opentext™

# OpenText® Identity Manager
## Driver for ACF2 Implementation Guide

**January, 2025**

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# About this Book and the Library

This guide explains implementation of the OpenText® Identity Manager 4.10 driver for ACF2 on mainframes (z/OS operating system).

The driver synchronizes data from a connected mainframe system using ACF2, the IBM* security system, with OpenText Identity Manager 4.10, the comprehensive identity management suite that allows organizations to manage the full user life cycle, from initial hire, through ongoing changes, to ultimate retirement of the user relationship.

## Intended Audience

This driver for ACF2 for Identity Manager was created for the following audiences:

- Enterprise IT developers
- Consultants
- Sales engineers
- Architects or system designers
- System administrators

This driver is aimed at information technology professionals who:

- Plan, install, configure, and use the Identity Manager bidirectional driver for ACF2
- Are familiar with Identity Manager, OpenText eDirectory™, and the administration of systems and platforms you connect to Identity Manager

You don't need to be a developer or programmer to use Designer. Designer contains fourteen builders to help you build working policies and drivers, seven editors to assist you in editing projects, and wizards to help you build drivers. Designer also contains over thirty views to help you design and implement Identity Manager solutions. Experienced users can bypass the wizards and interact directly at any level of detail.

## Other Information in the Library

The library provides the following information resources:

**Identity Manager Setup Guide**

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

**Designer Administration Guide**

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

**User Application: Administration Guide**

Describes how to administer the Identity Manager User Application.

**User Application: User Guide**

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

**User Application: Design Guide**

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

**Identity Reporting Module Guide**

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

**Analyzer Administration Guide**

Describes how to administer Analyzer for Identity Manager.

**Identity Manager Common Driver Administration Guide**

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

**Identity Manager Driver Guides**

Provides implementation information about Identity Manager drivers.

# 1 Overview

The OpenText® Identity Manager 4.10 driver for ACF2 synchronizes data between Identity Manager and an ACF2 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 ACF2 Logonid fields in accordance with the z/OS ACF2 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 ACF2. 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 ACF2 using customizable REXX execs that issue native TSO commands through the z/OS service routine `IKJEFTSR`. This flexible interface provides the option for implementing additional business logic through REXX programming.

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

The Identity Manager 4.10 driver for ACF2 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 ACF2 passwords and password phrases

The following sections present a basic overview of the driver:


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

# Driver Architecture

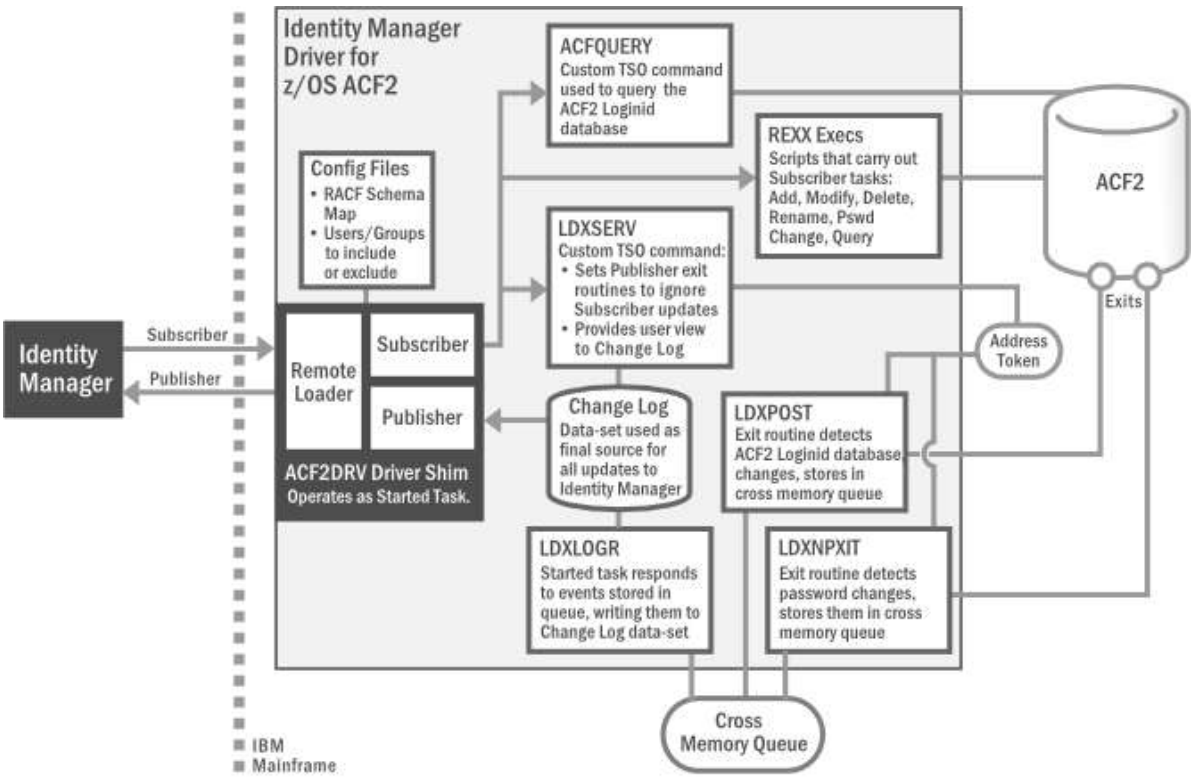
The driver synchronizes information between the Identity Vault on the Identity Manager platform and ACF2 on the connected z/OS system.

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 ACF2 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 ACF2.

When changes to passwords and other items relevant to Identity Manager are made at the local ACF2 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*** *ACF2 Driver Architecture*




The following topics describe the driver architecture in more detail:

- "Component Summary" on page 11
- "Component Discussion" on page 14

## Component Summary

Most components of the bidirectional ACF2 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 ACF2. In this way, ACF2 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 ACF2, through the driver on the host z/OS system, and on to Identity Manager. In this way, ACF2 functions as a *publisher* of events to Identity Manager, sending any updates from its individual ACF2 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 | Schema Map | Provides a reference to the hierarchy of objects and attributes available in ACF2. The driver reads the schema map, usually at startup. It's also used by Identity Manager's Policy Editor to map the schema of the Identity Vault to the schema for ACF2. |
| | Include/Exclude File | Optional configuration file for listing local ACF2 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. |
| | REXX Execs | Mainframe scripts that apply the schema map and standard TSO commands to issue changes to ACF2 accounts—including adds, modifies, deletes, and renames—for User objects, and to handle password synchronization. Can be extended to support other object types and events. |

| Data Channel | Component | Description |
|---|---|---|
| Publisher | LDXPOST | Exit routine that detects changes to the ACF2 Logonid database. These changes are written to the cross memory queue; the change log started task is notified each time an event is placed in the memory queue. |
| | LDXNPXIT | Exit routine that detects password changes to ACF2. These changes are written to the cross memory queue; the change log started task is notified each time an event is placed in the memory queue. |
| | LDXNPHXT | Exit routine that detects password phrase changes to ACF2. These changes are written to the cross memory queue; the change log started task is notified 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 `LDXPOST` and `LDXNPXIT` notify `LDXLOGR` of each event added to the memory queue. |
| | Change Log | z/OS data-set representing the final location where updates are placed in the driver's portion of the Publisher channel before sending to Identity Manager. The driver's Publisher component removes events from the change log at configurable intervals and submits them to Identity Manager. |

| Data Channel | Component | Description |
|---|---|---|
| Both | ACF2DRV (Driver Shim) | z/OS started task that encapsulates the Remote Loader, Subscriber and Publisher channels. It maintains the network connectivity between the ACF2 system and the Identity Vault; it delivers event data to the REXX scriptable framework, where it is used to modify the ACF2 database; it retrieves event data from the ACF2 change log to be published to the Identity Vault. |
| | Remote Loader | Enables communication between Identity Manager and ACF2 as if they were running in a common environment. Identity Manager has no specific knowledge of the Remote Loader. For improved efficiency, the ACF2 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:<br>◆ When updates are passed to ACF2 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.<br>◆ `LDXSERV` can also be executed manually (with the `STATUS` parameter) to display information in the change log data set. |
| | ACFQUERY | Tool used by both channels to query the ACF2 Logonid database for records and fields. |
| None (z/OS Components) | ACF2 | (Access Control Facility) CA product option for z/OS security system requirement. |
| | Token Address Space | z/OS system memory space used to process changes detected by ACF2 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 ACF2 exit routines, and are removed from the queue by the `LDXLOGR` started task. The memory queue is located in Subpool 231 (fetch-protected ECSA). |

# Component Discussion

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

## Driver Shim Started Task

The driver shim, `ACF2DRV`, 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 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.

### Scriptable Framework

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

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

For more information about the REXX execs and the scriptable framework, see "The Scriptable Framework" on page 53.

### Schema File

The configuration of class and attribute definitions for the connected system is specified using the schema file. You can modify and extend this file to include new objects and attributes. For details about configuring the schema file, see "The Connected System Schema File" on page 59.

The driver uses the keywords of the ACF2 administrative commands to define the schema. The schema includes one class: Logonid. This corresponds to ACF2 Logonid records.

Some items in the schema refer to keywords used to create and modify ACF2 Logonids, 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 ACF2 administrative command. The auxiliary schema used to extend eDirectory does not include these attributes.

### Include/Exclude File

The include/exclude file allows local system policies to enforce which objects are included or excluded from provisioning by the Subscriber channel. This allows for administrative rules to be set and enforced locally rather than having processing decisions made by the Metadirectory engine. For details about using the include/exclude file, see "The Connected System Include/Exclude File" on page 61.

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

## Publisher Channel Components

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

### Security System Exit Routines

ACF2 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 `LDXPOST`, `LDXNPXIT` and `LDXNPHXT`.

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 ACF2 in the Subscriber channel, `LDXSERV` is called (with the `NOLOG` parameter) to flag those items with a token in the Publisher event address space. The token's presence causes the exit routines to ignore the updates. This prevents redundant loopback to Identity Manager for any changes made through the Subscriber channel.

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

# Configuration Overview

This section discusses driver configuration details specific to the Identity Manager driver for ACF2. For basic configuration information, see the *Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/). For detailed information about configuring the driver, see Chapter 4, "Configuring the ACF2 Driver," on page 47.

The following topics include each Designer ACF2 Package available for configuration:


- "ACF2 Base" on page 17
- "ACF2 Default Configuration" on page 17
- "ACF2 Entitlements" on page 18
- "ACF2 Password Synchronization" on page 19
- "ACF2 Account Tracking" on page 20
- "ACF2 Managed System Information" on page 20

## ACF2 Base

The ACF2 Base provides the policies and settings necessary to provide a basic functioning ACF2 Driver.

The ACF2 Base Package includes the following Global Configuration Variables:

- **Remote Loader:** A boolean true/false value indicating whether or not to use the Remote Loader service. For this driver, this value should always be set to true.
- **Host Name:** The physical DNS hostname or IP address for the ACF2 system to connect to.
- **Port:** The TCP/IP port of the remote loader running on the ACF2 system (default 8090).
- **KMO:** The SSL KMO object to use for secure communication.
- **Remote Password:** The remote loader password.
- **Driver Password:** The driver object password.

The ACF2 Base Package provides the following Identity Manager policies:

- **NOVLACF2BASE-ot-AppendACF2CMD:** This output transform converts XDS documents from the Subscriber channel into ACF2 commands that will be executed by the ACF2 driver shim.
- **NOVLACF2BASE-it-ChangeLog:** This input transform converts ACF2 ChangeLog events into XDS that can be interpreted by the rest of the Publisher channel.

## ACF2 Default Configuration

The ACF2 Default Configuration provides a set of configuration settings to begin synchronizing ACF2 Logonid records with Identity Vault users.

The ACF2 Default Configuration Package includes the following Global Configuration Variables (GCVs):

- **User Base Container:** A DN value that represents a container in the Identity Vault from which Subscriber events are restricted from and new and matched User objects are created under on the Publisher channel.
- **Subscriber Passphrase Synchronization:** A boolean true/false value indicating whether to synchronize Vault passwords with ACF2 passphrases.
- **Publisher Passphrase Synchronization:** A boolean true/false value indicating whether to synchronize ACF2 passphrases with Vault passwords.

The ACF2 Default Configuration Package provides the following Identity Manager policies:

- **NOVLACF2DCFG-pub-cp:** This Publisher Create Policy provides a default Surname using either the Full Name field or Association value from the add event.
- **NOVLACF2DCFG-pub-mp:** This Publisher Matching Policy attempts to match Users by the CN attribute within the User Base Container GCV.
- **NOVLACF2DCFG-pub-pp:** This Publisher Placement Policy sets the target DN for new users to be the concatenation of the User Base Container GCV and the lowercase value of the CN attribute.
- **NOVLACF2DCFG-sub-cp:** This Subscriber Create Policy requires the CN and Password and reformats the CN value to be uppercase.

- **NOVLACF2DCFG-sub-et:** This Subscriber Event Transform vetoes events not in the User Base Container and also renames and moves.
- **NOVLACF2DCFG-sub-mp:** This Subscriber Matching Policy queries ACF2 for Users that match the CN attribute.

The ACF2 Default Configuration Package provides the **NOVLACF2DCFG-smp** schema mapping policy and the **NOVLACF2DCFG-filter** filter policy. See "Default ACF2 Schema" on page 114 for details.

***Table 1-2*** *Default Schema Mapping and Filter*

| eDirectory Class | eDirectory Attribute | ACF2 Record | ACF2 Field |
|---|---|---|---|
| User | CN | Logonid | LID |
| User | Login Disabled | Logonid | SUSPEND |
| User | nspmDistributionPassword | Logonid | PASSWORD |
| User | Full Name | Logonid | NAME |
| User | Telephone Number | Logonid | PHONE |

In addition, the remaining ACF2 fields are automatically mapped to corresponding attributes in the ACF2 Auxiliary Schema. For a complete list, see Table C-5 on page 112. Each additional auxiliary attribute in the filter is intentionally set to ignore on both channels by default, so they can be conveniently configured otherwise if necessary.

