CHAPTER 10

Configuring the Embedded Event Manager

This chapter describes how to configure the Embedded Event Manager (EEM) to detect and handle critical events on a device.

This chapter includes the following sections:

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- Configuration Guidelines and Limitations, page 10-6
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Information About EEM

EEM monitors events that occur on your device and takes action to recover or troubleshoot these events, based on your configuration.

This section includes the following topics:

- EEM Overview, page 10-2
- Policies, page 10-2
- Event Statements, page 10-3
- Action Statements, page 10-4
- VSH Script Policies, page 10-4
- Environment Variables, page 10-4
- High Availability, page 10-5
- Virtualization Support, page 10-5

EEM Overview

EEM consists of three major components:

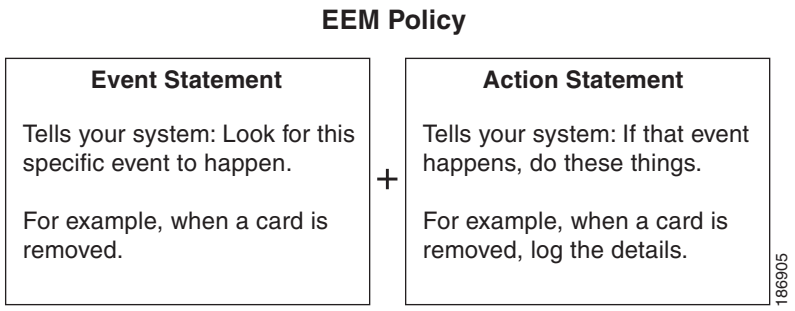
- Event statements—Events to monitor from another Cisco NX-OS component that may require some action, workaround, or notification.
- Action statements —An action that EEM can take, such as sending an e-mail, or disabling an interface, to recover from an event.
- Policies—An event paired with one or more actions to troubleshoot or recover from the event.

Policies

An EEM policy consists of an event statement and one or more action statements. The event statement defines the event to look for as well as the filtering characteristics for the event. The action statement defines the action EEM takes when the event occurs.

Figure 10-1 shows the two basic statements in an EEM policy.

Figure 10-1 EEM Policy Statements



You can configure EEM policies using the CLI or using a VSH script.

EEM gives you a device-wide view of policy management. You configure EEM policies on the supervisor, and EEM pushes the policy to the correct module(s) based on the event type. EEM takes any actions for a triggered event either locally on the module or on the supervisor (the default option).

EEM maintains event logs on the supervisor.

Cisco NX-OS has a number of preconfigured system policies. These system policies define many common events and actions for the device. System policy names begin with two underscore characters (__).

You can create user policies to suit your network. If you create a user policy, any actions in your policy occur after EEM triggers any system policy actions related to the same event as your policy. To configure a user policy, see the "Defining a User Policy Using the CLI" section on page 10-6.

You can also override some system policies. The overrides that you configure take the place of the system policy. You can override the event or the actions.

Use the **show event manager system-policy** command to view the preconfigured system policies and determine which policies that you can override.

To configure an overriding policy, see the "Overriding a Policy" section on page 10-13.

Note You should use the **show running-config eem** command to check the configuration of each policy. An override policy that consists of an event statement and no action statement triggers no action and no notification of failures.

Note Your override policy should always include an event statement. An override policy without an event statements overrides all possible events in the system policy.

