C H A P T E R **13**

Intelligent Traffic Mirroring

This chapter provides an overview of intelligent traffic mirroring, explaining what is it and how it works. It also explains the various procedures for configuring and monitoring intelligent traffic mirroring.

Traffic mirroring is a new SCE platform capability that complements the range of services provided by the SCA BB solution. It copies a specified portion of the traffic streams and sends this copy to third party servers who do offline analysis.

The criteria for traffic mirroring is based on L7 attributes and subscriber awareness. This fine granularity, along with load sharing capability for servers providing the same service, substantially reduces the number of solution components.

The traffic that is copied is also processed by the SCA BB application and forwarded without interruption to its original destination. The copy of the traffic is presumed not to return to the SCE platform after being processed by the third party servers.

Behavioral Targeting Use Case

Today WEB advertising is being executed by content providers (or publishers) in collaboration with ad-networks, which actually handle the syndication of ads from advertisers to web sites. The Cisco Service Control behavioral targeting solution provides the means for service providers to participate in the business of the online advertising. This solution allows the SPs to leverage their information about the subscribers and enables highly targeted advertising.

Based on Deep Packet Inspection (DPI) and subscriber integration, the Cisco SCE8000 platform filters out only what is relevant for the subscriber profiling. This greatly conserves the resources of the advertising servers, by eliminating the irrelevant web traffic before it even reaches them. This filtered traffic is processed as usual by the SCA BB application along with the rest of the traffic, but in addition a copy of it is passed to an external device which can do offline analysis on the subscriber behavior. The data can then be used for the targeted advertising.

Behavioral Targeting is accomplished using several SCE platform capabilities. This chapter describes the intelligent traffic mirroring capability, which is one of the features that enable the solution.

For more information regarding targeted advertising, see the following documents:

- *Cisco Service Control Online Advertising Solution Guide: Behavioral Profile Creation Using RDRs*
- *Cisco Service Control Online Advertising Solution Guide: Behavioral Profile Creation Using Traffic Mirroring.*

Traffic Mirroring and Value Added Services (VAS)

Value Added Services is term used in this context to describe high touch services which are executed by a server that is external to the Cisco SCE8000 platform.

Since these services require specific, complex and continuously changing logic, implementing them on the SCE platform would significantly impact flexibility, time to market and performance. On the other hand, in order for such services to be implemented inline, the vendor would have to implement carrier grade network functionality, which is typically not cost effective for them. VAS is a win-win architecture since it leverages the carrier grade architecture and performance of the SCE platform, while allowing vendors to focus on their high touch services (in this case, creating subscriber profiles to be used for targeted advertising purposes).

The VAS infrastructure enables two main capabilities:

- Diverting portions of the original traffic streams to an individual or cluster of VAS servers or appliances. This is also known as VAS traffic forwarding.
- Diverting a copy of specified traffic streams to an individual or cluster of VAS servers or appliances. This is known as traffic mirroring.

While VAS traffic forwarding enables inline analysis of traffic by third parties, traffic mirroring enables offline analysis. Due to this distinction, the two capabilities are quite different. However, the transport model of the VAS infrastructure (which is mainly based on VLAN tagging) is common to both capabilities and so are some of the configuration methods.

Note   Currently the SCE8000 supports only traffic mirroring

The diversion criteria in VAS in general and specifically in traffic mirroring is based on the subscriber package, flow type and the availability of the VAS servers.

The solution provides support for multiple VAS service types using different VAS server groups. Several servers of the same type can be deployed to increase the total capacity and resiliency.

The SCE platform performs subscriber load sharing between the servers of the same server group.

How Traffic Mirroring Works

Subscribers are provisioned to the traffic mirroring service as part of the normal provisioning process of new subscribers to SCA BB.

Flows that are classified to a traffic mirroring service get the usual SCA BB service, as well as being duplicated and mirrored to the VAS servers. The duplication is done after application handling regardless of the direction of the packet.

Routing the traffic to the VAS servers is done by using VLAN tags.

