

Adabas for Linux and Cloud

Adabas Security Features

Version 7.3.0

February 2025

This document applies to Adabas for Linux and Cloud Version 7.3.0 and all subsequent releases.

Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

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Document ID: ADAOS-SECFAC-730-20250228

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Adabas Security Features

This document describes the security facilities provided by Adabas and its subsystems.

Adabas Role-based Security (ADARBA)

Adabas Role-based Security (ADARBA) provides facilities for controlling access to database resources; for example:

- Restricting the execution of an Adabas utility;
- Restricting access to data via Adabas commands.

Adabas Password Security (ADASCR)

Adabas Password Security (ADASCR) provides facilities for controlling access and update to Adabas files; for example:

- Restricting user read and/or update requests on the basis of a whole file;
- Restricting user access to individual records within a file.

Adabas Encryption for Linux

Adabas Encryption for Linux prevents the unauthorized analysis of Adabas data-at-rest. It provides functionality to encrypt ASSO and DATA container files as well as PLOG and backup copies.

Ciphering

Ciphering prevents the unauthorized analysis of Adabas container files.



Notes:

1. Ciphering is no longer recommended for safe implementations.
2. Ciphering does not fulfill modern encryption standards and security regulations.
3. Ciphering is maintained for historic and maintenance reasons only.

Adabas Encryption for Linux is highly recommended as a state-of-the-art replacement.

SSL Trusted Relationship for Natural

SSL Trusted Relationship for Natural enables Natural to make use of the Role Based Access Control without providing user credentials or using the Adabas user exit 21.

The following topics are covered:

- *Adabas Role-Based Security (ADARBA)*
- *Adabas Password Security (ADASCR)*
- *Adabas Encryption for Linux*
- *For maintenance only: Ciphering*

- *Security Considerations*
- *SSL Trusted Relationship for Natural*
- *GDPR Compliance*

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About this Documentation

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Document Conventions

| Convention | Description |
|----------------|--|
| Bold | Identifies elements on a screen. |
| Monospace font | Identifies service names and locations in the format <i>folder.subfolder.service</i> , APIs, Java classes, methods, properties. |
| <i>Italic</i> | Identifies: Variables for which you must supply values specific to your own situation or environment. New terms the first time they occur in the text. References to other documentation sources. |
| Monospace font | Identifies: Text you must type in. Messages displayed by the system. Program code. |
| { } | Indicates a set of choices from which you must choose one. Type only the information inside the curly braces. Do not type the { } symbols. |
| | Separates two mutually exclusive choices in a syntax line. Type one of these choices. Do not type the symbol. |
| [] | Indicates one or more options. Type only the information inside the square brackets. Do not type the [] symbols. |
| ... | Indicates that you can type multiple options of the same type. Type only the information. Do not type the ellipsis (...). |

Online Information and Support

Product Documentation

You can find the product documentation on our documentation website at <https://documentation.softwareag.com>.

Product Training

You can find helpful product training material on our Learning Portal at <https://learn.software-ag.com>.

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You can collaborate with Software GmbH experts on our Tech Community website at <https://tech-community.softwareag.com>. From here you can, for example:

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- Ask questions and find answers in our discussion forums.
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Product Support

Support for Software GmbH products is provided to licensed customers via our Empower Portal at <https://empower.softwareag.com>. Many services on this portal require that you have an account. If you do not yet have one, you can request it at <https://empower.softwareag.com/register>. Once you have an account, you can, for example:

- Download products, updates and fixes.
- Search the Knowledge Center for technical information and tips.
- Subscribe to early warnings and critical alerts.
- Open and update support incidents.
- Add product feature requests.

Data Protection

Software GmbH products provide functionality with respect to processing of personal data according to the EU General Data Protection Regulation (GDPR). Where applicable, appropriate steps are documented in the respective administration documentation.

2 Adabas Role-Based Security (ADARBA)

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Important: Before securing databases with Adabas Role-based Security, please familiarize yourself with the concepts and implementation of this feature. Once enabled, security cannot be disabled.

Adabas Role-based Security implements Role-Based Access Control (RBAC) and restricts access based on the roles assigned a user and the permissions that are assigned to the role.

With Adabas Role-based Security, you can control what end-users can do at both broad and granular levels. You can designate the roles assigned a user and align the roles and access privileges with your users' tasks. This means a user can be assigned a minimum of privileges, only the privileges essential to perform a specific task.

This feature includes the functionality:

Authentication

This provides a means of validating credentials against an authority.

Authorization for Direct Call Interface

This provides a means of restricting the usage of Adabas commands, which access a file, by assigning users a role which represents selective access privileges.

Authorization for Adabas Utilities

This provides a means of restricting the execution of Adabas utilities by assigning users a role which has the execute privilege.

Audit Trail

This provides a means of tracking access attempts and security violations.

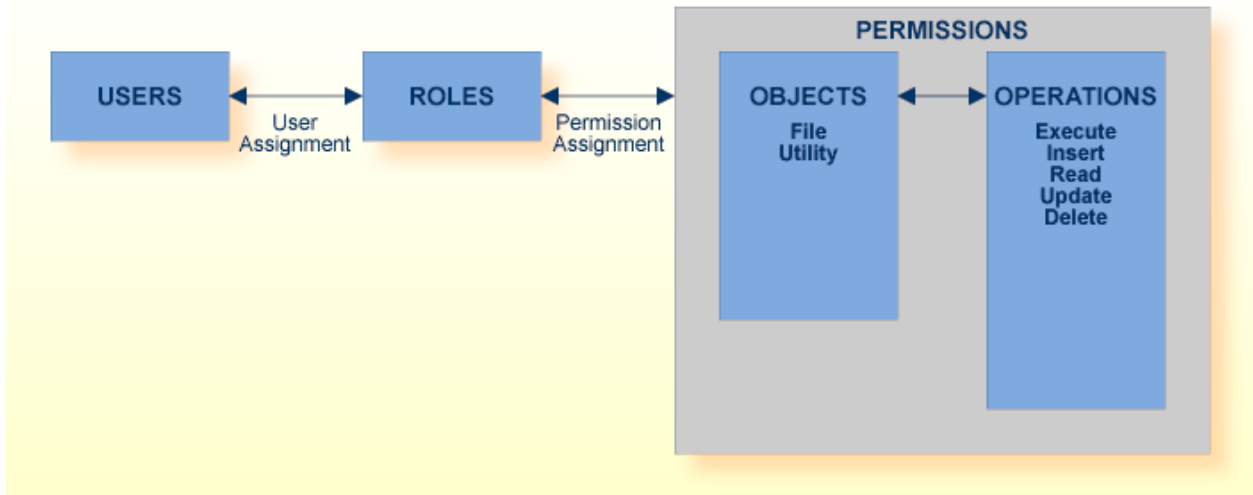
The utility ADARBA provides the functionality required to administer security definitions.

Adabas Role-Based Security Model

The RBAC reference model used by Adabas is based on the Core RBAC (RBAC0) of the ANSI Specification (ANSI INCITS 359-2004).

Core RBAC defines a minimum Role-Based Access Control system. This includes user-role assignment and permission-role assignment relations, considered fundamental in any RBAC system.

In the standard, the core RBAC model includes a set of sessions, where each session is a mapping between a user and an activated subset of roles that are assigned to the user. Sessions are currently not supported and are thus not part of the Adabas role-based security model.



The Adabas RBAC reference model enables the database or security administrator to implement the following:

- The assignment of **USERS** to **ROLES**,
- The assignment of **ROLES** to **PERMISSIONS**,
- where a **PERMISSION** consists of a set of **OPERATIONS** which can be performed on **OBJECTS**.

A *user* (**USER**) is defined as a human being. Although the concept of a user can be extended to include applications, the definition is limited to a person here for simplicity reasons.

A *role* (**ROLE**) is a job function within the context of an organization, with some associated semantics regarding the authority and responsibility conferred on the user assigned to the role.

Permissions (**PERMISSIONS**) are an approval to perform an operation on one or more RBAC protected objects.

An *operation* (**OPERATION**) is an action or function, such as the execution of an Adabas utility, Adabas command, etc.

An *object* (**OBJECT**) is a resource that is subject to access control, such as an Adabas database, file, etc.

Security Definitions

This section describes the location and content of the security definitions.

The security definitions are stored in the RBAC system file of a security-enabled database. The contents of the system file constitute the security repository.

The security repository stores granted privileges, the denial of specific operations is not supported. It is accessible when the database is online or offline.

Initial Security Definitions

The initial security definitions implement unrestricted access to all operations and can be adapted and extended as required.

The unrestricted access to operations is achieved via the **PUBLIC** user and **PUBLIC** role security definitions.

PUBLIC User

The **PUBLIC** user is a pre-defined security definition. It is a convenience definition that is used when the provided credentials cannot be validated. This user has the permissions that can be derived from the assigned roles.

The **PUBLIC** user may be modified as follows:

- The **PUBLIC** user may be dropped;
- The roles assigned to the **PUBLIC** user may be modified or removed as required. Additional roles may be assigned.

By default, the **PUBLIC** user is assigned the **PUBLIC** role.

PUBLIC Role

The **PUBLIC** role is a predefined security definition. All users have the permissions which are assigned to the **PUBLIC** role.

The **PUBLIC** role may be modified as follows:

- The **PUBLIC** role is a system definition and as such *should not be dropped*.
- The permissions assigned to the **PUBLIC** role may be modified or removed as required. Additional permissions may be assigned.

By default, the **PUBLIC** role has “legacy privileges”; for example, the privilege to execute to all Adabas utilities.

Authentication

Authentication provides a means of identifying a user, by having the user provide a valid user name and a valid password before access is granted.

The credentials are checked against an authentication authority, for example against an external authentication system such as LDAP, Active Directory, operating system, or an internal user repository. If the credentials match, the user is provided access to the database. If the credentials are at variance, authentication fails and access to the database is denied.

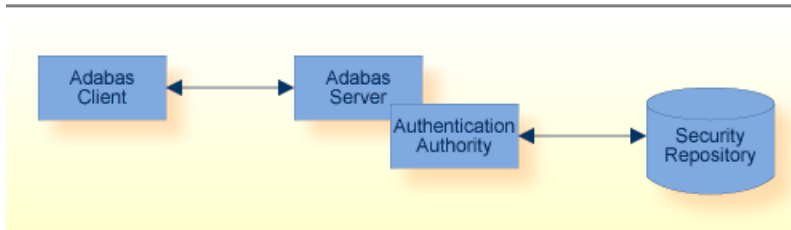
The results of the authentication check are protocolled in the audit trail log.

Please refer to the section *Configuration of the Infrastructure Security Libraries* for further information about the possible authentication authorities.

- [Architecture](#)
- [Credentials](#)

- Default State

Architecture



Adabas uses the Infrastructure Security Libraries to access the authentication authority for validation of credentials. These libraries enable the authentication of credentials against LDAP, Active Directory, and internal repository or the operating system.

The installation of the Infrastructure Security Libraries is mandatory for usage of this feature.

Please refer to the section on *configuration* for further details on how to configure the authentication feature.

Credentials

The credentials used by Adabas are user identification and password. The user identification consists of the user account name. In the case of Windows, the user identification also contains the domain of the user.

Adabas Direct Call Interface

Credentials can be provided by one of the following means:

- The application provides the credentials;
- The credentials are provided by the nucleus user exit 21.

The application should always provide the credentials to ensure that the application user can be identified. How applications credentials are supplied is described in the section *Developing Applications of Application Development*.

The nucleus user exit 21 can be used to transition existing applications to a secure database. Further information on this topic is provided in the section *Modifying Legacy Applications*.

The authentication authority that is to be used is defined in a database configuration file.

Adabas Utilities

Currently, the supported credentials are the local system credentials, which have been authenticated by the operating system.

- Linux: User ID
- Windows: Domain and User ID



Important: The Adabas utilities currently do not perform authentication checks. The local system credentials are used to perform the authorization check. This is subject to change in a future release.

Default State

By default, authentication is not enabled.

The configuration and usage of the authentication feature are described in [Configuration > Authentication](#) below.

