CHAPTER 11

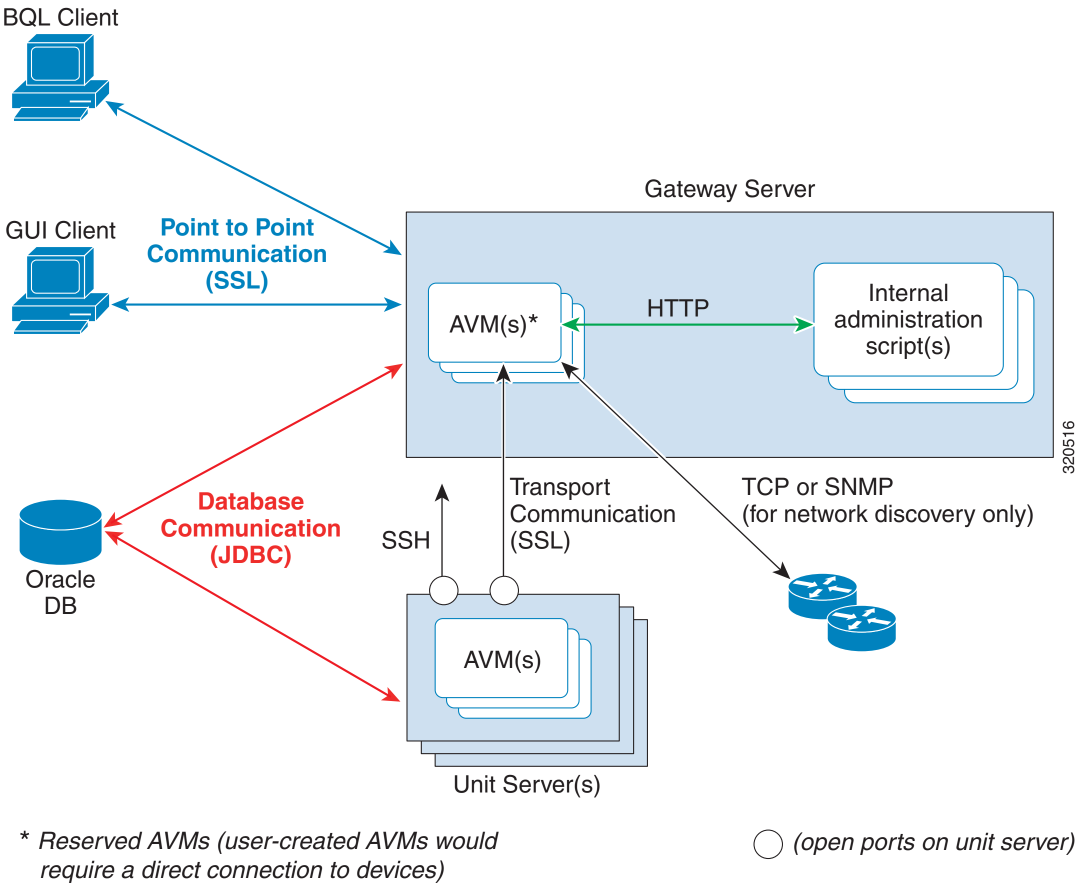
Managing System Security

These topics provide an overview of the communication and data security mechanism used by Prime Network:

Communication Security Between Prime Network Components

Figure 11-1 illustrates the different forms of secure communication that are implemented between the Prime Network gateway server, units, clients, and Oracle database. For information on the Infobright database used by Operations Reports, refer to the *Cisco Prime Network 4.3.1 Operations Reports User Guide*.

