April 3, 2019

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Chief Engineer, Cybersecurity
Chair, “PG1: Risk Management” in ISO/SAE 21434

ISO/SAE 21434 AUTOMOTIVE CYBERSECURITY STANDARD

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AGENDA

- Overview of Aptiv and cybersecurity
- ISO/SAE 21434 “Road vehicles: Cybersecurity Engineering”
  - Why the standard is needed and general background
  - Key principles
  - Scope
  - ISO and SAE delegations involved in the development
  - Overview of the document structure
  - Timeline
  - Cybersecurity Assurance Level

We are a global technology company that develops secure, safer, greener, and more connected solutions, which enable the future of mobility.

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Aptiv Addressing Mobility's Toughest Challenges

Aptiv Provides End-to-end Solutions that Allow us to Commercialize New Mobility

SMART VEHICLE ARCHITECTURE

- SOFTWARE
- SENSING AND COMPUTING
- SIGNAL AND POWER DISTRIBUTION
- CONNECTIVITY

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SMART MOBILITY SOLUTIONS


ACTIVE SAFETY


USER EXPERIENCE

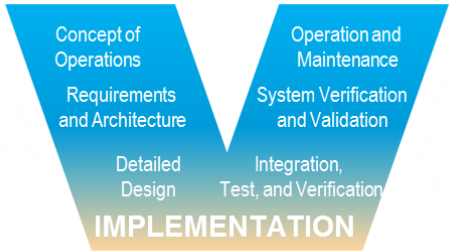

CONNECTED SERVICES


AUTONOMOUS SYSTEMS

Experience with Cybersecurity
Guidelines and Techniques

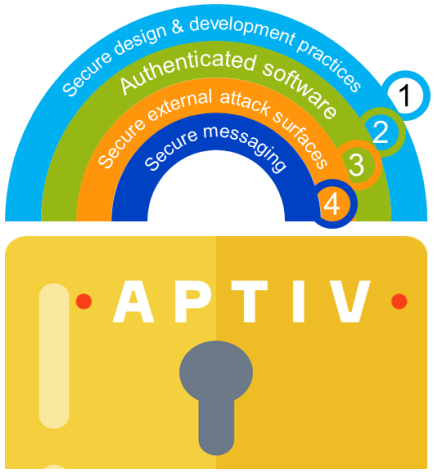
Security must be part of the entire product life-cycle

- Cybersecurity is a product architecture, a design, and a system qualification
- Cybersecurity follows the development v-cycle



We have a multi-layered guideline to protect products

- Proper protection is based on TARA (Threat Analysis / Risk Analysis) results



Aptiv's 4-levels of system security

Level 1 – Guidelines and best practices – TARA, reviews, code analysis

Level 2 – Authenticated software – secure boot, secure updates

Level 3 – Secure external attack surfaces – firewall, communication restrictions

Level 4 – Secure internal messaging – encrypt data, protect diagnostics

Experience with Cybersecurity

Established Cybersecurity Facility - CyberSEAL Lab

Operational World Class Cybersecurity Testing Facility

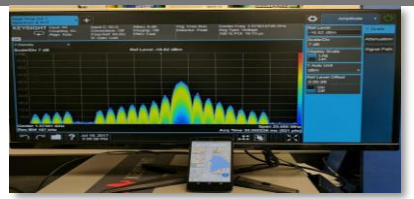
Lab Responsibilities

- Threat modeling (TARA)
- Vulnerability assessments
- Penetration assessments
- Development of advanced security tools
- Training & awareness in the art of exploitation (hands-on)
- Advanced cybersecurity R&D
  - Blockchain work group
- POC evaluations

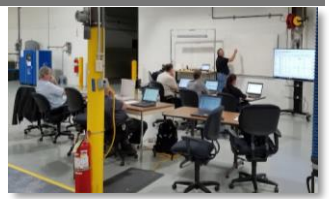
Lab Achievements

- Highly qualified security experts in place
- Completed penetration assessments
- Established lab test processes

