



Using Prepaid Billing

Cisco Prime Access Registrar (Prime Access Registrar) supports two types of prepaid billing, IS835C and Cisco Real-time Billing (CRB), a Cisco proprietary solution. The IS835C version adheres to industry standards and is the preferred version.

Three components are required to support a prepaid billing service, such as the following:

- AAA client
- Prime Access Registrar server
- External prepaid billing server

The most important factor for an effective prepaid billing service is in developing a shared library to be configured under the prepaid RemoteServer object. The shared library should be developed to implement all specified API functions. You will have to provide a shared library that meets the needs of your environment. The shared library must implement the API functions to perform the various tasks required for your specific implementation of the prepaid billing service.



Note

Cisco works with you to develop the prepaid billing service and implement the API. For more information, contact your Cisco systems engineer.

The chapter contains the following sections:

- [Overview](#)
- [IS835C Prepaid Billing](#)
- [CRB Prepaid Billing](#)
- [Implementing the Prepaid Billing API](#)

Overview

When a subscriber uses a prepaid billing service, each call requires a set of data about the subscriber. However, the AAA network has no previous knowledge of the subscriber's usage behavior. Prime Access Registrar uses an iterative authorization paradigm over multiple sessions to support the prepaid billing solution.

Each time an authorization request is made, the billing server apportions a fraction of the subscriber's balance into a quota. When a subscriber uses multiple sessions, each session must obtain its own quota. When a previously allocated quota is depleted, a session must be reauthorized to obtain a new quota.

**Note**

The granularity and the magnitude of the quota is in the design and implementation of the prepaid billing server and is beyond the scope of this document. In general, a smaller quota generates more network traffic, but allows more sessions per subscriber. When the quota is equal to a subscriber's total account balance, there is minimal network traffic, but only one session can be supported.

When a subscriber's current quota is depleted, the AAA client initiates a reauthorization request sending Access-Request packets. After the Prime Access Registrar server receives the request, it forwards the request to the billing server. The billing server then returns the next quota to use. The new quota might not be the same as the previous, and the billing server might adjust the quota dynamically.

IS835C Prepaid Billing

Prime Access Registrar acts as a RADIUS protocol head for all the requirements specified in the *cdma2000 Wireless IP Network Standard: PrePaid Packet Data Service* specification:

https://www.3gpp2.org/Public_html/Specs/X.S0011-006-C_v3.0_061030.pdf

As long as the prepaid client understands or accepts what the external billing server sends, the service should work. The Prime Access Registrar server neither imposes nor is affected by the values of attributes returned from the external billing server.

For additional information, see *cdma2000 Wireless IP Network Standard: Accounting Services and 3GPP2 RADIUS VSAs* at the following URL:

https://www.3gpp2.org/Public_html/Specs/X.S0011-005-C_v3.0_061030.pdf

The IS835C specification requires that the Prime Access Registrar server be able to determine that a particular user is a prepaid billing user. A user is accepted as a valid prepaid user when the response dictionary of the incoming packet contains the Prime Access Registrar internal subattribute named *prepaid*.

The IS835C specification requires prepaid users to first be authenticated by the RADIUS server. This requires the configuration of a group service with an authentication service first, followed by the prepaid service that adds prepaid attributes as shown in [Setting Up an Authentication Group Service, page 8-5](#). The group service configuration enables the AA service to add the prepaid subattribute to the response dictionary upon successful authentication, before the prepaid service is invoked.

Configuring IS835C Prepaid Billing

To configure an IS835C prepaid billing service, use the following sections to configure the required Prime Access Registrar objects:

- [Setting Up a Prepaid Billing RemoteServer](#)
- [Setting Up an IS835C Prepaid Service](#)
- [Setting Up Local Authentication](#)
- [Setting Up an Authentication Group Service](#)

Setting Up a Prepaid Billing RemoteServer

Prime Access Registrar loads the library dynamically and registers the API functions, then calls out the library initialization API once at startup. The call to initialize functions initializes various data structures and connections with the billing server, as required.

Table 8-1 lists and describes the properties required for an IS835C RemoteServer object.

Table 8-1 Prepaid-IS835C RemoteServer Properties

Property	Description
Filename	Name of the shared library provided by the billing server vendor, such as libprepaid.so
IPAddress	IP address of the billing server
Port	Port used on the billing server, such as port 66
Connections	Number of threads the prepaid service and billing server can each use (default is 8).

Setting Up a Prepaid Billing Remote Server

To set up a prepaid billing remote server:

Step 1 Use `aregcmd` to add a RemoteServer under `/Radius/RemoteServers`.

```
cd /radius/remoteserver
add prepaid-is835c
```

Step 2 Set remoteserver protocol to prepaid-is835c.

```
cd prepaid-is835c
set protocol prepaid-is835c

Set Protocol prepaid-is835c
```

The following is the default configuration of a prepaid-is835c RemoteServer.

```
[ //localhost/Radius/RemoteServers/prepaid-is835c ]
Name = prepaid-is835c
Description =
Protocol =
IPAddress =
```

```
Port = 0
Filename =
Connections = 8
```

Setting Up an IS835C Prepaid Service

Prime Access Registrar uses a service type **prepaid** to support the prepaid billing solution. The prepaid service mediates between the client NAS and the external prepaid billing server.

Setting Up an IS835C Prepaid Service

To set up an IS835C prepaid service:

Step 1 Use **aregcmd** to add a prepaid service under **/Radius/Services**:

```
cd /radius/services

add prepaid

Added prepaid
```

Step 2 Set the service type to prepaid.

```
cd prepaid

set type prepaid

Set Type prepaid
```

A prepaid service has the following default properties:

```
[ //localhost/Radius/Services/prepaid ]
Name = prepaid
Description =
Type = prepaid
IncomingScript~ =
OutgoingScript~ =
OutagePolicy~ = RejectAll
OutageScript~ =
MultipleServersPolicy = Failover
RemoteServers/
```

Step 3 Add a reference to the is835c-prepaid RemoteServer.

```
cd RemoteServer

add 1 prepaid-is835c

Added 1
```

Setting Up Local Authentication

If you use the Prime Access Registrar server for authentication and authorization in your prepaid billing solution, you should configure an AA service. For example, you might configure a service similar to **local-users** (in the example configuration) for authentication and authorization of local users.

