

# Rules Authors Introduction to Writing Snort 3 Rules

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This guide introduces some of the new changes to Snort 3 rules language. The goal of this guide is to facilitate the transition of rules writing skills from Snort 2 to Snort 3 syntax.

## Rule Header

The rule header follows a specific format:

Action Protocol Networks Ports Direction Operator Networks Ports

Examples:

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS (RULE_OPTIONS)
alert udp $EXTERNAL_NET $FILE_DATA_PORTS -> $HOME_NET any (RULE_OPTIONS)
```

In Snort 3, the options Protocol, Networks, Ports, and Direction Operator are optional and can be omitted, effectively matching any; analogous to replacing Networks and Ports with the keyword any.

Examples:

```
alert tcp (RULE_OPTIONS)
```

This allows for faster and less redundant rules authoring. Omitting the options should be selective to avoid ambiguity when reading the rules. A typical scenario is when writing rules to detect content regardless to its direction (inbound/outbound) and protocol (tcp, udp, or icmp).

## Alert “http” Service Keyword

In Snort 2, the protocol used when writing rules to detect content in the HTTP URI, Header, or Body is defined as tcp. In Snort 3, a new protocol keyword http is available for HTTP content detection. This provides the following benefits:

1. Snort can detect and alert on HTTP content regardless of ports (HTTP on non-standard ports). Thus, the rule writer need not to worry about the ports some malware is communicating on.
2. The service mapping defined in the metadata option in Snort 2 (e.g.: service http) is no longer required. Thus, removing the burden from the rule writer of having to define the service mapping in the rule metadata option. The metadata option is discussed further in this guide.
3. The ability to use new sticky and dynamic buffers available in Snort 3 allow for streamlined and potential performance improvements to Snort 3 rules as discussed in the following sections.

## New Sticky Buffers and Dynamic Buffer Selectors

Sticky buffers such as file\_data and sip\_header allow rule writers to define the detection cursor at specific buffers that hold content such as the HTTP response body or SIP header. Sticky buffers must precede the content being detected and remain in effect until changed. Snort 3 introduces new sticky buffers and selectors, specifically for HTTP content detection, such as http\_uri and http\_header. In addition, Snort 3 adds dynamic buffer selectors as subcategories under certain sticky buffers, such as the field selector under the http\_header sticky buffer. Using the field selector, the rule author can restrict the content match against a specific HTTP header, where header names are case insensitive.

## Example – “http\_uri” Sticky Buffer:

In this example, the use of the `http_uri` sticky buffer in Snort 3 removes the redundant need for using the `http_uri` content option after each content match.

### Snort 2:

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_uri sticky buffer Example";
  flow:to_server,established;
  content:"var=1"; http_uri;
  content:"malicious"; within:20; http_uri;
  metadata: service http;
  sid:1;
)
```

http\_uri content  
option per  
content match

http\_uri

HTTP service mapping  
via metadata

### Snort 3:

```
alert http $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_uri sticky buffer Example";
  flow:to_server,established;
  http_uri;
  content:"var=1";
  content:"malicious", within 20;
  sid:1;
)
```

Sticky Buffer preceding  
content match

http\_uri content  
option & metadata  
removed

## Example – “http\_header” Sticky Buffer and “field” Dynamic Buffer Selector:

In this example, the use of the `http_header` along with the `field` selector allows the rule writer to target the content match at a specific field within the HTTP request header (case insensitive).

### Snort 2:

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_header sticky buffer Example";
  flow:to_server,established;
  content:"User-Agent"; http_header;
  content:"malicious"; within:200; http_header;
  pcre:"/^User-Agent\s*:[^\n]*malicious/smi";
  metadata: service http;
  sid:2;
)
```

http\_header content  
option per content  
match

http\_header

HTTP service mapping  
via metadata

Sticky Buffer with  
Selector preceding  
content match

### Snort 3:

```
alert http $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_header sticky buffer Example";
  flow:to_server,established;
  http_header:field user-agent;
  content:"malicious";
  sid:2;
)
```

Content Options,  
pcre & metadata  
removed

## Example – Sticky Buffers and Deleted PCRE Options

In Snort 2, the post-re modifiers (B, U, P, H, M, C, I, D, K, S, Y) set compile time flags for the regular expression. For example, the Snort specific modifier for pcre U is used to match the decoded URI buffers.

In Snort 3, some of post-re modifiers (B, U, P, H, M, C, I, D, K, S, Y) have been deleted in favor of sticky buffers.

### Snort 2:

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_uri sticky buffer Example";
  content: "/malicious="; http_uri;
  pcre: "/\\malicious\\x3d\\w+/"U;
  sid: 3;
)
```

The diagram shows a blue line connecting the `http_uri` content option to a dashed box labeled "http\_uri with pcre post-re modifier". A red line connects the PCRE modifier `/\\malicious\\x3d\\w+/"U` to the text "PCRE modifier matching decoded URI buffer".