Figure 11-1 Prime Network Communication Architecture


BQL Client
GUI Client
Point to Point Communication (SSL)
Gateway Server
AVM(s)*
HTTP
Internal administration script(s)
320516
Oracle DB
Database Communication (JDBC)
SSH
Transport Communication (SSL)
TCP or SNMP (for network discovery only)
AVM(s)
Unit Server(s)
* Reserved AVMs (user-created AVMs would require a direct connection to devices)
○ (open ports on unit server)

A socket factory service that runs on the gateway server implements SSL sockets between:

- The gateway and all units
- The gateway and all clients

With SSL version 3.0, keys are created when you install Prime Network on the gateway server. All secured connections use the same private key and certificate for SSL authentication. After installation, these keys are distributed by the gateway to the clients and other units. SSL keys can be recreated (as described in the *Cisco Prime Network Integration Developer Guide*).

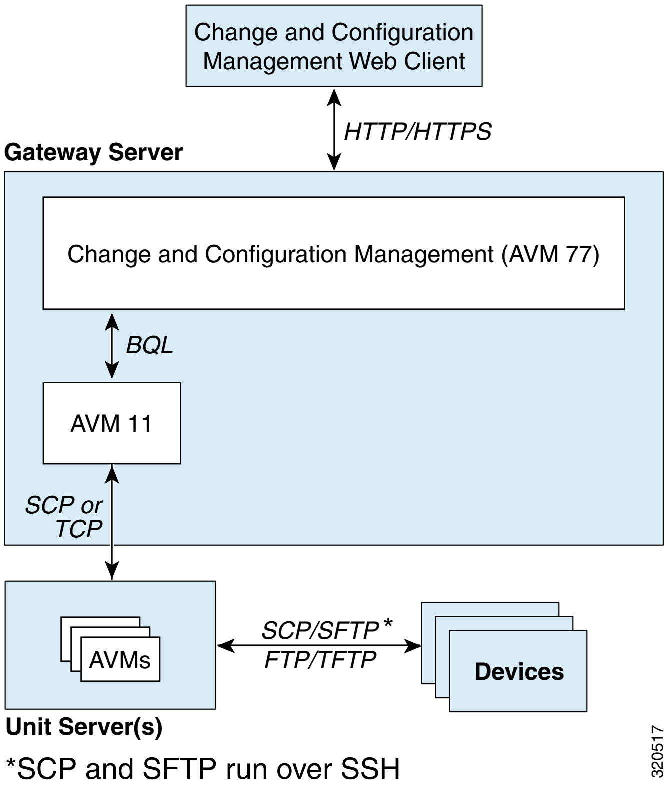
Whenever a socket cannot be opened, a System event is generated and is displayed in Prime Network Events.

The gateway only connects directly to devices when using the Network Discovery feature to add VNEs to the system. Only reserved AVMs should run on the gateway because they do not host VNEs and thus do not require a direct connection to devices.

Figure 11-2 provides a simplified illustration of the methods and protocols that Change and Configuration Management, and devices use to communicate with each other.

Caution FTP is not a secure mode of transfer. Use SCP/SFTP instead, for secure device configuration and software image file transfers. You should also configure a special FTP user for file transfers. For information on how to do this, refer to the Change and Configuration Management information in the *Cisco Prime Network 4.3.1 User Guide*. If you want to change the SCP port that a device is using, be sure to also change it in the device's VNE properties. You can do this by editing the setting in the VNE properties Telnet/SSH tab; see Telnet/SSH VNE Properties Reference, page D-6.

Figure 11-2 Change and Configuration Management Communication Architecture


Change and Configuration Management Web Client
HTTP/HTTPS
Gateway Server
Change and Configuration Management (AVM 77)
BQL
AVM 11
SCP or TCP
AVMs
SCP/SFTP*
FTP/TFTP
Devices
Unit Server(s)
*SCP and SFTP run over SSH
320517

Gateway Server and Unit Communication Security

Communication between the gateway server and units is called *transport* communication. Transport connections are encrypted when the unit and gateway are on different machines, but are not encrypted when both are local to the same machine. Similarly, AVMs use transport communication, and communication between AVMs is encrypted when the AVMs are on different machines. There is no option to change this behavior in the GUI clients.

