

Service Policies

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Threat defense service policies

Use Threat Defense service policies to apply services to specific traffic classes. Service policies let you apply different services to different connections entering the device or interface.

For example, you can use a service policy to create a timeout configuration that is specific to a particular TCP application, as opposed to one that applies to all TCP applications. A service policy consists of multiple actions or rules applied to an interface or applied globally.

Traffic class types

A traffic class is a combination of the interface and an extended access control list (ACL). The ACL "allow" rules determine which connections are part of the class. Any "denied" traffic in the ACL simply does not have the service applied to it: these connections are not actually dropped. You can use IP addresses and TCP/UDP ports to identify matching connections as precisely as you require.

There are two types of traffic class:

- **Interface-based rules**—If you specify a security zone or interface group in a service policy rule, the rule applies to the ACL "allowed" traffic that goes through any interface that is part of the interface objects.

  Interface-based rules that are applied to the ingress interface always take precedence over global rules for any feature. If an ingress interface-based rule applies to a connection, the system ignores any matching global rule. If no ingress interface or global rule applies, then an interface service rule on the egress interface is applied.

- **Global rules**—These rules apply to all interfaces. If an interface-based rule does not apply to a connection, the global rules are checked and applied to any connections that the ACL "allows." If none apply, then the connections proceed without any services applied.

A given connection can match only one traffic class, either interface-based or global, for a given feature. There should be at most one rule for a given interface object/traffic flow combination.

Service policy rules are applied after access control rules. These services are configured only for connections you are allowing.

Service policy relationships with FlexConfig and other features

Connection-related service policy features are managed separately from other service-rule features, so overlapping traffic classes generally aren't an issue, but they should still be configured carefully.

Service policy feature interactions

Because connection-related service policy features are treated as a separate feature group from other service-rule implemented features, you should not run into problems with overlapping traffic classes. However, please be mindful when configuring these features:

- QoS policy rules: QoS policy rules are implemented using the service policy CLI. These rules are applied before connection-based service policy rules. However, both QoS and connection settings can be applied to the same or overlapping traffic classes.
- FlexConfig policies: You can use FlexConfig policies to implement custom application inspections and NetFlow. Use the **show running-config** command to examine the CLI that already configures service rules, including the **policy-map**, **class-map**, and **service-policy** commands. Netflow and application inspection are compatible with QoS and connection settings, but you need to understand the existing configuration before implementing FlexConfig. Connection settings are applied before application inspections and Netflow.



Note Traffic classes that are created from the Threat Defense service policy are named **class_map_***ACLname*, where *ACLname* is the name of the extended ACL object used in the service policy rule.

Connection settings

Connection settings refer to a variety of features that manage connections through a device.

Connection setting types

Connection settings include these types:

- **Global timeouts for various protocols**—All global timeouts have default values. Change them only if you experience premature connection loss. You configure global timeouts in the Threat Defense platform policy. Select **Devices** > **Platform Settings**.
- **Connection timeouts per traffic class**—You can override the global timeouts for specific types of traffic using service policies. All traffic class timeouts have default values, so you do not have to set them.
- **Connection limits and TCP Intercept**—By default, there are no limits on how many connections can go through (or to) the Firewall Threat Defense. Use service policy rules to set limits on particular traffic classes. This protects servers from denial of service attacks. Particularly, you can set limits on embryonic connections (those that have not finished the TCP handshake), which protects against SYN flooding

attacks. When embryonic limits are exceeded, the TCP Intercept component activates to proxy connections and throttle attacks.

- **Dead connection detection (DCD)**—Enable dead connection detection if you have persistent connections that are valid but often idle. These connections may get closed when they exceed idle timeout settings. Dead connection detection identifies idle but valid connections and keeps them alive by resetting their idle timers. Whenever idle times are exceeded, DCD probes both sides of the connection to see if both sides agree that the connection is valid. The **show service-policy** command output includes counters to show the amount of activity from DCD. You can use the **show conn detail** command to get information about the initiator and responder and how often each has sent probes.
- **TCP sequence randomization**—Each TCP connection has two initial sequence numbers (ISN): one generated by the client and one generated by the server. By default, the Firewall Threat Defense randomizes the ISN of the TCP SYN passing in both the inbound and outbound directions. Randomization prevents an attacker from predicting the next ISN for a new connection and potentially hijacking the new session. However, TCP sequence randomization effectively breaks TCP SACK (Selective Acknowledgement), as the sequence numbers the client sees are different from what the server sees. You can disable randomization per traffic class if desired.
- **TCP normalization**—The TCP Normalizer protects against abnormal packets. You can configure how some types of packet abnormalities are handled by traffic class. You can configure TCP Normalization using the FlexConfig policy.
- **TCP state bypass**—You can bypass TCP state checking if you use asymmetrical routing in your network.

Requirements and prerequisites for service policies

- You must have one of these user roles: **Admin**, **Access Admin**, or **Network Admin**.
- Assign an access control policy to each target device before you add or edit service-policy rules.
- Create an extended access control list (ACL) for each traffic class. Include **Allow** rules for the connections that should receive the service.
- For interface-based rules, configure the interfaces on the target devices and add them to security zones or interface groups.

Guidelines and limitations for service policies

Service policies apply to routed or switch interfaces only, in either routed or transparent mode. They do not apply to inline set or passive interfaces.