### Snort 3:

```
alert http $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_uri sticky buffer Example";
  http_uri;
  content: "/malicious=";
  pcre: "/\\malicious\\x3d\\w+/" ;
  sid: 3;
)
```

The diagram shows a green line connecting the `http_uri` sticky buffer to a dashed box labeled "http\_uri Sticky Buffer". A red dashed line connects the PCRE modifier `/\\malicious\\x3d\\w+/"` to the text "PCRE modifier (omitted) applies to the specified Sticky Buffer".

## Example – Sticky Buffers and URL Length with “bufferlen” Option

In Snort 2, inspecting the URI length is achieved via the `urilen` option.

In Snort 3, the option `urilen` is removed and is replaced with the generic buffer `bufferlen`, which applies to the specified sticky buffer.

### Snort 2:

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_uri sticky buffer - bufferlen";
  urilen: <20;
  content: "/malicious=123456"; http_uri;
  sid: 4;
)
```

The diagram shows a blue line connecting the `urilen: <20` option to a dashed box labeled "http\_uri with pcre post-re modifier". Another blue line connects the `http_uri` content option to the same dashed box. The text "urilen option" is placed above the first blue line, and "http\_uri content option" is placed below the second blue line.

### Snort 3:

```
alert http $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_uri sticky buffer - bufferlen";
  http_uri;
  bufferlen: <20;
  sid: 4;
)
```

The diagram shows a green line connecting the `http_uri` sticky buffer to a dashed box labeled "http\_uri Sticky Buffer with bufferlen". Another green line connects the `bufferlen: <20` option to the same dashed box. The text "Sticky Buffer preceding content match" is placed above the first green line, and "New keyword bufferlen applying to the specified sticky buffer" is placed below the second green line.

## Example – Sticky Buffers and User-Agent Length with “bufferlen” Option

The introduction of the generic buffer `bufferlen` in Snort 3 creates new detective capabilities. For example, detecting the length of the User-Agent in the HTTP request header.

```
alert http $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS
(
  msg: "Snort 3 http_uri sticky buffer Example";
  http_header:field user-agent;
  content:"malicious";
  bufferlen:=10;
  sid:5;
)
```

Sticky Buffer with Selector preceding content match

http\_header

New keyword `bufferlen` applying to the specified

## Alert “file” Keyword

The `file` keyword after the rule action applies to anywhere a file is seen regardless of protocol or encoding. This removes the rule writer from the burden of:

1. Maintaining multiple rules to detect the same file or content over different protocols.
2. Maintaining multiple rules to detect the same or content traversing at different directions.
3. Creating or modifying rules when new protocols are added.
4. No having to worry about and potentially replace `flowbits` options in rules.

## Example – Detect Specific Content Regardless of Protocol or Direction

This example attempts at detecting malicious content traversing the network over HTTP (download) and SMTP (upload).

### Snort 2:

```
alert tcp $EXTERNAL_NET $FILE_DATA_PORTS -> $HOME_NET any
(
  msg: "Alert File example - Download";
  flow:to_client,established;
  file_data; content:"malicious_stuff";
  sid:6;
)

alert tcp $EXTERNAL_NET $FILE_DATA_PORTS -> $SMTP_SERVERS 25
(
  msg: "Alert File example - Upload";
  flow:to_server,established;
  file_data; content:"malicious_stuff";
  sid:7;
)
```

Rule flow download

Rule network direction

Rule flow upload

Two separate rules for download/upload

### Snort 3:

```
alert file
(
  msg: "Alert File example";
  file_data; content:"malicious_stuff";
  sid:6;
)
```

Rule network direction omitted

Rule flow omitted

'tcp' keyword replaced with 'file' keyword

One rule for both download/upload regardless of protocol

The use of the `file` keyword in Snort rules should also improve performance. The below examples demonstrating rules syntax differences between Snort 2 and Snort 3 although they are subtle.

## Example – Detect Single File Type

### Snort 2:

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File Detected";
  file_type: PDF;
  sid:8;
)
```

### Snort 3:

```
alert file $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File Detected";
  file_type: "PDF";
  sid:8;
)
```

Similar file\_type  
keyword syntax  
with quotes  
surrounding the  
file type in Snort 3

### Sample Snort 3 Output (alert talos)

```
##### test.pcap #####
[1:8:0] PDF File Detected (alerts: 881)
#####
```

## Example – Detect Single File Type with Version

### Snort 2:

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File version 1.5 Detected";
  file_type: PDF,1.5;
  sid:9;
)
```

### Snort 3:

```
alert file $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File version 1.5 Detected";
  file_type: "PDF,1.5";
  sid:9;
)
```

Similar file\_type  
keyword syntax  
with quotes  
surrounding the  
file type and  
version in Snort 3

### Sample Snort 3 Output (alert talos)

```
##### test.pcap #####
[1:9:0] PDF File version 1.5 Detected (alerts: 881)
#####
```

## Example – Detect Single File Type with Multiple Versions

### Snort 2:

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File version 1.5 Detected";
  file_type: PDF,1.5,1.7;
  sid:10;
)
```

### Snort 3:

```
alert file $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File version 1.5 Detected";
  file_type: "PDF,1.5,1.7";
  sid:10;
)
```

Similar file\_type  
keyword syntax  
with quotes  
surrounding the  
file type and  
version in Snort 3

### Sample Snort 3 Output (alert talos)

```
##### test.pcap #####
[1:10:0] PDF File version 1.5 Detected (alerts: 881)
#####
```

## Example – Detect Multiple File Types

### Snort 2:

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF or MSEXE Files Detected";
  file_type: PDF|MSEXE;
  sid:11;
)
```

### Snort 3:

```
alert file $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF or MSEXE Files Detected";
  file_type: "PDF MSEXE";
  sid:11;
)
```

Similar file\_type  
keyword syntax  
with quotes  
surrounding the  
file type and  
replacing the pipe  
"|" with space " "

### Sample Snort 3 Output (-A cmg)

```
10/13-13:55:36.104000 [**] [1:11:0] "PDF or MSEXE Files Detected" [**] [Priority: 0] [AppID:
HTTP] {TCP} 173.37.145.84:80 -> 192.168.0.1:9208
http_inspect.stream_tcp[16389]:
-----
4D 5A 90 00 03 00 00 00 04 00 00 00 FF FF 00 00 MZ.....
0/13-13:55:44.130000 [**] [1:8:0] "PDF or MSEXE Files Detected" [**] [Priority: 0] [AppID: HTTP]
{TCP} 173.37.145.84:80 -> 192.168.0.1:14685
http_inspect.stream_tcp[16391]:
-----
67 E1 39 D8 07 CF C3 0B BF 28 E7 C9 21 0D 4F BD g.9..... .(!.0.
```

## Example – Detect Multiple File Types and Versions

### Snort 2:

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File Detected";
  file_type: PDF,1.6,1.7|RAR,1.1;
  sid:12;
)
```

### Snort 3:

```
alert file $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "PDF File version 1.5 Detected";
  file_type: "PDF,1.5,1.7 RAR,1.1";
  sid:12;
)
```

Similar file\_type keyword syntax with quotes surrounding the file types and versions in Snort 3 and replacing the pipe "|" with space " "

## Application Detection with OpenAppID (ODP)

### Snort 2:

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "Firefox Detected";
  appid: Firefox;
  sid:13;
)
```

### Snort 3:

```
alert file $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any
(
  msg: "Firefox Detected";
  appids: "Firefox";
  sid:13;
)
```

Replace "appid" keyword from Snort 2 with the keyword "appids" while also surrounding the app name with quotes

## Rule Metadata Option

In Snort 2, certain keywords such as `engine`, `soid`, and `service` keys in the `metadata` option can affect Snort detection behavior, such as using `service` key for Target-Based Service Identifier when a Host Attribute Table is provided.

In Snort 3, `metadata` is now truly metadata with no impact on detection. Snort does not care about metadata internal structure/syntax.

### Example – Replacing Services in Metadata with ‘Service’ Key in Metadata

#### Snort 2:

```
alert tcp any any -> any any
(
  msg: "Service Key Example";
  ...;
  metadata:service http, service smtp;
  sid:14;
)
```

‘service’ key is repeated  
for each service within  
the ‘metadata’ keyword

#### Snort 3:

```
alert tcp any any -> any any
(
  msg: "Service Key Example";
  ...;
  service:http, smtp;
  sid:14;
)
```

‘service’ is a  
standalone keyword  
without repetition

‘service’  
key

## Rule Remarks Option

The remarks `rem` option is a new option allows including arbitrary comments in the rule body.

### Example – ‘rem’ Option

```
alert tcp any any -> any any
(
  msg: "rem option Example";
  ...;
  rem: "tlp white";
  sid:15;
)
```

‘rem’  
option

## References

1. <https://www.youtube.com/watch?v=3gS7MKO-cFE>
2. <https://github.com/snort3/snort3>
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