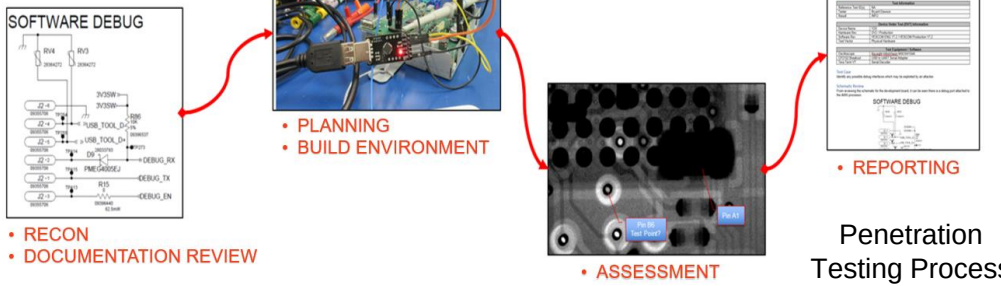
Test Benches



Advanced Tools (Aptiv GPS spoofing tool)



Training



Penetration Testing Process

Multiple Partnerships with Leading Cybersecurity Companies

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Why is Standard needed for Automotive Cybersecurity?

- Existing cybersecurity standards do not address unique automotive challenges
  - Safety
  - Long lifecycle
  - Use of embedded controllers
  - etc.

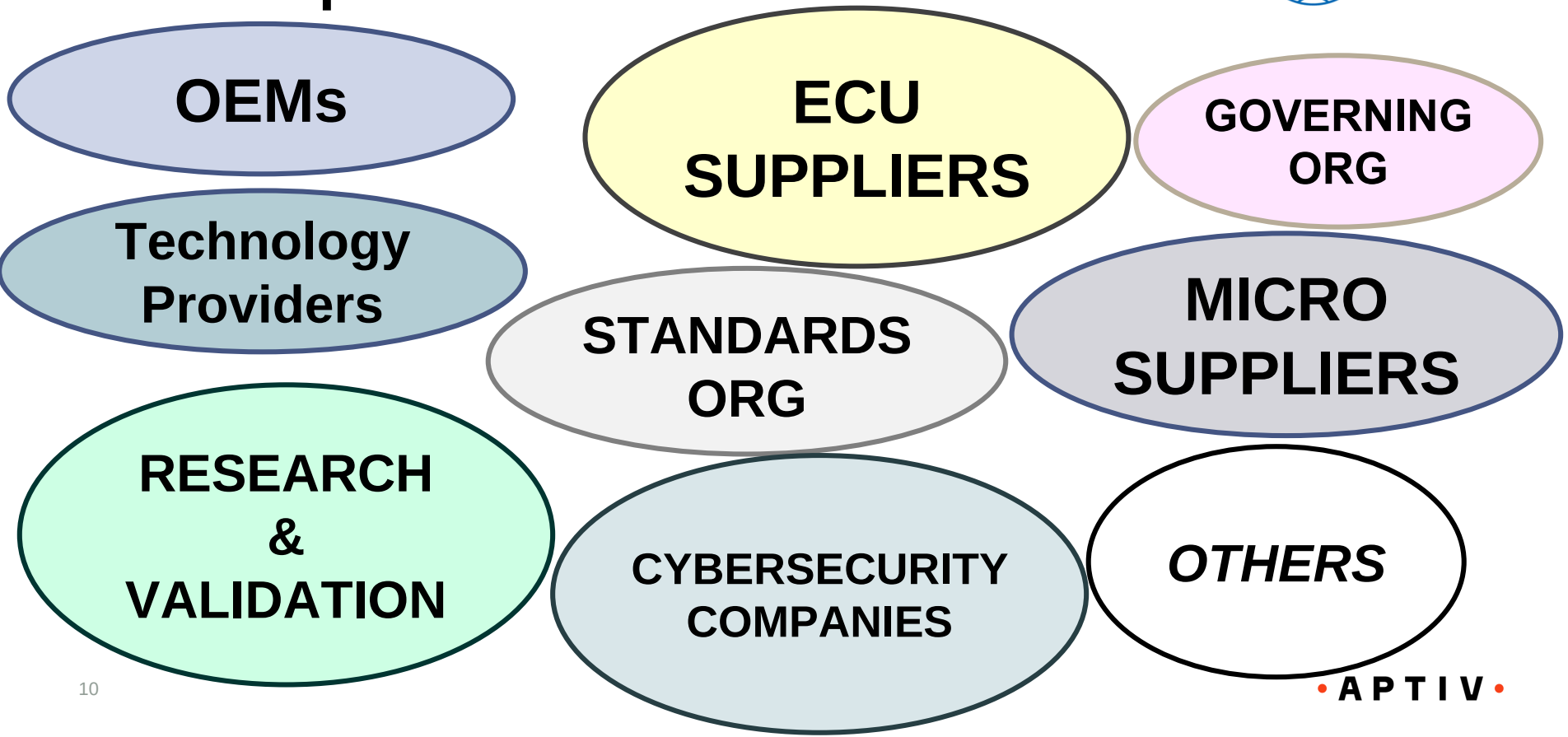
Benefit of Standard for Automotive Cybersecurity

