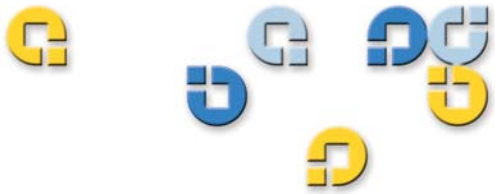
Quantum



User's Guide User's Guide User's Guide User's Guide User's Guide

Quantum Encryption Key Manager

Scalar i3/i6 Tape Libraries

6-01847-02

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Preface

Audience

This book is intended for storage and security administrators responsible for security and backup of vital data, and anyone assisting in the setup and maintenance of Quantum Encryption Key Manager (Q-EKM) servers in the operating environment. It assumes the reader has a working knowledge of storage devices and networks.

Purpose

This book contains information to help you use the Q-EKM component for the Java™ platform. It includes concepts and procedures pertaining to:

- Encryption on the IBM LTO-4 and LTO-5 tape drives
- Cryptographic keys
- Digital certificates

Document Organization

This document is organized as follows:

- Chapter 1, Overview, provides an overview of tape encryption and the Quantum Encryption Key Manager (Q-EKM) components.
- Chapter 2, Planning Your Q-EKM Environment, provides the information you need and the factors you should consider when determining the best configuration for your Q-EKM environment.
- Chapter 3, Tips for Success, provides tips for maintaining successful Q-EKM operations and recovery in case of server failure.
- Chapter 4, Upgrading Q-EKM, provides instructions for upgrading your Q-EKM software.
- Chapter 5, Q-EKM Server Operation and Configuration, provides operational procedures for using Q-EKM.
- Chapter 6, Sharing Encrypted Tapes – Import/Export Operations, provides instructions on how to share encrypted tapes with different sites, including importing and exporting public certificates and encryption keys.
- Chapter 7, Running Reports, describes several reports you can run from the Q-EKM interface.
- Chapter 8, Troubleshooting, provides troubleshooting procedures for common Q-EKM issues.
- Appendix A, Setting the System Path Variable in Windows, tells you how to set the system path so you can enter Q-EKM commands from the command line without changing the directory to the Q-EKM directory.

This document concludes with a glossary and an index.

Notational Conventions

This manual uses the following conventions:

Note: Notes emphasize important information related to the main topic.

Caution: Cautions indicate potential hazards to equipment and are included to prevent damage to equipment.

Warning: Warnings indicate potential hazards to personal safety and are included to prevent injury.

This manual also uses the following conventions:

Convention	Usage
bold	**Bold** words or characters represent system elements that you must use literally, such as command names, file names, flag names, path names, and selected menu options.
Arial regular text	Examples, text specified by the user, and information that the system displays appear in Arial regular font.
italic	*Italicized* words or characters represent variable values that you must supply.
[item]	Indicates optional items.
{item}	Encloses a list from which you must choose an item in format and syntax descriptions.
|	A vertical bar separates items in a list of choices.
<key>	Indicates keys you press.

Related Documents

The following publications provide information related to encryption on Scalar® libraries:

Document No.	Document Title
6-01210-xx	*Scalar i500 User's Guide*
6-00421-xx	*Scalar i2000 User's Guide*
6-66879-xx	*Scalar i6000 User's Guide*

Refer to the appropriate product manuals for information about your tape drive and cartridges.

Contacts

Quantum company contacts are listed below.

Quantum Corporate Headquarters

To order documentation on Quantum Encryption Key Manager or other products contact:

Quantum Corporation (Corporate Headquarters)
1650 Technology Drive, Suite 700
San Jose, CA 95110-1382

Technical Publications

To comment on existing documentation send an e-mail to:

doc-comments@quantum.com

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Chapter 1

Overview

Data is one of the most highly valued resources in a competitive business environment. Protecting that data, controlling access to it, and verifying its authenticity while maintaining its availability are priorities in our security-conscious world. Data encryption is a tool that answers many of these needs.

IBM LTO-4 and LTO-5 Fibre Channel and SAS tape drives are capable of encrypting data as it is written to compatible data cartridges. Encryption is performed at full line speed in the tape drive after compression. (Compression is more efficiently done before encryption.) This new capability adds a strong measure of security to stored data without the processing overhead and performance degradation associated with encryption performed on the server or the expense of a dedicated appliance.

This chapter covers:

Library Managed Encryption

The library managed tape drive encryption solution is composed of the following elements:

- Encryption-Enabled Tape Drive
- Quantum Encryption Key Management (Q-EKM)
- Encryption-Enabled Tape Library

Encryption-Enabled Tape Drive

IBM LTO-4 and LTO-5 Fibre Channel and SAS tape drives are *encryption-capable*. This means that they are functionally capable of performing hardware encryption, but this capability has not yet been activated. In order to perform hardware encryption, the tape drives must be *encryption-enabled*. They can be encryption enabled via the tape library.

SCSI IBM LTO-4 tape drives are *encryption aware* (they can load and handle encrypted LTO-4 cartridges, but cannot process encryption operations).

See Supported Libraries and Tape Drives on page 10 for a list of which tape drives are supported by your library.

Quantum Encryption Key Management (Q-EKM)

Encryption involves the use of several kinds of keys. How these keys are generated, maintained, controlled, and transmitted depends upon the operating environment where the encrypting tape drive is installed. Some host applications are capable of performing key management. For environments without such applications or those where application agnostic encryption is desired, Quantum provides the Quantum Encryption Key Manager (Q-EKM) component for the Java platform to perform all necessary key management tasks. Managing Encryption With Q-EKM on page 3 describes these tasks in more detail.

Encryption-Enabled Tape Library

On an encryption-enabled library, tape encryption occurs automatically and transparently. The library communicates with the EKM server to obtain encryption keys for the drives to read from or write to encrypted data to the tapes.

Library managed encryption is provided for IBM LTO-4 and LTO-5 tape drives in a Quantum Scalar tape libraries (see Supported Libraries and Tape Drives on page 10).

Managing Encryption With Q-EKM

Quantum Encryption Key Manager (Q-EKM) generates, protects, stores, and maintains data encryption keys that are used to encrypt information being written to, and decrypt information being read from, tape media (tape and cartridge formats).

Q-EKM uses a keystore to hold JCEKS keys and certificates required for all encryption tasks.

Q-EKM acts as a process awaiting key generation or key retrieval requests sent to it through a TCP/IP communication path between Q-EKM and the tape library.

When a tape drive writes encrypted data, it first requests an encryption key from Q-EKM.

Upon receipt of the request, Q-EKM retrieves an existing Advanced Encryption Standard (AES) key from a keystore and wraps it for secure transfer to the tape drive, where it is unwrapped upon arrival and used to encrypt the data being written to tape.

When an encrypted tape is read by a tape drive, the tape drive requests, via the library, the required data encryption key from the Q-EKM server. Q-EKM retrieves the required data encryption key from the keystore and securely transfers it to the library, which provides it to the tape drive. The tape drive uses the data encryption key to perform encryption and decryption.

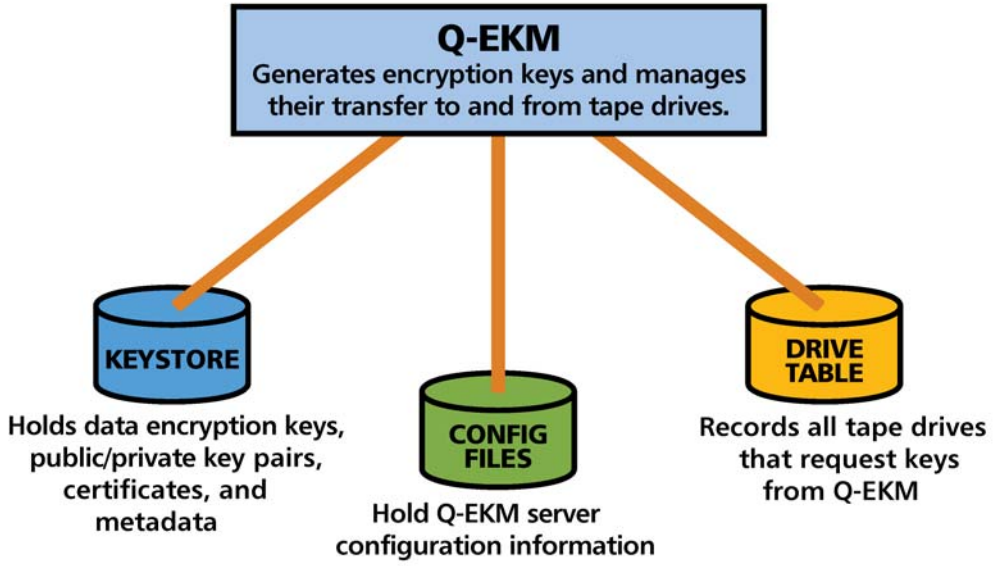
No data encryption key is stored anywhere on the cartridge memory or the tape. Only the name of the data encryption key is stored on the tape, so that in the future the key can be requested for further read or write purposes.

Quantum Encryption Key Manager (Q-EKM) Components

Q-EKM is part of the IBM Java environment and uses the IBM Java Security components for its cryptographic capabilities. Q-EKM has three main components:

- Keystore
- Configuration Files
- Tape Drive Table

Figure 1 Q-EKM Components



Keystore

The keystore is defined as part of the Java Cryptography Extension (JCE) and an element of the Java Security components, which are, in turn, part of the Java runtime environment. Q-EKM supports the JCEKS keystore.

The keystore contains:

- The 1024 data encryption keys generated by the Q-EKM server on which it resides. These keys are used for encrypting and decrypting tapes.
- Data encryption keys that you imported (for example, keys that other companies or individuals sent to you). These keys can be used to decrypt tapes provided by the other parties.
- Your Q-EKM server's native public certificate.
- Public certificates that you imported from other parties. These are used to wrap your data encryption keys for transit to another party to use in decrypting tapes you may have provided to them).
- Public and private keys used for secure communication.
- Metadata (for example, which data encryption keys were used on which tapes).

The keystore file is named **EKMKeys.jck** and is located in the root **QEKM** directory as follows:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Caution: It is impossible to overstate the importance of preserving your keystore data. Without access to your keystore, you will not be able to decrypt your encrypted tapes. Please see Backing Up Keystore and Configuration Data on page 15 and Disaster Recovery Planning on page 16 for information on how to protect your keystore data.