Figure 13-1   Typical Traffic Mirroring Installation
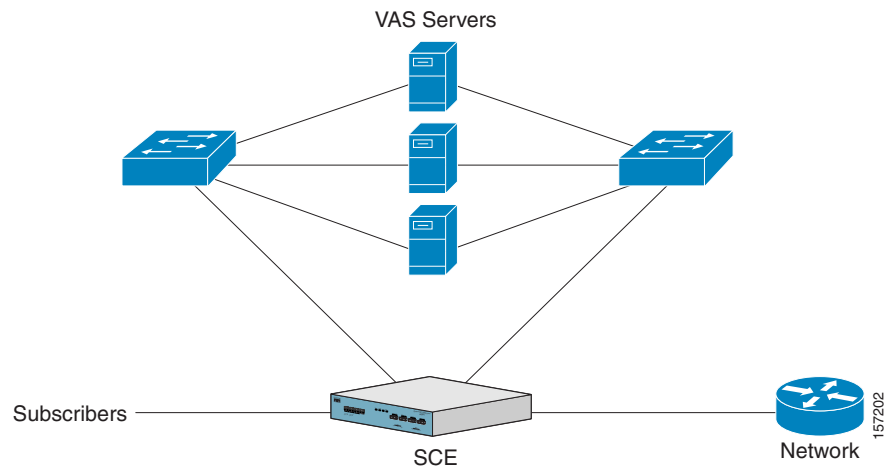
Important information:

- A single SCE platform can support up to 64 VAS servers.
- A maximum of 64 SCE8000 platforms can be connected.
- Each VAS server may be used by more than one SCE platform.
- A maximum of eight VAS server groups can be defined for the entire system.

The following sections provide a more detailed description of how traffic mirroring works.

Traffic Mirroring and SCA BB

When traffic mirroring is configured for a certain type of traffic, in addition to all its basic functions, the SCA BB application decides whether each flow is to be mirrored or not, based on L7 classification.

Traffic mirroring rules are configured through the SCA-BB console. These rules map the traffic to be mirrored and analyzed to the VAS server groups. When a flow is marked for traffic mirroring, the VAS server group for this flow is selected. If the group includes more than one VAS server, traffic will be forwarded in such a way that the subscriber load is shared between the servers on the same group.

The mapping of traffic portions to VAS server groups is done through the standard SCA BB GUI, this definition is given per package.

VLAN Tags for Traffic Mirroring

The traffic is routed between the SCE platform and the VAS servers by VLANs. The SCOS adds the VLAN tag to the duplicated packets before sending them out of the platform to the VAS servers. If there is already a VLAN tag, it is replaced; traffic with more than one VLAN tag cannot be defined for traffic mirroring.

The VLAN tag to be used for each VAS server is configured by the user. To preserve consistency of the traffic flow, the VAS solution requires the user to configure a unique VLAN tag for each SCE platform/VAS server combination.

The VLAN tag format is shown in the figure below.

Figure 13-2   VLAN Tag Format
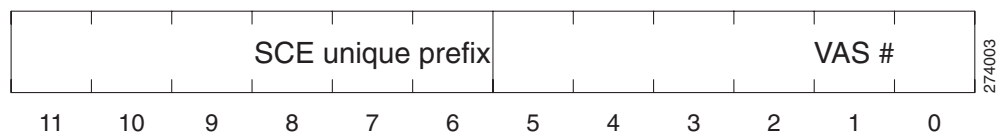
The VLAN tag has twelve bits, divided as follows:

- The lower six bits identify the VAS server.
- The higher six bits identify the SCE platform. These six bits must be the same for all VAS servers attached to a specific SCE platform.
- For example:
- 0x100 = 100 000000 = SCE #4, VAS #0
- 0x10D = 100 001101 = SCE #4, VAS #13
- 0x1FF = 111 111111 = SCE #7, VAS #63

The SCE platform enforces that the VLAN tags configured by the user keep this format, meaning that the lower six bits match the VAS server number for which the VLAN tag is configured and that the higher six bits match the higher six bits previously configured for other VAS servers on this SCE platform.

Note that the use of VLAN tags is an integral part of the VAS solution, and therefore requires the VAS device to be able to work in 802.1q trunk while preserving the VLAN information.

Mirroring Termination

Mirroring of a flow can continue until the flow is terminated, or be limited to a certain volume passed over the flow. This enables a huge data reduction on the server side, as well as performance saving in the SCE platform.

An RST packet is sent to the server when the mirroring is stopped due to a stop condition. This is done in order to signal the server that the mirroring has stopped.

The RST packet is sent in the direction of intiator to initatee with the additional VLAN tag.

