

بسمه تعالی		
گزارش کار آزمایشگاه سیستم عامل		
تاریخ: 1402/11/29		
نام و نام خانوادگی: صبیحه دردآب	شماره دانشجویی: 40073116	استاد درس: استاد لویمی
اهداف و عناوین آزمایش:		<ul style="list-style-type: none"> آشنایی با مراحل بوت شدن لینوکس اعمال تغییرات و کامپایل مجدد هسته ی سیستم عامل

مراحل بوت شدن کامپیوتر به اختصار:

1.UEFI/BIOS:

- بایوس (یا یوایف آی) ابتدا سخت افزار را بررسی کرده و سپس به سراغ دیسک بوت می رود.

2.GPT/MBR:

- در این مرحله، بوت لودر از MBR یا GPT بارگذاری می شود.
- MBR یا GPT اطلاعات مربوط به پارتیشن های دیسک و کدهای بوت لودر را در خود ذخیره می کند.

3.Bootloader:

- در این مرحله، بوت لودر بارگذاری می شود.
- بوت لودر هسته سیستم عامل را از روی دیسک بارگذاری کرده و مدیریت سیستم را به آن واگذار می کند.

4. Kernel:

- در این مرحله، هسته سیستم عامل بارگذاری می شود.
- هسته سیستم عامل نقش اصلی در ارتباط برنامه های مختلف با سخت افزار و مدیریت آن ها را ایفا می کند.

5.systemd/init:

- systemd یا init اولین فرآیندی است که توسط هسته اجرا می شود.
- systemd یا init وظیفه مدیریت فرآیندهای سیستم را بر عهده دارند.

6.Targets/Runlevel:

- در این مرحله، سطوح اجرایی یا اهداف برای اجرای سرویس ها تعیین می شود.
- این سطوح مشخص می کنند که سرویس هایی که باید در هر سطح اجرایی اجرا شوند چیستند.

دستور **uname -r** نسخه هسته فعلی لینوکس را نشان می دهد:

```
sabih@sabih:~$ uname -r
6.5.0-9-generic
```

دستور **uname** با آپشن های مختلفش اطلاعاتی در رابطه با سیستم فعلی نشان می دهد، آپشن **-r** نشان دهنده Release می باشد.

برای دریافت سورس کد هسته از **apt-get install linux-source-x.x.x** استفاده می کنیم.(X.X.X نسخه هسته مورد نظر می باشد،برای دریافت سورس کد هسته فعلی از خروجی **uname -r** استفاده می شود):

```
sabih@sabih:~$ sudo apt-get install linux-source-6.5.0
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu gcc gcc-13 libasan8
  libbinutils libc-bin libc-dev-bin libc-devtools libc6 libc6-dbg libc6-dev
  libgcc1-0 libcrypt-dev libctf-nobfd0 libctf0 libgcc-13-dev libgprofng0
  libhwasan0 libitm1 liblsan0 libnsd-dev libquadmath0 libstdc++6 libtirpc-dev
  libtsan2 libubsan1 linux-libc-dev locales make manpages-dev rpcsvc-proto
Suggested packages:
  binutils-doc gprofng-gui gcc-multilib autoconf automake libtool flex bison
  gcc-doc gcc-13-multilib gcc-13-doc gcc-13-locales glibc-doc libcurses-dev
  ncurses-dev kernel-package libqt3-dev make-doc
The following NEW packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu gcc gcc-13 libasan8
  libbinutils libc-dev-bin libc-devtools libc6-dev libgcc1-0 libcrypt-dev
  libctf-nobfd0 libctf0 libgcc-13-dev libgprofng0 libhwasan0 libitm1 liblsan0
  libnsd-dev libquadmath0 libstdc++6 libtirpc-dev libtsan2 libubsan1
  linux-libc-dev linux-source-6.5.0 make manpages-dev rpcsvc-proto
The following packages will be upgraded:
  libc-bin libc6 libc6-dbg locales
4 upgraded, 30 newly installed, 0 to remove and 153 not upgraded.
Need to get 403 MB of archives.
After this operation, 510 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://archive.ubuntu.com/ubuntu mantic-updates/main amd64 libc6-dbg amd64 2.38-1ubuntu6.1 [13.0 MB]
Get:2 http://archive.ubuntu.com/ubuntu mantic-updates/main amd64 libc6 amd64 2.38-1ubuntu6.1 [3,248 kB]
Get:3 http://archive.ubuntu.com/ubuntu mantic-updates/main amd64 libc-bin amd64 2.38-1ubuntu6.1 [680 kB]
Get:4 http://archive.ubuntu.com/ubuntu mantic-updates/main amd64 locales all 2.38-1ubuntu6.1 [4,239 kB]
Get:5 http://archive.ubuntu.com/ubuntu mantic/main amd64 binutils-common amd64 2.41-Subunit1 [248 kB]
Get:6 http://archive.ubuntu.com/ubuntu mantic/main amd64 libstdc++6 amd64 2.41-Subunit1 [14.5 kB]
Get:7 http://archive.ubuntu.com/ubuntu mantic/main amd64 libbinutils amd64 2.41-Subunit1 [561 kB]
Get:8 http://archive.ubuntu.com/ubuntu mantic/main amd64 libctf-nobfd0 amd64 2.41-Subunit1 [96.3 kB]
```

```
sabih@sabih:~$ sudo apt-get install linux-source-6.5.0
en_ZW.UTF-8... done
Generation complete.
Setting up libstdc++6:amd64 (2.41-Subunit1) ...
Setting up libc6-dbg:amd64 (2.38-1ubuntu6.1) ...
Setting up libtirpc-dev:amd64 (1.3.3+ds-1) ...
Setting up rpcsvc-proto (1.4.2-0ubuntu6) ...
Setting up make (4.3-4.1build1) ...
Setting up libquadmath0:amd64 (13.2.0-4ubuntu3) ...
Setting up libubsan1:amd64 (13.2.0-4ubuntu3) ...
Setting up libnsd-dev:amd64 (1.3.0-2build2) ...
Setting up libhwasan0:amd64 (13.2.0-4ubuntu3) ...
Setting up libcrypt-dev:amd64 (1:4.4.36-2) ...
Setting up libasan8:amd64 (13.2.0-4ubuntu3) ...
Setting up libtsan2:amd64 (13.2.0-4ubuntu3) ...
Setting up libbinutils:amd64 (2.41-Subunit1) ...
Setting up libc-dev-bin (2.38-1ubuntu6.1) ...
Setting up libgcc1-0:amd64 (13.2.0-4ubuntu3) ...
Setting up liblsan0:amd64 (13.2.0-4ubuntu3) ...
Setting up libitm1:amd64 (13.2.0-4ubuntu3) ...
Setting up libc-devtools (2.38-1ubuntu6.1) ...
Setting up libctf0:amd64 (2.41-Subunit1) ...
Setting up libgprofng0:amd64 (2.41-Subunit1) ...
Setting up libgcc-13-dev:amd64 (13.2.0-4ubuntu3) ...
Setting up libc6-dev:amd64 (2.38-1ubuntu6.1) ...
Setting up binutils-x86-64-linux-gnu (2.41-Subunit1) ...
Setting up binutils (2.41-Subunit1) ...
Setting up linux-source-6.5.0 (6.5.0-17.17) ...
Setting up gcc-13 (13.2.0-4ubuntu3) ...
Setting up gcc (4:13.2.0-1ubuntu1) ...
Processing triggers for man-db (2.11.2-3) ...
Processing triggers for libc-bin (2.38-1ubuntu6.1) ...
sabih@sabih:~$
```