You can configure up to 25 traffic classes for an interface or the global policy.

- Global policy: You can configure up to 25 service policy rules for a given security zone or interface group.
- Interface-based rules: The limit applies to the interfaces themselves, not to each zone or interface group. Because an interface can belong to both a security zone and an interface group, the number of rules allowed for a zone or group might be lower than 25, depending on its member interfaces.

You can have at most one rule for a given interface object/traffic flow combination.

When you make service policy changes to the configuration, all new connections use the new service policy. Existing connections continue to use the policy that was configured at the time of the connection establishment. If you want all connections to immediately use the new policy, you need to disconnect the current connections so they can reconnect using the new policy. Use an SSH or Console CLI session to enter the **clear conn** or **clear local-host** commands.

QoS rules and service policy rules (in the access control policy) are translated to commands on the firewall. This includes creating policy maps. There can be only one policy map per interface. The system automatically combines QoS and service policy configurations in a single policy map per interface.

However, you can also create policy maps manually using FlexConfig. For lower-end firewalls, such as the Secure Firewall 3100, you can create up to 64 policy maps in the configuration. For more powerful firewalls, such as the Firepower 4100, you can create up to 128. Be careful not to exceed this limit, or deployment will fail. You can view the device configuration from the CLI or use the deployment transcript to see how rules are translated to commands.

Configure threat defense service policies

A service policy consists of multiple actions or rules applied to an interface or applied globally. Use Threat Defense service policies to apply services to specific traffic classes.

Procedure

Step 1 Choose **Policies** > **Access Control heading** > **Access Control**, and click **Edit** (✎) for the access control policy whose Threat Defense service policy you want to edit.

Step 2 Click **Advanced Settings** from the **More** drop-down arrow at the end of the packet flow line.

Step 3 Click **Edit** (✎) in the **Threat Defense Service Policy** group.

A dialog box opens that shows the existing policy. The policy consists of an ordered list of rules, separated between global rules (which apply to all interfaces) and interface-based rules. The table shows the interface object and extended access control list name (which combined defines the traffic class for the rule), and the services applied.

Step 4 Do any of the following:

- Click **Add Rule** to create a new rule. See Configure a service policy rule, on page 5.
- Click **Edit** (✎) to edit an existing rule. See Configure a service policy rule, on page 5.
- Click **Delete** (🗑) to delete a rule.
- Click a rule and drag it to a new location to move it. You cannot drag rules between the interface and global lists. Instead you must edit the rule to change the interface/global setting. The first rule in the list that matches a connection is applied to the connection.

Step 5 Click **OK** when you are finished editing the policy.

Step 6 Click **Save** on the **Advanced** window. The changes are not saved until you click **Save**.

Configure a service policy rule

Service policy rules allow you to control and customize how network traffic is handled by applying specific services and connection settings to defined traffic classes.

Before you begin

Go to **Objects** > **Object Management** > **Access List** > **Extended** and create an extended access list that defines the traffic to which the rule applies. The rule is applied to any connections that match Allow rules in the extended access list. Define the ACL rules precisely, so that your service policy rule applies to only the traffic that requires the service.

If you are creating an interface-based rule, you must also have configured the interfaces on the assigned devices and added them to security zones or interface groups.

Procedure

Step 1 If you are not already in the Threat Defense service policy dialog box, choose **Policies** > **Access Control heading** > **Access Control**, edit the access control policy, select **Advanced Settings** from the **More** drop-down arrow at the end of the packet flow line, then edit the **Threat Defense Service Policy**.

Step 2 Do any of the following:

- Click **Add Rule** to create a new rule.
- Click **Edit** (✎) to edit an existing rule.

The service policy rule wizard opens to step you through the process of configuring the rule.

Step 3 In the **Interface Object** step, select the option that defines the interfaces that will use the policy.

- **Apply Globally**—Select this option to create a global rule, which applies to all interfaces.
- **Select Interface Objects**—Select this option to create an interface-based rule. Then, select the security zones or interface objects that contain the desired interfaces, and click **Add** to move them to the selected list. The service policy rule will be configured on each interface contained in the selected objects; it is not configured on the zone/group itself.

Click **Next** when the interface criterion is complete.

Step 4 In the **Traffic Flow** step, select the extended ACL object that defines the connections to which the rule applies, then click **Next**.

Step 5 In the **Connection Setting** step, configure the services to apply to this traffic class.

- **Enable TCP State Bypass** (TCP connections only)—Implement TCP state bypass. Connections subject to TCP state bypass are not inspected by any inspection engines, and they bypass all TCP state checking and TCP normalization. For detailed information, see Bypass TCP state checks for asymmetrical routing (TCP state bypass), on page 8.

Note Use TCP state bypass for troubleshooting purposes or when asymmetric routing cannot be resolved. This feature disables multiple security features, which can cause a high number of connections if you do not implement it properly with a narrowly defined traffic class.

- **Randomize TCP Sequence Number** (TCP connections only)—Whether to enable or disable TCP sequence number randomization. Randomization is enabled by default. For more information, see Disable TCP sequence randomization, on page 12.
- **Enable Decrement TTL** (TCP connections only)—Decrement the time-to-live (TTL) on packets that match the class. If you decrement time to live, packets with a TTL of 1 will be dropped, but a connection will be opened for the session on the assumption that the connection might contain packets with a greater TTL. Note that some packets, such as Open Shortest Path First (OSPF) hello packets, are sent with TTL = 1, so decrementing time to live can have unexpected consequences.

