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OpenText® Identity Manager
Driver for RACF Implementation Guide

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About this Book and the Library

This guide explains implementation of the OpenText® Identity Manager 4.10 driver for RACF on mainframes (z/OS* operating system).

The driver synchronizes data from a connected mainframe system using RACF, the IBM* security system, with OpenText Identity Manager 4.10, the comprehensive identity management suite that allows organizations to manage the full user life cycle, from initial hire, through ongoing changes, to ultimate retirement of the user relationship.

Audience

This guide is for system administrators and others who plan, install, configure, and use the Identity Manager bidirectional driver for RACF. It assumes that you are familiar with Identity Manager, OpenText eDirectory™, and the administration of systems and platforms you connect to Identity Manager.

Other Information in the Library

The library provides the following information resources:

Identity Manager Setup Guide

Provides overview of Identity Manager and its components. This book also provides detailed planning and installation information for Identity Manager.

Designer Administration Guide

Provides information about designing, testing, documenting, and deploying Identity Manager solutions in a highly productive environment.

User Application: Administration Guide

Describes how to administer the Identity Manager User Application.

User Application: User Guide

Describes the user interface of the Identity Manager User Application and how you can use the features it offers, including identity self-service, the Work Dashboard, role and resource management, and compliance management.

User Application: Design Guide

Describes how to use the Designer to create User Application components, including how to work with the Provisioning view, the directory abstraction layer editor, the provisioning request definition editor, the provisioning team editor, and the role catalog.

Identity Reporting Module Guide

Describes the Identity Reporting Module for Identity Manager and how you can use the features it offers, including the Reporting Module user interface and custom report definitions, as well as providing installation instructions.

Analyzer Administration Guide

Describes how to administer Analyzer for Identity Manager.

Identity Manager Common Driver Administration Guide

Provides information about administration tasks that are common to all Identity Manager drivers.

Identity Manager Driver Guides

Provides implementation information about Identity Manager drivers.

1 Overview

The OpenText® Identity Manager 4.10 driver for RACF synchronizes data between Identity Manager and a RACF installation on a connected mainframe. Identity Manager, installed on any Identity Manager supported platform, communicates with the driver on the target z/OS system over a secure network link.

The driver gives you access to RACF user and group attributes in accordance with the z/OS RACF schema. The driver also allows you to issue arbitrary TSO commands on the z/OS system. Identity Manager gives you access to eDirectory™ objects and their attributes via its Identity Vault.

The driver uses embedded Remote Loader technology to communicate with Identity Manager, bidirectionally synchronizing changes between the Identity Vault and RACF. It implements this technology using its own embedded Remote Loader component as part of the main driver shim, which runs as a started task on the connected z/OS system.

The driver shim's Subscriber function commits changes to RACF using customizable REXX execs that issue native TSO commands through the z/OS service routine `IKJEFTSR`. This flexible interface provides the option for implementing additional business logic through REXX programming.

The driver shim's Publisher function uses standard security system exit routines to capture events of interest and submits them to the Identity Manager Metadirectory engine.

The Identity Manager 4.10 driver for RACF combines the flexibility of the Fan-Out driver and the bidirectional support and Identity Manager policy options available from traditional Identity Manager drivers. Key features of the driver include:

- Bidirectional synchronization of data
- Customizable schema to integrate all aspects of account administration
- Customizable REXX execs to handle all data to be synchronized
- Driver shim implemented as a traditional z/OS started task
- Operator command control for starting and stopping the driver shim, configuring Remote Loader options, and displaying status information
- Support for RACF passwords and password phrases

The following sections present a basic overview of the driver:

- "Driver Architecture" on page 10
- "Configuration Overview" on page 16

Driver Architecture

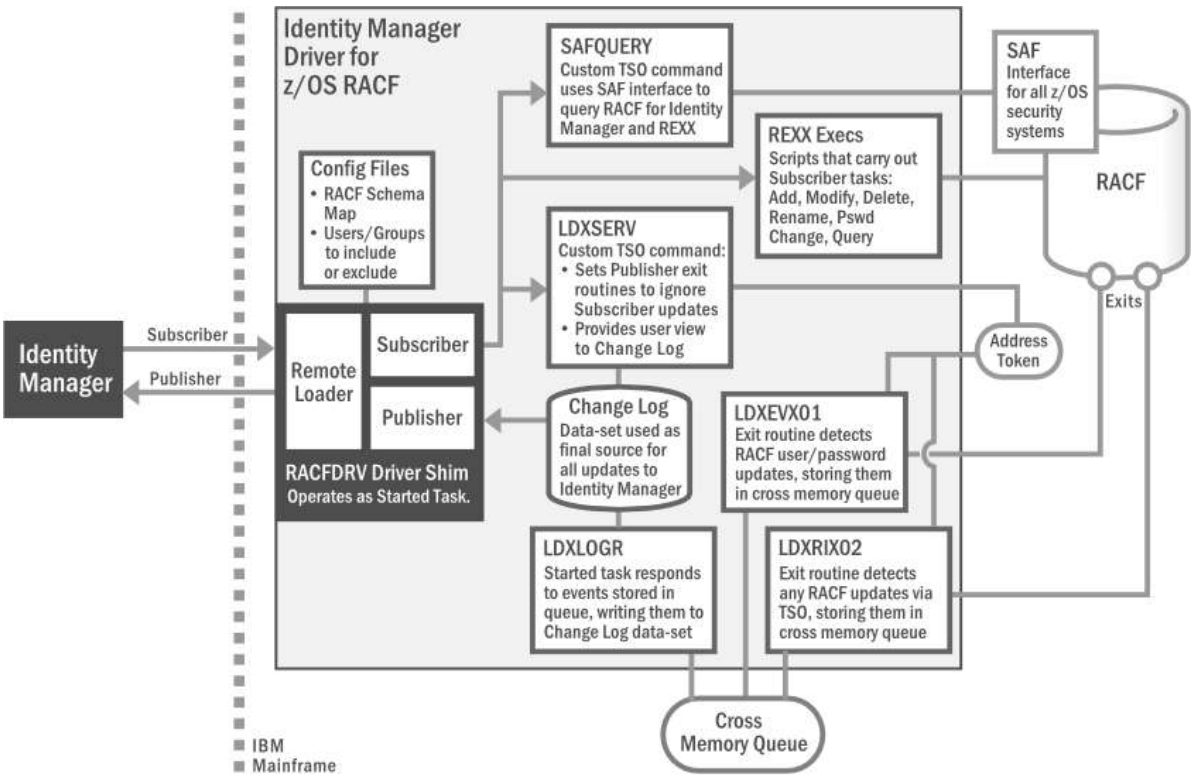
The driver synchronizes information between the Identity Vault on the Identity Manager platform and RACF on the connected z/OS system.

When Identity Manager detects relevant changes to identities in its Identity Vault, it uses the Subscriber channel to process and communicate the updates to all connected systems. Events are received by the Subscriber component of the RACF driver, which runs as a started task on the z/OS host system. This Subscriber component securely passes the information to customizable REXX execs that carry out the updates to RACF.

When changes to passwords and other items relevant to Identity Manager are made at the local RACF installation, two security system exit routines are used to capture the changes and place them in a cross memory queue. The change log, another z/OS started task, moves events from the memory queue to the change log data set, where they are stored for processing. At configurable intervals, the Publisher component of the driver polls the change log for events and submits them to Identity Manager, where they are processed for posting to the Identity Vault.

Figure 1-1 illustrates the driver's architecture.

Figure 1-1 *RACF Driver Architecture*



The following topics describe the driver architecture in more detail:

- "Component Summary" on page 11
- "Component Discussion" on page 13

Component Summary

Most components of the bidirectional RACF driver can be associated with one of the two channels of communication—Subscriber and Publisher—used by the driver and Identity Manager in general.

Subscriber Channel Represents data flowing from Identity Manager to the driver on the connected z/OS system, then on to its final destination in RACF. In this way, RACF functions as a *subscriber* to Identity Manager events, receiving any updates from the central Identity Vault via the Subscriber channel.

Publisher Channel Represents data flowing from RACF, through the driver on the host z/OS system, and on to Identity Manager. In this way, RACF functions as a *publisher* of events to Identity Manager, sending any updates from its individual RACF installation to the central Identity Vault via the Publisher channel.

NOTE: The term "channel," within the context of Identity Manager data flow, should not be confused with the same term used in mainframe nomenclature to describe a physical cable or connection.

Given this general organization, Table 1-1 provides a summary description for each of the driver's main components, including the data channel it relates to.

Table 1-1 *Summary of Driver Components*

Data Channel	Component	Description
Subscriber	RACF Schema Map	Provides a reference to the hierarchy of objects and attributes available in RACF. The driver reads the schema map, usually at startup. Also used by Identity Manager's Policy Editor to map the schema of the Identity Vault to the schema of RACF.
	Include/Exclude File	Optional configuration file for listing local RACF identities that you wish to be included or excluded from the central Identity Vault. Allows local system policy to enforce which objects receive provisioning through the Subscriber channel.
	SAFQUERY	Custom, APF-authorized, TSO command used by the driver to query RACF via SAF (System Authorization Facility), the common interface for all z/OS security systems. It uses `RACROUTE`, a z/OS security macro, to access SAF.
	REXX Execs	Mainframe scripts that apply the schema map and standard TSO commands to issue changes to RACF accounts—including adds, modifies, deletes, and renames—for User and Group objects, and to handle password synchronization. Can be extended to support other object types and events.

Data Channel	Component	Description
Publisher	LDXEVX01	Exit routine that detects RACF user/password updates relevant to Identity Manager, writing them to the cross memory queue. It also notifies the change log started task each time an event is placed in the memory queue.
	LDXRIX02	Exit routine that detects any RACF updates effected by TSO commands, writing them to the cross memory queue. It also notifies the change log started task each time an event is placed in the memory queue.
	LDXLOGR	z/OS started task that responds to events stored in the cross memory queue by writing them to the change log data set. The exit routines `LDXEVX01` and `LDXRIX02` notify `LDXLOGR` of each event added to the memory queue.
	Change Log	z/OS data-set representing the final location where updates are placed in the driver's portion of the Publisher channel before sending to Identity Manager. The driver's Publisher component removes events from the change log at configurable intervals and submits them to Identity Manager.

Data Channel	Component	Description
Subscriber and Publisher	RACFDRV (Driver Shim)	z/OS started task that encapsulates the Remote Loader, Subscriber and Publisher channels. It maintains the network connectivity between the RACF system and the Identity Vault; it delivers event data to the REXX scriptable framework, where it is used to modify the RACF database; it retrieves event data from the RACF change log to be published to the Identity Vault.
	Remote Loader	Enables communication between Identity Manager and RACF as if they were running in a common environment. Identity Manager has no specific knowledge of the Remote Loader. For improved efficiency, the RACF driver has its own embedded remote loader, which is used in place of the standard version bundled with Identity Manager.
	Subscriber Component	Translates XDS event data from the Identity Vault into REXX variables, which are processed by the REXX execs. This component also replies to the Metadirectory engine with XDS status documents.
	Publisher Component	Polls the change log for new event data and sends it to the Metadirectory engine for processing. It also clears each event entry from the change log after it has been processed.
	LDXSERV	Custom, APF-authorized, TSO command providing two key services for the driver: ◆ When updates are passed to RACF in the Subscriber channel, `LDXSERV` is called (with the `NOLOG` parameter) to flag those items with a token in the Publisher event address space. The token's presence causes the exit routines to ignore the updates. This prevents redundant loopback to Identity Manager for any changes made through the Subscriber channel. ◆ `LDXSERV` can also be executed manually (with the `STATUS` parameter) to display information in the change log data set.
None (z/OS Components)	RACF	(Resource Access Control Facility) IBM product option for z/OS security system requirement.
	Token Address Space	z/OS system memory space used to process changes detected by RACF exit routines. Can be flagged with tokens by `LDXSERV` for changes initiated through Subscriber channel to prevent loopback to Identity Manager.
	Cross Memory Queue	The memory queue is an encrypted, in-storage buffer used to record events sequentially. Events are added to the memory queue by the RACF exit routines, and are removed from the queue by the `LDXLOGR` started task. The memory queue is located in Subpool 231 (fetch-protected ECSA).

Component Discussion

This section discusses each of the driver components in more detail.

Driver Shim Started Task

The driver shim, RACFDRV, runs as a started task. Only one system that shares the security system database runs the driver shim started task. The driver shim started task must be started as part of your normal z/OS system initialization procedure and stopped during normal system shutdown.

Subscriber Channel Components

The Subscriber channel of the driver shim started task receives XDS command documents from the Metadirectory engine, stores them using z/OS name/token callable services, then calls the appropriate REXX execs to handle the command.

The Subscriber shim calls the LDXSERV command on startup to identify itself to the security system exit routines for loopback detection. This prevents the exit routines from generating events for commands issued by the Subscriber shim.

REXX Execs

REXX Execs are essentially scripts that are designed to run on a mainframe. The provided REXX execs support adds, modifies, deletes, and renames for User and Group objects, and handle password synchronization. The REXX execs use standard TSO commands to apply the changes. You can extend the REXX execs to support other object types and events. The REXX execs have secure access to the original XDS command data using the IDMGETV command. IDMGETV accesses z/OS name/token callable services and places the data in REXX variables.

SAFQUERY Command

SAFQUERY is an APF-authorized TSO command that is used by the driver to query security system information. SAFQUERY uses the RACROUTE macro for z/OS to retrieve information from the security system database through the system authorization facility (SAF).

Scriptable Framework

The interface between the security system and the driver shim uses customizable REXX execs. You can extend the execs that are provided with the driver to support other applications and databases.

Several utility execs and helper commands are provided with the driver to enable communication with the driver shim and the change log. An extensible connected system schema file allows you to add your own objects and attributes to those already supported by the driver.

For more information about the REXX execs and the scriptable framework, see "The Scriptable Framework" on page 55.

Schema File

The configuration of class and attribute definitions for the connected system is specified using the schema file. You can modify and extend this file to include new objects and attributes. For details about configuring the schema file, see "The Connected System Schema File" on page 61.

The driver uses the keywords of the RACF administrative commands to define the schema. The schema includes two classes: USER and GROUP. These correspond to RACF users and groups.

Some items in the schema refer to keywords used to create and modify RACF users, but cannot be queried or synchronized. These attributes can be used only by Identity Manager policies to make event-time decisions that affect the behavior of the RACF administrative command. The auxiliary schema used to extend eDirectory does not include these attributes.

The schema contains some attributes that consolidate multiple RACF attributes.

Include/Exclude File

The include/exclude file allows local system policies to enforce which objects are included or excluded from provisioning by the Subscriber channel. This allows for administrative rules to be set and enforced locally rather than having processing decisions made by the Metadirectory engine. For details about using the include/exclude file, see "The Connected System Include/Exclude File" on page 63.

To control which objects are processed by the Publisher channel, use policies. For details about customizing policies, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

Publisher Channel Components

The Publisher shim periodically examines the change log for events. When the Publisher shim finds events in the change log, it decrypts, processes, and sends them to the Metadirectory engine over a Secure Sockets Layer (SSL) network link. The Metadirectory engine applies policies, takes appropriate actions, and posts the events to the Identity Vault.

Security System Exit Routines

RACF provides two exit interfaces. The driver uses these exits to detect activities of interest and to place events in the memory queue. When the driver exit routines place an event in the memory queue, they notify the change log started task. The change log started task then moves the event information to the change log data set. Each system that shares the security system database must run these exit routines provided by the driver in modules `LDXEVX01` and `LDXRIX01`.

The driver exit routines perform the following tasks:

- Monitor password changes from the local security system and record user and password information in the memory queue.
- Monitor security system administrative commands entered by users, either directly from the TSO command line, or as generated by the administrative panels. The exit routines record these commands and related information, such as the issuer and time stamp, in the memory queue.

Memory Queue

The memory queue is an encrypted, in-storage buffer that holds events. Events are added to the memory queue by the security system exit routines, and are removed from the queue by the change log started task. The memory queue is located in Subpool 231 (fetch-protected ECSA).

Change Log Started Task

The change log started task is notified of events added to the memory queue by the driver exit routines and moves them to the change log data set.

Each system that shares a security system database must run the change log started task. The change log started task must be started as part of your normal z/OS system initialization procedure and stopped during normal system shutdown.

Change Log Data Set

The change log started task removes encrypted events from the memory queue and stores them in the change log data set for processing by the Publisher shim. The Publisher shim removes events from the change log at configurable intervals and submits them to the Metadirectory engine. If communication with the Metadirectory engine is temporarily lost, events remain in the change log until communication becomes available again.

The change log data set is a standard z/OS direct access (DSORG=DA) data set. There is one change log data set for the set of systems that share the security system database. The change log data set must reside on a shared device unless the security system database is not shared.

LDXSERV Command

`LDXSERV` is an APF-authorized, TSO command used in both the Publisher and Subscriber channels.

When updates are passed to RACF in the Subscriber channel, `LDXSERV` is called (with the `NOLOG` parameter) to flag those items with a token in the Publisher event address space. The token's presence causes the exit routines to ignore the updates. This prevents redundant loopback to Identity Manager for any changes made through the Subscriber channel.

`LDXSERV` can also be executed manually (with the `STATUS` parameter) to display information in the change log data set. To use the command, you must include the driver load library in the logon procedure `STEPLIB` concatenation.

Configuration Overview

This section discusses driver configuration details specific to the Identity Manager driver for RACF. For basic configuration information, see the *Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/). For detailed information about configuring the driver, see Chapter 4, "Configuring the RACF Driver," on page 41.

Topics include

- "Data Flow" on page 17
- "OMVS Information Management" on page 17
- "TSO Information Management" on page 17
- "Filter and Schema Mapping" on page 17
- "RACF Password Phrases" on page 18
- "Policies" on page 18

Data Flow

Filters and policies control the data flow of users and groups to and from the connected system and the Identity Vault. The **Data Flow** option, specified during driver import, determines how these filters and policies behave:

- **Bidirectional:** Sets classes and attributes to be synchronized on both the Subscriber and Publisher channels.
- **Application to Identity Vault:** Sets classes and attributes to be synchronized on the Publisher channel only.
- **Identity Vault to Application:** Sets classes and attributes to be synchronized on the Subscriber channel only.

OMVS Information Management

The **Set Preconfigured OMVS Data** option, specified during driver import, determines whether the driver sets preconfigured OMVS (UNIX System Services) attributes for new users in the security system.

The attributes you can configure are:

- **OMVSPGM:** The default program (login shell)
- **UID Assignment:** Whether UID and GID numbers are assigned by the security system or by the Identity Vault
- **HOME:** The default home directory

TSO Information Management

The **Set Preconfigured TSO Data** option, specified during driver import, determines whether the driver sets preconfigured Time Sharing Option (TSO) information for new users in the security system.

The attributes you can configure are:

- **ACCT:** The default account number
- **PROC:** The default logon procedure
- **UNIT:** The default unit name

Filter and Schema Mapping

The Metadirectory engine uses filters to control which objects and attributes are shared. The default filter configuration for the driver allows objects and attributes to be shared as described in the following table:

Table 1-2 Default Filter and Schema Mapping

eDirectory Class	eDirectory Attribute	RACF Class	RACF Attribute
User	CN	User	DirXML-RACF-userid
User	Group Membership	User	DirXML-RACF-groups
User	Login Disabled	User	DirXML-RACF-revoked
User	Login Expiration Time	User	DirXML-RACF-revokedate
User	Password Expiration Interval	User	DirXML-RACF-password-interval
User	Password Expiration Time	User	DirXML-RACF-expired
Group	CN	Group	DirXML-RACF-group

RACF Password Phrases

In z/OS 1.10, RACF supports password phrases, which may be case-sensitive and up to 100 characters in length. This is a departure from the previous requirements for RACF passwords, in which you were allowed a maximum of 8 non-case-sensitive characters. You can allow the driver to capture and synchronize RACF password phrases by selecting this option.

Policies

The Metadirectory engine uses policies—each with its own set of specific rules—to control the flow of information into and out of the Identity Vault. This section describes each policy and its rules.

Subscriber Policies

This section describes policies categorized under the Subscriber channel.

Event Transformation Policies

The driver includes one policy in this category: NOVLRACFDCFG-sub-et. Its purpose is to:

- Veto events that fall outside of the configured container scope for Users and Groups
- Veto move and rename events, which are not natively supported by RACF

Matching Policies

One policy exists in this category: NOVLRACFDCFG-sub-mp. The purpose of this policy is to query the RACF database for objects matching the CN attribute value of the User or Group event being processed.