## ACF2 Entitlements

The ACF2 Entitlements Package provides a basic entitlement for an ACF2 Logonid record. This package leverages the DirXML-EntitlementsRef attribute, set by the Role Based Entitlements Driver. When entitlements are granted or revoked, you can take the appropriate action in ACF2 by creating, suspending or deleting the Logonid record.

The ACF2 Entitlements Package provides the following Identity Manager policies:

- **NOVLACF2ENT-pub-et-DisallowDeletes:** When this Publisher Event Transformation detects a user is deleted from ACF2, it removes the user's Vault association and vetoes the event.
- **NOVLACF2ENT-sub-cp-EntitlementsImpl:** This Subscriber Create Policy blocks account creation when an Entitlement is not granted.
- **NOVLACF2ENT-sub-ct-EntitlementsImpl:** When this Subscriber Command Transformation detects a removed entitlement, it results in a delete or suspension. It is based upon the on-account-remove GCV.
- **NOVLACF2ENT-sub-mp-EntitlementsImpl:** When this Subscriber Matching Policy detects an ACF2 User account managed by entitlements, it vetoes the matching existing account.

The ACF2 Entitlements Package also provides a filter that includes the User attribute DirXML-EntitlementsRef. This attribute, configured for notification on the Subscriber channel, is set outside the driver whenever a process grants or removes an entitlement for a User.

## ACF2 Password Synchronization

The ACF2 Password Synchronization Package leverages the Common Password Synchronization policies to provide email notifications for failed password synchronization and configuration options for Universal Passwords.

The ACF2 Password Synchronization Package provides the following Identity Manager policies:

- **NOVLPWDSYNC-pub-ctp-AddPwdPayload:** Publish password payloads.
- **NOVLPWDSYNC-pub-ctp-CheckPwdGCV:** Publish password changes.
- **NOVLPWDSYNC-pub-ctp-DefaultPwd:** On User add, provide default password if none exists.
- **NOVLPWDSYNC-pub-ctp-PublishDistPwd:** Publish passwords to NMAS distribution password.
- **NOVLPWDSYNC-pub-ctp-PublishNDSPwd:** Publish passwords to NDS password.
- **NOVLPWDSYNC-sub-ctp-AddPwdPayload:** Payloads for subscribe to password changes.
- **NOVLPWDSYNC-sub-ctp-CheckPwdGCV:** Subscribe to password changes.
- **NOVLPWDSYNC-sub-ctp-DefaultPwd:** On User add, provide default password of Surname if no password exists.
- **NOVLPWDSYNC-sub-ctp-TransformDistPwd:** Transform NMAS attribute to password elements.
- **NOVLPWDSYNC-itp-EmailOnFailedPwdSub:** Email notifications for failed password subscriptions.
- **NOVLPWDSYNC-otp-EmailOnFailedPwdPub:** Email notifications for failed password publications.

The ACF2 Password Synchronization Package includes the following Global Configuration Variables (GCVs):

- **Connected System or Driver Name:** The name of the connected system, application or Identity Manager driver. This value is used by the e-mail notification templates.
- **Application accepts passwords from Identity Manager:** Option to allow passwords to flow from the Identity Manager vault to the connected system.
- **Identity Manager accepts passwords from application:** Option to allow passwords to flow from the connected system to the Identity Manager data store.
- **Publish passwords to NDS password:** Use the password from the connected system to set the non-reversible NDS password in eDirectory.
- **Publish passwords to Distribution Password:** Use the password from the connected system to set the NMAS Distribution Password used for Identity Manager password synchronization.
- **Require password policy validation before publishing passwords:** Option to apply the NMAS password policies during password operations on the Publisher channel. The password is not written to the data store if it does not comply.
- **Reset user's external system password to the Identity Manager password on failure:** Attempt to reset the password in the connected system by using the Distribution Password from the Identity Vault when a publish Distribution Password failure occurs.
- **Notify the user of password synchronization failure via e-mail:** Notify the user of a password synchronization failure via email.

## ACF2 Account Tracking

The ACF2 Account Tracking Package allows the driver to track the accounts and identities of each user in your system.

The ACF2 Account Tracking Package (with the prerequisite Data Collection Common and Account Tracking Common packages) provides the following Identity Manager policies:

- **NOVLATRKBASE-itp-Publish**
- **NOVLATRKBASE-itp-WriteAccounts**
- **NOVLATRKBASE-otp-Subscribe**
- **NOVLDATACOLL-itp-DataCollectionQuerySupport:** Convert selected attributes to a form most commonly used in the Identity Vault.
- **NOVLDATACOLL-smp-SkipSchemaMapping**

The ACF2 Account Tracking Package (with the prerequisite Data Collection Common and Account Tracking Common packages) includes the following Global Configuration Variables (GCVs):

- **Enable account tracking:** If true, account tracking policies are enabled. If false, account tracking policies are not executed.
- **Realm:** Name of realm. The realm must be set to the ACF2 DNS name (Example: acf2.yourcompany.org).
- **Object class:** Add the object class to track. Class names must be in the application namespace.
- **Identifiers:** Add the account identifier attributes. Attribute names must be in the application namespace.
- **Status attribute:** Name of the attribute in the application namespace to represent the account status.
- **Status active value:** Value of the status attribute that represents an active state.
- **Status inactive value:** Value of the status attribute that represents an inactive state.
- **Subscription default status:** Default status the policies will assume when an object is subscribed to the application and the status attribute is not set in the identity vault.
- **Publication default status:** Default status the policies will assume when an object is published to the identity vault and the status attribute is not set in the application.

## ACF2 Managed System Information

The ACF2 Managed System Information Package provides settings that help the Identity Reporting Module generate reports.

The ACF2 Managed System Information Package includes the following Global Configuration Variables (GCVs):

- **General Information**
  - **Name:** Descriptive name for the ACF2 connected system. This name is displayed in the reports.
  - **Description:** Brief description of this connected ACF2 system. This description is displayed in the reports.

    - **Location:** The physical location of this connected ACF2 system. This location is displayed in the reports.
    - **Vendor:** The vendor of this connected ACF2 system (Computer Associates). This information is displayed in the reports.
    - **Version:** The version of this connected ACF2 system. This version information is displayed in the reports.
- **System Ownership**
    - **Business Owner**
    - **Application Owner**
- **System Classification**
    - **Classification**
    - **Environment**
- **Connection and miscellaneous Information:** This options is always set to hide so that you don't make changes to these options. These options are system options that are necessary for reporting to work. If you make any changes, reporting stops working.

# 2 Planning for the ACF2 Driver

This section helps you plan for deployment of the OpenText® Identity Manager 4.10 driver for ACF2. Topics include


- "Deployment Planning" on page 23
- "Migration Planning" on page 24
- "Customization Planning" on page 24
- "Establishing a Security-Equivalent User" on page 25


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

## Deployment Planning

- Review Chapter 3, "Installing the ACF2 Driver," on page 27 and Chapter 4, "Configuring the ACF2 Driver," on page 47.
- Is this a new installation or an upgrade?
  - If you are installing the ACF2 driver on a system for the first time, use Chapter 3, "Installing the ACF2 Driver," on page 27, as your main procedural reference.
- Consider where and how you will install each component.

  The driver shim libraries (SAMPLIB, IDMLOAD, ACF2EXEC) must be installed on a volume that is shared by each system that shares the security system database.
- If you will use the Publisher channel to track changes made in ACF2, you will need to:
  - Run the driver shim started task on only one system that shares the ACF2 security system database.
  - Create the change log data set on a volume that is shared by all systems that share the security system database.
  - Install the Exit routines on each system that shares the security system database.
  - Schedule an IPL for the Exit installations.
- How will you stage, test and roll out your deployment of the ACF2 driver?
- What are the host names or IP addresses of your Metadirectory server and the ACF2 system that will run the driver shim started task?
- Will you use the default TCP port numbers (see Table 2-1) and are they accessible through your network infrastructure?

*Table 2-1 Default TCP Port Numbers*

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

# Migration Planning

Since identities will be synchronized between the Vault and ACF2, you will need to consider the following:

- Where will these identities be located and managed in the Vault?
- Can you use the default Matching policy to associate Logonid LID fields with the Vault CN attribute, or will you need to base matching on other properties?
- How will you handle existing Vault IDs that do not meet the requirements for ACF2?

You will also need to decide whether to use the migration tool provided with Identity Manager or a more manual process for importing your data.

# Customization Planning

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

  For details about the provided execs, see Table 5-1, "Identity Vault Command Processing Execs," on page 54; Table 5-2, "Other Execs," on page 54; and the execs themselves.
- Do you plan to add attributes or classes to the connected system schema file?

  For details about the connected system schema file, see "The Connected System Schema File" on page 59.
- What options do you plan to use in your driver shim configuration file?

  For details about the driver shim configuration file, see "The Driver Shim Configuration File" on page 47.
- Do you plan to customize the include/exclude file?

  For details about the include/exclude file, see "The Connected System Include/Exclude File" on page 61.
- Do you plan to customize policies?

  For details about customizing policies, see the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).
- Are the resources needed to perform the customization available within your organization?

# Establishing a Security-Equivalent User

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

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

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

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

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

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

# 3 Installing the ACF2 Driver

This section provides the information you need for first-time installation of the OpenText® Identity Manager 4.10 driver for ACF2.

Topics include


- "Before You Begin" on page 27
- "Required Knowledge and Skills" on page 27
- "Prerequisites" on page 27
- "Getting the Installation Files" on page 28
- "Creating the Driver in Designer" on page 28
- "Installing the Driver Shim on the Connected System" on page 34
- "Post-Installation Tasks" on page 43
- "Uninstalling the Driver" on page 43


## Before You Begin

- Review Chapter 2, "Planning for the ACF2 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 NetIQ Support Web site (http://support.netiq.com).

## Required Knowledge and Skills

To successfully install, configure, and use the driver, you must have system administration skills and rights for Identity Manager, z/OS, and ACF2. You must be proficient with using Identity Console or Designer to configure Identity Manager drivers. You must be familiar with the facilities of the driver, and you must have developed a deployment plan.

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

For information about planning for the driver, see Chapter 2, "Planning for the ACF2 Driver," on page 23.

For information about administering your target systems, see your IBM and ACF2 documentation.

## Prerequisites


- "Connected System Requirements" on page 28
- "Identity Vault Requirements" on page 28

## Connected System Requirements

- ❒ z/OS 2.3, 2.4, 2.5
- ❒ ACF2 Security for z/OS r15, r16

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

## Identity Vault Requirements

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

# Getting the Installation Files

1. Obtain the most recent distribution of the Identity Manager 4.10 Driver for ACF2 from the NetIQ Downloads Web site (https://dl.netiq.com/index.jsp).

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

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

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

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

   ```
   SAMPLIB.XMT
   IDMLOAD.XMT
   ACF2EXEC.XMT
   ```

   These files are located under `ACF2`.

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 z/OS system.

# Creating the Driver in Designer

The ACF2 Driver supports Designer 4 Package features, which allows you to create a driver by selecting which packages to install. After you create and configure the driver, you need to deploy it to the Identity Vault and start it.

Topics include


- "Importing the Current Driver Packages" on page 29
- "Installing the Driver Packages" on page 30
- "Configuring the Driver" on page 33

- "Deploying the Driver" on page 33
- "Starting the Driver" on page 34

## Importing the Current Driver Packages

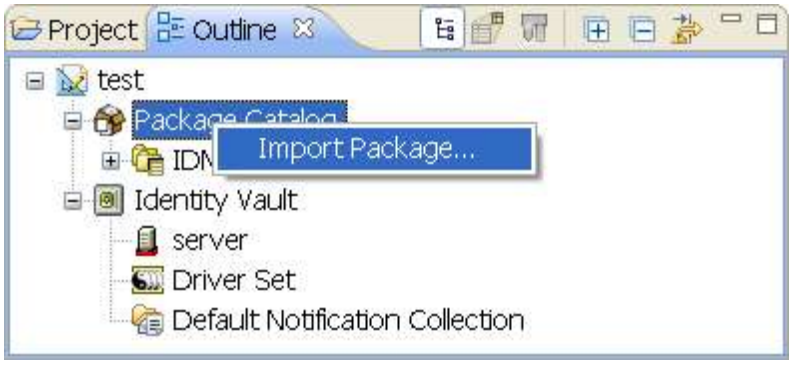
Driver packages can be updated at any time and are stored in the Package Catalog. Packages are initially imported into the Package Catalog when you create a project, import a project, or convert a project. It is important to verify you have the latest packages imported into the Package Catalog before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

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

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

   *or*

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




6. Select the ACF2 packages.

   *or*

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

   ---

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

   ---

7. Click **OK** to import the selected packages, then click **OK** in the successfully imported packages message.
8. After the current packages are imported, continue to the next section, "Installing the Driver Packages" on page 30.

## Installing the Driver Packages

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

1. In Designer, open your project.
2. In the Modeler, right-click the driver set where you want to create the driver, then select **New** > **Driver**.
3. Select **ACF2 Base** from the list of base packages, then click **Next**.
4. Select the optional features to install for the ACF2 driver. The options are:

   ---

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

   ---

   **Default Configuration:** This package contains the default configuration information for the ACF2 driver. Always leave this option selected.

   **Entitlements:** This package contains configuration information for synchronizing ACF2 accounts and policies that enable account creation and auditing for the ACF2 driver. To enable account creation and auditing, verify that this option is selected. For more information, see the *Identity Manager 4.10 Entitlements Guide*.

   **Password Synchronization:** This package contains the policies that enable the ACF2 driver to synchronize passwords. To synchronize passwords, verify that this option is selected. For more information, see the *Identity Manager 4.10 Password Management Guide*.

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

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

   **User Container:** Select the Identity Vault container where ACF2 users will be added if they don't already exist in the vault. This value becomes the default for all drivers in the driver set.

