Libtasn1

Abstract Syntax Notation One (ASN.1) library for the GNU system
for version 3.3, 24 March 2013

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This manual is for GNU Libtasn1 (version 3.3, 24 March 2013), which is a library for Abstract Syntax Notation One (ASN.1) and Distinguished Encoding Rules (DER) manipulation.

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1 Introduction

This document describes the Libtasn1 library that provides Abstract Syntax Notation One (ASN.1, as specified by the X.680 ITU-T recommendation) parsing and structures management, and Distinguished Encoding Rules (DER, as per X.690) encoding and decoding functions.

The main features of this library are:

- On-line ASN.1 structure management that doesn't require any C code file generation.
- Off-line ASN.1 structure management with C code file generation containing an array.
- Distinguished Encoding Rules (DER) encoding support.
- No limits for INTEGER and ENUMERATED values.
- It's Free Software. Anybody can use, modify, and redistribute the library under the terms of the GNU Lesser General Public License version 2.1 or later. The command line tools, self-tests and build infrastructure are licensed under the GNU General Public License version 3.0 or later.
- Thread-safety. No global variables are used and multiple library handles and session handles may be used in parallel.
- Portability. The code should work on all Unix like operating systems, and Windows. The library itself should be portable to any C89 system, not even POSIX is required.

2 ASN.1 structure handling

2.1 ASN.1 syntax

The parser is case sensitive. The comments begin with `--` and end either with another `--`, or at the end of the respective line, whichever comes first. The C-style `/*`, `*/` comments are not supported.

For an example of the syntax, check the '`pkix.asn`' file distributed with the library.

ASN.1 definitions must follow the syntax below:

```
definitions_name {<object definition>}

DEFINITIONS <EXPLICIT or IMPLICIT> TAGS ::=

BEGIN

<type and constants definitions>

END
```

The `::=` token must be separate from other elements, so the following declaration is invalid:

```
-- INCORRECT
Version ::=INTEGER
```

The correct form is:

```
Version ::= INTEGER
```

Here is the list of types that the parser can manage:

- `INTEGER`;
- `ENUMERATED`;
- `BOOLEAN`;
- `OBJECT IDENTIFIER`;
- `NULL`;
- `BIT STRING`;
- `OCTET STRING`;
- `UTCTime`;
- `GeneralizedTime`;
- `GeneralString`;
- `NumericString`;
- `IA5String`;
- `TeletexString`;
- `PrintableString`;
- `UniversalString`;
- `BMPString`;

- UTF8String;
- VisibleString;
- SEQUENCE;
- SEQUENCE OF;
- SET;
- SET OF;
- CHOICE;
- ANY;
- ANY DEFINED BY.

This version doesn't handle the REAL type. It doesn't support the AUTOMATIC TAGS option, and the EXPORT and IMPORT sections, either.

The SIZE constraints are allowed, but no check is done on them.

2.2 Naming

Consider this definition:

```
Example { 1 2 3 4 }

DEFINITIONS EXPLICIT TAGS ::=

BEGIN

Group ::= SEQUENCE {
   id   OBJECT IDENTIFIER,
   value  Value
}

Value ::= SEQUENCE {
   value1  INTEGER,
   value2  BOOLEAN
}

END
```

The notation to access the 'Group' type of the 'Example' definition above is 'Example.Group' (as a NUL-terminated string.) Such strings are used in the functions described below.

Others examples:

- field 'id' of the 'Group' type: 'Example.Group.id';
- field 'value1' of the 'value' field of the 'Group' type: 'Example.Group.value.value1'.

Elements of structured types unnamed by the respective definition receive the names ?1, ?2, and so on.

The ?LAST name indicates the last element of a SET OF or SEQUENCE OF.

2.3 Simple parsing

For simple types like `OCTET STRING` the simple parsing functions listed below may be used instead.

- [asn1_decode_simple_der], page 19
- [asn1_encode_simple_der], page 14

2.4 Library Notes

The header file of this library is '`libtasn1.h`'.

The main type used in it is `asn1_node`, and it's used to store the ASN.1 definitions and structures (instances).

The `NULL` constant can be used for the variable initialization. For example:

```
asn1_node definitions = NULL;
```

Some functions require an `errorDescription` argument of type `char *`, pointing to a pre-allocated buffer of at least `ASN1_MAX_ERROR_DESCRIPTION_SIZE` bytes size (e.g., as in '`char description[ASN1_MAX_ERROR_DESCRIPTION_SIZE];`').

`ASN1_MAX_NAME_SIZE` is the maximum number of characters allowed for an ASN.1 identifier.

2.5 Future developments

- Add functions for a C code file generation containing equivalent data structures (not a single array like now).
- The `REAL` type.

