C H A P T E R **21**

Using Open Database Connectivity

Cisco Prime Access Registrar (Cisco Prime AR) supports Open Database Connectivity (ODBC) , an open specification that provides application developers a vendor-independent API with which to access data sources. In addition, Cisco Prime AR supports Oracle Call Interface (OCI). It provides RemoteServer objects and services to support ODBC or OCI. You can use Cisco Prime AR to authenticate and authorize access requests by querying user information through ODBC or OCI.

ODBC or OCI is an application program interface (API). Real data exchange between an application and data store is still carried out by SQL through ODBC or OCI. To achieve the most flexibility, you are required to define your own SQL using **aregcmd**. Cisco Prime AR will register the SQL statements and send them to the data store through ODBC or OCI when required. Because you can define your own SQL, Cisco Prime AR supports sites that have their own data stores.

ODBC is configured using **.ini** files, specifically **odbc.ini** and **odbcinst.ini**. However, you cannot create or modify these files directly. Cisco Prime AR creates the **.ini** files after you use **aregcmd** to configure the ODBC connection. The SQL is stored in the local database (MCD). During execution, the Cisco Prime AR server reads the local database, prepares the SQL statements, and sends the SQL to the data source.

Note For OCI, the **.ini** files are not needed to connect to the database.

Note Cisco Prime AR uses its own ODBC driver manager and does not share existing ODBC drivers (if you already have ODBC installed). If you are already using ODBC, you will have to maintain two separate ODBC installations.

The ODBC or OCI memory requirement depends on your configuration. The more datasources you configure, the more memory is required. Packet processing time might increase if you configure a large number of SQL statements under SQLDefinition.

The Cisco Prime AR package includes some ODBC and OCIlib Drivers, and you should use the included driver whenever possible. If a data store's ODBC driver is not included with Cisco Prime AR, you are required to install it. You configure the driver library using **aregcmd** to modify the associated **ini** file.

This chapter contains the following sections:

- Oracle Software Requirements
- Configuring ODBC/OCI
- MySQL Support

Oracle Software Requirements

The Cisco Prime AR ODBC feature requires that you have Oracle 9i and/or 10g client software installed. The OCI feature requires that you have Oracle 10g or 11g client software installed. All Oracle client software library files are expected under **$ORACLE_HOME/lib.**

When you install Cisco Prime AR software, the installation process prompts you for ORACLE_HOME variable and sets it in the Cisco Prime AR start-up script, **/etc/init.d/arserver**. Two other environment variables (ODBCINI and ODBCSYSINI) are also set in the **arserver** script. To change any of these variables, modify the **/etc/init.d/arserver** script and restart the Cisco Prime AR server.

The following changes have been made to support Oracle 9 for the ODBC feature:

- The file **liboraodbc.so** has been renamed to **liboraodbc8.so**.
- The file **liboraodbc9.so** has been added.

> **Note**   Install the Oracle 10g client for Solaris and Linux using 10gr2_client_sol.cpio.gz, instantclient-basic-solaris32-10.1.0.5-20060502.zip, 10201_client_linux32.zip, and instantclient-basic-linux32-10.1.0.5-20060511.zip respectively.

> **Note**   For OCI services, ensure that you have installed the Oracle client properly by using tnsping or sqlplus utilities.

Configuring ODBC/OCI

You use **aregcmd** to define your ODBC configuration and SQL statements. The Cisco Prime AR server automatically creates the **ODBC.ini** file for your driver manager and driver based on how you configure ODBC.

Configuring the ODBC and ODBC-Accounting Remote Servers

To use ODBC in Cisco Prime AR for AA:

Step 1   Configure an ODBC DataSource.

Step 2   Configure an ODBC RemoteServer object with protocol type as 'odbc'.

Step 3   Configure an ODBC Service with service type as 'odbc'.

Step 4   Set ODBC service as the DefaultAuthenticationService and DefaultAuthorizationService.

Step 5   Save your configuration.

To use ODBC in Cisco Prime AR for Accounting:

Step 1   Configure an ODBC DataSource.

Step 2   Configure an ODBC RemoteServer object with protocol type as 'odbc-account'.