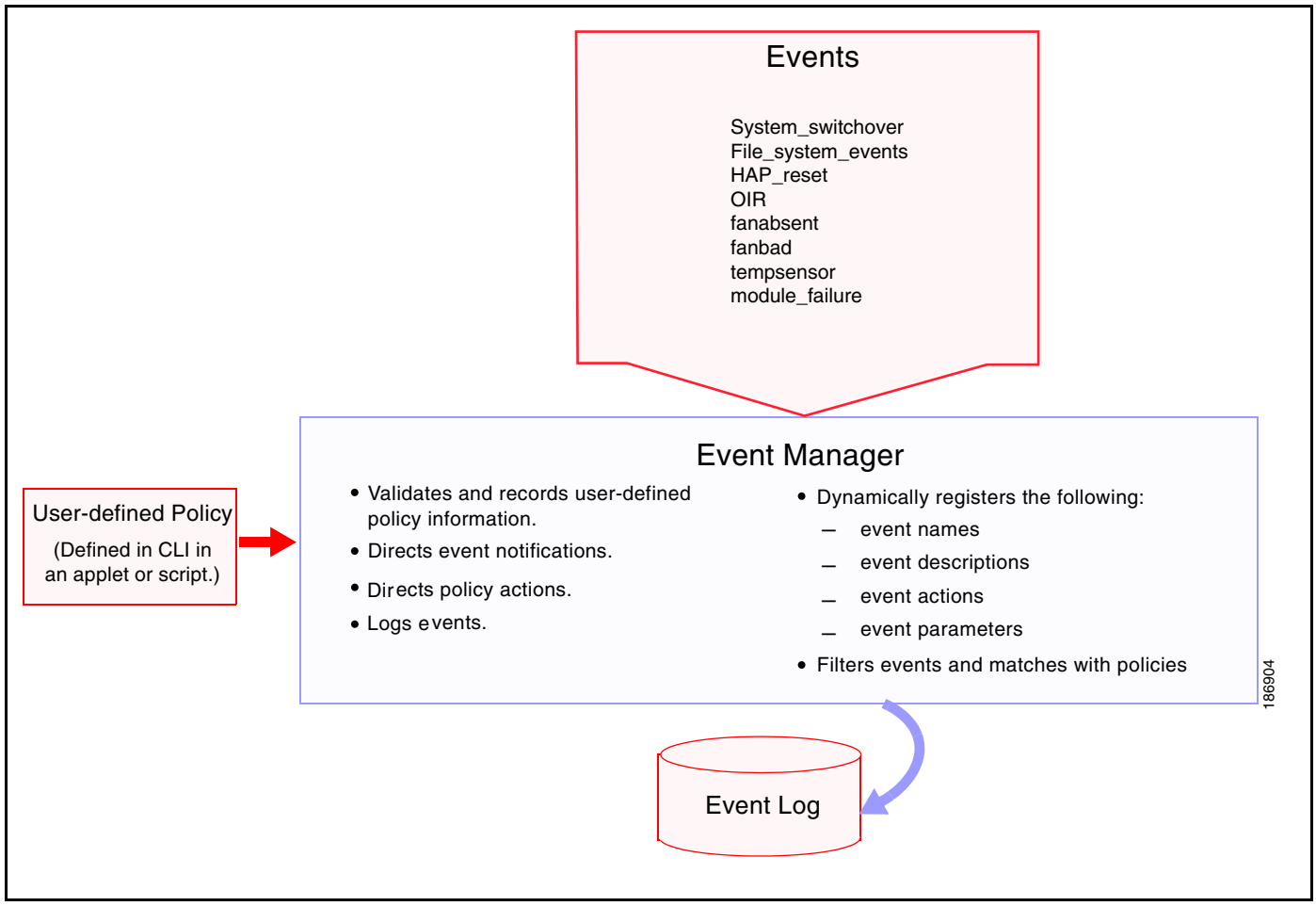
Event Statements

An event is any device activity for which some action, such as a work around or a notification, should be taken. In many cases, these events are related to faults in the device such as when an interface or a fan malfunctions.

EEM defines event filters so only critical events or multiple occurrences of an event within a specified time period trigger an associated action.

Figure 10-2 shows events that are handled by EEM.

Figure 10-2 EEM Overview



Event statements specify the event that triggers a policy to run. You can configure only one event statement per policy.

EEM schedules and runs policies on the basis of event statements. EEM examines the event and action commands and runs them as defined.