Creation Policies

There is one default policy, NOVLRACFDCFG-sub-cp, which provides the following:

- Require RACF password and NAME fields
- Set default Group and Owner fields

Additional package NOVLRACFOMVS-sub-cp may be added to provide:

- Default OMVS segment fields
- UID and/or GID assignments
- Configures default OMVS segment fields

Additional package NOVLRACFTSO-sub-cp may be added to provide:

- Default TSO segment fields

Command Transformation Policies

Four policies exist under this category. The first policy, Command Transformation, performs several tasks, depending on how the driver was imported:

- Updates the RACF NAME field, when the Given Name or Surname attributes change
- Transforms the Login Expiration Time into a a RACF revoke date format
- Transforms the Password Expiration Interval into a RACF password interval
- Transforms the Identity Vault password into a RACF pass phrase

The next three policies transform the Distribution Password into a RACF modify-password event and optionally veto the password sync if the driver is configured to do so on the Subscriber.

Output Transformation Policies

Three policies exist under this category:

- The first policy assigns default RACF CONNECT attributes when a Group Membership (CONNECT) is being added in RACF.
- The second policy sends an e-mail notice to any user that fails during password synchronization.
- The third policy generates a pseudo-attribute called RACFCMD. This attribute is the actual RACF command that will be executed on the RACF system.

  IMPORTANT: Proper execution of the default REXX scripts requires the RACFCMD pseudo-attribute. Therefore, it is imperative that this policy is not removed or modified.

Publisher Policies

This section describes policies categorized under the Publisher channel.

Input Transformation Policies

Four policies exist under this category. They are designed to convert events that originated on RACF into XDS format, suitable to be processed by the Identity Vault.

NOTE: These policies are necessary for proper XML conversion, therefore it is imperative that these policies are not removed. Modifications to these policies require a fundamental understanding of the RACF change log format, the Java Parser and XSLT.

The first policy, TSO (RACF) Input Transform, recognizes various RACF change log document formats, including password changes, pass phrase changes and command images. This policy is an XSLT style sheet, which uses a Java parser to convert the change log format to XDS format.

The next policy, RACF Back Patch Transform, may perform queries against RACF to gather information about an event for which all necessary information is not currently available.

The next policy, Final TSO Input Transform, is the last transformation policy in the chain to handle RACF change log events. It transforms the original change log event into a Publisher status document.

The last of the input transformation policies, Password(Pub)-Sub Email Notifications, generates email notifications to users whose passwords did not synchronize properly with RACF.

Matching Policies

One policy exists under this category: Matching Rule. The purpose of this policy is to query the Identity Vault for User or Group objects whose CN attributes match the name of the RACF User or Group being processed.

Creation Policies

One policy exists under this category: Create Rule. This policy sets the required eDirectory attribute for User objects, Surname, equal to the CN value.

Placement Policies

One policy exists under this category: Placement Rule. This policy places User objects into the configured User container and Group objects into the configured Group container.

Command Transformation Policies

Four policies exists under this category. All related to user passwords, the rules in these polices:

- Strip passwords from events, if configured to do so
- Transform password events into Distribution Passwords the Login Expiration Time into a RACF revoke date format
- Add meta information to password events, to trap conditions where the sync may fail

2 Planning for the RACF Driver

This section helps you plan for deployment of the OpenText® Identity Manager 4.10 driver for RACF. Topics include

- "Deployment Planning" on page 21
- "Migration Planning" on page 22
- "Customization Planning" on page 22
- "Establishing a Security-Equivalent User" on page 23

For more information about planning, see the *Identity Manager 4.10 Installation Guide* on the Identity Manager Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

Deployment Planning

- Review Chapter 3, "Installing the RACF Driver," on page 25 and Chapter 4, "Configuring the RACF Driver," on page 41.
- Is this a new installation or an upgrade?
  - If you are installing the RACF driver on a system for the first time, use Chapter 3, "Installing the RACF Driver," on page 25, as your main procedural reference.
- Consider where and how you will install each component.
  - You must install the driver libraries (samples library, load library, and REXX exec library) on a volume that is shared by each system that shares the security system database.
  - You must run the driver shim started task on only one system that shares the security system database.
  - You must create the change log data set on a volume that is shared by all systems that share the security system database.
  - You must run the change log started task on each system that shares the security system database.
  - You must install the exit routines on each system that shares the security system database.
- Consider how you will respond to the installation prompts and other installation decisions.
- You must provide a connected system schema file during installation. A file with the required classes and attributes is provided in the driver samples library member `SCHEMDEF`.

  For details about the connected system schema file, see "The Connected System Schema File" on page 61.
- You must provide a driver shim configuration file during installation. A file that you can customize is provided in the driver samples library member `DRVCONF`.

  For details about the driver shim configuration file, see "The Driver Shim Configuration File" on page 49.

- You must provide an include/exclude file during installation. A file with basic suggested content is provided in the driver samples library member `INCEXC`.

  You can use the include/exclude file on the connected system to limit your initial deployment to a small number of users and groups.

  For details about the include/exclude file, see "The Connected System Include/Exclude File" on page 63.
- How will you prototype, test, and roll out your deployment?
- What are the host names or IP addresses of your Metadirectory server and the system that will run the driver shim started task?
- Will you use the default TCP port numbers?

Table 2-1 *Default TCP Port Numbers*

Purpose	TCP Port Number
Driver shim connection to the Metadirectory engine	8090
Driver shim HTTP services for log viewing	8091
Secure LDAP port	636
Non-secure LDAP port	389

Migration Planning

- Where are the objects that you plan to manage with the driver?
- Can you use a Matching policy to select the objects to manage based on criteria such as department, group membership, or some other attribute?

Customization Planning

- Do you plan to customize the REXX execs provided with the driver?

  For details about the provided execs, see Table 5-1, "Identity Vault Command Processing Execs," on page 56; Table 5-2, "Other Execs," on page 56; and the execs themselves.
- Do you plan to add attributes or classes to the connected system schema file?

  For details about the connected system schema file, see "The Connected System Schema File" on page 61.
- What options do you plan to use in your driver shim configuration file?

  For details about the driver shim configuration file, see "The Driver Shim Configuration File" on page 49.
- How will you use the include/exclude file?

  For details about the include/exclude file, see "The Connected System Include/Exclude File" on page 63.
- Do you plan to customize policies?

For details about customizing policies, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

- Are the resources needed to perform the customization available within your organization?

Establishing a Security-Equivalent User

The driver object must run with security equivalence to a user with sufficient rights. You can set the driver equivalent to Admin or a similar user. For stronger security, you can define a user with only the minimal rights necessary for the operations you want the driver to perform.

The driver user must be a trustee of the containers where synchronized users and groups reside, with the rights shown in Table 2-2. Inheritance must be set for [Entry Rights] and [All Attribute Rights].

Table 2-2 *Base Container Rights Required by the Driver Security-Equivalent User*

Operation	[Entry Rights]	[All Attribute Rights]
Subscriber notification of account changes (recommended minimum)	Browse	Compare and Read
Creating objects in the Identity Vault without group synchronization	Browse and Create	Compare and Read
Creating objects in the Identity Vault with group synchronization	Browse and Create	Compare, Read, and Write
Modifying objects in the Identity Vault	Browse	Compare, Read, and Write
Renaming objects in the Identity Vault	Browse and Rename	Compare and Read
Deleting objects from the Identity Vault	Browse and Erase	Compare, Read, and Write
Retrieving passwords from the Identity Vault	Browse and Supervisor	Compare and Read
Updating passwords in the Identity Vault	Browse and Supervisor	Compare, Read, and Write

If you do not set Supervisor for [Entry Rights], the driver cannot set passwords. If you do not want to set passwords, set the Subscribe setting for the User class nspmDistributionPassword attribute to Ignore in the filter to avoid superfluous error messages. For details about accessing and editing the filter, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

For complete information about rights, see the *OpenText eDirectory™ Administration Guide*.

3 Installing the RACF Driver

This section provides the information you need for first-time installation of the OpenText® Identity Manager 4.10 driver for RACF.

Topics include:

- "Before You Begin" on page 25
- "Required Knowledge and Skills" on page 25
- "Prerequisites" on page 25
- "Getting the Installation Files" on page 26
- "Creating the Driver in Designer" on page 26
- "Installing the Driver Shim on the Connected System" on page 33
- "Post-Installation Tasks" on page 39
- "Uninstalling the Driver" on page 40

Before You Begin

- Review Chapter 2, "Planning for the RACF Driver," on page 21.
- Ensure that you have the most recent distribution, support pack, and patches for the driver.
- Review the most recent support information for the driver on the NetIQ Support Web site (http://support.netiq.com).

Required Knowledge and Skills

To successfully install, configure, and use the driver, you must have system administration skills and rights for Identity Manager, z/OS, and RACF. You must be proficient with using Identity Console to configure Identity Manager drivers. You must be familiar with the facilities of the driver, and you must have developed a deployment plan.

For an overview of driver facilities, see Chapter 1, "Overview," on page 9.

For information about planning for the driver, see Chapter 2, "Planning for the RACF Driver," on page 21.

For information about administering your target systems, see your IBM and RACF documentation.

Prerequisites

- "Connected System Requirements" on page 26
- "Identity Vault Requirements" on page 26

Connected System Requirements

- ❒ z/OS 2.4, 2.5, 3.1
- ❒ RACF Security for z/OS

For information about supported platforms and operating environments, see the Identity Manager 4.10 Drivers Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/). From this index page, you can select a readme file associated with the platform(s) for which you need support.

Identity Vault Requirements

- ❒ OpenText Identity Manager (Metadirectory engine) 4.10 or later with the latest Support Pack

Getting the Installation Files

1. Obtain the most recent distribution of the Identity Manager 4.10 Driver for RACF from the NetIQ Downloads Web site (https://dl.netiq.com/index.jsp).

   At the time of this Implementation Guide's release, the RACF Driver was included in the following ISO package:

   ```
   NIdM_Integration_Module_4.10.0_Mainframes_Midrange.iso
   ```

2. Based on the version of the Identity Manager Metadirectory engine you are using, determine which files you will need to copy from the software distribution.

   2a Regardless of the Metadirectory engine version you are running, the following files are required for all installations:

   ```
   SAMPLIB.XMT
   IDMLOAD.XMT
   RACFEXEC.XMT
   ```

   These files are located under `bidirectional/RACF`.

3. Copy the files the files you will need (see Step 2) onto the workstation you will use for the installation. You will use this workstation to set up the driver on the Metadirectory server and to FTP files to the target system.

Creating the Driver in Designer

The RACF Driver supports Designer Package features, which allows you to create a driver by selecting which packages to install. After you create and configure the driver, you need to deploy it to the Identity Vault and start it.

Topics in this section include

- "Importing the Current Driver Packages" on page 27
- "Installing the Driver Packages" on page 28
- "Configuring the Driver" on page 31

- "Deploying the Driver" on page 32
- "Starting the Driver" on page 33

Importing the Current Driver Packages

Driver packages can be updated at any time and are stored in the Package Catalog. Packages are initially imported into the Package Catalog when you create a project, import a project, or convert a project. It is important to verify you have the latest packages imported into the Package Catalog before you install the driver.

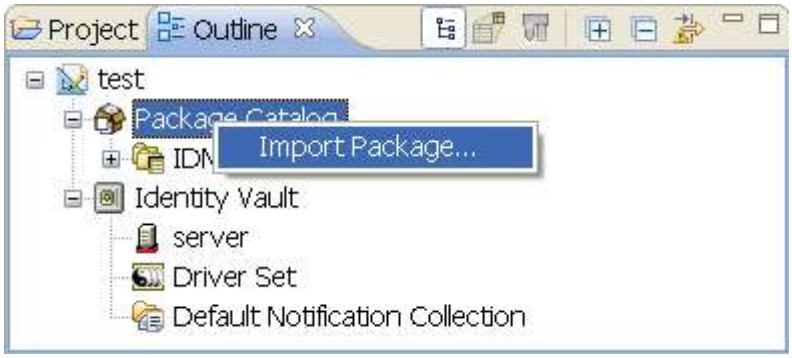
To verify you have the latest packages imported into the Package Catalog:

1. Open Designer.
2. In the toolbar, click **Help** > **Check for Package Updates**.
3. Click **OK** if there are no package updates

   or

   Click **OK** to import the package updates.
4. In the Outline view, right-click the **Package Catalog**.
5. Click **Import Package**.

   Figure 3-1 **Import Package**



6. Select the RACF Packages

   or

   Click **Select All** to import all of the packages displayed, then click **OK**.

   NOTE: By default, only the base packages are displayed. Deselect **Show Base Packages Only** to display all packages.

   ---
7. Click **OK** to import the selected packages, then click **OK** in the successfully imported packages message.
8. After the current packages are imported, continue to the next section, "Installing the Driver Packages" on page 28.

Installing the Driver Packages

After you have imported the current driver packages into the Package Catalog, you can install the driver packages to create a new driver.

1. In Designer, open your project.
2. In the Modeler, right-click the driver set where you want to create the driver, then select **New** > **Driver**.
3. Select **RACF Base** from the list of base packages, then click **Next**.
4. Select the optional features to install for the RACF driver. The options are:

   NOTE: Publications referenced in the following option descriptions can be accessed at the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

   Default Configuration: This package contains the default configuration information for the RACF driver. Always leave this option selected.

   Entitlements: This package contains configuration information for synchronizing RACF accounts and policies that enable account creation and auditing for the RACF driver. To enable account creation and auditing, verify that this option is selected. For more information, see the *Identity Manager 4.10 Entitlements Guide*.

   Password Synchronization: This package contains the policies that enable the RACF driver to synchronize passwords. To synchronize passwords, verify that this option is selected. For more information, see the *Identity Manager 4.10 Password Management Guide*.

   Data Collection: This package contains the policies that enable the driver to collect data for reports. If you are using the Identity Reporting Module, verify that this option is selected. For more information, see the *Identity Reporting Module Guide*.

   Account Tracking: This package contains the policies that enable you to track accounts for reports. If you are using the Identity Reporting Module, verify that this option is selected. For more information, see the *Identity Reporting Module Guide*.
5. After selecting the optional packages, click **Next**.
6. (Conditional) If the packages you selected to install have package dependencies, you must also install them to install the selected package. Click **OK** to install the listed package dependencies.
7. (Conditional) If more than one type of package dependency must be installed, you are presented with these packages separately. Continue to click **OK** to install any additional package dependencies.
8. (Conditional) The Common Settings page is displayed only if the Common Settings package is installed as a dependency. On the Install Common Settings page, fill in the following fields:

   User Container: Select the Identity Vault container where RACF users will be added if they don't already exist in the vault. This value becomes the default for all drivers in the driver set.

   If you want a unique location for this driver, set the value for all drivers on this page. After the driver is created, change the value on the driver's Global Configuration Values page.

   Group Container: Select the Identity Vault container where RACF users will be added if they don't already exist in the vault. This value becomes the default for all drivers in the driver set.
9. (Conditional) If not already configured, fill in the following fields on the Common Settings Advanced Edition page, then click **Next**:

User Application Provisioning Services URL: specify the User Application Identity Manager Provisioning URL.

User Application Provisioning Services Administrator: Specify the DN of the User Application Administrator user. This user should have the rights for creating and assigning resources. For more information, see "Setting Up Administrative Accounts" in the *OpenText Identity Manager 4.10 Common Driver Administration Guide*.

10 On the Install RACF page, fill in the following field:

Driver Name: Specify a name for the driver that is unique within the driver set.

11 On the Install RACF Base page, fill in the following fields to connect to the Remote Loader and click **Next**:

Connect to Remote Loader: By default, the driver is configured to connect using the Remote Loader. You must select **Yes** for this option.

Host Name: Specify the hostname or IP address of the mainframe where the RACF Driver Shim is running.

Port: Specify the port number where the Remote Loader is installed and is running for this driver. The default port number is 8090.

Remote Password: Specify the Remote Loader's password as defined on the Remote Loader. The Metadirectory server (or Remote Loader shim) requires this password to authenticate to the Remote Loader.

Driver Password: Specify the driver object password that is defined in the Remote Loader service. The Remote Loader requires this password to authenticate to the Metadirectory server.

12 On the Install RACF Base page, fill in the following fields for the driver parameters:

Polling Interval: An interval, in seconds, that specifies how often the driver shim should check for publisher events.

Heartbeat Interval: An interval, in seconds, that specifies how often the publisher should send Heartbeat status messages from the driver shim.

Publisher Disabled: Specifies whether the publisher channel should be disabled.

Synchronize RACF Password Phrases: Specifies whether Identity Vault passwords should be synchronized with RACF Password Phrases.

13 (Conditional) On the Install RACF OMVS page, fill in the following fields for the driver parameters and click **Next**.

UID Assignment: Select whether OMVS UID's should be assigned by RACF or the Identity Vault.

Default Home Directory: Enter a file system location path to create user's OMVS home directories.

Default Program: Enter a default OMVS shell for new users.

14 (Conditional) On the Install RACF TSO page, fill in the following fields for the driver parameters and click **Next**:

User Default TSO Account Number: Enter a default TSO Account Number to assign to new TSO Users.

User Default TSO Proc: Enter a default TSO Logon Procedure to assign to new TSO Users.

15 (Conditional) On the RACF Default Configuration page, fill in the following fields for the driver parameters and click **Next**:

User Default Group: Enter a RACF Default Group for new RACF Users.

User Default Owner: Enter a RACF Default Owner for new RACF Users.

Default CONNECT Owner: Enter a RACF Default Owner for new RACF Connects.

Default CONECT Authority: Enter a default level of Authority for RACF Connects.

Default CONNECT Access-Authority: Enter a default value for the Universal Access Authority for RACF Connects.

Synchronize RACF Pass Phrases on Publisher: Select whether to synchronize RACF password phrases to the Identity Vault password on the publisher channel.

Synchronize RACF Pass Phrases on Subscriber: Select whether to synchronize the Identity Vault password to RACF password phrases on the subscriber channel.

16 (Conditional) On the Entitlements Name to CSV File Mappings page, click the **Add Name to File Mapping** icon to populate the page with the entitlement configuration options. Identity Manager uses the CSV file to map RACF entitlements into corresponding resources in the Identity Manager catalog.

NOTE: This page is displayed only if you installed the Entitlements package.

The information that you specify in this page is used for creating the permissions catalog. Fill in the following fields, then click **Next**:

Entitlement Name: Specify a descriptive name for the entitlement to map it to the CSV file that contains the RACF entitlement details.

Entitlement Name is the name of the entitlement. This parameter corresponds to the Entitlement Assignment Attribute in RACF. For example, you could define an entitlement called *ParkingPass*.

Entitlement Assignment Attribute: Specify a descriptive name for the assignment attribute for an entitlement.

Entitlement Assignment Attribute holds the entitlement values in RACF. For example, you could have an attribute called *Parking*.

You must add this parameter to Field Names in the Driver Parameters page or modify it in driver settings after creating the driver.

CSV File: Specify the location of the CSV file. This file must be located on the same server as the driver. This file contains the values for the application entitlements.

Multi-valued?: Set the value of this parameter to **True** if you want to assign resources and entitlements multiple times with different values to the same user. Otherwise, set it to **False**.

17 (Conditional) On the General Information page, fill in the following fields to define your RACF system, then click **Next**:

Name: Specify a descriptive name for this RACF system. The name is displayed in reports.

Description: Specify a brief description for this RACF system. The description is displayed in reports.

Location: Specify the physical location for this RACF system. The location is displayed in reports.

Vendor: Leave IBM as the vendor of RACF. This information is displayed in reports.

Version: Specify the version of this RACF system. The version is displayed in reports.

NOTE: This page is displayed only if you installed the Managed System package.

---

18 (Conditional) This page is displayed only if you selected to install the Managed System Information packages. On the Install RACF Managed System Information page, fill in the following fields, then click **Next**:

Classification: Select the classification of the RACF system. This information is displayed in the reports. Options include:

- **Mission-Critical**
- **Vital**
- **Not-Critical**
- **Other**

If you select **Other**, you must specify a custom classification for the RACF system.

Environment: Select the type of environment the RACF system provides. Options include:

- **Development**
- **Test**
- **Staging**
- **Production**
- **Other**

If you select **Other**, you must specify a custom classification for the RACF system.

NOTE: This page is displayed only if you installed the Managed System package.

---

19 (Conditional) On the System Ownership page, fill in the following fields to define the ownership of the RACF system, then click **Next**:

Business Owner: Select a user object in the Identity Vault that is the business owner of the RACF system. This can only be a user object, not a role, group, or container.

Application Owner: Select a user object in the Identity Vault that is the application owner of the RACF system. This can only be a user object, not a role, group, or container.

