

# Deploying SUSE Linux Micro Using Network PXE Boot On IBM Z

## WHAT?

SUSE Linux Micro provides images that can be deployed remotely using the PXE boot of the target device.

## WHY?

You want to deploy SUSE Linux Micro remotely.

## EFFORT

It takes about 15 minutes to read the article.

## GOAL

A properly configured instance of SUSE Linux Micro.

## REQUIREMENTS

A properly configured PXE boot server.

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## Contents

- 1 Introduction to the PXE installation of SUSE Linux Micro 3
- 2 Creating firstboot configuration 3
- 3 Preparing the TFTP server 23
- 4 Deploying the image remotely 25

- 5 Post-deployment steps 27
- 6 Legal Notice 28
- A GNU Free Documentation License 28

# 1 Introduction to the PXE installation of SUSE Linux Micro

SUSE Linux Micro can be installed via a Preboot Execution Environment (PXE). The client hardware needs to support booting via PXE. The network needs to provide a DHCP server and a TFTP server providing the required data to the clients.

The deployment procedure can be summarized to the following steps:

1. *(Optional)* To perform a more complex first boot configuration or installation without user interaction, prepare the first boot configuration used by Combustion or Ignition. For example, you can define users of the system, install packages, configure the host name, register the system and many other task. For details, refer to [Section 2.2, “Configuring SUSE Linux Micro deployment with Combustion”](#) or [Section 2.3, “Configuring SUSE Linux Micro deployment with Ignition”](#).
2. Make sure the DHCP server is configured properly.
3. Prepare the TFTP or HTTP server by adding the installation image, configuring the boot settings, and placing the Combustion/Ignition configuration on the TFTP server. For details, refer to [Section 3, “Preparing the TFTP server”](#).
4. On the target machine, select PXE boot and boot the machine. For details, refer to [Section 4, “Deploying the image remotely”](#).

## 2 Creating firstboot configuration

The following sections provide information about two tools that you can use to configure SUSE Linux Micro on the first boot. You can use either Combustion and write a configuration BASH script, or you can use Ignition and use JSON. Alternatively, if you do not need a complex configuration or unattended configuration, you can skip this step as basic configuration can be performed using JeOS Firstboot as described in [Section 4.1, “Configuring SUSE Linux Micro with JeOS Firstboot”](#).

## 2.1 First boot detection

The deployment configuration runs on the first boot only. To distinguish between the first and subsequent boots, the file `/etc/machine-id` is created after the first boot finishes. If the file is not present in the file system, the system assumes that this is a first boot and triggers the configuration process. After completing the first boot, the `/etc/machine-id` file is created.



### Note: The `/etc/machine-id` file is always created

Even though the configuration may not be successful because of improper or missing configuration files, the `/etc/machine-id` file is created.

### 2.1.1 Force system reconfiguration on a subsequent boot

If you need to reconfigure your system after the first boot happened, you can force the reconfiguration on the subsequent boot. Here you have two options.

- You can pass the `ignition.firstboot` or `combustion.firstboot` attribute to the kernel command line.
- You can delete the file `/etc/machine-id` and reboot the system.

## 2.2 Configuring SUSE Linux Micro deployment with Combustion

Combustion is a dracut module that enables you to configure your system on the first boot. You can use Combustion, for example, to change the default partitions, set user passwords, create files, or install packages.

### 2.2.1 How does Combustion work?

Combustion is invoked after the `ignition.firstboot` argument is passed to the kernel command line. Combustion reads a provided file named `script`, executes included commands, and thus performs changes to the file system. If `script` includes the network flag, Combustion tries to configure the network. After `/sysroot` is mounted, Combustion tries to activate all mount points in `/etc/fstab` and then calls `transactional-update` to apply other changes, for example, setting `root` password or installing packages.

The configuration script must reside on the TFTP server and during the boot, its URL must be provided to the kernel using the `combustion.url` parameter. For details, refer to [Section 3, “Preparing the TFTP server”](#).



### Tip: Using Combustion together with Ignition

Combustion can be used along with Ignition. If you intend to do so, label your configuration medium `ignition` and include the `ignition` directory with the `config.ign` to your directory structure as shown below:

```
<root directory>
├─ combustion
│   └─ script
│   └─ other files
├─ ignition
│   └─ config.ign
```

In this scenario, Ignition runs before Combustion.

