This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 608090.

HyRiM

Detection of Cyber-Attacks Against SCADA

An evaluation of anomaly detection techniques

Antonios Gouglidis

Novel Approaches in Risk and Security Management for Critical Infrastructures

Vienna, 19th and 20th September 2017

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Contents

- Resilience reference framework
- Performance analysis of detection techniques
- Concluding remarks

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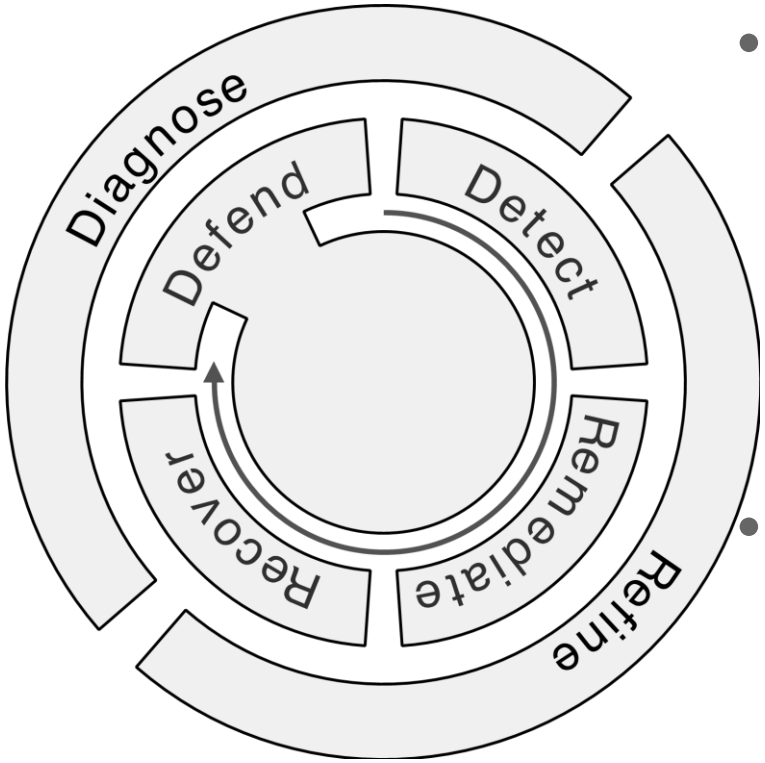
Resilience and ways of achieving it…



Resilience strategy

- *'… the ability of a network/system to defend against and maintain an acceptable level of service in the presence of challenges.' **
- D^2R^2+DR
  - Real-time control (internal) loop
  - Background (external) loop

* Sterbenz, James PG, et al. "Resilience and survivability in communication networks: Strategies, principles, and survey of disciplines." Computer Networks 54.8 (2010): 1245-1265.