Configuration Files

The configuration files contain the configuration information for your Q-EKM server installatio

The two configuration files are named:

- ClientKeyManagerConfig.properties
- KeyManagerConfig.properties

The configuration files are located in the root **QEKM** directory as follows:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Caution: Do not edit these files. If you make a mistake when altering the configuration files, you could lose access to your keystore and be unable to encrypt or restore data.

Tape Drive Table

The tape drive table is used by Q-EKM to keep track of all the tape drives that have ever requested a key from the Q-EM server. The tape drive table is a non-editable, binary file. Q-EKM automatically adds new/replaced tape drives to the drive table.

Encryption Keys

An encryption key is typically a random string of bits generated specifically to scramble and unscramble data. Encryption keys are created using algorithms designed to ensure that each key is unique and unpredictable. The longer the length of key used, the harder it is to break the encryption code.

The IBM LTO-4 and LTO-5 method of encryption uses 256-bit AES algorithm keys to encrypt data. 256-bit AES is the encryption standard currently recognized and recommended by the U.S. government, which allows three different key lengths. 256-bit keys are the longest allowed by AES.

Q-EKM uses two types of encryption algorithms:

- Symmetric
- Asymmetric

Symmetric, or secret key encryption, uses a single key for both encryption and decryption. Symmetric key encryption is generally used for encrypting large amounts of data in an efficient manner. 256-bit AES keys are symmetric keys.

Asymmetric, or public/private encryption, uses a pair of keys. Data that is encrypted using one key can only be decrypted using the other key in the public/private key pair. When an asymmetric key pair is generated, the public key is typically used to encrypt, and the private key is typically used to decrypt.

Q-EKM uses both symmetric and asymmetric keys—symmetric encryption for high-speed encryption of user or host data, and asymmetric encryption (which is necessarily slower) for protecting the symmetric key.

Upon installation, Q-EKM generates 1024 unique encryption keys.

Encryption Key Processing

In library-managed tape encryption, unencrypted data is sent to the tape drive and converted to ciphertext using a pre-generated symmetric data key from the keystore available to Q-EKM, and is then written to tape.

Q-EKM selects a pre-generated data key in round-robin fashion. Data keys are reused on multiple tape cartridges when all pre-generated data keys have been used at least once.

The data key is sent to the tape drive in encrypted, or *wrapped*, form by Q-EKM. The tape drive unwraps this data key and uses it to perform encryption or decryption. However, no wrapped key is stored anywhere on the tape cartridge.

After the encrypted volume is written, the data key must be accessible, based on the alias or key label, and available to Q-EKM in order for the volume to be read.

Encryption Certificates

Each Q-EKM server pair uses one unique encryption certificate. The encryption certificate contains the public key of the public/private key pair that protects data encryption keys during transit to another site. The destination Q-EKM server provides its public key to the source Q-EKM server as part of its public certificate, which the source Q-EKM server uses to wrap (encrypt) exported data encryption keys for transport. Upon arrival, the file containing the wrapped data encryption keys can only be unwrapped by the corresponding private key, which resides on the destination Q-EKM server and is never shared.

Chapter 2

Planning Your Q-EKM Environment

Use the information in this chapter to determine the best Q-EKM configuration for your needs. Many factors must be considered when you are planning how to set up your encryption strategy. Please review these topics with care.

System Requirements

Server Requirements

Q-EKM server requirements are:

- Xeon-class server.
- Minimum 1 GB memory.
- Minimum 10 GB free hard disk space.

- The Q-EKM server must have IP connectivity through any firewalls to all Quantum libraries using the Q-EKM server to obtain data encryption keys. The Q-EKM firmware uses TCP port 3801 for the Q-EKM server and TCP port 443 for SSL, by default.
- Domain Name System (DNS) must be configured on all Q-EKM servers in order for the servers to communicate successfully.
- The Q-EKM server should be protected and backed up following your data protection practices so that critical keystore data can be quickly restored in the event of a server failure.
- It is strongly recommended that the server(s) you designate for Q-EKM not be running any other programs or have any other files on them, especially .jre or java. If they do, you may have problems with installation.
- On Windows machines, Q-EKM must be installed on the "C" drive only. Make sure your server has a working "C" drive.

Operating System Requirements

Q-EKM runs on:

- Windows Server 2003
- Windows Server 2008
- Red Hat Enterprise Linux 4
- Red Hat Enterprise Linux 5

Supported Libraries and Tape Drives

Q-EKM supports the following libraries and tape drives:

Scalar i500 tape library	IBM LTO-4 (Fibre-Channel and SAS) IBM LTO-5 (Fibre-Channel)
Scalar i2000 tape library	IBM LTO-4 (Fibre-Channel)
Scalar i6000 tape library	IBM LTO-4 (Fibre-Channel) IBM LTO-5 (Fibre-Channel)

Note: In order to use LTO-5 tape drives with Q-EKM, you must be running Q-EKM version 2.0 or higher.

Supported Media

Q-EKM supports IBM LTO-4 and IBM LTO 5 media.

Library Firmware Requirements

It is recommended that you upgrade your library to the latest released version.

Tape Drive Firmware Requirements

It is recommended that you upgrade your tape drive firmware to the latest version qualified with your library firmware.

Linux System Library Requirements

For Linux, the following libraries must be installed on your Q-EKM server:

- **glibc**, version 2.3 or later
- **libstdc++.so5**
- **libXp.so.6**

Using Multiple Q-EKM Servers for Redundancy

Q-EKM is designed to work with tape drives and libraries to allow redundancy, and thus high availability, so you can have up to two Q-EKM server servicing the same tape drives and libraries. Moreover, these Q-EKM servers need not be on the same systems as the tape drives and libraries. The only requirement is that they be available to the libraries through TCP/IP connectivity.

This allows you to have two Q-EKM servers that are mirror images of each other with built-in synchronization as well as a failover in the event that one Q-EKM server becomes unavailable. When you configure your library, you can point it to two Q-EKM servers (primary and secondary). If the primary Q-EKM server becomes unavailable for any reason, the library will use the secondary Q-EKM server.

In order for the secondary server to be used in a failover situation, its keystore must be identical to that of the primary server. Keeping the keystores matched is a manual process (it does not happen automatically). See Keeping the Keystores Matched on page 36.

Q-EKM Server Configurations

Q-EKM can be installed as a Single-Server Configuration or as a Two-Server Configuration.

Single-Server Configuration

A single-server configuration, shown in Figure 2, is the simplest Q-EKM configuration. However, because of the lack of redundancy, it is not recommended. In this configuration, all tape drives rely on a single key manager server with no backup. Should the server go down, the keystore becomes unavailable, making any encrypted tape unreadable (and preventing encrypted writes). In a single-server configuration, you must make sure that current, non-encrypted backup copies of the keystore and configuration files are maintained in a safe place, separate from Q-EKM, so its function can be rebuilt on a replacement server if the server copies are lost.

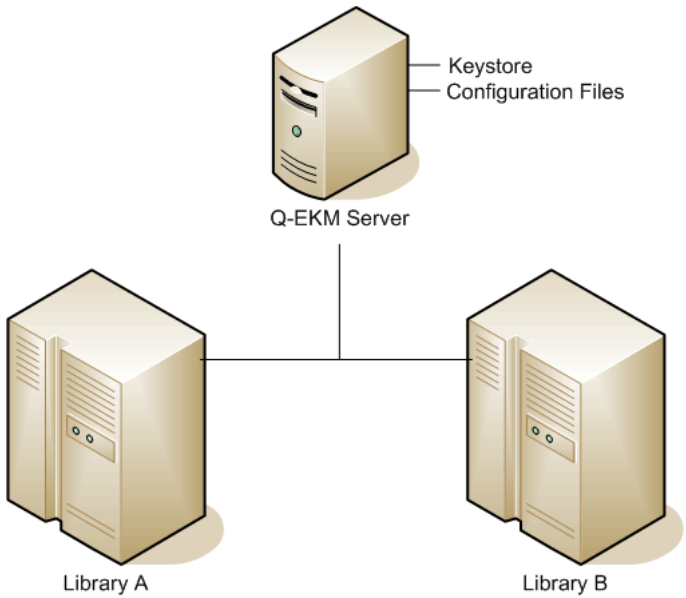
The keystore and configuration files are:

- ClientKeyManagerConfig.properties
- EKMKeys.jck
- KeyManagerConfig.properties
- library_serialnum
- library_wwnamekey
- QEKMIEKey<librarySN>.pk12

The files are all in the root **QEKM** directory located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Figure 2 Single Q-EKM Server



Two-Server Configuration

The recommended two-server configuration allows the library to automatically fail over to the secondary Q-EKM server should the primary Q-EKM server be inaccessible for any reason.

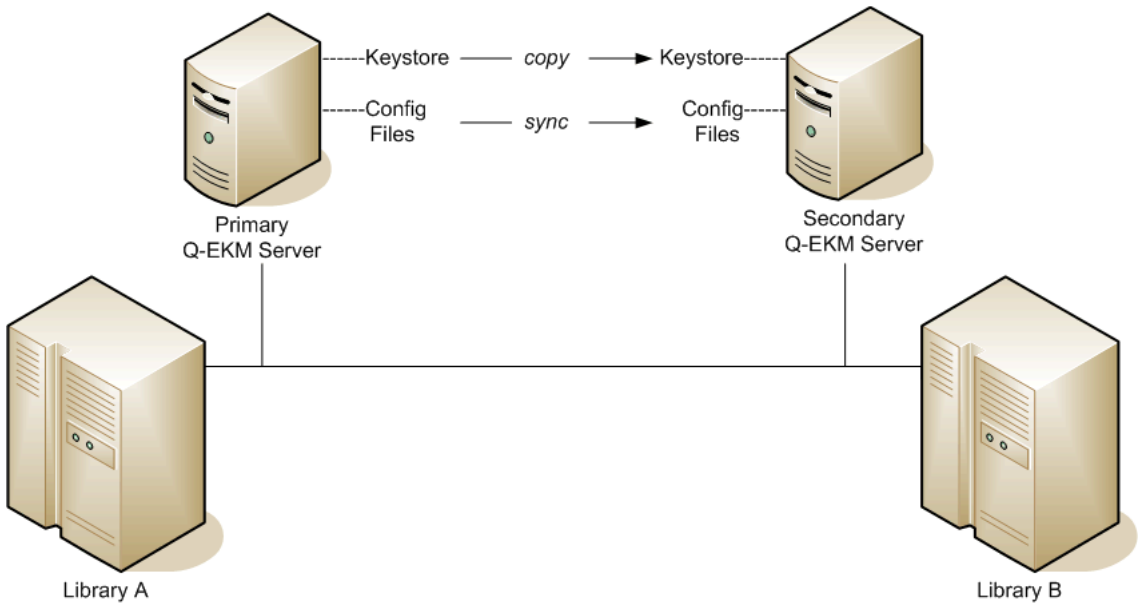
> **Note:** When different Q-EKM servers are used to handle requests from the same set of tape drives, the information in the associated keystores MUST be identical. This is required so that regardless of which Q-EKM server is contacted, the necessary information is available for the Q-EKM server to support requests from the tape drives.

