AUTHORIZED DOCUMENTATION

Implementation Guide

Novell®

Identity Manager Driver for Mainframes: RACF*

4.0.1

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Contents

About This Guide

This guide explains implementation of the Novell® Identity Manager 4.0.1 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 Novell Identity Manager 4.0.1, 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.

This guide includes the following sections:

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, Novell eDirectory™, and the administration of systems and platforms you connect to Identity Manager.

Feedback

We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the User Comments feature at the bottom of each page of the online documentation, or go to the Novell Documentation Feedback site (http://www.novell.com/documentation/feedback.html) and enter your comments there.

Documentation Updates

For the most recent version of this guide, visit the Identity Manager 4.0.1 Drivers Documentation Web site (http://www.novell.com/documentation/idm401drivers).

Additional Documentation

For additional documentation about Identity Manager drivers, see the Identity Manager 4.0.1 Drivers Documentation Web site (http://www.novell.com/documentation/idm401drivers).

For additional documentation about Identity Manager, see the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

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When a single pathname can be written with a backslash for some platforms or a forward slash for other platforms, the pathname is presented with a backslash. Users of platforms that require a forward slash, such as Linux* or UNIX*, should use forward slashes as required by your software.

Overview

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The Novell® Identity Manager 4.0.1 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 4.0.1 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:

- Section 1.1, "Driver Architecture," on page 11
- Section 1.2, "Configuration Overview," on page 18

1.1 Driver Architecture

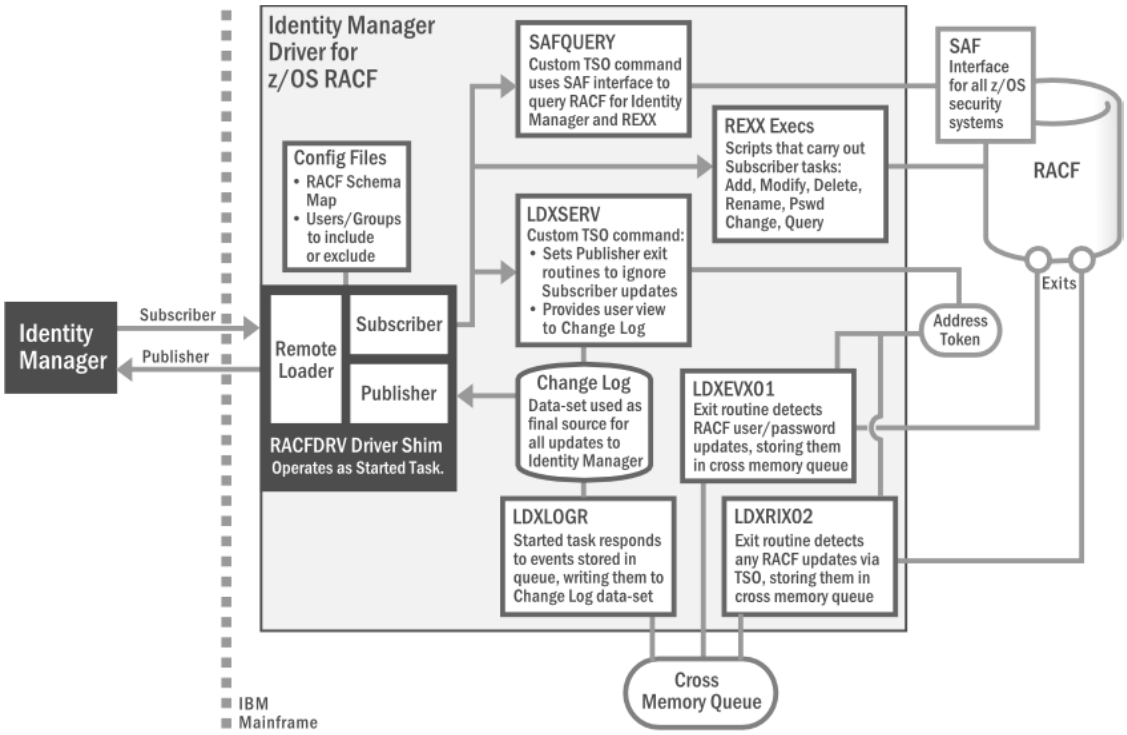
The driver synchronizes information between the Identity Vault on the Identity Manager platform and RACF on the connected z/OS system.

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:

- Section 1.1.1, "Component Summary," on page 12
- Section 1.1.2, "Component Discussion," on page 15

1.1.1 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.
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.

Data Channel	Component	Description
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).

1.1.2 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 Section 6.1, “The Scriptable Framework,” on page 61.

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 Section 6.2, “The Connected System Schema File,” on page 67.

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 Section 6.3, “The Connected System Include/Exclude File,” on page 69.

To control which objects are processed by the Publisher channel, use policies. For details about customizing policies, see the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

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.

1.2 Configuration Overview

This section discusses driver configuration details specific to the Identity Manager driver for RACF. For basic configuration information, see the *Identity Manager 4.0.1 Administration Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401). For detailed information about configuring the driver, see Chapter 5, "Configuring the RACF Driver," on page 49.

Topics include

1.2.1 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.

1.2.2 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

1.2.3 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

1.2.4 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

1.2.5 RACF Password Phrases

In z/OS 1.10, RACF supports password phrases, which may be case-sensitive and up to 255 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.

1.2.6 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: Event Transformation. 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: Matching Rule. 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

One policy exists in this category: Create Rule. This policy may perform several tasks, based on how the RACF driver was configured during import:

- Vetoes the event if the CN attribute is missing
- Requires a password is present in the Identity Vault
- Sets a RACF default group for new RACF users
- Sets a RACF owner for new RACF users
- Converts the CN attribute to uppercase
- Sets the RACF NAME field to Given Name + Surname
- Configures default TSO segment fields
- Configures default OMVS 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

Planning for the RACF Driver 2

This section helps you plan for deployment of the Novell® Identity Manager 4.0.1 driver for RACF. Topics include

For more information about planning, see the *Identity Manager 4.0.1 Installation Guide* on the Identity Manager Documentation Web site (http://www.novell.com/documentation/idm401).

