

CAOS Assignment 0

Linux Kernel Compilation




ubuntu

Install Ubuntu Server
Multiple server install with MAAS
Check disc for defects
Test memory
Boot from first hard disk
Rescue a broken system

F1 Help F2 Language F3 Keymap F4 Modes F5 Accessibility F6 Other Options

Screen after inserting bootable

Usb drive



Partitioning the Vdi to for installing the server

[!!] Partition disks

This is an overview of your currently configured partitions and mount points. Select a partition to modify its settings (file system, mount point, etc.), a free space to create partitions, or a device to initialize its partition table.

- Guided partitioning
- Configure software RAID
- Configure the Logical Volume Manager
- Configure encrypted volumes
- Configure iSCSI volumes

SCSI3 (0,0,0) (sda) - 64.4 GB ATA VBOX HARDDISK


#1	primary	999.3 MB	f	swap	swap
#2	primary	63.4 GB	f	ext4	/

Undo changes to partitions

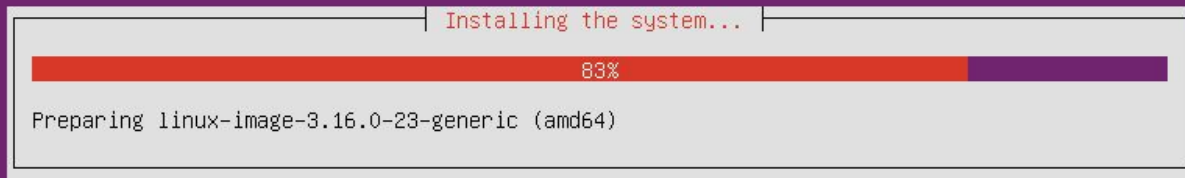
Finish partitioning and write changes to disk


<Go Back>

<F1> for help; <Tab> moves; <Space> selects; <Enter> activates buttons



Installing the main
System with kernel
3.16.0-23





Changing the sources.list
to old-releases to get
updates & upgrades

```
GNU nano 2.2.6                               File: /etc/apt/sources.list                               Modified

#

# deb cdrom:[Ubuntu-Server 14.10 _Utopic Unicorn_ - Release amd64 (20141022.2)]/ utopic main restri$
#deb cdrom:[Ubuntu-Server 14.10 _Utopic Unicorn_ - Release amd64 (20141022.2)]/ utopic main restric$

# See http://help.ubuntu.com/community/UpgradeNotes for how to upgrade to
# newer versions of the distribution.
deb http://old-releases.ubuntu.com/ubuntu/ utopic main restricted universe multiverse
deb-src http://old-releases.ubuntu.com/ubuntu/ utopic main restricted universe multiverse

## Major bug fix updates produced after the final release of the
## distribution.
deb http://old-releases.archive.ubuntu.com/ubuntu/ utopic-updates main restricted universe multiverse
deb-src http://old-releases.archive.ubuntu.com/ubuntu/ utopic-updates main restricted universe mult$

## M.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team. Also, please note that software in universe WILL NOT receive any
## review or updates from the Ubuntu security team.
#deb http://us.archive.ubuntu.com/ubuntu/ utopic universe
#deb-src http://us.archive.ubuntu.com/ubuntu/ utopic universe
#deb http://us.archive.ubuntu.com/ubuntu/ utopic-updates universe
#deb-src http://us.archive.ubuntu.com/ubuntu/ utopic-updates universe

## M.B. software from this repository is ENTIRELY UNSUPPORTED by the Ubuntu
## team, and may not be under a free licence. Please satisfy yourself as to
## your rights to use the software. Also, please note that software in
## multiverse WILL NOT receive any review or updates from the Ubuntu
## security team.
#deb http://us.archive.ubuntu.com/ubuntu/ utopic multiverse
#deb-src http://us.archive.ubuntu.com/ubuntu/ utopic multiverse
#deb http://us.archive.ubuntu.com/ubuntu/ utopic-updates multiverse

^G Get Help      ^O WriteOut     ^R Read File    ^Y Prev Page    ^K Cut Text     ^C Cur Pos
^X Exit          ^J Justify      ^W Where Is     ^V Next Page    ^U UnCut Text   ^T To Spell
```




