Chapter 10

Configuring Simple Shared Shaping of Traffic

This chapter provides information for configuring simple shared shaping of traffic on the E-series router.

QoS topics are discussed in the following sections:

Simple Shared Shaping Overview

Simple shared shaping shapes the best-effort node or queue associated with a logical interface to a shared rate.

Bandwidth Allocation for Simple Shared Shaping

Once per second, the simple shared shaper calculates the combined rate of the voice and video queues for the logical interface, and shapes the best-effort queue for the data traffic to the shared rate minus the video and voice queue rates. The bandwidth for the voice and video queues is determined by the configuration of the hierarchical scheduler. The shared shaper does not actively manage the video and voice queues.

Simple Shared Shaping on the Best-Effort Scheduler Node

If you have a second traffic class for data in addition to the best-effort data traffic class, configure shared shaping on the best-effort scheduler node. In this scenario, two weighted queues are stacked above the best-effort scheduler node, one for the best-effort traffic class and the other for the second data traffic class. If you configure the shared-shaping rate on the best-effort queue, then the shared shaper can have a tendency to starve the best-effort queue in favor of the second data queue. If you instead configure the shared-shaping rate on the best-effort node, the hierarchical scheduler allocates bandwidth between multiple data queues based on their relative weight and assured rate.

If you are configuring VP shared shaping, configure shared shaping on the best-effort scheduler node for the VP. Shaping the best-effort scheduler node for the VP has the effect of shaping all the VC best-effort queues for that VP. This enables you to retain the advantages of per-VC queuing in the hierarchical scheduler.

If you are configuring VC shared shaping and the SAR is operating in low-CDV mode, we recommend you configure the shared-shaping rate on the best-effort scheduler node for the VP or VC. The router sets the SAR shaper for the VC or VP to match the shared-shaping rate on VC and VP nodes in the hierarchical scheduler; this is usually the desired behavior. A shared shaper configured on the best-effort queue does not trigger the matching shaper in the SAR.

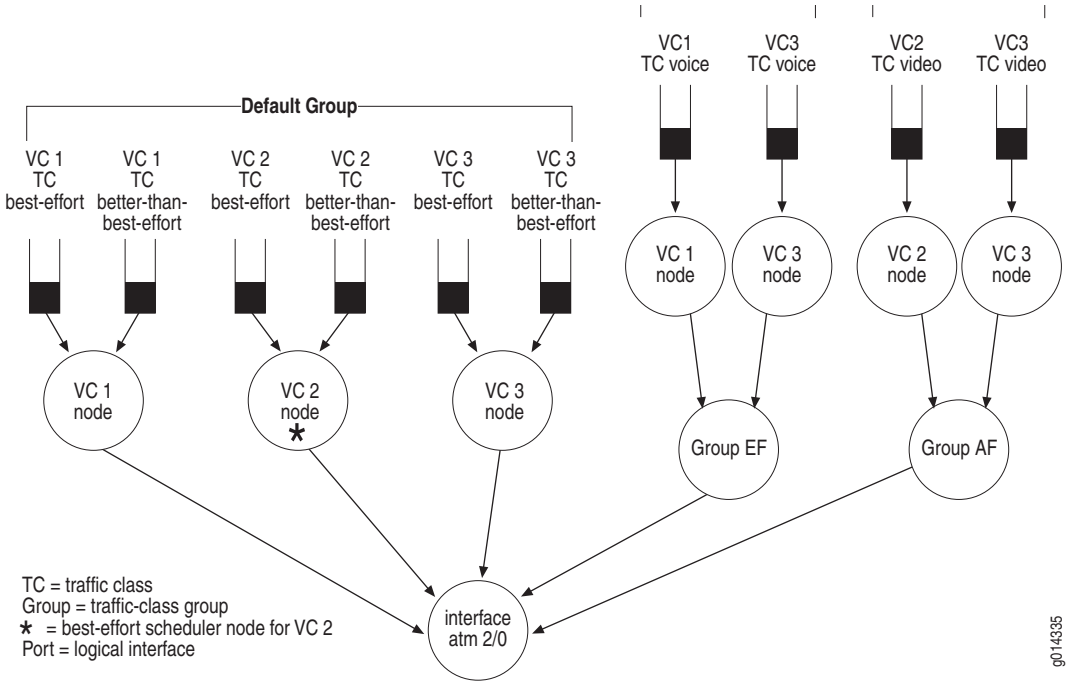
Simple Shared Shaping for Triple-Play Networks

Simple shared shaping enables you to shape the logical interface to a single rate for triple-play networks.