20 (Conditional) On the Account Tracking page, fill in the following field, then click **Next**:

Realm: Specify the realm, security domain, or namespace where the account name is unique.

NOTE: The page is displayed only if you installed the Account Tracking Package.

---

21 Review the summary of tasks that will be completed to create the driver, then click **Finish**.

The driver is created. You can modify the configuration settings by continuing with the next section, "Configuring the Driver" on page 31. If you don't need to configure the driver, skip ahead to "Deploying the Driver" on page 32.

Configuring the Driver

There are many settings that can help you customize and optimize the driver. The settings are divided into categories such as Driver Configuration, Engine Control Values, and Global Configuration Values (GCVs). Although it is important for you to understand all of the settings, your

first priority should be to review the Driver Parameters located on the Driver Configuration page and the Global Configuration Values. These settings must be configured properly for the driver to start and function correctly.

To access the Driver Properties page:

1 Open your project.

2 In the Modeler, right-click the driver icon or the driver line, then select **Properties**.

3 Modify the driver settings as necessary.

IMPORTANT: In addition to the driver settings, you should review the set of default policies and rules provided by the basic driver configuration. Although these policies and rules are suitable for synchronizing with RACF*, your synchronization requirements for the driver might differ from the default policies. If this is the case, you need to change them to carry out the policies you want. The default policies and rules are discussed in "Configuration Overview" on page 16.

---

4 Continue with the next section, "Deploying the Driver" on page 32.

Deploying the Driver

After a driver is created in Designer, it must be deployed into the Identity Vault:

1 In Designer, open your project.

2 In the Modeler, right-click the driver icon or the driver line, then select **Live** > **Deploy**.

3 If you are authenticated to the Identity Vault, skip to Step 5; otherwise, specify the following information:

Host: Specify the IP address or DNS name of the server hosting the Identity Vault.

Username: Specify the DN of the user object used to authenticate to the Identity Vault.

Password: Specify the user's password.

4 Click **OK**.

5 Read through the deployment summary, then click **Deploy**.

6 Read the successful message, then click **OK**.

7 Click **Define Security Equivalence** to assign rights to the driver.

7a Click **Add**, then browse to and select the object with the correct rights.

7b Click **OK** twice.

8 Click **Exclude Administrative Roles** to exclude users that should not be synchronized.

You should exclude any administrative User objects (for example, Admin and DriversUser) from synchronization:

8a Click **Add**, then browse to and select the user object you want to exclude.

8b Click **OK**.

8c Repeat Step 8a and Step 8b for each object you want to exclude.

8d Click **OK**.

9 Click **OK**.

Starting the Driver

When a driver is created, it is stopped by default. To make the driver work, you must start the driver and cause events to occur. Identity Manager is an event-driven system, so after the driver is started, it won't do anything until an event occurs.

To start the driver:

1. In Designer, open your project.
2. In the Modeler, right-click the driver icon or the driver line, then select **Live** > **Start Driver**.

Installing the Driver Shim on the Connected System

The driver shim and its files are installed into data sets that you specify, and into files created by the installation process in the HFS.

The driver uses an embedded Remote Loader. It is not necessary to install Java on the connected system.

For all procedures in this section that are performed using the target RACF system, you must use a privileged user with both TSO and OMVS segments.

Topics in this section include

- "Setting Up the Libraries on Your z/OS System" on page 33
- "Authorizing the Driver TSO Commands" on page 35
- "Securing the Driver Shim with SSL" on page 35
- "Configuring the Remote Loader and Driver Object Passwords" on page 35
- "Allocating and Initializing the Change Log Data Set" on page 36
- "Setting Up the Started Tasks" on page 36
- "Testing before Installing the Security System Exit" on page 38
- "Installing the Driver Security System Exits" on page 38
- "Testing the Completed Connected System Installation" on page 39

Setting Up the Libraries on Your z/OS System

The driver shim is packaged as z/OS partitioned data sets (PDS) unloaded with the `TRANSMIT` command.

- **Driver Samples Library:** `samplib.xmt` contains sample cataloged procedures, other JCL, and sample configuration-related files.
- **Driver Load Library:** `idmload.xmt` contains executable programs for the driver shim.
- **Driver REXX Exec Library:** `racfexec.xmt` contains the REXX execs for the scriptable framework and to perform configuration tasks.

To upload these files to the target system and extract them:

1. Use FTP to upload the files to the target system from the workstation where you placed them in Step 2 on page 26.

```
c:\> ftp Your-z/OS-Host
User: Your-User-ID
Password:
ftp> quote site lrecl=80 recfm=fb
ftp> binary
ftp> put samplib.xmt
ftp> put racfexec.xmt
ftp> quote site pri=30 sec=5 cyl
ftp> put idmload.xmt
ftp> quit
```

2 Log on to z/OS using the same user ID that you used for the FTP session.

3 Use the TSO `RECEIVE` command to extract the data sets. When `RECEIVE` prompts you for parameters, specify the appropriate data set names and volumes according to your standards.

   Place these data sets on a disk volume that is shared by the systems that share the security system database.

```
READY
receive indataset(samplib.xmt)
INMR901I Dataset IDM.SAMPLIB from ADMIN on SYSB
INMR906A Enter restore parameters or 'DELETE' or 'END' +
dsname('sys3.idm.samplib') volume(work0a)
. . . many IEBCOPY messages . . .
INMR001I Restore successful to dataset 'SYS3.IDM.SAMPLIB'
READY
receive indataset(idmload.xmt)
INMR901I Dataset IDM.LOAD from ADMIN on SYSB
INMR906A Enter restore parameters or 'DELETE' or 'END' +
dsname('sys3.idm.load') volume(work0a)
. . . many IEBCOPY messages . . .
INMR001I Restore successful to dataset 'SYS3.IDM.LOAD'
READY
receive indataset(racfexec.xmt)
INMR901I Dataset IDM.RACFEXEC from ADMIN on SYSB
INMR906A Enter restore parameters or 'DELETE' or 'END' +
dsname('sys3.racf.racfexec') volume(work0a)
. . . many IEBCOPY messages . . .
INMR001I Restore successful to dataset 'SYS3.RACF.RACFEXEC'
READY
```

4 Add the driver load library to the APF list.

   Use the `PARMLIB IEAAPF`*xx* or `PROG`*xx* member as appropriate. If you use the dynamic APF facility, you can use the `SET PROG` command to activate your changes. Otherwise, you must IPL for the change to take effect.

5 Restrict access to the driver load library.

WARNING: Do not put the driver load library in the linklist unless you use program protection to secure its contents against unauthorized use. Failure to protect the driver load library introduces security exposures.

---

6 Customize the JOB card and run the job in the samples library member `HFSINST`.

   This creates the HFS file system structure for the driver.

Authorizing the Driver TSO Commands

LDXSERV and SAFQUERY require APF authorization. They reside in the driver load library, which you added to the APF list in Step 4 on page 34. You must also add them to the list of authorized TSO commands.

1 Add LDXSERV and SAFQUERY to the AUTHCMD NAMES(...) statement in member IKJTSO*xx* of SYS1.PARMLIB or its equivalent.

Example 3-1 *Example:*

```
AUTHCMD NAMES( +
  . . . other commands . . . +
  LDXSERV SAFQUERY)
```

2 Use the PARMLIB TSO command to activate your changes.

Example 3-2 *Example:*

```
PARMLIB CHECK(00)
PARMLIB UPDATE(00)
```

For more information about the PARMLIB command, see the *TSO/E System Programming Command Reference* for your system.

Securing the Driver Shim with SSL

1 Run the REXX exec in the REXX exec library member SETCERT.

2 When prompted, enter the Metadirectory server host name or IP address and secure LDAP port number (default is 636).

3 When prompted, enter Y to accept the certificate authority presented.

```
  You are about to connect to the eDirectory LDAP server to retrieve
  the eDirectory Tree Trusted Root public certificate.

  Enter the LDAP Server Host Address [localhost]:
sr.digitalairlines.com
  Enter the LDAP Server Port [636]:

  Certificate Authority:
     Subject:       ou=Organizational CA,o=TREENAME
     Not Before:    20160821144845Z
     Not After:     20260821144845Z
  Do you accept the Certificate Authority? (Y/N) y
```

Configuring the Remote Loader and Driver Object Passwords

Run the REXX exec in the driver REXX exec library member SETPWDS, and respond to the prompts.

Use the same passwords that you used in Step 11 on page 29 when setting up the driver on the Metadirectory server.

Allocating and Initializing the Change Log Data Set

The change log data set is a standard z/OS direct access data set. The change log data set must reside on a shared device unless it is used by only a single system.

Create one change log data set. It is shared by each z/OS system that shares the security system database.Use the log file utility `LDXUTIL` to initialize the change log data set. The change log data set must be initialized before you start the driver shim started task for the first time.

To allocate and initialize the change log data set:

1. Customize the samples library member `LOGINIT`.

   Update the JCL to conform to your local installation requirements, and specify the following:

   - The name of your driver load library.
   - A name for your change log data set.
   - The shared disk volume where the change log is to be allocated. Specify a different unit name if appropriate.
2. Run the LOGINIT job.

   An IEC031I D37 message is normal and should be ignored.
3. Ensure that your change log data set is protected appropriately for the sensitive nature of its contents.

WARNING: If you initialize a change log data set that contains data, the data is lost.

Setting Up the Started Tasks

- "Setting Up the Change Log Started Task" on page 36
- "Setting Up the Driver Shim Started Task" on page 37

Setting Up the Change Log Started Task

You must install and run the change log started task on each system that shares the security system database.

To install the change log started task:

1. Copy member `LDXLOGR` from the samples library to your started task procedure library (`SYS1.PROCLIB` or its equivalent). You can give the change log started task a different name if necessary.
2. Update the JCL to specify the following:

   - The name of your driver load library
   - The name of your change log data set
3. Add the change log started task to your system startup and shutdown procedures.

   For information about starting and stopping the change log started task, see "Starting and Stopping the Change Log Started Task" on page 69.

The change log started task should be started during your system startup procedure before user processing begins. Any events of interest that occur are stored in the memory queue until the change log started task has initialized.

The change log started task should be stopped during your system shutdown procedure after all user processing has ended. Any events of interest that occur after the change log started task shuts down remain in the memory queue and are lost when the system is shut down.

4 Review your Workload Manager definitions to ensure that the change log started task is assigned to a Service Class appropriate for its role.

Setting Up the Driver Shim Started Task

Install and run the driver shim started task on only one system that shares the security system database.

To install the driver shim started task:

1 Copy member `RACFDRV` from the samples library to your started task procedure library (`SYS1.PROCLIB` or its equivalent). You can give the driver shim started task a different name if necessary.

2 Update the JCL to specify the following:

- The name of your driver load library
- The name of your driver shim configuration file

  You can use your driver samples library member `DRVCONF` as a model. For details, see "The Driver Shim Configuration File" on page 49.
- The name of your connected system schema file

  You can use your driver samples library member `SCHEMDEF` as a model. For details, see "The Connected System Schema File" on page 61.
- The name of your include/exclude file

  You can use your driver samples library member `INCEXC` as a model. For details, see "The Connected System Include/Exclude File" on page 63.
- The name of your change log data set
- The name of your driver REXX exec library

3 Add the driver shim started task to your system startup and shutdown procedures.

For information about starting and stopping the driver shim started task, see "Starting and Stopping the Driver Shim Started Task" on page 69.

The driver shim started task should be started during your system startup procedure before user processing begins. The driver shim started task should be stopped during your system shutdown procedure after all user processing has ended.

4 Review your Workload Manager definitions to ensure that the driver shim started task is assigned to a Service Class appropriate for its role.

5 Assign a restricted user ID to the `RACFDRV` started task, which has OMVS and TSO segments. This user ID must have read/write permissions to the `opt/novell/racfdrv` directory and subdirectories to run properly.

```
  ADDUSER RACFDRV OMVS(UID(0)) TSO RESTRICTED SPECIAL AUDITOR
NOPASSWORD NOOIDCARD
  SETROPTS GENERIC(STARTED)
  RDEFINE STARTED RACFDRV.* STDATA(USER(RACFDRV) GROUP(SYS1)
TRUSTED(YES))
  SETROPTS CLASSACT(STARTED)
  SETROPTS RACLIST(STARTED)
  SETROPTS RACLIST(STARTED) REFRESH
```

In this example, adding the `SPECIAL` and `AUDITOR` attributes allows the driver shim (`RACFDRV`) to enter any valid RACF command. `NOPASSWORD` and `NOIDCARD` "protects" the RACF ID against being used to enter system by any means that requires a password. You will also need to change the `SYS1` placeholder to the value of a GROUP profile on your RACF system that can be assigned to started tasks.

If you wish to assign `RACFDRV` a UNIX user ID other than "0", you must then ensure the owner of the `/opt/novell/racfdrv` directory reflects this new user ID:

```
oshell chown -R RACFDRV /opt/novell/racfdrv
```

Testing before Installing the Security System Exit

You can use the `LDXSERV` command to test your installation before you install the exit.

1. If it is not already running, start the change log started task.

   For details about starting the change log started task, see "Starting and Stopping the Change Log Started Task" on page 69.

2. Issue the following command from a TSO session that has the driver load library included in its STEPLIB concatenation:

   ```
   LDXSERV STATUS
   ```

   Examine the output of the command. You should see information about the memory queue, information about the change log started task, and a valid, empty change log data set.

Installing the Driver Security System Exits

Follow your normal procedure for applying such changes to your z/OS system. We recommend that you

- Install and test the exits on a test system or partition first.
- Make a copy of your system volumes before applying any changes.
- Consider packaging the exits as SMP/E user modifications.

To install the RACF exits:

1. Install `LDXEVX01`, the Common Command exit, using the Dynamic Exit Facility.

   For testing, we recommend that you set up two `PROGxx` members in `SYS1.PARMLIB` (or equivalent), to allow for easy removal of the exit if desired.

   1. Edit `SAMPLIB` members `PROGAD` and `PROGDL`. Change <LDX load library> to your LDX load library name.

2. Copy these two members to your system PARMLIB data set. If you already have a PROGAD or PROGDL member, rename the LDX members to a PROGxx name that's not in use.
3. When ready, use the console command SET PROG=AD to activate LDXEVX01 as an IRREVX01 exit point.
4. To uninstall the LDX exit, issue SET PROG=DL as a console command.

For permanent installation, do one of the following:

- Add the EXIT ADD statement in PROGAD to your production PROG *xx* PARMLIB member.
- Add a SET PROG=AD command to CONSOL00 or an automation script, so that it is issued during your IPL procedure.

2 Install ICHRIX02, the RACROUTE REQUEST=VERIFY(X) (RACINIT) postprocessing exit.

- If you do not have an existing ICHRIX02 exit, run the job in the samples library member RIX0A. This job uses SMP/E to linkedit LDXRIX02 into SYS1.LPALIB as exit ICHRIX02.
- If you have an existing ICHRIX02 exit, update samples library member RIX0B as appropriate. RIX0B installs a router that calls the driver postprocessing exit and your existing exit.

NOTE: To uninstall this exit, use the SMP/E RESTORE function and then IPL with the CLPA option.

---

3 After you have installed these two exits, IPL the z/OS system with the CLPA option.

Testing the Completed Connected System Installation

1 If it is not already running, start the change log started task.

For details about starting the change log started task, see "Starting and Stopping the Change Log Started Task" on page 69.

2 Perform some actions to exercise the security system exit routines and create some sample events.

2a Change a password using the logon screen.

2b Create new user ID.

3 Issue the following command from a TSO session that has the driver load library included in its STEPLIB concatenation:

```
LDXSERV STATUS
```

Examine the output of the command. You should see the exit routines loaded, information about the memory queue, information about the change log started task, and a valid, non-empty change log data set.

Post-Installation Tasks

1 If desired, set **Startup Option** on the Driver Configuration page to **Auto start**. This causes the driver to start when the Metadirectory engine starts.

2 Activate the driver.

Identity Manager and Identity Manager drivers must be activated within 90 days of installation or they shut down. At any time during the 90 days, or afterward, you can activate Identity Manager products.

For details about activating OpenText Identity Manager Products, see the *Identity Manager 4.10 Installation Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

Uninstalling the Driver

- "Uninstalling the Security System Exits" on page 40
- "Uninstalling the Driver Shim" on page 40
- "Uninstalling the Driver Object from eDirectory" on page 40

Uninstalling the Security System Exits

To uninstall exit `LDXEVX01`, the Common Command exit, issue `SET PROG=DL` from the console.

To uninstall exit `LDXRIX02`, use the SMP/E RESTORE function and then IPL with the CLPA option.

Uninstalling the Driver Shim

1. Remove the change log started task and driver shim started task from your system startup and shutdown procedures.
2. Stop the change log started task and driver shim started task.

   For details, see "Starting and Stopping the Change Log Started Task" on page 69 and "Starting and Stopping the Driver Shim Started Task" on page 69.
3. Remove members `LDXLOGR` and `RACFDRV` from your started task procedure library.
4. Remove the driver load library from your APF list.

   Reverse the action you took in Step 4 on page 34.
5. Remove the `LDXSERV` and `SAFQUERY` commands from `IKJTSO`*xx*.

   Reverse the actions you took in "Authorizing the Driver TSO Commands" on page 35.
6. Remove the driver files from the HFS. They were created in Step 6 on page 34.

   ```
   rm -rf /opt/novell
   ```
7. Delete the driver samples library, load library, and REXX exec library that you created in Step 3 on page 34.
8. Delete the change log data set that you created in "Allocating and Initializing the Change Log Data Set" on page 36.

Uninstalling the Driver Object from eDirectory

1. In Identity Console, select the **IDM Administration** page from the landing page.
2. Click the **Actions Menu** icon from the driver object to delete and select **Delete Driver**.
3. Click **OK** to confirm.

4 Configuring the RACF Driver

After you have installed the Identity Manager 4.10 driver for RACF, use the information in this section for configuration. Topics include

- "Driver Parameters and Global Configuration Values" on page 41
- "The Driver Shim Configuration File" on page 49
- "Setting the Remote Loader and Driver Object Passwords" on page 51
- "Migrating Identities" on page 52
- "International Considerations" on page 53

Driver Parameters and Global Configuration Values

You can control the operation of the driver by modifying the properties described in the following sections.

IMPORTANT: Changing these values requires a restart of the driver.

- "Setting Properties during Driver Import" on page 41
- "Driver Configuration Page" on page 43
- "Global Configuration Values Page" on page 45

To change import-only properties, you must re import the driver configuration file `RACF-IDM3_6_0-V5.xml` over the existing driver, or add the required additional Designer packages. For details, see "Creating the Driver in Designer" on page 26.

To edit the properties shown on the Driver Configuration page and the Global Config Values page:

1. In Identity Console, select the Identity Manager **Drivers** module landing page.
2. Select your driver and click the **Configuration** tab.
3. Select **Driver Parameters** or **Global Config Values** as appropriate.
4. Edit the property values as desired, then click the **Save** icon.

Setting Properties during Driver Import

Properties that you can set only during driver import are used to generate policies and other configuration details.

Table 4-1 Driver Import-Only Parameters

Property Name	Values or Format
"Data Flow" on page 42	Bidirectional Application to Identity Vault Identity Vault to Application
"Set Preconfigured TSO Data" on page 42	Yes No
"Set Preconfigured OMVS Data" on page 42	Yes No
"Enable Entitlements" on page 43	Yes No
"Use SSL" on page 43	Yes No

Data Flow

- **Bidirectional:** Identities are synchronized from both the Identity Vault and the connected system (application). After all pending events are processed, the Identity Vault and connected system mirror each other.
- **Application to Identity Vault:** Identities are synchronized from the connected system (application) to the Identity Vault, but not vice versa. For example, an identity created in the Identity Vault is not created on the connected system unless explicitly migrated.
- **Identity Vault to Application:** Identities are synchronized from the Identity Vault to the connected system (application), but not vice versa. For example, changes made to a RACF identity are not synchronized to the Identity Vault.

Set Preconfigured TSO Data

- **Yes:** Enables prompts for the default TSO account number and default TSO procedure.
- **No:** Disables prompts for the default TSO account number and default TSO procedure.

Set Preconfigured OMVS Data

- **Yes:** Enables prompts for the UID and GID number assignment source (RACF or Identity Vault), the default home directory path and the default program.
- **No:** Disables prompts for the UID and GID number assignment source (RACF or Identity Vault), the default home directory path and the default program.

Enable Entitlements

Specifies whether the driver uses either Approval Flow or Roles-Based Entitlements with the Entitlements Service driver.

Enable entitlements for the driver only if you plan to use the User Application or Roles-Based Entitlements with the driver.

