Measuring the effectiveness of SDN mitigations against cyber attacks

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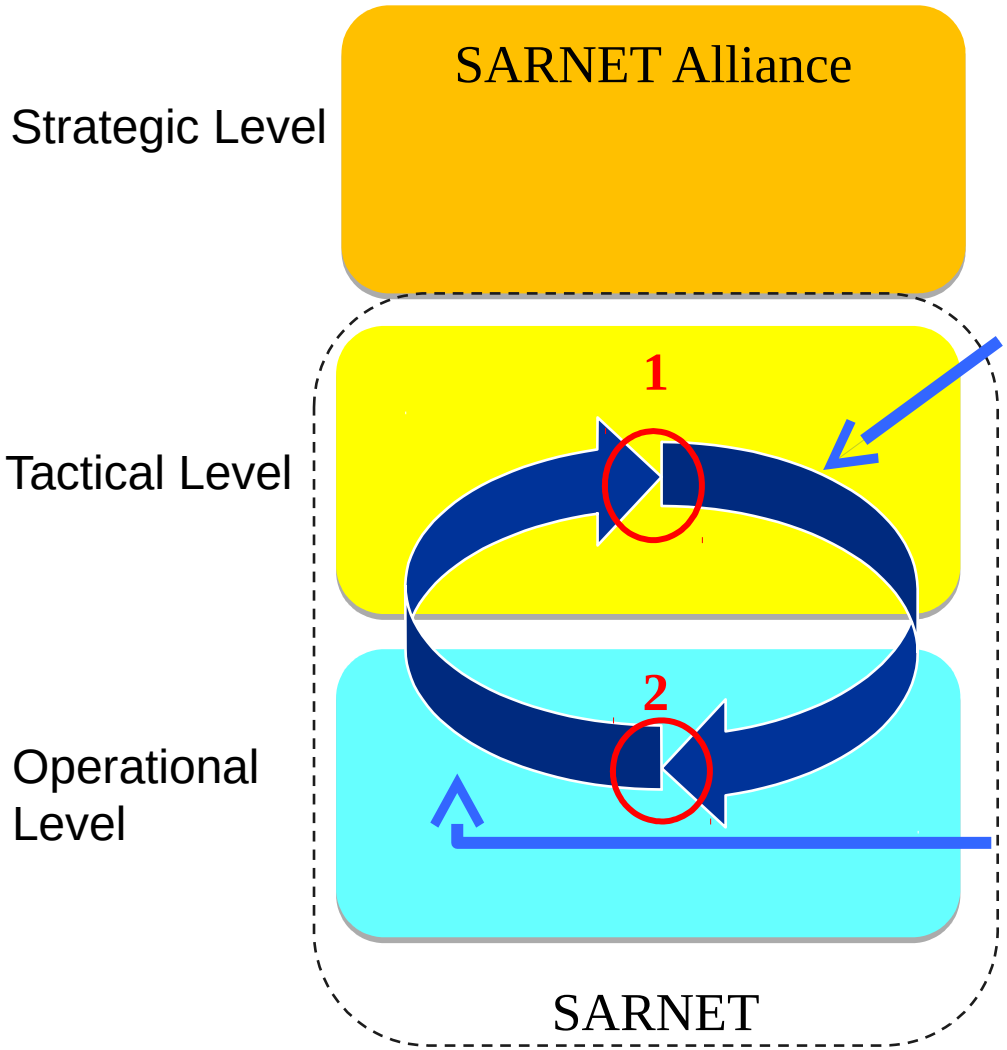
Context

