DHCP ODAP Server Support

The DHCP ODAP Server Support feature introduces the capability to configure a Cisco IOS Dynamic Host Configuration Protocol (DHCP) server (or router) as a subnet allocation server. This capability allows the IOS DHCP server to be configured with a pool of subnets for lease to On-Demand Address Pool (ODAP) clients. Subnet pools can be configured for global ODAP clients or Multiprotocol Label Switched (MPLS) Virtual Private Network (VPN) ODAP clients on a per-client basis. The DHCP subnet allocation server creates bindings for the subnet leases and stores these leases in the DHCP database. This feature also supports database agents for subnet lease recovery.

Feature Specifications for the DHCP ODAP Server Support feature

Feature History	
Release	**Modification**
12.2(15)T	This feature was introduced.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for DHCP ODAP Server Support

Your network should be configured to run DHCP. You will also need to complete the following tasks before you can configure this feature:

- Identify an external FTP, TFTP, or remote copy protocol (rcp) server that you will use to store the DHCP bindings database.
- Configure an ODAP manager in the network.

Restrictions for DHCP ODAP Server Support

A router can be configured as a subnet allocation server and a DHCP server at the same time with one restriction: separate pools must be created for subnet allocation and IP address assignment. An address pool cannot be used by DHCP for both subnet allocation and IP address assignment.

Information About DHCP ODAP Server Support

To configure this feature, you must understand the following concepts

- On-Demand Address Pool Management, page 2
- ODAP Manager Support, page 2

On-Demand Address Pool Management

ODAPs are used to centralize the management of large pools of addresses and simplify the configuration of large networks. ODAP provides a central management point for the allocation and assignment of IP addresses. When a Cisco IOS router is configured as an ODAP manager, pools of IP addresses are dynamically increased or reduced in size depending on the address utilization level. The ODAP manager is supported by centralized RADIUS or DHCP servers and is configured to request an initial pool of addresses from either the RADIUS or DHCP server. The ODAP manager controls IP address assignment and will allocate additional IP addresses as necessary. This method of address allocation and assignment optimizes the use of available address space and simplifies the configuration of medium-sized and large networks.

ODAP Manager Support

The ODAP Server Support feature introduces functionality that allows the ODAP manager to allocate address space on a per-subnet basis. This feature provides the network operator with the capability to configure a Cisco IOS router as a subnet allocation server. The operation of a subnet allocation server is very similar to the operation of a DHCP server, except that pools of subnets are created and assigned instead of pools of IP addresses. Subnet allocation pools are created and configured by using the **subnet prefix-length** command in DHCP pool configuration mode. The size of each assigned or allocated subnet is set by the *prefix-length* argument, using standard CIDR bit count notation to determine the number of addresses that are configured in each subnet lease.

When a DHCP server is configured as a subnet allocation server, it provides subnet allocation pools for ODAP manager allocation. The ODAP manager allocates subnets from the subnet allocation server based on the demand for IP addresses and subnet availability. The ODAP manager is configured to allocate an initial amount of address space in the form of subnets. The size of the subnet allocated by the ODAP manager is determined by the subnet size that is configured on the subnet allocation server. The ODAP manager will then assign addresses to clients from these subnets and allocate more subnets as the need for address space increases.

When the ODAP manager allocates a subnet, the subnet allocation server creates a subnet binding. This binding is stored in the DHCP database for as long as the ODAP manager requires the address space. The binding is destroyed and the subnet is returned to the subnet pool only when the ODAP manager releases the subnet as address space utilization decreases.

The subnet allocation server can be configured to assign subnets from subnet pools for global space and from VPN pools for MPLS VPN clients. VPN routes between the ODAP manager and the subnet allocation server are configured based on VRF name or VPN ID configuration. The VRF and VPN ID are configured to maintain routing information that defines customer VPN sites. This customer site is attached to a provider edge (PE) router. A VRF consists of an IP routing table, a derived Cisco Express Forwarding (CEF) table, a set of interfaces that use the forwarding table, and a set of rules and routing protocol parameters that control the information that is included in the routing table.