In Figure 18 on page 80, the AF traffic-class group contains the video traffic class. The EF traffic-class group contains the voice traffic class. The best-effort and better-than-best-effort traffic classes remain outside any traffic-class group. Because the voice, video, and data queues are stacked in separate scheduler hierarchies, you must use the shared shaper to shape the logical interface aggregate to a single rate.

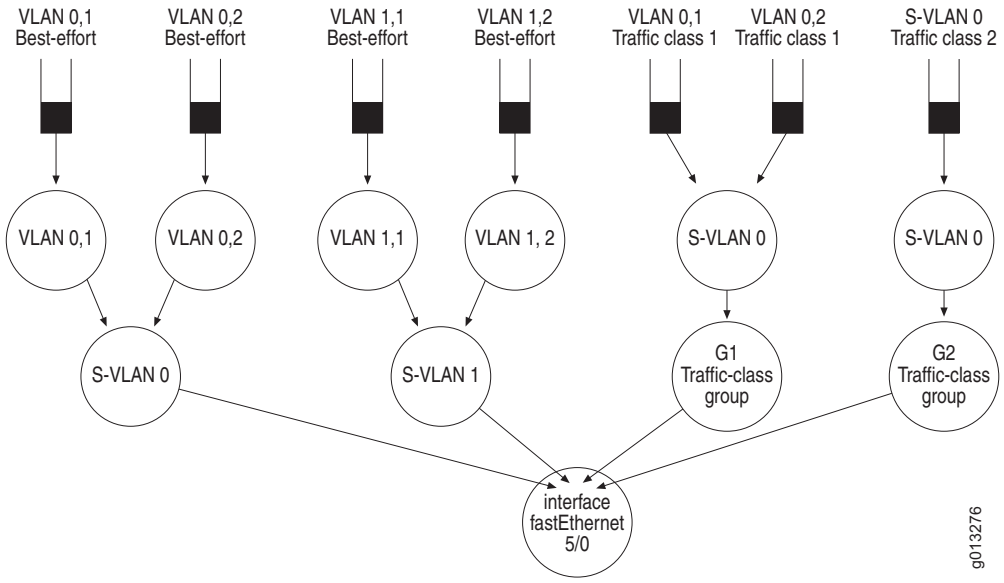
In this example, VC 1 is configured for voice and data. VC 2 is configured for data and video. VC 3 is configured for data, voice, and video. The shared shaper is configured on the best-effort node or queue for VC 1; the corresponding voice queue for VC 1 shares the configured rate.

Figure 18: Simple Shared Shaping over ATM



In a typical triple-play network configuration over Ethernet, individual subscribers are represented on the B-RAS by VLANs and DSLAMs by SVLANs. Figure 19 illustrates how to shape the subscriber aggregate of voice, video, and data to a single rate in Ethernet.

Figure 19: Simple Shared Shaping over Ethernet



Related Topics

- For a list of shared shaper terms, see *Shared Shaping Overview* on page 71
- Configuring Simple Shared Shaping on page 81
- Constituent Selection for Shared Shaping Overview on page 111

Configuring Simple Shared Shaping

This section explains how to configure the shared shaper by specifying a shared-shaping rate for either the best-effort queue or the best-effort scheduler node for the logical interface. The router locates the other queues associated with the logical interface and shapes that set of queues to the shared rate.

You do not explicitly specify shared shaping on the other queues for the logical interface. You can configure individual shaping rates on the other queues that are less than the shared rate. These individual shapers have the effect of reserving some of the shared bandwidth for the other queues.

Before you configure simple shared shaping:

- Configure the traffic classes and traffic-class groups.

  See *Configuring Traffic Classes That Define Service Levels* on page 15 and *Configuring Traffic-Class Groups That Define Service Levels* on page 15.

To configure simple shared shaping:

1. Create the scheduler profile.

   host1(config)#**scheduler-profile shared-1mbps**

2. Configure the shared-shaping rate.

   host1(config-scheduler-profile)#**shared-shaping-rate 128000 burst 32767 simple**
   host1(config-scheduler-profile)#**shared-shaping-rate 80000 + 53000**
   host1(config-scheduler-profile)#**exit**

   The range for the shared-shaping rate is 1000–100000000 bps (1 Kbps–1000 Kbps); the default is the minimum shaping rate (1 Kbps).

