**Concepts & Examples**
**ScreenOS Reference Guide**

# Volume 10: Virtual Systems

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# About This Volume

*Volume 10: Virtual Systems* describes virtual systems, dedicated and shared interfaces, and VLAN-based and IP-based traffic classification.

This volume contains the following chapters:

- Chapter 1, “Virtual Systems,” discusses virtual systems and profiles, objects, and administrative tasks.
- Chapter 2, “Traffic Sorting,” explains how ScreenOS sorts traffic.
- Chapter 3, “VLAN-Based Traffic Classification,” explains VLAN-based traffic classification for virtual systems.
- Chapter 4, “IP-Based Traffic Classification,” explains IP-based traffic classification for virtual systems.

## Document Conventions

This document uses several types of conventions, which are introduced in the following sections:

- "CLI Conventions" on this page
- "Illustration Conventions" on page vii
- "Naming Conventions and Character Types" on page viii
- "WebUI Conventions" on page ix

### *CLI Conventions*

The following conventions are used to present the syntax of CLI commands in examples and text.

In examples:

- Anything inside square brackets [ ] is optional.
- Anything inside braces { } is required.
- If there is more than one choice, each choice is separated by a pipe ( | ). For example:

  set interface { ethernet1 | ethernet2 | ethernet3 } manage

  means "set the management options for the ethernet1, the ethernet2, *or* the ethernet3 interface."
- Variables are in *italic* type:

  set admin user *name1* password *xyz*

In text:

- Commands are in **boldface** type.
- Variables are in *italic* type.

---

**NOTE:** When entering a keyword, you only have to type enough letters to identify the word uniquely. For example, typing **set adm u kath j12fmt54** is enough to enter the command **set admin user kathleen j12fmt54**. Although you can use this shortcut when entering commands, all the commands documented here are presented in their entirety.

---

### *Illustration Conventions*

The following figure shows the basic set of images used in illustrations throughout this document.

**Figure 1: Images in Illustrations**

### Naming Conventions and Character Types

ScreenOS employs the following conventions regarding the names of objects—such as addresses, admin users, auth servers, IKE gateways, virtual systems, VPN tunnels, and zones—defined in ScreenOS configurations:

- If a name string includes one or more spaces, the entire string must be enclosed within double quotes; for example:

  **set address trust "local LAN" 10.1.1.0/24**

- Any leading spaces or trailing text within a set of double quotes are trimmed; for example, **" local LAN "** becomes **"local LAN"**.

- Multiple consecutive spaces are treated as a single space.

- Name strings are case-sensitive, although many CLI keywords are case-insensitive. For example, **"local LAN"** is different from **"local lan"**.

ScreenOS supports the following character types:

- Single-byte character sets (SBCS) and multiple-byte character sets (MBCS). Examples of SBCS are ASCII, European, and Hebrew. Examples of MBCS—also referred to as double-byte character sets (DBCS)—are Chinese, Korean, and Japanese.

- ASCII characters from 32 (0x20 in hexadecimals) to 255 (0xff), except double quotes ( " ), which have special significance as an indicator of the beginning or end of a name string that includes spaces.

---

**NOTE:** A console connection only supports SBCS. The WebUI supports both SBCS and MBCS, depending on the character sets that your browser supports.

---

### WebUI Conventions

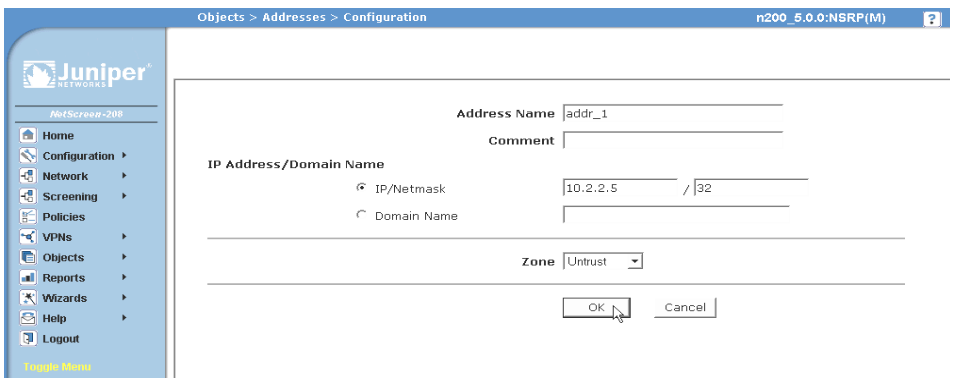
To perform a task with the WebUI, you first navigate to the appropriate dialog box, where you then define objects and set parameters. A chevron ( > ) shows the navigational sequence through the WebUI, which you follow by clicking menu options and links. The set of instructions for each task is divided into navigational path and configuration settings.

The following figure lists the path to the address configuration dialog box with the following sample configuration settings:

Objects > Addresses > List > New: Enter the following, then click **OK**:

Address Name: addr_1
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.5/32
Zone: Untrust

**Figure 2: Navigational Path and Configuration Settings**




## Juniper Networks Documentation

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If you find any errors or omissions in this document, please contact us at the email address below:

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## Chapter 1

# Virtual Systems

This chapter discusses virtual systems, objects, and administrative tasks. It contains the following sections:


- "Overview" on page 2
- "Vsys Objects" on page 4
  - "Creating a Vsys Object and Admin" on page 4
  - "Setting a Default Virtual Router for a Vsys" on page 6
  - "Binding Zones to a Shared Virtual Router" on page 6
- "Logging In as a Vsys Admin" on page 7
- "Virtual System Profiles" on page 8
  - "Creating a Vsys Profile" on page 10
  - "Adding Session Limits Through Vsys Profile Assignment" on page 12
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  - "Deleting a Policy Schedule" on page 30


## Overview

You can logically partition a single Juniper Networks security system into multiple virtual systems to provide multi-tenant services. Each virtual system (vsys) is a unique security domain and can have its own administrators (called *virtual system administrators* or *vsys admins*) who can individualize their security domain by setting their own address books, user lists, custom services, VPNs, and policies. Only a root-level administrator, however, can set firewall security options, create virtual system administrators, and define interfaces and subinterfaces.

**NOTE:** Refer to the Juniper Networks marketing literature to see which platforms support this feature.

For more information about the various levels of administration that ScreenOS supports, see "Levels of Administration" on page **3**-31.

Juniper Networks virtual systems support two kinds of traffic classifications: VLAN-based and IP-based, both of which can function exclusively or concurrently.

Table 1 shows the interfaces a vsys can support for Untrust and Trust security zones:

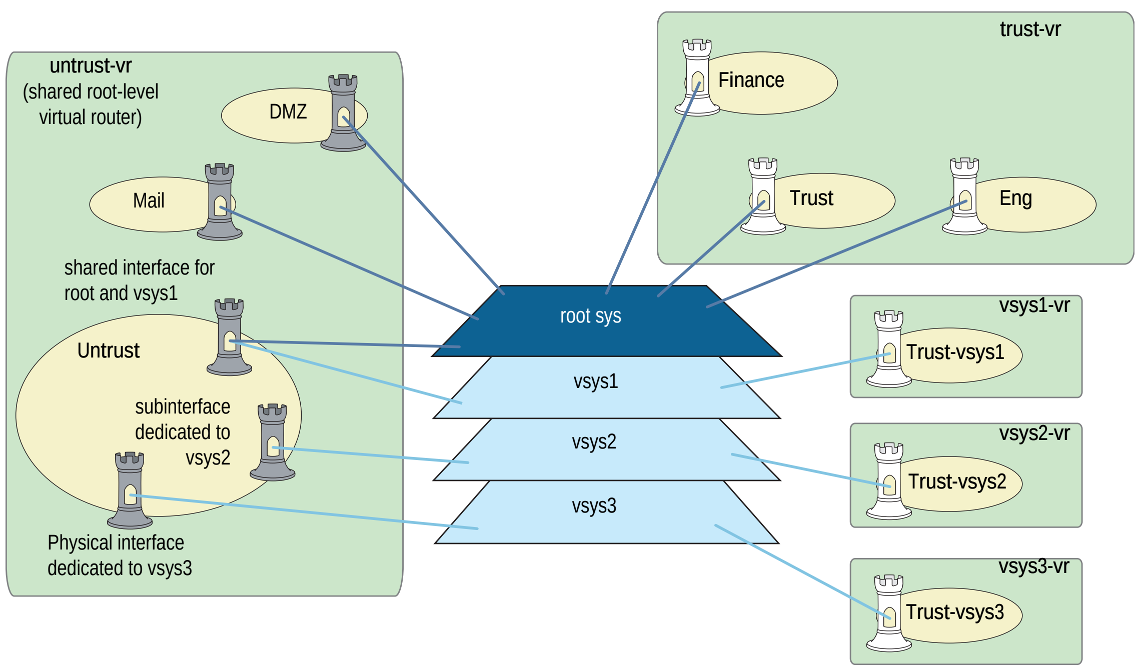
**Table 1: Vsys Support**

| Untrust Zone Interface Types | Trust Zone Interface Types |
|---|---|
| Dedicated physical interface | Dedicated physical interface |
| Subinterface (with VLAN tagging as a means for trunking[1] inbound and outbound traffic) | Subinterface (with VLAN tagging) |
| Shared interface (physical, subinterface, redundant interface, aggregate interface) with root system | Shared physical interface with root system (and IP-based traffic classification[2]) |

1.For information about VLAN tagging and trunking concepts, see "VLAN-Based Traffic Classification" on page 41.
2.For information about IP-based traffic classification, see "IP-Based Traffic Classification" on page 69.

Figure 1 shows how you can bind one, two, or all three of the above interface types to a security zone concurrently. You can also bind multiple interfaces of each type to a zone.

**Figure 1: Interface and Zone Bindings with Vsys**



## Vsys Objects

The root administrator or root-level read/write admin must complete the following tasks to create a vsys object:

- Define a virtual system
- (Optional) Define one or more vsys admins

**NOTE:** A root-level administrator can define one vsys admin with read-write privileges and one vsys admin with read-only privileges per vsys.

- Select the virtual router that you want the vsys to use for its Trust-*vsysname* zone, Untrust-Tun-*vsysname* zone, and Global-*vsysname* zone

After creating a vsys object, as the root-level admin, you need to perform other configurations to make it functional. You must configure subinterfaces or interfaces for the vsys, and possibly shared virtual routers and shared security zones. Subsequent configurations depend on whether the vsys is intended to support VLAN-based or IP-based traffic classifications, or a combination of both. After completing these configurations, you can then exit the virtual system and allow a vsys admin, if defined, to log in and begin configuring addresses, users, services, VPNs, routes, and policies.

### *Creating a Vsys Object and Admin*

In this example, as a root-level admin, you create three vsys objects: vsys1, vsys2, vsys3. For vsys1, you create vsys admin Alice with password wIEaS1v1. For vsys2, you create vsys admin Bob with password pjF56Ms2. For vsys3, you do not define a vsys admin. Instead, you accept the admin definition that the security device automatically generates. In the case of vsys3, the security device creates the admin "vsys_vsys3" with password "vsys_vsys3."

**NOTE:** Only a root-level administrator can create a vsys admin's profile (username and password). Because the security device uses usernames to determine the vsys to which a user belongs, vsys admins cannot change their usernames. However, vsys admins can (and should) change their passwords.

Vsys names, admin names, and passwords are case-sensitive. "Vsys abc" is different from "vsys ABC."

For vsys1 and vsys2, you use the default virtual router. For vsys3, you choose the sharable root-level untrust-vr.

After you create a vsys through the WebUI, you remain at the root level. Entering the newly created vsys requires a separate step:

Vsys: Click **Enter** (for the virtual system you want to enter).

The WebUI pages of the vsys you have entered appear, with the name of the vsys above the central display area—Vsys:*Name*.

When you create a vsys through the CLI, you immediately enter the system that you have just created. (To enter an existing vsys from the root level, use the **enter vsys** *name_str* command.) When you enter a vsys, the CLI command prompt changes to include the name of the system in which you are now issuing commands.

***WebUI***

1. **Vsys1:**
   Vsys > New: Enter the following, then click **OK**:

   Vsys Name: vsys1
   Vsys Admin Name: Alice
   Vsys Admin New Password: wIEaS1v1
   Confirm New Password: wIEaS1v1
   Virtual Router:
   Create a default virtual router: (select)

2. **Vsys2:**
   Vsys > New: Enter the following, then click **OK**:

   Vsys Name: vsys2
   Vsys Admin Name: Bob
   Vsys Admin New Password: pjF56Ms2
   Confirm New Password: pjF56Ms2
   Virtual Router:
   Create a default virtual router: (select)

3. **Vsys3:**
   Vsys > New: Enter the following, then click **OK**:

   Vsys Name: vsys3
   Virtual Router:
   Select an existing virtual router: (select), untrust-vr

***CLI***

1. **Vsys1:**
```
device-> set vsys vsys1
device(vsys1)-> set admin name Alice
device(vsys1)-> set admin password wIEaS1v1
device(vsys1)-> save
device(vsys1)-> exit
```

**NOTE:** After issuing any commands, you must issue a **save** command before issuing an **exit** command or the security device loses your changes.

2. **Vsys2**
```
device-> set vsys vsys2
device(vsys2)-> set admin name Bob
device(vsys2)-> set admin password pjF56Ms2
device(vsys2)-> save
device(vsys2)-> exit
```

3. **Vsys3**
device-> set vsys vsys3 vrouter share untrust-vr
device(vsys3)-> save

### *Setting a Default Virtual Router for a Vsys*

When a root-level admin creates a vsys object, the vsys automatically has the following virtual routers available for its use:

- All shared root-level virtual routers, such as the untrust-vr

  In the same way that a vsys and the root system share the Untrust zone, they also share the untrust-vr, and any other virtual routers defined at the root level as sharable.

- Its own virtual router

  By default, a vsys-level virtual router is named *vsysname-vr*. You can also customize its name to make it more meaningful. This is a vsys-specific virtual router that, by default, maintains the routing table for the Trust-*vsysname* zone. All vsys-level virtual routers are nonsharable.

You can select any shared virtual router or the vsys-level virtual router as the default virtual router for a vsys. To change the default virtual router, enter a vsys and use the following CLI command: **set vrouter** *name* **default-vrouter**.

As a root-level administrator, if you want all of the vsys zones to be in the untrust-vr routing domain—for example, if all the interfaces bound to the Trust *-vsysname* zone are in Route mode—you can dispense with the vsysname-vr by changing the vsys-level security zone bindings from the *vsysname*-vr to the untrust-vr. For more information about virtual routers, see "Routing" on page **7**-13.

**NOTE:** This release of ScreenOS supports user-defined virtual routers within a virtual system.

### *Binding Zones to a Shared Virtual Router*

Each virtual system (vsys) is a unique security domain and can share security zones with the root system and have its own security zones. When a root-level admin creates a vsys object, the following zones are automatically inherited or created:

- All shared zones (inherited from the root system)
- Shared Null zone (inherited from the root system)
- Trust-*vsys_name* zone
- Untrust-Tun-*vsys_name* zone
- Global-*vsys_name* zone

**NOTE:** For information about each of these zone types, see "Zones" on page **2**-25.

Each vsys can also support extra user-defined security zones. You can bind these zones to any shared virtual routers defined at the root level or to the virtual router dedicated to that vsys. To create a security zone for a vsys named vsys1, do either of the following:

***WebUI***

Vsys > Enter (for vsys1)

Network > Zones > New: Enter the following, then click **OK**:

Zone Name: (type a name for the zone)
Virtual Router Name: (select a virtual router from the drop-down list)
Zone Type: Layer 3

***CLI***

```
device-> enter vsys vsys1
device(vsys1)-> set zone name name_str
device(vsys1)-> set zone vrouter vrouter
device(vsys1)-> save
```

The maximum number of security zones that a vsys or the root system can contain is limited only by the number of security zones available at the device level. It is possible for a single vsys to consume all available security zones if the root admin or a root-level read/write admin assigns all of them to that particular vsys. Conversely, if all virtual systems share root-level security zones and do not make use of any user-defined vsys-level zones, then all security zones are available for root-level use.

**NOTE:** The total number of user-definable (or “custom”) security zones available at the device level is the sum of the number of root-level custom zones—as defined by one or more zone license keys—and the number of custom zones permitted by the vsys license key.

## Logging In as a Vsys Admin

Vsys admins enter their vsys directly, unlike root-level administrators, who enter their vsys from the root level. When a vsys admin exits a vsys, the connection is immediately severed; however, when root-level administrators exit a vsys, they exit to the root system.

The following example shows how you log into a vsys as a vsys admin, change your password, and log out.

In this example, you, as a vsys admin, log into vsys1 by entering your assigned login name **jsmith** and password **Pd50iH10**. You change your password to **I6Dls13guh**, and then log out.

**NOTE:** Vsys admins cannot change their login names (usernames) because the security device uses those names, which must be unique among all vsys admins, to route the login connection to the appropriate vsys.

***WebUI***

1. **Logging In**
   In the URL field in your browser, enter the Untrust zone interface IP address for vsys1.

   When the Network Password dialog box appears, enter the following, then click **OK**:

   User Name: jsmith
   Password: Pd50iH10

2. **Changing Your Password**
   Configuration > Admin > Administrators: Enter the following, then click **OK**:

   Vsys Admin Old Password: Pd50iH10
   Vsys Admin New Password: I6Dls13guh
   Confirm New Password: I6Dls13guh

3. **Logging Out**
   Click **Logout**, located at the bottom of the menu column.

***CLI***

1. **Logging In**
   From a Secure Command Shell (SCS), Telnet, or HyperTerminal session command-line prompt, enter the Untrust zone interface IP address for vsys1.

   Log in with the following username and password:

   - User Name: jsmith
   - Password: Pd50iH10

2. **Changing Your Password**
   set admin password I6Dls13guh
   save

3. **Logging Out**
   exit

## Virtual System Profiles

A root-level user (the administrator for the security device) can enable or disable session and resource limits on a per-vsys basis. If you configure a session limit for a particular vsys and the vsys reaches or exceeds its session limits, the security device enforces the session limit and begins dropping packets for that vsys. In the case of oversubscription, where the total number of vsys sessions is greater than the overall number of system sessions, you can reserve a specified number of sessions for a particular vsys. The security device tracks packets that are dropped due to a session limit.