Authorization

Authorization provides the means of restricting operations which are to be performed on a resource or, in other words, the execution of

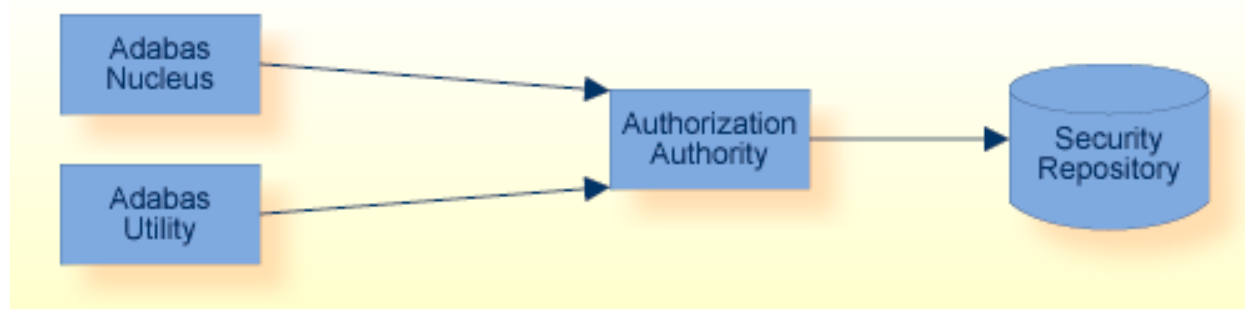
- An Adabas command on a file, or
- An Adabas utility on a database.

An access request can be issued by either the Adabas nucleus or an Adabas utility.

- The Adabas nucleus issues an access request prior to processing an Adabas command.
- An Adabas utility issues an access request prior to executing the requested utility.

The access request is validated by the authorization authority. It is validated against the security repository stored in the database. The credentials used to process the access request were validated previously by the authentication authority.

The results of the authorization check are protocolled in the audit trail log.



- Adabas Direct Call Interface
- Adabas Utilities
- Default State

Adabas Direct Call Interface

Authorization for Adabas Direct Call Interface allows you to secure specific database files against unauthorized access via Adabas commands.

This feature uses role-based security definitions to restrict and monitor the usage of the Adabas commands, which can be performed on a specific file in the database.

If a matching access privilege is found, the user is authorized to execute the requested operation, otherwise the request is rejected.

Attempts to execute a controlled operation, here an Adabas command, are documented in an audit trail. The configuration of the audit trail log is described in [Configuration > Audit Trail](#) below.

The following table is a list of controlled access operations on files:

| Operation | Description | Commands |
|-----------|---|--|
| READ | Read data stored in file | L1, L2, L3, L4, L5, L6, L9, S1, S2, S4, S8, S9 |
| INSERT | Insert data into the file | N1, N2 |
| UPDATE | Update data that is stored in a file | A1 |
| DELETE | Delete data that is stored in a file | E1 |
| ANY | This is a convenience notation. It includes the READ, INSERT, UPDATE and DELETE operations. | All of the commands above |



Note: In the current version, the execution of Adabas commands, which are not listed above, is not restricted. This will change in a future release.

The operation names above are the external representation of the security definitions.

When using the LIST function of the ADARBA utility, the internal representation of the security definition is shown.

| Operation | Description | LIST Layout |
|-----------|--------------------------------------|----------------|
| READ | Read data stored in a file | ada.dml.read |
| INSERT | Insert data into a file | ada.dml.insert |
| UPDATE | Update data that is stored in a file | ada.dml.update |
| DELETE | Delete data that is stored in a file | ada.dml.delete |

Adabas Utilities

Authorization for Adabas Utilities allows you to secure a specific database against unauthorized access via Adabas utilities.

This feature uses role-based security definitions to restrict and monitor the usage of the Adabas utilities, which can be performed on a specific database.

If a matching access privilege is found, the user is authorized to execute the requested operation, otherwise the request is rejected. The authorization of a request implies the privilege to execute the Adabas utility.

All attempts to execute an Adabas utility are documented in an audit trail.

The following table is a list of possible access operations on Adabas utilities; all values are case-sensitive:

| Operation Name | Utility | Description |
|----------------|---------|---|
| ada.uti.bck | ADABCK | Backup and restore database or files |
| ada.uti.clp | ADACLP | Command log report |
| ada.uti.cmp | ADACMP | Compression of data |
| ada.uti.cvt | ADACVT | Convert a database from a previous version |
| ada.uti.dbm | ADADBM | Database modification |
| ada.uti.dcu | ADADCU | Decompression of data |
| ada.uti.dev | ADADEV | Disk space management |
| ada.uti.ela | ADAELA | Event analytics administration |
| ada.uti.elp | ADAELP | Event log report |
| ada.uti.err | ADAERR | Error file report |
| ada.uti.fdu | ADAFDU | File definition |
| ada.uti.fin | ADAFIN | File information report |
| ada.uti.inv | ADAINV | Creating, removing and verifying inverted lists |
| ada.uti.mon | ADAMON | Monitoring the database nucleus |

| Operation Name | Utility | Description |
|----------------|---------|--|
| ada.uti.mup | ADAMUP | Mass add and delete |
| ada.uti.nuc | ADANUC | Starting the database, defining nucleus parameters |
| ada.uti.opr | ADAOPR | Operator utility |
| ada.uti.ord | ADAORD | Reorder the database or export/import files |
| ada.uti.plp | ADAPLP | Protection log printout |
| ada.uti.pri | ADAPRI | Print Adabas blocks |
| ada.uti.rba | ADARBA | RBAC administration |
| ada.uti.rec | ADAREC | Recovery of database or files |
| ada.uti.rep | ADAREP | Database report |
| ada.uti.scr | ADASCR | Manage and enable security functionality |
| ada.uti.uld | ADAULD | File unloading |
| ada.uti.vfy | ADAVFY | Database consistency check |



Note: The operation names listed above are subject to change.

Default State

By default, authorization is not enabled.

The configuration and usage of the authorization feature are described in [Configuration > Authorization](#) below.

Audit Trail

An audit trail entry is written to the audit trail log file for each authentication and authorization attempt. The audit trail logs both successful and failed attempts to access the database.

The content of each audit trail entry provides the following information on the attempted access:

- Timestamp of access attempt;
- Information about the application or utility, which attempted access;
- User and session identification of access attempt;
- Information about the attempted operation;
- Information about the object of the operation.

The following requirements apply to the audit trail log file:

- The audit entries are appended to the log file;

- The size of the log file should be monitored and the log file should be backed-up or moved as required.
 - [Authentication](#)
 - [Authorization for Adabas Direct Call Interface](#)
 - [Authorization for Adabas Utilities](#)
 - [Default State](#)

Authentication

The location and layout of the audit trail log file is described in the section *Authorization for Adabas Direct Call Interface*.

Authorization for Adabas Direct Call Interface

Location

The audit trail log is database-specific and is located in the database directory. The file name is *NUCADT.log*.

Layout of Audit Trail Entry

The layout of the audit trail log file is CSV format. The values of the audit trail entry are separated by comma “,”.

The following table contains a description of the audit trail entries for authentication and authorization, the values provided in each audit trail entry are dependent on the type of entry.


| Column | Description | Value |
|---------------|---|--------------------|
| Timestamp | Timestamp | |
| Security Mode | Security Mode | A[ctive] W[arn] |
| Result | Processing result - access is allowed or not | YES NO |
| DBID | Database ID | |
| DBName | Database name | |
| Session ID | Client information, as specified in the Adabas User Queue | |
| ET User | ET User | |
| Security User | User credential provided for authentication | |
| RBAC User | User credential used to determine access privileges | |
| RBAC Role | Role with which access privilege was given | |

| Column | Description | Value |
|---------------|---|------------------------------------|
| Operation | Adabas command category | INSERT READ UPDATE DELETE |
| Command | Adabas command code | |
| File Number | Adabas file number | |
| File Name | Adabas file name | |
| Authority | Authentication or Authorization authority | SSX RBAC |
| Response Code | Adabas response code | |
| Subcode | Adabas subcode | |
| SSX Response | SSX response | |
| SSX Message | SSX message | |

Authorization for Adabas Utilities

In this release, the *adaaudit.ini* configuration file defines the layout and location of the audit trail.

Please refer to the section *Location of Configuration and Logging Files* for further information about the location, configuration and content of the audit trail for Authorization for Adabas Utilities.

 **Important:** The location and configuration of the audit trail log file for Authorization for Adabas utilities is deprecated. It is subject to change in a future release.

Layout of Audit Trail Entry.

| Column | Description | Prefix | Values |
|---------------|--------------------------------------|-----------------|--------------------------|
| Timestamp | Timestamp | | yyyy-mm-ddThh:mm:ssZ |
| Message Type | Message indicator | %AUTHORIZATION- | I[nformation] E[rror] |
| Hostname | Host name of machine | HOST= | <hostname> |
| Opsys Version | Name and version of operating system | OS= | <operating_system> |
| Credentials | Name of user account | USER= | [<domain>/]<user> |
| Operation | Name of attempted operation | OPERATION= | <operation> |
| DBID | Database ID | DBID= | <number> |
| Result | Result of authorization | AUTHORIZED= | YES NO |

Default State

The audit trail is automatically enabled when either authentication or authorization is enabled.

Please refer to the section *Location of Configuration and Logging Files* for further information on the configuration of the contents of the audit trail log file.

The configuration and usage of the authorization feature are described below.

Configuration

This section describes the configuration of the Adabas Role-based Security feature.

- [Initial Security Configuration](#)
- [Authentication](#)
- [Authorization](#)
- [Audit Trail](#)

Initial Security Configuration

An initial security configuration is created during installation.

- Authentication is not enabled;
- Authorization is not enabled;
- Audit Trail is not enabled.

Authentication



Important: Database security cannot be disabled once it has been activated.

Enable Authentication

Use the SECURITY function of the ADADBM utility to enable the authentication. The security mode can either be set to WARN or ACTIVE.

The security mode ACTIVE implies that only authenticated users are allowed access to the database. Security violations, such as authentication errors, are protocolled as “Error” in the audit trail.

The security mode WARN is intended for transitioning applications to use a secure database. It implies that all users are allowed access to the database. Security violations, like authentication or authorization errors, are protocolled as “Warning” in the audit trail. In case of a security violation, access to the operation is not rejected.

Once enabled, the security mode can only be changed from mode WARN to ACTIVE.

When you introduce this feature, Software AG strongly recommends that you initially start with security mode WARN.

Please refer to the section *Nucleus user exit 21* for detailed information on how to provide authentication credentials for legacy applications.

Configure Authentication Authority

The following types of authentication authority are supported:

- Authentication Type OS (Operating System)
- Authentication Type TEXT (Internal User Repository)
- Authentication Type LDAP
- Authentication Type ADSI

These settings are described in the section *Configuration of the Infrastructure Security Library*, where you can find example templates for the different authentication types. These templates are not complete as some of the settings are customer-specific and must be modified where necessary.

These configuration settings are stored in the section [SSX_CONFIGURATION] of the *DBnnn.INI* file. Use the administration command ADAINI to set and modify these settings.

Authorization

Enable Authorization

Use the INITIALIZE function with the RBAC_FILE parameter of the ADARBA utility to load the RBAC system file.

Define Security Definitions

Use the ADARBA utility to manage customer-specific security definitions.

Please refer to the examples in section *Getting Started* for further information.



Note: The RBAC System File is closely related to the database. It has to be backed up and restored together with the complete database and cannot be restored individually.

Audit Trail

Authentication and Authorization for Direct Call Interface

The audit trail log is written to the file *NUCADT.log*, which is located in the database directory.

The configuration settings are stored in the section [AUDIT_TRAIL] of the *DBnnn.INI* file. Use the administration command ADAINI to set and modify these settings.

The following AUDIT_TRAIL settings can be used to configure the audit trail:

ACTION

Enable or disable Audit Trail logging for authentication and authorization.

FILTER

Log ALL audit trail entries or just the entries for REJECTED authentications and authorizations.

MAXFILESIZE

If the current NUCADT log file exceeds this value(default 100 MB), new audit file will be created with next sequential number.

Please refer to the section *Configuration Files* for further information on AUDIT_TRAIL settings .

Authorization for Utilities

The configuration settings for the audit trail log file are stored in the database.

The following options are available:

- The item FORMAT defines the layout of an audit log entry.
- The item SEPARATOR defines the character to be used to separate values in CSV format.
- The item LOG_FILE defines the location and file name of the audit log.

Please refer to the section *Configuring Adabas Role-based Security* for further information.

Administration

The utilities required to configure and administer the authorization feature are:

- ADADBM
- ADAINI
- ADAREP

■ **ADARBA**

ADADBM

- Use the SECURITY function to enable Adabas RBAC Security;



Note: These functions require that the database is offline.

ADAINI

- Use the administration command ADAINI to set and modify the configuration of security features;
- Configure the authentication authority;
- Configure the audit trail;
- Display the configuration settings.

