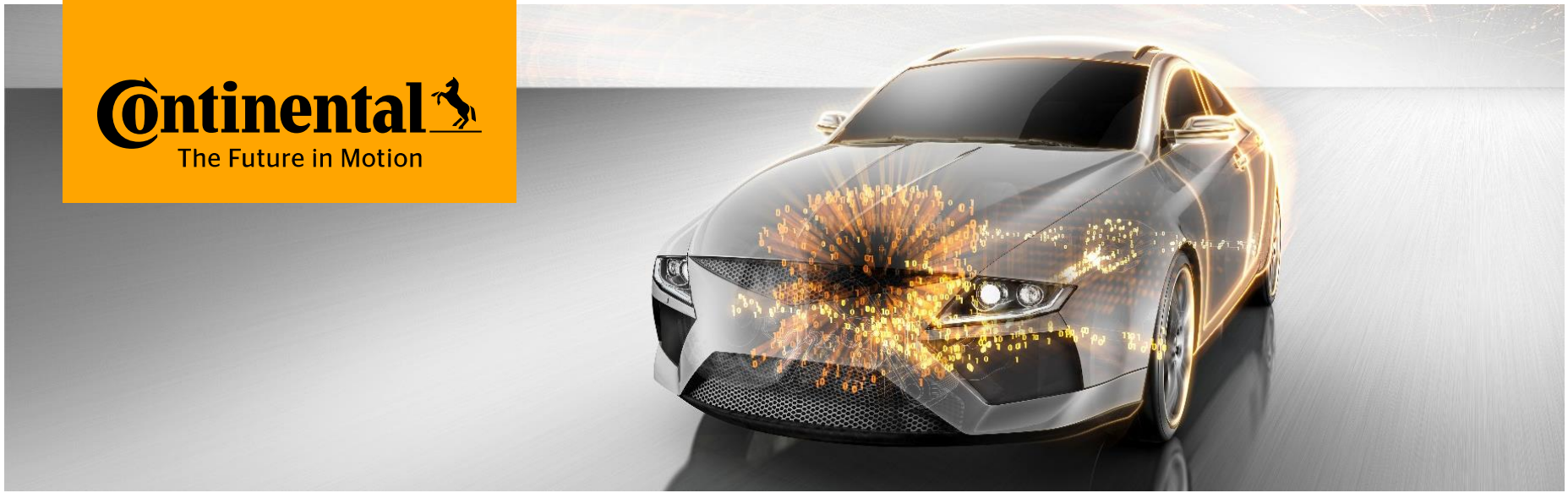
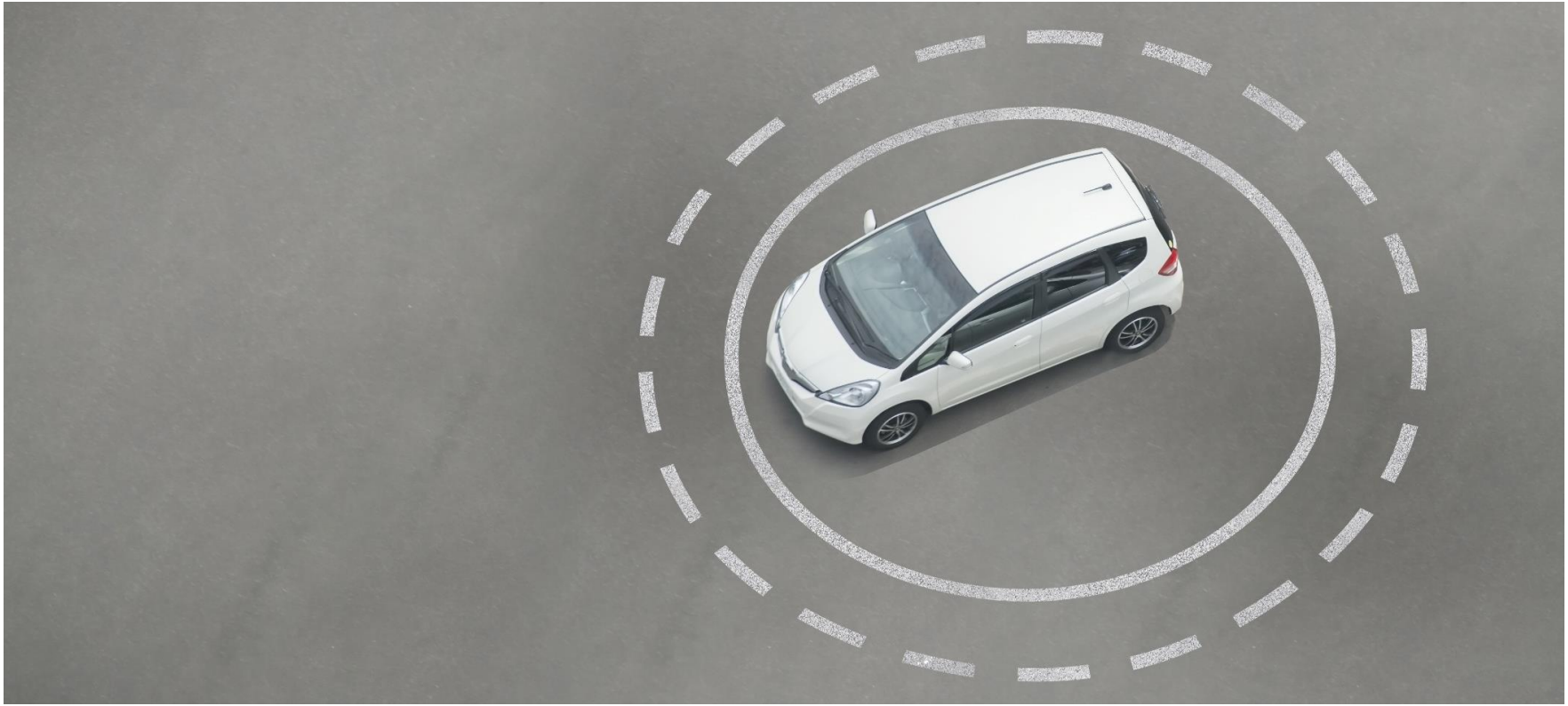
Continental
The Future in Motion



Cybersecurity in the Automotive Domain

PWIN Guest Lecture

Dr. Markus Tschersich | July 13th, 2017 | Goethe University Frankfurt



Cybersecurity in the Automotive Domain
Agenda

1. **Introduction to Continental**
2. Automotive Security
3. New Challenges of Automotive Megatrends
4. Interplay of Safety and Security
5. Developing a Cybersecurity Engineering Standard
6. Entry Possibilities at Continental

„My“ Continental Location

Continental Teves | Frankfurt am Main

4,000

Employees

Chassis & Safety HQ

4 BUs, Corporate

Divisions/ Business Units

EBS, ESC

Main Products

Our Vision

Your Mobility. Your Freedom. Our Signature.

Our world is made up of:

Highly developed, intelligent technologies for mobility, transport and processing

We want to provide:

The best solutions for each of our customers in each of our markets

For our stakeholders:

The most value-creating, highly reliable and respected partner

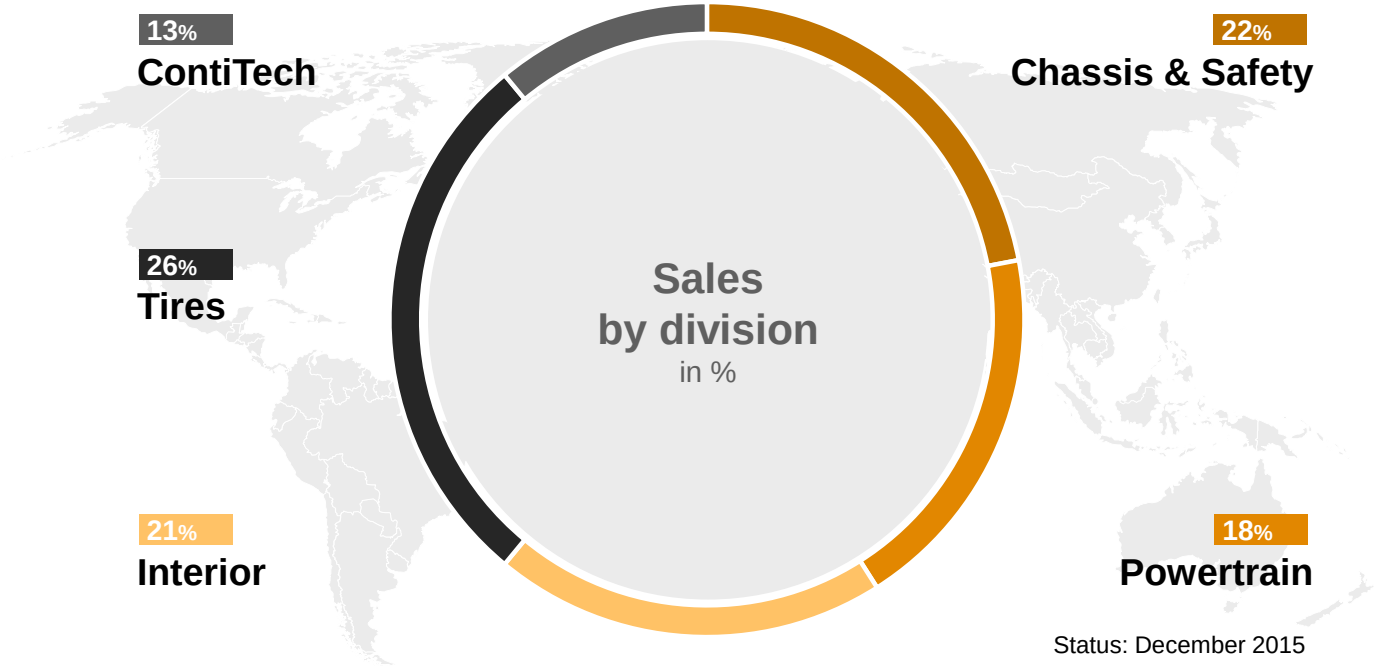
We Shape the Megatrends in the Automotive Industry:
Safety, Environment, Information, Affordable Cars

