DDoS Attack Mitigation with Firewall on Demand (FoD) and RARE

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Demo Overview

A use case of Distributed Denial of Service (DDoS) attack mitigation based on **GÉANT open-source software solutions:**

- **RARE:** Router for Academia, Research & Education
- **FoD:** Firewall on Demand

RARE:

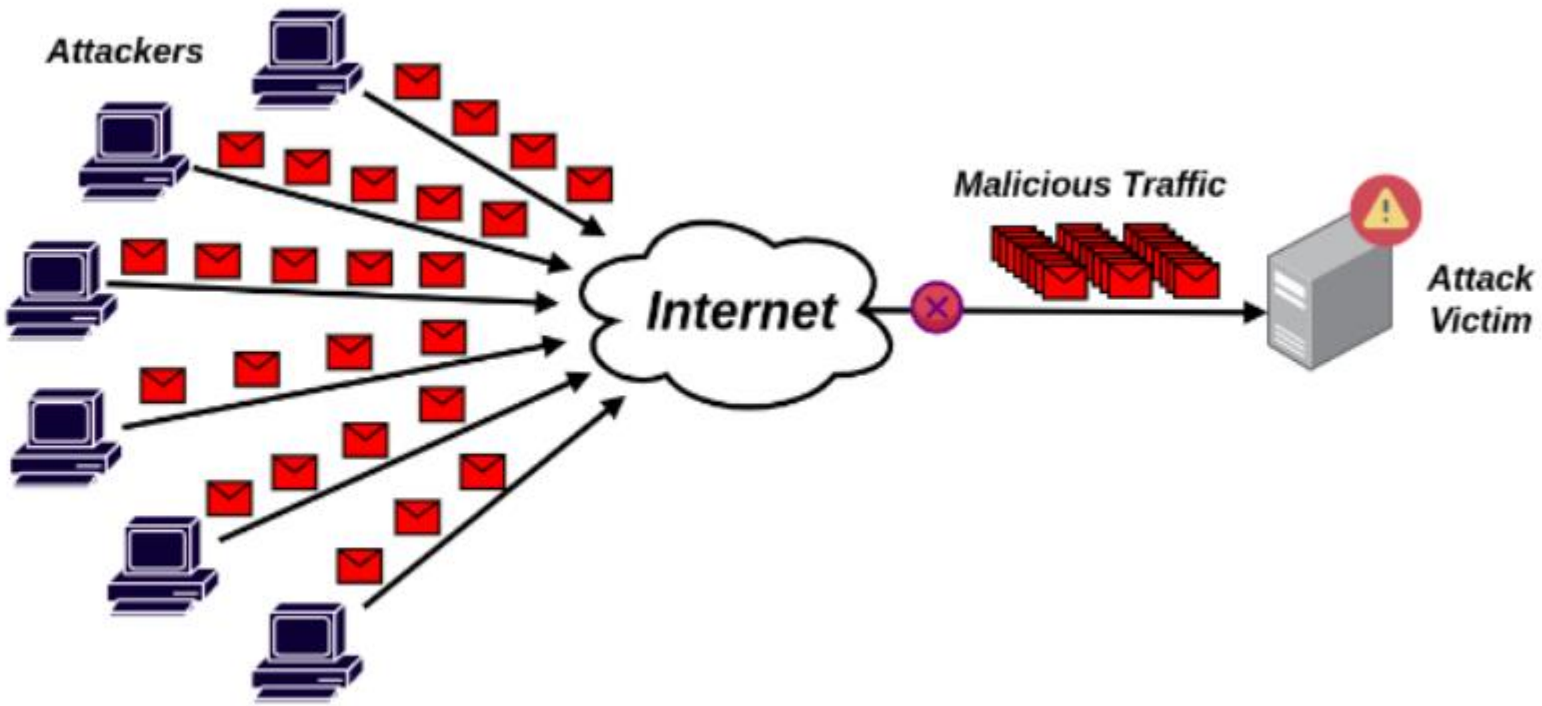
- Solutions for Research & Education (R&E) use cases based on routing software platforms
- Developed under GN5-1, Work Package 6

