CHAPTER 18

Managing Address Space

Address blocks provide an organizational structure for addresses used across the network. Address blocks can consist of static addresses or dynamic addresses allocated to DHCP servers for lease assignment. An address block can have any number of child address blocks and can culminate in one or more child subnets. The address block administrator is responsible for these objects. This administrator can create parent and child address blocks or subnets, which are always the leaf nodes of the address space. Static subnets can be further subdivided into one or more IP address ranges. However, dynamically added subnets create their own subnets that the administrator cannot modify or delete.

Address Block Administrator Role

The address block administrator role manages address space at a higher level than that of specific subnet or static address allocations. This is actually a middle manager role, as there is likely to be a higher authority handing out address blocks to the system.

Required Permissions

To exercise the functions available to the address administrator, you must have:

- On the regional cluster:
  - The addrspace license entered in the system
  - The regional-addr-admin role assigned—This role should probably be unencumbered by further subnet-utilization, lease-history, ric-management, and dhcp-management subrole restrictions
- On the local cluster, the addrblock-admin role assigned

Role Functions

These functions are available to the address block administrator:

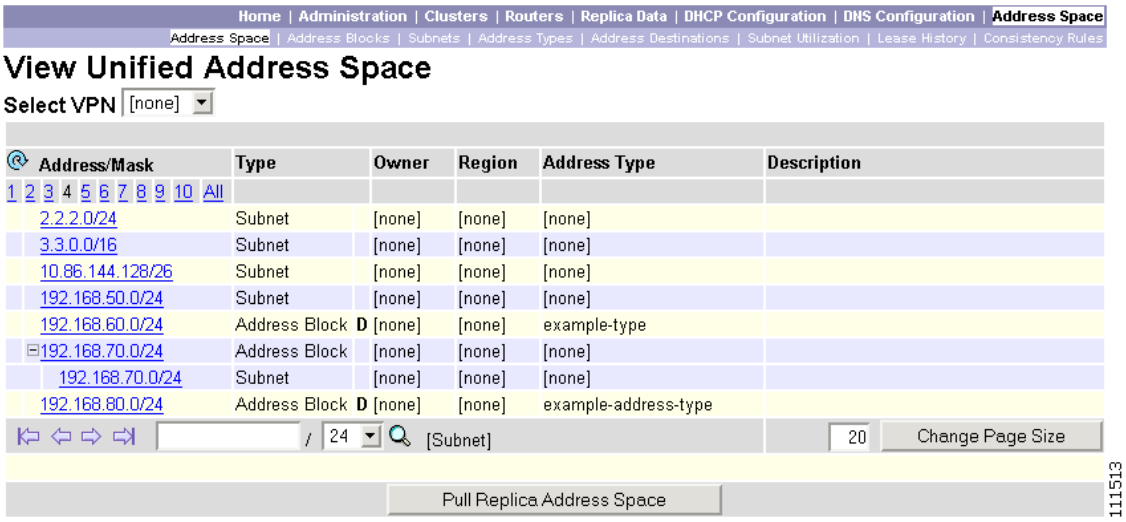
- On the regional cluster:
  - Address aggregation—For example, if the 10.0.0.0/16 address block exists at the regional cluster and a local cluster administrator creates the 10.1.1.0/24 address block, the local address block (through replication) is rolled up under its parent at the regional cluster. This allows a unified view of the address space at the regional cluster without affecting the local cluster configuration.

- Address delegation—Administrators can delegate address space to the local cluster, thereby giving up authority of the delegated object.
- Subnet utilization reports—The regional cluster supports subnet utilization reporting across regions, protocol servers, and sets of network hardware. The central configuration administrator can poll the local clusters for subnet utilization by VPN (if defined), time range and criteria that contain the following selections: owner, region, address type, address block, subnet, or all. For details on querying subnet utilization, see the "Generating Subnet Utilization Reports" section on page 18-12.
- Lease history reports—This provides a single vantage point on the lease history of multiple DHCP servers. The administrator can query the history data at the local cluster to constrain the scope of the history report. Lease histories can be queried by VPN (if defined), time range and criteria that contain the following selections: IP address, MAC address, IP address range, or all. This is an important feature to meet government and other agency mandates concerning address traceability. For details on querying lease history, see the "Running Lease Histories" section on page 12-13.
- Polling configurations—The administrator can control the intervals and periods of local cluster polling for replication, IP histories, and subnet utilization. You can also set the lease history and subnet utilization trimming ages and compacting intervals at the CCM server level. (See Chapter 5, "Managing the Central Configuration.")
- Check the DHCP and address data consistency
- On the local cluster:
- Manage address blocks, subnets, and address types
- Check the DHCP and address data consistency

Viewing Unified Address Space

You can view the static and dynamic address space on the View Unified Address Space page (see Figure 18-1). This address space is a hierarchical tree of address blocks and subnets, sorted in IP address order. You can select the level of depth to display the tree. You can also expand and contract nodes, which recursively expands or contracts all child nodes. If you pick a new level, this overrides the previous expansion or contraction. This page is available in the local cluster and regional cluster Web UI.

Figure 18-1 View Unified Address Space Page



Pulling Replica Address Space from Local Clusters

You may choose to pull address space from the replica data of the local clusters instead of explicitly creating them.

