

# libSRTP 1.4.5 Overview and Reference Manual

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## Preface

The original implementation and documentation of libSRTP was written by David McGrew of Cisco Systems, Inc. in order to promote the use, understanding, and interoperability of Secure RTP. Michael Jerris contributed support for building under MSVC. Andris Pavenis contributed many important fixes. Brian West contributed changes to enable dynamic linking. Yves Shumann reported documentation bugs. Randell Jesup contributed a working SRTCP implementation and other fixes. Alex Vanzella and Will Clark contributed changes so that the AES ICM implementation can be used for ISMA media encryption. Steve Underwood contributed x86\_64 portability changes. We also give thanks to Fredrik Thulin, Brian Weis, Mark Baugher, Jeff Chan, Bill Simon, Douglas Smith, Bill May, Richard Prestley, Joe Tardo and others for contributions, comments, and corrections.

This reference material in this documentation was generated using the `doxygen` utility for automatic documentation of source code.

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## Chapter 1

# Introduction to libSRTP

This document describes libSRTP, the Open Source Secure RTP library from Cisco Systems, Inc. RTP is the Real-time Transport Protocol, an IETF standard for the transport of real-time data such as telephony, audio, and video, defined by RFC 3550. Secure RTP (SRTP) is an RTP profile for providing confidentiality to RTP data and authentication to the RTP header and payload. SRTP is an IETF Proposed Standard, defined in RFC 3711, and was developed in the IETF Audio/Video Transport (AVT) Working Group. This library supports all of the mandatory features of SRTP, but not all of the optional features. See the [Supported Features](#) section for more detailed information.

This document is organized as follows. The first chapter provides background material on SRTP and overview of libSRTP. The following chapters provide a detailed reference to the libSRTP API and related functions. The reference material is created automatically (using the doxygen utility) from comments embedded in some of the C header files. The documentation is organized into modules in order to improve its clarity. These modules do not directly correspond to files. An underlying cryptographic kernel provides much of the basic functionality of libSRTP, but is mostly undocumented because it does its work behind the scenes.

## 1.1 License and Disclaimer

libSRTP is distributed under the following license, which is included in the source code distribution. It is reproduced in the manual in case you got the library from another source.

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## 1.2 Supported Features

This library supports all of the mandatory-to-implement features of SRTP (as defined by the most recent Internet Draft). Some of these features can be selected (or de-selected) at run time by setting an appropriate policy; this is done using the structure [srtp\\_policy\\_t](#). Some other behaviors of the protocol can be adapted by defining an appropriate event handler for the exceptional events; see the [SRTP events and callbacks](#) section.

Some options that are not included in the specification are supported. Most notably, the TMMH authentication function is included, though it was removed from the SRTP Internet Draft during the summer of 2002.

Some options that are described in the SRTP specification are not supported. This includes

- the Master Key Index (MKI),
- key derivation rates other than zero,
- the cipher F8,
- anti-replay lists with sizes other than 128,
- the use of the packet index to select between master keys.

The user should be aware that it is possible to misuse this library, and that the result may be that the security level it provides is inadequate. If you are implementing a feature using this library, you will want to read the Security



Considerations section of the Internet Draft. In addition, it is important that you read and understand the terms outlined in the [License and Disclaimer](#) section.

## 1.3 Installing and Building libSRTP

To install libSRTP, download the latest release of the distribution from `srtp.sourceforge.net`. The format of the names of the distributions are `srtp-A.B.C.tgz`, where A is the version number, B is the major release number, C is the minor release number, and `tgz` is the file extension<sup>1</sup> You probably want to get the most recent release. Unpack the distribution and extract the source files; the directory into which the source files will go is named `srtp`.

libSRTP uses the GNU `autoconf` and `make` utilities<sup>2</sup>. In the `srtp` directory, run the configure script and then make:

```
./configure [ options ]  
make
```

The configure script accepts the following options:

- help** provides a usage summary.
- disable-debug** compiles libSRTP without the runtime dynamic debugging system.
- enable-generic-aesicm** compile in changes for ismacryp
- enable-syslog** use syslog for error reporting.
- disable-stdout** disables stdout for error reporting.
- enable-console** use `/dev/console` for error reporting
- gdoi** use GDOI key management (disabled at present).

By default, dynamic debugging is enabled and stdout is used for debugging. You can use the configure options to have the debugging output sent to syslog or the system console. Alternatively, you can define `ERR_REPORTING_FILE` in `include/conf.h` to be any other file that can be opened by libSRTP, and debug messages will be sent to it.

This package has been tested on the following platforms: Mac OS X (powerpc-apple-darwin1.4), Cygwin (i686-pc-cygwin), Solaris (sparc-sun-solaris2.6), RedHat Linux 7.1 and 9 (i686-pc-linux), and OpenBSD (sparc-unknown-openbsd2.7).

---

<sup>1</sup>The extension `.tgz` is identical to `tar.gz`, and indicates a compressed tar file.

<sup>2</sup>BSD make will not work; if both versions of make are on your platform, you can invoke GNU make as `gmake`.

## 1.4 Applications

Several test drivers and a simple and portable srtp application are included in the `test/` subdirectory.

Test driver	Function tested
<code>kernel_driver</code>	crypto kernel (ciphers, auth funcs, rng)
<code>srtp_driver</code>	srtp in-memory tests (does not use the network)
<code>rdbx_driver</code>	rdbx (extended replay database)
<code>roc_driver</code>	extended sequence number functions
<code>replay_driver</code>	replay database
<code>cipher_driver</code>	ciphers
<code>auth_driver</code>	hash functions

The app `rtpw` is a simple rtp application which reads words from `/usr/dict/words` and then sends them out one at a time using `[s]rtp`. Manual srtp keying uses the `-k` option; automated key management using `gdoi` will be added later.

The usage for `rtpw` is

```
rtpw [[-d <debug>]* [-k <key> [-a][-e]] [-s | -r] dest_ip dest_port] | [-l]
```

Either the `-s` (sender) or `-r` (receiver) option must be chosen. The values `dest_ip`, `dest_port` are the IP address and UDP port to which the dictionary will be sent, respectively. The options are:

- `-s` (S)RTP sender - causes app to send words
- `-r` (S)RTP receive - causes app to receive words
- `-k <key>` use SRTP master key `<key>`, where the key is a hexadecimal value (without the leading "0x")
- `-e` encrypt/decrypt (for data confidentiality) (requires use of `-k` option as well)
- `-a` message authentication (requires use of `-k` option as well)
- `-l` list the available debug modules
- `-d <debug>` turn on debugging for module `<debug>`

In order to get a random 30-byte value for use as a key/salt pair, you can use the `rand_gen` utility in the `test/` subdirectory.

An example of an SRTP session using two `rtpw` programs follows:

```
[sh1] set k=`test/rand_gen -n 30`
[sh1] echo $k
c1eec3717da76195bb878578790af71c4ee9f859e197a414a78d5abc7451
```

```
[sh1]$ test/rtpw -s -k $k -ea 0.0.0.0 9999
Security services: confidentiality message authentication
set master key/salt to C1EEC3717DA76195BB878578790AF71C/4EE9F859E197A414A78D5ABC7451
setting SSRC to 2078917053
sending word: A
sending word: a
sending word: aa
sending word: aal
sending word: aalii
sending word: aam
sending word: Aani
sending word: aardvark
...

[sh2] set k=c1eec3717da76195bb878578790af71c4ee9f859e197a414a78d5abc7451
[sh2]$ test/rtpw -r -k $k -ea 0.0.0.0 9999
security services: confidentiality message authentication
set master key/salt to C1EEC3717DA76195BB878578790AF71C/4EE9F859E197A414A78D5ABC7451
19 octets received from SSRC 2078917053 word: A
19 octets received from SSRC 2078917053 word: a
20 octets received from SSRC 2078917053 word: aa
21 octets received from SSRC 2078917053 word: aal
...
```

## 1.5 Secure RTP Background

In this section we review SRTP and introduce some terms that are used in libSRTP. An RTP session is defined by a pair of destination transport addresses, that is, a network address plus a pair of UDP ports for RTP and RTCP. RTCP, the RTP control protocol, is used to coordinate between the participants in an RTP session, e.g. to provide feedback from receivers to senders. An *SRTP session* is similarly defined; it is just an RTP session for which the SRTP profile is being used. An SRTP session consists of the traffic sent to the SRTP or SRTCP destination transport addresses. Each participant in a session is identified by a synchronization source (SSRC) identifier. Some participants may not send any SRTP traffic; they are called receivers, even though they send out SRTCP traffic, such as receiver reports.