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

   **Group Container:** Since the ACF2 driver does not synchronize Group objects, this setting can be ignored.
9. (Conditional) If not already configured, fill in the following fields on the Common Settings Advanced Edition page, then click **Next**:

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

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

10 On the Install ACF2 page, fill in the following field:

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

11 (Conditional) On the Driver Parameters page, review the default Subscriber and Publisher Options. Edit, if necessary, and click **Next**.

12 On the Install ACF2 Base page, fill in the following fields to connect to the Remote Loader and click **Next**:

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

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

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

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

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

13 (Conditional) On the Account Tracking page, review the default values. Edit, if necessary, and click **Next**.

14 (Conditional) On the Entitlements Name to CSV File Mappings page, click the **Add Name to File Mapping** icon to populate the page with the entitlement configuration options. Identity Manager uses the CSV file to map ACF2 entitlements into corresponding resources in the Identity Manager catalog.

---

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

---

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

**Entitlement Name**: Specify a descriptive name for the entitlement to map it to the CSV file that contains the ACF2 entitlement details.

*Entitlement Name* is the name of the entitlement. This parameter corresponds to the Entitlement Assignment Attribute in ACF2. For example, you could define an entitlement called *ParkingPass*.

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

*Entitlement Assignment Attribute* holds the entitlement values in ACF2. For example, you could have an attribute called *Parking*.

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

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

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

15 (Conditional) On the Entitlements page, review the default values. Edit, if necessary, and click **Next**.

16 (Conditional) On the General Information page, fill in the following fields to define your ACF2 system, then click **Next**:

**Name**: Specify a descriptive name for this ACF2 system. The name is displayed in reports.

**Description**: Specify a brief description for this ACF2 system. The description is displayed in reports.

**Location**: Specify the physical location for this ACF2 system. The location is displayed in reports.

**Vendor**: Leave CA as the vendor of ACF2. This information is displayed in reports.

**Version**: Specify the version of this ACF2 system. The version is displayed in reports.

---

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

---

17 (Conditional) This page is displayed only if you selected to install the Managed System Information packages. On the Install ACF2 Managed System Information page, fill in the following fields, then click **Next**.

**Classification**: Select the classification of the ACF2 system. This information is displayed in the reports. Options include:

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

If you select **Other**, you must specify a custom classification for the ACF2 system.

**Environment**: Select the type of environment the ACF2 system provides. Options include:

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

If you select **Other**, you must specify a custom classification for the ACF2 system.

18 (Conditional) On the System Ownership page, fill in the following fields to define the ownership of the ACF2 system, then click **Next**:

**Business Owner**: Select a user object in the Identity Vault that is the business owner of the ACF2 system. This can only be a user object, not a role, group, or container.

**Application Owner:** Select a user object in the Identity Vault that is the application owner of the ACF2 system. This can only be a user object, not a role, group, or container.

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

The driver is created. You can modify the configuration settings by continuing with the next section, "Configuring the Driver" on page 33. If you don't need to configure the driver, skip ahead to "Deploying the Driver" on page 33.

## Configuring the Driver

There are many settings that can help you customize and optimize the driver. The settings are divided into categories such as Driver Configuration, Engine Control Values, and Global Configuration Values (GCVs). Although it is important for you to understand all of the settings, your first priority should be to review the Driver Parameters located on the Driver Configuration page and the Global Configuration Values. These settings must be configured properly for the driver to start and function correctly.

To access the Driver Properties page:

1 Open your project.

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

3 Modify the driver settings as necessary.

---

**IMPORTANT:** In addition to the driver settings, you should review the set of default policies and rules provided by the basic driver configuration. Although these policies and rules are suitable for synchronizing with ACF2*, your synchronization requirements for the driver might differ from the default policies. If this is the case, you need to change them to carry out the policies you want. The default policies and rules are discussed in "Configuration Overview" on page 16.

---

4 Continue with the next section, "Deploying the Driver" on page 33.

## Deploying the Driver

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

1 In Designer, open your project.

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

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

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

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

**Password:** Specify the user's password.

4 Click **OK**.

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

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

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

The driver requires rights to objects within the Identity Vault. The Admin user object is most often used to supply these rights. However, you might want to create a DriversUser (for example) and assign security equivalence to that user. Whatever rights that the driver needs to have on the server, the DriversUser object must have the same security rights:

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

**7b** Click **OK** twice.

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

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

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

**8b** Click **OK**.

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

**8d** Click **OK**.

**9** Click **OK**.

## Starting the Driver

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

To start the driver:

**1** In Designer, open your project.

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

# Installing the Driver Shim on the Connected System

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

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

For all procedures in this section that are performed using the target ACF2 system, you must use a privileged user with both TSO and OMVS segments.

Topics in this section include


- "Setting Up the Libraries on Your z/OS System" on page 35
- "Securing the Driver Shim with SSL" on page 36
- "Configuring the Remote Loader and Driver Object Passwords" on page 37
- "Allocating and Initializing the Change Log Data Set" on page 37
- "Setting Up the Started Tasks" on page 38
- "Authorizing the Driver TSO Commands" on page 39
- "Testing Before Installing the Security System Exit" on page 40

- "Installing the Driver Security System Exits" on page 41
- "Testing the Completed Connected System Installation" on page 42

## 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:** `ACF2EXEC.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 acf2exec.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(acf2exec.xmt)
INMR901I Dataset IDM.ACF2EXEC from ADMIN on SYSB
INMR906A Enter restore parameters or 'DELETE' or 'END' +
dsname('sys3.acf2.acf2exec') volume(work0a)
. . . many IEBCOPY messages . . .
INMR001I Restore successful to dataset 'SYS3.ACF2.ACF2EXEC'
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 and run the JOB card samples library member `SAMPLIB(HFSINST)`.

   This creates the HFS file system structure for the driver.

7 Verify the Unix file structure was created:

```
/opt/novell/acf2drv/
/opt/novell/acf2drv/keys
/opt/novell/acf2drv/logs
```

## Securing the Driver Shim with SSL

1 Customize the REXX exec member `EXEC(SETCERT)` to specify the LOAD library and `DRVCONF` locations for your installation.

2 Run the REXX member `EXEC(SETCERT)`.

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

4 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
```

5 Verify the following file was created:

```
/opt/novell/acf2drv/keys/ca.pem
```

**NOTE:** If you are unable to contact the LDAP server using these steps, see "Driver Certificate Setup Failure" on page 75.

## Configuring the Remote Loader and Driver Object Passwords

1 Customize the REXX `EXEC(SETPWDS)` member to specify the LOAD library and `DRVCONF` location for your installation.

2 Run the REXX member `EXEC(SETPWDS)` and respond to the prompts.

3 Verify the following files were created:

```
/opt/novell/acf2drv/keys/lpwd1f40
/opt/novell/acf2drv/keys/dpwdlf40
```

## Allocating and Initializing the Change Log Data Set

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

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

To allocate and initialize the change log data set:

1 Customize the samples library member `LOGINIT`.

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

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

2 Run the LOGINIT job.

An IEC031I D37 message is normal and should be ignored.

3 Ensure that your change log data set is protected appropriately for the sensitive nature of its contents.

---

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

---

# Setting Up the Started Tasks


- "Setting Up the Change Log Started Task" on page 38
- "Setting Up the Driver Shim Started Task" on page 38


## 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 more information, see "Starting and Stopping the Change Log Started Task" on page 67.

   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 `ACF2DRV` from the samples library to your started task procedure library (`SYS1.PROCLIB` or its equivalent). You can give the driver shim started task a different name if necessary.

2 Update the JCL to specify the following:

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

  You can use your driver samples library member `DRVCONF` as a model. For details, see "The Driver Shim Configuration File" on page 47.
- The name of your connected system schema file

  You can use your driver samples library member `SCHEMDEF` as a model. For details, see "The Connected System Schema File" on page 59.
- The name of your include/exclude file

  You can use your driver samples library member `INCEXC` as a model. For details, see "The Connected System Include/Exclude File" on page 61.
- The name of your change log data set
- The name of your driver REXX exec library

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

For information about starting and stopping the driver shim started task, see "Starting and Stopping the Driver Shim Started Task" on page 67.

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 `ACF2DRV` started task, which has been authorized for OMVS and TSO.

```
acf
set lid
insert acf2drv account audit job security stc tso group(omvsgrp)
set profile(user) div(omvs)
insert acf2drv uid(0) home(/) omvspgm(/bin/sh)
```

This user ID must have read/write permissions to the `/opt/novell/acf2drv/` directory and subdirectories to run properly. In the example above, these permissions are given to `ACF2DRV` by `uid(0)` and `group(omvsgrp)`.

## Authorizing the Driver TSO Commands

The ACF2 driver uses two TSO commands, `LDXSERV` and `ACFQUERY`, to interact with the ACF2 system. These two commands need to be APF-authorized and configured as TSO commands on the ACF2 system:

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

***Example 3-1*** *Example:*

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

2 Use the `PARMLIB` TSO command to activate your changes.

***Example 3-2*** *Example:*

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

## Testing Before Installing the Security System Exit

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

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

For details about starting the change log started task, see "Starting and Stopping the Change Log Started Task" on page 67.

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

```
LDXSERV STATUS
```

3 Examine the output of the command. As in the following example, you should see information about the memory queue and the change log started task, as well as a valid, empty change log data set:

```
READY
ldxserv status

<ldx>
  <source>
    <product build="20210103" instance="ldxserv" version="4.83">
      NetIQ IDM ACF2 Driver Version 4.8.3.0
    </product>
    <contact>NetIQ Corporation</contact>
  </source>
  <output>
    <status level="success">
     <queue version="4.83" state="active" created-by="" entries="0"/>
      <logger version="4.83" state="active" taskid="LDXLOGR"
         logfilename="SYSTEMS.LDXACF.V4810103.LOGFILE"/>
      <logfile name="SYSTEMS.LDXACF.V4810103.LOGFILE" state="empty"/>
    </status>
  </output>
</ldx>
```

4 Also in this output, check for the following information:

- The `<logfile>` element describes the change log data set created earlier (see "Allocating and Initializing the Change Log Data Set" on page 37). The `name` attribute describes the data set location and the `state` attribute describes how full the change log is, expressed either as a percentage or with the keyword `empty`.

- The `<logger>` element displays the status of the change log started task, including attributes for its `version`, assigned `taskid` and `logfilename` if the change log data set is configured for writing.
- The `<queue>` element displays the properties of the cross-memory queue, including attributes for `version`, number of `entries` currently queued, and `created-by` (which module created the queue). Before the Exits are installed, the `entries` attribute will be `0` and the `created-by` attribute should be empty.

## Installing the Driver Security System Exits

The ACF2 driver uses three ACF2 exits for capturing changes in ACF2 and publishing them to the Identity Vault.

- `LDXPOST` is the ACF2 Logonid exit, invoked by the `LIDPOST` exit point, which captures and queues changes to the Logonid record database.
- `LDXNPXIT` is the ACF2 exit, invoked by the `NEWPXIT` exit point, which captures and queues password changes from terminal logon.

  **NOTE:** The `LDXNPXIT` exit does not capture administrative password changes from the ACF2 menus or the interactive `ACF` command.

- `LDXNPHXT` is the ACF2 exit, invoked by the `NPWPEXIT` exit point, which captures and queues password phrase changes from terminal logon.

All three exits are optional for capturing changes to ACF2. If you do not intend to capture changes to the Logonid records, then you do not need to install `LDXPOST`. If you do not intend to capture user password changes at logon time, then you do not need to install `LDXNPXIT`. If you do not intend to capture password phrases at logon time, then you do not need to install `LDXNPHXT`.

To install `LDXPOST`, the Logonid database exit:

1. Copy the LOAD library member `LDXPOST` into a library specified by `SYS1.PARMLIB` member `LPALSTxx`. If you add an additional load library to LPA, you will also need to IPL your system to apply these changes.
2. Update the ACF2 GSO option to add the exits. From TSO Ready:

   ```
   ACF
   SET CONTROL(GSO) SYSID(NAME)
   INSERT SYSID(NAME) EXITS LIDPOST(LDXPOST)
   QUIT
   ```

3. Refresh the GSO record.

   ```
   MODIFY ACF2,REFESH(EXITS)
   ```

4. IPL the system if LPA has been modified.

To install LDXNPXIT, the password change exit:

1. Copy the LOAD library member LDXNPXIT into a library specified by SYS1.PARMLIB member LPALSTxx. If you add an additional load library to LPA, you will also need to IPL your system to apply these changes.
2. Update the ACF2 GSO option to add the exit. From TSO Ready:

```
ACF
SET CONTROL(GSO) SYSID(NAME)
INSERT SYSID(NAME) EXITS NEWPXIT(LDXNPXIT)
QUIT
```

3. Refresh the GSO record.

```
MODIFY ACF2,REFESH(EXITS)
```

4. IPL the system if LPA has been modified.

To install LDXNPHXT, the password phrase change exit:

1. Copy the LOAD library member LDXNPHXT into a library specified by SYS1.PARMLIB member LPALSTxx. If you add an additional load library to LPA, you will also need to IPL your system to apply these changes.
2. Update the ACF2 GSO option to add the exit. From TSO Ready:

```
ACF
SET CONTROL(GSO) SYSID(NAME)
INSERT SYSID(NAME) EXITS NPWPEXIT(LDXNPHXT)
QUIT
```

3. Refresh the GSO record.