## 2.2.2 Combustion configuration examples

### 2.2.2.1 The script configuration file

The `script` configuration file is a set of commands that are parsed and executed by Combustion in a **`transactional-update`** shell. This article provides examples of configuration tasks performed by Combustion.



### Tip: Use Fuel Ignition to generate the Combustion script

To create the Combustion script, you can use the Fuel Ignition Web application. There you can select appropriate parameters and the application generates a Combustion script that you can download.

## Important: Include interpreter declaration

As the `script` file is interpreted by the shell, always start the file with the interpreter declaration on its first line. For example, in case of Bash:

```
#!/bin/bash
```

To log in to your system, include at least the `root` password. However, it is recommended to establish the authentication using SSH keys. If you need to use a `root` password, make sure to configure a secure password. For a randomly generated password, use at least 10 characters. If you create your password manually, use even more than 10 characters and combine uppercase and lowercase letters and numbers.

### 2.2.2.1.1 Default partitioning

Each image has the following subvolumes:

```
/home  
/root  
/opt  
/srv  
/usr/local  
/var
```

The `/etc` directory is mounted as overlayFS, where the upper directory is mounted to `/var/lib/overlay/1/etc/`.

You can recognize the subvolumes mounted by default by the option `x-initrd.mount` in `/etc/fstab`. Other subvolumes or partitions must be configured either by Ignition or Combustion.

If you want to add a new user or modify any of the files on a subvolume that is not mounted by default, you need to declare such subvolume first so that it is mounted as well.

### 2.2.2.1.2 Network configuration

To configure and use the network connection during the first boot, add the following statement to `script`:

```
# combustion: network
```

Using this statement passes the `rd.neednet=1` argument to dracut. The network configuration defaults to using DHCP. If a different network configuration is needed, proceed as described in [Section 2.2.2.1.3, “Performing modifications in the initramfs”](#).

If you do not use the statement, the system remains configured without any network connection.

### 2.2.2.1.3 Performing modifications in the initramfs

You may need to perform changes to the initramfs environment, for example, to write a custom network configuration for NetworkManager into /etc/NetworkManager/system-connections/. To do so, use the prepare statement.

For example, to create a connection with a static IP address and configure DNS:

```
#!/bin/bash
# combustion: network prepare
set -euxo pipefail

nm_config() {
    umask 077 # Required for NM config
    mkdir -p /etc/NetworkManager/system-connections/
    cat >/etc/NetworkManager/system-connections/static.nmconnection <<-EOF
    [connection]
    id=static
    type=ethernet
    autoconnect=true

    [ipv4]
    method=manual
    dns=192.168.100.1
    address1=192.168.100.42/24,192.168.100.1
EOF
}

if [ "${1-}" = "--prepare" ]; then
    nm_config # Configure NM in the initrd
    exit 0
fi

# Redirect output to the console
exec >>(exec tee -a /dev/tty0) 2>&1

    nm_config # Configure NM in the system
    curl example.com

# Close outputs and wait for tee to finish
exec 1>&- 2>&-; wait;

# Leave a marker
```

```
echo "Configured with combustion" > /etc/issue.d/combustion
```

#### 2.2.2.1.4 Waiting for the task to complete

Some processes may be run in background, for example, the **tee** process that redirects output to the terminal. To ensure that all running processes are completed before the script execution finishes, add the following line:

```
exec 1>&- 2>&-; wait;
```

#### 2.2.2.1.5 Partitioning

SUSE Linux Micro raw images are delivered with a default partitioning scheme. You might want to use a different partitioning. The following set of example snippets moves the /home to a different partition.



### Important: Certain directories must reside on the same partition as /

When changing partitioning, do not place the following directories on a different partition than the root file system: /boot, /usr, /etc, /dev.



### Note: Performing changes outside of directories included in snapshots

The following script performs changes that are not included in snapshots. If the script fails and the snapshot is discarded, certain changes remain visible and cannot be reverted, for example, the changes to the /dev/vdb device.

