# Void Linux

## We heard you like little endian

# Firstly, who am I?

- A programmer from the Czech Republic
- Involved in open source since 2007
- Background in graphics toolkits (EFL), programming languages, game development
- Currently the primary maintainer for POWER architecture support in Void (and other several things)

# What is Void Linux?

- Independent Linux distro with its own package manager
- Focus on simplicity and pragmatism
- Rolling release, stable software, binary based
- Portable (also on x86, ARM, MIPS), choice of glibc and musl, runit, “ports” (xbps-src), cross-compilation
- Low barrier of entry, open and inclusive, informal

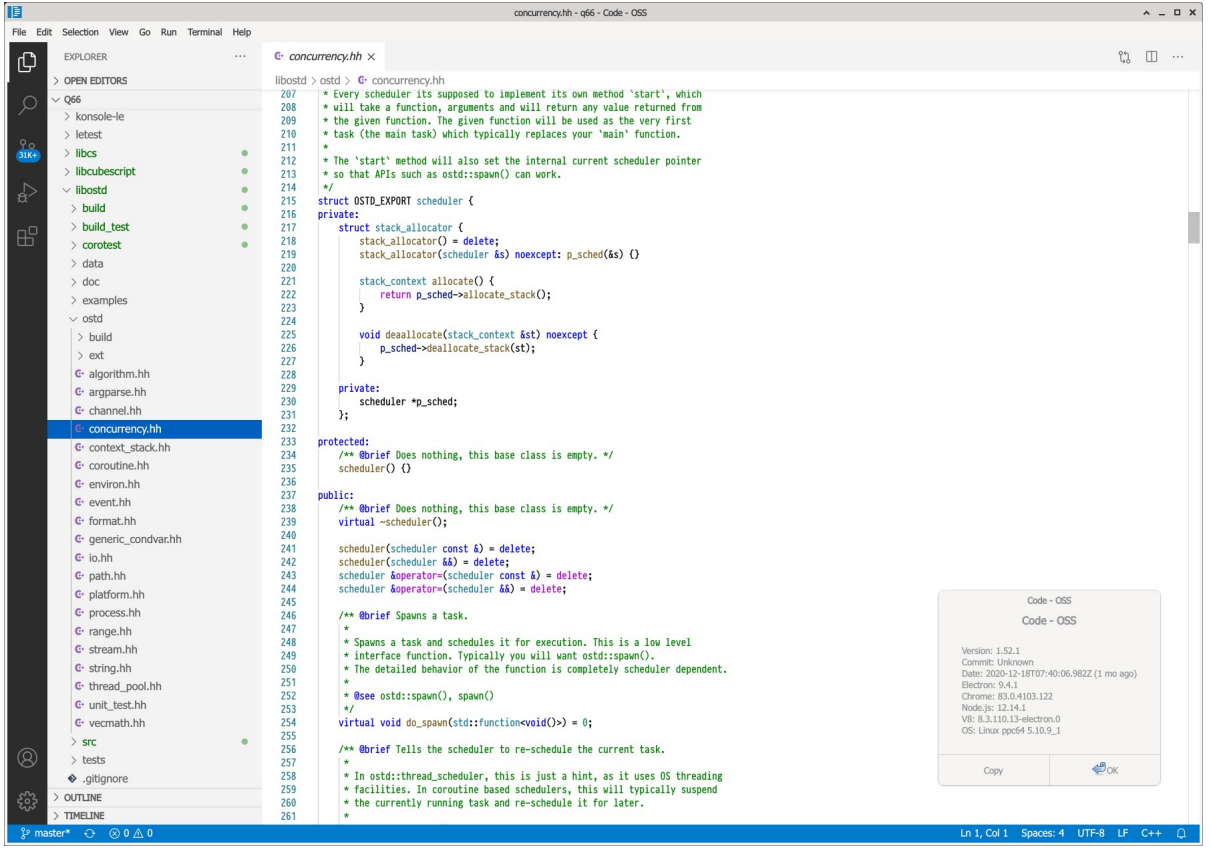
# Void on POWER vs other distros

- Desktop/workstation focus, not server
- Both little and big endian support
- ELFv2 ABI on big endian glibc
- 4K pages kernel by default
- Wider desktop software support