ADAREP

- Use the SUMMARY function to display the database system files and whether security is enabled;
- The SECURITY setting is displayed if security is enabled;
- The RBAC system file information is displayed if the RBAC system file is defined.

ADARBA

- Use the CREATE, DROP, GRANT, REVOKE functions to create, modify and delete security definitions;
- Use the LIST functions to display the security definitions.
- Use the RBAC_FILE function to create the RBAC system file.



Note: These functions require that the database is online.

Performance Considerations

Authentication

This feature could have a detrimental effect on the overall system performance for the following reasons:

- Due to the effort required to authenticate the credentials;
- Due to the large number of entries being written to the audit trail log file.

Authorization for Direct Call Interface

This feature could have a detrimental effect on the overall system performance for the following reasons:

- Due to the effort required to authenticate the credentials;
- Due to the effort required to determine the user's access privileges;
- Due to the large number of entries being written to the audit trail log file.

Authorization for Adabas Utilities

This feature only has minimal impact on the overall system performance.

Audit Trail

Due to the high number of synchronized file I/Os, this feature could have a detrimental influence on the overall system performance.

The impact can be minimized by using the AUDIT_TRAIL parameter setting FILTER=REJECTED for authentication and authorization for Direct Call Interface requests.

The following configuration options have a detrimental influence on performance, and should be used with care:

| Feature | Option | Explanation |
|-------------|--------|--|
| Audit Trail | Filter | <p>A large number of user sessions or Adabas commands will result in a large number of security entries being written to the audit trail log file. The size of the audit trail log file increases rapidly with the numbers of user sessions or Adabas commands.</p> <p>Default value: FILTER = ALL</p> <p>Recommended value: FILTER = REJECTED</p> |

| Feature | Option | Explanation |
|----------------------------|----------------|--|
| SSX Logging/Diagnostics | nativeloglevel | Multiple user sessions attempting to write diagnostic information concurrently to the security infrastructure log file. Default value: None Recommended value: 0 or None |

Application Development

This section covers the following topics:

- [Developing Applications](#)
- [Modifying Legacy Applications](#)
- [Error Handling](#)
- [Messages and Codes](#)

Developing Applications

The application is responsible for setting the user credentials prior to opening a database session.

The following Adabas client functions are provided to manage client sessions and set credentials:

| Step | Function | Description |
|------|---------------------|---|
| 1 | lnk_set_adabas_id() | Set the session identification. |
| 2 | lnk_set_uid_pw() | Set the authentication credentials for a specific database. |

Details about the above Adabas client functions can be found in the section *Calling Adabas with Authentication* in the section *Calling Adabas* in the *Command Reference*.

It is recommended to use `OPTIONS=OPEN_REQUIRED`.

Modifying Legacy Applications

Without modification, legacy applications will receive the nucleus response 200 “security violation”, when accessing secured databases.

The Adabas nucleus user exit 21 can be used to set authentication credentials via the Adabas server API functions. The routine is called when the processing of a session begins.

This routine should be used as briefly as possible. It is intended for use during the transition period, until all applications use and support the Adabas security authentication feature.

For further details, see the nucleus user exit 21 in the section *User Exits and Hyperexits*.

Error Handling

Security Mode Active

If a security violation occurs during authentication processing, Adabas issues a response code, backs out the user's current transaction, and closes the user session.

- Response code 9, subcode SE
- Response code 200, subcode 31

If a security violation occurs during authorization processing, Adabas issues a response code,

- Response code 200, subcode 175

Security Mode WARN

The error handling for security mode WARN is intended for transitioning to a secure database. The error handling is described below. It differs to that of mode ACTIVE.

- The current transaction is not backed out;
- The response code returned indicates “success” (response 0);
- A “Warning” entry is entered in the audit trail log file.

Messages and Codes

The following Adabas nucleus response codes indicate that a security issue has occurred:

Authentication

| Response Code | Explanation | Action |
|---------------|---|---|
| 9/SE | The credentials have been modified since the start of the session. Hence the credentials are invalid, and the user session has been terminated. | Ensure that the credentials are not set or modified during a user session. To proceed processing, set the credentials and open a new user session. |
| 200/31 | The credentials could not be validated by the authentication authority. | Ensure that the credentials have been provided and that they are valid. |

Authorization

| Response Code | Explanation | Action |
|---------------|--|---|
| 200/175 | The user identified by the provided credentials does not have the privileges to perform the requested operation. | Ensure that the credentials have the required privileges. |

Getting Started

This section covers the following topics:

- [Prerequisites](#)
- [Configuration](#)
- [Authentication](#)
- [Authorization for Direct Call Interface](#)
- [Authorization for Adabas Utilities](#)

Prerequisites

In order to execute the steps described in the following section, you will require a database.

The following prerequisites are mandatory:

- The Infrastructure Security Libraries are installed.
- The security feature is enabled.

Authentication has the following prerequisites:

- The security mode is enabled.
- The user credentials that are to be validated by the authentication authority.

Authorization has the following prerequisites:

- The RBAC system file is loaded.
- Security definitions will be required.

You, or an administrator, will require the necessary access privileges:

- To modify the security configuration files.
- To create and configure a database.
- To start and stop a database.



Important: When starting with the Adabas RBAC security feature, it is recommended to create a database and to initially use the SECURITY mode WARN. Once the Adabas role-based security feature has been enabled, it cannot be disabled.

Configuration

This section describes how to configure Adabas role-based security (ADARBA).

Authentication

The following steps describe how to enable authentication.

1. Ensure the database is offline.
2. Configure the authentication authority for the database.
3. Enable authentication by setting the SECURITY mode.
4. Start the database.



Note: Authentication is not required and does not have to be enabled for Authorization for Adabas Utilities.

The authentication examples below use the internal user repository as the authentication authority.

Example: Create Credential in an Internal User Repository

This example shows how to create a user, password credential in an internal user repository.

```
> ssxtxtpasswd -f SAGInternalUserRepository.txt -c -p mypsw myuid

Hash: ↵
b0EOAPEEEJBKv+4z0ELiYcFqY7qFh1LZz1ha7Ztf7j/drJHGy2ML0LXEu/kX7TD52Aj7XfwiZ+vpI19DqRbVka==
User entry for "myuid" successfully added
```

The contents of the file *SAGInternalUserRepository.txt* are shown below:

```
*
*
* SAG Internal User Repository
*
version:3.0
*
user:myuid:$6a$b0EOAPEEEJBKv+4z0ELiYcFqY7qFh1LZz1ha7Ztf7j/drJHGy2ML0LXEu/kX7TD52Aj7XfwiZ+vpI19DqRbVka
```

Please refer to the section *Configuring the Infrastructure Security Libraries* for further information about how to create and administer an internal user repository.

Example: Configure the Authentication Authority

This example shows the configuration of authentication with a text file. This file contains authenticated credentials and passwords. Please refer to the section describing the [Configuration](#) for further information on the creation and administration of an authentication text file.

```
DBnnn.INI
```

```
> adaini dbid=nnn add topic=DB_PARAMETER topic=SSX_CONFIGURATION item=authType=TEXT  
> adaini dbid=nnn add topic=DB_PARAMETER topic=SSX_CONFIGURATION ↵  
item=internalRepository=SAGInternalUserRepository.txt
```

Please refer the section *Validating the Configuration* for an example on how to display the SSX_CONFIGURATION settings.

Example: Enable Security Mode

This example shows how to enable the security mode, which enables authentication. When starting with the Adabas RBAC security feature, it is recommended to initially use the SECURITY mode WARN.

Use the SECURITY function of the ADADBM utility to activate the authentication feature.

```
> adadbm dbid=nnn security=warn  
%ADADBM-I-STARTED,      15-AUG-2018 11:13:39, Version 6.7.0.0  
%ADADBM-I-DBOFF, database 224 accessed offline  
%ADADBM-I-FUNC, function SECURITY executed
```

Authorization

The following steps describe how to enable authorization.

1. Ensure the database is offline.
2. Load the RBAC system file.
3. Start the database.

Example: Load the RBAC System File

Use the INITIALIZE function of the ADARBA utility to load the RBAC system file. The RBAC_FILE function of the ADADBM utility, which was previously used to load the RBAC system file, has been deprecated.


```
> adarba dbid=190 initialize rbac_file=250
%ADARBA-I-STARTED,      05-JUN-2023 10:35:21, Version 7.2.0.0 (Linux 64Bit)
%ADARBA-I-INP, dbid=190
%ADARBA-I-DBON, database 190 accessed online
%ADARBA-I-INP, initialize,rbac_file=250
%ADARBA-I-LOADED, file 250, "RBAC-FILE" loaded
%ADARBA-I-STATCMD, 0 error(s) occurred
Restore files dumped on 27-JUL-2018 09:00:19
%ADARBA-I-TERMINATED,   05-JUN-2023 10:35:22, elapsed time: 00:00:01
```

Please refer the section *Validating the Configuration* for an example of how to display the RBAC system file information.

Audit Trail

Authentication and Authorization Adabas Direct Call Interface

The audit trail log file for authentication and authorization for Adabas direct call interface is located in the database directory. The file name is *NUCADT.LOG*.

The following steps describe how to enable the audit trail for authentication and authorization for Adabas direct call interface.

1. Configure the audit trail for authentication and authorization for Adabas direct call interface.
2. Restart the database, so that the modifications are active.

The following example shows the configuration of the audit trail for authentication and authorization for Adabas direct call interface.

```
DBnnn.INI

> adaini dbid=nnn add topic=DB_PARAMETER topic=AUDIT_TRAIL item=FILTER=ALL
> adaini dbid=nnn add topic=DB_PARAMETER topic=AUDIT_TRAIL item=ACTION=YES
```

Please refer the section *Validating the Configuration* for an example of how to display the audit trail settings.

Authorization Adabas Utilities

The modification of the audit trail configuration file settings is described in the section *Configuration for Authorization for Adabas Utilities*.

Example: Display Audit Definitions

The example shows the initial values for audit of utility authorization. Start the database and display the audit definitions.

```
> adarba db=nnn audit,display

%ADARBA-I-STARTED,      26-MAR-2024 14:58:52, Version 7.3.0.0 (Linux 64Bit)
%ADARBA-I-INP, dbid=nnn
%ADARBA-I-DBON, database nnn accessed online
%ADARBA-I-INP, audit,display

AUDIT=YES
FORMAT=TEXT
SEPARATOR=;
LOGFILE=${ADADATADIR}/dbnnn/adaaudit.log

%ADARBA-I-STATCMD, 0 error(s) occurred
%ADARBA-I-TERMINATED,   26-MAR-2024 14:58:52, elapsed time: 00:00:00
```

Validating the Configuration

The following examples show how you can validate the configuration of authentication and authorization.

Example: Database Report - Security Configuration

Use the SUMMARY function of the ADAREP utility to display the SECURITY mode setting and the RBAC system file information.

When enabled, the SECURITY mode will be displayed with a value of either WARN or ACTIVE. When not enabled, the SECURITY mode is not displayed.

When loaded, the file number of RBAC system file will be shown.

```
> adarep dbid=nnn summary

%ADAREP-I-STARTED,      15-AUG-2018 15:37:23, Version 6.7.0.0

Summary of Database nnn      15-AUG-2018 15:37:23

DATABASE NAME              EXAMPLE-DB
DATABASE ID                224
MAXIMUM FILE NUMBER LOADED 255
SYSTEM FILES               255 (CHK), 251 (SEC), 254 (USR)
                           250 (RBAC)
ACTUAL FILES LOADED        8
CURRENT PLOG NUMBER        4
CURRENT CLOG NUMBER        0
SECURITY                   WARN

Container  Device  Extents in Blocks  Number of  Block  Total Size
File      Type    from             to         Blocks Size  (Megabytes)
```

| | | | | | | |
|--|------|-------|--------|-------|-------|-------|
| ----- | | | | | | |
| ASS01 | file | 1 | 2,000 | 2,000 | 2,048 | 3.91 |
| ASS02 | file | 2,001 | 10,000 | 8,000 | 2,048 | 15.63 |
| | | | | | | |
| DATA1 | file | 1 | 2,000 | 2,000 | 4,096 | 7.81 |
| DATA2 | file | 2,001 | 10,000 | 8,000 | 4,096 | 31.25 |
| | | | | | | |
| WORK1 | file | 1 | 2,000 | 2,000 | 4,096 | 7.81 |
| ----- | | | | | | |
| | | | | | | 66.41 |
| | | | | | | ===== |
| | | | | | | |
| %ADAREP-I-IOCNT, 17 IOs on dataset ASS0 | | | | | | |
| %ADAREP-I-TERMINATED, 15-AUG-2018 15:37:23, elapsed time: 00:00:00 | | | | | | |

Example: Display Authentication Configuration

Use the SHOW function of the administration command ADAINI to display the authentication configuration.

