



## **Cisco Application Control Engine Module Virtualization Configuration Guide**

Software Version A2(3.0)  
October 2009

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Text Part Number: OL-20821-01

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## Preface

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This guide describes how to configure a single context or multiple contexts on the Cisco Application Control Engine (ACE) module for the Catalyst 6500 series switches or a Cisco 7600 series router, hereinafter referred to as the switch or router, respectively.

Multiple contexts use the concept of virtualization to partition your ACE into multiple virtual devices or contexts. The guide describes how to use the virtualization feature tools to closely and efficiently manage the system resources and users of the ACE, and the services you provide to your customers.

You can configure the ACE by using the following interfaces:

- The command-line interface (CLI), a line-oriented user interface that provides commands for configuring, managing, and monitoring the ACE.
- Device Manager graphic user interface (GUI), a Web browser-based GUI interface that provides a graphical user interface for configuring, managing, and monitoring the ACE.

This preface contains the following major sections:

- [Audience](#)
- [How to Use This Guide](#)
- [Related Documentation](#)
- [Symbols and Conventions](#)
- [Obtaining Documentation, Obtaining Support, and Security Guidelines](#)

## Audience

This guide is intended for the following trained and qualified service personnel who are responsible for configuring the ACE:

- Web master
- System administrator
- System operator

## How to Use This Guide

This guide is organized as follows:

Chapter	Description
<a href="#">Chapter 1, Overview</a>	Provides an overview of the basic concepts to partition your ACE into multiple virtual devices or contexts. It includes information about: <ul style="list-style-type: none"> <li>• Contexts</li> <li>• Domains</li> <li>• Role-Based Access Control (RBAC)</li> <li>• Resource Classes</li> </ul>
<a href="#">Chapter 2, Configuring Virtualization</a>	Describes how to configure the ACE to operate in either a single context or in multiple contexts, allocate resources, create domains, and create users and user roles. This chapter also describes how to display configuration and statistical information for the contexts configured on your ACE.

## Related Documentation

In addition to this document, the ACE documentation set includes the following:

Document Title	Description
<i>Release Note for the Cisco 4700 Series Application Control Engine Appliance</i>	Provides information about operating considerations, caveats, and command-line interface (CLI) commands for the ACE.
<i>Cisco Application Control Engine Module Hardware Installation Note</i>	Provides information for installing the ACE into the Catalyst 6500 series switch or a Cisco 7600 series router.
<i>Cisco Application Control Engine Module Getting Started Guide</i>	Describes how to perform the initial setup and configuration tasks for the ACE.
<i>Cisco Application Control Engine Module Administration Guide</i>	Describes how to perform the following administration tasks on the ACE: <ul style="list-style-type: none"> <li>• Setting up the ACE</li> <li>• Establishing remote access</li> <li>• Managing software licenses</li> <li>• Configuring class maps and policy maps</li> <li>• Managing the ACE software</li> <li>• Configuring SNMP</li> <li>• Configuring redundancy</li> <li>• Configuring the XML interface</li> <li>• Upgrading the ACE software</li> </ul>

<b>Document Title</b>	<b>Description</b>
<i>Cisco Application Control Engine Module Routing and Bridging Configuration Guide</i>	<p>Describes how to perform the following routing and bridging tasks on the ACE:</p> <ul style="list-style-type: none"> <li>• Configuring VLAN interfaces</li> <li>• Configuring routing</li> <li>• Configuring bridging</li> <li>• Configuring Dynamic Host Configuration Protocol (DHCP)</li> </ul>
<i>Cisco Application Control Engine Module Server Load-Balancing Guide</i>	<p>Describes how to configure the following server load-balancing features on the ACE:</p> <ul style="list-style-type: none"> <li>• Real servers and server farms</li> <li>• Class maps and policy maps to load balance traffic to real servers in server farms</li> <li>• Server health monitoring (probes)</li> <li>• Stickiness</li> <li>• Firewall load balancing</li> <li>• TCL scripts</li> </ul>
<i>Cisco Application Control Engine Module Security Configuration Guide</i>	<p>Describes how to configure the following ACE security features:</p> <ul style="list-style-type: none"> <li>• Security access control lists (ACLs)</li> <li>• User authentication and accounting using a Terminal Access Controller Access Control System Plus (TACACS+), Remote Authentication Dial-In User Service (RADIUS), or Lightweight Directory Access Protocol (LDAP) server</li> <li>• Application protocol and HTTP deep packet inspection</li> <li>• TCP/IP normalization and termination parameters</li> <li>• Network Address Translation (NAT)</li> </ul>
<i>Cisco Application Control Engine Module SSL Configuration Guide</i>	<p>Describes how to configure the following Secure Sockets Layer (SSL) features on the ACE:</p> <ul style="list-style-type: none"> <li>• SSL certificates and keys</li> <li>• SSL initiation</li> <li>• SSL termination</li> <li>• End-to-end SSL</li> </ul>
<i>Cisco Application Control Engine Module System Message Guide</i>	<p>Describes how to configure system message logging on the ACE. This guide also lists and describes the system log (syslog) messages generated by the ACE.</p>
<i>Cisco Application Control Engine Module Command Reference</i>	<p>Provides an alphabetical list and descriptions of all CLI commands by mode, including syntax, options, and related commands.</p>
<i>Cisco CSM-to-ACE Conversion Tool User Guide</i>	<p>Describes how to use the CSM-to-ACE conversion tool to migrate Cisco Content Switching Module (CSM) running- or startup-configuration files to the ACE.</p>

Document Title	Description
<i>Cisco CSS-to-ACE Conversion Tool User Guide</i>	Describes how to use the CSS-to-ACE conversion tool to migrate Cisco Content Services Switches (CSS) running-configuration or startup-configuration files to the ACE.
<i>Cisco Application Control Engine (ACE) Module Troubleshooting Guide, Release A2(x)</i>	Describes the procedures and methodology in wiki format to troubleshoot the most common problems that you may encounter during the operation of your ACE.

## Symbols and Conventions

This publication uses the following conventions:

Convention	Description
<b>boldface font</b>	Commands, command options, and keywords are in <b>boldface</b> . Bold text also indicates a command in a paragraph.
<i>italic font</i>	Arguments for which you supply values are in <i>italics</i> . Italic text also indicates the first occurrence of a new term, book title, emphasized text.
{ }	Encloses required arguments and keywords.
[ ]	Encloses optional arguments and keywords.
{x   y   z}	Required alternative keywords are grouped in braces and separated by vertical bars.
[x   y   z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
screen font	Terminal sessions and information the system displays are in <i>screen font</i> .
<b>boldface screen font</b>	Information you must enter in a command line is in <b>boldface screen font</b> .
<i>italic screen font</i>	Arguments for which you supply values are in <i>italic screen font</i> .
^	The symbol ^ represents the key labeled Control—for example, the key combination ^D in a screen display means hold down the Control key while you press the D key.
< >	Nonprinting characters, such as passwords are in angle brackets.

Notes use the following conventions:



### Note

Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the publication.

Cautions use the following conventions:

**Caution**

---

Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

---

Warnings use the following conventions:

**Warning**

---

Means ***possible physical harm or equipment damage***. A warning describes an action that could cause you physical harm or damage the equipment.

---

For additional information about CLI syntax formatting, see the *Cisco 4700 Series Application Control Engine Appliance Command Reference*.

## Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>





## Overview

---

This chapter provides an overview of the basic concepts involved with virtualization. Virtualization consists of the following functional areas:

- [Contexts](#)
- [Domains](#)
- [Role-Based Access Control](#)
- [Resource Classes](#)

## Contexts

The virtualized environment is divided into objects called contexts. Each context behaves like an independent ACE appliance with its own policies, interfaces, domains, server farms, real servers, and administrators. Each context also has its own management VLAN that you can access using Telnet or Secure Shell (SSH).

As the global administrator (Admin), you can configure and manage all contexts through the Admin context, which contains the basic settings for each virtual device or context. When you log in to the ACE using the console, Telnet, or SSH, you are authenticated in the Admin context.

The Admin context is similar to other contexts. The difference is that when you log in to the Admin context (for example, using SSH), you have full system administrator access to the entire ACE and all contexts and objects within it. The Admin context provides access to network-wide resources, for example, a syslog server or context configuration server. All global commands for the ACE settings, contexts, resource classes, and so on, are available only in the Admin context.

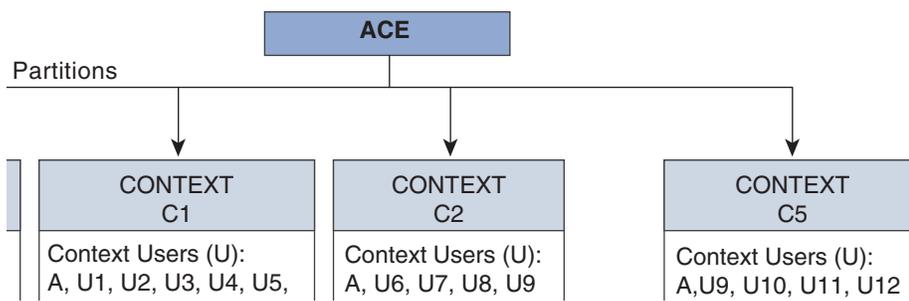
Each context, including the Admin context, has its own configuration file and local user database that are stored in the local disk partition on the flash disk or that can be downloaded from a File Transfer Protocol (FTP), Trivial File Transfer Protocol (TFTP), or HTTP(S) server. The startup-config for each context is stored as the startup configuration file on the flash disk.

In the Admin context, use the **changeto** command in Exec mode or the **do changeto** command in configuration modes to move between contexts. Only users authenticated in the Admin context can use the **changeto** command.

For information about configuring a context, see [Chapter 2, Configuring Virtualization](#).

Figure 1-1 shows how you can use virtualization to create partitions that enable the ACE to function as multiple virtual devices.

Figure 1-1 ACE Virtualization Chart



Each context that you create represents a virtual device. You can partition each context into domains for managing access to context resources. [Table 1-1](#) describes the various components of [Figure 1-1](#).

