



# USER GUIDE

**FortiGate**  
**IPS User Guide**  
**Version 3.0 MR7**

**FORTINET™**

[www.fortinet.com](http://www.fortinet.com)

*FortiGate IPS User Guide*  
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# Introduction

This section introduces you to the FortiGate Intrusion Prevention System (IPS) and the following topics:

- [The FortiGate IPS](#)
- [About this document](#)
- [Fortinet documentation](#)
- [Customer service and technical support](#)

## The FortiGate IPS

Spam and viruses are not the only threats facing enterprises and small businesses. Sophisticated, automated attack tools are prevalent on the Internet today, making intrusion detection and prevention vital to securing corporate networks. An attack or intrusion can be launched to steal confidential information, force a costly web site crash, or use network resources to launch other attacks.

The FortiGate IPS detects intrusions by using attack signatures for known intrusion methods, and detects anomalies in network traffic to identify new or unknown intrusions. Not only can the IPS detect and log attacks, but users can choose actions to take on the session when an attack is detected. This guide describes how to configure and use the IPS and the IPS response to some common attacks.

This guide describes:

- [IPS overview and general configuration](#)
- [Predefined signatures](#)
- [Custom signatures](#)
- [Protocol decoders](#)
- [IPS sensors](#)
- [DoS sensors](#)
- [SYN flood attacks](#)
- [ICMP sweep attacks](#)

## About this document

### Document conventions

The following document conventions are used in this guide:

- In the examples, private IP addresses are used for both private and public IP addresses.
- Notes and Cautions are used to provide important information:



**Note:** Highlights useful additional information.



**Caution:** Warns you about commands or procedures that could have unexpected or undesirable results including loss of data or damage to equipment.

### Typographic conventions

FortiGate documentation uses the following typographical conventions:

Convention	Example
<b>Keyboard input</b>	In the Gateway Name field, type a name for the remote VPN peer or client (for example, <code>Central_Office_1</code> ).
<b>Code examples</b>	<pre>F-SBID (--protocol tcp; --flow     established; --content "content here";     --no_case)</pre>
<b>CLI command syntax</b>	<pre>config firewall policy edit id_integer     set http_retry_count &lt;retry_integer&gt;     set natip &lt;address_ipv4mask&gt; end</pre>
<b>Document names</b>	<i>FortiGate Administration Guide</i>
<b>File content</b>	<pre>&lt;HTML&gt;&lt;HEAD&gt;&lt;TITLE&gt;Firewall Authentication&lt;/TITLE&gt;&lt;/HEAD&gt; &lt;BODY&gt;&lt;H4&gt;You must authenticate to use this service.&lt;/H4&gt;</pre>
<b>Menu commands</b>	Go to <b>VPN &gt; IPSEC &gt; Phase 1</b> and select Create New.
<b>Program output</b>	Welcome!
<b>Variables</b>	<address_ipv4>

## Fortinet documentation

The most up-to-date publications and previous releases of Fortinet™ product documentation are available from the Fortinet Technical Documentation web site at <http://docs.forticare.com>.

The following [FortiGate product documentation](#) is available:

- *FortiGate QuickStart Guide*

Provides basic information about connecting and installing a FortiGate unit.

- *FortiGate Installation Guide*  
Describes how to install a FortiGate unit. Includes a hardware reference, default configuration information, installation procedures, connection procedures, and basic configuration procedures. Choose the guide for your product model number.
- *FortiGate Administration Guide*  
Provides basic information about how to configure a FortiGate unit, including how to define FortiGate protection profiles and firewall policies; how to apply intrusion prevention, antivirus protection, web content filtering, and spam filtering; and how to configure a VPN.
- *FortiGate online help*  
Provides a context-sensitive and searchable version of the *Administration Guide* in HTML format. You can access online help from the web-based manager as you work.
- *FortiGate CLI Reference*  
Describes how to use the FortiGate CLI and contains a reference to all FortiGate CLI commands.
- *FortiGate Log Message Reference*  
Describes the structure of FortiGate log messages and provides information about the log messages that are generated by FortiGate units.
- *FortiGate High Availability User Guide*  
Contains in-depth information about the FortiGate high availability feature and the FortiGate clustering protocol.
- *FortiGate IPS User Guide*  
Describes how to configure the FortiGate Intrusion Prevention System settings and how the FortiGate IPS deals with some common attacks.
- *FortiGate IPSec VPN User Guide*  
Provides step-by-step instructions for configuring IPSec VPNs using the web-based manager.
- *FortiGate SSL VPN User Guide*  
Compares FortiGate IPSec VPN and FortiGate SSL VPN technology, and describes how to configure web-only mode and tunnel-mode SSL VPN access for remote users through the web-based manager.
- *FortiGate PPTP VPN User Guide*  
Explains how to configure a PPTP VPN using the web-based manager.
- *FortiGate Certificate Management Guide*  
Contains procedures for managing digital certificates including generating certificate requests, installing signed certificates, importing CA root certificates and certificate revocation lists, and backing up and restoring installed certificates and private keys.
- *FortiGate VLANs and VDOMs User Guide*  
Describes how to configure VLANs and VDOMs in both NAT/Route and Transparent mode. Includes detailed examples.

## Fortinet Knowledge Center

Additional Fortinet technical documentation is available from the Fortinet Knowledge Center. The knowledge center contains troubleshooting and how-to articles, FAQs, technical notes, and more. Visit the Fortinet Knowledge Center at <http://kc.forticare.com>.

## Comments on Fortinet technical documentation

Please send information about any errors or omissions in this document, or any Fortinet technical documentation, to [techdoc@fortinet.com](mailto:techdoc@fortinet.com).

## Customer service and technical support

Fortinet Technical Support provides services designed to make sure that your Fortinet systems install quickly, configure easily, and operate reliably in your network.

Please visit the Fortinet Technical Support web site at <http://support.fortinet.com> to learn about the technical support services that Fortinet provides.



# IPS overview and general configuration

This section contains the following topics:

- [The FortiGate IPS](#)
- [Network performance](#)
- [Monitoring the network and dealing with attacks](#)
- [Using IPS sensors in a protection profile](#)

## The FortiGate IPS

An IPS is an Intrusion Prevention System for networks. While early systems focused on intrusion detection, the continuing rapid growth of the Internet, and the potential for the theft of sensitive data, has resulted in the need for not only detection, but prevention.

The FortiGate IPS detects intrusions by using attack signatures for known intrusion methods, and detects anomalies in network traffic to identify new or unknown intrusions. Not only can the IPS detect and log attacks, but users can choose actions to take on the session when an attack is detected. This guide describes how to configure and use the IPS and the IPS response to some common attacks.

Both the IPS predefined signatures and the IPS engine are upgraded through the FortiGuard Distribution Network (FDN). These upgrades provide the latest protection against IM/P2P and other threats. Firmware upgrades will update anomaly options. The FortiGate IPS default settings implement the recommended settings for all signatures and anomalies. Signature settings and some anomaly thresholds are pre-set to work best with the normal traffic on the protected networks. You can create custom signatures for the FortiGate IPS in diverse network environments.

Administrators are notified of intrusions and possible intrusions through log messages and alert email.

Packet logging provides administrators with the ability to analyze packets for forensics and false positive detection.

### IPS settings and controls

Configure the Intrusion Protection system using either the web-based manager or the CLI, then select IPS sensors in individual firewall protection profiles.



**Note:** If virtual domains are enabled on the FortiGate unit, the Intrusion Protection settings are configured separately in each VDOM. All sensors and custom signatures will appear only in the VDOM in which they were created.

To create an IPS sensor, go to **Intrusion Protection > IPS Sensor**. See [“IPS sensors” on page 39](#) for details. To access the protection profile IPS sensor selection, go to **Firewall > Protection Profile**, select Edit or Create New, and select IPS.

To create a DoS Sensor, go to **Intrusion Protection > DoS Sensor**. See [“DoS sensors” on page 45](#) for details.

## When to use IPS

IPS is best for large networks or for networks protecting highly sensitive information. Using IPS effectively requires monitoring and analysis of the attack logs to determine the nature and threat level of an attack. An administrator can adjust the threshold levels to ensure a balance between performance and intrusion prevention. Small businesses and home offices without network administrators may be overrun with attack log messages and not have the networking background required to configure the thresholds and other IPS settings. In addition, the other protection features in the FortiGate unit, such as antivirus (including grayware), spam filters, and web filters offer excellent protection for all networks.

## Network performance

The FortiGate IPS is extremely accurate and reliable as an in-line network device. Independent testing shows that the FortiGate IPS successfully detects and blocks attacks even under high traffic loads, while keeping latency within expected limits.

This section describes:

- [Default signature and anomaly settings](#)
- [Default fail open setting](#)
- [Controlling sessions](#)
- [Setting the buffer size](#)

### Default signature and anomaly settings

You can use IPS sensors to apply appropriate IPS signatures to different protection profiles, then different firewall policies.

### Default fail open setting

If for any reason the IPS should cease to function, it will fail open by default. This means that crucial network traffic will not be blocked and the Firewall will continue to operate while the problem is resolved.

Change the default fail open setting using the CLI:

```
config ips global
    set fail-open [enable | disable]
end
```

## Controlling sessions

Use this command to ignore sessions after a set amount of traffic has passed. The default is 204800 bytes.

```
config ips global
  set ignore-session-bytes <byte_integer>
end
```

## Setting the buffer size

Set the size of the IPS buffer. The size of the buffer is model-dependent.

```
config ips global
  set socket-size <ips_buffer_size>
end
```

# Monitoring the network and dealing with attacks

After configuring IPS and enabling it in protection profiles, it is time to set up tracking and notification of attacks. Enabling logging and alert email to maintain user awareness of attacks on the network.

The next step is dealing with attacks if and when they occur. The FortiGuard Center at <http://www.fortinet.com/FortiGuardCenter/> provides a comprehensive Attack Encyclopedia to help decide what actions to take to further protect the network.

This section describes:

- [Configuring logging and alert email](#)
- [Attack log messages](#)
- [The FortiGuard Center](#)

## Configuring logging and alert email

Whenever the IPS detects or prevents an attack, it generates an attack log message that can be recorded or sent as an alert email.

The FortiGate unit categorizes attack log messages by signature or anomaly and includes the attack name in the log message. Enable logging and alert email for attack signatures and attack anomalies.



**Note:** Attack and intrusion attempts occur frequently on networks connected to the Internet. Reduce the number of log messages and alert email by disabling signatures for attacks that the system is not vulnerable to (for example, web attacks when not running a web server).

### To configure logging and alert email for IPS events using the web-based manager

- 1 Go to **Log&Report > Log Config > Log Setting**.
- 2 Select and configure the settings for any logging locations to use.
- 3 Select Apply.
- 4 Go to **Log&Report > Log Config > Alert Email**.

- 5 Select and configure authentication if required and enter the email addresses that will receive the alert email.
- 6 Enter the time interval to wait before sending log messages for each logging severity level.



**Note:** If more than one log message is collected before an interval is reached, the messages are combined and sent out as one alert email.

- 7 Select Apply.

#### To access log messages from memory or on the local disk

View and download log messages stored in memory or on the FortiGate local disk from the web-based manager. Go to **Log&Report > Log Access** and select the log type to view.

See the *FortiGate Administration Guide* and the *FortiGate Log Message Reference Guide* for more logging procedures.

