Device Sensor

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Device Sensor feature is used to gather raw endpoint data from network devices using protocols such as Cisco Discovery Protocol (CDP), Link Layer Discovery Protocol (LLDP), and DHCP. The endpoint data is made available to registered clients in the context of an access session.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Contents of this Guide

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About Device Sensor

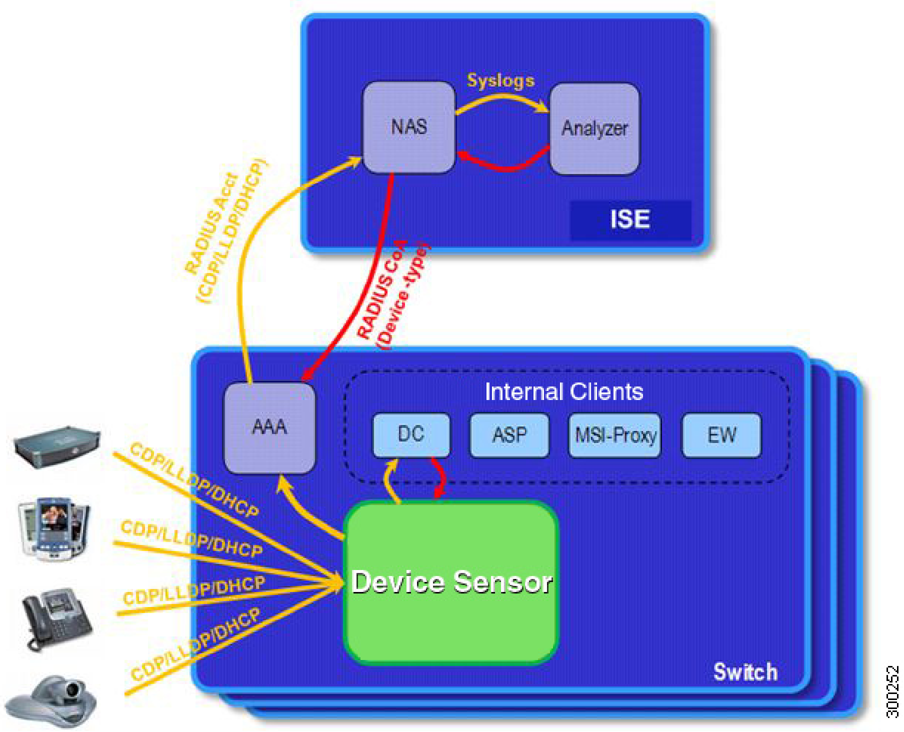
Device Sensor introduces the device-sensor capability, which is used to gather raw endpoint data from network devices. The endpoint information aids in completing the profiling capability of switches. Profiling is the determination of the endpoint type based on information gleaned from various protocol packets from an endpoint during its connection to a network.

The profiling capability consists of two parts:

- Collector--Gathers endpoint data from network devices.
- Analyzer--Processes the data and determines the type of device.

Device Sensor represents the embedded collector functionality. The illustration below shows Device Sensor in the context of the profiling system and also features other possible clients of the sensor.

Figure 1 Device Sensor and Its Clients



A switch with sensor capability gathers endpoint information from network devices using protocols such as Cisco Discovery Protocol (CDP), LLDP, and DHCP, subject to statically configured filters, and makes this information available to its registered clients in the context of an access session. An access session represents an endpoint's connection to the network device.

Device Sensor has internal and external clients. The internal clients include components such as the embedded Device Classifier (local analyzer), ASP, MSI-Proxy, and EnergyWise (EW). The external client, that is the Identity Services Engine (ISE) analyzer, will use RADIUS accounting to receive additional endpoint data.

Client notifications and accounting messages containing profiling data along with the session events, and other session-related data, such as MAC address and ingress port are generated and sent to the internal and external clients (ISE). By default, for each supported peer protocol, client notifications and accounting events are only generated where an incoming packet includes a TLV that has not previously been received in the context of a given session. You can enable client notifications and accounting events for all TLV changes, where either a new TLV has been received or a previously received TLV has been received with a different value using CLI commands.

Device Sensor's port security protects the switch from consuming memory and crashing during deliberate or unintentional denial-of-service (DoS) type attack. The sensor limits the maximum device monitoring sessions to 32 per port (access ports and trunk ports). In case of lack of activity from hosts, the age session time is 12 hours.

How to Configure Device Sensor

Device Sensor is enabled by default. These tasks are applicable only if you want to configure the sensor based on your specific requirements.