دستور **apt-cache search linux-source** برای جستجوی پکیج‌های مرتبط با سورس کد هسته لینوکس در APT استفاده می‌شود.

خروجی در ماشین مجازی(شامل فقط یک نسخه):

```
sabih@sabih:~$ apt-cache search linux-source
linux-source - Linux kernel source with Ubuntu patches
linux-source-6.5.0 - Linux kernel source for version 6.5.0 with Ubuntu patches
sabih@sabih:~$
```

تلاش برای دریافت نسخه دیگر در ماشین مجازی(با APT):

```
sabih@sabih:~$ sudo apt-get install linux-source-6.2.0
[sudo] password for sabih:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package linux-source-6.2.0
E: Couldn't find any package by glob 'linux-source-6.2.0'
E: Couldn't find any package by regex 'linux-source-6.2.0'
sabih@sabih:~$
```

خروجی در لینوکس نصب شده به صورت دوال بوت (شامل چهار نسخه):

```
sabih@sabih-Vivobook-ASUSLaptop-K6500ZC-K6500ZC:~$ apt-cache search linux-source
linux-source - Linux kernel source with Ubuntu patches
linux-source-5.15.0 - Linux kernel source for version 5.15.0 with Ubuntu patches
linux-source-5.19.0 - Linux kernel source for version 5.19.0 with Ubuntu patches
linux-source-6.2.0 - Linux kernel source for version 6.2.0 with Ubuntu patches
linux-source-6.5.0 - Linux kernel source for version 6.5.0 with Ubuntu patches
```

تلاش برای دریافت نسخه دیگر لیست موفقیت آمیز (اما نسخه خارج از لیست همچنان ناموفق):

```
sabih@sabih-Vivobook-ASUSLaptop-K6500ZC-K6500ZC:~$ uname -r
6.5.0-18-generic
sabih@sabih-Vivobook-ASUSLaptop-K6500ZC-K6500ZC:~$ sudo apt-get install linux-source-6.2.0
[sudo] password for sabih:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  linux-headers-6.2.0-26-generic linux-hwe-6.2.0-headers-6.2.0-26 linux-image-6.2.0-26-generic linux-modules-6.2.0-26-generic
Use 'sudo apt autoremove' to remove them.
Suggested packages:
  libncurses-dev | ncurses-dev kernel-package libqt3-dev
The following NEW packages will be installed:
  linux-source-6.2.0
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 423 MB of archives.
After this operation, 440 MB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 linux-source-6.2.0 all 6.2.0-39.40~22.04.1 [423 MB]
44% [1 linux-source-6.2.0 231 MB/423 MB 55%]
```

دریافت جدیدترین نسخه از kernel.org:

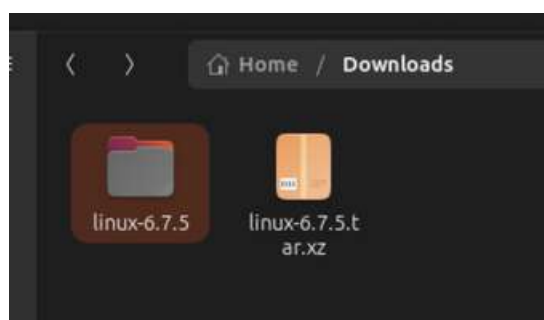
The Linux Kernel Archives website interface. The header includes navigation links: About, Contact us, FAQ, Releases, Signatures, Site news, and the Linux penguin logo. A green box highlights the 'Latest Release' section, which displays '6.7.5' with a download icon. Below this, a table lists various kernel versions and their release dates.

Protocol	Location
HTTP	https://www.kernel.org/pub/
GIT	https://git.kernel.org/
RSYNC	rsync://rsync.kernel.org/pub/

mainline:	6.8-rc5	2024-02-18	[tarball]	[patch]	[inc. patch]	[view diff]	[browse]
stable:	6.7.5	2024-02-16	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff] [browse] [changelog]
longterm:	6.6.17	2024-02-16	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff] [browse] [changelog]
longterm:	6.1.78	2024-02-16	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff] [browse] [changelog]
longterm:	5.15.148	2024-01-25	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff] [browse] [changelog]
longterm:	5.10.209	2024-01-25	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff] [browse] [changelog]
longterm:	5.4.268	2024-01-25	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff] [browse] [changelog]
longterm:	4.19.306	2024-01-25	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff] [browse] [changelog]
linux-next:	next-20240221	2024-02-21					[browse]

استخراج سورس کد:

```
~/Downloads$ tar xvf linux-6.7.5.tar.xz
```



دریافت ابزارهای لازم برای کامپایل و نصب هسته :

