Recent developments in the Hurd

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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

It's all about freedom #0

```
From: xxx <xxx@yyy.fr>
Subject: Network expertise
Date: Thu, 31 Jan 2013 12:37:34 +0100
[…] Would it be possible to route to my VPN the
traffic of only one application?
```

Actually, also well-known classical issue of full-VPN: traffic of the VPN itself shouldn't go through the VPN!

And yet, here root capabilities!!

Spoiler: Yes, GNU/Hurd can already do it. Without asking root.

It's all about freedom #0

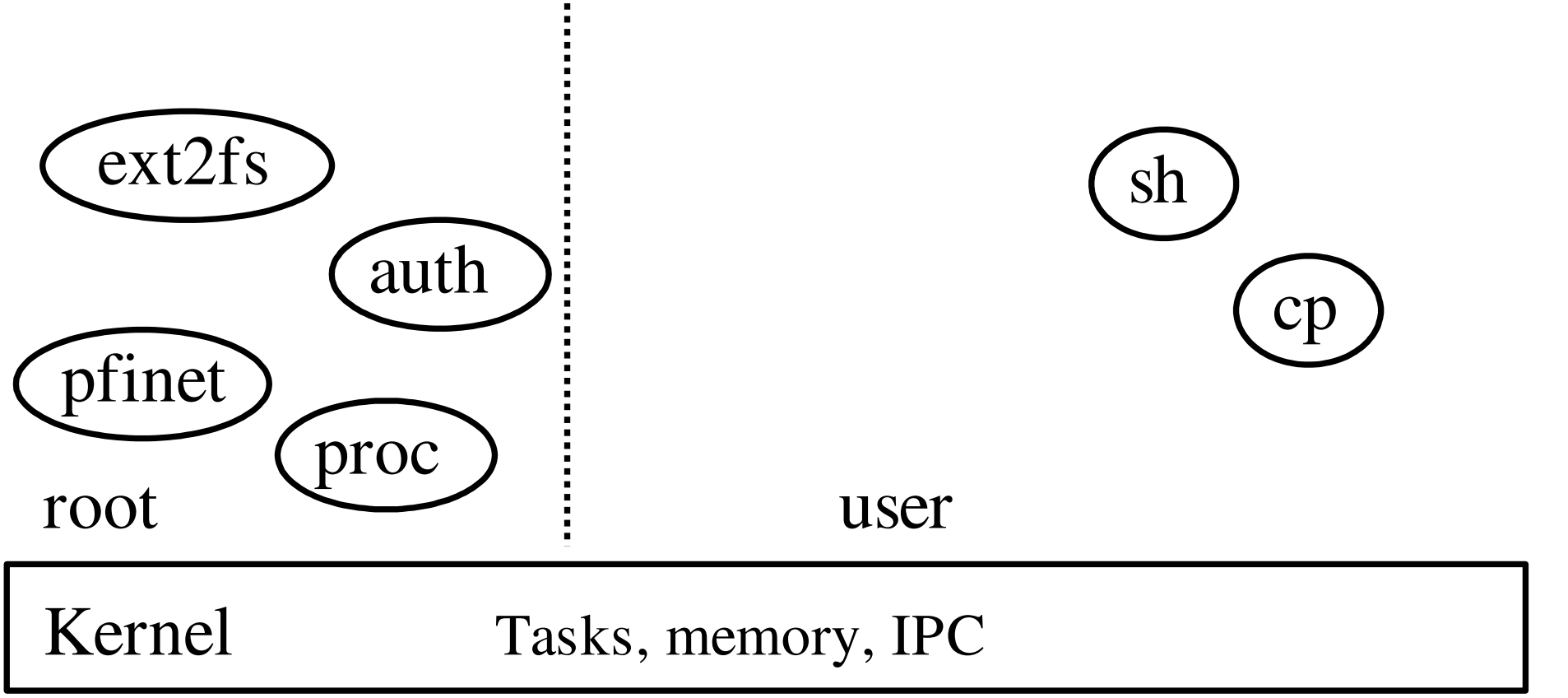
Extensibility for the user

- Mount one's own files
  - Access archives content
  - Access remote files
  - Experiment with filesystems
- Access one's own network
  - Access remote networks / VPN
  - Access virtual machine network
- Redirect one's sound
  - Through network
  - Sound effects
  - Recording
- ...

