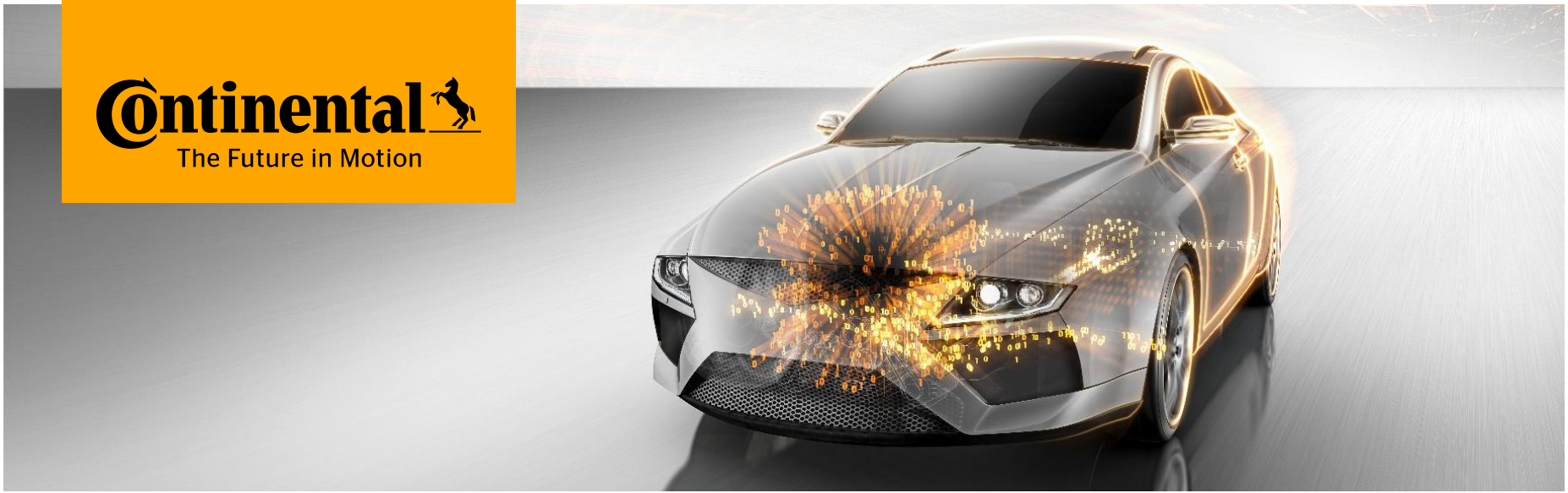
Continental
The Future in Motion



Long-term Security Challenges Ahead of Automotive Applications: An Industrial Perspective

Ahmad Sabouri | Deputy Head Security and Privacy Consulting
Marc Stöttinger | Senior Specialist Security and Privacy
Gregor H. Molter | Head of Security & Privacy Research Embedded Systems

http://links.conti.de/SCC

Automotive Systems and Technology
Security & Privacy Competence Center

Long-term Security Challenges Ahead of Automotive Applications

Agenda

1. Introduction
2. Related Work on Sustaining Security
3. Problem and Solution Space
4. Conclusion

Long-term Security Challenges Ahead of Automotive Applications

Agenda

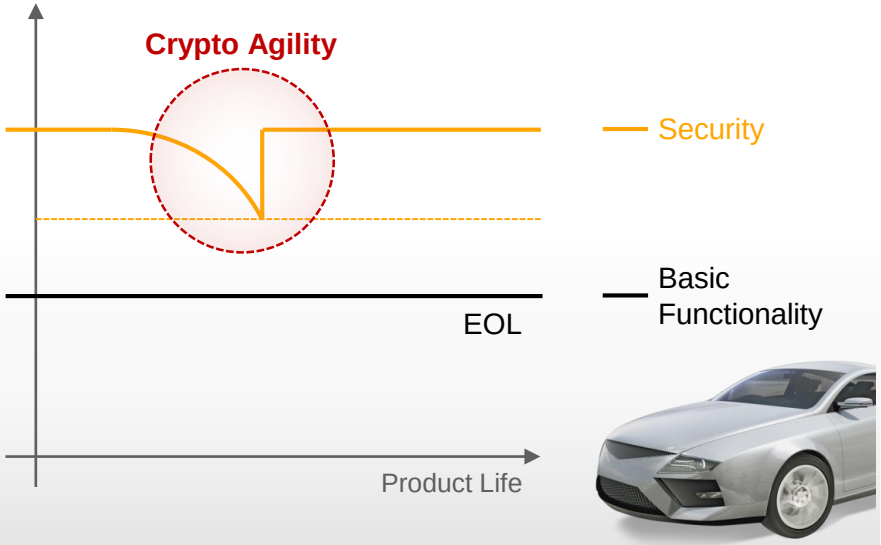
1. **Introduction**
2. Related Work on Sustaining Security
3. Problem and Solution Space
4. Conclusion

