NAME

zfs-fido2-add-backup — allow another FIDO2 device to unlock ZFS dataset

SYNOPSIS

zfs-fido2-add-backup *dataset*

DESCRIPTION

After zfs-fido2-change-key(8) derives the key for a dataset from a FIDO2 device, **zfs-fido2-add-backup** may be executed to extend this to any number of additional devices.

First, the wrapping key is extracted as normally during zfs-fido2-load-key(8), then a credential is made as-if during zfs-fido2-change-key(8) (except the "primary" device and all the ones holding backups are excluded from the search); however, the hmac-secret is instead used as a symmetric AES-256-GCM (EVP_CIPHER-AES(7ssl)) key to encrypt the wrapping key directly with a random IV.

This turns the xyz.nabijaczleweli:tzpfms.key variable into a dot-separated list of device bundles:

salt:*credential-ID*:*credential-public-key*[.*backup-salt*:*backup-credential-ID*:*backup-credential-public-key*:*IV*:*encrypted-key*]...

The first one is as-described in zfs-fido2-change-key(8). Subsequent ones also include (identically-encoded) IVs and encrypted blobs.

zfs-fido2-load-key(8) shops assertions around devices in a device-major order — depending on device numbering, a backup may be loaded even if the primary device is present.

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

- $1 Pre-formatted noun phrase with all the information below, for use as a prompt
- $2 Either the dataset name or the device feature being prompted for
- $3 "new" if this is for a new passphrase, otherwise blank
- $4 "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

FIDO2 back-end configuration

Environment variables

FIDO_DEBUG If set, enables libfido2 debug logging to the standard error stream.

Device selection

When creating, the first device which supports the hmac-secret extension is used. When loading, the assertion yielding the key is shopped around to every such device.

See also

The libfido2 documentation at https://developers.yubico.com/libfido2/.

SPECIAL THANKS

To all who support further development, in particular:

- ThePhD
- Embark Studios
- Jasper Bekkers
- EvModder

REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/fzifdso

~nabijaczleweli/tzpfms@lists.sr.ht, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

NAME

zfs-fido2-change-key — change ZFS dataset key to one authenticated by a FIDO2 device

SYNOPSIS

zfs-fido2-add-backup [**-b** *backup-file*] *dataset*

DESCRIPTION

To normalise the *dataset*, **zfs-fido2-add-backup** will open its encryption root in its stead. **zfs-fido2-add-backup** will *never* create or destroy encryption roots; use zfs-change-key(8) for that.

First, a connection is made to the FIDO2 device, which *must* support the hmac-secret extension.

If *dataset* was previously encrypted with **fzifdso** and the **FIDO2** back-end was used, previous credentials will be deleted from their devices (as-if via zfs-fido2-clear-key(8)), if available. Otherwise, or in case of an error, data required for manual intervention will be written to the standard error stream.

Next, a new credential of type ES256 is generated on the device (with relying party ID fzifdso and name equal to the dataset name) with the hmac-secret extension requested; the device PIN, if any, is prompted for here. This mimicks a WebAuthn registration step.

Then, the credential is asserted with a 32-byte random salt, which hashes it with device-private data, and thus generates the wrapping key (which is optionally backed up (see **OPTIONS**)). This mimicks a WebAuthn login step.

The following properties are set on *dataset*:

- xyz.nabijaczleweli:tzpfms.backend=**FIDO2**
- xyz.nabijaczleweli:tzpfms.key=*salt*:*credential-ID*:*credential-public-key*[...]...

tzpfms.backend identifies this dataset for work with **FIDO2**-back-ended **tzpfms** tools (i.e. **fzifdso** zfs-fido2-change-key(8), zfs-fido2-load-key(8), zfs-fido2-add-backup(8), and zfs-fido2-clear-key(8)).

tzpfms.key is a colon-separated tuple of unpadded URL-safe base64 blobs; the first one is the random salt; the second represents the ID of created credential, and the third – its public key. There exists no other user-land tool for deciphering this; perhaps there should be.

Finally, the equivalent of **zfs change-key -o** keylocation=prompt **-o** keyformat=raw *dataset* is performed with the new key. If an error occurred, best effort is made to clean up the properties, or to issue a note for manual intervention into the standard error stream.