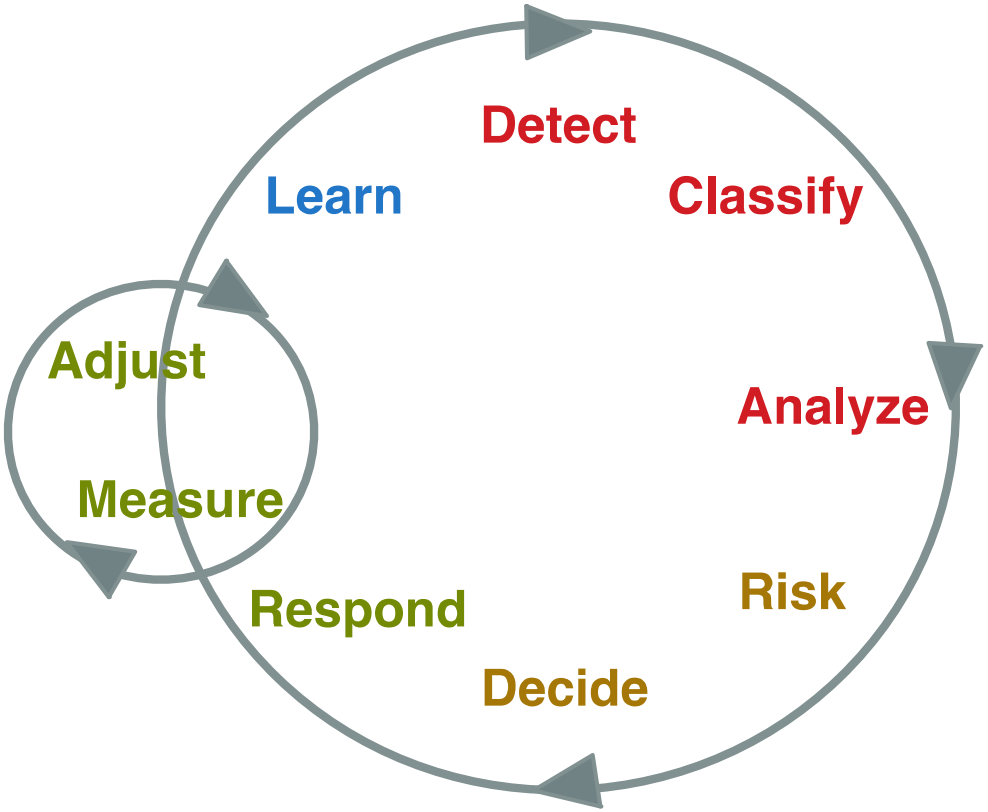


Ameneh Deljoo (PhD):
Why create SARNET Alliances?
Model autonomous SARNET behaviors to identify risk and benefits for SARNET stakeholders

Gleb Polevoy (PD):
Determine best defense scenario against cyberattacks deploying SARNET functions (**1**) based on security state and KPI information (**2**).

Ralph Koning (PhD)
Ben de Graaff (SP):
1. Design functionalities needed to operate a SARNET using SDN/NFV
2: deliver security state and KPI information (e.g cost)

Control loop



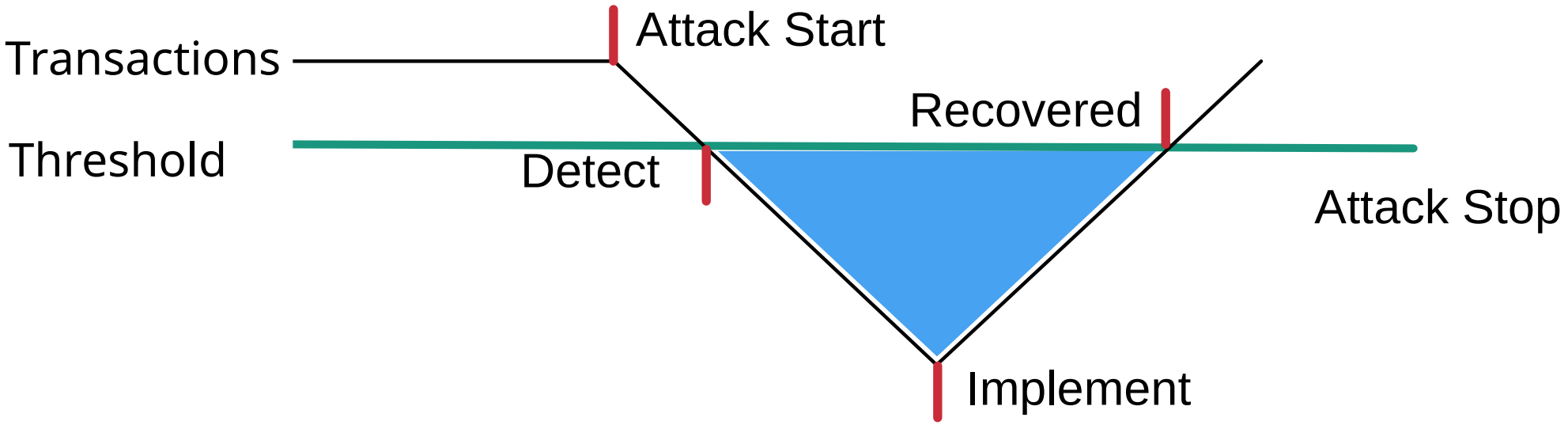
Detection phase: Detect, Classify, Analyze