3 Utilities

3.1 Invoking asn1Parser

`asn1Parser` reads a single file with ASN.1 definitions and generates a file with an array to use with libtasn1 functions.

```
Usage:  asn1Parser [options] file

Options:
 -h : shows the help message.
 -v : shows version information and exit.
 -c : checks the syntax only.
 -o file : output file.
 -n name : array name.
```

3.2 Invoking asn1Coding

`asn1Coding` generates a DER encoding from a file with ASN.1 definitions and another one with assignments.

The file with assignments must have this syntax:

```
InstanceName  Asn1Definition

nameString  value

nameString  value
...
```

To specify the field of a `CHOICE` to be used, specify its name as a value to the `CHOICE` element itself. Use `''` to denote the root element itself. (as in the example below.)

The output file is a binary file with the DER encoding.

```
Usage:  asn1Coding [options] file1 file2
 file1 : file with ASN1 definitions.
 file2 : file with assignments.
Options:
 -h : shows the help message.
 -v : shows version information and exit.
 -c : checks the syntax only.
 -o file : output file.
```

For example, consider an ASN.1 definitions file as follows:

```
PKIX1 { }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

Dss-Sig-Value ::= SEQUENCE {
```

```
     r       INTEGER,
     s       INTEGER
}

END
```

And a assignments file as follows:

```
dp PKIX1.Dss-Sig-Value

r 42
s 47
```

Running the command below will generate a '`assign.out`' file, containing the DER encoding of `PKIX1.Dss-Sig-Value`.

```
$ asn1Coding pkix.asn assign.asn1
```

If the root element is of the `CHOICE` type, the assignment file may be like (using the types defined in '`pkix.asn`'):

```
elt PKIX1Implicit88.GeneralName

''      dNSName
dNSName example.org
```

3.3 Invoking asn1Decoding

`asn1Decoding` generates an ASN.1 structure from a file with ASN.1 definitions and a binary file with a DER encoding.

```
Usage:  asn1Decoding [options] file1 file2 type
 file1 : file with ASN1 definitions.
 file2 : binary file with a DER encoding.
 type : ASN1 definition name.
Options:
 -h : shows the help message.
 -v : shows version information and exit.
 -o file : output file.
```

For example, after generating the '`assign.out`' file from the example section of the `asn1Coding` command above, the following invocation will decode the DER data.

```
$ asn1Decoding pkix.asn assign.out PKIX1.Dss-Sig-Value
```

4 Function reference

4.1 ASN.1 schema functions

asn1_parser2tree

`int asn1_parser2tree` (*const char * **file***, *asn1_node * **definitions***, *char * **error_desc***) [Function]

file: specify the path and the name of file that contains ASN.1 declarations.

definitions: return the pointer to the structure created from "file" ASN.1 declarations.

error_desc: return the error description or an empty string if success.

Function used to start the parse algorithm. Creates the structures needed to manage the definitions included in `file` file.

Returns: `ASN1_SUCCESS` if the file has a correct syntax and every identifier is known, `ASN1_ELEMENT_NOT_EMPTY` if `definitions` not `NULL`, `ASN1_FILE_NOT_FOUND` if an error occured while opening `file`, `ASN1_SYNTAX_ERROR` if the syntax is not correct, `ASN1_IDENTIFIER_NOT_FOUND` if in the file there is an identifier that is not defined, `ASN1_NAME_TOO_LONG` if in the file there is an identifier whith more than `ASN1_MAX_NAME_SIZE` characters.

asn1_parser2array

`int asn1_parser2array` (*const char * **inputFileName***, *const char * **outputFileName***, *const char * **vectorName***, *char * **error_desc***) [Function]

inputFileName: specify the path and the name of file that contains ASN.1 declarations.

outputFileName: specify the path and the name of file that will contain the C vector definition.

vectorName: specify the name of the C vector.

error_desc: return the error description or an empty string if success.

Function that generates a C structure from an ASN1 file. Creates a file containing a C vector to use to manage the definitions included in `inputFileName` file. If `inputFileName` is "/aa/bb/xx.yy" and `outputFileName` is `NULL`, the file created is "/aa/bb/xx_asn1_tab.c". If `vectorName` is `NULL` the vector name will be "xx_asn1_tab".

Returns: `ASN1_SUCCESS` if the file has a correct syntax and every identifier is known, `ASN1_FILE_NOT_FOUND` if an error occured while opening `inputFileName`, `ASN1_SYNTAX_ERROR` if the syntax is not correct, `ASN1_IDENTIFIER_NOT_FOUND` if in the file there is an identifier that is not defined, `ASN1_NAME_TOO_LONG` if in the file there is an identifier whith more than `ASN1_MAX_NAME_SIZE` characters.

