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DeMONS: A DDoS Mitigation NFV Solution

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Summary

- **Introduction**
- **Related Works**
- **DeMONS: DDoS Mitigation NFV Solution**
- **Evaluation**
  - Evaluation Methodology
  - Comparative Tests
  - Reputation Systems Test
- **Conclusion**

Introduction

- **Distributed Denial of Service (DDoS)**
    - IP spoofing and real source IPs
- **DDoS mitigation**
    - Capacity based
    - Filter based
- **Network Function Virtualization (NFV)**
    - Decoupling network functions from its associated hardware
    - Network services creation (Service Function Chaining)
- **Security provided by NFV**
    - Adaptability to network changes
    - Security Service Chaining (SSC)

Related Works

- **Holistic DDoS mitigation using NFV**
    - Generic architecture to attacks mitigation
    - Treatment by network layers
- **VFence: A Defense against Distributed Denial of Service Attacks Using Network Function Virtualization**
    - SYN Flood attacks mitigation
    - Three way handshake, blacklists and whitelists
- **A Collaborative DDoS Defence Framework using Network Function Virtualization**
    - SYN Flood attacks mitigation
    - Multidomain VFence application

Related Works

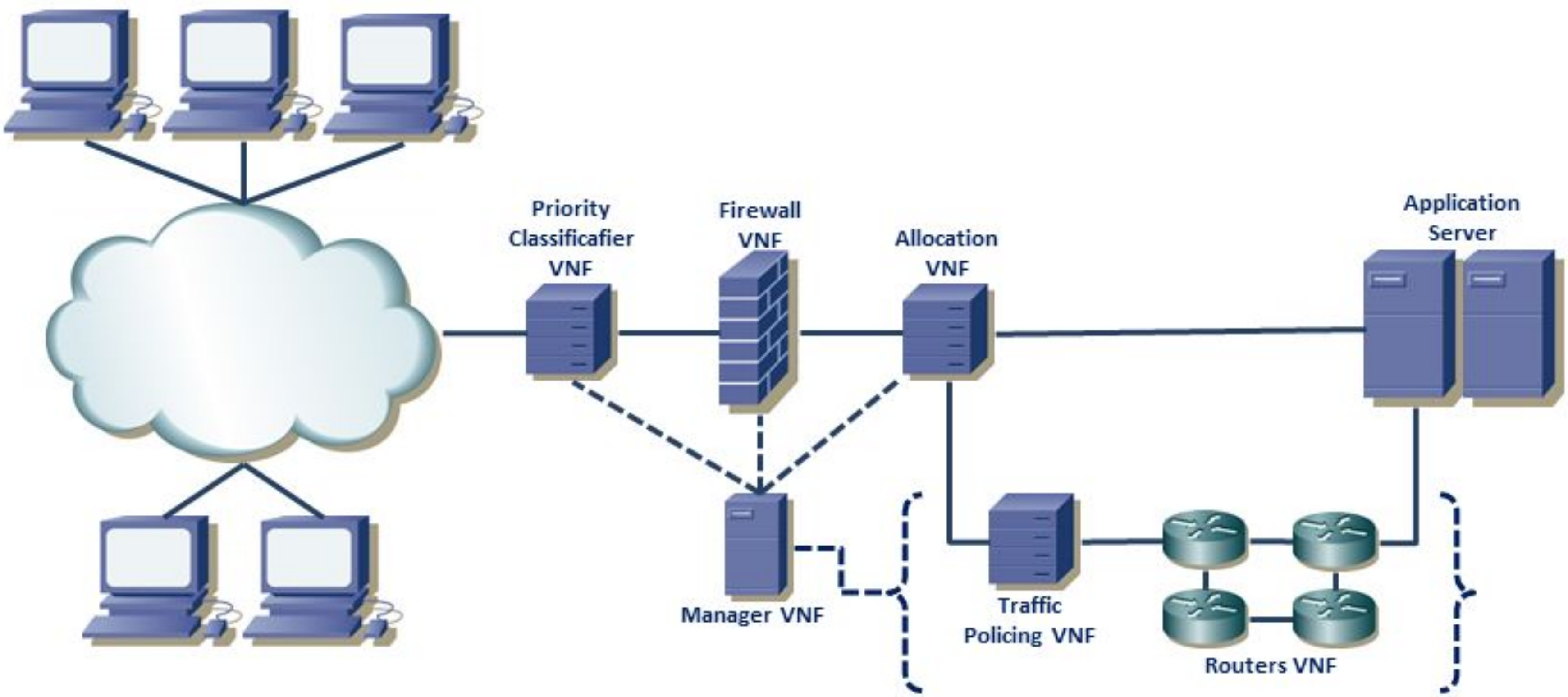
VGuard: A distributed denial of service attack mitigation method using network function virtualization