Note If you do not perform these configuration tasks, then the following TLVs are included by default:

- Cisco Discovery Protocol filter--secondport-status-type and powernet-event-type (type 28 and 29)
- LLDP filter--organizationally-specific (type 127)
- DHCP filter--message-type (type 53)

Enabling Accounting Augmentation

For the sensor protocol data to be added to the accounting messages, you must enable session accounting by using the following standard Authentication, Authorization, and Accounting (AAA), and RADIUS configuration commands:

```
Switch(config)# aaa new-model
Switch(config)# aaa accounting dot1x default start-stop group radius
Switch(config)# radius-server host{hostname|ip-address}[auth-port
port-number][acct-port port-number][timeout seconds][retransmit retries][key string]
Switch(config)# radius-server vsa send accounting
```

Beginning in privileged EXEC mode, follow these steps to add Device Sensor protocol data to accounting records.

	Command	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**device-sensor accounting** **Example:** `Switch(config)# device-sensor accounting`	Enables the addition of sensor protocol data to accounting records and also enables the generation of additional accounting events when new sensor data is detected.

Step 3	**end**
	Example:
	`Switch(config)# end`
		Returns to privileged EXEC mode.

Creating a Cisco Discovery Protocol Filter

Beginning in privileged EXEC mode, follow these steps to create a Cisco Discovery Protocol filter containing a list of TLVs that can be included or excluded in Device Sensor output.

	Command	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**device-sensor filter-list cdp list tlv-list-name** **Example:** `Switch(config)# device-sensor filter-list cdp list cdp-list`	Creates a TLV list and enters CDP sensor configuration mode, where you can configure individual TLVs.

Step 3	**tlv** {**name'***tlv-name* | **number** *tlv-number*}
	Example:
	`Switch(config-sensor-cdplist)# tlv number 10`
		Adds individual CDP TLVs to the TLV list. You can delete the TLV list without individually removing TLVs from the list by using the **no device-sensor filter-list cdp list tlv-list-name** command.

Step 4	**end**
	Example:
	`Switch(config-sensor-cdplist)# end`
		Returns to privileged EXEC mode.

Creating an LLDP Filter

Beginning in privileged EXEC mode, follow these steps to create an LLDP filter containing a list of TLVs that can be included or excluded in Device Sensor output.

	Command	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**device-sensor filter-list lldp list tlv-list-name** **Example:** `Switch(config)# device-sensor filter-list lldp list lldp-list`	Creates a TLV list and enters LLDP sensor configuration mode, where you can configure individual TLVs.

Step 3	**tlv** {**name** *tlv-name* | **number** *tlv-number*}
	Example:
	`Switch(config-sensor-cdplist)# tlv number 10`
		Adds individual LLDP TLVs to the TLV list. You can delete the TLV list without individually removing TLVs from the list by using the **no device-sensor filter-list lldp list tlv-list-name** command.

Step 4	**end**
	Example:
	`Switch(config-sensor-lldplist)# end`
		Returns to privileged EXEC mode.

Creating a DHCP Filter

Beginning in privileged EXEC mode, follow these steps to create a DHCP filter containing a list of options that can be included or excluded in Device Sensor output.

	Command	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**device-sensor filter-list dhcp list option-list-name** **Example:** `Switch(config)# device-sensor filter-list dhcp list dhcp-list`	Creates an options list and enters DHCP sensor configuration mode, where you can configure individual options.

	Command	Purpose

Step 3	**option** {**name** *option-name* | **number** *option-number*}
	Example:
	`Switch(config-sensor-dhcplist)# option number 50`
		Adds individual DHCP options to the option list. You can delete the option list without individually removing options from the list by using the **no device-sensor filter-list dhcp list option-list-name** command.

Step 4	**end**
	Example:
	`Switch(config)# end`
		Returns to privileged EXEC mode.

Applying a Protocol Filter to Device Sensor Output

Beginning in privileged EXEC mode, follow these steps to apply a CDP, LLDP, or DHCP filter to the sensor output. The output is session notifications to internal sensor clients and accounting requests.

	Command	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.

Step 2	**device-sensor filter-spec** {**cdp** | **dhcp** | **lldp**} {**exclude** {**all** | **list list-name**} | **include list list-name**}
	Example:
	`Switch(config)# device-sensor filter-spec cdp include list list1`
		Applies a specific protocol filter containing a list of TLV fields to Device Sensor output.
		• **cdp**--Applies a CDP TLV filter list to Device Sensor output.
		• **lldp**--Applies an LLDP TLV filter list to Device Sensor output.
		• **dhcp**--Applies a DHCP TLV filter list to Device Sensor output.
		• **exclude**--Specifies the TLVs that must be excluded from Device Sensor output.
		• **include**--Specifies the TLVs that must be included from Device Sensor output.
		• **all**--Disables all notifications for the associated protocol.
		• **list list-name**--Protocol TLV filter list name.