Decision phase: Risk, Decide

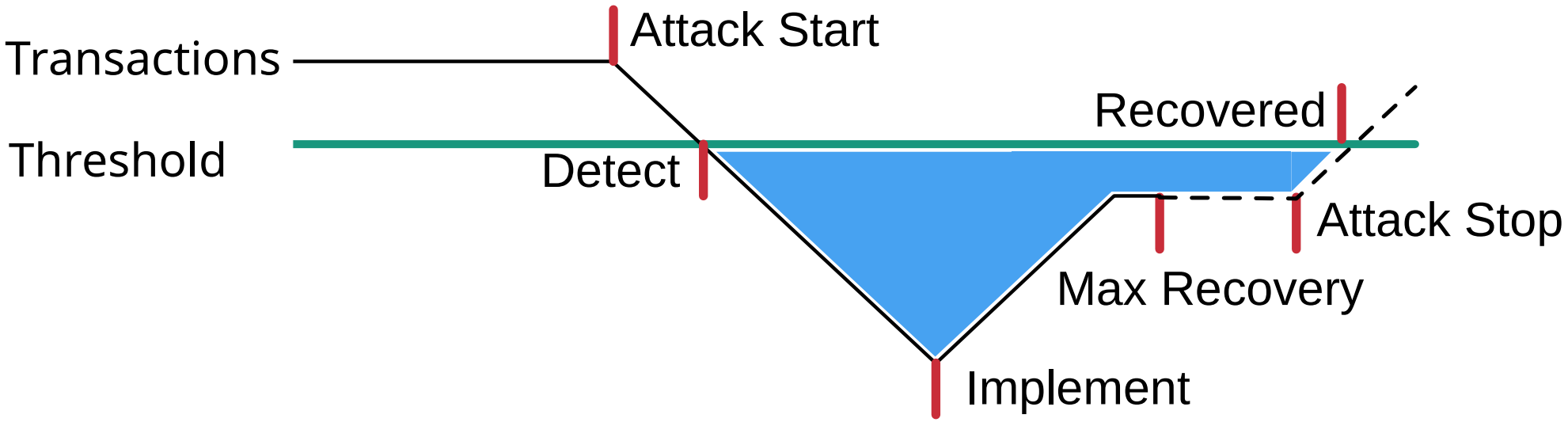
Response phase: Respond, Adjust, Measure

Learn phase: Learn (with input form other phases)

