AUtomotive Risk Assessment

Study and application of the MAGERIT methodology and the PILAR tool to an automotive scenario

AURA

rev3rse SECURITY

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Who Am I

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Risk Management

"If you don't invest in risk management,

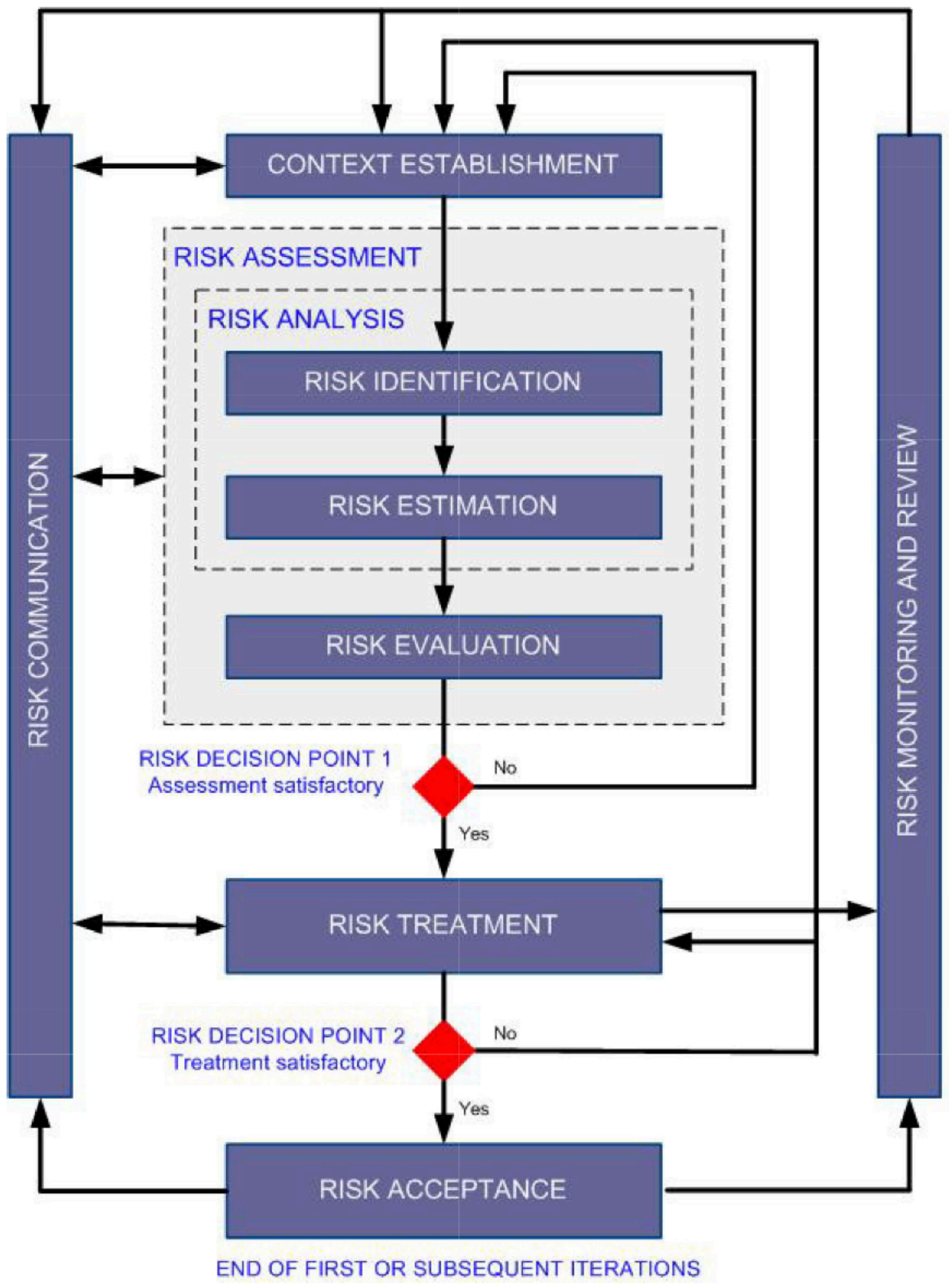
it doesn't matter what business you're in, it's a risky business."

Gary Cohn

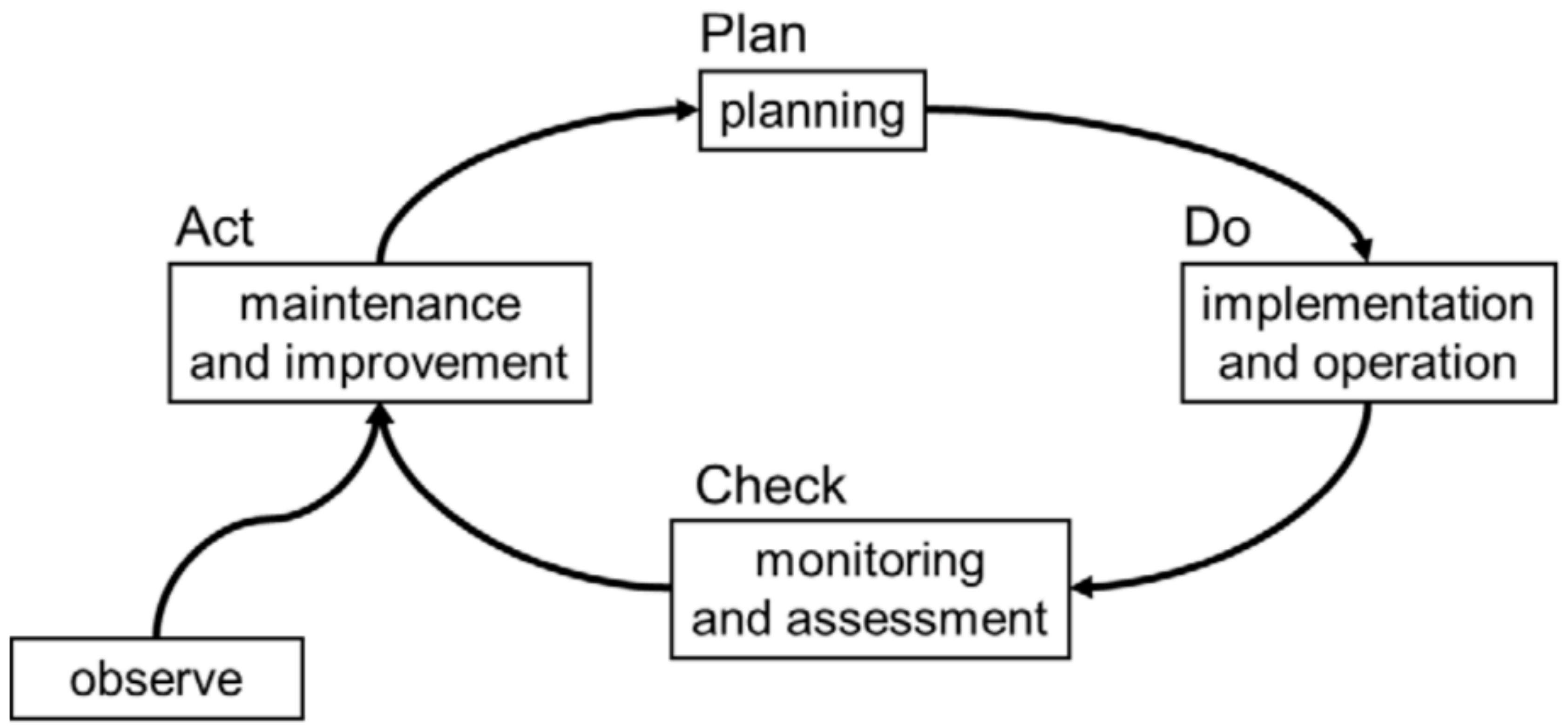
RM in a Nutshell

- Risk Management
  - Risk Assessment
    - Risk Identification
    - Risk Estimation
    - Risk Evaluation
  - Risk Treatment