FoD:

- System and GÉANT service for effective DDoS attack mitigation
- Developed under GN5-1, Work Package 8

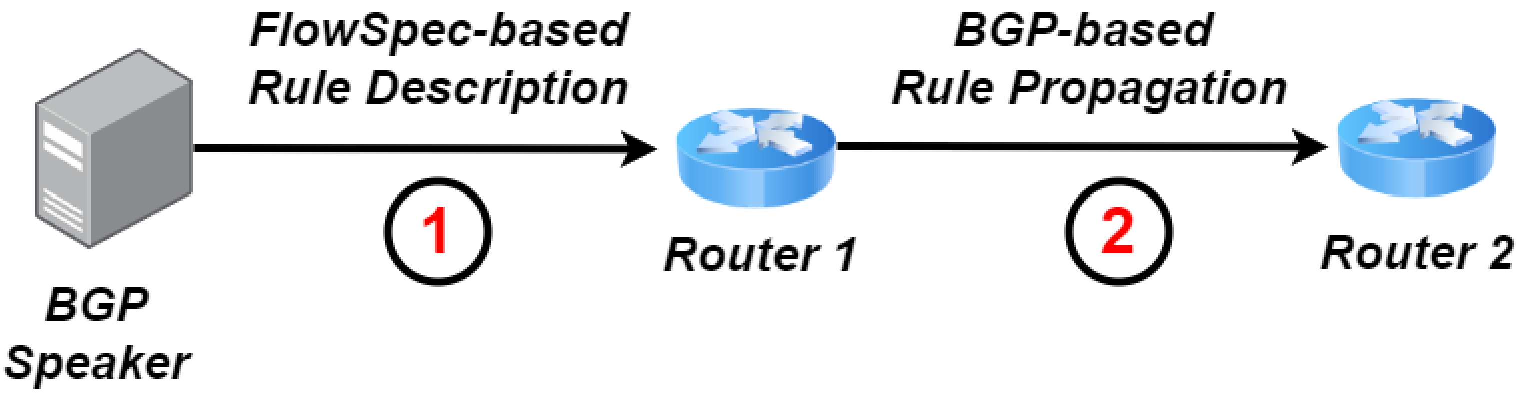
Background: DDoS Attacks

- Multiple Internet sources (e.g. Internet of Things – IoT devices) flood victims with massive traffic to deplete:
  - System resources (e.g. processors and/or memory)
  - Bandwidth of links leading to victims
- Victims are unable to process legitimate traffic, which is eventually discarded



Background: FlowSpec-based DDoS Attack Mitigation

- **Flow Specification (FlowSpec)** matches traffic based on flow characteristics that may involve:
  - source/destination IP addresses
  - source/destination port numbers
  - protocol types (e.g. TCP, UDP, ICMP)
- Matched traffic may be dropped, rate limited or redirected for further inspection
- **Border Gateway Protocol (BGP)** enables the propagation of FlowSpec rules to upstream routers, thus facilitating distributed DDoS attack mitigation
- FlowSpec rules are usually triggered by a **BGP Speaker** (e.g. ExaBGP)