You can use Role-Based Entitlements to integrate the driver with the Identity Manager User Application. For more information about Roles-Based Entitlements, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

Use SSL

Specifies whether the driver uses Secure Sockets Layer (SSL) to encrypt the connection between the Identity Vault and the application.

OpenText strongly recommends that you use SSL. If you do not use SSL, your identity data, including passwords, is sent across the network in clear text.

Driver Configuration Page

Table 4-2 *Driver Configuration Page*

Property Name	Values or Format
Driver Module	Connect to Remote Loader must be selected
"Driver Object Password" on page 44	Text value
Authentication ID	Not used
Authentication Context	Not used
"Remote Loader Connection Parameters" on page 44	Host name or IP address and port number of the driver shim on the connected system, and the RDN of the object with the server certificate
Driver Cache Limit	The recommended value is 0 (zero)
Application Password	Not used
"Remote Loader Password" on page 44	Text value
Startup Option	Auto start Manual
"Automatic Loopback Detection" on page 44	Yes No
"Polling Interval" on page 44	Number of seconds
"Heartbeat Interval" on page 45	Number of seconds
"Publisher Disabled" on page 44	Yes No

Driver Object Password

The Driver object password is used by the driver shim (embedded Remote Loader) to authenticate itself to the Metadirectory engine. This must be the same password that is specified as the Driver object password on the connected system driver shim.

Remote Loader Connection Parameters

The Remote Loader Connection Parameters option specifies information that the driver uses for Secure Sockets Layer (SSL) communication with the connected system.

Table 4-3 *Remote Loader Connection Parameters*

Parameter	Description
`host=`*`hostName`*	Connected system host name or IP address.
`port=`*`portNumber`*	Connected system TCP port number. The default is 8090.
`kmo=`*`objectRDN`*	The RDN of the object with the server certificate signed by the tree's certificate authority. Enclose the RDN in double quotes (") if the name contains spaces.

The following is an example Remote Loader connection parameter string:

```
hostname=192.168.17.41 port=8090 kmo="SSL CertificateDNS"
```

Remote Loader Password

The Remote Loader password is used to control access to the driver shim (embedded Remote Loader). This must be the same password that is specified as the Remote Loader password on the connected system driver shim.

Automatic Loopback Detection

Specifies whether the driver shim discards events that would cause loopback conditions. This function supplements the loopback detection provided by the Metadirectory engine. The RACF driver provides its own loopback detection, so this option should always be set to **No**.

Polling Interval

Specifies the number of seconds that the Publisher shim waits after running the polling exec and sending events from the change log to the Metadirectory engine. The default interval is 60 seconds.

Publisher Disabled

Specifies whether the Publisher shim is active.

Select **Yes** if you are using Identity Vault to Application (one-way) data flow. This saves processing time.

Heartbeat Interval

Specifies how often, in seconds, the driver shim contacts the Metadirectory engine to verify connectivity. Specify 0 to disable the heartbeat.

Global Configuration Values Page

Table 4-4 *Global Configuration Values*

Property Name	Values or Format
“Connected System or Driver Name” on page 46	Text value
“User Default Group” on page 46	Text value
“User Default Owner” on page 46	Text value
“Default CONNECT Attributes” on page 46	Text value
“User Default TSO Account Number” on page 46	Text value
“User Default TSO Proc” on page 46	Text value
“UID Assignment” on page 46	Assign by RACF Assign by Identity Vault
“Default Home Directory” on page 47	Text value
“Default Program” on page 47	Text value
“The RACF Connected System Accepts Passwords from the Identity Vault” on page 47	Yes No
“The Identity Vault Accepts Passwords from the RACF Connected System” on page 47	Yes No
“Publish Passwords to NDS Password” on page 47	Yes No
“Publish Passwords to Distribution Password” on page 47	Yes No
“Require Password Policy Validation before Publishing Passwords” on page 47	Yes No
Reset User’s External System Password to the Identity Manager Password on Failure	Yes No
“Synchronize RACF Pass Phrases to Identity Vault Passwords on the Publisher Channel” on page 48	Yes No
“Synchronize RACF Pass Phrases to Identity Vault Passwords on the Publisher Channel” on page 48	Yes No
“Synchronize Identity Vault Passwords to RACF Pass Phrases on the Subscriber Channel” on page 48	Yes No

Property Name	Values or Format
"Synchronize RACF Passwords to Identity Vault Passwords on the Publisher Channel" on page 48	Yes No
"User Base Container" on page 48	Identity Vault Container object
"Group Base Container" on page 48	Identity Vault Container object

To view and edit Password Management GCVs, select **Show** for **Show Password Management Policy**.

To view and edit User and Group Placement GCVs, select **Show** for **Show User and Group Placements**.

Connected System or Driver Name

Specifies the name of the driver. This value is used by the e-mail notification templates.

User Default Group

Specifies the default group for new users.

User Default Owner

Specifies the default owner for new users.

Default CONNECT Attributes

When a Group Membership (CONNECT) is added in RACF, additional operands can be specified as properties of the CONNECT. This field allows you to edit the default values. The default values are

```
authority(use) uacc(read)
```

User Default TSO Account Number

Specifies the default account number for new users.

User Default TSO Proc

Specifies the default cataloged procedure name for new users. For example, `IKJACCNT`.

UID Assignment

Specifies how UID and GID numbers are assigned to new users and groups. Select **Assign by RACF** or **Assign by Identity Vault**.

Default Home Directory

Specifies the default OMVS home directory path for new users. Include the ending slash (`/`) in the directory path. The user's user ID is appended to the value that you specify. Use a value similar to the following:

```
/home/
```

In this example, the home directory that is assigned by the driver for a user whose user ID is `IBMUSER` is `/home/IBMUSER`.

Default Program

Specifies the default OMVS program (login shell). Use a value similar to the following:

```
/bin/sh
```

The RACF Connected System Accepts Passwords from the Identity Vault

Specifies whether the driver allows passwords to flow from the Identity Vault to the connected system.

The Identity Vault Accepts Passwords from the RACF Connected System

Specifies whether the driver allows passwords to flow from the connected system to the Identity Vault.

Publish Passwords to NDS Password

Specifies whether the driver uses passwords from the connected system to set NDS® passwords in the Identity Vault. NDS passwords in the Identity Vault are not bidirectional and cannot be synchronized to another system.

Publish Passwords to Distribution Password

Specifies whether the driver uses passwords from the connected system to set NMAS™ Distribution Passwords, which are used for Identity Manager password synchronization.

Require Password Policy Validation before Publishing Passwords

Specifies whether the driver applies NMAS password policies to published passwords. If so, a password is not written to the Identity Vault if it does not conform.

Reset User's External System Password to the Identity Manager Password on Failure

Specifies whether, on a publish Distribution Password failure, the driver attempts to reset the password on the connected system using the Distribution Password from the Identity Vault.

Notify the User of Password Synchronization Failure via E-Mail

Specifies whether the driver sends an e-mail to a user if the password cannot be synchronized.

Synchronize RACF Pass Phrases to Identity Vault Passwords on the Publisher Channel

Specifies whether the driver should publish and synchronize changes to the RACF pass phrase to the Identity Vault password.

Synchronize Identity Vault Passwords to RACF Pass Phrases on the Subscriber Channel

Specifies whether password changes in the Identity Vault should be synchronized with the RACF pass phrase.

Synchronize RACF Passwords to Identity Vault Passwords on the Publisher Channel

Specifies whether password changes in RACF should be synchronized with the Identity Vault password.

User Base Container

Specifies the base container object in the Identity Vault for user synchronization. This container is used in the Subscriber channel Event Transformation policy to limit the Identity Vault objects being synchronized. This container is used in the Publisher channel Placement policy as the destination for adding objects to the Identity Vault. Use a value similar to the following:

```
users.myorg
```

Group Base Container

Specifies the base container object in the Identity Vault for group synchronization. This container is used in the Subscriber channel Event Transformation policy to limit the Identity Vault objects being synchronized. This container is used in the Publisher channel Placement policy as the destination when adding objects to the Identity Vault. Use a value similar to the following:

```
groups.myorg
```

The Driver Shim Configuration File

The driver shim configuration file controls operation of the driver shim. You can specify the configuration options listed in Table 4-5, one per line. You can also specify these options on the command line. For details about driver shim command line values, see "Driver Shim Command Line Options" on page 107.

The driver shim configuration file must be a sequential file or a member of a partitioned data set. The `DRVCONF DD` statement in the driver shim started task JCL identifies the driver shim configuration file. An example driver shim configuration file is provided in the driver samples library member `DRVCONF`.

Table 4-5 *Driver Shim Configuration File Statements*

Option (Short and Long Forms)	Description

`-conn <connString>`
`-connection <connString>`
	A string with connection options. Enclose the string in double quotes ("). If you specify more than one option, separate the options with spaces.
	`port=<driverShimPort>`
	`ca=<Certificate Authority Key File>`

`-hp <httpPort>` `-httpport <httpPort>`	Specifies the HTTP services port number. The default HTTP services port number is 8091. You can connect to this port to view log files. For details, see "The Trace File" on page 75 and "The Status Log" on page 76.
`-path <driverPath>`	Specifies the path for driver files. The default path is `/opt/novell/racfdrv`.
`-sp <RLpassword>,<DOpassword>,` `-setpassword <RLpassword>,<DOpassword>,`	Sets the Remote Loader and Driver object passwords.
`-t <traceLevel>` `-trace <traceLevel>`	Sets the level of debug tracing. 0 is no tracing, and 10 is all tracing. For details, see "The Trace File" on page 75. The output file location is specified by the `tracefile` option.

Option (Short and Long Forms)	Description
`-tfm` *`size`* `-tracefilemax` *`size`*	Specifies the limit to the size of the trace file for this instance. Specify the value in kilobytes, megabytes, or gigabytes, using the abbreviation for the byte type. The minimum value is 100K. For example: ◆ `-tracefilemax 1000K` ◆ `-tracefilemax 100M` ◆ `-tracefilemax 10G` **NOTE:** ◆ When you add this option to the configuration file, the application uses the specified name for the tracefile and includes up to 9 “roll-over” files. Each file size is 1/10th of the total size specified. The roll-over files are named using the base of the main trace filename plus `_n`, where `n` is 1 through 9. ◆ If the trace file data is larger than the specified maximum when the Driver Shim is started, the trace file data remains larger than the specified maximum until roll-over is completed through all 10 files.
`-ndl`	Disables writing to the driver status log file.
`-nodirxmllog`	Disables writing to `dirxml.log`.
`-nohttpport`	Disables the HTTP service.
`-disablerexx`	Disables REXX script invocations; enables driver shim to invoke RACF commands directly.
`-pollinginterval n`	Sets driver shim’s Publisher polling interval in seconds. This overrides the driver parameters.
`-heartbeatinterval n`	Sets driver shim’s heartbeat interval in seconds. This overrides the driver parameters.

Example Driver Shim Configuration File

```
-tracefile /opt/novell/racfdrv/logs/trace.log
-trace 3
-connection "ca=/opt/novell/racfdrv/keys/ca.pem"
-path /opt/novell/racfdrv/
```

Setting the Remote Loader and Driver Object Passwords

The Remote Loader password is used by the Metadirectory engine to authenticate itself to the driver shim (embedded Remote Loader). The Driver object password is used by the driver shim to authenticate itself to the Metadirectory engine.

These passwords are set during installation. You can set them at any time later using the procedures in the following sections. The corresponding passwords you set on the connected system and in the Identity vault must be identical.

- "Connected System" on page 51
- "Identity Vault" on page 51

Connected System

The Remote Loader and Driver object passwords are stored on the connected system under `/opt/novell/racfdrv/keys` in encrypted files `dpwdlf40` (Driver object password) and `lpwdlf40` (Remote Loader password).

To set the passwords on the connected system:

1. Run the REXX exec in the REXX exec library member `SETPWDS` and respond to the prompts.
2. Restart the driver shim started task.

Identity Vault

The Remote Loader and Driver object passwords are set for the driver through Identity Console and are stored in the Identity Vault. Each password on the connected system must exactly match its counterpart in the Identity vault.

To change the passwords in the Identity Vault after driver installation:

1. In Identity Console, click the Identity Manager **Drivers** module from the landing page.
2. Click the specific driver to edit.
3. Select the **Connection Parameters** tab.
4. Ensure **Connect to Remote Loader** is selected.
5. Specify the Driver object password.
6. Specify the Remote Loader password.
7. Click **OK**.
8. Restart the driver.

Migrating Identities

When you first run the driver, you might have identities in the Identity Vault that you want to provision to the connected system, or vice versa. Identity Manager provides a built-in migration feature to help you accomplish this.

- "Migrating Identities from the Identity Vault to the Connected System" on page 52
- "Migrating Identities from the Connected System to the Identity Vault" on page 52
- "Synchronizing the Driver" on page 53

Migrating Identities from the Identity Vault to the Connected System

1. In Identity Console, click the Identity Manager **Drivers** module from the landing page.
2. Click the specific driver to perform your migration.
3. Click the **Data Transformation and Synchronization** tab.
4. Click **Migrate From IDVault** tab.
5. Click the **Add** icon. A browse and search dialog box that allows you to select objects is displayed.
6. Select the objects you want to migrate, then click **OK**.

To view the results of the migration, click **View the Driver Status Log**. For details about the log, see "The Status Log" on page 76.

If a user has a Distribution Password, the Distribution Password is migrated to the connected system as the user's password. Otherwise, no password is migrated. For information about Universal Passwords and Distribution Passwords, see the appropriate version of the *Password Management Administration Guide* at the NetIQ Documentation Web site (https://www.netiq.com/documentation).

Migrating Identities from the Connected System to the Identity Vault

1. In Identity Console, click the Identity Manager **Drivers** module from the landing page.
2. Click the specific driver to perform your migration.
3. Click **Migrate Into IDVault** tab.
4. Use the Edit Migration Criteria icon.
5. Specify your search criteria:
   - **5a** Select class User or class Group.

     IMPORTANT: Identity Manager imports objects by class in the order specified in the list. Migrate users before you migrate groups so that the users can be added to the newly created groups.

   - **5b** Select the attributes to be used as search criteria for objects of the selected class, then click **OK**.

The eDirectory attributes map to RACF attributes as specified by the driver schema: CN maps to DirXML-RACF-userid, etc. For the default mappings, see Table 1-2, "Default Filter and Schema Mapping," on page 18.

5c Specify values for the selected attributes, then click **OK**.

6 Click the **Migrate Into IDVault** icon.

To view the results of the migration, click **View the Driver Status Log**. For details about the log, see "The Status Log" on page 76.

Because local passwords cannot be retrieved from RACF, they cannot be submitted to the Metadirectory engine until they are changed. The password change exit routine captures password changes.

Synchronizing the Driver

To generate events for associated objects that have changed since the driver's last processing, in Identity Console:

1. In Identity Console, click the Identity Manager **Drivers** module from the landing page.
2. Click the specific driver to perform your synchronization.
3. Click the **Data Transformation and Synchronization** tab.
4. Click the **Synchronize** tab.
5. Select to **Examine all objects** or **Use a starting date/time**, and click the **Synchronize** icon.

International Considerations

The Identity Manager driver for RACF assumes the RACF system is using the EBCDIC Latin 1 (Open Systems) codepage for translating data to and from the Identity Manager Metadirectory engine. This codepage, IBM-1047, is configured in the `SAMPLIB` member `RACFDRV`, the JCL for starting the RACF driver shim. If your system uses a codepage other than IBM-1047, you will need to change the JCL for starting the RACF driver to ensure correct character translation.

The following line, specified in the `SAMPLIB(RACFDRV)` member, illustrates how the environment is configured for the default codepage IBM-1047:

```
//  SET ENV='ENVAR("LC_CTYPE=IBM-1047")'
```

You may change this text to reflect the codepage of your RACF system. The format is IBM-*CCSID*, where *CCSID* is a coded character set identifier, represented in decimal.

For a list of valid codepage identifiers, see the IBM CCSID reference table (https://www.ibm.com/docs/en/zos/2.5.0?topic=tapes-coded-character-sets-sorted-by-ccsid). The following table lists a subset of sample values:

Codepage	Description
IBM-858	IBM-PC
IBM-1047	Latin 1 (Open Systems)

Codepage	Description
IBM-1140	US/Canada
IBM-1141	Austria/Germany
IBM-1142	Denmark/Norway
IBM-1143	Finland/Sweden
IBM-1144	Italy
IBM-1145	Spain/Spanish Latin America
IBM-1146	UK
IBM-1147	France
IBM-1148	International
IBM-1149	Iceland

5 Customizing the RACF Driver

This section provides information about available resources for customizing the Identity Manager 4.10 driver for RACF.

Topics include

- "The Scriptable Framework" on page 55
- "The Connected System Schema File" on page 61
- "The Connected System Include/Exclude File" on page 63
- "Managing Additional Attributes" on page 68

For details about the filters and policies provided with the driver, see "Filter and Schema Mapping" on page 17 and "Policies" on page 18.

The Scriptable Framework

The driver provides a comprehensive scriptable framework that you can use to add to the built-in support for the security system, and to add support for other applications and security system fields that have been customized for a particular installation.

The driver's scriptable framework includes components that simplify the job of extending the driver to support new applications and fields.

- Embedded Remote Loader
  - Full SSL support, and an installer to easily configure the certificates
  - Web access to debugging information from the embedded Remote Loader
- Encrypted change log that stores changes from the application to the Identity Vault if there is a communication problem
- Loopback detection system to prevent subscribed events from being published back to the Identity Vault
- z/OS name/token callable services helper programs that provide for securely passing large variables to and from the REXX execs
- Easily extendable connected system schema file to support any application
- Include/exclude file for simplified testing and deployment by the platform administrator
- Event support, both for applications that have exits or callouts, and for applications that must be polled for changes

The names of objects and attributes in the REXX execs are the names specified in the connected system schema file.

The following tables describe the major REXX execs.

Table 5-1 Identity Vault Command Processing Execs

REXX Exec	Identity Vault Event
IDMADDG	Add Group
IDMADDU	Add User
IDMDELG	Delete Group
IDMDELU	Delete User
IDMMODG	Modify Group
IDMMODU	Modify User
IDMMODPW	Password Change
IDMQUERY	Query
IDMCHOPW	Check Password

Table 5-2 Other Execs

REXX Exec	Purpose
IDMSUB	Calls the appropriate command processing exec based on the type of event and object. This is executed for every Subscriber event.
IDMPOLL	Not used for RACF. You can use this exec as needed to support your own applications if they do not generate events when changes are made.
IDMHRTBT	Heartbeat exec.
IDMGLBLS	Holds configurable options that all REXX execs can use during event processing.
IDMSTATS	Sends a status document to report the health of the application.
IDMTSOEX	Executes a TSO command and returns the command return code and command output.
SETPWDS	Sets the Remote Loader and Driver object passwords, which are used to authenticate and authorize the connection between the driver shim started task and the Metadirectory system.
SETCERT	Retrieves the certificate authority for the Metadirectory engine that uses SSL to communicate with the driver shim started task.

Modifying a REXX Exec

Each of the REXX execs that come with the driver is designed with a common format, which makes it easy to read, edit, and maintain. Following are functional descriptions of the standard sections included in each exec:

- Retrieve subscriber shim variables, using `IDMGETV` sub.
- Retrieve event data variables, using `IDMGETV` event.

- Trace a useful message to be logged to the TSO print file.
- Provide comments instructing where to insert custom code before the TSO command is executed.
- Execute the TSO command stored in variable *RACFCMD*, which performs the basic action.
- Provide comments instructing where to insert custom code after the TSO command has been executed.
- Return of status document, using the `IDMSTATS` function.

Retrieving and Returning Information with IDMGETV and IDMSETV

The REXX execs use `IDMGETV` to obtain information about the event and about the properties configured on the RACF driver. The REXX execs use `IDMSETV` to return information to the driver shim or Metadirectory engine for processing. Both `IDMGETV` and `IDMSETV` are utilities, found in the distribution `LOAD` library, which transport information between REXX variables and memory storage. When information is retrieved using `IDMGETV`, the REXX variables will be created and populated and a special variable, *VariableList*, will also be created to contain a list of the available REXX variables from the shim.

