GNU SASL

Simple Authentication and Security Layer for the GNU system
for version 1.10.0, 1 January 2021

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1 Introduction

This manual can be used in several ways. If read from the beginning to the end, it gives the reader an understanding of the SASL framework and the GNU SASL implementation, and how the GNU SASL library is used in an application. Forward references are included where necessary. Later on, the manual can be used as a reference manual to get just the information needed about any particular interface of the library. Experienced programmers might want to start looking at the examples at the end of the manual, and then only read up those parts of the interface which are unclear.

1.1 SASL Overview

SASL is a framework for application protocols, such as SMTP or IMAP, to add authentication support. For example, SASL is used to prove to the server who you are when you access an IMAP server to read your e-mail.

The SASL framework does not specify the technology used to perform the authentication, that is the responsibility for each SASL mechanism. Popular SASL mechanisms include CRAM-MD5 and GSSAPI (for Kerberos V5).

Typically a SASL negotiation works as follows. First the client requests authentication (possibly implicitly by connecting to the server). The server responds with a list of supported mechanisms. The client chose one of the mechanisms. The client and server then exchange data, one round-trip at a time, until authentication either succeeds or fails. After that, the client and server knows more about who is on the other end of the channel.

For example, in SMTP communication happens like this:

```
250-mail.example.com Hello pc.example.org [192.168.1.42], pleased to meet you
250-AUTH DIGEST-MD5 CRAM-MD5 LOGIN PLAIN
250 HELP
AUTH CRAM-MD5
334 PDk5MDgwNDEzMDUwNTUyMTE1NDQ5LjBAbG9jYWxob3N0Pg==
amFzIDBkZDRkODZkMDVjNjI4ODRkYzc3OTcwODE4ZGI5MGY3
235 2.0.0 OK Authenticated
```

Here the first three lines are sent by the server and contains the list of supported mechanisms (DIGEST-MD5, CRAM-MD5, etc). The next line is sent by the client to select the CRAM-MD5 mechanism. The server replies with a challenge, which is a message that can be generated by calling GNU SASL functions. The client replies with a response, which also is a message that can be generated by GNU SASL functions. Depending on the mechanism, there can be more than one round trip, so do not assume all authentication exchanges consists of one message from the server and one from the client. The server accepts the authentication. At that point it knows it is talking to a authenticated client, and the application protocol can continue.

Essentially, your application is responsible for implementing the framing protocol (e.g., SMTP or XMPP) according to the particular specifications. Your application uses GNU SASL to generate the authentication messages.

1.2 Implementation

GNU SASL is an implementation of the Simple Authentication and Security Layer framework and a few common SASL mechanisms.

GNU SASL consists of a library (`libgsasl`), a command line utility (`gsasl`) to access the library from the shell, and a manual. The library includes support for the framework (with authentication functions and application data privacy and integrity functions) and at least partial support for the ANONYMOUS, CRAM-MD5, DIGEST-MD5, EXTERNAL, GS2-KRB5, GSSAPI, LOGIN, NTLM, PLAIN, SCRAM-SHA-1, SCRAM-SHA-1-PLUS, SCRAM-SHA-256, SCRAM-SHA-256-PLUS, SAML20, OPENID20, and SECURID mechanisms.

The library is easily ported because it does not do network communication by itself, but rather leaves it up to the calling application. The library is flexible with regards to the authorization infrastructure used, as it utilizes a callback into the application to decide whether a user is authorized or not.

GNU SASL is developed for the GNU/Linux system, but runs on over 20 platforms including most major Unix platforms and Windows, and many kind of devices including iPAQ handhelds and S/390 mainframes.

GNU SASL is written in pure ANSI C89 to be portable to embedded and otherwise limited platforms. The entire library, with full support for ANONYMOUS, EXTERNAL, PLAIN, LOGIN and CRAM-MD5, and the front-end that supports client and server mode, and the IMAP and SMTP protocols, fits in under 80kb on an Intel x86 platform, without any modifications to the code. (This figure was accurate as of version 1.1.)

The design of the library and the intended interaction between applications and the library through the official API is illustrated below.

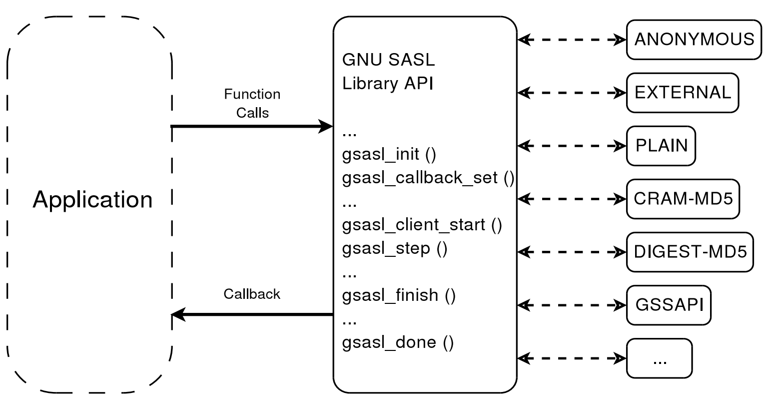


Illustration 1.1: Logical overview showing how applications use authentication mechanisms through an abstract interface.

1.3 Features

GNU SASL might have a couple of advantages over other libraries doing a similar job.

It's Free Software

Anybody can use, modify, and redistribute it under the terms of the GNU General Public License version 3.0 or later. The library uses the GNU Lesser General Public License version 2.1 or later.

It's thread-safe
: No global variables are used and multiple library handles and session handles may be used in parallel.

It's internationalized
: It handles non-ASCII usernames and passwords and user visible strings used in the library (error messages) can be translated into the users' language.

It's portable
: It should work on all Unix like operating systems, including Windows. The library itself should be portable to any C89 system, not even POSIX is required.

It's small
: The library has been rewritten with embedded platforms in mind. For example, no API consumes more than around 250 bytes of stack space.

Note that the library does not implement any policy to decide whether a certain user is "authenticated" or "authorized" or not. Rather, it uses a callback into the application to answer these questions.

1.4 Requirements

The GNU SASL library does not have any required external dependencies, but some optional features are enabled if you have a specific external library.

LibNTLM
: The NTLM mechanism requires the library LibNTLM, `http://www.nongnu.org/libntlm/`.

GSS-API
: The GSSAPI and GS2-KRB5 mechanisms requires a GSS-API library, see GNU GSS (`http://www.gnu.org/software/gss/`). MIT Kerberos or Heimdal are also supported.

LibIDN
: Processing of non-ASCII usernames and passwords requires the SASLprep implementation in LibIDN (`http://www.gnu.org/software/libidn/`). This is needed for full conformance with the latest SASL protocol drafts, but is optional in the library for improved portability.

Libgcrypt
: The GNU SASL library ships with its own cryptographic implementation, but it can use the one in libgcrypt (`http://www.gnupg.org/`) instead, if it is available. This is typically useful for desktop machines which have libgcrypt installed.

The command-line interface to GNU SASL requires a POSIX or Windows platform for network connectivity. The command-line tool can make use of GnuTLS (`http://www.gnutls.org/`) to support the STARTTLS modes of IMAP and SMTP, but GnuTLS is not required.

Note that the library does not need a POSIX platform or network connectivity.

1.5 Supported Platforms

GNU SASL has at some point in time been tested on the following platforms.

1. Debian GNU/Linux

   GCC and GNU Make. This is the main development platform. `x86_64-linux-gnu`, `alphaev67-unknown-linux-gnu`, `alphaev6-unknown-linux-gnu`, `arm-unknown-linux-gnu`, `hppa-unknown-linux-gnu`, `hppa64-unknown-linux-gnu`, `i686-pc-linux-gnu`, `ia64-unknown-linux-gnu`, `m68k-unknown-linux-gnu`, `mips-unknown-linux-gnu`, `mipsel-unknown-linux-gnu`, `powerpc-unknown-linux-gnu`, `s390-ibm-linux-gnu`, `sparc-unknown-linux-gnu`, `armv4l-unknown-linux-gnu`.

2. Tru64 UNIX

   Tru64 UNIX C compiler and Tru64 Make. `alphaev67-dec-osf5.1`, `alphaev68-dec-osf5.1`.
3. SuSE Linux 7.1

   GCC 2.96 and GNU Make. `alphaev6-unknown-linux-gnu`, `alphaev67-unknown-linux-gnu`.
4. SuSE Linux 7.2a

   GCC 3.0 and GNU Make. `ia64-unknown-linux-gnu`.
5. RedHat Linux 7.2

   GCC 2.96 and GNU Make. `alphaev6-unknown-linux-gnu`, `alphaev67-unknown-linux-gnu`, `ia64-unknown-linux-gnu`.
6. RedHat Linux 8.0

   GCC 3.2 and GNU Make. `i686-pc-linux-gnu`.
7. RedHat Advanced Server 2.1

   GCC 2.96 and GNU Make. `i686-pc-linux-gnu`.
8. Slackware Linux 8.0.01

   GCC 2.95.3 and GNU Make. `i686-pc-linux-gnu`.
9. Mandrake Linux 9.0

   GCC 3.2 and GNU Make. `i686-pc-linux-gnu`.
10. IRIX 6.5

    MIPS C compiler, IRIX Make. `mips-sgi-irix6.5`.
11. AIX 4.3.2

    IBM C for AIX compiler, AIX Make. `rs6000-ibm-aix4.3.2.0`.
12. Microsoft Windows 2000 (Cygwin)

    GCC 3.2, GNU make. `i686-pc-cygwin`.
13. HP-UX 11

    HP-UX C compiler and HP Make. `ia64-hp-hpux11.22`, `hppa2.0w-hp-hpux11.11`.
14. SUN Solaris 2.8

    Sun WorkShop Compiler C 6.0 and SUN Make. `sparc-sun-solaris2.8`.
15. SUN Solaris 2.9

    Sun Forte Developer 7 C compiler and GNU Make. `sparc-sun-solaris2.9`.
16. NetBSD 1.6

    GCC 2.95.3 and GNU Make. `alpha-unknown-netbsd1.6`, `i386-unknown-netbsdelf1.6`.
17. OpenBSD 3.1 and 3.2

    GCC 2.95.3 and GNU Make. `alpha-unknown-openbsd3.1`, `i386-unknown-openbsd3.1`.

18. FreeBSD 4.7

    GCC 2.95.4 and GNU Make. `alpha-unknown-freebsd4.7`, `i386-unknown-freebsd4.7`.

19. Cross compiled to uClinux/uClibc on Motorola Coldfire.

    GCC 3.4 and GNU Make `m68k-uclinux-elf`.

If you port GNU SASL to a new platform, please report it to the author so this list can be updated.

1.6 Getting help

A mailing list where users may help each other exists, and you can reach it by sending e-mail to `help-gsasl@gnu.org`. Archives of the mailing list discussions, and an interface to manage subscriptions, is available through the World Wide Web at `http://lists.gnu.org/mailman/listinfo/help-gsasl/`.

1.7 Commercial Support

Commercial support is available for users of GNU SASL. The kind of support that can be purchased may include:

- Implement new features. Such as a new SASL mechanism.
- Port GNU SASL to new platforms. This could include porting to an embedded platforms that may need memory or size optimization.
- Integrating SASL as a security environment in your existing project.
- System design of components related to SASL.

The following companies have expressed an interest in providing this support:

- Simon Josefsson Datakonsult AB

  Contact through `https://josefsson.org/` and email `simon@josefsson.org`.

If your company provides support related to GNU SASL and would like to be mentioned here, please let us know (see Section 1.9 [Bug Reports], page 8).

1.8 Downloading and Installing

The package can be downloaded from several places, including:

`ftp://ftp.gnu.org/gnu/gsasl/`

The latest version is stored in a file, e.g., '`gsasl-1.10.0.tar.gz`' where the '`1.10.0`' value is the highest version number in the directory.

The package is then extracted, configured and built like many other packages that use Autoconf. For detailed information on configuring and building it, refer to the `INSTALL` file that is part of the distribution archive.

Here is an example terminal session that downloads, configures, builds and install the package. You will need a few basic tools, such as '`sh`', '`make`' and '`cc`'.

```
$ wget -q ftp://ftp.gnu.org/gnu/gsasl/gsasl-1.10.0.tar.gz
$ tar xfz gsasl-1.10.0.tar.gz
```

```
$ cd gsasl-1.10.0/
$ ./configure
...
$ make
...
$ make install
...
```

After that gsasl should be properly installed and ready for use.

A few `configure` options may be relevant, summarized in the table.

`--disable-client`
`--disable-server`
: If your target system require a minimal implementation, you may wish to disable the client or the server part of the code. This does not remove symbols from the library, so if you attempt to call an application that uses server functions in a library built with `--disable-server`, the function will return an error code.

`--disable-obsolete`
: Remove backwards compatibility (see Appendix B [Old Functions], page 81). Use if you want to limit the size of the library.

`--disable-anonymous`
`--disable-external`
`--disable-plain`
`--disable-login`
`--disable-securid`
`--disable-ntlm`
`--disable-cram-md5`
`--disable-digest-md5`
`--disable-gssapi`
`--disable-gs2`
`--enable-kerberos_v5`
`--disable-scram-sha1`
`--disable-scram-sha256`
`--disable-saml20`
`--disable-openid20`
: Disable or enable individual mechanisms (see Chapter 5 [Mechanisms], page 27).

`--without-stringprep`
: Disable internationalized string processing. Note that this will result in a SASL library that is compatible with RFC 2222 but not RFC 4422.

For the complete list, refer to the output from `configure --help`.

1.8.1 Installing under Windows

There are two ways to build GNU SASL on Windows: via MinGW or via Microsoft Visual Studio. Note that a binary release for Windows is available from `http://josefsson.org/gnutls4win/`.

With MinGW, you can build a GNU SASL DLL and use it from other applications. After installing MinGW (`http://mingw.org/`) follow the generic installation instructions (see Section 1.8 [Downloading and Installing], page 5). The DLL is installed by default.

For information on how to use the DLL in other applications, see: `http://www.mingw.org/mingwfaq.shtml#faq-msvcdll`.

You can build GNU SASL as a native Visual Studio C++ project. This allows you to build the code for other platforms that VS supports, such as Windows Mobile. You need Visual Studio 2005 or later.

First download and unpack the archive as described in the generic installation instructions (see Section 1.8 [Downloading and Installing], page 5). Don't run `./configure`. Instead, start Visual Studio and open the project file `lib/win32/libgsasl.sln` inside the GNU SASL directory. You should be able to build the project using Build Project.

Output libraries will be written into the `lib/win32/lib` (or `lib/win32/lib/debug` for Debug versions) folder.

Warning! Unless you build GNU SASL linked with libgcrypt, GNU SASL uses the Windows function `CryptGenRandom` for generating cryptographic random data. The function is known to have some security weaknesses. See `http://eprint.iacr.org/2007/419` for more information. The code will attempt to use the Intel RND crypto provider if it is installed, see `lib/gl/gc-gnulib.c`.

1.8.2 Kerberos on Windows

Building GNU SASL with support for Kerberos via GSS-API on Windows is straight forward if you use GNU GSS and GNU Shishi as the Kerberos implementation.

If you are using MIT Kerberos for Windows (KfW), getting GNU SASL to build with Kerberos support is not straightforward because KfW does not follow the GNU coding style and it has bugs that needs to be worked around. We provide instructions for this environment as well, in the hope that it will be useful for GNU SASL users.

Our instructions assumes you are building the software on a dpkg-based GNU/Linux systems (e.g., gNewSense) using the MinGW cross-compiler suite. These instructions were compiled for KfW version 3.2.2 which were the latest as of 2010-09-25.

We assume that you have installed a normal build environment including the MinGW cross-compiler. Download and unpack the KfW SDK like this:

```
$ mkdir ~/kfw
$ cd ~/kfw
$ wget -q http://web.mit.edu/kerberos/dist/kfw/3.2/kfw-3.2.2/kfw-3-2-2-sdk.zip
$ unzip kfw-3-2-2-sdk.zip
```

Fix a bug in the "win-mac.h" header inside KfW by replacing `#include <sys\foo.h>` with `#include <sys/foo.h>`:

```
perl -pi -e 's,sys\\,sys/,' ~/kfw/kfw-3-2-2-final/inc/krb5/win-mac.h
```

Unpack your copy of GNU SASL:

```
$ wget -q ftp://alpha.gnu.org/gnu/gsasl/gsasl-1.10.0.tar.gz
$ tar xfz gsasl-1.10.0.tar.gz
$ cd gsasl-1.10.0
```

Configure GNU SASL like this:

```
$ lt_cv_deplibs_check_method=pass_all ./configure --host=i586-mingw32msvc --build=i686
```

The 'lt_cv_deplibs_check_method=pass_all' setting is required because the KfW SDK does not ship with Libtool `*.la` files and is using non-standard DLL names. The `-DSSIZE_T_DEFINED` is necessary because the `win-mac.h` file would provide an incorrect duplicate definitions of `ssize_t` otherwise. By passing `--with-gssapi-impl=kfw` you activate other bug workarounds, such as providing a `GSS_C_NT_HOSTBASED_SERVICE` symbol.

Build the software using:

```
$ make
```

If you have Wine installed and your kernel is able to invoke it automatically for Windows programs, you can run the self tests. This is recommended to make sure the build is sane.

```
$ make check
```

You may get error messages about missing DLLs, like this error:

```
err:module:import_dll Library gssapi32.dll (which is needed by L"Z:\\home\\jas\\src\\g
```

If that happens, you need to make sure that Wine can find the appropriate DLL. The simplest solution is to copy the necessary DLLs to `~/.wine/drive_c/windows/system32/`.

You may now copy the following files onto the Windows machine (e.g., through a USB memory device):

```
lib/src/.libs/libgsasl-7.dll
src/.libs/gsasl.exe
```

The remaining steps are done on the Windows XP machine. Install KfW and configure it for your realm. To make sure KfW is working properly, acquire a user ticket and then remove it. For testing purposes, you may use the realm 'interop.josefsson.org' with KDC 'interop.josefsson.org' and username 'user' and password 'pass'.

Change to the directory where you placed the files above, and invoke a command like this:

```
gsasl.exe -d interop.josefsson.org
```

KfW should query you for a password, and the tool should negotiate authentication against the server using GS2-KRB5.

1.9 Bug Reports

If you think you have found a bug in GNU SASL, please investigate it and report it.

- Please make sure that the bug is really in GNU SASL, and preferably also check that it hasn't already been fixed in the latest version.
- You have to send us a test case that makes it possible for us to reproduce the bug.
- You also have to explain what is wrong; if you get a crash, or if the results printed are not good and in that case, in what way. Make sure that the bug report includes all information you would need to fix this kind of bug for someone else.

Please make an effort to produce a self-contained report, with something definite that can be tested or debugged. Vague queries or piecemeal messages are difficult to act on and don't help the development effort.

If your bug report is good, we will do our best to help you to get a corrected version of the software; if the bug report is poor, we won't do anything about it (apart from asking you to send better bug reports).

If you think something in this manual is unclear, or downright incorrect, or if the language needs to be improved, please also send a note.

Send your bug report to:

'bug-gsasl@gnu.org'

1.10 Contributing

If you want to submit a patch for inclusion – from solve a typo you discovered, up to adding support for a new feature – you should submit it as a bug report (see Section 1.9 [Bug Reports], page 8). There are some things that you can do to increase the chances for it to be included in the official package.

Unless your patch is very small (say, under 10 lines) we require that you assign the copyright of your work to the Free Software Foundation. This is to protect the freedom of the project. If you have not already signed papers, we will send you the necessary information when you submit your contribution.

For contributions that doesn't consist of actual programming code, the only guidelines are common sense. Use it.

For code contributions, a number of style guides will help you:

- Coding Style. Follow the GNU Standards document (see Section "top" in `standards`).

  If you normally code using another coding standard, there is no problem, but you should use '`indent`' to reformat the code (see Section "top" in `indent`) before submitting your work.
- Use the unified diff format '`diff -u`'.
- Return errors. No reason whatsoever should abort the execution of the library. Even memory allocation errors, e.g. when `malloc` return `NULL`, should work although result in an error code.
- Design with thread safety in mind. Don't use global variables. Don't even write to per-handle global variables unless the documented behaviour of the function you write is to write to the per-handle global variable.
- Avoid using the C math library. It causes problems for embedded implementations, and in most situations it is very easy to avoid using it.
- Document your functions. Use comments before each function headers, that, if properly formatted, are extracted into Texinfo manuals and GTK-DOC web pages.
- Supply a ChangeLog and NEWS entries, where appropriate.

2 Preparation

To use GNU SASL, you have to perform some changes to your sources and the build system. The necessary changes are small and explained in the following sections. At the end of this chapter, it is described how the library is initialized, and how the requirements of the library are verified.

A faster way to find out how to adapt your application for use with GNU SASL may be to look at the examples at the end of this manual (see Chapter 13 [Examples], page 55).

2.1 Header

All interfaces (data types and functions) of the library are defined in the header file `gsasl.h`. You must include this in all programs using the library, either directly or through some other header file, like this:

```
#include <gsasl.h>
```

The name space is `gsasl_*` for function names, `Gsasl*` for data types and `GSASL_*` for other symbols. In addition the same name prefixes with one prepended underscore are reserved for internal use and should never be used by an application.