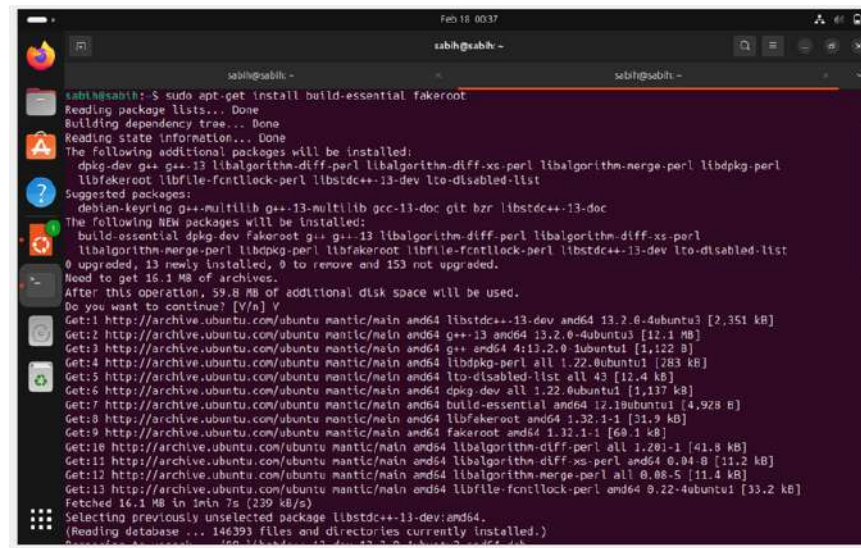
apt-get install build-essential fakeroot

The build-essentials packages are the form of meta-packages that are essential to compile software. They contain the GNU/g++ compiler collection, GNU debugger, and a few more libraries and tools that are needed for compiling a program.

fakeroot ابزاری است که به پروسه‌ها اجازه می‌دهد بدون داشتن دسترسی root واقعی، به طور شبیه‌سازی شده دسترسی root داشته باشند.

apt-get build-dep linux

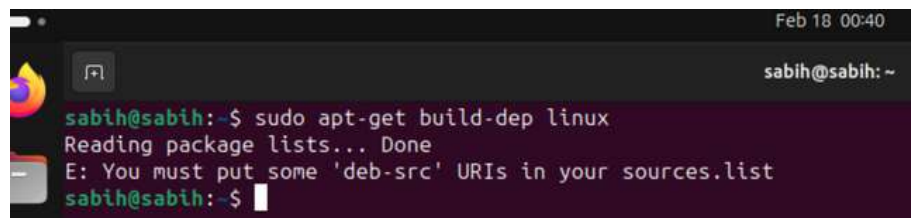
این دستور برای نصب تمام وابستگی‌ها و پیش‌نیازهای لازم برای کامپایل هسته لینوکس از سورس استفاده می‌شود.



```
sabih@sabih:~$ sudo apt-get install build-essential fakeroot
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done

The following additional packages will be installed:
  dpkg-dev g++-13 libalgorithm-diff-perl libalgorithm-diff-xs-perl libalgorithm-merge-perl libdpkg-perl
  libfakeroot libfile-fcntllock-perl libstdc++-13-dev lto-disabled-list
Suggested packages:
  debconf debconf-i18n g++-13-multilib gcc-13-doc git bzr libstdc++-13-doc
The following NEW packages will be installed:
  build-essential dpkg-dev fakeroot g++-13 libalgorithm-diff-perl libalgorithm-diff-xs-perl
  libalgorithm-merge-perl libdpkg-perl libfakeroot libfile-fcntllock-perl libstdc++-13-dev lto-disabled-list
0 upgraded, 13 newly installed, 0 to remove and 153 not upgraded.
Need to get 16.1 MB of archives.
After this operation, 59.8 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://archive.ubuntu.com/ubuntu mantic/main amd64 libstdc++-13-dev amd64 13.2.0-4ubuntu3 [2,351 kB]
Get:2 http://archive.ubuntu.com/ubuntu mantic/main amd64 g++-13 amd64 13.2.0-4ubuntu3 [12.1 MB]
Get:3 http://archive.ubuntu.com/ubuntu mantic/main amd64 g++ amd64 4:13.2.0-1ubuntu1 [1,122 B]
Get:4 http://archive.ubuntu.com/ubuntu mantic/main amd64 libdpkg-perl all 1.22.0ubuntu1 [283 kB]
Get:5 http://archive.ubuntu.com/ubuntu mantic/main amd64 lto-disabled-list all 43 [12.4 kB]
Get:6 http://archive.ubuntu.com/ubuntu mantic/main amd64 dpkg-dev all 1.22.0ubuntu1 [1,137 kB]
Get:7 http://archive.ubuntu.com/ubuntu mantic/main amd64 build-essential amd64 12.10ubuntu1 [4,928 B]
Get:8 http://archive.ubuntu.com/ubuntu mantic/main amd64 libfakeroot amd64 1.32.1-1 [31.9 kB]
Get:9 http://archive.ubuntu.com/ubuntu mantic/main amd64 fakeroot amd64 1.32.1-1 [60.1 kB]
Get:10 http://archive.ubuntu.com/ubuntu mantic/main amd64 libalgorithm-diff-perl all 1.201-1 [41.8 kB]
Get:11 http://archive.ubuntu.com/ubuntu mantic/main amd64 libalgorithm-diff-xs-perl amd64 0.04-0 [11.2 kB]
Get:12 http://archive.ubuntu.com/ubuntu mantic/main amd64 libalgorithm-merge-perl all 0.08-5 [11.4 kB]
Get:13 http://archive.ubuntu.com/ubuntu mantic/main amd64 libfile-fcntllock-perl amd64 0.22-4ubuntu1 [33.2 kB]
Fetched 16.1 MB in 1min 7s (239 kB/s)
Selecting previously unselected package libstdc++-13-dev:amd64.
(Reading database ... 146393 files and directories currently installed.)
Preparing to unpack .../libstdc++-13-dev_13.2.0-4ubuntu3_amd64.deb ...
Unpacking libstdc++-13-dev:amd64 (13.2.0-4ubuntu3) ...
Setting up libstdc++-13-dev:amd64 (13.2.0-4ubuntu3) ...
Setting up g++-13 (13.2.0-4ubuntu3) ...
Setting up g++ (4:13.2.0-1ubuntu1) ...
Setting up dpkg-dev (1.22.0ubuntu1) ...
Setting up build-essential (12.10ubuntu1) ...
Setting up libfakeroot:amd64 (1.32.1-1) ...
Setting up fakeroot (1.32.1-1) ...
Setting up libalgorithm-diff-perl (1.201-1) ...
Setting up libalgorithm-diff-xs-perl (0.04-0) ...
Setting up libalgorithm-merge-perl (0.08-5) ...
Setting up libfile-fcntllock-perl (0.22-4ubuntu1) ...
```

