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Red Hat Enterprise Linux Release 9.2 Manual Pages on 'tpm2_loadexternal.1' command

\$ man tpm2_loadexternal.1

tpm2_loadexternal(1) General Commands Manual tpm2_loadexternal(1)

NAME

tpm2_loadexternal(1) - Load an external object into the TPM.

SYNOPSIS

tpm2_loadexternal [OPTIONS]

DESCRIPTION

tpm2_loadexternal(1) - This command loads an external object into the TPM, forgoing TPM protections. Ie, the key material is not protected by the parent object's seed. The command allows loading of just the public portion of an object or both the public and private portions of an object.

The tool outputs the name of the loaded object in a YAML dictionary format with the key name where the value for that key is the name of the object in hex format, for example:

```
name: 000bac25cb8743111c8e1f52f2ee7279d05d3902a18dd1af694db5d1afa7adf1c8b3
```

It also saves a context file for future interactions with the object.

OPTIONS

? -C, --hierarchy=OBJECT:

Hierarchy to use for the ticket, optional. Defaults to n, null.

Supported options are:

? o for the owner hierarchy.

? p for the platform hierarchy.

? e for the endorsement hierarchy.

? n for the null hierarchy.

? -G, --key-algorithm=ALGORITHM:

The algorithm used by the key to be imported. Supports:

? aes - AES 128,192 or 256 key.

? rsa - RSA 1024 or 2048 key.

? ecc - ECC NIST P192, P224, P256, P384 or P521 public and private key.

? -u, --public=FILE:

The public portion of the object, this can be one of the following file formats:

? TSS - The TSS/TPM format. For example from option -u of command tpm2_create(1).

? RSA - OSSL PEM formats. For example public.pem from the command openssl rsa -in private.pem -out public.pem -pubout

? ECC - OSSL PEM formats. For example public.pem from the command openssl ec -in private.ecc.pem -out public.ecc.pem -pubout

? -r, --private=FILE:

The sensitive portion of the object, optional. If one wishes to use the private portion of a key, this must be specified. Like option -u, this command takes files in the following format:

? RSA - OSSL PEM formats. For example private.pem from the command openssl genrsa -out private.pem 2048 Since an RSA public key can be derived from the private PEM file, there is no need to specify -u for the public portion.

Note: The private portion does not respect TSS formats as it's impossible to get a TPM2B_SENSITIVE output from a previous command. They are always protected by the TPM as TPM2B_PRIVATE blobs.

? -p, --auth=AUTH:

The authorization value for the key, optional.

? -L, --policy=POLICY_FILE:

The input policy file, optional. A file containing the hash of a policy derived from tpm2_createpolicy.

? -g, --hash-algorithm=ALGORITHM:

The hash algorithm for generating the objects name. This is optional and defaults to sha256 when not specified. However, load external supports having a null name algorithm. In this case, no cryptographic binding checks between the public and private portions are performed.

? -a, --attributes=ATTRIBUTES:

The object attributes, optional. The default for created objects is:

TPMA_OBJECT_SIGN_ENCRYPT|TPMA_OBJECT_DECRYPT. Optionally, if -p is specified or no -p or -L is specified then TPMA_OBJECT_USERWITHAUTH is added to the default attribute set.

Note: If specifying attributes, the TPM will reject certain at?

tributes like TPMA_OBJECT_FIXEDTPM, as those guarantees cannot be made.

? -c, --key-context=FILE

The file name to save the object context, required.

? -n, --name=FILE:

An optional file to save the object name, which is in a binary hash format. The size of the hash is based on name algorithm or the -g option.

? --passin=OSSL_PEM_FILE_PASSWORD

An optional password for an Open SSL (OSSL) provided input file. It mirrors the -passin option of OSSL and is known to support the pass, file, env, fd and plain password formats of openssl. (see man(1) openssl) for more.

References

Context Object Format

The type of a context object, whether it is a handle or file name, is determined according to the following logic in-order:

? If the argument is a file path, then the file is loaded as a restored TPM transient object.

? If the argument is a prefix match on one of:

? owner: the owner hierarchy

? platform: the platform hierarchy

? endorsement: the endorsement hierarchy

? lockout: the lockout control persistent object

? If the argument argument can be loaded as a number it will be treated as a handle, e.g. 0x81010013 and used directly._OBJECT_.

Authorization Formatting

Authorization for use of an object in TPM2.0 can come in 3 different forms: 1. Password 2. HMAC 3. Sessions

NOTE: ?Authorizations default to the EMPTY PASSWORD when not specified?.

