Clarify Firepower Threat Defense Access Control Policy Rule Actions

Contents

Introduction

This document describes the various actions available on the Firepower Threat Defense (FTD) Access Control Policy (ACP) and Prefilter Policy.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Flow Offload
- Packet captures on Firepower Threat Defense appliances
- Packet tracer and capture with trace option on FTD appliances

Components Used

The information in this document is based on these software and hardware versions:

- Cisco Firepower 4110 Threat Defense Version 6.4.0 (Build 113) and 6.6.0 (Build 90)
- Firepower Management Center (FMC) Version 6.4.0 (Build 113) and 6.6.0 (Build 90)

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Related Products

This document can be also used with these hardware and software versions:

- ASA5506-X, ASA5506W-X, ASA5506H-X, ASA5508-X, ASA5516-X
- ASA5512-X, ASA5515-X, ASA5525-X, ASA5545-X, ASA5555-X
- FPR1000, FPR2100, FPR4100, FPR9300
- VMware (ESXi), Amazon Web Services (AWS), Kernel-based Virtual Machine (KVM)
- Integrated Service Router (ISR) router module
- FTD software version 6.1.x and later

  Note: Flow Offload is supported only on native instances of the ASA and FTD applications and on FPR4100 and FPR9300 platforms. FTD container instances do not support flow offload.

Background Information

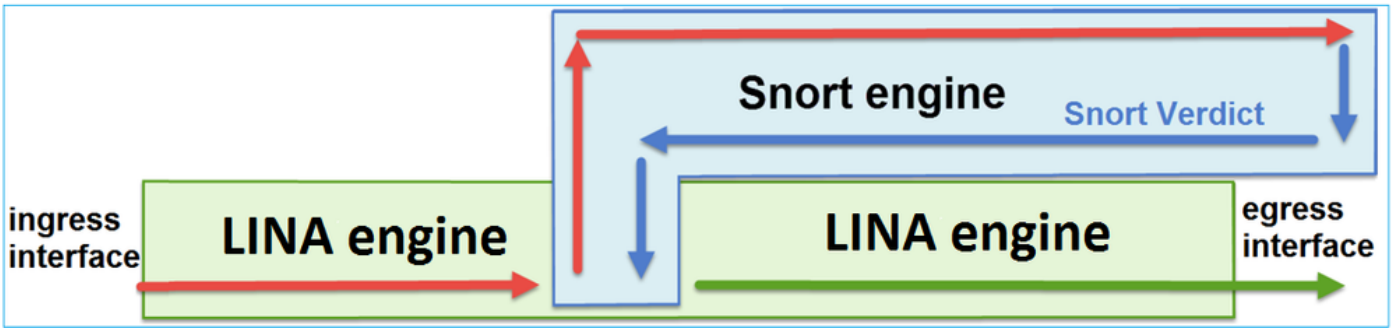
The background operation of each action is examined along with its interaction with other features like Flow Offload and protocols that open secondary connections.

FTD is a unified software image that consists of 2 main engines:

- LINA engine

- Snort engine

This figure shows how the 2 engines interact:



- A packet enters the ingress interface and it is handled by the LINA engine
- If it is required by the FTD policy the packet is inspected by the Snort engine
- The Snort engine returns a verdict (permit list or block list) for the packet
- The LINA engine drops or forwards the packet based on Snort's verdict

How ACP is Deployed

The FTD policy is configured on FMC when off-box (remote) management is used or Firepower Device Manager (FDM) when local management is used. In both scenarios, the ACP is deployed as:

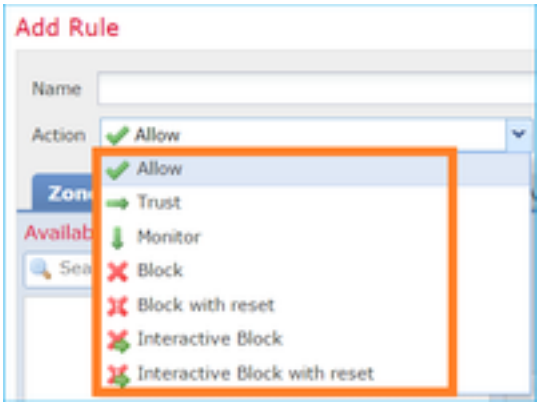
- A global Access Control List (ACL) named CSM_FW_ACL_ to the FTD LINA engine
- Access Control (AC) rules in the /ngfw/var/sf/detection_engines/<UUID>/ngfw.rules file to the FTD Snort engine

Configure

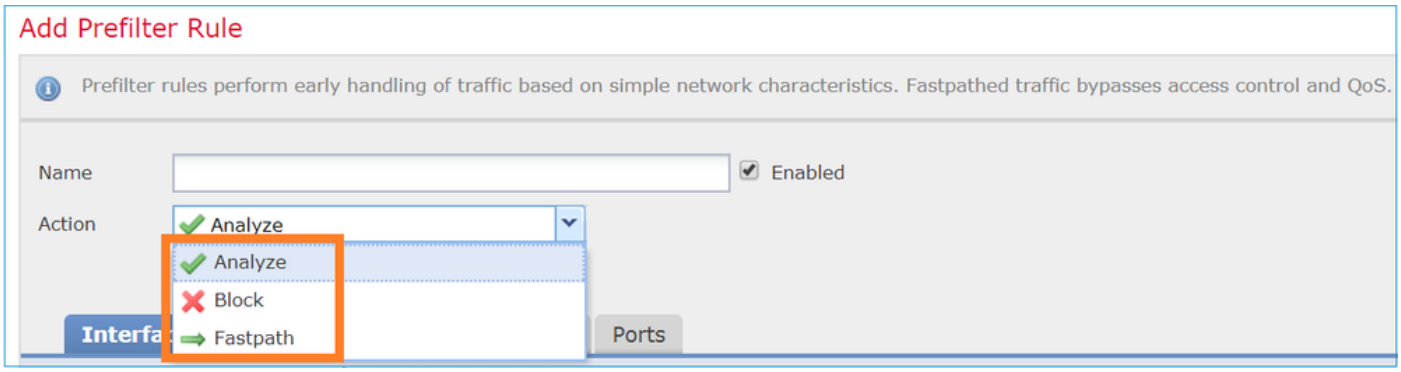
ACP Available Actions

The FTD ACP contains one or more rules and each rule can have one of these actions and as shown in the image:

- **Allow**
- **Trust**
- **Monitor**
- **Block**
- **Block with reset**
- **Interactive Block**
- **Interactive Block with reset**



Similarly, a Prefilter Policy can contain one or more rules and the possible actions are shown in the image:



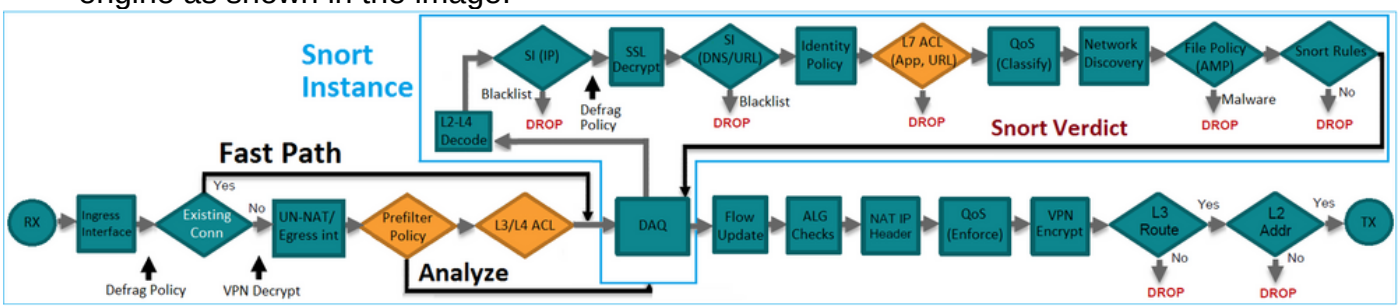
How ACP and Prefilter Policy Interact

The Prefilter Policy was introduced in the 6.1 version and serves 2 main purposes:

1. It allows the inspection of tunneled traffic where the FTD LINA engine checks the outer IP header while the Snort engine checks the inner IP header. More specifically, in the case of tunneled traffic (for example GRE) the rules in the Prefilter Policy always act on the **outer headers,** while the rules in the ACP are always applicable to the inside sessions **(inner headers).** The tunneled traffic refers to these protocols:

- GRE
- IP-in-IP
- IPv6-in-IP
- Teredo Port 3544

2. It provides Early Access Control (EAC) which allows the flow to completely bypass the Snort engine as shown in the image.



The Prefilter Rules are deployed on FTD as L3/L4 Access Control Elements (ACEs) and precede

the configured L3/L4 ACEs as shown in the image:

```
firepower# show access-list
access-list CSM_FW_ACL_ line 1 remark rule-id 268434457: PREFILTER POLICY: FTD_Prefilter_Policy
access-list CSM_FW_ACL_ line 2 remark rule-id 268434457: RULE: Fastpath_Rule1
access-list CSM_FW_ACL_ line 3 advanced trust ip host 192.168.75.16 any rule-id 268434457 event-log both (hitcnt=0)
access-list CSM_FW_ACL_ line 4 remark rule-id 268434456: PREFILTER POLICY: FTD_Prefilter_Policy
access-list CSM_FW_ACL_ line 5 remark rule-id 268434456: RULE: DEFAULT TUNNEL ACTION RULE
access-list CSM_FW_ACL_ line 6 advanced permit ipinip any any rule-id 268434456 (hitcnt=0) 0xf5b597d6
access-list CSM_FW_ACL_ line 7 advanced permit 41 any any rule-id 268434456 (hitcnt=0) 0x06095aba
access-list CSM_FW_ACL_ line 8 advanced permit gre any any rule-id 268434456 (hitcnt=2) 0x52c7a066
access-list CSM_FW_ACL_ line 9 advanced permit udp any any eq 3544 rule-id 268434456 (hitcnt=0) 0xcf6309bc
access-list CSM_FW_ACL_ line 10 remark rule-id 268434445: ACCESS POLICY: FTD5506-1 - Mandatory/1
access-list CSM_FW_ACL_ line 12 advanced deny ip host 10.1.1.1 any rule-id 268434445 event-log flow-start (hitcnt=0) 0x8bf72c63
access-list CSM_FW_ACL_ line 14 remark rule-id 268434434: L4 RULE: DEFAULT ACTION RULE
access-list CSM_FW_ACL_ line 15 advanced permit ip any any rule-id 268434434 (hitcnt=410) 0xa1d3780e
```

Prefilter Rules

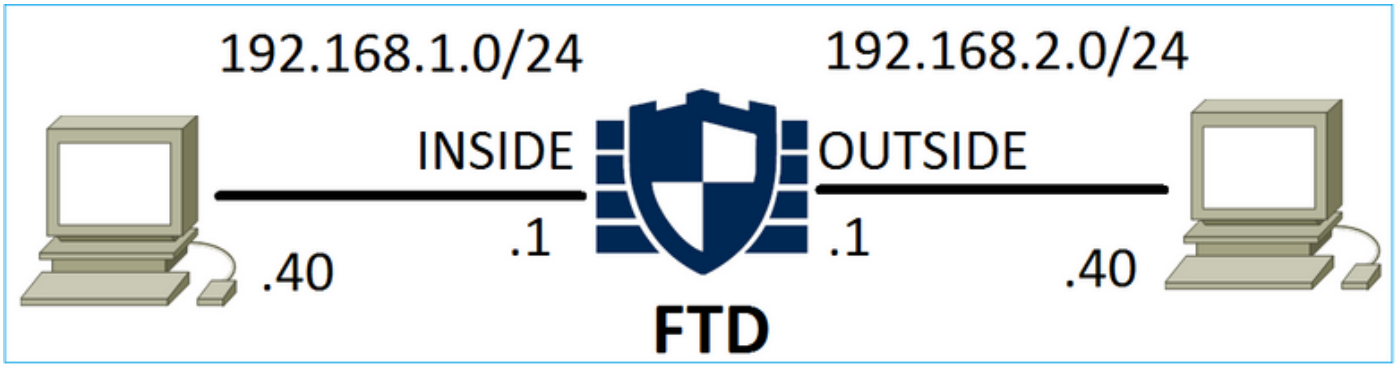
Tunnel Prefilter Rules

L3/L4 ACEs

Note: Prefilter v/s ACP rules = the first match is applied.

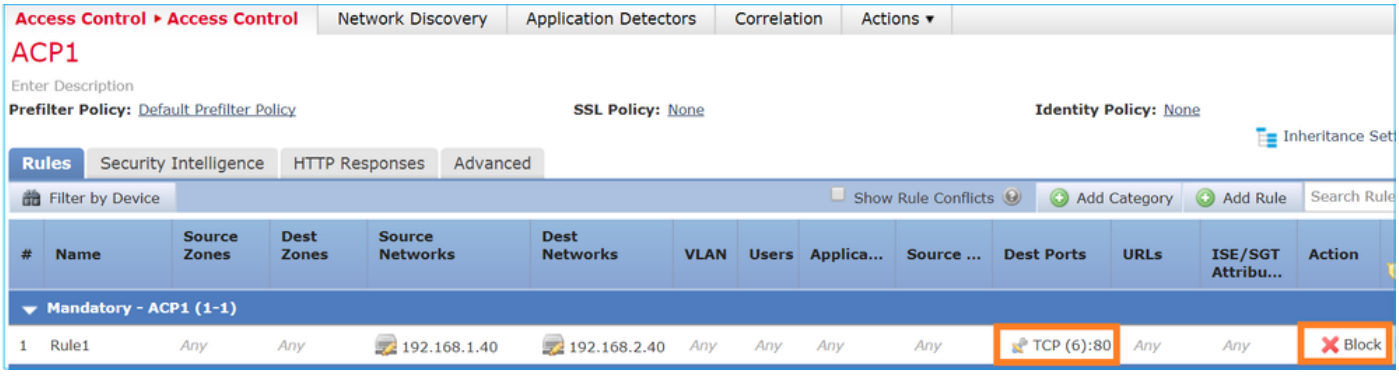
ACP Block Action

Consider the topology shown in this image:



Scenario 1. Early LINA Drop

The ACP contains a Block rule which uses an L4 condition (Destination Port TCP 80) as shown in the image:



The deployed policy in Snort:

```
268435461 deny any 192.168.1.40 32 any any 192.168.2.40 32 80 any 6
```

The deployed policy in LINA. Note that the rule is pushed as **deny** action:

```
firepower# show access-list
…
```

```
access-list CSM_FW_ACL_ line 9 remark rule-id 268435461: L4 RULE: Rule1
access-list CSM_FW_ACL_ line 10 advanced deny tcp host 192.168.1.40 host 192.168.2.40 eq www
rule-id 268435461 event-log flow-start (hitcnt=0) 0x6149c43c
```

Verify Behavior:

When host-A (192.168.1.40) tries to open an HTTP session to host-B (192.168.2.40) the TCP synchronize (SYN) packets are dropped by the FTD LINA engine and do reach the Snort Engine or the destination:

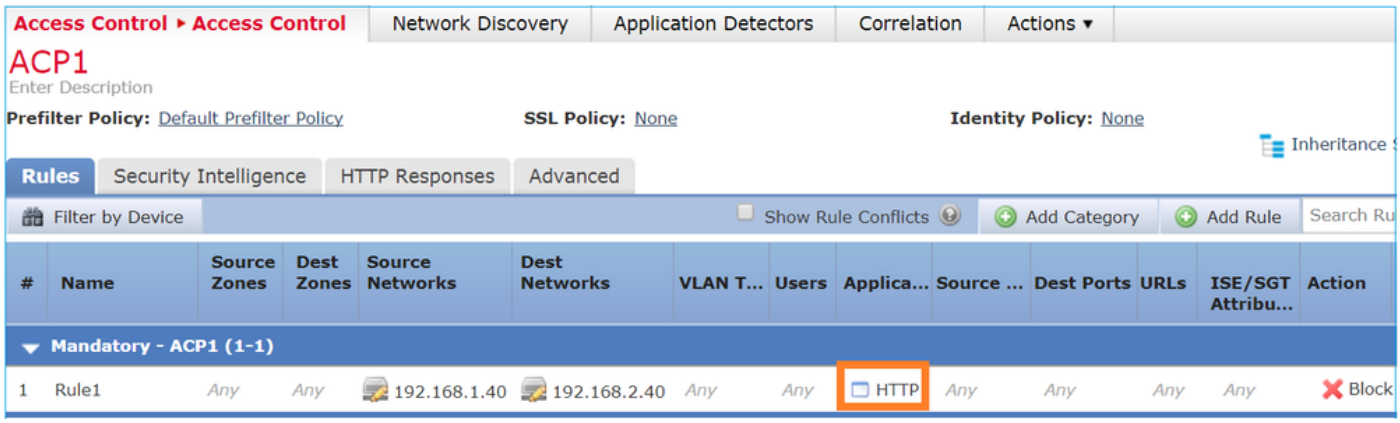
```
firepower# show capture
capture CAPI type raw-data buffer 33554432 trace trace-count 100 interface INSIDE [Capturing -
430 bytes]
  match ip host 192.168.1.40 any
capture CAPO type raw-data buffer 33554432 trace trace-count 100 interface OUTSIDE [Capturing -
0 bytes]
  match ip host 192.168.1.40 any
```

```
firepower# show capture CAPI
   1: 11:08:09.672801  192.168.1.40.32789 > 192.168.2.40.80: S 3249160620:3249160620(0) win 2920
<mss 1460,sackOK,timestamp 4060517 0>
   2: 11:08:12.672435  192.168.1.40.32789 > 192.168.2.40.80: S 3249160620:3249160620(0) win 2920
<mss 1460,sackOK,timestamp 4063517 0>
   3: 11:08:18.672847  192.168.1.40.32789 > 192.168.2.40.80: S 3249160620:3249160620(0) win 2920
<mss 1460,sackOK,timestamp 4069517 0>
   4: 11:08:30.673610  192.168.1.40.32789 > 192.168.2.40.80: S 3249160620:3249160620(0) win 2920
<mss 1460,sackOK,timestamp 4081517 0>
```

```
firepower# show capture CAPI packet-number 1 trace
   1: 11:08:09.672801  192.168.1.40.32789 > 192.168.2.40.80: S 3249160620:3249160620(0) win 2920
<mss 1460,sackOK,timestamp 4060517 0>
...

Phase: 4
Type: ACCESS-LIST
Subtype: log
Result: DROP
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced deny tcp host 192.168.1.40 host 192.168.2.40 eq www rule-id
268435461 event-log flow-start
access-list CSM_FW_ACL_ remark rule-id 268435461: ACCESS POLICY: ACP1 - Mandatory
access-list CSM_FW_ACL_ remark rule-id 268435461: L4 RULE: Rule1
Additional Information:
                            <- No Additional Information = No Snort Inspection

Result:
input-interface: INSIDE
input-status: up
input-line-status: up
output-interface: OUTSIDE
output-status: up
output-line-status: up
Action: drop
Drop-reason: (acl-drop) Flow is denied by configured rule
```

Scenario 2. Drop Due to Snort Verdict

The ACP contains a Block rule which uses an L7 condition (Application HTTP) as shown in the image:



The deployed policy in Snort:

```
268435461 deny any 192.168.1.40 32 any any 192.168.2.40 32 any any any  (appid 676:1)
```

Appid 676:1 = HTTP

The deployed policy in LINA.