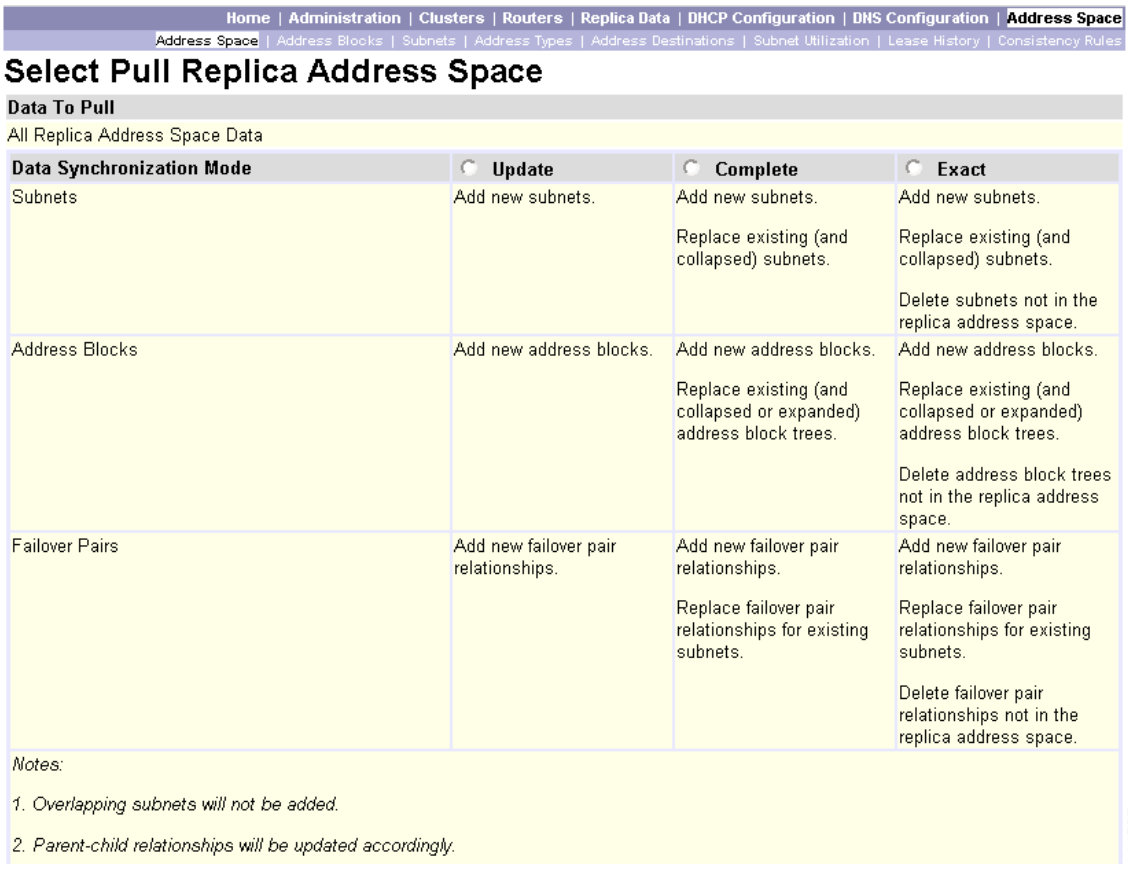
Note Pulling replica address space from a local cluster where subnets were removed does not clear the server name on the subnet. Although the subnet is no longer used, it is still considered allocated to the server. Hence, the delete operation does not appear for the subnet, so that you cannot delete the subnet from the regional cluster. To push or re-allocate the subnet to a different cluster, or remove it from the regional cluster, you must first reclaim the subnet (see the "Reclaiming Subnets" section on page 18-10). This clears the reference to the local server.

To pull the replica address space:

Step 1 On the View Unified Address Space page, click **Pull Replica Address Space**.

Step 2 Select the data synchronization mode on the Select Pull Replica Address Space page (see Figure 18-2).

Figure 18-2 Select Pull Replica Address Space Page



Step 3 Click **Report** at the bottom of the page.

Step 4 Click **Run** on the Report Pull Replica Address Space page.

Step 5 Click **OK** on the Run Pull Replica Address Space page.

Address Blocks and Subnets

An address block is an aggregate of IP addresses based on a power-of-two address space that can be delegated to an authority. For example, the 192.168.0.0/16 address block (part of the RFC 1918 private address space) includes 2^{16} (or 65536) addresses. Address blocks can be further divided into child address blocks and subnets. For example, you might want to delegate the 192.168.0.0/16 address block further into four child address blocks—192.168.0.0/18, 192.168.64.0/18, 192.168.128.0/18, and 192.168.192.0/18.

Note The DHCP server also uses address blocks to manage subnet allocation for on-demand address pools (see Chapter 19, "Configuring Virtual Private Networks and Subnet Allocation"). Address blocks used for dynamic address pools must be created using the **address-block** command in the CLI. The unified address view in the Web UI also displays these dynamic address blocks, but does not provide an edit link

to them, because they have been delegated in their entirety to the DHCP server. They should not be further subdivided for subnet allocation. The DHCP server automatically handles these address blocks as it receives subnet requests. These address pools are indicated by a **D** (for "Delegated").

A subnet is the leaf node of the address space and cannot be further subdivided. If you create the 192.168.50.0/24 subnet, you can subsequently create an address block by that same name, and the subnet will become a child of the address block. However, you cannot further subdivide or delegate the 192.168.50.0/24 subnet.

Subnets can have one or more defined address ranges. Address blocks cannot have address ranges. When you create an address range for a subnet using the Web UI, it becomes a static range, meaning that it cannot be allocated dynamically using DHCP. However, the Web UI shows any dynamic ranges defined by DHCP scopes for the subnet. Displaying the ranges as such indicates where overlaps may occur between assigning static addresses for the address space and dynamic addresses for scopes.