Step 3	**end**
	Example:
	`Switch(config)# end`
		Returns to privileged EXEC mode.

Tracking TLV Changes

Beginning in privileged EXEC mode, follow these steps to enable client notifications and accounting events for all TLV changes. By default, for each supported peer protocol, client notifications and accounting events will only be generated where an incoming packet includes a TLV that has not previously been received in the context of a given session.

	Command	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**device-sensor notify all-changes** **Example:** `Switch(config)# device-sensor notify all-changes`	Enables client notifications and accounting events for all TLV changes, that is, where either a new TLV is received or a previously received TLV is received with a new value in the context of a given session. **Note** Use the default device-sensor notify or the device-sensor notify new-tlvs command to return to the default TLV.

Step 3	**end**
	Example:
	`Switch(config)# end`
		Returns to privileged EXEC mode.

Verifying Device Sensor Configuration

Beginning in privileged EXEC mode, follow these steps to verify the sensor cache entries for all devices.

	Command	Purpose
Step 1	**show device-sensor cache mac mac-address**	Displays sensor cache entries (the list of protocol TLVs or options received from a device) for a specific device.
Step 2	**show device-sensor cache all** **Example:** `Switch(config)# device-sensor notify all-changes`	Displays sensor cache entries for all devices.

Here is an example for the **show device-sensor cache mac mac-address** privileged EXEC command.

```
Switch# show device-sensor cache mac 0024.14dc.df4d

Device: 0024.14dc.df4d on port GigabitEthernet1/0/24
--------------------------------------------------
Proto Type:Name                       Len Value
cdp     26:power-available-type        16 00 1A 00 10 00 00 00 01 00 00 00 00 FF FF FF FF
cdp     22:mgmt-address-type           17 00 16 00 11 00 00 00 01 01 01 CC 00 04 09 1B 65
                                          0E
cdp     11:duplex-type                  5 00 0B 00 05 01
cdp      9:vtp-mgmt-domain-type         4 00 09 00 04
cdp      4:capabilities-type            8 00 04 00 08 00 00 00 28
cdp      1:device-name                 14 00 01 00 0E 73 75 70 70 6C 69 63 61 6E 74
lldp     0:end-of-lldpdu                2 00 00
lldp     8:management-address          14 10 0C 05 01 09 1B 65 0E 03 00 00 00 01 00
lldp     7:system-capabilities          6 0E 04 00 14 00 04
lldp     4:port-description            23 08 15 47 69 67 61 62 69 74 45 74 68 65 72 6E 65
                                          74 31 2F 30 2F 32 34
lldp     5:system-name                 12 0A 0A 73 75 70 70 6C 69 63 61 6E 74
dhcp    82:relay-agent-info            20 52 12 01 06 00 04 00 18 01 18 02 08 00 06 00 24
                                          14 DC DF 80
dhcp    12:host-name                   12 0C 0A 73 75 70 70 6C 69 63 61 6E 74
dhcp    61:client-identifier           32 3D 1E 00 63 69 73 63 6F 2D 30 30 32 34 2E 31 34
                                          64 63 2E 64 66 34 64 2D 47 69 31 2F 30 2F 32 34
dhcp    57:max-message-size             4 39 02 04 80
```

Here is an example for the **show device-sensor cache all** privileged EXEC command.

```
Switch# show device-sensor cache all

Device: 001c.0f74.8480 on port GigabitEthernet2/1
--------------------------------------------------
Proto Type:Name Len Value
dhcp 52:option-overload 3 34 01 03
dhcp 60:class-identifier 11 3C 09 64 6F 63 73 69 73 31 2E 30
dhcp 55:parameter-request-list 8 37 06 01 42 06 03 43 96
dhcp 61:client-identifier 27 3D 19 00 63 69 73 63 6F 2D 30 30 31 63 2E 30 66
37 34 2E 38 34 38 30 2D 56 6C 31
dhcp 57:max-message-size 4 39 02 04 80
Device: 000f.f7a7.234f on port GigabitEthernet2/1
--------------------------------------------------
Proto Type:Name Len Value
cdp 22:mgmt-address-type 8 00 16 00 08 00 00 00 00
cdp 19:cos-type 5 00 13 00 05 00
cdp 18:trust-type 5 00 12 00 05 00
cdp 11:duplex-type 5 00 0B 00 05 01
cdp 10:native-vlan-type 6 00 0A 00 06 00 01
cdp 9:vtp-mgmt-domain-type 9 00 09 00 09 63 69 73 63 6F
```

Troubleshooting Tips

The following commands can help troubleshoot Device Sensor.