> **Note**: The rule is pushed as a **permit** action because LINA cannot determine that the session uses HTTP. On FTD the Application Detection mechanism is in the Snort engine.

```
firepower# show access-list
…
access-list CSM_FW_ACL_ line 9 remark rule-id 268435461: L7 RULE: Rule1
access-list CSM_FW_ACL_ line 10 advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id
268435461 (hitcnt=0) 0xb788b786
```

For a Block rule that uses **Application** as a condition, the trace of a real packet shows that the session is dropped by the LINA due to the Snort engine verdict.

> **Note**: In order for the Snort engine to determine the application it has to inspect a few packets (usually 3-10 which depends on the application decoder). Thus a few packets are allowed through the FTD and they make it to the destination. The allowed packets are still subject to the Intrusion Policy check based on the **Access Policy > Advanced > 'Intrusion Policy used before Access Control rule is determined'** option.

Verify Behavior:

When host-A (192.168.1.40) tries to establish an HTTP session with host-B (192.168.2.40) the LINA ingress capture shows:

```
firepower# show capture CAPI

8 packets captured

   1: 11:31:19.825564  192.168.1.40.32790 > 192.168.2.40.80: S 357753151:357753151(0) win 2920
```

```
<mss 1460,sackOK,timestamp 5450579 0>
   2: 11:31:19.826403  192.168.2.40.80 > 192.168.1.40.32790: S 1283931030:1283931030(0) ack
357753152 win 2896 <mss 1380,sackOK,timestamp 5449236 5450579>
   3: 11:31:19.826556  192.168.1.40.32790 > 192.168.2.40.80: P 357753152:357753351(199) ack
1283931031 win 2920 <nop,nop,timestamp 5450580 5449236>
   4: 11:31:20.026899  192.168.1.40.32790 > 192.168.2.40.80: P 357753152:357753351(199) ack
1283931031 win 2920 <nop,nop,timestamp 5450781 5449236>
   5: 11:31:20.428887  192.168.1.40.32790 > 192.168.2.40.80: P 357753152:357753351(199) ack
1283931031 win 2920 <nop,nop,timestamp 5451183 5449236>
 ...
```

The egress capture:

```
firepower# show capture CAPO

5 packets captured

   1: 11:31:19.825869  192.168.1.40.32790 > 192.168.2.40.80: S 1163713179:1163713179(0) win 2920
<mss 1380,sackOK,timestamp 5450579 0>
   2: 11:31:19.826312  192.168.2.40.80 > 192.168.1.40.32790: S 354801457:354801457(0) ack
1163713180 win 2896 <mss 1460,sackOK,timestamp 5449236 5450579>
   3: 11:31:23.426049  192.168.2.40.80 > 192.168.1.40.32790: S 354801457:354801457(0) ack
1163713180 win 2896 <mss 1460,sackOK,timestamp 5452836 5450579>
   4: 11:31:29.426430  192.168.2.40.80 > 192.168.1.40.32790: S 354801457:354801457(0) ack
1163713180 win 2896 <mss 1460,sackOK,timestamp 5458836 5450579>
   5: 11:31:41.427208  192.168.2.40.80 > 192.168.1.40.32790: S 354801457:354801457(0) ack
1163713180 win 2896 <mss 1460,sackOK,timestamp 5470836 5450579>
```

The trace shows that the first packet (TCP SYN) is allowed by the Snort since the Application Detection verdict has not been reached yet:

```
firepower# show capture CAPI packet-number 1 trace
   1: 11:31:19.825564  192.168.1.40.32790 > 192.168.2.40.80: S 357753151:357753151(0) win 2920
<mss 1460,sackOK,timestamp 5450579 0>
...

Phase: 4
Type: ACCESS-LIST
Subtype: log
Result: ALLOW
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id 268435461
access-list CSM_FW_ACL_ remark rule-id 268435461: ACCESS POLICY: ACP1 - Mandatory
access-list CSM_FW_ACL_ remark rule-id 268435461: L7 RULE: Rule1
Additional Information:
 This packet will be sent to snort for additional processing where a verdict will be reached
...
Phase: 10
Type: FLOW-CREATION
Subtype:
Result: ALLOW
Config:
Additional Information:
New flow created with id 23194, packet dispatched to next module
…
Phase: 12
Type: SNORT
Subtype:
```

```
Result: ALLOW
Config:
Additional Information:
Snort Trace:
Packet: TCP, SYN, seq 357753151
AppID: service unknown (0), application unknown (0)
Firewall: starting rule matching, zone -1 -> -1, geo 0 -> 0, vlan 0, sgt 65535, user 9999997,
icmpType 0, icmpCode 0
Firewall: pending rule-matching, id 268435461, pending AppID
NAP id 1, IPS id 0, Verdict PASS
Snort Verdict: (pass-packet) allow this packet

Result:
input-interface: OUTSIDE
input-status: up
input-line-status: up
output-interface: OUTSIDE
output-status: up
output-line-status: up
Action: allow
```

The same for the TCP SYN/ACK packet:

```
firepower# show capture CAPO packet-number 2 trace
   2: 11:31:19.826312 192.168.2.40.80 > 192.168.1.40.32790: S 354801457:354801457(0) ack
1163713180 win 2896 <mss 1460,sackOK,timestamp 5449236 5450579>
…

Phase: 3
Type: FLOW-LOOKUP
Subtype:
Result: ALLOW
Config:
Additional Information:
Found flow with id 23194, using existing flow
…

Phase: 5
Type: SNORT
Subtype:
Result: ALLOW
Config:
Additional Information:
Snort Trace:
Packet: TCP, SYN, ACK, seq 1283931030, ack 357753152
AppID: service unknown (0), application unknown (0)
Firewall: starting rule matching, zone -1 -> -1, geo 0 -> 0, vlan 0, sgt 65535, user 9999997,
icmpType 0, icmpCode 0
Firewall: pending rule-matching, id 268435461, pending AppID
NAP id 1, IPS id 0, Verdict PASS
Snort Verdict: (pass-packet) allow this packet

Result:
input-interface: INSIDE
input-status: up
input-line-status: up
output-interface: INSIDE
output-status: up
output-line-status: up
Action: allow
```

Snort returns a DROP verdict once an inspection of the third packet completes:

```
firepower# show capture CAPI packet-number 3 trace
   3: 11:31:19.826556  192.168.1.40.32790 > 192.168.2.40.80: P 357753152:357753351(199) ack
1283931031 win 2920 <nop,nop,timestamp 5450580 5449236>

Phase: 3
Type: FLOW-LOOKUP
Subtype:
Result: ALLOW
Config:
Additional Information:
Found flow with id 23194, using existing flow

Phase: 5
Type: SNORT
Subtype:
Result: DROP
Config:
Additional Information:
Snort Trace:
Packet: TCP, ACK, seq 357753152, ack 1283931031
AppID: service HTTP (676), application unknown (0)
Firewall: starting rule matching, zone -1 -> -1, geo 0(0) -> 0, vlan 0, sgt 65535, user 9999997,
url http://192.168.2.40/128k.html
Firewall: block rule, id 268435461, drop
Snort: processed decoder alerts or actions queue, drop
NAP id 1, IPS id 0, Verdict BLOCKLIST, Blocked by Firewall
Snort Verdict: (block-list) block list this flow

Result:
input-interface: INSIDE
input-status: up
input-line-status: up
Action: drop
Drop-reason: (firewall) Blocked by the firewall preprocessor
```

You can also run the command **system support trace** from FTD CLISH mode. This tool provides 2 functions:

- Shows the Snort verdict for each packet as it is sent to the Data Acquisition library (DAQ) and seen in LINA. DAQ is a component located between the FTD LINA engine and the Snort engine
- Allows to run **system support firewall-engine-debug** at the same time to see what happens within the Snort engine itself

Here is the output:

```
> system support trace

Please specify an IP protocol: tcp
Please specify a client IP address: 192.168.1.40
Please specify a client port:
Please specify a server IP address: 192.168.2.40
Please specify a server port:
Enable firewall-engine-debug too? [n]: y
Monitoring packet tracer debug messages

Tracing enabled by Lina
```

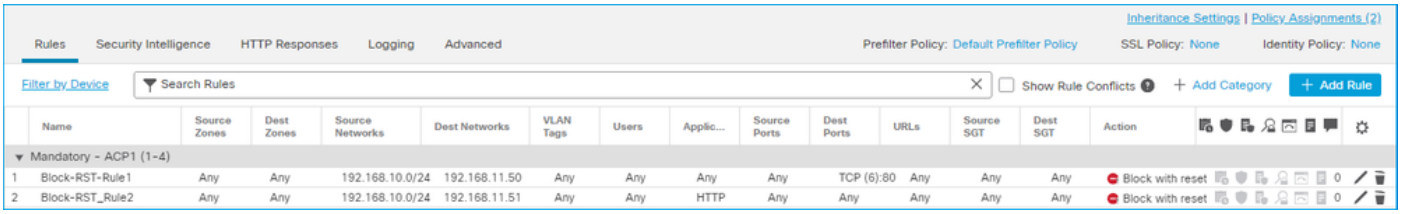
```
192.168.2.40-80 - 192.168.1.40-32791 6 Packet: TCP, SYN, seq 2620409313
192.168.2.40-80 - 192.168.1.40-32791 6 AppID: service unknown (0), application unknown (0)
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 New session
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 Starting with minimum 2, 'Rule1', and SrcZone
first with zones -1 -> -1, geo 0 -> 0, vlan 0, inline sgt tag: untagged, ISE sgt id: 0, svc 0,
payload 0, client 0, misc 0, user 9999997, icmpType 0, icmpCode 0
192.168.1.40-32791 > 192.168.2.40-80 6 Firewall: starting rule matching, zone -1 -> -1, geo 0 ->
0, vlan 0, sgt 65535, user 9999997, icmpType 0, icmpCode 0
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 pending rule order 2, 'Rule1', AppID
192.168.1.40-32791 > 192.168.2.40-80 6 Firewall: pending rule-matching, 'Rule1', pending AppID
192.168.1.40-32791 > 192.168.2.40-80 6 NAP id 1, IPS id 0, Verdict PASS
Trace buffer and verdict reason are sent to DAQ's PDTS

Tracing enabled by Lina
192.168.2.40-80 - 192.168.1.40-32791 6 Packet: TCP, SYN, ACK, seq 3700371680, ack 2620409314
192.168.2.40-80 - 192.168.1.40-32791 6 AppID: service unknown (0), application unknown (0)
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 Starting with minimum 2, 'Rule1', and SrcZone
first with zones -1 -> -1, geo 0 -> 0, vlan 0, inline sgt tag: untagged, ISE sgt id: 0, svc 0,
payload 0, client 0, misc 0, user 9999997, icmpType 0, icmpCode 0
192.168.1.40-32791 > 192.168.2.40-80 6 Firewall: starting rule matching, zone -1 -> -1, geo 0 ->
0, vlan 0, sgt 65535, user 9999997, icmpType 0, icmpCode 0
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 pending rule order 2, 'Rule1', AppID
192.168.1.40-32791 > 192.168.2.40-80 6 Firewall: pending rule-matching, 'Rule1', pending AppID
192.168.1.40-32791 > 192.168.2.40-80 6 NAP id 1, IPS id 0, Verdict PASS
Trace buffer and verdict reason are sent to DAQ's PDTS

Tracing enabled by Lina
192.168.2.40-80 - 192.168.1.40-32791 6 Packet: TCP, ACK, seq 2620409314, ack 3700371681
192.168.2.40-80 - 192.168.1.40-32791 6 AppID: service HTTP (676), application unknown (0)
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 Starting with minimum 2, 'Rule1', and SrcZone
first with zones -1 -> -1, geo 0(0) -> 0, vlan 0, inline sgt tag: untagged, ISE sgt id: 0, svc
676, payload 0, client 686, misc 0, user 9999997, url http://192.168.2.40/128k.html, xff
192.168.1.40-32791 > 192.168.2.40-80 6 Firewall: starting rule matching, zone -1 -> -1, geo 0(0)
-> 0, vlan 0, sgt 65535, user 9999997, url http://192.168.2.40/128k.html
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 match rule order 2, 'Rule1', action Block
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 deny action
192.168.1.40-32791 > 192.168.2.40-80 6 Firewall: block rule, 'Rule1', drop
192.168.1.40-32791 > 192.168.2.40-80 6 Snort: processed decoder alerts or actions queue, drop
192.168.1.40-32791 > 192.168.2.40-80 6 AS 1 I 0 Deleting session
192.168.1.40-32791 > 192.168.2.40-80 6 NAP id 1, IPS id 0, Verdict BLOCKLIST
192.168.1.40-32791 > 192.168.2.40-80 6 ===> Blocked by Firewall
```

Summary

- The ACP Block Action gets deployed as either permit or deny rule in LINA which depends on the rule conditions
- If the conditions are L3/L4 then the LINA blocks the packet. In the case of TCP, the first packet (TCP SYN) is blocked
- If the conditions are L7 then the packet is forwarded to the Snort engine for further inspection. In the case of TCP, a few packets are allowed through FTD until Snort reaches a verdict. The allowed packets are still subject to the Intrusion Policy check based on the **Access Policy > Advanced > 'Intrusion Policy used before Access Control rule is determined'** option.

ACP Block with reset Action

A Block with rest rule configured on FMC UI:



The Block with reset rule is deployed on FTD LINA engine as a **permit** and to Snort engine as a **reset** rule:

```
firepower# show access-list
…
access-list CSM_FW_ACL_ line 10 advanced permit tcp 192.168.10.0 255.255.255.0 host
192.168.11.50 eq www rule-id 268438864 (hitcnt=0) 0xba785fc0
access-list CSM_FW_ACL_ line 11 remark rule-id 268438865: ACCESS POLICY: ACP1 - Mandatory
access-list CSM_FW_ACL_ line 12 remark rule-id 268438865: L7 RULE: Block-RST_Rule2
access-list CSM_FW_ACL_ line 13 advanced permit ip 192.168.10.0 255.255.255.0 host 192.168.11.51
rule-id 268438865 (hitcnt=0) 0x622350d0
```

Snort engine:

```
admin@firepower:~$ cat /var/sf/detection_engines/9e080e5c-adc3-11ea-9d37-44884cf7e9ba/ngfw.rules
…
# Start of AC rule.
268438864 reset any 192.168.10.0 24 any any 192.168.11.50 32 80 any 6
# End rule 268438864
268438865 reset any 192.168.10.0 24 any any 192.168.11.51 32 any any any (appid 676:1)
(ip_protos 6, 17)
# End rule 268438865
```

When a packet matches Block with reset rule FTD sends a **TCP Reset** packet or an **ICMP Type 3 Code 13** Destination Unreachable (Administratively filtered) message:

```
root@kali:~/tests# wget 192.168.11.50/file1.zip
--2020-06-20 22:48:10--  http://192.168.11.50/file1.zip
Connecting to 192.168.11.50:80... failed: Connection refused.
```

Here is a capture taken on the FTD ingress interface:

```
firepower# show capture CAPI
2 packets captured
1: 21:01:00.977259 802.1Q vlan#202 P0 192.168.10.50.41986 > 192.168.11.50.80: S
3120295488:3120295488(0) win 29200 <mss 1460,sackOK,timestamp 3740873275 0,nop,wscale 7>
2: 21:01:00.978114 802.1Q vlan#202 P0 192.168.11.50.80 > 192.168.10.50.41986: R 0:0(0) ack
3120295489 win 0 2 packets shown
```

System support trace output, in this case, shows that the packet is dropped due to the Snort verdict:

```
> system support trace

Enable firewall-engine-debug too? [n]: y
Please specify an IP protocol: tcp
Please specify a client IP address: 192.168.10.50
Please specify a client port:
```

```
Please specify a server IP address: 192.168.11.50
Please specify a server port:
Monitoring packet tracer and firewall debug messages


192.168.10.50-41984 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, SYN, seq 3387496622
192.168.10.50-41984 - 192.168.11.50-80 6 AS 1-1 CID 0 Session: new snort session
192.168.10.50-41984 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.10.50-41984 > 192.168.11.50-80 6 AS 1-1 I 9 new firewall session
192.168.10.50-41984 > 192.168.11.50-80 6 AS 1-1 I 9 using HW or preset rule order 2, 'Block-RST-
Rule1', action Reset and prefilter rule 0
192.168.10.50-41984 > 192.168.11.50-80 6 AS 1-1 I 9 HitCount data sent for rule id: 268438864,
192.168.10.50-41984 > 192.168.11.50-80 6 AS 1-1 I 9 reset action
192.168.10.50-41984 > 192.168.11.50-80 6 AS 1-1 I 9 deleting firewall session flags = 0x0,
fwFlags = 0x0
192.168.10.50-41984 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: block w/ reset rule, 'Block-RST-
Rule1', drop
192.168.10.50-41984 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort: processed decoder alerts or actions
queue, drop
192.168.10.50-41984 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 9, NAP id 1, IPS id 0, Verdict
BLOCKLIST
192.168.10.50-41984 - 192.168.11.50-80 6 AS 1-1 CID 0 ===> Blocked by Firewall
Verdict reason is sent to DAQ
```

Use Cases

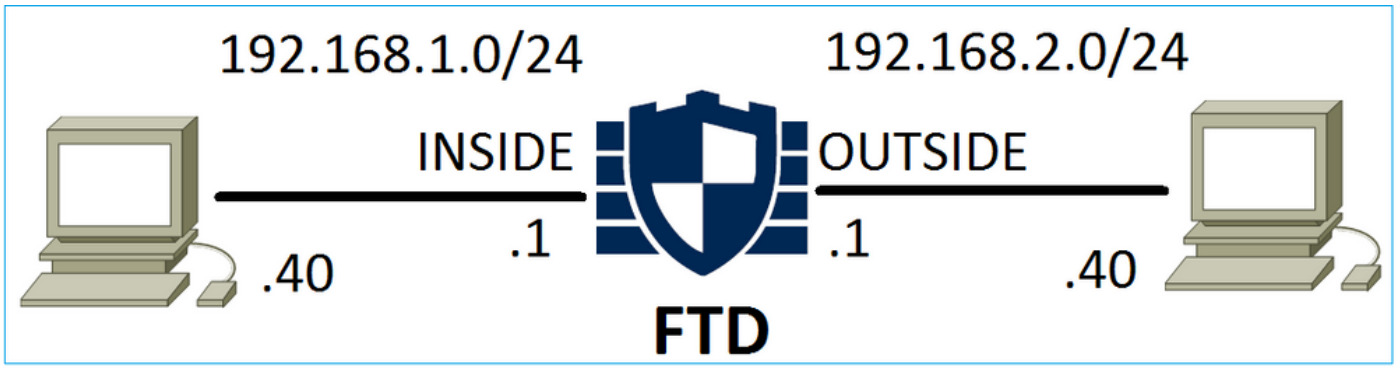
Same as **Block** action, but terminates immediately the connection.