# Quick history of Void on POWER

- Late 2018 – initial port on Talos 2 Lite (ppc64le)
- Early 2019 – gradual expansion of package coverage
- 64-bit BE musl port, 32-bit ports
- April 2019 – 64-bit BE glibc port (ELFv2 ABI)
- Late 2019 – complete repository coverage
- OpenPOWER Summit EU talk
- November 2019 – commit bit in upstream

# News since then



# Java bootstrap

- OpenJDK 8 and 11 in repositories
- Needs itself to build (one version older)
- Re-introduction of GCC6 (last version with GCJ)
- Bootstrap packages for JDK 7, 9, 10
- JITed on ppc64(le), slow on ppc32 (zero backend)

# Go bootstrap

- Only on ppc64le
- Using binary bootstrap (official binaries)
- gccgo unreliable (gcompat on musl)
- BE support – wrong ABI and needs POWER8
- 32-bit support – missing entirely

# Haskell bootstrap

- Self-built binary bootstrap snapshots
- Includes musl (figured out cross-builds)
- BE missing for now (ELFv2 patch made though)
- Big endian bugs prevent functional bindist
- More target support later for 8.10

# Other languages

- Greater Common Lisp support
- SBCL finally in repos (for now LE only)
- Bootstrapped with ECL
- Preparing a Clisp update
- D, Zig and some others still missing

# LibreSSL performance

- Void uses LibreSSL instead of OpenSSL
- Assembly only on x86 and some 32-bit ARM
- Inferior performance and no hardware crypto support
- Solution: import assembly bits from OpenSSL upstream

# LibreSSL performance

- https://github.com/q66/libressl-portable-asm
- Now shipping in Void
- Also adds Aarch64 assembly support and improves ARM
- Up to 20x performance increase
- Especially in hw crypto (ghash/AES etc.) on POWER9

# Chromium support

- No official upstream support
- Downstream patches available
- Shipping in Void since 84
- Currently only browser engine with JIT support
- Works on musl as well

# Electron support

- We have systemwide Electron now
- For now enables VS Code, Element, Rocket.Chat-Desktop
- Only LE, musl works
- Ugly build system workarounds