## Attack log messages

### Signature

The following log message is generated when an attack signature is found:

---

<b>Message ID:</b>	70000
<b>Severity:</b>	Alert
<b>Message:</b>	attack_id=<value_attack_id> src=<ip_address> dst=<ip_address> src_port=<port_num> dst_port=<port_num> interface=<interface_name> src_int=<interface_name> dst_int=<interface_name> status={clear_session   detected   dropped   reset} proto=<protocol_num> service=<network_service> msg="<string><[url]>"
<b>Example:</b>	2004-07-07 16:21:18 log_id=0420073000 type=ips subtype=signature pri=alert attack_id=101318674 src=8.8.120.254 dst=11.1.1.254 src_port=2217 dst_port=25 interface=internal src_int=n/a dst_int=n/a status=reset proto=6 service=smtp msg="signature: Dagger.1.4.0.Drives [Reference: <a href="http://www.fortinet.com/ids/ID101318674">http://www.fortinet.com/ids/ID101318674</a> ]"
<b>Meaning:</b>	Attack signature message providing the source and destination addressing information and the attack name.
<b>Action:</b>	Get more information about the attack and the steps to take from the Fortinet Attack Encyclopedia in the FortiGuard Center. Copy and paste the URL from the log message into your browser to go directly to the signature description in the Attack Encyclopedia.

---

## Anomaly

The following log message is generated when an attack anomaly is detected:

---

<b>Message ID:</b>	73001
<b>Severity:</b>	Alert
<b>Message:</b>	<pre> attack_id=&lt;value_attack_id&gt; src=&lt;ip_address&gt; dst=&lt;ip_address&gt; src_port=&lt;port_num&gt; dst_port=&lt;port_num&gt; interface=&lt;interface_name&gt; src_int=&lt;interface_name&gt; dst_int=&lt;interface_name&gt; status={clear_session   detected   dropped   reset} proto=&lt;protocol_num&gt; service=&lt;network_service&gt; msg="&lt;string&gt;&lt;url&gt;" </pre>
<b>Example:</b>	<pre> 2004-04-07 13:58:53 log_id=0420073001 type=ips subtype=anomaly pri=alert attack_id=100663396 src=8.8.120.254 dst=11.1.1.254 src_port=2217 dst_port=25 interface=internal src_int=n/a dst_int=n/a status=reset proto=6 service=smtp msg="anomaly: syn_flood, 100 &gt; threshold 10.[Reference: http://www.fortinet.com/ids/ID100663396]" </pre>
<b>Meaning:</b>	Attack anomaly message providing the source and destination addressing information and the attack name.
<b>Action:</b>	Get more information about the attack and the steps to take from the Fortinet Attack Encyclopedia in the FortiGuard Center. Copy and paste the URL from the log message into your browser to go directly to the signature description in the Attack Encyclopedia.

---

## The FortiGuard Center

The FortiGuard Center combines the knowledge base of the Fortinet technical team into an easily searchable database. FortiGuard Center includes both virus and attack information. Go to <http://www.fortinet.com/FortiGuardCenter/>.

Search for attacks in the FortiGuard Attack Encyclopedia by any of the criteria shown in [Figure 1](#).

**Figure 1: Searching the FortiGuard Attack Encyclopedia**

**Vulnerability Description Search**

By Name:

By ID:

By Key Words:

By Class:

By CVE ID:

By MS Bulletin ID:

By BugTraq ID:

Results Per Page:

Type in the name or ID of the attack, or copy and paste the URL from the log message or alert email into a browser.

## Using IPS sensors in a protection profile

IPS can be combined with other FortiGate features – antivirus, spam filtering, web filtering, and web category filtering – to create protection profiles. Protection profiles are then added to individual user groups and then to firewall policies, or added directly to firewall policies.

This section describes:

- [Creating a protection profile that uses IPS sensors](#)
- [Adding protection profiles to firewall policies](#)
- [Adding protection profiles to user groups](#)

### Creating a protection profile that uses IPS sensors

To create a protection profile using the web-based manager

- 1 Go to **Firewall > Protection Profile**.
- 2 Select **Create New**.

**Figure 2: New Protection Profile**

- 3 Enter a name for the protection profile.
- 4 Expand the IPS option list.
- 5 Select an IPS sensor from the dropdown list. For information about IPS sensors, see [“IPS sensors” on page 39](#).
- 6 Configure any other required protection profile options.
- 7 Select **OK**.

The protection profile can now be added to any firewall policies that require it. The protection profile can also be added to user groups and these user groups can be used to apply authentication to firewall policies.

### Adding protection profiles to firewall policies

Adding a protection profile to a firewall policy applies the profile settings, including IPS, to traffic matching that policy.

## Adding protection profiles to user groups

When creating a user group, select a protection profile that applies to that group. Then, when configuring a firewall policy that includes user authentication, select one or more user groups to authenticate. Each user group selected for authentication in the firewall policy can have a different protection profile, and therefore different IPS settings, applied to it.





# Predefined signatures

This section describes:

- [IPS predefined signatures](#)
- [Viewing the predefined signature list](#)

## IPS predefined signatures

Predefined signatures are arranged in alphabetical order. By default, some signatures are disabled to prevent interference with common traffic, but logging is enabled for all signatures.

Use the IPS sensor to customize the predefined signatures and apply appropriate sensors to different protection profiles. For details, see [“IPS sensors” on page 39](#).



**Note:** By allowing your IPS signature settings to run on default, you may be slowing down the overall performance of the FortiGate unit. By fine tuning the predefined signature and logging setting, you can ensure maximum performance as well as maximum protection. See [“Fine tuning IPS predefined signatures for enhanced system performance” on page 18](#).

## Viewing the predefined signature list

The predefined signature list displays the characteristics of each signature. Use these characteristics to define which signatures are included in your IPS sensors. The signature list also displays the default action, the default logging status, and whether the signature is enabled by default.



**Note:** If virtual domains are enabled on the FortiGate unit, the Intrusion Protection settings are configured separately in each VDOM. All sensors and custom signatures will appear only in the VDOM in which they were created.

To view the predefined signature list, go to **Intrusion Protection > Signature > Predefined**. You can also use filters to display the signatures you want to view.

**Figure 3: Predefined signature list**

Name	Severity	Target	Protocols	OS	Applications	Enable	Action	ID	Logging
2BGal_disp_album.php.SQL.Injection	Low	Server	TCP, HTTP	All	PHP_app	✓	Pass	102629422	✓
3CDaemon.FTP.Server.Information.Disclosure	Low	Client	TCP, FTP	Windows	Other	✓	Pass	101777501	✓
3COM.OfficeConnect.DoS	Low	Server	TCP, HTTP	Other	Other	✓	Drop	103350399	✓
3COM.OfficeConnect.SoftReset	Low	Server	TCP, HTTP	Other	Other	✓	Drop	103350470	✓
BPixel.net.SimpleBlog.SQL.Injection	High	Server	TCP, HTTP	All	Other	✓	Pass	14078	✓
AA.bot.Botlist.File.Access	Low	Server	TCP, HTTP	Windows	Other	✓	Pass	14384	✓
Aardvark.Topsites.PHP.Arbitrary.Command.Execution	Medium	Server	TCP, HTTP	All	PHP_app	✓	Pass	14340	✓
Aardvark.Topsites.PHP.Remote.Command.Execution	Medium	Server	TCP, HTTP	All	PHP_app	✓	Pass	14341	✓
ABitWhizzy.ABitWhizzy.php.Directory.Traversal	Medium	Server	TCP, HTTP	All	PHP_app	✓	Drop	103546904	✓
Absolute.Image.Gallery.XE.ASS	Medium	Server	TCP, HTTP	Windows	Other	✓	Drop	103546905	✓
AbsoluteTelnet.Title.Bar.Buffer.Overflow	High	Client	TCP, TELNET	Windows	Other	✓	Pass	102694941	✓
AcAl.Arbitrary.Command.Execution	Medium	Server	TCP, HTTP	All	PHP_app	✓	Pass	14343	✓
ACDSee.XPMHeaders.Buffer.Overflow	High	Client	TCP, HTTP	Windows	Other	✓	Pass	14667	✓
Acrobat.Reader.Filespec.Overflow.A	Low	Client	TCP, HTTP	Linux, Other	Adobe	✓	Pass	103350745	✓
Acrobat.Reader.Filespec.Overflow.B	Low	Client	TCP, HTTP	Linux, Other	Adobe	✓	Pass	103350746	✓
Acronym.Mod.Admin.Acronyms.PHP.SQL.Injection	Medium	Server	TCP, HTTP	All	PHP_app	✓	Pass	14205	✓

By default, the signatures are sorted by name. To sort the table by another column, select the required column header name.

<b>Column Settings</b>	Select to customize the signature information displayed in the table. You can also readjust the column order.
<b>Clear All Filters</b>	If you have applied filtering to the predefined signature list display, select this option to clear all filters and display all the signatures.
<b>Name</b>	The name of the signature, linked to the FortiGuard Center web page about the signature.
<b>Severity</b>	The severity rating of the signature. The severity levels, from lowest to highest, are Information, Low, Medium, High, and Critical.
<b>Target</b>	The target of the signature. Servers, clients, or both.
<b>Protocols</b>	The protocol the signature applies to.
<b>OS</b>	The operating system the signature applies to.
<b>Applications</b>	The applications the signature applies to.
<b>Enable</b>	The default status of the signature. A green circle indicates the signature is enabled. A gray circle indicates the signature is not enabled.
<b>Action</b>	The default action for the signature. The available actions are pass and drop. <ul style="list-style-type: none"> <li>• Pass allows the traffic to continue without any modification. If you want to determine what effect IPS protection would have on your network traffic, you can enable the required signatures, set the action to pass, and enable logging. Traffic will not be interrupted, but you will be able to examine in detail which signatures were detected.</li> <li>• Drop prevents the traffic with detected signatures from reaching its destination.</li> </ul> <p>If logging is enabled, the action appears in the status field of the log message generated by the signature.</p>
<b>ID</b>	A unique numeric identifier for the signature.
<b>Logging</b>	The default logging behavior of the signature. A green circle indicates logging is enabled. A gray circle indicates logging is disabled.
<b>Group</b>	A functional group that is assigned to the signature. This group is only for reference and cannot be used to define filters.
<b>Packet Log</b>	The default packet log status of the signature. A green circle indicates packet log is enabled. A gray circle indicates packet log is disabled.
<b>Revision</b>	The revision level of the signature. If the signature is updated, the revision number will be incremented.

## Fine tuning IPS predefined signatures for enhanced system performance

In FortiOS the FortiGate unit will have most of the predefined signatures enabled and will log all of them by default. To meet your specific network requirements, you need to fine tune the signature settings.

By fine tuning the signatures and log settings you can provide the best protection available but also free up valuable FortiGate resources. Fine tuning enables you to turn off features that you are not using. By turning off signatures and logs that you do not use, you allow the FortiGate unit to perform tasks faster thus improving overall system performance.

Not all systems require you to scan for all signatures of the IPS suite all the time. By configuring the FortiGate unit to not monitor for these signatures, you will maintain a high level of security and increase overall performance.

You should also review exactly how you use the information provided by the logging feature. If you find that you do not review the information, it is best to turn off IPS logging. Logging is best used to provide actionable intelligence.

**To create an IPS sensor**

- 1** Go to **Intrusion Protection > IPS Sensor**.
- 2** Create a sensor and add IPS filters to it.



# Custom signatures

Custom signatures provide the power and flexibility to customize the FortiGate Intrusion Protection system for diverse network environments. The FortiGate predefined signatures represent common attacks. If you use an unusual or specialized application or an uncommon platform, you can add custom signatures based on the security alerts released by the application and platform vendors.