If some of the users are non-prepaid users or if the prepaid users need to have RADIUS authorization attributes returned, you should configure an AA service to perform that authentication and authorization.

Setting Up a Local Authentication

To set up a local authentication:

Step 1 Use **aregcmd** to set up a local authentication service.

```
cd /radius/services

add Prepaid-LocalAuthentication

Added prepaid-LocalAuthentication

cd prepaid-LocalAuthentication

[ //localhost/Radius/Services/prepaid-LocalAuthentication ]
  Name = prepaid-LocalAuthentication
  Description =
  Type =
```

Step 2 Set the service type to local.

```
set type local

Set Type local
```

Step 3 Set the **UserList** property to the userlist that contains IS835C prepaid users.

```
set UserList userlist_name

Set UserList userlist_name
```



Note You can use an LDAP or ODBC service in place of the local authentication service.

The authentication service must add the Prime Access Registrar internal attribute *prepaid* (subattribute 22) to the response upon successful authentication.

Setting Up an Authentication Group Service

Your prepaid billing solution usually requires a group service to tie together an AA service with a prepaid service, a group service to tie together an accounting service with a prepaid service, or both.

If you are using an AA service with your prepaid billing solution, you must configure a group service, for example **prepaid-users**, that ties the requests to the AA service (**local-users** in our example) with the prepaid service.

If you are using Prime Access Registrar for an accounting service with your prepaid billing solution, you must configure a group service, for example **prepaid-file**, that ties accounting requests to both the regular accounting service (**local-file** in our example) and the prepaid service.

Setting Up an Authentication Group Service

To set up an authentication group service:

Step 1 Use **aregcmd** to add a prepaid authentication group service under **/Radius/Services**.

```
cd /radius/services
```

```
add prepaid-groupAuthentication
```

```
Added prepaid-groupAuthentication
```

```
cd prepaid-groupAuthentication
```

```
[ //localhost/Radius/Services/prepaid-groupAuthentication ]
  Name = group-prepaidAuthentication
  Description =
  Type =
```

Step 2 Set the service type to group.

```
set type group
```

```
Set Type group
```

The group service requires the ResultRule to be set to AND, the default setting for a group service.

```
ls
```

```
[ //localhost/Radius/Services/group-prepaidAuthentication ]
  Name = group-prepaidAuthentication
  Description =
  Type = group
  IncomingScript~ =
  OutgoingScript~ =
  ResultRule = AND
  GroupServices/
```

Step 3 Change directory to GroupServices and add references to the prepaid service and the authentication service.

```
cd GroupServices
```

```
[ //localhost/Radius/Services/group-prepaidAuthentication/GroupServices ]
```

```
add 1 Prepaid-LocalAuthentication
```

```
Added 1
```

```
add 2 prepaid
```

```
Added 2
```

CRB Prepaid Billing

Cisco Real-Time Billing (CRB) is a Cisco proprietary method of providing prepaid billing service. Prime Access Registrar uses vendor-specific attributes (VSA) to extend the standard RADIUS protocol to carry information not usually present in the standard RADIUS packet. Prime Access Registrar uses a set of VSAs allocated to the Cisco VSA pool [26,9].

Prime Access Registrar required several different types of measurements to support a prepaid billing solution. These measurements require the use of metering variables to perform usage accounting. [Table 8-2](#) lists the different measurements and what the AAA client, Prime Access Registrar server, and billing server do with them.

Table 8-2 *Measurements and Component Actions*

Measurement Type	Billing Server Action	AAA Server Action	AAA Client Action
Duration	Return duration quota	Convert duration quota to VSAs and pass along	Compare running duration quota with quota returned by Prime Access Registrar server
Total volume	Return volume quota	Convert volume quota to VSAs and pass along	Compare running volume quota with quota returned by Prime Access Registrar server
Uplink volume	Return volume quota	Convert volume quota to VSAs and pass along	Compare running volume quota with quota returned by Prime Access Registrar server
Downlink volume	Return volume quota	Convert volume quota to VSAs and pass along	Compare running volume quota with quota returned by Prime Access Registrar server
Total packets	Return packet quota	Convert packet quota to VSAs and pass along	Compare running packet quota with quota returned by Prime Access Registrar server
Uplink packets	Return packet quota	Convert packet quota to VSAs and pass along	Compare running packet quota with quota returned by Prime Access Registrar server

Table 8-2 *Measurements and Component Actions (continued)*

Measurement Type	Billing Server Action	AAA Server Action	AAA Client Action
Downlink packets	Return packet quota	Convert packet quota to VSAs and pass along	Compare running packet quota with quota returned by Prime Access Registrar server
Logical OR of two measurements	Return quota of both measurements	Convert both to VSA and pass along	Monitor both quota and issue reauthorization packet when any one trips

Prime Access Registrar provides maximum flexibility to billing servers by allowing the metering variable to be modified as the service is used. This requires network nodes to measure all parameters all the time, but to report values only after receiving a reauthorization request.

**Note**

If you have been using an earlier implementation of CRB prepaid billing (Cisco Access Registrar 3.5.2 or earlier), you must recompile the API implementation with the newer API due to the addition of the parameter `ebs_context` as the first parameter to all API methods. Contact your Cisco systems engineer for assistance with the new API.

This section contains the following topics:

- [Configuring CRB Prepaid Billing](#)
- [Configuring CRB Prepaid Billing for SSG](#)
- [Generic Call Flow](#)
- [Vendor-Specific Attributes](#)

Configuring CRB Prepaid Billing

To configure an CRB prepaid billing service, use the following sections to configure the required Prime Access Registrar objects:

- [Setting Up a Prepaid Billing RemoteServer](#)
- [Setting Up a CRB Prepaid Service](#)
- [Setting Up a Local Accounting Service](#)
- [Setting Up a Local Authentication Service](#)
- [Setting Up a Prepaid Accounting Group Service](#)
- [Setting Up an Authentication Group Service](#)

If you are using CRB prepaid billing with Service Selection Gateway (SSG), you must also configure extension point scripts and prepaid clients. See [Configuring CRB Prepaid Billing for SSG, page 8-15](#).

