



CHAPTER 7

Overview of the Cisco Network Registrar for the Cisco uBR7200 Series

This chapter supplements the Cisco Network Registrar (CNR) documentation by providing additional cable-specific instructions that are pertinent to the Cisco uBR7200 series and CMTS management.

For additional information about CNR, refer to these documents on Cisco.com:

- [Cisco Network Registrar for the Cisco uBR7200 Series Universal Broadband Routers](#)
- [CNR and DHCP FAQs for Cable Environment](#)
- [Recommended CNR Settings and Management](#)

Cisco Network Registrar Description

CNR is a dynamic IP address management system, currently running on Windows NT or Solaris 2.6, that uses the Dynamic Host Configuration Protocol (DHCP) to assign IP addresses to cable interfaces, PCs, and other devices on the broadband network. The CNR tool includes script extensions that allow a cable system administrator to define and view individual DHCP options, define the identity or type of device on the network, and assign the device to a predefined class or group.

Using the CNR tool, a cable system administrator can specify policies to provide:

- Integrated DHCP and Domain Name Server (DNS) services
- Time of Day (ToD) and Trivial File Transfer Protocol (TFTP) server based on the size of the network
- DHCP safe failover and dynamic DNS updates



Note This is available only in CNR 3.0 or higher.

Using the CNR tool and the extension scripts identified in the “[Overview of Scripts](#)” section, a cable system administrator can specify scopes, policies, and options for the network and each cable interface based on the services and configuration to support at each subscriber site.



Note

Scopes refer to the administrative grouping of TCP/IP addresses; all IP addresses within a scope should be on the same subnet.

The cable system administrator defines system default policies for all standard options and uses scope-specific policies for options related to particular subnets, such as cable interfaces. This allows DHCP to send the information with the IP address.

Seven entry points exist for scripts:

- post-packet-decode
- pre-client-lookup

- post-client-lookup—Examines and takes action on results of the client-class process, places data items in the environment dictionary to use at the pre-packet-encode extension point, includes DHCP relay option
- check-lease-acceptable
- pre-packet-encode
- post-sent-packet
- pre-dns-add-forward

Cable Modem DHCP Response Fields

Each cable interface on the broadband network requires the following fields in the DHCP response:

- CM's IP address
- CM's subnet mask



Note For cable operators with less experience in networking, you can fill in a guess based on the network number and indicate how your IP network is divided.

- Name of the DOCSIS configuration file on the TFTP server intended for the cable interface
- Time offset of the cable interface from the Universal Coordinated Time (UTC), which the cable interface uses to calculate the local time when time-stamping error logs
- Time server address from which the cable interface obtains the current time

DOCSIS DHCP Fields

DOCSIS DHCP option requirements include:

- IP address of the next server to use in the TFTP bootstrap process; this is returned in the siaddr field
- DOCSIS configuration file that the cable interface downloads from the TFTP server



Note If the DHCP server is on a different network that uses a relay agent, then the relay agent must set the gateway address field of the DHCP response.

- IP address of the security server should be set if security is required

DHCP Relay Option (DOCSIS Option 82)

DOCSIS Option82 modifies DHCPDISCOVER packets to distinguish cable interfaces from the CPE devices or “clients” behind them. The DOCSIS Option82 is comprised of the following two suboptions:

- Suboption 1, Circuit ID:

```
Type 1 (1 byte)
Len 4 (1 byte)
Value (8 bytes)
<bit 31,30,.....0)
<xYYYYYYYYYYYYYYYYYYYY>
```

where the MSB indicates if the attached device is a cable interface.

x=1 Cable Modem REQ

x=0 CPE device

(Behind the cable interface with the cable interface MAC address shown in suboption 2.)

The rest of the bits make up the SNMP index to the CMTS interface.

y=0xYYYYYY is the SNMP index to the CMTS interface.

- Suboption 2, MAC address of the cable interface:

```
Type 2 (1 byte)
Len 6 (1 byte)
Value xxxx.xxxx.xxxx (6 bytes)
```

For additional information about

Overview of Scripts

This section lists the scripts applicable to cable interface configuration.