For more information about ODAP Manager configuration, refer to the *DHCP Server—On-Demand Address Pool Manager* feature released in 12.2(8)T:

http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t8/ftondhcp.htm

How to Configure DHCP ODAP Subnet Allocation Server Support

This procedure contains the following tasks:

- Configuring a Global Pool on a Subnet Allocation Server, page 17 (required)
- Configuring a VRF Subnet Pool on a Subnet Allocation Server, page 19 (optional)
- Using a VPN ID to Configure a VRF Subnet Pool on a Subnet Allocation Server, page 21 (optional)
- Verifying the Subnet Allocation and DHCP Bindings, page 23 (optional)
- Troubleshooting the DHCP ODAP Subnet Allocation Server, page 9 (optional)

Configuring a Global Pool on a Subnet Allocation Server

Perform this task to configure a global subnet pool on a subnet allocation server.

Global Subnet Pools

Global subnet pools are created in a centralized network. The ODAP manager allocates subnets from the subnet allocation server based on subnet availability. When the ODAP manager allocates a subnet, the subnet allocation server creates a subnet binding. This binding is stored in the DHCP database for as long as the ODAP manager requires the address space. The binding is destroyed and the subnet is returned to the subnet pool only when the ODAP manager releases the subnet as address space utilization decreases.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp pool** *pool-name*
4. **network** *network-number* [*mask* | */prefix-length*]
5. **subnet prefix-length** *prefix-length*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip dhcp pool** *pool-name* **Example:** `Router(config)# ip dhcp pool GLOBAL-POOL`	Enters DHCP pool configuration mode and specifies the subnet pool name.
Step 4	**network** *network-number* [*mask* | */prefix-length*] **Example:** `Router(config-dhcp)# network 10.0.0.0 255.255.255.0`	Configures the subnet number and mask for a DHCP address pool on a Cisco IOS DHCP server. • The subnet mask or the prefix length can be configured in this step. The values that can be configured for the *prefix-length* argument follow CIDR bit count notation. The forward slash character must be used when configuring the *prefix-length* argument.
Step 5	**subnet prefix-length** *prefix-length* **Example:** `Router(config-dhcp)# subnet prefix-length 8`	Configures the subnet prefix length. The range of the *prefix-length* argument is from 1 to 31. • This command configures the number of IP addresses that each subnet is configured to allocate from the subnet pool. The values that can be configured for the *prefix-length* argument follow CIDR bit count notation format.

Configuring a VRF Subnet Pool on a Subnet Allocation Server

This task shows how to configure a VRF subnet pool on a subnet allocation server.

VRF Subnet Pools

A subnet allocation server can be configured to assign subnets from VRF subnet allocation pools for MPLS VPN clients. VPN routes between the ODAP manager and the subnet allocation server are configured based on VRF name or VPN ID configuration. The VRF and VPN ID are configured to maintain routing information that defines customer VPN sites. The VPN customer site (or Customer Equipment [CE]) is attached to a provider edge (PE) router. The VRF is used to specify the VPN and consists of an IP routing table, a derived Cisco Express Forwarding (CEF) table, a set of interfaces that use the forwarding table, and a set of rules and routing protocol parameters that control the information that is included in the routing table.

Prerequisites

The VRF name and VPN ID can be configured on the ODAP manager and subnet allocation server prior to the configuration of the subnet allocation pool.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp pool** *pool-name*
4. **vrf** *vrf-name*
5. **network** *network-number* [*mask* | */prefix-length*]
6. **subnet prefix-length** *prefix-length*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip dhcp pool** *pool-name* **Example:** `Router(config)# ip dhcp pool VRF-POOL`	Enters DHCP pool configuration mode and specifies the subnet pool name.

	Command or Action	Purpose
Step 4	**vrf** *vrf-name* **Example:** `Router (config-dhcp)# vrf RED`	Associates the on-demand address pool with a VPN routing and forwarding (VRF) instance name (or tag). • The **vrf** keyword and *vrf-name* argument are used to specify the VPN for the VRF pool. The *vrf-name* argument must match the VRF name (or tag) that is configured for the client.
Step 5	**network** *network-number* [*mask* | */prefix-length*] **Example:** `Router(config-dhcp)# network 10.1.1.0 /24`	Configures the subnet number and mask for a DHCP address pool on a Cisco IOS DHCP Server. • The subnet mask or the prefix length can be configured in this step. The values that can be configured for the *prefix-length* argument follow CIDR bit count notation. The forward slash character must be used when configuring the *prefix-length* argument.
Step 6	**subnet prefix-length** *prefix-length* **Example:** `Router(config-dhcp)# subnet prefix-length 16`	Configures the subnet prefix length. The range of the *prefix-length* argument is from 1 to 31. • This command configures the number of IP addresses that each subnet is configured to allocate from the subnet pool. The values that can be configured for the *prefix-length* argument follow CIDR bit count notation format.

