Chapter 6

Classifying Interfaces and Subscribers with the SRC CLI

This chapter provides information for configuring and using classification scripts with the SRC command line interface (CLI).

You can also use SDX Admin to configure classification scripts on Solaris platforms. See *Chapter 7, Classifying Interfaces and Subscribers on a Solaris Platform*.

Topics in this chapter include:

Overview of Classification Scripts

The SAE uses classification scripts to determine whether it manages router interfaces, to select default policies, to find subscriber profiles, and to choose DHCP profiles. The SAE has three classification scripts:

- Interface classification script—When a subscriber's IP interface comes up on the router, the router sends the subscriber's login and interface information to the SAE. The SAE runs the interface classification script to determine whether the SAE manages the interface and if so, what default policies to send to the router.
- Subscriber classification script—If the SAE is managing the interface, the SAE uses the login and interface information that the router sends to run the subscriber classification script to determine which subscriber profile to load into memory.

- DHCP classification script—For DHCP subscribers, the SAE runs DHCP classification scripts to choose DHCP profiles.

How Classification Scripts Work

Classification scripts consist of *targets* and *conditions*.

- A target is the result of the classification script. For example, the result of subscriber classification scripts is an LDAP search string that is used to find a unique subscriber profile. The result of interface classification scripts is a policy group.

- Conditions are match criteria. The script attempts to match conditions in the script with information sent from the router. For example, match conditions for a subscriber classification script might be login type or domain name. Match conditions for an interface classification script could be interface IP address or interface description.

Each script can have multiple targets, and each target can have multiple conditions. When an object needs classification, the script processes the targets in turn. Within each target, the script processes conditions sequentially. When it finds that the classification conditions for a target match, it returns the target to the SAE. If the script does not find any targets that can be matched, the classifier engine returns a no-match message to the SAE.

Because classification scripts examine conditions sequentially as the conditions appear in the script, you should put more specific conditions at the beginning of the script and less specific conditions at the end of the script.

Interface Classification Scripts

When a subscriber's IP interface comes up on the router, the router sends the subscriber's login and interface information to the SAE. For example, the router might send the following information:

```
IP address=0.0.0.0
Virtual router name=default@erx5_ssp58
Interface name=FastEthernet3/1.1
PPP login name (PPP)=pebbles@virneo.net
User IP address (PPP)=192.168.55.5
Interface speed=100000000
Interface description=P3/1.1
Interface alias=1st pppoe int
RADIUS class=null
```

The SAE invokes the interface classification script and provides to the script the information that it received from the router. The script engine matches the information sent from the router to the conditions in the interface classification script. The script examines each condition in sequential order to find a match.

- If it finds a match, the script processing stops, and the target for that condition is returned to the SAE. The target is the path of a policy group. This policy group is the default policy. The SAE installs the policy on the interface and begins managing the interface.

- If it does not find a match, the script sends a no-match message to the SAE. The SAE does not manage the interface; that is, the policies installed through RADIUS or the CLI remain in effect. The SAE does not install policies.

Subscriber Classification Scripts

When the SAE begins managing an interface, it determines whether a subscriber is associated with the interface by running the subscriber classification script. The SAE also runs the subscriber classification script when certain login events occur. See *Login Events* on page 16 for a description of login event types.

To find the matching subscriber profile, the SAE uses interface information that it received from the router when the interface became operational (for example, virtual router name, interface name, interface alias). It also uses login information that it received from the router or the portal application when the subscriber attempted to log in (for example, subscriber IP address, login name, or login event type).

When the SAE runs the subscriber classification script, the script engine matches the information sent from the router to the conditions in the subscriber classification script. The script examines each condition in sequential order to find a match.

- If it finds a match, the script processing stops, and the target for the matching condition is returned to the SAE. The target is an LDAP query that uniquely identifies a subscriber profile. The SAE loads the subscriber entry and uses the entry to create a subscriber session in memory.

- If it does not find a match, the script sends a no-match message to the SAE. The SAE does not load a subscriber session onto the interface, and services cannot be activated for this session.

DHCP Classification Scripts

DHCP classification scripts choose DHCP profiles. See *Assigning DHCP Addresses to Subscribers* on page 132 for information about how DHCP classification scripts are used.

Overview of Configuring Classification Scripts

Classification scripts are organized into rules. Each rule has a target and one or more match conditions. For example:

Subscriber Classifiers

```
subscriber-classifier {
.
.
.
rule rule-2 {
    target <-unauthenticatedUserDn->;
    condition {
      "loginType == \"ADDR\"";
      "loginType == \"AUTHADDR\"";
    }
  }
}
```

DHCP Classifiers

```
dhcp-classifier {
.
.
.
rule rule-2 {
    target cn=default,<-dhcpProfileDN->;
    condition {
      1;
    }
  }
}
```

Interface Classifiers

```
interface-classifier {
.
.
.
rule rule-5 {
    target /sample/junose/DHCP;
    condition {
      "interfaceName=\"fastEthernet*\"";
      "interfaceName=\"atm*/*.*\"";
    }
  }
}
```

Classification Targets

A target is the result of the classification script that gets returned to the SAE. There are two special types of targets:

- No-match targets—Targets that begin with a - (single dash) are interpreted as no match. If the conditions of this target are matched, a no-match message is returned to SAE. You can use this type of target to exclude certain patterns or to shortcut known nonmatches. To speed up processing, use this target to specify interfaces that you do not want the SAE to manage.

- Script targets—The content of the script rule is interpreted when the classifier is initially loaded. The script rule can contain definitions of custom functions, which can be called during the matching process. Because you can insert arbitrary code into a script, you can use classification scripts to perform arbitrary tasks.

  Because script targets use * (asterisks), you cannot use * in other types of targets.

Target Expressions

A target can contain expressions. These expressions can refer to an object in the SAE's memory or configuration, to specific matching conditions, or to another function or script.

Suppose the classification object in a subscriber classifier contains a field called userName. The classifier target uniqueId = <- userName -> is expanded to contain the actual content of the userName field before it is returned to the SAE; for example, for userName = juser, uniqueId = juser is returned.

Target expressions are enclosed in angle brackets and hyphens; for example, <-retailerDn->. The classifier expands expressions before it returns the target to the SAE. The expression is interpreted by an embedded Python interpreter and can contain variables and Python operations. In the simplest case an expression can be a single variable that is replaced with its current contents. Available variable names are all fields of the object passed to the classifier and names created with regular expression matching.

Because a scripting interpreter interprets expressions, more complex operations are possible. Examples are:

- Indexing—var[index] returns the element index of a sequence. The first element is at index 0.