You can also create custom signatures to help you block P2P protocols.

After creation, you need to specify custom signatures in IPS sensors created to scan traffic.

This section describes:

- [IPS custom signatures](#)
- [Viewing the custom signature list](#)
- [Custom signature configuration](#)
- [Creating custom signatures](#)

## IPS custom signatures

The FortiGate predefined signatures cover common attacks. If an unusual or specialized application or an uncommon platform is being used, add custom signatures based on the security alerts released by the application and platform vendors.

Use custom signatures to block or allow specific traffic. For example, to block the SMTP “vrfy” command, add custom signatures similar to the following:

```
F-SBID( --name "Block.SMTP.VRFY.COMD"; --protocol tcp;
--service SMTP; --pattern "vrfy"; --no_case;
--context header; )
```



**Note:** If virtual domains are enabled on the FortiGate unit, IPS is configured separately in each VDOM. Sensors, filters, and custom signatures will only appear in the VDOM in which they were created.

## Viewing the custom signature list

To view the custom signature list, go to **Intrusion Protection > Signature > Custom**.

**Figure 4: The custom signature list**

Create New	
Name	Signature
Another attack	F-SBID( --name "Another attack"; --attack_id 6149; --protocol tcp; --flow established; --content "the_attack"; --no_case)
Unusual attack	F-SBID( --name "Unusual attack"; --attack_id 7273; --protocol tcp; --flow established; --content "this_is_the_attack"; --no_case)

<b>Create New</b>	Select to create a new custom signature.
<b>Name</b>	The custom signature name.
<b>Signature</b>	The signature syntax.
<b>Delete icon</b>	Select to delete the custom signature.
<b>Edit icon</b>	Select to edit the custom signature.

## Custom signature configuration

Add custom signatures using the web-based manager or the CLI. For more information about custom signature syntax, see [“Creating custom signatures” on page 23](#) and [“Custom signature syntax” on page 24](#).

### Adding custom signatures using the web-based manager

#### To add a custom signature

- 1 Go to **Intrusion Protection > Signature > Custom**.
- 2 Select **Create New** to add a new custom signature, or select the **Edit icon** to edit a custom signature.

**Figure 5: Edit Custom Signature**

- 3 Enter a name for the custom signature.
- 4 Enter the Signature.
- 5 Select **OK**.

### Adding custom signatures using the CLI

After adding the custom signature, configure the settings for it under the signature group named custom.

#### Command syntax pattern

```
config ips custom
    edit <name_str>
        set signature <signature_str>
    end
```

Keywords and variables	Description	Default
name_str	The name of the custom signature.	
signature <signature_str>	Enter the custom signature.	No default.

## Creating custom signatures

Custom signatures are added separately to each VDOM. In each VDOM, there can be a maximum of 255 custom signatures.

A custom signature definition is limited to a maximum length of 512 characters. A definition can be a single line or span multiple lines connected by a backslash (\) at the end of each line.

A custom signature definition begins with a header, followed by a set of keyword/value pairs enclosed by parenthesis [( )]. The keyword and value pairs are separated by a semi colon (;) and consist of a keyword and a value separated by a space. The basic format of a definition is HEADER (KEYWORD VALUE;)

You can use as many keyword/value pairs as required within the 512 character limit.

### Custom signature fields

Table 1 shows the valid characters for custom signature fields.

**Table 1: Valid characters for custom signature fields**

Field	Valid Characters	Usage
<b>HEADER</b>	F-SBID	The header for an attack definition signature. Each custom signature must begin with this header.
<b>KEYWORD</b>	Each keyword must start with "--", and be a string of 1 to 19 characters. Normally, keywords are an English word or English words connected by "-". Keywords are case insensitive.	The keyword is used to identify a parameter. See <a href="#">"Custom signature syntax" on page 24</a> for tables of supported keywords.
<b>VALUE</b>	Double quotes must be used around the value if it contains a space and/or a semicolon. If the value is NULL, the space between the KEYWORD and VALUE can be omitted. Values are case sensitive. Note: if double quotes are used for quoting the value, the double quotes are not considered as part of the value string.	Set the value for a parameter identified by a keyword.

## Custom signature syntax

**Table 2: Information keywords**

Keyword and value	Description
<code>--attack_id &lt;id_int&gt;;</code>	<p>This optional value is used to identify the signature. It cannot be the same value as any other custom rules within the same VDOM. If an attack ID is not specified, the FortiGate automatically assigns an attack ID to the signature.</p> <p>An attack ID you assign must be between 1000 and 9999.</p> <p>Example:</p> <pre>--attack_id 1234;</pre>
<code>--name &lt;name_str&gt;;</code>	<p>Enter the name of the rule. A rule name must be unique within the same VDOM.</p> <p>The name you assign must be a string greater than 0 and less than 64 characters in length.</p> <p>Example:</p> <pre>---name "Buffer_Overflow";</pre>

**Table 3: Session keywords**

Keyword and value	Description
<code>--flow {from_client   from_server   bi_direction };</code>	<p>Specify the traffic direction and state to be inspected. They can be used for all IP traffic.</p> <p>Example:</p> <pre>--src_port 41523; --flow bi_direction;</pre> <p>The signature checks traffic to and from port 41523. Previous FortiOS versions used <code>to_client</code> and <code>to_server</code> values. These are now deprecated, but still function for backwards compatibility.</p>
<code>--service {HTTP   TELNET   FTP   DNS   SMTP   POP3   IMAP   SNMP   RADIUS   LDAP   MSSQL   RPC   SIP   H323   NBSS   DCERPC   SSH   SSL};</code>	<p>Specify the protocol type to be inspected.</p> <p>This keyword allows you to specify the traffic type by protocol rather than by port. If the decoder has the capability to identify the protocol on any port, the signature can be used to detect the attack no matter what port the service is running on. Currently, HTTP, SIP, SSL, and SSH protocols can be identified on any port based on the content.</p>



**Table 4: Content keywords**

Keyword and value	Description
<pre>--byte_jump &lt;bytes_to_convert&gt;, &lt;offset&gt;[, relative] [, big] [, little] [, string] [, hex] [, dec] [, oct] [, align];</pre>	<p>Use the <code>byte_jump</code> option to extract a number of bytes from a packet, convert them to their numeric representation, and jump the match reference up that many bytes (for further pattern matching or byte testing). This keyword allows relative pattern matches to take into account numerical values found in network data.</p> <p>The available keyword options include:</p> <ul style="list-style-type: none"> <li>• <code>&lt;bytes_to_convert&gt;</code>: The number of bytes to examine from the packet.</li> <li>• <code>&lt;offset&gt;</code>: The number of bytes into the payload to start processing.</li> <li>• <code>relative</code>: Use an offset relative to last pattern match.</li> <li>• <code>big</code>: Process the data as big endian (default).</li> <li>• <code>little</code>: Process the data as little endian.</li> <li>• <code>string</code>: The data is a string in the packet.</li> <li>• <code>hex</code>: The converted string data is represented in hexadecimal notation.</li> <li>• <code>dec</code>: The converted string data is represented in decimal notation.</li> <li>• <code>oct</code>: The converted string data is represented in octal notation.</li> <li>• <code>align</code>: Round up the number of converted bytes to the next 32-bit boundary.</li> </ul>

Table 4: Content keywords (Continued)

Keyword and value	Description
<pre>--byte_test &lt;bytes_to_convert&gt;, &lt;operator&gt;, &lt;value&gt;, &lt;offset&gt;[, relative] [, big] [, little] [, string] [, hex] [, dec] [, oct];</pre>	<p>The FortiGate unit compares a byte field against a specific value (with operator). This keyword is capable of testing binary values or converting representative byte strings to their binary equivalent and testing them. The available keyword options include:</p> <ul style="list-style-type: none"> <li>• <code>&lt;bytes_to_convert&gt;</code>: The number of bytes to compare.</li> <li>• <code>&lt;operator&gt;</code>: The operation to perform when comparing the value (&lt;, &gt;, =, !, &amp;).</li> <li>• <code>&lt;value&gt;</code>: The value to compare the converted value against.</li> <li>• <code>&lt;offset&gt;</code>: The number of bytes into the payload to start processing.</li> <li>• <code>relative</code>: Use an offset relative to last pattern match.</li> <li>• <code>big</code>: Process the data as big endian (default).</li> <li>• <code>little</code>: Process the data as little endian.</li> <li>• <code>string</code>: The data is a string in the packet.</li> <li>• <code>hex</code>: The converted string data is represented in hexadecimal notation.</li> <li>• <code>dec</code>: The converted string data is represented in decimal notation.</li> <li>• <code>oct</code>: The converted string data is represented in octal notation.</li> </ul>
<pre>--depth &lt;depth_int&gt;;</pre>	<p>The FortiGate unit looks for the contents within the specified number of bytes after the starting point defined by the <code>offset</code> keyword. If no <code>offset</code> is specified, the <code>offset</code> is assumed to be equal to 0. If the value of the <code>depth</code> keyword is smaller than the length of the value of the <code>content</code> keyword, this signature will never be matched. The <code>depth</code> must be between 0 and 65535.</p>
<pre>--distance &lt;dist_int&gt;;</pre>	<p>The FortiGate unit searches for the contents within the specified number of bytes relative to the end of the previously matched contents. If the <code>within</code> keyword is not specified, continue looking for a match until the end of the payload. The <code>distance</code> must be between 0 and 65535.</p>
<pre>--content [!]"&lt;content_str&gt;";</pre>	<p><b>Deprecated, see <code>pattern</code> and <code>context</code> keywords.</b></p> <p>The FortiGate unit will search for the content string in the packet payload. The content string must be enclosed in double quotes.</p> <p>To have the FortiGate search for a packet that does not contain the specified context string, add an exclamation mark (!) before the content string.</p> <p>Multiple content items can be specified in one rule. The value can contain mixed text and binary data. The binary data is generally enclosed within the pipe ( ) character.</p> <p>The double quote ("), pipe sign( ) and colon(:) characters must be escaped using a back slash if specified in a content string.</p>

Table 4: Content keywords (Continued)

Keyword and value	Description
<code>--context {uri   header   body   host};</code>	<p>Specify the protocol field that the pattern should be looked for. If context is not specified for a pattern, the FortiGate unit searches for the pattern anywhere in the packet buffer. The available context variables are:</p> <ul style="list-style-type: none"> <li><code>uri</code>: Search the pattern in HTTP URI line.</li> <li><code>header</code>: Search the pattern in HTTP header lines or SMTP/POP3/SMTP control messages.</li> <li><code>body</code>: Search the pattern in HTTP body or SMTP/POP3/SMTP email body.</li> <li><code>host</code>: Search the pattern in HTTP HOST line.</li> </ul> <p>Example:</p> <pre>--pattern "GET " --context uri --pattern "yahoo.com" --context host --no_case --pcre "/DESCRIBE\s+\s+RTSP\/\/i" --context header</pre>
<code>--no_case;</code>	The no-case keyword forced the FortiGate unit to perform a case-insensitive pattern match.
<code>--offset &lt;offset_int&gt;;</code>	<p>The FortiGate unit starts looking for the contents the specified number of bytes into the payload. The specified number of bytes is an absolute value in the payload. Follow the <code>offset</code> keyword with the <code>depth</code> keyword to stop looking for a match after a specified number of bytes. If no <code>depth</code> is specified, the FortiGate unit continues looking for a match until the end of the payload.</p> <p>The <code>offset</code> must be between 0 and 65535.</p>
<code>--pattern [!]"&lt;pattern_str&gt;;</code>	<p>The FortiGate unit will search for the specified pattern. A <code>pattern</code> keyword normally is followed by a <code>context</code> keyword to define where to look for the pattern in the packet. If a <code>context</code> keyword does not present, the FortiGate unit looks for the pattern anywhere in the packet buffer.</p> <p>To have the FortiGate search for a packet that does not contain the specified URI, add an exclamation mark (!) before the URI.</p> <p>Example:</p> <pre>--pattern "/level/" --pattern " E8 D9FF FFFF /bin/sh" --pattern "! 20 RTSP/"</pre>