Installing dependencies

required for

downloading new kernel

```
maalik@maalik-ka-chaos:~$ sudo apt-get install libncurses-dev flex bison dkms libssl-dev libelf-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
Note, selecting 'libncurses5-dev' instead of 'libncurses-dev'
The following extra packages will be installed:
  binutils cpp cpp-4.9 fakeroot gcc gcc-4.9 libasan1 libatomic1 libbison-dev libc-dev-bin
  libc6-dev libcilkrts5 libcloog-isl4 libfakeroot libfl-dev libgcc-4.9-dev libgomp1 libisl10
  libitm1 liblsan0 libmpc3 libquadmath0 libssl-doc libtinfo-dev libtsan0 libubsan0 linux-libc-dev
  m4 make manpages-dev zlib1g-dev
Suggested packages:
  binutils-doc bison-doc cpp-doc gcc-4.9-locales dpkg-dev debhelper build-essential gcc-multilib
  autoconf automake libtool gdb gcc-doc gcc-4.9-multilib gcc-4.9-doc libgcc1-dbg libgomp1-dbg
  libitm1-dbg libatomic1-dbg libasan1-dbg liblsan0-dbg libtsan0-dbg libubsan0-dbg libcilkrts5-dbg
  libquadmath0-dbg glibc-doc ncurses-doc make-doc
The following NEW packages will be installed:
  binutils bison cpp cpp-4.9 dkms fakeroot flex gcc gcc-4.9 libasan1 libatomic1 libbison-dev
  libc-dev-bin libc6-dev libcilkrts5 libcloog-isl4 libelf-dev libfakeroot libfl-dev libgcc-4.9-dev
  libgomp1 libisl10 libitm1 liblsan0 libmpc3 libncurses5-dev libquadmath0 libssl-dev libssl-doc
  libtinfo-dev libtsan0 libubsan0 linux-libc-dev m4 make manpages-dev zlib1g-dev
0 upgraded, 37 newly installed, 0 to remove and 0 not upgraded.
Need to get 24.8 MB of archives.
After this operation, 95.9 MB of additional disk space will be used.
Do you want to continue? [Y/n] _
```



Downloading the kernel
using wget (coz apt-get
was too slow, it can be
seen in the slide)

```
Processing triggers for initramfs-tools (0.103ubuntu8) ...
update-initramfs: Generating /boot/initrd.img-3.16.0-23-generic
Processing triggers for ca-certificates (20141019ubuntu0.14.10.1) ...
Updating certificates in /etc/ssl/certs... 10 added, 5 removed; done.
Running hooks in /etc/ca-certificates/update.d....done.
maalik@maalik-ka-chaos:~$ sudo apt-get source linux-image-$(uname -r)
[sudo] password for maalik:
Reading package lists... Done
Building dependency tree
Reading state information... Done
Picking 'linux' as source package instead of 'linux-image-3.16.0-23-generic'
NOTICE: 'linux' packaging is maintained in the 'Git' version control system at:
http://kernel.ubuntu.com/git-repos/ubuntu/ubuntu-utopic.git
Need to get 128 MB of source archives.
Get:1 http://old-releases.ubuntu.com/ubuntu/ utopic-updates/main linux 3.16.0-44.59 (dsc) [11.2 kB]
Get:2 http://old-releases.ubuntu.com/ubuntu/ utopic-updates/main linux 3.16.0-44.59 (tar) [122 MB]
4% [2 linux 4,639 kB/122 MB 4%] 119 kB/s 17min 17s^
maalik@maalik-ka-chaos:~$ wget https://www.kernel.org/pub/linux/kernel/v3.x/linux-3.16.tar.xz
--2019-08-09 02:39:42-- https://www.kernel.org/pub/linux/kernel/v3.x/linux-3.16.tar.xz
Resolving www.kernel.org (www.kernel.org)... 147.75.46.191, 2604:1380:4080:c00::1
Connecting to www.kernel.org (www.kernel.org):147.75.46.191:443... connected.
HTTP request sent, awaiting response... 301 Moved Permanently
Location: https://mirrors.edge.kernel.org/pub/linux/kernel/v3.x/linux-3.16.tar.xz [following]
--2019-08-09 02:39:43-- https://mirrors.edge.kernel.org/pub/linux/kernel/v3.x/linux-3.16.tar.xz
Resolving mirrors.edge.kernel.org (mirrors.edge.kernel.org)... 147.75.95.133, 2604:1380:3000:1500::1
Connecting to mirrors.edge.kernel.org (mirrors.edge.kernel.org):147.75.95.133:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 80501624 (77M) [application/x-xz]
Saving to: 'linux-3.16.tar.xz'

100%[=====>] 80,501,624  71.7KB/s   in 19m 3s

2019-08-09 02:58:47 (68.8 KB/s) - 'linux-3.16.tar.xz' saved [80501624/80501624]

maalik@maalik-ka-chaos:~$ ls
linux_3.16.0-44.59.dsc  linux_3.16.0.orig.tar.gz  linux-3.16.tar.xz
maalik@maalik-ka-chaos:~$
```