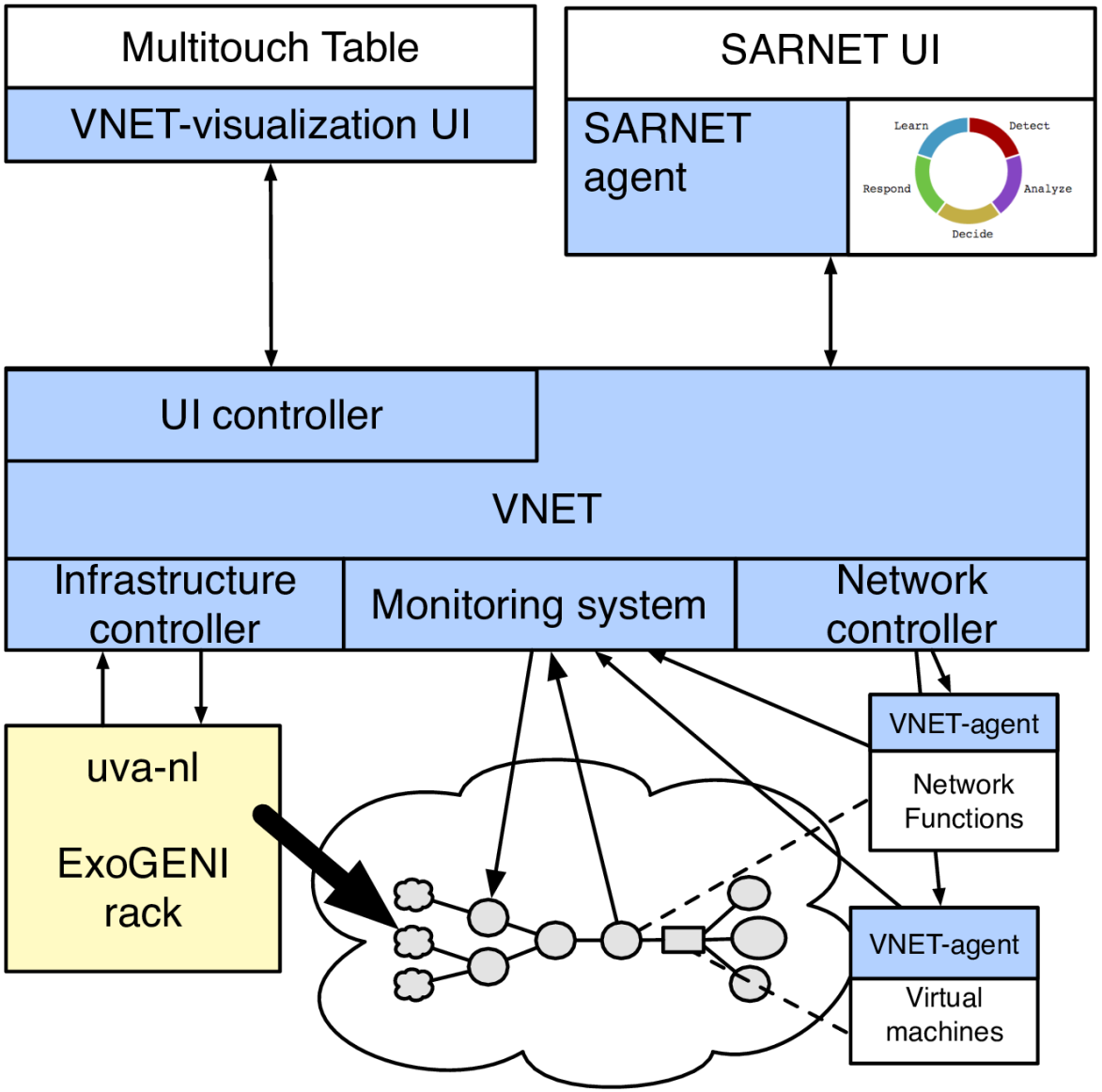
Effectiveness and Impact



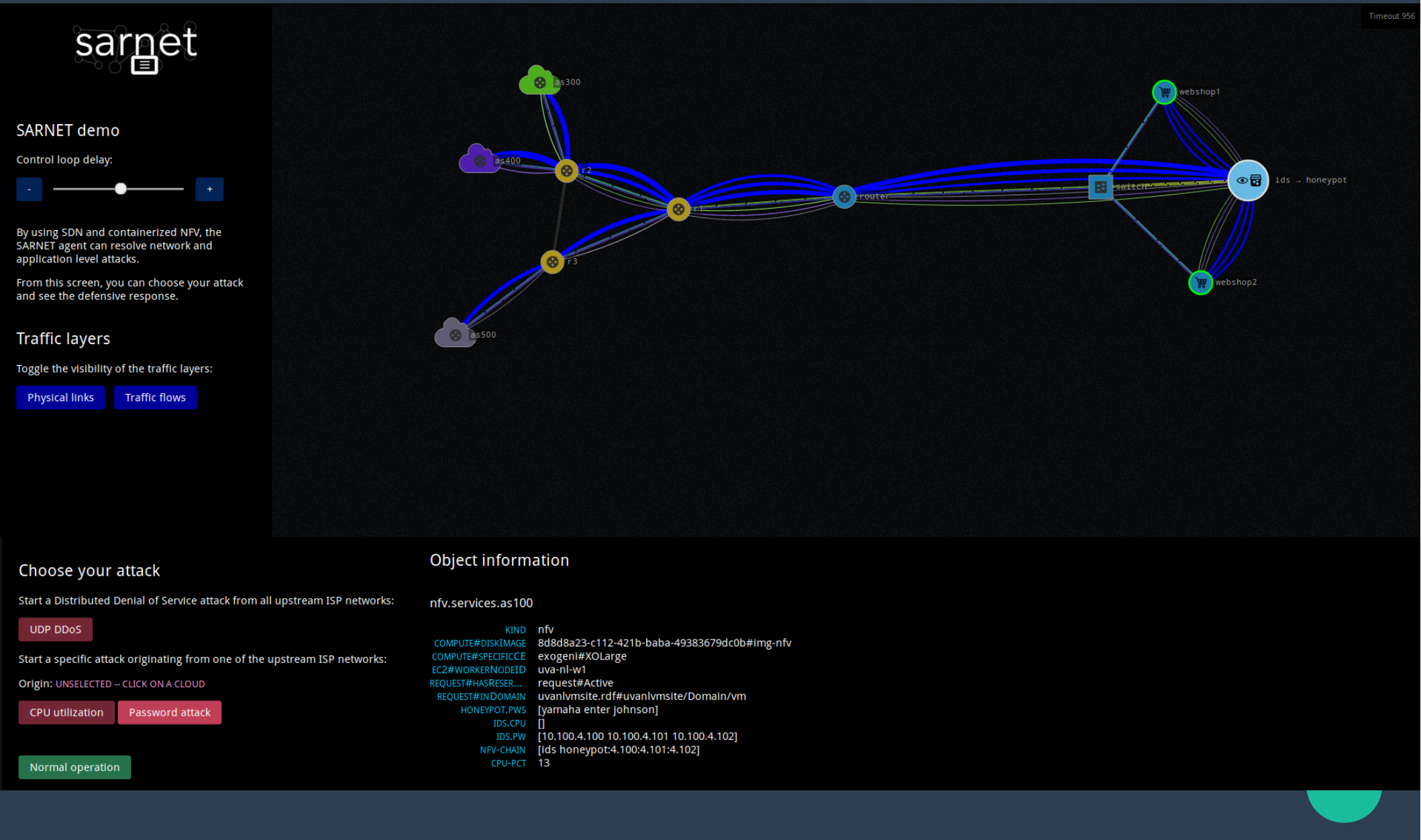
Effectiveness and Impact (2)