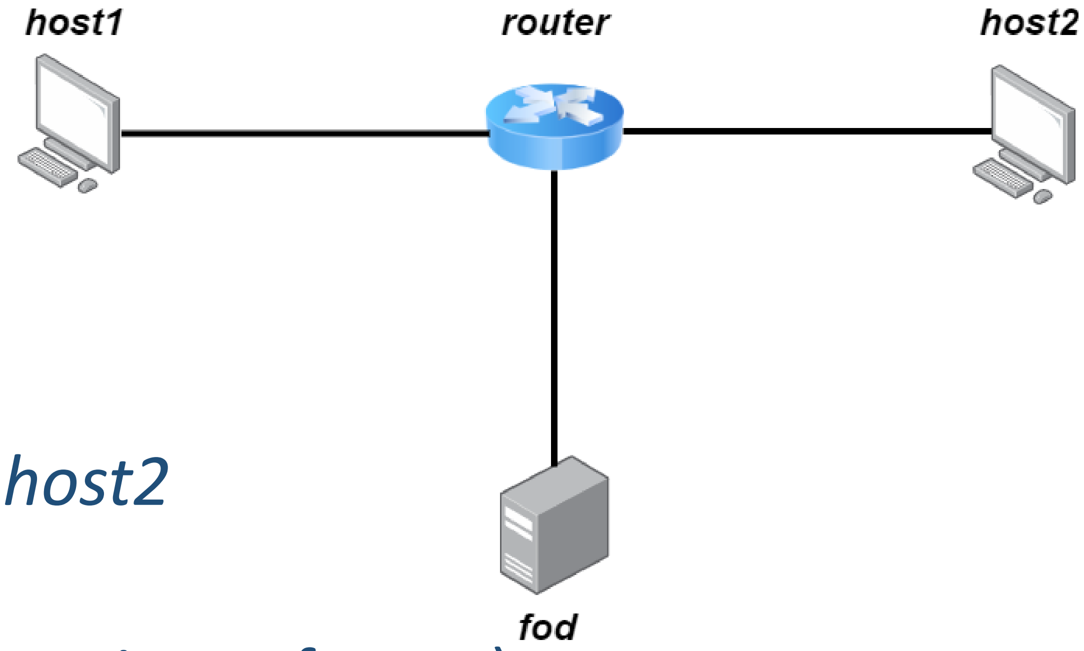


Firewall on Demand – FoD

FoD relies on BGP FlowSpec for DDoS attack mitigation

- **FoD characteristics:**
  - Mitigation actions are triggered by users themselves
    → Users may start, edit and stop the mitigation process
  - Multi-tenant, eduGAIN-based
  - Involves both a User Interface (UI) and a REST API
  - Based on the ExaBGP BGP speaker to establish neighborships with routers and trigger DDoS attack mitigation
- **GÉANT FoD service instance:**
  - Enables mitigation within the GÉANT core
  - NREN NOC admins trigger mitigation actions without contacting GÉANT NOC
  - Productive for more than 8 years

Demo Setup



Components:

- ***host1***: Simulates an ICMP flood attack against *host2*
- ***host2***: The attack victim
- ***router***: RARE platform (relying on the ***freeRtr*** routing software)
  - → Forwards network traffic
  - → Exports NetFlow data to the FoD platform for further analysis
  - → Filters traffic based on BGP FlowSpec
- ***fod***: The Firewall on Demand (FoD) platform
  - → Analyzes the received NetFlow records
  - → Triggers DDoS attack mitigation