2.1 Deployment Planning

- Review Chapter 3, “Installing the RACF Driver,” on page 27 and Chapter 5, “Configuring the RACF Driver,” on page 49.
- 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 27, as your main procedural reference.
  - If you are upgrading a system that already uses an RACF driver, begin with Chapter 4, “Upgrading the Driver,” on page 41, which includes instructions for upgrading from both the Fan-Out RACF driver and the Java-based bidirectional RACF driver.
- 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 Section 6.2, “The Connected System Schema File,” on page 67.
- 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 Section 5.2, “The Driver Shim Configuration File,” on page 56.

- 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 Section 6.3, “The Connected System Include/Exclude File,” on page 69.
- 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

2.2 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?

2.3 Customization Planning

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

  For details about the provided execs, see Table 6-1, “Identity Vault Command Processing Execs,” on page 62; Table 6-2, “Other Execs,” on page 62; 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 Section 6.2, “The Connected System Schema File,” on page 67.
- What options do you plan to use in your driver shim configuration file?

  For details about the driver shim configuration file, see Section 5.2, “The Driver Shim Configuration File,” on page 56.
- How will you use the include/exclude file?

  For details about the include/exclude file, see Section 6.3, “The Connected System Include/Exclude File,” on page 69.
- Do you plan to customize policies?

For details about customizing policies, see the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

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

2.4 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 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

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

Installing the RACF Driver

3

This section provides the information you need for first-time installation of the Novell® Identity Manager 4.0.1 driver for RACF.

NOTE: If you are upgrading a system that already uses an Identity Manager RACF driver, begin with Chapter 4, “Upgrading the Driver,” on page 41, which includes instructions for upgrading from both the Fan-Out RACF driver and the Java-based bidirectional RACF driver.

Topics include

3.1 Before You Begin

- Review Chapter 2, “Planning for the RACF Driver,” on page 23.
- 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 Novell Support Web site (http://support.novell.com).

3.2 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 iManager to configure Identity Manager drivers. You must be familiar with the facilities of the driver, and you must have developed a deployment plan.

To find other documentation related to this product and its installation, see “Additional Documentation” on page 9.

For an overview of driver facilities, see Chapter 1, “Overview,” on page 11.

For information about planning for the driver, see Chapter 2, “Planning for the RACF Driver,” on page 23.

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

3.3 Prerequisites

3.3.1 Connected System Requirements

- ❑ z/OS
- ❑ RACF Security for z/OS

For information about supported platforms and operating environments, see the Identity Manager 4.0.1 Drivers Documentation Web site (http://www.novell.com/documentation/idm401drivers). From this index page, you can select a readme file associated with the platform(s) for which you need support.

3.3.2 Identity Vault Requirements

- ❑ Novell Identity Manager (Metadirectory engine) 3.6.1 or later with the latest Support Pack

3.4 Getting the Installation Files

1. Obtain the most recent distribution of the Identity Manager 4.0.1 Driver for RACF from the Novell Downloads Web site (http://download.novell.com/).

   At the time of this Implementation Guide’s release, the driver was included in the following ISO package:

   ```
   NIdM_Integration_Module_4.0_MainframesMidrange.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`.

   2b If you are *not* running the Identity Manager 4.0.1 Metadirectory engine, the following files are also required:

   ```
   RACF-IDM3-6-0-V1.xml
   racf.sch
   zOS.jar
   novell-DXMLracf.rpm
   novell-DXMLracf.ppc.rpm
   DXMLracf.pkg
   ```

   These files are located under `bidirectional/RACF/Metadirectory`.

NOTE: If you are running the Identity Manager 4.0.1 Metadirectory engine, these files should already be installed for you.

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.

3.5 Extending the Schema for Identity Manager

You must extend the schema if you want to use the Identity Vault to manage connected system attributes that are not already mapped to standard eDirectory™ attributes. Otherwise, it is not necessary.

NOTE: If you are running the Identity Manager 4.0.1 Metadirectory engine and you selected the RACF driver during that installation, the schema definitions were added at that time and you do not need to complete this task.

Extending the schema adds auxiliary classes to eDirectory User and Group objects for RACF user and group attributes.

1 In iManager, select the *Extend Schema* task under *Schema*.

2 Select *Import data from file on disk*, then click *Next*.

3 Select a file type of *Schema File*.

4 Type or browse for `racf.sch` as the file to import, then click *Next*.

5 Specify the host name or IP address and the LDAP port number of your Metadirectory server.

To connect to the non-secure LDAP port (389), you must have the *Require TLS for Simple Binds with Password* option disabled on your LDAP Group. If necessary, you can edit this option using the *LDAP Options* task under *LDAP* in iManager. For details, see the *Novell eDirectory Administration Guide*.

6 Select *Authenticated login* and log in as Admin or another user with rights to extend the schema.

7 Click *Next* to go to the summary.

8 Click *Finish* to extend the schema.

3.6 Installing the Java Class File on the Metadirectory Server

The file `zOS.jar` contains Java classes used by the Publisher and Subscriber channels to convert XDS command documents into TSO commands and vice versa. RPM and PKG archives are provided for the appropriate operating systems to install `zOS.jar` into the correct location.

NOTE: If you are running the Identity Manager 4.0.1 Metadirectory engine and you selected the RACF driver during that installation, the correct Java classes were added at that time and you do not need to complete this task.

If you selected the RACF driver during your installation of Novell Identity Manager, then you will need to remove the old driver class files before installing the new one.

3.6.1 Removing Old RACF Driver Class Files

Depending on your operating system, remove the existing class files as follows:

- If you are running Linux or AIX, enter

  ```
  rpm -e novell-DXMLracf
  rpm -e novell-DXMLtss
  ```

- If you are running Solaris, enter

  ```
  pkgrm -n DXMLracf
  pkgrm -n DXMLtss
  ```

- If you are running Windows, locate and remove `RACF.jar` and `zOS.jar` from

