Contents

Tables ........................................................................................................ vii

Figures ....................................................................................................... ix

About this document ................................................................................ xi
Who should use this document ................................................................. xi
How this document is organized ................................................................. xi
Where to find more information ............................................................... xi
  Softcopy publications ........................................................................... xi
  Internet sources ..................................................................................... xi
  Using LookAt to look up message explanations ...................................... xii
  Accessing licensed documents on the Internet ....................................... xii
Conventions used in this document ........................................................ xiii

How to send your comments to IBM ....................................................... xv
If you have a technical problem ............................................................... xv

Summary of changes .............................................................................. xvii
Changes made in z/OS Version 1 Release 13 as updated April 2012 .......... xvii
Changes made in z/OS Version 1 Release 13 ........................................... xvii
Changes made in z/OS Version 1 Release 12 ........................................... xvii

Part 1. Guide

Chapter 1. Introducing Network Authentication Service ....................... 1-1
  Overview ................................................................................................ 1-1
  Supported RFCs ................................................................................... 1-1
  Authentication ...................................................................................... 1-2
  Realms .................................................................................................. 1-3
  Principals .............................................................................................. 1-4
  Registry database types: SAF or NDBM .............................................. 1-4
  Encryption types and strong encryption ............................................. 1-7
  Application programming interfaces .................................................. 1-7

Chapter 2. Configuring Network Authentication Service ...................... 2-1
  Making the program operational .......................................................... 2-1
  Configuration of encryption types ...................................................... 2-4
  Security runtime configuration with LDAP and DNS considerations ...... 2-5
  LDAP schema definitions .................................................................... 2-7
  Security server configuration ............................................................... 2-8
    Configuring the primary security server for the realm ....................... 2-8
    Configuring a secondary security server for the realm ..................... 2-10
  Security runtime environment variables .......................................... 2-11
  Security server environment variables .............................................. 2-17
  Security runtime configuration profile .............................................. 2-19
    Configuration profile file sections .................................................. 2-20
    Sample /etc/skrb/krb5.conf configuration file ................................. 2-24

Chapter 3. Administering Network Authentication Service ................... 3-1
  Adding principals ............................................................................... 3-1
    Local principals .............................................................................. 3-1
    Foreign principals ........................................................................... 3-1
    Principal names .............................................................................. 3-1
# Tables

1. Typographic conventions ............................................. xiii
2-1. Supported RFC numbers ........................................... 1-1
2-2. LDAP object classes .............................................. 2-7
2-3. LDAP attributes ................................................... 2-7
2-4. Environment variables for security runtime .................... 2-12
2-5. Environment variables for security server ....................... 2-17
2-6. Sections of the configuration profile file ....................... 2-20
5-1. Time zones recognized by the `kadmin` command ............ 5-3
6-1. GSS-API calling errors ........................................... 6-1
6-2. GSS-API routine errors ........................................... 6-1
6-3. GSS-API supplementary status bits .............................. 6-2
8-1. Subcomponent numbers ............................................ 8-2
Figures

1-1. Cross-Sysplex Environment Using SAF Databases ............................... 1-5
1-2. Cross-Platform Environment Using NDBM Databases ......................... 1-6
6-1. GSS status code bit locations. ....................................................... 6-1
A-1. KRB390.IBM.COM configuration - creating SRV entries ...................... A-3
A-2. KRB390.IBM.COM configuration - creating a TXT record .................... A-4
A-3. KRB2003.IBM.COM configuration - creating a TXT record to map host names A-5
A-4. KRB390.IBM.COM configuration - setting up the Windows 2003 side of the peer-to-peer trust relationships .............................. A-6
A-5. MITKRB.IBM.COM configuration - creating an SRV record using the UDP protocol A-7
A-6. MITKRB.IBM.COM configuration - creating an SRV record using the TCP protocol A-8
A-7. MITKRB.IBM.COM configuration - creating a TXT record to map host names . A-9
A-8. MITKRB.IBM.COM configuration - setting up the Windows 2003 side of the peer-to-peer trust relationships ........................................ A-10
About this document

This publication describes how to configure and administer z/OS® Integrated Security Services Network Authentication Service. It supports z/OS (5694-A01).

Who should use this document

This document is for someone installing the product who has system programmer skills and for system administrators.

How this document is organized

This document is divided into two parts. Part 1 is the Guide; it provides overview and how-to information. Part 2 is the Reference; it contains information that you might need to look up.

The chapters in Part 1 are:

- Chapter 1, “Introducing Network Authentication Service,” on page 1-1 - this chapter gives an overview of the z/OS Integrated Security Services Network Authentication Service.
- Chapter 2, “Configuring Network Authentication Service,” on page 2-1 - this chapter tells you how to perform the tasks done after installing the product but before using it.
- Chapter 3, “Administering Network Authentication Service,” on page 3-1 - this chapter provides background information for the administrator plus the few operator commands you need.

The chapters in Part 2 are:

- Chapter 5, “Commands,” on page 5-1 - this chapter presents Network Authentication Service for z/OS commands in alphabetical order.
- Chapter 6, “Status codes,” on page 6-1 - this chapter lists the status codes for z/OS Network Authentication Service.
- Chapter 7, “Messages,” on page 7-1 - this chapter contains three sets of messages: messages from Kerberos runtime (EUVF02000 through EUVF03999), messages from the Security Server (EUVF04000 through EUVF05999), and messages from Kerberos commands (EUVF06000 through EUVF06999).

Where to find more information

Where necessary, this document refers to information in other documents. For complete titles and order numbers for all elements of z/OS, see [z/OS Information Roadmap].

The companion publication for this document is [z/OS Integrated Security Services Network Authentication Service Programming], which describes application programming interfaces for the product. The “Bibliography” on page F-1 lists selected publications of z/OS Integrated Security Services.

Softcopy publications

The z/OS Integrated Security Services Network Authentication Service library is available on a CD-ROM, z/OS Collection, SK3T-4269. The CD-ROM online library collection is a set of unlicensed documents for z/OS and related products that includes the IBM Library Reader. This is a program that enables you to view the BookManager® files. This CD-ROM also contains the Portable Document Format (PDF) files. You can view or print these files with the Adobe Acrobat Reader.

Internet sources

z/OS online library
The softcopy z/OS publications are also available for web browsing, and PDF versions for viewing or printing using the following URL:


You can also provide comments about this document and any other z/OS documentation by visiting that URL. Your feedback is important in helping to provide the most accurate and high-quality information.

**Using LookAt to look up message explanations**

LookAt is an online facility that allows you to look up explanations for most of the z/OS, z/VM, and VSE messages you encounter, as well as system abends, and some codes. Using LookAt to find information is faster than a conventional search, because, in most cases, LookAt goes directly to the message explanation.

You can use LookAt from the Internet at:


or from anywhere in z/OS where you can access a TSO/E command line (for example, TSO/E prompt, ISPF, z/OS UNIX Systems Services running OMVS).

You can also download code from the z/OS Collection, SK3T-4269, or from the LookAt Web site so you can access LookAt from a PalmPilot (Palm VIIx suggested).

To use LookAt on the Internet to find a message explanation, go to the LookAt Web site and simply enter the message identifier (for example, $HASP701 or $HASP*). You can select a specific release to narrow your search.

To use LookAt as a TSO/E command, you must have LookAt installed on your host system. You can obtain the LookAt code for TSO/E from a disk on your z/OS Collection, SK3T-4269, or from the LookAt Web site. To obtain the code from the LookAt Web site, do the following:

2. Click News.
3. Scroll to Download LookAt Code for TSO/E and z/VM.
4. Click the ftp link, which takes you to a list of operating systems. Click the appropriate operating system. Then click the appropriate release.
5. Open the lookat.me file and follow its detailed instructions.

After you have LookAt installed, you can access a message explanation from a TSO/E command line by entering: `lookat message-id`. LookAt displays the message explanation for the message requested. To find a message explanation from a TSO command line, simply enter: `lookat message-id`. LookAt displays the message explanation for the message requested.

**Note:** Some messages have information in more than one document. For example, IEC192I has routing and descriptor codes listed in [z/OS MVS System Messages, Vol 7 (IEB-IEE)](http://www.ibm.com/servers/eserver/zseries/zos/bkserv/BK00007.html). For such messages, LookAt displays a list of documents in which the message appears. You can then click the message identifier under each document title to view information about the message.

**Accessing licensed documents on the Internet**

z/OS licensed documentation is available on the Internet in BookManager and PDF format at the IBM Resource Link® Web site at:

http://www.ibm.com/servers/resourcelink
Licensed documents are available only to customers with a z/OS license. Access to these documents requires an IBM Resource Link user ID, and password, and a key code. With your z/OS order you received a Memo to Licensees, GI10-0671, that includes this key code.

To obtain your IBM Resource Link user ID and password, log on to:

http://www.ibm.com/servers/resourcelink

To register for access to the z/OS licensed documents:
1. Sign in to Resource Link using your Resource Link user ID and password
2. Select User Profiles located on the left-hand navigation bar
3. Click Request Access to z/OS Licensed Books
4. Supply the key code where requested and click Submit.

If you supplied the correct key code, you will receive confirmation that your request is being processed. After your request is processed, you will receive an e-mail confirmation.

Note: You cannot access the z/OS licensed documents unless you have registered for access to them and received an e-mail confirmation informing you that your request has been processed.

To access the licensed documents:
1. Sign in to Resource Link using your Resource Link user ID and password
2. Select Library located on the left-hand navigation bar.
3. Click zSeries.
4. Click Software.
5. Click the release of z/OS.
6. Click Licensed publications.

Printed licensed documents are not available from IBM.

You can use the PDF format on either z/OS Licensed Product Library CD-ROM or IBM Resource Link to print licensed documents.

**Conventions used in this document**

This document uses the following typographic conventions:

<table>
<thead>
<tr>
<th><strong>Table 1. Typographic conventions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boldface</strong></td>
</tr>
<tr>
<td>• The item you need to select</td>
</tr>
<tr>
<td>• A field, option, parameter, or command</td>
</tr>
<tr>
<td>• A new term</td>
</tr>
<tr>
<td><strong>Italic</strong></td>
</tr>
<tr>
<td><strong>Monofont</strong></td>
</tr>
<tr>
<td>• Names of directories, files, and user IDs</td>
</tr>
<tr>
<td>• Information displayed by the system</td>
</tr>
<tr>
<td>• An example</td>
</tr>
<tr>
<td>• A portion of a file or sample code</td>
</tr>
<tr>
<td>• A previously entered value.</td>
</tr>
<tr>
<td><strong>Bold Monofont</strong></td>
</tr>
<tr>
<td>[]</td>
</tr>
</tbody>
</table>
Table 1. Typographic conventions (continued)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ }</td>
<td>Braces enclose a list of required items, in format and syntax descriptions, from which you must select one.</td>
</tr>
<tr>
<td></td>
<td>A vertical bar separates items in a list of choices.</td>
</tr>
<tr>
<td>&lt; &gt;</td>
<td>Angle brackets enclose the name of a key on the keyboard.</td>
</tr>
<tr>
<td>. . .</td>
<td>Horizontal ellipsis points indicate that you can repeat the preceding item one or more times.</td>
</tr>
<tr>
<td>\</td>
<td>A backslash is used as a continuation character when entering commands from the shell that exceed one line (255 characters). If the command exceeds one line, use the backslash character as the last nonblank character on the line to be continued, and continue the command on the next line.</td>
</tr>
</tbody>
</table>
How to send your comments to IBM

We appreciate your input on this publication. Feel free to comment on the clarity, accuracy, and completeness of the information or give us any other feedback that you might have.

Use one of the following methods to send us your comments:

1. Send an email to mhvrcfs@us.ibm.com
3. Mail the comments to the following address:
   IBM Corporation
   Attention: MHVRCFS Reader Comments
   Department H6MA, Building 707
   2455 South Road
   Poughkeepsie, NY 12601-5400
   U.S.A.
4. Fax the comments to us as follows:
   From the United States and Canada: 1+845+432-9405
   From all other countries: Your international access code +1+845+432-9405

Include the following information:
- Your name and address
- Your email address
- Your telephone or fax number
- The publication title and order number:
  z/OS V1R13.0 Integrated Security Services Network Authentication Service Administration
  SC24-5926-11
- The topic and page number related to your comment
- The text of your comment.

When you send comments to IBM, you grant IBM a nonexclusive right to use or distribute your comments in any way it believes appropriate without incurring any obligation to you.

IBM or any other organizations will only use the personal information that you supply to contact you about the issues that you submit.

If you have a technical problem

Do not use the feedback methods listed above. Instead, do one of the following:
- Contact your IBM service representative
- Call IBM technical support
- Visit the IBM support portal at [http://www.ibm.com/systems/z/support/](http://www.ibm.com/systems/z/support/)
Summary of changes

This document contains terminology, maintenance, and editorial changes to improve consistency and retrievability. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

Changes made in z/OS Version 1 Release 13 as updated April 2012

This document contains information previously presented in Integrated Security Services Network Authentication Service, SC24-5926-10, which supports z/OS Version 1 Release 13.

Changed information:
- The description of use_dvipa_override was clarified. See “Configuration profile file sections” on page 2-20 for more details.

Changes made in z/OS Version 1 Release 13

This document contains information previously presented in Integrated Security Services Network Authentication Service, SC24-5926-09, which supports z/OS Version 1 Release 12.

New information:
- “Defining your local realm” on page 4-2 was updated to include a new option CHECKADDRS.

Changed information:
- The example for “Defining your local realm” on page 4-2 was enhanced.
- The KRB5_SERVER_KEYTAB entry to Table 2-3 on page 2-12 of “Security runtime environment variables” on page 2-11 in Chapter 2, “Configuring Network Authentication Service,” on page 2-1, was enhanced.

Changes made in z/OS Version 1 Release 12

This document contains information that was previously presented in Your Book Title, XXnn-nnnn-nn, which supports z/OS Version 1 Release 11.

New information:
- The “Authentication” on page 1-2 subject of Chapter 1, “Introducing Network Authentication Service,” on page 1-1 was updated with new information.
- Chapter 2, “Configuring Network Authentication Service,” on page 2-1 was updated with a new 7 on page 2-3 step.
- Added information on use_dvipa_override. See “Configuration profile file sections” on page 2-20 for more details.
- A new note was added to the following Kadmin subcommands, regarding z/OS not supporting hardware authentication:
  - 5-6 attribute of get_principal
  - 5-8 attribute of add_principal
  - 5-10 attribute of modify_principal

Changed information:
• The "Readers' Comments - We'd Like to Hear from You" section at the back of this publication has been replaced with a new section [How to send your comments to IBM on page xv]. The hardcopy mail-in form has been replaced with a page that provides information appropriate for submitting comments to IBM.

• Enhanced information on the KRB5_SERVER_KEYTAB environment variable. See ["Security runtime environment variables" on page 2-11] for more details.
Part 1. Guide

This part of the document contains information on:

- Introducing Network Authentication Service for z/OS
- Configuring Network Authentication for Service z/OS
- Administering Network Authentication for Service z/OS
Chapter 1. Introducing Network Authentication Service

This chapter provides an introduction to z/OS Integrated Security Services Network Authentication Service.

Overview

Integrated Security Services Network Authentication Service for z/OS is the IBM z/OS program based on Kerberos™ Version 5 and GSS. This component of z/OS will be referred to hereafter as “Network Authentication Service for z/OS,” “z/OS Network Authentication Service,” or “Network Authentication Service.”

Network Authentication Service for z/OS provides Kerberos security services without requiring that you purchase or use a middleware product. These services include native Kerberos application programming interface (API) functions, as well as the Generic Security Service Application Programming Interface (GSS-API) functions.

Starting with z/OS version 1 release 9, the Network Authentication Service GSS-APIs support the SPKM-3/LIPKEY mechanisms. The infrastructure required to use the SPKM-3/LIPKEY mechanisms of GSS is not described in this manual, but is described in Chapter 9, "Certificate/key Management" in z/OS Cryptographic Services System SSL Programming. The use of the SPKM-3/LIPKEY mechanism within GSS-APIs is documented in z/OS Integrated Security Services Network Authentication Service Programming.

Environmental variables that are used by the SPKM-3/LIPKEY mechanisms are GSS_KEY_LABEL, GSS_KEYRING_NAME, and GSS_KEYRING_PW. For more information on these mechanisms, see Table 2-3 on page 2-12. The GSS-API LIPKEY/SPKM mechanism codes are described in "GSS-API LIPKEY/SPKM mechanism codes (numbers 025EA160-025EA18F)" on page 6-5. The RFCs that are relevant to the SPKM-3/LIPKEY mechanisms are in Table 1-1.

Unless stated otherwise, this document mainly describes the Network Authentication Service based on the Kerberos protocol.

There is a glossary of terms for Network Authentication Service in the "Glossary" on page E-1.

Supported RFCs

The following RFC numbers are supported:

<table>
<thead>
<tr>
<th>RFC Area</th>
<th>RFC Number and Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerberos</td>
<td>RFC 3961 - Encryption and Checksum Specifications for Kerberos</td>
</tr>
<tr>
<td></td>
<td>RFC 3962 - Advanced Encryption Standard (AES) Encryption for Kerberos</td>
</tr>
<tr>
<td></td>
<td>RFC 4120 - The Kerberos Network Authentication Service (V5)</td>
</tr>
<tr>
<td></td>
<td>RFC 4537 - Kerberos Cryptosystem Negotiation Extension</td>
</tr>
</tbody>
</table>
Table 1-1. Supported RFC numbers (continued)

<table>
<thead>
<tr>
<th>RFC Area</th>
<th>RFC Number and Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSS</td>
<td>RFC 2078 - Generic Security Service Application Program Interface (V2)</td>
</tr>
<tr>
<td></td>
<td>RFC 2744 - Generic Security Service Application Program Interface Version 2: C</td>
</tr>
<tr>
<td></td>
<td>Bindings</td>
</tr>
<tr>
<td></td>
<td>RFC 2744 - Generic Security Service Application Program Interface Version 2: C</td>
</tr>
<tr>
<td>Kerberos Mechanism</td>
<td>RFC 1964 - The Kerberos Version 5 GSS-API Mechanism</td>
</tr>
<tr>
<td></td>
<td>RFC 4121 - The Kerberos Version 5 Generic Security Service Application Program</td>
</tr>
<tr>
<td></td>
<td>Interface (GSS-API) Mechanism: Version 2</td>
</tr>
<tr>
<td></td>
<td>draft-raeburn-krb-gssapi-krb5-3des-01.txt - Triple-DES Support for the Kerberos 5</td>
</tr>
<tr>
<td></td>
<td>GSSAPI Mechanism</td>
</tr>
<tr>
<td>LIPKEY Mechanism</td>
<td>RFC 2847 - LIPKEY - A Low Infrastructure Public Key Mechanism Using SPKM</td>
</tr>
<tr>
<td>SPKM-3 Mechanism</td>
<td>RFC 2025 - The Simple Public-Key GSS-API Mechanism (SPKM)</td>
</tr>
<tr>
<td></td>
<td>RFC 2253 - UTF-8 String Representation of Distinguished names</td>
</tr>
<tr>
<td></td>
<td>RFC 2459 - X.509 Public Key Infrastructure</td>
</tr>
</tbody>
</table>

Authentication

Network Authentication Service for z/OS performs authentication as a trusted third-party authentication service by using conventional shared secret-key cryptography. Network Authentication Service provides a means of verifying the identities of principals, without relying on authentication by the host operating system, without basing trust on host addresses, without requiring physical security of all the hosts on the network, and under the assumption that packets traveling along the network can be read, modified, and inserted at will.

The two methods for obtaining credentials, the initial-ticket exchange and the ticket-granting-ticket exchange, use slightly different protocols and require different API routines.

The basic difference an application programmer sees is that the initial-ticket exchange does not require a ticket-granting-ticket (TGT) but does require the client’s secret key. Usually, the initial-ticket exchange is for a TGT, and TGT exchanges are used from then on. In a TGT exchange, the TGT is sent as part of the request for a ticket and the reply is encrypted in the session key obtained from the TGT. Thus, once a user’s password is used to obtain the initial TGT, it is not required for subsequent TGT exchanges to obtain additional tickets.

A ticket-granting ticket contains the Kerberos server (krbtgt/realm) as the server name. A service ticket contains the application server as the server name. A ticket-granting ticket is used to obtain service tickets. In order to obtain a service ticket for a server in another realm, the application must first obtain a ticket-granting ticket to the Kerberos server for that realm.

The Kerberos server reply consists of a ticket and a session key, encrypted either in the user’s secret key or the TGT session key. The combination of a ticket and a session key is known as a set of credentials. An application client can use these credentials to authenticate to the application server by sending the ticket and an authenticator to the server. The authenticator is encrypted in the session key of the ticket and contains the name of the client, the name of the server, and the time the authenticator was created.

In order to verify the authentication, the application server decrypts the ticket using its service key, which is known only by the application server and the Kerberos server. Inside the ticket, the Kerberos server has placed the name of the client, the name of the server, a session key associated with the ticket, and some additional information.
The application server then uses the ticket session key to decrypt the authenticator and verifies that the information in the authenticator matches the information in the ticket. The server also verifies that the authenticator timestamp is recent to prevent replay attacks (the default is 5 minutes). Since the session key was generated randomly by the Kerberos server and delivered encrypted in the service key and a key known only by the user, the application server can be confident that users really are who they claim to be, by virtue of the fact that the user was able to encrypt the authenticator in the correct key.

To provide detection of both replay attacks and message stream modification attacks, the integrity of all the messages exchanged between principals can also be guaranteed by generating and transmitting a collision-proof checksum of the client's message, keyed with the session key. The privacy and integrity of the messages exchanged between principals can be secured by encrypting the data to be passed using the session key.

Authorization is checking if a specific user is allowed access to the requested data or resources where authentication is verifying that the user is who they say they are. Application developers must remember that these are not the same thing and after authentication is complete, they still need to check to see if the authenticated user is authorized to access the requested data and/or resources.

Realms
The Kerberos protocol is designed to operate across organizational boundaries. Each organization wishing to run a Kerberos server establishes its own realm. The name of the realm in which a client is registered is part of the client's name and can be used by the application server to decide whether to honor a request.

By establishing inter-realm keys, the administrators of two realms can allow a client authenticated in one realm to use its credentials in the other realm. The exchange of inter-realm keys registers the ticket-granting service of each realm as a principal in the other realm. A client is then able to obtain a ticket-granting ticket for the remote realm's ticket-granting service from its local ticket-granting service. Tickets issued to a service in the remote realm indicate that the client was authenticated from another realm.

This method can be repeated to authenticate throughout an organization across multiple realms. To build a valid authentication path to a distant realm, the local realm must share an inter-realm key with the target realm or with an intermediate realm that communicates with either the target realm or with another intermediate realm.

Realms are typically organized hierarchically. Each realm shares a key with its parent and a different key with each child. If an inter-realm key is not directly shared by two realms, the hierarchical organization allows an authentication path to be easily constructed. If a hierarchical organization is not used, it may be necessary to add a CAPATHS section to the krb5.conf configuration file in order for Kerberos to construct an authentication path between realms.

Although realms are typically hierarchical, intermediate realms may be bypassed to achieve cross-realm authentication through alternate authentication paths. It is important for the end-service to know which realms were transited when deciding how much faith to place in the authentication process. To facilitate this decision, a field in each ticket contains the names of the realms that were involved in authenticating the client.

For more information on realms, and specifically realm trust relationships, see Chapter 3, "Administering Network Authentication Service," on page 3-1.
Principals

These are the unique names of users and services used by Kerberos. They have the format Primary/Instance@Realm and will contain a password and encryption types supported by the user or service. Because the Kerberos database only contains information about users and services on the machines within the local realm, the realm name will always be the local realm except for peer trust relationships.

Note: RACF uses a special format for entering and displaying fully qualified principal names due to the '@' being a variant character. This format is /.../Realm/Primary/Instance.

For users, the Primary is the users name, the Instance is null and the Realm is the realm assigned to the machine the user is using, for example: fred@XYZ.COM. If the user can sign on via two or more computers in the same realm then only one principal needs to be defined for that user but if the user can sign on via two or more computers in different realms then that user will need a principal defined in each realm that they can sign on from. There are some applications that will require the user to have an extra principal with an Instance related to the application, for example: fred@XYZ.COM.

For services, the Primary is the name of the service, the Instance is the machine name where the service is located and the Realm is the realm where the machine is located, for example: ftp/server01.xyz.com@XYZ.COM. Peer Trust Relationships are implemented as special Ticket Granting Service (TGS) principals where the Primary is krbtgt, the Instance is the realm name of the TGS you want to request tickets from and the Realm is the realm name of the KDC that issued the TGT. For example, krbtgt/WILMA.REALM@FRED.REALM which would be the TGT for WILMA.REALM issued by FRED.REALM).

These are the conventions but, if you are designing your own application, you can use any principal name. If you do deviate from these conventions, then you should be aware that some of the API calls might fill in missing data. For example, krb5_import_name will include the host name for a service principal if an instance is not provided, have naming restrictions (Primary and Instance cannot contain an '@' symbol) or have length restrictions (eg. RACF local principals, including the realm name, cannot exceed 240 characters).

Registry database types: SAF or NDBM

The Kerberos security server supports two registry database types: SAF (Kerberos principals stored in the System Authorization Facility database) and NDBM (Kerberos principals stored in a Unix System Services database using HFS files). IBM recommends that the SAF registry be used unless it is necessary to share the Kerberos registry with one or more KDC instances running on another operating system.
The SAF registry database has these capabilities and requirements:

- Kerberos information is integrated with the z/OS system authorization profiles. All information is managed by SAF and stored in the SAF database. The KDC does not maintain its own registry database.
- The SAF database is shared within the sysplex and can be shared with other z/OS systems by using RACF Remote Sharing Facility (RRSF). Figure 1-1 shows an example of this environment.
- SAF callable services are provided to map Kerberos principals to system user IDs and to map system user IDs to Kerberos principals.
- Support is provided for using system-authenticated user IDs to eliminate the use of Kerberos passwords and key tables when obtaining and decrypting tickets.
- No Kerberos administration support is provided due to semantic differences between the SAF database and the Kerberos administration wire protocols.
- All KDC instances in the realm must share the same SAF database (homogeneous environment).
- The SAF registry scales to support a large number of principals.
The NDBM registry database has these capabilities and requirements:

- The KDC maintains its own registry database using the Unix System Services NDBM support. The database files are located in the `/var/skrb/krb5kdc` directory and must be protected and backed up appropriately.
- The NDBM database is not shared within the sysplex. Each KDC instance must have its own NDBM database files. Database propagation is used to synchronize the database files for each KDC. An example of this environment is shown in Figure 1-2.
- SAF callable services can be used to map Kerberos principals to system user IDs and to map system user IDs to Kerberos principals. In order to use these services, the Kerberos administrator must define the Kerberos principals in the SAF database as well as in the NDBM database. However, there is no need to synchronize the SAF password for the principal with the NDBM password for the principal since Kerberos always uses the password obtained from the NDBM database.
- System authentication can be used to eliminate the use of Kerberos passwords and key tables when obtaining and decrypting tickets. In order to use these services, the Kerberos administrator must define the Kerberos principals in the SAF database as well as in the NDBM database. However, there is no need to synchronize the SAF password for the principal with the NDBM password for the principal since Kerberos always uses the password obtained from the NDBM database.
- Full Kerberos administration support is provided.
- The realm can contain both z/OS KDC and non-z/OS KDC instances (heterogeneous environment).
- The NDBM registry is limited by the maximum size of an HFS database. In addition, the database propagation protocol is inefficient for a large number of principals unless the update propagation protocol is used.
Encryption types and strong encryption

Network Authentication Service for z/OS supports the following encryption types:
- 56-bit DES, referred to specifically as DES
- 56-bit DES with key derivation, referred to specifically as DESD
- 168-bit DES, referred to specifically as DES3
- 128-bit AES, referred to specifically as AES128
- 256-bit AES, referred to specifically as AES256

A Kerberos ticket has two portions, a user portion and a server portion, and both are encrypted with possibly different encryption types. The encryption type of the server portion is selected by the KDC as the first encryption type from the SKDC_TKT_ENCTYPES environment variable (processed left to right) that is available in the local realm definition. The encryption type of the user portion for a TGT is selected by the KDC as the first encryption type from the default_tkt_enctypes environment variables (processed left to right) that is available in the users principal definition. The encryption type of the user portion for a service ticket is selected by the KDC as the first encryption type from the default_tgs_enctypes environment variables (processed left to right) that is available in the service principal definition. The KDC does not pick encryption types based on encryption strength but on the order of the entries in the environmental variables (left to right) so it is important that you make these correct as they affect the entire system. If a particular system does not support an encryption type it is not necessary to disable that encryption type for everyone but to remove it from the appropriate principal.

In Network Authentication Service for z/OS, DES encryption is always supported. DES3, AES128, and AES256 encryptions are available for authentication purposes. However, due to US government export regulations, they may not be available for user data encryption. This means that tickets can be obtained for instance by using DES3 encryption but the session keys in service tickets may need to be restricted to DES encryption (the session key is often used for user data encryption).

Thus, the use of DES3 encryption can be controlled on an individual server basis when necessary. For example, if a foreign realm does not support DES3 encryption, the `krbtgt/foreign-realm@local-realm` principal entry in the KDC registry database contains just a DES key and not a DES3 key.

Application programming interfaces

An entire document, Z/OS Integrated Security Services Network Authentication Service Programming, is devoted to the APIs for Network Authentication Service for z/OS. This document explains how to use the APIs, as well as providing a reference section that describes each API individually.
Chapter 2. Configuring Network Authentication Service

This chapter provides configuration information for Network Authentication Service for z/OS.

Making the program operational

After you have installed z/OS, you must take certain steps to make Network Authentication Service operational. Here are those steps:

1. These steps assume that Resource Access Control Facility (RACF®) is your external security manager. If you have a different but equivalent external security manager, consult the documentation for that product for the corresponding instructions and commands.
   a. Copy the SKRBKDC started task procedure from EUVF.SEUVFSAM to SYS1.PROCLIB. Change the PARM keyword to specify –nokdc instead of –kdc if you want to use the SKRBKDC application services (such as application component trace or sysplex credentials caches), but do not want to run a KDC on the system.
   b. Copy the SKRBKDC sample configuration file from /usr/lpp/skrb/examples/krb5.conf to /etc/skrb/krb5.conf. The file permissions should allow everyone to read the file and only the administrator to update it.
   c. Copy the SKRBKDC environment variable definitions from /usr/lpp/skrb/examples/skrbkdc.envar to /etc/skrb/home/kdc/envar. Modify the SKDC_DATABASE environment variable to select either the SAF or NDBM registry. The SAF registry is used if this environment variable is not set. IBM recommends that the SAF registry be used unless it is necessary to share the Kerberos registry with one or more KDC instances running on another operating system. The file permissions should allow only the administrator to read and update the file.

   Set the TZ value for your installation, and determine which type of database, NDBM or SAF, your site will use. TZ is explained in the C/C++ Run-Time library reference, and instructions on modifying it are in the z/OS XL C/C++ Programming Guide “Using the TZ or _TZ Environment Variable to Specify Time Zone”.
   d. If your installation uses the SERVAUTH RACF class profiles to control access to TCP/IP ports and stacks, also use the RACF publications as a guide to update the TCP/IP resource permissions needed for Network Authentication Service users and KDCs.
   e. The IRR.RUSERMAP resource in the FACILITY class must be defined if you are going to obtain service keys from a local instance of the KDC instead of from a key table. The application server system IDs must have RACF READ access to IRR.RUSERMAP resource to use the KRB5_SERVER_KEYTAB variable set to 1. To define IRR.RUSERMAP and grant READ authority to all system users:

      RDEFINE FACILITY IRR.USERMAP UACC(READ)
      SETROPTS RACLIST(FACILITY) REFRESH

      See “Security runtime environment variables” on page 2-11 for more on the KRB5_SERVER_KEYTAB environment variable.
   f. The following steps are to be used only if you are implementing the SAF database. Skip these steps if you are using NDBM.
      1) Before starting the SKRBKDC started task, when using the SAF database implementation, be sure that the REALM definitions and other configuration and RACF items are completed for your installation. See Chapter 3, “Administering Network Authentication Service,” on page 3-1 for more information. Refer also to the appropriate sections of z/OS Security Server RACF Security Administrator’s Guide and supporting publications for updating the RACF Database template and the Dynamic Parsing task before using Network Authentication Service for z/OS.
      2) Define the RACF Remote Sharing Facility (RRSF) for the local system, even if you do not plan to set up an RRSF network. An RRSF local node must be defined in order to generate the...
Configuring

corresponding Kerberos secret key whenever users change their password. Refer to [z/OS Security Server RACF Security Administrator's Guide](#) for information on defining the local RRSF node.

a) Create the SKRBKDC user ID. This user ID must have UID(0).

```bash
ADDUSER SKRBKDC DFLTGRP(SYS1) NOPASSWORD OMVS(UID(0)
PROGRAM('/bin/sh') HOME('/etc/skrb/home/kdc'))
```

b) Activate the APPL class if it is not already active.

```bash
SETROPTS CLASSACT(APPL) RACLIST(APPL)
```

3) Define the SKRBKDC application and set the universal access to READ. Alternately, you can set the universal access to NONE and define individual groups or users to the SKRBKDC application. Users must have access to the SKRBKDC application to use the `kpasswd` command to change their passwords.

```bash
RDEFINE APPL SKRBKDC UACC(READ)
```

4) Activate the PTKTDATA class if it is not already active.

```bash
SETROPTS CLASSACT(PTKTDATA) RACLIST(PTKTDATA)
```

5) Define the PassTicket data for the SKRBKDC application. PassTickets are used internally by the Kerberos security server when the user password is changed. A PassTicket is never given to a user by the Kerberos security server. The secured signon key can be any valid DES key as described in [z/OS Security Server RACF Security Administrator's Guide](#).

```bash
RDEFINE PTKTDATA SKRBKDC UACC(NONE) SSIGNON(KEYMASKED(3734343237343131))
```

6) Refresh the APPL and PTKTDATA classes.

```bash
SETROPTS RACLIST(APPL PTKTDATA) REFRESH
```

g. Define the SKRBKDC started task and associate it with the SKRBKDC user ID. Define the SKRBWTR started task and associate it with the SKRBKDC user ID if you plan to perform component tracing with the SKRBWTR procedure.

```bash
RDEFINE STARTED SKRBKDC.** STDATA(USER(SKRBKDC))
RDEFINE STARTED SKRBWTR.** STDATA(USER(SKRBKDC))
```

h. Refresh the STARTED Class.

```bash
SETROPTS RACLIST(STARTED) REFRESH
```

2. If you wish, customize the `/etc/services` file to assign ports to the Kerberos services. Add the following service names and change the default entries for port/protocol to reflect how you operate the network at your installation. Each line represents a line in the `/etc/services` file showing the service name and the default values for the port/protocol. Kerberos uses the default port assignments if `/etc/services` does not contain the Kerberos entries, so customizing `/etc/services` is an optional step and only needs to be done if the default port assignments are not acceptable.

```plaintext
kerberos 88/udp
kerberos 88/tcp
kpasswd 464/udp
kpasswd 464/tcp
kerberos-adm 749/tcp
krb5 prop 754/tcp
```

3. Because the master KDC function in the DCE Security Server uses port 749, and the primary KDC administration function in Network Authentication Service defaults to port 749, you must take the following action to avoid a conflict. There are these possible situations:

- If you are not running a master DCE Security Server on your system, you will not have a conflict. Skip to Step 4 on page 2-3

  **Note:** The administration service is started only on the DCE master security server. DCE security server replicas do not use port 749.

- If you are not planning to use an NDBM database, you will not have a conflict. Skip to Step 4 on page 2-3
If you are planning to use an NDBM database, but the primary KDC is not on this system, you will not have a conflict. Skip to Step 4.

If you are planning to use an NDBM database, and if you are running a master DCE Security Server on your system, your primary NDBM KDC `envar` file must specify the environment variable `SKDC_KADMIN_PORT` with a value other than 749 that complies with how you operate the network at your installation.

4. Because the KDC function in the DCE Security Server uses port 88, and the KDC function in Network Authentication Service defaults to port 88, you must take the following action to avoid a conflict. There are these possible situations:
   - If you are not running a DCE Security Server on your system, you will not have a conflict. Skip to Step 5.
   - If you are running a DCE Security Server on your system, but are not using the KDC portion of it, add the line `SECD_ENABLE_KDC=0` to the DCE Security Server `envar` file to disable DCE use of port 88. (You must stop and start the DCE Security Server to bring changes to its `envar` file online.)
   - If you are running a DCE Security Server on your system, and you are using the KDC portion of it, the Network Authentication Service KDC `envar` file in `/etc/skrb/home/kdc` must specify the environment variable `SKDC_PORT` with a value other than 88 that complies with how you operate the network at your installation. Corresponding changes to the `/etc/skrb/krb5.conf` file, LDAP KDC port specification, or DNS SRV records will be necessary to inform users of this KDC port change.

5. Customize the Communications Server PROFILE DD name member to ensure that the selected ports for the KDC (usually Port 88, unless it was changed above), the KPASSWD port (usually Port 464), and the KADMIN port (usually Port 749 unless it was changed above) are reserved for z/OS UNIX System Services.

6. Because DCE uses the same commands and environment variables as Network Authentication Service, you must perform these steps:
   a. Determine which user IDs will be using Network Authentication Service. These user IDs must not use DCE.
   b. Customize the LOGON procedures for the Network Authentication Service users:
      - Remove the DCE REXX exec dataset if it is present in the SYSEXEC DD name concatenation.
      - Add the Network Authentication Service REXX exec dataset, EUVF.SEUVFEXEC, to the SYSEXEC DD name concatenation.
      - Update the users' UNIX System Services `.profile` by customizing the PATH environment variable to place `/usr/lpp/skrb/bin` ahead of any `/bin` or DCE subdirectory reference.

7. File permissions and other considerations
   a. Configuration files in `/etc/skrb`
      - All files are only to be updateable by your administrator (replace xxx with userid).
        ```
        chown -R xxx /etc/skrb/
        ```
      - All configuration files (exceptions to follow) only need to be readable by the KDC.
        ```
        chmod -R 600 /etc/skrb
        ```
      - The two directories need to have execute permissions so the administrator can change into them.
        ```
        chmod 700 /etc/skrb/home /etc/skrb/home/kdc
        ```
      - `krb5.conf` (and the parent directory) need to readable by everyone.
        ```
        chmod 644 /etc/skrb/krb5.conf
        chmod 755 /etc/skrb
        ```
      - Any keytabs in `/etc/skrb` need to allow the application server (not client) read access.
   b. Keytab files
      - Keytabs can be in any directory and should be readable only by the application servers (not clients) that need to use them and writable only by the administrator. No one else should have access.
Configuring

- Keytabs should not contain keys from other realms.
- To minimize misuse of keys, split your keytabs up by application so that you have one keytab per application or one keytab per instance of an application if you run multiple instances of the same application. Why not put the keytab in the application servers home directory?
- If you are going to allow one application to use multiple service principals, then all the service principals (keys) used by that application must be in the one keytab file because the application will only be able to open the one keytab file.

Configuration of encryption types

The default_tkt_enctypes value in the Kerberos configuration profile specifies the encryption types to be used for session keys in initial ticket-granting tickets. This is a list of one or more encryption types specified from most-preferred to least-preferred. The KDC selects the first supported encryption type in the list when it generates the session key for an initial ticket-granting ticket. This encryption type is also used for preauthentication information.

The default_tgs_enctypes value in the Kerberos configuration profile specifies the encryption types to be used for session keys in service tickets. This is a list of one or more encryption types specified from most-preferred to least-preferred. The KDC selects the first supported encryption type in the list when it generates the session key for a service ticket.

The three environmental variables that deal with encryption types (default_tkt_enctypes, default_tgs_enctypes and SKDC_TKT_ENCTYPE) process the list of encryption types from left to right until an encryption type meets the requirements needed for that environmental variable. If the list is exhausted, that is an encryption type is not selected, then an error will be reported. To specify default_tkt_enctypes or default_tgs_enctypes, specify the following in the Kerberos configuration profile (/etc/skrb/krb5.conf):

- specify des-cbc-crc for DES
- specify des-hmac-sha1 for DESD
- specify des3-cbc-sha1-kd for DES3
- specify aes128-cts-hmac-sha1-96 for AES128
- specify aes256-cts-hmac-sha1-96 for AES256

Make the same updates to specify SKDC_TKT_ENCTYPE, located in /etc/skrb/home/kdc/envar.

If the variable is not specified, the default is DES.

Some examples:

- To enable 168-bit DES3 support for tickets
  SKDC_TKT_ENCTYPE=des3-cbc-sha1,des-cbc-crc
- To enable 168-bit DES3 support for authentication information,
  default_tkt_enctypes = des3-cbc-sha1-kd,des-cbc-crc
- To enable 168-bit DES3 support for user data,
  default_tgs_enctypes = des3-cbc-sha1-kd,des-cbc-crc

Do not enable DES3, AES128 or AES256 ticket support until the Kerberos runtimes for all systems in the realm support that encryption type. Otherwise, you can obtain tickets that cannot be processed on a given system. In addition, do not enable DES3, AES128 or AES256 encryption support for user data unless all systems in the realm support that encryption type for user data. Otherwise, you can obtain session keys that are unuseable for exchanging encrypted data. This means that all systems sharing the database must be running z/OS Version 1 Release 2 or later for DES3 or z/OS Version 1 Release 9 or later for AES128 or AES256.
When granting a service ticket, the KDC attempts to use the same encryption algorithm for the service ticket that was used for the ticket-granting ticket. This enables cross-realm encryption compatibility with realms that do not support the same encryption algorithms as the local realm. If the server principal does not have a key for that encryption type, then the KDC selects a key from the list specified by the SKDC_TKT_ENCTYPE environment variable.

All supported keys are generated for a principal when the password for that principal is changed even if some encryption types are disabled. When multiple z/OS releases are used, changing a principal's password on an older z/OS release might not generate all the keys supported by the higher z/OS release so it is best to only change passwords on the higher z/OS release. Principals that are migrated from an older release of z/OS will not have AES keys until they change their password on a z/OS R9 or higher system. Also, if the principals were migrated from a system that had the RACF option KERBLVL set to 0, then these principals will not have DESD and DES3 keys until they change their password on a z/OS R9 or higher system.

---

Security runtime configuration with LDAP and DNS considerations

1. Perform the following steps to customize `/etc/skrb/krb5.conf` for your installation:
   - Update the default_realm value with the name of your Kerberos realm
   - If you want to use LDAP to locate servers and to resolve host names, set the `use_ldap_lookup` value to 1
   - If you want to use DNS SRV and TXT records to locate servers and to resolve host names, set the `use_dns_lookup` value to 1
   - If you will not be using LDAP or DNS lookup, update the `[realms]` section to identify your Kerberos realm, and then update each realm that can be reached from your realm. The `[realms]` section is also used when a directory lookup request is unsuccessful.

   For example, if the default realm is KRB390.IBM.COM with two KDC servers using the SAF database, and a peer realm is KRB2000.IBM.COM with one KDC server, the `[realms]` section is defined as follows. Since the z/OS implementation combines the KDC and the password change server when the SAF database is implemented, each instance of the Kerberos security server provides both the `kdc` and the `kpasswd_server` services.

   ```
   [realms]
   KRB390.IBM.COM = {
      kdc = kdcsrvr1.krb390.ibm.com:88
      kdc = kdcsrvr2.krb390.ibm.com:88
      kpasswd_server = kdcsrv1.krb390.ibm.com:464
      kpasswd_server = kdcsrv2.krb390.ibm.com:464
   }
   KRB2000.IBM.COM = {
      kdc = winsrvr1.krb2000.ibm.com:88
   }
   ```

   - If you will not be using LDAP or DNS lookup, update the `[domain_realm]` section to identify the host-to-realm mappings for your Kerberos realm and each realm that can be reached from your realm. The `[domain_realm]` section is also used when a directory lookup request is unsuccessful.

   Using the same example, the `[domain_realm]` section is defined as follows:

   ```
   [domain_realm]
   .krb390.ibm.com = KRB390.IBM.COM
   ```

   If no matching entry is found, the default action is to remove the first label from the host name, put what is left in upper case, and use that for the realm name. In this case, the definitions given in the preceding examples are not really needed since they match the default.

2. If you are using DNS lookup, define the Kerberos hosts and servers in the DNS database:
   - SRV records are added for each KDC server in the realm. The Kerberos runtime searches for an SRV record using the realm name as the DNS search name. Note that DNS searches are not case-sensitive, so you cannot have two different realms whose names differ only in their case.
The general form of the Kerberos SRV record is:

```
service.protocol.realm ttl class SRV priority weight port target
```

The _kerberos_ service entries define KDC instances, while the _kerberos-adm_ service entries define administration service instances, and _kpasswd_ entries define the password change service instances. Since the z/OS implementation combines the KDC and the password change server when the SAF database is implemented, each instance of the Kerberos security server provides both the KDC and the password change services. Administration service support on z/OS is available only when the NDBM database is implemented.

The server entries are tried in priority order (0 is the highest priority). Server entries with the same priority are tried in a random order. _udp_ protocol records are required for the _kerberos_ and _kpasswd_ services while _tcp_ protocol records are required for the _kerberos-adm_ service. _tcp_ protocol records should be present if the server supports TCP as well as UDP requests (the z/OS Kerberos security server supports both UDP and TCP requests) for _kerberos_ and _kpasswd_.

For example, to define z/OS Kerberos security servers krbsrv1 and krbsrv2 for the KRB390.IBM.COM realm, add the following SRV records:

```
_kerberos._udp.krb390.ibm.com IN SRV 0 8 krbsrv1.krb390.ibm.com
_kerberos._tcp.krb390.ibm.com IN SRV 0 8 krbsrv1.krb390.ibm.com
_kpasswd._udp.krb390.ibm.com IN SRV 0 464 krbsrv1.krb390.ibm.com
_kpasswd._tcp.krb390.ibm.com IN SRV 0 464 krbsrv1.krb390.ibm.com
_kerberos._udp.krb390.ibm.com IN SRV 0 8 krbsrv2.krb390.ibm.com
_kerberos._tcp.krb390.ibm.com IN SRV 0 8 krbsrv2.krb390.ibm.com
_kpasswd._udp.krb390.ibm.com IN SRV 0 464 krbsrv2.krb390.ibm.com
_kpasswd._tcp.krb390.ibm.com IN SRV 0 464 krbsrv2.krb390.ibm.com
```

An example of an _kerberos-adm_ SRV record for a z/OS primary KDC implementing the NDBM database is:

```
_kerberos-adm._tcp.krb390.ibm.com IN SRV 0 749 krbsrv1.krb390.ibm.com
```

TXT records are added to associate host names with realm names. The Kerberos runtime searches for a TXT record starting with the host name. If no TXT record is found, the first label is removed and the search is retried with the new name. This process continues until a TXT record is found or the root is reached.

The general form of the Kerberos TXT record is:

```
service.name ttl class TXT realm
```

For example, to associate the endicott.ibm.com domain with the KRB390.IBM.COM realm, add the following TXT record:

```
_kerberos.endicott.ibm.com IN TXT KRB390.IBM.COM
```

Note that the realm name is case-sensitive in the TXT record.

3. If you are using LDAP lookup, define the Kerberos objects and attributes for the LDAP server:

- Add a suffix definition to the LDAP server configuration file for the root domain name. For example, if your Kerberos realm names end in .COM, add the following statement to the LDAP configuration file:

  ```
suffix "dc=COM"
  ```

- Use the `ldapadd` command to define the default realm in the LDAP directory. Use the `/usr/lpp/skrb/examples/slapd.ldif` file as an example. Each component of the Kerberos realm name is represented by a domain component entry in the LDAP directory.

For example, to define the KRB2000.IBM.COM realm in LDAP, use the following `ldif` definitions:

```
dn: dc=COM
dc: COM
objectClass: domain

dn: dc=IBM, dc=COM
dc: IBM
objectClass: domain
```
Use the ksetup command to define the host systems in your Kerberos realm as well as the location of each security server. If you do not want to define each host system in LDAP, you can use the [domain_realm] section of the Kerberos configuration file to supply default rules to map host names to a Kerberos realm.

Using the example above, define the security servers with the SAF database implementation as follows:

```
addkdc kdcsvr1.krb390.ibm.com KRB390.IBM.COM
addkdc kdcsvr2.krb390.ibm.com KRB390.IBM.COM
addpwd kdcsvr1.krb390.ibm.com KRB390.IBM.COM
```

For the NDBM database implementation, the addpwd command is issued for the Primary KDC only. The addadmin command is also issued for the Primary KDC only. Here is an example:

```
addadmin kdcsvr1.krb390.ibm.com:749 KRB390.IBM.COM
```

Refer to IBM Tivoli Directory Server Administration and Use for z/OS for more information on setting up the LDAP server.