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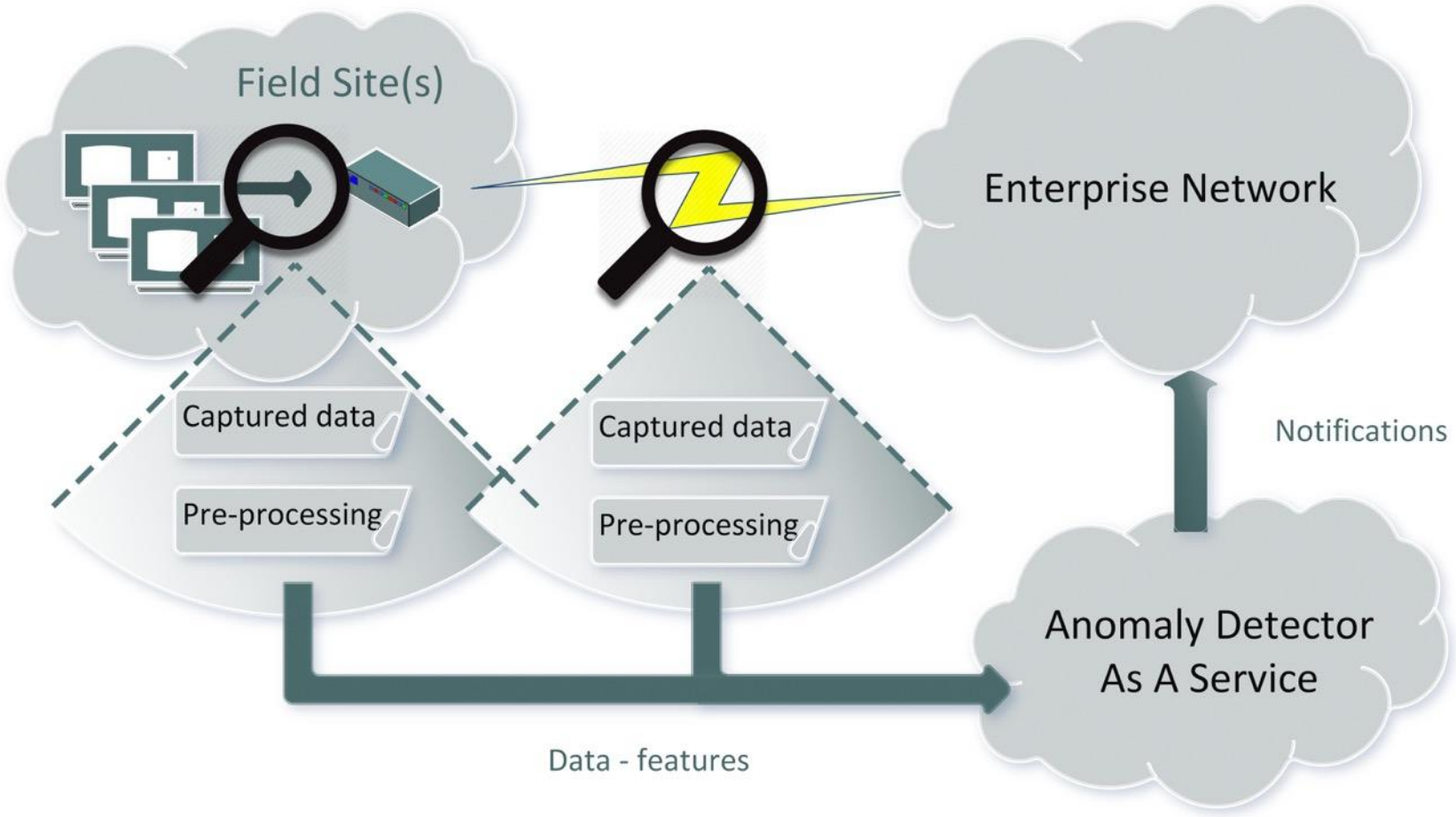
Overall concept



