



Firewall Support in CUPS

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Revision History



Note Revision history details are not provided for features introduced before release 21.24.

Revision Details	Release
First introduced	Pre 21.24

Feature Description

Subscriber Firewall feature on CUPS architecture allows you to configure Stateless and Stateful packet inspection and packet filtering to protect the subscribers from malicious attacks. The firewall configuration allows the system to inspect each packet of the subscriber data session. It also evaluates the security threat and applies the policies configured on uplink and downlink traffic.



Note The subscriber firewall implementation in CUPS is like the firewall implementation in non-CUPS architecture. For more details on the subscriber firewall in non-CUPS, see the *PSF Administration Guide*.

Overview

Firewall feature includes the support for the following:

- DoS attack
- DDoS attack
- Packet Filtering
- Stateless & stateful packet inspection
- Application level gateways
- SNMP thresholding and logging

Configuring the Default Firewall Feature

Following is the default configuration for the FW policy.

```
configure
    active-charging service service_name
    fw-and-nat policy policy_name
end
```

Along with the preceding service configuration, Following is the default CLI behavior of various FW related CLI within the service.

```
Dos-Protection:
Source-Route                : Disabled
Win-Nuke                    : Disabled
Mime-Flood                  : Disabled
FTP-Bounce                  : Disabled
IP-Unaligned-Timestamp     : Disabled
Seq-Number-Prediction      : Disabled
TCP-Window-Containment     : Disabled
Teardrop                    : Disabled
UDP Flooding                : Disabled
ICMP Flooding              : Disabled
SYN Flooding                : Disabled
Port Scan                   : Disabled
IPv6 Extension Headers Limit : Disabled
IPv6 Hop By Hop Options    : Disabled
Hop By Hop Router Alert Option : Disabled
Hop By Hop Jumbo Payload Option : Disabled
Invalid Hop By Hop Options : Disabled
Unknown Hop By Hop Options : Disabled
IPv6 Destination Options   : Disabled
Invalid Destination Options : Disabled
Unknown Destination Options : Disabled
IPv6 Nested Fragmentation  : Disabled

Max-Packet-Size:
ICMP                       : 65535
Non-ICMP                   : 65535

Flooding:
ICMP limit                 : 1000
UDP limit                  : 1000
TCP-SYN limit              : 1000
```

```

Sampling Interval           : 1

TCP-SYN Flood Intercept:
  Mode                      : None
  Max-Attempts              : 5
  Retrans-timeout          : 60
  Watch-timeout            : 30
Mime-Flood Params:
  HTTP Header-Limit        : 16
  HTTP Max-Header-Field-Size : 4096

No Firewall Ruledef Match Action:
  Uplink Action            : permit
  Downlink Action         : deny

TCP RST Message Threshold  : Disabled
ICMP Dest-Unreachable Threshold : Disabled
Action upon receiving TCP SYN packet with ECN/CWR Flag set : Permit
Action upon receiving a malformed packet : Deny
Action upon IP Reassembly Failure : Deny
Action upon receiving an IP packet with invalid Options : Permit
Action upon receiving a TCP packet with invalid Options : Permit
Action upon receiving an ICMP packet with invalid Checksum: Deny
Action upon receiving a TCP packet with invalid Checksum: Deny
Action upon receiving an UDP packet with invalid Checksum: Deny
Action upon receiving an ICMP echo packet with id zero : Permit
TCP Stateful Checks : Enabled
First Packet Non-SYN Action: Drop
ICMP Stateful Checks: Enabled
TCP Partial Connection Timeout: 30

```

Enabling Firewall for IPv4 and IPv6

Following is the configuration to enable the firewall for IPv4 and IPv6:

configure

```

active-charging service service_name
fw-and-nat policy policy_name
firewall policy ipv4-and-ipv6
end

```

Configuration Support for Subscriber Firewall

The Control Plane pushes the required configuration for the subscriber firewall to the User Plane through PFD management. Firewall configurations are available under active charging configuration.

- Access-Rule-Defs
- Firewall-Nat Policy

Firewall feature configuration supports activation of firewall feature using rulebase, APN-based, and/or subscriber-based activation.

This section details the different aspect of configuration for the subscriber firewall in CUPS.

- Config delete command deletes the configuration immediately. It doesn't wait for bulk config timer as the said config is removed from the SCT and it's deleted from all Sessmgrs immediately.

- Addition/deletion/Modification of firewall configuration from CP to UP propagates using CLI command “push config-to-up all”.

Monitoring and Troubleshooting

Following is the show command output for the default Firewall feature on Control Plane.

