HOW TO ACCESS SINGLE-USER MODE WITHOUT PASSWORD

I was asked to reset root password on some long forgotten Debian box. It was an easy and straightforward task, but, as there are some interesting pitfalls, I will describe the whole process of acquiring root shell without password using single-user mode and a couple of ways to prevent it.

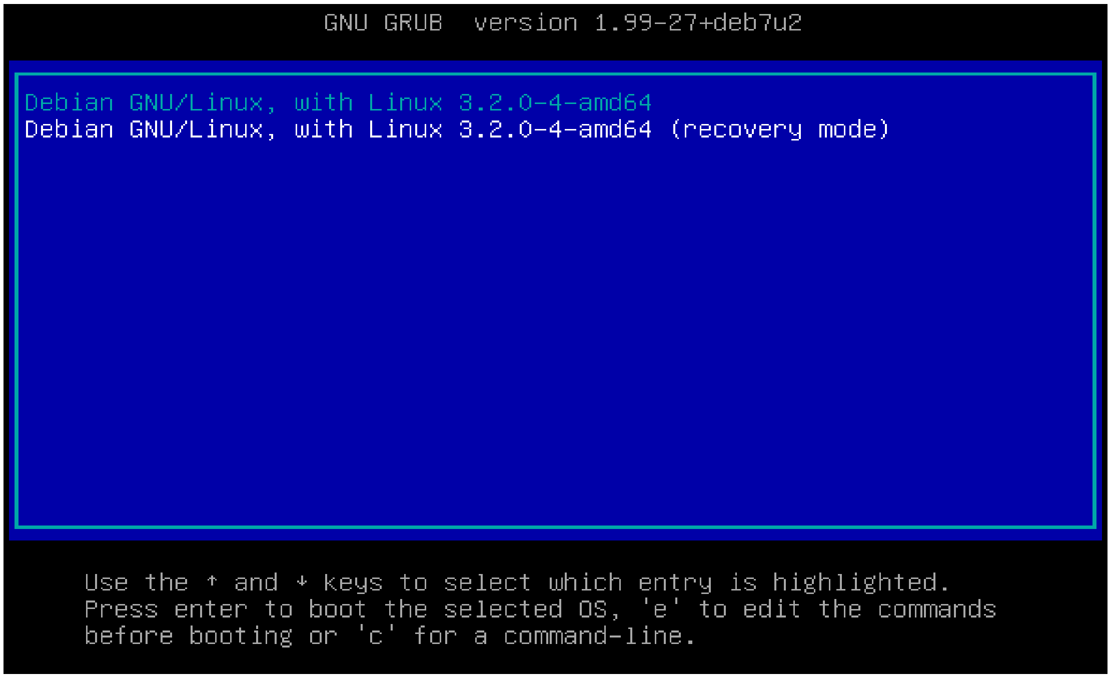
What is single-user mode?

To access root shell without password you need to have physical access to the machine. Then you can modify kernel parameters to boot system into single-user mode which is just a single super user maintenance/recovery mode with all services disabled.

How to access single-user mode?

Default Debian configuration will require password before executing single-user mode and this is a standard behavior found in today's Linux distributions.

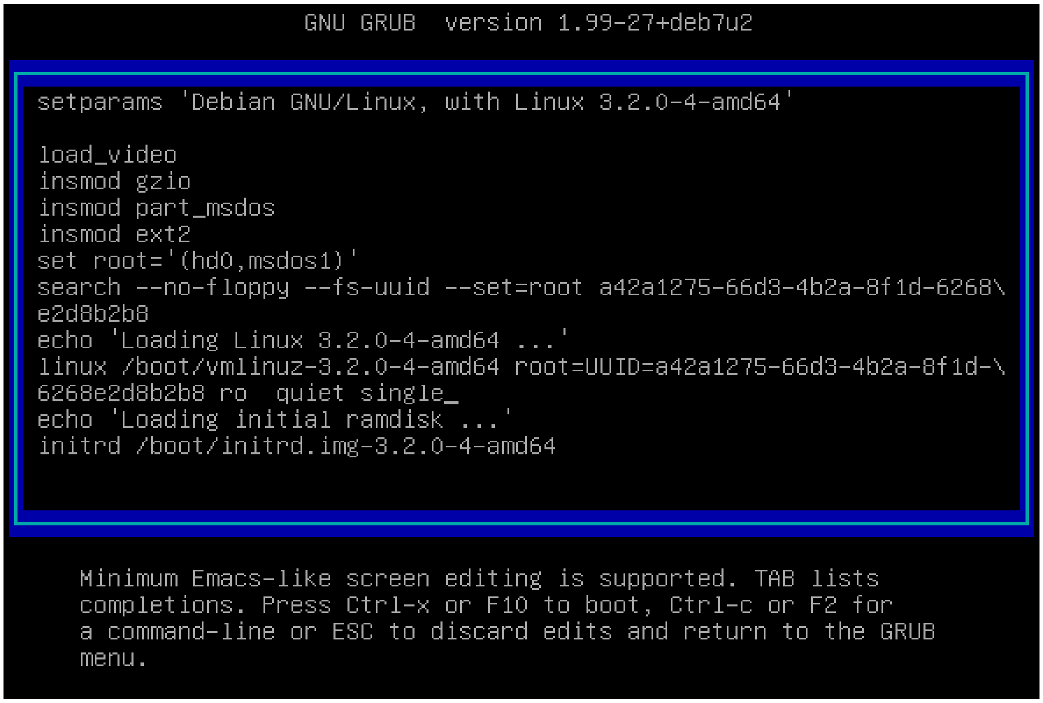
To boot into this mode you need to turn on computer, access GRUB menu and select *Recovery mode* entry.



```
                       GNU GRUB  version 1.99-27+deb7u2

Debian GNU/Linux, with Linux 3.2.0-4-amd64
Debian GNU/Linux, with Linux 3.2.0-4-amd64 (recovery mode)

    Use the ↑ and ↓ keys to select which entry is highlighted.
    Press enter to boot the selected OS, 'e' to edit the commands
    before booting or 'c' for a command-line.
```