The following snippet creates a GPT partitioning schema with a single partition on the /dev/vdb device:

```
sfdisk /dev/vdb <<EOF
sleep 1
label: gpt
type=linux
EOF

partition=/dev/vdb1
```



As the **sfdisk** command may take longer time to complete, postpone **label** by using the **sleep** command after **sfdisk**.

The partition is formatted to Btrfs:

```
wipefs --all ${partition}
mkfs.btrfs ${partition}
```

Possible content of `/home` is moved to the new `/home` folder location by the following snippet:

```
mount /home
mount ${partition} /mnt
rsync -aXP /home/ /mnt/
umount /home /mnt
```

The snippet below removes an old entry in `/etc/fstab` and creates a new entry:

```
awk -i inplace '$2 != "/home"' /etc/fstab
echo "${blkid -o export ${partition} | grep ^UUID=) /home btrfs defaults 0 0" >>/etc/
fstab
```

#### 2.2.2.1.6 Creating new users

As some services, such as Cockpit, require login using a non-root user, define at least one unprivileged user here. Alternatively, you can create such a user from a running system as described in [Section 5.2, "Adding users"](#).

To add a new user account, first create a hash string that represents the user's password. Use the **openssl passwd -6** command.

After you obtain the password hash, add the following lines to the `script`:

```
mount /home
useradd -m EXAMPLE_USER
echo 'EXAMPLE_USER:PASSWORD_HASH' | chpasswd -e
```

#### 2.2.2.1.7 Setting a password for root

Before you set the `root` password, generate a hash of the password, for example, by using the **openssl passwd -6**. To set the password, add the following line to the `script`:

```
echo 'root:PASSWORD_HASH' | chpasswd -e
```

#### 2.2.2.1.8 Adding SSH keys

The following snippet creates a directory to store the root's SSH key and then copies the public SSH key located on the configuration device to the authorized\_keys file.

```
mkdir -pm700 /root/.ssh/  
cat id_rsa_new.pub >> /root/.ssh/authorized_keys
```



#### Note

The SSH service must be enabled in case you need to use remote login via SSH. For details, refer to [Section 2.2.2.1.9, “Enabling services”](#).

#### 2.2.2.1.9 Enabling services

To enable system services, for example, the SSH service, add the following line to script:

```
systemctl enable sshd.service
```

#### 2.2.2.1.10 Installing packages



#### Important: Network connection and registering your system may be necessary

As certain packages may require additional subscription, you may need to register your system beforehand. An available network connection may also be needed to install additional packages.

During the first boot configuration, you can install additional packages to your system. For example, you can install the vim editor by adding:

```
zypper --non-interactive install vim-small
```



#### Note

Bear in mind that you will not be able to use **zypper** after the configuration is complete and you boot to the configured system. To perform changes later, you must use the **transactional-update** command to create a changed snapshot.