```
MODIFY ACF2,REFESH(EXITS)
```

4. IPL the system if LPA has been modified.

## Testing the Completed Connected System Installation

You can, again, use the LDXSERV command to test your installation after installing the ACF2 security exit(s). 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. As in the following example, you should see information about the exits, LDXNPXIT and LDXPOST:

```
READY
ldxserv status

<ldx>
  <source>
    <product build="20210103" instance="ldxserv" version="4.83">
      Novell IDM ACF2 Driver Version 4.8.3.0
    </product>
    <contact>NetIQ Corporation</contact>
  </source>
  <output>
    <status level="success">
      <exit name="LDXNPXIT" state="enabled" version="4.83"
        build-date="20210103" times-called="0" events-queued="1"
info="OK"/>,
      <exit name="LDXPOST " state="enabled" version="4.83"
        build-date="20210103" times-called="0" events-queued="1"
info="ok"/>
    </status>
  </output>
</ldx>
```

The output will show two `<exit>` elements that describe the state of each ACF2 exit. Each exit will include:

- A `version` attribute to describe the version level
- A `build-date` attribute to describe the exact date of assembly
- A `times-called` attribute describing how many times the exit has been invoked
- An `events-queued` attribute to show how many events this particular exit has queued an event into memory

# Post-Installation Tasks

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

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

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

# Uninstalling the Driver


- "Uninstalling the Security System Exits" on page 44
- "Uninstalling the Driver Shim" on page 44

## Uninstalling the Security System Exits

The procedure you use for uninstalling the security exits depends on how you set them up.

If you linked the `LDXNPXIT` exit with exits of your own:

1. Reinstall your original exits, then IPL with CLPA to load the relinked exits in the active LPA.
2. If you change the exit names as you relinked them, be sure to also update the GSO EXITS record with the changed exit names.
3. Delete the exit modules from the LPA library containing them. Then IPL with CLPA at a convenient time.

If you are using `LDXNPXIT`, `LDXNPHXT` or `LDXPOST` alone:

1. Update the GSO `EXITS` record to remove the exit names.

   **1a** Enter the following TSO commands:

   ```
    READY
   acf
     ACF
   set control(gso) sysid(system)
     CONTROL
   insert sysid(system) exits lidpost() newpxit() npwpexit()
   ```

   **1b** Install the new values. From an z/OS console, enter:

   ```
    MODIFY ACF2,REFRESH
   ```

2. Delete the exit modules from the LPA library containing them. Then IPL with CLPA at a convenient time.

## Uninstalling the Driver Shim

1. Remove the change log started task (`LDXLOGR`) and driver shim (`ACF2DRV`) started task from your system startup and shutdown procedures.
2. Stop both started tasks (`LDXLOGR` and `ACF2DRV`).

   For details, see "Starting and Stopping the Change Log Started Task" on page 67 and "Starting and Stopping the Driver Shim Started Task" on page 67.
3. Remove members `LDXLOGR` and `ACF2DRV` from your started task procedure library.
4. Remove the driver load library from your APF list by modifying `PARMLIB IEAAPFxx` or `PROGxx` member as appropriate.

   **NOTE:** 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 affect.

5. Remove the `LDXSERV` and `ACFQUERY` TSO commands from `IKJTSOxx`.
6. Remove the driver files from the HFS:

   ```
   oshell rm -rf /opt/novell
   ```

7 Delete the `SAMPLIB`, `LOAD` and `EXEC` driver data sets.

8 Delete the change log data set that you created in "Allocating and Initializing the Change Log Data Set" on page 37.

# 4 Configuring the ACF2 Driver

After you have installed the Identity Manager 4.10 driver for ACF2, use the information in this section for configuration. Topics include


- "The Driver Shim Configuration File" on page 47
- "Setting the Remote Loader and Driver Object Passwords" on page 49
- "Migrating Identities" on page 50
- "International Considerations" on page 51


## The Driver Shim Configuration File

The driver shim configuration file controls operation of the driver shim. You can specify the configuration options listed in Table 4-1, one per line. You can also specify these options on the command line. For details about driver shim command line values, see "Driver Shim Command Line Options" on page 105.

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

***Table 4-1*** *Driver Shim Configuration File Statements*

| Option (Short and Long Forms) | Description |
|---|---|
| `-conn <connString>`<br>`-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.<br>`port=<driverShimPort>`<br>`ca=<Certificate Authority Key File>` |
| `-hp <httpPort>`<br>`-httpport <httpPort>` | Specifies the HTTP services port number. The default HTTP services port number is 8091.<br>You can connect to this port to view log files. For details, see "The Trace File" on page 73 and "The Status Log" on page 74. |
| `-path <driverPath>` | Specifies the path for driver files. The default path is `/opt/novell/acf2drv`. |
| `-sp <RLpassword>,<DOpassword>,`<br>`-setpassword <RLpassword>,<DOpassword>,` | Sets the Remote Loader and Driver object passwords. |

| Option (Short and Long Forms) | Description |
|---|---|
| `-t <traceLevel>`<br>`-trace <traceLevel>` | Sets the level of debug tracing. 0 is no tracing, and 10 is all tracing. For details, see "The Trace File" on page 73. |
| `-tfm size`<br>`-tracefilemax size` | Specifies the limit to the size of the trace file for this instance. Specify the value in kilobytes, megabytes, or gigabytes, using the abbreviation for the byte type. The minimum value is 100K. For example:<br>◆ `-tracefilemax 1000K`<br>◆ `-tracefilemax 100M`<br>◆ `-tracefilemax 10G`<br>**NOTE:**<br>◆ When you add this option to the configuration file, the application uses the specified name for the tracefile and includes up to 9 "roll-over" files. Each file size is 1/10th of the total size specified. The roll-over files are named using the base of the main trace filename plus `_n`, where `n` is 1 through 9.<br>◆ If the trace file data is larger than the specified maximum when the Driver Shim is started, the trace file data remains larger than the specified maximum until roll-over is completed through all 10 files. |
| `-ndl` | Disables writing to the driver status log file. |
| `-nodirxmllog` | Disables writing to `dirxml.log`. |
| `-nohttpport` | Disables the HTTP service. |
| `-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/acf2drv/logs/trace.log
-trace 0
-connection "ca=/opt/novell/acf2drv/keys/ca.pem"
-path /opt/novell/acf2drv/
```

# Setting the Remote Loader and Driver Object Passwords

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

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


- "Connected System" on page 49
- "Identity Vault" on page 49


## Connected System

The Remote Loader and Driver object passwords are stored on the connected system under `/opt/novell/acf2drv/keys` in encrypted files `dpwdlf40` (Driver object password) and `lpwdlf40` (Remote Loader password).

To set the passwords on the connected system:

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

## Identity Vault

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

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

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

# Migrating Identities

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


- "Migrating Identities from the Identity Vault to the Connected System" on page 50
- "Migrating Identities from the Connected System to the Identity Vault" on page 50
- "Synchronizing the Driver" on page 51


## Migrating Identities from the Identity Vault to the Connected System

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

To view the results of the migration, click **View the Driver Status Log**. For details about the log, see "The Status Log" on page 74.

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

## Migrating Identities from the Connected System to the Identity Vault

1. In Identity Console, click the Identity Manager **Drivers** module from the landing page.
2. Click the specific driver to perform your migration.
3. Click **Migrate Into IDVault** tab.
4. Use the Edit Migration Criteria icon.
5. Specify your search criteria:
   - **5a** Select class User.
   - **5b** Select the attributes to be used as search criteria for objects of the selected class, then click **OK**.

The eDirectory attributes map to ACF2 attributes as specified by the driver schema: CN maps to DirXML-ACF2-LID, etc. For the default mappings, see Table 1-2, "Default Schema Mapping and Filter," on page 18.

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

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

To view the results of the migration, click **View the Driver Status Log**. For details about the log, see "The Status Log" on page 74.

Because local passwords cannot be retrieved from ACF2, they cannot be submitted to the Metadirectory engine until they are changed. The password change exit routine captures password changes.

## Synchronizing the Driver

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

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

# International Considerations

The Identity Manager driver for ACF2 assumes the ACF2 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 `ACF2DRV`, the JCL for starting the ACF2 driver shim. If your system uses a codepage other than IBM-1047, you will need to change the JCL for starting the ACF2 driver to ensure correct character translation.

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

```
ENVAR("LC_CTYPE=IBM-1047")
```

You may change this text to reflect the codepage of your ACF2 system. The format is IBM-*CCSID*, where *CCSID* is a coded character set identifier, represented in decimal.

For a list of valid codepage identifiers, see the IBM CCSID reference table (https://www.ibm.com/docs/en/zos/3.1.0?topic=tapes-coded-character-sets-sorted-by-ccsid). The following table lists a subset of sample values:

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

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

# 5 Customizing the ACF2 Driver

This section provides information about available resources for customizing the Identity Manager 4.10 driver for ACF2.

Topics include


- "The Scriptable Framework" on page 53
- "The Connected System Schema File" on page 59
- "The Connected System Include/Exclude File" on page 61
- "Managing Additional Attributes" on page 65


For details about the filters and policies provided with the driver, see "ACF2 Default Configuration" on page 17 and "ACF2 Password Synchronization" on page 19.

## The Scriptable Framework

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

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

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

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

The following tables describe the major REXX execs.

*Table 5-1 Identity Vault Command Processing Execs*

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

*Table 5-2 Other Execs*

| REXX Exec | Purpose |
|---|---|
| IDMSUB | Calls the appropriate command processing exec based on the type of event and object. This is executed for every Subscriber event. |
| IDMPOLL | Not used for ACF2. You can use this exec as needed to support your own applications if they do not generate events when changes are made. |
| IDMHRTBT | Heartbeat exec. |
| IDMGLBLS | Holds configurable options that all REXX execs can use during event processing. |
| IDMSTATS | Sends a status document to report the health of the application. |
| IDMTSOEX | Executes a TSO command and returns the command return code and command output. |
| SETPWDS | Sets the Remote Loader and Driver object passwords, which are used to authenticate and authorize the connection between the driver shim started task and the Metadirectory system. |
| SETCERT | Retrieves the certificate authority for the Metadirectory engine that uses SSL to communicate with the driver shim started task. |

# Modifying a REXX Exec

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

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

- Trace a useful message to be logged to the TSO print file.
- Provide comments instructing where to insert custom code before the TSO command is executed.
- Execute the TSO command stored in variable *ACF2CMD*, 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 ACF2 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 ACF2 driver shim:

```
<modify class-name="User" event-id="12345">
  <association>IBMUSER</association>
  <modify-attr attr-name="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=IBMUSER
REMOVE_NAME=IBMUSER
ADD_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 ACF2CMD Variable

Before an XDS command is sent to the driver shim, the Output Transformation policy converts the XDS document into a ACF2 TSO administrative command and stores the result in the attribute, `ACF2CMD`. 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 `ACF2CMD` 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 `ACF2DRV` 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_LID">.");
```

## 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", response, EVENT_ID);
end;
```

## Putting It All Together

The following code sample illustrates how the IMMADDU exec can be modified to additionally create an 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_LID">.");

/*
   INSERT CUSTOM CODE HERE

   Add any custom code here that needs to be executed before
   creating the user in the ACF2 database.
*/

/* Add the user to the ACF2 database using a TSO command */
if wordpos("ADD_ACF2CMD.0", variablelist) <= 0; then do;
  /* we did not get a ACF2CMD from the event document */
  success = IDMSTATS("error", "No ACF2 command found", EVENT_ID);
  exit 0;
end;

do i = 1 to ADD_ACF2CMD.0
  tsocmd = ADD_ACF2CMD.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 occurred, 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 ACF2 database.
*/

/* check for the home directory attribute and create it */
if wordpos("ADD_OMVSHOME", VariableList) > 0; then do
  makeDir = "oshell mkdir '"ADD_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. */

parse upper var ADD_LID 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;
```

# The Connected System Schema File

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

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

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

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

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


- "Schema File Syntax" on page 59
- "Example Schema File" on page 61


## Schema File Syntax

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

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

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

## Comments

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

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

## Schema Definition

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

```
SCHEMA [HIERARCHICAL]
```

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

## Class Definition

```
CLASS className [CONTAINER]
```

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

## Attribute Definition

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

```
ATTRIBUTE attributeName [TypeAndProperties]
```

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

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

- `STRING`
- `INTEGER`
- `STATE`
- `DN`

Allowable attribute properties are:

- `REQUIRED`
- `NAMING`
- `MULTIVALUED`
- `CASESENSITIVE`
- `READONLY`

## Example Schema File

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

```
SCHEMA
  CLASS Logonid
    ATTRIBUTE LID NAMING REQUIRED
    ATTRIBUTE MAXDAYS INTEGER
    ATTRIBUTE ACCOUNT STATE
```

# The Connected System Include/Exclude File

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

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

The connected system include/exclude file must be a sequential file or a member of a partitioned data set. The `INCEXC DD` statement in the driver shim started task JCL identifies the include/exclude file. An example include/exclude file that excludes many common z/OS users, 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 at first, and then adding more as you gain confidence and experience.


- "Include/Exclude Processing" on page 61
- "Include/Exclude File Syntax" on page 62
- "Example Include/Exclude Files" on page 65


## Include/Exclude Processing

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

Included identities are treated normally by the Subscriber shim.

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

Identities are matched in the following priority:

1. Exclude rules
2. Include rules

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

## Include/Exclude File Syntax

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

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

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

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

Class and attribute names used in the include/exclude file must correspond to the names specified in the schema file. For details about the schema file, see "The Connected System Schema File" on page 59.

