CHAPTER 7

PacketCable Voice Configuration

This chapter describes the tasks you must perform to bring a PacketCable voice deployment into service.

This chapter contains information on these variants of PacketCable:

- PacketCable Secure eMTA Provisioning, page 7-1
- PacketCable Basic eMTA Provisioning, page 7-30
- Euro PacketCable, page 7-31

For information that will help you solve issues in a PacketCable voice technology deployment, see Troubleshooting PacketCable eMTA Provisioning, page 16-11.

This chapter assumes that you are familiar with the contents of the PacketCable Multimedia Terminal Adapter (MTA) Device Provisioning Specification, PKT-SP-PROV1.5-I03-070412. For details, see the PacketCable website.

PacketCable Secure eMTA Provisioning

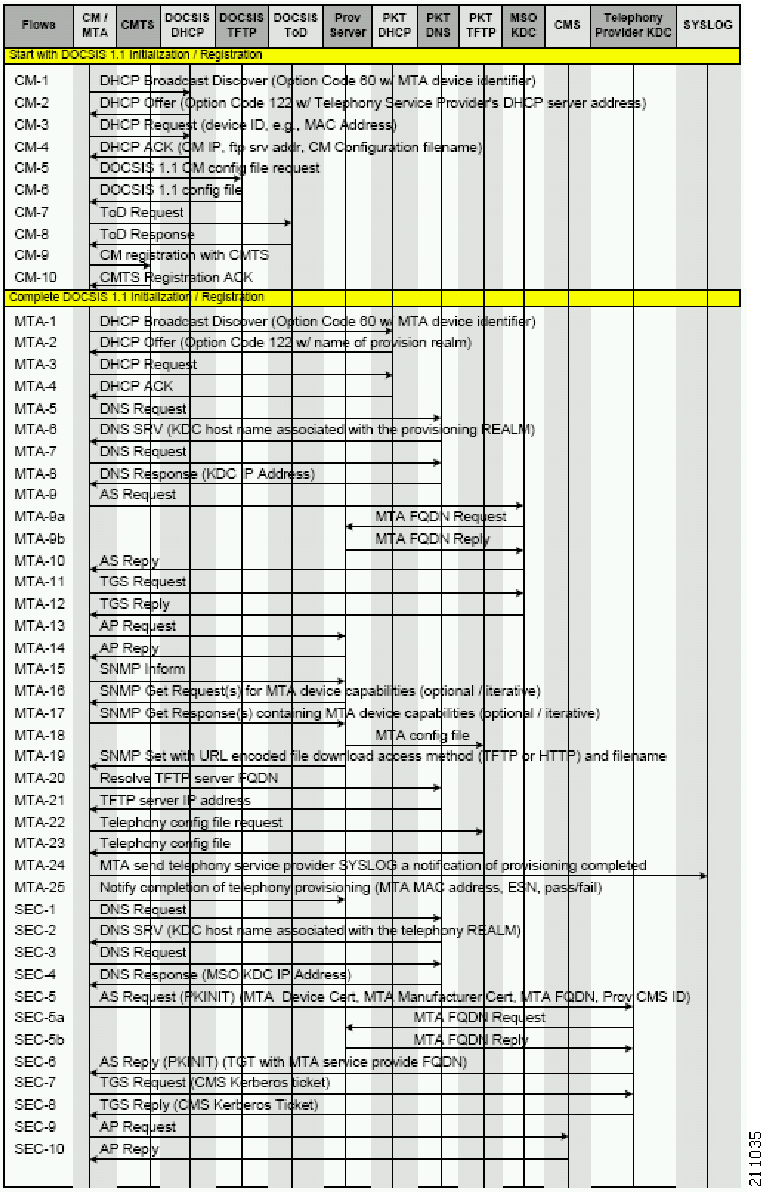
This section deals exclusively with Secure PacketCable voice provisioning. PacketCable Secure is designed to minimize the possibility of theft of telephony service, malicious disruption of service, and so on. PacketCable Secure depends on the Kerberos infrastructure to mutually authenticate the MTA and the provisioning system; in Cisco BAC, the Key Distribution Center (KDC) functions as the Kerberos server. SNMPv3 is also used to secure the conversation between the MTA and the provisioning system.

Cisco BAC PacketCable Secure Provisioning Flow

All PacketCable provisioning flows are defined as a sequence of steps.

Figure 7-1 illustrates the Secure provisioning flow for PacketCable eMTAs.

Figure 7-1 Embedded-MTA Secure Power-On Provisioning Flow



Start with DOCSIS 1.1 Initialization / Registration

CM-1 DHCP Broadcast Discover (Option Code 60 w/ MTA device identifier)
CM-2 DHCP Offer (Option Code 122 w/ Telephony Service Provider's DHCP server address)
CM-3 DHCP Request (device ID, e.g., MAC Address)
CM-4 DHCP ACK (CM IP, ftp srv addr, CM Configuration filename)
CM-5 DOCSIS 1.1 CM config file request
CM-6 DOCSIS 1.1 config file
CM-7 ToD Request
CM-8 ToD Response
CM-9 CM registration with CMTS
CM-10 CMTS Registration ACK

Complete DOCSIS 1.1 Initialization / Registration

MTA-1 DHCP Broadcast Discover (Option Code 60 w/ MTA device identifier)
MTA-2 DHCP Offer (Option Code 122 w/ name of provision realm)
MTA-3 DHCP Request
MTA-4 DHCP ACK
MTA-5 DNS Request
MTA-6 DNS SRV (KDC host name associated with the provisioning REALM)
MTA-7 DNS Request
MTA-8 DNS Response (KDC IP Address)
MTA-9 AS Request
MTA-9a MTA FQDN Request
MTA-9b MTA FQDN Reply
MTA-10 AS Reply
MTA-11 TGS Request
MTA-12 TGS Reply
MTA-13 AP Request
MTA-14 AP Reply
MTA-15 SNMP Inform
MTA-16 SNMP Get Request(s) for MTA device capabilities (optional / iterative)
MTA-17 SNMP Get Response(s) containing MTA device capabilities (optional / iterative)
MTA-18 MTA config file
MTA-19 SNMP Set with URL encoded file download access method (TFTP or HTTP) and filename
MTA-20 Resolve TFTP server FQDN
MTA-21 TFTP server IP address
MTA-22 Telephony config file request
MTA-23 Telephony config file
MTA-24 MTA send telephony service provider SYSLOG a notification of provisioning completed
MTA-25 Notify completion of telephony provisioning (MTA MAC address, ESN, pass/fail)
SEC-1 DNS Request
SEC-2 DNS SRV (KDC host name associated with the telephony REALM)
SEC-3 DNS Request
SEC-4 DNS Response (MSO KDC IP Address)
SEC-5 AS Request (PKINIT) (MTA Device Cert, MTA Manufacturer Cert, MTA FQDN, Prov CMS ID)
SEC-5a MTA FQDN Request
SEC-5b MTA FQDN Reply
SEC-6 AS Reply (PKINIT) (TGT with MTA service provide FQDN)
SEC-7 TGS Request (CMS Kerberos ticket)
SEC-8 TGS Reply (CMS Kerberos Ticket)
SEC-9 AP Request
SEC-10 AP Reply

Note It is strongly recommended that you use a protocol analyzer (protocol sniffer) with the ability to capture data packets to understand exactly which step is failing.

In addition, the content of the KDC log file is critical to understanding the root cause of any KDC failure.

When diagnosing problems in provisioning an embedded Multimedia Terminal Adapters (eMTA), the flow description in Table 7-1 helps identify which step in the PacketCable provisioning flow is failing.

Table 7-1 PacketCable Secure eMTA Provisioning

Step	Workflow	Description
CM-1	DHCP Broadcast Discover	This is similar to the DOCSIS cable modem (CM) boot flow for DHCPv4 or DHCPv6 with DHCP options added to provide the MTA with a list of PacketCable DHCP servers from which the MTA is allowed to accept DHCP offers.
CM-2	DHCP Offer	
CM-3	DHCP Request	
CM-4	DHCP Ack	
CM-5	DOCSIS 1.1 CM Config File Request	
CM-6	DOCSIS 1.1 Config File	
CM-7	ToD Request	
CM-8	ToD Response	
CM-9	CM Registration with CMTS (cable modem termination system)	
CM-10	CMTS Registration Ack	

Table 7-1 PacketCable Secure eMTA Provisioning (continued)

Step	Workflow	Description
MTA-1	DHCP Broadcast Discover	Using DHCP, the MTA announces itself as a PacketCable MTA and provides information on the capabilities and provisioning flows it supports (Secure, Basic, and so on.). The MTA also obtains addressing information and DHCP Option 122. DHCP Option 122 contains the PacketCable provisioning server address and the security realm name. This information is used to allow the MTA to contact the KDC and provisioning server. Some key troubleshooting hints are: • Check the DHCP relay agent on the CMTS for the correct configuration; ensure that your CMTS points to the correct DHCP server. • Verify that you have the correct routing between the MTA, CMTS, DHCP server, and the DPE. • Verify that secondary subnets are configured correctly on the CMTS. • Check the Cisco Network Registrar DHCP configuration. Verify if the scopes are configured, if IP addresses are available, and if all secondary subnets are configured. • Check the Cisco BAC configuration. Check the *cnr_ep.properties* file and ensure that the required PacketCable Network Registrar extension properties are configured. For more information, see "Mapping PacketCable DHCP Options to Cisco BAC Properties". If a packet trace reveals that the MTA is cycling between steps MTA-1 and MTA-2, there could be a problem with the configuration of DHCP Option 122 (realm name or provisioning server FQDN suboptions), DHCP Option 12 (hostname), or DHCP Option 15 (domain name).
MTA-2	DHCP Offer	
MTA-3	DHCP Request	
MTA-4	DHCP Ack	
MTA-5	DNS Request	MTA uses the security realm name (delivered within DHCP Option 122) to perform a DNS SRV lookup on the KDC service and then resolves the KDC IP address. Some key troubleshooting hints are: • Use a packet sniffer to watch for misdirected or malformed DNS packets sent to the Network Registrar DNS. • Set the Network Registrar DNS log level to detailed packet tracing and verify what arrives there. • Check the DNS configuration—The DNS server specified in *cnr_ep.properties* must contain the realm zone, the SRV record, and the DNS 'A' record for the KDC.
MTA-6	DNS Srv	
MTA-7	DNS Request	
MTA-8	DNS Response	

Table 7-1 PacketCable Secure eMTA Provisioning (continued)

