Administering SUSE Linux Micro Using `transactional-update`

WHAT?

The **`transactional-update`** command enables you to modify a read-only file system. The modifications are performed in a separate snapshot and do not influence the running system until you boot into the snapshot.

WHY?

You want to administer SUSE Linux Micro and manage its updates, minimizing the risk of system downtime due to update failures while ensuring easy rollbacks.

EFFORT

It takes less than 30 minutes to understand the **`transactional-update`** command.

GOAL

You will understand how **`transactional-update`** works and how you can use it to administer your system.

REQUIREMENTS

- A running instance of SUSE Linux Micro
- `root` privileges

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Contents

1 Transactional updates

1.1 What are transactional updates?

To keep the base operating system stable and consistent, the SUSE Linux Micro uses a read-only root file system. Therefore, you cannot perform direct changes to the root file system, for example, by using the **zypper** command. Instead, SUSE Linux Micro introduces *transactional updates* that allow you to apply one or more changes to the root file system.

The default **transactional-update** behavior is to create a new snapshot from the current root file system after each change. To apply the changes, you need to reboot the host. You cannot run the **transactional-update** command multiple times without rebooting to add more changes to the snapshot. This action creates separate independent snapshots that do not include changes from the previous snapshots.

1.2 How do transactional updates work?

Each time you call the **transactional-update** command to change your system—either to install a package, perform an update, or apply a patch—the following actions take place:

PROCEDURE 1: MODIFYING THE ROOT FILE SYSTEM

1. A new read-write snapshot is created from your current root file system, or from a snapshot that you specified.
2. All changes are applied (updates, patches or package installation).
3. The snapshot is switched back to read-only mode.
4. If the changes were applied successfully, the new root file system snapshot is set as default.
5. After rebooting, the system boots into the new snapshot.

1.3 Benefits of transactional updates

- They are atomic—the update is applied only if it completes successfully.
- Changes are applied in a separate snapshot and so do not influence the running system.
- Changes can easily be rolled back.

1.4 Environment within the **transactional-update** command

Each time you run the **transactional-update** command, the changes are performed in a new snapshot. The environment in the snapshot may differ from the one in the shell you run the **transactional-update** command from. For example, the current working directory (`$PWD`) is not set to the directory from which you run the **transactional-update**, but is set to `/`.

From within the snapshot, you cannot access the `/var` directory. This directory is also not included in the snapshot. However, some directories are not included in the snapshot but are accessible inside the **transactional-update** environment, for example, the `/root` directory.

2 Usage of the **transactional-update** command

The **transactional-update** command enables the atomic installation or removal of updates. Updates are applied only if all can be successfully installed. **transactional-update** creates a snapshot of your system and uses it to update the system. Later you can restore this snapshot. All changes become active only after reboot.

The **transactional-update** command syntax is as follows:

```
transactional-update [option] [general_command] [package_command] standalone_command
```

Note: Running **transactional-update** without arguments

If you do not specify any command or option while running the **transactional-update** command, the system updates itself.

Possible command parameters are described further.

transactional-update OPTIONS

`--interactive, -i`

Can be used along with a package command to turn on interactive mode.

`--non-interactive, -n`

Can be used along with a package command to turn on non-interactive mode.

`--continue [number], -c`

The `--continue` option is for making multiple changes to the root file system without rebooting. Refer to *Section 3, "Applying multiple changes without rebooting"* for more details.

Another useful feature of the `--continue` option is that you may select any existing snapshot as the base for your new snapshot. The following example demonstrates running **`transactional-update`** to install a new package in a snapshot based on snapshot 13, and then running it again to install another package:

```
> sudo transactional-update pkg install package_1
```

```
> sudo transactional-update --continue 13 pkg install package_2
```

`--no-selfupdate`

Disables self-updating of **`transactional-update`**.

`--drop-if-no-change, -d`

Discards the snapshot created by **`transactional-update`** if there were no changes to the root file system. If there are changes to the `/etc` directory, those changes merged back to the current file system.

`--quiet`

The **`transactional-update`** command does not output to `stdout` .

`--help, -h`

Prints help for the **`transactional-update`** command.

`--version`

Displays the version of the **`transactional-update`** command.

2.1 General commands

This section lists general purpose commands of **`transactional-update`**.

`grub.cfg`

Use this command to rebuild the GRUB boot loader configuration file.

`bootloader`

The command reinstalls the boot loader.

`initrd`

Use the command to rebuild `initrd`.

