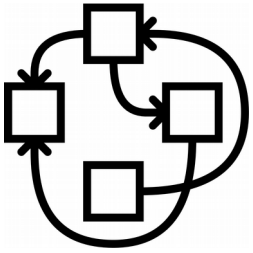
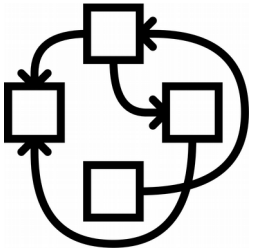


Latest news about GNU Hurd

Samuel Thibault

2016 August 18th



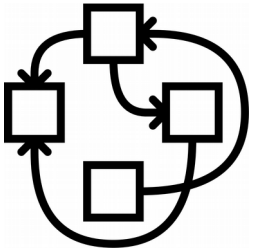
It's all about freedom #0

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

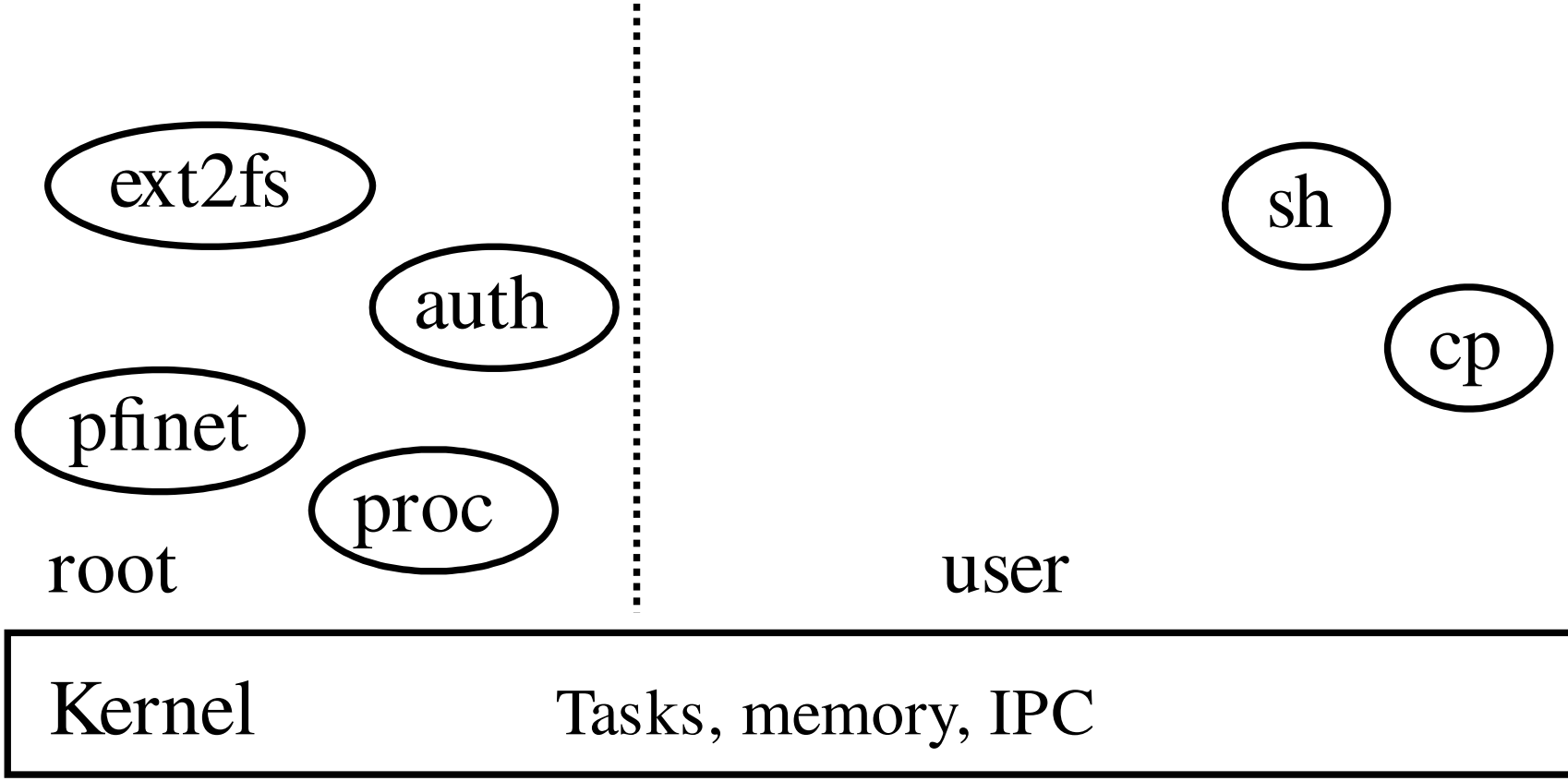
I.e.:

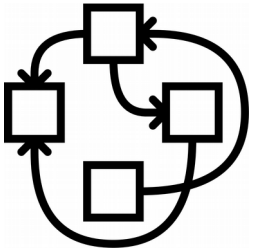
- Freedom from sysadmin!
  - WTH is fdisk/mke2fs/... hidden in /sbin?
  - I should be able to just work with my disk/network access
- Freedom to innovate
  - Experimental filesystem, personal work-flow, new kind of process combination,...

