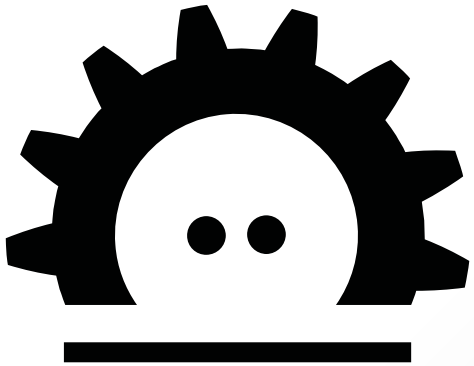
Tools that helped to build HelenOS

http://www.helenos.org



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HelenOS

Compilers

Compilers vs. supported targets

	GNU Compiler Collection	LLVM/Clang	Intel C++ Compiler	Sun Studio	Portable C Compiler
amd64	yes	yes	yes	yes	yes
arm32	yes	yes	no	no	no
ia32	yes	yes	yes	yes	yes
ia64	yes	no	yes	no	no
mips32	yes	no	no	no	no
ppc32	yes	no	no	no	no
sparc32	yes	no	no	yes	no
sparc64	yes	no	no	yes	no

Compilers

All aim for GCC compatibility

Most assume/require binutils

None but GCC supports all architectures

binutils + GCC = **natural choice**

Clang doesn't do the whole trick yet

GCC

Interesting bugs and limitations

- ia64: wrong scheduling of chk.s (bugs 53975, 66660)
- mips32: incorrect unaligned accesses (bug 23824)
- mips32: problems parsing TLS accesses prior to 4.1.0
- mips32: scheduling RDHWR in a branch delay slot
- sparc64: limitations of inline assembly constrains
- Use of `-Werror -Wall -Wextra` with `-O3`
- Lack of `returns_twice` attribute

Toolchain script

Different versions of GCC support different features

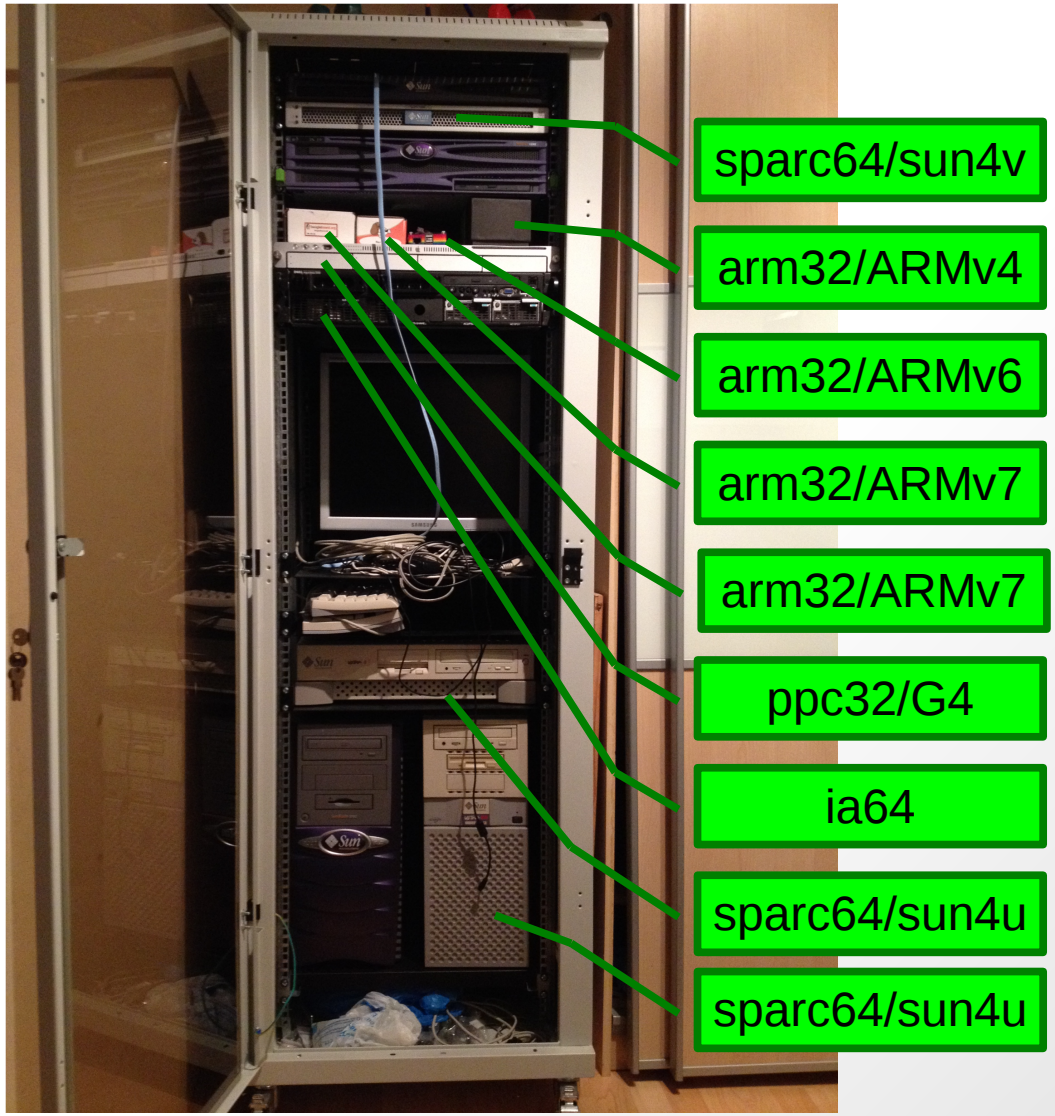
Different versions of GCC produce different warnings