**Table 1-1 ACE Virtualization Elements**

Element	Description
Context ( <i>Cn</i> )	You can configure a single ACE to behave as multiple virtual devices by creating partitions called <i>contexts</i> . Each context functions as an independent device with its own set of users, objects, and allocated resources. By default, the ACE comes preconfigured with an Admin context and five configurable user contexts. To upgrade to a maximum of 250 user contexts, you must purchase a separate license from Cisco Systems. For more information about contexts, see the “ <a href="#">Contexts</a> ” section.
Domain ( <i>Dn</i> )	You can divide each context into multiple partitions called <i>domains</i> , which allow you to manage user access to the objects within a context. When you create a domain, you form an association between a select group of context users and a select group of context objects. For more information about domains, see the “ <a href="#">Domains</a> ” section.
User ( <i>A</i> , <i>Un</i> )	The ACE is preconfigured with a default global system administrator that provides access to all ACE functionality and allows you to create additional users. Any user that you create while you are in Admin context, by default, will have access to all resources in the ACE. Any user that you create while you are in a user-defined context will have access only to the resources within that context. You assign each user a role, which determines the commands and resources that are available to that user. For more information about users and user roles, see <a href="#">Chapter 2, Configuring Virtualization</a> .
Object ( <i>Cn_On</i> , <i>Dn_On</i> )	The following objects are user-configurable items: <ul style="list-style-type: none"> <li>• Access lists</li> <li>• Defined interfaces</li> <li>• Policy maps</li> <li>• Health probes</li> <li>• Real servers</li> <li>• Server farms</li> <li>• Scripts</li> <li>• Sticky groups</li> </ul> <p>The objects that you create are specific to the context that you are in while creating the object. If the context is partitioned into multiple domains, you allocate objects within each domain.</p>

## Domains

For management purposes, contexts are divided into objects called *domains* and each domain is fully contained within a context. A domain provides a namespace in which a user operates and each user is associated with at least one domain. The role assigned to a user determines the operations that a user can perform on the objects in a domain and the command set available to that user. When you create a context, the ACE automatically creates a default domain for that context.

The global admin or context administrators can create additional domains. A domain name must be unique within the context with which it is associated.

You can add any object that you can create (for example, a server farm, a real server, a probe, a VLAN, and so on) to a domain, and you can add an object to multiple domains. If you add an object that has other objects associated with it (for example, a server farm configured with real servers) to a domain, the associated objects do not automatically become part of the domain. You must add each object individually. When you create an object, the ACE automatically adds it to your domain.


**Note**

A domain does not restrict the context configuration that you can display using the **show running-config** command. However, a domain does restrict a user's access to configurable objects in the ACE. You can further restrict the operations that a user can perform on those configurable objects by assigning a role to a user. For information about user roles, see the “[Role-Based Access Control](#)” section.

For information about configuring a domain, see [Chapter 2, Configuring Virtualization](#).

## Role-Based Access Control

The ACE provides role-based access control (RBAC), which is a mechanism that determines the commands and resources available to each user. A role defines a set of permissions that allow you to access the objects and resources in a context and the actions that you can perform on them. The global or context administrator assigns roles to users based on their network function and the resources to which you want them to have access.

The ACE provides the following predefined roles that you cannot delete or modify:

- Admin—If created in the Admin context, has complete access to, and control over, all contexts, domains, roles, users, resources, and objects in the entire ACE. If created in a user context, this role gives a user complete access to and control over all the objects in that context. A context administrator can create, configure, and modify any object in that context, including policies, roles, domains, server farms, real servers, and so on.
- Network Admin—Complete access to and control over the following features:
  - Interfaces
  - Routing
  - Connection parameters
  - Network Address Translation (NAT)
  - VIPs
  - Copy configurations
  - **changeto** command
- Network-Monitor—Access only to the **changeto** command and **show** commands except for the following **show** commands:
  - **show backup**
  - **show bootvar**
  - **show capture**
  - **show cde**
  - **show cfgmgr**
  - **show crypto**
  - **show debug**

- **show ft**
- **show hyp**
- **show inventory**
- **show ipcp**
- **show licences**
- **show login**
- **show processes**
- **show restore**
- **show tech-support**
- **show telnet**
- **show vlans**

If you do not explicitly assign a role to a user with the **username** command, this is the default role.

- Security-Admin—Complete access to and control over the following security-related features within a context:
  - Access control lists (ACLs)
  - Application inspection
  - Connection parameters
  - Interfaces (modify privileges only)
  - Authentication and authorization (AAA)
  - NAT
  - Copy configurations
  - **changeto** command
- Server-Appln-Maintenance—Complete access to and control over the following features:
  - Real servers
  - Server farms
  - Load balancing
  - Copy configurations
  - **changeto** command
- Server-Maintenance—Real server maintenance, monitoring, and debugging for the following features:
  - Real servers—Modify permission
  - Server farms—Debug permission
  - VIPs—Debug permission
  - Probes—Debug permission
  - Load balancing—Debug permission
  - **changeto** command—Create permission

- SLB-Admin—Complete access to and control over the following ACE features within a context:
  - Real servers
  - Server farms
  - VIPs
  - Probes
  - Load balancing (Layer 3/4 and Layer 7)
  - NAT
  - Interfaces
  - Copy configurations
  - **changeto** command
- SSL-Admin—Administrator for all Secure Sockets Layer (SSL) features:
  - SSL—Create permission
  - Public key infrastructure (PKI)—Create permission
  - Interfaces—Modify permission
  - Copy configurations—Create permission
  - **changeto** command—Create permission

In addition to these predefined roles, Admins in any context can define new roles. For more information, see [Chapter 2, Configuring Virtualization](#).

## Resource Classes

Resource classes allow you to manage context access to ACE resources, such as concurrent connections or bandwidth rate. The ACE is preconfigured with a default resource class that it applies to the Admin context and any user context upon creation. The default resource class is configured to allow a context to operate within a range that can vary from no resource access (0 percent) to complete resource access (100 percent).

When you use the default resource class with multiple contexts, you run the risk of oversubscribing ACE resources because the ACE permits all contexts to have full access to all of the resources on a first-come, first-served basis. When a resource is utilized to its maximum limit, the ACE denies additional requests made by any context for that resource.

To avoid oversubscribing resources and to help guarantee access to a resource by any context, the ACE allows you to create customized resource classes that you associate with one or more contexts. A context becomes a *member* of the resource class when you make the association. Creating a resource class allows you to set limits on the minimum and maximum amounts of each ACE resource that a member context is entitled to use. You define the minimum and maximum values as a percentage of the whole. For example, you can create a resource class that allows its member contexts access to no less than 25 percent of the total number of SSL connections that the ACE supports.

You can limit and manage the allocation of the following ACE resources:

- ACL memory
- Buffers for syslog messages and TCP out-of-order (OOO) segments
- Concurrent connections (through-the-ACE traffic)
- Management connections (to-the-ACE traffic)

- Proxy connections
- Set resource limit as a rate (number per second)
- Regular expression (regexp) memory
- SSL connections
- Sticky entries
- Static or dynamic network address translations (Xlates)

By default, when you create a context, the ACE associates the context with the default resource class. The default resource class provides resources of a minimum of 0 and a maximum of unlimited for all resources except sticky entries. For stickiness to work properly, you must explicitly configure a minimum resource limit for sticky entries by using the **limit-resource** command.

For more information about configuring and limiting resources, see [Chapter 2, Configuring Virtualization](#). For more information about stickiness, see the *Cisco Application Control Engine Module Server Load-Balancing Guide*.





## Configuring Virtualization

---

This chapter describes how to create and configure virtualization for your ACE. As the global administrator (SuperUser), you configure and manage all contexts through the Admin context, which contains the basic settings for each virtual device or context. Each context that you configure contains its own set of policies, interfaces, resources, and administrators.

This chapter contains the following sections:

- [Information About Virtualization](#)
- [Licensing Requirements for Virtualization](#)
- [Guidelines and Limitations](#)
- [Default Settings](#)
- [Configuring Virtualization](#)
- [Displaying Virtualization Configuration Information](#)
- [Displaying Virtualization Statistics](#)
- [Configuration Examples for Virtualization](#)

### Information About Virtualization

You can operate your Cisco Application Control Engine (ACE) module in a single context or in multiple contexts. Multiple contexts use virtualization to partition your ACE into multiple virtual devices or contexts. Each context contains its own set of policies, interfaces, resources, and administrators.

This feature provides you with the tools to more closely and efficiently manage the system resources and users of the ACE, and the services you provide to your customers.

For a detailed overview on virtualization, see [Chapter 1, Overview](#).

### Licensing Requirements for Virtualization

By default, your ACE provides an Admin context and five user contexts that allows you to use multiple contexts if you choose to configure them. To increase the number of user contexts up to a maximum of 250, you must obtain a separate license from Cisco.

[Table 2-1](#) shows the licensing requirements for virtualization.

**Table 2-1** ACE Virtualization Licensing Options

**Table 2-1 ACE Virtualization Licensing Options**

Feature	License Model	Description
Virtualization	ACE-VIRT-020	20 virtual contexts.
	ACE-VIRT-050	50 virtual contexts.
	ACE-VIRT-100	100 virtual contexts.
	ACE-VIRT-250	250 virtual contexts.
	ACE-VIRT-UP1	Upgrades 20 to 50 contexts.
	ACE-VIRT-UP2	Upgrades 50 to 100 contexts.
	ACE-VIRT-UP3	Upgrades 100 to 250 contexts.

For details about licensing, see the *Cisco Application Control Engine Module Administration Guide*.

## Guidelines and Limitations

This section includes the guidelines and limitations for virtualization:

- [Throughput and Management Traffic Bandwidth Rate Guidelines](#)
- [Resource Minimum Value Guidelines](#)
- [Changing the Resource Allocation of a Resource Class Guidelines](#)
- [Managed System Resources Guidelines](#)

### Throughput and Management Traffic Bandwidth Rate Guidelines

The maximum bandwidth rate per context is determined by your bandwidth license. By default, the entry-level ACE has a 4-Gbps through-traffic bandwidth and a 1-Gbps management-traffic bandwidth for a total maximum bandwidth of 5 Gbps. You can upgrade the ACE with an optional 8-Gbps or 16-Gbps bandwidth license. With the 8-Gbps license, the ACE has a 8-Gbps through-traffic bandwidth and a 1-Gbps management-traffic bandwidth for a total maximum bandwidth of 9 Gbps.

When you configure a minimum bandwidth value for a resource class in the ACE by using the **limit-resource** command (see the [“Allocating Resources within a Resource Class”](#) section), the ACE subtracts that configured value from the total bandwidth maximum value of all contexts in the ACE, regardless of the resource class with which they are associated. The total bandwidth rate of a context consists of the following two components:

- throughput—Limits through-the-ACE traffic. This is a derived value (you cannot configure it directly) and it is equal to the **bandwidth** rate minus the **mgmt-traffic** rate for the 4-Gbps and 8-Gbps licenses. With a 16-Gbps license, this value is calculated slightly differently.
- management traffic—Limits management (to-the-ACE) traffic in bytes per second. This parameter is independent of the **limit-resource all minimum** command. To guarantee a minimum amount of management traffic bandwidth, you must explicitly allocate a minimum percentage to management traffic using the **limit-resource rate mgmt-traffic minimum** command. When you allocate a minimum percentage of bandwidth to management traffic, the ACE subtracts that value from the maximum available management traffic bandwidth for all contexts in the ACE. By default, management traffic is guaranteed a minimum bandwidth rate of 0 and a maximum bandwidth rate of 1 Gbps, regardless of which bandwidth license that you install in the ACE.