   Use the *operator* and *operandValue* variables to specify the shared shaping rate as an expression.

   Use the **bps** or **kbps** keywords to specify the unit of the shaping rate. By default, the shaping rate is configured in bps.

   Use the **burst** keyword to configure the catch-up number associated with the shaper; the range is 0–522240 (0–510 KB). If you do not specify a burst value, the router selects an applicable default value.

   Use the **milliseconds** or **bytes** keywords to specify the unit of the burst size.

   You can specify **simple** to shape data queue rates to the value of the shared rate minus the combined voice and video traffic rate. By default, shared shaping is set to **auto**. In this mode, the router selects the type of shared shaping that is applied according to the type of line module. Compound shared shaping is hardware-dependent. If you specify **compound** for line modules that do not support it, an error message is generated and the router applies simple shared shaping.

3. Configure the QoS profile and reference the scheduler profile.

   (config)#**qos-profile subscriber-default-mode**
   (config-qos-profile)#**atm-vc node**
   (config-qos-profile)#**atm-vc node group AF**
   (config-qos-profile)#**atm-vc node group EF**
   (config-qos-profile)#**atm-vc queue traffic-class best-effort scheduler-profile shared-1mbps**
   (config-qos-profile)#**exit**

TIP: The scheduler profile that you configured with the shared-shaping rate must be referenced in the best-effort queue or the best-effort scheduler node.

4. Attach the profile to the interface.

```
(config)#interface atm 11/0.10
(config-subif)#qos-profile subscriber-default-mode
(config-scheduler-profile)#exit
```

Related Topics

- Simple Shared Shaping Overview on page 79
- Guidelines for Configuring Simple and Compound Shared Shaping on page 74
- For more information about specifying an expression that you can reference within a scheduler profile, see *Using Expressions for Bandwidth and Burst Values in a Scheduler Profile* on page 49
- Simple Shared Shaping Configuration Examples on page 83
- Constituent Selection for Shared Shaping Overview on page 111
- Configuring Simple Shared Shaper Algorithm Variables on page 96
- **node** command
- **qos-profile** command
- **queue** command
- **scheduler-profile** command
- **shared-shaping-rate** command
- **traffic-class** command
- **traffic-class-group** command

Simple Shared Shaping Configuration Examples

This section explains how to configure the shared shaper by specifying a shared-shaping rate for either the best-effort queue or the best-effort scheduler node for the logical interface. The router locates the other queues associated with the logical interface and shapes that set of queues to the shared rate.

VC Simple Shared Shaping Example

The following commands configure a simple shared shaper for a VC, as shown in Figure 18 on page 80. In this example, the best-effort queue for logical interface VC 3 is shaped to a shared rate of 1 Mbps. The voice and video queues for VC 3 share the 1 Mbps with the best-effort traffic. The voice queue has first claim on the shared 1 Mbps, but only up to its individual shaping rate of 200 Kbps. The video queue claims up to the next 300 Kbps. The best-effort queue obtains whatever bandwidth remains of the 1 Mbps after the voice and video traffic have made their claims.

1. Configure the traffic classes and traffic-class groups.

   (config)#**traffic-class voice**
   (config-traffic-class)#**fabric-strict-priority**
   (config-traffic-class)#**exit**
   (config)#**traffic-class video**
   (config-traffic-class)#**exit**

   (config)#**traffic-class-group EF auto-strict-priority**
   (config-traffic-class-group)#**traffic-class voice**
   (config-traffic-class-group)#**exit**
   ((config)#**traffic-class-group AF extended**
   (config-traffic-class-group)#**traffic-class video**
   (config-traffic-class-group)#**exit**

2. Configure the shared shaper.

   (config)#**scheduler-profile 200kbps**
   (config-scheduler-profile)#**shaping-rate 200000**
   (config-scheduler-profile)#**exit**
   (config)#**scheduler-profile 300kbps**
   (config-scheduler-profile)#**shaping-rate 300000**
   (config-scheduler-profile)#**exit**
   (config)#**scheduler-profile shared-1mbps**
   (config-scheduler-profile)#**shared-shaping-rate 1000000 simple**
   (config-scheduler-profile)#**exit**