Using a VPN ID to Configure a VRF Subnet Pool on a Subnet Allocation Server

Perform this task to configure a VRF subnet pool, using a VPN ID, on a subnet allocation server.

VRF Pools and VPN IDs

A subnet allocation server can also be configured to assign subnets from VPN subnet allocation pools based on the VPN ID of a client. The VPN ID (or Organizational Unique Identifier [OUI]) is a unique identifier assigned by the IEEE.

Prerequisites

The VRF name and VPN ID can be configured on the ODAP manager and subnet allocation server prior to the configuration of the subnet allocation pool.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip vrf** *vrf-name*
4. **rd** *route-distinguisher*
5. **route-target both** *route-target-number*
6. **vpn id** *vpn-id*

7. **exit**
8. **ip dhcp pool** *pool-name*
9. **vrf** *vrf-name*
10. **network** *network-number* [*mask* | */prefix-length*]
11. **subnet prefix-length** *prefix-length*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip vrf** *vrf-name* **Example:** `Router(config)#ip vrf RED`	Creates a VRF routing table and specifies the VRF name (or tag). • The *vrf-name* argument must match the VRF name that is configured for the client and VRF pool in step 8.
Step 4	**rd** *route-distinguisher* **Example:** `Router(config-vrf)#rd 100:1`	Creates routing and forwarding tables for a VRF instance created in step 3. • There are two formats for configuring the route distinguisher argument. It can be configured in the as-number:network number (ASN:nn) format, as shown in the example, or it can be configured in the IP address:network number format (IP-address:nn).
Step 5	**route-target both** *route-target-number* **Example:** `Router(config-vrf)#route-target both 100:1`	Creates a route-target extended community for the VRF instance that was created in step 3. • The **both** keyword is used to specify which routes should be imported and exported to the target VPN extended community (or the ODAP manager in this configuration). • The *route-target-number* argument follows the same format as the *route-distinguisher* argument in step 4. These two arguments must match.
Step 6	**vpn id** *vpn-id* **Example:** `Router(config-vrf)# vpn id 1234:123456`	Configures the VPN ID. • This command is only used if the client (ODAP manager) is also configured with or assigned a VPN ID.
Step 7	**exit** **Example:** `Router(config-vrf)# exit`	Exits VRF configuration mode and enters global configuration mode.

	Command or Action	Purpose
Step 8	**ip dhcp pool** *pool-name* **Example:** `Router(config)# ip dhcp pool VPN-POOL`	Enters DHCP pool configuration mode and specifies the subnet pool name. • The **VRF** keyword and *vrf-name* argument are used to specify the VPN for the VRF pool. The *vrf-name* argument must match the VRF name (or tag) that is configured for the client.
Step 9	**vrf** *vrf-name* **Example:** `Router(config-dhcp)#vrf RED`	Associates the on-demand address pool with a VRF instance name. • The *vrf-name* argument must match the *vrf-name* argument that was configured in Step 3.
Step 10	**network** *network-number* [*mask* | */prefix-length*] **Example:** `Router(config-dhcp)# network 192.168.0.0 /24`	Configures the subnet number and mask for a DHCP address pool on a Cisco IOS DHCP server. • The subnet mask or the prefix length can be configured in this step. The values that can be configured for the *prefix-length* argument follow CIDR bit count notation. The forward slash character must be used when configuring the *prefix-length* argument.
Step 11	**subnet prefix-length** *prefix-length* **Example:** `Router(config-dhcp)# subnet prefix-length 16`	Configures the subnet prefix length. • The range of the *prefix-length* argument is from 1 to 31. • This command configures the number of IP addresses that each subnet is configured to allocate from the subnet pool. The values that can be configured for the *prefix-length* argument follow CIDR bit count notation format.

Verifying the Subnet Allocation and DHCP Bindings

Perform this task to verify subnet allocation and DHCP bindings.

