

# Task1

## Step1 - 配置 Busybox

Bash

```
1 cd busybox-1.36.1
2 make menuconfig
```

BusyBox 1.36.1 Configuration

### Settings

Arrow keys navigate the menu. <Enter> selects submenus --->. Highlighted letters are hotkeys. Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search. Legend: [\*] built-in [ ] excluded <M> module < > module capable

↑(-)

```
[*] Support --show SCRIPT
[*] Support --install [-s] to install applet links at runtime
[ ] Don't use /usr
[*] Drop SUID state for most applets
[*] Enable SUID configuration via /etc/busybox.conf
[*] Suppress warning message if /etc/busybox.conf is not readable
[ ] exec prefers applets
(/proc/self/exe) Path to busybox executable
[ ] Support NSA Security Enhanced Linux
[ ] Clean up all memory before exiting (usually not needed)
[*] Support LOG_INFO level syslog messages
--- Build Options
[*] Build static binary (no shared libs)
[ ] Force NOMMU build
() Cross compiler prefix
() Path to sysroot
```

↓(+)

<Select> < Exit > < Help >

```

→ make menuconfig
scripts/kconfig/mconf Config.in
#
# using defaults found in .config
#
*** End of configuration.
*** Execute 'make' to build the project or try 'make help'.

```

Bash

```
1 make install -j$(nproc)
```

```

-----
You will probably need to make your busybox binary
setuid root to ensure all configured applets will
work properly.
-----

```

## Step2 - 安装 Qemu

Bash

```

1 sudo apt install qemu-system-x86
2 qemu-system-x86_64 --version

```

```

→ qemu-system-x86_64 --version
QEMU emulator version 4.2.1 (Debian 1:4.2-3ubuntu6.27)
Copyright (c) 2003-2019 Fabrice Bellard and the QEMU Project developers

```

## Step3 - 安装 Rust

```
cicv-r4l-Lolioy/linux on master
→ rustc --version
rustc 1.62.0 (a8314ef7d 2022-06-27)
cicv-r4l-Lolioy/linux on master
→ cargo --version
cargo 1.62.0 (a748cf5a3 2022-06-08)
```

## Step4 - 配置 Linux 文件夹

Bash

```
1 rustup override set $(scripts/min-tool-version.sh rustc)
```

```
cicv-r4l-Lolioy/linux on master
→ rustup override set $(scripts/min-tool-version.sh rustc)
info: using existing install for '1.62.0-x86_64-unknown-linux-gnu'
info: override toolchain for '/home/lolioy/Workspace/rust/cicv-r4l-Lolioy/linux' set to '1.62.0-x86_64-unknown-linux-gnu'
1.62.0-x86_64-unknown-linux-gnu unchanged -- rustc 1.62.0 (a8314ef7d 2022-06-27)
```

Bash

```
1 rustup component add rust-src
```

```
cicv-r4l-Lolioy/linux on master
→ rustup component add rust-src
info: component 'rust-src' is up to date
```

Bash

```
1 sudo apt install clang llvm
```

```
..Loloiy/linux  X + v
5 CodeQL warning go/incorrect-integer-conversion Incorrect conversion
6 CodeQL warning go/incorrect-integer-conversion Incorrect conversion
cicv-r4l-Loloiy/linux on master
> sudo apt install clang llvm
Reading package lists... Done
Building dependency tree
Reading state information... Done
clang is already the newest version (1:10.0-50~exp1).
llvm is already the newest version (1:10.0-50~exp1).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
```

Bash

```
1 cargo install --locked --version $(scripts/min-tool-version.sh bindgen) bindgen
```

```
..Loloiy/linux  X + v
5 CodeQL warning go/incorrect-integer-conversion Incorrect conversion ... pkg/service/not
6 CodeQL warning go/incorrect-integer-conversion Incorrect conversion ... pkg/service/use
cicv-r4l-Loloiy/linux on master
→ cargo install --locked --version $(scripts/min-tool-version.sh bindgen) bindgen
Ignored package `bindgen v0.56.0` is already installed, use --force to override
```

Bash

```
1 rustup component add rustfmt
2 rustup component add clippy
```

```
..Loloiy/linux  X + v
5 CodeQL warning go/incorrect-integer-conversion Incorrect conversion ... pkg/service
6 CodeQL warning go/incorrect-integer-conversion Incorrect conversion ... pkg/service
cicv-r4l-Loloiy/linux on master
→ rustup component add rustfmt
info: component 'rustfmt' for target 'x86_64-unknown-linux-gnu' is up to date
cicv-r4l-Loloiy/linux on master
→ rustup component add clippy
info: component 'clippy' for target 'x86_64-unknown-linux-gnu' is up to date
```

Bash

```
1 make LLVM=1 rustavailable
```

```
cicv-r4l-Lolioy/linux on ↗ master [?]  
> # make LLVM=1 rustavailable  
Rust is available!
```