  ```
  \novell\nds\lib
  ```

3.6.2 Installing New RACF Driver Class Files

Depending on your operating system, install the new class files as follows:

- If you are running Linux, enter

  ```
  rpm -ivh novell-DXMLracf.rpm
  ```

- If you are running AIX, enter

  ```
  rpm -ivh novell-DXMLracf.ppc.rpm
  ```

- If you are running Solaris, enter

  ```
  pkgadd -n -d DXMLracf.pkg DXMLracf
  ```

- If you are running Windows, copy `zOS.jar` to

  ```
  \novell\nds\lib
  ```

3.7 Setting Up the Driver on the Metadirectory Server

1. In iManager, select the *Identity Manager Utilities* task *New Driver*.
2. Select a driver set where you want to create the driver, then click *Next*.

   If you place this driver in a new driver set, you must specify a driver set name, context, and associated server.

   Only one driver set can be active on a server.
3. Import the driver rules file.

   Select *Import a driver configuration from the client (.XML file)*, type or browse for `RACF-IDM3_6_0-V1.xml` on the workstation (where you placed it in Step 2 on page 28), then click *Next*.

   NOTE: If you are running the Identity Manager 4.0.1 Metadirectory engine, this XML file should be selectable through the drop-down.

   ---
4. Specify the configuration settings as described in the following table, then click *Next*.

Configuration Setting	Action
Driver Name	Specify a name for the driver object.
Data Flow	Select *Bidirectional*, *Application to Identity Vault*, or *Identity Vault to Application*. For details, see "Data Flow" on page 50.
Base Container	Specify the Identity Vault container where synchronized users and groups reside. You can specify separate containers for users and groups by updating the driver properties later. For details, see "User Base Container" on page 56 and "Group Base Container" on page 56.
Set Preconfigured TSO Data	Select *Yes* or *No*. For details, see Section 1.2.3, "TSO Information Management," on page 18.
Set Preconfigured OMVS Data	Select *Yes* or *No*. For details, see Section 1.2.2, "OMVS Information Management," on page 18.
Default Group	Specify a group to be used as the default group for new users created by the driver. For details, see "User Default Group" on page 54.
Enable RACF Password Phrases	Select *Yes* or *No*. For details, see Section 1.2.5, "RACF Password Phrases," on page 19.
Enable Entitlements	Select *Yes* or *No*. For details, see "Enable Entitlements" on page 50.
Polling Interval	Specify the number of seconds the Publisher shim waits after sending events from the change log to the Metadirectory engine. For details, see "Polling Interval" on page 52.
Remote Host Name and Port	Specify the host name or IP address and TCP port number of the driver shim on your connected system. The default port number is 8090.
Use SSL	Select *Yes* or *No*. For details, see "Use SSL" on page 51.
Driver Object Password Remote Loader Password	Specify secure passwords and remember them. You must enter them when you run the `SETPDWDS` exec while installing the driver shim on the connected system. For details, see "Driver Object Password" on page 51 and "Remote Loader Password" on page 52.
Default TSO Account Number	Specify the default account number for new users created by the driver. For details, see "User Default TSO Account Number" on page 54.
Default TSO Procedure	Specify the default cataloged procedure name for new users created by the driver. For details, see "User Default TSO Proc" on page 54.
UID and GID Assignment	Select *Assign by RACF* or *Assign by Identity Vault*. For details, see "UID Assignment" on page 54.

Configuration Setting	Action
Default Home Directory	Specify an HFS file path to be used as the default home directory for new users created by the driver. For details, see "Default Home Directory" on page 54.
Default Program	Specify the default login shell to be assigned to new users created by the driver. For details, see "Default Program" on page 54.
Synchronize IDV passwords to RACF phrases	Select *Yes* or *No*. If you select *Yes*, Identity Vault passwords will be synchronized to RACF password phrases.
Synchronize RACF phrases to IDV passwords	Select *Yes* or *No*. If you select *Yes*, RACF password phrases will be synchronized to the Identity Vault.
Synchronize RACF passwords to IDV passwords	Select *Yes* or *No*. If you select *Yes*, RACF passwords will be synchronized to the Identity Vault.

5 Click *Define Security Equivalences* and make the driver equivalent to Admin or another high-rights user so the driver can obtain information from the Identity Vault and create users and groups there.

   For details about the rights required by the user, see Table 2-2, "Base Container Rights Required by the Driver Security-Equivalent User," on page 25.

6 (Optional) Click *Exclude Administrative Roles* to exclude users with administrative rights from being processed by the driver.

7 Click *Finish* to complete the driver installation.

8 Start the driver.

   Click the upper right corner of the driver icon, then click *Start driver*.

3.8 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

- Section 3.8.8, “Installing the Driver Security System Exits,” on page 37
- Section 3.8.9, “Testing the Completed Connected System Installation,” on page 38

3.8.1 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 28.

   ```
   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.

3.8.2 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:

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

2 Use the PARMLIB TSO command to activate your changes.

   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.

3.8.3 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:    20060821144845Z
   Not After:     20160821144845Z
Do you accept the Certificate Authority? (Y/N) y
```

3.8.4 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 4 on page 30 when setting up the driver on the Metadirectory server.

3.8.5 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.

3.8.6 Setting Up the Started Tasks

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

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 Section 7.2, “Starting and Stopping the Change Log Started Task,” on page 75.

   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 Section 5.2, “The Driver Shim Configuration File,” on page 56.
   - The name of your connected system schema file

     You can use your driver samples library member `SCHEMDEF` as a model. For details, see Section 6.2, “The Connected System Schema File,” on page 67.
   - The name of your include/exclude file

     You can use your driver samples library member `INCEXC` as a model. For details, see Section 6.3, “The Connected System Include/Exclude File,” on page 69.

- 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 Section 7.3, “Starting and Stopping the Driver Shim Started Task,” on page 75.

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
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 may 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
```

3.8.7 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 Section 7.2, “Starting and Stopping the Change Log Started Task,” on page 75.