Step	Workflow	Description
MTA-9	AS Request	The AS-REQ request message is used by the KDC to authenticate the MTA. Some key troubleshooting hints are: • Check the KDC log file to determine if the AS-REQ arrives and to observe any errors or warnings. • Check that the KDC is configured with the correct MTA_Root certificate. The Manufacturer and Device certificates sent by the MTA within the AS-REQ message must chain with the MTA_Root certificate installed at the KDC.
MTA-9a	MTA FQDN Request	The KDC extracts the MTA MAC address from the MTA certificate and sends it to the provisioning server for validation. If the provisioning server has the FQDN for that MAC address, it is returned to the KDC. The KDC then compares the FQDN received from the MTA to the FQDN received in the FQDN-REP reply message. Some key troubleshooting hints are: • Use a packet sniffer to watch for misdirected or malformed DNS packets. The MTA passes the provisioning server FQDN (which the MTA received in DHCP Option 122) within the AS-REP message to the KDC. The KDC then uses this FQDN to resolve the IP address of the provisioning server. • Check the filenames and content of the KDC key file; the KDC service key in the DPE must match the service key at the KDC. The names of the service key files at the KDC are critical.
MTA-9b	MTA FQDN Reply	
MTA-10	AS Reply (AS-REP)	The KDC grants a provisioning service ticket to the MTA and also sends the Service Provider, Local System Provider (optional), and KDC certificate to the MTA. The MTA then verifies if the certificates sent by the KDC chain to the Service Provider Root certificate stored in the MTA. If these certificates do not chain, the MTA loops back to step MTA-1 of the provisioning flow. See Using the PKCert.sh Tool, page 14-2, for additional information on the *KDC.cer* file. A key troubleshooting hint: Verify if the KDC log files show that the AS-REP message was sent to the device. If a packet trace reveals the MTA is cycling between steps MTA-1 and MTA-10, there is a problem with the service provider certificate chain.
MTA-11	TGS Request	The MTA receives either a service ticket or a ticket-granting-ticket (TGT) following step MTA-10. If the MTA had obtained a TGT instead of a service ticket in step MTA-10, it contacts the ticket-granting-server (KDC) to obtain a service ticket.
MTA-12	TGS Reply	The KDC sends a service ticket in the TGS Reply to the MTA.
MTA-13	AP Request (AP-REQ)	The MTA presents the ticket (received at step MTA-10) to the provisioning server specified by DHCP Option 122.

Table 7-1 PacketCable Secure eMTA Provisioning (continued)

Step	Workflow	Description
MTA-14	AP Reply (AP-REP)	The provisioning server uses the KDC shared secret to decrypt the AP-REQ, validates the provisioning server ticket presented by the MTA, and sends AP-REP with SNMPv3 keys. SNMPv3 is now authenticated and (optionally) encrypted.
MTA-15	SNMP Inform	The MTA signals to the provisioning server that it is ready to receive provisioning information.
MTA-16	SNMP Get Request	SNMPv3—If the provisioning server (DPE) requires additional device capabilities, it sends the MTA one or more SNMPv3 Get requests to obtain the required information on MTA capability. The provisioning server (DPE) may use a GetBulk request to request a bulk of information in a single message.
MTA-17	SNMP Get Response	SNMPv3—The MTA sends to the provisioning server (DPE) a response for each GetRequest that contains information on MTA capabilities requested in step MTA-16.
MTA-18	MTA Config file	Using information made available in steps MTA-16 and MTA-17, the provisioning server (DPE) determines the contents of the MTA configuration data file.
MTA-19	SNMP Set	SNMPv3—The provisioning server performs an SNMPv3 Set to the MTA containing the URL for the MTA configuration file, encryption key for the file, and the file hash value.
MTA-20	Resolve TFTP Server FQDN	DNS Request—If the URL-encoded access method contains an FQDN instead of an IPv4 address, the MTA uses the DNS server of the service provider network to resolve the FQDN into an IPv4 address of the TFTP server or the HTTP server.
MTA-21	TFTP Server IP Address	DNS Response—The DNS server returns the IPv4 IP address of the service provider network as requested in step MTA-20.
MTA-22	Telephony Config File Request	The MTA proceeds to download the VoIP configuration file from the specified TFTP server. Note that Cisco BAC integrates the TFTP server into the DPE component.
MTA-23	Telephony Config File	
MTA-24	MTA Send	The MTA optionally sends a syslog notification to the service provider that provisioning is complete.
MTA-25	Notify completion of telephony provisioning	The MTA signals to the provisioning server if the new configuration is acceptable.
SEC-1 to SEC-10	These steps are the post-MTA provisioning security flow and are not applicable to Cisco BAC provisioning. This flow involves getting Kerberos tickets associated with each CMS with which the MTA communicates. For details, see the PacketCable Security Specifications.	

KDC in Provisioning PacketCable Secure eMTAs

PacketCable Secure depends on the Kerberos infrastructure to mutually authenticate the MTA and the provisioning system; in Cisco BAC, the KDC functions as the Kerberos server. For an overview of the KDC component, see Key Distribution Center, page 2-16.

For important information related to the KDC, see:

- Default KDC Properties, page 7-7
- KDC Certificates, page 7-9
- KDC Licenses, page 7-9
- Multiple Realm Support, page 7-10

Default KDC Properties

The KDC has several default properties that are populated during a Cisco BAC installation into the *BPR_HOME/kdc/<Operating System>/kdc.ini* properties file. You can edit this file to change values as operational requirements dictate.

Note Be careful in editing the *kdc.ini* file if operational requirements dictate. Incorrect values can render the KDC inoperative. If you do make changes, restart the KDC.

The default properties are:

- interface address—Specifies the IP address of the local Ethernet interface that you want the KDC to monitor for incoming Kerberos messages.

  For example:

  ```
  interface address = 10.10.10.1
  ```

- FQDN—Identifies the fully qualified domain name (FQDN) on which the KDC is installed.

  For example:

  ```
  FQDN = kdc.example.com
  ```

  Note You must enter the interface address and FQDN values through the KDC Realm Name screen during installation. For specific information, see the *Installation and Setup Guide for Cisco Broadband Access Center 4.2*.

- maximum log file size—Specifies the maximum size, in kilobytes, that the log file that is generated by the KDC can reach. The KDC creates a new log file only when the current file reaches this maximum size.

  For example:

  ```
  maximum log file size = 1000
  ```

- *n* saved log files—Defines the number of old log files that the KDC saves. The default value is 7. You can specify as many as required.

  For example:

  ```
  n saved log files = 10
  ```

- log debug level—Specifies the logging level for the log file.

  ```
  log debug level = 5
  ```

  Table 7-2 describes the available logging levels for the KDC log file.

Table 7-2 KDC Logging Levels

Log Level	Description
0	Error conditions exist. Sets the logging function to save all error messages and those of a more severe nature.
1	Warning conditions exist. Sets the logging function to save all warning messages and those of a more severe nature.
2	Informational messages. Sets the logging function to save all logging messages available.
{*3-7*}	Debugging messages. Sets the logging function to save all debugging messages at various levels, from level 3 to level 7.

- minimum (maximum) ps backoff—Specifies the minimum (or maximum) time, in tenths of a second, that the KDC waits for Cisco BAC to respond to the FQDN-Request.

  For example:

  ```
  minimum ps backoff = 150
  ```

Using the sample values shown above, a sample INI file might contain data similar to that shown in Example 7-1.

Example 7-1 Sample kdc.ini Configuration File

```
interface address =  10.10.10.1
FQDN = kdc.example.com
maximum log file size = 1000
n saved log files = 10
log debug level = 5
minimum ps backoff = 150
maximum ps backoff = 300
```

You can set the times for both minimum and maximum ticket duration to effectively smooth out excessive numbers of ticket requests that could occur during deployment. This setting is beneficial given that most deployments occur during traditional working hours and excessive loading might, from time to time, adversely affect performance.

Note Shortening the ticket duration forces the MTA to authenticate to the KDC much more frequently. While this results in greater control over the authorization of telephony endpoints, it also causes heavier message loads on the KDC and increased network traffic. In most situations, the default setting is appropriate and should not be changed.

- maximum ticket duration—Defines the maximum duration for tickets generated by the KDC. The default unit is hours; however, by appending an **m** or **d**, you can change the units to minutes or days, respectively.

  The default value is 168, or seven days. We recommend that you not change this value because this value is the length of time required to conform to the PacketCable security specification.

  For example:

  ```
  maximum ticket duration = 168
  ```

- minimum ticket duration—Defines the minimum duration for tickets generated by the KDC. The default unit is hours; however, by appending an **m** or **d**, you can change the units to minutes or days, respectively.

  The default value is 144, or six days. We recommend that you not change this value.

  For example:

  ```
  minimum ticket duration = 144
  ```

KDC Certificates

The certificates used to authenticate the KDC are not shipped with Cisco BAC. You must obtain the required certificates from Cable Television Laboratories, Inc. (CableLabs), and the content of these certificates must match the content in the certificates installed in the MTA.

Note Certificates are required for the KDC to function.

You can use the PKCert tool to install, and manage, the certificates that the KDC requires for its operation. The PKCert tool installs the CableLabs service provider certificates as certificate files. For information on running this tool, see Using the PKCert.sh Tool, page 14-2.

The PKCert tool is available only if you have installed the KDC component.

KDC Licenses

Obtain a KDC license from your Cisco representative and then install it in the correct directory.

To install a KDC license file:

Step 1 Obtain your license file from your Cisco representative.

Step 2 Log in to the Cisco BAC host as *root*.

Step 3 Copy the license file to the *BPR_HOME/kdc* directory.

Caution Be careful not to copy the file as an ASCII file. The file contains binary data susceptible to unwanted modification during an ASCII transfer.

Do not copy KDC license files between operating systems because the transfer process may damage the file.

Step 4 To restart the KDC server and make the changes take effect, run the **bprAgent restart kdc** command from the */etc/init.d* directory.

Multiple Realm Support

The Cisco BAC KDC supports the management of multiple realms, for which a complete set of valid PacketCable X.509 certificates and a KDC private key must be present. These certificates must reside in the *BPR_HOME/kdc/<Operating System>/packetcable/certificates* directory.

Cisco BAC supports additional realms by installing subdirectories under the *BPR_HOME/kdc/<Operating System>/packetcable/certificates* directory; each subdirectory is named after a specific realm.

Table 7-3 lists the different certificates, with their corresponding filenames, that must be available in the *BPR_HOME/kdc/<Operating System>/packetcable/certificates* directory.