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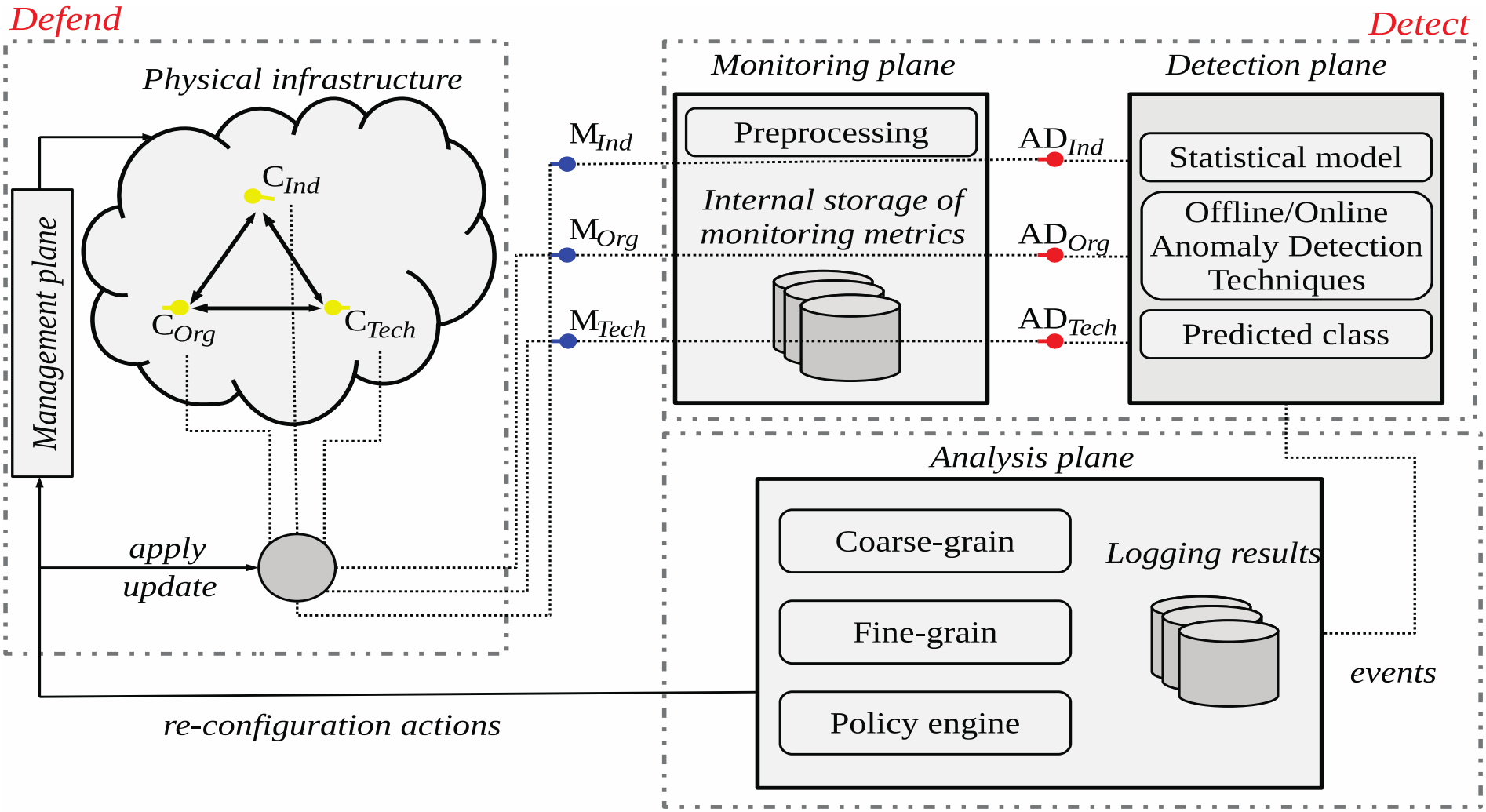
Resilience architecture



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Dataset and techniques

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- Dataset*
  - Simulated traffic on a gas pipeline
  - Modbus traffic including read/write command for a PLC
  - Attacks included: Response injection (naïve, complex), reconnaissance, DoS, command injection (state, parameters, function code)
- Detection techniques
  - Supervised: K-Means, Naïve Bayesian
  - Unsupervised: PCA – Singular value decomposition, GMM, Data Density

* Mississippi State University lab

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Method for evaluating techniques

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- Obtain most significant features from the dataset
  - Normalization of data
- Split dataset in 8 trace files
  - Combined dataset (1 file)
  - Attack trace plus normal data (7 files)
- Submit each trace file to the detector
- Compare the output against ground truth

