Install and verify Docker Container based NGINX, MODSECURITY WAF, OWASP Core Rule Sets and SSL

Tested Operating System and Architecture,

```
root@ip-172-31-3-97:~# cat /etc/os-release
PRETTY_NAME="Ubuntu 22.04.1 LTS"
NAME="Ubuntu"
VERSION_ID="22.04"
VERSION="22.04.1 LTS (Jammy Jellyfish)"
VERSION_CODENAME=jammy
ID=ubuntu
ID_LIKE=debian
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
UBUNTU_CODENAME=jammy
root@ip-172-31-3-97:~# uname -m
x86_64
root@ip-172-31-3-97:~#
```

Steps to Install docker,

apt update && apt upgrade -y

sudo apt install apt-transport-https ca-certificates curl software-properties-common

curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg

echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null

sudo apt update

apt-cache policy docker-ce

sudo apt install docker-ce -y

sudo systemctl status docker

docker container ls -a (Ensure no container exists)

```
root@ip-172-31-3-97:~# sudo systemctl status docker
● docker.service - Docker Application Container Engine
     Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
     Active: active (running) since Tue 2023-01-17 06:46:52 UTC; 1h 1min ago
TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
   Main PID: 15218 (dockerd)
      Tasks: 25
     Memory: 24.4M
        CPU: 2.159s
     CGroup: /system.slice/docker.service
             ├─15218 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock
             ├─15732 /usr/bin/docker-proxy -proto tcp -host-ip 0.0.0.0 -host-port 8443 -container-ip 172.17.0.2 -container-port 443
             └─15738 /usr/bin/docker-proxy -proto tcp -host-ip :: -host-port 8443 -container-ip 172.17.0.2 -container-port 443
```

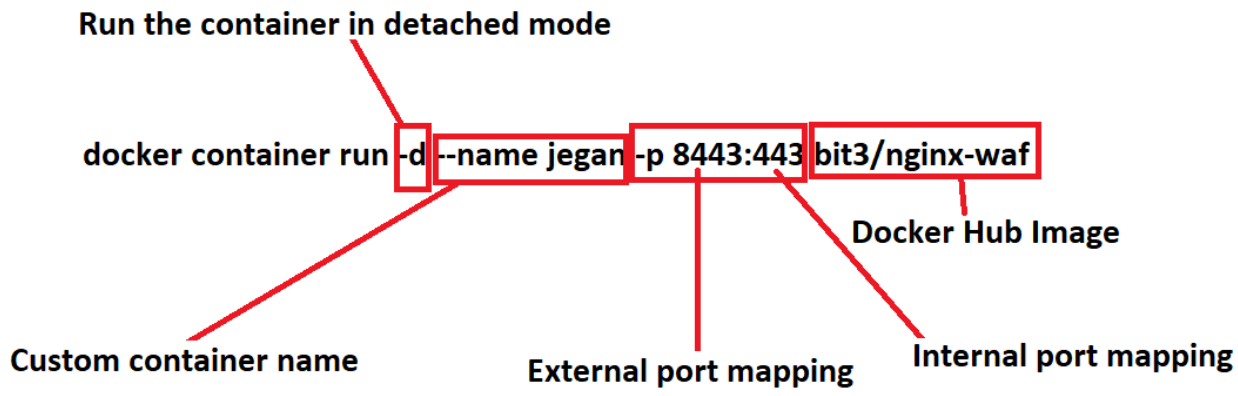
```
root@ip-172-31-3-97:~# docker container ls -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@ip-172-31-3-97:~#
root@ip-172-31-3-97:~#
```

