



DHCP for WLANs

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Information About Dynamic Host Configuration Protocol

You can configure WLANs to use the same or different Dynamic Host Configuration Protocol (DHCP) servers or no DHCP server. Two types of DHCP servers are available—internal and external.

Internal DHCP Servers

The device contains an internal DHCP server. This server is typically used in branch offices that do not have a DHCP server.

The internal server provides DHCP addresses to wireless clients, direct-connect APs, and DHCP requests that are relayed from APs. Only lightweight APs are supported. If you want to use the internal DHCP server, ensure that you configure SVI for the client VLAN, and set the IP address as DHCP server IP address.

DHCP option 43 is not supported on the internal server. Therefore, the APs must use an alternative method to locate the management interface IP address of the device, such as local subnet broadcast, Domain Name System (DNS), or priming.

When clients use the internal DHCP server of the device, IP addresses are not preserved across reboots. As a result, multiple clients can be assigned to the same IP address. To resolve any IP address conflicts, clients must release their existing IP address and request a new one.



Note

- VRF is not supported in the internal DHCP servers.
 - DHCPv6 is not supported in the internal DHCP servers.
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General Guidelines

- Internal DHCP server serves both wireless client and wired client (wired client includes AP).

- To serve wireless client with internal DHCP server, an unicast DHCP server IP address must be configured for wireless client. Internal DHCP server IP address must be configured under the server facing interface, which can be loopback interface, SVI interface, or L3 physical interface.
- To use internal DHCP server for both wireless and wired client VLAN, an IP address must be configured under client VLAN SVI interface.
- For wireless client, in DHCP helper address configuration, the IP address of the internal DHCP server must be different from address of wireless client VLAN SVI interface.
- For wireless client with internal DHCP server support, the internal DHCP server can be configured using global configuration command, under the client VLAN SVI interface or under the wireless policy profile.
- An internal DHCP server pool can also serve clients of other controllers .

External DHCP Servers

The operating system is designed to appear as a DHCP relay to the network and as a DHCP server to clients with industry-standard external DHCP servers that support DHCP Relay, which means that each controller appears as a DHCP relay agent to the DHCP server, and as a DHCP server in the virtual IP address to wireless clients.

Because the controller captures the client IP address that is obtained from a DHCP server, it maintains the same IP address for that client during intra controller, inter controller, and inter-subnet client roaming.



Note External DHCP servers support DHCPv6.

DHCP Assignments

You can configure DHCP on a per-interface or per-WLAN basis. We recommend that you use the primary DHCP server address that is assigned to a particular interface.

You can assign DHCP servers for individual interfaces. You can configure the management interface, AP manager interface, and dynamic interface for a primary and secondary DHCP server, and configure the service-port interface to enable or disable DHCP servers. You can also define a DHCP server on a WLAN (in this case, the server overrides the DHCP server address on the interface assigned to the WLAN).

Security Considerations

For enhanced security, we recommend that you ask all clients to obtain their IP addresses from a DHCP server. To enforce this requirement, you can configure all the WLANs with a DHCP Address Assignment Required setting, which disallows client static IP addresses. If DHCP Address Assignment Required is selected, clients must obtain an IP address through DHCP. Any client with a static IP address is not allowed on the network. The controller monitors DHCP traffic because it acts as a DHCP proxy for the clients.



- Note**
- WLANs that support management over wireless must allow management (device-servicing) clients to obtain an IP address from a DHCP server.
 - The operating system is designed to appear as a DHCP relay to the network and as a DHCP server to clients with industry-standard external DHCP servers that support DHCP relay. This means that each controller appears as a DHCP relay to the DHCP server and as a DHCP server at the virtual IP address to wireless clients.

You can create WLANs with DHCP Address Assignment Required disabled. If you do this, clients have the option of using a static IP address or obtaining an IP address from a designated DHCP server. However, note that this might compromise security.