- Define common terminology for use throughout supply chain
- Drive industry consensus on key cybersecurity issues
- Set minimum criteria for vehicle cybersecurity engineering
- Reference for regulators, etc. to minimize contradictions
- Provide evidence that industry is taking cybersecurity seriously

ISO/SAE 21434 – How Did This Begin?

- SAE issued Best Practice document
  - J3061 “Cybersecurity Guidebook for Cyber-Physical Vehicle Systems”
  - Issued 2016-01-14
- ISO New Item Work Proposal 3556 “Automotive Security Engineering”
- Nov. 2016: Partnership Standards Development Organization (PSDO)
- Cooperation agreement between ISO and SAE in two areas:
  - Road Vehicles
  - Intelligent Transportation Systems
- SAE & ISO to work together to develop cybersecurity standard
- ISO/SAE 21434 = first standard to be created under new agreement
  - Will be jointly released by both SAE and ISO

ISO SAE 21434 Participation - 82 companies



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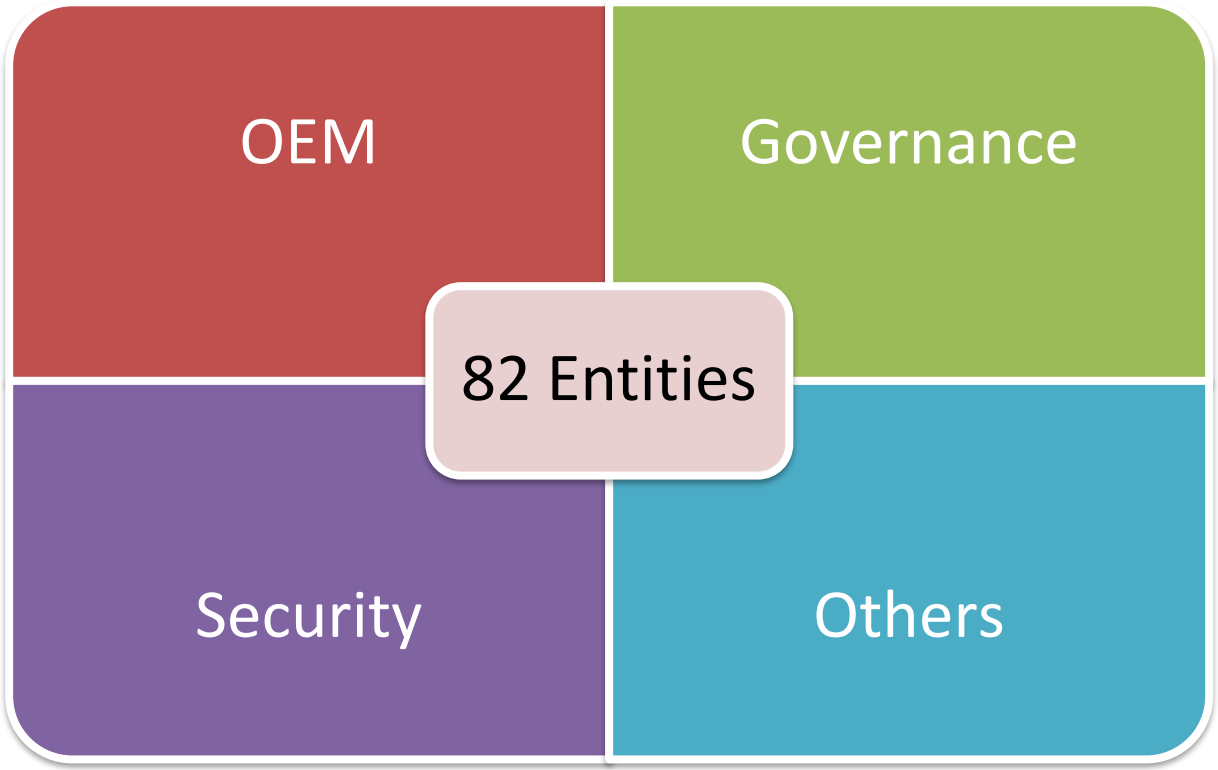
ISO SAE 21434 Participation



