HP Open Source Security for OpenVMS
Volume 3: Kerberos

Kerberos Version Version 3.0 for OpenVMS, based on MIT Kerberos V5 Release 1.4.1

OpenVMS I64 Version 8.2 or higher
OpenVMS Alpha Version 7.3-2 or higher

This manual supersedes *HP Open Source Security for OpenVMS Volume 3: Kerberos*, Version 8.2

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Legal Notice

The HP OpenVMS documentation set is available on CD-ROM.

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Preface

HP Open Source Security for OpenVMS, Volume 3: Kerberos describes how to install, configure, and use Kerberos Version 3.0 for OpenVMS, which is based on MIT Kerberos V5 Release 1.4.1.

The information in this manual applies Kerberos on OpenVMS Industry Standard 64 and OpenVMS Alpha. For information about Kerberos on OpenVMS VAX, see *HP Open Source Security for OpenVMS, Volume 3: Kerberos* for Kerberos Version 2.0 (released with OpenVMS Version 7.3-2).

Intended Audience

This document is for application developers who want to implement the Kerberos protocol that uses strong cryptography, so that a client can prove its identity to a server (and vice versa) across an insecure network connection.

Document Structure

This manual consists of the following chapters:

Chapter 1 provides an overview of Kerberos.

Chapter 2 contains installation and configuration instructions.

Chapter 3 includes information about client programs.

Chapter 4 is a programming tutorial about how to use Kerberos in your application.

Chapter 5 is a reference section that includes documentation about the GSSAPI.

Chapter 6 is a reference section that includes documentation about the KRB5 APIs.

Related Documents

The following HP OpenVMS documents are recommended for further information:

- *HP Open Source Security for OpenVMS, Volume 1: Common Data Security Architecture*
- *HP Open Source Security for OpenVMS, Volume 2: HP SSL for OpenVMS*
- *HP OpenVMS Guide to System Security*

The following MIT Kerberos documents are available from the Kerberos for OpenVMS web site, and in the Kerberos kit in the `KRB$ROOT:[DOC]` directory:

- *Kerberos V5 Application Programming Library* (`LIBRARY.PDF`)
- *Kerberos V5 Implementer's Guide* (`IMPLEMENT.PDF`)
- *Kerberos V5 Installation Guide* (`INSTALL-GUIDE.PS`)
- *Kerberos V5 System Administrator's Guide* (`ADMIN-GUIDE.PS`)
- *Kerberos V5 UNIX User's Guide* (`USER-GUIDE.PS`)
- *Upgrading to Kerberos V5 from Kerberos V4* (`KRB425-GUIDE.PS`)

For additional information about OpenVMS products and services, see the following World Wide Web address:

http://www.hp.com/go/openvms/

For information about downloading the latest version of Kerberos for OpenVMS, see the following World Wide Web address:

http://h71000.www7.hp.com/openvms/products/kerberos/

For additional information about Kerberos, see the MIT Kerberos web site at the following World Wide Web address:

http://web.mit.edu/kerberos/www/

Related RFCs

The following RFCs are related to Kerberos and may be of interest.

RFC 1510	The Kerberos Network Authentication Service
RFC 1964	The Kerberos Version 5 GSS-API Mechanism
RFC 2743	GSS-API Version 2, Update 1
RFC 2744	GSS-API Version 2, C Bindings
RFC 2942	Telnet Authentication: Kerberos Version 5
RFC 3129	Requirements for Kerberized Internet Negotiation of Keys
RFC 3244	Microsoft Windows 2000 Kerberos Change Password and Set Password Protocols
RFC 3961	Encryption and Checksum Specifications for Kerberos 5
RFC 3962	Advanced Encryption Standard (AES) Encryption for Kerberos 5
RFC 4120	The Kerberos Network Authentication Service (V5)
RFC 4121	The Kerberos Version 5 Generic Security Service Application Program Interface (GSS-API) Mechanism: Version 2

Reader's Comments

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Conventions

Convention	Meaning
Ctrl/x	A sequence such as Ctrl/x indicates that you must hold down the key labeled Ctrl while you press another key or a pointing device button.
PF1 x	A sequence such as PF1 *x* indicates that you must first press and release the key labeled PF1 and then press and release another key (x) or a pointing device button.
Return	In examples, a key name in bold indicates that you press that key.
...	A horizontal ellipsis in examples indicates one of the following possibilities: – Additional optional arguments in a statement have been omitted. – The preceding item or items can be repeated one or more times. – Additional arguments, values, or other information can be entered.
. . .	A vertical ellipsis indicates the omission of items from a code example or command format; the items are omitted because they are not important to the topic being discussed.
( )	In command format descriptions, parentheses indicate that you must enclose choices in parentheses if you specify more than one.
[ ]	In command format descriptions, brackets indicate optional choices. You can choose one or more items or no items. Do not type the brackets on the command line. However, you must include the brackets in the syntax for OpenVMS directory specifications and for a substring specification in an assignment statement.
|	In command format descriptions, vertical bars separate choices within brackets or braces. Within brackets, the choices are optional; within braces, at least one choice is required. Do not type the vertical bars on the command line.
{ }	In command format descriptions, braces indicate required choices; you must choose at least one of the items listed. Do not type the braces on the command line.
bold type	Bold type represents the introduction of a new term. It also represents the name of an argument, an attribute, or a reason. In command or script examples, bold text indicates user input.
italic type	Italic type indicates important information, complete titles of manuals, or variables. Variables include information that varies in system output (Internal error *number*), in command lines (/PRODUCER=*name*), and in command arguments in text (where (*dd*) represents the predefined par code for the device type).
UPPERCASE TYPE	Uppercase type indicates a command, the name of a routine, the name of a file, or the abbreviation for a system privilege.

Convention	Meaning
`Example`	This typeface indicates code examples, command examples, and interactive screen displays. In text, this type also identifies URLs, UNIX command and pathnames, PC-based commands and folders, and certain elements of the C programming language.
–	A hyphen at the end of a command format description, command line, or code line indicates that the command or statement continues on the following line.
numbers	All numbers in text are assumed to be decimal unless otherwise noted. Nondecimal radixes—binary, octal, or hexadecimal—are explicitly indicated.

1 Introduction to Kerberos

Kerberos is a network authentication protocol designed to provide strong authentication for client/server applications by using secret-key cryptography. It was developed at the Massachusetts Institute of Technology as part of Project Athena in the mid-1980s. Project Athena's mandate was to explore diverse uses of computing and to build the knowledge base needed for longer-term strategic decisions about how computers fit into the MIT curriculum.

Kerberos is the name of the three-headed dog that guarded the gates of Hades in Greek mythology. Cerberus, who many argue should be the name used, is the Latin name for the equivalent entity in Roman mythology.

Until Kerberos V4, this technology was not available to the general public. Prior versions were for only internal Project Athena use. Kerberos V5, the current implementation, is the first commercial-ready release.

The Kerberos protocol uses strong cryptography, so that a client can prove its identity to a server (and vice versa) across an insecure network connection. After a client and server have used Kerberos to prove their identity, they can also encrypt all of their communications to assure privacy and data integrity.

OpenVMS provides support for both Kerberos clients and servers, beginning with OpenVMS Version 7.3-1. Kerberos Version 3.0 for OpenVMS is based on MIT Kerberos V5 Release 1.4.1.

1.1 Kerberos Terminology

The following are commonly used Kerberos terms and their definitions.

Key Distribution Center (KDC)

The Ticket-Granting Service (TGS) and the Authentication Server are usually collectively known as the Key Distribution Center.

Principal Name

A principal is a unique identity to which Kerberos can assign tickets. It is analogous to an OpenVMS user. The Kerberos database, which performs a function similar to the UAF file on OpenVMS, stores information about principals.

By convention, a principal name is divided into three parts:

- A primary – For a user, a user name. For a system, the word *host*.
- The instance – An optional string that qualifies the primary.
- The realm – Generally, the DNS domain name in uppercase letters.

Realm

The administrative domain that encompasses Kerberos clients and servers is called a realm. Each Kerberos realm has at least one Kerberos server, zero or more Kerberos slave servers, and any number of clients. The master Kerberos database for that site or administrative domain is stored on the Kerberos server. Slave servers have read-only copies of the database that are periodically propagated from the master server.

Secret vs. Private

Secret and private are often used interchangeably. In this manual, it takes two (or more) to share a secret, therefore a shared DES key is a secret key. A key is private only when no one but its owner knows it. Therefore, in public key cryptosystems, one has a public and a private key.

Tickets

Kerberos tickets, also known as credentials, are a set of electronic information used to verify your identity. Kerberos tickets can be stored in a file, or they may exist only in memory.

The first ticket you obtain is a generic Ticket-Granting Ticket (TGT), which is granted upon your initial login to the Kerberos realm. The TGT allows you to obtain additional tickets that give you permission for specific services.

1.2 Understanding Kerberos

Kerberos performs authentication as a trusted third-party authentication service by using conventional (shared secret key) cryptography. Kerberos 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.

When you integrate Kerberos into an application, it is important to review how and when Kerberos routines ensure that the application design does not compromise the authentication. For instance, an application is not secure if it uses Kerberos routines only on initiation of a stream-based network connection and assumes the absence of any active attackers who might hijack the stream connection.

The Kerberos protocol code libraries, whose API is described in Chapters 5 and 6, can be used to provide encryption to any application. To add authentication to its transactions, a typical network application adds one or two calls to the Kerberos library, which results in the transmission of the necessary messages to achieve authentication.

The two methods for obtaining credentials—the initial ticket exchange and the TGT exchange—use slightly different protocols and require different API routines. The basic difference an API programmer will see is that the initial request does not require a TGT. It does require the client's secret key, because the reply is sent back encrypted in the client's secret key. Usually this request is for a TGT, and TGT-based exchanges are used from then on. In a TGT exchange, the TGT is sent as part of the request for tickets and the reply is encrypted in the session key from the TGT. For example, once a user's password is used to obtain a TGT, it is not required for subsequent TGT exchanges.

The reply consists of a ticket and a session key, encrypted either in the user's secret key (password) or the TGT session key. The combination of a ticket and a session key is known as a credentials cache. (In Kerberos V4, a credentials cache was called a ticket file.) 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 had placed the name of the client, the name of the server, a key associated with this 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 and that the timestamp in the authenticator is recent (to prevent reply attacks). Because the session key was generated randomly by the Kerberos server and delivered encrypted only in the service key and in a key known only by the user, the application server can be confident that user is really who he or she claims to be, because the user was able to encrypt the authenticator using 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. Privacy and integrity of the messages exchanged between principals can be secured by encrypting the data to be passed using the session key.

1.2.1 Realms

The Kerberos protocol operates across organizational boundaries. Each organization that runs 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 end service to decide whether to honor a request.

By establishing inter-realm keys, the administrators of two realms can allow a client authenticated in the local realm to use its credentials remotely. The exchange of inter-realm keys (a separate key may be used for each direction) 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 realm. When that ticket-granting ticket is used, the remote ticket-granting service uses the inter-realm key (which usually differs from its own normal TGS key) to decrypt the ticket-granting ticket and to assure that it was issued by the client's own TGS. Tickets issued by the remote ticket-granting service will indicate to the end service that the client was authenticated from another realm.

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

Realms are typically organized hierarchically. Each realm shares a key with its parent and a different key with each child. If two realms do not directly share an inter-realm key, the hierarchical organization allows an authentication path to be easily constructed. If a hierarchical organization is not used, it may be necessary to consult some database 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 traversed when deciding how much faith to place in the authentication process. To make this easier, a field in each ticket contains the names of the realms that were involved in authenticating the client.

1.2.2 Security Limitations in Kerberos

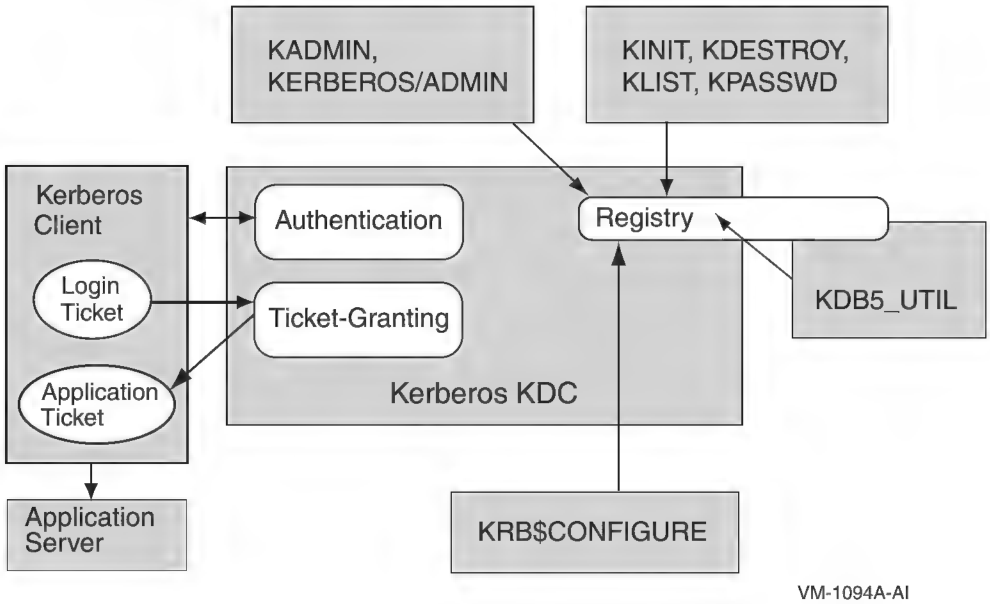
When you are designing a secure application, be aware of the following limitations of Kerberos:

- Kerberos does not address denial of service attacks. There are places in the Kerberos protocol where an intruder can prevent an application from participating in the proper authentication steps. Detection and solution of such attacks (some of which can appear to be normal failure modes for the system) is usually best left to the human administrators and users.
- Principals must keep their secret keys secret. If an intruder somehow steals a principal's key, they can use it to masquerade as that principal or impersonate a server to legitimate principals.
- Password-guessing attacks are not solved by Kerberos. If a user chooses a poor password, it is possible for an attacker to successfully mount an offline dictionary attack by repeatedly attempting to decrypt, with successive entries from a dictionary, messages obtained that are encrypted under a key derived from the user's password.

1.3 Kerberos Components

Figure 1-1 depicts the interrelationship between the various components of Kerberos.

Figure 1-1 Interrelationships Among Kerberos Components



When a client logs in to the realm, an authentication request is sent to the Kerberos Key Distribution Center (KDC). A Ticket-Granting Ticket (TGT) is returned as the result of authentication. When the client application starts, the TGT is used to request an application ticket. The application ticket is then sent to the application server, which verifies the application ticket with the KDC. Normal communication can then begin.

The Kerberos registry can be manipulated in several ways. It is initially created via the `KRB$CONFIGURE` command procedure. Other tools used to access the Kerberos information are:

- `kadmin` – Used for reading or updating the Kerberos registry.
- `kinit` – Creates credentials for a user.
- `klist` – Displays the existing credentials for a user.
- `kdestroy` – Deletes a user's credentials.
- `kpasswd` – Changes a user's Kerberos password.
- `kdb5_util` – Dumps or loads the Kerberos database for save and restore operations.

1.3.1 KDC

Each Kerberos realm will have at least one Kerberos server. This server, the Key Distribution Center, contains the Authentication Service, the Ticket-Granting Service, and the master database for Kerberos. These services are implemented as a single daemon: the KDC (`KRB$KRB5KDC`).

1.3.2 Authentication Service

The authentication service handles user authentication, or the process of verifying that principals are correctly identified. It consists of the security server (or servers) in the KDC (or KDCs), and security clients.

A security client communicates with a security server to request information and operations. The security server accesses the registry database to perform queries and updates and to validate user logins.

1.3.3 Ticket-Granting Service

Once authenticated, a principal will be granted a TGT and a ticket session key, which gives the principal the right to use the ticket. This combination of the ticket and its associated key is known as your credentials.

A principal's credentials are stored in a credentials cache, which is often just a file in the principal's local directory tree.

1.3.4 The Kerberos Database

The Kerberos database contains all of the realm's Kerberos principals, their passwords, and other administrative information about each principal.

Each KDC contains its own copy of the Kerberos database. The master KDC contains the primary copy of the database, which it propagates at regular intervals to the slave KDCs. All database changes are made on the master KDC. Slave KDCs provide ticket-granting services only, with no database administration. This allows clients to continue to obtain tickets when the master KDC is unavailable.

1.3.5 Kerberos Utility Programs

OpenVMS provides three different versions of each of the Kerberos user interface programs: the original UNIX® style, a DCL version, and an X Windows version. The DCL interface for the user utilities (`kinit, klist, kdestroy, kpasswd`) is invoked by the DCL command:

```
$ KERBEROS
```

The DCL interface for the administrative utility (`kadmin`) is invoked by the DCL command:

```
$ KERBEROS/ADMIN
```

Either DCL interface can be modified with an `/INTERFACE` qualifier to invoke the X Windows version. For example, the command line for the administrative program is as follows:

```
$ KERBEROS/ADMIN/INTERFACE=DECWINDOWS
```

DCL help is available within each of the DCL interfaces.

kadmin

The `kadmin` program allows for the maintenance of Kerberos principals, policies, and service key tables (keytabs).

kinit

The `kinit` program explicitly obtains Kerberos tickets. Similarly, if a user's Kerberos ticket expires, `kinit` is used to obtain a new one.

klist

The klist program displays the existing tickets for a principal and various details about those tickets, including expiration time.

kdestroy

The kdestroy program removes all of the tickets for a principal. Because Kerberos tickets can be stolen and because someone who steals a ticket can masquerade as another principal, Kerberos tickets should be destroyed when you are away from your computer.

kpasswd

The kpasswd program changes a Kerberos principal's password. Passwords should be changed periodically.

kdb5_util

The kdb5_util program creates, destroys, dumps, and loads the Kerberos database. It also allows the creation of a key stash file, which allows a KDC to authenticate itself to the database utilities. Unlike the Kerberos utility programs (with the exception of kadmin), access to kdb5_util is generally limited to Kerberos administrators.

kprop

The kprop program propagates the master KDC database to slave KDC servers.

ktutil

The ktutil command invokes a menu from which an administrator can read, write, or edit entries in a Kerberos V5 keytab or V4 srvtab file.

2 Installation and Configuration

This chapter contains information about installing and configuring Kerberos for OpenVMS.

NOTE For the latest release notes for the current version of Kerberos for OpenVMS, see the Kerberos for OpenVMS web site at:

`http://h71000.www7.hp.com/openvms/products/kerberos/`

2.1 Prerequisites

Operating System

- HP OpenVMS Industry Standard 64 Version 8.2 or higher, or
- HP OpenVMS Alpha Version 7.3-2 or higher

TCP/IP Transport

- HP TCP/IP Services for OpenVMS Version 5.6 or higher
  (for Kerberos on OpenVMS I64 and OpenVMS Alpha Version 8.3)
- HP TCP/IP Services for OpenVMS Version 5.5 or higher
  (for Kerberos on OpenVMS I64 and OpenVMS Alpha Version 8.2)
- HP TCP/IP Services for OpenVMS Version 5.4 or higher
  (for Kerberos on OpenVMS Alpha Version 7.3-2)

NOTE If you are running a third-party TCP/IP network product such as MultiNet or TCPware from Process Software Corporation, contact your provider regarding running Kerberos Version 3.0 with their TCP/IP network product.

2.2 Downloading the Kit

Kerberos Version 3.0 is included in the OpenVMS Version 8.3 operating system distribution media. If you are running OpenVMS Version 7.3-2, 8.2, or 8.2-1, you can download and install Kerberos Version 3.0.

To download the Kerberos kit from the OpenVMS web site, fill out and submit the Kerberos for OpenVMS registration form at the following URL:

`http://h71000.www7.hp.com/openvms/products/kerberos/`

2.3 Secure Delivery and Kerberos

The Kerberos for OpenVMS kit is a self-extracting executable file containing a compressed .PCSI file and an associated encrypted, signed manifest (.*_ESW) file.

If you copy the Kerberos kit to another location, keep the Kerberos kit and manifest file in the same directory.

NOTE If you are installing Kerberos Version 3.0 on a version of OpenVMS earlier than Version 8.3, the manifest is ignored.

2.4 Installing and Configuring Kerberos on OpenVMS Version 8.2 or Higher

Kerberos Version 3.0 is automatically installed during the installation of OpenVMS Version 8.3, or during an upgrade from a previous version of OpenVMS to Version 8.3.

2.4.1 Configure HP TCP/IP Services for OpenVMS to Change Hostname Definition to Fully Qualfied Domain Name

Before configuring or starting Kerberos, check the HP TCP/IP Services for OpenVMS Local Host Database to determine whether your hostname definition is the short name (for example, node1) or the Fully Qualified Domain Name (FQDN) (for example, node1.hp.com).

NOTE If your hostname definition is the short name, you must run TCPIP$CONFIG to change the definition to the fully qualified name. If your hostname definition is the FQDN, continue to Section 2.4.2.

Example 2-1 contains a log of such a change.

Example 2-1 Changing Hostname Definition from Short Name to Fully Qualified Domain Name

```
$ TCPIP SHOW HOST/LOCAL NODE1

     LOCAL database

Host address    Host name

1.2.3.4         node1

$ @SYS$STARTUP:TCPIP$CONFIG

                TCP/IP Network Configuration Procedure

        This procedure helps you define the parameters required
        to run HP TCP/IP Services for OpenVMS on this system.

        Checking TCP/IP Services for OpenVMS configuration database files.
```

```
        HP TCP/IP Services for OpenVMS Configuration Menu

        Configuration options:

                 1  -  Core environment
                 2  -  Client components
                 3  -  Server components
                 4  -  Optional components

                 5  -  Shutdown HP TCP/IP Services for OpenVMS
                 6  -  Startup HP TCP/IP Services for OpenVMS
                 7  -  Run tests

                 A  -  Configure options 1 - 4
                [E] -  Exit configuration procedure

Enter configuration option: 1

        HP TCP/IP Services for OpenVMS Core Environment Configuration Menu

        Configuration options:

                 1  -  Domain
                 2  -  Interfaces
                 3  -  Routing
                 4  -  BIND Resolver
                 5  -  Time Zone

                 A  -  Configure options 1 - 5
                [E] -  Exit menu

Enter configuration option: 2

      HP TCP/IP Services for OpenVMS Interface & Address Configuration Menu

 Hostname Details: Configured=node1, Active=node1

 Configuration options:

   1  -  WE0 Menu (EWA0: TwistedPair 1000mbps)
   2  -  1.2.3.4/21    node1                Configured,Active

   3  -  IE0 Menu (EIA0: TwistedPair 100mbps)

   I  -  Information about your configuration

  [E] -  Exit menu

Enter configuration option: 2

      HP TCP/IP Services for OpenVMS Address Configuration Menu

      WE0 1.2.3.4/21 node1 Configured,Active WE0

 Configuration options:

         1  - Change address
         2  - Set "node1" as the default hostname
         3  - Delete from configuration database
         4  - Remove from live system
         5  - Add standby aliases to configuration database (for failSAFE IP)

        [E] - Exit menu
```

```
Enter configuration option: 1

    IPv4 Address may be entered with CIDR bits suffix.
    E.g. For a 16-bit netmask enter 10.0.1.1/16

Enter IPv4 Address [1.2.3.4/21]:
Enter hostname [node1]: node1.hp.com

Requested configuration:

      Address  : 1.2.3.4/21
      Netmask  : 255.255.248.0 (CIDR bits: 21)
      Hostname : node1.hp.com

* Is this correct [YES]:

  "node1" is currently associated with address "1.2.3.4".
  Continuing will associate "node1.hp.com" with "1.2.3.4".

* Continue [NO]: YES
Deleted host node1 from host database
Added hostname node1.hp.com (1.2.3.4) to host database
* Update the address in the configuration database [NO]: YES
Updated address WE0:1.2.3.4 in configuration database
* Update the active address [NO]: YES
WE0: delete active inet address node1.hp.com
Updated active address to be WE0:1.2.3.4

      HP TCP/IP Services for OpenVMS Interface & Address Configuration Menu

 Hostname Details: Configured=node1, Active=node1

 Configuration options:

   1  -  WE0 Menu (EWA0: TwistedPair 1000mbps)
   2  -  1.2.3.4/21    node1.hp.com     Configured,Active

   3  -  IE0 Menu (EIA0: TwistedPair 100mbps)

   I  -  Information about your configuration

  [E] -  Exit menu

Enter configuration option: E

        HP TCP/IP Services for OpenVMS Core Environment Configuration Menu

        Configuration options:

                 1  -  Domain
                 2  -  Interfaces
                 3  -  Routing
                 4  -  BIND Resolver
                 5  -  Time Zone

                 A  -  Configure options 1 - 5
                [E] -  Exit menu

Enter configuration option: E

        HP TCP/IP Services for OpenVMS Configuration Menu

        Configuration options:
```

```
                 1  -  Core environment
                 2  -  Client components
                 3  -  Server components
                 4  -  Optional components

                 5  -  Shutdown HP TCP/IP Services for OpenVMS
                 6  -  Startup HP TCP/IP Services for OpenVMS
                 7  -  Run tests

                 A  -  Configure options 1 - 4
                [E] -  Exit configuration procedure

Enter configuration option: E

$ TCPIP SHOW HOST/LOCAL NODE1

     LOCAL database

Host address    Host name

1.2.3.4         node1.hp.com
```

2.4.2 Configuring Kerberos for OpenVMS on OpenVMS 8.2 or Higher

If you have not previously configured an earlier version of Kerberos on your system, you must run the configuration program before starting Kerberos.

NOTE If you are reconfiguring Kerberos on a system on which Kerberos was previously configured, you must enter the **kdestroy** command before you run the configuration command procedure SYS$STARTUP:KRB$CONFIGURE.COM. The kdestroy command is defined in KRB$SYMBOLS.COM.

After you have a valid configuration, start Kerberos with the following command:

```
$ @SYS$STARTUP:KRB$STARTUP.COM
```

Example 2-2 shows a configuration log.

Example 2-2 Kerberos Configuration Log on OpenVMS

```
  $ @SYS$STARTUP:KRB$CONFIGURE

      Kerberos V3.0 for OpenVMS Configuration Menu

      Configuration options:

             1  -  Setup Client configuration
             2  -  Edit Client configuration

             3  -  Setup Server configuration
             4  -  Edit Server configuration

             5  -  Shutdown Servers
             6  -  Startup Servers

             E  -  Exit configuration procedure

      Enter Option: 1

    Where will the OpenVMS Kerberos 5 KDC be running [ system ]:
    What is the OpenVMS Kerberos 5 default domain [ abc.xyz.com ]:
```

```
What is the OpenVMS Kerberos 5 Realm name [ SYSTEM.ABC.XYZ.COM ]:

Press Return to continue ...

  Kerberos V3.0 for OpenVMS Configuration Menu

  Configuration options:

         1  -  Setup Client configuration
         2  -  Edit Client configuration

         3  -  Setup Server configuration
         4  -  Edit Server configuration

         5  -  Shutdown Servers
         6  -  Startup Servers

         E  -  Exit configuration procedure

  Enter Option: 3

Where will the OpenVMS Kerberos 5 KDC be running [ system ]:
What is the OpenVMS Kerberos 5 default domain [ abc.xyz.com ]:
What is the OpenVMS Kerberos 5 Realm name [ SYSTEM.ABC.XYZ.COM ]:
The type of roles the KDC can perform are:
    NO_KDC     -- where the KDC will not be run
    SINGLE_KDC -- where the KDC is the only one in the realm
    MASTER_KDC -- where the KDC is the master of 1 or more other KDCs
    SLAVE_KDC  -- where the KDC is slave to another KDC
What will be the KDC's role on this node [ SINGLE_KDC ]:
Create the OpenVMS Kerberos 5 database [ Y ]:

Creating OpenVMS Kerberos 5 database ...
Initializing database 'krb$root:[krb5kdc]principal' for realm
'SYSTEM.ABC.XYZ.COM',
master key name 'K/M@SYSTEM.ABC.XYZ.COM'
You will be prompted for the database Master Password.
It is important that you NOT FORGET this password.

Enter KDC database master key:
Re-enter KDC database master key to verify:
Priority: info
No dictionary file specified, continuing without one.

Please enter a default OpenVMS Kerberos 5 administrator [ SYSTEM ]:
Authenticating as principal SYSTEM/admin@SYSTEM.ABC.XYZ.COM with password.

Enter password for principal "SYSTEM/admin@SYSTEM.ABC.XYZ.COM":
Re-enter password for principal "SYSTEM/admin@SYSTEM.ABC.XYZ.COM":
Principal "SYSTEM/admin@SYSTEM.ABC.XYZ.COM" created.
Priority: info
No dictionary file specified, continuing without one.
WARNING: no policy specified for SYSTEM/admin@SYSTEM.ABC.XYZ.COM; defaulting to no policy
Create OpenVMS Kerberos 5 principals [ Y ]: N
Authenticating as principal SYSTEM/admin@SYSTEM.ABC.XYZ.COM with password.
Priority: info
No dictionary file specified, continuing without one.
KADMIN_LOCAL: Entry for principal kadmin/admin with kvno 3, encryption type Triple
DES cbc mode with HMAC/sha1 added to keytab WRFILE=KRB$ROOT:[KRB5KDC]KADM5.KEYTAB.

KADMIN_LOCAL: Entry for principal kadmin/admin with kvno 3, encryption type DES
cbc mode with CRC-32 added to keytab WRFILE=KRB$ROOT:[KRB5KDC]KADM5.KEYTAB.

Authenticating as principal SYSTEM/admin@SYSTEM.ABC.XYZ.COM with password.
```

```
Priority: info  No dictionary file specified, continuing without one.
KADMIN_LOCAL: Entry for principal kadmin/changepw with kvno 3, encryption type Triple
DES cbc mode with HMAC/sha1 added to keytab WRFILE=KRB$ROOT:[KRB5KDC]KADM5.KEYTAB.

KADMIN_LOCAL: Entry for principal kadmin/changepw with kvno 3, encryption type DES
cbc mode with CRC-32 added to keytab WRFILE=KRB$ROOT:[KRB5KDC]KADM5.KEYTAB.
Press Return to continue ...

  Kerberos V3.0 for OpenVMS Configuration Menu

  Configuration options:

         1  -  Setup Client configuration
         2  -  Edit Client configuration

         3  -  Setup Server configuration
         4  -  Edit Server configuration

         5  -  Shutdown Servers
         6  -  Startup Servers

         E  -  Exit configuration procedure

  Enter Option: 6

Starting OpenVMS Kerberos Servers (Role: SINGLE_KDC)...

Starting OpenVMS Kerberos server KRB$KRB5KDC ...
%RUN-S-PROC_ID, identification of created process is 00000060
Starting OpenVMS Kerberos server KRB$KADMIND ...
%RUN-S-PROC_ID, identification of created process is 00000061

Press Return to continue ...

  Kerberos V3.0 for OpenVMS Configuration Menu

  Configuration options:

         1  -  Setup Client configuration
         2  -  Edit Client configuration

         3  -  Setup Server configuration
         4  -  Edit Server configuration

         5  -  Shutdown Servers
         6  -  Startup Servers

         E  -  Exit configuration procedure

  Enter Option: E
```

2.5 Installing and Configuring Kerberos on OpenVMS Alpha Version 7.3-2

Kerberos Version 2.0 was automatically installed during the installation of OpenVMS Version 7.3-2, or during an upgrade from a previous version of OpenVMS to Version 7.3-2. Perform the following steps to upgrade Kerberos to Version 3.0 on OpenVMS Version 7.3-2.

See Example 2-2 for a sample Kerberos configuration log. (The configuration log is the same on OpenVMS I64, OpenVMS Alpha, and OpenVMS VAX.) Example 2-3 shows an installation log on OpenVMS Alpha Version 7.3-2.

1. Download the Kerberos kit from the Kerberos for OpenVMS website at

   `http://h71000.www7.hp.com/openvms/products/kerberos/`

2. Shut down Kerberos by executing `SYS$STARTUP:KRB$SHUTDOWN.COM`.
3. Install the Kerberos Version 3.0 kit by entering `PRODUCT INSTALL KERBEROS`. This command will automatically remove the previously installed version. (You do not need to expand the PCSI$COMPRESSED file; PCSI installs from the compressed kit directly.)
4. Add `@SYS$STARTUP:KRB$SYMBOLS` to `SYS$MANAGER:SYLOGIN.COM`, if Kerberos was not previously installed and configured.
5. Execute `KRB$CONFIGURE.COM`, if Kerberos was not previously installed and configured.
6. Start Kerberos by executing `SYS$STARTUP:KRB$STARTUP.COM`.

Example 2-3 Kerberos Installation Log on OpenVMS Version 7.3-2

```
Username: system
Password:

     Last interactive login on Tuesday, November 2, 2005 11:12 AM
    Last non-interactive login on Wednesday, November 3, 2005 02:30 PM

$ @SYS$STARTUP:KRB$SHUTDOWN
$ PRODUCT INSTALL KERBEROS

The following product has been selected:

    HP AXPVMS KERBEROS V3.0             Layered Product

 Do you want to continue? [YES]

Configuration phase starting ...

You will be asked to choose options, if any, for each selected product and for
any products that may be installed to satisfy software dependency requirements.

HP AXPVMS KERBEROS V3.0

Do you want the defaults for all options? [YES]

Do you want to review the options? [NO]

Execution phase starting ...

The following product will be installed to destination:
    HP AXPVMS KERBEROS V3.0                 DKA0:[VMS$COMMON.]

The following product will be removed from destination:
    HP AXPVMS KERBEROS V2.1                DKA0:[VMS$COMMON.]

Portion done: 0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%

The following product has been installed:
    HP AXPVMS KERBEROS V3.0                 Layered Product

The following product has been removed:
    HP AXPVMS KERBEROS V2.1                Layered Product
```

```
HP AXPVMS KERBEROS V3.0

If Kerberos will be run on this system, but has not been
used previously, you need to perform the following steps.

 o Run the Kerberos configuration procedure:

    @SYS$STARTUP:KRB$CONFIGURE.COM

 o Add the following line to SYS$MANAGER:SYSTARTUP_VMS.COM:

    $ @SYS$STARTUP:KRB$STARTUP

 o Add the following line to SYS$MANAGER:SYLOGIN.COM:

    $ @SYS$MANAGER:KRB$SYMBOLS

 $
```

2.6 Configuring Kerberos for OpenVMS Telnet and OpenVMS SSH

Using Kerberos with TCP/IP SSH for OpenVMS or TCP/IP Telnet for OpenVMS, you can authenticate your SSH or Telnet connections between OpenVMS systems.

An OpenVMS account and a corresponding Kerberos principal are required to use both “Kerberized” Telnet and SSH. For each OpenVMS user you create, create a Kerberos principal that exactly matches (including case) its OpenVMS account name. Passwords do not need to match.

To configure Kerberos to use TCP/IP SSH for OpenVMS or TCP/IP Telnet for OpenVMS, or both, perform the following steps. Then see Section 2.7 or Section 2.8 and follow the instructions in the section that applies to you.

1. **Create the principal**. For the Kerberos configuration, you can use either DCL or UNIX-style commands to create the principal.

   The first example below shows the DCL commands. The second example shows the UNIX-style commands. Both styles of commands are entered on an OpenVMS system.