- **debug device-sensor** {**errors** | **events**}
- **debug authentication all**

Restrictions for Device Sensor

- Only CDP, LLDP, and DHCP protocols are supported.
- The Session limit for profiling ports is 32.
- The length of one TLV must not be more than 1024 and the total length of TLVs (combined length of TLVs) of all protocols must not be more than 4096.
- The sensor profiles devices that are only one hop away.

Configuration Examples for Device Sensor Feature

The following example shows how to create a CDP filter containing a list of TLVs:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-list cdp list cdp-list
Switch(config-sensor-cdplist)# tlv name address-type
Switch(config-sensor-cdplist)# tlv name device-name
Switch(config-sensor-cdplist)# tlv number 34
Switch(config-sensor-cdplist)# end
```

The following example shows how to create an LLDP filter containing a list of TLVs:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-list lldp list lldp-list
Switch(config-sensor-lldplist)# tlv name chassis-id
Switch(config-sensor-lldplist)# tlv name management-address
Switch(config-sensor-lldplist)# tlv number 28
Switch(config-sensor-lldplist)# end
```

The following example shows how to create a DHCP filter containing a list of options:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-list dhcp list dhcp-list
Switch(config-sensor-lldplist)# option name domain-name
Switch(config-sensor-lldplist)# option name host-name
Switch(config-sensor-lldplist)# option number 50
Switch(config-sensor-lldplist)# end
```

The following example shows how to apply a CDP TLV filter list to Device Sensor output:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-spec cdp include cdp-list1
```

The following example shows how to enable client notifications and accounting events for all TLV changes:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor notify all-changes
```

Additional References

Here are some additional references for Device Sensor feature.

Related Documents

Related Topic	Document Title
Device Sensor with Cisco Identity Services Engine (ISE)	Cisco Identity Services Engine User Guide: Configuring Endpoint Profiling Policies
Cisco IOS Commands	Cisco IOS Master Commands List, All Releases
Security Commands	• Cisco IOS Security Command Reference: Commands A to C • Cisco IOS Security Command Reference: Commands D to L • Cisco IOS Security Command Reference: Commands M to R • Cisco IOS Security Command Reference: Commands S to Z

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Device Sensor

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Feature Name	Releases	Feature Information
Device Sensor	15.0(1)SE1	Device Sensor feature is used to gather raw endpoint data from network devices using protocols such as Cisco Discovery Protocol, Link Layer Discovery Protocol (LLDP), and DHCP. The endpoint data that is gathered is made available to registered clients in the context of an access session. The following commands were introduced or modified: **debug device-sensor**, **device-sensor accounting**, **device-sensor filter-list cdp**, **device-sensor filter-list dhcp**, **device-sensor filter-list lldp**, **device-sensor filter-spec**, **device-sensor notify**, and **show device-sensor cache**.

Device Sensor Commands

This section contains the command references for Device Sensor feature.

device-sensor accounting

To add Device Sensor protocol data to accounting records and to generate additional accounting events when new sensor data is detected, use the **device-sensor accounting** command in global configuration mode. To disable adding Device Sensor protocol data to accounting records and to disable generating accounting events, use the **no** form of this command.

device-sensor accounting

no device-sensor accounting

Syntax Description

This command has no arguments or keywords.

Defaults

Device Sensor protocol data is added to the accounting records and additional accounting events are generated when new sensor data is detected.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)SE1	This command was introduced.

Usage Guidelines

Device Sensor is used to glean endpoint information from Cisco Discovery Protocol (CDP), Link Layer Discovery Protocol (LLDP), and DHCP messages and make this information available to registered clients in the context of an access session. You can use the device-sensor accounting command to include the data gleaned by Device Sensor in RADIUS accounting messages.

For the sensor-protocol data to be added to the accounting messages, you must enable session accounting by using the following standard AAA and RADIUS configuration commands:

```
Switch(config)# aaa new-model
Switch(config)# aaa accounting dot1x default start-stop group radius
Switch(config)# radius-server host{hostname|ip-address}[auth-port port-number][acct-port
port-number][timeout seconds][retransmit retries][key string]
Switch(config)# radius-server vsa send accounting
```

Examples

The following example shows how to add Device Sensor protocol data to the accounting records:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor accounting
```

Related Commands

Command	Description
debug device-sensor	Enables debugging for Device Sensor.
show device-sensor cache	Displays Device Sensor cache entries.

device-sensor filter-spec

To apply a specific protocol filter containing a list of Type-Length-Value (TLV) fields to Device Sensor output, use the **device-sensor filter-spec** command in global configuration mode. To remove the protocol filter list from Device Sensor output, use the **no** form of this command.

device-sensor filter-spec {cdp | dhcp | lldp} {exclude {all | list list-name} | include list list-name}

Syntax Description

cdp	Applies a Cisco Discovery Protocol TLV filter list to Device Sensor output.
dhcp	Applies a DHCP TLV filter list to Device Sensor output.
lldp	Applies a Link Layer Discovery Protocol (LLDP) TLV filter list to Device Sensor output.
exclude	Specifies the TLVs that should be excluded from Device Sensor output.
all	Disables all notifications for the associated protocol.
list list-name	Name of the protocol TLV filter list.
include	Specifies the TLVs that should be included in Device Sensor output.