The address space view shows the hierarchy of address block and subnets and their parent-child relationships. The hierarchy does not go down to the level of address ranges for each subnet. These are displayed when you access the subnet.

Viewing Address Blocks and Subnets

To view the address blocks and subnets created for a network in both the local cluster and regional cluster Web UIs, click **Address Space** on the Primary Navigation bar, then **Address Space** on the Secondary Navigation bar. This opens the View Unified Address Space page (see Figure 18-1 on page 18-3).

To select a level of depth for the address space, click one of the numbers across the top, or click **All** to get all levels. The address space appears below the row of numbers. The Address Type column identifies the type of object displayed, an address block or a subnet. The Owner column identifies the owner of the address space, and the Region column identifies the assigned region for the address space.

Address spaces that were assigned dynamically are indicated by a **D** (for "Delegated") in the Address Type column. You cannot delete this delegated address space.

To refresh the view, click the Refresh icon ( ).

Knowing When to Add Address Blocks

This use case describes the set of user actions associated with adding a new address block to the network in a shared management network. These preconditions are assumed:

1. From summary IP address utilization reports (see "Enabling Subnet Utilization Collection" section on page 5-6), an address block administrator notes that the company's top level address block is nearing the 90% utilization mark.
2. The address block administrator submits a request for more address space from ARIN (or some other numbering authority) and the request is granted.

Once the address space is made available, the regional address administrator:

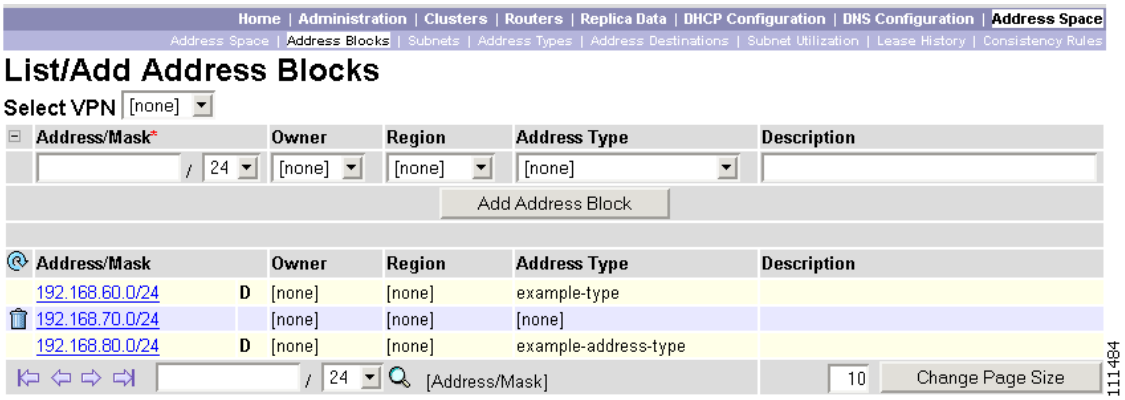
1. Adds the new blocks to the central address block map, and based on a review of the utilization reports, creates and delegates address blocks to be used by the local clusters. The action of delegating the address blocks causes them to be pushed to the local clusters.
2. Allocates the new address space to network elements as needed, using router and failover synchronization features to simplify the configuration tasks:

- Allocates subnets to a failover pair—Gets a scope template for the subnet, either from the subnet or the failover pair.
- Allocates subnets to a router interface configuration (RIC) server interface and failover pair.
- Finds a free subnet—Finds the address block of the right type.
- Allocates the free subnet to an address destination (DHCP server or other destination).

Adding Address Blocks

To view address block in the local cluster and regional cluster Web UIs, click **Address Blocks** on the Secondary Navigation bar to open the List/Add Address Blocks page (see Figure 18-3 for a partial view of the regional cluster version of this page).

Figure 18-3 List/Add Address Blocks Page



To add an address block, enter its network address in the Address/Mask field, then select the address mask from the drop-down list. For example, enter 192.168.50.0 in the Address Mask field, then select 24 in the drop-down list to create the 192.168.50.0/24 address block, which is all the addresses in the range 192.168.50.0 through 192.168.50.256.

For a review of the number of available addresses for each subnet mask, see Table 18-1. These available hosts exclude the two network and broadcast addresses in each range.

Table 18-1 Subnet Masking

Network Mask	Octet Designation	Available Hosts in Each Address Range
/8	255.0.0.0	16777214
/9	255.128.0.0	8338606
/10	255.192.0.0	4194302
/11	255.224.0.0	2097150
/12	255.240.0.0	1048574
/13	255.248.0.0	524286
/14	255.252.0.0	262142
/15	255.254.0.0	131070
/16	255.255.0.0	65534

Table 18-1 Subnet Masking (continued)

Network Mask	Octet Designation	Available Hosts in Each Address Range
/17	255.255.128.0	32766
/18	255.255.192.0	16382
/19	255.255.224.0	8190
/20	255.255.240.0	4084
/21	255.255.248.0	2046
/22	255.255.252.0	1022
/23	255.255.254.0	5010
/24	255.255.255.0	254
/25	255.255.255.128	126
/26	255.255.255.192	62
/27	255.255.255.224	30
/28	255.255.255.240	14
/29	255.255.255.248	6
/30	255.255.255.252	2

Delegating Address Blocks

Address block delegation is the coordinated actions of marking the delegated address block in the regional cluster as being delegated to a local cluster and creating the delegated address block in the local cluster. To delegate an address block to a local cluster, the address block cannot have child address blocks or subnets. The delegated address block created at the local server must have the same address size as the one at the regional cluster.

