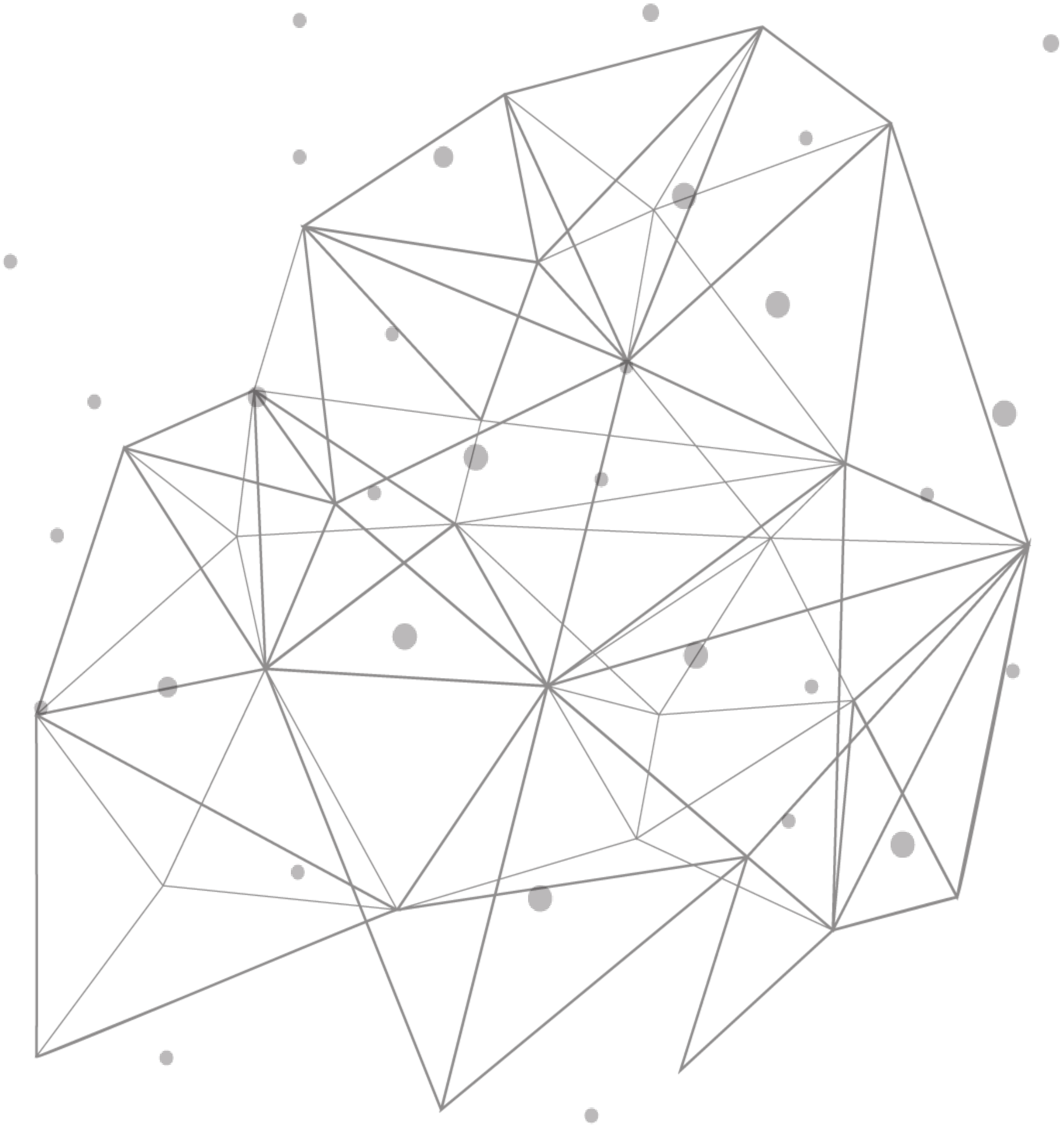
# Improve Security Using Suricata Threat Protection in TCPWave



# Introduction

To improve security and protect DNS appliances and users from DNS-based attacks, including protecting users from malicious websites, TCPWave includes Suricata, a powerful and high-performance rule-based network threat detection and prevention system. Suricata can monitor network traffic, including DNS traffic, in real time to detect and prevent malicious activity. Administrators can create and import rules for Suricata, including from third parties, to drop specific packets and produce alerts on specific packets and series of packets. Also, rules can be used permanently or temporarily, such as while waiting for a security patch to be created, tested, and deployed after a new vulnerability has been identified.

