NGINX APP PROTECT UDP LAB INSTRUCTIONS

VERSION 3 29TH JUNE 2022 PETE WHITE

INTRODUCTION

The basic lab setup is complete – networking is configured and Nginx+ and App Protect are installed on nginx-1 with a basic nginx configuration.

This lab will run through the following exercises:

1. Enabling the App Protect module
2. Install the default policy
3. Configure remote logging
4. Enable various policy features
    a. enforcementMode
    b. VIOL_HTTP_PROTOCOL
    c. VIOL_EVASION
    d. VIOL_FILETYPE
5. Enable multiple policies
6. Perform troubleshooting of issues

You will also have experience of creating and managing policies using Ansible and other useful tools

LAB SETUP

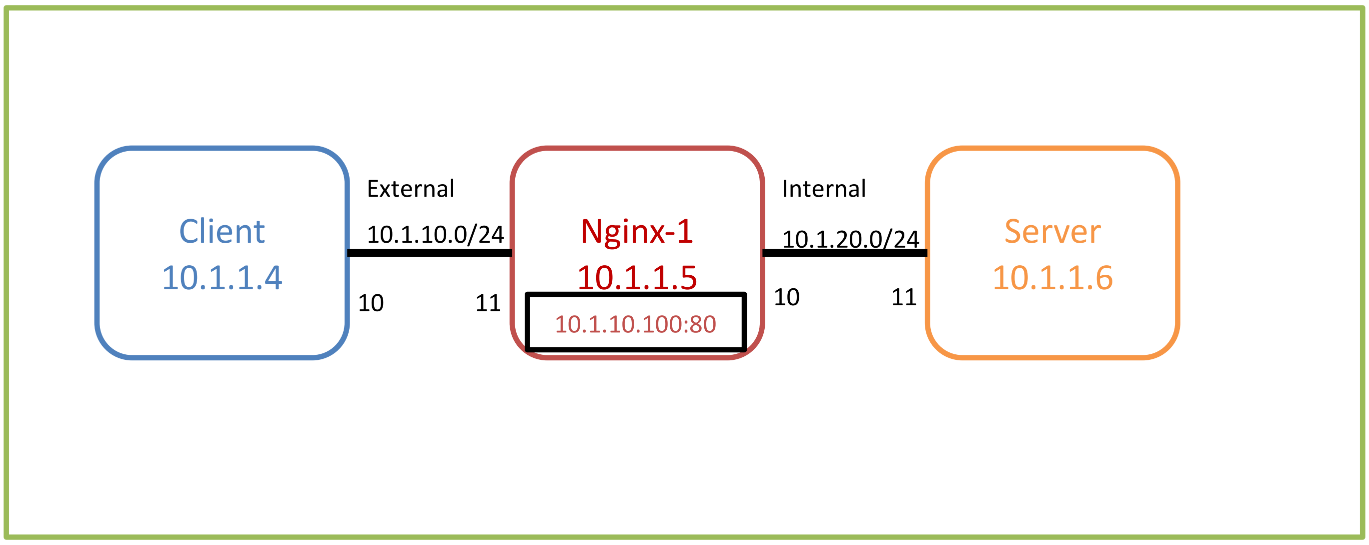
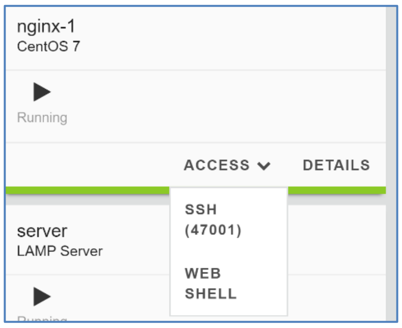


Figure 1 Lab Network Diagram

AN IMPORTANT NOTE ABOUT SSH ACCESS

There are two methods by which you can access the devices – ssh or webshell. SSH is the most functional but requires some setup and web shell is the simplest but for instance doesn't support copy and paste. See https://help.udf.f5.com/en/articles/3347769-accessing-a-component-via-ssh for more detailed information. **If you know how to do it, use SSH.**



REFERENCES

Use the following as references where you have issues or further questions

DESCRIPTION	URL
App Protect Admin Guide	https://docs.nginx.com/nginx-app-protect/admin-guide/
App Protect Configuration Guide	https://docs.nginx.com/nginx-app-protect/configuration/
App Protect Declarative Policy Guide	https://docs.nginx.com/nginx-app-protect/policy/
App Protect Troubleshooting Guide	https://docs.nginx.com/nginx-app-protect/troubleshooting/
"Getting started with NGINX App-Protect" F5 Internal Reference Pages	https://docs.f5net.com/display/~melnik/Getting+started+with+NGINX+App-Protect

LAB EXERCISES

LAB 1 – ENABLE THE APP PROTECT MODULE

This section demonstrates basic loadbalancing via nginx, tests the networking, and adds the App Protect module

REVIEW AND TEST BASIC CONNECTIVITY

- Login to the client
- Run the command `curl -k https://app.example.com` and ensure that the web page is returned, as below:

```
ubuntu@ip-10-1-1-4:~$ curl -k https://app.example.com
  % Total    % Received % Xferd  Average Speed   Time    Time
Time  Current
                                 Dload  Upload   Total   Spent
Left  Speed
100  3968  100  3968    0     0   361k      0 --:--:-- --:--:-- --:--
:--  387k
<html>
<head>
<TITLE>Using virtual server app_example_com and pool member
10.1.20.11 (Node #1)
</TITLE>
<meta http-equiv="Content-Type" content="text/html; charset=us-ascii"
/>
```