- **DDoS attacks mitigation**
- **Uncertainty levels to determine if flows are malicious**
  - Specially appropriated to botnets attacks
- **Based mostly on capacity**
  - Only discards flows when there are a 100% certainty
- **VGuard architecture**
  - Traffic classifier
  - Firewall Virtualized Network Function
  - DDoS Virtualized Network Function
  - High and low priority tunnels

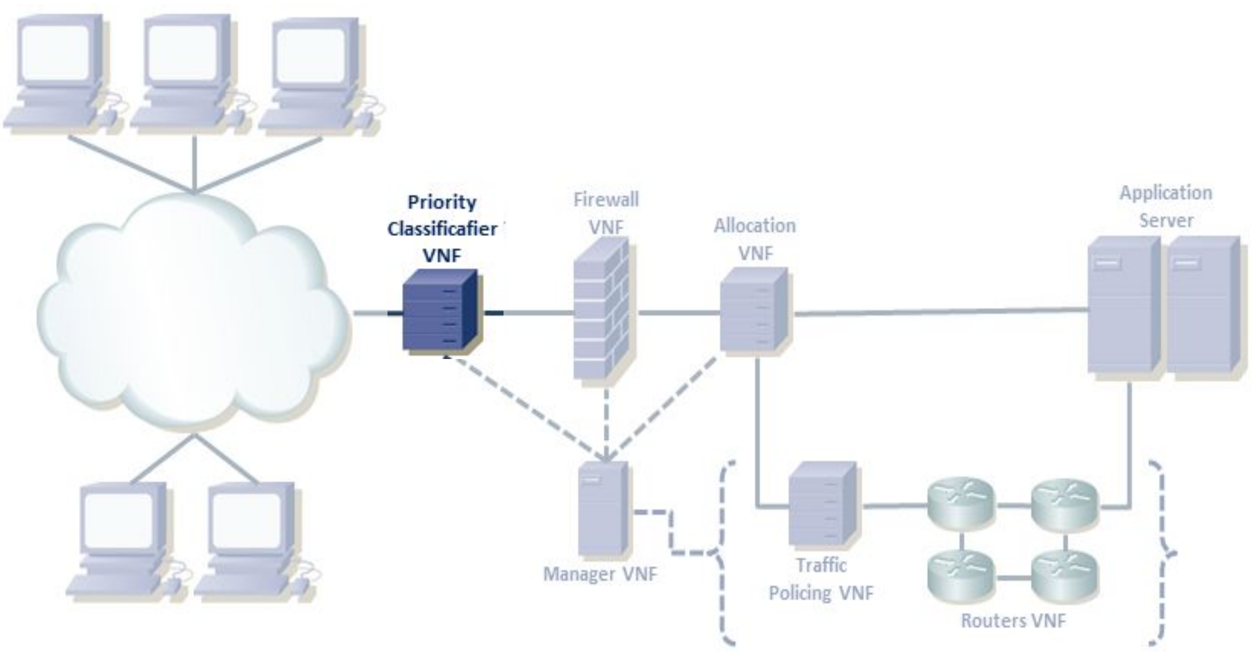
DeMONS: DDoS Mitigation NFV Solution

- **DDoS attacks mitigation**
- **Uncertainty levels to determine if flows are malicious**
  - Specially appropriated to botnets attacks
- **Hybrid approach - based on capacity and filter**
  - Discards all the flows considered 100% malicious
  - Partially discards flows considered suspects in a overloaded scenario

DeMONS: DDoS Mitigation NFV Solution



DeMONS: DDoS Mitigation NFV Solution



Priority classifier

Determines the flow priority according to its confidence ([0;1])