   ```
   DCL:

   $ KERBEROS/ADMIN
   KerberosAdmin> login "SYSTEM/admin"
   Enter password:
   Authenticating as principal SYSTEM/admin with password.
   KerberosAdmin> list principal
   K/M@NODE1.HP.COM
   SYSTEM/admin@NODE1.HP.COM
   kadmin/admin@NODE1.HP.COM
   kadmin/changepw@NODE1.HP.COM
   kadmin/node1@NODE1.HP.COM
   kadmin/history@NODE1.HP.COM
   krbtgt/NODE1.HP.COM@NODE1.HP.COM
   KerberosAdmin> create principal "USER1"
   Authenticating as principal SYSTEM/admin with password.
   WARNING: no policy specified for USER1@NODE1.HP.COM; defaulting to
   ```

```
          no policy
Enter password for principal “USER1@NODE1.HP.COM”:
Re-enter password for principal “USER1@NODE1.HP.COM”:
Principal “USER1@NODE1.HP.COM” created.
KerberosAdmin> list principal
Authenticating as principal SYSTEM/admin with password.
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
USER1@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/node1@NODE1.HP.COM
kadmin/history@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM

UNIX:

$ kinit “SYSTEM/admin”
Password for SYSTEM/admin@NODE1.HP.COM:
$ kadmin
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
Enter password:
KADMIN: listprincs
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/node1@NODE1.HP.COM
kadmin/history@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM
KADMIN: addprinc “USER1”
WARNING: no policy specified for USER1@NODE1.HP.COM; defaulting to no policy
Enter password for principal “USER1@NODE1.HP.COM”:
Re-enter password for principal “USER1@NODE1.HP.COM”:
Principal “USER1@NODE1.HP.COM” created.
KADMIN: listprincs
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
USER1@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/node1@NODE1.HP.COM
kadmin/history@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM
```

2. **Create the Kerberos host principals**. For the Kerberos configuration, you can use either DCL or UNIX-style commands to create the principal. The first example below shows the DCL commands. The second example shows the UNIX-style commands.

```
DCL:

KerberosAdmin> create principal/random “host/node1.hp.com@NODE1.HP.COM”
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
Principal “host/node1.hp.com@NODE1.HP.COM” created.
KerberosAdmin> create principal/random “host/node1@NODE1.HP.COM”
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
Principal “host/node1@NODE1.HP.COM” created.
KerberosAdmin> list principal
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
```

```
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
USER1@NODE1.HP.COM
host/node1.hp.com@NODE1.HP.COM
host/node1@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/history@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM
KerberosAdmin> create keytab "host/node1.hp.com@NODE1.HP.COM"
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
KRB$KERBEROS: Entry for principal host/node1.hp.com@NODE1.HP.COM with
kvno 3, encryption type Triple DES cbc mode with HMAC/sha1 added to
keytab WRFILE=krb$root:[etc]krb5.keytab.

KRB$KERBEROS: Entry for principal host/node1.hp.com@NODE1.HP.COM with
kvno 3, encryption type DES-CBC-CRC mode with CRC-32 added to keytab
WRFILE=krb$root:[etc]krb5.keytab.

KerberosAdmin> create keytab "host/node1@NODE1.HP.COM"
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
KRB$KERBEROS: Entry for principal host/node1@NODE1.HP.COM with
kvno 3, encryption type Triple DES cbc mode with HMAC/sha1 added to
keytab WRFILE=krb$root:[etc]krb5.keytab.

KRB$KERBEROS: Entry for principal host/node1@NODE1.HP.COM with
kvno 3, encryption type DES-CBC-CRC mode with CRC-32 added to keytab
WRFILE=krb$root:[etc]krb5.keytab.

KerberosAdmin> list keytab
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
host/node1.hp.com@NODE1.HP.COM (kvno: 3, etype: Triple DES cbc mode with
HMAC/sha1)
host/node1.hp.com@NODE1.HP.COM (kvno: 3, etype: DES cbc mode with CRC-32)
host/node1@NODE1.HP.COM (kvno: 3, etype: Triple DES cbc mode with
HMAC/sha1)
host/node1@NODE1.HP.COM (kvno: 3, etype: DES cbc mode with CRC-32)
KerberosAdmin> exit
$

UNIX:

KADMIN: addprinc -randkey "host/node1.hp.com@NODE1.HP.COM"
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
Principal "host/node1.hp.com@NODE1.HP.COM" created.
KADMIN: addprinc -randkey "host/node1@NODE1.HP.COM"
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
Principal "host/node1@NODE1.HP.COM" created.
KADMIN: listprincs
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
USER1@NODE1.HP.COM
host/node1.hp.com@NODE1.HP.COM
host/node1@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/history@NODE1.HP.COM SYSTEM/admin@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM
```

```
KADMIN: ktadd "host/node1.hp.com@NODE1.HP.COM"
KRB$KADMIN: Entry for principal host/node1.hp.com@NODE1.HP.COM with
kvno 3, encryption type Triple DES cbc mode with HMAC/sha1 added to
keytab WRFILE=krb$root:[etc]krb5.keytab.

KRB$KADMIN: Entry for principal host/node1.hp.com@NODE1.HP.COM with
kvno 3, encryption type DES-CBC-CRC mode with CRC-32 added to keytab
WRFILE=krb$root:[etc]krb5.keytab.
KADMIN: ktadd "host/node1@NODE1.HP.COM"
KRB$KADMIN: Entry for principal host/node1@NODE1.HP.COM with
kvno 3, encryption type Triple DES cbc mode with HMAC/sha1 added to
keytab WRFILE=krb$root:[etc]krb5.keytab.

KRB$KADMIN: Entry for principal host/node1@NODE1.HP.COM with
kvno 3, encryption type DES-CBC-CRC mode with CRC-32 added to keytab
WRFILE=krb$root:[etc]krb5.keytab.
KADMIN: ktlist
host/node1.hp.com@NODE1.HP.COM (kvno: 3, etype: Triple DES cbc mode with
HMAC/sha1)
host/node1.hp.com@NODE1.HP.COM (kvno: 3, etype: DES cbc mode with CRC-32)
host/node1@NODE1.HP.COM (kvno: 3, etype: Triple DES cbc mode with
HMAC/sha1)
host/node1@NODE1.HP.COM (kvno: 3, etype: DES cbc mode with CRC-32)
KADMIN: exit
$
```

2.7 Configuring HP TCP/IP Services for OpenVMS SSH with Kerberos

Using Kerberos with TCP/IP SSH for OpenVMS, you can authenticate your SSH connections between OpenVMS systems.

The minimum version of TCP/IP Services for OpenVMS necessary for Kerberized SSH is Version 5.6.

To "Kerberize" your SSH connections, perform the following steps.

1. Install and configure TCP/IP for OpenVMS Services Version 5.6 or higher.
2. Install and configure Kerberos for OpenVMS.

   If you have already installed OpenVMS Version 7.3-2 or higher, Kerberos is part of the OpenVMS installation procedure. If you have an earlier version of OpenVMS installed, you can download the Kerberos for OpenVMS PCSI kit from the Kerberos web site at `http://h71000.www7.hp.com/openvms/products/kerberos/`
3. Shut down Kerberos, if it is running, by entering the following command:

   ```
   $ @SYS$STARTUP:KRB$SHUTDOWN
   ```
4. Configure TCP/IP Services for OpenVMS by entering the following command:

   ```
   $ @SYS$STARTUP:TCPIP$CONFIG
   ```
5. Select #2, Client components, from the TCP/IP Configuration Menu:

```
HP TCP/IP Services for OpenVMS Configuration Menu

Configuration options:

  1  -  Core environment
  2  -  Client components
  3  -  Server components
  4  -  Optional components

  5  -  Shutdown HP TCP/IP Services for OpenVMS
  6  -  Startup HP TCP/IP Services for OpenVMS
  7  -  Run tests

  A  -  Configure options 1 - 4
 [E] -  Exit configuration procedure

Enter configuration option: 2
```

6. Ensure that the SSH Client and Server services are enabled. Select #7, SSH Client, from the TCP/IP Configuration Menu:

```
HP TCP/IP Services for OpenVMS Client Components Configuration Menu

Configuration options:

         1  -  DHCP Client      Disabled Stopped
         2  -  FTP Client       Enabled  Started
         3  -  NFS Client       Disabled Stopped
         4  -  REXEC and RSH    Enabled  Started
         5  -  RLOGIN           Enabled  Started
         6  -  SMTP             Disabled Stopped
         7  -  SSH Client       Disabled Stopped
         8  -  TELNET           Enabled  Started
         9  -  TELNETSYM        Disabled Stopped

         A  -  Configure options 1 - 9
        [E] -  Exit menu

Enter configuration option: 7
```

7. Select #2, Enable service on this node, from the TCP/IP Configuration Menu. Type YES when it asks if you want to configure the SSH SERVER. If SSH is already enabled, skip to step 9.

```
SSH CLIENT configuration options:

         1 - Enable service on all nodes
         2 - Enable service on this node

         3 - Stop service on this node

        [E] - Exit SSH_CLIENT configuration

Enter configuration option: 2

The SSH SERVER is enabled.

* Do you want to configure SSH SERVER [NO]: YES
```

8. Select #2, Enable Service on this node, from the TCP/IP Configuration Menu. Press return to select the default or type YES to create a new default server host key.

```
SSH configuration options:

         1 - Enable service on all nodes
         2 - Enable service on this node

         3 - Stop service on this node

        [E] - Exit SSH configuration

Enter configuration option: 2
* Create a new default server host key? [YES]: YES
Creating private key file: TCPIP$SSH_DEVICE:[TCPIP$SSH.SSH2]HOSTKEY
Creating public key file: TCPIP$SSH_DEVICE:[TCPIP$SSH.SSH2]HOSTKEY.PUB
```

9. Select Exit twice to exit from each submenu of the TCP/IP Configuration Menu.
10. If the system asks if you want to start SSH now, answer NO.

```
The following services are enabled but not started:

 SSH, SSH_CLIENT

 * Start these services now? [N] NO

 You may start services individually with:

 @SYS$STARTUP:TCPIP$<service>_STARTUP.COM
```

11. If SSH is not already running, manually start the SSH client and server by entering the following commands:

```
$ @SYS$STARTUP:TCPIP$SSH_STARTUP.COM
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SSHD2.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SFTP-SERVER2.EXE installed
%TCPIP-I-INFO, logical names created
%TCPIP-I-INFO, service enabled
%TCPIP-S-STARTDONE, TCPIP$SSH startup completed

$ @SYS$STARTUP:TCPIP$ssh_client_STARTUP.COM
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SCP2.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SFTP2.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SSH-ADD2.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SSH-AGENT2.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SSH-KEYGEN2.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SSH-SIGNER2.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$SSH_SSH2.EXE installed
%TCPIP-I-INFO, logical names created
%TCPIP-S-STARTDONE, TCPIP$SSH_CLIENT startup completed
```

12. Start Kerberos by entering the following command:

```
$ @SYS$STARTUP:KRB$STARTUP
```

13. Verify that the SSH service is enabled by entering the following command:

```
$ TPCIP SHOW SERV

Service          Port  Proto    Process          Address        State

FTP                21  TCP      TCPIP$FTP        0.0.0.0        Enabled
REXEC             512  TCP      TCPIP$REXEC      0.0.0.0        Enabled
```

```
RLOGIN          513  TCP     not defined      0.0.0.0        Enabled
RSH             514  TCP     TCPIP$RSH        0.0.0.0        Enabled
SSH              22  TCP     TCPIP$SSH        0.0.0.0        Enabled
TELNET           23  TCP     not defined      0.0.0.0        Enabled
```

14. Modify the following SSH configuration files to enable the Kerberos authentication methods:

```
SYS$SYSDEVICE:[000000.TCPIP$SSH.SSH2]
        SSH2_CONFIG.           (SSH client)
        SSHD2_CONFIG.           (SSH server)
```

    In each file, under the 'Authentication' section, you must add the Kerberos authentication methods you would like to use. Following is an example that uses all three methods, plus the regular methods. Make sure you indent and space as the example in the file shows:

```
AllowedAuthentications      gssapi-with-mic, kerberos-2@ssh.com,
                            kerberos-tgt-2@ssh.com, publickey,
                             password, hostbased
```

    You should only have one AllowedAuthentications line uncommented. If there are others that are uncommented, comment them out with a # sign as shown below:

```
#   AllowedAuthentications       publickey, keyboard-interactive, password
```

15. Add the following lines to SYS$MANAGER:SYSTARTUP_VMS.COM to install the 32-bit Kerberos images at boot time. They are needed for the Kerberos-based functionality with SSH:

```
$ INSTALL CREATE SYS$SHARE:KRB$RTL32.EXE/OPEN/HEADER_RESIDENT/SHARED
$ INSTALL CREATE SYS$SHARE:GSS$RTL32.EXE/OPEN/HEADER_RESIDENT/SHARE
```

16. If you are using TCP/IP Version 5.6 and Kerberos Version 2.1 and want to use the `gssapi-with-mic` authentication method with SSH, you must define the following system logical:

```
$ DEFINE/SYSTEM TCPIP$SSH_KRBRTL_HACK 1
```

17. Set up the Kerberos symbols, if you have not already done so. Add the following command to the SYS$MANAGER:SYLOGIN.COM file.

```
$ @SYS$MANAGER:KRB$SYMBOLS
```

The following steps should be performed by each user who will use Kerberized SSH.

A. Log into the OpenVMS system.

```
Welcome to OpenVMS (TM) Alpha Operating System, Version 8.3

Username: user1
Password:
```

B. Perform a `kinit` with the principal name that matches the OpenVMS username. To do so, enter one of the following commands at the DCL prompt each time you start a Kerberized application, such as TCP/IP Services for OpenVMS SSH. You are then prompted for the password associated with the principal. (The `-f` is required for the `kerberos-tgt-2` authentication method.)

```
$ kinit -f "USER1"
password for user1@NODE1.HP.COM

$ kinit "USER1"
password for user1@NODE1.HP.COM
```

C. Enter the SSH command specifying the Kerberos authentication method to use and the hostname as follows:

```
$ ssh -o"AllowedAuthentications gssapi-with-mic" node1
Authentication successful.

Welcome to OpenVMS (TM) Operating System, Version 8.3

$ ssh -o"AllowedAuthentications kerberos-2@ssh.com" node1
Authentication successful.

Welcome to OpenVMS (TM)  Operating System, Version 8.3

$ ssh -o"AllowedAuthentications kerberos-tgt-2@ssh.com" node1
Authentication successful.

Welcome to OpenVMS (TM) Operating System, Version 8.3

$
```

D. See the *HP TCP/IP Services for OpenVMS Guide to SSH* for more information about configuring SSH and troubleshooting.

2.8 Configuring HP TCP/IP Services for OpenVMS Telnet with Kerberos

Using Kerberos with TCP/IP KTELNET for OpenVMS, you can authenticate your Telnet connections between OpenVMS systems.

The minimum version of TCP/IP Services for OpenVMS necessary for Kerberized Telnet is Version 5.3. If you are using a version of TCP/IP Services for OpenVMS prior to Version 5.5, you must download the Kerberized Telnet client (TCPIP$TELNET.EXE) and server (TCPIP$TELNET_SERVER.EXE) kits from `http://h71000.www7.hp.com/openvms/products/kerberos/`

NOTE If you download the Telnet client and server, you must copy TCPIP$TELNET.EXE and TCPIP$TELNET_SERVER.EXE to SYS$COMMON:[SYSEXE].

You do not need to run these files directly. They are executed when you first run Telnet after following the instructions below.

To "Kerberize" your Telnet connections, perform the following steps.

1. Install and configure TCP/IP for OpenVMS Services Version 5.3 or higher.
2. Install and configure Kerberos for OpenVMS. If you have already installed OpenVMS Version 7.3-2 or higher, Kerberos is part of the OpenVMS installation procedure. If you have an earlier version of OpenVMS installed, you can download the Kerberos for OpenVMS PCSI kit from the Kerberos web site at `http://h71000.www7.hp.com/openvms/products/kerberos/`
3. Shut down Kerberos, if it is running, by entering the following command:

   ```
   $ SYS$STARTUP:KRB$SHUTDOWN
   ```
4. Configure TCP/IP Services for OpenVMS by entering the following command:

   ```
   $ @SYS$STARTUP:TCPIP$CONFIG
   ```

5. Select #2, Client components, from the TCP/IP Configuration Menu:

```
HP TCP/IP Services for OpenVMS Configuration Menu

Configuration options:

     1  -  Core environment
     2  -  Client components
     3  -  Server components
     4  -  Optional components

     5  -  Shutdown HP TCP/IP Services for OpenVMS
     6  -  Startup HP TCP/IP Services for OpenVMS
     7  -  Run tests

     A  -  Configure options 1 - 4
    [E] -  Exit configuration procedure

Enter configuration option: 2
```

6. Ensure that the Telnet service is stopped. If Telnet is already stopped, skip to step 8. If Telnet is not currently stopped, select #8, Telnet, from the TCP/IP Configuration Menu:

```
HP TCP/IP Services for OpenVMS Client Components Configuration Menu

Configuration options:

            1  -  DHCP Client       Disabled Stopped
            2  -  FTP Client        Enabled  Started
            3  -  NFS Client        Disabled Stopped
            4  -  REXEC and RSH     Enabled  Started
            5  -  RLOGIN            Enabled  Started
            6  -  SMTP              Disabled Stopped
            7  -  SSH Client        Enabled  Started
            8  -  TELNET            Enabled  Started
            9  -  TELNETSYM         Disabled Stopped

            A  -  Configure options 1 - 9
           [E] -  Exit menu

Enter configuration option: 8
```

NOTE You must stop the Telnet service before you can begin to configure Kerberized Telnet. Stopping the Telnet service disconnects current Telnet sessions.

7. Select #3, Stop service on this node, from the TCP/IP Configuration Menu:

```
TELNET configuration options:

            1 - Enable service on all nodes
            2 - Enable service on this node

            3 - Stop service on this node

           [E] - Exit TELNET configuration

Enter configuration option: 3
```

8. Select [E], Exit menu, from the TCP/IP Configuration Menu:

```
Configuration options:

            1  -  DHCP Client      Disabled Stopped
            2  -  FTP Client       Enabled  Started
            3  -  NFS Client       Disabled Stopped
            4  -  REXEC and RSH    Enabled  Started
            5  -  RLOGIN           Enabled  Started
            6  -  SMTP             Disabled Stopped
            7  -  SSH Client       Enabled  Started
            8  -  TELNET           Enabled  Stopped
            9  -  TELNETSYM        Disabled Stopped

            A  -  Configure options 1 - 9
           [E] -  Exit menu

Enter configuration option: E
```

9. Select #4, Optional components, from the TCP/IP Configuration Menu:

```
 HP TCP/IP Services for OpenVMS Configuration Menu

 Configuration options:

     1  -  Core environment
     2  -  Client components
     3  -  Server components
     4  -  Optional components

     5  -  Shutdown HP TCP/IP Services for OpenVMS
     6  -  Startup HP TCP/IP Services for OpenVMS
     7  -  Run tests

     A  -  Configure options 1 - 4
    [E] -  Exit configuration procedure

Enter configuration option: 4
```

10. Select #4, Configure Kerberos Applications, from the TCP/IP Configuration Menu:

```
 HP TCP/IP Services for OpenVMS Optional Components Configuration Menu

 Configuration options:

     1  -  Configure PWIP Driver (for DECnet-Plus and PATHWORKS)
     2  -  Configure SRI QIO Interface (INET Driver)
     3  -  Set up Anonymous FTP Account and Directories
     4  -  Configure Kerberos Applications
     5  -  Configure failSAFE IP

     A  -  Configure options 1 - 5
    [E] -  Exit menu

Enter configuration option: 4
```

11. Select #1, Add Kerberos for TELNET server, from the TCP/IP Configuration Menu:

```
 Kerberos Applications Configuration Menu

 TELNET Kerberos is not defined in the TCPIP$SERVICE database.
```

```
Configuration options:

         1  -  Add Kerberos for TELNET server
         2  -  Remove Kerberos for TELNET server

        [E] -  Exit menu

Enter configuration option: 1
```

12. Select Exit three times to exit from the submenus of the TCP/IP Configuration Menu.

13. If the system asks if you want to start Telnet now, answer NO.

```
The following services are enabled but not started:

TELNET

Start these services now? [N] NO

You may start services individually with:

@SYS$STARTUP:TCPIP$<service>_STARTUP.COM
```

14. Manually start Telnet by entering the following command:

```
$ @SYS$STARTUP:TCPIP$TELNET_STARTUP.COM

%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$TELNET_SERVER.EXE installed
%TCPIP-I-INFO, image SYS$SYSTEM:TCPIP$TELNET.EXE installed
%TCPIP-I-INFO, logical names created
%TCPIP-I-INFO, telnet service enabled
%TCPIP-I-INFO, telnet (kerberos) service enabled
%TCPIP-S-STARTDONE, TCPIP$TELNET startup completed
```

15. Start Kerberos by entering the following command:

```
$ @SYS$STARTUP:KRB$STARTUP
```

16. Verify that the Kerberos Telnet (KTELNET) service is enabled by entering the following command. (If KTELNET is disabled, you can enable it using the $ TCPIP ENABLE SERVICE KTELNET command.)

```
$ TPCIP SHOW SERV

Service         Port  Proto    Process          Address        State

FTP               21  TCP      TCPIP$FTP        0.0.0.0        Enabled
KTELNET         2323  TCP      TCPIP$TELNET     0.0.0.0        Enabled
REXEC            512  TCP      TCPIP$REXEC      0.0.0.0        Enabled
RLOGIN           513  TCP      not defined      0.0.0.0        Enabled
RSH              514  TCP      TCPIP$RSH        0.0.0.0        Enabled
SSH               22  TCP      TCPIP$SSH        0.0.0.0        Enabled
TELNET            23  TCP      not defined      0.0.0.0        Enabled
```

17. Set up the Kerberos symbols, if you have not already done so. Add the following command to the SYS$MANAGER:SYLOGIN.COM file.

```
$ @SYS$MANAGER:KRB$SYMBOLS
```

The following steps should be performed by each user who will user Kerberized Telnet.

A. Log into the OpenVMS system.

```
Welcome to OpenVMS (TM) Alpha Operating System, Version 8.3

Username: user1
Password:
```

B. Perform a kinit with the principal name that matches the OpenVMS username. To do so, enter the following command at the DCL prompt each time you start a Kerberized application, such as TCP/IP Services for OpenVMS Telnet. You are then prompted for the password associated with the principal. (The -f denotes forwardable credentials.)

```
$ kinit -f “USER1”
password for user1@node1.hp.com
```

C. Enter the TELNET/AUTH command specifying Kerberos port 2323 to start the TELNET session, as follows:

```
$ kinit -f “USER1”
$ TELNET/AUTH NODE1 2323
TELNET-I-TRYING, Trying ... 1.2.3.4
%TELNET-I-SESSION, Session 01, host node1, port 2323
-TELNET-I-ESCAPE, Escape character is ^]
[ Kerberos V5 accepts you as ''user1.NODE1.HP.COM'' ]
```

D. Optionally, enter the TELNET/AUTH/FORW command specifying Kerberos port 2323 to forward credentials. (Note: Forwarding credentials to non-OpenVMS servers works properly, but there is currently a problem in forwarding credentials to OpenVMS servers. This will be corrected in a future TCP/IP Services for OpenVMS ECO kit.)

```
$ TELNET/AUTH/FORW NODE1 2323
TELNET-I-TRYING, Trying ... 1.2.3.4
%TELNET-I-SESSION, Session 01, host node1, port 2323
-TELNET-I-ESCAPE, Escape character is ^]
[Kerberos V5 accepts you as ''user1@NODE1.HP.COM'' ]
[ Kerberos V5 refuses authentication ]
```

E. If you are using Kerberized Telnet to a non-OpenVMS system, the default port of 23 should be specified. Port 2323 is only used when contacting a Kerberized Telnet server on an OpenVMS system. This is because Telnet on OpenVMS currently uses different servers for regular and Kerberized Telnet.

2.9 Configuring and Starting the Kerberos ACME Agent

HP OpenVMS Version 8.3 includes pre-production images for the Kerberos ACME agent. The Kerberos ACME agent is an addition to the existing Kerberos authentication provided by the Kerberos utilities. The Kerberos ACME provides functionality similar to the `pam_krb5` utility on UNIX systems using Kerberos.

NOTE The images described in this section are "pre-production" images and are not qualified for production use. After additional rigorous production quality testing and qualification is completed, a maintenance update (ECO) will be made available to allow for production use deployments.

To use Kerberos with previous versions of OpenVMS, you needed to log in twice: once to log in to OpenVMS itself, and once to obtain Kerberos credentials. These steps worked with separate principal, or user, names, and with separate passwords.

With the Kerberos ACME agent, you can obtain your Kerberos credentials as part of the OpenVMS login process. The user authentication is processed against the Kerberos KDC database instead of against the OpenVMS User Authorization File (UAF).

After you install and configure Kerberos Version 3.0, perform the following steps to configure and start the Kerberos ACME agent.

1. **Install ACME Login** from a privileged account. OpenVMS Version 8.3 includes pre-production images for ACME Login. See the file SYS$HELP:ACME_DEV_README.TXT for information about installation and set up.
2. **Install the Kerberos persona extensio**n by entering the following commands:

   ```
   $ MCR SYSMAN
   SYSMAN> SYS_LOADABLE ADD/LOG KERBEROS KRB$ACME_KRB_PERSONA_EXT
   %SYSMAN-I-IMGADDED, added image KRB$ACME_KRB_PERSONA_EXT for product KERBEROS

   $ @SYS$UPDATE:VMS$SYSTEM_IMAGES.COM
   ```

3. **Reboot the system**. This is required one time only, after you have installed the Kerberos persona extension.
4. To start the Kerberos ACME agent automatically, **edit the file SYS$MANAGER:ACME$START.COM** to **uncomment** the following line:

   ```
   $! @SYS$STARTUP:KRB$STARTUP_KERBEROS_ACME
   ```

5. **Edit the file SYSTARTUP_VMS.COM** to include the following command after all dependent software is started:

   ```
   $ SET SERVER ACME/RESTART
   ```

6. **Create an OpenVMS account** with the EXTAUTH flag set.
7. **Create a Kerberos principal name** that exactly matches (including case) the OpenVMS account name created in step 6. Passwords do not need to match. For the Kerberos configuration, you can use either DCL or UNIX-style commands to create the principal.

   The first example below shows the DCL commands. The second example shows the UNIX-style commands. Both styles of commands are entered on an OpenVMS system.

   ```
   DCL:

   $ KERBEROS/ADMIN
   KerberosAdmin> login "SYSTEM/admin"
   Enter password:
   Authenticating as principal SYSTEM/admin with password.
   KerberosAdmin> list principal
   K/M@NODE1.HP.COM
   SYSTEM/admin@NODE1.HP.COM
   kadmin/admin@NODE1.HP.COM
   kadmin/changepw@NODE1.HP.COM
   kadmin/node1@NODE1.HP.COM
   kadmin/history@NODE1.HP.COM
   krbtgt/NODE1.HP.COM@NODE1.HP.COM
   KerberosAdmin> create principal "ACMEUSER"
   Authenticating as principal SYSTEM/admin with password.
   WARNING: no policy specified for ACMEUSER@NODE1.HP.COM; defaulting to
            no policy
   Enter password for principal "ACMEUSER@NODE1.HP.COM":
   Re-enter password for principal "ACMEUSER@NODE1.HP.COM":
   ```

```
Principal "ACMEUSER@NODE1.HP.COM" created.
KerberosAdmin> list principal
Authenticating as principal SYSTEM/admin with password.
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
ACMEUSER@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/node1@NODE1.HP.COM
kadmin/history@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM

UNIX:

$ kinit "SYSTEM/admin"
Password for SYSTEM/admin@NODE1.HP.COM:
$ kadmin
Authenticating as principal SYSTEM/admin@NODE1.HP.COM with password.
Enter password:
KADMIN: listprincs
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/node1@NODE1.HP.COM
kadmin/history@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM
KADMIN: addprinc "ACMEUSER"
WARNING: no policy specified for ACMEUSER@NODE1.HP.COM; defaulting to no policy
Enter password for principal "ACMEUSER@NODE1.HP.COM":
Re-enter password for principal "ACMEUSER@NODE1.HP.COM":
Principal "ACMEUSER@NODE1.HP.COM" created.
KADMIN: listprincs
K/M@NODE1.HP.COM
SYSTEM/admin@NODE1.HP.COM
USER1@NODE1.HP.COM
kadmin/admin@NODE1.HP.COM
kadmin/changepw@NODE1.HP.COM
kadmin/node1@NODE1.HP.COM
kadmin/history@NODE1.HP.COM
krbtgt/NODE1.HP.COM@NODE1.HP.COM
```

8. **SET HOST or Telnet to the system** on which you installed the ACME Agent and the Kerberos persona extension in steps 1 and 2. Enter one of the following commands:

   ```
   $ TELNET NODE1
   ```

   or

   ```
   $ SET HOST NODE1
   ```

9. **Enter the username and password**. You must enclose the username in quotes so that the case of the username is preserved. For example:

   ```
   Welcome to OpenVMS (TM) Alpha Operating System, Version 8.3

         Username: "ACMEUSER"
         Password:

         **** Logon Message from ACME_KRB_DOI ACME Agent ***
   ```

The logon message indicates that you successfully obtained your Kerberos credentials as part of the OpenVMS login process.

3 Kerberos Client and Administrative Programs

In addition to the Kerberos database and Key Distribution Center, there are a number of user and administrative programs that allow interaction with Kerberos. This chapter will detail the use of those programs.

The Kerberos user client programs include the following:

- **kinit** – Obtains a Kerberos ticket-granting ticket
- **klist** – Lists cached Kerberos tickets
- **kdestroy** – Destroys Kerberos tickets
- **kpasswd** – Changes a user's Kerberos password

The Kerberos administrative client programs include the following:

- **kadmin** and **kadmin_local** – Administers the Kerberos database
- **kdb5_util** – Dumps and restores the Kerberos database
- **ktutil** – Reads, writes, or edits entries in a Kerberos V5 `keytab` or V4 `srvtab` file
- **kprop** – Propagates the master KDC database to slave KDCs

The symbols for these programs are defined by SYS$MANAGER:KRB$SYMBOLS.COM.

On OpenVMS, these programs are located in the system directory and are prefaced by KRB$; for example, `SYS$SYSTEM:KRB$KINIT.EXE`.

NOTE All options for the client programs are case sensitive. Uppercase options should be enclosed in double quotation marks. For example:

```
$ kinit "-R"
```

3.1 User Client Programs

This section describes the user client programs `kinit`, `klist`, `kdestroy`, and `kpasswd`.

3.1.1 kinit

The `kinit` program allows the user to obtain and cache a Kerberos ticket-granting ticket. A Kerberos principal name must have already been created for the user, or another pre-existing principal must be specified.

The `kinit` program optionally uses the logical name `KRB5CCNAME` to specify the location and name of the credentials (ticket) cache. The default location for the credentials cache is in the `[.KRB.<nodename>]` subdirectory of the user's login directory. The default name of the credentials cache is `KRB5CC_xxxxxx.;` where *xxxxxx* is a randomly generated numeric string.

SYNOPSIS

`kinit` [-5] [-4] [-V] [-l *lifetime*] [-s *start_time*] [-r *renewable_life*]
[-p] [-P] [-f] [-F] [-A] [-v] [-R] [–k [-t *keytab_file*]]
[-c *cache_name*] [-S *service_name*] [*principal*]

OPTIONS

-5
Get Kerberos 5 tickets, overriding the default built-in behavior. This option may be used with `-4`.

-4
Get Kerberos 4 tickets, overriding the default built-in behavior. This option may be used with `-5`.

-V
Display verbose output.

-l ***lifetime***
Request a ticket whose lifetime is specified by *lifetime*. The value for *lifetime* must be followed immediately by one of the following delimiters:

s *seconds*

m *minutes*

h *hours*

d *days*

For example:

```
kinit -l 90m
```

You cannot mix units; a value of `30h30m` will result in an error.

If the `-l` option is not specified, the default ticket lifetime (configured by each site) is used. Specifying a ticket lifetime longer than the maximum ticket lifetime (configured by each site) results in a ticket with the maximum lifetime.

-s ***start_time***
Request a postdated ticket, valid starting at `start_time`. Postdated tickets are issued with the invalid flag set, and need to be fed back to the KDC before use.

-r ***renewable_life***
Request renewable tickets, with a total lifetime of `renewable_life`. The duration is the same format as the `-l` option, with the same delimiters. (Not applicable to Kerberos 4.)

-f
Request tickets that can be forwarded to another system. (Not applicable to Kerberos 4.)

-F
Do not request forwardable tickets. (Not applicable to Kerberos 4.)

-p
Request proxiable tickets. (Not applicable to Kerberos 4.)

-P
Do not request proxiable tickets. (Not applicable to Kerberos 4.)

-A
Request address-less tickets. (Not applicable to Kerberos 4.)

-v Request that the ticket granting ticket in the cache (with the invalid option set) be passed to the KDC for validation. If the ticket is within its requested time range, the cache is replaced with the validated ticket. (Not applicable to Kerberos 4.)

-R Request renewal of the ticket-granting ticket. Note that an expired ticket cannot be renewed, even if the ticket is still within its renewable life. When using this option with Kerberos 4, the KDC must support Kerberos 5 to Kerberos 4 ticket conversion.

-k [**-t *keytab_file***] Request a host ticket, obtained from a key in the local host's keytab file. The name and location of the keytab file may be specified with the `-t keytab_file` option; otherwise the default name and location will be used. When using this option with Kerberos 4, the KDC must support Kerberos 5 to Kerberos 4 ticket conversion.

-c ***cache_name*** Use `cache_name` as the credentials (ticket) cache name and location; if this option is not used, the default cache name and location are used.

The default credentials cache may vary between systems. If the `KRB5CCNAME` logical name is set, its value is used to name the default ticket cache. Any existing contents of the cache are destroyed by `kinit`. (Not applicable to Kerberos 4).

-S ***service_name*** Specify an alternate service name to use when getting initial tickets.

3.1.2 klist

The `klist program` allows the user to display information about their cached Kerberos tickets. (Applicable to Kerberos 5, or to Kerberos 4 ticket conversion if you use both Kerberos 5 and Kerberos 4 with a KDC that supports Kerberos 5.)

SYNOPSIS

`klist` [-5] [-4] [-e] [[-c] [-f] [-s] [-a [-n]]] [-k [-t] [-K]]

[*cache_name* | *keytab_name*]

OPTIONS

-5 List Kerberos 5 credentials. This overrides whatever the default built-in behavior may be. This option may be used with `-4`.

-4 List Kerberos 4 credentials. This overrides whatever the default built-in behavior may be. This option may be used with `-5`.

-e Display the encryption types of the session key and the ticket for each credential in the credential cache, or each key in the keytab file.

-c List the tickets held in a credentials cache. This is the default if neither `-c` nor `-k` is specified.

-f Show the options present in the credentials. Possible options are as follows:

- *A* Pre-authenticated
- *a* anonymous
- *D* postDateable

d postdated

F Forwardable

f forwarded

H Hardware authenticated

I Initial

i invalid

O OK as delegate

P Proxiable

p proxy

R Renewable

T Transit policy checked

-s Cause `klist` to run silently (produce no output) but to still set the exit status according to whether it finds the credential cache. The exit status is `SS$_NORMAL` if `klist` finds a credentials cache.

-a Display list of addresses in credentials.

-n Show numeric addresses instead of reverse-resolving addresses.

-k List the keys held in a keytab file.

-t Display the time entry timestamps for each keytab entry in the keytab file.

-K Display the value of the encryption key in each keytab entry in the keytab file.

If *cache_name* or *keytab_name* is not specified, `klist` will display the credentials in the default credentials cache or keytab file as appropriate. If the `KRB5CCNAME` logical name is set, its value will be used to name the default ticket cache.

3.1.3 kdestroy

The `kdestroy` program destroys the user's active Kerberos authorization tickets by writing zeros to the specified credentials cache that contains them. If the credentials cache is not specified, the default credentials cache is destroyed. The default behavior is to destroy both Kerberos 5 and Kerberos 4 credentials.

SYNOPSIS

`kdestroy` [-5] [-4] [-q] [-c *cache_name*]

OPTIONS

-5 Destroy Kerberos 5 credentials. This option may be used with –4.

-4 Destroy Kerberos 4 credentials. This option may be used with –5.

-q Quiet mode. Normally, `kdestroy` beeps if it fails to destroy the user's tickets, in addition to issuing an error message. The `-q` option suppresses the beep, and only an error is issued.

-c ***cache_name*** Use *cache_name* as the credentials (ticket) cache name and location. If this option is not used, the default cache name and location are used.

If the KRB5CCNAME logical name is set, its value is used to name the default ticket cache.

HP recommends that you place the `kdestroy` command in a logout command file, so that your tickets are destroyed automatically when you log out.

3.1.4 kpasswd

The `kpasswd` program is used to change a Kerberos principal's password. The `kpasswd` program prompts for the current Kerberos password, which is used to obtain a `changepw` ticket from the KDC for the user's Kerberos realm. If `kpasswd` successfully obtains the `changepw` ticket, the user is prompted twice for the new password, and the password is changed.

If the principal is governed by a policy that specifies the length or number of character classes required in the new password, the new password must conform to the policy. (The five-character classes are: lowercase, uppercase, numbers, punctuation, and all other characters.)

SYNOPSIS

`kpasswd` [*principal*]

OPTIONS

principal — Change the password for the Kerberos principal specified by `principal`. Otherwise, the principal is derived from the identity of the user invoking the `kpasswd` command.

3.2 Administrative Client Programs

This section describes the administrative utilities `kadmin`, `kadmin_local`, `kdb5_util`, and `kprop`.

3.2.1 kadmin and kadmin_local

The `kadmin` program allows the Kerberos administrator to make changes to the Kerberos database. The `kadmin` program provides for the maintenance of Kerberos principals, policies, and service key tables (keytabs). It exists as both a Kerberos client (`kadmin`), using Kerberos authentication and an RPC to operate securely from anywhere on the network, and as a local client (`kadmin_local`), intended to run directly on the KDC without Kerberos authentication.

SYNOPSIS

`kadmin` [-r *realm*] [-p *principal*] [-w *password*] [-q *query*]
[-s *admin_server[:port]*] [[-c *credentials_cache*] |
[-k *keytab*]]

`kadmin_local` [-d *dbname*] [-e *"enc:salt …"*] [-m]

Options

-r realm — Use *realm* as the default Kerberos realm for the database.

-p ***principal***	Use the Kerberos principal *principal* to authenticate to Kerberos. If this option is not given, `kadmin` will append `admin` to either the primary principal name or to the username of the current process.
-w ***password***	Use *password* as the password instead of prompting for one. **Caution**: Placing the password for a Kerberos principal with administrative access into a command file can be dangerous if unauthorized users gain read access to the file.
-q ***query***	Pass the string *query* directly to `kadmin`. This is useful for writing command procedures that pass specific queries to `kadmin`.
-s ***admin_server[:port]***	Use *admin_server* as the KDC to contact. Optionally specify the TCP/IP port to use for communication.
-c ***credentials_cache***	Use *credentials_cache* as the credentials cache. The credentials cache should contain a service ticket for the `kadmin/admin` service, which can be acquired with the `kinit` program. If this option is not specified, `kadmin` requests a new service ticket from the KDC and stores it in its own temporary cache.
-k ***keytab***	Use the keytab *keytab* to decrypt the KDC response instead of prompting for a password on the terminal. In this case, the principal will be `host/hostname`.
-d ***dbname***	This option is valid for `kadmin_local` only. Specify the filename of the KDC database.
-e ***"enc:salt..."***	This option is valid for `kadmin_local` only. It sets the list of cryptosystem and salt types to be used for any new keys created. Available types include `des3-cbc-sha1:normal, des-cbc-crc:normal`, and `des-cbc-crc:v4`.
-m	This option is valid for `kadmin_local` only. Specify the KDC database master key.