Two-way Cable Modem Scripts

To support two-way configurations at a subscriber site, use these scripts:

- **Relay.tcl**
- **SetRouter.tcl**

Telco Return Cable Modem Scripts

To support telco return and two-way cable interface configurations on the same cable interface card or chassis, use these scripts:

- **PostClientLookup.tcl**
- **PrePacketEncode.tcl**

Placement of Scripts

Windows NT

For CNR running on Windows NT, place the appropriate scripts in the following directory:

```
\program files\network registrar\extensions\dhcp\scripts\tcl
```

Solaris

For CNR running on Solaris, place the appropriate scripts in the following directory:

```
/opt/nwreg2/extensions/dhcp/scripts/tcl
```

Activate Scripts in Cisco Network Registrar

To activate the scripts after you have placed them in the appropriate directory:

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- Step 1** Open up a text editor.
 - Step 2** Open one of the scripts at the **nrcmd>** command prompt.
 - Step 3** Create the extension points and attach them to the system.



Note The easiest way to do this is to simply cut and paste the command lines from the scripts to the **nrcmd>** command line.

- Step 4** After you have created and attached the extension points, do a **dhcp** reload.
The scripts are active.
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Configuring the Cisco uBR7200 Series to Use Scripts

Each cable interface must be set up as a BOOTP forwarder and have the relay-option enabled. The primary and secondary IP addresses for each cable interface must be in sync with the CNR tool.

To properly communicate with scripts in the system, implement the following commands on the Cisco uBR7200 series universal broadband router:

- On Cisco IOS Release 11.3—Command is interface specific:

```
cable relay-agent-option
```

This enables Option82 on the Cisco uBR7200 series.

- On Cisco IOS Release 12.0—Command has been changed to the following global option:

```
ip dhcp relay info option
```

- On Cisco IOS Release 12.0 to 12.5, use the following command:

```
no ip dhcp relay information option check
```



Note

You can also use the **cable dhcp-giaddr** command in cable interface configuration mode to modify the GIADDR field of DHCPDISCOVER and DHCPREQUEST packets to provide a relay IP address before packets are forwarded to the DHCP server. Use this command to set a “policy” option such that primary addresses are used for CMs and secondary addresses are used for hosts behind the CMs.

Configure the System Default Policy

Add these options to the system default policy for:

- Cable modems to support on your network
- PCs to support behind each cable interface on your network

Cable Modems

Define these settings following the CNR tool documentation:

- TFTP server (IP address) for those cable interfaces using BOOTP
- Time-server (IP address)
- Time-offset (Hex value, 1440 for Eastern Standard Time)
- Packet-siaddr (IP address of CNR)
- Router (set to 0.0.0.0)
- Boot-file (name of .cm file for those cable interfaces using BOOTP)
- Packet-file-name (.cm file name)

PCs

Define these settings following the CNR tool documentation:

- Domain name
- Name servers (IP address of DNS servers)

Create Selection Tag Scopes

General

When you create your scope selection tags:

Step 1 Cut and paste the scope **selection tag create** commands from the scripts into the **nrcmd>** command line.



Note

These names have to be exactly as they appear in the scripts.

Step 2 Then attach the selection tags to the appropriate scripts:

Example:

```
CM_Scope tagCablemodem
PC_Scope tagComputer
```

Telco Return


Note

If you are using the **prepacketencode** and **postclientlookup .tcl** scripts for telco return, the telco return scope does not have a selection tag associated to the scope.

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- Step 1** Put the tag **Telcocablemodem** on the primary cable interface scope to pull addresses from that pool instead.
- Step 2** Follow the same procedure as above, but use a telco return policy which has a different .cm file with telco-specific commands in it.
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Create Network Scopes