To check for the existence of a REXX variable, set by `IDMGETV`, use:

```
if wordpos("VariableName", VariableList) > 0; then do;
  /* REXX variable, VariableName exists and was created by IDMGETV */
end;
```

Where *`VariableName`* is the name of the variable of interest. Event variables will contain the prefix ADD_ or REMOVE_ to indicate that this attribute has been added or removed from the object in question. For example, to check if the REVOKE field has been removed:

```
if wordpos("REMOVE_REVOKED", VariableList) > 0; then do;
  /* User had REVOKED value removed */
end;
```

For example, if the following XDS document is sent to the RACF driver shim:

```
<modify class-name="User" event-id="12345">
  <association>USER\IBMUSER</association>
  <modify-attr attr-name="DirXML-RACF-name">
    <remove-value>
      <value>IBMUSER</value>
    </remove-value>
    <add-value>
      <value>THE IBMUSER</value>
    </add-value>
  </modify-attr>
</modify>
```

The resulting REXX variables would look like:

```
COMMAND=modify
CLASS_NAME=User
EVENT_ID=12345
ASSOCIATION=USER\IBMUSER
REMOVE_DIRXML_RACF_NAME=IBMUSER
ADD_DIRXML_RACF_NAME=THE IBMUSER
```

When attributes are mapped to REXX variables, all invalid REXX variable characters are converted into underscore ("_") characters. These include "-", "@" and "...".

Multivalued (Stem) Variables

When attributes are multivalued, `IDMGETV` assigns a suffix to the variable name to index its values. The count of the number of values is represented by `suffix.0` and the values are represented from .1 to .n, where *n* is the total count. For example, if the variable `CLASSES` was multivalued with values: CLS1, CLS2, CLS3, the following variables would be created:

```
CLASSES.0=3
CLASSES.1=CLS1
CLASSES.2=CLS2
CLASSES.3=CLS3
```

To iterate over each value, use a REXX do loop:

```
do i = 1 to CLASSES.0
  class = CLASSES.i
end;
```

Returning Status Documents Using IDMSTATS

Identity Manager uses status documents, returned by the driver, to investigate whether an event was processed by the driver shim. Therefore, it's important for the REXX execs to return a status document indicating whether the event was successful or resulted in an error. Use the supplied REXX exec, `IDMSTATS`, to return a status document:

```
x = IDMSTATS("success", "Event was processed successfully", EVENT_ID);
```

The `IDMSTATS` script takes three parameters: level, message and event id. The level must be one of: success, error, warning, retry or fatal.

```
<status level="success" event-id="12345">
  Event was processed successfully
</status>
```

Understanding the RACFCMD Variable

Before an XDS command is sent to the driver shim, the Output Transformation policy converts the XDS document into a RACF TSO administrative command and stores the result in the attribute, `RACFCMD`. This process avoids adding parsing logic inside the REXX execs to build the command, making the REXX execs cleaner, shorter, and easier to read. Therefore the default action of each REXX exec is to look for the `RACFCMD` variable, which may be multivalued, and execute the command by default.

Using IDMTRACE To Print Messages

`IDMTRACE` is another REXX exec, supplied by the driver distribution, that allows you to simply trace a message to the TSO print file (`SYSTSPRT`), allocated by the `RACFDRV` JCL. It will only trace messages if `ENABLE_TRACE` is set to true in `IDMGLBLS`. It will also print the date and time before the message for convenience.

```
x = IDMTRACE("IDMADDU is running for user <"ADD_DIRXML_RACF_USERID">.");
```

Global Settings in member IDMGLBLS

The REXX exec `IDMGLBLS` is a simple script containing global settings that all scripts may use. It provides a common repository of variables you may change to alter the behavior of the other REXX execs. There are four variables of interest:

- SUBCOMMAND_SEPARATOR: Defines the character to be recognized as a delimiter between lines of output received from TSO when executing commands that produce output. The default is the EBDIC newline character.
- MESSAGE_PREFIX: Defines a string that precedes lines in the TSO print file (`SYSTSPRT`) in which a TSO command is about to be executed. The default is `-->TSO:`
- DISPLAY_TSO_OUTPUT: A boolean variable that controls whether TSO output received from a command should be displayed in the TSO print file (`SYSTSPRT`). The default is `true`
- ENABLE_TRACE: A boolean variable that controls whether `IDMTRACE` messages should be displayed. The default is `true`

NOTE: Enabling trace can be useful for troubleshooting and log collecting; however, disabling trace can reduce the amount of output that is saved in the `SYSTSPRT` file.

Using IDMTSOEX To Execute A TSO Command

In REXX, a TSO command can be evaluated simply by entering the command on its own line:

```
cmd = "ALU IBMUSER NAME(IBMUSER)IDMTRACE");
cmd;
```

The `IDMTSOEX` exec, also supplied by the distribution, will provide a few other options:

```
x = IDMSOEX(cmd);
```

- Log the command (password sanitized) using `IDMTRACE`
- Trap the output and return code from the command
- Return the code and output of the command to the caller

It's convenient to use this output to display a message back to the engine through a status document:

```
response = IDMTSOEX("ALU IBMUSER NAME(IBMUSER)");

/* first word is the return code */
if word(cmd_response) > 0 then do;
  x = IDMSTATS("error", response, EVENT_ID);
end;
else do;
  x = IDMSTATS("success", respons, EVENT_ID);
end;
```

Putting It All Together

The following code sample illustrates how the IMMADDU exec can be modified to additionally create and OMVS home directory:

```
/* retrieve subscriber variables */
"IDMGETV sub";

/* retrieve event variables */
"IDMGETV event";

/* trace a message to SYSTSPRT */
x = idmtrace("IDMADDU running for user <"ADD_DIRXML_RACF_USERID">.");

/*
   INSERT CUSTOM CODE HERE

   Add any custom code here that needs to be executed before
   creating the user in the RACF database.
*/

/* Add the user to the RACF database using a TSO command */
if wordpos("ADD_RACFCMD.0", variablelist) <= 0; then do;
  /* we did not get a RACFCMD from the event document */
  success = IDMSTATS("error", "No RACF command found", EVENT_ID);
  exit 0;
end;

do i = 1 to ADD_RACFCMD.0
  tsocmd = ADD_RACFCMD.i
  /* For an event, multiple TSO commands may be generated */
  cmd_response = IDMTSOEX(tsocmd);
  /* check the return code from our command */
  if word(cmd_response, 1) > 0 then do;
    /* an error occured, report an error and exit from script */
    success = IDMSTATS("error", cmd_response, EVENT_ID);
    exit 0;
  end;
  else do;
    success = IDMSTATS("success", cmd_response, EVENT_ID);
  end;
end;

/*
INSERT CUSTOM CODE HERE
Add any custom code here that needs to be executed after
creating the user in the RACF database.
*/

/* check for the home directory attribute and create it */
if wordpos("ADD_DIRXML_RACF_OMVS_HOME", VariableList) > 0; then do
  makeDir = "mkdir '"ADD_DIRXML_RACF_OMVS_HOME"'";
  response = IDMTSOEX(makeDir);
  if word(response, 1) > 0 then do;
    x = IDMSTATS("warning", response, EVENT_ID);
```

```
  end;
end;

/* All is successful, so we need to return an association
 for this user.  RACF associations are of the form:
   USER\USERID*/

parse upper var ADD_DIRXML_RACF_USERID ASSOCIATION;
ASSOCIATION = "USER\"ASSOCIATION;

"IDMSETV MODIFY NAME(COMMAND) VALUE(ADD_ASSOCIATION)";
"IDMSETV MODIFY NAME(ASSOCIATION) VALUE("ASSOCIATION")";
"IDMSETV MODIFY NAME(EVENT_ID) VALUE("EVENT_ID")";

if SRC_DN <> "SRC_DN"; then
  "IDMSETV MODIFY NAME(DEST_DN) VALUE("SRC_DN")";
end;

if SRC_ENTRY_ID <> "SRC_ENTRY_ID"; then
  "IDMSETV MODIFY NAME(DEST_ENTRY_ID) VALUE("SRC_ENTRY_ID")";
end;

/* Exit the script with return code 0 (no error) */
exit 0;
```

REXX Performance Considerations

Using the REXX execs to customize policy on the RACF system provides a powerful and flexible option for mainframe system administrators. However, it should be noted that using them for processing will impose a slight decrease in performance. To understand more about these effects on performance, see "Performance Information" on page 111. To disable REXX processing, see the `-disablerexx` driver shim option found in Table 4-5 on page 49.

The Connected System Schema File

The schema file on the connected system is used to specify the classes and attributes that are available on the system.

The schema file is read by the driver shim when the Metadirectory engine requests it. This typically happens at driver startup. The schema file is also used by the Policy Editor to map the schema of the Identity Vault to the schema of the external application.

If you change the schema file, you must restart the driver shim and the driver.

The REXX execs that are provided with the driver depend on the classes and attributes in the schema file that is provided with the driver.

The connected system schema file must be a sequential file or a member of a partitioned data set. The `SCHEMDEF DD` statement in the driver shim started task JCL identifies the schema file. An example schema file with the required classes and attributes is provided in the driver samples library member `SCHEMDEF`.

- "Schema File Syntax" on page 62
- "Example Schema File" on page 63

Schema File Syntax

Each line in the schema file represents an element and must begin with the element name: SCHEMA, CLASS, or ATTRIBUTE.

The first element of the schema file is the schema definition. The schema definition is followed by class definitions. Each class definition can contain attribute definitions.

Except for the values of class and attribute names, the contents of the schema file are case insensitive.

Comments

Lines that begin with an octothorpe (#) are comments.

```
# This is a comment.
```

Schema Definition

The first line in the schema file that is not a comment must be the schema definition.

```
SCHEMA [HIERARCHICAL]
```

HIERARCHICAL specifies that the target application is not a flat set of users and groups, but is organized by hierarchical components, such as a directory-based container object.

Class Definition

```
CLASS className [CONTAINER]
```

You must specify a class name. Enclose the class name in double quotes (") if it contains spaces. Add the CONTAINER keyword if objects of this class can contain other objects. End the class definition by another class definition or by the end of the file.

Attribute Definition

Any number of attribute definitions can follow a class definition. Attribute definitions define attributes for the class whose definition they follow.

```
ATTRIBUTE attributeName [TypeAndProperties]
```

An attribute name is required. Enclose the attribute name in double quotes (") if it contains spaces.

If no attribute type is specified, the default is string. Allowable types are:

- STRING
- INTEGER
- STATE
- DN

Allowable attribute properties are:

- REQUIRED
- NAMING
- MULTIVALUED
- CASESENSITIVE
- READONLY

Example Schema File

For a complete example connected system schema file, see the driver samples library member SCHEMDEF. An excerpt from that file follows.

```
SCHEMA
  CLASS USER
    ATTRIBUTE DirXML-RACF-userid NAMING REQUIRED
    ATTRIBUTE DirXML-RACF-groups MULTIVALUED DN
    ATTRIBUTE DirXML-RACF-category MULTIVALUED
    ATTRIBUTE DirXML-RACF-adsp STATE
    . . .
  CLASS GROUP
    ATTRIBUTE DirXML-RACF-group NAMING REQUIRED
    ATTRIBUTE DirXML-RACF-data
    ATTRIBUTE DirXML-RACF-omvs-gid INTEGER
    . . .
```

The Connected System Include/Exclude File

You can use an optional include/exclude file on the connected system to control which identities are or are not synchronized from the Identity Vault to the connected system.

To control which objects are synchronized from the connected system to the Identity Vault, use policies. For details about customizing policies, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

The connected system include/exclude file must be a sequential file or a member of a partitioned data set. The INCEXC DD statement in the driver shim started task JCL identifies the include/exclude file. An example include/exclude file that excludes many common z/OS users and groups, such as JES, OMVS, and INIT, is provided in the driver samples library member INCEXC.

The file is read when the driver shim starts. If you make changes to it, you must restart the driver shim.

The include/exclude file can contain rules for both including and excluding accounts. To ensure optimal performance, each include/exclude file should contain no more than 50 entries total.

You can use the include/exclude file to phase in your deployment of the driver, excluding most users and groups at first, and then adding more as you gain confidence and experience.

- "Include/Exclude Processing" on page 64
- "Include/Exclude File Syntax" on page 64
- "Example Include/Exclude Files" on page 67

Include/Exclude Processing

Identity Vault events for identities that match an exclude rule are discarded by the Subscriber shim.

Included identities are treated normally by the Subscriber shim.

Identities that do not match an include rule or an exclude rule in the file are included.

Identities are matched in the following priority:

1. Exclude rules
2. Include rules

Within each level of this matching priority, identities are matched against rules in the order that the rules appear in the file. The first rule that matches determines whether the identity is included or excluded.

Include/Exclude File Syntax

Except for class names, attribute names, and the values to match, the contents of the include/exclude file are case insensitive.

The Subscriber Creation policy converts object names to uppercase. Use uppercase names in the include/exclude file to match identities.

The include/exclude file can contain any number of include sections, exclude sections, and single-line rules.

Include sections and exclude sections can contain class matching rules, and class matching rules can contain attribute matching rules. Include sections and exclude sections can also contain association matching rules.

Class and attribute names used in the include/exclude file must correspond to the names specified in the schema file. For details about the schema file, see "The Connected System Schema File" on page 61.

Comments

Lines that begin with an octothorpe (#) are comments.

```
# This is a comment.
```

Include and Exclude Sections

Include and exclude sections provide rules to specify which objects are to be included or excluded from synchronization.

An include section begins with an include line and ends with an `ENDINCLUDE` line.

```
INCLUDE
   .
   .
   .
ENDINCLUDE
```

An exclude section begins with an exclude line and ends with an `ENDEXCLUDE` line.

```
EXCLUDE
   .
   .
   .
ENDEXCLUDE
```

You can use class matching rules and association matching rules within an include section and an exclude section.

Class Matching Rules

Use a class matching rule within an include section or an exclude section to specify the name of a class of objects to include or exclude.

A class matching rule is defined by a class line that specifies the name of the class and ends with an `ENDCLASS` line.

```
CLASS className
   .
   .
   .
ENDCLASS
```

You can use attribute matching rules within a class matching rule.

Attribute Matching Rules

You can use attribute matching rules within a class matching rule to limit the objects that are included or excluded. If no attribute matching rules are specified for a class, all objects of the specified class are included or excluded.

An attribute matching rule comprises an attribute name, an equals sign (=), and an expression. The expression can be an exact value, or it can use limited regular expressions. For details about limited regular expressions, see "Limited Regular Expressions" on page 67.

```
attributeName=expression
```

Multiple attribute matching rules can be specified for a given class.

Attribute matching rules within a class matching rule are logically ANDed together. To logically OR attribute matching rules for a class, specify multiple class matching rules. For example, the following include/exclude file excludes both user01 and user02:

```
# Exclude the User object if its RACF userid is USER01 or USER02.
EXCLUDE
CLASS USER
    DirXML-RACF-userid=USER01
ENDCLASS
CLASS USER
    DirXML-RACF-userid=USER02
ENDCLASS
ENDEXCLUDE
```

Association Matching Rules

You can specify association matching rules in an include or exclude section. Association matching rule expressions can specify an exact association or a limited regular expression. For details about limited regular expressions, see "Limited Regular Expressions" on page 67.

By default, an association is the RACF user ID. Association formation can be customized in the Subscriber REXX execs.

For example, to exclude the root user, specify

```
EXCLUDE
  ROOT
ENDEXCLUDE
```

Special Considerations

Using the Include/Exclude rules can be a convenient way to control processing decisions from the RACF administration point. They can quickly filter events before they reach the Identity Manager Metadirectory engine, thus saving time and resources. However, it is not recommended that you use the Include/Exclude rules for processing if you plan to create more than 50 rules. Each rule adds additional complexity that the driver shim must process for every event.

Single-Line Rules

```
INCLUDE|EXCLUDE [className] objectSelection
```

Where *objectSelection* can be

```
{associationMatch | attributeName=expression}
```

You must specify whether the rule is to include or exclude the objects it matches.

You can specify a class name to limit matches to only objects of that class.

You must specify either an association or an attribute matching expression. The syntax of the association and attribute matching expression is the same as that of association matching rules and attribute matching rules previously described. For details, see "Association Matching Rules" on page 66 and "Attribute Matching Rules" on page 65.

For example, to ignore events from the Admin user in the Identity Vault:

```
# Do not subscribe to events for the Admin user.
EXCLUDE ADMIN
```

Limited Regular Expressions

A limited regular expression is a pattern used to match a string of characters.

Character matching is case sensitive.

Any literal character matches that character.

A period (`.`) matches any single character.

A bracket expression is a set of characters enclosed by left (`[`) and right (`]`) brackets that matches any listed character. Within a bracket expression, a range expression is a pair of characters separated by a hyphen, and is equivalent to listing all of the characters that sort between the given characters. For example, `[0-9]` matches any single digit.

An asterisk (`*`) indicates that the preceding item is matched zero or more times.

A plus sign (`+`) indicates that the preceding item is matched one or more times.

A question mark (`?`) indicates that the preceding item is matched zero or one times.

You can use parentheses to group multiple expressions into a single item. For example, `(abc)+` matches `abc`, `abcabc`, `abcabcabc`, etc. Nesting of parentheses is not supported.

Example Include/Exclude Files

Example 5-1 *Example 1*

```
# Exclude users whose names start with TEMP
EXCLUDE
    CLASS USER
        DirXML-RACF-userid=TEMP.*
    ENDCLASS
ENDEXCLUDE
```

Example 5-2 *Example 2*

```
# Exclude USERA and USERB
# Because attribute rules are ANDed, these must be in separate
# CLASS sections.
EXCLUDE
    CLASS USER
        DirXML-RACF-userid=USERA
    ENDCLASS
    CLASS USER
        DirXML-RACF-userid=USERB
    ENDCLASS
ENDEXCLUDE
```

Managing Additional Attributes

You can add additional attributes to the driver for both the Publisher and Subscriber channels. These attributes can be accessed by the REXX execs for all event types.

To publish or subscribe to additional attributes, you must add them to the filter and add support for them into the REXX execs.

- "Modifying the Filter" on page 68

Modifying the Filter

1. Select the Identity Manager **Drivers** module from the Identity Console landing page.
2. Select the **Data Transformation and Synchronization** tab.
3. Expand the **Class Attribute Filters** panel.
4. Select the flow of this attribute for the Publisher and Subscriber channels.
   - **Synchronize:** Changes to this object are reported and automatically synchronized.
   - **Ignore:** Changes to this object are not reported and not automatically synchronized.
   - **Notify:** Changes to this object are reported, but not automatically synchronized.
   - **Reset:** Resets the object value to the value specified by the opposite channel. (You can set this value on either the Publisher or Subscriber channel, but not both.)
5. Click the **Save** icon.

If you want to map this attribute to an existing attribute in the connected system schema file, modify the Schema Mapping policy for the driver.

For complete details about managing filters and Schema Mapping policies, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

6 Using the RACF Driver

This section provides information about operational tasks commonly used with the Identity Manager 4.10 driver for RACF.

Topics include

- "Starting and Stopping the Driver" on page 69
- "Starting and Stopping the Change Log Started Task" on page 69
- "Starting and Stopping the Driver Shim Started Task" on page 69
- "Displaying Driver Shim Status" on page 70
- "Changing the Driver Shim Trace Level" on page 70
- "Monitoring Driver Messages" on page 70

Starting and Stopping the Driver

To start the driver:

1. Click the **IDM Administration** tab from the Identity Console home screen.
2. Click the specific driver set object on the right hand side of your computer screen to display all the drivers associated to it.
3. Click the Actions icon on the specific driver and select **Start Driver**.
4. To stop a driver object, click the Actions icon on the specific driver and select **Stop Driver**.

Starting and Stopping the Change Log Started Task

The change log started task must be run on each system that shares the security system database.

To start the change log started task, issue the following operator command:

```
START LDXLOGR
```

To stop the change log started task, issue the following operator command:

```
STOP LDXLOGR
```

Starting and Stopping the Driver Shim Started Task

The driver shim started task must be run on only one system that shares the security system database.

To start the driver shim started task, issue the following operator command:

```
START RACFDRV
```

To stop the driver shim started task, issue the following operator command:

```
STOP RACFDRV
```

Displaying Driver Shim Status

To see status, version and statistic information for the driver shim, issue the following operator command:

```
MODIFY RACFDRV,APPL=STATUS
```

You can use the `LDXSERV` TSO command to display information about the Publisher channel event subsystem. Enter the following TSO command:

```
LDXSERV STATUS
```

To use the `LDXSERV` command, you must include the driver load library in your STEPLIB concatenation.

Changing the Driver Shim Trace Level

To change the trace level setting for the driver shim, issue the following operator command with the desired trace level:

```
MODIFY RACFDRV,APPL='CTL(desired_trace_level)'
```

Example 6-1 *For example*

```
MODIFY RACFDRV,APPL='CTL(9)'
```

For details about the trace file and trace levels, see "The Trace File" on page 75.