RTP allows multiple sources to send RTP and RTCP traffic during the same session. The synchronization source identifier (SSRC) is used to distinguish these sources. In libSRTP, we call the SRTP and SRTCP traffic from a particular source a *stream*. Each stream has its own SSRC, sequence number, rollover counter, and other data. A particular choice of options, cryptographic mechanisms, and keys is called a *policy*. Each stream within a session can have a distinct policy applied to it. A session policy is a collection of stream policies.

A single policy can be used for all of the streams in a given session, though the case in which a single *key* is shared across multiple streams requires care. When key sharing is used, the SSRC values that identify the streams **must**

be distinct. This requirement can be enforced by using the convention that each SRTP and SRTCP key is used for encryption by only a single sender. In other words, the key is shared only across streams that originate from a particular device (of course, other SRTP participants will need to use the key for decryption). libSRTP supports this enforcement by detecting the case in which a key is used for both inbound and outbound data.

## 1.6 libSRTP Overview

libSRTP provides functions for protecting RTP and RTCP. RTP packets can be encrypted and authenticated (using the [srtp\\_protect\(\)](#) function), turning them into SRTP packets. Similarly, SRTP packets can be decrypted and have their authentication verified (using the [srtp\\_unprotect\(\)](#) function), turning them into RTP packets. Similar functions apply security to RTCP packets.

The typedef `srtp_stream_t` points to a structure holding all of the state associated with an SRTP stream, including the keys and parameters for cipher and message authentication functions and the anti-replay data. A particular `srtp_stream_t` holds the information needed to protect a particular RTP and RTCP stream. This datatype is intentionally opaque in order to better separate the libSRTP API from its implementation.

Within an SRTP session, there can be multiple streams, each originating from a particular sender. Each source uses a distinct stream context to protect the RTP and RTCP stream that it is originating. The typedef `srtp_t` points to a structure holding all of the state associated with an SRTP session. There can be multiple stream contexts associated with a single `srtp_t`. A stream context cannot exist independent from an `srtp_t`, though of course an `srtp_t` can be created that contains only a single stream context. A device participating in an SRTP session must have a stream context for each source in that session, so that it can process the data that it receives from each sender.

In libSRTP, a session is created using the function [srtp\\_create\(\)](#). The policy to be implemented in the session is passed into this function as an [srtp\\_policy\\_t](#) structure. A single one of these structures describes the policy of a single stream. These structures can also be linked together to form an entire session policy. A linked list of [srtp\\_policy\\_t](#) structures is equivalent to a session policy. In such a policy, we refer to a single [srtp\\_policy\\_t](#) as an *element*.

An [srtp\\_policy\\_t](#) structure contains two [crypto\\_policy\\_t](#) structures that describe the cryptographic policies for RTP and RTCP, as well as the SRTP master key and the SSRC value. The SSRC describes what to protect (e.g. which stream), and the [crypto\\_policy\\_t](#) structures describe how to protect it. The key is contained in a policy element because it simplifies the interface to the library. In many cases, it is desirable to use the same cryptographic policies across all of the streams in a session, but to use a distinct key for each stream. A [crypto\\_policy\\_t](#) structure can be initialized by using either the [crypto\\_policy\\_set\\_rtp\\_default\(\)](#) or [crypto\\_policy\\_set\\_rtcp\\_default\(\)](#) functions, which set a crypto policy structure to the default policies for RTP and RTCP protection, respectively.

## 1.7 Example Code

This section provides a simple example of how to use libSRTP. The example code lacks error checking, but is functional. Here we assume that the value `ssrc` is already set to describe the SSRC of the stream that we are sending, and that the functions `get_rtp_packet()` and `send_srtp_packet()` are available to us. The former puts an RTP packet into the buffer and returns the number of octets written to that buffer. The latter sends the RTP packet in the buffer, given the length as its second argument.

```
srtp_t session;
srtp_policy_t policy;
uint8_t key[30];

// initialize libSRTP
srtp_init();

// set policy to describe a policy for an SRTP stream
crypto_policy_set_rtp_default(&policy.rtp);
crypto_policy_set_rtcp_default(&policy.rtcp);
policy.ssrc = ssrc;
policy.key = key;
policy.next = NULL;

// set key to random value
crypto_get_random(key, 30);

// allocate and initialize the SRTP session
srtp_create(&session, &policy);

// main loop: get rtp packets, send srtp packets
while (1) {
    char rtp_buffer[2048];
    unsigned len;

    len = get_rtp_packet(rtp_buffer);
    srtp_protect(session, rtp_buffer, &len);
    send_srtp_packet(rtp_buffer, len);
}
```

## 1.8 ISMA Encryption Support

The Internet Streaming Media Alliance (ISMA) specifies a way to pre-encrypt a media file prior to streaming. This method is an alternative to SRTP encryption, which is potentially useful when a particular media file will be streamed multiple times. The specification is available online at <http://www.isma.tv/specreq.nsf/SpecRequest>.

libSRTP provides the encryption and decryption functions needed for ISMAcryp in the library `libaesicm.a`, which is included in the default Makefile target. This library is used by the MPEG4IP project; see <http://mpeg4ip.sourceforge.net/>.

Note that ISMAcryp does not provide authentication for RTP nor RTCP, nor confidentiality for RTCP. ISMAcryp RECOMMENDS the use of SRTP message authentication for ISMAcryp streams while using ISMAcryp encryption to protect the media itself.

## Chapter 2

# Module Index

### 2.1 Modules

Here is a list of all modules:

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## Chapter 3

# Data Structure Index

### 3.1 Data Structures

Here are the data structures with brief descriptions:

<a href="#">crypto_policy_t</a>	Crypto_policy_t describes a particular crypto policy that can be applied to an SRTP stream . . . . .	45
<a href="#">debug_module_t</a>	. . . . .	47
<a href="#">srtp_event_data_t</a>	Srtp_event_data_t is the structure passed as a callback to the event handler function . . . . .	47
<a href="#">srtp_policy_t</a>	Policy for an SRTP session . . . . .	48
<a href="#">ssrc_t</a>	An <a href="#">ssrc_t</a> represents a particular SSRC value, or a ‘wildcard’ SSRC . . . . .	50



## Chapter 4

# Module Documentation

### 4.1 Secure RTP

libSRTP provides functions for protecting RTP and RTCP. See Section [libSRTP Overview](#) for an introduction to the use of the library.