- Also provide freedom from misbehaving programs and drivers

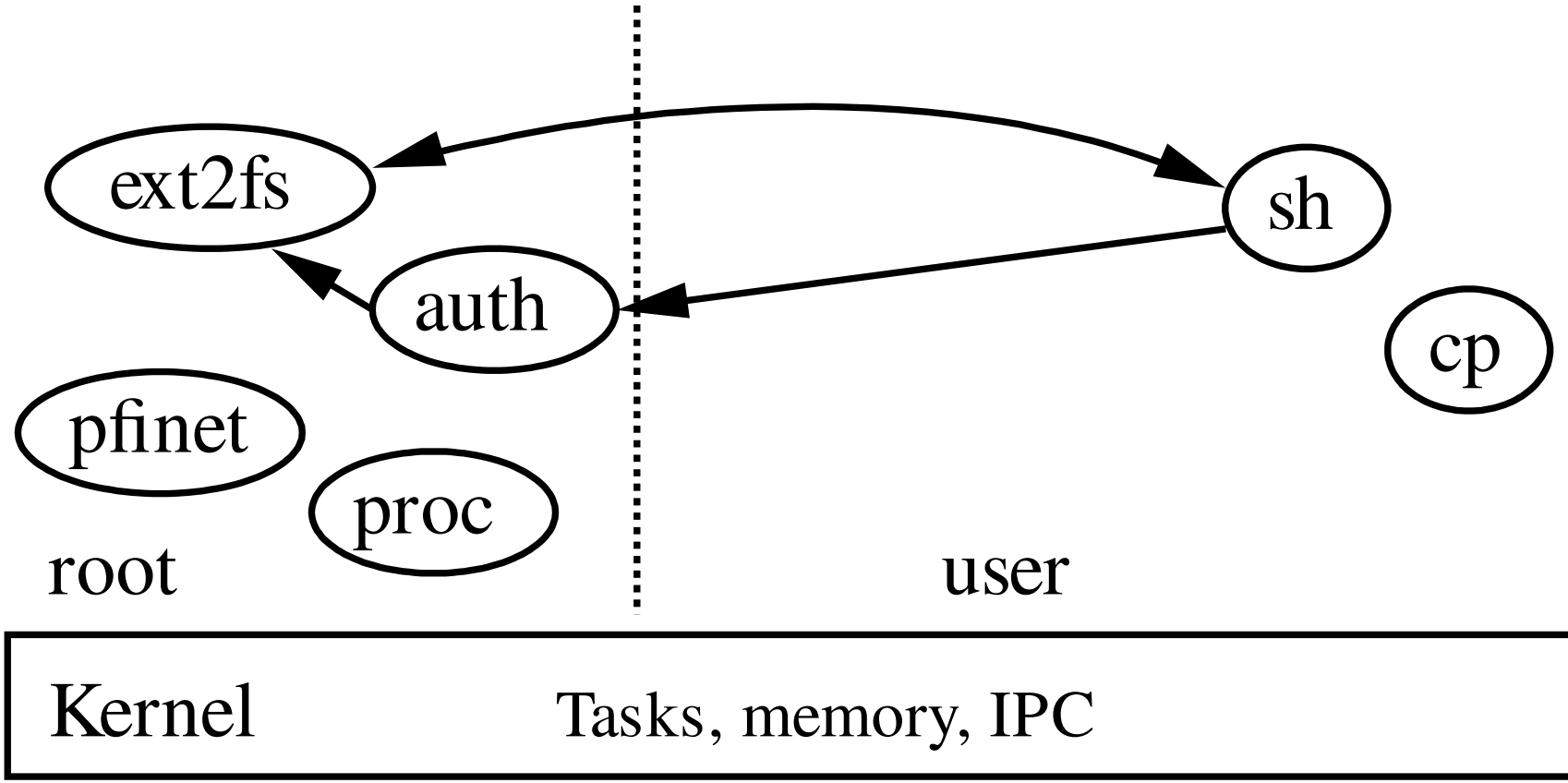


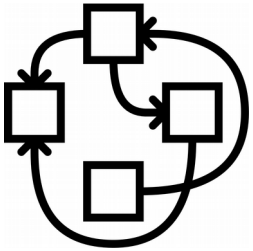
Micro-kernel layering





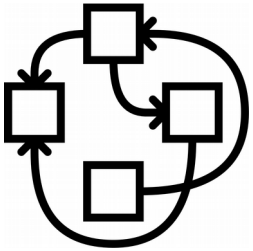
Micro-kernel layering



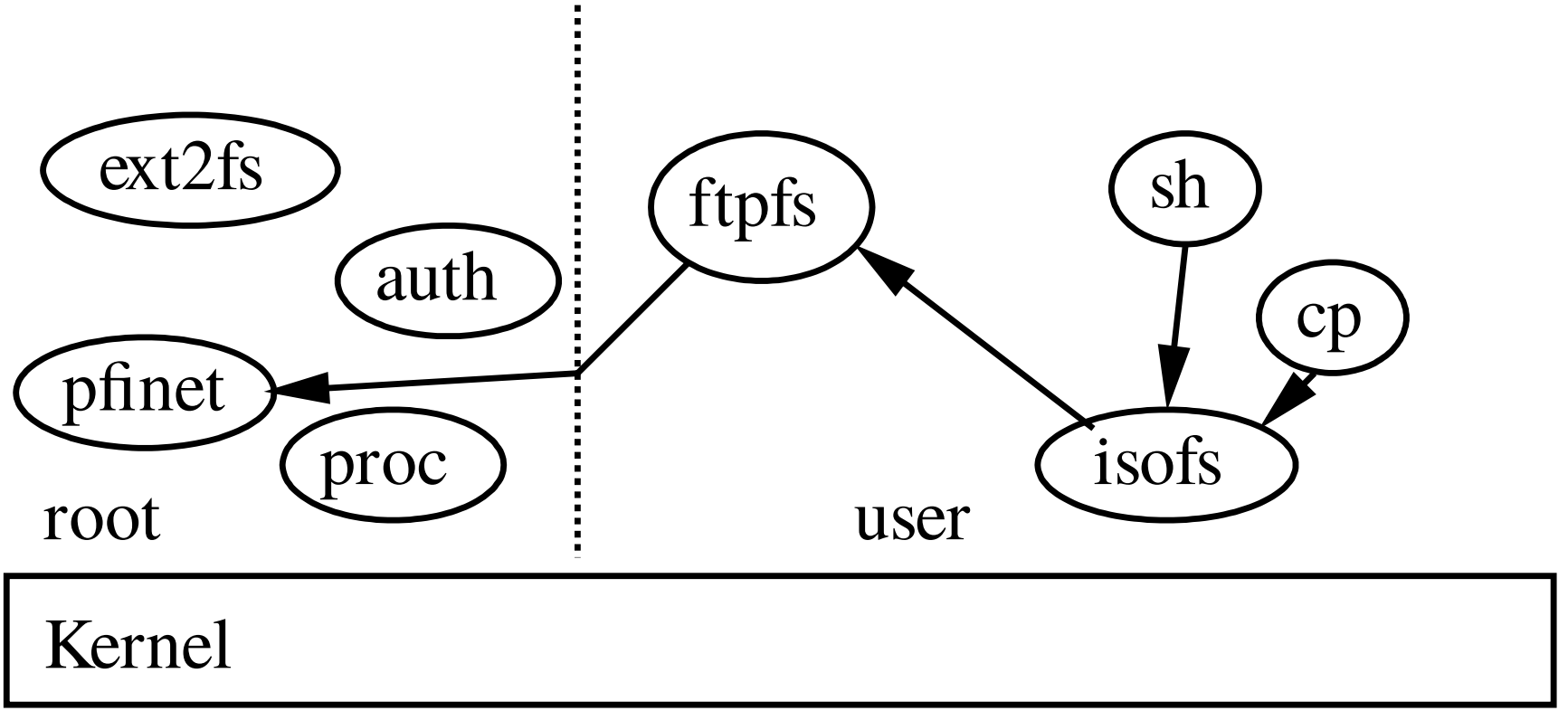


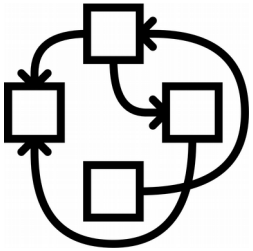
Micro-kernel layering

- 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



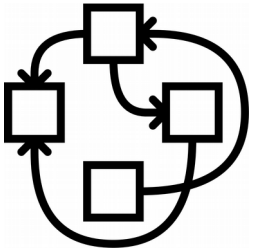


Hurd possibilities

```
€ 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

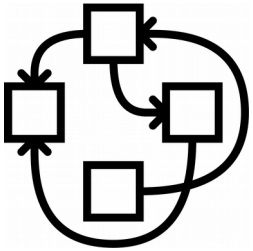
```