3.2.2 kdb5_util

The `kdb5_util` program provides a way for the Kerberos administrator to create, delete, load, or dump a Kerberos database. It also includes a command to stash a copy of the master database key in a file on a KDC, so that the KDC can authenticate itself to the `kadmind` and `krb5kdc` daemons at boot time.

SYNOPSIS

`kdb5_util`	[-r *realm*] [-d *dbname*] [-k *mkeytype*] [-M *mkeyname*]
	[-sf *stashfilename*] [-m] command [*command_options*]

OPTIONS

-r ***realm***	Use *realm* as the default Kerberos realm for the database.
-d ***dbname***	Specify the filename of the KDC database.
-k ***mkeytype***	Specify the encryption type to use from the list of supported `mtypes` in `KDC.CONF`.
-M ***mkeyname***	Specify the master key name.

-sf ***stashfilename*** Specify the file that stores the master key. If you specify this file, you are not prompted for the master key.

-m Specify the KDC database master key.

command

The `kdb5_util` command can be one of the following:

ark [-e etype_list] principal

Add a random key for a Kerberos 5 database entry principal. This assumes the *max key* version number. As a side effect, all old keys older than the maximum key version number are deleted.

-e etype_list

Specify the key salt to use for the random key.

create [-s]

Create a new Kerberos database. If you specify the `-s` option, `kdb5_util` stashes a copy of the master key in a stash file.

destroy [-f]

Destroy the existing Kerberos database. If you do not specify the `-f` option, you are prompted with "are you sure?" before the database is destroyed.

dump [-old] [-b6] [-ov] [-verbose] [-mkey_convert] [-new_mkey_file mkey_file] [-rev] [-recurse] [filename [princs…]]

Dump a Kerberos database to a file.

-old

Cause the dump file to be Kerberos 5 Beta 5 and earlier dump format (`kdb5_edit load_dump version 2.0`).

-b6

Cause the dump file to be Kerberos 5 Beta 6 format ("kdb5_edit load_dump version 3.0").

-ov

Cause the dump to be in `ovsec_adm_export` format.

-verbose

Cause the name of each principal and policy to be printed as it is loaded.

-mkey_convert

Change master key as part of dump.

-new_mkey_file mkey file

Get master key from file `mkey_file`.

-rev

Dump in reverse order.

-recurse

Do recursive descent tree traversal of database instead of using previous/next pointers.

filename

File name of the dump file to be output.

[**princs**]

Principal name to be dumped.

dump_v4 filename

Dump a Kerberos database to a file in Kerberos V4 format.

filename

File name of the dump file to be output.

load [-old] [-b6] [-ov] [-verbose] [-update] filename

Restore a Kerberos database dump from a file, specified by *filename*.

-old

Requires the dump to be in the Kerberos 5 Beta 5 and earlier dump format (`kdb5_edit load_dump v2.0`).

-b6

Require the dump to be in the Kerberos 5 Beta 6 format (`kdb5_edit load_dump v3.0`).

-ov

Require the dump to be in `ovsec_adm_export` format

-verbose

Cause the name of each principal and policy to be printed as it is dumped.

-update

Cause records from the dump file to be updated in or added to the existing database.

filename

File name of the dump file to load.

load_v4 [-t] [-n] [-v] [-K] [-s stashfile] inputfile

Restore a Kerberos database dump from a Kerberos V4 format dump file (specified by *inputfile*).

-t

Allow modification of an existing database. If you do not specify `-t`, the load will abort if the database exists.

-n

Read the Kerberos V4 master key from the key file.

-v

Cause the name of each principal and policy to be printed as it is loaded.

-K

Prompt for the Kerberos V5 database master password.

-s stashfile

Specify the location of the Kerberos V4 master key file.

inputfile

Filename of the V4 dump file to load.

stash [-f keyfile]

Create a stash file, which allows a KDC to authenticate itself to the database programs `kadmin`, `kadmind`, `krb5kdc`, and `kdb5_util`. If the `-f` option is not specified, `kdb5_util` stashes the key in the file specified in the `KRB$ROOT:[KRB5KDC]KDC.CONF` file.

3.2.3 ktutil

The `ktutil` program invokes a menu from which an administrator can read, write, or edit entries in a Kerberos V5 `keytab` or V4 `srvtab` file.

SYNOPSIS

`ktutil`

command

The command on the `ktutil` menu can be one of the following:

clear_list, clear

Clear the current key list.

read_kt, rkt

Read a `krb5` keytab into the current keylist.

read_st, rst

Read a `krb4 srvtab` into the current keylist.

write_kt, wkt

Write the current keylist to a `krb5 keytab`.

write_st, wst

Write the current keylist to a `krb4 srvtab`.

add_entry, addent

Add an entry to the current keylist.

delete_entry, delent

Delete an entry from the current keylist.

list, l

List the current keylist.

list_requests, lr, ?

List available requests.

quit, exit, q

Exit program.

3.2.4 kprop

The `kprop` program propagates the master KDC database to slave KDCs.

The following sections describe the procedure you should use to propagate your master KDC database. This procedure involves performing steps first on the master system, then the slave system, and back and forth again until finishing with the master system.

In the following procedure, the steps are numbered M1, M2, and so on for the master KDC server, and S1, S2 and so on for the slave KDC server.

Kerberos must be installed on both the master and slave systems.

PROCEDURE

3.2.4.1 Step 1: Configure the Master KDC Server for Propagation

M1. On the master KDC server, enter the following command:

```
$ @SYS$STARTUP:KRB$CONFIGURE
```

M2. Set up the client.

M3. Set up the server.

M4. Exit the `KRB$CONFIGURE.COM` file.

M5. If you added additional `USER/admin` principals during your configuration (other than your first admin principal), add them to `KRB$ROOT:[KRB5KDC]KADM5.ACL`.

M6. Add your anticipated slave hosts to `KRB$ROOT:[ETC]KRB5.CONF` under the `realms` tag using a `kdc` tag as follows:

`USER/admin@`*`REALM`*

`kdc = `*`nodename.domain`*`:88`

M7. To create `KRB$ROOT:[BIN]KRB$KPROP.DAT` from the template file `KRB$KPROP_DAT.TEMPLATE`, copy `KRB$KPROP_DAT.TEMPLATE` to `KRB$KPROP.DAT`, and edit `KRB$KPROP.DAT` as follows:

a. Comment out the example node name lines with a # sign.

b. Add all of your slave node names either as just the simple node name or as fully qualified node names that include their respective domain names. Be consistent in the naming method you choose. It is safest to use the node name form that is used to define your node names in your local TCP/IP host setting. If you use DNS to manage your local host lookups, you will need to use fully qualified node and domain name strings.

   If you specify local host names, know the form of the node name you use, define all propagation node names that way in the local TCP/IP host database, and enter these propagation node names in the form that they are locally defined.

   Try to define all propagation nodes in your local TCP/IP hosts database, or leave them all defined in DNS and not in your local database. If you see client not found errors during propagation, review your node name definitions and the form that you have in the local TCP/IP database.

c. The `KRB$KPROP.DAT` file is simply a data file that is read by the `kprop` command file to see where database propagation is performed. Make sure you do not include the local server node name in this data file. The propagation server does not need its own data propagated to itself.

d. You need only perform step M7 on those nodes that might act as the master KDC server at some future point, and need to have master database changes propagated to them.

M8. Create the `KRB$ROOT:[KRB5KDC]KPROPD.ACL` file as follows. There is no template for this file. This file defines the names of the hosts that will be involved in propagation and includes the master server entity. (This step will also have to be performed on each of your slave KDCs.)

a. Edit `KRB$ROOT:[KRB5KDC]KPROPD.ACL` to add each slave KDC `host/name` keytab entry that will be created in Step M11.

   The form depends on how your node names are defined in TCP/IP. You can use either of the following forms. The `@REALM` portion is required.

   `host/`*`yournode@REALM`*

   `host/`*`yournode.yourdomain@REALM`*

b. If your local TCP/IP database defines the node names, the form of your node name in Step M8a must match that of your TCP/IP database

c. Be sure to include the `host/entry` for your master KDC.

M9. Start your master server and run `KADMIN`.

NOTE In steps M10 and M11, it is critical that the node names are in the same form as your local TCP/IP node name. You can use either simple node names or fully qualified DNS node names, as long as you are consistent.

M10. Add the `host/principals` with the following commands:

`addprinc -randkey host/`*`yourmasternode`*

`addprinc -randkey host/`*`yourslavenode`*

M11. Add/export the `host/keytabs` with the following commands:

`ktadd host/`*`yourmasternode@REALM`*

`ktadd host/`*`yourslavenode@REALM`*

NOTE The `@REALM` part of this file name is important and must match the REALM entered into `KPROPD.ACL` in step M8.

M12. Restart your master KDC server using the latest configuration.

3.2.4.2 Step 2: Configure the Slave KDC Servers for Propagation

After you configure the master server, perform the following steps to configure each slave KDC server.

S1. To configure your slave KDC client, enter the master KDC server name when asked where the master KDC server resides. Do not use your local node name.

S2. Set up your slave KDC server by entering the following command:

```
$ @SYS$STARTUP:KRB$CONFIGURE
```

Note the following:

- Your KDC node name is your local node, not the master KDC node name.
- Specify `SLAVE_KDC`, if it is not the default.
- Add a local `admin` principal. (This will not be used.)
- Accept the defaults for the remaining questions.

S3. Exit the configuration file and perform step M7 from the previous section only if, in the future, you may use this slave KDC as a master KDC server. Otherwise, go to step S4.

S4. Perform Step 1, M8 on your slave KDC node. You can copy the file from the server or edit a new file using the same `host/entry` information. This step is required for propagation.

S5. Export the master server's `host/keytabs` to the local KDC slave server keytab file. Because the slave server is configured as a client in the master KDC, you can `kinit` as the master KDC server's admin and run `kadmin` to extract the server's keytabs as shown in Step 1, M11. This will create your local keytab file with the MASTER KDC server keytab information. Issue a `listprincs` command and then `ktadd` the host principals.

S6. Edit `KRB$ROOT:[KRB5KDC]KRB$ROLE.DAT`. Change the second data line from a zero to a one (0 to 1), and save the file. This tells `KRB$CONFIGURE` that the `KRB$KPROPD.EXE` daemon must be started when the slave server is started.

S7. Edit `KRB$ROOT:[ETC]KRB5.CONF` and add the slave and master KDC nodes under the `realms` tag, if they do not exist. Here, you can safely specify fully qualified node names with their domain names as follows:

`kdc =` *`yourmasternode.yourdomain`*`:88`

`kdc =` *`yourslavenode.yourdomain`*`:88`

Make sure the record format for `KRB5.CONF` and `KPROPD.ACL` is `STREAM_LF`.

CAUTION Do not start the slave server yet.

3.2.4.3 Step 3: Complete the Configuration of the Master KDC Server

Perform the following steps on the master server.

M13. Run `kadmin` and re-export only the master's `host/keytab` as in Step 1, M11. Because this keytab was exported on one or more slaves, the key version number is now greater than when this keytab was originally exported, and the slave KDCs will not be able to authenticate to the master KDC with a lower key version number.

M14. In `kadmin`, enter the following command:

```
ktadd host/yourmaster@REALM
```

NOTE You may have to remove the host keytabs and principals and re-add them if the slave and master cannot agree on the key version numbers. This is an issue only with the master KDC keytab after keys are added to the slaves. This step does correct certain authentication problems.

M15. Restart the master server.

3.2.4.4 Step 4: Complete the Configuration of the Slave KDC Server

Perform the following steps on the slave server.

S8. Use `kinit` to get to your master server's `admin` account. This will refresh the master's host keytab on the local system and start the slave server in preparation for its first propagation from the master.

3.2.4.5 Step 5: Propagate the Master KDC Server to Each Configured Slave Server

Perform the following steps to complete the propagation procedure.

M16. Enter the following command:

```
@KRB$ROOT:[BIN]KRB$KPROP.COM
```

The `kprop` command procedure causes the following to occur:

a. The master server is stopped, the database dumped, the servers restarted, and a connection to each slave `kpropd` daemon is made in order to transfer the master database to the slave servers listed in `KRB$ROOT:[BIN]KRB$KPROP.DAT`.

b. The slave servers are stopped, the master KDC database is loaded, the slave servers are restarted, and a signal is sent to the master server that the propagation has successfully completed.

c. The master server produces a file called `SLAVE_DATATRANS_DAT_`*`YOURSLAVENODE`*`.LAST_PROP` that indicates that the propagation to the individual slave node has completed.

d. When propagation to each slave server completes, the kpropd.exe daemon exits. The next propagation can be done only after starting the `kpropd` daemon on each of the KDC slave servers. This is why `kpropd` should be a TCP/IP service. The TCP/IP system automatically starts the `kpropd` daemon for each slave server requested by the master server.

4 Kerberos Programming Concepts

This chapter provides an overview of programming with Kerberos on OpenVMS.

Information in this chapter includes:

- An overview of building a Kerberos application on OpenVMS
- Descriptions of the Kerberos example programs

4.1 Overview of Building a Kerberos Application on OpenVMS

Kerberos programming on OpenVMS works much the same as on any other platform. The following sections indicate differences and important information.

4.1.1 Compiling a Kerberos Program on OpenVMS

When you compile your program, you will need to add the `/INCLUDE=KRB$ROOT:[INCLUDE]` qualifier to your compiler command line. For example:

```
$ cc/list/include=krb$root:[include]/prefix=all gss_client
```

4.1.2 Linking a Kerberos Program on OpenVMS

Kerberos on OpenVMS provides shareable libraries in both 64-bit and 32-bit formats. All Kerberos libraries can be found in `SYS$LIBRARY`.

Library Name	Bit Format
GSS$RTL.EXE	64 bits
GSS$RTL32.EXE	32 bits
KRB$RTL.EXE	64 bits
KRB$RTL32.EXE	32 bits

One of the `GSS$RTL*` libraries should be used when your program calls the GSS API. If the KRB5 API is called, then one of the `KRB$RTL*` libraries will need to be linked with the program.

Because Kerberos routines are located in shareable libraries, the use of a link options file is recommended. For details about using link options files, refer to the *HP OpenVMS Linker Utility Manual*. The Kerberos example programs described in this chapter provide examples of using link options files for Kerberos applications.

4.2 Kerberos Example Programs

This section describes the Kerberos example programs. Kerberos must be configured before any example program is run. For the configuration procedure, see Chapter 2.

The Kerberos example programs are found in `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS...]`.

The Kerberos example programs are divided between those examples that use DCL to build and those that use GMAKE to build.

4.2.1 DCL Example Programs

The `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.DCL]` directory in the Kerberos example directory tree contains the Version 1.0 example programs and build procedures. (No new examples were added to the DCL directory for Version 3.0.) These example programs are described in the following sections.

There are two DCL example programs, each of which has a client and server piece. Command procedures to build and help set up the example programs are provided, along with `readme` files specific to each example.

The examples should be built and run from a local build area or directory. The following table lists the DCL example programs and information about what aspect of Kerberos each program is attempting to convey.

DCL Example Program	Description
`GSS_CLIENT` and `GSS_SERVER`	GSSAPI example program
`KRB_CLIENT` and `KRB_SERVER`	KRB5 API example program

4.2.1.1 GSSAPI Example Program

The GSSAPI example program is a simple client/server program that authenticates using the GSSAPI.

To run the GSSAPI example client program, perform the following steps:

1. Create a Kerberos principal name of `gss_sample/`<*node name*>`@`<*realm name*> before this program is run.
2. Copy the `GSS_*.*` example files and the `BUILD.COM` and `SETUP.COM` files into a local build area, and then execute the `BUILD` command file as follows:

```
$ COPY SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.DCL]GSS*.* local_build_area
$ COPY SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.DCL]*.COM local_build_area
$ SET DEF local_build_area
$ @BUILD GSS
```

3. Execute the `SETUP` command file to define the necessary symbols to run the example.
4. Ensure that Kerberos has been initialized and started, and that the necessary Kerberos principal name has been created in the Kerberos database. The `SETUP` command file has additional information about creating the principal name.
5. Copy either `GSS_CLIENT.EXE` or `GSS_SERVER.EXE` to another node in the same Kerberos realm, along with the `SETUP` command file.
6. Start the client program and server programs using the symbols defined in `SETUP.COM`.

4.2.1.1.1 GSS_CLIENT

SYNOPSIS

gss_client [-p *port*] [*message*] [*host*] [*service*]

OPTIONS

-p port

Specifies the TCP/IP port to use for communications. If this argument is absent, port number 4444 is used.

message

Specifies the text message to pass between client and server.

host

Specifies the host system where the GSS_SERVER is located.

service

4.2.1.1.2 GSS_SERVER

SYNOPSIS

gss_server [-p *port*] [-l *logfile*] [*service*]

OPTIONS

-p port

Specifies the TCP/IP port to use for communications. If this argument is absent, port number 4444 is used.

-l logfile

Indicates that a logging file with the file name specified by *logfile* should be opened when the GSS_SERVER program is started.

service

Specifies the service name. If this argument is absent, gss_sample is used as the service name.

4.2.1.2 KRB5 API Example Program

The KRB5 example program is a simple client/server program that authenticates using the Kerberos API.

To run the KRB5 API example program, perform the following steps:

1. Create a Kerberos principal name of krb_sample/*node name@realm name* before this program is run.
2. Copy the KRB_*.* example files and the BUILD.COM and SETUP.COM files into a local build area, and then execute the BUILD command file as follows:

```
$ COPY SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.DCL]KRB*.* local_build_area
$ COPY SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.DCL]*.COM local_build_area
$ SET DEF local_build_area
$ @BUILD KRB
```

3. Execute the SETUP command file to define the necessary symbols to run the example.
4. Ensure that Kerberos has been initialized and started and that the necessary Kerberos principal name has been created in the Kerberos database. The SETUP command file has additional information about creating the principal name.

5. Copy either the KRB_CLIENT.EXE or KRB_SERVER.EXE to another node in the same Kerberos realm, along with the SETUP command file.
6. Start the client and server programs using the symbols defined in SETUP.COM.

4.2.1.2.1 KRB5_CLIENT

SYNOPSIS

`krb5_client [-p port] [message] [host] [service]`

OPTIONS

-p *port*

Specifies the TCP/IP port to use for communications. If this argument is absent, port number 4444 is used.

message

Specifies the text message to pass between client and server.

host

Specifies the host system where the KRB_SERVER is located.

service

Specifies the service name. If this argument is absent, krb_sample is used as the service name.

4.2.1.2.2 KRB5_SERVER

SYNOPSIS

`krb_server [-p port] [-l logfile] [service]`

OPTIONS

-p *port*

Specifies the TCP/IP port to use for communications. If this argument is absent, port number 4444 is used.

-l *logfile*

Indicates that a logging file with the file name specified by *logfile* should be opened when the KRB_SERVER program is started.

service

Specifies the service name. If this argument is absent, krb_sample is used as the service name.

4.2.2 GMAKE Example Programs

The SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE...] directory in the Kerberos example directory tree contains the examples that build with GMAKE.

4.2.2.1 GMAKE.VMS Directory

The example programs in the SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE.VMS] subdirectory contain the original OpenVMS Kerberos Version 1.0 example programs (GSSAPI and KRB5). These examples are built with GMAKE instead of DCL. These programs show you how the two GMAKE and DCL build processes compare using the same code base.

This build can produce the GSS and KRB example programs built against the 64-bit and 32-bit Kerberos and GSS libraries respectively. Both types of builds can be produced without directory conflict, and they can be run out of their respective build directories.

The server awaits a connection on a socket, receives a message from the client that it prints out, and then echoes back to the client. Run each program with "-?" to see the runtime options for the client and server.

4.2.2.2 GMAKE.MIT Directory

Four example programs are included in the `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE.MIT]` subdirectory.

Each of these examples builds against the 32-bit KRB and GSS runtime libraries. Because of the form of UNIX I/O functions that they use, the 64-bit Kerberos libraries cannot be used.

The following table lists the new GMAKE example programs found in `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE.MIT]` and information about what aspect of Kerberos each program is attempting to convey.

GMAKE Example Program	Description
`GSS-SAMPLE`	32-bit based application that uses the 32-bit GSS$RTL32 library on Alpha, and the 32-bit implementations of the UNIX I/O library function calls
`SAMPLE`	Demonstration client/server application
`SIMPLE`	UDP-based client and server application
`USER_USER`	Demonstrates a TCP/IP service name used to securely communicate between two network applications

4.2.2.3 GSS-SAMPLE Example Program

The `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE.MIT.GSS-SAMPLE]` subdirectory contains a `GSS-SAMPLE.README` file that describes in detail the function and operation of the `GSS-SAMPLE` program. It is a 32-bit based application that uses the 32-bit `GSS$RTL32` library on Alpha. It also uses the 32-bit implementations of the UNIX I/O library function calls.

This directory also contains a sample GSSAPI client and server application. In addition to serving as an example of GSSAPI programming, this application is also intended to be a tool for testing the performance of GSSAPI implementations. Each time the client is invoked, it performs one or more exchanges with the server.

The client application can be used to simulate a variety of workloads on the server. It can serve as an example of how to create a performance application to test a new Kerberos GSSAPI based application of your own.

Several command line options can be used to define how the client will interact with the server. The `GSS-SAMPLE.README` file lists these options in detail. The following is a summary of `GSS-SAMPLE` options:

SYNOPSIS

```
gss-sample [-d] [-f] [-ccount] [-mcount] [-na] [-nx] [-nw] [-nm]
```

OPTIONS

-d

Tells the client to delegate credentials to the server. For the Kerberos GSSAPI mechanism, this means that a forwardable TGT will be sent to the server, which will put it in its credential cache. You must have acquired your tickets with `kinit -f` for this to work.

-f

Tells the client that the `msg` argument is actually the name of a file whose contents should be used as the message.

-ccount

Specifies how many sessions the client should initiate with the server (the `connection count`).

-mcount

Specifies how many times the message should be sent to the server in each session (the `message count`).

-na

Tells the client not to do any authentication with the server. Implies `-nw`, `-nx` and `-nm`.

-nx

Tells the client not to encrypt messages.

-nw

Tells the client not to wrap messages. Implies `-nx`.

-nm

Tells the client not to ask the server to send back a cryptographic checksum (MIC).

4.2.2.4 SAMPLE Example Program

The `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE.MIT.SAMPLE]` subdirectory contains the build for a server and a client called `sserver` and `sclient`, respectively, that are a simple demonstration client/server application.

When `sclient` connects to `sserver`, it performs a Kerberos authentication, then `sserver` returns to `sclient` the Kerberos principal that was used for the Kerberos authentication. This example provides a good test that Kerberos has been successfully installed and configured on a machine.

The `sclient` and `sserver` images are built in separate directories, but the client and server are run from the top-level directory. There is a complete README file in the `sserver` directory that describes the detailed information for configuring and running these examples. You can get a fast start by simply running `SAMPLE_SETUP.COM` in this directory for both the client and the server windows.

4.2.2.5 SIMPLE Example Program

The `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE.MIT.SIMPLE]` subdirectory contains a UDP-based client and server example. It is similar to the original Version 1.0 `KRB_CLIENT` and `KRB_SERVER` examples, except that it uses UDP socket-based I/O. The server receives a message from the client and simply reports what it has received. The client reports that it successfully sent the data.

4.2.2.6 USER_USER Example Program

The `SYS$COMMON:[SYSHLP.EXAMPLES.KERBEROS.GMAKE.MIT.USER_USER]` subdirectory holds a client and a server example that can be used to see how a TCP/IP service name can be used to securely communicate between two network applications. It is similar to the original Version 1.0 `KRB_CLIENT` and `KRB_SERVER` examples, except that a TCP/IP service name is defined and used to tell the client the port number on which the server is listening. The client sends its data to the server and the server responds to the client with the message the client sent.

5 GSSAPI (Generic Security Services Application Programming Interface)

This chapter describes the C language bindings for the routines that make up the Generic Security Services Application Programming Interface (GSSAPI).

The GSSAPI provides security services to its callers, and is intended for implementation atop alternative underlying cryptographic mechanisms. In this manual, the underlying cryptographic mechanism is assumed to be Kerberos.

The GSSAPI allows a communicating application to authenticate the user associated with another application, to delegate rights to another application, and to apply security services such as confidentiality and integrity on a per-message basis.

There are four stages to using the GSSAPI:

- The application acquires a set of credentials with which it can prove its identity to other processes.
- A pair of communicating applications establish a joint security context using their credentials. The security context is a pair of GSSAPI data structures that contain shared state information.
- Per-message services are invoked to apply either integrity and data origin authentication, or confidentiality, integrity, and data authentication to application data.
- At the completion of a communications session, the peer applications call GSSAPI routines to delete the security context.

Routines described in this chapter are implemented in the Generic Security Service library (`GSS$RTL.EXE` for 64-bit interfaces, or `GSS$RTL32.EXE` for 32-bit interfaces) in `SYS$LIBRARY`.

gss_accept_sec_context — Establish a security context

C Prototype

```
OM_uint32 gss_accept_sec_context(
        OM_uint32               * minor_status,
        gss_ctx_id_t            * context_handle,
        gss_cred_id_t             acceptor_cred_handle,
        gss_buffer_t              input_token_buffer,
        gss_channel_bindings_t    input_chan_bindings,
        gss_name_t              * src_name,
        gss_OID                 * mech_type,
        gss_buffer_t              output_token,
        OM_uint32               * ret_flags,
        OM_uint32               * time_rec,
        gss_cred_id_t           * delegated_cred_handle );
```

Arguments

minor_status (output)	Mechanism-specific status code.
context_handle (input/output)	The context handle for the new context. Supply GSS_C_NO_CONTEXT for the first call; use the value returned in subsequent calls. Once `gss_accept_sec_context` has returned a value via this argument, resources have been assigned to the corresponding context, and must be freed by the application after use with a call to `gss_delete_sec_context`.
acceptor_cred_handle (input)	The credential handle claimed by the context acceptor. Specify GSS_C_NO_CREDENTIAL to accept the context as a default principal. If GSS_S_NO_CREDENTIAL is specified, but no default acceptor principal is defined, GSS_S_NO_CRED will be returned.
input_token_buffer (input)	The token obtained from the remote application.
input_chan_bindings (input)	Application-specified bindings. Allows the application to securely bind channel identification information to the security context. If channel bindings are not used, specify GSS_C_NO_CHANNEL_BINDINGS.
src_name (output)	The authenticated name of the context initiator. After use, this name should be deallocated by passing it to `gss_release_name`. If not required, specify NULL.
mech_type (output)	The security mechanism used. The returned OID value will be a pointer into static storage, and should be treated as read only by the caller (in particular, it does not need to be freed). If not required, specify NULL.
output_token (output)	The token to be passed to the peer application. If the length field of the returned token buffer is zero, then no token need be passed to the peer application. If a nonzero length field is returned, the associated storage must be freed after use by the application with a call to `gss_release_buffer`.

ret_flags (output)

A bit mask which contains various independent flags, each of which indicates that the context supports a specific service option. Symbolic names are provided for each flag, and the symbolic names corresponding to the required flags should be logically ANDed with the `ret_flags` value to test whether a given option is supported by the context. The flags are:

GSS_C_DELEG_FLAG

TRUE — Delegated credentials are available via the `delegated_cred_handle` argument.

FALSE — No credentials were delegated.

GSS_C_MUTUAL_FLAG

TRUE — The remote peer asked for mutual authentication.

FALSE — The remote peer did not ask for mutual authentication.

GSS_C_REPLAY_FLAG

TRUE — Replay of protected messages will be detected.

FALSE — Replayed messages will not be detected.

GSS_C_SEQUENCE_FLAG

TRUE — Out-of-sequence protected messages will be detected.

FALSE — Out-of-sequence messages will not be detected.

GSS_C_CONF_FLAG

TRUE — Confidentiality service may be invoked by calling the `gss_wrap` routine.

FALSE — No confidentiality service (via `gss_wrap`) is available. The `gss_wrap` routine will provide message encapsulation, data-origination authentication and integrity services only.

GSS_C_INTEG_FLAG

TRUE — Integrity service may be invoked by calling either the `gss_get_mic` or `gss_wrap` routine.

FALSE — Per-message integrity service is unavailable.

GSS_C_ANON_FLAG

TRUE — The initiator does not wish to be authenticated; the src_name argument (if requested) contains an anonymous internal name.

FALSE — The initiator has been authenticated normally.

GSS_C_PROT_READY_FLAG

TRUE — Protection services (as specified by the states of the GSS_C_CONF_FLAG and GSS_C_INTEG_FLAG) are available if the accompanying status return value is either GSS_S_COMPLETE or GSS_S_CONTINUE_NEEDED.

FALSE — Protection services (as specified by the states of the GSS_C_CONF_FLAG and GSS_C_INTEG_FLAG) are available only if the accompanying status return value is GSS_S_COMPLETE.

GSS_C_TRANS_FLAG

	TRUE — The resultant security context may be transferred to other processes via a call to `gss_export_sec_context`. FALSE — The security context is not transferable. All other bits should be zero.
time_rec (output)	The number of seconds for which the context will remain valid. Specify NULL if not required.
delegated_cred_handle (output)	The credential handle for credentials received from the context initiator. Only valid if `deleg_flag` in `ret_flags` is TRUE, in which case an explicit credential handle (that is, not GSS_C_NO_CREDENTIAL) will be returned; if `deleg_flag` is false, `gss_accept_context` will set this argument to GSS_C_NO_CREDENTIAL. If a credential handle is returned, the associated resources must be released by the application after use with a call to `gss_release_cred`. Specify NULL if not required.

Description

This routine allows a remotely initiated security context between the application and a remote peer to be established. The routine may return an `output_token` that should be transferred to the peer application, where the peer application will present it to `gss_init_sec_context`. If no token need be sent, `gss_accept_sec_context` will indicate this by setting the length field of the `output_token` argument to zero. To complete the context establishment, one or more reply tokens may be required from the peer application; if so, `gss_accept_sec_context` will return a status flag of GSS_S_CONTINUE_NEEDED, in which case it should be called again when the reply token is received from the peer application, passing the token to `gss_accept_sec_context` via the `input_token` arguments.

Portable applications should be constructed to use the token length and return status to determine whether a token needs to be sent or waited for. A typical portable caller should always invoke `gss_accept_sec_context` within a loop. For example:

```
gss_ctx_id_t context_hdl = GSS_C_NO_CONTEXT;

do {receive_token_from_peer(input_token);
    maj_stat = gss_accept_sec_context(  &min_stat,
                                        &context_hdl,
                                        cred_hdl,
                                        input_token,
                                        input_bindings,
                                        &client_name,
                                        &mech_type,
                                        output_token,
                                        &ret_flags,
                                        &time_rec,
                                        &deleg_cred);
    if (GSS_ERROR(maj_stat)) {
        report_error(maj_stat, min_stat);
    };
    if (output_token->length != 0) {
        send_token_to_peer(output_token);
        gss_release_buffer(&min_stat, output_token);
    };
    if (GSS_ERROR(maj_stat)) {
        if (context_hdl != GSS_C_NO_CONTEXT)
            gss_delete_sec_context(     &min_stat,
                                        &context_hdl,
```

```
                                        GSS_C_NO_BUFFER);
        break;
    };
} while (maj_stat & GSS_S_CONTINUE_NEEDED);
```

Whenever the routine returns a status that includes the value GSS_S_CONTINUE_NEEDED, the context is not fully established and the following restrictions apply to the output arguments:

- The value returned via the `time_rec` argument is undefined unless the accompanying `ret_flags` argument contains the bit GSS_C_PROT_READY_FLAG, indicating that per-message services may be applied in advance of a successful completion status. The value returned via the `mech_type` argument may be undefined until the routine returns a status of GSS_S_COMPLETE.
- The value of the GSS_C_DELEG_FLAG, GSS_C_MUTUAL_FLAG, GSS_C_REPLAY_FLAG, GSS_C_SEQUENCE_FLAG, GSS_C_CONF_FLAG, GSS_C_INTEG_FLAG, and GSS_C_ANON_FLAG bits returned via the `ret_flags` argument contain the values that the implementation expects would be valid if context establishment were to succeed.
- The values of the GSS_C_PROT_READY_FLAG and GSS_C_TRANS_FLAG bits within `ret_flags` indicate the actual state at the time `gss_accept_sec_context` returns, whether or not the context is fully established.

  Although this requires that GSSAPI implementations set the GSS_C_PROT_READY_FLAG in the final `ret_flags` returned to a caller (that is, when accompanied by a GSS_S_COMPLETE status code), applications should not reply on this behavior as the flag was not defined in Version 1 of the GSSAPI. Instead, applications should be prepared to use per-message services after a successful context establishment, according to the GSS_C_INTEG_FLAG and GSS_C_CONF_FLAG values.
- All other bits within the `ret_flags` argument will be set to zero. While the routine returns GSS_S_CONTINUE_NEEDED, the values returned via the `ret_flags` argument indicate the services that the implementation expects to be available from the established context.
- During context establishment, the information status bits GSS_S_OLD_TOKEN and GSS_S_DUPLICATE_TOKEN indicate fatal errors, and GSSAPI mechanisms return them in association with a routine error of GSS_S_FAILURE. This requirement for pairing did not exist in Version 1 of the GSSAPI specification, so applications that wish to run over Version 1 implementations must special-case these codes.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_CONTINUE_NEEDED	The service completed successfully and synchronously (returned only if the DDTM$M_SYNCH flag is set).
GSS_S_DEFECTIVE_TOKEN	Indicates that consistency checks performed on the `input_token` failed.
GSS_S_DEFECTIVE_CREDENTIAL	The options flags were invalid or the TID argument was omitted and the bid argument was not 0.
GSS_S_NO_CRED	The supplied credentials were not valid for context acceptance, or the credential handle did not reference any credentials.
GSS_S_CREDENTIALS_EXPIRED	The referenced credentials have expired.

GSS_S_BAD_BINDINGS	The `input_token` contains different channel bindings to those specified via the `input_chan_bindings` argument.
GSS_S_NO_CONTEXT	Indicates that the supplied context handle did not refer to a valid context.
GSS_S_BAD_SIG	The `input_token` contains an invalid MIC.
GSS_S_OLD_TOKEN	The `input_token` was too old. This is a fatal error during context establishment.
GSS_S_DUPLICATE_TOKEN	The `input_token` is valid, but is a duplicate of a token already processed. This is a fatal error during context establishment.
GSS_S_BAD_MECH	The received token specified a mechanism that is not supported by the implementation or the provided credential.

gss_acquire_cred — Acquire credential handle

C Prototype

```
OM_uint32 gss_acquire_cred(
        OM_uint32                * minor_status,
        gss_name_t                 desired_name,
        OM_uint32                  time_req,
        gss_OID_set                desired_mechs,
        gss_cred_usage_t           cred_usage,
        gss_cred_id_t             * output_cred_handle,
        gss_OID_set               * actual_mechs,
        OM_uint32                 * time_rec );
```

Arguments

minor_status (output)	The mechanism-specific status code.
desired_name (input)	The name of the principal whose credential should be acquired.
time_req (input)	The number of seconds that credentials should remain valid. Specify GSS_C_INDIFINITE to request that the credentials have the maximum permitted lifetime.
desired_mechs (input)	The set of underlying security mechanisms that may be used. GSS_C_NULL_OID_SET may be used to obtain an implementation-specific default.
cred_usage (input)	One of the following values: **GSS_C_BOTH** — Credentials may be used either to initiate or accept security contexts. **GSS_C_INITIATE** — Credentials will only be used to initiate security contexts. **GSS_C_ACCEPT** — Credentials will only be used to accept security contexts.
output_cred_handle (output)	The returned credential handle. Resources associated with this credential handle must be released by the application after use with a call to `gss_release_cred`.
actual_mechs (output)	The set of mechanisms for which the credential is valid. Storage associated with the returned OID-set must be released by the application after use with a call to `gss_release_oid_set`. Specify NULL if not required.
time_rec (output)	The actual number of seconds for which the returned credentials will remain valid. If the implementation does not support expiration of credentials, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.

Description

This routine allows an application to acquire a handle for a pre-existing credential by name. GSSAPI implementations must impose a local access-control policy on callers of this routine to prevent unauthorized callers from acquiring credentials to which they are not entitled. This routine is not intended to provide a "login to the network" function, as such a function would result in the creation of new credentials rather than merely acquiring a handle to existing credentials.

If desired_name is GSS_C_NO_NAME, the call is interpreted as a request for a credential handle that will invoke default behavior when passed to `gss_init_sec_context` (if cred_usage is GSS_C_INITIATE or GSS_C_BOTH) or `gss_accept_sec_context` (if cred_usage is GSS_C_ACCEPT or GSS_C_BOTH).

This routine is expected to be used primarily by context acceptors.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_MECH	Unavailable mechanism requested.
GSS_S_BAD_NAMETYPE	The type contained within the `desired_name` argument is not supported.
GSS_S_BAD_NAME	The value supplied for the `desired_name` argument is ill formed.
GSS_S_NO_CRED	The supplied credentials were not valid for context acceptance, or the credential handle did not reference any credentials.
GSS_S_CREDENTIALS_EXPIRED	The referenced credentials have expired.

gss_add_cred — Construct credentials incrementally

C Prototype

```
OM_uint32 gss_add_cred(
        OM_uint32                * minor_status,
        gss_cred_id_t              input_cred_handle,
        gss_name_t                 desired_name,
        gss_OID                    desired_mech,
        gss_cred_usage_t           cred_usage,
        OM_uint32                  initiator_time_req,
        OM_uint32                  acceptor_time_req,
        gss_cred_id_t             * output_cred_handle,
        gss_OID_set               * actual_mechs,
        OM_uint32                 * initiator_time_rec,
        OM_uint32                 * acceptor_time_rec );
```

Arguments

minor_status (output) — An implementation-specific status code.

input_cred_handle (input) — The credential to which a credential-element will be added. If GSS_C_NO_CREDENTIAL is specified, the routine will compose the new credential based on default behavior. (See description). Note that, while the credential handle is not modified by `gss_add_cred`, the underlying credential will be modified if `output_cred_handle` is NULL.

desired_name (input) — The name of the principal whose credential should be acquired.

desired_mech (input) — The underlying security mechanism with which the credential may be used.

cred_usage (input) — How the credential may be used. Valid values are as follows:

GSS_C_INITIATE — Credential will only be used to initiate security contexts.