The **show ip dhcp pool** and **show ip dhcp binding** commands do not need to be issued together or even in the same session as there are differences in the information that is provided. These commands, however, can be used to display and verify subnet allocation and DHCP bindings. The **show running-config | begin dhcp** command is used to display the local configuration of DHCP and the configuration of the **subnet prefix-length** command.

SUMMARY STEPS

1. **enable**
2. **show running-config** | **begin dhcp**
3. **show ip dhcp pool**
4. **show ip dhcp binding**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show running-config** | **begin dhcp** **Example:** `Router# show running-config | begin dhcp`	Used to display the local configuration of the router. • The configuration of the **subnet prefix-length** command will be displayed under the DHCP pools, for which subnet lease allocation has been configured. The subnet allocation size will be shown, following this command, in CIDR bit count notation. • The sample output is filtered with the **begin** keyword to start displaying output at the DHCP section of the running configuration.
Step 3	**show ip dhcp pool** [*pool-name*] **Example:** `Router> show ip dhcp pool`	Displays information about DHCP pools. • This command can be used to verify subnet allocation pool configuration on both the subnet allocation server and the ODAP manager. • The output of this command displays specific address pool information, including the name of the pool, utilization of address space, subnet size, number of total addresses, number of leased address, and pending events.
Step 4	**show ip dhcp binding** [*ip-address*] **Example:** `Router> show ip dhcp binding`	Displays information about DHCP bindings. • This command can be used to display subnet allocation to DHCP binding mapping information. • The output from this command displays binding information for individual IP address assignment and allocated subnets. The output that is generated for DHCP IP address assignment and subnet allocation is almost identical, except that subnet leases display an IP address followed by the subnet mask (which shows the size of the allocated subnet). Bindings for individual IP address only display an IP address and are not followed by a subnet mask.

Troubleshooting the DHCP ODAP Subnet Allocation Server

Perform this task to troubleshoot the DHCP ODAP subnet allocation server.

SUMMARY STEPS

1. **enable**
2. **debug dhcp** [**detail**]

3. **debug ip dhcp server**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**debug dhcp** [**detail**] **Example:** `Router# debug dhcp detail`	Displays debugging information about DHCP client activities and monitors the status of DHCP packets. • This command is issued with the **detail** keyword on the ODAP manager. The **detail** keyword is used to display and monitor the lease entry structure of the client and the state transitions of lease entries. This command also displays the values of the op, htype, hlen, hops, server identifier option, xid, secs, flags, ciaddr, yiaddr, siaddr, and giaddr fields of the DHCP packet that are shown in addition to the length of the options field.

Step 3	**debug ip dhcp server** {**events** | **packets** | **linkage**}
	
	Example:
	`Router# debug ip dhcp server packets`
	`Router# debug ip dhcp server events`
		Enables DHCP server debugging.
		• This command is issued with the **packets** and **events** keywords on the subnet allocation server. The output displays lease transition and reception, as well as database information.

Configuration Examples for DHCP ODAP Server Support

This section provides the following configuration examples:

Configuring a Global Pool for a Subnet Allocation Server: Example

The following example shows how to configure a router to be a subnet allocation server and create a global subnet allocation pool named “GLOBAL-POOL” that allocates subnets from the 10.0.0.0/24 network. The configuration of the **subnet prefix-length** command in this example configures the size of each subnet that is allocated from the subnet pool to support 254 host IP addresses.

```
ip dhcp pool GLOBAL-POOL
 network 10.0.0.0 255.255.255.0
 subnet prefix-length 24
!
```

Configuring a VRF Pool for a Subnet Allocation Server: Example

The following example shows how to configure a router to be a subnet allocation server and create a VRF subnet allocation pool named “VRF-POOL” that allocates subnets from the 172.16.0.0/16 network and configures the VPN to match the VRF named “RED.” The configuration of the **subnet prefix-length** command in this example configures the size of each subnet that is allocated from the subnet pool to support 62 host IP addresses.

```
 ip dhcp pool VRF-POOL
 vrf RED
 network 172.16.0.0 /16
 subnet prefix-length 26
!
```