Defaults

All TLVs are included in notifications and will trigger notifications.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)SE1	This command was introduced.

Usage Guidelines

Use the device-sensor filter-spec command to specify the TLVs that must be included in all sensor outputs (session notifications sent to internal sensor clients and accounting requests).

Certain TLVs and message types such as DISCOVER, OFFER, REQUEST, ACK, and IP address are unconditionally excluded because they are used as transport for higher layer protocols and will change frequently without conveying any useful information about the endpoint.

OFFER messages will also be ignored as they may be received from multiple servers and will not convey any useful endpoint data.

Examples

The following example shows how to apply a Cisco Discovery Protocol TLV filter list to Device Sensor output:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-spec cdp include cdp-list1
```

Related Commands

Command	Description
debug device-sensor	Enables debugging for Device Sensor.
device-sensor accounting	Adds Device Sensor protocol data to accounting records and generates additional accounting events when new sensor data is detected.
device-sensor filter-list cdp	Creates a Cisco Discovery Protocol filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list dhcp	Creates a DHCP filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list lldp	Creates an LLDP filter containing a list of TLV fields that can be included or excluded in Device Sensor output.
show device-sensor cache	Displays Device Sensor cache entries.

device-sensor filter-list dhcp

To create a Dynamic Host Configuration Protocol (DHCP) filter containing a list of options that can be included or excluded in Device Sensor output, use the **device-sensor filter-list dhcp** command in global configuration mode. To remove the DHCP filter containing the list of options, use the **no** form of this command.

device-sensor filter-list dhcp list ***option-list-name***

no device-sensor filter-list dhcp list ***option-list-name***

Syntax Description

list	Contains a DHCP options filter list.
option-list-name	DHCP options filter list name.

Defaults

DHCP options filter list is not available.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)SE1	This command was introduced.

Usage Guidelines

Use the **device-sensor filter-list dhcp list option-list-name** command to configure the name of the DHCP options filter list and enter into DHCP sensor configuration mode. You can configure the list of options in DHCP sensor configuration mode using the **option** {**name** *option-name* | **number** *option-number*} command. Use the **name** *option-name* keyword-argument pair to specify the name of the TLV. Enter **?** for querying the available TLV names. Use the **number** *option-number* keyword-argument pair to specify the TLV number to be added to the DHCP options filter list.

Use the **no option** {**name** *option-name* | **number** *option-number*} command to remove individual options from the DHCP options filter list.

Use the **no device-sensor filter-list dhcp list** *option-list-name* command to remove the entire TLV list containing all the TLVs.

Examples

The following example shows how to create a DHCP filter containing a list of options:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-list dhcp list dhcp-list
Switch(config-sensor-dhcplist)# option name domain-name
Switch(config-sensor-dhcplist)# option name host-name
Switch(config-sensor-dhcplist)# option number 50
Switch(config-sensor-dhcplist)# end
```

Related Commands

Command	Description
debug device-sensor	Enables debugging for Device Sensor.
device-sensor accounting	Adds Device Sensor protocol data to accounting records and generates additional accounting events when new sensor data is detected.
device-sensor filter-list cdp	Creates a Cisco Discovery Protocol filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list lldp	Creates an LLDP filter containing a list of TLV fields that can be included or excluded in Device Sensor output.
show device-sensor cache	Displays Device Sensor cache entries.

device-sensor filter-list lldp

To create a Link Layer Discovery Protocol (LLDP) filter containing a list of Type-Length-Value (TLV) fields that can be included or excluded in Device Sensor output, use the **device-sensor filter-list lldp** command in global configuration mode. To remove the LLDP filter containing the list of TLV fields, use the **no** form of this command.

device-sensor filter-list lldp list ***tlv-list-name***

no device-sensor filter-list lldp list ***tlv-list-name***

Syntax Description

list	Contains an LLDP TLV filter list.
tlv-list-name	Name of the LLDP TLV filter list.

Defaults

LLDP TLV filter list is not available.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)SE1	This command was introduced.