   (config)#**qos-profile subscriber-default-mode**
   (config-qos-profile)#**atm-vc node**
   (config-qos-profile)#**atm-vc node group AF**
   (config-qos-profile)#**atm-vc node group EF**
   (config-qos-profile)#**atm-vc queue traffic-class best-effort scheduler-profile shared-1mbps**
   (config-qos-profile)#**atm-vc queue traffic-class video scheduler-profile 300kbps**
   (config-qos-profile)#**atm-vc queue traffic-class voice scheduler-profile 200kbps**
   (config-qos-profile)#**exit**

3. Delete the rule in the default port type profile that creates IP best-effort queues by default.

   config)#**qos-profile atm-default**
   (config-qos-profile)#**no ip queue traffic-class best-effort**
   (config-qos-profile)#**exit**

4. Attach the profile to the ATM subinterface for VC 3.

```
(config)#interface atm 11/0.10
(config-subif)#qos-profile subscriber-default-mode
(config-scheduler-profile)#exit
```

The **qos-profile subscriber-default-mode** command shown in this example is appropriate if you have configured the SAR to be in default mode (by issuing the **no qos-mode-port** command). If this QoS profile is attached in low-CDV mode, the shaper is effective but the CDV is not correctly bounded, because the VC is not reshaped in the SAR.

The following commands configure a QoS profile different from the one shown in the previous example. In this example, the best-effort scheduler node for VC 3 is shaped to a shared rate of 1 Mbps. The **qos-profile subscriber-low-cdv-mode** command is appropriate if you configure the SAR in low-CDV mode (by issuing the **qos-mode-port low-cdv** command). The VC is reshaped to 1 Mbps in the SAR. If this QoS profile is attached in the SAR default mode, the 1-Mbps shaper is disabled by VC backpressure from the SAR.

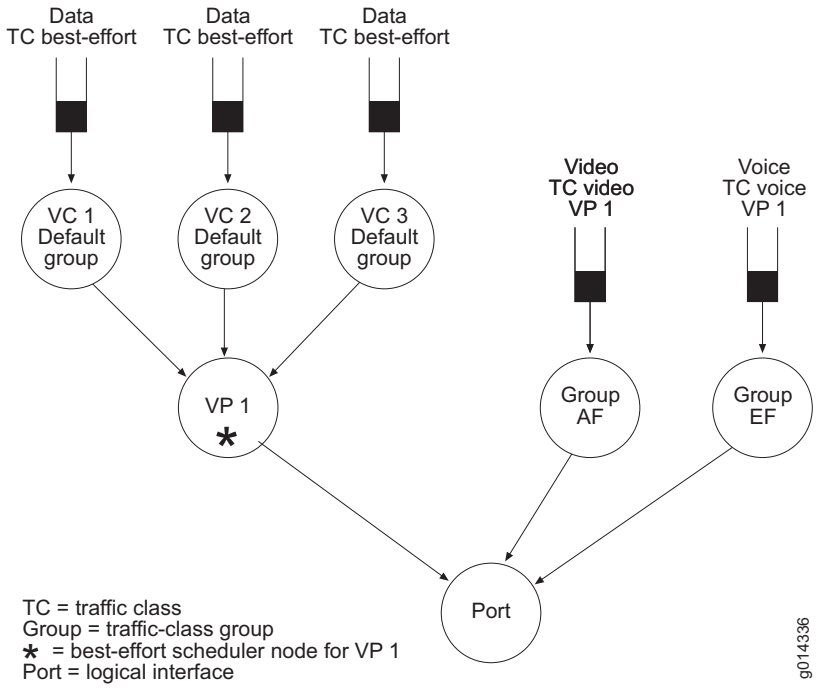
```
(config)#qos-profile subscriber-low-cdv-mode
(config-qos-profile)#atm-vc node scheduler-profile shared-1mbps
(config-qos-profile)#atm-vc node group AF
(config-qos-profile)#atm-vc node group EF
(config-qos-profile)#atm-vc queue traffic-class best-effort
(config-qos-profile)#atm-vc queue traffic-class video scheduler-profile 300kbps
(config-qos-profile)#atm-vc queue traffic-class voice scheduler-profile 200kbps
(config-qos-profile)#exit
```

VP Simple Shared Shaping Example

In the example shown in Figure 20 on page 86, VP 1 is shaped to a shared rate of 5 Mbps. The shared shaper requires that voice and video traffic be carried in queues associated with the logical interface, which in this scenario is the VP. VP-level queuing does not guarantee fairness to the voice and video traffic for each VC, but fairness is not a major issue because admission control guarantees that the voice and video queues do not become congested.

