DefensePro X v1.5.1
Demo Lab Guide

Last Update: 12.05.2024

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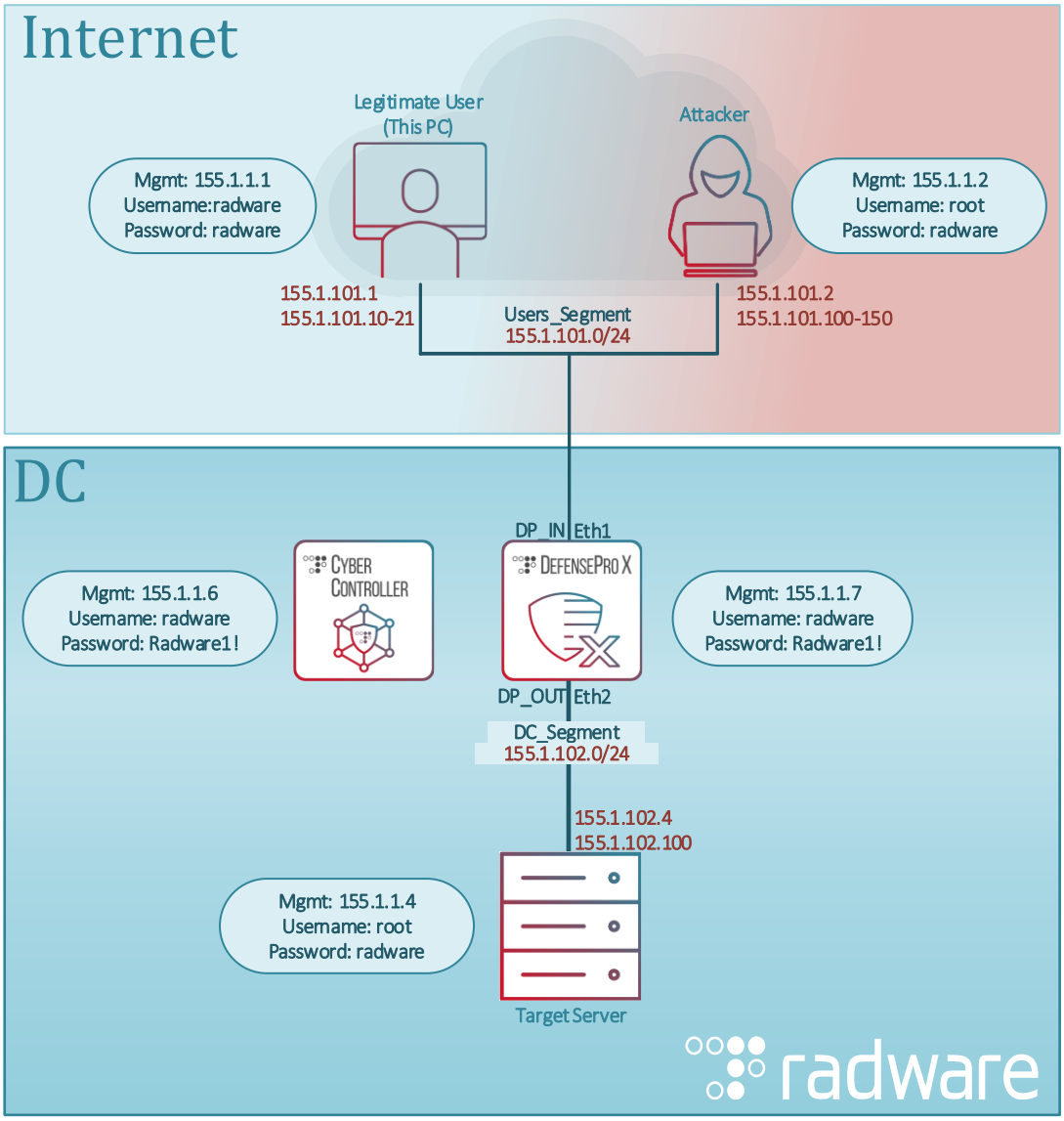
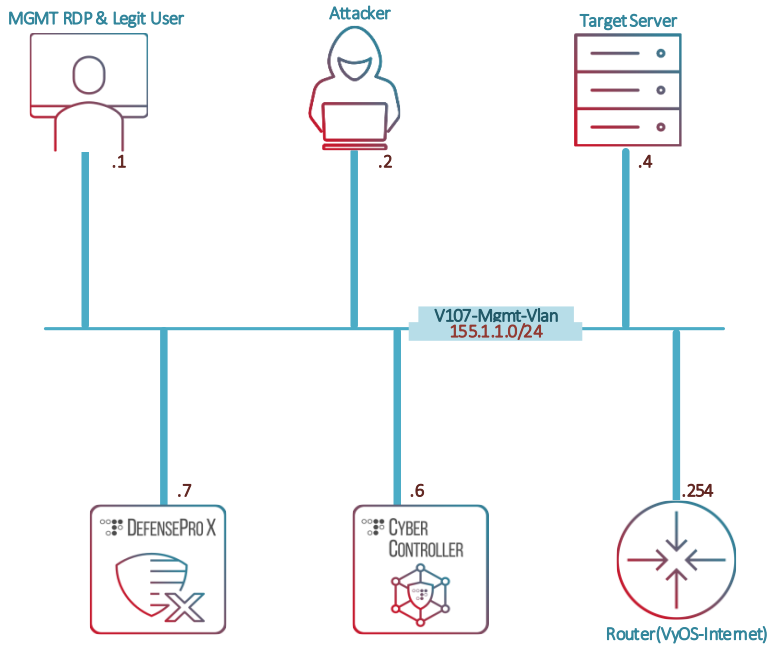
LAB ENIVIRONMENT

Topology Data Segment



Topology Management Segment



Lab Environment Credentials

Device	User	Password	MGMT IP
Cyber Controller	radware	Radware1!	Internal MGMT: 155.1.1.6
DefensePro X	radware	Radware1!	Internal MGMT: 155.1.1.7
Attacker	root	radware	Internal MGMT: 155.1.1.2
Target Server	radware	radware	Internal MGMT: 155.1.1.4
Grafana	radware	Radware1!	Internal MGMT: 155.1.1.4

Management (MGT) Station

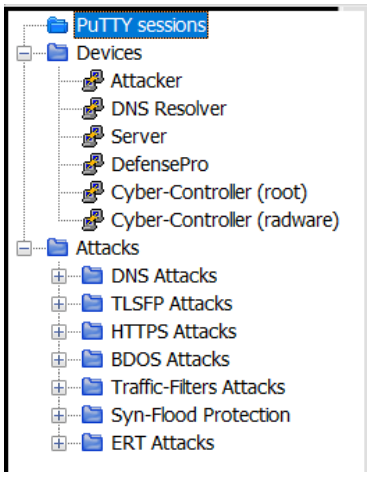
The demonstration is performed from the management station, which includes:

- Access to Cyber Controller
- Access to environment devices
- Legitimate traffic generation
- Attack traffic generation (via remote to attacker station)

The management station includes two network interfaces: one interface connects to the lab data segment, and the second interface connects to the management segment.

Connecting the environment devices and running attacks

We use the Management station to connect the rest of the lab devices with the help of Multi PuTTy Manager tool. To access the Multi PuTTy click the black icon in the task bar.



Legitimate Traffic Generation

To generate legitimate traffic in the demo environment, use the management station. The management station uses the **JMeter** tool for HTTPS and DNS traffic generation.

Note: certain attacks have their own legit traffic, described in the relevant scenarios.

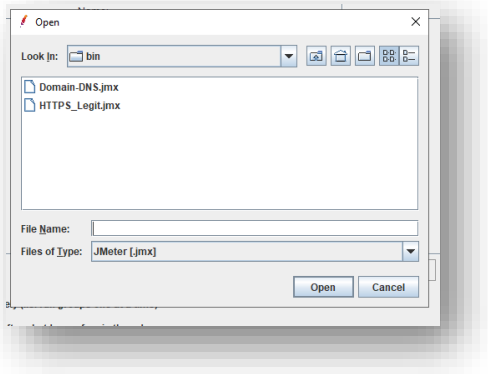
Generating Traffic with JMeter

JMeter is a Java-based stress tool that is used in the demo lab to generate DNS and HTTPS requests from the legitimate host (management station) to the protected object in the policy, and for simulated HTTPS requests from authenticated and unauthenticated sources (Attackers) in the HTTPS protection scenario.

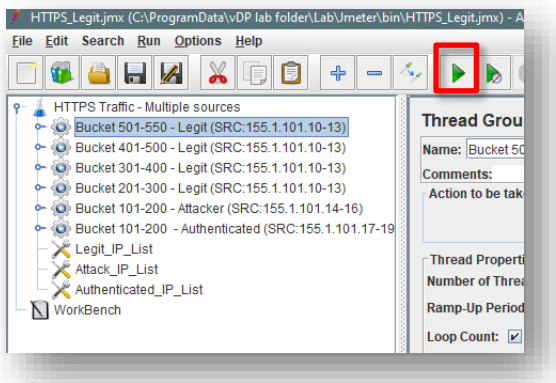
For more information regarding the buckets used in the HTTPS protection scenario click here.

To load the profile template, do the following:

1. From the management station, click **JMeter**, which is located on the desktop.
2. Open the file menu→click on “open”.
3. Select the **JM legit script** folder:



4. Select the **HTTPS_Legit.jmx** script.
5. To start the test traffic, after loading the template, click **Play**.



6. After the test runs, the number of running users displays at the upper right of the pane.

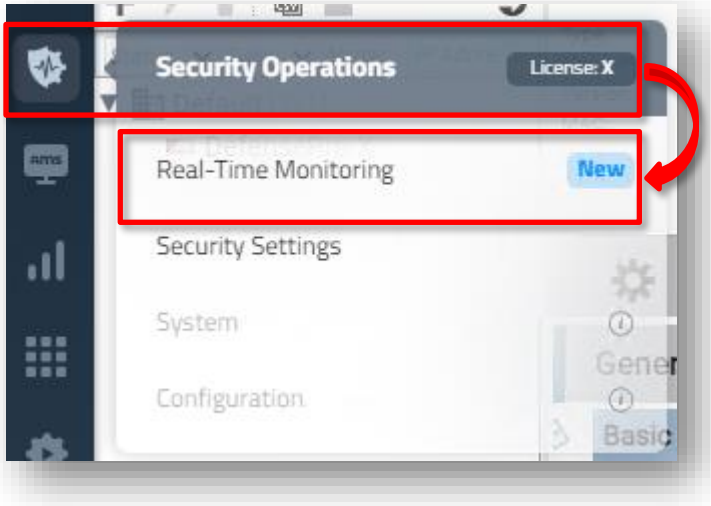
7. To stop the test traffic, click the red **x** button.

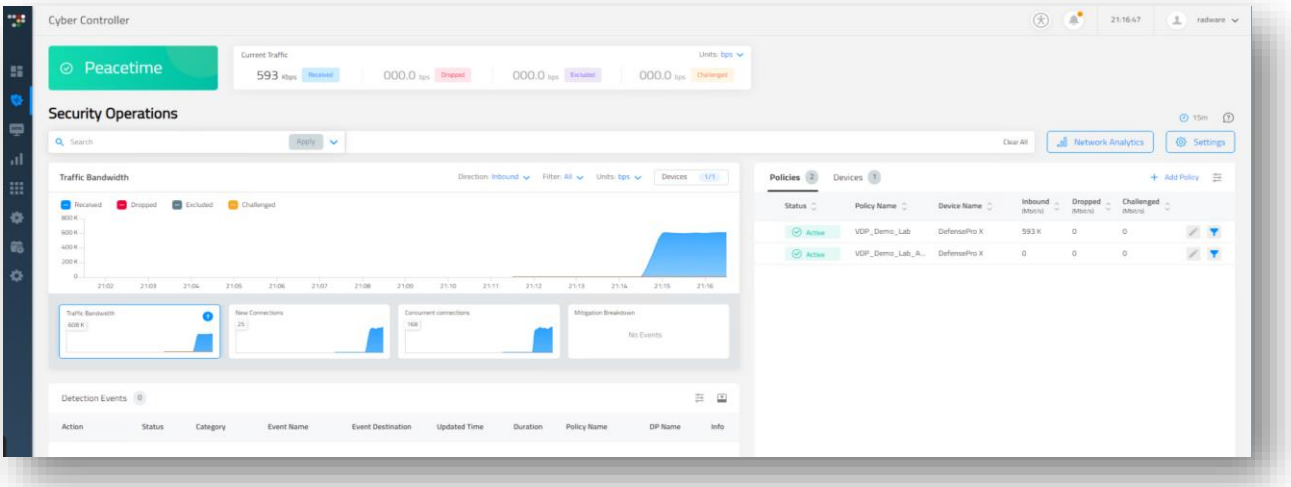
Note: some of the attacks includes specific legit traffic generation

For the scenario of DNS Flood Protection and BDoS Advanced UDP Protection, there is a different legit traffic, which is mentioned on the scenario section.

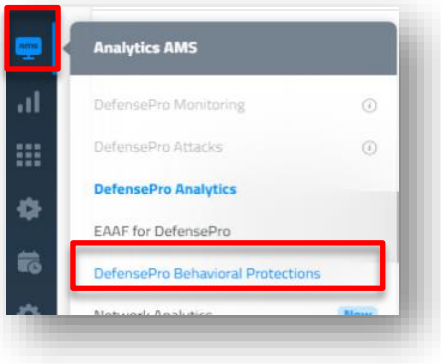
Verify legit traffic on the Cyber Controller Dashboards

1. Once the legitimate traffic has started, it is displayed in the **Analytics AMS > DefensePro X Monitoring**:



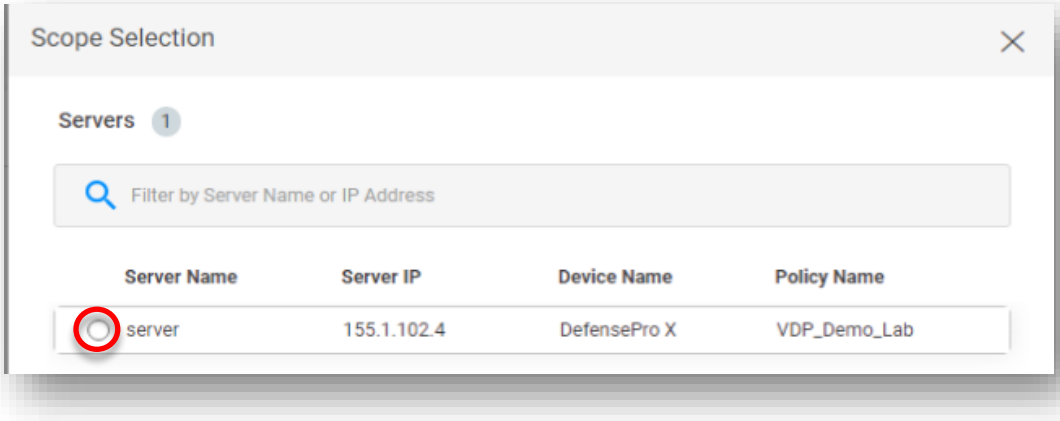


2. Verify the data on the HTTPS Flood dashboard. Go to **Analytics AMS > DefensePro X Behavioral Protections**:

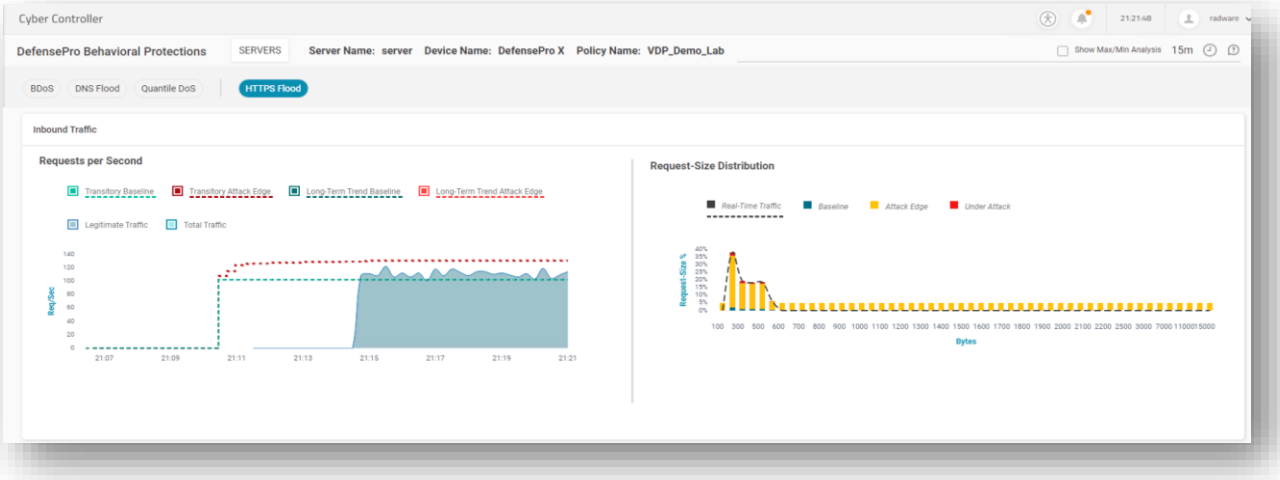


3. On the "**DefensePro Behavioral Protections**" page click on the "**HTTPS Flood**" button and then click on the "**Server**" button and choose "**Change Scope**".

4. On the "**Scope Selection**" window, choose the server with the IP "155.1.102.4" and click "Submit".



5. The HTTPS Flood dashboard includes a graph with all the buckets with more detailed information (such as attack edge, real-time traffic, baselines, and so on):



Attack Generation Tool

The DefensePro X Demo lab includes the Kali Linux client as the attacking tool for all attack scenarios:

Kali is a well-known penetration machine that runs various types of attacks. The demo lab uses Kali to execute HTTPS, DNS, UDP floods, and page scanning attacks.

DefensePro X High-Level Configuration Overview

DefensePro X Network Protection Policies

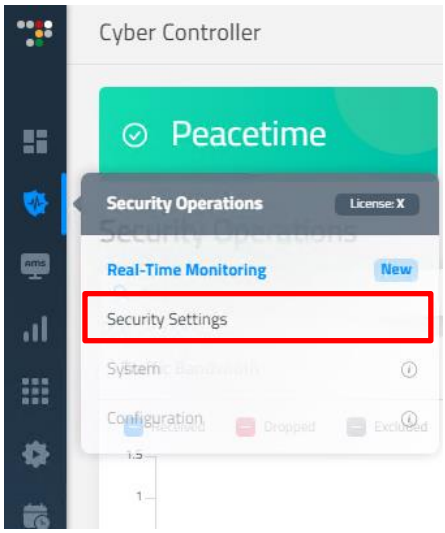
The following table provides a high-level overview of the DefensePro X demo lab configurations:

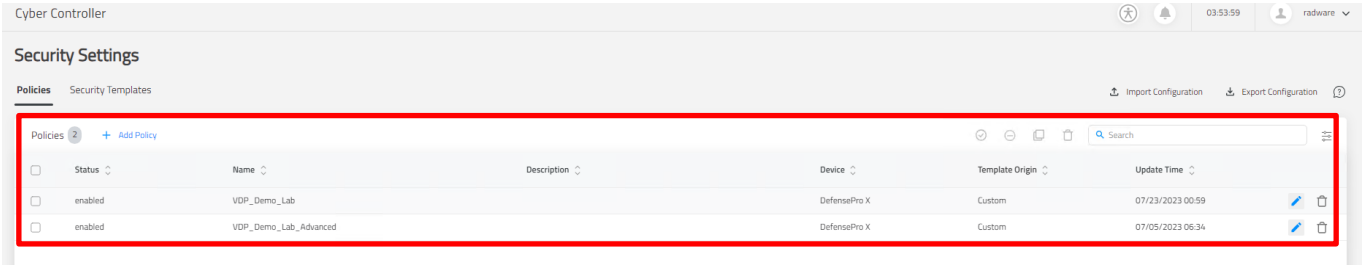
Protection Policy Name	Priority	Protected Object	Protections Profiles
VDP_Demo_Lab_Advanced	**10**	**udp_server** (155.1.102.100 /32)	• BDoS (for the advanced UDP)
VDP_Demo_Lab	5	**Protected Webserver** (155.1.102.4/32)	• HTTPS • Traffic Filter • TLS Fingerprint • ERT Attacker Feed • Spoofed Syn Flood • DNS Flood • BDoS

DefensePro X configurations include two major network protection.

To view the network protection configurations in Cyber Controller:

1. Go to **Ssecurity Operations > Security Setting**:





DEFENSEPRO X DEMO LAB SCENARIOS

DNS Authoritative Protection

In this scenario, we'll delve into the new protection for authoritative name servers, introduced in DefensePro X version 10.5. The updated DNS protection now encompasses two types of modes: Recursive, the familiar DNS protection from previous versions, and Authoritative, a new protection specifically designed for authoritative name servers which we will focus on.

Our scenario comprises of several components:

1. **Server**: This is our Authoritative DNS server, housing 16 zone files from **dp-demo-1.com** to **dp-demo-16.com**.

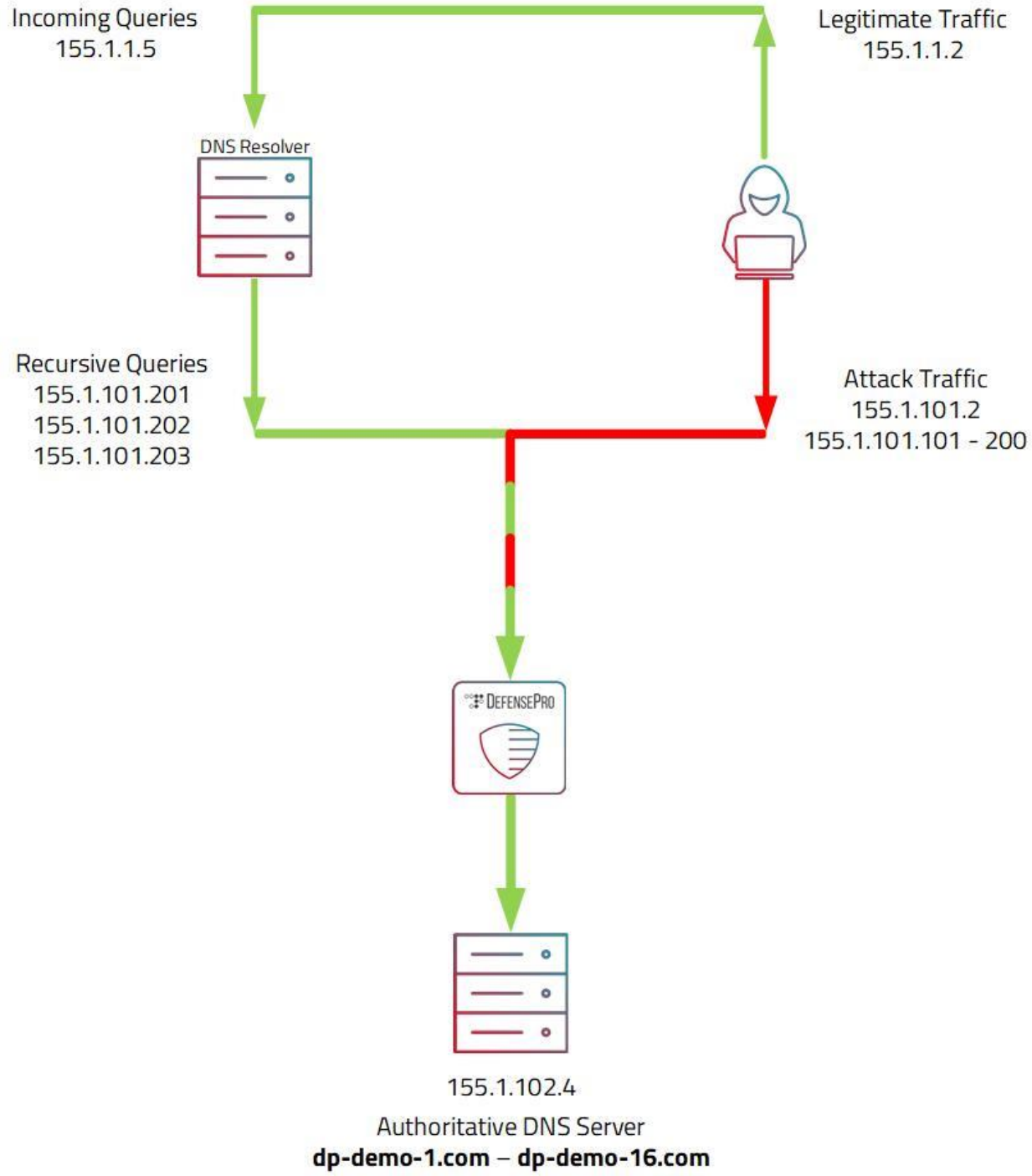
2. **Resolver** (newly introduced server): The resolver plays a crucial role in serving legitimate traffic and navigating the challenge/response mechanism introduced in the new Authoritative protection. This allows the protection to distinguish between legitimate resolvers and attackers. It's important to note that the resolver in our demo is configured to forward all requests to our Authoritative server when doing recursive lookups, and caching has been disabled, ensuring it performs recursive lookups for each request.

3. **Attacker**: responsible for generating both attack and legitimate traffic. Attack traffic is directed straight to the authoritative server, targeting the **dp-demo-1.com** domain exclusively. Legitimate traffic, on the other hand, is sent directly to the resolver, with queries distributed across all 16 domains on our authoritative server.

4. **Cyber-Controller**: configured with a scheduled task to retrieve all 16 zone files from our authoritative server and automatically configure them on the DNS Protection allow list. The new protection uses the DNS allow list first, it's essential to maintain a one-to-one representation of the zone files in the DefensePro allow list for proper mitigation without false positives.

5. **Grafana:** available in chrome bookmarks bar a link to Grafana dashboard. The dashboard displays graphs that offer insights into the types of queries and responses received by both the authoritative and resolver servers.

Scenario Topology

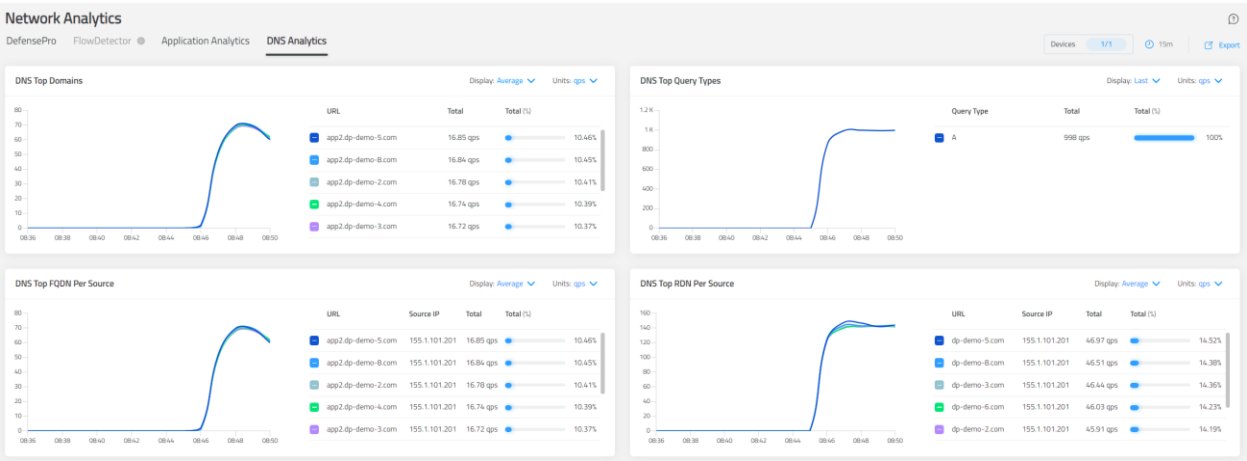


Running Legitimate Traffic

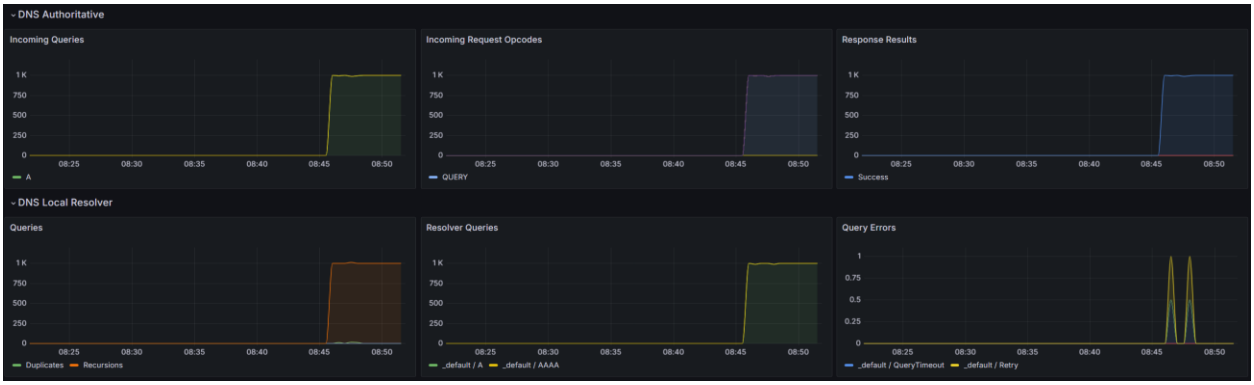
To start legitimate traffic, open **MTPutty** and double-click on "**Start DNS Legit Traffic**". Our legitimate traffic is configured to run at a rate of 1000 Queries per Second and includes queries from all existing domains. This traffic is sent directly to the resolver, which then performs recursive lookups through our authoritative server.

When observing the Real-Time Monitoring screen and the units are displayed in PPS (Packets per Second), we can observe that we are receiving 1000 Packets per Second, equivalent to our 1000 Queries per Second.

Since Cyber-Controller 10.5, DNS Analytics has been added and can be accessed via the Network Analytics feature. Here, we can gain valuable insights into our legitimate traffic. We observe that we are sending only A queries from a single source, which is our resolver with IP address 155.1.101.201. Additionally, we can see that these queries span across all of our domains.



Accessing the Grafana dashboard (available in Chrome bookmarks), we can access information about both our Authoritative and Resolver servers. The Authoritative server receives A type queries and responds successfully at a rate of 1000 queries per second (QPS). Similarly, our resolver receives 1000 QPS from our legitimate clients and performs recursive lookups at the same rate of 1000 QPS.



DNS Attacks

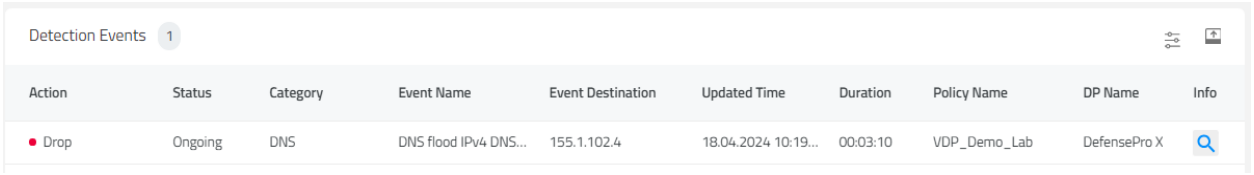
In this scenario, we will demonstrate three different DNS attack types, each corresponding to a mitigation method used by the new Authoritative protection. We will run the attacks in the same order in which the protection escalates, starting from Allow-List, then proceeding to Challenge/Response, and finally, Adaptive Rate-Limit.

1. DNS Water Torture Attack

To start the attack open **MTPutty** and double click on "**Start Water Torture Attack**".

Water Torture attacks are basically a random sub-domain query, in our attack we are generating a random string for **dp-demo-1.com** domain in the form of **<random>.dp-demo-1.com**. this attack generates 7000 QPS.

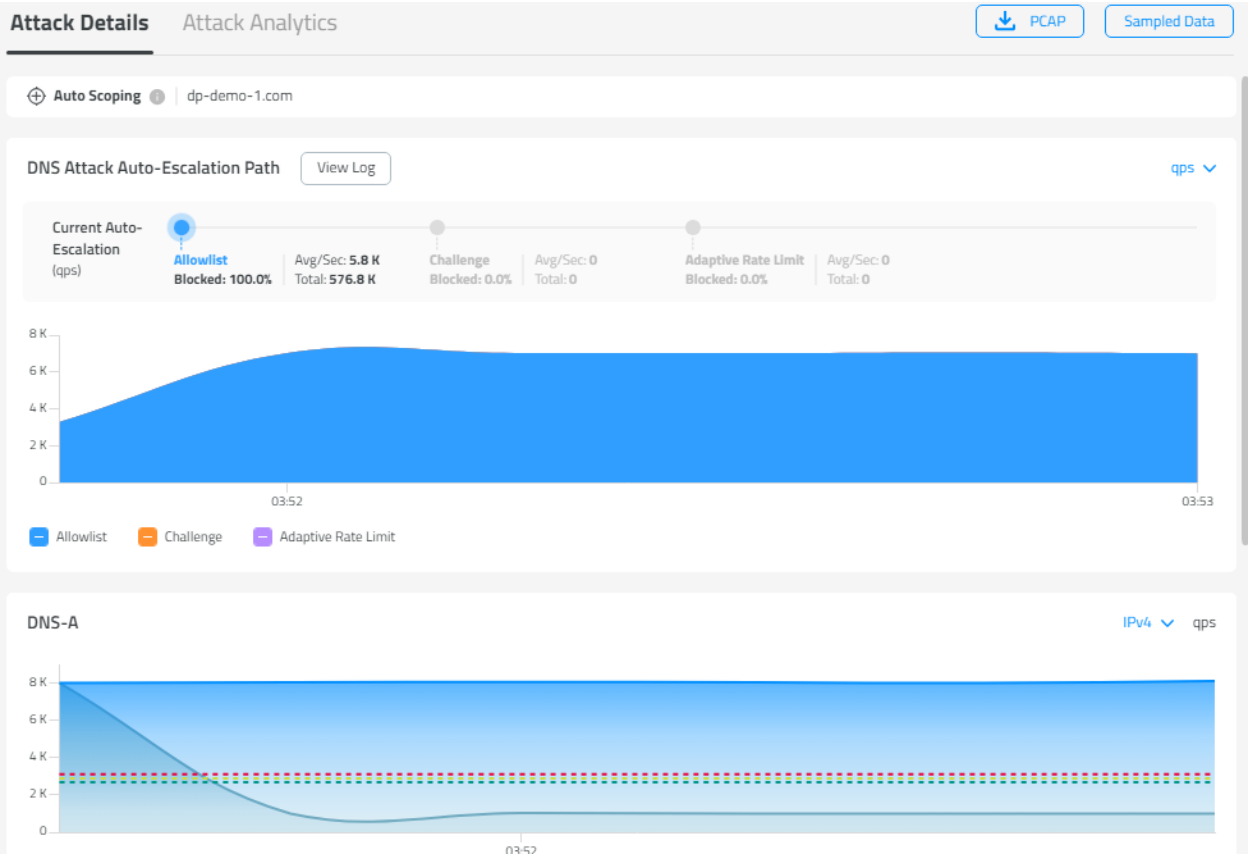
Once the attack is running, we will be able to see a DNS event detected, clicking on the magnifying glass will take us to the attack details.



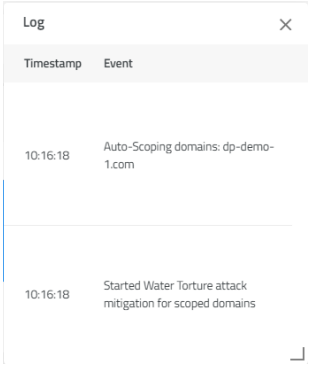
In the attack details we can see multiple items from top to bottom:

- Auto Scoping – Identifying that the attack is currently targeting the **dp-demo-1.com** domain.
- Escalation Path – Currently utilizing the Allow-List method for mitigation.
- Escalation Path Graph – Illustrating the mitigation of 7000 QPS using the Allowlist method.

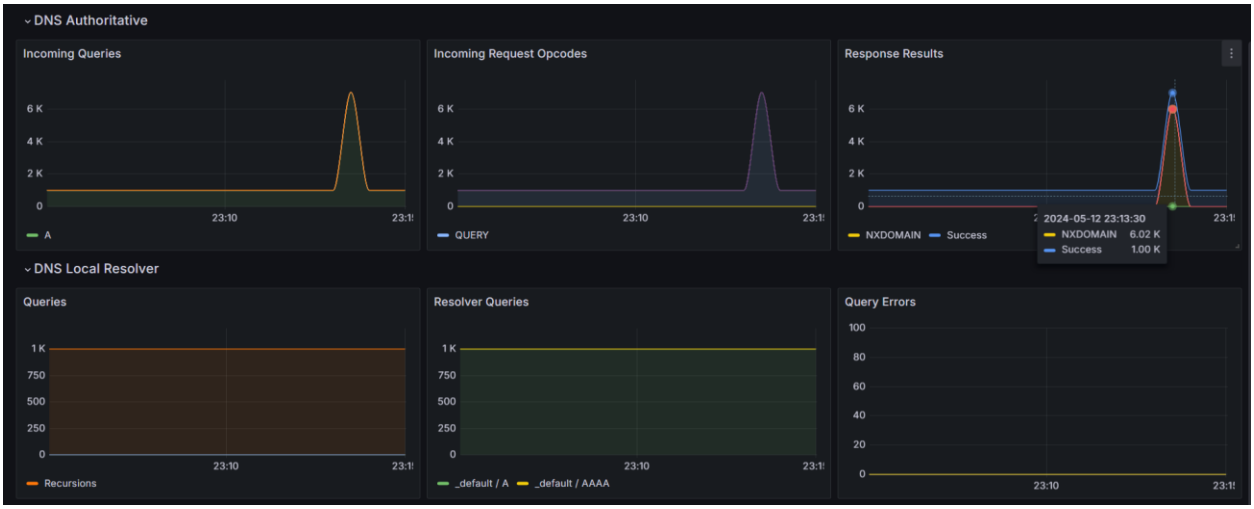
- DNS-A Graph – showing A query mitigation along with the legit traffic not impacted, which maintains its rate of 1000 QPS.



In the Escalation Path, we can also click on the 'View Log' to examine the events that triggered the Allowlist mitigation. In our case, upon reviewing the log, we observe that a Water Torture attack was detected, and the Auto-Scoping feature identified the attacked domain as **dp-demo-1.com**, thereby limiting the allowlist mitigation to this specific domain.



While the Water Torture attack is running, you can switch to the Grafana dashboard and observe the Authoritative DNS responses. Since the attack generates nonexistent domains, you'll notice an increase in NXDomain responses from the server, as a real-world attack would.