In an environment with two Q-EKM servers, such as those shown in Figure 3, the library will automatically fail over to the secondary Q-EKM server should the primary go down. In such a configuration it is essential that the servers are synchronized and that the two keystores match.

Once synchronization is configured, updates to the configuration files of the primary Q-EKM server are automatically duplicated on the secondary Q-EKM server (see Synchronizing Primary and Secondary Q-EKM Servers on page 33). However, the keystore file is not automatically updated. Any change to the keystore on the primary server (such as

importing certificates and keys) must be manually duplicated on the secondary server (see Keeping the Keystores Matched on page 36).

Figure 3 Two Q-EKM Servers



Multiple Libraries Accessing One Q-EKM Server or Server Pair

Multiple libraries may access and use the same Q-EKM server (in a single-server configuration) or server pair. The only requirement is that the libraries be available to the Q-EKM servers through TCP/IP connectivity. If you want to connect more than one library to an Q-EKM server/pair, keep the following in mind:

- Each library must have its own Encryption Key Management license (see your library user's guide for instructions).

- Each library can only be configured to use one Q-EKM server/pair at a time.
- The ports configured on the library must be set to the same values as the ports on the Q-EKM server (see Changing the Communication Port Settings on page 37 and your library user's guide for details).

Backing Up Keystore and Configuration Data

Due to the critical nature of the keys in the keystore, you should always back up the keystore so that you can recover it, if needed, and be able to read the tapes that were encrypted using certificates imported into the keystore.

Your configuration files are also important to back up so that if your server dies you can reconstruct it exactly as it was configured before.

Use your system backup capabilities to back up the entire **QEKM** directory regularly. The **QEKM** directory is located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Caution: Do not use Q-EKM to encrypt the backups! Back up to clear tape! If you encrypt your backup, and you later lose your keystore, you will not be able to decrypt the tapes to recover your data.

For disaster recovery, see Disaster Recovery Planning on page 16.

Disaster Recovery Planning

Quantum recommends that you plan for disaster recovery in the event that your primary and secondary servers become unavailable.

Disaster recovery requires that you maintain, in a secure location, current, non-Q-EKM encrypted copies of the following files:

- ClientKeyManagerConfig.properties
- EKMKeys.jck
- KeyManagerConfig.properties
- library_serialnum
- library_wwnamekey
- QEKMIEKey<librarySN>.pk12

The files are all in the root **QEKM** directory located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Successful recovery requires the following two things:

- The backed-up files must be current. Any time the keystore or configuration files are changed (i.e., creating, importing, or exporting keys or certificates), you must remember to save a backup. If you back up your files regularly as recommended, this should not be an issue (see Backing Up Keystore and Configuration Data on page 15).
- The backup files must not be encrypted with Q-EKM. If the primary and secondary servers are unavailable, the encrypted files will not be able to be decrypted and reused in the disaster recovery server.

Upon failure of the Q-EKM server, Quantum Support can set up a new "disaster recovery" Q-EKM server or servers to replace the ones that became unavailable.

Chapter 3

Tips for Success

Do these things to ensure optimal performance and successful recovery in case of server loss:

- **Remember your keystore password —** otherwise you can't import and export certificates and keys, or share encrypted tapes with other sites.
- **Remember your Q-EKM admin password —** otherwise you can't log onto Q-EKM Commands or upgrade your system.
- **Save a copy of your keystore and configuration files from your initial install.** Quantum Support will provide these files to you at the install. Quantum recommends you store them securely and don't touch them unless needed. If you lose both your servers and all your backups, these files will allow you to recover. You will not have any imported keys or certificates, but you will have what you need to read and write YOUR tapes, and you can always re-import keys and certificates from others at a future date.
- **Keep the keystores matched.** This is a manual process. In a two-server configuration, any time you update the keystore on one server (by importing public certificates or encryption keys), you must either import the items on the other server or copy the keystore manually from one server to the other. This will allow one server to take over for the other in a failover scenario.
- **Make sure your servers are synchronized.** For two-server configurations, Quantum Support will set up synchronization at initial install. This keeps your configuration files the same. This is important for communication between the paired servers and between the servers and the library.

- **Back up your keystore and configuration files regularly.** In case of catastrophic server failure, a current backup will allow you to start up again immediately right where you left off.

Chapter 4

Upgrading Q-EKM

Upgrading updates the Q-EKM software to the latest version, preserving your keystore and configuration settings.

Note: If you have a Q-EKM server pair, you should upgrade both Q-EKM servers in the pair. You may upgrade them at the same time or with time in between upgrades. The order of the steps presented here is for upgrading servers with time between upgrades. If you upgrade the servers at the same time, or with little time in between upgrades, you can avoid the having to turn library partitions offline and online twice by performing Step 2 before upgrading either server and performing Step 14 after both servers are upgraded. Library partitions must be offline during the upgrade, and all host communication to the Q-EKM server must be stopped, so this may or may not be practical for your situation.

Note: If you need to downgrade your Q-EKM system (meaning, go to a lower version), this requires a Service installation. Contact Quantum Support to schedule an appointment.

1. Stop all host I/O communication to the Q-EKM server.
2. On all libraries that access the Q-EKM server, make the following configuration changes (see your library user's guide or online help for instructions):
   a. If automatic EKM path diagnostics is enabled, disable it.
   b. For all partitions configured for library managed encryption, make sure all move operations are completed.
   c. Turn all partitions configured for library managed encryption **offline**.
3. Determine which version of Q-EKM software is currently installed. If you don't know, then open a command window and type **versionQEKMServer** at the command prompt (in Windows you must be in the c:\Program Files\Quantum\QEKM directory). This command works if you are running the initial version of code (2.1_007). If the command fails, follow the instructions in Displaying the Q-EKM Software Version on page 30.
4. Manually stop the Q-EKM server process as follows:

If your currently installed version is...	Do this...
2.1_007	Enter **stopQEKMServer** at the command prompt.
250Q.GC01400 or greater:	Follow the instructions in Stopping the Q-EKM Server Process on page 30.

5 Insert the upgrade CD into your Q-EKM server's CD ROM drive. If the CD does not autorun, do the following:

Windows	Do one of the following: • Navigate to the CD directory and double-click the file named **installWindows.bat**; or • Open a command window. Change the directory to the root directory on the CD. At the command prompt, enter **installWindows.bat**.
Linux	Open a command window. Change the directory to the Q-EKM CD directory. At the command prompt, enter **sh installLinux.sh**.

The installation process checks for currently installed versions of Q-EKM.

6 **Possible Step:** If a previously installed version of Q-EKM is detected and you did not accept the End User License Agreement (EULA) in the previous version, you must do so now. If the EULA does not display, then skip this step.

a Read the EULA. Press **<Enter>** repeatedly to scroll through the EULA.

When the EULA ends, you are asked if you accept the EULA.

b Accept the End User License Agreement by pressing **y** and **<Enter>**.

7 If a previously installed version of Q-EKM is detected, the screen displays three choices:

- **r**) Remove/uninstall current Q-EKM server version x.
- **u**) Upgrade Q-EKM server to version y.
- **q**) Quit.

8 Enter **u** to upgrade.

Caution: Do **NOT** choose remove/uninstall! This will delete your keystore and configuration files! If you accidentally remove/uninstall Q-EKM, contact Quantum Support.

9. If the Q-EKM server is running, you are prompted for the Q-EKM admin password. Enter the password (see Q-EKM Admin Password on page 25). If the Q-EKM server is not running, no password is requested.

   The Q-EKM server process confirms it is stopped.

10. When prompted, press **<Enter>**.

    The old JRE is removed and a new one is installed. This may take a few minutes. The Q-EKM server process restarts. When the upgrade process is complete, you are prompted to press **<Enter>**.

11. When prompted, press **<Enter>**.

    The command window may close.

12. Log on to Q-EKM Commands to verify the new version is installed (the version displays at the top of the command menu). See Logging On to Q-EKM Commands on page 27 for instructions.

13. Verify the Q-EKM server process started by doing one of the following:

    - Issue the **Display the Q-EKM server status** command (see Displaying the Q-EKM Server On/Off Status on page 30), or
    - Check the **native_stdout.log** file (located in the **keymanager** folder in the **QEKM** directory; see Standard Out Messages Log on page 66).

14. On all libraries that access the Q-EKM server, make the following configuration changes (see your library user's guide or online help for instructions):

    a. If you disabled automatic EKM path diagnostics earlier, then re-enable it.

    b. Turn all partitions configured for library managed encryption **online**.

15. Resume host I/O communication to the Q-EKM server.

16. Repeat this process on the other Q-EKM server in the Q-EKM server pair.

17. Run EKM Path Diagnostics to verify both Q-EKM servers and the library are connected and working together as they should (see your library user's guide or online help for instructions).

18 Make a copy of the keystore and configuration files and store these in a secure location. If you were to ever lose your servers, you could recover with this backup. (It is preferable to use a current backup [see Backing Up Keystore and Configuration Data on page 15], but you should keep this also in a secure location in case nothing else exists.) Do NOT use Q-EKM to encrypt this backup!