You can delegate only one address block to one local cluster at a time; you cannot delegate it to multiple local clusters. In the local cluster, the only allowed address destination is the local DHCP server. In the central or regional cluster, the address destination can be either a remote DHCP server or a remote CCM cluster.

To delegate an address block, you must:

1. Have the central configuration administrator create a local cluster to which to delegate the address block (see the "Setting Up Server Clusters" section on page 5-1).
2. Have the central configuration administrator synchronize the regional cluster with the local cluster (see the "Synchronizing with Local Clusters" section on page 5-3). The local cluster will have address source references to the regional cluster through the synchronization process.
3. Create an address destination at the regional cluster to which to delegate the address block.
4. Delegate the address space to that address destination.

For example:

Step 1 Have the central configuration administrator create a local cluster, ServProv-One, then resynchronize it with the local cluster:

a. Log in to the regional cluster as the central configuration administrator.

b. Click **Clusters** on the Primary Navigation bar, then **Cluster List** on the Secondary Navigation bar.

c. Click **Add Cluster** on the List Server Clusters page to open the Add Server Cluster page.

d. Enter the cluster name **ServProv-One** and the connection data, then click **Add Cluster**.

e. On the List Server Clusters page, click the Resynchronize icon ( ) next to the ServProv-One cluster.

Step 2 As regional address administrator, create an address block:

a. Log in to the regional cluster as the regional address administrator.

b. Click **Address Space** on the Primary Navigation bar, then **Address Blocks** on the Secondary Navigation bar to open the List/Add Address Blocks page.

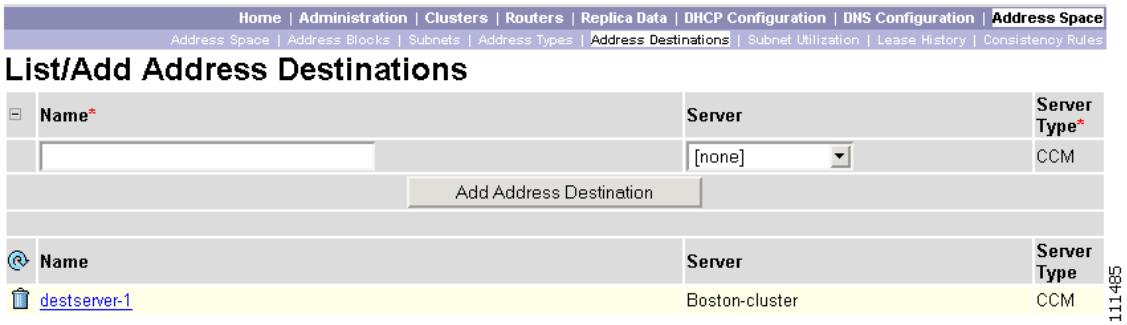
c. Enter **192.168.50.0** in the Address/Mask field, then select **24** in the mask drop-down list.

d. Click **Add Address Block**.

Step 3 Create an address destination (SP1-Dest) for the local cluster:

a. Click **Address Space** on the Primary Navigation bar, then **Address Destinations** on the Secondary Navigation bar to open the List/Add Address Destinations page (see Figure 18-4).

Figure 18-4 List/Add Address Destinations Page



b. Enter **SP1-Dest** in the Name field, then select **ServProv-One** from the Server drop-down list.

c. Click **Add Address Destination**.

Step 4 Delegate the address block to the address destination:

a. Click **Address Blocks** on the Secondary Navigation bar to open the List/Add Address Blocks page.

b. Click the name of the **192.168.50.0/24** address block to open the Edit Address Block page.

c. In the Address Block Delegation section of the page, select **SP1-Dest** in the drop-down list, then click **Delegate Block**.

d. The Edit Address Block page indicates that the "Block is delegated to SP1-Dest."

e. Click **Modify Address Block**.

f. The List/Add Address Blocks page now identifies the address block as being delegated (**D**). You can now no longer delete it, because it is delegated to the ServProv-One cluster.

Pushing Subnets to Local DHCP Servers and Routers

To add a subnet to a local cluster and also to a router:

Step 1 Have the central configuration administrator create a local cluster and resynchronize it with the local cluster. If pushing to a router, also ensure that a router license exists on the regional cluster.

Step 2 Create a subnet on the regional cluster:

a. On the Primary Navigation bar, click **Address Space**, then **Subnets** on the Secondary Navigation bar. This opens the List/Add Subnets page (see Figure 4-17 on page 4-19).

b. Enter at least the network address and select the mask of the subnet, then click **Add Subnet**.

Step 3 Have the central configuration administrator create a scope template so that it can create a scope to contain a subnet:

a. Log in to the regional cluster as the central configuration administrator.

b. Click **DHCP Configuration** on the Primary Navigation bar, then **Scope Templates** on the Secondary Navigation bar to open the List DHCP Scope Templates page.

c. Click **Add Scope Template** to open the Add DHCP Scope Template page.

d. Among other entries on this page, enter the **create-range** expression in the Range Expression field to create a scope with that subnet. (If you select a policy for the scope template, be sure that the policy exists on the local cluster, or you must push the policy to the local cluster. See the "Pushing Policies to Local Clusters" section on page 5-18.) Click **Add Scope Template**.