Step 3   Configure an ODBC Service with service type as 'odbc-accounting'.

Step 4   Set ODBC service as the DefaultAccountingService.

Step 5   Save your configuration.

After you **save** and validate your configuration, it is saved in the MCD database. If you have configured an ODBC service, Cisco Prime AR will query the MCD database and create or modify the **odbc.ini** file before it builds a connection to the database. When you reload your configuration, Cisco Prime AR shuts down any existing ODBC connections, then queries the MCD database to create or modify the **odbc.ini** file and build a new connection for any configured ODBC Data Sources.

The following shows an example configuration for AA remote server:

```
[ //localhost/Radius/RemoteServers/oracle-access ]
Name = oracle-access
Description =
Protocol = odbc
ReactivateTimerInterval = 300000
Timeout = 15
DataSourceConnections = 8
ODBCDataSource = gordon
SNMPTrapIP =
SNMPTrapPort = 1521
KeepAliveTimerInterval = 0
SQLDefinition/
UserPasswordAttribute = password
SQLStatements/
Entries 1 to 1 from 1 total entries
Current filter: <all>

 sql1/
   Name = sql1
   Description =
   Type = query
   SQL = "select password , username from arusers where username = ?"
   ExecutionSequenceNumber = 1
   MarkerList = UserName/SQL_CHAR
ODBCToRadiusMappings/
ODBCToEnvironmentMappings/
ODBCToCheckItemMappings/
```

The following shows an example configuration for AAA remote server:

```
[ //localhost/Radius/RemoteServers/ora_acc ]
Name = ora_acc
Description =
Protocol = odbc-accounting
ReactivateTimerInterval = 1000
Timeout = 15
DataSourceConnections = 8
ODBCDataSource = gordon
SNMPTrapIP =
SNMPTrapPort = 1521
KeepAliveTimerInterval = 1000
BufferAccountingPackets = TRUE
```

```
MaximumBufferFileSize = "10 Megabytes"
NumberOfRetriesForBufferedPacket = 3
BackingStoreEnvironmentVariables =
UseLocalTimeZone = FALSE
AttributeList =
Delimiter =
SQLDefinition/
SQLStatements/
Entries 1 to 1 from 1 total entries
Current filter: <all>

 sql/
  Name = sql
  Description =
  Type = insert
  SQL = "insert into accounting(username,acct_status_type) values (? , ?)"
  ExecutionSequenceNumber = 1
  MarkerList = "UserName/SQL_CHAR Acct-Status-Type/SQL_CHAR "
```

You use **aregcmd** to define your OCI configuration and SQL statements.

Configuring an OCI and OCI-Accounting Remote Servers

To use OCI in Cisco Prime AR for AA:

Step 1 Configure the DataSource type as oracle_oci.

Step 2 Configure an OCI RemoteServer object protocol type as 'oci'.

Step 3 Configure an OCI Service with type as 'oci'.

Step 4 Set OCI service as the DefaultAuthenticationService and DefaultAuthorizationService.

Step 5 Save your configuration.

To use OCI in Cisco Prime AR for Accounting:

Step 1 Configure the DataSource type as oracle_oci.

Step 2 Configure an OCI RemoteServer object protocol type as 'oci-accounting'.

Step 3 Configure an OCI Service with type as 'oci-accounting'.

Step 4 Set OCI service as the DefaultAccountingService.

Step 5 Save your configuration .

After you **save** and validate your configuration, it is saved in the MCD database.

The following shows an example configuration for AA remote server:

```
[ //localhost/Radius/RemoteServers/oracle-access ]
Name = oracle-access
Description =
Protocol = oci
ReactivateTimerInterval = 300000
Timeout = 15
DataSourceConnections = 8
ODBCDataSource = gordon
SNMPTrapIP =
```

```
SNMPTrapPort = 1521
KeepAliveTimerInterval = 0
SQLDefinition/
UserPasswordAttribute = password
SQLStatements/
Entries 1 to 1 from 1 total entries
Current filter: <all>

 sql1/
  Name = sql1
  Description =
  Type = query
  SQL = "select password , username from arusers where username = ?"
  ExecutionSequenceNumber = 1
  MarkerList = UserName/SQL_CHAR
  OCIToRadiusMappings/
  OCIToEnvironmentMappings/
  OCIToCheckItemMappings/
```