Note If you want the Firewall Threat Defense device to appear on traceroutes, you must configure the decrement TTL option and also set the Internet Control Message Protocol (ICMP) unreachable rate limit in the platform settings policy. See Configure the Firewall Threat Defense device to appear on traceroutes, on page 17.

- **Connections**—Limits for the number of connections allowed for the entire class. You can configure these options:
  - **Maximum TCP and UDP** (TCP/UDP connections only)—The maximum number of simultaneous connections that are allowed, between 0 and 2000000, for the entire class. For TCP, this count applies to established connections only. The default is 0, which allows unlimited connections. Because the limit is applied to a class, one attacking host can consume all the connections and leave none for the rest of the hosts that are matched to the class. Set the per-client limit to ameliorate this problem.
  - **Maximum Embryonic** (TCP connections only)—The maximum number of simultaneous embryonic TCP connections (those that have not finished the TCP handshake) allowed, between 0 and 2000000. The default is 0, which allows unlimited connections. By setting a non-zero limit, you enable TCP intercept, which protects inside systems from a denial of service (DoS) attack perpetrated by flooding an interface with TCP SYN packets. Also set the per-client options to protect against SYN flooding. For more information, see Protect servers from a SYN flood DoS attack (TCP intercept), on page 14.
- **Connections Per Client**—Limits for the number of connections allowed for a given client (source IP address). You can configure these options:
  - **Maximum TCP and UDP** (TCP/UDP connections only)—The maximum number of simultaneous connections allowed per client, between 0 and 2000000. For TCP, this includes established, half-open (embryonic), and half-closed connections. The default is 0, which allows unlimited connections. This option restricts the maximum number of simultaneous connections that are allowed for each host that is matched to the class.

- **Maximum Embryonic** (TCP connections only)—The maximum number of simultaneous embryonic TCP connections allowed per client, between 0 and 2000000. The default is 0, which allows unlimited connections. For more information, see Protect servers from a SYN flood DoS attack (TCP intercept), on page 14.

- **Connections SYN Cookie MSS**—The server maximum segment size (MSS) for SYN-cookie generation for embryonic connections upon reaching the embryonic connections limit, from 48 to 65535 . The default is 1380. This setting is meaningful only if you configure **Maximum Embryonic** for connections or per-client, or both.
- **Connections Timeout**—The timeout settings to apply to the traffic class. These timeouts override the global timeouts defined in the platform settings policy. You can configure these options:
  - **Embryonic** (TCP connections only)—The timeout period until a TCP embryonic (half-open) connection is closed, between 0:0:5 and 1193:00:00. The default is 0:0:30.
  - **Half Closed** (TCP connections only)—The idle timeout period until a half-closed connection is closed, between 0:0:30 and 1193:0:0. The default is 0:10:0. Half-closed connections are not affected by dead connection detection (DCD). Also, the system does not send a reset when taking down half-closed connections.
  - **Idle** (TCP, UDP, ICMP, IP connections)—The idle timeout period after which an established connection of any protocol closes, between 0:0:1 and 1193:0:0. The default is 1:0:0, unless you select the TCP state bypass option, where the default is 0:2:0.
  - **Reset Connection Upon Timeout** (TCP connections only)—Whether to send a TCP RST packet to both end systems after idle connections are removed.
- **Detect Dead Connections** (TCP connections only)—Whether to enable dead connection detection (DCD). Before expiring an idle connection, the system probes the end hosts to determine if the connection is valid. If both hosts respond, the connection is preserved, otherwise the connection is freed. When operating in transparent firewall mode, you must configure static routes for the endpoints. You cannot configure DCD on connections that are also offloaded, so do not configure DCD on connections you are fast-pathing in the prefilter policy. Use the **show conn detail** command in the Firewall Threat Defense CLI to track how many DCD probes have been sent by the initiator and responder.

  Configure these options:
  - **Detection Timeout**—The time duration in hh:mm:ss format to wait after each unresponsive DCD probe before sending another probe, between 0:0:1 and 24:0:0. The default is 0:0:15.

    For systems that are operating in a cluster or high-availability configuration, we recommend that you do not set the interval to less than one minute (0:1:0). If the connection needs to be moved between systems, the changes required take longer than 30 seconds, and the connection might be deleted before the change is accomplished.
  - **Detection Retries**—The number of consecutive failed retries for DCD before declaring the connection dead, from 1 to 255. The default is 5.

Step 6 Click **Finish** to save your changes.

The rule is added to the bottom of the appropriate list, either Interfaces or Global. Global rules are matched in top-down order. Rules in the Interfaces list are matched in top down order for each interface object. Place

rules for narrowly-defined traffic classes above broader rules, to ensure the right services get applied. You can move rules within each list by using drag and drop. You cannot move rules between lists.

Bypass TCP state checks for asymmetrical routing (TCP state bypass)

TCP state bypass allows traffic to bypass stateful inspection checks on Firewall Threat Defense devices.

Implementation considerations

If you have an asymmetrical routing environment in your network, where the outbound and inbound flow for a given connection can go through two different Firewall Threat Defense devices, you need to implement TCP state bypass on the affected traffic.