Continental Corporation

Over 140 Years of Innovation and Progress

1871 1900 1930 1960 1990 2017

Continental Corporation
Overview 2016



Sales of appr.
€40.5 billion

Status: December 2015

Continental – Achieving Success From Inner Strength

Our BASICS

Our four values are **the crucial element** here

Trust

Freedom To Act

Passion To Win

For One Another

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Introduction to Automotive Security
Increasing Complexity

Increasing number of ECUs

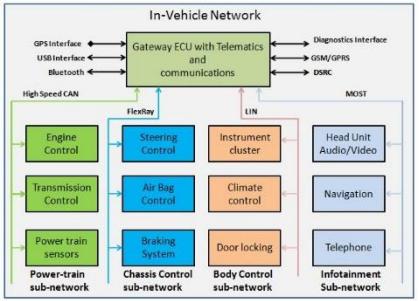
- 1997: 5 ECUs in Audi A6
- 2007: about 50 ECUs in Audi A4
- today: about 80 to 100 ECUs

Change in ECU usage

- Traditionally one task per ECU
- New trend of
  - distributing functions across ECUs
  - Integration multiple functions on one ECU

Variety of Applications

- Lane Assistance
- Collision avoidance
- Accident Reporting (eCall)
- Autonomous and Cooperative Driving



ECU: Electronic Control Unit

Introduction to Automotive Security

Understanding Security

NO

security

security „gate“

OKAY

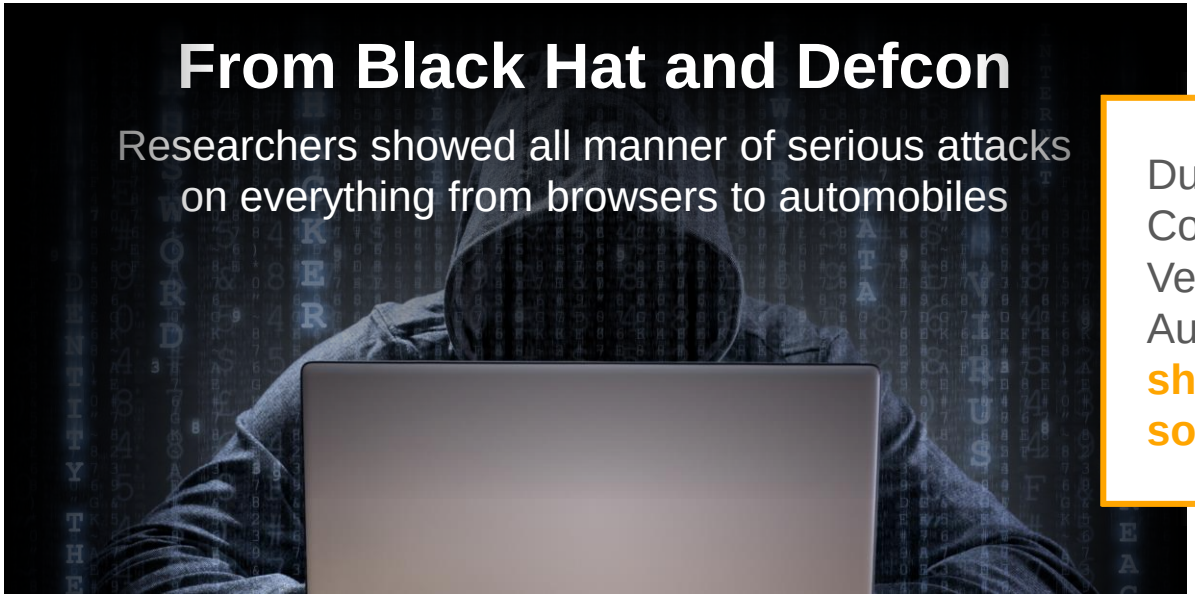
Security

BYPASSED

Unfortunately, implementation attacks are hard to predict.

Introduction to Automotive Security

Consequences from a lack of security



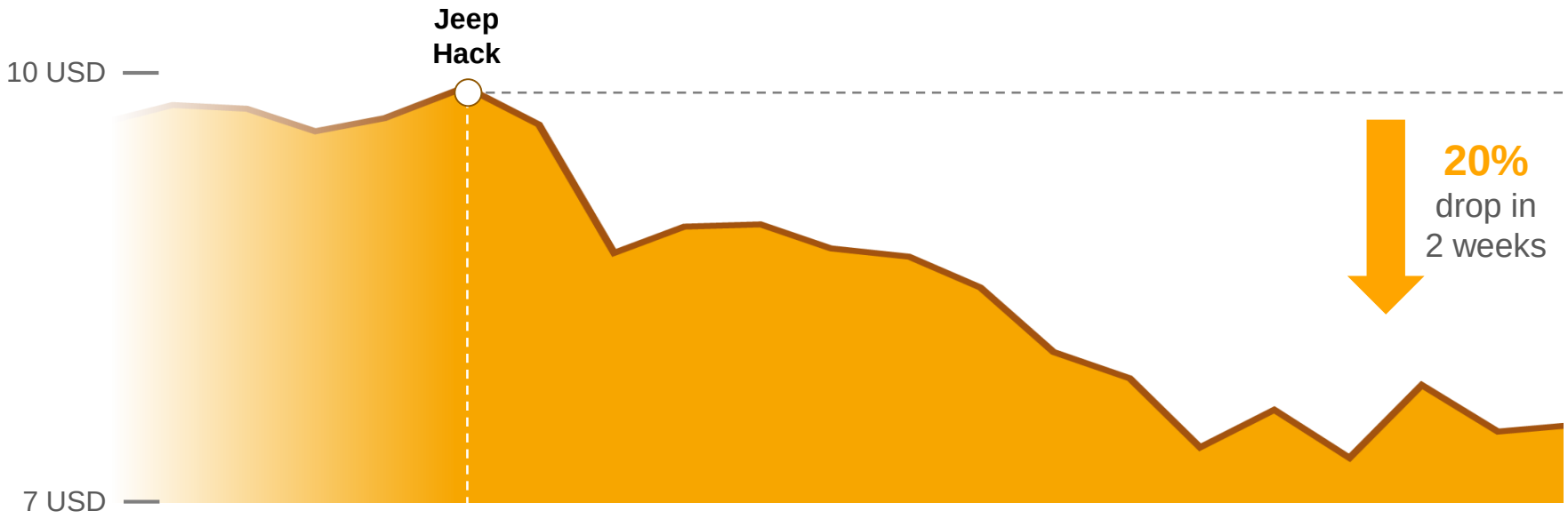
During the Hacking Conferences - “Black Hat Las Vegas & Defcon Las Vegas” Aug 2015 - a **video was shown** and **distributed via social media**.

Introduction to Automotive Security
Consequences

„After this jeep hack, **Chrysler recalled 1.4 Mill. vehicles for a security bug fix**.”