Automated Setup based on Containerlab

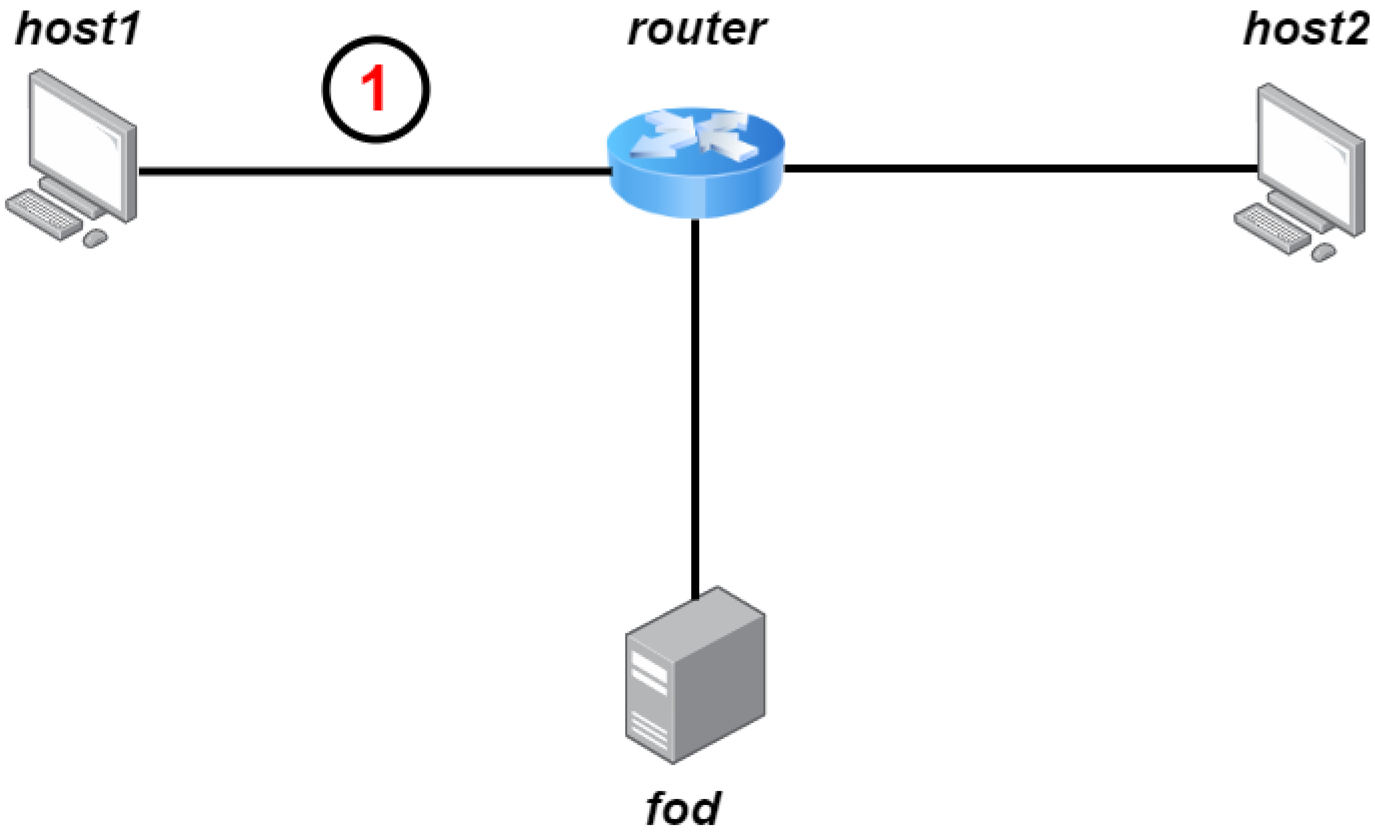
- The demo setup is automated based on **Docker** and **Containerlab**

Containerlab:

- Includes Command Line Interface (CLI) tools for creating and managing container-based networking labs
- Handles the networking between the containers of the lab topology