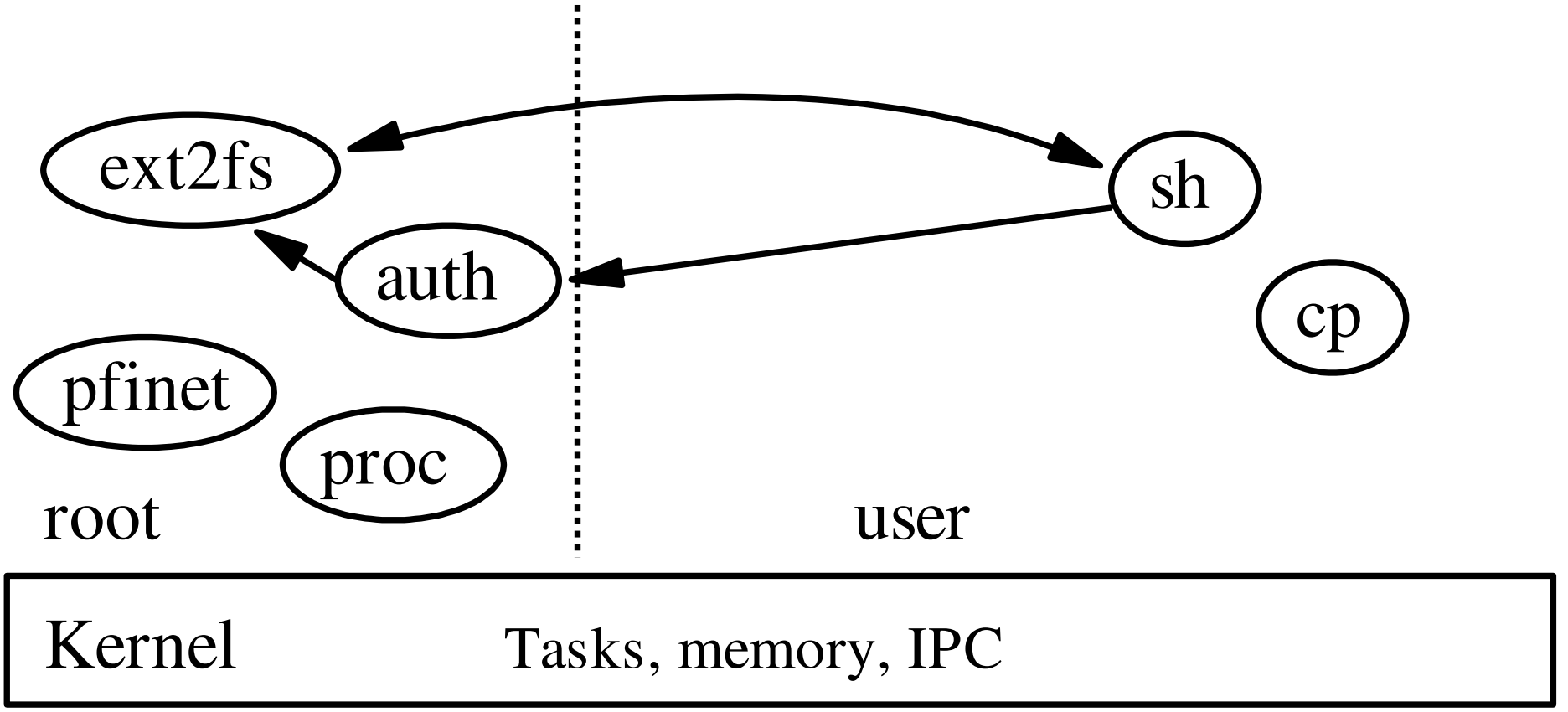
Outline

- Hurd architecture Overview
- Console support
- Network support
- Nice translators
- Real-life nice story
- Software support
- Hardware support
- Releases & future