Following is an example for creating scopes for your network. This example assumes two Cisco uBR7200 series universal broadband routers in two locations, with one cable interface card on one Cisco uBR7200 series configured for telco return.

```
cm-toledo1_2-0 10.2.0.0 255.255.0.0 assignable 10.2.0.10-10.2.254.254 tagCablemodem
tagTelcomodem Default GW=10.2.0.1 (assigned by scripts)
```

```
cm-toledo1_3-0 10.3.0.0 255.255.0.0 assignable 10.3.0.10-10.3.254.254 tagCablemodem
tagTelcomodem Default GW=10.3.0.1 (assigned by scripts)
```

```
pc-toledo1_2-0 208.16.182.0 255.255.255.248 assignable 208.16.182.2-208.16.182.6
tagComputer Default GW=208.16.182.1 (assigned by scripts)
```

```
pc-toledo1_3-0 208.16.182.8 255.255.255.248 assignable 208.16.182.10-208.16.182.14
tagComputer Default GW=208.16.182.9 (assigned by scripts)
```

```
telco_return_2-0 192.168.1.0 255.255.255.0 (No assignable addresses, tag was put on cable
modem primary scope to force telco-return cable modem to pull address from primary scope)
```

```
cm-arlington1_2-0 10.4.0.0 255.255.0.0 assignable 10.4.0.10-10.4.254.254 tagCablemodem
Default GW=10.4.0.1 (assigned by scripts)
```

```
cm-arlington1_3-0 10.5.0.0 255.255.0.0 assignable 10.5.0.10-10.5.254.254 tagCablemodem
Default GW=10.5.0.1 (assigned by scripts)
```

```
pc-arlington1_2-0 208.16.182.16 255.255.255.248 assignable 208.16.182.17-208.16.182.22
tagComputer Default GW=208.16.182.17 (assigned by scripts)
```

```
pc-toledo1_3-0 208.16.182.24 255.255.255.248 assignable 208.16.182.2-208.16.182.30
tagComputer Default GW=208.16.182.25 (assigned by scripts)
```


Note

Remember the last valid address in the .248 subnet range is the broadcast address; do not use this.

Create Policies for Class of Service or for Upgrading Cable Modem Cisco IOS Images

To support Class of Service (CoS), define:

- Scope selection tags—Identifiers that describe types of scope configurations



Note This is needed for Option82.

- Client classes—Class with which a group of clients is associated



Note Scope selection tags are excluded from or included in client-classes.

- Client—Specific DHCP clients and the defined class to which they belong

To assign the CoS or use Option82, make a client entry with a MAC address and point to the appropriate policy. To use client-based MAC provisioning, add a client entry “default - exclude,” then put in MAC addresses for all devices (for example, cable interfaces and PCs) in the client tab and select the policy to use, including the appropriate tag.



Note

For more detailed information about Cisco Network Registrar, please refer to the document *Cisco Network Registrar for the Cisco uBR10000 Series Universal Broadband Routers*.

CNR Steps to Support Subinterfaces

The CNR configuration is done differently if subinterfaces are configured. Here is an example. If you have configured two ISP subinterfaces and one management subinterface on a Cisco uBR7200 series, make sure that the management subinterface is the first subinterface that is configured. If cable interface three—c3/0—is being used, create c3/0.1, c3/0.2 and c3/0.3 as three subinterfaces and c3/0.1 as the first subinterface configured as the management subinterface.



Note

The Cisco uBR7200 series requires management subinterfaces to route DHCP packets from CMs when they first initialize because the Cisco uBR7200 series does not know the subinterfaces they belong to until it has seen the IP addresses assigned to them by gleaning DHCP reply message from CNR.

In CNR, complete the following steps for such a configuration:

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- Step 1** Create two scope selection tags such as: **isp1-cm-tag** and **isp2-cm-tag**
 - Step 2** Configure three scopes; for example, **mgmt-scope**, **isp1-cm-scope**, and **isp2-cm-scope** such that **isp1-cm-scope** and **isp2-cm-scope** each define **mgmt-scope** to be the primary scope
 - Step 3** Also configure two scopes for PCs for each of the ISPs; **isp1-pc-scope** and **isp2-pc-scope**. For scope **isp1-cm-scope**, configure **isp1-cm-tag** to be the scope selection tag. For scope **isp2-cm-scope**, configure **isp2-cm-tag** to be the scope selection tag
 - Step 4** Configure two client classes; for example, **isp1-client-class** and **isp2-client-class**
 - Step 5** Create client entries with their MAC addresses for CMs that belong to **ISP1** and assign them to **isp1-client-class**. Also assign the scope selection tag **isp1-cm-tag**

- Step 6** Create client entries for CMs that belong to **ISP2** and assign them to **isp2-client-class**. Also assign the scope selection **tag isp2-cm-tag**
- Step 7** Enable client class processing from the scope-selection-tag window



Note Overlapping address ranges cannot be configured on these subinterfaces because software gleans the DHCP reply to figure out the subinterface it really belongs to. Although CNR can be configured with overlapping address range scopes, it cannot be used to allocate addresses from these scopes.