The following shows an example configuration for AAA remote server:

```
[ //localhost/Radius/RemoteServers/ora_acc ]
Name = ora_acc
Description =
Protocol = oci-accounting
ReactivateTimerInterval = 1000
Timeout = 15
DataSourceConnections = 8
ODBCDataSource = gordon
SNMPTrapIP =
SNMPTrapPort = 1521
KeepAliveTimerInterval = 1000
BufferAccountingPackets = TRUE
MaximumBufferFileSize = "10 Megabytes"
NumberOfRetriesForBufferedPacket = 3
BackingStoreEnvironmentVariables =
UseLocalTimeZone = FALSE
AttributeList =
Delimiter =
SQLDefinition/
SQLStatements/
Entries 1 to 1 from 1 total entries
Current filter: <all>

 sql/
  Name = sql
  Description =
  Type = insert
  SQL = "insert into accounting(username,acct_status_type) values (? , ?)"
  ExecutionSequenceNumber = 1
  MarkerList = "UserName/SQL_CHAR Acct-Status-Type/SQL_CHAR "
```

This section contains the following topics:

- Configuring an ODBC/OCI Service
- Configuring an ODBC/OCI RemoteServer
- Configuring an ODBC DataSource
- Setting ODBC/OCI As Authentication and Authorization Service
- Setting ODBC/OCI As Accounting Service
- Saving Your Configuration
- Oracle Stored Procedures

Configuring an ODBC/OCI Service

You configure an ODBC or OCI service under **/Radius/Services**. When you define an ODBC or OCI service under **/Radius/Services**, you must set its type to ODBC or OCI and provide the following configuration options:

Note   We will use ODBC or OCI as the ODBC or OCI service name in the following examples.

Example configuration for ODBC

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

Example configuration for OCI

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

Table 21-1 describes the ODBC or OCI service parameters.

Table 21-1   ODBC/OCI Service Parameters

Parameter	Description
Name	Required; inherited from the upper directory
Description	An optional description of the service
Type	Must be set to ODBC for ODBC service or OCI for OCI service
IncomingScript	Optional
OutgoingScript	Optional
OutagePolicy	Required; must be set to AcceptAll or Drop Packet, or defaults to RejectAll
OutageScript	Optional

Table 21-1   ODBC/OCI Service Parameters (continued)

Parameter	Description
MultipleServersPolicy	Required; must be set to RoundRobin or defaults to Failover.
	When set to Failover, Cisco Prime AR directs requests to the first server in the list until it determines the server is offline. If so, Cisco Prime AR redirects all requests to the next server in the list until it finds an online server.
	When set to RoundRobin, Cisco Prime AR directs each request to the next server in the RemoteServers list to share the resource load across all servers in the RemoteServers list.
RemoteServers	Required list of remote servers defined under **/Radius/Services/ODBC/RemoteServers** such as **ODBC-Primary** and **ODBC-Secondary**

Configuring an ODBC/OCI RemoteServer

Configuring an ODBC Remote Server

You must configure an ODBC RemoteServer object for each RemoteServer object you list under **/Radius/Services/ODBC/RemoteServers**. Use the **aregcmd** command **add** to add ODBC servers under **/Radius/RemoteServers**.

Configuring an OCI Remote Server

You must configure an OCI RemoteServer object for each RemoteServer object you list under **/Radius/Services/OCI/RemoteServers**. Use the **aregcmd** command **add** to add OCI servers under **/Radius/RemoteServers**.

Table 21-2 describes the ODBC or OCI service parameters. The fields that are displayed in the table changes based on the protocol type selected.