A final verification should be made by running **zfs-fido2-load-key -n** *dataset*. If that command succeeds, all is well, but otherwise the dataset can be manually rolled back to a passphrase with **zfs-fido2-clear-key** *dataset* (or, if that fails to work, **zfs change-key -o** keyformat=passphrase *dataset*), and you are hereby asked to report a bug, please.

zfs-fido2-clear-key *dataset* can be used to clear the properties and go back to using a passphrase.

OPTIONS

-b *backup-file* Save a back-up of the key to *backup-file*, which must not exist beforehand. This back-up *must* be stored securely, off-site. In case of a catastrophic event, the key can be loaded by running

zfs load-key *dataset* < *backup-file*

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

`$1` Pre-formatted noun phrase with all the information below, for use as a prompt
`$2` Either the dataset name or the device feature being prompted for
`$3` "new" if this is for a new passphrase, otherwise blank
`$4` "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

FIDO2 back-end configuration

Environment variables

`FIDO_DEBUG` If set, enables libfido2 debug logging to the standard error stream.

Device selection

When creating, the first device which supports the `hmac-secret` extension is used. When loading, the assertion yielding the key is shopped around to every such device.

See also

The libfido2 documentation at https://developers.yubico.com/libfido2/.

SPECIAL THANKS

To all who support further development, in particular:

- ThePhD
- Embark Studios
- Jasper Bekkers
- EvModder

REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/fzifdso

`~nabijaczleweli/tzpfms@lists.sr.ht`, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

NAME

zfs-fido2-clear-key — rewrap ZFS dataset key in passsword and clear tzpfms FIDO2 metadata

SYNOPSIS

zfs-fido2-add-backup *dataset*

DESCRIPTION

After verifying *dataset* was encrypted with the **tzpfms FIDO2** backend:

1. performs the equivalent of **zfs change-key -o** keylocation=prompt **-o** keyformat=passphrase *dataset*,
2. loads the primary and every backup credential, and for each success, if the device containing it supports the credMgmt feature and has a PIN set, tries to delete the credential from the device,
3. removes the xyz.nabijaczleweli:tzpfms.{backend, key} properties from *dataset*.

For every removal failure and missing device or PIN an instruction for manual removal with fido2-token(1) is issued.

See zfs-fido2-change-key(8) for a detailed description.

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

- $1 Pre-formatted noun phrase with all the information below, for use as a prompt
- $2 Either the dataset name or the device feature being prompted for
- $3 "new" if this is for a new passphrase, otherwise blank
- $4 "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

FIDO2 back-end configuration

Environment variables

FIDO_DEBUG If set, enables libfido2 debug logging to the standard error stream.

Device selection

When creating, the first device which supports the hmac-secret extension is used. When loading, the assertion yielding the key is shopped around to every such device.

See also

The libfido2 documentation at https://developers.yubico.com/libfido2/.

SPECIAL THANKS

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REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/fzifdso

~nabijaczleweli/tzpfms@lists.sr.ht, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

NAME

zfs-fido2-load-key — load FIDO2-encrypted ZFS dataset key

SYNOPSIS

zfs-fido2-add-backup [**-n**] *dataset*

DESCRIPTION

After verifying *dataset* was encrypted with the **tzpfms FIDO2** backend, asserts the preserved challenge, HMACking the salt with the on-device secret, and loads the resulting key into *dataset*.

See zfs-fido2-change-key(8) for a detailed description.

OPTIONS

-n Do a no-op/dry run, can be used even if the key is already loaded. Equivalent to **zfs load-key**'s **-n** option.

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

- $1 Pre-formatted noun phrase with all the information below, for use as a prompt
- $2 Either the dataset name or the device feature being prompted for
- $3 "new" if this is for a new passphrase, otherwise blank
- $4 "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

FIDO2 back-end configuration

Environment variables

FIDO_DEBUG If set, enables libfido2 debug logging to the standard error stream.

Device selection

When creating, the first device which supports the hmac-secret extension is used. When loading, the assertion yielding the key is shopped around to every such device.

See also

The libfido2 documentation at https://developers.yubico.com/libfido2/.