GSS_C_ACCEPT — Credential will only be used to accept security contexts.

initiator_time_req (input) — The number of seconds that the credential should remain valid for initiating security contexts. This argument is ignored if the composed credentials are of type GSS_C_ACCEPT. Specify GSS_C_INDEFINITE to request that the credentials have the maximum permitted initiator lifetime.

acceptor_time_req (input) — The number of seconds that the credential should remain valid for accepting security contexts. This argument is ignored if the composed credentials are of type GSS_C_INITIATE. Specify GSS_C_INDEFINITE to request that the credentials have the maximum permitted initiator lifetime.

output_cred_handle (output) — The returned credential handle, containing the new credential-element and all the credential-elements from `input_cred_handle`. If a valid pointer to a `gss_cred_id_t` is supplied for this argument, `gss_add_cred`

	creates a new credential handle containing all credential-elements from the `input_cred_handle` and the newly acquired credential-element; if NULL is specified for this argument, the newly acquired credential-element will be added to the credential identified by `input_cred_handle`.
	The resources associated with any credential handle returned via this argument must be released by the application after use with a call to `gss_release_cred`.
actual_mechs (output)	The complete set of mechanisms for which the new credential is valid. Storage for the returned OID-set must be freed by the application after use with a call to `gss_release_oid_set`. Specify NULL if not required.
initiator_time_rec (output)	The actual number of seconds for which the returned credentials will remain valid for initiating contexts using the specified mechanism. If the implementation or mechanism does not support expiration of credentials, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.
acceptor_time_rec (output)	The actual number of seconds for which the returned credentials will remain valid for accepting security contexts using the specified mechanism. If the implementation or mechanism does not support expiration of credentials, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.

Description

This routine adds a credential-element to a credential. The credential-element is identified by the name of the principal to which it refers. This routine is not intended to provide a "login to the network" function, as such a function would involve the creation of new mechanism-specific authentication data, rather than merely acquiring a GSSAPI handle to existing data.

If `desired_name` is GSS_C_NO_NAME, the call is interpreted as a request to add a credential element that will invoke default behavior when passed to `gss_init_sec_context` (if `cred_usage` is GSS_C_INITIATE or GSS_C_BOTH) or `gss_accept_sec_context` (if `cred_usage` is GSS_C_ACCEPT or GSS_C_BOTH).

This routine is expected to be used primarily by context acceptors, since implementations are likely to provide mechanism-specific ways of obtaining GSSAPI initiator credentials from the system login process. Some implementations may therefore not support the acquisition of GSS_C_INITIATE or GSS_C_BOTH credentials via `gss_acquire_cred` for any name other than GSS_C_NO_NAME, or a name produced by applying either `gss_inquire_cred` to a valid credential, or `gss_inquire_context` to an active context.

This routine can be used to either compose a new credential containing all credential-elements of the original in addition to the newly acquired credential element, or to add the new credential-element to an existing credential. If NULL is specified for the `output_cred_handle` argument, the new credential-element will be added to the credential identified by `input_cred_handle`; if a valid pointer is specified for the `output_cred_handle` argument, a new credential handle will be created.

If GSS_C_NO_CREDENTIAL is specified as the `input_cred_handle`, `gss_add_cred` will compose a credential (and set the `output_cred_handle` argument accordingly) based on default behavior. That is, the call will have the same effect as if the application had first made a call to `gss_acquire_cred`, specifying the same usage and passing GSS_C_NO_NAME as the `desired_name` argument to obtain an explicit credential handle embodying default behavior, passed this credential handle to `gss_add_cred`, and finally called `gss_release_cred` on the first credential handle.

If GSS_C_NO_CREDENTIAL is specified as the `input_cred_handle` argument, a nonNULL `output_cred_handle` must be supplied.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_MECH	Unavailable mechanism requested.
GSS_S_BAD_NAMETYPE	The type contained within the `desired_name` argument is not supported.
GSS_S_BAD_NAME	The value supplied for the `desired_name` argument is ill formed.
GSS_S_DUPLICATE_ELEMENT	The credential already contains an element for the requested mechanism with overlapping usage and validity period.
GSS_S_CREDENTIALS_EXPIRED	The required credentials could not be added because they have expired.
GSS_S_NO_CRED	No credentials were found for the specified name.

gss_add_oid_set_member — Add an object identifier to a set

C Prototype

```
OM_uint32 gss_add_oid_set_member(
        OM_uint32                * minor_status,
        gss_OID                    member_oid,
        gss_OID_set              * oid_set );
```

Arguments

minor_status (output)	An implementation-specific status code.
member_oid (input)	The object identifier to be copied into the set.
oid_set (input/output)	The set in which the object identifier should be inserted.

Description

This routine adds an object identifier to an object identifier set. It is intended for use in conjunction with `gss_create_empty_oid_set` when constructing a set of mechanism OIDs for input to `gss_acquire_cred`. The `oid_set` argument must refer to an OID-set that was created by GSSAPI (for example, a set returned by `gss_create_empty_oid_set`). GSSAPI creates a copy of the `member_oid` and inserts this copy into the set, expanding the storage allocated to the OID-set's elements array if necessary. The routine may add the new member OID anywhere within the elements array; if the `member_oid` is already present, the `oid_set` remains unchanged.

Return Values

This routine returns the following GSS status code:

GSS_S_COMPLETE	Successful completion.

gss_compare_name — Allow application to compare two internal names

C Prototype

```
OM_uint32 gss_compare_name(
        OM_uint32          * minor_status,
        gss_name_t           name1,
        gss_name_t           name2,
        int                * name_equal );
```

Arguments

minor_status (output)	An implementation-specific status code.
name1 (input)	Internal-form name 1.
name2 (input)	Internal-form name 2.
name_equal (output)	A Boolean value.
	TRUE — Names refer to the same entity.
	FALSE — Names refer to different entities (strictly, the names are not known to refer to the same identity).

Description

This routine allows an application to compare two internal-form names to determine whether they refer to the same entity. If either name presented to `gss_compare_name` denotes an anonymous principal, the routine will indicate that the two names do not refer to the same identity.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_NAMETYPE	The type contained within either name1 or name2 was unrecognized, or the names were of incomparable types.
GSS_S_BAD_NAME	One or both of name1 or name2 was ill formed.

gss_canonicalize_name — Convert internal name to internal mechanism name

C Prototype

```
OM_uint32 gss_canonicalize_name(
        OM_uint32              * minor_status,
        const gss_name_t         input_name,
        const gss_OID            mech_type,
        gss_name_t             * output_name );
```

Arguments

minor_status (output)	An implementation-specific status code.
input_name (input)	The name for which a canonical form is desired.
mech_type (input)	The authentication mechanism for which the canonical form of the name is desired. The desired mechanism must be specified explicitly; no default is provided.
output_name (output)	The resultant canonical name. Storage associated with this name must be freed by the application after use by a call to `gss_release_name`.

Description

This routine generates a canonical mechanism name (MN) from an arbitrary internal name. The mechanism name is the name that would be returned to a context acceptor on successful authentication of a context where the initiator used the `input_name` in a successful call to `gss_acquire_cred`, specifying an OID set containing `mech_type` as its only member, followed by a call to `gss_init_sec_context`, specifying `mech_type` as the authentication mechanism.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_MECH	The identified mechanism is not supported.
GSS_S_BAD_NAMETYPE	The provided internal name contains no elements that could be processed by the specified mechanism.
GSS_S_BAD_NAME	The `input_name` argument was ill formed.

gss_context_time — Check how much longer context is valid

C Prototype

```
OM_uint32 gss_context_time(
        OM_uint32                * minor_status,
        gss_ctx_id_t               context_handle,
        OM_uint32                * time_rec );
```

Arguments

minor_status (output)	An implementation-specific status code.
context_handle (input)	Identifies the context to be interrogated.
time_rec (output)	The number of seconds that the context will remain valid. If the context has already expired, zero will be returned.

Description

Determines the number of seconds for which the specified context will remain valid.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_CONTEXT_EXPIRED	The context has already expired.
GSS_S_NO_CONTEXT	The `context_handle` argument did not identify a valid context.

gss_create_empty_oid_set — Create a set containing no object identifiers

C Prototype

```
OM_uint32 gss_create_empty_oid_set(
        OM_uint32                  * minor_status,
        gss_OID_set                * oid_set );
```

Arguments

minor_status (output)	An implementation-specific status code.
oid_set (output)	The empty object identifier set. The routine will allocate the `gss_OID_set_desc` object, which the application must free after use with a call to `gss_release_oid_set`.

Description

This routine creates an object identifier set containing no object identifiers, to which members may be subsequently added using the `gss_add_oid_set_member` routine. These routines are intended to be used to construct sets of mechanism object identifiers, for input to `gss_acquire_cred`.

Return Values

This routine returns the following GSS status code:

GSS_S_COMPLETE	Successful completion.

gss_delete_sec_context — Delete a security context

C Prototype

```
OM_uint32 gss_delete_sec_context(
        OM_uint32              * minor_status,
        gss_ctx_id_t           * context_handle,
        gss_buffer_t             output_token );
```

Arguments

minor_status (output)	A mechanism-specific status code.
context_handle (input/output)	A context handle identifying the context to delete. After deleting the context, the GSSAPI will set this context handle to GSS_C_NO_CONTEXT.
output_token (output)	A token to be sent to the remote application to instruct it to also delete the context. It is recommended that applications specify GSS_C_NO_BUFFER for this argument, requesting local deletion only. If a buffer argument is provided by the application, the mechanism will either return a token in it, or set the length field of this token to zero to indicate to the application that no token is to be sent to the peer.

Description

This routine deletes a security context. The `gss_delete_sec_context` routine deletes the local data structures associated with the specified security context, and may generate an `output_token`, which when passed to the peer `gss_process_context_token` will instruct it to do likewise. No further security services may be obtained using the context specified by context_handle.

The `output_token` argument is retained for compatibility with Version 1 of the GSSAPI. It is recommended that both peer applications invoke `gss_delete_sec_context` passing the value GSS_C_NO_BUFFER for the `output_token` argument, indicating that no token is required, and that `gss_delete_sec_context` should simply delete local context data structures.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_FAILURE	Failure. See `minor_status` for more information.
GSS_S_NO_CONTEXT	No valid context was supplied.

gss_display_name — Provide textual representation of opaque internal name

C Prototype

```
OM_uint32 gss_display_name(
        OM_uint32                * minor_status,
        gss_name_t                 input_name,
        gss_buffer_t               output_name_buffer,
        gss_OID                  * output_name_type );
```

Arguments

minor_status (output)	An implementation-specific status code.
input_name (input)	The name to be displayed.
output_name_buffer (output)	A buffer to receive the textual name string. The application must free storage associated with this name after use with a call to `gss_release_buffer`.
output_name_type (output)	The type of the returned name. The returned `gss_OID` will be a pointer into static storage, and should be treated as read-only by the caller. (In particular, the application should not attempt to free it). Specify NULL if not required.

Description

This routine allows an application to obtain a textual representation of an opaque internal-form name for display purposes. The syntax of a printable name is defined by the GSSAPI implementation.

If `input_name` denotes an anonymous principal, the routine will return the `gss_OID` value GSS_C_NT_ANONYMOUS as the `output_name_type`, and a textual name that is syntactically distinct from all valid supported printable names in the `output_name_buffer`.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_NAMETYPE	The type of `input_name` was not recognized.
GSS_S_BAD_NAME	The `input_name` was ill formed.

gss_display_status — Convert GSSAPI status code to text for user display

C Prototype

```
OM_uint32 gss_display_status(
        OM_uint32              * minor_status,
        OM_uint32                status_value,
        int                      status_type
        gss_OID                  mech_type,
        OM_uint32              * message_context,
        gss_buffer_t             status_string );
```

Arguments

minor_status (output)	An implementation-specific status code.
status_value (input)	The status value to be converted.
status_type (input)	One of the following values: **GSS_C_GSS_CODE** — The `status_value` is a GSS status code. **GSS_C_MECH_CODE** — The `status_value` is a mechanism status code.
mech_type (input)	The underlying mechanism (used to interpret a `minor_status` value). Supply GSS_C_NO_OID to obtain the system default.
message_context (input/output)	This argument should be initialized to zero by the caller on the first call. If further messages are contained in the `status_value` argument, `message_context` will be nonzero on return, and this value should be passed back to subsequent calls, along with the same `status_value`, `status_type`, and `mech_type` arguments.
status_string (output)	The textual interpretation of the `status_value`. Storage associated with this argument must be freed by the application after use with a call to `gss_release_buffer`.

Description

This routine allows an application to obtain a textual representation of a GSSAPI status code, for display to the user or for logging purposes. Since some status values may indicate multiple conditions, applications may need to call `gss_display_status` multiple times, each call generating a single text string. The `message_context` argument is used to store state information about which error messages have already been extracted from a given `status_value`; `message_context` must be initialized to zero by the application prior to the first call, and `gss_display_status` will return a nonzero value in this argument if there are further messages to extract.

The `message_context` argument contains all state information required by `gss_display_status` in order to extract further messages from the `status_value`; even when a nonzero value is returned in this argument, the application is not required to call `gss_display_status` again unless subsequent messages are desired. The following code extracts all messages from a given status code and prints them to SYS$ERROR.

```
OM_uint32 message_context;
OM_uint32 status_code;
OM_uint32 maj_status;
OM_uint32 min_status;
gss_buffer_desc status_string;
 .
 .
 .
message_context = 0;

do {
    maj_status = gss_display_status(&min_status
                                                 status_code,
                                                 GSS_C_GSS_CODE,
                                                 GSS_C_NO_OID,
                                                 &message_context,
                                                 &status_string);
    fprintf(stderr,
                "%.*s\n",
                (int)status_string.length,
                (char *)status_string.value);
    gss_release_buffer(&min_status, &status_string);
} while (message_context != 0);
```

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_MECH	Indicates that translation in accordance with an unsupported mechanism type was requested.
GSS_S_BAD_STATUS	The `status_value` was not recognized, or the `status_type` was neither GSS_C_GSS_CODE nor GSS_C_MECH_CODE.

gss_duplicate_name — Create a copy of an internal name

C Prototype

```
OM_uint32 gss_duplicate_name(
        OM_uint32                * minor_status,
        const gss_name_t           input_name,
        gss_name_t               * dest_name );
```

Arguments

minor_status (output)	An implementation-specific status code.
input_name (input)	The internal name to be duplicated.
dest_name (output)	The resultant copy of `input_name`. Storage associated with this name must be freed by the application after use by a call to `gss_release_name`.

Description

This routine creates a duplicate of the existing internal name `input_name`. The new `dest_name` will be independent of `input_name` (that is, `input_name` and `dest_name` must both be released, and the release of one will not affect the validity of the other).

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_NAME	The `input_name` argument was ill formed.

gss_export_name — Convert an internal mechanism name to export form

C Prototype

```
OM_uint32 gss_export_name(
        (OM_uint32            * minor_status,
        const gss_na            input_name,
        gss_buffer_t            exported_name );
```

Arguments

minor_status (output)	An implementation-specific status code.
input_name (input)	The mechanism name to be exported.
exported_name (output)	The canonical contiguous string form of `input_name`. Storage associated with this string must be freed by the application after use by a call to `gss_release_buffer`.

Description

This routine produces a canonical contiguous string representation of a mechanism name (MN), suitable for direct comparison (for example, with `memcmp`) for use in authorization functions (for example, matching entries in an access-control list). The `input_name` argument must specify a valid MN (that is, an internal name generated by `gss_accept_sec_context` or by `gss_canonicalize_name`).

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_NAME_NOT_MN	The provided internal name was not a mechanism name.
GSS_S_BAD_NAME	The provided internal name was ill formed.
GSS_S_BAD_NAMETYPE	The internal name was of a type not supported by the GSSAPI implementation.

gss_export_sec_context — Transfer a security context to another process

C Prototype

```
OM_uint32 gss_export_sec_context(
        OM_uint32              * minor_status,
        gss_ctx_id_t           * context_handle,
        gss_buffer_t             interprocess_token );
```

Arguments

minor_status (output)	An implementation-specific status code.
context_handle (input/output)	The context handle identifying the context to transfer.
interprocess_token (output)	The token to be transferred to the target process. Storage associated with this token must be freed by the application after use with a call to `gss_release_buffer`.

Description

This routine is provided to support the sharing of work between multiple processes. It will typically be used by the context acceptor, in an application where a single process receives incoming connection requests and accepts security contexts over them, then passes the established context to one or more other processes for message exchange. The `gss_export_sec_context` routine deactivates the security context for the calling process and creates an interprocess token which, when passed to `gss_import_sec_context` in another process, will re-activate the context in the second process. Only a single instantiation of a given context may be active at any one time; a subsequent attempt by a context exporter to access the exported security context will fail.

The implementation may constrain the set of processes by which the interprocess token may be imported, either as a function of local security policy, or as a result of implementation decisions. For example, some implementations may constrain contexts to be passed only between processes that run under the same account, or which are part of the same process group.

The interprocess token may contain security-sensitive information (for example, cryptographic keys).

If the creation of the interprocess token is successful, all process-wide resources associated with the security context will be deallocated, and the `context_handle` will be set to GSS_C_NO_CONTEXT.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_CONTEXT_EXPIRED	The context has expired.
GSS_S_NO_CONTEXT	The context was invalid.
GSS_S_UNAVAILABLE	The operation is not supported.

gss_get_mic — Generate a cryptographic MIC for a message

C Prototype

```
OM_uint32 gss_get_mic(
        OM_uint32                * minor_status,
        gss_ctx_id_t               context_handle,
        gss_qop_t                  qop_req,
        gss_buffer_t               message_buffer,
        gss_buffer_t               message_token );
```

Arguments

minor_status (output)	An implementation-specific status code.
context_handle (input)	Identifies the context on which the message will be sent.
qop_req (input)	Specifies the requested quality of protection. Callers are encouraged, on portability grounds, to accept the default quality of protection offered by the chosen mechanism, which may be requested by specifying GSS_C_QOP_DEFAULT for this argument. If an unsupported protection strength is requested, `gss_get_mic` will return a status of GSS_S_BAD_QOP.
message_buffer (input)	The message to be protected.
message_token (output)	A buffer to receive the token. The application must free storage associated with this buffer after use with a call to `gss_release_buffer`.

Description

This routine supports data origin authentication and data integrity services. When `gss_get_mic` is invoked on an input message, it generates a cryptographic MIC, and places the MIC in a per-message token containing data items that allow underlying mechanisms to provide the specified security services. The original message, along with the generated per-message token, is passed to the remote peer; these two data elements are processed by `gss_verify_mic`, which validates the message in conjunction with the separate token. The `qop_req` argument allows a choice between several cryptographic algorithms.

This routine is functionally equivalent to the `gss_sign` routine. New code should use `gss_get_mic` instead of `gss_sign`. Although both routines are supported, `gss_sign` has been deprecated in the GSSAPI Version 2 specification.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Indicates that an integrity check, suitable for an established security context, was successfully applied and that the message and corresponding `per_msg_token` are ready for transmission.
GSS_S_CONTEXT_EXPIRED	Indicates that context-related data items have expired, so that the requested operation cannot be performed.

GSS_S_NO_CONTEXT	Indicates that the `context_handle` argument did not identify a valid context.
GSS_S_BAD_QOP	Indicates that the provided QOP value is not recognized or supported for the context.

gss_import_name — Convert a printable string to an internal form

C Prototype

```
OM_uint32 gss_import_name(
        OM_uint32                * minor_status,
        gss_buffer_t               input_name_buffer,
        gss_OID                    input_name_type,
        gss_name_t               * output_name );
```

Arguments

minor_status (output)	An implementation-specific status code.
input_name_buffer (input)	A buffer containing the contiguous string name to convert.
input_name_type (input)	The object ID specifying the type of printable name. Applications may specify either GSS_C_NO_OID to use a local system-specific printable syntax, or an OID recognized by the GSSAPI implementation to name a specific namespace.
output_name (output)	The returned name in internal form. Storage associated with this name must be freed by the application after use with a call to `gss_release_name`.

Description

This routine converts a contiguous string name to internal form. In general, the internal name returned (via the output_name argument) will not be an internal mechanism name; the exception to this is if the input_name_type indicates that the contiguous string provided via the `input_name_buffer` argument is of type GSS_C_NT_EXPORT_NAME, in which case the returned internal name will be a mechanism name for the mechanism that exported the name.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_NAMETYPE	The `input_name_type` was unrecognized.
GSS_S_BAD_NAME	The `input_name_buffer` argument could not be interpreted as a name of the specified type.
GSS_S_BAD_MECH	The input name type was GSS_C_NT_EXPORT_NAME, but the mechanism contained within the input name is not supported.

gss_import_sec_context — Import a transferred context

C Prototype

```
OM_uint32 gss_import_sec_context(
        OM_uint32               * minor_status,
        gss_buffer_t              interprocess_token,
        gss_ctx_id_t            * context_handle );
```

Arguments

minor_status (output)	An implementation-specific status code.
interprocess_token (input/output)	The token received from the exporting process.
context_handle (output)	The context handle of the newly reactivated context. Resources associated with this context handle must be released by the application after use with a call to `gss_delete_sec_context`.

Description

This routine allows a process to import a security context established by another process. A given interprocess token may be imported only once. See `gss_export_sec_context` for additional information.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_NO_CONTEXT	The token did not contain a valid context reference.
GSS_S_DEFECTIVE_TOKEN	The token was invalid.
GSS_S_UNAVAILABLE	The operation is unavailable.
GSS_S_UNAUTHORIZED	Local policy prevents the import of this context by the current process.

gss_indicate_mechs — Allow an application to determine which security mechanisms are available

C Prototype

```
OM_uint32 gss_indicate_mechs(
        OM_uint32            * minor_status,
        gss_OID_set          * mech_set );
```

Arguments

minor_status (output)	An implementation-specific status code.
mech_set (output)	A set of implementation-supported mechanisms. The returned `gss_OID_set` value will be a dynamically allocated OID set that should be released by the caller after use with a call to `gss_release_oid_set`.

Description

This routine allows an application to determine which underlying security mechanisms are available.

Return Values

This routine returns the following GSS status code:

GSS_S_COMPLETE	Successful completion.

gss_init_sec_context — Establish a security context

C Prototype

```
OM_uint32 gss_init_sec_context(
        OM_uint32                * minor_status,
        gss_cred_id_t              claimant_cred_handle,
        gss_ctx_id_t             * context_handle,
        gss_name_t                 target_name,
        gss_OID                    mech_type,
        OM_uint32                  req_flags,
        OM_uint32                  time_req,
        gss_channel_bindings_t     input_chan_bindings,
        gss_buffer_t               input_token,
        gss_OID                  * actual_mech_type,
        gss_buffer_t               output_token,
        OM_uint32                * ret_flags,
        OM_uint32                * time_rec );
```

Arguments

minor_status (output)	An implementation-specific status code.
claimant_cred_handle (input)	A handle for credentials claimed. Supply GSS_C_NO_CREDENTIAL to act as a default initiator principal. If no default initiator is defined, the routine will return GSS_S_NO_CRED.
context_handle (input/output)	The context handle for the new context. Supply GSS_C_NO_CONTEXT for the first call; use the value returned by the first call in continuation calls. Resources associated with this context handle must be released by the application after use with a call to `gss_delete_sec_context`.
target_name (input)	The name of the target.
mech_type (input)	The object ID of the desired mechanism. Supply GSS_C_NOOID to obtain A mechanism-specific default.
req_flags (input)	Contains various independent flags, each of which requests that the context support a specific service option. Symbolic names are provided for each flag, and the symbolic names corresponding to the required flags should be logically ORed together to form the bit-mask value. Valid values are: **GSS_C_DELEG_FLAG** TRUE — Delegate credentials to the remote peer. FALSE — Do not delegate. **GSS_C_MUTUAL_FLAG** TRUE — Request that the remote peer authenticate itself. FALSE — Authenticate self to the remote peer only. **GSS_C_REPLAY_FLAG**

TRUE — Enable replay detection for messages protected with `gss_wrap` or `gss_get_mic`.

FALSE — Do not attempt to detect replayed messages.

GSS_C_SEQUENCE_FLAG

TRUE — Enable detection of out-of-sequence protected messages.

FALSE — Do not attempt to detect out-of-sequence messages.

GSS_C_CONF_FLAG

TRUE — Request that confidentiality service be made available (by calling `gss_wrap`).

FALSE — No per-message confidentiality service is required.

GSS_C_INTEG_FLAG

TRUE — Request that integrity service be made available (by calling either `gss_get_mic` or `gss_wrap`).

FALSE — No per-message integrity service is required.

GSS_C_ANON_FLAG

TRUE — Do not reveal the initiator's identity to the acceptor.

FALSE — Authenticate normally.

time_req (input) — The desired number of seconds for which the context should remain valid. Supply zero to request a default validity period.

input_chan_bindings (input) — Application-specified bindings. Allows the application to securely bind channel identification information to the security context. Specify GSS_C_NO_CHANNEL_BINDINGS if channel bindings are not used.

input_token (input) — The token received from the peer application. Supply GSS_C_NO_BUFFER, or a pointer to a buffer containing the value GSS_C_EMPTY_BUFFER on the initial call.

actual_mech_type (output) — The actual mechanism used. The OID returned via this argument will be a pointer to static storage that should be treated as read only; in particular the application should not attempt to free it. Specify NULL if not required.

output_token (output) — The token to be sent to the peer application. If the length field of the returned buffer is zero, no token need be sent to the peer application. Storage associated with this buffer must be freed by the application after use with a call to `gss_release_buffer`.

ret_flags (output) — Contains various independent flags, each of which indicates that the context supports a specific service option. Specify NULL if not required. Symbolic names are provided for each flag, and the symbolic names corresponding to the required flags should be logically ANDed with the `ret_flags` value to test whether a given option is supported by the context. The flags are:

GSS_C_DELEG_FLAG

TRUE — Credentials were delegated to the remote peer.

FALSE — No credentials were delegated.

GSS_C_MUTUAL_FLAG

TRUE — The remote peer has authenticated itself.

FALSE — The remote peer has not authenticated itself.

GSS_C_REPLAY_FLAG

TRUE — Replay of protected messages will be detected.

FALSE — Replayed messages will not be detected.

GSS_C_SEQUENCE_FLAG

TRUE — Out-of-sequence protected messages will be detected.

FALSE — Out-of-sequence messages will not be detected.

GSS_C_CONF_FLAG

TRUE — Confidentiality service may be invoked by calling the `gss_wrap` routine.

FALSE — No confidentiality service (via `gss_wrap`) is available. The `gss_wrap` routine will provide message encapsulation, data-origin authentication, and integrity services only.

GSS_C_INTEG_FLAG

TRUE — Integrity service may be invoked by calling either `gss_get_mic` or `gss_wrap` routines.

FALSE — Per-message integrity service is unavailable.

GSS_C_ANON_FLAG

TRUE — The initiator's identity has not been revealed, and will not be revealed if any emitted token is passed to the acceptor.

FALSE — The initiator's identity has been or will be authenticated normally.

GSS_C_PROT_READY_FLAG

TRUE — Protection services (as specified by the states of the GSS_C_CONF_FLAG and GSS_C_INTEG_FLAG) are available for use if the accompanying status return value is either GSS_S_COMPLETE or GSS_S_CONTINUE_NEEDED.

FALSE — Protection services (as specified by the states of the GSS_C_CONF_FLAG and GSS_C_INTEG_FLAG) are available only if the accompanying major status return value is GSS_S_COMPLETE.

GSS_S_TRANS_FLAG

TRUE — The resultant security context may be transferred to other processes via a call to `gss_export_sec_context`.

FALSE — The security context is not transferable.

All other bits should be set to zero.

time_rec (output) — The number of seconds for which the context will remain valid. If the implementation does not support credential expiration, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.

Description

This routine indicates the establishment of a security context between the application and a remote peer. Initially, the `input_token` argument should be specified either as GSS_C_NO_BUFFER, or as a pointer to a `gss_buffer_desc` object whose length field contains the value zero. The routine may return an `output_token` that should be transferred to the peer application, where the peer application will present it to `gss_accept_sec_context`. If no token need be sent, `gss_init_sec_context` will indicate this by setting the length field of the `output_token` argument to zero. To complete the context establishment, one or more reply tokens may be required from the peer application; if so, `gss_init_sec_context` will return a status containing the supplementary information bit GSS_S_CONTINUE_NEEDED. In this case, `gss_init_sec_context` should be called again when the reply token is received from the peer application, passing the token to `gss_init_sec_context` via the `input_token` arguments.

Portable applications should be constructed to use the token length and return status to determine whether a token needs to be sent or waited for. Thus a typical portable caller should always invoke `gss_init_sec_context` within a loop:

```
int context_established = 0;
gss_ctx_id_t context_hdl = GSS_C_NO_CONTEXT;

input_token->length = 0;

while (!context_established) {
    maj_stat = gss_init_sec_context(&min_stat,
                                               cred_hdl,
                                               &context_hdl,
                                               target_name,
                                               desired_mech,
                                               desired_services,
                                               desired_time,
                                               input_bindings,
                                               input_token,
                                               &actual_mech,
                                               output_token,
                                               &actual_services,
                                               &actual_time);
  if (GSS_ERROR(maj_stat)) {
      report_error(maj_stat, min_stat);
  };

  if (output_token->length != 0) {
      send_token_to_peer(output_token);
      gss_release_buffer(&min_stat, output_token)
  };
  if (GSS_ERROR(maj_stat)) {

      if (context_hdl != GSS_C_NO_CONTEXT)
          gss_delete_sec_context(       &min_stat,
                                               &context_hdl,
                                               GSS_C_NO_BUFFER);
      break;
  };
  if (maj_stat & GSS_S_CONTINUE_NEEDED) {
      receive_token_from_peer(input_token);
  } else {
        context_established = 1;
```

```
    };
};
```

Whenever the routine returns a status that indicates the value GSS_S_CONTINUE_NEEDED, the context is not fully established and the following restrictions apply to the output arguments:

- The value returned via the time_rec argument is undefined unless the accompanying `ret_flags` argument contains the bit GSS_C_PROT_READY_FLAG, indicating that per-message services may be applied in advance of a successful completion status, the value returned via the `actual_mech_type` argument is undefined until the routine returns a status value of GSS_S_COMPLETE.
- The values of the GSS_C_DELEG_FLAG, GSS_C_MUTUAL_FLAG, GSS_C_REPLAY_FLAG, GSS_C_SEQUENCE_FLAG, GSS_C_CONF_GLAG, GSS_C_INTEG_FLAG and GSS_C_ANON_FLAG bits returned via the `ret_flags` argument contain the values that the implementation expects would be valid if context establishment were to succeed. In particular, if the application has requested a service such as delegation or anonymous authentication via the `req_flags` argument, and such a service is unavailable from the underlying mechanism, `gss_init_sec_context` generates a token that will not provide the service, and indicates via the `ret_flags` argument that the service will not be supported. The application may choose to abort the context establishment by calling `gss_delete_sec_context` (if it cannot continue in the absence of the service), or it may choose to transmit the token and continue context establishment (if the service was merely desired but not mandatory).
- The values of the GSS_C_PROT_READY_FLAG and GSS_C_TRANS_FLAG bits within `ret_flags` indicate the actual state at the time `gss_init_sec_context` returns, whether or not the context is fully established.
- GSSAPI implementations that support per-message protection are encouraged to set the GSS_C_PROT_READY_FLAG in the final `ret_flags` returned to a caller (that is, when accompanied by a GSS_S_COMPLETE status code). However, applications should not rely on this behavior, as the flag was not defined in Version 1 of the GSSAPI. Instead, applications should determine what per-message services are available after a successful context establishment according to the GSS_C_INTEG_FLAG and GSS_C_CONF_FLAG values.

If the initial call of `gss_init_sec_context` fails, a context object is not created, and the value of the `context_handle` argument is set to GSS_C_NO_CONTEXT to indicate this.

During context establishment, the informational status bits GSS_OLD_TOKEN and GSS_S_DUPLICATE_TOKEN indicate fatal errors, and GSSAPI mechanisms return them in association with a routine error of GSS_S_FAILURE. This requirement for pairing did not exist in Version 1 of the GSSAPI specification, so applications that wish to run over Version 1 implementations must special-case these codes.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_CONTINUE_NEEDED	Indicates that a token from the peer application is required to complete the context and that `gss_init_sec_context` must be called again with that token.
GSS_S_DEFECTIVE_TOKEN	Indicates that consistency checks performed on the `input_token` failed.

GSS_S_DEFECTIVE_CREDENTIAL	Indicates that consistency checks performed on the credential failed.
GSS_S_NO_CRED	The supplied credentials were not valid for context initiation, or the credential handle did not reference any credentials.
GSS_S_CREDENTIALS_EXPIRED	The referenced credentials have expired.
GSS_S_BAD_BINDINGS	The `input_token` contains different channel bindings to those specified via the `input_chan_bindings` argument.
GSS_S_BAD_SIG	The `input_token` contains an invalid MIC, or a MIC that could not be verified.
GSS_S_OLD_TOKEN	The `input_token` was too old. This is a fatal error during context establishment.
GSS_S_DUPLICATE_TOKEN	The `input_token` is valid, but is a duplicate of a token already processed. This is a fatal error during context establishment.
GSS_S_NO_CONTEXT	Indicates that the supplied context handle did not refer to a valid context.
GSS_S_BAD_NAMETYPE	The provided `target_name` argument contained an invalid or unsupported type of name.
GSS_S_BAD_NAME	The provided `target_name` argument was ill formed.
GSS_S_BAD_MECH	The specified mechanism is not supported by the provided credential, or is unrecognized by the implementation.

gss_inquire_context — Extract security context information

C Prototype

```
OM_uint32 gss_inquire_context(
        OM_uint32                * minor_status,
        gss_ctx_id_t               context_handle,
        gss_name_t               * src_name,
        gss_name_t               * targ_name,
        OM_uint32                * lifetime_rec,
        gss_OID                  * mech_type,
        OM_uint32                * ctx_flags,
        int                      * locally_initiated,
        int                      * open );
```

Arguments

minor_status (output) — An implementation-specific status code.

context_handle (input) — A context handle identifying the context for which information is to be returned.

src_name (output) — The name of the context initiator. If the context was established using anonymous authentication, and if the application invoking `gss_inquire_context` is the context acceptor, an anonymous name will be returned. Storage associated with this name must be freed by the application after use with a call to `gss_release_name`.

targ_name (output) — The name of the context target. Storage associated with this name must be freed by the application after use with a call to `gss_release_name`. If the context acceptor did not authenticate itself, and if the initiator did not specify a target name in its call to `gss_init_sec_context`, the value GSS_C_NO_NAME will be returned. Specify NULL if not required.

lifetime_rec (output) — The number of seconds for which the context will remain valid. If the context has expired, this argument will be set to zero. If the implementation does not support credential expiration, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.

mech_type (output) — The security mechanism providing the context. The returned OID will be a pointer to static storage that should be treated as read only by the application; in particular the application should not attempt to free it. Specify NULL if not required.

ctx_flags (output) — Contains several independent flags, each of which indicates that the context supports (or is expected to support, if open is FALSE), a specific service option. If not needed, specify NULL. Symbolic names are provided for each flag, and the symbolic names corresponding to the required flags should be logically ANDed with the `ret_flags` value to test whether a given option is supported by the context. The flags are:

GSS_C_DELEG_FLAG

TRUE — Credentials were delegated from the initiator to the acceptor.

FALSE — No credentials were delegated.

GSS_C_MUTUAL_FLAG

TRUE — The acceptor was authenticated to the initiator.

FALSE — The acceptor did not authenticate itself.

GSS_C_REPLAY_FLAG

TRUE — Replay of protected messages will be detected.

FALSE — Replay messages will not be detected.

GSS_C_SEQUENCE_FLAG

TRUE — Out-of-sequence protected messages will be detected.

FALSE — Out-of-sequence messages will not be detected.

GSS_C_CONF_FLAG

TRUE — Confidentiality service may be invoked by calling the `gss_wrap` routine.

FALSE — No confidentiality service (via `gss_wrap`) is available. The `gss_wrap` routine provides message encapsulation, data-origin authentication, and integrity services only.

GSS_C_INTEG_FLAG

TRUE — Integrity service may be invoked by calling either the `gss_get_mic` or `gss_wrap` routine.

FALSE — Per-message integrity service is unavailable.

GSS_C_ANON_FLAG

TRUE — The initiator's identity will not be revealed to the acceptor. The `src_name` argument (if requested) contains an anonymous internal name.

FALSE — The initiator has been authenticated normally.

GSS_C_PROT_READY_FLAG

TRUE — Protection services (as specified by the states of the GSS_C_CONF_FLAG and GSS_C_INTEG_FLAG) are available for use.

FALSE — Protection services (as specified by the states of the GSS_C_CONF_FLAG and GSS_C_INTEG_FLAG) are available only if the context is fully established (that is, if the open argument is nonzero).

GSS_C_TRANS_FLAG

TRUE — The resultant security context may be transferred to other processes via a call to `gss_export_sec_context`.

FALSE — The security context is not transferable.

locally_initiated (output)

A Boolean value. Specify NULL if not required.

