# Configure Layer 3 CTS with Ingress Reflector

## Contents

## Introduction

This document describes how to configure the Layer 3 Cisco TrustSec (CTS) with Ingress Reflector.

## Prerequisites

### Requirements

Cisco recommends that you have basic knowledge of CTS solution.

### Components Used

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

- Catalyst 6500 Switches with Supervisor Engine 2T on IOS® Release 15.0(01)SY
- IXIA Traffic Generator

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, make sure that you understand the potential impact of any command.

## Background Information

CTS is an advanced network access control and identity solution to provide end-to-end secure connectivity across Service Providers backbone and Data Center networks.

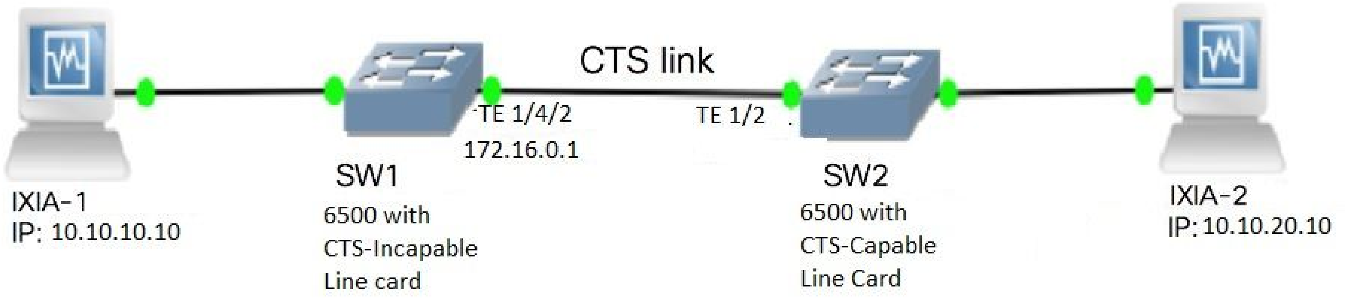
The Catalyst 6500 switches with Supervisor Engine 2T and 6900 Series line cards provide complete hardware and software support in order to implement CTS. When a Catalyst 6500 is configured with the Supervisor Engine 2T and 6900 Series line cards, the system is fully capable of providing CTS features.

Since customers would like to continue to use their Catalyst 6500 switches and line cards that already exist while they migrate to a CTS network, and for this reason, Supervisor Engine 2T needs to be compatible with certain line cards that already exist when deployed in a CTS network.

In order to support new CTS functionality such as Security Group Tag (SGT) and IEEE 802.1AE MACsec link encryption, there are dedicated application-specific integrated circuits (ASICs) used on the Supervisor Engine 2T and the new 6900 Series line cards. Ingress reflector mode provides compatibility between legacy line cards that do not use CTS. Ingress reflector mode supports only centralized forwarding, packet forwarding will occur on the PFC of Supervisor Engine 2T. Only 6148 Series or fabric-enabled Centralized Forwarding Card (CFC) line cards such as the 6748-GE-TX line cards are supported. The Distributed Forwarding Card (DFC) Line cards and 10 Gigabit Ethernet line cards are not supported when ingress reflector mode is enabled. With ingress reflector mode configured, non-supported line cards do not power up. Ingress reflector mode is enabled with the use of a global configuration command and requires a system reload.

# Configure

## Network Diagram



## Step 1. Setup CTS Layer3 on Egress Interface between SW1 and SW2

-
  ```
  SW1(config)#int t1/4/2
  SW1(config-if)#ip address 172.16.0.1 255.255.255.0
  SW1(config-if)# cts layer3 ipv4 trustsec forwarding
  SW1(config-if)# cts layer3 ipv4 policy
  SW1(config-if)#no shutdown
  SW1(config-if)#exit

  SW2(config)#int t1/2
  SW2(config-if)#ip address 172.16.0.2 255.255.255.0
  SW2(config-if)# cts layer3 ipv4 trustsec forwarding
  SW2(config-if)# cts layer3 ipv4 policy
  SW2(config-if)#no shutdown
  SW2(config-if)#exit
  ```

## Step 2. Enable CTS Ingress Reflector Globally

```
SW1(config)#platform cts ingress
SW1#sh platform  cts
```

```
 CTS Ingress mode enabled
```