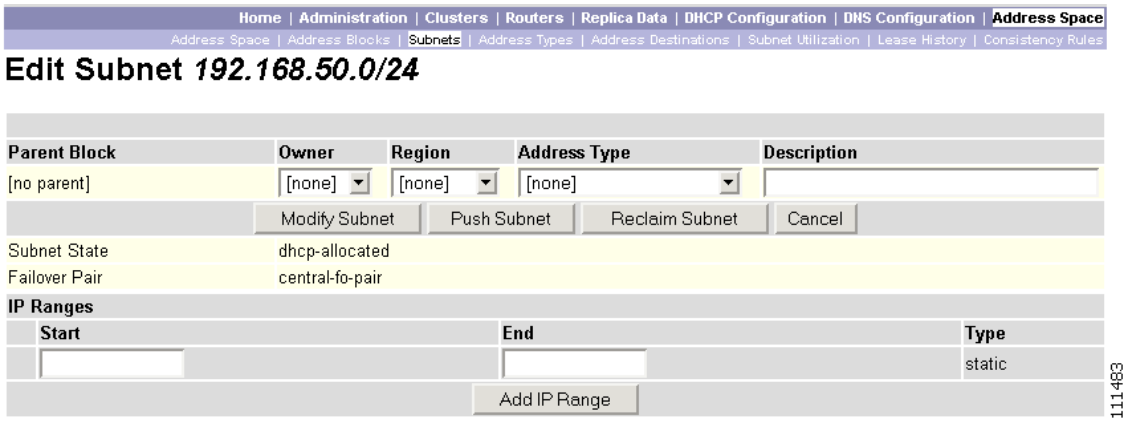
Step 4 As regional address administrator, add the subnet to the local cluster's DHCP server:

a. Log in to the regional cluster as the regional address administrator.

b. Click **Address Space** on the Primary Navigation bar, then **Subnets** on the Secondary Navigation bar to open the List/Add Subnets page.

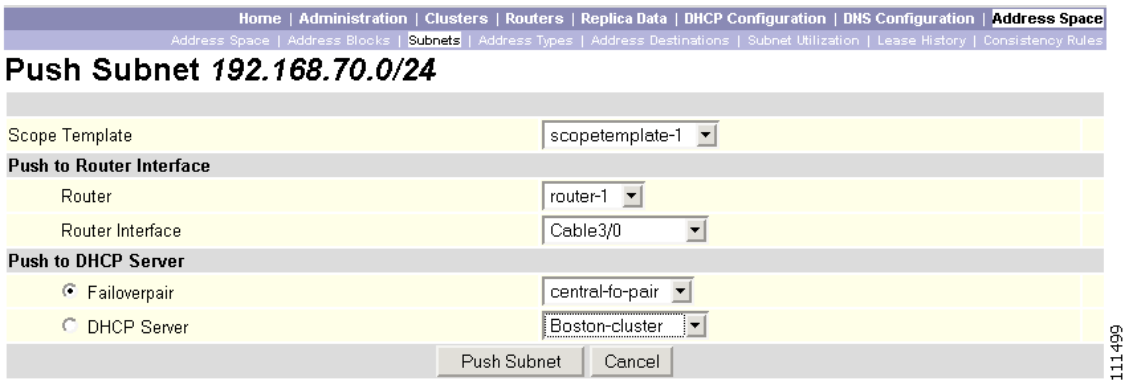
c. Click the name of the subnet to open the Edit Subnet page (see Figure 18-5).

Figure 18-5 Edit Subnet Page



d. Click **Push Subnet**. This opens the Push Subnet page (see Figure 18-6).

Figure 18-6 Push Subnet Page



e. Select the scope template from the drop-down list.

f. Select the router and the router interface from the drop-down lists.

g. Select the DHCP Server radio button, then select the cluster from the drop-down list.

h. Click **Push Subnet**.

Reclaiming Subnets

Once you delegate a subnet to the DHCP or RIC server, you can reclaim it if necessary:

Step 1 Click **Address Space** on the Primary Navigation bar, then **Subnets** on the Secondary Navigation bar to open the List/Add Subnets page.

Step 2 Click the name of the subnet to open the Edit Subnet page (see Figure 18-5 on page 18-9).

Step 3 Click **Reclaim Subnet**.

Step 4 On the Reclaim Subnet page, click **Reclaim Subnet**.

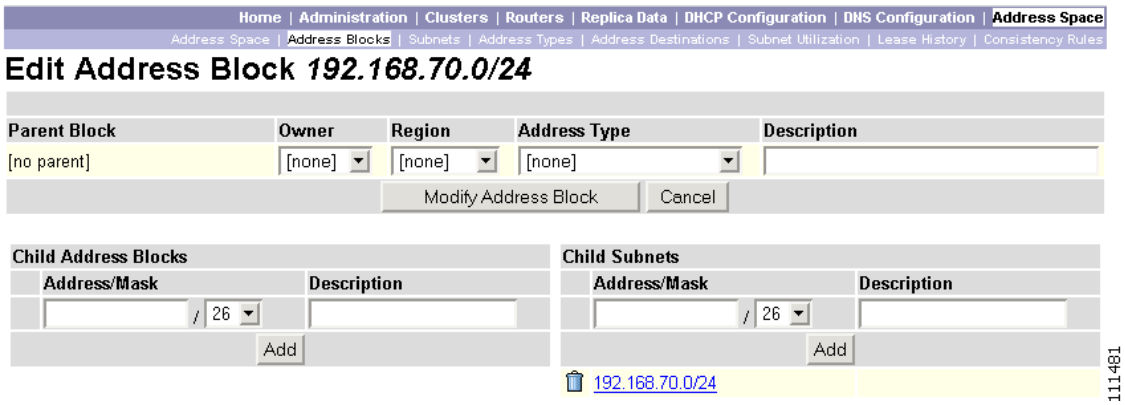
Adding Children to Address Blocks

You might want to subdivide undelegated address blocks into child address blocks or subnets. You can do this on the regional and local cluster.