- Login to nginx-1 and check the nginx logs using the command `tail /var/log/nginx/access.log`, check the output is as per below:

```
[centos@ip-10-1-1-5 nginx]$ tail -5 access.log
10.1.10.10 - - [08/Jun/2020:17:34:55 +0000] "GET / HTTP/1.1" 200 3968
"-" "curl/7.47.0" "-"
```

ENABLE THE APP PROTECT MODULE

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and add the load_module command as the first line, as shown below:

```

load_module modules/ngx_http_app_protect_module.so;
user  nginx;
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown
- Run the command `curl -k https://app.example.com?a=%3Cscript%3E` and ensure the page is shown as previously
- Check the nginx logs using the command `tail /var/log/nginx/access.log`, check the output is as per below:

```
10.1.10.10 - - [08/Jun/2020:18:50:29 +0000] "GET / HTTP/1.1" 200 3968
"-" "curl/7.47.0" "-"

10.1.10.10 - - [08/Jun/2020:18:50:32 +0000] "GET /?a=%3Cscript%3E
HTTP/1.1" 200 247 "-" "curl/7.47.0" "-"
```

LAB 2 - ENABLE THE DEFAULT APP PROTECT SECURITY POLICY

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and add the *app_protect_enable on* command as the first line of the http stanza, as shown below:

```
http {
    app_protect_enable on;


    include /etc/nginx/mime.types;
```

- Run the command `curl -k https://app.example.com?a=%3Cscript%3E` and ensure that the request **IS** blocked as shown below:

```
ubuntu@ip-10-1-1-4:~$ curl -k https://app.example.com?a=%3Cscript%3E
<html><head><title>Request Rejected</title></head><body>The requested
URL was rejected. Please consult with your administrator.<br><br>Your
support ID is: 16094438418830557963<br><br><a
href='javascript:history.back();'>[Go
Back]</a></body></html>ubuntu@ip-10-1-1-4:~$
```

Note that this request has been blocked by the default App Protect policy

LAB 3 – CONFIGURE REMOTE LOGGING

BASIC SETUP

NGINX CONFIGURATION

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and add the *app_protect_security_log_enable* and *app_protect_security_log* commands below the previous configuration, as shown below:

```
http {
    app_protect_enable on;
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-default.json" 
syslog:server=10.1.20.11:514;
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

VIEWING LOG MESSAGES

- Login to the server system and run the command `tailf /var/log/syslog`
- Run the command `curl -k https://app.example.com?a=%3Cscript%3E` and ensure that the request **IS** blocked as previously
- Ensure that the log arrives at the server such as below:

```
Jun  8 20:26:26 ip-10-1-1-5.us-west-2.compute.internal ASM:
attack_type="Non-browser Client,Abuse of Functionality,Cross Site
Scripting (XSS)",blocking_exception_reason="N/A",date_time="2020-06-
08
20:26:26",dest_port="80",ip_client="10.1.10.10",is_truncated="",metho
d="GET",policy_name="app_protect_default_policy",protocol="HTTP",requ
est_status="blocked",response_code="0",severity="Critical",sig_cves="
N/A",sig_ids="200001475,200000098",sig_names="XSS script tag end
(Parameter) (2),XSS script tag (Parameter)",sig_set_names="{Cross
Site Scripting Signatures;High Accuracy Signatures},{Cross Site
Scripting Signatures;High Accuracy
Signatures}",src_port="59092",sub_violations="N/A",support_id="695582
2085203780933",unit_hostname="N/A",uri="/",violation_rating="5",vs_na
me="38-app.example.com:1-
/",x_forwarded_for_header_value="N/A",outcome="REJECTED",outcome_reas
on="SECURITY_WAF_VIOLATION",violations="Illegal meta character in
value,Attack signature detected,Violation Rating Threat detected"
```

- Run the command `curl -k https://app.example.com` and ensure that the request **IS NOT** blocked
- Ensure that the log arrives at the server as below:

```
Jun  8 20:27:24 ip-10-1-1-5.us-west-2.compute.internal ASM:
attack_type="N/A",blocking_exception_reason="N/A",date_time="2020-06-
08
20:27:24",dest_port="80",ip_client="10.1.10.10",is_truncated="",metho
```

```
d="GET",policy_name="app_protect_default_policy",protocol="HTTP",requ
est_status="passed",response_code="200",severity="Informational",sig_
cves="N/A",sig_ids="N/A",sig_names="N/A",sig_set_names="N/A",src_port
="59094",sub_violations="N/A",support_id="6955822085203781443",unit_h
ostname="N/A",uri="/",violation_rating="0",vs_name="38-
app.example.com:1-
/",x_forwarded_for_header_value="N/A",outcome="PASSED",outcome_reason
="SECURITY_WAF_OK",violations="N/A",violation_details="N/A",request="
GET / HTTP/1.1\r\nHost: app.example.com\r\nUser-Agent:
curl/7.47.0\r\nAccept: */*\r\n"#015
```

LOG ILLEGAL REQUESTS ONLY

NGINX CONFIGURATION

- Create a new file called log-illegal.json using the command `sudo vi /etc/nginx/log-illegal.json` with the content below:

```
{
    "filter": {
        "request_type": "illegal"
    },
    "content": {
        "format": "user-defined",
        "format_string": "Request ID %support_id%: %method% %uri%
received on %date_time% from IP %ip_client% had the following
violations: %violations%",
        "max_request_size": "any",
        "max_message_size": "5k"
    }
}
```

Note that you can try different options here by referencing the documentation at https://docs.nginx.com/nginx-app-protect/troubleshooting/#app-protect-logging-overview