2.2 Initialization

The library must be initialized before it can be used. The library is initialized by calling `gsasl_init` (see Chapter 6 [Global Functions], page 36). The resources allocated by the initialization process can be released if the application no longer has a need to call 'Libgsasl' functions, this is done by calling `gsasl_done`. For example:

```
int
main (int argc, char *argv[])
{
  Gsasl *ctx = NULL;
  int rc;
...
  rc = gsasl_init (&ctx);
  if (rc != GSASL_OK)
    {
      printf ("SASL initialization failure (%d): %s\n",
              rc, gsasl_strerror (rc));
      return 1;
    }
...
```

In order to make error messages from `gsasl_strerror` be translated (see *GNU Gettext*) the application must set the current locale using `setlocale` before calling `gsasl_init`. For example:

```
int
main (int argc, char *argv[])
{
  Gsasl *ctx = NULL;
```

```
  int rc;
...
  setlocale (LC_ALL, "");
...
  rc = gsasl_init (&ctx);
  if (rc != GSASL_OK)
    {
      printf (gettext ("SASL initialization failure (%d): %s\n"),
              rc, gsasl_strerror (rc));
      return 1;
    }
...
```

In order to take advantage of the secure memory features in Libgcrypt[1], you need to initialize secure memory in your application, and for some platforms even make your application setuid root. See the Libgcrypt documentation for more information. Here is example code to initialize secure memory in your code:

```
#include <gcrypt.h>
...
int
main (int argc, char *argv[])
{
  Gsasl *ctx = NULL;
  int rc;
...
  /* Check version of libgcrypt. */
  if (!gcry_check_version (GCRYPT_VERSION))
    die ("version mismatch\n");

  /* Allocate a pool of 16k secure memory.  This also drops priviliges
     on some systems. */
  gcry_control (GCRYCTL_INIT_SECMEM, 16384, 0);

  /* Tell Libgcrypt that initialization has completed. */
  gcry_control (GCRYCTL_INITIALIZATION_FINISHED, 0);
...
  rc = gsasl_init (&ctx);
  if (rc != GSASL_OK)
    {
      printf ("SASL initialization failure (%d): %s\n",
              rc, gsasl_strerror (rc));
      return 1;
    }
...
```

[1] Note that GNU SASL normally use its own internal implementation of the cryptographic functions. Take care to verify that GNU SASL really use Libgcrypt, if this is what you want.

If you do not do this, keying material will not be allocated in secure memory (which, for most applications, is not the biggest secure problem anyway). Note that the GNU SASL Library has not been audited to make sure it stores passwords or keys in secure memory.

2.3 Version Check

It is often desirable to check that the version of the library used is indeed one which fits all requirements. Even with binary compatibility, new features may have been introduced but, due to problem with the dynamic linker, an old version may actually be used. So you may want to check that the version is okay right after program startup.

gsasl_check_version

`const char * gsasl_check_version` (*const char * `req_version`*) [Function]

req_version: version string to compare with, or NULL.

Check GNU SASL Library version.

See `GSASL_VERSION` for a suitable `req_version` string.

This function is one of few in the library that can be used without a successful call to `gsasl_init()` .

Return value: Check that the version of the library is at minimum the one given as a string in `req_version` and return the actual version string of the library; return NULL if the condition is not met. If NULL is passed to this function no check is done and only the version string is returned.

The normal way to use the function is to put something similar to the following early in your `main`:

```
if (!gsasl_check_version (GSASL_VERSION))
  {
    printf ("gsasl_check_version failed:\n"
            "Header file incompatible with shared library.\n");
    exit(1);
  }
```

2.4 Building the source

If you want to compile a source file including the `gsasl.h` header file, you must make sure that the compiler can find it in the directory hierarchy. This is accomplished by adding the path to the directory in which the header file is located to the compilers include file search path (via the `-I` option).

However, the path to the include file is determined at the time the source is configured. To solve this problem, the library uses the external package `pkg-config` that knows the path to the include file and other configuration options. The options that need to be added to the compiler invocation at compile time are output by the `--cflags` option to `pkg-config libgsasl`. The following example shows how it can be used at the command line:

```
gcc -c foo.c `pkg-config libgsasl --cflags`
```

Adding the output of '`pkg-config libgsasl --cflags`' to the compiler command line will ensure that the compiler can find the `gsasl.h` header file.

A similar problem occurs when linking the program with the library. Again, the compiler has to find the library files. For this to work, the path to the library files has to be added to the library search path (via the `-L` option). For this, the option `--libs` to `pkg-config libgsasl` can be used. For convenience, this option also outputs all other options that are required to link the program with the library (for instance, the '`-lidn`' option). The example shows how to link `foo.o` with the library to a program `foo`.

```
gcc -o foo foo.o `pkg-config libgsasl --libs`
```

Of course you can also combine both examples to a single command by specifying both options to `pkg-config`:

```
gcc -o foo foo.c `pkg-config libgsasl --cflags --libs`
```

2.5 Autoconf tests

If you work on a project that uses Autoconf (see Section "top" in `autoconf`) to help find installed libraries, the suggestions in the previous section are not the entire story. There are a few methods to detect and incorporate the GNU SASL Library into your Autoconf based package. The preferred approach, is to use Libtool in your project, and use the normal Autoconf header file and library tests.

2.5.1 Autoconf test via '`pkg-config`'

If your audience is a typical GNU/Linux desktop, you can often assume they have the '`pkg-config`' tool installed, in which you can use its Autoconf M4 macro to find and set up your package for use with Libgsasl. The following example illustrates this scenario.

```
AC_ARG_ENABLE(gsasl,
  AC_HELP_STRING([--disable-gsasl], [don't use GNU SASL]),
  gsasl=$enableval)
if test "$gsasl" != "no" ; then
  PKG_CHECK_MODULES(GSASL, libgsasl >= 1.10.0,
    [gsasl=yes],
    [gsasl=no])
  if test "$gsasl" != "yes" ; then
    gsasl=no
    AC_MSG_WARN([Cannot find GNU SASL, disabling])
  else
    gsasl=yes
    AC_DEFINE(USE_GSASL, 1, [Define to 1 if you want GNU SASL.])
  fi
fi
AC_MSG_CHECKING([if GNU SASL should be used])
AC_MSG_RESULT($gsasl)
```

2.5.2 Standalone Autoconf test using Libtool

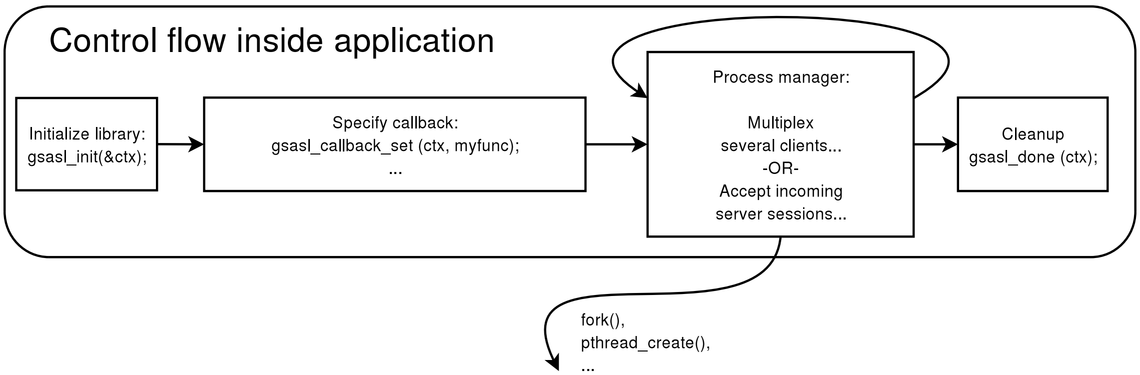
If your package uses Libtool (see Section "top" in `libtool`), you can use the normal Autoconf tests to find Libgsasl and rely on the Libtool dependency tracking to include the proper dependency libraries (e.g., Libidn). The following example illustrates this scenario.

```
AC_CHECK_HEADER(gsasl.h,
```

```
  AC_CHECK_LIB(gsasl, gsasl_check_version,
    [gsasl=yes AC_SUBST(GSASL_LIBS, -lgsasl)],
    gsasl=no),
  gsasl=no)
AC_ARG_ENABLE(gsasl,
  AC_HELP_STRING([--disable-gsasl], [don't use GNU SASL]),
  gsasl=$enableval)
if test "$gsasl" != "no" ; then
  AC_DEFINE(USE_SASL, 1, [Define to 1 if you want GNU SASL.])
else
  AC_MSG_WARN([Cannot find GNU SASL, diabling])
fi
AC_MSG_CHECKING([if GNU SASL should be used])
AC_MSG_RESULT($gsasl)
```

3 Using the Library

Your application's use of the library can be roughly modeled into the following steps: initialize the library, optionally specify the callback, perform the authentication, and finally clean up. The following image illustrates this.



The third step may look complex, but for a simple client it will actually not involve any code. If your application needs to handle several concurrent clients, or if it is a server that needs to serve many clients simultaneous, things do get a bit more complicated.

For illustration, we will write a simple client. Writing a server would be similar, the only difference is that, later on, instead of supplying a username and password, you need to decide whether someone should be allowed to log in or not. The code for what we have discussed so far make up the `main` function in our client (see Section 13.1 [Example 1], page 55):

```
int main (int argc, char *argv[])
{
  Gsasl *ctx = NULL;
  int rc;

  if ((rc = gsasl_init (&ctx)) != GSASL_OK)
    {
      printf ("Cannot initialize libgsasl (%d): %s",
              rc, gsasl_strerror (rc));
      return 1;
    }

  client (ctx);

  gsasl_done (ctx);

  return 0;
}
```

Here, the call to the function `client` correspond to the third step in the image above.

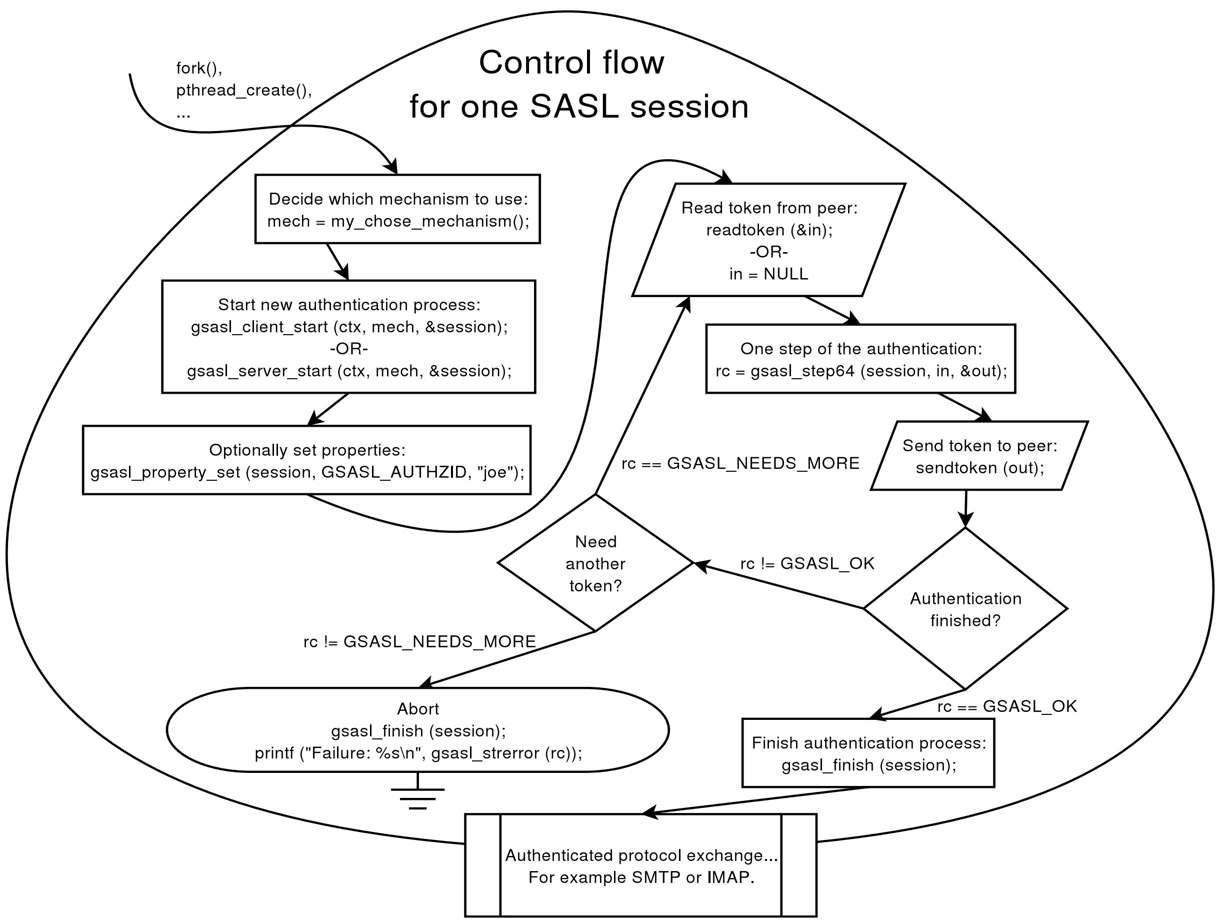
For a more complicated application, having several clients running simultaneous, instead of a simple call to `client`, it may have created new threads for each session, and call `client` within each thread. The library is thread safe.

An actual authentication session is more complicated than what we have seen so far. These are the steps: decide which mechanism to use, start the session, optionally specify the callback, optionally set any properties, perform the authentication loop, and clean up. Naturally, your application will start to talk its own protocol (e.g., SMTP or IMAP) after these steps have concluded.

The authentication loop is based on sending tokens (typically short messages encoded in base 64) back and forth between the client and server. It continues until authentication succeeds or an error occurs. The format of the data to be transferred, the number of iterations in the loop, and other details are specified by each mechanism. The goal of the library is to isolate your application from the details of all different mechanisms.

Note that the library does not send data to the server itself, but returns it in an buffer. You must send it to the server, following an application protocol profile. For example, the SASL application protocol profile for SMTP is described in RFC 2554.

The following image illustrates the steps we have been talking about.



We will now show the implementation of the `client` function used before.

```
void client (Gsasl *ctx)
```

```
{
  Gsasl_session *session;
  const char *mech = "PLAIN";
  int rc;

  /* Create new authentication session. */
  if ((rc = gsasl_client_start (ctx, mech, &session)) != GSASL_OK)
    {
      printf ("Cannot initialize client (%d): %s\n",
              rc, gsasl_strerror (rc));
      return;
    }

  /* Set username and password in session handle.  This info will be
     lost when this session is deallocated below.  */
  gsasl_property_set (session, GSASL_AUTHID, "jas");
  gsasl_property_set (session, GSASL_PASSWORD, "secret");

  /* Do it. */
  client_authenticate (session);

  /* Cleanup. */
  gsasl_finish (session);
}
```

This function is responsible for deciding which mechanism to use. In this case, the 'PLAIN' mechanism is hard coded, but you will see later how this can be made more flexible. The function creates a new session, then it stores the username and password in the session handle, then it calls another function `client_authenticate` to handle the authentication loop, and finally it cleans up up. Let's continue with the implementation of `client_authenticate`.

```
void client_authenticate (Gsasl_session * session)
{
  char buf[BUFSIZ] = "";
  char *p;
  int rc;

  /* This loop mimics a protocol where the server sends data
     first. */

  do
    {
      printf ("Input base64 encoded data from server:\n");
      fgets (buf, sizeof (buf) - 1, stdin);
      if (buf[strlen (buf) - 1] == '\n')
        buf[strlen (buf) - 1] = '\0';
```

```
          rc = gsasl_step64 (session, buf, &p);

          if (rc == GSASL_NEEDS_MORE || rc == GSASL_OK)
            {
              printf ("Output:\n%s\n", p);
              free (p);
            }
        }
      while (rc == GSASL_NEEDS_MORE);

      printf ("\n");

      if (rc != GSASL_OK)
        {
          printf ("Authentication error (%d): %s\n",
                  rc, gsasl_strerror (rc));
          return;
        }

      /* The client is done.  Here you would typically check if the
         server let the client in.  If not, you could try again. */

      printf ("If server accepted us, we're done.\n");
    }
```

This last function needs to be discussed in some detail. First, you should be aware that there are two versions of this function, that differ in a subtle way. The version above (see Section 13.2 [Example 2], page 57) is used for application profiles where the server sends data first. For some mechanisms, this may waste a roundtrip, because the server needs input from the client to proceed. Therefor, today the recommended approach is to permit client to send data first (see Section 13.1 [Example 1], page 55). Which version you should use depends on which application protocol you are implementing.

Further, you should realize that it is bad programming style to use a fixed size buffer. On GNU systems, you may use the `getline` functions instead of `fgets`. However, in practice, there are few mechanisms that use very large tokens. In typical configurations, the mechanism with the largest tokens (GSSAPI) can use at least 500 bytes. A fixed buffer size of 8192 bytes may thus be sufficient for now. But don't say I didn't warn you, when a future mechanism doesn't work in your application, because of a fixed size buffer.

The function `gsasl_step64` (and of course also `gasl_step`) returns two non-error return codes. `GSASL_OK` is used for success, indicating that the library considers the authentication finished. That may include a successful server authentication, depending on the mechanism. You must not let the client continue to the application protocol part unless you receive `GSASL_OK` from these functions. In particular, don't be fooled into believing authentication were successful if the server replies "OK" but these functions have failed with an error. The server may have been hacked, and could be tricking you into sending confidential data, without having successfully authenticated the server.

The non-error return code GSASL_NEEDS_MORE is used to signal to your application that you should send the output token to the peer, and wait for a new token, and do another iteration. If the server concludes the authentication process, with no data, you should call gsasl_step64 (or gsasl_step) specifying a zero-length token.

If the functions (gsasl_step and gsasl_step64) return any non-error code, the content of the output buffer is undefined. Otherwise, it is the callers responsibility to deallocate the buffer, by calling free. Note that in some situations, where the buffer is empty, NULL is returned as the buffer value. You should treat this as an empty buffer.

3.1 Choosing a mechanism

Our earlier code was hard coded to use a specific mechanism. This is rarely a good idea. Instead, it is recommended to select the best mechanism available from the list of mechanisms supported by the server. Note that without TLS or similar, the list may have been maliciously altered, by an attacker. This means that you should abort if you cannot find any mechanism that exceeds your minimum security level. There is a function gsasl_client_suggest_mechanism (see Chapter 6 [Global Functions], page 36) that will try to pick the "best" available mechanism from a list of mechanisms. Our simple interactive example client (see Section 13.3 [Example 3], page 60) includes the following function to decide which mechanism to use. Note that the code doesn't blindly use what is returned from gsasl_client_suggest_mechanism, rather it lets some logic (in this case the user, through an interactive query) decide which mechanism is acceptable.

```
const char *client_mechanism (Gsasl *ctx)
{
  static char mech[GSASL_MAX_MECHANISM_SIZE + 1] = "";
  char mechlist[BUFSIZ] = "";
  const char *suggestion;

  printf ("Enter list of server supported mechanisms, separate by SPC:\n");
  fgets (mechlist, sizeof (mechlist) - 1, stdin);

  suggestion = gsasl_client_suggest_mechanism (ctx, mechlist);
  if (suggestion)
    printf ("Library suggests use of ‘%s’.\n", suggestion);

  printf ("Enter mechanism to use:\n");
  fgets (mech, sizeof (mech) - 1, stdin);
  mech[strlen (mech) - 1] = ’\0’;

  return mech;
}
```

When running this example code, it might look like in the following output.

```
Enter list server supported mechanisms, separate by SPC:
CRAM-MD5 DIGEST-MD5 GSSAPI FOO BAR
Library suggests use of ‘GSSAPI’.
Enter mechanism to use:
```

```
CRAM-MD5
Input base64 encoded data from server:
Zm5vcmQ=
Output:
amFzIDkyY2U1NWE5MTM2ZTY4NzEyMTUyZTFjYmFmNjVkZjgx

If server accepted us, we're done.
```

3.2 Using a callback

Our earlier code specified the username and password before the authentication loop, as in:

```
gsasl_property_set (ctx, GSASL_AUTHID, "jas");
gsasl_property_set (ctx, GSASL_PASSWORD, "secret");
```

This may work for simple mechanisms, that need only a username and a password. But some mechanism requires more information, such as an authorization identity, a special PIN or passcode, a realm, a hostname, a service name, or an anonymous identifier. Querying the user for all that information, without knowing exactly which of it is really needed will result in a poor user interface. The user should not have to input private information, if it isn't required.

The approach is a bad idea for another reason. What if the server aborts the authentication process? Then your application has already queried the user for a username and password. It would be better if you only asked the user for this information, annoying to input, when it is known to be needed.

A better approach to this problem is to use a callback. Then the mechanism may query your application whenever it needs some information, like the username and password. It will only do this at the precise step in the authentication when the information is actually needed. Further, if the user aborts, e.g., a password prompt, the mechanism is directly informed of this (because it invoked the callback), and could recover somehow.

Our final example (see Section 13.4 [Example 4], page 63) specifies a callback function, inside `main` as below.

```
/* Set the callback handler for the library. */
gsasl_callback_set (ctx, callback);
```

The function itself is implemented as follows.

```
int callback (Gsasl * ctx, Gsasl_session * sctx, Gsasl_property prop)
{
  char buf[BUFSIZ] = "";
  int rc = GSASL_NO_CALLBACK;

  /* Get user info from user. */

  printf ("Callback invoked, for property %d.\n", prop);

  switch (prop)
    {
    case GSASL_PASSCODE:
```

```
          printf ("Enter passcode:\n");
          fgets (buf, sizeof (buf) - 1, stdin);
          buf[strlen (buf) - 1] = '\0';

          gsasl_property_set (sctx, GSASL_PASSCODE, buf);
          rc = GSASL_OK;
          break;

        case GSASL_AUTHID:
          printf ("Enter username:\n");
          fgets (buf, sizeof (buf) - 1, stdin);
          buf[strlen (buf) - 1] = '\0';

          gsasl_property_set (sctx, GSASL_AUTHID, buf);
          rc = GSASL_OK;
          break;

        default:
          printf ("Unknown property!  Don't worry.\n");
          break;
        }

      return rc;
    }
```

Again, it is bad style to use a fixed size buffer. Mmm'kay.

