Integrated Framework for Predictive and Collaborative Security of Financial Infrastructures

Predictive Analytics for Cyber-Physical Threat Intelligence in Financial Sector Infrastructures – 14/01 -2021

This project has received funding from the European Union's horizon 2020 research and innovation programme under grant agreement no 786727

Predictive Analytics for Cyber - Physical Threat Intelligence in Financial Sector Infrastructures

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Agenda

- What is predictive analytics
- Use case in Financial Services
- Findings
- Key takeaways

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What is predictive analytics

Predictive analytics is the use of historical data and machine learning to develop mathematical models that can then be applied to predict what will happen next

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Predictive Analytics cyber-physical security

- Proactively identifying assets at risk
- Anticipating threats
- Prediction of attack indicators
- Filtering and prioritizing security risks
- Automated identification of security insights
- Providing earlywarning of abnormalities and irregularities

Use Case in Financial Services: Predictive Analytics Service for Security of Blockchain and Peer-to-Peer Payment Solutions

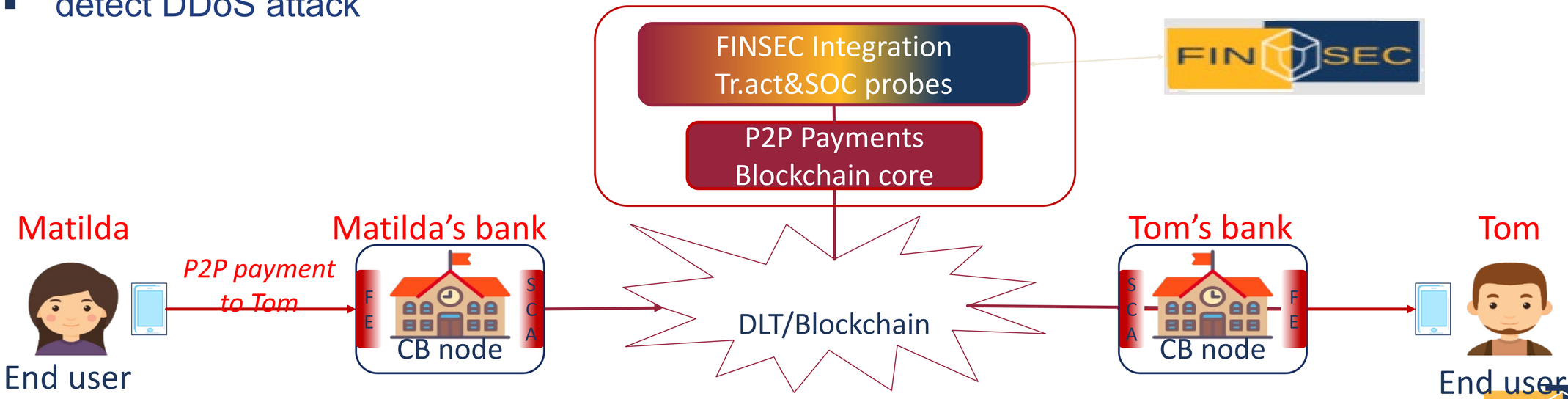
Background

- The financial sector is highly digitised and interconnected
  - BigData, Internet of Things (IoT), Artificial Intelligence (AI), blockchains, mobile Apps, Cloud services and web infrastructures
- Blockchain and P2P solutions become widely adopted by financial institutions to secure the payment system
  - the attackers follow the development by detecting and exploiting vulnerabilities in blockchain solutions
- An advanced cyber-defence infrastructure is required

Securing Blockchain Peer-to-Peer payments: monitor, detect and mitigate

- Demonstrate the capability of the FINSEC platform to predict and detect suspicious behaviors or attacks to a Blockchain based P2P Payments application
  - identify common trends
  - detection of abnormal behavior
  - critical node fault(s), node hijacking
  - overloading
  - detect DDoS attack

- Aim to secure the solution both at application and infrastructure level
- Two classes of use cases: security for alerting and transaction filtering



Environment

- A private and permissioned blockchain
- To identify abnormal behaviours
- To assess the blockchain network behaviour
- Datasets were produced separately
- Data were pre-processed in the temporal domain