Table 7-3 PacketCable Certificates

Certificate	Certificate Filename
MTA Root	*MTA_Root.cer*
Service Provider Root	*CableLabs_Service_Provider_Root.cer*
Service Provider CA	*Service_Provider.cer*
Local System Operator CA	*Local_System.cer*
KDC	*KDC.cer*

The primary realm is set up during installation of the KDC component. For the primary realm, the KDC certificate (*KDC.cer*) resides in the *BPR_HOME/kdc/<Operating System>/packetcable/certificates* directory. Its private key (KDC_private_key.pkcs8) resides in the *BPR_HOME/kdc/<Operating System>/* directory.

To configure additional realms, follow this procedure, which is described in detail subsequently.

Step 1 Locate the directory containing your KDC certificates.

Step 2 Create a subdirectory under the directory that stores the KDC certificates.

Note Match the name of the subdirectory with the name of the specific realm. Use only uppercase characters while naming the subdirectory.

Step 3 Place the KDC certificate and the private key for the realm in the subdirectory you created.

Step 4 If the new realm is not chained to the same service provider as the KDC certificate, include all additional higher-level certificates that differ from those in the certificates directory.

Note Because all realms must be rooted in the same certificate chain, a KDC installation supports only one locale (North American PacketCable or Euro PacketCable) at any given point.

Table 7-4 describes the directory structure and files for a primary realm (for example, CISCO.COM) with two secondary realms (for example, CISCO1.COM and CISCO2.COM). The structure assumes that the higher-level certificates are similar for the primary realm and its secondary realms.

Table 7-4 Directory Structure for Multiple Realms

Directory	File Content in Directory
BPR_HOME/kdc/solaris	For primary realm CISCO.COM: KDC private key
BPR_HOME/kdc/<Operating System>/packetcable/certificates	For primary realm CISCO.COM: • *MTA_Root.cer* • *CableLabs_Service_Provider_Root.cer* • *Service_Provider.cer* • *Local_System.cer* • *KDC.cer* Directory */CISCO1.COM* Directory */CISCO2.COM*
BPR_HOME/kdc/<Operating System>/packetcable/certificates/CISCO1.COM	For secondary realm CISCO1.COM: • *KDC.cer* • KDC private key
BPR_HOME/kdc/<Operating System>/packetcable/certificates/CISCO2.COM	For secondary realm CISCO2.COM: • *KDC.cer* • KDC private key

Configuring the KDC for Multiple Realms

This section describes the workflow to configure the KDC for multiple realms. Before proceeding, complete the installation of the RDU, the DPE, and the Network Registrar extensions. For installation instructions, see the *Installation and Setup Guide for the Cisco Broadband Access Center 4.2*.

The following workflow uses sample realms and directories to describe how to configure the KDC for multiple realms. The primary realm used here is CISCO.COM and its secondary realms are CISCO1.COM and CISCO2.COM.

The setup featured in the following workflow provisions three MTAs: a Motorola SBV 5120 MTA, a Linksys CM2P2 MTA, and an SA WebStar DPX 2203 MTA. Each MTA is to be provisioned in one realm: the Motorola in the CISCO.COM realm, the Linksys MTA in the CISCO1.COM realm, and the SA MTA in the CISCO2.COM realm.

Note The sample output shown in the following procedure has been trimmed for demonstration purposes.

To configure the KDC for multiple realms:

Step 1 Verify the following configuration settings on the DPE:

a. Ensure that PacketCable services are enabled, by using the **show run** command.

To enable the PacketCable service, use the **service packetcable** *1..1* **enable** command.

For example:

```
dpe# show run
  aaa authentication local
  dpe port 49186
  dpe provisioning-group primary default
  service packetcable 1 enable
  snmp-server location equipmentrack5D
  snmp-server udp-port 8001
  tacacs-server retries 2
  tacacs-server timeout 5
```

For details on the commands, see the *Cisco Broadband Access Center DPE CLI Reference 4.2.*

b. Ensure that the security used for communication between the KDC and a DPE is set, by using the **show run** command.

To generate and set the security key, use the **service packetcable** *1..1* **registration kdc-service-key** command.

For example:

```
dpe# show run
  aaa authentication local
  debug dpe events
  dpe port 49186
  service packetcable 1 enable
  service packetcable 1 registration kdc-service-key <value is set>
  snmp-server contact AceDuffy-ext1234
```

For details on the commands, see the *Cisco Broadband Access Center DPE CLI Reference 4.2.*

c. Ensure that the security key that permits secure communication between the DPE and the RDU for PacketCable SNMPv3 cloning is set. Again, use the **show run** command. To generate and set the security key, use the **service packetcable** *1..1* **snmp key-material** command.

For example:

```
dpe# show run
  aaa authentication local
  debug dpe events
  dpe port 49186
  service packetcable 1 enable
  service packetcable 1 registration kdc-service-key <value is set>
  service packetcable 1 snmp key-material <value is set>
```

For details on the commands, see the *Cisco Broadband Access Center DPE CLI Reference 4.2.*

Note When you configure PacketCable settings on the DPE, ensure that you run the **dpe reload** command so that the changes take effect.

Step 2 In the configuration file for Network Registrar extension points (*cnr_ep.properties)*, verify if the **/ccc/kerb/realm** parameter is set to the primary realm; in this case, CISCO.COM. To do this, run the **more cnr_ep.properties** command from the *BPR_HOME/cnr_ep/conf* directory.

For example:

```
/opt/CSCObac/cnr_ep/conf# more cnr_ep.properties
#DO NOT MODIFY THIS FILE.
#This file was created on Wed, March 4 06:34:34 EDT 2007
/rdu/port=49187
/rdu/fqdn=dpe4.cisco.com
/cache/provGroupList=Default
/cnr/sharedSecret=fggTaLg0XwKRs
/pktcbl/enable=enabled
/ccc/tgt=01
/ccc/kerb/realm=CISCO.COM
/ccc/dhcp/primary=10.10.0.1
/ccc/dns/primary=10.10.0.1
```

Step 3 Enable static routes appropriately to ensure Cisco BAC connectivity with devices behind the CMTS.

Step 4 Create DNS realm zones for the DNS server that is listed in the *cnr_ep.properties* file. You can add zones using the Network Registrar administrator user interface via the **DNS > Forward Zones > List/Add Zones** pages.

Note Ensure that the zones you add contain the SRV record and the DNS 'A' record for the KDC server, and that the SRV record for each zone (in this example, CISCO.COM, CISCO1.COM, and CISCO2.COM) point to one KDC.

For information on configuring zones from the administrator user interface, see the *User Guide for Cisco Network Registrar 7.2.*

Step 5 Configure certificates using the PKCert.sh tool.

a. Create directories for the secondary realms (for example, CISCO1.COM and CISCO2.COM) under *BPR_HOME/kdc/<Operating System>/packetcable/certificates*.

For example:

```
/opt/CSCObac/kdc/<Operating System>/packetcable/certificates# mkdir CISCO1.COM
/opt/CSCObac/kdc/<Operating System>/packetcable/certificates# mkdir CISCO2.COM
```

For more information on creating directories, see Solaris documentation.

b. Create a directory in which you can copy the following certificates:

- *CableLabs_Service_Provider_Root.cer*
- *Service_Provider.cer*
- *Local_System.cer*
- *MTA_Root.cer*
- *Local_System.der*

For example:

```
# cd /var
# mkdir certsInput
```

Note The */certsInput* directory created under the */var* directory is only an example. You can choose to create any directory under any other directory. For more information on creating directories, see the specific Operating System documentation.

c. Copy the certificates mentioned in the previous step into the directory that you created.

d. Copy the following certificates to the *BPR_HOME/kdc/<Operating System>/packetcable/certificates* directory:

- *CableLabs_Service_Provider_Root.cer*
- *Service_Provider.cer*
- *Local_System.cer*
- *MTA_Root.cer*

For information on copying files, see Solaris documentation on the **cp** command.

e. Create the KDC certificate and its associated private key for the primary realm.

For example:

```
# ./opt/CSCObac/kdc/PKCert.sh -c "-s /var/certsInput -d /var/certsOutput
-k /var/certsInput/Local_System.der -c /var/certsInput/Local_System.cer
-r CISCO.COM -n 100 -a bactest.cisco.com -o"
Pkcert Version 1.0
Logging to pkcert.log
Source Directory: /var/certsInput
Destination Directory: /var/certsOutput
Private Key File: /var/certsInput/Local_System.der
Certificate File: /var/certsInput/Local_System.cer
Realm: CISCO.COM
Serial Number: 100
DNS Name of KDC: bactest.cisco.com
WARNING - Certificate File will be overwritten
SP Cert subject name: C=US,O=CableLabs\, Inc.,OU=ABC Cable Company,CN=Shared-01
CableLabs Local System CA
File written: /var/certsOutput/KDC_private_key.pkcs8
File written: /var/certsOutput/KDC_private_key_proprietary.
File written: /var/certsOutput/KDC_PublicKey.der
File written: /var/certsOutput/KDC.cer
KDC Certificate Successfully Created at /var/certsOutput/KDC.cer

Copy KDC.cer to the KDC certificate directory (i.e. /opt/CSCObac/kdc/<Operating
System>/
packetcable/certificates)
Copy KDC_private_key.pkcs8 to the KDC platform directory (i.e. /opt/CSCObac/
kdc/solaris)
Copy KDC_private_key_proprietary. to the KDC platform directory (i.e. /opt/CSCObac/
kdc/solaris)
```

For more information on the tool, see Using the PKCert.sh Tool, page 14-2.

f. Copy the *KDC.cer* file to the KDC certificate directory (*BPR_HOME/kdc/<Operating System>/packetcable/certificates*). For information on copying files, see Solaris documentation on the **cp** command.

g. Copy the private key KDC_private_key.pkcs8 to the KDC platform directory (*BPR_HOME/kdc/solaris*). For information on copying files, see Solaris documentation on the **cp** command.

h. Copy the private key KDC_private_key_proprietary. to the KDC platform directory (*BPR_HOME/kdc/solaris*). For information on copying files, see Solaris documentation on the **cp** command.

i. Create the KDC certificate and its associated private key for the secondary realm; in this case, CISCO1.COM.