A default ruleset for Suricata is included with TCPWave that consists of over 2,500 DNS-related rules that produce alerts. It is based on Proofpoint Emerging Threats' Open Ruleset and can be modified. These default rules primarily detect protocol anomalies, higher than expected frequencies of specific packets and DNS queries, and queries for domains related to malware, ransomware, command and control, phishing, and tunnels.

These threat detection and prevention capabilities help protect DNS Appliances and users by using DNS-specific rules and considering traffic patterns that go beyond the functionality of general-purpose firewalls. To enable administrators to understand and take advantage of these capabilities, information on the following topics is presented in the sections below:

- Overview of Suricata rules
- Configuring Suricata in TCPWave
- Viewing alerts and logs on threats

# Overview of Suricata Rules

As described in the Introduction, Suricata uses rules to detect and drop malicious packets. More specifically, when a rule matches the contents of a packet or series of packets, Suricata can drop the potentially harmful packet(s) and generate an alert or just generate an alert. Suricata runs on TCPWave DNS Appliances, and Suricata alerts are displayed in the Fault Management section of TCPWave.

TCPWave customers can use the default Suricata ruleset included with TCPWave, rulesets from third parties, their own custom rulesets, or a combination of these. The default TCPWave ruleset consists of over 2,500 DNS-related rules that produce alerts and is based on Proofpoint Emerging Threats' Open Ruleset. These default rules primarily detect protocol anomalies, higher than expected frequencies of specific packets and DNS queries, and queries for domains related to malware, ransomware, command and control, phishing, and tunnels. After these rules are imported into a template in TCPWave, they can be viewed in the TCPWave GUI. Also, these rules can be viewed in the suricata-dns.rules file in the /opt/tcpwave/var/lib/suricata/rules directory on TCPWave IPAM Appliances.

For those interested in better understanding Suricata rules, overview information on two example rules from the TCPWave default ruleset and one custom rule is presented here. Rules consist of three parts, which are color-coded in the following example rule from the default ruleset:

```
alert dns any any -> any any (msg:"ET MALWARE Suspected Snugy DNS Backdoor Initial Beacon";
content:"|00 00 01 00 01|"; endswith; dns.query; bsize:>19; content:"646"; offset:2; depth:5;
fast_pattern; pcre:"/^[qbedm]{1}[a-zA-Z]{1,3}646[a-zA-Z0-9]{1,3}+\./";
reference:url,unit42.paloaltonetworks.com/xhunt-campaign-backdoors/;
reference:md5,162959ebfd839229969d5e830c7d1dbc; classtype:command-and-control; sid:2031193;
rev:2; metadata:attack_target Client_Endpoint, created_at 2020_11_09, deployment Perimeter,
former_category MALWARE, performance_impact Low, signature_severity Major, updated_at
2021_04_09;)
```

A summary of the rule parts is as follows:

Action: Specifies the action taken when a rule matches a packet. Values include Alert, Drop, and Reject.
Header: Specifies the protocol, IP addresses, ports, and direction of the rule.
Options: States the specifics of the rule.

Furthermore, in the Options part of a rule, various keywords can be used, and these typically vary in different rules. The rule above is presented again, but this time with the keywords highlighted:

```
alert dns any any -> any any (msg:"ET MALWARE Suspected Snugy DNS Backdoor Initial Beacon";
content:"|00 00 01 00 01|"; endswith; dns.query; bsize:>19; content:"646"; offset:2; depth:5;
fast_pattern; pcre:"/^[qbedm]{1}[a-zA-Z]{1,3}646[a-zA-Z0-9]{1,3}+\./";
reference:url,unit42.paloaltonetworks.com/xhunt-campaign-backdoors/;
reference:md5,162959ebfd839229969d5e830c7d1dbc; classtype:command-and-control; sid:2031193;
rev:2; metadata:attack_target Client_Endpoint, created_at 2020_11_09, deployment Perimeter,
former_category MALWARE, performance_impact Low, signature_severity Major, updated_at
2021_04_09;)
```

Note that as per the pcre keyword (which stands for Perl-compatible regular expression), part of the matching criteria in this example rule is a regular expression.

