TRIDEnT: Trustworthy collaboRative Intrusion DETection

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Introduction

Cyber attacks and Intrusion Detection

- Cyber attacks are increasing in terms of numbers and sophistication
- Intrusion Detection Systems (IDSs) are nowadays considered mandatory
- However, isolated IDSs cannot provide strong detection accuracy and do not scale to large-scale networks

Collaborative Intrusion Detection Systems (CIDSs)

- CIDSs overcome these shortcomings by employing a synergetic network of multiple IDSs
- CIDSs create a holistic view of the monitored network
- Trust between collaborators is a vital, yet challenging issue

Motivation & Background

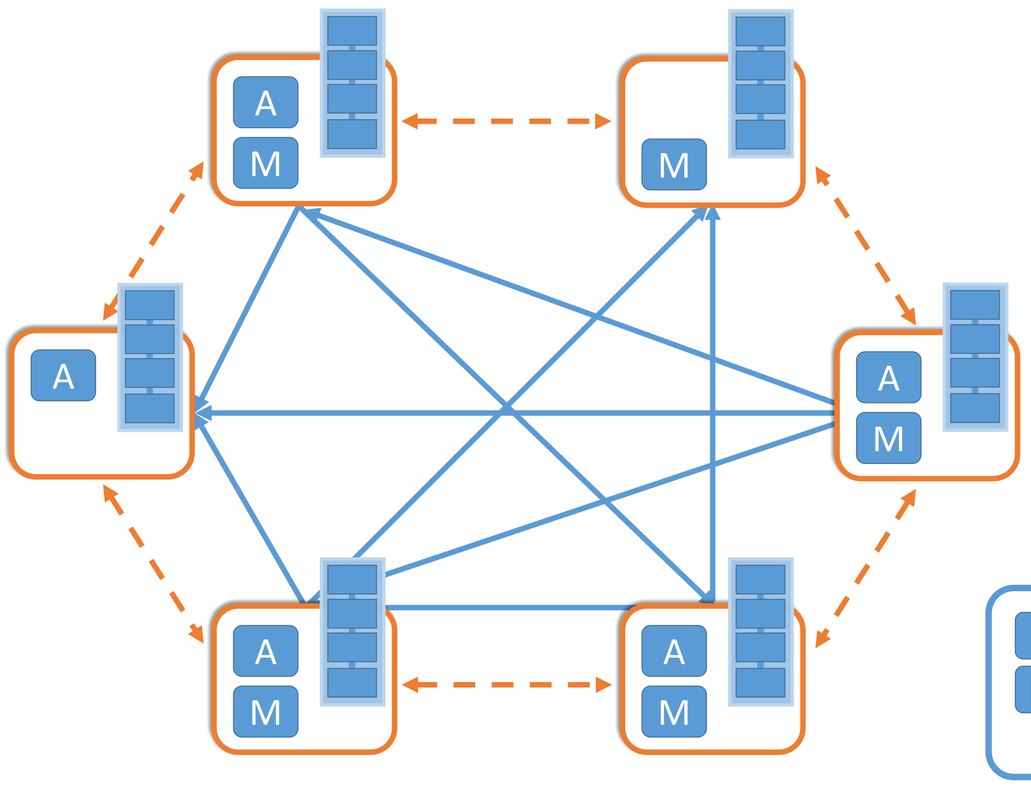
Motivation

- A CIDS infrastructure needs to be *robust, accountable* and *resilient to internal attacks*
- Existing approaches, based e.g. on Computational Trust, offer only a partial solution to the problem
- Blockchain technology can offer a secure-by-design platform

Background

- Blockchain technology offers a distributed ledger among peers
- The security guarantees of the ledger stem from the consensus protocol in use
- Blockchains can be classified as public or consortium:
  - ❑ in public blockchains membership is uncontrolled,
  - ❑ in consortium ones a pre-defined subset of peers is in charge of the process

TRIDEnT's Architecture

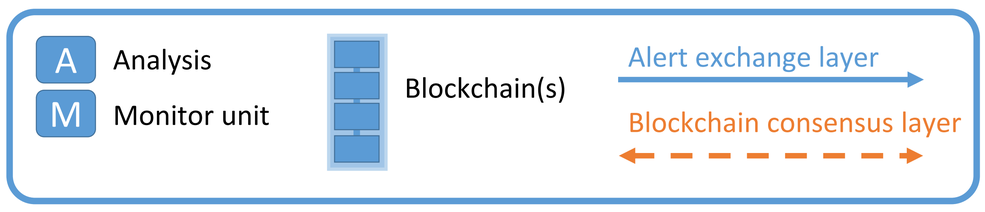


General Idea:

- Use a blockchain as the collaborative mechanism
- Break down communication into two layers:
  - ❑ Alert exchange: on-demand data dissemination
  - ❑ Consensus: create global view of peer actions
- Store compact representations of alert data on the blockchain

Advantages:

- Public verifiability
- Accountability
- Data Integrity
- Resilience



Design Considerations

Blockchain governance:

- Public (e.g. Bitcoin or Ethereum) vs. Consortium (e.g. Hyperledger)
- Does open participation offer advantages?

Consensus algorithm:

- Proof of Work vs Proof of Stake vs PBFT etc.

Data on/off the ledger:

- Raw alerts vs compact representations (e.g. Bloom filters)

Data encryption – Privacy:

- Encrypted vs Plaintext alert data exchange

Next Steps

Future Work

- Proof of concept implementation of TRIDEnT using Hyperledger Fabric
- Include computational trust techniques in the architecture
- Experiment with various design alternatives

Related Publications

- Alexopoulos N., Daubert J., Mühlhäuser M., Habib S. M., Beyond the Hype: *On Using Blockchains in Trust Management for Authentication*. IEEE TrustCom, 2017.
- Vasilomanolakis E., Karuppayah S., Mühlhäuser M., Fischer M.: *Taxonomy and Survey of Collaborative Intrusion Detection*. ACM Comput. Surv., 2015.
- Cachin, C. *Architecture of the Hyperledger blockchain fabric*. In Workshop on Distributed Cryptocurrencies and Consensus Ledgers, 2016.
- Vasilomanolakis E., Habib S. M., Milaszewicz P., Malik R. S., Mühlhäuser M. *Towards Trust-Aware Collaborative Intrusion Detection: Challenges and Solutions*. *IFIPTM*. Springer, 2017.

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