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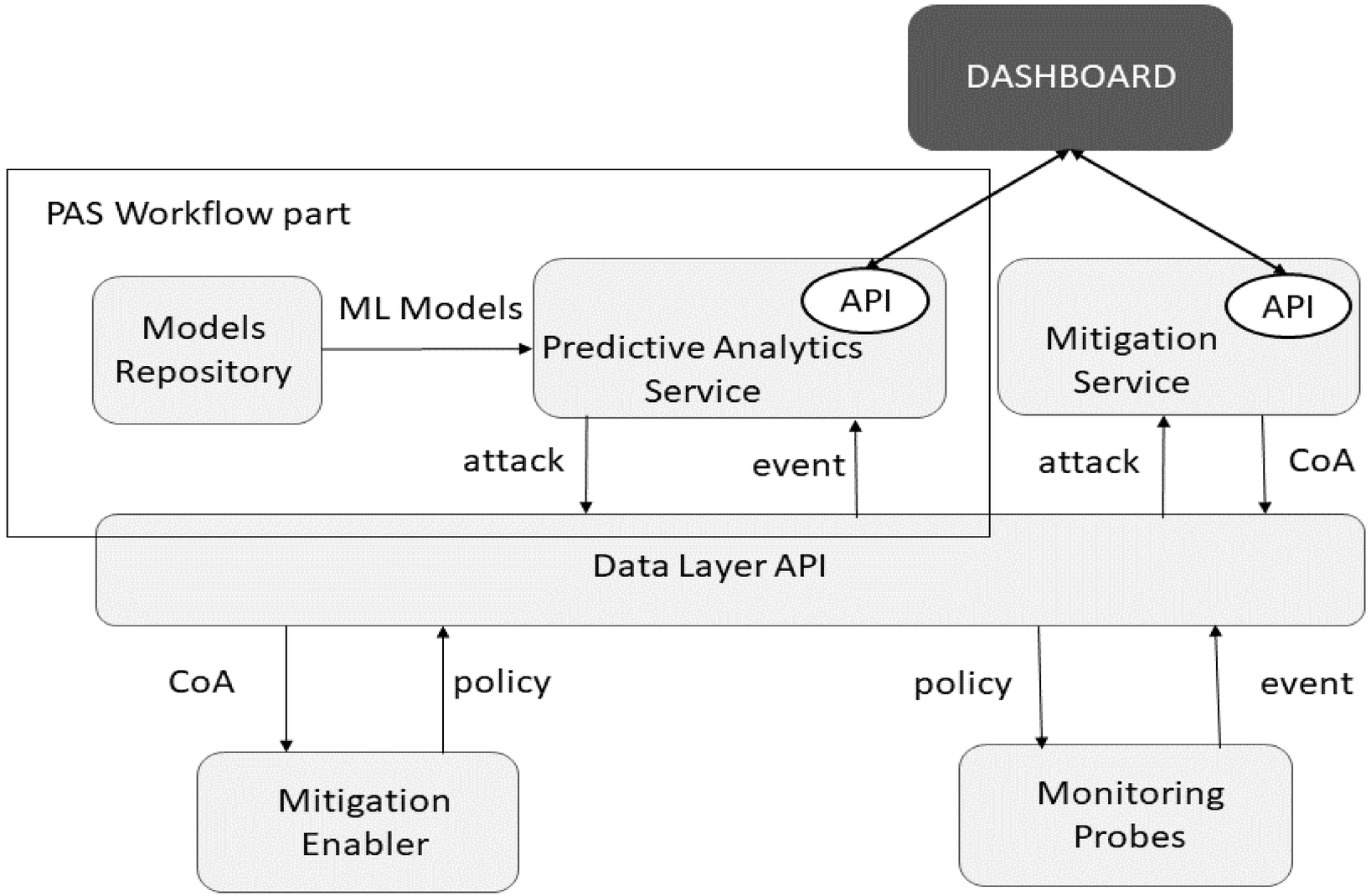