`kdump`

In case you perform changes to your hardware or storage, you may need to rebuild the Kdump initrd.

reboot

The behavior of **reboot** depends on the configuration and changes performed to the system. If **soft-reboot** is enabled, only the user space may be restarted without rebooting the hardware and kernel. The enabling and configuration of **soft-reboot** are described in *Section 2.2, "Configuration of* **soft-reboot***"*.

run *<command>*

Runs the provided command in a new snapshot.

shell

Opens a read-write shell in the new snapshot before exiting. The command is typically used for debugging purposes.

setup-fips

The command performs all changes needed to enable FIPS on your system.

setup-selinux

Installs and enables targeted SELinux policy.

2.2 Configuration of **soft-reboot**

2.2.1 Enabling/disabling **soft-reboot**

To enable **soft-reboot** (https://documentation.suse.com/sle-micro/6.1/html/Micro-systemd-basics/index.html#systemctl-commands-managing-states) on **transactional-update**, proceed as follows:

1. Create a directory `/etc/tukit.conf.d/`

```
> sudo mkdir /etc/tukit.conf.d/
```

2. Create a file `/etc/tukit.conf.d/soft-reboot.conf` with the following content:

```
REBOOT_ALLOW_SOFT_REBOOT=true
```

For example, by running the following command:

```
> sudo echo "REBOOT_ALLOW_SOFT_REBOOT=true" > /etc/tukit.conf.d/soft-reboot.conf
```

To disable **soft-reboot**, change `true` to `false` in the `/etc/tukit.conf.d/soft-reboot.conf` file.

2.2.2 Configuration of **soft-reboot**

You can define which packages require specific types of reboots in the `/usr/etc/zypp/zypp-boot-plugin.conf` file. To make changes, copy this file to `/etc/zypp/zypp-boot-plugin.conf`, which is writable and is not replaced during updates. The `/etc/zypp/zypp-boot-plugin.conf` file also has a higher priority than `/usr/etc/zypp/zypp-boot-plugin.conf`, so your configuration is preferred to the default one.

In the `/etc/zypp/zypp-boot-plugin.conf` file, under the `[main]` section, there are three reboot options:

reboot
: Here you specify the packages that require a hardware reboot when they are changed.

kexec
: Provides a list of packages whose changes require a kernel reboot. However, a hardware reboot does not take place, and GRUB2 is not triggered.

soft-reboot
: Specifies packages whose changes only require a reboot of the user space.

Entries can be a comma-separated list of package names or a list of all packages that provide a particular application or system component. Regular expressions can also be used. Here is an example:

```
soft-reboot = glibc, dbus-broker
```

Or using the `provides` statement:

```
soft-reboot = provides: dbus
```

3 Applying multiple changes without rebooting

The **transactional-update** command applies changes to the root file system on a transactional system. The default behavior is to create a new snapshot from the current root file system after each change and reboot to apply the changes.

To make multiple changes to the root file system without rebooting, you have several options, which are described in the following sections:

3.1 The `transactional-update --continue` option

Use the **`transactional-update`** command together with the `--continue` option to make multiple changes without rebooting. A separate snapshot is created on each run that contains all changes from the previous snapshot, plus your new changes. The final snapshot includes all changes. To apply them, reboot the system and your final snapshot becomes the new root file system.

3.2 The `transactional-update run` command

The **`transactional-update run`** command normally runs only a single command. However, you can use it to run multiple commands in one transactional session by concatenating them within a command shell such as **`bash`**, for example:

```
> sudo transactional-update run bash -c 'ls && date; if [ true ]; then echo -n "Hello ";
 echo '\''world'\''; fi'
```

Note

The **`transactional-update run`** command has the same limitations as the **`transactional-update shell`** command described in *Section 3.3, "The `transactional-update` shell"* except that the entered commands are logged in the `/var/log/transactional-update.log` file.

3.3 The `transactional-update` shell

The **`transactional-update shell`** command opens a shell in the transactional-update environment. In the shell, you can enter almost any Linux command to make changes to the file system, for example, install multiple packages with the **`zypper`** command or perform changes to files that are part of the read-only file system. You can also verify that the changes you previously made with the **`transactional-update`** command are correct.

Important

The transactional shell has several limitations. For example, you cannot operate start or stop services using `systemd` commands, or modify the `/var` partition because it is not mounted. Also, commands entered during a shell session are not logged in the `/transactional-update.log` file.

All changes that you make to the file system are part of a single snapshot. After you finish making changes to the file system and leave the shell with the **`exit`** command, you need to reboot the host to apply the changes.

4 Performing snapshots cleanup

You can use **`transactional-update`** to clean unused file system snapshots and unreferenced `/etc` overlay directories.