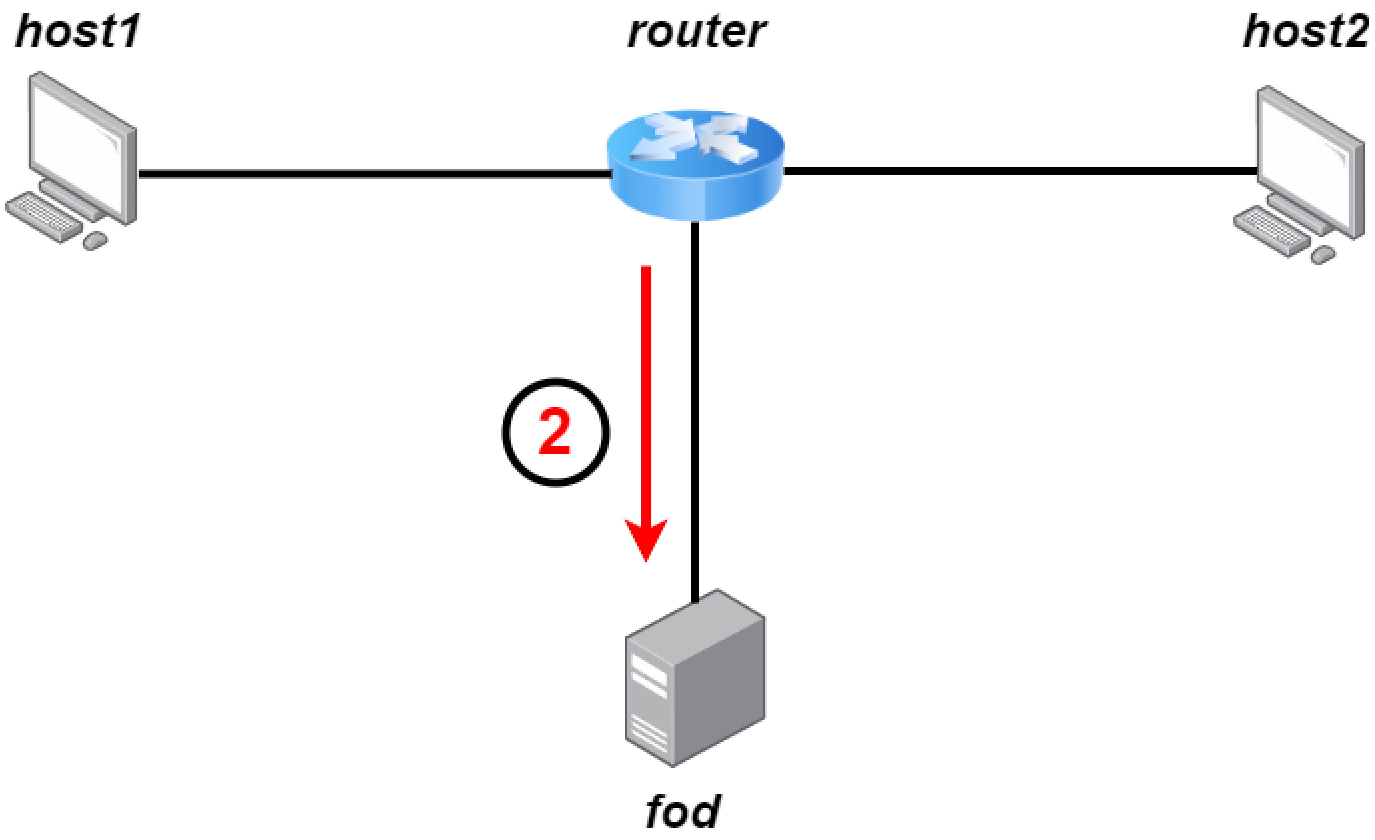
→ *topology.clan.yml*: Contains general information about the lab and involves details about the container networking

Demo Process (1/5)