Table 21-2   ODBC/OCI Remote Server Parameters

Parameter	Description
Name	Required; inherited from the upper directory
Description	An optional description of the server
Protocol	Required and must be set to ODBC or OCI for ODBC or OCI service respectively; no default value
ReactivateTimerInterval	Required; default is 300000 (ms)
Timeout	Required; default is 15 (seconds)
DataSourceConnections	Required; number of concurrent connections to data source (default is 8)
ODBCDataSource	Required; no default value

Table 21-2   ODBC/OCI Remote Server Parameters (continued)

Parameter	Description
SQLDefinition	SQLDefinition/ (mandatory, no default); UserPasswordAttribute = (mandatory, no default; data store field for user password)
	SQLStatements/
	SQLStatement1/
	SQLStatement2/
ODBCToRadiusMappings (OCIToRadiusMappings)	Optional; a list of name/value pairs in which the name is the name of the **odbc** attribute to retrieve from the user record, and the value is the name of the RADIUS attribute to set to the value of the **odbc** attribute retrieved.
	For example, when the **ODBCToRadiusMappings** has the entry: **FramedIPAddress = Framed-IP-Address**, the RemoteServer retrieves the **FramedIPAddress** attribute from the **odbc** user entry for the specified user, uses the value returned, and sets the Response variable **Framed-IP-Address** to that value.
	Note When you select the protocol as OCI, the field name will be displayed as OCIToRadiusMappings.
ODBCToEnvironmentMappings (OCIToEnvironmentMappings)	Optional; a list of name/value pairs in which the name is the name of the **odbc** attribute to retrieve from the user record, and the value is the name of the Environment variable to set to the value of the **odbc** attribute retrieved.
	For example, when the **ODBCToEnvironmentMappings** has the entry: **group = User-Group**, the RemoteServer retrieves the **group** attribute from the **odbc** user entry for the specified user, uses the value returned, and sets the Environment variable **User-Group** to that value.
	Note When you select the protocol as OCI, the field name will be displayed as OCIToEnvironmentMappings.
ODBCToCheckItemMappings (OCIToCheckItemMappings)	Optional; a list of ODBC *attribute/value* pairs which must be present in the RADIUS access request and must match, both name and value, for the check to pass.
	For example, when the **ODBCToCheckItemMappings** has the entry: **group = User-Group**, the Access Request must contain the attribute **group**, and it must be set to **User-Group**.
	Note When you select the protocol as OCI, the field name will be displayed as OCIToCheckItemMappings.

ODBC Data Source

ODBCDataSource is the name of the datasource to be used by the remote server. An ODBCDataSource name can be reused by multiple remote servers. You configure ODBCDataSources under **/Radius/Advanced/ODBCDataSources**. See Configuring an ODBC DataSource, page 21-11, for more information.

Tuning $ORACLE_HOME/network/admin/sqlnet.ora file on the Oracle Client

For proper function of the reactivate timer interval, one or more of the following parameters in sqlnet.ora file needs to be tuned:

- SQLNET.INBOUND_CONNECT_TIMEOUT
- SQLNET.SEND_TIMEOUT
- SQLNET.RECV_TIMEOUT

Ensure that the ReactivateTimerInterval of ODBC/ODBC-Accounting remoteservers should be greater than the timeout values configured in sqlnet.ora.

SQL Definitions

SQLDefinitions lists the UserPasswordAttribute and one or more SQL statements, listed numerically in the order to be run. The UserPasswordAttribute represents a column in the database that contains users' password information. Individual SQLStatements are numbered SQL1 through SQLn under SQLStatements, as shown in the following example:

```
SQLDefinition/
    UserPasswordAttribute = asdfjkl
    SQLStatements/
        SQL1/
        SQL2/
        SQL3/
        ...
```

The following example is an SQL statement used for Authentication and Authorization:

```
SQLStatements/
    SQL1
        Name = SQL1
        Type = query (mandatory, no default; must be query/procedure)
        SQL = SQL statement (mandatory, no default)
        ExecutionSequenceNumber = Sequence number for SQLStatement execution.(mandatory,
        no default and must be greater than zero).
        MarkerList = UserName/SQL_DATA_TYPE …… (mandatory, UserName must be defined)
```

For more information on stored procedures and stored functions, refer Oracle Stored Procedures, page 21-13.

Table 21-3 describes the SQL Statement parameters.