Show the configuration of the authentication authority.

```
> adaini dbid=nnn show topic=DB_PARAMETER topic=SSX_CONFIGURATION

authType=TEXT
internalRepository=path_and_name_ssxuser_file
```

Display Audit Trail Configuration

Use the SHOW function of the administration command ADAINI to display the audit trail configuration.

Show the audit trail configuration for authentication and authorization for Adabas direct call interface.

```
> adaini dbid=nnn show topic=DB_PARAMETER topic=AUDIT_TRAIL

ACTION=YES
FILTER=ALL
```

Example: Security Infrastructure Initialized

The security infrastructure is initialized during the start of the ADANUC utility. This infrastructure is used for authentication and indicates that the authentication feature is enabled and that the SSX_CONFIGURATION parameters have been processed.

```
> adanuc dbid=nnn

%ADANUC-I-STARTED,      15-AUG-2018 16:21:59, Version 6.7.0.0

%ADANUC-I-SSXINI, SSX Security Infrastructure initialized
%ADANUC-I-CREATED, dataset NUCTMP1, file D:\ADADATADIR\dbnnn\NUCTMP1.nnn created
%ADANUC-I-PLOGCRE, plog NUCPLG, file 'D:\ADADATADIR\dbnnn\NUCPLG.0001' created
%ADANUC-I-DBSTART, Database nnn, session 5 started, 15-AUG-2018 16:22:02
```

Example: Display Security Definitions

The examples below show the initial values of the security definitions stored in the security repository. Start the database and display the security definitions.

```
> adarba dbid=nnn list,user
```

This shows the user *PUBLIC*.

```
> adarba dbid=nnn list,role
```

This shows the role *PUBLIC*.

```
> adarba dbid=nnn list,assignment,user
```

This shows the assignment *PUBLIC,PUBLIC*. That is the role *PUBLIC* has been assigned to the user *PUBLIC*.

Authentication

The usage of authentication requires that the credentials be set by the application, or be provided by the Adabas nucleus user exit 21. Please refer the section [Application Development](#) for further information on the setting credentials.

Example: Use ADATST to validate Credentials

The example below show how ADATST can be used to verify the authentication of credentials.

```
> adatst

%ADATST-I-STARTED,      16-AUG-2018 12:11:22, Version 6.7.0.0

> adatst: ;----- Database ID
> adatst: dbid=<dbid>

> adatst: ;----- Credentials (without trailing whitespace)
> adatst: sec_uid=<userid>
> adatst: sec_pwd=<password>
```

```

> adatst: ;----- Session Open
> adatst: cc=op
> adatst: rb=.
> adatst: go

    Command : OP      Test-Nr : 1 Started
%ADATST-I-NORMAL, normal successful completion
    Command : OP      Test-Nr : 1 Completed

> adatst: ;----- Session Close
> adatst: cc=cl
> adatst: go

    Command : CL      Test-Nr : 2 Started
%ADATST-I-NORMAL, normal successful completion
    Command : CL      Test-Nr : 2 Completed

> adatst: quit

%ADATST-I-TERMINATED, 16-AUG-2018 12:11:22, elapsed time: 00:00:00

```

A nucleus response code 200 with subcode 31 indicates a security violation; the authentication check in the external security system failed.

Possible causes of a security violation are:

- The credentials are invalid.
- The configuration of the authentication authority is invalid.
- The authentication authority is not accessible.

A nucleus response code 9 with subcode SE indicates that the credentials have been modified; for example by altering the credentials during the open session.

Example: Use ADATST to validate the usage of Nucleus user exit 21

The example below shows how ADATST can be used to verify that valid credentials are provided by nucleus user exit 21. The user exit is called to provide credentials if the calling application has not provided credentials.

```

> adatst

%ADATST-I-STARTED, 16-AUG-2018 12:11:22, Version 6.7.0.0

> adatst: ;----- Database ID
> adatst: dbid=<dbid>

> adatst: ;----- Session Open
> adatst: cc=op
> adatst: rb=.
> adatst: go

```

```

Command : OP      Test-Nr : 1 Started
%ADATST-I-NORMAL, normal successful completion
Command : OP      Test-Nr : 1 Completed

> adatst: ;----- Session Close
> adatst: cc=cl
> adatst: go

Command : CL      Test-Nr : 2 Started
%ADATST-I-NORMAL, normal successful completion
Command : CL      Test-Nr : 2 Completed

> adatst: quit

%ADATST-I-TERMINATED, 16-AUG-2018 12:11:22, elapsed time: 00:00:00

```

A nucleus response code 200 with subcode 31 indicates a security violation; the authentication check in the external security system failed.

Possible causes of a security violation are:

- Nucleus user exit 21 is not enabled.
- The provided credentials are invalid.
- The configuration of the authentication authority is invalid.
- The authentication authority is not accessible.

Authorization for Direct Call Interface

This section describes how to secure access to application data, for example allowing all users READ access to the EMPLOYEES file, and at the same time restricting the privilege to modify data.

In this example, you will create and modify the security definitions. In the end, only users assigned the HR_department role are able to modify data in the EMPLOYEES file, but all users are allowed to READ the file.

To achieve this, you need to:

- Create a HR_department role;
- Grant the role permission to modify the EMPLOYEES file;
- Create an HR_userid user;
- Grant the user the HR_department role;
- Grant the *PUBLIC* role permission to READ the EMPLOYEES file.

Example: Secure access to the EMPLOYEES File

The examples below show the security definitions required to restrict access to the EMPLOYEES file.

```
> adarba
> adarba: dbid=nnn

> adarba: create,role=HR_department
> adarba: grant,operation=ANY,object=11,to,role=HR_department

> adarba: create,user=HR_userid
> adarba: grant,role=HR_department,to,user=HR_userid

> adarba: grant,operation=READ,object=11,to,role=PUBLIC
```

The following security definitions are created or modified:

■ Created:

- Role: *HR_department*
- User: *HR_userid*
- Permission to Operation and Object: *ANY, File 11 (EMPLOYEES-NAT)*

■ Modified:

- Role: *PUBLIC*
- Permission to Operation and Object: *READ, File 11 (EMPLOYEES-NAT)*



Note: The role name and the user name are site-specific.

The user name used for authorization is the same as the one used for authentication.

The user name must be defined for both authorization and authentication.

List Security Definitions

The example below shows the security definitions which secure access to the EMPLOYEES file.

```
> adarba
> adarba: dbid=nnn

> adarba: ; ----- USERS
> adarba: list,user
PUBLIC
HR_userid
```

```
> adarba: ; ----- ROLES
> adarba: list,role
PUBLIC
HR_department

> adarba: ; ----- USER-ROLE ASSIGNMENTS
> adarba: list,assignment,user
PUBLIC,PUBLIC
HR_department,HR_userid

> adarba: ; ----- PERMISSIONS
> adarba: list,assignment,permission
ada.uti....,DBID.CURRENT,PUBLIC
ada.uti....,DBID.CURRENT,PUBLIC
ada.uti....,DBID.CURRENT,PUBLIC

ada.dml.delete,FILE.00000011,HR_department
ada.dml.insert,FILE.00000011,HR_department
ada.dml.read,FILE.00000011,HR_department
ada.dml.update,FILE.00000011,HR_department

ada.dml.read,FILE.00000011,PUBLIC
```

Authorization for Adabas Utilities

This section describes how to secure access to an Adabas utility, for example the ADADBM utility.

In this example, you will create and modify the security definitions. By default, all users with the *PUBLIC* role have access to and can execute the ADADBM utility. In the end, only users assigned the database administrator role are able to execute the utility.

To achieve this, you need to:

- Create a *database administrator* role;
- Grant the role permission to execute the utility;
- Create a user that is to be assigned the *database administrator* role;
- Grant the user the *database administrator* role;
- Revoke the permission to execute the utility from the role *PUBLIC*.

Example: Secure access to the ADADBM utility

```

> adarba
> adarba: dbid=nnn

> adarba: create,role=database_administrator
> adarba: grant,operation=ada.uti.dbm,to,role=database_administrator

> adarba: create,user=dba_userid
> adarba: grant,role=database_administrator,to,user=dba_userid

> adarba: revoke,operation=ada.uti.dbm,from,role=PUBLIC

```

In this example, the following security definitions are created or modified:

■ Created:

- Role: *database_administrator*
- User credentials: *dba_userid*
- Permission to operation: *ada.uti.dbm*

■ Modified:

- Role: *PUBLIC*
- Permission to operation: *ada.uti.dbm*



Note: The role name and the user credentials are site-specific. The user credentials used for authorization are local system credentials.

Example: List Security Definitions

The example below shows the security definitions that secure access to the ADADBM utility.

```

> adarba
> adarba: dbid=nnn

> adarba: ; ----- USERS
> adarba: list,user
PUBLIC
dba_userid

> adarba: ; ----- ROLES
> adarba: list,role
PUBLIC
database_administrator

> adarba: ; ----- USER-ROLE ASSIGNMENTS

```

```
> adarba: list,assignment,user
PUBLIC,PUBLIC
database_administrator,dba_userid

> adarba: ; ----- PERMISSIONS
> adarba: list,assignment,permission
ada.uti....,DBID.CURRENT,PUBLIC
ada.uti....,DBID.CURRENT,PUBLIC
ada.uti....,DBID.CURRENT,PUBLIC

ada.uti.dbm,DBID.CURRENT,database_administrator
```

Infrastructure Security Library

The infrastructure security libraries are used to access the authentication authority. The following sections contain configuration templates for the `SSX_CONFIGURATION` parameters, organized by type.

- [Authentication Type OS \(Operating System\)](#)
- [Authentication Type TEXT \(Internal User Repository\)](#)
- [Authentication Type LDAP](#)
- [Authorization Type ADSI](#)
- [Creating Internal User Repository Files](#)

Authentication Type OS (Operating System)

The security definitions for authentication type OS are managed by the local operating system.

```
[SSX_CONFIGURATION]

# This is a sample properties file for the case
# when authType is OS and the user database is
# the local operating system -
# On Linux Systems it is using PAM authentication
# On Windows a local LogonUser()

# Specifies the authentication type.
# Is Required: Yes
# Valid values: {"OS", "TEXT", "LDAP", "ADSI"}
# Default Value: None

authType=OS

# Specifies the explicit path of the privileged daemon process.
# Specify this parameter -
# if the sagssxauthd2 executable file is not in the current directory.
```

```

# Valid value is the valid path to the sagssxauthd2 module.
# Default Value: None
# Note: Linux only.

###authDaemonPath

# Specify a default group name here to be returned
# with any of the group results that are returned by the repository manager.
# A valid value is any valid group name.
# Default Value: None
# Optional.

###defaultGroup

# If this parameter is specified, its value is used at authentication time
# when domain name is not specified by the user.
# If a domain name is specified, the value of this parameter is not used.
# A valid value is any valid domain name.
# Default Value: None
# Optional.

###defaultDomain

# Specifies how to access data.
# Valid values are:
# o true - Access is under the account of the running process.
# o false - Access is under the impersonated user ID of the logged on user.
# Default Value: FALSE
# Note: Windows only.
# Optional.

###noImpersonation

# Specifies the local machine name (on which the user is authenticated).
# The machine name is added before users and groups;
# for example,machine_name\user.
# Valid values are:
# o true - If set to TRUE (and there is no domain field), you are authenticated ←
against the local machine only.
# o false - You are authenticated on the domain that you logged on.
# Default Value: FALSE
# Optional.

###linuxAddMachineName

# Specifies the log level.
# Is Required: No
# Valid values:
# 0 - No logging
# Min: 1
# Max: 6
# Default Value: None

```

```
##nativeLogLevel=0

# Specifies the log file.
# Is Required: No
# Valid values:
#   fully qualified file name
# Default Value: None

##nativeLogFile=SAGSSXCLIENTA_SSX.LOG

[SSX_CONFIGURATION-END]
```

Authentication Type TEXT (Internal User Repository)