Setting Up a Prepaid Billing RemoteServer

[Table 8-3](#) lists and describes the properties required for an CRB RemoteServer object.

Table 8-3 *Prepaid-CRB RemoteServer Properties*

Property	Description
Filename	Name of the shared library provided by the billing server vendor, such as libprepaid.so
IPAddress	IP address of the billing server
Port	Port used on the billing server, such as port 66
Connections	Number of threads the prepaid service and billing server can each use (default is 8).

Setting Up a Prepaid Billing Remote Server

To set up a prepaid billing remote server:

Step 1 Use `aregcmd` to add a RemoteServer under `/Radius/RemoteServers`.

```
cd /radius/remoteservers
add prepaid-crb
Added prepaid-crb
```

Step 2 Set the RemoteServer protocol to prepaid-crb.

```
cd prepaid-crb
set protocol prepaid-crb
Set Protocol prepaid-crb
```

The following is the default configuration of a prepaid-crb RemoteServer.

```
[ //localhost/Radius/RemoteServers/prepaid-crb ]
Name = prepaid-crb
Description =
Protocol =
IPAddress =
Port = 0
Filename =
Connections = 8
```

Setting Up a CRB Prepaid Service

Prime Access Registrar uses a service type **prepaid** to support the prepaid billing solution. The prepaid service mediates between the client NAS and the external prepaid billing server.

The prepaid service must receive accounting requests to accurately charge the prepaid billing user. You can also set the prepaid service in a group service to log accounting requests locally or to proxy the accounting requests to another service or to both locations.

Setting Up a CRB Prepaid Service

To set up a CRB prepaid service:

Step 1 Use `aregcmd` to add a prepaid service under `/Radius/Services`:

```
cd /radius/services
```

```
add prepaid
```

```
Added prepaid
```

Step 2 Set the service type to prepaid.

```
cd prepaid
```

```
set type prepaid
```

```
Set Type prepaid
```

A prepaid service has the following default properties:

```
[ //localhost/Radius/Services/prepaid ]
Name = prepaid
Description =
Type = prepaid
IncomingScript~ =
OutgoingScript~ =
OutagePolicy~ = RejectAll
OutageScript~ =
MultipleServersPolicy = Failover
RemoteServers/
```

Step 3 Add a reference to the prepaid-crb RemoteServer.

```
cd RemoteServers
```

```
add 1 prepaid-crb
```

```
Added 1
```



Note The following steps are required only when using Prepaid-CRB with SSG.

Step 4 Set the IncomingScript to **IncomingScript PPI-Parse-Prepaid-Incoming**.

```
set IncomingScript PPI-Parse-Prepaid-Incoming
```

```
Set IncomingScript PPI-Parse-Prepaid-Incoming
```

Step 5 Set the OutgoingScript to **PPO-Parse-Prepaid-Outgoing**.

```
set OutgoingScript PPO-Parse-Prepaid-Outgoing
```

```
Set OutgoingScript PPO-Parse-Prepaid-Outgoing
```

Setting Up a Local Accounting Service

If you want to use the Prime Access Registrar server to record the accounting records locally or to forward the accounting records to another RADIUS server, you must configure an accounting service. You might configure a service similar to **local-file** (in the example configuration) for accounting requests. Accounting requests can be logged locally (with an accounting service) or remotely (with a RADIUS service).

If you use the prepaid billing server to generate the accounting records, an accounting service is not necessary.

Setting Up a Local Accounting Service

To set up a local accounting service:

Step 1 Use **aregcmd** to add a local accounting service under **/Radius/Services**.

```
cd /radius/services

add prepaid-LocalFileAccounting

add prepaid-LocalFileAccounting
```

Step 2 Set the service type to file.

```
cd prepaid-LocalFileAccounting

set type file

Set Type file
```

The file type service has the following properties:

```
[ //localhost/Radius/Services/prepaid-LocalFileAccounting ]
Name = prepaid-LocalFileAccounting
Description =
Type = file
IncomingScript~ =
OutgoingScript~ =
OutagePolicy~ = RejectAll
OutageScript~ =
FilenamePrefix = accounting
MaxFileSize = "10 Megabytes"
MaxFileAge = "1 Day"
RolloverSchedule =
UseLocalTimeZone = FALSE
```

Step 3 Set the **FilenamePrefix** to **Prepaid-Accounting**.

```
set FilenamePrefix Prepaid-Accounting

Set FilenamePrefix Prepaid-Accounting
```

Step 4 Set the **MaxFileAge** to one hour.

```
set MaxFileAge "1 Hour"

Set MaxFileAge "1 Hour"
```

The **MaxFileSize** should remain at the default value of 10 megabytes.

Step 5 Set `UseLocalTimeZone` to `TRUE`.

```
set UseLocalTimeZone TRUE
```

```
Set UseLocalTimeZone TRUE
```

Setting Up a Local Authentication Service

If you use the Prime Access Registrar server for authentication and authorization in your prepaid billing solution, you should configure an AA service. For example, you might configure a service similar to **local-users** (in the example configuration) for authentication and authorization of local users.

If some of the users are non-prepaid users or if the prepaid users need to have RADIUS authorization attributes returned, you should configure an AA service to perform that authentication and authorization.

If all of the users in a realm are prepaid users and the prepaid billing client does not require normal RADIUS authorization attributes, an AA service is not necessary.

Setting Up a Local Authentication Service

To set up a local authentication service:

Step 1 Use `aregcmd` to set up a local authentication service.

```
cd /radius/services
```

```
add Prepaid-LocalAuthentication
```

```
Added prepaid-LocalAuthentication
```

```
cd prepaid-LocalAuthentication
```

```
[ //localhost/Radius/Services/prepaid-LocalAuthentication ]
  Name = prepaid-LocalAuthentication
  Description =
  Type =
```

Step 2 Set the service type to local.

```
set type local
```

```
Set Type local
```

Step 3 Set the `UserList` property to the userlist that contains IS835C prepaid users.

```
set UserList userlist_name
```

```
Set UserList userlist_name
```



Note

You can use an LDAP or ODBC service in place of the local authentication service.