RM Topology



ISO 27005



ISMS PDCA Cycle [ISO 27001]

MAGERIT

Magerit responds to what is called:

“Risk Management Process” [ISO 31000]

- Developed by the Spanish Ministry of Public Administrations
- Framework and guide to the Public Administration (and more for its open nature)
- Compliance: ISO 31000:2009, ISO 27001:2005, ISO 15408:2005, ISO 17799:2005, ISO 13335:2004

Five phases: Risk identification -> Threats -> Safeguards -> Risk analysis -> Risk evaluation

PILAR

Pilar is a tool that supports Magerit

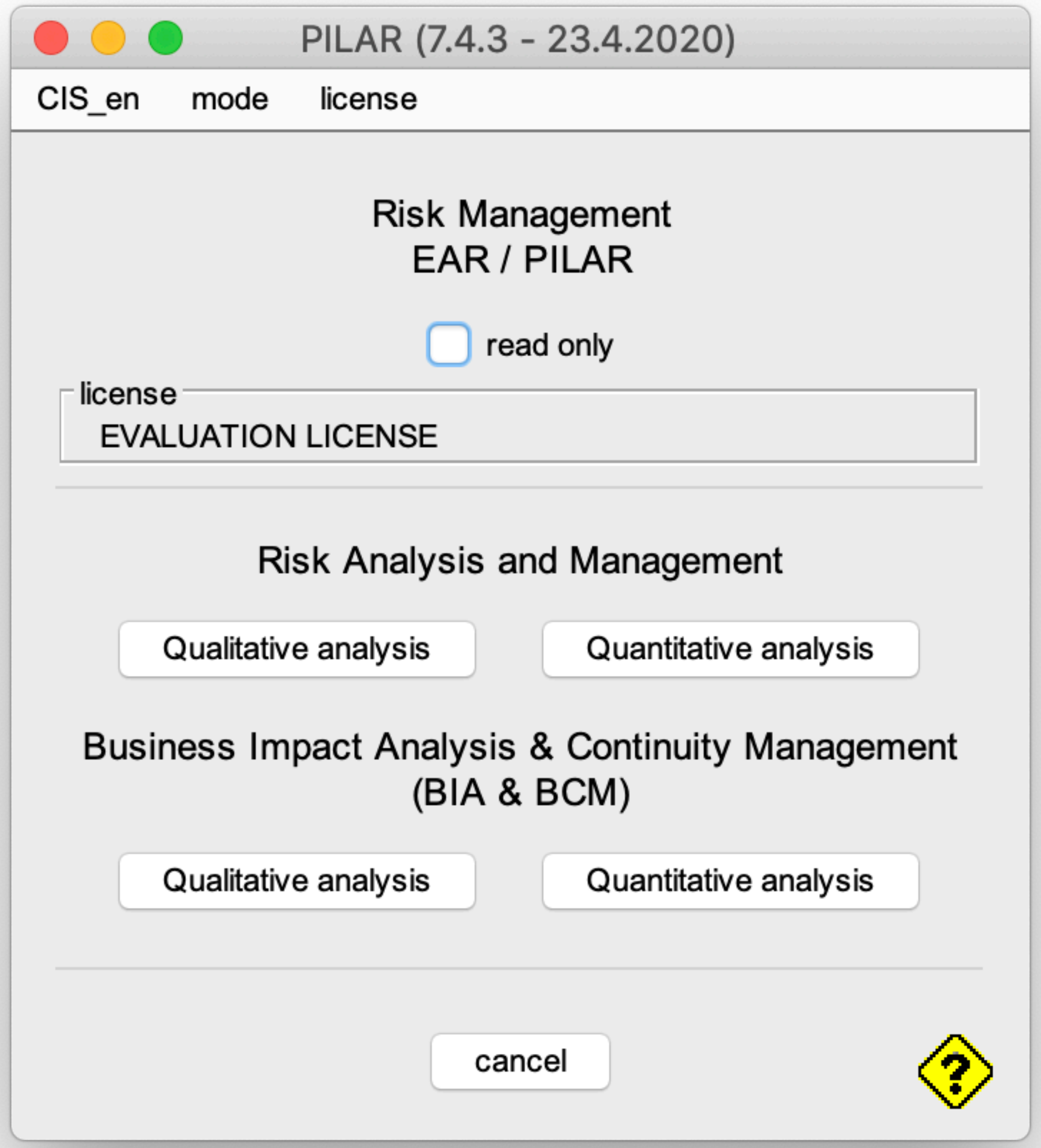
- Partly funded by the Centro Criptológico Nacional (NSA)
- Provides a standard library for assets, threats and safeguards
- ISO 27002:2005 - Code of practice for information security management
- General Data Protection Regulation (GDPR) 2016/679

Qualitative analysis may be used:

- as an initial assessment to identify risks
- where there is a lack of info or resources

Quantitative analysis depends on:

- the accuracy of the assigned values
- the validity of the statistical models used



RA Concepts

RA inputs:

- Assets
- Threats
- Safeguards

RA outputs:

- Impact
- Risk

Risk		Likelihood				
		VL	L	M	H	VH
Impact	VH	H	VH	VH	VH	VH
	H	M	H	H	VH	VH
	M	L	M	M	H	H
	L	VL	L	L	M	M
	VL	VL	VL	VL	L	L

Other factors:

- Security dimensions
- Likelihood

Risk for dummies $R = L \times I$

Actual risk $R = \ldots ?$

where R is the risk, L the likelihood and I the impact.

PILAR Reverse Engineering

Impact $I = V \times d$

where I is the impact, V the asset value and d the degradation.

PILAR Impact $I = V - \delta$ where $\delta = \begin{cases} 6 & \text{if } d = 1\,\% \\ 3 & \text{if } d = 10\,\% \\ 2 & \text{if } d = 20\,\% \\ 1 & \text{if } d = 50\,\% \\ 0 & \text{if } d = 100\,\% \end{cases}$

Exponential fit $y = 1002.75e^{0.767241x}$ with $r = 0.99$

E.g. $V = 6\ (= 100000),\ d = 20\,\%$

$I = V - \delta = 6 - 2 = 4$

$I = V \times d = 100000 \times 20\,\% = 20000 \simeq_{(Exp\,fit)} 3.9 \simeq 4$

Level	Value
0	1000
1	2150
2	4650
3	10000
4	21500
5	46500
6	100000
7	215000
8	465000
9	1000000
10	2150000