**NOTE:** To use virtual systems, you must install a vsys key and then enable this feature. It is disabled by default.

ScreenOS provides two ways to configure resource limits for a vsys:

- Profile assignment
- Command overrides

Per-vsys resources for which you can define maximum and reserve limits include the following items:

- Dynamic IP addresses (DIPs)
- Mapped IP addresses (MIPs)
- User-defined services and groups
- Policies and multicast policies
- Sessions
- Zone address book entries and groups, which are per zone per vsys limits
- User-defined security zones

---

**NOTE:** ScreenOS enforces zone address book and zone address group limits for the shared zone, a zone that contains address and address groups from all virtual systems. When viewing addresses or address groups of a shared zone from a vsys, only those addresses and address groups configured in that vsys are listed. The resources used for addresses and address groups in a shared zone is charged against the root system in which the shared zone was created.

You cannot reserve addresses or address groups in shared zones.

---

Vsys profiles can also contain CPU weights, which allow you to allocate a certain percentage of CPU processing time for a particular vsys. See "Configuring CPU Weight" on page 17 for more information.

### *Vsys Session Counters*

When the security device creates a new session for a particular vsys, the session counter for that vsys increments. When the session ends, the counter decrements.

The security device counts all sessions, active and inactive ones, held by the vsys at any time.

### *Vsys Session Information*

The security device records session statistics on a per-vsys basis. The security device administrator (root admin) can view all of the collected statistics and session information for all vsys. A vsys administrator can only view the sessions and statistics pertaining to that administrator's vsys domain.

### Behavior in High-Availability Pairs

When two devices configured with NetScreen Redundancy Protocol (NSRP) are in active-active mode and two sessions are simultaneously created, the result could mean that a vsys might have one session more than the configured limit.

For more information about NSRP or active-active mode, see Volume 11: High Availability.

### Creating a Vsys Profile

A *vsys profile* is a holder for the maximum limits and, in case of overload, specific limits and session-only alarm thresholds that you want ScreenOS to impose on a particular vsys or group of virtual systems. You can design tiered limits for services that fit the needs of your vsys clients. For example, you can set up different classes of service, such as gold, silver, and bronze, and assign each one different resource maximums.

Two default profiles exist:

- VsysDefaultProfile

  By default, when you create a new vsys, it uses the VsysDefaultProfile. By definition, the VsysDefaultProfile allows access to all resources but does not guarantee them. You can then re-assign a different vsys profile to the new vsys to control resource access. You cannot edit this vsys profile.

- RootProfile

  By default, the root vsys uses the RootProfile. You can configure limits in the Root Profile to reserve certain static resources for the root virtual system's exclusive use.

You can create 18 vsys profiles in addition to the default profiles. After creating profiles, you can assign one or more vsys to a vsys profile.

### Setting Resource Limits

The global maximum value for any vsys resource is dependent on the security device. If you do not explicitly set maximum and reserved limits, the default values for the device are used. To see the vsys limit values, use the **get vsys** *vsys_name* command after creating the vsys.

When setting maximum and reserved limits for resources, keep the following in mind:

- You cannot set the maximum value higher than the device-dependent global maximum value. See the global maximum values by using the **get vsys-profile global** command.
- For all resources except sessions, you cannot set the maximum value lower than the resources currently being used (actual-use value). To see the actual-use value, use the **get vsys-profile global** command.

For sessions, you can set the maximum value of sessions lower than the number of sessions used. If you do so, no current sessions are dropped. The maximum value is enforced when the session actual-use value falls below the maximum value, but in the meantime, no new sessions can be created. If you use the **get vsys session-limit** command, the number of available sessions shown is a negative number.

- You cannot set the reserved value higher than the configured maximum value.
- The total allocated usage, which is the sum of reserved values or actual-use values (whichever is higher) for all virtual systems, cannot exceed the global maximum value.

The following table lists how allocated usage is calculated for MIPs for three virtual systems (vs1, vs2, and vs3):

| | vs1 | vs2 | vs3 | Global |
|---|---|---|---|---|
| Reserved value (configured value) | 20 | 2 | 40 | |
| Actual-use | 40 | 15 | 37 | |
| Allocated usage | 40 | 15 | 40 | 95 |

Although the actual-use value for vs3 is lower than the configured reserved value, the reserved value is used when calculating allocated usage. The global maximum value is 95.

In the following example, you create a new vsys profile with the following settings:

- Name: gold
- CPU weight: 30 (default = 50)
- DIPs: maximum: 25, reserve: 5
- MIPs: maximum: 25
- Mpolicies: maximum: 5
- Policies: maximum: 50
- Sessions: maximum: 1200

***WebUI***

Vsys > Profile: Select **New**, enter the name and desired settings, then click **OK**.

***CLI***

```
set vsys-profile name gold cpu-weight 30
set vsys-profile gold dips max 25 reserve 5
set vsys-profile gold mips max 25
set vsys-profile gold mpolicies max 5
set vsys-profile gold policies max 50
set vsys-profile gold sessions max 1200
save
```

### Adding Session Limits Through Vsys Profile Assignment

You can assign a session limit to a vsys profile in the WebUI or the CLI. To set session limits, you need to configure one or more of the following parameters:

- session max

  The session maximum is a number between 100 and the maximum session number for the overall security system. The default value is the maximum session number for the overall security system (as if no session limitation is in force).

- reserve

  In case of over-subscription, the reserve number is the number of sessions you reserve or guarantee for the specified vsys. The reserve value is a number between zero (0) and the maximum number of sessions you allocate for the specified vsys.

- alarm

  The alarm threshold is a percentage of the maximum limit that triggers the alarm. The default value is 100% of the session limit for a configured vsys.

In the following example, you configure a session limitation in a vsys profile named **gold**. The desired limits are as follows:

- Session max: 2500
- Reserve: 2000
- Alarm: 90 (indicates the alarm triggers when 90% of the session maximum is achieved)

A vsys that you assign to this profile can hold up to 2500 sessions at a time. When the overall security device becomes over-subscribed only 2000 sessions are guaranteed to the assigned vsys. At any time, if the assigned vsys consumes 90% of the session maximum value an alarm triggers.

#### WebUI

Vsys > Profile > Edit

#### CLI

```
set vsys-profile gold session max 2500 reserve 2000 alarm 90
```

To assign the newly created vsys profile to a vsys named *vsys1*, you can use the WebUI or the CLI.

#### WebUI

Vsys > Edit

#### CLI

```
set vsys vsys1 vsys-profile name gold
```

### Setting a Session Override

For each vsys, you can set an override for a session limit or reserve value defined in an existing vsys profile; you can also override the alarm threshold. To do this, you first enter the vsys and set the override. By default, no overrides exist in virtual systems.

---

**NOTE:** ScreenOS associates session overrides with a vsys and not with a vsys profile.

---

In the following example, you set an override to allow the session maximum to be 3500 instead of 2500.

***WebUI***

Vsys > Edit (*vsys*)

***CLI***

```
enter vsys vsys1
    (vsys1) set override session-limit max 3500
    (vsys1) save
```

#### Overriding a Session Limit Reached Alarm

You can configure a session limit reached (SLR) alarm. The alarm triggers when the SLR level is reached or exceeded. The security device removes the alarm if the number of sessions of the vsys drops below the alarm trigger level for 10 consecutive seconds. The security device logs the alarm messages.

You can configure Simple Network Management Protocol (SNMP) traps for vsys SLR alarms. For more information about SNMP, see *Volume 2: Fundamentals*.

In the following example, you configure an alarm to trigger when the number of vsys sessions is 80% of the session limit. The original “gold” profile indicates that the alarm triggers at 90% of the session limit.

***WebUI***

Vsys > Configure > Edit (*vsys*)

***CLI***

```
enter vsys vsys1
    (vsys1) set override session-limit alarm 80
    (vsys1) save
```

### Deleting a Vsys Profile

You can delete a vsys profile in the WebUI or in the CLI. Before you delete a vsys profile, make sure that the profile is not used by any vsys. ScreenOS does not allow you to delete a profile that is in use.

If you receive a message that a profile you want to delete is in use, change the vsys profile of the vsys to use another profile and try to delete the profile again.

In the following example, you delete the vsys profile **gold**.

***WebUI***

Vsys > Profile: To the right of the vsys profile that you want to delete, click **Remove**.

***CLI***

unset vsys-profile gold

## *Viewing Vsys Settings*

The administrator for the security device can view the session statistics for all virtual systems. Within a vsys context, however, you can view only the statistics for that particular vsys.

### Viewing Overrides

To view the configured overrides for a particular vsys in the CLI, you can enter the **get vsys** *vsys_name* command or the **get vsys override** command. You can also enter the vsys context and then enter the **get override session-limit** command.

The following is sample output for **get vsys vsys2**:

device-> **get vsys vsys2**

```
Total number of vsys: 2

Name            Id Profile  Interface           IP Address         Vlan vsd
vsys2            2 VsysDef~ N/A                 N/A                N/A
Vsys-limit        Maximum   Reserved  Actual-use
dips                  254        0           0
mips                  384        0           0
mpolicies             200        0           0
policies              512        0           0
sessions           250064        0           0
user-serv-grps        128        0           0
user-servs            512        0           0
user-zones            215        0           1
zone-addr-grps        512        0           0(Untrust)
zone-addrs          20000        4           4(Untrust)
cpu-weight             50        -           0
(* - The marked setting has been overridden.)
```

You can also view the overrides in the WebUI.

In the following example, while in a vsys context, you view the reserve for a vsys named branch1.

***WebUI***

Vsys > Profile > Edit

***CLI***

enter vsys branch1
    (branch1) get override session-limit
    (branch1) exit

## Viewing a Profile

As root administrator, you can view each vsys profile with the WebUI or the CLI. From the WebUI, you cannot view all profiles or a summary of current usage. From the CLI, as root administrator, you can view all vsys profiles and a global usage summary that includes actual use statistics. As vsys administrator, using the CLI, you can enter a vsys and view the vsys-profile used for the vsys.

### *WebUI*

Vsys > Profile: Select a profile to view.

### *CLI 1*

device-> **get vsys-profile red**

```
 vsys-profile-name  ref-cnt  vsys-limit      maximum   reserved   peak-use
---------------------------------------------------------------------------
 red                      0  dips                254       0       0
                             mips                384       0       0
                             mpolicies           200       0       0
                             policies            512       0       0
                             sessions           3000     100       0
                             user-serv-grps      128       0       0
                             user-servs          512       0       0
                             user-zones          215       0       0
                             zone-addr-grps      512       0       0
                             zone-addrs        20000       4       0
                             cpu-weight = 44, 29% of total cpu-weight 150
                             session alarm level = 100%
---------------------------------------------------------------------------
```

### *CLI 2*

device-> **get vsys-profile**

```
* indicates default vsys profile.
 vsys-profile-name  ref-cnt  vsys-limit      maximum   reserved   peak-use
-----------------------------------------------------------------------------
*VsysDefaultProfile      2   dips                254       0       0
                             mips                384       0       0
                             mpolicies           200       0       0
                             policies            512       0       0
                             sessions         250064       0       0
                             user-serv-grps      128       0       0
                             user-servs          512       0       0
                             user-zones          215       0       1(vsys2)
                             zone-addr-grps      512       0       0
                             zone-addrs        20000       4    4(vsys2/Unt~)
                             cpu-weight = 50, 33% of total cpu-weight 150
                             session alarm level = 100%
-----------------------------------------------------------------------------
 RootProfile             1   dips                254       0       0
                             mips               6144       0       0
                             mpolicies           200       0       0
                             policies          20000       0       0
                             sessions         250064       0       0
                             user-serv-grps      128       0       0
                             user-servs         2048       0       0
                             user-zones          215       0       0
                             zone-addr-grps      512       0       2(Root/Tru~)
                             zone-addrs        20000       0       7(Root/Tru~)
                             cpu-weight = 50, 33% of total cpu-weight 150
                             session alarm level = 100%
```

```
--------------------------------------------------------------------------------
 red                    0   dips               254       0       0
                            mips               384       0       0
                            mpolicies          200       0       0
                            policies           512       0       0
                            sessions          3000     100       0
                            user-serv-grps     128       0       0
                            user-servs         512       0       0
                            user-zones         215       0       0
                            zone-addr-grps     512       0       0
                            zone-addrs       20000       4       0
                            cpu-weight = 44, 29% of total cpu-weight 150
                            session alarm level = 100%
--------------------------------------------------------------------------------
global usage summary:       global-limit     maximum   allocated  actual
                                                          use      use
--------------------------------------------------------------------------------
                            dips             65535       0       0
                            mips              6145       0       0
                            mpolicies          200       0       0
                            policies         20000       0       0
                            sessions        250064       0       0
                            user-serv-grps     128       0       0
                            user-servs        2048       0       0
                            user-zones         215       1       1
                            zone-addr-grps     512       2       2
                            zone-addrs       20000      95      75
                                                total cpu-weight = 150
```

**NOTE:** The peak-use value is the highest value among all virtual systems using a vsys profile

### Viewing Session Statistics

To view session statistics, enter the vsys context, then enter the **get session** command.

***WebUI***

Not available.

***CLI***

(vsys1)-> **get session**
vsys1: sw alloc 0/max 3500, alloc failed 0, mcast alloc 0
Total 0 sessions shown
(vsys1)->

## Sharing and Partitioning CPU Resources

By default, virtual systems within a single security system share the same CPU resources. It is possible for one virtual system (vsys) to consume excess CPU resources at the expense of other virtual systems.

For example, if one virtual system, within a security system that houses 20 virtual systems, experiences a DOS attack that consumes all of the CPU resources, the CPU is unable to process traffic for any of the other 19 virtual systems. In essence, all 20 virtual systems experience the DOS attack. CPU overutilization protection, also known as the CPU limit feature, is intended to protect against this.

Overutilization protection allows you to configure the security device for “fair use,” or fair mode, as opposed to “shared use,” or shared mode. To enable a more fair distribution of processing resources, you can assign a flow CPU utilization threshold to trigger a transition to fair mode, and you can choose a method for transition back to shared mode. By default, the security device operates in shared mode.

To enforce fair use, you assign a CPU weight to each vsys that you configure. ScreenOS uses these weights, relative to the weights of all virtual systems in the security device to assign time quotas proportional to those weights. ScreenOS then enforces the time quotas over one second intervals. This means that as long as a vsys does not exceed its time quota over that one second period and the firewall is not too heavily loaded, no packets for that vsys should be dropped.

**NOTE:** The CPU overutilization protection feature is independent of the session limits imposed by a vsys profile.

As system administrator, you determine how much traffic passes through a given vsys in fair mode by setting its CPU weight in relation to that of other virtual systems.

You must identify any anticipated burstiness while the security system is in fair mode, and then choose the CPU weight for each vsys appropriately so that bursts pass through the security system. We recommend verifying that adverse packet dropping does not occur with the chosen weights prior to deployment.

With this feature, you can also ensure a fixed CPU weight for the Root vsys.

### *Configuring CPU Weight*

CPU weight is a dimensionless quantity used to calculate the CPU time quota for each vsys. The CPU weight for a vsys is used in combination with the CPU weight for all the other virtual systems in a security device when calculating the time quota.

For example, you have virtual systems with the following CPU weights:

- vsys1: 10
- vsys2: 20
- vsys3: 30
- vsys4: 40

The sum of the CPU weights is 100. The time quota is calculated as the ratio of CPU weight to the sum of CPU weights multiplied by the CPU resources and expressed as a percentage of available CPU resources available to a vsys over one-second intervals. The time quotas for the virtual systems are as follows:

- 10/100: 10%
- 20/100: 20%

- 30/100: 30%
- 40/100: 40%

---

**NOTE:** CPU weight is not a static resource. ScreenOS recalculates CPU weight when you delete or add a vsys.

---

When you create a vsys, unless you specify another vsys profile, the default vsys profile (VsysDefaultProfile) is automatically applied. The default vsys profile has a CPU weight of 50 configured. You can change the CPU weight for the vsys profile, which applies to the virtual systems that use that vsys profile, or you can override the CPU weight for a vsys by entering the vsys and using the **set override cpu-weight** command.

In the following example, you change the CPU weight to 40 for the **corp-profile** vsys profile.

***WebUI***

Vsys > CPU Limit: Click **Edit** for the corp-profile vsys profile, type 40 in the CPU Weight field, and click **OK**.

***CLI***

```
set vsys-profile corp-profile cpu-weight 40
```

## *Fair Mode Packet Flow*

If you enable overutilization protection and the security device becomes heavily loaded, ScreenOS transitions the device into fair mode.

While in fair mode, ScreenOS processes a packet as follows:

1. The system allocates resources for the packet and timestamps it.
2. The flow CPU processes the packet.
3. The system determines the virtual system against which the packet should be charged and that virtual system's time quota balance. If the vsys is over its time quota, the system drops the packet. Refer to Table 2 to see how ScreenOS determines which vsys to charge.
4. After the system processes the packet, the system computes the CPU processing time for the packet from the current time and timestamp from step 1. The system then charges the amount against the remaining time quota for the vsys.

When a virtual system's time quota is exhausted, the system drops all subsequent packets for that vsys.

**Table 2: Determining Charged Vsys**

| Source Vsys | Destination Vsys | Charged Vsys |
|---|---|---|
| Root | Root | Root |
| Root | Destination vsys | Destination vsys |
| Source vsys | Root | Source vsys |
| Source vsys | Destination vsys | Source vsys |

**NOTE:** This packet dropping (enforcement) is only done in fair mode.

The system refreshes time quotas every 125 milliseconds.

**NOTE:** CPU overutilization protection is performed solely by the flow CPU with no hardware support. This feature provides a best effort to process packets of virtual systems that are not over their time quotas. There is no guarantee, however, that each virtual system cannot use more than its assigned time quota, as it takes time to determine the appropriate vsys against which packets are charged.

The time required to drop packets for a vsys that is over its time quota is also charged to that vsys. If a vsys is receiving heavy traffic and consistently over its time quota, no packets can pass through the system for that vsys.

### *Returning from Fair Mode to Shared Mode*

Depending on how a root administrator configures the security device, ScreenOS:

- Remains in fair mode until an administrator explicitly configures the security device to shared mode.
- Returns to shared mode after a specific time limit.