show config active-charging service name acs verbose

```
fw-and-nat policy SFW_NAT_TEST
  no firewall dos-protection source-router
  no firewall dos-protection winnuke
  no firewall dos-protection mime-flood
  no firewall dos-protection ftp-bounce
  no firewall dos-protection ip-unaligned-timestamp
  no firewall dos-protection tcp-window-containment
  no firewall dos-protection teardrop
  no firewall dos-protection flooding udp
  no firewall dos-protection flooding icmp
  no firewall dos-protection flooding tcp-syn
  no firewall dos-protection port-scan
  no firewall dos-protection ipv6-extension-hdrs
  no firewall dos-protection ipv6-hop-by-hop
  no firewall dos-protection ipv6-hop-by-hop router-alert
  no firewall dos-protection ipv6-hop-by-hop jumbo-payload
  no firewall dos-protection ipv6-hop-by-hop invalid-options
  no firewall dos-protection ipv6-hop-by-hop unknown-options
  no firewall dos-protection ipv6-dst-options
  no firewall dos-protection ipv6-dst-options invalid-options
  no firewall dos-protection ipv6-dst-options unknown-options
  no firewall dos-protection ipv6-frag-hdr nested-fragmentation
  no firewall dos-protection ip-sweep tcp-syn
  no firewall dos-protection ip-sweep udp
  no firewall dos-protection ip-sweep icmp
  firewall max-ip-packet-size 65535 protocol icmp
  firewall max-ip-packet-size 65535 protocol non-icmp
  firewall flooding protocol icmp packet limit 1000
  firewall flooding protocol udp packet limit 1000
  firewall flooding protocol tcp-syn packet limit 1000
  firewall flooding sampling-interval 1
  firewall tcp-syn-flood-intercept mode none
  firewall tcp-syn-flood-intercept watch-timeout 30
  firewall mime-flood http-headers-limit 16
  firewall mime-flood max-http-header-field-size 4096
  no firewall icmp-destination-unreachable-message-threshold
  access-rule no-ruleddef-matches uplink action permit
  access-rule no-ruleddef-matches downlink action deny
  firewall tcp-idle-timeout-action reset
  no firewall tcp-reset-message-threshold
  firewall tcp-syn-with-ecn-cwr permit
  firewall malformed-packets drop
  firewall ip-reassembly-failure drop
  no firewall validate-ip-options
  firewall tcp-options-error permit
  firewall icmp-echo-id-zero permit
  firewall icmp-checksum-error drop
  firewall tcp-checksum-error drop
  firewall udp-checksum-error drop
  firewall tcp-fsm first-packet-non-syn drop
  firewall icmp-fsm
```

```
firewall policy ipv4-and-ipv6
firewall tcp-partial-connection-timeout 30
no nat policy
no nat binding-record
no nat pkts-drop edr-format
no nat pkts-drop timeout
default nat suppress-aaa-update
nat private-ip-flow-timeout 180
nat check-point-info basic limit-flows 100
nat check-point-info sip-alg
nat check-point-info h323-alg
nat max-chunk-per-realm single-ip
#exit
```

Show CLIs for CUPS

Following are the show CLIs for the CUPS:

For User Plane:

- show subscribers user-plane-only full all
- show subscribers user-plane-only flows
- show user-plane-service inline-services firewall statistics verbose
- show user-plane-service statistics rulebase all
- show alarm outstanding all
- show alarm outstanding all verbose
- show alarm statistics
- show user-plane-service statistics rulebase name <rulebasename>

For Control Plane:

- show active-charging fw-and-nat policy all
- show active-charging fw-and-nat policy name "fw_nat_policy_name"
- show active-charging firewall track-list attacking-servers
- show active-charging ruledef name

SNMP Traps

Following are the SNMP traps in support of this feature for CUPS, Use the respective trap CLIs on the User Plane to enable the trap.

- **DoS-Attacks:** When the number of DoS attacks exceed the set threshold value, the SNMP trap is generated, and the trap is cleared when the number falls below the threshold value within the time interval configured.
- **Drop-Packets:** When the number of packets dropped exceeds the threshold value, the SNMP trap is generated, the trap is cleared when the number falls below the threshold value within the time interval configured.

- **Deny-Rule:** When the number of Deny Rules exceeds the threshold value, the SNMP trap is generated, the trap is cleared when the number falls below the threshold value within the time interval configured.
- **No-Rule:** When the number of No Rules exceeds the threshold value, the SNMP trap is generated, the trap is cleared when the number falls below the threshold value within the time interval configured.

Reassembly Behavior Change

Following are the details about the CUPS reassembly, which are different from the non-CUPS architecture:

- In non-CUPS architecture, with the default FW configuration, fragments are buffered up to 64K bytes. Beyond 64K, all buffered and subsequent fragments are dropped. In non-CUPS architecture, this 64K limit was configurable from 30000 -> 65535. In CUPS, it is possible to reassemble the packet size of maximum 9k in a maximum of six fragments.
- Following are the four CLIs from the non-CUPS architecture that are deprecated in the CUPS:
 - firewall dos-protection teardrop
 - firewall dos-protection ipv6-frag-hdr nested-fragmentation
 - firewall max-ip-packet-size <30000-65535> protocol non-icmp
 - o firewall max-ip-packet-size <30000-65535>protocol icmp
- The following is a single CLI that covers teardrop attack, nested fragmentation, and general ip-reassembly-failure. Max-ip-packet size support is limited to six fragments (~9000 bytes).
 - o Firewall ip-reassembly-failure
- Following are the counters in firewall statistics, that gets incremented for all the attacks related to reassembly.
 - Packets Dropped due to IPv4 Reassembly Failure
 - Downlink Dropped Bytes on IPv4 Reassembly Failure
 - Uplink Dropped Bytes on IPv4 Reassembly Failure
 - Packets Dropped due to IPv6 Reassembly Failure
 - Downlink Dropped Bytes on IPv6 Reassembly Failure
 - Uplink Dropped Bytes on IPv6 Reassembly Failure