€ settrans ~/.signature /hurd/run /usr/games/fortune
```



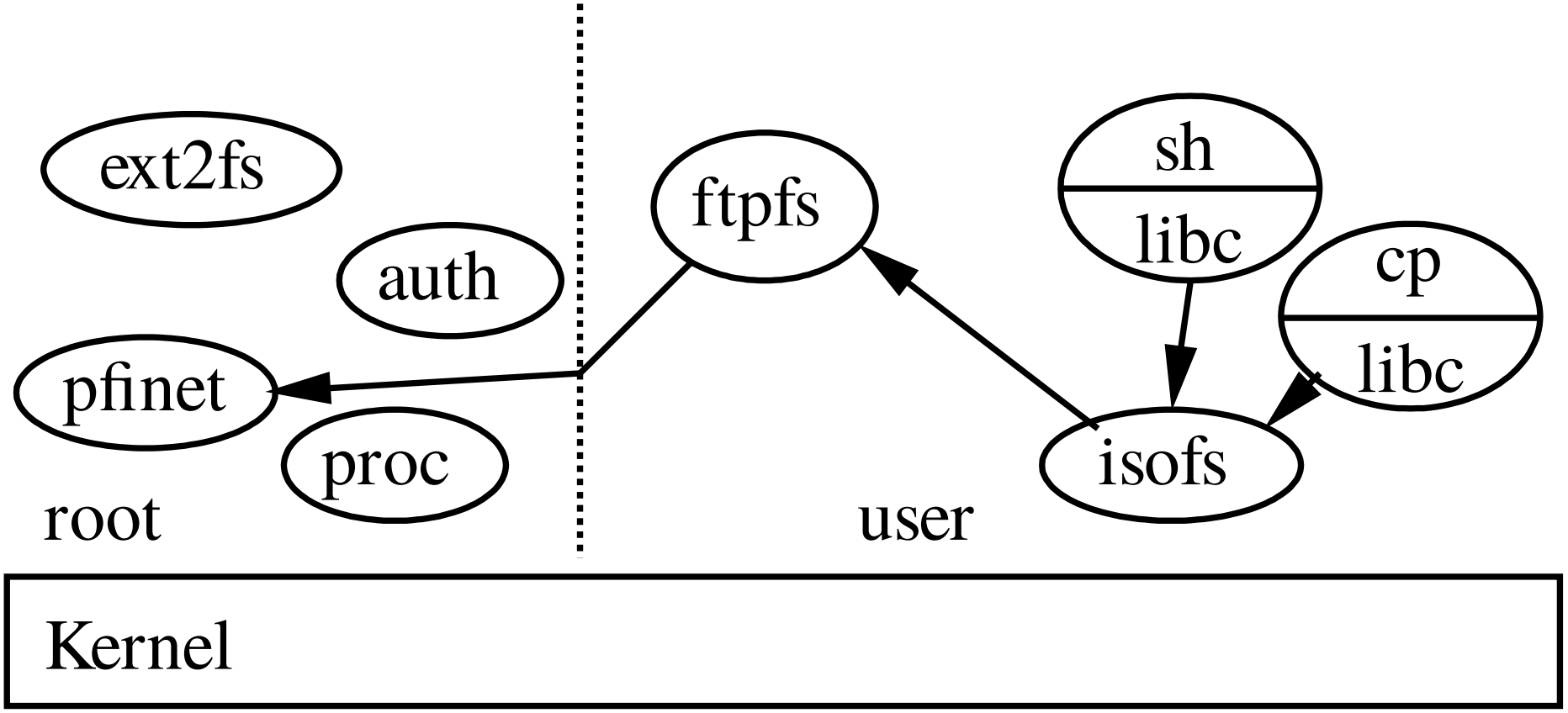
But also

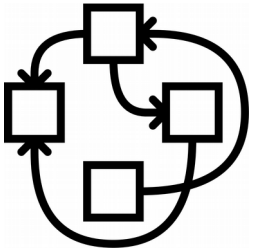
```
€ remap /bin/sh $HOME/bin/sh
€ remap /bin $HOME/unionbin
…
```

- Check out Stow/Nix/Guix!



How does it work?

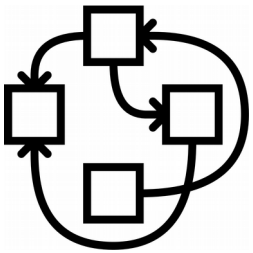




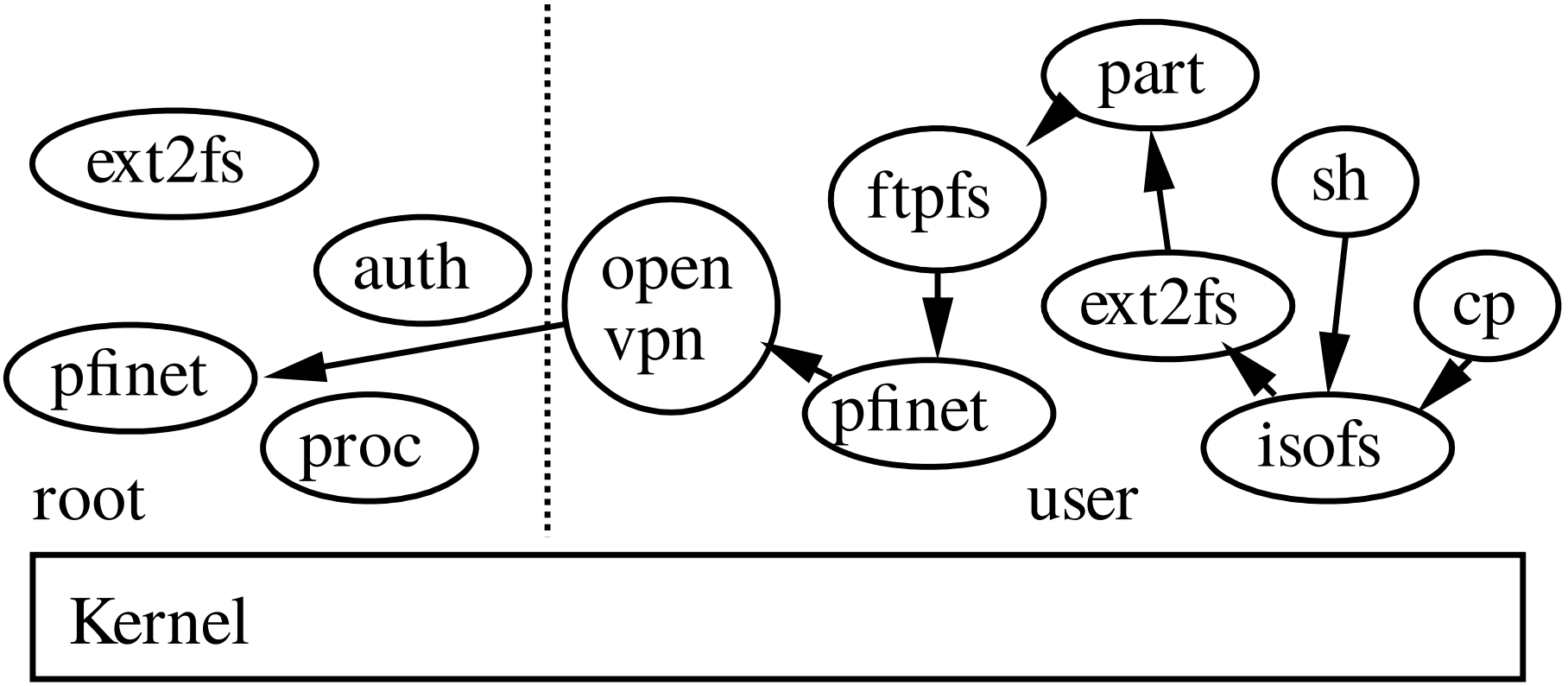
Rationale

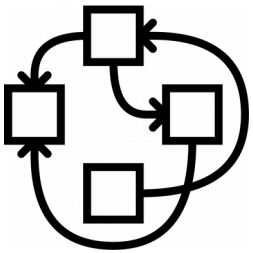
- **Everything** is an (interposable) RPC
- Translators exposed in the FS
  - The user gets to decide what/how to interpose
    - Without need for costly ptrace or fragile libc symbols interposition.