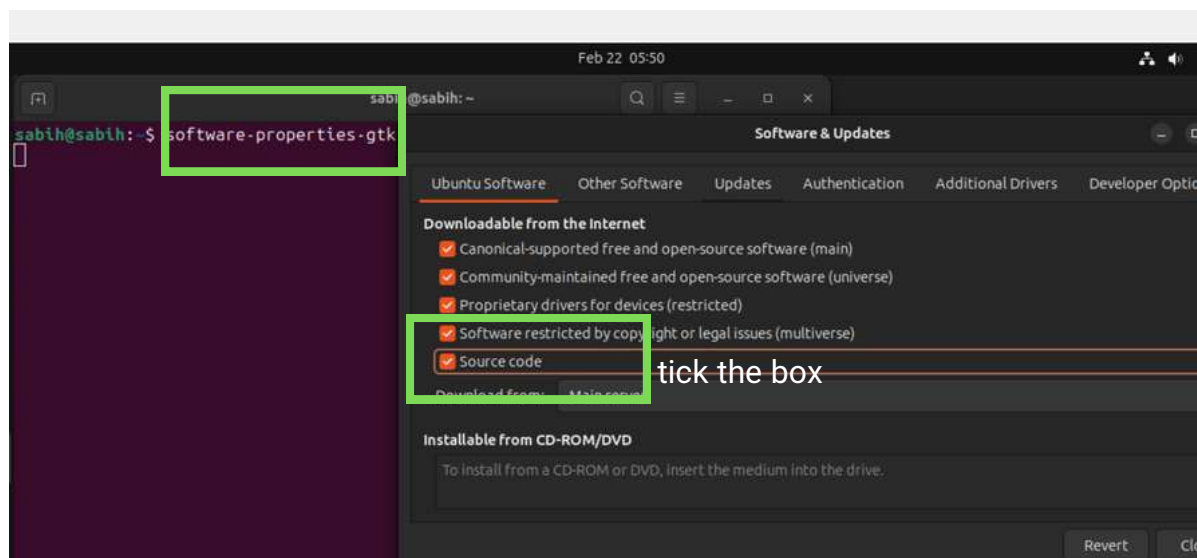
برخورد با ارور در اجرای **apt-get build-dep linux**:



```
sabih@sabih:~$ sudo apt-get build-dep linux
Reading package lists... Done
E: You must put some 'deb-src' URIs in your sources.list
sabih@sabih:~$
```

رفع ارور:

<https://askubuntu.com/questions/496549/error-you-must-put-some-source-uris-in-your-sources-list>



```
Feb 18 00:58
sabihs@sabihi:~$ sudo apt-get build-dep linux
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
asciidoc asciidoc-base asciidoc-common autoconf automake autopoint autotools-dev bindgen-0.56 bison
ca-certificates-java clang-14 clang-15 cpp-12 curl debhelper debugedit default-jdk-headless default-jre-headless
dh-autoreconf dh-strip-nondeterminism dkms docbook-dsssl docbook-utils docbook-xsl docutils-common dvipng dwz
fig2dev flex fonts-font-awesome fonts-lato fonts-lmodern gawk gcc-12 gcc-12-base gettext graphviz imagemagick
imagemagick-6-common imagemagick-6.q16 intltool-debian java-common latexmk libann0 libapache-pom-java
libarchive-perl libaudit-dev libcap-dev libcap-ng-dev libcdt5 libcglib6 libclang-common-14-dev
libclang-common-15-dev libclang-cpp14 libclang-cpp15 libclang1-14 libclang1-15 libcommons-logging-java
libcommons-parent-java libdavi16 libde265-0 libdehelper-perl libdw-dev libelf-dev libexpat1-dev libfftw3-double3
libfile-stripnondeterminism-perl libfontbox-java libgc1 libgcc-12-dev libgts-0.7.5 libgvc6 libgvpr2
libheif-plugin-dav1d libheif-plugin-libde265 libheif1 libiberty-dev libjs-jquery libjs-sphinxdoc libjs-underscore
libjson-perl liblab-gamut1 libllvml14 liblqr-1-0 liblzma-dev libmagickcore-6.q16-6 libmagickwand-6.q16-6 libnetpbm11
libnewt-dev libnuma-dev libobjc-13-dev libobjc4 libosp5 libostyle1c2 libpathplan4 libpci-dev libpdfbox-java
libpkcs3conf3 libpng-dev libpotrace0 libptexenc1 libpython3-dev libpython3.11-dev librsync-bin libsgmls-perl
libsigsegv2 libslang2-dev libssl-dev libstd-rust-1.62 libstd-rust-1.62-dev libstd-rust-1.68 libstd-rust-1.68-dev
libsub-override-perl libteckit0 libtexlua53-5 libtool libudev-dev libunwind-dev libxml2-utils libzstd-dev
libzip-0.13 llvm-14-linker-tools llvm-15-linker-tools lynx lynx-common m4 nakedumpfile netpbm openjade
openjdk-17-jdk-headless openjdk-17-jre-headless opensp pahole pkg-config pkgconf pkgconf-bin po-debconf
preview-latex-style python3-alabaster python3-dev python3-distutils python3-docutils python3-imagesize
python3-lib2to3 python3-packaging python3-roman python3-snowballstemmer python3-sphinx python3-sphinx-rtd-theme
python3-sphinxcontrib-jquery python3.11-dev rust-1.68-src rustc-1.62 rustc-1.68 rustfmt-1.68 sgmlspl sharutils
sphinx-common sphinx-rtd-theme-common tiutils teckit tex-common texlive-base texlive-binaries
texlive-fonts-recommended texlive-formats-extra texlive-latex-base texlive-latex-extra texlive-latex-recommended
texlive-pictures texlive-plain-generic texlive-xetex tipa uuid-dev xmlto xsltproc zlib-dev
The following packages will be upgraded:
libcurl3-gnutls libcurl4 libnss-systemd libpam-systemd libssl3 libsystemd-shared libsystemd0 libudev1 openssl
```