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ISO/SAE 21434 – Key Principles (1 of 2)

1. Applicable to **road-vehicles**
2. Goal of **reasonably secure** vehicles and systems
3. Automakers and suppliers can use to show “**due diligence**”
4. Focus on **automotive cybersecurity engineering**
5. Based on **current state-of-the-art** for cybersecurity engineering

ISO/SAE 21434 – Key Principles (2 of 2)

6. **Risk-oriented** approach
   - Risk is used for prioritization of action
   - Analyses of risk factors for methodical elicitation of cybersecurity requirements
   - Common language for communicating/managing cyber risk among stakeholders

7. **Management activities for cybersecurity**

8. Cybersecurity activities/processes for **all phases of vehicle lifecycle**:
   - Design and Engineering, Production, Operation by Customer
   - Maintenance and Service, Decommissioning

ISO/SAE 21434
What will it be applicable to?

- Applicable to:
  - Road vehicle,
  - its systems,
  - its components,
  - its software,
  - its connection from vehicle to any external device/network.

ISO/SAE 21434 – What is Out of Scope?

- ISO/SAE 21434 will:
  - **NOT** prescribe specific cybersecurity technology or solutions
  - **NOT** include requirements on specific remediation methods
  - **NOT** include requirements for telecommunications system
  - **NOT** specify requirements for connected back-office
  - **NOT** specify requirements for electric vehicle chargers
  - **NOT** specify unique requirements for autonomous vehicles

ISO/SAE 21434 -- Purpose

The purpose is to:

- Define a structured process to ensure cybersecurity is designed in upfront
  - Following a structured process helps reduce the potential for a successful attack, thus reducing the likelihood of losses
  - A structured process also provides a clear means to react to a continually changing threat landscape
- Maintain consistency across global industry
- Be complete and promote conscious decision making

ISO/SAE 21434 – Joint Working Group (JWG)

- Equal number of votes for SAE experts and ISO delegations:
  - 1 vote per ISO Delegation
  - 1 vote per SAE expert (limited to equivalent number of national delegations)
- Co-chaired by SAE & ISO
- Votes on key issues relative to 21434
- Coordinate work of Project Groups (PGs)

Delegations

- ISO
  - Austria
  - Belgium
  - China
  - France
  - Germany
  - Israel
  - Italy
  - Japan
  - Korea
  - Netherlands
  - Sweden
  - Switzerland
  - United Kingdom

- SAE Experts (13 votes)
  - Angela Barber
  - Lisa Boran
  - Jonathon Brookfield
  - Chris Clark
  - Gary English
  - Di Jin
  - John Krzeszewski
  - Susan Lightman
  - Bill Mazarra
  - Brian Murray
  - Dan Selke
  - Anuja Sonalker
  - Alan Tatourian
  - Giri Venkat
  - David Ward
  - André Weimerskirch

ISO/SAE 21434 – Project Groups (PGs)

- PG1: Risk Assessment Methods — 54 participants
- PG2: Product Development — 42 participants
- PG3: Production, Operations & Maintenance — 29 participants
- PG4: Process Overview and Interdependencies — 37 participants
- Drafting Team (ISO co-chair; SAE co-chair)
- Terms & Definitions Team (member from each PG)
- Use Case Team (members from each PG)

ISO/SAE 21434 – Committee Draft Outline
(1 of 4)

1.0 Scope
2.0 Normative References
3.0 Terms and Abbreviations
4.0 General Considerations
5.0 Management of Cybersecurity
6.0 Risk Assessment Methods & Trea
7.0 Concept Phase
8.0 Product Development
9.0 Production, Operations and Maintenance
10.0 Supporting Processes
Annexes

Mandatory elements of every ISO standard.

- What the standard does & its applicability
- External sources of mandatory contents

ISO/SAE 21434 – Committee Draft Outline
(2 of 4)

1.0 Scope
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Annexes

Informative text – no requirements.
- Provides context
- Describes structure of the standard
- Explains interrelationships of clauses

Cybersecurity-specific or cybersecurity focused management activities:
- At corporate level
- For different phases of engineering lifecycle
- Over product lifetime

ISO/SAE 21434 – Committee Draft Outline
(3 of 4)

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Annexes

Methodolgy for analysis, assessment and management of cybersecurity risk.