May use IDS, IPS or DPI techniques

User policies may be included

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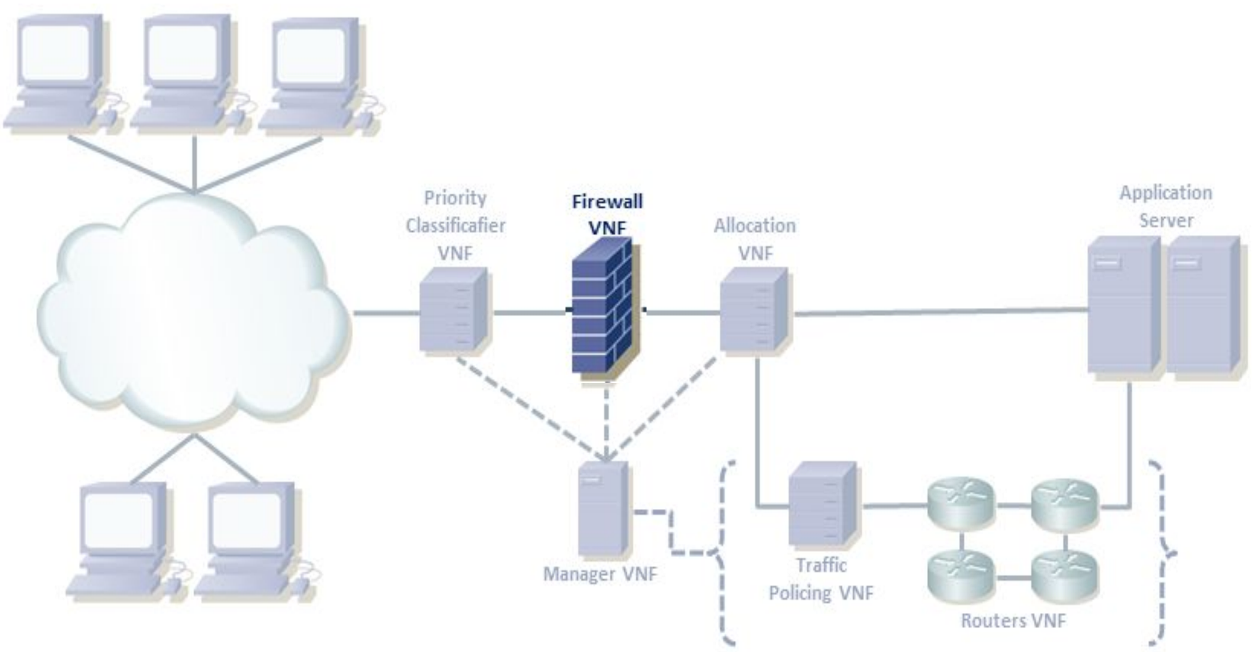

Firewall

Blocks all 0 priority flows

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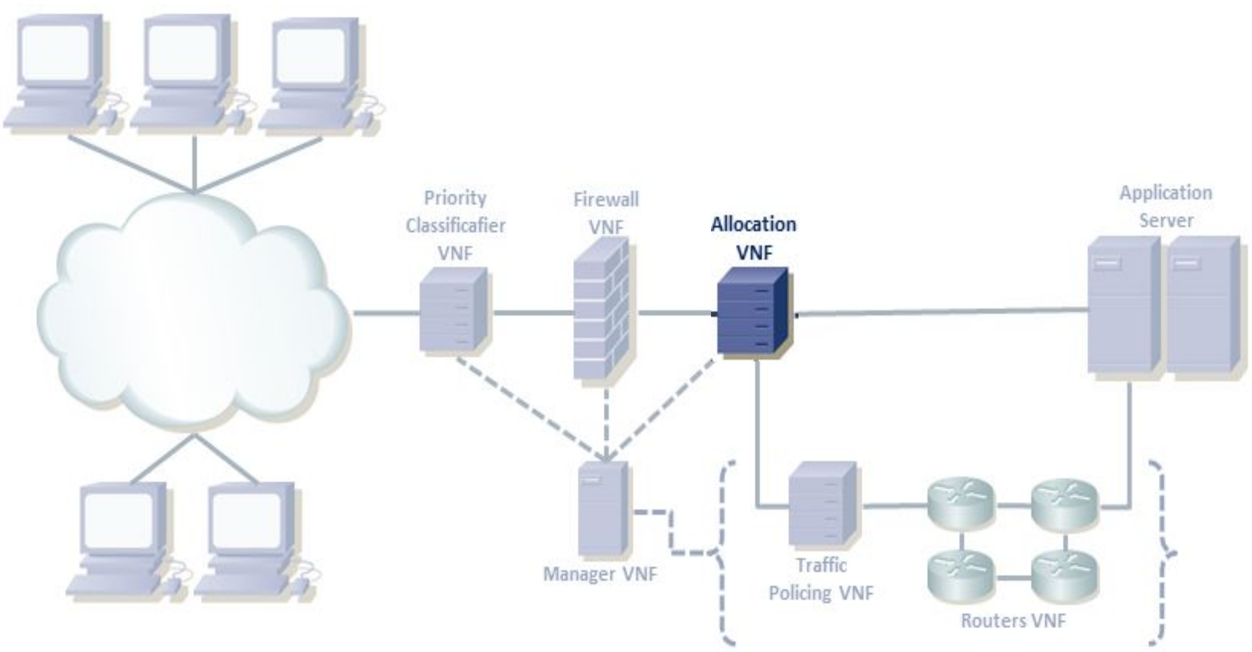

Allocation

Executes an allocation algorithm to insert flows in the low or high priority tunnel