Usage Guidelines

Use the **device-sensor filter-list lldp list** *tlv-list-name* command to configure the name of the LLDP TLV filter list and enter LLDP sensor configuration mode. You can configure the list of TLVs in LLDP sensor configuration mode using the **tlv** {**name'** *tlv-name* | **number** *tlv-number*} command. Use the **name** *tlv-name* keyword-argument pair to specify the name of the TLV. Enter **?** for querying the available TLV names. Use the **number** *tlv-name* keyword-argument pair to specify the TLV number to be added to the LLDP TLV filter list.

Use the **no tlv** {**name'** *tlv-name* | **number** *tlv-number*} command to remove individual TLVs from the LLDP TLV filter list.

Use the **no device-sensor filter-list lldp list** *tlv-list-name* command to remove the entire TLV list containing all the TLVs.

Examples

The following example shows how to create an LLDP filter containing a list of TLVs:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-list lldp list lldp-list
Switch(config-sensor-lldplist)# tlv name address-type
Switch(config-sensor-lldplist)# tlv name device-name
Switch(config-sensor-lldplist)# tlv number 34
Switch(config-sensor-lldplist)# end
```

Related Commands

Command	Description
debug device-sensor	Enables debugging for Device Sensor.
device-sensor accounting	Adds Device Sensor protocol data to accounting records and generates additional accounting events when new sensor data is detected.
device-sensor filter-list cdp	Creates a Cisco Discovery Protocol filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list dhcp	Creates a DHCP filter containing a list of options that can be included or excluded in Device Sensor output.
show device-sensor cache	Displays Device Sensor cache entries.

device-sensor notify

To enable client notifications and accounting events for Type-Length-Value (TLV) changes, use the **device-sensor notify** command in global configuration mode. To disable client notifications and accounting events for TLV changes, use the **no** form of this command.

device-sensor notify all-changes new-tlvs

no device-sensor notify all-changes new-tlvs

Syntax Description

all-changes	Enables client notifications and accounting events for all TLV changes.
new-tlvs	Enables client notifications and accounting events for only new TLV changes.

Defaults

Client notifications and accounting events are generated only for new TLVs.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)SE1	This command was introduced.

Usage Guidelines

By default, for each supported peer protocol, client notifications and accounting events will only be generated when an incoming packet includes a TLV that has not been previously received in the context of a given session.

To enable client notifications and accounting events for all TLV changes, where either a new TLV has been received or a previously received TLV has been received with a different value, use the **device-sensor notify all-changes** command.

To return to the default behavior, use the **device-sensor notify new-tlvs** or the **default device-sensor notify** command.

Examples

The following example shows how to enable client notifications and accounting events for all TLV change:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor notify all-changes
```

Related Commands

Command	Description
debug device-sensor	Enables debugging for Device Sensor.
device-sensor accounting	Adds Device Sensor protocol data to accounting records and generates additional accounting events when new sensor data is detected.

Command	Description
device-sensor filter-list cdp	Creates a Cisco Discovery Protocol filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list dhcp	Creates a DHCP filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list lldp	Creates an LLDP filter containing a list of TLV fields that can be included or excluded in Device Sensor output.
show device-sensor cache	Displays Device Sensor cache entries.

device-sensor filter-list cdp

To create a Cisco Discovery Protocol filter containing a list of Type-Length-Value (TLV) fields that can be included or excluded in Device Sensor output, use the **device-sensor filter-list cdp** command in global configuration mode. To remove the Cisco Discovery Protocol filter containing the list of TLV fields, use the **no** form of this command.

device-sensor filter-list cdp list ***tlv-list-name***

no device-sensor filter-list cdp list ***tlv-list-name***

Syntax Description

list	Contains a Cisco Discovery Protocol TLV filter list.
tlv-list-name	Cisco Discovery Protocol TLV filter list name.

Defaults

Cisco Discovery Protocol TLV filter list is not available.

Command Modes

Global configuration

Command History

Release	**Modification**
15.0(1)SE1	This command was introduced.

Usage Guidelines

Use the **device-sensor filter-list cdp list** *tlv-list-name* command to configure the name of the Cisco Discovery Protocol TLV filter list and enter Cisco Discovery Protocol sensor configuration mode. You can configure the list of TLVs in Cisco Discovery Protocol sensor configuration mode using the **tlv** {**name** *tlv-name* | **number** *tlv-number*} command. Use the **name** *tlv-name* keyword-argument pair to specify the name of the TLV. Enter **?** for querying the available TLV names. Use the **number** *tlv-number* keyword-argument pair to specify the TLV number to be added to the Cisco Discovery Protocol TLV filter list.

Use the **no tlv** {**name'** *tlv-name* | **number** *tlv-number*} command to remove individual TLVs from the Cisco Discovery Protocol TLV filter list.