Action Statements

Action statements describe the action triggered by a policy. Each policy can have multiple action statements. If no action is associated with a policy, EEM still observes events but takes no actions.

EEM supports the following actions in action statements:

- Execute any CLI commands.
- Update a counter.
- Log an exception.
- Force the shut down of any module.
- Reload the device.
- Shut down specified modules because the power is over budget.
- Generate a syslog message.
- Generate a Call Home event.
- Generate an SNMP notification.
- Use the default action for the system policy.

Note Verify that your action statements within your user policy or overriding policy do not negate each other or adversely affect the associated system policy.

VSH Script Policies

You can also write policies in a VHS script, using a text editor. These policies have an event statement and action statement(s) just as other policies, and these policies can either augment or override system polices. After you write your script policy, copy it to the device and activate it. To configure a policy in a script, see the "Defining a Policy using a VSH Script" section on page 10-12.

Environment Variables

You can define environment variables for EEM that are available for all policies. Environment variables are useful for configuring common values that you can use in multiple policies. For example, you can create an environment variable for the IP address of an external e-mail server.

You can use an environment variable in action statements by using the parameter substitution format.

Example 10-1 shows a sample action statement to force a module 1 shutdown, with a reset reason of "EEM action."

Example 10-1 Action Statement

```
switch (config-eem-policy)# action 1.0 forceshut module 1 reset-reson "EEM action."
```

If you define an environment variable for the shutdown reason, called default-reason, you can replace that reset reason with the environment variable, as shown in Example 10-2.

Example 10-2 Action Statement with Environment Variable

```
switch (config-eem-policy)# action 1.0 foreshut module 1 reset-reason $default-reason
```

You can reuse this environment variable in any policy. For more information on environment variables, see the "Defining an Environment Variable" section on page 10-15.

High Availability

Cisco NX-OS supports stateless restarts for EEM. After a reboot or supervisor switchover, Cisco NX-OS applies the running configuration.

Virtualization Support

You configure EEM in the virtual device context (VDC) that you are logged into. By default, Cisco NX-OS places you in the default VDC. You must be in this VDC to configure policies for module-based events.

Not all actions or events are visible in all VDCs. You must have network-admin or vdc-admin privileges to configure policies.

See the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 4.0*. for more information on VDCs.

Licensing Requirements for EEM

The following table shows the licensing requirements for this feature:

Product	License Requirement
NX-OS	EEM requires no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you. For a complete explanation of the NX-OS licensing scheme, see the *Cisco Nexus 7000 Series NX-OS Licensing Guide, Release 4.0*.

Prerequisites for EEM

EEM has the following prerequisites:

- You must have network-admin or vdc-admin user privileges to configure EEM.

Configuration Guidelines and Limitations

EEM has the following configuration guidelines and limitations:

- Action statements within your user policy or overriding policy should not negate each other or adversely affect the associated system policy.
- An override policy that consists of an event statement and no action statement triggers no action and no notification of failures.
- An override policy without an event statement overrides all possible events in the system policy.

Configuring EEM

This section includes the following topics:

- Defining a User Policy Using the CLI, page 10-6
- Defining a Policy using a VSH Script, page 10-12
- Registering and Activating a VSH Script Policy, page 10-12
- Overriding a Policy, page 10-13

Defining a User Policy Using the CLI

You can define a user policy using the CLI.

This section includes the following topics:

- Configuring Event Statements, page 10-7
- Configuring Action Statements, page 10-9

BEFORE YOU BEGIN

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that you are logged in with administrator privileges.