Introduction to Automotive Security

Stock Value Fiat Chrysler August 2015



Introduction to Automotive Security

Stock Value Fiat Chrysler August 2015

Lack of Security has a deep impact on a companies value

Even if the hack is done by only friendly scientists

Introduction to Automotive Security

… and more attacks with increasing press perception

2004: DRIVING; Altering Your Engine With New Chip (NY Times)
2003: Gentlemen, Start Hacking Your Engines (NY Times)
2002: How To Hack Your Car (Forbes)

< 2005

2010: Security and Privacy Vulnerabilities of In-Car Wireless Networks: A Tire Pressure Monitoring System Case Study (Rutgers, USC)
2010: Experimental Security Analysis of a Modern Automobile (Center for Automotive Embedded Systems Security)
2007: Hackers can take over car navigation system (The Telegraph)
2005: RFID Chips in Car Keys and Gas Pump Pay Tags Carry Security Risks (John Hopkins University)
2005: Linux Bluetooth hackers hijack car audio (The Register)
2005: Hacking the Hybrid Vehicle (Wired)

2005-2010

2016: Nissan Leaf electric cars hack vulnerability disclosed (BBC)
2014: A Survey of Remote Automotive Attack Surfaces (IOActive)
2014: Most Hackable Cars (CNN Money)
2014: How to Hack a Car (Vice)
2014: The Robot Car of Tomorrow May Just Be Programmed to Hit You (Wired)
2013: Digital Carjackers Show Off New Attacks (Forbes)
2013: Jury Finds Toyota Liable in Fatal Wreck in Oklahoma (New York Times)
2013: Adventures in Automotive Networks and Control Units (IOActive)
2013: Car Hacking: Your Computer-Controlled Vehicle Could Be Manipulated Remotely (CBS)
2013: How to Hack Your Mini Cooper: Reverse Engineering CAN Messages on Passenger Automobiles (Defcon 21)
2011: Can Your Car be Hacked? (Car and Driver)
2011: Comprehensive Experimental Analyses of Automotive Attack Surfaces (Center for Automotive Embedded Systems Security)

> 2010

Introduction to Automotive Security

Odometer Example: Good old times

Expertise	› Automotive mechanist
Tools	› Specific tools or garage
Time	› Hours
Evidence	› Mechanical Traces

Video: https://www.youtube.com/watch?v=vUh-8GEhzJM

Introduction to Automotive Security

Odometer Example: Nowadays

Expertise	› Search on google › Make a call
Tools	› Tester for ODB interface
Time	› Minutes
Evidence	› No digital traces

Video: https://www.youtube.com/watch?v=orMsibfLcFY

Introduction to Automotive Security
Attackers and their Damage Categories

Thieves	› Stealing assets › Stealing vehicles
Owner/Driver	› Manipulating vehicle data › Manipulating vehicle Settings › Spoofing licences
OEM/Tier-1	› Stealing business secrets › Conducting product piracy
Software manufacturer	› Elevating privilidges
Hacker, Virus, Malware	› Stealing of personal data › Manipulating the functional safety

Damage Categories

- Property
- Image
- Business Model
- Legislation
- Know-How
- Reliability
- Functional Safety
- Privacy

Introduction to Automotive Security

Trends on Automotive Products – IT Technology

Inceasing amount of digital electronic and software

Long time ago | Past | Present | Future




- Simple mechanical vehicles change to intelligent, connected, and software-based IT-Systems
- Flexibility, compatibility, costs, and weight are driving the change

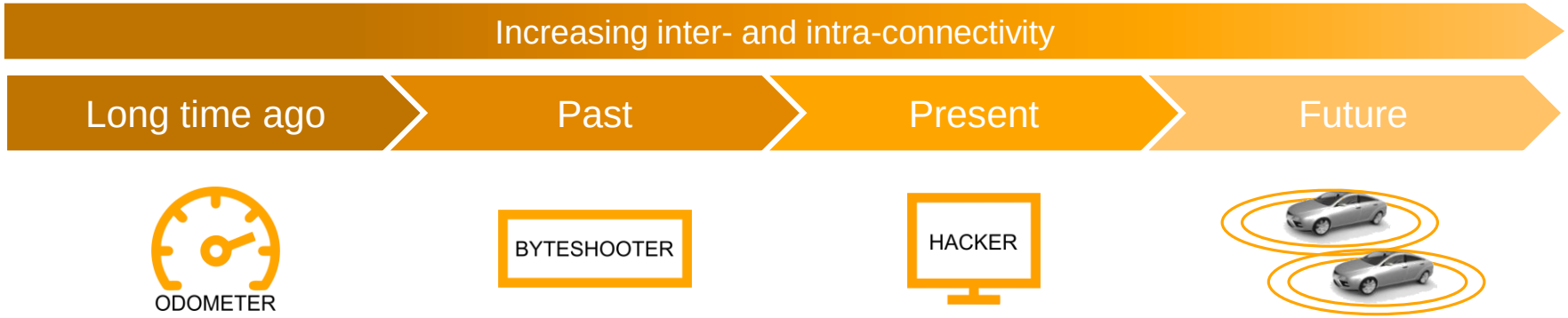
Introduction to Automotive Security

Trends on Automotive Products – Interconnectivity

- Evolutionary step from closed system to a complex interconnected and interactive communication party
- The need for an efficient and safe traffic regulation is one driver next to infotainment and internet connectivity.

Introduction to Automotive Security

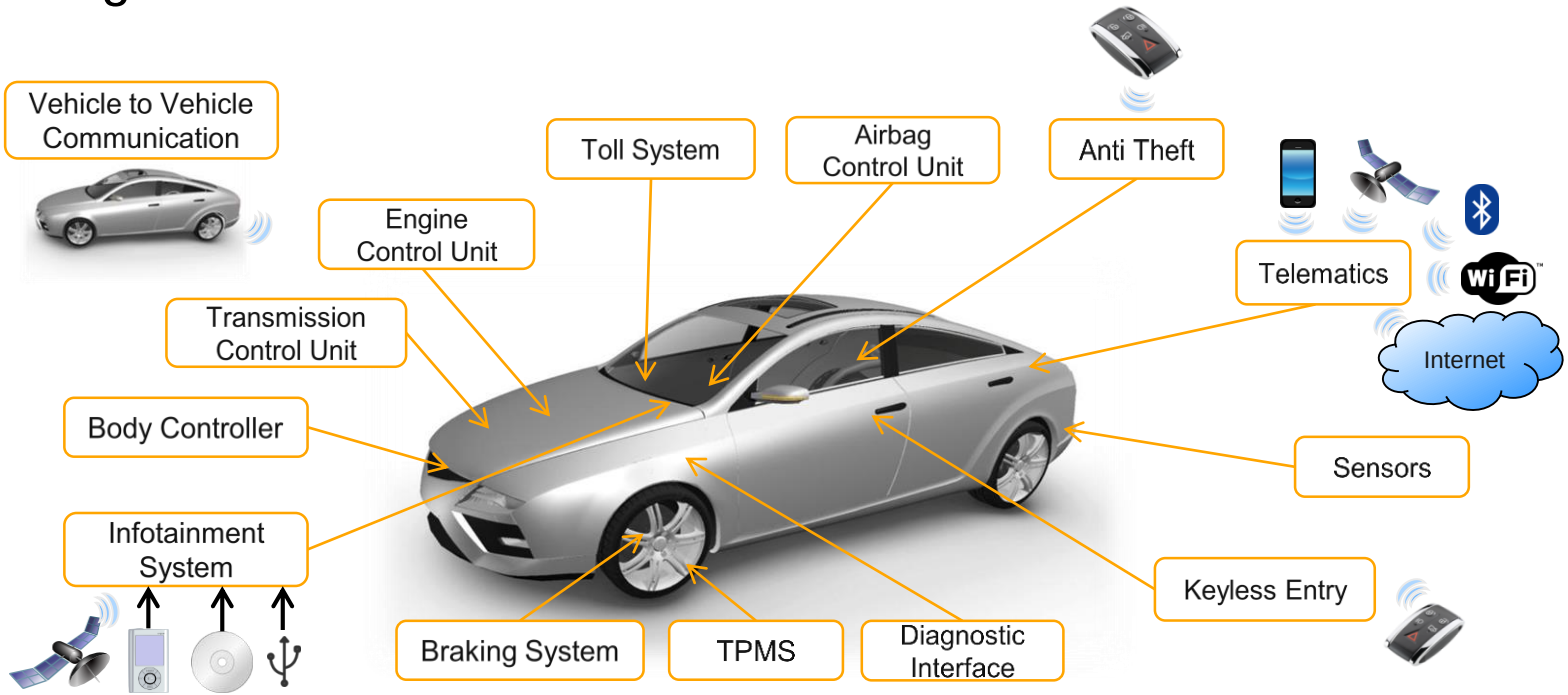
Trends on Automotive Products – Scaleability of Attacks



- Attacks are scaling from single manipulations of ECUs to organized network wide attacks
- Driver for this development on various stakeholder (owner, companies, 3rd parties): fun, fame, sabotage

Automotive Security Threats

Increasing attack surface



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New Challenges of Automotive Megatrends
Increasing Threats and Attack Potential at the Horizon

Electric Mobility

Autonomous Driving

Information

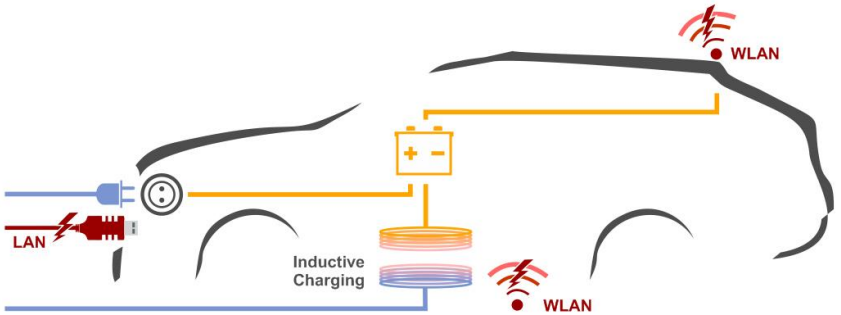
Megatrend: Electric Mobility
Infrastructure Necessary to be Protected

Charging Infrastructure

- Connects Automotive to the critical infrastructure “Electric Power”
- Electromobility is highly depending on the availability of charging infrastructure
- Implications with NIS Directive Regulation on the horizon