Monitoring Driver Messages

The driver shim started task writes messages to the system console, `SYSLOG`, and the driver operational log. The driver operational log data set is defined by the `DRVLOG DD` statement in the `RACFDRV` started task JCL. Monitor driver activity there in the same way you monitor other key system functions. For details about the messages written by the driver, see Appendix B, "System and Error Messages," on page 83.

7 Securing the RACF Driver

This section describes best practices for securing the Identity Manager 4.10 driver for RACF. Topics include

- "Using SSL" on page 71
- "Physical Security" on page 71
- "Network Security" on page 71
- "Driver Security Certificates" on page 71
- "Driver REXX Execs" on page 72
- "The Change Log" on page 72
- "Driver Passwords" on page 72
- "Driver Code" on page 73
- "Administrative Users" on page 73
- "Connected Systems" on page 73

For additional information about Identity Manager security, see the *OpenText® Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

Using SSL

Enable SSL for communication between the Metadirectory engine and the driver shim on the connected system. For more information, see "Use SSL" on page 43.

If you don't enable SSL, you are sending information, including passwords, in the clear.

Physical Security

Keep your servers in a physically secure location with access by authorized personnel only.

Network Security

Require users outside of the corporate firewall to use a VPN to access corporate data.

Driver Security Certificates

SSL uses security certificates to control, encrypt, and authenticate communications.

Ensure that the security certificate directory `/opt/novell/racfdrv/keys` is appropriately protected. The installation program sets secure file permissions for this directory.

The Driver Shim and the Identity Manager engine communicate through SSL using a certificate created in the Identity Vault and retrieved by the driver shim during the installation process. For more information on this certificate and how to renew or install third-party certificates, refer to the *Identity Manager Administration Guide*.

The Embedded Remote Loader web interface uses a dynamically generated, self-signed certificate for SSL communication. The details of this certificate are as follows:

Table 7-1 *Security Certificate Details*

Property Name	Values / Parameters
Subject	SSL Server
Issuer	SSL Server
Validity	1 year
Serial Number	0
Key	1024-bit RSA

Renewal of this certificate automatically occurs when the Driver Shim is restarted on the connected platform.

Driver REXX Execs

The driver uses REXX execs to perform updates on the connected system, and to collect changes made there.

Ensure that the driver REXX exec library is appropriately protected.

The Change Log

The change log data set contains information about events on the connected system, including passwords. It is encrypted, but it should be protected against access by unauthorized users.

Ensure that the change log data set is appropriately protected.

Driver Passwords

Use strong passwords for the Driver object and Remote Loader passwords, and restrict knowledge of them to authorized personnel. These passwords are stored in encrypted form in the security certificate directory `/opt/novell/racfdrv/keys`. The installation program sets secure file permissions for this directory.

Driver Code

Ensure that the driver load library is appropriately protected.

Do not put the driver load library in the linklist unless you use program protection to secure its contents against unauthorized use.

Administrative Users

Ensure that accounts with elevated rights on the Metadirectory system, Identity Vault systems, and the connected systems are appropriately secure. Protect administrative user IDs with strong passwords.

Connected Systems

Ensure that connected systems can be trusted with account information, including passwords, for the portion of the tree that is configured as their base containers.

A Troubleshooting

This section provides information about troubleshooting the Identity Manager 4.10 driver for RACF. Topics include

- "Driver Status and Diagnostic Files" on page 75
- "Troubleshooting Common Problems" on page 77

Driver Status and Diagnostic Files

There are several log files that you can view to examine driver operation.

- "The System Log" on page 75
- "The Trace File" on page 75
- "The REXX Exec Output File" on page 76
- "DSTrace" on page 76
- "The Status Log" on page 76
- "The Operational Log" on page 77
- "Change Log Started Task Message Log" on page 77

The System Log

`SYSLOG` is used by the driver shim to record urgent, informational, and debug messages. Examining these should be foremost in your troubleshooting efforts. For detailed message documentation, see Appendix B, "System and Error Messages," on page 83.

The Trace File

The default trace file exists on the connected system at `/opt/novell/racfdrv/logs/trace.log`. A large amount of debug information can be written to this file. Use the trace level setting in the driver shim configuration file to control what is written to the file. For details about the driver shim configuration file, see "The Driver Shim Configuration File" on page 49.

Table A-1 *Driver Shim Trace Levels*

Trace Level	Description
0	No debugging.
1–3	Identity Manager messages. Higher trace levels provide more detail.
4	Previous level plus Remote Loader, driver, driver shim, and driver connection messages.

Trace Level	Description
5–7	Previous level plus change log and loopback messages. Higher trace levels provide more detail.
8	Previous level plus driver status log, driver parameters, driver security, driver Web server, driver schema, driver encryption, and driver include/exclude file messages.
9	Previous level plus low-level networking and operating system messages.
10	Previous level plus maximum low-level program details (all options).

The following is an example `the driver shim configuration file` line to set the trace level:

```
-trace 9
```

To view the trace file:

1. Use a Web browser to access the driver shim at `https://driver-address:8091`. Substitute the DNS name or IP address of your driver for *driver-address*.
2. Authenticate by using any user name and the password that you specified as the Remote Loader password.
3. Click **Trace**.

The REXX Exec Output File

Output from the REXX execs is written to DDNAME `SYSTSPRT` of the driver shim started task. This file captures the standard error output from all execs executed by the driver shim.

DSTrace

You can view Identity Manager information using the DSTrace facility on the Metadirectory server. Use Identity Console to set the tracing level. For example, trace level 2 shows Identity Vault events in XML documents, and trace level 5 shows the results of policy execution. Because a high volume of trace output is produced, we recommend that you capture the trace output to a file. For details about using DSTrace, see the *OpenText® Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

The Status Log

The status log is a condensed summary of the events that have been recorded on the Subscriber and Publisher channels. This file exists on the connected system at `/opt/novell/racfdrv/logs/dirxml.log`. For details about using the status log, see the *OpenText Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

To view the status log:

1. Use a Web browser to access the driver shim at `https://driver-address:8091`. Substitute the DNS name or IP address of your driver for *driver-address*.

2 Authenticate by using any user name and the password that you specified as the Remote Loader password.

3 Click **Status**.

The Operational Log

The operational log contains both important and informational messages that indicate the operational status of the driver shim. These messages indicate items that are not urgent enough to warrant operator response, but useful for tracking the progress of the driver. The location of the operational log is specified by the DRVLOG DD statement in the driver shim started task JCL.

Change Log Started Task Message Log

The change log started task writes important and informational messages to DDNAME `SYSPRINT`.

Troubleshooting Common Problems

- "Driver Shim Installation Failure" on page 77
- "Driver Rules Installation Failure" on page 77
- "Schema Update Failure" on page 77
- "Driver Certificate Setup Failure" on page 78
- "Driver Start Failure" on page 78
- "Driver Shim Startup or Communication Failure" on page 79
- "Users or Groups Are Not Provisioned to the Connected System" on page 79
- "Users or Groups Are Not Provisioned to the Identity Vault" on page 79
- "Identity Vault User Passwords Are Not Provisioned to the Connected System" on page 80
- "Connected System User Passwords Are Not Provisioned to the Identity Vault" on page 80
- "Users or Groups Are Not Modified, Deleted, Renamed, or Moved" on page 81
- "Change Log Errors" on page 81

Driver Shim Installation Failure

Ensure that you use binary mode to FTP the driver samples library, load library, and REXX exec library XMT files to the target system.

Driver Rules Installation Failure

Ensure that you use a version of Identity Console compatible with your version of Identity Manager.

Schema Update Failure

- Examine the log file at `/var/nds/schema.log`.

- Ensure that you specify the correct parameters (host name, Admin FDN in dotted format, and password).
- Ensure that you have network connectivity to the Metadirectory server.

Driver Certificate Setup Failure

To set up certificates, the driver shim communicates with the Metadirectory server using the LDAP secure port (636).

- Ensure that eDirectory™ is running LDAP with SSL enabled. For details about configuring eDirectory, see the *OpenText eDirectory Administration Guide*.
- Ensure that the connected system has network connectivity to the Metadirectory server.

You can use the driver REXX exec library member `SETCERT` to configure the certificate at any time.

If you cannot configure SSL using LDAP, you can install the certificate manually.

1. Click **Certificate Management** > **Trusted Root Management** options from the Identity Console landing page. The **Trusted Root Container** check box will be selected by default. Select the **Trusted Root** check box.
2. Select the appropriate trusted root certificate from the list and click the export icon.
3. In the next screen, do not select the check box for **Export Private key**.
4. Select **Base64** format, then click **OK**.
5. Use FTP or another method to store the file on the connected system as `/opt/novell/racfdrv/keys/ca.pem`.

   NOTE: The `ca.pem` file is an ASCII text file and must be transferred accordingly.

Driver Start Failure

- Examine the status log and DSTRACE output.
- The driver must be specified as a Remote Loader driver. You can set this option in Identity Console.
- You must activate both Identity Manager and the driver within 90 days. The **IDM Administration** page in Identity Console shows when Identity Manager requires activation. The **Drivers** page shows when the driver requires activation.

  For details about activating OpenText Identity Manager Products, see the *Identity Manager 4.10 Installation Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).
- Ensure that the driver load library is APF-authorized.

  You can use the `DISPLAY PROG,APF` operator command to display your APF-authorized libraries.
- Ensure that the `LDXSERV` and `SAFQUERY` commands are listed as authorized TSO commands in your active `IKJTSOxx` member.

  You can use the `DISPLAY IKJTSO,AUTHCMD` operator command to display authorized TSO commands.

For more information about troubleshooting Identity Manager engine errors, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

Driver Shim Startup or Communication Failure

- Examine the trace file.
- Ensure that the connected system's operating system and security system versions are supported. For a list of supported operating systems, see "Connected System Requirements" on page 26.
- Apply all maintenance for your operating system and security system.
- Ensure that the Remote Loader and Driver object passwords that you specified while setting up the driver on the Metadirectory server match the passwords stored with the driver shim.

  To update these passwords on the connected system, use the `SETPWDS` REXX exec. The passwords are stored under `/opt/novell/racfdrv/keys` in encrypted files `dpwdlf40` (Driver object password) and `lpwdlf40` (Remote Loader password).

  To update these passwords on the Metadirectory server, use Identity Console to update the driver configuration. For details, see "Driver Configuration Page" on page 43.
- Ensure that the correct host name and port number of the connected system are specified in the Driver Configuration Remote Loader connection parameters. You can change the port number (default 8090) in the driver shim configuration file.
- Ensure that the driver shim started task has been set up properly. For details, see "Setting Up the Started Tasks" on page 36.
- Ensure that only one system in a complex that shares the security system database is running the driver shim started task.

Users or Groups Are Not Provisioned to the Connected System

- Examine the status log, DSTRACE output, trace file, and REXX exec output file.
- To be provisioned, users and groups must be in the appropriate base container. You can view and change the base containers in Identity Console on the **Global Config Values** page of the **Drivers** page. For more details, see "Global Configuration Values Page" on page 45.
- To provision identities from the Identity Vault to the connected system, the driver Data Flow property must be set to Bidirectional or Identity Vault to Application. To change this value, re-import the driver rules file over your existing driver.
- The user that the driver is security equivalent to must have rights to read information from the base container. For details about the rights required, see Table 2-2, "Base Container Rights Required by the Driver Security-Equivalent User," on page 23.

Users or Groups Are Not Provisioned to the Identity Vault

- Examine the status log, DSTRACE output, and trace file.
- Examine the **User Base Container** and **Group Base Container** GCV values. For more details, see "Global Configuration Values Page" on page 45.

- To provision identities from the connected system to the Identity Vault, the driver Data Flow property must be set to Bidirectional or Application to Identity Vault. To change this value, re-import the driver rules file over your existing driver.
- The user that the driver is security equivalent to must have rights to update the base container. For details about the rights required, see Table 2-2, "Base Container Rights Required by the Driver Security-Equivalent User," on page 23.
- Ensure that the security system exit has been installed, that LLA has been refreshed, and that the exit has been activated. For details, see "Installing the Driver Security System Exits" on page 38.

Identity Vault User Passwords Are Not Provisioned to the Connected System

- Examine the status log, DSTRACE output, and REXX exec output file.
- Several password management properties are available in Identity Console on the **Global Config Values** page of the **Drivers** module. Ensure that the connected system accepts passwords from the Identity Vault. To determine the right settings for your environment, view the help for the options, or see the *OpenText Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).
- Ensure that the user's container has an assigned Universal Password policy and that the **Synchronize Distribution Password When Setting Universal Password** option is set for this policy.

Connected System User Passwords Are Not Provisioned to the Identity Vault

- Examine the status log, DSTRACE output, and the trace file.
- Several password management properties are available in Identity Console on the **Global Config Values** page. Ensure that at least one of the following options is set:
  - **The Identity Vault Accepts Passwords from the RACF Connected System**
  - **The Identity Vault Accepts Administrative Password Resets from the RACF Connected System**

  To determine the right settings for your environment, view the help for the options, or see the *OpenText Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).
- If the **Require Password Policy Validation before Publishing Passwords** GCV is set, the user's password must satisfy the password rules in the password policy assigned to the user container.
- Ensure that the change log started task is running on all systems that share the security system database.
- Ensure that the security system exit has been installed, that LLA has been refreshed, and that the exit has been activated. For details, see "Installing the Driver Security System Exits" on page 38.

Users or Groups Are Not Modified, Deleted, Renamed, or Moved

- Examine the status log, DSTRACE output, trace file, and REXX exec output file.
- Examine the driver Data Flow setting to verify the authoritative source for identities.
- Identity Vault and connected system identities must be associated before events are synchronized. To view an identity's associations, use the **Object Inspector** page in Identity Console and search for the object. You can migrate identities to establish associations. For details, see "Migrating Identities" on page 52.
- Identity Vault move events can remove the identity from the base container monitored by the driver to a container that is not monitored by the driver. This makes the move appear to be a delete.
- Moving a user or group is not supported by RACF.

Change Log Errors

- Examine the change log started task messages.
- Ensure that the change log started task is running on all systems that share the security system database.
- Ensure that the change log started task has been set up properly. For details, see "Setting Up the Started Tasks" on page 36.
- Ensure that you initialized the change log data set during installation. For details about initializing the change log data set, see "Allocating and Initializing the Change Log Data Set" on page 36.
- You can use the `LDXSERV` TSO command to display information about the change log data set. Enter the following TSO command:

  ```
  LDXSERV STATUS
  ```

  To use the `LDXSERV` command, you must include the driver load library in your STEPLIB concatenation.

B System and Error Messages

Components of the Identity Manager 4.10 driver for RACF write messages to report operational status and problems. For detailed troubleshooting information, see Appendix A, "Troubleshooting," on page 75.

Each message begins with a code of 3-6 characters associated with the driver component that generated the message. Use this code to find message information quickly as follows:

- "CFG Messages" on page 83
- "DOM Messages" on page 84
- "DRVCOM Messages" on page 84
- "HES Messages" on page 85
- "LDX0 Messages" on page 85
- "LDXL Messages" on page 87
- "LDXS Messages" on page 90
- "LDXU Messages" on page 91
- "LDXV Messages" on page 93
- "LWS Messages" on page 95
- "NET Messages" on page 103
- "RDXML Messages" on page 103

CFG Messages

Messages beginning with CFG are issued by configuration file processing.

CFG001E Could not open configuration file *filename*.

Explanation: Could not open the configuration file.

Possible cause: The file does not exist.

Possible cause: You don't have permission to read the file.

Action: Ensure that the configuration file exists at the correct location and that you have file system rights to read it.

CFG002E Error parsing configuration file line: <*configline*>.

Explanation: The line is not formatted as a valid configuration statement and cannot be parsed.

Action: Correct the line in the configuration file.

CFG003W Configuration file line was ignored. No matching statement name found: <*configline*>.

Explanation: This line is formatted as a valid configuration file statement, but the statement is not recognized. The line is ignored.

Possible cause: The statement is incorrectly typed or the statement name is used only in a newer version of the software.

Action: Correct the statement.

CFG004E Error parsing configuration file line. No statement name was found: <*configLine*>.

Explanation: Could not find a statement name on the configuration line.

Action: Correct the line in the configuration file to supply the required statement.

CFG005E A required statement *statement_id* is missing from the configuration file.

Explanation: The *statement_id* statement was not specified in the configuration file, but is required for the application to start.

Action: Add the required statement to the configuration file.

DOM Messages

Messages beginning with DOM are issued by driver components as they communicate among themselves.

DOM0001W XML parser error encountered: *errorString*.

Explanation: An error was detected while parsing an XML document.

Possible cause: The XML document was incomplete, or it was not a properly constructed XML document.

Action: See the error string for additional details about the error. Some errors, such as no element found, can occur during normal operation and indicate that an empty XML document was received.

DRVCOM Messages

Messages beginning with DRVCOM are issued by the include/exclude system.

DRVCOM000I *nameversion* Copyright 2005 Omnibond Systems, LLC. ID=*code_id_string*.

Explanation: This message identifies the system component version.

Action: No action is required.

DRVCOM001W Invalid include/exclude CLASS statement.

Explanation: The include/exclude configuration file contains an invalid CLASS statement.

Action: Correct the include/exclude configuration file with proper syntax.

DRVCOM002D An include/exclude Rule was added for class: *class*.

Explanation: The include/exclude configuration supplied a rule for the specified class.

Action: None.

DRVCOM003D An include/exclude Association Rule was added for association *association*.

Explanation: The include/exclude configuration supplied an association rule for the specified association.

Action: None.

HES Messages

Messages beginning with HES are issued by driver components as they use HTTP to communicate.

HES001E Unable to initialize the HTTP client.

Explanation: Communications in the client could not be initialized.

Possible cause: Memory is exhausted.

Action: Increase the amount of memory available to the process.

HES002I Connecting to host *host_name* on port *port_number*.

Explanation: The client is connecting to the specified server.

Action: None.

HES003W SSL communications have an incorrect certificate. rc = *rc*.

Explanation: The security certificate for SSL services could not be verified.

Possible cause: The certificate files might be missing or invalid.

Action: Obtain a new certificate.

LDX0 Messages

Messages beginning with LDX0 are issued by the driver security system exit modules `LDEVX01` and `LDXRIX01` and the `LDXSERV` command.

LDX0001E There are old events on the LDX queue. Ensure that LDXLOGR is started.

Explanation: The memory queue access routine in the security system exit found events in the memory queue that have been unprocessed for at least fifteen minutes. During normal operation, the change log started task processes events from the queue immediately.

Possible cause: The change log started task is not running.

Action: Ensure that the change log started task is running.

LDX0002I Unexpected RC *xxxxxxxx* during token processing routine.

Explanation: An unexpected return code was received from z/OS name/token callable services by a driver component.

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText® Technical Support.

LDX0103E Unable to parse command line.

Explanation: The `LDXSERV` command contained invalid operands and was unable to prompt for correct information.

Action: Correct the syntax of the `LDXSERV` command and reissue it. If the command was issued by the driver shim, collect diagnostic information and contact OpenText Technical Support.

LDX0105E Internal error: *description*.

Explanation: An unexpected error occurred in the `LDXSERV` command. The message contains a description of the problem.

Possible cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDX0106E Unable to open the log file.

Explanation: `LDXSERV` was unable to open the change log data set.

Possible cause: The user ID running the `LDXSERV` command does not have access to the change log data set.

Action: Check the session log and message files for additional messages concerning the failure. If you are unable to determine and correct the cause of the error, collect diagnostic information and contact OpenText Technical Support.

LDX0107E No preallocated log file and no valid environment.

Explanation: The `LDXSERV` command was unable to find the change log data set because there was no LOGFILE DD statement and there was no valid LDX environment. The LDX environment is created when the security system exit is invoked for the first time after an IPL or when the change log started task first starts.

Action: Ensure that you are logged on to a system where the driver is installed and that the security system exit has been properly installed and is active. If you are unable to determine and correct the cause of the error, collect diagnostic information and contact OpenText Technical Support.

LDX0108E No preallocated log file and logger is not active.

Explanation: The `LDXSERV` command was unable to find the change log data set because there was no LOGFILE DD statement and the change log started task was not active.

Action: If you are unable to determine and correct the cause of the error, collect diagnostic information and contact OpenText Technical Support.

LDX0109E Dynamic allocation failed for log file *dsname*, s99rc=*rc*, s99error=*err*.

Explanation: The `LDXSERV` command was unable to dynamically allocate the change log data set. The dynamic allocation return code and reason codes are given in the message by *rc* and *err* respectively.

Dynamic allocation return codes and reason codes are documented in the IBM publication *z/OS Programming: Authorized Assembler Services Guide*.

Action: If you are unable to determine and correct the cause of the error, collect diagnostic information and contact OpenText Technical Support.