Mirroring Exceptions

Since the decision to mirror is based on service classification, which can be done on the first payload or after first few packets, the entire TCP handshake is not mirrored.

To save in performance on both sides, zero payload packets are also not mirrored. (note that this type of packets have no real value for offline analysis).

Load Balancing

The VAS Server Group to which the flow should be attached is determined by the package of the subscriber and the service the flow was classified to. The selection of a specific VAS server from the VAS servers within this group is based on the current load on each VAS server. The system tries to create an equal subscriber load for all the VAS servers belonging to the same group.

In some cases, a VAS server may be used by more than one SCE platform. Remember that the SCE platform performs load balancing only on the traffic that it sends to the VAS server; it is not aware how much of a load the VAS server may be bearing from a different SCE platform. It is the responsibility of the user to allocate available VAS servers to the SCE platforms in a way that ensures proper total load on each VAS server.

Load Balancing and Subscribers

The system balances the usage of the VAS servers within a VAS Server Group, trying to create an equal subscriber load for all the VAS servers in one VAS Server Group. The load balancing is subscriber based, meaning that the subscribers are evenly distributed between the servers.

VAS load sharing is subscriber-based rather than bandwidth-based to ensure that all the traffic of the subscriber gets to the same server so the server can make subscriber based decisions.

The SCE platform uses the same VAS server for all the traffic of a subscriber (per server group) even if there is a change in the number of active servers in the group. Traffic from a subscriber is assigned to a new server only if the current server becomes inactive. This will only apply on new flows. Flows that were already mapped to a server before it became active will remain attached to it.

The mapping of subscriber to VAS servers not is saved across logouts or SCE platform reload

Load Balancing and Subscriber Mode

Since the load balancing is subscribers based, this solution will not work properly in subscriberless mode, as the entire traffic load would be carried only by one VAS server per group.

Note   Use anonymous mode rather than subscriberless mode with traffic mirroring.

In Pull mode, the first flow of the subscriber behaves as configured in the anonymous template. If no anonymous template is configured, such first flows will be processed as defined by the default template. Therefore, the default template should provide a proper package, so these flows will be mirrored.

SCE Connectivity

Traffic mirroring is implemented by sending the mirrored packets over a designated VLAN through a predefined link of the SCE platform. The link that has been defined for traffic mirroring can be either used exclusively for this purpose, or it can be one of the traffic ports, in which case the Tx capacity of the link will be shared between the original egress traffic and the mirrored traffic.

The direction of the flow is preserved when mirrored, so traffic that is received on the subscriber interface on either link is sent over a VLAN on the network interface over this predefined link. And traffic that is received on the network interface on either link is sent over a VLAN on the subscriber interface over this predefined link. The mirrored traffic does not return to the SCE platform.
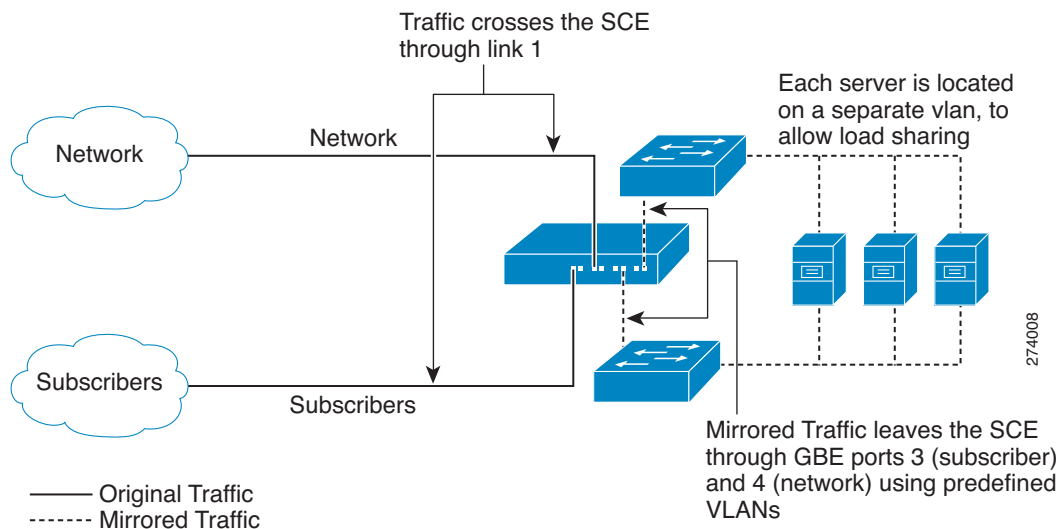
Note Enabling traffic morroring is expected to impact the SCE performance due to the excessive processing associated with it; the actual figure depending on the amount of the mirrored traffic. It is recommended that you monitor SCE platform performance when enabling this capability.