- Slicing—var[start : end] creates a substring of the variable *var* starting at index startup to, but not including, index end; for example, var = Hello, var[2:4] = ll

Classification Conditions

You can configure multiple classification conditions for a rule. For example:

```
rule rule-2 {
  target /ent/EntDefault;
  condition {
    "pppLoginName=\"\"";
    "&interfaceName!=\"fastEthernet0*\"";
    "&interfaceName!=\"null*\"";
    "&interfaceName!=\"loopback*\"";
```

If you prefix a condition with an & (ampersand) character, the condition is examined only if the previous condition matches.

If you prefix a condition with a | (pipe) character, the condition is examined only if the previous conditions have not produced a positive match.

You can use glob or regular expression matching to configure each target's conditions.

Glob Matching

Glob matches are of the form:

```
field = match
or
field != match
```

where match is a pattern similar to UNIX filename matching. Glob matches are case insensitive. "field != match" is true, if field = match is not true.

- *—Matches any substring.
- ?—Matches any single character.
- [range]—Matches a single character in the specified range. Ranges can have the form a-z or abcd.
- [!range]—Matches a single character outside the specified range.
- C—Matches the single character c.

The available field names are described for the specific classifiers. Examples are:

- interfaceName = fastEthernet3/0 # matches the string "fastEthernet3/0" directly.
- interfaceName = fast*3/1 # matches any string that starts with "fast" and ends with "3/1"
- interfaceName = fast*3/1.* # starts with "fast", contains "3/1." arbitrary ending
- interfaceName = fast*3/[2-57] # starts with "fast", contains "3/" followed by 2,3,4,5 or 7

Regular Expression Matching

Regular expression matches are of the form:

```
field =~ re
or
field !~ re
```

where field !~ re is true if field =~ re is not true. The regular expression is *re*. For a complete description of the syntax, see:
http://www.python.org/doc/2.0/lib/re-syntax.html

You can group regular expressions with pairs of parentheses. If such an expression matches, the contents of the groups are made available for target expressions. Group number *n* is available as G[*n*], where *n* is the number of the opening parenthesis of the group. You can also name groups by using the special notation (?P < name > …).

Examples:

```
ifAlias =~ "SSP(.*)"
# match a string starting with "SSP". The remainder is stored
# in the variable "G[1]"

ifAlias =~ (?P<dn>name=(?P<name>[^,]*).*)
        # match a string starting with “name=“. The whole match is
        # stored in the variable “dn”. A submatch which does not
        # contain any “,”-characters and starts after “name=“
        # is stored in variable “name”
```

Classifying Interfaces

Use the following configuration statements to define interface classification scripts:

```
shared network device name interface-classifier rule name {
    target target;
    script script;
}

shared network device name interface-classifier rule name condition name ...
```

A classification script can contain either a target and a condition or a script. If you do not define a script, the classifier must have both a target and a condition.

To define interface classification scripts:

1. From configuration mode, enter the interface classifier configuration for a device.

   ```
   user@host# edit shared network device erx-node1 interface-classifier
   ```

2. Create a rule for the subscriber classifier. You can create multiple rules for the classifier.

   ```
   [edit shared network device erx-node1 interface-classifier]
   user@host# edit rule rule-3
   ```

3. Configure either a target or a script for the rule.

   ```
   [edit shared network device erx-node1 interface-classifier rule rule-3]
   user@host# set script script
   ```

   OR

   ```
   [edit shared network device erx-node1 interface-classifier rule rule-3]
   user@host# set target target
   ```

4. If you configured a target for the rule, you must configure a match condition for the rule. You can create multiple conditions for the rule. See *Interface Classification Conditions* on page 72.

   ```
   [edit shared network device erx-node1 interface-classifier rule rule-3]
   user@host# set condition name
   ```

5. (Optional) Change the order of rules.

   ```
   [edit shared network device erx-node1 interface-classifier]
   user@host# insert rule rule-5 before rule-4
   ```

6. (Optional) Rename a rule.

   ```
   [edit shared network device erx-node1 interface-classifier]
   user@host# rename rule rule-5 to DHCP
   ```

7. (Optional) Verify the classifier rule configuration.

```
[edit shared network device erx-node1 interface-classifier rule rule-3]
user@host# show
target /sample/junose/PPP-special;
condition {
  "pppLoginName=\"*@special.com\"";
}
```

8. (Optional) Verify the interface classifier configuration.

```
[edit shared network device erx-node1 interface-classifier]
user@host# show
rule rule-1 {
  script "
# Use the following syntax:
#
# descr-file ::= [script] section*
# section    ::= ('[' type ']' nl conditions) | ('[*]' nl script)
# type       ::= 'a-zA-Z0-9-_'*
# nl         ::= '\\n'
# conditions ::= ((('#'|';') comment) |
#                ('&'|'|'] field-name ( '='|'=='|'!=') match) nl)*
# field-name ::= member of InterfaceObject
# match      ::= UNIX style filename matching
# script     ::= regular python script, defined functions need to be
#                  included in the list \"classify\"
#
# the section-names correspond to a PolicyList object below
# o=Policies, o=umc:
# [name] => DN: \"policyGroupName=name, o=Policies, o=umc\"
#
# Use one of the following \"field names\":
#   pppLoginName      - set to \"user@realm\", if interface is PPP
#   interfaceName     - name of the ERX Interface in CLI syntax
#   virtualRouterName - name of the VR the interface is connected to

";
}
rule rule-2 {
  script "
# apply different default policies for PPP subscribers in realm
\"special.com\"
def log(obj):
    from net.juniper.smgt.sae import Main
    icc = Main.theComponentRegistry.get(\"icc.component\")
    if icc is None:
        Main.theComponentRegistry.put(\"icc.component\", [])
    else:
        icc.append(obj)
classify.append(log)
";
}
rule rule-3 {
  target /sample/junose/PPP-special;
  condition {
    "pppLoginName=\"*@special.com\"";
  }
}
rule rule-4 {
  target /sample/junose/PPP;
  condition {
```

```
    "pppLoginName!=\"\"";
  }
}
rule rule-5 {
  target /sample/junose/DHCP;
  condition {
    "interfaceName=\"fastEthernet*\"";
    "interfaceName=\"atm*/*.*\"";
  }
}
```

Interface Classification Conditions

Use the fields in this section to define interface classification conditions.