SPECIAL THANKS

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- ThePhD
- Embark Studios
- Jasper Bekkers
- EvModder

REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/fzifdso

~nabijaczleweli/tzpfms@lists.sr.ht, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

NAME

zfs-tpm-list — print dataset tzpfms metadata

SYNOPSIS

zfs-fido2-add-backup [**-H**] [**-r**|**-d** *depth*] [**-a**|**-b** *back-end*] [**-u**|**-l**]
[*filesystem*|*volume*]...

DESCRIPTION

Lists the following properties on encryption roots:

`name`

`back-end` the **tzpfms** back-end (e.g. **TPM2** for `zfs-tpm2-change-key`(8) or **TPM1.X** for `zfs-tpm1x-change-key`(8)), or "**-**" if none is configured

`keystatus` **available** or **unavailable**

`coherent` **yes** if either both `xyz.nabijaczleweli:tzpfms.backend` and `xyz.nabijaczleweli:tzpfms.key` are present or missing, **no** otherwise

Incoherent datasets require immediate operator attention, with either the appropriate **zfs-tpm*-clear-key** program or **zfs change-key** and **zfs inherit** — if the key becomes unloaded, they will require restoration from back-up. However, this should never occur, unless something went horribly wrong with the dataset properties.

If no datasets are specified, all matching encryption roots are listed — by default, those managed by **tzpfms**.

OPTIONS

-H Scripting mode — remove headers and separate fields by a single tab instead of columnating them with spaces.

-r Recurse into all descendants of specified datasets.

-d *depth* Recurse at most *depth* datasets deep. Default: **0**.

-a List all encryption roots, even ones not managed by **tzpfms**.

-b *back-end* List only encryption roots with the specified **tzpfms** *back-end*.

-u List only encryption roots whose keys are unavailable.

-l List only encryption roots whose keys are available.

EXAMPLES

```
$ zfs-fido2-add-backup
NAME             BACK-END  KEYSTATUS    COHERENT
tarta-zoot       TPM1.X    available    yes
tarta-zoot/home  TPM2      unavailable  yes

$ zfs-fido2-add-backup -ad0
NAME     BACK-END  KEYSTATUS  COHERENT
filling  -         available  yes

$ zfs-fido2-add-backup -b TPM2
NAME             BACK-END  KEYSTATUS    COHERENT
tarta-zoot/home  TPM2      unavailable  yes

$ zfs-fido2-add-backup -ra tarta-zoot
NAME             BACK-END  KEYSTATUS    COHERENT
tarta-zoot       TPM1.X    available    yes
tarta-zoot/home  TPM2      unavailable  yes
tarta-zoot/bkp   -         available    yes
tarta-zoot/vm    -         available    yes

$ zfs-fido2-add-backup -al
NAME             BACK-END  KEYSTATUS  COHERENT
filling          -         available  yes
tarta-zoot       TPM1.X    available  yes
tarta-zoot/bkp   -         available  yes
tarta-zoot/vm    -         available  yes
```

SPECIAL THANKS

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- Embark Studios
- Jasper Bekkers
- EvModder

REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/tzpfms

`~nabijaczleweli/tzpfms@lists.sr.ht`, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

NAME

zfs-tpm1x-change-key — change ZFS dataset key to one stored on the TPM

SYNOPSIS

zfs-fido2-add-backup [**-b** *backup-file*] [**-P** *PCR*[,*PCR*]...] *dataset*

DESCRIPTION

To normalise the *dataset*, **zfs-fido2-add-backup** will open its encryption root in its stead. **zfs-fido2-add-backup** will *never* create or destroy encryption roots; use zfs-change-key(8) for that.

First, a connection is made to the TPM, which *must* be TPM-1.X-compatible.

If *dataset* was previously encrypted with **tzpfms** and the **TPM1.X** back-end was used, the metadata will be silently cleared. Otherwise, or in case of an error, data required for manual intervention will be written to the standard error stream.

Next, a new wrapping key is generated on the TPM, optionally backed up (see **OPTIONS**), and sealed on the TPM; the user is prompted for an optional passphrase to protect the key with, and for the SRK passphrase, set when taking ownership, if not "well-known" (all zeroes).