Connect an interface from a NON CTS supported line card to IXIA.

```
SW1#sh run int gi2/4/1
Building configuration...

Current configuration : 90 bytes
!
interface GigabitEthernet2/4/1
 no switchport
 ip address 10.10.10.1 255.255.255.0
end
```

Assign static SGT in SW1 switch for packets received from the IXIA 1 connected to SW1. Setup permit policy to do CTS L3 only for packets in the desired subnet on authenticator.

```
SW1(config)#cts role-based sgt-map 10.10.10.10 sgt 15
SW1(config)#ip access-list extended traffic_list
SW1(config-ext-nacl)#permit ip 10.10.10.0 0.0.0.255 any
SW1(config)#cts policy layer3 ipv4 traffic traffic_list
```

# Verify

Use this section in order to confirm that your configuration works properly.

Verify that the IFC-state is OPEN on both switches. The outputs must look like this:

```
SW1#sh cts int summary

Global Dot1x feature is Enabled
CTS Layer2 Interfaces
---------------------
Interface  Mode    IFC-state dot1x-role peer-id    IFC-cache    Critical Authentication
-----------------------------------------------------------------------------
Te1/4/1    DOT1X   OPEN      Supplic    SW2        invalid  Invalid
Te1/4/4    MANUAL  OPEN      unknown    unknown    invalid  Invalid
Te1/4/5    DOT1X   OPEN      Authent    SW2        invalid  Invalid
Te1/4/6    DOT1X   OPEN      Supplic    SW2        invalid  Invalid
Te2/3/9    DOT1X   OPEN      Supplic    SW2        invalid  Invalid

CTS Layer3 Interfaces
---------------------
Interface   IPv4 encap       IPv6 encap       IPv4 policy      IPv6 policy
Te1/4/2     OPEN             ----------       OPEN             -----------

SW2#sh cts int summary
Global Dot1x feature is Enabled
CTS Layer2 Interfaces
---------------------
Interface  Mode    IFC-state dot1x-role peer-id    IFC-cache    Critical-Authentication
-----------------------------------------------------------------------------
Te1/1      DOT1X   OPEN      Authent    SW1         invalid     Invalid
Te1/4      MANUAL  OPEN      unknown    unknown     invalid     Invalid
Te1/5      DOT1X   OPEN      Supplic    SW1         invalid     Invalid
```

```
Te1/6      DOT1X   OPEN      Authent    SW1         invalid     Invalid
Te4/5      DOT1X   OPEN      Authent    SW1         invalid     Invalid

CTS Layer3 Interfaces
---------------------
Interface   IPv4 encap       IPv6 encap       IPv4 policy      IPv6 policy
--------------------------------------------------------------------------
Te1/2       OPEN             ----------       OPEN             -----------
```

### Verify through Netflow Output

Netflow can be configured with these commands:

```
SW2(config)#flow record rec2
SW2(config-flow-record)#match ipv4 protocol
SW2(config-flow-record)#match ipv4 source address
SW2(config-flow-record)#match ipv4 destination address
SW2(config-flow-record)#match transport source-port
SW2(config-flow-record)#match transport destination-port
SW2(config-flow-record)#match flow direction
SW2(config-flow-record)#match flow cts source group-tag
SW2(config-flow-record)#match flow cts destination group-tag
SW2(config-flow-record)#collect routing forwarding-status
SW2(config-flow-record)#collect counter bytes
SW2(config-flow-record)#collect counter packets
SW2(config-flow-record)#exit
SW2(config)#flow monitor mon2
SW2(config-flow-monitor)#record rec2
SW2(config-flow-monitor)#exit
```

Apply netflow on the ingress port of SW2 switch interface as shown:

```
SW2#  sh run int t1/2
Building configuration...

Current configuration : 166 bytes
!
interface TenGigabitEthernet1/2
 ip address 172.16.0.2 255.255.255.0
 ip flow monitor mon2 input
 cts layer3 ipv4 trustsec forwarding
 cts layer3 ipv4 policy
end
```