---

### LDAP schema definitions

If you are planning to use LDAP directory lookup functions, the Kerberos runtime requires the following LDAP schema definitions. These definitions are supplied with IBM LDAP servers as part of the IBM schema. You should also create the appropriate schema definitions for other LDAP servers.

- Integer values are represented as a signed-numeric character string with a maximum length of 11 characters
- Boolean values are represented by the character strings "TRUE" and "FALSE"
- Time values are represented as 15-byte character strings encoded in the format "YYYYMMDDhhmmssZ." All times are represented as UTC values.

<table>
<thead>
<tr>
<th>Table 2-1. LDAP object classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object</strong></td>
</tr>
<tr>
<td>domain</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>eSAP</td>
</tr>
<tr>
<td>eService</td>
</tr>
<tr>
<td>ibmCom1986-Krb-KerberosService</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2-2. LDAP attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attribute</strong></td>
</tr>
<tr>
<td>dc</td>
</tr>
<tr>
<td>description</td>
</tr>
</tbody>
</table>
Table 2-2. LDAP attributes (continued)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Table Name</th>
<th>Type</th>
<th>Size</th>
<th>Access</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ibmCom1986-Krb-KerberosRealm</td>
<td>krbRealm</td>
<td>caseExactString</td>
<td>256</td>
<td>normal</td>
<td>single</td>
</tr>
<tr>
<td>ipServicePort</td>
<td>ipServicePort</td>
<td>integer</td>
<td>11</td>
<td>normal</td>
<td>single</td>
</tr>
<tr>
<td>labeledURI</td>
<td>labeledURI</td>
<td>caseExactString</td>
<td>100</td>
<td>normal</td>
<td>multiple</td>
</tr>
<tr>
<td>sapName</td>
<td>sapName</td>
<td>caseIgnoreString</td>
<td>256</td>
<td>normal</td>
<td>single</td>
</tr>
<tr>
<td>sapPtr</td>
<td>sapPtr</td>
<td>DN</td>
<td>1000</td>
<td>normal</td>
<td>multiple</td>
</tr>
<tr>
<td>seeAlso</td>
<td>seeAlso</td>
<td>DN</td>
<td>1000</td>
<td>normal</td>
<td>multiple</td>
</tr>
<tr>
<td>serviceHint</td>
<td>serviceHint</td>
<td>DN</td>
<td>1000</td>
<td>normal</td>
<td>single</td>
</tr>
<tr>
<td>serviceName</td>
<td>serviceName</td>
<td>caseIgnoreString</td>
<td>256</td>
<td>normal</td>
<td>single</td>
</tr>
<tr>
<td>startMode</td>
<td>startMode</td>
<td>caseExactString</td>
<td>10</td>
<td>normal</td>
<td>single</td>
</tr>
<tr>
<td>startupParameters</td>
<td>startupParameters</td>
<td>caseExactString</td>
<td>256</td>
<td>normal</td>
<td>single</td>
</tr>
</tbody>
</table>

Security server configuration

Configuring the primary security server for the realm

1. Create the Kerberos definitions:
   - If you plan to use SAF for the registry database, do these steps to create the Kerberos definitions in the z/OS security registry:
     a. Define the local realm and the default policy.
        For example, to define the KRB2000.IBM.COM realm with a minimum ticket lifetime of 15 seconds, a maximum ticket lifetime of 24 hours, and a default ticket lifetime of 10 hours:
        ```
        RDEFINE REALM KERBDFLT KERB(KERBNAME(KRB2000.IBM.COM)
        PASSWORD(password)
        MINTKTLFE(15) DEFTKTLFE(3600) MAXTKTLFE(86400))
        ```
     b. Create peer trust definitions.
        There will be two definitions for each trust relationship. For example, to define a trust relationship between the KRB2000.IBM.COM and WIN2000.IBM.COM realms:
        ```
        RDEFINE REALM /.../KRB2000.IBM.COM/krbtgt/WIN2000.IBM.COM
        KERB(PASSWORD(password))
        ```
        ```
        KERB(PASSWORD(password))
        ```
     c. Define the administration service. The user ID can be any acceptable name but the Kerberos principal must be `kadmin/admin`.
        ```
        ADDUSER KADMIN DFLTGRP(SYS1) PASSWORD(temporary password)
        ALTUSER KADMIN PASSWORD(password) NOEXPIRED
        KERB(KERBNAME(kadmin/admin))
        ```
     d. Define the password change server. The user ID can be any acceptable name but the Kerberos principal must be `kadmin/changepw`.
        ```
        ADDUSER CHANGEPW DFLTGRP(SYS1) PASSWORD(temporary_password)
        ALTUSER CHANGEPW PASSWORD(password) NOEXPIRED KERB(KERBNAME(kadmin/changepw))
        ```
     e. Add Kerberos segments to existing user definitions.
        For example, to associate the principal `test_server@KRB2000.IBM.COM` with the `krbsrv` user:
        ```
        ALTUSER KRBSRV PASSWORD(password) NOEXPIRED KERB(KERBNAME(test_server))
        ```
Note: The ALTUSER command converts the password to upper case if the MIXEDCASE SETROPTS option is not set. If MIXEDCASE is not set, you must ensure that the uppercase value is used when you request an initial ticket. The principal name is not converted to upper case and the realm name is not included. You must change the password for the user in order to create the Kerberos secret key.

f. See z/OS Security Server RACF Command Language Reference for more information.

- If you plan to use NDBM for the registry database instead of SAF, do these steps to create the Kerberos definitions for the NDBM database. Refer to Chapter 1, “Introducing Network Authentication Service,” on page 1-1 for details on the Kerberos commands used in this section.

  a. Use the kdb5_ndbm command to create the initial registry database files. This command creates the architected principals for the Kerberos realm. It also creates two user principals, IBMUSER and IBMUSER/admin, with an initial password of IBMUSER. IBM recommends that you use the kadmin command and authenticate with the IBMUSER/admin principal to create your own administration principal after the security server is running. The passwords for the IBMUSER and IBMUSER/admin principals should then be changed or the principals should be deleted.

  b. Copy the example KDC configuration file from /usr/lpp/skrb/examples/kdc.conf to /etc/skrb/home/kdc/kdc.conf.

  c. Set the min_life, max_life, max_renewable_life, and default_life values in kdc.conf to the appropriate minimum ticket life, maximum ticket life, maximum renewable ticket life, and default ticket life values. The following relationship must be observed: min_life <= default_life <= max_life <= max_renewable_life. The maximum ticket life and maximum renewable ticket life values for a specific principal are the smaller of the values specified in the principal entry and the values specified in the KDC configuration profile.

  d. Set the check_client_address value in kdc.conf to 1 if you want the KDC to validate the address list contained in tickets presented by clients. Note that client address validation fails if requests pass through a firewall or a Network Address Translation (NAT) router because the client address in the ticket does not match the client address as seen by the server.

  e. Add Kerberos segments to existing user definitions if you want to use SAF mapping services to map a Kerberos principal to a system user ID. These mappings are required if you plan to use Kerberos system-authentication services to eliminate the need to provide a key when requesting an initial ticket or decrypting a service ticket.

For example, to associate the principal test_server@KRB2000.IBM.COM with the krbsrv user:

ALTUSER KRBSRV KERB(KERBNAME(test_server))

2. Copy the example administration access control file from /usr/lpp/skrb/examples/kadm5.acl to /etc/skrb/home/kdc/kadm5.acl and customize it for your installation if you will be using Kerberos administration services. This file controls the Kerberos administration privileges granted to a user. Each line represents a single administration access definition, has a maximum length of 255 characters, and is assumed to be in the code page specified by the LANG environment variable. Comment lines start with a semi-colon and blank lines are ignored. Each line consists of 2 fields: the client principal name and the privileges granted. The order of the lines in the file is important because the search stops as soon as a match is found for the principal making an administration request.

The following privileges are defined. Use lowercase letters to define the granted privileges (any privilege not listed is denied) and use uppercase letters to define the denied privileges (any privilege not listed is granted). Do not mix uppercase and lowercase letters in the same definition.

<table>
<thead>
<tr>
<th>a</th>
<th>ADD is granted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ADD is denied</td>
</tr>
<tr>
<td>c</td>
<td>CHANGEPW is granted</td>
</tr>
<tr>
<td>C</td>
<td>CHANGEPW is denied</td>
</tr>
<tr>
<td>d</td>
<td>DELETE is granted</td>
</tr>
</tbody>
</table>
### Configuring

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>DELETE is denied</td>
</tr>
<tr>
<td>g</td>
<td>GET is granted (this may also be specified as i)</td>
</tr>
<tr>
<td>G</td>
<td>GET is denied (this may also be specified as I)</td>
</tr>
<tr>
<td>I</td>
<td>LIST is granted</td>
</tr>
<tr>
<td>L</td>
<td>LIST is denied</td>
</tr>
<tr>
<td>m</td>
<td>MODIFY is granted</td>
</tr>
<tr>
<td>M</td>
<td>MODIFY is denied</td>
</tr>
<tr>
<td>s</td>
<td>SETKEY is granted</td>
</tr>
<tr>
<td>S</td>
<td>SETKEY is denied</td>
</tr>
<tr>
<td>*</td>
<td>All privileges are granted</td>
</tr>
</tbody>
</table>

The client principal name can contain the following wildcards:
- ? represents a single character
- * represents zero or more characters
- Paired [ ] represent any one of the characters between the brackets.

3. Copy the example propagation control file from `/usr/lpp/skrb/examples/kpropd.acl` to `/etc/skrb/home/kdc/kpropd.acl` and customize it for your installation if you will be using Kerberos database propagation. The propagation control file contains an entry for each Kerberos security server in the realm and specifies the role assigned to each of the servers. The role should be specified as MANUAL until the secondary security server has been configured and the initial database propagation has been performed. Refer to [Kerberos database propagation](#) on page 3-12 for more information.

4. Start the SKRBKDC started task.

5. Change the passwords for IBMUSER and IBMUSER/admin if you are using the NDBM database. These principals are automatically created when the database is created and have an initial password of IBMUSER. You can use the `kpasswd` command or the `kadmin` command to change the passwords. You can also create your own administration user IDs and then delete IBMUSER and IBMUSER/admin if desired.

### Configuring a secondary security server for the realm

#### Using a SAF registry database
The same SAF registry database must be shared by all of the security servers in the realm. This means you do not need to repeat the RACF (or other external security manager) commands described above when you configure a secondary security server. Database propagation is not used by the Kerberos security server for a SAF registry database since the external security manager is responsible for any required propagation.

If the `/etc/skrb` file system is not shared between systems, copy the `/etc/skrb/krb5.conf` and `/etc/skrb/home/kdc/envar` files from the primary system to the secondary system. You do not need the `/etc/skrb/home/kdc/kadm5.acl` configuration file because Kerberos administration services are not available for the SAF registry database.

Finally, copy the SKRBKDC JCL procedure and, optionally, the message exit used to start the SKRBKDC started task. Once this has been done, you can start the SKRBKDC started task on the secondary system.

#### Using an NDBM registry database
The NDBM registry database is not shared by each security server in the realm (the file system containing the `/var/skrb/krb5kdc` directory must not be shared between systems). Instead, each security server maintains its own NDBM database and receives updates from the primary security server through the database propagation protocol.
If the /etc/skrb file system is not shared between systems, copy the /etc/skrb/krb5.conf and 
/etc/skrb/home/kdc/envar files from the primary system to the secondary system. Also copy the 
/etc/skrb/home/kdc/kpropd.acl configuration file. You do not need to copy the /etc/skrb/home/kdc/ 
 kadm5.acl configuration file since a secondary KDC does not provide Kerberos administration services for 
the NDBM registry database.

Use the kdb5_ndbm command to create the database master key stash file on the secondary system. 
The master key is used to decrypt Kerberos database entries. This key is not sent over the network as 
part of the database propagation protocol. For example:

text

Use the kadmin command to create the host key table used during database propagation. This key table 
is used to authenticate the secondary security server to the primary security server. The principal is 
host/system-name where system-name is the host name for the secondary system. The host name must 
be the primary host name for the system as returned by the DNS name server. For example, to create a 
host principal and key table for the dcesec4.krb390.ibm.com system:

text

Use the kpropd command to receive the initial database propagation from the primary KDC for the realm. 
Refer to the section on database propagation for more information.

Finally, copy the SKRBKDC JCL procedure and, optionally, the message exit used to start the SKRBKDC 
started task. Once this has been done, you can start the SKRBKDC started task on the secondary system.

---

**Security runtime environment variables**

Environment variables can be defined in the current command shell using the export command. They can 
also be defined in an environment variable (envar) file, which is processed during security runtime 
initialization. Any variables defined through the shell override the same variables in the envar file. The 
_EUV_ENVAR_FILE environment variable can be used to specify the location of the envar file. By default, 
the $HOME/envar file is used.

z/OS generally sets environment variables in either /etc/profile (system-wide settings) or in 
$HOME/.profile (user-specific settings). Environment variables defined in either place override the same 
variables in the envar file.

The following environment variables are supported:
### Configuring

#### Table 2-3. Environment variables for security runtime

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>_EUV_ENVAR_FILE</td>
<td>Specifies the name of the file that contains environment variable definitions. If this variable is not set, the default is to use the envar file located in the home directory (as specified by the _EUV_HOME or HOME environment variable). A dataset name can be specified by preceding the dataset name with &quot;//&quot;, and a DD name can be specified by preceding the DD name with &quot;//DD:&quot;</td>
</tr>
<tr>
<td></td>
<td>Each line of the file consists of the variable name followed by &quot;=&quot; followed by the variable value with no intervening blanks or other punctuation. The variable value consists of everything following the &quot;=&quot; up to the end of the line (including any trailing blanks). Any line beginning with &quot;#&quot; is treated as a comment line. A line can be continued by ending the line with &quot;&quot;.</td>
</tr>
<tr>
<td></td>
<td>Note that the environment variables are not set until the first time that a function in the security runtime is called. Thus, it is mainly useful for setting environment variables that are used by functions within the security runtime, although it can be used to set environment variables that are used by the application as well. In this case, the application should not rely on the environment variable values until after the security runtime has been initialized.</td>
</tr>
<tr>
<td></td>
<td>The application can access these environment variables using the <code>getenv()</code> function. The environment variables are maintained by the C runtime library, so they are not available to operating system functions.</td>
</tr>
<tr>
<td>_EUV_EXC_ABEND_DUMP</td>
<td>Specifies whether a dump is to be generated when an abnormal termination occurs within the security runtime. This environment variable applies only to errors that are caught and processed by the security runtime. The default is to not take a dump if an abnormal termination occurs (the system may still take a dump if the exception percolates to the top of the condition handler stack without being handled). No dump is taken if _EUV_DUMP is set to 0 even if _EUV_EXC_ABEND_DUMP is set to enable a dump.</td>
</tr>
<tr>
<td></td>
<td>The following values may be specified for dump control:</td>
</tr>
<tr>
<td></td>
<td>• 0 = No dump (this is the default)</td>
</tr>
<tr>
<td></td>
<td>• 1 = Dump only if no CATCH/CATCH_ALL was found to handle the exception</td>
</tr>
<tr>
<td></td>
<td>• 2 = Dump only if no explicit catch clause was found to handle the exception (that is, the exception was caught by a CATCH_ALL clause)</td>
</tr>
<tr>
<td>_EUV_HOME</td>
<td>The security runtime home directory is set to the value of this environment variable. If this variable is not specified, the HOME variable is used to determine the security runtime home directory. If the HOME variable is not set, the current directory is used.</td>
</tr>
<tr>
<td>Environment Variable</td>
<td>Explanation</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>_EUV_HW_CRYPTO</td>
<td>Specifies whether the hardware cryptographic support is used. A value of 0 disables the use of the hardware support, and a value of 65535 enables the use of the hardware support. The hardware support is used if this environment variable is not defined. Note that Integrated Cryptographic Service Facility (ICSF) must be configured and running in order to use the hardware cryptographic support. Selected hardware cryptographic functions can be disabled by setting the appropriate bits to zero in the _EUV_HW_CRYPTO value. The corresponding software algorithms are used when a hardware function is disabled. For example, DES can be enabled and DES3 can be disabled by setting _EUV_HW_CRYPTO to 2. The following bit assignments are defined:&lt;br&gt; 2 = DES encryption/decryption&lt;br&gt; 4 = DES3 encryption/decryption&lt;br&gt; 8 = AES128 encryption/decryption&lt;br&gt; 16 = AES256 encryption/decryption</td>
</tr>
<tr>
<td>_EUV_SEC_KRB5CCNAME_FILE</td>
<td>Specifies the name of the file used to locate the default Kerberos credentials cache. If this variable is not set, the default is to use the krb5ccname file located in the security runtime home directory (the home directory is specified by _EUV_HOME or HOME). Precede the dataset name with &quot;//&quot; to specify an MVS™ dataset name and precede the DD name with &quot;//DD:&quot; to specify an MVS DD name.</td>
</tr>
<tr>
<td>_EUV_SVC_DBG</td>
<td>Specifies subcomponents and levels for the debug messages. Debug messages for a particular subcomponent are not logged unless the subcomponent is included in the _EUV_SVC_DBG list and the debug message level is greater than or equal to the specified level. An asterisk (<em>) may be used to specify all subcomponents. Debug level 1 generates the minimum amount of debug output, debug level 8 generates the maximum amount of debug output, and debug level 9 generates data dumps in addition to the debug messages. The subcomponent list consists of a subcomponent name and a debug level separated by a period. Multiple subcomponents may be specified by separating the entries with commas. For example,&lt;br&gt;_EUV_SVC_DBG=</em>.1,KRB_CCACHE.8&lt;br&gt;enables debug level 1 for all subcomponents and debug level 8 for the KRB_CCACHE subcomponent.</td>
</tr>
<tr>
<td>_EUV_SVC_DBG_FILENAME</td>
<td>Specifies the fully-qualified name of the file to receive debug messages. Debug messages are written to the file specified by the _EUV_SVC_STDOUT_FILENAME if this environment variable is not defined. If _EUV_SVC_STDOUT_FILENAME is not specified, debug messages are written to stdout. The current process identifier is included as part of the trace file name when the name contains a percent sign (%). For example, if _EUV_SVCDBG_FILENAME is set to /tmp/kerberos.%out and the current process identifier is 247, then the file name will be /tmp/kerberos.247.out.</td>
</tr>
</tbody>
</table>
### Table 2-3. Environment variables for security runtime (continued)

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>_EUV_SVC_DBG_MSG_LOGGING</strong></td>
<td>Specifies whether debug messages are generated. The default is to suppress debug messages.</td>
</tr>
<tr>
<td></td>
<td>The following values may be specified:</td>
</tr>
<tr>
<td></td>
<td>• 0 = Suppress debug messages</td>
</tr>
<tr>
<td></td>
<td>• 1 = Write debug messages</td>
</tr>
<tr>
<td><strong>_EUV_SVC_DUMP</strong></td>
<td>Specifies whether or not a dump is taken by the security runtime if a serious error is detected. This environment variable applies only to errors that are caught and processed by the security runtime. Error processing for errors handled by the Language Environment® (LE) runtime are controlled by the LE runtime options that are in effect at the time of the error.</td>
</tr>
<tr>
<td></td>
<td>The following values may be specified for this value:</td>
</tr>
<tr>
<td></td>
<td>• 0 = No dump is taken. This suppresses dumps generated as a result of an exception as well as dumps requested by the security runtime. A dump may still be taken by the operating system depending upon the nature of the error.</td>
</tr>
<tr>
<td></td>
<td>• 1 = A dump is taken (this is the default)</td>
</tr>
<tr>
<td><strong>_EUV_SVC_MSG_FACILITY</strong></td>
<td>Specifies the facility class for messages written to the system logging facility. The valid facility classes are: KERN, USER, MAIL, NEWS, UUCP, DAEMON, AUTH, CRON, LPR, LOCAL0, LOCAL1, LOCAL2, LOCAL3, LOCAL4, LOCAL5, LOCAL6, LOCAL7. The default is USER.</td>
</tr>
<tr>
<td><strong>_EUV_SVC_MSG_IDENTITY</strong></td>
<td>Specifies the identity string prefixed to messages written to the system logging facility. The default is SKRB.</td>
</tr>
<tr>
<td><strong>_EUV_SVC_MSG_LEVEL</strong></td>
<td>Specifies the message level when logging messages. Messages that do not meet this criterion are suppressed. The default is to log all messages.</td>
</tr>
<tr>
<td></td>
<td>The following values may be specified:</td>
</tr>
<tr>
<td></td>
<td>• FATAL - Only fatal messages are logged</td>
</tr>
<tr>
<td></td>
<td>• ERROR - Only fatal and error message are logged.</td>
</tr>
<tr>
<td></td>
<td>• USER - Only fatal, error, and user messages are logged</td>
</tr>
<tr>
<td></td>
<td>• WARNING - Only fatal, error, user, and warning messages are logged</td>
</tr>
<tr>
<td></td>
<td>• NOTICE - Only fatal, error, user, warning, and notice messages are logged</td>
</tr>
<tr>
<td></td>
<td>• VERBOSE - All messages are logged.</td>
</tr>
<tr>
<td><strong>_EUV_SVC_MSG_LOGGING</strong></td>
<td>Specifies the target where messages are logged. The default is to write informational messages to <strong>stdout</strong> and error messages to <strong>stderr</strong>.</td>
</tr>
<tr>
<td></td>
<td>The following values may be specified:</td>
</tr>
<tr>
<td></td>
<td>• NO_LOGGING = Suppress all messages</td>
</tr>
<tr>
<td></td>
<td>• STDOUT_LOGGING = Write all messages (informational and error) to <strong>stdout</strong> and also write error messages to <strong>stderr</strong></td>
</tr>
<tr>
<td></td>
<td>• STDERR_LOGGING = Write informational messages to <strong>stdout</strong> and error messages to <strong>stderr</strong>.</td>
</tr>
<tr>
<td></td>
<td>• SYSTEM_LOGGING = Write all messages to the system logging facility (<strong>syslogd</strong> daemon).</td>
</tr>
</tbody>
</table>
### Table 2-3. Environment variables for security runtime (continued)

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| _EUV_SVC_STDERR_FILENAME          | Specifies the fully-qualified name of the file to receive standard error messages. Messages are written to stderr if this environment variable is not defined.  

The current process identifier is included as part of the file name when the name contains a percent sign (%). For example, if _EUV_SVC_STDERR_FILENAME is set to /tmp/kerberos.%.out and the current process identifier is 247, then the file name will be /tmp/kerberos.247.out. |
| _EUV_SVC_STDOUT_FILENAME          | Specifies the fully-qualified name of the file to receive standard output messages. Messages are written to stdout if this environment variable is not defined.  

The current process identifier is included as part of the file name when the name contains a percent sign (%). For example, if _EUV_SVC_STDOUT_FILENAME is set to /tmp/kerberos.%.out and the current process identifier is 247, then the file name will be /tmp/kerberos.247.out. |
| GSS_CRL_CACHE_TIMEOUT             | Specifies the number of hours that a cached CRL will remain valid. The valid timeout values are 0 through 720 and defaults to 24. A value of 0 will disable the CRL cache. |
| GSS_KEY_LABEL                     | Specifies the label of the key used to authenticate the application. The default key will be used if a key label is not specified. |
| GSS_KEYRING_NAME                  | Specifies the name of the key database HFS file or the SAF key ring. A key database is used if the GSS_KEYRING_PW or GSS_KEYRING_STASH environment variable is also specified. Otherwise a SAF key ring is used. The SAF key ring name is specified as "userid/keyring". The current userid is used if the userid is omitted. The user must have READ access to the IRR.DIGTCERT.LISTRING resource in the FACILITY class when using a SAF key ring owned by the user. The user must have UPDATE access to the IRR.DIGTCERT.LISTRING resource in the FACILITY class when using a SAF key ring owned by another user. Note that certificate private keys are not available when using a SAF key ring owned by another user. |
| GSS_KEYRING_PW                    | Specifies the password for the key database. |
| GSS_KEYRING_STASH                 | Specifies the name of the key database password stash file. The stash file name always has an extension of ".sth" and the supplied name will be changed if it does not have the correct extension. The GSS_KEYRING_PW environment variable will be used instead of the GSS_KEYRING_STASH environment variable if it is also specified. |
| GSS_LDAP_PASSWORD                 | Specifies the password to use when connecting to the LDAP server. This environment variable is ignored if the GSS_LDAP_USER environment variable is not defined. |
| GSS_LDAP_PORT                     | Specifies the LDAP server port. Port 389 will be used if no LDAP server port is specified. |
### Configuring

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GSS_LDAP_SERVER</strong></td>
<td>Specifies one or more blank-separated LDAP server host names. Each host name can contain an optional port number separated from the host name by a colon. The LDAP server is used to obtain CA certificates when validating a certificate and the local database does not contain the required certificate. The local database must contain the required certificates if no LDAP server is specified. Even when an LDAP server is used, root CA certificates must be found in the local database since the LDAP server is not a trusted data source. The LDAP server is also used to obtain certificate revocation lists.</td>
</tr>
<tr>
<td><strong>GSS_LDAP_USER</strong></td>
<td>Specifies the distinguished name to use when connecting to the LDAP server. An anonymous connection will be used if this environment variable is not defined.</td>
</tr>
<tr>
<td><strong>KRB5CCNAME</strong></td>
<td>Specifies the default name for the credentials cache and is specified as &quot;type:name,&quot; The supported types are FILE and MEMORY. The default credentials cache name is obtained from the credentials cache pointer file identified by the _EUV_SEC_KRB5CCNAME_FILE environment variable if the KRB5CCNAME environment variable is not set.</td>
</tr>
<tr>
<td><strong>KRB5RCACHEDIR</strong></td>
<td>Specifies the default replay cache directory and defaults to /tmp.</td>
</tr>
<tr>
<td><strong>KRB5RCACHENAME</strong></td>
<td>Specifies the default replay cache name. The Kerberos runtime generates a replay cache name if the KRB5RCACHENAME environment variable is not defined.</td>
</tr>
<tr>
<td><strong>KRB5RCACHETYPE</strong></td>
<td>Specifies the default replay cache type and defaults to dfl.</td>
</tr>
<tr>
<td><strong>KRB5_CONFIG</strong></td>
<td>Specifies one or more configuration file names separated by colons. The default configuration file is /etc/skrb/krb5.conf.</td>
</tr>
<tr>
<td><strong>KRB5_KTNAME</strong></td>
<td>Specifies the default key table name. The default key table name is obtained from the default_keytab_name configuration file entry if the KRB5_KTNAME environment variable is not defined. The default key table is /etc/skrb/krb5.keytab if no configuration file entry is found.</td>
</tr>
</tbody>
</table>
### Security server environment variables

The following environment variables are supported for the SKRBKDC started task. These variables are specified in `/etc/skrb/home/kdc/envar`.

#### Table 2-4. Environment variables for security server

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKDC_CONSOLE_LEVEL</td>
<td>Specifies the message level for console logging. Kerberos security server</td>
</tr>
<tr>
<td></td>
<td>messages will be logged on the system console if the message severity is</td>
</tr>
<tr>
<td></td>
<td>greater than or equal to the specified severity level. The valid severity</td>
</tr>
<tr>
<td></td>
<td>levels are I, W, E and A. The default is E if this environment variable is</td>
</tr>
<tr>
<td></td>
<td>not defined.</td>
</tr>
<tr>
<td>SKDC_CREDS_SIZE</td>
<td>Specifies the credentials data space size in kilobytes, with a minimum</td>
</tr>
<tr>
<td></td>
<td>value of 1024, a maximum value of 2097148, and a default value of 20480. The</td>
</tr>
<tr>
<td></td>
<td>Kerberos security server stores cross-memory credentials in this data space.</td>
</tr>
</tbody>
</table>
### Table 2-4. Environment variables for security server (continued)

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| SKDC_DATABASE        | Specifies the type of registry database used by the security server:  
  • SAF - Indicates the security registry is maintained in the system security database available through the System Authorization Facility (SAF). The database is administered using commands provided by the external security manager. The external security manager is responsible for propagating any database changes to other systems in the realm where an instance of the KDC is running. Kerberos database propagation is not used with the SAF database.  
  • NDBM - Indicates the security registry is maintained in HFS files located in the /var/skrb/krb5kdc directory. The database is administered using Kerberos administration commands. The KDC is responsible for propagating any database changes to other systems in the realm where an instance of the KDC is running. |
| SKDC_KADMIN_PORT     | Specifies the administration service port number. If this environment variable is not defined, the administration service port is obtained from the kerberos-adm entry in the TCP/IP services files. If this entry is not defined, the administration service port defaults to 749. The administration service uses just the TCP protocol. |
| SKDC_KPASSWD_PORT    | Specifies the password change service port number. If this environment variable is not defined, the password change service port is obtained from the kpasswd entry in the TCP/IP services file. If this entry is not defined, the password change service port defaults to 464. The password change service uses both the UDP and TCP protocols. |
| SKDC_KPROP_INTERVAL  | Specifies the database propagation interval in minutes and defaults to 15. The security server sends the current registry database to each secondary security server that is using the full replacement protocol. This propagation occurs at the end of each propagation interval. No propagation is done if the database has not been changed since the last propagation. Secondary security servers that are using the update protocol receive database updates immediately and do not wait for the end of a propagation interval. |
| SKDC_KPROP_PORT      | Specifies the database propagation port number. If this environment variable is not defined, the database propagation port is obtained from the krb5_prop entry in the TCP/IP services file. If this entry is not defined, the database propagation service port defaults to 754. Database propagation uses just the TCP protocol. |
| SKDC_LOCAL_THREADS   | Specifies the number of threads to be used for local requests that use the S/390® Program Call instruction to communicate with the security server. The default value is 10 and the minimum value is 2. |
| SKDC_LOGIN_AUDIT     | Specifies the desired auditing level for login attempts (that is, granting a Kerberos initial ticket). The allowed values are:  
  • NONE = no auditing is done  
  • FAILURE = only login attempts that fail due to an invalid password are audited  
  • ALL = both success and failure login attempts are audited.  
  The audit level is set to FAILURE if the SKDC_LOGIN_AUDIT environment variable is not specified or is set to an incorrect value. SMF type 80 records with event code 68 are written for an audit event. See [z/OS Security Server RACF Macros and Interfaces](http://www.ibm.com/support/docview.wss?uid=swg27046826) for more information about the format of the SMF records. |
Table 2-4. Environment variables for security server (continued)

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKDC_NETWORK_POLL</td>
<td>Specifies the network interface poll interval in minutes and defaults to 5. The security server queries the network configuration at the end of each poll interval to detect new network interfaces or the activation of a failed network interface.</td>
</tr>
<tr>
<td>SKDC_NETWORK_THREADS</td>
<td>Specifies the number of threads to be used for remote requests that use TCP/IP to communicate with the security server. The default value is 10 and the minimum value is 2.</td>
</tr>
<tr>
<td>SKDC_PORT</td>
<td>Specifies the KDC port number. If this environment variable is not defined, the KDC port is obtained from the kerberos entry in the TCP/IP services file. If this entry is not defined, the KDC port defaults to 88. The KDC uses both the UDP and the TCP protocols.</td>
</tr>
<tr>
<td>SKDC_TKT_ENCTYPE</td>
<td>Specifies the encryption types to be used for ticket-granting tickets and for service tickets. This is a list of one or more encryption types separated by commas, specified from most-preferred to least-preferred. When generating a ticket, the KDC selects the first entry in the list that is available for the server specified in the ticket. The KDC uses <code>des-cbc-crc</code> if this environment variable is not defined. Refer to &quot;Security runtime configuration profile&quot; for a list of available encryption types. The encryption types specified by the SKDC_TKT_ENCTYPE environment variable are also used by the Kerberos administration server when it generates new keys for a principal and no encryption types are specified by the administration request.</td>
</tr>
</tbody>
</table>

Security runtime configuration profile

The default security runtime configuration profile is `/etc/skrb/krb5.conf`. You can change this by defining the KRB5_CONFIG environment variable. You can specify multiple configuration files for the KRB5_CONFIG variable by separating the names with colons.

If a named entry can have just one value, then the first occurrence of the name is used. Otherwise, all of the entries for the same name are grouped together in the order they are encountered.

The file is divided into sections. Each section contains one or more name/value pairs with one pair per line. The name and value are separated by an equal sign. The value may be either a character string or a group of name/value pairs. If a character string is specified, it consists of all characters starting with the first non-blank character following the equal sign and continuing until the last non-blank character on the line. The maximum length of a single line in the configuration file is 2046 bytes. Comment lines are denoted by a semi-colon in the first position of the line. Blank lines are ignored.

A section name is enclosed in brackets and must appear on a line by itself. Group values are enclosed in braces with one group per line. The opening brace for a group may follow the equal sign or may be on a line by itself. The closing brace must be on a line by itself so that it won't be treated as part of the value string.

The configuration file must be in code page 1047. To support other code pages, you can use the following trigraphs:

<table>
<thead>
<tr>
<th>Characters</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>??(</td>
<td>left bracket</td>
</tr>
</tbody>
</table>
Configuring

<table>
<thead>
<tr>
<th>Characters</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>??)</td>
<td>right bracket</td>
</tr>
<tr>
<td>??&lt;</td>
<td>left brace</td>
</tr>
<tr>
<td>??&gt;</td>
<td>right brace</td>
</tr>
</tbody>
</table>

Numeric values can be specified as follows:

<table>
<thead>
<tr>
<th>Format</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>dddddddd</td>
<td>decimal number</td>
</tr>
<tr>
<td>0ddddd</td>
<td>octal number</td>
</tr>
<tr>
<td>0xddddd</td>
<td>hexadecimal number</td>
</tr>
</tbody>
</table>

Supported checksum types are:
- crc32
- rsa-md4
- rsa-md4-des
- descbc
- rsa-md5
- rsa-md5-des
- nist-sha
- hmac-sha1-des3
- hmac-sha1-96-aes128
- hmac-sha1-96-aes256

Supported encryption types are:
- des-cbc-crc
- des-cbc-md4
- des-cbc-md5
- des-hmac-sha1
- des3-cbc-sha1-kd
- aes128-cts-hmac-sha1-96
- aes256-cts-hmac-sha1-96

Note: Previous releases of z/OS Network Authentication Service used encryption description des3-cbc-sha1. Since Network Authentication Service does not allow des3 without key derivation, that description has been changed to des3-cbc-sha1-kd. des3-cbc-sha1 will continue to be accepted, but will be converted to des3-cbc-sha1-kd.

Configuration profile file sections

The following sections of the configuration profile file are supported:

<table>
<thead>
<tr>
<th>Section</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>[libdefaults]</td>
<td>This section provides defaults for the Kerberos runtime routines.</td>
</tr>
</tbody>
</table>
Table 2-5. Sections of the configuration profile file (continued)

<table>
<thead>
<tr>
<th>Section</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>[realms]</td>
<td>This section defines each of the realms that can be reached from the local realm. For each realm, one or more key distribution center (KDC) hosts must be defined. The [realms] section is used if no DNS or LDAP server is available or if the desired Kerberos service is not found using the DNS or LDAP server.</td>
</tr>
<tr>
<td>[domain_realm]</td>
<td>This section defines the mapping between DNS names and Kerberos realm names. The [domain_realm] section is used if no DNS or LDAP server is available or if the desired mapping is not found using the DNS or LDAP server.</td>
</tr>
<tr>
<td>[capaths]</td>
<td>This section defines connection paths between realms. This section is not required if the Kerberos realms are arranged in a hierarchical configuration or if each realm has a peer connection to every other realm. Even in a hierarchical configuration, this section should be defined if there are direct connections between realms.</td>
</tr>
</tbody>
</table>

The information that follows provides details about these sections.

**[libdefaults] section**

- **ap_req_checksum_type**
  Specifies the default checksum type for an application request. The default is rsa-md5.

- **ccache_type**
  Specifies the format of the credentials cache file as an integer value between 1 and 4. The default is 3.

- **check_delegate**
  Specifies whether the runtime should check the OK-AS-DELEGATE flag in service tickets. Specify 1 to check the flag and 0 to ignore the flag. If checking is enabled and the service ticket returned by the key distribution center (KDC) does not have the OK-AS-DELEGATE flag set, the gss_init_sec_context() function does not enable delegation for the target principal. The default is to enable checking.

- **clockskew**
  Specifies the maximum clock difference in seconds. The default is 300 (5 minutes). A Kerberos request is rejected if the difference between the server time and the request timestamp exceeds the clock skew value.

- **clock_offset**
  Specifies a fixed offset in minutes between network time and the system clock. The specified offset is added to the system clock to obtain the network time. The default is 0. The value specified by clock_offset will be overridden by the KDC time offset if kdc_timesync is set to 1.

- **default_keytab_name**
  Specifies the default key table type and name. The KRB5_KTNAME environment variable overrides this specification. The default is /etc/skrb/krb5.keytab.

- **default_realm**
  Specifies the default realm.

- **default_tgs_enctypes**
  Specifies one or more session key encryption types separated by commas. The default is des-cbc-crc,des-cbc-md5. The des-cbc-crc encryption type must be included in the list if you are using GSS-API. The KDC uses the first supported encryption type when generating the session key for a service ticket.

- **default_tkt_enctypes**
  Specifies one or more ticket encryption types separated by commas. The default is des-cbc-crc,des-cbc-md5. The KDC uses the first supported encryption type when generating the session key for an initial ticket-granting ticket.
Configuring

**kdc_default_options**
Specifies the default options used when requesting an initial ticket from the KDC as follows:

- 0x00000010 = KDC_OPT_RENEWABLE_OK
- 0x10000000 = KDC_OPT_PROXIABLE
- 0x40000000 = KDC_OPT_FORWARDABLE

Multiple options may be specified by ORing the values together. The default is 0x00000010.

**kdc_req_checksum_type**
Specifies the default checksum type for a KDC request. The default is rsa-md5.

**kdc_timesync**
Specifies whether or not to synchronize the local time is with the KDC time. Specify 1 to synchronize the time and 0 not to synchronize the time. Do not specify 1 if the local system is running a time daemon that synchronizes the clock. The default is 0.

The time synchronization occurs when an initial ticket-granting-ticket is obtained from the KDC.

**kdc_use_tcp**
Set this value to 1 to use TCP stream connections instead of UDP datagrams when sending a request to the KDC. If a TCP connection cannot be established with the KDC, the runtime retries by sending a UDP datagram to the KDC. Set this value to 0 to always use UDP datagrams. The default is 0.

**kpasswd_use_tcp**
Set this value to 1 to use TCP stream connections instead of UDP datagrams when sending a request to the password change server. If a TCP connection cannot be established with the server, the runtime tries again by sending a UDP datagram to the password change server. Set this value to 0 to always use UDP datagrams. The default is 1.

**ldap_server**
Specifies the location of the LDAP server. The value consists of the host name and the port, separated by a colon. If the port is omitted, it defaults to 389.

**rsa_md4_des_compat**
Beta versions of Kerberos Version 5 computed the checksum incorrectly for the rsa-md4-des checksum type. Specify 1 to use the old algorithm for compatibility with these beta versions of Kerberos Version 5. The default is to use the new algorithm.

**rsa_md5_des_compat**
Beta versions of Kerberos Version 5 computed the checksum incorrectly for the rsa-md5-des checksum type. Specify 1 to use the old algorithm for compatibility with these beta versions of Kerberos Version 5. The default is to use the new algorithm.

**safe_checksum_type**
Specifies the default checksum type for a safe request. The default is rsa-md5-des. The specified checksum type must be compatible with the session key encryption type if the checksum uses an encrypted hash. The following shows the checksum types that use an encrypted hash and the required session key encryption type:

<table>
<thead>
<tr>
<th>Checksum Type</th>
<th>Encryption Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>descbc</td>
<td>DES</td>
</tr>
<tr>
<td>rsa-md4-des</td>
<td>DES</td>
</tr>
<tr>
<td>rsa-md5-des</td>
<td>DES</td>
</tr>
<tr>
<td>hmac-sha1-des3</td>
<td>DES3</td>
</tr>
<tr>
<td>hmac-sha1-96-aes128</td>
<td>AES128</td>
</tr>
<tr>
<td>hmac-sha1-96-aes256</td>
<td>AES256</td>
</tr>
</tbody>
</table>

**use_dns_lookup**
Set this value to 1 to use the domain name service (DNS) name server to locate the KDC and to resolve host names. The KDC is located using SRV records, and host names are resolved to realm
names using TXT records. The [realms] and [domain_realm] sections are used if the resolution is unsuccessful using the DNS name server. Set this value to 0 to bypass the DNS lookup step. The default is 0. The priority value for SRV records is used to order the service records. Entries with the same priority are randomly selected each time the client needs to contact a Kerberos server.

**use_dvipa_override**
- Set this value to 1 to allow the principal in the incoming service ticket to override the principal specified on the **krb5_rd_req**, **krb5_rd_req_verify** or **gss_accept_sec_context** API call provided only the instance (host name) of the two principals is different. If the primary or realm portion of both principals are different or either principal is a nonstandard service principal (does not have an instance or has 2 or more instances) then the incoming ticket is rejected. The application will require access to the encryption keys for the principal in the incoming service ticket (either via a keytab file or via the KDC if KRB5_SERVER_KEYTAB is set) to decrypt the ticket. Ensure the Kerberos server is running on all system images where the application runs when the value is set to 1. Set this value to 0 to only allow incoming service tickets that match the service principal specified on the **krb5_rd_req**, **krb5_rd_req_verify** or **gss_accept_sec_context** API call. The default is 0.

**use_ldap_lookup**
- Set this value to 1 to use the Lightweight Directory Access Protocol (LDAP) directory to locate the KDC and to resolve host names. The [realms] and [domain_realm] sections are used if the resolution is unsuccessful. Set this value to 0 to bypass the LDAP lookup step. The default is 0. If both LDAP and DNS are used, LDAP is checked first, followed by DNS. The **ldap_server** value must also be specified to use LDAP lookup. LDAP directory entries are randomly selected each time the client needs to contact a Kerberos server.

**[realms] section**

**realm**
- The **realm** value is a Kerberos realm name. The value is a group definition that defines the Kerberos servers for the realm. Each realm that can be contacted by applications on the local system must have an entry in the [realms] section of the configuration file unless DNS or LDAP lookup is enabled. The group entry consists of one or more occurrences of **kdc**, **admin_server**, and **kpasswd_server** names. Entries are randomly selected each time the client needs to contact a Kerberos server.

The value for each **kdc** name entry is the host name, the port assigned to the KDC on that system, and the protocol (UDP or TCP), separated by colons. If the port is omitted, it defaults to 88. If the protocol is omitted, the entry can be used with both protocols.

The value for each **admin_server** entry is the host name and the port assigned to the administration service on that system, separated by a colon. If the port is omitted, it defaults to 749. The protocol is always TCP for the administration service.

The value for each **kpasswd_server** entry is the host name, the port assigned to the password service on that system, and the protocol (UDP or TCP), separated by colons. If the port is omitted, it defaults to 464. If the protocol is omitted, the entry can be used with both protocols.

**[domain realm] section**

**hostname**
- The **hostname** value is a DNS host name. The value is the name of the Kerberos realm that contains the specified host system.

**.suffix**
- The **.suffix** value is the domain portion of a DNS host name. The value is the name of the Kerberos realm that contains host systems in the specified domain. A specific host name definition takes precedence over the domain specification.

If a matching entry is not found for a particular host name, the default is to remove the first label, put what is left in upper case, and use that for the realm name. For example, if no match is found for **host25.krb390.ibm.com**, the realm name is set to KRB390.IBM.COM.
Configuring

[capaths] section
realm
Each realm value is a Kerberos realm name and represents the starting point for a request. If the configuration file is not shared between systems, then the only realm that needs to be specified is the local realm. Otherwise, there needs to be a realm definition for each system sharing the configuration file. The value is a group definition that defines the target realms. If multiple trust hops are required to reach the target realm, there are multiple entries defining each of the trust relationships from the local realm to the target realm. If there is a trust relationship between the local realm and the target realm, specify the hop as a period.

Sample /etc/skrb/krb5.conf configuration file

[libdefaults]
default_realm=KRB390.IBM.COM
dc_req_checksum_type = rsa-md5
ap_req_checksum_type = rsa-md5
safe_checksum_type = rsa-md5-des
default_tkt_enctypes = des-cbc-crc,des-cbc-md5
default_tgs_enctypes = des-cbc-crc,des-cbc-md5
dc_default_options = 0x40000010

[realms]
KRB390.IBM.COM = {
    kdc = dcesec4.krb390.ibm.com:88
    kdc = dcesec7.krb390.ibm.com:88
    admin_server = dcesec4.krb390.ibm.com:749
    kpasswd_server = dcesec4.krb390.ibm.com:464
}

KRB2000.IBM.COM = {
    kdc = sstone1.krb2000.ibm.com:88
    kpasswd_server = sstone1.krb2000.ibm.com:464
}

[domain_realm]
.kr390.ibm.com = KRB390.IBM.COM
.endicott.ibm.com = KRB390.IBM.COM

[capaths]
KRB390.IBM.COM = {
    KRB2000.IBM.COM = .
}


Chapter 3. Administering Network Authentication Service

This chapter provides information on administering Network Authentication Service for z/OS.

Adding principals

The following details how to add principals to the database.

Local principals

Local principals can be added to an NDBM database using the kadmin command (Refer to the description of the kadmin command for more information). For a RACF database, the Kerbname value of the altuser command can be used to associate a Kerberos principal with an existing RACF user. The kerbname value of the RACF adduser command can be used to create a new user id and associate it with a Kerberos principal (refer to \textit{z/OS Security Server RACF Command Language Reference} for the format of these commands).

Foreign principals

Some applications require that you associate principals with local RACF identities. For Foreign Kerberos principals, this can be done by using the KERBLINK class (refer to Mapping Foreign principals in \textit{z/OS Security Server RACF Security Administrator's Guide}). Note that the association of a foreign Kerberos principal with a local RACF identity via the KERBLINK class does not create a local Kerberos segment, as is done by the adduser and altuser commands. RACF services such as R\_USERMAP can only be used to map the RACF ID to the local kerberos segment, but can map many foreign principals to the local RACF ID using the KERBLINK association and the Kerberos segment. Creating a KERBLINK association is not required for local principals added by the adduser and altuser commands.

Principal names

All principal names and passwords should consist only of characters from the POSIX portable character set, but should not include any variant characters, such as brace, bracket, or currency symbols. (See \textit{z/OS Integrated Security Services Network Authentication Service Programming} or a table of the POSIX characters.) In addition, principal names should not contain blanks or the commercial "at" sign (@).

If for some reason you need to use blanks in a principal name as part of a command-line argument, enclose the whole name in quotation marks.

If you have a need to use principal names or passwords that contain characters not in the POSIX portable character set (in other words, for national language reasons), be sure that the LANG value for the SKRBKDC started task is set to a code page that translates the national language characters to those that RACF can use. This applies to z/OS clients as well.

For users, principal names can be chosen to match their user ids. For services the format of the name to be defined in the KDC and/or in the keytab file has the format service\_name/realm\_name.

For services, the service\_name depends on the Kerberized application, and could use the word "host" or the name of the application. For example, for Kerberized ftp the principal name at realm dcesec4.krb390.ibm.com could be ftp/dcesec4.krb390.ibm.com or host/dcesec4.krb390.ibm.com. The service principal name in the KDC or the keytab must match the name used by the Kerberized application. Please consult the documentation of your Kerberized application.

Realm trust relationships

Network Authentication Service for z/OS supports two types of trust relationships: peer and transitive.
Peer trust
In a peer trust relationship, two realms exchange secret keys so that one realm can create a ticket-granting ticket (TGT) that will be accepted by the other realm. The trust relationship is established by defining a pair of principals in each realm. For example, if a peer trust relationship is to be established between KRB390.IBM.COM and KRB2000.IBM.COM, the following principals must be defined in each realm:
krbtgt/KRB390.IBM.COM@KRB2000.IBM.COM
krbtgt/KRB2000.IBM.COM@KRB390.IBM.COM

Principal names beginning with krbtgt/ are reserved for this purpose and must not be used for other purposes.

Transitive trust
In a transitive trust relationship, two realms trust each other if they trust the intermediate realms involved in granting a ticket. Kerberos transitive trust is based upon a hierarchical trust path between the ticket client and the ticket server. The components in the trust path are formed by using periods to separate the realm name into its constituent parts. The common portion between the two realm names forms the top ancestor in the trust path.

For example, if the client is in realm SSTONE1.KRB2000.IBM.COM and the server is in realm DCESEC4.KRB390.IBM.COM, the trust path consists of the following entries:
- SSTONE1.KRB2000.IBM.COM
- KRB2000.IBM.COM
- IBM.COM
- KRB390.IBM.COM
- DCESEC4.KRB390.IBM.COM

If each realm involved in granting the service ticket is present in the trust path, then the ticket is trusted.