TRUE if the caller is the context initiator.

FALSE if the caller is the acceptor.

open (output)

A Boolean value. Specify NULL if not required.

TRUE if the context is fully established

FALSE if a context-establishment token is expected from the peer application.

Description

This routine is used to extract information describing characteristics of a security context. The caller must already have obtained a handle that refers to the context, although the context need not be fully established.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Indicates that the referenced context is valid and that `ctx_flags`, `locally_initiated`, and `open` return values describe the corresponding characteristics of the context. If `open` is TRUE, `lifetime_rec` is also returned; if `open` is TRUE and the context peer's name is known, `src_name` and `targ_name` are valid in addition to the values listed previously. The `mech_type` value must be returned for contexts where `open` is TRUE and may be returned for contexts where `open` is FALSE.
GSS_S_NO_CONTEXT	Indicates that no valid context was recognized for the input `context_handle` provided. Return values other than `minor_status` are undefined.

gss_inquire_cred — Provide calling application with information about a credential

C Prototype

```
OM_uint32 gss_inquire_cred(
        OM_uint32              * minor_status,
        gss_cred_id_t            cred_handle,
        gss_name_t             * name,
        OM_uint32              * lifetime,
        gss_cred_usage_t       * cred_usage,
        gss_OID_set            * mechanisms );
```

Arguments

minor_status (output)	An implementation-specific status code.
cred_handle (input)	A handle that refers to the target credential. Specify GSS_C_NO_CREDENTIAL to inquire about the default initiator principal.
name (output)	The name whose identity the credential asserts. Storage associated with this name should be freed by the application after use with a call to `gss_release_name`. Specify NULL if not required.
lifetime (output)	The number of seconds for which the credential will remain valid. If the credential has expired, this argument will be set to zero. If the implementation does not support credential expiration, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.
cred_usage (output)	How the credential may be used. Specify NULL if not required. Valid values are as follows: **GSS_C_INITIATE** **GSS_C_ACCEPT** **GSS_C_BOTH**
mechanisms (output)	The set of mechanisms supported by the credential. Storage associated with this OID set must be freed by the application after use with a call to `gss_release_oid_set`. Specify NULL if not required.

Description

This routine obtains information about a credential. The caller must already have obtained a handle that refers to the credential.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.

GSS_S_NO_CRED	The referenced credentials could not be accessed.
GSS_S_DEFECTIVE_CREDENTIAL	The referenced credentials were invalid.
GSS_S_CREDENTIALS_EXPIRED	The referenced credentials have expired. If the lifetime argument was not passed as NULL, it will be set to zero.

gss_inquire_cred_by_mech — Obtain per-mechanism information about a credential

C Prototype

```
OM_uint32 gss_inquire_cred_by_mech(
        OM_uint32                * minor_status,
        gss_cred_id_t              cred_handle,
        gss_OID                    mech_type,
        gss_name_t               * name,
        OM_uint32                * initiator_lifetime,
        OM_uint32                * acceptor_lifetime,
        gss_cred_usage_t         * cred_usage );
```

Arguments

minor_status (output) — A handle that refers to the target credential. Specify GSS_C_NO_CREDENTIAL to inquire about the default initiator principal.

mech_type (input) — The mechanism for which information should be returned.

name (output) — The name whose identity the credential asserts.

initiator_lifetime (output) — The number of seconds for which the credential will remain capable of initiating security contexts under the specified mechanism. If the credential can no longer be used to initiate contexts, or if the credential usage for this mechanism is GSS_C_ACCEPT, this argument will be set to zero. If the implementation does not support expiration of initiator credentials, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.

acceptor_lifetime (output) — The number of seconds for which the credential will remain capable of accepting security contexts under the specified mechanism. If the credential can no longer be used to accept contexts, or if the credential usage for this mechanism is GSS_C_INITIATE, this argument will be set to zero. If the implementation does not support expiration of acceptor credentials, the value GSS_C_INDEFINITE will be returned. Specify NULL if not required.

cred_usage (output) — How the credential may be used with the specified mechanism. Specify NULL if not required. Valid values are as follows:

GSS_C_INITIATE

GSS_C_ACCEPT

GSS_C_BOTH

Description

This routine obtains per-mechanism information about a credential.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_NO_CRED	The referenced credentials could not be accessed.
GSS_S_DEFECTIVE_CREDENTIAL	The referenced credentials were invalid.

gss_inquire_names_for_mech — Return set of supported nametypes

C Prototype

```
OM_uint32 gss_inquire_names_for_mech(
        OM_uint32                * minor_status,
        gss_OID                    mechanism,
        gss_OID_set              * name_types );
```

Arguments

minor_status (output)	An implementation-specific status code.
mechanism (input)	The mechanism to be interrogated.
name_types (output)	The set of `name-types` supported by the specified mechanism. The returned OID set must be freed by the application after use with a call to `gss_release_oid_set`.

Description

This routine returns the set of nametypes supported by the specified mechanism.

Return Values

This routine returns the following GSS status code:

GSS_S_COMPLETE	Successful completion.

gss_process_context_token — Pass a security context to the security service

C Prototype

```
OM_uint32 gss_process_context_token(
      OM_uint32              * minor_status,
      gss_ctx_id_t             context_handle,
      gss_buffer_t             token_buffer );
```

Arguments

minor_status (output)	An implementation-specific status code.
context_handle (input)	The context handle of the context on which the token is to be processed.
token_buffer (input)	A pointer to the token to process.

Description

This routine provides a way to pass an asynchronous token to the security service. Most context-level tokens are emitted and processed synchronously by `gss_init_sec_context` and `gss_accept_sec_context`, and the application is informed as to whether further tokens are expected by the GSS_C_CONTINUE_NEEDED status return. Occasionally, a mechanism may need to emit a context-level token at a point when the peer entity is not expecting a token. For example, the initiator's final call to `gss_init_sec_context` may emit a token and return a status of GSS_S_COMPLETE, but the acceptor's call to `gss_accept_sec_context` may fail. The acceptor's mechanism may wish to send a token containing an error indication to the initiator, but the initiator is not expecting a token at this point, believing that the context is fully established. The `gss_process_context_token` routine provides a way to pass such a token to the mechanism at any time.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_DEFECTIVE_TOKEN	Indicates that consistency checks performed on the token failed.
GSS_S_FAILURE	Failure. See `minor_status` for more information.
GSS_S_NO_CONTEXT	The `context_handle` did not refer to a valid context.

gss_release_buffer — Free storage associated with a buffer

C Prototype

```
OM_uint32 gss_release_buffer(
      OM_uint32             * minor_status,
      gss_buffer_t            buffer );
```

Arguments

minor_status (output)	An implementation-specific status code.
buffer (input/output)	The storage associated with the buffer will be deleted. The gss_buffer_desc object will not be freed, but its length field will be zeroed.

Description

This routine frees storage associated with a buffer. The storage must have been allocated by a GSSAPI routine. In addition to freeing the associated storage, the routine will zero the length field in the descriptor to which the `buffer` argument refers. Any `buffer` object returned by a GSSAPI routine may be passed to `gss_release_buffer` (even if there is no storage associated with the buffer).

Return Values

This routine returns the following GSS status code:

GSS_S_COMPLETE	Successful completion.

gss_release_cred — Mark a credential for deletion

C Prototype

```
OM_uint32 gss_release_cred(
        OM_uint32               * minor_status,
        gss_cred_id_t           * cred_handle );
```

Arguments

minor_status (output)	A mechanism-specific status code.
cred_handle (input/output)	A buffer containing an opaque credential handle identifying the credential to be released. If GSS_C_NO_CREDENTIAL is supplied, the routine will complete successfully, but will do nothing.

Description

This routine informs GSSAPI that the specified credential handle is no longer required by the application, and frees associated resources. When all processes have released a credential, it will be deleted.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_NO_CRED	The credentials could not be accessed.

gss_release_name — Free storage associated with an internal name that was allocated by a GSSAPI routine

C Prototype

```
OM_uint32 gss_release_name(
        OM_uint32              * minor_status,
        gss_name_t             * input_name );
```

Arguments

minor_status (output)	An implementation-specific status code.
input_name (input/output)	The name to be deleted.

Description

This routine frees GSSAPI allocated storage associated with an internal form name.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Successful completion.
GSS_S_BAD_NAME	The `input_name` argument did not contain a valid name.

gss_release_oid_set — Free storage associated with a gss_OID_set object

C Prototype

```
OM_uint32 gss_release_oid_set(
        OM_uint32               * minor_status,
        gss_OID_set             * set );
```

Arguments

minor_status (output)	An implementation-specific status code.
set (input)	The gss_OID_set whose storage is to be deleted.

Description

This routine frees storage associated with a GSSAPI generated gss_OID_set object. The set argument must refer to an OID-set that was returned from a GSSAPI routine. The gss_release_oid_set routine frees the storage associated with each individual member OID, the OID set's elements array, and the gss_OID_set_desc.

Return Values

This routine returns the following GSS status code:

GSS_S_COMPLETE	Successful completion.

gss_test_oid_set_member — Determine whether an object identifier is a member of the set

C Prototype

```
OM_uint32 gss_test_oid_set_member(
        OM_uint32                * minor_status,
        gss_OID                    member,
        gss_OID_set                set,
        int                      * present );
```

Arguments

minor_status (output)	An implementation-specific status code.
member (input)	The object identifier whose presence is to be tested.
set (input)	The object identifier set.
present (output)	A Boolean value: TRUE — The specified OID is a member of the set. FALSE — The specified OID is not a member of the set.

Description

This routine interrogates an object identifier set to determine whether a specified object identifier is a member. It is intended to be used with OID sets returned by `gss_indicate_mechs`, `gss_acquire_cred`, and `gss_inquire_cred`, but will also work with user-generated sets.

Return Values

This routine returns the following GSS status code:

GSS_S_COMPLETE	Successful completion.

gss_unwrap — Verify a message with attached MIC and decrypt message content

C Prototype

```
OM_uint32 gss_unwrap(
        OM_uint32                * minor_status,
        gss_ctx_id_t               context_handle,
        gss_buffer_t               input_message_buffer,
        gss_buffer_t               output_message_buffer,
        int                      * conf_state,
        gss_qop_t                * qop_state );
```

Arguments

minor_status (output)	An implementation-specific status code.
context_handle (input)	Identifies the context in which the message arrived.
input_message_buffer (input)	The protected message.
output_message_buffer (output)	A buffer to receive the unwrapped message. Storage associated with this buffer must be freed by the application after use with a call to `gss_release_buffer`.
conf_state (output)	A Boolean value indicating which services have been applied. Specify NULL if not required. TRUE — Confidentiality and integrity protection services have been applied. FALSE — Only integrity service has been applied.
qop_state (output)	The quality of protection provided. Specify NULL if not required.

Description

This routine converts a message previously protected by `gss_wrap` back to a usable form, verifying the embedded Message Integrity Code (MIC). The `conf_state` argument indicates whether the message was encrypted; the `qop_state` argument indicates the strength of the protection that was used to provide the confidentiality and integrity services.

This routine is functionally equivalent to the `gss_unseal` routine. New code should use `gss_unwrap` instead of `gss_unseal`. Although both routines are supported, `gss_unseal` has been deprecated in the GSSAPI Version 2 specification.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Indicates that the `input_message_buffer` was successfully processed and that the `output_message_buffer` is ready for transmission.

GSS_S_DEFECTIVE_TOKEN	Indicates that the `input_message_buffer` was successfully processed and that the `output_message_buffer` is ready for transmission.
GSS_S_BAD_SIG	Indicates that consistency checks performed on the token extracted from the `input_message_buffer` failed, preventing further processing from being performed with that token.
GSS_S_DUPLICATE_TOKEN	Indicates that the MIC extracted from the `input_message_buffer` contains an incorrect integrity check for the message.
GSS_S_OLD_TOKEN	The token extracted from the `input_message_buffer` is valid, and contained a correct MIC for the message, but is a duplicate of a token already processed. This is a fatal error during context establishment.
GSS_S_UNSEQ_TOKE	Indicates that the token was valid, and contained a correct MIC for the message, but has been verified out of sequence; a later token has already been received.
GSS_S_GAP_TOKEN	Indicates that the token was valid, and contained a correct MIC for the message, but has been verified out of sequence; an earlier expected token has not yet been received.
GSS_S_CONTEXT_EXPIRED	Indicates that context-related data items have expired, so that the requested operation cannot be performed
GSS_S_NO_CONTEXT	Indicates that no valid context was recognized for the input `context_handle` provided.

gss_verify_mic — Check that a cryptographic MIC fits the applied message

C Prototype

```
OM_uint32 gss_verify_mic(
        OM_uint32               * minor_status,
        gss_ctx_id_t              context_handle,
        gss_buffer_t              message_buffer,
        gss_buffer_t              message_token,
        gss_qop_t               * qop_state );
```

Arguments

minor_status (output)	An implementation-specific status code.
context_handle (input)	Specifies the context on which the message arrived.
message_buffer (input)	Specifies the message to be verified.
message_token (input)	Specifies the token to be associated with the message.
qop_state (output)	Returns the quality of protection gained from the MIC. Specify NULL if not required.

Description

This routine checks that a cryptographic MIC, contained in the `message_token` argument, fits the message in the `message_buffer` argument. The `qop_state` argument allows a message recipient to determine the strength of protection that was applied to the message.

This routine is functionally equivalent to the `gss_verify` routine. New code should use `gss_verify_mic` instead of `gss_verify`. Although both routines are supported, `gss_verify` has been deprecated in the GSSAPI Version 2 specification.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Indicates that the message was successfully verified.
GSS_S_DEFECTIVE_TOKEN	Indicates that consistency checks performed on the received `message_token` failed, preventing further processing from being performed with that token.
GSS_S_BAD_SIG	Indicates that the received `message_token` contains an incorrect MIC for the message.
GSS_S_DUPLICATE_TOKEN	The `message_token` was valid, and contained a correct MIC for the message, but is a duplicate of a token already processed. This is a fatal error during context establishment.

GSS_S_OLD_TOKEN	The `message_token` was valid, and contained a correct MIC for the message, but the `message_token` was too old to check for duplication. This is a fatal error during context establishment.
GSS_S_UNSEQ_TOKEN	Indicates that the cryptographic check value on the received message was correct, and the `message_token` contained a correct MIC, but the token has been verified out of sequence; a later token has already been received.
GSS_S_GAP_TOKEN	Indicates that the cryptographic check value on the received message was correct, and the `message_token` contained a correct MIC, but the token has been verified out of sequence; an earlier expected token has not yet been received.
GSS_S_CONTEXT_EXPIRED	Indicates that context-related data items have expired, so that the requested operation cannot be performed
GSS_S_NO_CONTEXT	Indicates that no valid context was recognized for the input `context_handle` provided.

gss_wrap — Attach a MIC to a message and encrypt the message

C Prototype

```
OM_uint32 gss_wrap(
        OM_uint32              * minor_status,
        gss_ctx_id_t             context_handle,
        int                      conf_req_flag,
        gss_qop_t                qop_req,
        gss_buffer_t             input_message_buffer,
        int                    * conf_state,
        gss_buffer_t             output_message_buffer );
```

Arguments

minor_status (output) — An implementation-specific status code.

context_handle (input) — Identifies the context on which the message will be sent.

conf_req_flag (input) — A Boolean value indicating which services are to be used.

TRUE — Both confidentiality and integrity services are requested.

FALSE — Only integrity service is requested.

qop_req (input) — Specifies the required quality of protection. A mechanism-specific default may be requested by setting `qop_req` to GSS_C_QOP_DEFAULT. If an unsupported protection strength is requested, `gss_wrap` will return a status of GSS_S_BAD_QOP.

input_message_buffer (input) — The message to be protected.

conf_state (output) — A Boolean value indicating which services have been applied. Specify NULL if not required.

TRUE — Confidentiality, data origin authentication and integrity services have been applied.

FALSE — Only integrity and data origin services have been applied.

output_message_buffer (output) — The buffer to receive the protected message. Storage associated with this message must be freed by the application after use with a call to `gss_release_buffer`.

Description

This routine attaches a cryptographic MIC and optionally encrypts the specified `input_message_buffer`. The `output_message_buffer` contains both the MIC and the message. The `qop_req` argument allows a choice between several cryptographic algorithms.

This routine is functionally equivalent to the `gss_seal` routine. New code should use `gss_wrap` instead of `gss_seal`. Although both routines are supported, `gss_seal` has been deprecated in the GSSAPI Version 2 specification.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Indicates that the `input_message_buffer` was successfully processed and that the `output_message_buffer` is ready for transmission.
GSS_S_CONTEXT_EXPIRED	Indicates that context-related data items have expired, so that the requested operation cannot be performed.
GSS_S_NO_CONTEXT	Indicates that the `context_handle` argument did not identify a valid context.
GSS_S_BAD_QOP	Indicates that the provided QOP value is not recognized or supported for the context.

gss_wrap_size_limit — Check expected size of wrapped output

C Prototype

```
OM_uint32 gss_wrap_size_limit(
        OM_uint32               * minor_status,
        gss_ctx_id_t              context_handle,
        int                       conf_req_flag,
        gss_qop_t                 qop_req,
        OM_uint32                 req_output_size,
        OM_uint32               * max_input_size );
```

Arguments

minor_status (output)
: An implementation-specific status code.

context_handle (input)
: A handle that refers to the security over which the messages will be sent..

conf_req_flag (input)
: A Boolean value indicating whether `gss_wrap` will be asked to apply confidentiality protection in addition to integrity protection.

  TRUE — Both confidentiality and integrity services are requested.

  FALSE — Only integrity service is requested.

qop_req (input)
: Specifies the requested quality of protection that `gss_wrap` will be asked to provide. Callers are encouraged, on portability grounds, to accept the default quality of protection offered by the chosen mechanism, which may be requested by specifying GSS_C_QOP_DEFAULT for this argument.

req_output_size (input)
: The desired maximum size for tokens emitted by `gss_wrap`.

max_input_size (output)
: The maximum input message size that may be presented to `gss_wrap` in order to guarantee that the emitted token shall be no larger than `req_output_size` bytes.

Description

This routine allows an application to determine the maximum message size that, if presented to `gss_wrap` with the same `conf_req_flag` and `qop_req` arguments, will result in an output token containing no more than `req_output_size` bytes.

This call is intended for use by applications that communicate over protocols that impose a maximum message size. It enables the application to fragment messages prior to applying protection.

This call is intended for use by applications that communicate over protocols that impose a maximum message size. It enables the application to fragment messages prior to applying protection.

Successful completion of this call does not guarantee that `gss_wrap` will be able to protect a message of length `max_input_size` bytes, since this ability may depend on the availability of system resources at the time that `gss_wrap` is called.

Return Values

This routine returns one of the following GSS status codes:

GSS_S_COMPLETE	Indicates a successful token size determination: an input message with a length in octets equal to the returned `max_input_size` value will, when passed to `gss_wrap` for processing on the context identified by the `context_handle` argument with the confidentiality request state as provided in conf_req_flag and with the quality of protection specifier provided in the `qop_req` argument, yield an output token no larger than the value of the provided `req_output_size` argument.
GSS_S_CONTEXT_EXPIRED	Indicates that the provided input `context_handle` is recognized, but that the referenced context has expired. Return values other than `minor_status` are undefined.
GSS_S_NO_CONTEXT	Indicates that no valid context was recognized for the input `context_handle` provided. Return values other than `minor_status` are undefined.
GSS_S_BAD_QOP	Indicates that the provided QOP value is not recognized or supported for the context.

6 KRB5 (Kerberos V5) Application Programming Interface

This chapter describes the C language bindings for the routines that make up the KRB5 Application Programming Interface.

The APIs in the following list are now obsolete, and their use should be avoided. (A future version of Kerberos may remove these APIs.) The column on the right indicates the API that should be used as a substitute for the obsolete API.

Table 6-1 Obsolete and Replacement APIs

Obsolete API	Replacement API
krb5_auth_con_getlocalsubkey	krb5_auth_con_getsendsubkey
krb5_auth_con_getremotesubkey	krb5_auth_con_getrecvsubkey
krb5_auth_con_initivector	None
krb5_get_in_tkt_with_skey	None
krb5_get_in_tkt_with_password	krb5_get_init_creds_password
krb5_get_in_tkt_with_keytab	krb5_get_init_creds_keytab
krb5_get_in_tkt	None

NOTE Additional Kerberos KRB5 APIs are not documented in this manual. The APIs themselves are included in the Kerberos for OpenVMS library (KRB$RTL.EXE for 64 bit interfaces, or KRB$RTL32.EXE for 32 bit interfaces) in SYS$LIBRARY.

krb5_425_conv_principal — Convert a Kerberos V4 principal name to V5 format

C Prototype

```
krb5_error_code krb5_425_conv_principal(
        krb5_context            context,
        const char              *name,
        const char              *instance,
        const char              *realm,
        krb5_principal          *princ );
```

Arguments

context (input/output)	The context structure.
name (input)	Kerberos V4 name.
instance (input)	Kerberos V4 instance.
realm (input)	Kerberos V4 realm.
principal (output)	Kerberos V5 principal name.

Description

This routine builds a principal `princ` from a V4 specification made up of `name.instance@realm`. The routine is site customized to convert the V4 naming scheme to a V5 scheme. For instance, the V4 `rcmd` is changed to `host`.

The returned principal should be freed with `krb5_free_principal`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_524_conv_principal — Separate a Kerberos V5 principal into components

C Prototype

```
krb5_error_code krb5_524_conv_principal (
        krb5_context            context,
        krb5_const_principal    princ,
        char                    *name,
        char                    *inst,
        char                    *realm );
```

Arguments

context (input/output)	The context structure.
princ (input)	The Kerberos V5 principal.
name (output)	The principal name.
inst (output)	The principal instance name.
realm (output)	The principal realm name.

Description

This routine separates a Kerberos V5 principal into `name`, `instance`, and `realm`.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_INVALID_PRINCIPAL	Invalid principal name.
KRB5_CONFIG_CANTOPEN	Can't open/find Kerberos configuration file.

krb5_524_convert_creds — Convert Kerberos V5 credentials to V4

C Prototype

```
krb5_error_code krb5_524_convert_creds (
        krb5_context                    context,
        krb5_creds                      *v5creds,
        CREDENTIALS                     *v4creds );
```

Arguments

context (input/output)	The context structure.
v5creds (input)	A pointer to the Kerberos V5 credentials to be converted.
v4creds (output)	A pointer to the Kerberos V4 credential structure to be filled in.

Description

This routine takes a set of Kerberos V5 credentials, and converts them to V4 format.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
-1	Bad key.
KRB5_INVALID_PRINCIPAL	Invalid principal name.
KRB5_CONFIG_CANTOPEN	Can't open/find Kerberos configuration file.
KRB5_REALM_UNKNOWN	Unknown realm.
KRB524_KRB5_DISABLED	Kerberos V4 compatibility is disabled.
ENOMEM	Insufficient memory.

krb5_address_compare — Compare two addresses

C Prototype

```
krb5_boolean krb5_address_compare(
         krb5_context           context,
         const krb5_address     *addr1,
         const krb5_address     *addr2 );
```

Arguments

context (input/output)	The context structure.
addr1 (input)	The first address to compare.
addr2 (input)	The second address to compare.

Description

This routine compares two Kerberos addresses.

Return Values

This routine returns one of the following KRB5 status codes:

TRUE	The two addresses are the same.
FALSE	The two addresses are different.

krb5_address_order — Return an ordering of two addresses

C Prototype

```
int krb5_address_order(
         krb5_context            context,
         const krb5_address      *addr1,
         const krb5_address      *addr2 );
```

Arguments

context (input/output)	The context structure.
addr1 (input)	The first address to compare.
addr2 (input)	The second address to compare.

Description

This routine returns an ordering on the two addresses.

Return Values

This routine returns one of the following KRB5 status codes:

= 0	The two addresses are the same.
< 0	First address is less than second.
> 0	First address is greater than second.

krb5_address_search — Search for address in address list

C Prototype

```
krb5_boolean krb5_address_search(
         krb5_context               context,
         const krb5_address         *addr,
         krb5_address * krb5_const  *addrlist );
```

Arguments

context (input/output)	The context structure.
addr (input)	The address to search for.
addrlist (input)	The address list to search, as an array of addresses. The last entry in the array must be a NULL pointer. Specify NULL for this argument if no address list is present.

Description

This routine searches `addrlist` for the address in `addr`.

Return Values

This routine returns one of the following KRB5 status codes:

TRUE	`addr` is listed in `addrlist`, or `addrlist` is NULL.
FALSE	`addr` is not listed in `addrlist`.

krb5_aname_to_localname — Convert a principal name to a local name

C Prototype

```
krb5_error_code krb5_aname_to_localname(
         krb5_context              context,
         krb5_const_principal      aname,
         int                       lnsize,
         char                      *lname );
```

Arguments

context (input)	The context structure.
aname (input)	A principal name.
lnsize (input)	Specifies the maximum length name that is to be filled into `lname`.
lname (output)	The local name.

Description

This routine converts a principal name `aname` to a local name suitable for use by programs wishing a translation to an environment-specific name (for example, user account name).

The translation will be NULL terminated in all nonerror returns.

Return Values

This routine returns the following KRB5 status code:

System errors.

krb5_appdefault_boolean — Check Boolean values in appdefault

C Prototype

```
void krb5_appdefault_boolean(
        krb5_context    context,
        const char      *appname,
        const krb5_data *realm,
        const char      *option,
        int             default_value
        int             *ret_value );
```

Arguments

context (input)	The context structure.
appname (input)	A pointer to the application name.
realm (input)	A pointer to the Kerberos realm name.
option (input)	A pointer to the option to be checked.
default_value (input)	A default Boolean value to return if no match is found.
ret_value (output)	A pointer to the returned Boolean value.

Description

This routine checks the `[appdefaults]` section of the `krb5.conf` file. The `ret_value` argument returns the Boolean value of the particular option passed in `the option` argument. The `appname` argument provides the application name (for example, Telnet) whose option is being checked.

Use `krb5_appdefault_string` for checking string values in the `[appdefaults]` section of `krb5.conf`.

Return Values

None.

krb5_appdefault_string — Check string values in appdefault

C Prototype

```
void krb5_appdefault_string (
        krb5_context    context,
        const char      *appname,
        const krb5_data *realm,
        const char      *option,
        const char      *default_value,
        char            **ret_value );
```

Arguments

context (input)	The context structure.
appname (input)	A pointer to the application name.
realm (input)	A pointer to the Kerberos realm name.
option (input)	A pointer to the option to be checked.
default_value (input)	A default Boolean value to return if no match is found.
ret_value (output)	A pointer to the returned string value.

Description

This routine checks the `[appdefaults]` section of the `krb5.conf` file. The `ret_value` argument returns the string value of the particular option passed in `the option` argument. The `appname` argument provides the application name (for example, Telnet) whose option is being checked.

Use `krb5_appdefault_boolean` for checking Boolean values in the `[appdefaults]` section of `krb5.conf`.

Return Values

None.

krb5_auth_con_free — Free auth_context

C Prototype

```
krb5_error_code krb5_auth_con_free(
        krb5_context         context,
        krb5_auth_context    auth_context );
```

Arguments

context (input/output)	The context structure.
auth_context (output)	A per connection context.

Description

This routine frees the `auth_context` returned by `krb5_auth_con_init`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_genaddrs — Get full IP address from address and port

C Prototype

```
krb5_error_code krb5_auth_con_genaddrs(
        krb5_context       context,
        krb5_auth_context  auth_context,
        int                infd,
        int                flags );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
infd (input)	Input socket file descriptor.
flags (input)	Input flags. These symbols are defined in `KRB$ROOT:[INCLUDE]KRB5.H.` The values can be OR'd together. Possible values for `flags` are: KRB5_AUTH_CONTEXT_GENERATE_LOCAL_ADDR KRB5_AUTH_CONTEXT_GENERATE_REMOTE_ADDR KRB5_AUTH_CONTEXT_GENERATE_LOCAL_FULL_ADDR KRB5_AUTH_CONTEXT_GENERATE_REMOTE_FULL_ADDR

Description

This routine takes an IP address and port, and generates a full IP address.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.

krb5_auth_con_get_checksum_func — Get the checksum function and data structure

C Prototype

```
krb5_error_code krb5_auth_con_get_checksum_func (
        krb5_context                    context,
        krb5_auth_context               auth_context,
        krb5_mk_req_checksum_func       *func,
        void                            **data );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
func (output)	A pointer to a function that performs the checksum.
data (output)	A pointer to the data structure that holds the checksum.

Description

This routine returns the checksum function and the data structure used to hold the checksum data.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getrcache — Get the rcache element from the auth_context

C Prototype

```
krb5_error_code krb5_auth_con_getrcache (
        krb5_context            context,
        krb5_auth_context,      auth_context,
        krb5_rcache             rcache );
```

Arguments

context (input/output)	The context structure.
auth_context (input)	The authorization context.
rcache (output)	The `rcache` element from the `auth_context`.

Description

This routine takes an IP address and port, and generates a full IP address.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getaddrs — Retrieve address fields from the auth_context

C Prototype

```
krb5_error_code krb5_auth_con_getaddrs(
         krb5_context           context,
         krb5_auth_context      auth_context,
         krb5_address          **local_addr,
         krb5_address          **remote_addr );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
local_addr (output)	Local address.
remote_addr (output)	Remote address.

Description

This routine retrieves `local_addr` and `remote_addr` from `auth_context`. If `local_addr` or `remote_addr` is not NULL, the memory is first freed with `krb5_free_address` and then newly allocated. It is the caller's responsibility to free the returned addresses in this way.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getauthenticator — Retrieve authenticator used during mutual authentication

C Prototype

```
krb5_error_code krb5_auth_con_getauthenticator(
        krb5_context            context,
        krb5_auth_context       auth_context,
        krb5_authenticator      **authenticator );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
authenticator (output)	The authenticator used during mutual authentication.

Description

This routine retrieves the authenticator that was used during mutual authentication. It is the caller's responsibility to free the memory allocated to authenticator by calling `krb5_free_authenticator`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getflags — Retrieve the flags in auth_context

C Prototype

```
krb5_error_code krb5_auth_con_getflags(
         krb5_context            context,
         krb5_auth_context       auth_context,
         krb5_int32              *flags );
```

Arguments

context (input/output)	The context structure.
auth_context (input)	A per connection context.
flags (input)	A bit mask representing the flags to set in the auth_context. Valid flags are: KRB5_AUTH_CONTEXT_DO_TIME — Use timestamps. KRB5_AUTH_CONTEXT_RET_TIME — Save timestamps to output structure. KRB5_AUTH_CONTEXT_DO_SEQUENCE — Use sequence numbers. KRB5_AUTH_RET_SEQUENCE — Copy sequence numbers to output structure.

Description

This routine retrieves the flags from auth_context.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getkey — Retrieve keyblock from auth_context

C Prototype

```
krb5_error_code krb5_auth_con_getkey(
         krb5_context          context,
         krb5_auth_context     auth_context,
         krb5_keyblock         **keyblock );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
keyblock (output)	Key stored in auth_context.

Description

This routine retrieves the keyblock stored in auth_context. The memory allocated in this function should be freed with a call to krb5_free_keyblock.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getlocalseqnumber — Retrieve and store the local sequence number

C Prototype

```
krb5_error_code krb5_auth_con_getlocalseqnumber(
         krb5_context           context,
         krb5_auth_context      auth_context,
         krb5_int32             *seqnumber );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
seqnumber (input)	The address of the location to store the local sequence number.

Description

This routine retrieves the local sequence number that was used during authentication and stores it in `seqnumber`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getrecvsubkey — Retrieve the recv_subkey keyblock from auth_context

C Prototype

```
krb5_error_code krb5_auth_con_getrecvsubkey(
        krb5_context              context,
        krb5_auth_context         auth_context,
        krb5_keyblock             **keyblock );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
keyblock (output)	`recv_subkey` keyblock stored in `auth_context`.

Description

This routine retrieves the `recv_subkey` keyblock stored in `auth_context`. The memory allocated in this function should be freed with a call to `krb5_free_keyblock`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getremoteseqnumber — Retrieve and store the remote sequence number

C Prototype

```
krb5_error_code krb5_auth_con_getremoteseqnumber(
        krb5_context              context,
        krb5_auth_context         auth_context,
        krb5_int32                *seqnumber );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
seqnumber (input)	The address of the location to store the remote sequence number.

Description

This routine retrieves the remote sequence number that was used during authentication and stores it in `seqnumber`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_getsendsubkey — Retrieve the send_subkey keyblock from auth_context

C Prototype

```
krb5_error_code krb5_auth_con_getsendsubkey(
        krb5_context           context,
        krb5_auth_context      auth_context,
        krb5_keyblock          **keyblock );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
keyblock (output)	`send_subkey` keyblock stored in `auth_context`.

Description

This routine retrieves the `send_subkey` keyblock stored in `auth_context`. The memory allocated in this function should be freed with a call to `krb5_free_keyblock`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_init — Initialize the auth_context

C Prototype

```
krb5_error_code krb5_auth_con_init(
        krb5_context        context,
        krb5_auth_context   *auth_context );
```

Arguments

context (input/output)	The context structure.
auth_context (output)	A per connection context.

Description

This routine initializes the auth_context. The auth_context contains all data pertinent to the various authentication routines.

The default flags for the context are set to enable the use of the replay cache (krb5_auth_context_do_time) but no sequence numbers. The function krb5_auth_con_setflags allows the flags to be changed.

The default checksum type is set to CKSUMTYPE_RSA_MD4_DES. This may be changed with krb5_auth_con_setcksumtype.

The auth_context structure should be freed with krb5_auth_con_free.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_set_checksum_func — Set the checksum function and data structure

C Prototype

```
krb5_error_code krb5_auth_con_set_checksum_func (
        krb5_context                    context,
        krb5_auth_context               auth_context,
        krb5_mk_req_checksum_func       func,
        void                            *data );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
func (input)	A function that performs the checksum.
data (input)	A pointer to the data structure that holds the checksum.

Description

This routine sets the `checksum` function and the sets up the data structure used to hold the `checksum` data.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_setaddrs — Set address fields in auth_context

C Prototype

```
krb5_error_code krb5_auth_con_setaddrs(
         krb5_context           context,
         krb5_auth_context      auth_context,
         krb5_address           *local_addr,
         krb5_address           *remote_addr );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
local_addr (input)	Local address.
remote_addr (input)	Remote address.

Description

This routine copies the `local_addr` and `remote_addr` into `auth_context`. If either address is NULL, the previous address remains in place.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_setflags — Set the flags in auth_context

C Prototype

```
krb5_error_code krb5_auth_con_setflags(
        krb5_context       context,
        krb5_auth_context  auth_context,
        krb5_int32         flags );
```

Arguments

context (input/output) — The context structure.

auth_context (output) — A per-connection context.

flags (input) — A bit mask representing the flags to set in `auth_context`. Valid values are:

KRB5_AUTH_CONTEXT_DO_TIME — Use timestamps.

KRB5_AUTH_CONTEXT_RET_TIME — Save timestamps to output structure.

KRB5_AUTH_CONTEXT_DO_SEQUENCE — Use sequence numbers.

KRB5_AUTH_RET_SEQUENCE — Copy sequence numbers to output structure.

Description

This routine sets the flags of `auth_context` to the `flags` argument.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_setports — Set port fields in the auth_context

C Prototype

```
krb5_error_code krb5_auth_con_setports(
         krb5_context            context,
         krb5_auth_context       auth_context,
         krb5_address            *local_port,
         krb5_address            *remote_port );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
local_addr (input)	Local address.
remote_addr (input)	Remote address.

Description

This routine copies the `local_port` and `remote_port` addresses into `auth_context`. If either address is NULL, the previous address remains in place. These addresses are set by `krb5_auth_con_genaddrs`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_auth_con_setrcache — Set the replay cache

C Prototype

```
krb5_error_code krb5_auth_con_setrcache(
         krb5_context           context,
         krb5_auth_context      auth_context,
         krb5_rcache            rcache );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
rcache (input)	The replay cache to be set.

Description

This routine sets the replay cache that is used by the authentication routines to `rcache`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_setrecvsubkey — Set the recv_subkey keyblock in auth_context

C Prototype

```
krb5_error_code krb5_auth_con_setrecvsubkey (
        krb5_context            context,
        krb5_auth_context       auth_context,
        krb5_keyblock           *keyblock );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
keyblock (ouput)	The `recv_subkey` keyblock stored in `auth_context`.

Description

This routine sets the `recv_subkey` keyblock that is stored in `auth_context`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_setsendsubkey — Set the send_subkey keyblock in auth_context

C Prototype

```
krb5_error_code krb5_auth_con_setsendsubkey (
        krb5_context            context,
        krb5_auth_context       auth_context,
        krb5_keyblock           *keyblock );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
keyblock (ouput)	The send_subkey keyblock stored in auth_context.

Description

This routine sets the send_subkey keyblock that is stored in auth_context.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_auth_con_setuseruserkey — Set keyblock field in auth_context to temporary key

C Prototype

```
krb5_error_code krb5_auth_con_setuseruserkey(
         krb5_context           context,
         krb5_auth_context      auth_context,
         krb5_keyblock          *keyblock );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
keyblock (input)	Server key for incoming request.

Description

This routine overloads the keyblock field. It is only useful prior to a `krb5_rd_req_decode` call for user-to-user authentication where the server has the key and needs to use it to decrypt the incoming request. Once decrypted, this key is no longer necessary. It is then overwritten with the session key sent by the client.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_build_principal — Build a principal name

C Prototype

```
krb5_error_code krb5_build_principal(
         krb5_context       context,
         krb5_principal     *principal,
         int                rlen,
         const char         *realm,
         char               *s1, ... )
```

Arguments

context (input/output)	The context structure.
principal (output)	Principal name.
rlen (input)	Realm name length.
realm (input)	Realm name.
... (input)	A variable-length argument list. These arguments are added to the principal data.

