

Простейшая кастомная FS.

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>

int main(void)
{
    printf("HELL 0000 (levin)!!!\n");
    sleep(20);
    return 0;
}
```

```
user@vm:/CLINUX/homeworks/cross_build_fs$ arm-linux-gnueabi-gcc -static init.c -o init
```

```
user@vm:/CLINUX/homeworks/cross_build_fs$ echo init | cpio -o -H newc | gzip > initramfs.cpio.gz
1032 blocks
```

```
user@vm:/CLINUX/kernel/linux/arch/arm/boot/dts$
user@vm:/CLINUX/homeworks/cross_build_fs/part1$ QEMU_AUDIO_DRV=none qemu-system-arm -M vexpress-a9 -kernel zImage -dtb vexp
ress-v2p-ca9.dtb -initrd initramfs.cpio.gz -append "console=ttyAMA0" -nographic
[ 0.000000] Booting Linux on physical CPU 0x0
[ 0.000000] Linux version 5.19.0Levin_DD_kernel-dirty (user@vm) (arm-linux-gnueabi-gcc (Ubuntu 10.5.0-1ubuntu1) 10.5.0
, GNU ld (GNU Binutils for Ubuntu) 2.41) #1 SMP Tue Jul 2 21:58:18 +07 2024
[ 0.000000] CPU: ARMv7 Processor [410fc090] revision 0 (ARMv7), cr=10c5387d
[ 0.000000] CPU: PIPT / VIPT nonaliasing data cache, VIPT nonaliasing instruction cache
[ 0.000000] OF: fdt: Machine model: V2P-CA9
[ 0.000000] Memory policy: Data cache writeback
[ 0.000000] efi: UEFI not found.
[ 0.000000] Reserved memory: created DMA memory pool at 0x4c000000, size 8 MiB
[ 0.000000] OF: reserved mem: initialized node vram@4c000000, compatible id shared-dma-pool
[ 0.000000] cma: Failed to reserve 64 MiB
[ 0.000000] Zone ranges:
[ 0.000000]   DMA      [mem 0x0000000060000000-0x0000000067ffffff]
[ 0.000000]   Normal  empty
[ 0.000000]   HighMem  empty
[ 0.000000] Movable zone start for each node
[ 0.000000] Early memory node ranges
[ 0.000000]   node 0: [mem 0x0000000060000000-0x0000000067ffffff]
[ 0.000000] Initmem setup node 0 [mem 0x0000000060000000-0x0000000067ffffff]
[ 0.000000] CPU: All CPU(s) started in SVC mode
```

```
[ 2.100870] dart-pt011 10009000.dart: no DMA platform data
[ 2.143511] Freeing unused kernel image (initmem) memory: 2048K
[ 2.152559] input: AT Raw Set 2 keyboard as /devices/platform/bus@40000000/bus@40000000:motherboard-bus@40000000/bus@400
00000:motherboard-bus@40000000:iofpga@7,00000000/10006000.kmi/serio0/input/input0
[ 2.163373] Run /init as init process
HELL 0000 (levin)!!!
[ 2.874476] input: ImExPS/2 Generic Explorer Mouse as /devices/platform/bus@40000000/bus@40000000:motherboard-bus@400000
00/bus@40000000:motherboard-bus@40000000:iofpga@7,00000000/10007000.kmi/serio1/input/input2
[ 22.215644] Kernel panic - not syncing: Attempted to kill init! exitcode=0x00000000
[ 22.216133] CPU: 0 PID: 1 Comm: init Not tainted 5.19.0Levin_DD_kernel-dirty #1
[ 22.216436] Hardware name: ARM-Versatile Express
[ 22.217101] unwind_backtrace from show_stack+0x10/0x14
[ 22.217876] show_stack from dump_stack_lvl+0x40/0x4c
[ 22.218049] dump_stack_lvl from panic+0x108/0x33c
[ 22.218284] panic from do_exit+0x92c/0x930
[ 22.218421] do_exit from do_group_exit+0x34/0x98
[ 22.218566] do_group_exit from __wake_up_parent+0x0/0x18
[ 22.219271] ---[ end Kernel panic - not syncing: Attempted to kill init! exitcode=0x00000000 ]---
```

FS от BusyBox