Dynamic algorithm - adapts to network changes

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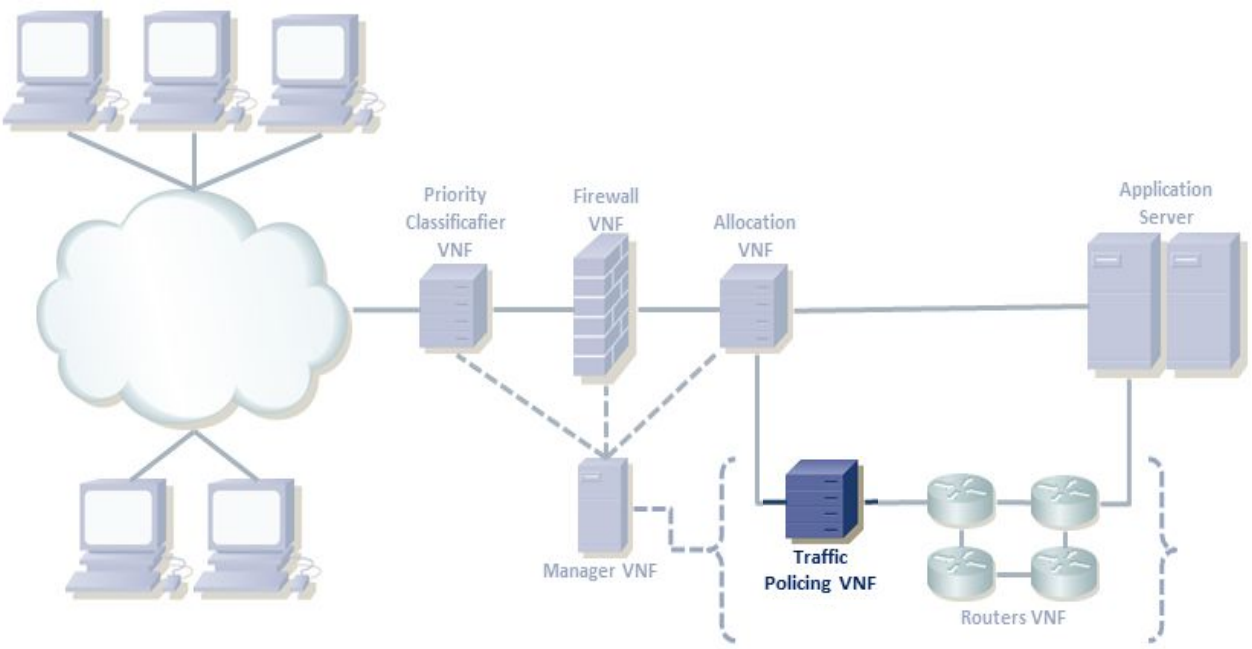

Traffic policing

Operates in the low level tunnel

Applies partial discarding policies

Activated in an overloaded tunnel scenario

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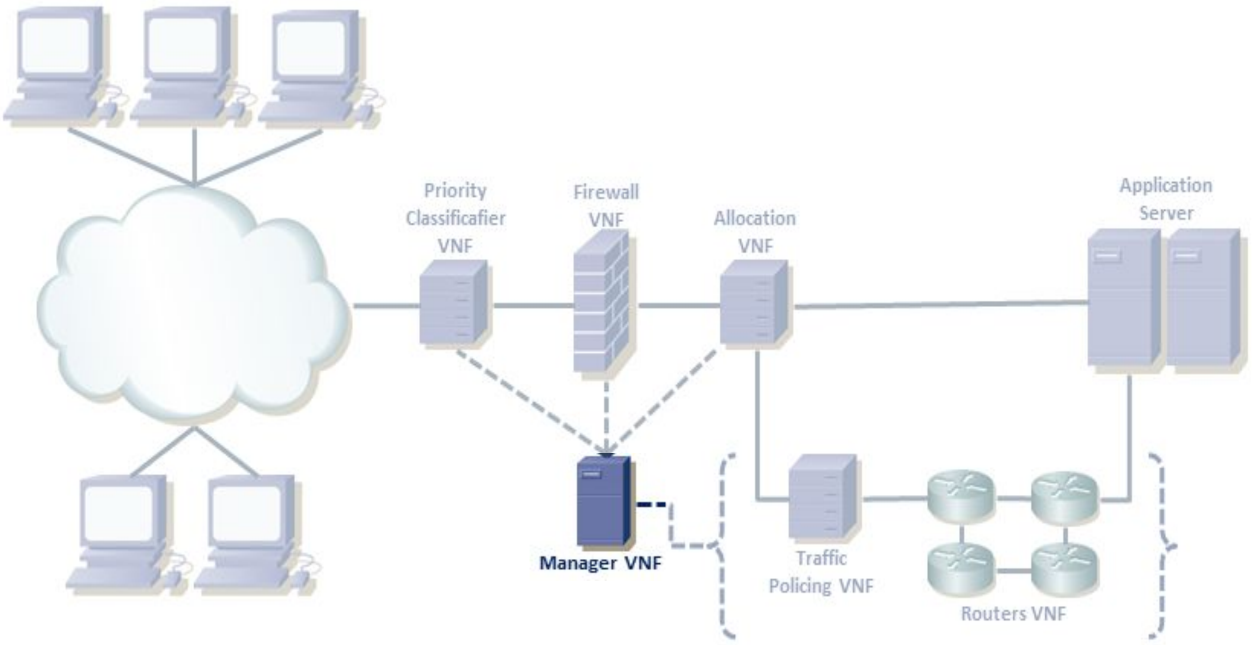