## Step5 - 配置内核

Bash

```
1 make x86_64_defconfig
```

```
cicv-r4l-Lolioy/linux on □ master  
> make x86_64_defconfig  
HOSTCC scripts/basic/fixdep  
HOSTCC scripts/kconfig/conf.o  
HOSTCC scripts/kconfig/confdata.o  
HOSTCC scripts/kconfig/expr.o  
LEX scripts/kconfig/lexer.lex.c  
YACC scripts/kconfig/parser.tab.[ch]  
HOSTCC scripts/kconfig/lexer.lex.o  
HOSTCC scripts/kconfig/menu.o  
HOSTCC scripts/kconfig/parser.tab.o  
HOSTCC scripts/kconfig/preprocess.o  
HOSTCC scripts/kconfig/symbol.o  
HOSTCC scripts/kconfig/util.o  
HOSTLD scripts/kconfig/conf  
#  
# configuration written to .config  
#
```

## Step6 - 自定义配置

Bash

```
1 make LLVM=1 menuconfig
```

```
cicv-r4l-Loliy/linux on □ master
> make LLVM=1 menuconfig
HOSTCC  scripts/basic/fixdep
HOSTCC  scripts/kconfig/confdata.o
HOSTCC  scripts/kconfig/expr.o
HOSTCC  scripts/kconfig/lexer.lex.o
HOSTCC  scripts/kconfig/menu.o
HOSTCC  scripts/kconfig/parser.tab.o
HOSTCC  scripts/kconfig/preprocess.o
HOSTCC  scripts/kconfig/symbol.o
HOSTCC  scripts/kconfig/util.o
UPD      scripts/kconfig/mconf-cfg
HOSTCC  scripts/kconfig/mconf.o
HOSTCC  scripts/kconfig/lxdialog/checklist.o
HOSTCC  scripts/kconfig/lxdialog/inputbox.o
HOSTCC  scripts/kconfig/lxdialog/menubox.o
HOSTCC  scripts/kconfig/lxdialog/textbox.o
HOSTCC  scripts/kconfig/lxdialog/util.o
HOSTCC  scripts/kconfig/lxdialog/yesno.o
HOSTLD  scripts/kconfig/mconf

*** End of the configuration.
*** Execute 'make' to start the build or try 'make help'.
```



```
.config ~ Linux/x86 6.1.0-rc1 Kernel Configuration

Linux/x86 6.1.0-rc1 Kernel Configuration
Arrow keys navigate the menu. <Enter> selects submenus ----> (or empty submenus ----). Highlighted letters are hotkeys. Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search. Legend: [*] built-in [ ] excluded <M> module < > module capable

General setup ---->
[*] 64-bit kernel
Processor type and features ---->
[*] Mitigations for speculative execution vulnerabilities ---->
Power management and ACPI options ---->
Bus options (PCI etc.) ---->
Binary Emulations ---->
[*] Virtualization ---->
General architecture-dependent options ---->
[*] Enable loadable module support ---->
-- Enable the block layer ---->
Executable file formats ---->
Memory Management options ---->
[*] Networking support ---->
Device Drivers ---->
File systems ---->
Security options ---->
-- Cryptographic API ---->
v(+)

<Select> < Exit > < Help > < Save > < Load >
```

```
.config ~ Linux/x86 6.1.0-rc1 Kernel Configuration
> General setup

General setup
Arrow keys navigate the menu. <Enter> selects submenus ----> (or empty submenus ----). Highlighted letters are hotkeys. Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search. Legend: [*] built-in [ ] excluded <M> module < > module capable


^(-)
-- Kernel->user space relay support (formerly relayfs)
[*] Initial RAM filesystem and RAM disk (initramfs/initrd) support
() Initramfs source file(s)
[*] Support initial ramdisk/ramfs compressed using gzip
[*] Support initial ramdisk/ramfs compressed using bzip2
[*] Support initial ramdisk/ramfs compressed using LZMA
[*] Support initial ramdisk/ramfs compressed using XZ
[*] Support initial ramdisk/ramfs compressed using LZ0
[*] Support initial ramdisk/ramfs compressed using LZ4
[*] Support initial ramdisk/ramfs compressed using ZSTD
[ ] Boot config support
[*] Preserve cpio archive mtimes in initramfs
Compiler optimization level (Optimize for performance (-O2)) ---->
[ ] Configure standard kernel features (expert users) ---->
[ ] Embedded system
Kernel Performance Events And Counters ---->
[*] Profiling support
[*] Rust support

<Select> < Exit > < Help > < Save > < Load >
```

## Step7 - 编译 Linux 内核

Bash

```
1 make LLVM=1 -j$(nproc)
```

cicv-r4l-loliyo/linux on  master [?] took 6m

> file vmlinux

vmlinux: ELF 64-bit LSB executable, x86-64, version 1 (SYSV), statically linked, BuildID[sha1]=ec34cbd2f15e4b3743d08f36b15099fb720aff8b, not stripped