Setting Up a Prepaid Accounting Group Service

A prepaid billing solution usually requires a group service to tie together an AA service with a prepaid service, a group service to tie together an accounting service with a prepaid service, or both.

If you are using an AA service with your prepaid billing solution, you must configure a group service, for example **prepaid-users**, that ties the requests to the AA service (**local-users** in our example) with the prepaid service.

If you are using Prime Access Registrar for an accounting service with your prepaid billing solution, you must configure a group service, for example **prepaid-file**, that ties accounting requests to both the regular accounting service (**local-file** in our example) and the prepaid service.

Setting Up a Prepaid Accounting Group Service

To set up a prepaid accounting group service:

Step 1 Use `aregcmd` to create an accounting group service under `/Radius/Services`.

```
cd /radius/services

add Prepaid-Accounting

Added prepaid-accounting
```

Step 2 Set the service type to group.

```
cd prepaid-accounting

[ //localhost/Radius/Services/prepaid-accounting ]
Name = prepaid-accounting
Description =
Type =

set type group

Set Type group
```

The group service has the following properties:

```
[ //localhost/Radius/Services/prepaid-accounting ]
Name = prepaid-accounting
Description =
Type = group
IncomingScript~ =
OutgoingScript~ =
ResultRule = AND
GroupServices/
```

Step 3 Reference the Prepaid and Prepaid-LocalAccounting services under GroupServices.

```
cd GroupServices

[ //localhost/Radius/Services/prepaid-accounting/GroupServices ]

add 1 prepaid

Added 1
```

add 2 prepaid-LocalFileAccounting

```
Added 2
```

Setting Up an Authentication Group Service

A prepaid billing solution usually requires a group service to tie together an AA service with a prepaid service, a group service to tie together an accounting service with a prepaid service, or both.

If you are using an AA service with your prepaid billing solution, you must configure a group service, for example **prepaid-users**, that ties the requests to the AA service with the prepaid service.

If you are using Prime Access Registrar for an accounting service with your prepaid billing solution, you must configure a group service, for example **prepaid-file**, that ties accounting requests to both the regular accounting service and the prepaid service.

Setting Up an Authentication Group Service

To set up an authentication group service:

-
- Step 1** Use **aregcmd** to add a prepaid authentication group service under **/Radius/Services**.

```
cd /radius/services
```

```
add prepaid-groupAuthentication
```

```
Added group-prepaidAuthentication
```

```
cd group-prepaidAuthentication
```

```
[ //localhost/Radius/Services/group-prepaidAuthentication ]
  Name = group-prepaidAuthentication
  Description =
  Type =
```

- Step 2** Set the service type to group.

```
set type group
```

```
Set Type group
```

The group service requires the ResultRule to be set to AND, the default setting for a group service.

```
ls
```

```
[ //localhost/Radius/Services/group-prepaidAuthentication ]
  Name = group-prepaidAuthentication
  Description =
  Type = group
  IncomingScript~ =
  OutgoingScript~ =
  ResultRule = AND
  GroupServices/
```

- Step 3** Change directory to GroupServices and add references to the prepaid service and the authentication service.

```
cd GroupServices
```

```
[ //localhost/Radius/Services/group-prepaidAuthentication/GroupServices ]
```

```
add 1 Prepaid-LocalAuthentication
```

```
Added 1
```

```
add 2 prepaid
```

```
Added 2
```

Configuring CRB Prepaid Billing for SSG

In addition to the configuration described in [CRB Prepaid Billing, page 8-7](#), when using CRB-Prepaid billing with SSG, you must also perform the following:

- [Setting Up an Outgoing Script](#)
- [Setting Up an Incoming Script](#)
- [Setting Up a Prepaid Outgoing Script](#)
- [Adding Prepaid Clients](#)

Setting Up an Outgoing Script

To set up an outgoing script:

- Step 1** Use `aregcmd` to add the **PCO-Parse-Client-Outgoing** outgoing script under `/Radius/Scripts`:

```
cd /radius/scripts
```

```
add PCO-Parse-Client-Outgoing
```

```
Added PCO-Parse-Client-Outgoing
```

```
cd PCO-Parse-Client-Outgoing
```

```
[ //localhost/Radius/Scripts/PCO-Parse-Client-Outgoing ]
```

```
Name = PCO-Parse-Client-Outgoing
```

```
Description =
```

```
Language =
```

- Step 2** Set the language to tcl.

```
set language tcl
```

```
Set Language tcl
```

- Step 3** Set the filename to **PCO-parse.client-outgoing.tcl**.

```
set filename PCO-parse.client-outgoing.tcl
```

```
Set Filename PCO-parse-client-outgoing.tcl
```

Step 4 Set the EntryPoint to PCO-parse-client-outgoing.

```
set EntryPoint PCO-parse-client-outgoing
```

```
Set EntryPoint PCO-parse-client-outgoing
```

Setting Up an Incoming Script

To set up an incoming script:

Step 1 Use **aregcmd** to add the **PPI-Parse-Prepaid-Incoming** script under **/Radius/Scripts**.

```
cd /radius/scripts
```

```
add PPI-Parse-Prepaid-Incoming
```

Step 2 Set the language to tcl.

```
cd PPI-Parse-Prepaid-Incoming
```

```
set language tcl
```

```
Set Language tcl
```

Step 3 Set the filename to **PPI-Parse-Prepaid-Incoming.tcl**.

```
set filename PPI-Parse-Prepaid-Incoming.tcl
```

```
Set Filename PPI-Parse-Prepaid-Incoming.tcl
```

Step 4 Set the EntryPoint to PPO-Parse-Prepaid-Outgoing.

```
set EntryPoint PPO-Parse-Prepaid-Outgoing
```

```
Set EntryPoint PPO-Parse-Prepaid-Outgoing
```

Setting Up a Prepaid Outgoing Script

To set up a prepaid outgoing script:

Step 1 Use **aregcmd** to add the **PPO-Parse-Prepaid-Outgoing** outgoing script under **/Radius/Scripts**:

```
cd /radius/scripts
```