Table 4: Content keywords (Continued)

Keyword and value	Description
<pre>--pcre [!]"(&lt;/regex&gt;/ m&lt;delim&gt;&lt; regex&gt;&lt;delim&gt; [ismxAEGRU B]";</pre>	<p>Similar to the <code>pattern</code> keyword, <code>pcre</code> is used to specify a pattern using Perl-compatible regular expressions (PCRE). A <code>pcre</code> keyword can be followed by a <code>context</code> keyword to define where to look for the pattern in the packet. If no <code>context</code> keyword is present, the FortiGate unit looks for the pattern anywhere in the packet buffer.</p> <p>For more information about PCRE syntax, go to <a href="http://www.pcre.org">http://www.pcre.org</a>.</p> <p>The switches include:</p> <ul style="list-style-type: none"> <li><code>i</code>: Case insensitive.</li> <li><code>s</code>: Include newlines in the dot metacharacter.</li> <li><code>m</code>: By default, the string is treated as one big line of characters. <code>^</code> and <code>\$</code> match at the beginning and ending of the string. When <code>m</code> is set, <code>^</code> and <code>\$</code> match immediately following or immediately before any newline in the buffer, as well as the very start and very end of the buffer.</li> <li><code>x</code>: White space data characters in the pattern are ignored except when escaped or inside a character class.</li> <li><code>A</code>: The pattern must match only at the start of the buffer (same as <code>^</code>).</li> <li><code>E</code>: Set <code>\$</code> to match only at the end of the subject string. Without <code>E</code>, <code>\$</code> also matches immediately before the final character if it is a newline (but not before any other newlines).</li> <li><code>G</code>: Invert the "greediness" of the quantifiers so that they are not greedy by default, but become greedy if followed by <code>?</code>.</li> <li><code>R</code>: Match relative to the end of the last pattern match. (Similar to <code>distance:0</code>).</li> <li><code>U</code>: Deprecated, see the <code>context</code> keyword. Match the decoded URI buffers.</li> </ul>
<pre>--uri [!]"&lt;uri_str&gt;;</pre>	<p><b>Deprecated, see <code>pattern</code> and <code>context</code> keywords.</b></p> <p>The FortiGate unit will search for the URI in the packet payload. The URI must be enclosed in double quotes.</p> <p>To have the FortiGate search for a packet that does not contain the specified URI, add an exclamation mark (!) before the URI.</p> <p>Multiple content items can be specified in one rule. The value can contain mixed text and binary data. The binary data is generally enclosed within the pipe ( ) character.</p> <p>The double quote ("), pipe sign( ) and colon(:) characters must be escaped using a back slash if specified in a URI string.</p>
<pre>--within &lt;within_int&gt;;</pre>	<p>When used with the <code>distance</code> keyword, the FortiGate unit searches for the contents within the specified number of bytes of the payload.</p> <p>The <code>within</code> value must be between 0 and 65535.</p>

Table 5: IP header keywords

Keyword and Value	Description
<code>--dst_addr [!]&lt;ipv4&gt;;</code>	<p>The destination IP address.</p> <p>To have the FortiGate search for a packet that does not contain the specified address, add an exclamation mark (!) before the IP address. You can define up to 28 IP addresses or CIDR blocks. Enclose the comma separated list in square brackets.</p> <p>Example:</p> <ul style="list-style-type: none"> <li><code>dst_addr [172.20.0.0/16,10.1.0.0/16,192.168.0.0/16]</code></li> </ul>
<code>--ip_id &lt;field_int&gt;;</code>	Check the IP ID field for the specified value.
<code>--ip_option {rr   eol   nop   ts   sec   lsrr   ssrr   satid   any};</code>	<p>Use the <code>ip_option</code> keyword to check various IP option settings. The available options include:</p> <ul style="list-style-type: none"> <li><code>rr</code>: Check if IP RR (record route) option is present.</li> <li><code>eol</code>: Check if IP EOL (end of list) option is present.</li> <li><code>nop</code>: Check if IP NOP (no op) option is present.</li> <li><code>ts</code>: Check if IP TS (time stamp) option is present.</li> <li><code>sec</code>: Check if IP SEC (IP security) option is present.</li> <li><code>lsrr</code>: Check if IP LSRR (loose source routing) option is present.</li> <li><code>ssrr</code>: Check if IP SSRR (strict source routing) option is present.</li> <li><code>satid</code>: Check if IP SATID (stream identifier) option is present.</li> <li><code>any</code>: Check if IP any option is present.</li> </ul>
<code>--ip_tos &lt;field_int&gt;;</code>	Check the IP TOS field for the specified value.
<code>--ip_ttl [&lt;   &gt;] &lt;ttl_int&gt;;</code>	Check the IP time-to-live value against the specified value. Optionally, you can check for an IP time-to-live greater-than (>) or less-than (<) the specified value with the appropriate symbol.
<code>--protocol {&lt;protocol_int&gt;   tcp   udp   icmp};</code>	<p>Check the IP protocol header.</p> <p>Example:</p> <pre>--protocol tcp;</pre>
<code>--src_addr [!]&lt;ipv4&gt;;</code>	<p>The source IP address.</p> <p>To have the FortiGate search for a packet that does not contain the specified address, add an exclamation mark (!) before the IP address. You can define up to 28 IP addresses or CIDR blocks. Enclose the comma separated list in square brackets.</p> <p>Example:</p> <ul style="list-style-type: none"> <li><code>src_addr 192.168.13.0/24</code></li> </ul>

Table 6: TCP header keywords

Keyword and Value	Description
<code>--ack &lt;ack_int&gt;;</code>	Check for the specified TCP acknowledge number.
<code>--dst_port [!]{&lt;port_int&gt;   :&lt;port_int&gt;   &lt;port_int&gt;:   &lt;port_int&gt;:&lt;port_int&gt;;</code>	<p>The destination port number.</p> <p>You can specify a single port or port range:</p> <ul style="list-style-type: none"> <li>• &lt;port_int&gt; is a single port.</li> <li>• :&lt;port_int&gt; includes the specified port and all lower numbered ports.</li> <li>• &lt;port_int&gt;: includes the specified port and all higher numbered ports.</li> <li>• &lt;port_int&gt;:&lt;port_int&gt; includes the two specified ports and all ports in between.</li> </ul>
<code>--seq &lt;seq_int&gt;;</code>	Check for the specified TCP sequence number.
<code>--src_port [!]{&lt;port_int&gt;   :&lt;port_int&gt;   &lt;port_int&gt;:   &lt;port_int&gt;:&lt;port_int&gt;;</code>	<p>The source port number.</p> <p>You can specify a single port or port range:</p> <ul style="list-style-type: none"> <li>• &lt;port_int&gt; is a single port.</li> <li>• :&lt;port_int&gt; includes the specified port and all lower numbered ports.</li> <li>• &lt;port_int&gt;: includes the specified port and all higher numbered ports.</li> <li>• &lt;port_int&gt;:&lt;port_int&gt; includes the two specified ports and all ports in between.</li> </ul>

Table 6: TCP header keywords (Continued)

Keyword and Value	Description
<pre>--tcp_flags &lt;FSRPAU120&gt;[! * +] [,&lt;FSRPAU120&gt;];</pre>	<p>Specify the TCP flags to match in a packet.</p> <ul style="list-style-type: none"> <li>• S: Match the SYN flag.</li> <li>• A: Match the ACK flag.</li> <li>• F: Match the FIN flag.</li> <li>• R: Match the RST flag.</li> <li>• U: Match the URG flag.</li> <li>• P: Match the PSH flag.</li> <li>• 1: Match Reserved bit 1.</li> <li>• 2: Match Reserved bit 2.</li> <li>• 0: Match No TCP flags set.</li> <li>• +: Match on the specified bits, plus any others.</li> <li>• *: Match if any of the specified bits are set.</li> <li>• !: Match if the specified bits are not set.</li> </ul> <p>The first part if the value (&lt;FSRPAU120&gt;) defines the bits that must present for a successful match. For example:</p> <pre>--tcp_flags AP</pre> <p>only matches the case where both A and P bits are set.</p> <p>The second part ([, &lt;FSRPAU120&gt;]) is optional, and defines the additional bits that can present for a match. For example:</p> <pre>tcp_flags S,12</pre> <p>matches the following combinations of flags: S, S and 1, S and 2, S and 1 and 2.</p> <p>The modifiers !, * and + can not be used in the second part.</p>
<pre>--window_size [!]&lt;window_int&gt;;</pre>	<p>Check for the specified TCP window size.</p> <p>You can specify the window size as a hexadecimal or decimal integer. A hexadecimal value must be preceded by 0x.</p> <p>To have the FortiGate search for the absence of the specified window size, add an exclamation mark (!) before the window size.</p>

Table 7: UDP header keywords

Keyword and Value	Description
<code>--dst_port [!]{&lt;port_int&gt;   :&lt;port_int&gt;   &lt;port_int&gt;:   &lt;port_int&gt;:&lt;port_int&gt;;</code>	<p>The destination port number.</p> <p>You can specify a single port or port range:</p> <ul style="list-style-type: none"> <li>• &lt;port_int&gt; is a single port.</li> <li>• :&lt;port_int&gt; includes the specified port and all lower numbered ports.</li> <li>• &lt;port_int&gt;: includes the specified port and all higher numbered ports.</li> <li>• &lt;port_int&gt;:&lt;port_int&gt; includes the two specified ports and all ports in between.</li> </ul>
<code>--src_port [!]{&lt;port_int&gt;   :&lt;port_int&gt;   &lt;port_int&gt;:   &lt;port_int&gt;:&lt;port_int&gt;;</code>	<p>The source port number.</p> <p>You can specify a single port or port range:</p> <ul style="list-style-type: none"> <li>• &lt;port_int&gt; is a single port.</li> <li>• :&lt;port_int&gt; includes the specified port and all lower numbered ports.</li> <li>• &lt;port_int&gt;: includes the specified port and all higher numbered ports.</li> <li>• &lt;port_int&gt;:&lt;port_int&gt; includes the two specified ports and all ports in between.</li> </ul>

Table 8: ICMP keywords

Keyword and Value	Usage
<code>--icmp_code &lt;code_int&gt;;</code>	Specify the ICMP code to match.
<code>--icmp_id &lt;id_int&gt;;</code>	Check for the specified ICMP ID value.
<code>--icmp_seq &lt;seq_int&gt;;</code>	Check for the specified ICMP sequence value.
<code>--icmp_type &lt;type_int&gt;;</code>	Specify the ICMP type to match.