Find the below Docker Hub link to install NGINX OWASP MODSEC WAF CRS RULES container,

https://hub.docker.com/r/bit3/nginx-waf

Run the container image with the below command,

docker container run -d --name jegan -p 8443:443 bit3/nginx-waf

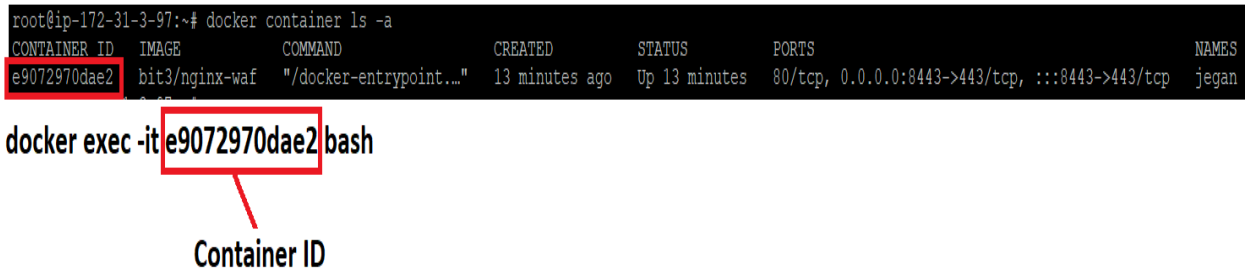


```
root@ip-172-31-3-97:~# docker container run -d --name jegan -p 8443:443 bit3/nginx-waf
Unable to find image 'bit3/nginx-waf:latest' locally
latest: Pulling from bit3/nginx-waf
7a6db449b51b: Pull complete
ca1981974b58: Pull complete
d4019c921e20: Pull complete
7cb804d746d4: Pull complete
e7a561826262: Pull complete
7247f6e5c182: Pull complete
a904d8a502b0: Pull complete
Digest: sha256:cfd6b022cc3831b0afa1f2d1e5feeced649105b759fe92be1dacf0ce7f5defdd
Status: Downloaded newer image for bit3/nginx-waf:latest
e9072970dae271d3505329a1f4220b65f42235b26149c39429bb81ad6b4290b3
root@ip-172-31-3-97:~# docker container ls -a
CONTAINER ID   IMAGE           COMMAND                  CREATED         STATUS         PORTS                                                NAMES
e9072970dae2   bit3/nginx-waf   "/docker-entrypoint.…"   7 seconds ago   Up 6 seconds   80/tcp, 0.0.0.0:8443->443/tcp, :::8443->443/tcp   jegan
root@ip-172-31-3-97:~#
```

Note : By default the above command will install all needed NGINX OWASP MODSEC WAF CRS RULES components.

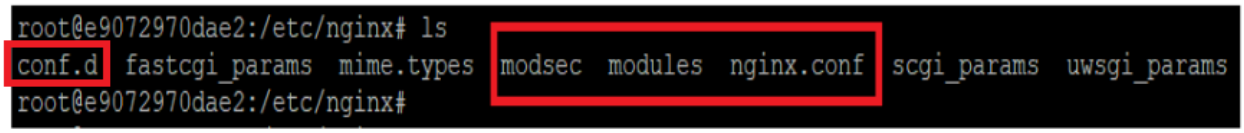
Log Into the container for SSL (Self Signed certificate example) configuration with the below command,

docker exec -it e9072970dae2 bash



Important directories in this container are /etc/nginx, /etc/nginx/modsec, /etc/nginx/modules, /etc/nginx/conf.d