Step 2 Add the **PPO-Parse-Prepaid-Outgoing** outgoing script under **/Radius/Scripts**.

```
cd /radius/scripts
```

```
add PPO-Parse-Prepaid-Outgoing
```

```
Added PPO-Parse-Prepaid-Outgoing
```


- Step 3** Set the language to tcl.
- ```
cd PPO-Parse-Prepaid-Outgoing
set language tcl
Set Language tcl
```
- Step 4** Set the filename to **PPO-Parse-Prepaid-Outgoing.tcl**.
- ```
set filename PPO-Parse-Prepaid-Outgoing.tcl
Set Filename PPO-Parse-Prepaid-Outgoing.tcl
```
- Step 5** Set the EntryPoint to PPO-Parse-Prepaid-Outgoing.
- ```
set EntryPoint PPO-Parse-Prepaid-Outgoing
Set EntryPoint PPO-Parse-Prepaid-Outgoing
```
- 

### Adding Prepaid Clients

To add prepaid clients:

- Step 1** Use **aregcmd** to add the prepaid clients under **/Radius/Clients**.

```
cd /radius/clients
add SSG
```

A RADIUS client has the following properties:

```
[//localhost/Radius/Clients/ssg]
Name = ssg
Description =
IPAddress =
SharedSecret =
Type = NAS
Vendor =
IncomingScript~ =
OutgoingScript~ =
EnableDynamicAuthorization = FALSE
NetMask =
```

- Step 2** Set the **IPAddress** property to the client IP address.

```
set IPAddress aaa.bbb.ccc.ddd
Set IPAddress aaa.bbb.ccc.ddd
```

- Step 3** Set the **SharedSecret**.

```
set sharedsecret cisco
Set SharedSecret cisco
```

- Step 4** Set the to **PCO-Parse-Client-Outgoing**.

**set out PCO-Parse-Client-Outgoing**

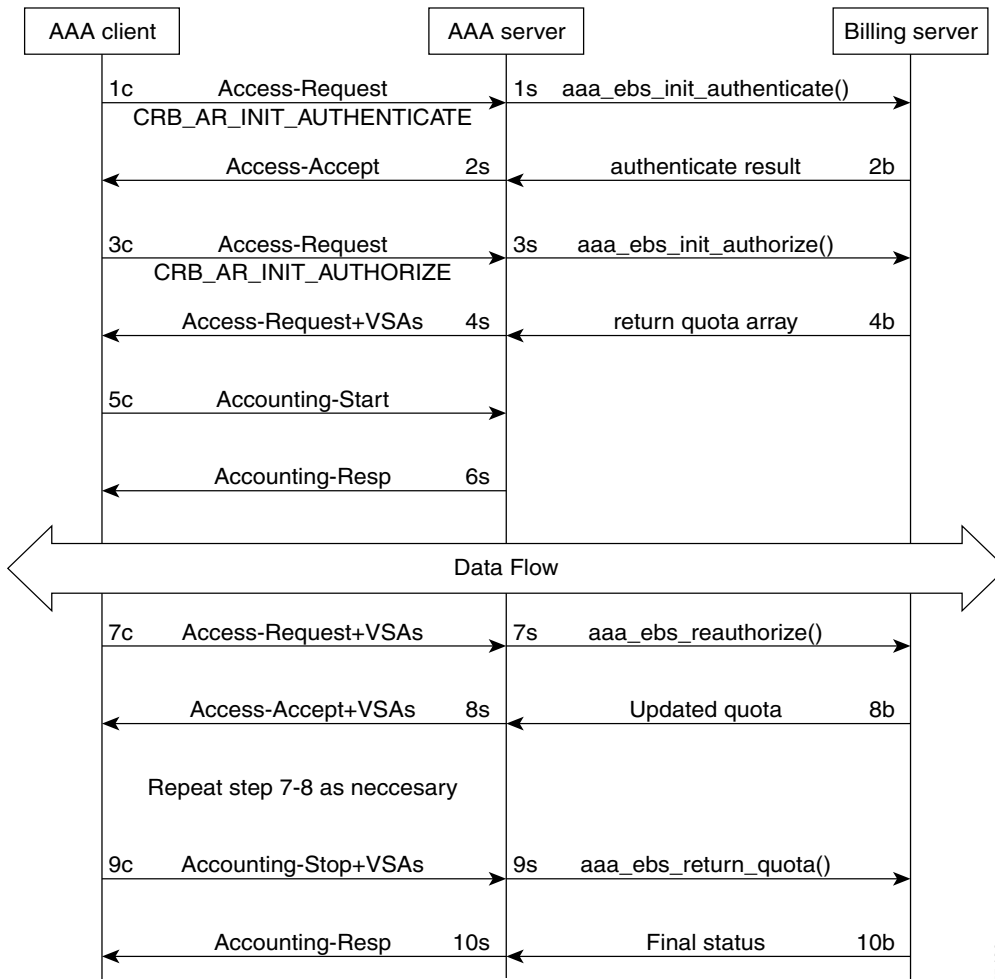
Set PCO-Parse-Client-Outgoing

## Generic Call Flow

This section describes the generic call flow for the Prime Access Registrar CRB prepaid billing. The call flow is controlled by the AAA client. The Prime Access Registrar server converts VSAs into calls to the billing server. For information about call flows and attributes for IS835C, see [IS835C Prepaid Billing, page 8-2](#).

The packet flows presented in [Figure 8-1](#) are specific to the Prime Access Registrar CRB prepaid billing only. The headlines in the packet flows are general and do represent all data transferred. The letters **c**, **s**, and **b** in [Figure 8-1](#) designate the packet's source of **client**, **server**, or **billing server**, respectively.