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and change the *app_protect_security_log* command to reference the new filename, as shown below:

```
http {
    app_protect_enable on;
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json"
syslog:server=10.1.20.11:514;
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

LEGAL REQUESTS

- Run the command `curl -k https://app.example.com` and ensure that the request **IS NOT** blocked
- Ensure that the log **DOES NOT** arrive at the server

ILLEGAL REQUESTS

- Run the command `curl -k https://app.example.com?a=%3Cscript%3E` and ensure that the request **IS** blocked as previously
- Ensure that the log arrives at the server as previously

LAB 4 – ENABLE VARIOUS POLICY FEATURES

In this section we will create various policy files to demonstrate some of the policy features available.

Refer to the nginx documentation at https://docs.nginx.com/nginx-app-protect/configuration/ where required.

ENFORCEMENT MODE

NGINX CONFIGURATION

- Create a new file called policy-transparent.json using the command `sudo vi /etc/nginx/policy-transparent.json` with the content below:

```
{
    "policy": {
        "name": "policy-transparent",
        "template": { "name": "POLICY_TEMPLATE_NGINX_BASE" },
        "applicationLanguage": "utf-8",
        "enforcementMode": "transparent"
    }
}
```

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and change the *app_protect_policy_file* command to reference the policy file, as shown below:

```
http {
    app_protect_enable on;
    app_protect_policy_file "/etc/nginx/policy-transparent.json";
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json"
syslog:server=10.1.20.11:514;
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

SEND ILLEGAL REQUEST

- Run the command `curl -k https://app.example.com?a=%3Cscript%3E` and ensure that the request **IS NOT** blocked
- Ensure that the log arrives at the server as previously

VIOL_HTTP_PROTOCOL

In this lab we will enable the VIOL_HTTP_PROTOCOL violation globally in the Blocking Settings section and configure the alarm and block settings independently. The policy file will be created using an Ansible playbook which merges a template file and variables.

NGINX CONFIGURATION

- Review the Jinja2 template file *nap_template.j2* using the command `more nap_template.j2`. Note the variables within the double braces : {{ }} (highlighted below in yellow) and the for command for looping over a list of values (highlighted below in green). View more about Ansible templating at https://docs.ansible.com/ansible/latest/user_guide/playbooks_templating.html and about Jinja at https://palletsprojects.com/p/jinja/

  Template File:

```
[centos@ip-10-1-1-5 ~]$ more nap_template.j2
{
  "name": "policy-viol_http_protocol",
  "template": {
    "name": "POLICY_TEMPLATE_NGINX_BASE"
  },
  "applicationLanguage": "utf-8",
  "enforcementMode": "{{ enforcementMode| default (blocking)
}}"
  "server-technologies": [
{% for srvtech in server_tech %}
   {
     "serverTechnologyName": "{{srvtech.name}}"
{% if loop.last %}
   }
{% else %}
   },
{% endif %}
{% endfor %}
  ],
  "signature-settings":{
        "signatureStaging": false
  },
  "modifications":[

--More--(34%)
```

- View the variables which are inserted into the *nap_vars.yaml* file using the command `more nap_vars.yaml` – note that this is in YAML syntax where a hyphen denotes a list of entries. To see more information about YAML, go to https://docs.ansible.com/ansible/latest/reference_appendices/YAMLSyntax.html
  Variables file:

```
[centos@ip-10-1-1-5 ~]$ more nap_vars.yaml
server_tech:
- t1:
  name: Unix/Linux

enforcementMode: blocking

block_violation:
- violation1:
  name: VIOL_HTTP_PROTOCOL
  alarm_switch: true
  block_switch: false
```

- Review the *nap_playbook.yaml* file with the command `more nap_playbook.yaml`. This contains tasks to be performed by Ansible. Note that the template and copy tasks are used. See more detail on these tasks at https://docs.ansible.com/ansible/latest/collections/ansible/builtin/template_module.html and https://docs.ansible.com/ansible/latest/collections/ansible/builtin/copy_module.html#ansible-collections-ansible-builtin-copy-module See a list of builtin plugins at https://docs.ansible.com/ansible/latest/collections/ansible/builtin/index.html
  Note the source template nap_template.j2 and destination file policy-viol_http_protocol.json

```
[centos@ip-10-1-1-5 ~]$ more nap_playbook.yaml
#!/usr/bin/env ansible-playbook

###############################################################
################
# Ansible Playbook for NGINX App Protect Policy Management
# Borrowed from https://github.com/fbchan/nginx-app-protect-
policy
# Example: ansible-playbook -i inventory nap_play.yml
# Author: Foo-Bang (fb@f5.com)
# Version: 0.01
###############################################################
################
---
- name: "### PLAYBOOK 01 ### - Create NGINX App Protect Policy"
  hosts: localhost
  connection: local
  gather_facts: False
  vars_files:
    - nap_vars.yaml
  tasks:
    - name: " # TASK 01 # - Generating NGINX App Protect policy
enforcement"
      template:
        src: nap_template.j2
        dest: policy-viol_http_protocol.json

- name: "### PLAYBOOK 02 ### - Transfering App Protect Policy
Enforcement"
  hosts: localhost
  tasks:
    - name: "# TASK 01 # - Transferring policy for enforcement"
      copy:
        src: ./policy-viol_http_protocol.json
        dest: /etc/nginx/policy-viol_http_protocol.json
        owner: root
        group: root
        force: yes
```