For details about how the ACE manages bandwidth for throughput and management traffic rates, see the examples of the **show resource-usage** command output that follow. For each bandwidth license, there are examples for the default values, 25 percent minimum allocation to all resources, and both a 25 percent minimum allocation to all resources and a 10 percent minimum allocation to management traffic. The output has been modified to show only the relevant fields. All values are in bytes per second; to convert to bits per second, multiply each value by 8.

**Example 2-1 Default Show Resource Usage Command Output for 4-Gbps License**

Resource	Allocation	
	Min	Max
bandwidth	0	625000000
throughput	0	500000000
mgmt-traffic rate	0	125000000

**Example 2-2 Show Resource Usage Command Output for 4-Gbps License with 25 Percent Minimum Allocation for All Resources (continued)**

Resource	Allocation	
	Min	Max
bandwidth	125000000	500000000
throughput	125000000	375000000
mgmt-traffic rate	0	125000000

**Example 2-3 Show Resource Usage Command Output for 4-Gbps License with 25 Percent Minimum Allocation for All Resources and 10 Percent Minimum Allocation for Management Traffic**

Resource	Allocation	
	Min	Max
bandwidth	137500000	487500000
throughput	125000000	375000000
mgmt-traffic rate	12500000	112500000

**Example 2-4 Default Show Resource Usage Command Output for 8-Gbps License**

Resource	Allocation	
	Min	Max
bandwidth	0	1125000000
throughput	0	1000000000
mgmt-traffic rate	0	125000000

**Example 2-5 Show Resource Usage Command Output for 8-Gbps License with 25 Percent Minimum Allocation for All Resources**

Allocation		
Resource	Min	Max
bandwidth	250000000	875000000
throughput	250000000	750000000
mgmt-traffic rate	0	125000000

**Example 2-6 Show Resource Usage Command Output for 8-Gbps License with 25 Percent Minimum Allocation for All Resources and 10 Percent Minimum Allocation for Management Traffic**

Allocation		
Resource	Min	Max
bandwidth	262500000	862500000
throughput	250000000	750000000
mgmt-traffic rate	12500000	112500000

**Example 2-7 Default Show Resource Usage Command Output for 16-Gbps License**

Allocation		
Resource	Min	Max
bandwidth	0	2000000000
throughput	0	2000000000
mgmt-traffic rate	0	125000000

**Example 2-8 Show Resource Usage Command Output for 16-Gbps License with 25 Percent Minimum Allocation for All Resources**

Allocation		
Resource	Min	Max
bandwidth	500000000	1500000000
throughput	500000000	1500000000
mgmt-traffic rate	0	125000000

**Example 2-9 Show Resource Usage Command Output for 16-Gbps License with 25 Percent Minimum Allocation for All Resources and 10 Percent Minimum Allocation for Management Traffic**

Allocation		
Resource	Min	Max
bandwidth	500000000	1500000000
throughput	487500000	1500000000
mgmt-traffic rate	12500000	112500000

### Resource Minimum Value Guidelines

When you configure a minimum value for a resource in a particular resource class in the ACE by using the **limit-resource** command (see the [“Allocating Resources within a Resource Class”](#) section), the ACE assigns the minimum resources only to the contexts that are members of the resource class. For all contexts, the ACE subtracts that configured minimum value from the maximum value of that resource, regardless of the resource class with which the contexts are associated. If the resource class has more than one context associated with it, the minimum value that the ACE subtracts from the maximum value is multiplied by the number of contexts in the resource class.

For example, with a 4-Gbps bandwidth license, if there are two contexts associated with the resource class and you configure a 25 percent minimum allocation for the bandwidth rate for the class, each context in the resource class would have the values that are shown in [Example 2-10](#) for the **show resource usage** command output for the bandwidth rate and throughput rate.

#### **Example 2-10 Show Resource Usage Command Output for 4-Gbps License with 25 Percent Minimum Allocation for Bandwidth**

Resource	Allocation	
	Min	Max
bandwidth	125000000	375000000
throughput	125000000	250000000
mgmt-traffic rate	0	125000000

All other contexts in the ACE would have the same maximum values as shown in [Example 2-10](#), but would have zero minimum values. Compare the values in [Example 2-10](#) with the values in [Example 2-2](#), which represents one context in a resource class.

### Changing the Resource Allocation of a Resource Class Guidelines

If you (as the global Admin) need to change the resource allocation in a resource class of which two or more user contexts are members, you may do so at any time by entering the appropriate CLI commands. For details about allocating resources, see the [“Allocating Resources within a Resource Class”](#) section.

However, the shift in resources between the contexts does not take place immediately unless the appropriate resources are available to accommodate the change. In most cases, to effect a change in resource allocation, you must inform the context administrators involved to ensure that the new resource allocation is possible.

For example, suppose that context A is using 100 percent of the available resources of the class and you want to allocate 50 percent of the resources to context A and 50 percent of the resources to context B. Although the CLI accepts your resource allocation commands, context B cannot allocate 50 percent of the resources until context A deallocates 50 percent of its resources. In this case, you must perform the following:

- Inform the Context A administrator to start deallocating resources
- Inform the Context B administrator to start allocating resources after the Context A administrator releases the resources

As resources are released from other contexts, the ACE assigns the resources to resource-starved contexts (contexts where the resource-class minimum allocations have not been met).

**Managed System Resources Guidelines**

Table 2-2 lists the managed system resources of the ACE. You can limit these resources per context or for all contexts associated with the resource class by using the **limit-resource** command. See the “Allocating Resources within a Resource Class” section.

**Table 2-2 System Resource Maximum Values**

Resource	Maximum Value
ACL Memory	78,610,432 bytes.
Buffer Memory (Syslog)	4,000,000 bytes.
Concurrent Connections (Layer 4)	4,000,000 connections.
Concurrent Connections (SSL)	200,000.
Management Connections	100,000 connections.
Proxy Connections (Layer 7)	524,286 connections.
SSL Proxy Connections	200,000.
<b>Rate</b>	
Bandwidth	4 gigabits per second (Gbps). You can upgrade the ACE maximum bandwidth to 8 Gbps or 16 Gbps by purchasing a separate license from Cisco Systems. For more information, see the <i>Cisco Application Control Engine Module Administration Guide</i> .
Connections (any kind)	325,000 connections per second.
MAC miss	2000 packets per second.
Management Traffic	1 Gbps.
SSL transactions	1000 transactions per second (TPS), upgradeable to 15000 TPS with a separate license. For more information, see the <i>Cisco Application Control Engine Module Administration Guide</i> .
syslog	For traffic going to the ACE (control plane), 5000 messages per second. For traffic going through the ACE (data plane), 350,000 messages per second.
Regular Expression Memory	1,048,576 bytes.
Sticky Entries	4,194,304 entries.
Xlates (network and port address translation entries)	1,000,000 translations.

# Default Settings

Table 2-3 lists the default settings for the virtualization function.

**Table 2-3**      **Default Virtualization Parameters**

Parameters	Default
Through-traffic Bandwidth	The entry-level ACE has a 4-Gbps through-traffic bandwidth and a 1-Gbps management-traffic bandwidth for a total maximum bandwidth of 5 Gbps. You can upgrade the ACE with an optional 8-Gbps or 16-Gbps bandwidth license. With the 8-Gbps license, the ACE has a 8-Gbps through-traffic bandwidth and a 1-Gbps management-traffic bandwidth for a total maximum bandwidth of 9 Gbps. You can upgrade the ACE with either an optional 2-Gbps or 4-Gbps bandwidth license (see the <i>Cisco Application Control Engine Module Administration Guide</i> ).
Management-traffic Bandwidth	Management traffic is guaranteed a minimum bandwidth rate of 0 and a maximum bandwidth rate of 1 Gbps, regardless of the bandwidth license that you install in the ACE.
Resource Allocation	Minimum: 0 percent. Maximum: 100 percent.
User Default Role	Network-Monitor.
Context Domain	Default-domain.
User accounts	admin and www.
User Password	Clear text.

# Configuring Virtualization

This section includes the following topics:

- [Task Flow for Configuring Virtualization](#)
- [Managing ACE Resources](#)
- [Configuring a Context](#)
- [Configuring User Roles](#)
- [Configuring Domains](#)
- [Configuring a User](#)
- [Logging Out a User](#)

For detailed information about the CLI command syntax described in this chapter, see the *Cisco Application Control Engine Module Command Reference* located at:

[http://www.cisco.com/en/US/products/ps6906/tsd\\_products\\_support\\_model\\_home.html](http://www.cisco.com/en/US/products/ps6906/tsd_products_support_model_home.html)

## Task Flow for Configuring Virtualization

Follows these steps to configure virtualization.

- 
- Step 1** Log in to the ACE as the global administrator using the console. By default, the console comes up with a single context called Admin.
- Step 2** Enter configuration mode.
- ```
host1/Admin# config
Enter configuration commands, one per line. End with CNTL/Z.
host1/Admin(config)#
```
- Step 3** Configure a resource class to limit resources used by user contexts. For example, to limit the resources of a context to 10 percent of the total resources available, enter the following commands:
- ```
host1/Admin(config)# resource-class RC1
host1/Admin(config-resource)# limit resource all minimum 10 maximum equal-to-min
host1/Admin(config-resource)# exit
```
- Step 4** Create a new context.
- ```
host1/Admin(config)# context C1
host1/Admin(config-context)#
```
- Step 5** Associate an existing VLAN with the context so that the context can receive traffic classified for it.
- ```
host1/Admin(config-context)# allocate-interface vlan 100
```
- Step 6** Associate the context with the resource class that you created in Step 3.
- ```
host1/Admin(config-context)# member RC1
```

**Step 7** Change to the C1 context that you created in Step 4 and enter configuration mode in that context.

```
host1/Admin(config-context)# do changeto C1
host1/C1(config-context)# exit
host1/C1(config)#
```

**Step 8** (Optional) Create a domain for the context.

```
host1/C1(config)# domain D1
host1/C1(config-domain)#
```

**Step 9** Allocate objects (for example, real servers, server farms, probes, ACLs, and so on) to the domain as needed.

```
host1/C1(config-domain)# add-object rserver SERVER1
```

**Step 10** (Optional) Create roles to define the object and resource permissions for different groups of users.

```
host1/C1(config)# role UR1
```

**Step 11** Create rules to define the role permissions.

```
host1/C1(config-role)# rule 1 permit create feature real
host1/C1(config-role)# rule 2 deny create feature acl
```

**Step 12** Configure users as required and associate roles and domains with the users.

```
host1/C1(config)# username user1 password 5 MYPASSWORD role UR1 domain D1
```

**Step 13** Verify the virtualization configuration by entering one of the following commands:

```
host1/C1# show running-config context
host1/C1# show running-config domain
host1/C1# show running-config resource-class
host1/C1# show running-config role
```

---

## Managing ACE Resources

You can allocate system resources to multiple contexts by creating and defining one or more resource classes and then associating the contexts with a resource class.