Long-term Security Challenges Ahead of Automotive Applications
Motivation

Cryptography enables security attributes
- Authenticity
- Integrity
- Confidentiality

Attacks on cryptographic methods by
- New methods to break cryptographic primitives
- New technologies to raise the power of brute force attacks
- Exploit implementation flaws

Needs for secure update/upgrade of cryptographic primitives



Long-term Security Challenges Ahead of Automotive Applications
Definition

> Crypto agility is the ability of a protocol to adapt to evolving cryptography and security requirements.

Deploy new cryptographic algorithm and replace deprecated ones

Increase the key sizes

Fix implementation flaws

Long-term Security Challenges Ahead of Automotive Applications

Prerequisite

> A modular mechanism is necessary to allow cryptographic algorithms to be updated without substantial disruption of the applications and services using the those primitives

Long-term Security Challenges Ahead of Automotive Applications

Agenda

1. Introduction
2. **Related Work on Sustaining Security**
3. Problem and Solution Space
4. Conclusion

Long-term Security Challenges Ahead of Automotive Applications

Related Work on Sustaining Security

Comparision of recommandations from …

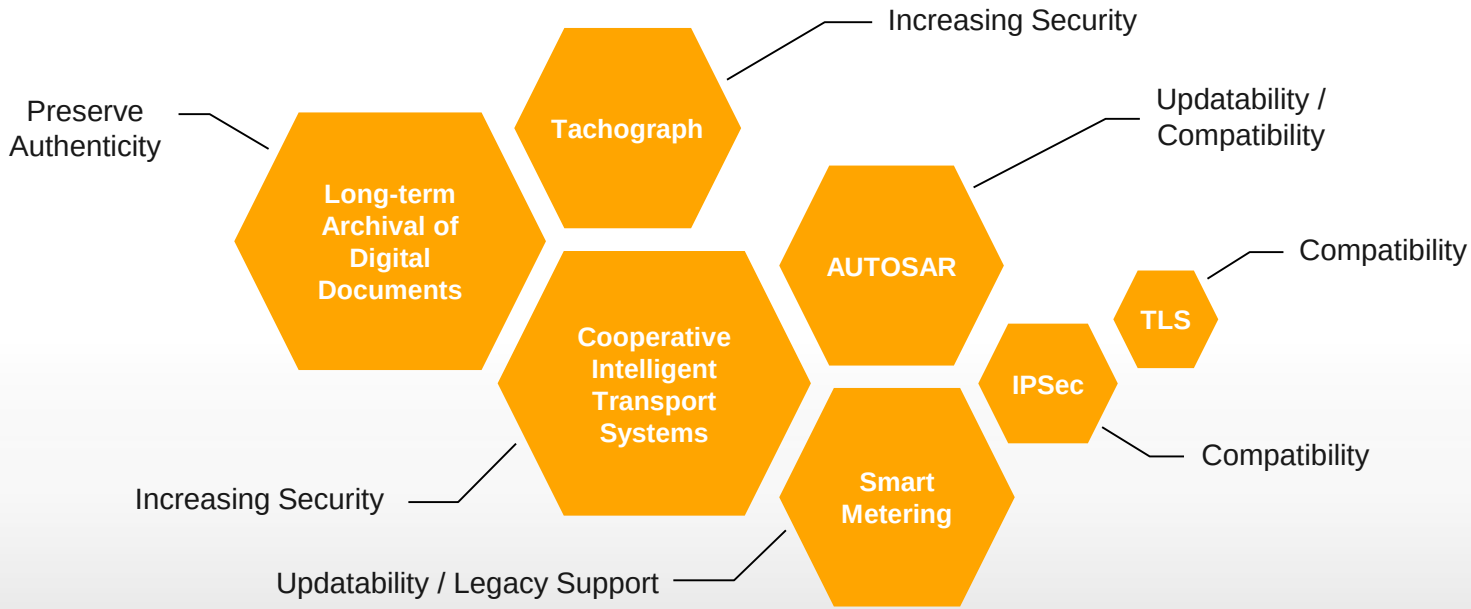
NIST

Reports contain recommendations on …

- Security levels for asymmetric (e.g. RSA, …)
- Security levels for symmetric algorithms (e.g. AES, …)
- Use of mode of operation for block ciphers (e.g. AES-CBC, …)
- Truncation settings for message authentication codes (e.g. HMAC, …)