### 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 64.

```
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 ACF2 LID is USER01 or USER02.
EXCLUDE
CLASS Logonid
    LID=USER01
ENDCLASS
CLASS Logonid
    LID=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 64.

By default, an association is the ACF2 user ID. Association formation can be customized in the Subscriber REXX execs.

For example, to exclude the root user, specify

```
EXCLUDE
  ACFUSER
ENDEXCLUDE
```

### Special Considerations

Using the Include/Exclude rules can be a convenient way to control processing decisions from the ACF2 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 63 and "Attribute Matching Rules" on page 63.

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

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

## Limited Regular Expressions

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

Character matching is case sensitive.

Any literal character matches that character.

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

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

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

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

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

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

## Example Include/Exclude Files

***Example 5-1*** *Example 1*

```
# Exclude users whose names start with TEMP
EXCLUDE
    CLASS Logonid
        LID=TEMP.*
    ENDCLASS
ENDEXCLUDE
```

***Example 5-2*** *Example 2*

```
# Exclude USERA and USERB
# Because attribute rules are ANDed, these must be in separate
# CLASS sections.
EXCLUDE
    CLASS Logonid
        LID=USERA
    ENDCLASS
    CLASS Logonid
        LID=USERB
    ENDCLASS
ENDEXCLUDE
```

# Managing Additional Attributes

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

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

- "Modifying the Filter" on page 65

## Modifying the Filter

1. Select the Identity Manager **Drivers** module from the Identity Console landing page.
2. Select the **Data Transformation and Synchronization** tab.
3. Expand the **Class Attribute Filters** panel.
4. Select the appropriate Class and click the Add Attribute icon, then select the attribute from the list.
5. 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.)

6 Click the **Save** icon.

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

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

# 6 Using the ACF2 Driver

This section provides information about operational tasks commonly used with the Identity Manager 4.10 driver for ACF2.

Topics include


- "Starting and Stopping the Driver" on page 67
- "Starting and Stopping the Change Log Started Task" on page 67
- "Starting and Stopping the Driver Shim Started Task" on page 67
- "Displaying Driver Shim Status" on page 68
- "Changing the Driver Shim Trace Level" on page 68
- "Monitoring Driver Messages" on page 68


## Starting and Stopping the Driver

To start the driver:

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

## Starting and Stopping the Change Log Started Task

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

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

```
START LDXLOGR
```

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

```
STOP LDXLOGR
```

## Starting and Stopping the Driver Shim Started Task

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

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

```
START ACF2DRV
```

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

```
STOP ACF2DRV
```

# Displaying Driver Shim Status

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

```
MODIFY ACF2DRV,APPL=STATUS
```

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

```
LDXSERV STATUS
```

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

# Changing the Driver Shim Trace Level

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

```
MODIFY ACF2DRV,APPL='CTL(desired_trace_level)'
```

***Example 6-1*** *For example*

```
MODIFY ACF2DRV,APPL='CTL(9)'
```

For details about the trace file and trace levels, see "The Trace File" on page 73.

# Monitoring Driver Messages

The driver shim started task writes messages to the system operator console and the driver operational log. The driver operational log data set is defined by the `DRVLOG DD` statement in the `ACF2DRV` 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 81.

# 7 Securing the ACF2 Driver

This section describes best practices for securing the Identity Manager 4.10 driver for ACF2. Topics include


- "Using SSL" on page 69
- "Driver Security Certificates" on page 69
- "Driver REXX Execs" on page 70
- "The Change Log" on page 70
- "Driver Passwords" on page 70
- "Driver Code" on page 70
- "Administrative Users" on page 71
- "Connected Systems" on page 71


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

## Using SSL

Enable SSL for communication between the Metadirectory engine and the driver shim on the connected system. This option is enabled by default.

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

## Driver Security Certificates

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

Ensure that the security certificate directory `/opt/novell/acf2drv/keys` is appropriately protected. The installation program sets secure file permissions for this directory.

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

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

*Table 7-1 Security Certificate Details*

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

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

# Driver REXX Execs

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

Ensure that the driver REXX exec library is appropriately protected.

# The Change Log

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

Ensure that the change log data set is appropriately protected.

# Driver Passwords

Use strong passwords for the Driver object and Remote Loader passwords, and restrict knowledge of them to authorized personnel. These passwords are stored in encrypted form in the security certificate directory `/opt/novell/acf2drv/keys`. The installation program sets secure file permissions for this directory. These passwords should be changed periodically.

# Driver Code

Ensure that the driver load library is appropriately protected.

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

## Administrative Users

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

## Connected Systems

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

# A Troubleshooting

This section provides information about troubleshooting the Identity Manager 4.10 driver for ACF2. Topics include


- "Driver Status and Diagnostic Files" on page 73
- "Troubleshooting Common Problems" on page 75


## Driver Status and Diagnostic Files

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


- "The System Log" on page 73
- "The Trace File" on page 73
- "The REXX Exec Output File" on page 74
- "DSTrace" on page 74
- "The Status Log" on page 74
- "The Operational Log" on page 75
- "Change Log Started Task Message Log" on page 75


### 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 81.

### The Trace File

The default trace file exists on the connected system at `/opt/novell/acf2drv/logs/trace.log`. A large amount of debug information can be written to this file. Use the trace level setting in the driver shim configuration file to control what is written to the file. For details about the driver shim configuration file, see "The Driver Shim Configuration File" on page 47.

***Table A-1*** *Driver Shim Trace Levels*

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

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

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

```
-trace 9
```

To view the trace file:

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

## The REXX Exec Output File

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

## DSTrace

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

## The Status Log

The status log is a condensed summary of the events that have been recorded on the Subscriber and Publisher channels. This file exists on the connected system at `/opt/novell/acf2drv/logs/dirxml.log`. For details about using the status log, see the *OpenText Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).

To view the status log:

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

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

3 Click **Status**.

## The Operational Log

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

## Change Log Started Task Message Log

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

# Troubleshooting Common Problems


- "Driver Shim Installation Failure" on page 75
- "Driver Certificate Setup Failure" on page 75
- "Driver Start Failure" on page 76
- "Driver Shim Startup or Communication Failure" on page 76
- "Users Are Not Provisioned to the Connected System" on page 77
- "Users Are Not Provisioned to the Identity Vault" on page 77
- "Identity Vault User Passwords Are Not Provisioned to the Connected System" on page 78
- "Connected System User Passwords Are Not Provisioned to the Identity Vault" on page 78
- "Users Are Not Modified, Deleted, Renamed, or Moved" on page 78
- "Change Log Errors" on page 79


## Driver Shim Installation Failure

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

## Driver Certificate Setup Failure

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

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

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

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

1 Click **Certificate Management** > **Trusted Root Management** options from the Identity Console landing page. The **Trusted Root Container** check box will be selected by default. Select the **Trusted Root** check box.

2 Select the appropriate trusted root certificate from the list and click the export icon.

3 In the next screen, do not select the check box for **Export Private key**.

4 Select **Base64 format**, then click **OK**.

5 Use FTP or another method to store the file on the connected system as `/opt/novell/acf2drv/keys/ca.pem`.

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

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## 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 Identity Console **Drivers** > **Connection Parameters** tab.
- You must activate both Identity Manager and the driver within 90 days. The **IDM Administration** page in Identity Console shows when Identity Manager requires activation. The **Drivers** page shows when the driver requires activation.

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

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

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

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

## Driver Shim Startup or Communication Failure

- Examine the trace file.
- Ensure that the connected system's operating system and security system versions are supported. For a list of supported operating systems, see "Connected System Requirements" on page 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/acf2drv/keys` in encrypted files `dpwdlf40` (Driver object password) and `lpwdlf40` (Remote Loader password).

  To update these passwords on the Metadirectory server, use Identity Console to update the driver configuration.
- 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 38.
- Ensure that only one system in a complex that shares the security system database is running the driver shim started task.

## Users Are Not Provisioned to the Connected System

- Examine the status log, DSTRACE output, trace file, and REXX exec output file.
- To be provisioned, users must be in the appropriate base container. You can view and change the base containers in Identity Console on the **Global Config Values** page of the **Drivers** > **Configuration** page.
- 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.

## Users Are Not Provisioned to the Identity Vault

- Examine the status log, DSTRACE output, and trace file.
- Examine the **User Base Container** GCV values.
- 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 "Installing the Driver Security System Exits" on page 41.

## Identity Vault User Passwords Are Not Provisioned to the Connected System

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

## Connected System User Passwords Are Not Provisioned to the Identity Vault

- Examine the status log, DSTRACE output, and the trace file.
- Several password management properties are available in Identity Console on the **Drivers** > **Configuration** > **Global Config Values** page. Ensure that at least one of the following options is set:
  - **The Identity Vault Accepts Passwords from the ACF2 Connected System**
  - **The Identity Vault Accepts Administrative Password Resets from the ACF2 Connected System**

  To determine the right settings for your environment, view the help for the options, or see the *OpenText Identity Manager 4.10 Administration Guide* on the Identity Manager 4.10 Documentation Web site (https://www.netiq.com/documentation/identity-manager-4.10/).
- If the **Require Password Policy Validation before Publishing Passwords** GCV is set, the user's password must satisfy the password rules in the password policy assigned to the user container.
- Ensure that the change log started task is running on all systems that share the security system database.
- Ensure that the security system exit has been installed, that LLA has been refreshed, and that the exit has been activated. For details, see "Installing the Driver Security System Exits" on page 41.

## Users 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 **Driver** module in Identity Console and click the **Inspector** tab. You can migrate identities to establish associations. For details, see "Migrating Identities" on page 50.

- 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 is not supported by ACF2.

## 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 38.
- Ensure that you initialized the change log data set during installation. For details about initializing the change log data set, see "Allocating and Initializing the Change Log Data Set" on page 37.
- You can use the `LDXSERV` TSO command to display information about the change log data set. Enter the following TSO command:

  ```
  LDXSERV STATUS
  ```

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

# B System and Error Messages

Components of the Identity Manager 4.10 driver for ACF2 write messages to report operational status and problems. For detailed troubleshooting information, see Appendix A, "Troubleshooting," on page 73.

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


- "CFG Messages" on page 81
- "DOM Messages" on page 82
- "DRVCOM Messages" on page 82
- "HES Messages" on page 83
- "LDX0 Messages" on page 83
- "LDXL Messages" on page 85
- "LDXS Messages" on page 88
- "LDXU Messages" on page 89
- "LDXV Messages" on page 91
- "LWS Messages" on page 93
- "NET Messages" on page 101
- "RDXML Messages" on page 101


## CFG Messages

Messages beginning with CFG are issued by configuration file processing.

### CFG001E Could not open configuration file *filename*.

Explanation: Could not open the configuration file.

Possible cause: The file does not exist.

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

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

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

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

Action: Correct the line in the configuration file.

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

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

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

Action: Correct the statement.

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

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

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

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

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

Action: Add the required statement to the configuration file.

## DOM Messages

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

### DOM0001W XML parser error encountered: *errorString*.

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

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

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

## DRVCOM Messages

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

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

Explanation: This message identifies the system component version.

Action: No action is required.

### DRVCOM001W Invalid include/exclude CLASS statement.

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

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

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

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

Action: None.

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

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

Action: None.

## HES Messages

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

### HES001E Unable to initialize the HTTP client.

Explanation: Communications in the client could not be initialized.

Possible cause: Memory is exhausted.

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

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

Explanation: The client is connecting to the specified server.

Action: None.

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

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

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

Action: Obtain a new certificate.

## LDX0 Messages

Messages beginning with LDX0 are issued by the driver security system exit modules `LIDPOST` and `LDXNPIXT`, the `LDXSERV` command and the `ACF2DRV` started task.

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

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

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

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

## LDX0002I Unexpected RC *xxxxxxxx* during token processing routine.

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

Possible cause: Internal system error.

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

## LDX0103E Unable to parse command line.

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

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

## LDX0105E Internal error: *description*.

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

Possible cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

## LDX0106E Unable to open the log file.

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

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

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

### LDX0107E No preallocated log file and no valid environment.

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

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

### LDX0108E No preallocated log file and logger is not active.

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

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

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

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

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

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

## LDXL Messages

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

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

Explanation: The change log started task has initialized.

Action: Informational only. No action is required.

### LDXL001 MESSAGE LOG DISABLED, SYSPRINT DD MISSING.

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

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

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

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

## LDXL002 EXECUTE STATEMENT PARAMETERS: *parm-values*.

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

Action: Informational only. No action is required.

## LDXL003 START COMMAND PARAMETERS: *parameters*.

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

Action: Informational only. No action is required.

## LDXL004 STOP COMMAND RECEIVED.

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

Action: Informational only. No action is required.

## LDXL005 MODIFY COMMAND PARAMETERS: *parameters*.

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

Action: Informational only. No action is required.

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

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

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

## LDXL007 OPERATOR CANCEL DETECTED, ATTEMPTING NORMAL SHUTDOWN.

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

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

## LDXL008 EVENT TRACING ENABLED.

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

Event tracing is turned on.

Action: Informational only. No action is required.

## LDXL009 EVENT TRACING DISABLED.

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

Event tracing is turned off.

Action: Informational only. No action is required.

## LDXL010 MODIFY COMMAND IGNORED, INVALID OR MISSING PARAMETERS.

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

The `MODIFY` command is ignored.

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

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

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

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

Processing continues.

Action: Informational only. No action is required.

## LDXL012 TERMINATING BECAUSE LOGGING ALREADY ACTIVE.

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

This instance of the change log started task terminates.

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

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

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

### LDXL013 LOGGING TO DATASET: *dsname*.

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

Action: Informational only. No action is required.

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

Explanation: The change log started task is ending.

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

Action: Informational only. No action is required.

## LDXS Messages

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

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

Explanation: This message identifies the system component version.

Action: No action is required.

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

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

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

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

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

Explanation: The change log API failed to initialize.

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

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

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

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

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

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

Possible cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

## LDXU Messages

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

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

Explanation: The log file utility has initialized.

Action: Informational only. No action is required.

### LDXU001W Message log disabled, SYSPRINT DD missing.

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

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

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

### LDXU002I Execute statement parameters: *parm-values*.

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

Action: Informational only. No action is required.

### LDXU003E Open failed for log file.

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

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

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

## LDXU004I Log file blocksize: *blksize*.

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

Action: Informational only. No action is required.

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

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

Action: Informational only. No action is required.

## LDXU006E Open failed for LOADIN file.

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

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

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

## LDXU007E Unrecognized or missing execute statement parameter.

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

Processing ends.

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

- INITIALIZE
- DUMP
- LOAD

Action: Correct the `PARM` value and resubmit the job.

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

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

Action: Informational only. No action is required.

## LDXU009E Add event failed, error code *code*.

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

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

### LDXU010E Read header failed, error code *code*.

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

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

### LDXU011E Read event failed, error code *code*.

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

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

### LDXU990I Open BDAM log succeeded.

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

Action: Informational only. No action is required.

### LDXU991E Open BDAM log failed.

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

Possible cause: Internal system error.

Action: Collect diagnostic information and contact OpenText Technical Support.

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

Explanation: The log file utility has completed processing.

Action: Informational only. No action is required.

## LDXV Messages

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

### LDXV001E IDM token not present.

Source: `IDMGETV` command, `IDMSETV` command

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

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

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

## LDXV002E Unable to parse command.

Source: `IDMGETV` command, `IDMSETV` command

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

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

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

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

Source: `IDMGETV` command

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

Possible Cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

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

Source: `IDMGETV` command, `IDMSETV` command

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

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

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

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

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

Source: `IDMGETV` command

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

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

Action: Call the command from within the REXX environment.

### LDXV006E GROUP or USER list required.

Source: `IDMSETV` command

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

Possible Cause: Use one of the required operands.

Action: Correct the operands of the command.

### LDXV007E GROUP and USER operands are mutually exclusive.

Source: `IDMSETV` command

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

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

Action: Correct the command.

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

Source: `IDMGETV` command, `IDMSETV` command

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

Possible Cause: Internal error.

Action: Collect diagnostic information and contact OpenText Technical Support.

## LWS Messages

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

### LWS0001I Server has been initialized.

Explanation: The server has successfully completed its initialization phase.

Action: None. Informational only.

## LWS0002I All services are now active.

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

Action: None. Informational only.

## LWS0003I Server shut down successfully.

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

Action: No action is required.

## LWS0004W Server shut down with warnings.

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

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

## LWS0005E Server shut down with errors.

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

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

## LWS0006I Starting *service*.

Explanation: The server is starting the specified service.

Action: None. Informational only.

## LWS0007E Failed to start *service*.

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

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

## LWS0008I Stopping all services.

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

Action: None. Informational only.

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

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

Action: None. Informational only.

## LWS0010I Local host is *IP_address*.

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

Action: None. Informational only.

## LWS0011I Server is now processing client requests.

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

Action: None. Informational only.

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

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

Action: None. Informational only.

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

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

Action: None. Informational only.

## LWS0014E An error was encountered while parsing execution parameters.

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

Action: Collect diagnostic information and contact OpenText Technical Support.

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

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

Action: Collect diagnostic information and contact OpenText Technical Support.

## LWS0020I Server *version* level: *level*.

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

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

## LWS0023I Listen port *number* is already in use.

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

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

## LWS0024W Too many retries to obtain port *number*.

Explanation: The server tried multiple attempts to establish a listen socket on the specified port number, but the port was in use. The server terminates with a return code of `4`.

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

## LWS0025I Local TCP/IP stack is down.

Explanation: The server detected that the local host TCP/IP service is not active or is unavailable. The server retries every two minutes to reestablish communication with the TCP/IP service.

Action: Ensure that the TCP/IP service is running.

## LWS0026E Unrecoverable TCP/IP error *number* returned from *internal_function_name*.

Explanation: An unrecoverable TCP/IP error was detected in the specified internal server function name. The server ends with a minimum return code of `8`. The error number reported corresponds to a TCP/IP errno value.

Action: Correct the error based on TCP/IP documentation for the specified errno.

## LWS0027W Listen socket was dropped for port *number*.

Explanation: The server connection to the displayed listen port was dropped. The server attempts to reconnect to the listen port so that it can receive new client connections.

Action: Determine why connections are being lost on the local host. Ensure that the host TCP/IP services are running.

## LWS0028E Unable to reestablish listen socket on port *number*.

Explanation: The listen socket on the specified port number was dropped. The server tried multiple attempts to reestablish the listen socket, but all attempts failed. The server ends with a return code of `8`.

Action: Determine if the host's TCP/IP service is running. If the host's TCP/IP service is running, determine if another task on the local host is using the specified port.

## LWS0029I <*id*> Client request started from *ip_address* on port *number*.

Explanation: A new client request identified by *id* has been started from the specified IP address on the displayed port number.

Action: None. Informational only.

## LWS0030I <*id*> Client request started from *host* (*ip_address*) on port *number*.

Explanation: A new client request identified by *id* has been started from the specified host and IP address on the displayed port number.

Action: None. Informational only.

## LWS0031W Unable to stop task *id*: *reason*.

Explanation: The server attempted to terminate a service task identified by *id*. The server could not stop the task for the specified reason. The server ends with a return code of `4`.

Action: See the *reason* text for more information about why the task could not terminate.

## LWS0032I <*id*> Client request has ended.

Explanation: The client requested identified by *id* has ended.

Action: None. Informational only.

## LWS0033I <*id*> Client request: *resource*.

Explanation: The client connection identified by *id* issued a request for *resource*.

Action: None. Informational only.

## LWS0034W <*id*> Write operation for client data has failed.

Explanation: A write operation failed for the connection identified by *id*. This is normally because the client dropped the connection. The client connection is dropped by the server.

Action: Ensure that the client does not prematurely drop the connection. Retry the client request if necessary.

## LWS0035W <*id*> Read operation for client data has timed out.

Explanation: A read operation on the connection identified by *id* has timed out because of inactivity. The client connection is dropped by the server.

Action: Ensure that the client does not prematurely drop the connection. Retry the client request if necessary.

## LWS0036W <*id*> Client request error: *error_code* - *error_text*.

Explanation: The server encountered an error while processing the client request. The server terminates the request.

Action: Determine why the request was in error by viewing the error code and error text that was generated.

## LWS0037W <*id*> Client request error: *code*.

Explanation: The server encountered an error while processing the client request. The server terminates the request.

Action: Determine why the request was in error by viewing the error code and error text that was generated.

## LWS0038I Received command: *command_text*.

Explanation: The server has received the displayed command from the operator. The server processes the command.

Action: None. Informational only.

## LWS0043E Task *id* ended abnormally with RC=*retcode*.

Explanation: The server detected a task that ended with a non-zero return code. The server ends with a minimum return code of 8.

Action: View the log for other messages that might have been generated regarding the error.

## LWS0045I Idle session time-out is *number* seconds.

Explanation: The message shows the idle time limit for connections. The server automatically terminates sessions that are idle for longer than the specified number of seconds.

Action: None. Informational only.

## LWS0046I Maximum concurrent sessions limited to *number*.

Explanation: The message shows the maximum number of concurrent sessions allowed. The server allows only the specified number of concurrent sessions to be active at any given time. All connections that exceed this limit are forced to wait until the total number of connections drops below the specified value.

Action: None. Informational only.

## LWS0047W Unable to delete log file *filename*.

Explanation: The log file could not be deleted as specified.

Possible cause: The user service or daemon does not have file system rights to delete old log files.

Action: Verify that the user service or daemon has the appropriate rights.

Action: Examine the current logs for related messages.

## LWS0048I Log file *filename* successfully deleted.

Explanation: The log file has been deleted as specified.

Action: None. Informational only.

## LWS0049E Error *error* authenticating to the directory as *fdn*.

Explanation: The connection manager could not connect to the directory as user *fdn*. The error was *error*.

Possible cause: The configuration parameters do not contain the correct user or password.

Action: Correct the cause of the error as determined from *error*.

Action: Verify that the User object has the appropriate rights.

Action: Verify that the password given for the User object in the configuration parameters is correct.

## LWS0050E Server application initialization failure was detected.

Explanation: During server initialization, an error was detected while initializing the server Application object.

Possible Cause This message is commonly logged when the driver is started and then immediately shut down. This can happen during installation, when the shim is started to generate keys or configure SSL. You can safely ignore this message in those cases.

Action: See the error logs for additional messages that indicate the cause of the error.

## LWS0051E Server initialization failure was detected.

Explanation: The server failed to initialize properly because of an initialization error specific to the operating system.

Action: See the log for additional messages that indicate the cause of the error.

## LWS0052W This server is terminating because of another instance already running (*details*).

Explanation: The server is shutting down because there is another active instance of this server running on the host.

Possible cause: A previous instance of the server was not stopped before starting a new instance.

Action: Stop or cancel the previous server instance before starting a new one.

## LWS0053I The parameter *keyword* is no longer supported.

Explanation: The specified parameter is not supported in this release and might be removed in future releases.

Possible cause: An execution parameter was specified that is no longer supported.

Action: Do not specify the unsupported parameter.

## LWS0054I The execution parameter *keyword* is in effect.

Explanation: The specified execution parameter is in effect for the server.

Action: Informational only. Processing continues.

## LWS0055W Invalid execution parameter detected: *keyword*.

Explanation: An invalid execution parameter was detected.

Action: Do not specify the invalid or unknown execution parameter.

## LWS0056I Not accepting new connections because of the MAXCONN limit. There are *number* active connections now for *service*.

Explanation: The specified service has a maximum connection limit that has been reached. The service no longer accepts new connections until at least one of the active connections ends.

Action: If you receive this message frequently, increase the `MAXCONN` limit for this service or set the `MAXCONN` to unlimited connections.

## LWS0057I New connections are now being accepted for *service*.

Explanation: The service was previously not accepting new connections because of the imposed `MAXCONN` limit. The service can now accept a new connection because at least one active connection has ended.

Action: None. Informational only.

### LWS0058I Listen socket on port *number* has been re-established.

Explanation: The previously dropped listen socket has been reestablished. Services using the specified port can now continue. The listen socket previously dropped because of an error or TCP/IP connectivity problems has been reestablished. Client connection processing continues.

Action: None. Informational only.

### LWS0059W Server is terminating because the required service *serviceName* is ending.

Explanation: The specified required service has ended. The server terminates because it cannot continue running without the required service.

Action: See related log messages to determine why the required service ended. Correct the problem and restart the server.

## NET Messages

Messages beginning with NET are issued by driver components during verification of SSL certificates.

### NET001W Certificate verification failed. Result is *result*.

Explanation: A valid security certificate could not be obtained from the connection client. Diagnostic information is given by *result*.

Possible cause: A security certificate has not been obtained for the component.

Possible cause: The security certificate has expired.

Possible cause: The component certificate directory has been corrupted.

Action: Respond as indicated by *result*. Obtain a new certificate if appropriate.

## RDXML Messages

Messages beginning with RDXML are issued by the embedded Remote Loader.

### RDXML000I *nameversion* Copyright 2005 Omnibond Systems, LLC. ID=*code_id_string*.

Explanation: This message identifies the system component version.

Action: No action is required.

## RDXML001I Client connection established.

Explanation: A client has connected to the driver. This can be the Metadirectory engine connecting to process events to and from the driver, or a Web-based request to view information or publish changes through the SOAP mechanism.

Action: No action required.

## RDXML002I Request issued to start Driver Shim.

Explanation: The driver received a command to start the driver shim and begin processing events.

Action: No action required.

## RDXML003E An unrecognized command was issued. The driver shim is shutting down.

Explanation: The driver received an unrecognized command from the Metadirectory engine. The driver shim is shutting down to avoid further errors.

Possible cause: Network error.

Possible cause: Invalid data sent to the driver.

Possible cause: The Metadirectory engine version might have been updated with new commands that are unrecognized by this version of the driver.

Possible cause: This message is logged when the driver shim process is shut down from the connected system rather than from a Driver object request. The local system can queue an invalid command to the driver shim to simulate a shutdown request and terminate the running process.

Action: Ensure that the network connection is secured and working properly.

Action: Apply updates for the engine or driver if necessary.

Action: If the driver shim process was shut down from the local system, no action is required.

## RDXML004I Client Disconnected.

Explanation: A client has disconnected from the driver. This might be the Metadirectory engine disconnecting after a driver shutdown request or a Web-based request that has ended.

Action: No action required.

## RDXML005W Unable to establish client connection.

Explanation: A client attempted to connect to the driver, but was disconnected prematurely.

Possible cause: The client is not running in SSL mode.

Possible cause: Mismatched SSL versions or mismatched certificate authorities.

Possible cause: Problems initializing SSL libraries because of improperly configured system entropy settings.

Action: Ensure that both the Metadirectory engine and the driver are running in the same mode: either clear text mode or SSL mode.

Action: If you are using SSL, ensure that the driver and Metadirectory engine have properly configured certificates, and that the driver system is configured properly for entropy.

## RDXML006E Error in Remote Loader Handshake.

Explanation: The Metadirectory engine attempted to connect to the driver, but the authorization process failed. Authorization requires that both supply mutually acceptable passwords. Passwords are configured at installation.

Possible cause: The Remote Loader or Driver object passwords do not match.

Action: Set the Remote Loader and Driver object passwords to the same value for both the driver and the driver shim. Use Identity Console to modify the driver properties. Re-configure the driver shim on the connected system.

## RDXML007I Driver Shim has successfully started and is ready to process events.

Explanation: The Metadirectory engine has requested the driver to start the shim for event processing, and the driver shim has successfully started.

Action: No action required.

## RDXML008W Unable to establish client connection from *remoteName*.

Explanation: A client attempted to connect to the driver, but was disconnected prematurely.

Possible cause: The client is not running in SSL mode.

Possible cause: Mismatched SSL versions or mismatched certificate authorities.

Possible cause: Problems initializing SSL libraries because of improperly configured system entropy settings.

Action: Ensure that both the Metadirectory engine and the driver are running in the same mode: either clear text mode or SSL mode.

Action: If you are using SSL, ensure that the driver and Metadirectory engine have properly configured certificates, and that the driver system is configured properly for entropy.

## RDXML009I Client connection established from *remoteName*.

Explanation: A client has connected to the driver. This can be the Metadirectory engine connecting to process events to and from the driver, or a Web-based request to view information or publish changes through the SOAP mechanism.

Action: No action required.

# C Technical Details

Topics in this section include


- "Driver Shim Command Line Options" on page 105
- "ACFQUERY Tool" on page 106
- "LDXSERV Tool" on page 107
- "Performance Information" on page 109
- "Default ACF2 Schema" on page 114


## Driver Shim Command Line Options

The following options can be specified on the driver shim command line. You can also specify driver shim configuration file statements as command line options. For details about the driver shim configuration file, see "The Driver Shim Configuration File" on page 47.

### 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`<br>`-secure` | Secures the driver by creating SSL certificates, then exits. |
| `-p`<br>`-password` | Specifies the Remote Loader password. |

### Other Options

***Table C-2*** *Other Driver Shim Command Line Options*

| Option (Short and Long Forms) | Description |
|---|---|
| `-c <congFile>`<br>`-config <configFile>` | Instructs the driver shim to read options from the specified configuration file.<br>Options are read from ddname `DRVCONF` by default. |

| Option (Short and Long Forms) | Description |
|---|---|
| -?<br>-help | Displays the command line options, then exits. |
| -v<br>-version | Displays the driver shim version and build date, then exits. |

# ACFQUERY Tool

The driver query processor uses the ACF2 API to retrieve information from the security system. Queries are used by the Metadirectory engine for matching and merging. The TSO command, ACFQUERY, is used to extract information from the ACF2 database. ACFQUERY has the following format for read operations:

```
ACFQUERY SCOPE(entry) CLASS(class) ASSOCIATION(association)
  [READATTRS(attrs...)|ALLREADATTRS] [PRINT]
```

The SCOPE tells ACFQUERY that information about a specific profile is being requested. The CLASS operand should always be set 'Logonid'. The ASSOCIATION operand specifies the association of the object to read. For Logonid profiles, simply use the LID field for association values. READATTRS operand specifies a list of attributes to return; optionally, you may specify ALLREADATTRS instead to return everything. The PRINT operand instructs ACFQUERY to print the results to the display. The output is a series of lines, each with a name=value pair. These pairs are interpreted by the driver shim to create an appropriate XDS document that the engine can use for processing. For example:

```
ACFQUERY SCOPE(entry) CLASS(Logonid) ASSOCIATION(IBMUSER)
   READATTRS(ACCOUNT)PRINT
```

```
COMMAND=instance
CLASS_NAME=Logonid
ASSOCIATION=IBMUSER
ATTR_ACCOUNT=true
COMMAND=status
STATUS_LEVEL=success
```

For search operations, a search criteria is specified:

```
  ACFQUERY SCOPE(subtree) SEARCHCLASSES(classes..)
SEARCHATTRS('attr=value' ...)
    [READATTRS(attrs...)|ALLREADATTRS] [PRINT]
```

The subtree SCOPE tells ACFQUERY 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:

```
ACFQUERY SCOPE(subtree) SEARCHCLASSES(Logonid)
  SEARCHATTRS('ACCOUNT=true') PRINT

COMMAND=instance
CLASS-NAME=Logonid
ASSOCIATION=ASCH
COMMAND=instance
CLASS_NAME=Logonid
ASSOCIATION=CICSA
COMMAND=instance
CLASS_NAME=Logonid
ASSOCIATION=CICSTART
COMMAND=status
STATUS_LEVEL=success
```

You will notice that there are multiple results returned. Search operations may return zero or more responses.

# LDXSERV Tool

LDXSERV is a TSO command tool that serves several functions. For the driver shim, it allows the started task to set a loopback token in its address space memory in order to prevent the Exit routines from logging its activity to the change log. From the user's perspective, LDXSERV can be used as a verification tool to investigate whether the Exits are in place correctly. It can also be used to query information from the change log queue and even modify the queue, if necessary.

The syntax for LDXSERV is as follows:

```
LDXSERV < STATUS | GETNEXT | [MARKDONE <EVENT(event-id)>] >
```

## STATUS

The `STATUS` operand reports back to the user an XML document describing the installed Event Subsystem. It provides several pieces of information, including the build date and version of each component, the state of each Exit, the number of events queued through each Exit, and the size and location of the log file.

```
ldxserv status
<ldx>
  <source>
    <product build="20210103" instance="ldxserv" version="4.83">
      Novell IDM ACF2 Driver Version 4.8.3.0
    </product>
    <contact>NetIQ Corporation</contact>
  </source>
  <output>
    <status level="success">
      <exit name="LDXNPXIT" state="enabled" version="4.83" build-
date="20171217"
        times-called="584" events-queued="2" info="ok"/>
      <exit name="LDXEVX01" state="enabled" version="4.83" build-
date="20171217"
        times-called="20" events-queued="7" info="ok"/>
      <queue version="4.83" state="active" created-by="LDXNPXIT"
entries="0"/>
      <logger version="4.83" state="active" taskid="LDXLOGRP"
        logfilename="LDX.LOGFILE"/>
      <logfile name="LDX.LOGFILE" state="0% used"/>
    </status>
  </output>
</ldx>
```

## GETNEXT

The `GETNEXT` operand reports back to the user an XML document describing the first event in the change log queue. Inside the XML document, you may view the type of event and details about the event, including the user that issued the event, the date and time of the event.

```
ldxserv getnext
<ldx>
  <source>
    <product build="20210103" instance="ldxserv" version="4.83">
      Novell IDM ACF2 Driver Version 4.8.3.0
    </product>
    <contact>NetIQ Corporation</contact>
  </source>
  <output>
    <modify-password date="2021-01-01" time=" 7:18" event-id="7006">
      <association>JAVIER</association>
      <password>********</password>
    </modify-password>
    <status level="success">
      <description>ok</description>
    </status>
  </output>
</ldx>
```

## MARKDONE

The `MARKDONE` operand instructs LDXSERV to remove the event in the queue, described by the `EVENTID` operand. The event-id must match the event-id found by the `GETNEXT` command. When complete, it reports back an XML document describing the success or error of the instruction.