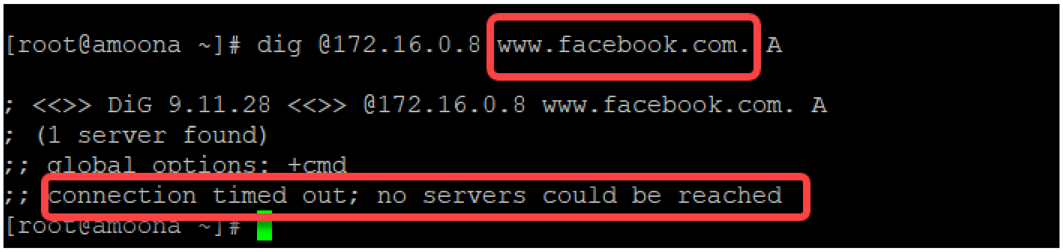
The following example DDoS rule, which is also from the default ruleset, considers the frequency that a matching packet occurs and will generate an alert only if there have been 10 or more DNS queries to ns1.hostasa.org within 2 minutes:

```
alert dns any any -> any any (msg:"ET MALWARE Likely Linux/Xorddos.F DDoS Attack Participation
(ns1.hostasa.org)"; threshold:type both, track by_src, count 10, seconds 120; dns.query;
content:"ns1.hostasa.org"; depth:15; fast_pattern; nocase; endswith;
reference:md5,3c49b5160b981f06bd5242662f8d0a54; classtype:trojan-activity; sid:2021327; rev:5;
metadata:created_at 2015_06_23, former_category CURRENT_EVENTS, updated_at 2020_09_17;)
```

An example custom rule, which is not in the default rules, is shown below, and it drops DNS queries for www.facebook.com:

```
drop dns any any -> any any (msg:"TCPWave DNS TITAN This is a drop test for www.facebook.com";
dns_query; content:"www.facebook.com"; depth:20; fast_pattern; endswith; nocase; classtype:pup-
activity; sid:200; rev:2;)
```

With this rule in use, the output of a query for www.facebook.com from a dig command is as shown in the screenshot below:



```
[root@amoona ~]# dig @172.16.0.8 www.facebook.com. A

; <<>> DiG 9.11.28 <<>> @172.16.0.8 www.facebook.com. A
; (1 server found)
;; global options: +cmd
;; connection timed out; no servers could be reached
[root@amoona ~]#
```

Note that since an Action of Drop was used in the rule, dig timed out waiting for a query response. If an Action of Reject were used, then in addition to the query being dropped, a rejection message would have been sent to the dig client.

Rules can vary greatly in their purpose and complexity. Complete information on Suricata rules, including on rule format and DNS keywords in rules, is in the *Suricata User Guide* in the section on rules, which is available at https://suricata.readthedocs.io/en/latest/rules/index.html.

## Configuring Suricata in TCPWave

Suricata is categorized as an Intrusion Prevention System (IPS), an Intrusion Detection System (IDS), and a Network Security Monitoring (NSM) system. However, for brevity, in the TCPWave GUI and documentation, it is referred to just as an IPS. To benefit from using Suricata, you first configure it in TCPWave as follows:

1. Create a Network Security Monitoring (NSM) Template, enable Intrusion Prevention in it, and import or create Suricata rules in it.
2. Associate the NSM Template with one or more DNS Appliances. An NSM Templates can only be associated with the following types of Appliances:

   - ISC BIND Authoritative Appliances with recursion enabled
   - ISC BIND Cache Appliances
   - Unbound Cache Appliances