The security definitions for authentication type TEXT are stored in a text file. The definitions can either be database-specific or be shared by multiple databases.

```
[SSX_CONFIGURATION]

# This is a sample properties file for the case
# when authType is TEXT and the user database is
# an SAG Internal User Repository
# created by the ssxtxtpasswd utility

# Specifies the authentication type.
# Is Required: Yes
# Valid values: {"OS", "TEXT", "LDAP", "ADSI"}
# Default Value: None

    authType=TEXT

# Specifies the internal repository file
# which has been created with ssxtxtpasswd utility
# Is Required: No
# Valid values:
#   fully qualified file name
# Default Value: None

    internalRepository=<fullpath>/<filename>.<ext>

# Specifies the log level.
# Is Required: No
# Valid values:
#   0 - No logging
#   Min: 1
#   Max: 6
# Default Value: None

##nativeLogLevel=0
```

```
# Specifies the log file.
# Is Required: No
# Valid values:
#   fully qualified file name
# No default value

##nativeLogFile=SAGSSXCLIENTA_SSX.LOG

[SSX_CONFIGURATION-END]
```

Authentication Type LDAP

```
[SSX_CONFIGURATION]

# This is a sample properties file for the case
# when authType is LDAP and the user database is OpenLDAP

# Specifies the authentication type.
# Is Required: Yes
# Valid values: {"OS", "TEXT", "LDAP", "ADSI"}
# Default Value: None

    authType=LDAP

# Specifies which server type will be used.
# Is Required: No
# Valid values: {"ActiveDirectory", "SunOneDirectory", "OpenLdap"}
# Default value: "OpenLdap"

    serverType=OpenLDAP

# Property name that denotes a user entry.
# Is Required: No
# Valid values: (attribute name according to LDAP conventions)
# Default Value: None

    userIdField=cn

# Enumeration of LDAP objectclasses that the user entries use in
# the target LDAP server.
# Is Required: No
# Valid values: (Comma separated list of objectclass names,
#   according to LDAP conventions)
# Default value - depending on serverType:
#   OpenLdap:
#     "top,person"
#   SunOneDirectory:
#     "top,person,organizationalperson, inetorgperson"
#   ActiveDirectory:
#     "top,person,organizationalPerson,user"
```

```
personObjClass=inetOrgPerson

# Enumeration of LDAP objectclasses that the group entries use in
# the target LDAP server.
# Is Required: No
# Valid values: (Comma separated list of objectclass names,
# according to LDAP conventions)
# Default value - depending on serverType:
#   OpenLdap:
#   "top,groupOfUniqueNames"
#   SunOneDirectory:
#   "top,groupofuniquenames"
#   ActiveDirectory:
#   "top,group"

groupObjClass=groupOfUniqueNames

# Property name that denotes a group entry.
# Is Required: No
# Valid values: (attribute name according to LDAP conventions)
# Default value: cn

groupIdField=cn

# Property name of a user entry that points to the group that
# the user is member of.
# Is Required: No
# Valid values: (attribute name according to LDAP conventions)
# Default value:
# depending on serverType:
#   OpenLdap:
#   "ou"
#   SunOneDirectory:
#   NULL
#   ActiveDirectory:
#   "memberOf"

personGrpAttr=ou

# Property name of a group entry that points to users (members)
# Is Required: No
# Valid values: (attribute name according to LDAP conventions)
# Default value:
# depending on serverType:
#   OpenLdap:
#   "uniqueMember"
#   SunOneDirectory:
#   "uniqueMember"
#   ActiveDirectory:
#   "member"

groupPrsAttr=uniqueMember
```

```
# Seconds how long auth. user remains in cache.
# Is Required: No
# Valid values:
# 0 - No cache
# Min: 1, Max: No limit
# Default value: 180

cacheTime=12

# Specify the max. number of cached users that have been successfully
# authenticated. When the cache overflows, the oldest entry is removed.
# Is Required: No
# Valid values:
# 0 - No cache
# Min: 1, Max: No limit
# Default value: 300

cacheSize=4

# Time (in seconds) how long to ignore any further authentication
# requests for a particular User-Id.
# Is Required: No
# Valid values:
# Min: 1, Max: No limit
# Default value: 100

denyTime=4

# Number of invalid logon attempts.
# Is Required: No
# Valid values:
# Min: 1, Max: No limit
# Default value: 3

denyCount=3

# Specifies an output file for logging.
# Is Required: No
# Valid values: (Valid log file path)
# Default Value: None

logCallback=true

# Specifies the log level.
# Is Required: No
# Valid values:
# 0 - No logging
# Min: 1
# Max: 6
# Default Value: None
```

```
##nativeLogLevel=0

# Specifies the log file.
# Is Required: No
# Valid values:
#   fully qualified file name
# No default value

##nativeLogFile=SAGSSXCLIENTA_SSX.LOG

# Default group to be automatically included for all requests
# that return any groups
# Is Required: No

##defaultGroup=DefGroup

# BaseBindDN where to find the users.
# Is Required: Yes
# and should contain the most detailed DN to find the users

#   personBindDn=ou=User,o=Org,dc=mycom,dc=com

# BaseBindDN where to find the groups.
# Is Required: Yes
# and should contain the most detailed DN to find the groups

##groupBindDn=ou=Groups,o=Org,dc=mycom,dc=com

# Attribute name of the password.
# Required when changing the password
# Is Required: Not always
# Default value:
#   depending on serverType:
#   OpenLdap:
#     "userPassword"
#   SunOneDirectory:
#     "userPassword"
#   ActiveDirectory:
#     "unicodePwd"

##passwdField=userPassword

# Allow to pass a complete BaseBindDN
# via the domain parameter.
# Is Required: No
# Valid values: 0, 1

##allowdomainasbasebinddn=0

# Allow to specify which fields to search for as properties
# of a user entry
# Is Required: No
```



```

# Valid values: string, for example: "cn,sn,description"

###personPropAttr

# Allow to specify which fields to search for as properties
# of a group entry
# Is Required: No
# Valid values: string, for example: "cn,description"

###groupPropAttr

# Allow to use the special secure authentication using SASL,
# providing the directory supports this mechanism.
# Is Required: No
# Valid values: 0, 1 (default: 0)

###ldapSaslBind

# Allow to switch from a non-secure connection to a TLS connection,
# providing the directory supports this mechanism.
# of a group entry
# Is Required: No
# Valid values: 0, 1 (default: 0)

###ldapStartTls

# By default, the first "dc=" occurrence within the distinguished name
# name string denotes the domain name.
# If additional abbreviations want to be defined, one can use
# the following 2 parameter.
# Example: Short="RnD;Admins;board"
#           with ↵
Long="ou=Rnd,ou=user,dc=mycom,dc=com;ou=Administrators,dc=mycom,dc=com;ou=VIP,dc=mycom,dc-com"

###ldapDomainShort
###ldapDomainLong

# If NOT the automatic domain name should be used to compose
# the canonical user id (SSXGetCanonicalUserId_A/W),
# specify this part of the ID here.

###canonicalDomainName

# Three algorithms are supported to find the groups of a user:
# "ru", recurse up: take the group pointer from the user entry
#                   and continue to search up for all groups
#                   found
# "rd", recurse down: search for all groups that have the
#                   user as member (no recursion)
# "cp", computed property: use a special field in the user
#                   entry to find all groups
#                   --> computedGroupProp retired

```

```
# Default: "ru"

###resolveGroups

# If resolveGroup is set to "cp", this parameter must provide
# the field name to look for in the user entry that denotes
# the user groups
# Default: None

###computedGroupProp=

# If the LDAP connection is protected by SSL/TLS, this
# parameter must be set.
# Valid Values: 0, 1
# Default: 0

###ldapSSLConnection=1

[SSX_CONFIGURATION-END]
```

Authorization Type ADISI

```
[SSX_CONFIGURATION]

# This is a sample properties file for the case
# when authType is ADISI and the user database is Active Directory

# Specifies the authentication type.
# Is Required: Yes
# Valid values: {"OS", "TEXT", "LDAP", "ADISI"}
# Default Value: None

    authType=ADISI

# Specifies the name of the AD Forest.
# Is Required: No, but should be specified
# Example: "dc=mycom,dc=com"
# (with a possible domain called "dc=eur,dc=mycom,dc=com")
# Default Value: None

###adsiForestDn

# Seconds how long auth. user remains in cache.
# Is Required: No
# Valid values:
# 0 - No cache
# Min: 1, Max: No limit
# Default value: 180

    cacheTime=12
```

```

# Specify the max. number of cached users that have been successfully
# authenticated. When the cache overflows, the oldest entry is removed.
# Is Required: No
# Valid values:
#   0 - No cache
#   Min: 1, Max: No limit
# Default value: 300

    cacheSize=4

# Time (in seconds) how long to ignore any further authentication
# requests for a particular User-Id.

# Is Required: No
# Valid values:
#   Min: 1, Max: No limit
# Default value: 100

    denyTime=4

# Number of invalid logon attempts.
# Is Required: No
# Valid values:
#   Min: 1, Max: No limit
# Default value: 3

    denyCount=3

# Specifies an output file for logging.
# Is Required: No
# Valid values: (Valid log file path)
# Default Value: None
#   nativeLogFile=SIN_SXX.log

    logCallback=true

# Specifies the log level.
# Is Required: No
# Valid values:
#   0 - No logging
#   Min: 1
#   Max: 6
# Default Value: None

##nativeLogLevel=0

# Specifies the log file.
# Is Required: No
# Valid values:
#   fully qualified file name
#   No default value

```

```

###nativeLogFile=SAGSSXCLIENTA_SSX.LOG

# In case the scope for the node to access users needs to be limited,
# one can specify a particular subtree:
# Example: "ou=user,ou=Rnd,dc=mycom,dc=com"

###adsiPersonBindDn

# In case the scope for the node to access groups needs to be limited,
# one can specify a particular subtree:
# Example: "ou=groups,ou=Rnd,dc=mycom,dc=com"

###adsiGroupBindDn

# By default, the first "dc=" occurrence within the distinguished name
# name string denotes the domain name.
# If additional abbreviations want to be defined, one can use
# the following 2 parameter.
# Example: Short="RnD;Admins;board"
#           with  ↵
Dn="ou=Rnd,ou=user,dc=mycom,dc=com;ou=Administrators,dc=mycom,dc=com;ou=VIP,dc=mycom,dc=com"

###adsiDomainShort
###adsiDomainDn

# If NOT the automatic domain name should be used to compose
# the canonical user id (SSXGetCanonicalUserId_A/W),
# specify this part of the ID here.

###canonicalDomainName

# Three algorithms are supported to find the groups of a user:
# "ru", recurse up: take the group pointer from the user entry
#                   and continue to search up for all groups
#                   found
# "rd", recurse down: search for all groups that have the
#                   user as member (no recursion)
# "cp", computed property: use a special field in the user
#                   entry to find all groups
#                   --> computedGroupProp retired
# Default: "ru"

###resolveGroups

# If resolveGroup is set to "cp", this parameter must provide
# the field name to look for in the user entry that denotes
# the user groups
# Default: None

###computedGroupProp=

[SSX_CONFIGURATION-END]

```

Creating Internal User Repository Files

The following section describes the creation and administration of the internal user repository file, which is used with Authorization Type TEXT.

You can create and/or modify internal user repository files with the `ssxtxtpasswd` tool.

To start the `ssxtxtpasswd` tool, you use a command prompt. When you start the tool, you enter a user name and a password which are then encrypted (SHA512 and Base64) and provided in the result text file. The tool adds new or replaces existing user credentials in the text file.



Note: When you enter a user name, you can use only digits, Latin letters, and the following characters: `!() - . ? [] _ ~`. When you enter a password, you can use only digits, Latin letters, and the following characters: `!"#$%&'()*+,-./:;<=>?[\]^_`{|}~`.

Example: Usage of `ssxtxtpasswd` tool

Tool to create or update an entry in the SSX text file based user repository.

Usage: `ssxtxtpasswd [-f filename] [-c] [-p password] [-d | -e] userId`

Use `"-c"` to create a new file.

Usually, the file should exist and user entries are replaced/added.

Use `"-p"` to provide the password on the command line instead via an extra prompt.

Use `"-d"` to remove the specified user entry from the text file.

Use `"-e"` to check, whether the `userId` is already stored in the text file.

Note: The password usually will be read via a non-echo command input.
When no filename is specified, a default of `"ssx_user"` is assumed.

Example: Add User and Password

```
ssxtxtpasswd -f SAGInternalUserRepository.txt -c -p mypsw myuid
```

Hash: ↵

```
b0EOAPEEEJBKv+4z0ELiYcFqY7qFh1LZz1ha7Ztf7j/drJHGy2ML0LXEu/kX7TD52Aj7XfwiZ+vpI19DqRbVKA==
User entry for "myuid" successfully added
```

Contents of SAGInternalUserRepository.txt

```
*  
*  
* SAG Internal User Repository  
*  
version:3.0  
*  
user:myuid:$6a$b0E0APEEEJBKv+4z0ELiYcFqY7qFh1LZz1ha7Ztf7j/drJHGy2ML0LXEu/kX7TD52Aj7XfwiZ+vpI19DqRbVKA==
```

3

Adabas Password Security (ADASCR)

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Introduction

The Adabas database security utility ADASCR provides facilities for controlling access and update to Adabas files.