Using a VPN ID to Configure a VRF Pool on a Subnet Allocation Server: Example

The following example shows how to configure a router to be a subnet allocation server and create a VRF subnet allocation pool named “VRF-POOL” that allocates subnets from the 192.168.0.0/24 network and configures the VRF named “RED.” The VPN ID must match the unique identifier that is assigned to the client site. The route target and route distinguisher are configured in the as-number:network-number format. The route target and route distinguisher must match. The configuration of the **subnet prefix-length** command in this example configures the size of each subnet that is allocated from the subnet pool to support 30 host IP addresses.

```
ip vrf RED
 rd 100:1
 route-target both 100:1
```

```
 vpn id 1234:123456
 exit
 ip dhcp pool VPN-POOL
  vrf RED
  network 192.168.0.0 /24
  subnet prefix-length /27
  exit
```

Verifying Local Configuration on a Subnet Allocation Server: Example

The following example is output from the **show running-config** command. This command can be used to verify the local configuration on a subnet allocation server. The output from this command displays the configuration of the **subnet prefix-length** command under the DHCP pool named "GLOBAL-POOL." The total size of the subnet allocation pool is set to 254 addresses with the **network** command. The configuration of the **subnet prefix-length** command configures this pool to allocate a subnet that will support 254 host IP addresses. Because the total pool size supports only 254 addresses, only one subnet can be allocated from this pool.

```
Router# show running-config | begin dhcp

ip dhcp pool GLOBAL-POOL
   network 10.0.0.0 255.255.255.0
   subnet prefix-length 24
!
```

Verifying Address Pool Allocation Information: Example

The following examples are output from the **show ip dhcp pool** command. This command can be used to verify subnet allocation pool configuration on the subnet allocation server and the ODAP manager. The output from this command displays information about the address pool name, utilization level, configured subnet size, total number of addresses (from subnet), pending events, and specific subnet lease information.

The following sample output shows that the configured subnet allocation size is /24 (254 IP addresses), that there is a pending subnet allocation request, and there are no subnets in the pool:

```
Router> show ip dhcp pool ISP-1

Pool ISP-1 :
 Utilization mark (high/low)    :100 / 0
 Subnet size (first/next)       :24 / 24 (autogrow)
 Total addresses                :0
 Leased addresses               :0
 Pending event                  :subnet request
 0 subnet is currently in the pool
```

The next example shows that the configured subnet allocation size is /24 (254 IP address), the configured VRF name is "RED", and a subnet containing 254 IP addresses has been allocated but no IP addresses have been leased from the subnet:

```
Router> show ip dhcp pool SUBNET-ALLOC

Pool SUBNET-ALLOC :
 Utilization mark (high/low)    :100 / 0
 Subnet size (first/next)       :24 / 24 (autogrow)
 VRF name                       :RED
 Total addresses                :254
 Leased addresses               :0
 Pending event                  :none
 1 subnet is currently in the pool :
```

```
Current index        IP address range                  Leased addresses
10.0.0.1              10.0.0.1          - 10.0.0.254          0
```

Verifying Subnet Allocation and DHCP Bindings: Example

The following example is from the **show ip dhcp binding** command. This command can be used to display subnet allocation to DHCP binding mapping information. The output of this command shows the subnet lease to MAC address mapping, the lease expiration, and the lease type (subnet lease bindings are configured to be automatically created and released by default). The output that is generated for DHCP IP address assignment and subnet allocation is almost identical, except that subnet leases display an IP address followed by the subnet mask (which shows the size of the allocated subnet) in CIDR bit count notation. Bindings for individual IP address only display an IP address and are not followed by a subnet mask.

```
Router# show ip dhcp binding

Bindings from all pools not associated with VRF:
IP address          Client-ID/              Lease expiration        Type
                    Hardware address/
                    User name
10.0.0.0/26         0063.6973.636f.2d64.    Mar 29 2003 04:36 AM    Automatic
                    656d.6574.6572.2d47.
                    4c4f.4241.4c
```

Additional References

For additional information related to the DHCP ODAP Server Support feature, refer to the following references:

Related Documents

Related Topic	Document Title
DHCP commands	*Cisco IOS IP Command Reference, Volume 1 of 3: Addressing and Services*, Release 12.2
DHCP configuration tasks	*Cisco IOS IP Configuration Guide*, Release 12.2
ODAP manager configuration tasks	*DHCP Server—On-Demand Address Pool Manager*, Release 12.2(15)T http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t8/ftondhcp.htm