Returns to shared mode automatically after the projected flow CPU utilization falls below a configured threshold.

### *Enabling the CPU Limit Feature*

Before you can use many of the CPU limit feature commands in the CLI, you must first initialize and allocate resources for the feature. After configuring the CPU limit parameters using the CLI, you then must enable the feature.

#### *WebUI*

Vsys > CPU Limit: Select the **CPU Limit Enable** checkbox and click **OK**.

#### *CLI*

To initialize and allocate resources for the CPU limit feature, enter the following command:

```
set cpu-limit
```

After configuring the CPU limit parameters, enter the following command to enable the feature:

```
set cpu-limit enable
```

To disable the feature, enter the following command:

```
unset cpu-limit enable
```

To disable the feature and deallocate resources, enter the following command:

```
unset cpu-limit
```

### Measuring CPU Use

Each security device measures how many CPU cycles have passed. Using the CPU weights for each vsys within a security device, you can assign a resource quota to each vsys.

To determine the current CPU usage for a security system, log in as root administrator and use the **get performance cpu-limit** or **get vsys cpu-limit** command. These commands return a per-vsys breakdown of the percentage of CPU usage in terms of the percentage of CPU time quota assigned to each vsys.

**NOTE:** Before you can use these commands, you must enable the CPU limit feature by using the **set cpu-limit enable** command. For more information about this command, see the *ScreenOS CLI Reference Guide*.

The following output for a security device with fair mode enabled shows a total of six configured virtual systems (five virtual systems plus the root virtual system):

```
                              CPU Quota %
Vsys Name     Wgt  Cfg %   1 min  5 min  15 min
Root           50   16.6      0      0       0
corp           50   16.6     99     99      99
v1             50   16.6      8     18      10
v2             50   16.6      8     18      10
v3             50   16.6      7     17       9
v4             50   16.6      7     17      13
```

The output lists the following details:

- Vsys Name
- Wgt—configured CPU weight for this vsys
- Cfg %—configured percentage of CPU resources for this vsys
- 1 min—percentage of CPU quota used by this vsys in the last minute
- 5 min—percentage of CPU quota used by this vsys in the last 5 minutes
- 15 min—percentage of CPU quota used by this vsys in the last 15 minutes

In the previous example, of the configured virtual systems, vsys corp used almost all of its CPU time quota in the last minute, last 5 minutes, and last 15 minutes. Except for the Root vsys, which used no CPU resources, the other virtual systems used 7 to 8% of their CPU time quotas in the last minute and 17 to 18% of their CPU time quotas in the last 5 minutes.

To look at detailed packet data for a vsys, use the **get performance cpu-limit detail vsys all** *vsys_name* command. This command returns statistics for the specified vsys over the last 60 seconds and last 60 minutes.

The following output shows the following information:

- Number of packets successfully passed
- Number of dropped packets
- CPU quota in percent

```
device-> get performance cpu-limit detail vsys corp
vsys corp:
Last 60 seconds (paks passed,paks dropped by cpu limit/cpu quota %):
59:   916, 10550/78  58:  1206, 13796/99  57:  1252, 13751/99
56:  1255, 13747/99  55:  1302, 13700/99  54:  1308, 13694/99
53:  1337, 13666/99  52:  1232, 13770/99  51:  1222, 13780/99
50:  1263, 13740/99  49:  1322, 13680/99  48:  1311, 13691/99
47:  1334, 13668/99  46:  1317, 13686/99  45:  1319, 13683/99
44:  1322, 13680/99  43:  1333, 13670/99  42:  1323, 13679/99
41:  1337, 13665/99  40:  1333, 13670/99  39:  1331, 13671/99
38:  1325, 13678/99  37:  1318, 13685/99  36:  1319, 13683/99
35:  1318, 13685/99  34:  1333, 13668/99  33:  1355, 13647/99
32:  1346, 13656/99  31:  1360, 13642/99  30:  1360, 13643/99
29:  1351, 13651/99  28:  1346, 13656/99  27:  1357, 13646/99
26:  1339, 13663/99  25:  1337, 13665/99  24:  1356, 13646/99
23:  1329, 13674/99  22:  7190,  6961/99  21: 13164,     0/ -
20: 13219,     0/ -  19: 13765,     0/ -  18: 15136,     0/ -
17:  7730,     0/ -  16:   200,     0/ -  15:   200,     0/ -
14:   200,     0/ -  13:   200,     0/ -  12:   200,     0/ -
11:   200,     0/ -  10:   200,     0/ -   9:   200,     0/ -
 8:   200,     0/ -   7:   200,     0/ -   6:   200,     0/ -
 5:   200,     0/ -   4:   200,     0/ -   3:   200,     0/ 7
 2:   648,  5566/47   1:  1317, 13685/99   0:  1333, 13670/99

Last 60 minutes (paks passed,paks dropped by cpu limit):
59:    77968,  471526 58:    85666,  537590 57:    33921,  523433
56:    21110,  564548 55:    80572,  748114 54:    91814,  538566
53:    83932,  544342 52:    72268,  624337 51:     1339,  708070
50:    87790,  970630 49:    96317, 1084226 48:    68805,  267087
47:        0,       0 46:        0,       0 45:        0,       0
44:        0,       0 43:        0,       0 42:        0,       0
41:        1,       0 40:        0,       0 39:        0,       0
38:        0,       0 37:        0,       0 36:        0,       0
35:        0,       0 34:        0,       0 33:        0,       0
32:        0,       0 31:        0,       0 30:        0,       0
29:        0,       0 28:        0,       0 27:        0,       0
26:        0,       0 25:        0,       0 24:        0,       0
23:        0,       0 22:        0,       0 21:        1,       0
20:        0,       0 19:        0,       0 18:        0,       0
17:        0,       0 16:        0,       0 15:        0,       0
14:        0,       0 13:        0,       0 12:        0,       0
11:        0,       0 10:    90714,  679865  9:    86549, 1478569
```

```
8:    88999, 1429512  7:   238258,  566208  6:   316219,  479793
5:   477711,       0  4:   376981,       0  3:   439035,       0
2:   395397,  735399  1:    87908,  743423  0:        0,       0
```

This output shows that in the last 60 seconds, the corp vsys exceeded its assigned CPU quota from second 0 until second 2 and from second 22 to second 59, with an approximate average packet drop rate of over 10,000 packets per second.

For instance, at second 1, 1317 packets were passed, but 13685 packets were dropped, as the corp vsys went over its assigned CPU quota. From second 3 until second 16, the corp vsys passed 200 packets per second, and the security device returned to shared mode (ScreenOS outputs "-" in the % CPU quota column when in shared mode). At second 22, the system re-entered fair mode.

As root administrator, you have several options for the level of detail when viewing CPU utilization statistics. See Table 3.

**Table 3: Get Command Options for CPU Utilization Protection**

| Command | Purpose |
|---|---|
| **get performance cpu-limit** | Returns CPU weights and corresponding CPU time quota percentages and CPU quota percentages for all virtual systems. |
| **get performance cpu-limit detail vsys** *vsys_name* | Returns detailed statistics collected over the last 60 seconds and 60 minutes for the specified vsys. |
| **get cpu-limit utilization** | Returns the flow CPU utilization or the projected flow CPU utilization over the last 60 seconds:<br>■ When the firewall is in shared mode, the number displayed is the flow CPU utilization.<br>■ When the firewall is in fair mode, the number displayed is the projected flow CPU utilization.<br>Use to determine the shared-to-fair and fair and fair-to-shared automatic thresholds.<br>Asterisk to the right of the number indicates that the device was in fair mode at that time.<br>Utilization shown using this command is 8 to 12% lower than the output shown using the **get performance cpu** command, as the **get cpu-limit utilization** command does not include some overhead values. |
| **get vsys cpu-limit** | Shows the same output as the **get performance cpu-limit** command. |

## *Setting the Shared to Fair Mode CPU Utilization Threshold*

You can set a security system to transition from shared mode (default) to fair mode to protect CPU resource availability for other virtual systems by following these steps. You might have to repeat portions of this procedure until you are satisfied with the settings and have verified their effectiveness.

You can set the CPU utilization threshold in the WebUI or the CLI. The WebUI example is a summary of the command choices. The steps in the CLI example are complete.

**NOTE:** The flow CPU utilization, as configured by the CPU limit feature, is calculated differently from the output from the **get performance cpu** command. To set the shared-to-fair threshold, use one of the following procedures.

***WebUI***

Vsys > CPU Limit: Select the **CPU Limit Enable** checkbox, then click **OK**.

Fair to Shared: Select how or if you want the security device to return to shared mode. If you select automatic, enter a threshold. If you select Fair time, which is an explicit number of seconds for the device to use Fair Mode, enter the desired number of seconds.
Shared to Fair: Enter a threshold and enter a hold down time (optional).

***CLI***

1. Verify that the device is not processing traffic.
2. To initialize the CPU limit feature, enter the following command:

   set cpu-limit

3. The **shared-to-fair-threshold** setting indicates the threshold above which the security device transitions from shared to fair mode.

   You can also optionally set a hold-down time, which is the minimum amount of time the CPU usage exceeds the specified shared-to-fair threshold at which the security mode enters fair mode.

   To set the **shared-to-fair-threshold** and **hold-down time** (optional), enter a threshold value (a number from 1 to 100) and a hold down time (a value from 0 through 1800 seconds (30 minutes)):

   set cpu-limit shared-to-fair threshold *threshold* [hold-down-time *number*]

4. To enable the CPU limit, enter the following command:

   set cpu-limit enable

5. To verify the current mode and other CPU limit parameters, enter the following command:

   get cpu-limit

   ```
   device-> get cpu-limit
   Current mode: shared
   Shared->fair: threshold 80%, hold down time 1
   Fair->shared: automatic, threshold 70%
   CPU limit: enabled
   ```

6. Send traffic at a level that should keep the device in shared mode.
7. To verify that the security system stays in shared mode, enter the following command:

   get cpu-limit utilization

   Sample output:

```
device-> get cpu-limit utilization
Last 60 seconds:
59:  14   58:  14   57:  14   56:  14   55:  14   54:  14
53:  14   52:  15   51:  14   50:  14   49:  14   48:  15
47:  14   46:  15   45:  14   44:  15   43:  14   42:  15
.... [output continues]
```

If asterisks appear in the output after the traffic is started, the firewall is in fair mode, and the shared to fair threshold is too low. Perform the following steps:

a. Stop traffic.

b. Raise the shared to fair threshold with the **set cpu-limit shared-to-fair threshold** *flow_threshold* command.

c. To force the security system to return to shared mode, enter:

exec cpu-limit mode shared

d. Restart traffic and repeat step 7 as necessary.

8. Increase the traffic to a level that should force the device to transition into fair mode.

9. To verify that the security system transitioned to fair mode, enter the following command:

get cpu-limit utilization

```
device-> get cpu-limit utilization
Last 60 seconds:
59:  96*  58:  94*  57:  96*  56:  96*  55:  96*  54:  82*
53:  20   52:  14   51:  15   50:  14   49:  15   48:  14
47:  14   46:  14   45:  14   44:  14   43:  14   42:  14
41:  15   40:  14   39:  15   38:  15   37:  15   36:  14
35:  15   34:  14   33:  14   32:  14   31:  15   30:  14
29:  14   28:  14   27:  15   26:  15   25:  15   24:  15
23:  91*  22:  96*  21:  97*  20:  96*  19:  97*  18:  96*
17:  97*  16:  96*  15:  98*  14:  96*  13:  98*  12:  96*
11:  98*  10:  96*   9:  97*   8:  96*   7:  97*   6:  96*
 5:  97*   4:  96*   3:  97*   2:  96*   1:  97*   0:  96*
(* - In fair mode; projected cpu utilization displayed.)
```

If the system is not in fair mode after the traffic is increased, the shared to fair threshold is set too high. Follow these steps:

a. Stop the traffic.

b. Lower the shared to fair threshold by entering the **set cpu-limit shared-to-fair threshold** *flow_threshold* command.

**NOTE:** You can use the **get cpu-limit utilization** command as a guide.

c. Restart the traffic and repeat step 9 until the threshold is correct.

### Configuring a Method to Return to Shared Mode

After setting the shared to fair CPU utilization threshold, you can configure the device to transition to shared mode automatically, transition to shared mode after an explicit period, or stay in fair mode.

- To configure automatic transition to shared mode, the security device uses a threshold value that you configure. The threshold is the projected flow CPU utilization value below which the security device transitions from fair mode to shared mode. You can also configure a hold-down time, which is the minimum amount of time that the flow CPU utilization percentage must exceed the flow CPU utilization percentage threshold.
- To configure an explicit period, set the security device to use fair mode with a fair time setting. The fair time can be between zero (0) and 7200 seconds.
- To maintain fair mode, select the **never** setting.

In the following example, logged in as the root administrator, you configure the security device to automatically revert back to shared mode after the projected flow CPU utilization falls below a specific threshold.

In this example, assume that you are setting the fair-to-shared CPU utilization threshold for the first time, so you might have to repeat the steps to try different settings before the device behaves as expected. Verification steps are included. The example shows the CLI commands.

---

**NOTE:** This procedure is necessary only if you want to enable fair automatic mode.

---

***WebUI***

Vsys > CPU Limit: Select the CPU Limit Enable checkbox, then click **OK**.

Fair to Shared: Select how or if you want the security device to return to shared mode. If you select **Automatic**, enter a threshold.

***CLI***

1. Verify that traffic is arriving to the security device at a level that keeps the device in fair mode.
2. To set the fair automatic threshold, enter the following command:

   set cpu-limit fair-to-shared automatic threshold *number*
3. Lower the traffic rate to a level that should trigger the device into shared mode.
4. Verify that the firewall returns to shared mode by entering the **get cpu-limit utilization** command.
5. If the firewall is still in fair mode, repeat all steps in this procedure using a lower value for the fair automatic threshold.

### Setting a Fixed Root Vsys CPU Weight

To specify an explicit CPU percentage for the root vsys, you can calculate the root vsys CPU weight. However, when you add or delete a vsys, you have to recalculate the root vsys CPU weight.

To ensure the calculated root vsys CPU weight is correct, you must configure the CPU weights of all other virtual systems. Then use the following formula to compute the required root vsys CPU weight:

$$R = \frac{PW}{1 - P}$$

where:

- R is the root vsys CPU weight
- P is the proportion of the CPU desired for root vsys where:

  $$0 \le P \le 1$$

- W is the sum of the weights of all the other virtual systems

In the following example, you want to assign 30 percent of the CPU resource to the root vsys when you have four virtual systems distributed among three vsys profiles as follows:

- Gold profile (CPU weight = 40): 1 vsys
- Silver profile (CPU weight = 30): 2 vsys
- RootProfile: 1 root vsys

The sum of the CPU weights of all vsys excluding the root vsys (W) is 100. The percentage (P) you want to assign to the root vsys is 30 percent or .3.

Using the previous equation: R = P*W/(1-P) = .3*100/.7 = 43

To check, the root vsys percentage is 43/(100 + 43), which yields approximately 30%.

If you add or delete a vsys in the future, you must redetermine *W* and recalculate the root vsys CPU weight *R*.

## Vsys and Virtual Private Networks

The root vsys admin can view the following virtual private network (VPN) information:

- All configured or only active security associations (SAs)
- Internet Key Exchange (IKE) cookies

Read-write and read-only vsys admins can see the information that pertains only to their vsys.

The next sections explain more about this information and how to view it.

### Viewing Security Associations

If you are the root system administrator for the security device, you can view the security associations (SAs) for all virtual systems by entering the **get sa** command. When you issue this command, you retrieve the total number of IPSec SAs stored in the security device, which is the root system plus all configured virtual systems.

To view only the active SAs you can enter the **get sa active** command.

You can also view SAs from the WebUI.

In the following example, as system administrator, you can view all of the SAs for all virtual systems and the root virtual system.

***WebUI***

VPNs > Monitor Status

***CLI***

```
get sa
```

If you are a vsys admin and are using the CLI, you can view the SAs that are applicable to your particular vsys by entering a vsys context then entering the **get sa** command.

To view only the active SAs, enter the **get sa active** command.

In the following example, as vsys administrator for clothing_store, you can view only the active SAs for your vsys.

***WebUI***

VPNs > Monitor Status

***CLI***

```
enter vsys clothing_store
(clothing_store) get sa active
(clothing_store) exit
```

### Viewing IKE Cookies

You can view IKE cookies from the CLI only.

As system administrator for the security device, you can view all of the IKE cookies for the system, which is the root plus the vsys IKE cookies. You can view them from the CLI by entering the **get ike cookie** command.

In the following example, as system administrator, you view the IKE cookies.

***WebUI***

Not available.

***CLI***

```
get ike cookie
```

As a vsys admin, you can view the IKE cookies for the vsys you manage by entering the vsys context and then entering the **get ike cookie** command.

In the following example, you view the IKE cookies for the vsys you manage, *card_shop*.

***WebUI***

Not available.

***CLI***

```
enter vsys card_shop
(card_shop) get ike cookie
(card_shop) exit
```

## Policy Scheduler

Within a vsys context, a vsys admin can schedule a single or recurrent timeslot within which a policy is active.

When a new policy is created, a vsys admin can create a scheduler and then bind it to one or more existing policies. The session ages out when the scheduler times out.

This section explains the following tasks:

- "Creating a Policy Scheduler" on this page
- "Binding a Policy Schedule to a Policy" on page 29
- "Viewing Policy Schedules" on page 29
- "Deleting a Policy Schedule" on page 30

### *Creating a Policy Scheduler*

As a vsys admin, you can schedule a policy to be active for one time only or on a recurrent basis. You can configure a meaningful name and a start and stop time for the scheduler. You can also attach comments.

In the following example, you configure a scheduler for a recurring service restriction from Monday to Friday from 8:00 to 11:30 am and from 1:00 to 5:00 pm. The scheduler sets the time restrictions; the policy sets the service restriction. You enter a vsys context and perform the configuration in the vsys context.

***WebUI***

Vsys > Configure > Enter

Objects > Schedules > Click **New** and fill in the schedule form, then click **OK**.