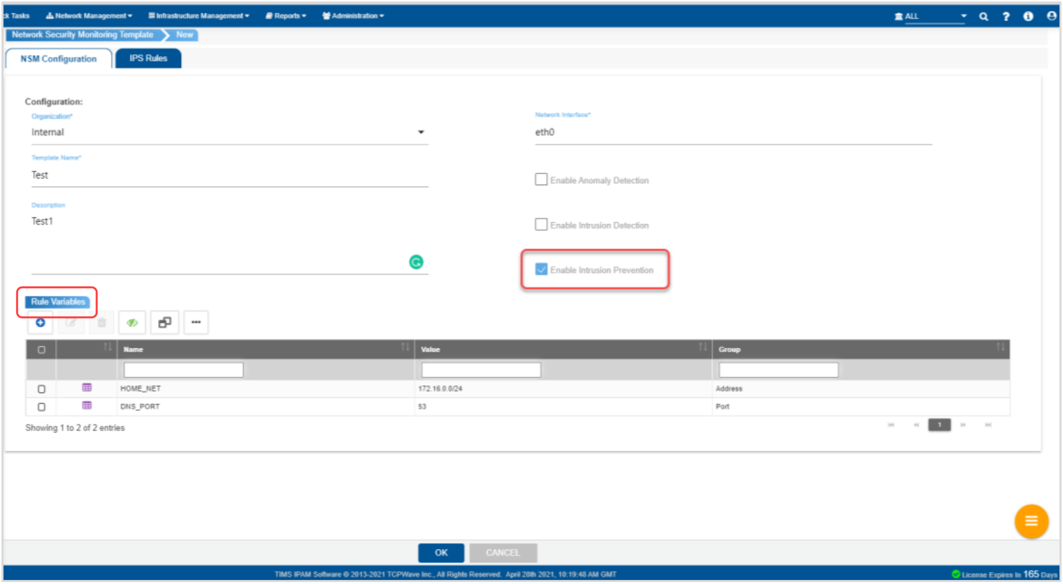
   Also, an NSM Template can only be associated with an Appliance in the same Organization as the Template.

Detailed information on these two configuration steps is provided in the subsections below.

**Create an NSM Template**

1. Go to **Network Management** > **DNS Management** > **DNS Security** > **DNS Threat Management**.
2. Select the **NSM Templates** tab, and then **Add** ⊕.
3. On the **NSM Configuration** tab, enter values as needed, including the following:
   a. Enter the **Network Interface** name, such as eth0, that the Suricata rules will protect.
   b. (Optional) Disable **Enable Anomaly Detection**. This feature is for DNS tunnel detection and is unrelated to Suricata, as described in the *TCPWave IPAM Administrator Reference Guide*.
   c. Select **Enable Intrusion Prevention**.

      **Result**: At the bottom of the NSM Configuration tab, the Rule Variables table is displayed.


k Tasks
Network Management
Infrastructure Management
Reports
Administration
ALL
Network Security Monitoring Template
New
NSM Configuration
IPS Rules
OK
CANCEL
TIMS IPAM Software © 2013-2021 TCPWave Inc., All Rights Reserved. April 28th 2021, 10:19:48 AM GMT
License Expires In 165 Days

Configuration:

Organization*: Internal

Network Interface*: eth0

Template Name*: Test

Description: Test1

□ Enable Anomaly Detection

□ Enable Intrusion Detection

☑ Enable Intrusion Prevention

Rule Variables

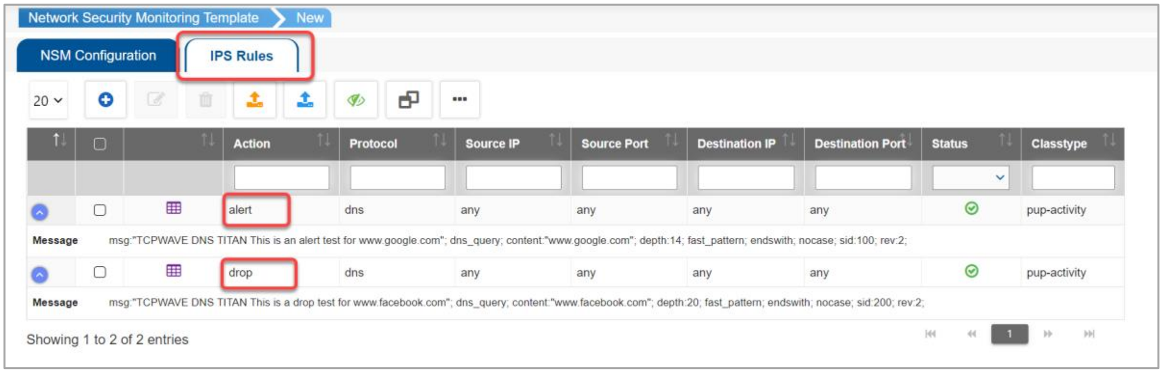
| □ | | Name | Value | Group |
|---|---|---|---|---|
| □ | ▦ | HOME_NET | 172.16.0.0/24 | Address |
| □ | ▦ | DNS_PORT | 53 | Port |

Showing 1 to 2 of 2 entries

d. (Optional) Enter **Rule Variables** for source and destination IP addresses and ports used in rules. More information on rule variables and entering them is in the *TCPWave IPAM Administrator Reference Guide*.

e. Select **OK**.