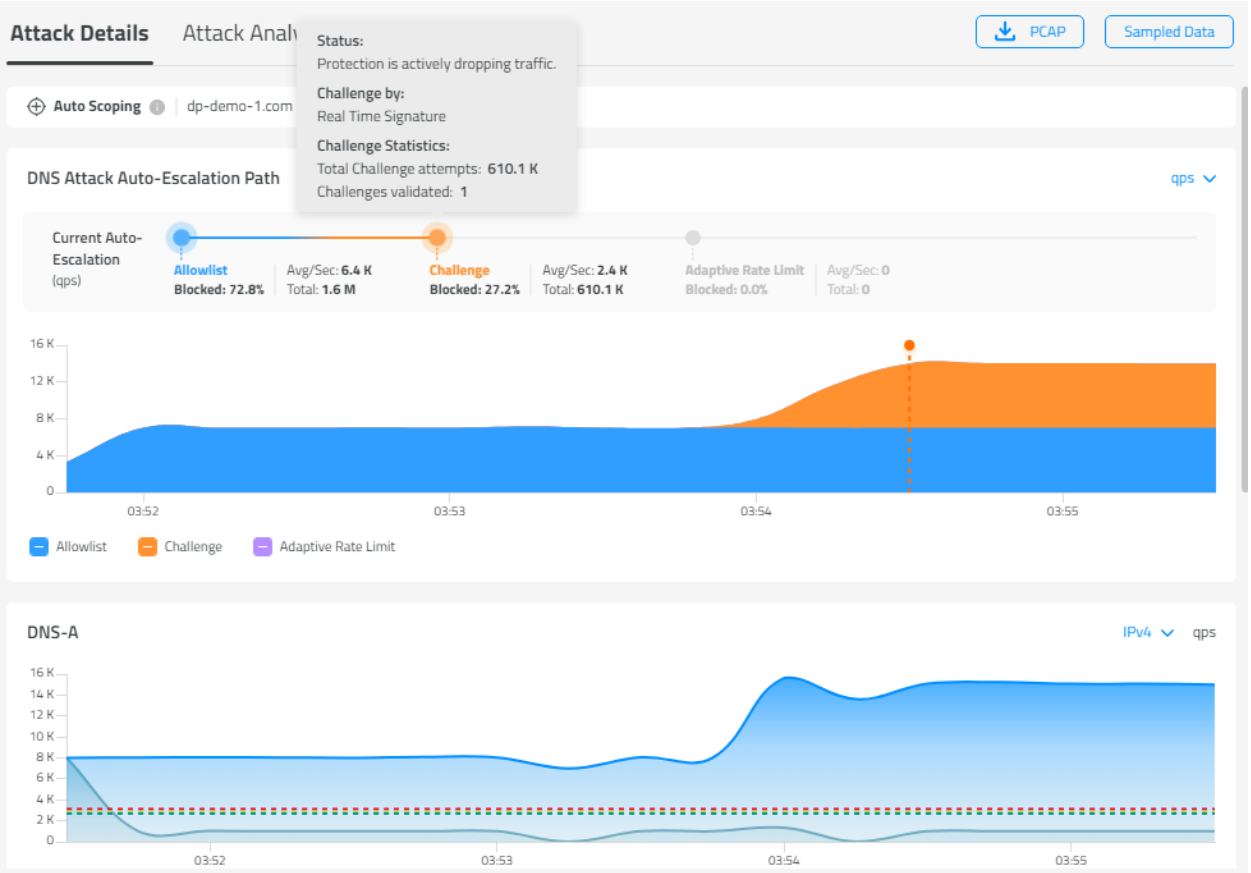
2. Dictionary Attack

To start the attack open **MTPutty** and double click on "**Start Dictionary Attack**".

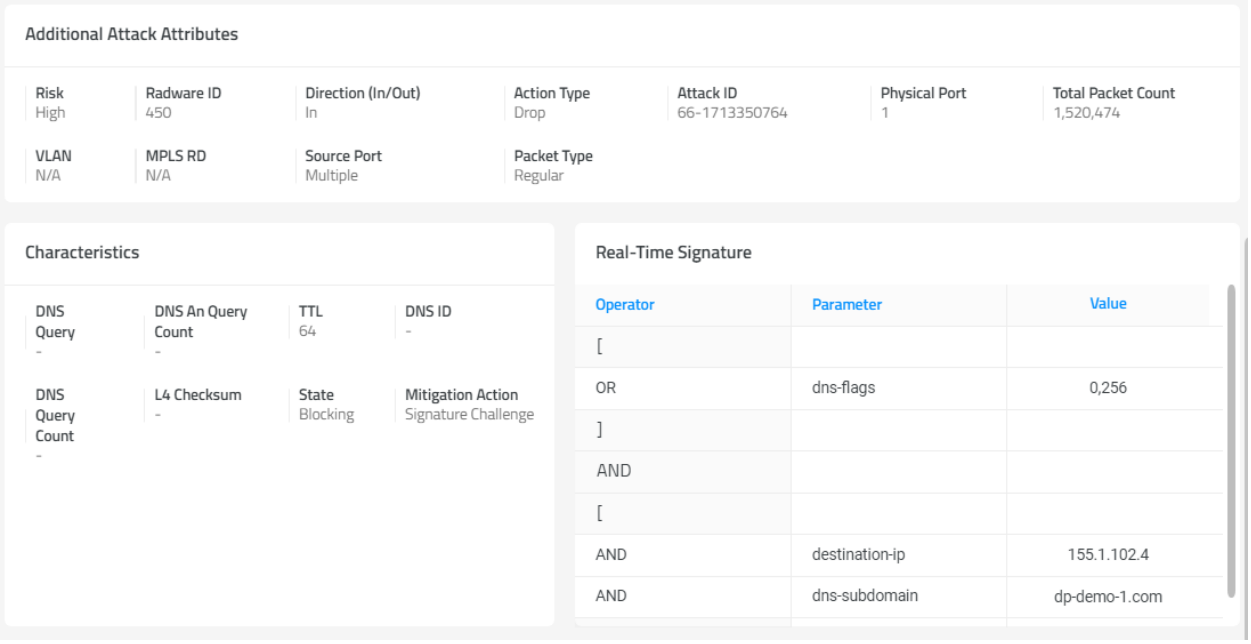
This attack involves flooding by sending an A query for **app1.dp-domain-1.com** at a rate of 7000 QPS. It's important to note that this FQDN is included in our allow list.

Once the attack is running, it will continue from the same event as detected by the Water Torture attack. Looking at the attack details we can see that the Escalation Path has escalated to the next mitigation approach, challenge.

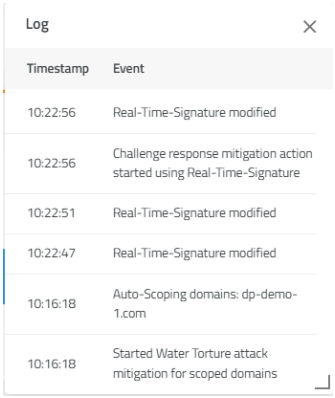
Hovering over the challenge dot in the escalation path will reveal a popup showing that we have sent 600k challenge attempts and only 1 has been validated. The one validated attempt is from our resolver, which successfully passes the challenge. This ensures that legitimate traffic continues to flow without interruption.



Scrolling down the Attack Details, we'll find the signature calculated by the DefensePro. It's essential to understand that this signature isn't used to block traffic; instead, it's used to identify the queries that will receive the challenge.



Examining the attack log, we notice that the Real-Time Signature has been calculated and is currently utilized for the Challenge\Response mitigation action.



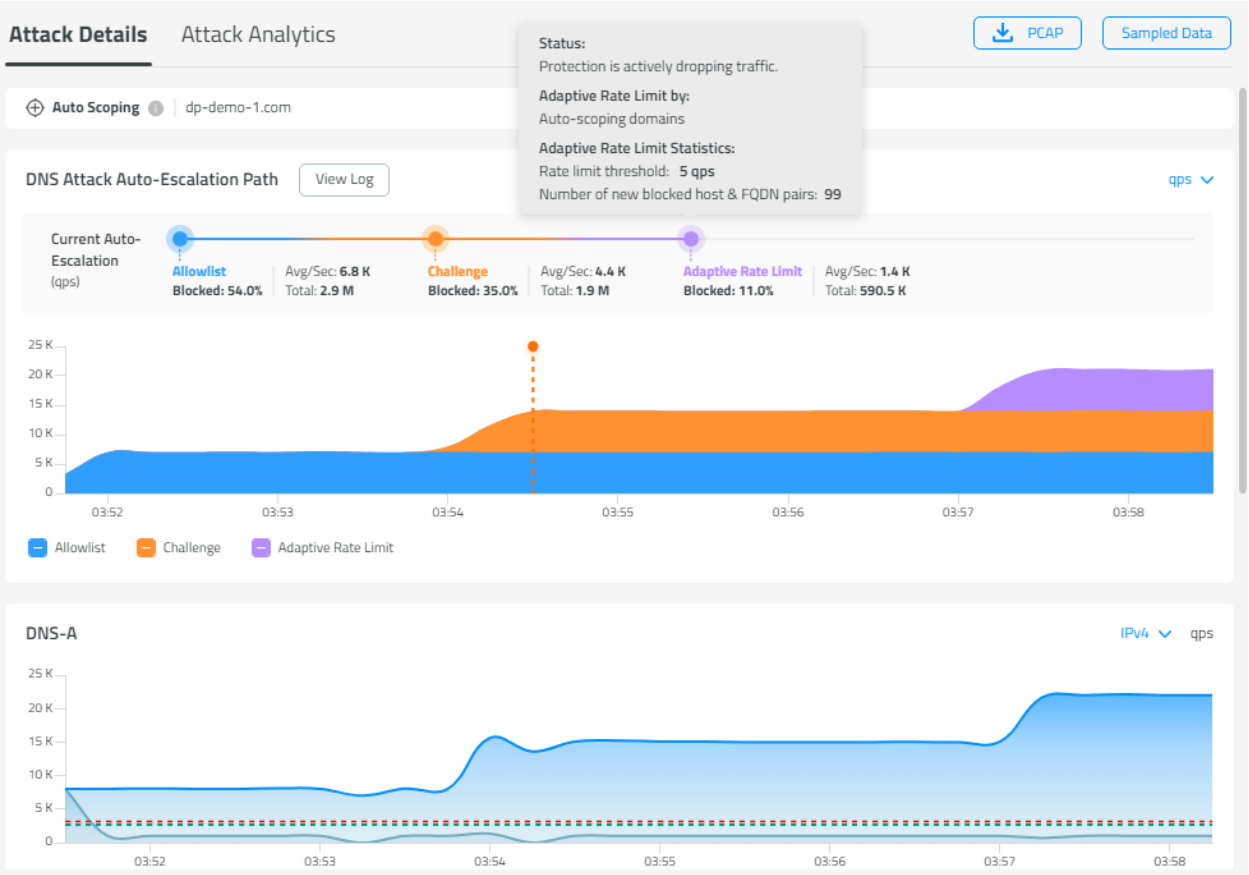
3. Authenticated Resolvers Dictionary Attack

To start the attack open **MTPutty** and double click on " **Start Authenticated Resolvers Dictionary Attack**".

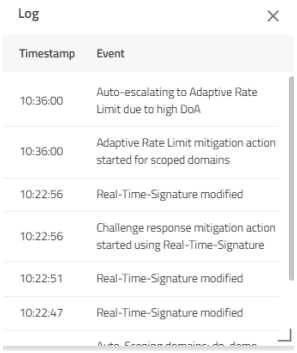
This attack involves flooding by sending an A query for **app1.dp-domain-1.com** at a rate of 7000 QPS. It's essentially the same attack as the Dictionary Attack, with the only difference being that the source IPs are authenticated. This simulates a dictionary attack through real resolvers that can pass the challenge.

Once the attack is active, we'll notice that the Escalation Path has progressed to the next mitigation approach, Adaptive Rate-Limit. With the Adaptive Rate-Limit, DefensePro tracks sources that request the same FQDN at a rate of 5 QPS or higher. These sources will be added to the suspend table along with the suspended FQDN. It's important to note that in this mitigation approach, the Real-Time Signature is not used, all queries that match the domains found by the Auto Scoping are considered eligible for suspension.

As observed by hovering over the Adaptive Rate-Limit in the Escalation Path, we have 99 Sources & FQDN pairs in the suspend table. At this point, our legitimate traffic is not impacted as we ensured that queries to **dp-demo-1.com** will not exceed 5 QPS.



Examining the attack log, we can observe that due to the high Degree of Attack during the challenge event, we escalated to Adaptive Rate-Limit.



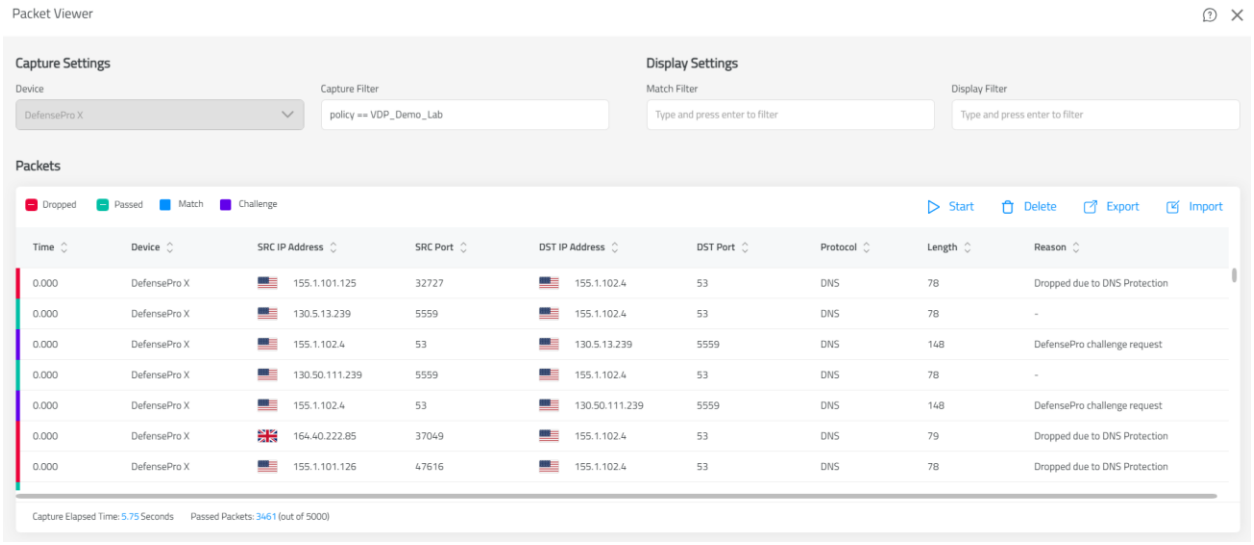
In our demo we are simulating 99 authenticated sources by authenticating the entire 155.1.101.0/24. Typically, resolvers will pass the challenge and enter the authentication table with a /32. However, in cases where a resolver receives a challenge with one source and responds with a second source IP, DefensePro authenticates the entire /24. We utilize this by authenticating 155.1.101.0/24 and execute the attack with source IPs from this range.

To observe the source in the authentication table, execute the following command in the DefensePro CLI: “system internal security dns challenge auth-table”. Then, using WinSCP, access the file located at “/mnt/applData/debug_dns_cr_authentication_table.txt” on DefensePro. This file contains the authenticated source IPs.

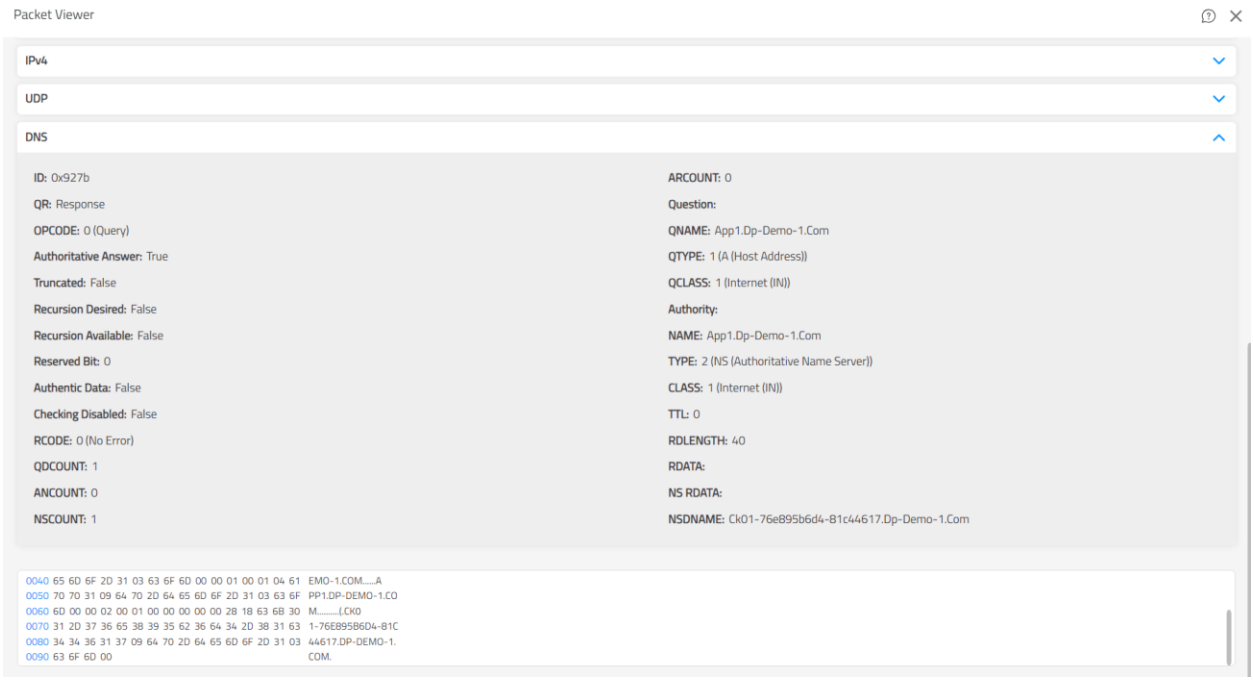
Packet Capture

At this stage, while all attacks are running, we can demonstrate our unique packet capture capabilities by initiating a packet capture for our policy "VDP_Demo_Lab". Simply click on the icon indicated below.

Once clicked, you'll be presented with the packet viewer. Pressing the Play button will initiate the packet capture, which will automatically stop after capturing 5000 packets. At this point you should be able to observe multiple types of packets (Dropped, Passed, Matched and Challenged) marked by different colors as shown below.



For each packet, you can expand the DNS payload to view additional information. Below, we can see a challenge sent by the DefensePro in the form of an NS response along with its cookie.



TLS Fingerprint Protection

Legit Traffic & Baseline Adjustment

Note: make sure JMETER is not running when demoing this protection.

The TLS Fingerprint protection needs a learning time between 6 hours to 3 days . To quickly set up a baseline, we use a script that automatically resets it and generates the necessary legit traffic for the demo.

To execute the script, open the Multi Putty and double-click on "**TLSFP_Legit_and_Baseline_Start**".

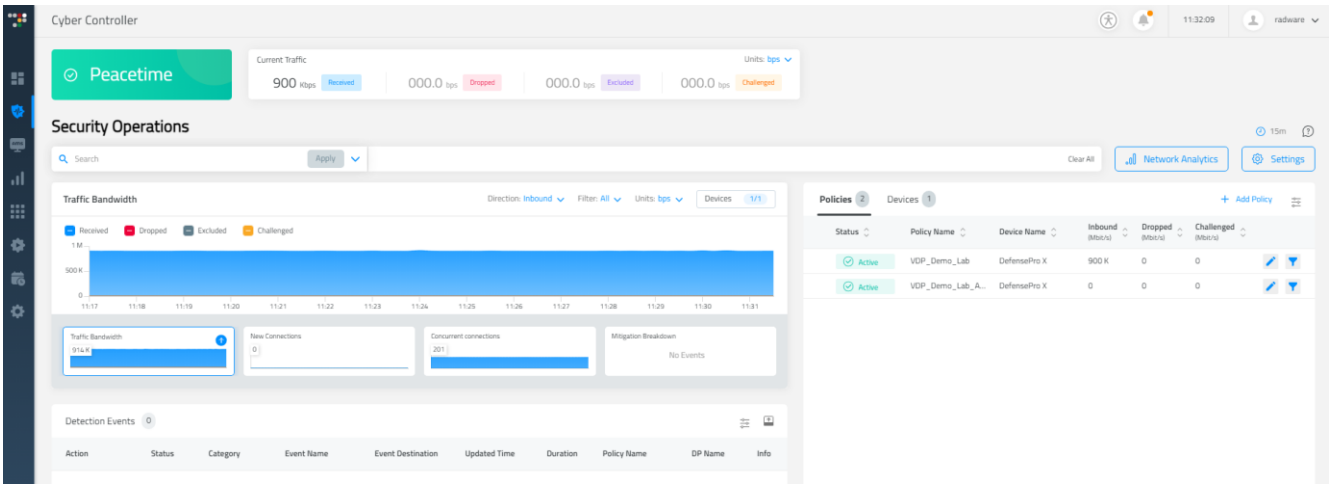
Here's a high-level overview of the script's actions:

1. Initiate legit traffic using a packet capture containing "Client Hello" from various legit clients.
2. Reduce the learning period to 120 seconds.
3. Reset the baseline.
4. Pause for 160 seconds.
5. Apply the learned baseline.
6. Restore the learning period to 60000.
7. Print the baseline.

To verify the script's successful execution, check that the printed baseline state is "**Detect**", and all the thresholds are populated with numbers as seen below.

```
# Policy Name  # State        # Learning  # RT BL R # RT Thre # BL Rate # BL Thre # Current # Current # Active  # Learning  # Suspend   # Start Time        #
#              #              # Hits      # ate     # shold   #         # shold   #  Rate   #  RI val # Attacks # Duration  #           #                     #
#              #              #           #         #        #         #         #         # ue       #         #           #           #                     #
#################################################################################################################################################################
# VDP_Demo_Lab # Detect       # 28246     # 2192.52 # 87.43   # 2189.36 # 87.43   # 2202    # 0.08     # 0       # 130       # 0         # 11-11-23 19:13:51 #
#################################################################################################################################################################
```

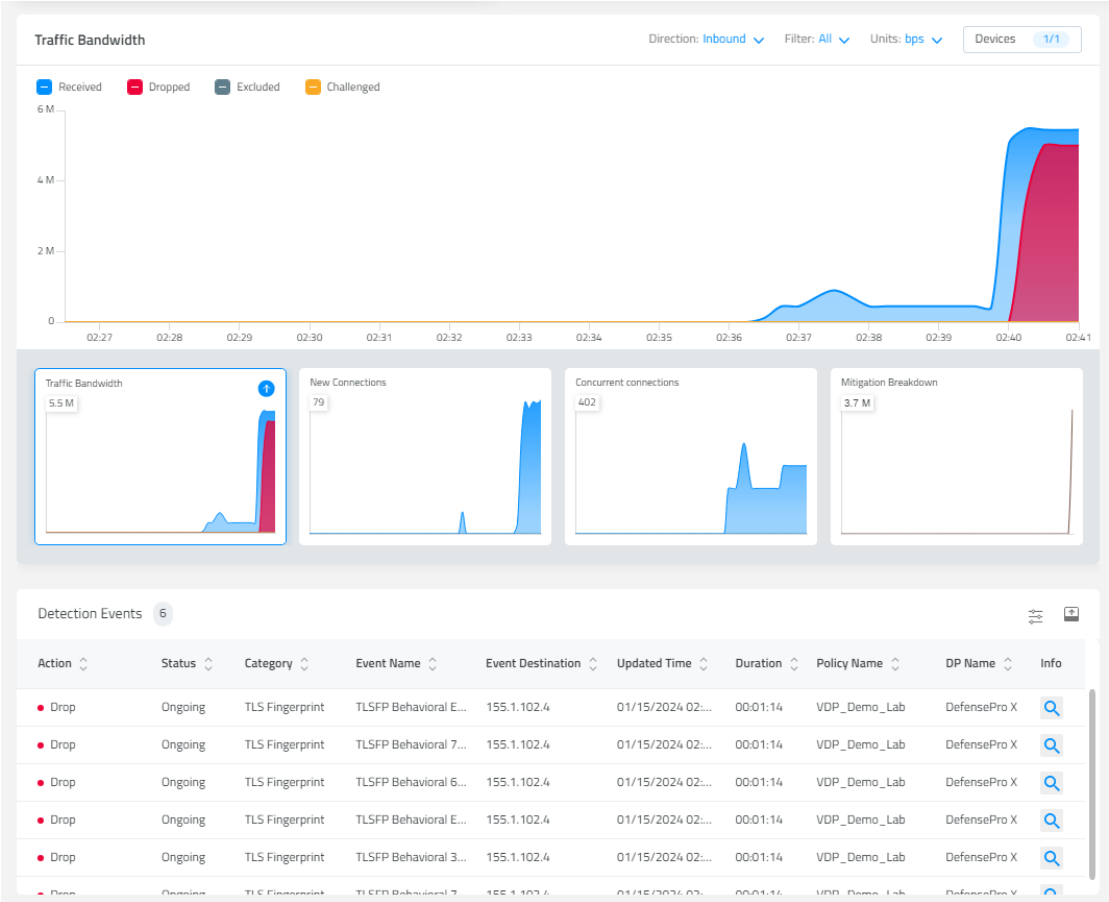
Additionally, in the Real-Time Monitoring and Network Analytics section of Cyber-Controller, confirm that the legitimate traffic is visible, resembling the captures below:



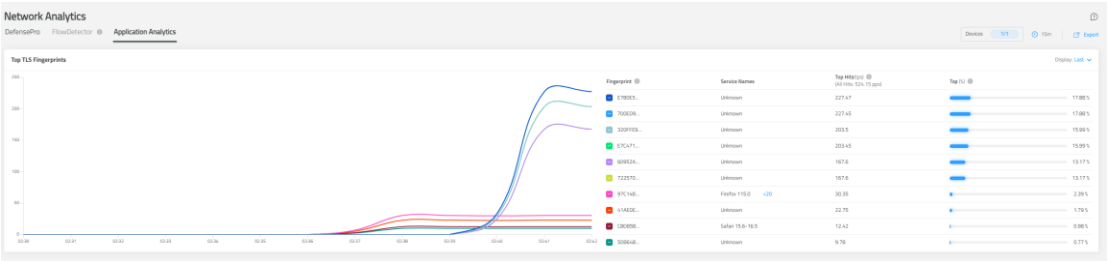
TLS Attacks

The TLS Fingerprint Scenario includes 3 different attacks:

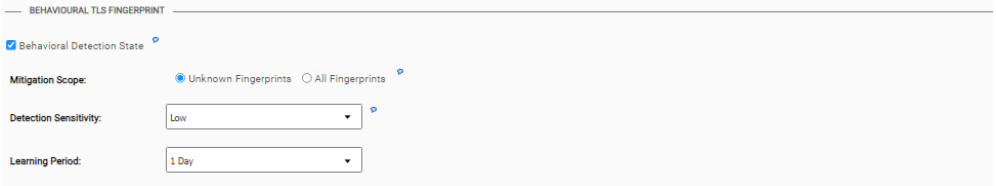
1. **Six fingerprint attack** – this attack is using a packet capture to send TLS Client-Hellos taken from actual real-world attack. To initiate the attack, open Multi Putty and double-click on "*TLS_6_Finger_Attack_Start*". Once the attack is running you should be able to observe 6 detected events in the Real-Time Monitoring screen as shown below:



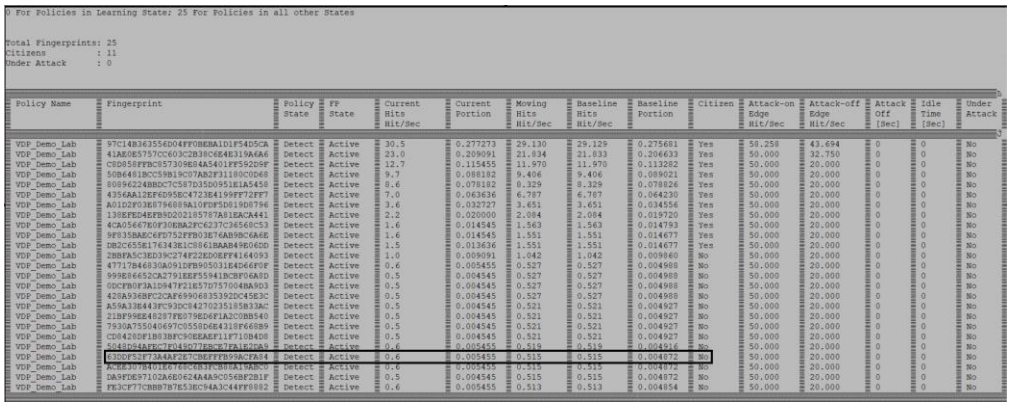
By examining the Application Analytics, you can easily identify the six fingerprints responsible for the attack. It's important to note that we manually selected the lower four fingerprints to display in the graph, providing a clear distinction between legitimate and malicious activity.



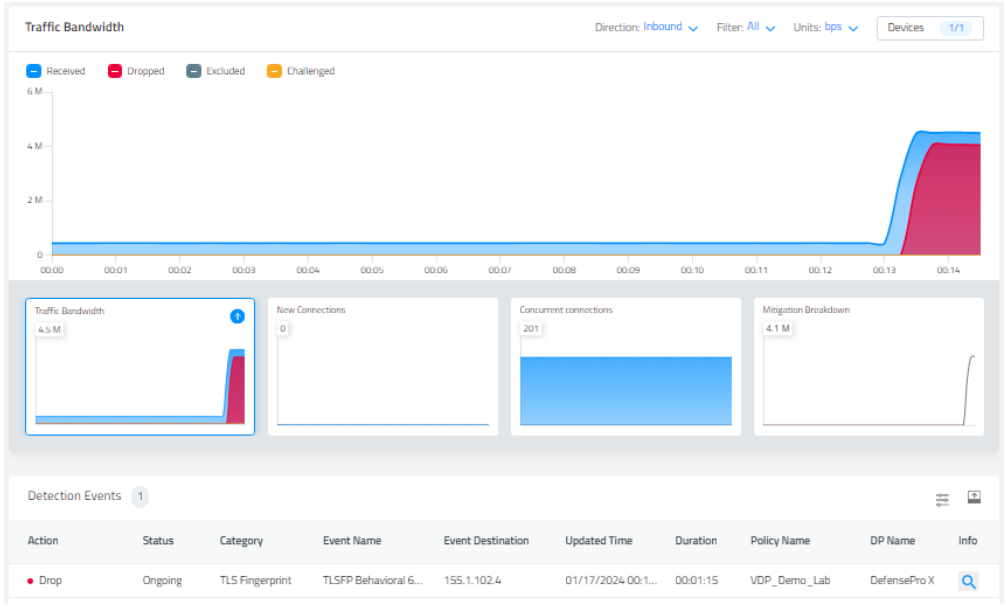
2. **Non-Citizen attack** – this attack is using a packet capture as well to send TLS Client-Hellos, the aim with this scenario is to show an attack on a fingerprint that existed during peace time and is considered non-Citizen as its traffic is significantly low, meaning it can be used for mitigation even though the TLS profile mitigation scope is configured for '*Unknown Fingerprints*' as shown below.



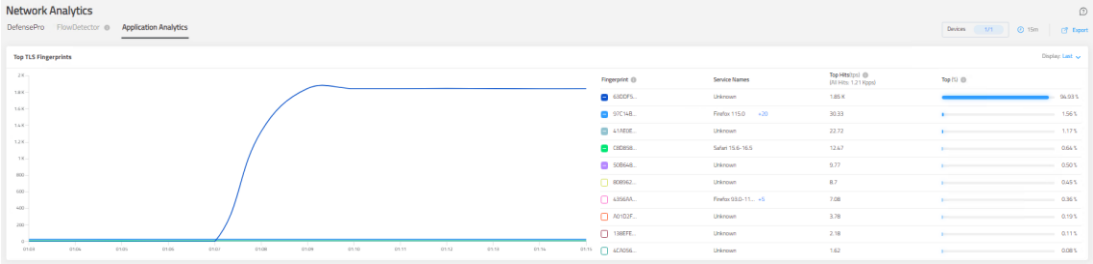
During peacetime you can observe the non-Citizen fingerprint highlighted below using the command "*system internal security tls-fingerprint behavioral fingerprint-data * -c 50*".



To initiate an Attack, open Multi Putty and double-click on "*TLS_Non_Citizen_Attack*". Looking at the Real-Time Monitoring screen you should be able to observe a single event detected.

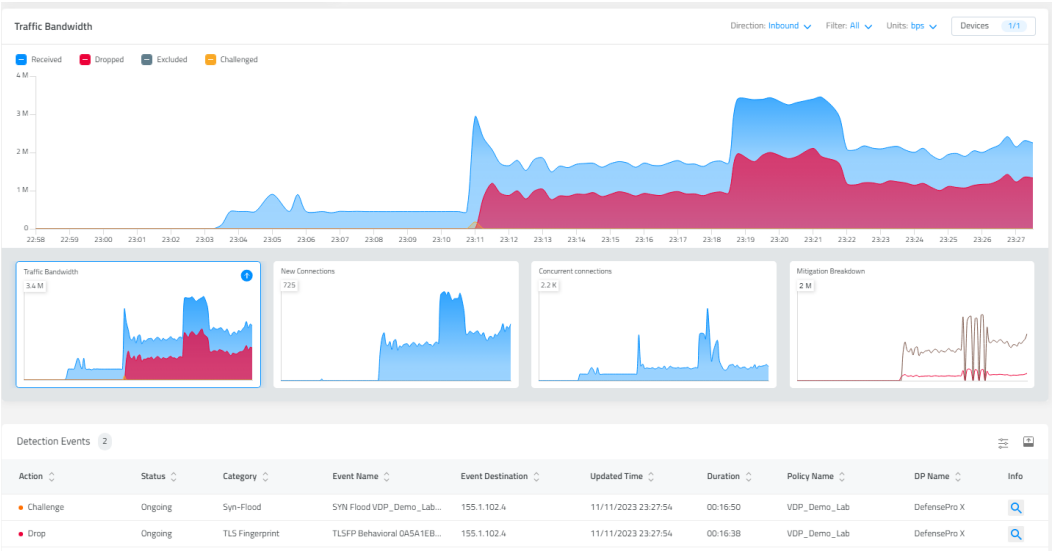


By examining the Application Analytics, you can identify the non-Citizen fingerprints responsible for the attack.

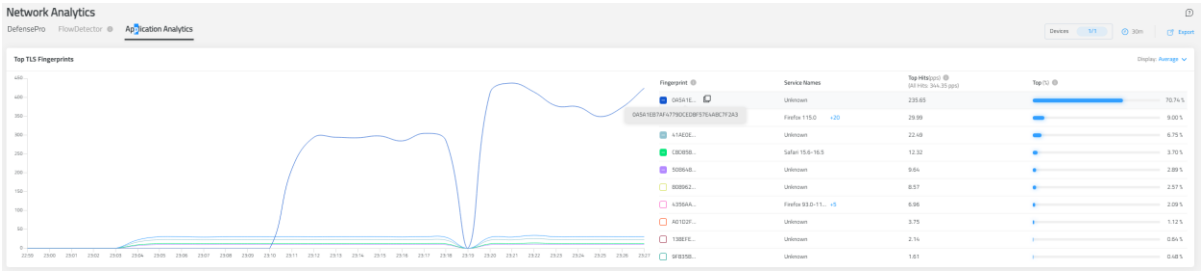


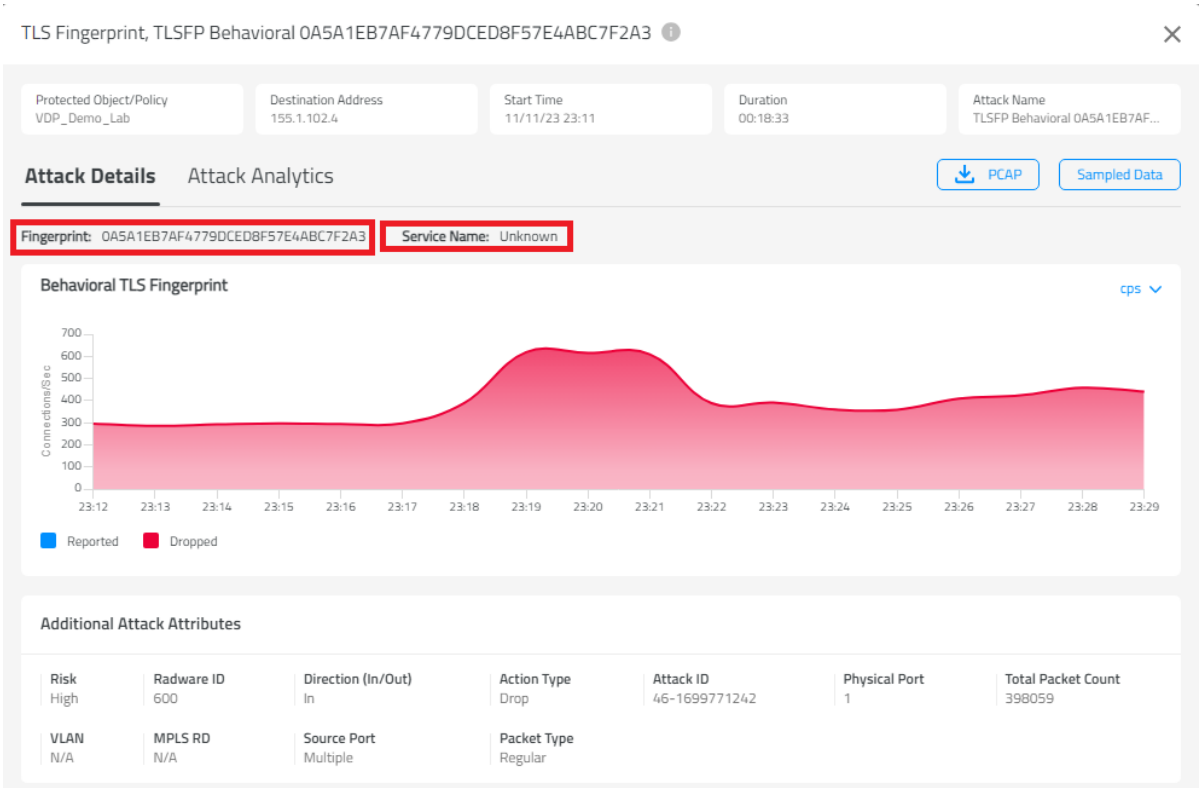
3. **Python script attack** – this script is used to create an HTTP attack involving a complete TCP connection followed by TLS handshake, unlike the previous two attacks that relied on packet captures with only TLS Client-Hello. The script establishes numerous HTTPS connections intentionally exceeding the learned baseline triggering a detection and subsequent mitigation by the TLSFP protection. To initiate the attack, open Multi Putty and double-click on "*TLSFP_Attack_Start*".

   Once the attack is running, you'll be able to see two detection events on the Real-Time Monitor screen of Cyber-Controller, Syn-Flood and TLS Fingerprint, as seen in the screen capture below. Please be aware that while Syn-Flood detection occurs due to an excess of SYN packets surpassing the threshold, the mitigation is carried out by TLSFP. "Client Hello" packets are dropped before the Challenge/Response phase can occur. To validate this, examine the mitigation breakdown for further confirmation.



Additionally, examining Network-Analytics will reveal the primary fingerprint behind most requests, specifically the attack initiated by the Python script. Refer to the TLSFP attack details for accurate information on the exact fingerprint being blocked during the mitigation process.





HTTPS Protection

For more additional information about this scenario, please refer to the "Appendix 1 - HTTPS Protection (Additional Info)" section.