- Run the Ansible playbook with the command `ansible-playbook nap_playbook.yaml`
  Example:

```
[centos@ip-10-1-1-5 ~]$ ansible-playbook nap_playbook.yaml
```

```
[WARNING]: provided hosts list is empty, only localhost is
available. Note that
the implicit localhost does not match 'all'

PLAY [### PLAYBOOK 01 ### - Create NGINX App Protect Policy]
*******************

TASK [# TASK 01 # - Generating NGINX App Protect policy
enforcement] ***********
ok: [localhost]

PLAY [### PLAYBOOK 02 ### - Transferring App Protect Policy
Enforcement] ********

TASK [Gathering Facts]
*********************************************************
ok: [localhost]

TASK [# TASK 01 # - Transferring policy for enforcement]
***********************
changed: [localhost]

PLAY RECAP
****************************************************************
******
localhost                  : ok=3    changed=1    unreachable=0
failed=0    skipped=0    rescued=0    ignored=0
```

- Ensure that there are no failed tasks.
- Ensure the policy file is created in the directory with the command `ls *.json`:

```
[centos@ip-10-1-1-5 ~]$ ls *.json
policy-viol_http_protocol.json
```

- View the content of the policy with the command `more policy-viol_http_protocol.json`

```
[centos@ip-10-1-1-5 ~]$ more policy-
viol_http_protocol.json
{
  "name": "policy-viol_http_protocol",
  "template": {
    "name": "POLICY_TEMPLATE_NGINX_BASE"
  },
  "applicationLanguage": "utf-8",
  "enforcementMode": "blocking"
  "server-technologies": [
   {
     "serverTechnologyName": "Unix/Linux"
   }
  ],
  "signature-settings":{
        "signatureStaging": false
  },
  "modifications":[

  ],
  "signatures": [
  ],
  "blocking-settings": {
   "violations": [
    {
--More--(77%)
```

Note the server-technologies, enforcementMode and violations taken from the variables file.

- Ensure that file has been copied to the /etc/nginx directory using the command `ls -la /etc/nginx/*.json`

```
[centos@ip-10-1-1-5 ~]$ ls -la /etc/nginx/*.json
-rw-r--r--. 1 root root 164 Jun  8  2020 /etc/nginx/log-default.json
-rw-r--r--  1 root root 538 May  6 15:42 /etc/nginx/policy-viol_http_protocol.json
```

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and change the *app_protect_policy_file* command to reference the policy file, as shown below:

```
http {
    app_protect_enable on;
    app_protect_policy_file "/etc/nginx/policy-viol_http_protocol.json";
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json" syslog:server=10.1.20.11:514;
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

SEND ILLEGAL REQUEST – BLOCKED BY WAF

- Run the command `curl -H "Host: 1.2.3.4" http://app.example.com` and ensure that the request **IS** blocked
- Ensure that the log arrives at the server as previously

SEND ILLEGAL REQUEST – BLOCKED BY NGINX

- Run the command `curl -H "Content-Length: -26" http://app.example.com` and ensure that the request is rejected by NGINX which returns the 400 Bad Request
- Ensure that the log arrives at the server as previously

TURN OFF ALARM

- Modify the nap_vars.yaml file to set the alarm to false using the command `vi nap_vars.yaml`

```
server_tech:
- t1:
  name: Unix/Linux

enforcementMode: blocking

block_violation:
- violation1:
  name: VIOL_HTTP_PROTOCOL
  alarm_switch: false
  block_switch: true
```

- Re-run the playbook with the command `ansible-playbook nap_playbook.yaml`

- Review the policy file using the command `more /etc/nginx/policy-viol_http_protocol.json.` Check that the violation is set to block but not alarm as below:

```
                    "name": "VIOL_HTTP_PROTOCOL",
                    "alarm": false,
                    "block": true
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

SEND ILLEGAL REQUEST – BLOCKED BUT NO LOG

- Run the command `curl -H "Host: 1.2.3.4" http://app.example.com` and ensure that the request **IS** blocked
- Ensure that the log **DOES NOT** arrive at the server

Note: If the log still arrives at the server, you should check that the WAF is only logging illegal requests. For reference, see Lab 3

TURN OFF BLOCKING

- Modify the the nap_vars.yaml variables file to set the violation to alarm but not block, re-run the Ansible playbook and check the policy is set as below:

```
                    "name": "VIOL_HTTP_PROTOCOL",
                    "alarm": true,
                    "block": false
```

- Restart the nginx daemon

SEND ILLEGAL REQUEST – LOGGED BUT NO BLOCK

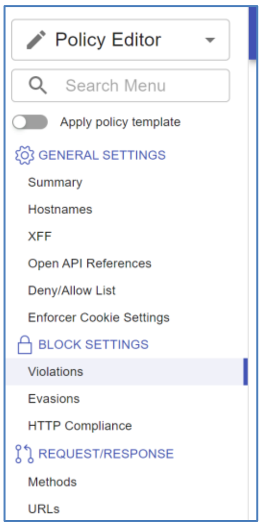
- Run the command `curl -H "Host: 1.2.3.4" http://app.example.com` and ensure that the request **IS NOT** blocked
- Ensure that the log **DOES** arrive at the server