Table 21-3   SQL Statement Parameters

Parameter	Description
Name	Name/number of SQL statement
Type	Query (mandatory, no default value)
SQL	SQL query statement

Table 21-3   SQL Statement Parameters (continued)

Parameter	Description
ExecutionSequenceNumber	Sequence number for SQLStatement execution, must be greater than zero (mandatory, no default)
MarkerList	Defines all markers for the query. MarkerList uses the format *UserName/SQL_DATA_TYPE*.

SQL Syntax Restrictions

You must observe the following SQL syntax restrictions in SQL queries for Cisco Prime AR.

1. The SQL statement must be in the format of SELECT ... FROM ... WHERE ..." (Statements might be in lowercase.)

> **Note**   'WHERE' is compulsory in the SQL statement.

2. Stored procedures with return value must be in the "*begin ? := <Stored_procedure_name> (<IN/OUT Parameters>); end*;" format.

3. Stored procedures without return value can be in the " CALL <Stored_procedure_name> (<IN/OUT Parameters>)" format.

4. Any arguments to Oracle functions like *distinct, count* must be given within braces, as shown in the following example:

   ```
   select distinct(attribute),password from profiles where username=?
   ```

   The resulted column from *distinct(attribute)* will be put into *attribute* which can be used for ODBC Mappings. The actual result set from Oracle for this column would be named *distinct(attribute)*.

5. The column list in the SQL statement must be delimited with a comma (**,**) and any extra spaces between statements are ignored. Aliasing for column names in SQL is not allowed. SQLDefinition properties define the SQL you want to execute, as shown in the following example.

Specifying More Than One Search Key

You can specify more than one search key for a table in the SQL SELECT. To do so, add another search criteria to the SQL statement and add the environment variable name to the MarkerList. For example, the following query and MarkerList can be used to look up a username and CLID match.

```
select password from user_table where username = ? and clid = ?
```

In this case, the marker list would look like this:

```
UserName/SQL_CHAR clid/SQL_CHAR
```

To configure the multiple entries in the MarkerList list, surround the entire string in double quotes like the following:

```
set MarkerList "UserName/SQL_CHAR CLID/SQL_CHAR"
```

To make this work, a variable called CLID must be in the environment dictionary. You can use a script to copy the appropriate value into the variable.

ODBCToRadiusMappings/OCIToRadiusMappings

You configure ODBCToRadiusMappings or OCIToRadiusMappings with a list of *name/value* pairs where name is the name of the data store attribute to retrieve from the user record and the value is the name of the RADIUS attribute to set to the value of the data store attribute retrieved.

For example, use the following **aregcmd** command to set a value for the variable *Framed-IP-Address*:

    set FramedIPAddress Framed-IP-Address

When the ODBCToRadiusMappings or OCIToRadiusMappings has this entry, the RemoteServer retrieves the attribute from the data store user entry for the specified user, uses the value returned, and sets the response variable *Framed-IP-Address* to that value.

When an SQL select statement returns more than one row for a column mapped under ODBCToRadiusMappings or OCIToRadiusMappings, multiple Radius attributes are created.

For example, consider the following SQL *select* statement with ciscoavpair configured to Cisco-AVPair under ODBCToRadiusMappings. The table.column syntax requires an SQL alias for the mapping to work, as shown in the following example:

```
SQLStatements/
    SQL1/
        select table1.abc as t1abc, password from table2 where username = ?
        Mapping: t1abc = my_mapping
```

If two rows are returned for ciscoavpair column, two Cisco-AVPair attributes will be created.

ODBCToEnvironmentMappings/OCIToEnvironmentMappings

Under ODBCToEnvironmentMappings or OCIToEnvironmentMappings there is a list of name and value pairs in which the name is the name of the data store attribute to retrieve from the user record, and the value is the name of the Environment variable to set to the value of the ODBC or OCI attribute retrieved.

For example, when the ODBCToEnvironmentMappings has the entry: group =User-Group, the RemoteServer retrieves the attribute from the ODBC user entry for the specified user, uses the value returned, and sets the environment variable User-Group to that value. When an SQL select statement returns more than one row for a column mapped under ODBCToEnvironmentMappings, the value for all rows is concatenated and assigned to the environment variable.

