STARLIGHT

Sustainable Autonomy and Resilience for
LEAs using AI against High Priority Threats

AI-based cybersecurity and protection of LEA AI solutions

Campus Cyber, 2024-06-10

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General objectives

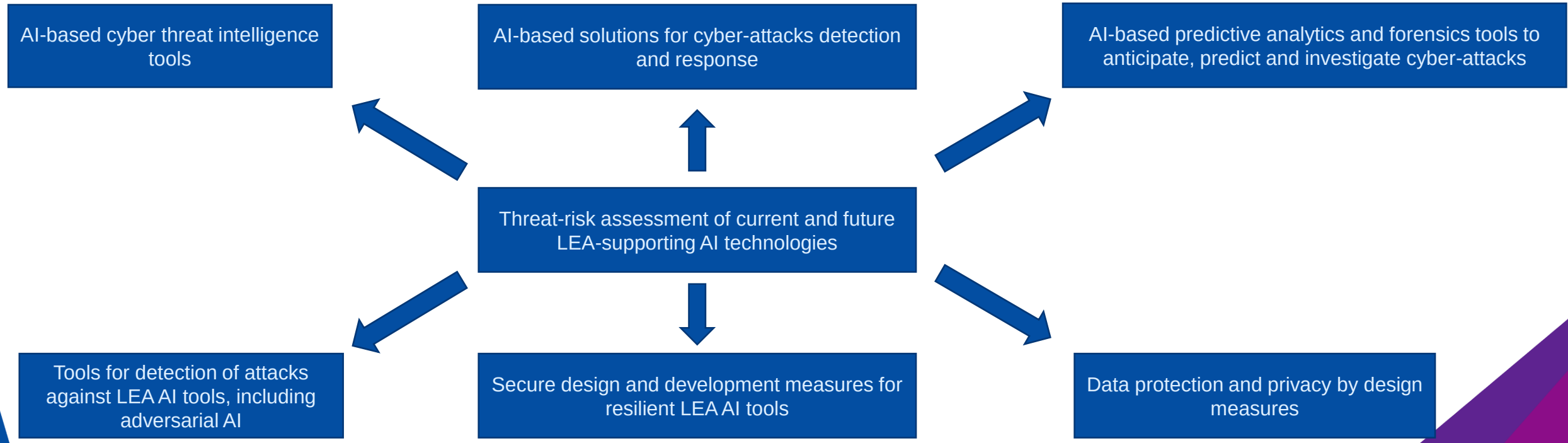
- **AI for cybersecurity:** Providing LEAs with AI-based tools to
  - analyze,
  - predict,
  - anticipate
  - mitigate

  } **present** and **future** cyber-attacks

- **Cybersecurity of AI**

  Building { methodologies / technologies } to ensure **robustness**, **security** and **resilience** of **AI tools** already in use, or to be used by LEAs

Topics of interest



From research institutions to agencies

Research

LEA / technical partners co-developments

Availability for LEA

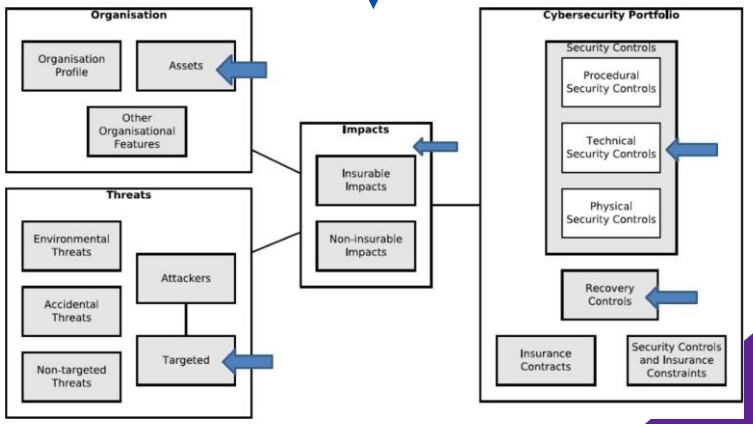
Threat-risk assessment of current and future LEA-supporting AI technologies

