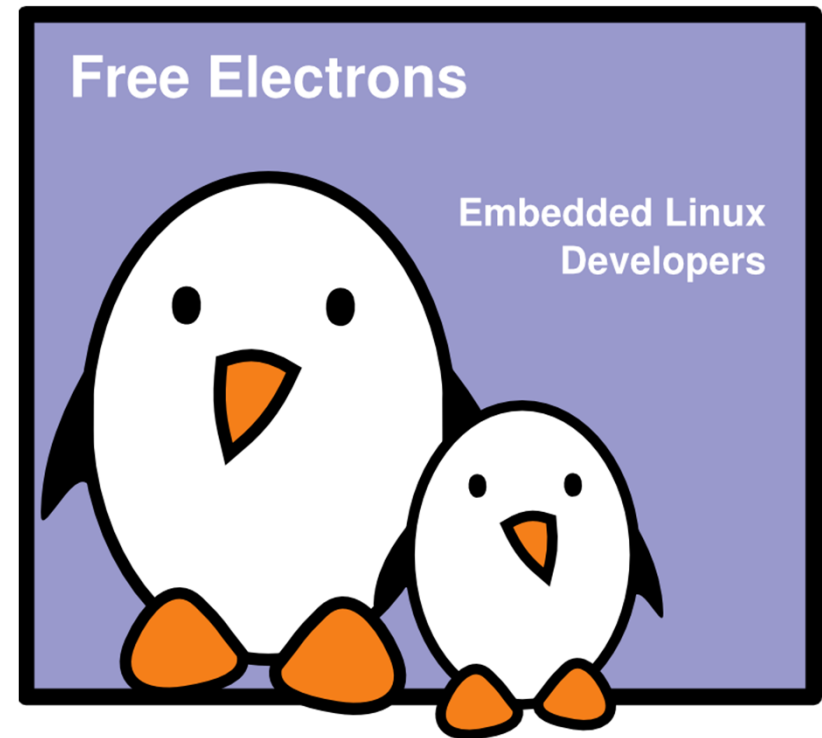# 08-1 BusyBox

The Swiss Army Knife of Embedded Linux

Embedded Linux system development

BusyBox

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Free Electrons

Why Busybox?

- A Linux system needs a basic set of programs to work
    - An init program
    - A shell
    - Various basic utilities for manipulation and system configuration
- In normal Linux systems, those programs are provided by different projects
    - `coreutils`, `bash`, `grep`, `sed`, `tar`, `wget`, `modutils`, etc. are all different projects
    - A lot of divergent components to integrate
    - Components not designed with embedded systems constraints in mind: they are not very configurable and have a wide range of features
- Busybox is an alternative solution, extremely common on embedded systems

General purpose toolbox: BusyBox

- Rewrite of many useful Unix command line utilities
  - Integrated into a single project, which makes it easy to work with
  - Designed with embedded systems in mind: highly congurable, no unnecessary features
- All the utilities are compiled into a single executable, `/bin/busybox`
  - Symbolic links to `/bin/busybox` are created for each application integrated into Busybox
- For a fairly featureful configuration, less than 500 KB (statically compiled with uClibc) or less than 1 MB (statically compiled with glibc).
- http://www.busybox.net/

BusyBox commands!