HTTPS Baseline Adjustment

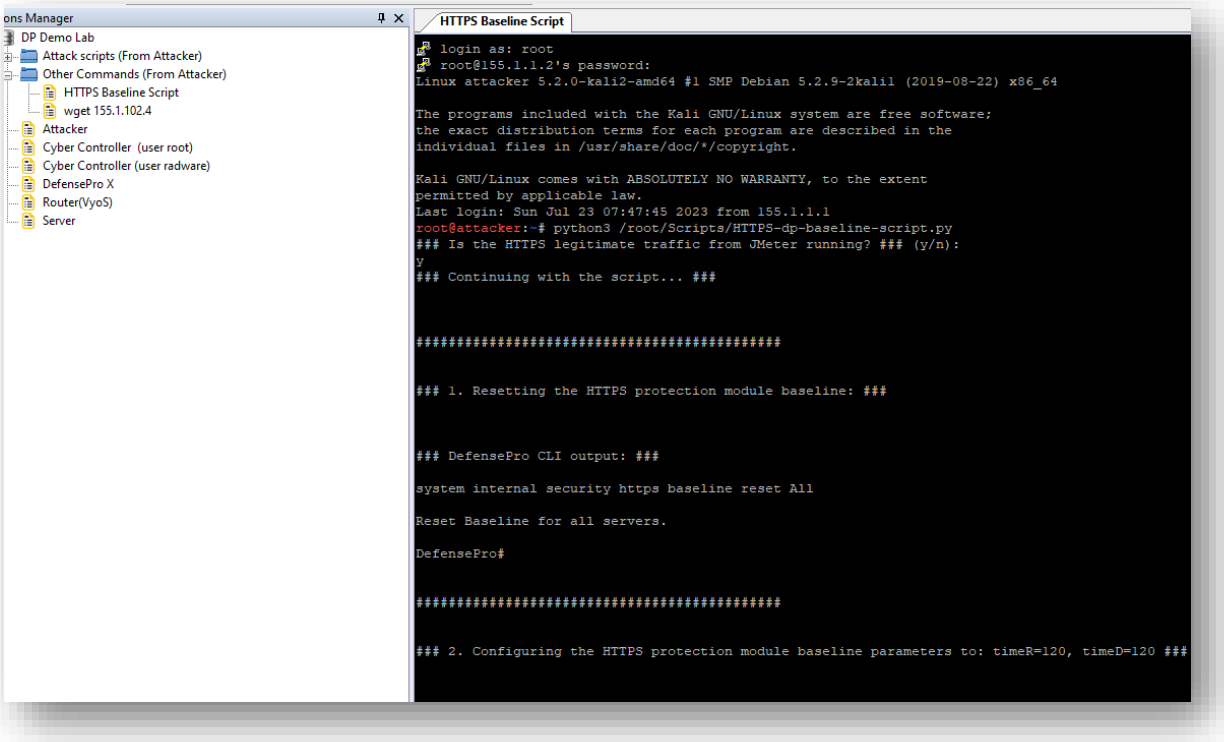
HTTPS protection requires baselining (default 7 days). As this is not possible during Demo, we suggest adjusting baseline learning period to 120 seconds.

Use the following script for adjusting the HTTPS baseline:

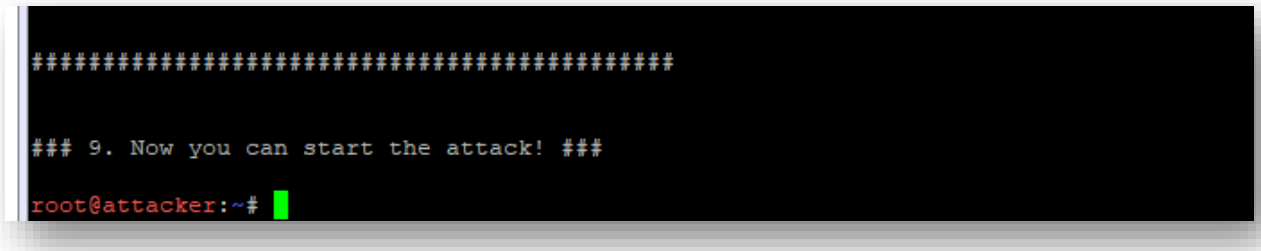
1. Open the Multi Putty Manager.
2. Double click on the "**HTTPS Baseline Script**" session, which is in:

   Sessions Manager àDP Demo Labà Other Commands (From Attacker)

3. When the script opens, press "y" if the legit HTTPS traffic is running (the HTTPS legit traffic must be running at this point!).

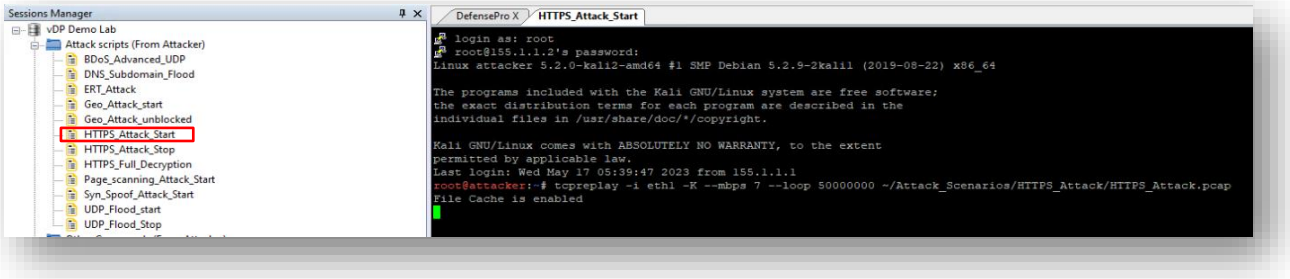


4. Now wait for the step number 9 on the script, which will tell you that you can start the attack:

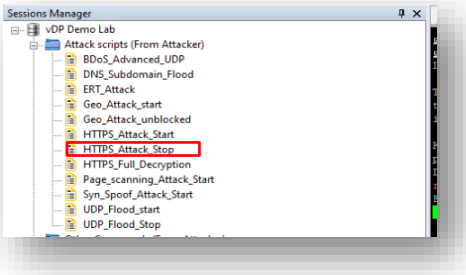

##
9. Now you can start the attack!
root@attacker:~#

Start the HTTPS Flood Attack from Kali and Verify Detection

1. From the session manager, select the **HTTPS_Attack_Start**.
   This script activates HTTPS flooding towards a specific bucket (101-200), which initiates the detection and mitigation phases.
   While the script is running, the following screen displays:



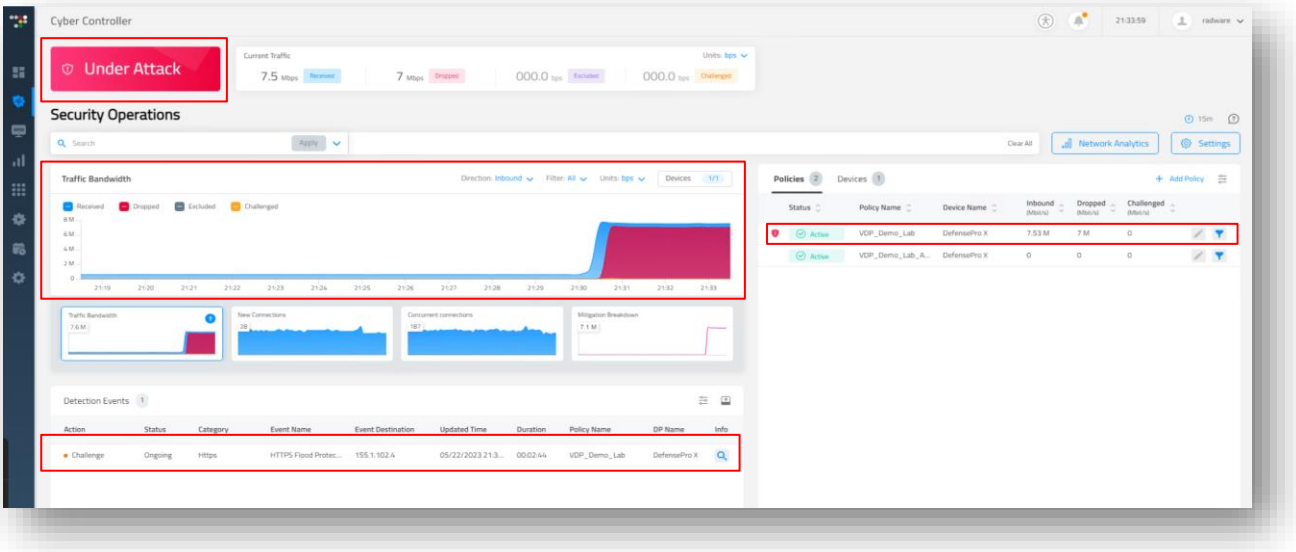
2. In order to **stop** the attack, double click on **HTTPS_Attack_Stop:**



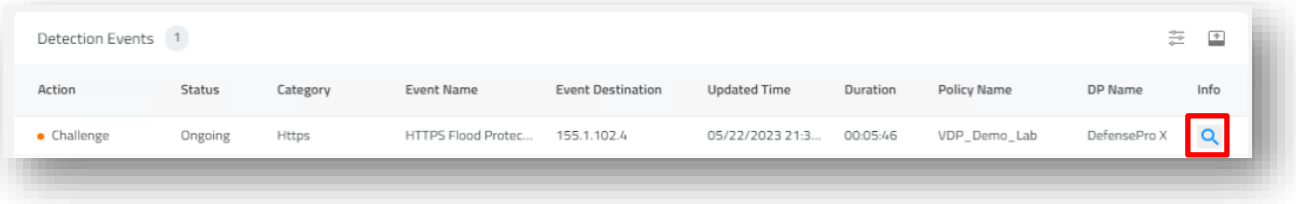
Attack Mitigation

While the attack is running, the HTTPS protection module begins the characterization process of the malicious sources.
In this phase, all sources whose destinations match the attacked bucket and their HTTPS requests rate towards the attacked bucket are above 80%, are challenged with a 302-redirection cookie challenge, those who do not pass the challenge are considered as attackers.

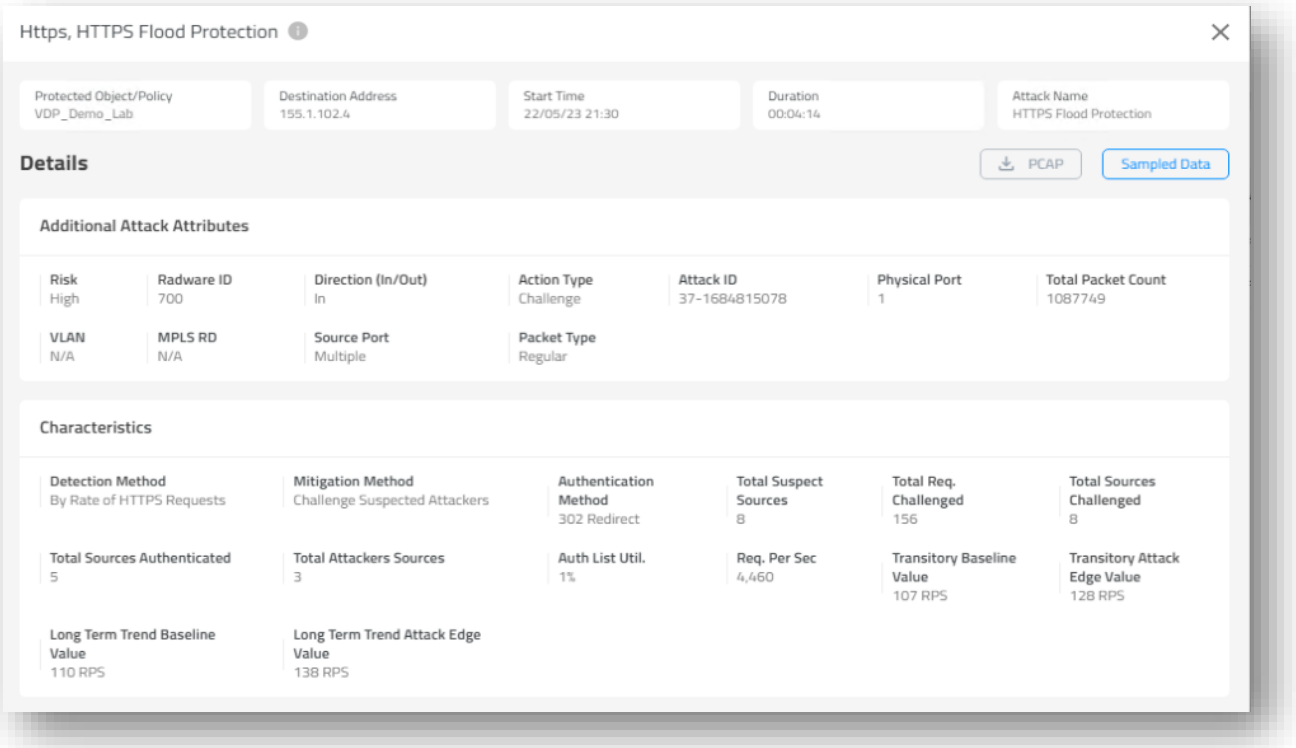
1. Verify the attack in Cyber Controller. Go to the **Security Operations -> Real-Time Monitoring**:



2. On the detection events section, you will find the event attack. You can verify the attack details by clicking on the magnifying glass button:

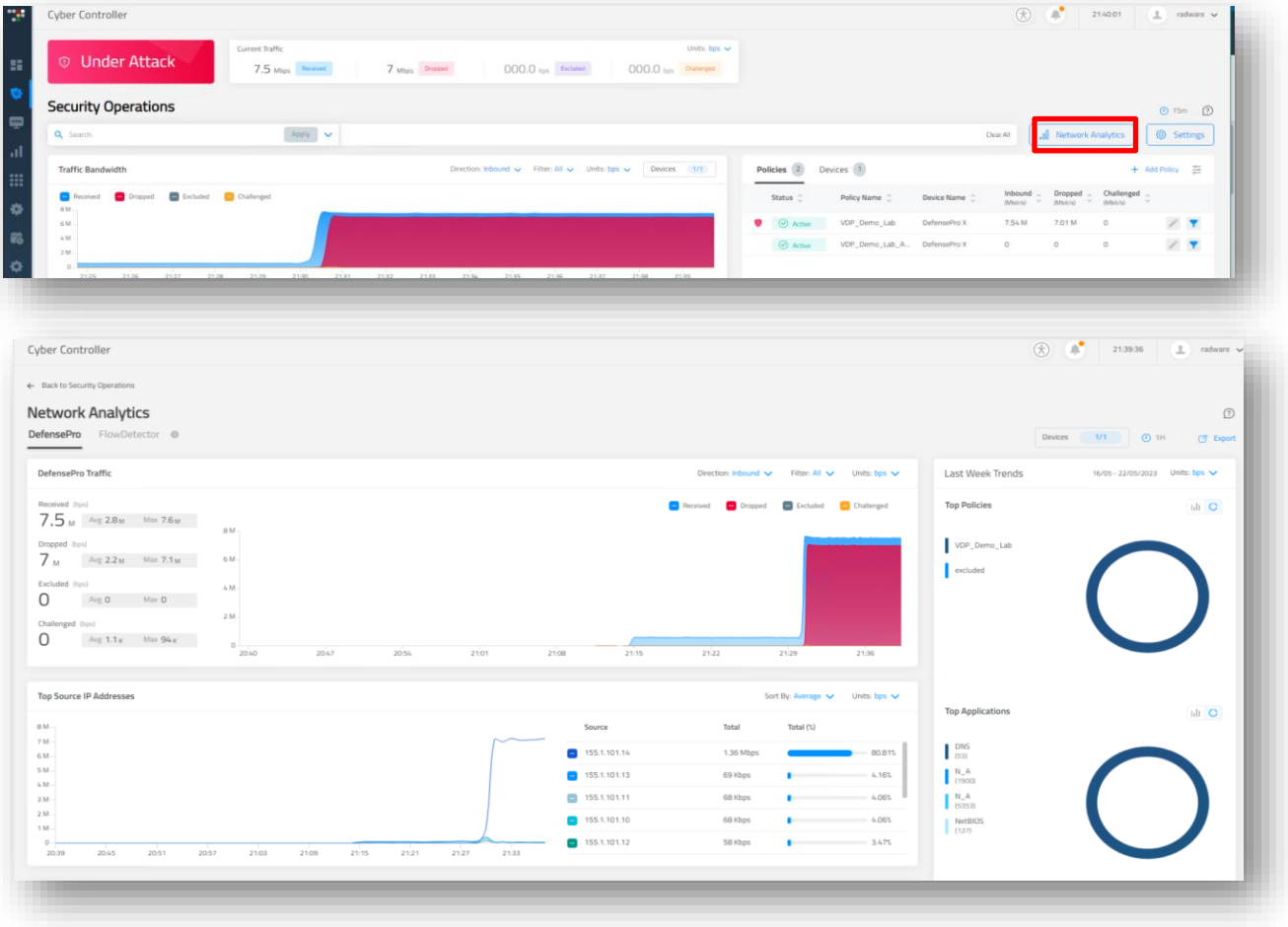


3. Verify the number of authenticated and attacker sources:



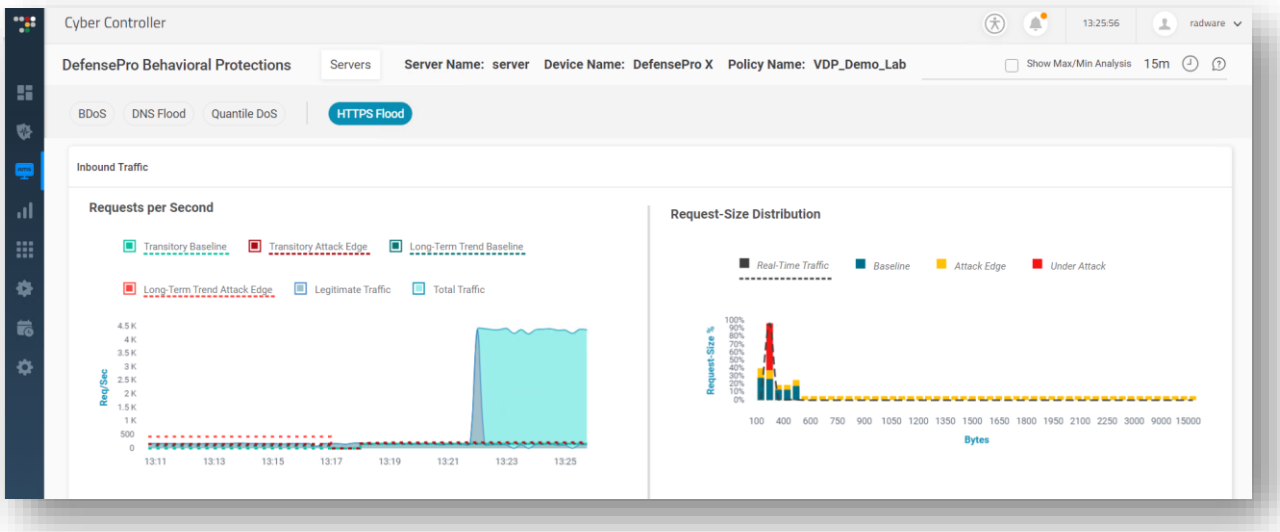
4. Close the detect event detail by clicking on the “x” button, so you will return back the real-time monitoring dashboard.

5. Click on the “Network Analytics” button:



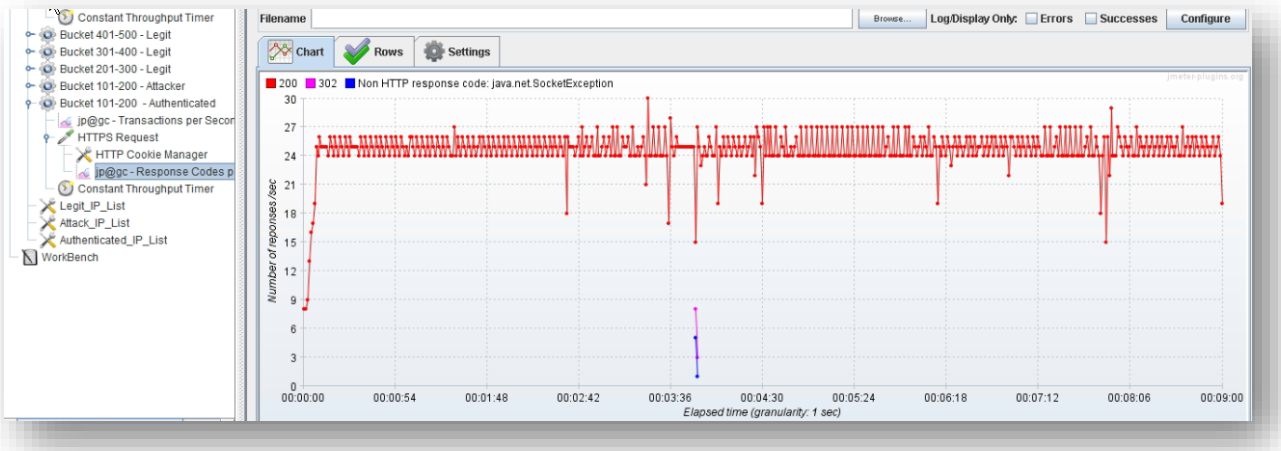
6. Verify the data on the HTTPS Flood dashboard. Go to **Analytics AMS > DefensePro Behavioral Protections > HTTPS Flood (make sure the server is selected)**:

   In the following screen, you should see a graph that includes all the buckets together. While under attack, a deviation in one or more of the buckets should occur. In this output, the deviation occurs in bucket 101-200:

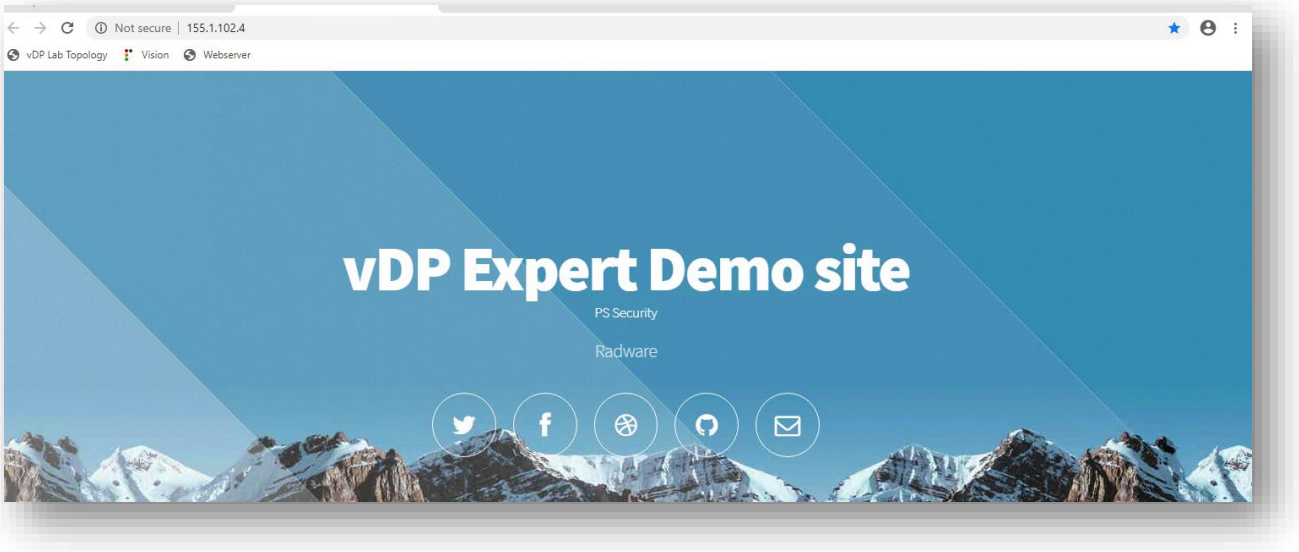


7. Open the *JMeter* pane and view the 302 results in the *Response code per second* pane:

   Open the bucket 101-200 – Authenticated (these sources are the legitimate traffic that has been passed the challenge):



8. Verify connectivity towards the attacking destination. Open the browser and select the **Webserver** bookmark (URL: http://155.1.102.4):



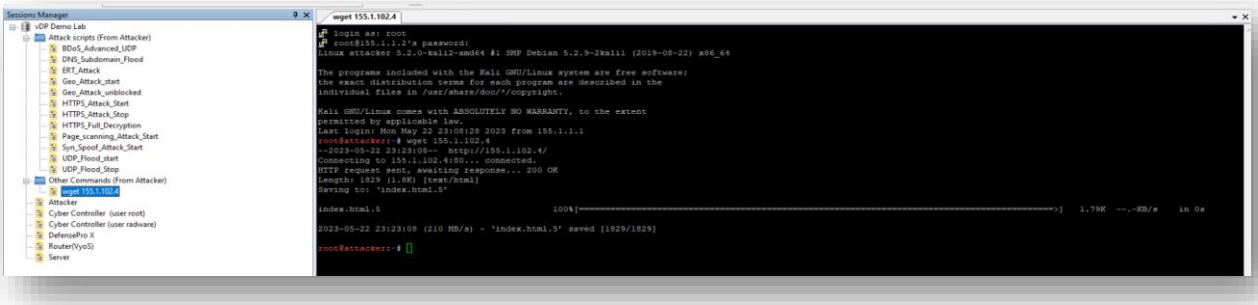
Traffic Filters

For more additional information about this scenario, please refer to the "Appendix 2 - Traffic Filters (Additional Info)" section.

Create an HTTP Page Scanning Attack from Kali and Verify Detection

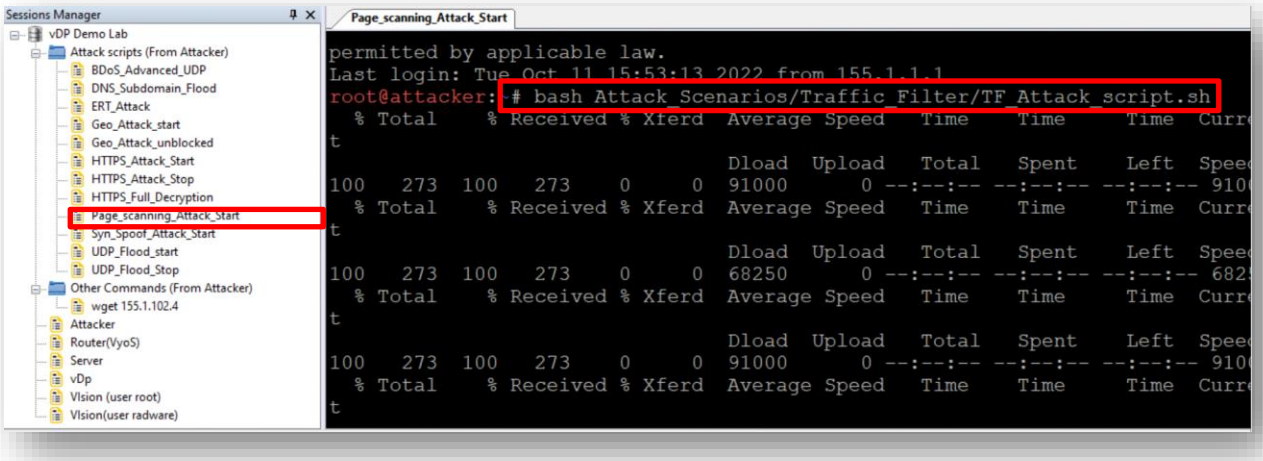
1. Check if the Webserver is reachable from the attacker *before* running the attack.

   Select the **wget 155.1.102.4** icon located in the **Other Commands (From Attacker)** folder on the Session Manager.



2. Click on the **Page_scanning_Attack_start** icon located in the **Attack scripts** folder on the Session Manager.
   This script activates an HTTP Page scanning attack towards the Webserver with a URL that does not exist on the Webserver.

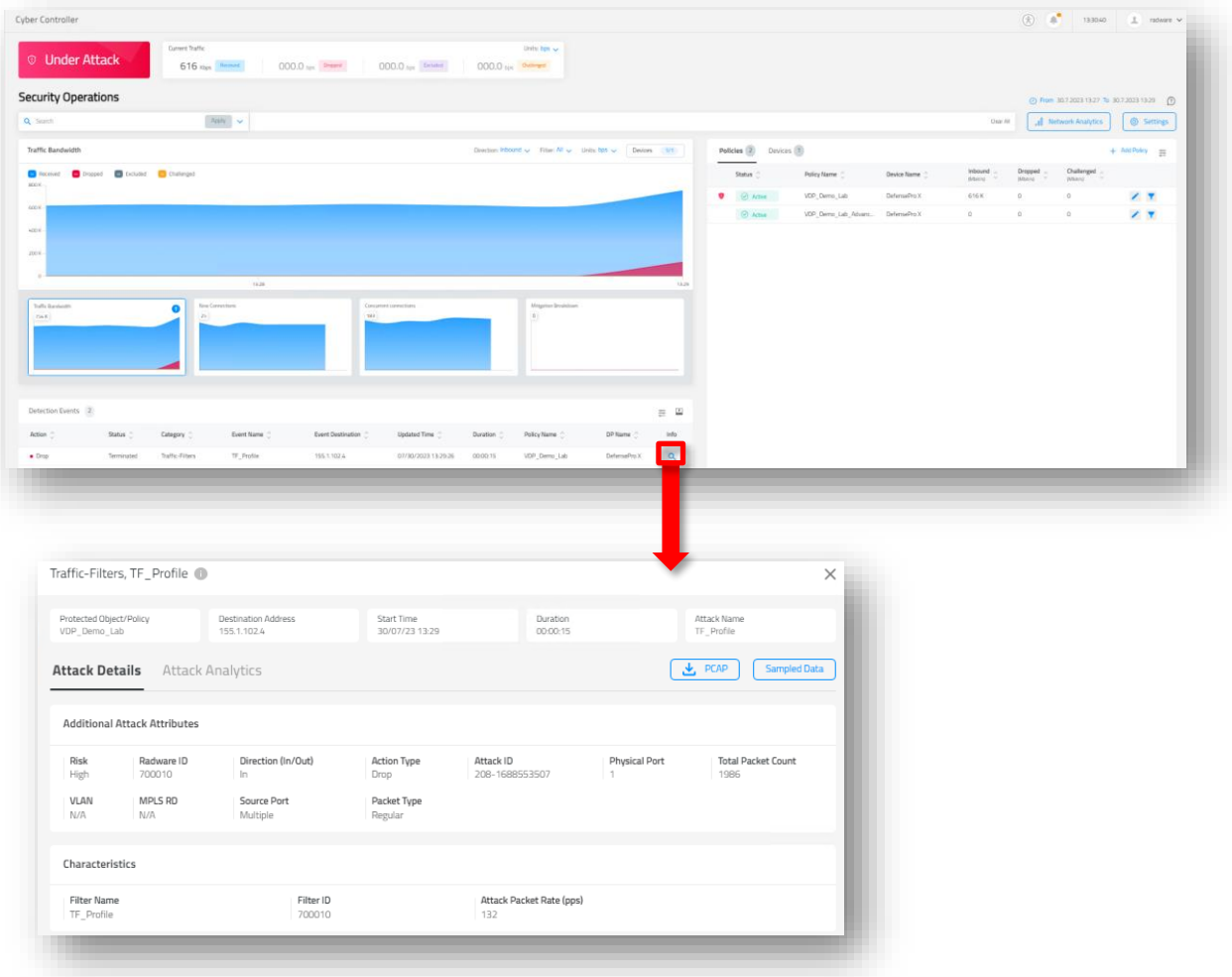
   While the script is running, the following screen displays:



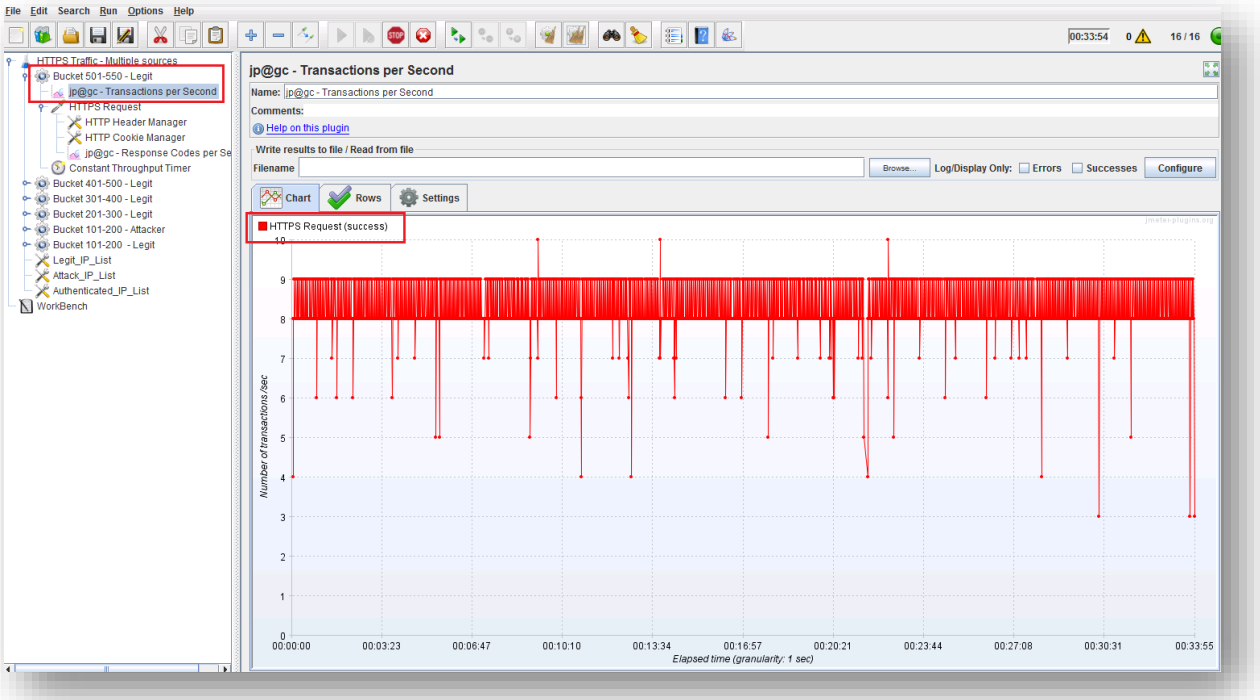
3. To *stop* the attack, press **Ctrl +C**

Attack Mitigation

1. Verify the attack in Cyber Controller. Go to the **Security Operations -> Real-Time Monitoring**:

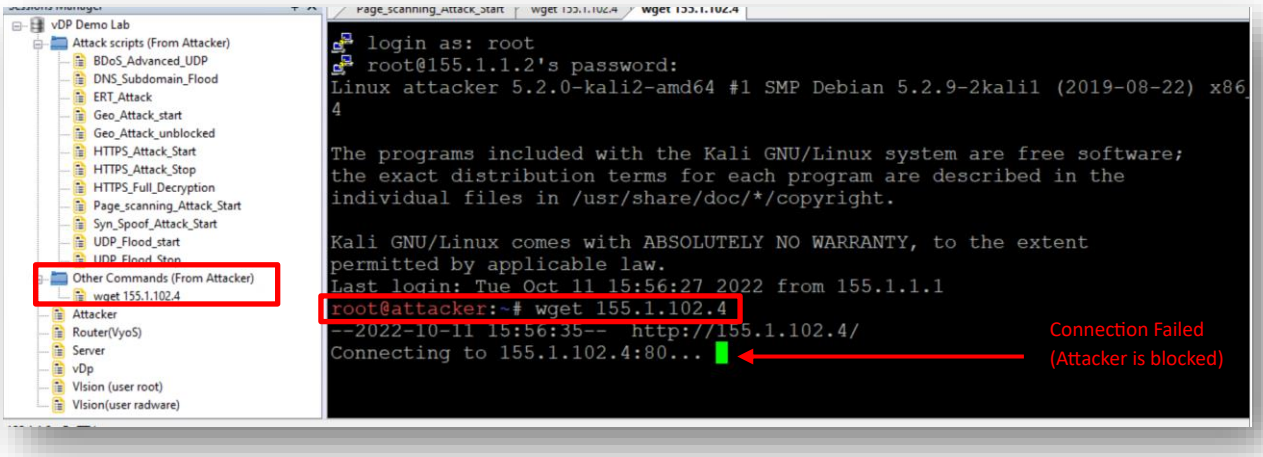


2. Open **JMeter** on the legitimate client and verify the information on the *Transactions Per Second* graph, select one of the legit buckets.

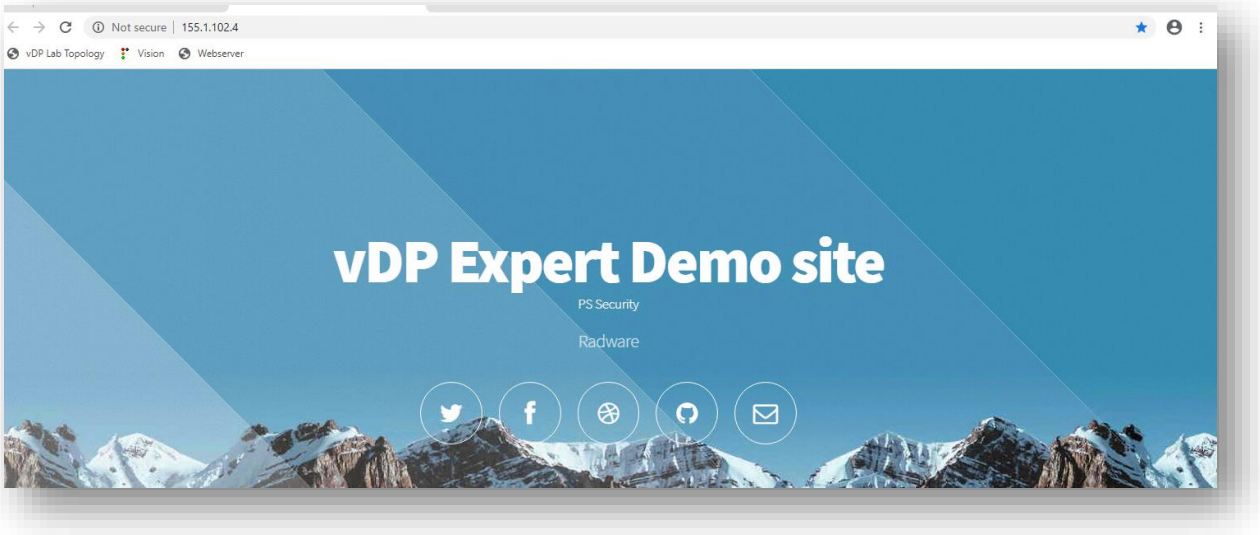


3. Check if the Attacker client can log in to the Webserver.

   Select the **wget 155.1.102.4** icon located in the **Other Commands (From Attacker)** folder on the Session Manager:



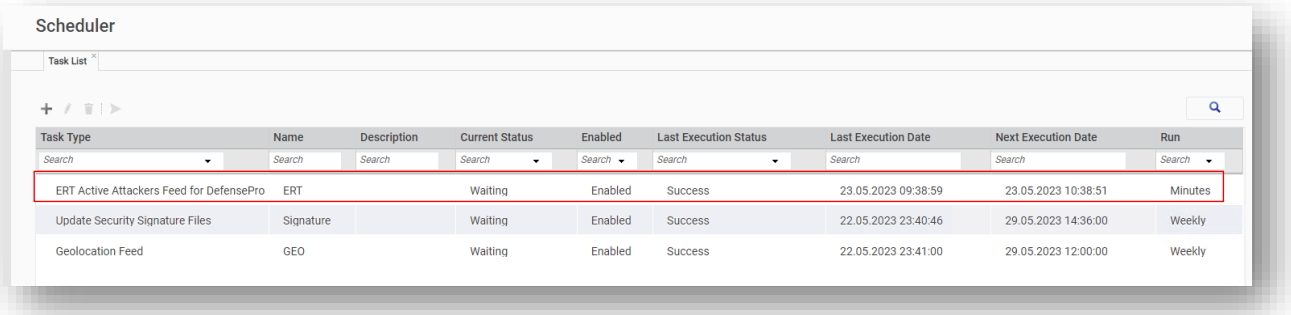
4. Verify connectivity towards the attacking destination. Open the browser and select the **Site(155.1.102.4)** bookmark (URL: http://155.1.102.4):



ERT Active Attacker Feed Protection

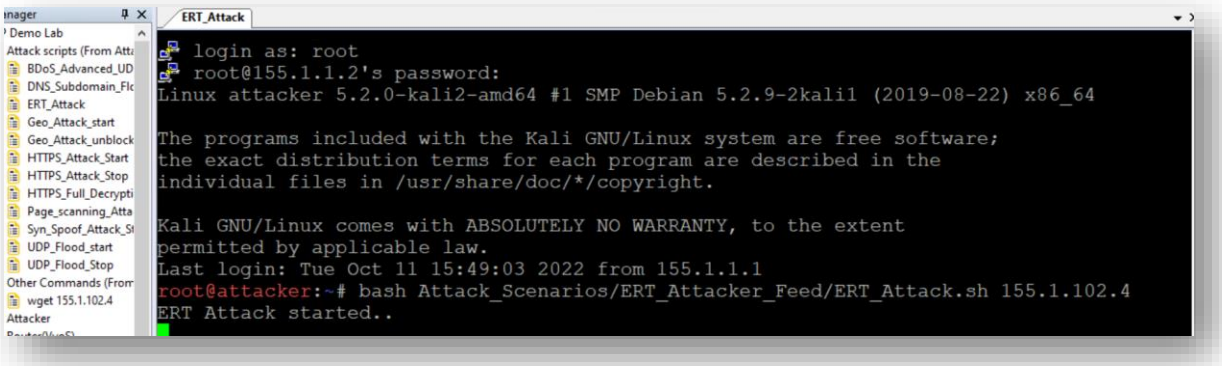
For more additional information about this scenario, please refer to the "Appendix 3 - ERT Active Attacker Feed Protection (Additional Info)" section.