The following properties are set on *dataset*:

- xyz.nabijaczleweli:tzpfms.backend=**TPM1.X**
- xyz.nabijaczleweli:tzpfms.key=*parent-key-blob*:*sealed-object-blob*

tzpfms.backend identifies this dataset for work with **TPM1.X**-back-ended **tzpfms** programs (namely zfs-tpm1x-change-key(8), zfs-tpm1x-load-key(8), and zfs-tpm1x-clear-key(8)).

tzpfms.key is a colon-separated pair of hexadecimal-string (i.e. "4F7730" for "Ow0") blobs; the first one represents the RSA key protecting the blob, and it is protected with either the passphrase, if provided, or the SHA1 constant CE4CF677875B5EB8993591D5A9AF1ED24A3A8736; the second represents the sealed object containing the wrapping key, and is protected with the SHA1 constant B9EE715DBE4B243FAA81EA04306E063710383E35. There exists no other user-land tool for decrypting this; perhaps there should be.

Finally, the equivalent of **zfs change-key -o** keylocation=prompt **-o** keyformat=raw *dataset* is performed with the new key. If an error occurred, best effort is made to clean up the properties, or to issue a note for manual intervention into the standard error stream.

A final verification should be made by running **zfs-tpm1x-load-key -n** *dataset*. If that command succeeds, all is well, but otherwise the dataset can be manually rolled back to a passphrase with **zfs-tpm1x-clear-key** *dataset* (or, if that fails to work, **zfs change-key -o** keyformat=passphrase *dataset*), and you are hereby asked to report a bug, please.

zfs-tpm1x-clear-key *dataset* can be used to clear the properties and go back to using a passphrase.

OPTIONS

-b *backup-file* Save a back-up of the key to *backup-file*, which must not exist beforehand. This back-up *must* be stored securely, off-site. In case of a catastrophic event, the key can be loaded by running

zfs load-key *dataset* < *backup-file*

-P *PCR*[,*PCR*]... Bind the key to space- or comma-separated *PCR*s — if they change, the wrapping key will not be able to be unsealed. The minimum number of PCRs for a PC TPM is **24** (numbered [**0**, **23**]). For most, this is also the maximum.

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

`$1` Pre-formatted noun phrase with all the information below, for use as a prompt
`$2` Either the dataset name or the element of the TPM hierarchy being prompted for
`$3` "new" if this is for a new passphrase, otherwise blank
`$4` "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

TPM1.X back-end configuration

TPM selection

The **tzpfms** suite connects to a local `tcsd`(8) process (at `localhost:30003`) by default. Use the environment variable `TZPFMS_TPM1X` to specify a remote TCS hostname.

The TrouSerS `tcsd`(8) daemon will try `/dev/tpm0`, then `/udev/tpm0`, then `/dev/tpm`; by occupying one of the earlier ones with, for example, shell redirection, a later one can be selected.

See also

The TrouSerS project page at https://sourceforge.net/projects/trousers.

The TPM 1.2 main specification index at https://trustedcomputinggroup.org/resource/tpm-main-specification.

SPECIAL THANKS

To all who support further development, in particular:

- ThePhD
- Embark Studios
- Jasper Bekkers
- EvModder

REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/tzpfms

`~nabijaczleweli/tzpfms@lists.sr.ht`, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

SEE ALSO

PCR allocations: https://wiki.archlinux.org/title/Trusted_Platform_Module#Accessing_PCR_registers and https://trustedcomputinggroup.org/wp-content/uploads/PC-ClientSpecific_Platform_Profile_for_TPM_2p0_Systems_v51.pdf, Section 2.3.4 "PCR Usage", Table 1.

NAME

zfs-tpm1x-clear-key — rewrap ZFS dataset key in passsword and clear tzpfms TPM1.X metadata

SYNOPSIS

zfs-fido2-add-backup *dataset*

DESCRIPTION

After verifying *dataset* was encrypted with the **tzpfms TPM1.X** backend:

1. performs the equivalent of **zfs change-key -o** `keylocation=prompt` **-o** `keyformat=passphrase` *dataset*,
2. removes the `xyz.nabijaczleweli:tzpfms.{backend, key}` properties from *dataset*.