Long-term Security Challenges Ahead of Automotive Applications

Related Work on Sustaining Security



Long-term Security Challenges Ahead of Automotive Applications
Summary of Analyzing Existing Update Processes

- The existing schemes mainly employ two methods to migrate between different cryptographic schemes:
  - **Implementing a Crypto Suite**
  - **Implementing a replacement mechanism**
- Even though in some cases detailed information are available for the migrations that need to happen, there is no well-defined process for the update itself.

Towards Cryptographic Agility in Automotive Systems

Agenda

1. Introduction
2. Related Work on Sustaining Security
3. **Problem and Solution Space**
4. Conclusion

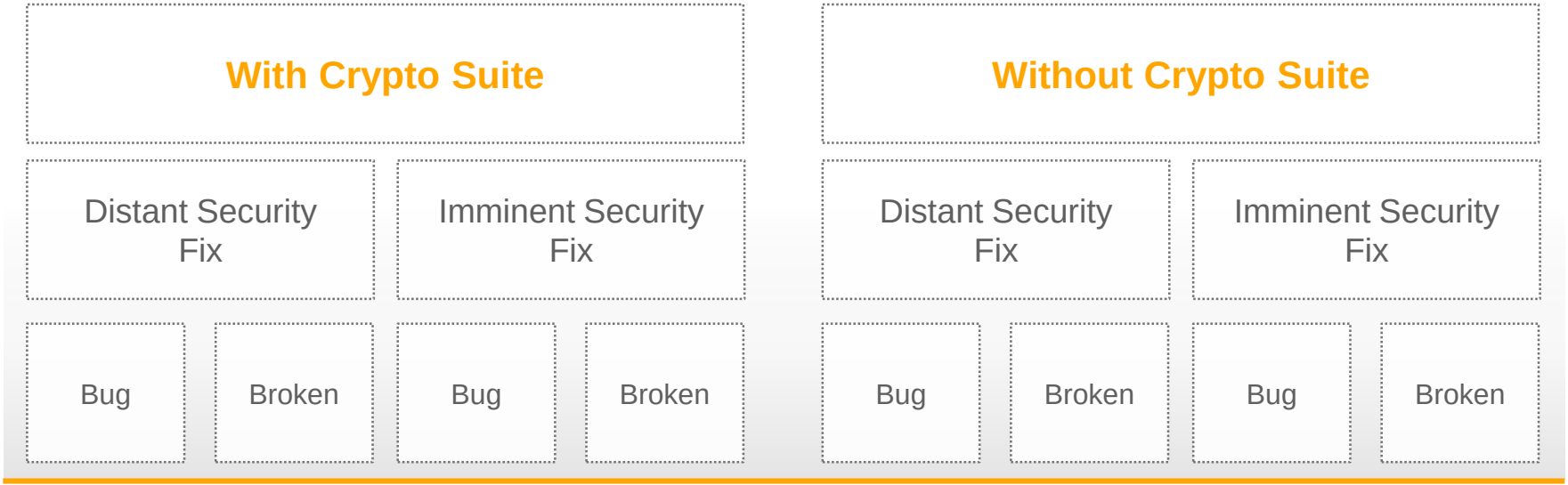
Towards Cryptographic Agility in Automotive Systems

Possible Scenarios When Update is Needed

	Distant security fix is needed	Imminent security fix is needed
Algorithm **A** gets updated, the authentication and integrity check is done by algorithm **B**	**OTA** or **Repair Shop**	**OTA** or **Repair Shop**
Algorithm **A** gets updated, the authentication and integrity check is done also by **A**	**OTA** or **Repair Shop**	**Repair Shop**