Step 1 On the Primary Navigation bar, click **Address Space**, then on the Secondary Navigation bar, click **Address Blocks**. This opens the List/Add Address Blocks page (see Figure 18-3 on page 18-6).

Step 2 Click the name of an address block that is not marked as delegated (**D**). This opens the Edit Address Block page (see Figure 18-7 for the local cluster page).

Figure 18-7 Edit Address Block Page



Step 3 To add a child address block, add an address in the Address/Mask field of the Child Address Blocks section of the page that is part of the address block network address, but select a higher mask value than the parent address block. Then click **Add**.

An error message appears if you try to set the same network address for a child address block as for a child subnet.

If you omit a value when you click **Add**, this automatically adds the subdivisions of the parent address space with the appropriate mask value. For example, if the parent space is 192.168.50.0/24, you omit any child subnet value, and click **Add**, the Web UI adds the children in this order:

192.168.50.0/26
192.168.50.64/26
192.168.50.128/26
192.168.50.192/26

Step 4 To add a child subnet, add an address in the Address/Mask field of the Child Subnets section of the page that is part of the address block network address, but select a higher mask value than the parent address block. Then click **Add**.

An error message appears if you try to set the same network address for a child address block as for a child subnet.

If you omit a value when you click **Add**, this automatically adds the subdivisions of the parent address space with the appropriate mask value. For example, if the parent space is 192.168.50.0/24, you omit any child subnet value, and click **Add**, the Web UI adds the children in this order:

192.168.50.0/26
192.168.50.64/26
192.168.50.128/26
192.168.50.192/26

Adding Address Ranges to Subnets

You can edit the subnet data and add any number of address ranges to a subnet. These ranges must be in the subnet's designated network.

Step 1 On the Primary Navigation bar, click **Address Space** tab, then click **Subnets** on the Secondary Navigation bar. This opens the List/Add Subnets page.

Step 2 Click the name of the subnet to which you want to add address ranges. This opens the Edit Subnet page (see Figure 18-5 on page 18-9).

Step 3 Enter the starting address of the range in the Start field in the IP Ranges area of the page, then add the ending address in the End field. If you add just the host numbers in these fields, the relative address in the range determined by the address mask is used.

Step 4 Click **Add IP Range**.

Generating Subnet Utilization Reports

You can extract subnet utilization data so that you can determine how many addresses in the subnet were allocated and what the free address space is. You can use additional administrative functions to trim and compact the subnet utilization database of records, so as to keep the size of the database from growing without bounds.

Enabling Subnet Utilization Recording on the Local Cluster

You must explicitly enable subnet utilization recording for the local cluster DHCP server. You can do this in the local Web UI:

Step 1 On the Primary Navigation bar, click **DHCP**, then click **DHCP Server** on the Secondary Navigation bar.

Step 2 On the Manage DHCP Server page, click the **Local DHCP** Server link.

Step 3 On the Edit DHCP Server page, look for the Subnet Utilization Settings attributes, which determine how frequently snapshots of the data are taken and how over which period of time the data should be maintained:

- *collect-addr-util-duration*—Maximum period, in hours, the DHCP server maintains address utilization data. This value is set to 0 by default. To disable DHCP server from collecting any address utilization data, unset this parameter or set it of 0.
- *collect-addr-util-interval*—Frequency, in minutes or hours, that the DHCP server should maintain address utilization data snapshots, assuming that the *collect-addr-util-duration* attribute is not unset or set to 0. This value is set to 15 minutes by default.

Note that both of these parameters can impact DHCP server memory. Each snapshot of data collected for every interval is 68 bytes. For example, if there are 10 scopes, the collection duration is set to 24 hours, and the collection interval is set to one hour, memory used by the DHCP server to maintain address utilization data is 24 times 68 bytes for each scope, or 16K.

Step 4 Click **Modify Server** at the bottom of the page.

Step 5 Reload the DHCP server.

Collecting Subnet Utilization Data

You collect subnet utilization by first having subnets and setting up the scopes, address ranges, and collection criteria on the local cluster. You then set up the local cluster containing the DHCP server as part of the regional cluster, and enable polling the subnet utilization data from the regional cluster:

Step 1 On the Primary Navigation bar, click **Clusters**, then on the Secondary Navigation bar, click **Cluster List**. This opens the List Server Clusters page.

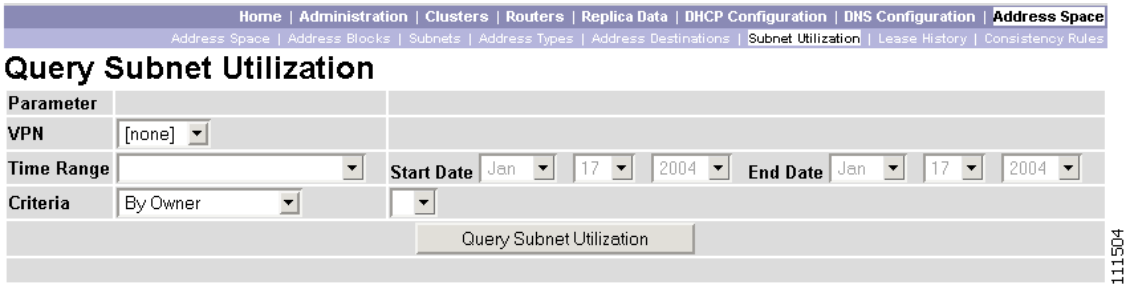
Step 2 Click the name of the local cluster to open the Edit Cluster page.