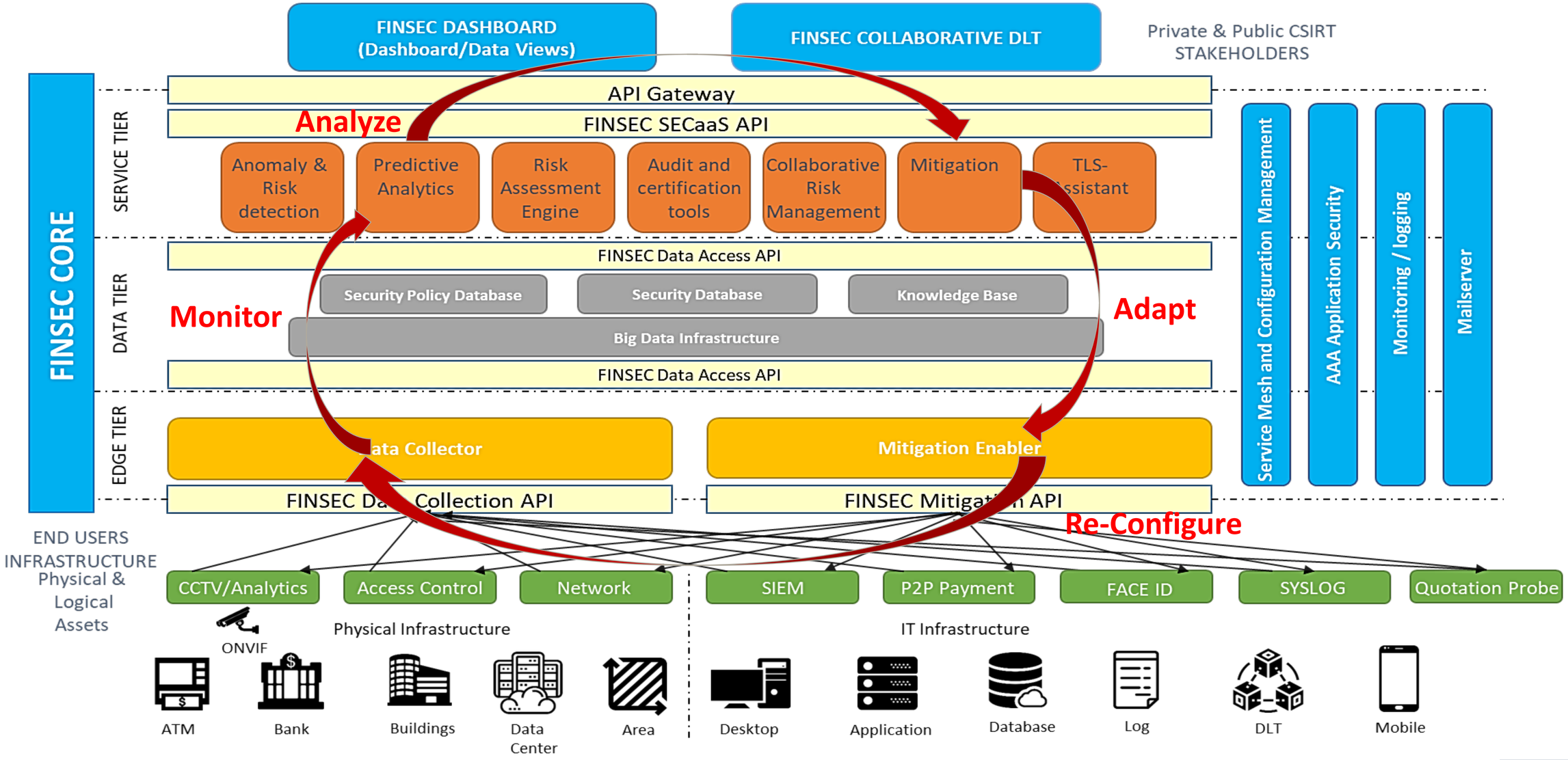
Predictive Analytics Service Workflow