Passwords

Passwords are interpreted in the following forms below using prefix identifiers.

Note: By default passwords are assumed to be in the string form when they do not have a prefix.

String

A string password, specified by prefix ?str:? or its absence (raw string without prefix) is not interpreted, and is directly used for authorization.

Examples

foobar

str:foobar

Hex-string

A hex-string password, specified by prefix ?hex:? is converted from a hexadecimal form into a byte array form, thus allowing passwords with non-printable and/or terminal un-friendly characters.

Example

hex:0x1122334455667788

File

A file based password, specified by prefix ?file:? should be the path of a file containing the password to be read by the tool or a ?-? to use stdin. Storing passwords in files prevents information leakage, passwords passed as options can be read from the process list or common shell history features.

Examples

```
# to use stdin and be prompted
```

```
file:-
```

```
# to use a file from a path
```

```
file:path/to/password/file
```

```
# to echo a password via stdin:
```

```
echo foobar | tpm2_tool -p file:-
```

```
# to use a bash here-string via stdin:
```

```
tpm2_tool -p file:- <<< foobar
```

Sessions

When using a policy session to authorize the use of an object, prefix the option argument with the session keyword. Then indicate a path to a session file that was created with `tpm2_startauthsession(1)`. Option? ally, if the session requires an auth value to be sent with the session handle (eg policy password), then append a + and a string as described in the Passwords section.

Examples

To use a session context file called `session.ctx`.

```
session:session.ctx
```

To use a session context file called `session.ctx` AND send the authvalue `mypassword`.

```
session:session.ctx+mypassword
```

To use a session context file called `session.ctx` AND send the HEX auth? value `0x11223344`.

```
session:session.ctx+hex:11223344
```

PCR Authorizations

You can satisfy a PCR policy using the `?pcr:?` prefix and the PCR mini? language. The PCR minilanguage is as follows:

```
<pcr-spec>=<raw-pcr-file>
```

The PCR spec is documented in in the section `?PCR bank specifiers?`.

The `raw-pcr-file` is an optional argument that contains the output of the raw PCR contents as returned by `tpm2_pcrread(1)`.

PCR bank specifiers (pcr.md)

Examples

To satisfy a PCR policy of sha256 on banks 0, 1, 2 and 3 use a specific?

er of:

```
pcr:sha256:0,1,2,3
```

specifying AUTH.

Algorithm Specifiers

Options that take algorithms support ?nice-names?.

There are two major algorithm specification string classes, simple and complex. Only certain algorithms will be accepted by the TPM, based on usage and conditions.

Simple specifiers

These are strings with no additional specification data. When creating objects, non-specified portions of an object are assumed to defaults.

You can find the list of known ?Simple Specifiers Below?.

Asymmetric

? rsa

? ecc

Symmetric

? aes

? camellia

Hashing Algorithms

? sha1

? sha256

? sha384

? sha512

? sm3_256

? sha3_256

? sha3_384

? sha3_512

Keyed Hash

? hmac

? xor

Signing Schemes

? rsassa

? rsapss

? ecdsa

? ecdaa

? ecschnorr

Asymmetric Encryption Schemes

? oaep

? rsaes

? ecdh

Modes

? ctr

? ofb

? cbc

? cfb

? ecb

Misc

? null

Complex Specifiers

Objects, when specified for creation by the TPM, have numerous algorithms to populate in the public data. Things like type, scheme and asymmetric details, key size, etc. Below is the general format for specifying this data: <type>:<scheme>:<symmetric-details>

Type Specifiers

This portion of the complex algorithm specifier is required. The remaining scheme and symmetric details will default based on the type specified and the type of the object being created.

? aes - Default AES: aes128

? aes128<mode> - 128 bit AES with optional mode (ctr|ofb|cbc|cfb|ecb).

If mode is not specified, defaults to null.

? aes192<mode> - Same as aes128<mode>, except for a 192 bit key size.

? aes256<mode> - Same as aes128<mode>, except for a 256 bit key size.

? ecc - Elliptical Curve, defaults to ecc256.

? ecc192 - 192 bit ECC

? ecc224 - 224 bit ECC

? ecc256 - 256 bit ECC

? ecc384 - 384 bit ECC

? ecc521 - 521 bit ECC

? rsa - Default RSA: rsa2048

? rsa1024 - RSA with 1024 bit keysize.