    - **Native** fakeroot/chroot
    - Fully virtualized and fine-grained interface
  - Just need to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

  and pile over it

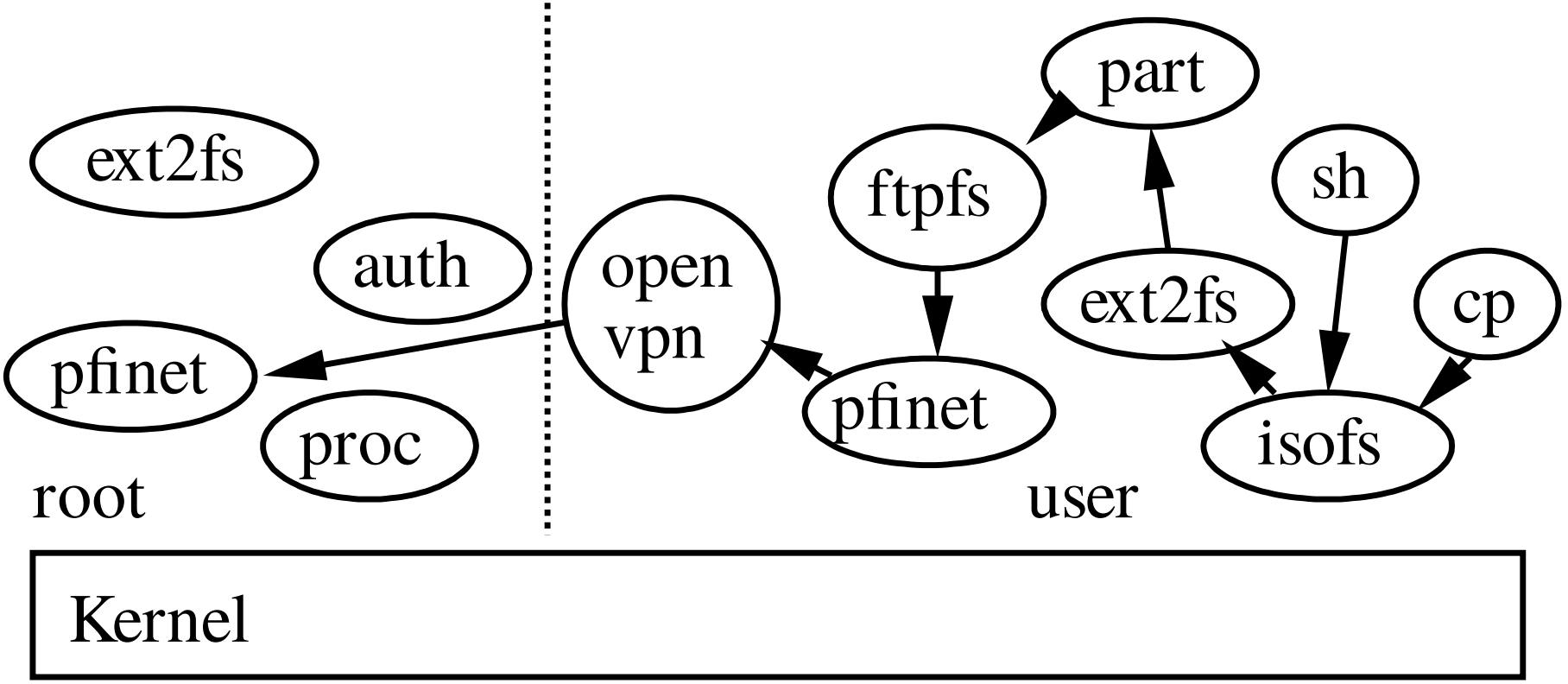


Hurd possibilities (cont'ed)

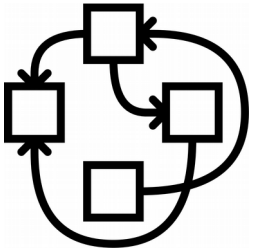




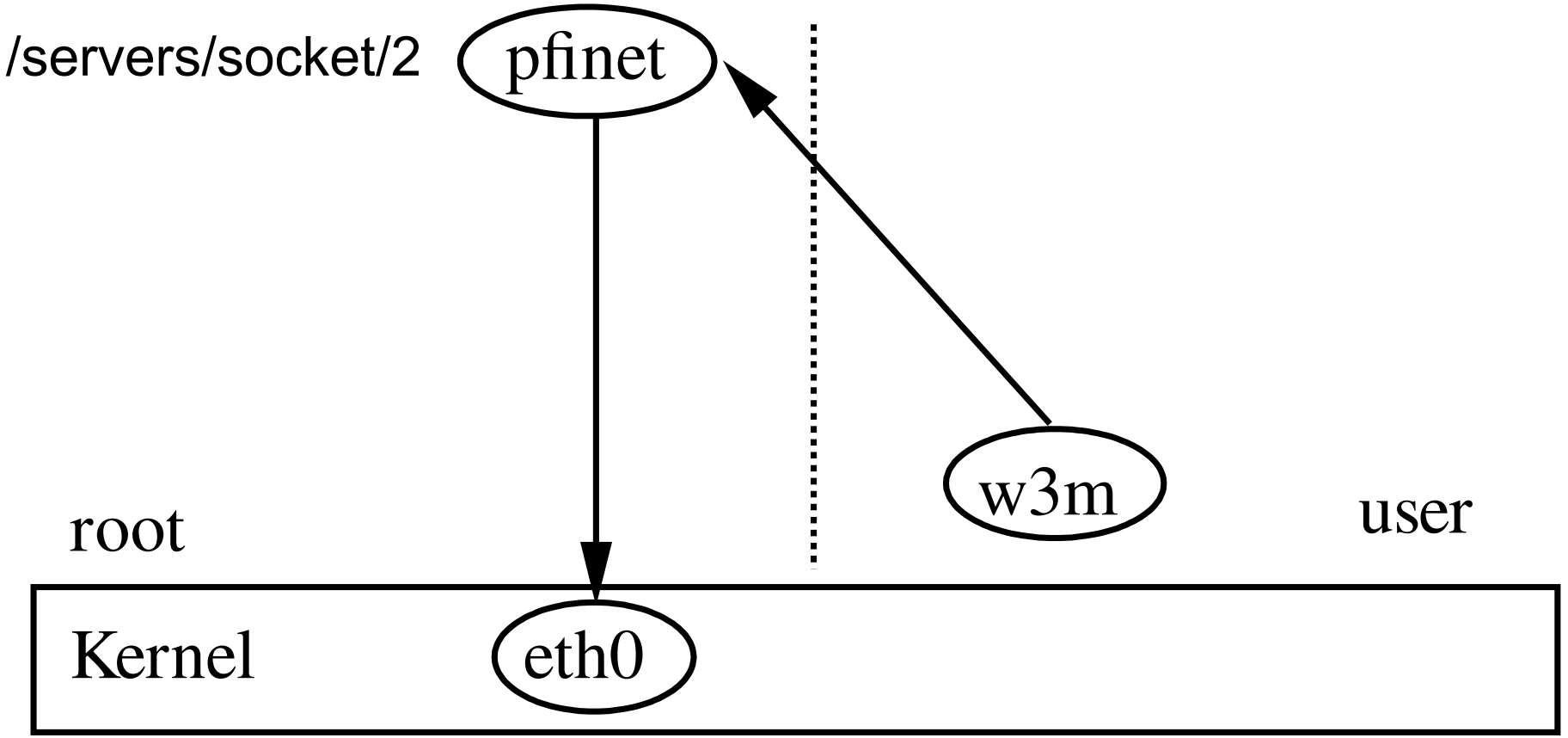
Hurd possibilities (cont'ed)

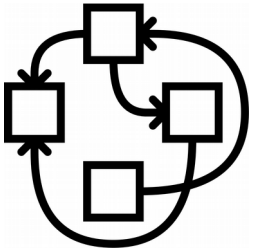


i.e. ISO image inside a partitioned disk image on ftp over a VPN

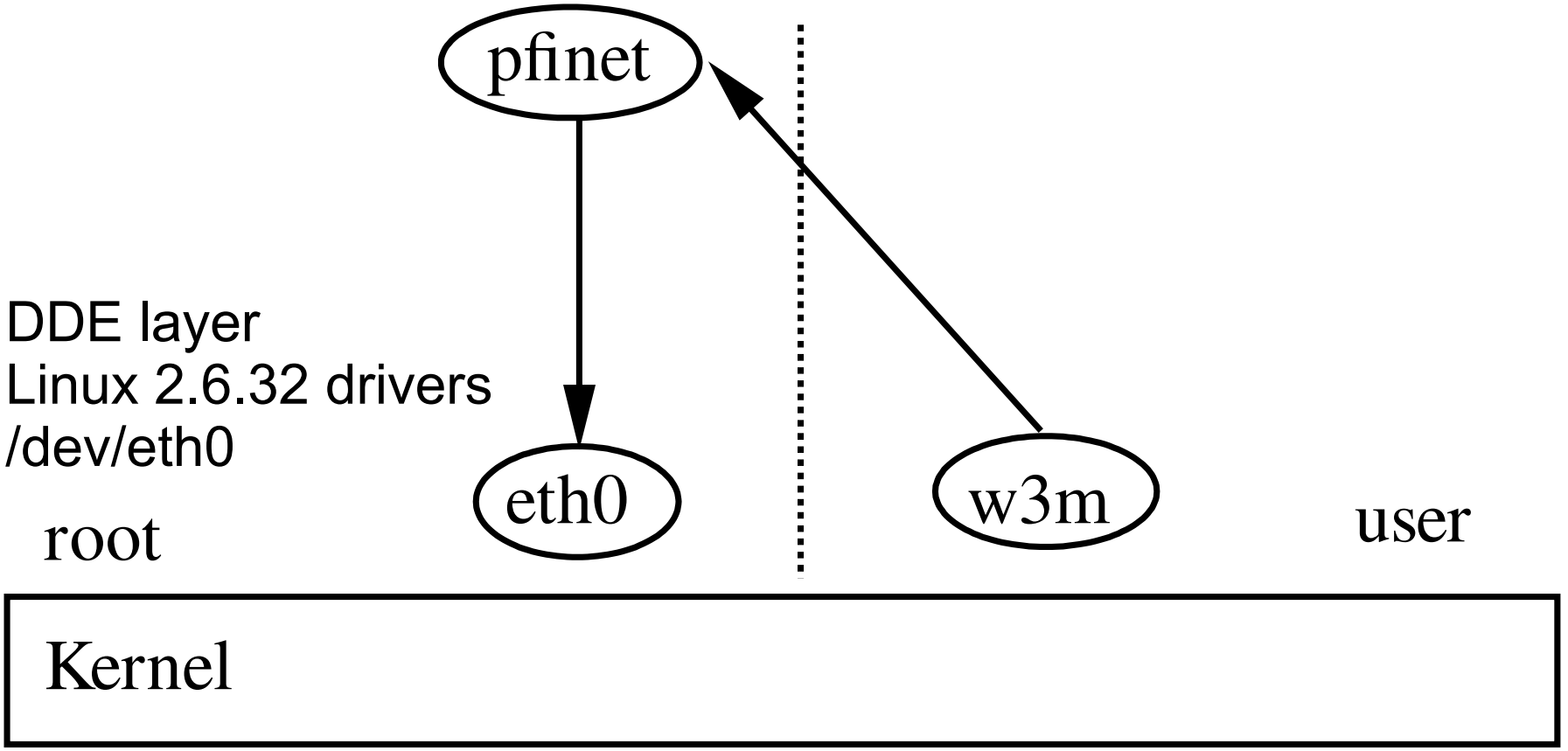


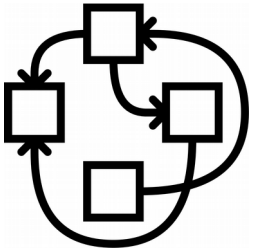
Hurd userland network support