Before running the test: Verify if the last ERT Attacker feed schedule was run successfully by clicking the Scheduler button in Cyber Controller:



Start a UDP Flood Attack and Verify Detection

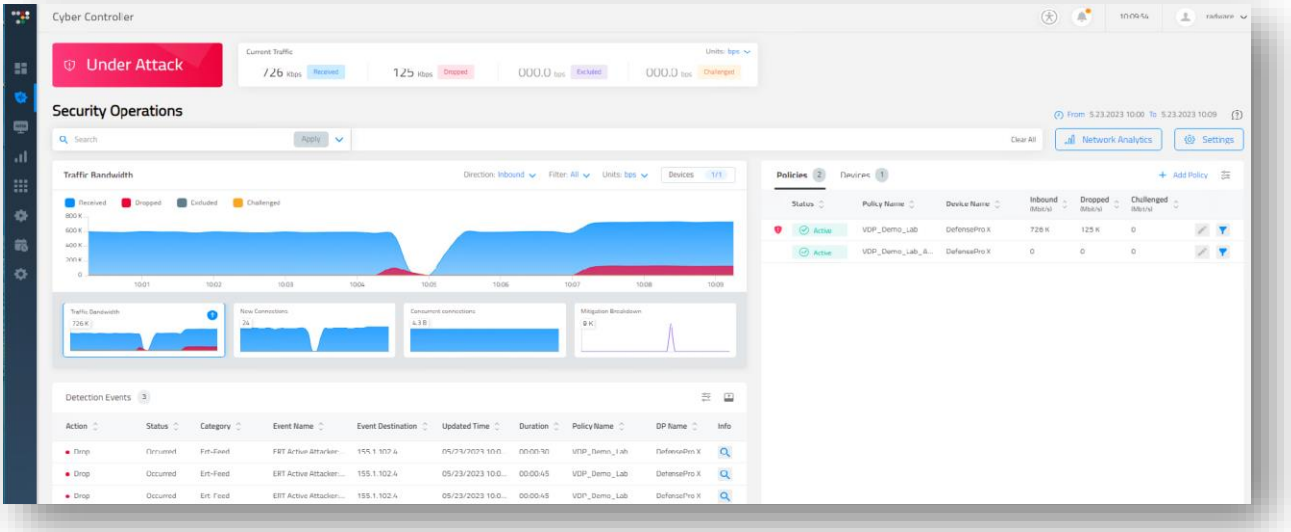
1. From the session manager, select the **ERT_Attack_start**.
   This script activates UDP flood attacks towards the Webserver from multiple sources that are on the ERT list.
   While the script is running, the following screen displays:



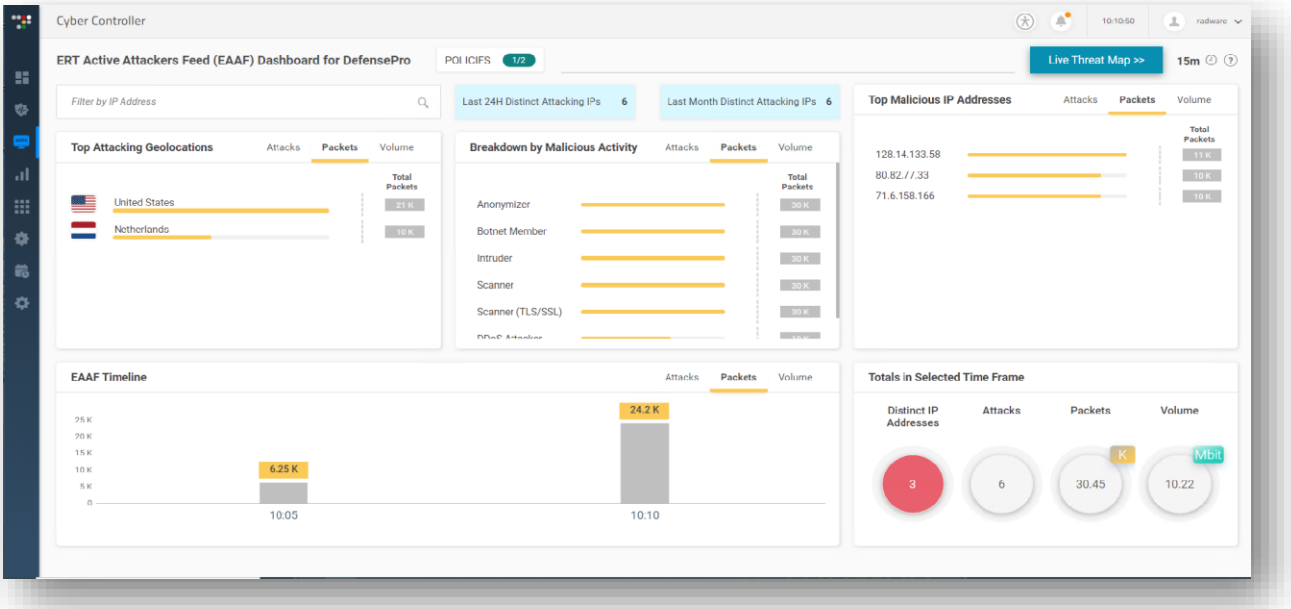
2. In order to **stop** the attack, press **Ctrl +C**.

Attack Mitigation

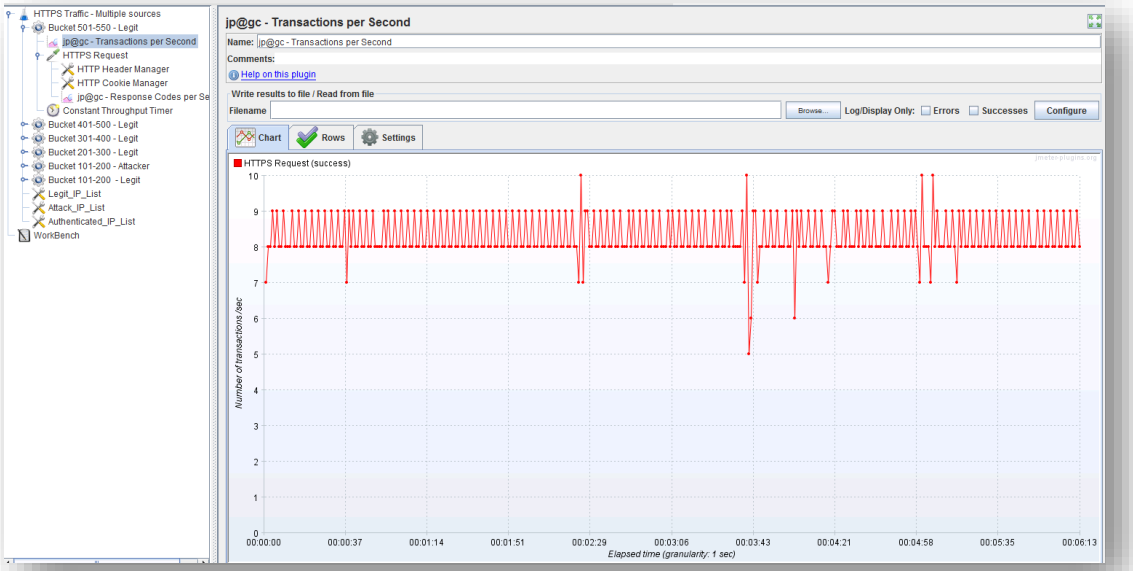
1. Verify the attack in Cyber Controller. Go to **Security Operations -> Real-Time Monitoring**:



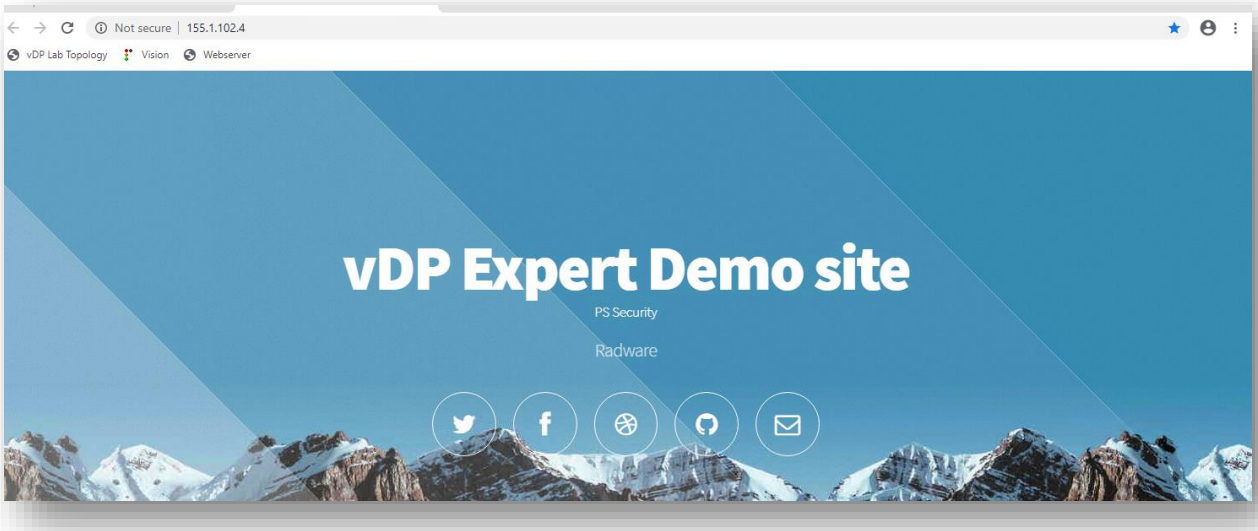
2. Verify the attack details on the **AMS > EEAF Dashboard**:



3. Open **JMeter** on the legitimate client and verify the information on the *Transactions per Second* graph:



4. Verify connectivity towards the attacking destination. Open the browser and select the **Webserver** bookmark (URL: http://155.1.102.4):

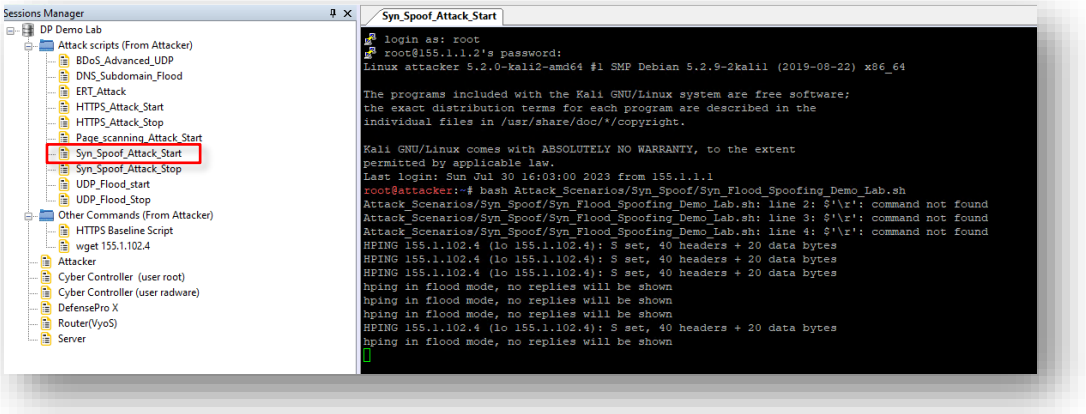


Spoofed Syn Attack Protection

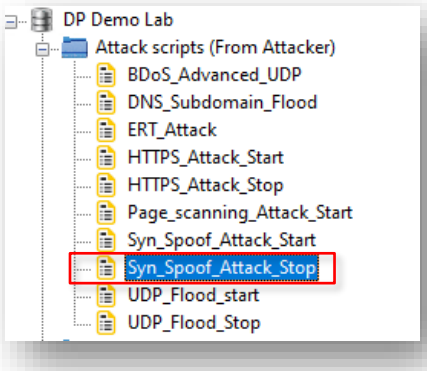
For more additional information about this scenario, please refer to the "Appendix 4 – Spoofed Syn Attack Protection (Additional Info)" section.

Start a Spoofed Syn Flood Attack And verify Detection

1. From the session manager, select the **Syn_Spoofed_Attack_start** .
   This script activates Spoofed Syn flood attacks towards the Webserver from multiple sources.
   While the script is running, the following screen displays:

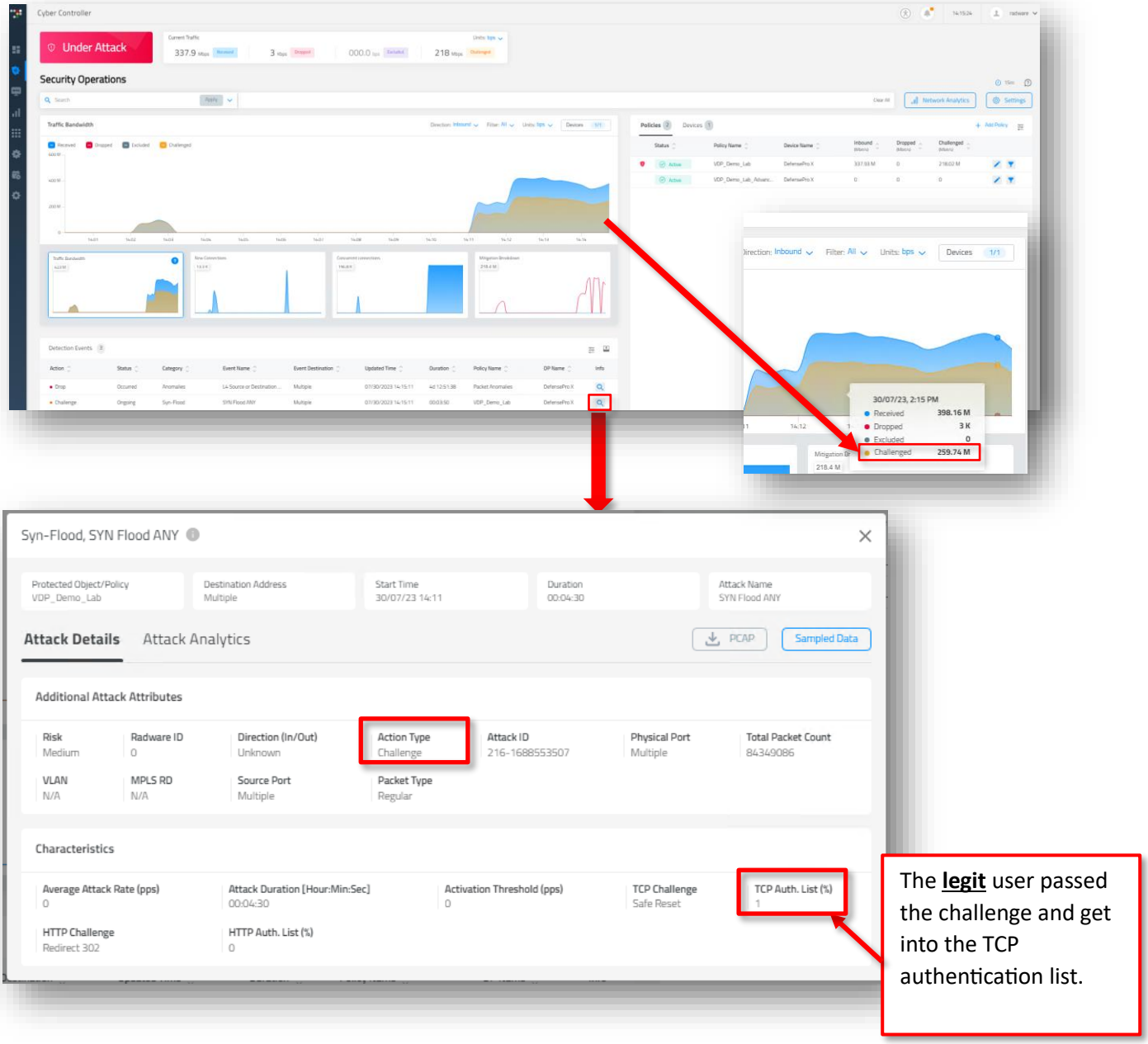


2. In order to **stop** the attack, double-click on **Syn_Spoofed_Attack:**

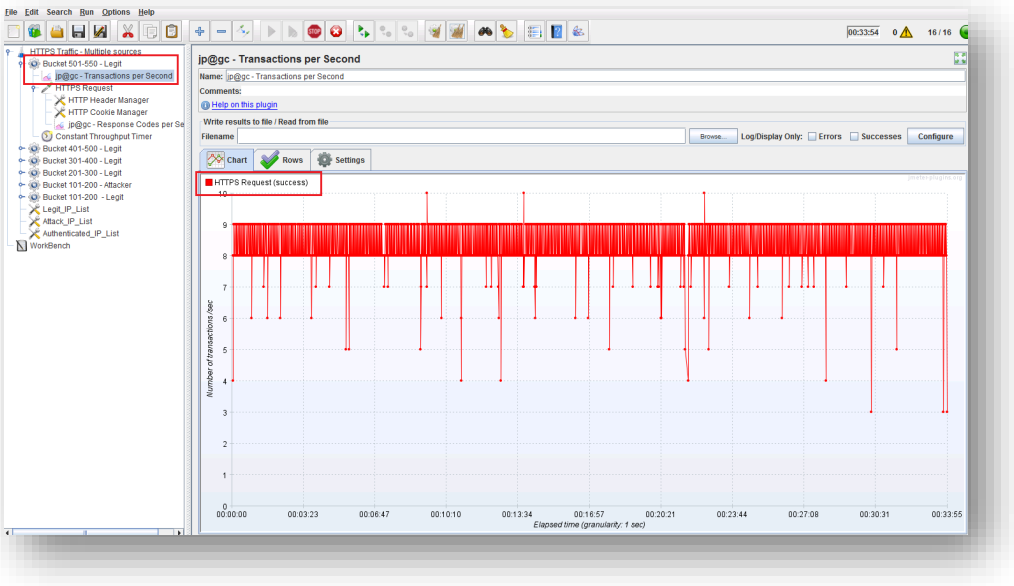


Attack Mitigation

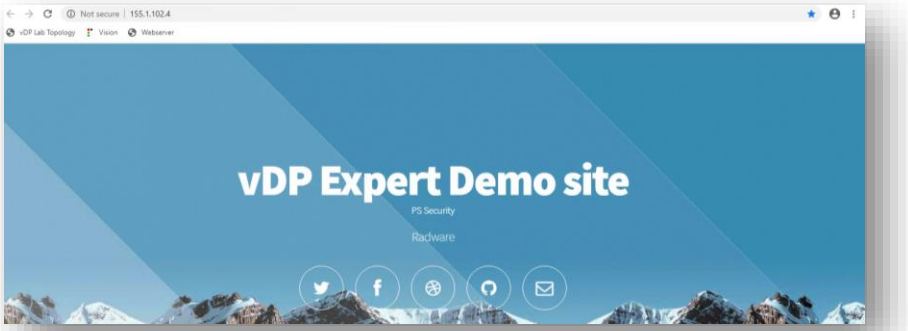
1. Verify the attack in Cyber Controller. Go to the **Security Operations -> Real-Time Monitoring**:



2. Open **JMeter** on the legitimate client and verify the information on the *Transactions Per Second* graph, select one of the legit buckets.



3. Verify connectivity towards the attacking destination. Open the browser and select the **Webserver** bookmark (URL:http://155.1.102.4):

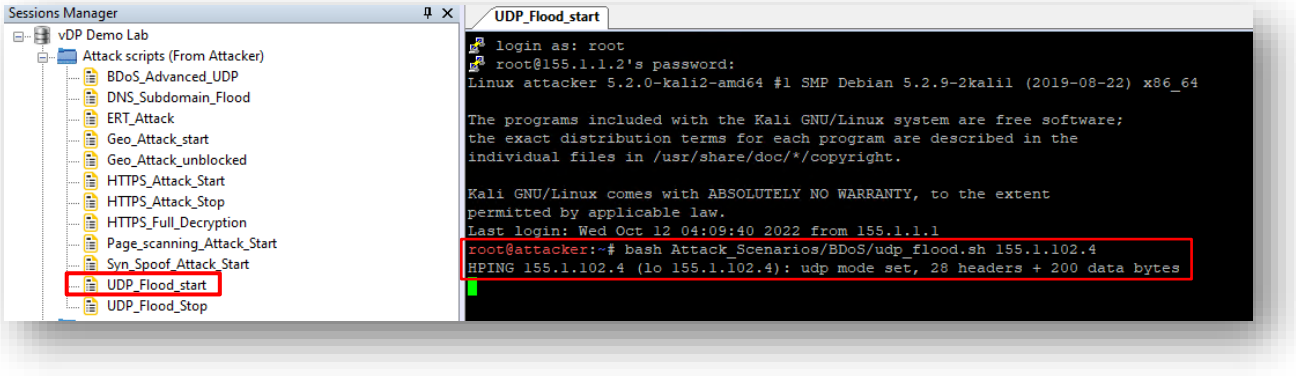


BDoS Protection

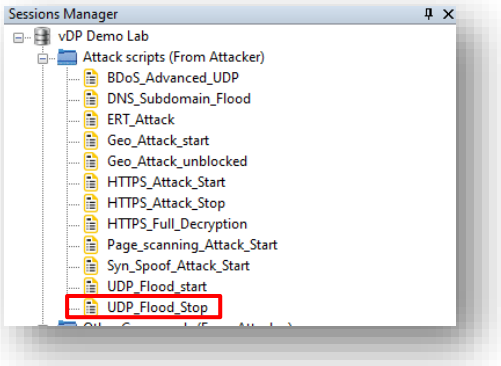
For more additional information about this scenario, please refer to the "Appendix 5 - BDoS Protection (Additional Info)" section.

Create a UDP Flood Attack and Verify Detection

1. From the session manager, select the **UDP_Flood_start**.
   This script activates UDP flood attacks towards the web server from multiple sources.
   The attack vectors are change after 100 seconds.
   While the script is running, the following screen displays:

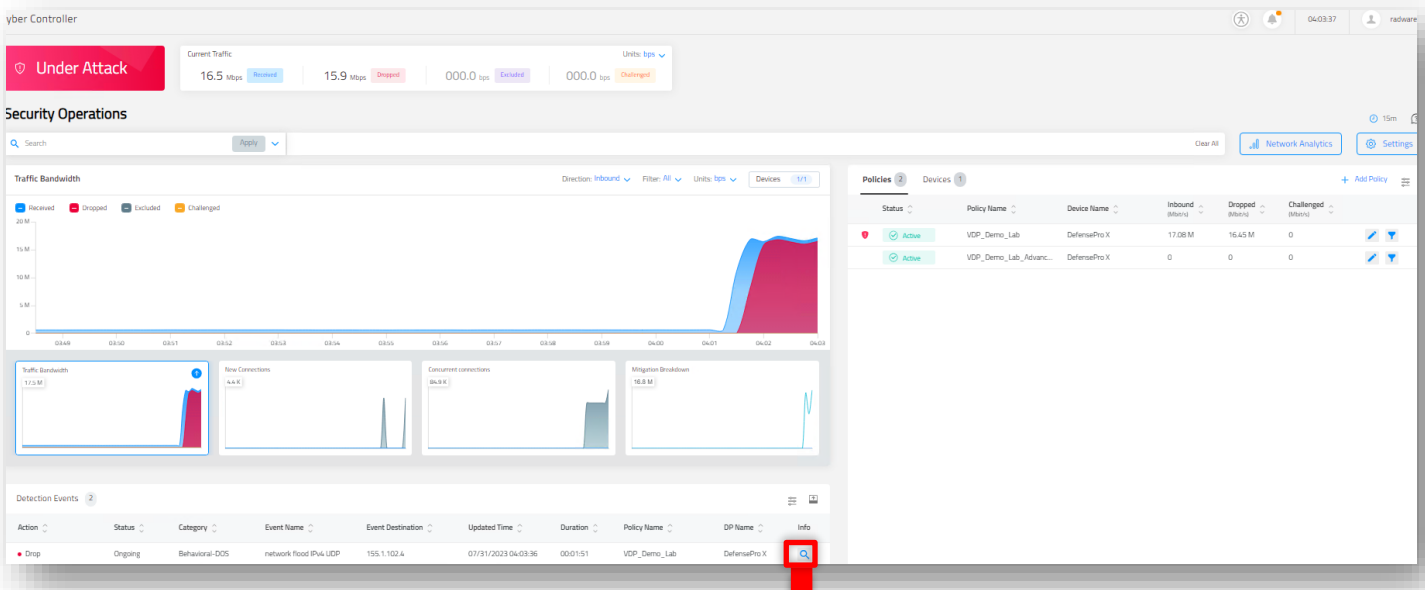


2. In order to **stop** the attack, double-click on **UDP_Flood_Stop:**

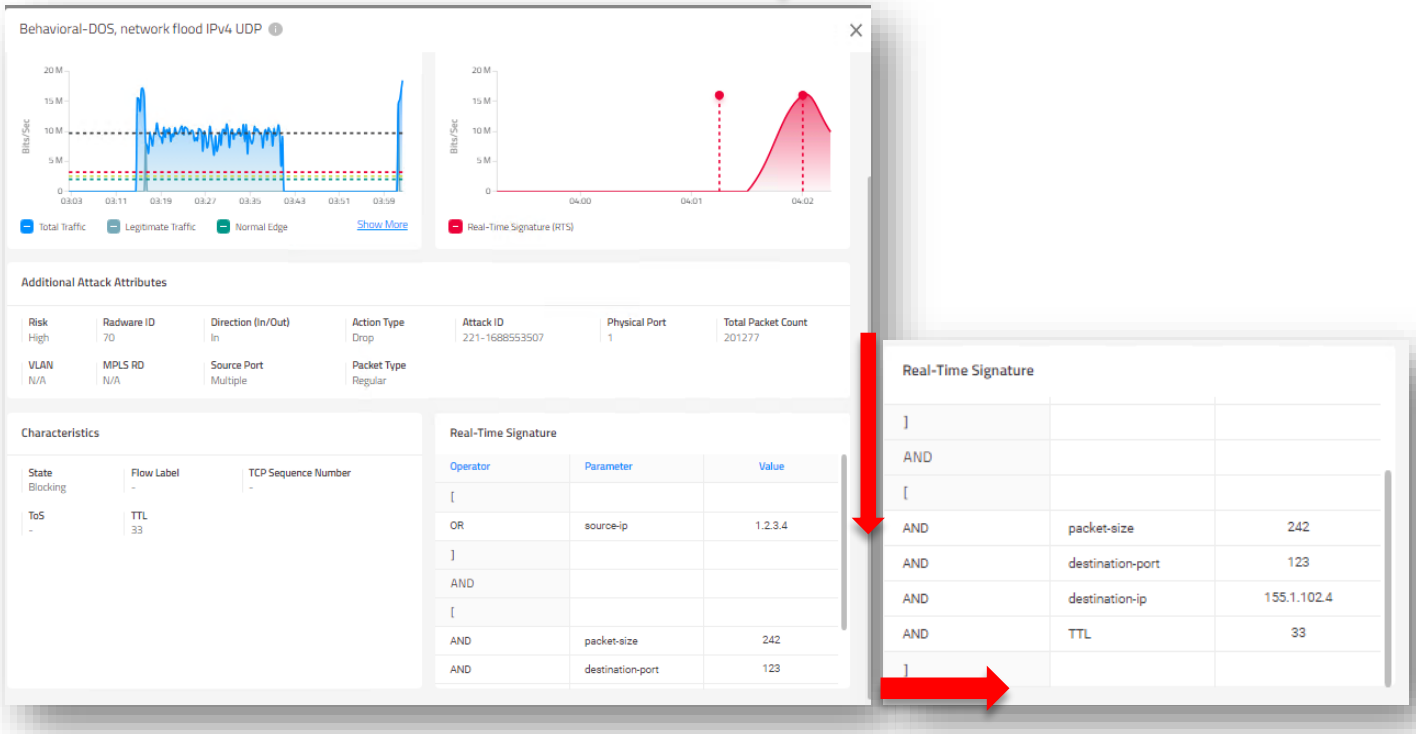


Attack Mitigation

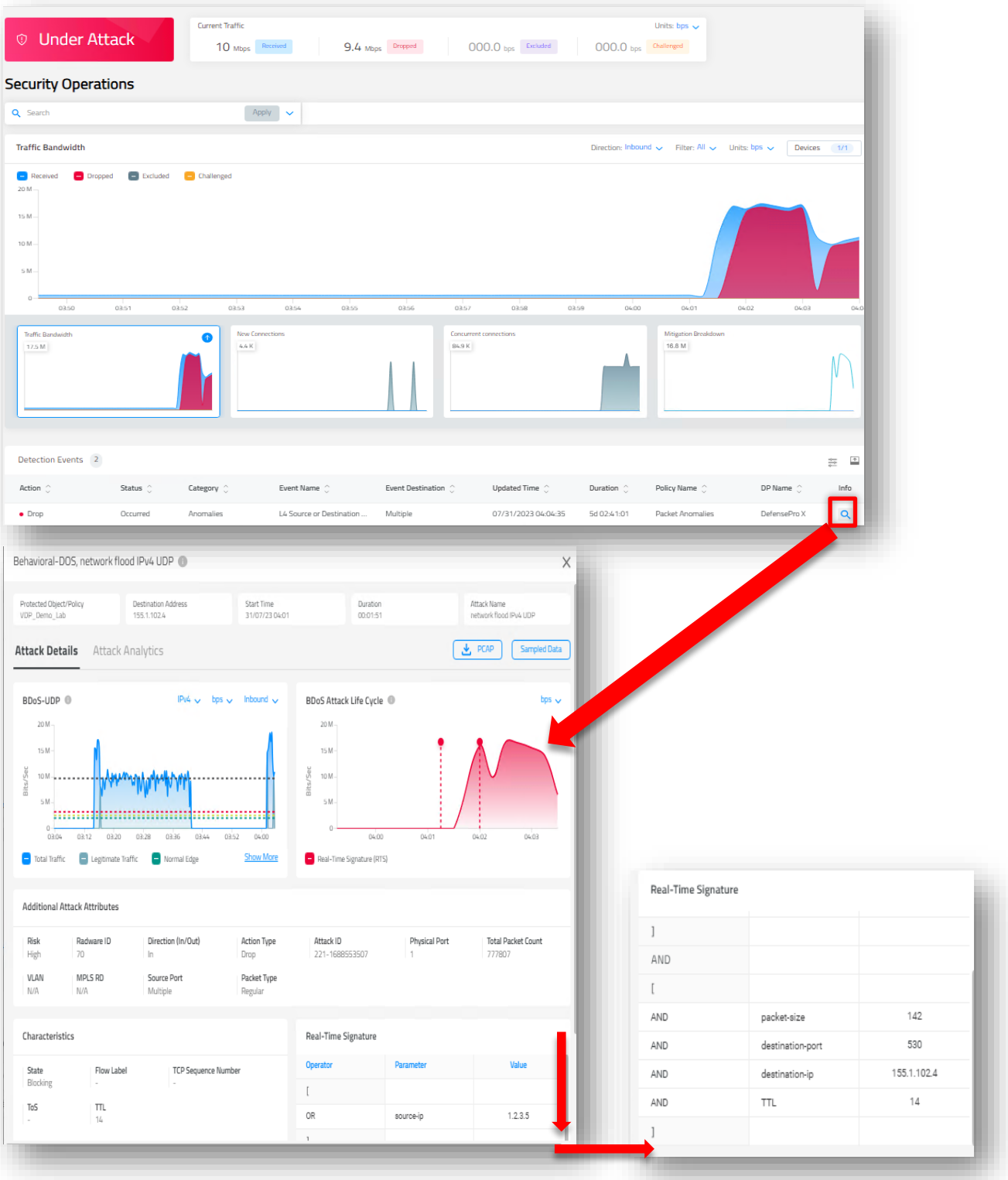
1. Verify the attack in Cyber Controller. Go to the **Security Operations -> Real-Time Monitoring**:



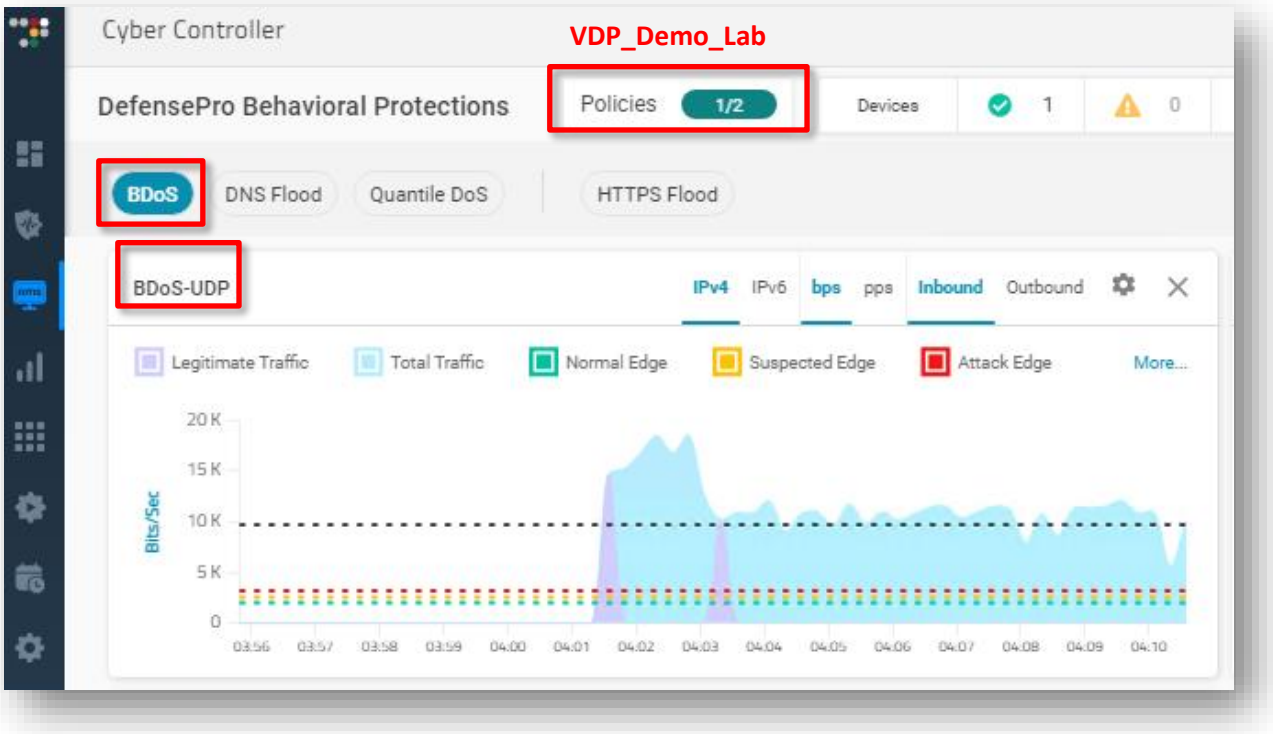
2. Verify the signature which DefensePro X generates for the **first** attack vectors:



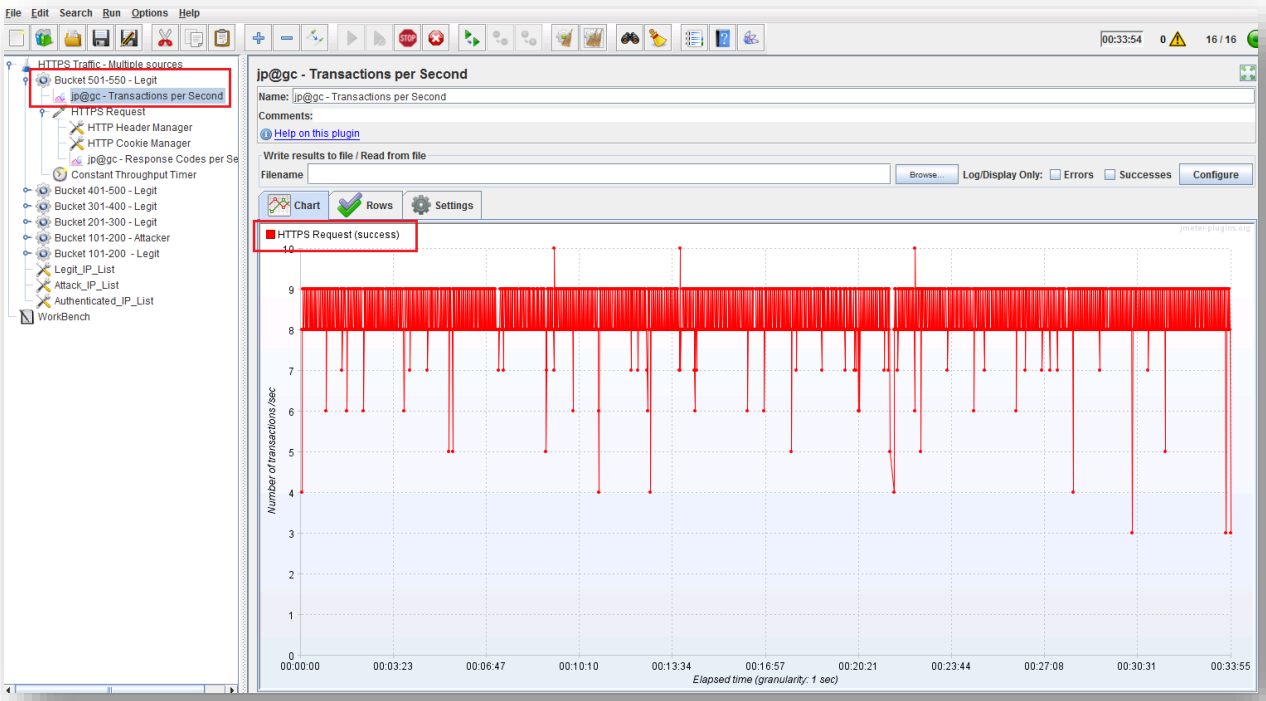
3. Verify the signature which DefensePro X generates for the **second** attack vectors:



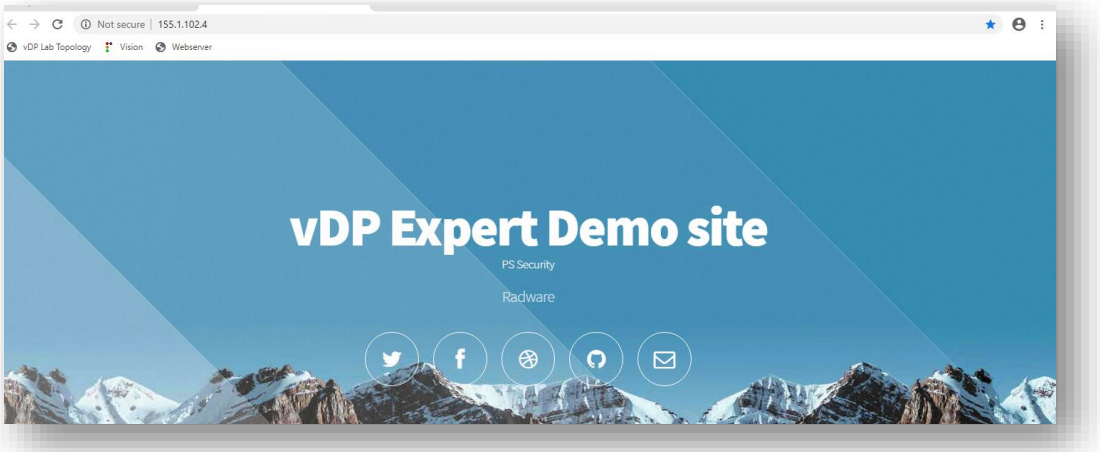
2. Check the current baselines of each BDoS controller in the **AMS > DefensePro Behavioral Protections** dashboard:



3. Open **JMeter** on the legitimate client and verify the information on the *Transactions per Second* graph:



4. Verify connectivity towards the attacking destination. Open the browser and select the **Webserver** bookmark (URL: http://155.1.102.4):

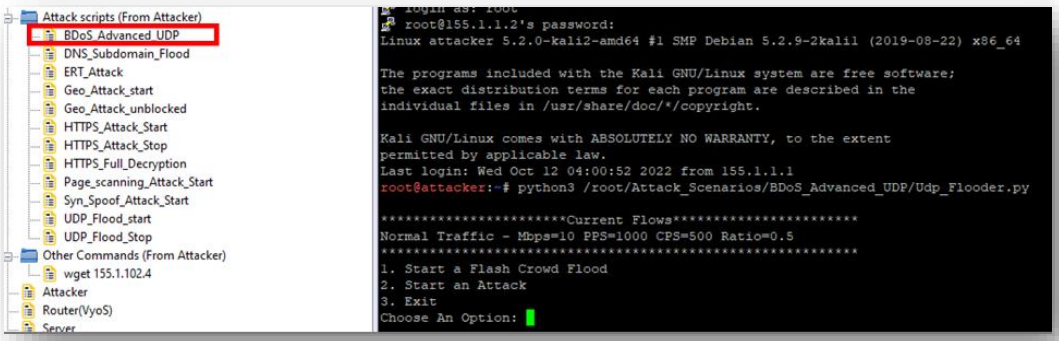


BDoS Advanced UDP Protection

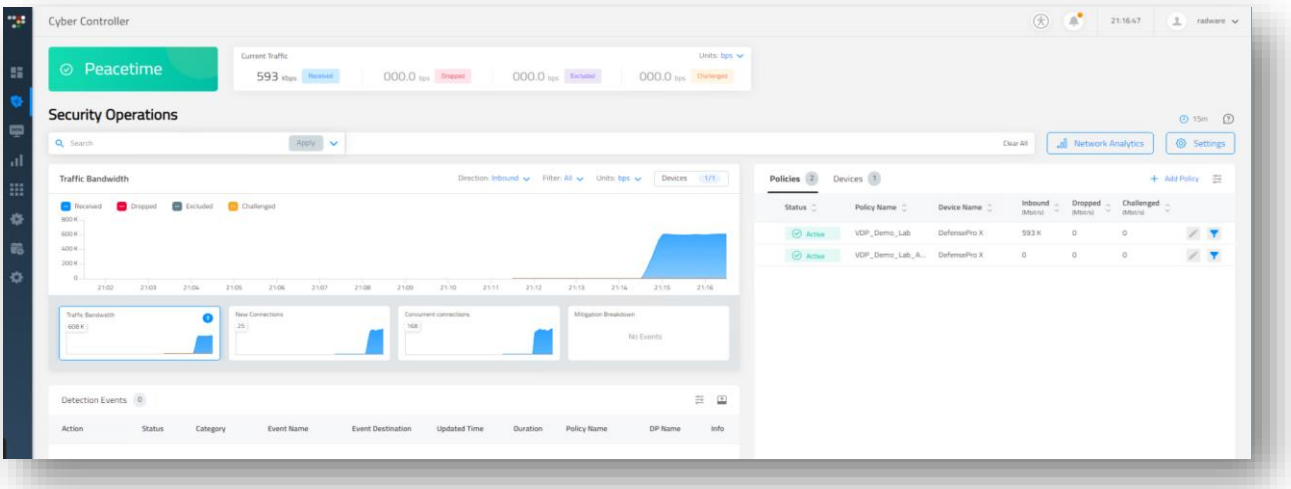
For more additional information about this scenario, please refer to the "Appendix 6 - BDoS Advanced Protection (Additional Info)" section.

Start Legitimate Traffic

From the session manager, select the **BDoS_Advanced_UDP.**
The script **automatically** starts with 10 Mbps of a legitimate UDP traffic once activated.
Note: The following output shows the current flows and the configured parameters.



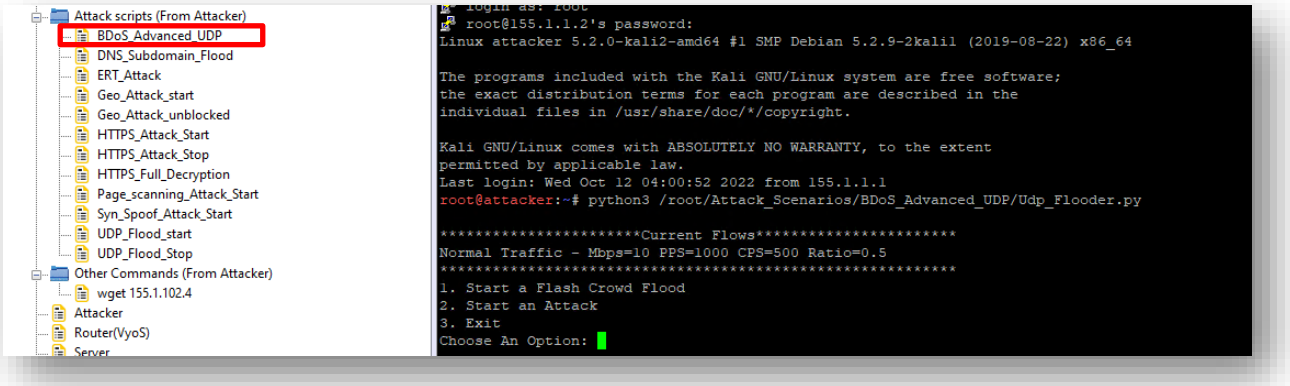
1. Once the legitimate traffic has started, it is displayed in the **Security Operations -> Real-Time Monitoring**:



Start a UDP Flood Attack

1. Select again the **BDoS_Advanced_UDP** icon located in the **Attack scripts** folder on the Session Manager.

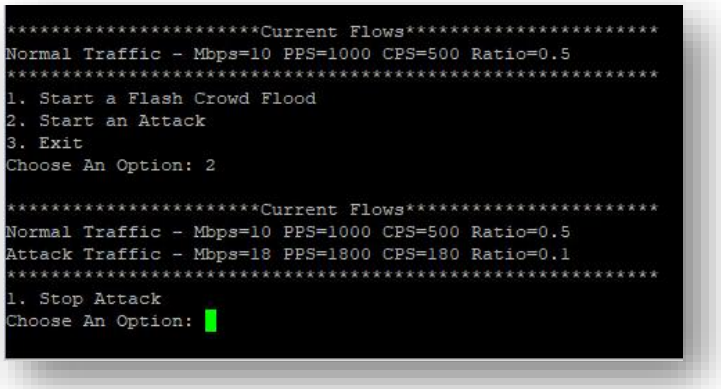
The script runs 10 Mbps of a legitimate UDP traffic once activated.
Press 2, in order to activate UDP Flood attack.



The script runs two different flows.

1. Normal Traffic
2. UDP Flood Attack

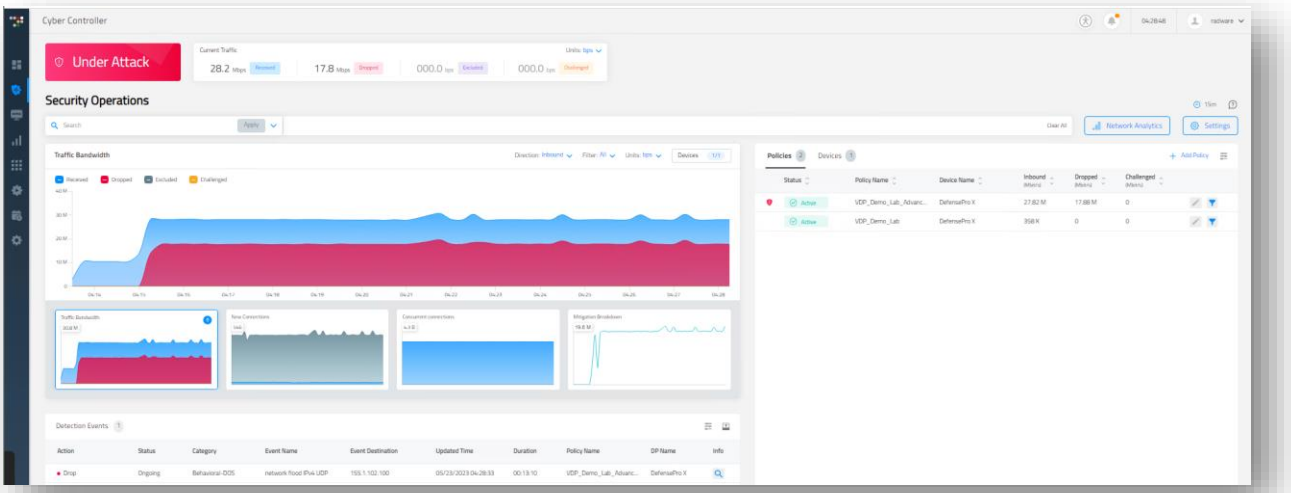
While the script is running, the following screen displays:



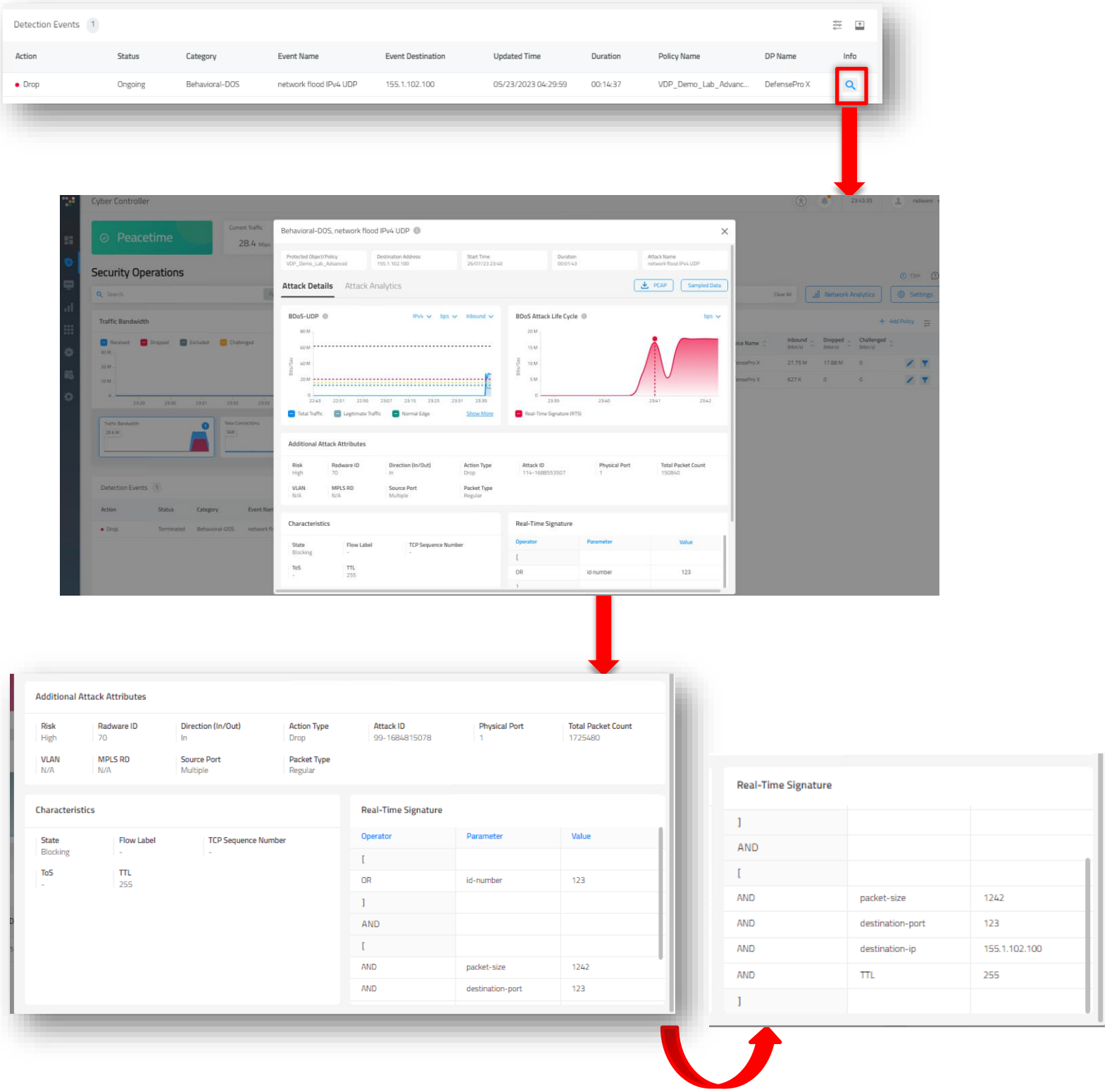
2. In order to **stop** the attack traffic, press **1.**

Attack Mitigation

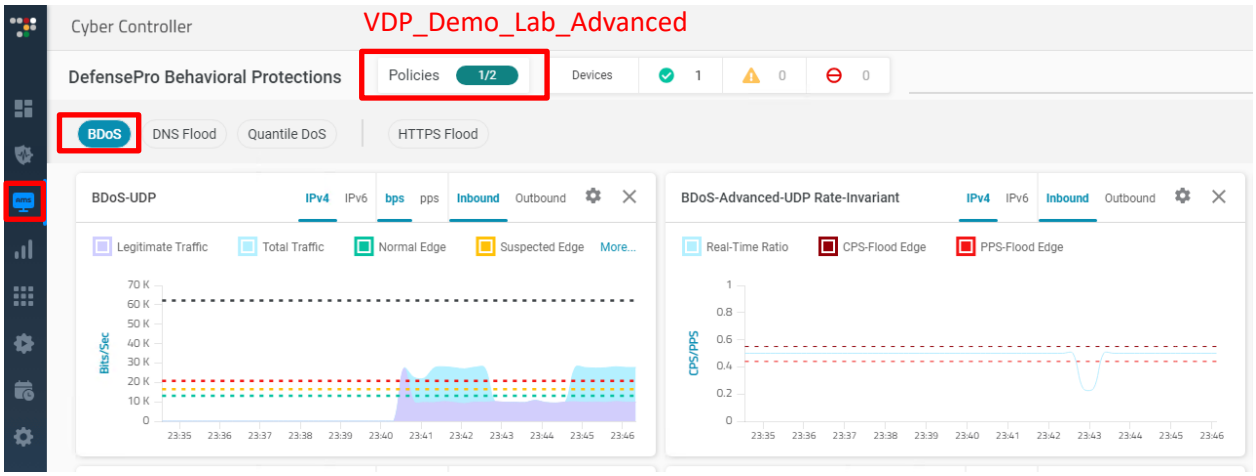
1. Verify the attack in Cyber Controller. Go to the **Security Operations -> Real-Time Monitoring**:



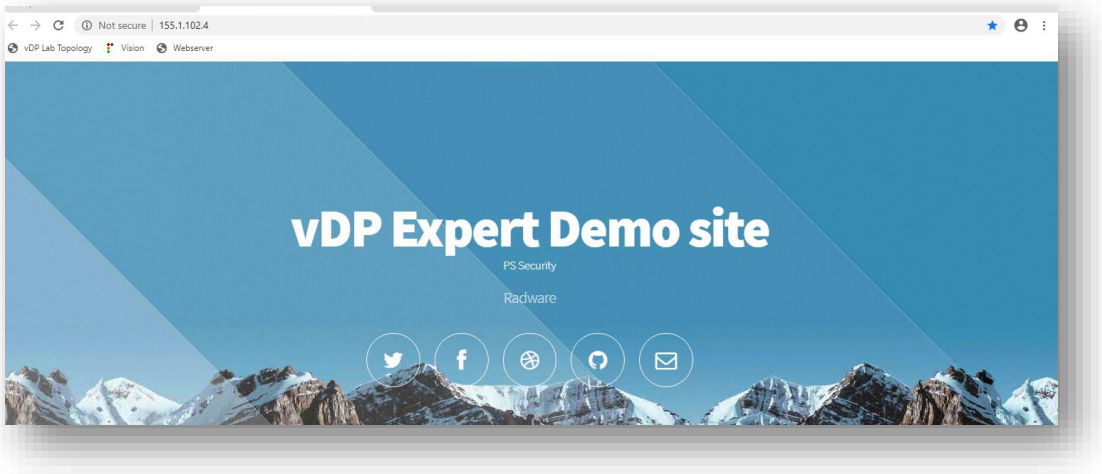
2. Verify the attack details and the BDoS fingerprint that the DefensePro X genetrated:



3. Verify the BDoS UDP graph on the **AMS > DefensePro Behavioral Protections** (choose the VDP_Demo_Lab_Advanced policy):

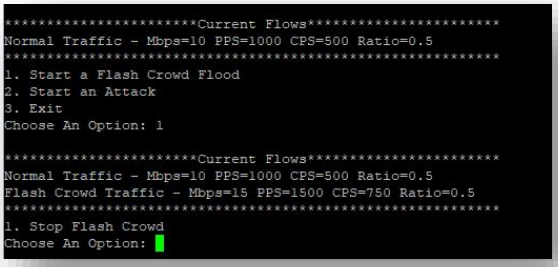


4. Verify connectivity towards the attacking destination. Open the browser and select the **Site (155.1.102.100)** bookmark (URL: http://**155.1.102.100**):



Start a UDP Flood Flash Crowed Legit Traffic

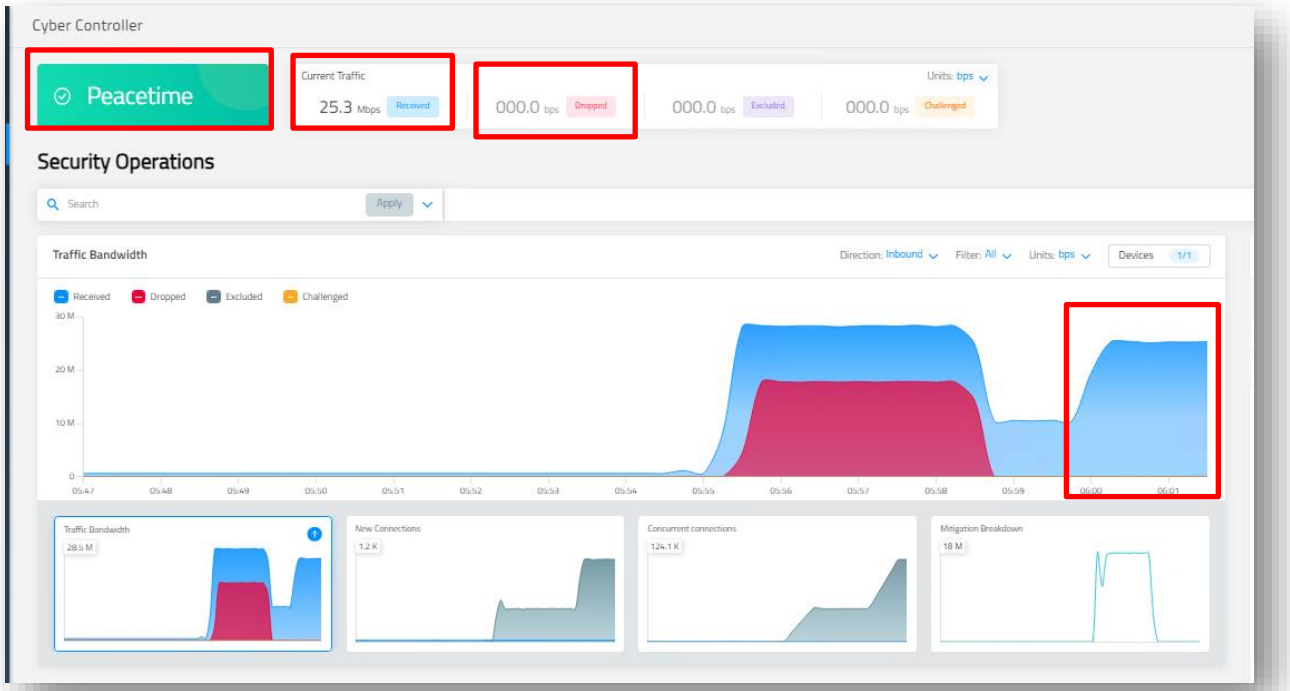
1. Select again the **BDoS_Advanced_UDP** icon located in the **Attack scripts** folder on the Session Manager.
   The script runs 10 Mbps of a legitimate UDP traffic once activated.
   Press 1, in order to activate Flash-Crowed traffic.
   The script runs two different flows.
   1. Normal Traffic
   2. Flash-Crowed traffic.



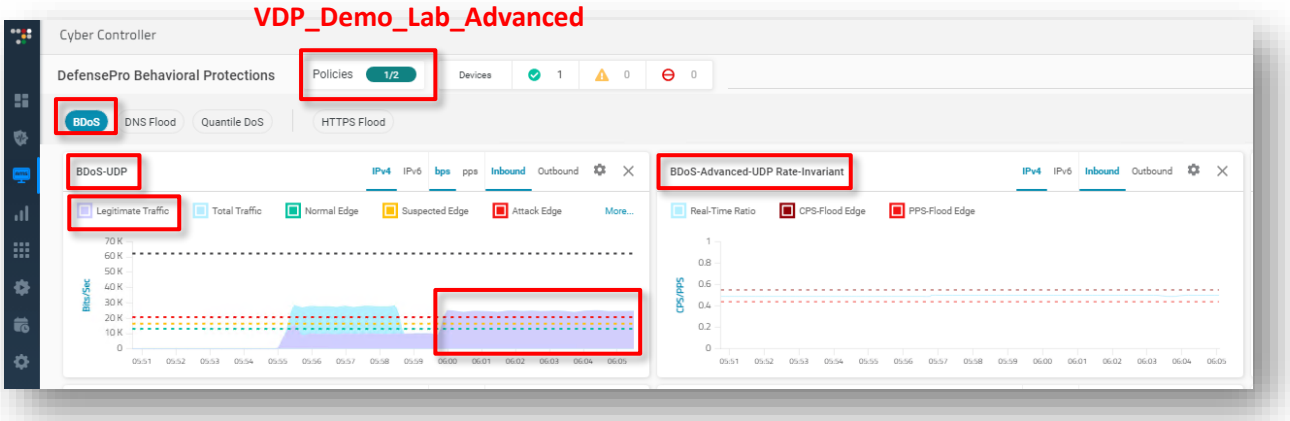
2. In order to **stop** the Flash-Crowed traffic, press **1.**

Verify Flash Crowed Isn't Getting Blocked

1. Verify that all the traffic (legit traffic with the flash crowd traffic) **isn't** getting blocked and that there **isn't** any attack detection. You can verify it on:



2. Verify the BDoS UDP graph on the **AMS > DefensePro Behavioral Protections** (choose the VDP_Demo_Lab_Advanced policy):



DNS Flood Protection

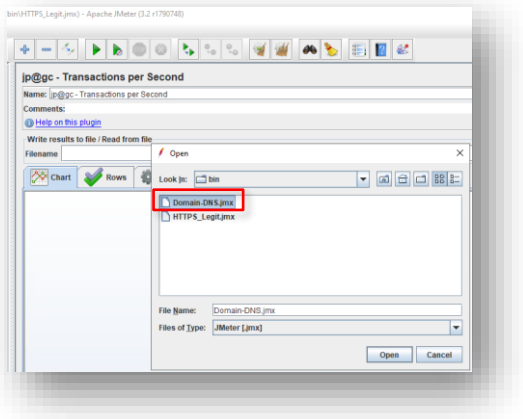
For more additional information about this scenario, please refer to the "Appendix 7 - DNS Flood Protection (Additional Info)" section.

Start DNS Legitimate Traffic

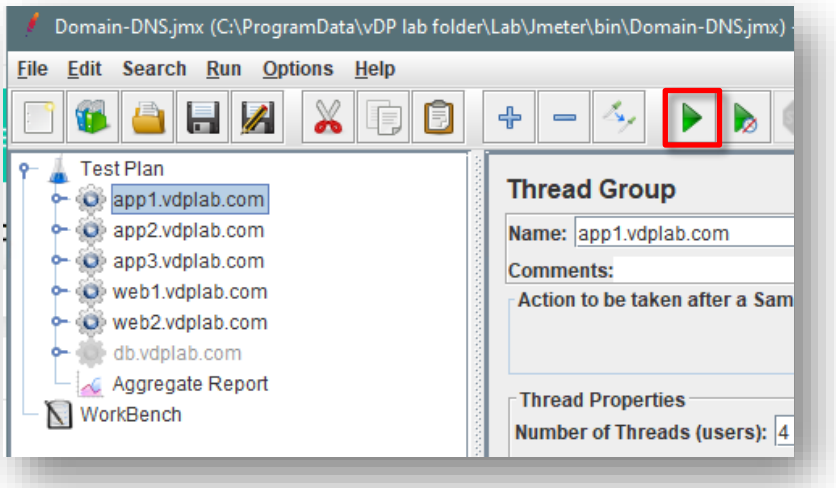
Before start this scenario, you need first to stop the HTTPS legitimate traffic (running two JMeters on parallel, can cause issue with resources of the nested ESXI of the demo lab).

1. Open the DNS legitimate traffic on the JMeter:

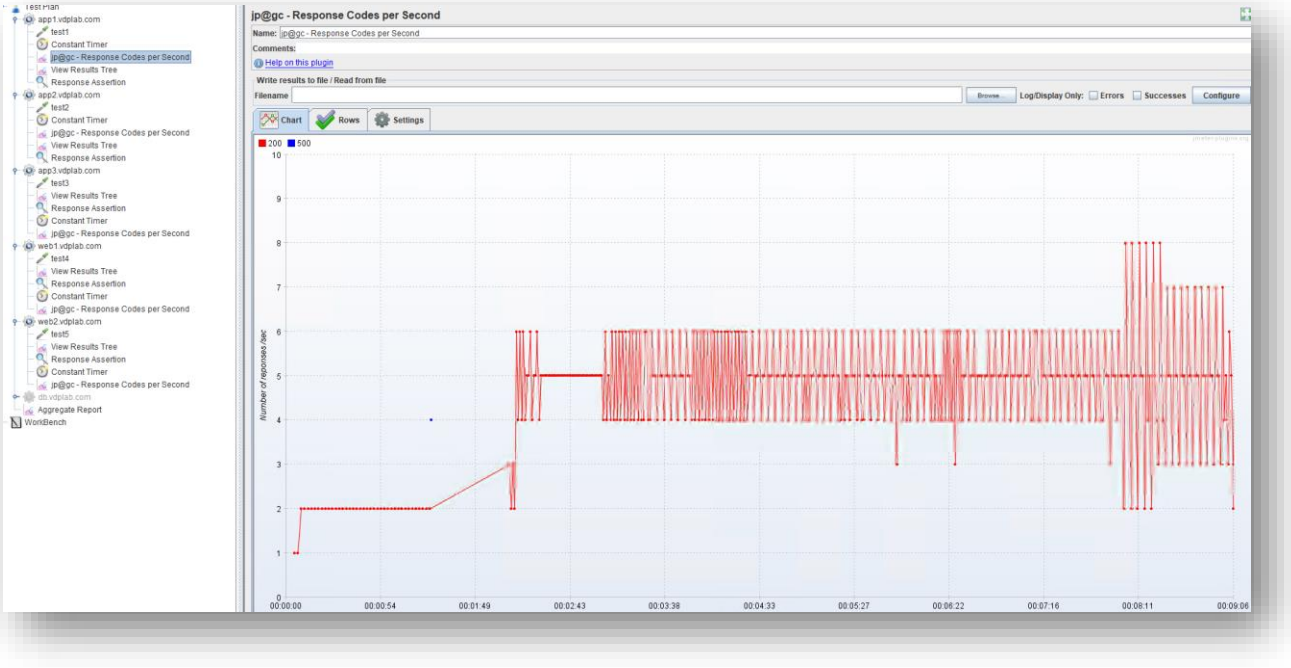
   Legitimate script location: **Desktop\Lab\Jmeter\JM legit script\bin\Domain-DNS.jmx**



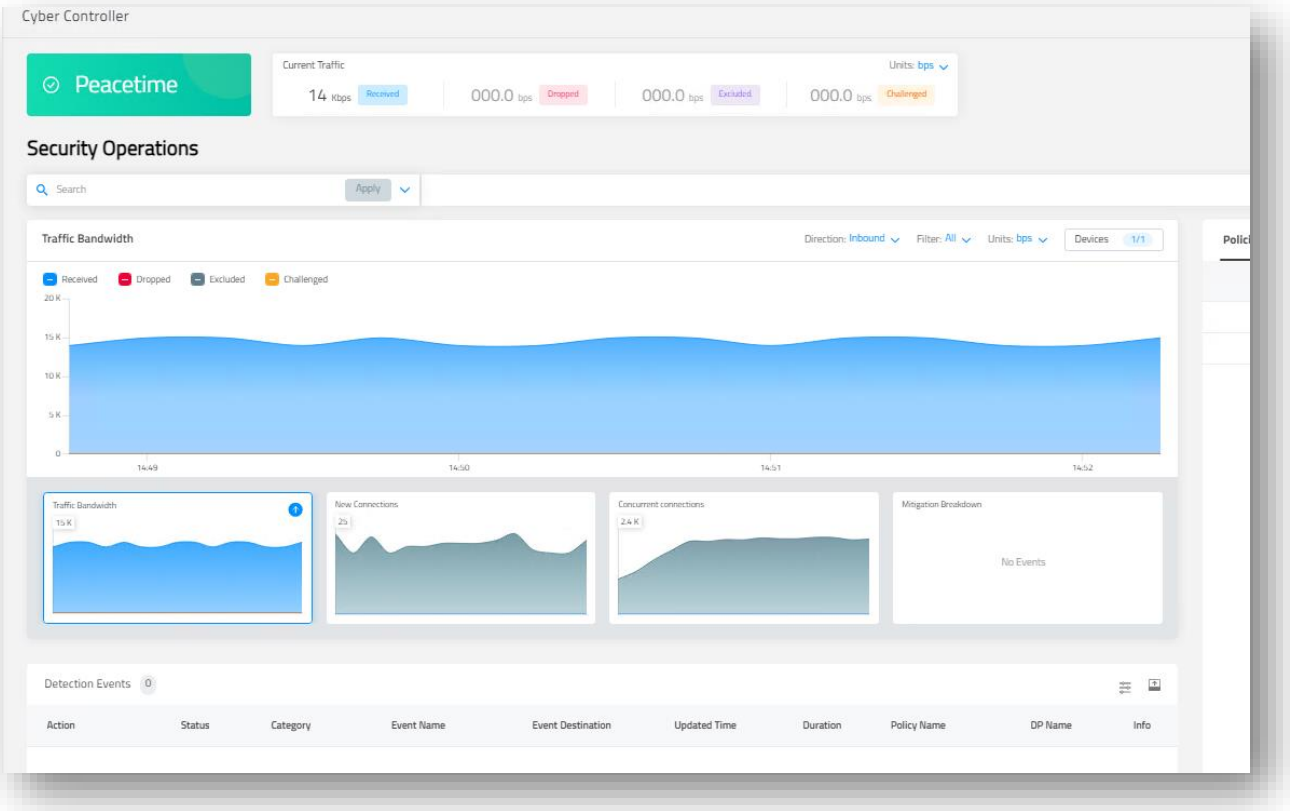
2. Press start.