4. On the **NSM Templates** tab, select the **Template Name** just created to edit the template.
5. Select the **IPS Rules** tab.
6. Do one or more of the following:
   - **Import Default Rules**: Select **Import Default IPS Rules** .
   - **Import Custom Rules**: Select **Import IPS Rules from File** **.**
   - **Create Custom Rules**: Select **Add** , and then enter rule values as needed. After a rule is created, additional rules can be added as needed. Two example rules are shown here and are described below.



| | □ | | Action | Protocol | Source IP | Source Port | Destination IP | Destination Port | Status | Classtype |
|---|---|---|---|---|---|---|---|---|---|---|
| | □ | ▦ | alert | dns | any | any | any | any | ✓ | pup-activity |
| **Message** | msg:"TCPWAVE DNS TITAN This is an alert test for www.google.com"; dns_query; content:"www.google.com"; depth:14; fast_pattern; endswith; nocase; sid:100; rev:2; | | | | | | | | | |
| | □ | ▦ | drop | dns | any | any | any | any | ✓ | pup-activity |
| **Message** | msg:"TCPWAVE DNS TITAN This is a drop test for www.facebook.com"; dns_query; content:"www.facebook.com"; depth:20; fast_pattern; endswith; nocase; sid:200; rev:2; | | | | | | | | | |

Showing 1 to 2 of 2 entries

**Example Detection Rule**: The following rule generates an alert if a DNS query is for www.google.com.

```
alert dns any any -> any any (msg:"TCPWave DNS TITAN This is an alert test for
www.google.com"; dns_query; content:"www.google.com"; depth:14; fast_pattern;
endswith; nocase; classtype:pup-activity; sid:100; rev:2;)
```

**Example Prevention Rule**: The following rule drops a DNS query if it is for www.facebook.com and generates an alert.

```
drop dns any any -> any any (msg:"TCPWave DNS TITAN This is a drop test for
www.facebook.com"; dns_query; content:"www.facebook.com"; depth:20;
fast_pattern; endswith; nocase; classtype:pup-activity; sid:200; rev:2;)
```

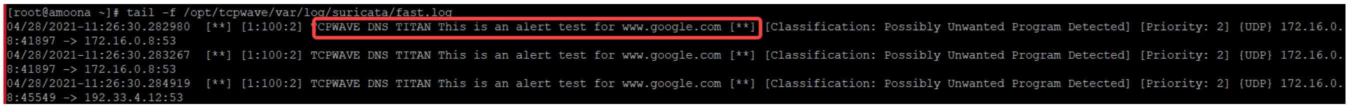
**Associate an NSM Template with a DNS Appliance**

1. Go to **Network Management** > **DNS Management**.
2. Select an **Appliance Name** to edit that Appliance's configuration.
3. In the **Template Attributes** section, select an **NSM Template**.
4. Select **OK**.

## Viewing Alerts and Logs on Threats

For most Actions, including Alert, Drop, and Reject, when a Suricata rule matches the contents of a packet or series of packets, Suricata logs an alert in a line in the fast.log file in the /opt/tcpwave/var/log/suricata directory on a DNS Appliance. (Note that, additionally, Suricata logs alerts and events in the eve.json file in the same directory. This file is in the Extensible Event Format and uses JSON.) The TCPWave monitoring service checks the fast.log file for new alerts every 5 minutes and displays them in the Fault Management section in the GUI.