ODBCToCheckItemMappings/OCIToCheckItemMappings

A list of ODBC or OCI *attribute/value* pairs which must be present in the RADIUS access request and must match, both name and value, for the check to pass.

For example, when the **ODBCToCheckItemMappings** or **OCIToCheckItemMappings** has the entry: **group = User-Group**, the Access Request must contain the attribute **group**, and it must be set to **User-Group**.

Configuring an ODBC DataSource

ODBCDataSource is the name of the datasource to be used by the remote server. You configure ODBCDataSources under **/Radius/Advanced/ODBCDataSources**. Multiple remote servers can use the same ODBCDataSource.

Under the ODBCDataSource object definition, for ODBC a list defines **ODBC.ini** filename/value pairs for a connection. The list includes a Type field and a Driver field, different for each Driver and Data Source, to indicate its Driver and Data Source. Cisco Prime AR currently supports only the Easysoft Open Source Oracle Driver.

For OCI services, ODBCDataSource type should be 'oracle_oci'. The following is an example configuration of ODBCDataSource for OCI services.

```
[ //localhost/Radius/Advanced/ODBCDataSources/gordon ]
Name = gordon
Description =
Type = oracle_oci
UserID = scott
Password = <encrypted>
DataBase = orcl.cisco.com
```

Table 21-4 describes the Easysoft Open Source Oracle Driver options for ODBC.

Table 21-4   Easysoft Open Source Oracle Driver Options for ODBC

Parameter	Description
Name	Name of the ODBCDataSource
Type	Required; must be Oracle_es
Driver	Required; **liboarodbc.so** (default value)
Database	Required; Oracle Client configuration database name (no default value)
UserID	Required; database username (no default value)
Password	Optional user password; shown encrypted

Table 21-5 describes the OCILib Open Source Oracle Driver options for OCI.

Table 21-5   OCILib Open Source Oracle Driver Options for OCI

Parameter	Description
Name	Name of the ODBCDataSource
Type	Required; must be Oracle_oci
Database	Required; Oracle Client configuration database name (no default value)
UserID	Required; database username (no default value)
Password	Optional user password; shown encrypted

Setting ODBC/OCI As Authentication and Authorization Service

Use **aregcmd** to configure the ODBC Service as the default authentication and authorization service under **//localhost /Radius** as in the following:

> **set DefaultAuthenticationService** *odbc-service*

set DefaultAuthorizationService *odbc-service*

Use **aregcmd** to configure the OCI Service as the default authentication and authorization service under **//localhost /Radius** as in the following:

set DefaultAuthenticationService *oci-service*

set DefaultAuthorizationService *oci-service*

> **Note**   When you use an ODBC or OCI service, configure the BackingStoreDiscThreshold property under **/Radius/Advanced** to ensure that the data generated by log files do not exceed the size limit configured.

Setting ODBC/OCI As Accounting Service

Use **aregcmd** to configure the ODBC Service as the default accounting service under **//localhost /Radius** as in the following:

set DefaultAccountingService *odbc-service*

Use **aregcmd** to configure the OCI Service as the default authentication and authorization service under **//localhost /Radius** as in the following:

set set DefaultAccountingService *oci-service*

Saving Your Configuration

When you use **aregcmd** to **save** your configuration, Cisco Prime AR attempts to validate the configuration, checks for all required parameters, and ensures there is no logic error. If the validation is successful, the configuration is saved to the MCD database. When you **reload**, Cisco Prime AR shuts down any current ODBC/OCI connections and builds new connections for the configured ODBC Data Sources.

Oracle Stored Procedures

A stored procedure is a database procedure similar to other programming language procedures, which is contained within the database itself. A SQL Server stored procedure that contains one or more IN parameters are used to pass data into the stored procedure.Similarly, one or more OUT parameters in the stored procedure are used to return data back to the calling application. Cisco Prime AR supports Oracle stored procedures/functions with IN and OUT parameters only over the OCI interface.

For Authentication and Authorization, Cisco Prime AR supports both Stored Procedures and Stored Functions with the In/Out parameters and return value. In the configuration for the AA remote server, the UserPasswordAttribute value must be in the marker list for procedures.