The section contains the following topics:

- [Creating a Resource Class for Resource Management](#)
- [Allocating Resources within a Resource Class](#)

### Creating a Resource Class for Resource Management

You can create a resource class to allocate and manage system resources by one or more contexts by using the **resource-class** command in configuration mode.

#### Restrictions

This configuration topic includes the following restrictions:

- The ACE supports a maximum of 100 resource classes.
- When you remove a resource class from the ACE, any contexts that were members of that resource class automatically become members of the default resource class. The default resource class allocates a minimum of 0.00 percent to a maximum of 100.00 percent of all ACE resources to each context. You cannot modify the default resource class.

#### Detailed Steps

|        | Command                                                                                                                                       | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>config</b><br><br><b>Example:</b><br>host1/Admin# config<br>(config)#                                                                      | Enters configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Step 2 | <b>resource-class name</b><br><br><b>Example:</b><br>host1/Admin(config)# resource-class RC1<br>host1/Admin(config-resource)                  | Creates a resource class and accesses the resource configuration mode.<br><br>For the <i>name</i> argument, enter an unquoted text string with no spaces and a maximum of 64 alphanumeric characters.                                                                                                                                                                                                                                                                                                                                       |
| Step 3 | <b>no resource-class name</b><br><br><b>Example:</b><br>host1/Admin(config)# no resource-class RC1                                            | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">  <p><b>Caution</b> The <b>no resource-class</b> command will remove all resources from any context to which the specified resource class is assigned. Be sure that you want to do this before you enter the command.</p> </div> (Optional) Removes a resource class from the configuration and removes all resources from any context to which the resource class is assigned. |
| Step 4 | <b>do copy running-config startup-config</b><br><br><b>Example:</b><br>host1/Admin(config-resource)# do copy<br>running-config startup-config | (Optional) Copies the running configuration to the startup configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Allocating Resources within a Resource Class

You can allocate all resources or individual resources to all member contexts of a resource class. For example, you can allocate only concurrent connections or sticky table memory. You allocate system resources to all members (contexts) of a resource class by using the **limit-resource** command in resource-class configuration mode.

### Prerequisites

This configuration topic includes the following prerequisites:

- When you plan the initial resource allocations for the virtual contexts in your configuration, allocate only the minimum required or estimated resources. The ACE protects resources that are in use, so to decrease a context's resources, those resources must be unused. Although it is possible to decrease the resource allocations in real time, it may require additional management overhead to clear any used resources before reducing them. Therefore, it is considered a best practice to initially keep as many resources in reserve as possible and allocate the unused reserved resources as needed.
- You must configure a minimum value for sticky to allocate resources for sticky database entries, because the sticky software receives no resources under the **unlimited** setting. You can allocate resources to sticky by either configuring a minimum percentage of resources specifically for sticky (**limit-resource sticky**) or by configuring a minimum percentage of resources for all (**limit-resource all**).

### Restrictions

This configuration topic includes the following restrictions:

- To address scaling and capacity planning, we recommend that new ACE installations do not exceed 60 to 80 percent of the module's total capacity. To accomplish this goal, create a reserved resource class with a guarantee of 20 to 40 percent of all the ACE resources. Configure a virtual context dedicated solely to ensuring that these resources are reserved. Then, you can efficiently distribute such reserved resources to contexts as capacity demands for handling client traffic increase over time.
- The limit that you set for individual resources when you use the **limit-resource** command overrides the limit that you set for all resources when you use the **limit-resource all** command.
- If you lower the limits for one context (context A) in order to increase the limits of another context (context B), you may experience a delay in the configuration change because the ACE will not lower the limits of context A until the resources are no longer being used by the context.

## Detailed Steps

| Command                                                                                                                                                                                                                                                                                                         | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 1</b></p> <pre><b>limit-resource</b> resources {<b>minimum</b> number} {<b>maximum</b> {<b>equal-to-min</b>   <b>unlimited</b>}</pre> <p><b>Example:</b><br/> host1/Admin(config)# resource-class RC1<br/> host1/Admin(config-resource)#limit-resource<br/> all minimum 20% maximum equal-to-min</p> | <p>Specifies the system resource that you want to limit. The keywords, arguments, and options are as follows:</p> <ul style="list-style-type: none"> <li>• <i>resources</i>—Enter one of the following keywords for the system resource: <ul style="list-style-type: none"> <li>– <b>acl-memory</b>—Limits memory space allocated for ACLs.</li> <li>– <b>all</b>—Limits all resources to the specified value for all contexts assigned to this resource class, except for management traffic bandwidth.</li> <li>– <b>buffer</b>—Limits the number of syslog buffers.</li> <li>– <b>conc-connections</b>—Limits the number of simultaneous connections.</li> <li>– <b>mgmt-connections</b>—Limits the number of management (to-the-ACE) connections.</li> <li>– <b>proxy-connections</b>—Limits the number of proxy connections.</li> <li>– <b>regexp</b>—Limits the amount of regular expression memory.</li> <li>– <b>sticky</b>—Limits the number of entries in the sticky table.</li> <li>– <b>xlates</b>—Limits the number of network and port address translations entries.</li> </ul> </li> <li>• <b>minimum number</b>—Specifies the lowest acceptable value for a resource. Enter an integer from 0.00 to 100.00 percent (two-decimal places of granularity). The <i>number</i> argument specifies a percentage value for all contexts that are members of the resource class.</li> </ul> <p><b>Note</b> For configuration guidelines on the <b>minimum</b> keyword, see the “<a href="#">Guidelines and Limitations</a>” section.</p> <ul style="list-style-type: none"> <li>• <b>maximum {equal-to-min   unlimited}</b>—Specifies the maximum resource value: either the same values as the minimum value or no limit.</li> </ul> |

| Command                                                                                                                                                                                                                                                                                 | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 2</b> <code>limit-resource rate rates {minimum number} {maximum {equal-to-min   unlimited}}</code></p> <p><b>Example:</b></p> <pre>host1/Admin(config)# resource-class RC1 host1/Admin(config-resource)#limit-resource rate bandwidth minimum 20% maximum equal-to-min</pre> | <p>Limits the resource as a number per second for the specified connections or syslog messages.</p> <ul style="list-style-type: none"> <li><i>rates</i>—Enter one of the following keywords for the rate: <ul style="list-style-type: none"> <li><b>bandwidth</b>—Limits the total ACE throughput in bytes per second for one or more contexts. The maximum bandwidth rate per context is determined by your bandwidth license (see the <a href="#">“Licensing Requirements for Virtualization”</a> section). When you configure a minimum bandwidth value for a resource class in the ACE, the ACE subtracts that configured value from the total bandwidth maximum value of all contexts in the ACE, regardless of the resource class with which they are associated.</li> </ul> </li> </ul> <p> <b>Note</b> For configuration guidelines on bandwidth, see the <a href="#">“Guidelines and Limitations”</a> section.</p> <ul style="list-style-type: none"> <li><b>connections</b>—Limits the number of connections of any kind per second.</li> <li><b>inspect conn</b>—Limits the number of application protocol inspection connections per second for File Transfer Protocol (FTP) and Real-Time Streaming Protocol (RTSP) only.</li> <li><b>mac-miss</b>—Limits the ACE traffic sent to the control plane when the encapsulation is not correct in bytes per second.</li> <li><b>mgmt-traffic</b>—Limits management (to-the-ACE) traffic in bytes per second.</li> <li><b>ssl-connections</b>—Limits the number of SSL connections per second.</li> <li><b>syslog</b>—Limits the number of syslog messages per second.</li> </ul> <ul style="list-style-type: none"> <li><b>minimum number</b>—Specifies the lowest acceptable value for a resource. Enter an integer from 0.00 to 100.00 percent (two-decimal places of granularity). The <i>number</i> argument specifies a percentage of the ACE's maximum value per second.</li> </ul> <p><b>Note</b> For configuration guidelines on the <b>minimum</b> keyword, see the <a href="#">“Guidelines and Limitations”</a> section.</p> <ul style="list-style-type: none"> <li><b>maximum {equal-to-min   unlimited}</b>—Specifies the maximum resource value: either the same values as the minimum value or no limit.</li> </ul> |

|               | <b>Command</b>                                                                                                                                                                                                                      | <b>Purpose</b>                                                                                                                 |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 3</b> | <pre>no limit-resource resources {minimum number} {maximum {equal-to-min   unlimited}}</pre> <p><b>Example:</b><br/> host1/Admin(config-resource)# no<br/> limit-resource all</p>                                                   | (Optional) Restores resource allocation to the default values of 0 percent minimum and 100 percent maximum for a resource.     |
| <b>Step 4</b> | <pre>no limit-resource rate rates {minimum number} {maximum {equal-to-min   unlimited}}</pre> <p><b>Example:</b><br/> host1/Admin(config-resource)# no<br/> limit-resource rate bandwidth minimum 20%<br/> maximum equal-to-min</p> | (Optional) Restores the resource rate limit to the default values of 0 percent minimum and 100 percent maximum for a resource. |
| <b>Step 5</b> | <pre>do copy running-config startup-config</pre> <p><b>Example:</b><br/> host1/Admin(config-resource)# do copy<br/> running-config startup-config</p>                                                                               | (Optional) Copies the running configuration to the startup configuration.                                                      |
| <b>Step 6</b> | <pre>exit</pre> <p><b>Example:</b><br/> host1/Admin(config-resource)# exit<br/> host1/Admin(config)#</p>                                                                                                                            | (Optional) Exits the resource configuration mode.                                                                              |

## Configuring a Context

A context provides a user view into the ACE and determines the resources available to a user. This section contains the following topics:

- [Creating a Context](#)
- [Configuring a Context Description](#)
- [Configuring a VLAN for a Context](#)
- [Associating a Context with a Resource Class](#)
- [Moving Between Contexts](#)

### Creating a Context

A context provides a user view into the ACE and determines the resources available to a user. You create a context by using the **context** command in configuration mode.



#### Note

When you create a context, the ACE automatically creates a default domain (default-domain) for that context. You can create a maximum of 63 additional domains in each context. For information about configuring a domain, see the “[Configuring Domains](#)” section.

### Detailed Steps

|        | Command                                                                                                                                      | Purpose                                                                                                                                                                                                                                 |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>config</b><br><br><b>Example:</b><br>host1/Admin# config<br>(config)#                                                                     | Enters configuration mode.                                                                                                                                                                                                              |
| Step 2 | <b>context</b> <i>name</i><br><br><b>Example:</b><br>host1/Admin(config)# context C1<br>host1/Admin(config-context)                          | Creates a context and accesses the context configuration mode.<br><br>For the <i>name</i> argument, enter a unique identifier of the context. Enter an unquoted text string with no spaces and a maximum of 64 alphanumeric characters. |
| Step 3 | <b>no context</b> <i>name</i><br><br><b>Example:</b><br>host1/Admin(config)# no context C1                                                   | (Optional) Removes a context from the configuration.                                                                                                                                                                                    |
| Step 4 | <b>do copy running-config startup-config</b><br><br><b>Example:</b><br>host1/Admin(config-context)# do copy<br>running-config startup-config | (Optional) Copies the running configuration to the startup configuration.                                                                                                                                                               |

## Configuring a Context Description

You enter a description for the context by using the **description** command in context configuration mode.