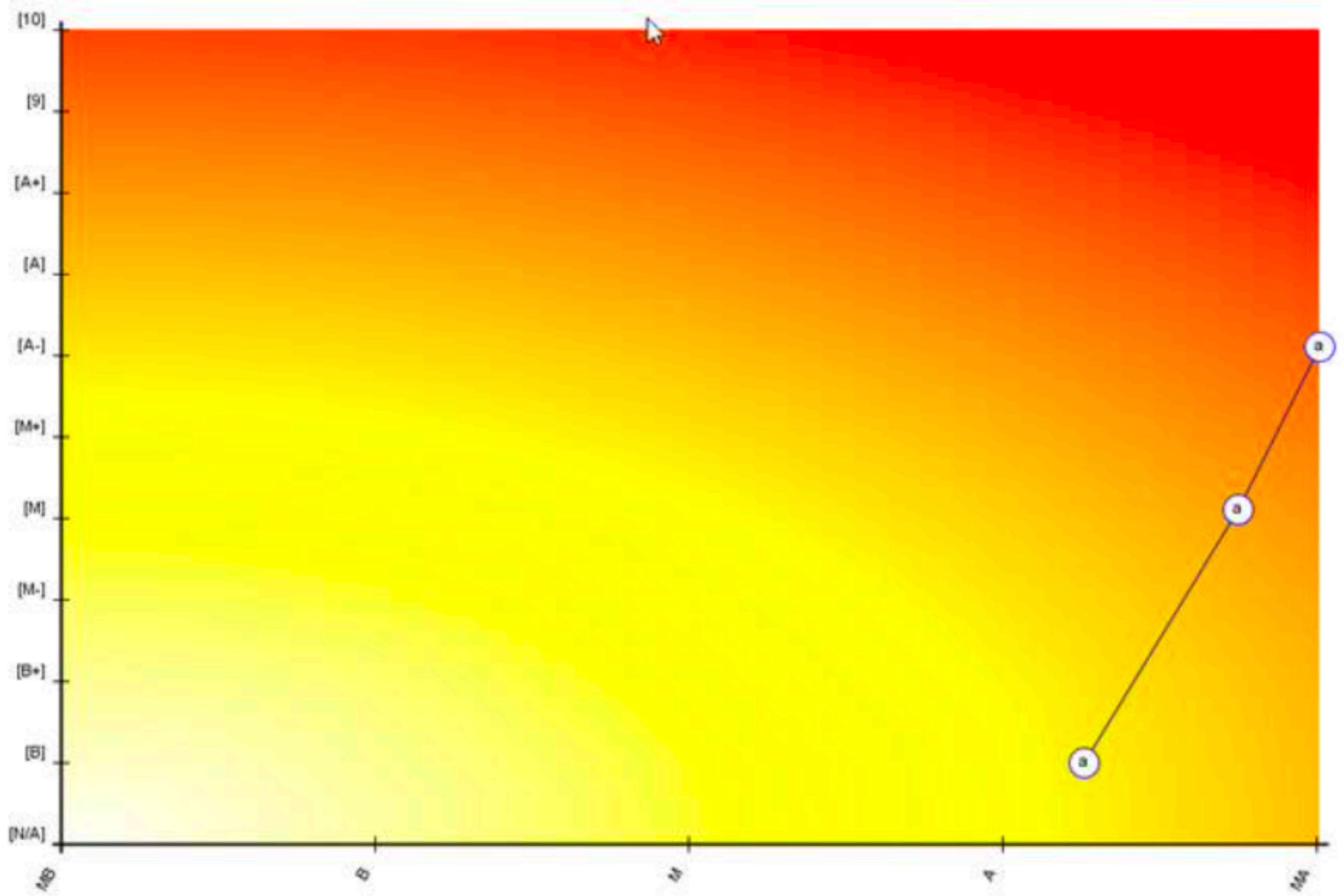
PILAR Levels Map

PILAR Reverse Engineering

PILAR Conjectured Risk

$$R = 0.6I + \lambda$$

where R is the risk, I the impact and $\lambda = \begin{cases} -0.9 & \text{if } L = VL \\ 0 & \text{if } L = L \\ 0.9 & \text{if } L = M \\ 1.8 & \text{if } L = H \\ 2.7 & \text{if } L = VH \end{cases}$