Currently defined functions:
[, [[, acpid, add-shell, addgroup, adduser, adjtimex, arp, arping, ash, awk, base64, basename, beep, blkid, blockdev, bootchartd, brctl, bunzip2, bzcat, bzip2, cal, cat, catv, chat, chattr, chgrp, chmod, chown, chpasswd, chpst, chroot, chrt, chvt, cksum, clear, cmp, comm, conspy, cp, cpio, crond, crontab, cryptpw, cttyhack, cut, date, dc, dd, deallocvt, delgroup, deluser, depmod, devmem, df, dhcprelay, diff, dirname, dmesg, dnsd, dnsdomainname, dos2unix, du, dumpkmap, dumpleases, echo, ed, egrep, eject, env, envdir, envuidgid, ether-wake, expand, expr, fakeidentd, false, fatattr, fbset, fbsplash, fdflush, fdformat, fdisk, fgconsole, fgrep, find, findfs, flock, fold, free, freeramdisk, fsck, fsck.minix, fstrim, fsync, ftpd, ftpget, ftpput, fuser, getopt, getty, grep, groups, gunzip, gzip, halt, hd, hdparm, head, hexdump, hostid, hostname, httpd, hush, hwclock, id, ifconfig, ifdown, ifenslave, ifplugd, ifup, inetd, init, insmod, install, ionice, iostat, ip, ipaddr, ipcalc, ipcrm, ipcs, iplink, iproute, iprule, iptunnel, kbd_mode, kill, killall, killall5, klogd, last, less, linux32, linux64, linuxrc, ln, loadfont, loadkmap, logger, login, logname, logread, losetup, lpd, lpq, lpr, ls, lsattr, lsmod, lsof, lspci, lsusb, lzcat, lzma, lzop, lzopcat, makedevs, makemime, man, md5sum, mdev, mesg, microcom, mkdir, mkdosfs, mke2fs, mkfifo, mkfs.ext2, mkfs.minix, mkfs.vfat, mknod, mkpasswd, mkswap, mktemp, modinfo, modprobe, more, mount, mountpoint, mpstat, mt, mv, nameif, nanddump, nandwrite, nbd-client, nc, netstat, nice, nmeter, nohup, nslookup, ntpd, od, openvt, passwd, patch, pgrep, pidof, ping, ping6, pipe_progress, pivot_root, pkill, pmap, popmaildir, poweroff, powertop, printenv, printf, ps, pscan, pstree, pwd, pwdx, raidautorun, rdate, rdev, readahead, readlink, readprofile, realpath, reboot, reformime, remove-shell, renice, reset, resize, rev, rm, rmdir, rmmod, route, rpm, rpm2cpio, rtcwake, run-parts, runlevel, runsv, runsvdir, rx, script, scriptreplay, sed, sendmail, seq, setarch, setconsole, setfont, setkeycodes, setlogcons, setserial, setsid, setuidgid, sh, sha1sum, sha256sum, sha3sum, sha512sum, showkey, shuf, slattach, sleep, smemcap, softlimit, sort, split, start-stop-daemon, stat, strings, stty, su, sulogin, sum, sv, svlogd, swapoff, swapon, switch_root, sync, sysctl, syslogd, tac, tail, tar, tcpsvd, tee, telnet, telnetd, test, tftp, tftpd, time, timeout, top, touch, tr, traceroute, traceroute6, true, tty, ttysize, tunctl, ubiattach, ubidetach, ubimkvol, ubirmvol, ubirsvol, ubiupdatevol, udhcpc, udhcpd, udpsvd, umount, uname, unexpand, uniq, unix2dos, unlink, unlzma, unlzop, unxz, unzip, uptime, users, usleep, uudecode, uuencode, vconfig, vi, vlock, volname, wall, watch, watchdog, wc, wget, which, who, whoami, whois, xargs, xz, xzcat, yes, zcat, zcip

Commands available in BusyBox 1.23 (~440 commands)

Applet highlight - BusyBox vi

- If you are using BusyBox, adding vi supports only adds 20K. (built with shared libraries, using uClibc)

- You can select which exact features to compile in

- Users hardly realize that they are using a lightweight vi version!

- Tip: you can learn vi on the desktop, by running the vimtutor command
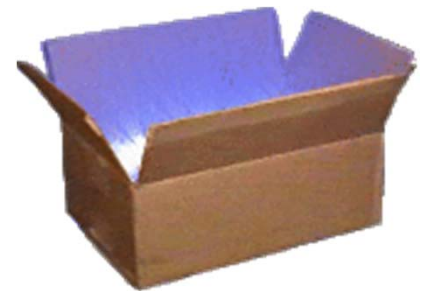
Configuring BusyBox

- Get the latest stable sources from http://busybox.net

- Configure BusyBox (creates a .config file):

    - `make defconfig`
    Good to begin with BusyBox.
    Configures BusyBox with all options for regular users.

    - `make allnoconfig`
    Unselects all options. Good to configure only what you need.

- `make gconfig` (`apt-get install libglade2-dev`)
    or `make menuconfig` (text)
    Same configuration interfaces as the ones used by the Linux kernel (though older versions are used).