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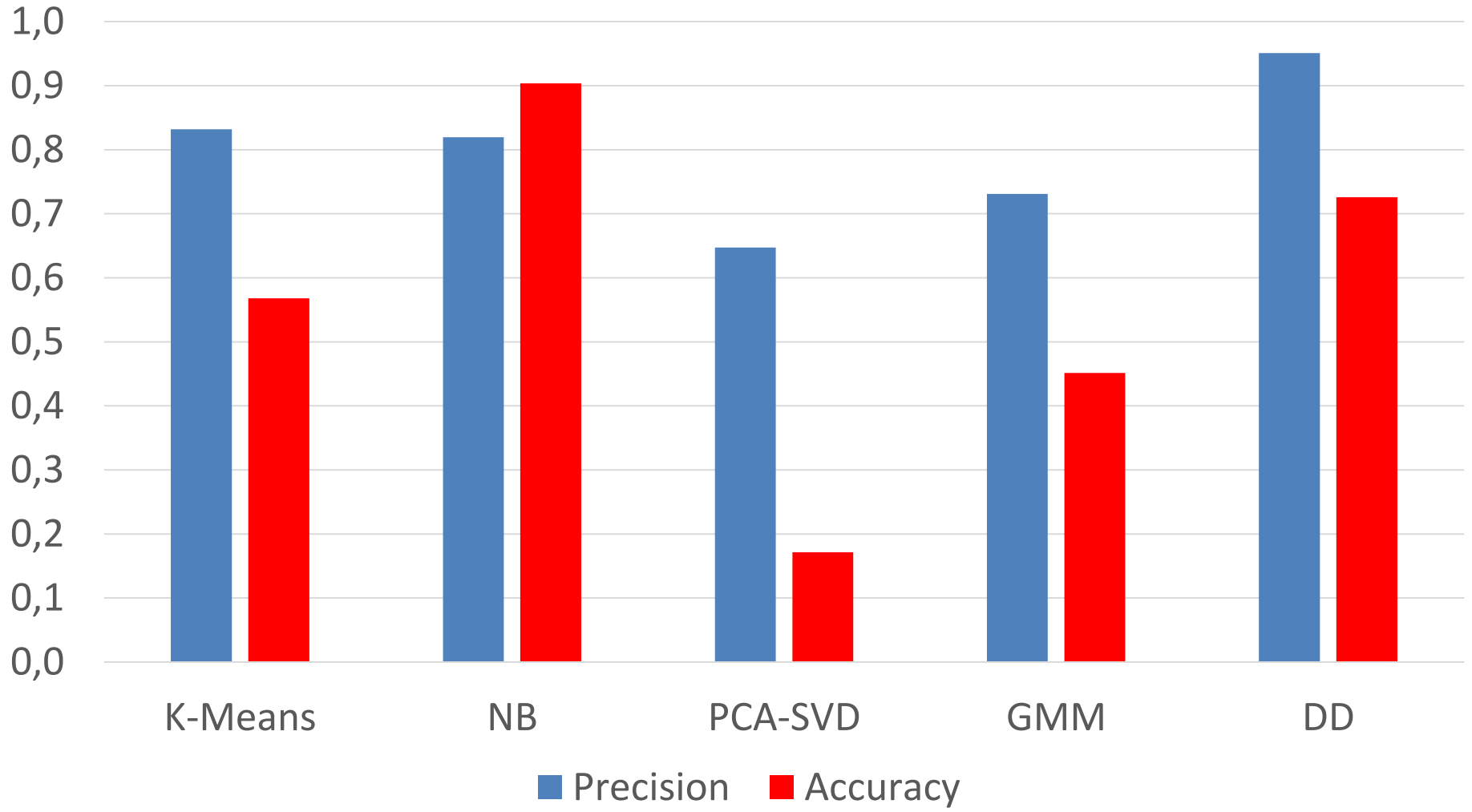
Combined dataset