VIOL_EVASION

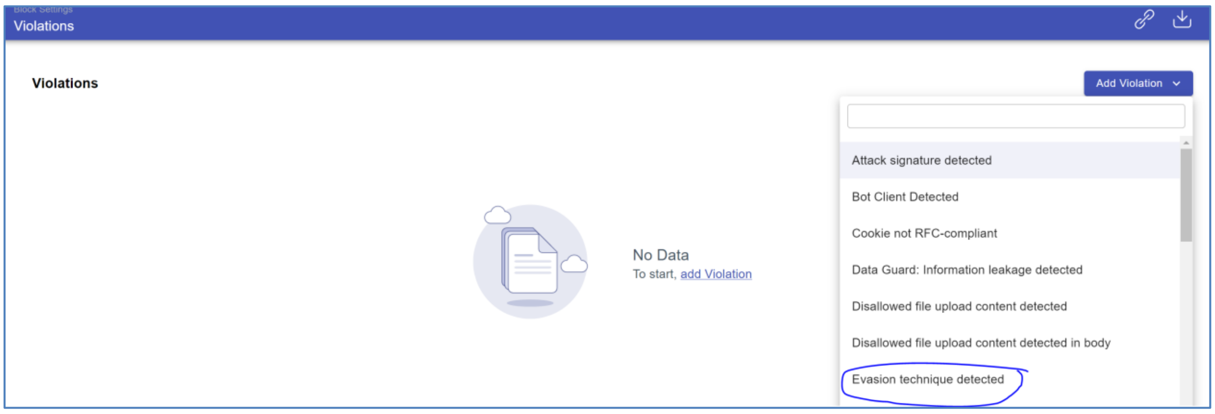
In this lab we will enable the VIOL_EVASION violation globally in the Blocking Settings section and look at how to disable blocking for individual evasion techniques. Here you will use a web-based tool for creating the policy.

NGINX CONFIGURATION

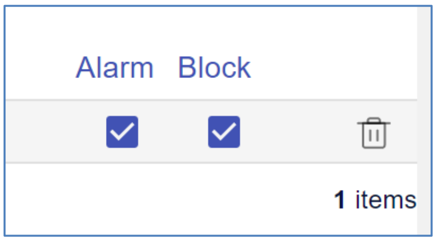
- Using your browser, navigate to https://waffler.dev/prod/ and create a policy named policy-viol_evasion.
  - In the left-hand menu, navigate to Violations under the BLOCK SETTINGS group.



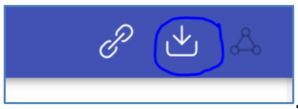
  - Click on Add Violation and select Evasion technique detected


Block Settings
Violations
Violations
Add Violation
No Data
To start, add Violation
Attack signature detected
Bot Client Detected
Cookie not RFC-compliant
Data Guard: Information leakage detected
Disallowed file upload content detected
Disallowed file upload content detected in body
Evasion technique detected

  - Click the Alarm and Block checkboxes for the violation



  - In the left-hand menu, navigate to Evasions under the BLOCK SETTINGS group

- Select all of the text in the JSON lower tab and copy with Ctrl-C (or export the file using the download function in the top right-hand side) .

- Create a new file called policy-viol_evasion.json using the command `sudo vi /etc/nginx/policy-viol_evasion.json` and paste in the JSON from the lower pane (or use scp or your preferred method of file transfer)
- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and change the *app_protect_policy_file* command to reference the policy file, as shown below:

```
http {
    app_protect_enable on;
    app_protect_policy_file "/etc/nginx/policy-viol_evasion.json";
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json"
syslog:server=10.1.20.11:514;
```

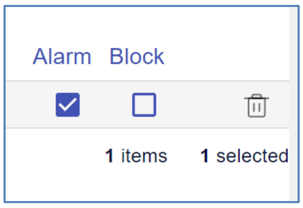
- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

SEND ILLEGAL REQUEST – BLOCKED BY WAF

- Run the command `curl -k https://app.example.com/%09` and ensure that the request **IS** blocked
- Ensure that the log arrives at the server as previously

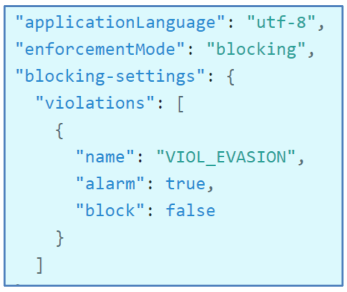
DISABLE BLOCKING FOR ALL VIOLATIONS

- Set the policy so that block is set to false for VIOL_EVASION and restart the nginx daemon:
  - Navigate to Blocking Settings>Violations and uncheck Block



Alarm Block
✓ ☐
1 items **1** selected

  - Check that the policy is updated to show "block" is set to false



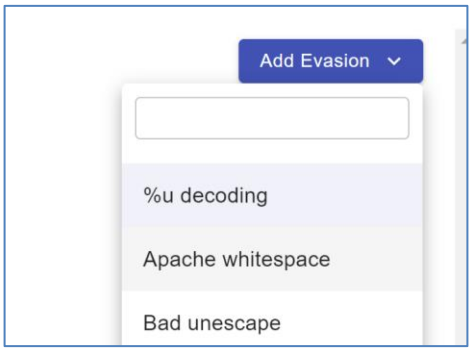
```
"applicationLanguage": "utf-8",
"enforcementMode": "blocking",
"blocking-settings": {
  "violations": [
    {
      "name": "VIOL_EVASION",
      "alarm": true,
      "block": false
    }
  ]
```

  - Update policy file as before
- Run the curl command as above and ensure that the response is 404 Not Found ie **NOT BLOCKED** by WAF

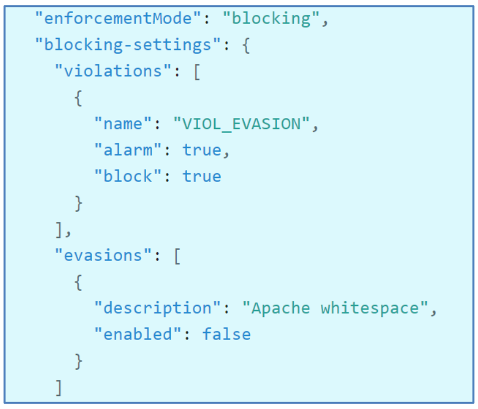
Note that this has disabled blocking for ALL evasion violations