For example:

```
# ./opt/CSCObac/kdc/PKCert.sh -c "-s /var/certsInput -d /var/certsOutput
-k /var/certsInput/Local_System.der -c /var/certsInput/Local_System.cer
-r CISCO1.COM -n 100 -a bactest.cisco.com -o"
Pkcert Version 1.0
Logging to pkcert.log
Source Directory: /var/certsInput
Destination Directory: /var/certsOutput
Private Key File: /var/certsInput/Local_System.der
Certificate File: /var/certsInput/Local_System.cer
Realm: CISCO.COM
Serial Number: 100
DNS Name of KDC: bactest.cisco.com
WARNING - Certificate File will be overwritten
SP Cert subject name: C=US,O=CableLabs\, Inc.,OU=ABC Cable Company,CN=Shared-01
CableLabs Local System CA
File written: /var/certsOutput/KDC_private_key.pkcs8
File written: /var/certsOutput/KDC_private_key_proprietary.
File written: /var/certsOutput/KDC_PublicKey.der
File written: /var/certsOutput/KDC.cer
KDC Certificate Successfully Created at /var/certsOutput/KDC.cer

Copy KDC.cer to the KDC certificate directory (i.e. /opt/CSCObac/kdc/<Operating
System>/
packetcable/certificates)
Copy KDC_private_key.pkcs8 to the KDC platform directory (i.e. /opt/CSCObac/
kdc/solaris)
Copy KDC_private_key_proprietary. to the KDC platform directory (i.e. /opt/CSCObac/
kdc/solaris)
```

For more information on the tool, see Using the PKCert.sh Tool, page 14-2.

j. Copy *KDC.cer* to the secondary realm directory; for example, the */CISCO1.COM* directory under *BPR_HOME/kdc/<Operating System>/packetcable/certificates*. For information on copying files, see Solaris documentation on the **cp** command.

k. Copy the private key KDC_private_key.pkcs8 to the secondary realm directory; for example, the */CISCO1.COM* directory under *BPR_HOME/kdc/<Operating System>/packetcable/certificates*. For information on copying files, see Solaris documentation on the **cp** command.

l. Copy the private key KDC_private_key_proprietary. to the secondary realm directory; for example, the */CISCO1.COM* directory under *BPR_HOME/kdc/<Operating System>/packetcable/certificates*. For information on copying files, see Solaris documentation on the **cp** command.

m. Create the KDC certificate and its associated private key for the secondary CISCO2.COM realm.

For example:

```
# ./opt/CSCObac/kdc/PKCert.sh -c "-s /var/certsInput -d /var/certsOutput
-k /var/certsInput/Local_System.der -c /var/certsInput/Local_System.cer
-r CISCO2.COM -n 100 -a bactest.cisco.com -o"
Pkcert Version 1.0
Logging to pkcert.log
Source Directory: /var/certsInput
Destination Directory: /var/certsOutput
```

```
Private Key File: /var/certsInput/Local_System.der
Certificate File: /var/certsInput/Local_System.cer
Realm: CISCO.COM
Serial Number: 100
DNS Name of KDC: bactest.cisco.com
WARNING - Certificate File will be overwritten
SP Cert subject name: C=US,O=CableLabs\, Inc.,OU=ABC Cable Company,CN=Shared-01
CableLabs Local System CA
File written: /var/certsOutput/KDC_private_key.pkcs8
File written: /var/certsOutput/KDC_private_key_proprietary.
File written: /var/certsOutput/KDC_PublicKey.der
File written: /var/certsOutput/KDC.cer
KDC Certificate Successfully Created at /var/certsOutput/KDC.cer

Copy KDC.cer to the KDC certificate directory (i.e. /opt/CSCObac/kdc/<Operating
System>/
packetcable/certificates)
Copy KDC_private_key.pkcs8 to the KDC platform directory (i.e. /opt/CSCObac/
kdc/solaris)
Copy KDC_private_key_proprietary. to the KDC platform directory (i.e. /opt/CSCObac/
kdc/solaris)
```

For information on the tool, see Using the PKCert.sh Tool, page 14-2.

n. Copy *KDC.cer* to the secondary realm directory; for example, the */CISCO2.COM* directory under *BPR_HOME/kdc/<Operating System>/packetcable/certificates*. For information on copying files, see Solaris documentation on the **cp** command.

o. Copy the private key KDC_private_key.pkcs8 to the secondary realm directory; for example, the */CISCO2.COM* directory under *BPR_HOME/kdc/<Operating System>/packetcable/certificates*. For information on copying files, see Solaris documentation on the **cp** command.

p. Copy the private key KDC_private_key_proprietary. to the secondary realm directory; for example, the */CISCO2.COM* directory under *BPR_HOME/kdc/<Operating System>/packetcable/certificates*. For information on copying files, see Solaris documentation on the **cp** command.

Step 6 Generate PacketCable service keys by using the KeyGen tool.

Note Ensure that the password that you use to generate a service key matches the password that you set on the DPE by using the **packetcable registration kdc service-key** command.

For example:

```
# /opt/CSCObac/kdc/keygen bactest.cisco.com CISCO.COM changeme
# /opt/CSCObac/kdc/keygen bactest.cisco.com CISCO1.COM changeme
# /opt/CSCObac/kdc/keygen bactest.cisco.com CISCO2.COM changeme
```

For details, see Using the KeyGen Tool, page 14-9.

Step 7 Ensure that the service keys you generated in Step 6, exist in the *BPR_HOME/kdc/<Operating System>/keys* directory.

For example:

```
/opt/CSCObac/kdc/<Operating System>/keys# ls -l
total 18
-rw-r--r--   1 root     other  2 Nov  4 09:44 krbtgt,CISCO1.COM@CISCO1.COM
-rw-r--r--   1 root     other  2 Nov  4 09:44 krbtgt,CISCO2.COM@CISCO2.COM
-rw-r--r--   1 root     other  2 Nov  4 09:44 krbtgt,CISCO.COM@CISCO.COM
-rw-r--r--   1 root     other  2 Nov  4 09:44 mtafqdnmap,bactest.cisco.com@CISCO1.COM
-rw-r--r--   1 root     other  2 Nov  4 09:44 mtafqdnmap,bactest.cisco.com@CISCO2.COM
-rw-r--r--   1 root     other  2 Nov  4 09:44 mtafqdnmap,bactest.cisco.com@CISCO.COM
```

```
-rw-r--r--   1 root     other 2 Nov  4 09:44 mtaprovsrvr,bactest.cisco.com@CISCO1.COM
-rw-r--r--   1 root     other 2 Nov  4 09:44 mtaprovsrvr,bactest.cisco.com@CISCO2.COM
-rw-r--r--   1 root     other 2 Nov  4 09:44 mtaprovsrvr,bactest.cisco.com@CISCO.COM
```

For more information, see Solaris documentation.

Step 8 Ensure that the various certificates and service keys exist in the *BPR_HOME/kdc* directory.

For example:

```
/opt/CSCObac/kdc# ls
PKCert.sh   internal keygen lib pkcert.log  solaris bacckdc.license

/opt/CSCObac/kdc# cd /internal/bin
/internal/bin# ls
kdc runKDC.sh shutdownKDC.sh

# cd /opt/CSCObac/kdc/lib
# ls
libgcc_s.so.1      libstdc++.so.5     libstlport_gcc.so

# cd /opt/CSCObac/<Operating System>/logs
# ls
kdc.log    kdc.log.1

# cd /opt/CSCObac/solaris
# ls
logs kdc.ini packetcable KDC_private_key_proprietary.

# cd keys
# ls
krbtgt,CISCO1.COM@CISCO1.COM
krbtgt,CISCO2.COM@CISCO2.COM
krbtgt,CISCO.COM@CISCO.COM
mtafqdnmap,bactest.cisco.com@CISCO1.COM
mtafqdnmap,bactest.cisco.com@CISCO2.COM
mtafqdnmap,bactest.cisco.com@CISCO.COM
mtaprovsrvr,bactest.cisco.com@CISCO1.COM
mtaprovsrvr,bactest.cisco.com@CISCO2.COM
mtaprovsrvr,bactest.cisco.com@CISCO.COM

# cd ./<Operating System>/packetcable/certificates
# ls
KDC.cer
Local_System.cer
CableLabs_Service_Provider_Root.cer  MTA_Root.cer
CISCO1.COM                          Service_Provider.cer
CISCO2.COM

# cd ./<Operating System>/packetcable/certificates/CISCO1.COM
# ls
KDC.cer
KDC_private_key_proprietary.

# cd ./<Operating System>/packetcable/certificates/CISCO2.COM:
# ls
KDC.cer
KDC_private_key_proprietary.
```

For more information, see Solaris documentation.

Step 9 Restart the KDC.

For example:

```
# /etc/init.d/bprAgent restart kdc
```

For more information, see Using the Cisco BAC Process Watchdog from the Command Line, page 9-2.

Step 10 Configure the Cisco BAC administrator user interface for multiple realms.

a. Add DHCP Criteria for the secondary realm; in this case, CISCO1.COM.

For example:

1. From **Configuration > DHCP Criteria > Manage DHCP Criteria**, click the **Add** button.
2. The Add DHCP Criteria page appears.
3. Enter **cisco1** in the DHCP Name field.
4. Click **Submit**.
5. Return to the Manage DHCP Criteria page, and click the cisco1 DHCP criteria. The Modify DHCP Criteria page appears.
6. Under Property Name, select */ccc/kerb/realm* and enter CISCO1.COM in the Property Value field.
7. Click **Add** and **Submit**.

For more information, see Configuring DHCP Criteria, page 13-17.

b. Add DHCP Criteria for the secondary realm; in this case, CISCO2.COM.

For example:

1. From **Configuration > DHCP Criteria > Manage DHCP Criteria**, click the **Add** button.
2. The Add DHCP Criteria page appears.
3. Enter **cisco2** in the DHCP Name field.
4. Click **Submit**.
5. Return to the Manage DHCP Criteria page, and click the cisco2 DHCP criteria. The Modify DHCP Criteria page appears.
6. Under Property Name, select */ccc/kerb/realm* and enter cisco2.COM in the Property Value field.
7. Click **Add** and **Submit**.

For more information, see Configuring DHCP Criteria, page 13-17.

c. Add templates as files to Cisco BAC for each of the devices being provisioned; in this step, for the Motorola MTA.

For example:

1. Choose **Configuration > Files**. The Manage Files page appears.
2. Click **Add**, and the Add Files page appears.
3. Select the CableLabs Configuration Template option from the File Type drop-down list.
4. Add the *mot-mta.tmpl* file. This file is the template used to provision a Motorola MTA. For template syntax, see Example 7-2 on page 7-26.
5. Click **Submit**.

For more information, see Managing Files, page 13-19.

d. Add templates as files to Cisco BAC for each of the devices being provisioned; in this step, for the Linksys MTA.