This example assumes the same traffic class and traffic-class group configurations that are used in *VC Simple Shared Shaping Example* on page 84.

Figure 20: VP Shared Shaping



The following set of commands configures the shared shaper in Figure 20.

```
(config)#scheduler-profile 2mbps
(config-scheduler-profile)#shaping-rate 2000000
(config-scheduler-profile)#exit
(config)#scheduler-profile 400kbps
(config-scheduler-profile)#shaping-rate 400000
(config-scheduler-profile)#exit
(config)#scheduler-profile shared-5mbps
(config-scheduler-profile)#shared-shaping-rate 5000000 simple
(config-scheduler-profile)#exit

(config)#qos-profile vp-subscriber1
(config-qos-profile)#atm-vp node scheduler-profile shared-5mbps
(config-qos-profile)#atm-vp node group AF
(config-qos-profile)#atm-vp node group EF
(config-qos-profile)#atm-vc node
(config-qos-profile)#atm-vc queue traffic-class best-effort scheduler-profile default
(config-qos-profile)#atm-vp queue traffic-class video scheduler-profile 2mbps
(config-qos-profile)#atm-vp queue traffic-class voice scheduler-profile 400kbps
(config-qos-profile)#exit
```

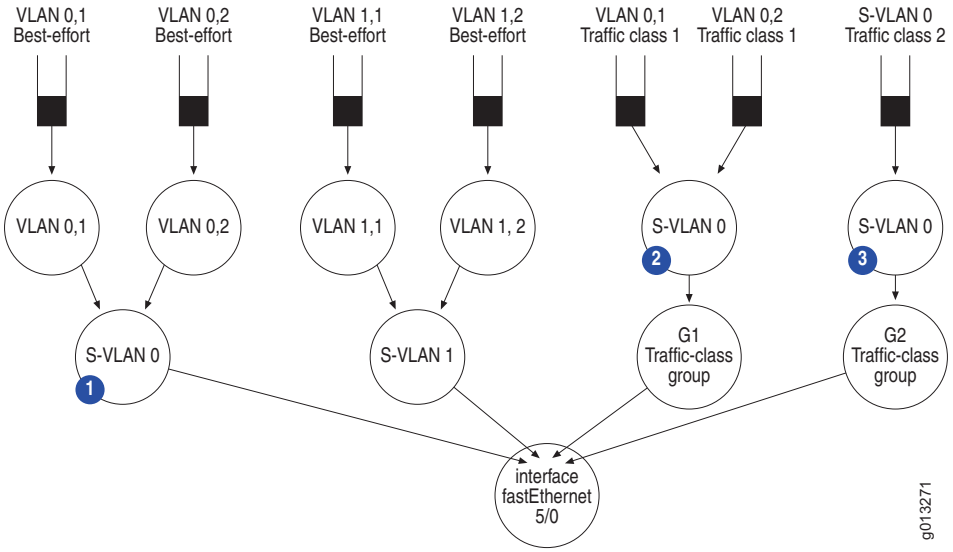
In this example, the best-effort scheduler node for the VP is shaped to a shared rate of 5 Mbps. The EF and AF queues for the VP share the 5 Mbps with the best-effort traffic. The EF queue has first claim on the shared 5 Mbps, but only up to its individual shaping rate of 400 Kbps. The AF queue claims up to the next 2 Mbps. The VC-level best-effort queues obtain whatever bandwidth remains of the 5 Mbps after the AF traffic and EF traffic have made their claims. This QoS profile is appropriate for low-CDV mode. If the provider configures a shapeless VP tunnel in the SAR, QoS sets the SAR shaper for the VP to match the 5-Mbps shared-shaping rate, and the CDV is bounded for the VP tunnel.

Ethernet Simple Shared Shaping Example

In a typical triple-play network configuration over Ethernet, individual subscribers are represented on the B-RAS by VLANs and DSLAMs by SVLANs. In this example, the provider shapes the subscriber aggregate of voice, video, and data to a single rate.

In this example, S-VLAN 0 has traffic in three traffic-class groups: the default group, the TC1 traffic class in the G1 group, and the TC2 traffic class in the G2 traffic-class group.