The following illustration shows an SCE platform using a dedicated link for mirroring (link-1).

Figure 13-3   Traffic Mirroring on a Dedicated Link

Traffic crosses the SCE through link 1

Each server is located on a separate vlan, to allow load sharing

Network

Network

Subscribers

Subscribers

274008

Mirrored Traffic leaves the SCE through GBE ports 3 (subscriber) and 4 (network) using predefined VLANs

—— Original Traffic
------- Mirrored Traffic

The following illustration shows an SCE platform using traffic ports for mirroring.

Figure 13-4   *Traffic Mirroring over Traffic Ports*
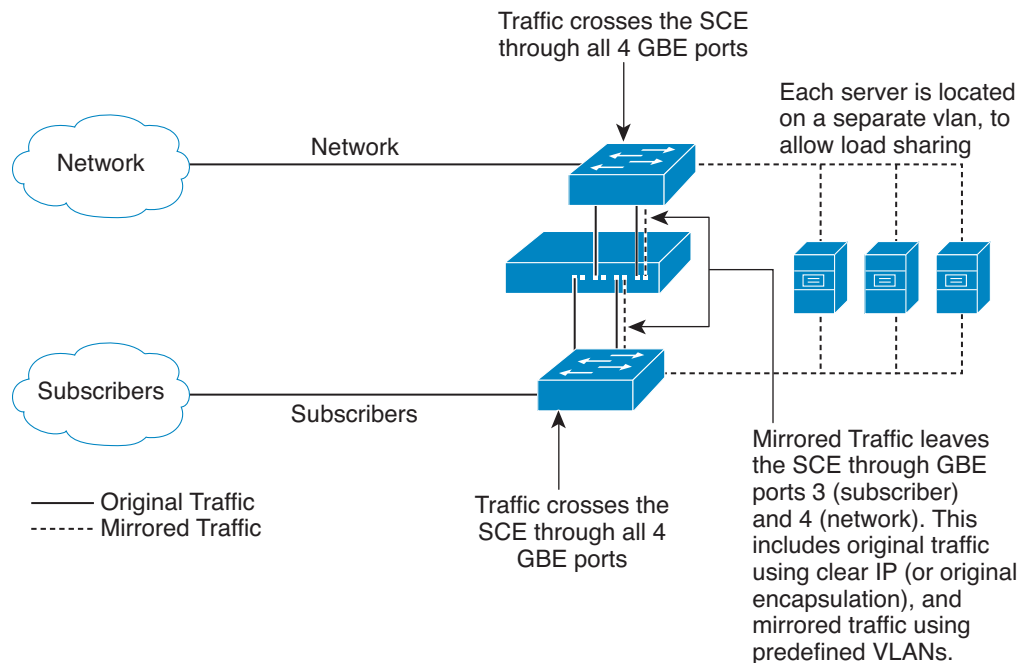
Interactions between Traffic Mirroring and Other SCE Platform Features

- Incompatible SCE Platform Features, page 13-7
- Traffic Mirroring and Bandwidth Management, page 13-8

Incompatible SCE Platform Features

There are certain SCE platform features that are incompatible with traffic mirroring. Before enabling traffic mirroring, it is the responsibility of the user to make sure that no incompatible features or modes are configured.

The features and modes listed below cannot coexist with traffic mirroring:

- Line-card connection modes — receive-only, receive-only-cascade
- Link mode other than forwarding
- Link encapsulation protocols, including MPLS and L2TP, with the exception of VLAN. Traffic with one VLAN can be defined as VAS traffic.

Traffic Mirroring and Bandwidth Management

In general, the bandwidth management rules to be applied to flows designated for mirroring are not affected by the mirroring decision. However note the following points:

- Bandwidth enforcement applies on the two copies of the flow as if there was only one copy; that is, if the flow should be limited to 50K, then its original copy which is sent to the original destination is limited to 50K, and the copy that is sent to the VAS server is also limited to 50K. This has no effect on the total volume that should be mirrored.