***CLI***

```
device(hr)-> set scheduler restrictionM recurrent monday start 8:00 stop 11:30
      start 13:00 stop 17:00
device(hr)-> set scheduler restrictionTu recurrent tuesday start 8:00 stop 11:30
      start 13:00 stop 17:00
device(hr)-> set scheduler restrictionW recurrent wednesday start 8:00 stop 11:30
      start 13:00 stop 17:00
device(hr)-> set scheduler restrictionTh recurrent thursday start 8:00 stop 11:30
      start 13:00 stop 17:00
device(hr)-> set scheduler restrictionF recurrent friday start 8:00 stop 11:30 start
      13:00 stop 17:00
device(hr)-> save
```

## *Binding a Policy Schedule to a Policy*

You can attach a scheduler to a policy as you create the policy, or you can bind the scheduler later in the WebUI.

In this example, you configure a new policy from Trust to Untrust and set the source and destination address-book entries.

***WebUI***

Vsys > Configure > Enter

Policies: Select the zones and click **New**. After configuring the policy, click **Advanced**: At the bottom of the page, select the Schedule from the dropdown list, then click **OK**.

***CLI***

```
device(hr)-> set policy id 1 from trust to untrust company any http deny schedule
      restrictionM
device(hr)-> set policy id 1 from trust to untrust company any http deny schedule
      restrictionTu
device(hr)-> set policy id 1 from trust to untrust company any http deny schedule
      restrictionW
device(hr)-> set policy id 1 from trust to untrust company any http deny schedule
      restrictionTh
device(hr)-> set policy id 1 from trust to untrust company any http deny schedule
      restrictionF
device(hr)-> save
```

## *Viewing Policy Schedules*

You can view configured schedules in the WebUI or the CLI.

***WebUI***

Vsys > Configure > Enter

Objects > Schedules

***CLI***

```
device(hr)-> get scheduler
```

### *Deleting a Policy Schedule*

In the following example, logged in as a vsys admin, you delete the schedule named **restrictionW**.

#### *WebUI*

Vsys > Configure > Enter

Objects > Schedules: Click **Remove**.

#### *CLI*

```
device(hr)-> unset scheduler restrictionW
```

Chapter 2

# Traffic Sorting

This chapter explains how ScreenOS sorts traffic. It contains the following sections:


- "Overview" on this page
    - "Sorting Traffic" on this page
    - "Sorting Through Traffic" on page 32
    - "Dedicated and Shared Interfaces" on page 37
- "Importing and Exporting Physical Interfaces" on page 39
    - "Importing a Physical Interface to a Virtual System" on page 39
    - "Exporting a Physical Interface from a Virtual System" on page 40


## Overview

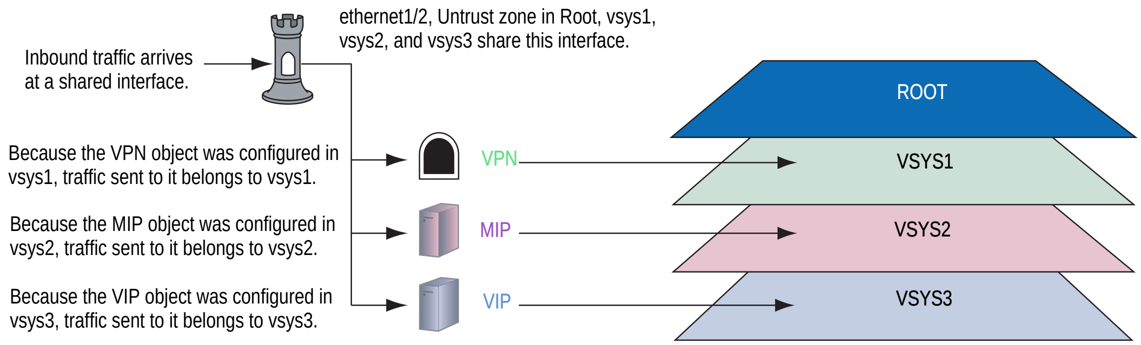
ScreenOS sorts every packet that it receives for delivery to the proper virtual system (vsys). A security device receives two kinds of user traffic, which it sorts in two different ways:

- Traffic destined for an IP address within the system itself, such as encrypted VPN traffic and traffic destined for a MIP or VIP
- Traffic destined for an IP address beyond the device

### *Sorting Traffic*

For traffic destined for an object (VPN, MIP, or VIP) on the security system, the system determines the vsys to which the traffic belongs through the association of the object with the vsys in which it was configured. Figure 2 displays how traffic is sorted.

**Figure 2: VPN, MIP, and VIP Association**




Inbound traffic can also reach a vsys through VPN tunnels; however, if the outgoing interface is a shared interface, you cannot create an AutoKey IKE VPN tunnel for a vsys and the root system to the same remote site.

## *Sorting Through Traffic*

For traffic destined for an IP address beyond the security device (also known as "through traffic"), the device uses techniques made possible by VLAN-based and IP-based traffic classifications. VLAN-based traffic classification uses VLAN tags in frame headers to identify the system to which inbound traffic belongs. IP-based traffic classification uses the source and destination IP address in IP packet headers to identify the system to which traffic belongs. The process that the security device uses to determine the system to which a packet belongs progresses through the following three steps:

---

**NOTE:** VLAN tagging requires the use of subinterfaces. A subinterface must be dedicated to a system, in contrast to a shared interface, which is shared by all systems.

---

1. **Ingress Interface/Source IP Traffic Classification**
   The security device checks if the ingress interface is a dedicated interface or a shared interface.

---

**NOTE:** For more information about shared and dedicated interfaces, see "Dedicated and Shared Interfaces" on page 37.

---

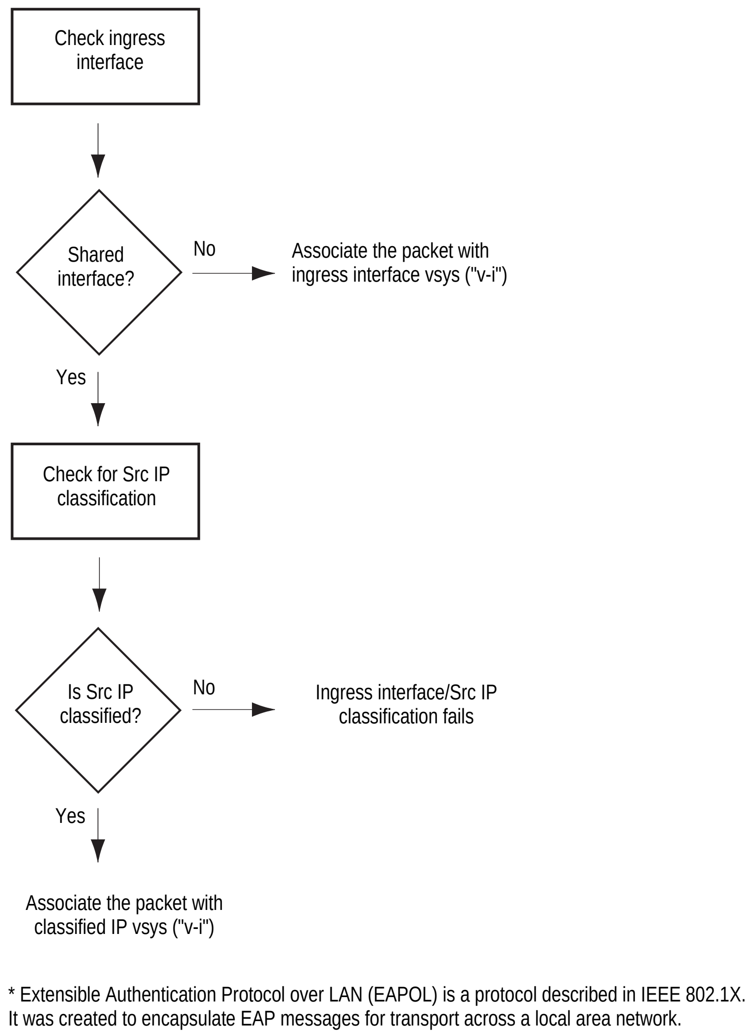
   a. If the ingress interface is dedicated to a vsys ("v-i", for example), the security device associates the traffic with the system to which the interface is dedicated.

   b. If the ingress interface is a shared interface, the security device uses IP classification to check if the source IP address is associated with a particular vsys. See Figure 3.

      - If the source IP address is not associated with a particular vsys, ingress IP classification fails.

      - If the source IP address is associated with a particular vsys, ingress IP classification succeeds.

**Figure 3: Step 1—Ingress Interface and Source IP Traffic Classification**




**2. Egress Interface/Destination IP Traffic Classification**

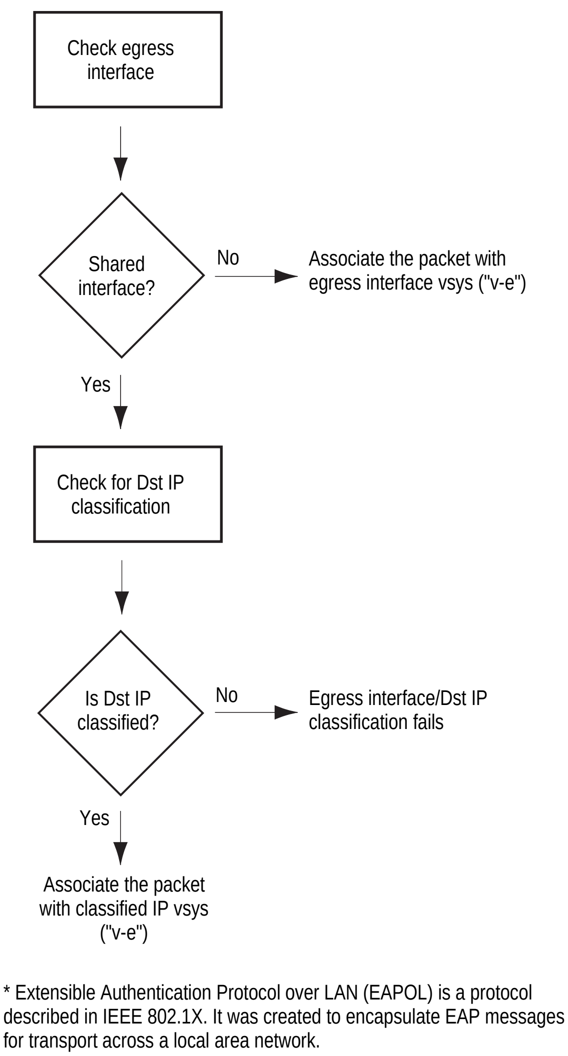
The security device checks if the egress interface is shared or dedicated.

a. If the egress interface is dedicated to a vsys ("v-e", for example), the security device associates the traffic with the system to which the interface is dedicated.

b. If the egress interface is a shared interface, the security device uses IP classification to check if the destination IP address is associated with a particular vsys. See Figure 4.

- If the destination IP address is not associated with a particular vsys, egress IP classification fails.
- If the destination IP address is associated with a particular vsys, egress IP classification succeeds.

**Figure 4: Step 2—Egress Interface/Destination IP Traffic Classification**




**3. Vsys Traffic Assignment**

Based on the outcome of the ingress interface/source IP (I/S) and egress interface/destination IP (E/D) traffic classifications, the security device determines the vsys to which traffic belongs. See Figure 5.

a. If I/S traffic classification succeeds, but E/D traffic classification fails, the security device uses the policy set and route table for the vsys associated with the ingress interface or source IP address (a vsys named "v-i", for example).

   I/S traffic classification is particularly useful when permitting outbound traffic from a vsys to a public network such as the Internet.

b. If E/D traffic classification succeeds, but I/S traffic classification fails, the security device uses the policy set and route table for the vsys associated with the egress interface or destination IP address (a vsys named "v-e", for example).

E/D traffic classification is particularly useful when permitting inbound traffic to one or more servers in a vsys from a public network such as the Internet.

c. If both classification attempts succeed and the associated virtual systems are the same, the security device uses the policy set and route table for that vsys.

   You can use both I/S and E/D IP traffic classification to permit traffic from specific addresses in one zone to specific addresses in another zone of the same vsys.

d. If both classification attempts succeed, the associated virtual systems are different, and the interfaces are bound to the same shared security zone, the security device first uses the policy set and route table for the I/S vsys, and then uses the policy set and route table for the E/D vsys.

   ScreenOS supports intrazone intervsys traffic when the traffic occurs in the same shared zone. The security device first applies the “v-i” policy set and route table, loops the traffic back on the Untrust interface, and then applies the “v-e” policy set and route table. Such intrazone traffic might be common if a single company uses one shared internal zone with different virtual systems for different internal departments and wants to allow traffic between the different departments.

e. If both classification attempts succeed, the associated virtual systems are different, and the interfaces are bound to different shared security zones, then the security device drops the packet.

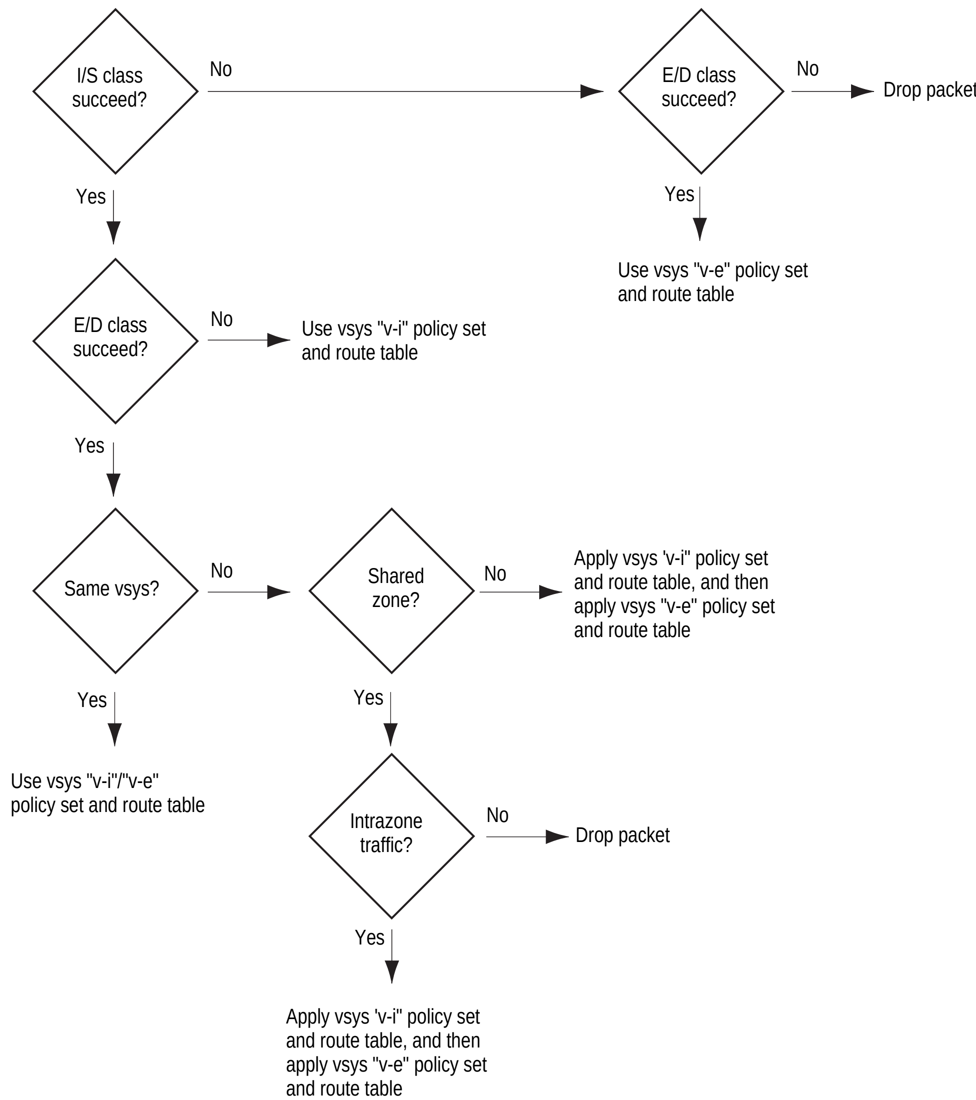
**NOTE:** ScreenOS does not support interzone intervsys traffic between shared security zones. You cannot use a custom zone instead of the Untrust zone.

f. If both classification attempts succeed, the associated virtual systems are different, and the ingress and egress interfaces are bound to zones dedicated to different virtual systems, the security device first applies the “v-i” policy set and route table. It then loops the traffic back on the Untrust interface and applies the “v-e” policy set and route table. (See “Communicating Between Virtual Systems” on page 64.)

   ScreenOS supports interzone intervsys traffic between dedicated security zones.

g. If both classification attempts fail, the security device drops the packet.

**Figure 5: Step 3—Vsys Traffic Assignment**




Extensible Authentication Protocol over Local Area Network (EAPOL) is a protocol described in IEEE 802.1X. It was created to encapsulate EAP messages for transport across a LAN.

### *Dedicated and Shared Interfaces*

Inbound traffic to dedicated and shared interfaces is sorted differently.

#### Dedicated Interfaces

A system—virtual and root—can have multiple interfaces or subinterfaces dedicated exclusively to its own use. Such interfaces are not sharable by other systems.

You can dedicate an interface to a system as follows:

- When you configure a physical interface, subinterface, redundant interface, or aggregate interface in the root system and bind it to a nonsharable zone, that interface remains dedicated to the root system.
- When you import a physical or aggregate interface into a vsys and bind it to either the shared Untrust zone or the Trust-*vsys_name* zone, that interface becomes a dedicated interface for that vsys.
- When you configure a subinterface in a vsys, it belongs to that vsys.

---

**NOTE:** When a system has a dedicated subinterface, the security device must employ VLAN-based traffic classification to properly sort inbound traffic.

---

#### Shared Interfaces

A system—virtual and root—can share an interface with another system. For an interface to be sharable, you must configure it at the root level and bind it to a shared zone in a shared virtual router. By default, the predefined untrust-vr is a shared virtual router, and the predefined Untrust zone is a shared zone. Consequently, a vsys can share any root-level physical interface, subinterface, redundant interface, or aggregate interface that you bind to the Untrust zone.

To create a shared interface in a zone other than the Untrust zone, you must define the zone as a shared zone at the root level. To do that, the zone must be in a shared virtual router, such as the untrust-vr or any other root-level virtual router that you define as sharable. Then, when you bind a root-level interface to the shared zone, it automatically becomes a shared interface.