به کمک دستور زیر، کدهای هسته (هسته فعلی) در یک پوشه مشخص بازگشایی می شود :

apt-get source linux

```
Feb 22 06:48
sabihs@sabihi:~$ apt-get source linux
Reading package lists... Done
NOTICE: 'linux' packaging is maintained in the 'Git' version control system at:
git://git.launchpad.net/~ubuntu-kernel/ubuntu/+source/linux/+git/mantic
Please use:
git clone git://git.launchpad.net/~ubuntu-kernel/ubuntu/+source/linux/+git/mantic
to retrieve the latest (possibly unreleased) updates to the package.
Need to get 228 MB of source archives.
Get:1 http://archive.ubuntu.com/ubuntu mantic-updates/main linux 6.5.0-17.17 (dsc) [9,241 B]
Get:2 http://archive.ubuntu.com/ubuntu mantic-updates/main linux 6.5.0-17.17 (tar) [224 MB]
Get:3 http://archive.ubuntu.com/ubuntu mantic-updates/main linux 6.5.0-17.17 (diff) [4,690 kB]
Fetched 228 MB in 22min 2s (173 kB/s)
dpg-source: info: extracting linux in linux-6.5.0
dpg-source: info: unpacking linux-6.5.0.orig.tar.gz
dpg-source: info: applying linux-6.5.0-17.17.diff.gz
dpg-source: info: upstream files that have been modified:
linux-6.5.0/Documentation/ABI/testing/lna_policy
linux-6.5.0/Documentation/ABI/testing/sysfs-bus-fst-devices-sbeffo
linux-6.5.0/Documentation/ABI/testing/sysfs-driver-chronos-acpi
linux-6.5.0/Documentation/ABI/testing/sysfs-fs-f2fs
linux-6.5.0/Documentation/Makefile
linux-6.5.0/Documentation/admin-guide/cgroup-v1/memory.rst
linux-6.5.0/Documentation/admin-guide/devices.txt
linux-6.5.0/Documentation/admin-guide/kernel-parameters.txt
linux-6.5.0/Documentation/admin-guide/sysctl/kernel.rst
linux-6.5.0/Documentation/arch/arm64/silicon-errata.rst
linux-6.5.0/Documentation/cgroups/namespaces.txt
linux-6.5.0/Documentation/devicetree/bindings/clock/xlnx,versal-clk.yaml
linux-6.5.0/Documentation/devicetree/bindings/extcon/nxp,max77843.yaml
linux-6.5.0/Documentation/devicetree/bindings/interrupt-controller/renesas,rzg2l-lrcc.yaml
linux-6.5.0/Documentation/devicetree/bindings/media/nxp,lm7-cst.yaml
linux-6.5.0/Documentation/devicetree/bindings/pcl/qcom,pcie-ep.yaml
linux-6.5.0/Documentation/devicetree/bindings/power/qcom,kpss-ac-v2.yaml
linux-6.5.0/Documentation/devicetree/bindings/regulator/qcom,rpm-regulator.yaml
```

```
sabihs@sabihi:~$ ls
Desktop
Documents
Downloads
linux-6.5.0
linux-6.5.0-17.17.diff.gz
linux-6.5.0-17.17.dsc
Music
Pictures
Temp
Videos
Public
```

در حال حاضر دو گزینه برای کامپایل وجود دارد، نسخه فعلی و جدید ترین نسخه که از kernel.org دانلود و بازگشایی شده بود.

ادامه با آخرین نسخه:

رفتن به دایرکتوری سورس کد:

```
sabihs@sabihi:~$ cd Downloads
sabihs@sabihi:~/Downloads$ ls
linux-6.7.5 linux-6.7.5.tar.xz
sabihs@sabihi:~/Downloads$ cd linux-6.7.5
sabihs@sabihi:~/Downloads/linux-6.7.5$
```

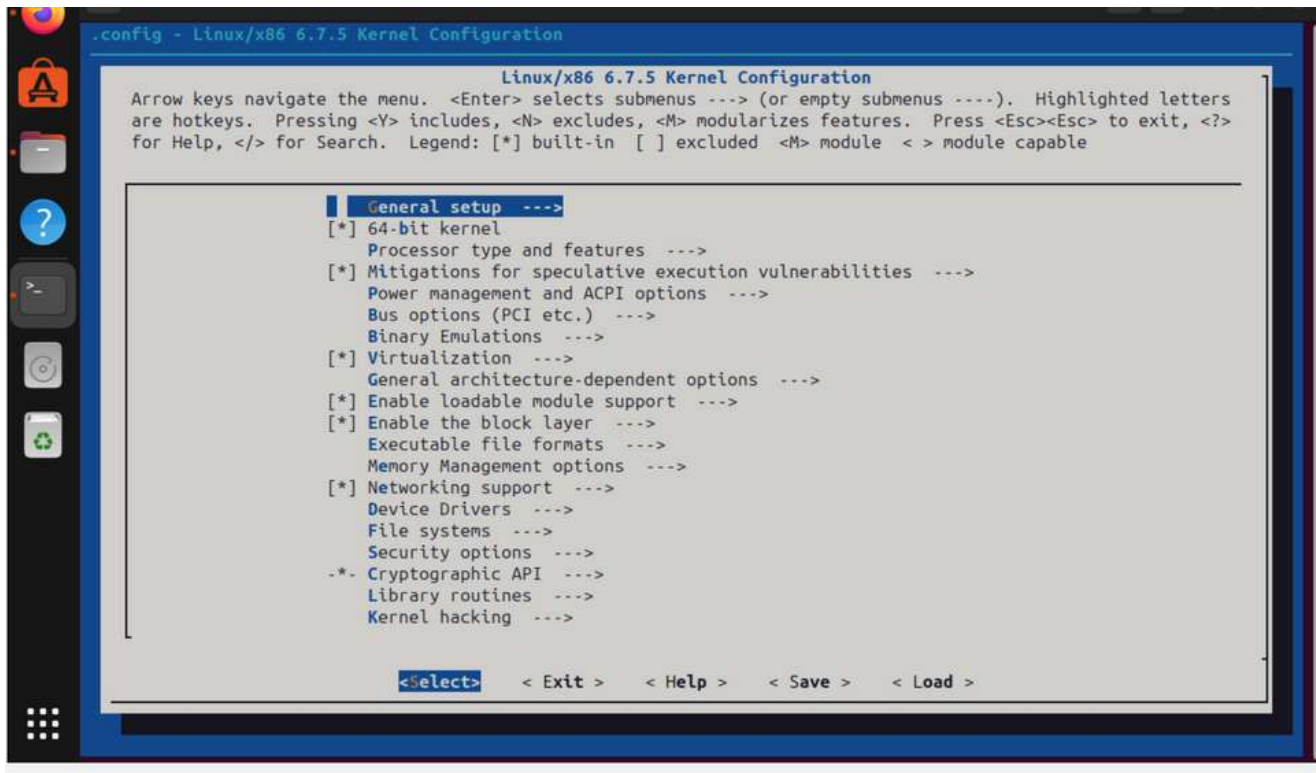
کپی پیکربندی فعلی `cp /boot/config-$(uname -r) .config`:

```
6.7.5$ cp /boot/config-$(uname -r) .config
```

```
sabih@sabih:~/Downloads/linux-6.7.5$ make menuconfig
HOSTCC scripts/basic/fixdep
*
* Unable to find the ncurses package.
* Install ncurses (ncurses-devel or libncurses-dev
* depending on your distribution).
*
* You may also need to install pkg-config to find the
* ncurses installed in a non-default location.
*
make[2]: *** [scripts/kconfig/Makefile:224: scripts/kconfig/mconf-libs] Error 1
make[1]: *** [/home/sabih/Downloads/linux-6.7.5/Makefile:685: menuconfig] Error 2
make: *** [Makefile:234: __sub-make] Error 2
sabih@sabih:~/Downloads/linux-6.7.5$
```