ACP Allow Action

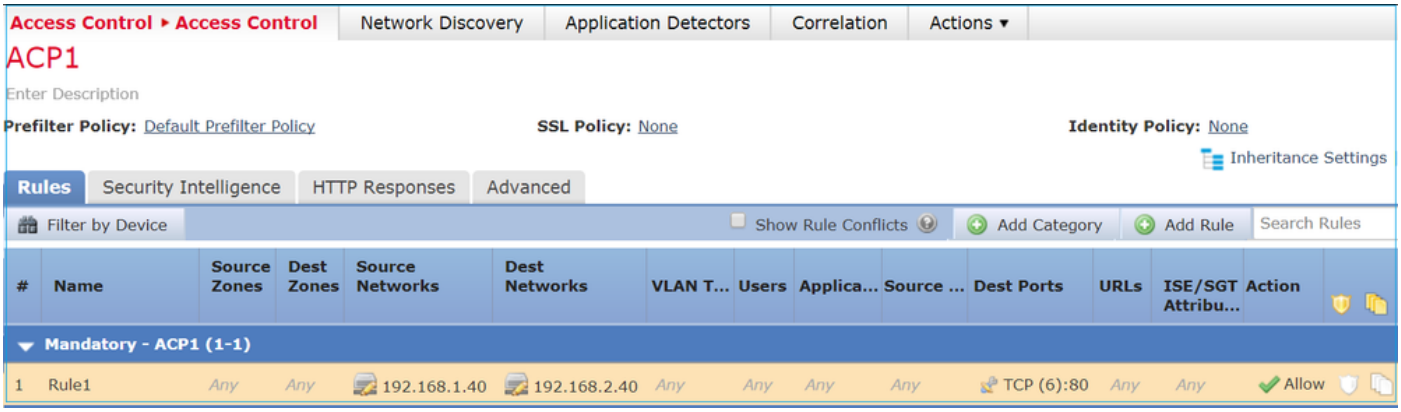
Scenario 1. ACP Allow Action (L3/L4 Conditions)

Normally, you would configure an Allow rule to specify additional inspections like an Intrusion Policy and/or a File Policy. This first scenario demonstrates the operation of an Allow rule when an L3/L4 condition is applied.

Consider this topology as shown in the image:



This policy is applied as shown in the image:



The deployed policy in Snort. Note that the rule is deployed as an **allow** action:

```
# Start of AC rule.
268435461 allow any 192.168.1.40 32 any any 192.168.2.40 32 80 any 6
```

The policy in LINA.

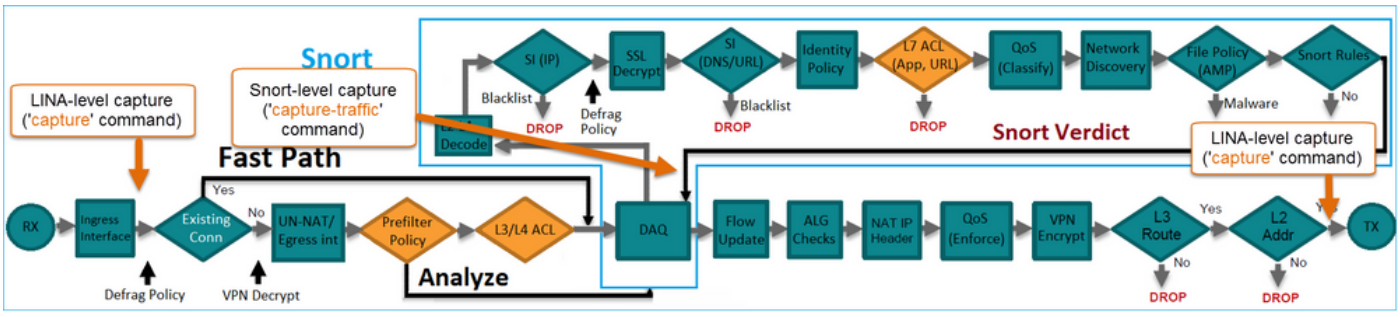
> **Note**: The rule is deployed as a **permit** action which essentially means redirection to Snort for further inspection.

```
firepower# show access-list
…
access-list CSM_FW_ACL_ line 9 remark rule-id 268435461: L7 RULE: Rule1
access-list CSM_FW_ACL_ line 10 advanced permit tcp host 192.168.1.40 host 192.168.2.40 eq www
rule-id 268435461 (hitcnt=1) 0x641a20c3
```

In order to see how FTD handles a flow that matches an Allow rule there are a few ways:

- Verify Snort Statistics
- With the use of system support trace CLISH tool
- With the use of capture with the trace option in LINA and optionally with capture-traffic in Snort engine

LINA capture vs Snort capture-traffic:



Verify Behavior:

Clear the Snort statistics, enable **system support trace** from CLISH, and initiate an HTTP flow from host-A (192.168.1.40) to host-B (192.168.2.40). All the packets are forwarded to the Snort engine and get the PASS verdict by the Snort:

```
firepower# clear snort statistics

> system support trace

Please specify an IP protocol:
Please specify a client IP address: 192.168.1.40
Please specify a client port:
Please specify a server IP address: 192.168.2.40
Please specify a server port:
Enable firewall-engine-debug too? [n]:
Monitoring packet tracer debug messages

Tracing enabled by Lina
192.168.2.40-80 - 192.168.1.40-32797 6 Packet: TCP, SYN, seq 361134402
192.168.2.40-80 - 192.168.1.40-32797 6 AppID: service unknown (0), application unknown (0)
192.168.1.40-32797 > 192.168.2.40-80 6 Firewall: allow rule, 'Rule1', allow
192.168.1.40-32797 > 192.168.2.40-80 6 NAP id 1, IPS id 0, Verdict PASS
Trace buffer and verdict reason are sent to DAQ's PDTS

Tracing enabled by Lina
192.168.2.40-80 - 192.168.1.40-32797 6 Packet: TCP, SYN, ACK, seq 1591434735, ack 361134403
192.168.2.40-80 - 192.168.1.40-32797 6 AppID: service unknown (0), application unknown (0)
192.168.1.40-32797 > 192.168.2.40-80 6 Firewall: allow rule, 'Rule1', allow
192.168.1.40-32797 > 192.168.2.40-80 6 NAP id 1, IPS id 0, Verdict PASS
Trace buffer and verdict reason are sent to DAQ's PDTS

Tracing enabled by Lina
192.168.2.40-80 - 192.168.1.40-32797 6 Packet: TCP, ACK, seq 361134403, ack 1591434736
192.168.2.40-80 - 192.168.1.40-32797 6 AppID: service HTTP (676), application unknown (0)
192.168.1.40-32797 > 192.168.2.40-80 6 Firewall: allow rule, 'Rule1', allow
192.168.1.40-32797 > 192.168.2.40-80 6 NAP id 1, IPS id 0, Verdict PASS
```

The Pass Packets counters increase:

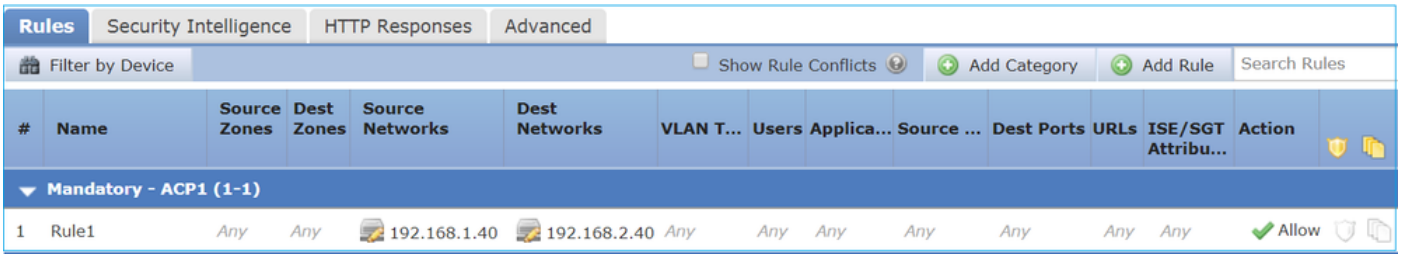
```
> show snort statistics

Packet Counters:
  Passed Packets                                    54
  Blocked Packets                                    0
  Injected Packets                                   0
  Packets bypassed (Snort Down)                      0
  Packets bypassed (Snort Busy)                      0

Flow Counters:
  Fast-Forwarded Flows                               0
  Blocklisted Flows                                  0
...
```

Passed Packets = Inspected by the Snort engine

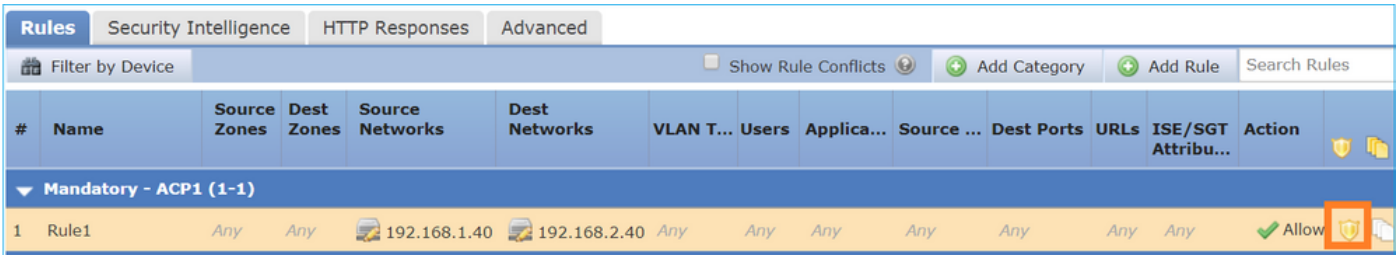
Scenario 2. ACP Allow Action (L3-7 Conditions)

Similar behavior is seen when the Allow rule is deployed as follows.

Only an L3/L4 condition as shown in the image:

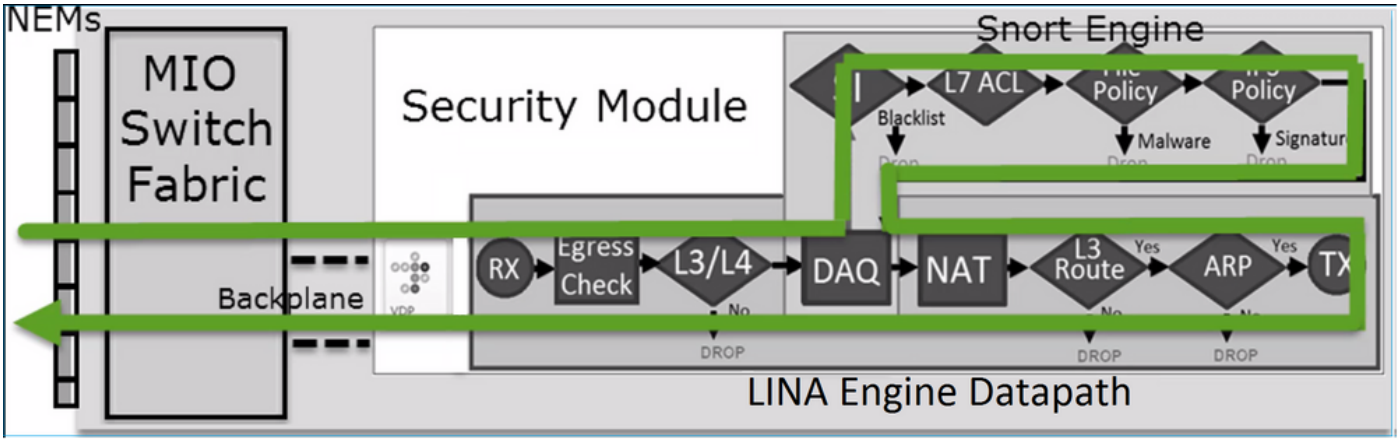


An L7 condition (for example Intrusion Policy, File Policy, Application, etc) is shown in the image:



Summary

In order to summarize, this is how a flow is handled by an FTD deployed on an FP4100/9300 when an Allow rule is matched as shown in the image:



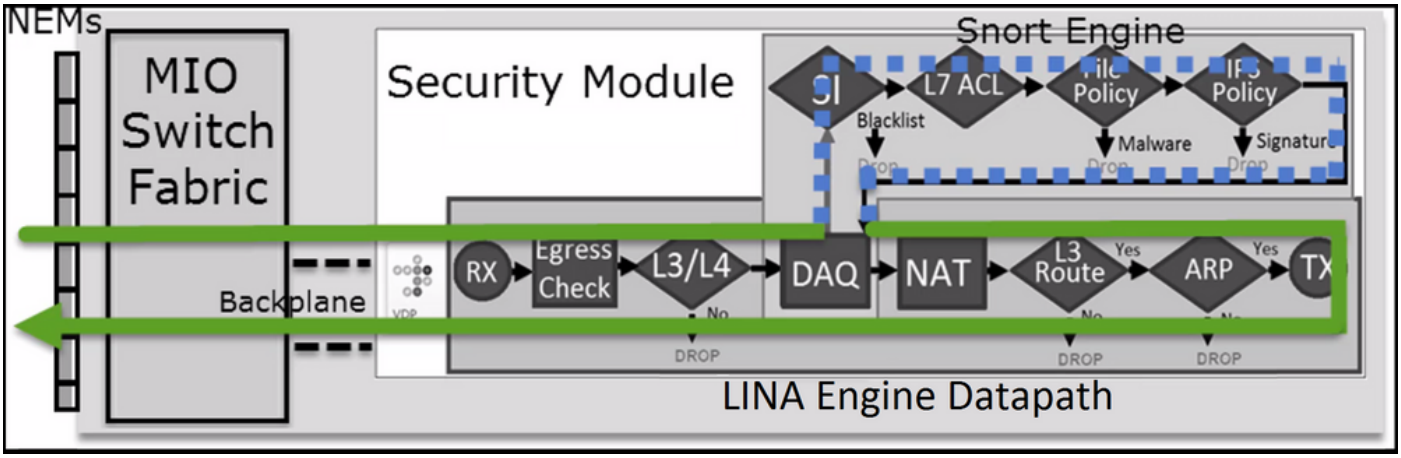
Note: Management Input Output (MIO) is the Supervisor engine of the firepower chassis.

Scenario 3. Snort Fast-Forward verdict with Allow

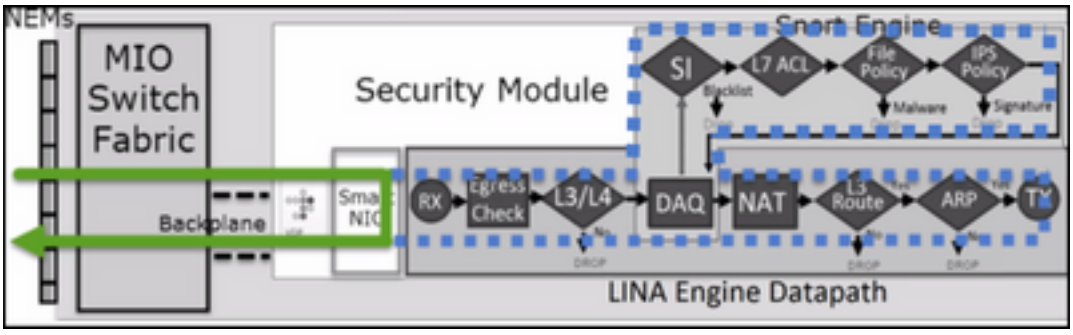
There are specific scenarios where the FTD Snort engine gives a PERMITLIST verdict (fast-forward) and the rest of the flow is offloaded to the LINA engine (in some cases then is offloaded to the HW Accelerator - SmartNIC). These are:

1. SSL traffic without an SSL policy configured
2. Intelligent application bypass (IAB)

This is the visual representation of the packet path:



Or in some cases:



Main Points

- The Allow Rule is deployed as **allow** in Snort and **permit** in LINA
- In most cases, all the packets of a session are forwarded to the Snort engine for additional inspection

Use Cases

You would configure an Allow rule when you need L7 inspection by Snort Engine such as:

- Intrusion Policy
- File Policy

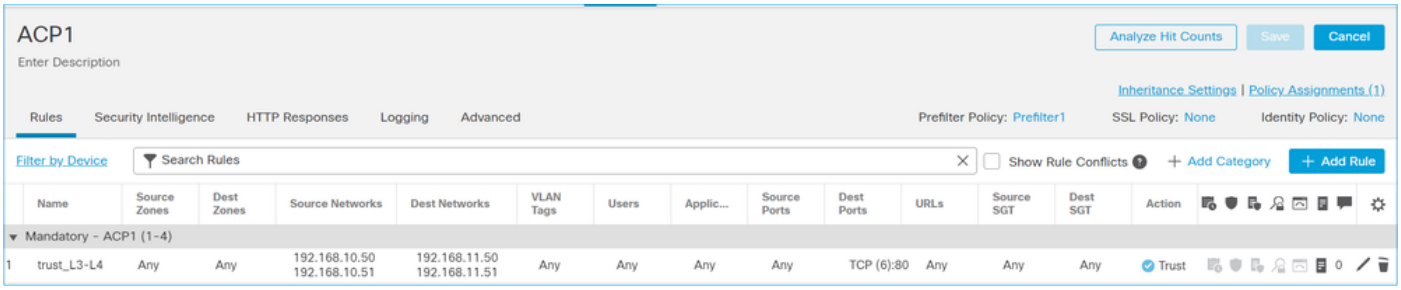
ACP Trust Action

Scenario 1. ACP Trust Action

If you do not want to apply advanced L7 inspection at the Snort level (for example Intrusion Policy, File Policy, Network Discovery), but you still want to use features like Security Intelligence (SI), Identity Policy, QoS, etc, then it is recommended to use the Trust action in your rule.

Topology:

The configured policy:



The Trust rule as it is deployed in FTD Snort engine:

```
# Start of AC rule.
268438858 fastpath any 192.168.10.50 31 any any 192.168.11.50 31 80 any 6 (log dcforward
flowend)
```

Note: The number 6 is the protocol (TCP).