Table 9: Other keywords

Keyword and Value	Description
<code>--data_size {&lt;size_int&gt;   &lt;&lt;size_int&gt;   &gt;&gt;size_int   &lt;port_int&gt;&lt;&gt;&lt;port_int&gt;;</code>	<p>Test the packet payload size. With <code>data_size</code> specified, packet reassembly is turned off automatically. So a signature with <code>data_size</code> and <code>only_stream</code> values set is wrong.</p> <ul style="list-style-type: none"> <li>• &lt;size_int&gt; is a particular packet size.</li> <li>• &lt;&lt;size_int&gt; is a packet smaller than the specified size.</li> <li>• &gt;&gt;size_int is a packet larger than the specified size.</li> <li>• &lt;size_int&gt;&lt;&gt;&lt;size_int&gt; within the range between the specified sizes.</li> </ul>
<code>--data_at &lt;offset_int&gt;[, relative];</code>	Verify that the payload has data at a specified offset, optionally looking for data relative to the end of the previous content match.



**Table 9: Other keywords (Continued)**

Keyword and Value	Description
<code>--rpc_num &lt;app_int&gt;[, &lt;ver_int&gt;   *][, &lt;proc_int&gt;   *];</code>	Check for RPC application, version, and procedure numbers in SUNRPC CALL requests. The * wildcard can be used for version and procedure numbers.
<code>--same_ip;</code>	The source and the destination have the same IP addresses.

## Example custom signatures

Custom signature fields and syntax are fully described in this chapter, though using them to build a custom signature can be complex. It's best to start with a simpler signature.

### Example 1: signature to block access to example.com

In this first example, we will create a custom signature to block access to the example.com URL.

#### 1 Custom signature basic format

All custom signatures have a header, and at least one keyword/value pair. The header is always the same:

```
F-SBID( )
```

The keyword/value pairs appear within the parentheses and each pair is followed by a semicolon.

#### 2 Choosing a name for the custom signature

Every custom signature requires a name, so it is good practice to assign a name before any other keywords are added.

Use the `--name` keyword to assign the custom signature a name. The name value follows the keyword after a space. Enclose the name value in double-quotes:

```
F-SBID( --name "Block.example.com"; )
```

The signature, as it appears here, will not do anything if used. It has a name, but doesn't look for any patterns in network traffic. You must specify a pattern for the FortiGate unit to search for.

#### 3 Adding a signature pattern

Use the `--pattern` keyword to specify what the FortiGate unit will search for:

```
F-SBID( --name "Block.example.com"; --pattern
"example.com"; )
```

The signature will now detect the example.com URL appearing in network traffic. The custom signature should only detect the URL in HTTP traffic, however. Any other traffic with the URL should be allowed to pass. For example, an Email message to or from example.com should not be stopped.

#### 4 Specifying the service

Use the `--service` keyword to limit the effect of the custom signature to only the HTTP protocol.

```
F-SBID( --name "Block.example.com"; --pattern
"example.com"; --service HTTP; )
```

The FortiGate unit will limit its search for the pattern to the HTTP protocol. Even though the HTTP protocol uses only TCP traffic, the FortiGate will search for HTTP protocol communication in TCP, UDP, and ICMP traffic. This is a needless waste of system resources.

#### 5 Specifying the traffic type.

Use the `--protocol tcp` keyword to limit the effect of the custom signature to only TCP traffic. This will save system resources by not unnecessarily scanning UDP and ICMP traffic.

```
F-SBID( --name "Block.example.com"; --pattern
        "example.com"; --service HTTP; --protocol tcp; )
```

The FortiGate unit will limit its search for the pattern to TCP traffic and ignore UDP and ICMP network traffic.

#### 6 Ignoring case sensitivity

By default, patterns are case sensitive. If a user directed his or her browser to Example.com, the custom signature would not recognize the URL as a match.

Use the `--no_case` keyword to make the pattern matching case insensitive.

```
F-SBID( --name "Block.example.com"; --pattern
        "example.com"; --service HTTP; --no_case; )
```

Unlike all of the other keywords in this example, the `--no_case` keyword has no value. Only the keyword is required.

#### 7 Limiting pattern scans to only traffic sent from the client

The `--flow` command can be used to further limit the network traffic being scanned to only that sent by the client or by the server.

```
F-SBID( --name "Block.example.com";
        --pattern "example.com"; --service HTTP; --no_case;
        --flow from_client; )
```

Web servers don't contact clients until clients first open a communication session. Therefore, using the `--flow from_client` command will force the FortiGate until to ignore all traffic originating from the server. Since the majority of HTTP traffic flows from the server to the client, this will save considerable system resources and still maintain protection.

#### 8 Specifying the context

When the client browser tries to contact example.com, a DNS is first consulted to get the example.com server IP address. The IP address is then specified in the URL field of the HTTP communication. The domain name will still appear in the host field so this custom signature will not function without the `--context host` keyword/value pair.

```
F-SBID( --name "Block.example.com";
        --pattern "example.com"; --service HTTP; --no_case;
        --flow from_client; --context host; )
```

## Example 2: signature to block the SMTP 'vrfy' command

The SMTP vrfy command can be used to verify the existence of a single email address, or it can be used to list all of the valid accounts on an email server. A spammer could potentially use this command to obtain a list of all valid email users and direct spam to their inboxes.

In this example, we will create a custom signature to block the use of the vrfy command. Since the custom signature blocks the vrfy command from coming through the FortiGate unit, the administrator can still use the command on the internal network.

### 1 Custom signature basic format

All custom signatures have a header, and at least one keyword/value pair. The header is always the same:

```
F-SBID( )
```

The keyword/value pairs appear within the parentheses and each pair is followed by a semicolon.

### 2 Choosing a name for the custom signature

Every custom signature requires a name, so it is good practice to assign a name before any other keywords are added.

Use the `--name` keyword to assign the custom signature a name. The name value follows the keyword after a space. Enclose the name value in double-quotes:

```
F-SBID( --name "Block.SMTP.VRFY.CMD"; )
```

The signature, as it appears here, will not do anything if used. It has a name, but doesn't look for any patterns in network traffic. You must specify a pattern for the FortiGate unit to search for.

### 3 Adding a signature pattern

Use the `--pattern` keyword to specify what the FortiGate unit will search for:

```
F-SBID( --name "Block.SMTP.VRFY.CMD"; --pattern "vrfy"; )
```

The signature will now detect the vrfy command appearing in network traffic. The custom signature should only detect the command in SMTP traffic, however. Any other traffic with the pattern should be allowed to pass. For example, an Email message discussing the vrfy command should not be stopped.

### 4 Specifying the service

Use the `--service` keyword to limit the effect of the custom signature to only the HTTP protocol.

```
F-SBID( --name "Block.SMTP.VRFY.CMD"; --pattern "vrfy";
--service SMTP; )
```

The FortiGate unit will limit its search for the pattern to the SMTP protocol.

Even though the SMTP protocol uses only TCP traffic, the FortiGate will search for SMTP protocol communication in TCP, UDP, and ICMP traffic. This is a needless waste of system resources.

### 5 Specifying the traffic type.

Use the `--protocol tcp` keyword to limit the effect of the custom signature to only TCP traffic. This will save system resources by not unnecessarily scanning UDP and ICMP traffic.

```
F-SBID( --name "Block.SMTP.VRFY.CMD"; --pattern "vrfy";
        --service SMTP; --protocol tcp; )
```

The FortiGate unit will limit its search for the pattern to TCP traffic and ignore the pattern in UDP and ICMP network traffic.

## 6 Ignoring case sensitivity

By default, patterns are case sensitive. If a user directed his or her browser to Example.com, the custom signature would not recognize the URL as a match.

Use the `--no_case` keyword to make the pattern matching case insensitive.

```
F-SBID( --name "Block.SMTP.VRFY.CMD"; --pattern "vrfy";
        --service SMTP; --no_case; )
```

Unlike all of the other keywords in this example, the `--no_case` keyword has no value. Only the keyword is required.

## 7 Specifying the context

The SMTP `vrfy` command will appear in the SMTP header. The `--context host` keyword/value pair allows you to limit the pattern search to only the header.

```
F-SBID( --name "Block.SMTP.VRFY.CMD"; --pattern "vrfy";
        --service SMTP; --no_case; --context header; )
```

# Protocol decoders

This section describes:

- [Protocol decoders](#)
- [Upgrading the IPS protocol decoder list](#)
- [Viewing the protocol decoder list](#)

## Protocol decoders

The FortiGate IPS uses protocol decoders to identify the abnormal traffic patterns that do not meet the protocol requirements and standards. For example, the HTTP decoder monitors the HTTP traffic to identify any HTTP packets that do not meet the HTTP protocol standards.

On the **Intrusion Protection > Signature > Protocol Decoder** page, you can view the decoders and the port numbers the protocol decoders monitor.

## Upgrading the IPS protocol decoder list

The Intrusion Protection system protocol decoders are upgraded automatically through the FortiGuard Distribution Network (FDN) if existing decoders are modified or new decoders added. The FDN keeps the protocol decoder list up-to-date with protection against new threats such as the latest versions of existing IM/P2P as well as against new applications.

## Viewing the protocol decoder list

To view the decoder list, go to **Intrusion Protection > Signature > Protocol Decoder**.

**Figure 6: The protocol decoder list**

Protocols	Ports
Back Orifice	Auto
DCE RPC	135, 1026
DNS	53
FTP	21
H323	1720
HTTP	Auto
Instant Messaging	Auto
IMAP	143
LDAP	389
MSSQL	1433
NetBIOS	139, 445
Peer-to-Peer	Auto
POP3	110
Protocol (L3/4) Analyser	Auto
RADIUS	1812,1813
Sun RPC	111, 32771
SIP	Auto
SMTP	25
SNMP	161, 162
SSH	Auto
TCP Reassembler	Auto
TFN DoS	Auto

**Protocols** The protocol decoder names.

**Port** The port number or numbers that the protocol decoder monitors.

# IPS sensors

You can group signatures into IPS sensors for easy selection in protection profiles. You can define signatures for specific types of traffic in separate IPS sensors, and then select those sensors in profiles designed to handle that type of traffic. For example, you can specify all of the web-server related signatures in an IPS sensor, and the sensor can then be used by a protection profile in a policy that controls all of the traffic to and from a web server protected by the FortiGate unit.

The FortiGuard Service periodically updates the pre-defined signatures, with signatures added to counter new threats. Because the signatures included in filters are defined by specifying signature attributes, new signatures matching existing filter specifications will automatically be included in those filters. For example, if you have a filter that includes all signatures for the Windows operating system, your filter will automatically incorporate new Windows signatures as they are added.

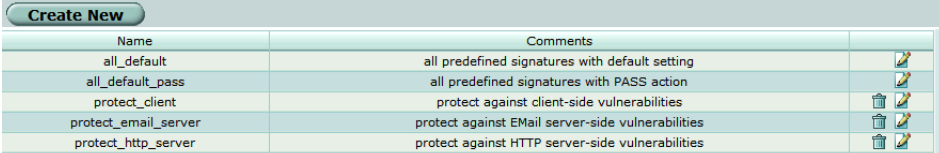
This section describes:

- [Viewing the IPS sensor list](#)
- [Configuring IPS sensors](#)

## Viewing the IPS sensor list

To view the IPS sensors, go to **Intrusion Protection > IPS Sensor**.

**Figure 7: IPS Sensor list showing the default sensors**



Name	Comments	
all_default	all predefined signatures with default setting	
all_default_pass	all predefined signatures with PASS action	
protect_client	protect against client-side vulnerabilities	
protect_email_server	protect against EMail server-side vulnerabilities	
protect_http_server	protect against HTTP server-side vulnerabilities	

The IPS sensor list displays the following information.

<b>Create New</b>	Add a new IPS sensor. For more information, see <a href="#">“Adding an IPS sensor” on page 40</a> .
<b>Name</b>	The name of each IPS sensor.
<b>Comments</b>	An optional description of the IPS sensor.
<b>Delete and Edit icons</b>	Delete or edit an IPS sensor.