Description

`This routine` and `krb5_build_principal_va` perform the same function. `krb5_build_principal` takes a variable-length argument list, which is added to the principal data being built.

Both functions take a realm name `realm`, realm name length `rlen`, and a list of null-terminated strings, and fill in a pointer to a principal structure principal, making it point to a structure representing the named principal. The last string must be followed in the argument list by a NULL pointer.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_build_principal_va — Fill in pointer to principal structure

C Prototype

```
krb5_error_code krb5_build_principal_va(
        krb5_context    context,
        krb5_principal  princ,
        int             rlen,
        const char      *realm,
        va_list         ap );
```

Arguments

context (input/output)	The context structure.
princ (output)	The principal structure.
rlen (input)	Realm name length.
realm (input)	Realm name.
ap (input)	A list of null-terminated strings.

Description

`krb5_build_principal` and `krb5_build_principal_va` perform the same function; the former takes variadic arguments, while the latter takes a pre-computed varargs pointer.

Both functions take a realm name `realm`, realm name length `rlen`, and a list of null-terminated strings, and fill in a pointer to a principal structure `princ`, making it point to a structure representing the named principal. The last string must be followed in the argument list by a null pointer.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_c_block_size — Get the block size for the given encryption type

C Prototype

```
krb5_error_code krb5_c_block_size (
        krb5_context            context,
        krb5_enctype            enctype,
        size_t                  *blocksize );
```

Arguments

context (input/output)	The context structure.
enctype (input)	The encryption type.
blocksize (output)	A pointer to the block size.

Description

This routine returns the block size for the encryption type `enctype` in the `blocksize` argument.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_BAD_ENCTYPE	Bad encryption type.
ENOMEM	Insufficient memory.

krb5_c_checksum_length — Get the checksum length for a checksum type

C Prototype

```
krb5_error_code krb5_c_checksum_length (
        krb5_context            context,
        krb5_cksumtype          cksumtype,
        size_t                  *length );
```

Arguments

context (input/output)	The context structure.
cksumtype (input)	The checksum type.
length (output)	A pointer to the checksum length.

Description

This routine returns the checksum length for the checksum in `cksumtype` in the `length` argument.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_BAD_ENCTYPE	Bad encryption type.

krb5_c_decrypt — Decrypt encrypted data

C Prototype

```
krb5_error_code krb5_c_decrypt (
        krb5_context            context,
        const krb5_keyblock     *key,
        krb5_keyusage           usage,
        const krb5_data         *ivec,
        const krb5_enc_data     *input,
        krb5_data               *output );
```

Arguments

context (input/output)	The context structure.
key (input)	The key value from a keytab, ticket, etc.
usage (input)	A salt value.
ivec (input)	Input vector.
input (input)	The encrypted data.
output (output)	The decrypted data.

Description

This routine decrypts encrypted data, given the proper key.

Return Values

This routine returns the following KRB5 status code:

KRB5_BAD_ENCTYPE	Bad encryption type.

krb5_c_encrypt — Encrypt data

C Prototype

```
krb5_error_code krb5_c_encrypt (
        krb5_context            context,
        const krb5_keyblock     *key,
        krb5_keyusage           usage,
        const krb5_data         *ivec,
        const krb5_data         *input,
        krb5_enc_data           *output );
```

Arguments

context (input/output)	The context structure.
key (input)	The key value from a keytab, ticket, etc.
usage (input)	A salt value.
ivec (input)	Input vector.
input (input)	The data to be encrypted.
output (output)	The encrypted data.

Description

This routine encrypts data with the given key.

Return Values

This routine returns the following KRB5 status code:

KRB5_BAD_ENCTYPE	Bad encryption type.

krb5_c_encrypt_length — Get the length of encrypted data

C Prototype

```
krb5_error_code krb5_c_encrypt_length (
        krb5_context            context,
        krb5_enctype            enctype,
        size_t                  inputlen,
        size_t                  *length );
```

Arguments

context (input/output)	The context structure.
enctype (input)	The encryption type.
inputlen (input)	The length of the encrypted data to check.
length (output)	The length of the unencrypted data.

Description

This routine finds the actual (unencrypted) length of data that has been encrypted. Encryption can potentially change the size of the data, so unencrypted and encrypted lengths may be different.

Return Values

This routine returns the following KRB5 status code:

KRB5_BAD_ENCTYPE	Bad encryption type.

krb5_c_enctype_compare — Compare two encryption types

C Prototype

```
krb5_error_code krb5_c_enctype_compare (
        krb5_context            context,
        krb5_enctype            e1,
        krb5_enctype            e2,
        krb5_Boolean            *similar );
```

Arguments

context (input/output)	The context structure.
e1 (input)	First encryption type.
e2 (input)	Second encryption type.
similar (output)	TRUE if types are similar; FALSE if types are different.

Description

This routine compares two encryption types.

Return Values

This routine returns the following KRB5 status code:

KRB5_BAD_ENCTYPE	Bad encryption type.

krb5_c_is_coll_proof_cksum — Test to see if a checksum is collision proof

C Prototype

```
krb5_boolean krb5_c_is_coll_proof_cksum (
        const krb5_cksumtype    ctype );
```

Arguments

ctype (input)	The checksum type to test.

Description

This routine tests the collision proof flag on the checksum given.

Return Values

This routine returns one of the following KRB5 status codes:

0	Checksum is not collision proof, or checksum type is not in the list.
1	Checksum is collision proof.

krb5_c_is_keyed_cksum — Test to see if a checksum uses derived keys

C Prototype

```
krb5_boolean krb5_c_is_keyed_cksum (
        const krb5_cksumtype    ctype );
```

Arguments

ctype (input)	The checksum type to test.

Description

This routine tests the derived flag for the checksum given.

Return Values

This routine returns one of the following KRB5 status codes:

0	Checksum does not use derived keys, or checksum type is not in the list.
1	Checksum uses derived keys.

krb5_c_keyed_checksum_types — Get a list of derived key checksums

C Prototype

```
krb5_error_code krb5_c_keyed_checksum_types (
        krb5_context            context,
        krb5_enctype            enctype,
        unsigned int            *count,
        krb5_cksumtype          **cksumtypes );
```

Arguments

context (input/output)	The context structure.
enctype (input)	The encryption type.
count (output)	Pointer to a count of checksums matching the encryption type.
cksumtypes (output)	A pointer to the list of matching checksums.

Description

This routine searches the list of derived checksum types supported by Kerberos, and returns the list of checksum types matching the encryption type passed in `enctype` in the output parameter `cksumtypes`. The number of checksum types in `cksumtypes` is returned in `count`.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_c_make_checksum — Compute a checksum

C Prototype

```
krb5_error_code krb5_c_make_checksum (
        krb5_context            context,
        krb5_cksumtype          cksumtype,
        const krb5_keyblock     *key,
        krb5_keyusage           usage,
        const krb5_data         *input,
        krb5_checksum           *cksum );
```

Arguments

context (input/output)	The context structure.
cksumtype (input)	The checksum type.
key (input)	A pointer to the encryption key.
usage (input)	A salt value.
input (input)	The data for which a checksum is to be produced.
cksum (output)	The checksum.

Description

This routine computes a checksum, which is returned in `cksum`. Input parameters include the checksum type `cksumtype`, the encryption key `key`, a salt value `usage`, and the data for which a checksum is to be produced in `input`.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_BAD_ENCTYPE	Bad encryption type.
ENOMEM	Insufficient memory.

krb5_c_make_random_key — Generate a random key

C Prototype

```
krb5_error_code krb5_c_make_random_key (
        krb5_context            context,
        krb5_enctype            enctype,
        krb5_keyblock           *random_key );
```

Arguments

context (input/output)	The context structure.
enctype (input)	The encryption type to use in generating the key.
random_key (output)	The random key.

Description

This routine generates a random key for a given encryption type.

Return Values

This routine returns the following KRB5 status codes:

KRB5_BAD_ENCTYPE	Bad encryption type.
ENOMEM	Insufficient memory.

krb5_c_random_make_octets — Create random data

C Prototype

```
krb5_error_code krb5_c_random_make_octets (
        krb5_context    context,
        krb5_data       *data );
```

Arguments

context (input/output)	The context structure.
data (output)	The random data.

Description

This routine creates random data using entropy from the Operating System.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_CRYPTO_INTERNAL	Cryptosystem internal error.

krb5_c_random_seed — Get a random seed

C Prototype

```
krb5_error_code Krb5_c_random_seed (
        krb5_context    context,
        krb5_data       *data );
```

Arguments

context (input/output)	The context structure.
data (output)	The random seed.

Description

This routine creates a random seed from sources of entropy available to the crypto routines.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_CRYPTO_INTERNAL	Cryptosystem internal error.

krb5_c_string_to_key — Convert a string to a key

C Prototype

```
krb5_error_code krb5_c_string_to_key (
        krb5_context            context,
        krb5_enctype            enctype,
        const krb5_data         *string,
        const krb5_data         *salt,
        krb5_keyblock           *key );
```

Arguments

context (input/output)	The context structure.
enctype (input)	The encryption type.
string (input)	The string to be converted.
salt (input)	The salt value.
key (output)	The generated key.

Description

This routine converts a string into a key, using the supplied encryption type and salt values.

Return Values

This routine returns the following KRB5 status codes:

KRB5_BAD_ENCTYPE	Bad encryption type.
KRB5_CRYPTO_INTERNAL	Cryptosystem internal error.
ENOMEM	Insufficient memory.

krb5_c_string_to_key_with_params — Convert string key to keyblock

C Prototype

```
krb5_error_code krb5_c_string_to_key_with_params (
        krb5_context            context,
        krb5_enctype            enctype,
        const krb5_data         *string,
        const krb5_data         *salt,
        const krb5_data         *parsms,
        krb5_keyblock           *key );
```

Arguments

context (input/output)	The context structure.
enctype (input)	The encryption type.
string (input)	The string form of the key.
salt (input)	The salt used in the encryption.
params (input)	Special parameters used on the conversion.
key (output)	The keyblock information.

Description

This routine converts a string key into a keyblock.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_BAD_ENCTYPE	Bad encryption type.
KRB5_CRYPTO_INTERNAL	Cryptosystem internal error.
ENOMEM	Insufficient memory.

krb5_c_valid_cksumtype — Validate a checksum type

C Prototype

```
krb5_boolean krb5_c_valid_cksumtype (
        const krb5_cksumtype    ctype );
```

Arguments

ctype (input)	The checksum type to validate.

Description

This routine tests to see whether a checksum type, passed in `ctype`, is a valid Kerberos checksum type.

Return Values

This routine returns one of the following KRB5 status codes:

0	Checksum type is invalid.
1	Checksum type is valid.

krb5_c_valid_enctype — Validate an encryption type

C Prototype

```
krb5_boolean krb5_c_valid_enctype (
        const krb5_enctype      etype );
```

Arguments

etype (input)	The encryption type to validate.

Description

This routine tests to see whether an encryption type, passed in `etype`, is a valid Kerberos encryption type.

Return Values

This routine returns one of the following KRB5 status codes:

0	Encryption type is invalid.
1	Encryption type is valid.

krb5_c_verify_checksum — Verify a checksum

C Prototype

```
krb5_error_code krb5_c_verify_checksum (
        krb5_context            context,
        const krb5_keyblock     *key,
        krb5_keyusage           usage,
        const krb5_data         *data,
        const krb5_checksum     *cksum,
        krb5_Boolean            *valid );
```

Arguments

context (input/output)	The context structure.
key (input)	The key used to create the data in `cksum`.
usage (input)	The key usage.
data (input)	Data.
cksum (input)	The checksum to verify.
valid (output)	Non-zero if the checksum verified correctly; zero if it did not.

Description

This routine verifies the checksum of data in `cksum` that was created with a key using the key usage `usage`.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_BAD_ENCTYPE	Bad encryption type.
KRB5_BAD_MSIZE	Message size is incompatible with encryption type.

krb5_cc_close — Close the credentials cache

C Prototype

```
krb5_error_code krb5_cc_close(
         krb5_context      context,
         krb5_ccache       id );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A credentials cache identifier.

Description

This routine closes the credentials cache id, invalidates `id`, and releases `id` and any other resources acquired during use of the credentials cache. It requires that `id` identifies a valid credentials cache. After return, `id` must not be used unless it is first reinitialized using `krb5_cc_resolve` or `krb5_cc_gen_new`.

Return Values

This routine returns the following KRB5 status code:

Successful completion.

krb5_cc_copy_creds — Copy a set of credentials

C Prototype

```
krb5_error_code krb5_cc_copy_creds (
        krb5_context            context,
        krb5_ccache             incc,
        krb5_ccache             outcc );
```

Arguments

context (input/output)	The context structure.
incc (input)	The credentials to be copied.
outcc (output)	The copy of the credentials.

Description

This routine creates a copy of the set of credentials found in `incc`. The copy is returned in `outcc`.

Return Values

This routine returns the following KRB5 status code:

Kerberos errors.

krb5_cc_default — Resolve the default credentials cache name

C Prototype

```
krb5_error_code krb5_cc_default(
         krb5_context   context,
         krb5_ccache    *ccache );
```

Arguments

context (input/output)	The context structure.
ccache (output)	A pointer to the credentials cache name.

Description

This routine is equivalent to `krb5_cc_resolve( context,krb5_cc_default_name(),ccache );)`.

Return Values

This routine returns the following KRB5 status codes:

KV5M_CONTEXT	Bad magic number for `krb5_context` structure.
Results of `krb5_cc_resolve`	

krb5_cc_default_name — Return the name of the default credentials cache

C Prototype

```
const char     *krb5_cc_default_name(
krb5_context    context );
```

Arguments

context (input/output)	The context structure.

Description

This routine returns the name of the default credentials cache; this may be equivalent to `getenv(KRB5CCNAME)` with an appropriate fallback.

Return Values

This routine returns the following KRB5 status codes:

Success	The name of the default credentials cache.
Failure	NULL

krb5_cc_destroy — Destroy a credentials cache

C Prototype

```
krb5_error_code krb5_cc_destroy(
         krb5_context   context,
         krb5_ccache    id );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A credentials cache identifier.

Description

This routine destroys the credentials cache identified by `id`, invalidates `id`, and releases any other resources acquired during use of the credentials cache. This routine requires that `id` identifies a valid credentials cache. After return, `id` must not be used unless it is first reinitialized using `krb5_cc_resolve` or `krb5_cc_gen_new`.

Return Values

This routine returns the following KRB5 status code:

Permission errors.

krb5_cc_end_seq_get — Finish processing credentials cache entries

C Prototype

```
krb5_error_code krb5_cc_end_seq_get(
         krb5_context     context,
         krb5_ccache      id,
         krb5_cc_cursor   *cursor );
```

Arguments

context (input/output) — The context structure.

id (input/output) — A credentials cache identifier.

cursor (input/output) — The cursor created by `krb5_cc_start_seq_get`.

Description

This routine finishes sequential processing mode and invalidates `*cursor`. `*cursor` must never be reused after this call.

It requires that `id` identifies a valid credentials cache and `*cursor` be a cursor returned by `krb5_cc_start_seq_get` or a subsequent call to `krb5_cc_next_cred`.

Return Values

This routine returns the following KRB5 status code:

Error code if `*cursor` is invalid.

krb5_cc_gen_new — Generate a new credentials cache identifier

C Prototype

```
krb5_error_code krb5_cc_gen_new(
         krb5_context          context,
         krb5_ccache           *id );
```

Arguments

context (input/output)	The context structure.
id (output)	A new, unique credentials cache identifier.

Description

This routine fills in `id` with a unique `ccache` identifier. The cache is left unopened.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_cc_get_name — Return the name of the credentials cache

C Prototype

```
const char * krb5_cc_get_name(
        krb5_context     context,
        krb5_ccache      id );
```

Arguments

context (input/output)	The context structure.
id (output)	A credentials cache identifier.

Description

This routine returns the name of the credentials cache denoted by `id`.

Return Values

This routine returns the following KRB5 status code:

Success	The name of the credentials cache specified as a second argument.
Failure	NULL.

krb5_cc_get_principal — Retrieve the primary principal of the credentials cache

C Prototype

```
krb5_error_code krb5_cc_get_principal(
         krb5_context     context,
         krb5_ccache      id,
         krb5_principal   *principal );
```

Arguments

context (input/output)	The context structure.
id (input)	A credentials cache identifier.
principal (output)	The returned primary principal.

Description

This routine retrieves the primary principal of the credentials cache (as set by `krb5_cc_initialize request`). The primary principal is set to `*principal`; the caller should release this memory by calling `krb5_free_principal` on `*principal` when finished.

It requires that `id` identifies a valid credentials cache.

Return Values

This routine returns the following KRB5 status code:

Successful completion.

krb5_cc_get_type — Return the CC prefix

C Prototype

```
const char *krb5_cc_get_type (
        krb5_context    context,
        krb5_ccache     cache );
```

Arguments

context (input/output)	The context structure.
cache (input)	he credentials cache.

Description

This routine returns the credentials cache prefix string as its return value.

Return Values

This routine returns the following:

A string representing the credentials cache prefix.

krb5_cc_initialize — Create/refresh a credentials cache

C Prototype

```
krb5_error_code krb5_cc_initialize(
         krb5_context     context,
         krb5_ccache      id,
         krb5_principal   primary_principal );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A credentials cache identifier.
primary_principal (input)	The primary principal for the credentials cache.

Description

This routine creates or refreshes a credentials cache identified by `id` with the primary principal set to `primary_principal`. If the credentials cache already exists, its contents are destroyed.

This routine also modifies cache identified by `id`.

Return Values

This routine returns one of the following KRB5 status codes:

System errors.

Permission errors.

krb5_cc_next_cred — Fetch the next credentials entry

C Prototype

```
krb5_error_code krb5_cc_next_cred(
         krb5_context      context,
         krb5_ccache       id,
         krb5_cc_cursor    *cursor,
         krb5_creds        *creds );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A credentials cache identifier.
cursor (input/output)	The cursor created by `krb5_cc_start_seq_get`. This value is updated upon return to be used in subsequent calls to `krb5_cc_next_cred`. The returned credentials cache entry.
creds (output)	The returned credentials cache entry.

Description

This routine fetches the next entry from `id`, returning its values in `*creds`, and updates `*cursor` for the next request. It requires that `id` identifies a valid credentials cache and `*cursor` is a cursor returned by `krb5_cc_start_seq_get` or a subsequent call to `krb5_cc_next_cred`. The `krb5_end_seq_get` routine is called when no more entries are to be read.

Return Values

This routine returns the following KRB5 status code:

Error code if there are no more cache entries.

krb5_cc_remove_cred — Remove credentials from the credentials cache

C Prototype

```
krb5_error_code krb5_cc_remove_cred(
        krb5_context     context,
        krb5_ccache      id,
        krb5_flags       which,
        krb5_creds       *cred );
```

Arguments

context (input/output) — The context structure.

id (input) — A credentials cache identifier.

which (input) — A bit mask representing the search flags to use. The values should be logically ORed together. Valid values are:

KRB5_TC_MATCH_TIMES – The requested lifetime is required to be at least as great as that specified.

KRB5_TC_MATCH_IS_SKEY – The `is_skey` field much match exactly.

KRB5_TC_MATCH_FLAGS – The set bits in `mcreds` must match in `creds`.

KRB5_TC_MATCH_TIMES_EXACT – The requested lifetime must match exactly.

KRB5_TC_MATCH_FLAGS_EXACT – All bits in `mcreds` must match exactly.

KRB5_TC_MATCH_AUTHDATA – The authorization data must match.

KRB5_TC_MATCH_SRV_NAMEONLY – Only the name portion of the principal name must match. The realm portion may be different. If this flag is not set, the entire principal name must match.

KRB5_TC_MATCH_2ND_TKT – The second tickets must match.

KRB5_TC_MATCH_KTYPE – The encryption key types must match.

KRB5_TC_MATCH_SUPPORTED_KTYPES – Check all matching entries that have any supported encryption type and return the one with the encryption type listed earliest. Return CC_NOT_KTYPE if a match is found except for having a supported encryption type.

cred (input) — The credentials to match.

Description

This routine removes any credentials from `id` which match the principal name (`cred->server`) and the fields in `cred` masked by `which`. It requires that `id` identifies a valid credentials cache.

Return Values

This routine returns one of the following KRB5 status codes:

Error code if nothing matches.

Error code if could not delete.

krb5_cc_resolve — Resolve a credentials cache name

C Prototype

```
krb5_error_code krb5_cc_resolve(
         krb5_context   context,
         char           *string_name,
         krb5_ccache    *id );
```

Arguments

context (input/output)	The context structure.
string_name (input)	The credentials cache name to resolve.
id (output)	The credentials cache identifier that corresponds to the name in `string_name`.

Description

This routine fills in `id` with a `ccache` identifier that corresponds to the name in `string_name`.

It requires that `string_name` be of the form `type=residual` and `type` is a type known to the library.

Because of OpenVMS file naming differences, the `string_name` argument is formed in a slightly different way than on other platforms. The equal sign (=) is substituted for the colon (:) to separate the type from the residual.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_cc_retrieve_cred — Search the cache for a credential and return it if found

C Prototype

```
krb5_error_code krb5_cc_retrieve_cred(
        krb5_context        context,
        krb5_ccache         id,
        krb5_flags          whichfields,
        krb5_creds          *mcreds,
        krb5_creds          *creds );
```

Arguments

context (input/output) The context structure.

id (input) A credentials cache identifier.

whichfields (input) A bit mask representing the search flags to use. The values should be logically ORed together. Valid values are:

KRB5_TC_MATCH_TIMES – The requested lifetime is required to be at least as great as that specified.

KRB5_TC_MATCH_IS_SKEY – The `is_skey` field much match exactly.

KRB5_TC_MATCH_FLAGS – The set bits in `mcreds` must match in `creds`.

KRB5_TC_MATCH_TIMES_EXACT – The requested lifetime must match exactly.

KRB5_TC_MATCH_FLAGS_EXACT – All bits in `mcreds` must match exactly.

KRB5_TC_MATCH_AUTHDATA – The authorization data must match.

KRB5_TC_MATCH_SRV_NAMEONLY – Only the name portion of the principal name must match. The realm portion may be different. If this flag is not set, the entire principal name must match.

KRB5_TC_MATCH_2ND_TKT – The second tickets must match.

KRB5_TC_MATCH_KTYPE – The encryption key types must match.

KRB5_TC_MATCH_SUPPORTED_KTYPES – Check all matching entries that have any supported encryption type and return the one with the encryption type listed earliest. Return CC_NOT_KTYPE if a match is found except for having a supported encryption type.

mcreds (input) The credentials to match.

creds (output) The credentials found in the cache that match the requested value.

Description

This routine searches the cache id for credentials matching `mcreds`. The fields which are to be matched are specified by set bits in `whichfields`, and always include the principal name `mcreds->server`. This routine requires that `id` identifies a valid credentials cache.

If at least one match is found, one of the matching credentials is returned in `*creds`. The credentials should be freed using `krb5_free_credentials`.

Return Values

This routine returns the following KRB5 status code:

Error code if no matches found.

krb5_cc_set_default_name — Set default CC name

C Prototype

```
krb5_error_code krb5_cc_set_default_name (
        krb5_context    context,
        const char      *name );
```

Arguments

context (input/output)	The context structure.
name (input/output)	The default credentials cache name.

Description

This routine sets the default credentials cache name. If the default name is not passed in the argument name, it defaults to the first valid entry of the following values: the KRB5CCNAME logical name, the file krb5cc_<PID> in a [.TMP] directory in the user's login directory (where <PID> is the user's process ID). If the KRB5CCNAME logical name is defined, it must not be a system-wide logical name.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KV5M_CONTEXT	Bad magic number for krb5_context structure.
ENOMEM	Insufficient memory.

krb5_cc_set_flags — Set the flags on the credentials cache

C Prototype

```
krb5_error_code krb5_cc_set_flags(
         krb5_context     context,
         krb5_ccache      id,
         krb5_flags       flags );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A credentials cache identifier.
flags (input)	A bit mask representing the flags to set. The values should be logically ORed together. Valid values are: **KRB5_TC_OPENCLOSE** – Turn on OPENCLOSE mode (open and close the cache each time a credentials cache routine is called). The default, if this flag is not set, is to have the cache stay open until `krb5_cc_close` is called.

Description

This routine sets the flags on the credentials cache `id` to `flags`.

Return Values

This routine returns the following KRB5 status code:

Successful completion.

krb5_cc_start_seq_get — Start sequential read of cached credentials

C Prototype

```
krb5_error_code krb5_cc_start_seq_get(
         krb5_context      context,
         krb5_ccache       id,
         krb5_cc_curso     *cursor );
```

Arguments

context (input/output)	The context structure.
id (input)	A credentials cache identifier.
cursor (output)	A cursor to be used in calls to `krb5_cc_next_cred`.

Description

This routine prepares to sequentially read every set of cached credentials.

Return Values

This routine returns the following KRB5 status code:

Successful completion.

krb5_cc_store_cred — Store a credential in the credentials cache

C Prototype

```
krb5_error_code krb5_cc_store_cred(
         krb5_context     context,
         krb5_ccache      id,
         krb5_creds       *creds );
```

Arguments

context (input/output)	The context structure.
id (input)	A credentials cache identifier.
creds (input)	The credentials to store in the cache.

Description

This routine stores creds in the cache `id`, tagged with `creds->client`. It requires that `id` identifies a valid credentials cache.

Return Values

This routine returns one of the following KRB5 status codes:

Permission error.

Storage failure error.

krb5_change_password — Change an existing password

C Prototype

```
krb5_error_code krb5_change_password (
        krb5_context    context,
        krb5_creds      *creds,
        char            *newpw,
        int             *result_code,
        krb5_data       *result_code_string,
        krb5_data       *result_string );
```

Arguments

context (input/output)	The context structure.
creds (input)	The Kerberos credentials.
newpw (input)	The new password.
result_code (output)	A numeric error code.
result_code_string (output)	The string equivalent of the result_code.
result_string (output)	The change password response from the KDC.

Description

This routine changes the password for an existing Kerberos account.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
KRB5KRB_AP_ERR_MODIFIED	Message stream modified.
KRB5KDC_ERR_BAD_PVNO	Requested protocol version not supported.
ENOMEM	Insufficient memory.
SOCKET_ERRNO	Error on socket.
ETIMEDOUT	Connection timed out.
EHOSTUNREACH	No route to host.

krb5_cksumtype_to_string — Convert checksum type to string representation

C Prototype

```
krb5_error_code krb5_cksumtype_to_string (
        krb5_cksumtype         cksumtype,
        char                   *buffer,
        size_t                 buflen );
```

Arguments

cksumtype (input)	The checksum type to convert.
buffer (output)	A pointer to a buffer to hold the string value of the checksum type.
buflen (input)	The maximum string length that can fit in `buffer`.

Description

This routine changes the password for an existing Kerberos account.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
EINVAL	Invalid argument.

krb5_copy_addresses — Copy Kerberos addresses

C Prototype

```
krb5_error_code krb5_copy_addresses(
         krb5_context           context,
         krb5_address * const   *inaddr,
         krb5_address           ***outaddr );
```

Arguments

context (input/output)	The context structure.
inaddr (input)	An array of addresses.
outaddr (output)	A pointer to a copy of the array of addresses.

Description

This routine copies addresses in `inaddr` to `*outaddr`, which is allocated memory and should be freed with `krb5_free_addresses`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_authdata — Copy a Kerberos authdata structure

C Prototype

```
krb5_error_code krb5_copy_authdata(
         krb5_context            context,
         krb5_authdata * const  *inauthdat,
         krb5_authdata          ***outauthdat );
```

Arguments

context (input/output)	The context structure.
inauthdat (input)	An array of `krb5_authdata` structures. The last element must be NULL.
outauthdat (output)	A copy of the array of `krb5_authdata` structures.

Description

This routine copies an `authdata` structure, filling in `*outauthdat` to point to the newly allocated copy, which should be freed with `krb5_free_authdata`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_authenticator — Copy an authenticator structure

C Prototype

```
krb5_error_code krb5_copy_authenticator(
         krb5_context                    context,
         const krb5_authenticator        *authfrom,
         krb5_authenticator              **authto );
```

Arguments

context (input/output)	The context structure.
authfrom (input)	The authenticator to be copied.
authto (output)	A copy of the authenticator.

Description

This routine copies an authenticator structure, filling in `*outauthdat` to point to the newly allocated copy, which should be freed with `krb5_free_authenticator`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_checksum — Copy a checksum structure

C Prototype

```
krb5_error_code krb5_copy_checksum(
         krb5_context           context,
         const krb5_checksum    *ckfrom,
         krb5_checksum          **ckto );
```

Arguments

context (input/output)	The context structure.
ckfrom (input)	The checksum to be copied.
ckto (output)	A pointer to a copy of the checksum.

Description

This routine copies a checksum structure, filling in `*ckto` to point to the newly allocated copy, which should be freed with `krb5_free_checksum`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_creds — Copy a credentials structure

C Prototype

```
krb5_error_code krb5_copy_creds(
         krb5_context           context,
         const krb5_creds       *incred,
         krb5_creds             **outcred );
```

Arguments

context (input/output)	The context structure.
incred (input)	The credentials structure to be copied.
outcred (output)	A pointer to a copy of the credentials structure.

Description

This routine copies a credentials structure, filling in `*outcred` to point to the newly allocated copy, which should be freed with `krb5_free_creds`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_data — Copy a Kerberos data structure

C Prototype

```
krb5_error_code krb5_copy_data(
         krb5_context      context,
         const krb5_data   *indata,
         krb5_data         **outdata );
```

Arguments

context (input/output)	The context structure.
indata (input)	The data structure to be copied.
outdata (output)	A pointer to a copy of the data structure.

Description

This routine copies a data structure, filling in `*outdata` to point to the newly allocated copy, which should be freed with `krb5_free_data`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_keyblock — Copy a keyblock

C Prototype

```
krb5_error_code krb5_copy_keyblock(
         krb5_context           context,
         const krb5_key lock    *from,
         krb5_keyblock          **to );
```

Arguments

context (input/output)	The context structure.
from (input)	The keyblock to copy.
to (output)	A pointer to a copy of the keyblock.

Description

This routine copies a keyblock, and sets the `*to` argument to point to the newly allocated copy, which should be freed with `krb5_free_keyblock`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_keyblock_contents — Copy a keyblock's contents

C Prototype

```
krb5_error_code krb5_copy_keyblock_contents(
         krb5_context          context,
         const krb5_keyblock   *from,
         krb5_keyblock         *to );
```

Arguments

context (input/output)	The context structure.
from (input)	The keyblock to copy the contents of.
to (output)	A pointer to a copy of the keyblock contents.

Description

This routine copies keyblock contents from `from` to `to`, including allocated storage. The allocated storage should be freed by using `free(to->contents)`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_principal — Copy a principal structure

C Prototype

```
krb5_error_code krb5_copy_principal(
         krb5_context            context,
         krb5_const_principal    inprinc,
         krb5_principal          *outprinc );
```

Arguments

context (input/output)	The context structure.
inprinc (input)	Principal name to be copied.
outprinc (output)	Copy of input principal name.

Description

This routine copies a principal structure, setting `*outprinc` to point to the newly allocated copy, which should be freed with `krb5_free_principal`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_copy_ticket — Copy a Kerberos ticket structure

C Prototype

```
krb5_error_code krb5_copy_ticket(
         krb5_context              context,
         const krb5_ticket         *from,
         krb5_ticket               **pto );
```

Arguments

context (input/output)	The context structure.
from (input)	The ticket structure to be copied.
pto (output)	A pointer to a copy of the ticket structure.

Description

This routine copies a ticket structure, setting `*pto` to point to the newly allocated copy, which should be freed with `krb5_free_ticket`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_decode_ticket — Decode a formatted ticket

C Prototype

```
krb5_error_code krb5_decode_ticket (
        const krb5_data          *code,
        krb5_ticket              **rep );
```

Arguments

code (input)	The formatted ticket.
rep (output)	The decoded ticket information.

Description

This routine takes a formatted ticket code and decodes it, filling in `rep` with the results.

The contents of `rep` are set to allocated storage that should be freed by the caller (using `krb5_free_ticket`) when finished with the ticket.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5KDC_ERR_BAD_PVNO	Bad key version number.

krb5_deltat_to_string — Convert a Kerberos relative time value to a string

C Prototype

```
krb5_error_code krb5_deltat_to_string (
        krb5_deltat     deltat,
        char            *buffer,
        size_t          buflen );
```

Arguments

deltat (input)	The relative time value to convert.
buffer (output)	A pointer to a buffer to hold the time string.
buflen (input)	The maximum length of the string that will fit in buffer.

Description

This routine converts a Kerberos relative time value into the corresponding string.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_enctype_to_string — Convert a Kerberos encryption type value to a string

C Prototype

```
krb5_error_code krb5_enctype_to_string (
        krb5_enctype    enctype,
        char            *buffer,
        size_t          buflen );
```

Arguments

enctype (input)	The encryption type value to convert.
buffer (output)	A pointer to a buffer to hold the encryption type string.
buflen (input)	The maximum length of the string that will fit in buffer.

Description

This routine converts a Kerberos encryption type value into the corresponding string.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_free_addresses — Free a group of addresses

C Prototype

```
void krb5_free_addresses(
         krb5_context     context,
         krb5_address     **val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees a series of addresses `*val` that have been previously allocated via Kerberos APIs such as `krb5_copy_addresses`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_ap_rep_enc_part — Free subkey and other data allocated by krb5_rd_rep or krb5_send_auth

C Prototype

```
void krb5_free_ap_rep_enc_part(
        krb5_context            context,
        krb5_ap_rep_enc_part    *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the subkey keyblock (if set) as well as `val` that has been allocated from `krb5_rd_rep` or `krb5_send_auth`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_authdata — Free an authdata structure

C Prototype

```
void krb5_free_authdata(
        krb5_context     context,
        krb5_authdata    **val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the authdata structure pointed to by `val` that has been allocated from `krb5_copy_authdata`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_authenticator — Free authenticator storage

C Prototype

```
void krb5_free_authenticator(
         krb5_context           context,
         krb5_authenticator     *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the authenticator `val`, including the pointer `val`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_checksum — Free a checksum

C Prototype

```
void krb5_free_checksum(
         krb5_context     context,
         krb5_checksum    *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees checksum and the pointer `val`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_checksum_contents — Free the contents of a checksum structure

C Prototype

```
void krb5_free_checksum_contents (
        krb5_context            context,
        register krb5_checksum  *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	The checksum value to free.

Description

This routine frees the contents of a Kerberos checksum structure.

Return Values

None.

krb5_free_cksumtypes — Free a checksum structure

C Prototype

```
void krb5_free_cksumtypes (
        krb5_context    context,
        krb5_cksumtype  *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	The checksum type to free.

Description

This routine frees a Kerberos checksum structure `val`. The contents of the structure should have already been freed.

Return Values

None.

krb5_free_context — Free a context structure

C Prototype

```
Void krb5_free_context(
        krb5_context    context );
```

Arguments

context (input)	Context structure to be freed.

Description

This routine frees the context returned by `krb5_init_context`. Internally calls `krb5_os_free_context`.

Return Values

None.

krb5_free_creds — Free credentials

C Prototype

```
void krb5_free_creds(
         krb5_context    context,
         krb5_creds      *val );
```

Arguments

context (input/output) The context structure.

val (input/output) A pointer to the data structure to be freed.

Description

This routine calls `krb5_free_cred_contents` with `val` as the argument. `val` is freed as well.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_cred_contents — Free credential structures

C Prototype

```
void krb5_free_cred_contents(
         krb5_context          context,
         krb5_creds            *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine zeros out the session key stored in the credential and then frees the credentials structures. The argument `val` is not freed.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_data — Free storage associated with a krb5_data object

C Prototype

```
void krb5_free_data(
         krb5_context    context,
         krb5_data       *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the data structure `val`, including the pointer `val`, which has been allocated by any of numerous routines.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_data_contents — Frees contents of a krb5_data structure

C Prototype

```
void krb5_free_data_contents (
        krb5_context            context,
        krb5_data               *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	The `krb5_data` structure to be freed.

Description

This routine frees the contents of a `krb5_data` structure, and sets the data field in the structure to zero.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_default_realm — Free the Kerberos default realm structure

C Prototype

```
void krb5_free_default_realm (
        krb5_context    context,
        char            *lrealm );
```

Arguments

context (input/output)	The context structure.
lrealm (input/output)	The realm structure to be freed.

Description

This routine frees the Kerberos default realm structure.

Return Values

None.

krb5_free_error — Free error information

C Prototype

```
void krb5_free_error(
         krb5_context   context,
         krb5_error     *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the error `val` that has been allocated from `krb5_read_error` or `krb5_sendauth`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_host_realm — Free storage allocated by krb5_get_host_realm

C Prototype

```
krb5_error_code krb5_free_host_realm(
         krb5_context     context,
         char * const     *realmlist );
```

Arguments

context (input)	The context structure.
realmlist (output)	A pointer to a list of realm names.