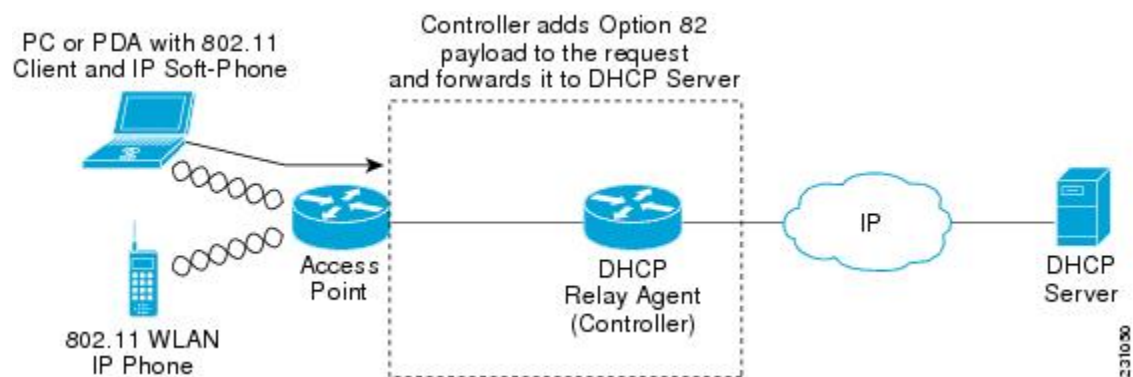
- Note** DHCP Address Assignment Required is not supported for wired guest LANs.

You can create separate WLANs with DHCP Address Assignment Required configured as disabled. This is applicable only if DHCP proxy is enabled for the controller. You must not define the primary or secondary configuration DHCP server instead you should disable the DHCP proxy. These WLANs drop all the DHCP requests and force clients to use a static IP address. These WLANs do not support management over wireless connections.

DHCP Option 82

DHCP option 82 provides additional security when DHCP is used to allocate network addresses. It enables the controller to act as a DHCP relay agent to prevent DHCP client requests from untrusted sources. You can configure the controller to add option 82 information to DHCP requests from clients before forwarding the requests to the DHCP server.

Figure 1: DHCP Option 82



The AP forwards all the DHCP requests from a client to the controller. The controller adds the DHCP option 82 payload and forwards the request to the DHCP server. The payload can contain the MAC address or the MAC address and SSID of the AP, depending on how you configure this option.



Note DHCP packets that already include a relay agent option are dropped at the controller.

For DHCP option 82 to operate correctly, DHCP proxy must be enabled.

Restrictions for Configuring DHCP for WLANs

- If you override the DHCP server in a WLAN, you must ensure that you configure the underlying Cisco IOS configuration to make sure that the DHCP server is reachable.
- WLAN DHCP override works only if DHCP service is enabled on the controller.

You can configure DHCP service in either of the following ways:

- Configuring the DHCP pool on the controller.
- Configuring a DHCP relay agent on the SVI. Note that the VLAN of the SVI must be mapped to the WLAN where DHCP override is configured.

How to Configure DHCP for WLANs

Configuring DHCP Scopes (GUI)

Procedure

- Step 1** Choose **Administration > DHCP Pools**.
- Step 2** In the **Pools** section, click **Add** to add a new DHCP pool.
The **Create DHCP Pool** dialog box is displayed.
- Step 3** In the **DHCP Pool Name** field, enter a name for the new DHCP pool.
- Step 4** From the **IP Type** drop-down list, choose the IP address type.
- Step 5** In the **Network** field, enter the network served by this DHCP scope. This IP address is used by the management interface with netmask applied, as configured in the **Interfaces** window.
- Step 6** In the **Subnet Mask** field, enter the subnet mask assigned to all the wireless clients.
- Step 7** In the **Starting ip** field, enter the starting IP address.
- Step 8** In the **Ending ip** field, enter the trailing IP address.
- Step 9** In the **Reserved Only** field, enable or disable it.
- Step 10** From the **Lease** drop-down list, choose the lease type as either **User Defined** or **Never Expires**. If you choose **User Defined**, you can enter the amount of time that an IP address is granted to a client.
- Step 11** To perform advanced configuration for DHCP scope, click **Advanced**.
- Step 12** Check the **Enable DNS Proxy** check box to enable DNS proxy.