The rule in FTD LINA:

```
firepower# show access-list | i 268438858
access-list CSM_FW_ACL_ line 17 remark rule-id 268438858: ACCESS POLICY: ACP1 - Mandatory
access-list CSM_FW_ACL_ line 18 remark rule-id 268438858: L7 RULE: trust_L3-L4
access-list CSM_FW_ACL_ line 19 advanced permit tcp object-group FMC_INLINE_src_rule_268438858
object-group FMC_INLINE_dst_rule_268438858 eq www rule-id 268438858 (hitcnt=19) 0x29588b4f
  access-list CSM_FW_ACL_ line 19 advanced permit tcp host 192.168.10.50 host 192.168.11.50 eq
www rule-id 268438858 (hitcnt=19) 0x9d442895
  access-list CSM_FW_ACL_ line 19 advanced permit tcp host 192.168.10.50 host 192.168.11.51 eq
www rule-id 268438858 (hitcnt=0) 0xd026252b
  access-list CSM_FW_ACL_ line 19 advanced permit tcp host 192.168.10.51 host 192.168.11.50 eq
www rule-id 268438858 (hitcnt=0) 0x0d785cc4
  access-list CSM_FW_ACL_ line 19 advanced permit tcp host 192.168.10.51 host 192.168.11.51 eq
www rule-id 268438858 (hitcnt=0) 0x3b3234f1
```

Verification:

Enable **system support trace** and initiate an HTTP session from host-A (192.168.10.50) to host-B (192.168.11.50). There are 3 packets forwarded to the Snort engine. Snort engine sends to LINA the PERMITLIST verdict which essentially offloads the rest of the flow to the LINA engine:

```
> system support trace

Enable firewall-engine-debug too? [n]: y
Please specify an IP protocol: tcp
Please specify a client IP address: 192.168.10.50
Please specify a client port:
Please specify a server IP address: 192.168.11.50
Please specify a server port: 80
Monitoring packet tracer and firewall debug messages

192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, SYN, seq 453426648
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Session: new snort session
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.10.50-42126 > 192.168.11.50-80 6 AS 1-1 I 2 new firewall session
192.168.10.50-42126 > 192.168.11.50-80 6 AS 1-1 I 2 using HW or preset rule order 5, 'trust_L3-
L4', action Trust and prefilter rule 0
192.168.10.50-42126 > 192.168.11.50-80 6 AS 1-1 I 2 HitCount data sent for rule id: 268438858,
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: trust/fastpath rule, 'trust_L3-
L4', allow
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 2, NAP id 2, IPS id 0, Verdict
PASS

192.168.11.50-80 - 192.168.10.50-42126 6 AS 1-1 CID 0 Packet: TCP, SYN, ACK, seq 2820426532, ack
453426649
192.168.11.50-80 - 192.168.10.50-42126 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.11.50-80 - 192.168.10.50-42126 6 AS 1-1 CID 0 Firewall: trust/fastpath rule, 'trust_L3-
L4', allow
192.168.11.50-80 - 192.168.10.50-42126 6 AS 1-1 CID 0 Snort id 2, NAP id 2, IPS id 0, Verdict
PASS

192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, ACK, seq 453426649, ack
2820426533
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: trust/fastpath rule, 'trust_L3-
L4', allow
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 2, NAP id 2, IPS id 0, Verdict
PERMITLIST
```

Once the connection is terminated the Snort engine gets the metadata info from the LINA engine and deletes the session:

```
192.168.10.50-42126 > 192.168.11.50-80 6 AS 1-1 I 2 Got end of flow event from hardware with
flags 00010001. Rule Match Data: rule_id 0, rule_action 0 rev_id 0, rule_flags 3
192.168.10.50-42126 > 192.168.11.50-80 6 AS 1-1 I 2 Logging EOF for event from hardware with
rule_id = 268438858 ruleAction = 3 ruleReason = 0
192.168.10.50-42126 > 192.168.11.50-80 6 AS 1-1 I 2 : Received EOF, deleting the snort session.

192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Session: deleting snort session, reason:
timeout
192.168.10.50-42126 > 192.168.11.50-80 6 AS 1-1 I 2 deleting firewall session flags = 0x10003,
fwFlags = 0x1115
192.168.10.50-42126 - 192.168.11.50-80 6 AS 1-1 CID 0 Session: deleted snort session using 0
bytes; protocol id:(-1) : LWstate 0xf LWFlags 0x6007
```

Snort capture shows the 3 packets that go to the Snort engine:

```
> capture-traffic

Please choose domain to capture traffic from:
  0 - management0
  1 - management1
  2 - Global

Selection? 2

Please specify tcpdump options desired.
(or enter '?' for a list of supported options)
Options: -n vlan and (host 192.168.10.50 and host 192.168.11.50)
10:26:16.525928 IP 192.168.10.50.42144 > 192.168.11.50.80: Flags [S], seq 3065553465, win 29200,
options [mss 1380,sackOK,TS val 3789188468 ecr 0,nop,wscale 7], length 0
10:26:16.525928 IP 192.168.11.50.80 > 192.168.10.50.42144: Flags [S.], seq 3581351172, ack
3065553466, win 8192, options [mss 1380,nop,wscale 8,sackOK,TS val 57650410 ecr 3789188468],
length 0
10:26:16.525928 IP 192.168.10.50.42144 > 192.168.11.50.80: Flags [.], ack 1, win 229, options
[nop,nop,TS val 3789188470 ecr 57650410], length 0
```

LINA capture shows the flow which goes through it:

```
firepower# show capture CAPI

437 packets captured

   1: 09:51:19.431007  802.1Q vlan#202 P0 192.168.10.50.42118 > 192.168.11.50.80: S
2459891187:2459891187(0) win 29200 <mss 1460,sackOK,timestamp 3787091387 0,nop,wscale 7>
   2: 09:51:19.431648  802.1Q vlan#202 P0 192.168.11.50.80 > 192.168.10.50.42118: S
2860907367:2860907367(0) ack 2459891188 win 8192 <mss 1380,nop,wscale 8,sackOK,timestamp
57440579 3787091387>
   3: 09:51:19.431847  802.1Q vlan#202 P0 192.168.10.50.42118 > 192.168.11.50.80: . ack
2860907368 win 229 <nop,nop,timestamp 3787091388 57440579>
   4: 09:51:19.431953  802.1Q vlan#202 P0 192.168.10.50.42118 > 192.168.11.50.80: P
2459891188:2459891337(149) ack 2860907368 win 229 <nop,nop,timestamp 3787091388 57440579>
   5: 09:51:19.444816  802.1Q vlan#202 P0 192.168.11.50.80 > 192.168.10.50.42118: .
2860907368:2860908736(1368) ack 2459891337 win 256 <nop,nop,timestamp 57440580 3787091388>
   6: 09:51:19.444831  802.1Q vlan#202 P0 192.168.11.50.80 > 192.168.10.50.42118: .
2860908736:2860910104(1368) ack 2459891337 win 256 <nop,nop,timestamp 57440580 3787091388>

…
```

Trace of the packets from LINA is another way to see the Snort verdicts. The first packet got the PASS verdict:

```
firepower# show capture CAPI packet-number 1 trace | i Type|Verdict
Type: CAPTURE
Type: ACCESS-LIST
Type: ROUTE-LOOKUP
Type: ACCESS-LIST
Type: CONN-SETTINGS
Type: NAT
Type: NAT
Type: IP-OPTIONS
Type: CAPTURE
Type: CAPTURE
Type: NAT
Type: CAPTURE
Type: NAT
```

```
Type: IP-OPTIONS
Type: CAPTURE
Type: FLOW-CREATION
Type: EXTERNAL-INSPECT
Type: SNORT
Snort id 22, NAP id 2, IPS id 0, Verdict PASS
Snort Verdict: (pass-packet) allow this packet
Type: INPUT-ROUTE-LOOKUP-FROM-OUTPUT-ROUTE-LOOKUP
Type: ADJACENCY-LOOKUP
Type: CAPTURE
```

Trace of the TCP SYN/ACK packet on the OUTSIDE interface:

```
firepower# show capture CAPO packet-number 2 trace | i Type|Verdict
Type: CAPTURE
Type: ACCESS-LIST
Type: FLOW-LOOKUP
Type: EXTERNAL-INSPECT
Type: SNORT
Snort id 22, NAP id 2, IPS id 0, Verdict PASS
Snort Verdict: (pass-packet) allow this packet
Type: INPUT-ROUTE-LOOKUP-FROM-OUTPUT-ROUTE-LOOKUP
Type: ADJACENCY-LOOKUP
Type: CAPTURE
```

The TCP ACK gets the PERMITLIST verdict:

```
firepower# show capture CAPI packet-number 3 trace | i Type|Verdict
Type: CAPTURE
Type: ACCESS-LIST
Type: FLOW-LOOKUP
Type: EXTERNAL-INSPECT
Type: SNORT
Snort id 22, NAP id 2, IPS id 0, Verdict PERMITLIST
Snort Verdict: (fast-forward) fast forward this flow
Type: CAPTURE
```

This is the full output from the Snort Verdict (packet #3)

```
firepower# show capture CAPI packet-number 3 trace | b Type: SNORT
Type: SNORT
Subtype:
Result: ALLOW
Config:
Additional Information:
Snort Trace:
Packet: TCP, ACK, seq 687485179, ack 1029625865
AppID: service unknown (0), application unknown (0)
Firewall: trust/fastpath rule, id 268438858, allow
Snort id 31, NAP id 2, IPS id 0, Verdict PERMITLIST
Snort Verdict: (fast-forward) fast forward this flow
```

The 4th packet is not forwarded to the Snort engine since the verdict is cached by the LINA engine:

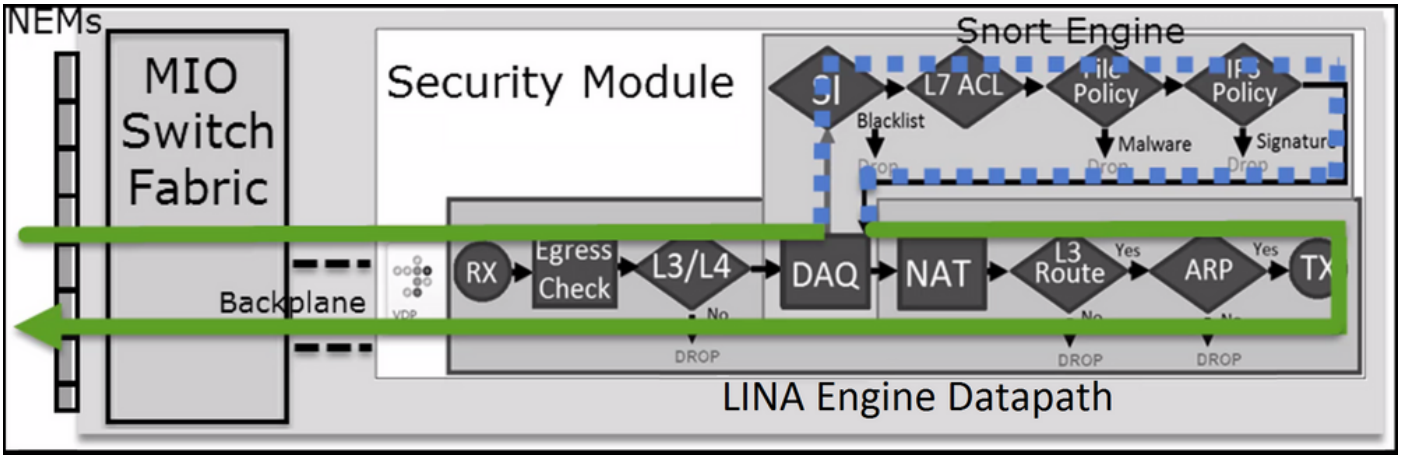
```
firepower# show capture CAPI packet-number 4 trace

441 packets captured

   4: 10:34:02.741523       802.1Q vlan#202 P0 192.168.10.50.42158 > 192.168.11.50.80: P
164375589:164375738(149) ack 3008397532 win 229 <nop,nop,timestamp 3789654678 57697031>
Phase: 1
Type: CAPTURE
Subtype:
Result: ALLOW
Config:
Additional Information:
MAC Access list

Phase: 2
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Config:
Implicit Rule
Additional Information:
MAC Access list

Phase: 3
Type: FLOW-LOOKUP
Subtype:
Result: ALLOW
Config:
Additional Information:
Found flow with id 1254, using existing flow

Phase: 4
Type: SNORT
Subtype:
Result: ALLOW
Config:
Additional Information:
Snort Verdict: (fast-forward) fast forward this flow

Result:
input-interface: INSIDE(vrfid:0)
input-status: up
input-line-status: up
Action: allow


1 packet shown
```

Snort statistics confirm this:

```
firepower# show snort statistics

Packet Counters:
  Passed Packets                                         2
  Blocked Packets                                        0
  Injected Packets                                       0
  Packets bypassed (Snort Down)                          0
  Packets bypassed (Snort Busy)                          0

Flow Counters:
  Fast-Forwarded Flows                                   1
  Blacklisted Flows                                      0
```

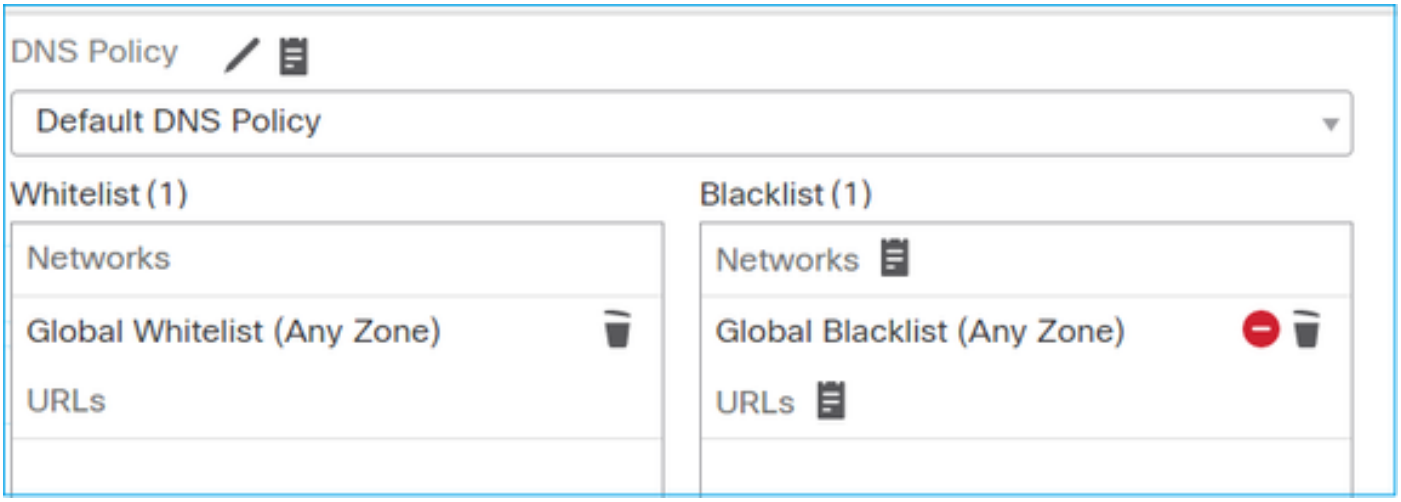
```
Miscellaneous Counters:
  Start-of-Flow events                                                    0
  End-of-Flow events                                                      1
  Denied flow events                                                      0
  Frames forwarded to Snort before drop                                   0
  Inject packets dropped                                                  0
```

Packet flow with Trust rule. A few packets are inspected by Snort and the rest are inspected by LINA:



Scenario 2. ACP Trust Action (without SI, QoS, and Identity Policy)

In case you want the FTD to apply Security Intelligence (SI) checks to all flows, SI is already enabled at the ACP level and you can specify the SI sources (TALOS, feeds, lists, etc). On the other hand, in case you want to disable it, you disable SI for Networks globally per ACP, SI for URL, and SI for DNS. The SI for Networks and URL is disabled as shown in the image:



In this case, the Trust rule is deployed to LINA as trust:

```
> show access-list
...
access-list CSM_FW_ACL_ line 9 remark rule-id 268435461: L4 RULE: Rule1
access-list CSM_FW_ACL_ line 10 advanced trust ip host 192.168.1.40 host 192.168.2.40 rule-id
268435461 event-log flow-end (hitcnt=0) 0x5c1346d6
```

Note: As of 6.2.2 FTD supports TID. TID works in a way similar to SI, but in case SI is disabled, it does not 'force' packet redirection to the Snort engine for TID inspection.