Five default IPS sensors are provided with the default configuration.

<b>all_default</b>	Includes all signatures. The sensor is set to use the default enable status and action of each signature.
<b>all_default_pass</b>	Includes all signatures. The sensor is set to use the default enable status of each signature, but the action is set to pass.

<b>protect_client</b>	Includes only the signatures designed to detect attacks against clients; uses the default enable status and action of each signature.
<b>protect_email_server</b>	Includes only the signatures designed to detect attacks against servers and the SMTP, POP3, or IMAP protocols; uses the default enable status and action of each signature.
<b>protect_http_server</b>	Includes only the signatures designed to detect attacks against servers and the HTTP protocol; uses the default enable status and action of each signature.

## Adding an IPS sensor

An IPS sensor must be created before it can be configured by adding filters and overrides. To create an IPS sensor, go to **Intrusion Protection > IPS Sensor** and select **Create New**.

**Figure 8: New IPS sensor**

<b>Name</b>	Enter the name of the new IPS sensor.
<b>Comment</b>	Enter an optional comment to display in the IPS sensor list.

## Configuring IPS sensors

Each IPS sensor consists of two parts: filters and overrides. Overrides are always checked before filters.

Each filter consists of a number of signatures attributes. All of the signatures with those attributes, and only those attributes, are checked against traffic when the filter is run. If multiple filters are defined in an IPS Sensor, they are checked against the traffic one at a time, from top to bottom. If a match is found, the FortiGate unit takes the appropriate action and stops further checking.

A signature override can modify the behavior of a signature specified in a filter. A signature override can also add a signature not specified in the sensor's filters. Custom signatures are included in an IPS sensor using overrides.

The signatures in the overrides are first compared to network traffic. If the IPS sensor does not find any matches, it then compares the signatures in each filter to network traffic, one filter at a time, from top to bottom. If no signature matches are found, the IPS sensor allows the network traffic.



To view an IPS sensor, go to **Intrusion Protection > IPS Sensor** and select the Edit icon of any IPS sensor. The Edit IPS Sensor window is divided into three parts: the sensor attributes, the filters, and the overrides.

**Figure 9: Edit IPS sensor**

#	Name	Severity	Target	Protocol	OS	Application	Enable	Logging	Action
1	1	all	server	SMTP, POP3, IMAP	all	all	Default	Default	Default

#	Name	Enable	Logging	Action
1	Adobe.Acrobat.and.Reader.mailto.URI.Code.Execution	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Reset

IPS sensor attributes:

- Name** The name of the IPS sensor. You can change it at any time.
- Comments** An optional comment describing the IPS sensor. You can change it at any time.
- OK** Select to save changes to Name or Comments.

IPS sensor filters:

- Add Filter** Add a new filter to the end of the filter list. For more information, see [“Configuring filters” on page 42](#).
- #** Current position of each filter in the list.
- Name** The name of the filter.
- Signature attributes** Signature attributes specify the type of network traffic the signature applies to.
- Severity** The severity of the included signatures.
- Target** The type of system targeted by the attack. The targets are client and server.
- Protocol** The protocols to which the signatures apply. Examples include HTTP, POP3, H323, and DNS.
- OS** The operating systems to which the signatures apply.
- Application** The applications to which the signatures apply.
- Enable** The status of the signatures included in the filter. The signatures can be set to enabled, disabled, or default. The default setting uses the default status of each individual signature as displayed in the signature list.
- Logging** The logging status of the signatures included in the filter. Logging can be set to enabled, disabled, or default. The default setting uses the default status of each individual signature as displayed in the signature list.
- Action** The action of the signatures included in the filter. The action can be set to pass all, block all, reset all, or default. The default setting uses the action of each individual signature as displayed in the signature list.
- Count** The number of signatures included in the filter. Overrides are not included in this total.
- Delete icon** Delete the filter.
- Edit icon** Edit the filter.
- Insert icon** Create a new filter and insert it above the current filter.

**Move to icon** After selecting this icon, enter the destination position in the window that appears, and select OK.

**View Rules icon** Open a window listing all of the signatures included in the filter.

IPS sensor overrides:

**Add Pre-defined Override** Select to create an override based on a pre-defined signature.

**Add Custom Override** Select to create an override based on a custom signature.

**#** Current position of each override in the list.

**Name** The name of the signature.

**Enable** The status of the override. A green circle indicates the override is enabled. A gray circle indicates the override is not enabled.

**Logging** The logging status of the override. A green circle indicates logging is enabled. A gray circle indicates logging is not enabled.

**Action** The action set for the override. The action can be set to pass, block, or reset.

**Delete and Edit icons** Delete or edit the filter.

## Configuring filters

To configure a filter, go to **Intrusion Protection > IPS Sensor**. Select the Edit icon of the IPS sensor containing the filter you want to edit. When the sensor window opens, select the Edit icon of the filter you want to change, or select Add Filter to create a new filter. Enter the information as described below and select OK.

**Figure 10: Edit IPS Filter**

**Edit IPS Filter**

Name

Severity  All  Specify  info  low  medium  high  critical

Target  All  Specify  server  client

OS  All  Specify  Other  Windows  Linux  BSD  Solaris  MacOS

Protocol  All  Specify

Available Selected

Other  
BO  
DCERPC  
DNS  
FTP  
H323  
HTTP

Application  All  Specify

Available Selected

Other  
ASP\_app  
Adobe  
Apache  
Apple  
CA  
CGI\_app

Configuration

Enable  Accept signatures' default setting  Enable all  Disable all

Logging  Accept signatures' default setting  Enable all  Disable all

Action  Accept signatures' default setting  Pass all  Block all  Reset all

**OK** **Cancel**

<b>Name</b>	Enter or change the name of the IPS filter.
<b>Severity</b>	Select All, or select Specify and then one or more severity ratings. Severity defines the relative importance of each signature. Signatures rated critical detect the most dangerous attacks while those rated as info pose a much smaller threat.
<b>Target</b>	Select All, or select Specify and then the type of systems targeted by the attack. The choices are server or client.
<b>OS</b>	Select All, or Select Specify and then select one or more operating systems that are vulnerable to the attack. Signatures with an OS attribute of All affect all operating systems. These signatures will be automatically included in any filter regardless of whether a single, multiple, or all operating systems are specified.
<b>Protocol</b>	Select All, or select Specify to list what network protocols are used by the attack. Use the Right Arrow to move the ones you want to include in the filter from the Available to the Selected list, or the Left Arrow to remove previously selected protocols from the filter.
<b>Application</b>	Select All, or select Specify to list the applications or application suites vulnerable to the attack. Use the Right Arrow to move the ones you want to include in the filter from the Available to the Selected list, or the Left Arrow to remove previously selected protocols from the filter.
<b>Enable</b>	Select from the options to specify what the FortiGate unit will do with the signatures included in the filter: enable all, disable all, or enable or disable each according to the individual default values shown in the signature list.
<b>Logging</b>	Select from the options to specify whether the FortiGate unit will create log entries for the signatures included in the filter: enable all, disable all, or enable or disable logging for each according to the individual default values shown in the signature list.
<b>Action</b>	Select from the options to specify what the FortiGate unit will do with traffic containing a signature match: pass all, block all, reset all, or block or pass traffic according to the individual default values shown in the signature list.

The signatures included in the filter are only those matching every attribute specified. When created, a new filter has every attribute set to "all" which causes every signature to be included in the filter. If the severity is changed to high, and the target is changed to server, the filter includes only signatures checking for high priority attacks targeted at servers.

## Configuring pre-defined and custom overrides

Pre-defined and custom overrides are configured and work mainly in the same way as filters. Unlike filters, each override defines the behavior of one signature.

Overrides can be used in two ways:

- To change the behavior of a signature already included in a filter. For example, to protect a web server, you could create a filter that includes and enables all signatures related to servers. If you wanted to disable one of those signatures, the simplest way would be to create an override and mark the signature as disabled.
- To add an individual signature, not included in any filters, to an IPS sensor. This is the only way to add custom signatures to IPS sensors.

When a pre-defined signature is specified in an override, the default status and action attributes have no effect. These settings must be explicitly set when creating the override.



**Note:** Before an override can affect network traffic, you must add it to a filter, and you must select the filter in a protection profile applied to a policy. An override does not have the ability to affect network traffic until these steps are taken.

To edit a pre-defined or custom override, go to **Intrusion Protection > IPS Sensor** and select the Edit icon of the IPS sensor containing the override you want to edit. When the sensor window opens, select the Edit icon of the override you want to change.

**Figure 11: Configure IPS override**

- Signature** Select the browse icon to view the list of available signatures. From this list, select a signature the override will apply to and then select OK.
- Enable** Select to enable the signature override.
- Action** Select one of Pass, Block or Reset. When the override is enabled, the action determines what the FortiGate will do with traffic containing the specified signature.
- Logging** Select to enable creation of a log entry if the signature is discovered in network traffic.
- Packet Log** Select to save packets that trigger the override to the FortiGate hard drive for later examination. This option is only valid on FortiGate units with an internal hard drive.
- Exempt IP:** Enter IP addresses to exclude from the override. The override will then apply to all IP addresses except those defined as exempt. The exempt IP addresses are defined in pairs, with a source and destination, and traffic moving from the source to the destination is exempt from the override.
- Source** The exempt source IP address. Enter 0.0.0.0/0 to include all source IP addresses.
- Destination:** The exempt destination IP address. Enter 0.0.0.0/0 to include all destination IP addresses.

# DoS sensors

The FortiGate IPS uses a traffic anomaly detection feature to identify network traffic that does not fit known or common traffic patterns and behavior. For example, one type of flooding is the denial of service (DoS) attack that occurs when an attacking system starts an abnormally high number of sessions with a target system. The high number of sessions slows down or disables the target system so legitimate users can no longer use it. This type of attack gives the DoS sensor its name, although it is capable of detecting and protecting against a number of anomaly attacks.

You can enable or disable logging for each traffic anomaly, and configure the detection threshold and action to take when the detection threshold is exceeded.

You can create multiple DoS sensors. Each sensor consists of 12 anomaly types that you can configure. Each sensor examines the network traffic in sequence, from top to bottom. When a sensor detects an anomaly, it applies the configured action. Multiple sensors allow great granularity in detecting anomalies because each sensor can be configured to examine traffic from a specific address, to a specific address, on a specific port, in any combination.

When arranging the DoS sensors, place the most specific sensors at the top and the most general at the bottom. For example, a sensor with one protected address table entry that includes all source addresses, all destination addresses, and all ports will match all traffic. If this sensor is at the top of the list, no subsequent sensors will ever execute.

The traffic anomaly detection list can be updated only when the FortiGate firmware image is upgraded.



**Note:** If virtual domains are enabled on the FortiGate unit, the Intrusion Protection settings must be configured separately in each VDOM. All sensors and custom signatures will appear only in the VDOM in which they were created.

















This section describes:

- [Viewing the DoS sensor list](#)
- [Configuring DoS sensors](#)
- [Understanding the anomalies](#)

## Viewing the DoS sensor list

To view the anomaly list, go to **Intrusion Protection > DoS Sensor**.

**Figure 12: The DoS sensor list**

Create New				
Status	ID	Name	Comments	
<input checked="" type="checkbox"/>	1	head_office	Action set to 'pass' for all traffic to/from head office.	   
<input type="checkbox"/>	2	web_server	Protection for web server.	   
<input type="checkbox"/>	5	mail_server	Limits for the mail server.	   
<input checked="" type="checkbox"/>	3	catch-all	If no other DoS sensors match, this one will be applied.	   