- Step 13** In the **Default Router(s)** field, enter the IP address of the optional router or routers that connect to the device and click the + icon to add them to the list. Each router must include a DHCP forwarding agent that enables a single device to serve the clients of multiple devices.
- Step 14** In the **DNS Server(s)** field, enter the IP address of the optional DNS server or servers and click the + icon to add them to the list. Each DNS server must be able to update a client's DNS entry to match the IP address assigned by the DHCP scope.
- Step 15** In the **NetBios Name Server(s)** field, enter the IP address of the optional Microsoft NetBIOS name server or servers, such as Microsoft Windows Internet Naming Service (WINS) server, and click the + icon to add them to the list.
- Step 16** In the **Domain** field, enter the optional domain name of the DHCP scope for use with one or more DNS servers.
- Step 17** To add **DHCP** options, click **Add** in the **DHCP Options List** section. DHCP provides an internal framework for passing configuration parameters and other control information, such as DHCP options, to the clients on your network. DHCP options carry parameters as tagged data stored within protocol messages exchanged between the DHCP server and its clients.
- Step 18** Enter the **DHCP** option that you want to add.
- Step 19** Click **Save & Apply to Device**.

Configuring DHCP Scopes (CLI)

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Device# <code>configure terminal</code>	Enters global configuration mode.
Step 2	ip dhcp pool <i>pool-name</i> Example: Device(config)# <code>ip dhcp pool test-pool</code>	Configures the DHCP pool address.
Step 3	network <i>network-name mask-address</i> Example: Device(dhcp-config)# <code>network 209.165.200.224 255.255.255.0</code>	Specifies the network number in dotted-decimal notation and the mask address.
Step 4	dns-server <i>hostname</i> Example: Device(dhcp-config)# <code>dns-server example.com</code>	Specifies the DNS name server. You can specify an IP address or a hostname.
Step 5	end Example: Device(dhcp-config)# <code>end</code>	Returns to privileged EXEC mode.

Configuring the Internal DHCP Server

Configuring the Internal DHCP Server Under Client VLAN SVI (GUI)

Procedure

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- Step 1** Choose **Configuration > Layer2 > VLAN > SVI**.
 - Step 2** Click an SVI.
 - Step 3** Click the **Advanced** tab.
 - Step 4** Under **DHCP Relay** settings, enter the **IPV4 Helper Address**.
 - Step 5** Click **Update & Apply to Device**.
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Configuring the Internal DHCP Server Under Client VLAN SVI (CLI)

Before you begin

- For wireless clients, only two DHCP servers are supported.
- To use the internal DHCP server for both wireless and wired client VLAN, an IP address must be configured under the client VLAN SVI.
- For wireless clients, the IP address of the internal DHCP server must be different from the address of the wireless client VLAN SVI (in the DHCP helper address configuration).
- For wireless clients, the internal DHCP server can be configured under the client VLAN SVI or under the wireless policy profile.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 2	interface loopback <i>interface-number</i> Example: Device(config)# interface Loopback0	Creates a loopback interface and enters interface configuration mode.
Step 3	ip address <i>ip-address</i> Example: Device(config-if)# ip address 10.10.10.1 255.255.255.255	Configures the IP address for the interface.

	Command or Action	Purpose
Step 4	exit Example: Device(config-if)# exit	Exits interface configuration mode.
Step 5	interface vlan <i>vlan-id</i> Example: Device(config)# interface vlan 32	Configures the VLAN ID.
Step 6	ip address <i>ip-address</i> Example: Device(config-if)# ip address 192.168.32.100 255.255.255.0	Configures the IP address for the interface.
Step 7	ip helper-address <i>ip-address</i> Example: Device(config-if)# ip helper-address 10.10.10.1	Configures the destination address for UDP broadcasts. Note If the IP address used in the ip helper-address command is an internal address of the controller an internal DHCP server is used. Otherwise, the external DHCP server is used.
Step 8	no mop enabled Example: Device(config-if)# no mop enabled	Disables the Maintenance Operation Protocol (MOP) for an interface.
Step 9	no mop sysid Example: Device(config-if)# no mop sysid	Disables the task of sending MOP periodic system ID messages.
Step 10	exit Example: Device(config-if)# exit	Exits interface configuration mode.
Step 11	ip dhcp excluded-address <i>ip-address</i> Example: Device(config)# ip dhcp excluded-address 192.168.32.1	Specifies the IP address that the DHCP server should not assign to DHCP clients.
Step 12	ip dhcp excluded-address <i>ip-address</i> Example: Device(config)# ip dhcp excluded-address 192.168.32.100	Specifies the IP addresses that the DHCP server should not assign to DHCP clients.