For Accounting, Cisco Prime AR supports both Stored Procedures and Stored Functions with only the In parameters, and does not support return value and Out parameters.

The following are the examples for stored functions and procedures calling inside Cisco Prime AR:

```
Example format for stored functions with return value
SQL = "begin ? := stress (?);end;"

Example for stored procedures
SQL = " CALL Accounting_Request( ?,?,?)"
```

Note   Cisco Prime AR does not support, return value with the "call" format for the stored procedures.

The following shows an example configuration for OCI AA remote server:

```
[ //localhost/Radius/RemoteServers ]
Entries 1 to 2 from 2 total entries
Current filter: <all>

oci-access/
 Name = oci-access
 Description =
 Protocol = oci
 ReactivateTimerInterval = 300000
 Timeout = 15
 DataSourceConnections = 8
 ODBCDataSource = 54
 SNMPTrapIP = 10.77.240.57
 SNMPTrapPort = 1521
 KeepAliveTimerInterval = 0
 SQLDefinition/
 UserPasswordAttribute = password
 SQLStatements/
 Entries 1 to 1 from 1 total entries
 Current filter: <all>

   sql1/
     Name = sql1
     Description =
     Type = procedure
     SQL = "begin ? := stress (?);end;"
     ExecutionSequenceNumber = 1
     MarkerList = "password/SQL_OUT UserName/SQL_CHAR"
   OCIToRadiusMappings/
   OCIToEnvironmentMappings/
   OCIToCheckItemMappings/
```

The following shows an example configuration for OCI AA remote server:

```
oci-acc/
Name = oci-acc
Description =
Protocol = oci-accounting
ReactivateTimerInterval = 300000
Timeout = 15
DataSourceConnections = 8
ODBCDataSource = 54
SNMPTrapIP =
SNMPTrapPort = 1521
KeepAliveTimerInterval = 0
BufferAccountingPackets = TRUE
MaximumBufferFileSize = "10 Megabytes"
NumberOfRetriesForBufferedPacket = 3
BackingStoreEnvironmentVariables =
UseLocalTimeZone = FALSE
```

```
AttributeList =
Delimiter =
SQLDefinition/
UserPasswordAttribute =
SQLStatements/
Entries 1 to 1 from 1 total entries
Current filter: <all>

 sql/
  Name = sql
  Description =
  Type = procedure
  SQL = " CALL Accounting_Request( ?,?,?)"
  ExecutionSequenceNumber = 1
  MarkerList = "UserName/SQL_CHAR Acct-Status-Type/SQL_CHAR Calling-Station-Id/SQL_CHAR "
```

Note   Cisco Prime AR supports Oracle stored procedures for OCI AA and OCI AAA remote servers.

MySQL Support

Cisco Prime AR provides support for MySQL to query user records from a MySQL database and enables you to write accounting records into MySQL when using Oracle accounting. Cisco Prime AR has been tested with MySQL 5.0.90 and MyODBC 3.51.27 (reentrant).

This section contains the following topics:

- MySQL Driver
- Configuring a MySQL Datasource
- Example Configuration

MySQL Driver

You can download the MySQL driver from the MySQL website at **http://mysql.com**. You can go directly to the driver download page using the following URL:

http://dev.mysql.com/downloads/connector/odbc/3.51.html

Save the downloaded file to a temporary location such as **/tmp**. Use commands like the following to unzip and install the driver:

gunzip -c mysql-connector-odbc-3.51.27-solaris10-sparc-32bit.pkg.gz

pkgadd -d /tmp mysql-connector-odbc-3.51.27-solaris10-sparc-32bit.pkg

ln -s mysql-connector-odbc-3.51.27-solaris10-sparc-32bit myodbc

Configuring a MySQL Datasource

You require the following to configure a MYSQL Datasource:

- ODBCDataSource object
- RemoteServer object

- ODBC service
- Default AA services

Configuring a MYSQL datasource

To configure the Cisco Prime AR server to query records form a MySQL database:

Step 1   Log in to the Cisco Prime AR server and launch **aregcmd**.

Log in as a user with administrative rights such as user **admin**.