Send packets from IXIA 1 to IXIA 2. It must be received properly on IXIA 2 connected to the SW2 switch according to the traffic policy. Ensure that the packets are SGT tagged.

```
SW2#sh flow monitor mon2 cache format  table
  Cache type:                               Normal
  Cache size:                                 4096
  Current entries:                               0
  High Watermark:                                0
  Flows added:                                   0
  Flows aged:                                    0
    - Active timeout      (  1800 secs)          0
    - Inactive timeout    (    15 secs)          0
    - Event aged                                 0
    - Watermark aged                             0
    - Emergency aged                             0

There are no cache entries to display.
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0

There are no cache entries to display.

Module 4:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0

There are no cache entries to display.

Module 2:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0
There are no cache entries to display.

Module 1:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               4

IPV4 SRC ADDR    IPV4 DST ADDR    TRNS SRC PORT  TRNS DST PORT  FLOW DIRN  FLOW CTS SRC GROUP
TAG  FLOW CTS DST GROUP TAG  IPPROT  ip fwd status                  bytes        pkts
===============  ===============  =============  =============  =========
======================  ======================  =======
========================================  ==========
1.1.1.10         2.2.2.10                     0              0  Input
10                       0      255  Unknown                       148121702     3220037
10.10.10.10      10.10.20.10                  0              0  Input
15                       0      255  Unknown                       23726754      515799
10.10.10.1       224.0.0.5                    0              0  Input
2                       0       89  Unknown                       9536          119
172.16.0.1       224.0.0.5                    0              0  Input
0                       0       89  Unknown                       400           5
```

Now, setup exception policy to skip CTS L3 for packets to a specific IP address in Authenticator switch.

```
SW2#sh flow monitor mon2 cache format  table
  Cache type:                               Normal
  Cache size:                                 4096
  Current entries:                               0
  High Watermark:                                0
  Flows added:                                   0
  Flows aged:                                    0
    - Active timeout      (  1800 secs)          0
    - Inactive timeout    (    15 secs)          0
    - Event aged                                 0
    - Watermark aged                             0
    - Emergency aged                             0

There are no cache entries to display.
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0

There are no cache entries to display.

Module 4:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0

There are no cache entries to display.

Module 2:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0
There are no cache entries to display.

Module 1:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               4

IPV4 SRC ADDR    IPV4 DST ADDR    TRNS SRC PORT  TRNS DST PORT  FLOW DIRN  FLOW CTS SRC GROUP
TAG  FLOW CTS DST GROUP TAG  IPPROT  ip fwd status                  bytes        pkts
===============  ===============  =============  =============  =========
======================  ======================  =======
========================================  ==========
1.1.1.10         2.2.2.10                     0              0  Input
10                       0      255  Unknown                     148121702     3220037
10.10.10.10      10.10.20.10                  0              0  Input
15                       0      255  Unknown                     23726754      515799
10.10.10.1       224.0.0.5                    0              0  Input
2                       0       89  Unknown                     9536          119
172.16.0.1       224.0.0.5                    0              0  Input
0                       0       89  Unknown                     400           5



SW2#sh flow monitor mon2 cache format table
Cache type:                               Normal
  Cache size:                                 4096
  Current entries:                               0
  High Watermark:                                0

  Flows added:                                   0
  Flows aged:                                    0
    - Active timeout      (  1800 secs)          0
    - Inactive timeout    (    15 secs)          0
    - Event aged                                 0
    - Watermark aged                             0
    - Emergency aged                             0

There are no cache entries to display.

  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown

Current entries:                               0

There are no cache entries to display.

Module 4:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0

There are no cache entries to display.

Module 2:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               0

There are no cache entries to display.

Module 1:
  Cache type:                               Normal (Platform cache)
  Cache size:                              Unknown
  Current entries:                               3

IPV4 SRC ADDR    IPV4 DST ADDR    TRNS SRC PORT  TRNS DST PORT  FLOW DIRN  FLOW CTS SRC GROUP
TAG  FLOW CTS DST GROUP TAG  IP PROT  ip fwd status                  bytes        pkts
===============  ===============  =============  =============  =========
======================  ======================  =======
========================================  =========
1.1.1.10         2.2.2.10                     0              0  Input
10                       0      255  Unknown                        1807478       39293
10.10.10.10      10.10.20.10                  0              0  Input
0                       0      255  Unknown                        1807478       39293
10.10.10.1       224.0.0.5                    0              0  Input
2                       0       89  Unknown                        164           2
```

Send packets from IXIA 1 to IXIA 2. They must be received properly on IXIA 2 connected to the SW2 switch according to the exception policy.

> **Note**: The packets are not SGT tagged because the exception policy takes precedence **FLOW CTS SRC GROUP TAG=0.**

## Troubleshoot

There is currently no specific troubleshooting information available for this configuration.