Processes and activities relative to cybersecurity engineering during concept phase.

ISO/SAE 21434 – Committee Draft Outline
(4 of 4)

1.0 Scope
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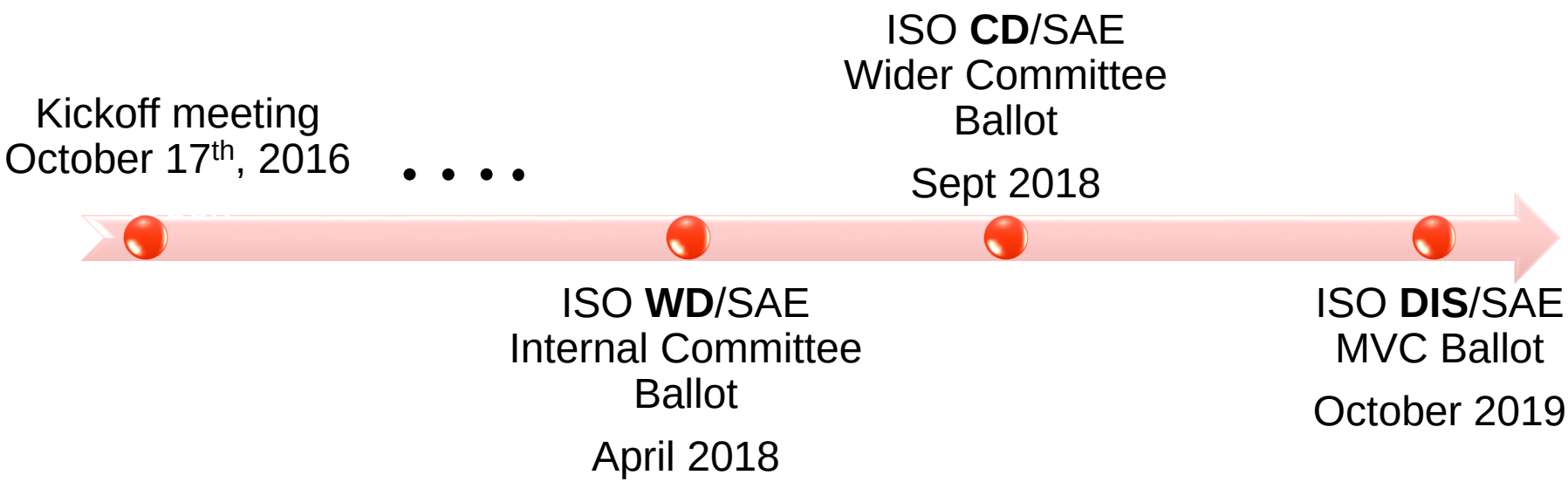
10.0 Supporting Processes
Annexes

Product Development phase processes and activities (not cybersecurity focused) that add to or support cybersecurity engineering.

Processes and activities relative to cybersecurity engineering in post-development phase.

General processes and activities (not cybersecurity focused) that add to or support cybersecurity engineering.

ISO/SAE 21434 – High-level Timeline



Expect a 2020 release
(Late in year, if DIS does not pass ballot)

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ISO/SAE 21434
Overview of Stages WD, CD, DIS

- **Working Draft (WD)**
  - Developed/reviewed by JWG participants
  - Informal comment resolution
- **Committee Draft (CD)**
  - Request for comments sent to ISO Technical Committee & SAE Committee
  - 8 weeks review period/ballot; approval by consensus
  - Formal comment resolution process
- **Draft International Standard (DIS)**
  - Request for comments sent to all ISO National Bodies and to SAE Committee
  - 12 weeks review period/ballot; 2/3 majority for approval
  - Formal comment resolution process (no technical comments for passage)
  - Publicly for sale

ISO/SAE 21434 – Committee Draft (CD)

- All CD comments received (3,534) must be formally addressed
  - Plan is to address majority of those by May for an internal draft
    - Internal draft review amongst 21434 delegates, resulting in DIS

- All normative clauses to be indicated by terms “shall” or “shall not”
  - Requirements to be strictly followed in order to meet ISO/SAE 21434
  - No deviation is permitted from these requirements

- Rationale will be provided for each normative clause
  - A short explanation of the purpose of a requirement, or group of requirements