<b>Create New</b>	Add a new DoS sensor to the bottom of the list.
<b>ID</b>	A unique identifier for each DoS sensor. The ID does not indicate the sequence in which the sensors examine network traffic.
<b>Status</b>	Select to enable the DoS sensor.
<b>Name</b>	The DoS sensor name.
<b>Comments</b>	An optional description of the DoS sensor.
<b>Delete</b>	Delete the DoS sensor.
<b>Edit icon</b>	Edit the following information: Action, Severity, and Threshold.
<b>Insert DoS Sensor before icon</b>	Create a new DoS sensor before the current sensor.
<b>Move To icon</b>	Move the current DoS sensor to another position in the list. After selecting this icon, enter the destination position in the window that appears, and select OK.

## Configuring DoS sensors

Because an improperly configured DoS sensor can interfere with network traffic, no DoS sensors are present on a factory default FortiGate unit. You must create your own and then enable them before they will take effect. Thresholds for newly created sensors are preset with recommended values that you can adjust to meet the needs of your network.



**Note:** It is important to know normal and expected network traffic before changing the default anomaly thresholds. Setting the thresholds too low could cause false positives, and setting the thresholds too high could allow otherwise avoidable attacks.

To configure DoS sensors, go to **Intrusion Protection > DoS Sensor**. Select the Edit icon of an existing DoS sensor, or select Create New to create a new DoS sensor.

Figure 13: Edit DoS Sensor

**Edit DoS Sensor**

Name:

Comments:  (maximum 63 characters)

**Anomalies Configuration:**

Name	<input type="checkbox"/> Enable	<input checked="" type="checkbox"/> Logging	Action	Threshold
tcp_syn_flood	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	2000
tcp_port_scan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	1000
tcp_src_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
tcp_dst_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
udp_flood	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	2000
udp_scan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	2000
udp_src_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
udp_dst_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
icmp_flood	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	250
icmp_sweep	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	100
icmp_src_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	300
icmp_dst_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	1000

**Protected Addresses:**

Destination:  Destination Port:  Source:

#	Destination	Destination Port	Source
	0.0.0.0/0	0	0.0.0.0/0

## DoS sensor attributes:

- Name** Enter or change the DoS sensor name.
- Comments** Enter or change an optional description of the DoS sensor. This description will appear in the DoS sensor list.

## Anomaly configuration:

- Name** The name of the anomaly.
- Enable** Select the check box to enable the DoS sensor to detect when the specified anomaly occurs. Selecting the check box in the header row will enable sensing of all anomalies.
- Logging** Select the check box to enable the DoS sensor to log when the anomaly occurs. Selecting the check box in the header row will enable logging for all anomalies. Anomalies that are not enabled are not logged.
- Action** Select Pass to allow anomalous traffic to pass when the FortiGate unit detects it, or set Block to prevent the traffic from passing.
- Threshold** Displays the number of sessions/packets that must show the anomalous behavior before the FortiGate unit triggers the anomaly action (pass or block). If required, change the number. For more information about how these settings affect specific anomalies, see [Table 10 on page 48](#).

Protected addresses:

Each entry in the protected address table includes a source and destination IP address as well as a destination port. The DoS sensor will be applied to traffic matching the three attributes in any table entry.



**Note:** A new DoS sensor has no protected address table entries. If no addresses are entered, the DoS sensor cannot match any traffic and will not function.

**Destination** The IP address of the traffic destination. 0.0.0.0/0 matches all addresses. If the FortiGate unit is running in transparent mode, 0.0.0.0/0 also includes the management IP address.

**Destination Port** The destination port of the traffic. 0 matches any port.

**Source** The IP address of the traffic source. 0.0.0.0/0 matches all addresses.

**Add** After entering the required destination address, destination port, and source address, select Add to add protected address to the Protected Addresses list. The DoS sensor will be invoked only on traffic matching all three of the entered values. If no addresses appear in the list, the sensor will not be applied to any traffic.

## Understanding the anomalies

Each DoS sensor offers four configurable statistical anomaly types for each of the TCP, UDP, and ICMP protocols.

**Table 10: The four statistical anomaly types.**

<b>Flooding</b>	If the number of sessions targeting a single destination in one second is over a specified threshold, the destination is experiencing flooding.
<b>Scan</b>	If the number of sessions from a single source in one second is over a specified threshold, the source is scanning.
<b>Source session limit</b>	If the number of concurrent sessions from a single source is over a specified threshold, the source session limit is reached.
<b>Destination session limit</b>	If the number of concurrent sessions to a single destination is over a specified threshold, the destination session limit is reached.

For each of the TCP, UDP, and ICMP protocols, DoS sensors offer four statistical anomaly types. The result is twelve configurable anomalies.

**Figure 14: The twelve individually configurable anomalies**

Anomaly	Description
<b>tcp_syn_flood</b>	If the SYN packet rate, including retransmission, to one destination IP address exceeds the configured threshold value, the action is executed. The threshold is expressed in packets per second.
<b>tcp_port_scan</b>	If the SYN packets rate, including retransmission, from one source IP address exceeds the configured threshold value, the action is executed. The threshold is expressed in packets per second.
<b>tcp_src_session</b>	If the number of concurrent TCP connections from one source IP address exceeds the configured threshold value, the action is executed.



Anomaly	Description
<b>tcp_dst_session</b>	If the number of concurrent TCP connections to one destination IP address exceeds the configured threshold value, the action is executed.
<b>udp_flood</b>	If the UDP traffic to one destination IP address exceeds the configured threshold value, the action is executed. The threshold is expressed in packets per second.
<b>udp_scan</b>	If the number of UDP sessions originating from one source IP address exceeds the configured threshold value, the action is executed. The threshold is expressed in packets per second.
<b>udp_src_session</b>	If the number of concurrent UDP connections from one source IP address exceeds the configured threshold value, the action is executed.
<b>udp_dst_session</b>	If the number of concurrent UDP connections to one destination IP address exceeds the configured threshold value, the action is executed.
<b>icmp_flood</b>	If the number of ICMP packets sent to one destination IP address exceeds the configured threshold value, the action is executed. The threshold is expressed in packets per second.
<b>icmp_sweep</b>	If the number of ICMP packets originating from one source IP address exceeds the configured threshold value, the action is executed. The threshold is expressed in packets per second.
<b>icmp_src_session</b>	If the number of concurrent ICMP connections from one source IP address exceeds the configured threshold value, the action is executed.
<b>icmp_dst_session</b>	If the number of concurrent ICMP connections to one destination IP address exceeds the configured threshold value, the action is executed.



# SYN flood attacks

This section describes:

- [What is a SYN flood attack?](#)
- [How SYN floods work](#)
- [The FortiGate IPS Response to SYN flood attacks](#)
- [Configuring SYN flood protection](#)
- [Suggested settings for different network conditions](#)

## What is a SYN flood attack?

A SYN flood is a type of Denial of Service (DoS) attack. DoS is a class of attacks in which an attacker attempts to prevent legitimate users from accessing an internet service, for example, a web server. Using SYN floods, an attacker attempts to disable an Internet service by flooding a server with TCP/IP connection requests which consume all the available slots in the server's TCP connection table. When the connection table is full, it is not possible to establish any new connections, and the web site on the server becomes inaccessible.

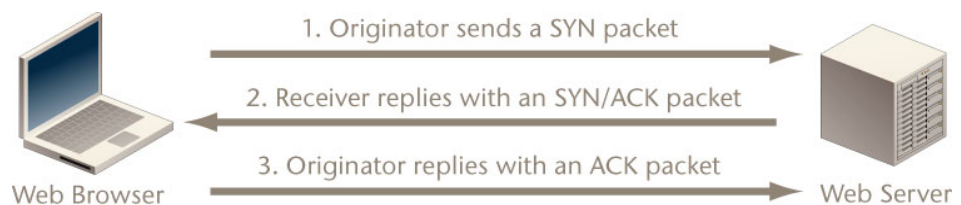
This section provides information about SYN flood attacks and the FortiGate IPS methods of preventing such attacks.

## How SYN floods work

SYN floods work by exploiting the structure of the TCP/IP protocol. An attacker floods a server with connection attempts but never acknowledges the server's replies to open the TCP/IP connection.

The TCP/IP protocol uses a three-step process to establish a network connection.

**Figure 15: Establishing a TCP/IP connection**



- 1 The originator of the connection sends a SYN packet (a packet with the SYN flag set in the TCP header) to initiate the connection.
- 2 The receiver sends a SYN/ACK packet (a packet with the SYN and ACK flags set in the TCP header) back to the originator to acknowledge the connection attempt.
- 3 The originator then sends an ACK packet (a packet with the ACK flag set in the TCP header) back to the receiver to open the connection.

After the handshaking process is complete the connection is open and data exchange can begin between the originator and the receiver, in this case the web browser and the web server.

Between steps 2 and 3 however, the web server keeps a record of any incomplete connections until it receives the ACK packet. A SYN flood attacker sends many SYN packets but never replies with the final ACK packet.

Since most systems have only a limited amount of space for TCP/IP connection records, a flood of incomplete connections will quickly block legitimate users from accessing the server. Most TCP/IP implementations use a fairly long timeout before incomplete connections are cleared from the connection table and traffic caused by a SYN flood is much higher than normal network traffic.

## The FortiGate IPS Response to SYN flood attacks

The FortiGate unit uses a defense method that combines the SYN Threshold and SYN Proxy methods to prevent SYN flood attacks.

### What is SYN threshold?

An IPS device establishes a limit on the number of incomplete TCP connections, and discards SYN packets if the number of incomplete connections reaches the limit.

### What is SYN proxy?

An IPS proxy device synthesizes and sends the SYN/ACK packet back to the originator, and waits for the final ACK packet. After the proxy device receives the ACK packet from the originator, the IPS device then "replays" the three-step sequence of establishing a TCP connection (SYN, SYN/ACK and ACK) to the receiver.

### How IPS works to prevent SYN floods

The FortiGate IPS uses a pseudo SYN proxy to prevent SYN flood attack. The pseudo SYN proxy is an incomplete SYN proxy that reduces resource usage and provides better performance than a full SYN proxy approach.

The IPS allows users to set a limit or threshold on the number of incomplete TCP connections. The threshold can be set either from the CLI or the web-based manager.

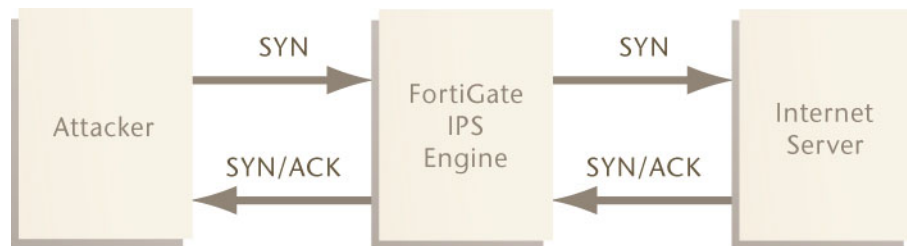
When the IPS detects that the total number of incomplete TCP connections to a particular target exceeds the threshold, the pseudo SYN proxy is triggered to operate for all subsequent TCP connections. The pseudo SYN proxy will determine whether a new TCP connection is a legitimate request or another SYN flood attack based on a "best-effect" algorithm. If a subsequent connection attempt is detected to be a normal TCP connection, the IPS will allow a TCP connection from the source to the target. If a subsequent TCP connection is detected to be a new incomplete TCP connection request, one of the following actions will be taken: Drop, Reset, Reset Client, Reset Server, Drop Session, Pass Session, Clear Session, depending upon the user configuration for SYN Flood anomaly in the IPS.