When attempting to obtain a service ticket, the Kerberos runtime starts with the client realm and attempts to obtain a TGT for the server realm. If the KDC for the client realm is unable to satisfy the request because there is no peer trust relationship between the client and server realms, the Kerberos runtime attempts to obtain a TGT to a realm that is in the trust path between the client and the server realms. As soon as it obtains a TGT to an intermediate realm, it tries to obtain a TGT to the server realm from the intermediate KDC. This process is repeated until either a server realm TGT is obtained or all of the intermediate realms have been tried.

When setting up transitive trust, a peer trust relationship should be defined between each realm and a common ancestor realm in the hierarchy. For example, consider the following realm tree:
- IBM.COM (Top node)
- KRB390.IBM.COM (First level node)
- DCESEC4.KRB390.IBM.COM (Second level node)
- DCESEC7.KRB390.IBM.COM (Second level node)
- KRB2000.IBM.COM (First level node)
- SSTONE1.KRB2000.IBM.COM (Second level node)
- SSTONE2.KRB2000.IBM.COM (Second level node)

A fully-connected hierarchy has, at a minimum, the following peer trust relationships:
- DCESEC4.KRB390.IBM.COM <-> KRB390.IBM.COM
- DCESEC7.KRB390.IBM.COM <-> KRB390.IBM.COM
- KRB390.IBM.COM <-> IBM.COM
An additional peer trust relationship can be defined to shorten the transited path between the lower layer of realms:

- KRB390.IBM.COM <---> KRB2000.IBM.COM

Do not include the top node in the trust hierarchy if there is no need to obtain tickets for that realm. In the above example, IBM.COM could be omitted and the peer trust relationships would then be the following:

- DCESEC4.KRB390.IBM.COM <---> KRB390.IBM.COM
- DCESEC7.KRB390.IBM.COM <---> KRB390.IBM.COM
- KRB390.IBM.COM <---> KRB2000.IBM.COM
- SSTONE1.KRB2000.IBM.COM <---> KRB2000.IBM.COM
- SSTONE2.KRB2000.IBM.COM <---> KRB2000.IBM.COM

Similarly, a lopsided trust hierarchy can be defined. Suppose there is no need to obtain tickets to the IBM.COM or KRB2000.IBM.COM realms. The peer trust relationships would then be the following:

- DCESEC4.KRB390.IBM.COM <---> KRB390.IBM.COM
- DCESEC7.KRB390.IBM.COM <---> KRB390.IBM.COM
- SSTONE1.KRB2000.IBM.COM <---> KRB390.IBM.COM
- SSTONE2.KRB2000.IBM.COM <---> KRB390.IBM.COM

When defining the transitive trust hierarchy, it is important to remember that the peer trust relationships must be symmetric (tickets can be obtained when traversing the trust path in either direction) and each realm in a peer trust relationship must be capable of either providing a TGT for the destination realm or for an intermediate realm which is further along the trust path between the client and the server realms.

**Passwords**

The krbtgt principals are used for ticket-granting tickets. When using the SAF database, KERBDFLT is used for your local realm (krbtgt/local-realm@local-realm) and the RDEFINE global name (../realm-name/principal-name) is used for peer-to-peer connections. In this respect, each pair of peer-to-peer principals is repeated in the foreign registries and must have the same passwords.

For example, if you are connecting REALMA and REALMB using the SAF database implementation, you would have the following RDEFINE statements in both REALMA and REALMB:

```
RDEFINE REALM /../REALMA/krbtgt/REALMB KERB(PASSWORD(PSWD1))
RDEFINE REALM /../REALMB/krbtgt/REALMA KERB(PASSWORD(PSWD2))
```

For the NDBM database, the krbtgt/REALMB@REALMA principal is used by the REALMA KDC to grant a ticket to REALMB. Similarly, the krbtgt/REALMA@REALMB principal is used by the REALMB KDC to grant a ticket to REALMA. These principals must be added to the NDBM database by the kadmin command to establish peer trust.

A password can be any value as long as you specify the same password each time you define the principal.

**Cache files**

The Kerberos runtime stores network credentials in cache files located in /var/skrb/creds. These files should be erased periodically. There are several ways to do this:
Administering

- Use a temporary file system mounted at `/var/skrb/creds`. This results in all the credentials cache files being deleted each time the system is restarted.
- Erase all of the files in `/var/skrb/creds` when the `/etc/rc` initialization script is run. This results in all of the credentials cache files being deleted each time the system is restarted.
- Set up a `cron` job to run the `kdestroy` command with the `-e` option. This results in the deletion of only expired credentials cache files. This is the preferred method for managing the credentials cache files. The `cron` job should run with UID 0 so that it can delete the cache files.

Audit

SMF Type 80 records are created for login requests (Kerberos initial ticket requests). Both success and failure events can be logged as determined by the SKDC_LOGIN_AUDIT environment variable. The event code is 68 and the record includes relocate sections 333 (Kerberos principal name), 334 (request source), and 335 (KDC error code).

The Kerberos principal is stored as a global name (`/.../realm-name/principal-name`) and not as a Kerberos name (`principal-name@realm-name`). This is done to avoid code page problems caused by the at-sign variant character. If the request is received through TCP/IP, the request source is the network address (`nnn.nnn.nnn.nnn:ppppp`). If the request is received through Program Call, the request source is the system user ID of the requester The KDC error code is a value between 0 and 127.

KDC error codes

The possible KDC error codes are:

- 0  No error
- 1  Client entry is expired
- 2  Server entry is expired
- 3  Protocol version is not supported
- 4  Client key is encrypted in an old master key
- 5  Server key is encrypted in an old master key
- 6  Client is not defined in the security registry
- 7  Server is not defined in the security registry
- 8  Principal is not unique in the security registry
- 9  No key is available for the principal
- 10  Ticket is not eligible for postdating
- 11  Ticket is never valid
- 12  Request rejected due to KDC policy
- 13  Request option is not supported
- 14  Encryption type is not supported
- 15  Checksum type is not supported
- 16  Preauthentication type is not supported
- 17  Transited data type is not supported
- 18  Client account is revoked
- 19  Server account is revoked
- 20  TGT is revoked
Client account is not valid yet
Server account is not valid yet
Password is expired
Preauthentication failed
Preauthentication required
Supplied authentication ticket is not for the requested server
Server requires user-to-user protocol
Decryption integrity check failed
Ticket is expired
Ticket is not valid yet
Request is a replay of a previous request
Supplied authentication ticket is not for the current realm
Ticket and authenticator do not match
Clock skew is too great
Incorrect network address
Protocol version mismatch
Invalid message type
Message stream has been modified
Message is out of order
Key version is not available
Service key is not available
Mutual authentication failed
Incorrect message direction
Alternative authentication method required
Incorrect message sequence number
Inappropriate checksum type
Generic error detected
Field is too long

Security server operator commands

The operator commands in this section are supported by Network Authentication Service for z/OS (SKRBKDC started task).

All principal names and passwords should consist only of characters from the POSIX portable character set, but should not include any variant characters, such as brace, bracket, or currency symbols. For more information on principal names, refer to “Adding principals” on page 3-1.

If for some reason you need to use blanks in a principal name as part of a command-line argument, enclose the whole name in quotation marks.
Administering

If you have a need to use principal names or passwords that contain characters not in the POSIX portable character set (in other words, for national language reasons), be sure that the LANG value for the SKRBKDC started task is set to a code page that translates the national language characters to those that Resource Access Control Facility (RACF) can use. This applies to z/OS clients as well.

F SKRBKDC,parameters

Format
Causes a command to be executed by the security server. This command is the same as MODIFY SKRBKDC.

F SKRBKDC,parameters

Options

DISABLE ADMIN
Disables the Kerberos administration service. No changes can be made to the Kerberos database while the administration service is disabled.

DISPLAY ADMIN
Displays the current status of the Kerberos administration service. This option may be abbreviated D ADMIN.

DISPLAY CREDS,owner,date
Displays all credentials data space allocations for a user that were created before the specified date. All data space allocations for a user are displayed if the date is omitted. All data space allocations are displayed if no owner is specified. A date can be specified without specifying an owner by using two successive commas. A maximum of 252 allocations can be displayed. The date is specified as yyyy.ddd.

This command can be abbreviated as D CREDS,owner,date.

DISPLAY CRYPTO
Displays the available encryption types, whether hardware cryptographic support is available, and whether the encryption type can be used for application data. This option may be abbreviated D CRYPTO.

DISPLAY LEVEL
Displays the current service level of the Kerberos security server. This option may be abbreviated D LEVEL.

DISPLAY NETWORK
Displays the status of the network interfaces. The SKDC_NETWORK_POLL environment variable determines how often the Kerberos security server updates the network interface status. This option may be abbreviated D NETWORK.

DISPLAY PROP
Displays the status of database propagation. The current update sequence number is displayed for each Kerberos security server in the realm that participates in database propagation. This information is available only on the primary security server for the realm. This option may be abbreviated D PROP.

DISPLAY XCF
Displays the status of all instances of the SKRBKDC started task in the sysplex.

This command can be abbreviated as D XCF.

DEBUG ON
Enables debug mode for the SKRBKDC started task using the current subcomponent debug values.

DEBUG OFF
Disables debug mode for the SKRBKDC started task.
DEBUG  subcomponent.level,subcomponent.level,...
Sets the SKRBKDC started task debug level for one or more subcomponents. All subcomponents can
be changed by specifying an asterisk for the subcomponent. The debug level must be an integer
between 0 and 9. All debug messages are suppressed for a subcomponent when its debug level is 0.
The initial debug settings are obtained from the SKRBKDC environment variable file
/etc/skrb/home/kdc/envar).

For example, F SKRBKDC,DEBUG *.1,KRB_KDC.8
This sets debug level to 1 for all subcomponents and then sets the debug level to 8 for the KRB_KDC
subcomponent.

ENABLE ADMIN
Enables the Kerberos administration service. The administration service can be enabled only if the
Kerberos database supports the administration function.

PROP secondary-name
Initiates a full database propagation to the specified secondary Kerberos security server. This
command can be issued only on the primary Kerberos security server. The secondary security server
must be defined in the /etc/skrb/home/kdc/kpropd.acl configuration file.

Usage
For the option subcomponent.level,subcomponent.level,..., all subcomponents can be changed by
specifying an asterisk for the subcomponent. The debug level must be an integer between 0 and 9. All
debug messages are suppressed for a subcomponent when its debug level is 0. The initial debug settings
are obtained from the SKRBKDC environment variable file /etc/skrb/home/kdc/envar.

Examples
To enable debug mode:
F SKRBKDC,DEBUG ON

To disable debug mode:
F SKRBKDC,DEBUG OFF

To set the debug level for one or more subcomponents:
F SKRBKDC,DEBUG *.1,KRB_KDC.8
This sets the debug level to 1 for all subcomponents and then sets the debug level to 8 for the KRB_KDC
subcomponent.

MODIFY SKRBKDC,parameters

Format
MODIFY SKRBKDC,parameters

Options
Same as the F SKRBKDC,parameters command.

Usage
Same as F SKRBKDC,parameters.

Examples
Same as F SKRBKDC, parameters.

CTRACE debugging utility
Component trace records can be captured using either in-storage wrap buffers or an external writer. The
component trace records contain the same information as the debug messages. The component trace
options parameter can be used to set or modify the initial subcomponent debug levels. The MODIFY SKRBKDC,DEBUG command can then be used to change the subcomponent levels once the trace has been started.

The following commands start the component trace (CTIKDC00 is a sample parmlib member):

TRACE CT,WTRSTART=SKRBWTR
TRACE CT,ON,COMP=SKRBKDC,PARM=CTIKDC00

The following commands stop the component trace:

TRACE CT,OFF,COMP=SKRBKDC
TRACE CT,WTRSTOP=SKRBWTR

IPCS can be used to format and display the component trace records that were written to the trace datasets or contained in a dump dataset. The trace entry type codes are the same as the subcomponent names.

P SKRBKDC

Format
P SKRBKDC

Causes an orderly shutdown of the security server. This command is the same as STOP SKRBKDC.

There are no parameters (options).

STOP SKRBKDC

Format
STOP SKRBKDC

Kerberos administration server

The Kerberos administration server is provided as part of the SKRBKDC started task. The administration capabilities are dependent upon the Kerberos database selected by the SKDC_DATABASE environment variable. Communication between the administration client and the administration server uses a variant of Sun RPC with GSS-API authentication. The kadmin command is provided to perform Kerberos administration functions. In addition, the kadm5_* API is provided for use by application programs.

z/OS Network Authentication Service now provides an administration server for the NDBM database. Administration for the SAF database is performed using the native system commands. The kadmin command and the kadm5_* API can be used with any Kerberos administration server that is compatible with Version 2 of the MIT Kerberos administration protocol.

Administration privileges

Authorization controls are provided through the /etc/skrb/home/kdc/kadm5.acl file. This file controls the Kerberos administration privileges. Each line represents a single administration access definition, has a maximum length of 255 characters, and is assumed to be in the code page specified by the LANG environment variable. Comment lines start with a semi-colon and blank lines are ignored. Each line consists of 2 fields: the client principal name and the privileges granted. The order of the lines in the file is important because the search stops as soon as a match is found for the principal making an administration request.

The client principal name can contain the following wildcards:

• ? represents a single character
The following administration privileges are defined. Use lowercase letters to define the granted privileges (any privilege not listed is denied) and use uppercase letters to define the denied privileges (any privilege not listed is granted). Do not mix uppercase and lowercase letters in the same definition.

<table>
<thead>
<tr>
<th>a</th>
<th>ADD is granted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ADD is denied</td>
</tr>
<tr>
<td>c</td>
<td>CHANGEPW granted</td>
</tr>
<tr>
<td>C</td>
<td>CHANGEPW denied</td>
</tr>
<tr>
<td>d</td>
<td>DELETE granted</td>
</tr>
<tr>
<td>D</td>
<td>DELETE denied</td>
</tr>
<tr>
<td>g</td>
<td>GET granted</td>
</tr>
<tr>
<td>G</td>
<td>GET denied</td>
</tr>
<tr>
<td>l</td>
<td>LIST granted</td>
</tr>
<tr>
<td>L</td>
<td>LIST denied</td>
</tr>
<tr>
<td>m</td>
<td>MODIFY granted</td>
</tr>
<tr>
<td>M</td>
<td>MODIFY denied</td>
</tr>
<tr>
<td>s</td>
<td>SETKEY granted</td>
</tr>
<tr>
<td>S</td>
<td>SETKEY denied</td>
</tr>
<tr>
<td>*</td>
<td>All privileges are granted</td>
</tr>
</tbody>
</table>

**Administration RPC functions**

- **CHPASS_PRINCIPAL** - Change the password for a principal.
  This function requires CHANGEPW authority or the principal entry must be the authenticated client entry. The new password is subject to the minimum password lifetime, minimum password classes, and minimum password length rules in effect for the Kerberos database. Depending upon the database implementation, existing keys are deleted when the password is changed.

- **CHPASS_PRINCIPAL3** - Change the password for a principal.
  This function is the same as the CHPASS_PRINCIPAL function with the addition that the key types and salt types can be specified. Depending upon the database implementation, existing keys can either be retained or deleted when the password is changed.

- **CHRAND_PRINCIPAL** - Generate random keys for a principal.
  This function requires CHANGEPW authority or the principal entry must be the authenticated client entry. The password change is subject to the minimum password lifetime rule in effect for the Kerberos database. Depending upon the database implementation, existing keys are deleted when the random keys are generated.

- **CHRAND_PRINCIPAL3** - Generate random keys for a principal.
  This function is the same as the CHRAND_PRINCIPAL function with the addition that the key types and salt types can be specified. Depending upon the database implementation, existing keys can either be retained or deleted when the random keys are generated.

- **CREATE_POLICY** - Create an administration policy.
  This function requires ADD authority. The maximum length of a policy name is 128 characters. The name must consist of displayable graphic characters as determined by the locale in effect for the administration server. The name may not contain the backslash character.

The following mask flags are supported:
Administering

- KADM5_POLICY - Policy name supplied (required)
- KADM5_PW_MIN_LIFE - Minimum password lifetime supplied
- KADM5_PW_MAX_LIFE - Maximum password lifetime supplied
- KADM5_PW_MIN_LENGTH - Minimum password length supplied
- KADM5_PW_MIN_CLASSES - Minimum number of password classes supplied
- KADM5_PW_HISTORY_NUM - Number of password history entries supplied

- CREATE_PRINCIPAL - Create a principal.
  This function requires ADD authority. The maximum length of a principal name is 235 characters, including the realm name and separator. The name must consist of displayable graphic characters as determined by the locale in effect for the administration server. The name may not contain the backslash or commercial at-sign characters.
  The following principal attributes are supported:
  - KRB5_KDB_DISALLOW_POSTDATED - Disallow post-dated tickets
  - KRB5_KDB_DISALLOW_FORWARDABLE - Disallow forwardable tickets
  - KRB5_KDB_DISALLOW_TGT_BASED - Disallow TGT-based tickets
  - KRB5_KDB_DISALLOW_RENEWABLE - Disallow renewable tickets
  - KRB5_KDB_DISALLOW_PROXIA - Disallow proxiable tickets
  - KRB5_KDB_DISALLOW_DUP_SKEY - Disallow duplicate session keys
  - KRB5_KDB_DISALLOW_ALL_TIX - Disallow all tickets
  - KRB5_KDBQUIRES_PWCHANGE_SERVICE - This is a password change service

  The following mask flags are supported:
  - KADM5_ATTRIBUTES - Principal attributes supplied
  - KADM5_KVNO - Initial key version number supplied
  - KADM5_MAX_LIFE - Maximum ticket lifetime supplied
  - KADM5_MAX_RLIFE - Maximum renewable ticket lifetime supplied
  - KADM5_POLICY - Policy name supplied
  - KADM5_PRINC_EXPIRE_TIME - Account expiration time supplied
  - KADM5_PRINCIPAL - Principal name supplied (required)
  - KADM5_PW_EXPIRATION - Password expiration time supplied
  - KADM5_TL_DATA - Tagged data supplied (the tagged data type must be greater than 255)

- CREATE_PRINCIPAL3 - Create a principal.
  This function is the same as the CREATE_PRINCIPAL function with the addition that the key types and salt types can be specified.

- DELETE_POLICY - Delete an administration policy.
  This function requires DELETE authority. An error is returned if the policy is still refered to by Kerberos principals.

- DELETE_PRINCIPAL - Delete a principal.
  This function requires DELETE authority.

- GET_POLICY - Get an administration policy.
  This function requires GET authority.

- GET_POLS - List the administration policy names.
This function requires LIST authority. An error is returned if there are more than 1000 matches for the search expression.

- **GET_PRINCIPAL** - Get a principal.
  
  This function requires GET authority.

- **GET_PRINCS** - List the principal names.
  
  This function requires LIST authority. An error is returned if there are more than 1000 matches for the search expression.

- **GET_PRIVS** - Get administration privileges for the authenticated client.
  
  This function can be issued by any client. The privileges are obtained by matching the authenticated client name to entries in the `/etc/skrb/home/kdc/kadm5.acl` control file.

- **MODIFY_POLICY** - Modify an administration policy.
  
  This function requires MODIFY authority.

  The following mask flags are supported:
  
  - `KADM5_PW_MIN_LIFE` - Minimum password lifetime supplied
  - `KADM5_PW_MAX_LIFE` - Maximum password lifetime supplied
  - `KADM5_PW_MIN_LENGTH` - Minimum password length supplied
  - `KADM5_PW_MIN_CLASSES` - Minimum number of password classes supplied
  - `KADM5_PW_HISTORY_NUM` - Number of password history entries supplied

- **MODIFY_PRINCIPAL** - Modify a principal.
  
  This function requires MODIFY authority. Only the maximum ticket lifetime and the maximum renewable ticket lifetime values can be modified for protected principals (the architected Kerberos principals for the realm).

  The following principal attributes are supported:
  
  - `KRB5_KDB_DISALLOW_POSTDATED` - Disallow post-dated tickets
  - `KRB5_KDB_DISALLOW_FORWARDABLE` - Disallow forwardable tickets
  - `KRB5_KDB_DISALLOW_TGT_BASED` - Disallow TGT-based tickets
  - `KRB5_KDB_DISALLOW_RENEWABLE` - Disallow renewable tickets
  - `KRB5_KDB_DISALLOW_PROXIABLE` - Disallow proxiable tickets
  - `KRB5_KDB_DISALLOW_DUP_SKEY` - Disallow duplicate session keys
  - `KRB5_KDB_DISALLOW_ALL_TIX` - Disallow all tickets
  - `KRB5_KDB_REQUIRES_PRE_AUTH` - Requires preauthentication
  - `KRB5_KDB_REQUIRES_HW_AUTH` - Requires hardware authentication
  - `KRB5_KDB_REQUIRES_PWCHANGE` - Requires password change
  - `KRB5_KDB_DISALLOW_SVR` - Disallow service tickets
  - `KRB5_KDB_PWCHANGE_SERVICE` - This is a password change service

  The following mask flags are supported:
  
  - `KADM5_ATTRIBUTES` - Principal attributes supplied
  - `KADM5_FAIL_AUTH_COUNT` - Failed authentication count supplied
  - `KADM5_KVNO` - Key version number supplied
  - `KADM5_MAX_LIFE` - Maximum ticket lifetime supplied
  - `KADM5_MAX_RLIFE` - Maximum renewable ticket lifetime supplied
  - `KADM5_POLICY` - Policy name supplied
  - `KADM5_POLICY_CLR` - No policy is associated with the principal
  - `KADM5_PRINC_EXPIRE_TIME` - Account expiration time supplied
  - `KADM5_PW_EXPIRATION` - Password expiration time supplied
  - `KADM5_TL_DATA` - Tagged data supplied (the tagged data type must be greater than 255)
Administering

- **RENAME_PRINCIPAL** - Rename a principal.
  This function requires ADD and DELETE authority.
- **SETKEY_PRINCIPAL** - Set the encryption keys for a principal.
  This function requires SETKEY authority. The password change is subject to the minimum password lifetime rule in effect for the Kerberos database. Depending upon the database implementation, existing keys are deleted when the new keys are set.
- **SETKEY_PRINCIPAL3** - Set the encryption keys for a principal.
  This function is the same as the SETKEY_PRINCIPAL function with the addition that the salt types can be specified. Depending upon the database implementation, existing keys can either be retained or deleted when the new keys are set.

### Kerberos database propagation

The Kerberos security server supports two types of security registries: SAF and NDBM. The SAF registry stores Kerberos information in the z/OS system security database and uses SAF services to interface with the external security manager. The external security manager is responsible for database propagation between systems in the same sysplex and between systems in different sysplexes. Kerberos database propagation is not used in this environment and does not need to be configured.

The NDBM registry uses the POSIX database support provided by Unix System Services. The database files are located in the `/var/skrb/krb5kdc` directory. Kerberos database propagation is used to synchronize these files between systems in the same sysplex and between systems in different sysplexes. The file system containing the `/var/skrb/krb5kdc` directory must be large enough to contain two copies of the registry database files plus a complete database dump file.

The Kerberos security server supports two database propagation protocols: full replacement and individual updates. The full replacement protocol sends the entire Kerberos database to each secondary Kerberos security server. This is the only propagation protocol supported by MIT Kerberos. The propagation occurs at timed intervals specified by the `SKDC_KPROP_INTERVAL` environment variable. A propagation does not occur if there have been no changes to the database since the last database propagation.

The individual update protocol sends just the database updates to each secondary Kerberos security server. The propagation occurs as each change is made to the database. The primary security server keeps track of the update level of each secondary security server and holds pending updates for an unavailable secondary server until the server becomes available. The individual update protocol should be used if it is supported by the primary KDC and the secondary KDC, since it performs much better than the full replacement protocol for large databases.

The `/etc/skrb/home/kdc/kpropd.acl` configuration file contains an entry for each Kerberos security server in the realm, and it specifies the role assigned to each of the servers. Each line consists of three fields, blank lines are ignored, comment lines are indicated by a semi-colon in the first position, and the file is assumed to be in the code page specified by the `LANG` environment variable. The maximum line length is 255 characters. The first field specifies the host name and optional port, separated by a colon, of a Kerberos security server. Port 754 is used for database propagation if a port is not specified either in `kpropd.acl` or for the `krb5_prop` service. The host name is used as the name of the Kerberos security server in the propagation status database and is converted to lowercase. The second field specifies the role assigned to that security server. The third field specifies the encryption type for the session key in the service ticket. The encryption type field is optional and the default encryption type list obtained from the Kerberos configuration file is used if the field is omitted.

The roles are:
- **Primary** - This is the primary security server for the realm. It owns the Kerberos registry database and sends updates to the other security servers in the realm.
• Replace - This is a secondary security server that receives updates by replacing the entire registry database as part of each propagation cycle. The database propagation contains principal policy and password history information. The secondary KDC must be at the MIT Kerberos 1.2.2 level or later.

• Compat - This is a secondary security server that receives updates by replacing the entire registry database as part of each propagation cycle. The database propagation does not contain principal policy or password history information. This propagation format is supported by MIT Kerberos 1.2.1 and earlier. Note that the principal policy and password history information is lost if a database created using this propagation method is later used by the primary KDC for the realm.

• Update - This is a secondary security server that receives individual database updates.

• Manual - This is a secondary security server that receives updates manually when the security server PROP command is issued.

The /etc/skrb/home/kdc/kpropd.acl configuration file must exist on the primary system and on each secondary system if database propagation is going to be used. The KDC assumes it is the only KDC in the realm if this file is not found. The host names specified in the kpropd.acl file must be valid DNS names and each must be the primary name assigned to its host system. The KDC locates its own entry by using DNS services to translate the host name returned by the gethostname() function and then by searching for the translated name in the configuration file.

The kpropd.acl file on the primary system must contain an entry for each KDC in the realm, including the primary KDC. These entries define the secondary servers to receive database propagations from the primary KDC.

The kpropd.acl file on the secondary systems requires only the entry for the primary KDC, although other entries can be specified. A secondary KDC accepts updates only from servers identified in its kpropd.acl configuration file. The secondary KDC checks for an authorized server by using DNS services to translate the remote IP address for a connection to a host name and then searching for the host name in the configuration file.

The KDC identified as the primary KDC provides Kerberos administration services by listening for requests on the administration and password change ports. The primary KDC does not listen for requests on the propagation port.

A KDC identified as a secondary KDC doesl not provide Kerberos administration services. It does not listen for requests on the administration or password change ports. A secondary KDC listens for propagation requests on the propagation port.

The Kerberos registry must contain a service principal for each system with a KDC, including the primary KDC. The principal name is host/primary-host-name where primary-host-name is the primary DNS name for the system. For example, if a KDC is running on system dcesec4.krb390.ibm.com, the Kerberos registry must contain the principal host/dcesec4.krb390.ibm.com.

Each system running a secondary KDC must have a /var/skrb/krb5kdc/kpropd.ktf key table file. This key table contains the host key for that system and is created using the kadmin ktadd subcommand. For example, if a secondary KDC is running on system dcesec7.krb390.ibm.com, the following kadmin commands should be issued on the dcesec7.krb390.ibm.com system:

addprinc host/dcesec7.krb390.ibm.com
ktadd -k /var/skrb/krb5kdc/kpropd.ktf host/dcesec7.krb390.ibm.com

The following is a sample kpropd.acl for a Kerberos realm containing three Kerberos security servers. Systems dcesec4.krb390.ibm.com and dcesec7.krb390.ibm.com are z/OS systems in the same sysplex, while system dcect.mitkrb.ibm.com is an AIX® system running MIT Kerberos. The KDC on dcesec4.krb390.ibm.com is the primary KDC for the realm. This sample configuration file can be found in /usr/lpp/skrb/examples/kpropd.acl:
Administering

; Sample kpropd.acl configuration file
;
; Host Role Encryption type
; ----- ---- ---------------
dcesec4.krb390.ibm.com:754 Primary des-cbc-crc

dcesec7.krb390.ibm.com:754 Update des-cbc-crc
dcektpt.mitkrb.ibm.com:754 Replace des-cbc-crc

The kpropd.acl file may be changed while the Kerberos security server is running and the changes will be picked up at the next propagation interval. However, the role of a security server may not be changed from primary to secondary or from secondary to primary while the security server is running.

Setting up a secondary KDC

A new secondary KDC is added to the realm by performing the following steps:

1. Use the kdb5_ndbm stash command to create the database master key stash file on the secondary system.
2. Create the /var/skrb/krb5kdc/kpropd.ktf key table on the secondary system. Use the kadmin ktadd subcommand to add an entry for the secondary system host principal. The kadmin command must either be issued on the secondary system or the kpropd.ktf file must be copied to the secondary system.
3. Create the /etc/skrb/home/kdc/kpropd.acl configuration file on the secondary system. The primary KDC system for the realm must be listed. The secondary KDC systems can also be included to make it easier to move the primary KDC in the future.
4. Start the kpropd command on the secondary system. The command waits to receive a database propagation from the primary KDC.
5. Edit the /etc/skrb/home/kdc/kpropd.acl configuration file on the primary system. Add the new secondary system and specify Manual for the role.
6. Use the security server PROP command to send the database to the waiting kpropd command.
7. Start the SKRBKDC started task on the new secondary system after the kpropd command has completed.
8. Edit the /etc/skrb/home/kdc/kpropd.acl configuration file on the primary system. Change the role of the secondary system to Update, Replace, or Compat. You should always specify Update if the secondary security server supports the update propagation protocol.

Moving the primary KDC to another system

The roles of the primary KDC and a secondary KDC can be swapped by performing the following steps:

1. Use the kadmin ktadd command to create the /var/skrb/krb5kdc/kpropd.ktf key table on the primary system if it does not already exist. This key table is used by a secondary KDC when it receives a database propagation from the primary KDC. Since the primary KDC is going to become a secondary KDC, it now needs this key table.
2. Use the security server DISABLE ADMIN command to freeze the database on the primary system.
3. Use the security server PROP command to send the current database to the secondary KDC.
4. Shut down the old and the new primary security servers.
5. Update the /etc/skrb/home/kdc/kpropd.acl control files and change the role of the old primary KDC to Compat, Replace or Update and change the role of the new primary KDC to Primary.
6. Restart both security servers.

Interoperability with MIT Kerberos

A z/OS security server can be a primary KDC or a secondary KDC in the same realm with MIT Kerberos (and compatible) security servers. The MIT Kerberos server must be at release 1.2.2 or later, if the z/OS security server is the primary KDC and the Replace role is used. The MIT Kerberos server must be at...
release 1.0 or later if the z/OS security server is the primary KDC and the **Compat** role is used. The MIT Kerberos server must be at release 1.0 or later if the z/OS security server is a secondary KDC.

If the z/OS security server is the primary KDC for the realm, then each MIT Kerberos security server must be listed in the `kpropd.acl` configuration file with the **Replace** or **Compat** propagation protocol. The `/etc/inetd.conf` configuration file on the secondary system must be updated to start the `kpropd` command when a propagation request is received from the primary KDC.

If the z/OS security server is a secondary KDC for the realm with an MIT Kerberos security server as the primary KDC, then the **Replace** protocol is always used. There is no need to update `/etc/inetd.conf` on the z/OS system since the SKRBKDC started task listens for database propagation requests. The `kpropd` command is used on the z/OS system to receive the initial database propagation before starting the SKRBKDC started task for the first time.

Refer to the MIT documentation for more information on setting up MIT Kerberos.
Chapter 4. RACF and z/OS Integrated Security Services
Network Authentication Service

Customizing your local environment ........................................... 4-1
   Defining your local RRSF node ........................................... 4-2
   Defining your local realm ................................................. 4-2
      Example of defining the local realm ............................... 4-3
   Defining local principals ............................................... 4-3
      Generating keys for local principals .............................. 4-4
      Automatic local principal name mapping ......................... 4-5
      Considerations for local principal names ....................... 4-5
Customizing your foreign environment .................................... 4-6
   Defining foreign realms ................................................ 4-6
   Mapping foreign principal names ..................................... 4-6
      Example of mapping foreign principal names ................. 4-7

This topic provides information on using RACF with z/OS Integrated Security Services Network Authentication Service.

z/OS Network Authentication Service uses RACF to store and administer information about principals and realms, using RACF user profiles and general resource profiles. The KERB segment of the user profile is used to store information about z/OS Network Authentication Service principals on your local system. The general resource class KERBLINK allows you to map principals to RACF user IDs on your system. The general resource class REALM defines the local z/OS Network Authentication Service realm and its trust relationships with foreign realms.

RACF also provides a callable service named R_ticketserv (IRRSPK00) for application servers that use z/OS Network Authentication Service services. See z/OS Security Server RACF Security Administrator's Guide for more information.

This topic describes how to use RACF to complete the following steps in the implementation of z/OS Network Authentication Service.

1. Customizing the local environment.
   a. Defining your local RRSF (RACF remote sharing facility) node.
   b. Defining your local realm.
   c. Defining local principals.
2. Defining your foreign environment.
   a. Defining foreign realms.
   b. Mapping RACF user IDs for foreign principals.

For implementation details, see the additional information with this material, or z/OS Integrated Security Services Network Authentication Service Programming.

Customizing your local environment

Before beginning to create RACF definitions to support your z/OS Network Authentication Service implementation, you must define your local system as the local RRSF node. If you have already implemented RRSF, you should review the details in z/OS Security Server RACF Security Administrator's Guide before beginning to create RACF definitions for principals and realms.
In this topic, we will discuss defining your local server as the local realm. Once this definition is complete, you can begin defining your users as local principals and ensuring that their keys are registered with your local server.

**Defining your local RRSF node**

You must define your local system as the local RRSF node using the TARGET command, even if you are not planning to exploit RRSF functions. For example:

```
@TARGET NODE(ENDMVSA) LOCAL
```

You must define your local system as the local RRSF node to allow keys to be generated for local principals who have their passwords changed through application updates. If the local RRSF node is not defined, RACF will not generate keys for local principals who change their own passwords. See "Generating keys for local principals" on page 4-4 for more information.

If RRSF is already implemented, you might have already defined your local system as a local RRSF node. However, be sure to review the information in [z/OS Security Server RACF Security Administrator's Guide](z/OS Security Server RACF Security Administrator's Guide).

**Defining your local realm**

You must define your local realm to RACF before you define local principals. This is because the local realm name is used to generate keys for local principals. You define your local realm by creating a profile in the REALM class called KERBDFLT. Using the KERB option of the RDEFINE and RALTER commands, you can specify the following information about your local realm:

- **KERBNAME** Name of the local realm.
- **MINTKTLFE** Minimum ticket lifetime for the local realm.
- **DEFTKTLFE** Default ticket lifetime for the local realm.
- **MAXTKTLFE** Maximum ticket lifetime for the local realm.
- **CHECKADDRS** KDC to check addresses in tickets as part of ticket validation processing. This should be disabled (default) if your requests pass through routers or firewalls using Network Address Translation (NAT).
- **ENCRYPT** Specifies which keys the realm is allowed to use. The supported key types are DES, DES3, DESD, AES128, and AES256.
- **PASSWORD** Value of the password for the local realm.

**Notes:**

1. This password is not a RACF user password. Therefore, it is not constrained by SETROPTS password rules that can be specified to control user passwords. In addition, the installation-defined new-password exit (ICHPWX01) is not invoked.
2. A password value must be supplied. A 1-128 character password can be specified.
3. Uppercase and lowercase letters are accepted and maintained in the case in which they are entered.

See [z/OS Security Server RACF Command Language Reference](z/OS Security Server RACF Command Language Reference) for detailed information about using the KERB option of the RDEFINE and RALTER commands to administer profiles in the REALM class.

**Important:** If your installation shares the RACF database with systems running different releases of z/OS, administer local Network Authentication Service realms from only the highest level z/OS system. If you alter local realms from a lower level z/OS system, the realms might lose the use of z/OS Network Authentication Service keys supported on higher levels of z/OS. In addition, if you list realm information using the RLIST command on a lower level z/OS system, you might receive inconsistent information.
Example of defining the local realm

The following example shows a local realm KRB2000.IBM.COM being defined with a minimum ticket lifetime of 30 seconds, a default ticket lifetime of 10 hours, a maximum ticket lifetime of 24 hours, and a password of 744275. All of the ticket lifetimes are specified in seconds. The administrator then lists the new REALM profile.

```
RDEFINE REALM KERBDFLT KERB(KERBNAME(KRB2000.IBM.COM) MINTKTLFE(30)
                            DEFTKTLFE(36000) MAXTKTLFE(86400) PASSWORD(NEW1pw))
```

```
RLIST REALM KERBDFLT KERB NORACF
```

<table>
<thead>
<tr>
<th>CLASS</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>REALM</td>
<td>KERBDFLT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KERB INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>KERBNAME= KRB2000.IBM.COM</td>
</tr>
<tr>
<td>MINTKTLFE= 0000000030</td>
</tr>
<tr>
<td>MAXTKTLFE= 00000086400</td>
</tr>
<tr>
<td>DEFTKTLFE= 0000036000</td>
</tr>
<tr>
<td>KEY VERSION= 001</td>
</tr>
<tr>
<td>KEY ENCRYPTION TYPE= DES DES3 DESD AES128 AES256</td>
</tr>
<tr>
<td>CHECK ADDRESSES= NO</td>
</tr>
</tbody>
</table>

See [z/OS Security Server RACF Command Language Reference](z/OS%20Security%20Server%20RACF%20Command%20Language%20Reference) for RLIST authorization requirements.

If Kerberos is in use at your installation and you wish to define a realm name, you must consider the following. In order to help you distinguish between RACF and Kerberos REALM names since RACF allows differentiation in the nomenclature, you can use the RDEFINE command to define the non-Kerberos profile names in the REALM class. For example, if you want to define the SAFDFLT profile in the REALM class (as opposed to the KERBDFLT profile) using the APPLDATA field to define the RACF realm name, issue:

```
RDEFINE REALM SAFDFLT APPLDATA('racf.winmvs2c')
```

As a result, the realm name racf.winmvs2c is selected to give a name to the set of user IDs and other user information held in the security manager database.

Defining local principals

You must define local principals as RACF users using the ADDUSER and ALTUSER commands with the KERB option. This creates a KERB segment in the user profile. Each local principal must have a RACF password or password phrase. Therefore, do not use the NOPASSWORD option when defining local principals.

You can specify the following information for your local principals:

**KERBNAME**  Local principal name.

**Note:** Uppercase and lowercase letters are accepted and maintained in the case in which they are entered.

**MAXTKTLFE** Maximum ticket lifetime for the local principal.

**ENCRYPT** Specifies which keys the local principal is allowed to use. The supported key types are DES, DES3, DESD, AES128, and AES256.

**Important:** Whenever you update a local principal's ENCRYPT options, the principal's password or password phrase may require a change to ensure that a key of each type is generated and stored in the principal's user profile.

Example defining local principals:

```
ALTUSER LEMIEUX KERB(KERBNAME('JacquesLemieux'))
```
Network Authentication

See [z/OS Security Server RACF Command Language Reference](#) for detailed information about using the KERB option of the ADDUSER and ALTUSER commands to administer user profiles for local principals.

**Important:** If your installation shares the RACF database with systems running different releases of z/OS, administer local Network Authentication Service principals from *only* the highest level z/OS system. If you alter local principals from a lower level z/OS system, the users might lose the use of z/OS Network Authentication Service keys supported on higher levels of z/OS. In addition, if you list user principal information using the LISTUSER command on a lower level z/OS system, you might receive inconsistent information.

**Generating keys for local principals**

Local principals must have keys registered with the local z/OS Network Authentication Service server in order to be recognized as local principals. The user's definition as a local principal is not complete until the keys are generated. A key of each encryption type is generated from the local principal's RACF user password or password phrase and stored in the principal's user profile at the time of the user's password or password phrase change. If you want keys generated, be sure to use a password or password phrase change facility that will not result in an expired password that the user must change at next logon. For example, you can change a principal's password using the NOEXPIRED option of the ALTUSER command.

The use of each key is based on the z/OS Network Authentication Service configuration. See [z/OS Integrated Security Services Network Authentication Service Administration](#) for information about how z/OS Network Authentication Service uses keys and how to customize environment variables related to keys.

**System considerations for key generation:** In order to successfully complete password changes for key generation, the RACF address space must be started and must be executing under the authority of a user ID that is associated with a user identifier (UID). In addition, each user or administrator who generates keys must also have an associated UID. As an alternative to defining individual UIDs for each user ID, you can customize your z/OS UNIX security environment to allow default OMVS segment processing. For more information, see [z/OS Security Server RACF Security Administrator's Guide](#).

**Important:** If your installation shares the RACF database with systems running different releases of z/OS, ensure that user password or password phrase changes (for purpose of key generation) are executed from *only* the highest level z/OS system. If user passwords or password phrases are changed from a lower level z/OS system, users might lose the use of z/OS Network Authentication Service keys supported on higher levels of z/OS.

**Methods for generating keys:** **Security administrator method:** You can change a user's password so that a key can be generated using the ALTUSER command with the NOEXPIRED option. For example:

```
ALTUSER LEMIEUX PASSWORD(new1pw) NOEXPIRED
```

**Notes:**

1. Do not use the NOPASSWORD option.
2. You must specify a password value so a key can be generated.
3. All characters of the password will be translated to upper case.

Alternatively, you can add a KERB segment for a local principal and generate the required key using a single RACF command. For example:

```
ALTUSER LEMIEUX PASSWORD(new1pw) NOEXPIRED KERB(KERBNAME('JacquesLemieux'))
```

You can also change a user's password phrase so that Kerberos keys are generated using the ALTUSER command with the NOEXPIRED option. For example:

```
ALTUSER LEMIEUX PHRASE(newphrase) NOEXPIRED
```
Notes:
1. The NOPHRASE option must not be used.
2. A password phrase value must be specified so a key can be generated.

For information about password phrase syntax rules, see [z/OS Security Server RACF Command Language Reference](#).

You can also add a KERBNAME for a local principal and specify a password phrase, generating the required keys using a single RACF command. For example:

```
ALTUSER LEMIEUX PHRASE(newphrase) NOEXPIRED KERB(KERBNAME('JacquesLemieux'))
```

Note: Since a user can have both a password and a password phrase it is recommended that administrators avoid changing both PASSWORD and PHRASE on the same RACF command. Any uncertainty about which value was last used for Kerberos key generation can be handled by issuing a LISTUSER command.

User method: Users can change their own passwords, completing their own definitions as local principals, by using any standard RACF password-change facility, such as one of the following:
- TSO PASSWORD command (without the ID option)
- TSO logon
- CICS® signon

Users who have been assigned a password phrase can also generate Kerberos keys and complete their own definitions as local principals, by using any standard facility which can be used to change their RACF password phrase, such as one of the following:
- TSO PASSWORD (or PHRASE) command
- TSO logon
- `kpasswd` Kerberos command

Notes:
1. Password change requests from applications that encrypt the password prior to calling RACF will not result in usable keys.
2. Some applications may not be able to support password phrases. If using one of these applications results in a password change, that new password becomes the principal's Kerberos password and new Kerberos keys will be generated. For more information on password phrase syntax rules, see [z/OS Security Server RACF Command Language Reference](#).

A local principal's key will be revoked whenever the user's RACF user ID is revoked or the RACF password or password phrase is considered expired. If the user's key is revoked, the server will reject ticket requests from this user.

Automatic local principal name mapping

For each local principal you define on your system using the KERB option of the ADDUSER and ALTUSER commands, RACF automatically creates a mapping profile in the KERBLINK class. When you issue the ALTUSER command with the NOKERB option or issue a DELUSER for a user with a KERB segment, RACF automatically deletes the KERBLINK profile.

The KERBLINK profile maps the local principal name to the user's RACF user ID. The name of the KERBLINK profile for a local principal is the principal name specified as the KERBNAME value with the ADDUSER or ALTUSER command.

Considerations for local principal names

The name of the KERBLINK profile contains the local principal name that is being mapped. Local principal names can contain imbedded blanks.
Network Authentication

Blanks are not permitted as a part of a RACF profile name. Therefore, when building the KERBLINK profile name, as a result of specifying KERBNAME with the ADDUSER or ALTUSER command, RACF command processing will replace each blank with the X'4A' character (which often resolves to the $ symbol). This can be seen in the output from the RLIST KERBLINK * command, and in the output from the RACF data base unload utility (IRRDBU00). RACF command processing also prevents the X'4A' character ($) from being specified as part of the actual local principal name.

For information about the set of characters supported for local principal names, see [z/OS Security Server RACF Command Language Reference](#).

Customizing your foreign environment

Your local z/OS Network Authentication Service server can trust authentications completed by other servers, and can be trusted by other servers, by participating in trust relationships. See the z/OS z/OS Network Authentication Service publications for details about trust relationships.

To participate in trust relationships, you must define each server as a foreign realm. Then, you can allow users who are authenticated in foreign realms (foreign principals) to access protected resources on your local system by mapping one or more RACF user IDs to foreign principal names. You do not need provide foreign principals ability to logon to your local system. You can simply provide mapping to one or more local user IDs so they can gain access privileges for local resources that are under the control of an application server, such as DB2®.

Defining foreign realms

You define foreign realms by creating profiles in the REALM class. The profile name of the REALM class profile contains the fully qualified name of both servers in the relationship. The profile name uses the following formats:

/.../realm_1/KRBTGT/realm_2

Using the KERB option of the RDEFINE and RALTER commands, you define a REALM profile and specify the following information:

**PASSWORD**

Value of the password for this trust relationship with a foreign realm.

**Notes:**

1. This password is not the same as a RACF user password. Therefore, it is not constrained by the SETROPTS password rules that can be specified to control user passwords.
2. A value must be supplied to establish a trust relationship with this foreign realm. A 1-128 character password can be specified.

See [z/OS Security Server RACF Command Language Reference](#) for detailed information about using the KERB option of the RDEFINE and RALTER commands to administer profiles in the REALM class.

For example:

RDEFINE REALM /.../KRBZOS.ENDICOTT.IBM.COM/KRBTGT/KER2000.ENDICOTT.IBM.COM
    KERB(PASSWORD(1276458))

Mapping foreign principal names

You map foreign principals names to RACF user IDs on your local system by defining general resource profiles in the KERBLINK class. You can map each principal in a foreign realm to its own user ID on your local system, or you can map all principals in a foreign realm to the same user ID on your system.
RACF user IDs that map to foreign principals do not need KERB segments. These user IDs are intended to be used only to provide local RACF identities to associate with access privileges for local resources that are under the control of an application server, such as DB2.

Each mapping profile in the KERBLINK class is defined and modified using the RDEFINE and RALTER commands. The name of the KERBLINK profile for a foreign principal contains the principal name, fully qualified with the name of the foreign realm. The profile name uses the following format:

```
/.../[foreign_realm]/[foreign-principal_name]
```

If you wish to map a unique RACF user ID to each foreign principal, you must specify the foreign realm name and the foreign principal name. If you wish to map the same RACF user ID to every foreign principal in the foreign realm, you need only specify the foreign realm name. In each case, you specify the local user ID using the APPLDATA option of the RDEFINE or RALTER command.

**Example of mapping foreign principal names**

In the following example, the users SYKORA and Nedved will have their foreign principal names mapped with individual user IDs on the local z/OS system. All other foreign principals presenting tickets from the KERBZOS.ENDICOTT.IBM.COM server will be mapped to the ENDKERB user ID on the local z/OS system.

```
RDEFINE KERBLINK /.../KERBZOS.ENDICOTT.IBM.COM/SYKORA APPLDATA('PETRS')
RDEFINE KERBLINK /.../KERBZOS.ENDICOTT.IBM.COM/Nedved APPLDATA('PAVELN')
RDEFINE KERBLINK /.../KERBZOS.ENDICOTT.IBM.COM/ APPLDATA('ENDKERB')
```

**Note:** The characters of the profile name are *not* translated to upper case so be sure to enter the realm portion of the profile name in *upper* case and the foreign principal name in the appropriate case.

See [z/OS Security Server RACF Command Language Reference](#) for detailed information about using the RDEFINE and RALTER commands to administer mapping profiles for foreign principals in the KERBLINK class.
Part 2. Reference

This Reference section contains:

- Commands for Network Authentication Service for z/OS
- Status Codes for Network Authentication Service for z/OS
- Messages for Network Authentication Service for z/OS
- Component trace for Network Authentication Service for z/OS
Chapter 5. Commands

This chapter presents Network Authentication Service for z/OS commands in alphabetical order. It provides the format, options, usage, and examples for each command.

The commands are installed in /usr/lpp/skrb/bin. In order to use these commands, you must update the PATH environment variable to place /usr/lpp/skrb/bin before /bin in the search order or else you must use the fully-qualified command name.

If you need to pass a parameter that includes a space or other special character in any of the commands then you will need to quote the argument or escape the special characters. For example:

```
kadmin -p fred -w "password with spaces"
```

or

```
kadmin -p fred -w password\ with\ spaces
```

---

**kadmin**

Administers the Kerberos database.

