Cisco TrustSec SGT Caching

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The Cisco TrustSec SGT Caching feature enhances the ability of Cisco TrustSec to make Security Group Tag (SGT) transportability flexible. This feature identifies IP-SGT bindings, and caches the corresponding SGTs so that network packets are forwarded through all the network services for normal deep-packet inspection processing, and at the service egress point the packets are re-tagged with the appropriate SGT.

Only IPv4 SGT caching is supported. High availability is supported for SGT caching.

The Cisco TrustSec SGT Caching feature is not supported on the C9500-12Q, C9500-16X, C9500-24Q, and C9500-40X models of the Cisco Catalyst 9500 Series Switches.

Restrictions for Cisco TrustSec SGT Caching

The global SGT caching configuration and the interface-specific ingress configuration are mutually exclusive. In the following scenarios, a warning message is displayed if you attempt to configure SGT caching both globally and on an interface:

- If an interface has ingress SGT caching enabled using the **cts role-based sgt-cache ingress** command in interface configuration mode, and a global configuration is attempted using the **cts role-based sgt-caching** command, a warning message is displayed, as shown in this example:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitEthernet 1/0/1
Device(config-if)# cts role-based sgt-cache ingress
Device(config-if)# exit
Device(config)# cts role-based sgt-caching

There is at least one interface that has ingress sgt caching configured. Please remove
 all interface ingress sgt caching configuration(s) before attempting global enable.
```

  This restriction specifically applies only to Layer 3-routed port interfaces. Also, the port must be a trusted port for SGT caching to work.

- Because SGT caching internally uses the NetFlow ternary content-addressable memory (TCAM) space, at any time on an interface, you can enable only either Flexible NetFlow or SGT caching in a given direction.
- If global configuration is enabled using the **cts role-based sgt-caching** command, and an interface configuration is attempted using the **cts role-based sgt-cache ingress** command in interface configuration mode, a warning message is displayed, as shown in this example:

```
Device> enable
Device# configure terminal
Device(config)# cts role-based sgt-caching
Device(config)# interface gigabitEthernet 1/0/1
Device(config-if)# cts role-based sgt-cache ingress