Copying the .config file
from pre installed kernel
Located in /boot

```
# o print "Entering directory ...";
MAKEFLAGS += -rR --no-print-directory

# Avoid funny character set dependencies
unexport LC_ALL
LC_COLLATE=C
LC_NUMERIC=C
export LC_COLLATE LC_NUMERIC

# Avoid interference with shell env settings
unexport GREP_OPTIONS

# We are using a recursive build, so we need to do a little thinking
# to get the ordering right.
#
# Most importantly: sub-Makefiles should only ever modify files in
# their own directory. If in some directory we have a dependency on
# a file in another dir (which doesn't happen often, but it's often
# unavoidable when linking the built-in.o targets which finally
# turn into vmlinux), we will call a sub make in that other dir, and
# after that we are sure that everything which is in that other dir
maalik@maalik-ka-chaos:~/linux-3.16$ ls
arch      crypto    fs        Kbuild    MAINTAINERS  README      security  virt
block     Documentation  include  Kconfig   Makefile     REPORTING-BUGS  sound
COPYING   drivers   init      kernel    mm           samples     tools
CREDITS   firmware  ipc       lib       net          scripts      usr
maalik@maalik-ka-chaos:~/linux-3.16$ ls /boot/
abi-3.16.0-23-generic      initrd.img-3.16.0-23-generic  memtest86+_multiboot.bin
config-3.16.0-23-generic  memtest86+.bin                System.map-3.16.0-23-generic
grub                      memtest86+.elf                vmlinuz-3.16.0-23-generic
maalik@maalik-ka-chaos:~/linux-3.16$ cp /boot/config-3.16.0-23-generic .config
maalik@maalik-ka-chaos:~/linux-3.16$ ls
arch      crypto    fs        Kbuild    MAINTAINERS  README      security  virt
block     Documentation  include  Kconfig   Makefile     REPORTING-BUGS  sound
COPYING   drivers   init      kernel    mm           samples     tools
CREDITS   firmware  ipc       lib       net          scripts      usr
maalik@maalik-ka-chaos:~/linux-3.16$
```



The original Makefile

Then add custom string
to EXTRAVERSION

```
VERSION = 3
PATCHLEVEL = 16
SUBLEVEL = 0
EXTRAVERSION =
NAME = Shuffling Zombie Juror


# *DOCUMENTATION*
# To see a list of typical targets execute "make help"
# More info can be located in ./README
# Comments in this file are targeted only to the developer, do not
# expect to learn how to build the kernel reading this file.

# Do not:
# o use make's built-in rules and variables
#   (this increases performance and avoids hard-to-debug behaviour);
# o print "Entering directory ...";
MAKEFLAGS += -rR --no-print-directory

# Avoid funny character set dependencies
unexport LC_ALL
LC_COLLATE=C
LC_NUMERIC=C
export LC_COLLATE LC_NUMERIC

# Avoid interference with shell env settings
unexport GREP_OPTIONS

# We are using a recursive build, so we need to do a little thinking
# to get the ordering right.
#
# Most importantly: sub-Makefiles should only ever modify files in
# their own directory. If in some directory we have a dependency on
# a file in another dir (which doesn't happen often, but it's often
# unavoidable when linking the built-in.o targets which finally
# turn into vmlinux), we will call a sub make in that other dir, and
# after that we are sure that everything which is in that other dir
"Makefile" 1545L, 52342C
```

```
# We are using a recursive build, so we need to do a little thinking
# to get the ordering right.
```

```
#
# Most importantly: sub-Makefiles should only ever modify files in
# their own directory. If in some directory we have a dependency on
# a file in another dir (which doesn't happen often, but it's often
# unavoidable when linking the built-in.o targets which finally
# turn into vmlinux), we will call a sub make in that other dir, and
# after that we are sure that everything which is in that other dir
# "Makefile" 1545L, 52348C written
```

```
maalik@maalik-ka-chaos:~/linux-3.16$ ls
```