4.2 ASN.1 field functions

asn1_array2tree

`int asn1_array2tree` (*const asn1_static_node * **array***, *asn1_node * **definitions***, *char * **errorDescription***) [Function]

array: specify the array that contains ASN.1 declarations

definitions: return the pointer to the structure created by *ARRAY ASN.1 declarations

errorDescription: return the error description.

Creates the structures needed to manage the ASN.1 definitions. `array` is a vector created by `asn1_parser2array()`.

Returns: `ASN1_SUCCESS` if structure was created correctly, `ASN1_ELEMENT_NOT_EMPTY` if *`definitions` not NULL, `ASN1_IDENTIFIER_NOT_FOUND` if in the file there is an identifier that is not defined (see `errorDescription` for more information), `ASN1_ARRAY_ERROR` if the array pointed by `array` is wrong.

asn1_delete_structure

`int asn1_delete_structure` (*asn1_node * **structure***) [Function]

structure: pointer to the structure that you want to delete.

Deletes the structure *`structure`. At the end, *`structure` is set to NULL.

Returns: `ASN1_SUCCESS` if successful, `ASN1_ELEMENT_NOT_FOUND` if *`structure` was NULL.

asn1_delete_element

`int asn1_delete_element` (*asn1_node **structure***, *const char * **element_name***) [Function]

structure: pointer to the structure that contains the element you want to delete.

element_name: element's name you want to delete.

Deletes the element named *`element_name` inside *`structure`.

Returns: `ASN1_SUCCESS` if successful, `ASN1_ELEMENT_NOT_FOUND` if the `element_name` was not found.

asn1_create_element

`int asn1_create_element` (*asn1_node **definitions***, *const char * **source_name***, *asn1_node * **element***) [Function]

definitions: pointer to the structure returned by "parser_asn1" function

source_name: the name of the type of the new structure (must be inside p_structure).

element: pointer to the structure created.

Creates a structure of type `source_name`. Example using "pkix.asn":

rc = asn1_create_element(cert_def, "PKIX1.Certificate", certptr);

Returns: `ASN1_SUCCESS` if creation OK, `ASN1_ELEMENT_NOT_FOUND` if `source_name` is not known.

asn1_print_structure

`void asn1_print_structure` (*FILE * **out***, *asn1_node **structure***, *const char * **name***, *int **mode***) [Function]

out: pointer to the output file (e.g. stdout).

structure: pointer to the structure that you want to visit.

name: an element of the structure

mode: specify how much of the structure to print, can be `ASN1_PRINT_NAME`, `ASN1_PRINT_NAME_TYPE`, `ASN1_PRINT_NAME_TYPE_VALUE`, or `ASN1_PRINT_ALL`.

Prints on the `out` file descriptor the structure's tree starting from the `name` element inside the structure `structure`.

asn1_number_of_elements

`int asn1_number_of_elements` (*asn1_node **element***, *const char * **name***, *int * **num***) [Function]

element: pointer to the root of an ASN1 structure.

name: the name of a sub-structure of ROOT.

num: pointer to an integer where the result will be stored

Counts the number of elements of a sub-structure called NAME with names equal to "?1","?2", ...

Returns: `ASN1_SUCCESS` if successful, `ASN1_ELEMENT_NOT_FOUND` if `name` is not known, `ASN1_GENERIC_ERROR` if pointer `num` is `NULL`.

asn1_find_structure_from_oid

`const char * asn1_find_structure_from_oid` (*asn1_node **definitions***, *const char * **oidValue***) [Function]

definitions: ASN1 definitions

oidValue: value of the OID to search (e.g. "1.2.3.4").

Search the structure that is defined just after an OID definition.

Returns: `NULL` when `oidValue` not found, otherwise the pointer to a constant string that contains the element name defined just after the OID.

asn1_copy_node

`int asn1_copy_node` (*asn1_node **dst***, *const char * **dst_name***, *asn1_node **src***, *const char * **src_name***) [Function]

dst: Destination asn1_node node.

dst_name: Field name in destination node.

src: Source asn1_node node.

src_name: Field name in source node.

Create a deep copy of a asn1_node variable.

Returns: Return `ASN1_SUCCESS` on success.

asn1_write_value

`int asn1_write_value (`*asn1_node* `node_root`, *const char ** `name`, *const void ** `ivalue`, *int* `len``)` [Function]

node_root: pointer to a structure

name: the name of the element inside the structure that you want to set.

ivalue: vector used to specify the value to set. If len is >0, VALUE must be a two's complement form integer. if len=0 *VALUE must be a null terminated string with an integer value.

len: number of bytes of *value to use to set the value: value[0]..value[len-1] or 0 if value is a null terminated string

Set the value of one element inside a structure.