Comparison of techniques



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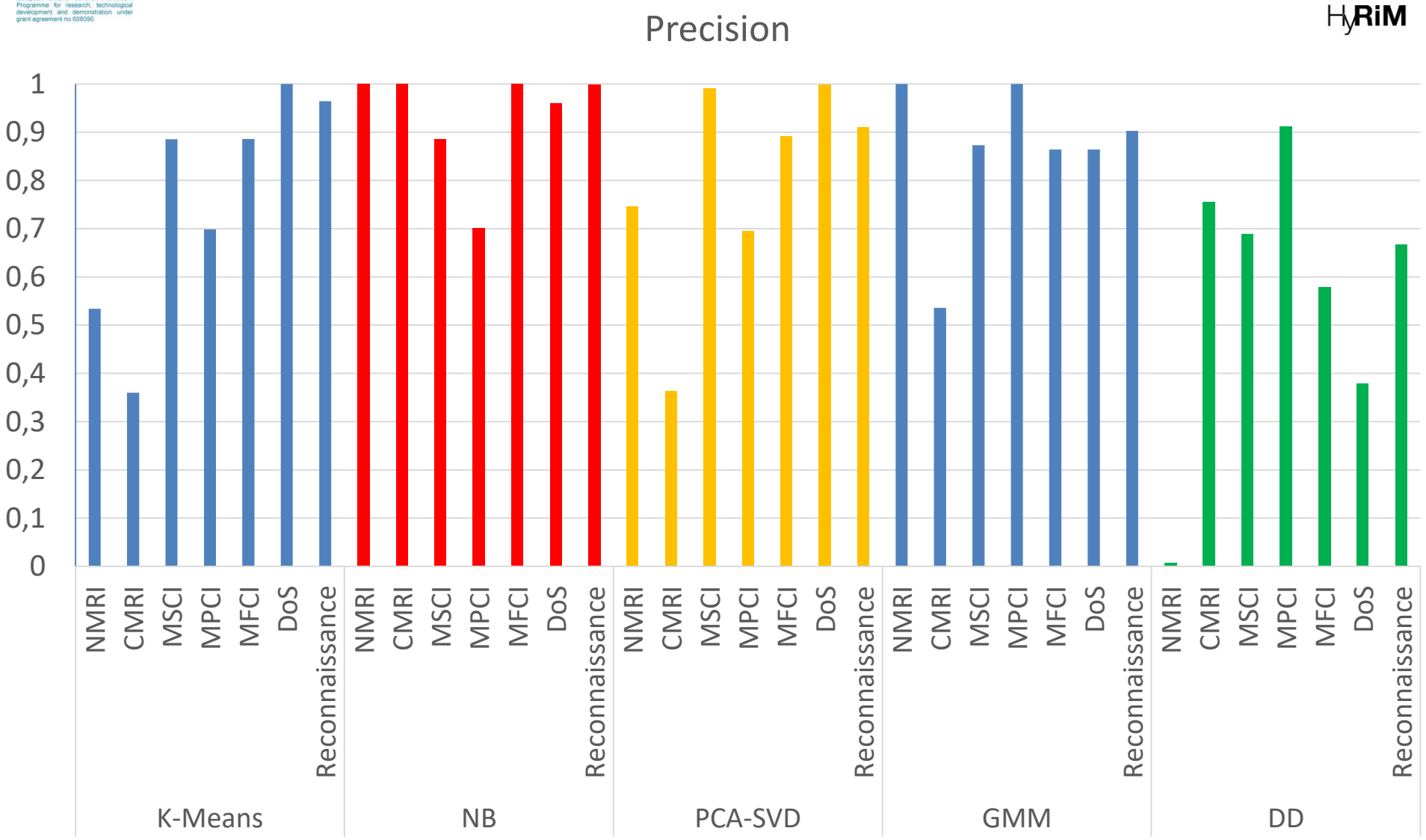
Precision of techniques per attack