Prime Network uses the SSH protocol for administrative messages (such as SCP) between the gateway and units. A random certificate (that is privately signed) is generated on the gateway at installation time. When Prime Network is installed on any unit (or the unit is restarted), the keys are copied from the gateway to the unit.

If a gateway server is behind a firewall, you must open ports on the firewall. The gateway will to need publicly addressable IP address.

If any unit servers are located behind firewalls or NAT devices:

- The unit is displayed in Prime Network Administration GUI client with an IP address of **0.0.0.#**. This is an artificial IP address used by the gateway server.
- You do not have to open special ports for the units. The units will always initiate communications.
- An Event Collector (AVM 100) must be running on at least one of the units behind the firewall. If you have several NAT sites with similar configuration, an Event Collector must be running on at least one unit at each site.

Gateway Server and Client (Including BQL) Communication Security

For gateway and client communication, Prime Network uses a proprietary protocol called *PTP* (Point to Point communication). This is encrypted using SSL. The SSL keys are downloaded to Prime Network clients using the JNLP (Webstart) protocol.

For BQL clients, the gateway server allows secured and unsecured connections from local clients (on port 9002), but only secured connections from clients on other machines. By default, port 9002 only allows unsecured connections. Information on how to change this behavior is described in the BQL documentation in the *Cisco Prime Network Integration Developer Guide*.

For a client to communicate with the Prime Network gateway using Perl, a certificate in .pem format is required. This can be generated from the .cer format using the two-stage process described in the *Cisco Prime Network Integration Developer Guide*.

If a client trusts all servers, the public key is automatically imported as part of the SSL handshake. However, for a client to validate a server's public key, the .truststore file must be manually copied from the server.

For more information on SSL sockets and BQL, such as the architecture and negotiation process, refer to the *Cisco Prime Network Integration Developer Guide*.

Oracle Database Connections

Prime Network is connected to the database using an Oracle encryption feature. All client-to-database connections are encrypted. Server-to-database connections are encrypted if are using an embedded Oracle database; otherwise, they are not.

To encrypt the database schemas, see Encrypting the External Oracle Database Schemas, page 11-5.

Device Connections

In Prime Network, *protocol collectors* are the components responsible for actively polling devices and transporting information between devices and the Prime Network gateway. Protocols collectors are part of the instrumentation layer of Prime Network VNEs. A device has a collector for each protocol it supports, such as one collector for SSH and another collector for SNMP. Each collector contains the necessary logic for its specific protocol.

The security of device communication is maintained by specifying SSH and SNMPv3 authentication and encryption methods when you create the VNE.

If there is a firewall between device and a GUI client, all attempted Telnet connections to the device will fail. The Prime Network Administration GUI client provides a device proxy feature that, when enabled, routes connections from the client through the gateway server and units, as required, to reach the device. Supported connections are Telnet, Ping, and SSH. When it is enabled, dedicated SSH connections are used between the gateway and the unit. For information on how to configure this feature, see Managing Configurations with Firewalls (Device Proxy), page 3-24.

For information on the security methods supported by each protocol (and how to change the SSHv2 settings not available from the VNE properties dialog), see Securing Device Connections: SSH and SNMPv3, page 11-6.

Encrypting the External Oracle Database Schemas

An external Oracle database can be connected to a gateway or unit. To encrypt the connection between the external Oracle database and the gateway or unit, use this procedure.

Note This procedure requires a Oracle database restart. You do not have to restart the gateway or unit (for unit-to-database connections).

Step 1 Make sure the values you set comply with the values set on the Oracle database server.

Step 2 Choose **Tools** > **Registry Controller** > **System Security**.