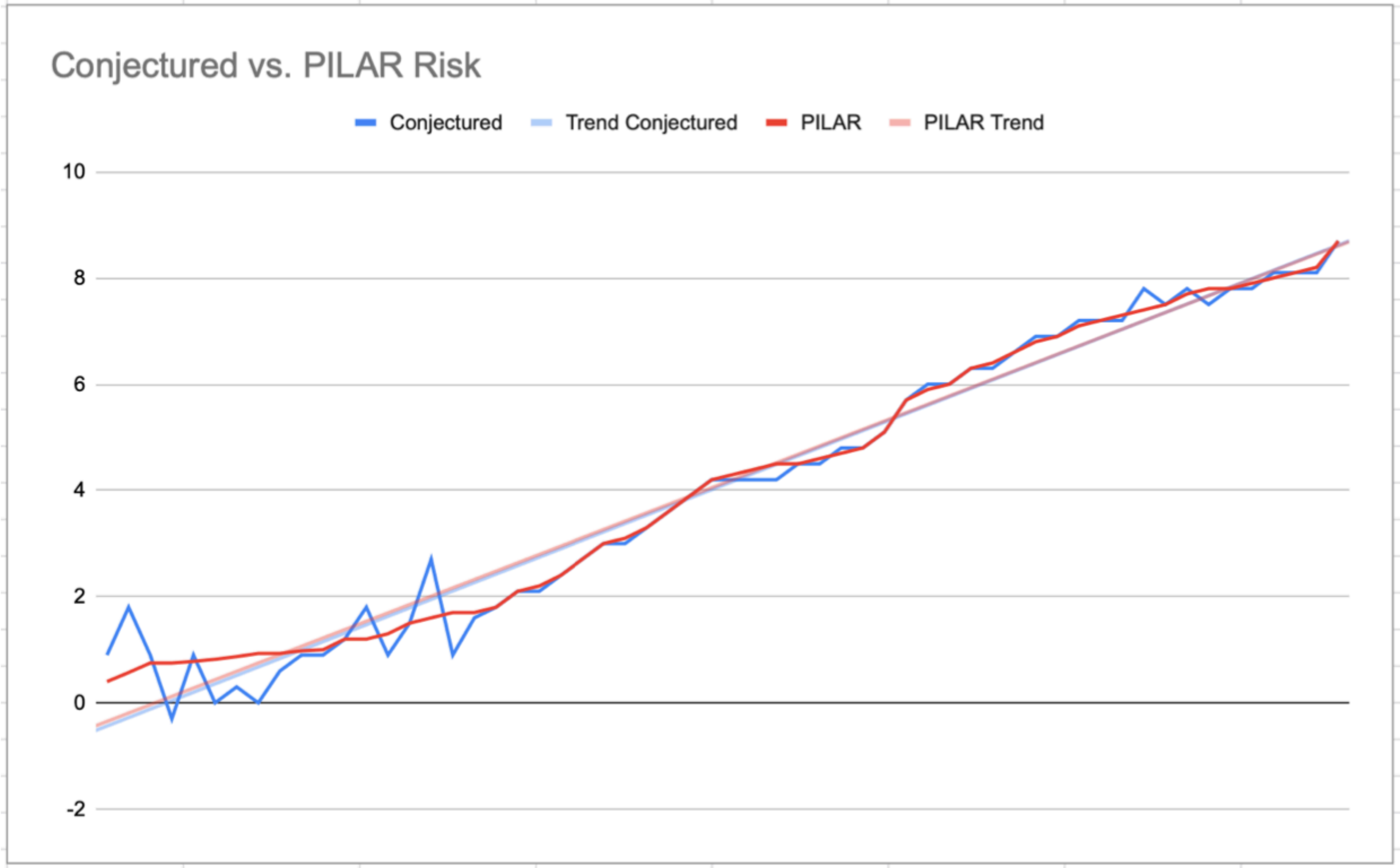
PILAR Heat Map

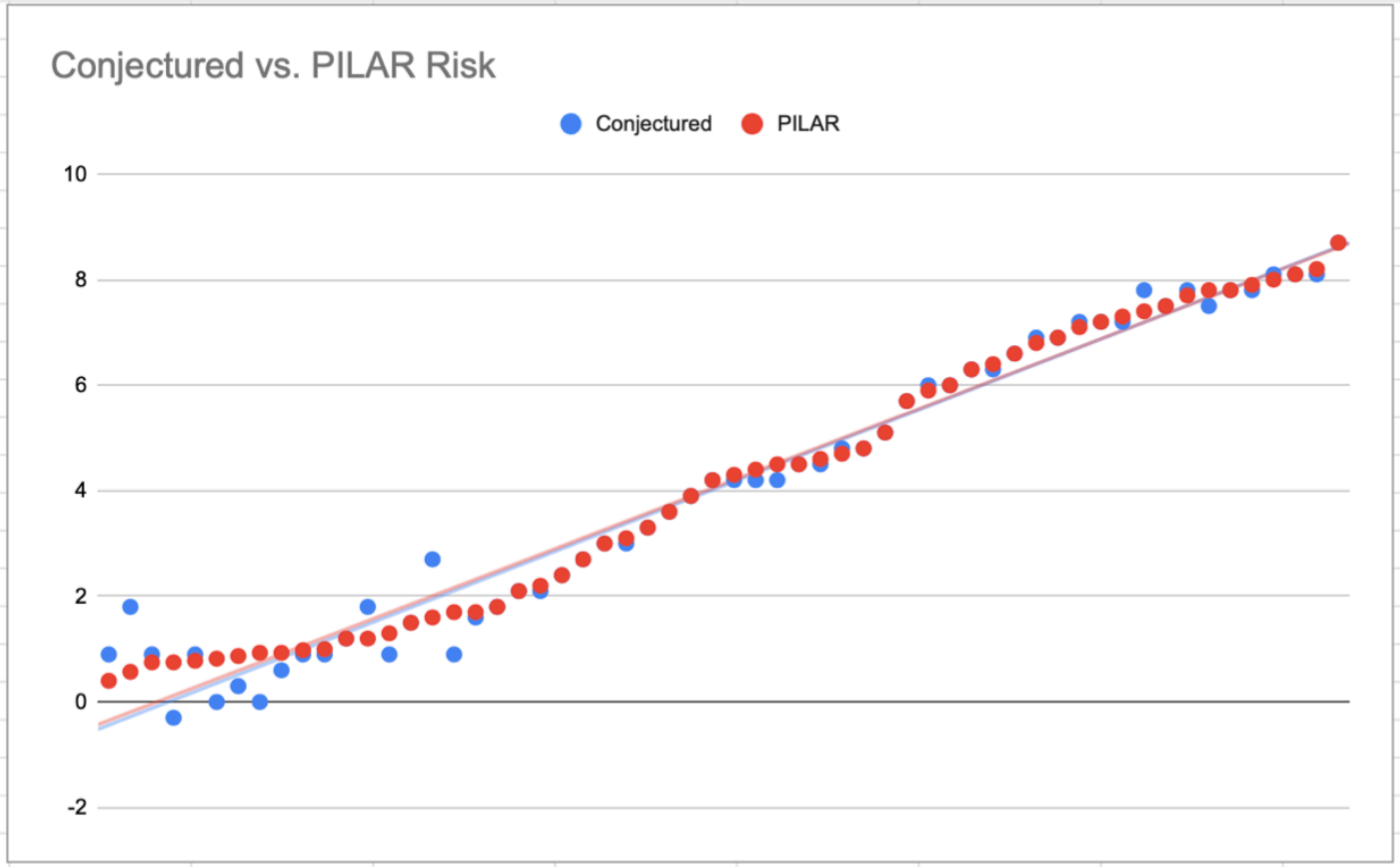
Risk	-0,9	0	0,9	1,8	2,7
10	5,1	6	6,9	7,8	8,7
9	4,5	5,4	6,3	7,2	8,1
8	3,9	4,8	5,7	6,6	7,5
7	3,3	4,2	5,1	6	6,9
6	2,7	3,6	4,5	5,4	6,3
5	2,1	3	3,9	4,8	5,7
4	1,5	2,4	3,3	4,2	5,1
3	0,9	1,8	2,7	3,6	4,5
2	0,3	1,2	2,1	3	3,9
1	0	0,6	1,5	2,4	3,3
0	0	0	0,9	1,8	2,7

PILAR Conjectured Map

PILAR Reverse Engineering

Linear fit $y = 0.97x + 0.15$ with $r = 0.9909792073$





STRIDE Methodology

Spoofing identity

- Illegally accessing and then using another user's authentication information

Tampering with data

- Malicious modification
- Unauthorized changes

Repudiation

- Deny performing an malicious action
- Non-repudiation refers to the ability of a system to counter repudiation threats

Elevation of privilege

- Unprivileged user gains privileged access to compromise the system
- Effectively penetrated and become part of the trusted system