### Detailed Steps

|        | Command                                                                                                                                      | Purpose                                                                                                                                                                     |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>description</b> <i>text</i><br><br><b>Example:</b><br>host1/Admin(config-context)# description<br>context for accounting users            | Enters a description for a user context.<br><br>For the <i>text</i> argument, enter a description as an unquoted text string with a maximum of 240 alphanumeric characters. |
| Step 2 | <b>no description</b><br><br><b>Example:</b><br>host1/Admin(config-context)# no<br>description                                               | (Optional) Removes the context description from the configuration.                                                                                                          |
| Step 3 | <b>do copy running-config startup-config</b><br><br><b>Example:</b><br>host1/Admin(config-context)# do copy<br>running-config startup-config | (Optional) Copies the running configuration to the startup configuration.                                                                                                   |

## Configuring a VLAN for a Context

The ACE uses class maps and policy maps to classify (filter) traffic and direct it to different interfaces (VLANs) using a service policy. A context uses VLANs to receive packets classified for that VLAN. You allocate one or more existing VLANs on which a user context can receive packets by using the **allocate-interface** command in context configuration mode in the Admin context. You can enter this command multiple times to specify multiple VLANs for a user context.

### Restrictions

This configuration topic includes the following restrictions:

- You can configure an interface directly in a user context, but the state of the interface remains Down until you enter the **allocate-interface** command for that interface in the Admin context. You can configure the interface and allocate the interface in any order.
- If you remove an interface in the Admin context and the same interface is in use in a user context, the state of the interface becomes Down. Entering the **show interface** command in the user context shows the interface as Down and the reason that the interface is no longer allocated in the Admin context.
- You cannot deallocate a VLAN from a user context if the VLAN is in use in that context.

## Detailed Steps

|        | Command                                                                                                                                                                                                                                                           | Purpose                                                                                                                                                                                                                                                    |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <p><b>allocate-interface vlan</b> <i>number1</i></p> <p><b>Example:</b><br/> <pre>host1/Admin(config-context)# allocate-interface vlan 100</pre></p> <p><b>Example:</b><br/> <pre>host1/Admin(config-context)# allocate-interface vlan 100-200</pre></p>          | <p>Allocate one or more existing VLANs on which a user context can receive packets.</p> <p>For the <i>number</i> argument, enter the number of an existing VLAN or a range of VLANs that you want to assign to the context as integers from 2 to 4094.</p> |
| Step 2 | <p><b>no allocate-interface vlan</b> <i>number1</i></p> <p><b>Example:</b><br/> <pre>host1/Admin(config-context)# no allocate-interface vlan 100</pre></p> <p><b>Example:</b><br/> <pre>host1/Admin(config-context)# no allocate-interface vlan 100-200</pre></p> | <p>(Optional) Deallocates a VLAN or range of VLANs from a context.</p>                                                                                                                                                                                     |
| Step 3 | <p><b>do copy running-config startup-config</b></p> <p><b>Example:</b><br/> <pre>host1/Admin(config-context)# do copy running-config startup-config</pre></p>                                                                                                     | <p>(Optional) Copies the running configuration to the startup configuration.</p>                                                                                                                                                                           |

## Associating a Context with a Resource Class

Resource classes limit the resources available to one or more contexts. You associate a context with a resource class or associate the same context with a different resource class by using the **member** command in context configuration mode.

### Prerequisites

This configuration topic includes the following prerequisites:

- The default resource class allocates a minimum of 0.00 percent to a maximum of 100.00 percent of all ACE resources to each context. You can associate a context with only one resource class. For more information about resource classes, see the “[Guidelines and Limitations](#)” section.
- When you remove a context from a resource class, the ACE releases all resources associated with that context and makes the resources available to other contexts in the class.

### Restrictions

This configuration topic includes the following restrictions:

- If you do not specify a resource class, the context automatically is a member of the default resource class.
- You can associate a context with only one resource class. If you try to associate more than one resource class to the context, the ACE overwrites the existing class.

- When you add a context to a resource class, the ACE adds only those resources that can remain within their configured limits. If you want to allocate additional resources to the context, you can do so if the resources are available. Otherwise, you must first release some resources from other contexts within the resource class. For details about modifying the resource allocation among contexts, see the “[Configuring a Context](#)” section.

## Detailed Steps

|        | Command                                                                                                                                           | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <p><b>member</b> <i>class</i></p> <p><b>Example:</b><br/>host1/Admin(config-context)# member RC1</p>                                              | <p>Associates a context with a resource class, or associates the same context with a different resource class.</p> <p>For the <i>class</i> argument, enter the name of an existing resource class as an unquoted text string with no spaces and a maximum of 64 alphanumeric characters. For information about configuring a resource class, see the “<a href="#">Creating a Resource Class for Resource Management</a>” section.</p> |
| Step 2 | <p><b>no member</b> <i>class</i></p> <p><b>Example:</b><br/>host1/Admin(config-context)# no member RC1</p>                                        | (Optional) Disassociates a context from a resource class                                                                                                                                                                                                                                                                                                                                                                              |
| Step 3 | <p><b>do copy running-config startup-config</b></p> <p><b>Example:</b><br/>host1/Admin(config-context)# do copy running-config startup-config</p> | (Optional) Copies the running configuration to the startup configuration.                                                                                                                                                                                                                                                                                                                                                             |
| Step 4 | <p><b>exit</b></p> <p><b>Example:</b><br/>host1/Admin(config-context)# exit<br/>host1/Admin(config)#</p>                                          | (Optional) Exits the context configuration mode.                                                                                                                                                                                                                                                                                                                                                                                      |

## Moving Between Contexts

You move between contexts by using the **changeto** command in Exec mode.

### Prerequisites

Context administrators, who have access to multiple contexts, must explicitly log in to the other contexts to which they have access.

### Restrictions

This configuration topic includes the following restrictions:

- You must have one of the predefined user roles in the Admin context to use the **changeto** command. For information about the predefined user roles, see the “[Role-Based Access Control](#)” section in [Chapter 1, Overview](#).
- The user role that is enforced after you enter the **changeto** command is that of the Admin context and not that of the non-Admin context.

- You cannot add, modify, or delete objects in a custom domain after you change to a non-Admin context.
  - If you originally had access to the default-domain in the Admin context prior to moving to a non-Admin context, the ACE allows you to configure any object in the non-Admin context.
  - If you originally had access to a custom domain in the Admin context prior to moving to a non-Admin context, any created objects in the new context will be added to the default-domain. However, an error message will appear when you attempt to modify existing objects in the non-Admin context.

## Detailed Steps

|        | Command                                                                                                                                                  | Purpose                                                                                                                                                                                                                                                                                                                                                 |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <p><b>changeto</b> <i>name</i></p> <p><b>Example:</b><br/>           host1/Admin# changeto C1<br/>           host1/C1#</p>                               | <p>Moves from one context on the ACE to another context.</p> <p><b>Note</b> You can move between contexts in configuration mode by using the <b>do changeto</b> command.</p> <p>The <i>name</i> argument specifies the identifier of an existing context. Enter an unquoted text string with no spaces and a maximum of 64 alphanumeric characters.</p> |
| Step 2 | <p><b>do copy running-config startup-config</b></p> <p><b>Example:</b><br/>           host1/C1# do copy running-config<br/>           startup-config</p> | <p>(Optional) Copies the running configuration to the startup configuration.</p>                                                                                                                                                                                                                                                                        |
| Step 3 | <p><b>exit</b></p> <p><b>Example:</b><br/>           host1/C1# exit<br/>           host1/Admin#</p>                                                      | <p>(Optional) Exits the context and returns to the Admin context.</p>                                                                                                                                                                                                                                                                                   |

## Configuring User Roles

This section contains the following topics:

- [Creating a User Role](#)
- [Assigning Privileges to a User Role](#)

### Creating a User Role

User roles determine the privileges that a user has, the commands that a user can enter, and the actions that a user can perform in a particular context. For a list of the predefined roles that the ACE provides, see [Chapter 1, Overview](#).

#### Prerequisites

Only the global administrator or a context administrator can configure additional roles.

#### Restrictions

If you do not assign a role to a new user, the default role is Network-Monitor. For users that you create in the Admin context, the default scope of access is the entire device. For users that you create in other contexts, the default scope of access is the entire context. If you need to restrict a user's access, you must assign a role-domain pair using the **username** command (see the “[Configuring a User](#)” section).

#### Detailed Steps

|        | Command                                                                                                                                | Purpose                                                                                                                                                                                                                                                                                                                                     |
|--------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>config</b><br><br><b>Example:</b><br>host1/Admin# config<br>(config)#                                                               | Enters configuration mode.                                                                                                                                                                                                                                                                                                                  |
| Step 2 | <b>role name</b><br><br><b>Example:</b><br>host1/C1(config)# role TECHNICIAN<br>host1/C1(config-role)#                                 | Creates a role and accesses the role configuration mode.<br><br><b>Note</b> To display the predefined roles in the CLI, enter the <b>show role</b> command in Exec mode.<br><br>The <i>name</i> argument is an identifier associated with a role. Enter an unquoted text string with no spaces and a maximum of 64 alphanumeric characters. |
| Step 3 | <b>no role name</b><br><br><b>Example:</b><br>host1/C1(config)# no role TECHNICIAN                                                     | (Optional) Removes the role from the configuration                                                                                                                                                                                                                                                                                          |
| Step 4 | <b>do copy running-config startup-config</b><br><br><b>Example:</b><br>host1/C1(config-role)# do copy<br>running-config startup-config | (Optional) Copies the running configuration to the startup configuration.                                                                                                                                                                                                                                                                   |

## Assigning Privileges to a User Role

After you create a user role, you can limit the features that a user has access to and the commands the user can enter for that feature by configuring rules for that role. You assign privileges per feature to a role by using the **rule** command in role configuration mode.