However, TCP state bypass weakens the security of your network, so you should apply bypass on very specific, limited traffic classes.

The asymmetrical routing problem

The asymmetrical routing problem occurs when return traffic for a connection goes through a different firewall than the outbound traffic. This causes packets to be dropped because they do not match existing connection entries in the fast path table.

Traffic inspection and fast path operation

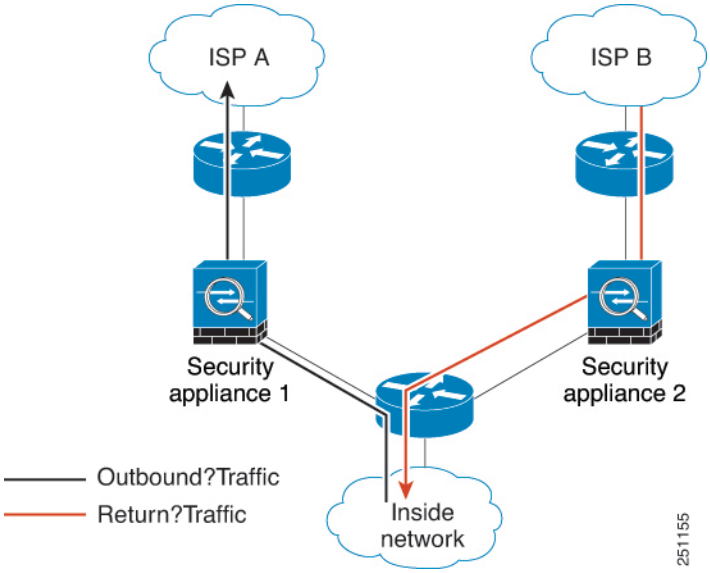
By default, the Firewall Threat Defense inspects all traffic using the Adaptive Security Algorithm. The Firewall Threat Defense allows or drops traffic based on the security policy. The Firewall Threat Defense maximizes the firewall performance by checking the state of each packet (new connection or established connection). It assigns new connection SYN packets to the session management path. It assigns established connections to the fast path. It assigns packets requiring advanced inspection to the control plane path.

The Firewall Threat Defense allows TCP packets that match existing connections to pass through via the fast path without rechecking every aspect of the security policy. This feature improves performance. However, the fast path establishment method can interfere with asymmetric routing solutions. The method uses SYN packets and performs checks such as TCP sequence number validation. Both outbound and inbound flows of a connection must pass through the same Firewall Threat Defense device.

Asymmetric routing scenario

For example, a new connection goes to Security Appliance 1. The SYN packet goes through the session management path, and an entry for the connection is added to the fast path table. If subsequent packets of this connection go through Security Appliance 1, then the packets match the entry in the fast path, and are passed through. But if subsequent packets go to Security Appliance 2, where no SYN packet went through the session management path, then no entry exists in the fast path for the connection, and Security Appliance 2 drops the packets. The following figure shows an asymmetric routing example where the outbound traffic goes through a different Firewall Threat Defense than the inbound traffic:

Figure 1: Asymmetric routing



If you have asymmetric routing configured on upstream routers and traffic alternates between two Firewall Threat Defense devices, then you can configure TCP state bypass for specific traffic. TCP state bypass alters the way sessions are established in the fast path and disables the fast path checks. This feature treats TCP traffic similarly to a UDP connection: when a non-SYN packet matching the specified networks enters the Firewall Threat Defense device, and there is not a fast path entry, then the packet goes through the session management path to establish the connection in the fast path. Once in the fast path, the traffic bypasses the fast path checks.

Guidelines and limitations for TCP state bypass

TCP state bypass unsupported features

The system does not support these features when you use TCP state bypass:

- Application inspection—Inspection requires both inbound and outbound traffic to go through the same Firewall Threat Defense, so inspection is not applied to TCP state bypass traffic.
- Snort inspection—Inspection requires both inbound and outbound traffic to go through the same device. However, Snort inspection is not automatically bypassed for TCP state bypass traffic. You must also configure a prefilter fastpath rule for the same traffic class for which you configure TCP state bypass. Otherwise, packets might be dropped unexpectedly because the TCP Normalizer is also not engaged.
- TCP Intercept, maximum embryonic connection limit, TCP sequence number randomization—The Firewall Threat Defense does not keep track of the state of the connection, so these features are not applied.
- TCP normalization—The TCP normalizer is disabled.
- TLS server identity discovery cannot be used with TCP state bypass on an inline or inline tap interface.

TCP state bypass NAT guidelines

Because the translation session is established separately for each device, be sure to configure static NAT on both devices for TCP state bypass traffic. If you use dynamic NAT, the address chosen for the session on Device 1 will differ from the address chosen for the session on Device 2.

Configure TCP state bypass

Configure TCP state bypass to handle asymmetrical routing environments where standard TCP state checking would interfere with traffic flow.

To bypass TCP state checking in asymetrical routing environments, carefully define a traffic class that applies only to the affected hosts or networks. Then, enable TCP state bypass on the traffic class using a service policy. You must also configure a corresponding prefilter fastpath policy for the same traffic to ensure that the traffic bypasses inspection.

Because bypass reduces the security of the network, limit its application as much as possible.