Micro-kernel layering



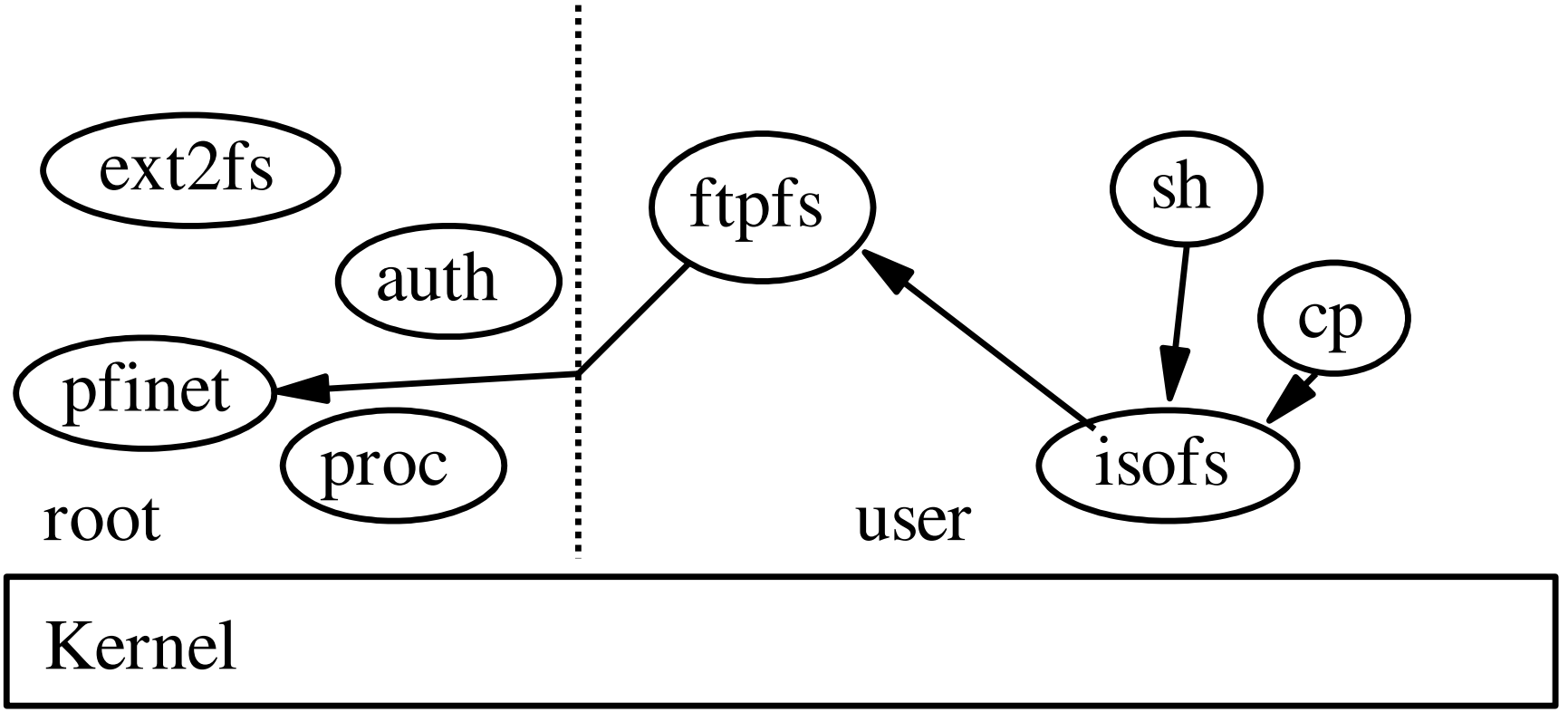
Micro-kernel layering



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



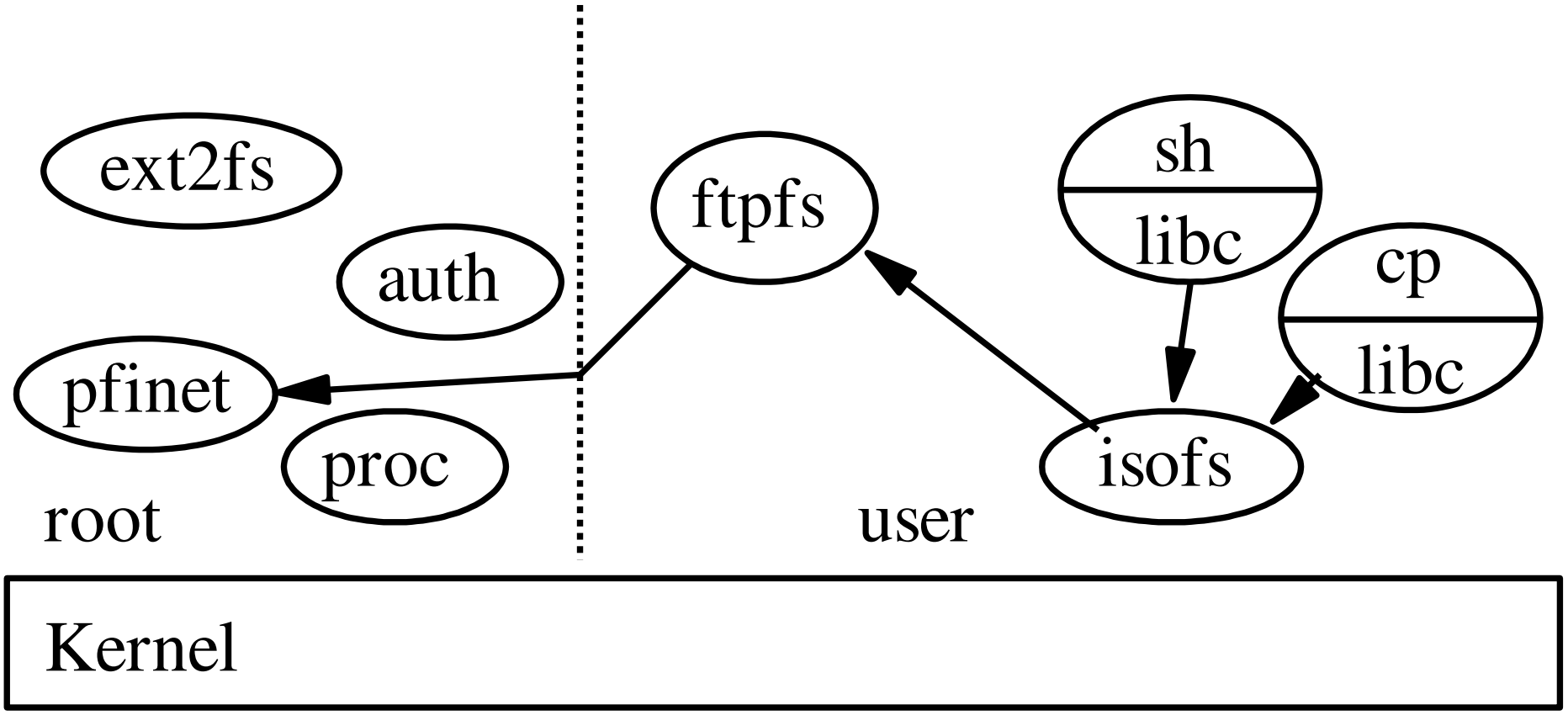
Hurd possibilities

```
€ settrans -c ~/ftp: /hurd/hostmux /hurd/ftpfs /
(just once for good)
€ settrans -a ~/mnt /hurd/iso9660fs
~/ftp://ftp.gnu.org/old-gnu/gnu-f2/hurd-F2-main.iso
€ ls ~/mnt
README-or-FAIL
…
```

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

```
€ settrans ~/.signature /hurd/run /usr/games/fortune
```

How does it work?