See `zfs-tpm1x-change-key`(8) for a detailed description.

TPM1.X back-end configuration

TPM selection

The **tzpfms** suite connects to a local `tcsd`(8) process (at `localhost:30003`) by default. Use the environment variable `TZPFMS_TPM1X` to specify a remote TCS hostname.

The TrouSerS `tcsd`(8) daemon will try `/dev/tpm0`, then `/udev/tpm0`, then `/dev/tpm`; by occupying one of the earlier ones with, for example, shell redirection, a later one can be selected.

See also

The TrouSerS project page at https://sourceforge.net/projects/trousers.

The TPM 1.2 main specification index at https://trustedcomputinggroup.org/resource/tpm-main-specification.

SPECIAL THANKS

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REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/tzpfms

`~nabijaczleweli/tzpfms@lists.sr.ht`, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

NAME

zfs-tpm1x-load-key — load TPM1.X-encrypted ZFS dataset key

SYNOPSIS

zfs-fido2-add-backup [**-n**] *dataset*

DESCRIPTION

After verifying *dataset* was encrypted with the **tzpfms TPM1.X** backend, unseals the key and load it into *dataset*.

The user is first prompted for the SRK passphrase, set when taking ownership, if not "well-known" (all zeroes); then for the additional passphrase, set when creating the key, if one was set.

See zfs-tpm1x-change-key(8) for a detailed description.

OPTIONS

-n Do a no-op/dry run, can be used even if the key is already loaded. Equivalent to **zfs load-key**'s **-n** option.

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

- $1 Pre-formatted noun phrase with all the information below, for use as a prompt
- $2 Either the dataset name or the element of the TPM hierarchy being prompted for
- $3 "new" if this is for a new passphrase, otherwise blank
- $4 "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

TPM1.X back-end configuration

TPM selection

The **tzpfms** suite connects to a local tcsd(8) process (at localhost:30003) by default. Use the environment variable TZPFMS_TPM1X to specify a remote TCS hostname.

The TrouSerS tcsd(8) daemon will try /dev/tpm0, then /udev/tpm0, then /dev/tpm; by occupying one of the earlier ones with, for example, shell redirection, a later one can be selected.

See also

The TrouSerS project page at https://sourceforge.net/projects/trousers.

The TPM 1.2 main specification index at https://trustedcomputinggroup.org/resource/tpm-main-specification.

SPECIAL THANKS

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REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/tzpfms

~nabijaczleweli/tzpfms@lists.sr.ht, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

NAME

zfs-tpm2-change-key — change ZFS dataset key to one stored on the TPM

SYNOPSIS

zfs-fido2-add-backup [**-b** *backup-file*] [**-P** *algorithm*:*PCR*[,*PCR*]...
[**+***algorithm*:*PCR*[,*PCR*]...]... [**-A**]] *dataset*

DESCRIPTION

To normalise *dataset*, **zfs-fido2-add-backup** will open its encryption root in its stead. **zfs-fido2-add-backup** will *never* create or destroy encryption roots; use zfs-change-key(8) for that.

First, a connection is made to the TPM, which *must* be TPM-2.0-compatible.

If *dataset* was previously encrypted with **tzpfms** and the **TPM2** back-end was used, the previous key will be freed from the TPM. Otherwise, or in case of an error, data required for manual intervention will be written to the standard error stream.

Next, a new wrapping key is generated on the TPM, optionally backed up (see **OPTIONS**), and sealed to a persistent object on the TPM under the owner hierarchy; if there is a passphrase set on the owner hierarchy, the user is prompted for it; the user is always prompted for an optional passphrase to protect the sealed object with.