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.	—

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

RFCs[1]	Title
RFC 2131	*Dynamic Host Configuration Protocol*
RFC 2132	*DHCP Options and BOOTP Vendor Extensions*
draft-ietf-dhc-agent-vpn-id-02.txt	*VPN Identifier sub-option for the Relay Agent Information Option*
draft-ietf-dhc-subnet-alloc-00.txt	*Subnet Allocation using DHCP*
draft-ietf-dhc-vpn-option-02.txt	*DHCP VPN Information option*

1. Not all supported RFCs are listed.

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, tools, and lots more. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Command Reference

This section documents new and modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

- subnet prefix-length
- show ip dhcp binding

subnet prefix-length

To configure a subnet allocation pool and determine the size subnets that are allocated from the pool, use the **subnet prefix-length** command in DHCP pool configuration mode. To unconfigure subnet pool allocation, use the **no** form of this command.

subnet prefix-length *prefix-length*

no subnet prefix-length *prefix-length*

Syntax Description

prefix-length	Configures the IP subnet prefix length in classless interdomain routing (CIDR) bit count notation. The range is from 1 to 31.

Defaults

No default behavior or values.

Command Modes

DHCP pool configuration

Command History

Release	Modification
12.2(15)T	This command was introduced.

Usage Guidelines

This command is used to configure a Cisco IOS router as a subnet allocation server for a centralized or remote VPN on-demand address pool (ODAP) manager. This command is configured under a DHCP pool. The *prefix-length* argument is used to determine the size of the subnets that are allocated from the subnet allocation pool. The values that can be configured for the *prefix-length* argument follow CIDR bit count notation format.

Configuring Global Subnet Pools

Global subnet pools are created in a centralized network. The ODAP server allocates subnets from the subnet allocation server based on subnet availability. When the ODAP manager allocates a subnet, the subnet allocation server creates a subnet binding. This binding is stored in the DHCP database for as long as the ODAP server requires the address space. The binding is destroyed and the subnet is returned to the subnet pool only when the ODAP server releases the subnet as address space utilization decreases.

Configuring VPN Subnet Pools

A subnet allocation server can be configured to assign subnets from VPN subnet allocation pools for MPLS VPN clients. VPN routes between the ODAP manager and the subnet allocation server are configured based on VRF name or VPN ID configuration. The VRF and VPN ID are configured to maintain routing information that defines customer VPN sites. This customer site is attached to a provider edge (PE) router. A VRF consists of an IP routing table, a derived Cisco Express Forwarding (CEF) table, a set of interfaces that use the forwarding table, and a set of rules and routing protocol parameters that control the information that is included in the routing table.

Configuring VPN Subnet Pools for VPN clients with VPN IDs

A subnet allocation server can also be configured to assign subnets from VPN subnet allocation pools based on the VPN ID of a client. The VPN ID (or Organizational Unique Identifier [OUI]) is a unique identifier assigned by the IEEE. VPN routes between the ODAP manager and the subnet allocation server are enabled by configuring the DHCP pool with a VPN ID that matches the VPN ID that is configured for the VPN client.

Examples

Global Configuration Example

The following example configures a router to be a subnet allocation server and creates a global subnet allocation pool named GLOBAL-POOL from the 10.0.0.0 network. The configuration of the **subnet prefix-length** command in this example configures each subnet that is allocated from the subnet pool to support 254 host IP addresses.

```
Router(config)# ip dhcp pool GLOBAL-POOL
Router(dhcp-config)# network 10.0.0.0 255.255.255.0
Router(dhcp-config)# subnet prefix-length 24
!
```

VPN Configuration Example

The following example configures a router to be a subnet allocation server and creates a VRF subnet allocation pool named VRF-POOL from the 172.16.0.0 network and configures the VPN to match the VRF named RED. The configuration of the **subnet prefix-length** command in this example configures each subnet that is allocated from the subnet pool to support 62 host IP addresses.

```
Router(config)# ip dhcp pool VRF-POOL
Router(dhcp-config)# vrf RED
Router(dhcp-config)# network 172.16.0.0 /16
Router(dhcp-config)# subnet prefix-length 26
!
```