Step 2   Change directory to the **/Radius/Advanced/ODBCDataSources** and add a new ODBCDataSource.

cd /Radius/Advanced/ODBCDataSources

add mysql

Step 3   Set the new ODBCDatasource type to myodbc.

cd mysql

```
[ //localhost/Radius/Advanced/ODBCDataSources/mysql ]
    Name = mysql
    Description =
    Type =
```

set type myodbc

The following is the default configuration for an ODBCDataSource object of type myodbc:

```
[ //localhost/Radius/Advanced/ODBCDataSources/mysql ]
    Name = mysql
    Description =
    Type = myodbc
    Driver =
    UserID =
    Password =
    DataBase =
    Server =
    Port = 3306
```

Step 4   Set the Driver property to the path of the MyODBC library. Use a command like the following:

set driver /scratch/myodbc/libmyodbc3_r.so

Step 5   Set the UserID property to a valid username for the MyODBC database and provide a valid password for this user.

set userid ar-mysql-user

set password biscuit

Step 6   Provide a DataBase name and the name of the Cisco Prime AR RemoteServer object to associate with the ODBCDataSource.

set database *database_name*

set server *remote_server_name*

Step 7   Change directory to **/Radius/RemoteServers** and add a RemoteServer object to associate with the new ODBCDatasource.

cd /Radius/RemoteServers

add mysql

Step 8   Change directory to the new RemoteServer and set its protocol to odbc.

cd mysql

set protocol odbc

Step 9   Set the ODBCDataSource property to the name of the ODBCDataSource to associate with this RemoteServer object.

set ODBCDataSource mysql

Step 10   Change directory to **/Radius/Services** and add an ODBC service as described in Configuring an ODBC/OCI Service, page 21-6.

Step 11   Change directory to **/Radius** and set the DefaultAuthenticationService and DefaultAuthorizationService properties to the ODBC service added in the previous step.

Example Configuration

The following shows an example configuration for a MySQL ODBC data source. See Configuring an ODBC DataSource, page 21-11 for more information.

```
[ //localhost/Radius/Advanced/ODBCDataSources/mysql ]
    Name = mysql
    Type = myodbc
    Driver = /tmp/libmyodbc3_r.so
    UserID = mysql
    Password = <encrypted>
    DataBase = test
    Server = mysql-a
    Port = 3306
```

The following shows an example configuration for a RemoteServer. See Configuring an ODBC/OCI RemoteServer, page 21-7 for more information.

```
[ //localhost/Radius/RemoteServers/mysql-a ]
    Name = mysql
    Description =
    Protocol = odbc
    ReactivateTimerInterval = 300000
    Timeout = 15
    DataSourceConnections = 8
    ODBCDataSource = mysql
    KeepAliveTimerInterval = 0
    SQLDefinition/
    UserPasswordAttribute = asdfjkl
    SQLStatements/
        SQL1/
            Name = SQL1
            Type = query (mandatory, no default; must be query)
            SQL = SQL statement (mandatory, no default)
```

```
                    ExecutionSequenceNumber = Sequence number for SQLStatement
                    execution.(mandatory, no default and must be greater than zero).
                    MarkerList = UserName/SQL_DATA_TYPE …… (mandatory, UserName must be defined)
            SQL2/
            SQL3/
        ODBCToRadiusMappings/
        ODBCToEnvironmentMappings/
        ODBCToCheckItemMappings/
```

The following shows an example configuration for an ODBC service. See Configuring an ODBC/OCI Service, page 21-6 for more information.

```
[ //localhost/Radius/Services/ODBC ]
    Name = ODBC
    Description =
    Type = ODBC
    IncomingScript~ =
    OutgoingScript~ =
    OutagePolicy~ = RejectAll
    OutageScript~ =
    MultipleServersPolicy = Failover
        RemoteServers/
            1.  mysql-a
```

The following shows an example configuration where the DefaultAuthenticationService and DefaultAuthorizationService properties have been set to the ODBC service.

```
[ //localhost/Radius ]
    Name = Radius
    Description =
    Version = 5.1
    IncomingScript~ =
    OutgoingScript~ =
    DefaultAuthenticationService~ = ODBC
    DefaultAuthorizationService~ = ODBC
```