#### Modules

- [Secure RTCP](#)  
*Secure RTCP functions are used to protect RTCP traffic.*
- [SRTP events and callbacks](#)  
*libSRTP can use a user-provided callback function to handle events.*

#### Data Structures

- struct [crypto\\_policy\\_t](#)  
*crypto\_policy\_t describes a particular crypto policy that can be applied to an SRTP stream.*
- struct [ssrc\\_t](#)  
*An ssrc\_t represents a particular SSRC value, or a 'wildcard' SSRC.*
- struct [srtp\\_policy\\_t](#)  
*represents the policy for an SRTP session.*

## Macros

- `#define SRTP_MAX_TRAILER_LEN SRTP_MAX_TAG_LEN`  
*the maximum number of octets added by `srtp_protect()`.*
- `#define crypto_policy_set_aes_cm_128_hmac_sha1_80(p) crypto_policy_set_rtp_default(p)`  
*`crypto_policy_set_aes_cm_128_hmac_sha1_80()` sets a crypto policy structure to the SRTP default policy for RTP protection.*

## Typedefs

- `typedef struct crypto_policy_t crypto_policy_t`  
*`crypto_policy_t` describes a particular crypto policy that can be applied to an SRTP stream.*
- `typedef struct ekt_policy_ctx_t * ekt_policy_t`  
*points to an EKT policy*
- `typedef struct ekt_stream_ctx_t * ekt_stream_t`  
*points to EKT stream data*
- `typedef struct srtp_policy_t srtp_policy_t`  
*represents the policy for an SRTP session.*
- `typedef struct srtp_ctx_t * srtp_t`  
*An `srtp_t` points to an SRTP session structure.*
- `typedef struct srtp_stream_ctx_t * srtp_stream_t`  
*An `srtp_stream_t` points to an SRTP stream structure.*

## Enumerations

- `enum sec_serv_t { sec_serv_none = 0, sec_serv_conf = 1, sec_serv_auth = 2, sec_serv_conf_and_auth = 3 }`  
*`sec_serv_t` describes a set of security services.*
- `enum ssrc_type_t { ssrc_undefined = 0, ssrc_specific = 1, ssrc_any_inbound = 2, ssrc_any_outbound = 3 }`  
*`ssrc_type_t` describes the type of an SSRC.*

## Functions

- `err_status_t srtp_init (void)`  
*`srtp_init()` initializes the srtp library.*
- `err_status_t srtp_shutdown (void)`  
*`srtp_shutdown()` de-initializes the srtp library.*
- `err_status_t srtp_protect (srtp_t ctx, void *rtp_hdr, int *len_ptr)`

- srtp\_protect()* is the Secure RTP sender-side packet processing function.
- `err_status_t srtp_unprotect (srtp_t ctx, void *srtp_hdr, int *len_ptr)`

*srtp\_unprotect()* is the Secure RTP receiver-side packet processing function.
- `err_status_t srtp_create (srtp_t *session, const srtp_policy_t *policy)`

*srtp\_create()* allocates and initializes an SRTP session.
- `err_status_t srtp_add_stream (srtp_t session, const srtp_policy_t *policy)`

*srtp\_add\_stream()* allocates and initializes an SRTP stream within a given SRTP session.
- `err_status_t srtp_remove_stream (srtp_t session, unsigned int ssrc)`

*srtp\_remove\_stream()* deallocates an SRTP stream.
- `void crypto_policy_set_rtp_default (crypto_policy_t *p)`

*crypto\_policy\_set\_rtp\_default()* sets a crypto policy structure to the SRTP default policy for RTP protection.
- `void crypto_policy_set_rtcp_default (crypto_policy_t *p)`

*crypto\_policy\_set\_rtcp\_default()* sets a crypto policy structure to the SRTP default policy for RTCP protection.
- `void crypto_policy_set_aes_cm_128_hmac_sha1_32 (crypto_policy_t *p)`

*crypto\_policy\_set\_aes\_cm\_128\_hmac\_sha1\_32()* sets a crypto policy structure to a short-authentication tag policy
- `void crypto_policy_set_aes_cm_128_null_auth (crypto_policy_t *p)`

*crypto\_policy\_set\_aes\_cm\_128\_null\_auth()* sets a crypto policy structure to an encryption-only policy
- `void crypto_policy_set_null_cipher_hmac_sha1_80 (crypto_policy_t *p)`

*crypto\_policy\_set\_null\_cipher\_hmac\_sha1\_80()* sets a crypto policy structure to an authentication-only policy
- `void crypto_policy_set_aes_cm_256_hmac_sha1_80 (crypto_policy_t *p)`

*crypto\_policy\_set\_aes\_cm\_256\_hmac\_sha1\_80()* sets a crypto policy structure to a encryption and authentication policy using AES-256 for RTP protection.
- `void crypto_policy_set_aes_cm_256_hmac_sha1_32 (crypto_policy_t *p)`

*crypto\_policy\_set\_aes\_cm\_256\_hmac\_sha1\_32()* sets a crypto policy structure to a short-authentication tag policy using AES-256 encryption.
- `err_status_t srtp_dealloc (srtp_t s)`

*srtp\_dealloc()* deallocates storage for an SRTP session context.
- `err_status_t crypto_policy_set_from_profile_for_rtp (crypto_policy_t *policy, srtp_profile_t profile)`

*crypto\_policy\_set\_from\_profile\_for\_rtp()* sets a crypto policy structure to the appropriate value for RTP based on an `srtp_profile_t`
- `err_status_t crypto_policy_set_from_profile_for_rtcp (crypto_policy_t *policy, srtp_profile_t profile)`

*crypto\_policy\_set\_from\_profile\_for\_rtcp()* sets a crypto policy structure to the appropriate value for RTCP based on an `srtp_profile_t`
- `unsigned int srtp_profile_get_master_key_length (srtp_profile_t profile)`

*returns the master key length for a given SRTP profile*
- `unsigned int srtp_profile_get_master_salt_length (srtp_profile_t profile)`

*returns the master salt length for a given SRTP profile*
- `void append_salt_to_key (unsigned char *key, unsigned int bytes_in_key, unsigned char *salt, unsigned int bytes_in_salt)`

*appends the salt to the key*

### 4.1.1 Detailed Description

### 4.1.2 Macro Definition Documentation

#### 4.1.2.1 #define crypto\_policy\_set\_aes\_cm\_128\_hmac\_sha1\_80( p ) crypto\_policy\_set\_rtp\_default(p)

##### Parameters

<i>p</i>	is a pointer to the policy structure to be set
----------	--

The function [crypto\\_policy\\_set\\_aes\\_cm\\_128\\_hmac\\_sha1\\_80\(\)](#) is a synonym for [crypto\\_policy\\_set\\_rtp\\_default\(\)](#). It conforms to the naming convention used in RFC 4568 (SDP Security Descriptions for Media Streams).

##### Returns

void.

#### 4.1.2.2 #define SRTP\_MAX\_TRAILER\_LEN SRTP\_MAX\_TAG\_LEN

SRTP\_MAX\_TRAILER\_LEN is the maximum length of the SRTP trailer (authentication tag and MKI) supported by libSRTP. This value is the maximum number of octets that will be added to an RTP packet by [srtp\\_protect\(\)](#).

### 4.1.3 Typedef Documentation

#### 4.1.3.1 typedef struct crypto\_policy\_t crypto\_policy\_t

A [crypto\\_policy\\_t](#) describes a particular cryptographic policy that can be applied to an SRTP or SRTCP stream. An SRTP session policy consists of a list of these policies, one for each SRTP stream in the session.

#### 4.1.3.2 typedef struct srtp\_policy\_t srtp\_policy\_t

A single [srtp\\_policy\\_t](#) struct represents the policy for a single SRTP stream, and a linked list of these elements represents the policy for an entire SRTP session. Each element contains the SRTP and SRTCP crypto policies for that

stream, a pointer to the SRTP master key for that stream, the SSRC describing that stream, or a flag indicating a 'wildcard' SSRC value, and a 'next' field that holds a pointer to the next element in the list of policy elements, or NULL if it is the last element.

The wildcard value `SSRC_ANY_INBOUND` matches any SSRC from an inbound stream that for which there is no explicit SSRC entry in another policy element. Similarly, the value `SSRC_ANY_OUTBOUND` will matches any SSRC from an outbound stream that does not appear in another policy element. Note that wildcard SSRCs cannot be used to match both inbound and outbound traffic. This restriction is intentional, and it allows libSRTP to ensure that no security lapses result from accidental re-use of SSRC values during key sharing.

### Warning

The final element of the list **must** have its 'next' pointer set to NULL.

#### 4.1.3.3 `typedef struct srtp_stream_ctx_t* srtp_stream_t`

The typedef `srtp_stream_t` is a pointer to a structure that represents an SRTP stream. This datatype is intentionally opaque in order to separate the interface from the implementation.

An SRTP stream consists of all of the traffic sent to an SRTP session by a single participant. A session can be viewed as a set of streams.