```
user@vm:/CLINUX/kernel/busybox-1.36.1$ ARCH=arm make defconfig
```

```
HOSTCC scripts/basic/fixdep
HOSTCC scripts/basic/split-include
HOSTCC scripts/basic/docproc
GEN include/applets.h
GEN include/usage.h
GEN networking/Kbuild
GEN networking/Config.in
GEN networking/libiproute/Kbuild
GEN networking/udhcp/Kbuild
GEN networking/udhcp/Config.in
GEN console-tools/Kbuild
GEN console-tools/Config.in
GEN libpwdgrp/Kbuild
GEN syslogd/Kbuild
GEN syslogd/Config.in
GEN shell/Kbuild
GEN shell/Config.in
```

```
user@vm:/CLINUX/kernel/busybox-1.36.1$ ARCH=arm make menuconfig
```

```
HOSTLD scripts/kconfig/mconf
HOSTCC scripts/kconfig/lxdialog/checklist.o
HOSTCC scripts/kconfig/lxdialog/inputbox.o
HOSTCC scripts/kconfig/lxdialog/lxdialog.o
HOSTCC scripts/kconfig/lxdialog/menubox.o
HOSTCC scripts/kconfig/lxdialog/msgbox.o
HOSTCC scripts/kconfig/lxdialog/textbox.o
```

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 files > 2 GB
[ ] Support PAM (Pluggable Authentication Modules)
[*] Use the devpts filesystem for Unix98 PTYs
[*] Support utmp file
[*] Support wtmp file
[*] Support writing pidfiles
(/var/run) Directory for pidfiles
[*] Include busybox applet
[*] 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
(arm-linux-gnueabihf-) Cross compiler prefix
() Path to sysroot
() Additional CFLAGS
() Additional LDFLAGS
() Additional LDLIBS
[ ] Avoid using GCC-specific code constructs
[*] Use -mpreferred-stack-boundary=2 on i386 arch
[*] Use -static-libgcc
--- Installation Options ("make install" behavior)
What kind of applet links to install (as soft-links) --->
↓(+)

```

<Select> < Exit > < Help >

```

HOSTCC scripts/kconfig/xdialog/textbox.o
HOSTCC scripts/kconfig/xdialog/util.o
HOSTCC scripts/kconfig/xdialog/yesno.o
HOSTLD scripts/kconfig/xdialog/xdialog
scripts/kconfig/mconf Config.in

```

```

#
# using defaults found in .config
#

```

```

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

```

```

user@vm:/CLINUX/kernel/busybox-1.36.1$ ARCH=arm make -j 12
SPLIT include/autoconf.h -> include/config/*
GEN include/bbconfigopts.h
GEN include/common_bufsiz.h
GEN include/embedded_scripts.h
HOSTCC applets/usage
HOSTCC applets/applet_tables

```

```
AR      util-linux/lib.a
AR      shell/lib.a
LINK    busybox_unstripped
Static linking against glibc, can't use --gc-sections
Trying libraries: m resolv rt
Library m is needed, can't exclude it (yet)
Library resolv is needed, can't exclude it (yet)
Library rt is not needed, excluding it
Library m is needed, can't exclude it (yet)
Library resolv is needed, can't exclude it (yet)
Final link with: m resolv
```

```
user@vm:/CLINUX/kernel/busybox-1.36.1$ ARCH=arm make install
./_install//bin/arch -> busybox
./_install//bin/ash -> busybox
./_install//bin/base32 -> busybox
./_install//bin/base64 -> busybox
./_install//bin/cat -> busybox
./_install//bin/chattr -> busybox
./_install//bin/chgrp -> busybox
./_install//bin/chmod -> busybox
./_install//bin/chown -> busybox
./_install//bin/conspy -> busybox
./_install//bin/cp -> busybox
./_install//bin/cpio -> busybox
./_install//bin/cttyhack -> busybox
./_install//bin/date -> busybox
./_install//bin/dd -> busybox
./_install//bin/df -> busybox
./_install//bin/dmesg -> busybox
./_install//bin/dnsdomainname -> busybox
./_install//bin/dumpkmap -> busybox
```

```
./_install//usr/sbin/ubdrename -> ../../bin/busybox
./_install//usr/sbin/ubirmvol -> ../../bin/busybox
./_install//usr/sbin/ubirsvol -> ../../bin/busybox
./_install//usr/sbin/ubiupdatevol -> ../../bin/busybox
./_install//usr/sbin/udhcpd -> ../../bin/busybox
```