? rsa2048 - RSA with 2048 bit keysize.

? rsa4096 - RSA with 4096 bit keysize.

Scheme Specifiers

Next, is an optional field, it can be skipped.

Schemes are usually Signing Schemes or Asymmetric Encryption Schemes.

Most signing schemes take a hash algorithm directly following the signing

scheme. If the hash algorithm is missing, it defaults to sha256.

Some take no arguments, and some take multiple arguments.

Hash Optional Scheme Specifiers

These scheme specifiers are followed by a dash and a valid hash algo?

rithm, For example: oaep-sha256.

? oaep

? ecdh

? rsassa

? rsapss

? ecdsa

? ecschnorr

Multiple Option Scheme Specifiers

This scheme specifier is followed by a count (max size UINT16) then

followed by a dash(-) and a valid hash algorithm. * ecdaa For example,

ecdaa4-sha256. If no count is specified, it defaults to 4.

No Option Scheme Specifiers

This scheme specifier takes NO arguments. * rsaes

Symmetric Details Specifiers

This field is optional, and defaults based on the type of object being

created and its attributes. Generally, any valid Symmetric specifier

from the Type Specifiers list should work. If not specified, an asym?

metric objects symmetric details defaults to aes128cfb.

Examples

Create an rsa2048 key with an rsaes asymmetric encryption scheme

```
tpm2_create -C parent.ctx -G rsa2048:rsaes -u key.pub -r key.priv
```

Create an ecc256 key with an ecdaa signing scheme with a count of 4 and

sha384 hash

```
/tpm2_create -C parent.ctx -G ecc256:ecdaa4-sha384 -u key.pub -r  
key.priv cryptographic algorithms ALGORITHM.
```

Object Attributes

Object Attributes are used to control various properties of created ob-

jects. When specified as an option, either the raw bitfield mask or

aliases may be used. The values can be found in Table 31 Part 2

of the TPM2.0 specification, which can be found here:

<<https://trustedcomputinggroup.org/wp-content/uploads/TPM-Rev-2.0-Part-2-Structures-01.38.pdf>>

Nice names are calculated by taking the name field of table 31 and re-

moving the prefix TPMA_OBJECT_ and lowercasing the result. Thus, TP-

MA_OBJECT_FIXEDTPM becomes fixedtpm. Nice names can be joined using

the bitwise or (|) symbol.

For instance, to set The fields TPMA_OBJECT_FIXEDTPM, TPMA_OBJECT_NODA,

and TPMA_OBJECT_SIGN_ENCRYPT, the argument would be:

fixedtpm|noda|sign specifying the object attributes ATTRIBUTES.

COMMON OPTIONS

This collection of options are common to many programs and provide in-

formation that many users may expect.

-h, --help=[man|no-man]: Display the tools manpage. By default, it

attempts to invoke the manpager for the tool, however, on failure

will output a short tool summary. This is the same behavior if the

man option argument is specified, however if explicit man is re-

quested, the tool will provide errors from man on stderr. If the

no-man option if specified, or the manpager fails, the short op-

tions will be output to stdout.

To successfully use the manpages feature requires the manpages to be

installed or on MANPATH, See man(1) for more details.

? -v, --version: Display version information for this tool, supported tctis and exit.

? -V, --verbose: Increase the information that the tool prints to the console during its execution. When using this option the file and line number are printed.

? -Q, --quiet: Silence normal tool output to stdout.

? -Z, --enable-errata: Enable the application of errata fixups. Useful if an errata fixup needs to be applied to commands sent to the TPM.

Defining the environment TPM2TOOLS_ENABLE_ERRATA is equivalent. Information many users may expect.

TCTI Configuration

The TCTI or ?Transmission Interface? is the communication mechanism with the TPM. TCTIs can be changed for communication with TPMs across different mediums.

To control the TCTI, the tools respect:

1. The command line option -T or --tcti
2. The environment variable: TPM2TOOLS_TCTI.

Note: The command line option always overrides the environment variable.

The current known TCTIs are:

? tabrmd - The resource manager, called tabrmd (<https://github.com/tpm2-software/tpm2-abrmd>). Note that tabrmd and abrmd as a tcti name are synonymous.

? mssim - Typically used for communicating to the TPM software simulator.

? device - Used when talking directly to a TPM device file.

? none - Do not initialize a connection with the TPM. Some tools allow for off-tpm options and thus support not using a TCTI. Tools that do not support it will error when attempted to be used without a TCTI connection. Does not support ANY options and MUST BE presented as the exact text of ?none?.