Manager

It does not replace the MANO, but indicates actions according to the security topology analysis

Turns up or down the low priority tunnel

Request to MANO scaling operations

DeMONS: DDoS Mitigation NFV Solution

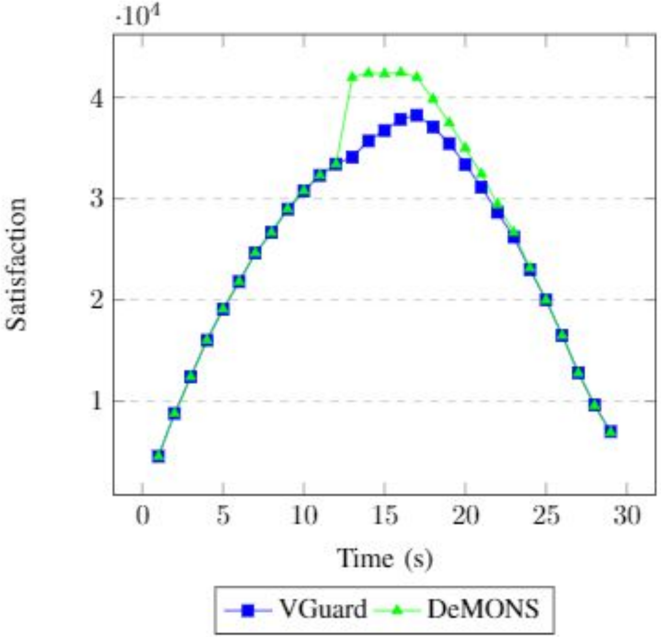
Flow allocation algorithm		
	VGuard	**DeMONS**
Underload	Alternate	Alternate or in the available tunnel
Traffic limitation	Selective mode	Selective mode
Flow balancing	-	In the selective mode entrance
Selective mode analysis	Priorities average	Lowest priorities
Overload	Unconditional allocation	Conditional allocationl

Comparative Tests

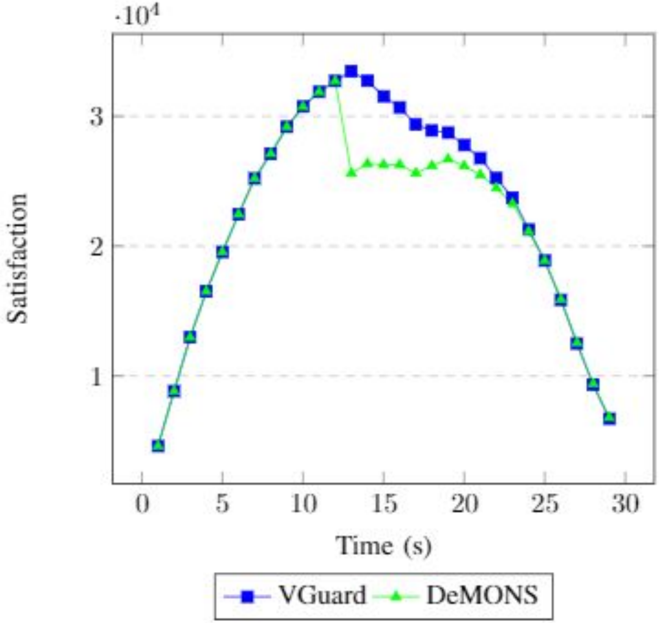
- **DeMONS**
  - Minimum discarding of 10%, medium restirctivity
- **VGuard**
  - Original dynamic flow allocation version
- **Tests configurations**
  - Tunnel capacity (both): 50 Mbps
  - Selective mode: 97%
  - Benign flows: 100 Kbps - degradation of 10 Kbps (0,4 <= p <= 1)
  - Malicious flows: 100 Kbps - no degradation until the attack ending (0,1 <= p <= 0,4)
  - Duration: 30 seconds
- **Evaluation metric**
  - Aggregated and weighted satisfaction