#### 4.1.3.4 `typedef struct srtp_ctx_t* srtp_t`

The typedef `srtp_t` is a pointer to a structure that represents an SRTP session. This datatype is intentionally opaque in order to separate the interface from the implementation.

An SRTP session consists of all of the traffic sent to the RTP and RTCP destination transport addresses, using the RTP/SAVP (Secure Audio/Video Profile). A session can be viewed as a set of SRTP streams, each of which originates with a different participant.

## 4.1.4 Enumeration Type Documentation

### 4.1.4.1 `enum sec_serv_t`

A `sec_serv_t` enumeration is used to describe the particular security services that will be applied by a particular crypto policy (or other mechanism).

**Enumerator:**

*sec\_serv\_none* no services  
*sec\_serv\_conf* confidentiality  
*sec\_serv\_auth* authentication  
*sec\_serv\_conf\_and\_auth* confidentiality and authentication

**4.1.4.2 enum ssrc\_type\_t**

An ssrc\_type\_t enumeration is used to indicate a type of SSRC. See [srtp\\_policy\\_t](#) for more information.

**Enumerator:**

*ssrc\_undefined* Indicates an undefined SSRC type.  
*ssrc\_specific* Indicates a specific SSRC value  
*ssrc\_any\_inbound* Indicates any inbound SSRC value (i.e. a value that is used in the function [srtp\\_unprotect\(\)](#))  
*ssrc\_any\_outbound* Indicates any outbound SSRC value (i.e. a value that is used in the function [srtp\\_protect\(\)](#))

**4.1.5 Function Documentation****4.1.5.1 void append\_salt\_to\_key ( unsigned char \* key, unsigned int bytes\_in\_key, unsigned char \* salt, unsigned int bytes\_in\_salt )**

The function call `append_salt_to_key(k, klen, s, slen)` copies the string `s` to the location at `klen` bytes following the location `k`.

**Warning**

There must be at least `bytes_in_salt + bytes_in_key` bytes available at the location pointed to by `key`.

**4.1.5.2 void crypto\_policy\_set\_aes\_cm\_128\_hmac\_sha1\_32 ( crypto\_policy\_t \* p )****Parameters**

<i>p</i>	is a pointer to the policy structure to be set
----------	--



The function call `crypto_policy_set_aes_cm_128_hmac_sha1_32(&p)` sets the `crypto_policy_t` at location `p` to use policy `AES_CM_128_HMAC_SHA1_32` as defined in RFC 4568. This policy uses AES-128 Counter Mode encryption and HMAC-SHA1 authentication, with an authentication tag that is only 32 bits long. This length is considered adequate only for protecting audio and video media that use a stateless playback function. See Section 7.5 of RFC 3711 (<http://www.ietf.org/rfc/rfc3711.txt>).

This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the `crypto_policy_t` datatype.

#### Warning

This crypto policy is intended for use in SRTP, but not in SRTCP. It is recommended that a policy that uses longer authentication tags be used for SRTCP. See Section 7.5 of RFC 3711 (<http://www.ietf.org/rfc/rfc3711.txt>).

#### Returns

void.

#### 4.1.5.3 void crypto\_policy\_set\_aes\_cm\_128\_null\_auth ( crypto\_policy\_t \* p )

##### Parameters

<code>p</code>	is a pointer to the policy structure to be set
----------------	--

The function call `crypto_policy_set_aes_cm_128_null_auth(&p)` sets the `crypto_policy_t` at location `p` to use the SRTP default cipher (AES-128 Counter Mode), but to use no authentication method. This policy is NOT RECOMMENDED unless it is unavoidable; see Section 7.5 of RFC 3711 (<http://www.ietf.org/rfc/rfc3711.txt>).

This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the `crypto_policy_t` datatype.

#### Warning

This policy is NOT RECOMMENDED for SRTP unless it is unavoidable, and it is NOT RECOMMENDED at all for SRTCP; see Section 7.5 of RFC 3711 (<http://www.ietf.org/rfc/rfc3711.txt>).

**Returns**

void.

**4.1.5.4 void crypto\_policy\_set\_aes\_cm\_256\_hmac\_sha1\_32 ( crypto\_policy\_t \* p )****Parameters**

<i>p</i>	is a pointer to the policy structure to be set
----------	--

The function call `crypto_policy_set_aes_cm_256_hmac_sha1_32(&p)` sets the `crypto_policy_t` at location `p` to use policy `AES_CM_256_HMAC_SHA1_32` as defined in `draft-ietf-avt-srtp-big-aes-03.txt`. This policy uses AES-256 Counter Mode encryption and HMAC-SHA1 authentication, with an authentication tag that is only 32 bits long. This length is considered adequate only for protecting audio and video media that use a stateless playback function. See Section 7.5 of RFC 3711 (<http://www.ietf.org/rfc/rfc3711.txt>).

This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the `crypto_policy_t` datatype.

**Warning**

This crypto policy is intended for use in SRTP, but not in SRTCP. It is recommended that a policy that uses longer authentication tags be used for SRTCP. See Section 7.5 of RFC 3711 (<http://www.ietf.org/rfc/rfc3711.txt>).

**Returns**

void.

**4.1.5.5 void crypto\_policy\_set\_aes\_cm\_256\_hmac\_sha1\_80 ( crypto\_policy\_t \* p )****Parameters**

<i>p</i>	is a pointer to the policy structure to be set
----------	--

The function call `crypto_policy_set_aes_cm_256_hmac_sha1_80(&p)` sets the `crypto_policy_t` at location `p` to use policy `AES_CM_256_HMAC_SHA1_80` as defined in `draft-ietf-avt-srtp-big-aes-03.txt`. This policy uses AES-256

Counter Mode encryption and HMAC-SHA1 authentication, with an 80 bit authentication tag.

This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the [crypto\\_policy\\_t](#) datatype.

#### Returns

void.

#### 4.1.5.6 `err_status_t crypto_policy_set_from_profile_for_rtcp ( crypto_policy_t * policy, srtp_profile_t profile )`

##### Parameters

<i>p</i>	is a pointer to the policy structure to be set
----------	--

The function call `crypto_policy_set_rtcp_default(&policy, profile)` sets the [crypto\\_policy\\_t](#) at location `policy` to the policy for RTCP protection, as defined by the `srtp_profile_t` profile.

This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the [crypto\\_policy\\_t](#) datatype.

#### Returns

values

- `err_status_ok` no problems were encountered
- `err_status_bad_param` the profile is not supported

#### 4.1.5.7 `err_status_t crypto_policy_set_from_profile_for_rtp ( crypto_policy_t * policy, srtp_profile_t profile )`

##### Parameters

<i>p</i>	is a pointer to the policy structure to be set
----------	--

The function call `crypto_policy_set_rtp_default(&policy, profile)` sets the [crypto\\_policy\\_t](#) at location `policy` to the policy for RTP protection, as defined by the `srtp_profile_t` profile.

This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the [crypto\\_policy\\_t](#) datatype.

### Returns

values

- `err_status_ok` no problems were encountered
- `err_status_bad_param` the profile is not supported

#### 4.1.5.8 void `crypto_policy_set_null_cipher_hmac_sha1_80` ( `crypto_policy_t * p` )

### Parameters

<i>p</i>	is a pointer to the policy structure to be set
----------	--

The function call `crypto_policy_set_null_cipher_hmac_sha1_80(&p)` sets the [crypto\\_policy\\_t](#) at location `p` to use H-MAC-SHA1 with an 80 bit authentication tag to provide message authentication, but to use no encryption. This policy is NOT RECOMMENDED for SRTP unless there is a requirement to forego encryption.

This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the [crypto\\_policy\\_t](#) datatype.

### Warning

This policy is NOT RECOMMENDED for SRTP unless there is a requirement to forego encryption.

### Returns

void.

#### 4.1.5.9 void `crypto_policy_set_rtcp_default` ( `crypto_policy_t * p` )

### Parameters

<i>p</i>	is a pointer to the policy structure to be set
----------	--

The function call `crypto_policy_set_rtcp_default(&p)` sets the `crypto_policy_t` at location `p` to the SRTP default policy for RTCP protection, as defined in the specification. This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the `crypto_policy_t` datatype.