**Figure 8-1 Generic Call Flow Diagram**



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This section contains the following topics:

- [Access-Request \(Authentication\)](#)
- [Access-Accept \(Authentication\)](#)
- [Access-Request \(Authorization\)](#)
- [Access-Accept \(Authorization\)](#)
- [Accounting-Start](#)
- [Data Flow](#)
- [Access-Request \(Quota Depleted\)](#)
- [Accept-Accept \(Quota Depleted\)](#)
- [Accounting Stop \(Session End\)](#)
- [Accounting Response \(Final Status\)](#)

## Access-Request (Authentication)

**Flow 1c** shows the client sending the Access-Request to AAA Server, part of a normal authentication request. The exact nature of the message contents is dictated by the access technology, be it be CDMA1X-RTT, GPRS, or another. The Access-Request might involve other messages such as PAP/CHAP or another form of authentication.

The **Flow 1c** Access-Request might contain a prepaid specific VSA, CRB\_AUTH\_REASON. [Table 8-4](#) lists the attributes included in the authentication Access-Request. This tells the Prime Access Registrar server to authenticate the subscriber with the Prepaid server as well. If the value is CRB\_AR\_INIT\_AUTHENTICATE, the initial quota must be obtained for a single service prepaid solution. If this VSA is not present, the Prime Access Registrar server will not authenticate with the Prepaid billing server.

**Table 8-4** Attributes Sent During Subscriber Authentication

| Attribute Number | Attribute Name                              | Description                      | Notes                               |
|------------------|---------------------------------------------|----------------------------------|-------------------------------------|
| 1                | User-Name                                   | APPL: Mobile Node Username       | Required                            |
| 2                | NAS IP Address                              | Accounting Node IP Address       | APPL: Required, POA                 |
| 31               | Calling-station-ID                          | APPL:MSISDN or IMSI              | APPL: Conditional                   |
| 26, 9            | CRB_AUTH_REASON<br>CRB_AR_INIT_AUTHENTICATE | See VSA section                  | Required                            |
| 26, 9            | CRB_USER_ID                                 | APPL:PDSN address or SSG address | APPL: Required, Address of the PDSN |

**Table 8-4** *Attributes Sent During Subscriber Authentication (continued)*

| Attribute Number | Attribute Name | Description                                                                   | Notes                                                                                                |
|------------------|----------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 26, 9            | CRB_SERVICE_ID | APPL: Service ID such as Simple IP service, Mobile IP service, or VPN service |                                                                                                      |
| 26, 9            | CRB_SESSION_ID | This VSA contains the session key ID information                              | Required; the session ID must be globally unique across all clients and across reboots of the client |

In **Flow 1s**, the Prime Access Registrar server sends a call to the billing server to authenticate the prepaid user and possibly determine more information about the subscriber's account. The Prime Access Registrar server can be configured to generate this packet flow, using a subscriber profile parameter, if the request is from a prepaid subscriber.

## Access-Accept (Authentication)

**Flow 2b** shows the billing server returning the authentication result. The billing server returns a failure if the prepaid subscriber has an inadequate balance.

**Flow 2s** shows the Prime Access Registrar server sending the Access-Accept to the AAA client. This message flow contains at least one prepaid billing-specific VSA (listed in [Table 8-5](#)) and might contain other access technology-specific attributes.

**Table 8-5** *Attributes Sent to AAA client in Access-Accept (Authentication)*

| Attribute Number | Attribute Name                             | Description                                               | Notes    |
|------------------|--------------------------------------------|-----------------------------------------------------------|----------|
| 26, 9            | CRB__USER_TYPE<br>CRB_AR_INIT_AUTHENTICATE | See <a href="#">Vendor-Specific Attributes, page 8-25</a> | Optional |

## Access-Request (Authorization)

In **Flow 3c**, the AAA client sends another Access-Request, this time to authorize the subscriber. [Table 8-6](#) lists the attributes required by the Prime Access Registrar server to authorize the subscriber. The session key ID used must be specified using a prepaid VSA pointing to the RADIUS attribute (standard or VSA).

**Table 8-6** *Attributes Sent During Subscriber Authorization*

| Attribute Number | Attribute Name | Description                | Notes               |
|------------------|----------------|----------------------------|---------------------|
| 1                | User-Name      | APPL: Mobile Node Username | Required            |
| 2                | NAS IP Address | Accounting Node IP Address | APPL: Required, POA |

**Table 8-6** *Attributes Sent During Subscriber Authorization (continued)*

| Attribute Number | Attribute Name                           | Description                                                                   | Notes                                                                                                |
|------------------|------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 31               | Calling-station-ID                       | APPL:MSISDN or IMSI                                                           | APPL: Conditional                                                                                    |
| 26, 9            | CRB_AUTH_REASON<br>CRB_AR_INIT_AUTHORIZE | See <a href="#">Vendor-Specific Attributes, page 8-25</a>                     | Required                                                                                             |
| 26, 9            | CRB_USER_ID                              | APPL:PDSN address or SSG address                                              | APPL: Required, Address of the PDSN                                                                  |
| 26, 9            | CRB_SERVICE_ID                           | APPL: Service ID such as Simple IP service, Mobile IP service, or VPN service |                                                                                                      |
| 26, 9            | CRB_SESSION_ID                           | This VSA contains the session key ID information                              | Required; the session ID must be globally unique across all clients and across reboots of the client |

.In **Flow 3s**, the Prime Access Registrar server sends the Prepaid billing server to obtain a quota. The quota might contain several values depending on the number of measurement parameters chosen.

## Access-Accept (Authorization)

**Flow 4b** shows the billing server returning the quota array for the subscriber.

In **Flow 4s**, the Prime Access Registrar server converts the quota array received into VSAs and sends an Access-Accept with the assembled VSAs to the AAA client. [Table 8-7](#) lists the prepaid-specific VSAs that might be included in the Access-Accept response message sent to the AAA client. For more detailed information about the VSAs, see [Vendor-Specific Attributes, page 8-25](#).

**Table 8-7** *Attributes Sent to AAA client in Access-Accept (Authorization)*

| Attribute Number | Attribute Name       |
|------------------|----------------------|
| 26, 9            | CRB_DURATION         |
| 26, 9            | CRB_TOTAL_VOLUME     |
| 26, 9            | CRB_UPLINK_VOLUME    |
| 26, 9            | CRB_DOWNLINK_VOLUME  |
| 26, 9            | CRB_TOTAL_PACKETS    |
| 26, 9            | CRB_UPLINK_PACKETS   |
| 26, 9            | CRB_DOWNLINK_PACKETS |

**Flows 3c** through **4s** are repeated for every service started or restarted by the AAA client.

However, if the return parameters indicate that the authorization is rejected, an Access-Accept message is generated and sent to the client as shown in [Table 8-8](#). When this type of error condition occurs, no other VSA is included in the Access-Accept message.