All the modsecurity owasp crs rules will reside inside /usr/local/owasp-modsecurity-crs-3.2.0/rules/ directory



```
root@e9072970dae2:/etc/nginx# cd modsec
root@e9072970dae2:/etc/nginx/modsec# ls
main.conf  modsecurity.conf  unicode.mapping
root@e9072970dae2:/etc/nginx/modsec#
```

```
root@e9072970dae2:/etc/nginx/modules# ls
ngx_http_geoip_module-debug.so        ngx_http_image_filter_module.so  ngx_http_modsecurity_module.so       ngx_stream_geoip_module-debug.so  ngx_stream_js_module.so
ngx_http_geoip_module.so              ngx_http_js_module-debug.so      ngx_http_xslt_filter_module-debug.so  ngx_stream_geoip_module.so
ngx_http_image_filter_module-debug.so ngx_http_js_module.so            ngx_http_xslt_filter_module.so        ngx_stream_js_module-debug.so
root@e9072970dae2:/etc/nginx/modules#
```

```
root@e9072970dae2:/etc/nginx/conf.d# ls
default.conf
root@e9072970dae2:/etc/nginx/conf.d#
```

```
root@e9072970dae2:/etc/nginx/modsec# cd /usr/local/owasp-modsecurity-crs-3.2.0/
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0# ls
CHANGES  CONTRIBUTING.md  CONTRIBUTORS.md  INSTALL  KNOWN_BUGS  LICENSE  README.md  crs-setup.conf  crs-setup.conf.example  documentation  rules  util
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0#
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0#
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0# cd rules/
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0/rules#
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0/rules#
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0/rules# pwd
/usr/local/owasp-modsecurity-crs-3.2.0/rules
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0/rules# ls
REQUEST-900-EXCLUSION-RULES-BEFORE-CRS.conf          REQUEST-933-APPLICATION-ATTACK-PHP.conf              java-code-leakages.data
REQUEST-900-EXCLUSION-RULES-BEFORE-CRS.conf.example  REQUEST-934-APPLICATION-ATTACK-NODEJS.conf           java-errors.data
REQUEST-901-INITIALIZATION.conf                      REQUEST-941-APPLICATION-ATTACK-XSS.conf              lfi-os-files.data
REQUEST-903.9001-DRUPAL-EXCLUSION-RULES.conf         REQUEST-942-APPLICATION-ATTACK-SQLI.conf             php-config-directives.data
REQUEST-903.9002-WORDPRESS-EXCLUSION-RULES.conf      REQUEST-943-APPLICATION-ATTACK-SESSION-FIXATION.conf php-errors.data
REQUEST-903.9003-NEXTCLOUD-EXCLUSION-RULES.conf      REQUEST-944-APPLICATION-ATTACK-JAVA.conf             php-function-names-933150.data
REQUEST-903.9004-DOKUWIKI-EXCLUSION-RULES.conf       REQUEST-949-BLOCKING-EVALUATION.conf                 php-function-names-933151.data
REQUEST-903.9005-CPANEL-EXCLUSION-RULES.conf         RESPONSE-950-DATA-LEAKAGES.conf                      php-variables.data
REQUEST-903.9006-XENFORO-EXCLUSION-RULES.conf        RESPONSE-951-DATA-LEAKAGES-SQL.conf                  restricted-files.data
REQUEST-905-COMMON-EXCEPTIONS.conf                   RESPONSE-952-DATA-LEAKAGES-JAVA.conf                 restricted-upload.data
REQUEST-910-IP-REPUTATION.conf                       RESPONSE-953-DATA-LEAKAGES-PHP.conf                  scanners-headers.data
REQUEST-911-METHOD-ENFORCEMENT.conf                  RESPONSE-954-DATA-LEAKAGES-IIS.conf                  scanners-urls.data
REQUEST-912-DOS-PROTECTION.conf                      RESPONSE-959-BLOCKING-EVALUATION.conf                scanners-user-agents.data
REQUEST-913-SCANNER-DETECTION.conf                   RESPONSE-980-CORRELATION.conf                        scripting-user-agents.data
REQUEST-920-PROTOCOL-ENFORCEMENT.conf                RESPONSE-999-EXCLUSION-RULES-AFTER-CRS.conf          sql-errors.data
REQUEST-921-PROTOCOL-ATTACK.conf                     RESPONSE-999-EXCLUSION-RULES-AFTER-CRS.conf.example  unix-shell.data
REQUEST-930-APPLICATION-ATTACK-LFI.conf              crawlers-user-agents.data                            windows-powershell-commands.data
REQUEST-931-APPLICATION-ATTACK-RFI.conf              iis-errors.data
REQUEST-932-APPLICATION-ATTACK-RCE.conf              java-classes.data
root@e9072970dae2:/usr/local/owasp-modsecurity-crs-3.2.0/rules#
```