Step 3 Look for the Subnet Utilization Settings attributes:

- *poll-subnet-util-interval*—Polling interval; be sure that this is set to a reasonable time interval greater than 0.
- *poll-subnet-util-retry*—Retry count in case of a polling failure; by default, this is set to one retry.
- *poll-subnet-util-offset*—Fixed time when polling occurs. For example, setting the offset to 13h (1 P.M.) with the polling interval set to 2h means that polling occurs every two hours, but it must occur at 1 P.M. each day.

Step 4 On the regional cluster, you must also set the selection criteria for querying the subnet utilization data—On the Primary Navigation bar, click **Address Space**, then on the Secondary Navigation bar, click **Subnet Utilization**. This opens the Query Subnet Utilization page (see Figure 18-8).

Figure 18-8 Query Subnet Utilization Page



Step 5 You can query subnet utilization based on the following criteria:

a. The virtual private network (VPN) for the addresses to be polled for lease data—A VPN selection is only available if at least one VPN was defined or pulled to the regional cluster (see the "Creating Virtual Private Networks" section on page 5-10 for how to do this). By default, the query is based on no specific VPN unless you select it from the VPN drop-down list on the page.

b. Time range for the query—Select from one of the following time ranges for the lease history data:

- last 10 days
- last 30 days
- last 60 days
- last 90 days
- from/to (limited to 90 days)

If you select this value, also select the Start Date and End Date month, day, and year from the drop-down lists. The result depends on the value of the *poll-lease-hist-interval* attribute. If the time range is set back one month, but ow you set the polling interval on the DHCP server, as previously described.

c. Criteria—Select the criteria on which you want to base the query:
   - By Owner—Select the owner from the adjacent drop-down list.
   - By Region—Select the region from the adjacent drop-down list.
   - By Address Type—Select the address type from the adjacent drop-down list.
   - By Address Block—Select the address block from the adjacent drop-down list.
   - By Subnet—Select the subnet from the adjacent drop-down list.
   - All—Select by all owners, regions, address types, address blocks, and subnets.

Step 6 Click **Query Subnet Utilization** to open the List Subnet Utilization Records page.

Trimming and Compacting Subnet Utilization Data

If you enabled subnet utilization, you should regularly trim the subnet utilization database so that you can reclaim disk space. Each record has an expiration time. You can also compact the data so that you can view subsets of the records older than a certain age.

The CCM server performs background trimming on the regional cluster, which trims off the subnet utilization data older than a certain age at regular intervals. The trimming intervals are set by default to 0, and the ages (how far back to go in time before trimming) to 24 weeks.

In the regional cluster Web UI, you must be a central configuration administrator assigned the database subrole to adjust the values of and perform subnet utilization trimming and compacting:

Step 1 Click **Administration** on the Primary Navigation, then **Servers** on the Secondary Navigation bar. This opens the Manage Servers page.

Step 2 Click the **Local CCM Server** link to open the Edit CCM Server page.

Step 3 Under the Subnet Utilization Settings, set the following attributes:

- *trim-subnet-util-interval*—How often to trim the old subnet utilization data automatically, the default being not to trim the data. You must set this to a value to trigger any background trimming. The bounded values are 0 to one year, and you can use units in seconds (s), minutes (m), hours (h), days (d), weeks (w), months (m), and years (y).
- *trim-subnet-util-age*—How far back in time to trim the old subnet utilization data automatically, the default being 24 weeks. (However, the *trim-subnet-util-interval* value must be set to other than 0 for trimming to be in effect at all.) The bounded values are 24 hours to one year, and you can use units in seconds (s), minutes (m), hours (h), days (d), weeks (w), months (m), and years (y).

Step 4 You can also force immediate trimming and compacting—At the bottom of the page, find the Trim/Compact Inputs section:

a. Trim/Compact age—How far in time to go back to trim the data. There are no bounds to this value. However, if you set a very small value (such as 1m), it trims or compacts very recent data, which can be undesirable. In fact, if you set it to zero, you lose all of the collected data. Setting the value too high (such as 10y) may end up not trimming or compacting any data.

b. Compact interval— Time interval at which to compact the subnet utilization records older than the Trim/Compact age. This interval can be some multiple of the polling interval. For example, if the compact interval is set to twice the polling interval, it eliminates every other record.

Step 5 If you are trimming immediately, click **Trim All Subnet Utilization** among the controls at the bottom of the page. If you are compacting the data, click **Compact All Subnet Utilization**.

Viewing Subnet Utilization Data

The DHCP server gathers subnet utilization data into three broad categories:

- Active Reserved
- Active Unreserved
- Free Reserved

Each of these categories has a current value for a given collection interval, and low and high values over the life of the DHCP server.

To illustrate the three subnet utilization categories, consider this DHCP scope configuration:

```
Scope 10.10.10.0/24
Range 10.10.10.1   10.10.10.10
Range 10.10.10.20 10.10.10.30
Reservation  10.10.10.1  MAC-1
Reservation  10.10.10.2  MAC-2
Reservation  10.10.10.41 MAC-3
Reservation  10.10.10.42 MAC-4
```

Of the 254 potential leases, only 31 are configured, and two reservations are outside the address range.