Which properties you should handle is up to you. If you don't know how to respond to a certain property, simply return `GSASL_NO_CALLBACK`. The basic properties to support are authentication identity (`GSASL_AUTHID`), authorization identity (`GSASL_AUTHZID`), and password (`GSASL_PASSWORD`). See Chapter 4 [Properties], page 22, for the list of all properties, and what your callback should (ideally) do for them, and which properties each mechanism require in order to work.

4 Properties

The library uses a concept called "properties" to request and pass data between the application and the individual authentication mechanisms. The application can set property values using the `gsasl_property_set` function. If a mechanism needs a property value the application has not yet provided, this is handled through a callback. The application provides a callback, using `gsasl_callback_set`, which will be invoked with a property parameter. The callback should set the property before returning, or fail. See Chapter 7 [Callback Functions], page 38, for more information.

There are two kind of properties. The first, a "data property" is the simplest to understand because it normally refers to short strings. For example, the property called `GSASL_AUTHID` correspond to the username string, e.g., `simon`.

The latter properties, called "logical properties", are used by the server to make a authentication decision, and is used as a way to get the application callback invoked. For example, the property `GSASL_VALIDATE_SIMPLE` is used by the server-side part of mechanisms like `PLAIN`. The purpose is to ask the server application to decide whether the user should be authenticated successfully or not. The callback typically look at other property fields, such as `GSASL_AUTHID` and `GSASL_PASSWORD`, and compare those values with external information (for example data stored in a database or on a LDAP server) and then return OK or not.

> **Warning:** Don't expect that all mechanisms invoke one of the "logical properties" in the server mode. For example, the CRAM-MD5 and SCRAM-SHA-1 mechanisms will use the data properties (i.e., username and password) provided by the application to internally decide whether to successfully authenticate the user. User authorization decisions needs to be made by the application outside of the SASL mechanism negotiation.

The logical properties are currently only used by servers, but data properties are used by both client and servers. It makes sense to think about the latter category as '`server properties`' but the reverse is not valid nor useful.

The semantics associated with a data property is different when it is used in client context and in the server context. For example, in the client context, the application is expected to set the property `GSASL_AUTHID` to signal to the mechanism the username to use, but in the server context, the `GSASL_AUTHID` property is set by the mechanism and can be used by the application (in the callback) to find out what username the client provided.

Below is a list of all properties and an explanation for each. First is the list of data properties:

- `GSASL_AUTHID`

  The authentication identity.
- `GSASL_AUTHZID`

  The authorization identity.
- `GSASL_PASSWORD`

  The password of the authentication identity.
- `GSASL_ANONYMOUS_TOKEN`

  The anonymous token. This is typically the email address of the user.

- `GSASL_SERVICE`

  The registered GSSAPI service name of the application service, e.g. "imap". While the names are registered for GSSAPI, other mechanisms such as DIGEST-MD5 may also use this.

- `GSASL_HOSTNAME`

  Should be the local host name of the machine.

- `GSASL_GSSAPI_DISPLAY_NAME`

  Contain the GSSAPI "display name", set by the server GSSAPI mechanism. Typically you retrieve this property in your callback, when invoked for `GSASL_VALIDATE_GSSAPI`.

- `GSASL_REALM`

  The name of the authentication domain. This is used by several mechanisms, including DIGEST-MD5, GSS-API, KERBEROS_V5 and NTLM.

- `GSASL_PASSCODE`

  The SecurID passcode.

- `GSASL_PIN`

  The SecurID personal identification number (PIN).

- `GSASL_SUGGESTED_PIN`

  A SecurID personal identification number (PIN) suggested by the server.

- `GSASL_DIGEST_MD5_HASHED_PASSWORD`

  For the DIGEST-MD5 mechanism, this is a hashed password. It is used in servers to avoid storing clear-text credentials.

- `GSASL_QOPS`

  The DIGEST-MD5 server query for this property to get the set of quality of protection (QOP) values to advertise. The property holds strings with comma separated keywords denoting the set of qops to use, for example `qop-auth, qop-int`. Valid keywords are `qop-auth`, `qop-int`, and `qop-conf`.

- `GSASL_QOP`

  The DIGEST-MD5 client query for this property to get the quality of protection (QOP) values to request. The property value is one of the keywords for `GSASL_QOPS`. The client must chose one of the QOP values offered by the server (which may be inspected through the `GSASL_QOPS` property).

- `GSASL_SCRAM_SALTED_PASSWORD`

  In a client, the SCRAM mechanism (see Section 5.7 [SCRAM], page 30) will request this property from the application. The value should be hex-encoded string (40 characters for SCRAM-SHA-1 and 64 characters for SCRAM-SHA-256) with the user's PBKDF2-prepared password. Note that the value is different for the same password for each value of the `GSASL_SCRAM_ITER` and `GSASL_SCRAM_SALT` properties. The property can be used to avoid storing a clear-text credential in the client, however note that an attacker who steal it may impersonate both a SCRAM client and SCRAM server. If the property is not available, the mechanism will ask for the `GSASL_PASSWORD` property instead.

The GSASL_SCRAM_SALTED_PASSWORD property is set by the SCRAM mechanism if it derived the value from a GSASL_PASSWORD value supplied during authentication. Thus, the application may cache this value for future authentication attempts.

- GSASL_SCRAM_ITER
- GSASL_SCRAM_SALT

  In the server, the application can set these properties to influence the hash iteration count and hash salt to use when deriving the password in the SCRAM mechanism (see Section 5.7 [SCRAM], page 30). The default hash iteration count is 4096 and often you should use a higher value. The salt should be a base64-encoded string with random data, typical length 4 to 16 bytes.

  In the client, the SCRAM mechanism set these properties (using values received from the server) before asking the application to provide a GSASL_SCRAM_SALTED_PASSWORD value.

  After the final authentication step, the properties are set by the mechanism, to allow the application to retrieve the values used (required when storing the GSASL_SCRAM_SALTED_PASSWORD value, for example).

- GSASL_SCRAM_SERVERKEY
- GSASL_SCRAM_STOREDKEY

  These properties are requested by the SCRAM server mechanism (see Section 5.7 [SCRAM], page 30), and if they are not available it will ask for GSASL_PASSWORD to complete authentication. The values are base64-encoded strings (28 characters for SCRAM-SHA-1 and 44 characters for SCRAM-SHA-256) with the ServerKey/StoredKey data. The properties are set after completing the final authentication step; so if GSASL_PASSWORD was used for authentication the application may extract GSASL_SCRAM_SERVERKEY and GSASL_SCRAM_STOREDKEY to use these values in a future authentication instead of the password. The values can be calculated using gsasl_scram_secrets_from_password, gsasl_scram_secrets_from_salted_password (see Chapter 10 [Utilities], page 45) or using the --mkpasswd parameter for the gsasl utility (see Chapter 15 [Invoking gsasl], page 76).

- GSASL_CB_TLS_UNIQUE

  This property holds base64 encoded tls-unique channel binding data. As a hint, if you use GnuTLS, the API gnutls_session_channel_binding can be used to extract channel bindings for a session. To be secure, a TLS channel MUST have the session hash extension (RFC 7627) negotiated, or session resumption MUST NOT have been used. The library cannot enforce this, so it is up to the application to only provide the GSASL_CB_TLS_UNIQUE property when the condition holds.

- GSASL_SAML20_IDP_IDENTIFIER

  This property holds the SAML identifier of the user. The SAML20 mechanism in client mode will send it to the other end for identification purposes, and in server mode it will be accessible in the GSASL_SAML20_REDIRECT_URL callback.

- GSASL_SAML20_REDIRECT_URL This property holds the SAML redirect URL that the server wants the client to access. It will be available in the GSASL_SAML20_AUTHENTICATE_IN_BROWSER callback for the client.

- GSASL_OPENID20_REDIRECT_URL This property holds the SAML redirect URL that the server wants the client to access. It will be available in the GSASL_OPENID20_AUTHENTICATE_IN_BROWSER callback for the client.
- GSASL_OPENID20_OUTCOME_DATA OpenID 2.0 authentication outcome data. This is either the OpenID SREG values or a value list starting with "openid.error=" to signal error.

Next follows a list of data properties used to trigger the callback, typically used in servers to validate client credentials:

- GSASL_VALIDATE_SIMPLE

  Used by multiple mechanisms in server mode. The callback may retrieve the GSASL_AUTHID, GSASL_AUTHZID and GSASL_PASSWORD property values and use them to make an authentication and authorization decision.
- GSASL_VALIDATE_EXTERNAL

  Used by EXTERNAL mechanism on the server side to validate the client. The GSASL_AUTHID will contain the authorization identity of the client.
- GSASL_VALIDATE_ANONYMOUS

  Used by ANONYMOUS mechanism on the server side to validate the client. The GSASL_ANONYMOUS_TOKEN will contain token that identity the client.
- GSASL_VALIDATE_GSSAPI

  Used by the GSSAPI and GS2-KRB5 mechanisms on the server side, to validate the client. You may retrieve the authorization identity from GSASL_AUTHZID and the GSS-API display name from GSASL_GSSAPI_DISPLAY_NAME.
- GSASL_VALIDATE_SECURID

  Used by SECURID mechanism on the server side to validate client. The GSASL_AUTHID, GSASL_AUTHZID, GSASL_PASSCODE, and GSASL_PIN will be set. It can return GSASL_SECURID_SERVER_NEED_ADDITIONAL_PASSCODE to ask the client to supply another passcode, and GSASL_SECURID_SERVER_NEED_NEW_PIN to require the client to supply a new PIN code.
- GSASL_VALIDATE_SAML20

  Used by the SAML20 mechanism on the server side to request that the application perform authentication. The callback should return GSASL_OK if the user should be permitted access, and GSASL_AUTHENTICATION_ERROR (or another error code) otherwise.
- GSASL_VALIDATE_OPENID20

  Used by the OPENID20 mechanism on the server side to request that the application perform authentication. The callback should return GSASL_OK if the user should be permitted access, and GSASL_AUTHENTICATION_ERROR (or another error code) otherwise.
- GSASL_SAML20_AUTHENTICATE_IN_BROWSER Used by the SAML20 mechanism in the client side to request that the client should launch the SAML redirect URL (the GSASL_SAML20_REDIRECT_URL property) in a browser to continue with authentication.
- GSASL_OPENID20_AUTHENTICATE_IN_BROWSER Used by the OPENID20 mechanism in the client side to request that the client should launch the OpenID redirect URL (the

GSASL_OPENID20_REDIRECT_URL property) in a browser to continue with authentication.

5 Mechanisms

Different SASL mechanisms have different requirements on the application using it. To handle these differences the library can use a callback function into your application in several different ways. Some mechanisms, such as 'PLAIN', are simple to explain and use. The client callback queries the user for a username and password. The server callback hands the username and password into any local policy deciding authentication system (such as `/etc/passwd` via PAM).

Mechanism such as 'CRAM-MD5' and 'SCRAM-SHA-256' uses hashed passwords. The client callback behaviour is the same as for PLAIN. However, the server does not receive the plain text password over the network but rather a hash of it. Existing policy deciding systems like PAM cannot handle this, so the server callback for these mechanisms are more complicated.

Further, mechanisms like GSSAPI/GS2-KRB5 (Kerberos 5) assume a specific authentication system. In theory this means that the SASL library would not need to interact with the application, but rather call this specific authentication system directly. However, some callbacks are supported anyway, to modify the behaviour of how the specific authentication system is used (i.e., to handle "super-user" login as some other user).

Some mechanisms, like 'EXTERNAL' and 'ANONYMOUS' are entirely dependent on callbacks.

5.1 The EXTERNAL mechanism

The EXTERNAL mechanism is used to authenticate a user to a server based on out-of-band authentication. EXTERNAL is typically used over TLS authenticated channels. Note that in the server, you need to make sure that TLS actually authenticated the client successfully and that the negotiated ciphersuite and other parameters are acceptable. It is generally not sufficient that TLS is used, since TLS supports anonymous and other variants that generally provide less assurance than you normally want.

In the client, this mechanism is always enabled, and it will send the `GSASL_AUTHZID` property as the authorization name to the server, if the property is set. If the property is not set, an empty authorization name is sent. You need not implement a callback.

In the server, this mechanism will request the `GSASL_VALIDATE_EXTERNAL` callback property to decide whether the client is authenticated and authorized to log in. Your callback can retrieve the `GSASL_AUTHZID` property to inspect the requested authorization name from the client.

The EXTERNAL mechanism was initially specified in the core SASL framework RFC 2222 and later revised in RFC 4422.

5.2 The ANONYMOUS mechanism

The ANONYMOUS mechanism is used to "authenticate" clients to anonymous services; or rather, just indicate that the client wishes to use the service anonymously. The client sends a token, usually her email address, which serve the purpose of some trace information suitable for logging. The token cannot be empty.

In the client, this mechanism is always enabled, and will send the `GSASL_ANONYMOUS_TOKEN` property as the trace information to the server.

In the server, this mechanism will invoke the GSASL_VALIDATE_ANONYMOUS callback to decide whether the client should be permitted to log in. Your callback can retrieve the GSASL_ANONYMOUS_TOKEN property to, for example, record it in a log file. The token is normally not used to decide whether the client should be permitted to log in or not.

The ANONYMOUS mechanism was initially specified in RFC 2245 and later revised in RFC 4505.

5.3 The PLAIN mechanism

The PLAIN mechanism uses username and password to authenticate users. Two user names are relevant. The first, the authentication identity, indicates the credential holder, i.e., whom the provided password belongs to. The second, the authorization identity, is typically empty to indicate that the user requests to log on to the server as herself (i.e., the authentication identity). If the authorization identity is not empty, the server should decide whether the authenticated user may log on as the authorization identity. This is typically used for super-user accounts like 'admin' to take on the role of a regular user.

In the client, this mechanism is always enabled, and require the GSASL_AUTHID and GSASL_PASSWORD properties. If set, GSASL_AUTHZID will also be used.

In the server, the mechanism is always enabled. Two approaches to authenticate and authorize the client are provided.

In the first approach, the server side of the mechanism will request the GSASL_VALIDATE_SIMPLE callback property to decide whether the client should be accepted or not. The callback may inspect the GSASL_AUTHID, GSASL_AUTHZID, and GSASL_PASSWORD properties. These property values will be normalized.

If the first approach fails (because there is no callback or your callback returns 'GSASL_NO_CALLBACK' to signal that it does not implement GSASL_VALIDATE_SIMPLE) the mechanism will continue to query the application for a password, via the GSASL_PASSWORD property. Your callback may use the GSASL_AUTHID and GSASL_AUTHZID properties to select the proper password. The password is then normalized and compared to the client credential.

Which approach to use? If your database stores hashed passwords, you have no option, but must use the first approach. If passwords in your user database are stored in prepared (SASLprep) form, the first approach will be faster. If you do not have prepared passwords available, you can use the second approach to make sure the password is prepared properly before comparison.

The PLAIN mechanism was initially specified in RFC 2595 and later revised in RFC 4616.

5.4 The LOGIN mechanism

The LOGIN mechanism is a non-standard mechanism, and is similar to the PLAIN mechanism except that LOGIN lacks the support for authorization identities. Always use PLAIN instead of LOGIN in new applications.

The callback behaviour is the same as for PLAIN, except that GSASL_AUTHZID is neither used nor required, and that the server does not normalize the password using SASLprep.

See Section A.2 [Use of SASLprep in LOGIN], page 80, for a proposed clarification of the interpretation of a hypothetical LOGIN specification.

5.5 The CRAM-MD5 mechanism

CRAM-MD5 is a widely used challenge-response mechanism that transfers hashed passwords instead of clear text passwords. It is official deprecated, initially in favor of first DIGEST-MD5 but today SCRAM-SHA-1. For insecure channels (e.g., when TLS is not used), it is has better properties than PLAIN since the unhashed password is not leaked. The CRAM-MD5 mechanism does not support authorization identities; that make the relationship between CRAM-MD5 and DIGEST-MD5/SCRAM-SHA-* similar to the relationship between LOGIN and PLAIN.

The disadvantage with hashed passwords is that the server cannot use normal authentication infrastructures such as PAM, because the server must have access to the unhashed password in order to validate every authentication attempt.

In the client, this mechanism is always enabled, and it requires the `GSASL_AUTHID` and `GSASL_PASSWORD` properties.

In the server, the mechanism will require the `GSASL_PASSWORD` callback property, which may use the `GSASL_AUTHID` property to determine which users' password should be used. The `GSASL_AUTHID` will be in normalized form. The server will then normalize the password, and compare the client response with the computed correct response, and accept the user accordingly.

See Section A.1 [Use of SASLprep in CRAM-MD5], page 80, for a clarification on the interpretation of the CRAM-MD5 specification that this implementation rely on.

The CRAM-MD5 mechanism was initially specified in RFC 2095 but quickly revised in RFC 2195. Note that both were published before the core SASL framework, which explains its lack of authorization identity.

5.6 The DIGEST-MD5 mechanism

The DIGEST-MD5 mechanism is based on repeated hashing using MD5. After the MD5 break may be argued to be weaker than HMAC-MD5 that CRAM-MD5 builds on, but DIGEST-MD5 supports other features. For example, authorization identities and data integrity and privacy protection are supported. Like CRAM-MD5, only a hashed password is transferred. Consequently, DIGEST-MD5 needs access to the correct password to verify the client response – however the server can store the password in hashed form, another improvement compared to CRAM-MD5 . Alas, this makes it impossible to use, e.g., PAM on the server side.

In the client, this mechanism is always enabled, and it requires the `GSASL_AUTHID`, `GSASL_PASSWORD`, `GSASL_SERVICE`, and `GSASL_HOSTNAME` properties. If set, `GSASL_AUTHZID` and `GSASL_REALM` will also be used.

In the server, the mechanism will first request the `GSASL_DIGEST_MD5_HASHED_PASSWORD` callback property to get the user's hashed password. If the callback doesn't supply a hashed password (i.e., it returns '`GSASL_NO_CALLBACK`'), the `GSASL_PASSWORD` callback property will be requested. Both callbacks may use the `GSASL_AUTHID`, `GSASL_AUTHZID` and `GSASL_REALM` properties to determine which users' password should be used. The server will then compare the client response with a computed correct response, and accept the user accordingly.

The server uses the GSASL_QOPS callback to get the set of quality of protection values to use. By default, it advertises support for authentication (qop-auth) only. You can use the callback, for example, to make the server advertise support for authentication with integrity layers.

The client uses the GSASL_QOP callback to get the quality of protection value to request. The client must choose one of the QOP values offered by the server (which may be inspected through the GSASL_QOPS property). If the client does not return a value, qop-auth is used by default.

The security layers of DIGEST-MD5 are rarely used in practice due to interoperability and security reasons. You are recommended to use TLS instead.

The DIGEST-MD5 mechanism is specified in RFC 2831. RFC 6331 labels DIGEST-MD5 as historic and it contains a good exposition of the disadvantages with DIGEST-MD5.

5.7 The SCRAM mechanisms

SCRAM is a family of mechanisms and we support SCRAM-SHA-1 and SCRAM-SHA-256. They differ only in the use of underlying hash function, SHA-1 and SHA-256 respectively. Channel bindings are supported through the SCRAM-SHA-1-PLUS and SCRAM-SHA-256-PLUS mechanisms, and will bind the authentication to a particular TLS channel. SCRAM provides mutual authentication, i.e., after a succesful authentication the client will know that the server knows the password, and the server will know that the client knows the password. Further, this can be achieved without storing the password in clear text on either side.

The SCRAM family is designed to provide the same capabilities that CRAM-MD5 and DIGEST-MD5 provides but with modern cryptographic techniques such as HMAC hashing and PKCS#5 PBKDF2 key derivation. SCRAM supports authorization identities. Like CRAM-MD5 and DIGEST-MD5, only a hashed password is transferred. Consequently, SCRAM servers needs access to the correct password (or the derived ServerKey/StoredKey) to verify the client response.

In the client, the non-PLUS mechanism is always enabled, and it requires the GSASL_AUTHID property, and either GSASL_PASSWORD or GSASL_SCRAM_SALTED_PASSWORD. When the GSASL_CB_TLS_UNIQUE property is available, the SCRAM-SHA-1-PLUS mechanism is also available and it will negotiate channel bindings when the server also supports it. If set, GSASL_AUTHZID will be used by the client. To be able to return the proper GSASL_SCRAM_SALTED_PASSWORD value, the callback needs to check the GSASL_SCRAM_ITER and GSASL_SCRAM_SALT values which are available when the GSASL_SCRAM_SALTED_PASSWORD property is queried for. The client/server may retrieve the calculated GSASL_SCRAM_SALTED_PASSWORD value by retrieving it after the final authentication step. The GSASL_SCRAM_SALTED_PASSWORD value can also be derived by using the gsasl_scram_secrets_from_password function (see Chapter 10 [Utilities], page 45), or through the --mkpasswd parameter for the gsasl utility (see Chapter 15 [Invoking gsasl], page 76).

In the server, the GSASL_AUTHID property (and, when provided by the client, the GSASL_AUTHZID property) will be set in order for the callback to retrieve the user credentials.

The server mechanism will request the GSASL_SERVERKEY and GSASL_STOREDKEY properties first, and will use them to complete authentication. Using ServerKey/StoredKey on the server make it possible for the server to avoid storing the clear-text password. If ServerKey/StoredKey is not available, the GSASL_PASSWORD property is requested, which will be used to derive the ServetKey/StoredKey secrets. The mechanism uses the credentials to authenticate the user. The application may set the GSASL_SCRAM_ITER and GSASL_SCRAM_SALT properties which allow the server to tell the clients what values to use for deriving a key from a password. When the application do not supply them, the SCRAM server will default to using a fresh random salt and an iteration count of 4096. After the final authentication step, the application may retrieve the GSASL_SCRAM_ITER, GSASL_SCRAM_SALT, GSASL_SCRAM_SALTED_PASSWORD, GSASL_SERVERKEY, and GSASL_STOREDKEY properties for potential storage in a database to avoid the need to store the cleartext password. Note that servers should normally not store GSASL_SCRAM_SALTED_PASSWORD as stealing that allow someone to impersonate the client, which is not (directly) possible otherwise. When the GSASL_CB_TLS_UNIQUE property is set, the SCRAM-*-PLUS mechanism is supported and is used to negotiate channel bindings.