Payment

- Needs to be secured to avoid financial harm for supplier and/or customer



Megatrend: Electric Mobility
Attacks Based on Loss of Data Integrity

Attack on EV performance

- Different data sources used to extend range (weather, altitude difference, traffic volume)
- Manipulation can lead to unexpected performance of electronic vehicle

Attack on components

- Overheated battery triggered by manipulation of temperature sensor
- Will cause financial harm

Megatrend: Autonomous Driving

SAE J3016 - Driving Automation Definitions

	SAE Level	Name	Steering, Acceleration, Deceleration	Monitoring of Driving Environment	Fallback Performance	System Capability (Driving Modes)
 Human driver monitors the driving environment	0	**No Automation**	Human	Human	Human	n/a
	1	**Driver Assistance**	Human and System	Human	Human	Some driving modes
	2	**Partial Automation**	**System**	Human	Human	Some driving modes
 Automated driving system monitors the driving environment	3	**Conditional Automation**	System	**System**	Human	Some driving modes
	4	**High Automation**	System	System	**System**	Some driving modes
	5	**Full Automation**	System	System	System	**All driving modes**

Megatrend: Autonomous Driving

Automated Driving System takes over more responsibility

- Impact of errors/attacks increases due to higher range of functions
- Simple shut-down in case of attacks is not working
- Need for redundancy and fallback systems
- Higher impact on privacy due to increased need of data collection and processing

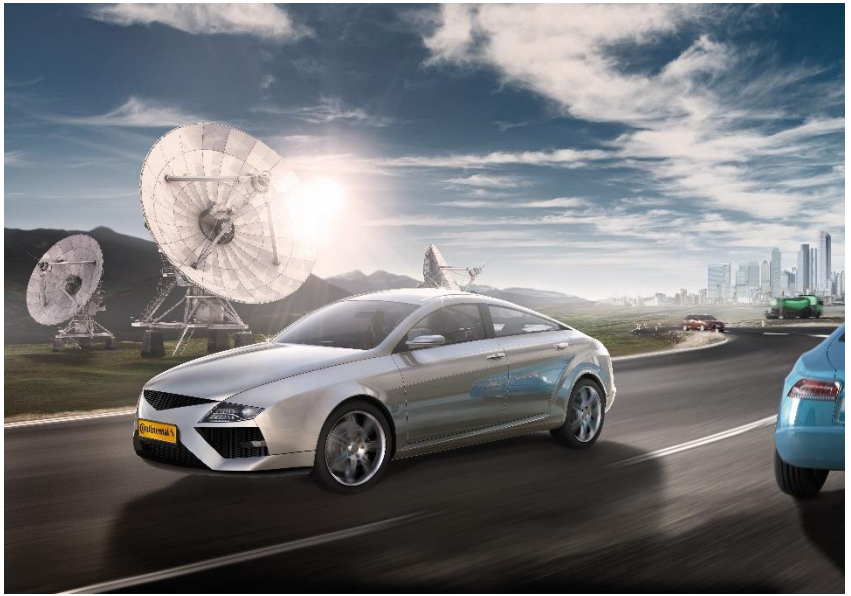
Megatrend: Information
New Opportunities and Risks of Big Data

Collection, processing and connectivity

- Improve driver assistant systems (Safety)
- More attractive/interactive infotainment systems
- Reduction of fuel/energy consumption
- Mobility Services, Smart Cities, Smart Home

Arising Risks of Big Data

- Increasing number of attack vectors
- Compliance with different legal privacy frameworks
- Higher attraction to data theft



Megatrend: Information

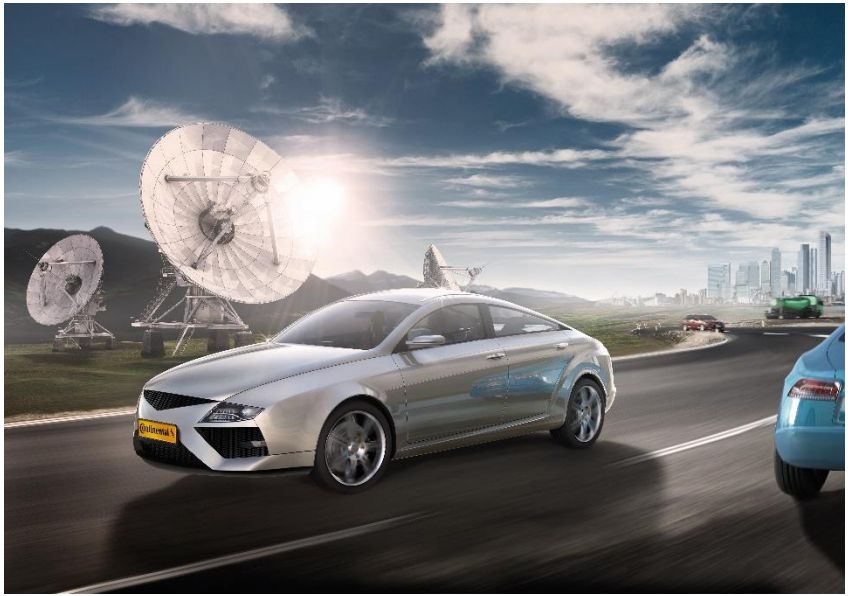
Over the Air is Enabler and Additional Risk

Opportunities

- Smart and fast way for bug fixing and security patches
- Enables automotive app ecosystem
- Provides live information

Attack Vectors

- Connection interface can be attacked
- Risk of infected automotive apps



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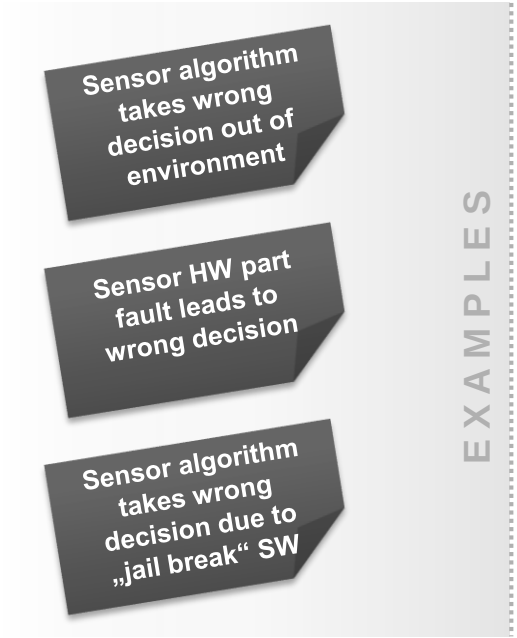
Ensuring Device Reliability

Interplay of Functional Safety and Security Required

- Safety a discipline with a long history in automotive
- Functional Safety and Security need to engage with each other to ensure high quality products
- Both disciplines need to be considered by the organization.

Differentiate Safety and Security
A Functional Safety Perspective



Target: Intended functional behavior

Safety in use / Safety of the intended functionality

- Is there any risk resulting out of the fault free functional behavior?
- Actually not standardized, in discussion for ISO 26262 2nd ed.

Functional safety

- Is there any risk resulting out of a faulty functional behavior?
- Standard: ISO 26262

Security

- Is there any risk resulting out of a faulty functional behavior resulting out of (criminal) intended or un-intended system changes?
- Partially reflected in ISO 26262 but only for “intended misuse”, i.e. w/o criminal intention
  → sep. standard on the way: ISO-SAE 21434:2019 (ongoing)

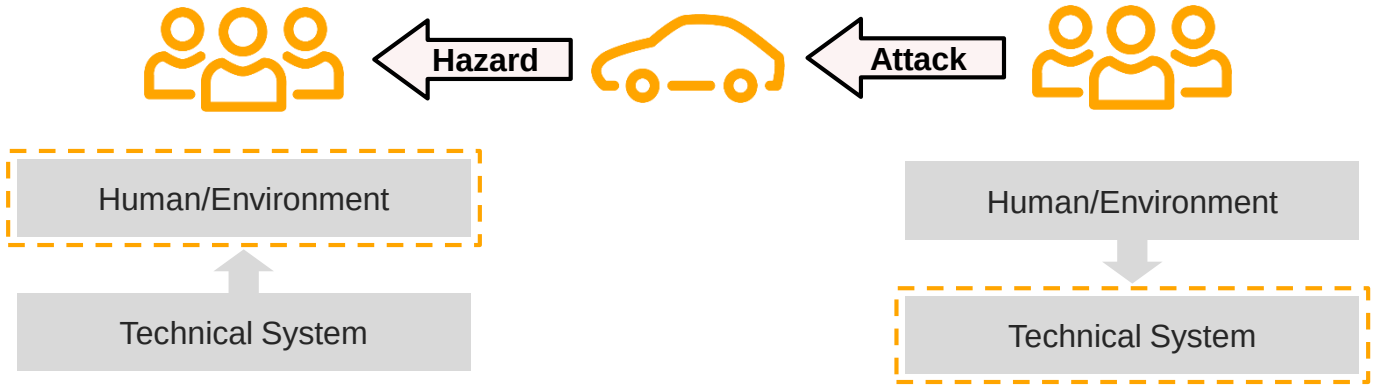
Differentiate Safety and Security
Security vs. Functional Safety

Functional Safety

› Protect human against threats proceeded from (known) technical systems.