broadcastAddr

- Interface broadcast address.
- Value—Valid broadcast address format
- Example—broadcastAddr.hostAddress = “255.255.255.255”

ifAlias

- Description of an interface.
- Value—Interface description that is configured on the router. For JUNOSe routers, it is the description configured with the **interface description** command.
- Example—ifAlias = “1st pppoe int”

ifDesc

- Alternate name of the interface that is used by SNMP. This name is a system-generated name.
- Value
  - On a JUNOSe router, the format of the description is

    ip<slot>/<port>.<subinterface>

  - On the JUNOS routing platform, ifDesc is the same as interfaceName.
- Example—ifDesc = “IP3/1.1”

interfaceName

- Name of the interface.
- Value
  - Name of the interface in your router CLI syntax
  - FORWARDING_INTERFACE for routing instance (used by traffic mirroring)
- Example—For JUNOSe routers: interfaceName = “fastethernet6/0.1”

  For JUNOS routing platforms: interfaceName = “fe-0/1/0.0”

  For forwarding interface: interfaceName = “FORWARDING_INTERFACE”

ipAddress

- Interface IP address.
- Value—Valid IPv4 IP address format
- Example—ipAddress = "10.10.30.1"

ipMask

- Interface network mask.
- Value—Valid IPv4 IP network mask format
- Example—ipMask = "255.255.255.255"

mtu

- Maximum transfer unit configured on the interface.
- Value—32-integer value
- Example—mtu = "1492"

nasPortId

- Port identifier of an interface.
- Value—Includes interface name and additional layer 2 information
- Example—nasPortId = "fastEthernet 3/1" (There is a space between fastEthernet and slot number 3/1 in the nasPortId.)

pppLoginName

- Login name for PPP subscribers.
- Value—Login name in the format username@domain
- Example—pppLoginName = "pebbles@virneo.net"

radiusClass

- RADIUS class attribute.
- Value—RADIUS class name
- Example—radiusClass = "Premium"

serviceBundle

- Content of the vendor-specific RADIUS attribute for the service bundle.
- Value—Name of a service bundle

userIpAddress

- Subscriber IP address (PPP only).
- Value—valid IPv4 address
- Example—userIpAddress = "192.168.30.15"

virtualRouterName

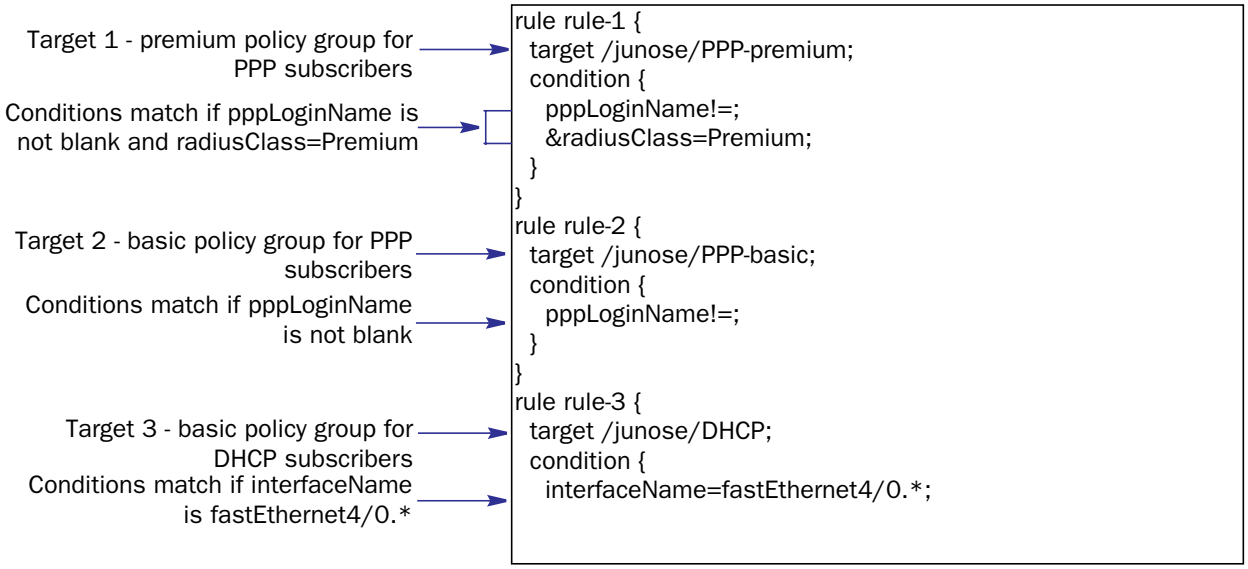
- Name of the virtual router or routing instance.
- Value—For JUNOSe routers: name of the virtual router in the format vrname@hostname

  For JUNOS routing platforms: name of the routing instance
- Example—virtualRouterName = “default@erx5”

Example: Managing Interfaces for Premium and Basic PPP and DHCP Subscribers

In this scenario, the router manages two types of PPP interfaces—DHCP subscriber interfaces and static IP interfaces. The fastEthernet4/0.1 to fastEthernet4/0.999 interfaces are VLAN interfaces used to terminate DHCP subscribers.

The service provider has separated the PPP subscribers into a premium subscriber group and a basic subscriber group. These groups are distinguished by a different set of default policies applied to the PPP interface. The RADIUS class attribute in the RADIUS profile for premium subscribers is set to Premium. The rules in the interface classification script for this scenario are:



The script is processed as follows:

1. If pppLoginName is not blank and radiusClass is Premium, the PPP-premium policy group is sent to the SAE, and script processing stops.
2. If script processing proceeds and pppLoginName is not blank, the PPP-basic policy group is sent to the SAE, and script processing stops.
3. If script processing proceeds and interfaceName is fastEthernet 4/0.0 through fastEthernet 4/0.999, the DHCP policy group is sent to the SAE, and script processing stops.

Example: Managing Specific Interfaces

This example causes the SAE to load the DHCP policy group on IP interfaces on Fast Ethernet modules in slot 3/port 1, slot 1/port 1, or any port on slot 2. The SAE then manages these interfaces.

```
[edit shared network device erx-node2 interface-classifier rule rule-1]
user@host# show
target /junose/DHCP;
condition {
  interfaceName=FastEthernet3/1;
  interfaceName=FastEthernet1/1;
  interfaceName=FastEthernet2/*;
}
```

Example: Managing Interfaces by Using the Interface Description

This example causes the SAE to load the DHCP policy group on any interface where the ifAlias starts with DHCP-subscribers.

```
[edit shared network device erx-node2 interface-classifier rule rule-2]
user@host# show
target /junose/DHCP;
condition {
  ifAlias=DHCP-subscribers*;
}
```

For this approach, you will need to use the ip description command to configure interface aliases that begin with DHCP-subscribers for all interfaces that support DHCP subscribers.

Classifying Subscribers

Changes that you make to subscriber classification scripts do not affect subscriber sessions that are already established. One effect of this behavior is that static IP subscriber sessions are not closed if the classification script is changed in a way that would no longer cause the SAE to load a profile for certain subscribers.