If an element is OPTIONAL and you want to delete it, you must use the value=NULL and len=0. Using "pkix.asn":

result=asn1_write_value(cert, "tbsCertificate.issuerUniqueID", NULL, 0);

Description for each type: INTEGER: VALUE must contain a two's complement form integer.

value[0]=0xFF , len=1 -> integer=-1. value[0]=0xFF value[1]=0xFF , len=2 -> integer=-1. value[0]=0x01 , len=1 -> integer= 1. value[0]=0x00 value[1]=0x01 , len=2 -> integer= 1. value="123" , len=0 -> integer= 123.

ENUMERATED: As INTEGER (but only with not negative numbers).

BOOLEAN: VALUE must be the null terminated string "TRUE" or "FALSE" and LEN != 0.

value="TRUE" , len=1 -> boolean=TRUE. value="FALSE" , len=1 -> boolean=FALSE.

OBJECT IDENTIFIER: VALUE must be a null terminated string with each number separated by a dot (e.g. "1.2.3.543.1"). LEN != 0.

value="1 2 840 10040 4 3" , len=1 -> OID=dsa-with-sha.

UTCTime: VALUE must be a null terminated string in one of these formats: "YYMMDDhhmmssZ", "YYMMDDhhmmssZ", "YYMMDDhhmmss+hh'mm'", "YYMMDDhhmmss-hh'mm'", "YYMMDDhhmm+hh'mm'", or "YYMMDDhhmm-hh'mm'". LEN != 0.

value="9801011200Z" , len=1 -> time=Jannuary 1st, 1998 at 12h 00m Greenwich Mean Time

GeneralizedTime: VALUE must be in one of this format: "YYYYMMDDhhmmss.sZ", "YYYYMMDDhhmmss.sZ", "YYYYMMDDhhmmss.s+hh'mm'", "YYYYMMDDhhmmss.s-hh'mm'", "YYYYMMDDhhmm+hh'mm'", or "YYYYMMDDhhmm-hh'mm'" where ss.s indicates the seconds with any precision like "10.1" or "01.02". LEN != 0

value="2001010112001.12-0700" , len=1 -> time=Jannuary 1st, 2001 at 12h 00m 01.12s Pacific Daylight Time

OCTET STRING: VALUE contains the octet string and LEN is the number of octets.

value="$\backslash$x01$\backslash$x02$\backslash$x03" , len=3 -> three bytes octet string

GeneralString: VALUE contains the generalstring and LEN is the number of octets.

value="$\backslash$x01$\backslash$x02$\backslash$x03" , len=3 -> three bytes generalstring

BIT STRING: VALUE contains the bit string organized by bytes and LEN is the number of bits.

value="$\backslash$xCF" , len=6 -> bit string="110011" (six bits)

CHOICE: if NAME indicates a choice type, VALUE must specify one of the alternatives with a null terminated string. LEN != 0. Using "pkix.asn"\:

result=asn1_write_value(cert, "certificate1.tbsCertificate.subject", "rdnSequence", 1);

ANY: VALUE indicates the der encoding of a structure. LEN != 0.

SEQUENCE OF: VALUE must be the null terminated string "NEW" and LEN != 0. With this instruction another element is appended in the sequence. The name of this element will be "?1" if it's the first one, "?2" for the second and so on.

Using "pkix.asn"\:

result=asn1_write_value(cert, "certificate1.tbsCertificate.subject.rdnSequence", "NEW", 1);

SET OF: the same as SEQUENCE OF. Using "pkix.asn":

result=asn1_write_value(cert, "tbsCertificate.subject.rdnSequence.?LAST", "NEW", 1);

Returns: `ASN1_SUCCESS` if the value was set, `ASN1_ELEMENT_NOT_FOUND` if `name` is not a valid element, and `ASN1_VALUE_NOT_VALID` if `ivalue` has a wrong format.

asn1_read_value

`int asn1_read_value` (*asn1_node* `root`, *const char ** `name`, *void ** `ivalue`, *int ** `len`) [Function]

root: pointer to a structure.

name: the name of the element inside a structure that you want to read.

ivalue: vector that will contain the element's content, must be a pointer to memory cells already allocated.

len: number of bytes of *value: value[0]..value[len-1]. Initialy holds the sizeof value.

Returns the value of one element inside a structure.

If an element is OPTIONAL and the function "read_value" returns `ASN1_ELEMENT_NOT_FOUND`, it means that this element wasn't present in the der encoding that created the structure. The first element of a SEQUENCE_OF or SET_OF is named "?1". The second one "?2" and so on.