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

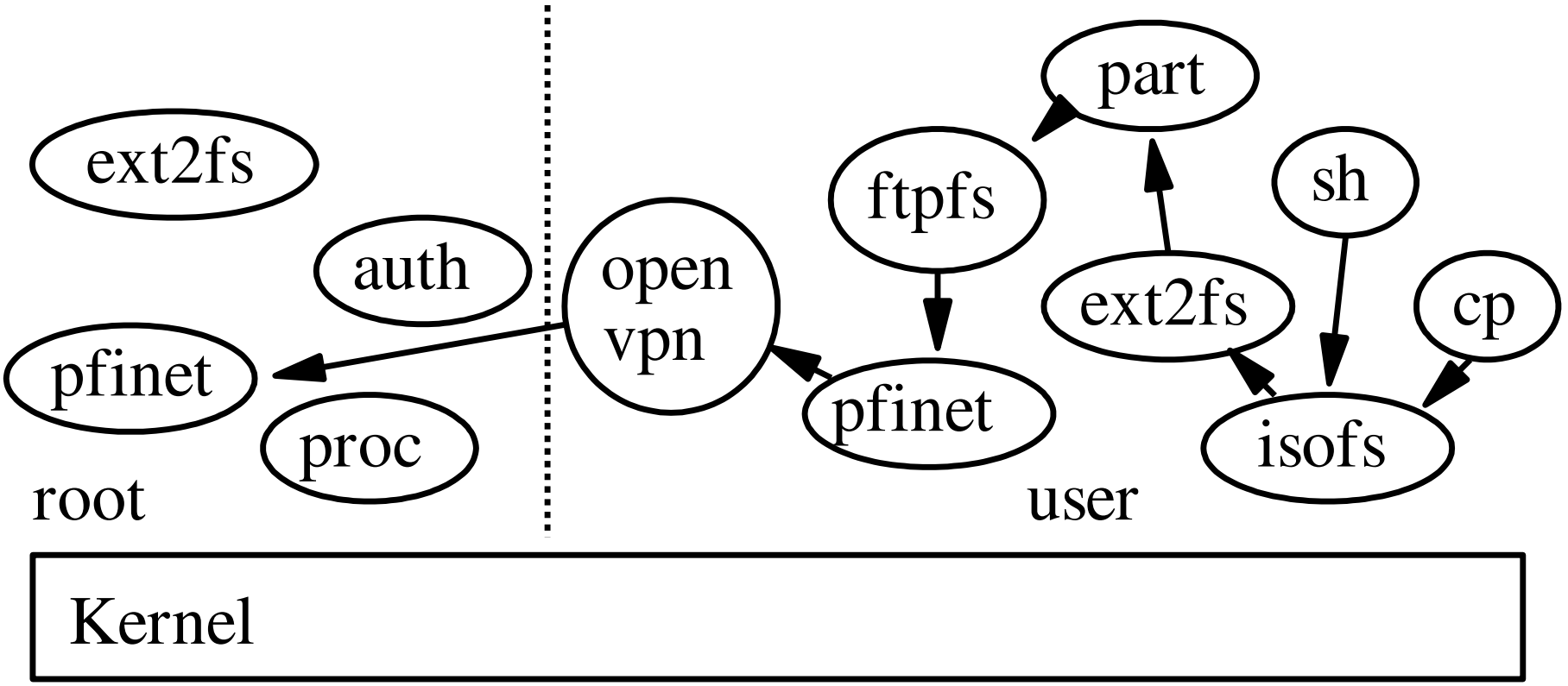
  and pile over it

But also

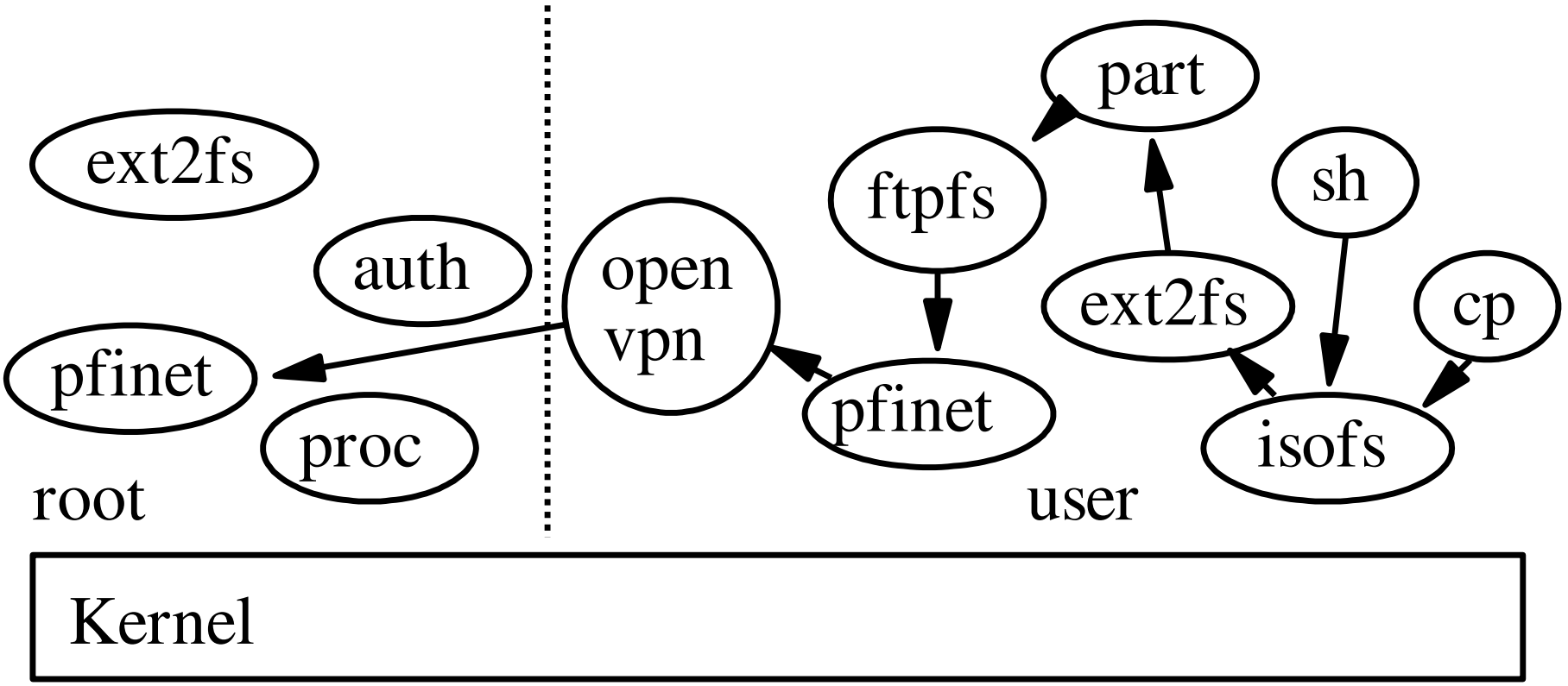
```
€ ~/remap/remap.sh /bin/sh $HOME/bin/sh
€ ~/remap/remap.sh /bin $HOME/unionbin
…
```

- Check out Stow/Nix/Guix!

Hurd possibilities (cont'ed)



Hurd possibilities (cont'ed)



i.e. ISO image inside a partitioned disk image on ftp over a VPN

Hurd possibilities (cont'ed)

- No less power than root
  - Since root uses the same mechanism anyway!
  - Except direct hardware access, of course
    - And still, can chmod o+rw /dev/eth0