The following properties are set on *dataset*:

- xyz.nabijaczleweli:tzpfms.backend=**TPM2**
- xyz.nabijaczleweli:tzpfms.key=*persistent-object-ID*
  [;*algorithm*:*PCR*[,*PCR*]...[**+***algorithm*:*PCR*[,*PCR*]...]...]

tzpfms.backend identifies this dataset for work with **TPM2**-back-ended **tzpfms** programs (namely zfs-tpm2-change-key(8), zfs-tpm2-load-key(8), and zfs-tpm2-clear-key(8)).

tzpfms.key is an integer representing the sealed object, optionally followed by a semicolon and PCR list as specified with **-P**, normalised to be **tpm-tools**-toolchain-compatible; if needed, it can be passed to **tpm2_unseal -c** `${tzpfms.key%%;*}` with **-p** "`str:${passphrase}`" or **-p** "`pcr:${tzpfms.key#*;}`", as the case may be, or equivalent, for back-up (see **OPTIONS**). If you have a sealed key you can access with that or equivalent tool and set both of these properties, it will funxion seamlessly.

Finally, the equivalent of **zfs change-key -o** keylocation=prompt **-o** keyformat=raw *dataset* is performed with the new key. If an error occurred, best effort is made to clean up the persistent object and properties, or to issue a note for manual intervention into the standard error stream.

A final verification should be made by running **zfs-tpm2-load-key -n** *dataset*. If that command succeeds, all is well, but otherwise the dataset can be manually rolled back to a passphrase with **zfs-tpm2-clear-key** *dataset* (or, if that fails to work, **zfs change-key -o** keyformat=passphrase *dataset*), and you are hereby asked to report a bug, please.

zfs-tpm2-clear-key *dataset* can be used to free the TPM persistent object and go back to using a passphrase.

OPTIONS

-b *backup-file* Save a back-up of the key to *backup-file*, which must not exist beforehand. This back-up *must* be stored securely, off-site. In case of a catastrophic event, the key can be loaded by running

zfs load-key *dataset* < *backup-file*

-P *algorithm*:*PCR*[,*PCR*]...[**+***algorithm*:*PCR*[,*PCR*]...]...
Bind the key to space- or comma-separated *PCR*s within their corresponding hashing *algorithm* — if they change, the wrapping key will not be able to be unsealed. There are **24** PCRs, numbered [**0**, **23**].

algorithm may be any of case-insensitive "**sha1**", "**sha256**", "**sha384**", "**sha512**", "**sm3_256**", "**sm3-256**", "**sha3_256**", "**sha3-256**", "**sha3_384**", "**sha3-384**", "**sha3_512**", or "**sha3-512**", and must be supported by the TPM.

-A With **-P**, also prompt for a passphrase. This is skipped by default because the passphrase is *OR*ed with the PCR policy — the wrapping key can be unsealed *either* passphraseless with the right PCRs *or* with the passphrase, and this is usually not the intent.

ENVIRONMENT VARIABLES

`TZPFMS_PASSPHRASE_HELPER`

By default, passphrases are prompted for and read in on the standard output and input streams. If `TZPFMS_PASSPHRASE_HELPER` is set and nonempty, it will be run via `/bin/`**`sh -c`** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

`$1` Pre-formatted noun phrase with all the information below, for use as a prompt
`$2` Either the dataset name or the element of the TPM hierarchy being prompted for
`$3` "new" if this is for a new passphrase, otherwise blank
`$4` "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

TPM2 back-end configuration

Environment variables

`TSS2_LOG` Any of: **NONE**, **ERROR**, **WARNING**, **INFO**, **DEBUG**, **TRACE**. Default: **WARNING**.

TPM selection

The library **`libtss2-tcti-default.so`** can be linked to any of the `libtss2-tcti-*.so` libraries to select the default, otherwise `/dev/tpmrm0`, then `/dev/tpm0`, then `localhost:2321` will be tried, in order (see `ESYS_CONTEXT`(3)).

See also

The tpm2-tss git repository at https://github.com/tpm2-software/tpm2-tss and the documentation at https://tpm2-tss.readthedocs.io.

The TPM 2.0 specifications, mainly at https://trustedcomputinggroup.org/resource/tpm-library-specification/, https://trustedcomputinggroup.org/wp-content/uploads/TPM-Rev-2.0-Part-1-Architecture-01.38.pdf, and related pages.

SPECIAL THANKS

To all who support further development, in particular:

- ThePhD
- Embark Studios
- Jasper Bekkers
- EvModder

REPORTING BUGS

https://todo.sr.ht/~nabijaczleweli/tzpfms

`~nabijaczleweli/tzpfms@lists.sr.ht`, archived at https://lists.sr.ht/~nabijaczleweli/tzpfms.