qAIScore
Qualitative multicriteria analysis based on ALTAI

AIRMF
Quantitative analysis of risks and impacts

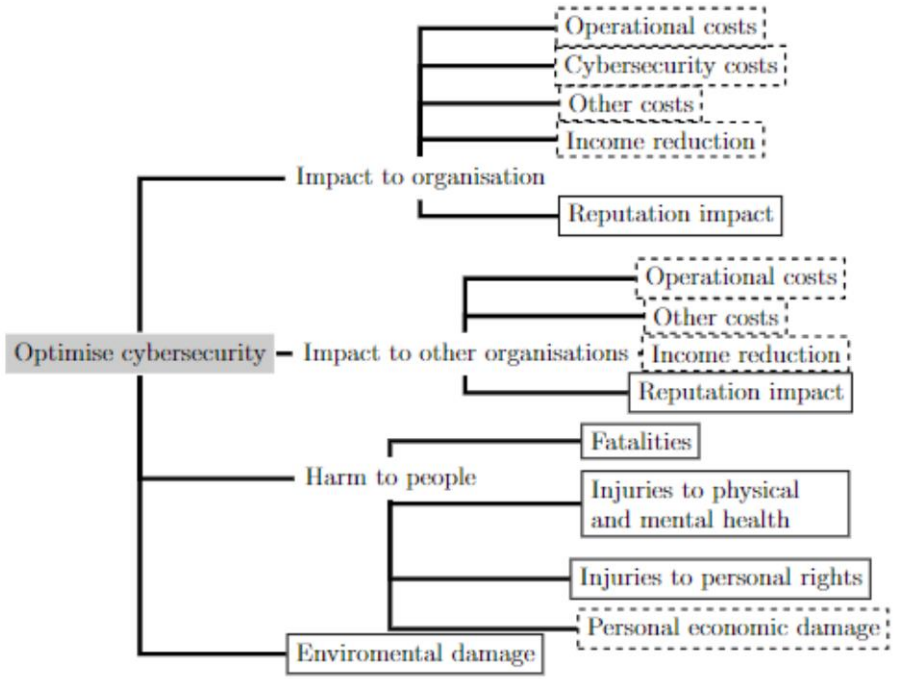
The evaluation and the comparison follow a qualitative scoring that can be used to:

- Reject AI tools that receive low scores. A qualitative analysis may already provide enough information to flag a tool as too risky.
- Understand that deeper analysis is required to understand risks and impacts when a qualitative analysis is too limited.
- Accept AI tools.



Threat-risk assessment of current and future LEA-supporting AI technologies

- J. M. Camacho, A. Couce-Vieira, D. Arroyo, et D. R. Insua, « A Cybersecurity Risk Analysis Framework for Systems with Artificial Intelligence Components ». arXiv, 3 janvier 2024. doi: 10.48550/arXiv.2401.01630.



A Cybersecurity Risk Analysis Framework for Systems with Artificial Intelligence Components

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Focus on « A Cybersecurity Risk Analysis Framework for Systems with Artificial Intelligence Components »

Novel Risk Analysis Issues

- Emergent AI capabilities and risks discovered post-deployment.
- Increased risks from AI's complexity.
- New challenges in explainability, reliability, and safety.

AI-related Impacts and Assets

- Broader vision of cybersecurity impacts beyond technical aspects.
- Inclusion of AI-specific impacts: accuracy, reliability, safety, and privacy.
- Adaptation of traditional cybersecurity frameworks to AI impacts.