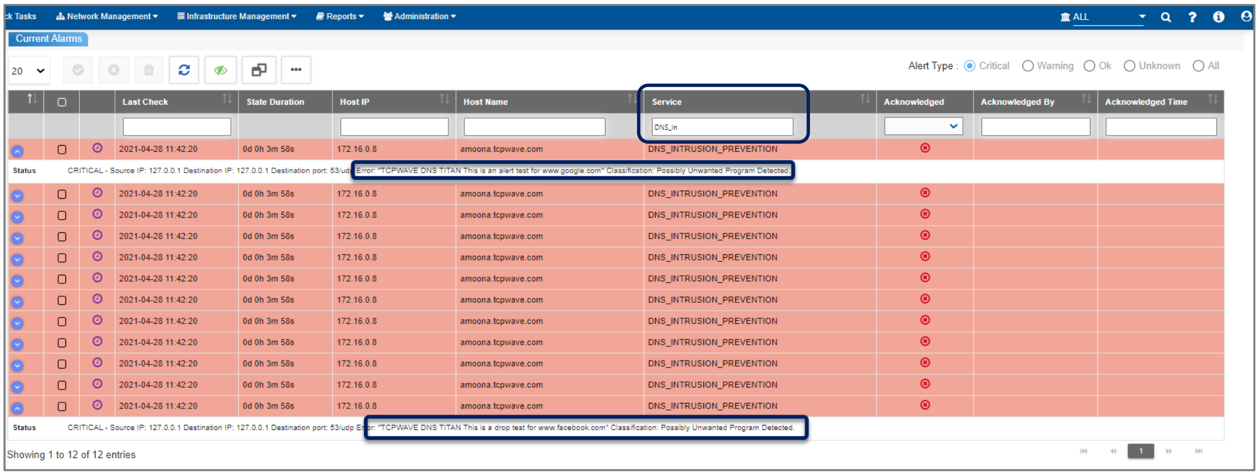
The contents of the fast.log file can be viewed in the DNS Statistics section of the GUI as well as on DNS Appliances. Example content from the fast.log file on a DNS Appliance is shown in the screenshot below:



```
[root@amoona ~]# tail -f /opt/tcpwave/var/log/suricata/fast.log
04/28/2021-11:26:30.282980  [**] [1:100:2] TCPWAVE DNS TITAN This is an alert test for www.google.com [**] [Classification: Possibly Unwanted Program Detected] [Priority: 2] {UDP} 172.16.0.
8:41897 -> 172.16.0.8:53
04/28/2021-11:26:30.283267  [**] [1:100:2] TCPWAVE DNS TITAN This is an alert test for www.google.com [**] [Classification: Possibly Unwanted Program Detected] [Priority: 2] {UDP} 172.16.0.
8:41897 -> 172.16.0.8:53
04/28/2021-11:26:30.284919  [**] [1:100:2] TCPWAVE DNS TITAN This is an alert test for www.google.com [**] [Classification: Possibly Unwanted Program Detected] [Priority: 2] {UDP} 172.16.0.
8:45549 -> 192.33.4.12:53
```

**View Suricata alerts**

1. Go to **Infrastructure Management** > **Fault Management**.
2. At the top of the **Service** column, enter a filter value of **DNS_Intrusion_Prevention** or the first few characters of it.



Alert Type : ● Critical ○ Warning ○ Ok ○ Unknown ○ All

| | □ | | Last Check | State Duration | Host IP | Host Name | Service | Acknowledged | Acknowledged By | Acknowledged Time |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | DNS_In | | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| Status | CRITICAL - Source IP: 127.0.0.1 Destination IP: 127.0.0.1 Destination port: 53/udp Error: "TCPWAVE DNS TITAN This is an alert test for www.google.com" Classification: Possibly Unwanted Program Detected. | | | | | | | | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| | □ | | 2021-04-28 11:42:20 | 0d 0h 3m 58s | 172.16.0.8 | amoona.tcpwave.com | DNS_INTRUSION_PREVENTION | ⊗ | | |
| Status | CRITICAL - Source IP: 127.0.0.1 Destination IP: 127.0.0.1 Destination port: 53/udp Error: "TCPWAVE DNS TITAN This is a drop test for www.facebook.com" Classification: Possibly Unwanted Program Detected. | | | | | | | | | |