Verify the behavior

Initiate an HTTP session from host-A (192.168.1.40) to host-B (192.168.2.40). Since this is an FP4100 and supports Flow Offload in hardware these things happen:

- A few packets are forwarded through the FTD LINA engine and the rest of the flow is offloaded to SmartNIC (HW accelerator)
- No packets are forwarded to the Snort engine

The FTD LINA connection table shows the flag '**o**' which means the flow was offloaded to HW. Also, note the absence of the '**N**' flag. This essentially means 'no Snort redirection':

```
firepower# show conn
1 in use, 15 most used

TCP OUTSIDE  192.168.2.40:80 INSIDE  192.168.1.40:32809, idle 0:00:00, bytes 949584, flags UIOo
```

Snort statistics show only logging events at the start and at the end of the session:

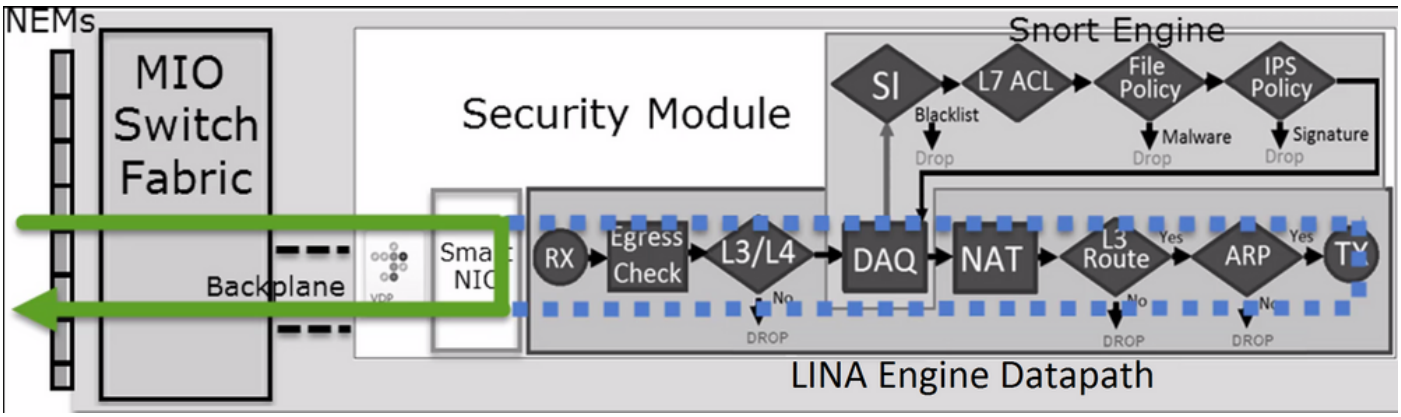
```
firepower# show snort statistics

Packet Counters:
  Passed Packets                                   0
  Blocked Packets                                  0
  Injected Packets                                 0
  Packets bypassed (Snort Down)                    0
  Packets bypassed (Snort Busy)                    0

Flow Counters:
  Fast-Forwarded Flows                             0
  Blacklisted Flows                                0

Miscellaneous Counters:
  Start-of-Flow events                             1
  End-of-Flow events                               1
```

FTD LINA logs show that for each session there were 2 flows (one per each direction) offloaded to HW:

```
Sep 27 2017 20:16:05: %ASA-7-609001: Built local-host INSIDE:192.168.1.40
Sep 27 2017 20:16:05: %ASA-6-302013: Built inbound TCP connection 25384 for
INSIDE:192.168.1.40/32809 (192.168.1.40/32809) to OUTSIDE:192.168.2.40/80 (192.168.2.40/80)
Sep 27 2017 20:16:05: %ASA-6-805001: Offloaded TCP Flow for connection 25384 from
INSIDE:192.168.1.40/32809 (192.168.1.40/32809) to OUTSIDE:192.168.2.40/80 (192.168.2.40/80)
Sep 27 2017 20:16:05: %ASA-6-805001: Offloaded TCP Flow for connection 25384 from
OUTSIDE:192.168.2.40/80 (192.168.2.40/80) to INSIDE:192.168.1.40/32809 (192.168.1.40/32809)
Sep 27 2017 20:16:05: %ASA-6-805002: TCP Flow is no longer offloaded for connection 25384 from
OUTSIDE:192.168.2.40/80 (192.168.2.40/80) to INSIDE:192.168.1.40/32809 (192.168.1.40/32809)
Sep 27 2017 20:16:05: %ASA-6-805002: TCP Flow is no longer offloaded for connection 25384 from
INSIDE:192.168.1.40/32809 (192.168.1.40/32809) to OUTSIDE:192.168.2.40/80 (192.168.2.40/80)
Sep 27 2017 20:16:05: %ASA-6-302014: Teardown TCP connection 25384 for INSIDE:192.168.1.40/32809
to OUTSIDE:192.168.2.40/80 duration 0:00:00 bytes 1055048 TCP FINs
```

```
Sep 27 2017 20:16:05: %ASA-7-609002: Teardown local-host INSIDE:192.168.1.40 duration 0:00:00
```

Packet flow with Trust rule deployed as **trust** action in LINA. A few packets are inspected by LINA and the rest are offloaded to SmartNIC (FP4100/FP9300):

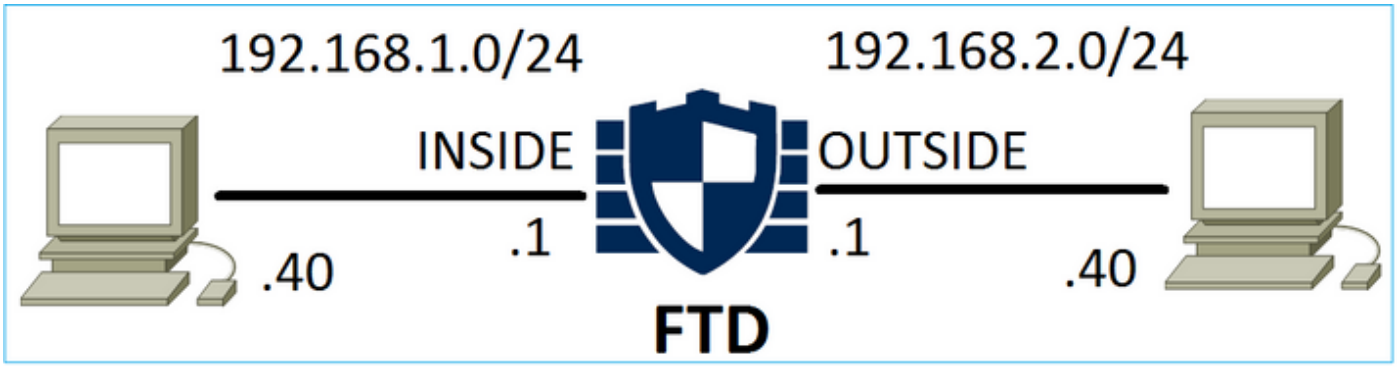


Use Cases

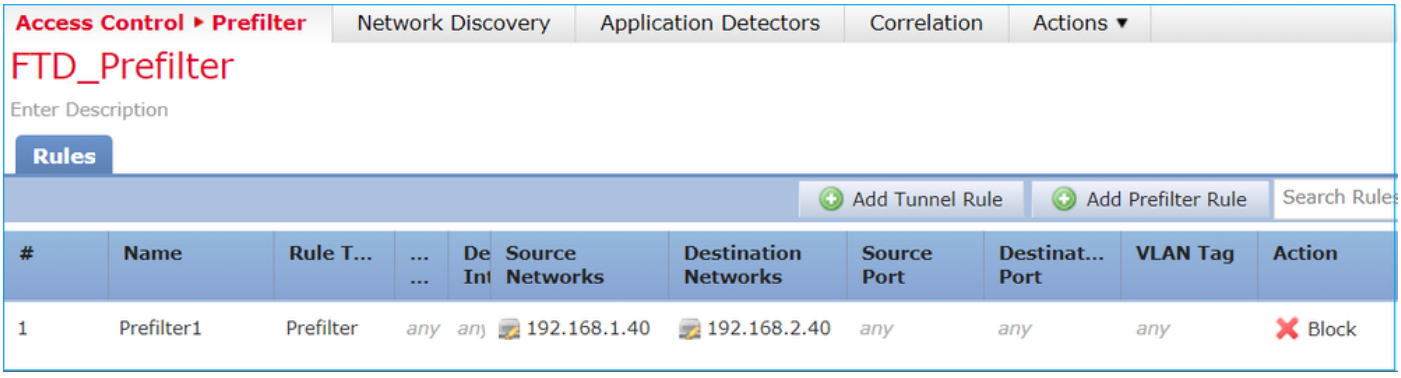
- You must use **Trust** action when you want only a few packets to be checked by the Snort engine (for example Application detection, SI check) and the rest of the flow to be offloaded to the LINA engine
- If you use FTD on FP4100/9300 and want the flow to completely bypass the Snort inspection then consider the Prefilter rule with **Fastpath** action (see the related section in this document)

Prefilter Policy Block Action

Consider the topology as shown in the image:



Consider also the policy as shown in the image:



This is the deployed policy in the FTD Snort engine (ngfw.rules file):

```
# Start of tunnel and priority rules.
# These rules are evaluated by LINA. Only tunnel tags are used from the matched rule id.
268437506 deny any 192.168.1.40 32 any any 192.168.2.40 32 any any any  (tunnel -1
```

In LINA:

```
access-list CSM_FW_ACL_ line 1 remark rule-id 268437506: PREFILTER POLICY: FTD_Prefilter
access-list CSM_FW_ACL_ line 2 remark rule-id 268437506: RULE: Prefilter1
access-list CSM_FW_ACL_ line 3 advanced deny ip host 192.168.1.40 host 192.168.2.40 rule-id
268437506 event-log flow-start (hitcnt=0) 0x76476240
```

When you trace a virtual packet, it shows that the packet is dropped by LINA and never forwarded to Snort:

```
firepower# packet-tracer input INSIDE icmp 192.168.1.40 8 0 192.168.2.40
…
Phase: 4
Type: ACCESS-LIST
Subtype: log
Result: DROP
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced deny ip host 192.168.1.40 host 192.168.2.40 rule-id 268437506
event-log flow-start
access-list CSM_FW_ACL_ remark rule-id 268437506: PREFILTER POLICY: FTD_Prefilter
access-list CSM_FW_ACL_ remark rule-id 268437506: RULE: Prefilter1
Additional Information:

Result:
input-interface: INSIDE
input-status: up
input-line-status: up
output-interface: OUTSIDE
output-status: up
output-line-status: up
Action: drop
Drop-reason: (acl-drop) Flow is denied by configured rule
```

Snort statistics show:

```
firepower# show snort statistics

Packet Counters:
  Passed Packets                                   0
  Blocked Packets                                  0
  Injected Packets                                 0
  Packets bypassed (Snort Down)                    0
  Packets bypassed (Snort Busy)                    0

Flow Counters:
  Fast-Forwarded Flows                             0
  Blacklisted Flows                                0

Miscellaneous Counters:
  Start-of-Flow events                             0
  End-of-Flow events                               0
```

```
  Denied flow events                                      1
```

LINA ASP drops show:

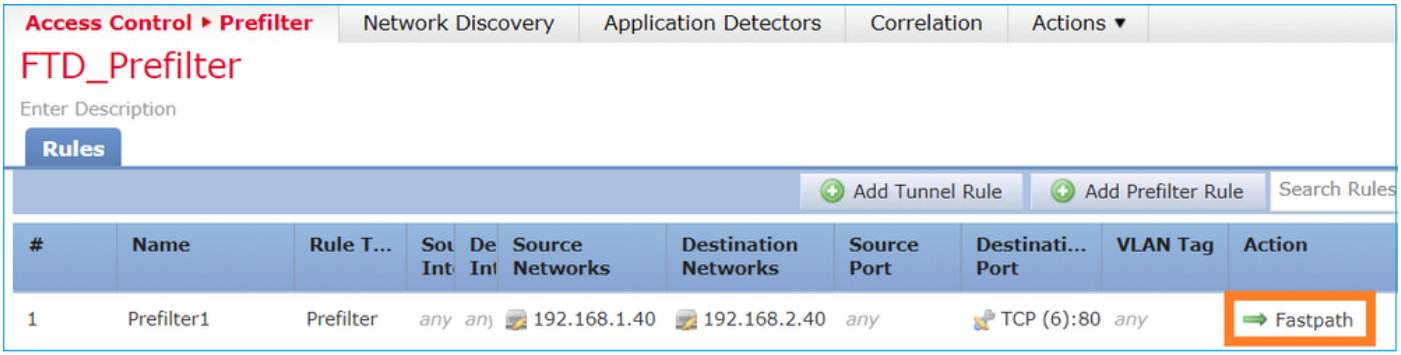
```
firepower# show asp drop

Frame drop:
  Flow is denied by configured rule (acl-drop)                1
```

Use Cases

You can use a Prefilter Block rule when you want to block traffic based on L3/L4 conditions and without the need to do any Snort inspection of the traffic.

Prefilter Policy Fastpath Action

Consider the Prefilter Policy rule as shown in the image:



This is the deployed policy in the FTD Snort engine:

```
268437506 fastpath any any any any any any any any (log dcforward flowend) (tunnel -1)
```

In FTD LINA:

```
access-list CSM_FW_ACL_ line 1 remark rule-id 268437506: PREFILTER POLICY: FTD_Prefilter
access-list CSM_FW_ACL_ line 2 remark rule-id 268437506: RULE: Prefilter1
access-list CSM_FW_ACL_ line 3 advanced trust tcp host 192.168.1.40 host 192.168.2.40 eq www
rule-id 268437506 event-log flow-end (hitcnt=0) 0xf3410b6f
```

Verify Behavior

When host-A (192.168.1.40) tries to open an HTTP session to host-B (192.168.2.40) a few packets go through LINA and the rest are offloaded to SmartNIC. In this case **system support trace** with **firewall-engine-debug** enabled shows:

```
> system support trace

Please specify an IP protocol: tcp
Please specify a client IP address: 192.168.1.40
Please specify a client port:
Please specify a server IP address: 192.168.2.40
Please specify a server port:
```

```
Enable firewall-engine-debug too? [n]: y
Monitoring packet tracer debug messages

192.168.1.40-32840 > 192.168.2.40-80 6 AS 1 I 8 Got end of flow event from hardware with flags
04000000
```

LINA logs show the offloaded flow:

```
Oct 01 2017 14:36:51: %ASA-7-609001: Built local-host INSIDE:192.168.1.40
Oct 01 2017 14:36:51: %ASA-7-609001: Built local-host OUTSIDE:192.168.2.40
Oct 01 2017 14:36:51: %ASA-6-302013: Built inbound TCP connection 966 for
INSIDE:192.168.1.40/32840 (192.168.1.40/32840) to OUTSIDE:192.168.2.40/80 (192.168.2.40/80)
Oct 01 2017 14:36:51: %ASA-6-805001: Offloaded TCP Flow for connection 966 from
INSIDE:192.168.1.40/32840 (192.168.1.40/32840) to OUTSIDE:192.168.2.40/80 (192.168.2.40/80)
Oct 01 2017 14:36:51: %ASA-6-805001: Offloaded TCP Flow for connection 966 from
OUTSIDE:192.168.2.40/80 (192.168.2.40/80) to INSIDE:192.168.1.40/32840 (192.168.1.40/32840)
```

LINA captures show 8 packets go through:

```
firepower# show capture
capture CAPI type raw-data buffer 33554432 trace trace-count 100 interface INSIDE [Capturing -
3908 bytes]
  match ip host 192.168.1.40 host 192.168.2.40
capture CAPO type raw-data buffer 33554432 trace trace-count 100 interface OUTSIDE [Capturing -
3908 bytes]
  match ip host 192.168.1.40 host 192.168.2.40
```

```
firepower# show capture CAPI

8 packets captured

   1: 14:45:32.700021  192.168.1.40.32842 > 192.168.2.40.80: S 3195173118:3195173118(0) win 2920
<mss 1460,sackOK,timestamp 332569060 0>
   2: 14:45:32.700372  192.168.2.40.80 > 192.168.1.40.32842: S 184794124:184794124(0) ack
3195173119 win 2896 <mss 1380,sackOK,timestamp 332567732 332569060>
   3: 14:45:32.700540  192.168.1.40.32842 > 192.168.2.40.80: P 3195173119:3195173317(198) ack
184794125 win 2920 <nop,nop,timestamp 332569060 332567732>
   4: 14:45:32.700876  192.168.2.40.80 > 192.168.1.40.32842: . 184794125:184795493(1368) ack
3195173317 win 2698 <nop,nop,timestamp 332567733 332569060>
   5: 14:45:32.700922  192.168.2.40.80 > 192.168.1.40.32842: P 184795493:184796861(1368) ack
3195173317 win 2698 <nop,nop,timestamp 332567733 332569060>
   6: 14:45:32.701425  192.168.2.40.80 > 192.168.1.40.32842: FP 184810541:184810851(310) ack
3195173317 win 2698 <nop,nop,timestamp 332567733 332569061>
   7: 14:45:32.701532  192.168.1.40.32842 > 192.168.2.40.80: F 3195173317:3195173317(0) ack
184810852 win 2736 <nop,nop,timestamp 332569061 332567733>
   8: 14:45:32.701639  192.168.2.40.80 > 192.168.1.40.32842: . ack 3195173318 win 2697
<nop,nop,timestamp 332567734 332569061>
```

FTD Flow-offload statistics show 22 packets offloaded to HW:

```
firepower# show flow-offload statistics
 Packet stats of port : 0
        Tx Packet count                 :              22
```

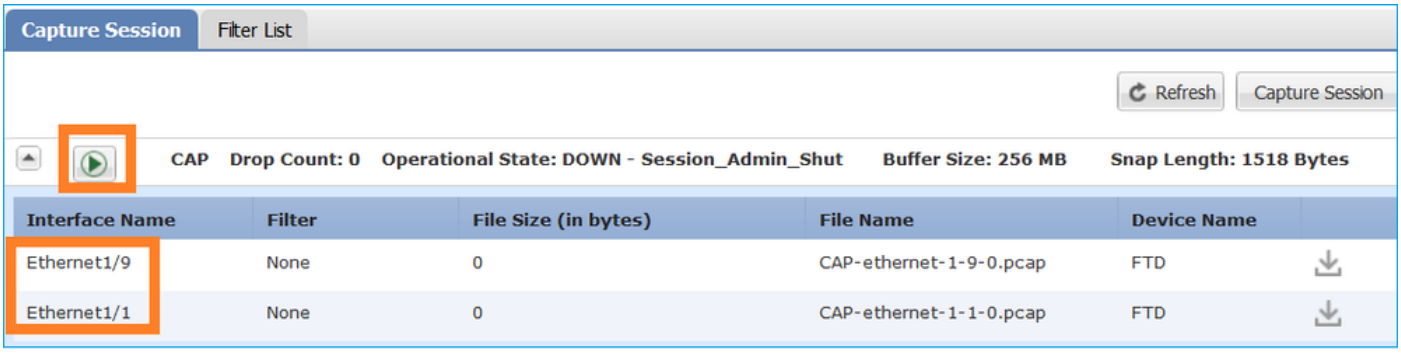
```
        Rx Packet count                :              22
        Dropped Packet count           :               0
        VNIC transmitted packet        :              22
        VNIC transmitted bytes         :           15308
        VNIC Dropped packets           :               0
        VNIC erroneous received        :               0
        VNIC CRC errors                :               0
        VNIC transmit failed           :               0
        VNIC multicast received        :               0
```

You can also use the **show flow-offload flow** command to see additional information related to the offloaded flows. Here is an example:

```
firepower# show flow-offload flow
Total offloaded flow stats: 2 in use, 4 most used, 20% offloaded, 0 collisions
TCP intfc 103 src 192.168.1.40:39301 dest 192.168.2.40:20, static, timestamp 616063741, packets
33240, bytes 2326800
TCP intfc 104 src 192.168.2.40:20 dest 192.168.1.40:39301, static, timestamp 616063760, packets
249140, bytes 358263320
firepower# show conn
5 in use, 5 most used
Inspect Snort:
       preserve-connection: 1 enabled, 0 in effect, 4 most enabled, 0 most in effect

TCP OUTSIDE  192.168.2.40:21 INSIDE  192.168.1.40:40988, idle 0:00:00, bytes 723, flags UIO
TCP OUTSIDE  192.168.2.40:21 INSIDE  192.168.1.40:40980, idle 0:02:40, bytes 1086, flags UIO
TCP OUTSIDE  192.168.2.40:80 INSIDE  192.168.1.40:49442, idle 0:00:00, bytes 86348310, flags UIO
N1
TCP OUTSIDE  192.168.2.40:20 INSIDE  192.168.1.40:39301, idle 0:00:00, bytes 485268628, flags Uo
<- offloaded flow
TCP OUTSIDE  192.168.2.40:20 INSIDE  192.168.1.40:34713, idle 0:02:40, bytes 821799360, flags
UFRIO
```