Adabas supports two classes of data access/update security: the first restricts user read and/or update requests on the basis of a whole file; the second restricts user access to individual records within a file.

Protection at File Level

Adabas files are security-protected if a file protection level greater than zero is assigned to the file. File protection levels are assigned separately for access (i.e. read) and update.

A user can access/update a security-protected file by entering a password with a permission level that is equal to or greater than the file protection level. Protection levels and password permission levels are assigned with the security utility ADASCR.

The file numbers that can be protected are limited by the block size of the ASSO1 container file. If the block size is 2KB, only files in the range 1 - 2047 can be protected (for 3KB the limit is 3071).

Protection at Record Level - Security by Value

Security by Value extends the Adabas File Protection Level security by enabling a user to further define separate data access and update restrictions according to the content of one or more fields in a data record.

Security by Value criteria are defined by using the ADASCR security utility. Each password may include value criteria for up to 99 separate Adabas files.

Record level security can only be used with security-protected files.

File Protection Levels

An Adabas file can be security-protected by assigning an access protection level and/or an update protection level greater than zero to the file.

File protection levels range from 0 to 15, with 15 being the maximum level of protection. A protection level of 0 means that all users can access/update the file. A value of 15 prevents all users from accessing/updating the file.

All Adabas files that have no protection levels assigned have a default protection level of zero. All users can access and/or update such files.

| File | Protection Level Number | |
|------|-------------------------|--------|
| | Access | Update |
| 10 | 7 | 11 |
| 11 | 2 | 2 |
| 12 | 4 | 4 |

User Passwords

Separate access and update levels for each Adabas file can be assigned for each password. Password permission levels can be assigned in the range from 0 to 14.

| Password | FILE 10 ACC/UPD | FILE 11 ACC/UPD | FILE 12 ACC/UPD |
|----------|--------------------|--------------------|--------------------|
| PASSWRD1 | 4/0 | 4/0 | 4/0 |
| PASSWRD2 | 2/2 | 2/2 | 2/2 |
| PASSWRD3 | 14/0 | 0/0 | 14/0 |
| PASSWRD4 | 14/14 | 14/14 | 14/14 |
| PASSWRD5 | 7/7 | 0/0 | 7/0 |

If the password access/update permission level is equal to or greater than the file access/update protection level, the password can be successfully used to access/update the file in question.

Using the examples for file protection levels and for password permission levels shown above,

- PASSWRD1 can be used to access file 11 or file 12.
- PASSWRD2 can be used to access/update file 11.
- PASSWRD3 and PASSWRD5 can each be used to access file 10 or file 12.
- PASSWRD4 can be used to access/update file 10, file 11 or file 12.

Security by Value Criteria

Separate access and update criteria for each Adabas file can be assigned for each password. Each value criterion consists of an Adabas search buffer and an associated value buffer.

The search and value buffers are constructed in the same manner as for regular Adabas search commands, including the use of non-descriptor fields and multiple value fields. However, soft-coupling and sub-, super-, hyper- and phonetic descriptor fields are not supported in Security by Value search criteria.

For further information on the syntax and construction of search buffers and value buffers, see the Command Reference Manual, Calling Adabas, Search and Value Buffers.

Value checking is performed only if data storage is either read or updated by the Adabas command.

The following table illustrates which criteria are tested for the various Adabas commands:

| Adabas Command | Security by Value Check Performed | |
|----------------|---|--------------|
| | Test Criterion | Test Data |
| A1 | Update | Before Image |
| E1 | Update | Before Image |
| L1 - L6 | Access | Before Image |
| L9 | <i>(Access to index only, no value check performed)</i> | |
| N1, N2 | Update | After Image |
| S1(*) | Access | Before Image |



Note: * An S1 command with a valid format buffer is handled in the same manner as if an S1 command followed by an L1 command with a given User ISN had been issued.

Security by Value criteria are ignored if the associated security level of the requested file is zero.

Adabas Security Processing

Using the password entered by a user and the file-protection information defined for the file, Adabas checks whether the user is authorized to access/update a given Adabas file. If the file is not security-protected, Adabas ignores any password that is entered. The following describes Adabas security processing for read and update commands.

Adabas determines whether the file to be accessed or updated is security-protected. If there is no security protection, security processing stops.

Security Response Codes

If the file to be processed is security-protected, Adabas checks whether the password supplied is defined in the password table.

If the password is undefined or if no password has been supplied, response code 201 is returned.

If the password is defined but not valid for the file to be processed, response code 202 is returned.

If the password is valid for the file to be processed, Adabas checks the permission level associated with this password against the file's access or update protection level. Response code 200 is returned if the password's permission level is less than the file's protection level.

If the permission level is sufficient, the password is further checked for Security by Value criteria for the current file. If a search criterion has been defined for the supplied password, this is tested against either the before or after image of the data, depending on the Adabas command issued. If the Security by Value check is unsuccessful, response code 200 is returned, otherwise the user's request is finally granted and the Adabas command is processed.

The following is a summary of the response codes that may be returned by Adabas security processing:

RESPONSE 200

| | |
|--------------------|------------------------------|
| Explanation | Security violation detected. |
| User Action | Supply the correct password. |

RESPONSE 201

| | |
|--------------------|---------------------------------------|
| Explanation | The password specified was not found. |
| User Action | Supply the correct password. |

RESPONSE 202

| | |
|--------------------|---|
| Explanation | An attempt was made to use a file for which the user is not authorized. |
| User Action | Supply the correct password. |

If an ET logic user receives the response codes 200 - 202, processing continues as if the user had exceeded the transaction time limit (see the TT parameter of ADANUC in the Utilities Manual for further information).

All Security by Value security violations cause response code 200 to be returned.

4 Adabas Encryption for Linux

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Adabas Encryption for Linux provides functionality to protect data-at-rest from unauthorized access. With Adabas Encryption for Linux, data-at-rest refers to container files, backup copies, PLOG files and other files created by Adabas, containing sensitive data container files and also PLOG and backup copies. Access to the information in these containers is controlled by means of encryption.

Prerequisite

A license for Adabas Encryption for Linux (AEL) is required.

Encryption of Data-At-Rest

Encryption Object

In the context of Adabas Encryption for Linux, data-at-rest refers to the following containers and files:

- ASSO
- DATA
- WORK
- TEMP
- SORT
- PLOG
- backup copies
- CMPDTA, DCUDTA, MUPDTA, ULDDTA (Compressed data)
- CMPDVT, MUPDVT, ULDDVT (Descriptor Value Table)
- MUPLOG and MUPLOB (Compressed data and LOB data)
- ORDEXP (Export copy)

Encryption Algorithm

Encryption is the process of converting plain data into cipher text which cannot be deciphered without access to the encryption key.

Decryption is the process of converting encrypted data back to its original form. Decryption of encrypted data requires the key. Without the key the original information cannot be recovered.

Adabas Encryption for Linux supports Advanced Encryption Standard (AES) in XTS mode, a symmetric-key algorithm, where the same key is used for both processes, encrypting and decrypting the data.

XTS-AES with a key length of 128 and 256 bits are supported.

Encryption Process

When formatting a database, the corresponding containers are encrypted according to the given parameters. All blocks written to disk are encrypted as well. Keys for encryption are managed by Adabas using the given Key Management System.



Note: Encryption cannot be disabled for existing databases. Encryption can only be undone by dumping and restoring a backup with the option `ENCRYPTION=NO`.

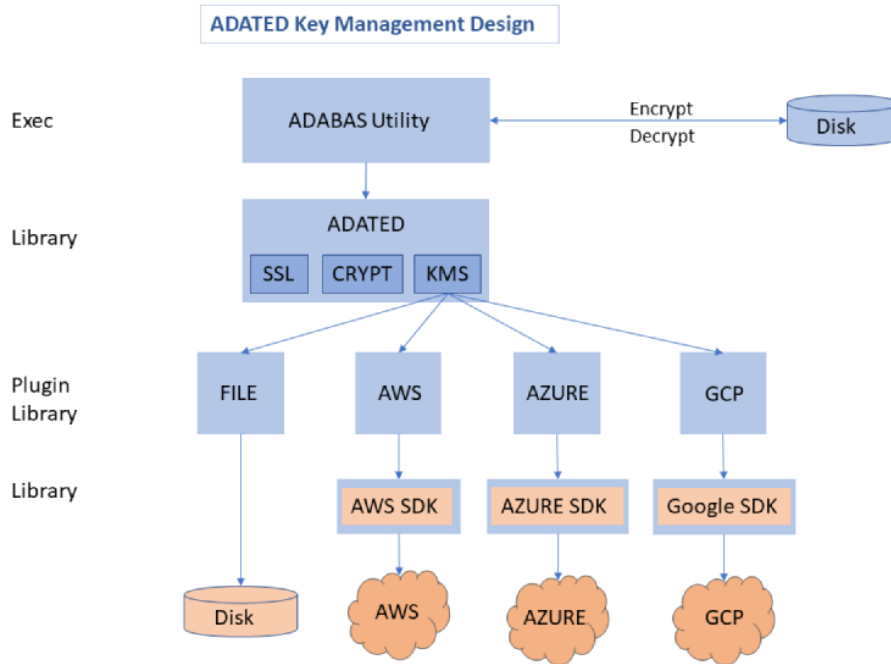
Key Management System

A key management system (KMS), also known as a cryptographic key management system (CKMS) or enterprise key management system (EKMS), is an integrated approach for generating, distributing, and managing cryptographic keys for devices and applications.

Adabas currently supports the following types of key management systems:

- File-based management system on the local disk
- Microsoft Azure Key Management System
- Amazon AWS Key Management Service
- Google GCP Key Management Service

This section describes how Adabas uses the KMS.



Adabas provides the ADATED library for the cryptographic functionality. The KMS function of ADATED uses plugin libraries, also provided by Adabas, for each supported key management system.

Adabas uses two types of encryption keys, the key encryption key (KEK) and the encrypted data encryption key (DEK). The KEK encrypts the DEK, which in turn encrypts the data in the database. The advantage of using two keys is that you can regularly change the key encryption key, so only the data encryption key is decrypted and newly encrypted. The data itself does not have to be decrypted and encrypted again.



Important: If the KEK is lost or corrupted, the data in the database is also lost regardless of which KMS is used.

- [File-Based Key Management System](#)
- [Amazon AWS Key Management System](#)
- [Microsoft Azure Key Management System](#)

- [Google GCP Key Management Service](#)

File-Based Key Management System

The file-based key management system uses a local disk file to store the key encryption keys. Database operations are performed only with the KMS file.

Select the file-based KMS by configuring the `KMSTARGET=FILE` parameter for either the `ADAFRM` or `ADABCK` utility when creating a database. The selected KMS type is stored in the database.

The file to store the keys is specified by the `ADAKMSFILE` environment variable. You can specify a fully qualified path name or directory name. The default location is `$ADADATADIR/etc` and the default file name is `adatedkmsfile.db`.



Important: If the Adabas file-based key management system is used, all Adabas utilities require access to the file `$ADADATADIR/etc/adatedkmsfile.db`. Otherwise an encrypted database becomes unusable.

The KMS file is stored encrypted in the file system. Nevertheless, access to it must be restricted with operating system features. File permissions must allow access only to the user/group that will run Adabas utilities.



Caution: It is recommended to implement a dedicated backup strategy to have the file-based KMS available in case of a disaster recovery. Without the corresponding KEK, it is not possible to restore Adabas backup copies or use encrypted data. To avoid this effort and possible risks, cloud-based key management services should be preferred.

Amazon AWS Key Management System

Amazon Web Services (AWS) provides a built-in key management service which you can use when Adabas is on an AWS virtual machine. The AWS KMS allows for the creation and storage of the key encryption key. The encrypted DEK is passed to the AWS KMS for decryption.

Select the AWS KMS by configuring the `KMSTARGET=AWS` parameter for either the `ADAFRM` or `ADABCK` utility when creating a database. The selected KMS type is stored in the database.