ENABLE BLOCKING FOR ALL VIOLATIONS, DISABLE APACHE WHITESPACE VIOLATION

- Modify the policy file to disable the Apache Whitespace check as below, and restart the nginx daemon:
    - Click on Add Evasion and select Apache Whitespace



    - Check the Enabled button twice until the JSON text in the lower pane shows "enabled": false For the Apache whitespace evasion



```
  "enforcementMode": "blocking",
  "blocking-settings": {
    "violations": [
      {
        "name": "VIOL_EVASION",
        "alarm": true,
        "block": true
      }
    ],
    "evasions": [
      {
        "description": "Apache whitespace",
        "enabled": false
      }
    ]
```

```
{
    "policy": {
        "name": "policy-viol_evasion",
        "template": { "name": "POLICY_TEMPLATE_NGINX_BASE" },
        "applicationLanguage": "utf-8",
        "enforcementMode": "blocking",
        "blocking-settings": {
            "violations": [
                {
                "name": "VIOL_EVASION",
                "alarm": true,
                "block": true
                }
            ],
            "evasions": [
                {
                "description": "Apache whitespace",
                "enabled": "false"
                }
            ]
        }
    }
}
```

- Run the curl command again and ensure that the request **IS NOT** blocked by the WAF

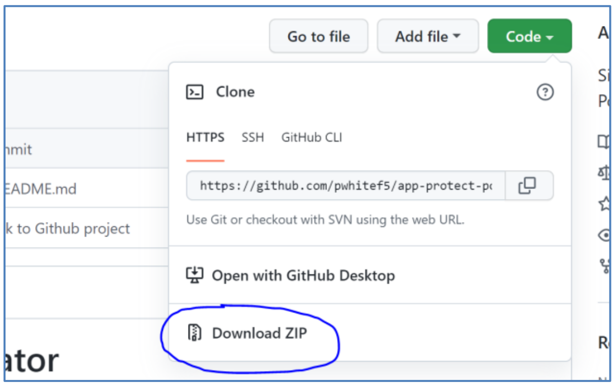
Note that we have enabled all violations and only disabled the one which gives us a problem. A much better solution

VIOL_FILETYPE

In this lab we will enable the VIOL_FILETYPE violation in Blocking Settings, and show the default negative policy ie all filetypes are accepted except for a specific list of disallowed file types. We will then change the default policy to block all filetypes except for the allowed type. ie positive policy. You will use another tool to initially create the policy – this one is portable and simple to use but has fewer features included.

NGINX CONFIGURATION

- Using your browser, navigate to https://github.com/pwhitef5/app-protect-policy-creator
    - Click on the green Code button and click on Download ZIP


Go to file
Add file
Code
Clone
HTTPS
SSH
GitHub CLI
https://github.com/pwhitef5/app-protect-p
Use Git or checkout with SVN using the web URL.
Open with GitHub Desktop
Download ZIP

    - Extract the zip archive and double-click on the create_policy.html file which should open in a web browser window.
    - In Policy Name, enter ***policy-viol_filetype***
    - Click on the [+] icon to the right of Violations. A frame containing a list of violations should open
    - Check both Alarm and Block checkboxes relating to VIOL_FILETYPE
    - Click Create Policy button at the bottom of the page
    - Click Export Policy button to export policy to a file
- Create a new file called policy- viol_evasion.json using the command `sudo vi /etc/nginx/policy-viol_filetype.json` with the content below, or copy exported file to device with the correct filename:

```
{
    "policy": {
        "name": "policy-viol_filetype",
        "template": {
            "name": "POLICY_TEMPLATE_NGINX_BASE"
        },
        "applicationLanguage": "utf-8",
        "enforcementMode": "blocking",
        "blocking-settings": {
            "violations": [
                  <snipped for clarity>
                {
                    "name": "VIOL_FILETYPE",
                    "alarm": true,
                    "block": true
                }
            ]
        }
    }
}
```

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and change the *app_protect_policy_file* command to reference the policy file, as shown below:

```
http {
    app_protect_enable on;
    app_protect_policy_file "/etc/nginx/policy-viol_filetype.json";
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json"
syslog:server=10.1.20.11:514;
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

SEND LEGAL REQUEST – ALLOWED

- Run the command `curl -k https://app.example.com/index.php` and ensure that the request **IS NOT** blocked or logged

SEND ILLEGAL REQUEST – BLOCKED

- Run the command `curl -k https://app.example.com/test.exe` and ensure that the request **IS** blocked
- Ensure that the log arrives at the server as previously

Note that .exe is on the list of disallowed filetypes which is the reason why this request is blocked

NGINX CONFIGURATION TO CHANGE THE DEFAULT POLICY

- Modify the file policy- viol_evasion.json to match the content below, and reload nginx:

```
{
    "policy": {
        "name": "policy-viol_filetype",
        "template": { "name": "POLICY_TEMPLATE_NGINX_BASE" },
        "applicationLanguage": "utf-8",
        "enforcementMode": "blocking",
        "blocking-settings": {
            "violations": [
                {
                    "name": "VIOL_FILETYPE",
                    "alarm": true,
                    "block": true
                }
            ]
        },
        "filetypes": [
            {
            "name": "html",
            "type": "explicit",
            "allowed": true
            }
        ]
    },
    "modifications": [
        {
        "entityChanges": {
            "type": "wildcard"
        },
        "entity": {
            "name": "*"
            },
        "entityType": "filetype",
        "action": "delete"
        }
    ]
}
```

This part is adding html as an explicit allowed filetype

This part is modifying the default policy to delete the wildcard filetype

SEND LEGAL REQUEST – ALLOWED

- Run the command `curl -k https://app.example.com/badlinks.html` and ensure that the request **IS NOT** blocked or logged

SEND ILLEGAL REQUEST – BLOCKED

- Run the command `curl -k https://app.example.com/index.php` and ensure that the request **IS** blocked
- Ensure that the log arrives at the server as previously

LAB 5 – ENABLE MULTIPLE POLICIES

In this section we will demonstrate the use of two policies which are applied to two different URLs within location blocks.

NGINX CONFIGURATION

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and change the *app_protect_policy_file* command to reference the default policy file, as shown below:

```
http {
    app_protect_enable on;
    app_protect_policy_file "/etc/nginx/NginxDefaultPolicy.json";
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json"
syslog:server=10.1.20.11:514;
```

- Add a new location block as below:

```
    server {
    listen 10.1.10.100:80 default_server;
        server_name  app.example.com;
        location / {
            proxy_pass http://app_example_com;
        }
        location /basic {
            app_protect_policy_file "/etc/nginx/policy-
viol_filetype.json";
            proxy_pass http://app_example_com;
        }
    }
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and ensure there are no error messages shown

SEND LEGAL REQUEST – ALLOWED

- Run the command `curl -k https://app.example.com/index.php` and ensure that the request **IS NOT** blocked or logged

SEND ILLEGAL REQUEST – BLOCKED

- Run the command `curl -k https://app.example.com/basic/index.php` and ensure that the request **IS** blocked
- Ensure that the log arrives at the server as previously

LAB 6 – TROUBLESHOOTING

In this section we will create various issues with the policy file and nginx.conf and show how to troubleshoot these.

NGINX.CONF ISSUES

In this lab we will demonstrate an issue with the nginx configuration – an incorrect filename which prevents the policy being loaded.

NGINX CONFIGURATION

- Using the command `sudo vi /etc/nginx/nginx.conf`, edit the nginx configuration file and remove the location /basic stanza created in lab 5 and also change the global policy filename to be incorrect, as shown below:

```
http {
    app_protect_enable on;
    app_protect_policy_file
"/etc/nginx/NginxDefaultPolicywrong.json";
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json"
syslog:server=10.1.20.11:514;
```

- Restart the nginx daemon using the command `sudo nginx -s reload` and view the error message as shown below:

```
[centos@ip-10-1-1-5 nginx]$ sudo nginx -s reload
{
   "completed_successfully" : false,
   "error_message" : "Failed to read
'/etc/nginx/NginxDefaultPolicywrong.json'",
   "error_line_number" : 19
}
nginx: [error] APP_PROTECT { "event": "configuration_load_failure",
"software_version": "2.52.1", "error_message":"Failed to read
'/etc/nginx/NginxDefaultPolicywrong.json'","completed_successfully":f
alse,"error_line_number":19}
[centos@ip-10-1-1-5 nginx]$
```

Note the error_line_number is the line on which the error is found and the error_message is relevant to the error

- View the error log using the command `sudo tail /var/log/nginx/error.log`, notice the error message such as below:

```
2020/06/26 11:59:19 [error] 2291#2291: APP_PROTECT { "event":
"configuration_load_failure", "software_version": "2.52.1",
"error_message":"Failed to read
'/etc/nginx/NginxDefaultPolicywrong.json'","completed_successfully":f
alse, "error_line_number":19}
```

Note that the log level is [error] and is tagged with APP_PROTECT. The content is in JSON format.

- Correct the filename in nginx.conf and reload nginx, ensure the policy loads as expected

POLICY ISSUES

In this lab we will demonstrate issues with the policy – non-JSON format, and incorrect variable types

POLICY CONFIGURATION

- Modify /etc/nginx/nginx.conf to use the policy as per Lab 4 - /etc/nginx/policy-viol_filetype.json
- Modify the policy to remove the double-quote at the start of filetypes as per below:

```
filetypes": [
            {
            "name": "html",
            "type": "explicit",
            "allowed": true
            }
        ]
```

- Restart the nginx daemon and note the failure message as below:

```
[centos@ip-10-1-1-5 nginx]$ sudo nginx -s reload
{
   "completed_successfully" : false,
   "error_message" : "Failed to import Policy '/etc/nginx/policy-
viol_filetype.json' from '/etc/nginx/policy-viol_filetype.json': Fail
parse JSON Policy: '\"' expected, at character offset 441 (before
\"filetypes\": [\\n     ...\") \n.",
   "error_line_number" : 44
}
nginx: [error] APP_PROTECT { "event": "configuration_load_failure",
"software_version": "2.52.1", "error_message":"Failed to import
Policy '/etc/nginx/policy-viol_filetype.json' from
'/etc/nginx/policy-viol_filetype.json': Fail parse JSON Policy: '\"'
expected, at character offset 441 (before \"filetypes\": [\\n
...\") \n.","completed_successfully":false,"error_line_number":44}
```

Note that the error indicates the error type ie 'Fail parse JSON policy: '\"' expected' and both the line number and the character offset

- View the error log using the command `sudo tail /var/log/nginx/error.log`, notice the error message such as below:

```
2020/06/26 12:05:03 [error] 2358#2358: APP_PROTECT { "event":
"configuration_load_failure", "software_version": "2.52.1",
"error_message":"Failed to import Policy '/etc/nginx/policy-
viol_filetype.json' from '/etc/nginx/policy-viol_filetype.json': Fail
parse JSON Policy: '\"' expected, at character offset 441 (before
\"filetypes\": [\\n     ...\")
\n.","completed_successfully":false,"error_line_number":44}
```