**Format**

```
```

**Options**

- `-r realm`
  Specifies the Kerberos administration realm. If this option is not specified, the realm is obtained from the principal name. This option is meaningful only if the administration server supports multiple realms.

- `-p principal`
  Specifies the administrator principal. If this option is not specified, the string /admin is appended to the principal name obtained from the default credentials cache. If there is no credentials cache, the string /admin is appended to the name obtained from the USER environment variable, or, if the USER environment variable is not defined, it is appended to the name obtained from the getpwuid() function. The local realm is used if an explicit realm is not part of the principal name.

- `-k keytab`
  Specifies the key table containing the password for the administrator principal. The user is prompted to enter the password if neither the `-k` nor the `-w` option is specified. When using `-k`, the principal name is host/host-name unless the `-p` option is specified. The host-name is the primary host name for the local system.

- `-w password`
  Specifies the password for the administrator principal. The user is prompted to enter the password if neither the `-k` nor the `-w` option is specified.

- `-A`
  Specifies that the initial ticket used by the `kadmin` command does not contain a list of client addresses. If this option is not specified, the ticket contains the local host address list. When an initial ticket contains an address list, it can be used only from one of the addresses in the address list.

- `-e`
  Echoes each command line to stdout. This is useful when stdout is redirected to a file.

**Usage**

The `kadmin` command is used to manage entries in the Kerberos database. You are prompted to enter one or more subcommands. Each subcommand has a maximum length of 1023 characters. To enter a subcommand using multiple input lines, end each line to be continued with a backslash (\) character.
The \texttt{kadmin} command can be used with any Kerberos administration server supporting Version 2 of the Kerberos administration protocol. The \texttt{z/OS} Kerberos security server provides Kerberos administration server support for the NDBM database but not the SAF database (the normal system security commands are used to administer the SAF database).

Subcommand options start with a minus (-) character and principal attributes start with a plus (+) character or a minus (-) character. This means that principal and policy names must not start with these characters. In addition, since the backslash (\) character is used to indicate continuation and the single quote (‘) and double quote (") characters are used as delimiters, a name or password must not contain any of these characters. The \texttt{kadmin} command imposes no other restrictions on the characters used in names or passwords, although it is recommended that you do not use any of the EBCDIC variant characters. The Kerberos administration server may impose additional restrictions.

The following encryption types are supported by the \texttt{kadmin} command. An error is returned if an encryption type is specified that is not supported by the administration server.

- \texttt{des-cbc-crc} - DES encryption with 32-bit CRC checksum
- \texttt{des-cbc-md4} - DES encryption with MD4 checksum
- \texttt{des-cbc-md5} - DES encryption with MD5 checksum
- \texttt{des-hmac-sha1} - DES encryption using key derivation and SHA1 checksum
- \texttt{des3-cbc-sha1-kd} - DES3 encryption using key derivation and SHA1 checksum
- \texttt{aes128-cts-hmac-sha1-96} - AES128 encryption using key derivation and SHA1 checksum
- \texttt{aes256-cts-hmac-sha1-96} - AES256 encryption using key derivation and SHA1 checksum

The following salt types are supported by the \texttt{kadmin} command. An error is returned if a salt type is specified that is not supported by the administration server.

- \texttt{normal} - Kerberos V5 salt using both the principal and realm names
- \texttt{norealm} - Kerberos V5 salt using just the principal name
- \texttt{onlyrealm} - Kerberos V5 salt using just the realm name
- \texttt{afs3} - AFS® V3 salt
- \texttt{v4} - Kerberos V4 salt

\textbf{Time units}

Dates are displayed as \texttt{day-of-week month day-of-month hour:minute:second timezone year} using the local timezone as specified by the TZ environment variable. Durations are displayed as \texttt{days-hours:minutes:seconds}.

The \texttt{kadmin} command supports a number of date and duration formats, such as:

- "15 minutes"
- "7 days"
- "1 month"
- "2 hours"
- "400000 seconds"
- "next year"
- "this Monday"
- "next Monday"
- yesterday
- tomorrow
- now
- "3/31/1992 10:00:07 PST"
- "January 23, 2007 10:05pm"
- "22:00 GMT"
- 2000-1-28
- 17-Jun.-2001
- "28 Feb 2002"
The date specification must be enclosed in double quotes if it contains spaces. You cannot use a number without a unit (for example, “60 seconds” is correct but “60” is incorrect). If an explicit timezone is not given as part of the date specification, the local timezone is used. The date specification is not case sensitive; it may be entered using uppercase or lowercase characters. The year must be between 1970 and 2037. Two-digit years may be used with 0-37 representing 2000-2037 and 70-99 representing 1970-1999. The unit specification can be either singular or plural (for example, “month” and “months” are both allowed).

A date may be specified as an absolute or a relative value. If a relative value is given, the current date is added to form the date. An interval may also be specified as an absolute or a relative value. If an absolute value is given, the current date is subtracted to form the interval.

Here are the values that are acceptable for various ways of expressing time:

**Units of time**
- year, month, fortnight, week, day, hour, minute, min, second, sec

**Relative time**
- tomorrow, yesterday, today, now, last, this, next, ago

**12-hour time delimiters**
- am, pm

**Months**
- january, jan, february, feb, march, mar, april, apr, may, june, jun, july, jul, august, aug, september, sept, sep, oktober, oct, november, nov, december, dec

**Days**
- sunday, sun, monday, mon, tuesday, tues, tue, wednesday, wednes, wed, thursday, thurs, thur, thu, friday, fri, saturday, sat

In addition, these time zones are acceptable:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Offset in Minutes</th>
<th>Daylight Savings Time Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMT</td>
<td>Greenwich Mean</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>UT</td>
<td>Universal (Coordinated)</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>UTC</td>
<td>Universal (Coordinated)</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>WET</td>
<td>Western European</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>BST</td>
<td>British Summer</td>
<td>0</td>
<td>Yes</td>
</tr>
<tr>
<td>WAT</td>
<td>West Africa</td>
<td>60 West</td>
<td>No</td>
</tr>
<tr>
<td>AT</td>
<td>Azores</td>
<td>120 West</td>
<td>No</td>
</tr>
<tr>
<td>NFT</td>
<td>Newfoundland</td>
<td>210 West</td>
<td>No</td>
</tr>
<tr>
<td>NST</td>
<td>Newfoundland Standard</td>
<td>210 West</td>
<td>No</td>
</tr>
<tr>
<td>NDT</td>
<td>Newfoundland Daylight</td>
<td>210 West</td>
<td>Yes</td>
</tr>
<tr>
<td>AST</td>
<td>Atlantic Standard</td>
<td>240 West</td>
<td>No</td>
</tr>
<tr>
<td>ADT</td>
<td>Atlantic Daylight</td>
<td>240 West</td>
<td>Yes</td>
</tr>
<tr>
<td>EST</td>
<td>Eastern Standard</td>
<td>300 West</td>
<td>No</td>
</tr>
<tr>
<td>EDT</td>
<td>Eastern Daylight</td>
<td>300 West</td>
<td>Yes</td>
</tr>
<tr>
<td>CST</td>
<td>Central Standard</td>
<td>360 West</td>
<td>No</td>
</tr>
<tr>
<td>CDT</td>
<td>Central Daylight</td>
<td>360 West</td>
<td>Yes</td>
</tr>
<tr>
<td>MST</td>
<td>Mountain Standard</td>
<td>420 West</td>
<td>No</td>
</tr>
</tbody>
</table>
### Table 5-1. Time zones recognized by the `kadmin` command  (continued)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Offset in Minutes</th>
<th>Daylight Savings Time Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDT</td>
<td>Mountain Daylight</td>
<td>420 West</td>
<td>Yes</td>
</tr>
<tr>
<td>PST</td>
<td>Pacific Standard</td>
<td>480 West</td>
<td>No</td>
</tr>
<tr>
<td>PDT</td>
<td>Pacific Daylight</td>
<td>480 West</td>
<td>Yes</td>
</tr>
<tr>
<td>YST</td>
<td>Yukon Standard</td>
<td>540 West</td>
<td>No</td>
</tr>
<tr>
<td>YDT</td>
<td>Yukon Daylight</td>
<td>540 West</td>
<td>Yes</td>
</tr>
<tr>
<td>HST</td>
<td>Hawaii Standard</td>
<td>600 West</td>
<td>No</td>
</tr>
<tr>
<td>HDT</td>
<td>Hawaii Daylight</td>
<td>600 West</td>
<td>Yes</td>
</tr>
<tr>
<td>CAT</td>
<td>Central Alaska</td>
<td>600 West</td>
<td>No</td>
</tr>
<tr>
<td>AHST</td>
<td>Alaska-Hawaii Standard</td>
<td>600 West</td>
<td>No</td>
</tr>
<tr>
<td>NT</td>
<td>Nome</td>
<td>660 West</td>
<td>No</td>
</tr>
<tr>
<td>IDLW</td>
<td>International Date Line West</td>
<td>720 West</td>
<td>No</td>
</tr>
<tr>
<td>CET</td>
<td>Central European</td>
<td>60 East</td>
<td>No</td>
</tr>
<tr>
<td>MET</td>
<td>Middle European</td>
<td>60 East</td>
<td>No</td>
</tr>
<tr>
<td>MEWT</td>
<td>Middle European Winter</td>
<td>60 East</td>
<td>No</td>
</tr>
<tr>
<td>MEST</td>
<td>Middle European Summer</td>
<td>60 East</td>
<td>Yes</td>
</tr>
<tr>
<td>SWT</td>
<td>Swedish Winter</td>
<td>60 East</td>
<td>No</td>
</tr>
<tr>
<td>SST</td>
<td>Swedish Summer</td>
<td>60 East</td>
<td>Yes</td>
</tr>
<tr>
<td>FWT</td>
<td>French Winter</td>
<td>60 East</td>
<td>No</td>
</tr>
<tr>
<td>FST</td>
<td>French Summer</td>
<td>60 East</td>
<td>Yes</td>
</tr>
<tr>
<td>EET</td>
<td>Eastern Europe</td>
<td>120 East</td>
<td>No</td>
</tr>
<tr>
<td>BT</td>
<td>Baghdad</td>
<td>180 East</td>
<td>No</td>
</tr>
<tr>
<td>IT</td>
<td>Iran</td>
<td>210 East</td>
<td>No</td>
</tr>
<tr>
<td>ZP4</td>
<td>Eastern Europe Zone 4</td>
<td>240 East</td>
<td>No</td>
</tr>
<tr>
<td>ZP5</td>
<td>Eastern Europe Zone 5</td>
<td>300 East</td>
<td>No</td>
</tr>
<tr>
<td>IST</td>
<td>Indian Standard</td>
<td>330 East</td>
<td>No</td>
</tr>
<tr>
<td>ZP6</td>
<td>Eastern Europe Zone 6</td>
<td>360 East</td>
<td>No</td>
</tr>
<tr>
<td>WAST</td>
<td>West Australian Standard</td>
<td>480 East</td>
<td>No</td>
</tr>
<tr>
<td>WADT</td>
<td>West Australian Daylight</td>
<td>420 East</td>
<td>Yes</td>
</tr>
<tr>
<td>JT</td>
<td>Java</td>
<td>450 East</td>
<td>No</td>
</tr>
<tr>
<td>CCT</td>
<td>China Coast</td>
<td>480 East</td>
<td>No</td>
</tr>
<tr>
<td>JST</td>
<td>Japan Standard</td>
<td>540 East</td>
<td>No</td>
</tr>
<tr>
<td>KST</td>
<td>Korean Standard</td>
<td>540 East</td>
<td>No</td>
</tr>
<tr>
<td>CAST</td>
<td>Central Australian Standard</td>
<td>570 East</td>
<td>No</td>
</tr>
<tr>
<td>CADT</td>
<td>Central Australian Daylight</td>
<td>570 East</td>
<td>Yes</td>
</tr>
<tr>
<td>EAST</td>
<td>Eastern Australian Standard</td>
<td>600 East</td>
<td>No</td>
</tr>
<tr>
<td>EADT</td>
<td>Eastern Australian Daylight</td>
<td>600 East</td>
<td>Yes</td>
</tr>
<tr>
<td>GST</td>
<td>Guam Standard</td>
<td>600 East</td>
<td>No</td>
</tr>
<tr>
<td>KDT</td>
<td>Korean Daylight</td>
<td>600 East</td>
<td>No</td>
</tr>
<tr>
<td>NZT</td>
<td>New Zealand</td>
<td>720 East</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 5-1. Time zones recognized by the \texttt{kadmin} command (continued)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Offset in Minutes</th>
<th>Daylight Savings Time Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZST</td>
<td>New Zealand Standard</td>
<td>720 East</td>
<td>No</td>
</tr>
<tr>
<td>NZDT</td>
<td>New Zealand Daylight</td>
<td>720 East</td>
<td>Yes</td>
</tr>
<tr>
<td>IDLE</td>
<td>International Date Line East</td>
<td>720 East</td>
<td>No</td>
</tr>
</tbody>
</table>

Subcommands

The following subcommand descriptions assume the administration server is using the standard MIT Kerberos database for the registry. Other database implementations may not support all of the subcommand options and attributes.

The following subcommands are supported:

\texttt{help [subcommand]}

The \texttt{help} subcommand displays the command syntax for the specified subcommand. If no subcommand name is specified, the available subcommands are displayed.

\texttt{get_privs}

The \texttt{get_privs} (also known as \texttt{getprivs}) subcommand lists the administrative privileges for the authenticated client. Additional authorization checking may be performed for a specific administration function depending upon the function and the database implementation.

\texttt{list_principals [expression]}

The \texttt{list_principals} (also known as \texttt{listprincs}) subcommand lists all of the principals in the Kerberos database that match the specified search expression. If no search expression is provided, all principals are listed. You must have \texttt{LIST} authority.

The search expression can include the “*” and “?” wild cards where “*” represents zero or more characters and “?” represents a single character. For example, the expression “/admin@*” returns all principal names that end with /admin, the expression \texttt{rwh*} returns all principal names that begin with \texttt{rwh}, and the expression \texttt{test_client?@*} returns principal names such as \texttt{test_client1}, \texttt{test_client2}, and so forth.

The search string can also contain paired “[/]” characters with one or more characters between the brackets. A match occurs if a name contains one of the characters between the brackets. For example, the expression “/ad*” returns all names containing /a and /d, while the expression “[ckr]*” returns all names beginning with c, k, or r.

\texttt{get_principal name}

The \texttt{get_principal} (also known as \texttt{getprinc}) subcommand displays information for a single principal entry. You must have \texttt{GET} authority, or the principal entry must be your own entry.

The following principal attributes can be displayed by the \texttt{get_principal} subcommand. The attributes that are supported by the administration server are dependent upon the Kerberos database implementation.

\texttt{DISALLOW_DUP_SKEY}

Specifies that a service ticket cannot be encrypted using the session key of an existing ticket.

\texttt{DISALLOW_FORWARDABLE}

Specifies that forwardable tickets are not allowed.

\texttt{DISALLOW_POSTDATED}

Specifies that postdated tickets are not allowed.

\texttt{DISALLOW_PROXIABLE}

Specifies that proxiable tickets are not allowed.
Commands

**DISALLOW_RENEWABLE**
Specifies that renewable tickets are not allowed.

**DISALLOW_SVR**
Specifies that service tickets cannot be obtained for this principal.

**DISALLOW_TGT_BASED**
Specifies that service tickets cannot be obtained using a ticket-granting ticket.

**DISALLOW_ALL_TIX**
Specifies that tickets cannot be obtained for this principal.

**REQUIRES_PWCHANGE**
Specifies that the password must be changed.

**PWCHANGE_SERVICE**
Specifies that this is a password-changing service. The KDC grants an initial ticket to a password-changing service even if the current password is expired.

**REQUIRES_HW_AUTH**
Specifies that hardware authentication must be used when requesting a ticket. When requesting an initial ticket, hardware authentication must be used, and when requesting a service ticket, the ticket-granting ticket must indicate hardware authentication.

**Note:** z/OS does not support hardware authentication for an initial ticket but it will grant a service ticket when hardware authentication is requested if the ticket-granting ticket is from a foreign realm where hardware authentication is supported and used.

**REQUIRES_PRE_AUTH**
Specifies that preauthentication must be used when requesting a ticket. When requesting an initial ticket, preauthentication data must be provided, and when requesting a service ticket, the ticket-granting ticket must indicate preauthentication.

**SUPPORT_DESMD5**
Specifies that ENCTYPE_DES_CBC_MD5 keys are supported for this principal.

**add_principal [options] [attributes] name**

The `add_principal` (also known as `addprinc`) subcommand adds a new principal entry to the Kerberos database. The options and attributes may be specified before or after the principal name and may be entered in any order. You must have ADD authority.

The following options are supported for the `add_principal` subcommand:

**-clearpolicy**
Specifies that no policy is to be associated with the principal entry. The default policy is used if neither `-policy` nor `-clearpolicy` is specified and a policy named `default` exists. This option is mutually exclusive with the `-policy` option.

**-e key types**
Specifies the key types to be generated. All available key types are generated if this option is not specified. Entries in the list are separated by commas. Each entry consists of an encryption type and a salt type, separated by a colon. The salt type can be omitted and defaults to normal. Similar encryption types are ignored when processing the list. For example, encryption types `des-cbc-crc` and `des-cbc-md5` use the same DES key, so only one of these encryption types needs to be specified to cause a DES key to be generated.

**-expire date**
Specifies the expiration date for the principal entry. If this option is not specified, the entry does not expire.

**-kvno version**
Specifies the key version number for the encryption keys generated by this command. If this option is not specified, the initial key version number is set to 1. A key version of 0 is not allowed.
-**maxlife** *interval*
  Specifies the maximum ticket lifetime. If this option is not specified, the maximum ticket lifetime is obtained from the KDC policy.

-**maxrenewlife** *interval*
  Specifies the maximum renewable ticket lifetime. If this option is not specified, the maximum renewable ticket lifetime is obtained from the KDC policy.

-**policy** *name*
  Specifies the policy associated with the principal. The default policy is used if neither `-policy` nor `-clearpolicy` is specified and a policy named `default` exists. This option is mutually exclusive with the `-clearpolicy` option.

-**pw** *password*
  Specifies the password for the principal entry. The user is prompted to enter the password in non-display mode if neither `-pw` nor `-randkey` is specified. This option is mutually exclusive with the `-randkey` option.

-**pwexpire** *date*
  Specifies the expiration date for the password. If this option is not specified, the password lifetime from the effective policy is used to set the password expiration date.

-**randkey**
  Specifies that a random key is to be generated for this principal. This option is mutually exclusive with the `-pw` option. If neither `-pw` nor `-randkey` is specified, the user is prompted to enter the password in non-display mode.

The following attributes are supported for the `add_principal` subcommand. The attributes that are supported by the administration server are dependent upon the Kerberos database implementation.

+**allow_dup_skey**
  Specifies that a service ticket can be encrypted using the session key of an existing ticket. This is the default.

-**allow_dup_skey**
  Specifies that a service ticket cannot be encrypted using the session key of an existing ticket.

+**allow_forwardable**
  Specifies that forwardable tickets are allowed. This is the default.

-**allow_forwardable**
  Specifies that forwardable tickets are not allowed.

+**allow_postdated**
  Specifies that postdated tickets are allowed. This is the default.

-**allow_postdated**
  Specifies that postdated tickets are not allowed.

+**allow_proxiable**
  Specifies that proxiable tickets are allowed. This is the default.

-**allow_proxiable**
  Specifies that proxiable tickets are not allowed.

+**allow_renewable**
  Specifies that renewable tickets are allowed. This is the default.

-**allow_renewable**
  Specifies that renewable tickets are not allowed.

+**allow_svr**
  Specifies that service tickets can be obtained for this principal. This is the default.
Commands

-allow_svr
  Specifies that service tickets cannot be obtained for this principal.

+allow_tgs_req
  Specifies that service tickets can be obtained using a ticket-granting ticket. This is the default.

-allow_tgs_req
  Specifies that service tickets cannot be obtained using a ticket-granting ticket.

+allow_tix
  Specifies that tickets can be obtained for this principal. This is the default.

-allow_tix
  Specifies that tickets cannot be obtained for this principal.

+needchange
  Specifies that the password must be changed.

-needchange
  Specifies that the password does not need to be changed. This is the default.

+password_changing_service
  Specifies that this is a password changing service. The KDC grants an initial ticket to a password changing service even if the current password is expired.

-password_changing_service
  Specifies that this is not a password changing service. This is the default.

+requires_hauth
  Specifies that hardware authentication must be used when requesting a ticket. Hardware authentication must be used when requesting an initial ticket, and the ticket-granting ticket must indicate hardware authentication when requesting a service ticket.

  Note: z/OS does not support hardware authentication for an initial ticket but it will grant a service ticket when hardware authentication is requested if the ticket-granting ticket is from a foreign realm where hardware authentication is supported and used.

-requires_hauth
  Specifies that hardware authentication is not required. This is the default.

+requires_preauth
  Specifies that preauthentication must be used when requesting a ticket. Preauthentication data must be provided when requesting an initial ticket, and the ticket-granting ticket must indicate preauthentication when requesting a service ticket.

  Note that a z/OS KDC always requires preauthentication when requesting an initial ticket, even if this attribute is not set. This is done to improve the security of the Kerberos secret keys.

-requires_preauth
  Specifies that preauthentication is not required. This is the default.

+support_desmd5
  Specifies that ENCTYPE_DES_CBC_MD5 keys are supported for this principal.

-support_desmd5
  Specifies that ENCTYPE_DES_CBC_MD5 keys are not supported for this principal. This is the default.

delete_principal name
  The delete_principal (also known as delprinc) subcommand deletes a principal entry from the Kerberos database. You must have DELETE authority.

modify_principal [options] [attributes] name
  The modify_principal (also known as modprinc) subcommand modifies an existing principal entry in

5-8  z/OS V1R13.0 Network Authentication Service Administration
the Kerberos database. The options and attributes may be specified before or after the principal name and may be entered in any order. You must have MODIFY authority.

The following options are supported for the **modify_principal** subcommand. The attributes that are supported by the administration server are dependent upon the Kerberos database implementation.

- **-clearpolicy**
  Specifies that no policy is to be associated with the principal entry. This option is mutually exclusive with the **-policy** option.

- **-expire date**
  Specifies the expiration date for the principal entry.

- **-kvno version**
  Specifies the key version number for the principal.

- **-maxlife interval**
  Specifies the maximum ticket lifetime.

- **-maxrenewlife interval**
  Specifies the maximum renewable ticket lifetime.

- **-policy name**
  Specifies the policy associated with the principal. This option is mutually exclusive with the **-clearpolicy** option.

- **-pwexpire date**
  Specifies the expiration date for the password.

The following attributes are supported for the **modify_principal** subcommand:

- **+allow_dup_skey**
  Specifies that a service ticket can be encrypted using the session key of an existing ticket. Resets the DISALLOW_DUP_SKEY attribute.

- **-allow_dup_skey**
  Specifies that a service ticket cannot be encrypted using the session key of an existing ticket. Sets the DISALLOW_DUP_SKEY attribute.

- **+allow_forwardable**
  Specifies that forwardable tickets are allowed. Resets the DISALLOW-forwardable attribute.

- **-allow_forwardable**
  Specifies that forwardable tickets are not allowed. Sets the DISALLOW-forwardable attribute.

- **+allow_postdated**
  Specifies that postdated tickets are allowed. Resets the DISALLOW-postdated attribute.

- **-allow_postdated**
  Specifies that postdated tickets are not allowed. Sets the DISALLOW-postdated attribute.

- **+allow_proxiable**
  Specifies that proxiable tickets are allowed. Resets the DISALLOW-proxiable attribute.

- **-allow_proxiable**
  Specifies that proxiable tickets are not allowed. Sets the DISALLOW-proxiable attribute.

- **+allow_renewable**
  Specifies that renewable tickets are allowed. Resets the DISALLOW-renewable attribute.

- **-allow_renewable**
  Specifies that renewable tickets are not allowed. Sets the DISALLOW-renewable attribute.

- **+allow_svr**
  Specifies that service tickets can be obtained for this principal. Resets the DISALLOW-svr attribute.
Commands

-allow_svr
   Specifies that service tickets cannot be obtained for this principal. Sets the DISALLOW_SVR attribute.

+allow_tgs_req
   Specifies that service tickets can be obtained using a ticket-granting ticket. Resets the DISALLOW_TGT_BASED attribute.

-allow_tgs_req
   Specifies that service tickets cannot be obtained using a ticket-granting ticket. Sets the DISALLOW_TGT_BASED attribute.

+allow_tix
   Specifies that tickets can be obtained for this principal. Resets the DISALLOW_TIX attribute.

-allow_tix
   Specifies that tickets cannot be obtained for this principal. Sets the DISALLOW_TIX attribute.

+needchange
   Specifies that the password must be changed. Sets the REQUIRES_PWCHANGE attribute.

-needchange
   Specifies that the password does not need to be changed. Resets the REQUIRES_PWCHANGE attribute.

+password_changing_service
   Specifies that this is a password changing service. The KDC grants an initial ticket to a password changing service even if the current password is expired. Sets the PWCHANGE_SERVICE attribute.

-password_changing_service
   Specifies that this is not a password changing service. Resets the PWCHANGE_SERVICE attribute.

+requires_hauth
   Specifies that hardware authentication must be used when requesting a ticket. Hardware authentication must be used when requesting an initial ticket, and the ticket-granting ticket must indicate hardware authentication when requesting a service ticket. Sets the REQUIRES_HW_AUTH attribute.

Note: z/OS does not support hardware authentication for an initial ticket but it will grant a service ticket when hardware authentication is requested if the ticket-granting ticket is from a foreign realm where hardware authentication is supported and used.

-requires_hauth
   Specifies that hardware authentication is not required. Resets the REQUIRES_HW_AUTH attribute.

+requires_pauth
   Specifies that preauthentication must be used when requesting a ticket. Preauthentication data must be provided when requesting an initial ticket, and the ticket-granting ticket must indicate preauthentication when requesting a service ticket. Sets the REQUIRES_PRE_AUTH attribute.

-requires_pauth
   Specifies that preauthentication is not required. Resets the REQUIRES_PRE_AUTH attribute.

   Note that a z/OS KDC always requires preauthentication when requesting an initial ticket, even if this attribute is not set. This is done to improve the security of the Kerberos secret keys.

+support_desmd5
   Specifies that ENCTYPE_DES_CBC_MD5 keys are supported for this principal. Sets the SUPPORT_DESMD5 attribute.
Commands

-support_desmd5
   Specifies that ENCTYPE_DES_CBC_MD5 keys are not supported for this principal. Resets the SUPPORT_DESMD5 attribute.

change_password [-randkey | -pw password] [-keepold] [-e keytypes] name
   The change_password (also known as cpw) subcommand changes the password for a principal. You must have CHANGEPW authority, or the principal entry must be your own entry.

   A random key is generated if the -randkey option is specified. Otherwise, you are prompted to enter the new password unless the -pw option is specified.

   Any existing encryption keys are discarded unless the -keepold option is specified. The number of retained keys is dependent upon the Kerberos database implementation.

   All available key types are generated unless the -e option is specified. Entries in the key types list are separated by commas. Each entry consists of an encryption type and a salt type, separated by a colon. The salt type can be omitted and defaults to normal. Similar encryption types are ignored when processing the list. For example, encryption types des-cbc-crc and des-cbc-md5 use the same DES key, so only one of these encryption types needs to be specified to cause a DES key to be generated.

rename_principal oldname newname
   The rename_principal (also known as renprinc) subcommand changes the name of a principal entry in the Kerberos database. You must have both ADD and DELETE authority.

   Since the principal name is often used as part of the password salt, you should change the password for the principal after the entry is renamed. Some implementations of the Kerberos administration server do not allow a principal to be renamed if the principal name is used in the password salt. In this case, you must delete the existing principal entry using the delete_principal subcommand and then add the new principal entry using the add_principal subcommand.

list_policies [expression]
   The list_policies (also known as listpols) subcommand lists all of the policies in the Kerberos database that match the specified search expression. All policies are listed if no search expression is provided. You must have LIST authority.

   The search expression can include the "*" and "?" wild cards where "*" represents zero or more characters and "?" represents a single character. For example, the expression *_local returns all policy names that end with _local, the expression def* returns all policy names that begin with def, and the expression test_policy? returns policy names such as test_policy1, test_policy2, and so forth.

   The search string can also contain paired "{" and "}" characters with one or more characters between the brackets. A match occurs if a name contains one of the characters between the brackets. For example, the expression [adh]* returns all names beginning with a,d, or h.

get_policy name
   The get_policy (also known as getpol) subcommand displays information for a single policy entry. You must have GET authority or the policy must be associated with your own principal entry.

add_policy [options] name
   The add_policy (also known as addpol) subcommand adds a new policy to the Kerberos database. The options may be specified before or after the policy name and may be specified in any order. You must have ADD authority.

   The following options are supported for the add_policy subcommand:

      -maxlife interval
         Specifies the maximum password lifetime. The password must be changed after this interval has elapsed.

      -minlife interval
         Specifies the minimum password lifetime. A new password cannot be changed until this interval has elapsed.
Commands

-channel-length number
   Specifies the minimum password length.

-minclasses number
   Specifies the minimum number of character classes in the password.

-history number
   Specifies the number of passwords in the password history. A new password cannot match any of
   the remembered passwords.

modify_policy [options] name
   The modify_policy (also known as modpol) subcommand modifies an existing policy in the Kerberos
   database. The options may be specified before or after the policy name and may be specified in any
   order. You must have MODIFY authority.

   The following options are supported for the modify_policy subcommand:

-maxlife interval
   Specifies the maximum password lifetime. The password must be changed after this interval has
   elapsed.

-minlife interval
   Specifies the minimum password lifetime. A new password cannot be changed until this interval
   has elapsed.

-minlength number
   Specifies the minimum password length.

-minclasses number
   Specifies the minimum number of character classes in the password.

-history number
   Specifies the number of passwords in the password history. A new password cannot match any of
   the remembered passwords.

delete_policy name
   The delete_policy (also known as delpol) subcommand deletes a policy entry from the Kerberos
   database. You must have DELETE authority.

add_key [[-keytab | -k] keytab_name] [-keyold] [-e keytypes] principal_name
   The add_key (also known as ktadd) subcommand generates a set of random encryption keys for the
   named principal and then adds the generated keys to the specified key table. You must have
   CHANGEPW authority or the principal entry must be your own entry.

   The default key table is used if the -keytab option is not specified. A key table name prefix of “FILE:”
   is changed to “WRFILE:” because the add_key subcommand must update the key table.

   Any existing encryption keys are discarded unless the -keyold option is specified. The number of
   retained keys is dependent upon the Kerberos database implementation.

   All available key types are generated unless the -e option is specified. Entries in the key types list are
   separated by commas. Each entry consists of an encryption type and a salt type, separated by a
   colon. The salt type can be omitted and defaults to normal. Similar encryption types are ignored when
   processing the list. For example, encryption types des-cbc-crc and des-cbc-md5 use the same DES
   key, so only one of these encryption types needs to be specified to cause a DES key to be generated.

kdb5_ndbm

This is the Kerberos NDBM database maintenance utility.
Format

kdb5_ndbm create [-k keytype] [-e keytypes]
kdb5_ndbm destroy
kdb5_ndbm dump [-k keytype] [-mkey_convert] [-compat][[-v] filename
kdb5_ndbm load [-k keytype] [-mkey_convert] [-v] filename
kdb5_ndbm stash [-k keytype]

Options

-e keytypes
Specifies the encryption types to be used when generating the initial principal keys. Keys are
generated for all supported encryption types if this option is not specified. Entries in the list are
separated by commas. Similar encryption types are ignored when processing the list. For example,
encryption types des-cbc-crc and des-cbc-md5 use the same 56-bit DES key, so only one of these
encryption types needs to be specified to cause a 56-bit DES key to be generated.

-k keytype
Specifies the encryption type for the database master key. The aes256-cts-hmac-sha1-96 encryption
type is used if this option is not specified. The encryption type specified for the -k option is added to
the encryption types specified for the -e option if it is not already in the list, because the K/M and
kadmin/history architected principals must have a key available for the database master key
encryption type.

-mkey_convert
Indicates that the master key is to be changed.

-compat
Creates the database dump using the version 4 format instead of the version 5 format.

-v The principal and policy names should be displayed as they are processed.

Usage

The kdb5_ndbm command is used to maintain a Kerberos NDBM registry database. It is not used with a
Kerberos SAF registry database. The kdb5_ndbm command must be run by a user with write access to
the /var/skrb/krb5kdc directory and to all of the files in this directory. The /var/skrb/krb5kdc directory
path is created if it does not already exist.

The following functions are provided:

- kdb5_ndbm create [-k keytype] [-e keytypes]
  This command creates a new Kerberos NDBM database. An error is reported if an NDBM database
  already exists. The architected KDC principals are created in the new database. In addition, user
  principals IBMUSER and IBMUSER/admin are created with an initial password of IBMUSER. Finally,
  the master key stash file is created.
  The kdb5_ndbm create command is used to create a new database for the primary KDC for a realm. It
  is not used to create a database for a secondary KDC since a secondary KDC receives its database by
  propagation from the primary KDC.
  You are prompted to enter the master key for the new database. This key is used to encrypt the
database entries and should not be an obvious password string. Do not forget this password since you
need it when you create a secondary KDC or when you attempt to reload the database from a backup
copy created by the kdb5_ndbm dump command.

- kdb5_ndbm destroy
  This command destroys an existing Kerberos NDBM database. The database files are removed along
  with the master key stash file.

- kdb5_ndbm dump [-k keytype] [-mkey_convert] [-compat] [-v] filename
Commands

This command creates a portable copy of the Kerberos NDBM database. The dump file is a printable text file created in the local code page as defined by the LANG environment variable. You should convert it to the code page of the target system when moving it to another system.

The kdb5_ndbm dump command is used to create a backup copy of the Kerberos database. The database can be recreated from the backup copy using the kdb5_ndbm load command. The backup copy can also be used to create a copy of the Kerberos database on another system. The NDBM database files themselves cannot be moved to another system since the internal database formats are not portable.

The database dump includes principal and policy information. The dump key is the same as the database master key unless the -mkey_convert option is specified.

The dump file created by the z/OS Network Authentication Service kdb5_ndbm command uses the version 5 dump format and is compatible with the dump file created by the MIT Kerberos 1.2.2 kdb5_util command. The version 5 dump format includes principal policy and password history information. Earlier releases of the MIT Kerberos kdb5_util command do not support this dump format. You can specify the -compat option to create a dump in the version 4 format, which can be processed by earlier releases of MIT Kerberos. A version 4 dump does not include principal policy or password history information. This information is lost if a database created from a version 4 dump is used by the primary KDC for the realm.

- kdb5_ndbm load [-k keytype] [-mkey_convert] [-v] filename
  This command creates a Kerberos NDBM database using the portable copy created by the kdb5_ndbm dump command. An error is returned if an NDBM database already exists.
  You are prompted for the dump key. The master key for the new database is the same as the dump key unless the -mkey_convert option is specified.
  The z/OS Network Authentication Service kdb5_ndbm command processes dump files created by MIT Kerberos 1.2 (version 4 dump format) and MIT Kerberos 1.2.2 (version 5 dump format). Per-principal policy information is lost if the version 4 dump format is used, because that dump format does not contain this information.

- kdb5_ndbm stash [-k keytype]
  This command creates the database master key stash file. An error is returned if the stash file already exists since the master key cannot be changed after the database is created. Use the kdb5_ndbm destroy command to remove an existing database before attempting to create a new database.
  The kdb5_ndbm stash command is used to create the master key stash file for a secondary KDC. An error occurs during database propagation if the stash file is created using the wrong database master key.

kdestroy

Destroys a Kerberos credentials cache.

Format

kdestroy [-c cache_name] [-e time_delta]

Options

- -c cache_name
  Specifies the name of the credentials cache to destroy. The default credentials cache is destroyed if no command options are specified. This option and the -e option are mutually exclusive.

- -e time_delta
  Specifies that all credentials cache files containing expired tickets are deleted if the tickets have been expired at least as long as the time_delta value.
Usage
The kdestroy command deletes a Kerberos credentials cache file.

The -e option causes the kdestroy command to check all of the credentials cache files in the default cache directory (/var/skrb/creds). Any file that contains only expired tickets that have expired for the time delta are deleted. The time delta is expressed as \texttt{nwnhdhmns} where \texttt{n} represents a number, \texttt{w} indicates weeks, \texttt{d} indicates days, \texttt{h} indicates hours, \texttt{m} indicates minutes, and \texttt{s} indicates seconds. The components must be specified in this order but any component may be omitted (for example, \texttt{4h5m} represents four hours and 5 minutes and \texttt{1w2h} represents 1 week and 2 hours). If only a number is specified, the default is hours.

To delete a credentials cache, the user must be the owner of the file or must be a root (uid 0) user.

Examples
To delete the default credentials cache for the user:
kdestroy
To delete all credentials caches with expired tickets older than 1 day:
kdestroy -e 1d

keytab
Manages a key table.

Format
keytab add principal [-r][-p password] [-v version] [-k keytab]
keytab check [principal] [-k keytab]
keytab delete principal [-v version] [-k keytab]
keytab list [principal] [-v version] [-k keytab]
keytab merge in_keytab [principal [-v version]] [-r] [-k keytab]

Options
-k keytab
Specifies the key table name. The default key table is used if this option is not specified.

-p password
Specifies the password. The user is prompted to enter the password if this option is not specified when adding an entry to the key table.

Note that the password provided for the keytab command must exactly match the password that was used to generate the key in the KDC. For example, this password is case sensitive. If your KDC uses a RACF database with mixed case passwords disabled then this password needs to be entered in upper case. If you are embedding spaces then they need to be escaped or the whole password needs to be quoted according to your shell rules.

-r
When specified on the keytab add, or merge options, entries whose principal name and version number are identical will be deleted from the target keytab file before the new entries for the given principal and version number are added.

-v version
Specifies the key version number. When adding a key, the next version number is assigned if this option is not specified. When deleting, listing or merging keytabs, all keys for the principal are deleted if this option is not specified. When the version number is specified, the principal name must also be specified.
**Commands**

`in_keytab` is the path of the keytab to be merged to the keytab file. It must be specified during a merge operation, and the file must exist.

The principal name is optional when merging, listing or checking a keytab. When the principal name is specified, only entries for that principal are operated on.

**Usage**

The `keytab` command is used to add or delete a key from a key table, display the entries in a key table or to merge the entries of two key tables. It can also be used to check keytab entries. Some operations may not be easily reversible without knowledge of matching passwords in the KDC, so you might want to save a copy of your keytab file, prior to performing the keytab command.

The `keytab` file contains multiple entries for the same principal and version number. These entries match the entries created in the KDC for different encryption types, provided the same case sensitive password was used to generate the keys during the creation of the keytab entries as was used when used adding or updating the principal's password in the KDC. Different version numbers may be used in order to allow the storing of old keys that may be used by some applications to decrypt old tickets during a transition.

During a `keytab` add operation, An entry is created for each unique key type. Key table entries are not created for all supported encryption types because some of the encryption types share the same key type.

During a `keytab` merge operation, unsupported encryption types are not added. Entry fields are copied from the input keytab file to the target keytab file without change. If a keytab entry does not exist for a supported encryption type in the input keytab file, it cannot be created in the target keytab file.

When retrieving a key from the key table, the Kerberos runtime selects the appropriate key based upon the requested encryption type.

See the "Encryption types and strong encryption" on page 1-7 and "Security runtime configuration profile" on page 2-19 for the supported key types and associated encryption types.

You must have a TGT in order to use the `keytab` check command. The KDC must be running and will be contacted to obtain service tickets during the check.

The `keytab` check attempts to obtain a service ticket for each principal in the keytab using the provided ticket-granting ticket (TGT), or for a given principal if specified on the keytab check command. It then uses an entry that matches each obtained ticket in principal name, version number, and encryption type to decrypt the ticket. Only entries that are used to decrypt service tickets are checked. These entries have the version number for a given principal that matches the highest version number for the same principal in the KDC, and usually have the same encryption type as used in the TGT. These entries are also used by service applications to decrypt tickets if the current setup is maintained. Only unsuccessful attempts are diagnosed. Entries for a principal that is missing in the keytab cannot be checked. If the setup is modified, it may be necessary to rerun the `keytab` check.

**Examples**

To add a key for principal `rwh` in the `/home/rwh/my_keytab` key table:

```
keytab add rwh -k /home/rwh/my_keytab
```

To list all of the entries in the `/home/rwh/my_keytab` key table:

```
keytab list -k /home/rwh/my_keytab
```

To merge all of the entries of keytab into my_keytab:

```
keytab merge keytab -k my_keytab
```
To merge all the entries only for principal fred in the above example (and ignore other entries):
keytab merge keytab fred -k my_keytab

**kinit**

Obtains or renews the Kerberos ticket-granting ticket.

**Format**

```
       [-k] [-t keytab] [principal]
```

**Options**

- `-s` Specifies that an initial ticket is to be obtained using the Kerberos principal associated with the current system identity. No password is used since the system has already verified the identity. The Kerberos security server must be running on the local system in order to use the `-s` option.

- `-r time` Specifies the renew time interval for a renewable ticket. The ticket may no longer be renewed after the expiration of this interval. The renew time must be greater than the end time. The ticket is not renewable if this option is not specified (a renewable ticket may still be generated if the requested ticket lifetime exceeds the maximum ticket lifetime). Refer to [Usage](#) for more information on the time format.

- `-R` Specifies that an existing ticket is to be renewed. No other ticket options may be specified when renewing an existing ticket.

- `-p` Specifies that the ticket is to be proxiable. The ticket is not proxiable if this option is not specified.

- `-f` Specifies that the ticket is to be forwardable. The ticket is not forwardable if this option is not specified.

- `-A` Specifies that the ticket should not contain a list of client addresses. The ticket contains the local host address list if this option is not specified. When an initial ticket contains an address list, it can be used only from one of the addresses in the address list.

- `-l time` Specifies the ticket end time interval. The ticket may not be used after this interval has expired unless it has been renewed. The interval is set to 10 hours if this option is not specified. Refer to [Usage](#) for more information on the time format.

- `-c cache` Specifies the name of the credentials cache that the kinit command uses. The default credentials cache is used if this option is not specified.

- `-k` Specifies obtaining the key for the ticket principal from a key table. The user is prompted to enter the password for the ticket principal if this option, the `-R` option, or the `-s` option, is not specified.

- `-t keytab` Specifies the key table name. The default key table is used if this option is not specified and the `-k` option is specified. The `-t` option implies the `-k` option.

- `principal` Specifies the ticket principal. The principal is obtained from the credentials cache if the principal is not specified on the command line.

**Usage**

The `kinit` command obtains or renews a Kerberos ticket-granting ticket. The KDC options specified by `kdc_default_options` in the Kerberos configuration file are used if no ticket options are specified on the `kinit` command.
Commands

If an existing ticket is not being renewed, the credentials cache is re-initialized and contains the new ticket-granting ticket received from the KDC. If the principal name is not specified on the command line and the -s option is not specified, the principal name is obtained from the credentials cache. The new credentials cache become the default credentials cache unless the cache name is specified using the -c option.

Ticket time values are expressed as \texttt{nwdnhmns} where \texttt{n} represents a number, \texttt{w} indicates weeks, \texttt{d} indicates days, \texttt{h} indicates hours, \texttt{m} indicates minutes, and \texttt{s} indicates seconds. The components must be specified in this order but any component may be omitted (for example, 4h5m represents four hours and 5 minutes and 1w2h represents 1 week and 2 hours). If only a number is specified, the default is hours.

Ticket time values that are \textit{actually obtained may not match those requested if limited by lifetime values setup in the KDC}. Refer to “Configuring the primary security server for the realm” on page 2-8 for more details.

Examples
To obtain a ticket-granting ticket with a lifetime of ten hours that is renewable for one week:
\texttt{kinit -l 10h -r 1w my\_principal}

To obtain an initial ticket based upon the current system identity:
\texttt{kinit -s}

To renew an existing ticket:
\texttt{kinit -R}

\textbf{klist}
Displays the contents of a Kerberos credentials cache or key table.

\textbf{Format}
\texttt{klist [-a] [-e] [-c] [-f] [-s] [-k] [-t] [-K] [filename]}

\textbf{Options}
-\texttt{a} Shows all tickets in the credentials cache, including expired tickets. Expired tickets are not listed if this option is not specified. This option is valid only when listing a credentials cache.
-\texttt{e} Displays the encryption type for the session key and the ticket or the key table entry depending on what type of file is being processed.
-\texttt{c} Lists the tickets in a credentials cache. This is the default if neither the -c nor the -k option is specified. This option and the -k option are mutually exclusive.
-\texttt{f} Shows the ticket flags using the following abbreviations. This option is valid only when listing a credentials cache.
  \begin{itemize}
  \item \texttt{A} - Preauthentication used
  \item \texttt{C} - Transited list checked by KDC
  \item \texttt{D} - Postdateable ticket
  \item \texttt{d} - Postdated ticket
  \item \texttt{F} - Forwardable ticket
  \item \texttt{f} - Forwarded ticket
  \item \texttt{H} - Hardware preauthentication used
  \item \texttt{I} - Initial ticket
  \item \texttt{i} - Invalid ticket
  \end{itemize}
**Commands**

- **P** - Proxiable ticket
- **p** - Proxy ticket
- **R** - Renewable ticket
- **O** - Server can be a delegate

- **-s** Suppresses command output but sets the exit status to 0 if a valid ticket-granting ticket is found in the credentials cache. This option is valid only when listing a credentials cache.
- **-k** Lists the entries in a key table. This option and the **-c** option are mutually exclusive.
- **-t** Displays timestamps for key table entries. This option is valid only when listing a key table.
- **-K** Displays the encryption key value for each key table entry. This option is valid only when listing a key table.

`filename`

Specifies the name of the credentials cache or key table. The default credentials cache or key table is used if no filename is specified.

**Usage**
The `klist` command displays the contents of a Kerberos credentials cache or key table.

**Examples**
To list all of the entries in the default credentials cache:
```bash
eklist
```

To list all of the entries in the `/krb5/my_keytab` key table with timestamps:
```bash
eklist -k -t /krb5/my_keytab
```

**kpasswd**

Changes the password for a Kerberos principal.

**Format**

```
kpasswd [principal]
```

**Options**

`principal`

Specifies the principal whose password is to be changed. The principal is obtained from the default credentials cache if the principal is not specified on the command line.

**Usage**
The `kpasswd` command changes the password for the specified Kerberos principal using the password change service. You must supply the current password for the principal as well as the new password. The password change server applies any applicable password policy rules to the new password before changing the password.

You may not change the password for a ticket-granting service principal (`krbtgt/realm`) using the `kpasswd` command.

If you have a SAF database, An RRSF local node must be defined in order to generate the corresponding Kerberos secret key whenever a password is changed. Refer to `z/OS Security Server RACF Security Administrator's Guide` for information on defining the local RRSF node.
**Commands**

**kpropd**
This is the Kerberos stand-alone database propagation catcher.

**Format**
```
kpropd [-r realm] [-P port] [-v]
```

**Options**

- **-P port**
  Specifies the port to use for the database propagation. The port assigned to the `krb5_prop` service is used if this option is omitted. Port 754 is used if the `krb5_prop` service is not defined.

- **-r realm**
  Specifies the database realm. The default realm obtained from the Kerberos configuration file is used if this option is omitted.

- **-v**
  The principal and policy names should be displayed as they are processed.

**Usage**
The `kpropd` command is used to receive a stand-alone database propagation from the primary KDC for the realm. The `kpropd` command is used when creating a secondary KDC or when recovering from a catastrophic database error.

To use the `kpropd` command for a secondary KDC, perform the following steps:

1. Stop the SKRBKDC started task if it is running on the secondary system.
2. Add the secondary system to the `/etc/skrb/home/kdc/kpropd.acl` configuration file on the primary system if it is not already defined. The propagation protocol should be set to Manual to prevent automatic propagation of database updates.
3. Use the `kdb5_ndbm destroy` command to remove an existing Kerberos database.
4. Use the `kdb5_ndbm stash` command to create the database master key stash file.
5. Create the `/etc/skrb/home/kdc/kpropd.acl` configuration file on the secondary system if it does not exist. The primary KDC for the realm must be listed in this file.
6. Use the `kadmin ktadd` command to create the `/var/skrb/krb5kdc/kpropd.ktf` key table if it does not exist. The principal name is `host/host-name` where `host-name` is the primary host name for the local system. The primary host name is determined by doing a DNS lookup on the host name to get the IP address and then doing a DNS lookup on the IP address to get the host name.
7. Start the `kpropd` command on the secondary system.
8. Issue the `PROP host-name` command on the primary KDC to initiate the database propagation.
9. Wait until the propagation is complete and the `kpropd` command ends.
10. Start the SKRBKDC started task on the secondary system.
11. Change the propagation protocol to Update in the `/etc/skrb/home/kdc/kpropd.acl` configuration file on the primary system.