VPN ID Configuration Example

The following example configures a router to be a subnet allocation server and creates a VRF subnet allocation pool named VRF-POOL from the 192.168.0.0 network and configures the VRF named RED. The VPN ID must match the unique identifier that is assigned to the client site. The route target and route distinguisher are configured in the as-number:network number format. The route target and route distinguisher must match. The configuration of the **subnet prefix-length** command in this example configures each subnet that is allocated from the subnet pool to support 30 host IP addresses.

```
Router(config)# ip vrf RED
Router(config-vrf)# rd 100:1
Router(config-vrf)# route-target both 100:1
Router(config-vrf)# vpn id 1234:123456
Router(config-vrf)# exit
Router(config)# ip dhcp pool VPN-POOL
Router(dhcp-config)# vrf RED
Router(dhcp-config)# network 192.168.0.0 /24
Router(dhcp-config)# subnet prefix-length /27
Router(dhcp-config)# exit
```

Related Commands

Command	Description
ip dhcp database	Configures a Cisco IOS DHCP server to save automatic bindings on a remote host called a database agent.
ip dhcp pool	Enables the IP address of an interface to be automatically configured when a DHCP pool is populated with a subnet from IPCP negotiation.
network (DHCP)	Configures the subnet number and mask for a DHCP address pool on a Cisco IOS DHCP server.
show ip dhcp pool	Displays information about the DHCP pools.

show ip dhcp binding

To display address bindings on the Cisco IOS Dynamic Host Configuration Protocol (DHCP) server, use the **show ip dhcp binding** command in user or privileged EXEC mode.

show ip dhcp binding [*ip-address*]

Syntax Description

ip-address	(Optional) Specifies the IP address of the DHCP client for which bindings will be displayed.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
12.0(1)T	This command was introduced.
12.2(15)T	Support to display allocated subnets was added to the output.

Usage Guidelines

This command is used to display DHCP binding information for IP address assignment and subnet allocation. If the address is not specified, all address bindings are shown. Otherwise, only the binding for the specified client is displayed. The output from this command displays binding information for individual IP address assignment and allocated subnets. The output that is generated for DHCP IP address assignment and subnet allocation is almost identical, except that subnet leases display an IP address followed by the subnet mask (which shows the size of the allocated subnet). Bindings for individual IP address only display an IP address and are not followed by a subnet mask.

Examples

IP Address Assignment Example

The following examples show the DHCP binding address parameters, including an IP address, an associated MAC address, a lease expiration date, and the type of address assignment that have occurred. Table 1 lists descriptions of the fields in each example.

```
Router# show ip dhcp binding 172.16.1.11

IP address    Hardware address    Lease expiration        Type
172.16.1.11   00a0.9802.32de      Feb 01 1998 12:00 AM    Automatic

Router# show ip dhcp binding 172.16.3.254

IP address    Hardware address    Lease expiration        Type
172.16.3.254  02c7.f800.0422      Infinite                Manual
```

Table 1 show ip dhcp binding Field Descriptions

Field	Description
IP address	The IP address of the host as recorded on the DHCP server.
Hardware address	The MAC address or client identifier of the host as recorded on the DHCP server.
Lease expiration	The lease expiration date and time of the IP address of the host.
Type	The manner in which the IP address was assigned to the host.

Subnet Allocation Example

The following example shows the subnet lease to MAC address mapping, the lease expiration, and the lease type (subnet lease bindings are configured to be automatically created and released by default). The output that is generated for DHCP IP address assignment and subnet allocation is almost identical, except that subnet leases display an IP address followed by the subnet mask (which shows the size of the allocated subnet) in CIDR bit count notation. Bindings for an individual IP address only display an IP address and are not followed by a subnet mask. Table 2 lists descriptions of the fields in each example.

```
Router# show ip dhcp binding

Bindings from all pools not associated with VRF:
IP address          Client-ID/              Lease expiration        Type
                    Hardware address/
                    User name
10.0.0.0/26         0063.6973.636f.2d64.    Mar 29 2003 04:36 AM    Automatic
                    656d.6574.6572.2d47.
                    4c4f.4241.4c
```

Table 2 show ip dhcp binding Field Descriptions

Field	Description
IP address	The IP address of the host as recorded on the DHCP server. The subnet that follows the IP address (/26) in the example defines this binding as a subnet allocation binding.
Hardware address	The MAC address or client identifier of the host as recorded on the DHCP server.
Lease expiration	The lease expiration date and time of the IP address of the host.
Type	The manner in which the IP address was assigned to the host.

Related Commands

Command	Description
clear ip dhcp binding	Deletes an automatic address binding from the Cisco IOS DHCP server database.