   For example:

   1. Choose **Configuration > Files**. The Manage Files page appears.
   2. Click **Add**, and the Add Files page appears.
   3. Select the CableLabs Configuration Template option from the File Type drop-down list.
   4. Add the *linksys-mta.tmpl* file. This file is the template used to provision a Linksys MTA. For template syntax, see Example 7-3 on page 7-27.
   5. Click **Submit**.

   For more information, see Managing Files, page 13-19.

e. Add templates as files to Cisco BAC for each of the devices being provisioned; in this step, for the SA MTA.

   For example:

   1. Choose **Configuration > Files**. The Manage Files page appears.
   2. Click **Add**, and the Add Files page appears.
   3. Select the CableLabs Configuration Template option from the File Type drop-down list.
   4. Add the *sa-mta.tmpl* file. This file is the template used to provision an SA MTA. For template syntax, see Example 7-4 on page 7-27.
   5. Click **Submit**.

   For more information, see Managing Files, page 13-19.

f. Add a Class of Service for the primary realm; in this case, CISCO.COM.

   For example:

   1. Choose **Configuration** > **Class of Service**.
   2. Click **Add**. The Add Class of Service page appears.
   3. Enter mot-mta as the name of the new Class of Service for the CISCO.COM realm.
   4. Choose the Class of Service Type as PacketCableMTA.
   5. Select */cos/packetCableMTA/file* from the Property Name drop-down list and associate it to the *mot-mta.tmpl* template file (which is used to provision the Motorola MTA in the primary CISCO.COM realm).
   6. Click **Add** and **Submit**.

   For more information, see Configuring Class of Service, page 13-1.

g. Add a Class of Service for the secondary realm; in this case, CISCO1.COM.

   For example:

   1. Choose **Configuration** > **Class of Service**.
   2. Click **Add**. The Add Class of Service page appears.
   3. Enter linksys-mta as the name of the new Class of Service for the CISCO1.COM realm.
   4. Choose the Class of Service Type as PacketCableMTA.
   5. Select */cos/packetCableMTA/file* from the Property Name drop-down list and associate it to the *linksys-mta.tmpl* template file (which is used to provision the Linksys MTA in the secondary CISCO1.COM realm).

6. Click **Add** and **Submit**.

For more information, see Configuring Class of Service, page 13-1.

h. Add a Class of Service for the secondary realm; in this case, CISCO2.COM.

For example:

1. Choose **Configuration > Class of Service**.
2. Click **Add**. The Add Class of Service page appears.
3. Enter sa-mta as the name of the new Class of Service for the CISCO1.COM realm.
4. Choose the Class of Service Type as PacketCableMTA.
5. Select */cos/packetCableMTA/file* from the Property Name drop-down list and associate it to the *sa-mta.tmpl* template file (which is used to provision the SA MTA in the secondary CISCO2.COM realm).
6. Click **Add** and **Submit**.

For more information, see Configuring Class of Service, page 13-1.

Step 11 Bring the devices online and provision them. See the following examples that describe the provisioning process.

Example 1

The following example describes how you can provision the Motorola SBV5120.

a. Provision the cable modem part of the device by setting it to use the **sample-bronze-docsis** Class of Service.

b. To provision the MTA part, go to the **Devices > Manage Devices** page. Search and select the PacketCable device you want to provision. The Modify Device page appears.

c. Set the domain name. This example uses bacclab.cisco.com.

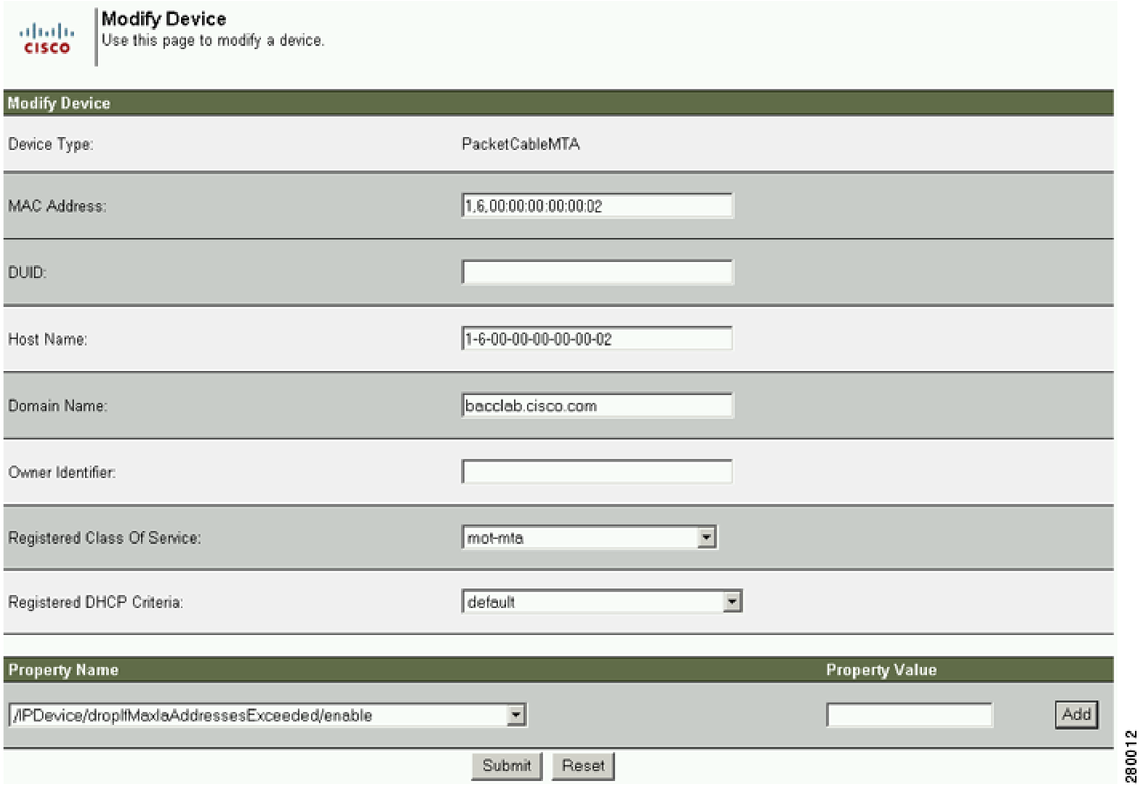
d. From the drop-down list corresponding to Registered Class of Service, select **mot-mta**. This is the Class of Service that you added in Step 10-f.

e. From the drop-down list corresponding to Registered DHCP Criteria, select the **default** option.

f. Click **Submit**.

Figure 7-2 lists device details for the Motorola MTA.

Figure 7-2 Provisioning Motorola MTA–Device Details



Modify Device

Device Type:	PacketCableMTA
MAC Address:	1,6,00:00:00:00:00:02
DUID:	
Host Name:	1-6-00-00-00-00-00-02
Domain Name:	bacclab.cisco.com
Owner Identifier:	
Registered Class Of Service:	mot-mta
Registered DHCP Criteria:	default

Property Name	Property Value
/IPDevice/dropIfMaxIaAddressesExceeded/enable	

Example 2

The following example illustrates how you can provision the Linksys CM2P2.

a. Provision the cable modem part of the device by setting it to use the **sample-bronze-docsis** Class of Service.

b. To provision the MTA part, go to the **Devices > Manage Devices** page. Search and select the PacketCable device you want to provision. The Modify Device page appears.

c. Set the domain name. This example uses bacclab.cisco.com.

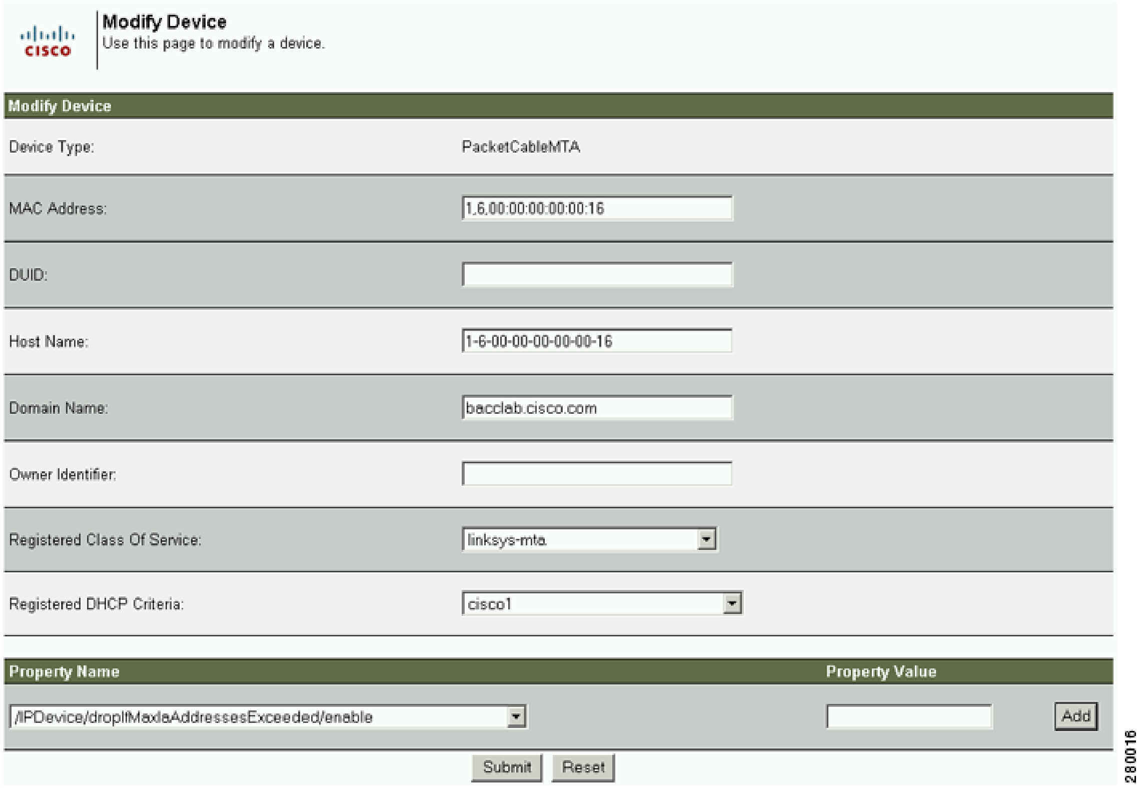
d. From the drop-down list corresponding to Registered Class of Service, select **linksys-mta**. This is the Class of Service that you added in Step 10-g.

e. From the drop-down list corresponding to Registered DHCP Criteria, select the **cisco1** option. This is the DHCP Criteria that you added for the secondary CISCO1.COM realm in Step 10-a.

f. Click **Submit**.