- The percentage is based on the '**show conn**' output. For example, if 5 conns in total go through the FTD LINA engine and 1 of them is offloaded then 20% is reported as offloaded
- The maximum limit of offloaded sessions depends on the software version (for example ASA 9.8.3 and FTD 6.2.3 support 4 million bi-directional (or 8 million unidirectional) offloaded flows)
- In case the number of offloaded flows reaches the limit (for example 4 million bi-directional flows) no new connections are offloaded until current connections are removed from the offloaded table

In order to see all the packets on FP4100/9300 that go through FTD (offloaded + LINA) there is a need to enable capture at chassis level as shown in the image:



Chassis backplane capture shows both directions. Due to FXOS capture architecture (2 capture points per direction) every packet is shown **twice** as shown in the image:

Packet statistics:

- Total packets through FTD: 30
- Packets through FTD LINA: 8
- Packets offloaded to SmartNIC HW accelerator: 22

In the case of a platform different than FP4100/FP9300 all the packets are handled by the LINA engine since flow-offload is not supported (note the absence of the **o** flag):

```
FP2100-6# show conn addr 192.168.1.40
33 in use, 123 most used
Inspect Snort:
        preserve-connection: 0 enabled, 0 in effect, 2 most enabled, 0 most in effect

TCP OUTSIDE  192.168.2.40:80 INSIDE  192.168.1.40:50890, idle 0:00:09, bytes 175, flags UxIO
```

The LINA syslogs only show connection setup and connection termination events:

```
FP2100-6# show log | i 192.168.2.40
Jun 21 2020 14:29:44: %FTD-6-302013: Built inbound TCP connection 6914 for
INSIDE:192.168.1.40/50900 (192.168.11.101/50900) to OUTSIDE:192.168.2.40/80 (192.168.2.40/80)
Jun 21 2020 14:30:30: %FTD-6-302014: Teardown TCP connection 6914 for INSIDE:192.168.1.40/50900
to OUTSIDE:192.168.2.40/80 duration 0:00:46 bytes 565 TCP FINs from OUTSIDE
```

Use Cases

- Use **Prefilter Fastpath** action when you want to bypass completely the Snort inspection. You typically want to do this for big fat flows that you trust like backups, database transfers, etc
- On FP4100/9300 appliances the **Fastpath** action triggers flow-offload and only a few packets go through the FTD LINA engine. The rest is handled by SmartNIC which decreases the latency

Prefilter Policy Fastpath Action (Inline-Set)

In case a Prefilter Policy Fastpath action is applied on traffic that goes through an inline-set (NGIPS interfaces) these points must be taken into consideration:

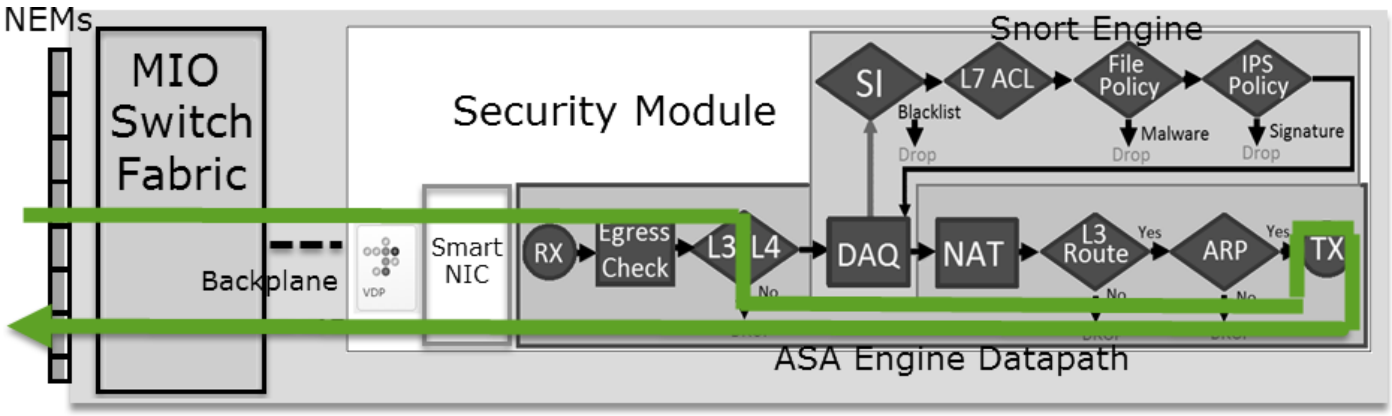
- The rule is applied to the LINA engine as a **trust** action
- The flow is not inspected by the Snort engine
- Flow offload (HW acceleration) does not occur since flow offload is not applicable on NGIPS interfaces

Here is an example of a packet trace in the case of Prefilter Fastpath action applied on an inline-set:

```
firepower# packet-tracer input inside tcp 192.168.1.40 12345 192.168.1.50 80 detailed

Phase: 1
Type: NGIPS-MODE
Subtype: ngips-mode
Result: ALLOW
Config:
Additional Information:
The flow ingressed an interface configured for NGIPS mode and NGIPS services will be applied
```

```
Forward Flow based lookup yields rule:
in id=0x2ad7ac48b330, priority=501, domain=ips-mode, deny=false
hits=2, user_data=0x2ad80d54abd0, cs_id=0x0, flags=0x0, protocol=0
src ip/id=0.0.0.0, mask=0.0.0.0, port=0, tag=any
dst ip/id=0.0.0.0, mask=0.0.0.0, port=0, tag=any, dscp=0x0
input_ifc=inside, output_ifc=any

Phase: 2
Type: ACCESS-LIST
Subtype: log
Result: ALLOW
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced trust ip object 192.168.1.0 object 192.168.1.0 rule-id
268438531 event-log flow-end
access-list CSM_FW_ACL_ remark rule-id 268438531: PREFILTER POLICY: PF1
access-list CSM_FW_ACL_ remark rule-id 268438531: RULE: 1
Additional Information:
Forward Flow based lookup yields rule:
in id=0x2ad9f9f8a7f0, priority=12, domain=permit, trust
hits=1, user_data=0x2ad9b23c5d40, cs_id=0x0, use_real_addr, flags=0x0, protocol=0
src ip/id=192.168.1.0, mask=255.255.255.0, port=0, tag=any, ifc=any
dst ip/id=192.168.1.0, mask=255.255.255.0, port=0, tag=any, ifc=any, vlan=0, dscp=0x0
input_ifc=any, output_ifc=any

Phase: 3
Type: NGIPS-EGRESS-INTERFACE-LOOKUP
Subtype: Resolve Egress Interface
Result: ALLOW
Config:
Additional Information:
Ingress interface inside is in NGIPS inline mode.
Egress interface outside is determined by inline-set configuration

Phase: 4
Type: FLOW-CREATION
Subtype:
Result: ALLOW
Config:
Additional Information:
New flow created with id 7, packet dispatched to next module
Module information for forward flow ...
snp_fp_ips_tcp_state_track_lite
snp_fp_ips_mode_adj
snp_fp_tracer_drop
snp_ifc_stat

Module information for reverse flow ...
snp_fp_ips_tcp_state_track_lite
snp_fp_ips_mode_adj
snp_fp_tracer_drop
snp_ifc_stat

Result:
input-interface: inside
input-status: up
input-line-status: up
Action: allow
```

This is the visual representation of the packet path:



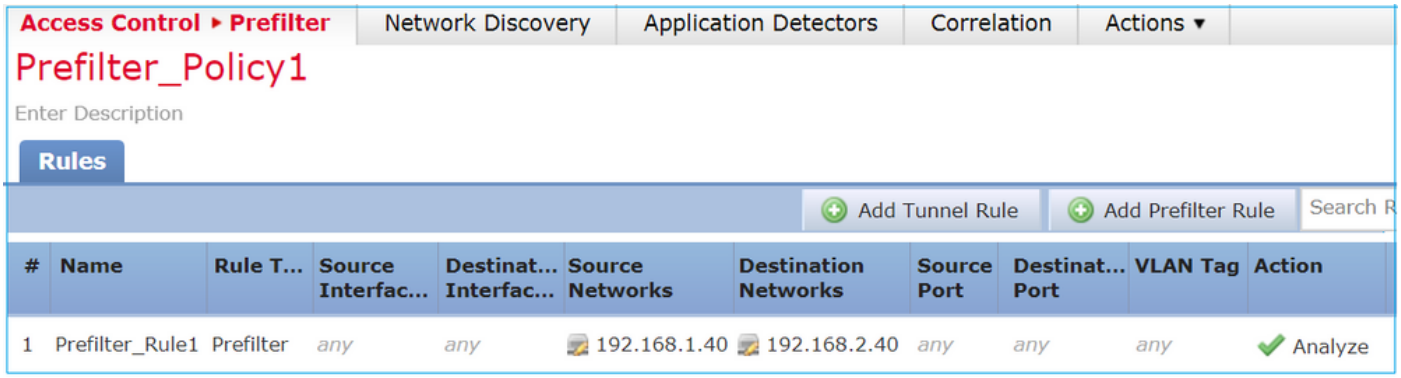
Prefilter Policy Fastpath Action (Inline-Set with Tap)

Same as the Inline-Set case

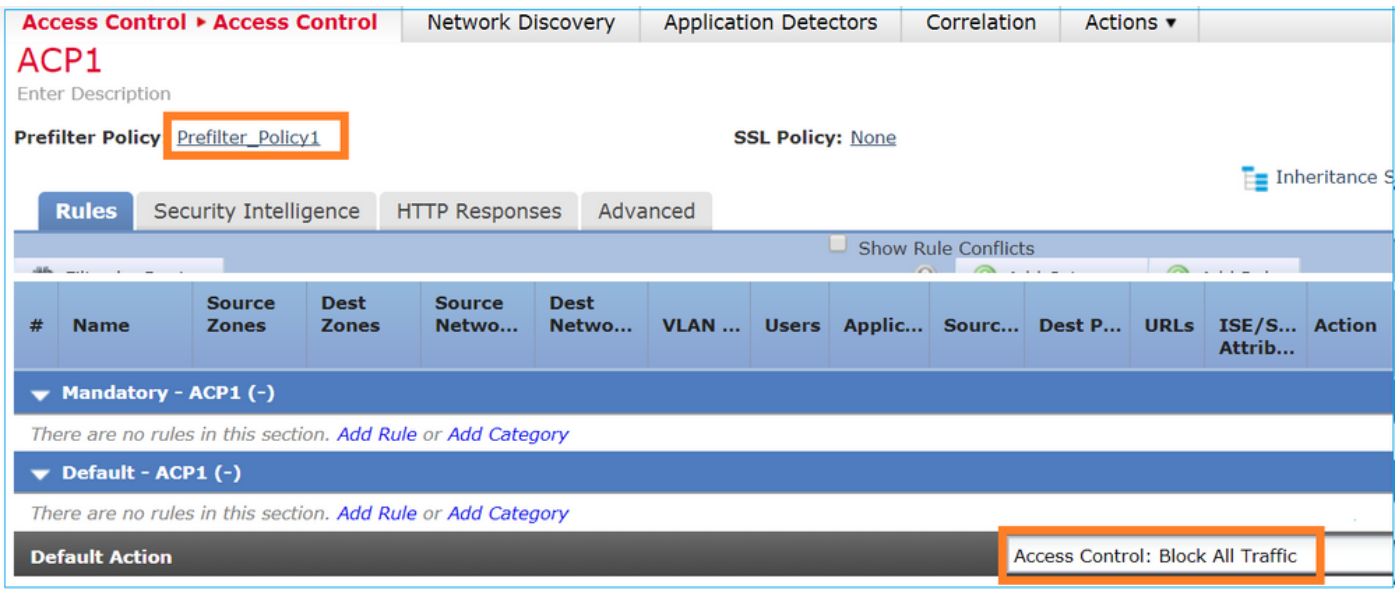
Prefilter Policy Analyze Action

Scenario 1. Prefilter Analyze with ACP Block Rule

Consider the Prefilter Policy which contains an Analyze rule as shown in the image:



The ACP contains only the default rule which is set to **Block All Traffic** as shown in the image:



This is the deployed policy in the FTD Snort engine (ngfw.rules file):

```
# Start of tunnel and priority rules.
# These rules are evaluated by LINA. Only tunnel tags are used from the matched rule id.
268435460 allow any 192.168.1.40 32 any any 192.168.2.40 32 any any any  (tunnel -1)
268435459 allow any any  1025-65535 any any  3544 any 17  (tunnel -1)
268435459 allow any any  3544 any any  1025-65535 any 17  (tunnel -1)
268435459 allow any any  any any any  any any 47  (tunnel -1)
268435459 allow any any  any any any  any any 41  (tunnel -1)
268435459 allow any any  any any any  any any 4  (tunnel -1)
# End of tunnel and priority rules.
# Start of AC rule.
268435458 deny any any  any any any  any any any  (log dcforward flowstart)
# End of AC rule.
```

This is the deployed policy in FTD LINA engine:

```
access-list CSM_FW_ACL_ line 3 advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id
268435460 (hitcnt=0) 0xb788b786
```

Verify Behavior

Packet-tracer shows that the packet is allowed by LINA, is forwarded to Snort engine (due to **permit** action) and Snort Engine returns a **Block** verdict since the default action from AC is matched.

> **Note**: Snort does not evaluate traffic based on tunnel rules

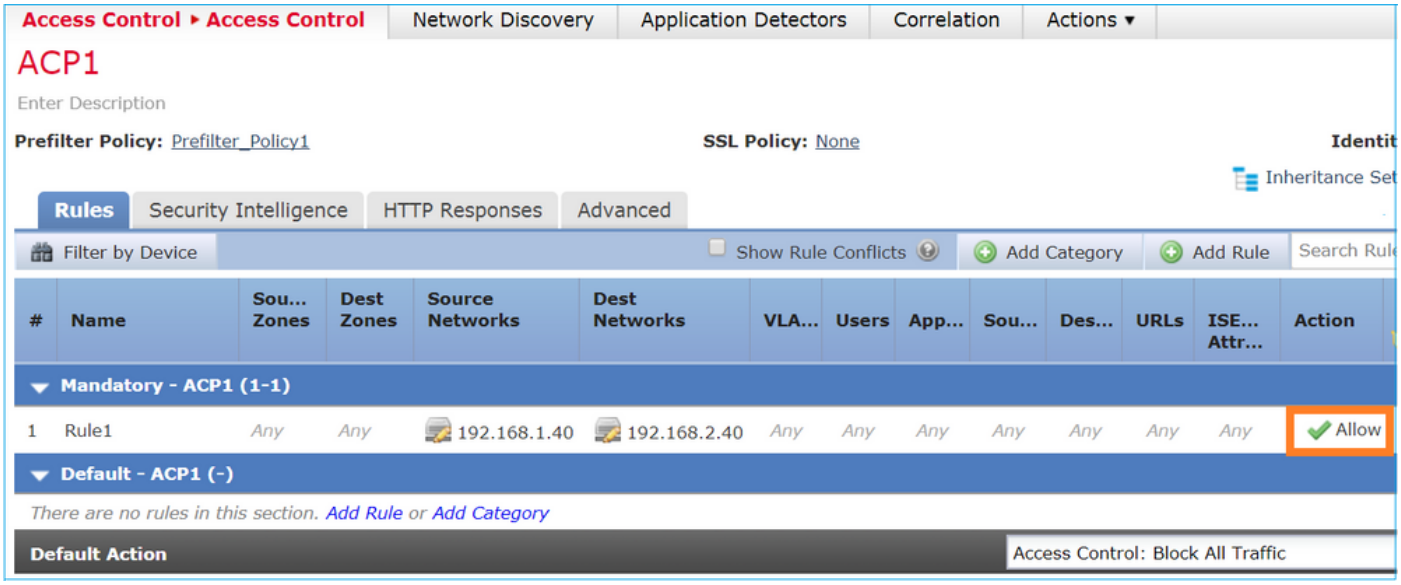
When you trace a packet it reveals the same:

```
firepower# packet-tracer input INSIDE icmp 192.168.1.40 8 0 192.168.2.40
...
Phase: 4
Type: ACCESS-LIST
Subtype: log
Result: ALLOW
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id 268435460
access-list CSM_FW_ACL_ remark rule-id 268435460: PREFILTER POLICY: Prefilter_Policy1
access-list CSM_FW_ACL_ remark rule-id 268435460: RULE: Prefilter_Rule1
Additional Information:
 This packet will be sent to snort for additional processing where a verdict will be reached

…
Phase: 14
Type: SNORT
Subtype:
Result: DROP
Config:
Additional Information:
Snort Trace:
Packet: ICMP
AppID: service ICMP (3501), application unknown (0)
Firewall: starting rule matching, zone -1 -> -1, geo 0 -> 0, vlan 0, sgt 65535, user 9999997,
icmpType 8, icmpCode 0
Firewall: block rule, id 268435458, drop
Snort: processed decoder alerts or actions queue, drop
NAP id 1, IPS id 0, Verdict BLOCKLIST, Blocked by Firewall
Snort Verdict: (block-list) block list this flow
```

```
Result:
input-interface: INSIDE
input-status: up
input-line-status: up
output-interface: OUTSIDE
output-status: up
output-line-status: up
Action: drop
Drop-reason: (firewall) Blocked by the firewall preprocessor
```

Scenario 2. Prefilter Analyze with ACP Allow Rule

If the goal is to allow the packet to traverse through the FTD, there is a need to add a rule in ACP. The Action can be either Allow or Trust which depends on the goal (for example if you want to apply an L7 inspection you must use **Allow** action) as shown in the image:



The deployed policy in FTD Snort engine:

```
# Start of AC rule.
268435461 allow any 192.168.1.40 32 any any 192.168.2.40 32 any any any
268435458 deny any any  any any any  any any any  (log dcforward flowstart)
# End of AC rule.
```

In LINA engine:

```
access-list CSM_FW_ACL_ line 3 advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id
268435460 (hitcnt=1) 0xb788b786
```