BusyBox make xconfig

You can choose:

- the commands to compile,

- and even the command options and features that you need!
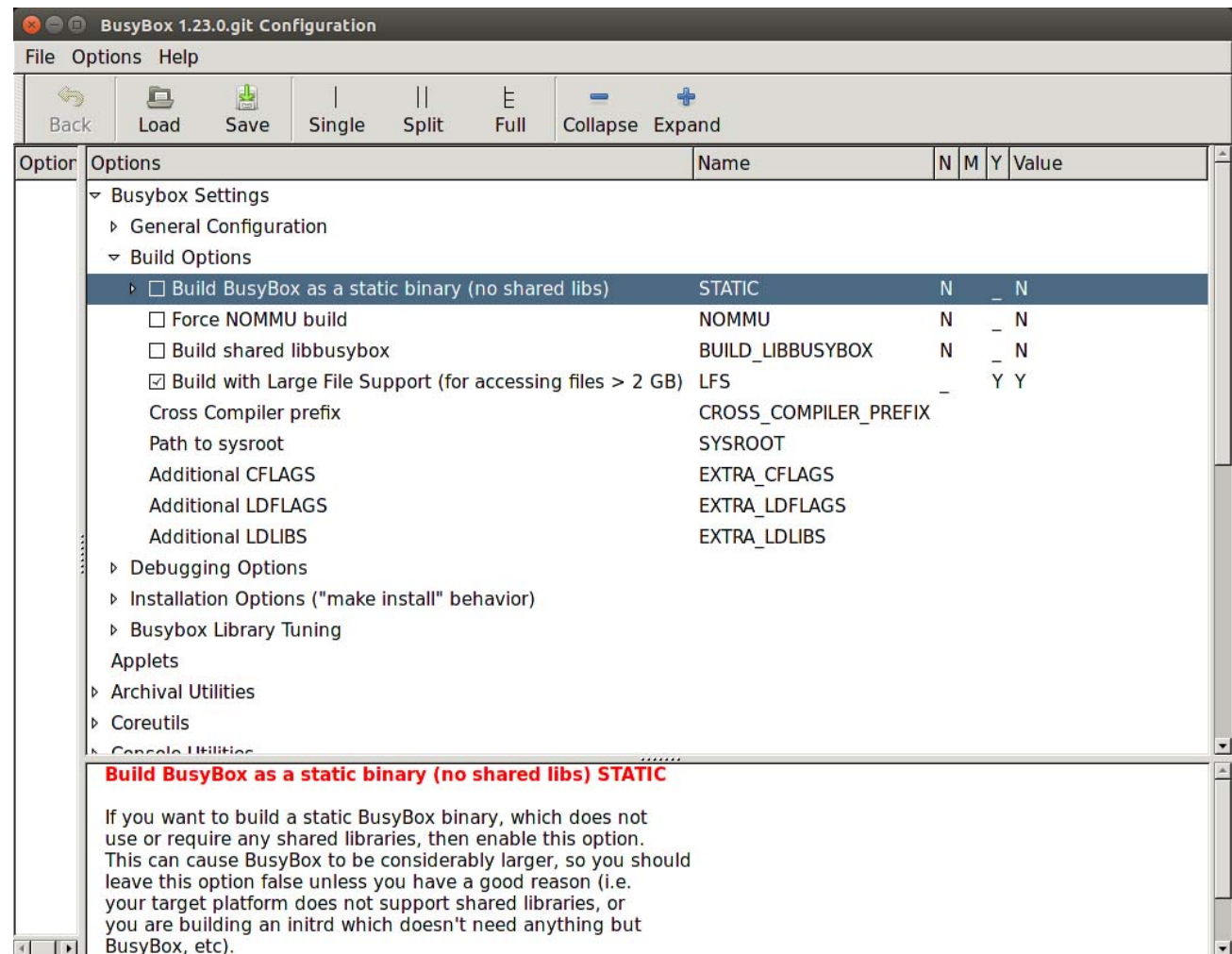
Compiling BusyBox

- Can compile on host or Bone

- See https://elinux.org/EBC_Exercise_27_BusyBox

Alternative to BusyBox: embutils

http://www.fefe.de/embutils/
From the creator of diet libc

- A similar set of tiny utilities for embedded systems.
  Version 0.19 (Aug. 2008): 90 common commands are
  implemented

- Can only be built statically with diet libc!

- Compared to BusyBox: Much less momentum,
  user and developer base. (Last date 2008) Still misses key
  commands and features (ifconfig, for example)

- But can achieve smaller size than BusyBox
  on standalone executables

Alternatives: coreutils

- http://www.gnu.org/software/coreutils/
- Basic file, shell and text manipulation utilities of the GNU operating system
- These are the core utilities which are expected to exist on every operating system
- Previously these utilities were offered as three individual sets of GNU utilities, Fileutils, Shellutils, and Textutils.
  - Those three have been combined into a single set of utilities called Coreutils
- 31-Oct-2017