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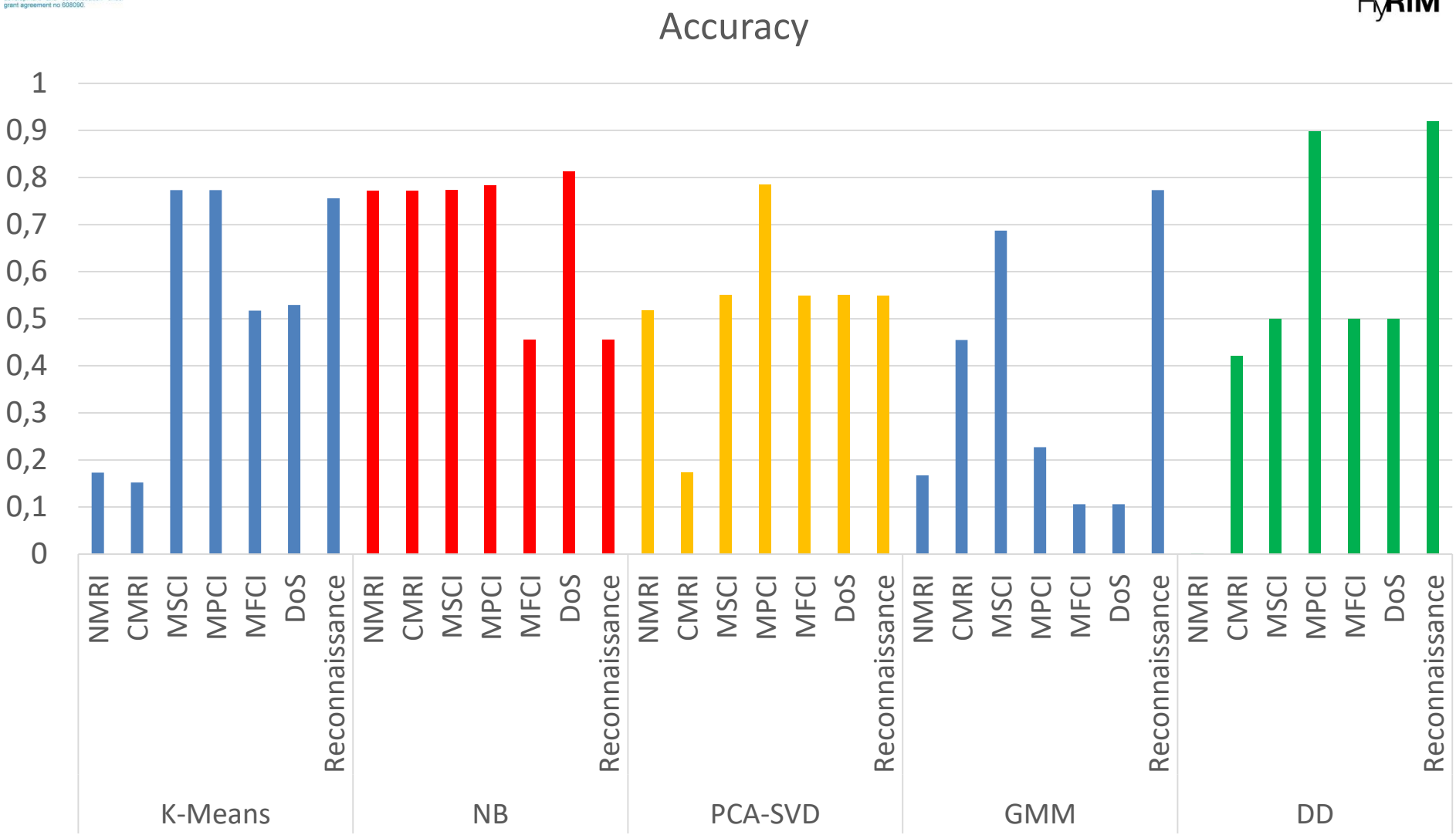
Accuracy of techniques per attack



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Concluding remarks

- Detection rate differs with respect to the
  - Type of attack
  - How different anomalous data packets are from normal traffic, intensity of the attack
- Supervised techniques perform better
- Is a dataset always available for training?

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Thank you!