Comparative Tests

- Scenario 01: benign flows and maximum total traffic of 99.1 Mbps



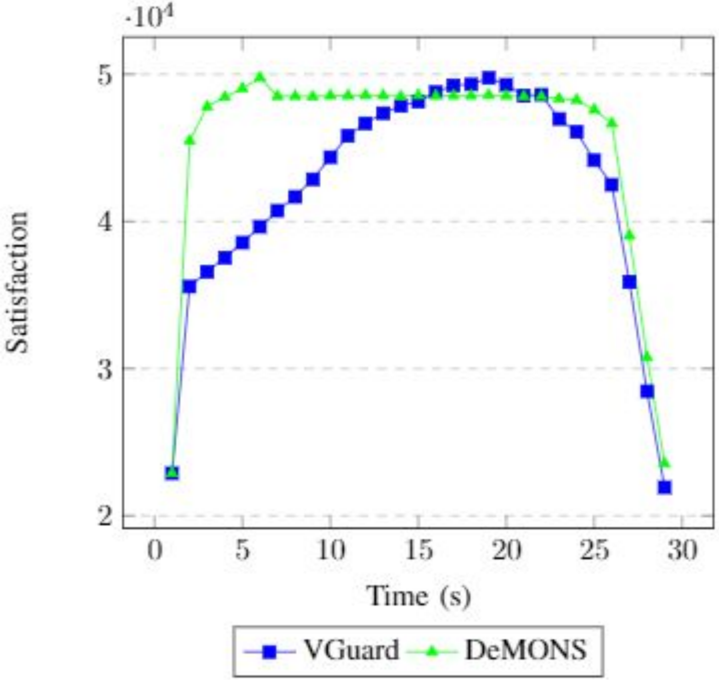
High Priority Tunnel



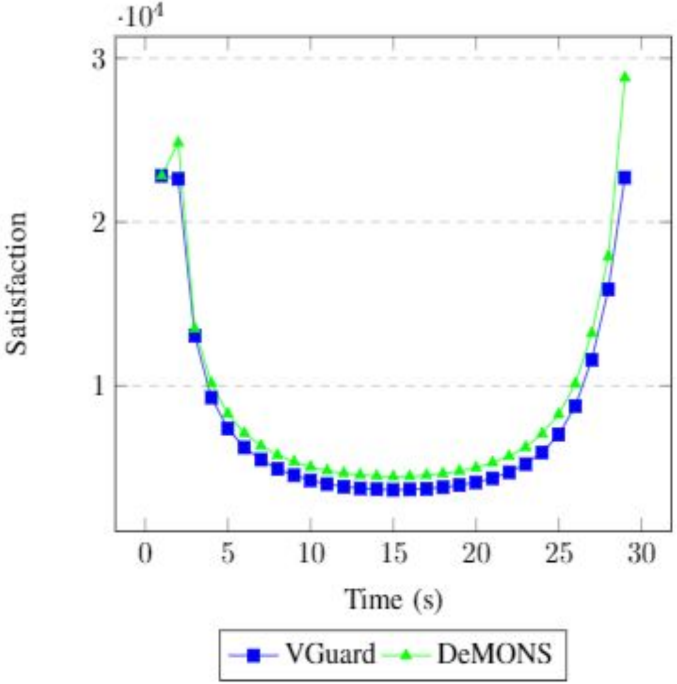
Low Priority Tunnel

Comparative Tests

- **Scenario 02: benign flows and maximum total traffic of 506 Mbps**



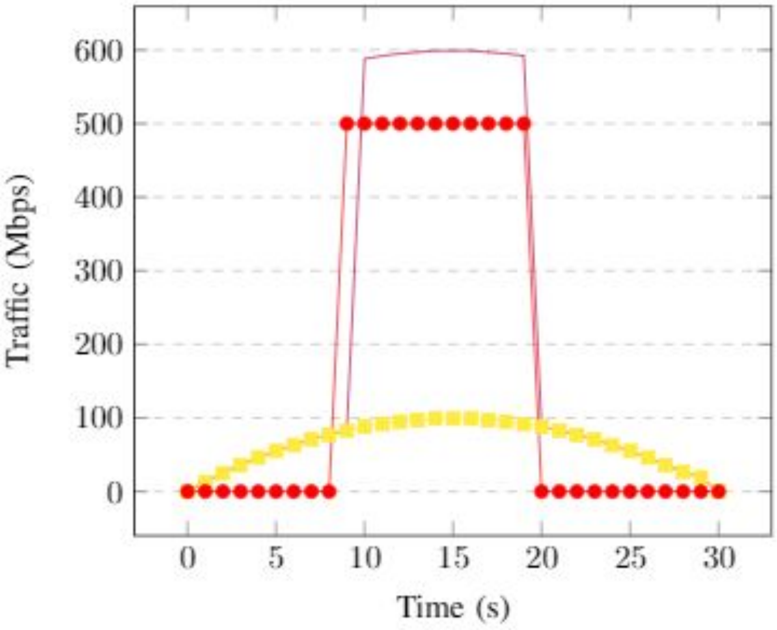
High Priority Tunnel



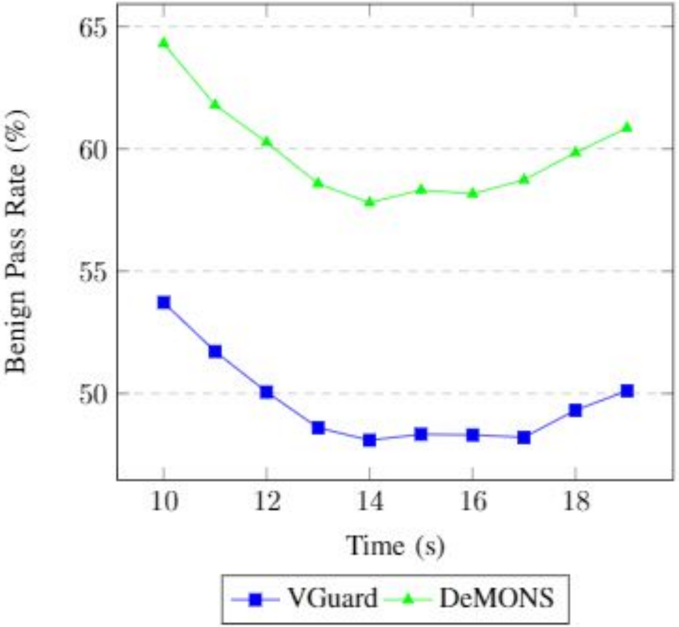
Low Priority Tunnel

Comparative Tests

- **Scenario 03: DDoS flood attack**



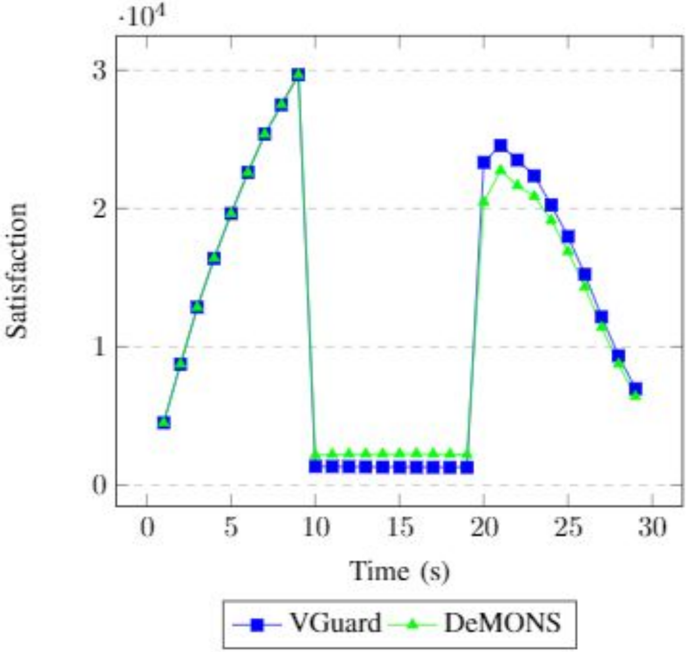
Attack Scenery



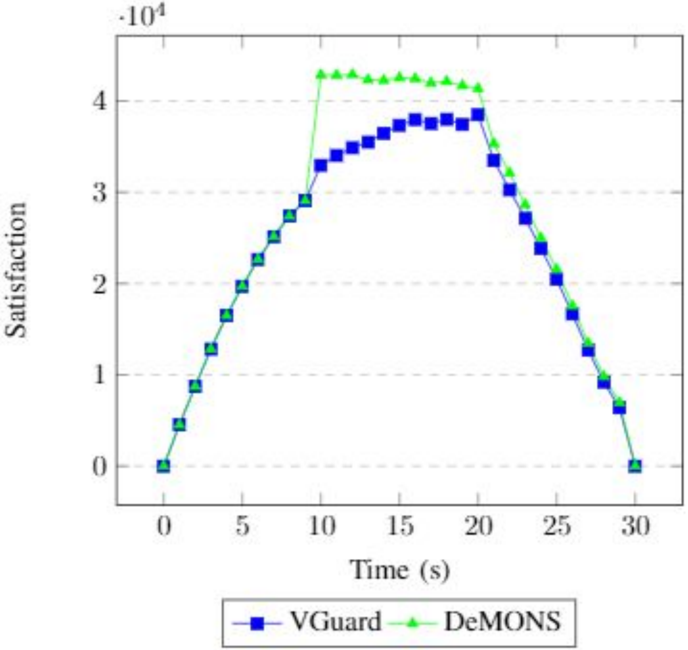
Benign Traffic Delivery

Comparative Tests

- **Scenario 03: DDoS flood attack**