- The mirrored volume is not counted and accounted in the BWM system, and therefore in cases where the mirrored traffic is congesting the link, the system will not be aware of the link congestion and will not know to shrink the BWC.

Configuring Traffic Mirroring

Following is a high-level description of the steps in configuring traffic mirroring.

1. Configure the SCE platform— define the servers and the server groups

2. Configure which traffic goes to which Server Group using the SCA BB console.

> **Note** Additional traffic mirroring configuration and monitoring options are available from the SCA BB Console. See *Managing Traffic Mirroring Settings* in the *Cisco Service Control Application for Broadband User Guide.*

Configuration of the traffic mirroring solution is distributed between the SCA BB console and the SCE platform CLI:

- SCE platform CLI configuration:

  There are three broad aspects to traffic mirroring configuration in the SCE platform:

  – Configuring the VAS traffic link.

  – Configuring the VLAN tag per VAS server.

  – Associating servers with server groups.

- SCA BB console configuration — the traffic mirroring rules, meaning which portion of the subscriber traffic should be mirrored to the VAS servers.

  This configuration is defined per package so different subscribers can receive different mirroring service, based on the package they bought.

How to Configure the VAS Traffic Link

By default, the mirrored traffic is transmitted on Link 1. If the VAS servers are connected on Link 0, you must configure the VAS traffic link to Link 0.

> **Note**   In a cascaded topology, the VAS traffic link should always be Link 0.

Options

The following option is available:

- **VAS traffic-link {link-0|link-1}** — The link number on which to transmit VAS traffic
  - Default — Link 1

How to Select the Link for VAS Traffic

Step 1   From the SCE(config if)# prompt, type **VAS-traffic-forwarding traffic-link {link-0|link-1}** and press **Enter**.

How to Revert to the Default Link for VAS Traffic

Step 1   From the SCE(config if)# prompt, type **no VAS-traffic-forwarding traffic-link** and press **Enter**.

How to Assign a VLAN ID to a VAS Server

Use this command to assign the VLAN ID to a specified VAS server.

Options

The following options are available:

- **number** — The number of the VAS server. (0-63)
- **vlan-id** — The VLAN tag to use for the specified VAS server

  The VLAN tag can be redefined as necessary.
  - Default — No VLAN.

Note the following important points:

- The VAS server is not operational until the VLAN tag is defined.
- Disabling the server does not remove the VLAN tag number configured to the server.
- The **no** form of the command (same as the **default** form of the command), removes the previously configured VLAN tag (no VLAN is the default configuration).

How to Configure the VLAN Tag Number for a Specified VAS Server

Step 1   From the SCE(config if)# prompt, type **VAS-traffic-forwarding VAS server-id** *number* **VLAN** *vlan-id* and press **Enter**.

How to Remove the VLAN Tag Number from a Specified VAS Server

Step 1   From the SCE(config if)# prompt, type **no VAS-traffic-forwarding VAS server-id** *number* **VLAN** and press **Enter**.

You can also use the default form of the command to remove the VLAN tag configuration.

default VAS-traffic-forwarding VAS server-id *number* **VLAN**

VAS Server Groups

The user may define up to eight VAS server groups. Each VAS server group has the following parameters:

- Server Group ID
- A list of VAS servers attached to this group.

Use the following commands to perform these operations for a VAS server group:

- Add or remove a VAS server to or from a specified group.

Adding and Removing Servers

Use these commands to add and remove servers to or from a specified VAS server group.

- Options, page 13-10
- How to Add a VAS Server to a Specified VAS Server Group, page 13-10
- How to Remove a VAS Server from a Specified VAS Server Group, page 13-11

Options

The following options are available:

- **group-number** — The ID number of the VAS server group (0-7)
- **id-number** — The ID number of the VAS server (0-63)

How to Add a VAS Server to a Specified VAS Server Group

Step 1   From the SCE(config if)# prompt, type **VAS-traffic-forwarding VAS server-group** *group-number* **server-id** *id-number* and press **Enter**.

How to Remove a VAS Server from a Specified VAS Server Group

Step 1   From the SCE(config if)# prompt, type **no VAS-traffic-forwarding VAS server-group** *group-number* **server-id** *id-number* and press **Enter**.