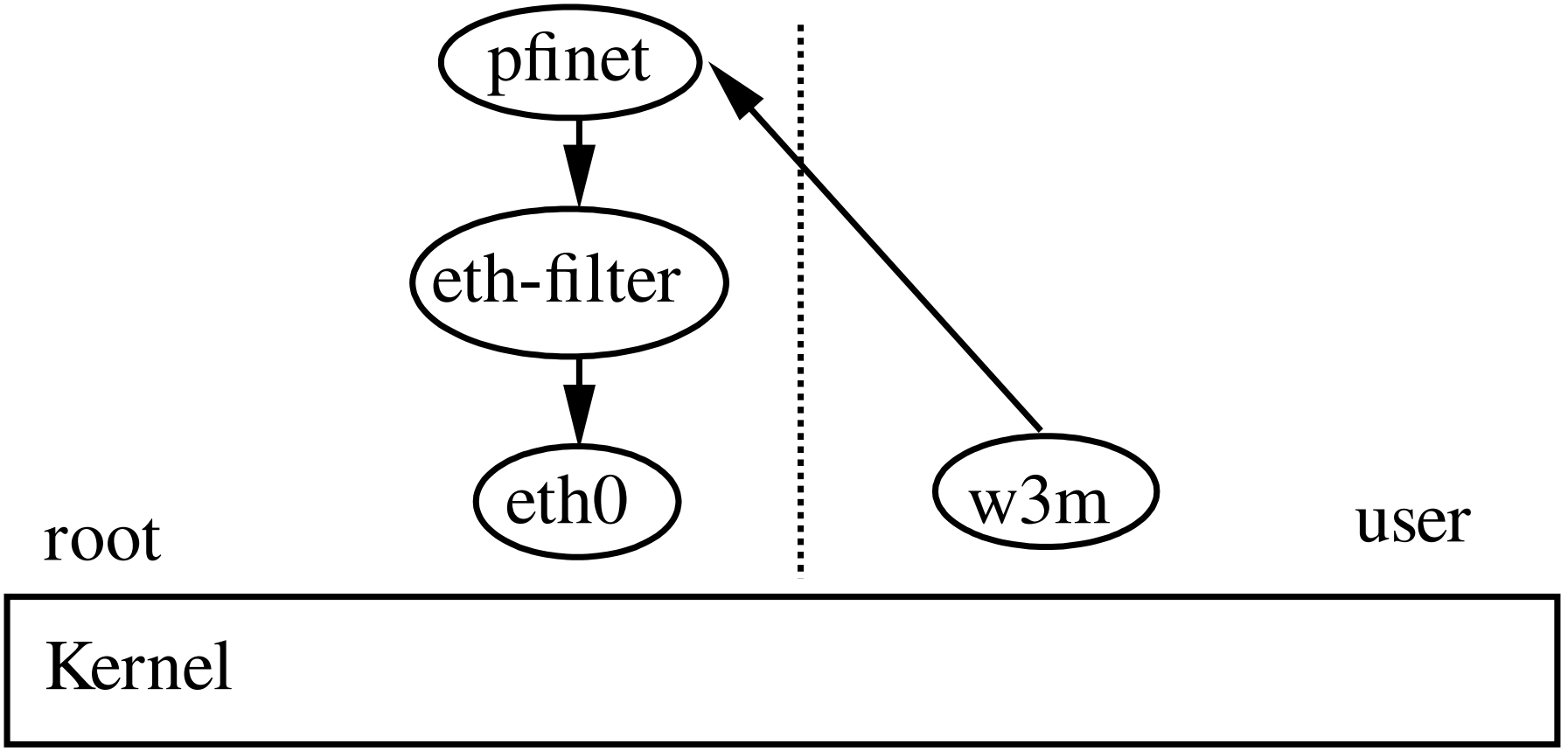


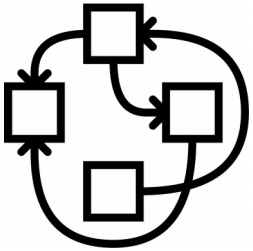
Hurd userland network support



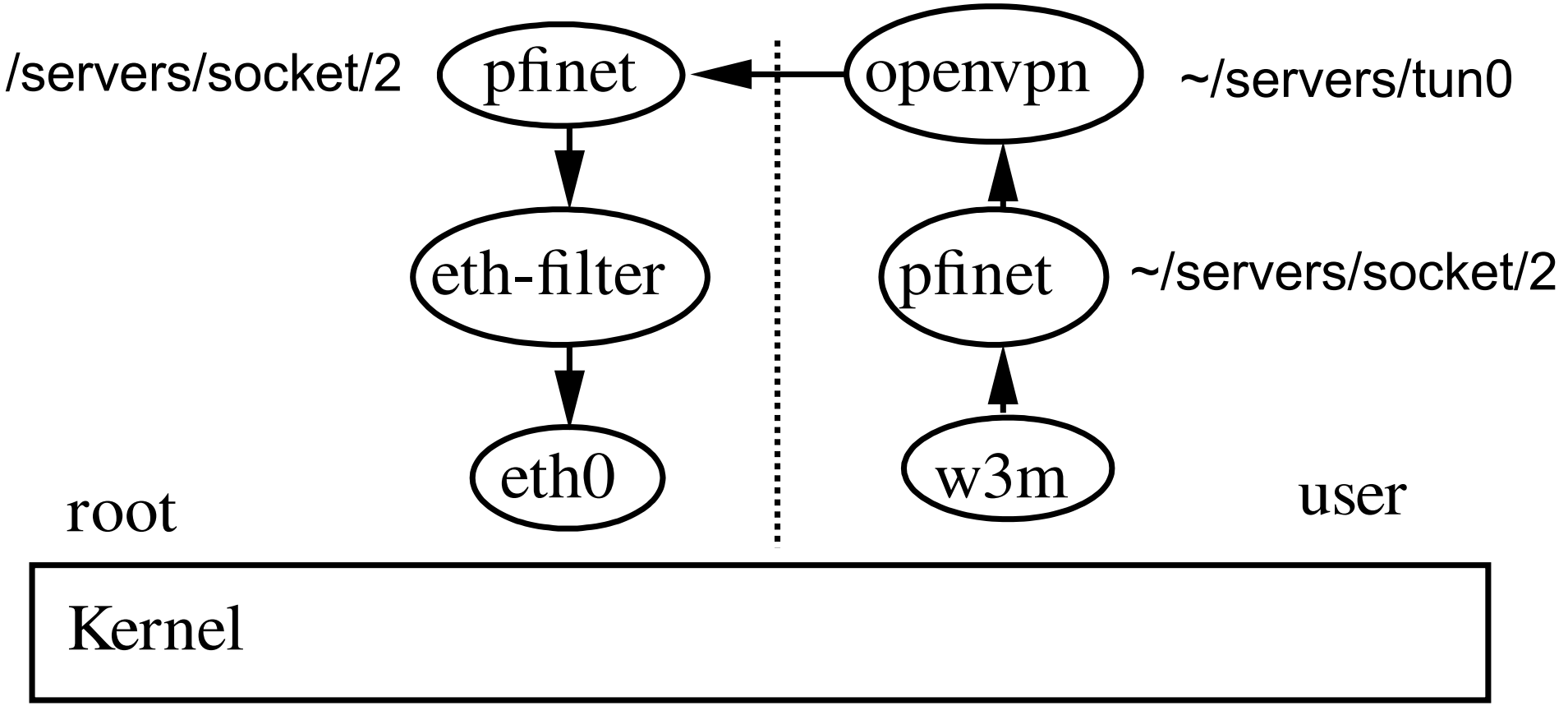


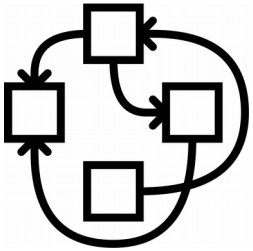
Hurd userland network support





Hurd userland network support

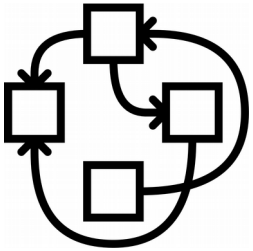




Hurd userland network support

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

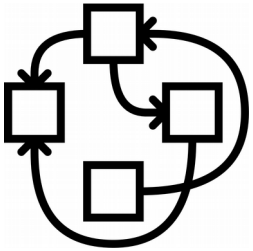
- My own translators
- Only wget accesses my pfinet (well, the shell too :))



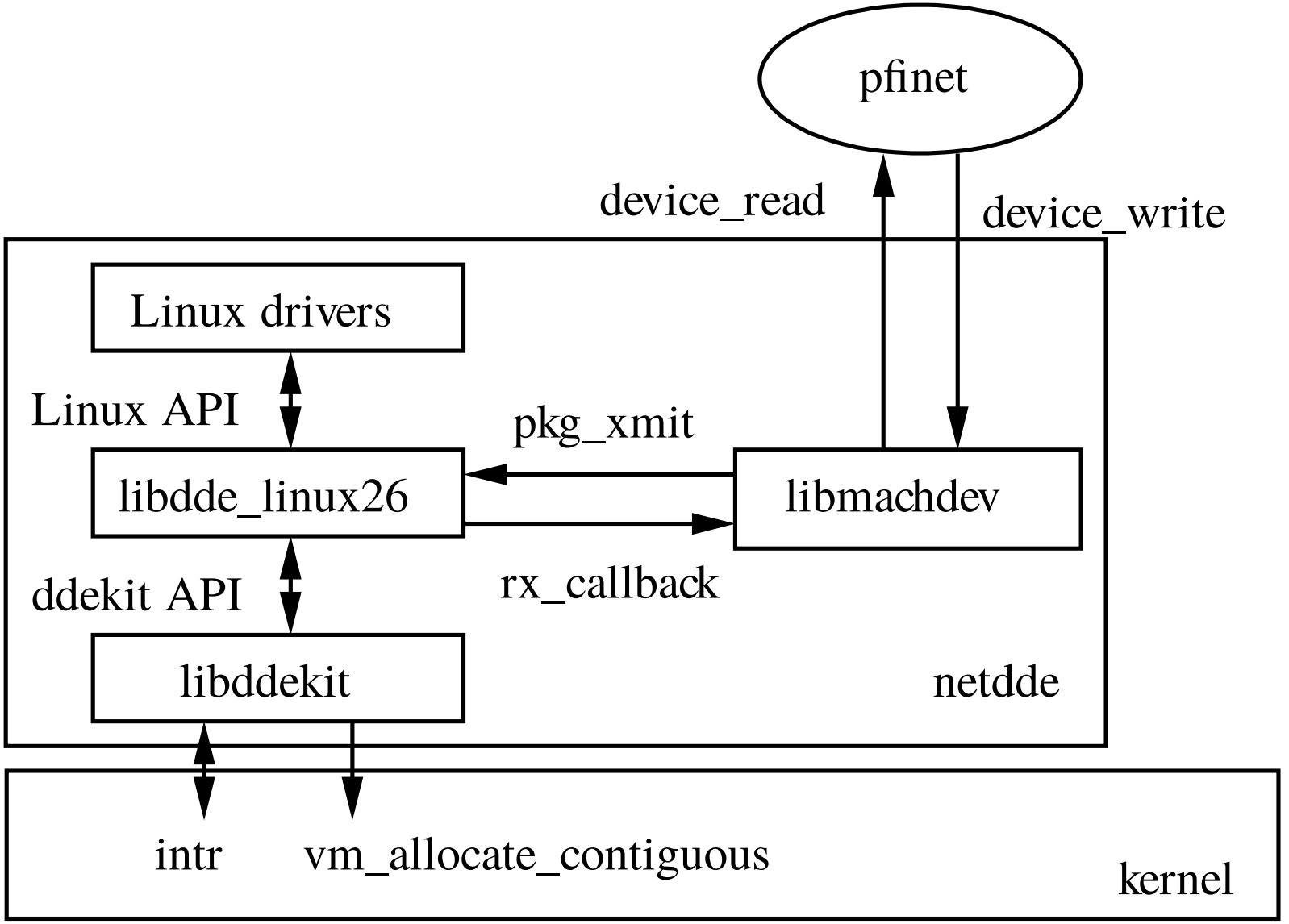
DDE stack