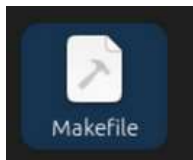
رفع ارور و نصب پیکج مورد نیاز و اجرای دوباره:

```
sabih@sabih:~/Downloads/linux-6.7.5$ sudo apt install ncurses-dev
[sudo] password for sabih:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'libncurses-dev' instead of 'ncurses-dev'
Suggested packages:
  ncurses-doc
The following NEW packages will be installed:
  libncurses-dev
0 upgraded, 1 newly installed, 0 to remove and 138 not upgraded.
Need to get 382 kB of archives.
After this operation, 2,405 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu mantic/main amd64 libncurses-dev amd64 6.4+20230625-2 [382 kB]
Fetched 382 kB in 1s (257 kB/s)
Selecting previously unselected package libncurses-dev:amd64.
(Reading database ... 209986 files and directories currently installed.)
Preparing to unpack .../libncurses-dev_6.4+20230625-2_amd64.deb ...
Unpacking libncurses-dev:amd64 (6.4+20230625-2) ...
Setting up libncurses-dev:amd64 (6.4+20230625-2) ...
Processing triggers for man-db (2.11.2-3) ...
```



It is quite possible that you might disable a critical portion of the kernel, so step through menuconfig with care. If you are not sure about an option, leave it alone. Or, better yet, stick with the configuration we just copied from the running kernel (as we know it works).

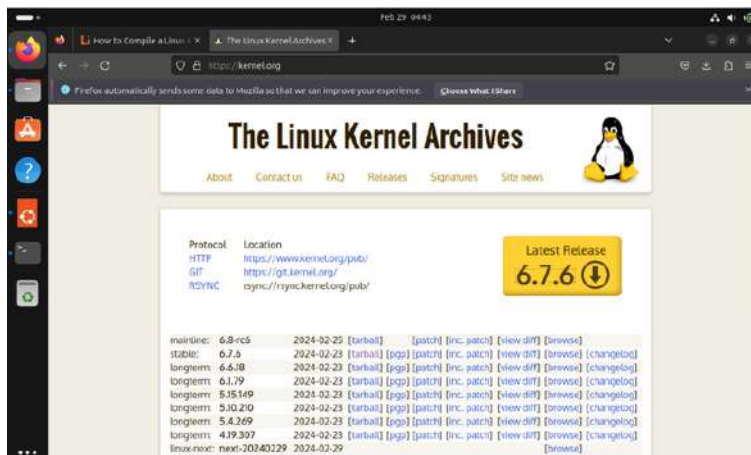
دستور **make** برای ساخت (build) و کامپایل نرم افزارها از سورس کد است. (با آپشن [N] -j مراحل سریع تر انجام می شود).



`-j [N], --jobs[=N]` Allow N jobs at once; infinite jobs with no arg.

دستور make فایل Makefile را پیدا می کند و به ترتیب دستوراتی که در آن تعریف شده اند را اجرا می کند.

به علت برخورد با یکسری ارور ها و راه حل نامناسب ، ابونتو دوباره نصب شد و همچنین مراحل برای last release جدید کرنل دوباره تکرار شد.



پس از اجرای دستور make برخورد با ارور: No rule to make target 'debian/canonical-certs.pem'

```
CHK kernel/kheaders_data.tar.xz
GEN kernel/kheaders_data.tar.xz
CC [M] kernel/kheaders.o
CC certs/system_keyring.o
make[3]: *** No rule to make target 'debian/canonical-certs.pem', needed by 'certs/x509_certificate_list'. Stop.
make[2]: *** [scripts/Makefile.build:480: certs] Error 2
make[1]: *** [/home/sabih/Downloads/linux-6.7.6/Makefile:1911: .] Error 2
make: *** [Makefile:234: __sub-make] Error 2
```

رفع ارور:

If you are compiling the kernel on Ubuntu, you may receive the following error that interrupts the building process:

No rule to make target 'debian/canonical-certs.pem'

Disable the conflicting security certificates by executing the two commands below:

```
scripts/config --disable SYSTEM_TRUSTED_KEYS
```

```
scripts/config --disable SYSTEM_REVOCATION_KEYS
```

The commands return no output. Start the building process again with **make**, and press **Enter** repeatedly to confirm the default options for the generation of new certificates.