**Table 8-8** Attribute Sent to Report Error Condition to AAA client

| Attribute Number | Attribute Name      | Description                                                                                                                                                             | Notes                                                                          |
|------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 26, 9            | CRB_TERMINATE_CAUSE | Identifies why a subscriber failed authentication:<br>1. Exceeded the balance<br>2. Exceeded the overdraft<br>3. Bad credit<br>4. Services suspended<br>5. Invalid User | Conditional; rejection might be returned with Access-Accept and zero (0) quota |

## Accounting-Start

In **Flow 5c**, the AAA client sends the Accounting-Start. In **Flow 6s**, the Prime Access Registrar server replies with the Accounting-Response.

## Data Flow

At this point, the data transfer begins. The AAA client monitors the subscriber's allocated quotas for metering parameters. A subscriber's Reauthorization request is generated when a quota for at least one of the metering parameters, is depleted.

## Access-Request (Quota Depleted)

**Flow 7c** shows the client sending an Access-Request to the Prime Access Registrar server because at least one quota has been depleted. The Access-Request includes different measurements of how much of the quotas were used in VSA format. This enables the billing server to account for the usage and manage the subscriber's balance before assigning a new quota. [Table 8-9](#) lists the attributes returned to the Prime Access Registrar server:

**Table 8-9** Attributes Sent by NAS When Quota Depleted

| Attribute Number | Attribute Name     | Description                       | Notes                                             |
|------------------|--------------------|-----------------------------------|---------------------------------------------------|
| 1                | User-Name          | APPL: Mobile Node Username        | Conditional                                       |
| 2                | NAS IP Address     | Accounting Node IP Address        | APPL: Required, POA address, or Home Node address |
| 31               | Calling-station-ID | APPL:MSISDN or IMSI               | APPL: Conditional                                 |
| 26, 9            | CRB_AUTH_REASON    | See VSA                           | Required                                          |
| 26, 9            | CRB_USER_ID        | APPL: PDSN address or SSG address | APPL: Required, address of SGSN                   |

**Table 8-9** *Attributes Sent by NAS When Quota Depleted (continued)*

| Attribute Number | Attribute Name       | Description                                               | Notes       |
|------------------|----------------------|-----------------------------------------------------------|-------------|
| 26, 9            | CRB_DURATION         | See <a href="#">Vendor-Specific Attributes, page 8-25</a> | Required    |
| 26, 9            | CRB_TOTAL_VOLUME     |                                                           | Conditional |
| 26, 9            | CRB_UPLINK_VOLUME    |                                                           |             |
| 26, 9            | CRB_DOWNLINK_VOLUME  |                                                           |             |
| 26, 9            | CRB_TOTAL_PACKETS    |                                                           |             |
| 26, 9            | CRB_UPLINK_PACKETS   |                                                           |             |
| 26, 9            | CRB_DOWNLINK_PACKETS |                                                           |             |

## Accept-Accept (Quota Depleted)

**Flow 7s** shows the Prime Access Registrar server returning the used quota array to the billing server. The call includes `aaa_ibs_reauthoriz()`. The billing server sends an updated quota array for the next period to the Prime Access Registrar server.

In **Flow 8s**, the Prime Access Registrar server converts the quota array into VSAs and sends them to the AAA client.

**Table 8-10** *Attributes Sent to AAA Client in Access-Accept (Reauthorization)*

| Attribute Number | Attribute Name       |
|------------------|----------------------|
| 26, 9            | CRB_USER_TYPE        |
| 26, 9            | CRB_DURATION         |
| 26, 9            | CRB_TOTAL_VOLUME     |
| 26, 9            | CRB_UPLINK_VOLUME    |
| 26, 9            | CRB_DOWNLINK_VOLUME  |
| 26, 9            | CRB_TOTAL_PACKETS    |
| 26, 9            | CRB_UPLINK_PACKETS   |
| 26, 9            | CRB_DOWNLINK_PACKETS |

## Accounting Stop (Session End)

In **Flow 9c**, the client sends an Accounting-Stop to the Prime Access Registrar server to end the session. The Accounting-Stop message includes an updated quota array with the usage adjustments since the previous authorization in the VSA form.

[Table 8-11](#) lists the attributes included in the Accounting-Stop message set to the Prime Access Registrar server and forwarded to the billing server.

## Accounting Response (Final Status)

In **Flow 9s**, the Prime Access Registrar server sends the used quota array to the billing server in an Accounting-Stop message. Any values returned by the billing server in **Flow 10b** are discarded.