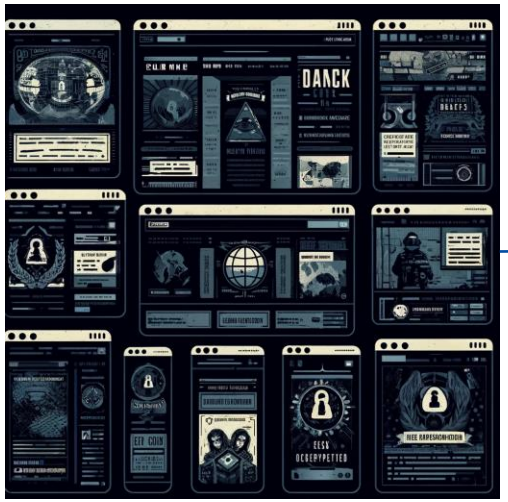
Algorithm 3 Attack simulation in a general facility

Input: G, Λ, distributions for P,Q,Q^s

for $j \in \{1, \ldots, M\}$ **do**
  Generate number N of attacks using Λ
  for $i \in \{1, \ldots, N\}$ **do**
    Generate P, Q, Q^s
    Simulate attack transit using P,Q, Q^s ▷ Algorithm 1
    Simulate impact l_i from attack ▷ Algorithm 2
  Aggregate $l^j = \sum_{i=1}^{N} l_i$
Return: $\{l^j\}_{j=1}^{M}$

AI-based cyber threat intelligence tools

Dark Web Monitor



Label

- Dark Web Monitor
  - Content classification module developed

Context-Aware Feature Vectors in Dark Web Page Classification

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Supervisors: Romana Pernisch[1,3] Eljo Haspels[2], and Mark van Staalduinen[2]

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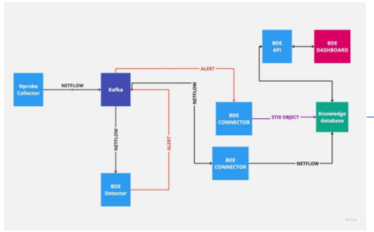
Codevelopment example 1 – lead by CEA & MinInt

- Log analysis to identify hacker source and compromised accounts

Technical Lead:	CEA
LEA lead:	MinInt
Interested/involved technical partners:	Pluribus One VicomTech ITTI
Interested/involved LEA partners:	Belgium Police
Others:	CNRS-IRIT, DCIS

Tools

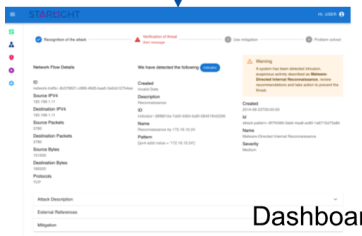
TCAD (Trustworthy Cyber-Attack Detector)
Netflow data analysis for detection of hidden patterns of malicious activities