**Returns**

void.

**4.1.5.10 void crypto\_policy\_set\_rtp\_default ( crypto\_policy\_t \* p )****Parameters**

<code>p</code>	is a pointer to the policy structure to be set
----------------	--

The function call `crypto_policy_set_rtp_default(&p)` sets the `crypto_policy_t` at location `p` to the SRTP default policy for RTP protection, as defined in the specification. This function is a convenience that helps to avoid dealing directly with the policy data structure. You are encouraged to initialize policy elements with this function call. Doing so may allow your code to be forward compatible with later versions of libSRTP that include more elements in the `crypto_policy_t` datatype.

**Returns**

void.

**4.1.5.11 err\_status\_t srtp\_add\_stream ( srtp\_t session, const srtp\_policy\_t \* policy )**

The function call `srtp_add_stream(session, policy)` allocates and initializes a new SRTP stream within a given, previously created session, applying the policy given as the other argument to that stream.

**Returns**

values:

- `err_status_ok` if stream creation succeeded.
- `err_status_alloc_fail` if stream allocation failed
- `err_status_init_fail` if stream initialization failed.

**4.1.5.12 err\_status\_t srtp\_create ( srtp\_t \* session, const srtp\_policy\_t \* policy )**

The function call `srtp_create(session, policy, key)` allocates and initializes an SRTP session context, applying the given policy and key.

**Parameters**

<i>session</i>	is the SRTP session to which the policy is to be added.
<i>policy</i>	is the <a href="#">srtp_policy_t</a> struct that describes the policy for the session. The struct may be a single element, or it may be the head of a list, in which case each element of the list is processed. It may also be NULL, in which case streams should be added later using <a href="#">srtp_add_stream()</a> . The final element of the list <b>must</b> have its 'next' field set to NULL.

**Returns**

- `err_status_ok` if creation succeeded.
- `err_status_alloc_fail` if allocation failed.
- `err_status_init_fail` if initialization failed.

**4.1.5.13 err\_status\_t srtp\_dealloc ( srtp\_t s )**

The function call `srtp_dealloc(s)` deallocates storage for the SRTP session context `s`. This function should be called no more than one time for each of the contexts allocated by the function [srtp\\_create\(\)](#).

**Parameters**

<i>s</i>	is the <code>srtp_t</code> for the session to be deallocated.
----------	---

**Returns**

- `err_status_ok` if there no problems.
- `err_status_dealloc_fail` a memory deallocation failure occurred.

**4.1.5.14 err\_status\_t srtp\_init ( void )**

**Warning**

This function **must** be called before any other srtp functions.

**4.1.5.15 err\_status\_t srtp\_protect ( srtp\_t ctx, void \* rtp\_hdr, int \* len\_ptr )**

The function call `srtp_protect(ctx, rtp_hdr, len_ptr)` applies SRTP protection to the RTP packet `rtp_hdr` (which has length `*len_ptr`) using the SRTP context `ctx`. If `err_status_ok` is returned, then `rtp_hdr` points to the resulting SRTP packet and `*len_ptr` is the number of octets in that packet; otherwise, no assumptions should be made about the value of either data elements.

The sequence numbers of the RTP packets presented to this function need not be consecutive, but they **must** be out of order by less than  $2^{15} = 32,768$  packets.

**Warning**

This function assumes that it can write the authentication tag into the location in memory immediately following the RTP packet, and assumes that the RTP packet is aligned on a 32-bit boundary.

This function assumes that it can write `SRTP_MAX_TRAILER_LEN` into the location in memory immediately following the RTP packet. Callers **MUST** ensure that this much writable memory is available in the buffer that holds the RTP packet.

**Parameters**

<i>ctx</i>	is the SRTP context to use in processing the packet.
<i>rtp_hdr</i>	is a pointer to the RTP packet (before the call); after the function returns, it points to the srtp packet.
<i>len_ptr</i>	is a pointer to the length in octets of the complete RTP packet (header and body) before the function call, and of the complete SRTP packet after the call, if <code>err_status_ok</code> was returned. Otherwise, the value of the data to which it points is undefined.

**Returns**

- `err_status_ok` no problems
- `err_status_replay_fail` rtp sequence number was non-increasing
- *other* failure in cryptographic mechanisms

**4.1.5.16** `err_status_t srtp_remove_stream ( srtp_t session, unsigned int ssrc )`

The function call `srtp_remove_stream(session, ssrc)` removes the SRTP stream with the SSRC value `ssrc` from the SRTP session context given by the argument `session`.

**Parameters**

<i>session</i>	is the SRTP session from which the stream will be removed.
<i>ssrc</i>	is the SSRC value of the stream to be removed.

**Warning**

Wildcard SSRC values cannot be removed from a session.

**Returns**

- `err_status_ok` if the stream deallocation succeeded.
- [other] otherwise.

**4.1.5.17** `err_status_t srtp_shutdown ( void )`**Warning**

No `srtp` functions may be called after calling this function.

**4.1.5.18** `err_status_t srtp_unprotect ( srtp_t ctx, void * srtp_hdr, int * len_ptr )`

The function call `srtp_unprotect(ctx, srtp_hdr, len_ptr)` verifies the Secure RTP protection of the SRTP packet pointed to by `srtp_hdr` (which has length `*len_ptr`), using the SRTP context `ctx`. If `err_status_ok` is returned, then `srtp_hdr` points to the resulting RTP packet and `*len_ptr` is the number of octets in that packet; otherwise, no assumptions should be made about the value of either data elements.

The sequence numbers of the RTP packets presented to this function need not be consecutive, but they **must** be out of order by less than  $2^{15} = 32,768$  packets.



**Warning**

This function assumes that the SRTP packet is aligned on a 32-bit boundary.

**Parameters**

<i>ctx</i>	is a pointer to the <code>srtp_t</code> which applies to the particular packet.
<i>srtp_hdr</i>	is a pointer to the header of the SRTP packet (before the call). after the function returns, it points to the rtp packet if <code>err_status_ok</code> was returned; otherwise, the value of the data to which it points is undefined.
<i>len_ptr</i>	is a pointer to the length in octets of the complete srtp packet (header and body) before the function call, and of the complete rtp packet after the call, if <code>err_status_ok</code> was returned. Otherwise, the value of the data to which it points is undefined.

**Returns**

- `err_status_ok` if the RTP packet is valid.
- `err_status_auth_fail` if the SRTP packet failed the message authentication check.
- `err_status_replay_fail` if the SRTP packet is a replay (e.g. packet has already been processed and accepted).
- [other] if there has been an error in the cryptographic mechanisms.

## 4.2 Secure RTCP

Secure RTCP functions are used to protect RTCP traffic.

### Functions

- `err_status_t srtp_protect_rtcp (srtp_t ctx, void *rtcp_hdr, int *pkt_octet_len)`  
*srtp\_protect\_rtcp() is the Secure RTCP sender-side packet processing function.*
- `err_status_t srtp_unprotect_rtcp (srtp_t ctx, void *rtcp_hdr, int *pkt_octet_len)`  
*srtp\_unprotect\_rtcp() is the Secure RTCP receiver-side packet processing function.*

### 4.2.1 Detailed Description

RTCP is the control protocol for RTP. libSRTP protects RTCP traffic in much the same way as it does RTP traffic. The function `srtp_protect_rtcp()` applies cryptographic protections to outbound RTCP packets, and `srtp_unprotect_rtcp()` verifies the protections on inbound RTCP packets.

A note on the naming convention: `srtp_protect_rtcp()` has an `srtp_t` as its first argument, and thus has ‘`srtp_`’ as its prefix. The trailing ‘`_rtcp`’ indicates the protocol on which it acts.