Figure 7-3 lists device details for the Linksys MTA.

Figure 7-3 Provisioning Linksys MTA–Device Details



Modify Device
Use this page to modify a device.

Modify Device

Device Type:	PacketCableMTA
MAC Address:	1,6,00:00:00:00:00:16
DUID:	
Host Name:	1-6-00-00-00-00-00-16
Domain Name:	bacclab.cisco.com
Owner Identifier:	
Registered Class Of Service:	linksys-mta
Registered DHCP Criteria:	cisco1

Property Name	Property Value
/IPDevice/dropIfMaxIaAddressesExceeded/enable	

Example 3

The following example illustrates how you can provision the SA WebStar DPX 2203.

a. Provision the cable modem part of the device by setting it to use the **sample-bronze-docsis** Class of Service.

b. To provision the MTA part, go to the **Devices > Manage Devices** page. Search and select the PacketCable device you want to provision. The Modify Device page appears.

c. Set the domain name. This example uses bacclab.cisco.com.

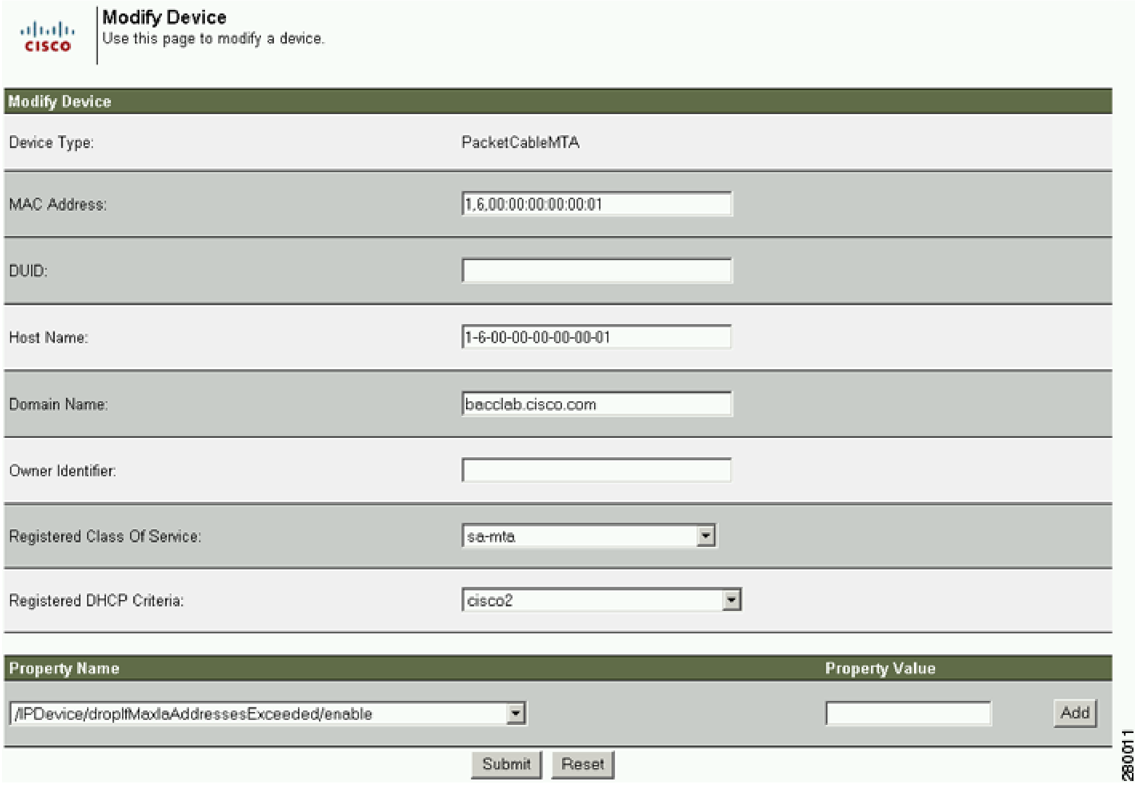
d. From the drop-down list corresponding to Registered Class of Service, select **sa-mta**. This is the Class of Service that you added in Step 10-h.

e. From the drop-down list corresponding to Registered DHCP Criteria, select the **cisco2** option. This is the DHCP Criteria that you added for the secondary CISCO2.COM realm in Step 10-b.

f. Click **Submit**.

Figure 7-4 lists device details for the SA MTA.

Figure 7-4 Provisioning SA MTA–Device Details



Modify Device
Use this page to modify a device.

Modify Device

Device Type:	PacketCableMTA
MAC Address:	1,6,00:00:00:00:00:01
DUID:	
Host Name:	1-6-00-00-00-00-00-01
Domain Name:	bacclab.cisco.com
Owner Identifier:	
Registered Class Of Service:	sa-mta
Registered DHCP Criteria:	cisco2

Property Name	Property Value
/IPDevice/dropIfMaxIaAddressesExceeded/enable	

Step 12 Verify if multiple realm support is operational by using an ethereal trace. See the sample output from the KDC and DPE log files shown here from the sample setup used in this procedure.

Example 1

The following example features excerpts from the KDC and DPE log files for the Motorola SBV 5120 MTA provisioned in the primary CISCO.COM realm:

KDC Log Sample Output–Motorola MTA

```
INFO [Thread-4] 2007-02-07 07:56:21,133 (DHHelper.java:114) - Time to create DH key
pair(ms): 48
 INFO [Thread-4] 2007-02-07 07:56:21,229 (DHHelper.java:114) - Time to create DH key
pair(ms): 49
 INFO [Thread-4] 2007-02-07 07:56:21,287 (DHHelper.java:150) - Time to create shared
secret: 57 ms.
 INFO [Thread-4] 2007-02-07 07:56:21,289 (PKAsReqMsg.java:104) - ##MTA-9a Unconfirmed AS
Request: 1133717956 Received from /10.10.1.2
 INFO [Thread-4] 2007-02-07 07:56:21,298 (KRBProperties.java:612) - Replacing property:
'minimum ps backoff' Old Value:'150' New Value: '150'
 INFO [Thread-4] 2007-02-07 07:56:21,324 (KDCMessageHandler.java:257) - AS-REQ contains
PKINIT - QA Tag.
 INFO [Thread-4] 2007-02-07 07:56:21,325 (KDCMessageHandler.java:279) - PK Request from
MTA received. Client is MTA - QA Tag
 INFO [Thread-4] 2007-02-07 07:56:21,365 (KDCMessageHandler.java:208) - ##MTA-9b KDC Reply
AS-REP Sent to /10.10.1.2:1039 Time(ms): 290
 WARN [main] 2005-11-07 07:56:23,193 (KDC.java:113) - Statistics Report   ASREP's: 1
 INFO [main] 2005-11-07 07:56:23,195 (KDC.java:121) - /pktcbl/mtaAsRepSent: 10
 INFO [main] 2005-11-07 07:56:23,195 (KDC.java:121) - /pktcbl/DHKeygenTotalTime: 1043
 INFO [main] 2005-11-07 07:56:23,196 (KDC.java:121) - /pktcbl/mtaAsReqRecvd: 10
 INFO [main] 2005-11-07 07:56:23,197 (KDC.java:121) - /pktcbl/DHKeygenNumOps: 20
 INFO [main] 2005-11-07 07:56:23,197 (KDC.java:121) - /pktcbl/total: 60
```

DPE Log Sample Output–Motorola MTA

```
dpe.cisco.com: 2007 02 07 07:56:24 EST: %BAC-DPE-6-4178: Adding Replay Packet:  []
dpe.cisco.com: 2007 02 07 07:56:24 EST: %BAC-PKTSNMP-6-0764: [System Description for MTA:
<<HW_REV: 1.0, VENDOR: Motorola Corporation, BOOTR: 8.1, SW_REV:
SBV5120-2.9.0.1-SCM21-SHPC, MODEL: SBV5120>>]
dpe.cisco.com: 2007 02 07 07:56:24 EST: %BAC-PKTSNMP-6-0764: [##MTA-15 SNMPv3 INFORM
Received From 10.10.1.2.]
dpe.cisco.com: 2007 02 07 07:56:24 EST: %BAC-DPE-6-0688: Received key material update for
device [1,6,01:11:82:61:5e:30]
dpe.cisco.com: 2007 02 07 07:56:24 EST: %BAC-PKTSNMP-6-0764: [##MTA-19 SNMPv3 SET Sent to
10.10.1.2]
dpe.cisco.com: 2007 02 07 07:56:24 EST: %BAC-TFTP-6-0310: Finished handling [read] request
from [10.10.1.2:1190] for [bpr0106001182615e300001]
dpe.cisco.com: 2007 02 07 07:56:25 EST: %BAC-PKTSNMP-6-0764: [##MTA-25 SNMP Provisioning
State INFORM Received from 10.10.1.2.  Value: 1]
```

Example 2

The following example features excerpts from the KDC and DPE log files for the Linksys CM2P2 MTA provisioned in the secondary CISCO1.COM realm:

KDC Log Sample Output–Linksys MTA

```
 INFO [Thread-8] 2007-02-07 08:00:10,664 (DHHelper.java:114) - Time to create DH key
pair(ms): 49
 INFO [Thread-8] 2007-02-07 08:00:10,759 (DHHelper.java:114) - Time to create DH key
pair(ms): 49
 INFO [Thread-8] 2007-02-07 08:00:10,817 (DHHelper.java:150) - Time to create shared
secret: 57 ms.
 INFO [Thread-8] 2007-02-07 08:00:10,819 (PKAsReqMsg.java:104) - ##MTA-9a Unconfirmed AS
Request: 1391094112 Received from /10.10.1.5
 INFO [Thread-8] 2007-02-07 08:00:10,828 (KRBProperties.java:612) - Replacing property:
'minimum ps backoff' Old Value:'150' New Value: '150'
 INFO [Thread-8] 2007-02-07 08:00:10,860 (KDCMessageHandler.java:257) - AS-REQ contains
PKINIT - QA Tag.
 INFO [Thread-8] 2007-02-07 08:00:10,862 (KDCMessageHandler.java:279) - PK Request from
MTA received. Client is MTA - QA Tag
 INFO [Thread-8] 2007-02-07 08:00:10,901 (KDCMessageHandler.java:208) - ##MTA-9b KDC Reply
AS-REP Sent to /10.10.1.5:3679 Time(ms): 296
 WARN [main] 2007-02-07 08:00:13,383 (KDC.java:113) - Statistics Report   ASREP's: 1
 INFO [main] 2007-02-07 08:00:13,384 (KDC.java:121) - /pktcbl/mtaAsRepSent: 11
 INFO [main] 2007-02-07 08:00:13,384 (KDC.java:121) - /pktcbl/DHKeygenTotalTime: 1141
```