### 2.2.2.2 A complete example of the script file

The following `script` provides complete settings that may serve you as a guide on how to write your own Combustion configuration. The example does not require any further Ignition configuration.

```
#!/bin/bash
# combustion: network prepare

set -euxo pipefail

## The OSA subchannels to enable
ZNET_SUBCHANNELS=0.0.1000,0.0.1001,0.0.1002

## Network information to configure
IPADDRESS="10.144.64.155/24" ## Formet is ipaddress/cidr
GATEWAY="10.144.64.254"
NAMESERVERS="10.144.53.53;10.144.53.54" ## A semicolon-separated list of name servers

## Hostname information
NODE_HOSTNAME="micro6"

## Add password for root user
## Use either 'openssl passwd -6' or 'mkpasswd --method=sha-512' to encrypt the
password.
ROOT_USER_PASSWORD='PASSWORD_HASH'
SSH_ROOT_PUBLIC_KEY=ssh_key.pub

## Add a regular user, because root login may be disallowed in some services.
CREATE_NORMAL_USER=user ## Replace the "user" with a desired username here.
NORMAL_USER_PASSWORD='PASSWORD_HASH'
SSH_USER_PUBLIC_KEY=ssh_key.pub

## Register to SUSE Customer Center and install additional packages
REG_EMAIL='tux@suse.com' ## Email address for product registration
SLMICRO_REGCODE='REGISTRATIONCODE' ## A registration code required to install
additional packages
ADDITIONAL_PACKAGES='' ## A space separated list of additional packages to install

nm_config() {
    umask 077 # Required for Network Manager configuration
    mkdir -p /etc/NetworkManager/system-connections/
    cat >'/etc/NetworkManager/system-connections/Wired connection 1.nmconnection' <<EOF
    [connection]
    id=static
    type=ethernet
```

```

    autoconnect=true

    [ipv4]
    method=manual
    address1=$IPADDRESS
    gateway=$GATEWAY
    dns=$NAMESERVERS
EOF
}

if [ "${1-}" = "--prepare" ]; then
    # Configure Network Manager in the initrd
    nm_config
    # Enable OSA network devices
    chzdev qeth $ZNET_SUBCHANNELS -ep
    chzdev qeth $ZNET_SUBCHANNELS -e
    exit 0
fi

## Post output on stdout
exec >>(exec tee -a /dev/ttyS0) 2>&1

## Set hostname
echo $NODE_HOSTNAME > /etc/hostname

## Set root password
echo root:$ROOT_USER_PASSWORD | chpasswd -e
## Add ssh public key as authorized key for the root user
mkdir -pm700 /root/.ssh/
cat $SSH_ROOT_PUBLIC_KEY >> /root/.ssh/authorized_keys

## Mount /var and /home so user can be created smoothly
if [ "$CREATE_NORMAL_USER" ]
then
    mount /var && mount /home
fi
## User creation
if [ "$CREATE_NORMAL_USER" ]
then
    echo "User creation is requested, creating user."
    useradd -m $CREATE_NORMAL_USER -s /bin/bash -g users
    echo $CREATE_NORMAL_USER:$NORMAL_USER_PASSWORD | chpasswd -e
    echo $CREATE_NORMAL_USER "ALL=(ALL) NOPASSWD: ALL" >> /etc/sudoers.d/adminusers
    mkdir -pm700 /home/$CREATE_NORMAL_USER/.ssh/
    chown -R $CREATE_NORMAL_USER:users /home/$CREATE_NORMAL_USER/.ssh/

```

```

cat $SSH_USER_PUBLIC_KEY >> /home/$CREATE_NORMAL_USER/.ssh/authorized_keys
echo "Requested user has been created, requested password has been set."
else
    echo "No user will be created"
fi

# Configure NM in the system
nm_config
# Enable OSA network device
chzdev qeth $ZNET_SUBCHANNELS -ep
chzdev qeth $ZNET_SUBCHANNELS -e

## Enable services
echo "Enabling services."
systemctl enable cockpit.socket
systemctl enable sshd


## Unmount var and home
if [ "$CREATE_NORMAL_USER" ]
then
    umount /var && umount /home
fi

# Close outputs and wait for tee to finish
exec 1>&- 2>&-; wait;

echo "Configured with Combustion at $(date)" > /etc/issue.d/combustion


```

## 2.3 Configuring SUSE Linux Micro deployment with Ignition

Ignition (<https://coreos.github.io/ignition/>)  is a provisioning tool that enables you to configure a system according to your specification on the first boot.

### 2.3.1 How does Ignition work?

When the system is booted for the first time, Ignition is loaded as part of an `initramfs` and searches for a configuration file within a specific directory (on a USB flash disk, or you can provide a URL). All changes are performed before the kernel switches from the temporary file system to the real root file system (before the `switch_root` command is issued).

Ignition uses a configuration file in the JSON format named `config.ign`. You can either write the configuration manually or use the Fuel Ignition Web application at <https://ignite.opensuse.org>  to generate it.

## Important

Fuel Ignition does not cover the complete Ignition vocabulary yet, and the resulting JSON file may need additional manual tweaking.

### 2.3.1.1 `config.ign`

The `config.ign` contains multiple data types: objects, strings, integers, booleans and lists of objects. For a complete specification, refer to [Ignition specification v3.3.0 \(https://coreos.github.io/ignition/configuration-v3\\_3/\)](https://coreos.github.io/ignition/configuration-v3_3/).

The `version` attribute is mandatory and in case of SUSE Linux Micro, its value must be set either to `3.4.0` or to any lower version. Otherwise, Ignition will fail.