    - And still, could be interfaced safely thanks to I/O MMU
- More power for everybody (root and non-root)
  - Combine translators, invent new ones without kernel programming, ...

Hurd userland console support

Modular design similar to screen

- Server running virtual ttys and gettys on them
- Client with drivers
  - Keyboard + mouse + VGA,
  - or ncurses,
  - or whatever

Hurd userland console support

Keyboard driver

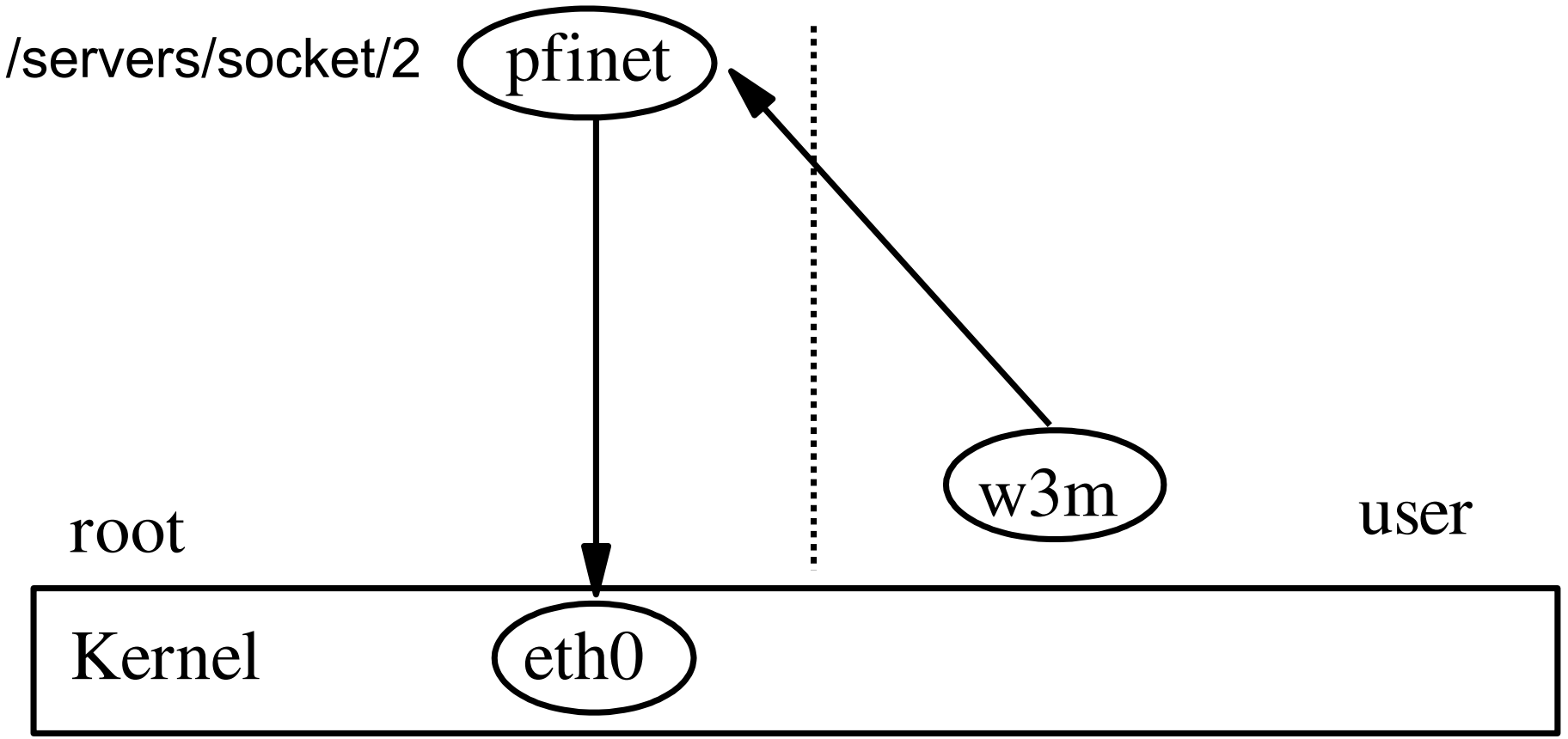
- Gets keyboard/mouse events from kernel
- Translation done through xkb
  - No need to maintain our own keymaps any more