`transactional-update` recognizes the following cleanup commands:

`cleanup-snapshots`
: The command marks all unused snapshots for removal by Snapper.

`cleanup-overlays`
: The command removes all unused overlay layers of `/etc` in the `/var/lib/overlay` directory.

`cleanup`
: The command combines the **`cleanup-snapshots`** and **`cleanup-overlays`** commands.

4.1 How the cleanup works

If you run the command **`transactional-update cleanup`**, all old snapshots without a cleanup algorithm will have one set. All important snapshots are also marked. The command also removes all unreferenced (and thus unused) `/etc` overlay directories in `/var/lib/overlay`.

The snapshots with the set `number` cleanup algorithm will be deleted according to the rules configured in `/etc/snapper/configs/root` by the following parameters:

NUMBER_MIN_AGE
: Defines the minimum age of a snapshot (in seconds) that can be automatically removed.

NUMBER_LIMIT/NUMBER_LIMIT_IMPORTANT

Defines the maximum count of stored snapshots. The cleaning algorithms delete snapshots above the specified maximum value, without taking into account the snapshot and file system space. The algorithms also delete snapshots above the minimum value until the limits for the snapshot and file system are reached.

The snapshot cleanup is also regularly performed by `systemd`.

5 Registering products

You can use the **`transactional-update register`** command to handle all tasks regarding product registration and its subscription management. You can supply the following options:

`--list-extensions`

With this option, the command lists available extensions for your system. You can use the output to find a product identifier for product activation.

`-p, --product`

Use this option to specify a product for activation. The product identifier has the following format: *<name>/<version>/<architecture>*, for example, `sle-module-live-patching/15.3/x86_64`. The corresponding command has the following form:

```
> sudo transactional-update register -p sle-module-live-patching/15.3/x86_64
```

`-r, --regcode`

Register your system with the registration code provided. The command registers the subscription and enables software repositories.

`-d, --de-register`

The option deregisters the system, or when used along with the `-p` option, deregisters an extension.

`-e, --email`

Specify an email address that is used in SUSE Customer Center for registration.

`--url`

Specify the URL of your registration server. The URL is stored in the configuration and is used in subsequent command invocations. For example:

```
> sudo transactional-update register --url https://scc.suse.com
```

`-s, --status`
: Displays the current registration status in JSON format.

`--write-config`
: Writes the provided options value to the `/etc/SUSEConnect` configuration file.

`--cleanup`
: Removes old system credentials.

`--version`
: Prints the version.

`--help`
: Displays the usage of the command.

6 Managing software packages

You can use **`transactional-update`** to install, update or remove software packages.

SUSE Linux Micro obtains software packages from repositories that are available after the product registration. Except for the main repository, SUSE Linux Micro can access an extra repository with a collection of unsupported packages provided as a convenience for customers, mainly for testing and development purposes.

`transactional-update` uses the following commands to manage software packages.

Tip: The **pkg** command and Zypper options

With **`transactional-update pkg`** commands, you can use any Zypper option that corresponds to the used subcommand. For example, **`transactional-update pkg install`** understands all options that **`zypper install`** does.

`pkg install`
: Installs individual packages from the available channels using the **`zypper install`** command. This command can also be used to install Program Temporary Fix (PTF) RPM files. The default option for this command is `--interactive`.

```
> sudo transactional-update pkg install package_name
```

or

```
> sudo transactional-update pkg install rpm1 rpm2
```

Or, to install a software pattern:

```
> sudo transactional-update pkg install -t pattern pattern_name
```

`pkg remove`

Removes individual packages from the active snapshot using the **`zypper remove`** command. This command can also be used to remove PTF RPM files. The default option for this command is `--interactive`.

```
> sudo transactional-update pkg remove package_name
```

`pkg update`

Updates individual packages from the active snapshot using the **`zypper update`** command. Only packages that are part of the snapshot of the base file system can be updated. The default option for this command is `--interactive`.

```
> sudo transactional-update pkg update package_name
```

`patch`

Checks for available patches and installs them. The default option for this command is `--non-interactive`.

`dup`

Performs an upgrade of your system. The default option for this command is `--non-interactive`.

`up`

Updates installed packages to newer versions. The default option for this command is `--non-interactive`.

`migration`

The command migrates your system to a selected target. Typically, it is used to upgrade your system if it has been registered via SUSE Customer Center.

7 Performing system rollback

GRUB 2 enables booting from btrfs snapshots and thus allows you to use any older functional snapshot in case the new snapshot does not work correctly.

When booting a snapshot, the parts of the file system included in the snapshot are mounted read-only; all other file systems and parts that are excluded from snapshots are mounted read-write and can be modified.