INTEGER: VALUE will contain a two's complement form integer.

integer=-1 -> value[0]=0xFF , len=1. integer=1 -> value[0]=0x01 , len=1.

ENUMERATED: As INTEGER (but only with not negative numbers).

BOOLEAN: VALUE will be the null terminated string "TRUE" or "FALSE" and LEN=5 or LEN=6.

OBJECT IDENTIFIER: VALUE will be a null terminated string with each number separated by a dot (i.e. "1.2.3.543.1").

LEN = strlen(VALUE)+1

UTCTime: VALUE will be a null terminated string in one of these formats: "YYMMDDhhmmss+hh'mm'" or "YYMMDDhhmmss-hh'mm'". LEN=strlen(VALUE)+1.

GeneralizedTime: VALUE will be a null terminated string in the same format used to set the value.

OCTET STRING: VALUE will contain the octet string and LEN will be the number of octets.

GeneralString: VALUE will contain the generalstring and LEN will be the number of octets.

BIT STRING: VALUE will contain the bit string organized by bytes and LEN will be the number of bits.

CHOICE: If NAME indicates a choice type, VALUE will specify the alternative selected.

ANY: If NAME indicates an any type, VALUE will indicate the DER encoding of the structure actually used.

Returns: `ASN1_SUCCESS` if value is returned, `ASN1_ELEMENT_NOT_FOUND` if `name` is not a valid element, `ASN1_VALUE_NOT_FOUND` if there isn't any value for the element selected, and `ASN1_MEM_ERROR` if The value vector isn't big enough to store the result, and in this case `len` will contain the number of bytes needed.

asn1_read_value_type

`int asn1_read_value_type` (*asn1_node* `root`, *const char* * `name`, *void* * `ivalue`, *int* * `len`, *unsigned int* * `etype`) [Function]

root: pointer to a structure.

name: the name of the element inside a structure that you want to read.

ivalue: vector that will contain the element's content, must be a pointer to memory cells already allocated.

len: number of bytes of *value: value[0]..value[len-1]. Initialy holds the sizeof value.

etype: The type of the value read (ASN1_ETYPE)

Returns the value of one element inside a structure.

If an element is OPTIONAL and the function "read_value" returns `ASN1_ELEMENT_NOT_FOUND`, it means that this element wasn't present in the der encoding that created the structure. The first element of a SEQUENCE_OF or SET_OF is named "?1". The second one "?2" and so on.

INTEGER: VALUE will contain a two's complement form integer.

integer=-1 -> value[0]=0xFF , len=1. integer=1 -> value[0]=0x01 , len=1.

ENUMERATED: As INTEGER (but only with not negative numbers).

BOOLEAN: VALUE will be the null terminated string "TRUE" or "FALSE" and LEN=5 or LEN=6.

OBJECT IDENTIFIER: VALUE will be a null terminated string with each number separated by a dot (i.e. "1.2.3.543.1").

LEN = strlen(VALUE)+1

UTCTime: VALUE will be a null terminated string in one of these formats: "YYMMDDhhmmss+hh'mm'" or "YYMMDDhhmmss-hh'mm'". LEN=strlen(VALUE)+1.

GeneralizedTime: VALUE will be a null terminated string in the same format used to set the value.

OCTET STRING: VALUE will contain the octet string and LEN will be the number of octets.

GeneralString: VALUE will contain the generalstring and LEN will be the number of octets.

BIT STRING: VALUE will contain the bit string organized by bytes and LEN will be the number of bits.

CHOICE: If NAME indicates a choice type, VALUE will specify the alternative selected.

ANY: If NAME indicates an any type, VALUE will indicate the DER encoding of the structure actually used.

Returns: `ASN1_SUCCESS` if value is returned, `ASN1_ELEMENT_NOT_FOUND` if `name` is not a valid element, `ASN1_VALUE_NOT_FOUND` if there isn't any value for the element selected, and `ASN1_MEM_ERROR` if The value vector isn't big enough to store the result, and in this case `len` will contain the number of bytes needed.

asn1_read_tag

`int asn1_read_tag` (*asn1_node* **`root`**, *const char* * **`name`**, *int* * **`tagValue`**, *int* * **`classValue`**) [Function]

root: pointer to a structure

name: the name of the element inside a structure.

tagValue: variable that will contain the TAG value.

classValue: variable that will specify the TAG type.

Returns the TAG and the CLASS of one element inside a structure.

CLASS can have one of these constants: `ASN1_CLASS_APPLICATION`, `ASN1_CLASS_UNIVERSAL`, `ASN1_CLASS_PRIVATE` or `ASN1_CLASS_CONTEXT_SPECIFIC`.