To log in to your system as `root`, you must at least include a password for `root`. However, it is recommended to establish access via SSH keys. To configure a password, make sure to use a secure one. If you use a randomly generated password, use at least 10 characters. If you create your password manually, use even more than 10 characters and combine uppercase and lowercase letters and numbers.

### 2.3.2 Ignition configuration examples

This section provides several examples of the Ignition configuration in the built-in JSON format.



## Note: The `version` attribute is mandatory

Each `config.ign` must include version 3.4.0 or lower that is then converted to the corresponding Ignition specification.

#### 2.3.2.1 Default partitioning

Each image has the following subvolumes:

```
/home
/root
/opt
/srv
/usr/local
/var
```

The `/etc` directory is mounted as overlayFS, where the upper directory is mounted to `/var/lib/overlay/1/etc/`.

You can recognize the subvolumes mounted by default by the option `x-initrd.mount` in `/etc/fstab`. Other subvolumes or partitions must be configured either by Ignition or Combustion.

If you want to add a new user or modify any of the files on a subvolume that is not mounted by default, you need to declare such subvolume first so that it is mounted as well.

### 2.3.2.2 Storage configuration

The `storage` attribute is used to configure partitions, RAID, define file systems, create files, etc. To define partitions, use the `disks` attribute. The `filesystems` attribute is used to format partitions. The `files` attribute can be used to create files in the file system.

The example below configures four partitions, including a dedicated swap partition, and creates a file system on each partition.

```
{
  "ignition": {
    "version": "3.0.0"
  },
  "storage": {
    "disks": [
      {
        "device": "/dev/vda",
        "partitions": [
          {
            "label": "root",
            "number": 1,
            "sizeMiB": 30720
          },
          {
            "label": "boot",
            "number": 2,
            "sizeMiB": 8720
          },
          {
            "label": "swap",
            "number": 3,
            "sizeMiB": 4096
          },
          {
            "label": "home",
            "number": 4,
```

```

        "sizeMiB": 30720
      }
    ],
    "wipeTable": true
  }
]
"filesystems": [
  {
    "device": "/dev/disk/by-partlabel/root",
    "format": "btrfs",
    "label": "root"
  },
  {
    "device": "/dev/disk/by-partlabel/swap",
    "format": "swap",
    "label": "swap"
  },
  {
    "device": "/dev/disk/by-partlabel/boot",
    "format": "btrfs",
    "label": "boot"
  },
  {
    "device": "/dev/disk/by-partlabel/home",
    "format": "ext4",
    "label": "home"
  }
]
}
}

```

Each of the mentioned attributes is described in the following sections.

#### 2.3.2.2.1 The `disks` attribute

The `disks` attribute is a list of devices that enables you to define partitions on these devices. The `disks` attribute must contain at least one `device`, other attributes are optional. Keep in mind that at least the `root` and `boot` partitions (`swap` if configured) need to be formatted to bear a file system.

The following example uses a single virtual device and divides the disk into four partitions:

```

...
"storage": {
  "disks": [
    {
      "device": "/dev/vda",

```



```

    "partitions": [
      {
        "label": "root", ❶
        "number": 1, ❷
        "sizeMiB": 30720 ❸
      },
      {
        "label": "boot",
        "number": 2,
        "startMiB": 30720, ❹
        "sizeMiB": 8720
      },
      {
        "label": "swap",
        "number": 3,
        "sizeMiB": 4096
      },
      {
        "label": "home",
        "number": 4,
        "sizeMiB": 30720
      }
    ],
    "wipeTable": true
  }
]
...

```

- ❶ The partition identification. Depending on the partition file system, it can have up to 16 characters for EXT-type file systems and 256 characters in the case of Btrfs.
- ❷ The position of the partition in the partition table. If set to 0, the next free position is used.
- ❸ The size of the partition in MiB.
- ❹ Identifies the starting point of the particular partition.