---

**NOTE:** For the shared zone option to be available, the security device must be operating at Layer 3 (Route mode), which means that you must previously assign an IP address to at least one root-level interface.

To create a virtual router, you need to obtain a vsys license key, which provides you with the ability to define virtual systems, virtual routers, and security zones for use either in a vsys or in the root system.

---

A shared virtual router can support both shared and nonsharable root-level security zones. You can define a root-level zone bound to a shared virtual router as sharable or not. Any root-level zone that you bind to a shared virtual router and define as sharable becomes a shared zone, available for use by other virtual systems, too.

Any root-level zone that you bind to a shared virtual router and define as nonsharable remains a dedicated zone for use by the root system alone. If you bind a vsys-level zone to either the virtual router dedicated to that vsys or to a shared virtual router created in the root system, the zone remains a dedicated zone, available for use only by the vsys for which you created it.

A shared zone can support both shared and dedicated interfaces. Any root-level interface that you bind to a shared zone becomes a shared interface, available for use by virtual systems also. Any vsys-level interface that you bind to a shared zone remains a dedicated interface, available for use only by the vsys for which you created it.

A nonsharable zone can only be used by the system in which you created it and can only support dedicated interfaces for that system. All vsys-level zones are nonsharable.

To create a shared interface, you must create a shared virtual router (or use the predefined untrust-vr), create a shared security zone (or use the predefined Untrust zone), and then bind the interface to the shared zone. You must do all three steps in the root system.

The options in the WebUI and CLI are as follows:

**1. To create a shared virtual router:**

**WebUI**

Network > Routing > Virtual Routers > New: Select the **Shared and accessible by other vsys** option, then click **Apply**.

**CLI**

set vrouter name *name_str*
set vrouter *name_str* shared

(You cannot modify an existing shared virtual router to make it unshared unless you first delete all virtual systems. However, you can modify a virtual router from unshared to shared at any time.)

**2. To create a shared zone, do the following at the root level:**

**WebUI**

**NOTE:** At the time of this release, you can only define a shared zone through the CLI.

**CLI**

set zone name *name_str*
set zone *zone* vrouter *sharable_vr_name_str*
set zone *zone* shared

**3. To create a shared interface, do the following at the root level:**

**WebUI**

Network > Interfaces > New (or Edit for an existing interface): Configure the interface and bind it to a shared zone, then click **OK**.

**CLI**

set interface *interface* zone *shared_zone_name_str*

When two or more virtual systems share an interface, the security device must employ IP-based traffic classification to properly sort inbound traffic. (For more information about IP-based traffic classification, including an example showing how to configure it for several vsys, see "IP-Based Traffic Classification" on page 69.)

## Importing and Exporting Physical Interfaces

You can dedicate one or more physical interfaces to a vsys. In effect, you import a physical interface from the root system to a virtual system. After importing a physical interface to a vsys, the vsys has exclusive use of it.

**NOTE:** Before you can import an interface to a virtual system, it must be in the Null zone at the root level.

### *Importing a Physical Interface to a Virtual System*

In this example, you—as the root admin—import the physical interface ethernet4/1 to vsys1. You bind it to the Untrust zone and assign it the IP address 1.1.1.1/24.

***WebUI***

1. **Entering Vsys1**
   Vsys: Click **Enter** (for vsys1).
2. **Importing and Defining the Interface**
   Network > Interfaces: Click **Import** (for ethernet4/1).

   Network > Interfaces > Edit (for ethernet4/1): Enter the following, then click **OK**:

   Zone Name: Untrust
   IP Address/Netmask: 1.1.1.1/24
3. **Exiting Vsys1**
   Click the **Exit Vsys** button (at the bottom of the menu column) to return to the root level.

***CLI***

1. **Entering Vsys1**
   ns-> enter vsys vsys1
2. **Importing and Defining the Interface**
   ns(vsys1)-> set interface ethernet4/1 import
   ns(vsys1)-> set interface ethernet4/1 zone untrust
   ns(vsys1)-> set interface ethernet4/1 ip 1.1.1.1/24
   ns(vsys1)-> save
3. **Exiting Vsys1**
   ns(vsys1)-> exit

### *Exporting a Physical Interface from a Virtual System*

In this example, you bind the physical interface ethernet4/1 to the Null zone in vsys1 and assign it the IP address 0.0.0.0/0. Then you export interface ethernet4/1 to the root system.

***WebUI***

1. **Entering Vsys1**
   Vsys: Click **Enter** (for vsys1).
2. **Exporting the Interface**
   Network > Interfaces > Edit (for ethernet4/1): Enter the following, then click **OK**:

   Zone Name: Null
   IP Address/Netmask: 0.0.0.0/0

   Network > Interfaces: Click **Export** (for ethernet4/1).

   (Interface ethernet4/1 is now available for use in the root system or in another vsys.)
3. **Exiting Vsys1**
   Click the **Exit Vsys** button (at the bottom of the menu column) to return to the root level.

***CLI***

1. **Entering Vsys1**
   ns-> enter vsys vsys1
2. **Exporting the Interface**
   ns(vsys1)-> unset interface ethernet4/1 ip
   ns(vsys1)-> unset interface ethernet4/1 zone
   ns(vsys1)-> unset interface ethernet4/1 import
   This command will remove all objects associated with interface, continue? y/[n] y
   ns(vsys1)-> save

   (Interface ethernet4/1 is now available for use in the root system or in another vsys.)
3. **Exiting Vsys1**
   ns(vsys1)-> exit

Chapter 3

# VLAN-Based Traffic Classification

This chapter explains VLAN-based traffic classification for virtual systems. It includes the following sections:


- "Overview" on this page
  - "VLANs" on page 42
  - "VLANS with Vsys" on page 42
- "Configuring Layer 2 Virtual Systems" on page 43
- "Defining Subinterfaces and VLAN Tags" on page 61
- "Communicating Between Virtual Systems" on page 64


## Overview

With VLAN-based traffic classification, a security device uses VLAN tagging to direct traffic to various subinterfaces bound to different systems.

By default, a vsys has two security zones—a shared Untrust zone and its own Trust zone. Each vsys can share the Untrust zone interface with the root system and with other virtual systems. A vsys can also have its own subinterface or a dedicated physical interface (imported from the root system) bound to the Untrust zone.

**NOTE:** ScreenOS supports VLANs compliant with the IEEE 802.1Q VLAN standard.

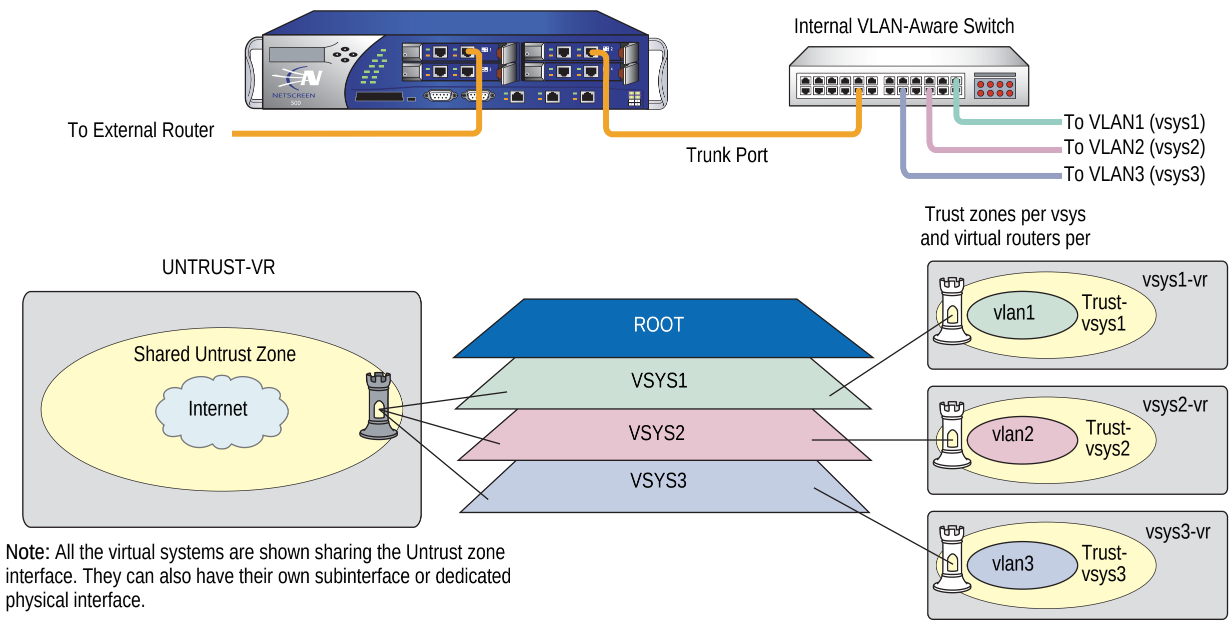
You can dedicate a physical interface to a virtual system by importing it from the root system to the virtual system. (See "Importing and Exporting Physical Interfaces" on page 39.) When using physical interfaces, VLAN tagging is unnecessary for traffic on that interface.

## *VLANs*

Figure 6 shows VLAN traffic classes. Each VLAN is bound to a system through a subinterface. Use the **set interface** *interface.subid* **tag** *vlanid* **zone** *zone_name* CLI command to assign a VLAN tag to a subinterface.

If a vsys shares the Untrust zone interface with the root system and has a subinterface bound to its Trust-*vsys_name* zone, the vsys must be associated with a VLAN in the Trust-*vsys_name* zone. If the vsys also has its own subinterface bound to the Untrust zone, the vsys must also be associated with another VLAN in the Untrust zone.

**Figure 6: VLAN Traffic Classes**




A subinterface stems from a physical interface, which then acts as a trunk port. A trunk port allows a Layer 2 network device to bundle traffic from several VLANs through a single physical port, sorting the various packets by the VLAN identifier (VID) in their frame headers. VLAN trunking allows one physical interface to support multiple logical subinterfaces, each of which must be identified by a unique VLAN tag. The VLAN identifier (tag) on an incoming ethernet frame indicates its intended subinterface—and hence the system—to which it is destined. When you associate a VLAN with an interface or subinterface, the security device automatically defines the physical port as a trunk port. When using VLANs at the root level in Transparent mode, you must manually define all physical ports as trunk ports with the following CLI command: **set interface vlan1 vlan trunk**.

## *VLANS with Vsys*

When a vsys uses a subinterface (not a dedicated physical interface) bound to the Trust-*vsys_name* zone, the internal switch and internal router in the Trust-*vsys_name* zone must have VLAN-support capabilities. If you create more than one subinterface on a physical interface, then you must define the connecting switch port as a trunk port and make it a member of all VLANs that use it.

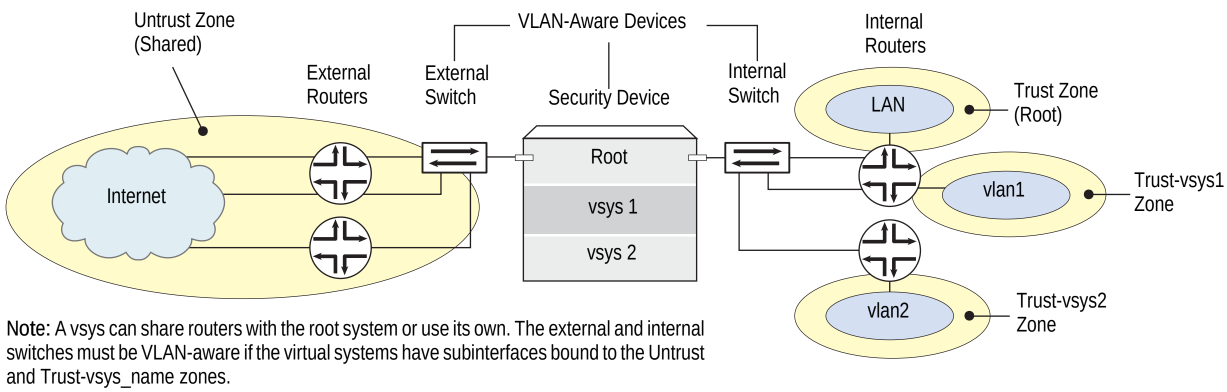
When a vsys uses a subinterface (not a shared interface or a dedicated physical interface) bound to the shared Untrust zone, the external switch and external router that receives its inbound and outbound traffic must have VLAN-support capabilities. The router tags the incoming frames so that when they reach the security device, it can direct them to the correct subinterface.

Although a vsys cannot be in Transparent mode, because it requires unique interface or subinterface IP addresses, the root system can be in Transparent mode. For the root system to support VLANs while operating in Transparent mode, use the following CLI command to enable the physical interfaces bound to Layer 2 security zones to act as trunk ports: **set interface vlan1 vlan trunk**. See Figure 7 for an example of a VLAN using vsys.

There are three tasks that a root-level administrator must perform to create a VLAN for a vsys:

1. Enter a vsys.
2. Define a subinterface.
3. Associate the vsys with a VLAN.

**Figure 7: VLAN with Vsys Example**



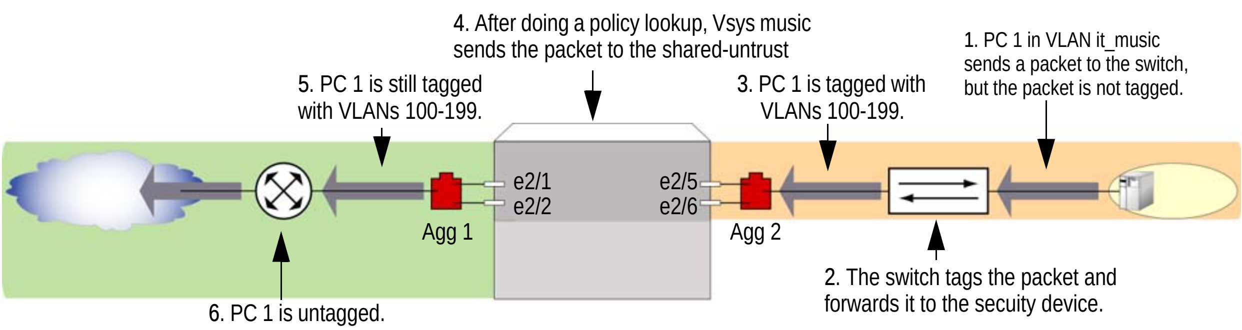

**NOTE:** When the root system is in Transparent mode, it cannot support virtual systems. It can, however, support root-level VLANs while in Transparent mode.

## Configuring Layer 2 Virtual Systems

When you configure virtual systems in Transparent mode, the security device functions much like a Layer 2 switch or bridge. Packets that traverse the security device are grouped with a unique virtual system (vsys) based on the virtual local area network (VLAN) tag in the packet header. Once the packet is grouped, it performs a policy lookup, then sends the packet through the security device without packet modification.

On the security device, you can logically partition a security system into multiple virtual systems, to provide multi-tenant services. Each vsys is a unique security domain within the device. Each vsys can have its own administrators (called "virtual system administrators" or "vsys admins") who can individualize their security domains by setting their own objects, such as address books, user lists, custom services, and policies. Administrators then use these objects when defining policies for traffic within a vsys, or between one vsys and other security domains.

The following diagram shows how the security device transfers data to trusted VLANs using vsys set policies. The numbers in the diagram represent the order of data transfer.




Virtual systems in transparent mode are classified by VLAN tags. On the system, a range of VLAN tags is assigned to a VLAN group object, which is then assigned to a security zone that is applied to a port assigned to a vsys. Traffic entering the security system is then classified to the vsys based on the VLAN tag. Once inside the vsys, the traffic is enforced using the configured security zones and policies. The security device can support up to 500 virtual systems in transparent mode. For more information about VLAN and vsys, see the Virtual Systems chapter in the security Concepts & Examples ScreenOS Guide.

ScreenOS also provides a management interface that manages a vsys when the interface is bound to the zone vlan. The security device creates the management zone vlan automatically when you create a vsys. You can bind more than one interface to the management zone for a single vsys. A VLAN management interface is created within a vsys so that the vsys administrator can manage the virtual systems using a unique IP address and VLAN ID. This management interface allows you to manage your virtual systems remotely or locally.

Only the root administrator can create a vsys and assign resources to it. The root administrator or vsys administrator can then use the CLI or WebUI to create and maintain a vsys configuration. Virtual systems can be used with ScreenOS 5.0-L2V only when policies are set correctly.

The security device supports a maximum of 4094 VLANs, which are classified in a vsys by way of VLAN tagging. Each vsys can be assigned from 2 to 4094; however, once a VLAN is assigned to one vsys it cannot be used in another. The root system is identified as vlan1. With a single 8G2 Secure Port Module (SPM), you can configure a maximum of two 4-port aggregate interfaces, four trusted and four untrusted. Assigning the VLANs to an aggregate interface provides a traffic bandwidth of 2Gps in each direction, with a maximum of 4Gps for bi-directional traffic per Application-Specific Integrated Circuit (ASIC).

The 8G SPM contains two ASICs. Ports ethernet2/1 through ethernet2/4 use one ASIC, ports ethernet2/5 through ethernet2/8 use the other. Aggregate interfaces must be configured in pairs, starting with port ethernet2/1. The following table shows assigned aggregate ports.

**Table 4: 8G SPM**

| | |
|---|---|
| aggregate1 | ethernet 2/1 and ethernet 2/2 |
| aggregate 2 | ethernet 2/3 and ethernet 2/4 |
| aggregate 3 | ethernet 2/5 and ethernet 2/6 |
| aggregate 4 | ethernet 2/7 and ethernet 2/8 |

If you are using the 8G2 SPM and the 5000M2 Management Module, you must use the configuration shown in the following table.