SUMMARY STEPS

1. **config t**
2. **event manager applet** *applet-name*
3. **description** *policy-description*
4. **event** *event-statement*
5. **action** *number action-statement*
   (Repeat Step 5 for multiple action statements.)
6. **show event manager policy** *name*
7. **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**config t** **Example:** switch# config t switch(config)#	Enters configuration mode.
Step 2	**event manager applet** *applet-name* **Example:** switch(config)# event manager applet monitorShutdown switch(config-applet)#	Registers the applet with EEM and enters applet configuration mode. The *applet-name* can be any case-sensitive alphanumeric string up to 32 characters.
Step 3	**description** *policy-description* **Example:** switch(config-applet)# description "Monitors interface shutdown."	(Optional) Configures a descriptive string for the policy. The string can be any alphanumeric string up to 80 characters. Enclose the string in quotation marks.
Step 4	**event** *event-statement* **Example:** switch(config-applet)# event cli match "shutdown"	Configures the event statement for the policy. See the "Configuring Event Statements" section on page 10-7.
Step 5	**action** *action-statement* **Example:** switch(config-applet)# action 1.0 cli "show interface e 3/1"	Configures an action statement for the policy. See the "Configuring Action Statements" section on page 10-9. Repeat Step 5 for multiple action statements.
Step 6	**show event manager policy** *name* **Example:** switch(config-applet)# show event manager policy monitorShutdown	(Optional) Displays information about the configured policy.
Step 7	**copy running-config startup-config** **Example:** switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

Configuring Event Statements

Use one the following commands in EEM configuration mode to configure an event statement:

Command	Purpose
event cli match *expression* [**count** repeats | **time** *seconds*] **Example:** switch(config-applet)# event cli match "shutdown"	Triggers an event if you enter a CLI command that matches the regular expression. The *repeats* range is from 0 to 4294967295. The time range, in seconds, is from 0 to 4294967295.
event counter name *counter* **entry-val** *entry* **entry-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**} [**exit-val** *exit* **exit-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**}] **Example:** switch(config-applet)# event counter name mycounter entry-val 20 gt	Triggers an event if the counter crosses the entry threshold (based on the entry operation—greater than, less than, and so on.) The event resets immediately. Optionally, you can configure the event to reset after the counter passes the exit threshold. The *counter* name can be any case-sensitive, alphanumeric string up to 32 characters. The *entry* and *exit* value ranges are from 0 to 2147483647.
event fanabsent [**fan** *number*] **time** *seconds* **Example:** switch(config-applet)# event fanabsent time 300	Triggers an event if a fan is removed from the device for more than the configured time, in seconds. The *number* range is from 1 to 4. The *seconds* range is from 0 to 4294967295.
event fanbad [**fan** *number*] **time** *seconds* **Example:** switch(config-applet)# event fanbad time 3000	Triggers an event if a fan fails for more than the configured time, in seconds. The *number* range is from 1 to 4. The *seconds* range is from 0 to 4294967295.
event gold module {*slot* | **all**} **test** *test-name* [**severity** {**major** | **minor** | **moderate**}] **testing-type** {**bootup** | **monitoring** | **ondemand** | **scheduled**} **consecutive-failure** *count* **Example:** switch(config-applet)# event gold module 2 test ASICRegisterCheck testing-type ondemand consecutive-failure 2	Triggers an event if the named online diagnostic test experiences the configured failure severity for the configured number of consecutive failures. The *slot* range is from 1 to 10. The *test-name* is the name of a configured online diagnostic test. The *count* range is from 1 to 1000.
event memory {**critical** | **minor** | **severe**} **Example:** switch(config-applet)# event memory critical	Triggers an event if a memory threshold is crossed.
event module-failure type *failure-type* ***module*** {*slot* | **all**} **count** *repeats* [**time** *seconds*] **Example:** switch(config-applet)# event module-failure type lc-failed module 3 count 1	Triggers an event if a module experiences the failure type configured. See the *Cisco Nexus 7000 Series NX-OS System Management Command Reference, Release 4.0* for information on the failure types. The *slot* range is from 1 to 10. The *repeats* range is from 1 to 4294967295. The *seconds* range is from 1 to 4294967295.