The GSASL_CB_TLS_UNIQUE property signal that this side of the authentication supports channel bindings. Setting the property will enable the SCRAM-SHA-1-PLUS and SCRAM-SHA-256-PLUS mechanisms. For clients, this also instructs the SCRAM-SHA-1 and SCRAM-SHA-256 mechanism to tell servers that the client believes the server does not support channel bindings if it is used (remember that clients should otherwise have chosen the SCRAM-SHA-1-PLUS mechanism instead of the SCRAM-SHA-1 mechanism). For servers, it means the SCRAM-SHA-1/SCRAM-SHA-256 mechanism will refuse to authenticate against a client that signals that it believes the server does not support channel bindings.

The SCRAM-SHA-*-PLUS mechanisms will never complete authentication successfully if channel bindings are not confirmed.

To offer the intended security, the SCRAM-SHA-*-PLUS mechanisms MUST be used over a TLS channel that has had the session hash extension (RFC 7627) negotiated, or session resumption MUST NOT have been used. The library cannot enforce this, so it is up to the application to only provide the GSASL_CB_TLS_UNIQUE property when this condition holds.

The SCRAM-SHA-1 mechanism is specified in RFC 5802 and SCRAM-SHA-256 is specified in RFC 7677. How to store SCRAM credentials in LDAP on the server side is described in RFC 5803.

5.8 The NTLM mechanism

The NTLM is a non-standard mechanism. Do not use it in new applications, and do not expect it to be secure. Currently only the client side is supported.

In the client, this mechanism is always enabled, and it requires the GSASL_AUTHID and GSASL_PASSWORD properties. It will set the 'domain' field in the NTLM request to the value of GSASL_REALM. Some servers reportedly need non-empty but arbitrary values in that field.

5.9 The SECURID mechanism

The SECURID mechanism uses authentication and authorization identity together with a passcode from a hardware token to authenticate users.

In the client, this mechanism is always enabled, and it requires the GSASL_AUTHID and GSASL_PASSCODE properties. If set, GSASL_AUTHZID will also be used. If the server requests it, the GSASL_PIN property is also required, and its callback may inspect the GSASL_SUGGESTED_PIN property to discover a server-provided PIN to use.

In the server, this mechanism will invoke the GSASL_VALIDATE_SECURID callback. The callback may inspect the GSASL_AUTHID, GSASL_AUTHZID, and GSASL_PASSCODE properties. The callback can return GSASL_SECURID_SERVER_NEED_ADDITIONAL_PASSCODE to ask for another additional passcode from the client. The callback can return GSASL_SECURID_SERVER_NEED_NEW_PIN to ask for a new PIN code from the client, in which case it may also set the GSASL_SUGGESTED_PIN property to indicate a recommended new PIN. If the callbacks is invoked again, after having returned GSASL_SECURID_SERVER_NEED_NEW_PIN, it may also inspect the GSASL_PIN property, in addition to the other properties, to find out the client selected PIN code.

The SECURID mechanism is specified in RFC 2808.

5.10 The GSSAPI mechanism

The GSSAPI mechanism allows you to authenticate using Kerberos V5. The mechanism was originally designed to allow for any GSS-API mechanism to be used, but problems with the protocol made it unpractical and it is today restricted for use with Kerberos V5. See the GS2 mechanism (see Section 5.11 [GS2-KRB5], page 32) for a general solution. However, GSSAPI continues to be widely used in Kerberos V5 environments.

In the client, the mechanism is enabled only if the user has acquired credentials (i.e., a ticket granting ticket), and it requires the GSASL_AUTHZID, GSASL_SERVICE, and GSASL_HOSTNAME properties. (For historical reasons, if the GSASL_AUTHZID property is not specified, this mechanism checks for the GSASL_AUTHZID property and if present will use that as the authorization identity – this behaviour will be removed after the year 2012 so you should update your code to use only GSASL_AUTHZID.)

In the server, the mechanism requires the GSASL_SERVICE and GSASL_HOSTNAME properties, and it will invoke the GSASL_VALIDATE_GSSAPI callback property in order to validate the user. The callback may inspect the GSASL_AUTHZID and GSASL_GSSAPI_DISPLAY_NAME properties to decide whether to authorize the user. Note that authentication is performed by the GSS-API library and that GSASL_AUTHID is not used by the server mechanism, its role is played by GSASL_GSSAPI_DISPLAY_NAME.

This implementation does not support security layers. You are recommended to use TLS instead.

The GSSAPI mechanism was specified as part of the initial core SASL framework, in RFC 2222, but later revised in RFC 4752 to only apply to Kerberos V5.

5.11 The GS2-KRB5 mechanism

GS2 is a protocol bridge between GSS-API and SASL, and allows every GSS-API mechanism that supports mutual authentication and channel bindings to be used as a SASL mechanism. Currently GS2-KRB5 is supported, for Kerberos V5 authentication, however our GS2 implementation is flexible enough to easily support other GSS-API mechanism if any gains popularity.

In the client, the mechanism is enabled only if the user has acquired credentials (i.e., a ticket granting ticket), and it requires the `GSASL_AUTHZID`, `GSASL_SERVICE`, and `GSASL_HOSTNAME` properties.

In the server, the mechanism requires the `GSASL_SERVICE` and `GSASL_HOSTNAME` properties, and it will invoke the `GSASL_VALIDATE_GSSAPI` callback property in order to validate the user. The callback may inspect the `GSASL_AUTHZID` and `GSASL_GSSAPI_DISPLAY_NAME` properties to decide whether to authorize the user. Note that authentication is performed by the GSS-API library and that `GSASL_AUTHID` is not used by the server mechanism, its role is played by `GSASL_GSSAPI_DISPLAY_NAME`.

The GS2 framework supports a variant of each mechanism, called the PLUS variant, which can also bind the authentication to a secure channel through channel bindings. Currently this is not supported by GNU SASL.

The GS2 mechanism family was specified in RFC 5801.

5.12 The SAML20 mechanism

The SAML20 mechanism makes it possible to use SAML in SASL, in a way that offloads the authentication exchange to an external web browser.

The mechanism makes use of the following properties: `GSASL_AUTHZID`, `GSASL_SAML20_IDP_IDENTIFIER`, `GSASL_SAML20_REDIRECT_URL`, `GSASL_SAML20_AUTHENTICATE_IN_BROWSER` and `GSASL_VALIDATE_SAML20`.

In client mode, the mechanism will retrieve the `GSASL_AUTHZID` and `GSASL_SAML20_IDP_IDENTIFIER` properties and form a request to the server. The server will respond with a redirect URL stored in the `GSASL_SAML20_REDIRECT_URL` property, which the client can retrieve from the `GSASL_SAML20_AUTHENTICATE_IN_BROWSER` callback. The intention is that the client launches a browser to the given URL, and then proceeds with authentication. The server responds whether authentication was successful or not.

In server mode, the mechanism will invoke the `GSASL_SAML20_REDIRECT_URL` callback and the application can inspect the `GSASL_AUTHZID` and `GSASL_SAML20_IDP_IDENTIFIER` properties when forming the redirect URL. The URL is passed to the client which will hopefully complete authentication in the browser. The server callback `GSASL_VALIDATE_SAML20` should check whether the authentication attempt was successful.

Note that SAML itself is not implemented by the GNU SASL library. On the client side, no SAML knowledge is needed, it is only required on the server side. The client only needs to be able to start a web browser to access the redirect URL. The server side is expected to call a SAML library to generate the AuthRequest and to implement an AssertionConsumerService (ACS) to validate the AuthResponse. There is a complete proof-of-concept example of a SMTP server with SAML 2.0 support distributed with GNU SASL in the `examples/saml20/` sub-directory. The example uses the Lasso SAML implementation (`http://lasso.entrouvert.org/`) and require a web server for the ACS side. The example may be used as inspiration for your own server implementation. The `gsasl` command line client supports SAML20 as a client.

The SAML20 mechanism is specified in RFC 6595.

5.13 The OPENID20 mechanism

The OPENID20 mechanism makes it possible to use OpenID in SASL, in a way that offloads the authentication exchange to an external web browser.

The mechanism makes use of the following properties: `GSASL_AUTHID` (for the OpenID User-Supplied Identifier), `GSASL_AUTHZID`, `GSASL_OPENID20_REDIRECT_URL`, `GSASL_OPENID20_OUTCOME_DATA`, `GSASL_OPENID20_AUTHENTICATE_IN_BROWSER`, and `GSASL_VALIDATE_OPENID20`.

In the client, the mechanism is enabled by default. The `GSASL_AUTHID` property is required and should contain the User-Supplied OpenID Identifier (for example `http://josefsson.org`). If set, `GSASL_AUTHZID` will be used by the client. The client will be invoked with the `GSASL_OPENID20_AUTHENTICATE_IN_BROWSER` callback to perform the OpenID authentication in a web browser. The callback can retrieve the `GSASL_OPENID20_REDIRECT_URL` property to find out the URL to redirect the user to. After authentication, the client can retrieve the `GSASL_OPENID20_OUTCOME_DATA` property with the OpenID Simple Registry (SREG) attributes sent by the server (if any).

In the server, the mechanism is enabled by default. The server will request the `GSASL_OPENID20_REDIRECT_URL` property, and your callback may inspect the `GSASL_AUTHID` to find the OpenID User-Supplied Identifier. The server callback should perform OpenID discovery and return the URL to redirect the user to. After this, the user would access the URL and proceed with authentication in the browser. The server is invoked with the `GSASL_VALIDATE_OPENID20` callback to perform the actual validation of the authentication. Usually the callback will perform some IPC communication with an OpenID consumer running in a web server. The callback should return `GSASL_OK` on successful authentication and `GSASL_AUTHENTICATION_ERROR` on authentication errors, or any other error code. If the server received some OpenID Simple Registry (SREG) attributes from the OpenID Identity Provider, it may use the `GSASL_OPENID20_OUTCOME_DATA` property to send these to the client.

Note that OpenID itself is not implemented by the GNU SASL library. On the client side, no OpenID knowledge is required, it is only required on the server side. The client only needs to be able to start a web browser to access the redirect URL. The server side is expected to use an OpenID library to generate the redirect URL and to implement the Service Provider (SP) to validate the response from the IdP. There is a complete proof-of-concept example with a SMTP server with OpenID 2.0 support distributed with GNU SASL in the `examples/openid20/` sub-directory. It uses the JanRain PHP5 OpenID implementation and require a web server to implement the OpenID SP. The example may be used as inspiration for your own server implementation. The `gsasl` command line client supports OPENID20 as a client.

The OPENID20 mechanism is specified in RFC 6616.

5.14 The KERBEROS_V5 mechanism

The KERBEROS_V5 is an experimental mechanism, the protocol specification is available on the GNU SASL homepage. It can operate in three modes, non-infrastructure mode, infrastructure mode and proxied infrastructure mode. Currently only non-infrastructure mode is supported.

In the non-infrastructure mode, it works as a superset of most features provided by PLAIN, CRAM-MD5, DIGEST-MD5 and GSSAPI while at the same time building on what is believed to be proven technology (the RFC 1510 network security system). In the non-infrastructure mode, the client must specify (via callbacks) the name of the user, and optionally the server name and realm. The server must be able to retrieve passwords given the name of the user.

In the infrastructure mode (proxied or otherwise), it allows clients and servers to authenticate via SASL in an RFC 1510 environment, using a trusted third party, a "Key Distribution Central". In the normal mode, clients acquire tickets out of band and then invokes a one roundtrip AP-REQ and AP-REP exchange. In the proxied mode, which can be used by clients without IP addresses or without connectivity to the KDC (e.g., when the KDC is IPv4 and the client is IPV6-only), the client uses the server to proxy ticket requests and finishes with the AP-REQ/AP-REP exchange. In infrastructure mode (proxied or otherwise), neither the client nor server need to implement any callbacks (this will likely change later, to allow a server to authorize users, similar to the GSSAPI callback).

XXX: update when implementation has matured

6 Global Functions

gsasl_init

`int gsasl_init` (*Gsasl *** `ctx`) [Function]

ctx: pointer to libgsasl handle.

This functions initializes libgsasl. The handle pointed to by ctx is valid for use with other libgsasl functions iff this function is successful. It also register all builtin SASL mechanisms, using `gsasl_register()` .

Return value: GSASL_OK iff successful, otherwise `GSASL_MALLOC_ERROR` .

gsasl_done

`void gsasl_done` (*Gsasl ** `ctx`) [Function]

ctx: libgsasl handle.

This function destroys a libgsasl handle. The handle must not be used with other libgsasl functions after this call.

gsasl_client_mechlist

`int gsasl_client_mechlist` (*Gsasl ** `ctx`, *char *** `out`) [Function]

ctx: libgsasl handle.

out: newly allocated output character array.

Return a newly allocated string containing SASL names, separated by space, of mechanisms supported by the libgsasl client. `out` is allocated by this function, and it is the responsibility of caller to deallocate it.

Return value: Returns `GSASL_OK` if successful, or error code.

gsasl_server_mechlist

`int gsasl_server_mechlist` (*Gsasl ** `ctx`, *char *** `out`) [Function]

ctx: libgsasl handle.

out: newly allocated output character array.

Return a newly allocated string containing SASL names, separated by space, of mechanisms supported by the libgsasl server. `out` is allocated by this function, and it is the responsibility of caller to deallocate it.

Return value: Returns `GSASL_OK` if successful, or error code.

gsasl_client_support_p

`int gsasl_client_support_p` (*Gsasl ** `ctx`, *const char ** `name`) [Function]

ctx: libgsasl handle.

name: name of SASL mechanism.

Decide whether there is client-side support for a specified mechanism.

Return value: Returns 1 if the libgsasl client supports the named mechanism, otherwise 0.

gsasl_server_support_p

int gsasl_server_support_p (*Gsasl * **ctx**, const char * **name***) [Function]

ctx: libgsasl handle.

name: name of SASL mechanism.

Decide whether there is server-side support for a specified mechanism.

Return value: Returns 1 if the libgsasl server supports the named mechanism, otherwise 0.

gsasl_client_suggest_mechanism

const char * gsasl_client_suggest_mechanism (*Gsasl * **ctx**, const char * **mechlist***) [Function]

ctx: libgsasl handle.

mechlist: input character array with SASL mechanism names, separated by invalid characters (e.g. SPC).

Given a list of mechanisms, suggest which to use.

Return value: Returns name of "best" SASL mechanism supported by the libgsasl client which is present in the input string, or NULL if no supported mechanism is found.

gsasl_register

int gsasl_register (*Gsasl * **ctx**, const Gsasl_mechanism * **mech***) [Function]

ctx: pointer to libgsasl handle.

mech: plugin structure with information about plugin.

This function initialize given mechanism, and if successful, add it to the list of plugins that is used by the library.

Return value: `GSASL_OK` iff successful, otherwise `GSASL_MALLOC_ERROR` .

Since: 0.2.0

7 Callback Functions

The callback is used by mechanisms to retrieve information, such as username and password, from the application. In a server, the callback is used to decide whether a user is permitted to log in or not. You tell the library of your callback function by calling `gsasl_callback_set`.

Since your callback may need access to data from other parts of your application, there are hooks to store and retrieve application specific pointers. This avoids the use of global variables, which wouldn't be thread safe. You store a pointer to some information (opaque from the point of view of the library) by calling `gsasl_callback_hook_set` and can later retrieve this data in your callback by calling `gsasl_callback_hook_get`.

gsasl_callback_set

`void gsasl_callback_set` (*Gsasl * ctx*, *Gsasl_callback_function cb*) [Function]

ctx: handle received from `gsasl_init()` .

cb: pointer to function implemented by application.

Store the pointer to the application provided callback in the library handle. The callback will be used, via `gsasl_callback()` , by mechanisms to discover various parameters (such as username and passwords). The callback function will be called with a Gsasl_property value indicating the requested behaviour. For example, for `GSASL_ANONYMOUS_TOKEN` , the function is expected to invoke gsasl_property_set(`CTX` , `GSASL_ANONYMOUS_TOKEN` , "token") where "token" is the anonymous token the application wishes the SASL mechanism to use. See the manual for the meaning of all parameters.

Since: 0.2.0

gsasl_callback

`int gsasl_callback` (*Gsasl * ctx*, *Gsasl_session * sctx*, *Gsasl_property prop*) [Function]

ctx: handle received from `gsasl_init()` , may be NULL to derive it from `sctx` .

sctx: session handle.

prop: enumerated value of Gsasl_property type.

Invoke the application callback. The `prop` value indicate what the callback is expected to do. For example, for `GSASL_ANONYMOUS_TOKEN` , the function is expected to invoke gsasl_property_set(`SCTX` , `GSASL_ANONYMOUS_TOKEN` , "token") where "token" is the anonymous token the application wishes the SASL mechanism to use. See the manual for the meaning of all parameters.

Note that if no callback has been set by the application, but the obsolete callback interface has been used, this function will translate the old callback interface into the new. This interface should be sufficient to invoke all callbacks, both new and old.

Return value: Returns whatever the application callback returns, or `GSASL_NO_CALLBACK` if no application was known.

Since: 0.2.0

gsasl_callback_hook_set

`void gsasl_callback_hook_set (Gsasl * ctx, void * hook)` [Function]

ctx: libgsasl handle.

hook: opaque pointer to application specific data.

Store application specific data in the libgsasl handle.

The application data can be later (for instance, inside a callback) be retrieved by calling `gsasl_callback_hook_get()` . This is normally used by the application to maintain a global state between the main program and callbacks.

Since: 0.2.0

gsasl_callback_hook_get

`void * gsasl_callback_hook_get (Gsasl * ctx)` [Function]

ctx: libgsasl handle.

Retrieve application specific data from libgsasl handle.

The application data is set using `gsasl_callback_hook_set()` . This is normally used by the application to maintain a global state between the main program and callbacks.

Return value: Returns the application specific data, or NULL.

Since: 0.2.0

gsasl_session_hook_set

`void gsasl_session_hook_set (Gsasl_session * sctx, void * hook)` [Function]

sctx: libgsasl session handle.

hook: opaque pointer to application specific data.

Store application specific data in the libgsasl session handle.

The application data can be later (for instance, inside a callback) be retrieved by calling `gsasl_session_hook_get()` . This is normally used by the application to maintain a per-session state between the main program and callbacks.

Since: 0.2.14

gsasl_session_hook_get

`void * gsasl_session_hook_get (Gsasl_session * sctx)` [Function]

sctx: libgsasl session handle.

Retrieve application specific data from libgsasl session handle.

The application data is set using `gsasl_callback_hook_set()` . This is normally used by the application to maintain a per-session state between the main program and callbacks.

Return value: Returns the application specific data, or NULL.

Since: 0.2.14

8 Property Functions

gsasl_property_set

void gsasl_property_set (*Gsasl_session * sctx*, *Gsasl_property prop*, *const char * data*) [Function]

sctx: session handle.

prop: enumerated value of Gsasl_property type, indicating the type of data in `data` .

data: zero terminated character string to store.

Make a copy of `data` and store it in the session handle for the indicated property `prop` .

You can immediately deallocate `data` after calling this function, without affecting the data stored in the session handle.

Since: 0.2.0

gsasl_property_set_raw

void gsasl_property_set_raw (*Gsasl_session * sctx*, *Gsasl_property prop*, *const char * data*, *size_t len*) [Function]

sctx: session handle.

prop: enumerated value of Gsasl_property type, indicating the type of data in `data` .

data: character string to store.

len: length of character string to store.

Make a copy of `len` sized `data` and store a zero terminated version of it in the session handle for the indicated property `prop` .

You can immediately deallocate `data` after calling this function, without affecting the data stored in the session handle.

Except for the length indicator, this function is identical to gsasl_property_set.

Since: 0.2.0

gsasl_property_fast

const char * gsasl_property_fast (*Gsasl_session * sctx*, *Gsasl_property prop*) [Function]

sctx: session handle.

prop: enumerated value of Gsasl_property type, indicating the type of data in `data` .

Retrieve the data stored in the session handle for given property `prop` .

The pointer is to live data, and must not be deallocated or modified in any way.

This function will not invoke the application callback.

Return value: Return property value, if known, or NULL if no value known.

Since: 0.2.0

gsasl_property_get

`const char * gsasl_property_get` (*Gsasl_session * `sctx`*, *Gsasl_property `prop`*) [Function]

sctx: session handle.

prop: enumerated value of Gsasl_property type, indicating the type of data in `data` .

Retrieve the data stored in the session handle for given property `prop` , possibly invoking the application callback to get the value.

The pointer is to live data, and must not be deallocated or modified in any way.

This function will invoke the application callback, using `gsasl_callback()` , when a property value is not known.

If no value is known, and no callback is specified or if the callback fail to return data, and if any obsolete callback functions has been set by the application, this function will try to call these obsolete callbacks, and store the returned data as the corresponding property. This behaviour of this function will be removed when the obsolete callback interfaces are removed.

Return value: Return data for property, or NULL if no value known.

Since: 0.2.0

9 Session Functions

gsasl_client_start

`int gsasl_client_start` (*Gsasl * `ctx`, const char * `mech`, Gsasl_session ** `sctx`*) [Function]

ctx: libgsasl handle.

mech: name of SASL mechanism.

sctx: pointer to client handle.

This functions initiates a client SASL authentication. This function must be called before any other gsasl_client_*() function is called.

Return value: Returns `GSASL_OK` if successful, or error code.

gsasl_server_start

`int gsasl_server_start` (*Gsasl * `ctx`, const char * `mech`, Gsasl_session ** `sctx`*) [Function]

ctx: libgsasl handle.

mech: name of SASL mechanism.

sctx: pointer to server handle.