Within AWS, you must configure your virtual machine to be able to access the AWS Key Management System. The Adabas AWS plugin uses a number of AWS APIs and KMS resources, which are managed through AWS Identity and Access Management (IAM). To use the APIs and access the specific KMS resources you must create an IAM role with a permission policy. The IAM role must be assigned to an EC2 instance (Amazon Elastic Compute Cloud) so that the EC2 instance can assume that role during its lifetime. The IAM role can be used for multiple EC2 instances.

For more information on how to create an IAM role and assign it to an EC2 instance, see the AWS Identity and Access Management and Amazon Elastic Compute Cloud documentation.

Microsoft Azure Key Management System

Azure provides a key management service for generating, storing, and accessing secrets, such as cryptographic keys. You can use this service when running Adabas in the Azure cloud. The cryptographic keys are stored and accessed in an Azure Key Vault. Adabas can use the Azure Key Management Service to store the keys used in an encrypted database.

To use the Azure Key Vault for Key Management purposes, specify `KMSTARGET=Azure` for either the `ADAFRM` or `ADABCK` utility when creating a database. The selected KMS type is stored in the database.

You must reference the key vault with the environment variable `AZURE_KEY_VAULT`.

```
export AZURE_KEY_VAULT=<key-vault-name>
```

Authentication

To access the key vault, you must be an authenticated user with access rights. It is recommended to use a managed identity if Adabas is run on the Azure Cloud.

To create a managed identity:

- Go to the Azure Portal and navigate to the virtual machine or container Adabas is running on.
- Select **Identity**.
- In the tab **System assigned**, set the **Status** to **On**. This creates a service principal that is tied to the resource.

To authenticate multiple resources, you can use a User assigned managed identity. If you require a different form of authentication, visit the Azure resources.

Key Vault Access

The created security principal needs to be given access to the Azure Key Vault resource. You can do this on the Azure Portal.

- Navigate to the used Key Vault and select **Access Policies**.
- Click **Create**.
- From the **Permissions**, check **Select all** for **Key Management Operations** and **Cryptographic Operations**.
- Choose the created managed identity for authentication with the Key Vault.
- Create the access policy.



Note: As the Key Vault holds the key encryption key of your database, the access rights to this resource should be kept to a minimum.

For more information about the Azure Key Vault, managed identities, or authentication with Azure, you can visit [Microsoft Learn](#).

Google GCP Key Management Service

Google Cloud Portal (GCP) provides a key management service for generating, storing, and accessing secrets, such as cryptographic keys. This key management service can be used when running Adabas in the Google Cloud. The cryptographic keys are stored and accessed in a Google key ring. Adabas can use the Google Key Management Service to store the keys used in an encrypted database.

To use the key ring for key management purposes, specify the `KMSTARGET=GCP` parameter for either the `ADAFRM` or `ADABCK` utility when creating a database. The selected KMS type is stored in the database.

The key ring resource must be located in the same region as your virtual machine. You must reference the key ring with: `export GCP_KEY_RING=key-ring-name`

Within the GCP, you must configure your VM service account to be able to access the key ring resource. Ensure that the VM service account has access to the following permissions:

```
cloudkms.cryptoKeyVersions.create
cloudkms.cryptoKeyVersions.destroy
cloudkms.cryptoKeyVersions.get
cloudkms.cryptoKeyVersions.list
cloudkms.cryptoKeyVersions.useToDecrypt
cloudkms.cryptoKeyVersions.useToEncrypt
cloudkms.cryptoKeys.create
cloudkms.cryptoKeys.get
cloudkms.cryptoKeys.list
```



Note: As the key ring holds the encryption key of your database, the access rights to this resource should be kept to a minimum.

For more information about the hierarchy of resources and roles within Cloud KMS, see the Google Cloud Key Management Service documentation.

Administration

Database Creation

Adabas automatically creates a new KEK with a unique name (KEKNAME) within the KMS. The KMS API provides a function to create an encrypted DEK. Adabas stores the encrypted DEK along with the unique KEKNAME of the corresponding KEK and other encryption related settings in the ASSO1 container file.

Encrypted databases are created with Adabas utilities ADAFRM and ADABCK.

■ ADAFRM

The control parameters ENCRYPTION and KMSTARGET specify the encryption algorithm and the key management system to be used. The container files are encrypted according to the parameter values.

```
ADAFRM ENCRYPTION=AES_256_XTS | AES_128_XTS  
      KMSTARGET=FILE (default) | AWS | Azure | GCP
```

Example 1:

The following example shows how to create an encrypted database with the encryption algorithm AES_256_XTS. The Adabas file-based key management system is used (default: KMSTARGET=FILE)

```
adafrm dbid=100 datasize=100 assosize=100 worksize=100 encryption=aes_256_xts
```

■ ADABCK RESTORE/OVERLAY

The control parameters ENCRYPTION and KMSTARGET specify the encryption algorithm and the key management system to be used. The container files are encrypted according to the parameter values.

As the target database is created and containers are encrypted, it must not already exist. For existing databases, these ADABCK control parameters ENCRYPTION and KMSTARGET will be rejected. An existing database will always retain its encryption settings, even in the case of "no encryption".

```
ADABCK ENCRYPTION=AES_256_XTS | AES_128_XTS  
      KMSTARGET=FILE (default) | AWS | Azure | GCP
```

Example 1:

The following example shows how to restore an encrypted database with the encryption algorithm AES_256_XTS from a non-encrypted Adabas backup copy. The Adabas file-based key

management system is used (default: KMSTARGET=FILE). In this example, BCK001 is a backup copy of a non-encrypted database.

```
adabck dbid=100 restore=* encryption=aes_256_xts
```

Example 2:

The following example shows how to overlay an encrypted database with the encryption algorithm AES_128_XTS from an non-encrypted Adabas backup copy. The Adabas file-based key management system is used. In this example, BCK001 is a backup copy of a non-encrypted database.

```
adabck dbid=100 overlay=* encryption=aes_128_xts kmstarget=file
```



Note: The control parameter ENCRYPTION is rejected if the database to be created already exists.

Creating a Non-encrypted Database from an Encrypted Database

ADABCK, can be used to restore or overlay a non-encrypted database from the backup of an encrypted database.

■ ADABCK

```
ADABCK ENCRYPTION=NO
```

Example:

The following examples show how to restore or overlay a non-encrypted database from an Adabas backup copy of an encrypted database. In these examples, BCK001 is a backup copy of an encrypted database.

```
adabck dbid=100 overlay=* encryption=no
```

```
adabck dbid=100 restore=* encryption=no
```

Database Report

The encryption settings include the encryption algorithm, the key management system and name of the key encryption key.

The ADAREP control parameter SUMMARY shows the encryption settings of an encrypted database.

The ADABCK control parameter SUMMARY shows the encryption settings of an Adabas backup copy of an encrypted database.

■ ADAREP

ADAREP SUMMARY

Example:

The following example shows the encryption settings of an encrypted database.

```
adarep dbid=100 summary
%ADAREP-I-STARTED,      02-MAY-2024 18:10:26, Version 7.3.0.0 (Linux 64Bit)
%ADAREP-I-DBOFF, database 100 accessed offline
Summary of Database 100      2-MAY-2024 18:10:26

DATABASE NAME              Database-100
DATABASE ID                 100
MAXIMUM FILE NUMBER LOADED      3
SYSTEM FILES                 1 (CHK),      2 (SEC),      3 (USR)
ACTUAL FILES LOADED           3
CURRENT PLOG NUMBER           0
CURRENT CLOG NUMBER           0
ENCRYPTION                   AES_256_XTS
KMSTARGET                    FILE
KEKNAME                       ↵
1714666215B382A0FD089977264681686464A029C3FA4497EE1EF150C0217295

Container  Device      Extents in Blocks      Number of      Block      Total Size
File       Type          from        to        Blocks      Size      (Megabytes)
-----
ASS01      file           1        25,600      25,600      4,096      100.00
DATA1      file           1         3,200       3,200      32,768      100.00
WORK1      file           1         6,400       6,400      16,384      100.00
-----
                                           300.00
                                           =====
```

```
%ADAREP-I-IOCNT, 7 IOs on dataset ASSO
%ADAREP-I-TERMINATED, 02-MAY-2024 18:10:26, elapsed time: 00:00:00
```

■ ADABCK

ADABCK SUMMARY

Example:

The following example shows the encryption settings of an encrypted database within a backup copy (BCK001).

```
adabck summary
2024-05-02 18:25:55 %ADABCK-I-STARTED, 02-MAY-2024 18:25:55, Version 7.3.0.0 ↵
(Linux 64Bit)
Database dumped on 2-MAY-2024 18:25:50

Database 100, Database-100

Summary of Database 100 2-MAY-2024 18:25:55

DATABASE NAME Database-100
DATABASE ID 100
MAXIMUM FILE NUMBER LOADED 3
SYSTEM FILES 1 (CHK), 2 (SEC), 3 (USR)
ACTUAL FILES LOADED 3
CURRENT PLOG NUMBER 0
CURRENT CLOG NUMBER 0
ENCRYPTION AES_256_XTS
KMSTARGET FILE
KEKNAME ↵
1714666215B382A0FD089977264681686464A029C3FA4497EE1EF150C0217295

Container Device Extents in Blocks Number of Block Total Size
File Type from to Blocks Size (Megabytes)
-----
ASS01 file 1 25,600 25,600 4,096 100.00
DATA1 file 1 3,200 3,200 32,768 100.00
WORK1 file 1 6,400 6,400 16,384 100.00
-----
300.00
=====

2024-05-02 18:25:55 %ADABCK-I-IOCNT, 1 IOs on dataset BCK001
```

```
2024-05-02 18:25:55 %ADABCK-I-TERMINATED, 02-MAY-2024 18:25:55, elapsed time: 00:00:00
```

Both reports show the current encryption algorithm, the key management system and the name of the key encryption key.

Database Backup and Restore

The Adabas backup copy of an encrypted database contains the encryption settings such as the encryption algorithm and key management system of the encrypted database. This data itself is not encrypted, while all database blocks within the backup copy are encrypted with the encryption settings of the database. The KMS containing the KEK of the database must be available to restore this backup.

Restore as new database

To restore the Adabas backup copy of an encrypted database as a new database you can

- omit the control parameter ENCRYPTION. The encryption settings are taken from the Adabas backup copy.
- specify the control parameter ENCRYPTION. The encryption settings are taken from the parameter.

To restore an Adabas backup copy of an encrypted database as a new non-encrypted database, set the control parameter ENCRYPTION=NO.

Restore to an existing database

To restore an Adabas backup copy to an existing database, whether encrypted or not encrypted, omit the control parameter ENCRYPTION. The data is restored according to the target database's encryption settings.

Database Access

Access to an encrypted database is transparent to the Adabas utilities and to the Adabas direct call interface. The data are encrypted on write access, and decrypted on read access, according to the database's encryption settings.

Adabas Utilities

For all ADABAS utilities when reading encrypted data, access is transparent. The goal in implementation was not to change utility syntax. This could not always be achieved and will be explained in more detailed in the corresponding utility pages. The current syntax changes include:

- ADAFRM can accept a dbid when using tempsize or sortsize.
- ADACMP can accept a dbid when compressing output from ADADCU.

5

Ciphering



Important: The implementation of the ciphering feature is different to that available in Adabas for mainframes. The cipher code in Adabas for Linux and Windows is static and is not provided in Additions 4. [Adabas Encryption for Linux](#) is highly recommended as a state-of-the-art replacement.



Notes:

1. Ciphering is no longer recommended for safe implementations.
2. Ciphering does not fulfill modern encryption standards and security regulations.
3. Ciphering is maintained for historic and maintenance reasons only.

The purpose of the ciphering in Adabas for Linux and Windows is to prevent unauthorized analysis of Adabas container files; e.g. via file dumps, editors, etc.

Unlike ciphering on the mainframe, it does not prohibit unauthorized access to the data; as both database utilities and database applications can access the data without the cipher code.

Adabas can cipher the data that it stores in container files. This, however, only applies to the data records that are stored in the Data storage, but not the values stored in the inverted lists on the Associator.

Ciphering prevents the unauthorized analysis of Adabas container files. If ciphering is enabled (see below), data records are ciphered when they are stored in a database by either the Adabas nucleus or by the mass update utility ADAMUP. The data records are then deciphered when they are requested by a user or application. This means that the ciphering is completely transparent to the user or application.

Ciphering can be enabled for individual Adabas files. This is done when defining the file with ADAFDU by setting the CIPHER/NO CIPHER option. The ciphering process uses internal parameters in order to achieve a maximum level of security. In some systems, identical fields and records

present a possible security risk: if an unauthorized user can decipher one, the other can also be deciphered. The Adabas ciphering process, however, treats identical fields and records as follows:

- Two identical fields within one record will be ciphered differently;
- Two identical records within one Adabas file will be ciphered differently;
- Two Adabas files with identical contents will be ciphered differently.