SEE ALSO

`tpm2_unseal`(1)

PCR allocations: https://wiki.archlinux.org/title/Trusted_Platform_Module#Accessing_PCR_registers and https://trustedcomputinggroup.org/wp-content/uploads/PC-ClientSpecific_Platform_Profile_for_TPM_2p0_Systems_v51.pdf, Section 2.3.4 "PCR Usage", Table 1.

NAME

zfs-tpm2-clear-key — rewrap ZFS dataset key in passsword and clear tzpfms TPM2 metadata

SYNOPSIS

zfs-fido2-add-backup *dataset*

DESCRIPTION

After verifying *dataset* was encrypted with the **tzpfms TPM2** backend:

1. performs the equivalent of **zfs change-key -o** keylocation=prompt **-o** keyformat=passphrase *dataset*,
2. frees the sealed key previously used to encrypt *dataset*,
3. removes the xyz.nabijaczleweli:tzpfms.{backend, key} properties from *dataset*.

See zfs-tpm2-change-key(8) for a detailed description.

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

$1 Pre-formatted noun phrase with all the information below, for use as a prompt
$2 Either the dataset name or the element of the TPM hierarchy being prompted for
$3 "new" if this is for a new passphrase, otherwise blank
$4 "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

TPM2 back-end configuration

Environment variables

TSS2_LOG Any of: **NONE**, **ERROR**, **WARNING**, **INFO**, **DEBUG**, **TRACE**. Default: **WARNING**.

TPM selection

The library **libtss2-tcti-default.so** can be linked to any of the libtss2-tcti-*.so libraries to select the default, otherwise /dev/tpmrm0, then /dev/tpm0, then localhost:2321 will be tried, in order (see ESYS_CONTEXT(3)).

See also

The tpm2-tss git repository at https://github.com/tpm2-software/tpm2-tss and the documentation at https://tpm2-tss.readthedocs.io.

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NAME

zfs-tpm2-load-key — load TPM2-encrypted ZFS dataset key

SYNOPSIS

zfs-fido2-add-backup [**-n**] *dataset*

DESCRIPTION

After verifying *dataset* was encrypted with the **tzpfms TPM2** backend, unseals the key and loads it into *dataset*.

The user is prompted for the additional passphrase, set when creating the key, if one was set.

See zfs-tpm2-change-key(8) for a detailed description.

OPTIONS

-n Do a no-op/dry run, can be used even if the key is already loaded. Equivalent to **zfs load-key**'s **-n** option.

ENVIRONMENT VARIABLES

TZPFMS_PASSPHRASE_HELPER

By default, passphrases are prompted for and read in on the standard output and input streams. If TZPFMS_PASSPHRASE_HELPER is set and nonempty, it will be run via /bin/**sh -c** to provide each passphrase, instead.

The standard output stream of the helper is tied to an anonymous file and used in its entirety as the passphrase, except for a trailing new-line, if any. The arguments are:

- $1 Pre-formatted noun phrase with all the information below, for use as a prompt
- $2 Either the dataset name or the element of the TPM hierarchy being prompted for
- $3 "new" if this is for a new passphrase, otherwise blank
- $4 "again" if it's the second prompt for that passphrase, otherwise blank

If the helper doesn't exist (the shell exits with **127**), a diagnostic is issued and the normal prompt is used as fall-back. If it fails for any other reason, the prompting is aborted.

TPM1.X back-end configuration

TPM selection

The **tzpfms** suite connects to a local tcsd(8) process (at localhost:30003) by default. Use the environment variable TZPFMS_TPM1X to specify a remote TCS hostname.

The TrouSerS tcsd(8) daemon will try /dev/tpm0, then /udev/tpm0, then /dev/tpm; by occupying one of the earlier ones with, for example, shell redirection, a later one can be selected.

See also

The TrouSerS project page at https://sourceforge.net/projects/trousers.

The TPM 1.2 main specification index at https://trustedcomputinggroup.org/resource/tpm-main-specification.

SPECIAL THANKS

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