Use the **no device-sensor filter-list cdp list** *tlv-list-name* command to remove the entire TLV list containing all the TLVs.

Examples

The following example shows how to create a Cisco Discovery Protocol filter containing a list of TLVs:

```
Switch> enable
Switch# configure terminal
Switch(config)# device-sensor filter-list cdp list cdp-list
Switch(config-sensor-cdplist)# tlv name address-type
Switch(config-sensor-cdplist)# tlv name device-name
Switch(config-sensor-cdplist)# tlv number 34
Switch(config-sensor-cdplist)# end
```

Related Commands

Command	Description
debug device-sensor	Enables debugging for Device Sensor.
device-sensor accounting	Adds Device Sensor protocol data to accounting records and generates additional accounting events when new sensor data is detected.
device-sensor filter-list dhcp	Creates a DHCP filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list lldp	Creates an LLDP filter containing a list of TLV fields that can be included or excluded in Device Sensor output.
show device-sensor cache	Displays Device Sensor cache entries.

show device-sensor cache

To display Device Sensor cache entries, use the **show device-sensor cache** command in privileged EXEC mode.

show device-sensor cache { mac ***mac-address*** **|** ***all*** **}**

Syntax Description

mac mac-address	Specifies the MAC address of the device for which the sensor cache entries are to be displayed.
all	Displays sensor cache entries for all devices.

Defaults

There are no defaults for this command.

Command Modes

Privileged EXEC

Command History

Release	Modification
15.0(1)SE1	This command was introduced.

Usage Guidelines

Use the **show device-sensor cache** command to display a list of Type-Length-Value (TLV) fields or options received from a particular device or from all devices.

Examples

The following is sample output from the **show device-sensor cache mac** *mac-address* command:

```
Router# show device-sensor cache mac 0024.14dc.df4d

Device: 0024.14dc.df4d on port GigabitEthernet1/0/24
--------------------------------------------------
Proto   Type:Name                     Len Value
cdp     26:power-available-type        16 00 1A 00 10 00 00 00 01 00 00 00 00 FF FF FF FF
cdp     22:mgmt-address-type           17 00 16 00 11 00 00 00 01 01 01 CC 00 04 09 1B 65
                                          0E
cdp     11:duplex-type                  5 00 0B 00 05 01
cdp      9:vtp-mgmt-domain-type         4 00 09 00 04
cdp      4:capabilities-type            8 00 04 00 08 00 00 00 28
cdp      1:device-name                 14 00 01 00 0E 73 75 70 70 6C 69 63 61 6E 74
lldp     0:end-of-lldpdu                2 00 00
lldp     8:management-address          14 10 0C 05 01 09 1B 65 0E 03 00 00 00 01 00
lldp     7:system-capabilities          6 0E 04 00 14 00 04
lldp     4:port-description            23 08 15 47 69 67 61 62 69 74 45 74 68 65 72 6E 65
                                          74 31 2F 30 2F 32 34
lldp     5:system-name                 12 0A 0A 73 75 70 70 6C 69 63 61 6E 74
dhcp    82:relay-agent-info            20 52 12 01 06 00 04 00 18 01 18 02 08 00 06 00 24
                                          14 DC DF 80
dhcp    12:host-name                   12 0C 0A 73 75 70 70 6C 69 63 61 6E 74
dhcp    61:client-identifier           32 3D 1E 00 63 69 73 63 6F 2D 30 30 32 34 2E 31 34
                                          64 63 2E 64 66 34 64 2D 47 69 31 2F 30 2F 32 34
dhcp    57:max-message-size             4 39 02 04 80
```

The following is sample output from the show device-sensor cache all command:

```
Router# show device-sensor cache all

Device: 001c.0f74.8480 on port GigabitEthernet2/1
--------------------------------------------------
Proto   Type:Name                       Len  Value
dhcp    52:option-overload               3  34 01 03
dhcp    60:class-identifier             11  3C 09 64 6F 63 73 69 73 31 2E 30
dhcp    55:parameter-request-list        8  37 06 01 42 06 03 43 96
dhcp    61:client-identifier            27  3D 19 00 63 69 73 63 6F 2D 30 30 31 63 2E 30 66
                                           37 34 2E 38 34 38 30 2D 56 6C 31
dhcp    57:max-message-size              4  39 02 04 80

Device: 000f.f7a7.234f on port GigabitEthernet2/1
--------------------------------------------------
Proto   Type:Name                       Len  Value
cdp     22:mgmt-address-type             8  00 16 00 08 00 00 00 00
cdp     19:cos-type                      5  00 13 00 05 00
cdp     18:trust-type                    5  00 12 00 05 00
cdp     11:duplex-type                   5  00 0B 00 05 01
cdp     10:native-vlan-type              6  00 0A 00 06 00 01
cdp      9:vtp-mgmt-domain-type          9  00 09 00 09 63 69 73 63 6F
```

The following table describes the significant fields shown in the display.