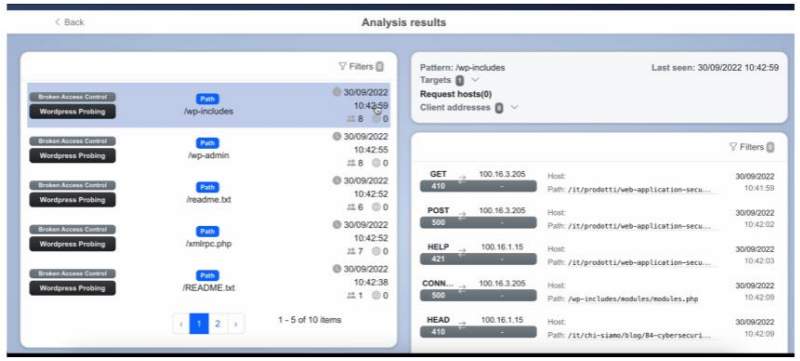
Architecture for detection

Precision results

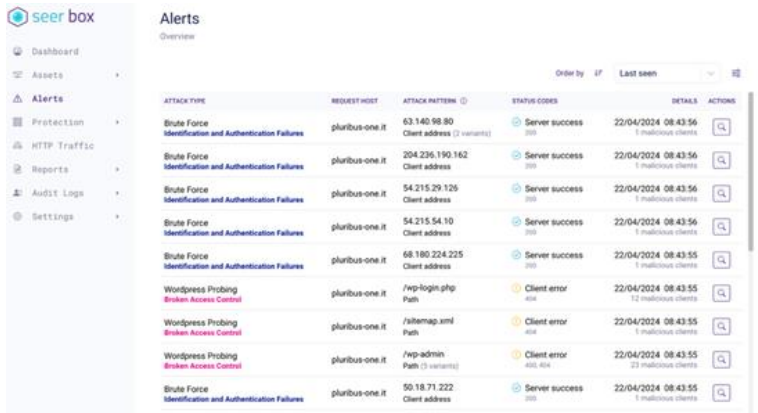
Random Forest – Spark TCAD				
	ACC	Precision	Recall	F1
Port Scanning	1	0.99	0.99	0.99
DoS	1	0.99	0.99	0.99
Brute Force	0.95	0.96	0.98	0.96