In case the *Recovery mode* menu entry is not available, you need to perform five simple steps in order to modify kernel parameters list.

1. Turn on computer.
2. Access GRUB menu.
3. Edit existing menu entry (use `e` key).
4. Add `single` keyword (alternatively you can use `-s` or `S`) to the Linux kernel parameters list.
5. Press `CTRL-X` or `F10` while still in edit mode to continue boot process.



```
                    GNU GRUB  version 1.99-27+deb7u2

 setparams 'Debian GNU/Linux, with Linux 3.2.0-4-amd64'

 load_video
 insmod gzio
 insmod part_msdos
 insmod ext2
 set root='(hd0,msdos1)'
 search --no-floppy --fs-uuid --set=root a42a1275-66d3-4b2a-8f1d-6268\
 e2d8b2b8
 echo 'Loading Linux 3.2.0-4-amd64 ...'
 linux /boot/vmlinuz-3.2.0-4-amd64 root=UUID=a42a1275-66d3-4b2a-8f1d-\
 6268e2d8b2b8 ro  quiet single_
 echo 'Loading initial ramdisk ...'
 initrd /boot/initrd.img-3.2.0-4-amd64

    Minimum Emacs-like screen editing is supported. TAB lists
    completions. Press Ctrl-x or F10 to boot, Ctrl-c or F2 for
    a command-line or ESC to discard edits and return to the GRUB
    menu.
```

How single-user mode is protected?

It is protected by using `sulogin` utility which is invoked by init process when system goes into single-user mode. You can verify this behavior manually by opening `/etc/inittab` file and looking for single-user runlevel definition.

```
$ cat /etc/inittab

[...]

# What to do in single-user mode.

~~:S:wait:/sbin/sulogin

[...]
```

You can change it to shell interpreter if you do not want to enter password.

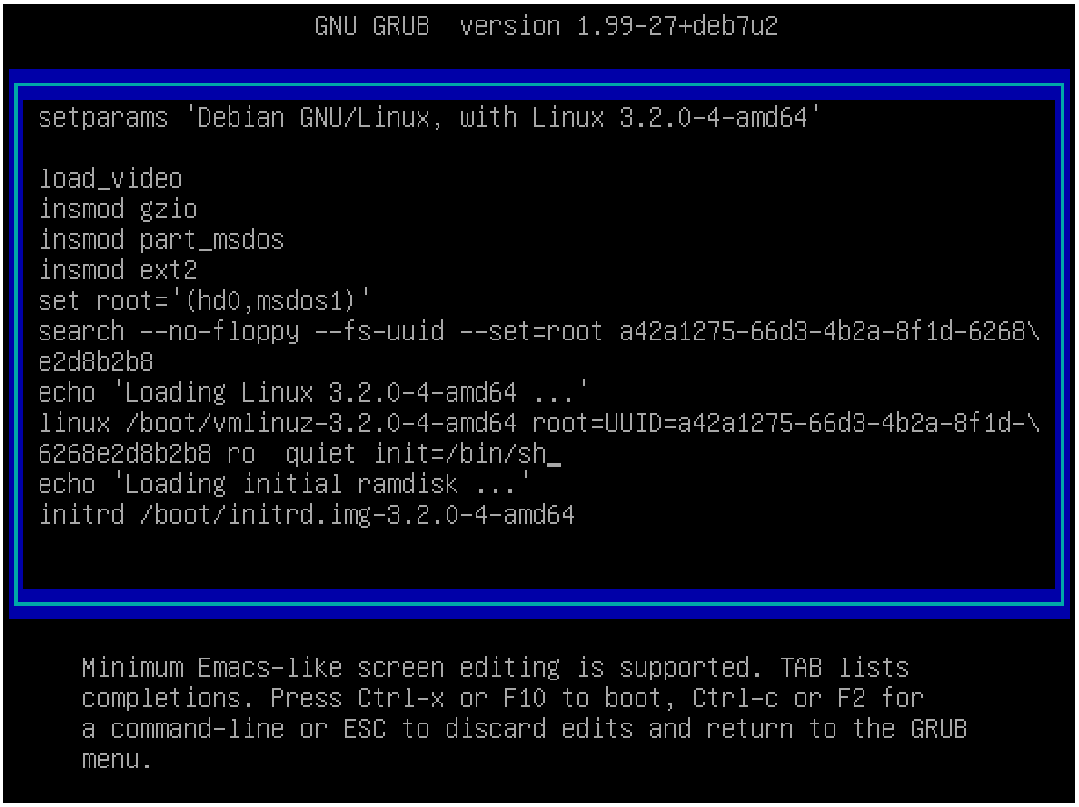
```
[...]
```

```
# What to do in single-user mode.

~~:S:wait:/bin/sh

[...]
```

How to overcome the above protection?