**ksetup**
Manages Kerberos service entries in the LDAP directory for a Kerberos realm.

**Format**
```
ksetup [-h host-name] [-n bind-name] [-p bind-password] [-e]
```
Options

- **h** `host-name`
  Specifies the host name for the LDAP server. The LDAP server specified in the Kerberos configuration file is used if this option is not specified.

- **n** `bind-name`
  Specifies the distinguished name to use when binding to the LDAP server. The LDAP_BINDDN environment variable is used to obtain the name if this option is not specified.

- **p** `bind-password`
  Specifies the password to use when binding to the LDAP server. The LDAP_BINDPW environment variable is used to obtain the password if this option is not specified.

- **e**  Echo each command line to `stdout`. This is useful when `stdout` is redirected to a file.

Usage

The `ksetup` command manages Kerberos service entries in the LDAP directory. The following subcommands are supported.

- **addadmin** `host-name:port-number realm-name`
  This subcommand adds an administration service entry for the specified realm. The port number is set to 749 if it is not specified. The fully-qualified host name should be used, so that it is resolved correctly no matter what default DNS name is in effect on the Kerberos clients. The default realm name is used if no realm name is specified.

- **addhost** `host-name realm-name`
  This subcommand adds a host entry for the specified realm. The fully-qualified host name should be used so that it is resolved correctly no matter what default DNS domain is in effect on the Kerberos clients. The default realm name is used if no realm name is specified. An error is displayed if the host entry already exists.

- **addkdc** `host-name:port-number realm-name`
  This subcommand adds a KDC entry for the specified realm. A host entry is created if one does not already exist. The port number is set to 88 if it is not specified. The fully-qualified host name should be used so that it is resolved correctly no matter what default DNS domain is in effect on the Kerberos clients. The default realm name is used if no realm name is specified. An existing KDC entry will be modified.

- **addpwd** `host-name:port-number real-name`
  This subcommand adds a password change service entry for the specified realm. The port number is set to 464 if it is not specified. The fully-qualified host name should be used so that it is resolved correctly no matter what default DNS domain is in effect on the Kerberos clients. The default realm name is used if no realm name is specified. An existing password service entry will be modified.

- **deladmin** `host-name real-name`
  This subcommand deletes an administration service entry for the specified host. The default realm name is used if no realm name is specified.

- **delhost** `host-name realm-name`
  This subcommand deletes a host entry and any associated KDC specification from the specified realm. The default realm name is used if no realm name is specified.

- **delkdc** `host-name realm-name`
  This subcommand deletes a KDC entry for the specified host. The host entry itself is not deleted. The default realm name is used if no realm name is specified.

- **delpwd** `host-name realm-name`
  This subcommand deletes a password change service entry for the specified host. The default realm name is used if no realm name is specified.

- **listadmin** `realm-name`
**Commands**

This subcommand lists the administration service entries for a realm. The default realm name is used if no realm name is specified.

- **listhost realm-name**
  This subcommand lists the host entries for a realm. The default realm name is used if no realm name is specified.

- **listkdc realm-name**
  This subcommand lists the KDC entries for a realm. The default realm name is used if no realm name is specified.

- **listpwd realm-name**
  This subcommand lists the password change service entries for a realm. The default realm name is used if no realm name is specified.

- **exit**
  This subcommand ends the **ksetup** command.

---

**kvno**

Displays the current key version number for a principal.

**Format**

`kvno [principal]`

**Options**

*principal*

Specifies the principal whose current key version number is to be displayed. The principal is obtained from the default credentials cache if the principal is not specified on the command line.
Chapter 6. Status codes

This chapter lists the status codes for z/OS Network Authentication Service. The status codes are listed in numerical order.

Major status values

GSS-API routines return GSS status codes as their function value. These codes indicate generic API errors and are common across GSS-API implementations. A GSS status code indicates a single API error from the routine and a single calling error. Additional status information can be contained in the GSS status code as supplementary information. The errors are encoded into a 32-bit GSS status code as follows:

If a GSS-API routine returns a GSS status code whose upper 16 bits contain a nonzero value, the call failed. If the calling error field is nonzero, the application's call of the routine was in error. In addition, the routine can indicate additional information by setting one or more bits in the supplementary information field of the status code.

The following table lists the GSS-API calling errors and their meanings:

<table>
<thead>
<tr>
<th>Error (Error Number, Hexidecimal)</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSS_S_CALL_INACCESSIBLE_READ (01)</td>
<td>Unable to read an input parameter</td>
</tr>
<tr>
<td>GSS_S_CALL_INACCESSIBLE_WRITE (02)</td>
<td>Unable to write an output parameter</td>
</tr>
<tr>
<td>GSS_S_CALL_BAD_STRUCTURE (03)</td>
<td>Incorrect parameter structure</td>
</tr>
</tbody>
</table>

The following table lists the GSS-API routine errors and their meanings:

<table>
<thead>
<tr>
<th>Error (Error Number, Hexidecimal)</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSS_S_BAD_MECH (01)</td>
<td>Mechanism is not supported</td>
</tr>
<tr>
<td>GSS_S_BAD_NAME (02)</td>
<td>Name is not valid</td>
</tr>
<tr>
<td>GSS_S_BAD_NAMETYPE (03)</td>
<td>Name type is not valid</td>
</tr>
<tr>
<td>GSS_S_BAD_BINDINGS (04)</td>
<td>Channel bindings are not correct</td>
</tr>
<tr>
<td>GSS_S_BAD_STATUS (05)</td>
<td>Status value is not valid</td>
</tr>
<tr>
<td>GSS_S_BAD_SIG (06)</td>
<td>Token signature is not correct</td>
</tr>
<tr>
<td>GSS_S_NO_CRED (07)</td>
<td>No credentials supplied</td>
</tr>
<tr>
<td>GSS_S_NO_CONTEXT (08)</td>
<td>No context established</td>
</tr>
<tr>
<td>GSS_S_DEFECTIVE_TOKEN (09)</td>
<td>Token is not valid</td>
</tr>
<tr>
<td>GSS_S_DEFECTIVE_CREDENTIAL (0A)</td>
<td>Credential is not valid</td>
</tr>
<tr>
<td>GSS_S_CREDENTIALS_EXPIRED (0B)</td>
<td>Credentials have expired</td>
</tr>
</tbody>
</table>

Figure 6-1. GSS status code bit locations

If a GSS-API routine returns a GSS status code whose upper 16 bits contain a nonzero value, the call failed. If the calling error field is nonzero, the application's call of the routine was in error. In addition, the routine can indicate additional information by setting one or more bits in the supplementary information field of the status code.
Status codes

Table 6-2. GSS-API routine errors (continued)

<table>
<thead>
<tr>
<th>Error (Error Number, Hexidecimal)</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSS_S_CONTEXT_EXPIRED (0C)</td>
<td>Context has expired</td>
</tr>
<tr>
<td>GSS_S_FAILURE (0D)</td>
<td>Routine failed (check minor status)</td>
</tr>
<tr>
<td>GSS_S_BAD_QOP (0E)</td>
<td>Bad quality-of-protection value</td>
</tr>
<tr>
<td>GSS_S_UNAUTHORIZED (0F)</td>
<td>Operation not authorized by local security policy</td>
</tr>
<tr>
<td>GSS_S_UNAVAILABLE (10)</td>
<td>Operation or option not available</td>
</tr>
<tr>
<td>GSS_S_DUPLICATE_ELEMENT (11)</td>
<td>Credential element already exists</td>
</tr>
<tr>
<td>GSS_S_NAME_NOT_MN (12)</td>
<td>Not a mechanism name</td>
</tr>
</tbody>
</table>

The following table lists the GSS-API supplementary status bits and their meanings:

Table 6-3. GSS-API supplementary status bits

<table>
<thead>
<tr>
<th>Status Bit (Number, Hexidecimal)</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSS_S_CONTINUE_NEEDED (0001)</td>
<td>Call routine again to complete request</td>
</tr>
<tr>
<td>GSS_S_DUPLICATE_TOKEN (0002)</td>
<td>Token is duplicate of earlier token</td>
</tr>
<tr>
<td>GSS_S_OLD_TOKEN (0004)</td>
<td>Token validity period has expired</td>
</tr>
<tr>
<td>GSS_S_UNSEQ_TOKEN (0008)</td>
<td>Later token has already been processed</td>
</tr>
<tr>
<td>GSS_S_GAP_TOKEN (0010)</td>
<td>Skipped predecessor token detected</td>
</tr>
</tbody>
</table>

Kerberos administration database (numbers 01B79C00 - 01B79CFF)

01B79C01 Principal or policy already exists.
Explanation: The principal or policy entry already exists in the Kerberos database.
User response: Specify a name that does not already exist.

01B79C02 Principal or policy does not exist.
Explanation: The principal or policy entry does not exist in the Kerberos database.
User response: Specify a name that does exist.

01B79C03 Database is not initialized.
Explanation: The Kerberos database is not initialized.
User response: Report the problem to the owner of the Kerberos administration server.

01B79C04 Policy name is not valid.
Explanation: The policy name is not valid.
User response: Contact the owner of the Kerberos administration server to obtain the policy name guidelines for that server.

01B79C05 Principal name is not valid.
Explanation: The principal name is not valid.
User response: Contact the owner of the Kerberos administration server to obtain the principal name guidelines for that server.

01B79C06 Database inconsistency detected.
Explanation: A database inconsistency has been detected by the Kerberos administration server.
User response: Report the problem to the owner of the Kerberos administration server.

01B79C07 XDR encoding error.
Explanation: The Kerberos administration server detected an error while decoding the administration request or while encoding the administration response.
User response: Report the problem to the owner of the Kerberos administration server.

01B79C08 Database operation failed.
Explanation: The Kerberos administration server is unable to complete a database operation.
User response: Report the problem to the owner of the Kerberos administration server.
Database lock mode is not valid.

**Explanation:** The Kerberos administration server is unable to lock the database.

**User response:** Report the problem to the owner of the Kerberos administration server.

Unable to lock database.

**Explanation:** The Kerberos administration server is unable to lock the database.

**User response:** Report the problem to the owner of the Kerberos administration server.

Database is not locked.

**Explanation:** The Kerberos administration server is unable to perform a database operation.

**User response:** Report the problem to the owner of the Kerberos administration server.

---

**GSS-API Kerberos mechanism codes (numbers 025EA100 - 025EA1FF)**

**025EA100** Principal is not found in credentials cache.

**Explanation:** The principal name in the default credentials cache is not the same as the principal name on the GSS-API request.

**User response:** Either specify the correct principal or specify GSS_C_NO_NAME to use the default principal.

**025EA101** Principal is not found in key table.

**Explanation:** The principal specified on a GSS-API request is not found in the key table.

**User response:** Specify a principal that is defined in the key table or use the KRBS_KTNAME environment variable to specify a different key table.

**025EA102** Ticket-granting ticket is not found in credentials cache.

**Explanation:** GSS-API is creating a credential that can be used to initiate a security context. The credentials cache does not contain a ticket-granting ticket that can be used to obtain service tickets.

**User response:** Obtain a valid ticket-granting ticket for the principal to be used to initiate the security context. Then retry the request.

**025EA104** Context already established.

**Explanation:** The gss_init_sec_context() function is called to continue setting up the security context. However, the security context has already been established. The application should not call gss_init_sec_context() again unless the previous call returned a major status of GSS_C_CONTINUE_NEEDED.

**User response:** Verify that the previous call to gss_init_sec_context() returned a major status of GSS_C_CONTINUE_NEEDED.

**025EA105** Signature algorithm is not supported.

**Explanation:** The signature algorithm is not supported by the local system or is not compatible with the current security context.

**User response:** Ensure that the selected signature algorithm is supported by both the local and the remote system and is compatible with the encryption key associated with the current security context. Contact your service representative if the error persists.

**025EA106** Length value is not correct.

**Explanation:** The length of a field in an input token is not correct.

**User response:** Ensure that the input token is not modified. Contact your service representative if the error persists.

**025EA107** Context is not established.

**Explanation:** A GSS-API function was called that requires an established security context. The supplied context has been initiated but the response from the context acceptor has not been received.

**User response:** Process the response token before attempting to use the security context.

**025EA108** Context identifier is not valid.

**Explanation:** An unassigned context identifier is specified on a GSS-API function call.
### Status codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>025EA109</td>
<td>Credential identifier is not valid.</td>
<td>An unassigned credential identifier is specified on a GSS-API function call.</td>
<td>Specify a valid credential identifier and then retry the request.</td>
</tr>
<tr>
<td>025EA10B</td>
<td>Token sequence number is not valid.</td>
<td>The token sequence number is not correctly formed.</td>
<td>Ensure that the token is not modified and that the correct security context is used to process the token.</td>
</tr>
<tr>
<td>025EA140</td>
<td>Token pad characters are not valid.</td>
<td>The token does not contain the correct pad characters.</td>
<td>Verify that the token is not modified.</td>
</tr>
<tr>
<td>025EA141</td>
<td>Data privacy service is not available.</td>
<td>The gss_unwrap() function was called to process a message that was encrypted by the sender.</td>
<td>Do not request message confidentiality protection unless both systems provide data encryption services.</td>
</tr>
<tr>
<td>025EA142</td>
<td>Seal algorithm is not supported.</td>
<td>The seal algorithm is not supported by the local system or is not compatible with the current security context.</td>
<td>Ensure that both systems are at compatible software levels.</td>
</tr>
<tr>
<td>025EA143</td>
<td>Token length is not correct.</td>
<td>The length of the buffer containing the input token is not correct.</td>
<td>Verify that the correct length is specified for the token buffer.</td>
</tr>
<tr>
<td>025EA144</td>
<td>Encryption type is not supported.</td>
<td>The encryption type specified in the input token is not valid or is not supported by the current software level.</td>
<td>Ensure that both systems are at compatible software levels. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>025EA145</td>
<td>No key is available to accept a security context.</td>
<td>The gss_accept_sec_context() function failed because it is unable to obtain the session key for the security context.</td>
<td>Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>025EA146</td>
<td>Bindings in token do not match supplied bindings.</td>
<td>The channel bindings specified on the gss_accept_sec_context() call do not match the channel bindings contained in the input token.</td>
<td>Ensure that the input token is not modified and that the context initiator is specifying the correct channel bindings on the gss_init_sec_context() call.</td>
</tr>
<tr>
<td>025EA147</td>
<td>Checksum in token is not valid.</td>
<td>The checksum in the input token does not have the correct type and length values.</td>
<td>Ensure that both systems are at compatible software levels. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>025EA148</td>
<td>Context is not in the correct state.</td>
<td>The context state is not valid for the requested operation.</td>
<td>Ensure that the context is in the correct state for the requested operation.</td>
</tr>
<tr>
<td>025EA149</td>
<td>Locking error is detected.</td>
<td>An internal locking error is detected.</td>
<td>Contact your service representative if the error persists.</td>
</tr>
</tbody>
</table>
No mechanism credentials available.

Explanation: The credential context supplied on the \texttt{gss\_init\_sec\_context} or the \texttt{gss\_inquire\_cred\_by\_mech} API function does not contain credentials for the requested mechanism.

User response: Specify a credential context that contains the necessary mechanism credentials. The \texttt{gss\_acquire\_cred} API function can be used to create the credential context.

No internal name provided for requested mechanism.

Explanation: A \texttt{gss\_name\_t} parameter does not contain an internal representation that is valid for the requested mechanism. Names returned by one mechanism may not be used with a different mechanism. The \texttt{gss\_import\_name} API function can be used to generate a \texttt{gss\_name\_t} that contains internal representations for all of the supported mechanisms.

User response: Provide a \texttt{gss\_name\_t} that is valid for the requested mechanism.

GSS-API LIPKEY/SPKM mechanism codes (numbers 025EA160-025EA18F)

025EA160 Certificate management services are not available.

Explanation: The certificate management services library cannot be loaded. The library name is GSKCMS31 for 31-bit applications or GSKCMS64 for 64-bit applications.

User response: Ensure that the required load module is installed and accessible. Then retry the failing operation. Contact your service representative if the error persists.

025EA161 Unable to decode X.509 certificate.

Explanation: Certificate management services is unable to decode an X.509 certificate. Additional information for the error can be obtained by turning on debug messages for subcomponent KRB\_GSSAPI.

User response: Ensure that the key database or SAF key ring has not been modified. Contact your service representative if the error persists.

025EA162 Unable to decode X.509 certificate revocation list.

Explanation: Certificate management services is unable to decode an X.509 certificate revocation list (CRL). Additional information for the error error can be obtained by turning on debug messages for subcomponent KRB\_GSSAPI.

User response: Ensure that the LDAP entry for the certification authority contains a valid CRL. Contact your service representative if the error persists.

025EA163 Unable to convert a distinguished name to an X.509 name.

Explanation: Certificate management services is unable to convert a distinguished name (DN) string to an X.509 name. Additional information for the error error can be obtained by turning on debug messages for subcomponent KRB\_GSSAPI.

User response: Contact your service representative if the error persists.

025EA164 Unable to convert an X.509 name to a distinguished name.

Explanation: Certificate management services is unable to convert an X.509 name to a distinguished name (DN) string. Additional information for the error can be obtained by turning on debug messages for subcomponent KRB\_GSSAPI.

User response: Ensure that the X.509 certificate or certificate revocation list has not been modified. Contact your service representative if the error persists.

025EA165 Unable to decode X.509 name.

Explanation: Certificate management services is unable to decode an X.509 name. Additional information for the error error can be obtained by turning on debug messages for subcomponent KRB\_GSSAPI.

User response: Ensure that the key database or SAF key ring has not been modified. Contact your service representative if the error persists.

025EA166 Unable to encode X.509 object.

Explanation: Certificate management services is unable to encode an X.509 object. Additional information for the error error can be obtained by turning on debug messages for subcomponent KRB\_GSSAPI.

User response: Contact your service representative if the error persists.

025EA167 Unable to obtain certificate.

Explanation: Certificate management services is
Status codes

unable to read a certificate from the key database or SAF key ring. Additional information for the error error can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.

**User response:** Ensure that the key database or SAF key ring has not been modified and that the application has access. Contact your service representative if the error persists.

---

025EA168 Certificate is not found.

**Explanation:** The requested X.509 certificate is not found in the key database or SAF key ring.

**User response:** Specify a valid certificate name.

---

025EA169 Certificate is not usable.

**Explanation:** The requested X.509 certificate is not usable. This error can occur if the certificate is expired or is not marked as trusted. This error can also occur for an application certificate if there is no private key for the certificate.

**User response:** Verify that the certificate is not expired and is marked as trusted. Verify that an application certificate has a private key in the key database or SAF key ring.

---

025EA16A More than one matching certificate.

**Explanation:** The key database or SAF key ring contains multiple certificates matching the supplied subject name.

**User response:** Either remove the extra certificates or specify a unique certificate subject name.

---

025EA16B Certificate database is not open.

**Explanation:** The key database or SAF key ring is not open. This error can occur if the GSS_KEYRING_NAME environment variable is not defined or if an error occurred when the database was opened.

**User response:** Ensure that the GSS_KEYRING_NAME environment variable is defined. In addition, either GSS_KEYRING_PW or GSS_KEYRING_STASH must be defined if you are using a key database instead of a SAF key ring.

---

025EA16C Target name is not valid.

**Explanation:** The target name for the acceptor of a GSS-API security context cannot be validated. This indicates the target name specified by the security context initiator cannot be used with the X.509 certificate supplied by the acceptor.

The target certificate must satisfy one of the following target name criteria:

- The target name must match the subject name or the common name component of the subject name.
- The target name must match a DN entry or the common name component of a DN entry for the subject alternate name in the target certificate.
- The host name portion of a target name created from a service name must match the common name component of the subject name.
- The host name portion of a target name created from a service name must match a DNS entry for the subject alternate name in the target certificate.

**User response:** Ensure that the target certificate is valid and the target name can be used with the certificate.

---

025EA16D Certificate is not valid.

**Explanation:** The X.509 certificate supplied by the communication partner cannot be validated. This error can occur if the certificate is not valid or has expired.

**User response:** Ensure that the supplied certificate is valid and has not expired.

---

025EA16E Certificate is not trusted.

**Explanation:** The X.509 certificate supplied by the communication partner is not trusted. This error can occur if the certificate has been revoked or a required certification authority root certificate is not found in the local database.

**User response:** Ensure that the certificate has not been revoked and that the local database contains the necessary certification authority root certificate.

---

025EA16F Unexpected certificate management error.

**Explanation:** An unexpected error is returned by Certificate Management Services. Additional information can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.

**User response:** Refer to the System SSL documentation for a description of the CMS error code.

---

025EA170 Incomplete certification chain.

**Explanation:** The certification chain for the application certificate is incomplete. The key database or SAF key ring must contain all certificates in the certification chain up to and including the root certificate for the certification authority.

**User response:** Ensure that all certificates in the certification chain are in the key database or SAF key ring and are trusted and not expired.
Status codes

025EA171 Unable to generate Diffie-Hellman key pair.
Explanation: A Diffie-Hellman public/private key pair cannot be generated. Additional information can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.
User response: Refer to the System SSL documentation for a description of the CMS error code.

025EA172 Unable to generate Diffie-Hellman secret.
Explanation: The Diffie-Hellman shared secret cannot be generated. Additional information can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.
User response: Refer to the System SSL documentation for a description of the CMS error code.

025EA173 Diffie-Hellman parameters are not valid.
Explanation: The Diffie-Hellman group parameters are not valid. Additional information can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.
User response: Refer to the System SSL documentation for a description of the CMS error code.

025EA174 Unable to sign token data.
Explanation: The GSS-API token data cannot be signed using the private key obtained from the X.509 certificate. Additional information can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.
User response: Refer to the System SSL documentation for a description of the CMS error code.

025EA175 Unable to verify token data signature.
Explanation: The signature for a GSS-API token cannot be verified using the public key obtained from the X.509 certificate. Additional information can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.
User response: Refer to the System SSL documentation for a description of the CMS error code.

025EA176 Token signature is not correct.
Explanation: The signature for a GSS-API token is not correct. This error can occur if the token data has been modified or the wrong X.509 certificate is used to verify the signature.
User response: Verify that the GSS-API token data is not modified. Contact your service representative if the error persists.

025EA177 Protocol version is not supported.
Explanation: The SPKM request token does not specify a protocol version supported by the local system. The only supported version is SPKM protocol version 0 as documented in RFC 2025 (Simple Public Key GSS-API Mechanism).
User response: Ensure that the latest software level is installed.

025EA178 Protocol error is detected.
Explanation: An SPKM token violates the protocol as defined in RFC 2025 (Simple Public Key GSS-API Mechanism).
User response: Contact your service representative.

025EA179 Target name is incorrect.
Explanation: An SPKM context cannot be accepted because the target name in the context cannot be used with the X.509 certificate in the acceptor credential.
User response: Change the application to specify the correct target name or use a different X.509 certificate with the target application.

025EA17A Bindings in token do not match supplied bindings.
Explanation: The channel bindings specified on the gss_accept_sec_context() call do not match the channel bindings contained in the input token.
User response: Ensure that the input token is not modified and that the context initiator is specifying the correct channel bindings on the gss_init_sec_context() call.

025EA17B Algorithm is not supported.
Explanation: An unsupported algorithm is specified in a GSS-API token.
User response: Verify that the latest software level is installed. Contact your service representative if the problem persists.

025EA17C Diffie-Hellman modulus is too small.
Explanation: The SPKM-3 and LIPKEY security mechanisms use the Diffie-Hellman key agreement algorithm to construct a shared secret. The Diffie-Hellman parameters provided by the context initiator cannot be used because the modulus is not large enough to construct key material for the negotiated algorithm set.
Status codes

User response: Contact your service representative.

025EA17D Unable to decode private key.
Explanation: Certificate management services is unable to decode a private key. Additional information for the error can be obtained by turning on debug messages for subcomponent KRB_GSSAPI.
User response: Ensure that the key database or SAF key ring has not been modified. Contact your service representative if the error persists.

025EA17E Password prompt canceled by user.
Explanation: The user canceled the password prompt issued by the GSS-API runtime. As a result, an initiate credential could not be obtained for use with the LIPKEY security mechanism.
User response: Enter the password when prompted or select a different security mechanism.

Kerberos administration codes (numbers 029C2500 - 029C25FF)

029C2500 Operation failed.
Explanation: A Kerberos administration request has failed. There may be additional information on the cause of the failure in the administration server log.
User response: Correct the cause of the failure and retry the request. Contact your service representative if the error persists.

029C2501 Operation requires 'get' privilege.
Explanation: A Kerberos administration request cannot be processed because the client is not authorized to retrieve an entry from the security registry.
User response: Repeat the request using a client with the proper authorization.

029C2502 Operation requires 'add' privilege.
Explanation: A Kerberos administration request cannot be processed because the client is not authorized to add an entry to the security registry.
User response: Repeat the request using a client with the proper authorization.

029C2503 Operation requires 'modify' privilege.
Explanation: A Kerberos administration request cannot be processed because the client is not authorized to modify an entry in the security registry.
User response: Repeat the request using a client with the proper authorization.

029C2504 Operation requires 'delete' privilege.
Explanation: A Kerberos administration request cannot be processed because the client is not authorized to delete an entry from the security registry.
User response: Repeat the request using a client with the proper authorization.

029C2505 Insufficient authorization for operation.
Explanation: A Kerberos administration request cannot be processed because the client does not have the necessary authorization.
User response: Repeat the request using a client with the proper authorization.

029C2506 Database inconsistency detected.
Explanation: The Kerberos administration server detects an error in the security registry.
User response: Contact your service representative.

029C2507 Principal or policy already exists.
Explanation: A Kerberos administration request cannot be processed because the principal or policy already exists in the security registry.
User response: Choose a different name for the new registry object or delete the existing registry object.

029C2508 Communication failure with administration server.
Explanation: A Kerberos administration request
cannot be processed due to an RPC communication failure.

**User response:** Verify that the administration server is running and there are no network problems. Contact your service representative if the error persists.

<table>
<thead>
<tr>
<th>Status Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2509</td>
<td>No administration server available.</td>
<td>No Kerberos administration server is available for the requested realm.</td>
<td>Verify that an administration server is defined for the realm and the server is running.</td>
</tr>
<tr>
<td>029C250A</td>
<td>Key version mismatch for password history principal.</td>
<td>The key version number for the password history principal is incorrect.</td>
<td>Verify that the key table contains the correct key for the principal. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>029C250B</td>
<td>Administration server connection is not initialized.</td>
<td>A connection to the Kerberos administration server has not been initialized. Use the \texttt{kadm5_init_with_password()}, \texttt{kadm5_init_with_skey()}, or \texttt{kadm5_init_with_creds()} routine to initialize a connection.</td>
<td>Correct the application to initialize the connection before calling any administration routines.</td>
</tr>
<tr>
<td>029C250C</td>
<td>Principal does not exist.</td>
<td>The requested principal does not exist in the security registry.</td>
<td>None</td>
</tr>
<tr>
<td>029C250D</td>
<td>Policy does not exist.</td>
<td>The requested policy does not exist in the security registry.</td>
<td>None</td>
</tr>
<tr>
<td>029C250E</td>
<td>Field mask is not valid for operation.</td>
<td>The configuration parameters field mask is not valid for the requested administration operation. Refer to the API documentation to determine which field mask settings are valid.</td>
<td>Correct the application to specify a valid field mask.</td>
</tr>
<tr>
<td>029C250F</td>
<td>Character class count is not valid.</td>
<td>The number of character classes is not valid for the requested administration operation.</td>
<td>Contact the owner of the Kerberos administration server to determine the allowable range for the number of character classes.</td>
</tr>
<tr>
<td>029C2510</td>
<td>Password length is not valid.</td>
<td>The password length is not valid. Contact your security administration to get the password requirements for your installation.</td>
<td>Contact the owner of the Kerberos administration server to determine the allowable range for the password length.</td>
</tr>
<tr>
<td>029C2511</td>
<td>Policy name is not valid.</td>
<td>The policy name is not valid.</td>
<td>Specify a valid policy name.</td>
</tr>
<tr>
<td>029C2512</td>
<td>Principal name is not valid.</td>
<td>The principal name is not valid.</td>
<td>Specify a valid principal name.</td>
</tr>
<tr>
<td>029C2513</td>
<td>Auxiliary attributes are not valid.</td>
<td>Auxiliary attributes are not valid.</td>
<td>Specify a valid set of auxiliary attributes.</td>
</tr>
<tr>
<td>029C2514</td>
<td>Password history count is not valid.</td>
<td>The password history count is not valid.</td>
<td>Contact the owner of the Kerberos administration server to determine the allowable range for the password history count.</td>
</tr>
<tr>
<td>029C2515</td>
<td>Minimum password lifetime is not valid.</td>
<td>The minimum password lifetime is not valid. The minimum lifetime must not be greater than the maximum lifetime.</td>
<td>Specify a valid password lifetime.</td>
</tr>
<tr>
<td>029C2516</td>
<td>Password is too short.</td>
<td>The password is too short. Contact your security administrator to get the password requirements for your installation.</td>
<td>Specify a valid password.</td>
</tr>
</tbody>
</table>
## Status codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2517</td>
<td>Password does not contain enough character classes.</td>
<td>The password does not contain characters from enough different character classes. Contact your security administrator to get the password requirements for your installation.</td>
<td>Specify a valid password.</td>
</tr>
<tr>
<td>029C2518</td>
<td>Password is in the password dictionary.</td>
<td>The password is in the password dictionary. Contact your security administrator to get the password requirements for your installation.</td>
<td>Specify a valid password.</td>
</tr>
<tr>
<td>029C2519</td>
<td>Password cannot be reused.</td>
<td>The password has already been used and cannot be used again. Contact your security administrator to get the password requirements for your installation.</td>
<td>None</td>
</tr>
<tr>
<td>029C2520</td>
<td>Structure version is not valid.</td>
<td>The structure version number is not valid.</td>
<td>Change the application to specify a valid version number.</td>
</tr>
<tr>
<td>029C2521</td>
<td>Old structure version is not supported.</td>
<td>An obsolete structure version number was specified by the application.</td>
<td>Change the application to use the current structure version.</td>
</tr>
<tr>
<td>029C2522</td>
<td>New structure version is not supported.</td>
<td>The structure version is not supported by the current level of the administration support.</td>
<td>Change the application to use a supported structure version.</td>
</tr>
<tr>
<td>029C2523</td>
<td>API version is not valid.</td>
<td>The API version is not valid.</td>
<td>Change the application to specify a valid version number.</td>
</tr>
<tr>
<td>029C2524</td>
<td>Old API version is not supported by the administration library.</td>
<td>An obsolete API version is specified by the application.</td>
<td>Change the application to use the current API version.</td>
</tr>
<tr>
<td>029C2525</td>
<td>Old API version is not supported by the administration server.</td>
<td>An obsolete API version is specified by the application.</td>
<td></td>
</tr>
</tbody>
</table>
## Status codes

**User response:** Change the application to use the current API version.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2526</td>
<td>New API version is not supported by the administration library.</td>
<td>The API version is not supported by the current level of the administration support.</td>
<td>Change the application to use a supported API version.</td>
</tr>
</tbody>
</table>

**User response:** Change the application to use a supported API version.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2527</td>
<td>New API version is not supported by the administration server.</td>
<td>The API version is not supported by the current level of the administration support.</td>
<td>Change the application to use a supported API version.</td>
</tr>
</tbody>
</table>

**User response:** Change the application to use a supported API version.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2528</td>
<td>Required administration principal is not found.</td>
<td>A required administration principal was not found in the security registry.</td>
<td>Contact your service representative.</td>
</tr>
</tbody>
</table>

**User response:** Contact your service representative if the error persists.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2529</td>
<td>Principal cannot be renamed.</td>
<td>The salt type for the principal does not allow the principal to be renamed.</td>
<td>None</td>
</tr>
</tbody>
</table>

**User response:** None

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2530</td>
<td>Required configuration parameter is missing.</td>
<td>A required configuration parameter is not specified in the Kerberos configuration profile.</td>
<td>Verify that all administration server configuration parameters are specified. Contact your service representative if the error persists.</td>
</tr>
</tbody>
</table>

**User response:** Verify that all administration server configuration parameters are specified. Contact your service representative if the error persists.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2531</td>
<td>Administration server host name is not valid.</td>
<td>The administration server host name is not valid.</td>
<td>Specify a valid host name.</td>
</tr>
</tbody>
</table>

**User response:** Specify a valid host name.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2532</td>
<td>Operation requires 'set-key' privilege.</td>
<td>A Kerberos administration request cannot be processed because the client is not authorized to set the encryption key for a principal.</td>
<td>Repeat the request using a client with the proper authorization.</td>
</tr>
</tbody>
</table>

**User response:** Repeat the request using a client with the proper authorization.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>029C2533</td>
<td>Duplicate encryption types specified.</td>
<td>Duplicate encryption types specified when setting the encryption key for a principal. This error can also occur if two encryption types are specified that use the same encryption key for</td>
<td></td>
</tr>
</tbody>
</table>

**User response:** None
Example, ENCTYPE_DES_CBC_CRC and ENCTYPE_DES_CBC_MD5 use the same DES encryption key).

User response: Do not specify duplicate encryption types.

029C2535 Encryption type mismatch.

Explanation: The key-salt entries do not match the corresponding key entries on a call to the kadm5_setkey_principal_3() routine.

User response: Specify a matching key-salt entry for each key entry.

029C25F0 Too many matching database records.

Explanation: A database search request resulted in more than 1000 matching records.

User response: Repeat the request using a more restrictive search expression.

029C25F1 Database record is too big.

Explanation: An attempt to create a Kerberos database entry failed because the record is too big. The Kerberos database has a maximum record size of 1024 bytes. This size includes the record key and any database overhead.

User response: Reduce the amount of data stored for the failing principal or policy.

029C25F2 Password change rejected.

Explanation: The password change was rejected by the system authorization facility. This error occurs if the password is too long or violates the password policy defined for the system.

User response: Select a different password. Contact your system administrator if the error persists.

029C25F3 Unsupported encryption type.

Explanation: The encryption type is not supported by the current software level.

User response: Upgrade to a software level that supports the encryption type.

029C25F4 Unsupported salt type.

Explanation: The password salt type is not supported by the current software level.

User response: Upgrade to a software level that supports the salt type.

029C25F5 Function not supported.

Explanation: The requested function is not supported by the Kerberos administration server.

User response: Refer to the documentation for the Kerberos administration server to determine which administration functions are supported.

029C25F6 Function disabled.

Explanation: The requested function is currently disabled by the Kerberos administration server.

User response: Retry the request when Kerberos administration services are enabled. Contact your Kerberos administrator if the error persists.

029C25F7 Target is not a Kerberos object.

Explanation: A request to rename or delete a registry object cannot be performed because the object was not created by the Kerberos administration service.

User response: The registry object must be renamed or deleted with the same service that was used to create it.
### Status codes

#### ASN.1 operations codes (numbers 6EDA3600 - 6EDA36FF)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
<th>Contact your service representative if the error persists</th>
</tr>
</thead>
<tbody>
<tr>
<td>6EDA3600</td>
<td>ASN.1 is unable to obtain the system time.</td>
<td>An ASN.1 encode/decode function is unable to obtain the current system time. This error can occur if the time provider is not running.</td>
<td>Verify that the time provider is running and is configured properly. Then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3601</td>
<td>An ASN.1 structure is missing a required field.</td>
<td>An ASN.1 encode function was unable to process a request because an input structure is missing a required field. This error can also occur on a decode request if the byte stream was created by a different level of the ASN.1 software.</td>
<td>Verify that all input structures contain all required fields and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3602</td>
<td>ASN.1 encounters an unexpected field number.</td>
<td>An ASN.1 decode function is unable to process a request because the input byte stream contains a misplaced field. This error can occur if the byte stream was created by a different level of the ASN.1 software.</td>
<td>Verify that the input byte stream has not been modified and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3603</td>
<td>ASN.1 type number is not correct.</td>
<td>An ASN.1 decode function is unable to process a request because the input byte stream contains an invalid type specification. This error can occur if the byte stream was created by a different level of the ASN.1 software.</td>
<td>Verify that the input byte stream has not been modified and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3604</td>
<td>ASN.1 value is too large.</td>
<td>An ASN.1 encode/decode function is unable to process a request because a data value is too large.</td>
<td>Verify that all data values are within the defined limits for that data type. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3605</td>
<td>ASN.1 endecoding operation fails at end of data.</td>
<td>An ASN.1 encoding function was unable to process a request because the end of the encoded stream was reached prematurely.</td>
<td>Verify that the encoded stream has not been modified and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3606</td>
<td>ASN.1 identifier does not match expected value.</td>
<td>An ASN.1 decode function was unable to process a request because an internal identifier does not match the expected value for the identifier. This error can occur if the byte stream was created by a different level of the ASN.1 software.</td>
<td>Verify that the input byte stream has not been modified and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3607</td>
<td>ASN.1 length is not correct.</td>
<td>An ASN.1 encode/decode function was unable to process a request because the length of a field does not match the expected value.</td>
<td>Verify that all field lengths are correct and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3608</td>
<td>ASN.1 encoded byte stream is not valid.</td>
<td>An ASN.1 decode function was unable to process a request because the input byte stream is formatted incorrectly. This error can occur if the byte stream was created by a different level of the ASN.1 software.</td>
<td>Verify that the input byte stream has not been modified and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>6EDA3609</td>
<td>ASN.1 is unable to parse the request.</td>
<td>An ASN.1 decode function was unable to process a request because the input byte stream cannot be parsed. This error can occur if the byte stream was created by a different level of the ASN.1 software.</td>
<td>Verify that the input byte stream has not been modified and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
</tbody>
</table>
# Status codes

## GSS-API codes (numbers 861B6D00 - 861B6DFF)

<table>
<thead>
<tr>
<th>Code</th>
<th>Message</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>861B6D00</td>
<td>Service name is not valid.</td>
<td>The supplied name is not a valid Kerberos service name.</td>
<td>Specify a valid service name.</td>
</tr>
<tr>
<td>861B6D01</td>
<td>UID string is not valid.</td>
<td>The supplied UID string is not valid.</td>
<td>Specify a valid UID string.</td>
</tr>
<tr>
<td>861B6D02</td>
<td>UID does not resolve to a user.</td>
<td>The specified UID does not resolve to a valid user on the local system.</td>
<td>Specify a UID that is valid on the local system and then retry the request.</td>
</tr>
<tr>
<td>861B6D03</td>
<td>Control block validation fails.</td>
<td>A GSS-API control block or token is not correct. This error can occur if an exported context or</td>
<td>Upgrade the Kerberos runtime to the same level on all systems.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>credential is imported by an earlier version of the Kerberos runtime.</td>
<td></td>
</tr>
<tr>
<td>861B6D04</td>
<td>Unable to allocate memory.</td>
<td>A GSS-API operation is unable to allocate memory.</td>
<td>Increase the memory available to the application and then retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>861B6D05</td>
<td>Message context is not valid.</td>
<td>The gss_display_status() routine was called with an incorrect message context.</td>
<td>Initialize the message context to zero before the first call to the gss_display_status() routine.</td>
</tr>
<tr>
<td>861B6D06</td>
<td>Buffer length is not correct.</td>
<td>The length of the supplied buffer is not correct for the operation being attempted.</td>
<td>Provide a buffer of the proper length and then retry the request.</td>
</tr>
<tr>
<td>861B6D07</td>
<td>Credential usage type is not valid.</td>
<td>The credential usage must be GSS_C_INITIATE or GSS_C_BOTH when initiating a security context.</td>
<td>Specify a credential usage that is valid for the operation being attempted.</td>
</tr>
<tr>
<td>861B6D08</td>
<td>Quality of protection is not valid.</td>
<td>The quality of protection (QOP) value specified for the GSS-API operation is not valid or is not supported by the current software level.</td>
<td>Specify a valid quality of protection value and then retry the request.</td>
</tr>
<tr>
<td>861B6D09</td>
<td>Security mechanism is not correct.</td>
<td>The security mechanism specified in the token header is not correct.</td>
<td>Verify that the token was created using a security mechanism that is supported by the current software level and that this security mechanism is the same security mechanism that was used to create the security context.</td>
</tr>
<tr>
<td>861B6D0A</td>
<td>Token header is not correct.</td>
<td>The GSS-API token header is malformed or is corrupted.</td>
<td>Verify that the token was not modified and then retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>861B6D0B</td>
<td>Packet replayed in the wrong direction.</td>
<td>The security mechanism specified in the token header is not correct.</td>
<td>A GSS-API token was processed by the wrong partner. Tokens generated by the context initiator must be processed by the context acceptor. Tokens generated by the context acceptor must be processed by the context initiator.</td>
</tr>
<tr>
<td>861B6D0C</td>
<td>Message is not within the current window.</td>
<td>The message is not within the current receive window. This indicates that multiple messages are missing or an old message is being replayed. GSS-API is unable to determine whether the message has been processed previously.</td>
<td>Verify that messages are being processed in the correct order and that no messages are being lost. Contact your service representative if the error persists.</td>
</tr>
</tbody>
</table>
Status codes

861B6D52  Message is after the next message in the sequence.
Explanation: The message is within the current receive window but is later than the next message in the sequence. This indicates that one or more messages are missing.
User response: Verify that messages are being processed in the correct order and that no messages are being lost. Contact your service representative if the error persists.

861B6D53  Message has already been received.
Explanation: The message is within the current receive window but has already been received. This indicates that an old message is being replayed.
User response: Verify that messages are being processed in the correct order and that no messages are being lost. Contact your service representative if the error persists.

861B6D54  Message is before the next message in the sequence.
Explanation: The message is within the current receive window but is earlier than the next message in the sequence. The message has not been received previously.
User response: Verify that messages are being processed in the correct order and that no messages are being lost. Contact your service representative if the error persists.

861B6D55  Token signature is not correct.
Explanation: The checksum computed using the token data does not match the checksum contained in the token.
User response: Verify that the token was not modified and then retry the request. Contact your service representative if the error persists.

861B6D56  Credential already contains a mechanism element.
Explanation: The gss_add_cred() function was called to add a mechanism element to a credential. The credential already contains an element for the requested mechanism.
User response: Do not add an existing mechanism to a credential.

861B6D57  Context is expired.
Explanation: The GSS-API context has expired. This indicates that either the context lifetime has expired or the associated Kerberos ticket is no longer valid.
User response: Create a new GSS-API security context.

861B6D58  Token type is not correct.
Explanation: An attempt to decode a token failed due to incorrect API usage.
User response: If the token was created using the gss_get_mic() function, use the gss_verify_mic() function to process it. If the token was created using the gss_wrap() function, use the gss_unwrp() function to process it. If the token was created using the gss_delete_sec_context() function, use the gss_process_context_token() function to process it. If the token was created using the gss_accept_sec_context() function, use the gss_init_sec_context() function to process it.

861B6D59  Credential is expired.
Explanation: The GSS-API credential has expired. This indicates that either the credential lifetime has expired or the associated Kerberos ticket is no longer valid.
User response: Create a new GSS-API credential.

861B6D5A  Required parameter is missing.
Explanation: A required parameter is not specified on a GSS-API function call.
User response: Specify the required parameter and then retry the request.

861B6D5B  Name is not a valid GSS-API name.
Explanation: A gss_name_t parameter does not refer to a valid GSS-API name.
User response: Verify that the name parameter is correct. Names created by an application must be converted to the internal representation by calling the gss_import_name() function.

861B6D5C  No name is specified.
Explanation: GSS_C_NO_NAME is specified on an API that requires that a name be provided.
User response: Specify a valid name and then retry the request.
Status codes

861B6D5D  No mechanism is specified.
Explanation:  GSS_C_NO_OID is specified for the
mechanism on an API that requires that a mechanism
be specified.
User response:  Specify a mechanism and then retry
the request.

861B6D5E  Name type is not valid.
Explanation:  The name type specified on the
gss_import_name() function call is not valid or is not
supported by the current software level.
User response:  Specify a valid name type and then
retry the request.

861B6D5F  Name is not valid.
Explanation:  An attempt to convert a name to its
internal representation was not successful, or a
different name was specified when
gss_init_sec_context() was called to finish establishing
the security context.
User response:  Specify a valid name and then retry
the request.

861B6D60  Security mechanism is not valid.
Explanation:  The security mechanism is not valid or is
not supported by the current software level.
User response:  Specify a supported security
mechanism.

861B6D61  Status type is not valid.
Explanation:  The status type specified on the
gss_display_status() function call is not valid.
User response:  Specify a valid status type and then
retry the request.

861B6D62  Status value is not valid.
Explanation:  The status value specified on the
gss_display_status() function call cannot be translated
to an error message.
User response:  Verify that the message catalog is
installed and is available to the application.

861B6D63  Object identifier encoding is not valid.
Explanation:  An object identifier does not have a valid
encoding. Object identifiers are encoded using ASN.1
encoding rules. The string encoding consists of a series
of blank-delimited or period-delimited numbers. The
entire string is enclosed in braces.
User response:  Specify a valid object identifier.

Kerberos database (numbers 95E73A00 - 95E73AFF)

95E73A01  Entry already exists in database.
Explanation:  A request to add an entry to the
Kerberos database failed because the entry already
exists.
User response:  Specify a name that does not already
exist in the database.

95E73A02  Unable to store entry in database.
Explanation:  An attempt to update the Kerberos
database failed.
User response:  Contact your service representative if
the error persists.

95E73A03  Unable to read entry from database.
Explanation:  An attempt to read an entry from the
Kerberos database failed.
User response:  Contact your service representative if
the error persists.

95E73A04  Not authorized to perform requested
operation.
Explanation:  The requested operation cannot be
performed because the client principal is not authorized.
User response:  Ask your Kerberos administrator to
grant the necessary authority to your Kerberos account.

95E73A05  Entry not found in database.
Explanation:  The requested entry is not found in the
Kerberos database.
User response:  None

95E73A06  Incorrect use of wildcard character.
Explanation:  A wildcard character is used incorrectly
as part of a database search request.
User response:  Specify a valid database search
argument.