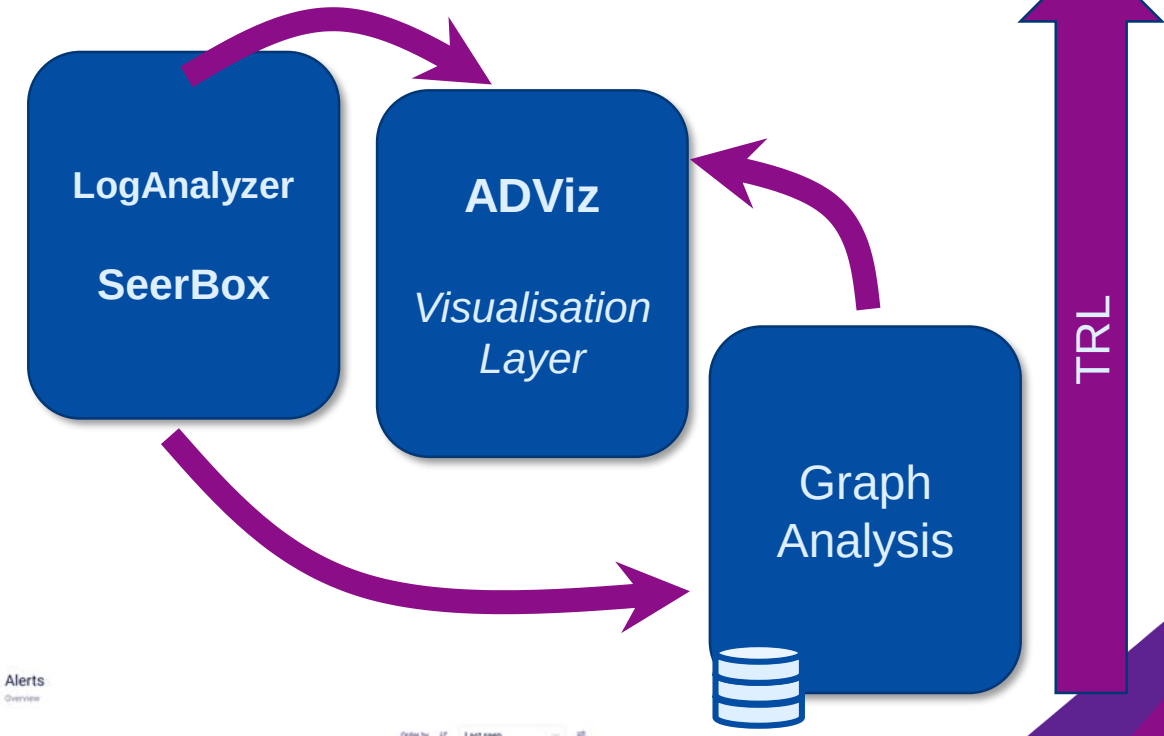


Dashboard

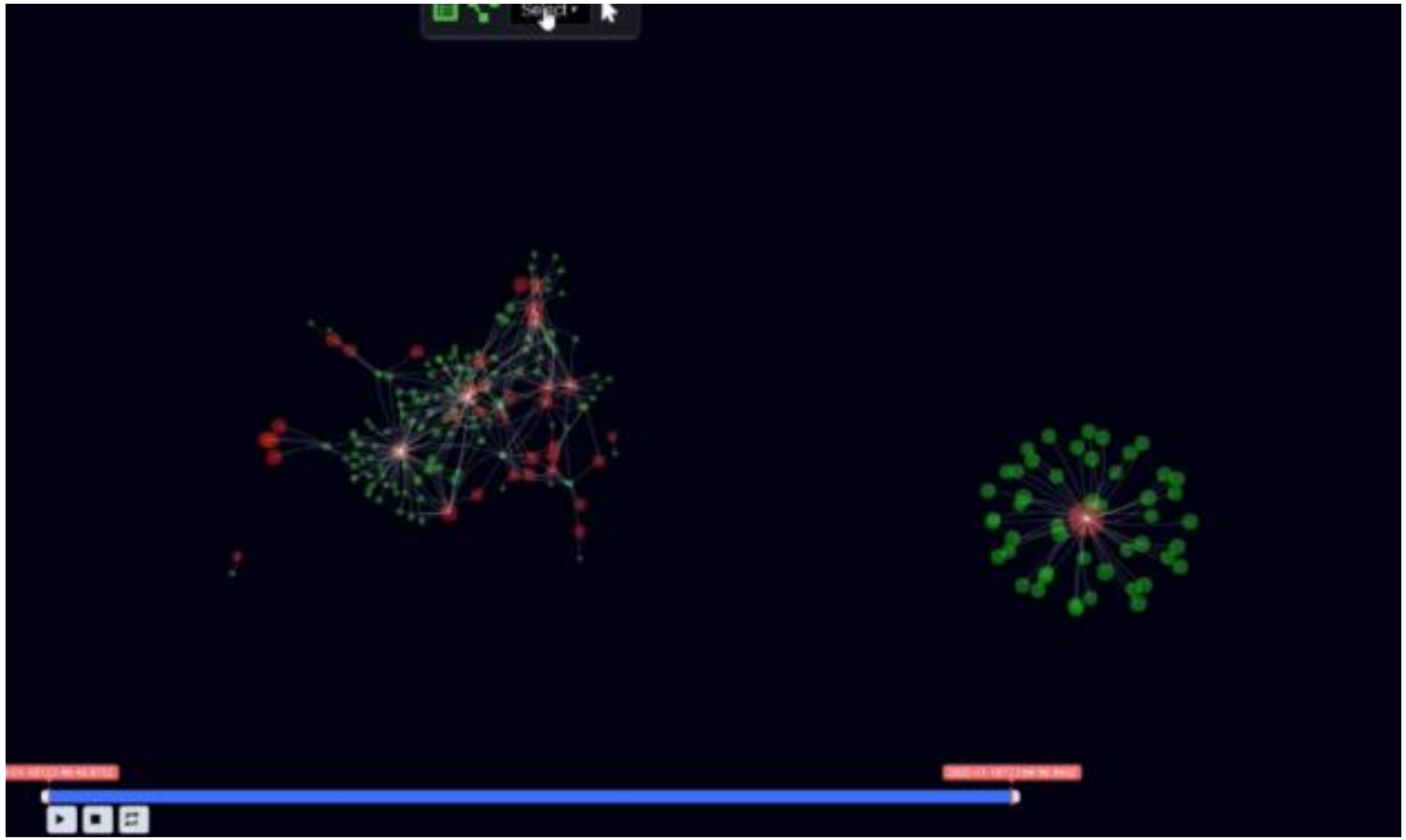


Log Analyzer
Pluribus tool





Adviz tool developed at CEA (live démo)



Codevelopment example 2 – lead by INOV & PJ

- Forensics: identification of cyberattacks in post-mortem systems

Technical Lead:	INOV
LEA lead:	PJ
Interested/involved technical partners:	
Interested/involved LEA partners:	
Others:	