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.

3.8.8 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.

3.8.9 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 Section 7.2, “Starting and Stopping the Change Log Started Task,” on page 75.

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.

3.9 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 Novell Identity Manager Products, see the *Identity Manager 4.0.1 Installation Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

3.10 Uninstalling the Driver

3.10.1 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.

3.10.2 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 Section 7.2, “Starting and Stopping the Change Log Started Task,” on page 75 and Section 7.3, “Starting and Stopping the Driver Shim Started Task,” on page 75.
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 Section 3.8.2, “Authorizing the Driver TSO Commands,” on page 34.
6. Remove the driver files from the HFS. They were created in Step 6 on page 34.

   ```
   rm -Rf /opt/novell
   rmdir -p /opt/novell/
   ```
7. Delete the driver samples library, load library, and REXX exec library that you created in Step 3 on page 33.
8. Delete the change log data set that you created in Section 3.8.5, “Allocating and Initializing the Change Log Data Set,” on page 35.

3.10.3 Uninstalling the Driver Object from eDirectory

1. In iManager, select *Identity Manager Overview* from the Identity Manager task list on the left side of the window.
2. Navigate to your driver set by searching the tree or by entering its name.
3. Click *Delete Driver* on the Identity Manager Overview page.
4. Select the Driver object to be deleted, then click *OK*.

Upgrading the Driver

4

This section provides information about upgrading the latest Identity Manager driver for RACF from other versions of Identity Manager RACF drivers.

Topics include

4.1 Updating from the Fan-Out Driver

The Fan-Out driver provides one-way synchronization to a heterogeneous mix of systems including Linux and UNIX systems, and IBM i5/OS* (OS/400* operating system) and z/OS systems. The Fan-Out driver also provides authentication redirection from those systems.

Moving to the Identity Manager 4.0.1 driver for RACF provides two main advantages:

- **Bidirectional Synchronization:** The driver allows synchronization from the connected system.
- **Standard Identity Manager Policies That Simplify Customization:** The Fan-Out driver makes minimal use of Identity Manager policies.

Consider the following before migrating from the Fan-Out driver:

- **Heterogeneity:** The Fan-Out driver supports operating system environments besides RACF. You can continue to use the Fan-Out driver for those systems while using the Identity Manager 4.0.1 driver for RACF on your RACF systems.
- **Authentication Redirection:** The Fan-Out driver provides authentication redirection using the password exit. The Identity Manager 4.0.1 driver for RACF provides bidirectional password synchronization.

4.1.1 Preparing for Migration

Novell® recommends that you perform the upgrade in a test environment similar to your production environment before upgrading production systems.

Before beginning the upgrade process, review Chapter 3, “Installing the RACF Driver,” on page 27.

To prepare for installing the upgrade:

1. Verify that you have the required knowledge and skills.

   For details, see Section 3.2, “Required Knowledge and Skills,” on page 27.
2. Ensure that the prerequisites are met.

   For details, see Section 3.3, “Prerequisites,” on page 28.
3. Prepare the distribution files for installation.

   For details, see Section 3.4, “Getting the Installation Files,” on page 28.

4.1.2 Migrating Fan-Out Driver Platform Services to the RACF Driver

To migrate, follow these tasks on your target platform system:

1. Stop the following started tasks:
   - `PLATRCVR`
   - `ASCLIENT`
2. Remove `ASCLIENT` and `PLATRCVR` from your system startup and shutdown procedures.
3. Remove the Fan-Out driver's RACF exit.
4. Install the driver shim on the connected system.

   For details, see Section 3.8, "Installing the Driver Shim on the Connected System," on page 32.

4.1.3 Configuring the Driver

To configure the driver:

1. Install and set up the Identity Manager driver for RACF on the Metadirectory server.

   For details, see Section 3.7, "Setting Up the Driver on the Metadirectory Server," on page 30.
2. Make any required policy modifications.

   Create or modify an appropriate policy to use the alternative naming attribute if one was used by the Fan-Out driver. For more information about policy customization, see the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).
3. Start the driver.

   Click the upper right corner of the driver icon, then click *Start driver*.
4. Migrate the users to make new associations. For details, see Section 5.4.1, "Migrating Identities from the Identity Vault to the Connected System," on page 58 and Section 5.4.2, "Migrating Identities from the Connected System to the Identity Vault," on page 59.

4.1.4 Post-Migration Tasks

Perform the tasks listed in Section 3.9, "Post-Installation Tasks," on page 39.

After the new driver is operating properly, you can remove the Fan-Out driver components:

1. Delete the Platform object from the Fan-Out driver configuration.
2. On the connected system, uninstall Platform Services.
3. If this is the last platform being served by the Fan-Out driver, you can uninstall the Fan-Out core driver.
   - **3a** Remove the `ASAM` directory from the file system.
   - **3b** Remove the ASAM System container object and all of its subordinates from the tree.
   - **3c** Uninstall the Fan-Out driver plug-ins.

4.2 Upgrading from the Java-Based RACF Driver

IMPORTANT: Please read carefully all points in this section regarding changes that need to be considered on systems running previous versions of the Identity Manager bidirectional driver for RACF.

The RACF driver for Identity Manager 4.0.1 introduces significant architectural changes over previous releases. The RACF driver that was provided with Identity Manager 3.6.1 and earlier releases employed a Java-based architecture, which leveraged the TELNET/TSO interface to interact with the RACF system.

The new RACF driver provides the same functionality through an improved design that is more efficient and easier to configure. To learn more about the new architecture, see Chapter 1, “Overview,” on page 11.

Given these changes, systems using previous versions of the driver require several adjustments before the new driver can be fully implemented. Some key components require removal and others will need to be migrated. Be sure to review and consider all points in this section as you decide on appropriate changes to both the Identity Vault and your RACF system.

4.2.1 Upgrading the RACF Event Subsystem

Your current RACF Event Subsystem is a collection of tasks, JCLs and TSO commands that were packaged as TRANSMIT archives named `idmload.xmt` and `samplib.xmt`. In past installations, the contents of these archives were added to the z/OS RACF system to provide the RACF driver with hooks into the RACF database for both Subscribing and Publishing events.