The files you need to copy are:

- ClientKeyManagerConfig.properties
- EKMKeys.jck
- KeyManagerConfig.properties
- library_serialnum
- library_wwnamekey
- QEKMIEKey<librarySN>.pk12

The files are all in the root **QEKM** folder located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Chapter 5

Q-EKM Server Operation and Configuration

This chapter details the Q-EKM passwords you will use and the commands available to customers via the command line interface. Topics include:

Overview

Once installed, Q-EKM performs all of its operations from a single folder on your server. The folder is called QEKM and is located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

This folder contains log files, your keystore, and configuration files.

To access the Q-EKM user interface to perform operations, you need to log into the Q-EKM commands menu (see Logging On to Q-EKM Commands on page 27).

Using and Changing Passwords

There are two different passwords you use with Q-EKM. They are:

- Q-EKM Admin Password
- Keystore Password

Q-EKM Admin Password

You use the Q-EKM admin password to enter the Q-EKM commands menu. The default Q-EKM admin password is **changeME**. Customers can change this password (see Changing the Q-EKM Admin Password on page 26)

The Q-EKM admin password is case sensitive, can contain a maximum of 24 characters, and can contain any combination of letters, numbers, and special characters.

> **Note:** Not all special characters are supported (for example, the "at" symbol [@] and asterisk [*] are not supported). If you get a message stating "invalid password," one of your special characters may not be supported.

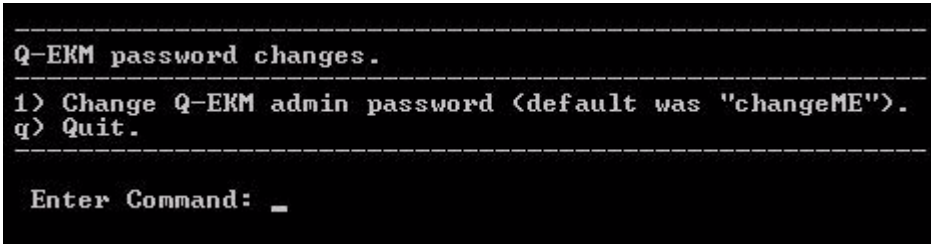
Changing the Q-EKM Admin Password

> **Caution:** It is **CRITICAL** that you remember the Q-EKM admin password! Without it, you will not be able to issue any Q-EKM commands.

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **4** (for **Change passwords)**.

   The Q-EKM password change menu displays (see Figure 4).

Figure 4 Password Changes Menu



3. Enter **1** (for **Change the Q-EKM admin password**).
4. Enter the new Q-EKM admin password.
5. Re-enter the new Q-EKM admin password.
6. Press **<Enter>** to return to the command menu.

Keystore Password

The keystore password allows you to add, import, and export keys or certificates to your Q-EKM server's native keystore (**EKMkeys.jck)**.

You set up the keystore password at the initial Q-EKM server installation. Q-EKM does not currently provide a way to change the keystore password.

The keystore password is case sensitive, must contain a minimum of 6 characters and a maximum of 24 characters, and can contain any combination of letters, numbers, and special characters.

Note: Not all special characters are supported (for example, the "at" symbol [@] and asterisk [*] are not supported). If you get a message stating "invalid password," one of your special characters may not be supported.

Encryption and decryption of tapes will still occur if you forget the password, but if you want to read encrypted tapes provided by another organization or company, of if you want to enable other organizations or companies to read your encrypted tapes, you will need to import and export keystore information, which you cannot do without the keystore password.

Caution: **REMEMBER THE PASSWORD!** If you forget the password, neither you nor Quantum will be able to recover it. You will not be able to import or export keys and certificates or share encrypted tapes.

Changing the Native Keystore Password

This feature is not currently implemented.

Logging On to Q-EKM Commands

Q-EKM provides a menu of commands to use.

Note: It is recommended that only one person be logged on to Q-EKM Commands at one time.

To log on:

1. Open a command window.

2 Navigate to the correct directory:

Windows	**C:\Program Files\Quantum\QEKM** (Alternatively, you may choose to update your Windows system path variable — see Appendix A, Setting the System Path Variable in Windows.)
Linux	**/opt/Quantum/QEKM**

3 Enter the following command to access the command menu:

Windows	**qekmcmds**
Linux	**./qekmcmds**

4 Enter the Q-EKM admin password (see Q-EKM Admin Password on page 25).

The list of commands displays (see Figure 5 on page 29).

Figure 5 Q-EKM Commands Menu

Q-EKM Server Commands

Q-EKM commands are presented in a menu format. For instructions on accessing these commands, see Logging On to Q-EKM Commands on page 27.

Caution: Any commands that change configuration settings will shut down and then restart the Q-EKM server process. Do not perform such commands if backup operations are in process.

Displaying the Q-EKM Software Version

The Q-EKM software version is displayed in the first line of the Q-EKM commands menu (see Logging On to Q-EKM Commands on page 27).

You can also find the software version listed in the **qekm_version** file located in the **QEKM** directory:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Displaying the Q-EKM Server On/Off Status

Displays whether Q-EKM server is running or stopped.

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **1**. You receive one of the following two responses:
   - If the Q-EKM server is running, you receive confirmation that looks similar to the following:

     Server is running. TCP port: 3801, SSL port: 443
   - If the Q-EKM server is not running, you receive the following:

     EKM server cannot be reached. It appears to be stopped.
3. Press **<Enter>** to return to the command menu.

Stopping the Q-EKM Server Process

Stops the Q-EKM server process.

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **2.**

   The server shuts down and you receive confirmation that looks similar to the following:

   EKMServer: shut down complete.
3. Press **<Enter>** to return to the command menu.

Starting the Q-EKM Server Process

Starts the Q-EKM server process.

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).

2 At the Enter Command prompt, enter **3.**

You receive the following message:

```
Starting EKM Server...
Please check the logs to make sure EKM Server has started
successfully.
```

3 Press **<Enter>** to return to the command menu.

4 Verify the Q-EKM server process started by doing one of the following:

- Issue the **Display the Q-EKM server status** command (see Displaying the Q-EKM Server On/Off Status on page 30), or
- Check the **native_stdout.log** file (located in the **keymanager** folder in the **QEKM** directory; see Standard Out Messages Log on page 66).

Turning Debug Logging On and Off

The debug log is named **debug_server** and is located here:

Windows	c:\Program Files\Quantum\QEKM\keymanager
Linux	/opt/Quantum/QEKM/keymanager

The debug log captures a record of everything the Q-EKM server does. The debug log does not collect information unless debug is turned on. This file will continue to grow as long as debug logging is turned on. The file can grow very quickly. When debug logging is turned off, the log captures no data.

Debug logging is turned off by default in order to prevent the debug log file from becoming too large and overwhelming the system. If you have a problem that requires assistance from Quantum Support, you will may

be asked to turn debug logging on and then re-create the problem in order to generate troubleshooting data.

> **Note:** **Remember to turn debug off once you have finished gathering data**. If you forget to do this and the file becomes too large, stop the Q-EKM server process, delete the **debug_server** file, and restart the Q-EKM server process. This re-creates the debug log with no data in it. You can then turn debug on or off as needed.

The current debug state (on or off) is listed on the Q-EKM commands menu under item number **5** (see Figure 5 on page 29).

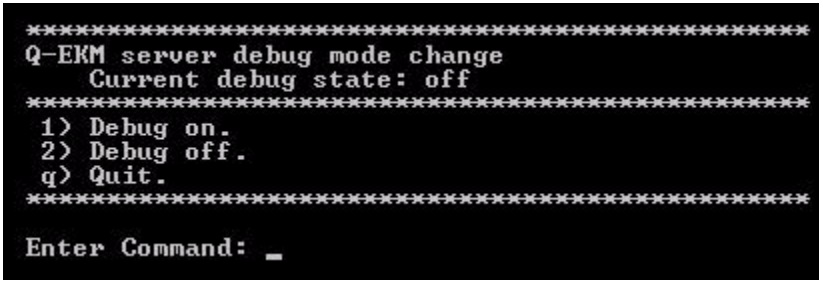
Turning the log on or off shuts down the Q-EKM server, changes the **KeyManagerConfig.properties** file, and then restarts the Q-EKM server.

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **5** (for **Set Q-EKM server debug logging on or off)**.

   The Q-EKM server process stops.
3. When prompted, press **<Enter>**.

   The Q-EKM server debug mode change menu displays.

Figure 6 Debug Mode Change Menu



4. At the Enter Command prompt, enter **1** to turn debug logging **ON**; **2** to turn debug logging **OFF**, or **q** to quit.

   The command is entered into the system.
5. Press **<Enter>**.

   The Q-EKM server process starts.

6 Verify the Q-EKM server process started by doing one of the following:

- Issue the **Display the Q-EKM server status** command (see Displaying the Q-EKM Server On/Off Status on page 30), or
- Check the **native_stdout.log** file (located in the **keymanager** folder in the **QEKM** directory; see Standard Out Messages Log on page 66).

7 Press **<Enter>** to return to the command menu.

8 Verify the debug logging is set as desired by checking the status on the Q-EKM commands menu.

Synchronizing Primary and Secondary Q-EKM Servers

A synchronized configuration means that the configuration files on the primary and secondary Q-EKM match.

The two configuration files are:

- ClientKeyManagerConfig.properties
- KeyManagerConfig.properties

The servers must be synchronized or you will not have accurate data should failover from the primary to the secondary server occur. (See What to do if Your Q-EKM Server Fails on page 64.)

Synchronization copies the two configuration files from the primary server to the secondary server automatically once per hour as long as both servers are up and running and connected to the network. The files are also coped immediately whenever a configuration change occurs on the primary server. In order for synchronization to occur, you must first set it up. Instructions for setting synchronization up follow below. Quantum Support should have set up synchronization at the initial install.

Note:	Only set up synchronization on the primary Q-EKM server.

Note: In order to synchronize properly, the TCP and SSL ports on the primary and secondary Q-EKM servers must be set to the same values. Synchronization causes the entire configuration files of the primary server to overwrite the configuration files on the secondary server. Because the TCP and SSL ports are listed in the configuration files, the primary and secondary servers must use the same TCP and SSL port settings. In addition, make sure the libraries that access these servers have their Q-EKM port configuration settings set to the correct values.