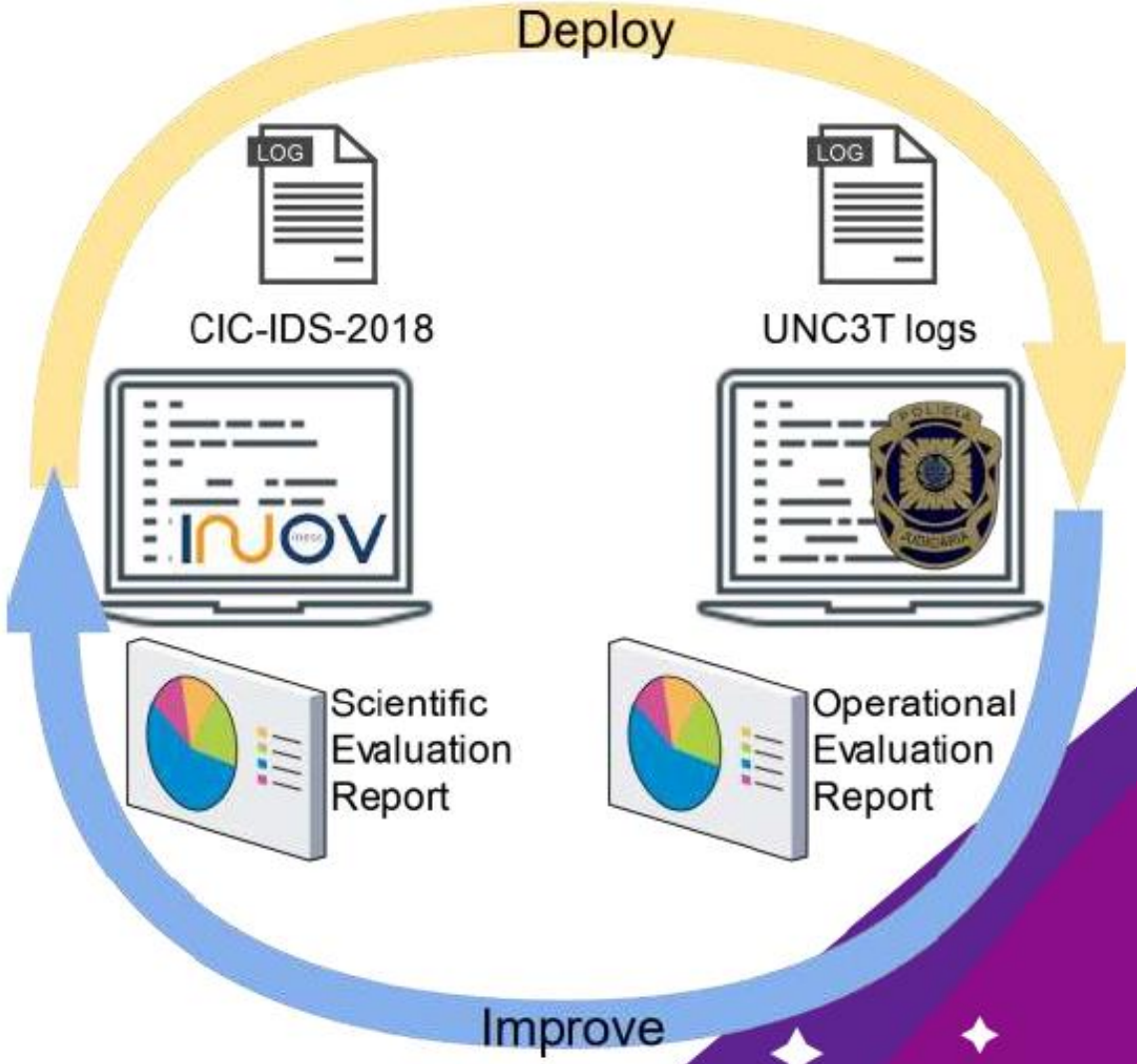
Detection of Cyberattacks in Post-mortem systems