Step 3 Set the encryption setting level for each schema.

a. Select **Database Schema Encryption**. The following schemas are listed and are editable using the Registry Controller.

db_schema	Description	Default Encryption Level
ep	Event Archive (event persistence and archiving)	required
xmp	Change and Configuration Management, Compliance Manager, and Command Manager	rejected
admin	Oracle Database maintenance	required
ep_rep	Reports data based on Event Archive schema	required

b. Choose the encryption level for each schema. The supported levels are listed below in order of increasing security. (For details about what these values mean, see your Oracle documentation.)

value	Description
rejected	Do not enable the security service on the gateway, even if it is required by the Oracle side.
accepted	Enable the security service on the gateway if it is required or requested by the Oracle side.
requested	Enable the security service on the gateway if the Oracle side permits it.
required	Security service must be enabled on both the gateway and the Oracle side.

c. Verify your changes to ensure you want to overwrite the current registry settings because after you click Apply, you cannot retrieve your settings using the Restore button.

d. Click **Apply** to save your changes.

Step 4 Set the algorithms the connections can use (from **Tools > Registry Controller > System Security**).

a. Select **Algorithms**.

b. Edit the comma-separated list to add or remove MAC, key exchange, host key, and ciphers that the connections can use. All supported algorithms are listed in the window in parentheses.

c. Verify your changes to ensure you want to overwrite the current registry settings because after you click Apply, you cannot retrieve your settings using the Restore button.

d. Click **Apply** to save your changes.

Step 5 Restart the external Oracle database. You do not have to restart the gateway.

For more information on the Oracle database schemas, see Overview of the Prime Network Oracle Database and Schemas, page 8-1.

Securing Device Connections: SSH and SNMPv3

In Prime Network, *protocol collectors* are the components responsible for actively polling devices and transporting information between devices and the Prime Network gateway. Protocols collectors are part of the instrumentation layer of Prime Network VNEs. A device has a collector for each protocol it supports, such as one collector for SSH and another collector for SNMP. Each collector contains the necessary logic for its specific protocol.

The security of device communication is maintained by specifying SSH and SNMPv3 authentication and encryption methods when you create the VNE. Table 11-1 summarizes the security methods that are supported by each protocol.

Table 11-1 Device Communication Security Features in SSHv1, SSHv2, and SNMPv3

Protocol	Supported Security Feature for Device Communication
SSHv1	Encryption ciphers: DES, 3DES, Blowfish
SSHv2	Client Authentication: password, public keys Server Authentication Method: none, save-first-auth, preconfigured Server Authentication Key: fingerprint or public key (not used if **none** is chosen for server authentication method) Key exchange: DH-group1-sha1, DH-group1-exchange-sha1 MAC algorithm: SHA1, MD5, SHA1-96, MD5-96 Ciphers: 3DES, AES-128, AES-192, AES-256, Blowfish, Arcfour Host Key Algorithm: DSA, RSA
SNMPv3	Authentication settings: NoAuthPriv (authentication without encryption), AuthPriv (authentication and encryption) Ciphers: DES, AES128, AES192, AES256 Encryption algorithms: MD5, SHA **Note** The use of SNMP V3 with AES192 or AES256 might be subject to import restrictions on cryptography key strength in some countries. Therefore, if you want to use these combinations, please open a TAC case.

The settings in Table 11-1 can be controlled from Prime Network Administration, as described in Telnet/SSH VNE Properties Reference, page D-6. The exceptions are the SSHv2 key exchange algorithm, MAC algorithms, ciphers, and host key algorithms, which you can only change by editing the registry. By default, all of the SSHv2 algorithm settings in Table 11-2 are supported.

Note All changes to the registry should only be carried out with the support of Cisco. For details, contact your Cisco account representative. Manually editing the SSHv2 connection properties can cause the connection between the VNE (client) and device (server) to fail. Change these settings only if you are familiar with their functionality.