DPE Log Sample Output–Linksys MTA

```
dpe.cisco.com: 2007 02 07 08:00:10 EST: %BAC-DPE-6-4112: Adding Replay Packet:  []
dpe.cisco.com: 2007 02 07 08:00:12 EST: %BAC-DPE-6-4178: Adding Replay Packet:  []
dpe.cisco.com: 2007 02 07 08:00:12 EST: %BAC-PKTSNMP-6-0764: [System Description for MTA:
Linksys Cable Modem with 2 Phone Ports (CM2P2) <<HW_REV: 2.0, VENDOR: Linksys, BOOTR:
2.1.6V, SW_REV: 2.0.3.3.11-1102, MODEL: CM2P2>>]
dpe.cisco.com: 2007 02 07 08:00:12 EST: %BAC-PKTSNMP-6-0764: [##MTA-15 SNMPv3 INFORM
Received From 10.10.1.5.]
dpe.cisco.com: 2007 02 07 08:00:12 EST: %BAC-DPE-6-0688: Received key material update for
device [1,6,00:0f:68:f9:42:f6]
dpe.cisco.com: 2007 02 07 08:00:12 EST: %BAC-PKTSNMP-6-0764: [##MTA-19 SNMPv3 SET Sent to
10.10.1.5]
```

```
dpe.cisco.com: 2007 02 07 08:00:18 EST: %BAC-TFTP-6-0310: Finished handling [read] request
from [10.10.1.5:1032] for [bpr0106000f68f942f60001]
dpe.cisco.com: 2007 02 07 08:00:18 EST: %BAC-PKTSNMP-6-0764: [##MTA-25 SNMP Provisioning
State INFORM Received from 10.10.1.5.  Value: 1]
```

Example 3

The following example features excerpts from the KDC and DPE log files for the SA WebStar DPX 2203 MTA provisioned in the secondary CISCO2.COM realm:

KDC Log Sample Output–SA MTA

```
 INFO [Thread-6] 2007-02-07 08:01:31,556 (DHHelper.java:114) - Time to create DH key
pair(ms): 49
 INFO [Thread-6] 2007-02-07 08:01:31,652 (DHHelper.java:114) - Time to create DH key
pair(ms): 50
 INFO [Thread-6] 2007-02-07 08:01:31,711 (DHHelper.java:150) - Time to create shared
secret: 57 ms.
 INFO [Thread-6] 2007-02-07 08:01:31,715 (PKAsReqMsg.java:104) - ##MTA-9a Unconfirmed AS
Request: 575634000 Received from /10.10.1.50
 INFO [Thread-6] 2007-02-07 08:01:31,727 (KRBProperties.java:612) - Replacing property:
'minimum ps backoff' Old Value:'150' New Value: '150'
 INFO [Thread-6] 2007-02-07 08:01:31,752 (KDCMessageHandler.java:257) - AS-REQ contains
PKINIT - QA Tag.
 INFO [Thread-6] 2007-02-07 08:01:31,753 (KDCMessageHandler.java:279) - PK Request from
MTA received. Client is MTA - QA Tag
 INFO [Thread-6] 2007-02-07 08:01:31,792 (KDCMessageHandler.java:208) - ##MTA-9b KDC Reply
AS-REP Sent to /10.10.1.50:3679 Time(ms): 292
 WARN [main] 2007-02-07 08:01:33,423 (KDC.java:113) - Statistics Report   ASREP's: 1
 INFO [main] 2007-02-07 08:01:33,424 (KDC.java:121) - /pktcbl/mtaAsRepSent: 12
 INFO [main] 2007-02-07 08:01:33,425 (KDC.java:121) - /pktcbl/DHKeygenTotalTime: 1240
 INFO [main] 2007-02-07 08:01:33,425 (KDC.java:121) - /pktcbl/mtaAsReqRecvd: 12
 INFO [main] 2007-02-07 08:01:33,426 (KDC.java:121) - /pktcbl/DHKeygenNumOps: 24
 INFO [main] 2007-02-07 08:01:33,426 (KDC.java:121) - /pktcbl/total: 72
```

DPE Log Sample Output–SA MTA

```
dpe.cisco.com: 2007 02 07 08:01:31 EST: %BAC-DPE-6-4112: Adding Replay Packet:  []
dpe.cisco.com: 2007 02 07 08:01:33 EST: %BAC-DPE-6-4178: Adding Replay Packet:  []
dpe.cisco.com: 2007 02 07 08:01:33 EST: %BAC-PKTSNMP-6-0764: [System Description for MTA:
S-A WebSTAR DPX2200 Series DOCSIS E-MTA Ethernet+USB (2)Lines VOIP <<HW_REV: 2.0, VENDOR:
S-A, BOOTR: 2.1.6b, SW_REV: v1.0.1r1133-0324, MODEL: DPX2203>>]
dpe.cisco.com: 2007 02 07 08:01:33 EST: %BAC-PKTSNMP-6-0764: [##MTA-15 SNMPv3 INFORM
Received From 10.10.1.50.]
dpe.cisco.com: 2007 02 07 08:01:33 EST: %BAC-DPE-6-0688: Received key material update for
device [1,6,00:0f:24:d8:6e:f5]
dpe.cisco.com: 2007 02 07 08:01:33 EST: %BAC-PKTSNMP-6-0764: [##MTA-19 SNMPv3 SET Sent to
10.10.1.50]
dpe.cisco.com: 2007 02 07 08:01:38 EST: %BAC-TFTP-6-0310: Finished handling [read] request
from [10.10.1.50:1037] for [bpr0106000f24d86ef50001]
dpe.cisco.com: 2007 02 07 08:01:39 EST: %BAC-PKTSNMP-6-0764: [##MTA-25 SNMP Provisioning
State INFORM Received from 10.10.1.50.  Value: 1]
```

Authoring Template for Provisioning Devices in Multiple Realms

You can use the template syntax described here to provision devices in a particular realm. The examples shown here are specific to the Motorola SBV5120 MTA (Example 7-2), the Linksys CM2P2 MTA (Example 7-3), and the SA WebStar DPX2203 MTA (Example 7-4).

Note You must modify these templates to suit the specifics of the MTA in your network.

Example 7-2 Template Used to Provision a Motorola MTA

```
#
# Example PacketCable MTA template: mot-mta.tmpl
#
# Note that this template is specific to the TI 401 MTA.
# This template must be modified to the specifics of your MTA.
#
# First, the start marker.
#
option 254 1
#
# Enable MTA
#
option 11 .pktcMtaDevEnabled.0,INTEGER,true
#
# Set CMS FQDN for each endpoint on the MTA.
# NOTE: the indexes (9 and 10 here) will differ per manufacturer.
#
option 11
.pktcNcsEndPntConfigTable.pktcNcsEndPntConfigEntry.pktcNcsEndPntConfigCallAgentId.9,STRING
,CMS.CISCO.COM
option 11
.pktcNcsEndPntConfigTable.pktcNcsEndPntConfigEntry.pktcNcsEndPntConfigCallAgentId.10,STRIN
G,CMS.CISCO.COM
#
# Set the realm org name.  This MUST match that contained in the cert chain used by the
device.
#
# "CableLabs, Inc."
option 11
.pktcMtaDevRealmTable.pktcMtaDevRealmEntry.pktcMtaDevRealmOrgName.'CISCO.COM',STRING,"Cabl
eLabs, Inc."
#
# Set the realm name and IPSec control for the CMS.
#
option 11
.pktcMtaDevCmsTable.pktcMtaDevCmsEntry.pktcMtaDevCmsIpsecCtrl.'CMS.CISCO.COM',INTEGER,true
option 11
pktcMtaDevCmsTable.pktcMtaDevCmsEntry.pktcMtaDevCmsKerbRealmName.'CMS.CISCO.COM',STRING,CI
SCO.COM
#
# Finally, the end marker.
#
option 254 255
```

Example 7-3 Template Used to Provision a Linksys MTA

Note that, in this template, the realm has been set to CISCO1.COM.

```
#
# Example PacketCable MTA template: linksys-mta.tmpl
#
# Note that this template is specific to the TI 401 MTA.
# This template must be modified to the specifics of your MTA.
#
# First, the start marker.
#
option 254 1
#
# Enable MTA
#
option 11 .pktcMtaDevEnabled.0,INTEGER,true
#
# Set CMS FQDN for each endpoint on the MTA.
# NOTE: the indexes (9 and 10 here) will differ per manufacturer.
#
option 11
.pktcNcsEndPntConfigTable.pktcNcsEndPntConfigEntry.pktcNcsEndPntConfigCallAgentId.9,STRING
,CMS.CISCO.COM
option 11
.pktcNcsEndPntConfigTable.pktcNcsEndPntConfigEntry.pktcNcsEndPntConfigCallAgentId.10,STRIN
G,CMS.CISCO.COM
#
# Set the realm org name.  This MUST match that contained in the cert chain used by the
device.
#
# "CableLabs, Inc."
option 11
.pktcMtaDevRealmTable.pktcMtaDevRealmEntry.pktcMtaDevRealmOrgName.'CISCO1.COM',STRING,"Cab
leLabs, Inc."
#
# Set the realm name and IPSec control for the CMS.
#
option 11
.pktcMtaDevCmsTable.pktcMtaDevCmsEntry.pktcMtaDevCmsIpsecCtrl.'CMS.CISCO.COM',INTEGER,true
option 11
pktcMtaDevCmsTable.pktcMtaDevCmsEntry.pktcMtaDevCmsKerbRealmName.'CMS.CISCO.COM',STRING,CI
SCO1.COM
#
# Finally, the end marker.
#
option 254 255
```

Example 7-4 Template Used to Provision an SA MTA

Note that, in the template, the realm has been set to CISCO2.COM.

```
#
# Example PacketCable MTA template: sa-mta.tmpl
#
# Note that this template is specific to the TI 401 MTA.
# This template must be modified to the specifics of your MTA.
#
# First, the start marker.
#
option 254 1
#
# Enable MTA
#
```

```
option 11 .pktcMtaDevEnabled.0,INTEGER,true
#
# Set CMS FQDN for each endpoint on the MTA.
# NOTE: the indexes (9 and 10 here) will differ per manufacturer.
#
option 11
.pktcNcsEndPntConfigTable.pktcNcsEndPntConfigEntry.pktcNcsEndPntConfigCallAgentId.9,STRING
,CMS.CISCO.COM
option 11
.pktcNcsEndPntConfigTable.pktcNcsEndPntConfigEntry.pktcNcsEndPntConfigCallAgentId.10,STRIN
G,CMS.CISCO.COM
#
# Set the realm org name.  This MUST match that contained in the cert chain used by the
device.
#
# "CableLabs, Inc."
option 11
.pktcMtaDevRealmTable.pktcMtaDevRealmEntry.pktcMtaDevRealmOrgName.'CISCO2.COM',STRING,"Cab
leLabs, Inc."
#
# Set the realm name and IPSec control for the CMS.
#
option 11
.pktcMtaDevCmsTable.pktcMtaDevCmsEntry.pktcMtaDevCmsIpsecCtrl.'CMS.CISCO.COM',INTEGER,true
option 11
pktcMtaDevCmsTable.pktcMtaDevCmsEntry.pktcMtaDevCmsKerbRealmName.'CMS.CISCO.COM',STRING,CI
SCO2.COM
#
# Finally, the end marker.
#
option 254 255
```

Configuring SRV Records in the Network Registrar DNS Server

You must configure the Network Registrar DNS server to operate with the KDC. To set up this configuration, see your Network Registrar documentation and these instructions.