Command	Purpose
event oir {**fan** | **module** | **powersupply**} {**anyoir** | **insert** | **remove**} [*number*] **Example:** switch(config-applet)# event oir fan remove 4	Triggers an event if the configured device element (fan, module, or power supply) is inserted or removed from the device. You can optionally configure a specific fan, module, or power supply number. The *number* range is as follows: • Fan number—The range is from 1 to 4. • Module number—The range is from 1 to 10. • Power supply number—The range is from 1 to 3.
event policy-default count *repeats* [**time** *seconds*] **Example:** switch(config-applet)# event policy-default count 3	Uses the event configured in the system policy. Use this option for overriding policies. The *repeats* range is from 1 to 4294967295. The *seconds* range is from 1 to 4294967295.
event poweroverbudget [**time** *seconds*] **Example:** switch(config-applet)# event poweroverbudget	Triggers an event if the power budget exceeds the capacity of the configured power supplies.
event snmp oid *oid* **get-type** {**exact** | **next**} **entry-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**} **entry-val** *entry* [**exit-comb** {**and** | **or**}] **exit-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**} **exit-val** *exit* **exit-time** *time* **polling-interval** *interval* **Example:** switch(config-applet)# event snmp oid 1.3.6.1.2.1.31.1.1.1.6 get-type next entry-op lt 300 entry-val 0 exit-op eq 400 exit-time 30 polling-interval 300	Triggers an event if the SNMP OID crosses the entry threshold (based on the entry operation—greater than, less than, and so on.) The event resets immediately or optionally, you can configure the event to reset after the counter passes the exit threshold. The OID is in dotted decimal notation. The *entry* and *exit* value ranges are from 0 to 18446744073709551615. The time and interval range, in seconds, is from 0 to 2147483647.
event storm-control **Example:** switch(config-applet)# event storm-control	Triggers an event if traffic on a port exceeds the configured storm control threshold.
event temperature [**module** *slot*] [*sensor number*] **threshold** {**any** | **major** | **minor**} **Example:** switch(config-applet)# event temperature module 2 threshold any	Triggers an event if the temperature sensor exceeds the configured threshold. The *slot* range is from 1 to 10. The sensor range is from 1 to 18.
event track *object-number* **state** {**any** | **down** | **up**} **Example:** switch(config-applet)# event track 1 state down	Triggers an event if the tracked object is in the configured state. The *object-numbe*r range is from 1 to 500.

Configuring Action Statements

Use the following commands in EEM configuration mode to configure action statements:

Command	Purpose
action *number*[.*number2*] **cli** *command1* [command2...] [**local**] **Example:** switch(config-applet)# action 1.0 cli "show interface e 3/1"	Executes the configured CLI commands. You can optionally execute the commands on the module where the event occurred. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9.
action *number*[.*number2*] **counter name** *counter* **value** *val* **op** {**dec** | **inc** | **nop** | **set**} **Example:** switch(config-applet)# action 2.0 counter name mycounter value 20 op inc	Modifies the counter by the configured value and operation. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The counter name can be any case-sensitive, alphanumeric string up to 32 characters. The *val* can be an integer from 0 to 2147483647 or a substituted parameter.
action *number*[.*number2*] **event-default** **Example:** switch(config-applet)# action 1.0 event-default.	Executes the default action for the associated event. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9.
action *number*[.*number2*] **forceshut** [**module** *slot* | **xbar** xbar-*number*] **reset-reason** *seconds* **Example:** switch(config-applet)# action 1.0 forceshut module 2 reset-reason "flapping links"	Forces a module, crossbar, or the entire system to shut down. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *slot* range is from 1 to 10, or a substituted parameter. The *xbar-number* range is from 1 to 4 or a substituted parameter. The reset reason is a quoted alphanumeric string up to 80 characters.
action *number*[.*number2*] **overbudgetshut** [**module** *slot* [**-** *slot*]] **Example:** switch(config-applet)# action 1.0 overbudgetshut module 3-5	Forces one or more modules or the entire system to shut down because of a power overbudget issue. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *slot* range is from 1 to 10, or a substituted parameter.
action *number*[.*number2*] **policy-default** **Example:** switch(config-applet)# action 1.0 policy-default.	Executes the default action for the policy that you are overriding. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9.