Environment



Scenario


sarnet
SARNET demo
Control loop delay:
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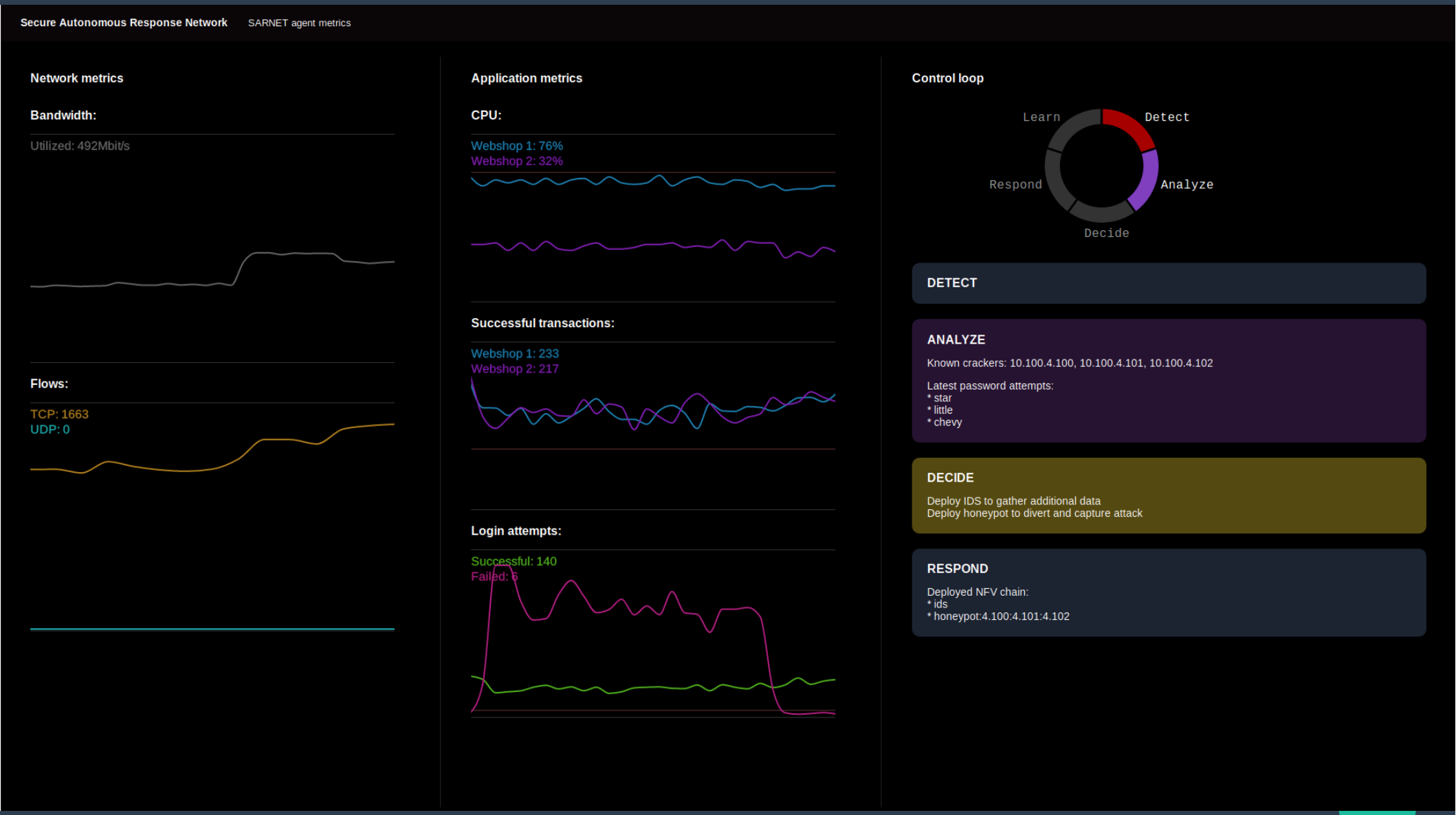
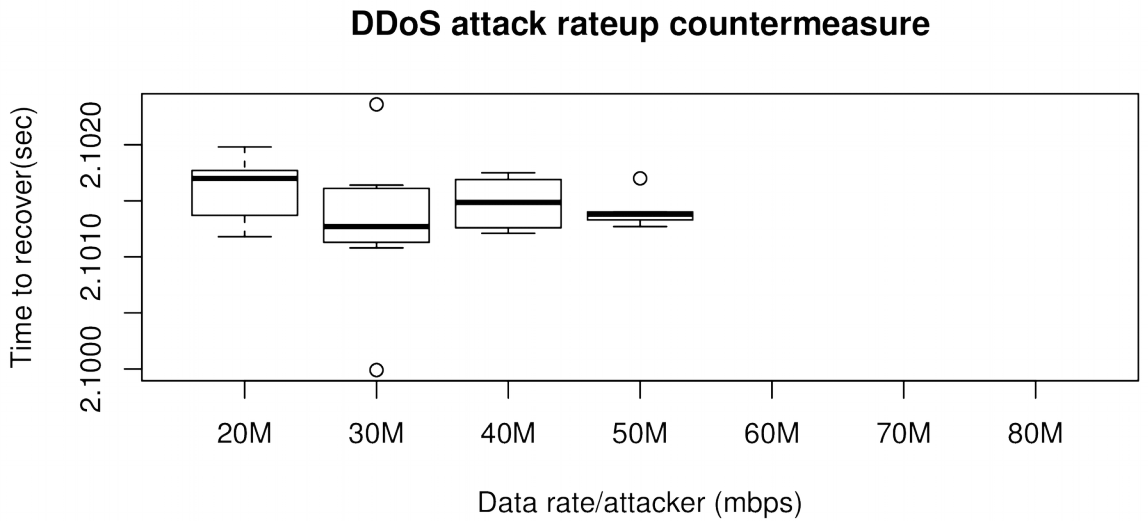
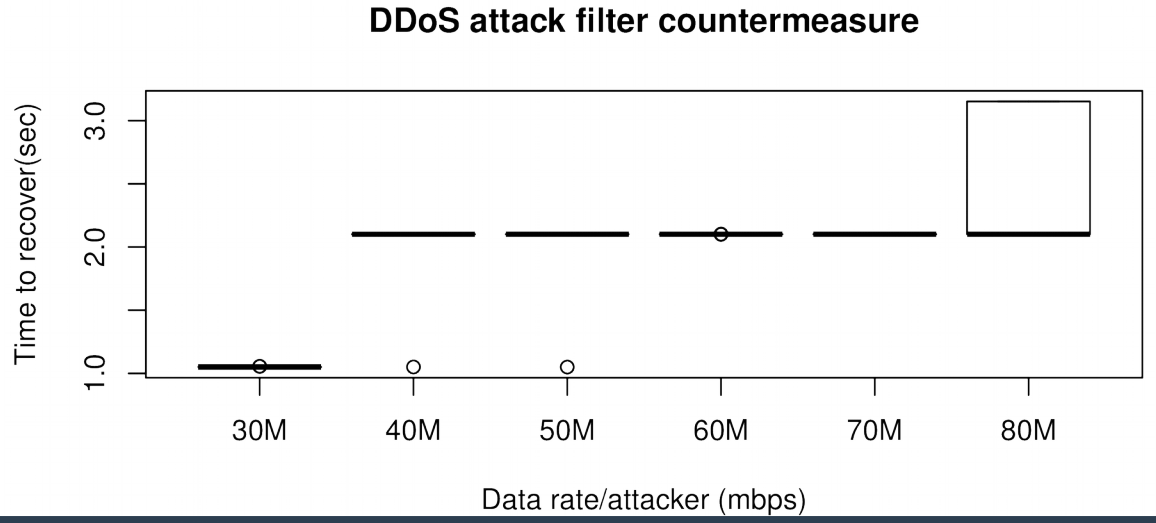
By using SDN and containerized NFV, the SARNET agent can resolve network and application level attacks.
From this screen, you can choose your attack and see the defensive response.
Traffic layers
Toggle the visibility of the traffic layers:
Physical links
Traffic flows
Timeout 956
as300
as400
as500
r2
r3
webshop1
webshop2
ids → honeypot
router
switch
Choose your attack
Start a Distributed Denial of Service attack from all upstream ISP networks:
UDP DDoS
Start a specific attack originating from one of the upstream ISP networks:
Origin: UNSELECTED -- CLICK ON A CLOUD
CPU utilization
Password attack
Normal operation
Object information
nfv.services.as100
KIND nfv
COMPUTE#DISKIMAGE 8d8d8a23-c112-421b-baba-49383679dc0b#img-nfv
COMPUTE#SPECIFICCE exogeni#XOLarge
EC2#WORKERNODEID uva-nl-w1
REQUEST#HASRESER... request#Active
REQUEST#INDOMAIN uvanlvmsite.rdf#uvanlvmsite/Domain/vm
HONEYPOT.PWS [yamaha enter johnson]
IDS.CPU []
IDS.PW [10.100.4.100 10.100.4.101 10.100.4.102]
NFV-CHAIN [ids honeypot:4.100:4.101:4.102]
CPU-PCT 13