Before you begin

Follow these steps to configure TCP state bypass:

Procedure

Step 1 Create the extended ACL that defines the traffic class.

For example, to define a traffic class for TCP traffic from 10.1.1.1 to 10.2.2.2, do the following:

a) Choose **Objects** > **Object Management** > **Access List** > **Extended**.
b) Click **Add Extended Access List**.
c) Enter a **Name** for the object, for example, bypass.
d) Click **Add** to add a rule.
e) Keep **Allow** for the action.
f) Enter 10.1.1.1 beneath the **Source** list and click **Add**. Then, enter 10.2.2.2 beneath the **Destination** list, and click **Add**.
g) Click **Port**, select **TCP (6)** beneath the **Selected Source Ports** list, then click **Add**. Do not enter a port number. Add TCP as the protocol. This will cover all ports.
h) In the Extended Access List Entry dialog box, click **Add** to add the rule to the ACL.
i) In the Extended Access List Object dialog box, click **Save** to save the ACL object.

Step 2 Configure the TCP state bypass service policy rule.

For example, to configure TCP state bypass for this traffic class globally, do the following:

a) Choose **Policies** > **Access Control heading** > **Access Control**, and edit the policy assigned to the devices that require this service.
b) Click **Advanced Settings** from the **More** drop-down arrow at the end of the packet flow line, and click **Edit** (✎) for the **Threat Defense Service Policy**.
c) Click **Add Rule**.
d) Select **Global** and click **Next**.
e) Select the extended ACL object you created for this rule and click **Next**.
f) Select **Enable TCP State Bypass**.
g) (Optional.) Adjust the **Idle** timeout for bypassed connections. The default is 2 minutes.

h) Click **Finish** to add the rule. If necessary, drag and drop the rule to the desired position in the service policy.

Click **OK** to save the changes to the service policy.

Click **Save** on **Advanced** to save the changes to the access control policy.

Step 3 Configure a prefilter fastpath rule for the traffic class.

You cannot use the ACL object in the prefilter rule, so you need to recreate the traffic class either directly in the prefilter rule, or by first creating network objects that define the class.

This procedure assumes that you already have a prefilter policy attached to the access control policy. If you have not created a prefilter policy yet, go to **Policies** > **Prefilter** and first create the policy. You can then follow this procedure to attach it to the access control policy and create the rule.

Keeping with our example, this procedure creates a fastpath rule for TCP traffic from 10.1.1.1 to 10.2.2.2.

a) Choose **Policies** > **Access Control heading** > **Access Control**, and edit the policy that has the TCP bypass service policy rule.
b) Click the link for the **Prefilter Policy**, which is to the left immediately under the policy description.
c) In the Prefilter Policy dialog box, select the policy to assign to the device if the correct one is not already selected. Do not click OK.

Because you cannot add rules to the default prefilter policy, you must choose a custom policy.

d) In the Prefilter Policy dialog box, click **Edit** (). This action opens a new browser window where you can edit the policy.
e) Click **Add Prefilter Rule** and configure a rule with these properties.

- **Name**—Any name that you find meaningful will do, such as TCPBypass.
- **Action**—Select **Fastpath**.
- **Interface Objects**—If you configured TCP state bypass as a global rule, leave the default, any, for both source and destination. If you created an interface-based rule, select the same interface objects you used for rule in the **Source Interface Objects** list, and keep any as the destination.
- **Networks**—Add 10.1.1.1 to the **Source Networks** list, and 10.2.2.2 to the **Destination Networks** list. You can either use network objects or manually add the addresses.
- **Ports**—Under **Selected Source Ports**, select TCP(6), **do not enter a port**, and click **Add**. This applies the rule to all TCP traffic, regardless of TCP port number.

f) Click **Add** to add the rule to the prefilter policy.
g) Click **Save** to save your changes to the prefilter policy.

You can now close the prefilter edit window and return to the access control policy edit window.

h) In the access control policy edit window, the Prefilter Policy dialog box should still be open. Click **OK** to save your changes to the prefilter policy assignment.
i) Click **Save** on the access control policy to save the changed prefilter policy assignment, if you changed it.

You can now deploy the changes to the affected devices.

Disable TCP sequence randomization

Disable TCP initial sequence number randomization to prevent issues with data scrambling and to support specific network configurations that require non-randomized sequence numbers.

Each TCP connection has two initial sequence numbers (ISN): one generated by the client and one generated by the server. The Firewall Threat Defense device randomizes the ISN of the TCP SYN passing in both the inbound and outbound directions.

Randomizing the ISN of the protected host prevents an attacker from predicting the next ISN for a new connection and potentially hijacking the new session. However, TCP sequence randomization effectively breaks TCP SACK (Selective Acknowledgement), as the sequence numbers the client sees are different from what the server sees.

You can disable TCP initial sequence number randomization if data is getting scrambled or if there is another necessity. This is useful in these situations:

- If another in-line firewall is also randomizing the initial sequence numbers, there is no need for both firewalls to be performing this action, even though this action does not affect the traffic.
- If you use eBGP multi-hop through the device, and the eBGP peers are using MD5. Randomization breaks the MD5 checksum.
- If you use a WAAS device that requires the device not to randomize the sequence numbers of connections.
- If you enable hardware bypass for the ISA 3000, and TCP connections are dropped when the ISA 3000 is no longer part of the data path.