Command	Purpose
action *number*[.*number2*] **reload** [**module** *slot* [**-** *slot*]] **Example:** switch(config-applet)# action 1.0 reload module 3-5	Forces one or more modules or the entire system to reload. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *slot* range is from 1 to 10, or a substituted parameter.
action *number*[.*number2*] **snmp-trap** {[**intdata1** *data* [**intdata2** *data*] [strdata string]} **Example:** switch(config-applet)# action 1.0 snmp-trap strdata "temperature problem"	Sends an snmp trap with the configured data. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *data* arguments can by any number up to 80 digits. The *string* can be any alphanumeric string up to 80 characters.
action *number*[.*number2*] **syslog** [**priority** *prio-val*] **msg** *error-message* **Example:** switch(config-applet)# action 1.0 syslog priority notifications msg "cpu high"	Sends a customized syslog message at the configured priority.*number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *error-message* can be any quoted alphanumeric string up to 80 characters.

Defining a Policy using a VSH Script

You can define a policy using a VSH script.

BEFORE YOU BEGIN

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that you are logged in with administrator privileges.

Ensure that your script name is the same name as the script filename.

DETAILED STEPS

Step 1 In a text editor, list the CLI commands that define the policy.

Step 2 Name the text file and save it.

Step 3 Copy the file to the following system directory:

bootflash://eem/user_script_policies

Registering and Activating a VSH Script Policy

You can register and activate a policy defined in a VSH script.

BEFORE YOU BEGIN

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that you are logged in with administrator privileges.

SUMMARY STEPS

1. **config t**
2. **event manager policy** *policy-script*
3. **show event manager policy** *name*
4. **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**config t** **Example:** switch# config t switch(config)#	Enters configuration mode.
Step 2	**event manager policy** *policy-script* **Example:** switch(config)# event manager policy moduleScript	Registers and activates an EEM script policy. The *policy-script* can be any case-sensitive alphanumeric string up to 32 characters.
Step 3	**show event manager policy** *name* **Example:** switch(config-applet)# show event manager policy moduleScript	(Optional) Displays information about the configured policy.
Step 4	**copy running-config startup-config** **Example:** switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

Overriding a Policy

You can override a system policy.

BEFORE YOU BEGIN

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that you are logged in with administrator privileges.

Ensure that you know the event and default actions for the policy that you are overriding.

SUMMARY STEPS

1. **config t**
2. **show event manager policy-state** *system-policy*
3. **event manager applet** *applet-name* **override** *system-policy*
4. **description** *policy-description*
5. **event** *event-statement*
6. **action** *number action-statement*
   (Repeat Step 6 for multiple action statements.)
7. **show event manager policy-state** *name*
8. **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**config t** **Example:** switch# config t switch(config)#	Enters configuration mode.
Step 2	**show event manager policy-state** *system-policy* **Example:** switch(config-applet)# show event manager policy-state __ethpm_link_flap Policy __ethpm_link_flap Cfg count : 5 Cfg time interval : 10.000000 (seconds) Hash default, Count 0	(Optional) Displays information about the system policy that you want to override, including thresholds. Use the **show event manager system-policy** command to find the system policy names.
Step 3	**event manager applet** *applet-name* **override** *system-policy* **Example:** switch(config)# event manager applet ethport override __ethpm_link_flap switch(config-applet)#	Overrides a system policy and enters applet configuration mode. The *applet-name* can be any case-sensitive alphanumeric string up to 32 characters. The *system-policy* must be one of the existing system policies.
Step 4	**description** *policy-description* **Example:** switch(config-applet)# description "Overrides link flap policy."	(Optional) Configures a descriptive string for the policy. The string can be any alphanumeric string up to 80 characters. Enclose the string in quotation marks.
Step 5	**event** *event-statement* **Example:** switch(config-applet)# event policy-default count 2 time 1000	Configures the event statement for the policy. See the "Configuring Event Statements" section on page 10-7.
Step 6	**action** *action-statement* **Example:** switch(config-applet)# action 1.0 syslog priority warnings msg "Link is flapping."	Configures an action statement for the policy. See the "Configuring Action Statements" section on page 10-9. Repeat Step 6 for multiple action statements.
Step 7	**show event manager policy-state** *name* **Example:** switch(config-applet)# show event manager policy-state ethport	(Optional) Displays information about the configured policy.
Step 8	**copy running-config startup-config** **Example:** switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