Mapping to FINSEC Reference Architecture



Evaluated Algorithms

- Several ensemble methods (100, 200, 300 estimators)
  - Random Forest Classifier
  - AdaBoost Classifier
  - Gradient Boosting Classifier
  - Extreme Gradient Boosting
- Support Vector Machines
- Decision Tree Classifier
- K-Nearest Neighbors algorithm
- Stochastic Gradient Descent algorithm
- Multilayer Perceptron classifier

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Evaluation metrics

- Accuracy (*a*)
  - defines the ratio of correctly predicted values to the total number of values
- Precision (*p*)
  - the ratio of correctly predicted positive values to the total number of values predicted as positive
- Recall (*r*)
  - the ratio of correctly predicted positive values to all positive values
- Weighted average metric (*m*)
  - ä $= w_a a + w_p p + w_r r$

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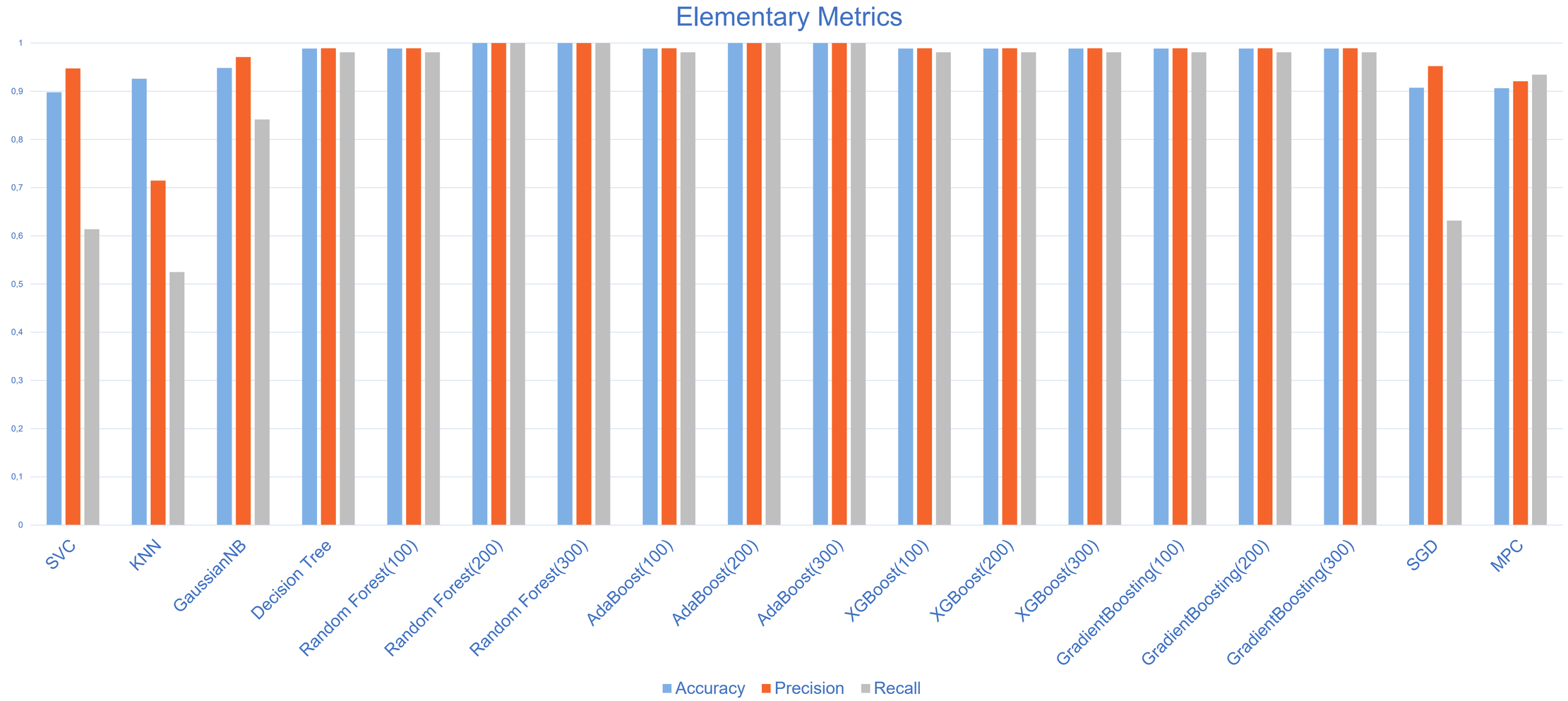
Results



We used predictive analytics service to predict cyber-physical attacks on Peer-to-Peer Payment Solution close to 99% accuracy, precision and recall