This functions initiates a server SASL authentication. This function must be called before any other gsasl_server_*() function is called.

Return value: Returns `GSASL_OK` if successful, or error code.

gsasl_step

`int gsasl_step` (*Gsasl_session * `sctx`, const char * `input`, size_t `input_len`, char ** `output`, size_t * `output_len`*) [Function]

sctx: libgsasl session handle.

input: input byte array.

input_len: size of input byte array.

output: newly allocated output byte array.

output_len: pointer to output variable with size of output byte array.

Perform one step of SASL authentication. This reads data from the other end (from `input` and `input_len`), processes it (potentially invoking callbacks to the application), and writes data to server (into newly allocated variable `output` and `output_len` that indicate the length of `output`).

The contents of the `output` buffer is unspecified if this functions returns anything other than `GSASL_OK` or `GSASL_NEEDS_MORE` . If this function return `GSASL_OK` or `GSASL_NEEDS_MORE` , however, the `output` buffer is allocated by this function, and it is the responsibility of caller to deallocate it by calling free (`output`).

Return value: Returns `GSASL_OK` if authenticated terminated successfully, `GSASL_NEEDS_MORE` if more data is needed, or error code.

gsasl_step64

`int gsasl_step64` (*Gsasl_session * sctx*, *const char * b64input*, *char ** b64output*) [Function]

sctx: libgsasl client handle.

b64input: input base64 encoded byte array.

b64output: newly allocated output base64 encoded byte array.

This is a simple wrapper around `gsasl_step()` that base64 decodes the input and base64 encodes the output.

The contents of the `b64output` buffer is unspecified if this functions returns anything other than `GSASL_OK` or `GSASL_NEEDS_MORE` . If this function return `GSASL_OK` or `GSASL_NEEDS_MORE` , however, the `b64output` buffer is allocated by this function, and it is the responsibility of caller to deallocate it by calling free (`b64output`).

Return value: Returns `GSASL_OK` if authenticated terminated successfully, `GSASL_NEEDS_MORE` if more data is needed, or error code.

gsasl_finish

`void gsasl_finish` (*Gsasl_session * sctx*) [Function]

sctx: libgsasl session handle.

Destroy a libgsasl client or server handle. The handle must not be used with other libgsasl functions after this call.

gsasl_encode

`int gsasl_encode` (*Gsasl_session * sctx*, *const char * input*, *size_t input_len*, *char ** output*, *size_t * output_len*) [Function]

sctx: libgsasl session handle.

input: input byte array.

input_len: size of input byte array.

output: newly allocated output byte array.

output_len: size of output byte array.

Encode data according to negotiated SASL mechanism. This might mean that data is integrity or privacy protected.

The `output` buffer is allocated by this function, and it is the responsibility of caller to deallocate it by calling free(`output`).

Return value: Returns `GSASL_OK` if encoding was successful, otherwise an error code.

gsasl_decode

`int gsasl_decode` (*Gsasl_session * sctx*, *const char * input*, *size_t input_len*, *char ** output*, *size_t * output_len*) [Function]

sctx: libgsasl session handle.

input: input byte array.

input_len: size of input byte array.

output: newly allocated output byte array.

output_len: size of output byte array.

Decode data according to negotiated SASL mechanism. This might mean that data is integrity or privacy protected.

The `output` buffer is allocated by this function, and it is the responsibility of caller to deallocate it by calling free(`output`).

Return value: Returns `GSASL_OK` if encoding was successful, otherwise an error code.

gsasl_mechanism_name

`const char * gsasl_mechanism_name` (*Gsasl_session* * *sctx*) [Function]

sctx: libgsasl session handle.

This function returns the name of the SASL mechanism used in the session. The pointer must not be deallocated by the caller.

Return value: Returns a zero terminated character array with the name of the SASL mechanism, or NULL if not known.

Since: 0.2.28

10 Utilities

gsasl_saslprep

`int gsasl_saslprep` (*const char * **in**, Gsasl_saslprep_flags **flags**, char ** **out**, int * **stringpreprc***) [Function]

in: a UTF-8 encoded string.

flags: any SASLprep flag, e.g., `GSASL_ALLOW_UNASSIGNED` .

out: on exit, contains newly allocated output string.

stringpreprc: if non-NULL, will hold precise stringprep return code.

Prepare string using SASLprep. On success, the `out` variable must be deallocated by the caller.

Return value: Returns `GSASL_OK` on success, or `GSASL_SASLPREP_ERROR` on error.

Since: 0.2.3

gsasl_base64_to

`int gsasl_base64_to` (*const char * **in**, size_t **inlen**, char ** **out**, size_t * **outlen***) [Function]

in: input byte array.

inlen: size of input byte array.

out: pointer to newly allocated base64-encoded string.

outlen: pointer to size of newly allocated base64-encoded string.

Encode data as base64. The `out` string is zero terminated, and `outlen` holds the length excluding the terminating zero. The `out` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` on success, or `GSASL_MALLOC_ERROR` if input was too large or memory allocation fail.

Since: 0.2.2

gsasl_base64_from

`int gsasl_base64_from` (*const char * **in**, size_t **inlen**, char ** **out**, size_t * **outlen***) [Function]

in: input byte array

inlen: size of input byte array

out: pointer to newly allocated output byte array

outlen: pointer to size of newly allocated output byte array

Decode Base64 data. The `out` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` on success, `GSASL_BASE64_ERROR` if input was invalid, and `GSASL_MALLOC_ERROR` on memory allocation errors.

Since: 0.2.2

gsasl_hex_to

int **gsasl_hex_to** (*const char * in, size_t inlen, char ** out, size_t * outlen*) [Function]

in: input byte array.

inlen: size of input byte array.

out: pointer to newly allocated hex-encoded string.

outlen: pointer to size of newly allocated hex-encoded string.

Hex encode data. The `out` string is zero terminated, and `outlen` holds the length excluding the terminating zero. The `out` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` on success, or `GSASL_MALLOC_ERROR` if input was too large or memory allocation fail.

Since: 1.10

gsasl_hex_from

int **gsasl_hex_from** (*const char * in, char ** out, size_t * outlen*) [Function]

in: input byte array

out: pointer to newly allocated output byte array

outlen: pointer to size of newly allocated output byte array

Decode hex data. The `out` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` on success, `GSASL_BASE64_ERROR` if input was invalid, and `GSASL_MALLOC_ERROR` on memory allocation errors.

Since: 1.10

gsasl_simple_getpass

int **gsasl_simple_getpass** (*const char * filename, const char * username, char ** key*) [Function]

filename: filename of file containing passwords.

username: username string.

key: newly allocated output character array.

Retrieve password for user from specified file. The buffer `key` contain the password if this function is successful. The caller is responsible for deallocating it.

The file should be on the UoW "MD5 Based Authentication" format, which means it is in text format with comments denoted by # first on the line, with user entries looking as "usernameTABpassword". This function removes CR and LF at the end of lines before processing. TAB, CR, and LF denote ASCII values 9, 13, and 10, respectively.

Return value: Return `GSASL_OK` if output buffer contains the password, `GSASL_AUTHENTICATION_ERROR` if the user could not be found, or other error code.

gsasl_nonce

`int gsasl_nonce` (*char * data, size_t datalen*) [Function]

data: output array to be filled with unpredictable random data.

datalen: size of output array.

Store unpredictable data of given size in the provided buffer.

Return value: Returns `GSASL_OK` iff successful.

gsasl_random

`int gsasl_random` (*char * data, size_t datalen*) [Function]

data: output array to be filled with strong random data.

datalen: size of output array.

Store cryptographically strong random data of given size in the provided buffer.

Return value: Returns `GSASL_OK` iff successful.

gsasl_hash_length

`size_t gsasl_hash_length` (*Gsasl_hash hash*) [Function]

hash: a `Gsasl_hash` element, e.g., `GSASL_HASH_SHA256` .

Return the digest output size for hash function `hash` . For example, gsasl_hash_length(GSASL_HASH_SHA256) returns GSASL_HASH_SHA256_SIZE which is 32.

Returns: size of supplied `Gsasl_hash` element.

Since: 1.10

gsasl_scram_secrets_from_salted_password

`int gsasl_scram_secrets_from_salted_password` (*Gsasl_hash hash, const char * salted_password, char * client_key, char * server_key, char * stored_key*) [Function]

hash: a `Gsasl_hash` element, e.g., `GSASL_HASH_SHA256` .

salted_password: input array with salted password.

client_key: pre-allocated output array with derived client key.

server_key: pre-allocated output array with derived server key.

stored_key: pre-allocated output array with derived stored key.

Helper function to derive SCRAM ClientKey/ServerKey/StoredKey. The `client_key` , `server_key` , and `stored_key` buffers must have room to hold digest for given `hash` , use `GSASL_HASH_MAX_SIZE` which is sufficient for all hashes.

Return value: Returns `GSASL_OK` if successful, or error code.

Since: 1.10

gsasl_scram_secrets_from_password

int **gsasl_scram_secrets_from_password** (*Gsasl_hash* **hash**, *const char ** **password**, *unsigned int* **iteration_count**, *const char ** **salt**, *size_t* **saltlen**, *char ** **salted_password**, *char ** **client_key**, *char ** **server_key**, *char ** **stored_key**) [Function]

hash: a `Gsasl_hash` element, e.g., `GSASL_HASH_SHA256` .

password: input parameter with password.

iteration_count: number of PBKDF2 rounds to apply.

salt: input character array of `saltlen` length with salt for PBKDF2.

saltlen: length of `salt` .

salted_password: pre-allocated output array with derived salted password.

client_key: pre-allocated output array with derived client key.

server_key: pre-allocated output array with derived server key.

stored_key: pre-allocated output array with derived stored key.

Helper function to generate SCRAM secrets from a password. The `salted_password` , `client_key` , `server_key` , and `stored_key` buffers must have room to hold digest for given `hash` , use `GSASL_HASH_MAX_SIZE` which is sufficient for all hashes.

Return value: Returns `GSASL_OK` if successful, or error code.

Since: 1.10

11 Memory Handling

gsasl_free

`void gsasl_free` (*void * ptr*) [Function]

ptr: memory pointer

Invoke free(`ptr`) to de-allocate memory pointer. Typically used on strings allocated by other libgsasl functions.

This is useful on Windows where libgsasl is linked to one CRT and the application is linked to another CRT. Then malloc/free will not use the same heap. This happens if you build libgsasl using mingw32 and the application with Visual Studio.

Since: 0.2.19

12 Error Handling

Most functions in the GNU SASL Library return an error if they fail. For this reason, the application should always catch the error condition and take appropriate measures, for example by releasing the resources and passing the error up to the caller, or by displaying a descriptive message to the user and cancelling the operation.

Some error values do not indicate a system error or an error in the operation, but the result of an operation that failed properly.

12.1 Error values

Errors are returned as `int` values.

The value of the symbol `GSASL_OK` is guaranteed to always be `0`, and all other error codes are guaranteed to be non-`0`, so you may use that information to build boolean expressions involving return codes. Otherwise, an application should not depend on the particular value for error codes, and are encouraged to use the constants even for `GSASL_OK` to improve readability. Possible values are:

`GSASL_OK` Libgsasl success

`GSASL_NEEDS_MORE`
SASL mechanism needs more data

`GSASL_UNKNOWN_MECHANISM`
Unknown SASL mechanism

`GSASL_MECHANISM_CALLED_TOO_MANY_TIMES`
SASL mechanism called too many times

`GSASL_TOO_SMALL_BUFFER`
SASL function needs larger buffer (internal error)

`GSASL_FOPEN_ERROR`
Could not open file in SASL library

`GSASL_FCLOSE_ERROR`
Could not close file in SASL library

`GSASL_MALLOC_ERROR`
Memory allocation error in SASL library

`GSASL_BASE64_ERROR`
Base 64 coding error in SASL library

`GSASL_CRYPTO_ERROR`
Low-level crypto error in SASL library

`GSASL_NEED_CLIENT_ANONYMOUS_CALLBACK`
SASL mechanism needs gsasl_client_callback_anonymous() callback (application error)

`GSASL_NEED_CLIENT_PASSWORD_CALLBACK`
SASL mechanism needs gsasl_client_callback_password() callback (application error)

`GSASL_NEED_CLIENT_PASSCODE_CALLBACK`
: SASL mechanism needs gsasl_client_callback_passcode() callback (application error)

`GSASL_NEED_CLIENT_PIN_CALLBACK`
: SASL mechanism needs gsasl_client_callback_pin() callback (application error)

`GSASL_NEED_CLIENT_AUTHORIZATION_ID_CALLBACK`
: SASL mechanism needs gsasl_client_callback_authorization_id() callback (application error)

`GSASL_NEED_CLIENT_AUTHENTICATION_ID_CALLBACK`
: SASL mechanism needs gsasl_client_callback_authentication_id() callback (application error)

`GSASL_NEED_CLIENT_SERVICE_CALLBACK`
: SASL mechanism needs gsasl_client_callback_service() callback (application error)

`GSASL_NEED_SERVER_VALIDATE_CALLBACK`
: SASL mechanism needs gsasl_server_callback_validate() callback (application error)

`GSASL_NEED_SERVER_CRAM_MD5_CALLBACK`
: SASL mechanism needs gsasl_server_callback_cram_md5() callback (application error)

`GSASL_NEED_SERVER_DIGEST_MD5_CALLBACK`
: SASL mechanism needs gsasl_server_callback_digest_md5() callback (application error)

`GSASL_NEED_SERVER_EXTERNAL_CALLBACK`
: SASL mechanism needs gsasl_server_callback_external() callback (application error)

`GSASL_NEED_SERVER_ANONYMOUS_CALLBACK`
: SASL mechanism needs gsasl_server_callback_anonymous() callback (application error)

`GSASL_NEED_SERVER_REALM_CALLBACK`
: SASL mechanism needs gsasl_server_callback_realm() callback (application error)

`GSASL_NEED_SERVER_SECURID_CALLBACK`
: SASL mechanism needs gsasl_server_callback_securid() callback (application error)

`GSASL_NEED_SERVER_SERVICE_CALLBACK`
: SASL mechanism needs gsasl_server_callback_service() callback (application error)

`GSASL_NEED_SERVER_GSSAPI_CALLBACK`
: SASL mechanism needs gsasl_server_callback_gssapi() callback (application error)

`GSASL_NEED_SERVER_RETRIEVE_CALLBACK`
SASL mechanism needs gsasl_server_callback_retrieve() callback (application error)

`GSASL_UNICODE_NORMALIZATION_ERROR`
Failed to perform Unicode Normalization on string.

`GSASL_SASLPREP_ERROR`
Could not prepare internationalized (non-ASCII) string.

`GSASL_MECHANISM_PARSE_ERROR`
SASL mechanism could not parse input

`GSASL_AUTHENTICATION_ERROR`
Error authenticating user

`GSASL_CANNOT_GET_CTX`
Cannot get internal library handle (library error)

`GSASL_INTEGRITY_ERROR`
Integrity error in application payload

`GSASL_NO_MORE_REALMS`
No more realms available (non-fatal)

`GSASL_NO_CLIENT_CODE`
Client-side functionality not available in library (application error)

`GSASL_NO_SERVER_CODE`
Server-side functionality not available in library (application error)

`GSASL_GSSAPI_RELEASE_BUFFER_ERROR`
GSSAPI library could not deallocate memory in gss_release_buffer() in SASL library. This is a serious internal error.

`GSASL_GSSAPI_IMPORT_NAME_ERROR`
GSSAPI library could not understand a peer name in gss_import_name() in SASL library. This is most likely due to incorrect service and/or hostnames.

`GSASL_GSSAPI_INIT_SEC_CONTEXT_ERROR`
GSSAPI error in client while negotiating security context in gss_init_sec_context() in SASL library. This is most likely due insufficient credentials or malicious interactions.

`GSASL_GSSAPI_ACCEPT_SEC_CONTEXT_ERROR`
GSSAPI error in server while negotiating security context in gss_accept_sec_context() in SASL library. This is most likely due insufficient credentials or malicious interactions.

`GSASL_GSSAPI_UNWRAP_ERROR`
GSSAPI error while decrypting or decoding data in gss_unwrap() in SASL library. This is most likely due to data corruption.

`GSASL_GSSAPI_WRAP_ERROR`
GSSAPI error while encrypting or encoding data in gss_wrap() in SASL library.

`GSASL_GSSAPI_ACQUIRE_CRED_ERROR`
GSSAPI error acquiring credentials in gss_acquire_cred() in SASL library. This is most likely due to not having the proper Kerberos key available in /etc/krb5.keytab on the server.

`GSASL_GSSAPI_DISPLAY_NAME_ERROR`
GSSAPI error creating a display name denoting the client in gss_display_name() in SASL library. This is probably because the client supplied bad data.

`GSASL_GSSAPI_UNSUPPORTED_PROTECTION_ERROR`
Other entity requested integrity or confidentiality protection in GSSAPI mechanism but this is currently not implemented.

`GSASL_KERBEROS_V5_INIT_ERROR`
Kerberos V5 initialization failure.

`GSASL_KERBEROS_V5_INTERNAL_ERROR`
Kerberos V5 internal error.

`GSASL_SECURID_SERVER_NEED_ADDITIONAL_PASSCODE`
SecurID needs additional passcode.

`GSASL_SECURID_SERVER_NEED_NEW_PIN`
SecurID needs new pin.

`GSASL_INVALID_HANDLE`
The provided library handle was invalid (application error)

`GSASL_NO_CALLBACK`
No callback specified by caller (application error).

`GSASL_NO_ANONYMOUS_TOKEN`
Authentication failed because the anonymous token was not provided.

`GSASL_NO_AUTHID`
Authentication failed because the authentication identity was not provided.

`GSASL_NO_AUTHZID`
Authentication failed because the authorization identity was not provided.

`GSASL_NO_PASSWORD`
Authentication failed because the password was not provided.

`GSASL_NO_PASSCODE`
Authentication failed because the passcode was not provided.

`GSASL_NO_PIN`
Authentication failed because the pin code was not provided.

`GSASL_NO_SERVICE`
Authentication failed because the service name was not provided.

`GSASL_NO_HOSTNAME`
Authentication failed because the host name was not provided.

`GSASL_GSSAPI_ENCAPSULATE_TOKEN_ERROR`
GSSAPI error encapsulating token.

`GSASL_GSSAPI_DECAPSULATE_TOKEN_ERROR`
GSSAPI error decapsulating token.

`GSASL_GSSAPI_INQUIRE_MECH_FOR_SASLNAME_ERROR`
GSSAPI error getting OID for SASL mechanism name.

`GSASL_GSSAPI_TEST_OID_SET_MEMBER_ERROR`
GSSAPI error testing for OID in OID set.

`GSASL_GSSAPI_RELEASE_OID_SET_ERROR`
GSSAPI error releasing OID set.

`GSASL_NO_CB_TLS_UNIQUE`
Authentication failed because a tls-unique CB was not provided.

`GSASL_NO_SAML20_IDP_IDENTIFIER`
Callback failed to provide SAML20 IdP identifier.

`GSASL_NO_SAML20_REDIRECT_URL`
Callback failed to provide SAML20 redirect URL.

`GSASL_NO_OPENID20_REDIRECT_URL`
Callback failed to provide OPENID20 redirect URL.

12.2 Error strings

gsasl_strerror

`const char * gsasl_strerror` (*int err*) [Function]

err: libgsasl error code

Convert return code to human readable string explanation of the reason for the particular error code.

This string can be used to output a diagnostic message to the user.

This function is one of few in the library that can be used without a successful call to `gsasl_init()` .

Return value: Returns a pointer to a statically allocated string containing an explanation of the error code `err` .

gsasl_strerror_name

`const char * gsasl_strerror_name` (*int err*) [Function]

err: libgsasl error code

Convert return code to human readable string representing the error code symbol itself. For example, gsasl_strerror_name(`GSASL_OK`) returns the string "GSASL_OK".

This string can be used to output a diagnostic message to the user.

This function is one of few in the library that can be used without a successful call to `gsasl_init()` .

Return value: Returns a pointer to a statically allocated string containing a string version of the error code `err` , or NULL if the error code is not known.

Since: 0.2.29

13 Examples

This chapter contains example code which illustrates how the GNU SASL Library can be used when writing your own application.