Table 11-2 Registry Settings for SSHv2 Communication Between Device and VNE

Registry Entry	Description	Default Value
mac-alg	Allow MAC algorithms	sha1,md5,sha1-96,md5-96,
keys-exchange-alg	Allow Key exchange algorithms	diffie-hellman-group1-sha1,diffie-hellman-group1-exchange-sha1,
host-key-alg	Allowed host key algorithms	dsa,rsa,
encryption-alg	Allowed encryption (ciphers) algorithms	3des,aes-128,aes-192,aes-256,blowfish,arcfour

The following procedure shows how to check and change your current settings.

Step 1 Log into the gateway as *pnuser* and change to the Main directory.

```
# cd $ANAHOME/Main
```

Step 2 Issue the following command to check the current default SSHv2 security settings for VNE and device communication:

```
# ./runRegTool.sh -gs 127.0.0.1 get 127.0.0.1
"agentdefaults/da/ip_default/protocols/telnet/connection/algorithms"
<key name="algorithms">
    <entry name="mac-alg">sha1,md5,sha1-96,md5-96,</entry>
    <entry
name="keys-exchange-alg">diffie-hellman-group1-sha1,diffie-hellman-group1-exchange-sha1
,</entry>
    <entry name="host-key-alg">dsa,rsa,</entry>
    <entry name="encryption-alg">3des,aes-128,aes-192,aes-256,</entry>
</key>
```

For example, the following command overwrites the encryption (ciphers) algorithms so that 3DES is no longer allowed for any newly-created VNEs:

Note Each algorithm type should have at least one algorithm entry (supported algorithm).

```
# ./runRegTool.sh -gs 127.0.0.1 set 0.0.0.0
"site/agentdefaults/da/ip_default/protocols/telnet/connection/algorithms/encryption-alg
" "aes-128,aes-192,aes-256,”
```

Step 3 Restart the AVM by right-clicking it and choosing **Actions > Stop**, then **Actions > Start**.

Changing Default Password in SSL Key Store

Step 1 Login as a Prime user.

Step 2 Navigate to the file location:

```
$ANAHOME/Main/resourcebundle/com/sheer/security.properties
```

Step 3 Open the **security.properties file** in an editor and change the **SSLpassword** parameter value from the default value to the required value:

```
For example,SSLPassword=abc@123#
```

Step 4 Navigate to the command scripts location:

```
$ANAHOME/Main/scripts
```

Step 5 Run the following SSL key command:

```
ANAHOME/Main/scripts#./createSSLKeys.cmd
```

Step 6 Restart the Prime Network gateway using the following command:

```
networkctl restart
```

Step 7 If you have a Prime Network Unit, restart the unit using the following command as a Prime user:

```
networkctl restart
```

Registry Security

The Golden Source registry is the master registry responsible for maintaining, distributing, and updating registry configuration files to all Prime Network units and the Prime Network gateway. The master copy of the Golden Source files is centrally located on the gateway server at:

NETWORKHOME/Main/registry/ConfigurationFiles

Credentials data is encrypted. This includes the SNMP, Telnet, and SSH credentials for VNEs, and the Oracle database password. Sections that are encrypted are marked with an ENCRYPTED_ENTRY_AES prefix.

Changing System Passwords (Oracle Database, Graphs Tool, root, bos* Users)

These topics explain how to change system-level passwords:

- Changing Password for bosenable, bosconfig, and bosusrmanager, and root, page 11-9
- Changing Password for Oracle Database Schemas, page 11-10
- Changing Password for Monitoring (Graphs) Tool, page 11-12

For information on managing individual user passwords, see Managing User Accounts and Authentication, page 7-1.

Changing Password for bosenable, bosconfig, and bosusrmanager, and root

The passwords for bosenable, bosconfig, bosusermanager, and root are established during the Prime Network installation. Use the following to change the bos passwords.

To change the root password, you can use Configuring E-Mail Notification Address in Global Report Settings, page 7-9. If you have lost the root password, you can use this procedure to reset it.