You can modify default behavior and specify your own command run as `init` process as long as you can define kernel parameters.

So, according to the above statement you can get around this protection mechanism and boot into single-user mode to access root shell without password by specifying `init` option in the kernel parameters list.



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How to protect against such attacks?

BIOS

Disable boot from external devices and lock boot device to the used one. Password protect BIOS settings. It is a weak protection but an important one, as circumventing it will surely draw an attention.

GRUB

Disable generation of recovery mode menu entries and lock down boot-loader to require authentication before accessing command line.

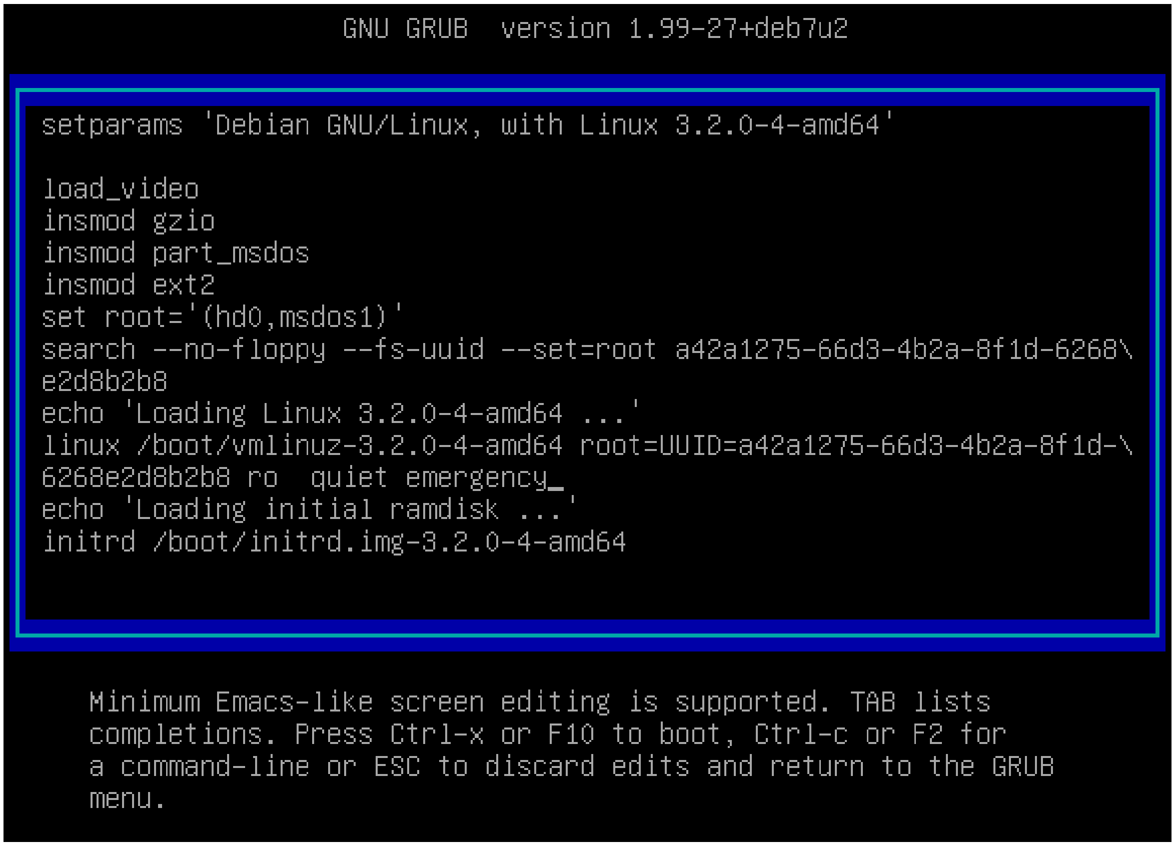
Encryption

This way is suitable only for personal devices but complements the above-mentioned methods with very strong protection. Full disk encryption will surely prevent access to the configuration files.

Emergency mode

Use this mode in case of emergency when you need to enter directly single-user mode without executing any other commands or startup scripts.

To start this mode use `-b` or `emergency` kernel option in the same way as the above ones.



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 echo 'Loading initial ramdisk ...'
 initrd /boot/initrd.img-3.2.0-4-amd64


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Please note that emergency shell configuration is hard-coded and will

use `sulogin` utility. Download `sysvinit` package source code if you want to modify it.

Source: https://blog.sleeplessbeastie.eu/2014/05/01/how-to-access-single-user-mode-without-password/