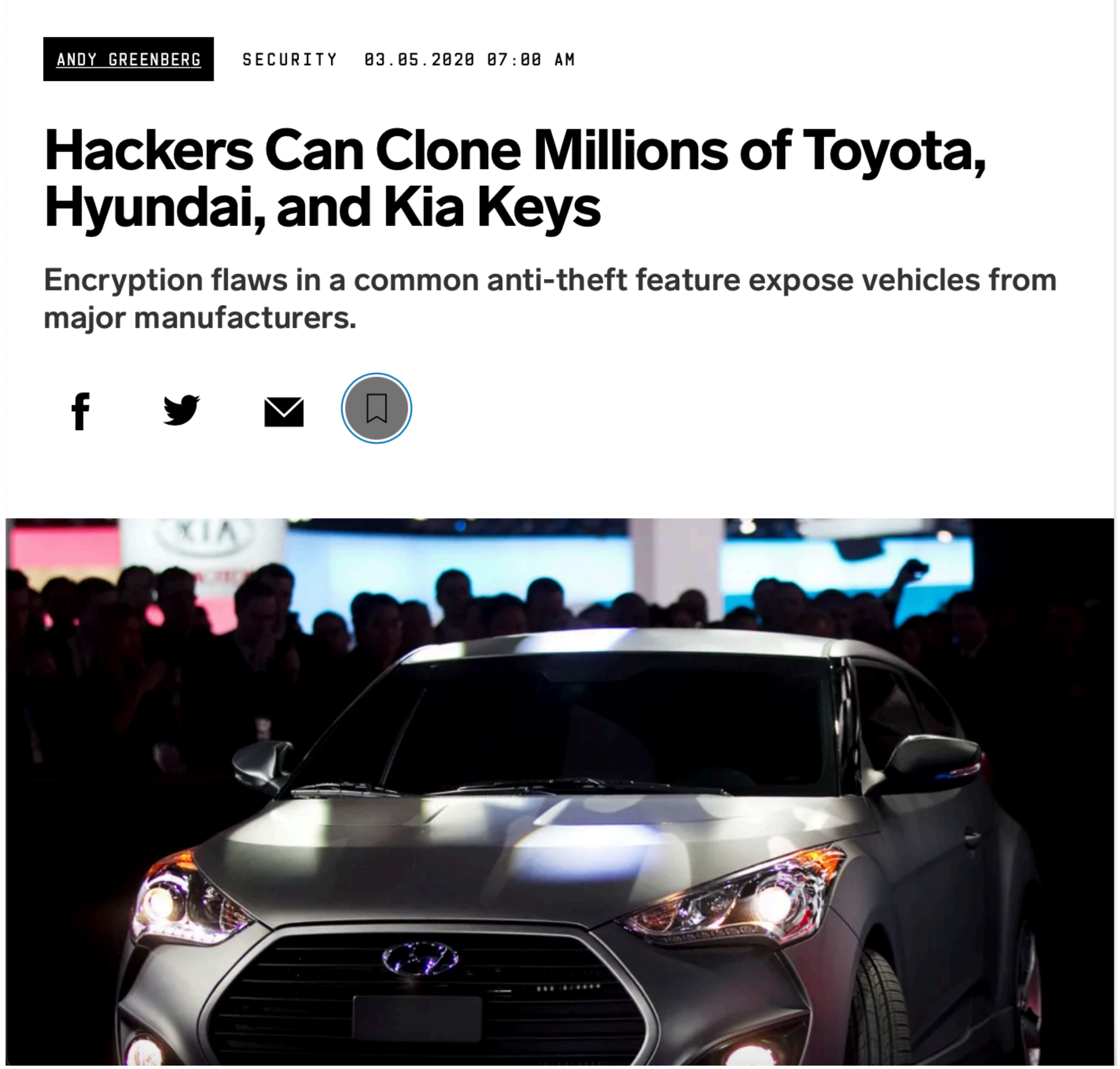
Denial of service

- Deny service to valid users
- Threats to system availability and reliability

Information disclosure

- Exposure of information to individuals not supposed to access

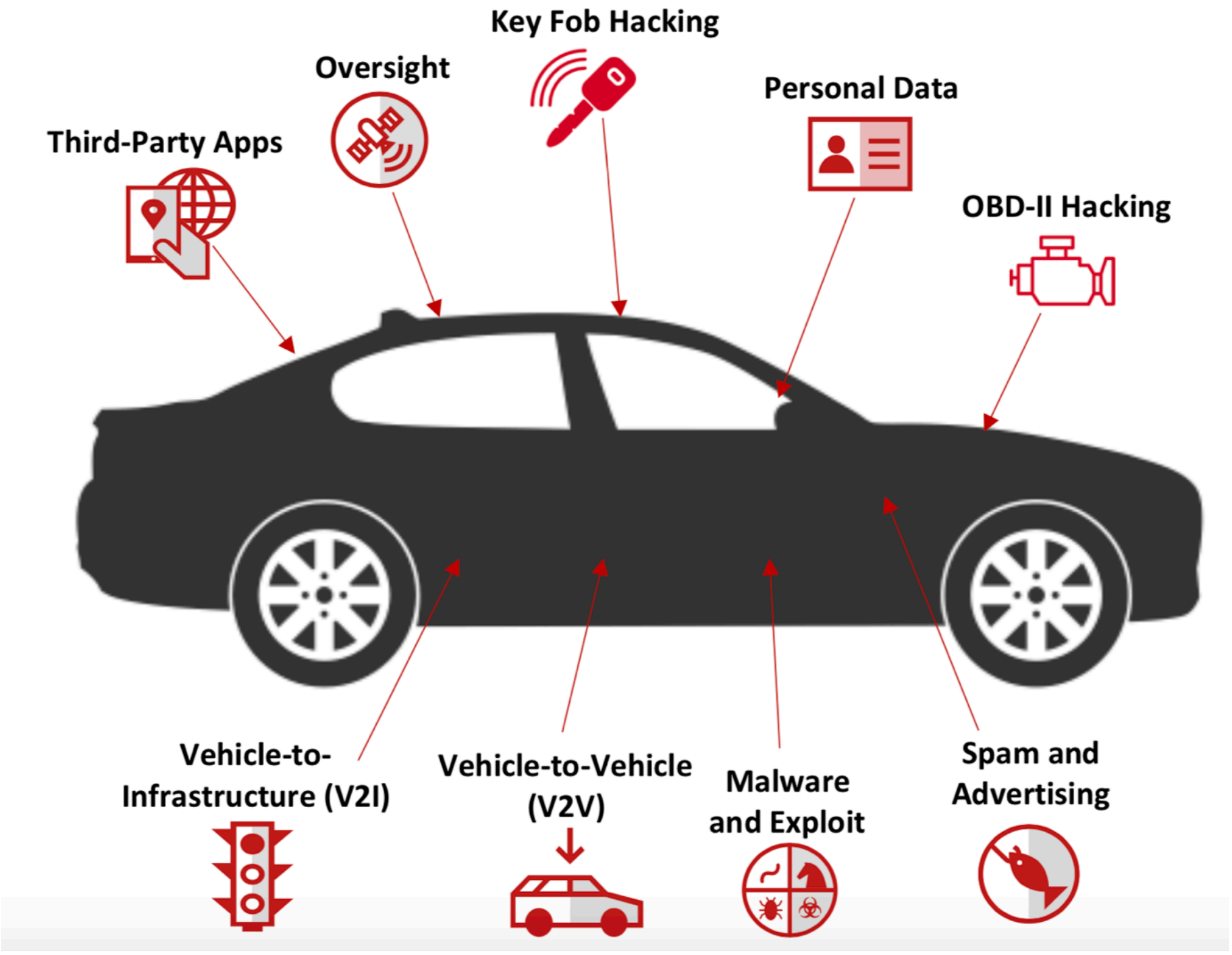