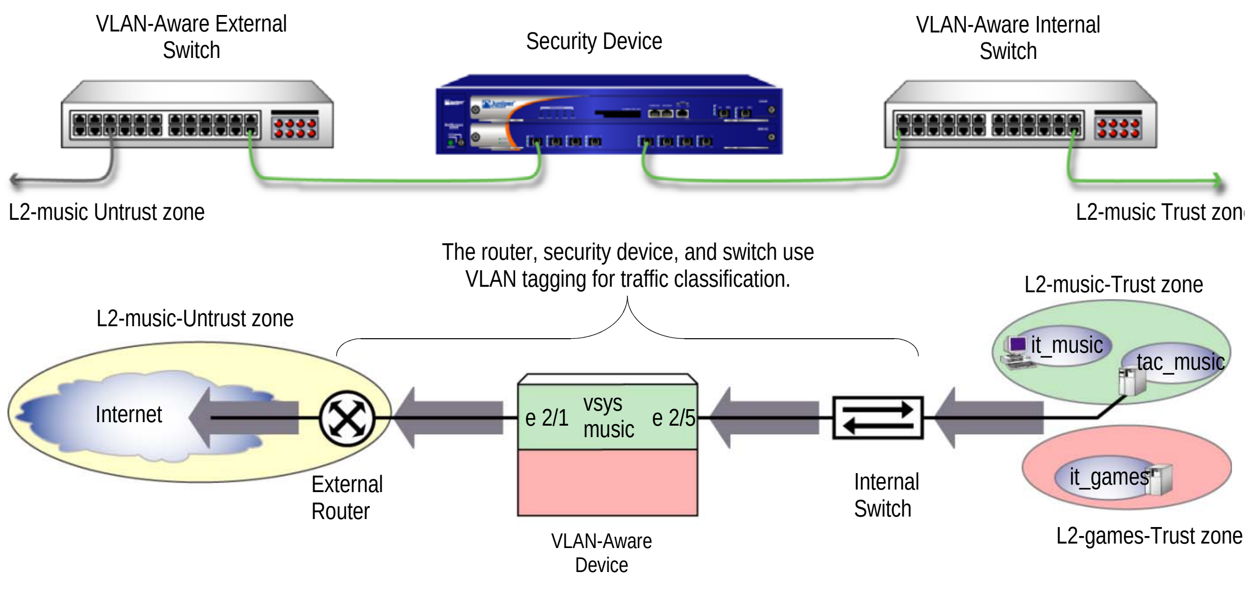
**Table 5: 8G2 SPM**

| | |
|---|---|
| aggregate1 | ethernet 2/1 and ethernet 2/2<br>ethernet 2/3 and ethernet 2/4 |
| aggregate 2 | ethernet 2/3 and ethernet 2/4<br>ethernet 2/7 and ethernet 2/8 |

## Example 1: Configuring a Single Port

In this example, the security device is configured to support the vsys music in transparent mode. This vsys shares the L2-music-Untrust zone with the root system. The following diagram shows how the security device secures the Trust and Untrust zones. You must import the VLANs to a vsys before they can be tagged.

**Figure 8: Single Port**



Configuring one Transparent mode virtual system (vsys) involves the following steps:

1. Create the vsys named music with a vsys admin name and password.
2. Import (assign) VLAN tags from the root system to classify traffic.
3. Create a VLAN group that contains the VLAN tags to be supported on each port.
4. Create two Layer 2 zones, one for the Trust port and one for the Untrust port.
5. Bind the VLAN group to the ports

**NOTE:** Only the root administrator can configure virtual systems, VLAN tags, and Layer 2 zones; however, both the root administrator and vsys administrator can set the management interface and policies. The root administrator can access any vsys in the security device. The vsys administrator can only access the vsys that is assigned to the vsys in which the policies were created.

6. Configure the policies for the vsys music. The policies configured in this example do the following:
   a. Permit HTTP traffic from the L2-music-Untrust zone to the L2-music-Trust zone
   b. Deny all other traffic from the L2-music-Untrust zone to the L2-music-Trust zone
   c. Permit all traffic from then L2-music-Trust zone to the L2-music-Untrust zone
7. Create the management interface. A VLAN management interface is created within a vsys so that the vsys administrator can manage the vsys using a unique IP address and VLAN ID

**NOTE:** ScreenOS 5.0-L2V with the security device can support up to 500 virtual systems.

***WebUI***

**1. Create Vsys Music**

Vsys > New: Enter the following, and then click OK:

Vsys Name: music
Vsys Admin Name: vsys_music
Vsys Admin New Password: xyz
Confirm New Password: xyz

2. **Import VLANs**

   Vsys: Click Enter (for vsys_music)

   Network > Vlan > Import: Enter the following, and then click Assign:

   Import Vlan ID:
   Start: 100
   End: 199

3. **Bind Ports**

   Network > Vlan > Group > Edit (for it_music) > Port: Enter the following, and then click Add:

   port: (select) ethernet2/5
   zone: (select) L2-music-Trust
   port: (select) ethernet2/1
   zone: (select) L2-music-Untrust

4. **Policies**

   Policies (From: L2-music-Untrust, To: L2-music-Trust) > New: Enter the following, and then click OK:

   Source Address:
   Address Book Entry: (select) Any
   Destination Address:
   Address Book Entry: (select) Any
   Service: (select) HTTP
   Action: (select) Permit

   Policies (From: L2-music-Untrust, To: L2-music-Trust) > New: Enter the following, and then click OK:

   Source Address:
   Address Book Entry: (select) Any
   Destination Address:
   Address Book Entry: (select) Any
   Service: (select) ANY
   Action: (select) Deny

   Policies (From: L2-music-Trust, To: L2-music-Untrust) > New: Enter the following, and then click OK:

   Source Address:
   Address Book Entry: (select) Any
   Destination Address:
   Address Book Entry: (select) Any
   Service: (select) ANY
   Action: (select) Permit

5. **Create Management Interface**

   Network > Interfaces > (select VLAN in the drop-down menu) > New: Enter the following, and then click OK:

   Interface Name Vlan: 199
   IP Address/Netmask: 1.0.1.199/24
   Management: (deselect)
   WebUI: (select)
   Telnet: (select)
   Ping: (select)

***CLI***

1. **Create Vsys Music**

```
device-> set vsys music
device(music)-> set admin name vsys_music
device(music)-> set admin password xyz
device(music)-> save
```

2. **Import VLAN Tag**

```
device(music)-> set vlan import 100 199
```

3. **Create VLAN Groups**

```
device(music)-> set vlan group name it_music
device(music)-> set vlan group it_music 100 199
```

4. **Create Layer 2 Zone**

```
device(music)-> set zone name L2-music-Trust L2
device(music)-> set zone name L2-music-Untrust L2
```

5. **Bind Ports**

```
device(music)-> set vlan port ethernet2/5 group it_music zone L2-music-Trust
device(music)-> set vlan port ethernet2/1 group it_music zone L2-music-Untrust
```

6. **Configure Policies**

```
device(music)-> set policy from L2-music-Untrust to L2-music-Trust any any http permit
device(music)-> set policy from L2-music-Untrust to L2-music-Trust any any any deny
device(music)-> set policy from L2-music-Trust to L2-music-Untrust any any any permit
```

7. **Create Management Interface**

```
device(music)-> set interface vlan199 zone vlan
device(music)-> set interface vlan199 ip 1.0.1.199/24
device(music)-> unset interface vlan199 manage
device(music)-> set interface vlan199 manage web
device(music)-> set interface vlan199 manage telnet
device(music)-> set interface vlan199 manage ping
device(music)-> save
device(music)-> exit
```

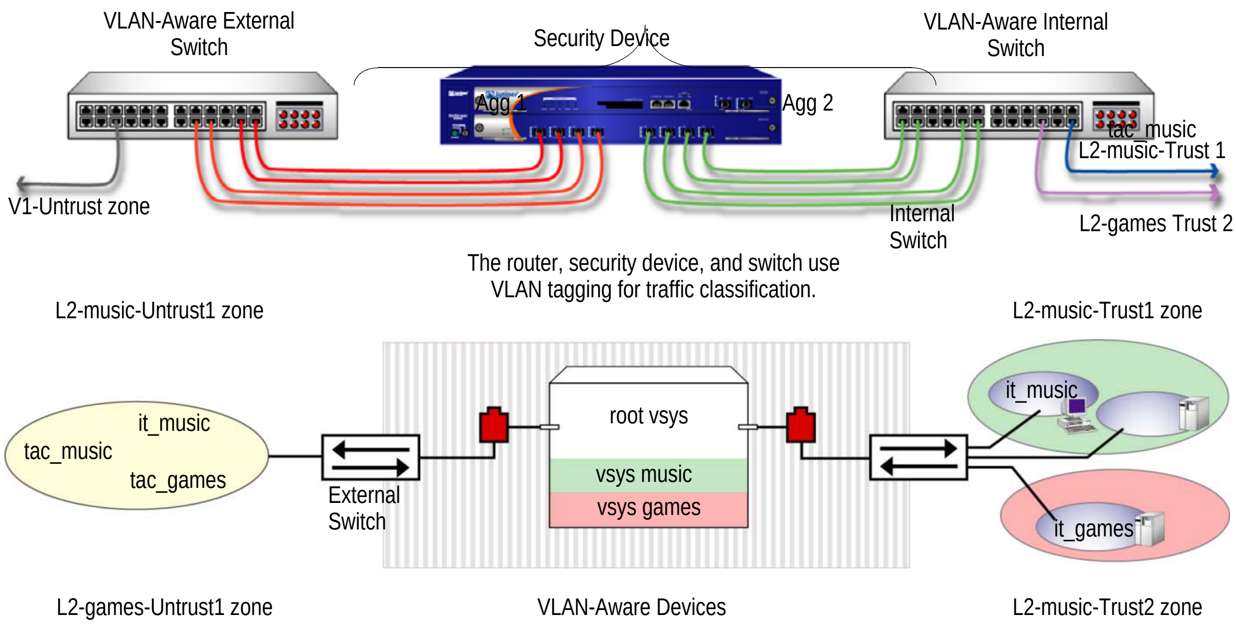
**(Optional) Get VLAN Groups**

```
devic-> get vlan group it_music
```

## Example 2: Configuring Two 4-Port Aggregates with Separate Untrust Zones

In this example, the security device is configured to support two virtual systems (vsys music and vsys games) in Transparent mode. The two virtual systems have separate security zones. Vsys music consists of VLANs it_music and tac_music. Vsys games consists of VLAN it_games. Figure 9 shows how the security device secures the Trust and Untrust zones. You must import the VLANs to a vsys before they can be tagged.

**Figure 9: Two 4-Port Aggregates with Separate Untrust Zones**




Configuring two Transparent mode virtual systems with two 4-port aggregates involves the following steps:

1. Set the aggregate ports at the root administration level.
2. Bind the interfaces to the aggregate ports.
3. Create the vsys named *music* with a vsys admin name and password.
4. Import (assign) VLAN tags from the root system to classify traffic for the vsys music.
5. Create the VLAN groups that contain the vsys tags for each port supported in the vsys music.
6. Create one Layer 2 zone for the Trust and Untrust interfaces in vsys music.
7. Bind aggregate ports to VLAN groups in the vsys music.

**NOTE:** Only the root administrator can configure virtual systems, VLAN tags, and Layer 2 zones or bind aggregate ports; however, both the root administrator and vsys administrator can set policies and management modules. The root administrator can access any vsys in the security device. The vsys administrator can only access the vsys that is assigned to the vsys in which the policies were created.

8. Set the IP address for the L2-music-Trust zone in the vsys music.
9. Configure the policies for vsys music. The policies configured in this example do the following:
   a. Permit HTTP traffic from the L2-music-Untrust zone to 10.0.1.200
   b. Deny all other traffic from the L2-music-Untrust zone to the L2-music-Trust zone
   c. Permit all traffic from the L2-music-Trust zone to the L2-music-Untrust zone
10. Create the management interface. A VLAN management interface is created within a vsys so that the vsys administrator can manage the vsys using a unique IP address and VLAN ID.
11. Create the vsys named games with a vsys admin name and password.
12. Import (assign) VLAN tags from the root system to classify traffic for the vsys games.
13. Create the VLAN groups that contain the vsys tags for each port supported in the vsys games.
14. Create one Layer 2 zone for the Trust and Untrust interfaces in the vsys games.
15. Bind aggregate ports to VLAN groups in the vsys games.
16. Configure the policies for the vsys games. The policies configured in this example do the following:
    a. Permit ftp traffic from the L2-games-Untrust zone to the L2-games-Trust zone
    b. Deny all other traffic from the L2-games-Untrust zone to the L2-games-Trust zone
    c. Permit all traffic from the L2-games-Trust zone to the L2-games-Untrust zone
17. Create the management interface.

**NOTE:** ScreenOS supports up to 500 virtual systems.

**NOTE:** In this example, each WebUI section lists only navigational paths, which lead to the pages necessary to configure the device. To see the specific parameters and values you need to set for any WebUI section, refer to the CLI section that follows it.

***WebUI***

1. **Set Aggregate Ports in Root**
   Network > Interfaces > (select Aggregate IF in the right side drop-down menu) > New

2. **Bind Interfaces to Aggregate Ports**
   Network > Interfaces > Edit (for ethernet2/1)

   Network > Interfaces > Edit (for ethernet2/2)

   Network > Interfaces > Edit (for ethernet2/3)

   Network > Interfaces > Edit (for ethernet2/4)

   Network > Interfaces > Edit (for ethernet2/5)

   Network > Interfaces > Edit (for ethernet2/6)

   Network > Interfaces > Edit (for ethernet2/7)

   Network > Interfaces > Edit (for ethernet2/8)

3. **Create Vsys Music**
   Vsys > New

4. **Import VLANs**
   Vsys: Click Enter (for vsys_music)

   Network > Vlan > Import

5. **Create Group**
   Network > Vlan > Group > New

6. **Create Layer 2 Zones**
   Network > Zones > New

7. **Bind Aggregate Ports**
   Network > Vlan > Group > Edit (for it_music) > Port

   Network > Vlan > Group > Edit (for tac_music) > Port

8. **Set IP Address**
   Objects > Addresses > List > V1-Untrust (select in the drop-down menu) > New

   Objects > Addresses > List > From: L2-music-Untrust To: L2-music-Trust > New

Objects > Addresses > List > From: L2-music-Untrust To: L2-music-Trust > New

Objects > Addresses > List > From: L2-music-Untrust To: L2-music-Trust > New

Objects > Addresses > List > From: L2-music-Trust To: L2-music-Untrust > New

9. **Policies**

   Policies (From: L2-music-Untrust, To: L2-music-Trust) > New

   Policies (From: L2-music-Untrust, To: L2-music-Trust) > New

   Policies (From: L2-music-Untrust, To: L2-music-Trust) > New

   Policies (From: L2-music-Trust, To: L2-music-Untrust) > New

10. **Create Management Interface**

    Network > Interfaces > (select VLAN in the right side drop-down menu) > New

11. **Create Vsys Games**

    Vsys > New

12. **Import VLAN**

    Vsys: Click Enter (for vsys_games)

    Network > Vlan > Import

13. **Create Groups**

    Network > Vlan > Group > New

14. **Create Layer 2 Zones**

    Network > Zones > New

15. **Bind Aggregate Ports**

    Network > Vlan > Group > Edit (for games) > Port

16. **Policies**

    Policies (From: L2-games-Untrust, To: L2-games-Trust) > New

    Policies (From: L2-games-Untrust, To: L2-games-Trust) > New

    Policies (From: L2-games-Trust, To: L2-games-Untrust) > New

17. **Create Management Interface**

    Network > Interfaces > (select VLAN in the right side drop-down menu) > New

***CLI***

1. **Set Aggregate Ports in Root**

```
device-> set interface aggregate1 zone null
device-> set interface aggregate2 zone null
```

2. **Bind Interfaces to Aggregate Ports**

```
device-> set interface ethernet2/1 aggregate aggregate1
device-> set interface ethernet2/2 aggregate aggregate1
device-> set interface ethernet2/3 aggregate aggregate1
device-> set interface ethernet2/4 aggregate aggregate1
device-> set interface ethernet2/5 aggregate aggregate2
device-> set interface ethernet2/6 aggregate aggregate2
device-> set interface ethernet2/7 aggregate aggregate2
device-> set interface ethernet2/8 aggregate aggregate2
```

3. **Create Vsys Music**

```
device-> set vsys music
device(music)-> set admin name vsys_music
device(music)-> set admin password xyz
device(music)-> save
```

4. **Import VLAN Tag**

```
device(music)-> set vlan import 100 199
device(music)-> set vlan import 1033
device(music)-> set vlan import 1133
```

5. **Create VLAN Groups**

```
device(music)-> set vlan group name it_music
device(music)-> set vlan group it_music 100 199
device(music)-> set vlan group name tac_music
device(music)-> set vlan group tac_music 1033
device(music)-> set vlan group tac_music 1133
```

6. **Create Layer 2 Zone**

```
device(music)-> set zone name L2-music-Trust L2
device(music)-> set zone name L2-music-Untrust L2
```

7. **Bind Aggregate Ports**

```
device(music)-> set vlan port aggregate2 group it_music zone L2-music-Trust
device(music)-> set vlan port aggregate1 group it_music zone L2-music-Untrust
device(music)-> set vlan port aggregate2 group tac_music zone L2-music-Trust
device(music)-> set vlan port aggregate1 group tac_music zone L2-music-Untrust
```

8. **Set IP Addresses**

```
device(music)-> set address L2-music-Trust 10.0.1.200 10.0.1.200
255.255.255.0
```

9. **Configure Policies**

```
device(music)-> set policy from L2-music-Untrust to L2-music-Trust any 10.0.1.200
http permit
device(music)-> set policy from L2-music-Untrust to L2-music-Trust any any http
permit
device(music)-> set policy from L2-music-Untrust to L2-music-Trust any any any
deny
device(music)-> set policy from L2-music-Trust to L2-music-Untrust any any any
permit
```

10. **Create Management Interface**

    device(music)-> set interface vlan1033 zone vlan
    device(music)-> set interface vlan1033 ip 1.0.0.33/24
    device(music)-> set interface vlan199 zone vlan
    device(music)-> set interface vlan199 ip 1.0.1.199/24
    device(music)-> unset interface vlan199 manage
    device(music)-> set interface vlan199 manage ping
    device(music)-> set interface vlan199 manage https
    device(music)-> set interface vlan199 manage telnet
    device(music)-> save
    device(music)-> exit

**(Optional) Get VLAN Groups**

device-> get vlan group it_music
device-> get vlan group tac_music

11. **Create Vsys Games**

    device-> set vsys games
    device(games)-> set admin name vsys_games
    device(games)-> set admin password abc
    device(games)-> save

12. **Import VLAN Tag**

    device(games)-> set vlan import 200 250

13. **Create VLAN Groups**

    device(games)-> set vlan group name games
    device(games)-> set vlan group games 200 250