To use the new release of the driver, you will need to ensure that all of these components are replaced with their latest versions, including any that bear the same file names.

Copy and unpack the new archives, `idmload.xmt`, `samplib.xmt` and `racfexec.xmt`, to your RACF system, using the instructions provided in Section 3.8.1, “Setting Up the Libraries on Your z/OS System,” on page 33.

Although you may replace your existing `LOAD` and `SAMPLIB` libraries with the updated versions, Novell recommends that you unpack the archives to new physical locations to avoid name and version confusion. Then, once the new driver is setup and running, you can remove the older `LOAD` and `SAMPLIB` data sets from your system.

HFS File System Structure

To use this release of the RACF driver, you need to prepare a location in the HFS file system. To assist you in this task, the `SAMPLIB` data set includes a Job Card named `HFSINST`.

Edit the paths in this file as appropriate to your local environment and submit it as a Job Card to create your default HFS path, located at `/opt/novell/racfdrv`. If you decide to change this path, you will also need to change the `DRVCONF` member to reflect the install path.

New Password Exit

NOTE: If you do not wish to synchronize RACF password phrases, you can skip this step.

The new RACF driver's password exit routine, LDXRIX02, supports the ability to capture changes in RACF password phrases, which is new to z/OS 1.10.

To install the ICHRIX02 exit, follow step 2 in Section 3.8.8, "Installing the Driver Security System Exits," on page 37.

Remote Loader Task

NOTE: If you are running the RACF driver locally on the Identity Vault system, you do not need the Remote Loader and therefore can skip this step.

The Remote Loader from the previous RACF driver is a job named LDXDRVRP that runs Java in the Open Edition environment. Since it is no longer needed you will need to stop LDXDRVRP and remove it from your system's startup routines.

The new embedded remote loader is included in the new RACF Driver Shim, RACFDRV, which runs as a native z/OS started task.

To install this new Driver Shim, follow the instructions in Section 3.8.6, "Setting Up the Started Tasks," on page 35. You will need to customize the RACFDRV JCL to include

- The DSN to locate the LOAD, SAMPLIB, and EXEC data sets, specified by RACFDSN
- The location of your existing change log data set, specified by LOGFILE
- The appropriate cod page, if necessary; see Section 5.5, "International Considerations," on page 59

Next, you will need to configure the Driver Shim started task with an SSL certificate for secure communication between the Identity Vault and RACF systems. Even if you have completed this once for the previous release of the RACF driver, you will need to repeat the task due to a difference in certificate formats. For instructions, see Section 3.8.3, "Securing the Driver Shim with SSL," on page 34.

Finally, you will need to set passwords for the Remote Loader and the RACF driver. If you have done this with the previous version of the RACF driver, you may migrate those passwords to the new location by copying the lpwd1f40 and dpwd1f40 files to /opt/novell/racfdrv/keys directory. If you have not, you will need to customize and run the SETPWDS script, included in the SAMPLIB data set. Ensure the file permissions on these two files are protected. By default, these permissions are set to owner(0) with read permissions only by owner (600). To assign a user ID to the RACFDRV started task with these UNIX permissions, see step 5 in Section 3.8.6, "Setting Up the Started Tasks," on page 35.

TSO Administrative RACF ID

This RACF ID was used in the previous version to log on to the RACF system and issue commands. In this release, the Remote Loader directly executes commands using the IKJEFTSR service routine interface. Therefore, this ID is no longer needed and may be removed from the RACF system.

Change Log Started Task

The change log started task, LDXLOGR, has not changed from the previous release, however it is recommended that you use the version that shipped with the updated LOAD library. Customize the LDXLOGRP JCL to include the latest LOAD library in its STEPLIB.

Publisher Change Log

The RACF driver now supports a new data event type for RACF password phrases. However, all of your existing events that may be queued in the change log will be processed, as is, by the new driver. You do not need to do anything to your existing change log.

However, please do not run the `LOGINIT` job, as this will clear all events in your existing change log data set.

APF Authorization

The new `LOAD` library location, which includes `LDXSERV` and `SAFQUERY`, will need to be added to your APF list.

Use the `PARMLIB` IEAAPFxx or PROGxx 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.

4.2.2 Upgrading the Identity Vault Components

NOTE: Before starting the upgrade, stop the existing RACF driver using iManager.

Java Utility Library

Previous versions of the RACF driver used methods contained in `RACF.jar` to convert XDS to RACF commands and RACF commands to XDS documents. This Java archive also provided Telnet routines for connecting to the RACF system and executing commands through the TSO interface. This archive needs to be removed from your Identity Vault's system path and replaced with the latest version, now named `zOS.jar`.

Depending on your operating system, remove the old RACF driver Java code as follows:

- If you are running Linux or AIX, enter

  ```
  rpm -e novell-DXMLracf
  ```

- If you are running Solaris, enter

  ```
  pkgrm -e DXMLracf
  ```

- If you are running Windows, locate and remove RACF.jar from

  ```
  \novell\nds\lib
  ```

Depending on your operating system, install the updated version as follows:

- If you are running Linux or AIX, enter

  ```
  rpm -ivh novell-DXMLracf-4.0-0.rpm
  ```

- If you are running Solaris, enter

  ```
  pkgadd -d DXMLracf-4.0.pkg DXMLracf
  ```

- If you are running windows, copy `zOS.jar` to

  ```
  \novell\nds\lib
  ```

Verify that `RACF.jar` has been removed and a later copy of `zOS.jar` has been installed.

IMPORTANT: Please be certain you have installed the latest version of `z0S.jar`, especially if you have ever used the CA-Top Secret* driver for Identity Manager. This driver includes an older version of `z0S.jar` that is not compatible with the RACF Driver.

Once you have replaced `RACF.jar` with the new `z0S.jar`, you will need to restart eDirectory to refresh the Metadirectory engine's Java classes.