### 4.2.2 Function Documentation

#### 4.2.2.1 `err_status_t srtp_protect_rtcp ( srtp_t ctx, void * rtcp_hdr, int * pkt_octet_len )`

The function call `srtp_protect_rtcp(ctx, rtp_hdr, len_ptr)` applies SRTCP protection to the RTCP packet `rtcp_hdr` (which has length `*len_ptr`) using the SRTCP session context `ctx`. If `err_status_ok` is returned, then `rtp_hdr` points to the resulting SRTCP packet and `*len_ptr` is the number of octets in that packet; otherwise, no assumptions should be made about the value of either data elements.

#### Warning

This function assumes that it can write the authentication tag into the location in memory immediately following the RTCP packet, and assumes that the RTCP packet is aligned on a 32-bit boundary.

This function assumes that it can write `SRTP_MAX_TRAILER_LEN+4` into the location in memory immediately following the RTCP packet. Callers MUST ensure that this much writable memory is available in the buffer that holds the RTCP packet.

**Parameters**

<i>ctx</i>	is the SRTP context to use in processing the packet.
<i>rtcp_hdr</i>	is a pointer to the RTCP packet (before the call); after the function returns, it points to the srtp packet.
<i>pkt_octet_len</i>	is a pointer to the length in octets of the complete RTCP packet (header and body) before the function call, and of the complete SRTCP packet after the call, if <code>err_status_ok</code> was returned. Otherwise, the value of the data to which it points is undefined.

**Returns**

- `err_status_ok` if there were no problems.
- [other] if there was a failure in the cryptographic mechanisms.

**4.2.2.2 `err_status_t srtp_unprotect_rtcp ( srtp_t ctx, void * srtcp_hdr, int * pkt_octet_len )`**

The function call `srtp_unprotect_rtcp(ctx, srtcp_hdr, len_ptr)` verifies the Secure RTCP protection of the SRTCP packet pointed to by `srtcp_hdr` (which has length `*len_ptr`), using the SRTP session context `ctx`. If `err_status_ok` is returned, then `srtcp_hdr` points to the resulting RTCP packet and `*len_ptr` is the number of octets in that packet; otherwise, no assumptions should be made about the value of either data elements.

**Warning**

This function assumes that the SRTCP packet is aligned on a 32-bit boundary.

**Parameters**

<i>ctx</i>	is a pointer to the <code>srtp_t</code> which applies to the particular packet.
<i>srtcp_hdr</i>	is a pointer to the header of the SRTCP packet (before the call). After the function returns, it points to the rtp packet if <code>err_status_ok</code> was returned; otherwise, the value of the data to which it points is undefined.
<i>pkt_octet_len</i>	is a pointer to the length in octets of the complete SRTCP packet (header and body) before the function call, and of the complete rtp packet after the call, if <code>err_status_ok</code> was returned. Otherwise, the value of the data to which it points is undefined.

**Returns**

- `err_status_ok` if the RTCP packet is valid.
- `err_status_auth_fail` if the SRTCP packet failed the message authentication check.

- `err_status_replay_fail` if the SRTCP packet is a replay (e.g. has already been processed and accepted).
- [other] if there has been an error in the cryptographic mechanisms.

## 4.3 SRTP events and callbacks

libSRTP can use a user-provided callback function to handle events.

### Data Structures

- struct `srtp_event_data_t`  
*srtp\_event\_data\_t* is the structure passed as a callback to the event handler function

### Typedefs

- typedef struct `srtp_event_data_t srtp_event_data_t`  
*srtp\_event\_data\_t* is the structure passed as a callback to the event handler function
- typedef void( `srtp_event_handler_func_t` )(srtp\_event\_data\_t \*data)  
*srtp\_event\_handler\_func\_t* is the function prototype for the event handler.

### Enumerations

- enum `srtp_event_t` { `event_src_collision`, `event_key_soft_limit`, `event_key_hard_limit`, `event_packet_index_limit` }  
*srtp\_event\_t* defines events that need to be handled

### Functions

- `err_status_t srtp_install_event_handler` (srtp\_event\_handler\_func\_t func)  
*sets the event handler to the function supplied by the caller.*

#### 4.3.1 Detailed Description

libSRTP allows a user to provide a callback function to handle events that need to be dealt with outside of the data plane (see the enum `srtp_event_t` for a description of these events). Dealing with these events is not a strict necessity; they are not security-critical, but the application may suffer if they are not handled. The function `srtp_set_event_handler()` is used to provide the callback function.

A default event handler that merely reports on the events as they happen is included. It is also possible to set the event handler function to NULL, in which case all events will just be silently ignored.

## 4.3.2 Typedef Documentation

### 4.3.2.1 typedef struct srtp\_event\_data\_t srtp\_event\_data\_t

The struct `srtp_event_data_t` holds the data passed to the event handler function.

### 4.3.2.2 typedef void( srtp\_event\_handler\_func\_t)(srtp\_event\_data\_t \*data)

The typedef `srtp_event_handler_func_t` is the prototype for the event handler function. It has as its only argument an `srtp_event_data_t` which describes the event that needs to be handled. There can only be a single, global handler for all events in libSRTP.

## 4.3.3 Enumeration Type Documentation

### 4.3.3.1 enum srtp\_event\_t

The enum `srtp_event_t` defines events that need to be handled outside the ‘data plane’, such as SSRC collisions and key expirations.

When a key expires or the maximum number of packets has been reached, an SRTP stream will enter an ‘expired’ state in which no more packets can be protected or unprotected. When this happens, it is likely that you will want to either deallocate the stream (using `srtp_stream_dealloc()`), and possibly allocate a new one.

When an SRTP stream expires, the other streams in the same session are unaffected, unless key sharing is used by that stream. In the latter case, all of the streams in the session will expire.

#### Enumerator:

*event\_ssrc\_collision* An SSRC collision occurred.

*event\_key\_soft\_limit* An SRTP stream reached the soft key usage limit and will expire soon.

*event\_key\_hard\_limit* An SRTP stream reached the hard key usage limit and has expired.

*event\_packet\_index\_limit* An SRTP stream reached the hard packet limit ( $2^{48}$  packets).

## 4.3.4 Function Documentation

### 4.3.4.1 `err_status_t srtp_install_event_handler ( srtp_event_handler_func_t func )`

The function call `srtp_install_event_handler(func)` sets the event handler function to the value `func`. The value `NULL` is acceptable as an argument; in this case, events will be ignored rather than handled.

#### Parameters

<i>func</i>	is a pointer to a fuction that takes an <a href="#">srtp_event_data_t</a> pointer as an argument and returns void. This function will be used by libSRTP to handle events.
-------------	--

## 4.4 Cryptographic Algorithms

### Modules

- [Cipher Types](#)

*Each cipher type is identified by an unsigned integer. The cipher types available in this edition of libSRTP are given by the #defines below.*

- [Authentication Function Types](#)

*Each authentication function type is identified by an unsigned integer. The authentication function types available in this edition of libSRTP are given by the #defines below.*

### 4.4.1 Detailed Description

This library provides several different cryptographic algorithms, each of which can be selected by using the cipher\_type\_id\_t and auth\_type\_id\_t. These algorithms are documented below.

Authentication functions that use the Universal Security Transform (UST) must be used in conjunction with a cipher other than the null cipher. These functions require a per-message pseudorandom input that is generated by the cipher.

The identifiers STRONGHOLD\_AUTH and STRONGHOLD\_CIPHER identify the strongest available authentication function and cipher, respectively. They are resolved at compile time to the strongest available algorithm. The stronghold algorithms can serve as did the keep of a medieval fortification; they provide the strongest defense (or the last refuge).



## 4.5 Cipher Types

Each cipher type is identified by an unsigned integer. The cipher types available in this edition of libSRTP are given by the #defines below.