13.1 Example 1

```
/* client.c --- Example SASL client.
 * Copyright (C) 2004-2021 Simon Josefsson
 *
 * This file is part of GNU SASL.
 *
 * This program is free software: you can redistribute it and/or modify
 * it under the terms of the GNU General Public License as published by
 * the Free Software Foundation, either version 3 of the License, or
 * (at your option) any later version.
 *
 * This program is distributed in the hope that it will be useful,
 * but WITHOUT ANY WARRANTY; without even the implied warranty of
 * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
 * GNU General Public License for more details.
 *
 * You should have received a copy of the GNU General Public License
 * along with this program.  If not, see <http://www.gnu.org/licenses/>.
 *
 */

#include <config.h>
#include <stdarg.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#include <gsasl.h>

static void
client_authenticate (Gsasl_session * session)
{
  char buf[BUFSIZ] = "";
  char *p;
  int rc;

  /* This loop mimics a protocol where the client send data first. */

  do
    {
      /* Generate client output. */
```

```
      rc = gsasl_step64 (session, buf, &p);

      if (rc == GSASL_NEEDS_MORE || rc == GSASL_OK)
        {
          /* If sucessful, print it. */
          printf ("Output:\n%s\n", p);
          gsasl_free (p);
        }

      if (rc == GSASL_NEEDS_MORE)
        {
          /* If the client need more data from server, get it here. */
          printf ("Input base64 encoded data from server:\n");
          p = fgets (buf, sizeof (buf) - 1, stdin);
          if (p == NULL)
            {
              perror ("fgets");
              return;
            }
          if (buf[strlen (buf) - 1] == '\n')
            buf[strlen (buf) - 1] = '\0';
        }
    }
  while (rc == GSASL_NEEDS_MORE);

  printf ("\n");

  if (rc != GSASL_OK)
    {
      printf ("Authentication error (%d): %s\n", rc, gsasl_strerror (rc));
      return;
    }

  /* The client is done.  Here you would typically check if the server
     let the client in.  If not, you could try again. */

  printf ("If server accepted us, we're done.\n");
}

static void
client (Gsasl * ctx)
{
  Gsasl_session *session;
  const char *mech = "PLAIN";
  int rc;

  /* Create new authentication session. */
```

```
  if ((rc = gsasl_client_start (ctx, mech, &session)) != GSASL_OK)
    {
      printf ("Cannot initialize client (%d): %s\n", rc, gsasl_strerror (rc));
      return;
    }

  /* Set username and password in session handle.  This info will be
     lost when this session is deallocated below.  */
  gsasl_property_set (session, GSASL_AUTHID, "jas");
  gsasl_property_set (session, GSASL_PASSWORD, "secret");

  /* Do it. */
  client_authenticate (session);

  /* Cleanup. */
  gsasl_finish (session);
}

int
main (void)
{
  Gsasl *ctx = NULL;
  int rc;

  /* Initialize library. */
  if ((rc = gsasl_init (&ctx)) != GSASL_OK)
    {
      printf ("Cannot initialize libgsasl (%d): %s", rc, gsasl_strerror (rc));
      return 1;
    }

  /* Do it. */
  client (ctx);

  /* Cleanup. */
  gsasl_done (ctx);

  return 0;
}
```

13.2 Example 2

```
/* client-serverfirst.c --- Example SASL client, where server send data first.
 * Copyright (C) 2004-2021 Simon Josefsson
 *
 * This file is part of GNU SASL.
 *
```

```
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 * along with this program.  If not, see <http://www.gnu.org/licenses/>.
 *
 */

#include <config.h>
#include <stdarg.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#include <gsasl.h>

static void
client_authenticate (Gsasl_session * session)
{
  char buf[BUFSIZ] = "";
  char *p;
  int rc;

  /* This loop mimics a protocol where the server send data first. */

  do
    {
      printf ("Input base64 encoded data from server:\n");
      p = fgets (buf, sizeof (buf) - 1, stdin);
      if (p == NULL)
        {
          perror ("fgets");
          return;
        }
      if (buf[strlen (buf) - 1] == '\n')
        buf[strlen (buf) - 1] = '\0';

      rc = gsasl_step64 (session, buf, &p);

      if (rc == GSASL_NEEDS_MORE || rc == GSASL_OK)
```

```
        {
          printf ("Output:\n%s\n", p);
          gsasl_free (p);
        }
    }
  while (rc == GSASL_NEEDS_MORE);

  printf ("\n");

  if (rc != GSASL_OK)
    {
      printf ("Authentication error (%d): %s\n", rc, gsasl_strerror (rc));
      return;
    }

  /* The client is done.  Here you would typically check if the server
     let the client in.  If not, you could try again. */

  printf ("If server accepted us, we're done.\n");
}

static void
client (Gsasl * ctx)
{
  Gsasl_session *session;
  const char *mech = "CRAM-MD5";
  int rc;

  /* Create new authentication session. */
  if ((rc = gsasl_client_start (ctx, mech, &session)) != GSASL_OK)
    {
      printf ("Cannot initialize client (%d): %s\n", rc, gsasl_strerror (rc));
      return;
    }

  /* Set username and password in session handle.  This info will be
     lost when this session is deallocated below.  */
  gsasl_property_set (session, GSASL_AUTHID, "jas");
  gsasl_property_set (session, GSASL_PASSWORD, "secret");

  /* Do it. */
  client_authenticate (session);

  /* Cleanup. */
  gsasl_finish (session);
}
```

```
int
main (void)
{
  Gsasl *ctx = NULL;
  int rc;

  /* Initialize library. */
  if ((rc = gsasl_init (&ctx)) != GSASL_OK)
    {
      printf ("Cannot initialize libgsasl (%d): %s", rc, gsasl_strerror (rc));
      return 1;
    }

  /* Do it. */
  client (ctx);

  /* Cleanup. */
  gsasl_done (ctx);

  return 0;
}
```

13.3 Example 3

```
/* client-mech.c --- Example SASL client, with a choice of mechanism to use.
 * Copyright (C) 2004-2021 Simon Josefsson
 *
 * This file is part of GNU SASL.
 *
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 * it under the terms of the GNU General Public License as published by
 * the Free Software Foundation, either version 3 of the License, or
 * (at your option) any later version.
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 * GNU General Public License for more details.
 *
 * You should have received a copy of the GNU General Public License
 * along with this program.  If not, see <http://www.gnu.org/licenses/>.
 *
 */

#include <config.h>
#include <stdarg.h>
#include <stdio.h>
```

```
#include <stdlib.h>
#include <string.h>

#include <gsasl.h>

static void
client_authenticate (Gsasl_session * session)
{
  char buf[BUFSIZ] = "";
  char *p;
  int rc;

  /* This loop mimics a protocol where the server send data first. */

  do
    {
      printf ("Input base64 encoded data from server:\n");
      p = fgets (buf, sizeof (buf) - 1, stdin);
      if (p == NULL)
        {
          perror ("fgets");
          return;
        }
      if (buf[strlen (buf) - 1] == '\n')
        buf[strlen (buf) - 1] = '\0';

      rc = gsasl_step64 (session, buf, &p);

      if (rc == GSASL_NEEDS_MORE || rc == GSASL_OK)
        {
          printf ("Output:\n%s\n", p);
          gsasl_free (p);
        }
    }
  while (rc == GSASL_NEEDS_MORE);

  printf ("\n");

  if (rc != GSASL_OK)
    {
      printf ("Authentication error (%d): %s\n", rc, gsasl_strerror (rc));
      return;
    }

  /* The client is done.  Here you would typically check if the server
     let the client in.  If not, you could try again. */
```

```
  printf ("If server accepted us, we're done.\n");
}

static const char *
client_mechanism (Gsasl * ctx)
{
  static char mech[GSASL_MAX_MECHANISM_SIZE + 1] = "";
  char mechlist[BUFSIZ] = "";
  const char *suggestion;
  char *p;

  printf ("Enter list of server supported mechanisms, separate by SPC:\n");
  p = fgets (mechlist, sizeof (mechlist) - 1, stdin);
  if (p == NULL)
    {
      perror ("fgets");
      return NULL;
    }

  suggestion = gsasl_client_suggest_mechanism (ctx, mechlist);
  if (suggestion)
    printf ("Library suggests use of `%s'.\n", suggestion);

  printf ("Enter mechanism to use:\n");
  p = fgets (mech, sizeof (mech) - 1, stdin);
  if (p == NULL)
    {
      perror ("fgets");
      return NULL;
    }

  mech[strlen (mech) - 1] = '\0';

  return mech;
}

static void
client (Gsasl * ctx)
{
  Gsasl_session *session;
  const char *mech;
  int rc;

  /* Find out which mechanism to use. */
  mech = client_mechanism (ctx);

  /* Create new authentication session. */
```

```
  if ((rc = gsasl_client_start (ctx, mech, &session)) != GSASL_OK)
    {
      printf ("Cannot initialize client (%d): %s\n", rc, gsasl_strerror (rc));
      return;
    }

  /* Set username and password in session handle.  This info will be
     lost when this session is deallocated below.  */
  gsasl_property_set (session, GSASL_AUTHID, "jas");
  gsasl_property_set (session, GSASL_PASSWORD, "secret");

  /* Do it. */
  client_authenticate (session);

  /* Cleanup. */
  gsasl_finish (session);
}

int
main (void)
{
  Gsasl *ctx = NULL;
  int rc;

  /* Initialize library. */
  if ((rc = gsasl_init (&ctx)) != GSASL_OK)
    {
      printf ("Cannot initialize libgsasl (%d): %s", rc, gsasl_strerror (rc));
      return 1;
    }

  /* Do it. */
  client (ctx);

  /* Cleanup. */
  gsasl_done (ctx);

  return 0;
}
```

13.4 Example 4

```
/* client-callback.c --- Example SASL client, with callback for user info.
 * Copyright (C) 2004-2021 Simon Josefsson
 *
 * This file is part of GNU SASL.
 *
```

```
#include <config.h>
#include <stdarg.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#include <gsasl.h>

static void
client_authenticate (Gsasl_session * session)
{
  char buf[BUFSIZ] = "";
  char *p;
  int rc;

  /* This loop mimics a protocol where the server send data first. */

  do
    {
      printf ("Input base64 encoded data from server:\n");
      p = fgets (buf, sizeof (buf) - 1, stdin);
      if (p == NULL)
        {
          perror ("fgets");
          return;
        }
      if (buf[strlen (buf) - 1] == '\n')
        buf[strlen (buf) - 1] = '\0';

      rc = gsasl_step64 (session, buf, &p);

      if (rc == GSASL_NEEDS_MORE || rc == GSASL_OK)
```

```
            {
              printf ("Output:\n%s\n", p);
              gsasl_free (p);
            }
        }
      while (rc == GSASL_NEEDS_MORE);

      printf ("\n");

      if (rc != GSASL_OK)
        {
          printf ("Authentication error (%d): %s\n", rc, gsasl_strerror (rc));
          return;
        }

      /* The client is done.  Here you would typically check if the server
         let the client in.  If not, you could try again. */

      printf ("If server accepted us, we're done.\n");
    }

    static void
    client (Gsasl * ctx)
    {
      Gsasl_session *session;
      const char *mech = "SECURID";
      int rc;

      /* Create new authentication session. */
      if ((rc = gsasl_client_start (ctx, mech, &session)) != GSASL_OK)
        {
          printf ("Cannot initialize client (%d): %s\n", rc, gsasl_strerror (rc));
          return;
        }

      /* Do it. */
      client_authenticate (session);

      /* Cleanup. */
      gsasl_finish (session);
    }

    static int
    callback (Gsasl * ctx, Gsasl_session * sctx, Gsasl_property prop)
    {
      char buf[BUFSIZ] = "";
      int rc = GSASL_NO_CALLBACK;
```

```
  char *p;

  /* Get user info from user. */

  printf ("Callback invoked, for property %u.\n", prop);

  switch (prop)
    {
    case GSASL_PASSCODE:
      printf ("Enter passcode:\n");
      p = fgets (buf, sizeof (buf) - 1, stdin);
      if (p == NULL)
        {
          perror ("fgets");
          break;
        }
      buf[strlen (buf) - 1] = '\0';

      gsasl_property_set (sctx, GSASL_PASSCODE, buf);
      rc = GSASL_OK;
      break;

    case GSASL_AUTHID:
      printf ("Enter username:\n");
      p = fgets (buf, sizeof (buf) - 1, stdin);
      if (p == NULL)
        {
          perror ("fgets");
          break;
        }
      buf[strlen (buf) - 1] = '\0';

      gsasl_property_set (sctx, GSASL_AUTHID, buf);
      rc = GSASL_OK;
      break;

    default:
      printf ("Unknown property!  Don't worry.\n");
      break;
    }

  return rc;
}

int
main (void)
{
```

```
  Gsasl *ctx = NULL;
  int rc;

  /* Initialize library. */
  if ((rc = gsasl_init (&ctx)) != GSASL_OK)
    {
      printf ("Cannot initialize libgsasl (%d): %s", rc, gsasl_strerror (rc));
      return 1;
    }

  /* Set the callback handler for the library. */
  gsasl_callback_set (ctx, callback);

  /* Do it. */
  client (ctx);

  /* Cleanup. */
  gsasl_done (ctx);

  return 0;
}
```

13.5 Example 5

```
/* smtp-server.c --- Example SMTP server with SASL authentication
 * Copyright (C) 2012-2021 Simon Josefsson
 *
 * This file is part of GNU SASL.
 *
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 * it under the terms of the GNU General Public License as published by
 * the Free Software Foundation, either version 3 of the License, or
 * (at your option) any later version.
 *
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 * but WITHOUT ANY WARRANTY; without even the implied warranty of
 * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
 * GNU General Public License for more details.
 *
 * You should have received a copy of the GNU General Public License
 * along with this program.  If not, see <http://www.gnu.org/licenses/>.
 *
 */

/* This is a minimal SMTP server with GNU SASL authentication support.

   The only valid password is "sesam".  This server will complete
```

```
   authentications using LOGIN, PLAIN, DIGEST-MD5, CRAM-MD5,
   SCRAM-SHA-1 and SCRAM-SHA-256.

   It accepts an optional command line parameter specifying the
   service name (i.e., a numerical port number or /etc/services name).
   By default it listens on port "2000".
*/

#include <config.h>
#include <string.h>
#include <stdlib.h>
#include <stdarg.h>
#include <netdb.h>
#include <signal.h>
#include <errno.h>

#include <gsasl.h>

static int
callback (Gsasl * ctx, Gsasl_session * sctx, Gsasl_property prop)
{
  int rc = GSASL_NO_CALLBACK;

  switch (prop)
    {
    case GSASL_PASSWORD:
      gsasl_property_set (sctx, prop, "sesam");
      rc = GSASL_OK;
      break;

    default:
      /* You may want to log (at debug verbosity level) that an
         unknown property was requested here, possibly after filtering
         known rejected property requests. */
      break;
    }

  return rc;
}

static ssize_t
gettrimline (char **line, size_t * n, FILE * fh)
{
  ssize_t s = getline (line, n, fh);

  if (s >= 2)
    {
```

```
      if ((*line)[strlen (*line) - 1] == '\n')
        (*line)[strlen (*line) - 1] = '\0';
      if ((*line)[strlen (*line) - 1] == '\r')
        (*line)[strlen (*line) - 1] = '\0';

      printf ("C: %s\n", *line);
    }

  return s;
}

#define print(fh, ...)                                                  \
  printf ("S: "), printf (__VA_ARGS__), fprintf (fh, __VA_ARGS__)

static void
server_auth (FILE * fh, Gsasl_session * session, char *initial_challenge)
{
  char *line = initial_challenge != NULL ? strdup (initial_challenge) : NULL;
  size_t n = 0;
  char *p;
  int rc;

  /* The ordering and the type of checks in the following loop has to
     be adapted for each protocol depending on its SASL properties.
     SMTP is normally a "server-first" SASL protocol, but if
     INITIAL_CHALLENGE is supplied by the client it turns into a
     client-first SASL protocol.  This implementation do not support
     piggy-backing of the terminating server response.  See RFC 2554
     and RFC 4422 for terminology.  That profile results in the
     following loop structure.  Ask on the help-gsasl list if you are
     uncertain.  */
  do
    {
      rc = gsasl_step64 (session, line, &p);
      if (rc == GSASL_NEEDS_MORE || (rc == GSASL_OK && p && *p))
        {
          print (fh, "334 %s\n", p);
          gsasl_free (p);

          if (gettrimline (&line, &n, fh) < 0)
            {
              print (fh, "221 localhost getline failure\n");
              goto done;
            }
        }
    }
  while (rc == GSASL_NEEDS_MORE);
```

```
  if (rc != GSASL_OK)
    {
      print (fh, "535 gsasl_step64 (%d): %s\n", rc, gsasl_strerror (rc));
      goto done;
    }

  {
    const char *authid = gsasl_property_fast (session, GSASL_AUTHID);
    const char *authzid = gsasl_property_fast (session, GSASL_AUTHZID);
    print (fh, "235 OK [authid: %s authzid: %s]\n",
           authid ? authid : "N/A", authzid ? authzid : "N/A");
  }

done:
  free (line);
}

static void
smtp (FILE * fh, Gsasl * ctx)
{
  char *line = NULL;
  size_t n = 0;
  int rc;

  print (fh, "220 localhost ESMTP GNU SASL smtp-server\n");

  while (gettrimline (&line, &n, fh) >= 0)
    {
      if (strncmp (line, "EHLO ", 5) == 0 || strncmp (line, "ehlo ", 5) == 0)
        {
          char *mechlist;

          rc = gsasl_server_mechlist (ctx, &mechlist);
          if (rc != GSASL_OK)
            {
              print (fh, "221 localhost gsasl_server_mechlist (%d): %s\n",
                     rc, gsasl_strerror (rc));
              continue;
            }

          print (fh, "250-localhost\n");
          print (fh, "250 AUTH %s\n", mechlist);

          gsasl_free (mechlist);
        }
      else if (strncmp (line, "AUTH ", 5) == 0
```

```
               || strncmp (line, "auth ", 5) == 0)
        {
          Gsasl_session *session = NULL;
          char *p = strchr (line + 5, ' ');

          if (p)
            *p++ = '\0';

          if ((rc = gsasl_server_start (ctx, line + 5, &session)) != GSASL_OK)
            {
              print (fh, "221 localhost gsasl_server_start (%d): %s: %s\n",
                     rc, gsasl_strerror (rc), line + 5);
              continue;
            }

          server_auth (fh, session, p);

          gsasl_finish (session);
        }
      else if (strncmp (line, "MAIL", 4) == 0)
        print (fh, "250 localhost OK\n");
      else if (strncmp (line, "RCPT", 4) == 0)
        print (fh, "250 localhost OK\n");
      else if (strncmp (line, "DATA", 4) == 0)
        {
          print (fh, "354 OK\n");
          while (gettrimline (&line, &n, fh) >= 0
                 && strncmp (line, ".", 2) != 0)
            ;
          print (fh, "250 OK\n");
        }
      else if (strncmp (line, "QUIT", 4) == 0
               || strncmp (line, "quit", 4) == 0)
        {
          print (fh, "221 localhost QUIT\n");
          break;
        }
      else
        print (fh, "500 unrecognized command\n");
    }

  if (errno)
    print (fh, "221 localhost getline failure: %s\n", strerror (errno));

  free (line);
}
```

```
int
main (int argc, char *argv[])
{
  const char *service = argc > 1 ? argv[1] : "2000";
  volatile int run = 1;
  struct addrinfo hints, *addrs;
  int sockfd;
  int rc;
  int yes = 1;
  Gsasl *ctx;

  setvbuf (stdout, NULL, _IONBF, 0);

  rc = gsasl_init (&ctx);
  if (rc < 0)
    {
      printf ("gsasl_init (%d): %s\n", rc, gsasl_strerror (rc));
      exit (EXIT_FAILURE);
    }

  printf ("%s [gsasl header %s library %s]\n",
          argv[0], GSASL_VERSION, gsasl_check_version (NULL));

  gsasl_callback_set (ctx, callback);

  memset (&hints, 0, sizeof (hints));
  hints.ai_flags = AI_PASSIVE | AI_ADDRCONFIG;
  hints.ai_socktype = SOCK_STREAM;

  rc = getaddrinfo (NULL, service, &hints, &addrs);
  if (rc < 0)
    {
      printf ("getaddrinfo: %s\n", gai_strerror (rc));
      exit (EXIT_FAILURE);
    }

  sockfd = socket (addrs->ai_family, addrs->ai_socktype, addrs->ai_protocol);
  if (sockfd < 0)
    {
      perror ("socket");
      exit (EXIT_FAILURE);
    }

  if (setsockopt (sockfd, SOL_SOCKET, SO_REUSEADDR, &yes, sizeof (yes)) < 0)
    {
      perror ("setsockopt");
      exit (EXIT_FAILURE);
```

```
    }

  rc = bind (sockfd, addrs->ai_addr, addrs->ai_addrlen);
  if (rc < 0)
    {
      perror ("bind");
      exit (EXIT_FAILURE);
    }

  freeaddrinfo (addrs);

  rc = listen (sockfd, SOMAXCONN);
  if (rc < 0)
    {
      perror ("listen");
      exit (EXIT_FAILURE);
    }

  signal (SIGPIPE, SIG_IGN);

  while (run)
    {
      struct sockaddr from;
      socklen_t fromlen = sizeof (from);
      char host[NI_MAXHOST];
      int fd;
      FILE *fh;

      fd = accept (sockfd, &from, &fromlen);
      if (fd < 0)
        {
          perror ("accept");
          continue;
        }

      rc = getnameinfo (&from, fromlen, host, sizeof (host),
                        NULL, 0, NI_NUMERICHOST);
      if (rc == 0)
        printf ("connection from %s\n", host);
      else
        printf ("getnameinfo: %s\n", gai_strerror (rc));

      fh = fdopen (fd, "w+");
      if (!fh)
        {
          perror ("fdopen");
          close (fd);
```

```
                continue;
              }

            smtp (fh, ctx);

            fclose (fh);
          }

        close (sockfd);
        gsasl_done (ctx);

        return 0;
      }
```

14 Acknowledgements

The makefiles, manuals, etc borrowed much from Libgcrypt written by Werner Koch.

Cryptographic functions for some SASL mechanisms uses Libgcrypt by Werner Koch et al. The NTLM mechanism uses Libntlm by Grant Edwards et al, using code from Samba written by Andrew Tridgell, and now maintained by Simon Josefsson. The KERBEROS_V5 mechanism uses Shishi by Simon Josefsson. The GSSAPI and GS2-KRB5 mechanism uses a GSS-API implementation, such as GNU GSS by Simon Josefsson.

Gnulib is used to simplify portability.

This manual borrows text from the SASL specification.

15 Invoking gsasl

Name

GNU SASL (gsasl) – Command line interface to libgsasl.

Description

`gsasl` is the main program of GNU SASL.

This section only lists the commands and options available.

Mandatory or optional arguments to long options are also mandatory or optional for any corresponding short options.