95E73A07  Database is in use by another process.
Explanation:  The Kerberos database is locked by
another process.
User response:  Wait for the other process to release
the Kerberos database and then retry the command.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>95E73A08</td>
<td>Database modified during read operation.</td>
<td>The Kerberos database was modified while a read request was being processed.</td>
<td>Retry the failing request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>95E73A09</td>
<td>Database record incomplete or corrupted.</td>
<td>A record in the Kerberos database is incomplete or has been corrupted.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A0A</td>
<td>Recursive database lock request.</td>
<td>The database support detected an attempt to lock the Kerberos database by a process that already holds the database lock.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A0B</td>
<td>Database is not locked.</td>
<td>The database support detected an attempt to access the Kerberos database without holding the database lock.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A0C</td>
<td>Incorrect database lock mode.</td>
<td>The database support detected an incorrect lock mode for a request to lock the Kerberos database.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A0D</td>
<td>Database is not initialized.</td>
<td>An attempt to access the Kerberos database failed because the database has not been initialized.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A0E</td>
<td>Database is already initialized.</td>
<td>An attempt to initialize the Kerberos database failed because the database has already been initialized.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A0F</td>
<td>Incorrect direction for key conversion.</td>
<td>An incorrect direction flag was specified for an attempt to convert a Kerberos key.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A10</td>
<td>No master key for database.</td>
<td>The master key for the Kerberos database cannot be found.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A11</td>
<td>Incorrect master key for database.</td>
<td>The master key is not the correct database master key.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A12</td>
<td>Key size is not valid.</td>
<td>The key size for a database entry is not valid.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A13</td>
<td>Unable to read stored master key.</td>
<td>The database support is unable to read the stored master key for the Kerberos database.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A14</td>
<td>Stored master key is corrupted.</td>
<td>The stored master key for the Kerberos database has been corrupted.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A15</td>
<td>Unable to lock database.</td>
<td>The database support is unable to lock the Kerberos database.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A16</td>
<td>Database corrupted.</td>
<td>The Kerberos database is corrupted.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73A17</td>
<td>Unsupported database version.</td>
<td>The Kerberos database version is not supported by the current software level.</td>
<td>Upgrade to a software level that supports the database version.</td>
</tr>
<tr>
<td>95E73A18</td>
<td>Unsupported salt type.</td>
<td>The password salt type is not supported by the current software level.</td>
<td>Upgrade to a software level that supports the salt type.</td>
</tr>
</tbody>
</table>
### Status codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>95E73A19</td>
<td>Unsupported encryption type.</td>
<td>The encryption type is not supported by the current software level.</td>
<td>Upgrade to a software level that supports the encryption type.</td>
</tr>
<tr>
<td>95E73A1A</td>
<td>Incorrect database creation flags.</td>
<td>An attempt to create the Kerberos database failed because the creation request is not correct.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73AF0</td>
<td>Database record is too big.</td>
<td>An attempt to create a Kerberos database entry failed because the record is too big. The Kerberos database has a maximum record size of 1024 bytes.</td>
<td>Contact your service representative.</td>
</tr>
<tr>
<td>95E73AF1</td>
<td>Too many matching database records.</td>
<td>A database search request resulted in more than 1000 matching records.</td>
<td>Reduce the amount of data stored for the failing principal or policy.</td>
</tr>
<tr>
<td>95E73AF2</td>
<td>Duplicate database entry.</td>
<td>A database entry cannot be created because an entry with the same name already exists.</td>
<td>Use a different name for the new database entry.</td>
</tr>
<tr>
<td>95E73AF3</td>
<td>Database entry is still referenced.</td>
<td>A database entry cannot be deleted because it is still referred to by other database entries.</td>
<td>Modify the other database entries to remove the reference to the database entry that is to be deleted. Then retry the delete request.</td>
</tr>
<tr>
<td>95E73AF4</td>
<td>Database function is not supported.</td>
<td>A database function was requested that is not supported by the current database.</td>
<td>Do not request unsupported database functions.</td>
</tr>
<tr>
<td>95E73AF5</td>
<td>Unknown security server.</td>
<td>The requested Kerberos security server is not defined.</td>
<td>Either define the Kerberos security server or specify an existing security server.</td>
</tr>
</tbody>
</table>

### Kerberos runtime codes (numbers 96C73A00 - 96C73CFF)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>96C73A01</td>
<td>Client entry in security registry has expired.</td>
<td>The client's entry in the registry database has expired.</td>
<td>Restore the client's access and then retry the request.</td>
</tr>
<tr>
<td>96C73A02</td>
<td>Server entry in security registry has expired.</td>
<td>The server's entry in the registry database has expired.</td>
<td>Restore the server's access and then retry the request.</td>
</tr>
<tr>
<td>96C73A03</td>
<td>Requested protocol version is not supported.</td>
<td>Kerberos request has been encoded using an unsupported protocol version.</td>
<td>Ensure that the client and the server are at compatible software levels.</td>
</tr>
<tr>
<td>96C73A04</td>
<td>Client key is encrypted using an old master key.</td>
<td>The client's key was encrypted using an old master key that is no longer contained in the registry database.</td>
<td>Authenticate the client again in order to obtain a new ticket that is encrypted with the current master key.</td>
</tr>
<tr>
<td>96C73A05</td>
<td>Server key is encrypted using an old master key.</td>
<td>The server's key was encrypted using an old master key that is no longer contained in the registry database.</td>
<td>Obtain a new service ticket for the desired server.</td>
</tr>
<tr>
<td>96C73A06</td>
<td>Client principal is not found in security registry.</td>
<td>The client principal in a Kerberos request was not found in the registry database.</td>
<td>Add the client principal to the registry database and then retry the request.</td>
</tr>
</tbody>
</table>
96C73A07 Server principal is not found in security registry.

Explanation: The server principal in a Kerberos request was not found in the registry database. This error can occur if server principal is not defined in the security registry or if the Kerberos runtime is unable to obtain a TGT for the realm containing the server principal.

User response: Add the server principal to the registry database for the server realm. Ensure that a trust relationship exists between the client realm and the server realm. Then retry the request.

96C73A08 Server principal is not unique.

Explanation: The server principal in a Kerberos request has multiple entries in the registry database.

User response: This error should never be reported by the z/OS security server. Contact your service representative.

96C73A09 Key in security registry is not valid.

Explanation: A principal does not have an associated key in the registry database.

User response: Create a key for the principal and then retry the request.

96C73A0A Ticket is ineligible for postdating.

Explanation: A Kerberos request contains a "good-since" date that is in the future. The current security policy does not allow postdated tickets.

User response: Retry the request without requesting a postdated ticket.

96C73A0B Effective ticket lifetime is too short.

Explanation: A Kerberos request specifies a lifetime that is less than the minimum lifetime allowed for a ticket.

User response: Retry the request specifying a longer lifetime.

96C73A0C Ticket request violates account administrative policy.

Explanation: A Kerberos request cannot be processed, for one of the following reasons:

- The client principal in the request is forbidden to have tickets by the administrative policy of the principal account.
- The server principal in the request is forbidden to be a server by the administrative policy of the principal account.

User response: Change the appropriate administrative policy to permit the request.

96C73A0D Ticket cannot be granted with requested properties.

Explanation: A Kerberos request cannot be processed because one or more of the ticket options are either not supported or are not allowed by the account policy.

User response: Change the account policy if desired and then retry the request.

96C73A0E Encryption type is not supported.

Explanation: A Kerberos request contains an encryption type that is not supported by the security server.

User response: Specify a supported encryption type and then retry the request. Ensure that the client and server software levels are compatible.

96C73A0F Checksum type is not supported.

Explanation: A Kerberos request contains a checksum type that is not supported by the security server.

User response: Specify a supported checksum type and then retry the request. Ensure that the client and server software levels are compatible.

96C73A10 Preauthentication type is not supported.

Explanation: A Kerberos request contains a preauthentication type that is not supported by the security server.

User response: Provide the ticket-granting ticket when making a request to the ticket-granting service. Ensure that the client and server software levels are compatible.

96C73A11 Transited ticket not supported.

Explanation: A Kerberos request for a foreign principal contains a ticket-granting ticket granted by a foreign realm. The foreign realm is not a trust peer of the security server receiving the request.

User response: Use a ticket-granting ticket granted by
the security server that will process the request or establish a trusted peer relationship between the two realms.

96C73A12 Client account is revoked.
Explanation: The "account valid" indicator is not set for the client account.
User response: Set the "account valid" indicator for the client account. Then retry the request.

96C73A13 Server account is revoked.
Explanation: The "account valid" indicator is not set for the server account.
User response: Set the "account valid" indicator for the server account. Then retry the request.

96C73A14 Ticket-granting ticket is expired.
Explanation: The expiration time for a ticket has been reached.
User response: Obtain a new ticket-granting ticket and then retry the request.

96C73A15 Client account is not yet valid.
Explanation: The "good-since" time for a client account is in the future.
User response: Wait until the client account becomes valid or change the "good-since" time for the account. Then retry the request.

96C73A16 Server account is not yet valid.
Explanation: The "good-since" time for a server account is in the future.
User response: Wait until the server account becomes valid or change the "good-since" time for the account. Then retry the request.

96C73A17 Password is expired.
Explanation: The principal's password has expired.
User response: Change the password for the principal and then retry the request.

96C73A18 Preauthentication failed.
Explanation: Preauthentication failed for a Kerberos request.
User response: Retry the failing request. Contact your service representative if the error persists.

96C73A19 Preauthentication required.
Explanation: An initial ticket request does not contain preauthentication data. The account policy for the principal requires preauthentication.
User response: Retry the request and provide preauthentication data.

96C73A1A Ticket is not for the requested server.
Explanation: The ticket supplied with a Kerberos request is not for the server specified in the request.
User response: Retry the request and provide the proper ticket.

96C73A1B Server requires ticket encrypted with session key.
Explanation: A request for a service ticket does not contain a session key. The account policy for the requested server requires that tickets be encrypted with a session key and not with the server key.
User response: Retry the request and provide the session key.

96C73A1C Transited path rejected.
Explanation: The KDC rejected the transited path encoded in the ticket-granting ticket provided with the request. This indicates that one of the realms involved in granting the ticket is not trusted by the KDC.
User response: Contact your administrator to update the trust relationships between the realms.

96C73A1D Service is not available.
Explanation: The requested service is not available.
User response: Retry the request. Contact your administrator if the problem persists.

96C73A1F Integrity check fails.
Explanation: The checksum computed using the decrypted message is not the same as the checksum contained within the message. This error can occur if the message has been modified or the wrong key was used to decrypt the message. The key can be incorrect if a password change has occurred for the principal. This error can also occur if the checksum contained in the authenticator does not match the checksum computed using the supplied application data.
User response: Verify that the message was not modified. If an incorrect key was used, retry the request with the correct key. Contact your service representative if the error persists.
96C73A20  Ticket is expired.
Explanation: A Kerberos request cannot be completed because the associated ticket has expired.
User response: Obtain a new ticket and then retry the request.

96C73A21  Ticket is not yet valid.
Explanation: A Kerberos request cannot be completed because the start time for the associated ticket is in the future.
User response: Obtain a new ticket or wait until the current ticket is valid. Then retry the request.

96C73A22  Replay attempt detected.
Explanation: The Kerberos replay detection mechanism indicates that the received request is a replay of a prior request.
User response: Try the request again. Contact your service representative if the error persists.

96C73A23  Server name is not correct.
Explanation: A Kerberos request contains a ticket-granting ticket for another ticket-granting service.
User response: Obtain a ticket to the desired ticket-granting service and then retry the request. Contact your service representative if the error persists.

96C73A24  Client name is not correct.
Explanation: The client principal stored in the authenticator part of the Kerberos request does not match the client principal stored in the accompanying ticket.
User response: Ensure that the proper authenticator is used and then retry the request. Contact your service representative if the error persists.

96C73A25  Time differential exceeds maximum clock skew.
Explanation: The absolute difference between the timestamp in the message and the current system time is greater than the maximum clock skew value (normally 5 minutes). This problem can occur if the time on the client system is not the same as the time on the server system.
User response: Ensure that the time on both systems is synchronized properly.

96C73A26  Network address is not correct.
Explanation: The address of the message sender does not match any of the possible client addresses stored in the associated ticket.
User response: Obtain a new ticket containing the correct client addresses. Then retry the request. Contact your service representative if the error persists.

96C73A27  Message protocol version is not correct.
Explanation: The protocol version in a Kerberos message is not correct or is not supported by the security server.
User response: Ensure that the client and server software levels are compatible. Then retry the request. Contact your service representative if the error persists.

96C73A28  Message type is not correct.
Explanation: The message type in Kerberos message is not correct or is not supported by the security server.
User response: Ensure that the client and server software levels are compatible. Then retry the request. Contact your service representative if the error persists.

96C73A29  Message stream is modified.
Explanation: The message packet sent to or received from the security server has been modified.
User response: Ensure that there are no communication problems between the client and the server. Then retry the request. Contact your service representative if the error persists.

96C73A2A  Security message received in incorrect order.
Explanation: A security message was received that is not in the correct sequence.
User response: Ensure that there are no communication problems between the client and the server. Then retry the request. Contact your service representative if the error persists.

96C73A2B  Illegal cross-realm ticket.
Explanation: An illegal cross-realm ticket was found when parsing an authorization service message.
User response: Obtain a ticket to the server that the request is attempting to access. Then retry the request. Contact your service representative if the error persists.
Status codes

96C73A2C  Service key version is not correct.
Explanation: The ticket associated with a Kerberos request specifies a server key type that is not correct or a server key version that is no longer contained in the registry database.
User response: Obtain a new ticket to the server that the request is attempting to access. Then retry the request. Contact your service representative if the error persists.

96C73A2D  Service key is not available.
Explanation: The server key is not available for the server principal specified in a ticket. This error can occur if the server account was deleted after the ticket was granted.
User response: Recreate the server account and then retry the request.

96C73A2E  Mutual authentication fails.
Explanation: A mutual authentication attempt failed.
User response: Retry the request. Contact your service representative if the error persists.

96C73A2F  Message direction is incorrect.
Explanation: The message direction in a Kerberos message stream is incorrect. This error can occur if Kerberos peer services are being used and one of the messages is received out of order.
User response: Retry the request. Contact your service representative if the error persists.

96C73A30  Alternative authentication method required.
Explanation: A Kerberos request specifies an authentication method that is not supported by the security server. An alternative authentication method is required.
User response: Ensure that the client and server software levels are compatible. Then retry the request using an authentication method that is supported by the server.

96C73A31  Message sequence number is incorrect.
Explanation: A message was received containing an incorrect sequence number. This error can occur if one or more messages have been dropped by the communications network.
User response: Ensure that no communication errors are causing messages to be lost. Then retry the request. Contact your service representative if the error persists.

96C73A32  Checksum type is not appropriate.
Explanation: A checksum type has been selected that does not have the required properties for use with a security message. For example, generated checksums may not be unique using the selected checksum algorithm.
User response: Retry the request using an appropriate checksum type.

96C73A33  Transited path rejected.
Explanation: The application server rejected the transited path encoded in the service ticket provided with the request. This indicates that one of the realms involved in granting the ticket is not trusted by the server.
User response: Contact the application administrator to update the trust relationships between the realms.

96C73A34  Response too large for datagram.
Explanation: The response cannot be returned because it is too large for a UDP datagram.
User response: Change the application to use TCP instead of UDP for its communications.

96C73A3C  Generic error occurs.
Explanation: An error has occurred that is not covered by any of the specific status codes defined for the Kerberos Key Distribution Center (KDC) component. Check the security server message log for more information about the cause of this error.
User response: Retry the request. Contact your service representative if the error persists.

96C73A3D  Message field is too long.
Explanation: A Kerberos message contains a field that is longer than the maximum length supported by the security server.
User response: Ensure that the client and server software levels are compatible. Then retry the request. Contact your service representative if the error persists.

96C73A81  Lock request is not valid.
Explanation: A request to lock a file does not specify a valid lock type.
User response: Specify a valid lock type and retry the request.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>96C73A82</td>
<td>Unable to read password.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> An attempt to read a password from the terminal failed due to an input/output error. This error can also occur if no password is entered.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Ensure that a valid input device is available to the application. Then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>96C73A83</td>
<td>Password does not match expected value.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> The supplied password does not match the expected value. This error can occur if the same password is not specified for both the password prompt and the password validation prompt.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Specify the same password for both the password prompt and the password validation prompt.</td>
<td></td>
</tr>
<tr>
<td>96C73A84</td>
<td>Password read is interrupted.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> An interrupt signal was received while reading the password from the terminal.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>96C73A85</td>
<td>Illegal character in component name.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> A component of a Kerberos name contains an illegal character.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Ensure that a valid input device is available to the application. Then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>96C73A86</td>
<td>Principal name is not valid.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> An error was detected while parsing the string representation of a principal name. The string representation consists of the name followed by an optional realm separated by &quot;@&quot; (the @ must be omitted if no realm is specified).</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Ensure that the principal name is properly formed.</td>
<td></td>
</tr>
<tr>
<td>96C73A87</td>
<td>Unable to open Kerberos configuration file.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> The Kerberos configuration file cannot be opened.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Ensure that the configuration file exists and that the file permissions allow read access. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>96C73A88</td>
<td>Kerberos configuration file format is not valid.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> The Kerberos configuration file format is not valid. Refer to the administration guide for more information about the proper format of the file.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Correct the file format errors and then retry the request.</td>
<td></td>
</tr>
<tr>
<td>96C73A89</td>
<td>Buffer is too small.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> The buffer specified on a Kerberos function call is too small to hold all of the return information.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Specify a larger buffer and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>96C73A8A</td>
<td>Message type is not valid.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> A Kerberos message cannot be encoded because the message type is not correct or is not supported by the current software level.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Ensure that the software is at the correct level and then retry the request. Contact your service representative if the error persists.</td>
<td></td>
</tr>
<tr>
<td>96C73A8B</td>
<td>Credentials cache name is not valid.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> The credentials cache name is not valid. A credentials cache name consists of an optional cache type followed by the name separated by a colon (:). The colon must be omitted if no cache type is specified.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Specify a valid credentials cache name and then retry the request.</td>
<td></td>
</tr>
<tr>
<td>96C73A8C</td>
<td>Credentials cache type is not valid.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> The credentials cache type is not valid or is not supported by the current software level. This error can occur if an application-specific cache type is specified and the cache type has not been registered with the Kerberos runtime.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Specify a valid credentials cache type and then retry the request.</td>
<td></td>
</tr>
<tr>
<td>96C73A8D</td>
<td>Matching credential is not found.</td>
</tr>
<tr>
<td><strong>Explanation:</strong> A search of the credentials cache does not find a credential with the requested attributes.</td>
<td></td>
</tr>
<tr>
<td><strong>User response:</strong> Change the search criteria and then retry the request.</td>
<td></td>
</tr>
</tbody>
</table>
### Status codes

<table>
<thead>
<tr>
<th>Status Code</th>
<th>Description</th>
<th>User Response</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>96C73A8E</td>
<td>End of credentials cache is reached.</td>
<td>No action is required.</td>
<td>A read request has reached the end of the credentials cache.</td>
</tr>
<tr>
<td>96C73A8F</td>
<td>Required ticket is not supplied.</td>
<td>Refresh the credentials cache and then retry the request. Contact your service representative if the error persists.</td>
<td>A Kerberos request does not have a required ticket or the ticket is not complete.</td>
</tr>
<tr>
<td>96C73A90</td>
<td>Application server principal is not correct.</td>
<td>Ensure that the application message is sent to the proper server.</td>
<td>The server principal in an application message does not match the principal name of the server receiving the request.</td>
</tr>
<tr>
<td>96C73A91</td>
<td>Application ticket is not valid.</td>
<td>Obtain a new service ticket and then retry the request. Contact your service representative if the error persists.</td>
<td>The ticket in an application message is not valid.</td>
</tr>
<tr>
<td>96C73A92</td>
<td>Principals do not match.</td>
<td>Obtain a ticket-granting ticket for the correct principal and then retry the request.</td>
<td>An attempt to obtain credentials failed because the principal in the ticket-granting ticket does not match the target principal.</td>
</tr>
<tr>
<td>96C73A93</td>
<td>Security server reply is modified.</td>
<td>Ensure that the security server reply was not modified. Contact your service representative if the error persists.</td>
<td>The values in the security server reply are not consistent with the request that was sent to the security server.</td>
</tr>
<tr>
<td>96C73A94</td>
<td>Clock skew in reply exceeds maximum value.</td>
<td>Ensure that the client and server system times are synchronized properly.</td>
<td>The absolute difference between the timestamp in the security server reply and the local system time exceeds the maximum clock skew (normally 5 minutes).</td>
</tr>
<tr>
<td>96C73A95</td>
<td>Realm mismatch in initial ticket request.</td>
<td>Ensure that the initial ticket request is sent to the security server for the client realm.</td>
<td>The client realm is not the same as the principal realm in an initial ticket request.</td>
</tr>
<tr>
<td>96C73A96</td>
<td>Encryption type is not valid.</td>
<td>Specify a valid encryption type and then retry the request. Contact your service representative if the error persists.</td>
<td>A Kerberos message specifies an encryption type that is not valid or is not supported by the current software level.</td>
</tr>
<tr>
<td>96C73A97</td>
<td>Key type is not valid.</td>
<td>Specify a valid key type and then retry the request. Contact your service representative if the error persists.</td>
<td>A Kerberos message specifies a key type that is not valid or is not supported by the current software level.</td>
</tr>
<tr>
<td>96C73A98</td>
<td>Encryption type is not correct.</td>
<td>Retry the request. Contact your service representative if the error persists.</td>
<td>A Kerberos message is encrypted with the incorrect encryption type.</td>
</tr>
<tr>
<td>96C73A99</td>
<td>Checksum type is not valid.</td>
<td>Specify a valid checksum type and then retry the request. Contact your service representative if the error persists.</td>
<td>A Kerberos message specifies a checksum type that is not valid or is not supported by the current software level.</td>
</tr>
<tr>
<td>96C73A9A</td>
<td>Unable to locate security server.</td>
<td>Ensure that the requested realm is defined in the LDAP directory, the DNS name server, or the Kerberos configuration file. Ensure that the appropriate lookup mode is enabled in the Kerberos configuration file. Then retry the request.</td>
<td>The Kerberos runtime is unable to locate the security server for the requested realm.</td>
</tr>
</tbody>
</table>
### Status codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>96C73A9B</td>
<td>Kerberos service is not defined.</td>
<td>The requested Kerberos service is not defined or is not supported by the current software level.</td>
<td>For an undefined service, define the desired service and then retry the request. For an unsupported service, upgrade to a software level that supports the service.</td>
</tr>
<tr>
<td>96C73A9C</td>
<td>Unable to contact security server.</td>
<td>The Kerberos runtime was unable to contact the security server for the requested realm.</td>
<td>Ensure that the security server is running and is defined correctly in the LDAP directory, the DNS name server, or the Kerberos configuration file. Ensure that the appropriate lookup mode is enabled in the Kerberos configuration file. Then retry the request.</td>
</tr>
<tr>
<td>96C73A9D</td>
<td>No local name found for principal.</td>
<td>The Kerberos runtime was unable to translate a foreign principal to a local name.</td>
<td>Ensure that a local name is defined for the foreign principal. Then try the request again.</td>
</tr>
<tr>
<td>96C73A9E</td>
<td>Mutual authentication fails.</td>
<td>A mutual authentication request was not successful.</td>
<td>Retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73A9F</td>
<td>Replay cache type is already registered.</td>
<td>The replay cache type is already registered with the Kerberos runtime.</td>
<td>No action is required.</td>
</tr>
<tr>
<td>96C73AA0</td>
<td>Replay cache operation is unable to allocate memory.</td>
<td>A memory allocation request failed for a replay cache control block.</td>
<td>Increase the amount of memory available to the application and then retry the request.</td>
</tr>
<tr>
<td>96C73AA1</td>
<td>Replay cache type is not valid.</td>
<td>The requested replay cache type is not valid or is not supported by the current software level. This error can occur if an application-specific cache type is requested and the cache type has not been registered with the Kerberos runtime.</td>
<td>Register the cache type with the Kerberos runtime and then retry the request.</td>
</tr>
<tr>
<td>96C73AA2</td>
<td>Replay cache operation detects an unexpected error.</td>
<td>An internal error was detected during a replay cache operation.</td>
<td>Retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73AA3</td>
<td>Message is a replay.</td>
<td>The current message is a replay of a previous message.</td>
<td>Ensure that your network has not been compromised and communication errors are not causing messages to be retransmitted. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73AA4</td>
<td>Replay cache operation fails.</td>
<td>A replay cache operation failed due to a file system error.</td>
<td>Retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73AA7</td>
<td>Replay cache file is truncated.</td>
<td>An attempt to read from the replay cache file failed due to a premature end-of-file.</td>
<td>Ensure that the replay cache file has not been modified. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73AA8</td>
<td>Replay cache file operation is unable to allocate memory.</td>
<td>A memory allocation request failed for a replay cache file request.</td>
<td>Increase the amount of memory available to the application and then retry the request.</td>
</tr>
<tr>
<td>96C73AA9</td>
<td>Replay cache operation is unable to access file.</td>
<td>An attempt to read from or write to the replay cache file failed.</td>
<td>Ensure that the replay cache file is not damaged and that the file permissions allow the desired file access. Contact your service representative if the error persists.</td>
</tr>
</tbody>
</table>
Status codes

96C73AAA  Replay cache file system request fails.
Explanation: A file system request failed for the replay cache file.
User response: Ensure that the replay cache file is not damaged. Contact your service representative if the error persists.

96C73AAB  Replay cache operation fails.
Explanation: A replay cache operation failed due to an internal error.
User response: Retry the request. Contact your service representative if the error persists.

96C73AAC  Replay cache operation fails due to insufficient space.
Explanation: A replay cache operation failed due to insufficient space in the file system.
User response: Increase the available space in the file system and then retry the request.

96C73AB2  Cryptographic system detects an unexpected error.
Explanation: An unexpected error was detected by the Kerberos cryptographic system.
User response: Retry the request. Contact your service representative if the error persists.

96C73AB3  Key table name is not valid.
Explanation: The key table name is not valid. A key table name consists of an optional key table type followed by the name separated by a colon (:). The colon must be omitted if the key table type is not specified.
User response: Specify a valid key table name and then retry the request.

96C73AB4  Key table type is not valid.
Explanation: The key table type is not valid or is not supported by the current software level. This error can occur if an application-specific key table type is specified, and the key table type has not been registered with the Kerberos runtime.
User response: Register the key table type with the Kerberos runtime and then retry the request.

96C73AB5  Key table entry is not found.
Explanation: The requested key table entry was not found in the key table.
User response: List the entries in the key table file and if there is no entry for the principal used by the application then you will need to add one with the correct version number. If there is an entry already there, you will need to verify that the version number in the key table entry matches the version number for the same principal in the KDC database. If the KDC database has more than one entry for the principal, you need to match the entry with the highest version number.

96C73AB6  End of key table is reached.
Explanation: A key table read operation failed because the end of the key table was reached.
User response: No action is required.

96C73AB7  Key table does not support write operations.
Explanation: An attempt to add or delete a key table entry failed because the key table does not support write operations. This error can occur if the key table is opened using the FILE key table type instead of the WRFILE key table type.
User response: Change the key table type to WRFILE and then retry the request.

96C73AB8  Key table operation fails due to file system error.
Explanation: An attempt to read from or write to a key table failed due to a file system error.
User response: Ensure that the key table file was not damaged and then retry the request. Contact your service representative if the error persists.

96C73AB9  No ticket is found for ticket-granting service.
Explanation: An attempt to obtain a service or privilege ticket failed because no ticket was found for the ticket-granting service. This error can occur if the ticket-granting ticket (TGT) has expired and the application has not renewed it.
User response: Obtain a ticket-granting ticket for the desired ticket-granting service and then retry the request.

96C73ABA  Key parity is not correct.
Explanation: A Data Encryption Standard (DES) key was supplied to the Kerberos cryptographic system. The DES key has incorrect parity. This error can occur if the DES key has been modified.
User response: Supply a valid DES key and then retry the request. Contact your service representative if the error persists.
Key does not provide adequate security.

Explanation: A Data Encryption Standard (DES) key was supplied to the Kerberos cryptographic system. The DES key is weak and does not provide adequate security for use by Kerberos.

User response: Supply a valid DES key and then retry the request. Contact your service representative if the error persists.

Encryption or checksum type is not supported.

Explanation: A cryptographic request failed because the requested encryption or checksum type is not supported.

User response: Specify a supported encryption or checksum type and then retry the request.

Key size is not valid.

Explanation: A key was supplied to the Kerberos cryptographic system. The key size is not valid.

User response: Specify a valid cryptographic key and then retry the request.

Encrypted message is too small.

Explanation: A request to decrypt a message failed because the message length is less than the minimum length for an encrypted message or the result buffer is smaller than the source buffer. A request to encrypt a message failed because the result buffer is too small. This error can also occur if the length of the initial vector is not correct for the requested encryption algorithm.

User response: For an error during decryption, ensure that the message has not been modified, and then retry the request. For an error during encryption, call the krb5_c_encrypt_length() routine to determine the required length for the result buffer. Contact your service representative if the error persists.

Credentials cache type is already registered.

Explanation: A request to register a credentials cache type failed because the credentials cache type is already registered with the Kerberos runtime.

User response: No action is required.

Key table type is already registered.

Explanation: A request to register a key table type failed because the key table type is already registered with the Kerberos runtime.

User response: Specify a credentials cache format that is supported and then retry the request. Contact your service representative if the error persists.
Status codes

96C73AC8  Credentials request specifies incorrect options.
Explanation: A security credentials request specifies options that are not correct or are not supported by the current software level.
User response: Specify valid options and then retry the request. Contact your service representative if the error persists.

96C73AC9  Credentials request does not contain second ticket.
Explanation: A credentials request cannot be processed because two tickets are required, and the request does not contain the second ticket.
User response: Provide the second ticket and then retry the request. Contact your service representative if the error persists.

96C73ACA  No credentials are available.
Explanation: A Kerberos function was called, but no credentials are provided by the caller.
User response: Provide the required credentials and then retry the request. Contact your service representative if the error persists.

96C73ACB  Incorrect authentication protocol version.
Explanation: The authentication protocol version in the message stream is not supported by the krb5_reccauth() routine.
User response: Ensure that compatible levels of the Kerberos runtime are installed on the local and remote systems. Contact your service representative if the error persists.

96C73ACC  Incorrect application version identifier.
Explanation: The application version identifier specified for the krb5_reccauth() routine does not match the application version identifier specified for the krb5_sendauth() routine.
User response: Specify the same application version identifier string.

96C73ACD  Unrecognized response received from remote application
Explanation: The remote application returned an unrecognized response.
User response: Ensure that compatible levels of the Kerberos runtime are installed on the local and remote systems. Contact your service representative if the error persists.

96C73ACE  Authentication rejected by application server.
Explanation: The remote application server has rejected the client authentication.
User response: Contact the application support programmer.

96C73ACF  Preauthentication type is not valid.
Explanation: The preauthentication type is not valid or is not supported by the current software level.
User response: Specify a valid preauthentication type and then retry the request. Contact your service representative if the error persists.

96C73ADO  No preauthentication key is provided.
Explanation: The Kerberos runtime is unable to encrypt the preauthentication data because the encryption key is not provided by the application.
User response: Provide the required encryption key and then retry the request. Contact your service representative if the error persists.

96C73ADD  Preauthentication fails.
Explanation: A preauthentication request failed. This error can occur if the incorrect principal key is specified. It can also occur if the system clocks on the client and server systems are not within 5 minutes of each other.
User response: Ensure that the system clocks are synchronized and the correct principal key is specified. Then retry the request. Contact your service representative if the error persists.

96C73ADE  Replay cache version number is not valid.
Explanation: The replay cache version number is not valid or is not supported by the current software level.
User response: Ensure that the replay cache file has not been modified and then retry the request. Contact your service representative if the error persists.

96C73AEE  Credentials cache version number is not valid.
Explanation: The credentials cache version number is not valid or is not supported by the current software level.
User response: Ensure that the credentials cache file has not been modified and then retry the request. Contact your service representative if the error persists.
Key table version number is not valid.

**Explanation:** The key table version number is not valid or is not supported by the current software level.

**User response:** Ensure that the key table file has not been modified and then retry the request. Contact your service representative if the error persists.

Address type is not valid.

**Explanation:** The network address type is not valid or is not supported by the current software level.

**User response:** Provide a valid network address type and then retry the request. Contact your service representative if the error persists.

Replay detection requires a replay cache.

**Explanation:** Replay detection was requested but no replay cache is available.

**User response:** Set up a replay cache and then retry the request. Contact your service representative if the error persists.

Host name is not defined.

**Explanation:** An attempt to obtain the network host entry using the `gethostbyname()` or `gethostbyaddr()` function failed. The most likely cause of this error is that the host name or network address is not defined to the domain name service.

**User response:** Ensure that the host name is defined to the domain name service and that name resolution is working. Then retry the request. Contact your service representative if the error persists.

Host realm is not defined.

**Explanation:** The realm corresponding to a host name cannot be determined.

**User response:** Ensure the host realm is defined in the Kerberos configuration file and then retry the request. Contact your service representative if the error persists.

Name cannot be converted to service principal.

**Explanation:** A name was provided that cannot be converted to a service principal because no conversion exists for the name type.

**User response:** Provide a name that can be converted to a service principal and then retry the request. Contact your service representative if the error persists.

Request loop is detected while obtaining initial ticket.

**Explanation:** The `krb5_get_in_tkt()` function detects a request loop while obtaining the intermediate ticket-granting tickets necessary to process the request. This error can occur if the peer trust relationships are not correct between the security servers in the intermediate realms.

**User response:** Retry the request. Contact your service representative if the error persists.
Status codes

96C73ADF  No default realm is specified in the configuration file.
Explanation: The Kerberos configuration file does not define a default realm.
User response: Define a default realm in the configuration file. Then retry the request.

96C73AE1  Key table name is too long.
Explanation: The key table name is too long.
User response: Specify a valid key table name and then retry the request.

96C73C00  Unable to load code page table.
Explanation: The Kerberos runtime is unable to load the tables that are used to convert text strings between the network code page and the local code page.
User response: Contact your service representative if the error persists.

96C73C01  Unable to convert text string.
Explanation: The Kerberos runtime is unable to convert a text string to/from the network code page.
User response: Contact your service representative if the error persists.

96C73C02  Unable to allocate memory.
Explanation: The Kerberos runtime was unable to allocate memory for a control block.
User response: Increment the memory available to the application and then retry the request. Contact your service representative if the error persists.

96C73C03  Unable to obtain the current time.
Explanation: The Kerberos runtime is unable to obtain the current time of day.
User response: Verify that the system time provider is running and is configured properly. Contact your service representative if the error persists.

96C73C04  Key table file specification is not valid.
Explanation: The key table file specification is not valid. Either the file name is not correct or the file cannot be accessed.
User response: Verify that the file name is correct and that the file permissions allow access by the application. Then retry the request. Contact your service representative if the error persists.

96C73C05  Key table operation encounters unexpected error.
Explanation: An unexpected error was detected during a key table operation.
User response: Contact your service representative if the error persists.

96C73C06  Unable to create socket.
Explanation: The Kerberos runtime was unable to create a socket because the socket() function failed.
User response: Contact your service representative if the error persists.

96C73C07  Unable to obtain local address information.
Explanation: The Kerberos runtime was unable to obtain local address information for a socket because the ioctl() function failed.
User response: Contact your service representative if the error persists.

96C73C08  Control block validation fails.
Explanation: A Kerberos control block does not contain the proper identifier value.
User response: Verify that the control block was not modified. Contact your service representative if the error persists.

96C73C09  Invalid parameter specified on function call.
Explanation: A parameter specified on a Kerberos function call is not correct.
User response: Verify that the proper parameters are specified and then retry the request. Contact your service representative if the error persists.

96C73C0A  Unsupported Kerberos function requested.
Explanation: A Kerberos function was requested that is not implemented in the current software configuration.
User response: Change the application to request a supported function.

96C73C0B  Replay cache file does not exist.
Explanation: The replay cache file does not exist.
User response: Verify that the replay cache file exists and that the file permissions allow access by the application.
### Status codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Explanation</th>
<th>User response</th>
</tr>
</thead>
<tbody>
<tr>
<td>96C73C0C</td>
<td>Not authorized to access credentials cache.</td>
<td>The application is not authorized to access the credentials cache.</td>
<td>Verify that the credentials cache access permissions allow access by the application.</td>
</tr>
<tr>
<td>96C73C0D</td>
<td>Not authorized to access replay cache.</td>
<td>The application is not authorized to access the replay cache.</td>
<td>Verify that the file permissions allow access by the application.</td>
</tr>
<tr>
<td>96C73C0E</td>
<td>Not authorized to access key table.</td>
<td>The application is not authorized to access the key table.</td>
<td>Verify that the file permissions allow access by the application.</td>
</tr>
<tr>
<td>96C73C0F</td>
<td>Data privacy service is not available.</td>
<td>The requested cryptographic algorithm is not available. This error can occur if the software algorithm is not installed or if a cryptographic algorithm requires the use of a hardware cryptographic processor that is not available on the current system.</td>
<td>Ensure that the proper hardware and software is installed for the cryptographic algorithm.</td>
</tr>
<tr>
<td>96C73C10</td>
<td>Unable to retrieve message msg-identifier from the message catalog.</td>
<td>The security runtime is unable to retrieve message text from the message catalog.</td>
<td>Ensure the NLSPATH environment variable is set properly and then retry the request.</td>
</tr>
<tr>
<td>96C73C11</td>
<td>Unable to contact server.</td>
<td>The Kerberos runtime is unable to contact the server providing the requested service.</td>
<td>Ensure that the server is running and is defined correctly in the LDAP directory, the DNS name server, or the Kerberos configuration file. Ensure that the appropriate lookup mode is enabled in the Kerberos configuration file. Then retry the request.</td>
</tr>
<tr>
<td>96C73C12</td>
<td>Key version value is not supported by the key table format.</td>
<td>The key version value is not within the range supported by the key table format. The current key table implementations store the key version as a 1-byte value. This means the key version must be between 1 and 255 when stored in a key table.</td>
<td>Use a key version between 1 and 255. If the Kerberos database does not allow the key version to be reset for a principal, you must delete the principal from the database and then add it again in order to reset the key version to 1.</td>
</tr>
<tr>
<td>96C73C13</td>
<td>Unable to send data to remote application.</td>
<td>The Kerberos runtime is unable to send data to the remote application.</td>
<td>Ensure that there are no network problems and that the remote application is running. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73C14</td>
<td>Unable to receive data from remote application.</td>
<td>The Kerberos runtime is unable to receive data from the remote application.</td>
<td>Ensure there are no network problems and the remote application is running. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73C15</td>
<td>Connection closed by remote application.</td>
<td>The Kerberos runtime is unable to receive data from the remote application because the connection has been closed. This error can occur if the local system is not authorized to establish a connection with the remote system.</td>
<td>Ensure that there are no network problems, that the remote application is running, and that the local system is authorized to establish the connection. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>96C73C16</td>
<td>Password is too long.</td>
<td>The password is longer than 128 characters.</td>
<td>Enter a shorter password.</td>
</tr>
<tr>
<td>96C73C17</td>
<td>Response too large.</td>
<td>The response cannot be returned because it is too large for the buffer provided.</td>
<td>Contact your service representative.</td>
</tr>
</tbody>
</table>
Status codes

Profile operations codes (numbers AACA6000 - AACA60FF)

AACA6002  Profile section is not found.
Explanation: A profile read request failed because the requested profile section was not found.
User response: No action is required.

AACA6003  Profile relation is not found.
Explanation: A profile read request failed because the requested profile relation was not found.
User response: No action is required.

AACA6004  Profile node is not a section node.
Explanation: A profile add was requested, but the supplied node is not a section node.
User response: Provide a section node and retry the request.

AACA6005  Profile section node has a value.
Explanation: A profile section node is not allowed to have a value.
User response: Verify that the configuration file is formatted properly. Contact your service representative if the error persists.

AACA6009  Profile section does not have a parent.
Explanation: The parent pointer in a profile section node is not valid.
User response: Verify that the profile entries in memory are not corrupted. Contact your service representative if the error persists.

AACA6013  Profile name set is not correct.
Explanation: The set of names specified for a profile lookup operation is not correct. The name set must include at least the section name and the relation name.
User response: Specify a valid name set and retry the request.

AACA6014  No profile is available.
Explanation: No Kerberos profile was found.
User response: Create a Kerberos configuration file if needed.

AACA600D  Opening brace is missing.
Explanation: An opening brace is missing for a list of relations while processing a profile definition.
User response: Verify that the configuration file is formatted properly. Contact your service representative if the error persists.

AACA600B  Profile relation is not correct.
Explanation: A profile relation is not formatted correctly.
User response: Verify that the configuration file is formatted properly. Contact your service representative if the error persists.

AACA600C  Extra closing brace is specified.
Explanation: An extra closing brace was found in a list of relations while processing a profile definition.
Chapter 7. Messages

This chapter contains three sets of messages:
- Messages from the Kerberos runtime (EUVF02000 through EUVF03999)
- Messages from the security server (EUVF04000 through EUVF05999)
- Messages from Kerberos commands (EUVF06000 through EUVF06999).

Messages are listed in numerical order.

### Kerberos runtime messages (numbers EUVF02000 - EUVF03999)

<table>
<thead>
<tr>
<th>Message Number</th>
<th>Description</th>
<th>User Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUVF02001E</td>
<td>Unable to read a required input parameter.</td>
<td>Verify that all required parameters are specified and then retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>EUVF02002E</td>
<td>Unable to modify a required output parameter.</td>
<td>Verify that all required parameters are specified and then retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>EUVF02003E</td>
<td>Parameter is incorrectly structured.</td>
<td>Verify that all parameters are correct and then retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>EUVF02004E</td>
<td>Security mechanism is not supported.</td>
<td>Specify a security mechanism that is supported by the current software level. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>EUVF02005E</td>
<td>Name value is not valid.</td>
<td>Specify a valid name value and then retry the request. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>EUVF02006E</td>
<td>Name type is not valid.</td>
<td>The specified name type is not valid.</td>
</tr>
</tbody>
</table>

### Kerberos security server messages (numbers EUVF04000 - EUVF05999)

<table>
<thead>
<tr>
<th>Message Number</th>
<th>Description</th>
<th>User Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUVF04001E</td>
<td>Security mechanism is not supported.</td>
<td>Specify a security mechanism that is supported by the current software level. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>EUVF04002E</td>
<td>No security credential supplied.</td>
<td>Provide a valid security credential that can be used to accept a security context.</td>
</tr>
</tbody>
</table>

### Kerberos command messages (numbers EUVF06000 - EUVF06999)

<table>
<thead>
<tr>
<th>Message Number</th>
<th>Description</th>
<th>User Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUVF06001E</td>
<td>Security mechanism is not supported.</td>
<td>Specify a security mechanism that is supported by the current software level. Contact your service representative if the error persists.</td>
</tr>
<tr>
<td>EUVF06002E</td>
<td>No security context established.</td>
<td>The requested function requires a security context but no security context is supplied.</td>
</tr>
</tbody>
</table>
Messages

User response: Provide a security context and then retry the request.

EUVF02012E  Token is not valid.
Explanation: The token contents are not valid.
User response: Verify that the token is not modified and then retry the request. Contact your service representative if the error persists.

EUVF02013E  Security credential is not valid.
Explanation: The security credential is not valid because internal consistency checks fail.
User response: Verify that no storage overlay has occurred and then retry the request. Contact your service representative if the error persists.

EUVF02014E  Security credential is expired.
Explanation: Either the security credential lifetime is expired or the associated ticket is no longer valid.
User response: Create a new security credential and then retry the request. Contact your service representative if the error persists.

EUVF02015E  Security context is expired.
Explanation: Either the security context lifetime is expired or the associated security credential is no longer valid.
User response: Create a new security context and then retry the request. Contact your service representative if the error persists.

EUVF02016E  Security mechanism detects error.
Explanation: The security mechanism detects an error. The minor status code provides additional information concerning the error. The minor status code is zero if the error cannot be isolated to a single security mechanism.
User response: Refer to the minor status code to determine the action to be taken. Contact your service representative if the error persists.

EUVF02017E  Quality of protection value is not valid.
Explanation: The quality of protection value is not valid or is not supported by the current software level.
User response: Specify a valid quality of protection value and then retry the request. Contact your service representative if the error persists.

EUVF02018E  Requested operation is not authorized.
Explanation: The requested operation is not authorized by the associated security credential.
User response: Obtain the necessary authorization and then retry the request. Contact your service representative if the error persists.

EUVF02019E  Requested operation is not available.
Explanation: The requested operation is not provided by the current software level.
User response: Upgrade the software to a level that supports the requested operation.

EUVF02020E  Duplicate credential element requested.
Explanation: The requested credential element is already present in the security credential.
User response: None required.

EUVF02021E  Name contains multiple mechanism elements.
Explanation: The supplied name contains elements for multiple mechanisms. The requested operation requires a name with a single mechanism element.
User response: Provide a valid name and then retry the request.

EUVF02022I  Response token required from peer application.
Explanation: To complete the security context, the current function must be called again with the response token obtained from the peer application.
User response: None required.

EUVF02023W  Message is a duplicate of one already received.
Explanation: The message is valid and is a duplicate of one that was already received.
User response: Application specific.

EUVF02024W  A more recent message was already received.
Explanation: The current message is old. A more recent message has already been received. The message validity period has expired, so the routine cannot determine whether the message is a duplicate of one that was already received.
User response: Application specific.
EUVF02025W  Message received out of sequence.
Explanation:  The message is valid but an earlier message in the sequence has not been received.
User response:  Application specific.

EUVF02026W  Skipped predecessor message detected.
Explanation:  The message is valid but a later message in the sequence has already been received.
User response:  Application specific.

EUVF02027E  Kerberos control block validation fails: Expected exp-value, Actual act-value.
Explanation:  Kerberos internal control blocks have a unique identifier for each type of control block. The Kerberos runtime detects a mismatch between the expected identifier and the actual identifier. This error can occur if storage has been overlaid or modified.
User response:  Contact your service representative.

EUVF02028E  The name system function detects an error. error-text.
Explanation:  A system function detects an error. Refer to the documentation for the failing system function to obtain more information about the cause of the failure.
User response:  Contact your service representative if the error persists.

EUVF02029E  The name system function detects an error on filename. error-text.
Explanation:  A system function detected an error while processing the indicated file.
User response:  Contact your service representative if the error persists.

EUVF02030E  Syntax error on line number of filename. Error number: error-text.
Explanation:  A syntax error was detected while processing the Kerberos profile.
User response:  Correct the line in error and restart the application.

EUVF02031E  The name cryptographic function detects an error: Return code rtn-code, Reason code rsn_code.
User response:  No action is required.

EUVF02033R  Enter password:
Explanation:  The security runtime needs the user password to complete a request.
User response:  Enter your password.

EUVF02034E  Unable to initialize Kerberos GSS-API mechanism: Error code.
Explanation:  An error occurred during the initialization of the Kerberos GSS-API mechanism.
User response:  Contact your service representative if the error persists.

EUVF02035E  Mutex operation fails. error-text.
Explanation:  A mutex operation failed. error-text is the message text associated with the error code.
User response:  Contact your service representative if the error persists.

EUVF02036I  Call stack traceback called from filename at line linenumber.
Explanation:  A call stack trace was requested by the security runtime. This message identifies the source module name and source line number that made the request.
User response:  No action is required.

EUVF02037I  Called from function at offset displacement.
Explanation:  A call stack trace was requested by the security runtime. This message is issued for each entry in the call stack and identifies the offset within the function that issued the call.
User response:  No action is required.

EUVF02038I  IBM Kerberos dump created.
Explanation:  A dump has been created by the security runtime. The dump was created in the directory specified by the _CEEDUMP_DIR environment variable.
Messages

User response: Contact your service representative and provide the dump file.

EUVF02039E Incorrect request format.
Explanation: The password change protocol packet is not formatted correctly. The result string returned by the password server contains additional information about the error.
User response: Contact your service representative if the error persists.

EUVF02040E Password server error.
Explanation: The password server detected an error. The result string returned by the password server contains additional information about the error.
User response: Contact your service representative if the error persists.

EUVF02041E Authentication error.
Explanation: The authentication information supplied with a password change request is not correct. The result string returned by the password server contains additional information about the error.
User response: Contact your service representative if the error persists.

EUVF02042E Password change rejected.
Explanation: The password change request is rejected by the password server. The result string returned by the password server contains additional information about the error.
User response: Choose a new password that meets the password policy. Contact your service representative if the error persists.

EUVF02043E Password change failed.
Explanation: The password change request was not successful.
User response: Contact your service representative if the error persists.

EUVF02044I Password changed.
Explanation: The password change request was successful.
User response: None
Security server messages (numbers EUVF04000 - EUVF05999)

EUVF04001I Security server version version.release Service level level.
Explanation: The security server is starting. This message displays the version, release, and service level of the security server.
User response: None

EUVF04002I Security runtime version version.release Service level level.
Explanation: The security server is starting. This message displays the version, release, and service level of the runtime DLL.
User response: None

EUVF04003A Unable to make address space non-swappable: Error error-code.
Explanation: The security server is unable to make its address space non-swappable. The error code is the value returned by the SYSEVENT system service. An error code of 1 indicates the security server job step is not APF-authorized. Refer to the description of the SYSEVENT macro in the appropriate volume of z/OS MVS Programming: Authorized Assembler Services Reference, for more information on the error.
User response: Verify that the SKRBKDC started task is APF-authorized. Contact your service representative if the error persists.

EUVF04004E The function-name system function detects an error: error-message.
Explanation: A system function detected an error. The error message text is returned by the strerror() function. Refer to the description of the failing system function in z/OS C/C++ Run-Time Library Reference, SA22-7821-03, for more information on the error.
User response: Contact your service representative if the error persists.

EUVF04005E Insufficient storage available.
Explanation: The security server is unable to obtain storage for an internal control block.
User response: Increase the storage available to the program and then retry the request.

EUVF04006I Security server shutdown requested.
Explanation: The system operator has entered a STOP command for the security server.
User response: None

EUVF04007E Unrecognized security server command: Specify DISABLE, DISPLAY, ENABLE, PROP or DEBUG.
Explanation: An unrecognized command name is specified on a MODIFY operator command. The only valid security server commands are DISABLE, DISPLAY, ENABLE, PROP or DEBUG.
User response: Specify a valid security server command.

EUVF04008I Debug option processed: debug-option.
Explanation: The indicated debug request has been processed by the security server.
User response: None

EUVF04009E Incorrect command option specified.
Explanation: An incorrect security server command option was specified. The valid DISPLAY command options are:
- ADMIN - Display the current status of the Kerberos administration service
- CREDS - Display credentials data space allocations
- CRYPTO - Display the available encryption types.
- LEVEL - Display the security server version, release, and service level.
- NETWORK - Display the network interface status.
- PROP - Display the database propagation status.
- XCF - Display security server sysplex status

The valid DEBUG command options are:
- OFF - Turn off debug messages.
- ON - Turn on debug messages.
- subcomp.level,subcomp.level,... - Set the debug level for one or more subcomponents.

User response: Specify a valid command option.

EUVF04010A Database type type is not supported.
Explanation: The SKDC_DATABASE environment variable specifies an unsupported database type.
User response: Specify a supported database type. The security server supports the SAF and NDBM databases.