arch	crypto	fs	Kbuild	MAINTAINERS	README	security	virt
block	Documentation	include	Kconfig	Makefile	REPORTING-BUGS	sound	
COPYING	drivers	init	kernel	mm	samples	tools	
CREDITS	firmware	ipc	lib	net	scripts	usr	

```
maalik@maalik-ka-chaos:~/linux-3.16$ make defconfig
```

```
HOSTCC scripts/basic/fixdep
HOSTCC scripts/kconfig/conf.o
SHIPPED scripts/kconfig/zconf.tab.c
SHIPPED scripts/kconfig/zconf.lex.c
SHIPPED scripts/kconfig/zconf.hash.c
HOSTCC scripts/kconfig/zconf.tab.o
```

```
In file included from scripts/kconfig/zconf.tab.c:2537:0:
```

```
scripts/kconfig/menu.c: In function 'get_symbol_str':
```

```
scripts/kconfig/menu.c:590:18: warning: 'jump' may be used uninitialized in this function [-Wmaybe-uninitialized]
    jump->offset = strlen(r->s);
                        ^
```

```
scripts/kconfig/menu.c:551:19: note: 'jump' was declared here
    struct jump_key *jump;
                        ^
```

```
HOSTLD scripts/kconfig/conf
```

```
*** Default configuration is based on 'x86_64_defconfig'
```

```
#
```

```
# configuration written to .config
```

```
#
```

```
maalik@maalik-ka-chaos:~/linux-3.16$
```

Using \$make defconfig

to make default

configuration




\$make -j4

To make the kernel

using 4 processor

```
CC      net/netfilter/xt_nat.mod.o
LD [M]  arch/x86/kernel/iosf_mbi.ko
LD [M]  drivers/thermal/x86_pkg_temp_thermal.ko
GZIP    arch/x86/boot/compressed/vmlinux.bin.gz
LD [M]  net/ipv4/netfilter/ipt_MASQUERADE.ko
LD [M]  net/ipv4/netfilter/iptable_nat.ko
LD [M]  net/ipv4/netfilter/nf_nat_ipv4.ko
LD [M]  net/netfilter/nf_nat.ko
LD [M]  net/netfilter/nf_nat_ftp.ko
LD [M]  net/netfilter/nf_nat_irc.ko
LD [M]  net/netfilter/nf_nat_sip.ko
LD [M]  net/netfilter/xt_LOG.ko
CC      arch/x86/boot/video.o
LD [M]  net/netfilter/xt_mark.ko
CC      arch/x86/boot/video-mode.o
LD [M]  net/netfilter/xt_nat.ko
CC      arch/x86/boot/version.o
CC      arch/x86/boot/video-vga.o
CC      arch/x86/boot/video-vesa.o
CC      arch/x86/boot/video-bios.o
HOSTCC  arch/x86/boot/tools/build
CPUSTR  arch/x86/boot/cpustr.h
CC      arch/x86/boot/cpu.o
MKPIGGY arch/x86/boot/compressed/piggy.S
AS      arch/x86/boot/compressed/piggy.o
LD      arch/x86/boot/compressed/vmlinux
ZOFFSET arch/x86/boot/zoffset.h
OBJCOPY arch/x86/boot/vmlinux.bin
AS      arch/x86/boot/header.o
LD      arch/x86/boot/setup.elf
OBJCOPY arch/x86/boot/setup.bin
BUILD  arch/x86/boot/bzImage
Setup is 15676 bytes (padded to 15872 bytes).
System is 5571 kB
CRC d0dbbf73
Kernel: arch/x86/boot/bzImage is ready (#1)
maalik@maalik-ka-chaos:~/linux-3.16$ make -j4_
```



Installing modules for the kernel

```
BUILD arch/x86/boot/bzImage
Setup is 15676 bytes (padded to 15872 bytes).
System is 5571 kB
CRC d0dbbf73
Kernel: arch/x86/boot/bzImage is ready (#1)
maalik@maalik-ka-chaos:~/linux-3.16$ sudo make modules_install install
[sudo] password for maalik:
INSTALL arch/x86/kernel/iosf_mbi.ko
INSTALL drivers/thermal/x86_pkg_temp_thermal.ko
INSTALL net/ipv4/netfilter/ipt_MASQUERADE.ko
INSTALL net/ipv4/netfilter/iptable_nat.ko
INSTALL net/ipv4/netfilter/nf_nat_ipv4.ko
INSTALL net/netfilter/nf_nat.ko
INSTALL net/netfilter/nf_nat_ftp.ko
INSTALL net/netfilter/nf_nat_irc.ko
INSTALL net/netfilter/nf_nat_sip.ko
INSTALL net/netfilter/xt_LOG.ko
INSTALL net/netfilter/xt_mark.ko
INSTALL net/netfilter/xt_nat.ko
DEPMOD 3.16.0MAALIK
sh ./arch/x86/boot/install.sh 3.16.0MAALIK arch/x86/boot/bzImage \
    System.map "/boot"
run-parts: executing /etc/kernel/postinst.d/apt-auto-removal 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/dkms 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
update-initramfs: Generating /boot/initrd.img-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/update-notifier 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/zz-update-grub 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-3.16.0-23-generic
Found initrd image: /boot/initrd.img-3.16.0-23-generic
Found linux image: /boot/vmlinuz-3.16.0MAALIK
Found initrd image: /boot/initrd.img-3.16.0MAALIK
Found memtest86+ image: /boot/memtest86+.elf
Found memtest86+ image: /boot/memtest86+.bin
done
maalik@maalik-ka-chaos:~/linux-3.16$ _
```