On JUNOSe routers that use the COPS-PR or COPS XDR router drivers, you can create a subscriber session for the router interface to start services such as script services and aggregate services. The SAE creates the router interface, but does not install any policies on it. You can create a subscriber classification rule, but not an interface classification rule for this interface.

Use the following configuration statements to define subscriber classification scripts:

```
shared sae subscriber-classifier rule name {
    target target;
    script script;
}

shared sae subscriber-classifier rule name condition name ...
```

A classification script can contain either a target and a condition or a script. If you do not define a script, the classifier must have both a target and a condition.

To define subscriber classification scripts:

1. From configuration mode, enter the subscriber classifier configuration. In this sample procedure, the subscriber classifier is configured in the west-region SAE group.

   ```
   user@host# edit shared sae group west-region subscriber-classifier
   ```

2. Create a rule for the subscriber classifier. You can create multiple rules for the classifier.

   ```
   [edit shared sae group west-region subscriber-classifier]
   user@host# edit rule rule-2
   ```

3. Configure either a target or a script for the rule.

   ```
   [edit shared sae group west-region subscriber-classifier rule rule-2]
   user@host# set target target
   ```

   OR

   ```
   [edit shared sae group west-region subscriber-classifier rule rule-2]
   user@host# set script script
   ```

   If you configure a target, see *Subscriber Classification Targets* on page 83.

4. If you configured a target for the rule, configure a match condition for the rule. You can create multiple conditions for the rule. See *Subscriber Classification Conditions* on page 79.

```
[edit shared sae group west-region subscriber-classifier rule rule-2]
user@host# edit condition name
```

5. (Optional) Change the order of rules.

```
[edit shared sae group west-region subscriber-classifier]
user@host# insert rule rule-5 before rule-4
```

6. (Optional) Rename a rule.

```
[edit shared sae group west-region subscriber-classifier]
user@host# rename rule rule-5 to Retailer
```

7. (Optional) Verify the classifier rule configuration.

```
[edit shared sae group west-region subscriber-classifier rule rule-2]
user@host# show
target <-unauthenticatedUserDn->;
condition {
  "loginType == \"ADDR\"";
  "loginType == \"AUTHADDR\"";
}
```

8. (Optional) Verify the subscriber classifier configuration.

```
[edit shared sae group west-region subscriber-classifier]
user@host# show
rule rule-1 {
  script "# User Classification script
#
# The following attributes MAY be available for comparison.
#  Attributes that are not available will have the value \"\" (empty
string).
#
#   loginType: one of \"INTF\", \"AUTHINTF\", \"ADDR\", \"AUTHADDR\",
#              \"PORTAL\", \"ASSIGNEDIP\"
#   userName:  Everything before the \"@\" in the user's login name.
#   domainName: Everything after the \"@\" in the user's login name.
#   serviceBundle: A RADIUS VSA available if the login event involves
#                  authentication with a properly configured RADIUS server.
#   radiusClass: The RADIUS class of user's ERX interface.
#   virtualRouterName: The name of the user's virtual router.
#   interfaceName: The name of the user's ERX interface (e.g.
#                  \"fastEthernet3/1.0\")
#   ifAlias: The alias of the user's ERX interface, as configured on the
ERX.
#   ifDesc: The description of the user's ERX interface, as configured on
#           the ERX.
#   nasPortId: The user's ERX interface including Layer 2 access information
#              (e.g. \"fastEthernet 3/1.0:3\")
#   macAddress: The MAC address of the user, if he is a DHCP user.
#   retailerDn: Generated by SSP for backwards compatibility; see below.
#
#  The loginType value available to this user classifier script will be
#  one of the following:
#
#  \"INTF\":
#  An INTF login is triggered every time an interface comes up and the
#  interface classifier script determines that SAE should manage that
#  interface, and the interface has not been authenticated by the router.
#
```

```
#  \"AUTHINTF\":
#  An AUTHINTF login is triggered every time an authenticated
#  interface comes up, for example as a result of an authenticated PPP
#  session.
#
#  \"ADDR\":
#  An ADDR login is triggered every time an `unauthenticated' IP
#  address is handed out by the DHCP server in the ERX.
#
#  \"AUTHADDR\":
#  An AUTHADDR login is triggered every time an `authenticated' IP
#  address is handed out by the DHCP server in the ERX.
#
#  \"PORTAL\":
#  A PORTAL login is triggered every time the portal API is invoked to
#  login a user.
#
#  See the customer documentation for a description of the values
#  for each login type available in the script.
#
#  One of the values available during some types of logins is the
#  `retailerDn'.  This is a generated value available for backwards
#  compatibility with previous versions of SAE.  SAE generates this
#  value as follows:
#
#  The retailerDn value is generated by, first, determining an
#  effective user domain name, and second, locating the retailer
#  entry in LDAP that contains that effective domain name.  If no
#  such retailer exists, the retailerDn value will be \"\".
#
#  The effective user domain name is the first of the following that yields
#  a result:
#
#  1. For PPP, PORTAL, and PUBLIC logins where a non-empty domainName
#     is supplied, that non-empty domain name is used as the effective
#     domain name.
#
#  2. For INTF logins, and for PPP, PORTAL, and PUBLIC logins where a
#     non-empty domain name is not supplied, the effective domain name
#     is the name of the user's virtual router, unless that effective
#     domain does not exist in some retailer in LDAP.
#
#  3. If neither step 1 nor step 2 yields an effective domain name,
#     \"default\" is used as the effective domain name.
#

";
}
rule rule-2 {
  target <-unauthenticatedUserDn->;
  condition {
    "loginType == \"ADDR\"";
    "loginType == \"AUTHADDR\"";
  }
}
rule rule-3 {
  target <-retailerDn->??sub?(uniqueID=<-userName->);
  condition {
    "retailerDn != \"\"";
    "& userName != \"\"";
  }
}
```

Subscriber Classification Conditions

Subscriber classification conditions define match criteria that are used to find the subscriber profile. Use the fields in this section to define subscriber classification conditions.

dhcp

- DHCP options. See *Sending DHCP Options to the JUNOSe Router* on page 82.

domainName

- Domain name of the subscriber.
- Value—Valid domain name
- Example—domainName = “isp99.com”

ifAlias

- Description of the interface.
- Value—Interface description that is configured on the router. For JUNOSe routers, it is the description configured with the interface description command
- Example—ifAlias = “dhcp-subscriber12”

ifDesc

- Alternate name for the interface that is used by SNMP. This name is a system-generated name.
- Value
  - On a JUNOSe router, the format of the description is

    ip<slot>/<port>.<subinterface>

  - On the JUNOS routing platform, ifDesc is the same as interfaceName.
- Example—ifDesc = “IP3/1.1”

interfaceName

- Name of the interface.
- Value
  - Name of the interface in your router CLI syntax
  - FORWARDING_INTERFACE for routing instance (used by traffic mirroring)
  - Router for a JUNOSe router instance
- Example—For JUNOSe routers: interfaceName = “fastEthernet6/0”

  For JUNOS routing platforms: interfaceName = “fe-0/1/0.0”

  For forwarding interface: interfaceName = “FORWARDING_INTERFACE”

loginName

- Name to be used to create a loginName attribute for a subscriber session for JUNOSe interfaces that are not otherwise assigned a loginName when a session starts, such as unauthenticated DHCP addresses, unauthenticated IP interfaces (that are not using PPP connections), or core-facing interfaces.