Observables

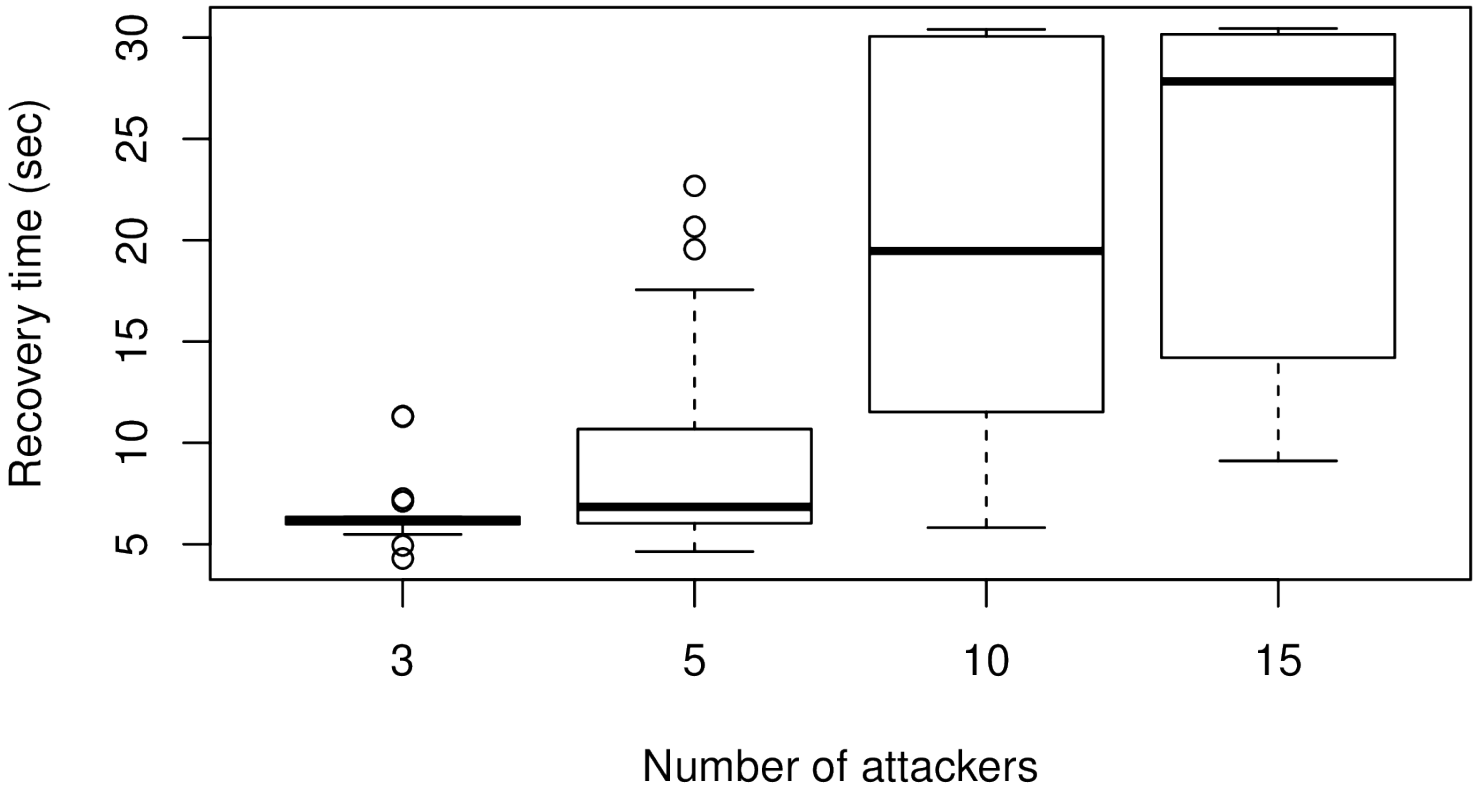


DDOS recovery time

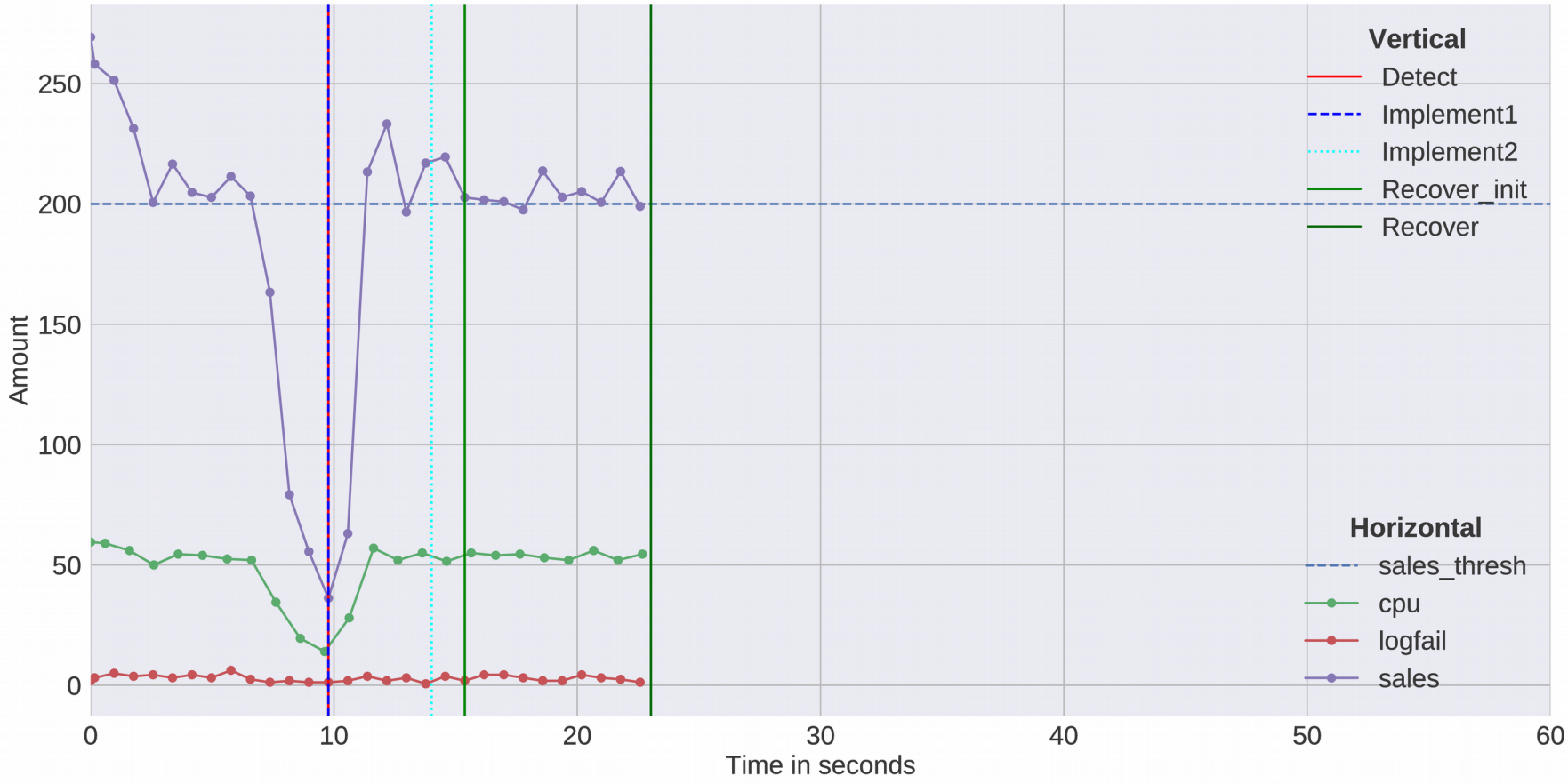




CPU attack recovery time



Example: DDoS attack



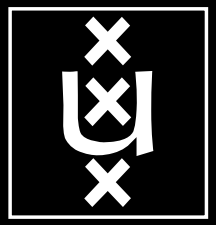
Conclusions

- **Detection and response times are dependent on attack characteristics.**

- **Determining effectiveness is a crucial first step towards ranking ranking countermeasures and self-learning.**

Future work

- **Metrics and Learning**
  - Adaptive observable thresholds
  - Combined attacks
- **Multi domain**
  - Cooperative vs non-cooperative domains
- **Intelligence sharing**
  - Sharing detection algorithms and countermeasures using containers



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