RACF Driver Configuration Import

The RACF driver configuration file is an XML file containing policies and installation options for the Driver object that is deployed in the Identity Vault. The new XML configuration file contains some new options for configuring TSO and OMVS segments as well as options for using RACF password phrases. Neither of these new options are required, however, there are new policies that must be installed into your existing RACF driver instance in order to properly convert data to and from the new RACF driver.

New Required Policies

Three new polices were added to the Publisher Input Policies: TSO (RACF) Input Transform, RACF Back Patch Transform and Final TSO Input Transform. Each of these XSLT policies is required for the Publisher channel to properly convert the RACF change log event data into XDS-formatted events that the Publisher channel can operate on.

One new policy was added to the Subscriber Output Transformation Policies: Subscriber Append RACFCMD. This new policy is required to convert the XDS document into a RACF command, which can then be processed by the new REXX scripts framework.

Importing as a New Driver

You can import the new XML configuration to create a brand new RACF Driver object and avoid having to update individual policies. However, if you choose this method, you will need to copy policies from your old driver that are needed for your provisioning guidelines. Furthermore, all associations made through the old driver object will now be invalid. Novell recommends you import and update your existing RACF driver.

Importing and Updating the Existing RACF Driver

IMPORTANT: Some policies in the new RACF driver have been updated. If you have customized any of the default policies that came with previous versions of the RACF driver, be sure to rename your policies so the upgrade process does not replace them.

When you import the new XML configuration, it will prompt you for a new driver name or allow you to select an existing driver to update. Follow these steps:

1. Select your existing RACF driver from the *Existing drivers* dropdown box.

   NOTE: The new RACF driver requires a Remote Loader configuration—even if you are not using the Remote Loader task with your existing RACF driver. Importing the new driver initiates a series of prompts.

2. When prompted for a remote host and port, enter the IP or DNS host address for the RACF system where the driver shim started task will be running. The default port is 8090.
3. Enter the driver object password when prompted.

4. Enter the Remote Loader password when prompted.
5. Respond to any remaining prompts according to how you intend to use the new rules and policies provided with the new RACF driver.
6. Once you have finished responding to these prompts, click *Next*.

   You will be prompted to choose any policies you wish to update.
7. If you want to maintain the policies currently in place for the existing RACF driver, select *Update everything about that driver and policy libraries*.
8. Click *Finish* to complete the upgrade.

You also will need to restore any custom RACF driver policies you have written. To do this

1. Return to the *Driver Overview* page.
2. Select the Policy Set from which you wish to restore custom policies.
3. Click *Insert > Use an existing policy* to browse for the name of the custom policy.
4. Repeat steps 2-4 for each custom policy you wish to restore.

Configuring the RACF Driver

5

After you have installed the Identity Manager 4.0.1 driver for RACF, use the information in this section for configuration. Topics include

5.1 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.

To change import-only properties, you must reimport the driver configuration file `RACF-IDM3_6_0-V1.xml` over the existing driver. For details, see Section 3.7, “Setting Up the Driver on the Metadirectory Server,” on page 30.

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

1. In iManager, select *Identity Manager Overview* from the Identity Manager task list on the left side of the window.
2. Navigate to your driver set by searching the tree or by entering its name.
3. Click the driver to open its overview.
4. Click the driver icon.
5. Select *Driver Configuration* or *Global Config Values* as appropriate.
6. Edit the property values as desired, then click *OK*.

5.1.1 Setting Properties during Driver Import

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

Table 5-1 *Driver Import-Only Parameters*

Property Name	Values or Format
Data Flow	Bidirectional Application to Identity Vault Identity Vault to Application
Set Preconfigured TSO Data	Yes No
Set Preconfigured OMVS Data	Yes No
Enable Entitlements	Yes No
Use SSL	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 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

Use SSL

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

Novell 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.

5.1.2 Driver Configuration Page

Table 5-2 *Driver Configuration Page*

Property Name	Values or Format
Driver Module	Connect to Remote Loader must be selected
Driver Object Password	Text value
Authentication ID	Not used
Authentication Context	Not used
Remote Loader Connection Parameters	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	Text value
Startup Option	Auto start Manual
Automatic Loopback Detection	Yes No
Polling Interval	Number of seconds
Heartbeat Interval	Number of seconds
Publisher Disabled	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 5-3 *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 CertificateIP"
```

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.

5.1.3 Global Configuration Values Page

Table 5-4 *Global Configuration Values*

Property Name	Values or Format
Connected System or Driver Name	Text value
User Default Group	Text value
User Default Owner	Text value
Default CONNECT Attributes	Text value
User Default TSO Account Number	Text value
User Default TSO Proc	Text value
UID Assignment	Assign by RACF Assign by Identity Vault
Default Home Directory	Text value
Default Program	Text value
The RACF Connected System Accepts Passwords from the Identity Vault	Yes No
The Identity Vault Accepts Passwords from the RACF Connected System	Yes No
Publish Passwords to NDS Password	Yes No
Publish Passwords to Distribution Password	Yes No
Require Password Policy Validation before Publishing Passwords	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	Yes No
Synchronize RACF Pass Phrases to Identity Vault Passwords on the Publisher Channel	Yes No
Synchronize Identity Vault Passwords to RACF Pass Phrases on the Subscriber Channel	Yes No
Synchronize RACF Passwords to Identity Vault Passwords on the Publisher Channel	Yes No
User Base Container	Identity Vault Container object
Group Base Container	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 may 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
```

5.2 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 5-5, one per line. You can also specify these options on the command line. For details about driver shim command line values, see Section C.1, “Driver Shim Command Line Options,” on page 111.

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 5-5 *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 Section A.1.2, “The Trace File,” on page 81 and Section A.1.5, “The Status Log,” on page 82.
`-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.