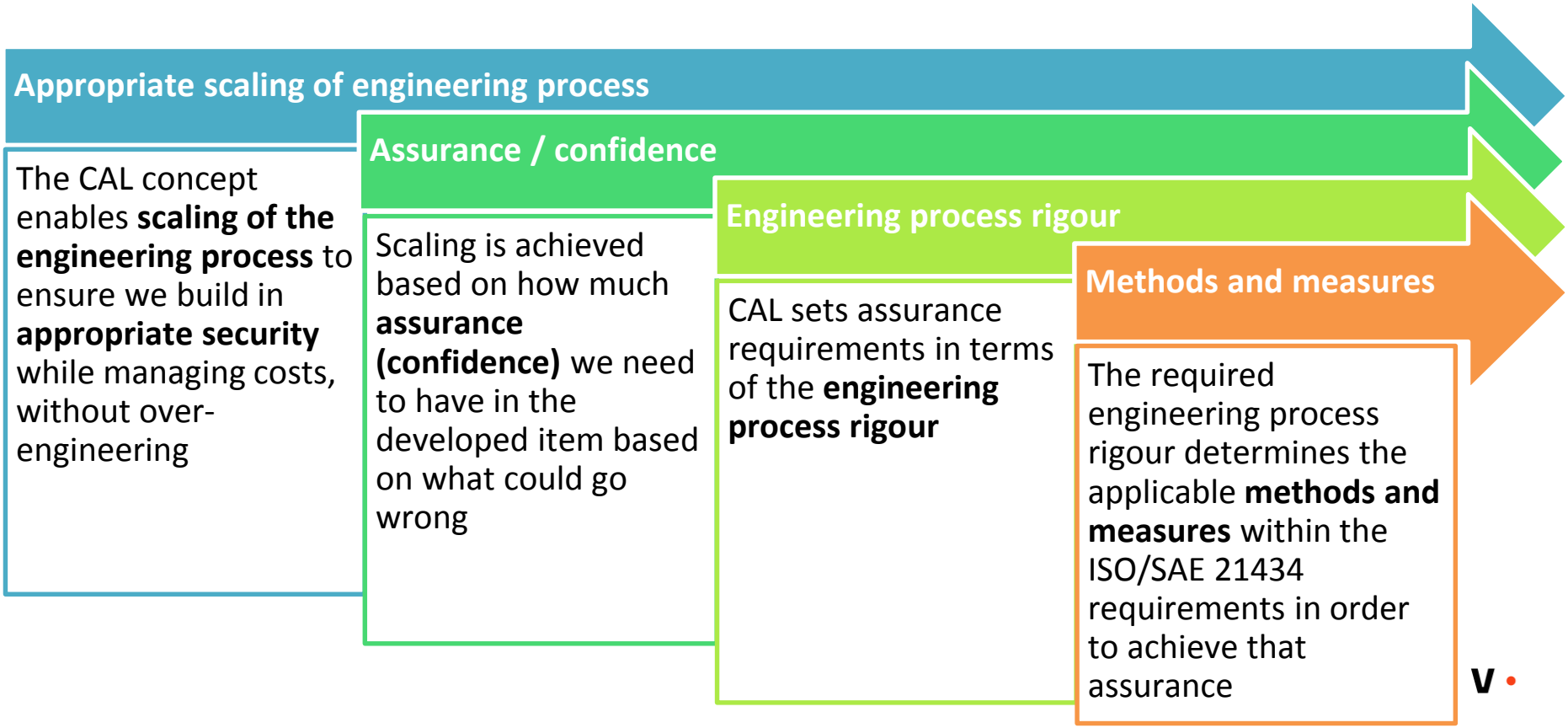
ISO/SAE 21434 – Committee Draft (CD)

- JWG has voted to have Cybersecurity Assurance Level (CAL) in 21434
- Decision made to including CAL:
  - CAL level would indicate the required level of cybersecurity process rigor
  - Methodology for determining CAL is defined in ISO/SAE 21434
  - CAL is **informational**
- CD has recently been released for comment

CAL Purpose and Benefits
- What problem does CAL solve?