  The loginName can also be used to identify a subscriber session through the SAE CORBA remote API.

- Value—Name in the form subscriber@domain
- <Login name>
- Guideline—The format is not defined. A loginName can be of form subscriber, domain\subscriber, subscriber@domain, or as otherwise defined by the login setup of the operator.
- Example—idp@idp

loginType

- Type of subscriber session to be created.
- Value—One of the following login types:
  - ASSIGNEDIP—For assigned IP subscribers. Triggered when an application accesses a subscriber object for an assigned IP subscriber that is not currently loaded into memory. (Supported on JUNOSe routers.)
  - AUTHINTF—For authenticated interface login requests. Triggered when a login Name is reported together with the interface, such as authenticated PPP or autoconfigured ATM interface, by means of the subscriber command. (Supported on JUNOSe routers.)
  - INTF—For unauthenticated interface login requests. Triggered when an interface comes up and the interface classification script determines that the SAE should manage the interface. (Supported on JUNOS routing platforms and JUNOSe routers.)
  - ADDR—For unauthenticated address login requests. Triggered when the DHCP server in the JUNOSe router provides an unauthenticated IP address. (Supported on JUNOSe routers.)
  - AUTHADDR—For authenticated address login requests. Triggered when the DHCP server in the JUNOSe router provides an authenticated IP address. (Supported on JUNOSe routers.)
  - PORTAL—Triggered when the portal API is invoked to log in a subscriber. (Supported on JUNOS routing platforms and JUNOSe routers.)
- Example—loginType = “AUTHADDR”

macAddress

- String representation of the DHCP subscriber media access control (MAC) address.
- Value—Valid MAC address
- Example—macAddress = “00:11:22:33:44:55”

nasPortId

- Port identifier of an interface.
- Value—Includes interface name and additional layer 2 information
- Example—nasPortId = “fastEthernet 3/1” (There is a space between fastEthernet and slot number 3/1 in the nasPortId.)

radiusClass

- RADIUS class used for authorization.
- Value—RADIUS class name
- Example—radiusClass = “Premium”

retailerDn

- DN of the retailer object. The object is found when the domain name is mapped to a retailer object in LDAP.
- Value—DN of a retailer

serviceBundle

- Content of the vendor-specific RADIUS attribute for the service bundle.
- Value—Name of a service bundle
- Example—serviceBundle = “goldSubscriber”

unauthenticatedUserDn

- DN of the unauthenticated subscriber profile (usable for target expressions only).
- Value—DN of a subscriber profile

userName

- Name of the subscriber.
- Value—Subscriber name without the domain name
- Example—userName = “peter”

virtualRouterName

- Name of the virtual router or routing instance.
- Value—For JUNOSe routers: name of the virtual router in the format vrname@hostname

  For JUNOS routing platforms: name of the routing instance
- Example—virtualRouterName = “default@e_series5”

Sending DHCP Options to the JUNOSe Router

Subscriber classification scripts support DHCP options conveyed through COPS. When COPS reports an address, the JUNOSe router sends DHCP options received for DHCP requests for that address. The DHCP options are available in the subscriber classification context for selecting the subscriber profile to load.

The fields in Table 12 are in the classification context of subscriber classification scripts.

Table 12: DHCP Options in UserClassificationContext Field

DHCP Option	UserClassificationContext Field	Comments
giAddr	dhcp.giAddr	Relay agent gateway address
Option 82 data	dhcp.getOption(82)	Content is accessible with getSubOptions()
Client ID	dhcp.getOption(61).getString()	
Lease time	dhcp.getOption(51).getInt()	
Client requested parameter list	dhcp.getOption(55).getBytes()	
Domain name sent to client	dhcp.getOption(12).getString() dhcp.getOption(15).getString()	12 = HostName 15 = DomainName
DNS server address(es) sent to client	dhcp.getOption(6).getIpAddresses()	
Subnet mask	dhcp.getOption(1).getIpAddress()	
NetBios name server address(es) sent to client	dhcp.getOption(44).getIpAddresses()	
NetBios node type	dhcp.getOption(46).getBytes()	
Default router address(es) sent to client	dhcp.getOption(3).getIpAddresses()	

The DHCP options are accessible to the subscriber classification script with the following syntax:

```
dhcp.giAddr = “match”

# interpret option 61 as string
dhcp[61].string = “match”

# interpret option 1 (subnet) as dotted decimal IP
dhcp[1].ipAddress = “match”

# option 82, suboption 1, interpreted as string
dhcp[82].subOptions[1].string = “match”
```

The received DHCP options are also stored in the UserSession and are available through the portal API (method User.getDhcpOptions).

Subscriber Classification Targets

The target of the subscriber classification script is an LDAP search string. The search string uses a syntax similar to an LDAP URL (see RFC 2255—The LDAP URL Format (December 1997)). The syntax is:

"baseDN [? [attributes] [? [scope] [? [filter]]]]"

- baseDN—Distinguished name of object where the LDAP search starts
- attributes—Can be used to override attributes in the loaded LDAP object. For example, for static IP subscribers the SAE must learn the IP address assigned to a particular subscriber. This address is defined in the ipAddress attribute of the subscriber profile. A target of the form baseDN?ipAddress=<-function(interfaceName)-> invokes function after the subscriber profile is loaded from LDAP and sets the IP address to the return value of function. The function is defined in the subscriber classification script, and can be used for a variety of things; for example, to query an external database.
- scope—Scope of search
  - base—Is the default, searches the base DN only.
  - one—Searches the direct children of the base DN.
  - sub—Searches the complete subtree below the base DN.
- filter—Is an RFC 2254–style LDAP search filter expression; for example, (uniqueId=<-userName->). See RFC 2254—The String Representation of LDAP Search Filters (December 1997).