Case Study: Automotive Overview


ANDY GREENBERG SECURITY 03.05.2020 07:00 AM

Hackers Can Clone Millions of Toyota, Hyundai, and Kia Keys

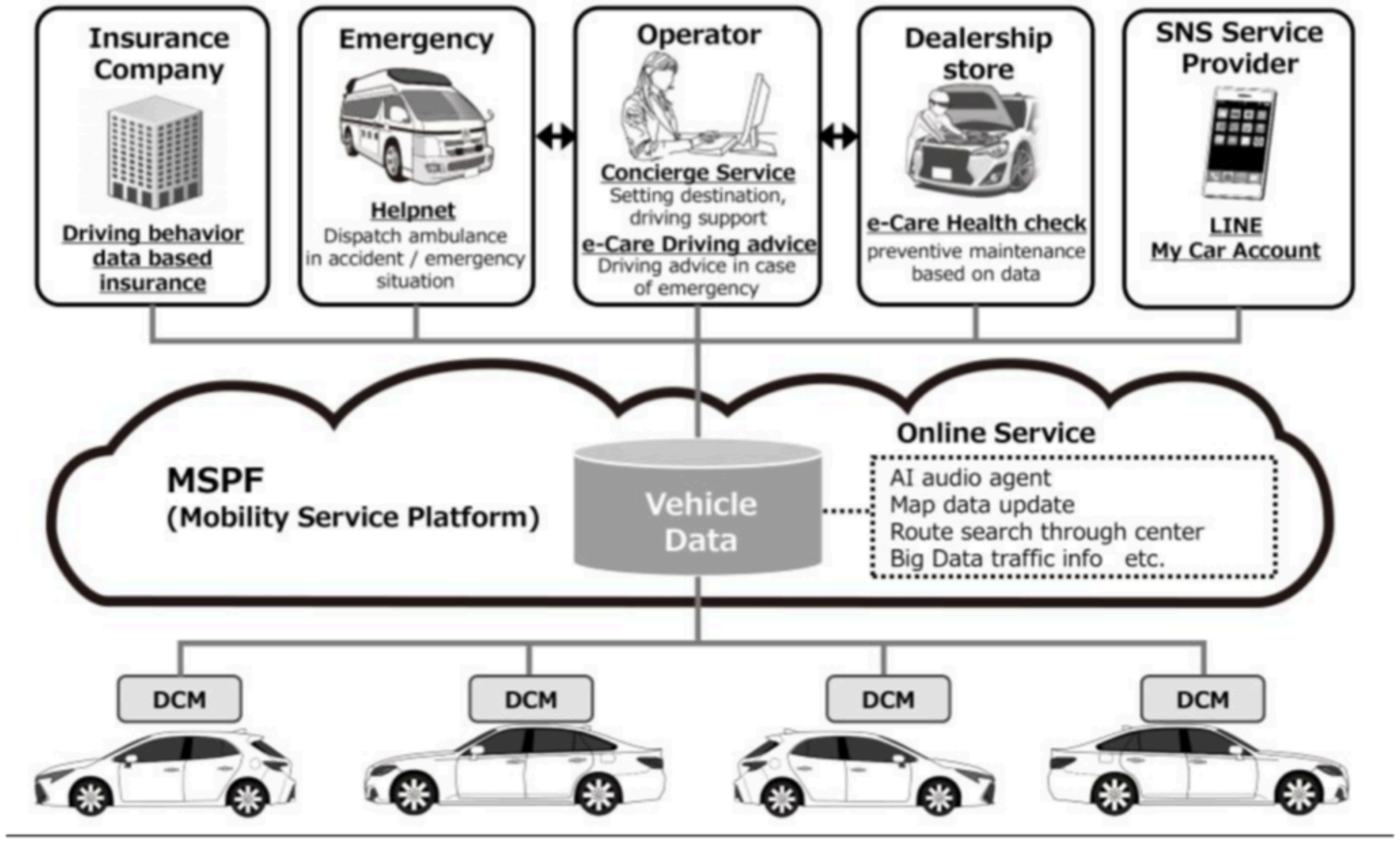
Encryption flaws in a common anti-theft feature expose vehicles from major manufacturers.