Procedure

Step 1 Create the extended ACL that defines the traffic class.

For example, to define a traffic class for TCP traffic from any host to 10.2.2.2, do the following:

a) Choose **Objects** > **Object Management** > **Access List** > **Extended**.
b) Click **Add Extended Access List**.
c) Enter a **Name** for the object, for example, preserve-sq-no.
d) Click **Add** to add a rule.
e) Keep **Allow** for the action.
f) Leave the **Source** list empty, enter 10.2.2.2 beneath the **Destination** list, and click **Add**.
g) Click **Port**, select **TCP (6)** beneath the **Selected Source Ports** list, and click **Add**. Do not enter a port number, simply add TCP as the protocol, which will cover all ports.
h) Click **Add** on the Extended Access List Entry dialog box to add the rule to the ACL.
i) Click **Save** on the Extended Access List Object dialog box to save the ACL object.

Step 2 Configure the service policy rule that disables TCP sequence number randomization.

For example, to disable randomization for this traffic class globally, do the following:

a) Choose **Policies** > **Access Control heading** > **Access Control**, and edit the policy assigned to the devices that require this service.
b) Click **Advanced Settings** from the **More** drop-down arrow at the end of the packet flow line, and click **Edit** (✎) for the **Threat Defense Service Policy**.

c) Click **Add Rule**.
d) Select **Global** and click **Next**.
e) Select the extended ACL object you created for this rule and click **Next**.
f) Deselect **Randomize TCP Sequence Number**.
g) (Optional.) Adjust the other connection options as needed.
h) Click **Finish** to add the rule. If necessary, drag and drop the rule to the desired position in the service policy.

Click **OK** to save the changes to the service policy.

Click **Save** on **Advanced** to save the changes to the access control policy.

You can now deploy the changes to the affected devices.

Monitor service policies

You can monitor service-policy related information using the device CLI. Use these commands to get the information you need.

Commands for monitoring service policies.

- **show conn** [**detail**]

  Shows connection information. Detailed information uses flags to indicate special connection characteristics. For example, the "b" flag indicates traffic subject to TCP state bypass.

  When you use the **detail** keyword, you can see information about dead connection detection (DCD) probing, which shows how often the connection was probed by the initiator and responder. For example, the connection details for a DCD-enabled connection would look like this:

```
TCP dmz: 10.5.4.11/5555 inside: 10.5.4.10/40299,
    flags UO , idle 1s, uptime 32m10s, timeout 1m0s, bytes 11828,
cluster sent/rcvd bytes 0/0, owners (0,255)
  Traffic received at interface dmz
        Locally received: 0 (0 byte/s)
  Traffic received at interface inside
        Locally received: 11828 (6 byte/s)
  Initiator: 10.5.4.10, Responder: 10.5.4.11
  DCD probes sent: Initiator 5, Responder 5
```

- **show service-policy**

  Shows service policy statistics, including dead connection detection (DCD) statistics.

- **show threat-detection statistics top TCP-intercept** [**all** | **detail**]

  View the top 10 protected servers under attack. The **all** keyword shows the history data of all the traced servers. The **detail** keyword shows history sampling data. The system samples the number of attacks 30 times during the rate interval, so for the default 30 minute period, statistics are collected every 60 seconds.

Examples for service policy rules

This section provides examples of service policy rules to help users understand how to configure and implement service policies effectively.

Protect servers from a SYN flood DoS attack (TCP intercept)

This task configures TCP intercept to protect servers from SYN flood denial of service attacks by limiting embryonic connections and enabling monitoring statistics.

A SYN-flooding denial of service (DoS) attack occurs when an attacker sends a series of SYN packets to a host. These packets usually originate from spoofed IP addresses. The constant flood of SYN packets keeps the server SYN queue full, which prevents it from servicing connection requests from legitimate users.

You can limit the number of embryonic connections to help prevent SYN flooding attacks. An embryonic connection is a connection request that has not finished the necessary handshake between source and destination.

When the embryonic connection threshold of a connection is crossed, the Firewall Threat Defense acts as a proxy for the server. It generates a SYN-ACK response to the client SYN request using the SYN cookie method. This approach prevents the connection from being added to the SYN queue of the targeted host. The SYN cookie is the initial sequence number returned in the SYN-ACK that is constructed from MSS, time stamp, and a mathematical hash of other items to essentially create a secret. If the Firewall Threat Defense receives an ACK from the client with the correct sequence number, and within the valid time window, it authenticates the client and allows the connection to the server. The component that performs the proxy is called TCP intercept.

Setting connection limits can protect a server from a SYN flood attack. You can optionally enable TCP intercept statistics and monitor the results of your policy. The following procedure explains the end-to-end process.

Before you begin

- Ensure that you set the embryonic connection limit lower than the TCP SYN backlog queue on the server that you want to protect. Otherwise, valid clients can no longer access the server during a SYN attack. To determine reasonable values for embryonic limits, carefully analyze the capacity of the server, the network, and server usage.
- The number of CPU cores affects the actual number of concurrent and embryonic connections the device can allow. Because each core manages connections, the actual counts can exceed the configured limits. In the worst case, a device with n cores can allow up to n − 1 additional connections of each type.

  For example, on a 4-core device configured for 6 concurrent connections and 4 embryonic connections, the device could allow up to 3 additional connections of each type.