Note: Synchronization does **NOT** copy the keystore. If the you make changes to the keystore by importing keys, you must manually copy the keystore file (**EKMKeys.jck**) from the **QEKM** directory on the primary server to the **QEKM** directory on the secondary server so the keystore data is the same (C:\Program Files\Quantum\QEKM on Windows and opt/Quantum/QEKM on Linux).

Note: Both the primary and secondary Q-EKM servers must be running in order for synchronization to occur.

Note: Keep in mind that synchronization occurs from the primary Q-EKM server to the secondary, not vice versa. The secondary server remains the secondary server, even during a failover. Do not make changes to the secondary server's configuration because the primary server's configuration files will overwrite them during the next synchronization.

To set up synchronization, do the following:

1. Ensure that both the primary and secondary Q-EKM servers are up and running and connected to the network.
2. Log on to Q-EKM Commands on the primary Q-EKM server (see Logging On to Q-EKM Commands on page 27).

   The primary Q-EKM server shuts down. You receive confirmation that looks similar to the following:

   ```
   Q-EKM Server: shut down complete.
   ```

3. Press **<Enter>**.

4 When prompted, enter the secondary Q-EKM server's IP address.

> **Caution:** Ensure you enter the correct IP address of the secondary Q-EKM server. If you enter the wrong IP address, changes to the configuration files will not be synchronized to the secondary server.

You receive a message that looks similar to the following:

```
Sync IP address: x.x.x.x
port: 443
ipaddress=x.x.x.x
  1 file(s) moved.
  1 file(s) moved.
```

5 When prompted, press **<Enter>**.

The primary Q-EKM server starts. You receive confirmation that looks similar to the following:

```
Starting EKM Server...
Please check the logs to make sure EKM Server has started successfully.
```

6 Press **<Enter>**.

7 Verify the Q-EKM server process started by doing one of the following:

- Issue the **Display the Q-EKM server status** command (see Displaying the Q-EKM Server On/Off Status on page 30), or
- Check the **native_stdout.log** file (located in the **keymanager** folder in the **QEKM** directory; see Standard Out Messages Log on page 66).

8 Press **<Enter>**.

The synchronization setup completes and the first sync occurs. You receive several lines of confirmation text:

```
* Verify primary to secondary server sync has been configured.
* Primary to secondary sync has been configured.
Syncing primary to secondary
-----------------------------------------------
Sync completed
-----------------------------------------------
```

Press **<Enter>** to return to the command menu.

Keeping the Keystores Matched

In order for failover to work, the primary and secondary keystores must match. Unlike the configuration files, which are copied from the primary to the secondary Q-EKM server automatically once you set up synchronization, the keystore is not automatically copied from one server to the other. You must manually ensure that the keystores match any time you make changes to the keystore. Changes to the keystore include:

- Importing keys
- Importing certificates

There are two was to make sure the keystores match. Do one of the following:

- Import the keys or certificates onto both Q-EKM servers (see Chapter 6, Sharing Encrypted Tapes – Import/Export Operations).
- Import the keys or certificates onto one Q-EKM server, and then copy the keystore file from that server onto the other server. The keystore file is called **EKMKeys.jck** and is located in the **QEKM** directory of the Q-EKM server:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Changing the Communication Port Settings

Changes the communication port settings on the Q-EKM server. You should not need to change the default port settings unless the default ports are being used by other software on the host.

The Q-EKM server is set up with the following ports by default:

- **TCP Port (also referred to as the EKM Port) – Default Value 3801**
- **SSL Port – Default Value 443**.

In order for synchronization between the primary and secondary Q-EKM servers to occur, the TCP and SSL port settings on the primary and secondary Q-EKM servers must be set to the same values. In order for library-to-Q-EKM communication to occur, all libraries accessing to the Q-EKM server(s) must have their Q-EKM port settings configured to the same values.

The current ports are listed on the Q-EKM commands menu under item number **7** (see Figure 5 on page 29).

To change either of the port numbers:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **7**.

   The Q-EKM server process stops.
3. Press **<Enter>**.
4. When prompted, enter **ssl** (to change the SSL port) or **tcp** (to change the TCP port).
5. Enter the new port number.

   The port number is changed.
6. When prompted, press **<Enter>**.

   The Q-EKM server starts.
7. Press **<Enter>** to return to the command menu.

8. Verify the Q-EKM server process started by doing one of the following:
   - Issue the **Display the Q-EKM server status** command (see Displaying the Q-EKM Server On/Off Status on page 30), or
   - Check the **native_stdout.log** file (located in the **keymanager** folder in the **QEKM** directory; see Standard Out Messages Log on page 66).
9. Verify the port changed by looking at the **Current ports** display on the command menu under item number **7**.
10. Change the port settings on the other Q-EKM server in the server pair to the same values.
11. Change the port settings on all libraries that access the Q-EKM server to match the new port settings. See your library user's guide or online help for instructions on how to do this.

Chapter 6

Sharing Encrypted Tapes – Import/Export Operations

This chapter covers:

Sharing Encrypted Tape Cartridges

It is common practice to share tapes with other organizations (that are not using the same Q-EKM server/keystore for encryption) for data transfer, joint development, contracting services, or other purposes.

Q-EKM creates unique key aliases across all Q-EKM installations worldwide (see Understanding How Q-EKM Uses Aliases on page 41). This ensures that you can safely share Q-EKM-encrypted tapes with other sites or companies.

In order to share encrypted data on an encrypted tape, a copy of the symmetric key used to encrypt the data on the tape must be made available to the other organization to enable them to read the tape.

In order for the symmetric key to be shared, the other organization must share their public key with you. This public key will be used to wrap the symmetric key when it is exported from the Q-EKM keystore.

When the other organization imports the symmetric key into their Q-EKM keystore, it will be unwrapped using their corresponding private key. This ensures that the symmetric key will be safe in transit since only the holder of the private key will be able to unwrap the symmetric key.

With the symmetric key that was used to encrypt the data in their Q-EKM keystore, the other organization will then be able to read the data on the tape.

The process is as follows:

1. The destination administrator exports the native **public certificate** that belongs to the destination Q-EKM server (see Exporting the Public Certificate on page 43).
2. The destination administrator sends the **public certificate** file to the source administrator.
3. The source administrator imports the **public certificate** onto the source Q-EKM server (see Importing a Public Certificate on page 45).
4. The source administrator exports the **data encryption keys**, assigning the **public certificate** from the destination server to wrap (encrypt) the keys. See Exporting Data Encryption Keys on page 47.
5. The source administrator sends the exported data encryption key file to the destination administrator.
6. The destination administrator imports the data encryption keys onto the destination Q-EKM server (see Importing Data Encryption Keys on page 52).
7. Tape drives installed in libraries connected to the destination Q-EKM server can now read the encrypted tapes.

Special Considerations for Exchanging Files Between Linux and Windows Servers

When moving public certificate files and key files between Linux and Windows servers, make sure the files are copied and transported in binary format. Files transported in other formats, such as ASCII, will become corrupted. (Windows defaults to an ASCII; FTP generally creates ASCII output.) Using SFTP to copy files will ensure they are binary.

Understanding How Q-EKM Uses Aliases

Q-EKM creates "aliases" as unique ways to identify public certificates and data encryption keys for use when sharing these items between Q-EKM environments. There are two types of aliases referred to in the Q-EKM scripts. Understanding what they mean may help you understand some of the script values that are returned in various situation.

Alias Type	Alias is Composed of
Public Certificate Alias	Library serial number
Data Encryption Key Alias	Library WWN key

Public Certificate Alias

The public certificate alias is the library serial number associated with the Q-EKM server from which the public certificate came. (It is the same library serial number that was entered during Q-EKM installation.) The alias (library serial number) appears in the file name of the public certificate file when it is exported from the Q-EKM server. For instance, in file name QEKMIECert**A0C0115928**.cer, the alias is **A0C0115928**.

Q-EKM needs the unique alias to associate with an imported public certificate. Normally Q-EKM pulls the alias off of the file name without any input from the user required. Occasionally, the owner of the file may change the file name so that the serial number no longer appears. In this

case, the recipient is asked to enter the library serial number when importing the file. In these cases, the originator must supply the alias.

The alias is listed in the **library_serialnum** file located in the **QEKM** directory of the originating Q-EKM server:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Data Encryption Key Alias

The data encryption key alias is the WWN key associated with the Q-EKM server from which the data encryption keys originated. (It is the same WWN key that was entered during Q-EKM installation.) The alias (WWN key) appears in the file name of the exported encryption key file when it is exported from the Q-EKM server. For instance, in file name EXK00E09E**0978f7**_29072010.jck, the alias is **0978f7**.

Q-EKM needs the unique alias to associate with an imported encryption key file. Normally Q-EKM pulls the alias off of the file name without any input from the user required. Occasionally, the owner of the file may change the file name so that the WWN key no longer appears. In this case, the recipient is asked to enter the WWN key when importing the file. In these cases, the originator must supply the alias.

The alias is listed in the **library_wwnamekey** file located in the **QEKM** directory:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Why You Should Not Change File Names

It is strongly recommended that you do NOT change the default names of public certificate files and data encryption key files that you export or import. Q-EKM allows you to change file names; however, it is not recommended. Changing the file name creates more work for both the sender and receiver of these files, and may cause confusion.

The reasons you should NOT change file names are:

- The default file name contains an alias, which is either the library serial number or WWN key (see Understanding How Q-EKM Uses Aliases on page 41). The alias is required in order to import the file. If you remove the alias from the name of a file you are sending to a recipient, you will still have to provide the recipient with the alias so they can enter it when importing the file. Then the recipient must perform an extra step to manually enter the alias during import, instead of allowing Q-EKM to pull the alias off of the file name automatically. If you change the name after you receive a file and before you import it, you will need to request the alias from the sender before importing.
- Even if a public certificate file name is changed, Q-EKM converts the file name back to the default file name when it imports the file. When Q-EKM displays the names of the certificates in a report or export operation, you will not see the same file name you imported, and might wonder what became of your file. If you like to keep track of files received and imported, this will make it more difficult.
- Encryption key file names are not displayed in reports or export scripts, but rather the WWN key (alias) and key ranges are displayed. For tracking purposes, if you leave the WWN key in the file name, at least you will have something with which to compare Q-EKM's displayed information.