### Detailed Steps

|        | Command                                                                                                                                                                                                                                                                                 | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <p><b>rule</b> <i>number</i> {<b>permit</b>   <b>deny</b>} {<b>create</b>   <b>modify</b>   <b>debug</b>   <b>monitor</b>} [<b>feature</b> <i>features</i>]</p> <p><b>Example:</b></p> <pre>host1/C1(config)# role TECHNICIAN host1/C1(config-role)# rule 1 permit create rserver</pre> | <p>Specifies whether to allow or disallow operations that can be performed by a user, the type of commands that can be permitted or disallowed by the role, and the ACE feature to use when configuring the rule. The keywords, arguments, and options are as follows:</p> <ul style="list-style-type: none"> <li>• <b>number</b>—Identifier of the rule and order of precedence. Enter a unique integer from 1 to 16. The rule number determines the order in which the ACE applies the rules, with a higher-numbered rule applied after a lower-numbered rule.</li> <li>• <b>permit</b>—Allows the role to perform the operations defined by the rest of the command keywords.</li> <li>• <b>deny</b>—Disallows the role to perform the operations defined by the rest of the command keywords.</li> <li>• <b>create</b>—Specifies commands for the creation of new objects or the deletion of existing objects (includes <b>modify</b>, <b>debug</b>, and <b>monitor</b> commands).</li> <li>• <b>modify</b>—Specifies commands for modifying existing configurations (includes <b>debug</b> and <b>monitor</b> commands).</li> <li>• <b>debug</b>—Specifies commands for debugging problems (includes <b>monitor</b> commands).</li> <li>• <b>monitor</b>—Specifies commands for monitoring resources and objects (<b>show</b> commands).f</li> <li>• <b>feature features</b>—(Optional) Specifies an ACE features for configuring this rule. For the <i>features</i> argument, enter one of the following keywords for the system resource: <ul style="list-style-type: none"> <li>– <b>AAA</b>—Specifies commands for authentication, authorization, and accounting.</li> <li>– <b>access-list</b>—Specifies commands for access control lists (ACLs). Includes ACL configuration, class maps for ACL, and policy maps that contain ACL class maps.</li> </ul> </li> </ul> |

| Command | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | <ul style="list-style-type: none"> <li data-bbox="829 264 1406 352">– <b>changeto-command</b>—Specifies the <b>changeto</b> command that enables the user to move between contexts.</li> <li data-bbox="829 373 1474 527">– <b>config-copy</b>—Specifies commands for copying the running-config file to the startup-config file, startup-config file to the running-config file, and copying both config files to the flash disk (disk0:) or a remote server.</li> <li data-bbox="829 548 1386 604">– <b>connection</b>—Specifies commands for network connections.</li> <li data-bbox="829 625 1386 682">– <b>dhcp</b>—Specifies commands for Dynamic Host Configuration Protocol.</li> <li data-bbox="829 703 1474 825">– <b>exec-commands</b>—Specifies the following Exec mode commands: <b>capture</b>, <b>clear</b>, <b>debug</b>, <b>delete</b>, <b>gunzip</b>, <b>mkdir</b>, <b>move</b>, <b>rmdir</b>, <b>set</b>, <b>setup</b>, <b>system</b>, <b>tac-pac</b>, <b>untar</b>, <b>write</b>, and <b>undebug</b>.</li> <li data-bbox="829 846 1459 873">– <b>fault-tolerant</b>—Specifies commands for redundancy.</li> <li data-bbox="829 894 1446 951">– <b>inspect</b>—Specifies commands for packet inspection used in data-center security.</li> <li data-bbox="829 972 1370 999">– <b>interface</b>—Specifies all interface commands.</li> <li data-bbox="829 1020 1474 1077">– <b>loadbalance</b>—Specifies commands for load balancing. Allows adding a load-balancing action in a policy map.</li> <li data-bbox="829 1098 1435 1186">– <b>nat</b>—Specifies commands for Network Address Translation (NAT) associated with a class map in a policy map used in data-center security.</li> <li data-bbox="829 1207 1377 1264">– <b>pki</b>—Specifies commands for SSL public key infrastructure (PKI).</li> <li data-bbox="829 1285 1443 1341">– <b>probe</b>—Specifies commands for keepalives for real servers.</li> <li data-bbox="829 1362 1474 1419">– <b>real-inservice</b>—Specifies commands for placing a real server in service.</li> <li data-bbox="829 1440 1435 1497">– <b>routing</b>—Specifies all commands for routing, both global and per interface.</li> <li data-bbox="829 1518 1435 1545">– <b>rserver</b>—Specifies commands for physical servers.</li> <li data-bbox="829 1566 1443 1593">– <b>serverfarm</b>—Specifies commands for server farms.</li> <li data-bbox="829 1614 1252 1642">– <b>ssl</b>—Specifies commands for SSL.</li> <li data-bbox="829 1663 1443 1690">– <b>sticky</b>—Specifies commands for server persistence.</li> <li data-bbox="829 1711 1435 1768">– <b>syslog</b>—Specifies the system logging facility setup commands.</li> <li data-bbox="829 1789 1474 1845">– <b>vip</b>—Specifies commands for virtual IP addresses and virtual servers.</li> </ul> |

|        | Command                                                                                                                                                                                                                                                   | Purpose                                                                   |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Step 2 | <pre>no rule <i>number</i> {<b>permit</b>   <b>deny</b>} {<b>create</b>   <b>modify</b>   <b>debug</b>   <b>monitor</b>} [<b>feature</b> {<i>features</i>}]</pre> <p><b>Example:</b><br/> host1/C1(config-role)# no rule 1 permit<br/> create rserver</p> | (Optional) Removes the rule from a role.                                  |
| Step 3 | <pre>do copy <b>running-config</b> <b>startup-config</b></pre> <p><b>Example:</b><br/> host1/C1(config-role)# do copy<br/> running-config startup-config</p>                                                                                              | (Optional) Copies the running configuration to the startup configuration. |
| Step 4 | <pre>exit</pre> <p><b>Example:</b><br/> host1/Admin(config-role)# exit<br/> host1/Admin(config)#</p>                                                                                                                                                      | (Optional) Exits the role configuration mode.                             |

## Configuring Domains

This section contains the following topics:

- [Creating a Domain](#)
- [Associating Objects With a Domain](#)

### Creating a Domain

A domain is the namespace in which a user operates.

#### Restrictions

This configuration topic includes the following restrictions:

- You can create a maximum of 63 additional domains in each context.
- A domain does not restrict the context configuration that you can display using the **show running-config** command. You can still display the running configuration for the entire context. However, a domain can restrict your access to the configurable objects within a context by adding only a limited subset of all the objects available to a context to the domain. You can further restrict the operations that a user can perform on those configurable objects by assigning a role to a user. For information about configuring user roles, see the “[Configuring User Roles](#)” section.

## Detailed Steps

|        | Command                                                                                                                                  | Purpose                                                                                                                                                                               |
|--------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>config</b><br><br><b>Example:</b><br>host1/Admin# config<br>(config)#                                                                 | Enters configuration mode.                                                                                                                                                            |
| Step 2 | <b>domain name</b><br><br><b>Example:</b><br>host1/C1(config)# domain D1<br>host1/C1(config-domain)#                                     | Creates a domain and access domain configuration mode.<br><br>For the <i>name</i> argument, enter an unquoted text string with no spaces and a maximum of 76 alphanumeric characters. |
| Step 3 | <b>no domain name</b><br><br><b>Example:</b><br>host1/C1(config)# no domain D1                                                           | (Optional) Removes the domain from the configuration.                                                                                                                                 |
| Step 4 | <b>do copy running-config startup-config</b><br><br><b>Example:</b><br>host1/C1(config-domain)# do copy<br>running-config startup-config | (Optional) Copies the running configuration to the startup configuration.                                                                                                             |

## Associating Objects With a Domain

After you create a domain, you can associate configurable objects with that domain (for example, a real server, server farm, interface, and so on). You associate a configurable object with a domain by using the **add-object** command in domain configuration mode.

### Detailed Steps

|        | Command                                                                                                                                                                                                                                                                                                      | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <pre>add-object {access-list {ethertype   extended}   all   class-map   interface {bvi   vlan}   parameter-map   policy-map   probe   rserver   script   serverfarm   sticky} name</pre> <p><b>Example:</b></p> <pre>host1/C1(config)# domain D1 host1/C1(config-domain)# add-object interface vlan 10</pre> | <p>Specifies the object to be associated with a domain. The keywords, arguments, and options are as follows:</p> <ul style="list-style-type: none"> <li>• <b>access-list</b>—Specifies an existing access control list (ACL) that you want to associate with the domain.</li> <li>• <b>ethertype</b>—Specifies an existing EtherType access control list that you want to associate with the domain.</li> <li>• <b>extended</b>—Specifies an existing extended access control list that you want to associate with the domain.</li> <li>• <b>all</b>—Specifies that all existing configuration objects in the context are added to the domain.</li> <li>• <b>class-map</b>—Specifies an existing class map for flow classification that you want to associate with the domain.</li> <li>• <b>interface</b>—Specifies an existing interface that you want to associate with the domain.</li> <li>• <b>parameter-map</b>—Specifies an existing parameter map that you want to associate with the domain.</li> <li>• <b>policy-map</b>—Specifies an existing policy map that you want to associate with the domain.</li> <li>• <b>probe</b>—Specifies an existing real server probe (keepalive) that you want to associate with the domain.</li> <li>• <b>rserver</b>—Specifies an existing real server that you want to associate with the domain.</li> <li>• <b>script</b>—Specifies an existing script that you created with the ACE TCL scripting language.</li> <li>• <b>serverfarm</b>—Specifies an existing server farm that you want to associate with the domain.</li> <li>• <b>sticky</b>—Specifies an existing sticky group that you want to associate with the domain to maintain persistence with a server.</li> <li>• <b>name</b>—Identifier of the specified object. Enter an unquoted text string with no spaces and a maximum of 64 alphanumeric characters.</li> </ul> |

|        | Command                                                                                                                                                                                                                                                                               | Purpose                                                                   |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Step 2 | <pre>no add-object {access-list {ethertype   extended}   all   class-map   interface {bvi   vlan}   parameter-map   policy-map   probe   rserver   script   serverfarm   sticky} name</pre> <p><b>Example:</b><br/> host1/C1(config-domain)# no add-object<br/> interface vlan 10</p> | (Optional) Removes the object from the domain.                            |
| Step 3 | <pre>do copy running-config startup-config</pre> <p><b>Example:</b><br/> host1/C1(config-domain)# do copy<br/> running-config startup-config</p>                                                                                                                                      | (Optional) Copies the running configuration to the startup configuration. |
| Step 4 | <pre>exit</pre> <p><b>Example:</b><br/> host1/Admin(config-domain)# exit<br/> host1/Admin(config)#</p>                                                                                                                                                                                | (Optional) Exits the domain configuration mode.                           |

## Configuring a User

You create a user and define the associated role and operating domains by using the **username** command in configuration mode.

The ACE creates the following default user accounts at startup: admin and www.

- The admin user is the global administrator and cannot be deleted.
- The ACE uses the www user account for the XML interface.

### Restrictions

This configuration topic includes the following restrictions:

- The global administrator (admin) assigns one user in each context as the context administrator. The context administrator can then log in to the context or contexts for which he or she is responsible and create additional users.
- If you do not assign a role to a new user, the default role is Network-Monitor. For users that you create in the Admin context, their default scope of access is the entire device. For users that you create in other contexts, their default scope of access is the entire context. If you need to restrict a user's access, you must assign a role-domain pair.