Source: Wired

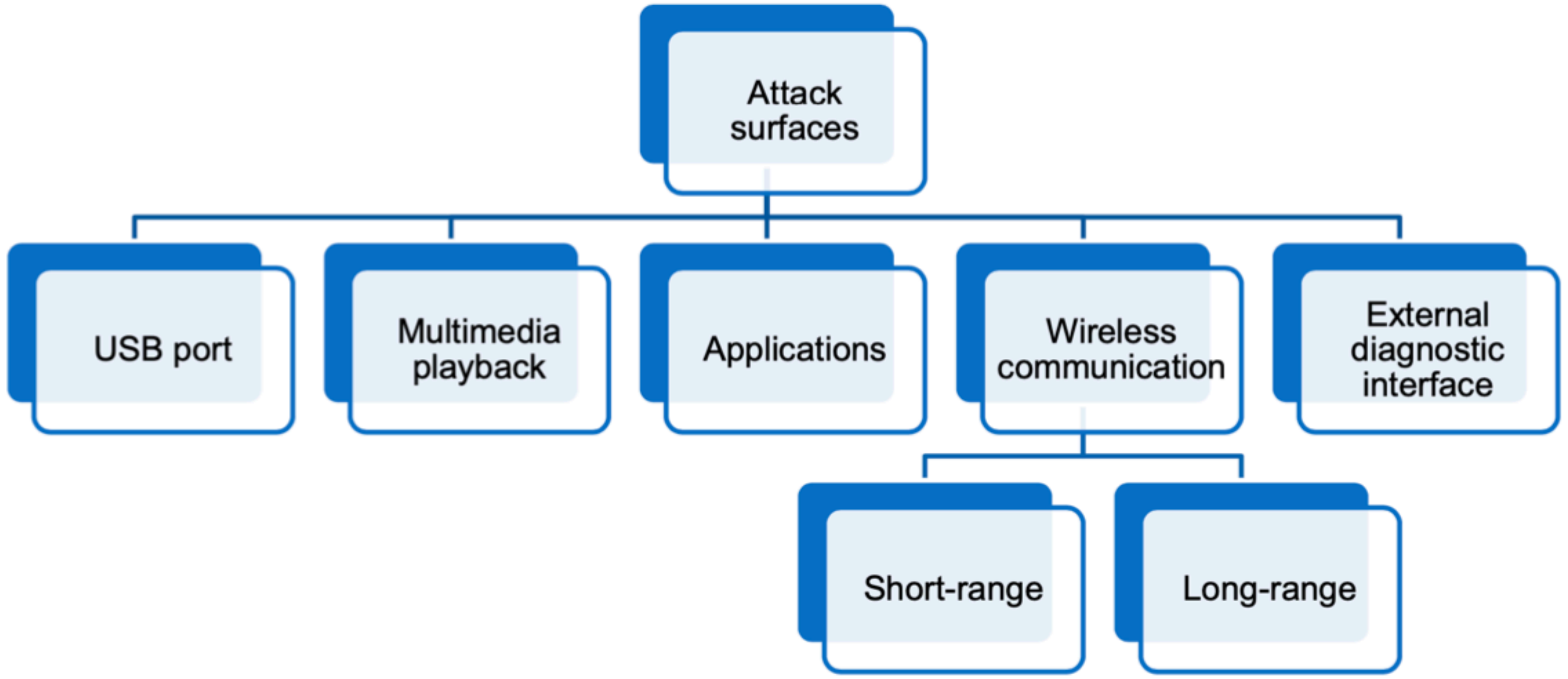


Source: McAfee

Case Study: Automotive Overview



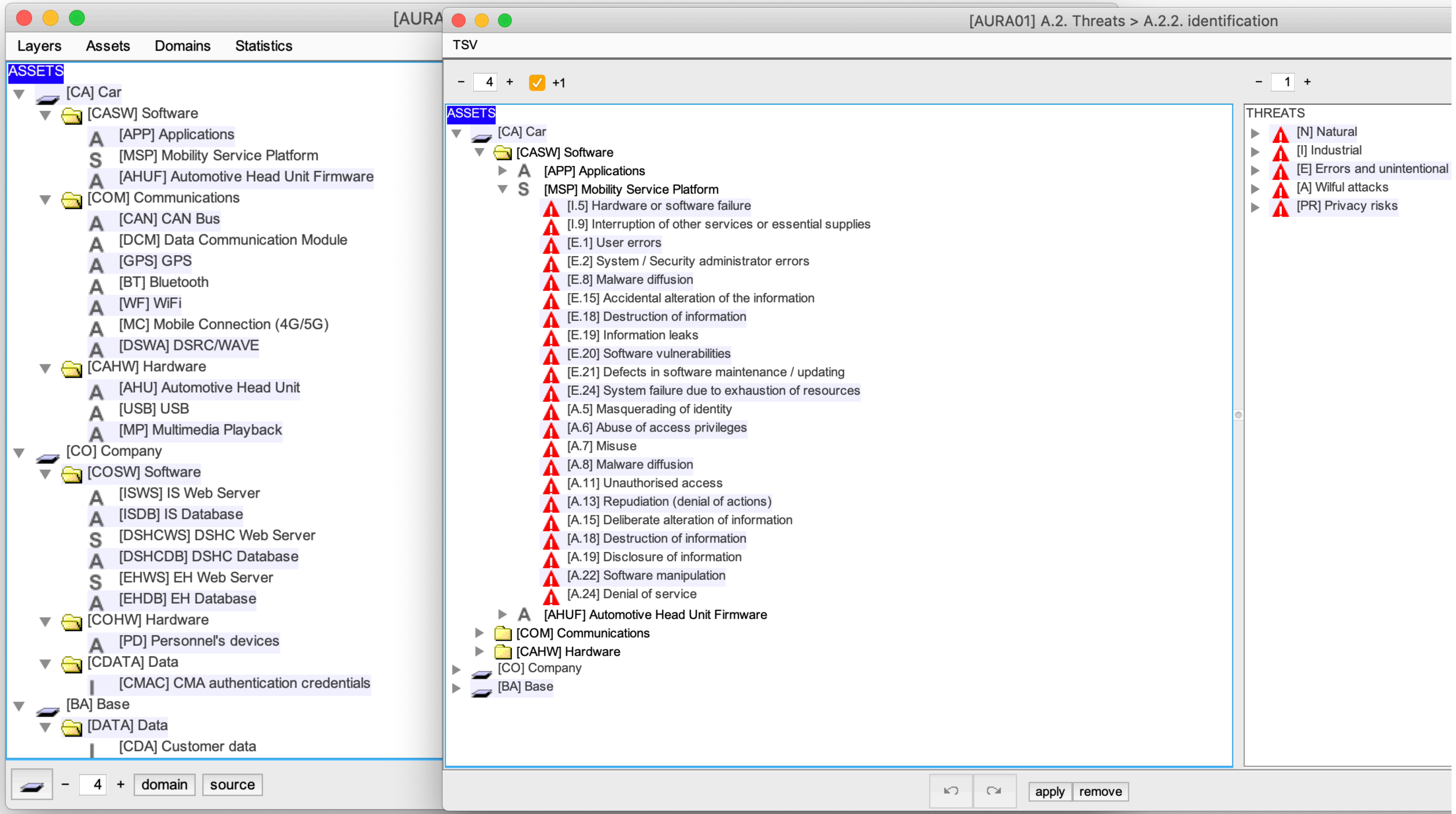
Source: Toyota



Source: ALS19

Case Study: Threat Modeling and PILAR Demo

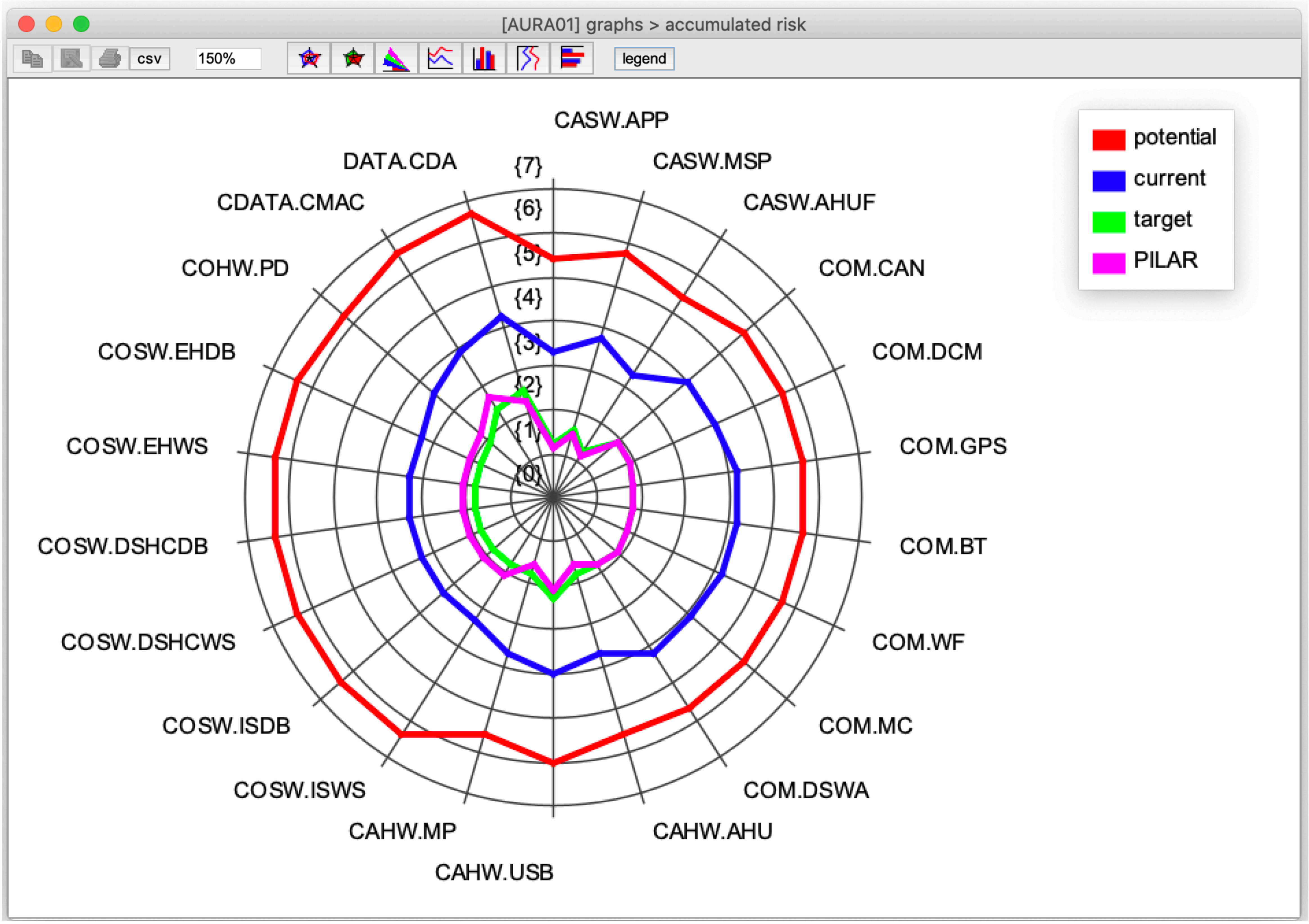
Threats Class 1 (T1): Authentication				
ID	Description	TA	STRIDE	Impact
T1.1	**Customer identity loss or identity sharing**: users leave their login credentials on a public place (e.g., write them down on a piece of paper) or share them with family, friends or relatives.	TA1.1	S	Low
T1.2	**Personnel identity loss or identity sharing**: personnel users and/or system admins leave their login credentials in public places or share them with others.	TA2.1, TA3.1, TA3.2	S	High