Exporting the Public Certificate

To receive encryption keys from another Q-EKM server (i.e., the "source" Q-EKM server), you must first send your Q-EKM server's native **public certificate** to that server. The public key contained in the certificate will be used to wrap (encrypt) the encryption keys to protect them during transport to you.

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Command Prompt, enter **i** (for **Import/export keys**).

   The Key Import/Export menu displays (see Figure 7).

Figure 7 Key Import/Export Menu

3 At the command prompt, enter **3** (for **Export public certificate**).

4 Enter the keystore password (see Keystore Password on page 26).

5 You are requested to "Enter a file name for the public certificate or press enter [QEKMIECert<library_SN>.cer]:" The name in [brackets] is the default file name of your native public certificate file.

To export the public certificate with the file name as shown, just press **<Enter>**. To change the name of the file, enter an alternate name and then press **<Enter>**.

> **Note:** **IMPORTANT:** It is recommended that you do **NOT** change the file name because it creates more work and may cause confusion. See Why You Should Not Change File Names on page 42.

The native public certificate is exported to the **QEKM** directory here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

6 Press **<Enter>** to return to the Key Import/Export menu.

7 Send the **public certificate** file to the source Q-EKM server administrator.

> **Note:** If sending between Linux and Windows systems, make sure the files are copied and transported in binary format (see Special Considerations for Exchanging Files Between Linux and Windows Servers on page 41).

8 If you changed the default name of the public certificate file so that it no longer includes the library serial number (the default name is **QEKMIECert<library SN>.cer**), you must provide the library serial number along with the public certificate file to the source Q-EKM server administrator, because they need it to export their keys for you. See Understanding How Q-EKM Uses Aliases on page 41 for more information.

The library serial number can be found in the **library_serialnum** file located in the **QEKM** directory:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Importing a Public Certificate

The **public certificate** contains a public key that is used to wrap (encrypt) encryption keys prior to transporting them to another Q-EKM server. When sharing tape cartridges, you need to import the public certificate of the destination Q-EKM server.

1 Receive the **public certificate** file from the Q-EKM server to which you will be sending keys, and place it in the **QEKM** directory:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

2 Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).

3 At the Command Prompt, enter **i** (for the **Import/export keys** option).

The Key Import/Export menu displays (see Figure 7 on page 44).

4 At the command prompt, enter **1** (for **Import public certificate**).

5 Enter the name of the **public certificate** file.

6 Enter your Q-EKM server's keystore password.

7 **Possible Step:** You may be asked to enter the library serial number associated with the public certificate. If you are not asked for the library serial number, then skip this step.

You will be asked for the library serial number if the default name of the key file was changed and Q-EKM cannot identify the library serial number from the file name (the default name is **QEKMIECert<library SN>.cer**). Q-EKM looks for the library serial number during the import process (see Understanding How Q-EKM Uses Aliases on page 41). If the library serial number no longer appears in the file name, then the administrator who sent you the file must provide the library serial number and you must enter it manually.

The library serial number can be found in the **library_serialnum** file located in the **QEKM** directory of the Q-EKM server that generated the public certificate:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

8 The public certificate is added to your keystore and the keystore is refreshed and reloaded.

9 When prompted, press **<Enter>** to return to the Key Import/Export menu.

10 Import the public certificate into the other server in the Q-EKM server pair, or copy the keystore over to the other server.

Caution: **IMPORTANT:** Importing certificates updates the keystore file. To make sure the primary and secondary keystores match, when finished importing, either import the public certificate into the other server in the Q-EKM server pair, or manually copy the keystore to the other server in the Q-EKM server pair. You must do this manually because the synchronization process does not copy the keystore.

The keystore file is called **EKMKeys.jck** and is located in the **QEKM** directory of the Q-EKM server:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Exporting Data Encryption Keys

In order for another Q-EKM server (i.e., the "destination server") to read tapes encrypted by your Q-EKM server, you need to export the encryption keys used to encrypt those tapes and send them to the destination server.

Currently, Q-EKM does not support exporting individual encryption keys. Instead, you must export complete sets of 1024 encryption keys. You can do the following types of exports:

- Exporting Your Native Keys — Exports your Q-EKM server's set of 1024 "native" encryption keys to enable other sites to read from or write to tapes encrypted by you.
- Exporting Imported Keys — Exports a set of keys that you previously imported. You might want to do this if an encrypted tape sent to you by another site (along with its encryption keys, which you imported) needs to be accessed by still another site.

In either case, the keys are exported as a single file.

Exporting Your Native Keys

To export your Q-EKM server's set of 1024 data encryption keys:

1. Make sure you have imported the public certificate of the destination Q-EKM server (see Importing a Public Certificate on page 45).
2. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
3. At the Command Prompt, enter **i** (for the **Import/export keys** option).

   The Key Import/Export menu displays (see Figure 7 on page 44).
4. From the Key Import/Export menu, enter **4** (for **Export native keys**).

5 Enter your keystore password.

A list of certificates available to export keys displays. The list includes your Q-EKM server's native public certificate and all public certificates that you have ever imported. The list displays in the following format:

```
Available certificates to export keys:

    Serial Number        Certificate
                           Source

-------------------------------------------------

A0C0123456      (QEKMIECertA0C0123456.cer)
A0C0789012      (QEKMIECertA0C0789012.cer)
A0C0234578      (Native)
```

The serial number listed is the library serial number associated with the Q-EKM server that generated the public certificate file, followed by the name of the public certificate file. The file identified as "Native" is your Q-EKM server's native public certificate.

> **Note:** Even if the file name for the public certificate was changed from the default format, Q-EKM converts it back into the default format when it is imported. This is one reason it is recommended NOT to change file names (see Why You Should Not Change File Names on page 42).

You are asked to enter one of the listed serial numbers to use to export the encryption keys.

6 Enter the serial number corresponding to the public certificate you want to use to wrap the exported keys. Choose the certificate that came from the server which will be importing the keys.

7 The data encryption key file is exported to the **QEKM** directory. The name and location of the file are displayed on the screen. The file is named: **EXK00E09E<WWN key>_<date>.jck** (where the WWN key is the WWN key entered at initial install) and is located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

8 Press **<Enter>** to return to the Key Import/Export menu.

9 Send the data encryption key file to the administrator of the destination Q-EKM server.

> **Note:** If sending between Linux and Windows systems, make sure the files are copied and transported in binary format (see Special Considerations for Exchanging Files Between Linux and Windows Servers on page 41).

> **Note:** **IMPORTANT:** It is recommended that you do **NOT** change the file name because it creates more work and may cause confusion. See Why You Should Not Change File Names on page 42.

If you change the default name of the exported encryption key file so that it no longer includes the WWN key (the default name is **EXK00E09E<WWN key>_<date>.jck**), you must provide the library WWN key along with the encryption key file to the destination Q-EKM server administrator, because they need it to import your keys (see Understanding How Q-EKM Uses Aliases on page 41). The library WWN key can be found in the **library_wwnamekey** file located in the **QEKM** directory:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Exporting Imported Keys

To export a set of data encryption keys that you previously imported:

1 Make sure you have imported the public certificate of the destination Q-EKM server (see Importing a Public Certificate on page 45).

2 Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).

3 At the Command Prompt, enter **i** (for the **Import/export keys** option).

The Key Import/Export menu displays (see Figure 7 on page 44).

4 From the Key Import/Export menu, enter **5** (for **Export imported keys**).

5 Enter your keystore password.

A list of certificates available to export keys displays. The list includes your Q-EKM server's native public certificate and all public certificates that you have ever imported. The list displays in the following format:

```
Available certificates to export keys:

    Serial Number        Certificate
                           Source

-------------------------------------------------

A0C0123456      (QEKMIECertA0C0123456.cer)
A0C0789012      (QEKMIECertA0C0789012.cer)
A0C0234578      (Native)
```

The serial number listed is the library serial number associated with the Q-EKM server that generated the public certificate file, followed by the name of the public certificate file. The file identified as "Native" is your Q-EKM server's native public certificate.

> **Note:** Even if the file name for the public certificate was changed from the default format, Q-EKM converts it back into the default format when it is imported. This is one reason it is recommended NOT to change file names (see Why You Should Not Change File Names on page 42).

You are asked to enter one of the listed serial numbers to use to export the encryption keys.

6 Enter the serial number corresponding to the public certificate you want to use to wrap the exported keys. Choose the certificate that came from the server which will be importing the keys.

7 A list of imported WWN key ranges available for export displays. The list displays in the following format:

```
    wwname key          Range

-------------------------------------------------------------

    09c330      key00000000009c330000-00000000009c3303ff
    033123      key00000000033123000-0000000000331233ff
    034123      key00000000034123000-0000000000341233ff
```

You are asked to enter one of the listed WWN keys to identify the range of keys that you want to export. Each range represents a set of 1024 encryption keys that you imported. You will need to know the WWN key of the set that you want to export. If you don't know the WWN key, your choices are either:

- Get the WWN key from the original owner of the key set.The library WWN key can be found in the **library_wwnamekey** file located in the **QEKM** directory of the server that originally generated the keys:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

- Export all of the key sets one by one (and the recipient would then have to import them all one by one).

8 Enter a listed WWN key for the key set you want to export.

9 The data encryption key file is exported to the **QEKM** directory. The name and location of the file are displayed on the screen. The file is named: **EXK00E09E<WWN key>_<date>.jck** (where the WWN key is the WWN key entered at initial install) and is located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

10 Press **<Enter>** to return to the Key Import/Export menu.

11 Send the data encryption key file to the administrator of the destination Q-EKM server.

Note: If sending between Linux and Windows systems, make sure the files are copied and transported in binary format (see Special Considerations for Exchanging Files Between Linux and Windows Servers on page 41).

Note: **IMPORTANT:** It is recommended that you do **NOT** change the file name because it creates more work and may cause confusion. See Why You Should Not Change File Names on page 42.

If you change the default name of the exported encryption key file so that it no longer includes the WWN key (the default name is **EXK00E09E<WWN key>_<date>.jck**), you must provide the library WWN key that you selected for the export in Step 7 along with the encryption key file to the destination Q-EKM server administrator, because they need it to import your keys. See Understanding How Q-EKM Uses Aliases on page 41 for more information.