LDXL Messages

Messages beginning with LDXL are issued by the change log started task.

LDXL000 LOGGING STARTED AT *hh:mm:ss* ON *mm/dd/yyyy*.

Explanation: The change log started task has initialized.

Action: Informational only. No action is required.

LDXL001 MESSAGE LOG DISABLED, SYSPRINT DD MISSING.

Explanation: During initialization, the change log started task was unable to open the SYSPRINT DD statement.

The change log started task continues processing, but no messages are written to SYSPRINT.

Possible cause: The SYSPRINT DD statement is missing from the JCL for the change log started task.

Action: Ensure that a SYSPRINT DD statement is present in the JCL and that it defines a file that the change log started task can write to.

LDXL002 EXECUTE STATEMENT PARAMETERS: *parm-values*.

Explanation: During initialization, the change log started task found the listed parameters present on the EXEC statement PARM parameter.

Action: Informational only. No action is required.

LDXL003 START COMMAND PARAMETERS: *parameters*.

Explanation: During initialization, the change log started task found the listed parameters present on the command line.

Action: Informational only. No action is required.

LDXL004 STOP COMMAND RECEIVED.

Explanation: An operator entered a `STOP` command for the change log started task. The change log started task ends.

Action: Informational only. No action is required.

LDXL005 MODIFY COMMAND PARAMETERS: *parameters*.

Explanation: An operator entered a `MODIFY` command for the change log started task with the listed parameters.

Action: Informational only. No action is required.

LDXL006 UNRECOGNIZED CIBVERB TYPE: X'*hh*', COMMAND IGNORED.

Explanation: During processing, the change log started task received a command input buffer (CIB) with a verb other than `STOP` or `MODIFY`. Processing continues.

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDXL007 OPERATOR CANCEL DETECTED, ATTEMPTING NORMAL SHUTDOWN.

Explanation: An operator has issued a `CANCEL` command without the `DUMP` parameter for the change log started task. The change log started task attempts a clean shutdown.

Action: Wait for the change log started task to end. If the change log started task does not end within a reasonable amount of time, issue another `CANCEL` command specifying the `DUMP` parameter. If you are unable to determine and correct the cause of the error, collect diagnostic information and contact OpenText Technical Support.

LDXL008 EVENT TRACING ENABLED.

Explanation: An operator has issued a `MODIFY` command for TRACE ON to the change log started task.

Event tracing is turned on.

Action: Informational only. No action is required.

LDXL009 EVENT TRACING DISABLED.

Explanation: An operator has issued a `MODIFY` command for TRACE OFF to the change log started task.

Event tracing is turned off.

Action: Informational only. No action is required.

LDXL010 MODIFY COMMAND IGNORED, INVALID OR MISSING PARAMETERS.

Explanation: An operator has issued a `MODIFY` command to the change log started task, but the command parameters are not recognized.

The `MODIFY` command is ignored.

Action: Reissue the `MODIFY` command with the intended parameters.

LDXL011 EVENT RC(*rc*) DATA: *event_data*.

Explanation: Event tracing is turned on and an event has been processed.

The return code from ProcessEvent is *rc*. The content of the event record is *event_data*.

Processing continues.

Action: Informational only. No action is required.

LDXL012 TERMINATING BECAUSE LOGGING ALREADY ACTIVE.

Explanation: On startup, the change log started task has detected that another change log started task is already running.

This instance of the change log started task terminates.

To detect this condition, the change log started task enqueues exclusively on qname `ldxlogr`, rname `#LDXENVIRONTOKEN` when it initializes. If the ENQ macro fails, this message is issued. The change log started task dequeues this resource on shutdown.

Possible cause: A `START` command for the change log started task has been issued more than once.

Action: Do not start more than one instance of the change log started task at a time.

LDXL013 LOGGING TO DATASET: *dsname*.

Explanation: The name of the change log data set in use is *dsname*.

Action: Informational only. No action is required.

LDXL999 LOGGING ENDED AT *hh:mm:ss* ON *mm/dd/yyyy*.

Explanation: The change log started task is ending.

Possible cause: An operator entered a `STOP` command for the change log started task.

Action: Informational only. No action is required.

LDXS Messages

Messages beginning with LDXS are issued by the driver shim change log API.

LDXS000I *nameversion* Copyright 2006 Omnibond Systems, LLC. ID=*code_id_string*.

Explanation: This message identifies the system component version.

Action: No action is required.

LDXS001A Error executing script *scriptName*. The return code is *returnCode*, the reason code is *reasonCode*, the abend code is *abendCode*.

Explanation: The driver shim could not execute *scriptName*.

Possible cause: The script or command does not exist or is not valid.

Action: Ensure that the driver shim is correctly configured to execute the command or script and that the command or script exists and is valid.

LDXS002A The change log service startup failed, rc = *rc*.

Explanation: The change log API failed to initialize.

Possible cause: The change log data set has not been initialized.

Possible cause: The driver load library is not properly configured.

Possible cause: The driver does not have the required rights to access the change log data set.

Action: Ensure that all of the steps of the installation procedure have been performed correctly and have not subsequently been reversed.

LDXS003A Unable to create token, return code from IEANTCR is *rc*.

Explanation: z/OS name/token callable services failed to create a token. The return code from IEANTCR is *rc*.

Possible cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDXU Messages

Messages beginning with LDXU are issued by the log file utility `LDXUTIL`.

LDXU000I Log File Utility started on *mm/dd/yyyy* at *hh:mm:ss*.

Explanation: The log file utility has initialized.

Action: Informational only. No action is required.

LDXU001W Message log disabled, SYSPRINT DD missing.

Explanation: During initialization, the log file utility was unable to open the SYSPRINT DD statement. The log file utility continues processing, but no messages are written to SYSPRINT.

Possible cause: The SYSPRINT DD statement is missing from the JCL for the log file utility.

Action: Ensure that a SYSPRINT DD statement is present in the JCL and that it defines a file that the log file utility can write to.

LDXU002I Execute statement parameters: *parm-values*.

Explanation: During initialization, the log file utility found the listed parameters present on the EXEC statement PARM parameter.

Action: Informational only. No action is required.

LDXU003E Open failed for log file.

Explanation: The log file utility could not open the change log data set.

Possible cause: The LOGFILE DD statement is missing from the JCL for the log file utility.

Action: Ensure that a LOGFILE DD statement is present in the JCL and that it defines a data set that the log file utility can write to.

LDXU004I Log file blocksize: *blksize*.

Explanation: The log file utility is initializing the change log data set with a blocksize of *blksize*.

Action: Informational only. No action is required.

LDXU005I Log file blocks written: *block-count*.

Explanation: While initializing the change log data set, the log file utility has written *block-count* blocks of empty records.

Action: Informational only. No action is required.

LDXU006E Open failed for LOADIN file.

Explanation: The log file utility load function could not open the LOADIN ddname.

Possible cause: The LOADIN DD statement is missing from the JCL for the log file utility.

Action: Ensure that a LOADIN DD statement is present in the JCL and that it defines a file that the log file utility can read.

LDXU007E Unrecognized or missing execute statement parameter.

Explanation: The log file utility found an unknown parameter in the EXEC statement PARM parameter.

Processing ends.

Possible cause: The EXEC statement PARM value is missing or does not contain one of the following functions:

- INITIALIZE
- DUMP
- LOAD

Action: Correct the PARM value and resubmit the job.

LDXU008I Log file events loaded: *event-count*.

Explanation: The log file utility load function has successfully loaded *event-count* events into the change log data set from the input file.

Action: Informational only. No action is required.

LDXU009E Add event failed, error code *code*.

Explanation: The log file utility load function was unable to add an event record to the change log data set. The LDXLADD LDXIOERR code was *code*.

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDXU010E Read header failed, error code *code*.

Explanation: The log file utility dump function was unable to read the header record of the change log data set. The LDXLGETE LDXIOERR code was *code*.

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDXU011E Read event failed, error code *code*.

Explanation: The log file utility dump function was unable to read an event record from the change log data set. The LDXLGETE LDXIOERR code was *code*.

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDXU990I Open BDAM log succeeded.

Explanation: The log file utility has initialized the change log data set with empty records and has successfully opened it to complete the initialization by updating the header information.

Action: Informational only. No action is required.

LDXU991E Open BDAM log failed.

Explanation: The log file utility has initialized the change log data set with empty records, but could not reopen it to complete the initialization by updating the header information.

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDXU999I Log File Utility ended on *mm/dd/yyyy* at *hh:mm:ss*.

Explanation: The log file utility has completed processing.

Action: Informational only. No action is required.

LDXV Messages

Messages beginning with LDXV are issued by the `IDMGETV` and `IDMSETV` commands.

LDXV001E IDM token not present.

Source: `IDMGETV` command, `IDMSETV` command

Explanation: The data areas that the driver shim sets up for the `IDMGETV` or `IDMSETV` command before calling a script are not present.

Possible Cause: The command was not called by the driver shim.

Action: Ensure that the commands are invoked by the driver shim. They are not intended to be used outside of this environment.

LDXV002E Unable to parse command.

Source: `IDMGETV` command, `IDMSETV` command

Explanation: The TSO parsing routine detected an error in the command and was unable to prompt for a correction.

Possible Cause: The command had a syntax error. It was not called from an interactive session and could not prompt for a correction.

Action: Examine the associated messages from the TSO parsing routine that describe the error. Correct the operands of the command.

LDXV003E Error from TSO service routine IKJCT441, RC <*rc*>.

Source: `IDMGETV` command

Explanation: TSO routine IKJCT441 detected a problem and ended with return code *rc* (decimal).

Possible Cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LDXV004W <*variablename*> contains invalid characters to be a REXX variable.

Source: `IDMGETV` command, `IDMSETV` command

Explanation: The command was directed to create the variable named in the message, but the variable name contained characters that are not acceptable in a REXX variable name. The acceptable characters are as follows:

Alphanumeric characters	`A-Z`, `a-z`, `0-9`
“At” sign	`@`
Octothorpe	`#`
“Dollar” sign	`$`
Exclamation mark	`!`
Question mark	`?`
Period	`.`
Underscore	`_`

Possible Cause: The variable named in the message was defined in eDirectory™ using one or more characters not in the list of acceptable characters. For example, some attribute names might contain spaces.

Action: Use the driver mapping rules to rename the variable to a name that meets the REXX naming requirements.

LDXV005E IDMGETV was not called from a CLIST or REXX exec.

Source: `IDMGETV` command

Explanation: The `IDMGETV` command must be called from a REXX exec, because it creates and manipulates REXX variables.

Possible Cause: The command was not called from within the REXX environment.

Action: Call the command from within the REXX environment.

LDXV006E GROUP or USER list required.

Source: `IDMSETV` command

Explanation: The `IDMSETV` command requires either the GROUP(*grouplist*) or USER(*userlist*) operand.

Possible Cause: Use one of the required operands.

Action: Correct the operands of the command.

LDXV007E GROUP and USER operands are mutually exclusive.

Source: `IDMSETV` command

Explanation: The command found both the USER and GROUP operands on the command line. These are mutually exclusive.

Possible Cause: Both GROUP and USER were specified on the `IDMSETV` command.

Action: Correct the command.

LDXV008E Error returned from <*service*>: RC <*rc*>.

Source: `IDMGETV` command, `IDMSETV` command

Explanation: The IBM service routine *service* returned the return code *rc* (decimal).

Possible Cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

LWS Messages

Messages beginning with LWS are issued by the integrated HTTP server.

LWS0001I Server has been initialized.

Explanation: The server has successfully completed its initialization phase.

Action: None. Informational only.

LWS0002I All services are now active.

Explanation: All of the services offered by the server are now active and ready for work.

Action: None. Informational only.

LWS0003I Server shut down successfully.

Explanation: The server processing completed normally. The server ends with a return code of `0`.

Action: No action is required.

LWS0004W Server shut down with warnings.

Explanation: The server processing completed normally with at least one warning. The server ends with a return code of `4`.

Action: See the log for additional messages that describe the warning conditions.

LWS0005E Server shut down with errors.

Explanation: The server processing ended with one or more errors. The server ends with a return code of `8`.

Action: See the log for additional messages that describe the error conditions.

LWS0006I Starting *service*.

Explanation: The server is starting the specified service.

Action: None. Informational only.

LWS0007E Failed to start *service*.

Explanation: The server attempted to start the specified service, but the service could not start. The server terminates processing.

Action: See the log for additional messages that describe the error condition.

LWS0008I Stopping all services.

Explanation: The server was requested to stop. All services are notified and will subsequently end processing.

Action: None. Informational only.

LWS0009I Local host is *host_name* (*IP_address*).

Explanation: This message shows the host name and IP address of the machine that the server is running on.

Action: None. Informational only.

LWS0010I Local host is *IP_address*.

Explanation: This message shows the IP address of the machine that the server is running on.

Action: None. Informational only.

LWS0011I Server is now processing client requests.

Explanation: The server has successfully started all configured services, and it is ready for clients to begin requests.

Action: None. Informational only.

LWS0012I *service* is now active on port *number*.

Explanation: The server *service* is running on the specified TCP port *number*. Clients can begin making requests to the specified service.

Action: None. Informational only.

LWS0013I *service* is now inactive on port *number*.

Explanation: The server *service* is not active on the specified TCP port *number*. Processing continues, but no client requests can be made to the service until it becomes active again.

Action: None. Informational only.

LWS0014E An error was encountered while parsing execution parameters.

Explanation: An error occurred while parsing the execution parameters. The server terminates with a minimum return code of `8`.

Action: Collect diagnostic information and contact OpenText Technical Support.

LWS0015E *service* failed to start with error *number*.

Explanation: The specified service failed to start. The server terminates with a minimum return code of `8`.

Action: Collect diagnostic information and contact OpenText Technical Support.

LWS0020I Server *version* level: *level*.

Explanation: This message contains information detailing the current service level for the server program being executed. The value of *version* indicates the current release of the server. The value of *level* is a unique sequence of characters that can be used by OpenText Technical Support to determine the maintenance level of the server being executed.

Action: Normally, no action is required. However, if you report a problem with the server to OpenText Technical Support, you might be asked to provide the information in the message.

LWS0023I Listen port *number* is already in use.

Explanation: The displayed listen port is already in use by another task running on the local host. The server retries establishing the listen port.

Action: Determine what task is using the required port number and restart the server when the task is finished, or specify a different port in the configuration file. If the port number is changed for the server, the client must also specify the new port number.

LWS0024W Too many retries to obtain port *number*.

Explanation: The server tried multiple attempts to establish a listen socket on the specified port number, but the port was in use. The server terminates with a return code of `4`.

Action: Determine what task is using the required port number, and restart the server when the task is finished, or specify a different port in the configuration file. If the port number is changed for the server, the client must also specify the new port number.

LWS0025I Local TCP/IP stack is down.

Explanation: The server detected that the local host TCP/IP service is not active or is unavailable. The server retries every two minutes to reestablish communication with the TCP/IP service.

Action: Ensure that the TCP/IP service is running.

LWS0026E Unrecoverable TCP/IP error *number* returned from *internal_function_name*.

Explanation: An unrecoverable TCP/IP error was detected in the specified internal server function name. The server ends with a minimum return code of `8`. The error number reported corresponds to a TCP/IP errno value.

Action: Correct the error based on TCP/IP documentation for the specified errno.

LWS0027W Listen socket was dropped for port *number*.

Explanation: The server connection to the displayed listen port was dropped. The server attempts to reconnect to the listen port so that it can receive new client connections.

Action: Determine why connections are being lost on the local host. Ensure that the host TCP/IP services are running.

LWS0028E Unable to reestablish listen socket on port *number*.

Explanation: The listen socket on the specified port number was dropped. The server tried multiple attempts to reestablish the listen socket, but all attempts failed. The server ends with a return code of `8`.

Action: Determine if the host's TCP/IP service is running. If the host's TCP/IP service is running, determine if another task on the local host is using the specified port.

LWS0029I <*id*> Client request started from *ip_address* on port *number*.

Explanation: A new client request identified by *id* has been started from the specified IP address on the displayed port number.

Action: None. Informational only.

LWS0030I <*id*> Client request started from *host* (*ip_address*) on port *number*.

Explanation: A new client request identified by *id* has been started from the specified host and IP address on the displayed port number.

Action: None. Informational only.

LWS0031W Unable to stop task *id*: *reason*.

Explanation: The server attempted to terminate a service task identified by *id*. The server could not stop the task for the specified reason. The server ends with a return code of `4`.

Action: See the *reason* text for more information about why the task could not terminate.

LWS0032I <*id*> Client request has ended.

Explanation: The client requested identified by *id* has ended.

Action: None. Informational only.

LWS0033I <*id*> Client request: *resource*.

Explanation: The client connection identified by *id* issued a request for *resource*.

Action: None. Informational only.

LWS0034W <*id*> Write operation for client data has failed.

Explanation: A write operation failed for the connection identified by *id*. This is normally because the client dropped the connection. The client connection is dropped by the server.

Action: Ensure that the client does not prematurely drop the connection. Retry the client request if necessary.

LWS0035W <*id*> Read operation for client data has timed out.

Explanation: A read operation on the connection identified by *id* has timed out because of inactivity. The client connection is dropped by the server.

Action: Ensure that the client does not prematurely drop the connection. Retry the client request if necessary.

LWS0036W <*id*> Client request error: *error_code* - *error_text*.

Explanation: The server encountered an error while processing the client request. The server terminates the request.

Action: Determine why the request was in error by viewing the error code and error text that was generated.

LWS0037W <*id*> Client request error: *code*.

Explanation: The server encountered an error while processing the client request. The server terminates the request.

Action: Determine why the request was in error by viewing the error code and error text that was generated.

LWS0038I Received command: *command_text*.

Explanation: The server has received the displayed command from the operator. The server processes the command.

Action: None. Informational only.

LWS0043E Task *id* ended abnormally with RC=*retcode*.

Explanation: The server detected a task that ended with a non-zero return code. The server ends with a minimum return code of 8.

Action: View the log for other messages that might have been generated regarding the error.

LWS0045I Idle session time-out is *number* seconds.

Explanation: The message shows the idle time limit for connections. The server automatically terminates sessions that are idle for longer than the specified number of seconds.

Action: None. Informational only.

LWS0046I Maximum concurrent sessions limited to *number*.

Explanation: The message shows the maximum number of concurrent sessions allowed. The server allows only the specified number of concurrent sessions to be active at any given time. All connections that exceed this limit are forced to wait until the total number of connections drops below the specified value.

Action: None. Informational only.

LWS0047W Unable to delete log file *filename*.

Explanation: The log file could not be deleted as specified.

Possible cause: The user service or daemon does not have file system rights to delete old log files.

Action: Verify that the user service or daemon has the appropriate rights.

Action: Examine the current logs for related messages.

LWS0048I Log file *filename* successfully deleted.

Explanation: The log file has been deleted as specified.

Action: None. Informational only.

LWS0049E Error *error* authenticating to the directory as *fdn*.

Explanation: The connection manager could not connect to the directory as user *fdn*. The error was *error*.

Possible cause: The configuration parameters do not contain the correct user or password.

Action: Correct the cause of the error as determined from *error*.

Action: Verify that the User object has the appropriate rights.

Action: Verify that the password given for the User object in the configuration parameters is correct.

LWS0050E Server application initialization failure was detected.

Explanation: During server initialization, an error was detected while initializing the server Application object.

Possible Cause This message is commonly logged when the driver is started and then immediately shut down. This can happen during installation, when the shim is started to generate keys or configure SSL. You can safely ignore this message in those cases.

Action: See the error logs for additional messages that indicate the cause of the error.

LWS0051E Server initialization failure was detected.

Explanation: The server failed to initialize properly because of an initialization error specific to the operating system.

Action: See the log for additional messages that indicate the cause of the error.

LWS0052W This server is terminating because of another instance already running (*details*).

Explanation: The server is shutting down because there is another active instance of this server running on the host.

Possible cause: A previous instance of the server was not stopped before starting a new instance.

Action: Stop or cancel the previous server instance before starting a new one.

LWS0053I The parameter *keyword* is no longer supported.

Explanation: The specified parameter is not supported in this release and might be removed in future releases.

Possible cause: An execution parameter was specified that is no longer supported.

Action: Do not specify the unsupported parameter.

LWS0054I The execution parameter *keyword* is in effect.

Explanation: The specified execution parameter is in effect for the server.

Action: Informational only. Processing continues.

LWS0055W Invalid execution parameter detected: *keyword*.

Explanation: An invalid execution parameter was detected.

Action: Do not specify the invalid or unknown execution parameter.