Description

This routine frees the storage taken by a `realmlist` returned by `krb5_get_host_realm`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_keyblock — Free keyblock memory

C Prototype

```
void krb5_free_keyblock(
         krb5_context     context,
         krb5_keyblock    *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the pointer `val` and memory, and zeroes the keyblock contents of `val`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_keyblock_contents — Free the contents of a key structure

C Prototype

```
void krb5_free_keyblock_contents (
        krb5_context            context,
        register krb5_keyblock  key );
```

Arguments

context (input/output)	The context structure.
key (input/output)	The key structure whose contents are to be freed.

Description

This routine frees the contents of a Kerberos keyblock structure.

Return Values

None.

krb5_free_keytab_entry_contents — Free the contents of a keytab entry

C Prototype

```
krb5_error_code krb5_free_keytab_entry_contents (
        krb5_context            context,
        krb5_keytab_entry       *entry );
```

Arguments

context (input/output)	The context structure.
entry (input/output)	The keytab entry whose contents are to be freed.

Description

This routine frees the contents of a Kerberos keytab entry.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_free_principal — Free the pwd_data allocated by krb5_copy_principal

C Prototype

```
void krb5_free_principal(
         krb5_context     context,
         krb5_principal   val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the `pwd_data val` that has been allocated from `krb5_copy_principal`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_tgt_creds — Free TGT credentials

C Prototype

```
void krb5_free_tgt_creds(
         krb5_context     context,
         krb5_creds       **tgts );
```

Arguments

context (input/output)	The context structure.
tgts (input/output)	A pointer to the credentials to be freed.

Description

This routine frees the TGT credentials `tgts` returned by `krb5_get_cred_from_kdc`.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_ticket — Free ticket allocated by krb5_copy_ticket

C Prototype

```
void krb5_free_ticket(
         krb5_context     context,
         krb5_ticket      *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	A pointer to the data structure to be freed.

Description

This routine frees the ticket `val` that has been allocated from `krb5_copy_ticket` and other routines.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_free_unparsed_name — Free a simple name

C Prototype

```
void krb5_free_unparsed_name (
        krb5_context            context,
        char                    *val );
```

Arguments

context (input/output)	The context structure.
val (input/output)	The name string to be freed.

Description

This routine frees the memory associated with a simple character string name.

Return Values

This routine returns the following KRB5 status code:

None.

krb5_fwd_tgt_creds — Get a TGT for use at a remote host

C Prototype

```
krb5_error_code krb5_fwd_tgt_creds (
        krb5_context            context,
        krb5_auth_context       auth_context,
        char                    *rhost,
        krb5_principal          client,
        krb5_principal          server,
        krb5_ccache             cc,
        int                     forwardable,
        krb5_data               *outbuf );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
rhost (input/output)	The remote host.
client (input)	The client principal.
server (input)	The server principal.
cc (input)	The credentials cache name.
forwardable (input)	A Boolean indicating whether the TGT should be forwardable.
outbuf (output)	The output buffer containing the TGT.

Description

This routine acquires a TGT for use at a remote host system.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_PRINC_NOMATCH	Requested principal and ticket don't match.
KRB5_NO_TKT_SUPPLIED	Request did not supply a ticket.
KRB5_CC_BADNAME	Credential cache name or principal name malformed.

krb5_get_credentials — Get an additional ticket for the client

C Prototype

```
krb5_error_code krb5_get_credentials(
        krb5_context            context,
        const krb5_flags        options,
        krb5_ccache             ccache,
        krb5_creds              *in_creds,
        krb5_creds              *out_creds );
```

Arguments

context (input/output)	The context structure.
options (input)	Valid values are as follows: **KRB5_GC_USER_USER** — Return a full user to user authentication ticket **KRB5_GC_CACHED** — Only search credentials cache for the ticket.
ccache (input)	The credentials cache.
in_creds (input)	Input credentials.
out_creds (output)	Output credentials.

Description

This routine attempts to use the credentials cache `ccache` or a TGS exchange to get an additional ticket for the client identified by `in_creds->client`, with the following information:

- The server identified by `in_creds->server`.
- The options in options. Valid choices are `KRB5_GC_USER_USER` and `KRB5_GC_CACHED`.
- The expiration date specified in `in_creds->times.endtime`.
- The session key type specified in `in_creds->keyblock.keytype` if it is nonzero.

If options specifies `KRB5_GC_CACHED`, then `krb5_get_credentials` will only search the credentials cache for a ticket.

If options specifies `KRB5_GC_USER_USER`, then `krb5_get_credentials` will get credentials for a user-to-user authentication. In a user-to-user authentication, the secret key for the server is the session key from the server's ticket granting ticket (TGT). The TGT is passed from the server to the client over the network; this is safe since the TGT is encrypted in a key known only by the Kerberos server. The client must pass this TGT to `krb5_get_credentials` in `in_creds->second_ticket`. The Kerberos server will use this TGT to construct a user-to-user ticket that can be verified by the server, by using the session key from its TGT.

The effective expiration date is the minimum of the following:

- The expiration date as specified in `in_creds->times.endtime.`
- The requested start time plus the maximum lifetime of the server as specified by the server's entry in the Kerberos database.

- The requested start time plus the maximum lifetime of tickets allowed in the local site, as specified by the KDC. This is a compile-time option, `KRB5_KDB_MAX_LIFE` in `config.h`, and is by default one day.

If any special authorization data needs to be included in the ticket for example, restrictions on how the ticket can be used, they should be specified in `in_creds->authdata`. If there is no special authorization data to be passed, `in_creds->authdata` should be NULL.

Any returned ticket and intermediate ticket-granting tickets are stored in `ccache`.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_get_credentials_renew — Renew a set of existing credentials

C Prototype

```
krb5_error_code krb5_get_credentials_renew (
        krb5_context            context,
        krb5_flags              options,
        krb5_ccache             ccache,
        krb5_creds              *in_creds,
        krb5_creds              **out_creds );
```

Arguments

context (input/output)	The context structure.
options (input)	Unused flag field.
ccache (input/output)	The credentials cache.
in_creds (input)	The credentials to be renewed.
out_creds (output)	The refreshed credentials.

Description

This routine attempts to contact a KDC to renew a set of existing Kerberos credentials.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_PROG_ETYPE_NOSUPP	Program lacks support for encryption type.
KRB5_KDCREP_MODIFIED	KDC reply did not match expectations.
Kerberos errors.	

krb5_get_credentials_validate — Validate a set of existing credentials

C Prototype

```
krb5_error_code krb5_get_credentials_validate (
        krb5_context            context,
        krb5_flags              options,
        krb5_ccache             ccache,
        krb5_creds              *in_creds,
        krb5_creds              **out_creds );
```

Arguments

context (input/output)	The context structure.
options (input)	Unused flag field.
ccache (input/output)	The credentials cache.
in_creds (input)	The credentials to be validated.
out_creds (output)	The validated credentials.

Description

This routine attempts to contact a KDC to validate a set of existing Kerberos credentials.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_PROG_ETYPE_NOSUPP	Program lacks support for encryption type.
KRB5_KDCREP_MODIFIED	KDC reply did not match expectations.
Kerberos errors.	

krb5_get_default_realm— Retrieve the default realm

C Prototype

```
krb5_error_code krb5_get_default_realm(
         krb5_context      context,
         char              **lrealm );
```

Arguments

context (input)	The context structure.
lrealm (output)	A pointer to the default realm.

Description

This routine retrieves the default realm to be used if no user-specified realm is available (for example, to interpret a user-typed principal name with the realm omitted for convenience), setting `lrealm` with a pointer to the default realm in allocated storage.

It is the caller's responsibility for freeing the allocated storage pointed to be `lrealm` when it is finished with it.

Return Values

This routine returns the following KRB5 status code:

System errors.

krb5_get_init_creds_keytab — Get initial credentials' keytab

C Prototype

```
krb5_error_code krb5_get_init_creds_keytab (
        krb5_context            context,
        krb5_creds              *creds,
        krb5_principal          client,
        krb5_keytab             arg_keytab,
        krb5_deltat             start_time,
        char                    *in_tkt_service,
        krb5_get_init_creds_opt *options );
```

Arguments

context (input/output)	The context structure.
creds (output)	A pointer to a Kerberos credentials structure.
client (input)	The client principal.
arg_keytab (input)	A keytab handle.
start_time (input)	The time when the ticket becomes valid.
in_tkt_service (input)	The principal name of the requesting server.
options (input)	A pointer to a structure containing flags and options.

Description

This routine gets the keytab associated with the initial credentials. This may be either the default context's keytab, or the keytab of the client credentials.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_get_init_creds_opt_init — Initialize options for krb5_get_init_creds* routines

C Prototype

```
void krb5_get_init_creds_opt_init (
        krb5_get_init_creds_opt *opt );
```

Arguments

opt (input/output)	A pointer to a structure containing flags and options.

Description

This routine sets the flags field of the `krb5_get_init_creds_opt` structure to zero.

Return Values

None.

krb5_get_init_creds_opt_set_address_list — Set the address list in krb5_get_init_creds_opt

C Prototype

```
void krb5_get_init_creds_opt_set_address_list (
        krb5_get_init_creds_opt         *opt,
        krb5_address                    **addresses );
```

Arguments

opt (output)	A pointer to the options field.
addresses (input)	A pointer to the address to set in the address list field in `opt`.

Description

This routine sets the address list in the `krb5_get_init_creds_opt` structure.

Return Values

None.

krb5_get_init_creds_opt_set_etype_list — Set the encryption list field in krb5_get_init_creds_opt

C Prototype

```
void krb5_get_init_creds_opt_set_etype_list (
        krb5_get_init_creds_opt         *opt,
        krb5_enctype                    *etype_list,
        int                             etype_list_length );
```

Arguments

opt (output)	A pointer to the options field.
etype_list (input)	A pointer to the encryption type to set.
etype_list_length (input)	The length of the `etype_list` field.

Description

This routine sets the encryption list field in the `krb5_get_init_creds_opt` structure.

Return Values

None.

krb5_get_init_creds_opt_set_forwardable — Set the forwardable field in krb5_get_init_creds_opt

C Prototype

```
void krb5_get_init_creds_opt_set_forwardable (
        krb5_get_init_creds_opt         *opt,
        int                             forwardable );
```

Arguments

opt (output)	A pointer to the options field.
forwardable (input)	A flag indicating whether the credentials are forwardable.

Description

This routine sets the forwardable field in the `krb5_get_init_creds_opt` structure.

Return Values

None.

krb5_get_init_creds_opt_set_preauth_list — Set the preauth_list field in krb5_get_init_creds_opt

C Prototype

```
void krb5_get_init_creds_opt_set_preauth_list (
        krb5_get_init_creds_opt         *opt,
        krb5_preauthtype                *preauth_list,
        int                             preauth_list_length );
```

Arguments

opt (output)	A pointer to the options field.
preauth_list (input)	A pointer to the preauthentication type to set.
preauth_list_length (input)	The length of the `preauth_list` field.

Description

This routine sets the `preauth_list` field in the `krb5_get_init_creds_opt` structure.

Return Values

None.

krb5_get_init_creds_opt_set_proxiable — Set the proxiable field in krb5_get_init_creds_opt

C Prototype

```
void krb5_get_init_creds_opt_set_proxiable (
        krb5_get_init_creds_opt         *opt,
        int                             proxiable );
```

Arguments

opt (output)	A pointer to the options field.
proxiable (input)	A flag indicating whether the credentials are proxiable.

Description

This routine sets the proxiable field in the `krb5_get_init_creds_opt` structure.

Return Values

None.

krb5_get_init_creds_opt_set_renew_life — Set the renewal lifetime field in krb5_get_init_creds_opt

C Prototype

```
void krb5_get_init_creds_opt_set_renew_life (
        krb5_get_init_creds_opt         *opt,
        krb5_deltat                     renew_life );
```

Arguments

opt (output)	A pointer to the options field.
renew_life (input)	The Kerberos ticket renewal lifetime.

Description

This routine sets the Kerberos ticket renewal lifetime field in the `krb5_get_init_creds_opt` structure.

Return Values

None.

krb5_get_init_creds_opt_set_salt — Set the salt field in krb5_get_init_creds_opt

C Prototype

```
void krb5_get_init_creds_opt_set_salt (
        krb5_get_init_creds_opt         *opt,
        krb5_data                       *salt );
```

Arguments

opt (output)	A pointer to the options field.
salt (input)	A pointer to the salt value.

Description

This routine sets the cryptographic salt field in the `krb5_get_init_creds_opt` structure.

Return Values

None.

krb5_get_init_creds_opt_set_tkt_life — Initialize the ticket lifetime for krb5_get_init_creds* routines

C Prototype

```
void krb5_get_init_creds_opt_set_tkt_life (
        krb5_get_init_creds_opt      *opt,
        krb5_deltat                  tkt_life );
```

Arguments

opt (input/output)	A pointer to a structure containing flags and options.
tkt_life (input)	The ticket lifetime.

Description

This routine initializes the ticket lifetime information in preparation for calling `krb5_get_init_creds*` routines. It sets the ticket lifetime flag in the options flag field, and initializes the ticket lifetime in `opt` to `tkt_life`.

Return Values

None.

krb5_get_init_creds_password — Get the initial credentials password

C Prototype

```
krb5_error_code krb5_get_init_creds_password (
        krb5_context            context,
        krb5_creds              *creds,
        krb5_principal          client,
        char                    *password,
        krb5_prompter_fct       prompter,
        void                    *data,
        krb5_deltat             start_time,
        char                    *in_tkt_service,
        krb5_get_init_creds_opt *options );
```

Arguments

context (input/output)	The context structure.
creds (output)	A pointer to a Kerberos credentials structure.
client (input)	The client principal.
password (input/output)	The password associated with the initial credentials.
prompter (input)	A pointer to a password prompt routine.
data (input)	The data for the password prompt routine.
start_time (input)	The time that the credentials first become valid.
in_tkt_service (input)	A pointer to the output buffer containing the TGT.
options (input)	A pointer to a structure containing flags and options.

Description

This routine acquires the password associated with the initial credentials.

Return Values

This routine returns the following KRB5 status codes:

None.	Successful completion.
EINVAL	Invalid argument.
KRB5_KDC_UNREACH	Cannot contact any KDC for requested realm.
KRB5_PREAUTH_FAILED	Generic preauthentication failure.
KRB5_LIBOS_PWDINTR	Password read interrupted.
KRB5_REALM_CANT_RESOLVE	Cannot resolve network address for KDC in requested realm.
KRB5KDC_ERR_KEY_EXP	Password has expired.

KRB5_LIBOS_BADPWDMATCH	Password mismatch.
KRB5_CHPW_PWDNULL	ew password cannot be zero length.
KRB5_CHPW_FAIL	Password change failed.

krb5_get_host_realm — Get the Kerberos realm names for a host

C Prototype

```
krb5_error_code krb5_get_host_realm(
         krb5_context      context,
         const char        *host,
         char              ***realmlist );
```

Arguments

context (input)	The context structure.
host (input)	The host name.
realmlist (output)	A pointer to a list of realm names.

Description

This routine determines the Kerberos realm names for `host`, filling in `realmlist` with a pointer to an argv[ ] style list of names, terminated with a NULL pointer.

If `host` is NULL, the local host's realms are determined.

If there are no known realms for the host, the filled-in pointer is set to NULL.

The pointer array and strings pointed to are all in allocated storage, and should be freed by the caller when finished.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_get_message — Convert an error code into the string representation

C Prototype

```
char * krb5_get_message(
        long code );
```

Arguments

code (input)	The Kerberos numeric error code.

Description

This routine is supported on the OpenVMS platform only. It converts a Kerberos numeric error code into the string that describes the error.

Return Values

A pointer to an ASCII string describing the error indicated by code. The storage allocated at this pointer location should not be freed; it is part of an internal table of error messages.

krb5_get_permitted_enctypes — Return a list of supported encryption types

C Prototype

```
krb5_error_code krb5_get_permitted_enctypes (
        krb5_context            context,
        krb5_enctype            **ktypes );
```

Arguments

context (input/output)	The context structure.
ktypes (output)	A pointer to the list of encryption types.

Description

This routine returns a list of the supported encryption types.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_CONFIG_ETYPE_NOSUPP	No valid encryption types configured.

krb5_get_prompt_types — Get prompt_types from the Kerberos context

C Prototype

```
krb5_prompt_type * krb5_get_prompt_types (
        krb5_context    context );
```

Arguments

context (input/output) The context structure.

Description

This routine returns the `prompt_types` field from the Kerberos context structure.

Return Values

A pointer to the `krb5_prompt_type` field, which contains one of the following values:

KRB5_PROMPT_TYPE_PASSWORD

KRB5_PROMPT_TYPE_NEW_PASSWORD

KRB5_PROMPT_TYPE_NEW_PASSWORD_AGAIN

KRB5_PROMPT_TYPE_PREAUTH

krb5_get_renewed_creds — Renew existing credentials

C Prototype

```
krb5_error_code krb5_get_renewed_creds (
        krb5_context            context,
        krb5_creds              *creds,
        krb5_principal          client,
        krb5_ccache             ccache,
        char                    *in_tkt_service );
```

Arguments

context (input/output)	The context structure.
creds (output)	A pointer to a Kerberos credentials structure.
client (input)	The client principal.
ccache (input)	The credentials cache name.
in_tkt_service (input)	A pointer to the principal name of the requesting server.

Description

This routine renews a set of existing Kerberos credentials.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_PROG_ETYPE_NOSUPP	Program lacks support for encryption type.

krb5_get_server_rcache — Create a replay cache for server use

C Prototype

```
krb5_error_code krb5_get_server_rcache(
         krb5_context             context,
         const krb5_data          *piece,
         krb5_rcache              *ret_rcache );
```

Arguments

context (input/output)	The context structure.
piece (input)	Used to distinguish this replay cache from others in use on the system. Typically, `piece` is the first component of the principal name for the client or server that is calling `krb5_get_server_rcache`.
ret_rcache (output)	A handle to an open `rcache`.

Description

This routine generates a replay cache name, allocates space for its handle, and opens it.

Upon successful return, `ret_rcache` is filled in to contain a handle to an open `rcache`, which should be closed with `krb5_rc_close`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_get_time_offsets — Get the time offsets from the os context

C Prototype

```
krb5_error_code krb5_get_time_offsets (
        krb5_context            context,
        krb5_int32              *seconds,
        krb5_int32              *microseconds );
```

Arguments

context (input/output)	The context structure.
seconds (output)	A pointer to os context `time_offset`.
microseconds (output)	A pointer to the os context `usec_offset`.

Description

This routine returns the second and microsecond time offsets from the os context.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_get_validated_creds — Get validated credentials

C Prototype

```
krb5_error_code krb5_get_validated_creds (
        krb5_context            context,
        krb5_creds              *creds,
        krb5_principal          client,
        krb5_ccache             ccache,
        char                    *in_tkt_service );
```

Arguments

context (input/output)	The context structure.
creds (output)	A pointer to a Kerberos credentials structure.
client (input)	The client principal.
ccache (input)	The credentials cache name.
in_tkt_service (input)	A pointer to the principal name of the requesting server.

Description

This routine acquires a set of validated credentials from the KDC.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
KRB5_NO_2ND_TKT	Request missing second ticket.
KRB5_NO_TKT_SUPPLIED	Request did not supply a ticket.
KRB5_PRINC_NOMATCH	Requested principal and ticket don't match.
KRB5_KDCREP_MODIFIED	KDC reply did not match expectations.
KRB5_KDCREP_SKEW	Clock skew too great in KDC reply.
ENOMEM	Insufficient memory.

krb5_init_context — Initialize a Kerberos context structure

C Prototype

```
krb5_error_code krb5_init_context(
        krb5_context   *context );
```

Arguments

context (output)	A pointer to the context structure that has been initialized.

Description

This routine initializes the context for the application. The context contains the encryption types, a pointer to operating specific data and the default realm. In the future, the context may also contain thread specific data. The data in the context should be freed with `krb5_free_context`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_init_keyblock — Set up an empty keyblock

C Prototype

```
krb5_error_code krb5_init_keyblock (
        krb5_context            context,
        krb5_enctype            enctype,
        size_t                  length,
        krb5_keyblock           **out );
```

Arguments

context (input/output)	The context structure.
enctype (input)	The encryption type.
length (input)	The length of the keyblock.
out (output)	A pointer to the empty keyblock.

Description

This routine sets up an empty keyblock.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_init_secure_context — Initialize a secure Kerberos context block

C Prototype

```
krb5_error_code krb5_init_secure_context (
        krb5_context            *context );
```

Arguments

context (output)	A pointer to the context structure to be initialized.

Description

This routine initializes a secure Kerberos context block, preparing it for use by other Kerberos APIs.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
Kerberos errors.	

krb5_is_thread_safe — Check whether the Kerberos client code supports multithreading

C Prototype

```
krb5_boolean krb5_is_thread_safe ( void );
```

Description

This routine returns a value indication whether the Kerberos client libraries (KRB$RTL.EXE, KRB$RTL32.EXE) are thread safe. On OpenVMS as of OpenVMS V8.3 (Kerberos V3.0), multithreading support is always enabled.

Return Values

This routine returns the following KRB5 status codes:

TRUE	Client libraries are thread safe.
FALSE	Client libraries are not thread safe.

krb5_kt_add_entry — Add an entry to a key table

C Prototype

```
krb5_error_code krb5_kt_add_entry(
         krb5_context          context,
         krb5_keytab           id,
         krb5_keytab_entry     *entry );
```

Arguments

context (input/output)	The context structure.
id (input)	A key table handle.
entry (input)	The new entry to add to the key table.

Description

This routine adds a new entry to a key table. If the table is not writeable, then KRB5_KT_NOWRITE is returned.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_kt_close — Close a key table

C Prototype

```
krb5_error_code krb5_kt_close(
         krb5_context      context,
         krb5_keytab       id );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A key table handle.

Description

This routine closes the keytab identified by `id` and invalidates `id`, and releases any other resources acquired during use of the key table.

It requires that `id` identifies a keytab.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_default — Return a handle to the default keytab

C Prototype

```
krb5_error_code krb5_kt_default(
         krb5_context     context
         krb5_keytab      *id );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A key table handle.

Description

This routine fills `id` with a handle identifying the default keytab.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_default_name — Get default key table name

C Prototype

```
krb5_error_code krb5_kt_default_name(
         krb5_context     context
         char             *name,
         int               namesize );
```

Arguments

context (input/output)	The context structure.
name (input/output)	Key table name to resolve.
namesize (input)	The size of the name to return. Anything more than `namesize` will be zeroed in `name` upon completion.

Description

This routine fills `name` with the first `namesize` bytes of the name of the default keytab. If the name is shorter than `namesize`, then the remainder of name will be zeroed.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_end_seq_get — Complete a series of sequential key table entry retrievals

C Prototype

```
krb5_error_code krb5_kt_end_seq_get(
          krb5_context      context,
          krb5_keytab       id,
          krb5_kt_cursor    *cursor );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A key table handle.
cursor (input/output)	The cursor to be invalidated.

Description

This routine finishes sequential processing mode and invalidates `cursor`, which must never be reused after this routine call.

This routine requires that `id` identifies a valid keytab and `*cursor` be a cursor returned by `krb5_kt_start_seq_get` or a subsequent call to `krb5_kt_next_entry`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_get_entry — Retrieve an entry from the key table

C Prototype

```
krb5_error_code krb5_kt_get_entry(
         krb5_context          context,
         krb5_keytab           id,
         krb5_principal        principal,
         krb5_kvno             vno,
         krb5_keytype          keytype,
         krb5_keytab_entry     *entry );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A key table handle.
principal (input)	A principal name.
vno (input)	Key version number. If `vno` is zero, the first entry whose principal matches is returned.
keytype (input)	The key encryption type. Use a `keytype` of zero if an encryption type does not matter.
entry (output)	The returned key table entry.

Description

This routine searches the keytab identified by `id` for an entry whose principal matches `principal`, whose keytype matches `keytype`, and whose key version number matches `vno`. It returns an error code if no suitable entry is found. If an entry is found, the entry is returned in `*entry`; its contents should be deallocated by calling `krb5_kt_free_entry` when no longer needed.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_get_name — Get key table name

C Prototype

```
krb5_error_code krb5_kt_get_name(
         krb5_context      context,
         krb5_keytab       id,
         char              *name,
         unsigned int      namesize );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A key table handle.
name (output)	The key table name.
namesize (input)	The maximum length to fill in name.

Description

This routine fills `name` with the first `namesize` bytes of the name of the keytab identified by `id`. If the name is shorter than `namesize`, then `name` will be NULL terminated.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_get_type — Return the keytab prefix

C Prototype

```
char * krb5_kt_get_type (
        krb5_context    context,
        krb5_keytab     keytab );
```

Arguments

context (input/output)	The context structure.
keytab (output)	The keytab structure whose type is returned.

Description

This routine returns the keytab prefix string as its return value.

Return Values

This routine returns the following:

A string representing the prefix value of the keytab structure.

krb5_kt_next_entry — Retrieve the next entry from the key table

C Prototype

```
krb5_error_code krb5_kt_next_entry(
         krb5_context        context,
         krb5_keytab         id,
         krb5_keytab_entry   *entry,
         krb5_kt_cursor      *cursor );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A key table handle.
entry (output)	The returned key table entry.
cursor (input/output)	A cursor to be used in subsequent calls to `krb5_kt_next_entry`.

Description

This routine fetches the next entry in the keytab, returning it in `*entry`, and updates `*cursor` for the next request. If the keytab changes during the sequential get, an error is guaranteed. The argument `*entry` should be freed after use by calling `krb5_kt_free_entry`.

This routine requires that `id` identifies a valid keytab, and `*cursor` be a cursor returned by `krb5_kt_start_seq_get` or a subsequent call to `krb5_kt_next_entry`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_read_service_key — Retrieve a service key from the key table

C Prototype

```
krb5_error_code krb5_kt_read_service_key( \funcinout
         krb5_context      context,
         krb5_pointer      keyprocarg,
         krb5_principal    principal,
         krb5_kvno         vno,
         krb5_keytype      keytype,
         krb5_keyblock     **key );
```

Arguments

context (input/output)	The context structure.
keyprocarg (input)	The name of a keytab, or NULL to use the default keytab.
principal (input)	The service principal.
vno (input)	Key version number. Use a `vno` of zero to specify the key with the highest version number.
keytype (input)	The key encryption type. Use a `keytype` of zero if an encryption type does not matter.
key (output)	The returned service key.

Description

The routine opens and searches keytab for the entry identified by principal, `keytype`, and `vno`, returning the resulting key in `*key` or returning an error code if it is not found. If `keyprocarg` is not NULL, it is taken to be a `char*` denoting the name of a keytab. Otherwise, the default keytab will be used.

`krb5_free_keyblock` should be called on `*key` when the caller is finished with the key.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kt_remove_entry — Remove an entry from a key table

C Prototype

```
krb5_error_code krb5_kt_remove_entry(
         krb5_context          context,
         krb5_keytab           id,
         krb5_keytab_entry     *entry );
```

Arguments

context (input/output)	The context structure.
id (input)	A key table handle.
entry (input)	The entry to remove from the key table.

Description

This routine removes an `entry` from a key table. If this routine is not available, then KRB5_KT_NOWRITE is returned.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
KRB5_KT_NOWRITE	Keytab is not writable.

krb5_kt_resolve — Get keytab handle

C Prototype

```
krb5_error_code krb5_kt_resolve(
        krb5_context    context,
        const char      *string_name,
        krb5_keytab     *id );
```

Arguments

context (input/output)	The context structure.
string_name (input)	The name of the keytab.
id (output)	A keytab handle.

Description

This routine fills in `id` with a handle identifying the keytab with the name `string_name`. The keytab is not opened. The routine requires that `string_name` be of the form `type:residual` and `type` is a type known to the library.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_KT_UNKNOWN_TYPE	Unknown keytab type.

krb5_kt_start_seq_get — Start a sequential retrieve of key table entries

C Prototype

```
krb5_error_code krb5_kt_start_seq_get(
         krb5_context       context,
         krb5_keytab        id,
         krb5_kt_cursor     *cursor );
```

Arguments

context (input/output)	The context structure.
id (input/output)	A key table handle.
cursor (output)	A cursor to be used in calls to `krb5_kt_next_entry`.

Description

This routine prepares to read sequentially every key in the keytab identified by `id`. The `cursor` argument is filled in with a cursor to be used in calls to `krb5_kt_next_entry`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_kuserok — Determine whether the local user is authorized to log in

C Prototype

```
krb5_boolean krb5_kuserok(
         krb5_context      context,
         krb5_principal    principal,
         const char        *luser );
```

Arguments

context (input)	The context structure.
principal (input)	A Kerberos principal name.
luser (input)	A local username.

Description

This routine determines whether user is authorized to log in to the account `luser`, given a Kerberos principal `principal` and a local username `luser`.

Return Values

This routine returns one of the following KRB5 status codes:

TRUE	User is authorized to log in.
FALSE	User is not authorized to log in.

krb5_mk_1cred — Encode a KRB_CRED message for krb5_rd_cred

C Prototype

```
krb5_error_code krb5_mk_1cred (
        krb5_context             context,
        krb5_auth_context        auth_context,
        krb5_creds               *pcreds,
        krb5_data                **ppdata,
        krb5_replay_data         *outdata );
```

Arguments

context (input/output)	The context structure.
auth_context (input)	The Kerberos authentication context.
pcreds (input)	A pointer to Kerberos credentials.
ppdata (input)	A pointer to a `krb5_data` structure (not used).
outdata (output)	A pointer to the KRB_CRED message.

Description

This routine takes a Kerberos credential, and returns a KRB_CRED message in `outdata` that is suitable for `krb5_rd_cred`. This is a convenience function that calls `krb5_mk_ncred` with only a single set of credentials.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_RC_REQUIRED	Message replay detection requires `rcache` parameter.

krb5_mk_error — Format an error message

C Prototype

```
krb5_error_code krb5_mk_error(
         krb5_context         context,
         const krb5_error     *dec_err,
         krb5_data            *enc_err );
```

Arguments

context (input/output)	The context structure.
dec_err (input)	The error structure to format.
enc_err (output)	The formatted error buffer.

Description

This routine formats the error structure `*dec_err` into an error buffer `*enc_err`.

The error buffer storage (`enc_err->data`) is allocated, and should be freed by the caller when finished.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_mk_ncred — Encode a KRB_CRED message for krb5_rd_cred

C Prototype

```
krb5_error_code krb5_mk_ncred (
        krb5_context            context,
        krb5_auth_context       auth_context,
        krb5_creds              **ppcreds,
        krb5_data               **ppdata,
        krb5_replay_data        *outdata );
```

Arguments

context (input/output)	The context structure.
auth_context (input)	The Kerberos authentication context.
ppcreds (input)	A pointer to an array of Kerberos credentials.
ppdata (input)	A pointer to a `krb5_data` structure (not used).
outdata (output)	A pointer to the KRB_CRED message.

Description

This routine takes an array of Kerberos credentials, and returns a KRB_CRED message in `outdata` that is suitable for `krb5_rd_cred`.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_RC_REQUIRED	Message replay detection requires `rcache` parameter.

krb5_mk_priv — Format a KRB_PRIV message

C Prototype

```
krb5_error_code krb5_mk_priv(
         krb5_context             context,
         krb5_auth_context        auth_context,
         const krb5_data          *userdata,
         krb5_data                *outbuf,
         krb5_replay_data         *outdata );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context. The flags from auth_context select whether sequence numbers or timestamps should be used to identify the message. Valid values are: **KRB5_AUTH_CONTEXT_DO_TIME** — Use timestamps and replay cache. **KRB5_AUTH_CONTEXT_RET_TIME** — Copy timestamp to *outdata. **KRB5_AUTH_CONTEXT_DO_SEQUENCE** — Use sequence numbers in replay cache. **KRB5_AUTH_CONTEXT_RET_SEQUENCE** — Use sequence numbers in replay cache and output data.
userdata (input)	The user data in the message.
outbuf (output)	The formatted KRB_PRIV buffer.
outdata (input/output)	Contains the sequence numbers if KRB5_AUTH_CONTEXT_RET_SEQUENCE was specified in auth_context.

Description

This routine formats a KRB_PRIV message into outbuf. Behaves similarly to krb5_mk_safe, but the message is encrypted and integrity protected rather than just integrity-protected.

The inbuf, auth_context, outdata and outbuf arguments function as in krb5_mk_safe.

As in krb5_mk_safe, the remote_addr and remote_port part of the auth_context is optional; if the receiver's address is not known, it may be replaced by NULL. The local_addr, however, is mandatory.

The encryption type is taken from the auth_context keyblock portion. If the i_vector portion of the auth_context is nonNULL, it is used as an initialization vector for the encryption (if the chosen encryption type supports initialization vectors), and its contents are replaced with the last block of encrypted data upon return.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.

krb5_mk_rep — Format and encrypt an AP_REP message

C Prototype

```
krb5_error_code krb5_mk_rep(
        krb5_context          context,
        krb5_auth_context     auth_context,
        krb5_data             *outbuf );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context.
outbuf (output)	AP_REQ message information.

Description

This routine formats and encrypts an AP_REP message, including in it the data in the `authentp` portion of `auth_context`, encrypted using the keyblock portion of `auth_context`.

When successful, `outbuf->length` and `outbuf->data` are filled in with the length of the AP_REQ message and allocated data holding it. The `outbuf->data` argument should be freed by the caller when it is no longer needed.

If the flags in `auth_context` indicate that a sequence number should be used (either KRB5_AUTH_CONTEXT_DO_SEQUENCE or KRB5_AUTH_CONTEXT_RET_SEQUENCE) and the local sequence number in the `auth_context` is 0, a new number will be generated with `krb5_generate_seq_number`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_mk_req — Format a KRB_AP_REQ message

C Prototype

```
krb5_error_code krb5_mk_req(
        krb5_context            context,
        krb5_auth_context       *auth_context,
        const krb5_flags        ap_req_options,
        char                    *service,
        char                    *hostname,
        krb5_data               *in_data,
        krb5_ccache             ccache,
        krb5_data               *outbuf );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context. Contains the checksum method to be used. A new authentication context will be returned if NULL is specified.
ap_req_options (input)	Specifies the KRB_AP_REQ options desired. Valid options are: **AP_OPTS_USE_SESSION_KEY** **AP_OPTS_MUTUAL_REQUIRED** **AP_OPTS_USE_SUBKEY**
service (input)	Used to specify the principal name, in conjunction with hostname.
hostname (input)	The server to receive the message.
in_data (input)	Application data whose checksum should be included in the authenticator. Specify NULL if no checksum is to be included.
ccache (input/output)	The credentials cache.
outbuf (output)	A pointer to an existing krb5_data structure to be filled. Returns the generated AP_REQ message.

Description

This routine formats a KRB_AP_REQ message into outbuf.

The principal of the server to receive the message is specified by hostname and service. If credentials are not present in the credentials cache ccache for this server, the TGS request with default arguments is used in an attempt to obtain such credentials, and they are stored in ccache.

The checksum method to be used is as specified in auth_context.

The outbuf argument should point to an existing krb5_data structure. outbuf->length and outbuf->data will be filled in on success, and the latter should be freed by the caller when it is no longer needed; if an error is returned, however, no storage is allocated and outbuf->data does not need to be freed.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.

krb5_mk_req_extended — Format a KRB_AP_REQ message with additional options

C Prototype

```
krb5_error_code krb5_mk_req_extended(
        krb5_context            context,
        krb5_auth_context       *auth_context,
        const krb5_flags        ap_req_options,
        krb5_data               *in_data,
        krb5_creds              *in_creds,
        krb5_data               *outbuf );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context. Contains the checksum method to be used. A new authentication context will be returned if NULL is specified.
ap_req_options (input)	Specifies the `KRB_AP_REQ` options desired. Valid options are: **AP_OPTS_USE_SESSION_KEY** **AP_OPTS_MUTUAL_REQUIRED**
in_data (input)	Application data whose checksum should be included in the authenticator. Specify NULL if no checksum is to be included.
in_creds (input)	Specifies the credentials for the service.
outbuf (output)	A pointer to an existing `krb5_data` structure to be filled. Returns the generated AP_REQ message.

Description

This routine formats a `KRB_AP_REQ` message into `outbuf`, with more complete options than `krb5_mk_req`.

`The outbuf`, `ap_req_options`, `auth_context`, and `ccache` arguments are used in the same fashion as for `krb5_mk_req`.

The `in_creds` argument is used to supply the credentials (ticket and session key) needed to form the request.

If `in_creds->ticket` has no data (length == 0), then an error is returned.

During a call to this routine, the structure elements in `in_creds` may be freed and reallocated. Hence all of the structure elements which are pointers should point to allocated memory, and there should be no other pointers aliased to the same memory, since it may be deallocated during this routine call.

If `ap_req_options` specifies `AP_OPTS_USE_SUBKEY`, then a subkey will be generated if need be by `krb5_generate_subkey`.

A copy of the authenticator will be stored in the `auth_context`, with the principal and checksum fields nulled out, unless an error is returned. (This is to prevent pointer-sharing problems; the caller should not need these fields anyway, since the caller supplied them.)

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_mk_safe — Format a KRB_SAFE message

C Prototype

```
krb5_error_code krb5_mk_safe(
        krb5_context          context,
        krb5_auth_context     *auth_context,
        const krb5_data       *userdata,
        krb5_data             *outbuf,
        krb5_replay_data      *outdata );
```

Arguments

context (input/output) — The context structure.

auth_context (input/output) — Authentication context. The `auth_context->auth_context_flags` select whether sequence numbers or timestamps should be used to identify the message. Valid flags are:

KRB5_AUTH_CONTEXT_DO_TIME — Use timestamps and replay cache.

KRB5_AUTH_CONTEXT_RET_TIME — Copy timestamp to `*outdata`.

KRB5_AUTH_CONTEXT_DO_SEQUENCE — Use sequence numbers.

KRB5_AUTH_CONTEXT_RET_SEQUENCE — Copy sequence numbers to `*outdata`.

userdata (input) — The user data in the message.

outbuf (output) — The formatted KRB_SAFE buffer.

outdata (input/output) — Contains the sequence numbers if KRB5_AUTH_CONTEXT_RET_SEQUENCE was specified in `auth_context`.