- To check the policy file for JSON errors, run the command `cat /etc/nginx/policy-viol_filetype.json | python -m json.tool` and note the output showing the error in more detail as below:

```
[centos@ip-10-1-1-5 nginx]$ cat /etc/nginx/policy-viol_filetype.json
| python -m json.tool
Expecting property name: line 44 column 9 (char 441)
[centos@ip-10-1-1-5 nginx]$
```

- To find the error in the file, open the policy using the command `sudo vi /etc/nginx/policy-viol_filetype.json` and use the command `:16` to jump to the relevant line, use `:goto 441` to jump to the character offset
- Fix the error by replacing the double-quote in the policy file and reloading nginx
- Re-check the file JSON format is correct as below ie no errors:

```
[centos@ip-10-1-1-5 nginx]$ cat /etc/nginx/policy-
viol_evasion.json|python -m json.tool
{
    "policy": {
        "applicationLanguage": "utf-8",
        "blocking-settings": {
            "evasions": [
                {
…
```

- Modify the policy and change “allowed”: true to “allowed”: 12 ie change from Boolean type to integer, as per below:

```
"filetypes": [
            {
            "name": "html",
            "type": "explicit",
            "allowed": 12
            }
        ]
```

- Reload nginx and view error as below:

```
[centos@ip-10-1-1-5 nginx]$ sudo nginx -s reload
{
   "completed_successfully" : false,
   "error_message" : "Failed to import Policy 'policy-viol_filetype'
from '/etc/nginx/policy-viol_filetype.json': Could not parse/validate
the File Type.  Invalid value '12' for field 'allowed'.",
   "error_line_number" : 44
}
nginx: [error] APP_PROTECT { "event": "configuration_load_failure",
"software_version": "2.52.1", "error_message":"Failed to import
Policy 'policy-viol_filetype' from '/etc/nginx/policy-
viol_filetype.json': Could not parse/validate the File Type.  Invalid
value '12' for field
'allowed'.","completed_successfully":false,"error_line_number":44}
[centos@ip-10-1-1-5 nginx]$
```

- Fix the error and reload nginx

DEBUGGING APP PROTECT

In this lab we will demonstrate how to turn on debugging of App Protect such as where a specific area of functionality is not working as expected.

NGINX CONFIGURATION

- Modify /etc/nginx/nginx.conf to use the HTTP protocol policy file from Lab 4, as below:

```
http {
    app_protect_enable on;
    app_protect_policy_file "/etc/nginx/policy-
viol_http_protocol.json";
    app_protect_security_log_enable on;
    app_protect_security_log "/etc/nginx/log-illegal.json"
syslog:server=10.1.20.11:514;
```

- Reload nginx

LOGGER CONFIGURATION FILE

- Modify /etc/app_protect/bd/logger.cfg (the default logging configuration file) using the command `sudo vi /etc/app_protect/bd/logger.cfg`
- Note the names of the modules which can be configured for debugging:

```
#####################################################################
###########################
#
#                                       Logger configuration file
#
#       Existing modules:
#
#       IO_PLUGIN (Requests & Responses) FTP_PLUGIN (ftp) SMTP_PLUGIN
(smtp)
#       BEM (Accumulation Responses), ECARD (Tables),
#       ECARD_POLICY (Enforcer), BD_SSL (Communications), UMU
(Memory),
#       IMF (Sockets), BD_MISC (Config and miscs),COOKIE_MGR
(Cookies), REG_EXP (Regular expressions),
#       RESP_PARAMS (Extractions), ATTACK_SIG (Attack Signatures),
BD_XML(XML Enforcer),
#       ATTACK_ENGINE (BF & BOT detect monitor), XML_PARSER (all xml
engine), ACY (pattern match engine),
#       BD_PB (policy builder), BD_PB_SAMPLING (sampling decisions
for pb), LEGAL_HASH (internal cache tables),
#       CLIENT_SIDE (Client Side infrastructre), STATS (policy
builder statistics), ICAP (content inspection),
#       CLUSTER_ANOMALY (the anomaly distributed channel), PIPE
(shmem channel bd-pbng, bd-lrn),
#       MPP_PARSER (Multipart parser), SA_PLUGIN (Session awareness),
DATA_PROTECT (Data Protection Library),
#       GDM (Guardium DB security), ASM_IRULE (ASM iRule commands),
LIBDATASYNC (Data Sync Library),
#       BD_CONF (BD MCP configuration), MPI_CHANNEL (BD initiated MPI
events),
#       BD_FLUSH_TBLS(flush BD conf tables), CSRF (CSRF feature),
BRUTE_FORCE_ENFORCER (Brute Force feature),
#       LONG_REQUEST (Long request), HTML_PARSER (HTML parser)
```

- Add the following lines at the end of the file:

```
MODULE = IO_PLUGIN;
LOG_LEVEL = TS_DEBUG;
FILE = 2;
```

- Run the following command to begin debugging: `sudo /bin/bash -c '/opt/app_protect/bin/set_active.pl -g' nginx`
- Capture the debug file output using the command `tail -f /var/log/app_protect/bd-socket-plugin.log`
- On the client, run the command `curl -H "Host: 1.2.3.4" http://app.example.com` and view the debug output
- Remove the added lines from /etc/app_protect/bd/logger.cfg and run the command `sudo /bin/bash -c '/opt/app_protect/bin/set_active.pl -g' nginx` to disable the debug logging

Well Done! This lab is complete