3. Verify the legitimate queries response code:

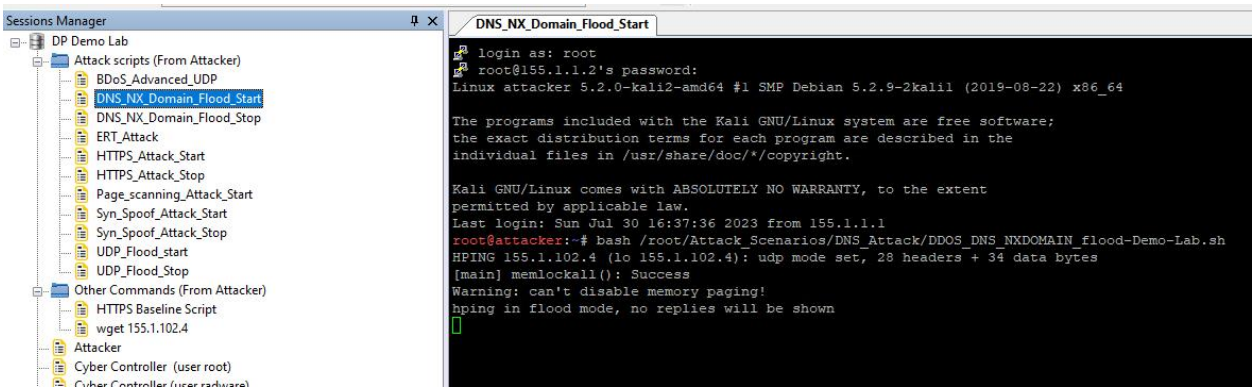


4. Once the legitimate traffic has started, it is displayed in the **Security Operations -> Real-Time Monitoring**:

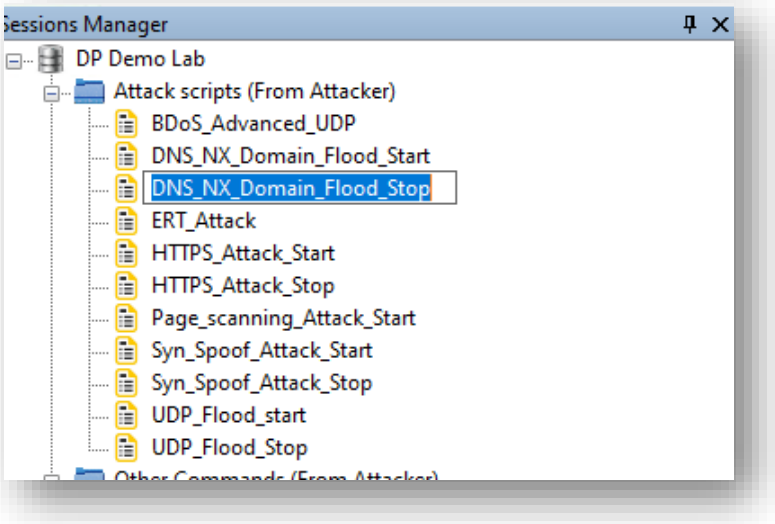


Start a DNS NX Domain Flood Attack and Verify Detection

1. From the session manager, select the **DNS_NX_Domain_Flood_Start**.
   This script activates NX Domain flood attacks towards the DNS server from multiple sources.
   While the script is running, the following screen displays:

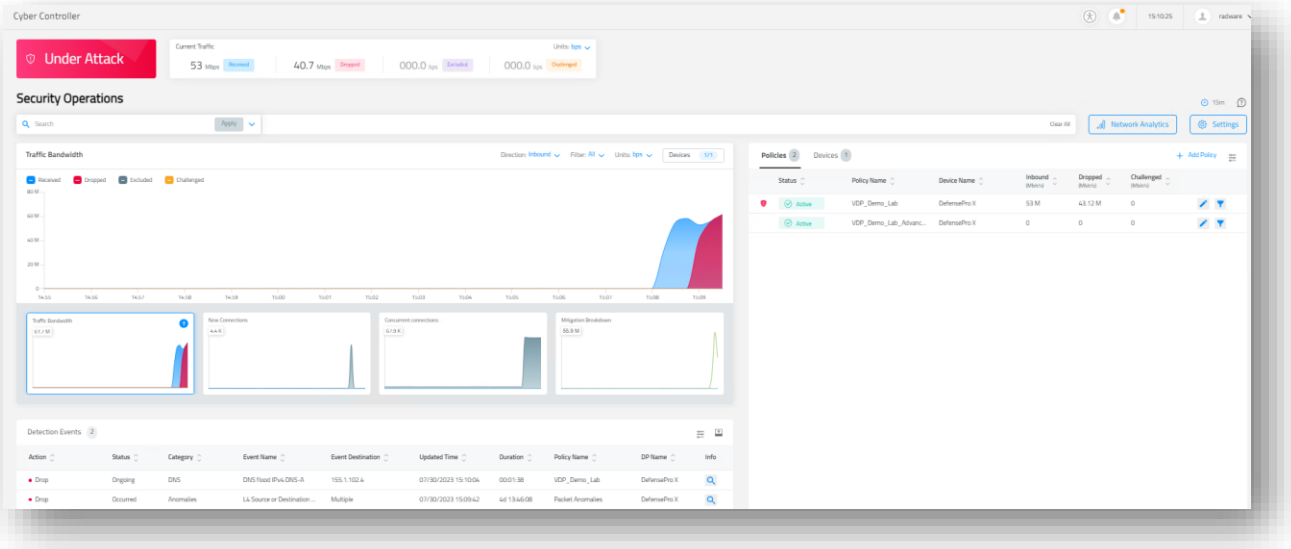


2. In order to **stop** the attack, double-click on **DNS_NX_Domain_Flood_Stop.**

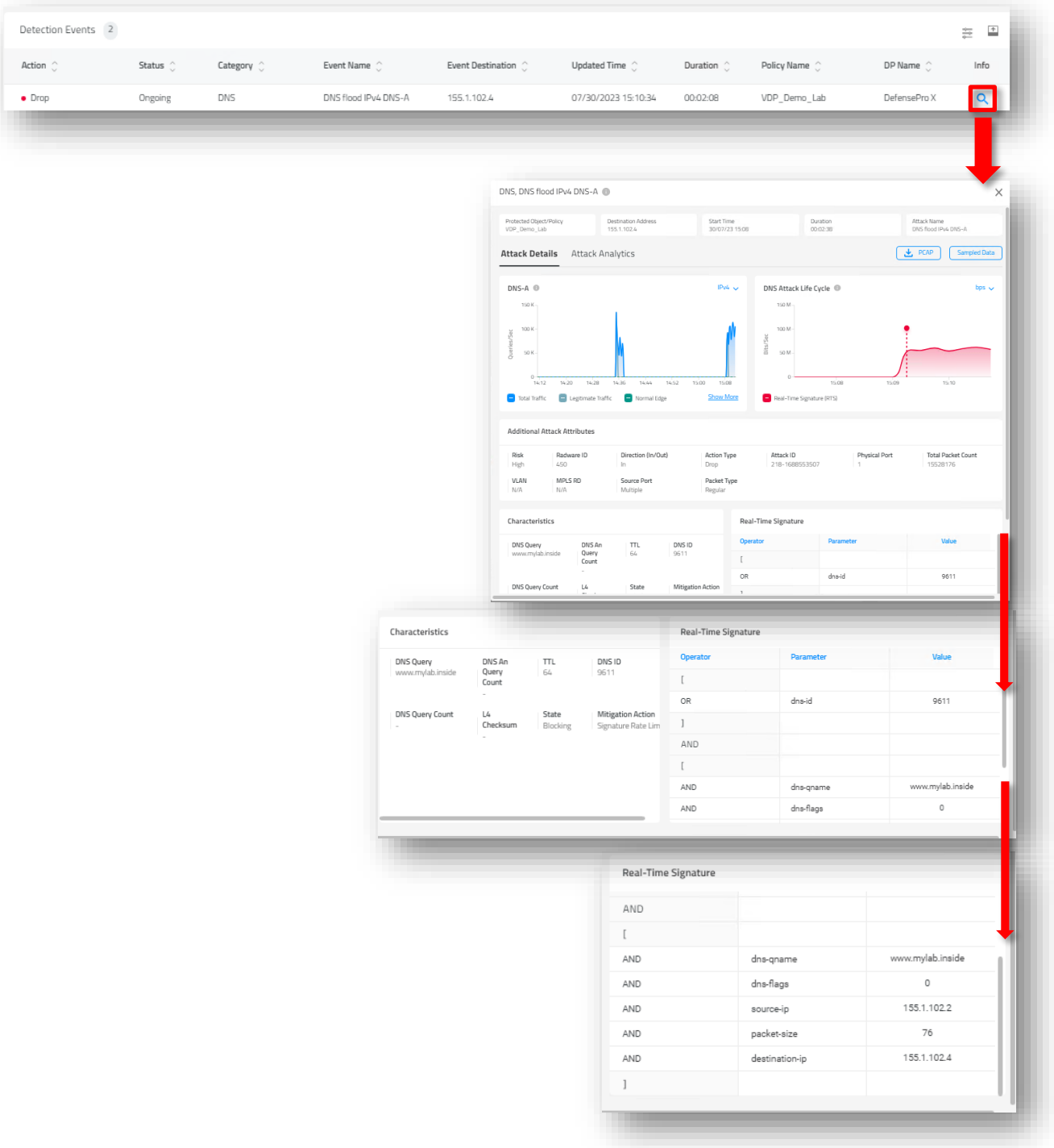


Attack Mitigation

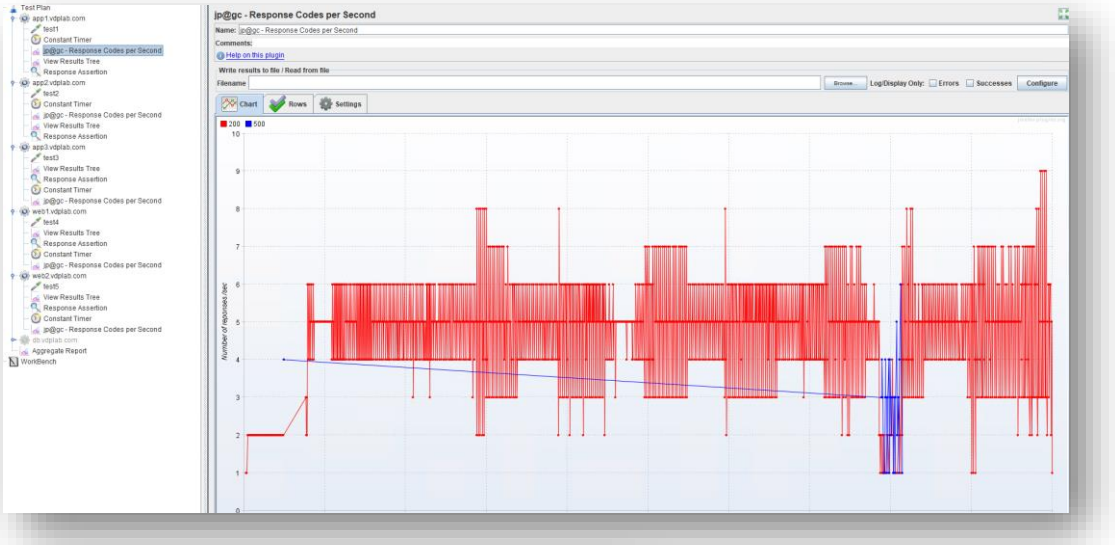
1. Verify the attack in Cyber Controller. Go to the **Security Operations -> Real-Time Monitoring:**

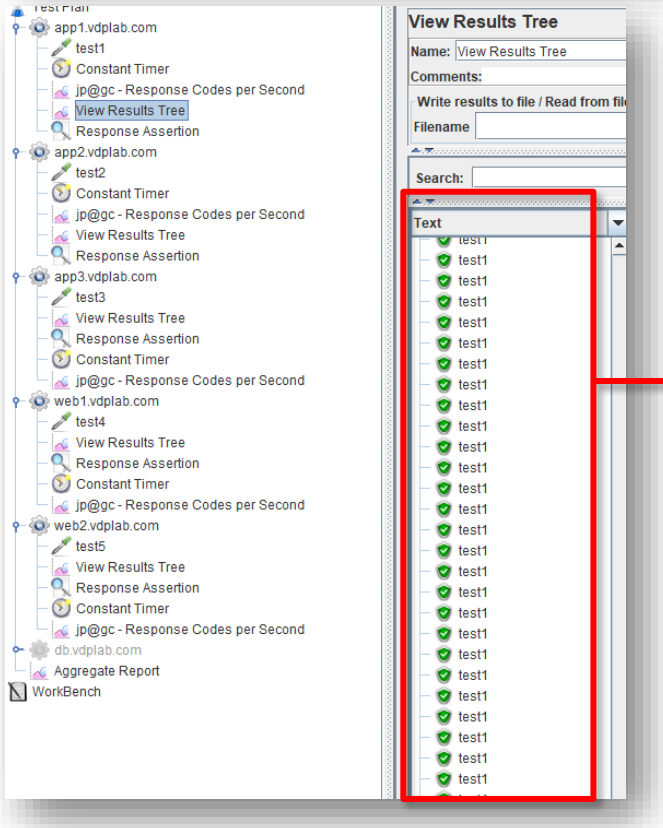


2. On the detection events section, you will find the event attack. You can verify the attack details by clicking on the magnifying glass button:



3. Open **JMeter** on the legitimate client and verify the information on the *Transactions per Second* graph and check the *results tree:*





After the attack get blocked, we can see that the DNS Queries from legit users don't get blocked, and they keep receiving DNS responses from the DNS server.

APPENDIX 1 - HTTPS PROTECTION (ADDITIONAL INFO)

Protection Overview

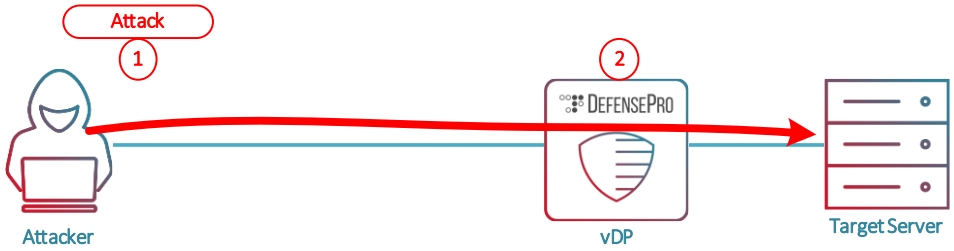
The HTTPS Flood mechanism introduced in DefensePro8 version 8.18.0.0 aims to stop denial of service (DoS) attacks on HTTPS servers by effectively blocking malicious traffic towards an attacked server.

By using the number of requests per second and outbound size per second, DefensePro X can create a baseline of the legitimate traffic behaviour and identify the case where the ratio of the request/response is increased significantly (above the baseline) and at the same time the average response size is also increased high above the baseline, which means the server is under attack.

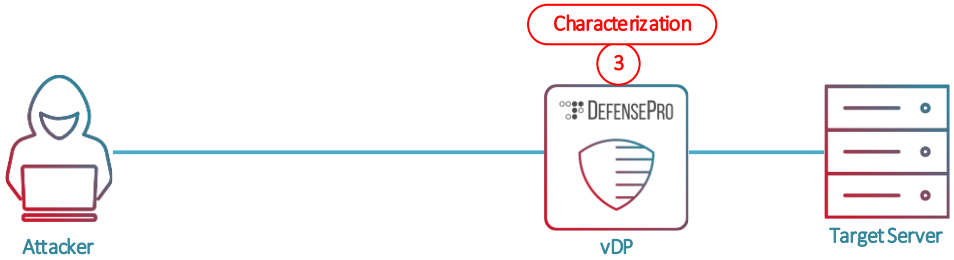
Inbound request rate learning is based on the rate of packets with an SSL record header of Content type: "Application Data (23)"

Scenario Steps Overview

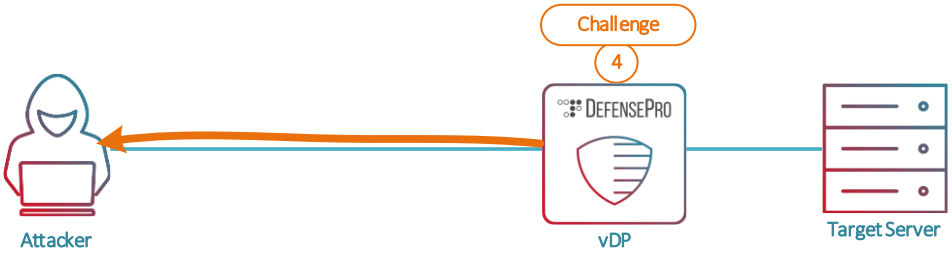
1. The attacker generates HTTPS Flood traffic from different sources towards the Webserver.
2. Detection on DefensePro begins:



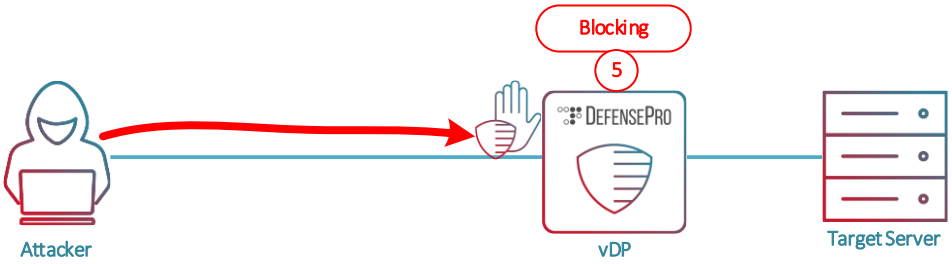
3. The attacker traffic rate goes above the Attack Edge baselines. The Detection phase begins HTTPS protection and enters the characterization stage:



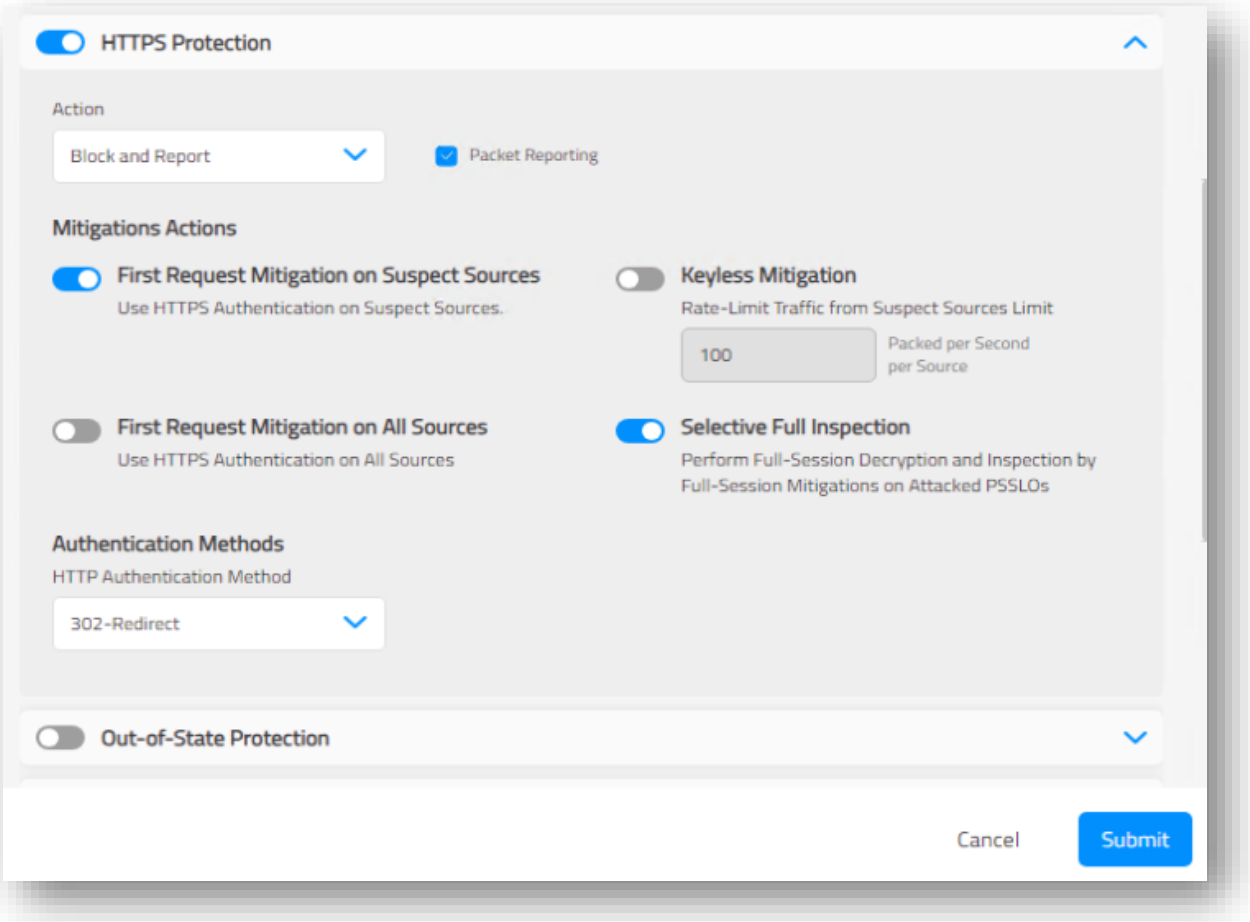
4. While in the characterization stage, DefensePro challenges all the suspected sources:



5. When the attacker is not able to pass the challenge, all the traffic coming from this source is blocked:



Configurations



APPENDIX 2 - TRAFFIC FILTERS (ADDITIONAL INFO)

Protection Overview

A traffic filter is a filter rule-based mitigation mechanism, which lets you mitigate an attack by a particular property, similar to an advanced ACL.

Moreover, Traffic filter can be used for mitigation of HTTP brute force, and SIP flood attacks.

To mitigate an attack, there are some filtering parameters that can be applied, such as:

- Source and destination network
- Packet size
- Source and destination ports
- TCP flags, and more
- Regex

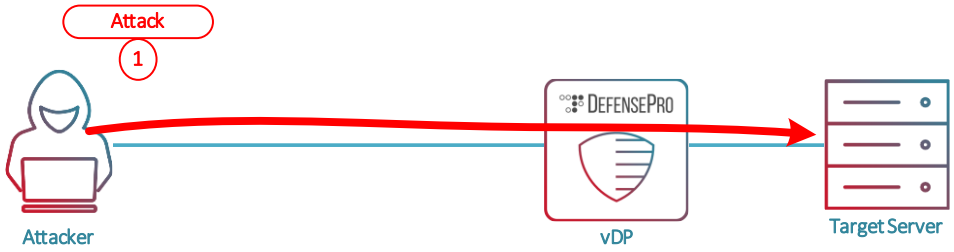
Traffic filter mitigation is performed by using a rate limit for the attacker traffic (in PPS, by default)

Some of the advantages of this protection are:

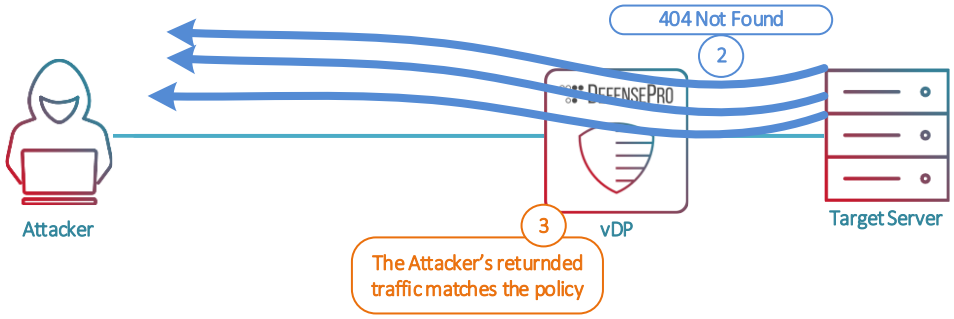
- Manual, more granular control
- Flexibility to meet unique needs

Scenario Steps Overview

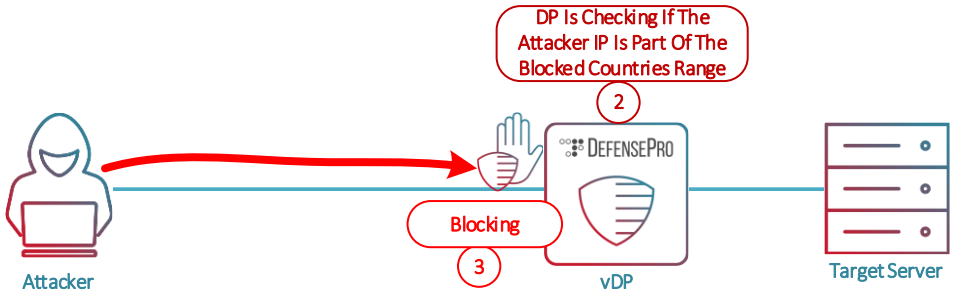
1. The attacker starts with an HTTP page scanning attack toward the Webserver.



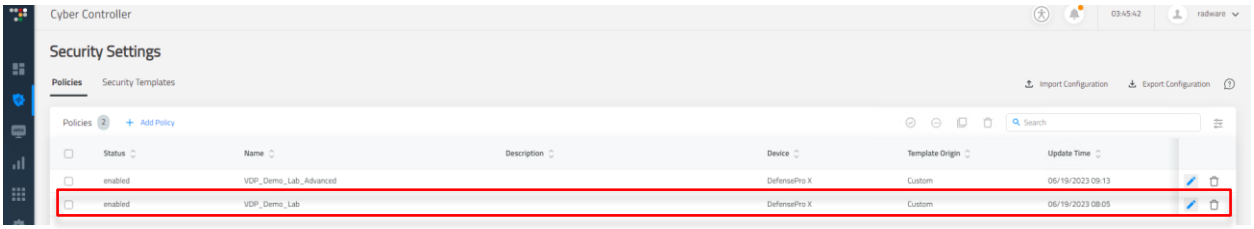
2. The Webserver responds with **404 page not found**.
3. The attacker's return traffic matches the configured traffic-filter profile (matches all returning traffic which includes a 404 error code):

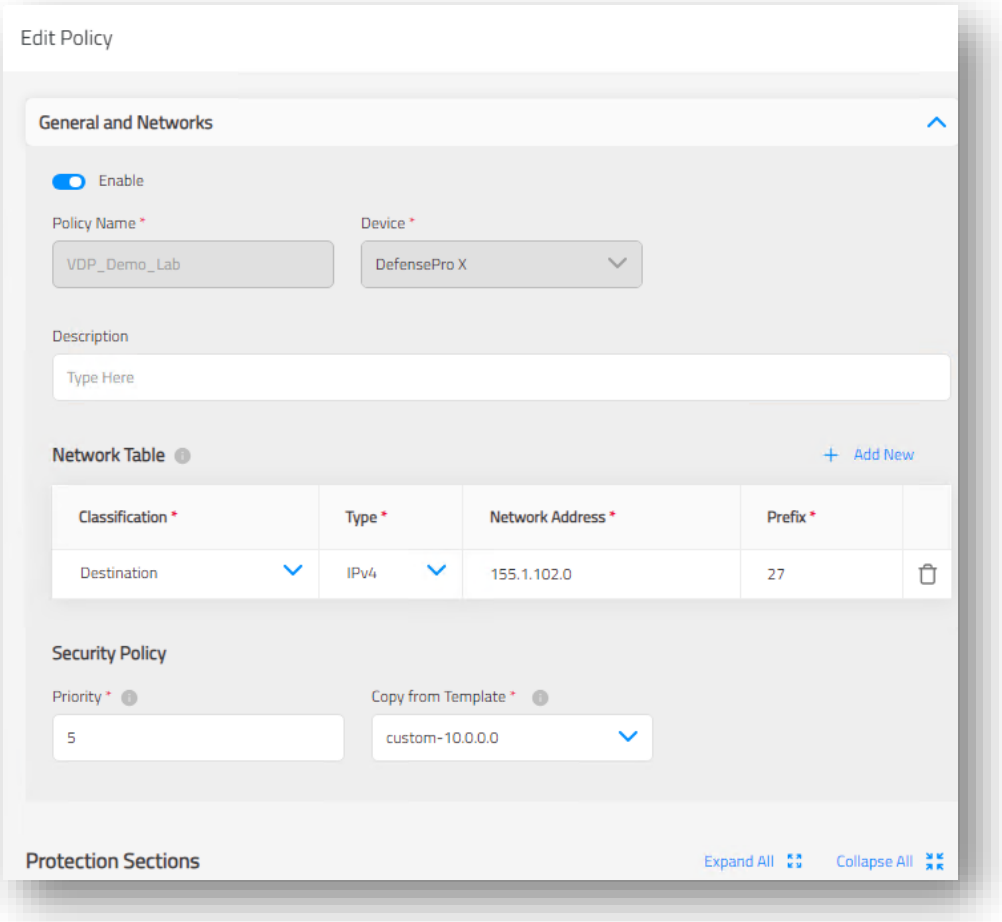


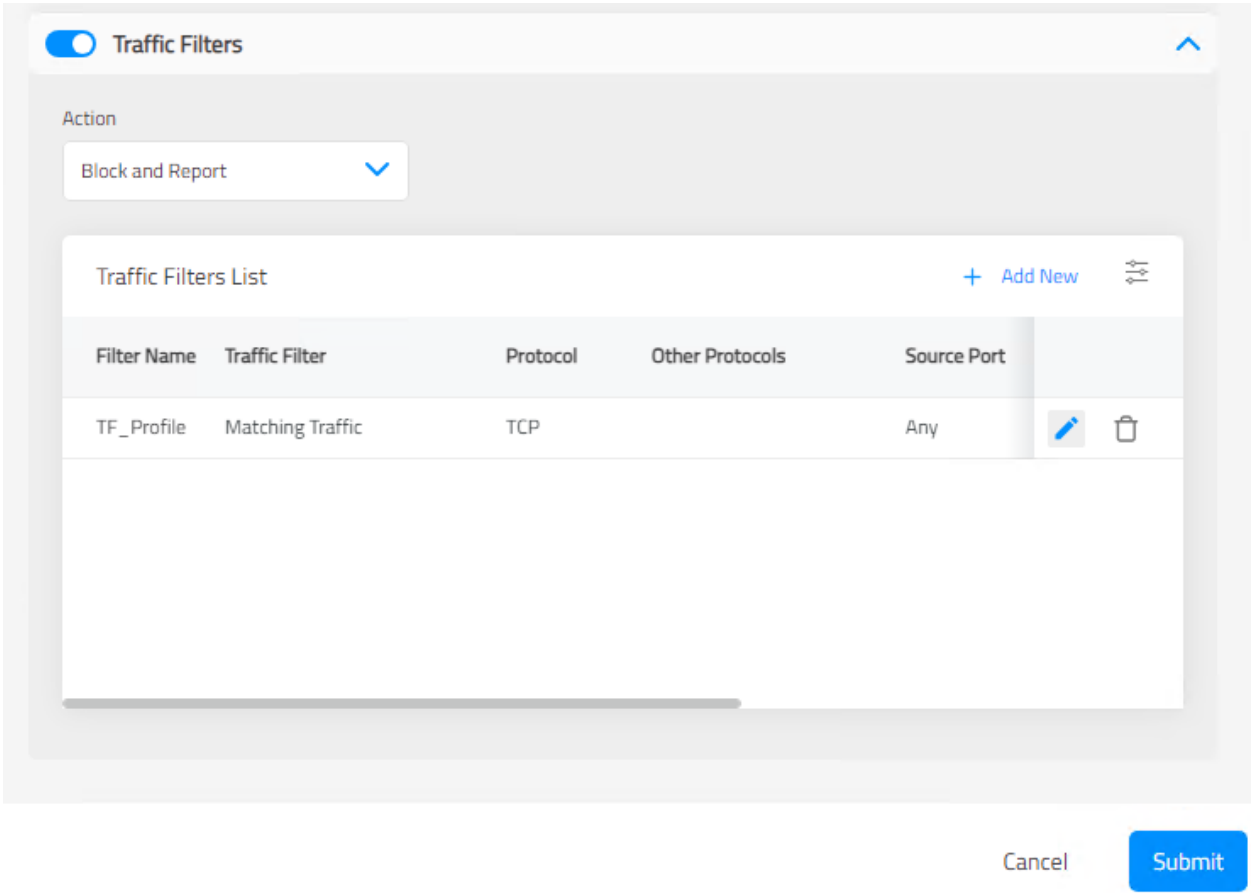
4. The attacker's IP address is added to the suspend – table and is blocked:

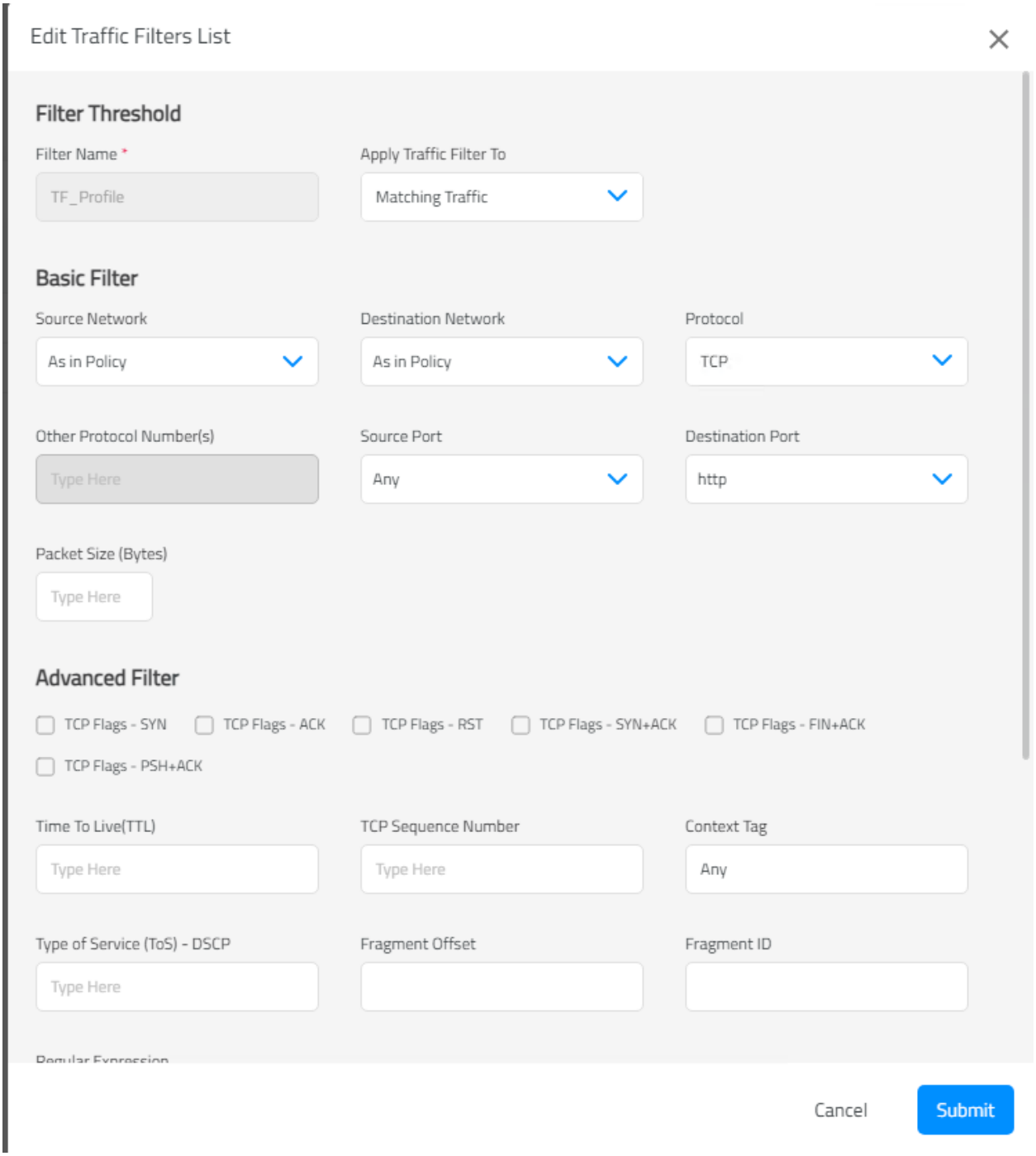


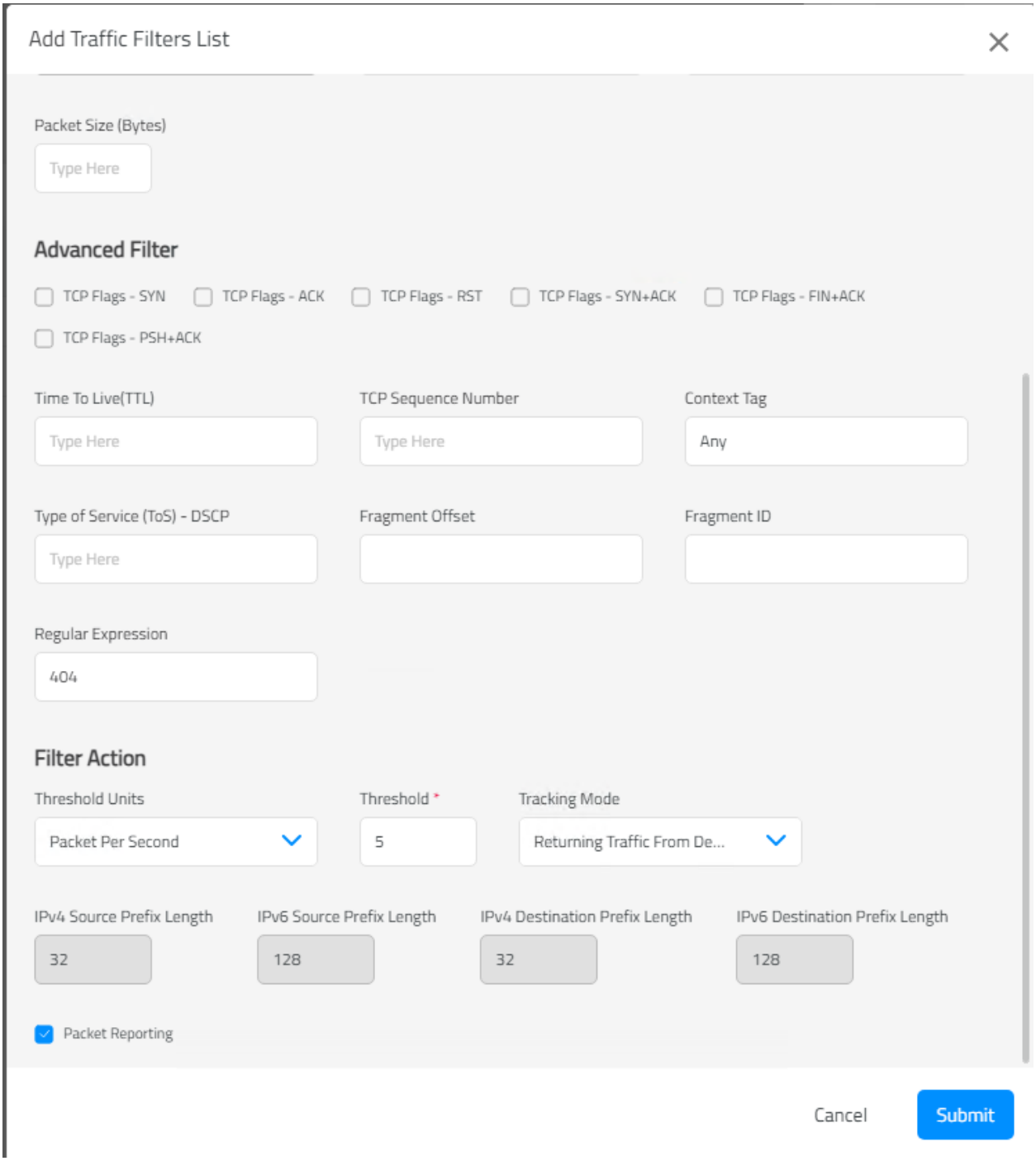
Configurations






Traffic Filters
Action
Block and Report
Traffic Filters List
Add New
Filter Name
Traffic Filter
Protocol
Other Protocols
Source Port
TF_Profile
Matching Traffic
TCP
Any
Cancel
Submit


Edit Traffic Filters List
Filter Threshold
Filter Name *
TF_Profile
Apply Traffic Filter To
Matching Traffic
Basic Filter
Source Network
As in Policy
Destination Network
As in Policy
Protocol
TCP
Other Protocol Number(s)
Type Here
Source Port
Any
Destination Port
http
Packet Size (Bytes)
Type Here
Advanced Filter
TCP Flags - SYN
TCP Flags - ACK
TCP Flags - RST
TCP Flags - SYN+ACK
TCP Flags - FIN+ACK
TCP Flags - PSH+ACK
Time To Live(TTL)
Type Here
TCP Sequence Number
Type Here
Context Tag
Any
Type of Service (ToS) - DSCP
Type Here
Fragment Offset
Fragment ID
Regular Expression
Cancel
Submit


Add Traffic Filters List
Packet Size (Bytes)
Type Here
Advanced Filter
TCP Flags - SYN
TCP Flags - ACK
TCP Flags - RST
TCP Flags - SYN+ACK
TCP Flags - FIN+ACK
TCP Flags - PSH+ACK
Time To Live(TTL)
Type Here
TCP Sequence Number
Type Here
Context Tag
Any
Type of Service (ToS) - DSCP
Type Here
Fragment Offset
Fragment ID
Regular Expression
404
Filter Action
Threshold Units
Packet Per Second
Threshold *
5
Tracking Mode
Returning Traffic From De...
IPv4 Source Prefix Length
32
IPv6 Source Prefix Length
128
IPv4 Destination Prefix Length
32
IPv6 Destination Prefix Length
128
Packet Reporting
Cancel
Submit

APPENDIX 3 - ERT ACTIVE ATTACKER FEED PROTECTION (ADDITIONAL INFO)

Protection Overview

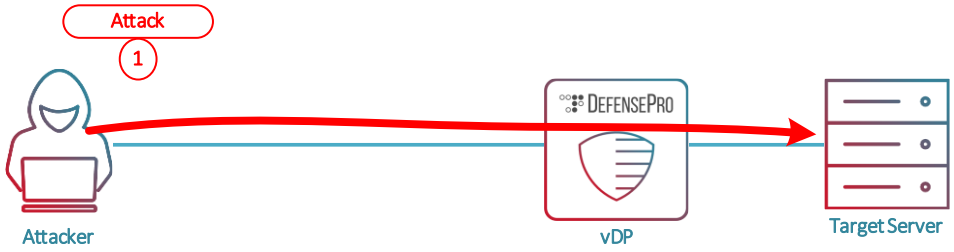
The ERT Attacker feed provides protection against well-known attackers' IP addresses that were recently actively involved in a DDoS attack.

The feed update process can be scheduled by the user per week/day.

The ERT Active Attackers Feed focuses on unique, real-time intelligence against emerging DDoS-specific threats including evolving IoT botnets and new DNS attack vectors.