EUVF04011E Unable to receive datagram. error_text.
Explanation: The security server is unable to receive a datagram from the network. The error text is returned by the strerror() routine.
Messages

User response: Contact your network support group.

EUVF04012E Unable to send response to network-address. error-text.

Explanation: The security server is unable to send data to the specified network address. The error text is returned by the _strerror() routine.

User response: Contact your network support group.

EUVF04013E Unable to initialize local services: Error error-code, Reason reason-code.

Explanation: The security server is unable to initialize the local services support. This support is used by applications running on the same system as the security server. The error code indicates the failing system function and the reason code is the error code returned by the system function.

The following error codes are defined:
- 1 = The job step is not APF-authorized.
- 2 = The security server is already running.
- 3 = ESTAEX failed. See the ESTAEX macro description in the appropriate volume of z/OS MVS Programming: Authorized Assembler Services for more information on the error.
- 5 = LXRES failed. See the LXRES macro description in the appropriate volume of z/OS MVS Programming: Authorized Assembler Services for more information.
- 6 = ETCRE failed. See the ETCRE macro description in the appropriate volume of z/OS MVS Programming: Authorized Assembler Services for more information.
- 7 = ETCON failed. See the ETCON macro description in the appropriate volume of z/OS MVS Programming: Authorized Assembler Services for more information.
- 8 = IEANTCR failed. See the IEANTCR macro description in the appropriate volume of z/OS MVS Programming: Authorized Assembler Services for more information.
- 9 = CTRACE DEFINE failed. See the CTRACE macro description in the appropriate volume of z/OS MVS Programming: Authorized Assembler Services for more information.

User response: Contact your service representative.

EUVF04015E Local program call request failed: Error error-code.

Explanation: The security server is unable to process a local program call request.

The following error codes are defined:
- 8 = Parameter buffer overflow
- 12 = Unable to allocate storage
- 16 = Local service support not enabled
- 20 = Program call task abended
- 24 = Unable to obtain control lock
- 28 = SRB mode is not supported.

User response: Contact your service representative.

EUVF04016E Login audit mode mode is not supported.

Explanation: The SKDC_LOGIN_AUDIT environment variable specified an unsupported audit mode. The supported audit modes are NONE, FAILURE, and ALL.

User response: Specify a supported login audit mode.

EUVF04017A Unable to initialize the KDC.

Explanation: The security server is unable to initialize the KDC (Key Distribution Center). A previous error message contains more information about the failure.

User response: Correct the problem and then restart the security server. Contact your service representative if the error persists.

EUVF04018I Security server initialization complete.

Explanation: The security server initialization is complete.

User response: None
EUVF04019A  Realm name name contains separator characters.

Explanation: The realm name contains the '/' or '@' characters. These characters are used as component separators and may not be used in the realm name.

User response: Use a valid realm name.

EUVF04020A  Security server is already running.

Explanation: Security server is already running.

User response: None

EUVF04021A  Unable to initialize registry database support.

Explanation: The security server is unable to initialize the registry database support. A previous message provides more information on the cause of the failure.

User response: Correct the problem and restart the security server. Contact your service representative if the error persists.

EUVF04022I  Security server start command processed.

Explanation: The security server has completed processing the START command.

User response: None

EUVF04023I  Security server stop command received.

Explanation: The security server has received a STOP command.

User response: None

EUVF04024E  Security server is not available.

Explanation: The component trace command processor is unable to call the Kerberos security server because the security server is either not running or is in the process of stopping.

User response: Restart the Kerberos security server and then retry the TRACE command.

EUVF04025E  Unable to call security server: Error number, Reason code.

Explanation: The component trace command processor is unable to call the Kerberos security server due to an error on the program call request.

The error codes have the following values:
- 8 = Parameter buffer overflow.
- 12 = Unable to allocate storage.
- 16 = Local service support not enabled.

User response: Contact your service representative if the error persists.

EUVF04026E  Incorrect trace option specified.

Explanation: The OPTIONS parameter on the TRACE CT command does not specify a valid list of subcomponent trace levels.

The OPTIONS parameter specifies the list of subcomponent trace levels as OPTIONS=(subcomp1.lvl1,subcomp2.lvl2,...). Trace messages for a particular subcomponent will not be logged unless the subcomponent is included in the trace list and the message level is greater than or equal to the specified level. An asterisk (*) may be used to specify all subcomponents. Trace level 1 generates the minimum amount of trace message output, trace level 8 generates the maximum amount of trace message output, and trace level 9 generates data dumps in addition to the trace messages. The subcomponent list consists of a subcomponent name and a trace level separated by a period. Multiple subcomponents may be specified by separating the entries with commas.

User response: Specify a valid list of subcomponent trace levels.

EUVF04027E  The trace buffer size must be between 64K and 512K.

Explanation: The trace buffer size specified on the TRACE CT command must be between 64K and 512K.

User response: Specify a valid trace buffer size.

EUVF04028E  Unable to retrieve information from the System Authorization Facility registry. SAF error error-code, Return code return-code, Reason code reason-code.

Explanation: The call to the IRRSIM00 system function fails with the indicated error code. Refer to z/OS Security Server RACF Callable Services for more information on the IRRSIM00 callable service and its error return values.

User response: Contact your service representative if the error persists.

EUVF04029E  Kerberos segment field field-name for user user-name is not valid.

Explanation: The Kerberos segment for the specified user is not valid. The data is either too long or is not formatted correctly.

User response: Use the ALTUSER (or equivalent)
Messages

command to correct the Kerberos segment data.

EUVF04030E Registry realm name does not match configured realm name.
Explanation: The realm name in the security registry is not the same as the default realm specified in the krb5.conf configuration file.
User response: Change the default realm name or create a new registry for the realm.

EUVF04031E Limit of number sockets exceeded.
Explanation: The maximum number of open sockets has been exceeded.
User response: Run additional instances of the security server on other systems within the Kerberos realm.

EUVF04032E Unable to receive data from network-address. error-text.
Explanation: The security server is unable to receive data from a client at the specified network address. The error text is returned by the strerror() routine.
User response: Contact your network support group.

EUVF04033E Message received from network-address with length size exceeds the maximum size.
Explanation: The security server received a request that is too large to be processed. The maximum request message size is 32768.
User response: Verify that the client is sending a valid Kerberos request to the security server. Contact your service representative if the problem persists.

Explanation: The R_kerbinfo (IRRSMK00) function call failed. Refer to z/OS Security Server RACF Callable Services for more information. In addition to the return codes documented in the callable services publication, you can also receive error code 8, return code 8, reason code 16, if the SKRBKDC started task is not APF-authorized.
User response: Contact your service representative if you are unable to correct the problem.

EUVF04035E Local Kerberos realm is not defined.
Explanation: The local Kerberos realm has not been defined in the system security database. Refer to z/OS Security Server RACF Command Language Reference for more information.
User response: Define the local realm and then restart the security server.

EUVF04036E Unable to generate PassTicket for userid.
Explanation: The security server is unable to generate a PassTicket for the indicated user.
User response: Verify that the PTKTDATA class is active and that the SKRBKDC application has been defined in the PTKTDATA class with a valid secured signon key.

EUVF04037E Unable to change password for userid. SAF error code, Return code code, Reason code code.
Explanation: The security server is unable to change the password for the indicated user. Refer to z/OS Security Server RACROUTE Macro Reference for more information about the error codes returned by the RACROUTE REQUEST=VERIFY function.
User response: Contact your service representative if the error persists.

EUVF04038I Kerberos login successful for principal at address.
Explanation: A request for an initial ticket was successful. This message is controlled by the SKDC_LOGIN_AUDIT environment variable.
User response: None

EUVF04039W Kerberos login failed for principal at address. KDC status code: error-text.
Explanation: A request for an initial ticket failed. This message is controlled by the SKDC_LOGIN_AUDIT environment variable.
User response: Regenerate the key for the principal associated with the userid. Additionally, contact the user attempting to get the initial ticket if the problem persists.

EUVF04040E Unable to encode database entry for name: Status status-code - status-message
Explanation: The Kerberos security server was unable to encode a database entry.
User response: Contact your service representative.
EUVF04041E Unable to read database master key: error-text.

Explanation: The Kerberos security server was unable to read the database master key from the stash file. This key is used to encrypt entries in the principal database. The error text is returned by the strerror() routine.

User response: Verify that the stash file /var/skrb/krb5kdc/.k5 exists and is accessible. Contact your service representative if the error persists.

EUVF04042E Unable to write database master key: error-text.

Explanation: The Kerberos security server was unable to write the database master key to the stash file. This key is used to encrypt entries in the principal database. The error text is returned by the strerror() routine.

User response: Verify that the stash file /var/skrb/krb5kdc/.k5 exists and is accessible. Contact your service representative if the error persists.

EUVF04043E Unable to store database entry for name. Error-text.

Explanation: The Kerberos security server was unable to store the indicated entry in its database. The database files are stored in the /var/skrb/krb5kdc directory. The error text is returned by the strerror() routine.

User response: Verify that the /var/skrb/krb5kdc directory exists and is mounted in read/write mode. Contact your service representative if the error persists.

EUVF04044E Unable to fetch database entry for name. Error-text.

Explanation: The Kerberos security server was unable to retrieve the indicated entry in its database. The database files are stored in the /var/skrb/krb5kdc directory. The error text is returned by the strerror() routine.

User response: Verify that the /var/skrb/krb5kdc directory exists and is mounted in read/write mode. Contact your service representative if the error persists.

EUVF04045A The security server must have UID 0.

Explanation: The Kerberos security server requires UID 0 authority.

User response: Ensure that the security server is started with UID 0.

EUVF04046E Unable to decode RPC message received from network-address.

Explanation: The Kerberos administration server was unable to decode an RPC message received from a client.

User response: Contact your service representative if the error persists.

EUVF04047E Unable to create directory name.

Explanation: The Kerberos security server was unable to create the indicated directory.

User response: Verify that all path components exist and that the security server is running with UID 0. Contact your service representative if the error persists.

EUVF04048E Unable to open database name.

Explanation: The Kerberos security server was unable to open the indicated registry database. The error text is returned by the strerror() routine.

User response: Verify that all path components exist and that the security server is running with UID 0. Contact your service representative if the error persists.

EUVF04049E Unable to open administration key table name. Status status-code - status-message.

Explanation: The Kerberos security server was unable to open the administration key table.

User response: Verify that all path components exist and that the security server is running with UID 0. Contact your service representative if the error persists.

EUVF04050E Unable to add entry to administration key table name. Status status-code - status-message.

Explanation: The Kerberos security server was unable to add an entry to the administration key table.

User response: Verify that all path components exist and that the security server is running with UID 0. Contact your service representative if the error persists.

EUVF04051E Unable to read entry for principal name. Status status-code - status-message.

Explanation: The Kerberos security server was unable to read a principal entry from the database.

User response: Verify that the principal entry exists in the database. Contact your service representative if the error persists.
Messages

**EUVF04052E** GSS-API function name detects error.

Explanation: The Kerberos security server was unable to process an administration request due to a GSS-API error. The z/OS Security Server supports the Kerberos Administration Version 2 protocol as implemented in MIT Kerberos 1.2.2. Refer to the description for the failing GSS-API function in [z/OS Integrated Security Services Network Authentication Service Programming](https://www.ibm.com/support/docview.setViewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.

User response: Contact your service representative if the error persists.

**EUVF04053E** Unable to create credentials data space: Error error-code, Reason reason-code.

Explanation: The Kerberos security server was unable to create the credentials data space.

The error codes have the following values:

- 1 = DSPSERV CREATE failed. The reason code contains the DSPSERV return code in the upper halfword and bits 8-23 of the DSPSERV reason code in the lower halfword. See the description of the DSPSERV macro in the appropriate volume of [z/OS MVS Programming: Authorized Assembler Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.
- 2 = ALESERV ADD failed. The reason code is the ALESERV return code. See the description of the ALESERV macro in the appropriate volume of [z/OS MVS Programming: Authorized Assembler Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.

User response: Security server initialization continues but data space services are not available. Contact your service representative if the error persists.

**EUVF04054E** Unable to delete credentials data space: Error error-code, Reason reason-code.

Explanation: The Kerberos security server was unable to delete the credentials data space.

The error codes have the following values:

- 1 = DSPSERV DELETE failed. The reason code contains the DSPSERV return code in the upper halfword and bits 8-23 of the DSPSERV reason code in the lower halfword. See the description of the DSPSERV macro in the appropriate volume of [z/OS MVS Programming: Authorized Assembler Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.
- 2 = ALESERV DELETE failed. The reason code is the ALESERV return code. See the description of the ALESERV macro in the appropriate volume of [z/OS MVS Programming: Authorized Assembler Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.

User response: Security server termination continues.

**EUVF04055E** Unable to extend the credentials data space: Error error-code, Reason reason-code.

Explanation: The Kerberos security server is unable to increase the size of the credentials data space.

The error codes have the following values:

- 1 = DSPSERV EXTEND failed. The reason code contains the DSPSERV return code in the upper halfword and bits 8-23 of the DSPSERV reason code in the lower halfword. See the description of the DSPSERV macro in the appropriate volume of [z/OS MVS Programming: Authorized Assembler Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.

User response: The new credentials are not stored in the credentials data space. The SKDC_CREDS_SIZE environment variable specifies the maximum allowable size for the credentials data space.

**EUVF04056E** Unable to initialize cross-system services: Error error-code, Reason reason-code.

Explanation: The Kerberos security server is unable to initialize cross-system services.

The error codes have the following values:

- 1 = The job step is not APF-authorized.
- 3 = IXCJOIN failed. The reason code contains the IXCJOIN return code in the upper halfword and the IXCJOIN reason code in the lower halfword. See the description of the IXCJOIN macro in [z/OS MVS Programming: Sysplex Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.
- 4 = IXCQUERY failed. The reason code contains the IXCQUERY return code in the upper halfword and the IXCQUERY reason code in the lower halfword. See the description of the IXCQUERY macro in [z/OS MVS Programming: Sysplex Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.

User response: Security server initialization continues but cross-system services are not available. Contact your service representative if the error persists.

**EUVF04057E** Unable to end cross-system services: Error error-code, reason-code.

Explanation: The Kerberos security server is unable to end cross-system services.

The error codes have the following values:

- 5 = IXCLEAVE failed. The reason code contains the IXCLEAVE return code in the upper halfword and the IXCLEAVE reason code in the lower halfword. See the description of the IXCLEAVE macro in [z/OS MVS Programming: Sysplex Services Reference](https://www.ibm.com/support/docview/viewDD?rs=964&context=SA&docType=ibm&vid=EN/X&url=docview%3Flocale%3Den%26doc%3Dpp17348-000.pdf) for more information on the error.

User response: Security server termination continues.
User response: Security server processing continues. Contact your service representative if the error persists.

EUVF04058I System name has joined the Kerberos security server group.
Explanation: The SKRBKDC started task has completed initialization on the indicated system and is now a member of the EUVFSKRB cross-system group.
User response: None

EUVF04059I System name has left the Kerberos security server group.
Explanation: The SKRBKDC started task is stopping on the indicated system.
User response: None

EUVF04060I Cross-system services ended due to sysplex partitioning.
Explanation: The local system is leaving the sysplex. As a result, Kerberos security server cross-system services are no longer available.
User response: Security server processing continues.

EUVF04061E Unable to send cross-system message: Error error-code, Reason reason-code.
Explanation: The Kerberos security server is unable to send a message to another member of the Kerberos security server group.
The error codes have the following values:
• 1 = Unable to obtain XCF control lock on target system.
• 2 = Cross-system services are not available.
• 3 = Requested token not found on target system.
• 4 = User not authorized to access token data.
• 5 = Unable to allocate storage on the target system.
• 6 = Target replica is not a member of the security server group.
• 7 = Target replica is not active.
• 8 = IXCMSGO failed. The reason code contains the IXCMSGO return code in the upper halfword and the IXCMSGI reason code in the lower halfword. See the description of the IXCMSGO macro in z/OS MVS Programming: Sysplex Services Reference for more information on the error.
• 9 = IXCMSGI failed on the target system. The reason code contains the IXCMSGI return code in the upper halfword and the IXCMSGI reason code in the lower halfword. See the description of the IXCMSGI macro in z/OS MVS Programming: Sysplex Services Reference for more information on the error.
• 10 = Request function code is not supported.

User response: The request was not processed. Contact your service representative if the error persists.

EUVF04062A The security server is not APF-authorized.
Explanation: The Kerberos security server must be APF-authorized.
User response: Verify that the dataset containing the EUVFSKDC load module is APF-authorized. If you are using a STEPLIB or JOBLIB for the SKRBKDC started task, verify that all datasets in the concatenation are APF-authorized.

EUVF04063E Unable to allocate size bytes in the credentials data space.
Explanation: The credentials data space is full. The SKDC_CREDS_SIZE environment variable can be used to increase the size of the credentials data space.
SKDC_CREDS_SIZE specifies the credentials data space size in kilobytes, with a minimum value of 1024, a maximum value of 2097148, and a default value of 20480.
User response: Increase the size of the credentials data space and then restart the Kerberos security server.

EUVF04064I Sysplex status.
Explanation: This message is displayed in response to the Kerberos security server DISPLAY XCF command. The remaining lines in this multi-line message display the status of each Kerberos security server in the sysplex. A security server is ACTIVE if the SKRBKDC started task is running. A security server is INACTIVE if the SKRBKDC started task has been stopped. No entry is displayed for a system where the SKRBKDC started task has not been active at any time since the local security server was started.
User response: None

EUVF04065I No active security servers.
Explanation: There are no active security servers in the sysplex. This message can occur if there was an
Messages

either error in setting up the cross-system coupling facility support.

User response: None

EUVF04066I Data space status.
Explanation: This message is displayed in response to the Kerberos security server DISPLAY CRDS command. The remaining lines in this multi-line message display the data space allocations.

User response: None

EUVF04067I No data space allocations.
Explanation: There are no data space allocations.

User response: None

EUVF04068I Maximum number of lines displayed.
Explanation: A maximum of 253 status lines can be displayed in response to a single command.

User response: None

EUVF04069I Listening for requests on network interface address.
Explanation: The security server is listening for requests on the indicated network interface.

User response: None

EUVF04070I No longer listening for requests on network interface address.
Explanation: The security server is no longer listening for requests on the indicated network interface.

User response: None

EUVF04071E Unable to bind socket to network-address: error-text.
Explanation: The security server is unable to bind a socket to listen for client requests on the indicated network interface. The error text is returned by the strerror() routine.

User response: Ensure that the TCP/IP configuration profile does not reserve the network port for use by another application. The SKDC_PORT, SKDC_KPASSWD_PORT, and SKDC_KADMIN_PORT environment variables can be used to change the ports used by the security server.

EUVF04072I Security server restart registration complete on system.
Explanation: The security server has successfully registered with ARM (Automatic Restart Management) on the indicated system. The security server is automatically restarted if it fails unexpectedly (the security server is not restarted if it detects an error and stops). The ARM element type is SYSKERB and the ARM element name is EUVFKDC_system-name. The ARM policy can be used to override the default registration values if needed. Refer to z/OS MVS Programming: Sysplex Services Guide for more information on automatic restart management.

User response: None

EUVF04073I Security server restarting on system.
Explanation: The security server is being restarted following an unexpected failure. The RESTART_ATTEMPTS value in the ARM policy determines the number of restarts attempted. Refer to z/OS MVS Programming: Sysplex Services Guide for more information on automatic restart management.

User response: None

EUVF04074E Unable to register for restart: Error error-code, Reason reason-code.
Explanation: The security server is unable to register with ARM (Automatic Restart Management). The IXCARM request failed with the indicated error and reason codes. See the description of the IXCARM macro in z/OS MVS Programming: Sysplex Services Reference for more information on the error.

User response: Contact your service representative if you are unable to correct the error.

EUVF04075E Cryptographic status.
Explanation: This message is displayed in response to the Kerberos security server DISPLAY CRYPTO command. The remaining lines in this multi-line message display the available encryption types and whether encryption and decryption operations are performed using the Integrated Cryptographic Service Facility (ICSF).

User response: None

EUVF04076E Unable to open access control file filename: error-text.
Explanation: The Kerberos security server was unable to open an access control file. The security server uses this file to control access to the Kerberos functions. The error text is returned by the strerror() routine.

User response: Verify that all path components exist, the security server is running with UID 0, and the access control file exists. Contact your service representative if the error persists.
Messages

EUVF04077E Unable to read access control file
filename: error-text

Explanation: The Kerberos security server is unable to read an access control file. The error text is returned by the strerror() routine.

User response: Contact your service representative if the error persists.

EUVF04078E Unable to convert expression to a regular expression: error-text

Explanation: The Kerberos security server is unable to parse a line in the administration access control file. The expression cannot be converted to a regular expression for the indicated reason. The error text is returned by the strerror() routine.

User response: Correct the expression in the administration access control file. Contact your service representative if the error persists.

EUVF04079E Unable to decode database entry for name: Status status-code - status-message

Explanation: The Kerberos security server is unable to decode a database entry.

User response: Contact your service representative.

EUVF04080E Unable to delete database entry for name: error-message

Explanation: The Kerberos security server is unable to delete an entry from the registry database.

User response: Contact your service representative if the error persists.

EUVF04081E Unable to validate database master key: Status status-code - status-message

Explanation: The Kerberos security server is unable to validate the database master key. This error can occur if the master key stash file is generated using the wrong database password. This error also can occur when loading a new database if the wrong master key is entered in response to the database password prompt.

User response: For an existing database, create a master key stash file containing the correct database master key. For a new database, enter the correct database master key when prompted. Contact your service representative if the error persists.

EUVF04082E The option-name option requires a value.

Explanation: A command option is specified without a corresponding value.

User response: Specify a value for the indicated option.

EUVF04083E option-name is not a valid command option.

Explanation: An unrecognized command option is specified.

User response: Specify a valid command option.

EUVF04084E The option-name option is not valid for the 'function-name' function.

Explanation: A valid option is specified but the option is not valid for the requested function.

User response: Specify a valid command option.


Explanation: This message displays the command syntax for the kdb5_ndbm command.

User response: None

EUVF04086E No database utility function specified.

Explanation: A database utility command is entered without specifying a function to be performed.

User response: Specify a database utility function.

EUVF04087E function-name is not a valid database utility function.

Explanation: An unrecognized function is specified for a database utility command.

User response: An unrecognized function is specified for a database utility command.

EUVF04088E Unable to create KDC database: Status status-code - status-message

Explanation: The Kerberos security server is unable to create the registry database.

User response: Ensure that the failing command is being run under a user ID with write access to the /var/skrb/krb5kdc directory and to all of the files in that directory. Contact your service representative if the error persists.
Messages

EUVF04089E Unable to obtain the default realm:
Status status-code - status-message
Explanation: The krb5_get_default_realm() function failed.
User response: Verify that the /etc/skrb/krb5.conf configuration file exists and contains an entry for the default realm. Contact your service representative if the error persists.

EUVF04090E Encryption type name is not supported.
Explanation: An unsupported encryption type was specified.
User response: Specify a supported encryption type.

EUVF04091R Enter the KDC database master password:
Explanation: Enter the master password for the KDC database. The password should not be obvious or easily guessed since it will be used to generate the master key for the database. The master key is used to encrypt the database entries.
User response: Enter the password string for the database master key.

EUVF04092R Re-enter the KDC database master password:
Explanation: Re-enter the master password for the KDC database to verify the password was entered correctly.
User response: Enter the same password string as you entered for the initial prompt.

EUVF04093E Unable to read the KDC database master password: Status status-code - status-message
Explanation: The Kerberos security server is unable to prompt for the database master password.
User response: Contact your service representative if the error persists.

EUVF04094E Unable to generate the KDC database master key: Status status-code - status-message
Explanation: The Kerberos security server is unable to convert the password string into an encryption key.
User response: Contact your service representative.

EUVF04095I KDC database master key created.
Explanation: The KDC database master key has been created.
User response: None

EUVF04096E A KDC database already exists.
Explanation: A request to create a new KDC database cannot be completed because a database already exists.
User response: Use the kdb5_ndbm command to remove the existing database and then retry the failing command.

EUVF04097E Unable to delete database file filename: error-text
Explanation: The Kerberos security server is unable to delete a database file. The error text is returned by the strerror() routine.
User response: Verify that the command is being run by a user ID with UID 0. Contact your service representative if the error persists.

EUVF04098I KDC database files deleted.
Explanation: The KDC database files have been deleted.
User response: None

EUVF04099I KDC database created.
Explanation: The KDC database has been created.
User response: None

EUVF04100E The dump filename must be specified.
Explanation: A database dump or load function was requested but no dump filename is provided.
User response: Specify the dump filename.

EUVF04101E Unable to dump the KDC database: Status status-code - status-message
Explanation: The Kerberos security server is unable to dump the KDC database.
User response: Contact your service representative if the error persists.

EUVF04102I KDC database dump file filename created.
Explanation: The KDC database has been dumped to the indicated file.
User response: None

EUVF04103E Unable to load the KDC database:

Status status-code - status-message

Explanation: The Kerberos security server is unable to load the KDC database.

User response: Contact your service representative.

EUVF04104I KDC database loaded from file filename.

Explanation: The KDC database has been loaded from the indicated file.

User response: None

EUVF04105E The KDC database does not exist.

Explanation: An attempt to read from the KDC database failed because the database does not exist.

User response: Verify that the database files exist. The files are located in the /var/skrb/krb5kdc directory. Contact your service representative if the error persists.

EUVF04106R Enter the database dump password:

Explanation: Enter the password for the database dump. The password should not be obvious or easily guessed since it will be used to encrypt the database entries in the dump.

User response: Enter the password string for the database dump key.

EUVF04107R Re-enter the database dump password:

Explanation: Re-enter the password for the database dump to verify the password was entered correctly.

User response: Enter the same password string as you entered for the initial prompt.

EUVF04108E Unable to read the database dump password: Status status-code - status-message

Explanation: The Kerberos security server is unable to prompt for the database dump password.

User response: Contact your service representative if the error persists.

EUVF04109E Unable to generate the database dump key: Status status-code - status-message

Explanation: The Kerberos security server is unable to convert the password string into an encryption key.

User response: Contact your service representative.

EUVF04110E Unable to write to dump file filename: error-text

Explanation: The Kerberos security server is unable to write to the indicated database dump file. The error text is returned by the strerror() routine.

User response: Verify that the user has write access to the directory and the file. Contact your service representative if the error persists.

EUVF04111E Unable to read from dump file filename: error-text

Explanation: The Kerberos security server is unable to read from the indicated database dump file. The error text is returned by the strerror() routine.

User response: Verify that the user has read access to the directory and the file. Contact your service representative if the error persists.

EUVF04112E Principal name references unknown policy name.

Explanation: A principal entry in the Kerberos database contains a reference to an unknown policy. This indicates the database has become corrupted.

User response: Either restore the database from a backup or remove the policy reference from the principal entry. Contact your service representative if the error persists.

EUVF04113E Database entry name with size number exceeds maximum size number.

Explanation: A database entry is larger than the maximum supported size. This indicates the database has become corrupted.

User response: Restore the database from a backup. Contact your service representative if the error persists.

EUVF04114E Architected principal name is not found in the KDC database.

Explanation: The Kerberos security server is unable to locate a required principal in the database. This indicates the database has become corrupted.

User response: Restore the database from a backup. Contact your service representative if the error persists.

EUVF04115W Password history for principal with number entries is too large.

Explanation: The password history for the indicated principal has become too large to be stored in the Kerberos database. The oldest entries will be removed until the resulting history is small enough to fit in a database record.
Messages

User response: Reduce the history count for the policy associated with the principal.

EUVF04116E  File filename does not contain a valid database dump.
Explanation: The indicated file does not contain a valid Kerberos database dump. This problem can occur if the dump is created using the database utility provided with an older Kerberos implementation.
User response: Recreate the dump using the current level of the Kerberos database utility command.

EUVF04117E  Dump record type name is not valid.
Explanation: A record in the database dump file was not recognized.
User response: Contact your support representative.

EUVF04118E  Unable to rename database file from oldname to newname: error-text
Explanation: The Kerberos security server is unable to rename a database file. The error text is returned by the strerror() routine.
User response: Contact your service representative.

EUVF04119E  No history key is available for master key type encryption-type.
Explanation: The history principal (kadmin/history) does not have a key for the encryption type defined by the database master key.
User response: Change the keys for the history principal and generate a new key with the same encryption type as the database master key.

EUVF04120E  Unable to encrypt database entry for name: Status status-code - status-message
Explanation: The Kerberos security server was unable to encrypt an entry in the KDC database.
User response: Contact your service representative.

EUVF04121E  Unable to decrypt database entry for name: Status status-code - status-message
Explanation: The Kerberos security server is unable to decrypt an entry in the KDC database. This error can be caused by an incorrect database master key.
User response: For a secondary KDC, destroy the existing Kerberos database and then recreate it from the primary KDC database. Ensure that the correct database master key is entered when you are prompted for the master password. Contact your service representative if the error persists.

EUVF04122E  Principal name name is not valid.
Explanation: A principal name is not composed of valid graphical characters as determined by the current locale. In addition, the backslash and commercial at-sign characters are not allowed in a principal name.
User response: Use only valid graphical characters in principal names.

EUVF04123E  Policy name name is not valid.
Explanation: A policy name is not composed of valid graphical characters as determined by the current locale. In addition, the backslash character is not allowed in a policy name.
User response: Use only valid graphical characters in principal names.

EUVF04124E  Unrecognized propagation role specified for name.
Explanation: The kpropd.acl access control file contains an unrecognized role specified for the indicated server entry. The valid roles are Primary, Replace, Compat, and Update.
User response: Specify a valid propagation role.

EUVF04125E  Unable to resolve host principal for name: Status status-code - status-message
Explanation: The Kerberos security server is unable to convert a host name to a Kerberos principal. This error can occur if the host name is not defined in the DNS name server or the DNS name server cannot be reached.
User response: Ensure the host name is defined and the DNS name server can be reached.

EUVF04126E  Unable to log type request from name: Status status-code - status-message
Explanation: The Kerberos security server is unable to log an administration request from the indicated user. This means that the database update will not be propagated to secondary security servers that are using the update protocol. The change has been made to the database on the primary security server.
User response: Use the Kerberos security server PROP command to force a full database replication for each secondary security server. Contact your service representative if the error persists.
Database propagation failed to host: Status status-code - status-message
Explanation: The Kerberos security server is unable to send a database update to the indicated secondary server.
User response: Verify that the secondary server is running and that there are no network problems. The update will be retried at the next propagation interval or the PROP command can be used to initiate a manual replication. Contact your service representative if the error persists.

Unable to fetch update number: error-text
Explanation: The Kerberos security server is unable to retrieve the indicated update from its database. The database files are stored in the /var/skrb/krb5kdc directory. The error text is returned by the strerror() routine.
User response: Verify that the /var/skrb/krb5kdc directory exists and is mounted in read/write mode. Contact your service representative if the error persists.

Unable to store update number: error-text
Explanation: The Kerberos security server is unable to store the indicated update in its database. The database files are stored in the /var/skrb/krb5kdc directory. The error text is returned by the strerror() routine.
User response: Verify that the /var/skrb/krb5kdc directory exists and is mounted in read/write mode. Contact your service representative if the error persists.

Update to delete update number: error-text
Explanation: The Kerberos security server is unable to delete the indicated update from its database. The database files are stored in the /var/skrb/krb5kdc directory. The error text is returned by the strerror() routine.
User response: Verify that the /var/skrb/krb5kdc directory exists and is mounted in read/write mode. Contact your service representative if the error persists.

Propagation complete.
Explanation: The Kerberos security server has successfully completed a database propagation request.
User response: None

Propagation failed: Status status-code - status-message
Explanation: The Kerberos security server is unable to process a PROP command for the indicated reason. The status of the secondary KDC involved in the propagation remains unchanged.
User response: Ensure that the secondary KDC is running and that there are no network problems. Contact your service representative if the error persists.

Missing command option.
Explanation: A Kerberos security server command was entered that requires a command option but no command option was entered.
User response: Enter a complete Kerberos security server command.

No propagation status.
Explanation: This message is displayed in response to the Kerberos security server DISPLAY PROP command when database propagation is not enabled or the security server is a secondary security server.
User response: Enter the DISPLAY PROP command at the primary security server for the realm.

The PROP command is not available.
Explanation: The Kerberos security server PROP command was entered on a system that does not support database propagation. This can occur if the Kerberos database does not support propagation, propagation is not enabled, or the Kerberos security server is not the primary security server for the realm.
User response: None

The primary security server cannot be changed.
Explanation: The propagation control file has been updated to change the role of the local Kerberos security server from primary to secondary or from secondary to primary while the security server is running. The security server must be stopped and then restarted in order to change its role.
User response: Stop both security servers involved in the role change, propagate the latest version of the Kerberos database from the old primary system to the
new primary system, and then restart both security servers.

EUVF04138E Unable to receive propagation from host - Status status-code - status-message
Explanation: The Kerberos security server was unable to receive a database propagation from the indicated host.
User response: Verify that the primary security server is correctly identified in the kpropd.acl configuration file and that there are no network errors. The primary security server must have a DNS entry and the entry must be associated with the IP address used for the database propagation. Contact your service representative if the error persists.

EUVF04139E Administration services are not available.
Explanation: The Kerberos security server database does not support the administration functions. Database administration must be performed using the system security commands.
User response: None

EUVF04140I Administration services are enabled.
Explanation: Kerberos administration services are enabled.
User response: None

EUVF04141I Administration services are disabled.
Explanation: Kerberos administration services are disabled. Either the Kerberos database does not support the administration functions or the DISABLE ADMIN command has been issued.
User response: Use the Kerberos security server ENABLE ADMIN command to enable administration services if the Kerberos database supports the administration functions.

EUVF04142I kpropd [-r realm] [-P port] [-v]
Explanation: This message lists the command syntax for the kpropd command.
User response: None

EUVF04143E port is not a valid port specification.
Explanation: The port specification is not a decimal number between 1 and 65535.
User response: Specify a valid port.

EUVF04144E No propagation servers are defined.
Explanation: No propagation servers are defined in the /etc/skrb/home/kdc/kpropd.acl configuration file. A database propagation is accepted only from servers listed in this configuration file.
User response: Add the name of the primary KDC for the realm to the propagation configuration file.

EUVF04145I Listening for database propagation on port number.
Explanation: The kpropd command is ready to receive a database propagation.
User response: Initiate the database propagation from the primary KDC for the realm.

EUVF04146I Receiving database propagation from server.
Explanation: The kpropd command is receiving a database propagation.
User response: None

EUVF04147I Network interface status.
Explanation: This message is displayed in response to the Kerberos security server DISPLAY NETWORK command. The remaining lines in this multi-line message display the status of each network interface. A network interface is ACTIVE if the Kerberos security server is listening for requests on that interface. A network interface is INACTIVE if the interface has been stopped and has not been restarted yet. No entry is displayed for network interfaces that have never been active since the security server was started. The Kerberos security server checks for network interface changes based on the value of the SKDC_NETWORK_POLL environment variable, which has a default value of 5 minutes.
User response: None

EUVF04148I No active network interfaces.
Explanation: There are no active network interfaces.
User response: None

EUVF04149R Enter 1 to delete the database or 0 to cancel the request.
Explanation: The kdb5_ndbm destroy command has been issued and the user is being prompted to confirm the request to delete the KDC database.
User response: Enter 1 to continue with the delete request or 0 to cancel the delete request.
EUVF04150I Component trace started.

Explanation: The Kerberos component trace has been started. The jobs specified on the TRACE CT command may be already running or may be started after the TRACE CT command is processed. However, any jobs that are already running must have been started after the SKRBKDC started task was started.

User response: None.

EUVF04151I Component trace ended.

Explanation: The Kerberos component trace has ended.

User response: None.

EUVF04152I Component trace started for jobname.

Explanation: The Kerberos component trace has started for the indicated job. This message is displayed for each job specified on the TRACE CT command when the application makes its first Kerberos API request after component tracing has been started.

User response: None.

EUVF04153W Component trace buffer overflow.

Explanation: Both of the Kerberos component trace buffers are full and additional trace entries cannot be added until the trace writer has written the current data to the trace dataset. Trace entries will be discarded until the trace writer has emptied one of the trace buffers.

User response: Increase the trace buffer size specified on the TRACE command and restart the component trace.

EUVF04154E Incorrect OPTIONS syntax.

Explanation: The OPTIONS parameter syntax on the IPCS CTRACE command is not correct for a Kerberos component trace. Kerberos supports four options: JOB, PID, TID and LVL. The CTRACE OPTIONS parameter is specified as CTRACE COMP(SKRBKDC) OPTIONS((JOB(name), PID(hexid), TID(hexid), LVL(hexdigit))).

User response: Specify a valid OPTIONS parameter.

EUVF04155E Incorrect trace option.

Explanation: An incorrect trace option was specified on the IPCS CTRACE command for a Kerberos component trace. Kerberos supports four options: JOB, PID, TID and LVL. The CTRACE OPTIONS parameter is specified as CTRACE COMP(SKRBKDC) OPTIONS((JOB(name), PID(hexid), TID(hexid), LVL(hexdigit))). The job name must be 1-8 characters. The PID and TID identifiers must be 1-8 hexadecimal digits. The message level must be a single hexadecimal digit.

User response: Specify a valid OPTIONS parameter.

EUVF04156E Duplicate trace option.

Explanation: A Kerberos trace option is specified more than once on the IPCS CTRACE command.

User response: Do not specify the same trace option more than once.

EUVF04157E Incorrect hexadecimal value.

Explanation: The value for the PID, TID and LVL trace options for the IPCS CTRACE command must be hexadecimal values. The PID and TID values may contain 1-8 hexadecimal digits while the LVL value must be a single hexadecimal digit.

User response: Specify a valid hexadecimal value.

EUVF04158I Kerberos KDC services are enabled.

Explanation: The SKRBKDC started task will provide Kerberos Key Distribution Center services. KDC services can be disabled by specifying PARM='-nokdc' instead of PARM='-kdc' when starting the SKRBKDC started task.

User response: None.

EUVF04159I Kerberos KDC services are disabled.

Explanation: The SKRBKDC started task will not provide Kerberos Key Distribution Center services. KDC services can be enabled by specifying PARM='-kdc' instead of PARM='-nokdc' when starting the SKRBKDC started task.

User response: None.

EUVF04160E Unrecognized SKRBKDC start parameter.

Explanation: An unrecognized parameter is specified in the PARMS field of the SKRBKDC started task. The supported parameters are -kdc and -nokdc.

User response: Specify a valid parameter and restart the SKRBKDC started task.
Messages

Messages for Kerberos commands (numbers EUVF06000 - EUVF06999)

- **EUVF06001E** The option option requires value.
  
  **Explanation:** A command line parameter is specified that requires a value. No value is found.
  
  **User response:** Specify a value for the command line parameter.

- **EUVF06002E** option is not a valid command option.
  
  **Explanation:** An unrecognized command line parameter is specified.
  
  **User response:** Specify a valid command line parameter.

- **EUVF06003E** Time delta value value is not valid.
  
  **Explanation:** The time delta specified is not correct. Time deltas are specified as a string of time values with no intervening blanks. Each time value consists of a decimal number followed by w, d, h, m, or s corresponding to weeks, days, hours, minutes, and seconds. If a number is specified without a letter, it defaults to hours. For example, 1d6h30m specifies a time delta of 1 day, 6 hours, 30 minutes.
  
  **User response:** Specify a valid time delta value.

  
  **Explanation:** This message displays the valid command line options for the kinit command.
  
  - **-s** Use the Kerberos principal associated with the current system identity. No password is used since the system has already verified the identity.
  - **-c** Specify the credentials cache name. The default credentials cache is used if this option is not specified.
  - **-k** Obtain the password from a key table. The user is prompted for the password if this option is not specified.
  - **-t** Specify the name of the key table. The default key table is used if this option is not specified.
  - **-A** Request a ticket that does not contain a client address list.
  - **-f** Request a ticket that can be forwarded.
  - **-p** Request a ticket that a proxy can use.
  - **-R** Renew an existing ticket.
  - **-l** Renew an existing ticket.
  
  -r Request a ticket that can be renewed for the specified time period.

  Delta times are specified as a string of time values with no intervening blanks. Each time value consists of a decimal number followed by w, d, h, m, or s, corresponding to weeks, days, hours, minutes, and seconds. If a number is specified without a letter, it defaults to hours. For example, 1d6h30m specifies a time delta of 1 day, 6 hours, 30 minutes.

  If no client principal is specified, the default principal for the credentials cache is used.

  **User response:** None

- **EUVF06005E** Unable to parse principal name.
  
  **Status** status-code - status-message.
  
  **Explanation:** The kinit command is unable to parse the principal name.
  
  **User response:** Specify a valid principal name on the kinit command line.

- **EUVF06006E** No options allowed when renewing or validating ticket.
  
  **Explanation:** No options may be specified when the -R option is specified for the kinit command.
  
  **User response:** Do not specify any other options when the -R option is specified.

- **EUVF06007E** Unable to obtain name of default credentials cache.
  
  **Explanation:** The kinit command is unable to obtain the default credentials cache name.
  
  **User response:** Verify that the KRB5CCNAME environment variable, if set, specifies a valid credentials cache name. Contact your service representative if the error persists.

- **EUVF06008E** Unable to resolve credentials cache name. Status status-code - status-message.
  
  **Explanation:** The kinit command is unable to resolve the credentials cache name.
  
  **User response:** Enter a valid credentials cache name. Contact your service representative if the error persists.

- **EUVF06009E** No initial ticket available.
  
  **Explanation:** The kinit command is unable to renew the initial ticket because no ticket is available in the credentials cache or because the ticket principal does
not match the principal specified on the kinit command line.

**User response:** Ensure the credentials cache contains a renewable initial ticket.

---

**EUVF06010E**  Principal name must be specified.

**Explanation:** No principal name is specified on the kinit command line but the credentials cache does not contain a default principal.

**User response:** Specify the principal name.

---

**EUVF06011E** Unable to retrieve principal from credentials cache name. Status status-code - status-message.

**Explanation:** The kinit command is unable to get the default principal name from the credentials cache.

**User response:** Verify that the credentials cache is not modified. Contact your service representative if the error persists.

---

**EUVF06012E** Unable to retrieve ticket from credentials cache name. Status status-code - status-message.

**Explanation:** The kinit command is unable to retrieve the ticket-granting ticket from the credentials cache. The most likely cause is that the ticket-granting ticket has expired.

**User response:** Use the kinit command to obtain a new initial ticket.

---

**EUVF06013E** Initial ticket is not renewable.

**Explanation:** The kinit command is invoked with the -R option but the initial ticket in the credentials cache is not renewable.

**User response:** Use the kinit command with the -r option to obtain a renewable initial ticket.

---

**EUVF06014E** Unable to obtain initial credentials. Status status-code - status-message.

**Explanation:** The kinit command is unable to obtain initial credentials from the Kerberos security server.

**User response:** Ensure the security server is operational and the correct password is entered. Contact your service representative if the error persists.

---

**EUVF06015E** Unable to resolve key table name. Status status-code - status-message.

**Explanation:** The kinit command is unable to resolve the key table name.

**User response:** Ensure the key table exists and can be accessed. Contact your service representative if the error persists.

---

**EUVF06016E** Password is not correct for name.

**Explanation:** The supplied password is not correct.

**User response:** Provide the correct password for the principal.

---

**EUVF06017R** Enter password:

**Explanation:** The kinit command is waiting for the user to enter the password.

**User response:** Enter your password.

---

**EUVF06018E** Unable to read password. Status status-code - status-message.

**Explanation:** The kinit command is unable to read the password.

**User response:** Contact your service representative if the error persists.

---

**EUVF06019E** Unable to store initial credentials in credentials cache name. Status status-code - status-message.

**Explanation:** The kinit command is unable to store the new credentials in the credentials cache.

**User response:** Ensure the credentials cache is available to the user. Contact your service representative if the error persists.

---


**Explanation:** This message displays the valid command line options for the klist command.

- **-c** List the contents of a credentials cache. This option is mutually exclusive with the -k option. This option is the default if neither -c nor -k is specified.

- **-k** List the contents of a key table. This option is mutually exclusive with the -c option.

- **-a** Display expired tickets.

- **-e** Display ticket encryption types.

- **-f** Display ticket flag values.

- **-s** Set exit status based on valid TGT existence.

- **-t** Show key table timestamps.

- **-K** Show key table keys.

If no name is specified, the default credentials cache or key table is used.
Messages

User response:  None

EUVF06021E  option-1 and option-2 may not be specified together
Explanation:  Mutually exclusive options are specified.
User response:  Specify just one of the options.

EUVF06022E  No default credentials cache found.
Explanation:  No credentials cache name is specified on the klist command line and a default credentials cache was not found.
User response:  Use the kinit command to create a default credentials cache or specify the name of the credentials cache on the klist command line.

EUVF06023E  Unable to resolve credentials cache name. Status status-code - status-message.
Explanation:  The klist command is unable to resolve the credentials cache name.
User response:  Enter a valid credentials cache name. Contact your service representative if the error persists.

EUVF06024E  Unable to retrieve principal from credentials cache name. Status status-code - status-message.
Explanation:  The klist command is unable to get the default principal name from the credentials cache.
User response:  Verify that the credentials cache is not modified. Contact your service representative if the error persists.

EUVF06025E  Unable to retrieve ticket from credentials cache name. Status status-code - status-message.
Explanation:  The klist command is unable to retrieve a ticket from the credentials cache.
User response:  Use the kinit command to create a new credentials cache.

EUVF06026E  Unable to decode ticket. Status status-code - status-message
Explanation:  The klist command is unable to decode a ticket retrieved from the credentials cache.
User response:  Verify that the credentials cache is not modified. Contact your service representative if the error persists.

EUVF06027E  No default key table found.
Explanation:  No key table name is entered on the klist command line and a default key table is not found.
User response:  Specify the key table name.

EUVF06028E  Unable to resolve key table name. Status status-code - status-message.
Explanation:  The klist command is unable to resolve the key table name.
User response:  Enter a valid key table name. Contact your service representative if the error persists.

EUVF06029E  Unable to read entry key table name. Status status-code - status-message.
Explanation:  The klist command is unable to read an entry from the key table.
User response:  Verify that the key table is not modified. Contact your service representative if the error persists.

EUVF06030I  Usage: kdestroy [-c cache_name] [-e exp_delta]
Explanation:  This message displays the valid command line options for the kdestroy command.
- c  Specify the credentials cache name. This option is mutually exclusive with the -e option. The default credentials cache is used if this option is not specified.
- e  Specify the credentials expiration time delta value. This option is mutually exclusive with the -c option. The expiration time is computed by subtracting this delta from the current time. A credentials cache is deleted if all of the credentials in the cache have an expiration time earlier than the computed expiration time.
User response:  None

EUVF06031E  No default credentials cache found.
Explanation:  No credentials cache name is specified on the kdestroy command line and a default credentials cache was not found.
User response:  Use the kinit command to create a default credentials cache or specify the name of the credentials cache on the kdestroy command line.

EUVF06032E  Unable to resolve credentials cache name. Status status-code - status-message.
Explanation:  The kdestroy command is unable to resolve the credentials cache name.
### Messages

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
<th>Operation</th>
<th>Principal Name</th>
<th>Key Table</th>
<th>User Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUVF06040E</td>
<td>Value is not a positive whole number.</td>
<td>You must specify add, delete, list, check or merge.</td>
<td>Specifying a negative integer was entered.</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>EUVF06041E</td>
<td>Unable to destroy credentials cache</td>
<td>You must specify add, delete, list, check or merge.</td>
<td>Status code - status-message.</td>
<td>None</td>
<td>You must specify add, delete, list, check or merge.</td>
</tr>
<tr>
<td>EUVF06042E</td>
<td>No default key table found.</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>EUVF06043E</td>
<td>Unable to retrieve ticket from credentials cache</td>
<td>None</td>
<td>Status code - status-message.</td>
<td>None</td>
<td>You must specify add, delete, list, check or merge.</td>
</tr>
<tr>
<td>EUVF06044E</td>
<td>Unable to resolve key table</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>EUVF06045E</td>
<td>You must specify the principal name.</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>EUVF06046E</td>
<td>Unable to parse principal name.</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>EUVF06047E</td>
<td>The option option is not valid for operation request.</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

**User response:** Enter a valid credentials cache name. Contact your service representative if the error persists.

**Explanation:** The kdestroy command is unable to delete the credentials cache.

**User response:** Verify that the credentials cache exists and is accessible. Contact your service representative if the error persists.

**Explanation:** The kdestroy command has successfully deleted the credentials cache.

**User response:** None

**Explanation:** The kdestroy command is unable to read the credentials cache directory.

**User response:** Ensure the credentials cache directory exists and is accessible. Contact your service representative if the error persists.