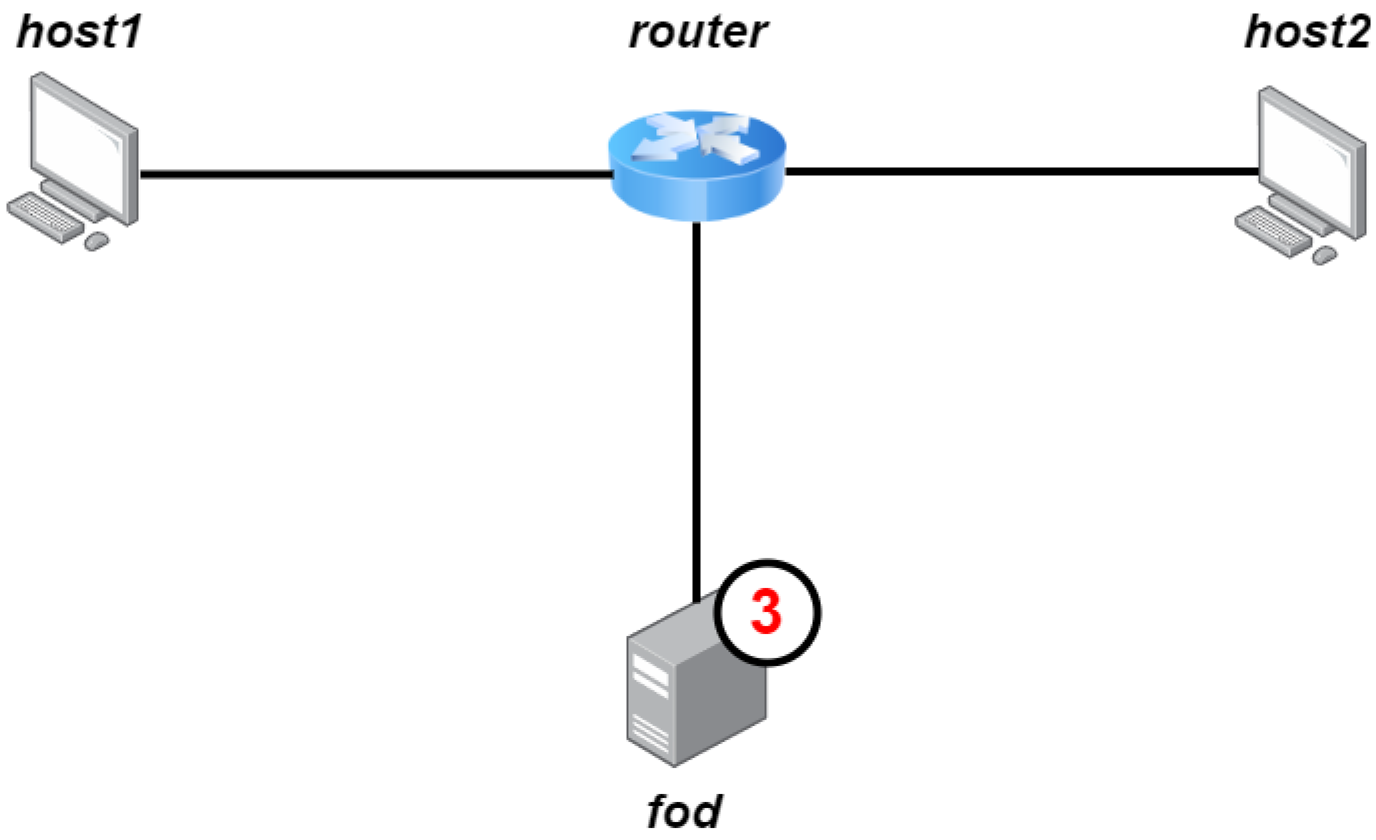
An **ICMP flood attack** will be executed from *host1* against *host2* using the **hping3** traffic simulator

Demo Process (2/5)