Module (load_module modules/ngx_http_modsecurity_module.so;) is the interface of NGINX and MODSEC WAF available in file /etc/nginx/nginx.conf

```
root@e9072970dae2:/etc/nginx# cat nginx.conf
load_module modules/ngx_http_modsecurity_module.so;
```

Install vim and nano (text editor) using the below commands inside the container,

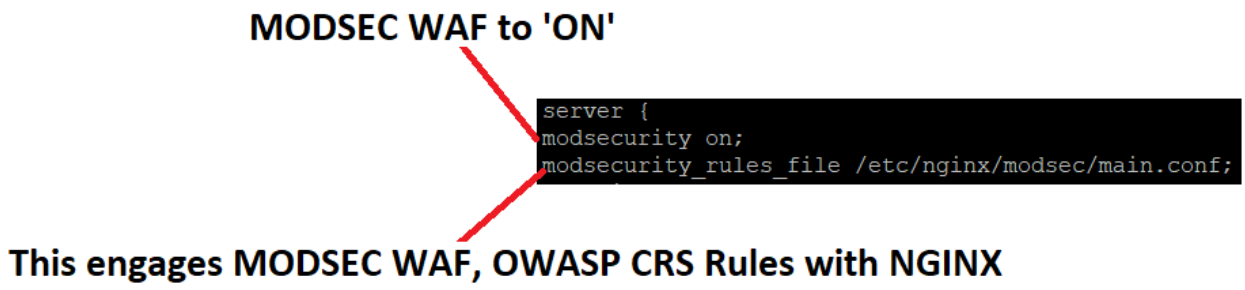
apt update -y
apt install vim nano -y

File /etc/nginx/modsec/modsecurity.conf represents the MODSEC WAF

File /etc/nginx/modsec/main.conf holds both rules files and MODSEC WAF file

File /etc/nginx/conf.d/default.conf binds SSL, MODSEC WAF and OWASP CRS RULES

From file /etc/nginx/conf.d/default.conf,



Remove this line (listen 80;) and add the below lines in the file /etc/nginx/conf.d/default.conf,

listen 443 ssl default_server;
listen [::]:443 ssl default_server;

Create the certificate/key files server.crt and server.key inside /etc/nginx/ and add the below lines in the file /etc/nginx/conf.d/default.conf,

openssl req -x509 -nodes -days 365 -newkey rsa:2048 -keyout server.key -out server.crt

ssl_certificate /etc/nginx/server.crt;
ssl_certificate_key /etc/nginx/server.key;

```
root@e9072970dae2:/etc/nginx# openssl req -x509 -nodes -days 365 -newkey rsa:2048 -keyout server.key -out server.crt
Generating a RSA private key
.....+++++
.....+++++
writing new private key to 'server.key'
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:IN
State or Province Name (full name) [Some-State]:TN
Locality Name (eg, city) []:CBE
Organization Name (eg, company) [Internet Widgits Pty Ltd]:ST21
Organizational Unit Name (eg, section) []:IT
Common Name (e.g. server FQDN or YOUR name) []:15.207.55.167
Email Address []:opensourcejegan@gmail.com
root@e9072970dae2:/etc/nginx# ls
conf.d  fastcgi_params  mime.types  modsec  modules  nginx.conf  scgi_params  server.crt  server.key  uwsgi_params
root@e9072970dae2:/etc/nginx#
```

```
server {
modsecurity on;
modsecurity_rules_file /etc/nginx/modsec/main.conf;
listen 443 ssl default_server;
listen [::]:443 ssl default_server;
    server_name  localhost;
ssl_certificate         /etc/nginx/server.crt;
ssl_certificate_key     /etc/nginx/server.key;
```