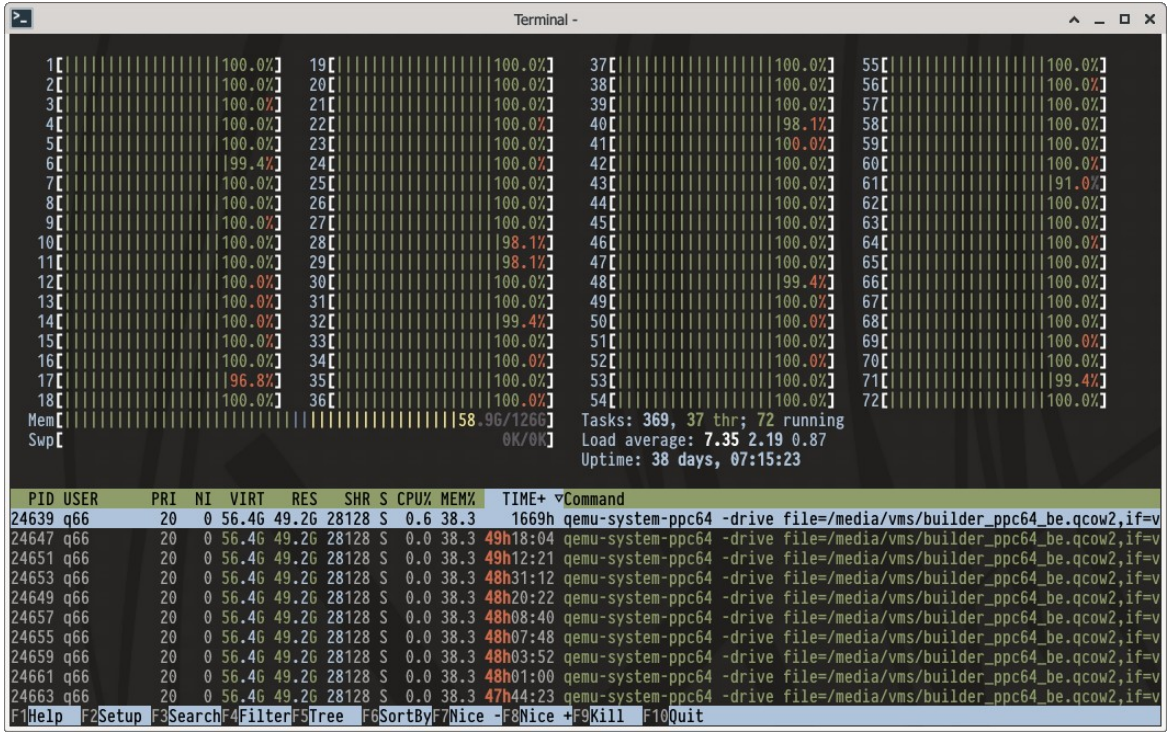
# AMD GPU support

- Problem: AMDGPU DC
- Haphazard hardware floating point usage
- Page size dependency
- Upstream support only in recent kernels
- Need backports – provided down to 5.4

# Cross-toolchain rework

- Code duplication for cross-toolchain build templates
- Solution: introduce a common build-style
- Each cross-toolchain template is now ~50 lines
- Extra goodies: glibc cross on musl hosts, etc.
- Unified configure args and so on for all
- No more dirty masterdirs