  To find the number of cores for your model, enter the **show CPU core** command in the device CLI.

Procedure

Step 1 Create the extended ACL that defines the traffic class, which is the list of servers you want to protect.

For example, to define a traffic class to protect the web servers with the IP addresses 10.1.1.5 and 10.1.1.6:

a) Choose **Objects** > **Object Management** > **Access List** > **Extended**.
b) Click **Add Extended Access List**.
c) Enter a **Name** for the object, for example, protected-servers.
d) Click **Add** to add a rule.
e) Keep **Allow** for the action.
f) Leave the **Source** list empty, enter 10.1.1.5 beneath the **Destination** list, and click **Add**.
g) Also enter 10.1.1.6 beneath the **Destination** list and click **Add**.
h) Click **Port**, select **HTTP** in the available ports list, and click **Add to Destination**. If your server also supports HTTPS connections, also add that port.
i) Click **Add** to add the rule to the ACL.

Click **Save** to save the ACL object.

Step 2 Configure the service policy rule that sets embryonic connection limits.

For example, to set the total concurrent embryonic limit to 1000 connections, and the per-client limit to 50 connections, do the following:

a) Choose **Policies** > **Access Control heading** > **Access Control**, and edit the policy assigned to the devices that require this service.
b) Click **Advanced Settings** from the **More** drop-down arrow at the end of the packet flow line, and click **Edit** (✎) for the **Threat Defense Service Policy**.
c) Click **Add Rule**.
d) Select **Global** and click **Next**.
e) Select the extended ACL object you created for this rule and click **Next**.
f) Enter 1000 for **Connections** > **Maximum Embryonic**.
g) Enter 50 for **Connections Per Client** > **Maximum Embryonic**.

(Optional.) Adjust the other connection options as needed.

h) Click **Finish** to add the rule. If necessary, drag and drop the rule to the desired position in the service policy.

Click **OK** to save the changes to the service policy.

Click **Save** on **Advanced** to save the changes to the access control policy.

Step 3 (Optional.) Configure the rates for TCP intercept statistics.

TCP intercept uses these options to determine the rate for collecting statistics. All options have default values, so if these rates suit your needs, you can skip this step.

- Rate Interval—The size of the history monitoring window, between 1 and 1440 minutes. The default is 30 minutes. During this interval, the system samples the number of attacks 30 times.
- Burst Rate—The threshold for syslog message generation, between 25 and 2147483647. The default is 400 per second. When the burst rate is exceeded, the device generates syslog message 733104.
- Average Rate—The average rate threshold for syslog message generation, between 25 and 2147483647. The default is 200 per second. When the average rate is exceeded, the device generates syslog message 733105.

If you want to adjust these options, do this:

a) Choose **Objects** > **Object Management** > **FlexConfig** > **Text Object**.

b) Click **Edit** (✎) for the **threat_defense_statistics** system-defined object.
c) Although you can directly change the values, the recommended approach is to open the **Override** section and click **Add** to create a device override.
d) Select the devices to which you will assign the service policy (through the access control policy assignment) and click **Add** to move them to the selected list.
e) Click **Override**.
f) The object must have 3 entries, so click **Count** as needed until you get 3.
g) Enter the values you need, in order from 1-3, as rate interval, burst rate, and average rate. Consult the object description to verify you enter the values in the right order.
h) Click **Add** in the Object Override dialog box.
i) Click **Save** in the Edit Text Object dialog box.

Step 4 Enable TCP intercept statistics.

You must configure a FlexConfig policy to enable TCP intercept statistics.

a) Choose **Devices** > **FlexConfig**.
b) If you already have a policy assigned to the devices, edit it. Otherwise, create a new policy and assign it to the affected devices.
c) Select the **Threat_Detection_Configure** object in the **Available FlexConfig** list and click >>. The object is added to the **Selected Append FlexConfigs** list.
d) Click **Save**.
e) (Optional.) You can verify that you have the right settings by clicking **Preview Config** and selecting one of the devices.

The system generates the CLI commands that will be written to the device during the next deployment. These commands will include those needed for the service policy as well as those needed for threat detection statistics. Scroll to the bottom of the preview to see the appended CLI. The TCP intercept statistics command should look something like this, if you use the default values (line break added for clarity):

```
###Flex-config Appended CLI ###

threat-detection statistics tcp-intercept rate-interval 30
       burst-rate 400 average-rate 200
```

Step 5 You can now deploy the changes to the affected devices.

Step 6 Monitor the TCP intercept statistics from the device CLI using these commands:

- **show threat-detection statistics top TCP-intercept** [**all** | **detail**]—View the top 10 protected servers under attack. The **all** keyword shows the history data of all the traced servers. The **detail** keyword shows history sampling data. The system samples the number of attacks 30 times during the rate interval, so for the default 30 minute period, statistics are collected every 60 seconds.

Note You can use the **shun** command to block attacking host IP addresses. To remove the block, use the **no shun** command.

- **clear threat-detection statistics TCP-intercept**—Erases TCP intercept statistics.