Figure 21: Hierarchical Simple Shared Shaping over Ethernet



In Figure 21, the S-VLANs labeled 1, 2, and 3 indicate the possible constituents for S-VLAN 0. The active constituents for the simple shared shaper are the three nodes for S-VLAN 0 in the three traffic-class groups.

NOTE: This example uses QoS parameters to configure shared shaping.

1. Configure the traffic classes and traffic-class groups.

   (config)#**traffic-class tc1**
   (config)#**exit**
   (config)#**traffic-class tc2**
   (config)#**exit**
   (config)#**traffic-class-group g1**
   (config-traffic-class-group)#**traffic-class tc1**
   (config-traffic-class-group)#**exit**
   (config)#**traffic-class-group g2 extended**
   (config-traffic-class-group)#**traffic-class tc2**
   (config-traffic-class-group)#**exit**

2. Configure the parameter definitions.

   (config)#**qos-parameter-define vlan-g1-max-rate**
   (qos-parameter-define)#**controlled-interface-type vlan**
   (qos-parameter-define)#**instance-interface-type vlan**
   (qos-parameter-define)#**exit**

   (config)#**qos-parameter-define svlan-g1-max-rate**
   (qos-parameter-define)#**controlled-interface-type svlan**
   (qos-parameter-define)#**instance-interface-type svlan**
   (qos-parameter-define)#**instance-interface-type ethernet**
   (qos-parameter-define)#**exit**

   (config)#**qos-parameter-define vlan-max-rate**
   (qos-parameter-define)#**controlled-interface-type vlan**
   (qos-parameter-define)#**instance-interface-type vlan**
   (qos-parameter-define)#**instance-interface-type svlan**
   (qos-parameter-define)#**exit**

   (config)#**qos-parameter-define svlan-max-rate**
   (qos-parameter-define)#**controlled-interface-type svlan**
   (qos-parameter-define)#**instance-interface-type svlan**
   (qos-parameter-define)#**instance-interface-type ethernet**
   (qos-parameter-define)#**exit**

3. Configure the shared shaper by referencing parameter definitions in the **shaping-rate** command.

   (config)#**scheduler-profile vlan-be**
   (config-scheduler-profile)#**shared-shaping-rate vlan-max-rate simple**
   (config-scheduler-profile)#**exit**
   (config)#**scheduler-profile svlan-be**
   (config-scheduler-profile)# **shared-shaping-rate svlan-max-rate simple**
   (config-scheduler-profile)#**exit**

   (config)#**scheduler-profile svlan-g1**
   (config-scheduler-profile)#**shaping-rate svlan-g1-max-rate**
   (config-scheduler-profile)#**exit**
   (config)#**scheduler-profile vlan-g1**
   (config-scheduler-profile)#**shaping-rate vlan-g1-max-rate**
   (config-scheduler-profile)#**exit**
   (config)#**scheduler-profile svlan-g2**
   (config-scheduler-profile)#**shaping-rate svlan-max-rate % 50**
   (config-scheduler-profile)#**exit**

4. Configure the QoS profile.

```
(config)#qos-profile svlan-4.1
(config-qos-profile)#vlan queue traffic-class best-effort
(config-qos-profile)#vlan node scheduler-profile vlan-be
(config-qos-profile)#svlan node scheduler-profile svlan-be
(config-qos-profile)#vlan queue traffic-class tc1
(config-qos-profile)#svlan node scheduler-profile svlan-g1 group g1
(config-qos-profile)#svlan queue traffic-class tc2
(config-qos-profile)#svlan node scheduler-profile svlan-g2 group g2
(config-qos-profile)#ethernet group g2 scheduler-profile default
```

5. Attach the QoS profile to the S-VLANs on Fast Ethernet interface 11/0.

```
(config)#interface fastEthernet 11/0
(config-if)#svlan 0 qos-parameter svlan-max-rate 4000000
(config-if)#svlan 0 qos-profile svlan-4.1
(config-if)#encapsulation vlan
(config-if)#exit

(config)#interface fastEthernet 11/0.1
(config-if)#svlan id 0 1
(config-if)#ip address 1.2.1.1 255.255.255.0
(config-if)#exit

(config)#interface fastEthernet 11/0.2
(config-if)#svlan id 0 2
(config-if)#ip address 1.3.1.1 255.255.255.0
(config-if)#exit
```

Related Topics

- Configuring Simple Shared Shaping on page 81
- Simple Shared Shaping Overview on page 79