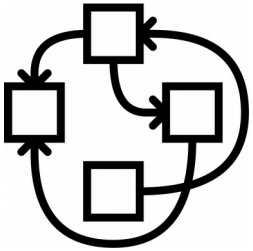
Based on TU-Dresden's DDE stack

- Zheng Da's GSOC
- Ported to Mach kernel
- Ported to Mach device interface
- Updated libdde_linux26 for long-term-supported linux 2.6.32
  - Most drivers (and mostly the really useful ones) just work without patches
- Used by default by Debian GNU/Hurd



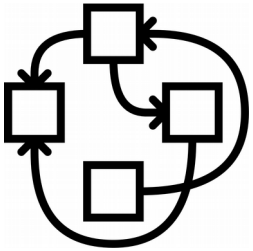
DDE stack


pfinet
device_read
device_write
Linux drivers
Linux API
pkg_xmit
libdde_linux26
libmachdev
ddekit API
rx_callback
libddekit
netdde
intr
vm_allocate_contiguous
kernel



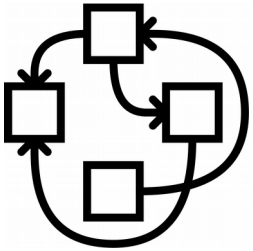
DDE stack

- Only two additions to the kernel
  - Interrupt delivery and masking
  - Physically-contiguous memory allocation
  - (Direct I/O access was already available)
- Performance similar to in-kernel driver
- Driver in a separate process
  - Can just crash and be happy with it...
  - Can easily debug and profile them
  - Stack smashing protection ;)
  - Could benefit from I/O MMU for better isolation.
    - For now drivers can just access all RAM...

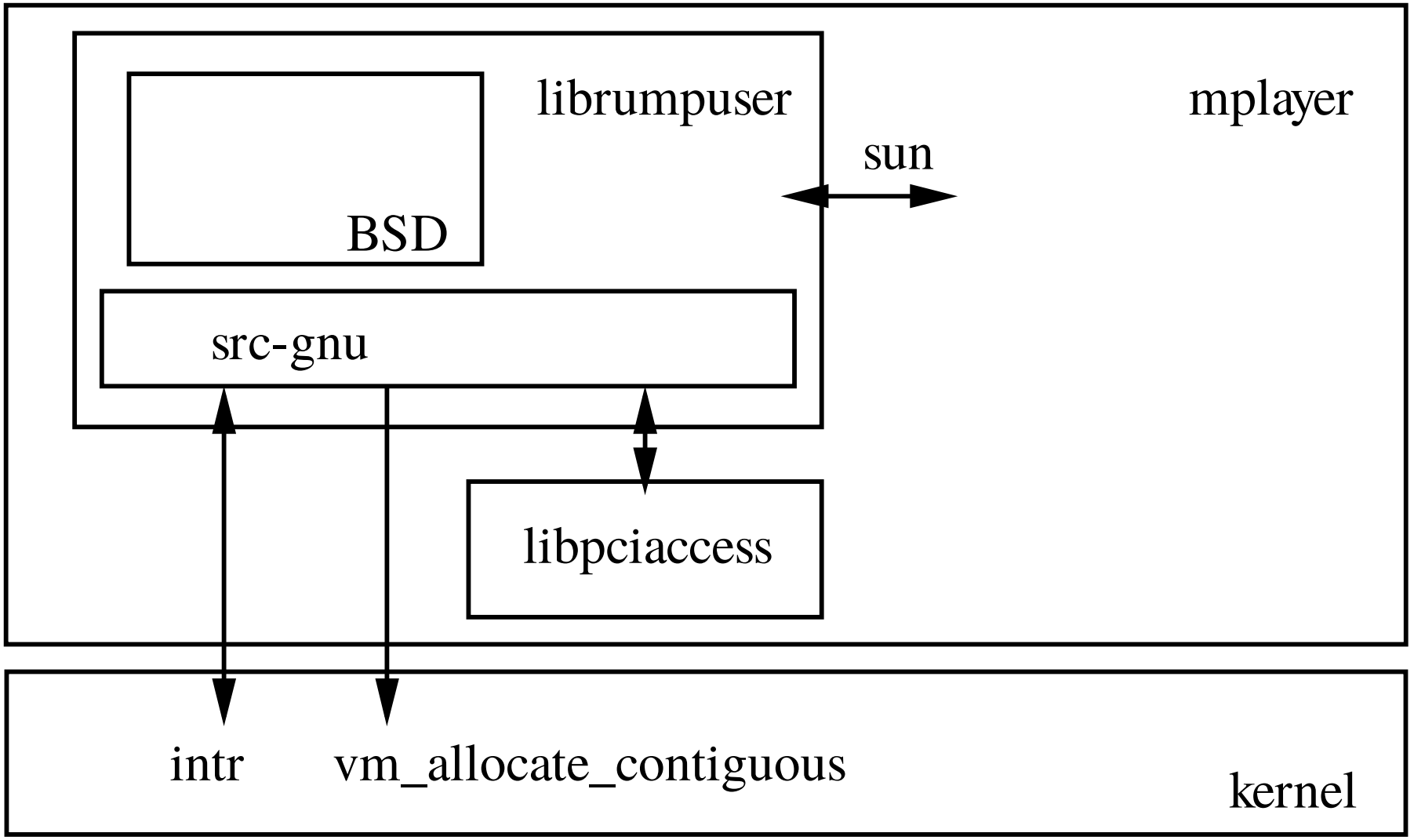


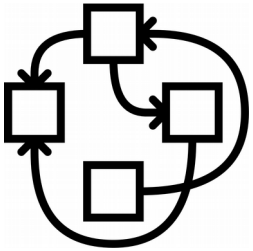
More DDE?

- Disk DDE is supposed to be working