```
ldxserv markdone event(7006)
<ldx>
  <source>
    <product build="20210103" instance="ldxserv" version="4.83">
      Novell IDM ACF2 Driver Version 4.8.3.0
    </product>
    <contact>NetIQ Corporation</contact>
  </source>
  <output>
    <status level="success">
      <description>ok</description>
    </status>
  </output>
</ldx>
```

# Performance Information

This section presents the results of a performance case study of the Identity Manager 4.10 driver for ACF2. The study is based on software and hardware configurations that may vary from your production deployment. Therefore, the results, which include real-time throughput and mainframe resource usage, are offered only as approximations for calculating similar measurements in your environment.

## Configuration Information

The system on which Identity Manager was installed was a VMWare virtual machine with the following configuration:

- Single Intel* Xeon* CPU at 2.5 GHz
- 8 GB RAM
- SLES 10.2 x86_64
- 64-bit eDirectory 8.8 SP5 (20601.18)
- 64-bit Identity Manager 4.0.1 (4.0.1-0)
- Single Driver Set with one driver (ACF2)
- Engine trace level 10

The connected z/OS system running ACF2 consisted of:

- IBM System z10 Business Class Mainframe 2098-E10 model D02
- 8 MB memory
- z/OS 1.13
- ACF2 with 1000 users

## Performance Metrics

All tests in the case study used three or more of the following benchmarks:

- Real-Time Speed
- CPU-Time
- EXCP-Cnt
- Memory Usage

### Real-Time Speed

This measurement describes the amount of time for a particular transaction in real seconds or milliseconds. It is useful for ascertaining how long a large migration may take or how many events per day can be processed by a particular channel in real time. Real-time measurements are helpful in previewing what to expect in a production deployment; however, they are dependent on a variety of factors, including speed of the mainframe and vault systems, size of the ACF2 database, size and layout of Identity Vault, operating systems workload, network delays, disk I/O speeds, trace levels, and customized policies.

### CPU-Time

On the mainframe, CPU-Time is a measurement of the amount of CPU processing time consumed by a particular job. This figure can be used for capacity planning.

### EXCP-Cnt

The EXCP-Cnt is the total number of blocks transferred for I/O requests. I/O utilization may also be used for capacity planning.

### Memory Usage

Memory usage is the number of frames allocated by a running task on z/OS. Each frame represents 4096 bytes of memory. In all tests for this study, the memory recorded was the highest observed peak that occurred during transactions.

## Idle Performance

Idle performance measures how the Driver Shim started task performs while no event transactions are being processed.

### Phase Discussion

Driver Shim idle performance is measured in four phases:

- Shim Startup
- Shim Idle (not connected)

- Shim Connection
- Shim Idle (connected)

### Shim Startup

When the ACF2 Driver Shim (`ACF2DRV`) 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*** *ACF2DRV Idle Performance*

| Phase | CPU-Time | EXCP-Cnt | Memory Usage |
|---|---|---|---|
| Startup | 0.90 seconds | 890 | 1338 (5.5 MB) |
| Idle (not connected) | 0.12 seconds/hour | 0/hour | 1338 (5.9 MB) |
| Connection | 1.55 seconds | 40 | 1935 (7.9 MB) |
| Idle (connected) | 0.6 seconds/hour | 12/hour | 1935 (7.9 MB) |

**NOTE:** The polling interval will affect the results for the Idle (connected) phase. For this study, the polling interval was set to 300 seconds (or 5 minutes) and the driver heartbeat was disabled.

***Table C-4*** *LDXLOGR (LDXLOGRP) Idle Performance*

| Phase | CU-Time | EXCP-Cnt | Memory Usage |
|---|---|---|---|
| Startup | 0.03 seconds | 8 | 279 (1.1 MB) |
| Idle | 0.04 seconds/hour | 0/hour | 283 (1.2 MB) |

## Subscriber Performance

The Subscriber channel processes events originating in Identity Manager that need to be replicated in the ACF2 database. In this study, all ACF2 rules and packages were applied with 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 ACF2
- Delete User - A user's deletion in Identity Manager causes that user's deletion in ACF2
- Change Password - A user's new password in Identity Manager is replicated in ACF2
- Entry Query User - Identity Manager queries a user in ACF2 and reads its NAME field
- Search Query User - Identity Manager queries ACF2 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*** *ACF2DRV Performance Per Transaction*

| Event | CPU-Time | EXCP-Cnt | Memory Usage | Real Time |
|---|---|---|---|---|
| Add User | 1.16 seconds | 216 | 2900 (11.9 MB) | 2.02 seconds |
| Modify User | 0.48 seconds | 181 | 2200 (9.0 MB) | 1.11 seconds |
| Delete User | 0.79 seconds | 287 | 2043 (8.4 MB) | 1.66 seconds |
| Change Password | 0.74 seconds | 399 | 2008 (8.2 MB) | 0.79 seconds |
| Entry Query User | 0.27 seconds | 93 | 2008 (8.2 MB) | 1.00 seconds |
| Search Query User | 1.16 seconds | 3264 | 2023 (8.3 MB) | 3.04 seconds |

## Publisher Performance

The Publisher channel processes events originating in the connected system's ACF2 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 ACF2 with minimum required fields is replicated in Identity Manager
- Add Group - A new group created in ACF2 with minimum required fields is replicated in Identity Manager
- Modify User - A change to a user's REVOKE field in ACF2 causes a change to that user's account in Identity Manager

- Delete User - A user deleted in ACF2 causes that user's deletion in Identity Manager
- Change Password - A user's new password in ACF2 is replicated in Identity Manager

For each test, a CLIST containing the commands for each event type, was executed against ACF2. 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 ACF2 commands being executed by ACF2.
- Finally, the Drive Shim (`ACF2DRV`) 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 ACF2 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-7 on page 113.

***Table C-6*** *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-7*** *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-8*** *ACF2DRV 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 | 0.023 seconds | 7 | 1976 (8.1 MB) | 0.12 seconds |
| Modify User | 0.022 seconds | 7 | 1977 (8.1 MB) | 0.10 seconds |

| Event | CPU-Time | EXCP-Cnt | Memory Usage | Real Time |
|---|---|---|---|---|
| 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 |

# Default ACF2 Schema

The default schema for the ACF2 Driver uses the installation default Logonid record supplied by CA. Table C-9 lists each field and its syntax.

***Table C-9*** *ACF2 Schema*

| eDirectory Attribute | ACF2 Field | Syntax |
|---|---|---|
| DirXML-ACF2-ACC-CNT | ACC-CNT | INTEGER |
| DirXML-ACF2-ACC-DATE | ACC-DATE | STRING |
| DirXML-ACF2-ACC-SRCE | ACC-SRCE | STRING |
| DirXML-ACF2-ACC-TIME | ACC-TIME | STRING |
| DirXML-ACF2-ACCOUNT | ACCOUNT | STATE |
| DirXML-ACF2-ACCTPRIV | ACCTPRIV | STATE |
| DirXML-ACF2-ACF2CICS | ACF2CICS | STATE |
| DirXML-ACF2-ACTIVE | ACTIVE | STRING |
| DirXML-ACF2-ALLCMDS | ALLCMDS | STATE |
| DirXML-ACF2-ATTR2 | ATTR2 | STRING |
| DirXML-ACF2-AUDIT | AUDIT | STATE |
| DirXML-ACF2-AUTHSUP1 | AUTHSUP1 | STATE |
| DirXML-ACF2-AUTHSUP2 | AUTHSUP2 | STATE |
| DirXML-ACF2-AUTHSUP3 | AUTHSUP3 | STATE |
| DirXML-ACF2-AUTHSUP4 | AUTHSUP4 | STATE |
| DirXML-ACF2-AUTHSUP5 | AUTHSUP5 | STATE |
| DirXML-ACF2-AUTHSUP6 | AUTHSUP6 | STATE |
| DirXML-ACF2-AUTHSUP7 | AUTHSUP7 | STATE |
| DirXML-ACF2-AUTHSUP8 | AUTHSUP8 | STATE |
| DirXML-ACF2-AUTOALL | AUTOALL | STATE |
| DirXML-ACF2-AUTODUMP | AUTODUMP | STATE |
| DirXML-ACF2-AUTONOPW | AUTONOPW | STATE |
| DirXML-ACF2-AUTOONLY | AUTOONLY | STATE |

| eDirectory Attribute | ACF2 Field | Syntax |
|---|---|---|
| DirXML-ACF2-BDT | BDT | STATE |
| DirXML-ACF2-CANCEL | CANCEL | STATE |
| DirXML-ACF2-CHAR | CHAR | STRING |
| DirXML-ACF2-CICS | CICS | STATE |
| DirXML-ACF2-CICSCL | CICSCL | STRING |
| DirXML-ACF2-CICSID | CICSID | STRING |
| DirXML-ACF2-CICSOPT | CICSOPT | STRING |
| DirXML-ACF2-CICSPRI | CICSPRI | INTEGER |
| DirXML-ACF2-CICSRSL | CICSRSL | STRING |
| DirXML-ACF2-CMD-LONG | CMD-LONG | STATE |
| DirXML-ACF2-CMD-PROP | CMD-PROP | STATE |
| DirXML-ACF2-CONSOLE | CONSOLE | STATE |
| DirXML-ACF2-CONSULT | CONSULT | STATE |
| DirXML-ACF2-CRE-TOD | CRE-TOD | STRING |
| DirXML-ACF2-CSDATE | CSDATE | STRING |
| DirXML-ACF2-CSWHO | CSWHO | STRING |
| DirXML-ACF2-DFT-DEST | DFT-DEST | STRING |
| DirXML-ACF2-DFT-PFX | DFT-PFX | STRING |
| DirXML-ACF2-DFT-SOUT | DFT-SOUT | STRING |
| DirXML-ACF2-DFT-SUBC | DFT-SUBC | STRING |
| DirXML-ACF2-DFT-SUBH | DFT-SUBH | STRING |
| DirXML-ACF2-DFT-SUBM | DFT-SUBM | STRING |
| DirXML-ACF2-DG84DIR | DG84DIR | STATE |
| DirXML-ACF2-DIALBYP | DIALBYP | STATE |
| DirXML-ACF2-DSNSCOPE | DSNSCOPE | STRING |
| DirXML-ACF2-DUMPAUTH | DUMPAUTH | STATE |
| DirXML-ACF2-EXPIRE | EXPIRE | STRING |
| DirXML-ACF2-GROUP | GROUP | STRING |
| DirXML-ACF2-GRP-OPT | GRP-OPT | STATE |
| DirXML-ACF2-GRP-USER | GRP-USER | STRING |
| DirXML-ACF2-GRPLOGON | GRPLOGON | STATE |
| DirXML-ACF2-HOMENODE | HOMENODE | STRING |

| eDirectory Attribute | ACF2 Field | Syntax |
|---|---|---|
| DirXML-ACF2-IDLE | IDLE | INTEGER |
| DirXML-ACF2-IMS | IMS | STATE |
| DirXML-ACF2-INTERCOM | INTERCOM | STATE |
| DirXML-ACF2-JCL | JCL | STATE |
| DirXML-ACF2-JOB | JOB | STATE |
| DirXML-ACF2-JOBFROM | JOBFROM | STATE |
| DirXML-ACF2-KERB-VIO | KERB-VIO | INTEGER |
| DirXML-ACF2-KERBCUR | KERBCUR | STRING |
| DirXML-ACF2-KERBCURV | KERBCURV | STRING |
| DirXML-ACF2-KERBPRE | KERBPRE | STRING |
| DirXML-ACF2-KERBPREV | KERBPREV | STRING |
| DirXML-ACF2-LDEV | LDEV | STATE |
| DirXML-ACF2-LDS | LDS | STATE |
| DirXML-ACF2-LDSNODES | LDSNODES | STRING |
| DirXML-ACF2-LDSNODEV | LDSNODEV | STATE |
| DirXML-ACF2-LEADER | LEADER | STATE |
| DirXML-ACF2-LGN-ACCT | LGN-ACCT | STATE |
| DirXML-ACF2-LGN-DEST | LGN-DEST | STATE |
| DirXML-ACF2-LGN-MSG | LGN-MSG | STATE |
| DirXML-ACF2-LGN-PERF | LGN-PERF | STATE |
| DirXML-ACF2-LGN-PROC | LGN-PROC | STATE |
| DirXML-ACF2-LGN-RCVR | LGN-RCVR | STATE |
| DirXML-ACF2-LGN-SIZE | LGN-SIZE | STATE |
| DirXML-ACF2-LGN-TIME | LGN-TIME | STATE |
| DirXML-ACF2-LGN-UNIT | LGN-UNIT | STATE |
| DirXML-ACF2-LID | LID | STRING |
| DirXML-ACF2-LIDSCOPE | LIDSCOPE | STRING |
| DirXML-ACF2-LIDTEMP | LIDTEMP | STATE |
| DirXML-ACF2-LIDZMAX | LIDZMAX | STATE |
| DirXML-ACF2-LIDZMIN | LIDZMIN | STATE |
| DirXML-ACF2-LINE | LINE | STRING |
| DirXML-ACF2-LOGSHIFT | LOGSHIFT | STATE |

| eDirectory Attribute | ACF2 Field | Syntax |
|---|---|---|
| DirXML-ACF2-MAIL | MAIL | STATE |
| DirXML-ACF2-MAINT | MAINT | STATE |
| DirXML-ACF2-MAXDAYS | MAXDAYS | INTEGER |
| DirXML-ACF2-MINDAYS | MINDAYS | INTEGER |
| DirXML-ACF2-MODE | MODE | STATE |
| DirXML-ACF2-MON-LOG | MON-LOG | STATE |
| DirXML-ACF2-MONITOR | MONITOR | STATE |
| DirXML-ACF2-MOUNT | MOUNT | STATE |
| DirXML-ACF2-MSGID | MSGID | STATE |
| DirXML-ACF2-MULTSIGN | MULTSIGN | STATE |
| DirXML-ACF2-MUSASS | MUSASS | STATE |
| DirXML-ACF2-MUSDLID | MUSDLID | STRING |
| DirXML-ACF2-MUSID | MUSID | STRING |
| DirXML-ACF2-MUSIDINF | MUSIDINF | STATE |
| DirXML-ACF2-MUSUPDT | MUSUPDT | STATE |
| DirXML-ACF2-NAME | NAME | STRING |
| DirXML-ACF2-NO-INH | NO-INH | STATE |
| DirXML-ACF2-NO-OMVS | NO-OMVS | STATE |
| DirXML-ACF2-NO-SMC | NO-SMC | STATE |
| DirXML-ACF2-NO-STATS | NO-STATS | STATE |
| DirXML-ACF2-NO-STORE | NO-STORE | STATE |
| DirXML-ACF2-NOMAXVIO | NOMAXVIO | STATE |
| DirXML-ACF2-NON-CNCL | NON-CNCL | STATE |
| DirXML-ACF2-NOSPOOL | NOSPOOL | STRING |
| DirXML-ACF2-NOTICES | NOTICES | STATE |
| DirXML-ACF2-OPERATOR | OPERATOR | STATE |
| DirXML-ACF2-PASSWORD | PASSWORD | STRING |
| DirXML-ACF2-PAUSE | PAUSE | STATE |
| DirXML-ACF2-PGM | PGM | STRING |
| DirXML-ACF2-PHONE | PHONE | STRING |
| DirXML-ACF2-PMT-ACCT | PMT-ACCT | STATE |
| DirXML-ACF2-PMT-PROC | PMT-PROC | STATE |

| eDirectory Attribute | ACF2 Field | Syntax |
|---|---|---|
| DirXML-ACF2-PP-TRC | PP-TRC | STATE |
| DirXML-ACF2-PP-TRCV | PP-TRCV | STATE |
| DirXML-ACF2-PPGM | PPGM | STATE |
| DirXML-ACF2-PREFIX | PREFIX | STRING |
| DirXML-ACF2-PRIV-CTL | PRIV-CTL | STATE |
| DirXML-ACF2-PROGRAM | PROGRAM | STRING |
| DirXML-ACF2-PROMPT | PROMPT | STATE |
| DirXML-ACF2-PRV-TOD1 | PRV-TOD1 | STRING |
| DirXML-ACF2-PRV-TOD2 | PRV-TOD2 | STRING |
| DirXML-ACF2-PRV-TOD3 | PRV-TOD3 | STRING |
| DirXML-ACF2-PRV-TOD4 | PRV-TOD4 | STRING |
| DirXML-ACF2-PRVPSWD1 | PRVPSWD1 | STRING |
| DirXML-ACF2-PRVPSWD2 | PRVPSWD2 | STRING |
| DirXML-ACF2-PRVPSWD3 | PRVPSWD3 | STRING |
| DirXML-ACF2-PRVPSWD4 | PRVPSWD4 | STRING |
| DirXML-ACF2-PSWA1TOD | PSWA1TOD | STRING |
| DirXML-ACF2-PSWA1VAL | PSWA1VAL | STATE |
| DirXML-ACF2-PSWD-DAT | PSWD-DAT | STRING |
| DirXML-ACF2-PSWD-EXP | PSWD-EXP | STATE |
| DirXML-ACF2-PSWD-INV | PSWD-INV | INTEGER |
| DirXML-ACF2-PSWD-MIX | PSWD-MIX | STATE |
| DirXML-ACF2-PSWD-MX8 | PSWD-MX8 | STATE |
| DirXML-ACF2-PSWD-SRC | PSWD-SRC | STRING |
| DirXML-ACF2-PSWD-TIM | PSWD-TIM | STRING |
| DirXML-ACF2-PSWD-TOD | PSWD-TOD | STRING |
| DirXML-ACF2-PSWD-UPP | PSWD-UPP | STATE |
| DirXML-ACF2-PSWD-VIO | PSWD-VIO | INTEGER |
| DirXML-ACF2-PSWD-XTR | PSWD-XTR | STATE |
| DirXML-ACF2-PSWD-XTV | PSWD-XTV | STRING |
| DirXML-ACF2-PSWDAES1 | PSWDAES1 | STRING |
| DirXML-ACF2-PSWDCVIO | PSWDCVIO | INTEGER |
| DirXML-ACF2-PTICKET | PTICKET | STATE |

| eDirectory Attribute | ACF2 Field | Syntax |
|---|---|---|
| DirXML-ACF2-PWP-DATE | PWP-DATE | STRING |
| DirXML-ACF2-PWP-VIO | PWP-VIO | INTEGER |
| DirXML-ACF2-PWPALLOW | PWPALLOW | STATE |
| DirXML-ACF2-READALL | READALL | STATE |
| DirXML-ACF2-RECOVER | RECOVER | STATE |
| DirXML-ACF2-REFRESH | REFRESH | STATE |
| DirXML-ACF2-RESTRICT | RESTRICT | STATE |
| DirXML-ACF2-RSRCVLD | RSRCVLD | STATE |
| DirXML-ACF2-RSTDACC | RSTDACC | STATE |
| DirXML-ACF2-RULEVLD | RULEVLD | STATE |
| DirXML-ACF2-SCPLIST | SCPLIST | STRING |
| DirXML-ACF2-SEC-VIO | SEC-VIO | INTEGER |
| DirXML-ACF2-SECURITY | SECURITY | STATE |
| DirXML-ACF2-SHIFT | SHIFT | STRING |
| DirXML-ACF2-SMSINFO | SMSINFO | STRING |
| DirXML-ACF2-SOURCE | SOURCE | STRING |
| DirXML-ACF2-SRF | SRF | STATE |
| DirXML-ACF2-STC | STC | STATE |
| DirXML-ACF2-SUBAUTH | SUBAUTH | STATE |
| DirXML-ACF2-SUSPEND | SUSPEND | STATE |
| DirXML-ACF2-SYNCNODE | SYNCNODE | STRING |
| DirXML-ACF2-SYNERR | SYNERR | STRING |
| DirXML-ACF2-SYSPEXCL | SYSPEXCL | STATE |
| DirXML-ACF2-TAPE-BLP | TAPE-BLP | STATE |
| DirXML-ACF2-TAPE-LBL | TAPE-LBL | STATE |
| DirXML-ACF2-TDISKVLD | TDISKVLD | STATE |
| DirXML-ACF2-TRACE | TRACE | STATE |
| DirXML-ACF2-TSO | TSO | STATE |
| DirXML-ACF2-TSO-TRC | TSO-TRC | STATE |
| DirXML-ACF2-TSOACCT | TSOACCT | STRING |
| DirXML-ACF2-TSOCMDS | TSOCMDS | STRING |
| DirXML-ACF2-TSOFSCRN | TSOFSCRN | STATE |

| eDirectory Attribute | ACF2 Field | Syntax |
|---|---|---|
| DirXML-ACF2-TSOPERF | TSOPERF | INTEGER |
| DirXML-ACF2-TSOPROC | TSOPROC | STRING |
| DirXML-ACF2-TSORBA | TSORBA | STRING |
| DirXML-ACF2-TSORGN | TSORGN | INTEGER |
| DirXML-ACF2-TSOSIZE | TSOSIZE | INTEGER |
| DirXML-ACF2-TSOTIME | TSOTIME | INTEGER |
| DirXML-ACF2-TSOUNIT | TSOUNIT | STRING |
| DirXML-ACF2-UID | UID | STRING |
| DirXML-ACF2-UIDSCOPE | UIDSCOPE | STRING |
| DirXML-ACF2-UNICNTR | UNICNTR | STATE |
| DirXML-ACF2-UPD-TOD | UPD-TOD | STRING |
| DirXML-ACF2-USER | USER | STATE |
| DirXML-ACF2-VAR-HIGH | VAR-HIGH | STATE |
| DirXML-ACF2-VLD-ACCT | VLD-ACCT | STATE |
| DirXML-ACF2-VLD-PROC | VLD-PROC | STATE |
| DirXML-ACF2-VLDRSTCT | VLDRSTCT | STATE |
| DirXML-ACF2-VLDVMACT | VLDVMACT | STATE |
| DirXML-ACF2-VM | VM | STATE |
| DirXML-ACF2-VMACCT | VMACCT | STRING |
| DirXML-ACF2-VMD4AUTH | VMD4AUTH | STATE |
| DirXML-ACF2-VMD4FSEC | VMD4FSEC | STATE |
| DirXML-ACF2-VMD4RSET | VMD4RSET | STATE |
| DirXML-ACF2-VMD4TARG | VMD4TARG | STATE |
| DirXML-ACF2-VMESM | VMESM | STATE |
| DirXML-ACF2-VMIDLEMN | VMIDLEMN | INTEGER |
| DirXML-ACF2-VMIDLEOP | VMIDLEOP | STRING |
| DirXML-ACF2-VMSAF | VMSAF | STATE |
| DirXML-ACF2-VMSFS | VMSFS | STATE |
| DirXML-ACF2-VMXA | VMXA | STATE |
| DirXML-ACF2-VSESRF | VSESRF | STATE |
| DirXML-ACF2-WTP | WTP | STATE |
| DirXML-ACF2-ZONE | ZONE | STRING |