Commands

`gsasl` recognizes these commands:

```
-c, --client              Act as client (the default).
    --client-mechanisms   Write name of supported client mechanisms
                          separated by space to stdout.
-s, --server              Act as server.
    --server-mechanisms   Write name of supported server mechanisms
                          separated by space to stdout.
-k, --mkpasswd            Derive password. Provide --mechanism as SCRAM-SHA-1 or
                          SCRAM-SHA-256.  The required inputs are
                          password (through --password or read from
                          terminal) and optional inputs are iteration
                          count (through --iteration-count, or
                          defaulting to 65536) and salt (through
                          --salt, or generated randomly).  The output
                          is a string of the form
                          "{mech}count,salt,stored-key,server-key[,salted-password]"
                          where "mech" is the mechanism, "count" is
                          the number of times password was hashed,
                          "salt" is the provided/generated
                          base64-encoded salt, "stored-key" and
                          "server-key" are the two derived and
                          base64-encoded server-side keys.  When
                          --verbose is provided, "salted-password"
                          will be included as the hex-encoded PBKDF2-derived
                          password.  (default=off)
```

Network Options

Normally the SASL negotiation is performed on the terminal, with reading from stdin and writing to stdout. It is also possible to perform the negotiation with a server over a TCP network connection.

```
    --connect=HOSTNAME[:SERVICE]
                           Connect to TCP server and negotiate on stream
                           instead of stdin/stdout. SERVICE is the protocol
                           service, or an integer denoting the port, and
                           defaults to 143 (imap) if not specified. Also sets
                           the --hostname default.
```

Miscellaneous Options:

These parameters affect overall behaviour.

```
  -d, --application-data   After authentication, read data from stdin and run
                           it through the mechanism's security layer and
                           print it base64 encoded to stdout. The default is
                           to terminate after authentication.
      --imap               Use a IMAP-like logon procedure (client only).
                           Also sets the --service default to "imap".
  -m, --mechanism=STRING   Mechanism to use.
      --no-client-first    Disallow client to send data first (client only).
```

SASL Mechanism Options

These options modify the behaviour of the callbacks (see Chapter 7 [Callback Functions], page 38) in the library. The default is to query the user on the terminal.

```
  -n, --anonymous-token=STRING    Token for anonymous authentication, usually
                                  mail address (ANONYMOUS only).
  -a, --authentication-id=STRING  Identity of credential owner.
  -z, --authorization-id=STRING   Identity to request service for.
      --disable-cleartext-validate
                           Disable cleartext validate hook, forcing server to
                           prompt for password.
      --enable-cram-md5-validate  Validate CRAM-MD5 challenge and response
                                  interactively.
      --hostname=STRING    Set the name of the server with the requested
                           service.
  -p, --password=STRING    Password for authentication (insecure for
                           non-testing purposes).
      --passcode=NUMBER    Passcode for authentication (SECURID only).
      --quality-of-protection=<qop-auth | qop-int | qop-conf>
                           How application payload will be protected.
```

```
                           "qop-auth" means no protection,
                           "qop-int" means integrity protection,
                           "qop-conf" means confidentiality.
                           Currently only used by DIGEST-MD5, where the
                           default is "qop-int".
-r, --realm=STRING         Realm. Defaults to hostname.
    --service=STRING       Set the requested service name (should be a
                           registered GSSAPI host based service name).
    --service-name=STRING  Set the generic server name in case of a
                           replicated server (DIGEST-MD5 only).
    --iteration-count=NUMBER  Indicate PBKDF2 hash iteration count (SCRAM
                                only).  (default='65536')
    --salt=B64DATA         Indicate PBKDF2 salt as base64-encoded string
                                (SCRAM only).
```

STARTTLS options

```
    --starttls                Force use of STARTTLS.  The default is to use
                                STARTTLS when available.  (default=off)
    --no-starttls             Unconditionally disable STARTTLS.
                                (default=off)
    --no-cb                   Don't set any channel bindings.  (default=off)
    --x509-ca-file=FILE       File containing one or more X.509 Certificate
                                Authorities certificates in PEM format, used
                                to verify the certificate received from the
                                server.  If not specified, verification uses
                                system trust settings.  If FILE is the empty
                                string, don't fail on X.509 server
                                certificates verification errors.
    --x509-cert-file=FILE     File containing client X.509 certificate in PEM
                                format.  Used together with --x509-key-file
                                to specify the certificate/key pair.
    --x509-key-file=FILE      Private key for the client X.509 certificate in
                                PEM format.  Used together with
                                --x509-key-file to specify the
                                certificate/key pair.
    --priority                Cipher priority string.
```

Other Options

These are some standard parameters.

```
-q, --quiet, --silent      Don't produce any diagnostic output.
-v, --verbose              Produce verbose output.

-?, --help                 Give this help list
```

```
    --usage                  Give a short usage message
-V, --version                Print program version
```

Appendix A Protocol Clarifications

This appendix contains clarifications to various SASL specification that we felt were necessary to include, if for nothing else it may serve as a guide for other implementers that worry about the same issues.

A.1 Use of SASLprep in CRAM-MD5

The specification, as of `draft-ietf-sasl-crammd5-04.txt`, is silent on whether a SASL server implementation applying SASLprep on a password received from an external, non-SASL specific database (i.e., the passwords are not stored in SASLprep form in the database), should set or clear the AllowUnassigned bit. The motivation for the AU-bit in StringPrep/SASLprep is for stored vs query strings. It could be argued that in this situation the server can treat the external password either as a stored string (from a database) or as a query (the server uses the string as a query into the fixed HMAC-MD5 hash).

The specification is also unclear on whether clients should set or clear the AllowUnassigned flag.

In the server, GNU SASL applies SASLprep to the password with the AllowUnassigned bit cleared.

A.2 Use of SASLprep in LOGIN

The non-standard mechanism LOGIN presumably does not support non-ASCII. We suggest that the client should send unprepared UTF-8 and that the server apply SASLprep with the AllowUnassigned bit cleared on the received username and password.

Appendix B Old Functions

As GNU SASL is still under heavy development, some API functions have been found to be less useful. Those old API functions will be supported during a transition period. Refer to the NEWS file to find out since when a function has been deprecated.

gsasl_client_listmech

`int gsasl_client_listmech` (*Gsasl * **ctx**, char * **out**, size_t * **outlen***) [Function]

ctx: libgsasl handle.

out: output character array.

outlen: input maximum size of output character array, on output contains actual length of output array.

Write SASL names, separated by space, of mechanisms supported by the libgsasl client to the output array. To find out how large the output array must be, call this function with a NULL `out` parameter.

Return value: Returns `GSASL_OK` if successful, or error code.

Deprecated: Use `gsasl_client_mechlist()` instead.

gsasl_server_listmech

`int gsasl_server_listmech` (*Gsasl * **ctx**, char * **out**, size_t * **outlen***) [Function]

ctx: libgsasl handle.

out: output character array.

outlen: input maximum size of output character array, on output contains actual length of output array.

Write SASL names, separated by space, of mechanisms supported by the libgsasl server to the output array. To find out how large the output array must be, call this function with a NULL `out` parameter.

Return value: Returns `GSASL_OK` if successful, or error code.

Deprecated: Use `gsasl_server_mechlist()` instead.

gsasl_client_step

`int gsasl_client_step` (*Gsasl_session * **sctx**, const char * **input**, size_t **input_len**, char * **output**, size_t * **output_len***) [Function]

sctx: libgsasl client handle.

input: input byte array.

input_len: size of input byte array.

output: output byte array.

output_len: size of output byte array.

Perform one step of SASL authentication in client. This reads data from server (specified with input and input_len), processes it (potentially invoking callbacks to the application), and writes data to server (into variables output and output_len).

The contents of the output buffer is unspecified if this functions returns anything other than `GSASL_NEEDS_MORE` .

Return value: Returns `GSASL_OK` if authenticated terminated successfully, `GSASL_NEEDS_MORE` if more data is needed, or error code.

Deprecated: Use `gsasl_step()` instead.

gsasl_server_step

`int` **`gsasl_server_step`** (*Gsasl_session * `sctx`, const char * `input`, size_t `input_len`, char * `output`, size_t * `output_len`*) [Function]

sctx: libgsasl server handle.

input: input byte array.

input_len: size of input byte array.

output: output byte array.

output_len: size of output byte array.

Perform one step of SASL authentication in server. This reads data from client (specified with input and input_len), processes it (potentially invoking callbacks to the application), and writes data to client (into variables output and output_len).

The contents of the output buffer is unspecified if this functions returns anything other than `GSASL_NEEDS_MORE` .

Return value: Returns `GSASL_OK` if authenticated terminated successfully, `GSASL_NEEDS_MORE` if more data is needed, or error code.

Deprecated: Use `gsasl_step()` instead.

gsasl_client_step_base64

`int` **`gsasl_client_step_base64`** (*Gsasl_session * `sctx`, const char * `b64input`, char * `b64output`, size_t `b64output_len`*) [Function]

sctx: libgsasl client handle.

b64input: input base64 encoded byte array.

b64output: output base64 encoded byte array.

b64output_len: size of output base64 encoded byte array.

This is a simple wrapper around `gsasl_client_step()` that base64 decodes the input and base64 encodes the output.

Return value: See `gsasl_client_step()` .

Deprecated: Use `gsasl_step64()` instead.

gsasl_server_step_base64

int gsasl_server_step_base64 (*Gsasl_session * sctx, const char * b64input, char * b64output, size_t b64output_len*) [Function]

sctx: libgsasl server handle.

b64input: input base64 encoded byte array.

b64output: output base64 encoded byte array.

b64output_len: size of output base64 encoded byte array.

This is a simple wrapper around `gsasl_server_step()` that base64 decodes the input and base64 encodes the output.

Return value: See `gsasl_server_step()` .

Deprecated: Use `gsasl_step64()` instead.

gsasl_client_finish

void gsasl_client_finish (*Gsasl_session * sctx*) [Function]

sctx: libgsasl client handle.

Destroy a libgsasl client handle. The handle must not be used with other libgsasl functions after this call.

Deprecated: Use `gsasl_finish()` instead.

gsasl_server_finish

void gsasl_server_finish (*Gsasl_session * sctx*) [Function]

sctx: libgsasl server handle.

Destroy a libgsasl server handle. The handle must not be used with other libgsasl functions after this call.

Deprecated: Use `gsasl_finish()` instead.

gsasl_client_ctx_get

Gsasl * gsasl_client_ctx_get (*Gsasl_session * sctx*) [Function]

sctx: libgsasl client handle

Get the libgsasl handle given a libgsasl client handle.

Return value: Returns the libgsasl handle given a libgsasl client handle.

Deprecated: This function is not useful with the new 0.2.0 API.

gsasl_client_application_data_set

void gsasl_client_application_data_set (*Gsasl_session * sctx, void * application_data*) [Function]

sctx: libgsasl client handle.

application_data: opaque pointer to application specific data.

Store application specific data in the libgsasl client handle. The application data can be later (for instance, inside a callback) be retrieved by calling `gsasl_client_application_data_get()` . It is normally used by the application to maintain state between the main program and the callback.

Deprecated: Use `gsasl_callback_hook_set()` or `gsasl_session_hook_set()` instead.

gsasl_client_application_data_get

`void * gsasl_client_application_data_get` (*Gsasl_session * sctx*) [Function]

sctx: libgsasl client handle.

Retrieve application specific data from libgsasl client handle. The application data is set using `gsasl_client_application_data_set()` . It is normally used by the application to maintain state between the main program and the callback.

Return value: Returns the application specific data, or NULL.

Deprecated: Use `gsasl_callback_hook_get()` or `gsasl_session_hook_get()` instead.

gsasl_server_ctx_get

`Gsasl * gsasl_server_ctx_get` (*Gsasl_session * sctx*) [Function]

sctx: libgsasl server handle

Get the libgsasl handle given a libgsasl server handle.

Return value: Returns the libgsasl handle given a libgsasl server handle.

Deprecated: This function is not useful with the new 0.2.0 API.

gsasl_server_application_data_set

`void gsasl_server_application_data_set` (*Gsasl_session * sctx, void * application_data*) [Function]

sctx: libgsasl server handle.

application_data: opaque pointer to application specific data.

Store application specific data in the libgsasl server handle. The application data can be later (for instance, inside a callback) be retrieved by calling `gsasl_server_application_data_get()` . It is normally used by the application to maintain state between the main program and the callback.

Deprecated: Use `gsasl_callback_hook_set()` or `gsasl_session_hook_set()` instead.

gsasl_server_application_data_get

`void * gsasl_server_application_data_get` (*Gsasl_session * sctx*) [Function]

sctx: libgsasl server handle.

Retrieve application specific data from libgsasl server handle. The application data is set using `gsasl_server_application_data_set()` . It is normally used by the application to maintain state between the main program and the callback.

Return value: Returns the application specific data, or NULL.

Deprecated: Use `gsasl_callback_hook_get()` or `gsasl_session_hook_get()` instead.

gsasl_randomize

`int gsasl_randomize (int strong, char * data, size_t datalen)` [Function]

strong: 0 iff operation should not block, non-0 for very strong randomness.

data: output array to be filled with random data.

datalen: size of output array.

Store cryptographically random data of given size in the provided buffer.

Return value: Returns `GSASL_OK` iff successful.

Deprecated: Use `gsasl_random()` or `gsasl_nonce()` instead.

gsasl_ctx_get

`Gsasl * gsasl_ctx_get (Gsasl_session * sctx)` [Function]

sctx: libgsasl session handle

Get the libgsasl handle given a libgsasl session handle.

Return value: Returns the libgsasl handle given a libgsasl session handle.

Deprecated: This function is not useful with the new 0.2.0 API.

gsasl_encode_inline

`int gsasl_encode_inline (Gsasl_session * sctx, const char * input, size_t input_len, char * output, size_t * output_len)` [Function]

sctx: libgsasl session handle.

input: input byte array.

input_len: size of input byte array.

output: output byte array.

output_len: size of output byte array.

Encode data according to negotiated SASL mechanism. This might mean that data is integrity or privacy protected.

Return value: Returns `GSASL_OK` if encoding was successful, otherwise an error code.

Deprecated: Use `gsasl_encode()` instead.

Since: 0.2.0

gsasl_decode_inline

`int gsasl_decode_inline (Gsasl_session * sctx, const char * input, size_t input_len, char * output, size_t * output_len)` [Function]

sctx: libgsasl session handle.

input: input byte array.

input_len: size of input byte array.

output: output byte array.

output_len: size of output byte array.

Decode data according to negotiated SASL mechanism. This might mean that data is integrity or privacy protected.

Return value: Returns `GSASL_OK` if encoding was successful, otherwise an error code.

Deprecated: Use `gsasl_decode()` instead.

Since: 0.2.0

gsasl_application_data_set

`void gsasl_application_data_set` (*Gsasl * ctx*, *void * appdata*) [Function]

ctx: libgsasl handle.

appdata: opaque pointer to application specific data.

Store application specific data in the libgsasl handle. The application data can be later (for instance, inside a callback) be retrieved by calling `gsasl_application_data_get()` . It is normally used by the application to maintain state between the main program and the callback.

Deprecated: Use `gsasl_callback_hook_set()` instead.

gsasl_application_data_get

`void * gsasl_application_data_get` (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Retrieve application specific data from libgsasl handle. The application data is set using `gsasl_application_data_set()` . It is normally used by the application to maintain state between the main program and the callback.

Return value: Returns the application specific data, or NULL.

Deprecated: Use `gsasl_callback_hook_get()` instead.

gsasl_appinfo_set

`void gsasl_appinfo_set` (*Gsasl_session * sctx*, *void * appdata*) [Function]

sctx: libgsasl session handle.

appdata: opaque pointer to application specific data.

Store application specific data in the libgsasl session handle. The application data can be later (for instance, inside a callback) be retrieved by calling `gsasl_appinfo_get()` . It is normally used by the application to maintain state between the main program and the callback.

Deprecated: Use `gsasl_callback_hook_set()` instead.

gsasl_appinfo_get

`void * gsasl_appinfo_get` (*Gsasl_session * sctx*) [Function]

sctx: libgsasl session handle.

Retrieve application specific data from libgsasl session handle. The application data is set using `gsasl_appinfo_set()` . It is normally used by the application to maintain state between the main program and the callback.

Return value: Returns the application specific data, or NULL.

Deprecated: Use `gsasl_callback_hook_get()` instead.

gsasl_server_suggest_mechanism

`const char * gsasl_server_suggest_mechanism` (*const char *mechlist* `_GL_UNUSED`, *const char *mechlist* `_GL_UNUSED`) [Function]

_GL_UNUSED: – undescribed –

_GL_UNUSED: – undescribed –

Get name of "best" SASL mechanism supported by the libgsasl server which is present in the input string.

Return value: Returns name of "best" SASL mechanism supported by the libgsasl server which is present in the input string.

Deprecated: This function was never useful, since it is the client that chose which mechanism to use.

gsasl_client_callback_authentication_id_set

`void gsasl_client_callback_authentication_id_set` (*Gsasl ** `ctx`, *Gsasl_client_callback_authentication_id* `cb`) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to set the authentication identity. The function can be later retrieved using `gsasl_client_callback_authentication_id_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_authentication_id_get

`Gsasl_client_callback_authentication_id gsasl_client_callback_authentication_id_get` (*Gsasl ** `ctx`) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_authentication_id_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_authentication_id_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_authorization_id_set

`void gsasl_client_callback_authorization_id_set` (*Gsasl ** `ctx`, *Gsasl_client_callback_authorization_id* `cb`) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to set the authorization identity. The function can be later retrieved using `gsasl_client_callback_authorization_id_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_authorization_id_get

`Gsasl_client_callback_authorization_id gsasl_client_callback_authorization_id_get` (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_authorization_id_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_authorization_id_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_password_set

`void gsasl_client_callback_password_set` (*Gsasl * ctx, Gsasl_client_callback_password cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to set the password. The function can be later retrieved using `gsasl_client_callback_password_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_password_get

`Gsasl_client_callback_password gsasl_client_callback_password_get` (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_password_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_password_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_passcode_set

void **gsasl_client_callback_passcode_set** (*Gsasl * ctx*, *Gsasl_client_callback_passcode cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to set the passcode. The function can be later retrieved using `gsasl_client_callback_passcode_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_passcode_get

Gsasl_client_callback_passcode **gsasl_client_callback_passcode_get** (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_passcode_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_passcode_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_pin_set

void **gsasl_client_callback_pin_set** (*Gsasl * ctx*, *Gsasl_client_callback_pin cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to chose a new pin, possibly suggested by the server, for the SECURID mechanism. This is not normally invoked, but only when the server requests it. The function can be later retrieved using `gsasl_client_callback_pin_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_pin_get

Gsasl_client_callback_pin **gsasl_client_callback_pin_get** (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_pin_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_pin_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_service_set

`void gsasl_client_callback_service_set` (*Gsasl * ctx*, *Gsasl_client_callback_service* `cb`) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to set the name of the service. The service buffer should be a registered GSSAPI host-based service name, hostname the name of the server. Servicename is used by DIGEST-MD5 and should be the name of generic server in case of a replicated service. The function can be later retrieved using `gsasl_client_callback_service_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_service_get

`Gsasl_client_callback_service gsasl_client_callback_service_get` (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_service_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_service_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_anonymous_set

`void gsasl_client_callback_anonymous_set` (*Gsasl * ctx*, *Gsasl_client_callback_anonymous* `cb`) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to set the anonymous token, which usually is the users email address. The function can be later retrieved using `gsasl_client_callback_anonymous_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_anonymous_get

`Gsasl_client_callback_anonymous gsasl_client_callback_anonymous_get (Gsasl * ctx)` [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_anonymous_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_anonymous_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_qop_set

`void gsasl_client_callback_qop_set (Gsasl * ctx, Gsasl_client_callback_qop cb)` [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to determine the qop to use after looking at what the server offered. The function can be later retrieved using `gsasl_client_callback_qop_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_qop_get

`Gsasl_client_callback_qop gsasl_client_callback_qop_get (Gsasl * ctx)` [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_qop_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_qop_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_maxbuf_set

`void gsasl_client_callback_maxbuf_set (Gsasl * ctx, Gsasl_client_callback_maxbuf cb)` [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to inform the server of the largest buffer the client is able to receive when using the DIGEST-MD5 "auth-int" or "auth-conf" Quality of Protection (qop). If this directive is missing, the default value 65536 will be assumed. The function can be later retrieved using `gsasl_client_callback_maxbuf_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_maxbuf_get

`Gsasl_client_callback_maxbuf` [Function]
`gsasl_client_callback_maxbuf_get` (*Gsasl * ctx*)

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_maxbuf_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_maxbuf_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_realm_set

`void gsasl_client_callback_realm_set` (*Gsasl * ctx, Gsasl_client_callback_realm cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the client to know which realm it belongs to. The realm is used by the server to determine which username and password to use. The function can be later retrieved using `gsasl_client_callback_realm_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_client_callback_realm_get

`Gsasl_client_callback_realm` [Function]
`gsasl_client_callback_realm_get` (*Gsasl * ctx*)

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_client_callback_realm_set()` .

Return value: Returns the callback earlier set by calling `gsasl_client_callback_realm_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_validate_set

void **gsasl_server_callback_validate_set** (*Gsasl * ctx*, *Gsasl_server_callback_validate cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for deciding if user is authenticated using authentication identity, authorization identity and password. The function can be later retrieved using `gsasl_server_callback_validate_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_validate_get

Gsasl_server_callback_validate **gsasl_server_callback_validate_get** (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_validate_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_validate_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_retrieve_set

void **gsasl_server_callback_retrieve_set** (*Gsasl * ctx*, *Gsasl_server_callback_retrieve cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for deciding if user is authenticated using authentication identity, authorization identity and password. The function can be later retrieved using `gsasl_server_callback_retrieve_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_retrieve_get

Gsasl_server_callback_retrieve **gsasl_server_callback_retrieve_get** (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_retrieve_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_retrieve_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_cram_md5_set

void gsasl_server_callback_cram_md5_set (*Gsasl * ctx*, *Gsasl_server_callback_cram_md5 cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for deciding if user is authenticated using CRAM-MD5 challenge and response. The function can be later retrieved using `gsasl_server_callback_cram_md5_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_cram_md5_get

Gsasl_server_callback_cram_md5 gsasl_server_callback_cram_md5_get (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_cram_md5_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_cram_md5_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_digest_md5_set

void gsasl_server_callback_digest_md5_set (*Gsasl * ctx*, *Gsasl_server_callback_digest_md5 cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for retrieving the secret hash of the username, realm and password for use in the DIGEST-MD5 mechanism. The function can be later retrieved using `gsasl_server_callback_digest_md5_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_digest_md5_get

Gsasl_server_callback_digest_md5 gsasl_server_callback_digest_md5_get (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_digest_md5_set()` .