The following example demonstrates this on the basis of two fields in a record which both contain the value 'TEST' (representations are hexadecimal):

| | | |
|----------|-----------------------|---------------------|
| Record 1 | Unciphered=0x54455354 | Ciphered=0xDD022537 |
| Record 2 | Unciphered=0x54455354 | Ciphered=0x55EF0A51 |



Note: The ciphered values shown above are just examples, and do not represent the actual ciphering mechanisms used.

The Adabas ciphering mechanism is characterized by the following features and restrictions:

- System files (checkpoint and security) cannot be ciphered.
- ADAM key files cannot be ciphered.
- The output files produced by the utilities ADACMP (compression) and ADAULD (unload) are not ciphered.
- The data saved on files produced by the backup utility ADABCK, and the EXPORT files produced by the export utility ADAORD are ciphered.
- The restart and recovery records that are written to the WORK and PLOG files are ciphered.
- The output produced by the FILE function of the report utility ADAREP contains information about file ciphering.

6

Security Considerations

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This section describes means or actions that that can or should be taken to secure (“harden”) the database.

Using the Linux Group Concept

If the Adabas users belong to different Linux groups, you can restrict the Adabas access to databases assigned to this group.



Note: This feature is only available for Linux, not for Windows platforms.

Example:

Assume you have two Linux groups called Production and Test. There are users belonging to the group Production, who should have access only to the production databases, and there are users belonging to the group Test, who should have access only to the test databases. Assume you have the following users for starting the database:

- dbaprod belongs to the group Production and should start the production databases
- dbatest belongs to the group Test and should start the test databases

The following is necessary to restrict the Adabas access to users of the group to which the databases belong:

- You must use two different NET_WORK_IDs, even if you are not using Net-Work. Because Adabas does not know if a Net-Work server will be started later, Adabas creates a shared memory section common with Net-Work, a GDT (global database table). The permission for GDT access is restricted to the group to which the Adabas nucleus belongs. Therefore, starting a nucleus fails if the same GDT is accessed as used by another nucleus belonging to a different group.

You can use different GDTs if you start the nucleus with a different NET_WORK_ID because a separate GDT is created for each NET_WORK_ID. NET_WORK_ID is an environment variable, which must be set when the Adabas nucleus is started - two NET_WORK_IDs are considered to be equal if the first character is equal. If the environment variable NET_WORK_ID is not set, an empty NET_WORK_ID is used.

In this example, you could start the production databases after setting NET_WORK_ID to P, and the test databases after setting NET_WORK_ID to T.

- The nucleus must be started with the parameter ADABAS_ACCESS=GROUP. Assume that you start in this example the Production databases with ADABAS_ACCESS=GROUP, but the Test databases with ADABAS_ACCESS=ALL (or without the parameter ADABAS_ACCESS). Then only the Production users can access the production databases, but all users can access the test databases.



Note: If you are using Net-Work, it is also necessary to start different Net-Work servers for different groups. You must take care to ensure that it is not possible for users to access databases via Net-Work for which they have no permissions.

Securing Administration of Adabas Role-Based Security

This section describes how to secure access to the ADARBA utility, which provides the functionality to administer the security definitions.

By default, all users with the **PUBLIC** role have access to and can execute the ADARBA utility.

The example below shows how access to ADARBA can be restricted by:

- Creating a *security administrator* role;
- Granting the role permission to execute the utility;
- Creating a user credential that is to be assigned the *security administrator* role;
- Granting the user *security administrator* role; and
- Revoking the permission to execute the utility from the role **PUBLIC**.

```
> adarba
> adarba: dbid=nnn

> adarba: create,role= security_administrator
> adarba: grant,operation=ada.uti.rba,to,role= security_administrator

> adarba: create,user=dbasec_userid
> adarba: grant,role= security_administrator,to,user=dbasec_userid

> adarba: revoke,operation=ada.uti.rba,from,role=PUBLIC
```

In this example, the following security definitions are created or modified:

- Created:
 - Role: *security_administrator*
 - User Credentials: *dbasec_userid*
 - Permission to Operation: **ada.uti.rba**
- Modified:
 - Role: **PUBLIC**
 - Permission to Operation: **ada.uti.rba**



Notes:

1. The role name and the user credentials are site-specific.
2. The credentials used for authorization must also be defined for authentication.

Preventing Loss of Administration Privileges

Lock Out Scenario

A 'lock out' scenario is possible. You must take appropriate action to prevent the 'loss of administration permissions'.

There is no recovery from a loss of administration privilege or a lock out scenario. This is a scenario in which no individual has access to the administration utilities, and the administration privilege for the security definitions has been lost.

The situation can be avoided by ensuring access to the following administration utilities.

- ADABCK
- ADADBM
- ADARBA

Recommended procedures to prevent a lock out scenario are to:

- Create more than one administration role;
- Assign access privileges to these administration roles;
- Assign the administration roles to more than one user credential.

In order to prevent an accidental loss of privileges, it is important to understand the processing logic behind the DROP function in ADARBA.

Drop Role Function

The DROP ROLE function in ADARBA deletes the following security definitions:

- All references to the ROLE definition are deleted:
 - The permissions granted to the ROLE are revoked;
 - The ROLE assignments to all USERS are revoked.
- The ROLE definition is deleted.

The function performs a cascading delete without issuing a warning message.

A loss of privileges scenario can occur if the administrator role is dropped, and no other role has access to the administration utilities.

Securing PUBLIC Access Privileges

You should review and restrict access privileges assigned to the role **PUBLIC**. This includes the roles assigned to the **PUBLIC** user, and the privileges assigned to the **PUBLIC** role.

PUBLIC access is provided when the RBAC system file has not been loaded, even though security is enabled.

You should take the following actions to secure access privileges assigned to **PUBLIC**:

- Ensure that the RBAC system file is loaded;
- Review the roles that are assigned to the **PUBLIC** user;
- Review the privileges that are granted to the **PUBLIC** role.

Securing the Audit Trail Log File

This section describes how to secure the audit trail log file used by the Authorization for Adabas utilities.

| File | Description |
|--------------|--|
| adaaudit.log | Audit Trail log file for Authorization for Utilities |

To secure the audit trail log file, please ensure the following:

- **READ/WRITE-ACCESS**

All users, which execute an Adabas utility, must be able to write to the audit trail log file.

7

SSL Trusted Relationship for Natural

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The main goal is to use the Adabas RBAC facility from Natural as client. Natural is at the moment not able to provide the user and password through the Adabas Client (using the `lnk_set_uid_pw()` function). The *SSL Trusted Relationship* should overcome this restriction. Neither Natural itself, nor any customer application should need to be changed.

The idea behind the *SSL Trusted Relationship* is that a client provides certificates over an SSL connection which are validated in Adabas. If the client provides certificates and they are successfully validated by Adabas, Adabas would assume that the client is allowed to access Adabas without presenting a password. The user id for the RBAC facility in Adabas will be taken from the so called *Adabas Session* or *Adabas ID*. The client (Natural) must make sure that the session (especially the user id) will be set up correctly.

Restrictions

We restrict the mechanism of trusted relationship on Natural as client. Only if these three conditions are fulfilled, Adabas trusts the incoming request:

1. Client uses ADATCPS (SSL) for the communication with Adabas
2. Client provides valid certificates that can be validated by Adabas
3. The client is Natural

The client is responsible to provide the user that will be authorized with the RBAC facility of Adabas. The user is taken from the Adabas Session (Adabas ID).

Adabas Operation

Adabas will check the validity of certificates at the connection level. As soon as a client connects via ADATCPS, Adabas will check whether the client provides client certificates. If so, they are validated in any case, regardless the setting of the SSLVERIFY nucleus parameter. A failed verification might not be an error, for example, if the SSLVERIFY is not set, clients need not to provide certificates, but credentials. If the SSLVERIFY option is set and the client certificate is invalid, then the connection will be rejected in any case. Adabas can be accessed in the traditional way in parallel. If using a secured database (RBAC), the clients must provide the user id and password (via the Adabas Client Interface) or use the user exit 21.

Client Configuration

On the client side ADATCP must be configured to use SSL and SSL certificates. This is done in normal cases in the \$ACLDIR/config/dbmapping.txt file.

Example:

```
<dbid> = ↵
adatcps://<host>:<sslport>?cert_file=<path>/client_cert.pem&key_file=<path>/client_key.pem
```

Adabas Configuration

The Adabas nucleus must be configured to use SSL and SSL certificates. In any case, Adabas will not start without server certificates when SSL should be used. That is the minimum requirement.

To enable Adabas to accept trusted Natural users, the nucleus must be configured with the parameter:

```
SSLTRUST = NATURAL
```

Example:

```
[NUCPARMS]
ADATCP
PORTNUMBER = 0
SSLCAFILE = /atc/certs/ca_chain.pem
SSLCERTFILE = /etc/certs/adabas_cert.pem
SSLKEYFILE = /etc/certs/adabas_key.pem
SSLPORTNUMBER = 56220
SSLTRUST = NATURAL
SSLVERIFY = 0
...
[NUCPARMS-END]
```

Setting the PORTNUMBER parameter to '0' disables the classic TCP/IP port and only SSL can be used.

8

GDPR Compliance

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Adabas on Linux and Windows stores the following personal data in log and audit files:

- Hostname of the machine
- User Identification (Local system credentials)

Therefore, so that your applications can be GDPR compliant, it is important for the Adabas administrator to be aware of the following files where personal data may be stored.

- Adabas Role-based Security
- Adabas Audit Trail
- Adabas Command Log
- Adabas Log file

Basic Actions to be taken

It is the responsibility of the database administrator to configure and delete files containing personal data. Adabas does not provide functionality to automatically delete personal data.

To ensure that personal data is not stored, the following is recommended:

- Disable logging features (when possible)
- Define a schedule and procedure to delete log files

The location and configuration of the database features storing personal data are described below.

Adabas Role-Based Security

When the Adabas Role-based Security feature is enabled, the following personal data is stored in the RBAC system file as a security definition:

- User Identification

This information is required and is used to determine the access privileges of a user.

Use the utility ADARBA to manage the security definitions.

Adabas Audit Trail

When the Adabas audit trail feature is enabled, the following personal data is logged:

- User Identification
- Hostname of the Adabas client
- Process Identification
- Timestamp of Access Request
- ET data
- Name of the access operation and the object of the operation

The location and configuration of the audit trail is feature-specific. For more information, please refer to [Configuration](#) in the section *Adabas Role-Based Security (ADARBA)*.

The Audit Trail for Authorization for the Adabas Direct Call Interface is automatically enabled with the feature and cannot be disabled.

Adabas Command Log

When the Adabas Command Log feature is enabled, the following personal data is logged:

- User Identification
- Hostname of the Adabas client
- Process Identification
- Timestamp
- Adabas Command

When enabled, a command log file is created in the database directory. The file is identified by the value of the environment variable `NUCCLG`. The file can have multiple extends.

The Adabas Command Log feature can be enabled or disabled via the `LOGGING` control parameter of either utility:

- `ADANUC`
- `ADAOPR`

Please refer to either the *ADANUC* or *ADAOPR* section of the *Adabas Utilities*, for further information on the `LOGGING` control parameter.

Adabas Log File

When the Adabas log feature is enabled, the following personal data is logged:

- User Identification
- Process Identification
- Timestamp
- Name of the Adabas Utility with the requested function

The configuration file *ADABAS.INI* contains the location and configuration of the Adabas log file.

By default, the file name is *\$ADADATADIR\etc\ADABAS.LOG*. The logging functionality is configured using the topic *NODE_PARAMETER* and its subtopics:

| Subtopic | Description |
|-----------------|---|
| ANALYSER | Enable the Adabas Extended Operations (AEO) feature |
| LOGGING | The Adabas log file is configured with the items: <ul style="list-style-type: none">■ ACTION - enables logging and■ LOG_PATH - defines the file location |
| ARCHIVE_LOGFILE | Enables the archiving of the Adabas log file |
| ALERT | The Adabas log file entry can be processed by an alert routine. This is enabled and configured with the items: <ul style="list-style-type: none">■ ACTION - enables alert processing and■ ACTION_ROUTINE - defines the alert routine |

Please refer to the section *ADABAS.INI* under *Configuration Files* in the *Adabas Extended Operations* documentation, for further information on the location and configuration of the Adabas log file.