- ISO/SAE 21434 is a single standard which is to be applied to many types of items, which contain assets with different levels of criticality
- Applying all requirements of ISO/SAE 21434 in all cases is neither appropriate nor feasible
- An appropriate means of scaling the effort and costs of implementing the cybersecurity engineering process requirements is required
- The automotive distributed development process requires a common means of communicating these process requirements through the supply chain, and also within an organization

CAL Purpose and Benefits - How CAL helps



1. CAL Purpose and Benefits
- Assurance – some definitions

- **grounds for confidence that a TOE meets the SFRs**
  - ISO/IEC 15408-1:2009
  - Information technology — Security techniques — Evaluation criteria for IT security

- **grounds for justified confidence that a claim has been or will be achieved**
  - ISO/IEC 15026-1:2013 (also NIST SP 800-160)
  - Systems and software engineering — Systems and software assurance

- **grounds for confidence that a deliverable meets its security objectives**
  - ISO/IEC 21827:2008
  - Information technology — Security techniques — Systems Security Engineering — Capability Maturity Model® (SSE-CMM®)

- Assurance in this context means **confidence**, it does **not** imply **guarantee**

CAL Purpose and Benefits
- “Heritage” of CAL

- Assurance levels are **not** a new invention for ISO/SAE 21434
- Variants of integrity or assurance levels can be found in other established standards:
  - **Functional safety**
    - IEC 61508 – Safety Integrity Level (SIL)
    - ISO 26262 – Automotive Safety Integrity Level (ASIL)
    - DO-178 – Design Assurance Level (DAL)
  - **Security**
    - ISO/IEC 15408 – Evaluation Assurance Level (EAL)
    - IEC 62443 – Security Level (SL)

The different risk models adopted by these standards mean that their uses of levels are not directly comparable

- None of these is suitable to use **directly** in ISO/SAE 21434
- However the CAL takes **inspiration** from several of these

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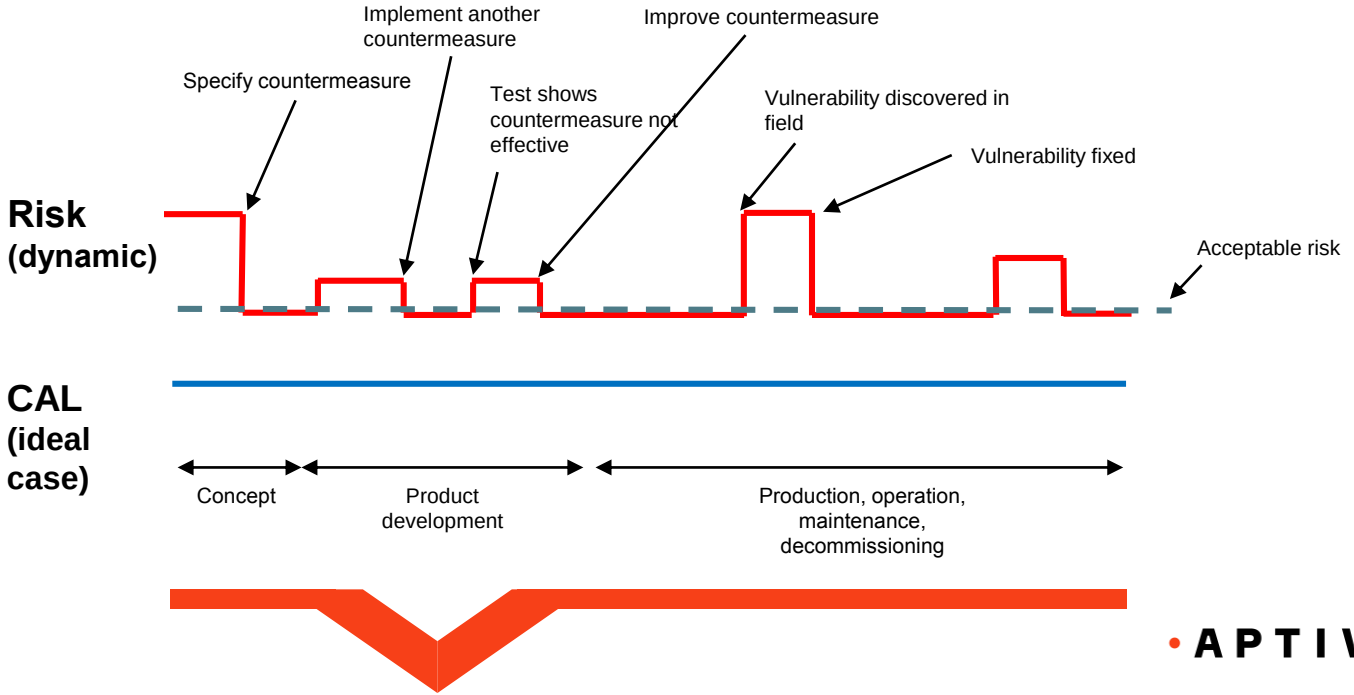
How CAL relates to other concepts

- **CAL** and **Risk** have a connection, but are **not the same**
- Need to decouple CAL and dynamic Risk factors (so CAL remains as stable as possible)

What is my current residual risk given the current spec / design / implementation?