Step 1 Log into the gateway as *pnuser* and change to the Main directory:

```
# cd $ANAHOME/Main
```

Step 2 Encrypt the new password in Prime Network using the following command:

java -classpath ./jars/classes.jar com.sheer.metromission.authentication2.PasswordEncrypt *password*

The encrypted password is listed in the command output (after the comma). You will need this information in Step 3.

For example, the following command creates a new password for **test**.

```
# java -classpath ./jars/classes.jar
com.sheer.metromission.authentication2.PasswordEncrypt test
```

The command returns the following output. The portion of the output that is in **bold** is what you will need in the subsequent step.

```
'test' -> 'PEv1:DC57A2A7', '7E84D3A8F60F30B7B62946D532E24608'
```

Step 3 Log into the Oracle database and change the password for bosenable, bosconfig, bosusermanager, and root in the database.

a. Log into the Oracle database as *pnuser*. In the following example, *pnuser* is **pn41** and the *pnuser* password is **admin**.

```
sqplplus pn41/admin
```

b. Change the password using the following command, where *xxx* is the second string of output from Step 2, and *user* is **bosenable**, **bosconfig**, **bosusermanager** or **root**. In this example, the bosenable password is being changed:

update bosuser set ENCRYPTEDPASSWORD='xxx' where username='bosenable';

For example:

```
SQL> update bosuser set ENCRYPTEDPASSWORD='7E84D3A8F60F30B7B62946D532E24608' where
username='bosenable';
1 row updated.
```

To update the **root** user password, you would use the following command:

update bosuser set ENCRYPTEDPASSWORD='xxx' where username='root';

c. Commit the change:

```
SQL> commit;
Commit complete.
```

d. Repeat Step b and Step c for bosconfig and bosusermanager.

Changing Password for Oracle Database Schemas

By default, an operating system account for the Prime Network application is created when Prime Network is installed. When the Oracle database is created, it uses this operating system account name as the basis for naming the schemas. The following are the Oracle database schemas that are created by Prime Network. As an example, in the following table the Prime Network operating system account (*pnuser*) is named **pn41**. (For more details about these schemas, see Overview of the Prime Network Oracle Database and Schemas, page 8-1.)

Schema Name	Description	Example
pnuser	Prime Network general data	**pn41**
*pnuser*_**ep**	Prime Network Event Archive (event persistence and archiving data)	**pn41_ep**
*pnuser*_**xmp**	Prime Network Change and Configuration Management, Compliance Manager, and Command Manager	**pn41_xmp**
*pnuser*_**admin**	Prime Network maintenance and administration data	**pn41_admin**
*pnuser*_**rep**	Prime Network reports data based on *main* schema	**pn41_rep**
*pnuser*_**ep_rep**	Prime Network reports data based on Event Archive schema	**pn41_ep_rep**

At installation time, the network-conf script assigns the same password to all of the schemas. After installation, you can assign different passwords to each schema. The following procedure describes how to change any or all of the passwords. Note that you have to change the password in two places: in the Oracle software and in the Prime Network software.

In the following procedure, *pnuser-DB*, *pnuser-EP-DB*, *pnuser-DWE-DB*, *pnuser-admin-DB*, and *pnuser-XMP-DB* are the user accounts for the four Oracle database schemas.

Step 1 Log into the Prime Network gateway server as *pnuser*.

Step 2 To change the *pnuser-DB* password (for the general data):

a. Enter the following sqlplus command to change the *pnuser-DB* password in the Oracle software:

sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql *DBA-username DBA-password pnuser-DB pnuser-DB-new-password DB-IP DB-port SID*

For example:

```
# sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql system systempassword pn41
pn41newDBpassword 127.0.0.1 1521 MCDB
```

b. Enter the following to change the *pnuser-DB* password in the Prime Network software (the gateway server must be up and running):

```
# cd $ANAHOME/Main
# ./runRegTool.sh -gs 127.0.0.1 setEncrypted 0.0.0.0
"site/persistency/nodes/main/PASS" pnuser-DB-new-password
```