#### 2.3.2.2.2 The **raid** attribute

The raid is a list of RAID arrays. The following attributes of raid are mandatory:

##### **level**

a level of the particular RAID array (linear, raid0, raid1, raid2, raid3, raid4, raid5, raid6)

##### **devices**

a list of devices in the array referenced by their absolute paths

### name

a name that will be used for the md device

For example:

```
{
  "ignition": {
    "version": "3.0.0"
  },
  "storage": {
    "raid": [
      {
        "devices": [
          "/dev/sda",
          "/dev/sdb"
        ],
        "level": "raid1",
        "name": "system"
      }
    ]
  }
}
```

#### 2.3.2.2.3 The `filesystems` attribute



#### Note: Ignition does not perform modifications to mount units

The `filesystems` attribute does not modify mount units. If you add a new partition or remove an existing partition, you must manually adjust the mount units.



#### Important: Certain directories must reside on the same partition as `/`

When changing partitioning, do not place the following directories on a different partition than the root file system: `/boot`, `/usr`, `/etc`, `/dev`.

`filesystems` must contain the following attributes:

### device

the absolute path to the device, typically `/dev/sda` in case of physical disk

## format

the file system format (btrfs, ext4, ext3, xfs, vfat or swap)



## Note

In case of SUSE Linux Micro, the root file system must be formatted to Btrfs.

The following example demonstrates using the filesystems attribute. The /opt directory will be mounted to the /dev/sda1 partition, which is formatted to Btrfs. The device will not be erased.

For example:

```
{
  "ignition": {
    "version": "3.0.0"
  },
  "storage": {
    "filesystems": [
      {
        "device": "/dev/sda1",
        "format": "btrfs",
        "path": "/opt",
        "wipeFilesystem": false
      }
    ]
  }
}
```

Normally, a regular user's home directory is located in the /home/USER\_NAME directory. Since /home is not mounted by default in the initrd, the mount has to be explicitly defined for the user creation to succeed:

```
{
  "ignition": {
    "version": "3.1.0"
  },
  "passwd": {
    "users": [
      {
        "name": "root",
        "passwordHash": "PASSWORD_HASH",
        "sshAuthorizedKeys": [
          "ssh-rsa SSH_KEY_HASH"
        ]
      }
    ]
  }
}
```

```

    },
    "storage": {
      "filesystems": [
        {
          "device": "/dev/sda3",
          "format": "btrfs",
          "mountOptions": [
            "subvol=@/home"
          ],
          "path": "/home",
          "wipeFilesystem": false
        }
      ]
    }
  }
}

```

#### 2.3.2.2.4 The `files` attribute

You can use the `files` attribute to create any files on your machine. Bear in mind that to create files outside the default partitioning schema, you need to define the directories by using the `filesystems` attribute.

In the following example, a host name is created by using the `files` attribute. The file `/etc/hostname` will be created with the `sl-micro1` host name:



### Important

Keep in mind that JSON accepts file modes in decimal numbers, for example, `420`.

JSON:

```

{
  "ignition": {
    "version": "3.0.0"
  },
  "storage": {
    "files": [
      {
        "overwrite": true,
        "path": "/etc/hostname",
        "contents": {
          "source": "data:,sl-micro1"
        },
        "mode": 420
      }
    ]
  }
}

```

```
]
}
}
```

#### 2.3.2.2.5 The `directories` attribute

The `directories` attribute is a list of directories that will be created in the file system. The `directories` attribute must contain at least one `path` attribute.

For example:

```
{
  "ignition": {
    "version": "3.0.0"
  },
  "storage": {
    "directories": [
      {
        "path": "/home/tux",
        "user": {
          "name": "tux"
        }
      }
    ]
  }
}
```

#### 2.3.2.3 Users administration

The `passwd` attribute is used to add users. As some services, such as Cockpit, require login using a non-root user, define at least one unprivileged user here. Alternatively, you can create such a user from a running system as described in [Section 5.2, “Adding users”](#).

To log in to your system, create `root` and a regular user and set their passwords. You need to hash the passwords, for example, by using the `openssl` command:

```
openssl passwd -6
```

The command creates a hash of the password you chose. Use this hash as the value of the `password_hash` attribute.

For example:

```
{
```

```

"ignition": {
  "version": "3.0.0"
},
"passwd": {
  "users": [
    {
      "name": "root",
      "passwordHash": "PASSWORD_HASH",
      "sshAuthorizedKeys": [
        "ssh-rsa SSH_KEY_HASH USER@HOST"
      ]
    }
  ]
}
}

```

The users attribute must contain at least one name attribute. ssh\_authorized\_keys is a list of ssh keys for the user.