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

```
user@vm:/CLINUX/kernel/busybox-1.36.1/_install$ rm @linuxrc
```

```
user@vm:/CLINUX/kernel/busybox-1.36.1/_install$ find . | cpio -o -H newc | gzip > initramfs.cpio.gz
3317 blocks
```

```

user@vm:/CLINUX/kernel/busybox-1.36.1/_install$
user@vm:/CLINUX/homeworks/cross_build_fs/part2$ QEMU_AUDIO_DRV=none qemu-system-arm -M vexpress-a9 -kernel zImage -dtb vexp
ress-v2p-ca9.dtb -initrd initramfs.cpio.gz -append "console=ttyAMA0 rdinit=/bin/ash" -nographic
[ 0.000000] Booting Linux on physical CPU 0x0
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[ 0.000000]   HighMem  empty
[ 0.000000] Movable zone start for each node
[ 0.000000] Early memory node ranges
[ 0.000000]   node 0: [mem 0x0000000060000000-0x0000000067ffffff]
[ 0.000000] Initmem setup node 0 [mem 0x0000000060000000-0x0000000067ffffff]
[ 0.000000] CPU: All CPU(s) started in SVC mode.
[ 0.000000] percpu: Embedded 16 pages/cpu s34260 r8192 d23084 u65536
[ 0.000000] Built 1 zonelists, mobility grouping on. Total pages: 32512
[ 0.000000] Kernel command line: console=ttyAMA0 rdinit=/bin/ash
[ 0.000000] Dentry cache hash table entries: 16384 (order: 4, 65536 bytes, linear)

```

```

[ 2.103223] NET: Registered PF_PACKET protocol family
[ 2.103345] can: controller area network core
[ 2.103636] NET: Registered PF_CAN protocol family
[ 2.103667] can: raw protocol
[ 2.103767] can: broadcast manager protocol
[ 2.103866] can: netlink gateway - max_hops=1
[ 2.105218] Key type dns_resolver registered
[ 2.105481] ThumbEE CPU extension supported.
[ 2.105539] Registering SWP/SWPB emulation handler
[ 2.107145] Loading compiled-in X.509 certificates
[ 2.123594] mmci-pl18x 10005000.mmci: Got CD GPIO
[ 2.123711] mmci-pl18x 10005000.mmci: Got WP GPIO
[ 2.126351] mmci-pl18x 10005000.mmci: mmc0: PL181 manf 41 rev0 at 0x10005000 irq 32,33 (pio)
[ 2.165041] 10009000.uart: ttyAMA0 at MMIO 0x10009000 (irq = 36, base_baud = 0) is a PL011 rev1
[ 2.200930] printk: console [ttyAMA0] enabled
[ 2.203026] 1000a000.uart: ttyAMA1 at MMIO 0x1000a000 (irq = 37, base_baud = 0) is a PL011 rev1
[ 2.204266] 1000b000.uart: ttyAMA2 at MMIO 0x1000b000 (irq = 38, base_baud = 0) is a PL011 rev1
[ 2.205499] 1000c000.uart: ttyAMA3 at MMIO 0x1000c000 (irq = 39, base_baud = 0) is a PL011 rev1
[ 2.209605] rtc-pl031 10017000.rtc: registered as rtc0
[ 2.210969] rtc-pl031 10017000.rtc: setting system clock to 2024-07-02T15:41:03 UTC (1719934863)
[ 2.219637] uart-pl011 10009000.uart: no DMA platform data
[ 2.261548] Freeing unused kernel image (initmem) memory: 2048K
[ 2.271211] input: AT Raw Set 2 keyboard as /devices/platform/bus@40000000/bus@40000000:motherboard-bus@40000000/bus@400
00000:motherboard-bus@40000000:iofpga@7,00000000/10006000.kmi/serio0/input/input0
[ 2.283101] Run /bin/ash as init process
/bin/ash: can't access tty; job control turned off
~ # [ 2.928612] input: ImExPS/2 Generic Explorer Mouse as /devices/platform/bus@40000000/bus@40000000:motherboard-bus@40
000000/bus@40000000:motherboard-bus@40000000:iofpga@7,00000000/10007000.kmi/serio1/input/input2
ls
bin          initramfs.cpio.gz  sbin
dev          root              usr
~ # rm initramfs.cpio.gz
~ # ls
bin  dev  root  sbin  usr
~ #

```