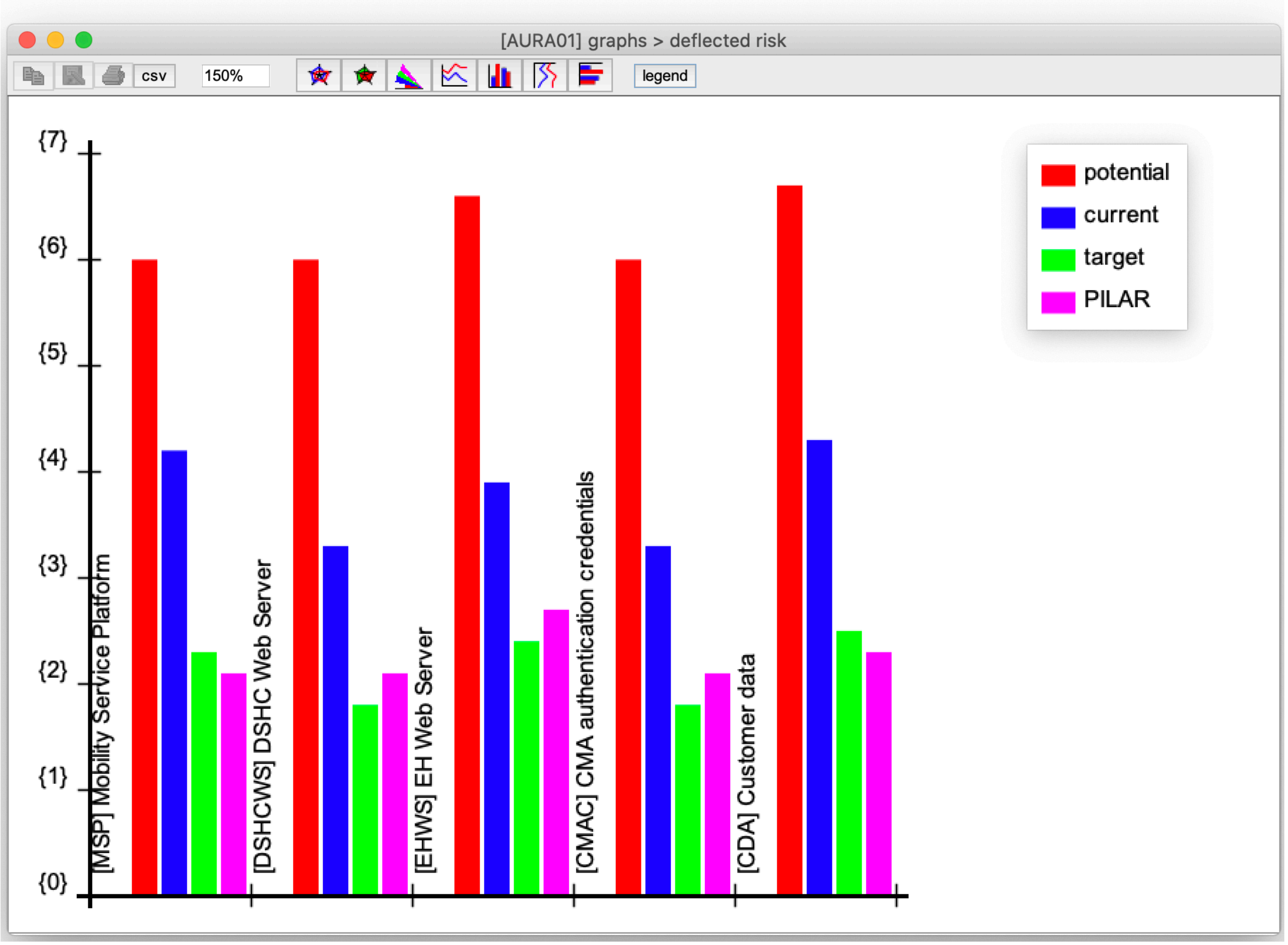
Threat Agents:

- Customer (TA1)
- Personnel (TA2)
- Administrator (TA3)
- Adversary (TA4)

Case Study: PILAR Results



Accumulated Risk



Deflected Risk

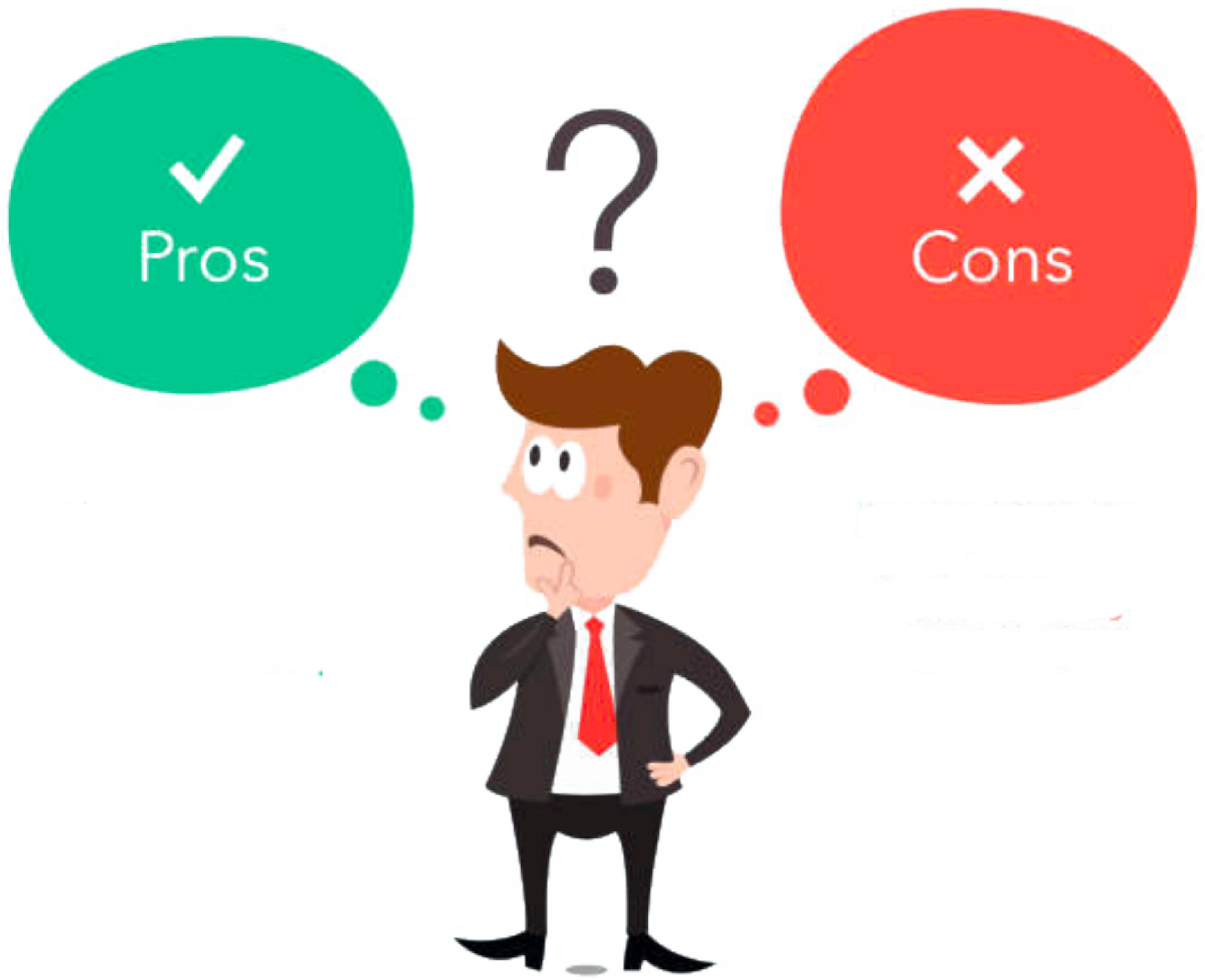
Conclusions

Magerit Pros:

- General methodology
- Compliance to international standards
- Threat Modeling integration (STRIDE)

Pilar Pros:

- Support to libraries (GDPR, ISO 27002)
- Assets/Threats classification
- Frequently updated



Magerit Cons:

- Variation of ISO 27005, without Pilar

Pilar Cons:

- Granularity*
- Repetitive and confusing
- Unknown algorithms implementation

Future work and improvements:

- Further investigations (Pilar)
- Comparison with other methodologies and tools
- DPIA integration (GDPR)
- Risk Treatment

Q&A