- In cases of post-mortem systems, **LEA investigators and forensic experts need** to **analyse logs** and interview security administrators, to **discover evidences** to prosecute the attacker.
- **Requires knowledge** of the affected system
- Insights gathered from **interviews with the affected ICT organization**
- Reconstitute the **timeline of the attack** and **modus-operandi**

Methodology

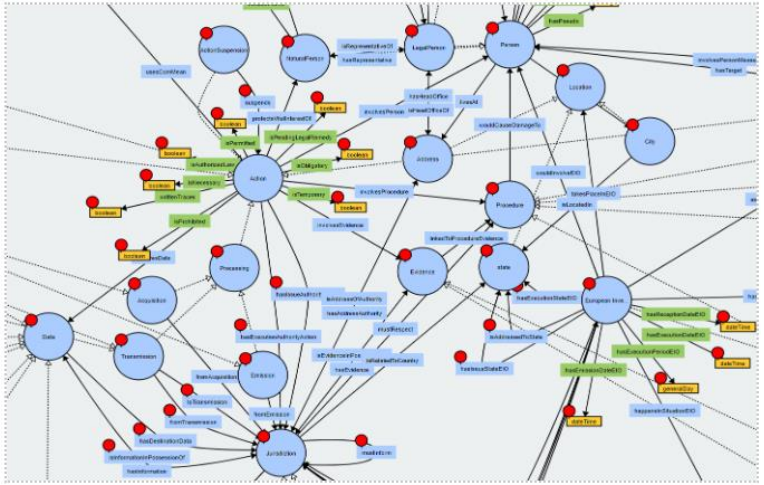
Roadmap

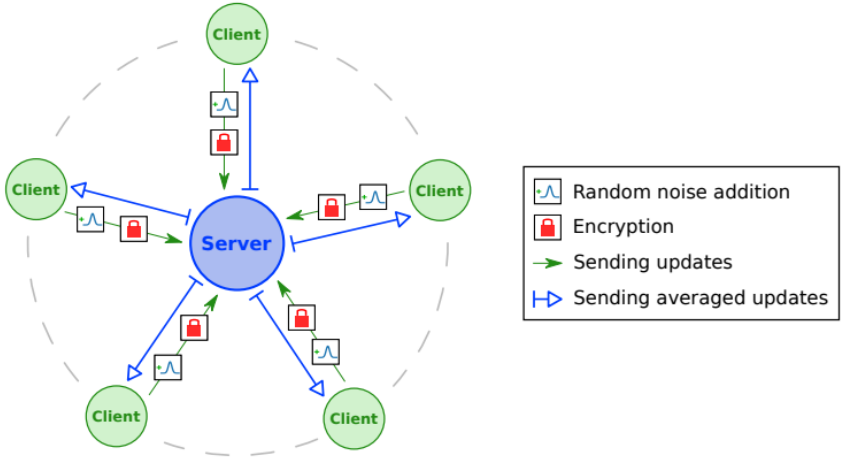
- INOV develops synthetic data from widely used CIC-IDS-2018
- PJ validates with UNC3T open cases
- 8 Sprint releases from january to september (next GA)