Tip: Rolling back to a specific installation state

An initial bootable snapshot is created at the end of the initial system installation. You can go back to that state at any time by booting this snapshot. The snapshot can be identified by the description `first root file system`.

There are two methods to perform a system rollback.

- From a running system, you can set the default snapshot, see more in *Procedure 2, "Rollback from a running system"*.
- Especially in cases where the current snapshot is broken, you can boot into the new snapshot and set it to default. For details, refer to *Procedure 3, "Rollback to a working snapshot"*.

If your current snapshot is functional, you can use the following procedure for a system rollback.

PROCEDURE 2: ROLLBACK FROM A RUNNING SYSTEM

1. Identify the snapshot that should be set as the default one and note its number.

```
> sudo snapper list
```

2. Set the snapshot as default.

```
> sudo transactional-update rollback snapshot_number
```

If you omit the *`snapshot number`*, the current snapshot will be set as default.

Tip: Setting the last working snapshot

To set the last working snapshot as the default one, run **`rollback last`**.

3. Reboot your system to boot into the new default snapshot.

The following procedure is used in case the current snapshot is broken and you cannot boot into it.

PROCEDURE 3: ROLLBACK TO A WORKING SNAPSHOT

1. Reboot your system and select `Start bootloader from a read-only snapshot`.

2. Choose a snapshot to boot. The snapshots are sorted according to the date of creation, with the latest one at the top.
3. Log in to your system and check whether everything works as expected. The data written to directories excluded from the snapshots will stay untouched.
4. If the snapshot you booted into is not suitable for the rollback, reboot your system and choose another one.
   If the snapshot works as expected, you can perform the rollback by running the following command:

   ```
   > sudo transactional-update rollback
   ```

   And reboot afterwards.

8 Managing automatic transactional updates

Automatic updates are controlled by **`systemd.timer`** that runs once per day. This applies all updates and informs **`rebootmgrd`** that the machine should be rebooted. You may adjust the time when the update runs, see systemd.timer(5) documentation.

8.1 Disabling automatic updates

The automatic updates are enabled by default. However, you can disable them with this command:

```
> sudo systemctl --now disable transactional-update.timer
```

8.2 Configuring notifications of failed updates

When an automatic **`transactional-update`** fails, the failed snapshot is deleted. Meanwhile the system may reboot, and then you cannot find out that the last automatic update failed. Therefore, you can configure a `systemd` service that will inform you about the failure of the automatic **`transactional-update`**. The procedure of doing so can be summarized into the following steps:

- Installing the required packages if not present on the system. For details, refer to *Section 8.2.1, "Installing required packages"*.
- Configuring the `systemd-status-mail` service. For details, refer to *Section 8.2.2, "Configuring the `systemd-status-mail` service"*.

8.2.1 Installing required packages

The packages `mailx` and `systemd-status-mail` are required to configure the notifications. They are present on the system by default. However, if you do not have them installed, install the packages by running the following command:

```
> sudo transactional-update pkg in systemd-status-mail mailx
```

Reboot the system.

8.2.2 Configuring the `systemd-status-mail` service

To configure the `systemd-status-mail` service, you can create a configuration file or you can use the `jeos-config` tool.

8.2.2.1 Configuring the service using `jeos-config`

To configure the email notifications, you can use the `jeos-config` tools as described bellow.

1. To open the configuration window, run the command:

   ```
   > sudo jeos-config status_mail
   ```

2. In the dialog, configure the items according to your needs.

3. Confirm with *OK*.

8.2.2.2 Configuring the service by editing a configuration file

The default configuration file is in `/usr/etc/default/systemd-status-mail`. To modify it, create a copy in `/etc/default/` and edit the following items:

ADDRESS

A mandatory entry. Specify the e-mail address the notification is sent to. For example:

```
ADDRESS="tux@example.com"
```

FROM

The sender e-mail of the notification mail. Ensure that the address is valid. For example:

```
FROM="geeko@example.com"
```

MAILER

The type of mail application for sending notifications. Use the `mailx` value as follows:

```
MAILER=“mailx”
```

RELAYHOST

Specify the mail relay used by mailx.

```
RELAYHOST=“mail.example.com:587”
```

MAILX_OPTIONS

Specify necessary options to ensure that the mail provider will accept the notification mail. ``

```
MAILX_OPTIONS="-Sverbose -Ssmtp-use-starttls -Ssmtp-auth=login -Ssmtp-auth-
user='tux@example.com' -Ssmtp-auth-password='TopSecret'"
```

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