### Detailed Steps

|        | Command                                                                          | Purpose                    |
|--------|----------------------------------------------------------------------------------|----------------------------|
| Step 1 | <pre>config</pre> <p><b>Example:</b><br/> host1/Admin# config<br/> (config)#</p> | Enters configuration mode. |

| Command                                                                                                                                                                                                                                                                              | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 2</b></p> <pre>username name1 [password [0   5] {password}] [expire date] [role name2 {domain name3 name4 . . . namen}]</pre> <p><b>Example:</b></p> <pre>host1/C1(config)# username USER2 password HERSECRET expire 2008-12-31 role Admin domain default-domain D2</pre> | <p>Creates a user or changes the default username and password. The keywords, arguments, and options are as follows:</p> <ul style="list-style-type: none"> <li><b>name1</b>—Identifier of the user that you are creating. Enter an unquoted text string with no spaces and a maximum of 24 alphanumeric characters.</li> </ul> <p>The ACE supports the following non-alphanumeric characters in a username:</p> <p style="text-align: center;">- _ @ \</p> <p>The ACE does not support the following characters:</p> <p style="text-align: center;">\$ / ; ! #</p> <p><b>Note</b> The “.” character is not supported on the local database but a username with this character is authenticated when it is configured on an ACS server.</p> <ul style="list-style-type: none"> <li><b>password</b>—(Optional) Keyword that indicates that a password follows.</li> <li><b>0</b>—(Optional) Specifies a clear text password.</li> <li><b>5</b>—(Optional) Specifies an MD5-hashed strong encryption password.</li> <li><b>password</b>—(Optional) Password in clear text or MD5 strong encryption, depending on the numbered option (0, 5, or 7) that you enter. If you do not enter a numbered option, the password is in clear text by default. If you enter the <b>password</b> keyword, you must enter a password. Enter a password as an unquoted text string with a maximum of 64 alphanumeric characters. The ACE supports the following special characters in a password:</li> </ul> <p style="text-align: center;">, . / = + - ^ @ ! % ~ # \$ * ( )</p> <p>Note that the ACE encrypts clear text passwords in the running-config.</p> <p> <b>Note</b> If you specify an MD5-hashed strong encryption password, the ACE considers a password to be weak if it is less than eight characters in length.</p> <ul style="list-style-type: none"> <li><b>expire date</b>—(Optional) Specifies the expiration date of the user account. Enter the expiration date in the format <i>yyyy-mm-dd</i>.</li> <li><b>role name2</b>—(Optional) Specifies an existing role that you want to assign to the user.</li> <li><b>domain name3 name4 . . . namen</b>—Specifies the domains in which the user can operate. You can enter multiple domain names up to a maximum of 10, including <b>default-domain</b>.</li> </ul> |

|        | Command                                                                                                                        | Purpose                                                                   |
|--------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Step 3 | <b>no username</b> <i>name1</i><br><br><b>Example:</b><br>host1/C1(config)# no username USER2                                  | (Optional) Deletes a user from the configuration.                         |
| Step 4 | <b>do copy running-config startup-config</b><br><br><b>Example:</b><br>host1/C1(config)# do copy running-config startup-config | (Optional) Copies the running configuration to the startup configuration. |

## Logging Out a User

You can force a user to log out and clear the user session by using the **clear user** command in Exec mode.

### Detailed Steps

| Command                                                                              | Purpose                                                                                                                                                                               |
|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>clear user</b> <i>name</i><br><br><b>Example:</b><br>host1/Admin# clear user John | Clears a user session.<br><br>For the <i>name</i> argument, enter the name of an existing user as an unquoted text string with no spaces and a maximum of 64 alphanumeric characters. |

## Displaying Virtualization Configuration Information

This section describes the **show** commands that allow you to display a range of configuration information for the contexts configured on your ACE.

This section contains the following topics:

- [Displaying Context Configurations](#)
- [Displaying Domain Configurations](#)
- [Displaying Resource Class Configurations](#)
- [Displaying Role Configurations](#)
- [Displaying Context Information](#)
- [Displaying Resource Allocation](#)
- [Displaying User Roles](#)
- [Displaying Domains](#)
- [Displaying User Information](#)

For detailed information about the CLI command syntax described in this chapter, see the *Cisco Application Control Engine Module Command Reference* located at:

[http://www.cisco.com/en/US/products/ps6906/tsd\\_products\\_support\\_model\\_home.html](http://www.cisco.com/en/US/products/ps6906/tsd_products_support_model_home.html)

## Displaying Context Configurations

You display context configurations by using the **show running-config context** command in Exec mode.

| Command                            | Purpose                                                                                              |
|------------------------------------|------------------------------------------------------------------------------------------------------|
| <b>show running-config context</b> | Displays all configured user contexts and their descriptions, resource classes, and allocated VLANs. |

## Displaying Domain Configurations

You display domain configurations by using the **show running-config domain** command in Exec mode.

| Command                           | Purpose                                                                                                             |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>show running-config domain</b> | Displays all configured domains and their objects (access control lists [ACLs], class maps, interfaces, and so on). |

## Displaying Resource Class Configurations

You display resource-class configurations by using the **show running-config resource-class** command in Exec mode.

| Command                                   | Purpose                                                                            |
|-------------------------------------------|------------------------------------------------------------------------------------|
| <b>show running-config resource-class</b> | Displays all configured resource classes and their resource allocation statements. |

## Displaying Role Configurations

You display role configurations by using the **show running-config role** command in Exec mode.

| Command                         | Purpose                                                                  |
|---------------------------------|--------------------------------------------------------------------------|
| <b>show running-config role</b> | Displays all configured roles, their descriptions, and associated rules. |

## Displaying Context Information

You display a list of contexts by using the **show context** command in Exec mode.

| Command                         | Purpose                                                                                                                                                                                                                                                                     |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show context</b> <i>name</i> | Displays a list of contexts, including the name, description, resource class, and interfaces<br><br>For the <i>name</i> argument, enter the unique identifier of an existing context as an unquoted text string with no spaces and a maximum of 64 alphanumeric characters. |

[Table 2-4](#) describes the fields in the **show context** command output.

**Table 2-4** Field Descriptions for the show context Command Output

| Field          | Description                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name           | Lists identifiers of all configured contexts. If you specify the <i>name</i> argument, the ACE displays the name of the context that you specify only. |
| Description    | Previously configured text description of the context.                                                                                                 |
| Resource-class | Resource class of which the context is a member.                                                                                                       |
| VLANs          | VLANs allocated to a user context from the Admin context.                                                                                              |

## Displaying Resource Allocation

You view the allocation for each resource across all resource classes and class members by using the **show resource allocation** command in Exec mode.



### Note

The **show resource allocation** command displays the resource allocation but does not show the actual resources being used. See the [“Displaying Virtualization Statistics”](#) section for more information about actual resource usage.

| Command                         | Purpose                                                                                  |
|---------------------------------|------------------------------------------------------------------------------------------|
| <b>show resource-allocation</b> | Displays the allocation for each resource across all resource classes and class members. |

Table 2-5 describes the fields in the **show resource allocation** command output.

**Table 2-5 Field Descriptions for the show resource allocation Command Output**

| Field     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter | Name of the resource that you can limit. See the “Configuring Virtualization” section for information about each resource.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Min       | Minimum percentage of the total system resources that is allocated for a parameter in the specified resource class. For the default resource class, the minimum value for each resource is 0.00 percent.<br><br><b>Note</b> For the Bandwidth Min value, this field does not display the percentage configured with the <b>limit resource all</b> command. The ACE includes the management traffic rate in addition to the throughput rate to calculate the value that appears in this field.                                                |
| Max       | Maximum percentage of the total system resources that is allocated to a parameter in the specified resource class. For the default resource class, the Max value for each resource is equal to the total Max value of all contexts using the default resource class. For example, if you configure two user contexts and do not associate them with a resource class, the ACE automatically assigns the default resource class. If the Admin context also uses the default resource class, the Max value would equal 300% for each resource. |
| Class     | Name of the resource class.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Displaying User Roles

You display the user roles by using the **show role** command.

| Command                      | Purpose                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show role</b> <i>name</i> | Displays the configured user roles (predefined and user-configured roles).<br><br>For the optional <i>name</i> argument, enter the unique identifier of the role as an unquoted text string with no spaces and a maximum of 64 alphanumeric characters. This parameter displays only the named role that you specify. To display all roles, enter the command without a name. |

Table 2-6 describes the fields in the **show role** command output.

**Table 2-6 Field Descriptions for the show role Command Output**

| Field           | Description                                                                                                                         |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Role            | Name of the role (for example, Admin).                                                                                              |
| Description     | Text that describes the role (for example, Administrator).                                                                          |
| Number of Rules | Number of rules associated with the role.                                                                                           |
| Rule            | Sequence number of the rule.                                                                                                        |
| Type            | Type of rule. Possible values are Permit or Deny.                                                                                   |
| Permission      | Permission level of the rule. The possible permission values ranked from highest to lowest, are Create, Modify, Debug, and Monitor. |
| Feature         | Software feature associated with the rule (for example, access-list).                                                               |

## Displaying Domains

You display information about the configured domains in the ACE by using the **show domain** command.

| Command                        | Purpose                                                                                                                                                                                                                                              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show domain</b> <i>name</i> | Displays the information about the configured domains in the ACE.<br>For the optional <i>name</i> argument, enter the unique identifier of an existing domain as an unquoted text string with no spaces and a maximum of 76 alphanumeric characters. |

Table 2-7 describes the fields in the **show domain** command output.

**Table 2-7 Field Descriptions for the show domain Command Output**

| Field       | Description                                                          |
|-------------|----------------------------------------------------------------------|
| Name        | Unique identifier of the domain.                                     |
| Object Type | List of objects associated with the domain (for example, Class-map). |
| Object Name | Configured identifier of the object.                                 |

## Displaying User Information

You display user and user account information by using the **show users** and **show user-account** commands.

| Command                                                                                             | Purpose                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show users</b> <i>name</i><br><br><b>Example:</b><br>host1/Admin# show users admin               | Displays the information for users that are currently logged in to the ACE.<br>For the optional <i>name</i> argument, enter the unique identifier of a user as an unquoted text string with no spaces and a maximum of 64 alphanumeric characters. |
| <b>show user-account</b> <i>name</i><br><br><b>Example:</b><br>host1/Admin# show user-account admin | Display user account information.<br>For the optional <i>name</i> argument, enter the unique identifier of a user as an unquoted text string with no spaces and a maximum of 64 alphanumeric characters.                                           |

Table 2-8 describes the fields in the **show users** command output.