### Macros

- #define `NULL_CIPHER` 0  
*The null cipher performs no encryption.*
- #define `AES_ICM` 1  
*AES Integer Counter Mode (AES ICM)*
- #define `AES_128_ICM` `AES_ICM`  
*AES-128 Integer Counter Mode (AES ICM) AES-128 ICM is a deprecated alternate name for AES ICM.*
- #define `SEAL` 2  
*SEAL 3.0.*
- #define `AES_CBC` 3  
*AES Cipher Block Chaining mode (AES CBC)*
- #define `AES_128_CBC` `AES_CBC`  
*AES-128 Cipher Block Chaining mode (AES CBC)*
- #define `STRONGHOLD_CIPHER` `AES_ICM`  
*Strongest available cipher.*

### Typedefs

- typedef uint32\_t `cipher_type_id_t`  
*A `cipher_type_id_t` is an identifier for a particular cipher type.*

#### 4.5.1 Detailed Description

A `cipher_type_id_t` is an identifier for a cipher\_type; only values given by the #defines above (or those present in the file `crypto_types.h`) should be used.

The identifier `STRONGHOLD_CIPHER` indicates the strongest available cipher, allowing an application to choose the strongest available algorithm without any advance knowledge about the available algorithms.

## 4.5.2 Macro Definition Documentation

### 4.5.2.1 `#define AES_128_CBC AES_CBC`

AES-128 CBC is a deprecated alternate name for AES CBC.

### 4.5.2.2 `#define AES_CBC 3`

AES CBC is the AES Cipher Block Chaining mode. This cipher uses a 16-, 24-, or 32-octet key.

### 4.5.2.3 `#define AES_ICM 1`

AES ICM is the variant of counter mode that is used by Secure RTP. This cipher uses a 16-, 24-, or 32-octet key concatenated with a 14-octet offset (or salt) value.

### 4.5.2.4 `#define NULL_CIPHER 0`

The `NULL_CIPHER` leaves its inputs unaltered, during both the encryption and decryption operations. This cipher can be chosen to indicate that no encryption is to be performed.

### 4.5.2.5 `#define SEAL 2`

SEAL is the Software-Optimized Encryption Algorithm of Coppersmith and Rogaway. Nota bene: this cipher is IBM proprietary.

### 4.5.2.6 `#define STRONGHOLD_CIPHER AES_ICM`

This identifier resolves to the strongest cipher type available.

## 4.5.3 Typedef Documentation

#### 4.5.3.1 `typedef uint32_t cipher_type_id_t`

A `cipher_type_id_t` is an integer that represents a particular cipher type, e.g. the Advanced Encryption Standard (AES). A `NULL_CIPHER` is available; this cipher leaves the data unchanged, and can be selected to indicate that no encryption is to take place.

## 4.6 Authentication Function Types

Each authentication function type is identified by an unsigned integer. The authentication function types available in this edition of libSRTP are given by the #defines below.

### Macros

- #define `NULL_AUTH` 0  
*The null authentication function performs no authentication.*
- #define `UST_TMMHv2` 1  
*UST with TMMH Version 2.*
- #define `UST_AES_128_XMAC` 2  
*(UST) AES-128 XORMAC*
- #define `HMAC_SHA1` 3  
*HMAC-SHA1.*
- #define `STRONGHOLD_AUTH` `HMAC_SHA1`  
*Strongest available authentication function.*

### Typedefs

- typedef uint32\_t `auth_type_id_t`  
*An `auth_type_id_t` is an identifier for a particular authentication function.*

#### 4.6.1 Detailed Description

An `auth_type_id_t` is an identifier for an authentication function type; only values given by the #defines above (or those present in the file [crypto\\_types.h](#)) should be used.

The identifier `STRONGHOLD_AUTH` indicates the strongest available authentication function, allowing an application to choose the strongest available algorithm without any advance knowledge about the available algorithms. The stronghold algorithms can serve as did the keep of a medieval fortification; they provide the strongest defense (or the last refuge).

#### 4.6.2 Macro Definition Documentation

#### 4.6.2.1 `#define HMAC_SHA1 3`

HMAC\_SHA1 implements the Hash-based MAC using the NIST Secure Hash Algorithm version 1 (SHA1).

#### 4.6.2.2 `#define NULL_AUTH 0`

The NULL\_AUTH function does nothing, and can be selected to indicate that authentication should not be performed.

#### 4.6.2.3 `#define STRONGHOLD_AUTH HMAC_SHA1`

This identifier resolves to the strongest available authentication function.

#### 4.6.2.4 `#define UST_AES_128_XMAC 2`

UST\_AES\_128\_XMAC implements AES-128 XORMAC, using UST. Nota bene: the XORMAC algorithm is IBM proprietary.

#### 4.6.2.5 `#define UST_TMMHv2 1`

UST\_TMMHv2 implements the Truncated Multi-Modular Hash using UST. This function must be used in conjunction with a cipher other than the null cipher. with a cipher.

### 4.6.3 Typedef Documentation

#### 4.6.3.1 `typedef uint32_t auth_type_id_t`

An `auth_type_id_t` is an integer that represents a particular authentication function type, e.g. HMAC-SHA1. A NULL\_AUTH is available; this authentication function performs no computation, and can be selected to indicate that no authentication is to take place.

## 4.7 Error Codes

### Enumerations

- enum `err_status_t` {  
    `err_status_ok` = 0, `err_status_fail` = 1, `err_status_bad_param` = 2, `err_status_alloc_fail` = 3,  
    `err_status_dealloc_fail` = 4, `err_status_init_fail` = 5, `err_status_terminus` = 6, `err_status_auth_fail` = 7,  
    `err_status_cipher_fail` = 8, `err_status_replay_fail` = 9, `err_status_replay_old` = 10, `err_status_algo_fail` = 11,  
    `err_status_no_such_op` = 12, `err_status_no_ctx` = 13, `err_status_cant_check` = 14, `err_status_key_expired` = 15,  
    `err_status_socket_err` = 16, `err_status_signal_err` = 17, `err_status_nonce_bad` = 18, `err_status_read_fail` = 19,  
    `err_status_write_fail` = 20, `err_status_parse_err` = 21, `err_status_encode_err` = 22, `err_status_semaphore_err` =  
    23,  
    `err_status_pfkey_err` = 24 }

### 4.7.1 Detailed Description

Error status codes are represented by the enumeration `err_status_t`.

### 4.7.2 Enumeration Type Documentation

#### 4.7.2.1 enum `err_status_t`

Enumerator:

- `err_status_ok`* nothing to report
- `err_status_fail`* unspecified failure
- `err_status_bad_param`* unsupported parameter
- `err_status_alloc_fail`* couldn't allocate memory
- `err_status_dealloc_fail`* couldn't deallocate properly
- `err_status_init_fail`* couldn't initialize
- `err_status_terminus`* can't process as much data as requested
- `err_status_auth_fail`* authentication failure
- `err_status_cipher_fail`* cipher failure
- `err_status_replay_fail`* replay check failed (bad index)
- `err_status_replay_old`* replay check failed (index too old)
- `err_status_algo_fail`* algorithm failed test routine

*err\_status\_no\_such\_op* unsupported operation  
*err\_status\_no\_ctx* no appropriate context found  
*err\_status\_cant\_check* unable to perform desired validation  
*err\_status\_key\_expired* can't use key any more  
*err\_status\_socket\_err* error in use of socket  
*err\_status\_signal\_err* error in use POSIX signals  
*err\_status\_nonce\_bad* nonce check failed  
*err\_status\_read\_fail* couldn't read data  
*err\_status\_write\_fail* couldn't write data  
*err\_status\_parse\_err* error parsing data  
*err\_status\_encode\_err* error encoding data  
*err\_status\_semaphore\_err* error while using semaphores  
*err\_status\_pfkey\_err* error while using pfkey

## 4.8 Cryptographic Kernel

### Modules

- [Ciphers](#)

*A generic cipher type enables cipher agility, that is, the ability to write code that runs with multiple cipher types. Ciphers can be used through the crypto kernel, or can be accessed directly, if need be.*

### 4.8.1 Detailed Description

All of the cryptographic functions are contained in a kernel.



## 4.9 Ciphers

A generic cipher type enables cipher agility, that is, the ability to write code that runs with multiple cipher types. Ciphers can be used through the crypto kernel, or can be accessed directly, if need be.