	Command or Action	Purpose
Step 13	ip dhcp pool <i>pool-name</i> Example: Device(config)# ip dhcp pool pool-vlan32	Configures the DHCP pool address.
Step 14	network <i>network-name mask-address</i> Example: Device(dhcp-config)# network 192.168.32.0 255.255.255.0	Specifies the network number in dotted-decimal notation, along with the mask address.
Step 15	default-router <i>ip-address</i> Example: Device(dhcp-config)# default-router 192.168.32.1	Specifies the IP address of the default router for a DHCP client.
Step 16	exit Example: Device(dhcp-config)# exit	Exits DHCP configuration mode.
Step 17	wireless profile policy <i>profile-policy</i> Example: Device(config)# wireless profile policy default-policy-profile	Configures the WLAN policy profile and enters wireless policy configuration mode.
Step 18	central association Example: Device(config-wireless-policy)# central association	Configures central association for locally switched clients.
Step 19	central dhcp Example: Device(config-wireless-policy)# central dhcp	Configures the central DHCP for locally switched clients.
Step 20	central switching Example: Device(config-wireless-policy)# central switching	Configures WLAN for central switching.
Step 21	description <i>policy-profile-name</i> Example: Device(config-wireless-policy)# description "default policy profile"	Adds a description for the policy profile
Step 22	vlan <i>vlan-name</i> Example: Device(config-wireless-policy)# vlan 32	Assigns the profile policy to the VLAN.

	Command or Action	Purpose
Step 23	no shutdown Example: Device(config-wireless-policy)# no shutdown	Enables the wireless profile policy.

Configuring the Internal DHCP Server Under a Wireless Policy Profile (GUI)

Procedure

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- Step 1** Choose **Configuration > Tags & Profiles > Policy**.
 - Step 2** Click a policy name.
 - Step 3** Click the **Advanced** tab.
 - Step 4** Under **DHCP** settings, check or uncheck the **IPv4 DHCP Required** check box and enter the **DHCP Server IP Address**.
 - Step 5** Click **Update & Apply to Device**.
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Configuring the Internal DHCP Server Under a Wireless Policy Profile

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 2	interface loopback <i>interface-number</i> Example: Device(config)# interface Loopback0	Creates a loopback interface and enters interface configuration mode.
Step 3	ip address <i>ip-address</i> Example: Device(config-if)# ip address 10.10.10.1 255.255.255.255	Configures the IP address for the interface.
Step 4	exit Example: Device(config-if)# exit	Exits interface configuration mode.
Step 5	interface vlan <i>vlan-id</i> Example:	Configures the VLAN ID.

	Command or Action	Purpose
	Device(config)# interface vlan 32	
Step 6	ip address <i>ip-address</i> Example: Device(config-if)# ip address 192.168.32.100 255.255.255.0	Configures the IP address for the interface.
Step 7	no mop enabled Example: Device(config-if)# no mop enabled	Disables the Maintenance Operation Protocol (MOP) for an interface.
Step 8	no mop sysid Example: Device(config-if)# no mop sysid	Disables the task of sending MOP periodic system ID messages.
Step 9	exit Example: Device(config-if)# exit	Exits interface configuration mode.
Step 10	ip dhcp excluded-address <i>ip-address</i> Example: Device(config)# ip dhcp excluded-address 192.168.32.100	Specifies the IP address that the DHCP server should not assign to DHCP clients.
Step 11	ip dhcp pool <i>pool-name</i> Example: Device(config)# ip dhcp pool pool-vlan32	Configures the DHCP pool address.
Step 12	network <i>network-name mask-address</i> Example: Device(dhcp-config)# network 192.168.32.0 255.255.255.0	Specifies the network number in dotted-decimal notation along with the mask address.
Step 13	default-router <i>ip-address</i> Example: Device(dhcp-config)# default-router 192.168.32.1	Specifies the IP address of the default router for a DHCP client.
Step 14	exit Example: Device(dhcp-config)# exit	Exits DHCP configuration mode.
Step 15	wireless profile policy <i>profile-policy</i> Example: Device(config)# wireless profile policy default-policy-profile	Configures a WLAN policy profile and enters wireless policy configuration mode.