Note We recommend that you create a zone name that matches the desired realm name, and that the only DNS record in this special zone (other than the records required by the DNS server to maintain the zone) should be the SRV record for the realm. This example assumes that the desired Kerberos realm is voice.example.com, and that all other KDC, Network Registrar, and DPE configurations have been performed. The FQDN of the KDC is assumed to be kdc.example.com.

Step 1 Start the **nrcmd** command-line tool (which resides, by default, in the */opt/nwreg2/local/usrbin* directory).

Step 2 Enter your username and password.

Step 3 To create a zone for the Kerberos realm, enter:

```
nrcmd> zone voice.example.com create primary address_of_nameserver hostmaster
```

where *address_of_nameserver* specifies the IP address of the name server.

Step 4 To add the SRV record to the new zone, enter:

```
nrcmd> zone voice.example.com. addRR _kerberos._udp. srv 0 0 88 KDC_FQDN
```

where *KDC_FQDN* specifies the FQDN of the KDC.

Step 5 To save and reload the DNS server, enter:

```
nrcmd> save
```

```
nrcmd> dns reload
```

Configuring SNMPv3 Cloning on the RDU and DPE for Secure Communication with PacketCable MTAs

Cisco BAC lets you enable an external network manager for SNMPv3 access to MTA devices. Additionally, the RDU is capable of performing SNMPv3 operations in a specific MTA.

To enable this capability, set the security key material at the DPEs and RDU. After the key material has been set, the Cisco BAC application programming interface (API) calls that are used to create cloned SNMPv3 entries are enabled.

Note Enabling this capability impacts provisioning performance.

Creating the Key Material and Generating the Key

Creating the key material is a two-step process:

1. Run a script command on the RDU.
2. Run a CLI command on the DPE.

Note This shared secret is not the same shared secret as the CMTS or the Cisco BAC shared secrets.

To create the key material:

Step 1 From the *BPR_HOME/rdu/bin* directory, run this script on the RDU:

```
# generateSharedSecret.sh password
```

where *password* is any password, from 6 to 20 characters, that you create. This password is then used to generate a 46-byte key. This key is stored in a file, called *keymaterial.txt*, that resides in the *BPR_HOME/rdu/conf* directory.

Step 2 Run the **service packetcable** *1..1* **snmp key-material** DPE CLI command, with the *password* used in Step 1 to generate that key, on all DPEs for which this voice technology is enabled. This command generates the same 46-byte key on the DPE and ensures that the RDU and DPEs are synchronized and can communicate with the MTA securely.

PacketCable Basic eMTA Provisioning

Cisco BAC also supports PacketCable Basic, which offers a simpler, DOCSIS-like, non-secure provisioning flow. Table 7-5 describes the BASIC.1 flow using the provisioning workflow in Figure 7-1 on page 7-2.

Table 7-5 PacketCable Basic eMTA Provisioning

Step	Workflow	Description
MTA-1	DHCP Broadcast Discover	Executes as for the Secure flow.
MTA-2	DHCP Offer	If the provisioning system is configured to provision the MTA in BASIC.1 mode, the provisioning system returns a DHCP Offer containing Option 122 suboption 6, which contains the special reserved realm name "BASIC.1". This reserved realm name commands the MTA to use the BASIC.1 provisioning flow. This Offer also contains the provisioning system IP address in Option 122.3, and the file and siaddr fields are populated with the configuration file location of the MTA.
MTA-3	DHCP Request	The remainder of the MTA DHCP exchange is executed (Request and Ack exchanged).
MTA-4	DHCP Ack	
MTA-22	Telephony Config File Request	The MTA skips directly to step MTA-22. Using the file and siaddr information, the MTA copies its configuration file from the provisioning system via TFTP. Note that Cisco BAC integrates the TFTP server into the DPE component. **Note** No authentication of MTA/provisioning server or encryption occurs.
MTA-23	Telephony Config File	

The BASIC.2 flow is identical to BASIC.1, with the following exceptions:

- "BASIC.2" is populated into the MTA's DHCP Option 122 suboption 6.
- The MTA issues a provisioning status SNMPv2c INFORM at the very end of the flow, MTA-25 (DHCP Option 122 suboption 3 specifies the Inform target).

The PacketCable Basic flow is similar to the DOCSIS flow with the following differences:

- There is no ToD exchange between MTA and the provisioning system.
- The MTA configuration file contains an integrity hash. Specifically, the SHA1 hash of the entire content of the configuration file is populated into a pktcMtadevConfigFileHash SNMP VarBind and placed within a TLV 11 just before the end of file TLV.
- BASIC.2 flow issues a provisioning status SNMPv2c Inform after the MTA receives and processes its configuration file. This Inform notifies Cisco BAC if MTA provisioning completed successfully. If there is a problem, an error is generated and an event sent from the DPE to the RDU, then on to a Cisco BAC client. This Inform is useful while debugging configuration file issues.

For additional information about the DOCSIS flow, see Chapter 6, "DOCSIS Configuration."

Note Before using the PacketCable Basic provisioning flow, ensure that you are using a PacketCable Basic-capable eMTA. The eMTA must report that it is Basic-capable with its DHCP Discover Option 60, TLV 5.18 (supported flows).

PacketCable TLV 38 and MIB Support

Cisco BAC supports the complete set of PacketCable 1.5 MIBs.

Cisco BAC supports TLV 38 in PacketCable configuration templates. This TLV lets you configure multiple SNMP notification targets. Configuration of this TLV means that all notifications are also issued to the targets configured through TLV 38.

SNMP v2C Notifications

Cisco BAC supports both SNMP v2C TRAP and INFORM notifications from the PacketCable MTA.

Euro PacketCable

Euro-PacketCable services are essentially the European equivalent of North American PacketCable services with the following differences:

- Euro PacketCable uses different MIBs.
- Euro PacketCable uses a different set of device certificates (*MTA_Root.cer*) and service provider certificates (Service Provider Root).

  For Euro-PacketCable certificates, the *kdc.ini* file must have the *euro-packetcable* property set to true. The KDC supports Euro-PacketCable (tComLabs) certificate chains. The following is a sample Euro PacketCable-enabled KDC configuration file.

```
[general]
interface address = 10.10.10.1
FQDN = servername.cisco.com
maximum log file size = 10000
n saved log files = 100
log debug level = 5 minimum
ps backoff = 150 maximum
ps backoff = 300
euro-packetcable = true
```

  When using Euro PacketCable, ensure that the value of the PacketCable property */pktcbl/prov/locale* is set to EURO. The default is NA (for North America). You can specify the locale in the Configuration File utility. See Using the Configuration File Utility for Template, page 5-32, for more information.

Euro-PacketCable MIBs

Euro-PacketCable MIBs are essentially snapshots of draft-IETF MIBs. MTA configuration files consist of SNMP VarBinds that reference the MIBs. There are substantial differences between the North American PacketCable and Euro-PacketCable MIBs; therefore, the North American PacketCable and Euro-PacketCable configuration files are incompatible. During installation, sample files for North American PacketCable (*cw29_config.tmpl*) and Euro PacketCable (*ecw15_mta_config.tmpl*) are copied to the *BPR_HOME/rdu/samples* directory.

Cisco BAC ships with the following Euro-PacketCable MIBs:

- DOCS-IETF-BPI2-MIB
- INTEGRATED-SERVICES-MIB
- DIFFSERV-DSCP-TC
- DIFFSERV-MIB
- TCOMLABS-MIB
- PKTC-TCOMLABS-MTA-MIB
- PKTC-TCOMLABS-SIG-MIB

Configuring Euro-PacketCable MIBs

To configure Cisco BAC to use Euro-PacketCable MIBs, you must change the Cisco BAC RDU property that specifies the MIBs to be loaded. By default, this property contains the PacketCable MIBs.

You can change the property in one of the following ways:

- Modify *rdu.properties* and restart the RDU.
- On the administrator user interface, navigate to **Configuration > Defaults > System Defaults** and replace the MIB list with the list shown below. You do not need to restart the RDU.
- Use the Prov API *changeSystemDefaults()* call. You do not need to restart the RDU.

The property name is */snmp/mibs/mibList* (properties file) or `SNMPPropertyKeys.MIB_LIST` (the Prov API constant name). The property value is a comma-separated value (CSV) consisting of the required MIB names, as shown:

```
/snmp/mibs/mibList=SNMPv2-SMI,SNMPv2-TC,INET-ADDRESS-MIB,CISCO-SMI,CISCO-TC,SNMPv2-MIB,RFC
1213-MIB,IANAifType-MIB,IF-MIB,DOCS-IF-MIB,DOCS-IF-EXT-MIB,DOCS-BPI-MIB,CISCO-CABLE-SPECTR
UM-MIB,CISCO-DOCS-EXT-MIB,SNMP-FRAMEWORK-MIB,DOCS-CABLE-DEVICE-MIB,DOCS-QOS-MIB,CISCO-CABL
E-MODEM-MIB,DOCS-IETF-BPI2-MIB,INTEGRATED-SERVICES-MIB,DIFFSERV-DSCP-TC,DIFFSERV-MIB,TCOML
ABS-MIB,PKTC-TCOMLABS-MTA-MIB,PKTC-TCOMLABS-SIG-MIB
```