<https://phoenixnap.com/kb/build-linux-kernel>

و پس از صبر زیاد، برخورد با ارور:

```
CHK kernel/kheaders_data.tar.xz
LD vmlinux.o
ld: final link failed: No space left on device
make[2]: *** [scripts/Makefile.vmlinux.o:62: vmlinux.o] Error 1
make[1]: *** [/home/sabih/Downloads/linux-6.7.6/Makefile:112: .] Error 2
make: *** [Makefile:234: __sub-make] Error 2
sabih@sabih:~/Downloads/linux-6.7.6$
```

رفع ارور با افزایش فضای دیسک مجازی: <https://www.youtube.com/watch?v=jpMaTnnmcyI>

```
LD [M] net/6lowpan/nhc_udp.ko
LD [M] net/ieee802154/6lowpan/ieee802154_6lowpan.ko
LD [M] net/ieee802154/ieee802154.ko
LD [M] net/ieee802154/ieee802154_socket.ko
LD [M] net/mac802154/mac802154.ko
LD [M] net/ceph/libceph.ko
LD [M] net/batman-adv/batman-adv.ko
LD [M] net/nfc/nfc.ko
LD [M] net/nfc/nci/nci.ko
LD [M] net/nfc/nci/nci_spi.ko
LD [M] net/nfc/nci/nci_uart.ko
LD [M] net/nfc/hci/hci.ko
LD [M] net/nfc/nfc_digital.ko
LD [M] net/psample/psample.ko
LD [M] net/ife/ife.ko
LD [M] net/openvswitch/openvswitch.ko
LD [M] net/openvswitch/vport-vxlan.ko
LD [M] net/openvswitch/vport-geneve.ko
LD [M] net/openvswitch/vport-gre.ko
LD [M] net/vmw_vsock/vsock.ko
LD [M] net/vmw_vsock/vsock_diag.ko
LD [M] net/vmw_vsock/vmw_vsock_vmci_transport.ko
LD [M] net/vmw_vsock/vmw_vsock_virtio_transport.ko
LD [M] net/vmw_vsock/vmw_vsock_virtio_transport_common.ko
LD [M] net/vmw_vsock/hv_sock.ko
LD [M] net/vmw_vsock/vsock_loopback.ko
LD [M] net/nsh/nsh.ko
LD [M] net/hsr/hsr.ko
LD [M] net/qrtr/qrtr.ko
LD [M] net/qrtr/qrtr-smd.ko
LD [M] net/qrtr/qrtr-tun.ko
LD [M] net/qrtr/qrtr-mhi.ko
LD [M] virt/lib/irqbypass.ko
```

sabih@sabih:~/Downloads/linux-6.7.6\$

نصب ماژول های مورد نیاز **make modules_install**:

```
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/vitesse.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/bcm7xxx.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/qsemi.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/marvell-88x2222.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/ax88796b.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/broadcom.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/dp83869.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/nxp-cbtv.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/ste10xp.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/icplus.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/teranetics.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/cicada.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/at803x.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/adin.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/bcm54148.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/xilinx-gml2rgml.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/microchip-t1.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/cortina.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/bcm87xx.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/smc.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/ncn2690.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/uPD69620.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/phy/mEDIATEK-ga.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/bareudp.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/bonding/bonding.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/etl.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/ant.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/ieee802154/nrf24j40.ko.zst: Permission denied
rm: cannot remove /lib/modules/6.7.6/kernel/drivers/net/ieee802154/ad7242.ko.zst: Permission denied
```

permission denied:)

اجرای دستور به عنوان سوپر یوزر:

sabih@sabih:~/Downloads/linux-6.7.6\$ sudo make modules_install

```
INSTALL /lib/modules/6.7.6/kernel/net/vmw_vsock/hv_sock.ko
SIGN /lib/modules/6.7.6/kernel/net/vmw_vsock/hv_sock.ko
ZSTD /lib/modules/6.7.6/kernel/net/vmw_vsock/hv_sock.ko.zst
INSTALL /lib/modules/6.7.6/kernel/net/vmw_vsock/vsock_loopback.ko
SIGN /lib/modules/6.7.6/kernel/net/vmw_vsock/vsock_loopback.ko
ZSTD /lib/modules/6.7.6/kernel/net/vmw_vsock/vsock_loopback.ko.zst
INSTALL /lib/modules/6.7.6/kernel/net/nsh/nsh.ko
SIGN /lib/modules/6.7.6/kernel/net/nsh/nsh.ko
ZSTD /lib/modules/6.7.6/kernel/net/nsh/nsh.ko.zst
INSTALL /lib/modules/6.7.6/kernel/net/hsr/hsr.ko
SIGN /lib/modules/6.7.6/kernel/net/hsr/hsr.ko
ZSTD /lib/modules/6.7.6/kernel/net/hsr/hsr.ko.zst
INSTALL /lib/modules/6.7.6/kernel/net/qrtr/qrtr.ko
SIGN /lib/modules/6.7.6/kernel/net/qrtr/qrtr.ko
ZSTD /lib/modules/6.7.6/kernel/net/qrtr/qrtr.ko.zst
INSTALL /lib/modules/6.7.6/kernel/net/qrtr/qrtr-smd.ko
SIGN /lib/modules/6.7.6/kernel/net/qrtr/qrtr-smd.ko
ZSTD /lib/modules/6.7.6/kernel/net/qrtr/qrtr-smd.ko.zst
INSTALL /lib/modules/6.7.6/kernel/net/qrtr/qrtr-tun.ko
SIGN /lib/modules/6.7.6/kernel/net/qrtr/qrtr-tun.ko
ZSTD /lib/modules/6.7.6/kernel/net/qrtr/qrtr-tun.ko.zst
INSTALL /lib/modules/6.7.6/kernel/net/qrtr/qrtr-mhi.ko
SIGN /lib/modules/6.7.6/kernel/net/qrtr/qrtr-mhi.ko
ZSTD /lib/modules/6.7.6/kernel/net/qrtr/qrtr-mhi.ko.zst
INSTALL /lib/modules/6.7.6/kernel/virt/lib/irqbypass.ko
SIGN /lib/modules/6.7.6/kernel/virt/lib/irqbypass.ko
ZSTD /lib/modules/6.7.6/kernel/virt/lib/irqbypass.ko.zst
DEPMOD /lib/modules/6.7.6
```

sabih@sabih:~/Downloads/linux-6.7.6\$


```
sabih@sabih:~/Downloads/linux-6.7.6$ sudo make install
INSTALL /boot
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 6.7.6 /boot/vmlinuz-6.7.6
update-initramfs: Generating /boot/initrd.img-6.7.6
run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 6.7.6 /boot/vmlinuz-6.7.6
run-parts: executing /etc/kernel/postinst.d/update-notifier 6.7.6 /boot/vmlinuz-6.7.6
run-parts: executing /etc/kernel/postinst.d/xx-update-initrd-links 6.7.6 /boot/vmlinuz-6.7.6
I: /boot/initrd.img is now a symlink to initrd.img-6.7.6
run-parts: executing /etc/kernel/postinst.d/zz-update-grub 6.7.6 /boot/vmlinuz-6.7.6
Sourcing file '/etc/default/grub'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-6.5.0-21-generic
Found initrd image: /boot/initrd.img-6.5.0-21-generic
Found linux image: /boot/vmlinuz-6.7.6
Found initrd image: /boot/initrd.img-6.7.6
Found memtest86+x64 image: /boot/memtest86+x64.bin
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
sabih@sabih:~/Downloads/linux-6.7.6$
```