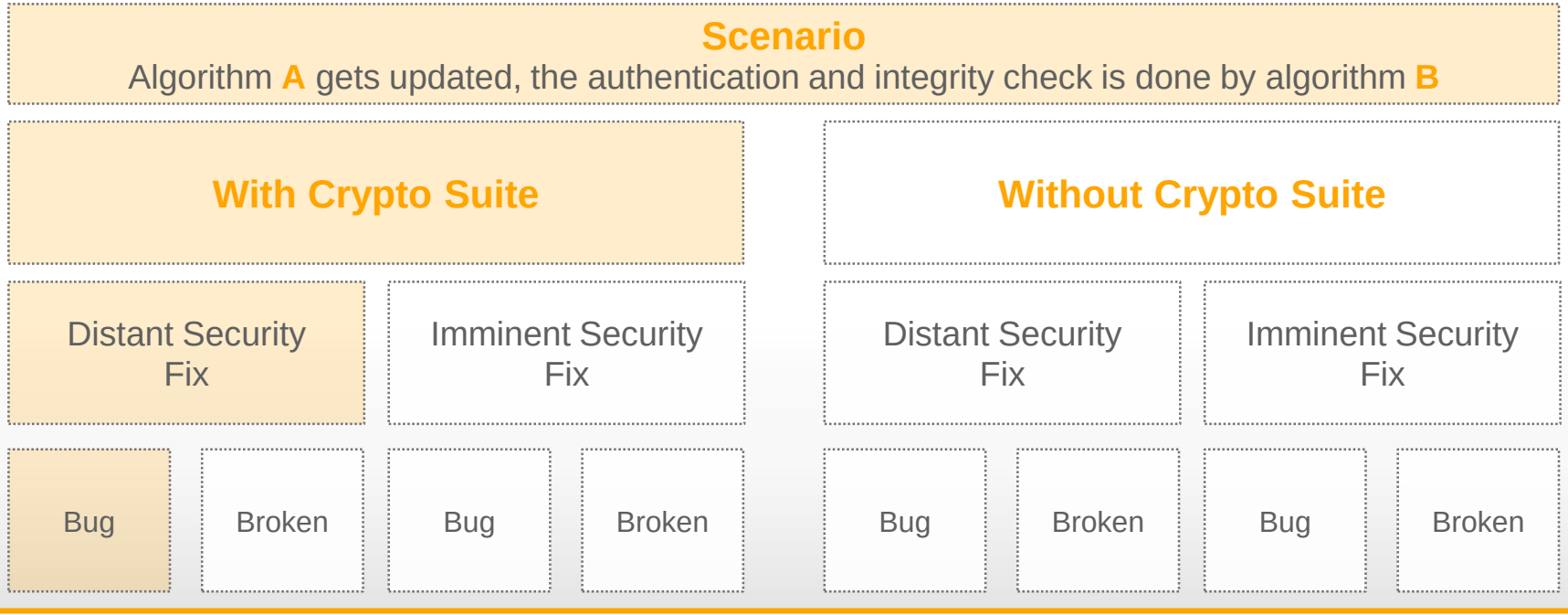
Towards Cryptographic Agility in Automotive Systems

Different Mechanisms and Problem Space



Towards Cryptographic Agility in Automotive Systems

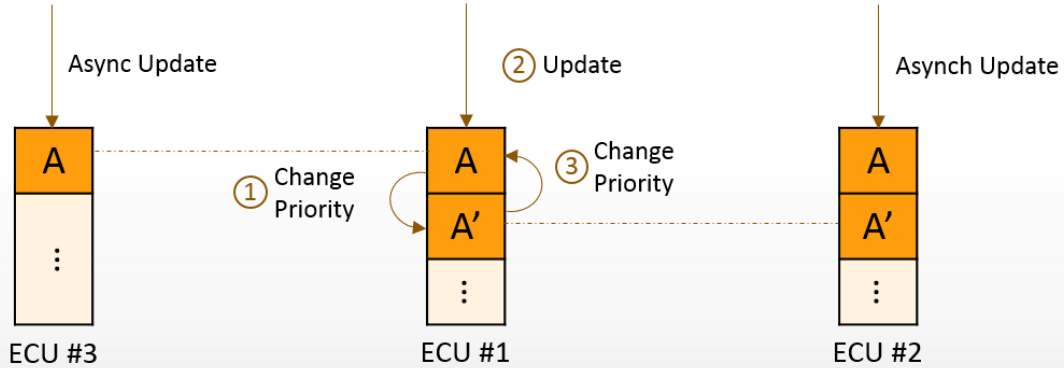
Example Case (1)