14. **Create Layer 2 Zone**

    device(games)-> set zone name L2-games-Trust L2
    device(games)-> set zone name L2-games-Untrust L2

15. **Bind Aggregate Ports**

    device(games)-> set vlan port aggregate2 group games zone L2-games-trust
    device(games)-> set vlan port aggregate1 group games zone L2-games-Untrust

16. **Configure Policies**

    device(games)-> set policy from L2-games-Untrust to L2-games-Trust any any ftp permit
    device(games)-> set policy from L2-games-Untrust to L2-games-Trust any any any deny
    device(games)-> set policy from L2-games-Trust to L2-games-Untrust any any any permit

17. **Create Management Interface**

    device(games)-> set interface vlan300 zone vlan
    device(games)-> set interface vlan300 ip 1.0.0.20/24
    device(games)-> unset interface vlan300 manage
    device(games)-> set interface vlan300 manage web
    device(games)-> set interface vlan300 manage telnet
    device(games)-> set interface vlan300 manage ping
    device(games)-> save
    device(games)-> exit

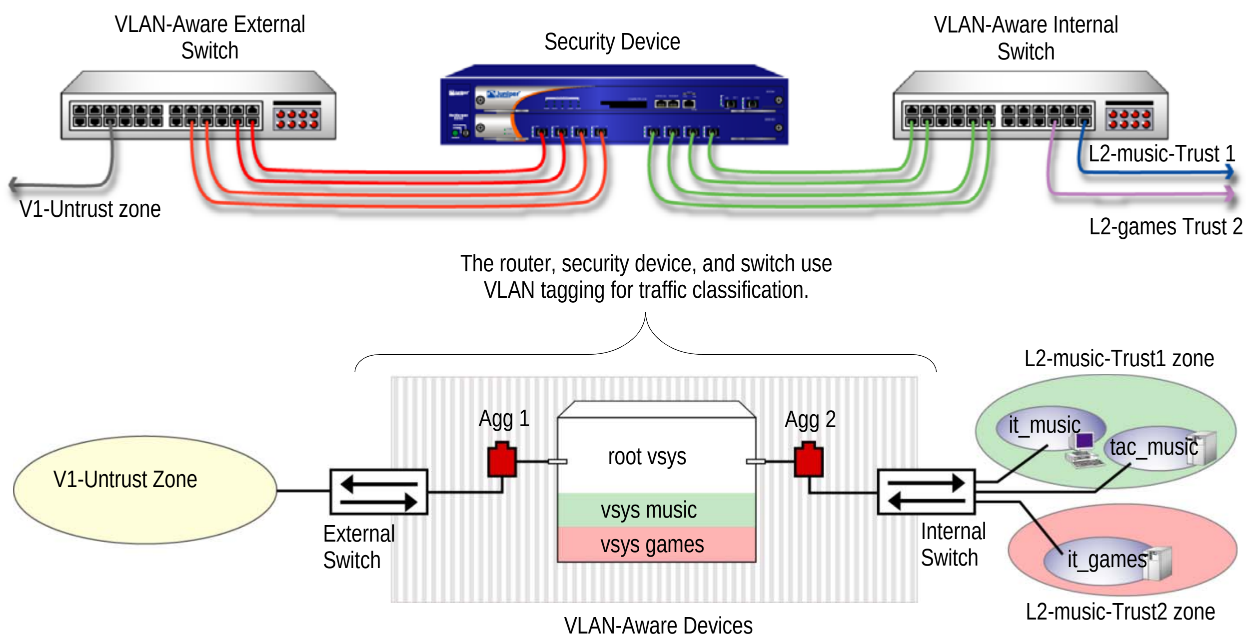
**(Optional) Get VLAN Groups**

device-> get vlan group games

## Example 3: Configuring Two 4-Port Aggregates that Share One Untrusted Zone

In this example, the security device is configured to support two virtual systems (vsys music and vsys games) in Transparent mode. The two virtual systems share the Untrust zone with the root system. Vsys music consists of VLANs it_music and tac_music. Vsys games consists of VLAN it_games. Figure 10 shows how the security device secures the Trust and Untrust zones. You must import the VLANs to a vsys before they can be tagged.

**Figure 10: Two 4-Port Aggregates that Share One Untrusted Zone**




Configuring two Transparent mode virtual systems with two aggregate ports and a shared Untrust zone involves the following steps:

1. Set the aggregate ports at the root administration level.
2. Bind the interfaces to the aggregate ports.
3. Create the vsys named music with a vsys admin name and password.
4. Import VLAN tags from the root system to classify traffic for the vsys music.
5. Create the VLAN groups that contain the vsys tags for each port supported in the vsys music.
6. Create Layer 2 zones for the Trust interface for the vsys music.
7. Bind aggregate ports to VLAN groups in the vsys music Trust and Untrust zones.

**NOTE:** Only the root administrator can configure virtual systems, VLAN tags, and Layer 2 zones or bind aggregate ports; however, both the root administrator and vsys administrator can set policies and management modules. The root administrator can access any vsys in the security device. The vsys administrator can only access the vsys that is assigned to the vsys in which the policies were created.

8. Set the IP address for each zone in the vsys music.
9. Configure the policies for the vsys music. The policies configured in this example do the following:
   a. Permit all traffic from 10.0.1.200 to 10.0.1.100
   b. Permit all traffic from 10.0.1.201 to 10.0.1.101
   c. Deny all traffic from the V1-Untrust zone to the L2-music-Trust zone
10. Create the management interface. A VLAN management interface is created within a vsys so that the vsys administrator can manage the vsys using a unique IP address and VLAN ID.
11. Create the vsys named games with a vsys admin name and password.
12. Import VLAN tags from the root system to classify traffic for the vsys games.
13. Create the VLAN groups that contain the vsys tags for each port supported in the vsys games.
14. Create Layer 2 zones for the Trust interface for the vsys games.
15. Bind aggregate ports to VLAN groups in the vsys games.
16. Set the IP address for each zone in the vsys games.
17. Configure the policies for the vsys games. The policies configured in this example do the following:
   a. Permit all traffic from 20.0.1.200 to 20.0.1.100
   b. Permit all traffic from 20.0.1.201 to 20.0.1.101
   c. Deny all traffic from the V1-Untrust zone to the L2-games-Trust1 zone
18. Create the management interface.

**NOTE:** ScreenOS 5 supports up to 500 virtual systems.

**NOTE:** In this example, each WebUI section lists only navigational paths, which lead to the pages necessary to configure the device. To see the specific parameters and values you need to set for any WebUI section, refer to the CLI section that follows it.

***WebUI***

1. **Set Aggregate Ports in Root**

   Network > Interfaces > (select Aggregate IF in drop-down menu four times)

2. **Bind Interfaces to Aggregate Ports**

   Network > Interfaces > Edit (for ethernet2/1 to aggregate1)

   Network > Interfaces > Edit (for ethernet2/2 to aggregate1)

   Network > Interfaces > Edit (for ethernet2/3 to aggregate1)

   Network > Interfaces > Edit (for ethernet2/4 to aggregate1)

   Network > Interfaces > Edit (for ethernet2/5 to aggregate2)

   Network > Interfaces > Edit (for ethernet2/6 to aggregate2)

   Network > Interfaces > Edit (for ethernet2/7 to aggregate2)

   Network > Interfaces > Edit (for ethernet2/8 to aggregate2)

3. **Create Vsys Music**

   Vsys > New

4. **Import VLANs**

   Vsys: Click Enter (for vsys_music)

   Network > Vlan > Import

5. **Create Group**

   Network > Vlan > Group > New: 100-199

   Network > Vlan > Group > New: 1033-1033

   Network > Vlan > Group > New: 1133-1133

6. **Create Layer 2 Zones**

   Network > Zones > New: L2-music-Trust1

   Network > Zones > New: L2-music-Trust2

7. **Bind Aggregate Ports**

   Network > Vlan > Group > Edit (for music) > Port

8. **Set IP Address**

   Objects > Addresses > List > (select V1-Untrust in the drop-down menu) > New

   Objects > Addresses > List > (select L2-music-Trust1 in the drop-down menu)

   Objects > Addresses > List > (select L2-music-Trust2 in the drop-down menu

9. **Policies**

   Policies (From: L2-music-Trust1, To: V1-Untrust) > New

   Policies (From: L2-music-Trust2, To: V1-Untrust) > New

   Policies (From: V1-Untrust, To: L2-music-Trust2) > New

   Policies (From: V1-Untrust, To: L2-music-Trust1) > New

10. **Create Management Interface**

    Network > Interfaces > (select VLAN in the right side drop-down menu) > New

    Network > Interfaces > (select VLAN in the right side drop-down menu) > New

11. **Create Vsys Games**

    Vsys > New

12. **Import VLANs**

    Vsys: Click Enter (for vsys_games)

    Network > Vlan > Import

13. **Create Group**

    Network > Vlan > Group > New: 200-299

    Network > Vlan > Group > New: 50-50

14. **Create Layer 2 Zones**

    Network > Zones > New: L2-games-Trust1

    Network > Zones > New: L2-games-Trust2

15. **Bind Aggregate Ports**

    Network > Vlan > Group > Edit (for games) > Port

16. **Set IP Addresses**

    Objects > Addresses > List > (select V1-Untrust in the right side drop-down menu) > New

17. **Policies**

    Policies (From: L2-games-Trust1, To: V1-Untrust) > New

18. **Create Management Interface**

    Network > Interfaces > (select VLAN in the drop-down menu) > New

***CLI***

1. **Set Aggregate Ports in Root**

```
device-> set interface aggregate1 zone null
device-> set interface aggregate2 zone null
```

2. **Bind Interfaces to Aggregate Ports**

```
device-> set interface ethernet2/1 aggregate aggregate1
device-> set interface ethernet2/2 aggregate aggregate1
device-> set interface ethernet2/3 aggregate aggregate1
device-> set interface ethernet2/4 aggregate aggregate1
device-> set interface ethernet2/5 aggregate aggregate2
device-> set interface ethernet2/6 aggregate aggregate2
device-> set interface ethernet2/7 aggregate aggregate2
device-> set interface ethernet2/8 aggregate aggregate2
```

3. **Create Vsys Music**

```
device-> set vsys music
device(music)-> set admin name vsys_music
device(music)-> set admin password xyz
device(music)-> save
```

4. **Import VLAN Tag**

```
device(music)-> set vlan import 100 199
device(music)-> set vlan import 1033
```

5. **Create VLAN Groups**

```
device(music)-> set vlan group name music
device(music)-> set vlan group music 100 199
device(music)-> set vlan group music 1033
```

6. **Create Layer 2 Zone**

```
device(music)-> set zone name L2-music-Trust1 L2
device(music)-> set zone name L2-music-Trust2 L2
```

7. **Bind Aggregate Ports**

```
device(music)-> set vlan port aggregate2 group music zone L2-music-Trust1
device(music)-> set vlan port aggregate2 group music zone L2-music-Trust2
device(music)-> set vlan port aggregate1 group music zone V1-Untrust
```

8. **Set IP Address**

```
device(music)-> set address V1-Untrust 10.0.1.100 10.0.1.100
255.255.255.255
device(music)-> set address V1-Untrust 10.0.1.101 10.0.1.101
255.255.255.255
device(music)-> set address L2-music-Trust1 10.0.1.200 10.0.1.200
255.255.255.255
device(music)-> set address L2-music-Trust2 10.0.1.201 10.0.1.201
255.255.255.255
```

9. **Configure Policies**

```
device(music)-> set policy id 1 from L2-music-Trust1 to V1-Untrust 10.0.1.200
10.0.1.100 any permit
device(music)-> set policy id 2 from L2-music-Trust2 to V1-Untrust 10.0.1.201
10.0.1.101 any permit
device(music)-> set policy id 3 from V1-Untrust to L2-music-Trust2 any any any
deny
device(music)-> set policy id 4 from V1-Untrust to L2-music-Trust1 any any any
deny
```

10. **Create Management Interface**

```
device(music)-> set interface vlan1033 zone vlan
device(music)-> set interface vlan1033 ip 1.0.0.33/24
device(music)-> set interface vlan199 zone vlan
device(music)-> set interface vlan199 ip 1.0.1.199/24
device(music)-> unset interface vlan199 manage
device(music)-> set interface vlan199 manage web
device(music)-> set interface vlan199 manage telnet
device(music)-> set interface vlan199 manage ping
device(music)-> save
device(music)-> exit
```

**(Optional) Get VLAN Groups**

```
device-> get vlan group music
```

11. **Create Vsys Games**

```
device-> set vsys games
device(games)-> set admin name vsys_games
device(games)-> set admin password abc
device(games)-> save
```

12. **Import VLAN Tag**

```
device(games)-> set vlan import 200 299
device(games)-> set vlan import 50
```

13. **Create VLAN Groups**

```
device(games)-> set vlan group name games
device(games)-> set vlan group games 200 299
device(games)-> set vlan group games 50
```

14. **Create Layer 2 Zone**

```
device(games)-> set zone name L2-games-Trust1 L2
device(games)-> set zone name L2-games-Trust2 L2
```

15. **Bind Aggregate Ports**

```
device(games)-> set vlan port aggregate2 group games zone L2-games-Trust1
device(games)-> set vlan port aggregate2 group games zone L2-games-Trust2
device(games)-> set vlan port aggregate1 group games zone V1-Untrust
```

16. **Set IP Address**

```
device(games)-> set address V1-Untrust 20.0.1.100 20.0.1.100
255.255.255.255
device(games)-> set address V1-Untrust 20.0.1.101 20.0.1.101
255.255.255.255
device(games)-> set address L2-games-Trust1 20.0.1.200 20.0.1.200
255.255.255.255
device(games)-> set address L2-games-Trust2 20.0.1.201 20.0.1.201
255.255.255.255
```

17. **Configure Policies**

```
device(games)-> set policy id 1 from L2-games-Trust1 to V1-Untrust 20.0.1.200
20.0.1.100 any permit
device(games)-> set policy id 2 from L2-games-Trust1 to V1-Untrust 20.0.1.201
20.0.1.101 any permit
device(games)-> set policy id 3 from V1-Untrust to L2-games-Trust1 any any any
deny
```

**18. Create Management Interface**

```
device(games)-> set interface vlan300 zone vlan
device(games)-> set interface vlan300 ip 1.0.0.20/24
device(games)-> unset interface vlan300 manage
device(games)-> set interface vlan300 manage web
device(games)-> set interface vlan300 manage telnet
device(games)-> set interface vlan300 manage ping
device(games)-> save
device(games)-> exit
```

**(Optional) Get VLAN Groups**

```
device-> get vlan group games
```

## Defining Subinterfaces and VLAN Tags

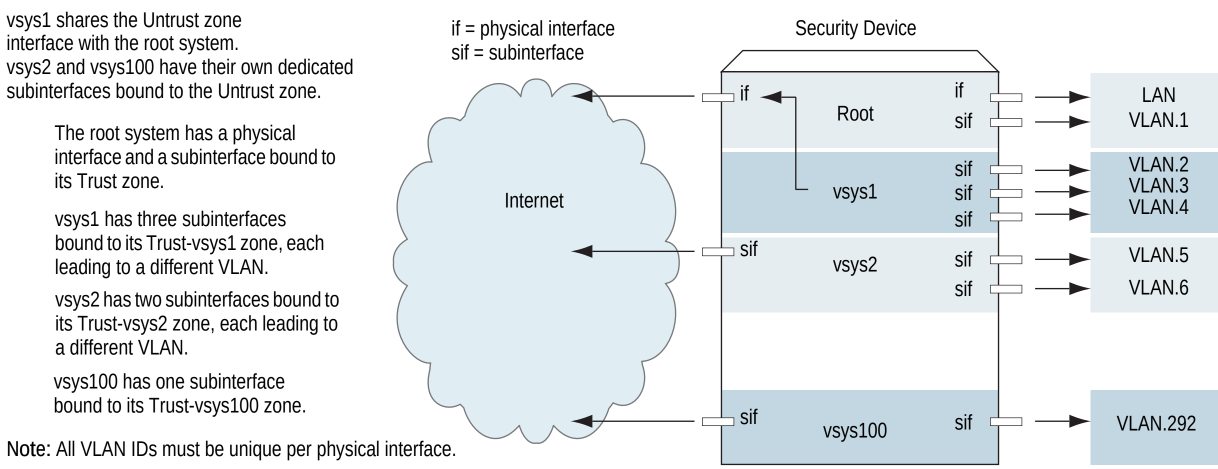
The Trust-*vsys_name* zone subinterface links a vsys to its internal VLAN. The Untrust zone subinterface links a vsys to the public WAN, usually the Internet. A subinterface has the following attributes:

- A unique VLAN ID (from 1 to 4095)
- A public or private IP address (the IP address is private by default)
- A netmask for a class A, B, or C subnet
- An associated VLAN

**NOTE:** For information about public and private IP addresses, see "Public IP Addresses" on page **2**-56 and "Private IP Addresses" on page **2**-56.

A vsys can have a single Untrust zone subinterface and multiple Trust-*vsys_name* zone subinterfaces. If a virtual system does not have its own Untrust zone subinterface, it shares the root level Untrust zone interface. Security devices also support subinterfaces, VLANs at the root level, and IEEE 802.1Q-compliant VLAN tags.

**Figure 11: VLAN Subinterfaces**




A VLAN tag is an added bit in the Ethernet frame header that indicates membership in a particular VLAN. By binding a VLAN to a vsys, the tag also determines to which vsys a frame belongs, and consequently, which policy is applied to that frame. If a VLAN is not bound to a vsys, policies set in the root system of the security device are applied to the frame.

A root-level administrator can create a VLAN, assign members to it, and bind it to a vsys. (The assigning of members to a VLAN can be done by several methods—protocol type, MAC address, port number—and is beyond the scope of this document.) The vsys admin, if there is one, then manages the vsys through the creation of addresses, users, services, VPNs, and policies. If there is no vsys admin, then a root-level administrator performs these tasks.

**NOTE:** If the root-level admin does not associate a VLAN to a vsys, the VLAN operates within the root system of the security device.

All subnets in a vsys must be disjointed; that is, there must be no overlapping IP addresses among the subnets in the same vsys. For example: Subinterface1 – 10.2.2.1 255.255.255.0 and Subinterface2 – 10.2.3.1 255.255.255.0 are disjointed and link to acceptable subnets.