Importing Data Encryption Keys

In order to read tapes encrypted by a different (i.e., source) Q-EKM server, you need to import the encryption keys used to encrypt those tapes onto your Q-EKM server (i.e., destination).

> **Note:** Currently, Q-EKM does not support importing individual encryption keys. Instead, you will import all 1024 data encryption keys as one file.

1. Receive the **encryption key** file from the administrator of the source Q-EKM server and place the file in the **QEKM** directory located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

2. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
3. At the Command Prompt, enter **i** (for the **Import/Export keys** option).

   The Key Import/Export menu displays (see Figure 7 on page 44).
4. At the command prompt, enter **2** (for **Import keys**).
5. Enter the file name of the encryption key file.

   The import process begins.
6. Enter your Q-EKM server's keystore password (see Keystore Password on page 26).

7 **Possible Step:** You may be asked to enter the WWN key for the imported keys. If you are not asked for the WWN key, then skip this step.

You will be asked for the WWN key if the default name of the key file was changed and Q-EKM cannot identify the WWN key from the file name (the default name is **EXK00E09E<WWN key>_<date>.jck**). Q-EKM looks for the WWN key during the import process (see Understanding How Q-EKM Uses Aliases on page 41). If the WWN key no longer appears in the file name, then the administrator who sent you the file must provide the WWN key and you must enter it manually.

The WWN key can be found in the **library_wwnamekey** file located in the **QEKM** directory on the Q-EKM server that generated the key file:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

8 The import process takes a few minutes. When complete, you are prompted to press **<Enter>**.

9 When prompted, press **<Enter>** to return to the Key Import/Export menu.

10 Import the data encryption keys on the other server in the Q-EKM server pair or copy the keystore to the other server.

Caution: **IMPORTANT:** Importing keys updates the keystore file. To make sure the primary and secondary keystores match, when finished importing, either import the keys on the other server in the Q-EKM server pair, or manually copy the keystore to the other server in the Q-EKM server pair. You must do this manually because the synchronization process does not copy the keystore.

The keystore file is called **EKMKeys.jck** and is located in the **QEKM** directory of the Q-EKM server:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Displaying the Native Public Certificate

You can view the contents of your Q-EKM server's native public certificate, including the alias (see Public Certificate Alias on page 41), owner/issuer, and validity dates.

To display the information:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Command Prompt, enter **i** (for the **Import/Export keys** option).

   The Key Import/Export menu displays (see Figure 7 on page 44).
3. At the command prompt, enter **d** (for **Display native public certificate**).
4. Enter your keystore password (see Keystore Password on page 26).

   The information is displayed.
5. Press **<Enter>** to return to the Key Import/Export menu.

Displaying Imported Public Certificates

You can view the contents of all the public certificates you imported onto your Q-EKM server, including the alias (see Public Certificate Alias on page 41), owner/issuer, and validity dates.

To display the information:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Command Prompt, enter **i** (for the **Import/Export keys** option).

   The Key Import/Export menu displays (see Figure 7 on page 44).
3. At the command prompt, enter **i** (for **Display imported public certificates**).

4 Enter your keystore password (see Keystore Password on page 26).

The information is displayed.

If it just displays "Keystore entries: xxxx" that means you have no imported certificates.

5 Press **<Enter>** to return to the Key Import/Export menu.

Chapter 7

Running Reports

This chapter details the reports you can run from the Q-EKM commands menu. The reports are:

- Drives that Accessed the Q-EKM Server
- Q-EKM Server Keys
- End User License Agreement
- Available WWN Key Ranges for Export

Drives that Accessed the Q-EKM Server

This report provides a list of all drives that have ever successfully asked for a key from the Q-EKM server. There is no maximum number of entries, and all drives will remain on the list even if they are removed from the library.

The data is displayed on the screen and also saved to a file. The file is named **drivereport.txt** and is located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

To generate the tape drive report:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **r (**for **Reports**).

   The Q-EKM Reports menu displays (see Figure 8).

Figure 8 Reports Menu

3. Enter **1** (for **List drives that have accessed the Q-EKM server)**.

   The information is displayed on the screen and also collected and saved to a file. The name and location of the file is displayed. The total number of drives, followed by a listing of all the drives by drive serial number, is displayed on the screen. The displayed data looks similar to the following:

   Drive entries: 2

   SerialNumber = 001300000392

   SerialNumber = 001310000363

4. Press **<Enter>** repeatedly to scroll through the list. To exit the scrolling display, enter **q**.
5. Press **<Enter>** to return to the Q-EKM reports menu.

Q-EKM Server Keys

This report provides a list of all the data encryption keys and certificates in the keystore. The list includes the keys and certificates generated by your Q-EKM server, plus all of the keys and certificates you imported.

The data is displayed on the screen and also saved to a file. The file is named **keyreport.txt** and is located here:

Windows	c:\Program Files\Quantum\QEKM
Linux	/opt/Quantum/QEKM

Note: The "alias" listed in the report is your Q-EKM server's public certificate alias (see Understanding How Q-EKM Uses Aliases on page 41)

To generate the key report:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **r (**for **Reports**).

   The Q-EKM Reports menu displays (see Figure 8 on page 57).
3. Enter **2** (for **List Q-EKM server keys)**.

   The information returned by the command looks similar to the following:

   key000000000094330119, Mon Aug 02 16:21:32 CDT 2010, keyEntry, AES, Active:True

   key000000000094330118, Mon Aug 02 16:21:32 CDT 2010, keyEntry, AES, Active:True

   key000000000094330117, Mon Aug 02 16:21:32 CDT 2010, keyEntry, AES, Active:True
4. Press **<Enter>** repeatedly to scroll through the list. To exit the scrolling display, enter **q**.
5. When finished, press **<Enter>** to return to the Q-EKM reports menu.

End User License Agreement

The End User License Agreement (EULA) is presented during the installation or upgrade process and must be accepted by the user before installation/upgrade can take place. If you wish to review the EULA at any time thereafter, do the following:

To generate the key report:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **r (**for **Reports**).

   The Q-EKM Reports menu displays (see Figure 8 on page 57).
3. Enter **3** (for **Display Q-EKM EULA)**.

   The EULA displays.
4. Press **<Enter>** repeatedly to scroll through the EULA.
5. When finished, press **<Enter>** to return to the Q-EKM reports menu.

Available WWN Key Ranges for Export

This report provides a list of WWN keys and their associated data encryption key ranges corresponding to the data encryption key sets that you imported. These are the imported key sets that you can export (see Exporting Imported Keys on page 49).

This report does not include your native set of 1024 data encryption keys.

You might want to run this report to make sure the keys you want to export are actually in your keystore before starting the export process.

To generate the key report:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).

2 At the Enter Command prompt, enter **r (**for **Reports**).

The Q-EKM Reports menu displays (see Figure 8 on page 57).

3 Enter **4** (for **Display available wwname key ranges for export)**.

The information returned by the command looks similar to the following:

```
wwname key          Range
-------------------------------------------------------------
09c330        key00000000009c330000-00000000009c3303ff
033123        key00000000033123000-0000000000331233ff
034123        key00000000034123000-0000000000341233ff
```

4 Press **<Enter>** to return to the Q-EKM reports menu.

Chapter 8

Troubleshooting

This chapter covers:

Frequently Asked Questions

Question	Answer
How can I tell if the Q-EKM server is running?	Do one of the following: • Issue the Q-EKM "status: command (see Displaying the Q-EKM Server On/Off Status on page 30). • Check the **native_stdout.log** (see Standard Out Messages Log on page 66).
What is the difference between Application-Managed Encryption (AME) and Library-Managed Encryption (LME) and how do they work?	AME is not part of Q-EKM. In AME, the ISV application manages the interaction with the encryption-capable drive. AME requires an ISV application that supports it. With LME, the library (and the Q-EKM server) manages the interaction with the encryption-capable tape drive. LME does not require any ISV support and is transparent to the application.
When is media encrypted?	Media (either new or re-labeled) is encrypted when it is initially written to at the beginning of the tape (BOT).
What state must the media be in to be encrypted using Q-EKM?	The media must be either blank or erased (re-labeled). If any unencrypted data is on the media, no encryption will occur. If the media contains anything other than LME-encrypted data, the data must be erased. Interleaving LME data with non-encrypted or AME-encrypted data is not supported.
How can I verify that tapes are being encrypted using Q-EKM?	• The library interface provides several reports that indicate which tapes are encrypted. See your library user's guide for details. • You can check the Q-EKM audit log for key retrieval traffic (see Audit Log on page 65).
How can I tell which tapes are encrypted and which are not encrypted?	The library interface provides several reports that indicate which tapes are encrypted. See your library user's guide for details

Question	Answer
How will I be notified of write/read errors or Q-EKM server problems?	Q-EKM does not report these types of errors. Errors are reported in the following ways: • The host/ISV application reports read and write failures. • The library issues a RAS ticket when a write or read operation fails. • The library issues a RAS ticket when it cannot communicate with a Q-EKM server.
How will I know if one of the Q-EKM servers in a pair goes down and fails over to the other one?	The library issues RAS tickets when: • The primary server failed and successful failover to the secondary server occurred. • A key request to a Q-EKM server failed.
How will I know if both Q-EKM servers go down?	If both servers go down, the library issues RAS tickets for key server communication failure.
How will I know if just the secondary Q-EKM server goes down (while the primary is still working fine)?	If Automatic EKM Path Diagnostics is enabled, the library will issue a RAS ticket if it cannot communicate with the secondary Q-EKM server. If Automatic EKM Path Diagnostics is not enabled, then you will not be notified.
Will I be notified if synchronization between the primary and secondary servers fails?	Not specifically. The Q-EKM audit log reports an error but Q-EKM does not overtly notify you. However, synchronization can only occur when both servers are running and connected. The library issues RAS tickets for server communication failure, which can signify that synchronization failed.

What to do if Your Q-EKM Server Fails

This section covers:

Single Server Configuration Failure

If the single Q-EKM server goes down, the library issues a “failed” RAS ticket indicating it cannot communicate with the server.

If the Q-EKM server failed due to circumstances within your control (for instance, a power outage), get it back up and running as soon as possible.