Updating the grub
menu for the new kernel

```
INSTALL net/netfilter/nf_nat_sip.ko
INSTALL net/netfilter/xt_LOG.ko
INSTALL net/netfilter/xt_mark.ko
INSTALL net/netfilter/xt_nat.ko
DEPMOD 3.16.0MAALIK
sh ./arch/x86/boot/install.sh 3.16.0MAALIK arch/x86/boot/bzImage \
    System.map "/boot"
run-parts: executing /etc/kernel/postinst.d/apt-auto-removal 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/dkms 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
update-initramfs: Generating /boot/initrd.img-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/update-notifier 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
run-parts: executing /etc/kernel/postinst.d/zz-update-grub 3.16.0MAALIK /boot/vmlinuz-3.16.0MAALIK
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-3.16.0-23-generic
Found initrd image: /boot/initrd.img-3.16.0-23-generic
Found linux image: /boot/vmlinuz-3.16.0MAALIK
Found initrd image: /boot/initrd.img-3.16.0MAALIK
Found memtest86+ image: /boot/memtest86+.elf
Found memtest86+ image: /boot/memtest86+.bin
done
maalik@maalik-ka-chaos:~/linux-3.16$ ls
arch      Documentation  init          lib           modules.order  samples      tools
block     drivers       ipc           MAINTAINERS  Module.symvers  scripts      usr
COPYING   firmware      Kbuild       Makefile     net             security     virt
CREDITS   fs            Kconfig      mm           README          sound        vmlinux
crypto    include       kernel       modules.builtin  REPORTING-BUGS  System.map  vmlinux.o
maalik@maalik-ka-chaos:~/linux-3.16$ sudo update-grub2
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-3.16.0-23-generic
Found initrd image: /boot/initrd.img-3.16.0-23-generic
Found linux image: /boot/vmlinuz-3.16.0MAALIK
Found initrd image: /boot/initrd.img-3.16.0MAALIK
Found memtest86+ image: /boot/memtest86+.elf
Found memtest86+ image: /boot/memtest86+.bin
done
maalik@maalik-ka-chaos:~/linux-3.16$ _
```



Final grub menu
with custom string
in the new kernel

GNU GRUB version 2.02~beta2-15ubuntu0.1

```
*Ubuntu, with Linux 3.16.0-23-generic
Ubuntu, with Linux 3.16.0-23-generic (recovery mode)
Ubuntu, with Linux 3.16.0MAALIK
Ubuntu, with Linux 3.16.0MAALIK (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. ESC to return previous
menu.



Showing the final
kernel with `uname -r`
& `uname -a`

```
System load: 1.51          Processes:      101
Usage of /:  4.1% of 58.01GB Users logged in: 0
Memory usage: 2%          IP address for eth0: 10.0.2.15
Swap usage:  0%
```

```
Graph this data and manage this system at:
https://landscape.canonical.com/
```

```
Your Ubuntu release is not supported anymore.
For upgrade information, please visit:
http://www.ubuntu.com/releaseendoflife
```

```
New release '15.04' available.
Run 'do-release-upgrade' to upgrade to it.
```

```
[ 50.020716] systemd-logind[1954]: Failed to start unit user@1000.service: Unknown unit: user@1000.service
[ 50.021055] systemd-logind[1954]: Failed to start user service: Unknown unit: user@1000.service
maalik@maalik-ka-chaos:~$ uname -r
3.16.0MAALIK
maalik@maalik-ka-chaos:~$ uname -a
Linux maalik-ka-chaos 3.16.0MAALIK #1 SMP Fri Aug 9 03:08:02 IST 2019 x86_64 x86_64 x86_64 GNU/Linux
maalik@maalik-ka-chaos:~$ _
```