However, subnets with the following subinterfaces overlap and are unacceptable within the same vsys: subinterface1 – 10.2.2.1 255.255.0.0 and subinterface2 – 10.2.3.1 255.255.0.0.

The address ranges of subnets in different vsys can overlap.

In this example, you define subinterfaces and VLAN tags for the three virtual systems that you created in “Creating a Vsys Object and Admin” on page 4—vsys1, vsys2, and vsys3. The first two subinterfaces are for two private virtual systems operating in NAT mode, and the third subinterface is for a public virtual system operating in Route mode. The subinterfaces are 10.1.1.1/24, 10.2.2.1/24, and 1.3.3.1/24. You create all three subinterfaces on ethernet3/2.

All three virtual systems share the Untrust zone and its interface (ethernet1/1; 1.1.1.1/24) with the root system. The Untrust zone is in the untrust-vr routing domain.

***WebUI***

1. **Vsys1 Subinterface and VLAN Tag**

   Vsys: Click **Enter** (for vsys1).

   Network > Interfaces > New Sub-IF (for ethernet3/2): Enter the following, then click **OK**:

   Interface Name: ethernet3/2.1
   Zone Name: Trust-vsys1
   IP Address / Netmask: 10.1.1.1/24
   VLAN Tag: 1

**NOTE:** You can define virtual systems to operate in Route mode or NAT mode. The default is NAT mode, and it is unnecessary to specify NAT when creating the first two subinterfaces in this example.

2. **Vsys2 Subinterface and VLAN Tag**

   Vsys: Click **Enter** (for vsys2).

   Network > Interfaces > New Sub-IF (for ethernet3/2): Enter the following, then click **OK**:

   Interface Name: ethernet3/2.2
   Zone Name: Trust-vsys2
   IP Address / Netmask: 10.2.2.1/24
   VLAN Tag: 2

3. **Vsys3 Subinterface and VLAN Tag**

   Vsys: Click **Enter** (for vsys3).

   Network > Interfaces > New Sub-IF (for ethernet3/2): Enter the following, then click **Apply**:

   Interface Name: ethernet3/2.3
   Zone Name: Trust-vsys3
   IP Address / Netmask: 1.3.3.1/24
   VLAN Tag: 3

   Select **Interface Mode: Route**, then click **OK**.

   Click **Exit Vsys** to return to the root level.

***CLI***

1. **Vsys1 Subinterface and VLAN Tag**

```
device-> enter vsys vsys1
device(vsys1)-> set interface ethernet3/2.1 zone trust-vsys1
device(vsys1)-> set interface ethernet3/2.1 ip 10.1.1.1/24 tag 1
device(vsys1)-> save
device(vsys1)-> exit
```

**NOTE:** You can define virtual systems to operate in Route mode or NAT mode. The default is NAT mode, and it is unnecessary to specify NAT when creating the first two subinterfaces in this example.

2. **Vsys2 Subinterface and VLAN Tag**

```
device-> enter vsys vsys2
device(vsys2)-> set interface ethernet3/2.2 zone trust-vsys2
device(vsys2)-> set interface ethernet3/2.2 ip 10.2.2.1/24 tag 2
device(vsys2)-> save
device(vsys2)-> exit
```

3. **Vsys3 Subinterface and VLAN Tag**

```
device-> enter vsys vsys3
device(vsys3)-> set interface ethernet3/2.3 zone trust-vsys3
device(vsys3)-> set interface ethernet3/2.3 ip 1.3.3.1/24 tag 3
device(vsys3)-> set interface ethernet3/2.3 route
device(vsys3)-> save
device(vsys3)-> exit
```

## Communicating Between Virtual Systems

The members of a VLAN within a vsys have unrestricted communication access with each other. The VLAN members of different virtual systems cannot communicate with one another unless the participating vsys administrators specifically configure policies allowing the members of their respective systems to do so.

Traffic between root-level VLANs operates within the parameters set by root-level policies. Traffic between virtual system VLANs operates within the parameters set by the participating virtual system policies. The security device passes only traffic allowed to leave the originating virtual system and allowed to enter the destination virtual system. In other words, the vsys admins of both virtual systems must set policies allowing the traffic to flow in the appropriate direction—outgoing and incoming.

**NOTE:** Policies set in the root system and in virtual systems do not affect each other.

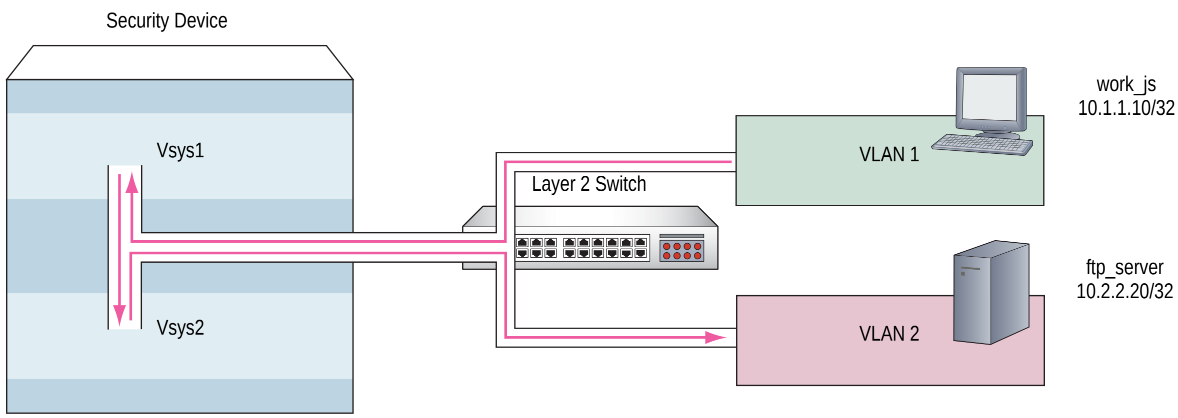
In this example configuration shown in Figure 12, the admins for vsys1 and vsys2—see "Defining Subinterfaces and VLAN Tags" on page 61—set up policies to enable traffic between a workstation (work_js with the IP address 10.1.1.10/32) in VLAN 1 and a server (ftp_server with the IP address 10.2.2.20/32) in VLAN 2. The connection is possible if the following two conditions are met:

- The vsys admin for vsys1 has set a policy permitting traffic from the workstation in Trust-vsys1 to the server in its Untrust zone.
- The vsys admin for vsys2 has set a policy permitting traffic from the workstation in its Untrust zone to the server in Trust-vsys2.

The network device in front of the internal interface on the security device is a Layer 2 switch. This forces traffic from VLAN 1 going to VLAN 2 to go through the switch to the security device for Layer 3 routing. If the network device were a Layer 3 router, traffic between VLAN1 and VLAN2 could pass through the router, bypassing all policies set on the security device.

The vsys1 and vsys2 admins also set up the appropriate routes. The shared Untrust zone is in the untrust-vr and the Trust zones in vsys1 and vsys2.

**Figure 12: InterVsys Communication**




***WebUI***

**1. Vsys1**

**Addresses**

Objects > Addresses > List > New: Enter the following, then click **OK**:

Address Name: work_js
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.10/32
Zone: Trust-vsys1

Objects > Addresses > List > New: Enter the following, then click **OK**:

Address Name: ftp_server
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.20/32
Zone: Untrust

**Routes**

Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click **OK**:

Network Address/Netmask: 10.1.1.0/24
Next Hop Virtual Router Name: (select); vsys1-vr

Network > Routing > Routing Entries > vsys1-vr New: Enter the following, then click **OK**:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Next Hop Virtual Router Name: (select); untrust-vr

**Policy**

Policies > (From: Trust-vsys1, To: Untrust) New: Enter the following, then click **OK**:

Source Address:
    Address Book Entry: (select), work_js
Destination Address:
    Address Book Entry: (select), ftp_server
Service: FTP-Get
Action: Permit

**2. Vsys2**

**Addresses**

Objects > Addresses > List > New: Enter the following, then click **OK**:

Address Name: ftp_server
IP Address/Domain Name:
    IP/Netmask: (select), 10.2.2.2/032
Zone: Trust-vsys2

Objects > Addresses > List > New: Enter the following, then click **OK**:

Address Name: work_js
IP Address/Domain Name:
    IP/Netmask: (select), 10.1.1.10/32
Zone: Untrust

**Routes**

Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click **OK**:

Network Address/Netmask: 10.2.2.0/24
Next Hop Virtual Router Name: (select); vsys2-vr

Network > Routing > Routing Entries > vsys2-vr New: Enter the following, then click **OK**:

Network Address/Netmask: 0.0.0.0/0
Next Hop Virtual Router Name: (select); untrust-vr

**Policy**

Policies > (From: Untrust, To: Trust-vsys2) New: Enter the following, then click **OK**:

Source Address:
    Address Book Entry: (select), work_js
Destination Address:
    Address Book Entry: (select), ftp_server
Service: FTP-Get
Action: Permit

***CLI***

**1. Vsys1**

**Addresses**

set address trust-vsys1 work_js 10.1.1.10/32
set address untrust ftp_server 10.2.2.20/32

**Routes**

set vrouter untrust-vr route 10.1.1.0/24 vrouter vsys1-vr
set vrouter vsys1-vr route 0.0.0.0/0 vrouter untrust-vr

**Policy**

set policy from trust-vsys1 to untrust work_js ftp_server ftp-get permit
save

**2. Vsys2**

**Addresses**

set address trust-vsys2 ftp_server 10.2.2.20/32
set address untrust work_js 10.1.1.10/32

**Routes**

set vrouter untrust-vr route 10.2.2.0/24 vrouter vsys2-vr
set vrouter vsys2-vr route 0.0.0.0/0 vrouter untrust-vr

**Vsys2 Policy**

set policy from untrust to trust-vsys2 work_js ftp_server ftp-get permit
save

Network > Zones > Edit (for Internal): Select the **IP Classification** checkbox, then click **OK**.

## Chapter 4
# IP-Based Traffic Classification

This chapter explains IP-based traffic classification for virtual systems. It contains the following sections:


- "Overview" on this page
- "Designating an IP Range to the Root System" on page 70
- "Configuring IP-Based Traffic Classification" on page 71

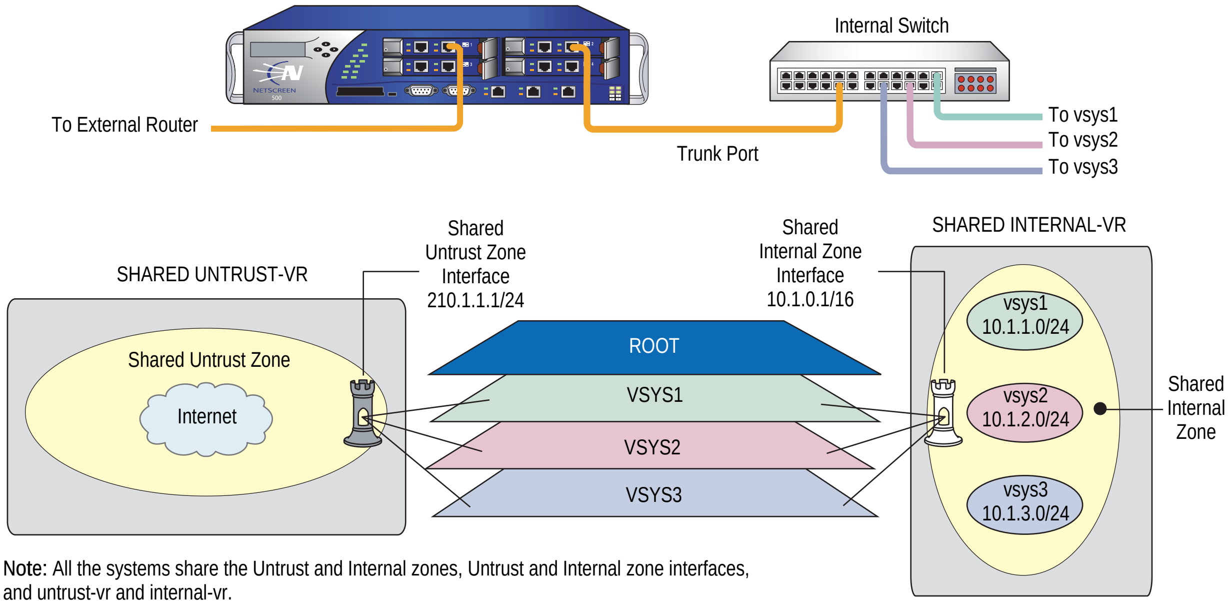

## Overview

Figure 13 shows how IP-based traffic classification allows you to use virtual systems without VLANs. Instead of VLAN tags, the security device uses IP addresses to sort traffic, associating a subnet or range of IP addresses with a particular system—root or vsys. Using IP-based traffic classification exclusively to sort traffic, all systems share the following:

- The untrust-vr and a user-defined internal-vr
- The Untrust zone and a user-defined internal zone
- An Untrust zone interface and a user-defined internal zone interface

**NOTE:** Even when using VLAN-based traffic classification for internal traffic, for external traffic all systems use the shared Untrust zone—and, unless a system has a dedicated interface, a shared Untrust zone interface. Using a shared interface on one side and a dedicated interface (with VLAN tagging) on the other constitutes a hybrid approach. VLAN-based and IP-based traffic classification can coexist within the same system or among different systems simultaneously.

**Figure 13: IP-Based Traffic Classification**




## Designating an IP Range to the Root System

To designate a subnet or range of IP addresses to the root system or to a previously created virtual system, you must do either of the following at the root level:

***WebUI***

Network > Zones > Edit (for *zone*) > IP Classification: Enter the following, then click **OK**:

System: (select **root** or ***vsys_name_str***)
Address Type: (select **Subnet** and enter ***ip_addr/mask***, or select **Range** and enter ***ip_addr1*** – ***ip_addr2***)

***CLI***

set zone *zone* ip-classification net *ip_addr/mask* { root | vsys *name_str* }
set zone *zone* ip-classification range *ip_addr1-ip_addr2* { root | vsys *name_str* }

Because IP-based traffic classification requires the use of a shared security zone, virtual systems cannot use overlapping internal IP addresses, as is possible with VLAN-based traffic classification. Also, because all the systems share the same internal interface, the operational mode for that interface must be either NAT or Route mode; you cannot mix NAT and Route modes for different systems. In this regard, the addressing scheme of an IP-based approach is not as flexible as that allowed by the more commonly used VLAN-based approach.

Sharing virtual routers, security zones, and interfaces is inherently less secure than dedicating an internal virtual router, internal security zone, and internal and external interfaces to each vsys. When all virtual systems share the same interfaces, it is possible for a vsys admin in one vsys to use the **snoop** command to gather information about the traffic activities of another vsys. Also, because IP-spoofing is possible on the internal side, we recommend that you disable the

IP-spoofing SCREEN option on the shared internal interface. When deciding which traffic classification scheme to use, you must weigh the ease of management offered by the IP-based approach against the increased security and greater addressing flexibility offered by the VLAN-based approach.

## Configuring IP-Based Traffic Classification

In this example, you set up IP-based traffic classification for the three virtual systems created in "Creating a Vsys Object and Admin" on page 4. You define the trust-vr as sharable. You create a new zone, name it *Internal*, and bind it to the trust-vr. You then make the Internal zone sharable. You bind ethernet3/2 to the shared Internal zone, assign it IP address 10.1.0.1/16, and select NAT mode.

You bind ethernet1/2 to the shared Untrust zone and assign it IP address 210.1.1.1/24. The IP address of the default gateway in the Untrust zone is 210.1.1.250. Both the Internal and Untrust zones are in the shared trust-vr routing domain.

The subnets and their respective vsys associations are as follows:

- 10.1.1.0/24 – vsys1
- 10.1.2.0/24 – vsys2
- 10.1.3.0/24 – vsys3

***WebUI***

**1. Virtual Routers, Security Zones, and Interfaces**

Network > Routing > Virtual Routers > Edit (for trust-vr): Select the **Shared and accessible by other vsys** checkbox, then click **OK**.

Network > Zones > New: Enter the following, then click **OK**:

Zone Name: Internal
Virtual Router Name: trust-vr
Zone Type: Layer 3

Network > Zones > Edit (for Internal): Select the **Share Zone** checkbox, then click **OK**.

Network > Interfaces > Edit (for ethernet3/2): Enter the following, then click **OK**:

Zone Name: Internal
IP Address/Netmask: 10.1.0.1/16

Network > Interfaces > Edit (for ethernet1/2): Enter the following, then click **OK**:

Zone Name: Untrust
IP Address/Netmask: 210.1.1.1/24

2. **Route**

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click **OK**:

   Network Address/Netmask: 0.0.0.0/0
   Gateway: (select)
      Interface: ethernet1/2
      Gateway IP Address: 210.1.1.250

3. **IP Classification of the Trust Zone**

   Network > Zones > Edit (for Internal) > IP Classification: Enter the following, then click **OK**:

   System: vsys1
   Address Type:
      Subnet: (select); 10.1.1.0/24

   Network > Zones > Edit (for Internal) > IP Classification: Enter the following, then click **OK**:

   System: vsys2
   Address Type:
      Subnet: (select); 10.1.2.0/24

   Network > Zones > Edit (for Internal) > IP Classification: Enter the following, then click **OK**:

   System: vsys3
   Address Type:
      Subnet: (select); 10.1.3.0/24

   Network > Zones > Edit (for Internal): Select the **IP Classification** checkbox, then click **OK**.

***CLI***

1. **Virtual Routers, Security Zones, and Interfaces**

```
set vrouter trust-vr shared
set zone name Internal
set zone Internal shared
set interface ethernet3/2 zone Internal
set interface ethernet3/2 ip 10.1.0.1/16
set interface ethernet3/2 nat
set interface ethernet1/2 zone untrust
set interface ethernet1/2 ip 210.1.1.1/24
```

2. **Route**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet1/2 gateway 210.1.1.250
```

3. **IP Classification of the Trust Zone**

```
set zone Internal ip-classification net 10.1.1.0/24 vsys1
set zone Internal ip-classification net 10.1.2.0/24 vsys2
set zone Internal ip-classification net 10.1.3.0/24 vsys3
set zone Internal ip-classification
save
```

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