Security (IT/Cyber)

› Protect a technical system against attacks (basically unknown) as well as disturbances from the environment or caused by human.



Differentiate Safety and Security

Similarities between Safety and Security

Risk oriented approach

› What can go wrong? How likely is it? What will the consequences be? (note: differences in probability estimations)

Development process

› Safe and secure software is achieved by using a systematic development approach rather than reactive patching

Testing

› Comprehensive testing is essential for confidence in the final product

Redundancy

› Double instances of safety/security mechanisms does not necessarily lead to double safety/security

Ultimate objective

› Achieving a **sufficiently safe/secure product**

Culture and values

› Knowledgeable, motivated and committed management and employees is a success factor for achieving safe and secure products

Differentiate Safety and Security

Differences between Safety and Security

Classification of consequences

- In safety typically divided into several levels (e.g. SIL/ASIL/DAL)
- In security quite binary, system is either compromised or not

Threat analysis, risk assessment

- In safety we have pretty well known, static fault models and fault assumptions
- In security threats changes regarding motivation, knowledge and attack vectors

Non-experts understanding

- In safety the consequences are easily understandable
- In security the threat models are often met with scepticism and might be judged as paranoid

Knowledge of experience

- In the safety domain there is a culture of discussion and sharing of experience
- In security, business actors tend to keep their experiences to themselves, thus efficiently slowing down the collective expertise

Challenges of Security in Automotive
Approaches to Address Challenges

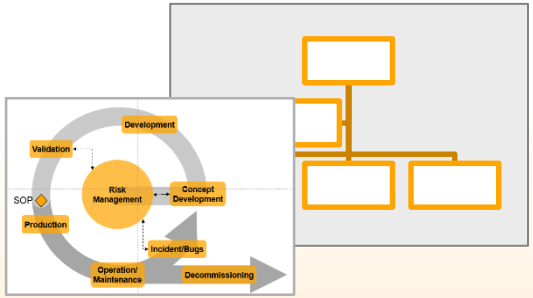
Strategic Projects

- Generic ECU Security Requirements
- V2X Security

Specific Products

- Smart Keyless Entry
- Balancing requirements: comfort, performance, safety, security … and costs(!)

Governance & Processes



- Governance and Management Awareness
- Establishing standardized and harmonized processes (e.g. PLC, TARA/HARA, Common Language)

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Standardizing Cybersecurity Engineering
Goals of the Initiative

The future standard shall…

1. Give uniform definition of notions relevant to automotive security
2. Specify minimum requirements on security engineering process and activities and define – wherever possible – criteria for assessment
3. Describe the state of the art of security engineering in automotive E/E development

Targeted effects on automotive industry

- Common and internationally agreed understanding of automotive cybersecurity engineering
- Sufficient rigor as reference for legislative institutions; ensure legal certainty

Standardizing Cybersecurity Engineering

Goals of the Initiative: A Common Language

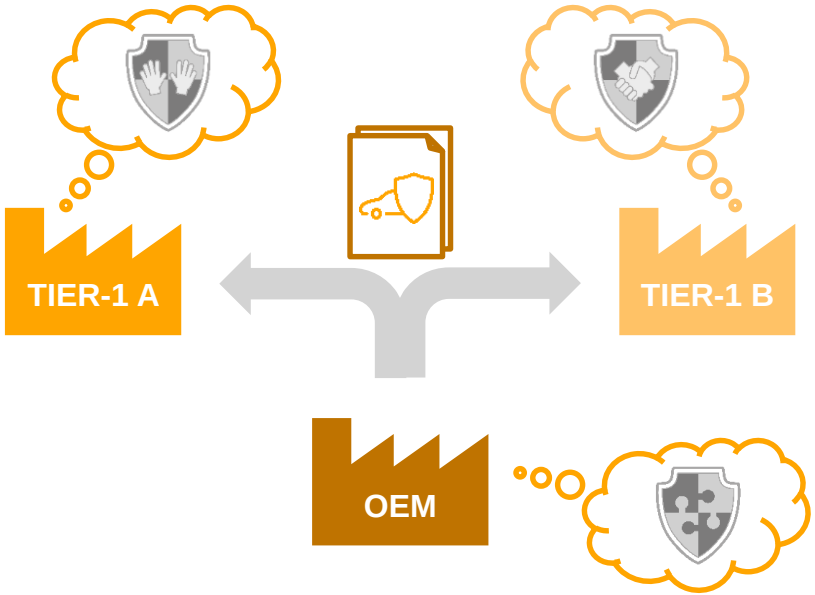
The future standard shall…

Goal

1 › Give uniform definition of notions relevant to automotive security

Current Situation

› Ambiguity and vagueness in use of security notions



Standardizing Cybersecurity Engineering
Goals of the Initiative: A Common Language

The future standard shall…

Goal

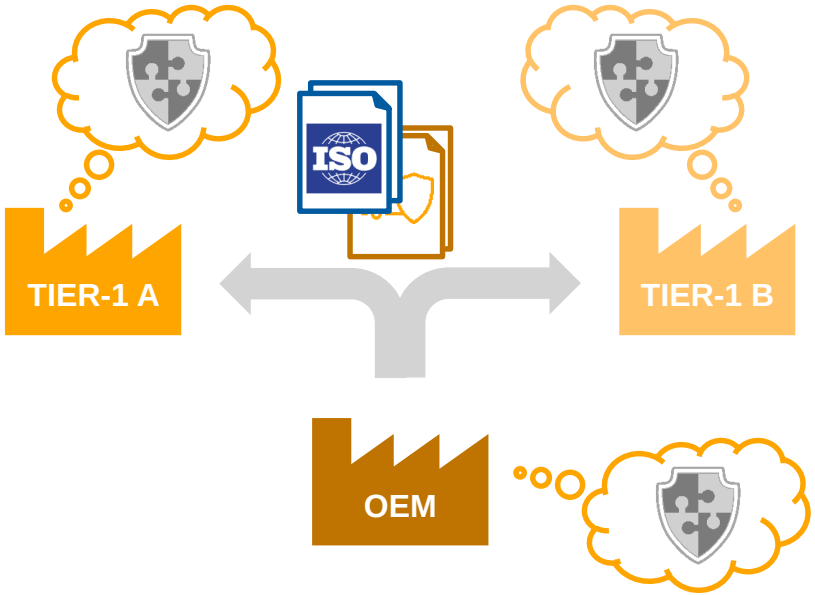
1 › Give uniform definition of notions relevant to automotive security

Targeted Effects

› Generate and foster a common and internationally agreed understanding of automotive cybersecurity engineering

› Enable and improve cooperation in development, manufacturing and maintenance of products

› Allow for efficient security processes



Standardizing Cybersecurity Engineering

Goals of the Initiative: Minimum Set of Requirements

The future standard shall…

Goal

2

› Specify minimum requirements on security engineering process and activities and define – wherever applicable – criteria for assessment

Current Situation

› Uncertainty about level of security

› Avoidance of communication on security

Standardizing Cybersecurity Engineering

Goals of the Initiative: Minimum Set of Requirements

The future standard shall…

Goal

2

› Specify minimum requirements on security engineering process and activities and define – wherever applicable – criteria for assessment

Targeted Effects

› Achieve sufficient rigor in order to be accepted as reference for legislative institutions etc. and ensure legal certainty

› Enable and improve cooperation in development, manufacturing and maintenance of products

› Allow for efficient security processes

Standardizing Cybersecurity Engineering

Goals of the Initiative: State of the Art

The future standard shall…

Goal

3 › Describe the state of the art of cybersecurity engineering in automotive E/E development

Current Situation

› Uncertainty about security levels

› Traditional IT Security management processes not feasible

Standardizing Cybersecurity Engineering

Goals of the Initiative: State of the Art

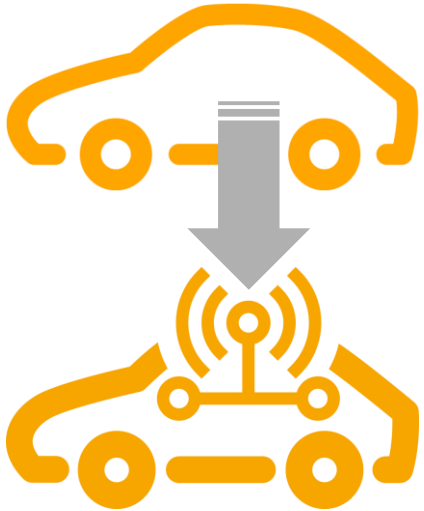
The future standard shall…

Goal

3 › Describe the state of the art of cybersecurity engineering in automotive E/E development

Targeted Effects

- › Raise automotive cyber security to the next level
- › Establish automotive cybersecurity as a proper engineering discipline
- › Generate and foster a common and internationally agreed understanding of automotive cybersecurity engineering