If the server failed and cannot be recovered, contact Quantum Support as soon as possible to arrange for a disaster recovery installation.

Two-Server Configuration Failure

If the primary Q-EKM server fails, the library “fails over” to the secondary server and issues a RAS ticket. The library will continue to use the secondary server for key requests (even if the primary server comes back online) until it the either the secondary server fails (in which case the library attempts to “fail over” to the primary server again) or the library is rebooted. When the primary server comes back online, if you want the library to go back to using the primary server, you must reboot the library.

If the primary server is down and the secondary server also goes down, the library issues a RAS ticket indicating it cannot communicate with the server.

If a Q-EKM server goes down due to circumstances within your control (for instance, a power outage), get it back up and running as soon as possible.

If a Q-EKM server fails and cannot be recovered, contact Quantum Support as soon as possible to arrange for a disaster recovery installation.

Note: Keep in mind that synchronization occurs from the primary Q-EKM server to the secondary, not vice versa. The secondary server remains the secondary server, even during a failover. Do not make changes to the secondary server's configuration because the primary server's configuration files will overwrite them during the next synchronization.

Log Files

Q-EKM provides the following log files that can be used for troubleshooting and debug:

- Audit Log
- Debug Log
- Standard Error Messages Log
- Standard Out Messages Log
- Capturing a Log Snapshot

Audit Log

The audit log timestamps drive vendor, serial number, world-wide name (WWN), media volser, and key servings results. The data it collects is a subset of the much more comprehensive Debug Log. The audit log is always available and collecting data. The Q-EKM application limits the size of this file to 10 MB. When the file reaches the maximum size, old information is deleted as new information is added.

The audit log file is named **\kms_audit.log** and is located here:

Windows	c:\Program Files\Quantum\QEKM\keymanager\audit
Linux	/opt/Quantum/QEKM/keymanager/audit

Debug Log

The debug log captures a record of everything the Q-EKM server does. The debug log does not collect information unless debug is turned on. Debug logging is turned off by default. See Turning Debug Logging On and Off on page 31 for more information about the debug log and how to to turn logging on and off.

The debug log file is named **debug_server** and is located here:

Windows	c:\Program Files\Quantum\QEKM\keymanager
Linux	/opt/Quantum/QEKM/keymanager

Standard Error Messages Log

The standard error messages log lists errors that occurred during Q-EKM startup or shutdown. This log is generally used in combination with the Standard Out Messages Log.

The standard error messages log file is named **native_stderr.log** and is located here:

Windows	c:\Program Files\Quantum\QEKM\keymanager
Linux	/opt/Quantum/QEKM/keymanager

Standard Out Messages Log

The standard out messages log provides information about Q-EKM startup and shutdown operations, and lets you know whether the operation completed successfully. This log is generally used in combination with the Standard Error Messages Log.

The standard out messages log file is named **native_stdout.log** and is located here:

Windows	c:\Program Files\Quantum\QEKM\keymanager
Linux	/opt/Quantum/QEKM/keymanager

Capturing a Log Snapshot

The capture log snapshot command creates a folder (in Windows) or a.tgz file (in Linux) containing information about Q-EKM at a given point in time. The folder/file contains configuration files and audit and error logs that Quantum Support can use to troubleshoot problems with the library. Normally you would only need to capture a snapshot when instructed by Quantum Support.

When you run the command, Q-EKM creates the following:

Windows	c:\Program Files\Quantum\QEKM\ **snapshot_<date>_<time>**
Linux	/opt/Quantum/QEKM/ **QEKMsnapshot_<date>_<time>.tgz**

To capture a log snapshot:

1. Log on to Q-EKM Commands (see Logging On to Q-EKM Commands on page 27).
2. At the Enter Command prompt, enter **8** (for **Capture log snapshot for Q-EKM server**).

   The snapshot folder/file is created and the screen displays the name and location.

Press **<Enter>** to return to the commands menu.

Errors Reported By Q-EKM

This section defines error messages that are reported by Q-EKM in the audit log (see Audit Log on page 65).

The table below includes the error number, a short description of the failure, and corrective actions.

Error Number	Description	Action
EE02	Encryption Read Message Failure: DriverErrorNotifyParameterError: "Bad ASC & ASCQ received. ASC & ASCQ does not match with either of Key Creation/Key Translation/Key Acquisition operation."	The tape drive asked for an unsupported action. Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Check the versions of drive or library firmware and update them to the latest release, if needed. Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.
EE0F	Encryption logic error: Internal error: "Unexpected error. Internal programming error in EKM."	Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Check the versions of drive or library firmware and update them to the latest release, if needed. Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.

Error Number	Description	Action
EE23	Encryption Read Message Failure: Internal error: "Unexpected error....."	The message received from the drive or library could not be parsed because of general error. Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.
EE25	Encryption Configuration Problem: Errors that are related to the drive table occurred.	Ensure that the config.drivetable.file.url is correct in the KeyManagerConfig.properties file, if that parameter is supplied. Run the listdrives -drivename <drivename> command on the Q-EKM server to verify whether the drive is correctly configured (for example, the drive serial number, alias, and certificates are correct). Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Check the versions of drive or library firmware and update them to the latest release, if needed. Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.

Error Number	Description	Action
EE29	Encryption Read Message Failure: Invalid signature	The message received from the drive or library does not match the signature on it. Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.
EE2B	Encryption Read Message Failure: Internal error: "Either no signature in DSK or signature in DSK can not be verified."	Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Check the versions of drive or library firmware and update them to the latest release, if needed. Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.

Error Number	Description	Action
EE2C	Encryption Read Message Failure: QueryDSKParameterError: "Error parsing a QueryDSKMessage from a device. Unexpected dsk count or unexpected payload."	The tape drive asked Q-EKM to do an unsupported function. Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Check the versions of drive or library firmware and update them to the latest release, if needed. Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Center.
EE2D	Encryption Read Message Failure: Invalid Message Type	Q-EKM received a message out of sequence or received a message that it does not know how to handle. Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.

Error Number	Description	Action
EE2E	Encryption Read Message Failure: Internal error: Invalid signature type	The message received from the drive or library does not have a valid signature type. Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.
EE31	Encryption Configuration Problem: Errors that are related to the keystore occurred.	Check the key labels that you are trying to use or configured for the defaults. If you know that you are trying to use the defaults, then run the listdrives -drivename *drivename* command on the Q-EKM server to verify whether the drive is correctly configured (for example, the drive serial number, and associated aliases/key labels are correct). If the drive in question has no aliases/key labels associated with it, then check the values of default.drive.alias1 and default.drive.alias2. If this does not help or the alias/key label exists, then turn on Debug on the Q-EKM server, gather debug logs, and contact Quantum Global Call Center. When finished collecting data, turn Debug off.

Error Number	Description	Action
EEE1	Encryption logic error: Internal error: "Unexpected error: EK/ EEDK flags conflict with subpage."	Ensure that you are running the latest version of Q-EKM (to determine the latest version, contact your Quantum Representative). Check the versions of drive or library firmware and update them to the latest release, if needed. Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.
EF01	Encryption Configuration Problem: "Drive not configured."	The drive that is trying to communicate with Q-EKM is not present in the drive table. Ensure that the config.drivetable.file.url is correct in the KeyManagerConfig.properties file, if that parameter is supplied. Run the listdrives command to check whether the drive is in the list. If not, configure the drive manually by using the adddrive command with the correct drive information or set the "drive.acceptUnknownDrives" property to true using the modconfig command. Turn on Debug on the Q-EKM server. Try to re-create the problem and gather debug logs. When finished collecting data, turn Debug off. If the problem persists, contact Quantum Global Call Center.

Appendix A

Setting the System Path Variable in Windows

You may wish to update your system Path environment variable to include the path to the **QEKM** directory. This allows you to enter Q-EKM commands on any command line rather than having to change the directory to the **QEKM** directory each time.

To update the system Path environment variable:

1. Choose **Start > Control Panel > System**.
2. Select the **Advanced** tab.
3. Click **Environment Variables**.
4. Under System variables, select **Path**.
5. Click **Edit**.
6. In the Edit System Variable dialog box, click in the **Variable** value field and enter **c:\Program Files\Quantum\QEKM**.

   Note: If there is already a value in the field, use a semicolon (;) to separate the paths.

7. Click **OK, OK, OK**.

Glossary

This glossary defines the special terms, abbreviations, and acronyms used in this publication and other related publications.

A

AES Advanced Encryption Standard. A block cipher adopted as an encryption standard by the US government.

alias A unique identifier used to match the encrypted data key with the private key required to unwrap the protected symmetric data key.

application-managed encryption (AME) A system of encryption where a host application manages the interaction with the encryption-capable drive. AME requires an application that supports it. Q-EKM is NOT part of AME.

C

certificate A digital document that binds a public key to the identity of the certificate owner, thereby enabling the certificate owner to be authenticated.

D

data key An alphanumeric string used to encrypt data.

E

EKM Encryption Key Management. A system whereby encryption keys are generated, stored, protected, transferred, loaded, and used.

encryption The conversion of data into a cipher. A key is required to encrypt and decrypt the data. Encryption provides protection from persons or software that attempt to access the data without the key.

I

IP Internet Protocol. The method or protocol by which data is transmitted from one computer (or host) to another over the Internet using a system of addresses and gateways.

J

JCE Java Cryptography Extension.

JCEKS Java Cryptography Extension Keystore.

K

keystore A database of private keys and their associated digital certificate chains used to authenticate the corresponding public keys.

L

library managed encryption (LME) A system of encryption whereby the library manages the interaction with the encryption-capable tape drive. LME does not require any ISV support and is transparent to the application. Q-EKM works with library managed encryption.

P

private key One key in an asymmetric key pair, typically used for decryption. Q-EKM uses private keys to unwrap protected AES data keys prior to decryption.

public key One key in an asymmetric key pair, typically used for encryption. Q-EKM uses public keys to wrap (protect) AES data keys prior to storing them on the tape cartridge.

Q

Q-EKM Quantum Encryption Key Manager. A Java application that handles encryption key management (EKM) via Quantum's tape libraries.

S

SSL Secure Sockets Layer. A security protocol that works in conjunction with IP to ensure that packets reach their intended destinations securely.

T

TCP Transmission Control Protocol. Works in conjunction with IP to ensure that packets reach their intended destinations.

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