Note that ingress sgt caching is already active on this interface due to global
sgt-caching enable.
```

- IPv6 SGT caching is not supported.
- SGT caching cannot be performed for the link-local IPv6 source address.

  A link-local address is a network address that is valid only for communications within the network segment (link) or the broadcast domain that the host is connected to. Link-local addresses are not guaranteed to be unique beyond a single network segment. Therefore, devices do not forward packets with link-local addresses. Because they are not unique, SGT tags are not assigned for packets with source as link-local IPv6 address.
- SGT caching cannot coexist on the same port interface that has Application Visibility and Control (AVC), Wired Device AVC (WDAVC), Encrypted Traffic Analysis (ETTA,) or NetFlow/Flexible NetFlow features configured. An error message is displayed on the console if both SGT caching and one of these features are configured on the same interface.

  When SGT caching is enabled along with any of the above mentioned features, the following error message is displayed on the console: *SGT Caching cannot be configured. Remove the configuration.* However; the SGT Caching feature is displayed in the output of the **show running-config** command. You need to manually remove SGT caching and reconfigure it, after removing the feature that cannot co-exist with it.
- Egress SGT caching and L2 SGT caching are not supported on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

Information About Cisco TrustSec SGT Caching

Identifying and Reapplying SGT Using SGT Caching

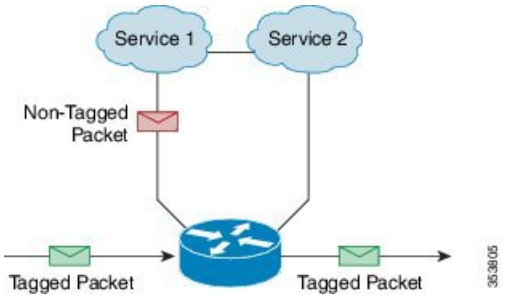
Cisco TrustSec uses Security Group Tag (SGT) caching to ensure that traffic that is tagged with SGT can also pass through services that are not aware of SGTs. Examples of services that cannot propagate SGTs are WAN acceleration or optimization, Intrusion Prevention Systems (IPSs), and upstream firewalls.

To configure SGACL caching on a VLAN, SGT caching must be enabled on the corresponding port and VLAN.

In one-arm mode (See the below figure), a packet tagged with SGT enters a device (where the tags are cached), and is redirected to a service. After that service is completed, the packet either returns to the device, or is redirected to another device. In such a scenario:

1. The Cisco TrustSec SGT Caching feature enables the device to identify the IP-SGT binding information from the incoming packet and caches this information.
2. The device redirects the packet to services that cannot propagate SGTs.
3. After the completion of the service, the packet returns to the device.
4. The appropriate SGT is reapplied to the packet at the service egress point.
5. Role-based enforcements are applied to the packet that has returned to the device from the service or services.
6. The packet with SGTs is forwarded to other Cisco TrustSec-capable devices downstream.

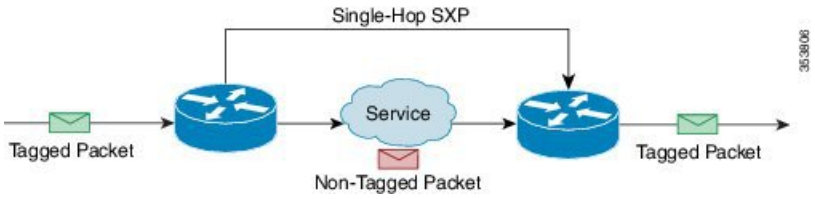
Figure 1: SGT Caching in One-Arm Mode



In certain instances, some services are deployed in a bump-in-the-wire topology (See the above figure). In such a scenario:

1. Packets that go through a service or services do not come back to the device.
2. Single-hop SGT Exchange Protocol (SXP) is used to identify and export the identified IP-SGT bindings.
3. The upstream device in the network identifies the IP-SGT bindings through SXP and reapplies the appropriate tags or uses them for SGT-based enforcement. During egress caching, the original pre-Network Address Translation (NAT) source IP address is cached as part of the identified IP-SGT binding information.
4. IP-SGT bindings that do not receive traffic for 300 seconds are removed from the cache.

Figure 2: SGT Caching in Bump-in-the-wire Topology



How to Configure Cisco TrustSec SGT Caching

This section describes how to configure SGT caching globally and on interfaces.

Configuring SGT Caching Globally

Before you begin

Before SGT caching is enabled, Security Exchange Protocol (SXP) must be established for information exchange.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**cts role-based sgt-caching** **Example:** `Device(config)# cts role-based sgt-caching`	Enables SGT caching in ingress direction for all interfaces.
Step 4	**end** **Example:** `Device(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.

Configuring SGT Caching on an Interface

When an interface is configured to be on a Virtual Routing and Forwarding (VRF) network, the IP-SGT bindings identified on that interface are added under the specific VRF. (To view the bindings identified on a corresponding VRF, use the **show cts role-based sgt-map vrf** *vrf-name* **all** command.) SGT caching can also be configured per VRF.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:**	Enters global configuration mode.

	Command or Action	Purpose
	`Device# configure terminal`	
Step 3	**interface** *type slot/port* **Example:** `Device(config)# interface gigabitethernet 1/0/1`	Configures an interface and enters interface configuration mode.
Step 4	**cts role-based sgt-cache** [**ingress** | **egress**] **Example:** `Device(config-if)# cts role-based sgt-cache ingress`	Configures SGT caching on a specific interface. • **ingress**: Enables SGT caching for traffic entering the specific interface (inbound traffic). • **ingress**: Enables SGT caching for traffic exiting the specific interface (outbound traffic).
Step 5	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Verifying Cisco TrustSec SGT Caching

Procedure

Step 1 **enable**

Enables privileged EXEC mode. Enter your password if prompted.

Example:

```
Device> enable
```

Step 2 **show cts**

Displays the Cisco TrustSec connections and the status of global SGT caching.

Example:

```
Device# show cts

Global Dot1x feature: Disabled
CTS device identity: ""
CTS caching support: disabled
CTS sgt-caching global: Enabled
Number of CTS interfaces in DOT1X mode:  0,    MANUAL mode: 0
Number of CTS interfaces in LAYER3 TrustSec mode: 0
Number of CTS interfaces in corresponding IFC state
```

```
  INIT            state:  0
  AUTHENTICATING  state:  0
  AUTHORIZING     state:  0
  SAP_NEGOTIATING state:  0
  OPEN            state:  0
  HELD            state:  0
  DISCONNECTING   state:  0
  INVALID         state:  0
CTS events statistics:
  authentication success: 0
  authentication reject : 0
  authentication failure: 0
  authentication logoff : 0
  authentication no resp: 0
  authorization success : 0
  authorization failure : 0
  sap success           : 0
  sap failure           : 0
  port auth failure     : 0
```

Step 3 **show cts interface**

Displays the Cisco TrustSec configuration statistics for an interface and SGT caching information with mode details (ingress or egress).

Example:

```
Device# show cts interface GigabitEthernet 1/0/1

Interface GigabitEthernet1/0/1
    CTS sgt-caching Ingress:  Enabled
    CTS sgt-caching Egress :  Disabled
    CTS is enabled, mode:     MANUAL
      Propagate SGT:          Enabled
      Static Ingress SGT Policy:
        Peer SGT:             200
        Peer SGT assignment:  Trusted