Reload nginx with the below command,

docker exec -it jegan nginx -s reload

```
root@ip-172-31-3-97:~# docker container ls -a
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS          PORTS                                                  NAMES
e9072970dae2   bit3/nginx-waf   "/docker-entrypoint.…"   About an hour ago   Up About an hour   80/tcp, 0.0.0.0:8443->443/tcp, :::8443->443/tcp   jegan
root@ip-172-31-3-97:~#
root@ip-172-31-3-97:~#
root@ip-172-31-3-97:~# docker exec -it jegan nginx -s reload
2023/01/17 09:06:53 [notice] 468#468: ModSecurity-nginx v1.0.3 (rules loaded inline/local/remote: 0/657/0)
2023/01/17 09:06:53 [notice] 468#468: signal process started
root@ip-172-31-3-97:~#
```

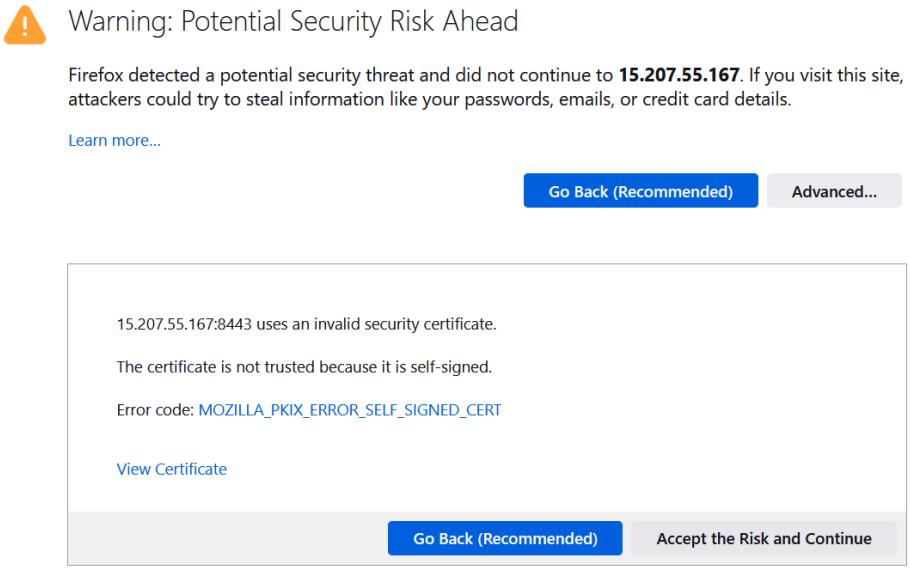
Container name

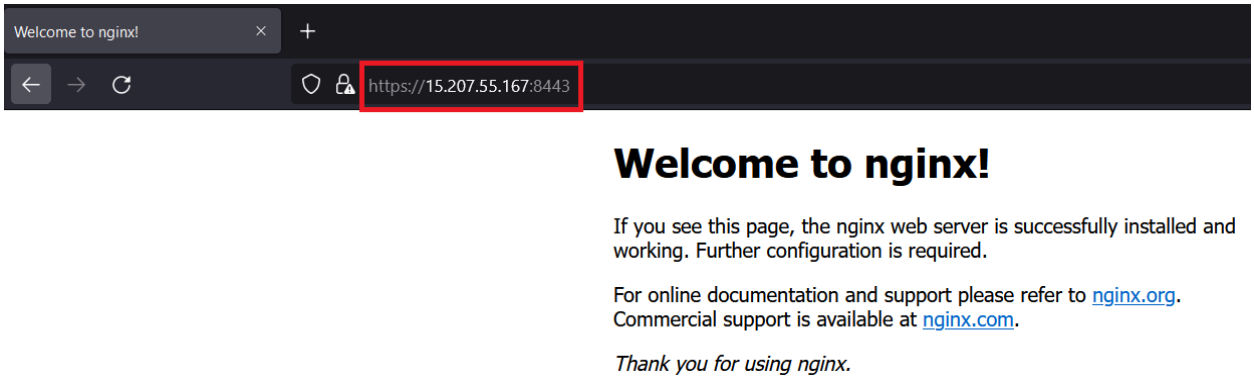
docker exec -it jegan nginx -s reload

Let's do the Testing of NGINX default page and with ATTACK URL like the below,

https://15.207.55.167:8443

Accept the exception, due to self signed server certificate, you will get the default NGINX page