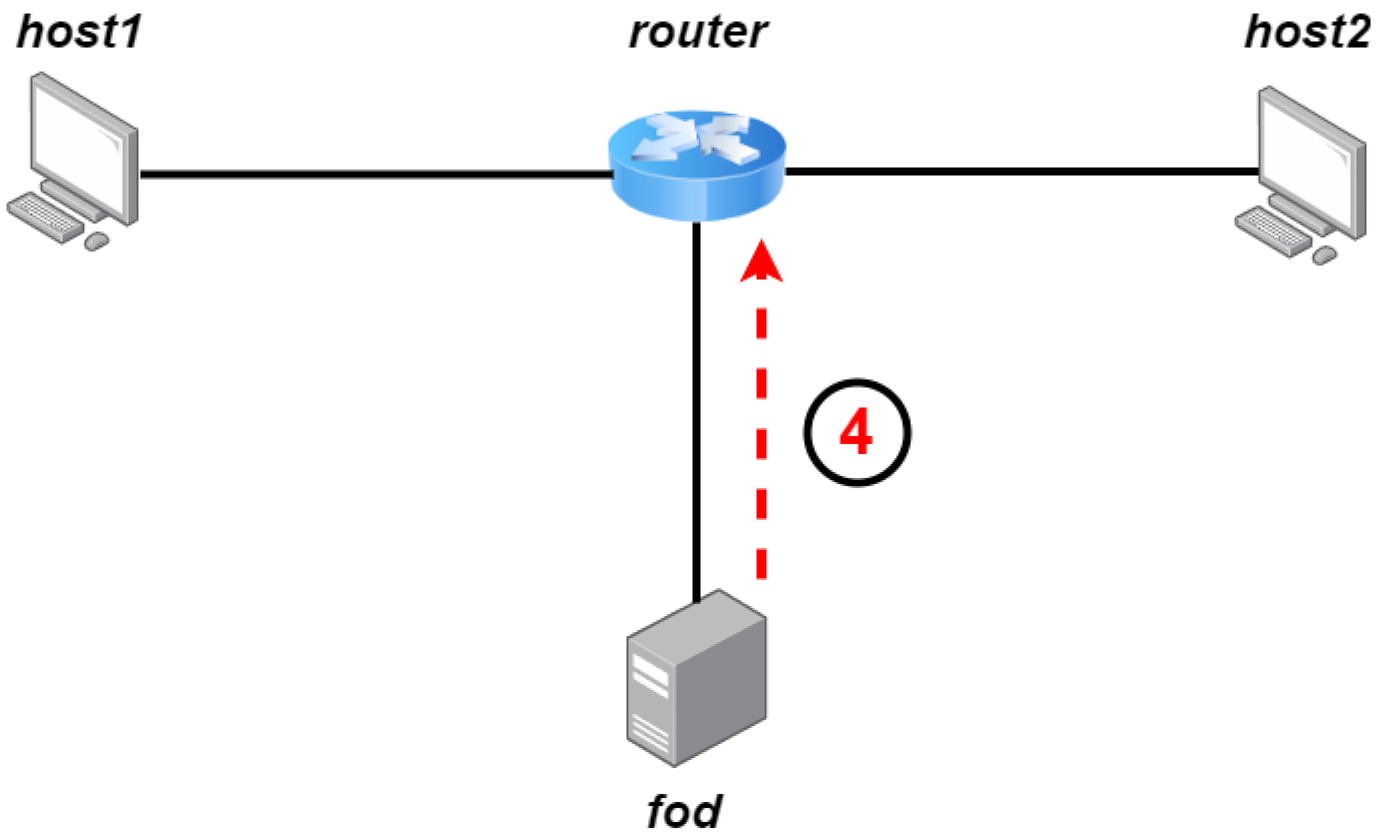
NetFlow records will be exported from the *router* to the *fod*

Demo Process (3/5)