Step 3 To change the *pnuser-EP-DB* password (for the event persistence and archiving data):

a. Enter the following sqlplus command to change the *pnuser-EP-DB* password in the Oracle software:

sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql *DBA-username DBA-password pnuser-EP-DB pnuser-EP-DB-new-password DB-IP DB-port SID*

For example:

```
# sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql system systempassword pn41_ep
EPnewDBpassword 127.0.0.1 1521 MCDB
```

b. Enter the following to change the *pnuser-EP-DB* password in the Prime Network software (the gateway server must be up and running):

```
# cd $ANAHOME/Main
# ./runRegTool.sh -gs 127.0.0.1 setEncrypted 0.0.0.0 "site/persistency/nodes/ep/PASS"
pnuser-EP-DB-new-password
```

Step 4 To change the *pnuser-admin-DB* password (for administration and maintenance data):

a. Enter the following sqlplus command to change the *pnuser-admin-DB* password in the Oracle software:

sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql *DBA-username DBA-password pnuser-admin-DB pnuser-admin-DB-new-password DB-IP DB-port SID*

For example:

```
# sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql system systempassword
pn41_admin adminnewDBpassword 127.0.0.1 1521 MCDB
```

b. Enter the following to change the *pnuser-admin-DB* password in the Prime Network software (the gateway server must be up and running):

```
# cd $ANAHOME/Main
# ./runRegTool.sh -gs 127.0.0.1 setEncrypted 0.0.0.0
"site/persistency/nodes/admin/PASS" pnuser-admin-DB-new-password
```

Step 5 To change the *pnuser-XMP-DB* password (for Change and Configuration Management, Compliance Manager, and Command Manager):

Note The password should not contain ampersand (@) or forward slash (/) characters. If you enter either of these special characters, future installations will fail.

a. Enter the following sqlplus command to change the *pnuser-XMP-DB* password in the Oracle software:

sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql *DBA-username DBA-password pnuser-XMP-DB pnuser-XMP-DB-new-password DB-IP DB-port SID*

For example:

```
# sqlplus /nolog \@$ANAHOME/Main/unix/setPassword.sql system systempassword pn41_xmp
pn41XMPnewDBpassword 127.0.0.1 1521 MCDB
```

b. Enter the following to change the *pnuser-XMP-DB* password in the Prime Network software:

```
# cd $XMP_HOME/bin
# xmpchangepw.ksh pnuser-XMP-DB-old-password pnuser-XMP-DB-new-password
```

Step 6 Stop the gateway server and units:

```
# cd $ANAHOME/Main
# networkctl stop
```

Step 7 Run the **unlock** command to ensure that the Prime Network Oracle accounts are not locked. A lock can happen if Prime Network accesses the Oracle database (which it does constantly) between the time when you run the sqlplus **setpassword.sql** command and the time when you run the **runRegTool.sh** or **xmpchangepw.ksh** scripts. In that period of time, the passwords are not in sync.

a. As the Oracle UNIX user, log into sqlplus:

```
# sqlplus /nolog
SQL> connect /as sysdba
```

b. Run the unlock command. You need only run the unlock command on accounts that were changed—in other words, in the following command, *account-name* can be *pnuser*, *pnuser-EP-DB*, *pnuser-DWE-DB*, or *pnuser-XMP-DB* from the previous steps.

```
SQL> alter user account-name account unlock
```

Step 8 Start the gateway server and units:

```
# cd $ANAHOME/Main
# networkctl start
```

Changing Password for Monitoring (Graphs) Tool

The username and password for the Monitoring Tool (described in Using the Monitoring (Graphs) Tool (Examples), page 3-39) is established during the Prime Network installation.