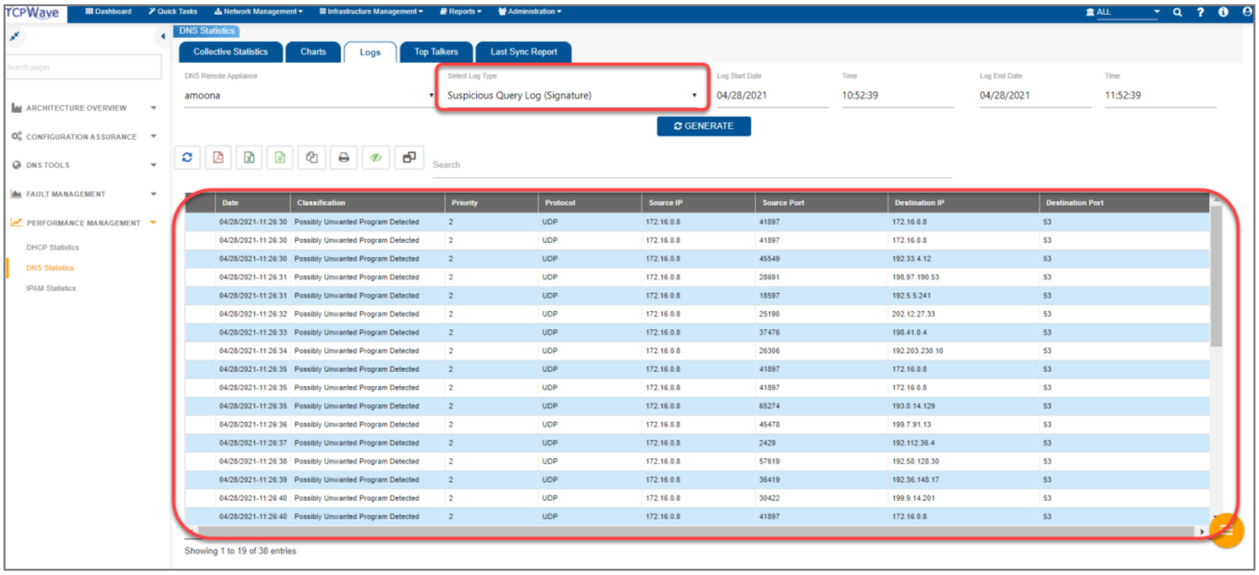
Showing 1 to 12 of 12 entries

**Note**: With default settings, Suricata alerts for the previous 24 hours are displayed. If they are not getting displayed as expected, check the following items:

- **Enable Monitoring Service**: The Enable Monitoring Service option must be enabled on DNS Appliances that are configured to use Suricata. This option is on the Appliance Configuration tab of each Appliance.
- **Enable DNS Network Security Monitoring Alerts**: The global option of Enable DNS Network Security Monitoring Alerts must be set to Yes.
- **DNS Network Security Monitoring Alerts Purge Interval**: The global option of DNS Network Security Monitoring Alerts Purge Interval specifies the number of hours after which old alerts will be deleted, and its default value is 24 hours.

### View Suricata log entries

1. Go to **Infrastructure Management** > **Performance Management** > **DNS Statistics**.
2. Select the **Logs** tab.
3. Select the **DNS Remote Appliance** of interest.
4. Select the **Log Type** of **Suspicious Query Log (Signature)**.



DNS Remote Appliance: amoona
Select Log Type: Suspicious Query Log (Signature)
Log Start Date: 04/28/2021 Time: 10:52:39
Log End Date: 04/28/2021 Time: 11:52:39

| Date | Classification | Priority | Protocol | Source IP | Source Port | Destination IP | Destination Port |
|---|---|---|---|---|---|---|---|
| 04/28/2021-11:26:30 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 41897 | 172.16.0.8 | 53 |
| 04/28/2021-11:26:30 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 41897 | 172.16.0.8 | 53 |
| 04/28/2021-11:26:30 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 45549 | 192.33.4.12 | 53 |
| 04/28/2021-11:26:31 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 28691 | 198.97.190.53 | 53 |
| 04/28/2021-11:26:31 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 18597 | 192.5.5.241 | 53 |
| 04/28/2021-11:26:32 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 25190 | 202.12.27.33 | 53 |
| 04/28/2021-11:26:33 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 37476 | 198.41.0.4 | 53 |
| 04/28/2021-11:26:34 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 26306 | 192.203.230.10 | 53 |
| 04/28/2021-11:26:35 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 41897 | 172.16.0.8 | 53 |
| 04/28/2021-11:26:35 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 41897 | 172.16.0.8 | 53 |
| 04/28/2021-11:26:35 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 65274 | 193.0.14.129 | 53 |
| 04/28/2021-11:26:36 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 45478 | 199.7.91.13 | 53 |
| 04/28/2021-11:26:37 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 2429 | 192.112.36.4 | 53 |
| 04/28/2021-11:26:38 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 57619 | 192.58.128.30 | 53 |
| 04/28/2021-11:26:39 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 36419 | 192.36.148.17 | 53 |
| 04/28/2021-11:26:40 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 30422 | 199.9.14.201 | 53 |
| 04/28/2021-11:26:40 | Possibly Unwanted Program Detected | 2 | UDP | 172.16.0.8 | 41897 | 172.16.0.8 | 53 |

Showing 1 to 19 of 38 entries

## Solutions

TCPWave sets a high security standard by offering scalable, integrated, and thorough protection of DNS infrastructure. For more information on how TCPWave and its extensive security features can meet your needs, contact the TCPWave Sales Team.