Returns: `ASN1_SUCCESS` if successful, `ASN1_ELEMENT_NOT_FOUND` if `name` is not a valid element.

asn1_read_node_value

`int asn1_read_node_value` (*asn1_node* **`node`**, *asn1_data_node_st* * **`data`**) [Function]

node: pointer to a node.

data: a point to a asn1_data_node_st

Returns the value a data node inside a asn1_node structure. The data returned should be handled as constant values.

Returns: `ASN1_SUCCESS` if the node exists.

4.3 DER functions

asn1_length_der

`void asn1_length_der (`*unsigned long int* **`len`**, *unsigned char * * **`der`**, *int * * **`der_len`**`)` [Function]

len: value to convert.

der: buffer to hold the returned encoding (may be `NULL`).

der_len: number of meaningful bytes of ANS (der[0]..der[der_len-1]).

Creates the DER encoding of the provided length value. The `der` buffer must have enough room for the output. The maximum length this function will encode is `ASN1_MAX_LENGTH_SIZE`.

To know the size of the DER encoding use a `NULL` value for `der`.

asn1_octet_der

`void asn1_octet_der (`*const unsigned char * * **`str`**, *int* **`str_len`**, *unsigned char * * **`der`**, *int * * **`der_len`**`)` [Function]

str: the input data.

str_len: STR length (str[0]..str[*str_len-1]).

der: encoded string returned.

der_len: number of meaningful bytes of DER (der[0]..der[der_len-1]).

Creates a length-value DER encoding for the input data. The DER encoding of the input data will be placed in the `der` variable.

Note that the OCTET STRING tag is not included in the output.

This function does not return any value because it is expected that `der_len` will contain enough bytes to store the string plus the DER encoding. The DER encoding size can be obtained using `asn1_length_der()`.

asn1_encode_simple_der

`int asn1_encode_simple_der (`*unsigned int* **`etype`**, *const unsigned char * * **`str`**, *unsigned int* **`str_len`**, *unsigned char * * **`tl`**, *unsigned int * * **`tl_len`**`)` [Function]

etype: The type of the string to be encoded (ASN1_ETYPE_)

str: the string data.

str_len: the string length

tl: the encoded tag and length

tl_len: the bytes of the `tl` field

Creates the DER encoding for various simple ASN.1 types like strings etc. It stores the tag and length in `tl`, which should have space for at least `ASN1_MAX_TL_SIZE` bytes. Initially `tl_len` should contain the size of `tl`.

The complete DER encoding should consist of the value in `tl` appended with the provided `str`.

Returns: `ASN1_SUCCESS` if successful or an error value.

asn1_bit_der

`void asn1_bit_der` (*const unsigned char * **str**, int **bit_len**, unsigned char * **der**, int * **der_len***) [Function]

str: BIT string.

bit_len: number of meaningful bits in STR.

der: string returned.

der_len: number of meaningful bytes of DER (der[0]..der[ans_len-1]).

Creates a length-value DER encoding for the input data as it would have been for a BIT STRING. The DER encoded data will be copied in `der`.

Note that the BIT STRING tag is not included in the output.

This function does not return any value because it is expected that `der_len` will contain enough bytes to store the string plus the DER encoding. The DER encoding size can be obtained using `asn1_length_der()`.

asn1_der_coding

`int asn1_der_coding` (*asn1_node **element**, const char * **name**, void * **ider**, int * **len**, char * **ErrorDescription***) [Function]

element: pointer to an ASN1 element

name: the name of the structure you want to encode (it must be inside *POINTER).

ider: vector that will contain the DER encoding. DER must be a pointer to memory cells already allocated.

len: number of bytes of *`ider`: `ider`[0]..`ider`[len-1], Initialy holds the sizeof of der vector.

Creates the DER encoding for the NAME structure (inside *POINTER structure).

Returns: `ASN1_SUCCESS` if DER encoding OK, `ASN1_ELEMENT_NOT_FOUND` if `name` is not a valid element, `ASN1_VALUE_NOT_FOUND` if there is an element without a value, `ASN1_MEM_ERROR` if the `ider` vector isn't big enough and in this case `len` will contain the length needed.

asn1_get_length_der

`long asn1_get_length_der` (*const unsigned char * **der**, int **der_len**, int * **len***) [Function]

der: DER data to decode.

der_len: Length of DER data to decode.

len: Output variable containing the length of the DER length field.

Extract a length field from DER data.