	Command or Action	Purpose
Step 16	central association Example: Device(config-wireless-policy)# central association	Configures central association for locally switched clients.
Step 17	central switching Example: Device(config-wireless-policy)# central switching	Configures local switching.
Step 18	description <i>policy-profile-name</i> Example: Device(config-wireless-policy)# description "default policy profile"	Adds a description for the policy profile.
Step 19	ipv4 dhcp opt82 Example: Device(config-wireless-policy)# ipv4 dhcp opt82	Enables DHCP Option 82 for the wireless clients.
Step 20	ipv4 dhcp opt82 ascii Example: Device(config-wireless-policy)# ipv4 dhcp opt82 ascii	Enables ASCII on DHCP Option 82.
Step 21	ipv4 dhcp opt82 format <i>vlan_id</i> Example: Device(config-wireless-policy)# ipv4 dhcp opt82 format vlan32	Enables VLAN ID.
Step 22	ipv4 dhcp opt82 rid <i>vlan_id</i> Example: Device(config-wireless-policy)# ipv4 dhcp opt82 rid	Supports the addition of Cisco 2-byte Remote ID (RID) for DHCP Option 82.
Step 23	ipv4 dhcp server <i>ip-address</i> Example: Device(config-wireless-policy)# ipv4 dhcp server 10.10.10.1	Configures the WLAN's IPv4 DHCP server.
Step 24	vlan <i>vlan-name</i> Example: Device(config-wireless-policy)# vlan 32	Assigns the profile policy to the VLAN.
Step 25	no shutdown Example:	Enables the wireless profile policy.

	Command or Action	Purpose
	Device (config-wireless-policy) # no shutdown	

Configuring the Internal DHCP Server Globally (GUI)

Procedure

-
- Step 1** Choose **Administration > DHCP Pools > Pools**.
- Step 2** Click **Add**.
The **Create DHCP Pool** window is displayed.
- Step 3** Enter the **DHCP Pool Name**, **Network**, **Starting ip**, and **Ending ip**.
- Step 4** From the **IP Type**, **Subnet Mask**, and **Lease** drop-down lists, choose a value.
- Step 5** Click the **Reserved Only** toggle button.
- Step 6** Click **Apply to Device**.
-

Configuring the Internal DHCP Server Globally (CLI)

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 2	interface loopback <i>interface-num</i> Example: Device (config) # interface Loopback0	Creates a loopback interface and enters interface configuration mode.
Step 3	ip address <i>ip-address</i> Example: Device (config-if) # ip address 10.10.10.1 255.255.255.255	Configures the IP address for the interface.
Step 4	exit Example: Device (config-if) # exit	Exits interface configuration mode.
Step 5	interface vlan <i>vlan-id</i> Example: Device (config) # interface vlan 32	Configures the VLAN ID.

	Command or Action	Purpose
Step 6	ip address <i>ip-address</i> Example: Device(config-if)# ip address 192.168.32.100 255.255.255.0	Configures the IP address for the interface.
Step 7	no mop enabled Example: Device(config-if)# no mop enabled	Disables the Maintenance Operation Protocol (MOP) for an interface.
Step 8	no mop sysid Example: Device(config-if)# no mop sysid	Disables the task of sending the MOP periodic system ID messages.
Step 9	exit Example: Device(config-if)# exit	Exits the interface configuration mode.
Step 10	ip dhcp-server <i>ip-address</i> Example: Device(config)# ip dhcp-server 10.10.10.1	Specifies the target DHCP server parameters.
Step 11	ip dhcp excluded-address <i>ip-address</i> Example: Device(config)# ip dhcp excluded-address 192.168.32.100	Specifies the IP address that the DHCP server should not assign to DHCP clients.
Step 12	ip dhcp pool <i>pool-name</i> Example: Device(config)# ip dhcp pool pool-vlan32	Configures the DHCP pool address.
Step 13	network <i>network-name mask-address</i> Example: Device(dhcp-config)# network 192.168.32.0 255.255.255.0	Specifies the network number in dotted-decimal notation along with the mask address.
Step 14	default-router <i>ip-address</i> Example: Device(dhcp-config)# default-router 192.168.32.1	Specifies the IP address of the default router for a DHCP client.
Step 15	exit Example: Device(dhcp-config)# exit	Exits DHCP configuration mode.