**Explanation:** The kdestroy command is unable to read a ticket from the credentials cache.

**User response:** Use the kinit command to create a new credentials cache.

**Explanation:** The kdestroy command is unable to resolve the key table name.

**User response:** Specify the key table name.

**Explanation:** The kdestroy command was unable to read an entry from the key table.

**User response:** Verify that the key table was not modified. Contact your service representative if the error persists.

**Explanation:** The principal name is not specified for a key table add or delete operation.

**User response:** Specify the principal name.

**Explanation:** An option was specified on the keytab command line that is not valid for the requested operation.

**User response:** Specify options that are supported by the requested operation.
Messages

EUVF06048R  Enter password:
Explanation: The keytab command needs the user password to complete a request.
User response: Enter your password.

EUVF06049R  Re-enter password:
Explanation: The keytab command needs the user password to complete a request.
User response: Enter your password.

EUVF06050E  Unable to read password. Status status-code - status-message.
Explanation: The keytab command is unable to obtain the password from the user.
User response: Contact your service representative if the error persists.

EUVF06051E  Unable to add entry to key table name.
Explanation: The keytab command is unable to add an entry to the key table.
User response: Contact your service representative if the error persists.

EUVF06052E  Unable to remove entry from key table name.
Explanation: The keytab command was unable to remove an entry from the key table.
User response: Contact your service representative if the error persists.

EUVF06053E  Key version version not found for principal in keytab keytab.
Explanation: The keytab command was unable to operate on the requested key version because the key table entry does not exist.
User response: None

EUVF06054E  No entries found for principal in keytab keytab.
Explanation: The keytab command was not able to find any key table entries for the specified principal.
User response: None

EUVF06055I  Usage: ksetup [-h host] [-n name] [-p password] [-e]
Explanation: This message displays the valid command line options for the ksetup command.
-h Specify the host for the LDAP server. The host is specified as host-name:port-number. The default LDAP port of 389 is used if the port number is omitted. The LDAP server specification in the Kerberos configuration file is used if this option is omitted.
-n Specify the distinguished name to use when binding to the LDAP server. The LDAP_BINDDN environment variables used if this option is omitted.
-p Specify the password to use when binding to the LDAP server. The LDAP_BINDPW environment variable is used if this option is omitted.
-e Echo each command to stdout.
User response: None

EUVF06056E  command is not a valid subcommand.
Explanation: The indicated subcommand is not valid for the ksetup command.
User response: Enter a valid subcommand.

EUVF06057I  Valid subcommands are addhost, addkdc, addpwd, addadmin, delhost, delkdc, delpwd, deladmin, listhost, listkdc, listpwd, listadmin, exit.
Explanation: This message lists the valid subcommands for the ksetup command.
User response: None

EUVF06058E  Unable to initialize LDAP client. error-text.
Explanation: The ksetup command was unable to initialize the LDAP client runtime. The error text provides additional information on the cause of the failure.
User response: Contact your service representative.

EUVF06059E  Unable to bind to LDAP server. error-text.
Explanation: The ksetup command was unable to bind to the LDAP server. The error text provides additional information on the cause of the failure.
User response: Ensure that the LDAP server is operational and that the bind name and password are correct. Contact your service representative if the error persists.
EUVF06060E  Realm name must be specified.
Explanation: The realm name must be specified on the ksetup subcommand.
User response: Specify a realm name.

EUVF06061E  Host name must be specified.
Explanation: The host name must be specified on the ksetup subcommand.
User response: Specify a host name.

EUVF06062E  Too many positional parameters.
Explanation: Too many positional parameters are specified.
User response: Specify a valid subcommand.

EUVF06063E  Host name already exists.
Explanation: The host cannot be added to the LDAP directory because it already exists.
User response: None.

EUVF06064E  Root domain name is not defined.
Explanation: The root domain is not defined in the LDAP directory.
User response: Add the root domain to the LDAP directory by adding the appropriate naming suffix entry to the LDAP server configuration file.

EUVF06065E  Realm name name is not valid.
Explanation: A realm name consists of one or more domain components separated by periods.
User response: Enter a valid realm name.

EUVF06066E  The name function detects an error.
  DN: distinguished-name error-text
Explanation: An LDAP function detected an error for the specified distinguished name.
User response: Ensure that the LDAP server is operational. Contact your service representative if the error persists.

EUVF06067E  Insufficient storage available.
Explanation: There is not enough storage available to process the request.
User response: Increase the amount of storage available to the command.

EUVF06068E  Host name name is not valid.
Explanation: A host name may not contain a colon.
User response: Enter a valid host name.

EUVF06069E  Port number value is not valid.
Explanation: The port value is not a valid number.
User response: Enter a valid number.

EUVF06070E  Host name is not defined.
Explanation: The ksetup command was unable to delete the indicated host because it is not defined in the LDAP directory.
User response: None.

EUVF06071E  No KDC defined for host name.
Explanation: The ksetup command was unable to delete the KDC definition because no KDC is defined for the indicated host.
User response: None.

EUVF06072E  Unable to obtain default realm name.
  Status status-code - status-message.
Explanation: The ksetup command is unable to obtain the default realm name.
User response: Ensure the default realm name is set in the Kerberos configuration file. Contact your service representative if the error persists.

EUVF06073E  Principal name not allowed with -s option.
Explanation: The principal name may not be specified on the kinit command when the -s option is specified.
User response: Do not specify a principal name when using the system identity.

EUVF06074E  Principal name is not valid. Status
  status-code - status-message.
Explanation: The principal name specified on the kvno command line is not valid.
User response: Enter a valid principal name.

EUVF06075E  Network credentials are not available.
  Status status-code - status-message.
Explanation: No default network credentials are available.
User response: Use the kinit command to create a default credentials cache and then retry the kvno command.
Messages

EUVF06076E Unable to obtain temporary credentials cache. Status status-code - status-message.
Explanation: The kvno command is unable to create a temporary credentials cache.
User response: Contact your service representative if the error persists.

EUVF06077E Unable to obtain service ticket for principal principal. Status status-code - status-message.
Explanation: An attempt to obtain a service ticket for the service principal has failed. The Status contains a more specific reason for the failure.
User response: Verify that the Kerberos security server is started and that the principal is defined in the KDC and is enabled for service tickets, then retry the command. Contact your service representative if the error persists.

EUVF06078E Principal name is not valid. Status status-code - status-message.
Explanation: The principal name specified on the kpasswd command line is not valid.
User response: Enter a valid principal name.

EUVF06079E Unable to read default credentials cache name. Status status-code - status-message.
Explanation: The kpasswd command is unable to obtain the principal name from the default credentials cache.
User response: Create a new default credentials cache using the kinit command and then retry the kpasswd command.

EUVF06080E No default credentials cache.
Explanation: There is no default credentials cache for the current user.
User response: Either create a default credentials cache using the kinit command or specify the principal name on the kpasswd command line.

EUVF06081E Unable to parse name. Status status-code - status-message.
Explanation: The kpasswd command is unable to parse the principal name.
User response: Enter a valid principal name and retry the command. Contact your support representative if the error persists.

EUVF06082E Unable to map user name to a Kerberos principal. SAF error code, Return code code, Reason code code.
Explanation: The kpasswd command is unable to map the user ID to a Kerberos principal. Refer to the description of the IRRSIM00 function in the z/OS Security Server RACF Callable Services document for more information on the error codes.
User response: Verify that the user ID is defined in the security database with an associated Kerberos principal.

EUVF06083I Changing password for principal.
Explanation: The kpasswd command is changing the password for the indicated principal.
User response: None

EUVF06084R Enter current password:
Explanation: The kpasswd command needs the current password for the principal.
User response: Enter the current password.

EUVF06085R Enter new password:
Explanation: The kpasswd command needs the new password for the principal.
User response: Enter the new password.

EUVF06086R Re-enter new password:
Explanation: The kpasswd command compares both new password values to check for typing errors.
User response: Enter the new password again.

EUVF06087E Unable to read password. Status status-code - status-message.
Explanation: The kpasswd command is unable to obtain a password from the user.
User response: Contact your service representative.

EUVF06088E Unable to obtain initial ticket. Status status-code - status-message.
Explanation: The kpasswd command is unable to obtain an initial ticket to the kadmin/changepw service.
User response: Verify that the kadmin/changepw principal is defined in the security database. Contact your service representative if the error persists.
Messages

EUVF06089E  Password is not correct for principal.
Explanation: The entered password is not correct.
User response: Enter the correct password for the principal. Contact your service representative if the error persists.

EUVF06090E  Unable to issue password change request. Status status-code - status-message.
Explanation: The kpasswd command was unable to send the password change request to the password server.
User response: Verify that the password server is defined properly and is operational. Contact your service representative if the error persists.

EUVF06091E  Password change request failed. Error code error-code - error-message.
Explanation: The password change request was rejected by the password server.
User response: Verify that the new password is valid for the user and that the user is authorized to change his password. Contact your service representative if the error persists.

EUVF06092E  Password change request failed. Error code error-code - error-message.
Server status: status-message.
Explanation: The password change request was rejected by the password server.
User response: Verify that the new password is valid for the user and that the user is authorized to change his password. Contact your service representative if the error persists.

EUVF06093E  Password changed.
Explanation: The password has been changed.
User response: None

EUVF06094E  Password change canceled.
Explanation: The password change request was canceled because no password was entered in response to the prompt.
User response: None

EUVF06095E  No password server defined for host name.
Explanation: The ksetup command is unable to delete a password server definition because no password server is associated with the indicated host.
User response: None

EUVF06096I Usage: kpasswd [-A] principal
Explanation: This message displays the valid command line options for the kpasswd command.
-A Specifies that an address list will not be included in the initial ticket used by the kpasswd command.
principal Specifies the principal whose password is to be changed.
User response: None

Explanation: This message displays the valid command line options for the kadmin command.
-r realm Specifies the Kerberos administration realm. The local realm is used if this option is not specified.
-p principal Specifies the administrator principal. The string /admin is appended to the principal obtained from the credentials cache if this option is not specified.
-k keytab Specifies the key table containing the password for the administrator principal. The user is prompted to enter the password if neither the -k nor the -w option is specified.
-w password Specifies the password for the administrator principal. The user is prompted to enter the password if neither the -k nor the -w option is specified.
-A Specifies that an address list will not be included in the initial ticket used by the kadmin command.
-e Echo each command to stdout.

Chapter 7. Messages 7-27
Messages

User response: None

EUVF06100E subcommand is not a valid subcommand.
Explanation: The specified subcommand is not valid for the kadmin command.
User response: Enter a valid subcommand.

EUVF06101I Valid subcommands:

```
list_principals (listprincs)
get_principal (getprinc)
add_principal (addprinc)
delete_principal (delprinc)
modify_principal (modprinc)
rename_principal (renprinc)
change_password (cpw)
list_policies (listpols)
get_policy (getpol)
add_policy (addpol)
modify_policy (modpol)
delete_policy (delpol)
get_prives (getprives)
add_key (ktadd)
exit (quit)
```
Explanation: This message lists the valid subcommands for the kadmin command.
User response: None

EUVF06102E Unable to obtain principal from default credentials cache. Status-code - Error-text.
Explanation: The kadmin command was unable to obtain the principal from the default credentials cache.
User response: Verify that the credentials cache can be accessed and has not been modified.

EUVF06103E Unable to determine the administration principal.
Explanation: The kadmin is unable to determine the administration principal.
User response: Either specify the -p command line option for the kadmin command or use the kinit command to set up a default credentials cache.

EUVF06104E Unable to initialize connection with administration server.
Explanation: The kadmin command is unable to establish a connection with the Kerberos administration server.
User response: Verify that the administration server is running and then retry the request.

EUVF06105E Unable to perform request-type administration request.
Explanation: The kadmin command is unable to perform the requested administration function.
User response: Verify that the administration server is running and then retry the request. Contact your service representative if the error persists.

EUVF06106E Too many positional parameters.
Explanation: Too many positional parameters are specified.
User response: Specify a valid subcommand.

EUVF06107I list_principals [expression]
Explanation: This message displays the syntax for the list_principals subcommand.
User response: None

EUVF06108E Unable to obtain default realm.
Explanation: The kadmin command is unable to get the default realm from the Kerberos configuration file.
User response: Verify that the default realm is defined in the Kerberos configuration file.

EUVF06109E No name specified.
Explanation: No object name is specified on a kadmin subcommand.
User response: Specify an object name.

EUVF06110I get_principal name
Explanation: This message displays the syntax for the get_principal subcommand.
User response: None

EUVF06111E Unable to parse principal name name.
Explanation: The kadmin command is unable to parse the indicated principal name.
User response: Specify a valid principal name.

EUVF06112I add_principal [options] [attributes] name
Explanation: This message displays the syntax for the add_principal subcommand.
User response: None
EUVF06113E  The name option requires a value.
Explanation:  The indicated kadmin subcommand option requires a value but no value was specified.
User response:  Specify a value for the option.

EUVF06114E  The date specified for the option is not valid.
Explanation:  The date is not valid. Refer to the z/OS Integrated Security Services Network Authentication Service Programming for a description of the valid date formats. This error can also occur if the specified date is in the past.
User response:  Specify a valid date.

EUVF06115E  Key version version is not valid.
Explanation:  The key version is not valid. The key version is an unsigned number between 1 and 2147483647.
User response:  Specify a valid key version.

EUVF06116R  Enter password:
Explanation:  The kadmin command is waiting for the user to enter the password.
User response:  Enter the password for the principal.

EUVF06117R  Re-enter password:
Explanation:  The kadmin command is waiting for the user to re-enter the password. The re-entered password must match the password that was entered previously.
User response:  Enter the password for the principal.

EUVF06118E  Password is too long.
Explanation:  The password is longer than 128 characters.
User response:  Enter a shorter password.

EUVF06119E  Unable to read password. Status status-code - status-message.
Explanation:  The kadmin command is unable to read the password.
User response:  Contact your service representative if the error persists.

EUVF06120I  list_policies [expression]
Explanation:  This message displays the syntax for the list_policies subcommand.
User response:  None

EUVF06121I  get_policy name
Explanation:  This message displays the syntax for the get_policy subcommand.
User response:  None

EUVF06122I  Principal name added.
Explanation:  The indicated principal has been added to the Kerberos database.
User response:  None

EUVF06123I  delete_principal name
Explanation:  This message displays the syntax for the delete_principal subcommand.
User response:  None

EUVF06124I  Principal name deleted.
Explanation:  The indicated principal has been deleted from the Kerberos database.
User response:  None

EUVF06125I  modify_principal [options] [attributes] name
Explanation:  This message displays the syntax for the modify_principal subcommand.
User response:  None

EUVF06126I  Principal name modified.
Explanation:  The indicated principal has been modified in the Kerberos database.
User response:  None

EUVF06127I  rename_principal oldname newname
Explanation:  This message displays the syntax for the rename_principal subcommand.
User response:  None

EUVF06128I  Principal oldname renamed to newname.
Explanation:  The indicated principal has been renamed in the Kerberos database.
User response:  None

EUVF06129E  Subcommand is too long.
Explanation:  The maximum length of a kadmin subcommand is 1023 characters.
User response:  Enter a shorter subcommand string.
Messages

EUVF06130I change_password [-randkey | -pw password] [-keepold] [-e keytypes] name
Explanation: This message displays the syntax for the change_password subcommand.
User response: None

EUVF06131I Random keys generated for name.
Explanation: Random keys have been generated for the indicated principal.
User response: None

EUVF06132I Administration request cancelled.
Explanation: The user canceled the current kadmin request by entering a zero-length password when prompted.
User response: None

EUVF06133I Password changed for name
Explanation: The password has been changed for the indicated principal.
User response: None

EUVF06134E value is not a valid numeric value.
Explanation: A positive number is required.
User response: Enter a valid number.

EUVF06135I add_policy [options] name
Explanation: This message displays the syntax for the add_policy subcommand.
User response: None

EUVF06136I Policy name added.
Explanation: The indicated policy has been added to the Kerberos database.
User response: None

EUVF06137I modify_policy [options] name
Explanation: This message displays the syntax for the modify_policy subcommand.
User response: None

EUVF06138I Policy name modified.
Explanation: The indicated policy has been modified in the Kerberos database.
User response: None

EUVF06139I delete_policy name
Explanation: This message displays the syntax for the delete_policy subcommand.
User response: None

EUVF06140I Policy name deleted.
Explanation: The indicated policy has been deleted from the Kerberos database.
User response: None

EUVF06141I help [subcommand]
Explanation: This message displays the syntax for the help subcommand.
User response: None

EUVF06142I exit
Explanation: This message displays the syntax for the exit subcommand.
User response: None

EUVF06143I add_key [keytab | -k] keytab_name [-keepold] [-e keytypes] principal_name
Explanation: This message displays the syntax for the add_key subcommand.
User response: None

EUVF06144I Keys generated for principal and added to keytab.
Explanation: Random keys have been generated for the indicated principal.
User response: None

EUVF06145E Unable to open key table name. Status status-code - status-message.
Explanation: The kadmin command is unable to open the indicated key table.
User response: Verify that the key table exists and can be accessed. Contact your service representative if the error persists.

EUVF06146E Unable to add entry to key table name. Status status-code - status-message.
Explanation: The kadmin command is unable to add an entry to the indicated key table.
User response: Verify that the key table can be accessed. Contact your service representative if the error persists.
EUVF06147I Authenticating as name.

Explanation: The kadmin command is obtaining an initial ticket for the indicated principal. The administration privileges associated with this principal are used for subsequent administration requests.

User response: None

EUVF06148I get_privs

Explanation: This message displays the syntax for the get_privs subcommand.

User response: None

EUVF06149E Encryption type name is not valid.

Explanation: An unrecognized encryption type was specified.

User response: Specify a valid encryption type.

EUVF06150E Salt type name is not valid.

Explanation: An unrecognized salt type was specified.

User response: Specify a valid salt type.

EUVF06151E Connection broken with the administration server.

Explanation: The connection with the administration server has been broken. This indicates either a network problem or a server failure.

User response: Verify the network connectivity with the administration server. Contact your service representative if the error persists.

EUVF06152E principal principal version version exists in keytab keytab.

Explanation: When adding a principal, or merging a keytab, the principal already existed in the keytab, and could not be replaced. Duplicate entries in the target keytab are not replaced.

User response: Specify the replace option if you want to replace keytab entries.

EUVF06153E keytab keytab is empty.

Explanation: The keytab does not contain any principals that can be operated on.

User response: Add the required principals to the keytab.

EUVF06154I Encryption type encryption_type is not supported.

Explanation: During a keytab operation at least one entry has been encountered using this encryption type, which is not supported by this release of z/OS Network Authentication Service. Entries that have unsupported encryption types are not merged. Other entries for the same principal that contain supported encryption types may still be merged.

User response: None.

EUVF06155E Usage: keytab add principal [-r] [-p password] [-v version] [-k keytab]

Explanation: This message displays information for the keytab command. For more information see "keytab" on page 5-15.

User response: None.

EUVF06156E Usage: keytab delete principal [-v version] [-k keytab]

Explanation: This message displays information for the keytab command. For more information see "keytab" on page 5-15.

User response: None.

EUVF06157E Usage: keytab list [principal [-v version]] [-k keytab]

Explanation: This message displays information for the keytab command. For more information see "keytab" on page 5-15.

User response: None.

EUVF06158E Usage: keytab merge in_keytab [principal [-v version]] [-r] [-k keytab]

Explanation: This message displays information for the keytab command. For more information see "keytab" on page 5-15.

User response: None.

EUVF06159E Cannot merge a keytab into itself.

Explanation: The source and the target of the keytab merge command are identical.

User response: Specify different names for the source and the target of the keytab merge.

EUVF06160E No entry found for principal principal version version, encryption encryption in keytab keytab.

Explanation: Keytab entries exist for this principal but...
none that match the version number and the encryption type.

**User response:** Ensure that the keytab entry version number matches the version number in the KDC, and that an entry exists for each supported encryption type that is used in the current environment.

---

**EUVF06161E** Failed decrypting ticket for principal principal, version version, encryption encryption in keytab keytab Status status.

**Explanation:** Keytab entries exist for this principal, version number and encryption type which matches the KDC entry, but the decryption of the ticket using this entry has failed. The status code contains more information, but the most common reason is a mismatching key due to an incorrect password.

**User response:** Ensure that the password used matches exactly what was specified in the KDC entry for the same principal and version number was created. The password is case sensitive, and may need to be entered in upper case, if a RACF database that is not mixed case was used to enter the key in the KDC. Spaces in the password may need to be escaped, or the entire password enclosed in quotes depending on your shell.

---

**EUVF06162E** Usage: keytab check [principal] [-k key tab]

**Explanation:** This message displays information for the keytab command. For more information see "keytab" on page 5-15.

**User response:** None.
Chapter 8. Component Trace

This chapter presents component trace information for Network Authentication Service for z/OS.

The SKRBKDC started task provides component trace support for any Kerberos application running on the same system as the SKRBKDC started task. The trace records can be written to a trace external writer or they can be kept in an in-storage trace buffer which is part of the SKRBKDC address space. For more information on writing to a trace buffer, see the Tracing applications section of z/OS MVS Programming: Authorized Assembler Services Guide.

IPCS is used to format and display the trace records from either a trace dataset or an SVC dump of the SKRBKDC address space. Refer to z/OS MVS Diagnosis: Tools and Service Aids for more information on setting up and using component trace. Refer to z/OS MVS System Commands for more information on the TRACE command. Refer to z/OS MVS IPCS User's Guide for more information on using IPCS to view a component trace.

Capturing Component Trace Data

The component trace can be started before the job to be traced is started or while the job is running. The trace will be active for the first instance of the job. For example, if the same job name is used for multiple jobs, only the first job with that name will be traced. Subsequent jobs with the same name will not be traced unless the component trace is stopped and then restarted.

A trace external writer is required if the trace records are to be written to a dataset. A sample started procedure is shipped as EUVF.SEUVFSAM(SKRBWTR). Copy this procedure to SYS1.PROCLIB(SKRBWTR) and modify as necessary to meet your installation requirements. The following MVS operator command will start the trace external writer:

```
TRACE CT,WTRSTART=SKRBWTR
```

A single Kerberos component trace may be active at a time and the trace can include from 1 to 16 separate jobs. The SKRBKDC started task will be traced if no job names are specified. The trace buffer size must be between 64K and 512K and will default to 64K.

The OPTIONS parameter specifies the list of subcomponent trace levels as OPTIONS=(subcomp1.lvl1,subcomp2.lvl2,...). Trace messages for a particular subcomponent will not be logged unless the subcomponent is included in the trace list and the message level is greater than or equal to the specified level. An asterisk (*) may be used to specify all subcomponents. Trace level 1 generates the minimum amount of trace message output, trace level 8 generates the maximum amount of trace message output, and trace level 9 generates data dumps in addition to the trace messages. The subcomponent list consists of a subcomponent name and a trace level separated by a period. Multiple subcomponents may be specified by separating the entries with commas.

The following example will enable trace level 1 for all subcomponents and trace level 8 for the KRB_CCACHE subcomponent.

```
OPTIONS=(*.1,KRB_CCACHE.8)
```

The following command will start a Kerberos component trace for jobs CS390IP and DB1G which includes all nondump trace entries and writes the trace records using the SKRBWTR trace writer:

```
TRACE CT,ON,COMP=SKRBKDC
R n,JOBNAME=(CS390IP,DB1G),OPTIONS=(*.8),WTR=SKRBWTR,END
```

The following commands will stop the Kerberos component trace and close the trace writer dataset:

```
TRACE CT,OFF,COMP=SKRBKDC
TRACE CT,WTRSTOP=SKRBWTR
```

© Copyright IBM Corp. 2000, 2012
Kerberos does not require a default trace member in SYS1.PARMLIB since the Kerberos component trace is not activated until the operator enters the TRACE command. SYS1.PARMLIB members can be created for frequently used trace commands and the member name can then be specified on the TRACE command to avoid the operator prompt for trace options. Sample entries CTIKDC00 and CTIKDC01 are shipped in EUVF.SEUVFSAM for tracing the SKRBKDC started task.

### Displaying the Trace Data

The trace records are displayed using the IPCS CTRACE command. The CTRACE ENTIDLIST parameter specifies the trace entries to be included in the display. The trace entry identifier is the Kerberos subcomponent number. All trace entries will be included if the ENTIDLIST parameter is not specified. The following subcomponent numbers are defined:

<table>
<thead>
<tr>
<th>Entry ID</th>
<th>Mnemonic</th>
<th>Mnemonic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>KRB_API</td>
<td>Kerberos API entry/exit</td>
</tr>
<tr>
<td>1</td>
<td>KRB_GENERAL</td>
<td>General Kerberos messages</td>
</tr>
<tr>
<td>2</td>
<td>KRB_CCACHE</td>
<td>Credentials cache messages</td>
</tr>
<tr>
<td>3</td>
<td>KRB_RCACHE</td>
<td>Replay cache messages</td>
</tr>
<tr>
<td>4</td>
<td>KRB_CRYPTO</td>
<td>Cryptography messages</td>
</tr>
<tr>
<td>5</td>
<td>KRB_GSSAPI</td>
<td>GSS-API messages</td>
</tr>
<tr>
<td>6</td>
<td>KRB_KEYTAB</td>
<td>Key table messages</td>
</tr>
<tr>
<td>7</td>
<td>KRB_LIB</td>
<td>Kerberos library messages</td>
</tr>
<tr>
<td>8</td>
<td>KRB_ASN1</td>
<td>ASN.1 messages</td>
</tr>
<tr>
<td>9</td>
<td>KRB_OS</td>
<td>Operating system interface</td>
</tr>
<tr>
<td>10</td>
<td>KRB_KDC</td>
<td>KDC messages</td>
</tr>
<tr>
<td>11</td>
<td>KRB_KDB</td>
<td>Kerberos database messages</td>
</tr>
<tr>
<td>12</td>
<td>KRB_KUT</td>
<td>Kerberos utility messages</td>
</tr>
<tr>
<td>13</td>
<td>KRB_RPC</td>
<td>RPC messages</td>
</tr>
<tr>
<td>14</td>
<td>KRB_ADMIN</td>
<td>Kerberos administration</td>
</tr>
</tbody>
</table>

The CTRACE OPTIONS parameter specifies additional filtering for the trace records. The JOB(name), PID(hexid), TID(hexid), and LVL(number) options can be specified to filter the trace entries based on job name, process identifier, thread identifier, and message level. All trace entries will be included if the OPTIONS parameter is not specified.

The JOBNAME parameter on the CTRACE command is used to select the address space in a dump. Since the address space is always the SKRBKDC address space, this parameter cannot be used to filter the trace entries. Instead, you must use the OPTIONS((JOB(name))) parameter to select the component trace entries for a specific job.

The following example shows how to display Kerberos API and General trace messages for job KRBSRV48 thread 6 and exclude data dumps:

```
IPCS CTRACE COMP(SKRBKDC) ENTIDLIST(0,1)
OPTIONS((JOB(KRBSRV48),TID(6),LVL(8))) FULL
```

A range can be specified for the entry identifiers. The following examples show how to display just Kerberos DLL trace records:

```
IPCS CTRACE COMP(SKRBKDC) ENTIDLIST(8:9,13:14) FULL
```
Sample Kerberos configurations

In this topic IBM provides sample configurations for three Kerberos realms:


- The MITKRB.IBM.COM realm with the KDC on AIX using MIT Kerberos 1.2.1. The DNS domain is mitkrb.ibm.com and the KDC is located on the decept.mitkrb.ibm.com system.

The DNS server for this example is located on Windows 2003.

The z/OS commands used in these examples assume that the external security manager is RACF.

KRB390.IBM.COM configuration

For this configuration, do these steps:

1. Network Authentication Service for z/OS supports five encryption types: 56-bit DES (DES), 56-bit DES with key derivation (DESD), 168-bit triple DES (DES3), 128-bit AES (AES128) and 256-bit AES (AES256). By default, only DES is enabled. The use of these encryption keys can be controlled on an individual user basis through the ENCRYPT option of the KERB keyword on the ALTUSER and RALTER commands.

2. By default, the z/OS KDC uses DES to encrypt tickets. If you want to enable the use of the additional encryption algorithms when encrypting tickets, add the following line to /etc/skrb/home/kdc/envar:

   SKDC_TKT_ENCTYPE=default
   SKDC_TKT_ENCTYPE=des3-cbc-sha1-kd,des-hmac-sha1,des-cbc-crc

3. Edit /etc/skrb/kgdb5.conf and define the local realm. Copy the initial configuration file from /usr/lpp/skrb/examples/kgdb5.conf. In this file, the default_realm value is set to the local realm, the kdc_default_options value is set to request forwardable tickets, and the use_dns_lookup value is set to use the DNS name server instead of the [realms] and [domain_realm] sections of the configuration file. For completeness, the [realms] and [domain_realm] sections are set but aren't needed since the DNS name server is used to locate Kerberos services (SRV records) and to resolve host names to realm names (TXT records).

   [libdefaults]
   default_realm = KRB390.IBM.COM
   kdc_default_options = 0x40000010
   use_dns_lookup = 1

   [realms]
   KRB390.IBM.COM = {
      kdc = dcesec4.krb390.ibm.com:88
      kdc = dcesec7.krb390.ibm.com:88
      kpasswd_server = dcesec4.krb390.ibm.com:464
      kpasswd_server = dcesec7.krb390.ibm.com:464
   }

   [domain_realm]
   .krb390.ibm.com = KRB390.IBM.COM

4. Define the default realm attributes in the RACF database. The password can be any value, but the resource name must be KERBDFLT. The KERBNAME value specifies the name of the local Kerberos realm. For this example, the minimum ticket life is 15 seconds, the default ticket life is 10 hours, and the maximum ticket life is 24 hours. Note that the realm name is converted to upper case by the RDEFINE command but the password is unchanged.

   RDEFINE REALM KERBDFLT KERB(KERBNAME(KRB390.IBM.COM)
   PASSWORD(4427532) MINTKTLFE(15) DEFTKTLFE(36000)
   MAXTTLFE(86400))
5. Define the password change service. The user name and password can be any value but the Kerberos principal must be kadmin/changepw. Note that the password is converted to upper case by the ALTUSER command if the MIXEDCASE SETROPTS option is not set, but the principal is unchanged.

```plaintext
ADDUSER CHANGEPW DFLTGRP(SYS1) PASSWORD(TEMPPASS)
ALTUSER CHANGEPW PASSWORD(74427533) NOEXPIRED
    KERB(KERBNAME(kadmin/changepw))
```

6. Create Kerberos principals for the samples shipped in `/usr/lpp/skrb/examples/gssapi_test` and `/usr/lpp/skrb/examples/krbmsg_test`. The user name and password can be any value but the Kerberos principal names must match the values coded in the examples. Note that the password is converted to upper case by the ALTUSER command but the principal is unchanged.

```plaintext
ADDUSER KRBSRV4 DFLTGRP(SYS1) PASSWORD(TEMPPASS)
ALTUSER KRBSRV4 PASSWORD(TEST4SRV) NOEXPIRED
    KERB(KERBNAME(test_server/dcesec4.krb390.ibm.com))
ADDUSER KRBSRV7 DFLTGRP(SYS1) PASSWORD(TEMPPASS)
ALTUSER KRBSRV7 PASSWORD(TEST7SRV) NOEXPIRED
    KERB(KERBNAME(test_server/dcesec7.krb390.ibm.com))
ADDUSER KRBDLG4 DFLTGRP(SYS1) PASSWORD(TEMPPASS)
ALTUSER KRBDLG4 PASSWORD(TEST4DLG) NOEXPIRED
    KERB(KERBNAME(test_delegate/dcesec4.krb390.ibm.com))
ADDUSER KRBDLG7 DFLTGRP(SYS1) PASSWORD(TEMPPASS)
ALTUSER KRBDLG7 PASSWORD(TEST7DLG) NOEXPIRED
    KERB(KERBNAME(test_delegate/dcesec7.krb390.ibm.com))
ADDUSER KRBCLNT DFLTGRP(SYS1) PASSWORD(TEMPPASS)
ALTUSER KRBCLNT PASSWORD(TESTPSWD) NOEXPIRED
    KERB(KERBNAME(test_client))
```

7. Because the SKRBKDC started task is running on each system in the sysplex, there is no need to set up key tables for use by applications. Instead, the KRB5_SERVER_KEYTAB environment variable is set to 1.

With RACF as the external security manager, the IRR.RUSERMAP resource in the FACILITY class must be defined. The test_server and test_delegate system IDs (for example, KRBSRV4 and KRBDLG4) must have RACF READ access to IRR.RUSERMAP resource to use the KRB5_SERVER_KEYTAB variable set to 1. To define IRR.RUSERMAP and grant READ authority to all system users:

```plaintext
REDEFINE FACILITY IRR.RUSERMAP UACC(READ)
SETROPTS RACLIST(FACILITY) REFRESH
```

See "Security runtime environment variables" on page 2-11 for more on the KRB5_SERVER_KEYTAB environment variable.

8. Create SRV records for the _kerberos and _kpasswd services using the UDP and TCP protocols. The example that follows uses the Microsoft® Windows® 2003 DNS management console to create the SRV entries for the krb390.ibm.com domain. The SKRBKDC started task is running on both the dcesec4 and dcesec7 systems, so there are _kerberos and _kpasswd entries for both systems. The Kerberos runtime randomly selects entries with the same priority when attempting to contact a service provider, so this example uses the same priority for all entries to provide rudimentary load balancing.
9. Create a TXT record to map host names in the krb390.ibm.com DNS domain to the KRB390.IBM.COM Kerberos realm. This example uses the Windows 2003 DNS management console to create the TXT record.

Figure A-1. KRB390.IBM.COM configuration - creating SRV entries
KRB2003.IBM.COM configuration

For this configuration, do these steps:

1. The usual Windows® 2003 server installation sets up the active directory and creates SRV records for the _kerberos and _kpasswd services provided by the Windows 2003 domain controller. However, the server installation does not create a TXT record to map host names in the Windows 2003 domain, so you have to create one yourself.

Figure A-2. KRB390.IBM.COM configuration - creating a TXT record
2. Set up a peer-to-peer trust relationship between the KRB390.IBM.COM realm and the KRB2003.IBM.COM. This allows clients in the KRB2003.IBM.COM realm to access services in the KRB390.IBM.COM realm, and vice versa.

3. The following RACF commands set up the z/OS side of the peer-to-peer trust relationship. Note that the password is case-sensitive on the RDEFINE REALM command but the realm name is converted to upper case.

   RDEFINE REALM
   
   /.../KRB390.IBM.COM/krbtgt/KRB2003.IBM.COM
   KERB(PASSWORD(peerw2kp))

   RDEFINE REALM
   
   /.../KRB2003.IBM.COM/krbtgt/KRB390.IBM.COM
   KERB(PASSWORD(peer390p))

4. Windows 2003 does not support the DESD, DES3, AES128 and AES256 encryption types. If these encryption types have been enabled for the z/OS KDC, they should be disabled for cross-realm ticket-granting tickets issued for the Windows 2003 realm.

   RALTER REALM
   
   /.../KRB390.IBM.COM/krbtgt/KRB2003.IBM.COM
   KERB(ENCRYPT(NODESD NODES3 NOAES128 NOAES256))

5. Use the Active Directory Domains and Trusts management console to set up the Windows 2003 side of the peer-to-peer trust relationships. Open the Properties dialog for the krb2003.ibm.com domain. The password specified for the “Domains trusted by this domain” entry must be the same as the password specified on the /.../KRB390.IBM.COM/krbtgt/KRB2003.IBM.COM RDEFINE command. The password specified for the “Domains that trust this domain” entry must be the same as the password specified on the /.../KRB2003.IBM.COM/krbtgt/KRB390.IBM.COM RDEFINE command.
6. Define the location of the KRB390.IBM.COM KDC on each Windows 2003 client using the \texttt{ksetup} command. This command is shipped as part of the Windows 2003 Support Tools on the Windows 2003 CD.

\begin{verbatim}
  ksetup /addkdc KRB390.IBM.COM dcesec4.krb390.ibm.com
  ksetup /addkdc KRB390.IBM.COM dcesec7.krb390.ibm.com
\end{verbatim}

\textbf{MITKRB.IBM.COM configuration}

For this configuration, do these steps:

1. Edit \texttt{/etc/krb5.conf} and add definitions for the KRB390.IBM.COM and KRB2003.IBM.COM realms.

\begin{verbatim}
[libdefaults]
  ticket_lifetime = 600
  default_realm = MITKRB.IBM.COM
  default_tkt_enctypes = des-cbc-crc
  default_tgs_enctypes = des-cbc-crc
  default_keytab_name = /etc/krb5.keytab

[realms]
  MITKRB.IBM.COM = {
    kdc = dcect.mitkrb.ibm.com:88
    kpasswd_server = dcect.mitkrb.ibm.com:464
    admin_server = dcect.mitkrb.ibm.com:749
    default_domain = mitkrb.ibm.com
  }

  KRB390.IBM.COM = {
    kdc = dcesec7.krb390.ibm.com:88
  }
\end{verbatim}

\textit{Figure A-4. KRB390.IBM.COM configuration - setting up the Windows 2003 side of the peer-to-peer trust relationships}
kpasswd_server = dcesec7.krb390.ibm.com:464
default_domain = krb390.ibm.com
}

KRB2003.IBM.COM = {
    kdc = sstone1.krb2003.ibm.com:88
    default_domain = krb2003.ibm.com
}

[domain_realm]
    .mitkrb.ibm.com = MITKRB.IBM.COM
    .krb390.ibm.com = KRB390.IBM.COM

[capaths]
    MITKRB.IBM.COM = {
        KRB390.IBM.COM = .
        KRB2003.IBM.COM = .
    }

2. Create SRV records for the _kerberos and _kpasswd services using the UDP protocol (MIT Kerberos does not support the TCP protocol for the _kerberos and _kpasswd services). Create an SRV record for the _kerberos-adm service using the TCP protocol. This example uses the Windows 2003 DNS management console to create the SRV entries for the mitkrb.ibm.com domain.

Figure A-5. MITKRB.IBM.COM configuration - creating an SRV record using the UDP protocol
3. Create a TXT record to map host names in the mitkrb.ibm.com DNS domain to the MITKRB.IBM.COM Kerberos realm. This example uses the Windows 2003 DNS management console to create the TXT record.
4. Set up peer-to-peer trust relationships between the KRB390.IBM.COM realm and the MITKRB.IBM.COM realm. This allows clients in one realm to access services in another realm.

5. The following RACF commands set up the z/OS side of the peer-to-peer trust relationship. Note that the password is case-sensitive on the RDEFINE REALM command but the realm name is converted to upper case.

   RDEFINE REALM /.../KRB390.IBM.COM/krbtgt/MITKRB.IBM.COM
   KERB(PASSWORD(s3902mit))
   RDEFINE REALM /.../MITKRB.IBM.COM/krbtgt/KRB390.IBM.COM
   KERB(PASSWORD(mit2s390))

6. Use the kadmin command to create the peer-to-peer trust relations on the MIT Kerberos side. This example uses the z/OS kadmin command to create the krbtgt principals in the MITKRB.IBM.COM Kerberos database.

   DCESEC4:/home/susec4/> kadmin -p rwh/admin@MITKRB.IBM.COM
   EUVF081471 Authenticating as rwh/admin@MITKRB.IBM.COM.
   EUVF082033R Enter password:

   kadmin>
   addprinc -pw s3902mit krbtgt/MITKRB.IBM.COM@KRB390.IBM.COM
   EUVF081221 Principal krbtgt/MITKRB.IBM.COM@KRB390.IBM.COM added.
   kadmin>
   addprinc -pw mit2s390 krbtgt/KRB390.IBM.COM@MITKRB.IBM.COM
   EUVF081221 Principal krbtgt/KRB390.IBM.COM@MITKRB.IBM.COM added.
   kadmin>
   addprinc -pw w2k2mit krbtgt/MITKRB.IBM.COM@KRB2003.IBM.COM
EUVF06122I Principal krbtgt/MITKRB.IBM.COM@KRB2003.IBM.COM added.

kadmin>
addprinc -pw mit2w2k krbtgt/KRB2003.IBM.COM@MITKRB.IBM.COM
EUVF06122I Principal krbtgt/KRB2003.IBM.COM@MITKRB.IBM.COM added.

7. Any encryption types that you disable for the MIT KDC must either be disabled for the z/OS KDC or you must disable the cross-realm ticket-granting tickets issued for the MIT Kerberos realm.

RALTER REALM
/.../KRB390.IBM.COM/krbtgt/MITKRB.IBM.COM
KERB(ENCRYPT(NODES NODES3))

8. Use the Windows 2003 Active Directory Domains and Trusts management console to set up the Windows 2003 side of the peer-to-peer trust relationships. Open the Properties dialog for the krb2003.ibm.com domain. The password specified for the “Domains trusted by this domain” entry must be the same as the password specified for the /.../MITKRB.IBM.COM/krbtgt/KRB2003.IBM.COM principal. The password specified for the “Domains that trust this domain” entry must be the same as the password specified for the /.../KRB2003.IBM.COM/krbtgt/MITKRB.IBM.COM principal.

9. Define the location of the MITKRB.IBM.COM KDC on each Windows 2003 client using the ksetup command. This command is shipped as part of the Windows 2003 Support Tools on the Windows 2003 CD.

ksetup /adddc MITKRB.IBM.COM dcect.mitkrb.ibm.com

Figure A-8. MITKRB.IBM.COM configuration - setting up the Windows 2003 side of the peer-to-peer trust relationships
Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully. The major accessibility features in z/OS enable users to:

- Use assistive technologies such as screen-readers and screen magnifier software
- Operate specific or equivalent features using only the keyboard
- Customize display attributes such as color, contrast, and font size

Using assistive technologies

Assistive technology products, such as screen-readers, function with the user interfaces found in z/OS. Consult the assistive technology documentation for specific information when using it to access z/OS interfaces.

Keyboard navigation of the user interface

Users can access z/OS user interfaces using TSO/E or ISPF. Refer to z/OS TSO/E Primer, SA22-7787, z/OS TSO/E User's Guide, SA22-7787 for information about accessing TSO/E and ISPF interfaces. These guides describe how to use TSO/E and ISPF, including the use of keyboard shortcuts or function keys (PF keys). Each guide includes the default settings for the PF keys and explains how to modify their functions.
Notices

This information was developed for products and services offered in the U.S.A. or elsewhere.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user’s responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A

For license inquiries regarding double-byte character set (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

Intellectual Property Licensing
Legal and Intellectual Property Law
IBM Japan, Ltd.
1623-14, Shimotsuruma, Yamato-shi
Kanagawa 242-8502 Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

Site Counsel
IBM Corporation
2455 South Road
Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this information and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement, or any equivalent agreement between us.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM’s future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

If you are viewing this information softcopy, the photographs and color illustrations may not appear.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrates programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. The sample programs are provided “AS IS”, without warranty of any kind. IBM shall not be liable for any damages arising out of your use of the sample programs.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Policy for unsupported hardware

Various z/OS elements, such as DFSMS, HCD, JES2, JES3, and MVS, contain code that supports specific hardware servers or devices. In some cases, this device-related element support remains in the product even after the hardware devices pass their announced End of Service date. z/OS may continue to service element code; however, it will not provide service related to unsupported hardware devices. Software problems related to these devices will not be accepted for service, and current service activity will cease if a problem is determined to be associated with out-of-support devices. In such cases, fixes will not be issued.
Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at [www.ibm.com/legal/copytrade.shtml](http://www.ibm.com/legal/copytrade.shtml).

Java and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Other company, product, and service names may be trademarks or service marks of others.
This glossary defines technical terms and abbreviations used in the documentation for z/OS Security Server Network Authentication Service. If you do not find the term you are looking for, refer to the index of the appropriate z/OS Security Server Network Authentication Service manual or view IBM Glossary of Computing Terms, available from:
http://www.ibm.com/ibm/terminology

A

Authentication. Verifying the claimed identity of a principal.

Authentication header. A record containing a ticket and an authenticator to be presented to a server as part of the authentication process.

Authentication path. A sequence of intermediate realms transited in the authentication process when communicating from one realm to another.

Authenticator. A record containing information that can be shown to have been recently generated using the session key known only by the client and the server.

Authorization. The process of determining whether a client may use a service, which objects the client is allowed to access, and the type of access allowed for each.

C

Ciphertext. The output of an encryption function. Encryption transforms plaintext into ciphertext.

Client. A process that makes use of a network service on behalf of a user. Note that in many cases a server may itself be a client of some other server (for example, a print server may be a client of a file server).

Credentials. A ticket plus the secret session key necessary to successfully use that ticket in an authentication exchange.

K

KDC. Key Distribution Center, a network service that supplies tickets and temporary session keys; or an instance of that service or the host on which it runs. The KDC processes both initial ticket and ticket-granting ticket requests. The initial ticket portion is sometimes referred to as the Authentication Service (AS) while the ticket-granting portion is sometimes referred to as the Ticket Granting Service (TGS).

Kerberos. This is the name given to the Massachusetts Institute of Technology (MIT) computing system authentication service, the protocol used by that service, and the programs used to implement the authentication service. The name comes from Greek mythology: Kerberos was the 3-headed dog guarding Hades.

P

Plaintext. The input to an encryption function or the output of a decryption function. Decryption transforms ciphertext into plaintext.

Principal. A uniquely named client or server instance that participates in a network communication.

Principal identifier. The name used to uniquely identify each different principal.

S

Seal. To encipher a record containing several fields in such a way that the fields cannot be individually replaced without either knowledge of the encryption key or leaving evidence of tampering.

Secret key. An encryption key shared by a principal and the KDC, distributed outside the bounds of the system, with a long lifetime. In the case of a human user's principal, the secret key is derived from a password.

Server. A particular principal that provides a resource to network clients.

Service. A resource provided to network clients, often provided by more than one server.

Session key. A temporary encryption key used between two principals, with a lifetime limited to the duration of a single login session.

Sub-session key. A temporary encryption key used between two principals, selected and exchanged by the principals using the session key, and with a lifetime limited to the duration of a single association.

T

Ticket. A record that helps a client authenticate itself to a server; it contains the client's identity, a session key, a timestamp, and other information, all sealed.
using the server's secret key. It serves to authenticate a client only when presented along with a fresh authenticator.
Bibliography

This is the same bibliography that appears in z/OS Integrated Security Services Network Authentication Service Programming.

z/OS documents for Network Authentication Service

- z/OS Integrated Security Services Network Authentication Service Administration, SC24-5926
- z/OS Integrated Security Services Network Authentication Service Programming, SC24-5927

Other Security Server publications

Lightweight Directory Access Protocol (LDAP)

- IBM Tivoli Directory Server Client Programming for z/OS, SA23-2214
- IBM Tivoli Directory Server Administration and Use for z/OS, SC23-5191
- IBM Tivoli Directory Server Plug-in Reference for z/OS, SA76-0148

Resource Access Control Facility (RACF)

- z/OS Security Server RACF Macros and Interfaces, SA22-7682
- z/OS Security Server RACF Callable Services, SA22-7691
- z/OS Security Server RACF Command Language Reference, SA22-7687
- z/OS Security Server RACROUTE Macro Reference, SA22-7692

MVS programming documents

- z/OS MVS Programming: Authorized Assembler Services Reference ALE-DYN, SA22-7609
- z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG, SA22-7610
- z/OS MVS Programming: Authorized Assembler Services Reference LLA-SDU, SA22-7611

Other documents

- z/OS MVS Programming: Authorized Assembler Services Reference SET-WTO, SA22-7612
- z/OS MVS Programming: Sysplex Services Guide, SA22-7617
- z/OS MVS Programming: Sysplex Services Reference, SA22-7618
- z/OS Cryptographic Services System SSL Programming, SC24-5901
- z/OS XL C/C++ Run-Time Library Reference, SA22-7821
LDAP schema definitions 2-7
libdefaults section of configuration profile 2-21
local principals, z/OS Network Authentication Service 4-3
local realms, z/OS Network Authentication Service 4-2

manage a key table 5-15
manage service entries in LDAP directory for a realm 5-20
messages 7-1
  for Kerberos commands 7-20
  Kerberos runtime 7-1
  security server 7-5
MODIFY SKRBKDC command 3-7

Network Authentication Service administration 3-1
Network Authentication Service configuration 2-1
nist-sha 2-20
notices A-1
Notices C-1

obtain or renew ticket-granting ticket 5-17
overview of Network Authentication 1-1

P SKRBKDC command 3-8
passwords 3-3
preface xi
profile operations status codes 6-32
  protecting z/OS Network Authentication Service resources 4-1

realm trust relationships 3-1
  peer trust 3-2
  transitive trust 3-2
realms 1-3
realms section of configuration profile 2-23
rsa-md4 2-20
rsa-md4-des 2-20
rsa-md5 2-20
rsa-md5-des 2-20

sample /etc/skrb/krb5.conf configuration file 2-24
security runtime configuration 2-5
security runtime environment variables 2-11
security server configuration 2-8
security server environment variables 2-17