With the exception of baseDN all the fields are optional.

The result of the LDAP search must be exactly one directory object. If no object or more than one object is found, the subscriber session is terminated.

Example: Subscriber Classification Scripts for Static IP Subscriber

In cases such as bridged 1483 DSL with a single subscriber, you can write the subscriber classification script so that it loads a specific subscriber profile. If the interface is matched to a subscriber profile, a subscriber session is immediately established. An SAE application (for example, a portal) can still force the subscriber with this subscriber profile to perform a Web login.

One way to achieve the mapping of subscriber interface to subscriber profile is to provision the assigned interface name in the associated subscriber profile in LDAP. In this case the subscriber classification script can include a rule like this:

```
[edit shared sae group west-region subscriber-classifier rule rule-1]
user@host# show
target retailerName=default,o=Users,o=umc??sub?(interfaceName=<-interfaceName->);
condition {
  "loginType==\"INTF\"";
  "&interfaceName=fastEthernet*";
}
```

Another way may include a special encoding of the interface alias (ifAlias) field of the subscriber interface. This encoding must then be provisioned when the interface for the subscriber is provisioned. In this example, the encoding SAE-username is chosen for ifAlias; for example, for subscriber juser the interface alias would be set to SAE-juser. The match is performed with a regular expression, which separates the user ID from the ifAlias prefix.

```
[edit shared sae group west-region subscriber-classifier rule rule-1]
user@host# show
target retailerName=default,o=Users,o=umc??sub?(uniqueID=<-userId>);
condition {
  "loginType==\"INTF\"";
  “&ifAlias=~SAE-(?P<userId>.*)”;
}
```

Example: Subscriber Classification Scripts Using a Subscriber Group

To support scenarios in which the SAE has no access to the subscriber database, the SAE can load anonymous profiles for groups of subscribers. The following example loads a particular subscriber profile when subscribers of domain another-isp.com log in

```
[edit shared sae group west-region subscriber-classifier rule rule-1]
user@host# show
target uniqueID=anon,ou=default,retailerName=another-isp,o=Users,o=umc;
condition {
  “domainName=another-isp.com”;
}
```

Example: Subscriber Classification Scripts for Enterprise Subscribers

For enterprise subscribers, you can create one general subscriber classifier script that matches a unique subscriber profile to each managed router interface. The subscriber profile is the access subscription that represents an Internet access in an enterprise. The following examples show two approaches to creating the general classifier script. You can use one of these strategies or a combination of strategies.

Matching on the Interface Name

In this scenario, you configure the interface name field in the access subscription for the site to match an interface on the router. The format for the interface name could be: interfaceName@virtualRouterName@routerName. You then create a classification script that searches for subscriber profiles that match a specific interface. For example:

```
[edit shared sae group west-region subscriber-classifier rule rule-1]
user@host# show
target ou=Managed
CPE,retailerName=Retailer-Two,o=Users,o=UMC??sub?(interfaceName=<-interfaceName->@<-virtualRouterName->
);
condition {
  "loginType==\"INTF\"";
  &interfaceName==\fe*\"";
}
```

Matching on the Interface Alias

For JUNOSe routers, you can configure the interface description on the router in a format that the classifier script can match to the interface alias in an access subscription. In a simple case, you can configure the interface description only for interfaces that terminate a managed CPE, and match them to the interface alias in the directory. The subscriber classifier could be configured as follows:

```
[edit shared sae group west-region subscriber-classifier rule rule-1]
user@host# show
target ou=Managed CPE,retailerName=Retailer-Two,o=Users,o=UMC??sub?(interfaceAlias=<-ifAlias->);
condition {
   ifAlias != \"\""
}
```

Example: Creating Router Interface Subscriber Session

Aggregate services or script services can be activated on a router instead of an interface or DHCP address. On JUNOSe routers that use the COPS-PR or COPS XDR router driver, the SAE automatically creates a router interface; and then a subscriber session as specified by the subscriber classification script.

For example, the following script searches for a router profile in the directory under ou = routers, retailerName = default, o = Users, o = umc, with a routerName attribute that matches the virtual router name (such as default@erx-node1).

```
[edit shared sae group west-region subscriber-classifier rule rule-1]
user@host# show
target ou=routers,retailername=default,o=Users,o=UMC??sub?(routerName=<-virtualRouterName->);
  condition {
    "interfaceName==\"Router\"";
  }
```

Example: Activating Services for a Group of Subscriber Sessions

A subscriber classification script can assign a shared subscriber profile and a login name to a subscriber session for a group of interface subscriber sessions. The following example assigns the login name idp@idp to subscriber sessions for JUNOSe interfaces that have core specified as the ifAlias (as configured on the JUNOSe router).

```
[edit shared sae group IDP subscriber-classifier rule rule-3]
root@buffy# show
target routerName=idp,ou=interfaces,retailername=SP-IDP,o=Users,o=UMC?loginName=idp@idp;
condition {
  "ifAlias==\"core\"";
}
```

You can use this type of subscriber classification to activate a service for a group of interface subscriber sessions that are to be treated the same. For example, in the configuration for an aggregate service, a fragment service could be created for all subscriber interface sessions on interfaces identified by the ifAlias core on a virtual router. The subscriber reference expression in the configuration for the fragment service would reference the virtual router name and the login name, such as vr = "<- virtualRouterName ->", login_name = "idp@idp."

You can also use the SAE CORBA remote API to get lists of the subscriber sessions that share the same login name.

Classifying DHCP Subscribers

Use the following configuration statements to configure DHCP classification scripts:

```
shared sae dhcp-classifier rule name {
    target target;
    script script;
}
```

```
shared sae dhcp-classifier rule name condition name ...
```

A classification script can contain either a target and a condition or a script. If you do not define a script, the classifier must have both a target and a condition.

To configure DHCP classification scripts:

1. From configuration mode, enter the DHCP classifier configuration. In this sample procedure, the classifier is configured in the west-region SAE group.

   ```
   user@host# edit shared sae group west-region dhcp-classifier
   ```

2. Create a rule for the subscriber classifier. You can create multiple rules for the classifier.

   ```
   [edit shared sae group west-region dhcp-classifier]
   user@host# edit rule rule-1
   ```

3. Configure either a target or a script for the rule.

4. (Optional) Configure the target for the rule.

   ```
   [edit shared sae group east-region dhcp-classifier rule rule-1]
   user@host# set target target
   ```

   OR

   ```
   [edit shared sae group east-region dhcp-classifier rule rule-1]
   user@host# set script script
   ```

   If you configure a target, see *DHCP Classification Targets* on page 89.