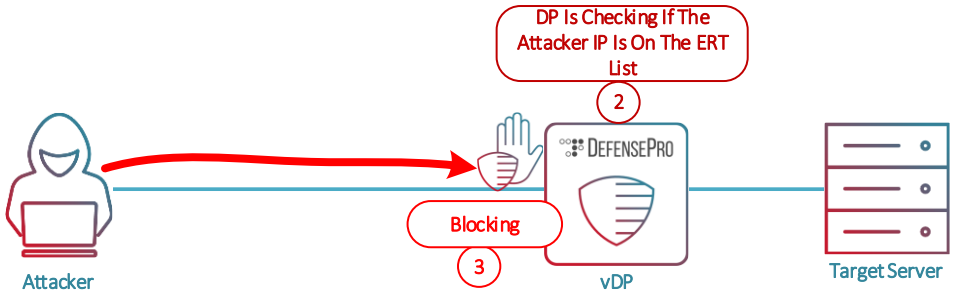
Scenario Steps Overview

1. An attacker with a malicious IP address (located on the ERT list) begins a UDP flood attack towards the Webserver.

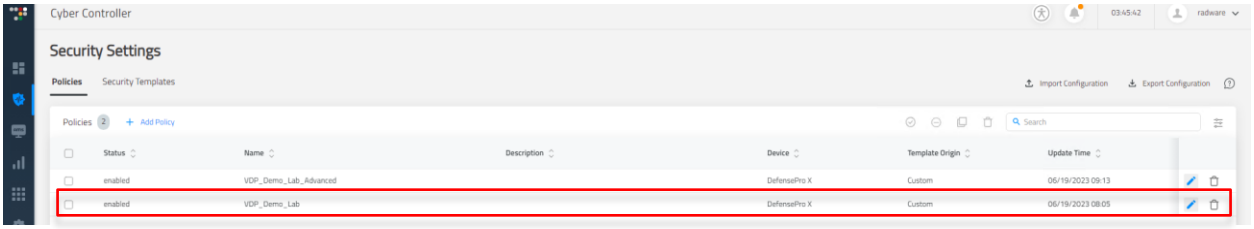


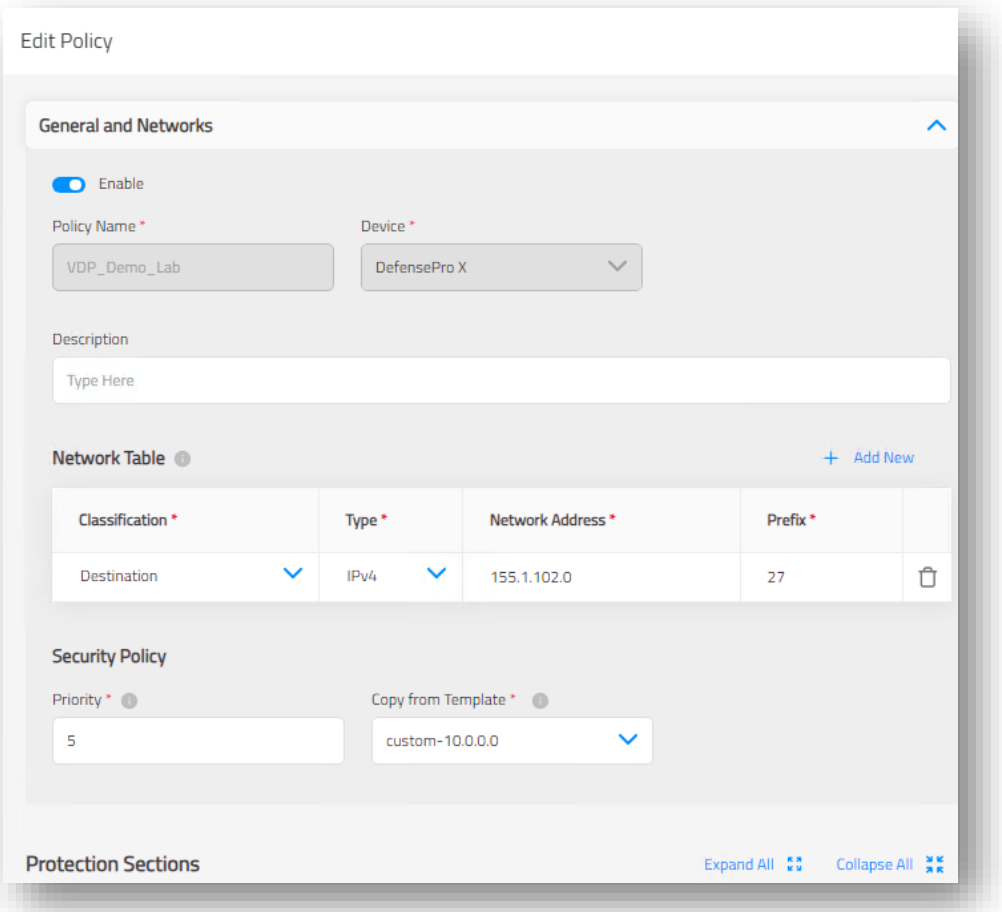
2. DefensePro checks if the IP address of the attacker is contained in the ERT file and mitigates the attack immediately.

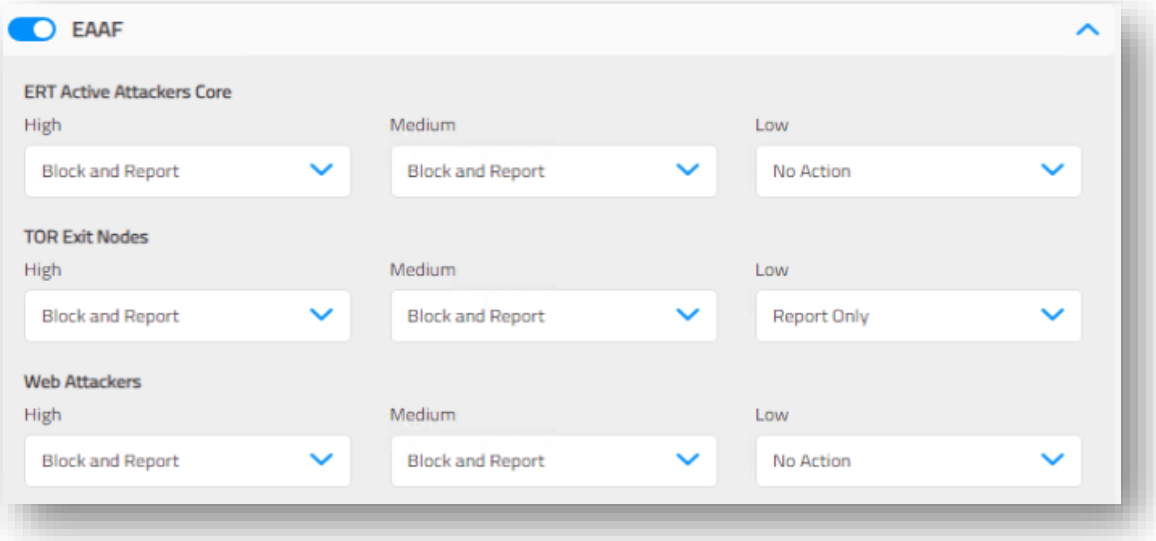
3. The IP address of the attacker is blocked immediately by DefensePro.



Configuration







Examples from the ERT file:

```
80.82.77.33; high; [ERT Active Attackers, Web Attackers]
89.248.167.131; high; [ERT Active Attackers, Web Attackers]
93.174.95.106; high; [ERT Active Attackers, Web Attackers]
77.247.108.119; high; [ERT Active Attackers, Web Attackers]
80.82.77.139; high; [ERT Active Attackers]
122.228.19.79; high; [ERT Active Attackers]

66.249.88.3; high; [Web Attackers]
66.249.88.46; high; [Web Attackers]

185.220.101.0; medium; [Tor Exit Nodes]
185.220.101.1; medium; [Tor Exit Nodes]
185.220.101.21; medium; [Tor Exit Nodes]
```

Note: The ERT file can be exported from DefensePro X, located at:
`/mnt/applData/EaafFeed/EaafFeed-imp`

APPENDIX 4 - SPOOFED SYN ATTACK PROTECTION (ADDITIONAL INFO)

Protection Overview

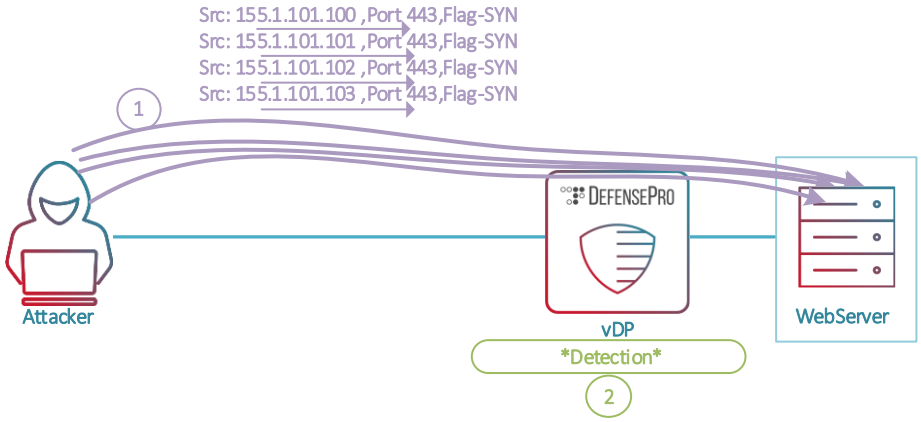
Spoofed SYN Attack protection is a new feature which allows mitigation of spoofed syn attacks targeting a wide range of IP's from the customer network.

With this new feature, syn protection can track the number of syn packet for the whole protected subnet together and not only for a specific server.

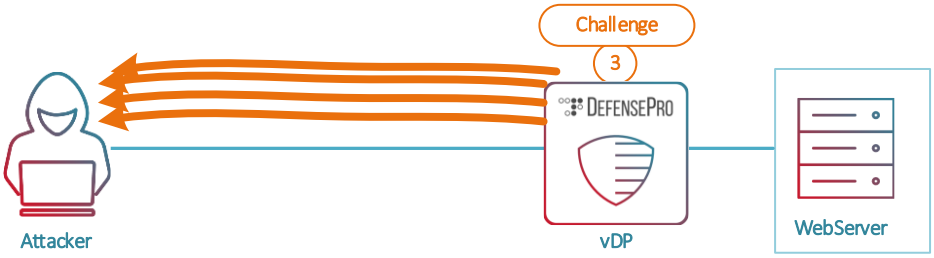
By using this kind of tracking technique, attacks like carpet bomb and others can be mitigated easily by DefensePro X.

Scenario Steps Overview

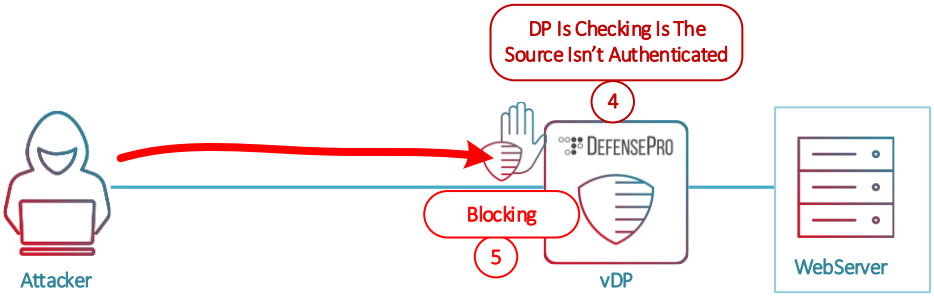
1. The attacker generates SYN flood attack using hping3 tool from different sources towards a web server.
2. Detection on DefensePro begins:



3. If the number of syn packets rate goes above the configured threshold. The DefensePro will begin challenging every source.

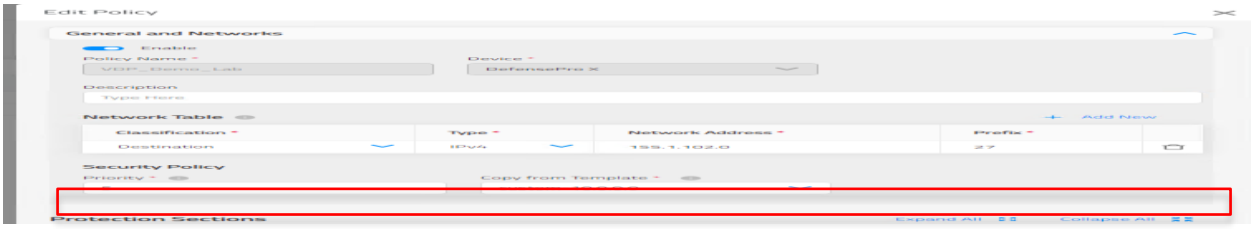


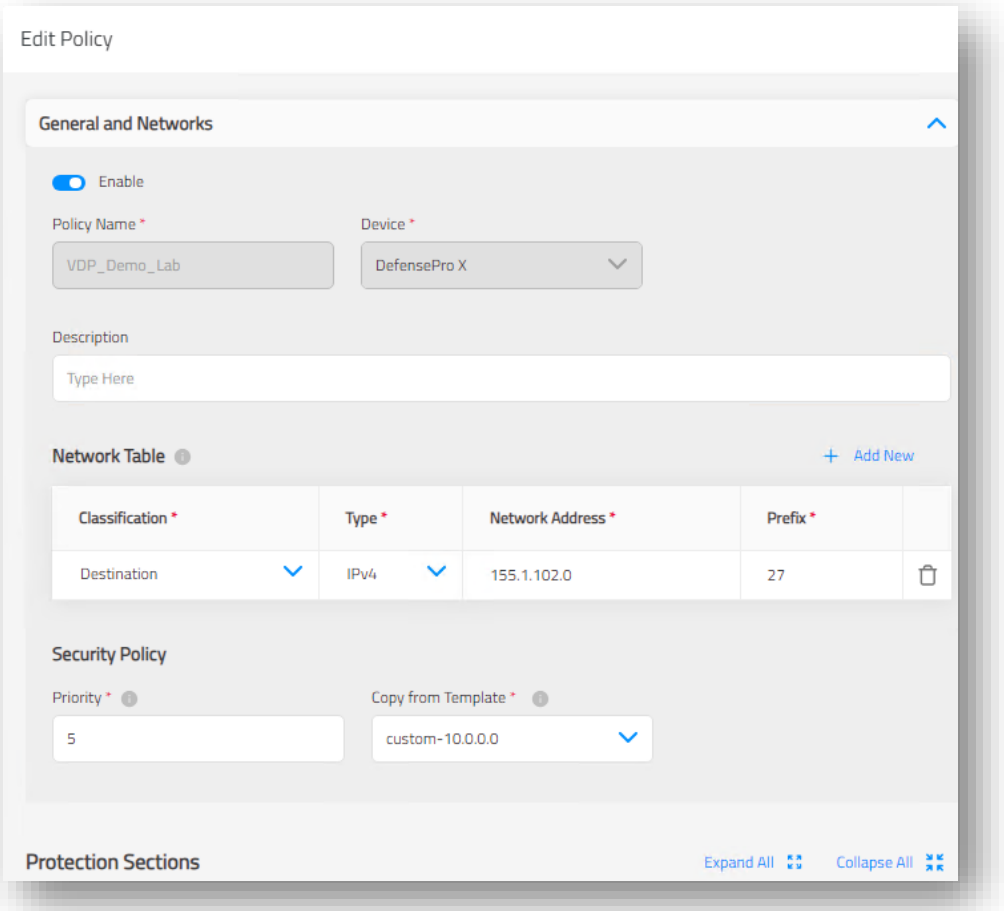
4. Every traffic from sources which didn't passed the challenge will be blocked by DefensePro X.

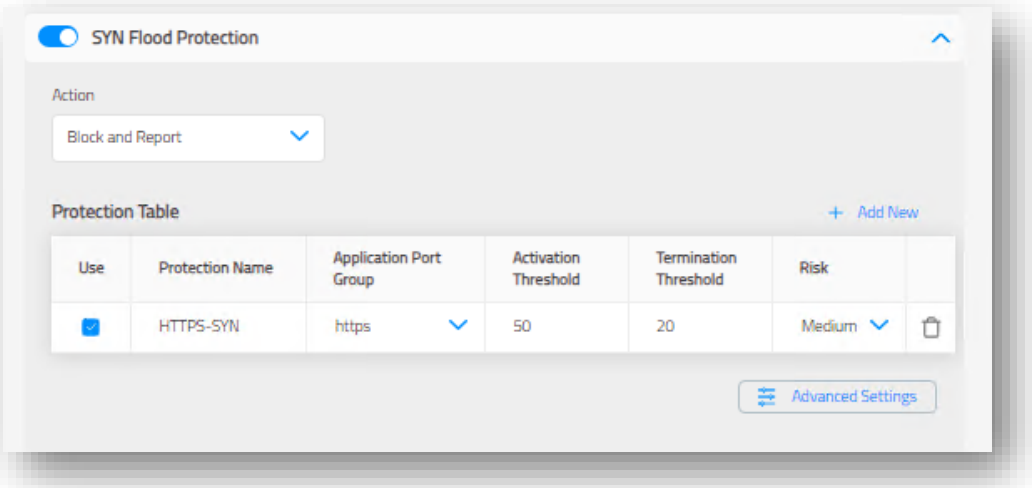


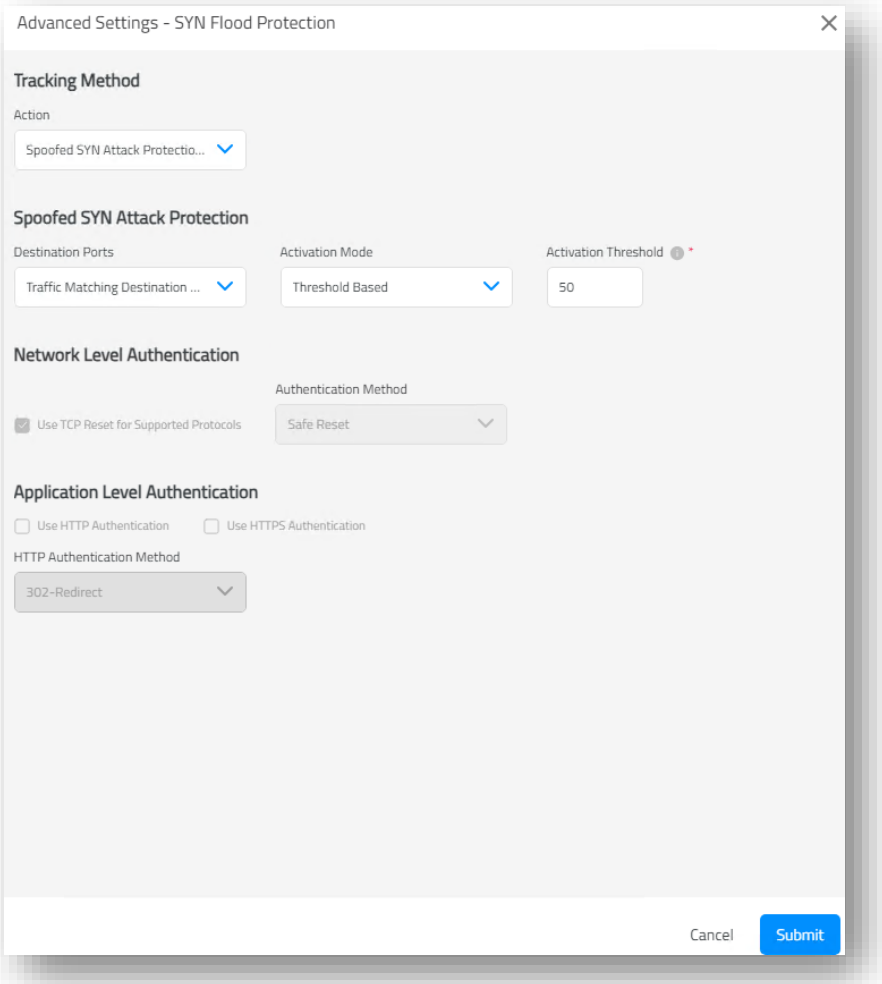
Configurations

With the configuration given below, while under attack, if the number of the total syn packets per second get above 50, DefensePro X starts challenge every source:






SYN Flood Protection
Action
Block and Report
Protection Table
Add New
Use
Protection Name
Application Port Group
Activation Threshold
Termination Threshold
Risk
HTTPS-SYN
https
50
20
Medium
Advanced Settings


Advanced Settings - SYN Flood Protection
Tracking Method
Action
Spoofed SYN Attack Protectio...
Spoofed SYN Attack Protection
Destination Ports
Traffic Matching Destination ...
Activation Mode
Threshold Based
Activation Threshold
50
Network Level Authentication
Authentication Method
Use TCP Reset for Supported Protocols
Safe Reset
Application Level Authentication
Use HTTP Authentication
Use HTTPS Authentication
HTTP Authentication Method
302-Redirect
Cancel
Submit

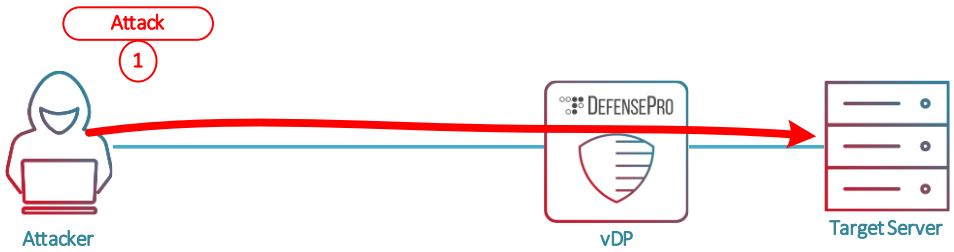
APPENDIX 5 - BDOS PROTECTION (ADDITIONAL INFO)

Protection Overview

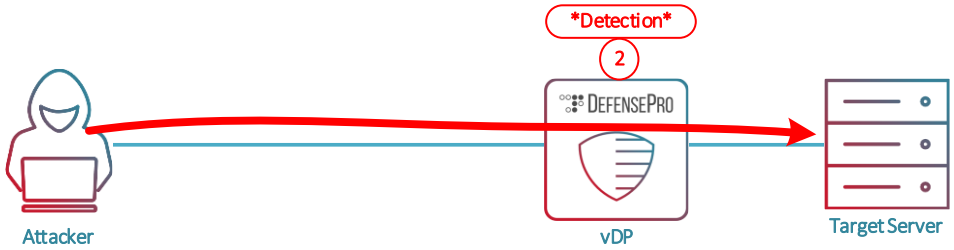
The BDoS module provides a behavior-based DoS protection that meets the detection and prevention challenge raised by the most sophisticated DDoS attack methods. Through an adaptive behavioral approach, based on analysis methods such as an adaptive Fuzzy Logic decision engine, probability theory and Closed-Feedback mechanism, the system provides a natural dynamic DoS protection system that is able to answer current and future needs. This system auto-mitigates DoS and DDoS flood attacks, and no human intervention is needed.

Scenario Steps Overview

1. The Attacker begins a UDP flood attack towards the web server and changes the vector of the attack after 100 seconds.

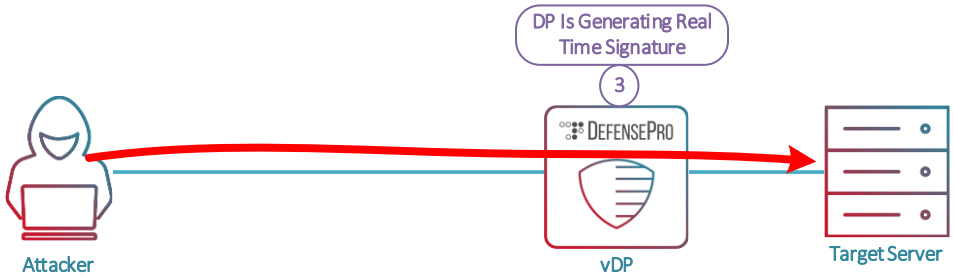


2. DefensePro checks if the UDP rate is above the attack edge baseline and begins the detection phase.

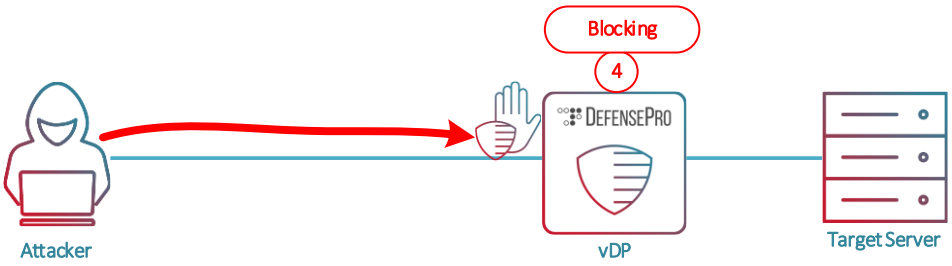


3. DefensePro generates a real time signature which will be used to mitigate the UDP Flood.

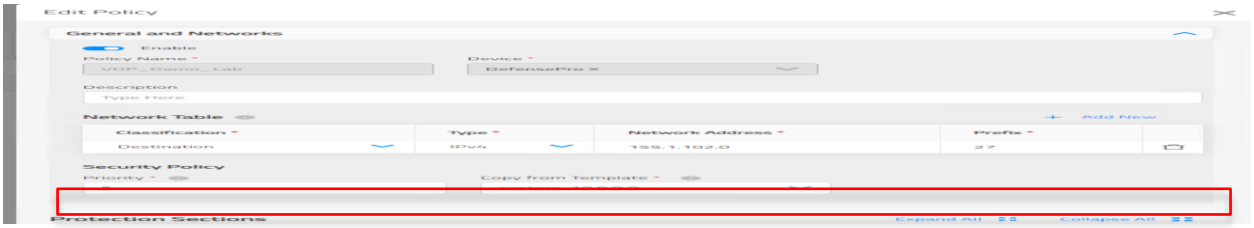
   When the attack vector changes, DefensePro generates a new signature.

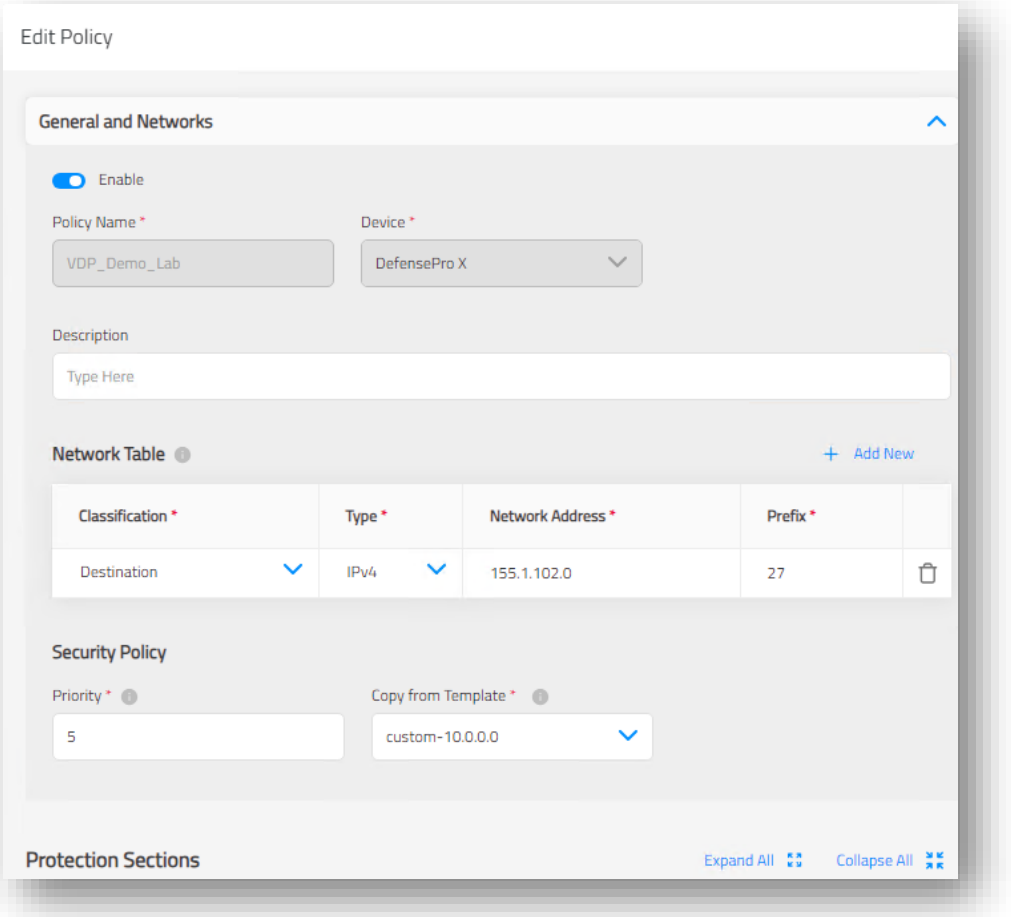


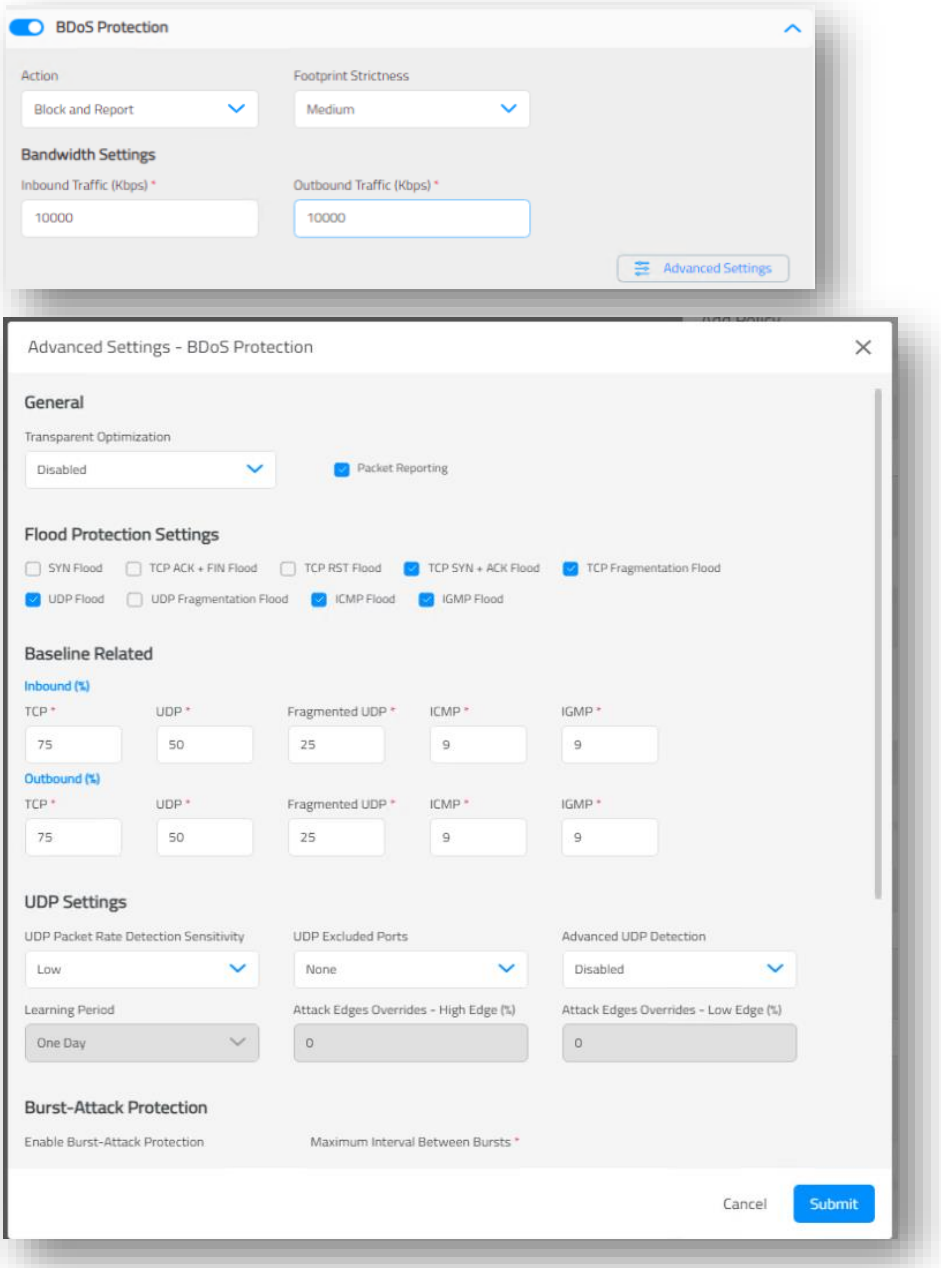
4. The UDP Flood is being blocked by DefensePro.

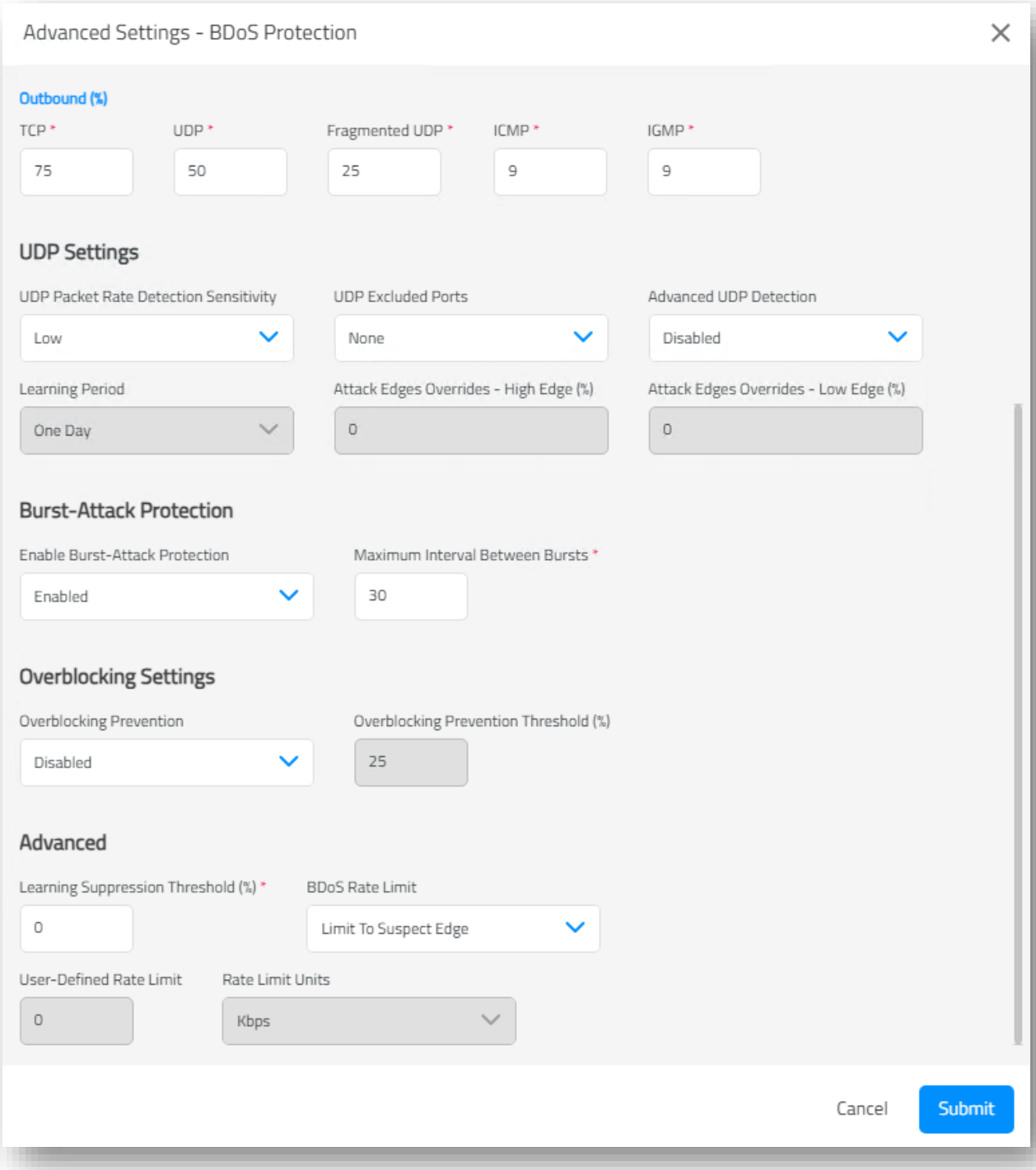


Configurations






BDoS Protection
Action
Block and Report
Footprint Strictness
Medium
Bandwidth Settings
Inbound Traffic (Kbps) *
10000
Outbound Traffic (Kbps) *
10000
Advanced Settings
Advanced Settings - BDoS Protection
General
Transparent Optimization
Disabled
Packet Reporting
Flood Protection Settings
SYN Flood
TCP ACK + FIN Flood
TCP RST Flood
TCP SYN + ACK Flood
TCP Fragmentation Flood
UDP Flood
UDP Fragmentation Flood
ICMP Flood
IGMP Flood
Baseline Related
Inbound (%)
TCP *
UDP *
Fragmented UDP *
ICMP *
IGMP *
75
50
25
9
9
Outbound (%)
TCP *
UDP *
Fragmented UDP *
ICMP *
IGMP *
75
50
25
9
9
UDP Settings
UDP Packet Rate Detection Sensitivity
Low
UDP Excluded Ports
None
Advanced UDP Detection
Disabled
Learning Period
One Day
Attack Edges Overrides - High Edge (%)
0
Attack Edges Overrides - Low Edge (%)
0
Burst-Attack Protection
Enable Burst-Attack Protection
Maximum Interval Between Bursts *
Cancel
Submit


Advanced Settings - BDoS Protection
Outbound (%)
TCP *
75
UDP *
50
Fragmented UDP *
25
ICMP *
9
IGMP *
9
UDP Settings
UDP Packet Rate Detection Sensitivity
Low
UDP Excluded Ports
None
Advanced UDP Detection
Disabled
Learning Period
One Day
Attack Edges Overrides - High Edge (%)
0
Attack Edges Overrides - Low Edge (%)
0
Burst-Attack Protection
Enable Burst-Attack Protection
Enabled
Maximum Interval Between Bursts *
30
Overblocking Settings
Overblocking Prevention
Disabled
Overblocking Prevention Threshold (%)
25
Advanced
Learning Suppression Threshold (%) *
0
BDoS Rate Limit
Limit To Suspect Edge
User-Defined Rate Limit
0
Rate Limit Units
Kbps
Cancel
Submit

APPENDIX 6 - BDOS ADVANCED UDP PROTECTION (ADDITIONAL INFO)

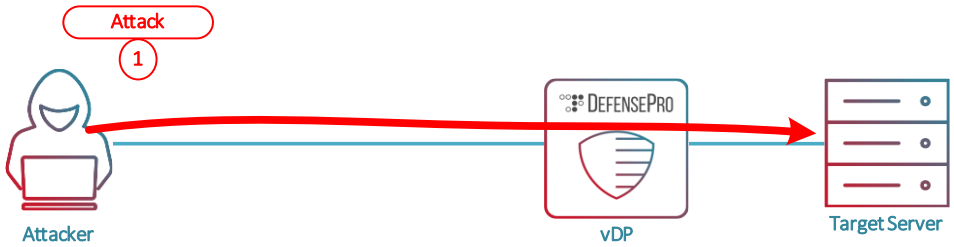
Protection Overview

The UDP Settings help the BDoS module detect UDP-flood DoS attacks, ensure good mitigation of such attacks, limit false positives, and reduce leakage of attack traffic.

The Advanced UDP Detection engine relies on rate and rate-invariant traffic statistics — including UDP bandwidth, packet rate, and connection rate — to ensure accurate detection of UDP floods. This engine can detect different types of UDP floods, based on high packet rate (PPS) or high connection rate (CPS).

Scenario Steps Overview

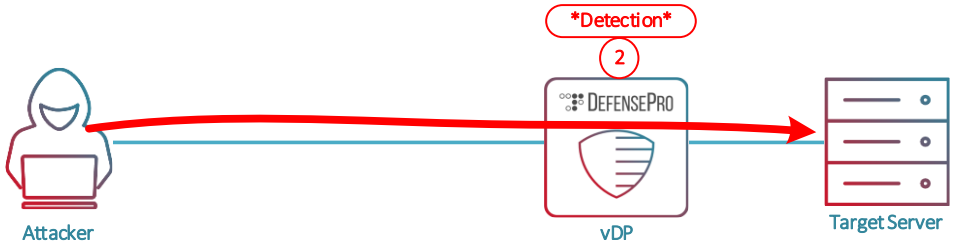
1. The Attacker begins a UDP flood attack towards the web server.