Immediately after configuring the scope, adding the ranges and reservations, and reloading the DHCP server, these counters appear for subnet utilization:

```
Active Reserved 0
Active Unreserved 0
Free Unreserved 20
```

As soon as clients MAC-1 and MAC-2 get their reserved leases, subnet utilization then shows as:

```
Active Reserved 2
Active Unreserved 0
Free Unreserved 20
```

When the client MAC-5 gets lease 10.10.10.3, subnet utilization then shows as:

```
Active Reserved 2
Active Unreserved 1
Free Unreserved 19
```

Access to the report is through **Address Space** on the Primary Navigation bar, then **Subnet Utilization** on the Secondary Navigation bar. This opens the List Subnet Utilization Records page.

Tip At the top left corner of the List Subnet Utilization Records page is either the Log icon () for the Netscape browsers that you can click to view a text version of the report, or the Save icon () for the Internet Explorer browser so that you can save the report to a file (.txt by default).

Click one of the records to open the View Subnet Utilization Record page for that record.

Viewing Data Consistency

Consistency rules let you check data inconsistencies, such as overlapping address ranges and subnets.

Adding Data Consistency Rules

You can set data consistency rules on the regional and local clusters. See Table 18-2 and Table 18-3 for the consistency rules you can set in each case.

Table 18-2 Data Consistency Rule Settings on the Regional Cluster

Regional Consistency Rule	Description
Attributes Consistency Rule	Ensures that policies and client-classes with the same names at replication have the same values.
Broadcast Address Rule	Ensures that the dynamic address range for a scope should not include a broadcast address.
Cable Helper Consistency Rule	Ensures that cable helpers and DHCP failover are consistent.
Client-Class Selection Match Tag Rule	Ensures that all client-classes have a scope-selection tag defined by some scope.
Ensure Scope for Subnet Rule	Ensures that a scope is present for every subnet.
Ensure Subnets for Scopes Rule	Ensures that a subnet is present for every scope.
IP Range Consistency Rule	Identifies any overlapping static or dynamic address ranges.
Owner Match Rule	Ensures that each subnet on the router has the same owner as the subinterface.
Router Subnets in Database Rule	Ensures that each subnet on the router has a corresponding subnet in the regional database.
Selection Tags Consistency Rule	Ensures that scope-selection tags on scopes match with one of those defined in the address types.
Subnet Consistency Rule	Identifies any overlapping subnets.
Utilization Collection Rule	Ensures that the DHCP server collection interval is greater than the regional server collection interval.

Table 18-3 Data Consistency Rule Settings on the Local Cluster

Local Consistency Rule	Description
Broadcast Address Rule	Ensures that the dynamic address range for a scope should not include a broadcast address.
Client-Class Selection Match Tag Rule	Ensures that all client-classes have a scope-selection tag defined by some scope.

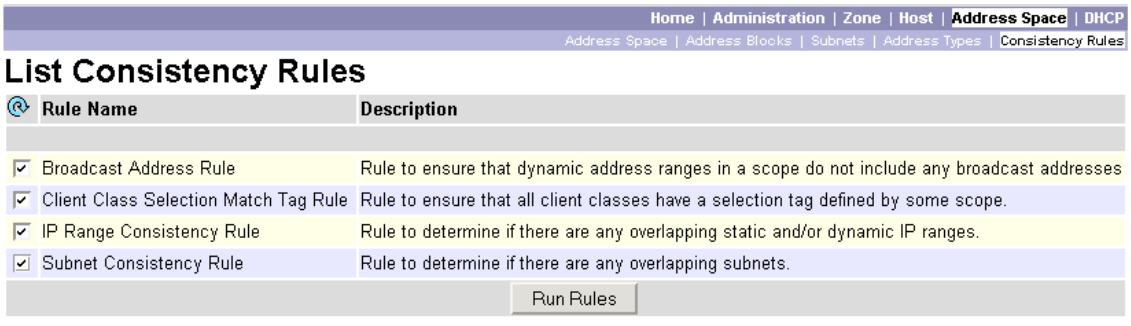
Table 18-3 Data Consistency Rule Settings on the Local Cluster (continued)

Local Consistency Rule	Description
IP Range Consistency Rule	Identifies any overlapping static or dynamic address ranges.
Subnet Consistency Rule	Identifies any overlapping subnets.

To set the data consistency rules on the regional and local cluster:

Step 1 On the Primary Navigation bar, click **Address Space**, then click **Consistency Rules** on the Secondary Navigation bar. This opens the List Consistency Rules page (see Figure 18-9 for the local cluster version of this page).

Figure 18-9 List Consistency Rules Page



Step 2 Click check marks for each of the listed consistency rules that you want to apply (see Table 18-2 on page 18-16 and Table 18-3 on page 18-16).

Step 3 Click **Run Rules**. This opens the Consistency Rules Result page. If violations were found, the page has the display columns indicated in Table 18-4.

Table 18-4 Display Columns on the Consistency Rules Result Page

Column	Description
Violation	How the consistency was violated. Results include violation values such as duplicated or overlapped. If you click the violation value, the Consistency Rule Details page appears.
Primary Object Name	Shows a range of addresses or subnets.
Primary Object Type	Includes object types such as CCMIPRange and CCMSubnet.
Secondary Object Name	Shows a range of addresses or subnets.
Secondary Object Type	Includes object types such as CCMIPRange and CCMSubnet.