Option (Short and Long Forms)	Description
`-t <traceLevel>` `-trace <traceLevel>`	Sets the level of debug tracing. 0 is no tracing, and 10 is all tracing. For details, see Section A.1.2, “The Trace File,” on page 81. The output file location is specified by the `tracefile` option.
`-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/
```

5.3 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.

- Section 5.3.1, “Connected System,” on page 57
- Section 5.3.2, “Identity Vault,” on page 58

5.3.1 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.

5.3.2 Identity Vault

The Remote Loader and Driver object passwords are set for the driver through iManager 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 iManager, navigate to the *Driver Overview* for the driver.
2. Click the driver icon.
3. Specify the Driver object password.
4. Specify the Remote Loader password.

   The Remote Loader password follows the Authentication heading.
5. Click *Apply*.
6. Restart the driver.

5.4 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.

- Section 5.4.1, “Migrating Identities from the Identity Vault to the Connected System,” on page 58
- Section 5.4.2, “Migrating Identities from the Connected System to the Identity Vault,” on page 59
- Section 5.4.3, “Synchronizing the Driver,” on page 59

5.4.1 Migrating Identities from the Identity Vault to the Connected System

1. In iManager, open the Identity Manager *Driver Overview* for the driver.
2. Click *Migrate from Identity Vault*. An empty list of objects to migrate is displayed.
3. Click *Add*. A browse and search dialog box that allows you to select objects is displayed.
4. 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 Section A.1.5, “The Status Log,” on page 82.

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 Novell Documentation Web site (htttp://www.novell.com/documentation).

5.4.2 Migrating Identities from the Connected System to the Identity Vault

1. In iManager, open the Identity Manager *Driver Overview* for the driver.
2. Click *Migrate into Identity Vault* to display the Migrate Data into the Identity Vault window.
3. Specify your search criteria:
   - **3a** To view the list of eDirectory™ classes and attributes, click *Edit List*.
   - **3b** 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.

   - **3c** 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 19.
   - **3d** Specify values for the selected attributes, then click *OK*.
4. Click *OK*.

To view the results of the migration, click *View the Driver Status Log*. For details about the log, see Section A.1.5, “The Status Log,” on page 82.

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.

5.4.3 Synchronizing the Driver

To generate events for associated objects that have changed since the driver’s last processing, open the Identity Manager Driver Overview page for the driver in iManager, then click *Synchronize*.

5.5 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 (http://www-01.ibm.com/software/globalization/ccsid/ccsid_registered.jsp). The following table lists a subset of sample values:

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

Customizing the RACF Driver

6

This section provides information about available resources for customizing the Identity Manager 4.0.1 driver for RACF.

Topics include

For details about the filters and policies provided with the driver, see Section 1.2.4, “Filter and Schema Mapping,” on page 19 and Section 1.2.6, “Policies,” on page 19.

6.1 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 6-1 *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 6-2 *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.

6.1.1 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 Section C.4, “Performance Information,” on page 114. To disable REXX processing, see the `-disablerexx` driver shim option found in Table 5-5 on page 56.

6.2 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`.

6.2.1 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 classNameName [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

6.2.2 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
    . . .
```

6.3 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 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

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.

- Section 6.3.1, “Include/Exclude Processing,” on page 69
- Section 6.3.2, “Include/Exclude File Syntax,” on page 70
- Section 6.3.3, “Example Include/Exclude Files,” on page 73

6.3.1 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.

6.3.2 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 Section 6.2, “The Connected System Schema File,” on page 67.

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 72.

```
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 72.

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 71 and “Attribute Matching Rules” on page 71.

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.

6.3.3 Example Include/Exclude Files

Example 1

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

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
```

6.4 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.

- Section 6.4.1, “Modifying the Filter,” on page 73

6.4.1 Modifying the Filter

1. On the iManager *Driver Overview* page for the driver, click the *Filter* icon on either the Publisher or Subscriber channel. It is the same object.
2. In the *Filter Edit* dialog box, click the class containing the attribute to be added.
3. Click *Add Attribute*, then select the attribute from the list.
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 *Apply*.

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 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

Using the RACF Driver 7

This section provides information about operational tasks commonly used with the Identity Manager 4.0.1 driver for RACF.

Topics include

7.1 Starting and Stopping the Driver

To start the driver:

1. In iManager, navigate to the Driver Overview for the driver.
2. Click the upper right corner of the driver icon.
3. Click *Start driver*.

To stop the driver:

1. In iManager, navigate to the Driver Overview for the driver.
2. Click the upper right corner of the driver icon.
3. Click *Stop driver*.

7.2 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
```

7.3 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
```

7.4 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.