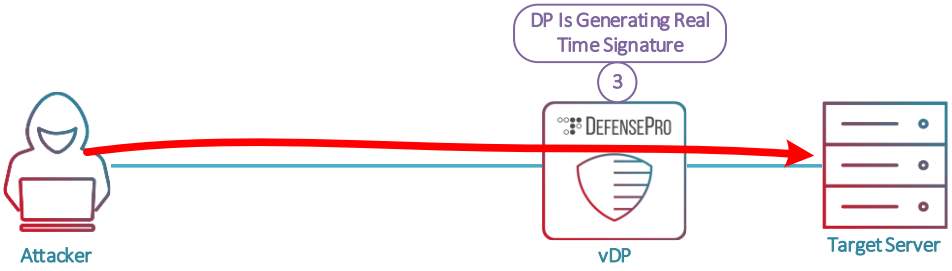
2. DefensePro checks if the UDP rate is above the Attack-Edge baseline:

If the rate-invariant remains the same (the ratio between cps and pps) means it is a “Flash-Crowed” event and no detection will occur.

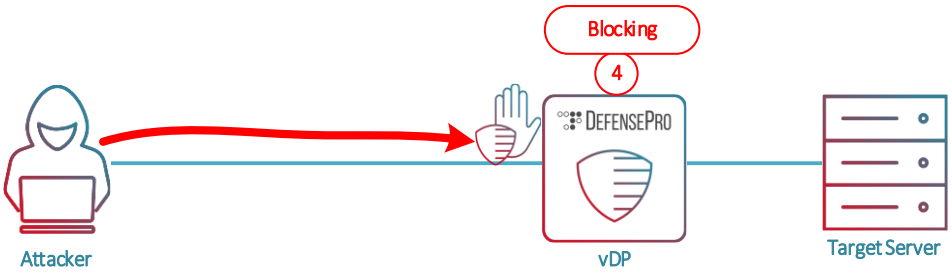
If the rate-invariant changes, DefensePro begins the Detection phase.



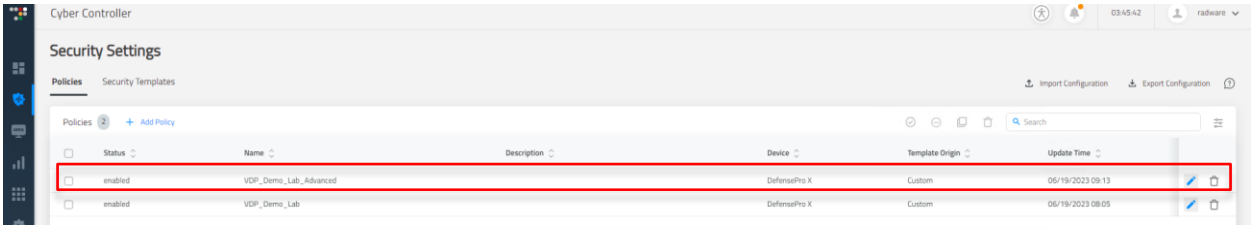
3. DefensePro generates a real time signature which will be used in order to mitigate the UDP Flood.

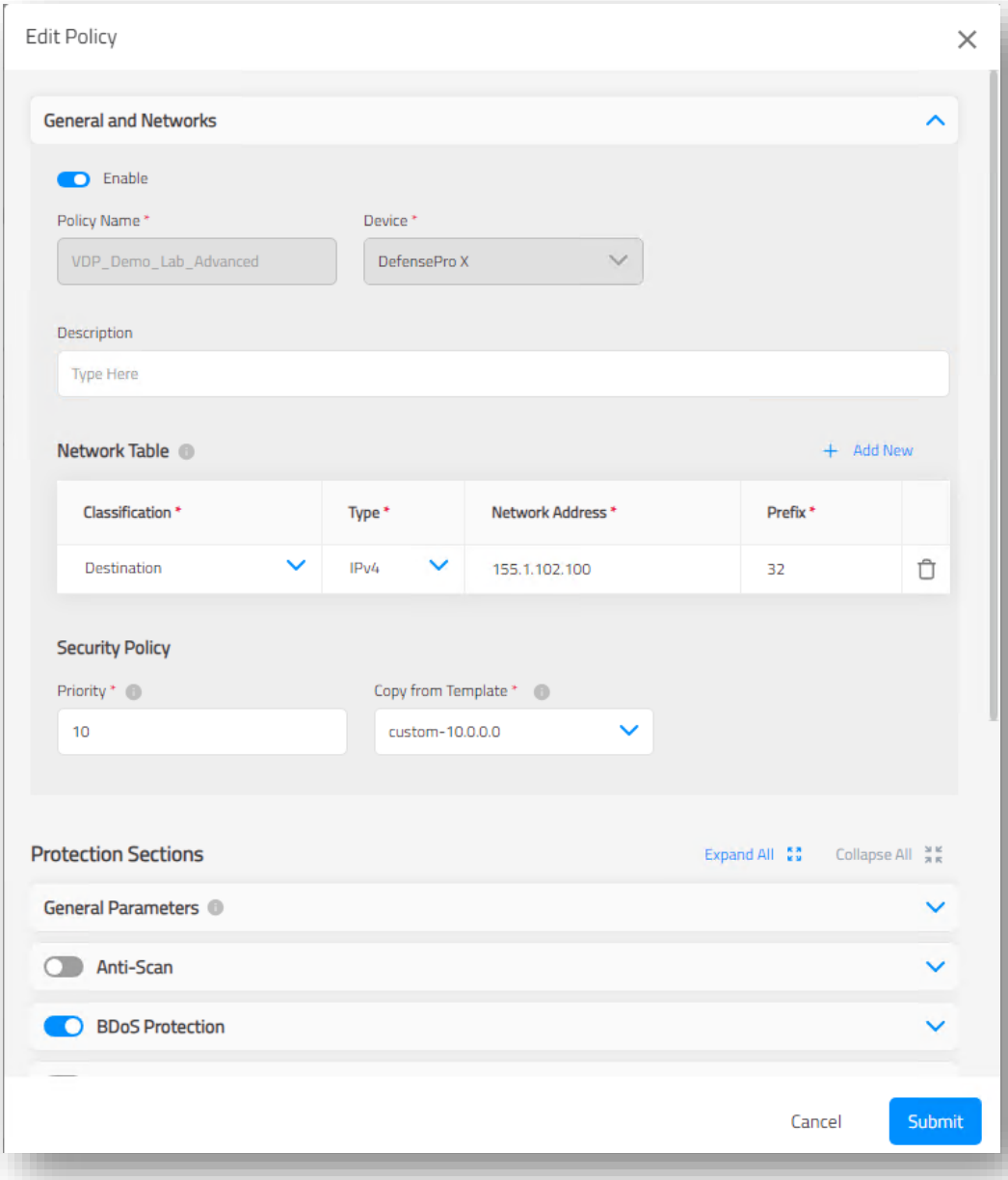


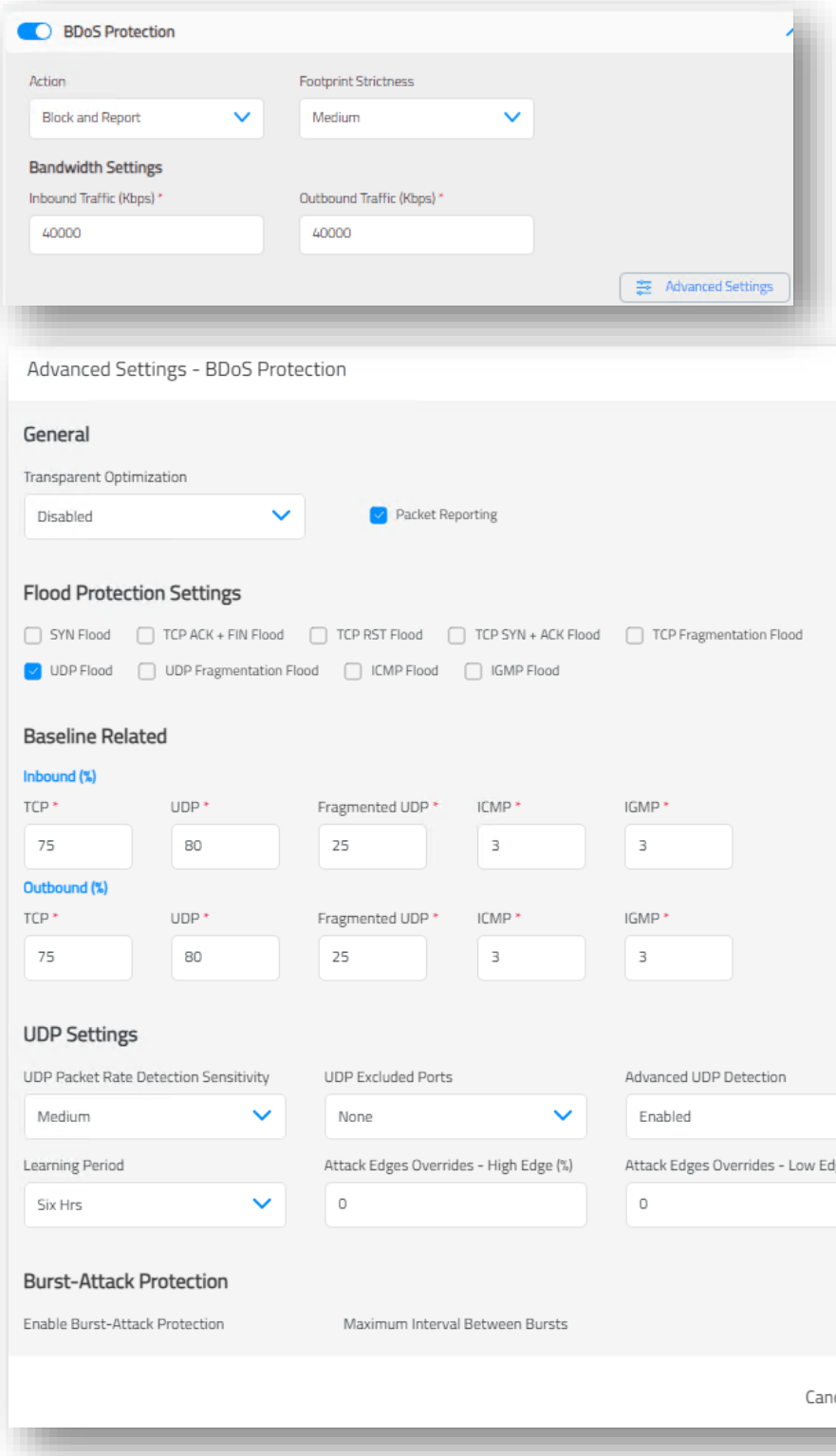
4. The UDP Flood is being blocked by DefensePro.

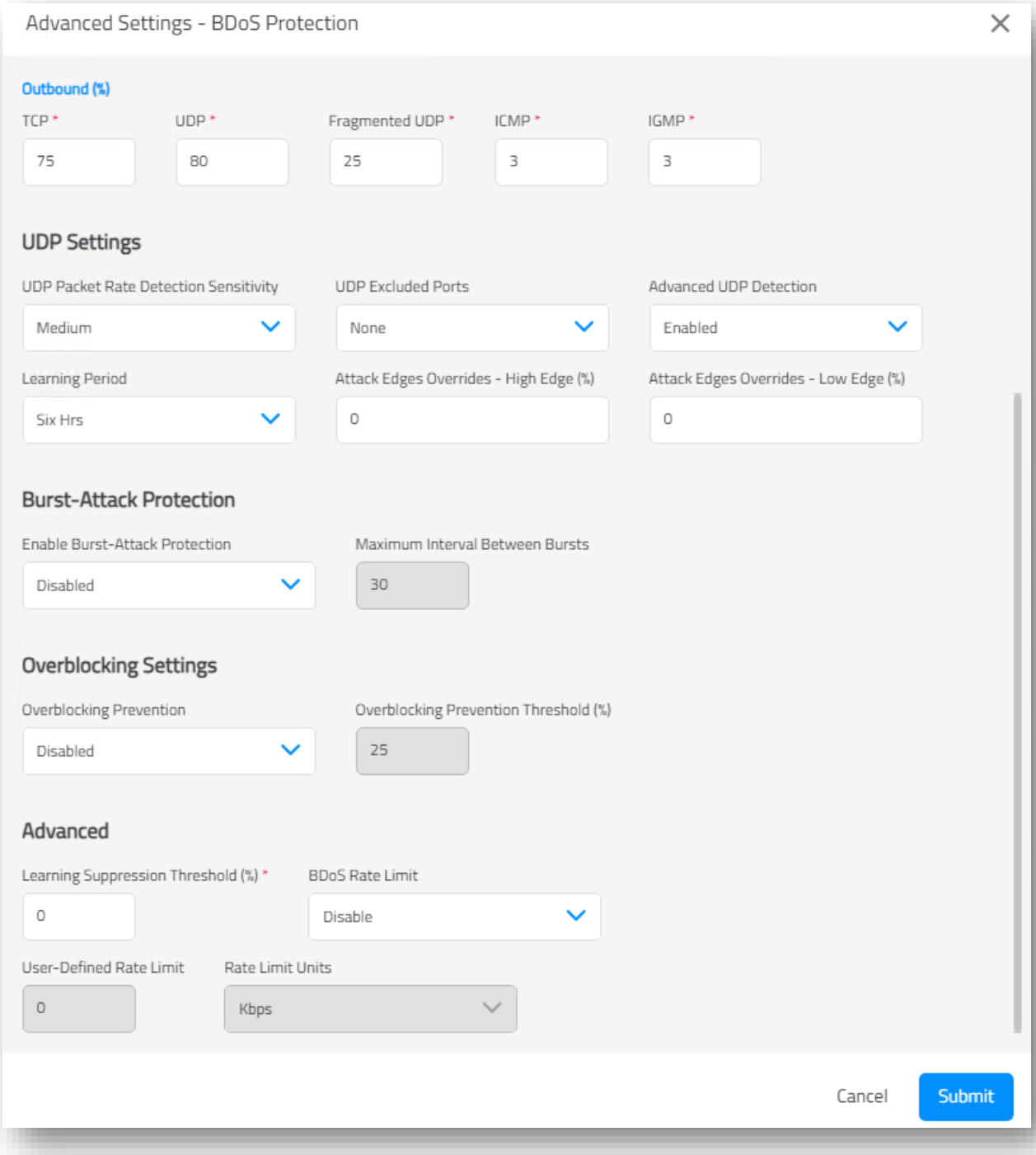


Configurations






BDoS Protection
Action
Block and Report
Footprint Strictness
Medium
Bandwidth Settings
Inbound Traffic (Kbps) *
40000
Outbound Traffic (Kbps) *
40000
Advanced Settings
Advanced Settings - BDoS Protection
General
Transparent Optimization
Disabled
Packet Reporting
Flood Protection Settings
SYN Flood
TCP ACK + FIN Flood
TCP RST Flood
TCP SYN + ACK Flood
TCP Fragmentation Flood
UDP Flood
UDP Fragmentation Flood
ICMP Flood
IGMP Flood
Baseline Related
Inbound (%)
TCP *
UDP *
Fragmented UDP *
ICMP *
IGMP *
75
80
25
3
3
Outbound (%)
TCP *
UDP *
Fragmented UDP *
ICMP *
IGMP *
75
80
25
3
3
UDP Settings
UDP Packet Rate Detection Sensitivity
Medium
UDP Excluded Ports
None
Advanced UDP Detection
Enabled
Learning Period
Six Hrs
Attack Edges Overrides - High Edge (%)
0
Attack Edges Overrides - Low Edge (%)
0
Burst-Attack Protection
Enable Burst-Attack Protection
Maximum Interval Between Bursts
Cancel
Submit


Advanced Settings - BDoS Protection
Outbound (%)
TCP *
75
UDP *
80
Fragmented UDP *
25
ICMP *
3
IGMP *
3
UDP Settings
UDP Packet Rate Detection Sensitivity
Medium
UDP Excluded Ports
None
Advanced UDP Detection
Enabled
Learning Period
Six Hrs
Attack Edges Overrides - High Edge (%)
0
Attack Edges Overrides - Low Edge (%)
0
Burst-Attack Protection
Enable Burst-Attack Protection
Disabled
Maximum Interval Between Bursts
30
Overblocking Settings
Overblocking Prevention
Disabled
Overblocking Prevention Threshold (%)
25
Advanced
Learning Suppression Threshold (%) *
0
BDoS Rate Limit
Disable
User-Defined Rate Limit
0
Rate Limit Units
Kbps
Cancel
Submit

APPENDIX 7 - DNS FLOOD PROTECTION (ADDITIONAL INFO)

Protection Overview

The DNS Flood module provides protection against DNS Flood attacks.

DNS module can be configured in two modes, Behavioral or Manual.

When using the behavioral mode, DefensePro X learns the legitimate traffic in peacetime and builds baseline for each DNS query (A, AAA, PTR, NS, etc.)

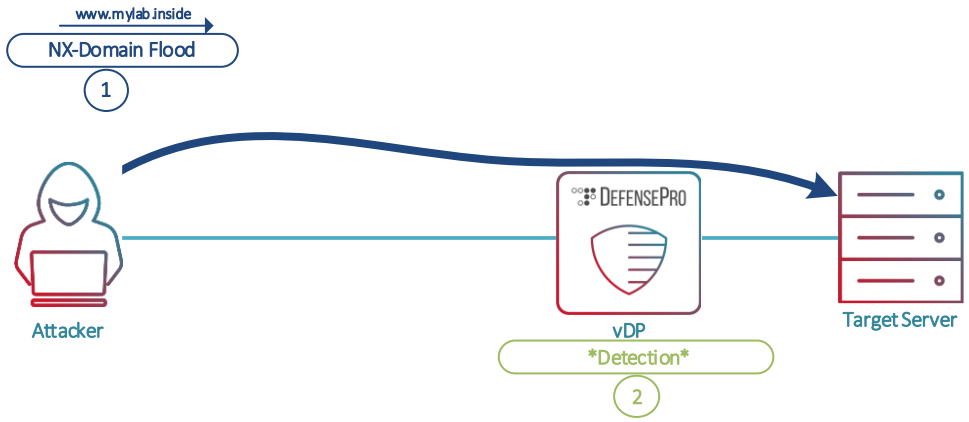
When under attack, DefensePro X will generate a Real-Time signature that matches the attack traffic pattern and use it to mitigate the attack while allows the legitimate queries to pass in.

In Manual mode, the user can specify explicit quires thresholds.

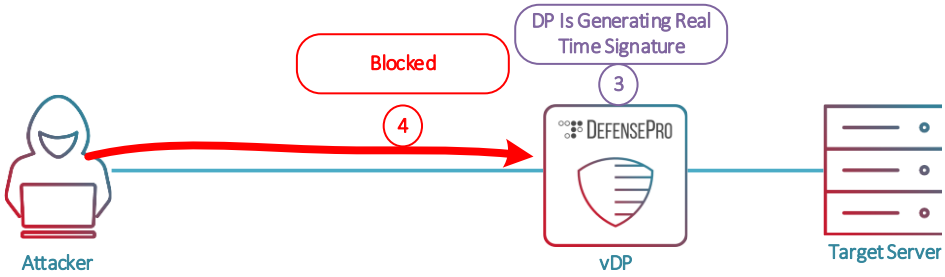
DNS protection can mitigate DNS sub-domain flood attacks while allowing only legitimate queries to pass.

Scenario Steps Overview

1. The attacker begins a DNS NX-Domain flood attack towards the DNS server.

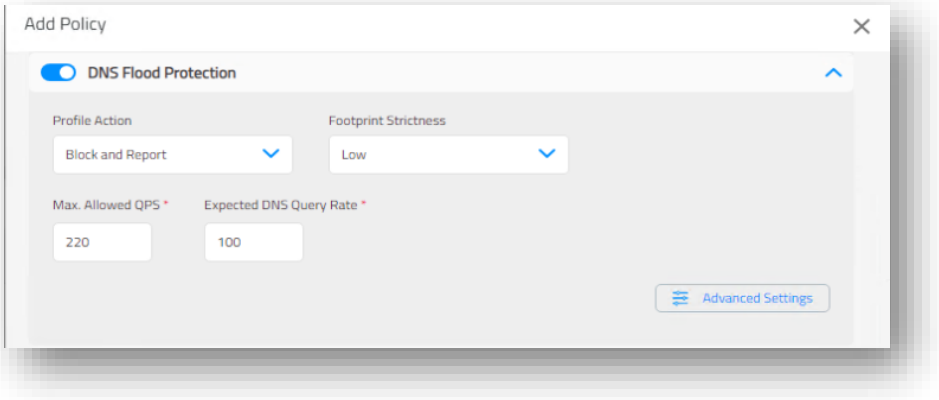


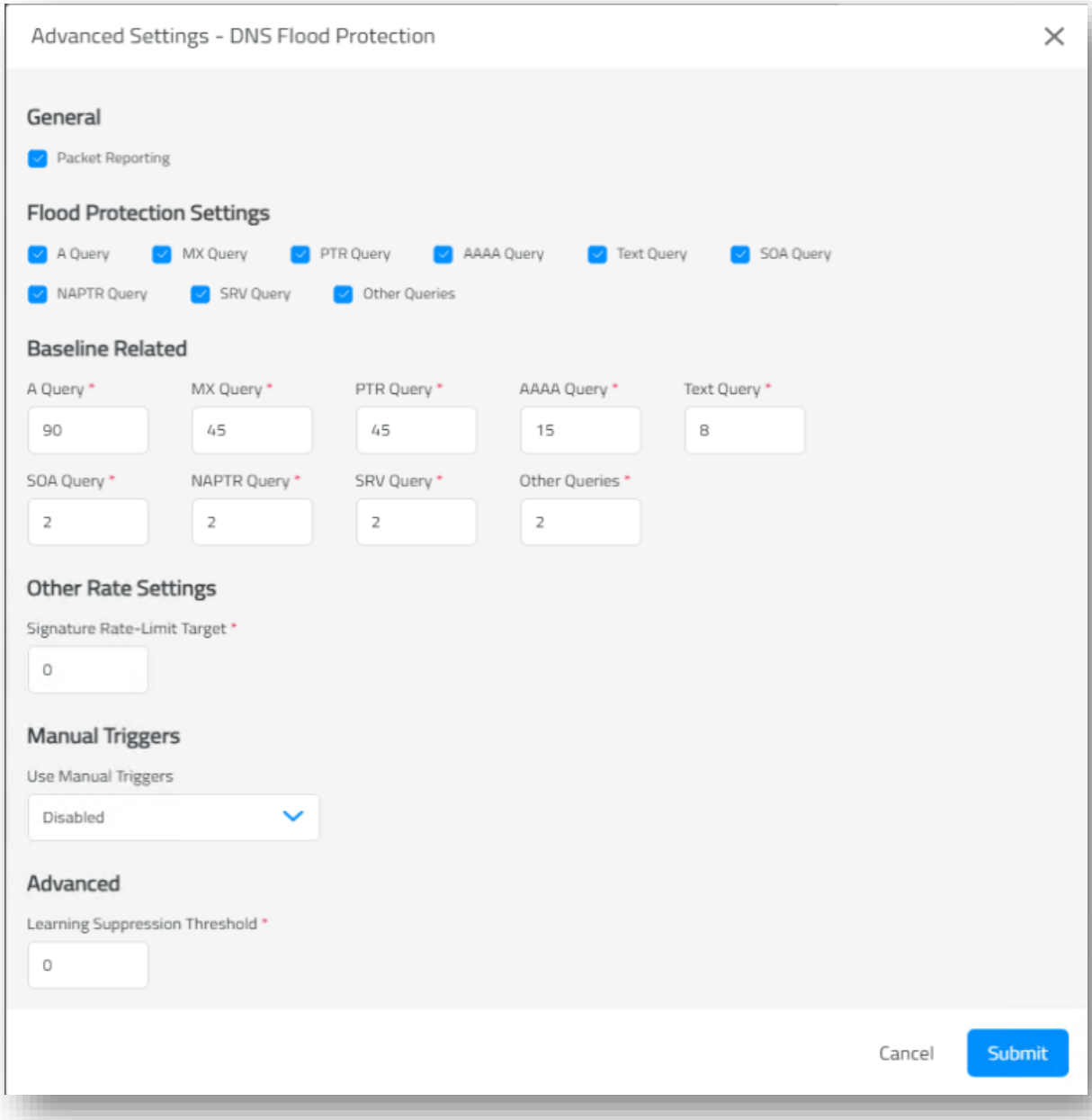
2. DefensePro X checks if the DNS queries rate is above the attack edge baseline.
3. DefensePro X generates a real time signature which will be used to mitigate the DNS NX domain flood attack.



Configurations

DNS Flood profile configured as follows:

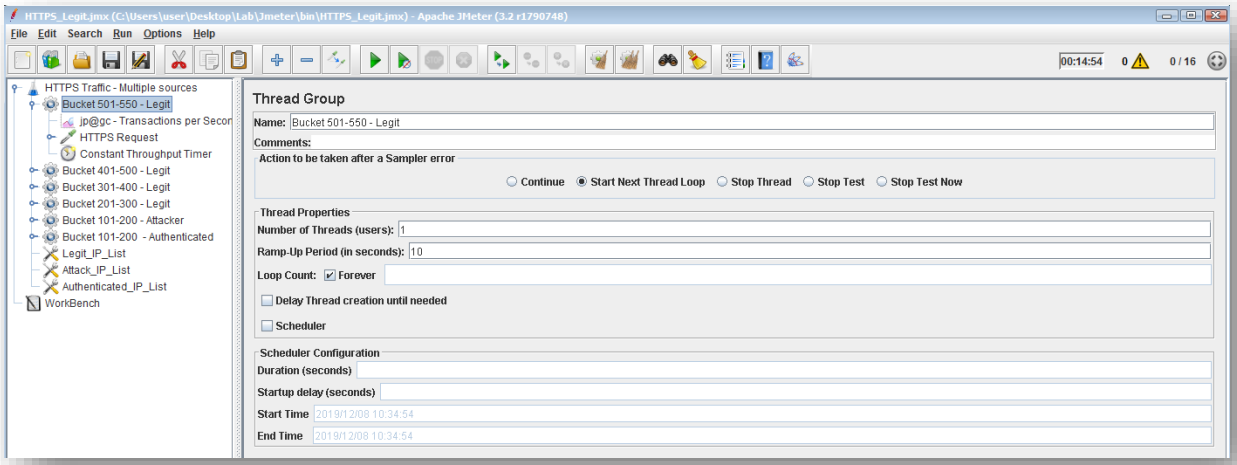



Advanced Settings - DNS Flood Protection
General
Packet Reporting
Flood Protection Settings
A Query
MX Query
PTR Query
AAAA Query
Text Query
SOA Query
NAPTR Query
SRV Query
Other Queries
Baseline Related
A Query *
90
MX Query *
45
PTR Query *
45
AAAA Query *
15
Text Query *
8
SOA Query *
2
NAPTR Query *
2
SRV Query *
2
Other Queries *
2
Other Rate Settings
Signature Rate-Limit Target *
0
Manual Triggers
Use Manual Triggers
Disabled
Advanced
Learning Suppression Threshold *
0
Cancel
Submit

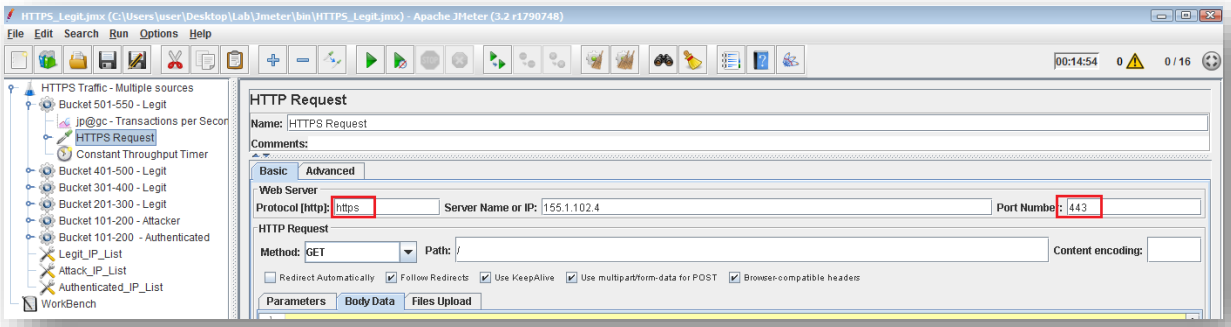
APPENDIX 8 - HTTPS TRAFFIC GENERATION TEMPLATE (ADDITIONAL INFO)

The HTTPS traffic template configured as follows:

1. Bucket # – The HTTPS request to the specific bucket size:
    - **Number of Threads** – Control the number of simultaneous users for the test.
    - **Ramp-Up Period** – The time to start all users.
    - **Loop Count** – Select **Forever** for an endless loop, or **manual** configuration.

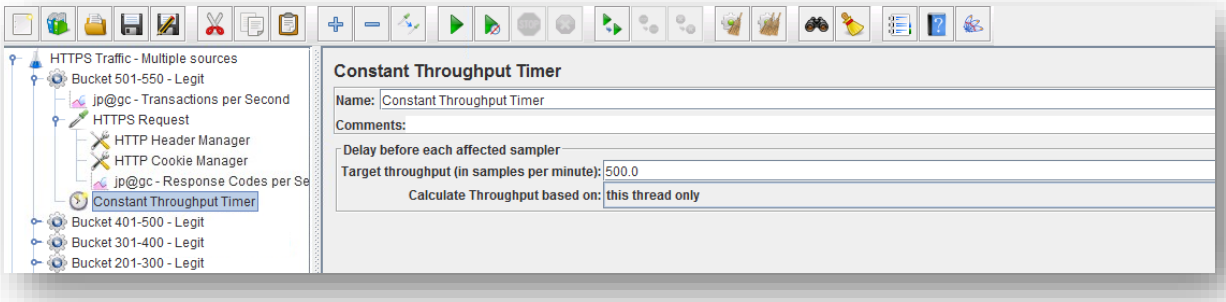


2. HTTP Request – The HTTPS header configuration:
    - **Server Name or IP** – The test destination.
    - **Port Number**– The test destination port
    - **Protocol** – Select HTTP or HTTPS. A blank value indicates HTTP.
    - **Path** – The request path.



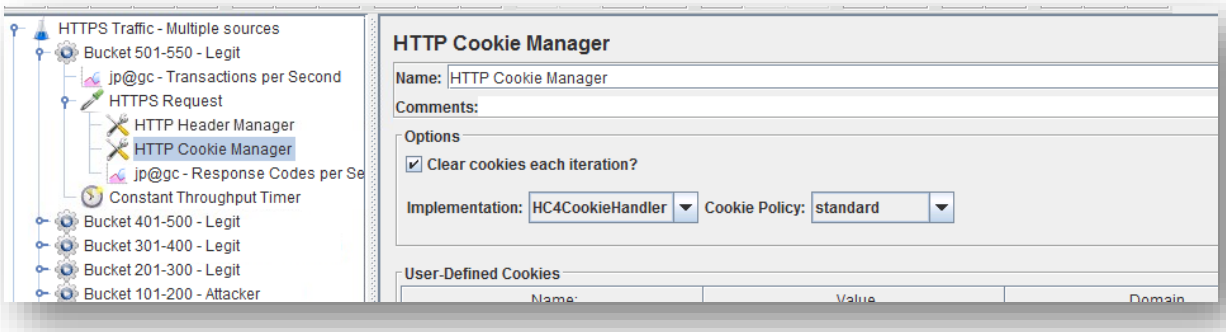
3. Set the Constant Throughput Timer:

   - **Thread Delay** – Test delay.

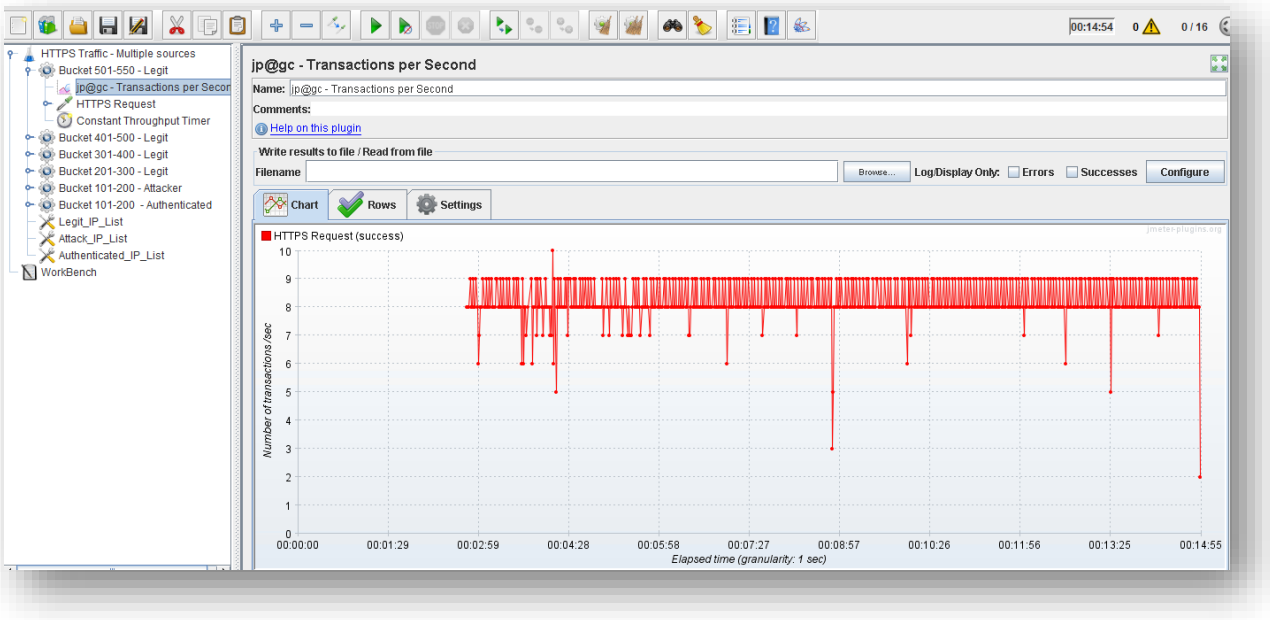


4. Set the HTTP Cookie Manager:

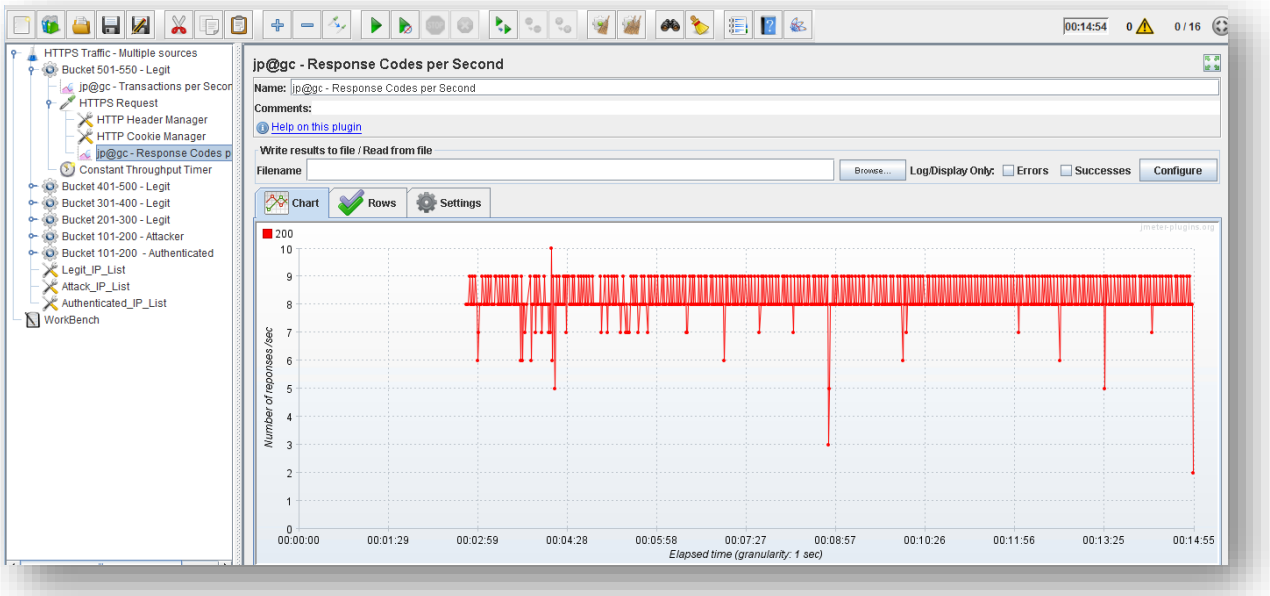
   - Used for a 302-cookie challenge



5. Set the Transactions per Second:



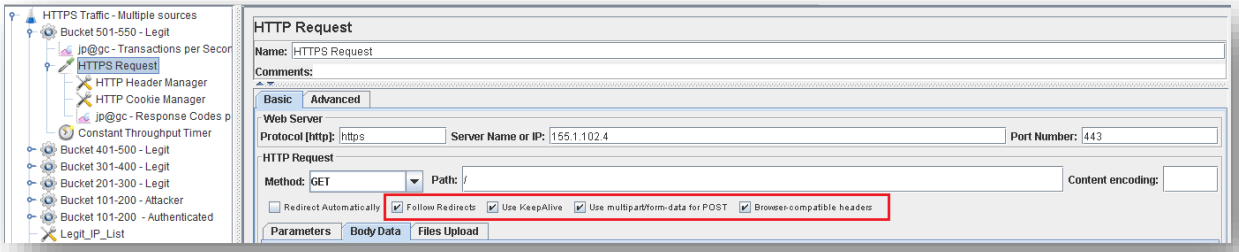
6. Set the Response Codes per Second:



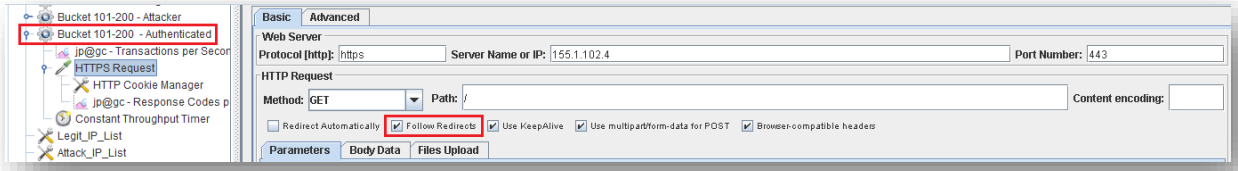
7. To clear statistics and graphs, click the **Brush** icon: 

8. Buckets Type:

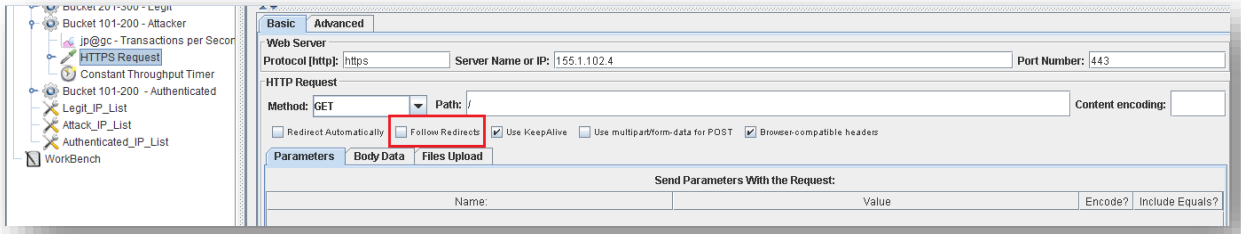
- Legit – Simulates traffic from legitimate users:



- Authenticated – Simulates traffic from legitimate users that passes the challenge:



9. Attacker – Simulate traffic from attacking users that do not pass the challenge: (**Follow redirect** is **disabled**):



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