    L2-SGT Statistics
        Pkts In                     : 16298041
        Pkts (policy SGT assigned)  : 0
        Pkts Out                    : 5
        Pkts Drop (malformed packet): 0
        Pkts Drop (invalid SGT)     : 0
```

Step 4 **show cts interface brief**

Displays SGT caching information with mode details (ingress or egress) for all interfaces.

Example:

```
Device# show cts interface brief

Interface GigabitEthernet1/0/1
    CTS sgt-caching Ingress:  Enabled
    CTS sgt-caching Egress :  Disabled
    CTS is disabled

Interface GigabitEthernet1/0/1
    CTS sgt-caching Ingress:  Enabled
    CTS sgt-caching Egress :  Disabled
```

```
    CTS is enabled, mode:     MANUAL
      Propagate SGT:          Enabled
      Static Ingress SGT Policy:
        Peer SGT:             200
        Peer SGT assignment:  Trusted

Interface GigabitEthernet1/0/2
    CTS sgt-caching Ingress:  Enabled
    CTS sgt-caching Egress :  Disabled
    CTS is enabled, mode:     MANUAL
      Propagate SGT:          Enabled
      Static Ingress SGT Policy:
        Peer SGT:             0
        Peer SGT assignment:  Untrusted

Interface GigabitEthernet1/0/3
    CTS sgt-caching Ingress:  Enabled
    CTS sgt-caching Egress :  Disabled
    CTS is disabled

Interface Backplane-GigabitEthernet1/0/4
    CTS sgt-caching Ingress:  Enabled
    CTS sgt-caching Egress :  Disabled
    CTS is disabled

Interface RG-AR-IF-INPUT1
    CTS sgt-caching Ingress:  Enabled
    CTS sgt-caching Egress :  Disabled
    CTS is disabled
```

Step 5 **show cts role-based sgt-map all ipv4**

Displays all the SGT-IPv4 bindings.

Example:

```
Device# show cts role-based sgt-map all ipv4

Active IPv4-SGT Bindings Information

IP Address              SGT     Source
============================================
192.0.2.1                50      CACHED
192.0.2.2                50      CACHED
192.0.2.3                50      CACHED
192.0.2.4                50      CACHED
192.0.2.5                3900    INTERNAL
192.0.2.6                3900    INTERNAL
192.0.2.7                3900    INTERNAL

IP-SGT Active Bindings Summary
============================================
Total number of CACHED   bindings = 20
Total number of INTERNAL bindings = 3
Total number of active   bindings = 23
```

Step 6 **show cts role-based sgt-map vrf** *vrf-name* **all ipv4**

Displays all the SGT-IP bindings for a specific Virtual Routing and Forwarding (VRF) interface.

Example:

```
Device# show cts role-based sgt-map vrf vrf1 all ipv4

%IPv6 protocol is not enabled in VRF vrf1
Active IPv4-SGT Bindings Information

IP Address              SGT     Source
============================================
192.0.2.1                50      CACHED
192.0.2.2                2007    CACHED
192.0.2.3                50      CACHED
192.0.2.4                50      CACHED
```

Step 7 The SGT cache entry is removed after a port shutdown or SGT cache timeout.

Configuration Examples for Cisco TrustSec Caching

Example: Configuring SGT Caching Globally

The following example shows how to configure SGT caching globally:

```
Device> enable
Device# configure terminal
Device(config)# cts role-based sgt-caching
Device(config)# end
```

Example: Configuring SGT Caching for an Interface

The following example shows how to configure SGT caching for an interface:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitEthernet 1/0/1
Device(config-if)# cts role-based sgt-cache ingress
Device(config-if)# end
```

Example: Disabling SGT Caching on an Interface

The following example shows how to disable SGT caching on an interface and displays the status of SGT caching on the interface when caching is enabled globally, but disabled on the interface.

```
Device> enable
Device# configure terminal
Device(config)# cts role-based sgt-caching
Device(config)# interface gigabitEthernet 1/0/1
Device(config-if)# no cts role-based sgt-cache ingress
Device(config-if)# end
Device# show cts interface GigabitEthernet 1/0/1

Interface GigabitEthernet1/0/1
    CTS sgt-caching Ingress:  Disabled
```

```
CTS sgt-caching Egress :  Disabled
CTS is enabled, mode:     MANUAL
  Propagate SGT:          Enabled
  Static Ingress SGT Policy:
    Peer SGT:             200
    Peer SGT assignment:  Trusted

L2-SGT Statistics
    Pkts In                      : 200890684
    Pkts (policy SGT assigned)   : 0
    Pkts Out                     : 14
    Pkts Drop (malformed packet): 0
    Pkts Drop (invalid SGT)      : 0
```

Feature History for Cisco TrustSec SGT Caching

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Fuji 16.9.1	Cisco TrustSec SGT Caching	The Cisco TrustSec SGT Caching feature enhances the ability of Cisco TrustSec to make SGT transportability flexible. Support for this feature was introduced on all the models of the Cisco Catalyst 9500 Series Switches.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.