Field	Description
Device	MAC address of the device and the interface which it is connected to.
Proto	Protocol from which the endpoint device data is being gleaned.
Type	Type of TLV.
Name	Name of the TLV.
Len	Length of the TLV.
Value	Value of the TLV.

Related Commands

Command	Description
debug device-sensor	Enables debugging for Device Sensor.
device-sensor accounting	Adds Device Sensor protocol data to accounting records and generates additional accounting events when new sensor data is detected.
device-sensor filter-list cdp	Creates a Cisco Discovery Protocol filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list dhcp	Creates a DHCP filter containing a list of options that can be included or excluded in Device Sensor output.
device-sensor filter-list lldp	Creates an LLDP filter containing a list of TLV fields that can be included or excluded in Device Sensor output.
show device-sensor cache	Displays Device Sensor cache entries.

debug device-sensor

To enable debugging for Device Sensor, use the **debug device-sensor** command in privileged EXEC mode.

debug device-sensor errors events

Syntax Description

errors	Displays Device Sensor error messages
events	Displays messages for events such as protocol packet arrivals, identity updates and release events sent to the session manager.

Defaults

There are no defaults for this command.

Command Modes

Privileged EXEC

Command History

Release	Modification
15.0(1)SE1	This command was introduced.

Usage Guidelines

Use the **debug device-sensor** command in conjunction with the **debug authentication all** command to troubleshoot scenarios where device sensor cache entries are not being created for the connected devices

Examples

The following is sample output from the debug device-sensor events command. The debug output shows how Cisco Discovery Protocol packets and Type-Length-Values (TLVs) are received from the device connected to the GigabitEthernet 2/1 interface:

```
Switch# debug device-sensor events

Switch#
*Nov 30 23:58:45.811: DSensor: Received cdp packet from GigabitEthernet2/1:00d0.2bdf.08a5
*Nov 30 23:58:45.811: DSensor: SM returned no or invalid session label for
GigabitEthernet2/1:00d0.2bdf.08a5
*Nov 30 23:58:45.811: DSensor: Updating SM with identity attribute list
  cdp-tlv              0   00 01 00 0B 4A 41 45 30 37 34 31 31 50 53 32
  cdp-tlv              0   00 03 00 03 32 2F 38
  cdp-tlv              0   00 04 00 04 00 00 00 0A
  cdp-tlv              0   00 05 00 68 57 53 2D 43 32 39 34 38 20 53 6F 66 74 77 61 72 65
2C 20 56 65 72 73 69 6F 6E 20 4D 63 70 53 57 3A 20 36 2E 34 28 35 2E
 30 29 20 4E 6D 70 53 57 3A 20 36 2E 34 28 35 29 0A 43 6F 70 79 72 69 67 68 74 20 28 63 29
20 31 39 39 35 2D 32 30 30 33 20 62 79 20 43 69 73 63 6F 20 53 79 73
74 65 6D 73 2C 20 49 6E 63 2E 0A
 cdp-tlv              0   00 06 00 08 57 53 2D 43 32 39 34 38
 cdp-tlv              0   00 09 00 00
 cdp-tlv              0   00 0A 00 02 00 21
 cdp-tlv              0   00 0B 00 01 01
 cdp-tlv              0   00 12 00 01 00
 cdp-tlv              0   00 13 00 01 00
 cdp-tlv              0   00 14 00 00
 cdp-tlv              0   00 15 00 0A 06 08 2B 06 01 04 01 09 05 2A
 cdp-tlv             0   00 16 00 16 00 00 00 02 01 01 CC 00 04 00 00 00 0001 01 CC 00 04
01 01 01 01
 cdp-tlv              0   00 17 00 01 00
 swidb                0   604702240 (0x240B0620)
 clid-mac-addr        0   00 D0 2B DF 08 A5
*Nov 30 23:58:46.831: DSensor: Received cdp packet from
GigabitEthernet2/1:00d0.2bdf.08a5exi
Switch#
*Nov 30 23:58:51.171: %SYS-5-CONFIG_I: Configured from console by console
```

Related Commands

Command	Description
debug authentication all	Displays all debugging information about the Authentication Manager and all features.
device-sensor accounting	Adds Device Sensor protocol data to the accounting records and generates additional accounting events when new sensor data is detected.

Obtaining Documentation and Submitting a Service Request

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