A true SYN proxy approach requires that all three packets (SYN, SYN/ACK, and ACK) are cached and replayed even before it is known if a TCP connection request is legitimate. The FortiGate IPS pseudo SYN proxy retransmits every TCP packet immediately from the packet source to the packet destination as soon as it records the necessary information for SYN flood detection.

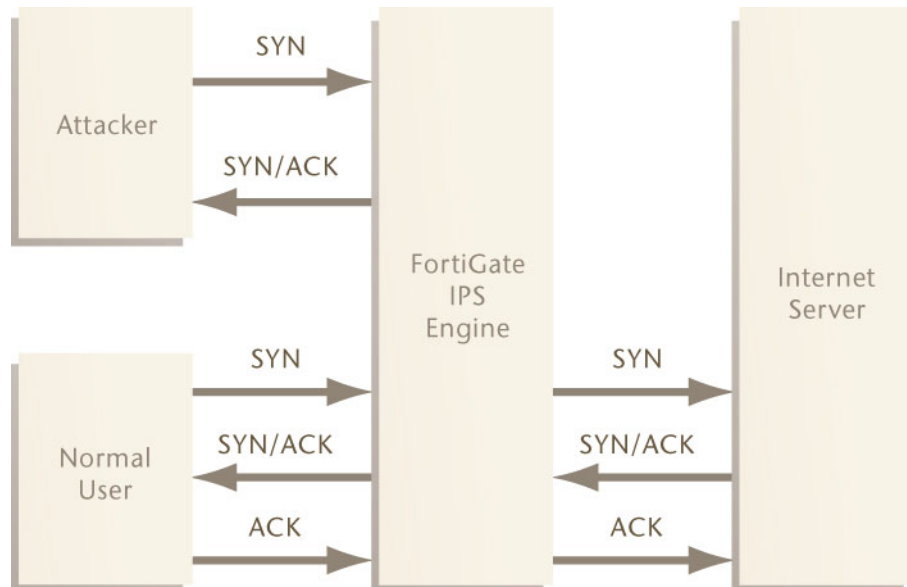
Since the pseudo SYN proxy in the IPS uses a “best effect” algorithm to determine whether a TCP connection is legitimate or not, some legitimate connections may be falsely detected as incomplete TCP connection requests and dropped. However, the ratio of the pseudo SYN proxy dropping legitimate TCP connection is quite small.

Figure 16 illustrates the operational behavior of the FortiGate IPS Engine before the SYN Flood threshold is reached. Figure 17 illustrates the operation behavior of the FortiGate IPS Engine after the SYN Flood threshold is reached.

**Figure 16: IPS operation before syn\_flood threshold is reached**



**Figure 17: IPS operation after syn\_flood threshold is reached**



## Configuring SYN flood protection

To configure the SYN flood protection

- 1 Go to **Intrusion Protection > DoS Sensor**.
- 2 Select **Create New**.
- 3 Configure the options for tcp\_syn\_flood.
- 4 Select **OK**.

Figure 18: Configuring the syn\_flood anomaly

**New Dos Sensor**

Name:

Comments:  (maximum 63 characters)

Anomalies Configuration:

Name	<input type="checkbox"/> Enable	<input checked="" type="checkbox"/> Logging	Action	Threshold
tcp_syn_flood	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	2000
tcp_port_scan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	1000
tcp_src_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
tcp_dst_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
udp_flood	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	2000
udp_scan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	2000
udp_src_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
udp_dst_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	5000
icmp_flood	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	250
icmp_sweep	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	100
icmp_src_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	300
icmp_dst_session	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pass	1000

Protected Addresses:

Destination:  Destination Port:  Source:

#	Destination	Destination Port	Source

## Suggested settings for different network conditions

The main setting that impacts the efficiency of the pseudo SYN proxy in detecting SYN floods is the threshold value. The default threshold is 2000. Select an appropriate value based on network conditions. Normally, if the servers being protected by the FortiGate unit need to handle heavier requests, such as a busy web server, the threshold should be set to a higher value. If the network carries lighter traffic, the threshold should be set to a lower value.

# ICMP sweep attacks

This section describes:

- [What is an ICMP sweep?](#)
- [How ICMP sweep attacks work](#)
- [The FortiGate IPS response to ICMP sweep attacks](#)
- [Configuring ICMP sweep protection](#)
- [Suggested settings for different network conditions](#)

## What is an ICMP sweep?

ICMP (Internet Control Message Protocol) is a part of the IP protocol and is generally used to send error messages describing packet routing problems. ICMP sweeps are not really considered attacks but are used to scan a target network to discover vulnerable hosts for further probing and possible attacks.

Attackers use automated tools that scan all possible IP addresses in the range of the target network to create a map which they can use to plan an attack.

## How ICMP sweep attacks work

An ICMP sweep is performed by sending ICMP echo requests - or other ICMP messages that require a reply - to multiple addresses on the target network. Live hosts will reply with an ICMP echo or other reply message. An ICMP sweep basically works the same as sending multiple pings. Live hosts accessible on the network must send a reply. This enables the attacker to determine which hosts are live and connected to the target network so further attacks and probing can be planned.

There are several ways of doing an ICMP sweep depending on the source operating system, and there are many automated tools for network scanning that attackers use to probe target networks.

## The FortiGate IPS response to ICMP sweep attacks

The FortiGate IPS provides predefined signatures to detect a variety of ICMP sweep methods. Each signature can be configured to pass, drop, or clear the session. Each signature can be configured to log when the signature is triggered.

Create custom signatures to block attacks specific to the network that are not included in the predefined signature list.

The FortiGate IPS also has an ICMP sweep anomaly setting with a configurable threshold.

## Predefined ICMP signatures

Table 11 describes all the ICMP-related predefined signatures and the default settings for each.



**Note:** The predefined signature descriptions in Table 11 are accurate as of the IPS Guide publication date. Predefined signatures may be added or changed with each Attack Definition update.

**Table 11: Predefined ICMP sweep signatures**

Signature	Description	Default settings
<b>AddressMask.Request</b>	AddressMask detects broadcast address mask request messages from a host pretending to be part of the network. The default action is to pass but log this traffic because it could be legitimate network traffic on some networks.	Signature enabled Logging enabled Action: Pass
<b>Broadscan.Smurf.Echo.Request</b>	Broadscan is a hacking tool used to generate and broadcast ICMP requests in a smurf attack. In a smurf attack, an attacker broadcasts ICMP requests on Network A using a spoofed source IP address belonging to Network B. All hosts on Network A send multiple replies to Network B, which becomes flooded.	Signature enabled Logging enabled Action: Drop
<b>Communication.Administratively.Prohibited.Reply</b>	This signature detects network packets that have been blocked by some kind of filter. The host that blocked the packet sends an ICMP (code 13) Destination Unreachable message notifying the source or apparent source of the filtered packet. Since this signature may be triggered by legitimate traffic, the default action is to pass but log the traffic, so it can be monitored.	Signature enabled Logging enabled Action: Pass
<b>CyberKit.2.2.Echo.Request</b>	CyberKit 2.2 is Windows-based software used to scan networks. ICMP echo request messages sent using this software contain special characters that identify Cyberkit as the source.	Signature enabled Logging enabled Action: Pass
<b>DigitalIsland.Bandwidth.Query</b>	Digital Island is a provider of content delivery networks. This company sends ICMP pings so they can better map routes for their customers. Use this signature to block their probes.	Signature enabled Logging enabled Action: Drop
<b>Echo.Reply</b>	This signature detects ICMP echo reply messages responding to ICMP echo request messages.	Signature disabled
<b>ISS.Pinger.Echo.Request</b>	ISS is Internet Security Scanner software that can be used to send ICMP echo request messages and other network probes. While this software can be legitimately used to scan for security holes, use the signature to block unwanted scans.	Signature enabled Logging enabled Action: Drop
<b>Nemesis.V1.1.Echo.Request</b>	Nemesis v1.1 is a Windows- or Unix-based scanning tool. ICMP echo request messages sent using this software contain special characters that identify Nemesis as the source.	Signature enabled Logging enabled Action: Drop
<b>Oversized.Echo.Request.Packet</b>	This signature detects ICMP packets larger than 32 000 bytes, which can crash a server or cause it to hang.	Signature enabled Logging enabled Action: Pass



Table 11: Predefined ICMP sweep signatures

Signature	Description	Default settings
<b>NMAP.Echo.Request</b>	NMAP is a free open source network mapping/security tool that is available for most operating systems. NMAP could be used maliciously to perform an ICMP sweep. ICMP echo request messages sent using this software contain special characters that identify NMAP as the source.	Signature disabled
<b>Redirect.Code4.Echo.Request</b>	This signature detects ICMP type 5 code 4 redirect messages. An ICMP redirect message describes an alternate route for traffic to take. An attacker may use ICMP redirect messages to alter the routing table or cause traffic to follow an unintended route.	Signature enabled Logging enabled Action: Pass
<b>Sniffer.Pro.NetXRay.Echo.Request</b>	Sniffer Pro and NetXRay are scanning tools. ICMP echo request messages sent using this software contain special characters that identify them as the source.	Signature enabled Logging enabled Action: Drop
<b>Superscan.Echo.Request</b>	Superscan is a free network scanning tool for Windows from Foundstone Inc. Superscan could be used maliciously to perform an ICMP sweep. ICMP echo request messages sent using this software contain special characters that identify Superscan as the source.	Signature enabled Logging enabled Action: Drop
<b>TimeStamp.Request</b>	TimeStamp detects timestamp request messages from a host pretending to be part of the network.	Signature enabled Logging enabled Action: Pass
<b>TJPingPro1.1.Echo.Request</b>	TJPingPro1.1 is a widely-used network tool for older versions of Windows. TJPingPro could be used maliciously to perform an ICMP sweep. ICMP echo request messages sent using this software contain special characters that identify TJPingPro as the source.	Signature enabled Logging enabled Action: Drop
<b>Traceroute.Traffic</b>	Traceroute is a very common network tool available on almost any operating system. This tool could be used maliciously to perform an ICMP sweep. ICMP echo request messages sent using this software contain special characters that identify traceroute as the source.	Signature enabled Logging enabled Action: Pass
<b>Whatsup.Echo.Request</b>	WhatsUp Gold is a network scanning tool for Windows from IPswitch. WhatsUp could be used maliciously to perform an ICMP sweep. ICMP echo request messages sent using this software contain special characters that identify WhatsUpGold as the source.	Signature enabled Logging enabled Action: Drop

## ICMP sweep anomalies

The FortiGate unit also detects ICMP sweeps that do not have a predefined signature to block them. The FortiGate IPS monitors traffic to ensure that ICMP messages do not exceed the default or user-defined threshold.

## Configuring ICMP sweep protection

To configure the ICMP sweep anomaly protection settings

- 1 Go to **Intrusion Protection > DoS Sensor**.
- 2 Select **Create New**.
- 3 Configure the options for `icmp_sweep`, `icmp_src_session`, and `icmp_dst_session`.
- 4 Select **OK**.

## Suggested settings for different network conditions

Enable or disable the ICMP predefined signatures depending on current network traffic and the network scanning tools being used.

To use the `icmp_sweep` anomaly, monitor the network to find out the normal ICMP traffic patterns. Configure the `icmp_sweep` anomaly threshold to be triggered when an unusual volume of ICMP requests occurs.

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