### Functions

- `err_status_t cipher_type_alloc` (`cipher_type_t *ctype`, `cipher_t **cipher`, unsigned `key_len`)  
*Allocates a cipher of a particular type.*
- `err_status_t cipher_init` (`cipher_t *cipher`, const `uint8_t *key`)  
*Initialized a cipher to use a particular key. May be invoked more than once on the same cipher.*
- `err_status_t cipher_set_iv` (`cipher_t *cipher`, void `*iv`)  
*Sets the initialization vector of a given cipher.*
- `err_status_t cipher_encrypt` (`cipher_t *cipher`, void `*buf`, unsigned int `*len`)  
*Encrypts a buffer with a given cipher.*
- `err_status_t cipher_output` (`cipher_t *c`, `uint8_t *buffer`, int `num_octets_to_output`)  
*Sets a buffer to the keystream generated by the cipher.*
- `err_status_t cipher_dealloc` (`cipher_t *cipher`)  
*Deallocates a cipher.*

### 4.9.1 Detailed Description

### 4.9.2 Function Documentation

#### 4.9.2.1 `err_status_t cipher_dealloc ( cipher_t * cipher )`

##### Warning

May be implemented as a macro.

#### 4.9.2.2 `err_status_t cipher_encrypt ( cipher_t * cipher, void * buf, unsigned int * len )`

##### Warning

May be implemented as a macro.

**4.9.2.3** `err_status_t cipher_init ( cipher_t * cipher, const uint8_t * key )`

**Warning**

May be implemented as a macro.

**4.9.2.4** `err_status_t cipher_output ( cipher_t * c, uint8_t * buffer, int num_octets_to_output )`

**Warning**

May be implemented as a macro.

**4.9.2.5** `err_status_t cipher_set_iv ( cipher_t * cipher, void * iv )`

**Warning**

May be implemented as a macro.

**4.9.2.6** `err_status_t cipher_type_alloc ( cipher_type_t * ctype, cipher_t ** cipher, unsigned key_len )`

**Warning**

May be implemented as a macro.

## Chapter 5

# Data Structure Documentation

### 5.1 `crypto_policy_t` Struct Reference

`crypto_policy_t` describes a particular crypto policy that can be applied to an SRTP stream.

#### Data Fields

- `cipher_type_id_t cipher_type`
- `int cipher_key_len`
- `auth_type_id_t auth_type`
- `int auth_key_len`
- `int auth_tag_len`
- `sec_serv_t sec_serv`

#### 5.1.1 Detailed Description

A `crypto_policy_t` describes a particular cryptographic policy that can be applied to an SRTP or SRTCP stream. An SRTP session policy consists of a list of these policies, one for each SRTP stream in the session.

#### 5.1.2 Field Documentation

**5.1.2.1 int crypto\_policy\_t::auth\_key\_len**

The length of the authentication function key in octets.

**5.1.2.2 int crypto\_policy\_t::auth\_tag\_len**

The length of the authentication tag in octets.

**5.1.2.3 auth\_type\_id\_t crypto\_policy\_t::auth\_type**

An integer representing the authentication function.

**5.1.2.4 int crypto\_policy\_t::cipher\_key\_len**

The length of the cipher key in octets.

**5.1.2.5 cipher\_type\_id\_t crypto\_policy\_t::cipher\_type**

An integer representing the type of cipher.

**5.1.2.6 sec\_serv\_t crypto\_policy\_t::sec\_serv**

The flag indicating the security services to be applied.

The documentation for this struct was generated from the following file:

- srtp.h

## 5.2 debug\_module\_t Struct Reference

The documentation for this struct was generated from the following file:

- err.h

## 5.3 srtp\_event\_data\_t Struct Reference

[srtp\\_event\\_data\\_t](#) is the structure passed as a callback to the event handler function

### Data Fields

- [srtp\\_t session](#)
- [srtp\\_stream\\_t stream](#)
- [srtp\\_event\\_t event](#)

### 5.3.1 Detailed Description

The struct [srtp\\_event\\_data\\_t](#) holds the data passed to the event handler function.

### 5.3.2 Field Documentation

#### 5.3.2.1 [srtp\\_event\\_t srtp\\_event\\_data\\_t::event](#)

An enum indicating the type of event.

#### 5.3.2.2 [srtp\\_t srtp\\_event\\_data\\_t::session](#)

The session in which the event happend.

### 5.3.2.3 srtp\_stream\_t srtp\_event\_data\_t::stream

The stream in which the event happend.

The documentation for this struct was generated from the following file:

- [srtp.h](#)

## 5.4 srtp\_policy\_t Struct Reference

represents the policy for an SRTP session.

### Data Fields

- [ssrc\\_t](#) `ssrc`
- [crypto\\_policy\\_t](#) `rtp`
- [crypto\\_policy\\_t](#) `rtcp`
- unsigned char \* `key`
- [ekt\\_policy\\_t](#) `ekt`
- unsigned long `window_size`
- int `allow_repeat_tx`
- struct [srtp\\_policy\\_t](#) \* `next`

### 5.4.1 Detailed Description

A single [srtp\\_policy\\_t](#) struct represents the policy for a single SRTP stream, and a linked list of these elements represents the policy for an entire SRTP session. Each element contains the SRTP and SRTCP crypto policies for that stream, a pointer to the SRTP master key for that stream, the SSRC describing that stream, or a flag indicating a ‘wild-card’ SSRC value, and a ‘next’ field that holds a pointer to the next element in the list of policy elements, or NULL if it is the last element.

The wildcard value `SSRC_ANY_INBOUND` matches any SSRC from an inbound stream that for which there is no explicit SSRC entry in another policy element. Similarly, the value `SSRC_ANY_OUTBOUND` will matches any SSRC from an outbound stream that does not appear in another policy element. Note that wildcard SSRCs &b cannot be used to match both inbound and outbound traffic. This restriction is intentional, and it allows libSRTP to ensure that no security lapses result from accidental re-use of SSRC values during key sharing.

**Warning**

The final element of the list **must** have its 'next' pointer set to NULL.

**5.4.2 Field Documentation****5.4.2.1 int srtp\_policy\_t::allow\_repeat\_tx**

Whether retransmissions of packets with the same sequence number are allowed. (Note that such repeated transmissions must have the same RTP payload, or a severe security weakness is introduced!)

**5.4.2.2 ekt\_policy\_t srtp\_policy\_t::ekt**

Pointer to the EKT policy structure for this stream (if any)

**5.4.2.3 unsigned char\* srtp\_policy\_t::key**

Pointer to the SRTP master key for this stream.

**5.4.2.4 struct srtp\_policy\_t\* srtp\_policy\_t::next**

Pointer to next stream policy.

**5.4.2.5 crypto\_policy\_t srtp\_policy\_t::rtcp**

SRTCP crypto policy.

**5.4.2.6 crypto\_policy\_t srtp\_policy\_t::rtp**

SRTP crypto policy.

#### 5.4.2.7 `ssrc_t srtp_policy_t::ssrc`

The SSRC value of stream, or the flags `SSRC_ANY_INBOUND` or `SSRC_ANY_OUTBOUND` if key sharing is used for this policy element.

#### 5.4.2.8 `unsigned long srtp_policy_t::window_size`

The window size to use for replay protection.

The documentation for this struct was generated from the following file:

- `srtp.h`

## 5.5 `ssrc_t` Struct Reference

An `ssrc_t` represents a particular SSRC value, or a ‘wildcard’ SSRC.

### Data Fields

- `ssrc_type_t type`
- unsigned int `value`

#### 5.5.1 Detailed Description

An `ssrc_t` represents a particular SSRC value (if its type is `ssrc_specific`), or a wildcard SSRC value that will match all outbound SSRCs (if its type is `ssrc_any_outbound`) or all inbound SSRCs (if its type is `ssrc_any_inbound`).

#### 5.5.2 Field Documentation

##### 5.5.2.1 `ssrc_type_t ssrc_t::type`

The type of this particular SSRC



### 5.5.2.2 unsigned int ssrc\_t::value

The value of this SSRC, if it is not a wildcard

The documentation for this struct was generated from the following file:

- srtp.h

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