5. If you configured a target for the rule, configure a match condition for the rule. You can create multiple conditions for the rule. See *DHCP Classification Conditions* on page 87.

   ```
   [edit shared sae group east-region dhcp-classifier rule rule-1]
   user@host# edit condition name
   ```

6. (Optional) Change the order of rules.

   ```
   [edit shared sae group east-region dhcp-classifier]
   user@host# insert rule rule-5 before rule-4
   ```

7. (Optional) Rename a rule.

```
[edit shared sae group east-region dhcp-classifier]
user@host# rename rule rule-2 to dhcp
```

8. (Optional) Verify the classifier rule configuration.

```
[edit shared sae group east-region dhcp-classifier rule rule-1]
user@host# show
target cn=default,<-dhcpProfileDN->;
condition {
  1;
}
```

9. (Optional) Verify the DHCP classifier configuration.

```
[edit shared sae group west-region dhcp-classifier]
user@host# show
rule rule-1 {
  script "# DHCP classification script
#
# The DHCP classification script can use the following fields:
#
# interfaceName          - interface where DHCP DISCOVER was received.
# ifAlias                - \"ip description\" of interface
# ifDesc                 - SNMP standard name of interface
# nasPortId
# virtualRouterName      - VR where DHCP DISCOVER was received
# macAddress             - MAC address of DHCP client
# dhcp                   - DHCP options
# poolName               - DHCP Pool name set by authorization plug-in
# authVirtualRouterName  - VR name set by authorization plug-in
# dhcpProfileDN          - search base for DHCP Profiles

";
}
rule rule-2 {
  target cn=default,<-dhcpProfileDN->;
  condition {
    1;
  }
}
```

DHCP Classification Conditions

DHCP classification conditions define match criteria that are used to find the DHCP profile. Use the fields in this section to define DHCP classification conditions.

authVirtualRouterName

- Name of JUNOSe virtual router that is set by an authorization plug-in through the authorization response.
- Value—Name of the virtual router in the format vrname@hostname

dhcp

- DHCP options. See *Setting DHCP Parameters with DHCP Options* on page 90.

dhcpProfileDN

- Search base for DHCP profiles. The DN can be used in target expressions.
- Value—DN of DHCP profile

interfaceName

- Name of the interface where the DHCP discover message was received.
- Value—Name of the interface in your router CLI syntax
- Example—interfaceName = fastEthernet6/0

ifAlias

- Description of the interface where the DHCP discover request was received.
- Value—Interface description that is configured on the router. For JUNOSe routers, it is the description configured with the **interface description** command
- Example—ifAlias = “dhcp-subscriber12”

ifDesc

- Alternate name for the interface where the DHCP discover request was received. This is a system-generated name that is used by SNMP.
- Value
  - On a JUNOSe router, the format of the description is:

    ip<slot>/<port>.<subinterface>

  - On the JUNOS routing platform, ifDesc is the same as interfaceName.

macAddress

- MAC address of the DHCP client that appears in DHCP request.
- Value—Valid MAC address
- Example—macAddress = “00:11:22:33:44:55”

nasPortId

- Port identifier of an interface.
- Value—Includes interface name and additional layer 2 information
- Example—nasPortId = “fastEthernet 3/1” (There is a space between fastEthernet and slot number 3/1 in the nasPortId.)

poolName

- IP address pool name that is set by an authorization plug-in through the authorization response.
- Value—Name of an address pool configured on the JUNOSe router

virtualRouterName

- Name of the virtual router.
- Value—Name of the virtual router in the format vrname@hostname

DHCP Classification Targets

The target of the DHCP classification script uses a syntax similar to an LDAP URL. With the exception of baseDN, all fields are optional. The syntax is:

```
baseDN [ ? [ attributes ] [ ? [ scope ] [ ? [ filter ] ] ] ]
```

- baseDN—DN of object where search starts.
- attributes—Comma-separated list of properties, in the format attribute = <-value->, that allow you to set specific attributes for directory objects that the script finds; see *DHCP Classification Conditions* on page 87.

  You can use the attribute configuration to override attributes in the directory. For example, to override the IP pool name that is stored in the DHCP profile with the pool name that the authorization plug-in sends, use the attribute statement radiusFramedPool = <-poolName->.
- scope—Scope of search in the directory
  - base—Searches the base DN only; default scope
  - one—Searches the direct subordinates of the base DN (one-level search)
  - sub—Searches all objects subordinate to the base DN
- filter—An RFC 2254–style LDAP search filter expression; for example, (uniqueId = <-userName->). See RFC 2254—The String Representation of LDAP Search Filters (December 1997).

Selecting DHCP Parameters

The SAE sends a set of parameters to the DHCP server in the JUNOSe router. The DHCP server determines the IP address offered, as well as the options sent to the DHCP client. The parameters comprise IP address authorization parameters, as well as parameters stored in a DHCP profile. Parameters in the DHCP profile override authorization parameters.

For more information about how the SAE handles DHCP subscribers, see:

- Assigning DHCP Addresses to Subscribers on page 132
- DHCP Subscriber Login and Service Activation on page 22

Setting DHCP Parameters with DHCP Options

NOTE: JUNOSe routers do not currently support the functionality described in this section. DHCP options and BOOTP options that the SAE sends to the JUNOSe router are ignored.

DHCP servers use DHCP options to configure DHCP clients. The DHCP local server in the JUNOSe router supports a subset of DHCP options. The SAE supports all DHCP options defined in RFC 2132—DHCP Options and BOOTP Vendor Extensions (March 1997) by name. It also supports other options, but you need to specify them by number and type. The DHCP options allow a flexible definition of parameters offered to DHCP subscribers. For example, they allow integration with cable modems or set-top boxes because you can configure options to control the boot sequence of these devices.

You can configure DHCP options in DHCP profiles and in DHCP classification scripts. Table 13 on page 90 lists the name, number, and type of all supported DHCP options. You can use these fields to configure DHCP options.

The following example shows how to specify an option by number and by type. The two statements identify the same option:

```
dhcp[12]

dhcp['host-name']
```

In SDX software earlier than Release 4.2, you had to include the option type in your option definition. For example:

```
dhcp[12].string = HOST
```

You can now write:

```
dhcp[12] = HOST
```

Note that the earlier method of defining options still works in Release 4.2 and later.