Example:

```
hostname(config)# show threat-detection statistics top tcp-intercept
Top 10 protected servers under attack (sorted by average rate)
Monitoring window size: 30 mins    Sampling interval: 30 secs
<Rank> <Server IP:Port> <Interface> <Ave Rate> <Cur Rate> <Total> <Source IP (Last Attack
Time)>
--------------------------------------------------------------------------------
1    10.1.1.5:80 inside 1249 9503 2249245 <various> Last: 10.0.0.3 (0 secs ago)
2    10.1.1.6:80 inside 10 10 6080 10.0.0.200 (0 secs ago)
```

Configure the Firewall Threat Defense device to appear on traceroutes

Make the Firewall Threat Defense device appear as a hop in traceroute results by decrementing the time-to-live on packets and adjusting ICMP rate limits.

By default, the Firewall Threat Defense device does not appear on traceroutes as a hop. To make it appear, you need to decrement the time-to-live on packets that pass through the device, and increase the rate limit on ICMP unreachable messages. To accomplish this, you must configure a service policy rule and adjust the ICMP platform settings policy.

Note If you decrement time to live, packets with a TTL of 1 will be dropped, but a connection will be opened for the session on the assumption that the connection might contain packets with a greater TTL. Note that some packets, such as OSPF hello packets, are sent with TTL = 1, so decrementing time to live can have unexpected consequences. Keep these considerations in mind when defining your traffic class.

Procedure

Step 1 Create the extended ACL that defines the traffic class for which to enable traceroute reporting.

For example, to define a traffic class for all addresses, but excluding OSPF traffic, do the following:

a) Choose **Objects** > **Object Management** > **Access List** > **Extended**.
b) Click **Add Extended Access List**.
c) Enter a **Name** for the object, for example, traceroute-enabled.
d) Click **Add** to add a rule to exclude OSPF.
e) Change the action to **Block**, click **Port**, select **OSPFIGP (89)** as the protocol beneath the **Destination Ports** list, and click **Add** to add the protocol to the selected list.
f) Click **Add** on the Extended Access List Entry dialog box to add the OSPF rule to the ACL.
g) Click **Add** to add a rule to include all other connections.
h) Keep **Allow** for the action, and leave both the Source and Destination lists empty.
i) Click **Add** on the Extended Access List Entry dialog box to add the rule to the ACL.

Ensure that the OSPF deny rule is above the Allow Any rule. Drag and drop to move the rules if necessary.

Click **Save** on the Extended Access List Object dialog box to save the ACL object.

Step 2 Configure the service policy rule that decrements the time-to-live value.

For example, to decrement time-to-live globally, do the following:

a) Choose **Policies** > **Access Control heading** > **Access Control**, and edit the policy assigned to the devices that require this service.
b) Click **Advanced Settings** from the **More** drop-down arrow at the end of the packet flow line, and click **Edit** (✎) for the **Threat Defense Service Policy**.
c) Click **Add Rule**.
d) Select **Global** and click **Next**.
e) Select the extended ACL object you created for this rule and click **Next**.
f) Select **Enable Decrement TTL**.
g) (Optional.) Adjust the other connection options as needed.
h) Click **Finish** to add the rule. If necessary, drag and drop the rule to the desired position in the service policy.

Click **OK** to save the changes to the service policy.

Click **Save** on **Advanced** to save the changes to the access control policy.

You can now deploy the changes to the affected devices.

Step 3 Increase the rate limit on ICMP unreachable messages.

a) Choose **Devices** > **Platform Settings**.
b) If you already have a policy assigned to the devices, edit it. Otherwise, create a new Threat Defense platform settings policy and assign it to the affected devices.
c) Select **ICMP** from the table of contents.
d) Increase the **Rate Limit**, for example, to 50. You might also want to increase the **Burst Size**, for example, to 10, to ensure enough responses are generated within the rate limit.

You can leave the ICMP rules table empty, it is not related to this task.

e) Click **Save**.

Step 4 You can now deploy the changes to the affected devices.

History for threat defense service policy

This reference provides a summary of feature changes by release for the service policy.

Feature	Minimum Firewall Management Center	Minimum Firewall Threat Defense	Description
Threat Defense Service Policy.	6.3	Any	You can now configure a Threat Defense service policy as part of your access control policy advanced options. You can use Threat Defense service policies to apply services to specific traffic classes. Features supported include TCP state bypass, randomizing TCP sequence numbers, decrementing the time-to-live (TTL) value on packets, dead connection detection, setting a limit on the maximum number of connections and embryonic connections per traffic class and per client, and timeouts for embryonic, half closed, and idle connections. New screen: **Policies** > **Access Control** > **Access Control**, **Advanced** tab, **Threat Defense Service Policy**. Supported platforms: Secure Firewall Threat Defense
Initiator and responder information for dead connection detection (DCD), and DCD support in a cluster.	6.5	Any	If you enable dead connection detection (DCD), you can use the **show conn detail** command to get information about the initiator and responder. Dead connection detection allows you to maintain an inactive connection, and the **show conn** output tells you how often the endpoints have been probed. In addition, DCD is now supported in a cluster. New/Modified commands: **show conn** (output only). Supported platforms: Secure Firewall Threat Defense
Configure the maximum segment size (MSS) for embryonic connections.	7.1	Any	You can configure a service policy to set the server maximum segment size (MSS) for SYN-cookie generation for embryonic connections upon reaching the embryonic connections limit. This is meaningful for service policies where you are also setting embryonic connection maximums. New or changed screens: **Connection Settings** in the Add/Edit Service Policy wizard.