Hurd userland console support

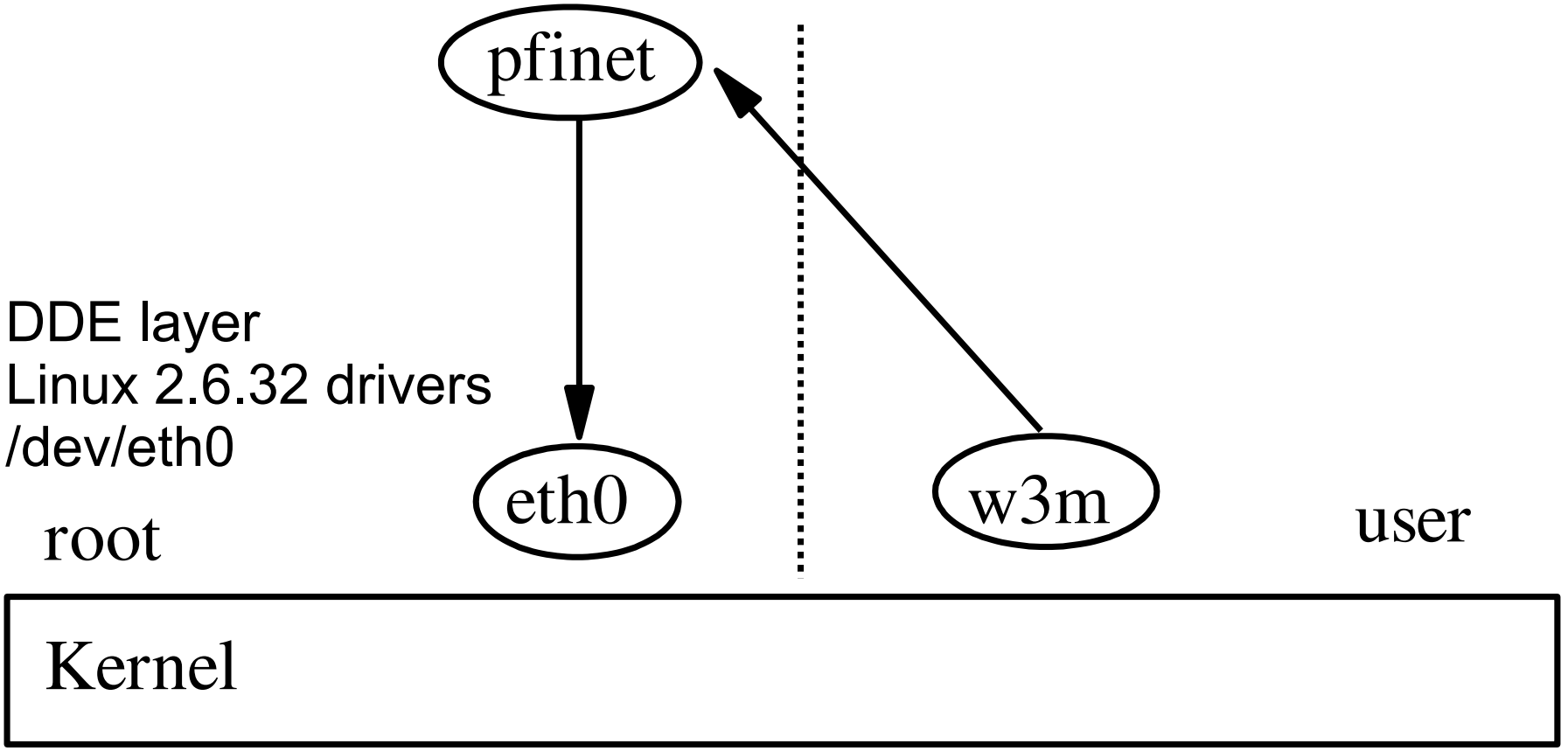
VGA driver

- Directly drives VGA board in VGA text mode
- 256/512 dynamic glyphs support
  - 32-126 static ASCII characters for compatibility
  - Other glyphs dynamically allocated from BFD font
  - GNU greets user!
- Double-width glyph support
  - Can print kanjis in text mode!