Returns: Return the decoded length value, or -1 on indefinite length, or -2 when the value was too big to fit in a int, or -4 when the decoded length value plus `len` would exceed `der_len`.

asn1_get_tag_der

`int asn1_get_tag_der` (*const unsigned char * der, int der_len, unsigned char * cls, int * len, unsigned long * tag*) [Function]

der: DER data to decode.

der_len: Length of DER data to decode.

cls: Output variable containing decoded class.

len: Output variable containing the length of the DER TAG data.

tag: Output variable containing the decoded tag.

Decode the class and TAG from DER code.

Returns: Returns `ASN1_SUCCESS` on success, or an error.

asn1_get_length_ber

`long asn1_get_length_ber` (*const unsigned char * ber, int ber_len, int * len*) [Function]

ber: BER data to decode.

ber_len: Length of BER data to decode.

len: Output variable containing the length of the BER length field.

Extract a length field from BER data. The difference to `asn1_get_length_der()` is that this function will return a length even if the value has indefinite encoding.

Returns: Return the decoded length value, or negative value when the value was too big.

Since: 2.0

asn1_get_octet_der

`int asn1_get_octet_der` (*const unsigned char * der, int der_len, int * ret_len, unsigned char * str, int str_size, int * str_len*) [Function]

der: DER data to decode containing the OCTET SEQUENCE.

der_len: Length of DER data to decode.

ret_len: Output variable containing the length of the DER data.

str: Pre-allocated output buffer to put decoded OCTET SEQUENCE in.

str_size: Length of pre-allocated output buffer.

str_len: Output variable containing the length of the OCTET SEQUENCE.

Extract an OCTET SEQUENCE from DER data.

Returns: Returns `ASN1_SUCCESS` on success, or an error.

asn1_get_bit_der

`int asn1_get_bit_der` (*const unsigned char * der, int der_len, int * ret_len, unsigned char * str, int str_size, int * bit_len*) [Function]

der: DER data to decode containing the BIT SEQUENCE.

der_len: Length of DER data to decode.

ret_len: Output variable containing the length of the DER data.

str: Pre-allocated output buffer to put decoded BIT SEQUENCE in.

str_size: Length of pre-allocated output buffer.

bit_len: Output variable containing the size of the BIT SEQUENCE.

Extract a BIT SEQUENCE from DER data.

Returns: Return `ASN1_SUCCESS` on success, or an error.

asn1_der_decoding

`int asn1_der_decoding` (*asn1_node * **element***, *const void * **ider***, *int **len***, *char * **errorDescription***) [Function]

element: pointer to an ASN1 structure.

ider: vector that contains the DER encoding.

len: number of bytes of *`ider`: `ider`[0]..`ider`[len-1].

errorDescription: null-terminated string contains details when an error occurred.

Fill the structure *`ELEMENT` with values of a DER encoding string. The structure must just be created with function `asn1_create_element()`. If an error occurs during the decoding procedure, the *`ELEMENT` is deleted and set equal to `NULL`.

Returns: `ASN1_SUCCESS` if DER encoding OK, `ASN1_ELEMENT_NOT_FOUND` if `ELEMENT` is `NULL`, and `ASN1_TAG_ERROR` or `ASN1_DER_ERROR` if the der encoding doesn't match the structure name (*`ELEMENT` deleted).

asn1_der_decoding_element

`int asn1_der_decoding_element` (*asn1_node * **structure***, *const char * **elementName***, *const void * **ider***, *int **len***, *char * **errorDescription***) [Function]

structure: pointer to an ASN1 structure

elementName: name of the element to fill

ider: vector that contains the DER encoding of the whole structure.

len: number of bytes of *der: der[0]..der[len-1]

errorDescription: null-terminated string contains details when an error occurred.

Fill the element named `ELEMENTNAME` with values of a DER encoding string. The structure must just be created with function `asn1_create_element()`. The DER vector must contain the encoding string of the whole `STRUCTURE`. If an error occurs during the decoding procedure, the *`STRUCTURE` is deleted and set equal to `NULL`.

Returns: `ASN1_SUCCESS` if DER encoding OK, `ASN1_ELEMENT_NOT_FOUND` if ELEMENT is `NULL` or `elementName` == NULL, and `ASN1_TAG_ERROR` or `ASN1_DER_ERROR` if the der encoding doesn't match the structure `structure` (*ELEMENT deleted).

asn1_der_decoding_startEnd

`int asn1_der_decoding_startEnd` (*asn1_node **element***, *const void * **ider***, *int **len***, *const char * **name_element***, *int * **start***, *int * **end***) [Function]

element: pointer to an ASN1 element

ider: vector that contains the DER encoding.

len: number of bytes of *`ider`: `ider`[0]..`ider`[len-1]

name_element: an element of NAME structure.

start: the position of the first byte of NAME_ELEMENT decoding (`ider`[*start])

end: the position of the last byte of NAME_ELEMENT decoding (`ider`[*end])

Find the start and end point of an element in a DER encoding string. I mean that if you have a der encoding and you have already used the function `asn1_der_decoding()` to fill a structure, it may happen that you want to find the piece of string concerning an element of the structure.