#### 2.3.2.4 Enabling systemd services

You can enable systemd services by specifying them in the systemd attribute.

For example:

```

{
  "ignition": {
    "version": "3.0.0"
  },
  "systemd": {
    "units": [
      {
        "enabled": true,
        "name": "sshd.service"
      }
    ]
  }
}

```

### 3 Preparing the TFTP server

To deploy SUSE Linux Micro using the PXE client, you need to perform the following steps:

1. Review the `tftpd` configuration in `/etc/sysconfig/tftp` and add or change options as required. Refer to [man 8 tftpd](#) for more details. The TFTP daemon works without changing the configuration. The default root directory for the files is `/srv/tftpboot`.
2. Ensure that `tftpd` is started at boot time, and restart it to read the new configuration.

```
> sudo systemctl enable tftp.socket
> sudo systemctl restart tftp.socket
```

Ensure that `tftp.socket` remains active during the whole deployment process, which may take several minutes.

3. Prepare the directory structure:

```
> sudo mkdir /srv/tftpboot/sl-micro
```

4. Navigate to the directory:

```
> cd /srv/tftpboot/sl-micro
```

5. Download the `SL-Micro.ARCHITECTURE-6.1-IMAGE_TYPE-GM.install.tar` to the TFTP server.

6. Unpack the TAR file:

```
> sudo tar xvf IMAGE_TAR -C .
```

Make sure that all necessary files are present in the `/srv/tftpboot/sl-micro`:

```
> ls

pxeboot.SL-Micro.ARCH-VERSION.kernel
pxeboot.SL-Micro.ARCH-VERSION.initrd
SL-Micro.ARCH-VERSION.append
SL-Micro.ARCH-VERSION.config.bootoptions
SL-Micro.ARCH-VERSION.initrd
SL-Micro.ARCH-VERSION.kernel
SL-Micro.ARCH-VERSION.md5
SL-Micro.ARCH-VERSION.xz
```

7. Create symlinks as follows:

```
> sudo ln -s pxeboot.*.kernel linux
> sudo ln -s pxeboot.*.initrd initrd
```

8. (Optional) Create directories for the first boot configuration:

a. for the Combustion configuration:

```
# mkdir combustion
```

b. for the Ignition configuration:

```
# mkdir ignition
```

9. Place the Combustion and/or Ignition configuration to corresponding directories.

10. Adjust the `/srv/tftpboot/grub2/grub.cfg` file to include SUSE Linux Micro:

```
menuentry 'Install SUSE Linux Micro' {
    linux sl-micro/linux PARAMETERS_TO_PASS_TO_KERNEL
    initrd sl-micro/initrd
}
```

The `PARAMETERS_TO_PASS_TO_KERNEL` are listed in the file `SL-Micro.ARCH-6.2.append`. Their explanations follow:

#### `rd.kiwi.install.image`

Provide the path to the installation image `SL-Micro.ARCH6.2.xz`. The path must include the protocol, IP address and the relative path to the installation image:

```
tftp://TFTP_SERVER/sl-micro/IMAGE_NAME
```

If the TFTP root directory is defined, make sure to omit it from the path. The default directory `/srv/tftpboot` can be configured in `/etc/sysconfig/tftp`, or you can specify the directory in a service unit file attribute that defines the binary to run using the `-s` option.

#### `rd.kiwi.oem.installdevice`

Passing this parameter enables you to perform unattended installation.



#### rd.kiwi.install.pass.bootparam

After the image is copied to the target disk, kiwi performs a kexec. This parameter instructs kiwi that it must pass additional parameters to the kernel. For example, the ones described below.

#### combustion.url

If needed, provide a full URL to the Combustion script that is passed to the kernel CLI.

#### ignition.config.url

If needed, provide a full URL to the Ignition configuration file that is passed to the kernel CLI. Can be used along with Combustion.

#### rd.zdev=qeth

The attribute specifies booting from a network over a network device. Define it as follows:

```
rd.zdev=qeth,READ_CHANNELWRITE_CHANNEL:DATA_CHANNEL
```

## 4 Deploying the image remotely

After you prepared the DHCP and TFTP servers, you can start deployment of SUSE Linux Micro on the target machine.