To change the passwords:

Step 1 Log into the Prime Network gateway as *pnuser* and change to the Main directory:

```
# cd $ANAHOME
```

Step 2 Change the username and password for the Diagnostics tool using the following command:

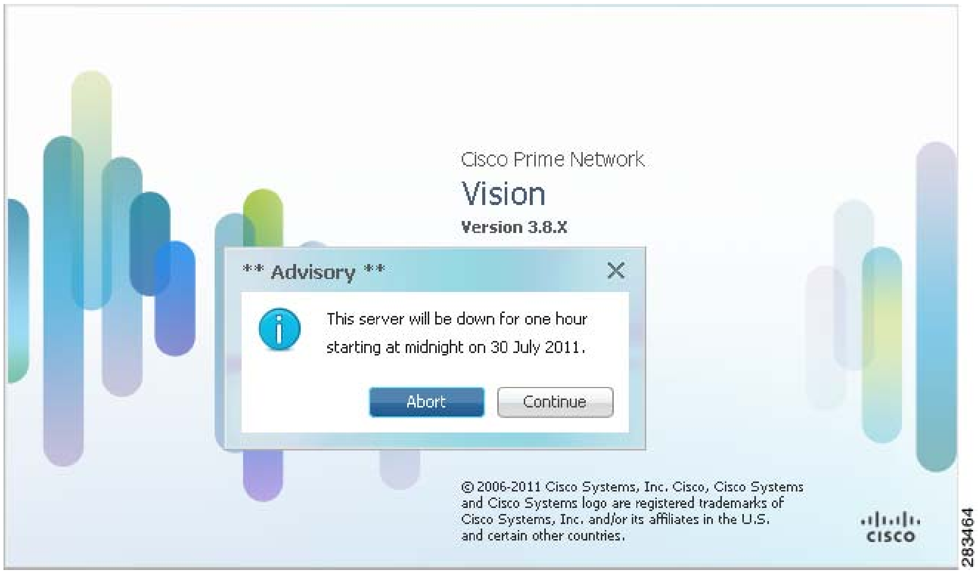
```
# utils/operating-system/apache/bin/htpasswd ./Main/webroot/.passwd new-username
```

The utility will prompt you for a new password for *new-username*.

Creating a GUI Client Banner Message

Prime Network Administration enables you to define a Message of the Day, or banner, that is displayed when a user logs into any client application. The user must accept the message before logging in. If the user does not accept the message, the user cannot log in. The message supports HTML format. Figure 11-3 provides an example.

Figure 11-3 Message of the Day Example



This server will be down for one hour starting at midnight on 30 July 2011.

Cisco Prime Network
Vision
Version 3.8.X
** Advisory **
Abort
Continue
© 2006-2011 Cisco Systems, Inc. Cisco, Cisco Systems and Cisco Systems logo are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the U.S. and certain other countries.
cisco
283464

The message can be changed as required. However, only one message is applied at a time.

To create a message of the day:

Step 1 Choose **Global Settings > Message of the Day**. The Title and Message fields appear in the content area.

Step 2 In the Title field, enter a title for the message.

Step 3 In the Message field, enter the text that is to appear when users log in.

Because the Abort and Continue buttons are displayed in the message dialog box by default, you should phrase the message in terms of these buttons. For example, “Do you accept the terms of use in the Product License Agreement? Click **Continue** to proceed or click **Abort** to cancel.”

Step 4 Click **Save**. A confirmation message is displayed.

Step 5 Click **OK**. The message is displayed when a user logs into any client application.

To delete a message of the day, edit the message so that the Title and Message field is empty, and click **Save**.

Tracking Security-Related Events

The following table provides ways you can get historical information on issues related security.

For historical events related to:	See:
Events related to security and passwords	AVM and other appropriate log files (see Log Files Reference, page C-3) Detailed Security events report (**Reports > Run Report > Events Reports** > **Detailed Non-Network Events** > **Security Events**) Detailed System events report (**Reports > Run Report > Events Reports** > **Detailed Non-Network Events** > **System Events**)