The arguments to either the command line option or the environment

variable are in the form:

<tcti-name>:<tcti-option-config>

Specifying an empty string for either the <tcti-name> or <tcti-option-config> results in the default being used for that portion respectively.

TCTI Defaults

When a TCTI is not specified, the default TCTI is searched for using dlopen(3) semantics. The tools will search for tabrmd, device and mssim TCTIs IN THAT ORDER and USE THE FIRST ONE FOUND. You can query what TCTI will be chosen as the default by using the -v option to print the version information. The ?default-tcti? key-value pair will indicate which of the aforementioned TCTIs is the default.

Custom TCTIs

Any TCTI that implements the dynamic TCTI interface can be loaded. The tools internally use dlopen(3), and the raw tcti-name value is used for the lookup. Thus, this could be a path to the shared library, or a library name as understood by dlopen(3) semantics.

TCTI OPTIONS

This collection of options are used to configure the various known TCTI modules available:

? device: For the device TCTI, the TPM character device file for use by the device TCTI can be specified. The default is /dev/tpm0.

Example: -T device:/dev/tpm0 or export TPM2TOOLS_TCTI=?device:/dev/tpm0?

? mssim: For the mssim TCTI, the domain name or IP address and port number used by the simulator can be specified. The default are 127.0.0.1 and 2321.

Example: -T mssim:host=localhost,port=2321 or export TPM2TOOLS_TCTI=?mssim:host=localhost,port=2321?

? abrmd: For the abrmd TCTI, the configuration string format is a series of simple key value pairs separated by a `,' character. Each key and value string are separated by a `=' character.

? TCTI abrmd supports two keys:

1. `bus_name` : The name of the tabrmd service on the bus (a string).
2. `bus_type` : The type of the dbus instance (a string) limited to `session` and `system`.

Specify the tabrmd tcti name and a config string of bus_name=com.ex?

ample.FooBar:

```
\--tcti=tabrmd:bus_name=com.example.FooBar
```

Specify the default (abrmd) tcti and a config string of bus_type=ses?

sion:

```
\--tcti:bus_type=session
```

NOTE: abrmd and tabrmd are synonymous. the various known TCTI modules.

NOTES

- ? If the hierarchy is null or the name hashing algorithm is null, tickets produced using the object will be NULL.
- ? If the private portion of an object is specified, the hierarchy must be null or the TPM will reject loading it.

EXAMPLES

Load a TPM generated public key into the owner hierarchy

```
tpm2_createprimary -c primary.ctx
```

```
tpm2_create -C primary.ctx -u pub.dat -r priv.dat
```

```
tpm2_loadexternal -C o -u pub.dat -c pub.ctx
```

```
name: 000b9be4d7c6193a57e1bfc86a42a6b03856a91d2f9e77c6cbdb796a783d52d4b3b9
```

Load an RSA public key into the owner hierarchy

```
openssl genrsa -out private.pem 2048
```

```
openssl rsa -in private.pem -out public.pem -outform PEM -pubout
```

```
tpm2_loadexternal -C o -Grsa -u public.pem -c key.ctx
```

```
name: 000b7b91d304d16995d42792b57d0fb25df7abe5fdd8afe9950730e00dc5b934ddbc
```

Load an RSA key-pair into the null hierarchy

```
openssl genrsa -out private.pem 2048
```

```
tpm2_loadexternal -C n -Grsa -r private.pem -c key.ctx
```

```
name: 000b635ea220b6c62ec1d02343859dd203c8ac5dad82ebc5b124e407d2502f88691f
```

Load an AES key into the null hierarchy

```
dd if=/dev/urandom of=sym.key bs=1 count=16
```

```
tpm2_loadexternal -C n -Gaes -r sym.key -c key.ctx
```

```
name: 000bfc4d8dd7e4f921bcc9dca4b04f49564243cd9def129a3740002bfd4b9e966d34
```

Returns

Tools can return any of the following codes:

? 0 - Success.

? 1 - General non-specific error.

? 2 - Options handling error.

? 3 - Authentication error.

? 4 - TCTI related error.

? 5 - Non supported scheme. Applicable to tpm2_testparams.

BUGS

Github Issues (<https://github.com/tpm2-software/tpm2-tools/issues>)

HELP

See the Mailing List (<https://lists.01.org/mailman/listinfo/tpm2>)

tpm2-tools

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