**Flow 10s** shows the Prime Access Registrar server sending final Accounting-Response message to the AAA client.

**Table 8-11** *Attributes Sent in Accounting-Stop Message*

| Attribute Number | Attribute Name       | Description                                                                                                | Notes                                                                 |
|------------------|----------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1                | User-Name            | APPL: Mobile Node Username                                                                                 | Conditional                                                           |
| 2                | NAS IP Address       | Accounting Node IP Address                                                                                 | APPL: Required, POA                                                   |
| 31               | Calling-station-ID   | APPL:MSISDN or IMSI                                                                                        | APPL: Conditional                                                     |
| 40, 2            | Acct_status_type     | Indicates the accounting “Stop” for the service                                                            | Required; this value (2) indicates an Accounting-Stop request message |
| 42               | Acct-Input-Octets    | The number of octets sent by the subscriber; uplink                                                        | Required                                                              |
| 43               | Acc_Output_Octets    | The number of octets received by the subscriber; downlink                                                  |                                                                       |
| 46               | Acct-Session-Time    | Duration of the session                                                                                    |                                                                       |
| 47               | Acct-Input-Packets   | Number of packets sent by the subscriber                                                                   |                                                                       |
| 48               | Acct-Output-Packets  | Number of packets received by the subscriber                                                               |                                                                       |
| 49               | Acct-Terminate-Cause | This parameter, used for tracking, should remain the same for all accounting requests for a given service. |                                                                       |
| 26, 9            | CRB_DURATION         | See <a href="#">Vendor-Specific Attributes, page 8-25</a>                                                  | Conditional                                                           |
| 26, 9            | CRB_TOTAL_VOLUME     |                                                                                                            |                                                                       |
| 26, 9            | CRB_UPLINK_VOLUME    |                                                                                                            |                                                                       |
| 26, 9            | CRB_DOWNLINK_VOLUME  |                                                                                                            |                                                                       |
| 26, 9            | CRB_TOTAL_PACKETS    |                                                                                                            |                                                                       |
| 26, 9            | CRB_UPLINK_PACKETS   |                                                                                                            |                                                                       |
| 26, 9            | CRB_DOWNLINK_PACKETS |                                                                                                            |                                                                       |
| 26, 9            | CRB_SESSION_ID       | Specifies the RADIUS attribute carrying the session ID information                                         | Optional                                                              |



## Vendor-Specific Attributes

Vendor-specific attributes are included in specific RADIUS packets to communicate prepaid user balance information from the Prime Access Registrar server to the AAA client, and actual usage, either interim or total, between the NAS and the Prime Access Registrar Server.

Table 8-12 lists the VSAs that will be defined in the API. Table 8-12 also lists the string to be used with Cisco-AVPair below the VSA.


**Note**

VSAs that start with CRB are used for Cisco Radius Billing prepaid service.

**Table 8-12 Vendor-Specific Attributes for the Cisco Prepaid Billing Solution**

| VSA Name                           | Type   | Source (Call Flow) | Description                                                                                                                                                                                                                     |
|------------------------------------|--------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CRB_AUTH_REASON<br>crb-auth-reason | Int8   | 1c, 7c, 7'c        | Passed with re-authorization:<br>1. Initial Authentication<br>2. Initial Authorization<br>3. Re-authorization<br>4. Return Quota<br>5. Query to EBS                                                                             |
| CRB_USER_ID<br>crb-user-id         | String | 1c, 7c, 7'c        | APPL: In PDSN this can be Address of the PDSN.                                                                                                                                                                                  |
| CRB_SERVICE_ID<br>crb-service-id   | String | 1c, 7c             | Identifies the subscriber's service                                                                                                                                                                                             |
| CRB_USER_TYPE<br>crb-entity-type   | Int8   | 4s                 | Type of user:<br>1. Prepaid user<br>2. Post-paid with no credit limit<br>3. Post-paid with credit limit<br>4. Invalid user<br><br>The source for this VSA value could be from the Subscriber profile or from the billing server |

**Table 8-12 Vendor-Specific Attributes for the Cisco Prepaid Billing Solution (continued)**

| VSA Name                                     | Type  | Source (Call Flow) | Description                                      |
|----------------------------------------------|-------|--------------------|--------------------------------------------------|
| CRB_DURATION<br>crb-duration                 | Int32 | 4s, 8s             | Downlink quota received by the AAA client        |
| CRB_TOTAL_VOLUME<br>crb-total-volume         |       |                    | Total Volume quota received by the AAA client    |
| CRB_UPLINK_VOLUME<br>crb-uplink-volume       |       |                    | Uplink volume quota received by the AAA client   |
| CRB_DOWNLINK_VOLUME<br>crb-downlink-volume   |       |                    | Uplink Volume quota received by the AAA client   |
| CRB_TOTAL_PACKETS<br>crb-total-packets       |       |                    | Downlink Packet quota received by the AAA client |
| CRB_UPLINK_PACKETS<br>crb-uplink-packets     |       |                    | Uplink Packet quota received by the AAA client   |
| CRB_DOWNLINK_PACKETS<br>crb-downlink-packets |       |                    | Uplink Volume quota received by the AAA client   |
| CRB_SESSION_ID<br>crb-session-id             |       |                    | String                                           |

**Table 8-12 Vendor-Specific Attributes for the Cisco Prepaid Billing Solution (continued)**

| VSA Name                                   | Type   | Source (Call Flow) | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------|--------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CRB_TERMINATE_CAUSE<br>crb-terminate-cause | Int8   | 4se                | Identifies why a subscriber failed authentication:<br><ol style="list-style-type: none"> <li>1. Exceeded the balance</li> <li>2. Exceeded the overdraft</li> <li>3. Bad credit</li> <li>4. Services suspended</li> <li>5. Invalid User</li> <li>6. Invalid Password</li> <li>7. System Error</li> <li>8. Disabled</li> <li>9. Expired</li> <li>10. Valid in Future</li> <li>11. Used up</li> <li>12. No Parallel sessions</li> <li>13. Session Already closed</li> <li>14. Invalid session</li> </ol> |
| CRB_PRIVATE<br>crb-private                 | String | n/a                | Reserved for future use                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## Implementing the Prepaid Billing API

A shared library must implement the API functions to perform the various tasks given in the description of each of the function. This needs to be compiled as a shared library and then specified as part of the remote server configuration at the Filename property. See [Setting Up a Prepaid Billing RemoteServer, page 8-3](#) or [Setting Up a Prepaid Billing RemoteServer, page 8-8](#).

At startup, Prime Access Registrar loads the library dynamically and registers the API functions, then calls out the library initialization API once at startup. The call to initialize functions initializes various data structures and connections with the billing server, as required.



### Note

Cisco works with you to develop the prepaid billing service and implement the API. For more information, contact your Cisco systems engineer.

At various times, according to the call flow described in the Prepaid Call Flow Specification (CRB or IS835C), Prime Access Registrar calls out appropriate API functions present in the shared library. The values for the arguments passed to these API calls are purely derived from the incoming RADIUS packet and Prime Access Registrar does not maintain any dynamic information related to the call flow. It is up to the API function to make use of the information passed to it as C structures to contact the Billing server, get appropriate data, and return the same to Prime Access Registrar using the designated arguments.



### Note

See the API specifications for more details pertaining to the arguments and return values of the API.