Road Vehicles – Cybersecurity Engineering

Towards a joint ISO/SAE Standardization Project

2014/2015	Preparatory work independently within VDA, SAE: research and drafting
01/2016	Publication of SAE J3061 “Guidebook for Cyber-Physical Vehicle Systems
01/2016	Submission of ISO NWIP3556 “Automotive Security Engineering” (Germany)
04/2016	Submission of ISO NWIP3586 based on SAE J3061 (USA)
05/2016	ISO/TC22 approves NWIP3556 and NWIP3586
06/2016	Start of negotiations at ISO/TC22 and SAE level about joint project
09/2016	PSDO* Agreement signed by ISO and SAE; Agreement to start joint project as PSDO
10/2016	ISO TC22/SC32 starts Project AWI 21434
10/2016	Kick-Off Meeting of ISO/SAE Joint Working Group in Munich

*Partnership Standards Development Organizations

Standardizing Cybersecurity Engineering
ISO/SAE 21434 – Overview

Joint Working Group

Working Groups within ISO
- ISO/TC22/SC32/WG11 - Cybersecurity
- JWG for ISO/SAE Cybersecurity Engineering

Co-Convenors
- SAE: Lisa Boran (Ford, US)
- ISO: Gido Scharfenberger-Fabian (carmeq/VW, DE)

Expert Groups
- 12 national delegations are involved

Document

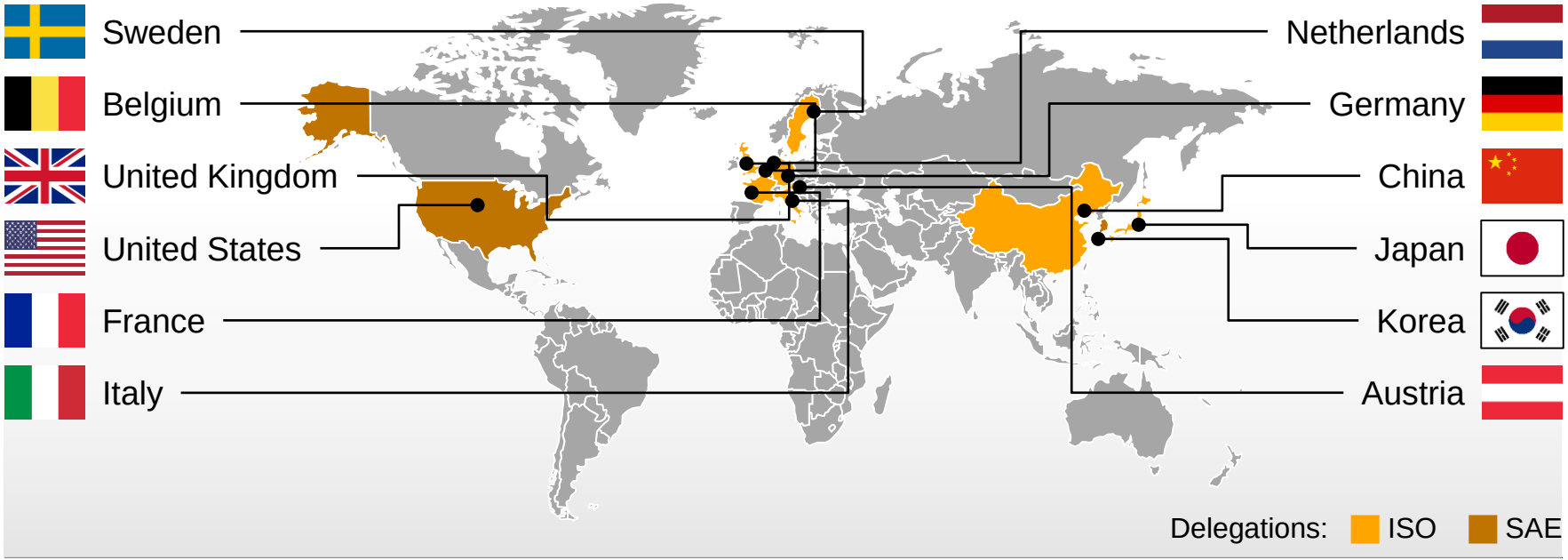
Standard
- ID: ISO/SAE 21434
- Title: Road vehicles – Cybersecurity Engineering

Scope
- Requirements for cybersecurity risk management
- process framework
- Common language
- Road vehicles (pre-defined by TC22)