Note : In the file /etc/nginx/conf.d/default.conf, if you replace the server.crt with Godaddy or any Public Certificate authority signed server.crt , you will not get the exception, you will get a green lock.

Execute ATTACK URL => https://15.207.55.167:8443/?exec=/bin/bash in browser and check the container log using 'tail -f /var/log/modsec_audit.log' command


```
---Vhqjbxo5---H--
ModSecurity: Warning. Matched "Operator `Rx' with parameter `^[\d.:]+$' against variable `REQUEST_HEADERS:Host' (Value: `15.207.55.167:8443' ) [file "/usr/local/owasp-modsecurity-c
rules/REQUEST-920-PROTOCOL-ENFORCEMENT.conf"] [line "678"] [id "920350"] [rev ""] [msg "Host header is a numeric IP address"] [data "15.207.55.167:8443"] [severity "4"] [ver "OWASP
0"] [maturity "0"] [accuracy "0"] [tag "application-multi"] [tag "language-multi"] [tag "platform-multi"] [tag "attack-protocol"] [tag "OWASP_CRS"] [tag "OWASP_CRS/PROTOCOL_VIOLATI
T"] [tag "WASCTC/WASC-21"] [tag "OWASP_TOP_10/A7"] [tag "PCI/6.5.10"] [hostname "172.17.0.2"] [uri "/"] [unique_id "1673947154"] [ref "o0,18v36,18"]
ModSecurity: Warning. Matched "Operator `PmFromFile' with parameter `unix-shell.data' against variable `ARGS:exec' (Value: `/bin/bash' ) [file "/usr/local/owasp-modsecurity-crs-3.2
REQUEST-932-APPLICATION-ATTACK-RCE.conf"] [line "488"] [id "932160"] [rev ""] [msg "Remote Command Execution: Unix Shell Code Found"] [data "Matched Data: bin/bash found within ARG
bin/bash"] [severity "2"] [ver "OWASP_CRS/3.2.0"] [maturity "0"] [accuracy "0"] [tag "application-multi"] [tag "language-shell"] [tag "platform-unix"] [tag "attack-rce"] [tag "OWAS
tag "OWASP_CRS/WEB_ATTACK/COMMAND_INJECTION"] [tag "WASCTC/WASC-31"] [tag "OWASP_TOP_10/A1"] [tag "PCI/6.5.2"] [hostname "172.17.0.2"] [uri "/"] [unique_id "1673947154"] [ref "o1,8
lDecodeUni,t:cmdLine,t:normalizePath,t:lowercase"]
ModSecurity: Access denied with code 403 (phase 2). Matched "Operator `Ge' with parameter `5' against variable `TX:ANOMALY_SCORE' (Value: `8' ) [file "/usr/local/owasp-modsecurity-
/rules/REQUEST-949-BLOCKING-EVALUATION.conf"] [line "79"] [id "949110"] [rev ""] [msg "Inbound Anomaly Score Exceeded (Total Score: 8)"] [data ""] [severity "2"] [ver ""] [maturity
curacy "0"] [tag "application-multi"] [tag "language-multi"] [tag "platform-multi"] [tag "attack-generic"] [hostname "172.17.0.2"] [uri "/"] [unique_id "1673947154"] [ref ""]
```

You will get 403 forbidden page in the browser and logs for the same at container level

Done!!!