Description

This routine formats a KRB_SAFE message into `outbuf`.

The `userdata` argument is formatted as the user data in the message. Portions of `auth_context` specify the checksum type, the keyblock that might be used to seed the checksum, and full addresses (host and port) for the sender and receiver. The `local_addr` portion of `*auth_context` is used to form the addresses used in the KRB_SAFE message. The `remote_addr` is optional; if the receiver's address is not known, it may be replaced by NULL. The `local_addr` argument, however, is mandatory.

If timestamps are to be used (that is, if KRB5_AUTH_CONTEXT_DO_TIME is set), an entry describing the message will be entered in the replay cache so that the caller may detect if this message is sent back by an attacker. If KRB5_AUTH_CONTEXT_DO_TIME is not set, the `auth_context` replay cache is not used.

If sequence numbers are to be used (if either KRB5_AUTH_CONTEXT_DO_SEQUENCE or KRB5_AUTH_CONTEXT_RET_SEQUENCE is set), then `auth_context` local sequence number will be placed in the protected message as its sequence number.

The outbuf buffer storage (`outbuf->data`) is allocated, and should be freed by the caller when finished.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.

krb5_os_localaddr — Return all protocol addresses of this host

C Prototype

```
krb5_error_code krb5_os_localaddr(
         krb5_context        context,
         krb5_address        ***addr );
```

Arguments

context (input)	The context structure.
addr (output)	A pointer to an array of address pointers.

Description

This routine returns all of the protocol addresses of this host.

Compile-time configuration flags will indicate which protocol family addresses might be returned. The `*addr` argument is filled in to point to an array of address pointers, terminated by a NULL pointer. All the storage pointed to is allocated and should be freed by the caller with `krb5_free_addresses` when no longer needed.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_parse_name — Convert string principal name to protocol format

C Prototype

```
krb5_error_code krb5_parse_name(
         krb5_context           context,
         const char             *name,
         krb5_principal         *principal );
```

Arguments

context (input/output)	The context structure.
name (input)	Single string representation of a Kerberos principal name.
principal (output)	Multipart principal format used in the protocols.

Description

This routine converts a single-string representation name of the principal name to the multi-part principal format used in the protocols.

A single-string representation of a Kerberos name consists of one or more principal name components, separated by slashes, optionally followed by the @ character and a realm name. If the realm name is not specified, the local realm is used.

The slash and @ characters can be quoted (included as part of a component rather than as a component separator or realm prefix) by preceding them with a backslash (\) character. Similarly, newline, tab, backspace, and NULL characters can be included in a component by using \n, \t,\b or \0, respectively.

The realm in a Kerberos name cannot contain the slash, colon, or NULL characters.

The `*principal` argument points to allocated storage that should be freed by the caller (using `krb5_free_principal`) after use.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_principal2salt — Convert a krb5_principal into it's default salt

C Prototype

```
krb5_error_code krb5_principal2salt (
        krb5_context                    context,
        register krb5_const_principal   pr,
        krb5_data                       *ret );
```

Arguments

context (input/output)	The context structure.
pr (input)	The principal name.
ret (output)	A pointer to the default salt for the given principal name.

Description

This routine converts a principal name into the default salt for that principal.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_principal_compare — Compare two principals

C Prototype

```
krb5_boolean krb5_principal_compare(
         krb5_context                context,
         krb5_const_principal        princ1,
         krb5_const_principal        princ2 );
```

Arguments

context (input/output)	The context structure.
princ1 (input)	First principal name.
princ2 (input)	Second principal name.

Description

This routine compares two principal names.

Return Values

This routine returns one of the following KRB5 status codes:

TRUE	Principals are the same.
FALSE	Principals are different.

krb5_prompter_posix — Prompt the user for the Kerberos password

C Prototype

```
krb5_error_code krb5_prompter_posix (
        krb5_context            context,
        void                    *data,
        const char              *name,
        const char              *banner,
        int                     num_prompts,
        krb5_prompt             prompts[] );
```

Arguments

context (input/output)	The context structure.
data (input)	[Not used].
name (input)	Name to output during prompt.
banner (input)	Banner to output during prompt.
num_prompts (input)	The number of prompts passed in prompts.
prompts (input/output)	A structure containing output prompts and replies.

Description

This routine prompts the user for the Kerberos password associated with the given principal name, and sets the reply field of the prompts argument to the password input. The hidden flag in the prompts structure controls whether the password input is echoed back to the terminal.

Return Values

This routine returns one of the following KRB5 status code:

0	Successful completion.

krb5_rd_cred — Read a KRB_CRED message

C Prototype

```
krb5_error_code krb5_rd_cred (
        krb5_context            context,
        krb5_auth_context       auth_context,
        krb5_data               *pcreddata,
        krb5_creds              ***pppcreds,
        krb5_replay_data        *outdata );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	A per-connection context.
pcreddata (input)	The KRB_CRED message.
pppcreds (output)	The array of forwarded credentials.
outdata (output)	The replay data information (the nonce).

Description

This routine reads a `KRB_CRED` message, validates it, and outputs the nonce and an array of the forwarded credentials.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
KRB5_RC_REQUIRED	Message replay detection requires rcache parameter.
KRB5KRB_AP_ERR_SKEW	Clock skew too great.
KRB5KRB_AP_ERR_BADORDER	Message out of order.
ENOMEM	Insufficient memory.

krb5_rd_error — Read an error protocol message

C Prototype

```
krb5_error_code krb5_rd_error (
        krb5_context    context,
        const krb5_data *enc_errbuf,
        krb5_error      **dec_error );
```

Arguments

context (input)	The context structure.
enc_errbuf (input)	A pointer to the error protocol message.
dec_error (output)	A pointer to allocated storage containing the error message.

Description

Parses an error protocol message from `enc_errbuf` and fills in `*dec_error` with a pointer to allocated storage containing the error message. The caller is responsible for freeing this structure by using `krb5_free_error`.

Return Values

This routine returns one of the following KRB5 status code:

0	Successful completion.

krb5_rd_priv — Parse a KRB_PRIV message

C Prototype

```
krb5_error_code krb5_rd_priv(
         krb5_context             context,
         krb5_auth_context        auth_context,
         const krb5_data          *inbuf,
         krb5_data                *outbuf,
         krb5_data                *outdata );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context.
inbuf (input)	The KRB_PRIV message to be parsed.
outbuf (output)	The data parsed from the KRB_PRIV message.
outdata (input/output)	Contains the sequence numbers if KRB5_AUTH_CONTEXT_RET_SEQUENCE was specified in `auth_context`.

Description

This routine parses a KRB_PRIV message from `inbuf`, placing the data in `*outbuf` after decrypting it. It behaves similarly to `krb5_rd_safe`, but the message is decrypted rather than integrity checked.

`The inbuf, auth_context, outdata` and `outbuf` arguments function as in `krb5_rd_safe`.

The `remote_addr` part of the `auth_context` as set by `krb5_auth_con_setaddrs` is mandatory; it specifies the address of the sender. If the address of the sender in the message does not match the `remote_addr`, the error KRB5KRB_AP_ERR_BADADDR will be returned.

If `local_addr` portion of the `auth_context` is nonNULL, then the address of the receiver in the message must match it.If it is NULL, the receiver address in the message will be checked against the list of local addresses as returned by `krb5_os_localaddr`.

The `keyblock` portion of `auth_context` specifies the key to be used for decryption of the message. If the `i_vector` element is nonNULL, it is used as an initialization vector for the decryption (if the encryption type of the message supports initialization vectors) and its contents are replaced with the last block of encrypted data in the message.

The `auth_context` flags specify whether timestamps (KRB5_AUTH_CONTEXT_DO_TIME) and sequence numbers (KRB5_AUTH_CONTEXT_DO_SEQUENCE) are to be used.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.

krb5_rd_rep — Parse and decrypt an AP_REP message

C Prototype

```
krb5_error_code krb5_rd_rep(
        krb5_context            context,
        krb5_auth_context       auth_context,
        const krb5_data         *inbuf,
        krb5_ap_rep_enc_part    **repl );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context.
inbuf (input)	The AP_REP message to parse and decrypt.
repl (output)	The parsed message.

Description

This routine parses and decrypts an AP_REP message from `*inbuf`, filling in *repl with a pointer to allocated storage containing the values from the message. The caller is responsible for freeing this structure with `krb5_free_ap_rep_enc_part`.

The keyblock stored in `auth_context` is used to decrypt the message after establishing any key preprocessing with `krb5_process_key`.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_rd_req — Parse a KRB_AP_REQ message

C Prototype

```
krb5_error_code krb5_rd_req(
        krb5_context            context,
        krb5_auth_context       *auth_context,
        const krb5_data         *inbuf,
        krb5_const_principal    server,
        krb5_keytab             keytab,
        krb5_flags              *ap_req_options,
        krb5_ticket             **ticket );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context. A new authentication context will be returned if NULL is specified.
inbuf (input)	Contains the KRB_AP_REQ message to be parsed.
server (input)	Specifies the expected server's principal name for the ticket.
keytab (input)	Specifies a keytab containing a decryption key. If NULL, `krb5_kt_default` will be used to find the default keytab and the key taken from there.
ap_req_options (input/output)	If nonNULL on input, this field will be set to contain the application request flags on output.
ticket (output)	Returns the ticket from the AP_REQ message. The caller is responsible for deallocating this space by using `krb5_free_ticket`. If no ticket is desired, specify NULL.

Description

This routine parses a KRB_AP_REQ message, returning its contents. Upon successful return, if ticket is nonNULL, `*ticket` will be modified to point to allocated storage containing the ticket information.

If `auth_context` is NULL, one will be generated and freed internally by the function.

The `server` argument specifies the expected server's name for the ticket.

If `server` is NULL, then any server name will be accepted if the appropriate key can be found, and the caller should verify that the server principal matches some trust criterion.

If server is not NULL, and a replay detection cache has not been established with `auth_context`, one will be generated.

If a keyblock is present in the `auth_context`, it will be used to decrypt the ticket request and the keyblock freed with `krb5_free_keyblock`. This is useful for user-to-user authentication.

If no keyblock is specified, the `keytab` is consulted for an entry matching the requested keytype, server, and version number and used instead.

The authenticator in the request is decrypted and stored in `auth_context`. The client specified in the decrypted authenticator is compared to the client specified in the decoded ticket to ensure that the compare was performed.

If the `remote_addr` portion of the `auth_context` is set, then this routine checks if the request came from the right client.

The replay cache is checked to see if the ticket and authenticator have been seen and, if so, returns an error. If not, the ticket and authenticator are entered into the cache.

Various other checks are made of the decoded data, including cross-realm policy, clockskew, and ticket validation times.

The keyblock, subkey, and sequence number of the request are all stored in the `auth_context` for future use.

If the request has the AP_OPTS_MUTUAL_REQUIRED bit set, the local sequence number, which is stored in the `auth_context`, is XORed with the remote sequence number in the request.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
KRB5KRB_AP_ERRR_BADADDR	Invalid address.

krb5_rd_safe — Parse a KRB_SAFE message

C Prototype

```
krb5_error_code krb5_rd_safe(
         krb5_context            context,
         krb5_auth_context       *auth_context,
         const krb5_data         *inbuf,
         krb5_data               *outbuf,
         krb5_replay_data        *outdata );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context.
inbuf (input)	The KRB_SAFE message to be parsed.
outbuf (output)	The data parsed from the KRB_SAFE message.
outdata (input/output)	Contains the sequence numbers if KRB5_AUTH_CONTEXT_RET_SEQUENCE was specified in `auth_context`.

Description

This routine parses a KRB_SAFE message from `inbuf`, placing the data in `outbuf` after verifying its integrity.

The keyblock used for verifying the integrity of the message is taken from the `auth_context` `local_subkey`, `remote_subkey`, or `keyblock`. The keyblock is chosen in the preceding order by the first one that is not NULL.

The `remote_addr` and `localaddr` portions of the `*auth_context` specify the full addresses (host and port) of the sender and receiver, and must be of type ADDRTYPE_ADDRPORT.

The `remote_addr` argument is mandatory; it specifies the address of the sender. If the address of the sender in the message does not match `remote_addr`, the error KRB5KRB_AP_ERR_BADADDR will be returned.

If `local_addr` is nonNULL, then the address of the receiver in the message much match it. If it is NULL, the receiver address in the message will be checked against the list of local addresses as returned by `krb5_os_localaddr`. If the check fails, KRB5KRB_AP_ERR_BADARRD is returned.

The `outbuf` buffer storage `(outbuf->data)` is allocated storage which the caller should free when it is no longer needed.

If `auth_context_flags` portion of `auth_context` indicates that sequence numbers are to be used (if KRB5_AUTH_CONTEXT_DOSEQUENCE is set in it), the `remote_seq_number` portion of `auth_context` is compared to the sequence number for the message, and KRB5_KRB_AP_ERR_BADORDER is returned if it does not match. Otherwise, the sequence number is not used.

If timestamps are to be used (if KRB5_AUTH_CONTEXT_DO_TIME is set in `auth_context`), then two additional checks are performed:

- The timestamp in the message must be within the permitted clock skew (which is usually five minutes), or KRB5KRB_AP_ERR_SKEW is returned.
- The message must not be a replayed message, according to `rcache`.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.

krb5_read_password — Read a password from the keyboard

C Prototype

```
krb5_error_code krb5_read_password(
         krb5_context     context,
         const char       *prompt,
         const char       *prompt2,
         char             *return_pwd,
         unsigned int     *size_return );
```

Arguments

context (input)	The context structure.
prompt (input)	First user prompt when reading password.
prompt2 (input)	Second user prompt, or NULL to read the password only once.
return_pwd (output)	The returned password.
size_return (input/output)	On input, the maximum size of the password to be returned. On output, the total number of bytes returned in `return_pwd`.

Description

This routine reads a password from the keyboard. The first `*size_return` bytes of the password entered are returned in `return_pwd`. If fewer than `*size_return` bytes are typed as a password, the remainder of `return_pwd` is zeroed. Upon success, the total number of bytes filled in is stored in `*size_return`.

The `prompt` argument is used as the prompt for the first reading of a password. It is printed to the terminal, and then a password is read from the keyboard. No newline or spaces are emitted between the prompt and the cursor, unless the newline/space is included in the prompt.

If `prompt2` is a NULL pointer, then the password is read once.

If `prompt2` is set, then it is used as a prompt to read another password in the same manner as described for `prompt`. After the second password is read, the two passwords are compared, and an error is returned if they are not identical.

Echoing is turned off when the password is read.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.

Error in reading or verifying the password.

krb5_realm_compare — Compare the realms of two principals

C Prototype

```
krb5_boolean krb5_realm_compare (
        krb5_context            context,
        krb5_const_principal    princ1,
        krb5_const_principal    princ2 );
```

Arguments

context (input/output)	The context structure.
princ1 (input)	First principal name.
princ2 (input)	Second principal name.

Description

Compares two realms. If the realms of the two principals are the same, return TRUE, else return FALSE.

Return Values

This routine returns one of the following KRB5 status codes:

True.	The realms are the same.
False.	The realms are the different.

krb5_recvauth — Receive authenticated message

C Prototype

```
krb5_error_code krb5_recvauth(
         krb5_context            context,
         krb5_auth_context       *auth_context,
         krb5_pointer            fd,
         char                    *appl_version,
         krb5_principal          server,
         krb5_int32              flags,
         krb5_keytab             keytab,
         krb5_ticket             **ticket );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context.
fd (input)	A pointer to a file descriptor describing the network socket.
appl_version (input)	A string describing the application protocol version that the client is expecting to use for this exchange. If the client is using a different application protocol, an error will be returned, and the authentication exchange will be aborted.
server (input)	If server is nonNULL, then `krb5_recvauth` verifies that the server principal requested by the client matches server. If not, an error will be returned and the authentication exchange will be aborted.
flags (input)	The flags argument allows the caller to modify the behavior of `krb5_recvauth`. For nonlibrary callers, flags should be 0.
keytab (input)	Specifies a keytab containing a decryption key.
ticket (output)	Ticket is optional and is only filled in if nonNULL. It is filled with the data from the ticket sent by the client, and should be freed with `krb5_free_ticket` when it is no longer needed.

Description

This routine provides a convenient means for client and server programs to send authenticated messages to one another through network connections. The `krb5_sendauth` routine is the matching routine to `krb5_recvauth` for the server. The `krb5_recvauth` routine will engage in an authentication dialog with the client program running `krb5_sendauth` to authenticate the client to the server. In addition, if requested by the client, `krb5_recvauth` will provide mutual authentication to prove to the client that the server represented by `krb5_recvauth` is legitimate.

The `fd` argument is a pointer to the network connection. As in `krb5_sendauth`, in the MIT UNIX and OpenVMS implementations, `fd` is a pointer to a file descriptor.

The arguments `server`, `auth_context`, and `keytab` are used by `krb5_rd_req` to obtain the server's private key.

If `server` is nonNULL, the principal component of it is used to determine the replay cache to use. Otherwise, `krb5_recvauth` will use a default replay cache.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_recvauth_version — Receive authenticated message with version information

C Prototype

```
krb5_error_code krb5_recvauth_version (
        krb5_context            context,
        krb5_auth_context       *auth_context,
        krb5_pointer            fd,
        krb5_principal          server,
        krb5_int32              flags,
        krb5_keytab             keytab,
        krb5_ticket             **ticket,
        krb5_data               *version );
```

Arguments

context (input/output)	The context structure.
auth_context (input)	The Kerberos authentication context.
fd (input)	The socket from which to read the client responses.
server (input)	If server is nonNULL , then `krb5_recvauth_version` verifies that the server principal requested by the client matches `server`. If it is NULL, an error is returned and the authentication exchange is aborted.
flags (input)	Allows the caller to modify the behavior of `krb5_recvauth_version`. For nonlibrary callers, `flags` should be 0.
keytab (input)	A Kerberos keytab, containing a decryption key.
ticket (output)	Optional argument that is filled in only if nonNULL. It is filled with the data from the ticket sent by the client, and should be freed with `krb5_free_ticket` when it is no longer needed.
version (output)	A pointer to the application version string.

Description

This routine provides a convenient means for client and server programs to send authenticated messages to one another through network connections. (The `k5b5_sendauth` routine is the matching routine to `krb5_recvauth_version` for the server.)

The `krb5_recvauth_version` routine engages in an authentication dialog with the client program running `krb5_sendauth` to authenticate the client to the server. In addition, if requested by the client, `krb5_recvauth_version` provides mutual authentication to prove to the client that the server represented by `krb5_recvauth_version` is legitimate.

The `fd` argument is a pointer to the network connection. As in `krb5_sendauth`, in the MIT UNIX and OpenVMS implementations, `fd` is a pointer to a file descriptor.

The arguments `server`, `auth_context`, and `keytab` are used by `krb5_rd_req` to obtain the server's private key.

If `server` is nonNULL, the principal component of it is used to determine the replay cache to use. Otherwise, `krb5_recvauth_version` uses a default replay cache.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
KRB5_SENDAUTH_BADAUTHVERS	Bad sendauth version was sent.
KRB5_SENDAUTH_BADAPPLVERS	Bad application version was sent (via `sendauth`).

krb5_salttype_to_string — Convert a salttype (krb5_int32) to a string

C Prototype

```
krb5_error_code krb5_salttype_to_string (
        krb5_int32      salttype,
        char            *buffer,
        size_t          buflen );
```

Arguments

salttype (input)	The salttype to convert.
buffer (output)	A pointer to the buffer to receive the converted string.
buflen (input)	The length of buffer.

Description

This routine converts a salttype (`krb5_int32`) into a string.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
EINVAL	Invalid parameter.
ENOMEM	Insufficient memory (buffer length less than output size).

krb5_sendauth — Send authenticated message

C Prototype

```
krb5_error_code krb5_sendauth(
         krb5_context           context,
         krb5_auth_context      *auth_context,
         krb5_pointer           fd,
         char                   *appl_version,
         krb5_principal         client,
         krb5_principal         server,
         krb5_flags             ap_req_options,
         krb5_data              *in_data,
         krb5_creds             *in_creds,
         krb5_ccache            ccache,
         krb5_error             **error,
         krb5_ap_rep_enc_part   **rep_result,
         krb5_creds             **out_creds );
```

Arguments

context (input/output)	The context structure.
auth_context (input/output)	Authentication context.
fd (input)	A pointer to a file descriptor describing the network socket.
appl_version (input)	A string describing the application protocol version that the client is expecting to use for this exchange. If the server is using a different application protocol, an error will be returned.
client (input)	The Kerberos principal for the client. Ignored if `in_creds` is nonNULL.
server (input)	The Kerberos principal for the server. Ignored if `in_creds` is nonNULL.
ap_req_options (input)	Specifies the KRB_AP_REQ flags that should be passed to `krb5_mk_req`. Valid flags are:
	AP_OPTS_USE_SESSION_KEY
	AP_OPTS_MUTUAL_REQUIRED
	AP_OPTS_USE_SUBKEY
in_data (input	The data to be sent to the server.
in_creds (input)	Input credentials, or NULL.
ccache (input/output)	The credentials cache.
error (output)	If nonNULL, contains the error packet returned from the server. This error should be freed with `krb5_free_error`.
rep_result (output)	If nonNULL, contains the result of the mutual authentication exchange. The `*rep_result` argument should be freed with `krb5_free_ap_rep_enc_part` when the caller is done with it.
out_creds (output)	If nonNULL, the retrieved credentials.

Description

This routine provides a convenient means for client and server programs to send authenticated messages to one another through network connections. The krb5_sendauth routine sends an authenticated ticket from the client program to the server program using the network connection specified by fd. In the MIT UNIX and OpenVMS implementations, fd should be a pointer to a file descriptor describing the network socket.

The arguments client and server specify the Kerberos principals for the client and the server. They are ignored if in_creds is nonNULL. Otherwise, server must be nonNULL, but client may be NULL, in which case the client principal used is the one in the credential cache's default principal.

The ap_req_options argument specifies the options that should be passed to krb5_mk_req. If ap_req_options specifies MUTUAL_REQUIRED, then krb5_sendauth will perform a mutual authentication exchange, and if rep_result is nonNULLl, it will be filled in with the result of the mutual authentication exchange; the caller should free *rep_result with krb5_free_ap_rep_enc_part when done with it.

If in_creds is nonNULL, then in_creds->client and in_creds->server must be filled in, and either the other structure fields should be filled in with valid credentials, or in_creds->ticket.length should be zero. If in_creds->ticket.length is nonzero, then in_creds will be used as-is as the credentials to send to the server, and ccache is ignored; otherwise, ccache is used as described later, and out_creds, if not NULL, is filled in with the retrieved credentials.

The ccache argument specifies the credential cache to use when one is needed (that is, when in_creds is NULL or in_creds->ticket.length is zero). When a credential cache is not needed, ccache is ignored. When a credential cache is needed and ccache is NULL, the default credential cache is used. Note that if the credential cache is needed and does not contain the needed credentials, they will be retrieved from the KDC and stored in the credential cache.

If mutual authentication is used and rep_result is nonNULL, the sequence number for the server is available to the caller in *rep_result->seq_number. (If mutual authentication is not used, there is no way to negotiate a sequence number for the server.)

If an error occurs during the authenticated ticket exchange and error is nonNULL, the error packet (if any) that was sent from the server will be placed in it. This error should be freed with krb5_free_error.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_set_default_realm — Sets the default realm

C Prototype

```
krb5_error_code krb5_set_default_realm(
         krb5_context        context,
         char                *realm );
```

Arguments

context (input)	The context structure.
realm (output)	The default realm to be set. If realm is NULL, then the operating system default value will used.

Description

This routine sets the default realm to be used if no user-specified realm is available (for example, to interpret a user-typed principal name with the realm omitted for convenience).

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_set_default_tgs_enctypes — Set default TGS encryption types

C Prototype

```
krb5_error_code krb5_set_default_tgs_enctypes (
        krb5_context            context,
        const krb5_enctype      *ktypes );
```

Arguments

context (input/output)	The context structure.
ktypes (input)	The encryption type(s) to set as the default.

Description

This routine sets the default Ticket Granting Service encryption types for the given Kerberos context.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.
KRB5_PROG_ETYPE_NOSUPP	Program lacks support for encryption type.

krb5_set_password — Implements set password per RFC 3244

C Prototype

```
krb5_error_code krb5_set_password (
        krb5_context            context,
        krb5_creds              *creds,
        char                    *newpw,
        krb5_principal          change_password_for,
        int                     *result_code,
        krb5_data               *result_code_string,
        krb5_data               *result_string );
```

Arguments

context (input/output)	The context structure.
creds (input)	The Kerberos credentials.
newpw (input)	The new password to be set.
change_password_for (input)	The principal for which the password change is to be performed. If NULL, then the change is to be done on the current principal. If nonNULL, the change is preformed on the principal name passed in `change_password_for`.
result_code (output)	A pointer to the result code returned from the remote system.
result_code_string (output)	A pointer to the result code translated into a readable message.
result_string (output)	A pointer to the result data returned from the remote system.

Description

This routine allows a new password to be set in a manner that is interoperable with Windows implementations, per RFC 3244.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
INVALID_SOCKET	Invalid socket.
ECONNREFUSED	Connection refused.
EHOSTUNREACH	Host unreachable.
ECONNABORTED	Connection aborted.
ETIMEDOUT	Connection timed out.
ENOMEM	Insufficient memory.

krb5_set_password_using_ccache — Implements RFC 3244 set password using credentials cache

C Prototype

```
krb5_error_code krb5_set_password_using_rcache (
        krb5_context    context,
        krb5_ccache     ccache,
        char            *newpw,
        krb5_principal  change_password_for,
        int             *result_code,
        krb5_data       *result_code_string,
        krb5_data       *result_string );
```

Arguments

context (input/output)	The context structure.
ccache (input)	The Kerberos credentials cache.
newpw (input)	The new password to be set.
change_password_for (input)	The principal for which the password change is to be performed. If NULL, the change is to be done on the current principal. If nonNULL, the change is preformed on the principal name passed in `change_password_for`.
result_code (output)	A pointer to the result code returned from the remote system.
result_code_string (output)	A pointer to the result code translated into a readable message.
result_string (output)	A pointer to the result data returned from the remote system.

Description

This routine allows a new password to be set in a manner that is interoperable with Windows implementations per RFC 3244. This routine uses the credentials cache instead of explicitly passed credentials (which are used in `krb5_set_password`).

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
INVALID_SOCKET	Invalid socket.
ECONNREFUSED	Connection refused.
EHOSTUNREACH	Host unreachable.
ECONNABORTED	Connection aborted.
ETIMEDOUT	Connection timed out.
ENOMEM	Insufficient memory.

krb5_set_principal_realm — Set the realm in the current context

C Prototype

```
krb5_error_code krb5_set_principal_realm (
        krb5_context            context,
        krbt5_principal         principal,
        const char              *realm );
```

Arguments

context (input/output)	The context structure.
principal (input)	The Kerberos principal name.
realm (input)	The new realm to which the context should be set.

Description

This routine sets the realm in the current context to `realm`.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
EINVAL	Invalid parameter.
ENOMEM	Insufficient memory.

krb5_set_real_time — Set time offset field in context structure

C Prototype

```
krb5_error_code krb5_set_real_time (
        krb5_context            context,
        krb5_int32              seconds,
        krb5_int32             microseconds );
```

Arguments

context (input/output)	The context structure.
seconds (input)	The number of seconds to set in the `time_offset` field in the context.
microseconds (input)	The number of microseconds to set in the `usec_offset` field in the context.

Description

This routine takes the "real time" as input, and sets the time offset fields in the Kerberos context structure so that the krb5 time routines will return the correct time, as corrected by the difference between the system time and the "real time" as passed to this routine.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.

krb5_sname_to_principal — Generate a full principal name from a service name

C Prototype

```
krb5_error_code krb5_sname_to_principal(
        krb5_context      context,
        const char        *hostname,
        const char        *sname,
        krb5_int32        type,
        krb5_principal    *ret_princ );
```

Arguments

context (input)	The context structure.
hostname (input)	The host name, or NULL to use the local host.
sname (input)	The service name.
type (input)	A principal type. The type argument controls how `krb5_sname_to_principal` generates the principal name, `ret_princ`, for the named service, `sname`. Valid values are: **KRB5_NT_SRV_HST** — The `hostname` will be canonicalized (a fully qualified lowercase hostname using the primary name and the domain name), before `ret_princ` is generated in the form `sname/hostname@LOCAL.REALM`. Most applications should use KRB5_NT_SRV_HST. **KRB5_NT_UNKNOWN** — While the generated principal name will have the form `sname/hostname@LOCAL.REALM`, the `hostname` will not be canonicalized first. It will appear exactly as it was passed in `hostname`.
ret_princ (output)	The returned full principal name.

Description

This routine generates a full principal name to be used when authenticating with the named service on the host., given a hostname `hostname` and a generic service name `sname`. The full principal name is returned in `ret_princ`.

The realm of the principal is determined internally by calling `krb5_get_host_realm`.

The caller should release the storage in `ret_princ` by calling `krb5_free_principal` when it is finished with the principal.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_string_to_cksumtype — Convert a string to a checksum type

C Prototype

```
krb5_error_code krb5_string_to_cksumtype (
        char             *string,
        krb5_cksumtype   *cksumtypep );
```

Arguments

string (input)	A pointer to the string value to convert to a checksum type.
cksumtypep (output)	A pointer to the checksum type.

Description

This routine converts a character string into a Kerberos checksum type.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
EINVAL	Invalid parameter.

krb5_string_to_deltat — Convert a string to a delta time value

C Prototype

```
krb5_error_code krb5_string_to_deltat (
        char                    *string,
        krb5_deltat             *deltatp );
```

Arguments

string (input)	A pointer to the string to convert to a delta time.
deltatp (output)	A pointer to the delta time.

Description

This routine converts a string to a delta time value for use in other Kerberos routines.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
EINVAL	Invalid parameter.

krb5_string_to_enctype — Convert a string to an encryption type

C Prototype

```
krb5_error_code krb5_string_to_enctype (
        char            *string,
        krb5_enctype    *enctypep );
```

Arguments

string (input)	A pointer to the string to convert to an encryption type.
deltatp (output)	A pointer to the encryption type.

Description

This routine converts a string to a Kerberos encryption type.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
EINVAL	Invalid parameter.

krb5_string_to_salttype — Convert a string to a salt type

C Prototype

```
krb5_error_code krb5_string_to_salttype (
        char                    *string,
        krb5_int32              *salttypep );
```

Arguments

string (input)	A pointer to the string to convert to a salt type.
salttypep (output)	A pointer to the salt type.

Description

This routine converts a string to a Kerberos salt type.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
EINVAL	Invalid parameter.

krb5_string_to_timestamp — Convert a string to a timestamp

C Prototype

```
krb5_error_code krb5_string_to_timestamp (
        char                *string,
        krb5_timestamp      *timestampp );
```

Arguments

string (input)	A pointer to the string to convert to a timestamp.
timestampp (output)	A pointer to the timestamp.

Description

This routine converts a string to a Kerberos timestamp.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
EINVAL	Invalid parameter.

krb5_timestamp_to_sfstring — Convert a timestamp to a string

C Prototype

```
krb5_error_code krb5_timestamp_to_sfstring (
        krb5_timestamp          timestamp,
        char                    *buffer,
        size_t                  buflen,
        char                    *pad );
```

Arguments

timestamp (input)	The timestamp to convert.
buffer (output)	The buffer to hold the converted timestamp.
buflen (input)	The length of buffer.
pad (input)	If the converted timestamp does not fill `buffer`, an optional value used to pad the rest of `buffer`.

Description

This routine converts a Kerberos timestamp to a string.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_timestamp_to_string — Convert a timestamp to a string

C Prototype

```
krb5_error_code krb5_timestamp_to_string (
        krb5_timestamp          timestamp,
        char                    *buffer,
        size_t                  buflen );
```

Arguments

timestamp (input)	The timestamp to convert.
buffer (output)	The buffer to hold the converted timestamp.
buflen (input)	The length of buffer.

Description

This routine converts a Kerberos timestamp to a string. It returns the string in the locale's appropriate date and time representation.

Return Values

This routine returns the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_unparse_name — Convert protocol format principal name to string format

C Prototype

```
krb5_error_code krb5_unparse_name (
         krb5_context             context,
         krb5_const_principal     principal,
         char                     **name );
```

Arguments

context (input/output)	The context structure.
principal (input)	Multipart principal format used in the protocols.
name (output)	Single string representation of a Kerberos principal name.

Description

This routine converts the multipart principal name principal from the format used in the protocols to a single-string representation of the name. The resulting single-string representation will use the format and quoting conventions described for `krb_parse_name`.

The `*name` argument points to allocated storage and should be freed by the caller when finished.

Return Values

This routine returns one of the following KRB5 status codes:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_unparse_name_ext — Convert multiple protocol format principal names to string format

C Prototype

```
krb5_error_code krb5_unparse_name_ext(
         krb5_context            context,
         krb5_const_principal    principal,
         char                    **name,
         int                     *size );
```

Arguments

context (input/output)	The context structure.
principal (input)	Multipart principal format used in the protocols.
name (output)	Single string representation of a Kerberos principal name.
size (output)	Size of the unparsed name buffer.

Description

`This routine` is designed for applications which must unparse a large number of principals, and are concerned about the speed impact of needing to do a lot of memory allocations and deallocations. It functions similarly to `krb5_unparse_name` except if `*name` is nonNULL, in which case, it is assumed to contain an allocated buffer of size `*size` and this buffer will be resized with `realloc` to hold the unparsed name. Note that in this case, `*size` must not be NULL.

The `*name` argument points to allocated storage and should be freed by the caller when finished.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.
ENOMEM	Insufficient memory.

krb5_us_timeofday — Retrieves the system time of day (in seconds and microseconds)

C Prototype

```
krb5_error_code krb5_us_timeofday(
         krb5_context     context,
         krb5_int32       *seconds,
         krb5_int32       *microseconds );
```

Arguments

context (input)	The context structure.
seconds (output)	The system time of day, in seconds, since the local system’s epoch.
microseconds (output)	The microseconds portion of the system time of day.

Description

This routine retrieves the system time of day, in seconds, since the local system's epoch.

The seconds portion is returned in `*seconds`, the microseconds portion in `*microseconds`.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_verify_init_creds — Verify initial credentials

C Prototype

```
krb5_error_code krb5_verify_init_creds (
        krb5_context                    context,
        krb5_creds                      *creds,
        krb5_principal                  server_arg,
        krb5_keytab                     keytab_arg,
        krb5_ccache                     *ccache_arg,
        krb5_verify_init_creds_opt      *options );
```

Arguments

context (input/output)	The context structure.
creds (input)	A pointer to the initial credentials.
server_arg (input)	The server principal.
keytab_arg (input)	The keytab entry.
ccache_arg (input/output)	A pointer to the credentials cache.
options (input)	A pointer to a structure containing flags and options.

Description

This routine verifies the set of initial credentials, and stores them in the credentials cache.

Return Values

This routine returns the following KRB5 status code:

0	Successful completion.

krb5_verify_init_creds_opt_init — Initialize krb5_verify_init_creds_opt structure

C Prototype

```
void krb5_verify_init_creds_opt_init (
        krb5_verify_init_creds_opt      *opt );
```

Arguments

opt (output)	A pointer to the options field.

Description

This routine initializes the flags field in the `krb5_verify_init_creds_opt` structure.

Return Values

None.

krb5_verify_init_creds_opt_set_ap_req_nofail — Initialize the ap_req_nofail field in krb5_verify_init_creds_opt

C Prototype

```
void krb5_verify_init_creds_opt_set_ap_req_nofail (
        krb5_verify_init_creds_opt      *opt,
        int                             ap_req_nofail );
```

Arguments

opt (output)	A pointer to the options field.
ap_req_nofail (input)	The value to set for the `ap_req_nofail` field in `opt`.

Description

This routine initializes the `ap_req_nofail` field in `krb5_verify_init_creds_opt` to `ap_req_nofail`, and sets the appropriate flag.

Return Values

None.

A Open Source Notices

A.1 Acknowledgments

The Kerberos model is based in part on Needham and Schroeder's trusted third-party authentication protocol and on modifications suggested by Denning and Sacco. The original design and implementation of Kerberos Versions 1 through 4 was the work of Steve Miller of the former Digital Equipment Corporation (now Hewlett-Packard Company) and Clifford Neuman (now at the Information Sciences Institute of the University of Southern California), along with Jerome Saltzer, Technical Director of Project Athena, and Jeffrey Schiller, MIT Campus Network Manager. Many other members of Project Athena have also contributed to the work on Kerberos. Version 4 is publicly available, and has seen wide use across the Internet.

Version 5 (described in this document) has evolved from Version 4 based on new requirements and desires for features not available in Version 4.

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Glossary

A-Z

authentication Verification of 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 server.

authorization The process of determining whether a client may use a service, the objects the client is allowed to access, and the type of access allowed.

ciphertext The output of an encryption function. Encryption transforms plaintext into ciphertext.

client A process that uses a network service on behalf of a user. In some 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.

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 services both initial ticket and ticket-granting ticket requests.

The initial ticket portion is sometimes referred to as the authentication server (or service). The ticket-granting ticket portion is sometimes referred to as the ticket-granting server (or service).

Kerberos 1. In ancient mythology, the three-headed dog guarding Hades. 2. The name given to Project Athena's authentication service, the protocol used by that service, or the code used to implement the authentication service.

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.

realm The administrative domain that encompasses Kerberos clients and servers.

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 (for example, remote file service).

session key A temporary encryption key used between two principals, with a lifetime limited to the duration of a single login session.

subsession 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.

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 only serves to authenticate a client when presented along with a fresh authenticator.