# Infrastructure status



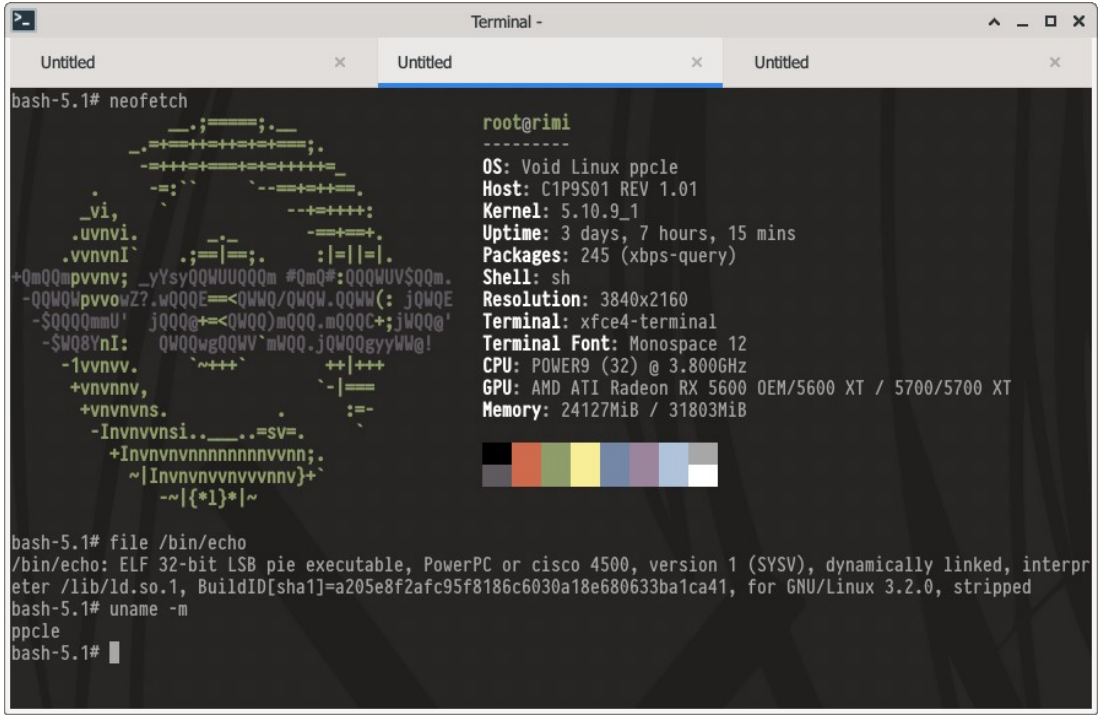
# Infrastructure status

- Still a Talos 2 Lite (18C, 128G RAM) in my bedroom
- Big endian builds in a VM (KVM-HV)
- Little endian builds on bare metal
- Primary mirror – separate server (in Chicago, IL)
- 10G network, 2TB storage

# Infrastructure status

- Several other mirrors provided by community
- Could use faster build hardware
- Could use hardware not in my bedroom
- Primary mirror should migrate to build machine
- More build automation necessary – WIP

# 32-bit little endian



# 32-bit little endian

- Why not?
- Officially does not exist
- In practice, this just works though
- Pretty basic bringup process
- Made easy by xbps-src

# 32-bit little endian

- No native support for 32-bit LE in Linux
- Works as a chroot on 64-bit kernel though
- But not out of box: fixes are needed
- Fix 32-bit compat in kernel first
- Several issues

# 32-bit LE kernel compat

- Entering signal handlers clears MSR_LE
- vDSO32 disabled by default
- Certain vDSOs broken on LE – disabled those
- Syscalls with 64-bit args: wrong byte order
- All very trivial patches
- Things “run” without them

# 32-bit LE kernel compat

- But they crash at random points
- After patching, no more known issues
- Fixes are being upstreamed
- VDSO32 will be fixed by moving it to C
- Backports in all Void kernels (4.19+)

# Bootstrapping 32-bit LE

- First: create build and cross xbps-src profiles
- Second: create cross-toolchains for 32-bit LE targets
- Minor patching in glibc and musl needed
- Adjustments around xbps-src needed

# Bootstrapping 32-bit LE

- Try cross-compiling base-chroot
- Minimal set of packages for the build container
- Fix any errors along the way
- Relatively few and mostly trivial
- Binary-bootstrap a build container after that
- Then rebuild every package (no cross)

# Bootstrapping 32-bit LE

- Now we can build the other base metapackages
- Afterwards, other software can be built
- Usual “fix whatever pops up” approach applies
- Most things generally just work
- Could probably function on 32-bit userland

# 32-bit LE: the Buts

- No official support in glibc
- Dynlinker, symvers etc. shared with 32-bit BE
- Going to propose an official port later
- Same SVR4 ABI as 32-bit BE
- Musl pretty much just works

# 32-bit LE: the Why

- Because we could, of course
- Easier emulation of 32-bit x86
- Port LE Linux to G3s/G4s? :)
- Or use BE Linux and swizzle syscall data?
- For now, strictly POWER8+ though

# 32-bit LE: the obstacles

- LLVM support
- Recently upstreamed by the FreeBSD folks
- Backported to Void
- Rust support
- Blocks a fair amount of userland right now
- WIP patches available

# 32-bit LE: the obstacles

- Proper glibc port needs to be made
- Use the opportunity to improve the ABI?
- Use 64-bit long doubles later (ditch ibm128)
- Choose a unique dynlinker name and fresh symvers
- Fix up our 32-bit BE ports too?

