It's all about freedom #0

“The freedom to run the program, for any purpose”

I.e.:

- Freedom from sysadmin!
  - WTH is fdisk/mke2fs/... hidden in /sbin?
  - I should be able to just work with my disk/network access

- Freedom to innovate
  - Experimental filesystem, personal work-flow, new kind of process combination,...

- Also provide freedom from misbehaving programs and drivers
Micro-kernel layering

Kernel  Tasks, memory, IPC

ext2fs  auth  proc
pfinet  root

user

sh  cp
Micro-kernel layering

- Server crash? Not a problem
  - “Computer bought the farm” is just an error, not something-of-the-death
- Easier to debug/tune
  - Just run gdb, gprof, …
- Can dare crazy things
  - The Hurd console has dynamic font support
    - See chinese support in pseudo-graphical mode (actually pure VGA textmode!) of Debian installer.
- Kernel only handles Tasks, memory, IPC
Hurd possibilities

Kernel

ext2fs

pfinet

auth

proc

ftpfs

user

sh

cp

isofs
Hurd possibilities

€ settrans -c ~/ftp: /hurd/hostmux /hurd/ftpfs /
(just once for good)

€ settrans -a ~/mnt /hurd/iso9660fs

€ ls ~/mnt

README-or-FAIL

... 

• Only downloads what is needed.
• Can be permanently stored in ext2fs

€ settrans ~/.signature /hurd/run /usr/games/fortune
Example: interpose TCP/IP stack

\[
\begin{align*}
\text{\euro} \text{ settrans -ca \$HOME/servers/socket/2} \\
& /hurd/pfinet -i \$HOME/servers/tun0 \\
\text{\euro} \text{ openvpn ... \$HOME/servers/tun0 &} \\
\text{\euro} \text{ remap /servers/socket/2} \\
& \$HOME/servers/socket/2 \\
\text{\euro\euro\euro} \text{ wget \texttt{www.gnu.org}}
\end{align*}
\]

- My own translator
- Can plug my own VPN software
- Only wget accesses it (well, the shell too :) )
But also

€ remap /bin/sh $HOME/bin/sh
€ remap /bin $HOME/unionbin

... 

• Check out Stow/Nix/Guix!
How does it work?

Kernel

ext2fs  
auth  
ftpfs  
isofs  
user  
root  
proc  
pfinet  
sh  
libc  
cp  
libc
Rationale

- **Everything** is an (interposable) RPC
- Translators exposed in the FS
  - The user gets to decide what/how to interpose
    - Without need for costly ptrace or fragile libc symbols interposition.
    - **Native** fakeroot/chroot
    - Fully virtualized and fine-grained interface
  - Just need to use what's provided by the admin, e.g.
    - $HOME/
    - TCP/IP stack
  - and pile over it
Hurd possibilities (cont'ed)

Kernel

ext2fs
pfinet
root

auth
proc
open vpn

ftpfs
pfinet
user

part
sh

ext2fs
iso fs

cp
Hurd possibilities (cont'ed)

i.e. ISO image inside a partitioned disk image on ftp over a VPN
Porting packages to hurd-i386

- This is essentially a POSIX system
  - So portable portable programs should just work fine
- Top dumb issues
  - Not linux or BSD? #include <windows.h>
  - Have mach.h? Must be MacOS
  - make -j $(grep … /proc/cpuinfo) → make -j
  - #include <linux/limits.h>
  - hardcoded errno values
  - Missing -lpthread, -ldl, -lX11, ...
- See Hurd porter page's developer corner
- And PATH_MAX not defined, as allowed by POSIX...
PATH_MAX is evil for you

Fragile semantic in POSIX

- Never meant to mean “reasonable size for a buffer containing a file name”
  - Linux' 4096 : a whole page, a whole TLB entry!
- Paths can actually be longer
  - “hidden”, ”protected” files?!
- Does that include the trailing \0? (not so clear in POSIX...)
  - Does your code actually properly handle that?

- A can of worms that nobody really tests...
Current State

Hardware support

- i686
- start of 64bit support
  - Kernel boots completely, now missing RPC 32/64bit translation
- DDE Linux 2.6.32 drivers layer for network boards
  - In userland netdde translator!
- IDE, Xorg, …
- AHCI driver for SATA
- Xen PV domU
  - Required GNU Mach changes only
- Preliminary sound support through userland Rump
- No USB yet
Current State

Software support

• Quite stable
  • Have not reinstalled boxes for a decade.
  • Debian buildds keep building packages, no hang after weeks!
• ~81% of Debian archive builds out of tree
  • XFCE, almost gnome, almost KDE
  • Firefox (aka iceweasel), gnumeric, ...
• Standard *native* Debian Installer
Recent work

Special thanks to Justus Winter!!

- Init system decoupled
  - Allows to use standard Debian sysvinit scripts!
  - Using dmd for Guix & such
- Distributed mtab translator
- Various optimizations
  - Protected payloads
  - Lockless implementations
  - Paging management
  - Message dispatch
- Valgrind start-of-port
Releases

- Nice 0.401 release on April 2011.
- Arch Hurd LiveCD release on August 2011.
- Released Debian-unofficial
  - wheezy/sid snapshot CDs on May 2013 \o/
  - jessie/sid snapshot CDs on May 2015 \o/
Removal from ftp-master

- Due since many years
- Not really useful to mirror all over the world anyway
- But beware of consequences
  - `buildd.debian.org` able to get fed from `debian-ports`?
    - Scheduled binNMUs for transitions
    - Losing this would be very tedious for ports maintainers
    - Exposure in e.g. `http://buildd.debian.org/yourpackage`
  - Toolchain version upgrades (gcc, perl)
    - Give `$WHOEVER_DOES_IT` accounts just to be able to check those?
- In short, managing to get most support without extra load?
  Conversely, those would help ports currently on `debian-ports`
- Real status for Second-Class Citizens
  - BoF?
Future work

- Xen PVH support, X86_64 support
- Language bindings for translators (ADA?)
- Read-ahead
- {hdd,sound,usb}dde?
- Rump drivers?
- GNU system: Guix/Hurd?
- Startup in scheme?
- Your own pet project?
Thanks!

- http://hurd.gnu.org/
- http://www.debian.org/ports/hurd/
- The increasing irrelevance of IPC performance for microkernel-based Operating Systems