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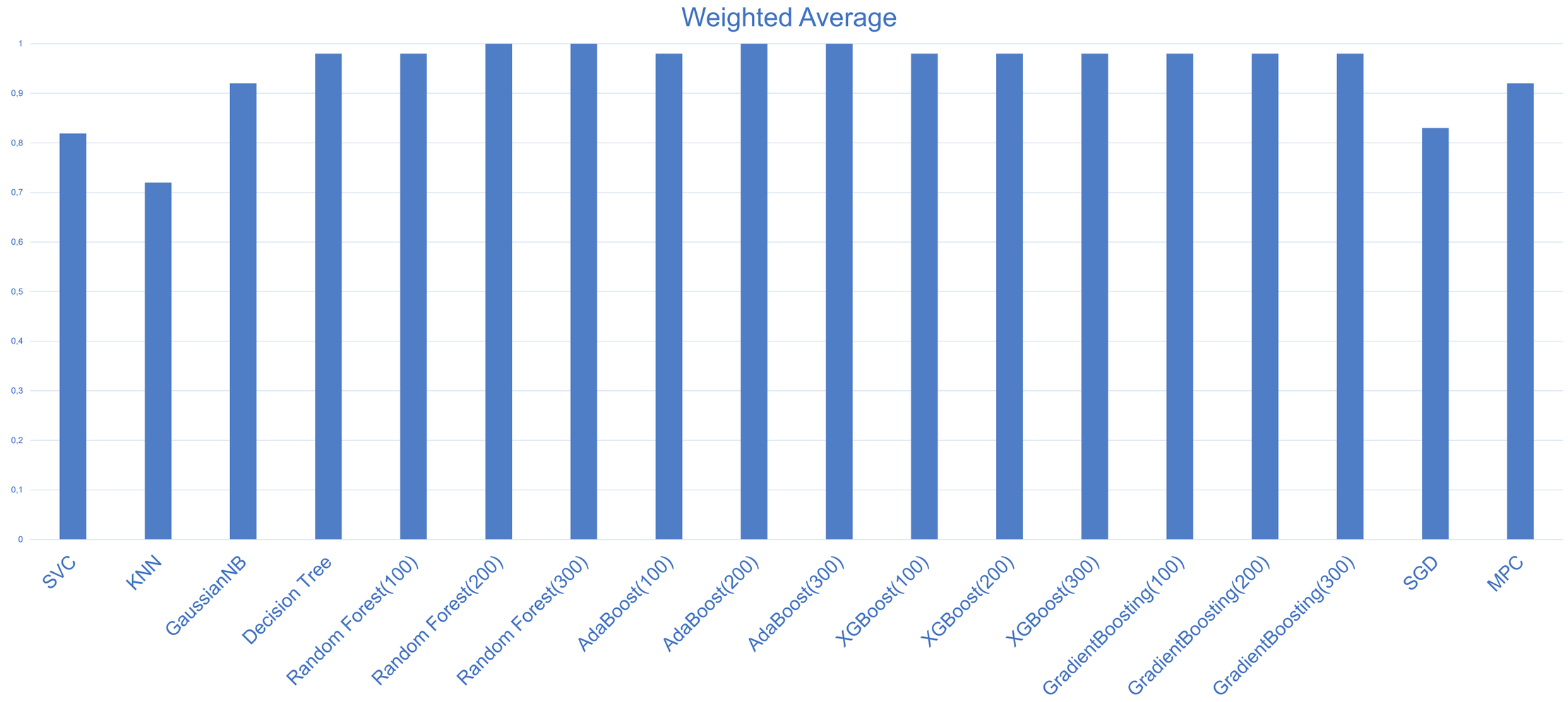
Results



We used weighted average to evaluate the predictive analytics algorithms how good they predict cyber physical attacks on Peer-to-Peer Payment Solution with close to 99%.

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Key Takeaways: Predictive Analytics for Security

- Predictive analytics provides increased automation and flexibility
- Predictive analytics improves detection capability by correlating wide-ranging data sources
- Predicts cyber-physical security attacks, threats and anomalies and alerts security officers
- Triggering of preventive and mitigation measures in advance of the occurrence of the attacks
- Predictive analytics helps to thwart whatever attacks adversaries are attempting to launch
- Predictive analytics is enabling the computer to predict threats and observe any anomalies with a lot more accuracy than any human can.
- Predictive analytics helps to understand patterns of behavior which can then be used to identify activities that could compromise infrastructures and applications

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Thank You

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