	Command or Action	Purpose
Step 16	wireless profile policy <i>profile-policy</i> Example: Device (config)# wireless profile policy default-policy-profile	Configures a WLAN policy profile and enters wireless policy configuration mode.
Step 17	central association Example: Device (config-wireless-policy)# central association	Configures central association for locally switched clients.
Step 18	central dhcp Example: Device (config-wireless-policy)# central dhcp	Configures central DHCP for locally switched clients.
Step 19	central switching Example: Device (config-wireless-policy)# central switching	Configures local switching.
Step 20	description <i>policy-profile-name</i> Example: Device (config-wireless-policy)# description "default policy profile"	Adds a description for the policy profile.
Step 21	vlan <i>vlan-name</i> Example: Device (config-wireless-policy)# vlan 32	Assigns the profile policy to the VLAN.
Step 22	no shutdown Example: Device (config-wireless-policy)# no shutdown	Enables the profile policy.

Verifying Internal DHCP Configuration

To verify client binding, use the following command:

```
Device# show ip dhcp binding
```

```
Bindings from all pools not associated with VRF:
IP address      Client-ID/          Lease expiration    Type      State
Interface
                Hardware address/
                User name
192.168.32.3    0130.b49e.491a.53   Mar 23 2018 06:42 PM Automatic Active
Loopback0
```

To verify the DHCP relay statistics for a wireless client, use the following command:

```
Device# show wireless dhcp relay statistics
```

```
DHCP Relay Statistics
-----

DHCP Server IP : 10.10.10.1

Message                Count
-----
DHCPDISCOVER          : 1
BOOTP FORWARD         : 137
BOOTP REPLY           : 0
DHCPPOFFER            : 0
DHCPrequest           : 54
DHCPACK               : 0
DHCPNAK               : 0
DHCPDECLINE           : 0
DHCPRELEASE           : 0
DHCPINFORM            : 82

Tx/Rx Time :
-----
LastTxTime : 18:42:18
LastRxTime : 00:00:00

Drop Counter :
-----
TxDropCount : 0
```

To verify the DHCP packet punt statistics in CPP, use the following command:

```
Device# show platform hardware chassis active qfp feature wireless punt statistics
```

```
CPP Wireless Punt stats:
```

App Tag	Packet Count
-----	-----
CAPWAP_PKT_TYPE_DOT11_PROBE_REQ	14442
CAPWAP_PKT_TYPE_DOT11_MGMT	50
CAPWAP_PKT_TYPE_DOT11_IAPP	9447
CAPWAP_PKT_TYPE_DOT11_RFID	0
CAPWAP_PKT_TYPE_DOT11_RRM	0
CAPWAP_PKT_TYPE_DOT11_DOT1X	0
CAPWAP_PKT_TYPE_CAPWAP_KEEPALIVE	2191
CAPWAP_PKT_TYPE_MOBILITY_KEEPALIVE	0
CAPWAP_PKT_TYPE_CAPWAP_CNTRL	7034
CAPWAP_PKT_TYPE_CAPWAP_DATA	0
CAPWAP_PKT_TYPE_MOBILITY_CNTRL	0
WLS_SMD_WEBAUTH	0
SISF_PKT_TYPE_ARP	5292
SISF_PKT_TYPE_DHCP	140
SISF_PKT_TYPE_DHCP6	1213
SISF_PKT_TYPE_IPV6_ND	350
SISF_PKT_TYPE_DATA_GLEAN	44
SISF_PKT_TYPE_DATA_GLEAN_V6	51
SISF_PKT_TYPE_DHCP_RELAY	122
CAPWAP_PKT_TYPE_CAPWAP_RESERVED	0