`-Werror` + `-Wall -Wextra` + `-O3`

tools/toolchain.sh installs the supported toolchain (binutils, GCC and GDB)

Simulators

Who needs simulators, anyway?



HW as a simulator of itself

eBay comes to rescue

BUT

Not very practical

SW is eternal, HW not so much

Simulators vs. architecture

	Bochs	VMware	msim	Ski	Simics	QEMU	PearPC	GXemul	VirtualBox	gem5
amd64	yes	yes	no	no	yes	yes	no	no	yes	yes
arm32	no	no	no	no	yes	yes	no	yes	no	yes
ia32	yes	yes	no	no	yes	yes	no	no	yes	yes
ia64	no	no	no	yes	yes	no	no	no	no	no
mips32	no	no	yes	no	yes	yes	no	yes	no	no
ppc32	no	no	no	no	yes	yes	yes	yes	no	no
sparc32	no	no	no	no	yes	no	no	no	no	no
sparc64	no	no	no	no	yes	yes	no	no	no	yes

Simics

Swiss Army knife of simulators v1

Introspection & tracing

- Reverse engineering FHC

Checkpoints & reverse emulation

Closed source

Virtutech → Intel

- Unpenetrable licensing procedure

QEMU

Swiss Army knife of simulators v2

- OpenBIOS for ppc32 and sparc64

Helped to bring sparc64 to QEMU

Good indication of QEMU regressions

Linuxisms: failing TLBP (mips32)

- https://bugs.launchpad.net/qemu/+bug/1128935

GDB can be used to debug guest

Ski

HP → open source → aging on SF

Nuisance to build on modern desktop

Some functionality broken

No active maintanance

Crossbreed with QEMU?

- Alternative to reviving KVM on Itanium

Bootloaders

Bootloaders vs. architecture

	GRUB	GRUB 2	SILO	ELILO	OBP	Das U-Boot	Yaboot
amd64	yes	yes	no	no	no	yes	no
arm32	no	no	no	no	no	yes	no
ia32	yes	yes	no	yes	no	yes	no
ia64	no	no	no	yes	no	no	no
mips32	no	no	no	no	no	yes	no
ppc32	no	yes	no	no	no	yes	yes
sparc32	no	no	no	no	no	yes	no
sparc64	no	Linux	yes	no	yes	no	no

Bootloaders

Microkernel boot issue: large initrd & init tasks

- Multiboot specificaiton
- image.boot

ELILO

- hello EFI application (GNU EFI + efilib)
- image.boot directly

OBP

- Serengeti (Simics) 544.3 kg

Build system

Build system

- make
- Python
  - Configuration
  - Autotooling
  - Autogenerated structures and offsets
    - JSON (no comments)
    - YAML (no tabs)
    - YAML → .h
  - Root file system creation

Conclusion

Non-portable/non-crosscompilable tools

Multitude of tools ↔ HelenOS portability

Linuxisms → latent bugs in tools

Vintage platforms → vintage tools

Vintage platforms ↔ computer architecture

“Perhaps addressing this problem fully isn't on anyone's TODO list for the moment (ia64...) but if speculation becomes more important in future target then...”

–from GCC Bugzilla

Q&A

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Thank you!