بروزرسانی initramfs:

```
done
sabih@sabih:~/Downloads/linux-6.7.6$ sudo update-initramfs -c -k 6.7.6
update-initramfs: Generating /boot/initrd.img-6.7.6
sabih@sabih:~/Downloads/linux-6.7.6$
```

بروزرسانی GRUB bootloader:

```
sabih@sabih:~/Downloads/linux-6.7.6$ sudo update-grub
Sourcing file '/etc/default/grub'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-6.5.0-21-generic
Found initrd image: /boot/initrd.img-6.5.0-21-generic
Found linux image: /boot/vmlinuz-6.7.6
Found initrd image: /boot/initrd.img-6.7.6
Found memtest86+x64 image: /boot/memtest86+x64.bin
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
sabih@sabih:~/Downloads/linux-6.7.6$
```

محتوای دایرکتوری boot:

```
sabih@sabih:/boot$ ls
config-6.5.0-21-generic  memtest86+x64.efi
config-6.7.6            System.map-6.5.0-21-generic
config-6.7.6.old        System.map-6.7.6
grub                    System.map-6.7.6.old
initrd.img              vmlinuz
initrd.img-6.5.0-21-generic vmlinuz-6.5.0-21-generic
initrd.img-6.7.6        vmlinuz-6.7.6
memtest86+ia32.bin      vmlinuz-6.7.6.old
memtest86+ia32.efi      vmlinuz.old
memtest86+x64.bin
sabih@sabih:/boot$
```

از آنجایی که الان دو نسخه vmlinuz داریم باید از گراب نسخه را تغییر دهیم.

```
h:~$ sudo nano /etc/default/grub
```

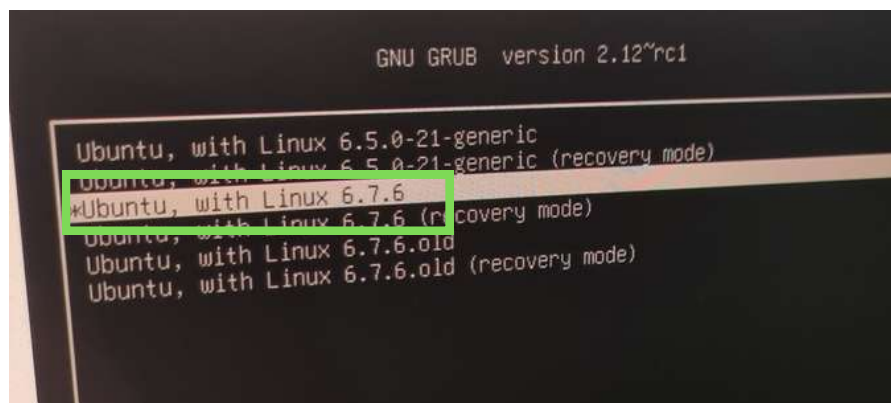
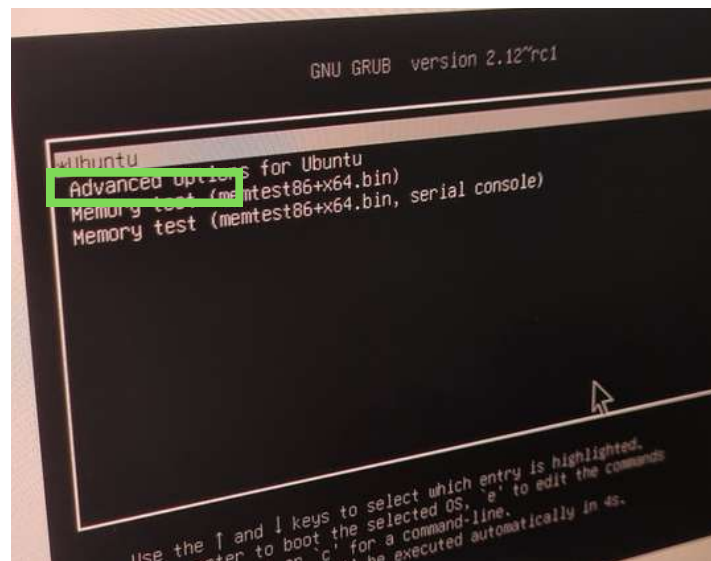
با اجرای دستور بالا تنظیمات گراب را به شکل زیر تغییر می‌دهیم:

```
# /boot/grub/grub.cfg.  
# For full documentation of the options in this file  
#   info -f grub -n 'Simple configuration'  
  
GRUB_DEFAULT=0  
GRUB_TIMEOUT_STYLE=menu  
GRUB_TIMEOUT=5  
GRUB_DISTRIBUTOR=`lsb_release -i -s 2> /dev/null ||  
GRUB_CMDLINE_LINUX_DEFAULT=""  
GRUB_CMDLINE_LINUX=""  
  
# If your computer has multiple operating systems installed, you can
```

خارج کردن گراب از حالت هیدن

```
] password for sabih:  
@sabih:~$ sudo update-grub
```

سیستم را reboot می‌کنیم و گزینه زیر را در گراب انتخاب می‌کنیم:



اجرای `uname -a`:

```
sabih@sabih:~$ uname -a  
Linux sabih 6.7.6 #1 SMP PREEMPT_DYNAMIC Thu Feb 29 15:55:20 EST 2023; root@ubuntu  
_64 x86_64 GNU/Linux  
sabih@sabih:~$
```



نتایج:

- آشنایی با مراحل بوت شدن کامپیوتر
- آشنایی با پیش نیاز های کامپایل کرنل
- آشنایی با مراحل کامپایل کرنل
- کامپایل کرنل