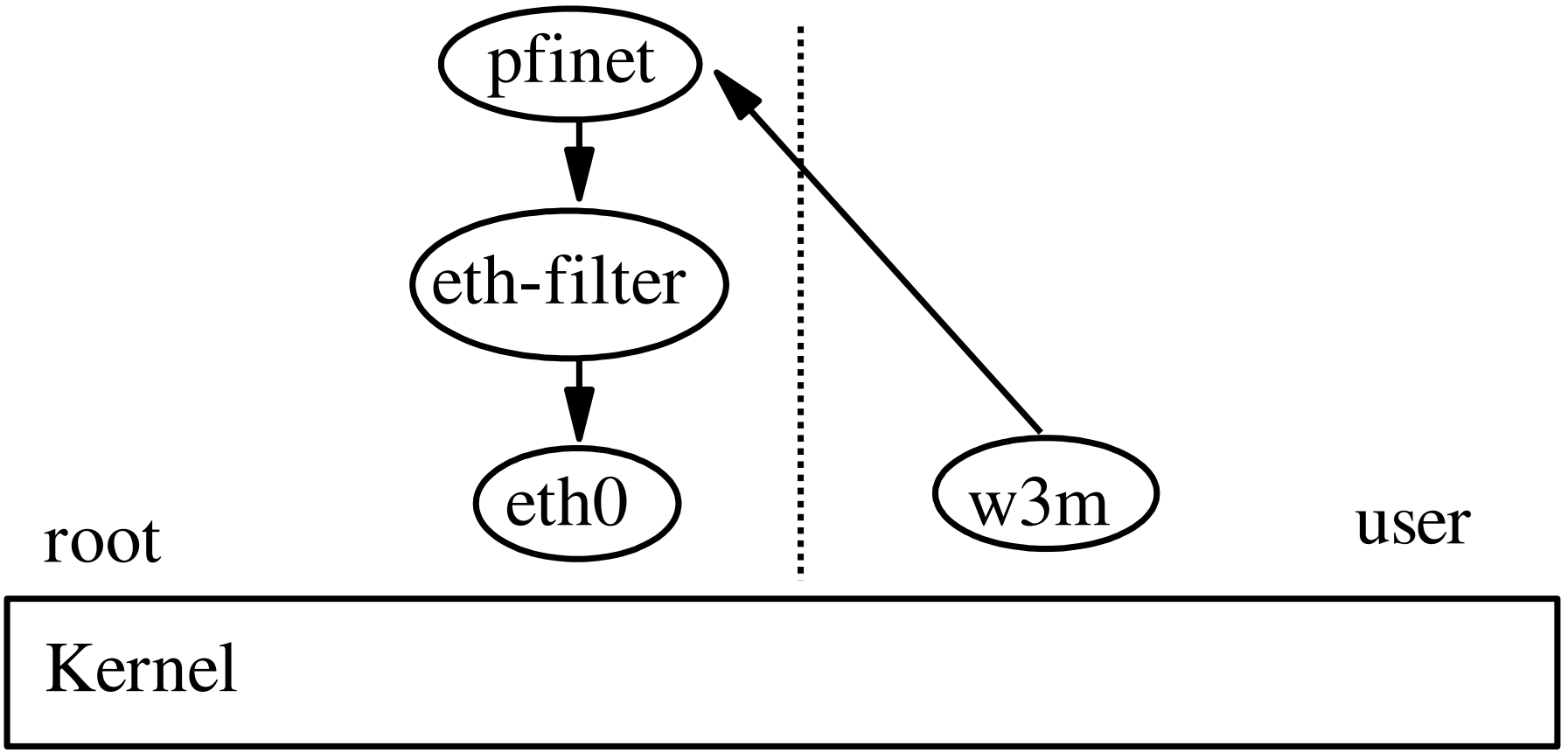
Hurd userland network support



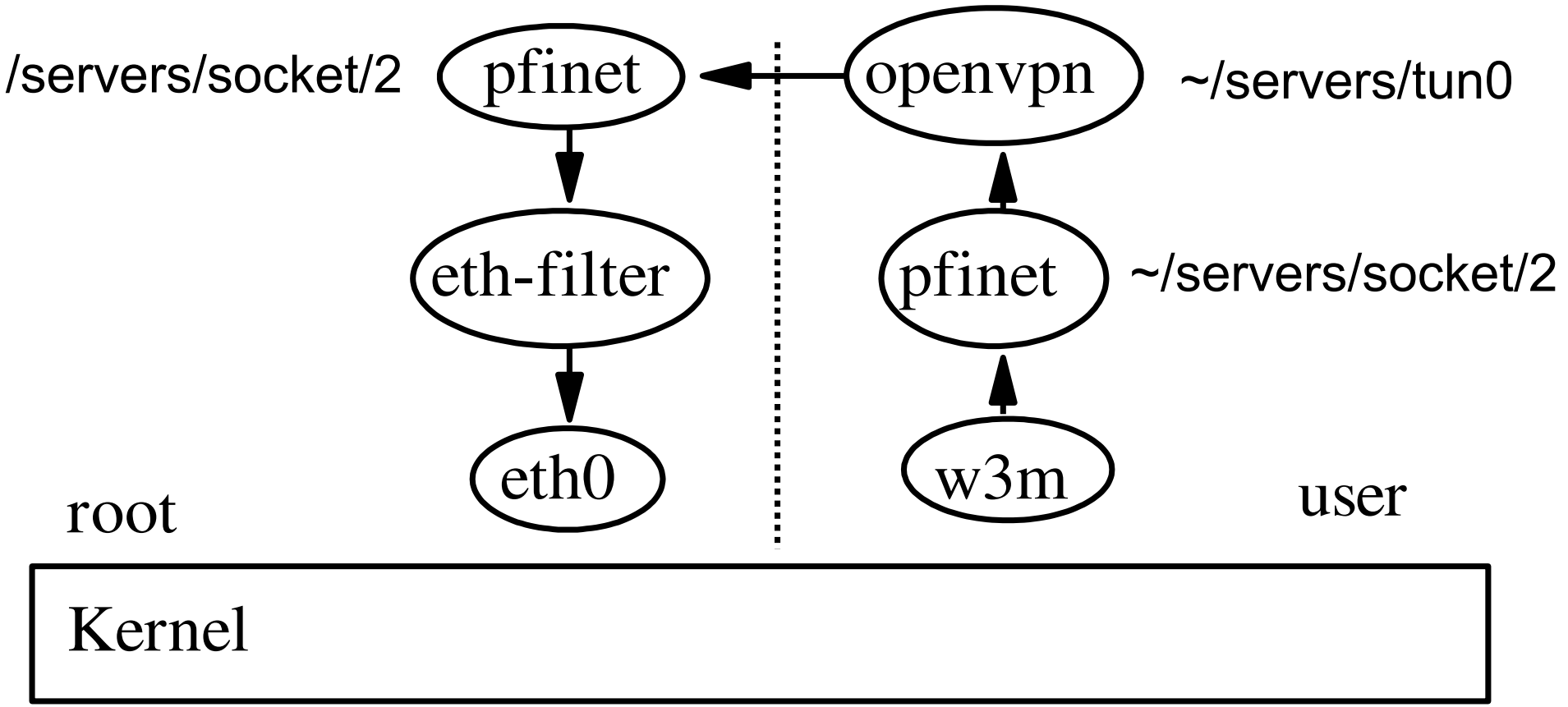
Hurd userland network support



Hurd userland network support



Hurd userland network support



Hurd userland network support

```
€ settrans -ca ~/servers/socket/2          \
      ~/bin/pfinet -i ~/servers/tun0       \
      -a 80.67.176.254 -p 80.67.179.1
€ vpn.sh &
€ ~/remap/remap.sh                                \
      /servers/socket/2 ~/servers/socket/2   \
      /etc/resolv.conf ~/resolv.conf
€€€ wget www.gnu.org
```

- My own translators
- Only wget accesses my pfinet (well, the shell too :))

Nice translators

- Tarfs, cvsfs, xmlfs, mboxfs
- Https, ftpfs, gopherfs
- Libfuse
- Run
  - Dynamic ~/.signature :)
- Netio/socketio (~= bash's /dev/tcp)
  - `cat ~/servers/socketio/tcp/ftp.gnu.org/21`
- Nsmux
  - `find foo.html,,xmlfs/body/ -name \*foo\*`
- Unionmount

Real-life ext2fs/e2fsck debugging

- Some ext2fs volume got corrupted
- ext2fs translator keeping crashing on opening it
  - A matter of gdb on ext2fs
  - Actually bogus inode number in the (hurd-only) translator record
  - e2fsck should have been able to clean that!
- Add i_translator check to e2fsck
- Remount with ext2fs, now fine

Real-life ext2fs/e2fsck debugging

- No actual system crash & reboot
- Mere gdb run and debunk
- Could even have been done as a user
  - (would have had to have access to the disk)

Recent software support

- GCJ, GNAT
- Gcc go: ongoing GSOC, issues with its own thread implementation
- Fixed lots of testsuite failures (perl, python, ...)
  - POSIX corners
  - Around the 99% figure now
- Languages for translators
  - Now using libpthread → python, perl, whatever...

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 (up to 2TiB disk support btw)
- Xen PV domU
  - Required GNU Mach changes only
- No USB, no sound yet

Current State

Software support

- Quite stable
  - Have not reinstalled boxes for years.
  - Debian buildds keep building packages, usually hang after some weeks, out of some remaining memory leak.
- ~78% of Debian archive builds out of tree
  - XFCE, almost gnome, almost KDE
  - Firefox (aka iceweasel), gnumeric, …
- Standard *native* Debian Installer

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/
- Toward Hurd 1.0 release?

Future work

- Xen PVH support, X86_64 support
- Language bindings for translators
- Read-ahead
- {hdd,sound,usb}dde?
- GNU system: Guix/Hurd?
- Debian GNU/Hurd Jessie?
- Your own pet project?

Thanks!

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

  http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.37.9653&rep=rep1&type=pdf