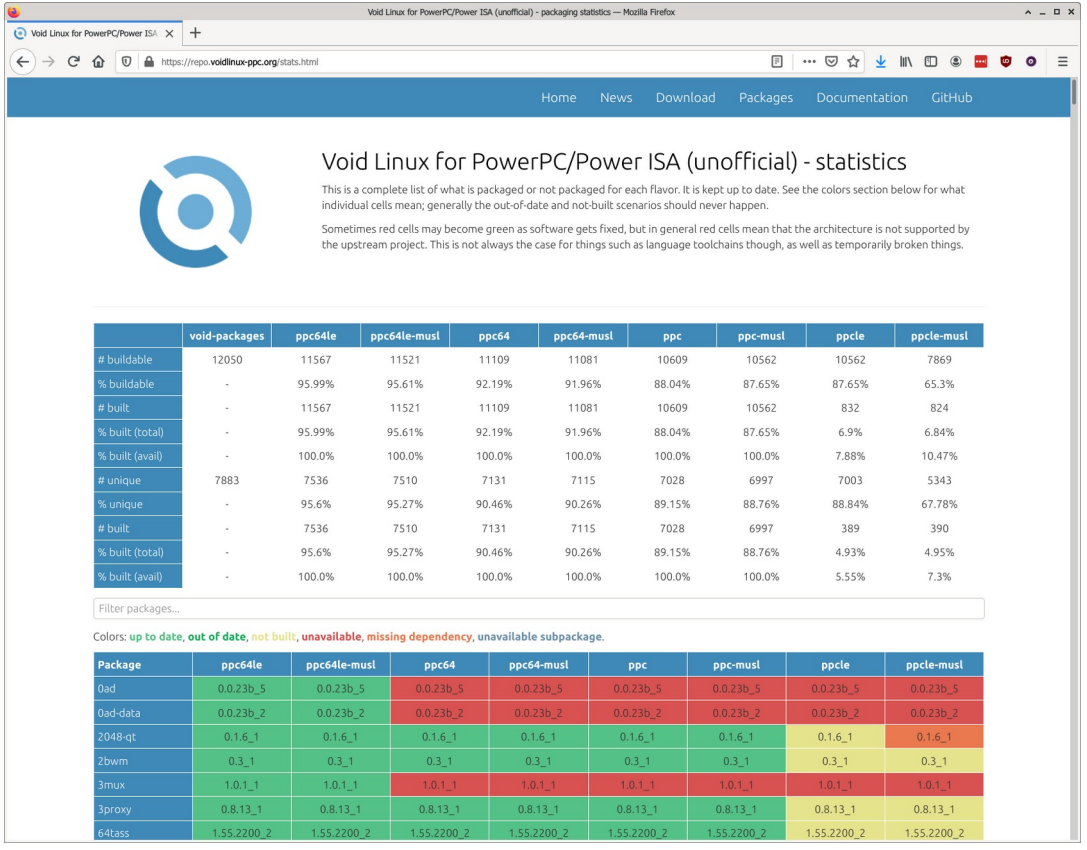
# 32-bit LE: the results

- Testing repos now available (glibc and musl)
- Can fully compile itself
- A portion of the repo packaged
- Core userland, dev tools, LLVM, Mesa, SDL...
- Initial port of box86

# Box86

- Linux x86 emulator developed for ARM devices
- Needs 32-bit little endian host
- Initial PowerPC port now
- Can run glxgears
- Can run Unreal Tournament
- Fairly slow though… no dynarec