Verify Behavior

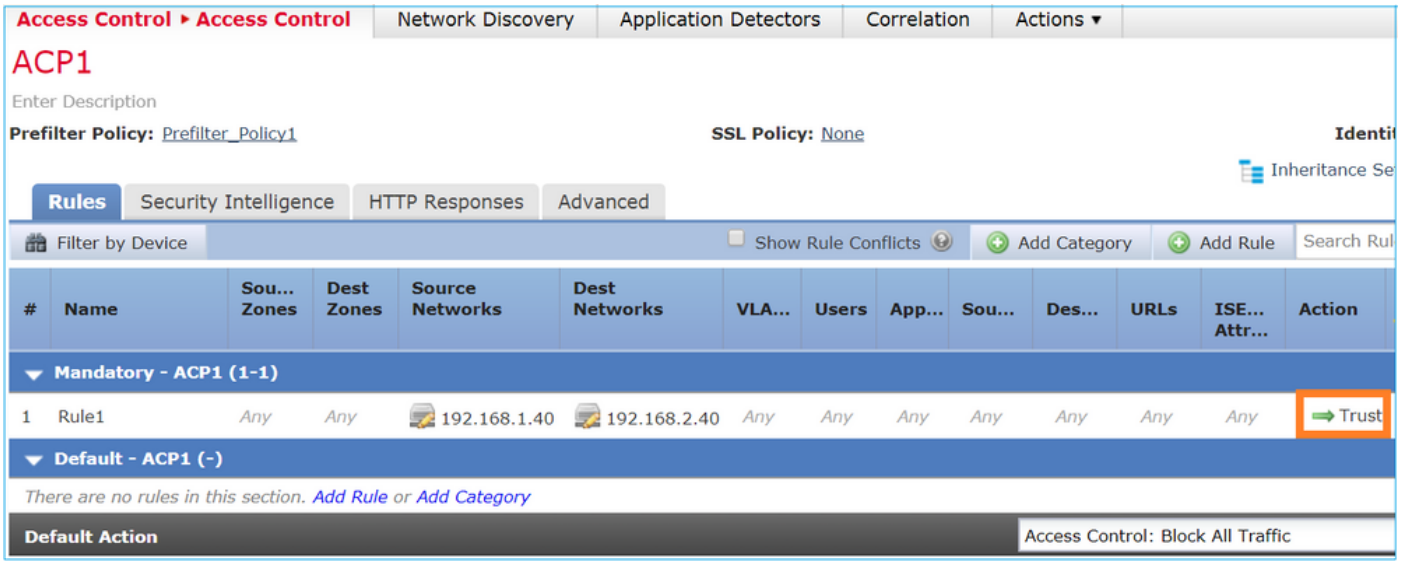
Packet-tracer shows that the packet matches rule **268435460** in LINA and **268435461** in Snort engine:

```
firepower# packet-tracer input INSIDE icmp 192.168.1.40 8 0 192.168.2.40
...
Phase: 4
Type: ACCESS-LIST
Subtype: log
```

```
Result: ALLOW
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id 268435460
access-list CSM_FW_ACL_ remark rule-id 268435460: PREFILTER POLICY: Prefilter_Policy1
access-list CSM_FW_ACL_ remark rule-id 268435460: RULE: Prefilter_Rule1
Additional Information:
 This packet will be sent to snort for additional processing where a verdict will be reached
…
Phase: 14
Type: SNORT
Subtype:
Result: ALLOW
Config:
Additional Information:
Snort Trace:
Packet: ICMP
AppID: service ICMP (3501), application unknown (0)
Firewall: starting rule matching, zone -1 -> -1, geo 0 -> 0, vlan 0, sgt 65535, user 9999997,
icmpType 8, icmpCode 0
Firewall: allow rule, id 268435461, allow
NAP id 1, IPS id 0, Verdict PASS
Snort Verdict: (pass-packet) allow this packet
…
Result:
input-interface: INSIDE
input-status: up
input-line-status: up
output-interface: OUTSIDE
output-status: up
output-line-status: up
Action: allow
```

Scenario 3. Prefilter Analyze with ACP Trust Rule

In case the ACP contains a Trust rule then you have this as shown in the image:



Snort:

```
# Start of AC rule.
268435461 fastpath any 192.168.1.40 32 any any 192.168.2.40 32 any any any
268435458 deny any any  any any any  any any any  (log dcforward flowstart)
```

```
# End of AC rule.
```

LINA:

```
access-list CSM_FW_ACL_ line 3 advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id
268435460 (hitcnt=2) 0xb788b786
```

Remember that since the SI is enabled by default, the Trust rule is deployed as **permit** action on LINA so at least a few packets are redirected to the Snort engine for inspection.

Verify Behavior

Packet-tracer shows that the Snort engine Permitlists the packet and essentially offloads the rest flow to LINA:

```
firepower# packet-tracer input INSIDE icmp 192.168.1.40 8 0 192.168.2.40
...
Phase: 4
Type: ACCESS-LIST
Subtype: log
Result: ALLOW
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id 268435460
access-list CSM_FW_ACL_ remark rule-id 268435460: PREFILTER POLICY: Prefilter_Policy1
access-list CSM_FW_ACL_ remark rule-id 268435460: RULE: Prefilter_Rule1
Additional Information:
 This packet will be sent to snort for additional processing where a verdict will be reached
…
Phase: 14
Type: SNORT
Subtype:
Result: ALLOW
Config:
Additional Information:
Snort Trace:
Packet: ICMP
AppID: service ICMP (3501), application unknown (0)
Firewall: starting rule matching, zone -1 -> -1, geo 0 -> 0, vlan 0, sgt 65535, user 9999997,
icmpType 8, icmpCode 0
Firewall: trust/fastpath rule, id 268435461, allow
NAP id 1, IPS id 0, Verdict PERMITLIST
Snort Verdict: (fast-forward) fast forward this flow
…
Result:
input-interface: INSIDE
input-status: up
input-line-status: up
output-interface: OUTSIDE
output-status: up
output-line-status: up
Action: allow
```

Scenario 4. Prefilter Analyze with ACP Trust Rule

In this scenario the SI was disabled manually.

The rule is deployed in Snort as follows:

```
# Start of AC rule.
268435461 fastpath any 192.168.1.40 32 any any 192.168.2.40 32 any any any
268435458 deny any any  any any any  any any any  (log dcforward flowstart)
# End of AC rule.
```

In LINA the rule is deployed as trust. A packet though matches the permit rule (see the ACE hit counts) that is deployed due to Analyze Prefilter rule and the packet is inspected by the Snort engine:

```
access-list CSM_FW_ACL_ line 3 advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id
268435460 (hitcnt=3) 0xb788b786
...
access-list CSM_FW_ACL_ line 13 advanced trust ip host 192.168.1.40 host 192.168.2.40 rule-id
268435461 event-log flow-end (hitcnt=0) 0x5c1346d6
...
access-list CSM_FW_ACL_ line 16 advanced deny ip any any rule-id 268435458 event-log flow-start
(hitcnt=0) 0x97aa021a
```

Verify Behavior

```
firepower# packet-tracer input INSIDE icmp 192.168.1.40 8 0 192.168.2.40
...
Phase: 4
Type: ACCESS-LIST
Subtype: log
Result: ALLOW
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced permit ip host 192.168.1.40 host 192.168.2.40 rule-id 268435460
access-list CSM_FW_ACL_ remark rule-id 268435460: PREFILTER POLICY: Prefilter_Policy1
access-list CSM_FW_ACL_ remark rule-id 268435460: RULE: Prefilter_Rule1
Additional Information:
 This packet will be sent to snort for additional processing where a verdict will be reached
...
Phase: 14
Type: SNORT
Subtype:
Result: ALLOW
Config:
Additional Information:
Snort Trace:
Packet: ICMP
AppID: service ICMP (3501), application unknown (0)
Firewall: starting rule matching, zone -1 -> -1, geo 0 -> 0, vlan 0, sgt 65535, user 9999997,
icmpType 8, icmpCode 0
Firewall: trust/fastpath rule, id 268435461, allow
NAP id 1, IPS id 0, Verdict PERMITLIST
Snort Verdict: (fast-forward) fast forward this flow
…
Result:
input-interface: INSIDE
input-status: up
input-line-status: up
output-interface: OUTSIDE
output-status: up
output-line-status: up
Action: allow
```

Main Points

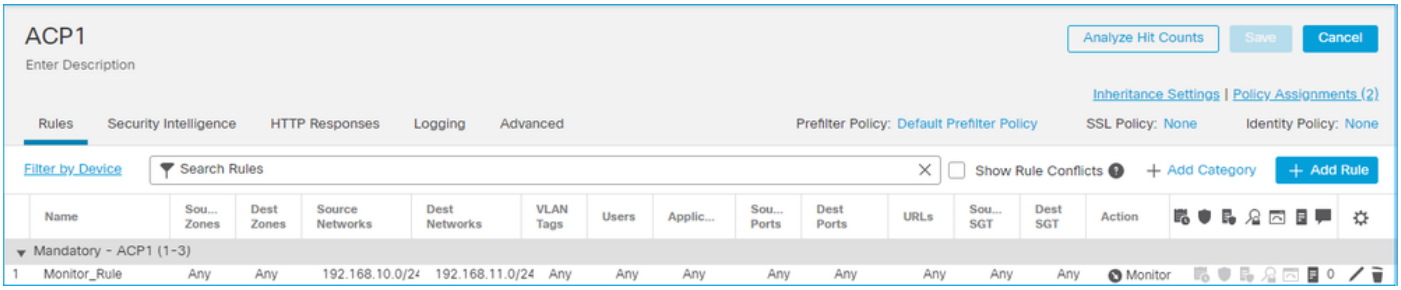
- The **Analyze** Action is deployed as a permit rule in the LINA engine. This has an effect on the packet to be forwarded to the Snort engine for inspection
- The **Analyze** Action does not deploy any rule in the Snort engine so you need to ensure that you configure a rule in ACP that is matched in Snort<
- It depends on the ACP rule that is deployed in the Snort engine (**block** vs **allow** vs **fastpath**) none or all or a few packets are allowed by Snort

Use Cases

- A use case of **Analyze** Action is when you have a broad Fastpath rule in the Prefilter policy and you want to put some exceptions for specific flows so that they are inspected by Snort

ACP Monitor Action

A monitor rule configured on FMC UI:



The monitor rule is deployed on the FTD LINA engine as a **permit** action and to the Snort engine as an **audit** action.

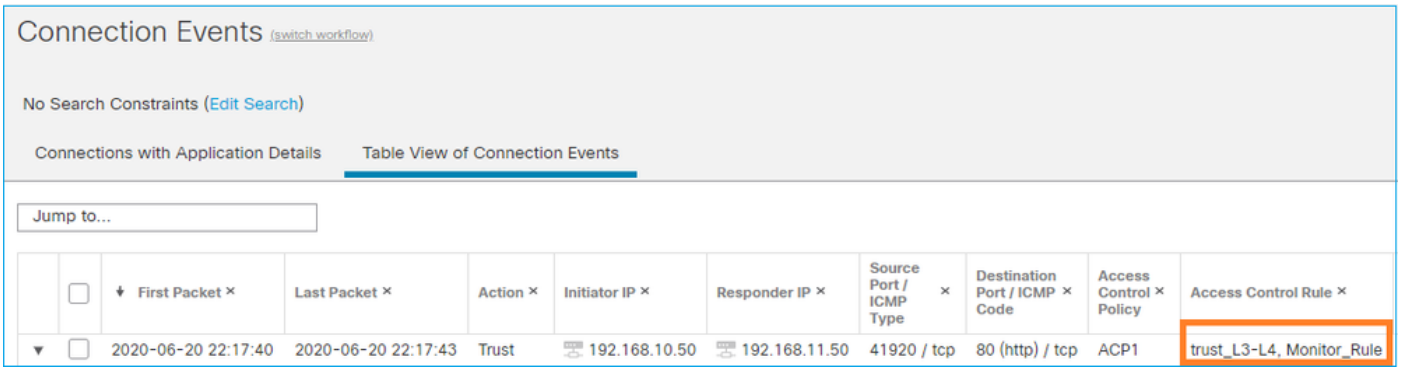
```
firepower# show access-list
…
access-list CSM_FW_ACL_ line 10 advanced permit ip 192.168.10.0 255.255.255.0 192.168.11.0
255.255.255.0 rule-id 268438863 (hitcnt=0) 0x61bbaf0c
```

The Snort rule:

```
admin@firepower:~$ cat /var/sf/detection_engines/9e080e5c-adc3-11ea-9d37-44884cf7e9ba/ngfw.rules
…
# Start of AC rule.
268438863 audit any 192.168.10.0 24 any any 192.168.11.0 24 any any any (log dcforward flowend)
# End rule 268438863
```

Main Points

- Monitor Rule does not drop or permit traffic but generates a Connection Event. The packet is checked against subsequent rules and it is either allowed or dropped
- FMC Connection Events show that the packet matched 2 rules:



System support trace output shows that packets match both rules:

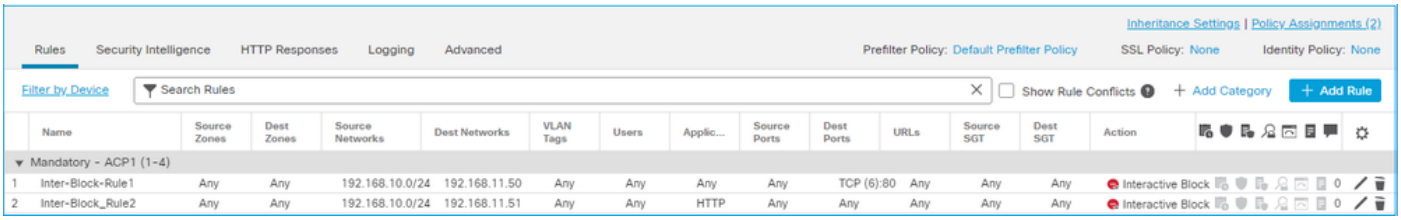
```
> system support trace

Enable firewall-engine-debug too? [n]: y
Please specify an IP protocol: tcp
Please specify a client IP address: 192.168.10.50
Please specify a client port:
Please specify a server IP address: 192.168.11.50
Please specify a server port:
Monitoring packet tracer and firewall debug messages


192.168.10.50-41922 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, SYN, seq 419031630
192.168.10.50-41922 - 192.168.11.50-80 6 AS 1-1 CID 0 Session: new snort session
192.168.10.50-41922 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.10.50-41922 > 192.168.11.50-80 6 AS 1-1 I 19 new firewall session
192.168.10.50-41922 > 192.168.11.50-80 6 AS 1-1 I 19 Starting AC with minimum 2, 'Monitor_Rule',
and IPProto first with zone           s -1 -> -1, geo 0 -> 0, vlan 0, source sgt type: 0, source
sgt tag: 0, ISE sgt id: 0, dest sgt type: 0, ISE dest sgt tag: 0,            svc 0, payload 0,
client 0, misc 0, user 9999997, icmpType 0, icmpCode 0
192.168.10.50-41922 > 192.168.11.50-80 6 AS 1-1 I 19 match rule order 2, 'Monitor_Rule', action
Audit
192.168.10.50-41922 > 192.168.11.50-80 6 AS 1-1 I 19 match rule order 3, 'trust_L3-L4', action
Trust
192.168.10.50-41922 > 192.168.11.50-80 6 AS 1-1 I 19 MidRecovery data sent for rule id:
268438858,rule_action:3, rev id:1078          02206, rule_match flag:0x2
```

Use Cases

Used to monitor network activity and generate a Connection Event

ACP Interactive Block Action

An Interactive Block rule configured on FMC UI:



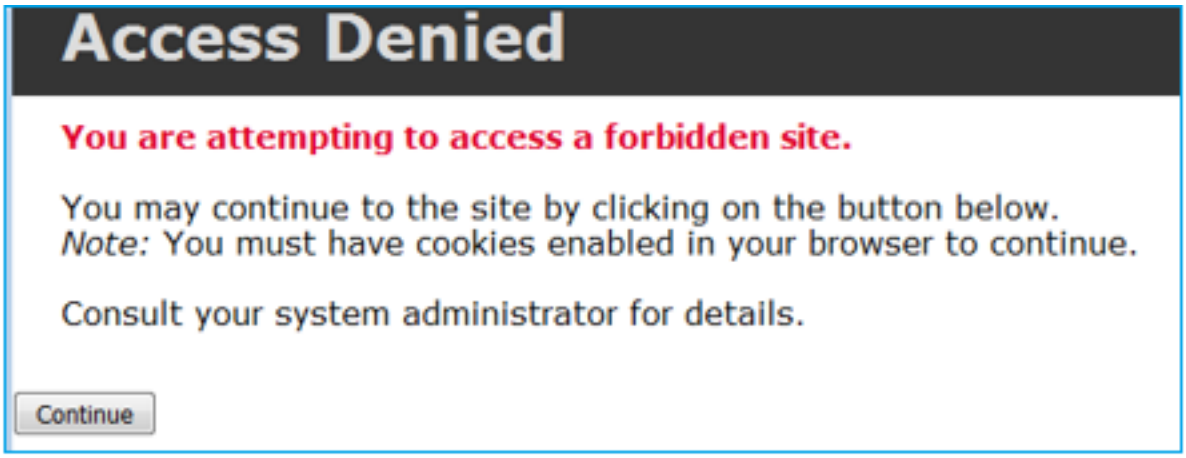
The Interactive Block rule is deployed on the FTD LINA engine as a **permit** action and to the Snort engine as a bypass rule:

```
firepower# show access-list
…
access-list CSM_FW_ACL_ line 9 remark rule-id 268438864: L7 RULE: Inter-Block-Rule1
access-list CSM_FW_ACL_ line 10 advanced permit tcp 192.168.10.0 255.255.255.0 host
192.168.11.50 eq www rule-id 268438864 (hitcnt=3) 0xba785fc0
access-list CSM_FW_ACL_ line 11 remark rule-id 268438865: ACCESS POLICY: ACP1 - Mandatory
access-list CSM_FW_ACL_ line 12 remark rule-id 268438865: L7 RULE: Inter-Block_Rule2
access-list CSM_FW_ACL_ line 13 advanced permit ip 192.168.10.0 255.255.255.0 host 192.168.11.51
rule-id 268438865 (hitcnt=0) 0x622350d0
```

Snort engine:

```
admin@firepower:~$ cat /var/sf/detection_engines/9e080e5c-adc3-11ea-9d37-44884cf7e9ba/ngfw.rules
…
# Start of AC rule.
268438864 bypass any 192.168.10.0 24 any any 192.168.11.50 32 80 any 6
# End rule 268438864
268438865 bypass any 192.168.10.0 24 any any 192.168.11.51 32 any any any (appid 676:1)
(ip_protos 6, 17)
# End rule 268438865
```

Interactive Block Rule prompts the user that the destination is forbidden



By default, the firewall allows to bypass the block for 600 seconds:

In the **system support trace** output you can see that initially the firewall blocks the traffic and shows

the block page:

```
> system support trace
…
192.168.10.52-58717 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, ACK, seq 983273680, ack
2014879580
192.168.10.52-58717 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service HTTP (676), application
unknown (0)
192.168.10.52-58717 > 192.168.11.50-80 6 AS 1-1 I 22 Starting AC with minimum 2, 'Inter-Block-
Rule1', and IPProto first with zones -1 -> -1, geo 0(0) -> 0, vlan 0, source sgt type: 0, sgt
tag: 0, ISE sgt id: 0, dest sgt type: 0, ISE dest_sgt_tag: 0, svc 676, payload 0, client 589,
misc 0, user 9999997, min url-cat-list 0-0-0, url http://192.168.11.50/, xff
192.168.10.52-58717 > 192.168.11.50-80 6 AS 1-1 I 22 match rule order 2, 'Inter-Block-Rule1',
action Interactive
192.168.10.52-58717 > 192.168.11.50-80 6 AS 1-1 I 22 bypass action sending HTTP interactive
response of 1093 bytes
192.168.10.52-58717 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: interactive block rule, 'Inter-
Block-Rule1', drop
192.168.10.52-58717 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort: processed decoder alerts or actions
queue, drop
192.168.10.52-58717 > 192.168.11.50-80 6 AS 1-1 I 22 deleting firewall session flags = 0x800,
fwFlags = 0x1002
192.168.10.52-58717 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 22, NAP id 1, IPS id 0, Verdict
BLACKLIST
192.168.10.52-58717 - 192.168.11.50-80 6 AS 1-1 CID 0 ===> Blocked by Firewall
Verdict reason is sent to DAQ
```

Once the user selects **Continue** (or refreshes the browser page) the debug shows that the packets are allowed by the same rule which mimics and **Allow** action:

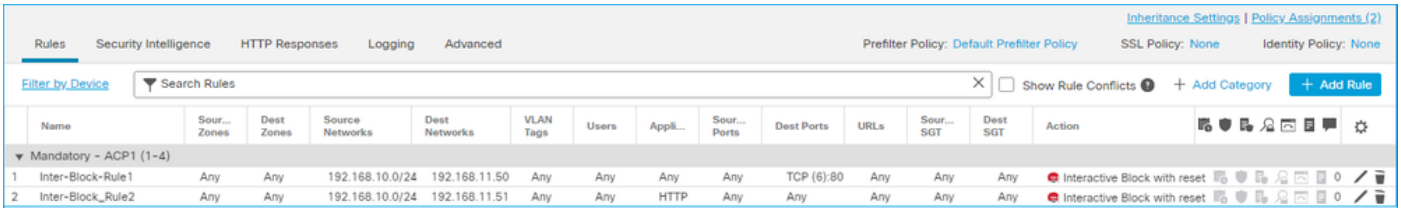
```
192.168.10.52-58718 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, ACK, seq 1357413630, ack
2607625293
192.168.10.52-58718 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service HTTP (676), application
unknown (0)
192.168.10.52-58718 > 192.168.11.50-80 6 AS 1-1 I 8 Starting AC with minimum 2, 'Inter-Block-
Rule1', and IPProto first with zones -1 -> -1, geo 0(0) -> 0, vlan 0, source sgt type: 0, sgt
tag: 0, ISE sgt id: 0, dest sgt type: 0, ISE dest_sgt_tag: 0, svc 676, payload 0, client 589,
misc 0, user 9999997, min url-cat-list 0-0-0, url http://192.168.11.50/, xff
192.168.10.52-58718 > 192.168.11.50-80 6 AS 1-1 I 8 match rule order 2, 'Inter-Block-Rule1',
action Interactive
192.168.10.52-58718 > 192.168.11.50-80 6 AS 1-1 I 8 bypass action interactive bypass
192.168.10.52-58718 > 192.168.11.50-80 6 AS 1-1 I 8 allow action
192.168.10.52-58718 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: allow rule, 'Inter-Block-Rule1',
allow
192.168.10.52-58718 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: interactive bypass rule, 'Inter-
Block-Rule1', allow
192.168.10.52-58718 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 8, NAP id 1, IPS id 0, Verdict
PASS
```

Use Cases

Show a warning page to web users and give them the option to continue.

ACP Interactive Block with reset Action

An Interactive Block with reset rule configured on FMC UI:



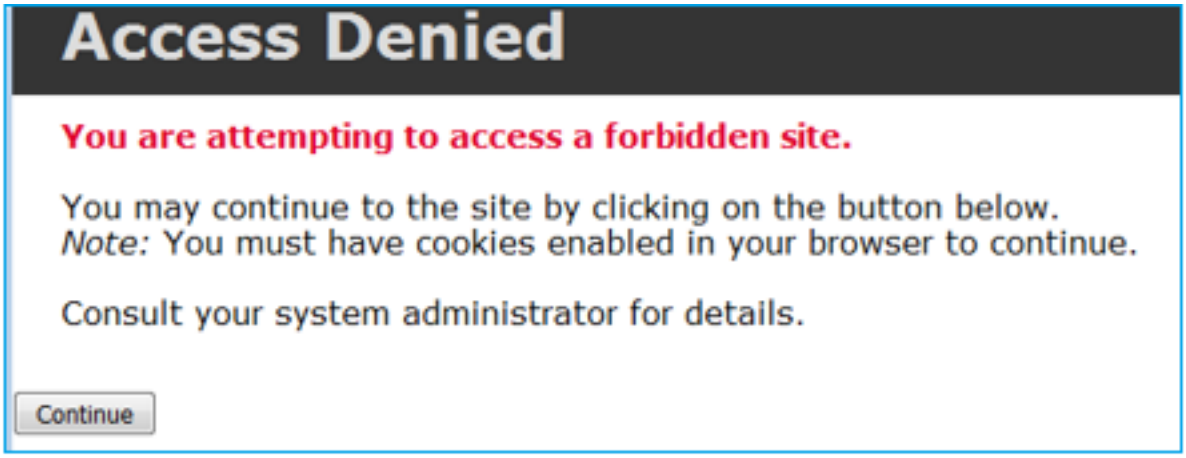
The Interactive Block with reset rule is deployed on FTD LINA engine as a **permit** action and to Snort engine as intreset rule:

```
firepower# show access-list
…
access-list CSM_FW_ACL_ line 9 remark rule-id 268438864: L7 RULE: Inter-Block-Rule1
access-list CSM_FW_ACL_ line 10 advanced permit tcp 192.168.10.0 255.255.255.0 host
192.168.11.50 eq www rule-id 268438864 (hitcnt=13) 0xba785fc0
access-list CSM_FW_ACL_ line 11 remark rule-id 268438865: ACCESS POLICY: ACP1 - Mandatory
access-list CSM_FW_ACL_ line 12 remark rule-id 268438865: L7 RULE: Inter-Block_Rule2
access-list CSM_FW_ACL_ line 13 advanced permit ip 192.168.10.0 255.255.255.0 host 192.168.11.51
rule-id 268438865 (hitcnt=0) 0x622350d0
```

Snort engine:

```
# Start of AC rule.
268438864 intreset any 192.168.10.0 24 any any 192.168.11.50 32 80 any 6
# End rule 268438864
268438865 intreset any 192.168.10.0 24 any any 192.168.11.51 32 any any any (appid 676:1)
(ip_protos 6, 17)
# End rule 268438865
```

Like the Block with Reset, the user can select the **Continue** option:



In the Snort debug the action shown in Interactive Reset:

```
> system support trace

Enable firewall-engine-debug too? [n]: y
Please specify an IP protocol: tcp
Please specify a client IP address: 192.168.10.52
Please specify a client port:
Please specify a server IP address: 192.168.11.50
Please specify a server port:
Monitoring packet tracer and firewall debug messages
```

```
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, SYN, seq 3232128039
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Session: new snort session
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 new firewall session
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 Starting AC with minimum 2, 'Inter-Block-
Rule1', and IPProto first with zones -1 -> -1, geo 0 -> 0, vlan 0, source sgt type: 0, source
sgt tag: 0, ISE sgt id: 0, dest sgt type: 0, ISE dest sgt tag: 0, svc 0, payload 0, client 0,
misc 0, user 9999997, icmpType 0, icmpCode 0
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 match rule order 2, 'Inter-Block-Rule1',
action Interactive Reset
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 MidRecovery data sent for rule id:
268438864,rule_action:8, rev id:1099034206, rule_match flag:0x0
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 HitCount data sent for rule id: 268438864,
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 24, NAP id 1, IPS id 0, Verdict
PASS

192.168.11.50-80 - 192.168.10.52-58958 6 AS 1-1 CID 0 Packet: TCP, SYN, ACK, seq 2228213518, ack
3232128040
192.168.11.50-80 - 192.168.10.52-58958 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.11.50-80 - 192.168.10.52-58958 6 AS 1-1 CID 0 Snort id 24, NAP id 1, IPS id 0, Verdict
PASS

192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, ACK, seq 3232128040, ack
2228213519
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service unknown (0), application
unknown (0)
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 24, NAP id 1, IPS id 0, Verdict
PASS

192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, ACK, seq 3232128040, ack
2228213519
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service HTTP (676), application
unknown (0)
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 Starting AC with minimum 2, 'Inter-Block-
Rule1', and IPProto first with zones -1 -> -1, geo 0(0) -> 0, vlan 0, source sgt type: 0, sgt
tag: 0, ISE sgt id: 0, dest sgt type: 0, ISE dest_sgt_tag: 0, svc 676, payload 0, client 589,
misc 0, user 9999997, min url-cat-list 0-0-0, url http://192.168.11.50/, xff
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 match rule order 2, 'Inter-Block-Rule1',
action Interactive Reset
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 bypass action sending HTTP interactive
response of 1093 bytes
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: interactive block rule, 'Inter-
Block-Rule1', drop
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort: processed decoder alerts or actions
queue, drop
192.168.10.52-58958 > 192.168.11.50-80 6 AS 1-1 I 24 deleting firewall session flags = 0x800,
fwFlags = 0x1002
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 24, NAP id 1, IPS id 0, Verdict
BLACKLIST
192.168.10.52-58958 - 192.168.11.50-80 6 AS 1-1 CID 0 ===> Blocked by Firewall
Verdict reason is sent to DAQ
```

At this point, the block page is shown to the end-user. If the user selects **Continue** (or refreshes the web page) the same rule matches which this time allows the traffic through:

```
192.168.10.52-58962 - 192.168.11.50-80 6 AS 1-1 CID 0 Packet: TCP, ACK, seq 1593478294, ack
3135589307
```

```
192.168.10.52-58962 - 192.168.11.50-80 6 AS 1-1 CID 0 AppID: service HTTP (676), application
unknown (0)
192.168.10.52-58962 > 192.168.11.50-80 6 AS 1-1 I 14 Starting AC with minimum 2, 'Inter-Block-
Rule1', and IPProto first with zones -1 -> -1, geo 0(0) -> 0, vlan 0, source sgt type: 0, sgt
tag: 0, ISE sgt id: 0, dest sgt type: 0, ISE dest_sgt_tag: 0, svc 676, payload 0, client 589,
misc 0, user 9999997, min url-cat-list 0-0-0, url http://192.168.11.50/, xff
192.168.10.52-58962 > 192.168.11.50-80 6 AS 1-1 I 14 match rule order 2, 'Inter-Block-Rule1',
action Interactive Reset
192.168.10.52-58962 > 192.168.11.50-80 6 AS 1-1 I 14 bypass action interactive bypass
192.168.10.52-58962 > 192.168.11.50-80 6 AS 1-1 I 14 allow action
192.168.10.52-58962 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: allow rule, 'Inter-Block-Rule1',
allow
192.168.10.52-58962 - 192.168.11.50-80 6 AS 1-1 CID 0 Firewall: interactive bypass rule, 'Inter-
Block-Rule1', allow
192.168.10.52-58962 - 192.168.11.50-80 6 AS 1-1 CID 0 Snort id 14, NAP id 1, IPS id 0, Verdict
PASS

192.168.11.50-80 - 192.168.10.52-58962 6 AS 1-1 CID 0 Packet: TCP, ACK, seq 3135589307, ack
1593478786
192.168.11.50-80 - 192.168.10.52-58962 6 AS 1-1 CID 0 AppID: service HTTP (676), application
unknown (0)
192.168.11.50-80 - 192.168.10.52-58962 6 AS 1-1 CID 0 Firewall: allow rule, 'Inter-Block-Rule1',
allow
192.168.11.50-80 - 192.168.10.52-58962 6 AS 1-1 CID 0 Firewall: interactive bypass rule, 'Inter-
Block-Rule1', allow
192.168.11.50-80 - 192.168.10.52-58962 6 AS 1-1 CID 0 Snort id 14, NAP id 1, IPS id 0, Verdict
PASS
```

The interactive block with reset rule sends a TCP RST to non-web traffic:

```
firepower# show cap CAPI | i 11.50
   2: 22:13:33.112954       802.1Q vlan#202 P0 192.168.10.50.40010 > 192.168.11.50.21: S
3109534920:3109534920(0) win 29200 <mss 1460,sackOK,timestamp 3745225378 0,nop,wscale 7>
   3: 22:13:33.113626       802.1Q vlan#202 P0 192.168.11.50.21 > 192.168.10.50.40010: S
3422362500:3422362500(0) ack 3109534921 win 8192 <mss 1380,nop,wscale 8,sackOK,timestamp
53252448 3745225378>
   4: 22:13:33.113824       802.1Q vlan#202 P0 192.168.10.50.40010 > 192.168.11.50.21: . ack
3422362501 win 229 <nop,nop,timestamp 3745225379 53252448>
   5: 22:13:33.114953       802.1Q vlan#202 P0 192.168.11.50.21 > 192.168.10.50.40010: P
3422362501:3422362543(42) ack 3109534921 win 256 <nop,nop,timestamp 53252448 3745225379>
   6: 22:13:33.114984       802.1Q vlan#202 P0 192.168.11.50.21 > 192.168.10.50.40010: P
3422362543:3422362549(6) ack 3109534921 win 256 <nop,nop,timestamp 53252448 3745225379>
   7: 22:13:33.114984       802.1Q vlan#202 P0 192.168.11.50.21 > 192.168.10.50.40010: P
3422362549:3422362570(21) ack 3109534921 win 256 <nop,nop,timestamp 53252448 3745225379>
   8: 22:13:33.115182       802.1Q vlan#202 P0 192.168.10.50.40010 > 192.168.11.50.21: . ack
3422362543 win 229 <nop,nop,timestamp 3745225381 53252448>
   9: 22:13:33.115411       802.1Q vlan#202 P0 192.168.10.50.40010 > 192.168.11.50.21: . ack
3422362549 win 229 <nop,nop,timestamp 3745225381 53252448>
  10: 22:13:33.115426       802.1Q vlan#202 P0 192.168.10.50.40010 > 192.168.11.50.21: . ack
3422362570 win 229 <nop,nop,timestamp 3745225381 53252448>
  12: 22:13:34.803699       802.1Q vlan#202 P0 192.168.10.50.40010 > 192.168.11.50.21: P
3109534921:3109534931(10) ack 3422362570 win 229 <nop,nop,timestamp 3745227069 53252448>
  13: 22:13:34.804523       802.1Q vlan#202 P0 192.168.11.50.21 > 192.168.10.50.40010: R
3422362570:3422362570(0) ack 3109534931 win 0
```

FTD Secondary Connections and Pinholes

In older releases (for example 6.2.2, 6.2.3, etc) the Snort engine does not open pinholes for secondary connections (for example FTD Data) if you use the **Trust** action. In recent releases, this behavior is changed and the Snort engine opens pinholes even with the **Trust** action.

FTD Rule Guidelines

- Use Prefilter Policy Fastpath rules for big fat flows and in order to decrease latency through the box
- Use Prefilter Block rules for traffic that must be blocked based on L3/L4 conditions
- Use ACP Trust rules if you want to bypass many of the Snort checks, but still take advantage of features like Identity Policy, QoS, SI, Application detection, URL filter
- Place rules that affect less the firewall performance at the top of the Access Control Policy with the use of these guidelines:

1. Block rules (layers 1-4) - Prefilter Block
2. Allow rules (layers 1-4) - Prefilter Fastpath
3. ACP Block rules (layers 1-4)
4. Trust rules (layers 1-4)
5. Block rules (layers 5-7 - application detection, URL filtering)
6. Allow rules (layers 1-7 - application detection, URL filtering, Intrusion Policy/File Policy)
7. Block rule (Default rule)

- Avoid excessive logging (log at the start or at the end and avoid both at the same time)
- Be aware of the rule expansion, to check the number of rules in LINA

```
firepower# show access-list | include elements
access-list CSM_FW_ACL_; 7 elements; name hash: 0x4a69e3f3
```

Summary

Prefilter Actions

Rule Action (FMC UI)	LINA Action	Snort Action	Notes
Fastpath	Trust	Fastpath	Static Flow Offload to SmartNIC (4100/9300). **No packets** are sent to Snort engine.
Analyze	Permit	-	The ACP rules are checked. **Few** or **all packets** are sent to Snort engine for inspection. Traffic is allowed or dropped based on Snort engine verdict
Block (Prefilter)	Deny	-	Early drop by FTD LINA **No packets** are sent to Snort engine

ACP Actions

Rule Action (FMC UI)	Additional Conditions	LINA Action	Snort Action	Notes
Block	The rule matches L3/L4 conditions	Deny	Deny	
Block	The rule has L7 conditions	Permit	Deny	
Allow		Permit	Allow	6.3+ supports Dynamic Flow Offload (4100/9300)
Trust	(SI, QoS, or ID) enabled	Permit	Fastpath	6.3+ supports Dynamic Flow Offload (4100/9300)
Trust	(SI, QoS, and ID) disabled	Trust	Fastpath	Static Flow Offload (4100/9300)
Monitor		Permit	Audit	Monitor Rule doesn't drop or permit traffic, but it generates a Connection Event. The packet is checked against subsequent rules and it is either allowed or dropped
Block with reset		Permit	Reset	When a packet matches Block with reset rule FTD sends a TCP Reset packet or an ICMP Type 3 Code 13 Destination Unreachable (Administratively filtered) message
Interactive Block		Permit	Bypass	Interactive Block Rule prompts the user that the destination is forbidden If bypassed, by default, the firewall allows to bypass the block for 600 seconds
Interactive Block with reset		Permit	Intreset	Same as Interactive Block with the addition of a TCP RST in case of non-web traffic

Note: As from 6.3 FTD software code Dynamic flow offload can offload connections that meet additional criteria, for example, trusted packets that require Snort inspection. Check the 'Offload Large Connections (Flows)' section from the Firepower Management Center Configuration Guide for more details

Related Information

- FTD Access Control Rules
- FTD Prefiltering and Prefilter Policies
- Analyze Firepower Firewall Captures to Effectively Troubleshoot Network Issues
- Working with Firepower Threat Defense (FTD) Captures and Packet-Tracer
- Configure Logging on FTD via FMC
- Technical Support & Documentation - Cisco Systems
- Offload Large Connections