1. Power on the target machine.
2. Enter the UEFI boot menu and select PXE booting.
3. The machine should start the deployment. Kernel and initrd are downloaded from the TFTP. Boot loader is started.
4. Select Install SUSE Linux Micro. This item may be different if you used a different value in /srv/tftpboot/grub2/grub.cfg .
5. Select a disk to deploy SUSE Linux Micro and confirm deleting data on that device. The image is then copied to the disk.
6. Using Kexec, your system reboots and is then prepared for the configuration process.
7. Start the configuration process by selecting *SL Micro*. If the Ignition or Combustion instructions have not been provided, JeOS Firstboot is triggered. For details, refer to [Section 4.1, "Configuring SUSE Linux Micro with JeOS Firstboot"](#).

## 4.1 Configuring SUSE Linux Micro with JeOS Firstboot

To configure the system with *JeOS Firstboot*, proceed as follows:

1. *JeOS Firstboot* displays a welcome screen. Confirm with **Enter** .
2. On the next screens, select keyboard, confirm the license agreement and select the time zone.
3. In the *Enter root password* dialog window, enter a password for the root and confirm it.

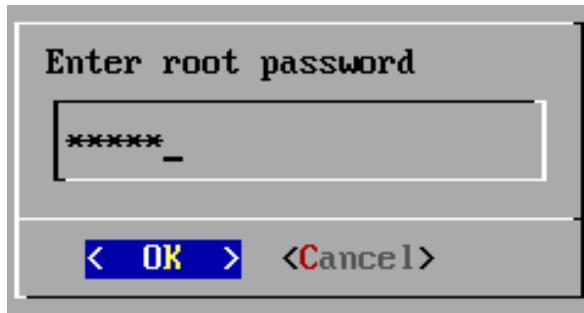


FIGURE 1: ENTER ROOT PASSWORD

4. (Optional) To enroll SSH keys for access, press **Yes** . If you pressed **YES** , proceed as described below:
  - a. Using SSH, connect to the displayed IP address.
  - b. If you received a public key properly, confirm it in the next screen.
  - c. A prompt to import an SSH key appears. Select the option according to your preferences.
5. (Optional) If desired, you can create an unprivileged user in the User Creation form. Fill in the user name, full name and a password twice. Confirm with **OK** .
6. (Optional) To set up MFA for accessing Cockpit, open a TOTP application and scan the QR code. Enter the OTP value provided by the application. Proceed with **OK** .
7. After successful deployment, register your system as described in [Section 5.1, "Registering SUSE Linux Micro from CLI"](#).

## 5 Post-deployment steps

### 5.1 Registering SUSE Linux Micro from CLI

After successful deployment, you need to register the system to get technical support and receive updates. Registering the system is possible from the command line using the **transactional-update register** command.

To register SUSE Linux Micro with SUSE Customer Center, proceed as follows:

1. Run **transactional-update register** as follows:

```
# transactional-update register -r REGISTRATION_CODE -e EMAIL_ADDRESS
```

To register with a local registration server, additionally provide the URL to the server:

```
# transactional-update register -r REGISTRATION_CODE -e EMAIL_ADDRESS \  
--url "https://suse_register.example.com/"
```

Replace REGISTRATION\_CODE with the registration code you received with your copy of SUSE Linux Micro. Replace EMAIL\_ADDRESS with the e-mail address associated with the SUSE account you or your organization uses to manage subscriptions.

2. Reboot your system to switch to the latest snapshot.
3. SUSE Linux Micro is now registered.



#### Note: Other registration options

For information that goes beyond the scope of this section, refer to the inline documentation with **SUSEConnect --help**.

### 5.2 Adding users

Since SUSE Linux Micro requires having an unprivileged user to log in via SSH or to access Cockpit by default, we recommend to create such an account.

This step is optional if you have defined an unprivileged user in the Combustion.

This step is optional if you have defined an unprivileged user during the deployment of the system. If not, you can proceed as described below:

1. Run the **useradd** command as follows:

```
# useradd -m USER_NAME
```

2. Set a password for that account:

```
# passwd USER_NAME
```


3. If needed, add the user to the **wheel** group:

```
# usermod -aG wheel USER_NAME
```

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