Return value: Return the callback earlier set by calling `gsasl_server_callback_digest_md5_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_external_set

`void gsasl_server_callback_external_set` (*Gsasl * ctx*, *Gsasl_server_callback_external cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for deciding if user is authenticated out of band. The function can be later retrieved using `gsasl_server_callback_external_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_external_get

`Gsasl_server_callback_external gsasl_server_callback_external_get` (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_external_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_external_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_anonymous_set

`void gsasl_server_callback_anonymous_set` (*Gsasl * ctx*, *Gsasl_server_callback_anonymous cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for deciding if user is permitted anonymous access. The function can be later retrieved using `gsasl_server_callback_anonymous_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_anonymous_get

`Gsasl_server_callback_anonymous gsasl_server_callback_anonymous_get (Gsasl * ctx)` [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_anonymous_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_anonymous_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_realm_set

`void gsasl_server_callback_realm_set (Gsasl * ctx, Gsasl_server_callback_realm cb)` [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server to know which realm it serves. The realm is used by the user to determine which username and password to use. The function can be later retrieved using `gsasl_server_callback_realm_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_realm_get

`Gsasl_server_callback_realm gsasl_server_callback_realm_get (Gsasl * ctx)` [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_realm_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_realm_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_qop_set

`void gsasl_server_callback_qop_set (Gsasl * ctx, Gsasl_server_callback_qop cb)` [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server to know which quality of protection it accepts. The quality of protection eventually used is selected by the client though.

It is currently used by the DIGEST-MD5 mechanism. The function can be later retrieved using `gsasl_server_callback_qop_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_qop_get

`Gsasl_server_callback_qop gsasl_server_callback_qop_get` (*Gsasl* * *ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_qop_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_qop_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_maxbuf_set

`void gsasl_server_callback_maxbuf_set` (*Gsasl* * *ctx*, *Gsasl_server_callback_maxbuf* *cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server to inform the client of the largest buffer the server is able to receive when using the DIGEST-MD5 "auth-int" or "auth-conf" Quality of Protection (qop). If this directive is missing, the default value 65536 will be assumed. The function can be later retrieved using `gsasl_server_callback_maxbuf_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_maxbuf_get

`Gsasl_server_callback_maxbuf gsasl_server_callback_maxbuf_get` (*Gsasl* * *ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_maxbuf_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_maxbuf_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_cipher_set

`void gsasl_server_callback_cipher_set (Gsasl * ctx, Gsasl_server_callback_cipher cb)` [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server to inform the client of the cipher suites supported. The DES and 3DES ciphers must be supported for interoperability. It is currently used by the DIGEST-MD5 mechanism. The function can be later retrieved using `gsasl_server_callback_cipher_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_cipher_get

`Gsasl_server_callback_cipher gsasl_server_callback_cipher_get (Gsasl * ctx)` [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_cipher_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_cipher_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_securid_set

`void gsasl_server_callback_securid_set (Gsasl * ctx, Gsasl_server_callback_securid cb)` [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for validating a user via the SECURID mechanism. The function should return GSASL_OK if user authenticated successfully, GSASL_SECURID_SERVER_NEED_ADDITIONAL_PASSCODE if it wants another passcode, GSASL_SECURID_SERVER_NEED_NEW_PIN if it wants a PIN change, or an error. When (and only when) GSASL_SECURID_SERVER_NEED_NEW_PIN is returned, suggestpin can be populated with a PIN code the server suggests, and suggestpinlen set to the length of the PIN. The function can be later retrieved using `gsasl_server_callback_securid_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_securid_get

`Gsasl_server_callback_securid gsasl_server_callback_securid_get` (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_securid_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_securid_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_gssapi_set

`void gsasl_server_callback_gssapi_set` (*Gsasl * ctx, Gsasl_server_callback_gssapi cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server for checking if a GSSAPI user is authorized for username (by, e.g., calling krb5_kuserok). The function should return GSASL_OK if the user should be permitted access, or an error code such as GSASL_AUTHENTICATION_ERROR on failure. The function can be later retrieved using `gsasl_server_callback_gssapi_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_gssapi_get

`Gsasl_server_callback_gssapi gsasl_server_callback_gssapi_get` (*Gsasl * ctx*) [Function]

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_gssapi_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_gssapi_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_service_set

`void gsasl_server_callback_service_set` (*Gsasl * ctx, Gsasl_server_callback_service cb*) [Function]

ctx: libgsasl handle.

cb: callback function

Specify the callback function to use in the server to set the name of the service. The service buffer should be a registered GSSAPI host-based service name, hostname the name of the server. The function can be later retrieved using `gsasl_server_callback_service_get()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_server_callback_service_get

`Gsasl_server_callback_service` [Function]
`gsasl_server_callback_service_get` (*Gsasl * ctx*)

ctx: libgsasl handle.

Get the callback earlier set by calling `gsasl_server_callback_service_set()` .

Return value: Returns the callback earlier set by calling `gsasl_server_callback_service_set()` .

Deprecated: This function is part of the old callback interface. The new interface uses `gsasl_callback_set()` to set the application callback, and uses `gsasl_callback()` or `gsasl_property_get()` to invoke the callback for certain properties.

gsasl_stringprep_nfkc

`char * gsasl_stringprep_nfkc` (*const char * in, ssize_t len*) [Function]

in: a UTF-8 encoded string.

len: length of `str` , in bytes, or -1 if `str` is nul-terminated.

Converts a string into canonical form, standardizing such issues as whether a character with an accent is represented as a base character and combining accent or as a single precomposed character.

The normalization mode is NFKC (ALL COMPOSE). It standardizes differences that do not affect the text content, such as the above-mentioned accent representation. It standardizes the "compatibility" characters in Unicode, such as SUPERSCRIPT THREE to the standard forms (in this case DIGIT THREE). Formatting information may be lost but for most text operations such characters should be considered the same. It returns a result with composed forms rather than a maximally decomposed form.

Return value: Return a newly allocated string, that is the NFKC normalized form of `str` , or NULL on error.

Deprecated: No replacement functionality in GNU SASL, use GNU Libidn instead. Note that in SASL, you most likely want to use SASLprep and not bare NFKC, see `gsasl_saslprep()` .

gsasl_stringprep_saslprep

`char * gsasl_stringprep_saslprep` (*const char * in, int * stringprep_rc*) [Function]

in: input ASCII or UTF-8 string with data to prepare according to SASLprep.

stringprep_rc: pointer to output variable with stringprep error code, or NULL to indicate that you don't care about it.

Process a Unicode string for comparison, according to the "SASLprep" stringprep profile. This function is intended to be used by Simple Authentication and Security Layer (SASL) mechanisms (such as PLAIN, CRAM-MD5, and DIGEST-MD5) as well as other protocols exchanging user names and/or passwords.

Return value: Return a newly allocated string that is the "SASLprep" processed form of the input string, or NULL on error, in which case `stringprep_rc` contain the stringprep library error code.

Deprecated: Use `gsasl_saslprep()` instead.

gsasl_stringprep_trace

`char * gsasl_stringprep_trace` (*const char * `in`, int * `stringprep_rc`*) [Function]

in: input ASCII or UTF-8 string with data to prepare according to "trace".

stringprep_rc: pointer to output variable with stringprep error code, or NULL to indicate that you don't care about it.

Process a Unicode string for use as trace information, according to the "trace" stringprep profile. The profile is designed for use with the SASL ANONYMOUS Mechanism.

Return value: Return a newly allocated string that is the "trace" processed form of the input string, or NULL on error, in which case `stringprep_rc` contain the stringprep library error code.

Deprecated: No replacement functionality in GNU SASL, use GNU Libidn instead.

gsasl_md5pwd_get_password

`int gsasl_md5pwd_get_password` (*const char * `filename`, const char * `username`, char * `key`, size_t * `keylen`*) [Function]

filename: filename of file containing passwords.

username: username string.

key: output character array.

keylen: input maximum size of output character array, on output contains actual length of output array.

Retrieve password for user from specified file. To find out how large the output array must be, call this function with out=NULL.

The file should be on the UoW "MD5 Based Authentication" format, which means it is in text format with comments denoted by # first on the line, with user entries looking as "usernameTABpassword". This function removes CR and LF at the end of lines before processing. TAB, CR, and LF denote ASCII values 9, 13, and 10, respectively.

Return value: Return GSASL_OK if output buffer contains the password, GSASL_AUTHENTICATION_ERROR if the user could not be found, or other error code.

Deprecated: Use `gsasl_simple_getpass()` instead.

gsasl_base64_encode

int gsasl_base64_encode (*char const * src*, *size_t srclength*, *char * target*, *size_t targsize*) [Function]

src: input byte array

srclength: size of input byte array

target: output byte array

targsize: size of output byte array

Encode data as base64. Converts characters, three at a time, starting at src into four base64 characters in the target area until the entire input buffer is encoded.

Return value: Returns the number of data bytes stored at the target, or -1 on error.

Deprecated: Use `gsasl_base64_to()` instead.

gsasl_base64_decode

int gsasl_base64_decode (*char const * src*, *char * target*, *size_t targsize*) [Function]

src: input byte array

target: output byte array

targsize: size of output byte array

Decode Base64 data. Skips all whitespace anywhere. Converts characters, four at a time, starting at (or after) src from Base64 numbers into three 8 bit bytes in the target area.

Return value: Returns the number of data bytes stored at the target, or -1 on error.

Deprecated: Use `gsasl_base64_from()` instead.

gsasl_md5

int gsasl_md5 (*const char * in*, *size_t inlen*, *char * [] out*) [Function]

in: input character array of data to hash.

inlen: length of input character array of data to hash.

out: newly allocated 16-byte character array with hash of data.

Compute hash of data using MD5. The `out` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` iff successful.

Deprecated: Use a crypto library.

gsasl_hmac_md5

int gsasl_hmac_md5 (*const char * key*, *size_t keylen*, *const char * in*, *size_t inlen*, *char * [] outhash*) [Function]

key: input character array with key to use.

keylen: length of input character array with key to use.

in: input character array of data to hash.

inlen: length of input character array of data to hash.

outhash: newly allocated 16-byte character array with keyed hash of data.

Compute keyed checksum of data using HMAC-MD5. The `outhash` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` iff successful.

Deprecated: Use a crypto library.

gsasl_sha1

`int gsasl_sha1` (*const char * `in`, size_t `inlen`, char * [] `out`*) [Function]

in: input character array of data to hash.

inlen: length of input character array of data to hash.

out: newly allocated 20-byte character array with hash of data.

Compute hash of data using SHA1. The `out` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` iff successful.

Since: 1.3

Deprecated: Use a crypto library.

gsasl_hmac_sha1

`int gsasl_hmac_sha1` (*const char * `key`, size_t `keylen`, const char * `in`, size_t `inlen`, char * [] `outhash`*) [Function]

key: input character array with key to use.

keylen: length of input character array with key to use.

in: input character array of data to hash.

inlen: length of input character array of data to hash.

outhash: newly allocated 20-byte character array with keyed hash of data.

Compute keyed checksum of data using HMAC-SHA1. The `outhash` buffer must be deallocated by the caller.

Return value: Returns `GSASL_OK` iff successful.

Since: 1.3

Deprecated: Use a crypto library.

B.1 Obsolete callback function prototypes

`int (*Gsasl_client_callback_anonymous)` (*Gsasl_session_ctx * `ctx`, char * `out`, size_t * `outlen`*) [Prototype]

ctx: libgsasl handle.

out: output array with client token.

outlen: on input the maximum size of the output array, on output contains the actual size of the output array.

Type of callback function the application implements. It should populate the output array with some input from the user and set the output array length, and return `GSASL_OK`, or fail with an error code.

If OUT is NULL, the function should only populate the output length field with the length, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_server_callback_anonymous)` (*Gsasl_session_ctx * ctx, const char * token*) [Prototype]

ctx: libgsasl handle.

ctx: output array with client token.

ctx: on input the maximum size of the output array, on output contains the actual size of the output array. If OUT is

Type of callback function the application implements. It should return `GSASL_OK` if user should be permitted anonymous access, otherwise `GSASL_AUTHENTICATION_ERROR`.

`int (*Gsasl_client_callback_authentication_id)` (*Gsasl_session_ctx * ctx, char * out, size_t * outlen*) [Prototype]

ctx: libgsasl handle.

out: output array with authentication identity.

outlen: on input the maximum size of the output array, on output contains the actual size of the output array.

Type of callback function the application implements. It should populate the output array with authentiction identity of user and set the output array length, and return `GSASL_OK`, or fail with an error code. The authentication identity must be encoded in UTF-8, but need not be normalized in any way.

If OUT is NULL, the function should only populate the output length field with the length, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_client_callback_authorization_id)` (*Gsasl_session_ctx * ctx, char * out, size_t * outlen*) [Prototype]

ctx: libgsasl handle.

out: output array with authorization identity.

outlen: on input the maximum size of the output array, on output contains the actual size of the output array.

Type of callback function the application implements. It should populate the output array with authorization identity of user and set the output array length, and return `GSASL_OK`, or fail with an error code. The authorization identity must be encoded in UTF-8, but need not be normalized in any way.

If OUT is NULL, the function should only populate the output length field with the length, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_client_callback_service)` (*Gsasl_session_ctx * ctx, char * service, size_t * servicelen, char * hostname, size_t * hostnamelen, char * servicename, size_t * servicenamelen*) [Prototype]

ctx: libgsasl handle.

service: output array with name of service.

servicelen: on input the maximum size of the service output array, on output contains the actual size of the service output array.

hostname: output array with hostname of server.

hostnamelen: on input the maximum size of the hostname output array, on output contains the actual size of the hostname output array.

servicename: output array with generic name of server in case of replication (DIGEST-MD5 only).

servicenamelen: on input the maximum size of the servicename output array, on output contains the actual size of the servicename output array.

Type of callback function the application implements. It should retrieve the service (which should be a registered GSSAPI host based service name, such as "imap") on the server, hostname of server (usually canoncial DNS hostname) and optionally generic service name of server in case of replication (e.g. "mail.example.org" when the hostname is "mx42.example.org", see the RFC 2831 for more information). It should return GSASL_OK, or an error such as GSASL_AUTHENTICATION_ERROR if it fails.

If SERVICE, HOSTNAME or SERVICENAME is NULL, the function should only populate SERVICELEN, HOSTNAMELEN or SERVICENAMELEN with the output length of the respective field, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size. Furthermore, SERVICENAMELEN may also be NULL, indicating that the mechanism is not interested in this field.

`int (*Gsasl_server_callback_cram_md5)` (*Gsasl_session_ctx * `ctx`, char * `username`, char * `challenge`, char * `response`*) [Prototype]

ctx: libgsasl handle.

username: input array with username.

challenge: input array with CRAM-MD5 challenge.

response: input array with CRAM-MD5 response.

Type of callback function the application implements. It should return GSASL_OK if and only if the validation of the provided credential was succesful. GSASL_AUTHENTICATION_ERROR is a good failure if authentication failed, but any available return code may be used.

`int (*Gsasl_server_callback_digest_md5)` (*Gsasl_session_ctx * `ctx`, char * `username`, char * `realm`, char * `secrethash`*) [Prototype]

ctx: libgsasl handle.

username: input array with authentication identity of user.

realm: input array with realm of user.

secrethash: output array that should contain hash of username, realm and password as described for the DIGEST-MD5 mechanism.

Type of callback function the application implements. It should retrieve the secret hash for the given user in given realm and return GSASL_OK, or an error such as GSASL_AUTHENTICATION_ERROR if it fails. The secrethash buffer is guaranteed to have size for the fixed length MD5 hash.

`int (*Gsasl_server_callback_external)` (*Gsasl_session_ctx * ctx*) [Prototype]

ctx: libgsasl handle.

Type of callback function the application implements. It should return `GSASL_OK` if user is authenticated by out of band means, otherwise `GSASL_AUTHENTICATION_ERROR`.

`int (*Gsasl_server_callback_gssapi)` (*Gsasl_session_ctx * ctx, char * clientname, char * authentication_id*) [Prototype]

ctx: libgsasl handle.

clientname: input array with GSSAPI client name.

authentication_id: input array with authentication identity.

Type of callback function the application implements. It should return GSASL_OK if and only if the GSSAPI user is authorized to log on as the given authentication_id. GSASL_AUTHENTICATION_ERROR is a good failure if authentication failed, but any available return code may be used. This callback is usually implemented in the application as a call to krb5_kuserok(), such as:

```
int
callback_gssapi (Gsasl_session_ctx *ctx,
 char *clientname,
 char *authentication_id)
{
  int rc = GSASL_AUTHENTICATION_ERROR;

  krb5_principal p;
  krb5_context kcontext;

  krb5_init_context (&kcontext);

  if (krb5_parse_name (kcontext, clientname, &p) != 0)
    return -1;
  if (krb5_kuserok (kcontext, p, authentication_id))
    rc = GSASL_OK;
  krb5_free_principal (kcontext, p);

  return rc;
}
```

`int (*Gsasl_client_callback_passcode)` (*Gsasl_session_ctx * ctx, char * out, size_t * outlen*) [Prototype]

ctx: libgsasl handle.

out: output array with passcode.

outlen: on input the maximum size of the output array, on output contains the actual size of the output array.

Type of callback function the application implements. It should populate the output array with passcode of user and set the output array length, and return `GSASL_OK`, or fail with an error code.

If OUT is NULL, the function should only populate the output length field with the length, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_client_callback_password)` (*Gsasl_session_ctx ** **ctx**, *char ** **out**, *size_t ** **outlen**) [Prototype]

ctx: libgsasl handle.

out: output array with password.

outlen: on input the maximum size of the output array, on output contains the actual size of the output array.

Type of callback function the application implements. It should populate the output array with password of user and set the output array length, and return `GSASL_OK`, or fail with an error code. The password must be encoded in UTF-8, but need not be normalized in any way.

If OUT is NULL, the function should only populate the output length field with the length, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_server_callback_retrieve)` (*Gsasl_session_ctx ** **ctx**, *char ** **authentication_id**, *char ** **authorization_id**, *char ** **realm**, *char ** **key**, *size_t ** **keylen**) [Prototype]

ctx: libgsasl handle.

authentication_id: input array with authentication identity.

authorization_id: input array with authorization identity, or NULL.

realm: input array with realm of user, or NULL.

key: output array with key for authentication identity.

keylen: on input the maximum size of the key output array, on output contains the actual size of the key output array.

Type of callback function the application implements. It should retrieve the password for the indicated user and return GSASL_OK, or an error code such as GSASL_AUTHENTICATION_ERROR. The key must be encoded in UTF-8, but need not be normalized in any way.

If KEY is NULL, the function should only populate the KEYLEN output length field with the length, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_server_callback_validate)` (*Gsasl_session_ctx ** **ctx**, *char ** **authentication_id**, *char ** **authorization_id**, *char ** **passcode**, *char ** **pin**, *char ** **suggestpin**, *size_t ** **suggestpinlen**) [Prototype]

ctx: libgsasl handle.

authorization_id: input array with authorization identity.

authentication_id: input array with authentication identity.

passcode: input array with passcode.

pin: input array with new pin (this may be NULL).

suggestpin: output array with new suggested PIN.

suggestpinlen: on input the maximum size of the output array, on output contains the actual size of the output array.

Type of callback function the application implements. It should return GSASL_OK if and only if the validation of the provided credential was succesful. GSASL_AUTHENTICATION_ERROR is a good failure if authentication failed, but any available return code may be used.

Two SECURID specific error codes also exists. The function can return GSASL_SECURID_SERVER_NEED_ADDITIONAL_PASSCODE to request that the client generate a new passcode. It can also return GSASL_SECURID_SERVER_NEED_NEW_PIN to request that the client generate a new PIN. If the server wishes to suggest a new PIN it can populate the SUGGESTPIN field.

If SUGGESTPIN is NULL, the function should only populate the output length field with the length, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_server_callback_service)` (*Gsasl_session_ctx * `ctx`, char * `service`, size_t * `servicelen`, char * `hostname`, size_t * `hostnamelen`*) [Prototype]

ctx: libgsasl handle.

service: output array with name of service.

servicelen: on input the maximum size of the service output array, on output contains the actual size of the service output array.

hostname: output array with hostname of server.

hostnamelen: on input the maximum size of the hostname output array, on output contains the actual size of the hostname output array.

Type of callback function the application implements. It should retrieve the service (which should be a registered GSSAPI host based service name, such as "imap") the server provides and hostname of server (usually canoncial DNS hostname). It should return GSASL_OK, or an error such as GSASL_AUTHENTICATION_ERROR if it fails.

If SERVICE or HOSTNAME is NULL, the function should only populate SERVICELEN or HOSTNAMELEN with the output length of the respective field, and return GSASL_OK. This usage may be used by the caller to allocate the proper buffer size.

`int (*Gsasl_server_callback_validate)` (*Gsasl_session_ctx * `ctx`, char * `authorization_id`, char * `authentication_id`, char * `password`*) [Prototype]

ctx: libgsasl handle.

authorization_id: input array with authorization identity.

authentication_id: input array with authentication identity.

password: input array with password.

Type of callback function the application implements. It should return GSASL_OK if and only if the validation of the provided credential was succesful. GSASL_AUTHENTICATION_ERROR is a good failure if authentication failed, but any available return code may be used.

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