# The future




| | void-packages | ppc64le | ppc64le-musl | ppc64 | ppc64-musl | ppc | ppc-musl | ppcle | ppcle-musl |
|---|---|---|---|---|---|---|---|---|---|
| # buildable | 12050 | 11567 | 11521 | 11109 | 11081 | 10609 | 10562 | 10562 | 7869 |
| % buildable | - | 95.99% | 95.61% | 92.19% | 91.96% | 88.04% | 87.65% | 87.65% | 65.3% |
| # built | - | 11567 | 11521 | 11109 | 11081 | 10609 | 10562 | 832 | 824 |
| % built (total) | - | 95.99% | 95.61% | 92.19% | 91.96% | 88.04% | 87.65% | 6.9% | 6.84% |
| % built (avail) | - | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 7.88% | 10.47% |
| # unique | 7883 | 7536 | 7510 | 7131 | 7115 | 7028 | 6997 | 7003 | 5343 |
| % unique | - | 95.6% | 95.27% | 90.46% | 90.26% | 89.15% | 88.76% | 88.84% | 67.78% |
| # built | - | 7536 | 7510 | 7131 | 7115 | 7028 | 6997 | 389 | 390 |
| % built (total) | - | 95.6% | 95.27% | 90.46% | 90.26% | 89.15% | 88.76% | 4.93% | 4.95% |
| % built (avail) | - | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 5.55% | 7.3% |

| Package | ppc64le | ppc64le-musl | ppc64 | ppc64-musl | ppc | ppc-musl | ppcle | ppcle-musl |
|---|---|---|---|---|---|---|---|---|
| 0ad | 0.0.23b_5 | 0.0.23b_5 | 0.0.23b_5 | 0.0.23b_5 | 0.0.23b_5 | 0.0.23b_5 | 0.0.23b_5 | 0.0.23b_5 |
| 0ad-data | 0.0.23b_2 | 0.0.23b_2 | 0.0.23b_2 | 0.0.23b_2 | 0.0.23b_2 | 0.0.23b_2 | 0.0.23b_2 | 0.0.23b_2 |
| 2048-qt | 0.1.6_1 | 0.1.6_1 | 0.1.6_1 | 0.1.6_1 | 0.1.6_1 | 0.1.6_1 | 0.1.6_1 | 0.1.6_1 |
| 2bwm | 0.3_1 | 0.3_1 | 0.3_1 | 0.3_1 | 0.3_1 | 0.3_1 | 0.3_1 | 0.3_1 |
| 3mux | 1.0.1_1 | 1.0.1_1 | 1.0.1_1 | 1.0.1_1 | 1.0.1_1 | 1.0.1_1 | 1.0.1_1 | 1.0.1_1 |
| 3proxy | 0.8.13_1 | 0.8.13_1 | 0.8.13_1 | 0.8.13_1 | 0.8.13_1 | 0.8.13_1 | 0.8.13_1 | 0.8.13_1 |
| 64tass | 1.55.2200_2 | 1.55.2200_2 | 1.55.2200_2 | 1.55.2200_2 | 1.55.2200_2 | 1.55.2200_2 | 1.55.2200_2 | 1.55.2200_2 |

# Infrastructure

- Official repo at some point?
- 64LE should be easy enough
- 64BE and 32-bit have some issues with server software
- They also need clearing up the ABI situation

# ELFv2 BE ABI

- We will need official support in glibc
- Right now things work “by accident”
- Need unique dynlinker name and symvers
- Upstream said they wouldn’t be against
- But, need to formalize the ABI

# ELFv2 BE ABI

- IBM thinks VSX requirement is a part of the ABI
- Solution: Formalize “ELFv2 Legacy-Compatible” ABI
- To be shared by the new glibc port, musl and FreeBSD
- ELFv2 minus POWER8/VSX requirement

# ELFv2 BE ABI

- Extension of the official spec
- No VSX nor VMX requirement
- 64-bit long doubles – ditch ibm128, and do not use ieee128 (needs vector registers for passing)
- Coming during 2021

# Other things

- Upstream as many patches as possible
- Write a new installer
- Work on enablement of new software
- Work with upstreams on adding support

# Conclusion

- Lots of work has been done in a year and half
- There is still plenty more to be done
- Join us on IRC: #voidlinux-ppc @ freenode
- For detailed statistics, visit https://repo.voidlinux-ppc.org/stats.html

# Questions time

## And thanks for listening!

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