7.5 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)'
```

For example

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

For details about the trace file and trace levels, see Section A.1.2, “The Trace File,” on page 81.

7.6 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 89.

Securing the RACF Driver

8

This section describes best practices for securing the Identity Manager 4.0.1 driver for RACF. Topics include

For additional information about Identity Manager security, see the *Novell® Identity Manager 4.0.1 Administration Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

8.1 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 51.

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

8.2 Physical Security

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

8.3 Network Security

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

8.4 Auditing

Track changes to sensitive information. Examine audit logs periodically.

For details about using Novell Audit to monitor driver operation, see the Novell Audit Documentation Web site (http://www.novell.com/documentation/novellaudit20/index.html).

For details about auditing RACF, see your *RACF Auditor Guide*.

8.5 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 8-1 *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.

8.6 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.

8.7 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.

8.8 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.

8.9 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.

8.10 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.

8.11 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.

Troubleshooting

A

This section provides information about troubleshooting the Identity Manager 4.0.1 driver for RACF. Topics include

A.1 Driver Status and Diagnostic Files

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

A.1.1 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 89.

A.1.2 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 Section 5.2, “The Driver Shim Configuration File,” on page 56.

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.
5–7	Previous level plus change log and loopback messages. Higher trace levels provide more detail.

Trace Level	Description
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*.

A.1.3 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.

A.1.4 DSTRACE

You can view Identity Manager information using the DSTRACE facility on the Metadirectory server. Use iManager 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 *Novell® Identity Manager 4.0.1 Administration Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

A.1.5 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`. You can also view the status log in iManager on the Driver Overview page. You can change the log level to specify what types of events to log. For details about using the status log, see the *Novell Identity Manager 4.0.1 Administration Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

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*.

A.1.6 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.

A.1.7 Change Log Started Task Message Log

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

A.2 Troubleshooting Common Problems

A.2.1 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.

A.2.2 Driver Rules Installation Failure

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

A.2.3 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.

A.2.4 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 *Novell 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. In iManager, browse the Security container to locate your tree's certificate authority (typically named *`treeName`* `CA`).
2. Click the certificate authority object.
3. Click *Modify Object*.
4. Select the *Certificates* tab.
5. Click *Public Key Certificate*.
6. Click *Export*.
7. Select *No* to export the certificate without the private key, then click *Next*.
8. Select *Base64 format*, then click *Next*.
9. Click *Save the exported certificate to a file*, then specify a location to save the file.
10. Use FTP or another method to store the file on the connected system as `/opt/novell/racfdrv/keys/ca.pem`.

A.2.5 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 the iManager Driver Edit Properties window.
- You must activate both Identity Manager and the driver within 90 days. The Driver Set Overview page in iManager shows when Identity Manager requires activation. The Driver Overview page shows when the driver requires activation.

  For details about activating Novell Identity Manager Products, see the *Identity Manager 4.0.1 Installation Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).
- 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 `IKJTSO`*`xx`* 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 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).

A.2.6 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 28.
- 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 iManager to update the driver configuration. For details, see Section 5.1.2, "Driver Configuration Page," on page 51.
- 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 35.
- Ensure that only one system in a complex that shares the security system database is running the driver shim started task.

A.2.7 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 iManager on the Global Configuration Values page of the Driver Edit Properties window. For more details, see Section 5.1.3, "Global Configuration Values Page," on page 53.
- 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 25.

A.2.8 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 Section 5.1.3, "Global Configuration Values Page," on page 53.
- 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 25.
- Ensure that the security system exit has been installed, that LLA has been refreshed, and that the exit has been activated. For details, see Section 3.8.8, “Installing the Driver Security System Exits,” on page 37.

A.2.9 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 iManager on the Global Configuration Values page of the Driver Edit Properties window. 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 *Novell Identity Manager 4.0.1 Administration Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).
- 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.

A.2.10 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 iManager on the Global Configuration Values page of the Driver Edit Properties window. 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 *Novell Identity Manager 4.0.1 Administration Guide* on the Identity Manager 4.0.1 Documentation Web site (http://www.novell.com/documentation/idm401).
- 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 Section 3.8.8, “Installing the Driver Security System Exits,” on page 37.

A.2.11 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 Modify User/Group in iManager and click the *Identity Manager* tab. You can migrate identities to establish associations. For details, see Section 5.4, "Migrating Identities," on page 58.
- 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.

A.2.12 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 35.
- Ensure that you initialized the change log data set during installation. For details about initializing the change log data set, see Section 3.8.5, "Allocating and Initializing the Change Log Data Set," on page 35.
- 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.

System and Error Messages

B

Components of the Identity Manager 4.0.1 driver for RACF write messages to report operational status and problems. For detailed troubleshooting information, see Appendix A, “Troubleshooting,” on page 81.

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:

B.1 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.

B.2 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.

B.3 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.

B.4 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.

B.5 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 Novell® 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 Novell 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 Novell 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 Novell 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 Novell 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 Novell 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 Novell Technical Support.

B.6 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 Novell 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 Novell 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.

B.7 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 Novell Technical Support.

B.8 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 Novell 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 Novell 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 Novell 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 Novell 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.

B.9 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 Novell 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 Novell Technical Support.

B.10 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 Novell 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 Novell 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 Novell 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 Novell 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.

B.11 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.

B.12 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 iManager 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.

Technical Details

C

Topics in this section include

C.1 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 Section 5.2, “The Driver Shim Configuration File,” on page 56.

C.1.1 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.

C.1.2 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.

Option (Short and Long Forms)	Description
`-v` `-version`	Displays the driver shim version and build date, then exits.

C.2 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 approXDS 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.

C.3 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)>] >
```

C.3.1 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="20091014" instance="ldxserv" version="4.00">
      Novell IDM RACF Driver Version 4.0.0
    </product>
    <contact>Novell, Inc.</contact>
  </source>
  <output>
    <status level="success">
      <exit name="LDXRIX02" state="enabled" version="4.00" build-
date="20091014"
        times-called="584" events-queued="2" info="ok"/>
      <exit name="LDXEVX01" state="enabled" version="4.00" build-
date="20091014"
        times-called="20" events-queued="7" info="ok"/>
      <queue version="4.00" state="active" created-by="LDXRIX02"
entries="0"/>
      <logger version="4.00" state="active" taskid="LDXLOGRP"
        logfilename="LDX.LOGFILE"/>
      <logfile name="LDX.LOGFILE" state="0% used"/>
    </status>
  </output>
</ldx>
```

C.3.2 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="20091014" instance="ldxserv" version="4.00">
      Novell IDM RACF Driver Version 4.0.0
    </product>
    <contact>Novell, Inc.</contact>
  </source>
  <output>
    <modify-password date="2009-10-15" time=" 7:18" event-id="7006">
      <association>USER\JAVIER</association>
      <password>********</password>
    </modify-password>
    <status level="success">
      <description>ok</description>
    </status>
  </output>
</ldx>
```

C.3.3 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="20091014" instance="ldxserv" version="4.00">
      Novell IDM RACF Driver Version 4.0.0
    </product>
    <contact>Novell, Inc.</contact>
  </source>
  <output>
    <status level="success">
      <description>ok</description>
    </status>
  </output>
</ldx>
```

C.4 Performance Information

This section presents the results of a performance case study of the Identity Manager 4.0.1 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.

C.4.1 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

C.4.2 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.

C.4.3 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)

Phase	CPU-Time	EXCP-Cnt	Memory Usage
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)

C.4.4 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

Event	CPU-Time	EXCP-Cnt	Memory Usage	Real Time
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

C.4.5 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 119.

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