Monitoring Traffic Mirroring

- How to Display Global VAS Status and Configuration, page 13-11
- How to Display Operational and Configuration Information for a Specific VAS Server Group, page 13-12
- How to Display Operational and Configuration Information for All VAS Server Groups, page 13-12
- How to Display Operational and Configuration Information for a Specific VAS Server, page 13-12
- How to Display Operational and Configuration Information for All VAS Servers, page 13-13
- How to Display the VAS Servers Used by a Specified Subscriber, page 13-13
- Traffic Mirroring Sample Configuration, page 13-13

Use these commands to display the following information for VAS configuration and operational status summary.

- Global VAS status summary — the traffic link used
- VAS Server Groups information summary — operational status, number of configured servers, number of current active servers.

This information may be displayed for a specific server group or all server groups

- VAS servers information summary — operational status, number of subscribers attached to this server.

This information may be displayed for a specific server or all servers

- Bandwidth per VAS server and VAS direction (to VAS / from VAS)

Sample outputs are included.

How to Display Global VAS Status and Configuration

Step 1   From the SCE> prompt, type **show interface linecard 0 VAS-traffic-forwarding** and press **Enter**.

Example

```
SCE>show interface linecard 0 VAS-traffic-forwarding
Traffic forwarding is disabled
VAS traffic link configured: Link-1  actual: Link-1
```

Note   For traffic mirroring, the VAS traffic link is the only relevant information. VAS traffic forwarding is not relevant to traffic mirroring.

How to Display Operational and Configuration Information for a Specific VAS Server Group

Step 1   From the SCE> prompt, type **show interface linecard 0 VAS-traffic-forwarding VAS server-group** *id-number* and press **Enter**.

Example

```
SCE>show interface linecard 0 VAS-traffic-forwarding VAS server-group 0
VAS server group 0:
State: Failure  configured servers: 1 active servers: 1
minimum active servers required for Active state: 1   failure action: Pass
This group is used for intelligent traffic mirroring
```

How to Display Operational and Configuration Information for All VAS Server Groups

Step 1   From the SCE> prompt, type **show interface linecard 0 VAS-traffic-forwarding VAS server-group all** and press **Enter**.

How to Display Operational and Configuration Information for a Specific VAS Server

Step 1   From the SCE> prompt, type **show interface linecard 0 VAS-traffic-forwarding VAS server-id** *id-number* and press **Enter**.

Example

```
SCE>show interface linecard 0 VAS-traffic-forwarding VAS server-id 0
VAS server 0:
Configured mode: enable   actual mode: enable   VLAN:  576 server group:    2
State: UP
Health Check configured mode: enable  status: NOT running, reason is: 1. VAS mode is
disabled 2. server assigned to a server group which is configured for mirroring
Health Check source port: 63140  destination port: 63141
Number of subscribers:       0
```

How to Display Operational and Configuration Information for All VAS Servers

Step 1   From the SCE> prompt, type **show interface linecard 0 VAS-traffic-forwarding VAS server-id all** and press **Enter**.

How to Display the VAS Servers Used by a Specified Subscriber

Step 1   From the SCE> prompt, type **show interface linecard 0 subscriber name** *subscriber-name* **VAS-servers** and press **Enter**.

Traffic Mirroring Sample Configuration

Following is a sample illustrating the steps in configuring the SCE8000 platform for traffic mirroring.

	Command	Purpose
Step 1	SCE#**configure** SCE(config)# **interface LineCard 0**	Enters LineCard Interface configuration mode
Step 2	SCE(config if)#**VAS-traffic-forwarding VAS server-id** *0* **VLAN** *640* SCE(config if)#**VAS-traffic-forwarding VAS server-id** *1* **VLAN** *641* SCE(config if)#**VAS-traffic-forwarding VAS server-id** *2* **VLAN** *642* SCE(config if)#**VAS-traffic-forwarding VAS server-id** *3* **VLAN** *643*	Assign VAS servers 0-3 to VLAN 640-643 respectively.
Step 3	SCE(config if)#**VAS-traffic-forwarding VAS server-group** *0* **server-id** *0* SCE(config if)#**VAS-traffic-forwarding VAS server-group** *0* **server-id** *1* SCE(config if)#**VAS-traffic-forwarding VAS server-group** *1* **server-id** *2* SCE(config if)#**VAS-traffic-forwarding VAS server-group** *1 server-id* *3*	Map VAS servers 0-1 and 2-3 to server groups 0 and 1 respectively, allowing server redundancy within each group.