LWS0056I Not accepting new connections because of the MAXCONN limit. There are *number* active connections now for *service*.

Explanation: The specified service has a maximum connection limit that has been reached. The service no longer accepts new connections until at least one of the active connections ends.

Action: If you receive this message frequently, increase the MAXCONN limit for this service or set the MAXCONN to unlimited connections.

LWS0057I New connections are now being accepted for *service*.

Explanation: The service was previously not accepting new connections because of the imposed MAXCONN limit. The service can now accept a new connection because at least one active connection has ended.

Action: None. Informational only.

LWS0058I Listen socket on port *number* has been re-established.

Explanation: The previously dropped listen socket has been reestablished. Services using the specified port can now continue. The listen socket previously dropped because of an error or TCP/IP connectivity problems has been reestablished. Client connection processing continues.

Action: None. Informational only.

LWS0059W Server is terminating because the required service *serviceName* is ending.

Explanation: The specified required service has ended. The server terminates because it cannot continue running without the required service.

Action: See related log messages to determine why the required service ended. Correct the problem and restart the server.

NET Messages

Messages beginning with NET are issued by driver components during verification of SSL certificates.

NET001W Certificate verification failed. Result is *result*.

Explanation: A valid security certificate could not be obtained from the connection client. Diagnostic information is given by *result*.

Possible cause: A security certificate has not been obtained for the component.

Possible cause: The security certificate has expired.

Possible cause: The component certificate directory has been corrupted.

Action: Respond as indicated by *result*. Obtain a new certificate if appropriate.

RDXML Messages

Messages beginning with RDXML are issued by the embedded Remote Loader.

RDXML000I *nameversion* Copyright 2005 Omnibond Systems, LLC. ID=*code_id_string*.

Explanation: This message identifies the system component version.

Action: No action is required.

RDXML001I Client connection established.

Explanation: A client has connected to the driver. This can be the Metadirectory engine connecting to process events to and from the driver, or a Web-based request to view information or publish changes through the SOAP mechanism.

Action: No action required.

RDXML002I Request issued to start Driver Shim.

Explanation: The driver received a command to start the driver shim and begin processing events.

Action: No action required.

RDXML003E An unrecognized command was issued. The driver shim is shutting down.

Explanation: The driver received an unrecognized command from the Metadirectory engine. The driver shim is shutting down to avoid further errors.

Possible cause: Network error.

Possible cause: Invalid data sent to the driver.

Possible cause: The Metadirectory engine version might have been updated with new commands that are unrecognized by this version of the driver.

Possible cause: This message is logged when the driver shim process is shut down from the connected system rather than from a Driver object request. The local system can queue an invalid command to the driver shim to simulate a shutdown request and terminate the running process.

Action: Ensure that the network connection is secured and working properly.

Action: Apply updates for the engine or driver if necessary.

Action: If the driver shim process was shut down from the local system, no action is required.

RDXML004I Client Disconnected.

Explanation: A client has disconnected from the driver. This might be the Metadirectory engine disconnecting after a driver shutdown request or a Web-based request that has ended.

Action: No action required.

RDXML005W Unable to establish client connection.

Explanation: A client attempted to connect to the driver, but was disconnected prematurely.

Possible cause: The client is not running in SSL mode.

Possible cause: Mismatched SSL versions or mismatched certificate authorities.

Possible cause: Problems initializing SSL libraries because of improperly configured system entropy settings.

Action: Ensure that both the Metadirectory engine and the driver are running in the same mode: either clear text mode or SSL mode.

Action: If you are using SSL, ensure that the driver and Metadirectory engine have properly configured certificates, and that the driver system is configured properly for entropy.

RDXML006E Error in Remote Loader Handshake.

Explanation: The Metadirectory engine attempted to connect to the driver, but the authorization process failed. Authorization requires that both supply mutually acceptable passwords. Passwords are configured at installation.

Possible cause: The Remote Loader or Driver object passwords do not match.

Action: Set the Remote Loader and Driver object passwords to the same value for both the driver and the driver shim. Use Identity Console to modify the driver properties. Re-configure the driver shim on the connected system.

RDXML007I Driver Shim has successfully started and is ready to process events.

Explanation: The Metadirectory engine has requested the driver to start the shim for event processing, and the driver shim has successfully started.

Action: No action required.

RDXML008W Unable to establish client connection from *remoteName*.

Explanation: A client attempted to connect to the driver, but was disconnected prematurely.

Possible cause: The client is not running in SSL mode.

Possible cause: Mismatched SSL versions or mismatched certificate authorities.

Possible cause: Problems initializing SSL libraries because of improperly configured system entropy settings.

Action: Ensure that both the Metadirectory engine and the driver are running in the same mode: either clear text mode or SSL mode.

Action: If you are using SSL, ensure that the driver and Metadirectory engine have properly configured certificates, and that the driver system is configured properly for entropy.

RDXML009I Client connection established from *remoteName*.

Explanation: A client has connected to the driver. This can be the Metadirectory engine connecting to process events to and from the driver, or a Web-based request to view information or publish changes through the SOAP mechanism.

Action: No action required.

C Technical Details

Topics in this section include

- "Driver Shim Command Line Options" on page 107
- "SAFQUERY Tool" on page 108
- "LDXSERV Tool" on page 109
- "Performance Information" on page 111

Driver Shim Command Line Options

The following options can be specified on the driver shim command line. You can also specify driver shim configuration file statements as command line options. For details about the driver shim configuration file, see "The Driver Shim Configuration File" on page 49.

Options Used to Set Up Driver Shim SSL Certificates

The following command line options are used to set up the driver shim SSL certificates:

Table C-1 *Driver Shim Command Line Options for Setting Up SSL Certificates*

Option (Short and Long Forms)	Description
`-s` `-secure`	Secures the driver by creating SSL certificates, then exits.
`-p` `-password`	Specifies the Remote Loader password.

Other Options

Table C-2 Other Driver Shim Command Line Options

Option (Short and Long Forms)	Description
`-c <congFile>` `-config <configFile>`	Instructs the driver shim to read options from the specified configuration file. Options are read from DDNAME `DRVCONF` by default.
`-?` `-help`	Displays the command line options, then exits.
`-v` `-version`	Displays the driver shim version and build date, then exits.

SAFQUERY Tool

The driver query processor uses the system authorization facility (SAF) to retrieve information from the security system. Queries are used by the Metadirectory engine for matching and merging. The TSO command, `SAFQUERY`, is used to extract information from the RACF database. `SAFQUERY` has the following format for read operations:

```
SAFQUERY SCOPE(entry) CLASS(class) ASSOCIATION(association)
  [READATTRS(attrs...)|ALLREADATTRS] [PRINT]
```

The SCOPE tells `SAFQUERY` that information about a specific profile is being requested. The CLASS operand specifies whether it's a User or Group profile. The ASSOCIATION operand specifies the association of the object to read. It must have the format USER\userid or GROUP\groupname. The TEADATTRS operand specifies a list of attributes to return; optionally, you may specify ALLREADATTRS instead to return everything. The PRINT operand instructs `SAFQUERY` to print the results to the display. The output is a series of lines, each with a name=value pair. These pairs are interpreted by the driver shim to create an appropriate XDS document that the engine can use for processing. For example:

```
SAFQUERY SCOPE(ENTRY) CLASS(User) ASSOCIATION(USER\IBMUSER)
  READATTRS(DirXML-RACF-special) PRINT

COMMAND=instance
CLASS_NAME=USER
EVENT_ID=?
ASSOCIATION=USER\IBMUSER
ATTR_DirXML-RACF-special=true
COMMAND=status
STATUS_LEVEL=success
```

For search operations, a search criteria is specified:

```
  SAFQUERY SCOPE(subtree) SEARCHCLASSES(classes..)
SEARCHATTRS('attr=value' ...)
    [READATTRS(attrs...)|ALLREADATTRS] [PRINT]
```

The subtree SCOPE tells `SAFQUERY` that information about a specific profile is being requested. The SEARCHCLASSES operand lists the class(es) of interest. The SEARCHATTRS provides a list of values and attributes to search on. For example:

```
  SAFQUERY SCOPE(subtree) SEARCHCLASSES(User)
    SEARCHATTRS('DirXML-RACF-revoke=true') PRINT

  COMMAND=instance
  CLASS-NAME=USER
  EVENT_ID=?
  ASSOCIATION=USER\ASCH
  COMMAND=instance
  CLASS_NAME=USER
  EVENT_ID=?
  ASSOCIATION=USER\CICSA
  COMMAND=instance
  CLASS_NAME=USER
  EVENT_ID=?
  ASSOCIATION=USER\CICSTART
  COMMAND=status
  STATUS_LEVEL=success
```

You will notice that there are multiple results returned. Search operations may return zero or more responses.

LDXSERV Tool

LDXSERV is a TSO command tool that serves several functions. For the driver shim, it allows the started task to set a loopback token in its address space memory in order to prevent the Exit routines from logging its activity to the change log. From the user's perspective, LDXSERV can be used as a verification tool to investigate whether the Exits are in place correctly. It can also be used to query information from the change log queue and even modify the queue, if necessary.

The syntax for LDXSERV is as follows:

```
  LDXSERV < STATUS | GETNEXT | [MARKDONE <EVENT(event-id)>] >
```

STATUS

The STATUS operand reports back to the user an XML document describing the installed Event Subsystem. It provides several pieces of information, including the build date and version of each component, the state of each Exit, the number of events queued through each Exit, and the size and location of the log file.

```
  ldxserv status
  <ldx>
    <source>
      <product build="20210103" instance="ldxserv" version="4.83">
        Novell IDM RACF Driver Version 4.8.3.0
      </product>
      <contact>NetIQ Corporation</contact>
    </source>
    <output>
      <status level="success">
        <exit name="LDXRIX02" state="enabled" version="4.83" build-
date="20210103"
          times-called="584" events-queued="2" info="ok"/>
        <exit name="LDXEVX01" state="enabled" version="4.83" build-
date="20210103"
          times-called="20" events-queued="7" info="ok"/>
        <queue version="4.83" state="active" created-by="LDXRIX02"
entries="0"/>
        <logger version="4.83" state="active" taskid="LDXLOGRP"
          logfilename="LDX.LOGFILE"/>
        <logfile name="LDX.LOGFILE" state="0% used"/>
      </status>
    </output>
  </ldx>
```

GETNEXT

The GETNEXT operand reports back to the user an XML document describing the first event in the change log queue. Inside the XML document, you may view the type of event and details about the event, including the user that issued the event, the date and time of the event.

```
  ldxserv getnext
  <ldx>
    <source>
      <product build="20210103" instance="ldxserv" version="4.83">
        Novell IDM RACF Driver Version 4.8.3.0
      </product>
      <contact>NetIQ Corporation</contact>
    </source>
    <output>
      <modify-password date="2021-01-15" time=" 7:18" event-id="7006">
        <association>USER\JAVIER</association>
        <password>********</password>
      </modify-password>
      <status level="success">
        <description>ok</description>
      </status>
    </output>
  </ldx>
```

MARKDONE

The MARKDONE operand instructs LDXSERV to remove the event in the queue, described by the EVENTID operand. The event-id must match the event-id found by the GETNEXT command. When complete, it reports back an XML document describing the success or error of the instruction.

```
ldxserv markdone event(7006)
<ldx>
  <source>
    <product build="20210103" instance="ldxserv" version="4.83">
      Novell IDM RACF Driver Version 4.8.3.0
    </product>
    <contact>NetIQ Corporation</contact>
  </source>
  <output>
    <status level="success">
      <description>ok</description>
    </status>
  </output>
</ldx>
```

Performance Information

This section presents the results of a performance case study of the Identity Manager 4.10 driver for RACF. The study is based on software and hardware configurations that may vary from your production deployment. Therefore, the results, which include real-time throughput and mainframe resource usage, are offered only as approximations for calculating similar measurements in your environment.

Configuration Information

The system on which Identity Manager was installed was a VMWare virtual machine with the following configuration:

- Single Intel* Xeon* CPU at 2.5 GHz
- 8 GB RAM
- SLES 10.2 x86_64
- 64-bit eDirectory 8.8 SP5 (20219.15)
- 64-bit Identity Manager 3.6.1 (3.6.10-20090520)
- Single Driver Set with one driver (RACF)
- Engine trace level 10

The connected z/OS system running RACF consisted of:

- IBM System z10 Business Class Mainframe 2098-E10 model D02
- 8 MB memory
- z/OS 1.10
- RACF with 1000 users

Performance Metrics

All tests in the case study used three or more of the following benchmarks:

- Real-Time Speed
- CPU-Time
- EXCP-Cnt
- Memory Usage

Real-Time Speed

This measurement describes the amount of time for a particular transaction in real seconds or milliseconds. It is useful for ascertaining how long a large migration may take or how many events per day can be processed by a particular channel in real time. Real-time measurements are helpful in previewing what to expect in a production deployment; however, they are dependent on a variety of factors, including speed of the mainframe and vault systems, size of the RACF database, size and layout of Identity Vault, operating systems workload, network delays, disk I/O speeds, trace levels, and customized policies.

CPU-Time

On the mainframe, CPU-Time is a measurement of the amount of CPU processing time consumed by a particular job. This figure can be used for capacity planning.

EXCP-Cnt

The EXCP-Cnt is the total number of blocks transferred for I/O requests. I/O utilization may also be used for capacity planning.

Memory Usage

Memory usage is the number of frames allocated by a running task on z/OS. Each frame represents 4096 bytes of memory. In all tests for this study, the memory recorded was the highest observed peak that occurred during transactions.

Idle Performance

Idle performance measures how the Driver Shim started task performs while no event transactions are being processed.

Phase Discussion

Driver Shim idle performance is measured in four phases:

- Shim Startup
- Shim Idle (not connected)

- Shim Connection
- Shim Idle (connected)

Shim Startup

When the RACF Driver Shim (`RACFDRV`) is started, various internal tasks are created and executed to create a network listener.

Shim Idle (not connected)

This phase describes the time after the Driver Shim has been started and before the engine has established a network connection.

Shim Connection

The connection between Identity Manager and the Driver Shim uses SSL negotiations and a handshake, which involves the exchange of passwords for the remote loader and driver. Internally, two new tasks are created to read and parse data exchange and to poll the change log data set.

Shim Idle (connected)

Once a connection is established, the Driver Shim periodically polls the change log data set for any new events to publish. In addition, Identity Manager sends *keep-alive* packets to the Driver Shim to ensure the connection remains intact. For this case study, this phase was tested with a 5-minute publisher polling interval.

Results

Table C-3 *RACFDRV Idle Performance*

Phase	CPU-Time	EXCP-Cnt	Memory Usage
Startup	0.85 seconds	1027	1447 (5.9 MB)
Idle (not connected)	0.12 seconds/hour	0/hour	1447 (5.9 MB)
Connection	1.3 seconds	477	1971 (8.1 MB)
Idle (connected)	1.37 seconds/hour	455/hour	1972 (8.1 MB)

NOTE: The polling interval will affect the results for the Idle (connected) phase. For this study, the polling interval was set to 300 seconds (or 5 minutes) and the driver heartbeat was disabled.

Table C-4 *LDXLOGR (LDXLOGRP) Idle Performance*

Phase	CU-Time	EXCP-Cnt	Memory Usage
Startup	0.03 seconds	8	279 (1.1 MB)
Idle	0.04 seconds/hour	0/hour	283 (1.2 MB)

Subscriber Performance

The Subscriber channel processes events originating in Identity Manager that need to be replicated in the RACF database. In this study, 1000 events were timed for each use case and the results were averaged across all 1000 events. Six event types were included:

- Add User - A new user in Identity Manager is replicated on the connected system using the minimum required fields
- Modify User - A change to a user in Identity Manager causes a change to that user's REVOKE field in RACF
- Delete User - A user's deletion in Identity Manager causes that user's deletion in RACF
- Change Password - A user's new password in Identity Manager is replicated in RACF
- Entry Query User - Identity Manager queries a user in RACF and reads its NAME field
- Search Query User - Identity Manager queries RACF with a search on the NAME field

Each test was run both with and without the REXX extensions. When the Driver Shim invokes the REXX scripts to execute commands, additional CPU, Time and I/O are consumed to accomplish the task. However, using REXX allows you to customize the provisioning process with native z/OS policy decisions.

Table C-5 *RACFDRV Performance Per Transaction (with REXX)*

Event	CPU-Time	EXCP-Cnt	Memory Usage	Real Time
Add User	0.61 seconds	310	2900 (11.9 MB)	1.38 seconds
Modify User	0.48 seconds	181	2200 (9.0 MB)	1.11 seconds
Delete User	0.47 seconds	294	2043 (8.4 MB)	1.19 seconds
Change Password	0.74 seconds	399	2008 (8.2 MB)	0.79 seconds
Entry Query User	0.26 seconds	165	2022 (8.3 MB)	1.85 seconds
Search Query User	1.16 seconds	3264	2023 (8.3 MB)	3.04 seconds

Table C-6 *RACFDRV Performance per Transaction (without REXX)*

Event	CPU-Time	EXCP-Cnt	Memory Usage	Real Time
Add User	0.28 seconds	94	2900 (11.9 MB)	0.87 seconds
Modify User	0.21 seconds	15	2200 (9.0 MB)	0.71 seconds
Delete User	0.20 seconds	86	2043 (8.4 MB)	0.77 seconds
Change Password	0.15 seconds	15	2008 (8.2 MB)	0.65 seconds
Entry Query User	0.10 seconds	41	2022 (8.3 MB)	0.60 seconds
Search Query User	0.60 seconds	1199	2023 (8.3 MB)	1.70 seconds

Publisher Performance

The Publisher channel processes events originating in the connected system's RACF database that need to be replicated in the Identity Vault. In this study, 1000 events were timed for each use case and the results were averaged across all 1000 events. Five event types were included:

- Add User - A new user created in RACF with minimum required fields is replicated in Identity Manager
- Add Group - A new group created in RACF with minimum required fields is replicated in Identity Manager
- Modify User - A change to a user's REVOKE field in RACF causes a change to that user's account in Identity Manager
- Delete User - A user deleted in RACF causes that user's deletion in Identity Manager
- Change Password - A user's new password in RACF is replicated in Identity Manager

For each test, a CLIST containing the commands for each event type, was executed against RACF. To gain accurate samples, measurements were taken in steps:

- First, `LDXLOGR` was started to move the events from cross memory to the change log.
- Then the CLIST was executed to begin queueing commands and changes. This implies that the performance of the `LDXLOGR` during this phase was in contention with the actual RACF commands being executed by RACF.
- Finally, the Drive Shim (`RACFDRV`) was started to fetch each event and publish to the Identity Vault. Default matching rules and placement policies were used.

When `LDXLOGRP` (monitored on the mainframe as `LDXLOGRP`) is not bottlenecked by RACF and started after the cross memory queue is populated with events, the CPU-Time and Real Time performance is more efficient. This is demonstrated by the bulk processing results in Table C-8 on page 116.

Table C-7 *LDXLOGR (LDXLOGRP) Performance Per Transaction (Individual Processing)*

Event	CPU-Time	EXCP-Cnt	Memory Usage	Real Time
Add User	0.002 seconds	5	285 (1.2 MB)	0.18 seconds
Add Group	0.002 seconds	5	285 (1.2 MB)	0.18 seconds
Modify User	0.002 seconds	5	285 (1.2 MB)	0.18 seconds
Delete User	0.002 seconds	5	285 (1.2 MB)	0.18 seconds
Change Password	0.002 seconds	5	285 (1.2 MB)	0.18 seconds

Table C-8 LDXLOGR (LDXLOGRP) Performance Per Transaction (Bulk Processing)

Event	CPU-Time	EXCP-Cnt	Memory Usage	Real Time
Add User	0.001 seconds	5	285 (1.2 MB)	0.003 seconds
Add Group	0.001 seconds	5	285 (1.2 MB)	0.003 seconds
Modify User	0.001 seconds	5	285 (1.2 MB)	0.003 seconds
Delete User	0.001 seconds	5	285 (1.2 MB)	0.003 seconds
Change Password	0.001 seconds	5	285 (1.2 MB)	0.003 seconds

Table C-9 RACFDRV Performance Per Transaction

Event	CPU-Time	EXCP-Cnt	Memory Usage	Real Time
Add User	0.027 seconds	7	1977 (8.1 MB)	0.14 seconds
Add Group	0.023seconds	7	1976 (8.1 MB)	0.12 seconds
Modify User	0.022 seconds	7	1977 (8.1 MB)	0.10 seconds
Delete User	0.022 seconds	7	1977 (8.1 MB)	0.10 seconds
Change Password	0.027 seconds	7	1975 (8.1 MB)	0.14 seconds