Towards Cryptographic Agility in Automotive Systems

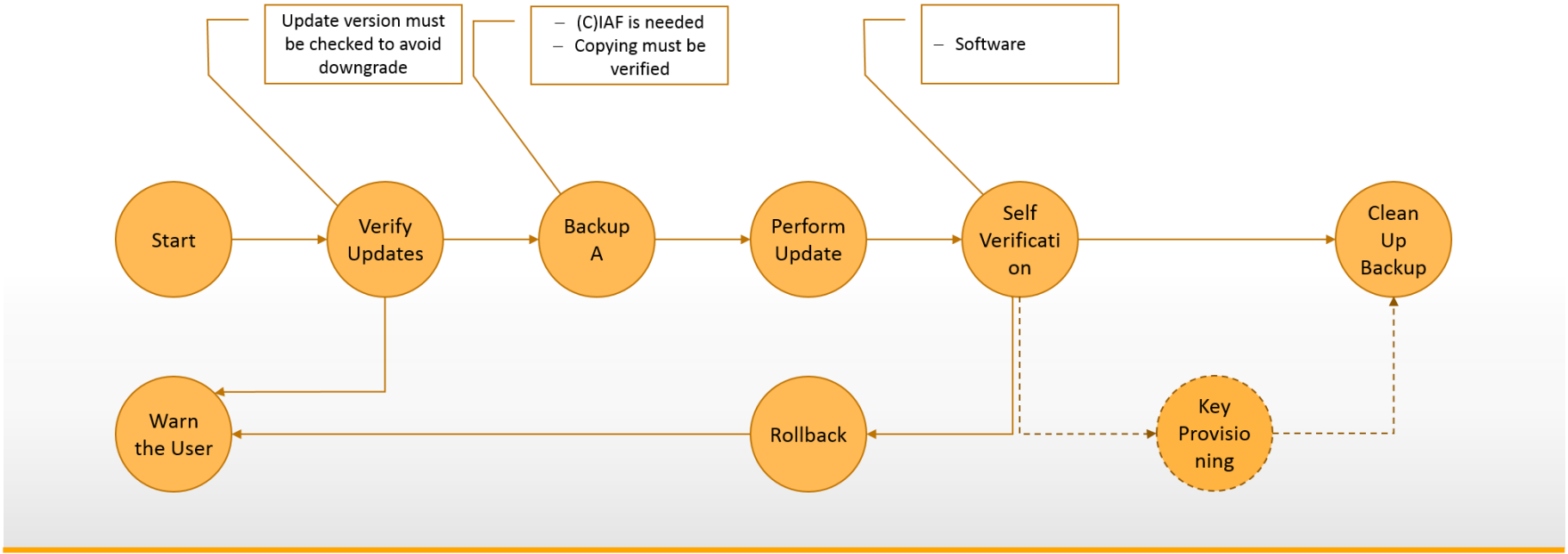
Example Case (2)

1. Allow negotiation if the counterparts are not yet updated, but put priority to use A’
2. Apply updates on A
3. Switch back to A



Towards Cryptographic Agility in Automotive Systems

Update Process and Orchestration

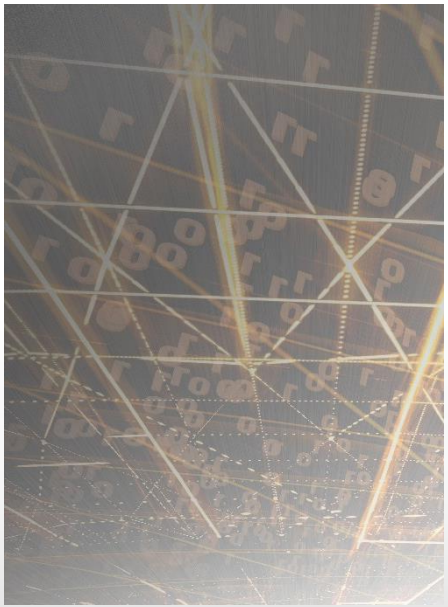


Long-term Security Challenges Ahead of Automotive Applications

Agenda

1. Introduction
2. Related Work on Sustaining Security
3. Problem and Solution Space
4. **Conclusion**

Long-term Security Challenges Ahead of Automotive Applications
Conclusion



- Considering the long age of vehicles, **Crypto Agility seems to be inevitable** in order to maintain the security of the vehicle;
- There is **no currently mature holistic solution available** to address this problem;
- Performing timely and remote update/upgrade of cryptographic primitive in a safely-critical system **without substantial disruption** of the operation is a major challenge and introduces a lot of complexity;
- Due to the cross-component effects of security protocols, the update process should be orchestrated through the entire vehicle.