One example is the sequence "tbsCertificate" inside an X509 certificate.

Returns: `ASN1_SUCCESS` if DER encoding OK, `ASN1_ELEMENT_NOT_FOUND` if ELEMENT is `asn1_node` EMPTY or `name_element` is not a valid element, `ASN1_TAG_ERROR` or `ASN1_DER_ERROR` if the der encoding doesn't match the structure ELEMENT.

asn1_expand_any_defined_by

`int asn1_expand_any_defined_by` (*asn1_node* ***definitions***, *asn1_node* * ***element***) [Function]

definitions: ASN1 definitions

element: pointer to an ASN1 structure

Expands every "ANY DEFINED BY" element of a structure created from a DER decoding process (asn1_der_decoding function). The element ANY must be defined by an OBJECT IDENTIFIER. The type used to expand the element ANY is the first one following the definition of the actual value of the OBJECT IDENTIFIER.

Returns: `ASN1_SUCCESS` if Substitution OK, `ASN1_ERROR_TYPE_ANY` if some "ANY DEFINED BY" element couldn't be expanded due to a problem in OBJECT_ID -> TYPE association, or other error codes depending on DER decoding.

asn1_expand_octet_string

`int asn1_expand_octet_string` (*asn1_node* ***definitions***, *asn1_node* * ***element***, *const char* * ***octetName***, *const char* * ***objectName***) [Function]

definitions: ASN1 definitions

element: pointer to an ASN1 structure

octetName: name of the OCTECT STRING field to expand.

objectName: name of the OBJECT IDENTIFIER field to use to define the type for expansion.

Expands an "OCTET STRING" element of a structure created from a DER decoding process (the `asn1_der_decoding()` function). The type used for expansion is the first one following the definition of the actual value of the OBJECT IDENTIFIER indicated by OBJECTNAME.

Returns: `ASN1_SUCCESS` if substitution OK, `ASN1_ELEMENT_NOT_FOUND` if `objectName` or `octetName` are not correct, `ASN1_VALUE_NOT_VALID` if it wasn't possible to find the type to use for expansion, or other errors depending on DER decoding.

asn1_decode_simple_der

`int asn1_decode_simple_der` (*unsigned int* `etype`, *const unsigned char ** `der`, *unsigned int* `der_len`, *const unsigned char *** `str`, *unsigned int ** `str_len`) [Function]

etype: The type of the string to be encoded (ASN1_ETYPE_)

der: the encoded string

der_len: the bytes of the encoded string

str: a pointer to the data

str_len: the length of the data

Decodes a simple DER encoded type (e.g. a string, which is not constructed). The output is a pointer inside the `der`.

Returns: `ASN1_SUCCESS` if successful or an error value.

4.4 Error handling functions

asn1_perror

`void asn1_perror` (*int* `error`) [Function]

error: is an error returned by a libtasn1 function.

Prints a string to stderr with a description of an error. This function is like `perror()`. The only difference is that it accepts an error returned by a libtasn1 function.

Since: 1.6

asn1_strerror

`const char * asn1_strerror` (*int* `error`) [Function]

error: is an error returned by a libtasn1 function.

Returns a string with a description of an error. This function is similar to strerror. The only difference is that it accepts an error (number) returned by a libtasn1 function.

Returns: Pointer to static zero-terminated string describing error code.

Since: 1.6

4.5 Auxilliary functions

asn1_find_node

`asn1_node asn1_find_node` (*asn1_node* `pointer`, *const char ** `name`) [Function]

pointer: NODE_ASN element pointer.

name: null terminated string with the element's name to find.

Searches for an element called `name` starting from `pointer`. The name is composed by differents identifiers separated by dots. When *`pointer` has a name, the first identifier must be the name of *`pointer`, otherwise it must be the name of one child of *`pointer`.

Returns: the search result, or `NULL` if not found.

asn1_check_version

`const char * asn1_check_version` (*const char * req_version*) [Function]

req_version: Required version number, or `NULL`.

Check that the version of the library is at minimum the requested one and return the version string; return `NULL` if the condition is not satisfied. If a `NULL` is passed to this function, no check is done, but the version string is simply returned.

See `ASN1_VERSION` for a suitable `req_version` string.

Returns: Version string of run-time library, or `NULL` if the run-time library does not meet the required version number.

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