Table 13: DHCP Options Supported on the SAE

Option Name	Option Number	Option Type
subnet-mask	1	ip-address
time-offset	2	int32
routers	3	ip-address
time-servers	4	ip-address
ien116-name-servers	5	ip-address
domain-name-servers	6	ip-address
log-servers	7	ip-address
cookie-servers	8	ip-address
lpr-servers	9	ip-address
impress-servers	10	ip-address

Table 13: DHCP Options Supported on the SAE (continued)

Option Name	Option Number	Option Type
resource-location-servers	11	ip-address
host-name	12	string
boot-size	13	int16
merit-dump	14	string
domain-name	15	string
swap-server	16	ip-address
root-path	17	string
extension-path	18	string
ip-forwarding	19	int8
non-local-source-routing	20	int8
policy-filter	21	ip-address
max-dgram-reassembly	22	int16
default-ip-ttl	23	int8
path-mtu-aging-timeout	24	int32
path-mtu-plateau-table	25	int16
interface-mtu	26	int16
all-subnets-local	27	int8
broadcast-address	28	ip-address
perform-mask-discovery	29	int8
mask-supplier	30	int8
router-discovery	31	int8
router-solicitation-address	32	ip-address
static-routes	33	ip-address
trailer-encapsulation	34	int8
arp-cache-timeout	35	int32
ieee802-3-encapsulation	36	int8
default-tcp-ttl	37	int8
tcp-keepalive-interval	38	int32
tcp-keepalive-garbage	39	int8
nis-domain	40	string
nis-servers	41	ip-address
ntp-servers	42	ip-address
netbios-name-servers	44	ip-address
netbios-dd-server	45	ip-address
netbios-node-type	46	int8
netbios-scope	47	string
font-servers	48	ip-address
x-display-manager	49	ip-address

Table 13: DHCP Options Supported on the SAE (continued)

Option Name	Option Number	Option Type
requested-ip-address	50	ip-address
ip-address-lease-time	51	int32
option-overload	52	int8
dhcp-msg-type	53	int8
server-identifier	54	ip-address
parameter-request-list	55	data-string
message	56	string
maximum-dhcp-msg-size	57	int16
renewal-time	58	int32
rebinding-time	59	int32
vendor-class-identifier	60	data-string
client-identifier	61	data-string
nisplus-domain	64	string
nisplus-servers	65	ip-address
tftp-server-name	66	string
bootfile-name	67	string
mobile-ip-home-agent	68	ip-address
smtp-server	69	ip-address
pop-server	70	ip-address
nntp-server	71	ip-address
www-server	72	ip-address
finger-server	73	ip-address
irc-server	74	ip-address
streettalk-server	75	ip-address
streetalk-directory-assistance-server	76	ip-address

Creating DHCP Profiles

When the SAE receives a DHCP discover request from the router, it uses the client's MAC address to find a DHCP profile in cache or in the directory. If it finds a DHCP profile, the SAE uses the information in the profile to create a discover decision that it returns to the router. The discover decision includes information to select an IP address and DHCP options to configure the DHCP client.

When a DHCP subscriber logs in to the SAE through a Web portal, the SAE registers the subscriber's equipment and creates a cached DHCP profile in the *o = AuthCache* directory. These profiles are keyed by the MAC address of the DHCP client device. They are created by the grantPublicIp or the registerEquipment methods.

You can also create DHCP profiles manually with SDX Admin or by adding DHCP profile entries to the directory. DHCP profiles are stored in the *o = AuthCache* directory in the dhcpProfile object class. The dhcpProfile object class is subordinate to the cachedAuthenticationProfles object class. Manually created profiles are keyed by the cn (common name) attribute.

For more information about how the SAE handles DHCP subscribers, see:

- Assigning DHCP Addresses to Subscribers on page 132
- DHCP Subscriber Login and Service Activation on page 22

Use the following configuration statements to create a DHCP profile:

```
shared auth-cache cached-dhcp-profile name {
    description description;
    pool-name pool-name;
    ip-address ip-address;
    dhcp-options dhcp-options;
    boot-server-name boot-server-name;
    boot-file-name boot-file-name;
    virtual-router virtual-router;
    local-interface local-interface;
    lease-time lease-time;
    user-name user-name;
    service-bundle service-bundle;
    radius-class radius-class;
}
```

To create a DHCP profile:

1. From configuration mode, enter the DCHP cached authentication profile configuration.

   ```
   user@host# edit shared auth-cache cached-dhcp-profile default
   ```

2. (Optional) Configure a description for the profile.

   ```
   [edit shared auth-cache cached-dhcp-profile default]
   user@host# set description description
   ```

3. (Optional) Configure the name of the IP address pool on the JUNOSe router from which a DHCP address is selected.

   ```
   [edit shared auth-cache cached-dhcp-profile default]
   user@host# set pool-name pool-name
   ```

4. (Optional) Configure the fixed IP address that is offered to the DHCP client if the client is part of a network in the configured DHCP pool.

   ```
   [edit shared auth-cache cached-dhcp-profile default]
   user@host# set ip-address ip-address
   ```

5. (Optional) Configure the DHCP options that are used to configure DHCP clients.

   [edit shared auth-cache cached-dhcp-profile default]
   user@host# **set dhcp-options** *dhcp-options*

6. (Optional) Configure the name of the server used to boot the DHCP client.

   [edit shared auth-cache cached-dhcp-profile default]
   user@host# **set boot-server-name** *boot-server-name*

7. (Optional) Configure the name of a boot file used to boot the DHCP client.

   [edit shared auth-cache cached-dhcp-profile default]
   user@host# **set boot-file-name** *boot-file-name*

8. (Optional) Configure the name of the JUNOSe virtual router that holds the IP address pool.

   [edit shared auth-cache cached-dhcp-profile default]
   user@host# **set virtual-router** *virtual-router*

9. (Optional) Configure the name of the JUNOSe interface that is used to check the validity of system-created DHCP profiles.

   [edit shared auth-cache cached-dhcp-profile default]
   user@host# **set local-interface** *local-interface*

10. (Optional) Configure the length of time the supplied IP address is valid.

    [edit shared auth-cache cached-dhcp-profile default]
    user@host# **set lease-time** *lease-time*

11. (Optional) Configure the name of DHCP user without the domain name.

    [edit shared auth-cache cached-dhcp-profile default]
    user@host# **set user-name** *user-name*

12. (Optional) Configure the vendor-specific RADIUS attribute that specifies the SRC service bundle to use.

    [edit shared auth-cache cached-dhcp-profile default]
    user@host# **set service-bundle** *service-bundle*

13. (Optional) Configure the RADIUS attribute class.

    [edit shared auth-cache cached-dhcp-profile default]
    user@host# **set radius-class** *radius-class*

14. (Optional) Verify your configuration.

```
[edit shared auth-cache cached-dhcp-profile default]
user@host# show
description "This DHCP profile is used to select addresses from the
\"default\"
pool.";
virtual-router *;
local-interface *;
```