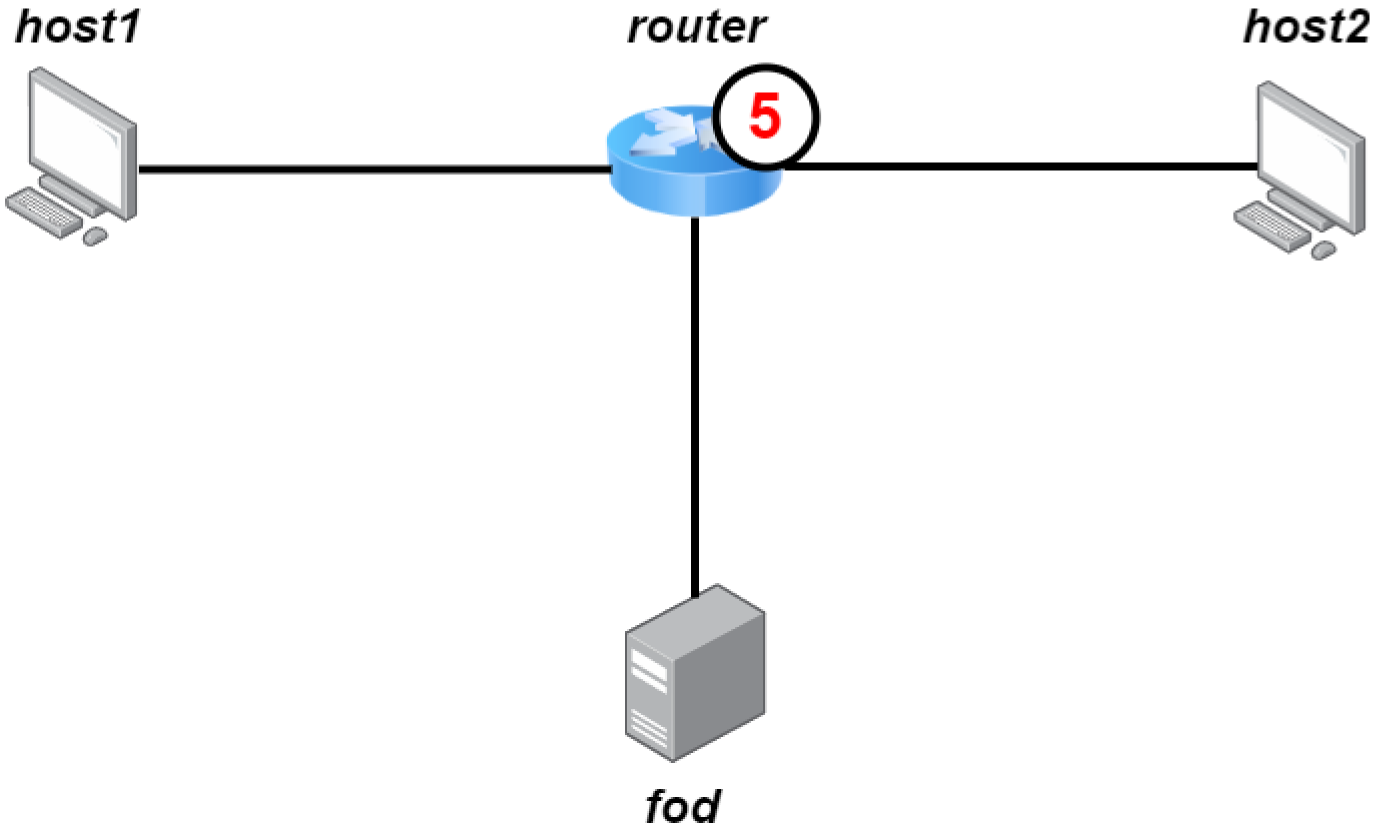
NetFlow data will be analyzed to detect an **ongoing attack** and determine the appropriate **filtering rules** (based on the attacker source IP)

Demo Process (4/5)



The **ExaBGP BGP speaker** will install appropriate mitigation rules to the *router* based on **BGP FlowSpec**

Demo Process (5/5)



Malicious traffic from the attacker IP will be dropped at the *router*

How to Replicate

1) Clone the demo repository:

→ *git clone https://github.com/nkostopoulos/rare-fod*

2) Deploy the Containerlab topology:

→ *containerlab deploy --topo topology.clab.yml*

3) Execute the appropriate commands to configure the Docker containers:

→ *python3 setup.py*

4) Verify that mitigation takes place by inspecting the "ifconfig" statistics for hosts *host1* and *host2*

Thank You

RARE mailing list: gn5-1-wp6-t1-rare@lists.geant.org

www.geant.org

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