Low Priority Tunnel



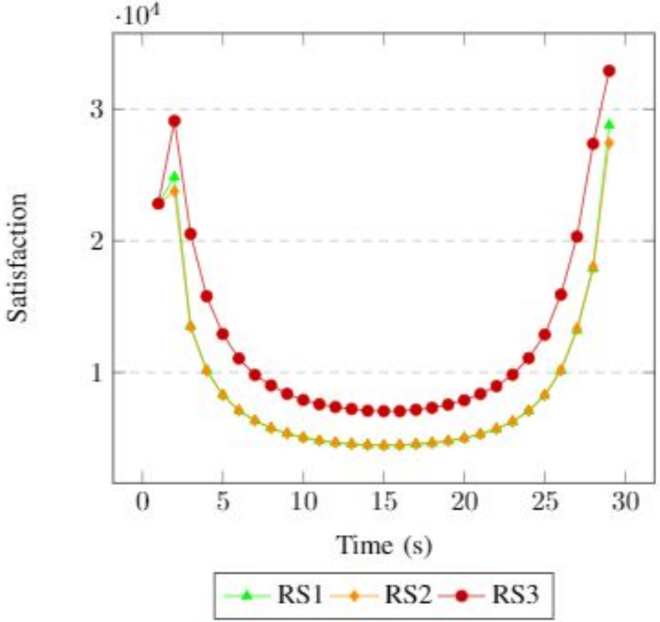
High Priority Tunnel

Reputation System Tests

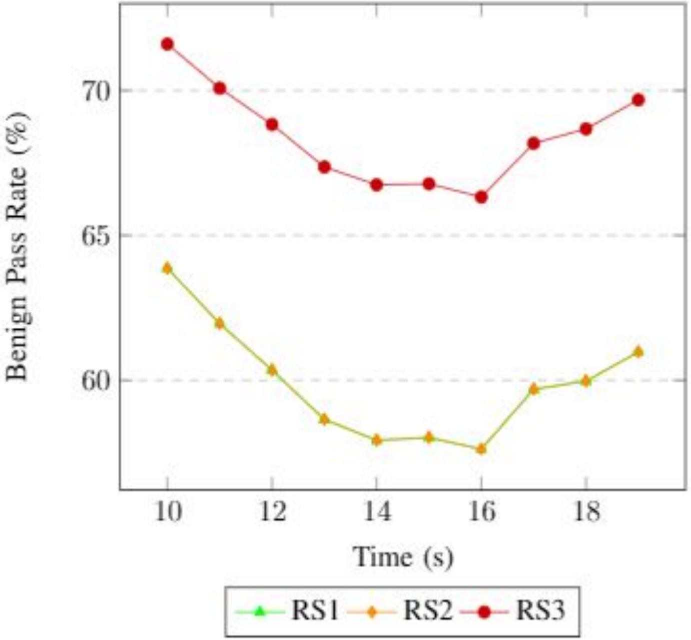
- **Different reputation systems integrated to the traffic policing module**
- **RS1**
  - Minimum discarding of 10%, medium restirctivity
- **RS2**
  - No minimum discarding, low restrictivity
- **RS3**
  - Discarding associated to total traffic excess, high restrictivity

Reputation System Tests

- Scenario 03: DDoS flood attack



Low Priority Tunnel



Benign Traffic Delivery

Conclusion

- **DeMONS solution viability**
  - Similar results to VGuard in benign traffic overload sceneries, but DeMONS reaches high priority tunnel satisfaction stability more fastly
  - Results superior to those of VGuard in the tested DDoS scenario, being able to 10% to 15% more of the amount of benign traffic delivery
  - Possibility of adapting system modules according to usage policies and scenarios
- **Future works**
  - Analysis of new reputation systems and verification of suitability in different scenarios
  - Analysis of the impact and time of the activation and deactivation of the architecture modules
  - Simulation of new DDoS scenarios
  - Solution Implementation in real NFV platform (Click-on-OSv - FENDE)

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Thanks!!

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