Data protection and privacy by design measures

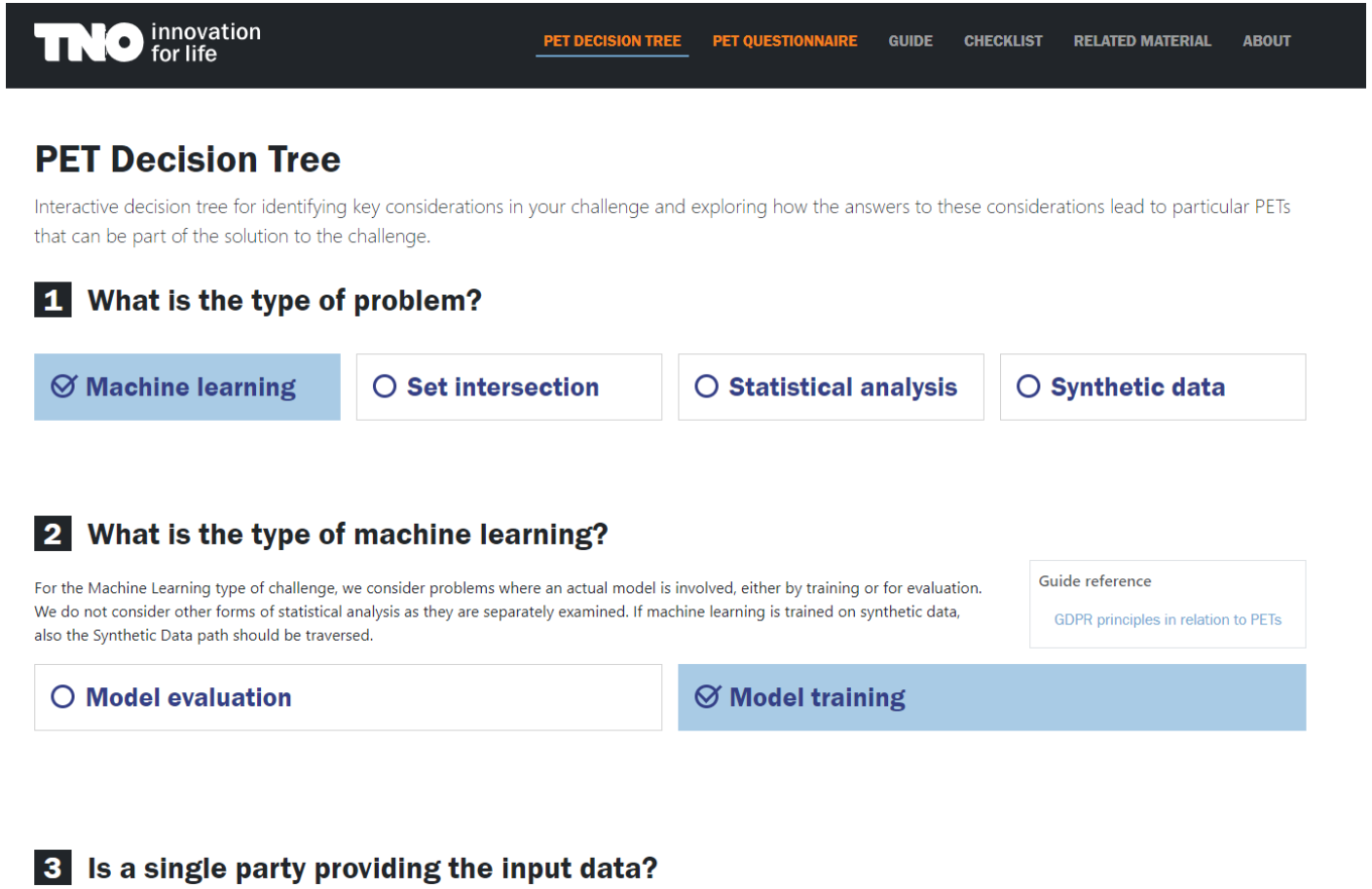
- Tool 1: design of a tool to support knowledge sharing among LEAs
  - Progress towards transforming regulations into formal rules
- Tool 2: design of a private-by-design AI training among LEAs
  - Federated learning for training without sharing
- Tool 3: decision tool to choose the adapted privacy-enhanced technology from objectives and constraints





Privacy-enhancing technologies

https://tno-pet-explorer.online/decision-tree/



Public material

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- S. Brinkhuijsen, « Context-Aware Feature Vectors in Dark Web Page Classification », Consulté le: 9 juin 2024. [En ligne]. Disponible sur: https://bnaic2022.uantwerpen.be/wp-content/uploads/BNAICBeNeLearn_2022_submission_8031.pdf

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Questions?

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