**Table 2-8 Field Descriptions for the show users name Command Output**

| Field      | Description                                                                         |
|------------|-------------------------------------------------------------------------------------|
| User       | Name of user.                                                                       |
| Context    | Name of the context associated with the user.                                       |
| Line       | Port through which the user connected to the ACE (for example, pts/1).              |
| Login Time | Month, day, and time that the user logged in to the ACE (for example, Dec 7 20:11). |
| Location   | Location of the user expressed as an IP address.                                    |

**Table 2-8** Field Descriptions for the `show users name` Command Output (continued)

| Field     | Description                                                    |
|-----------|----------------------------------------------------------------|
| Role      | Role assigned to the user (for example, Admin).                |
| Domain(s) | Domain associated with the user (for example, default-domain). |

Table 2-9 describes the fields in the `show user-account` command output.

**Table 2-9** Field Descriptions for the `show user-account` Command Output

| Field          | Description                                                        |
|----------------|--------------------------------------------------------------------|
| User           | Name of the user.                                                  |
| Account Expiry | Date, if any, that the user account expires.                       |
| Roles          | Role assigned to the user (for example, Admin).                    |
| Domain         | Domain associated with the user (for example, default-domain).     |
| Context        | Name of the context associated with the user (for example, Admin). |

## Displaying Virtualization Statistics

You display the resource usage statistics for each context from the Admin context by using the `show resource usage` command in Exec mode.



### Note

The `show resource usage` command 100 percent Allocation Min and Allocation Max values for `conc-connections`, `proxy-connections`, and other parameters display the bidirectional connections (inbound leg and outbound leg) for both IXP processors in the ACE. For example, the maximum number of concurrent connections that the ACE supports is 4,000,000, but the `show resource usage` command displays a maximum `conc-connections` value of 8000000, which is equal to 4,000,000 unidirectional connection records for each network processor times two network processors.

| Command                                                                                                                                                                       | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>show resource usage</b></p> <p><b>Example:</b><br/>host1/Admin# show resource usage</p>                                                                                 | <p>Displays the resource usage statistics for each context. This is the default setting.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p><b>show resource usage all [counter [all   current   denied   peak [count_threshold]]]</b></p> <p><b>Example:</b><br/>host1/Admin# show resource usage all counter all</p> | <p>Displays the resource usage for each context. You can optionally specify the <b>counter</b> keyword to specify a counter name and an optional threshold.</p> <p>The <b>counter</b> keywords and arguments are as follows:</p> <ul style="list-style-type: none"> <li>• <b>all</b>—(Optional) Displays all statistics. This is the default setting.</li> <li>• <b>current</b>—(Optional) Displays the active concurrent instances or the current rate of the resource.</li> <li>• <b>denied</b>—(Optional) Displays the number of denied uses of the resource since the resource statistics were last cleared.</li> <li>• <b>peak</b>—(Optional) Displays the peak concurrent instances, or the peak rate of the resource since the statistics were last cleared, either by using the <b>clear stats all</b> command or because the device rebooted.</li> <li>• <i>count_threshold</i>—(Optional) Number above which resources are shown. Enter an integer from 0 to 4294967295. The default is 1. If the usage of the resource is below the number that you set, then the resource is not shown. If you specify <b>all</b> for the counter name, then the <i>count_threshold</i> applies to the current usage. To show all resources, set the <i>count_threshold</i> to <b>0</b>.</li> </ul> |
| <p><b>show resource usage counter [all   current   denied   peak [count_threshold]]]</b></p> <p><b>Example:</b><br/>host1/Admin# show resource counter denied 1000</p>        | <p>Specifies a counter name and an optional threshold for the resource usage statistics.</p> <p>See above for the syntax description of the <b>counter</b> keyword and associated keywords, arguments, and options.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

| Command                                                                                                                                                                                                                                                                | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>show resource usage context <i>name</i> [resource <i>resources</i>   rate <i>rates</i>] [counter [all   current   denied   peak [count_threshold]]]  <b>Example:</b> host1/Admin# show resource usage context C1 resource conc-connections counter denied 0</pre> | <p>Displays the resource usage for a specific context. The keywords, arguments, and options are as follows:</p> <ul style="list-style-type: none"> <li>• <i>name</i>—Displays the resource usage for the specified context. The <i>name</i> argument is case sensitive.</li> <li>• <b>resource</b> <i>resources</i>—Displays statistics for a specified resource. For the <i>resources</i> argument, enter one of the following keywords for the system resource: <ul style="list-style-type: none"> <li>– <b>acl-memory</b>—Displays the ACL memory usage.<br/>If a context has fewer ACL memory resources than the configured Allocation Minimum, the ACE displays the Actual Minimum value that you can assign to the context.</li> <li>– <b>all</b>—Displays the resource usage for all resources used by the specified context or contexts.</li> <li>– <b>conc-connections</b>—Displays the resource usage for the number of simultaneous connections.</li> <li>– <b>mgmt-connections</b>—Displays the resource usage for the number of management connections.</li> <li>– <b>probes</b>—Displays the resource usage for the probes.</li> <li>– <b>proxy-connections</b>—Displays the resource usage for the proxy connections.</li> <li>– <b>regexp</b>—Displays the resource usage for the regular expressions.<br/>If a context has fewer regexp resources than the configured Allocation Minimum, the ACE displays the Actual Minimum value that you can assign to the context.</li> <li>– <b>sticky</b>—Displays the resource usage for the sticky entries.<br/>If a context has fewer sticky resources than the configured Allocation Minimum, the ACE displays the Actual Minimum value that you can assign to the context.</li> </ul> </li> </ul> |

| Command                                                                                                                                                                                                                                                                 | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>- <b>syslogbuffer</b>—Displays the resource usage for the syslog buffer. The ACE assigns syslog buffers in increments of 1024. If the resource-class Allocation Minimum value was satisfied, then the Current field of the <b>show resource usage syslogbuffer</b> command would display the highest multiple of 1024 that is less than the Allocation Min value.</li> <li>- <b>xlates</b>—Displays the resource usage by Network Address Translation (NAT) and Port Address Translation (PAT) entries.</li> <li>• <b>rate rates</b>—Displays the rate per second for the specified connections or syslog messages. For the <i>rates</i> argument, enter one of the following keywords for the rate: <ul style="list-style-type: none"> <li>- <b>bandwidth</b>—Displays the bandwidth in bytes per second. To convert to bits per second, multiply the displayed value by 8.</li> <li>- <b>connections</b>—Displays connections per second.</li> <li>- <b>http-comp</b>—Displays the HTTP compression rate in bytes per second. To convert to bits per second, multiply the displayed value by 8.</li> <li>- <b>inspect-conn</b>—Displays RTSP/FTP inspection connections per second.</li> <li>- <b>mac-miss</b>—Displays MAC miss traffic that was punted to the CP packets per second.</li> <li>- <b>mgmt-traffic</b>—Displays management traffic bytes per second. To convert to bits per second, multiply the displayed value by 8.</li> <li>- <b>ssl-connections</b>—Displays Secure Sockets Layer (SSL) connections.</li> <li>- <b>syslog</b>—Displays the syslog message buffer usage.</li> </ul> </li> </ul> <p>See above for the syntax description of the optional <b>counter</b> keyword and associated arguments and options.</p> |
| <pre>show resource usage resource {resources}   rate {rates}} [counter [all   current   denied   peak [count_threshold]]] [counter [all   current   denied   peak [count_threshold]]]  <b>Example:</b> host1/Admin# show resource usage resource conc-connections</pre> | <p>Displays usage statistics for a specific resource.</p> <p>See above for the syntax description of the optional <b>resource</b>, <b>rate</b>, and <b>counter</b> keywords and their associated keywords, arguments, and options.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Command                                                                                                                                                                                                                                                           | Purpose                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>show resource usage summary [resource {resources}   rate {rates}] [counter [all   current   denied   peak [count_threshold]]]</pre> <p><b>Example:</b><br/> host1/Admin# show resource usage summary<br/> resource mgmt-connections counter all</p>          | <p>Displays the total resource usage for all contexts. For example, the denied column shows the items that have been denied for each context limit.</p> <p>See above for the syntax description of the optional <b>resource</b>, <b>rate</b>, and <b>counter</b> keyword and associated keywords, arguments, and options.</p> |
| <pre>show resource usage top [resource {resources}   rate {rates}] [counter [all   current   denied   peak [count_threshold]]]</pre> <p><b>Example:</b><br/> host1/Admin# show resource usage context<br/> C1 resource conc-connections counter<br/> denied 0</p> | <p>Displays the greatest <i>n</i> users of a single resource arranged from the highest to the lowest percentage of resources used. You must specify a single resource type.</p> <p>You cannot use the <b>resource all</b> keywords with this option.</p>                                                                      |

Table 2-10 describes the fields in the **show resource usage** command output.

**Table 2-10 Field Descriptions for the show resource usage Command Output**

| Field                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resource             | The name of the limited resource in each context. See the “ <a href="#">Configuring Virtualization</a> ” section for more information about each resource name.                                                                                                                                                                                                                                                                                                                                                                          |
| Current              | Active concurrent instances or the current rate of the resource.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Peak                 | Highest value of resource usage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Allocation (Min/Max) | Allocation minimum value that indicates the resource units that are guaranteed to be available to each context. The allocation maximum value indicates the resource units that may be available to each context and are shared among all contexts from the oversubscription pool. When you configure the maximum value as <b>equal-to-minimum</b> , the maximum value is automatically set to 0. When the allocation maximum value is 0, no additional resource units are available beyond the allocation minimum value to each context. |
| Denied               | Number of denied resources because of oversubscription or resource depletion.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Actual Min           | Minimum ACL, regexp, sticky, or syslog buffer resources that you can allocate to the context if the resource-class minimum cannot be met.                                                                                                                                                                                                                                                                                                                                                                                                |

## Clearing Resource Usage Statistics

You clear resource usage statistics by using the following command.

| Command                | Purpose                                                                                |
|------------------------|----------------------------------------------------------------------------------------|
| <b>clear stats all</b> | Clear all statistical information in a context along with the resource usage counters. |

# Configuration Examples for Virtualization

The following running-configuration example shows a basic virtualization configuration with one user-defined context, one resource class, one domain, and one user.

```
resource-class RC1
  limit-resource rate syslog minimum 10.00 maximum equal-to-min
  limit-resource acl-memory minimum 10.00 maximum unlimited

access-list ACL1 line 10 extended permit ip any any

rserver host RS1
  ip address 192.168.2.251
  inservice
rserver host RS2
  ip address 192.168.2.252
  inservice
serverfarm host SF1
  rserver RS1
    inservice
  rserver RS2
    inservice

domain D1
  add-object access-list extended ACL1
  add-object rserver RS1
  add-object rserver RS2
  add-object serverfarm SF1

role SLB-Admin

context C1
  allocate-interface vlan 100-200
  description accounting department
  member RC1

username JANE password 5 adropgijaeprgja9erjg2uWgtce1 role SLB-Admin domain D1
```







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