Expected Publication Date
- Begin of 2020

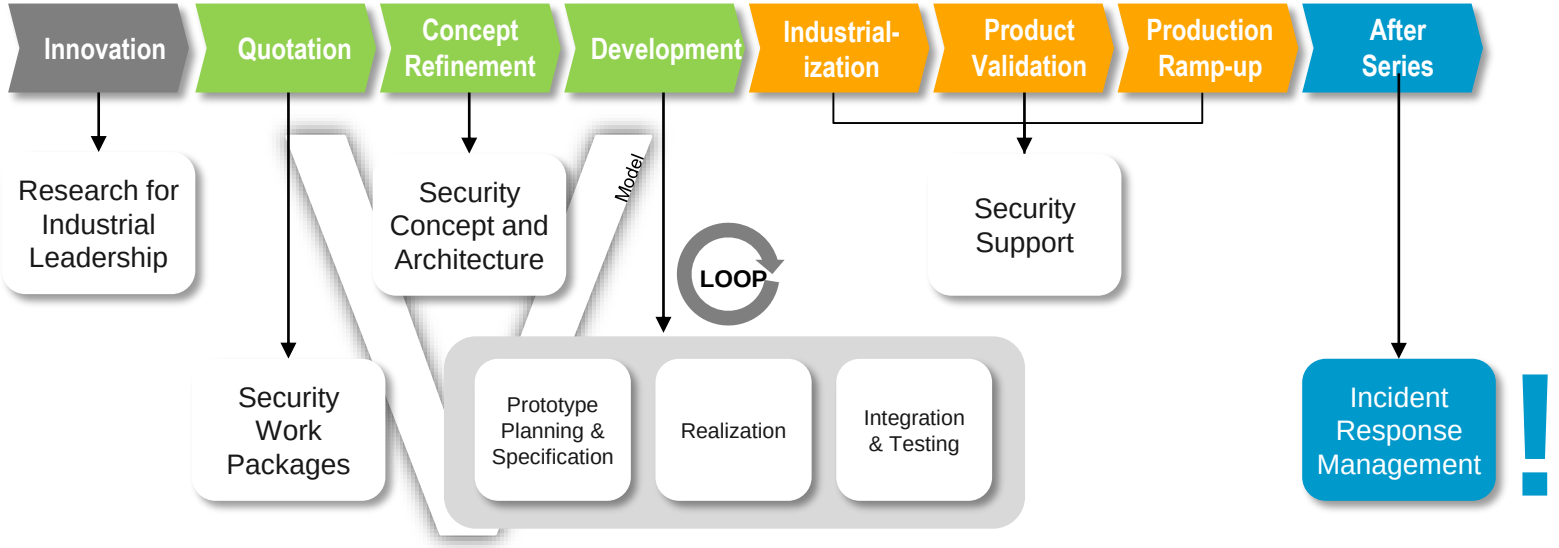
Structure and Organization

ISO/SAE 21434 - National Delegations

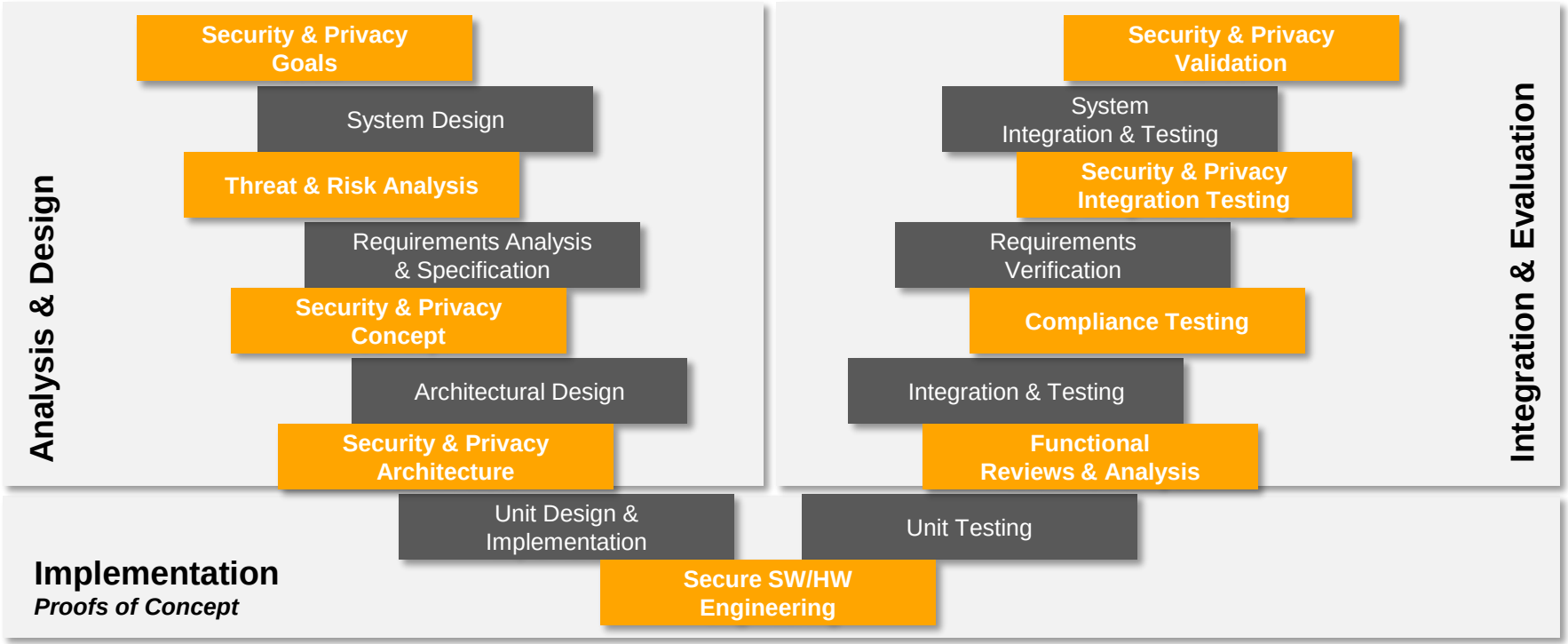


Standardizing Cybersecurity Engineering

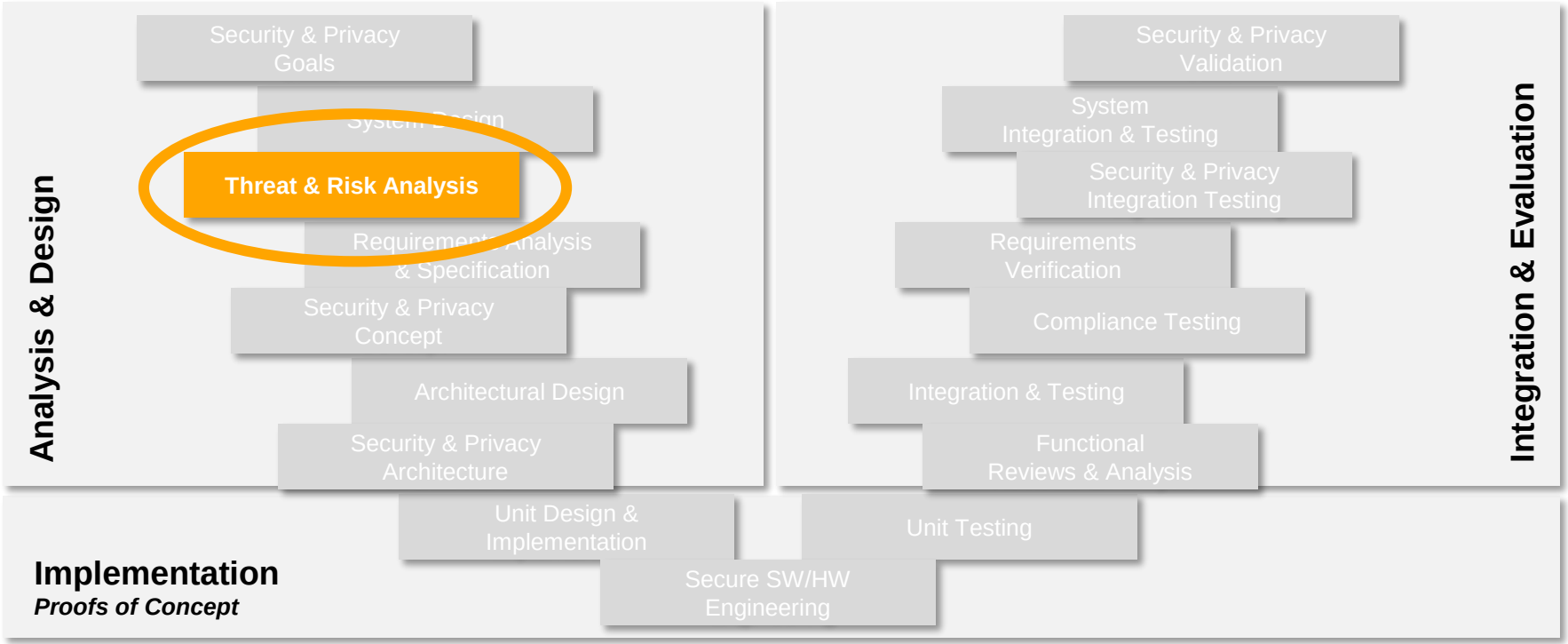
Security in the whole Product Life Cycle



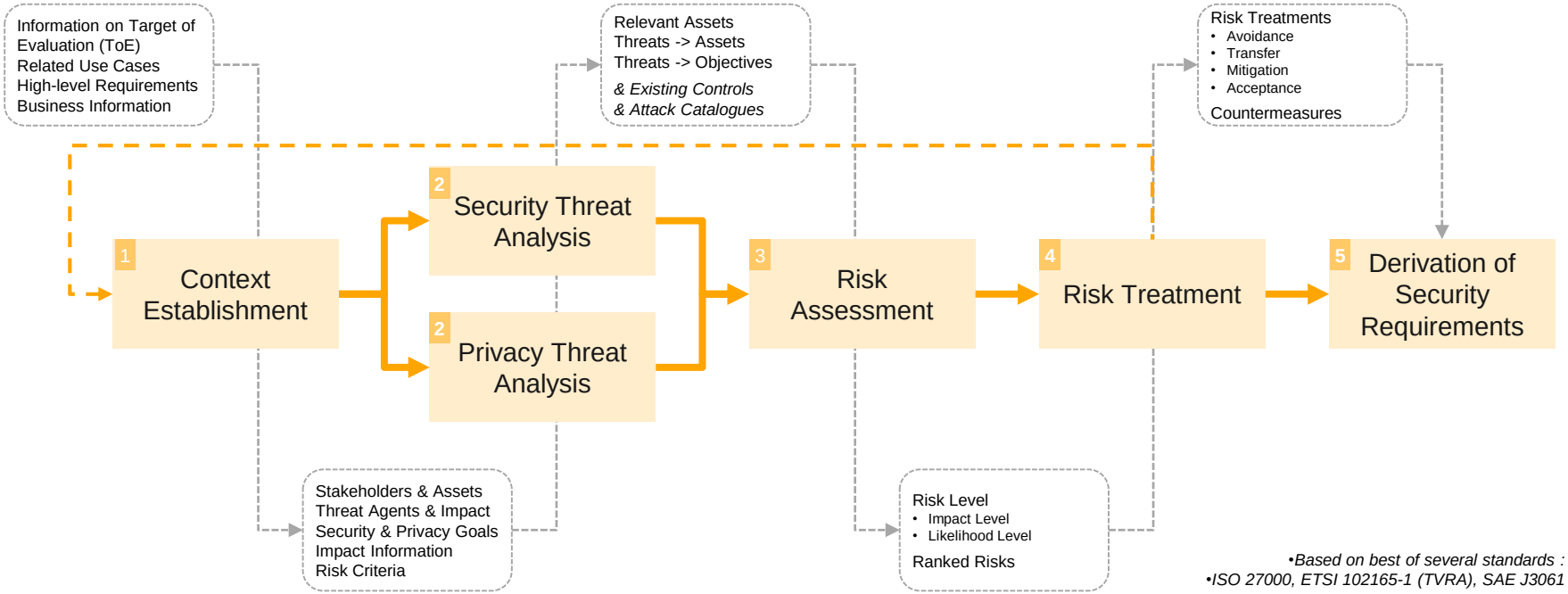
V-Model: Security & Privacy



V-Model: Security & Privacy

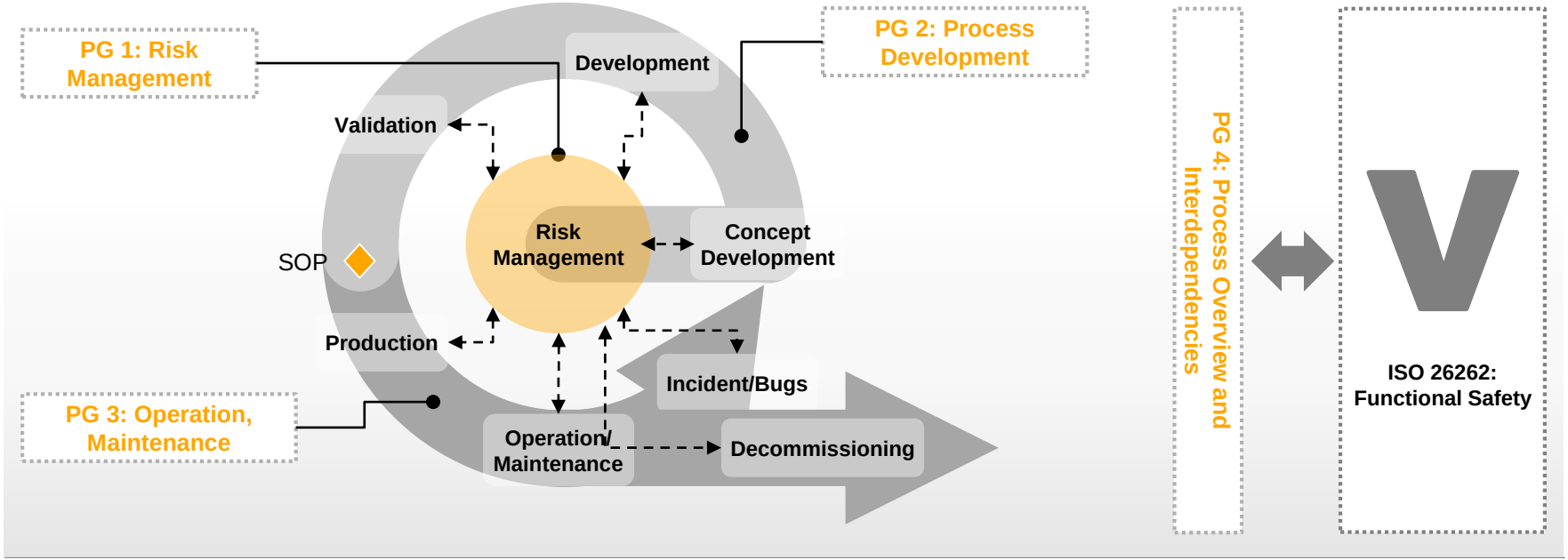


Threat Analysis and Risk Assessment (TARA*)