What level of assurance do I need given the criticality of the assets I need to protect?



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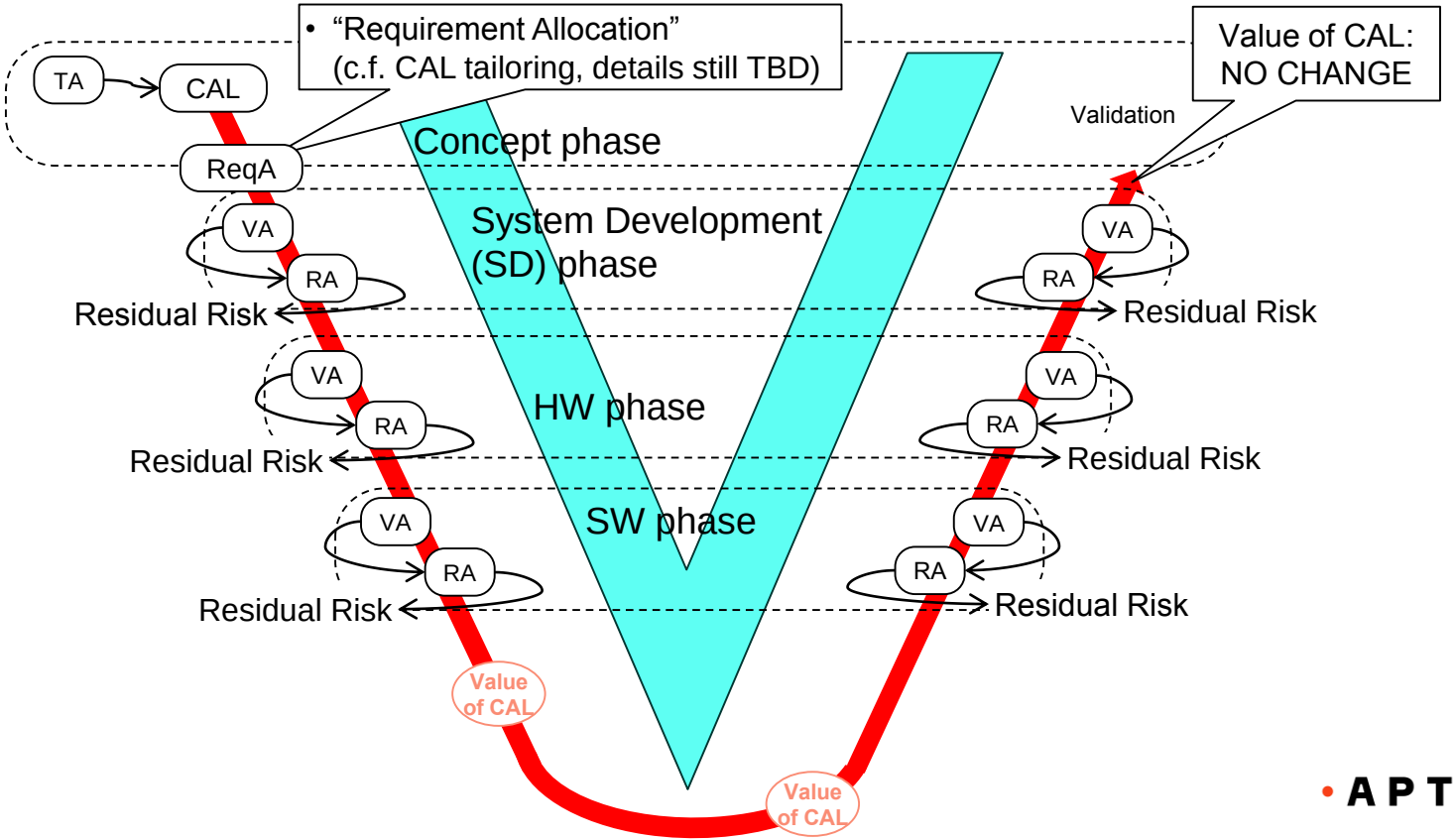
How CAL relates to other concepts



Thank you

Questions?

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Revisions

- Updated 19MAR19