Defining an Environment Variable

You can define a variable to serve as a parameter in an EEM policy.

BEFORE YOU BEGIN

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **config t**
2. **event manager environment** *variable-name variable-value*
3. **show event manager environment**
4. **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	**event manager environment** *variable-name variable-value* **Example:** `switch(config)# event manager environment emailto "admin@anyplace.com"`	Create an environment variable for EEM. The *variable-name* can be any case-sensitive alphanumeric string up to 32 characters. The *variable-value* can be any quoted alphanumeric string up to 32 characters,
Step 3	**show event manager environment** **Example:** `switch(config-applet)# show event manager environment`	(Optional) Displays information about the configured environment variables.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves this configuration change.

Verifying EEM Configuration

To display EEM configuration information, perform one of the following tasks:

Command	Purpose
show event manager environment [*variable-name* | **all**]	Displays information about the event manager environment variables.
show event manager event-types [*event* | **all** | **module** *slot*]	Displays information about the event manager event types.

Command	Purpose
show event manager history events [**detail**] [**maximum** *num-events*] [**severity** {**catastrophic** | **minor** | **moderate** | **severe**}]	Displays the history of events for all policies.
show event manager policy [*policy-name*] [**inactive**]	Displays information about the configured policies.
show event manager policy-state *policy-name*	Displays information about policy state, including thresholds.
show event manager script system [*policy-name* | **all**]	Displays information about the script policies.
show event manager system-policy [**all**]	Displays information about the predefined system policies.
show running-config eem	Displays information about the running configuration for EEM.
show startup-config eem	Displays information about the startup configuration for EEM.

EEM Example Configuration

This example overrides the __lcm_module_failure system policy by changing the threshold for just module 3 hitless upgrade failures. This example also sends a syslog message. The settings in the system policy, __lcm_module_failure, apply in all other cases.

```
event manager applet example2 override __lcm_module_failure
 event module-failure type hitless-upgrade-failure module 3 count 2
 action 1 syslog priority errors msg module 3 "upgrade is not a hitless upgrade!"
 action 2 policy-default
```

This example overrides the __ethpm_link_flap system policy and shuts down the interface.

```
event manager applet ethport override __ethpm_link_flap
  event policy-default count 2 time 1000
  action 1 cli conf t
  action 2 cli int et1/1
  action 3 cli no shut
```

Default Settings

Table 10-1 lists the default settings for EEM parameters.

Table 10-1 Default EEM Parameters

Parameters	Default
system policies	active

Additional References

For additional information related to implementing EEM, see the following sections:

- Related Documents, page 10-17
- Standards, page 10-17

Related Documents

Related Topic	Document Title
EEM CLI commands	*Cisco Nexus 7000 Series NX-OS System Management Configuration Guide, Release 4.0* at the following URL: http://www.cisco.com/en/US/docs/switches/datacenter/sw/4_0/nx-os/system_management/configuration/guide/sm_nx-os_config.html
VDCs	*Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 4.0* at the following URL: http://www.cisco.com/en/US/docs/switches/datacenter/sw/4_0/nx-os/virtual_device_context/configuration/guide/vdc_nx-os_book.html

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—