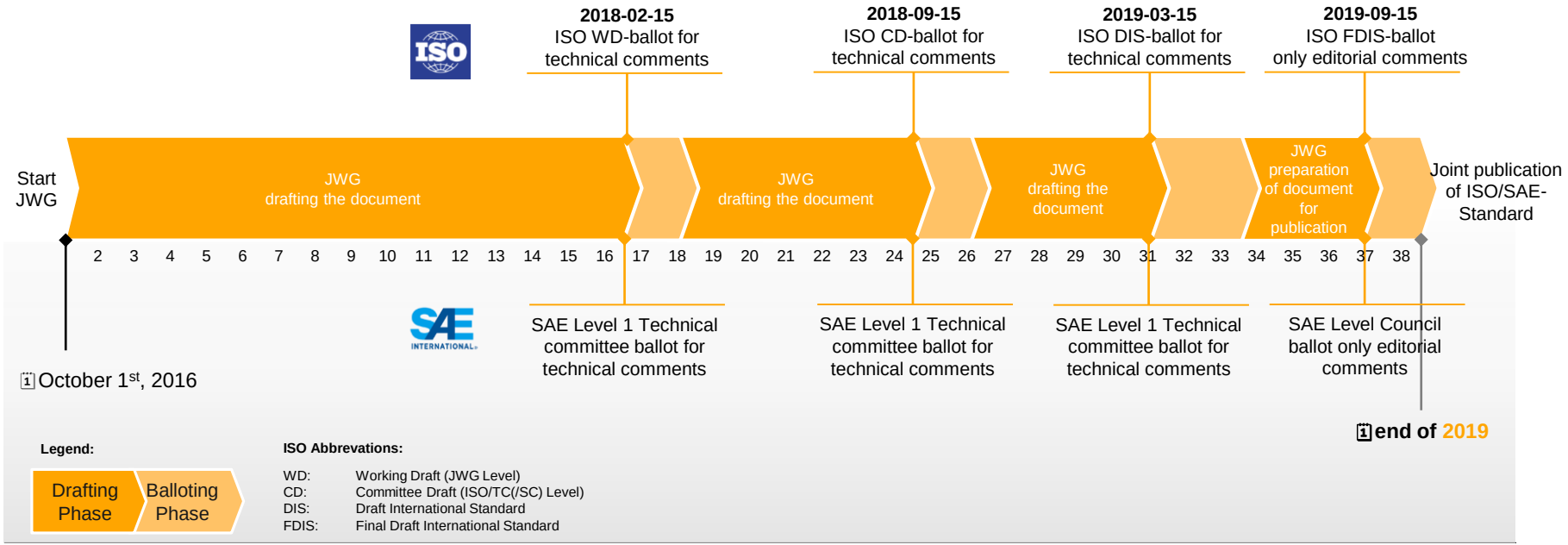
•Based on best of several standards :
•ISO 27000, ETSI 102165-1 (TVRA), SAE J3061

Scope and Timeline
ISO/SAE 21434 – Project Groups



Scope and Timeline

ISO/SAE 21434 – Overall Schedule



Road Vehicles – Cybersecurity Engineering
Outreach and Interaction

Liaison with ISO/IEC JTC1/SC27
- Development of 27xxx standards series, Common Criteria ISO 15408 and further standards of relevance to our project

Liaison with ISO/TC22/SC31 Road vehicles – Data communication
- Development of several automotive standards that include cybersecurity mechanisms specifications

Exchange with UNECE WP.29 TF CS/OTA
- Prepares rules for vehicle cybersecurity, potentially relevant for type approval

Exchange with NHTSA

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Entry Possibilities at Continental

This is Continental

- Truly international team around the globe
- Performance-oriented working atmosphere
- Early responsibility and exciting job challenges
- Achieving exceptional results through passion
- Open & informal culture: open doors & open minds
- Innovative Technology
- Significant contribution to sustainable mobility

Entry Possibilities at Continental

From Internship to Permanent Position

Possible entries at **Continental AG**

Students

Student @Continental | **Intern-ship** | **Working Students** | **Thesis**

Graduates

Continental Trainee & Graduates Programs | **Direct Entry**

Professionals

Direct Entry

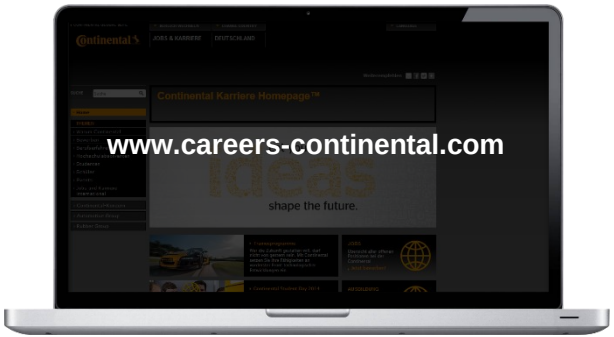
Entry Possibilities at Continental
Internship and Thesis

Requirements:

- **Apply 2 to 3 months before** your preferred internship start date
- Duration: **3-6 months**
- Current certificate of matriculation
- Very good language skills in **English**
- Proficient experience in working with **MS Office** (esp. Word, Excel, Power Point)

Take your chance!

Apply online:



Entry Possibilities at Continental

Continental Trainee & Graduates Programs

Automotive

AutomotiveTrainee Program

Rubber

ExploreTrainee Programs

ContiTechManagement Program

Entry Possibilities at Continental

Overall Information Continental Trainee Programs

We offer

- **Mentor** from the business
- Trainee & alumni **network**
- Corporate **entry program**
- **Trainings:** project management, self management, communication, presentation techniques
- **International** assignment

Entry Possibilities at Continental

Overall Information Continental Trainee Programs

We expect

Passionate interest in technology

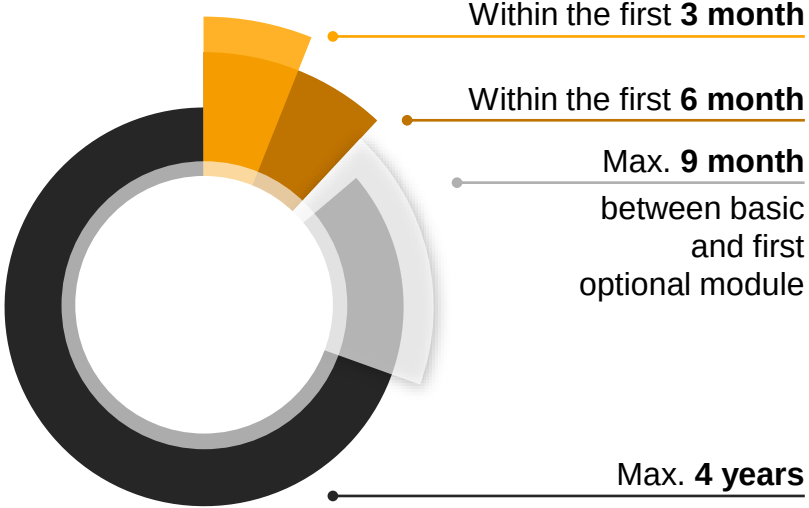
International experience through practical activities or study

Challenging internships related to industry

Teamwork & communication skills

Good command of English language

Continental Entry Program
Overview



START MODULE
C.OnBoard

BASIC MODULE
Continental Entry Conference (CEC)

Optional Modules

- Business Decisions (Basics)
- Effective Presentations
- Team Excellence
- Self Management
- Cross-cultural competence

Developing Talent „Across Borders“…
Cross Moves

General management know-how

Broadbanded business know-how

Intimate expertise for relevant professional fields

… be manager of your own talent

- Establish corporate thinking
- Generate new networks
- Improve your skills and expertise
- Increase intercultural competence

Cross divisional moves

Cross functional moves

Cross country moves

Application process

Online application
via Continental Career Homepage™

Recruiting process
Telephone interview or assessment center or personal interview

Final formal offer

Have we sparked your interest?
Then spark ours!

www.careers-continental.com

www.facebook.com/ ContinentalCareer

www.continental-people.com

Corporate Systems & Technology
Contact Details

Specialist Security & Privacy

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