  - Should be not very complex
    - device_read / device_write
  - Zheng Da said he didn't manage to make it work
- USB/sound DDE was mentioned as experimental
  - I don't know the status?
  - We would definitely love to have that
- Rather use Rump kernels?

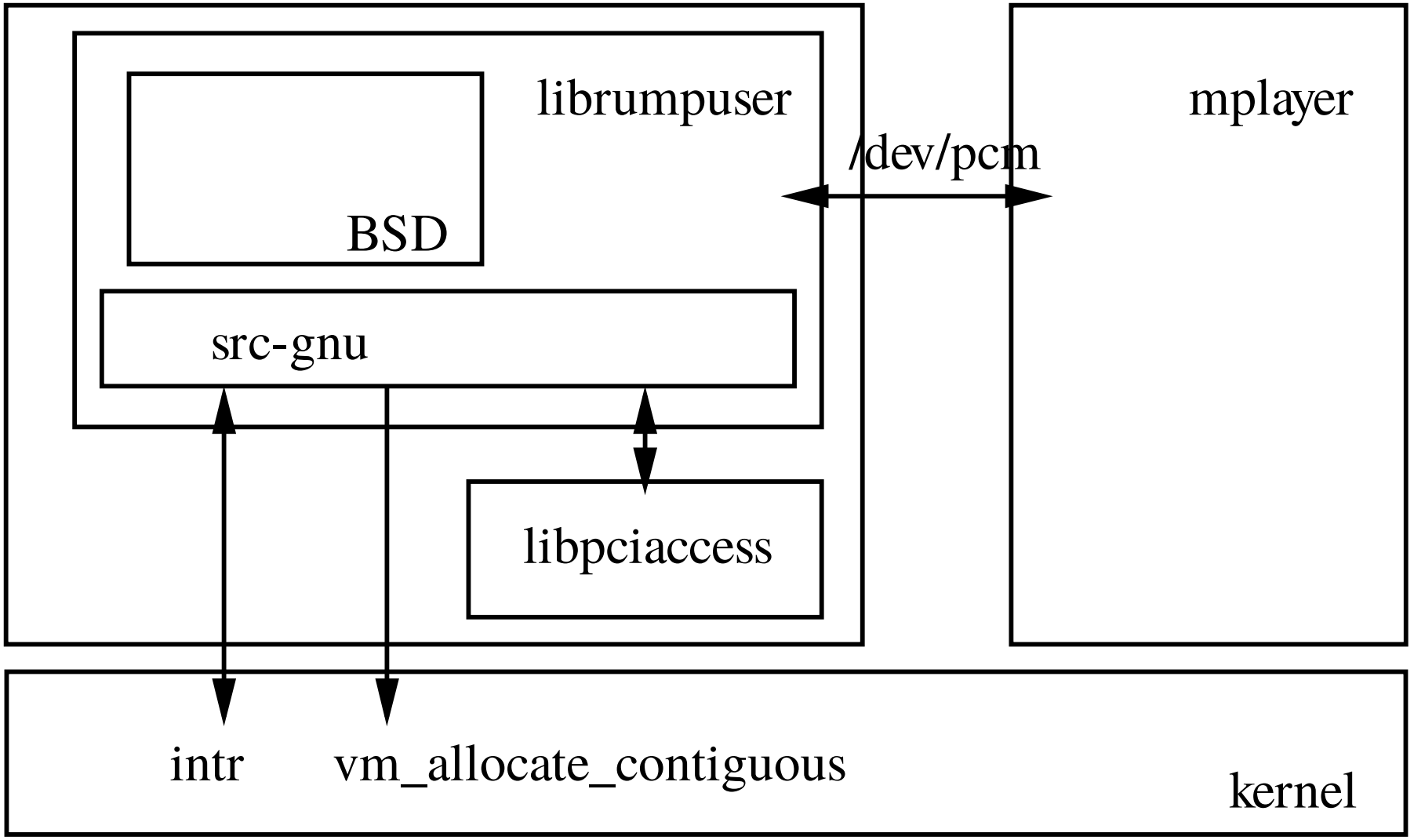


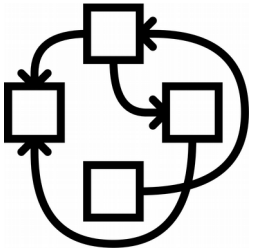
Rump sound support, v0



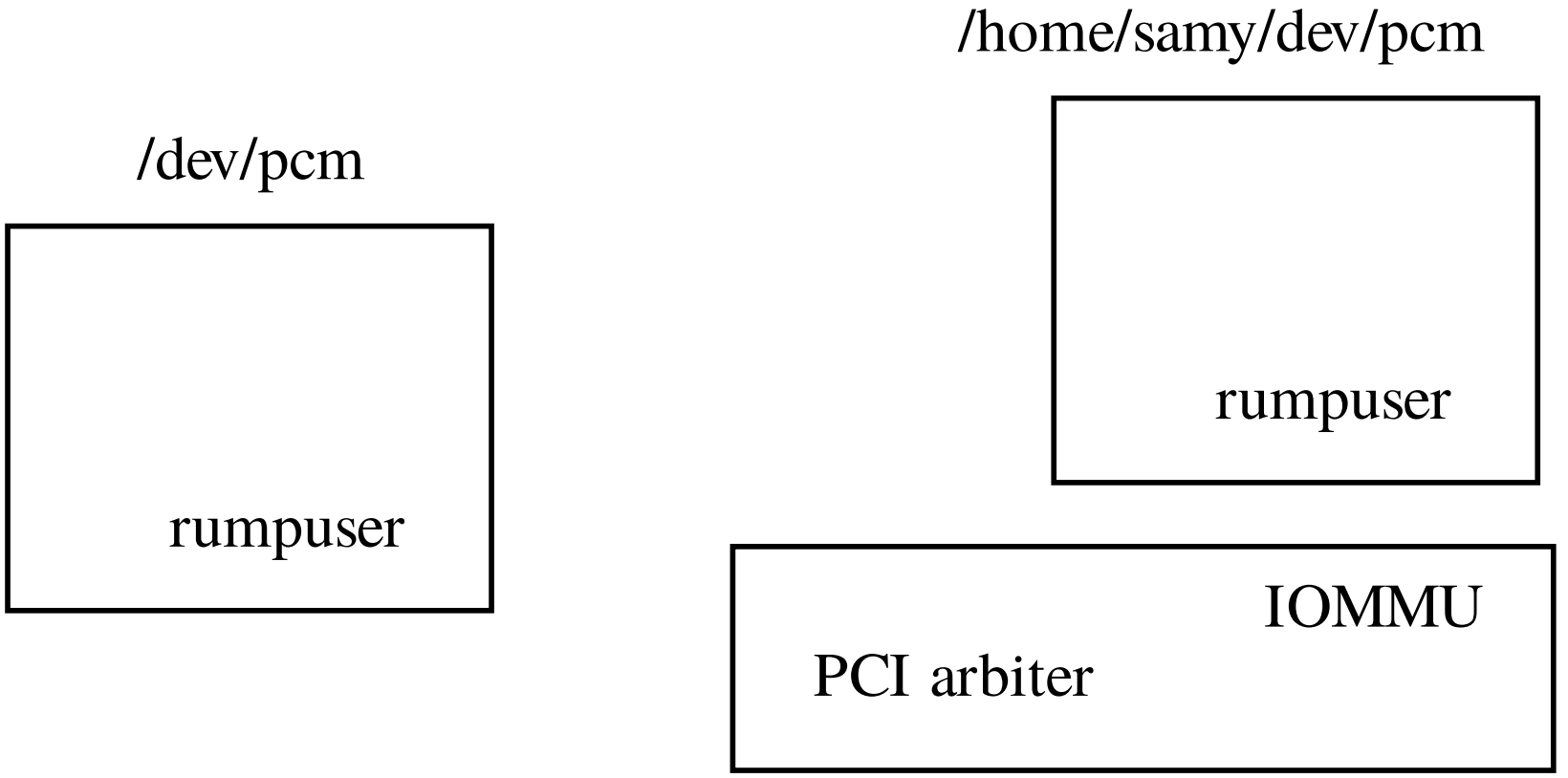


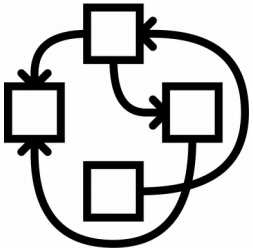
Rump sound support, v1



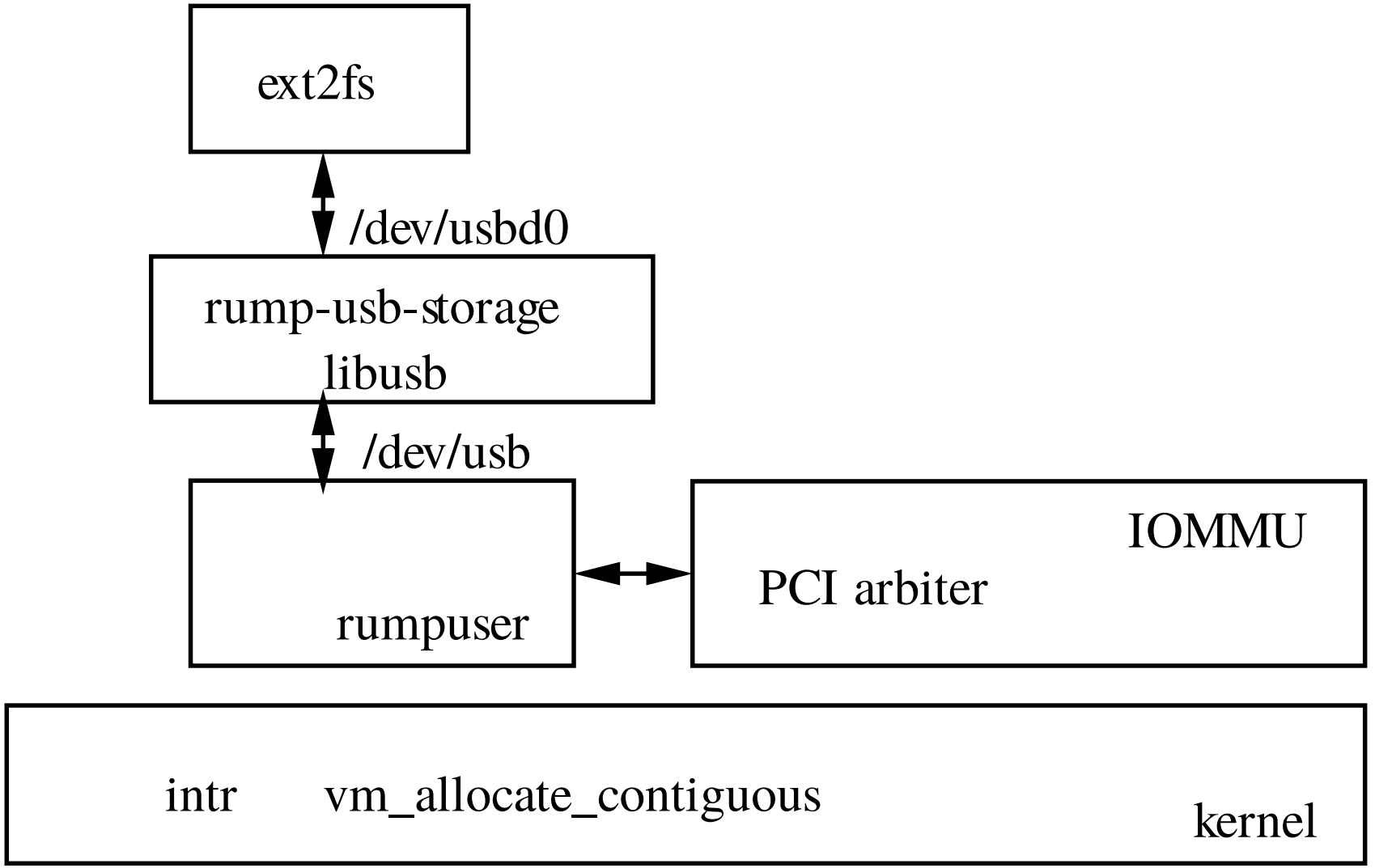


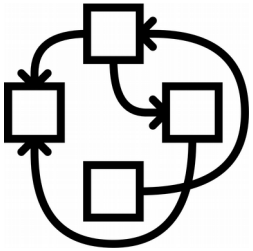
Rump sound support, v2



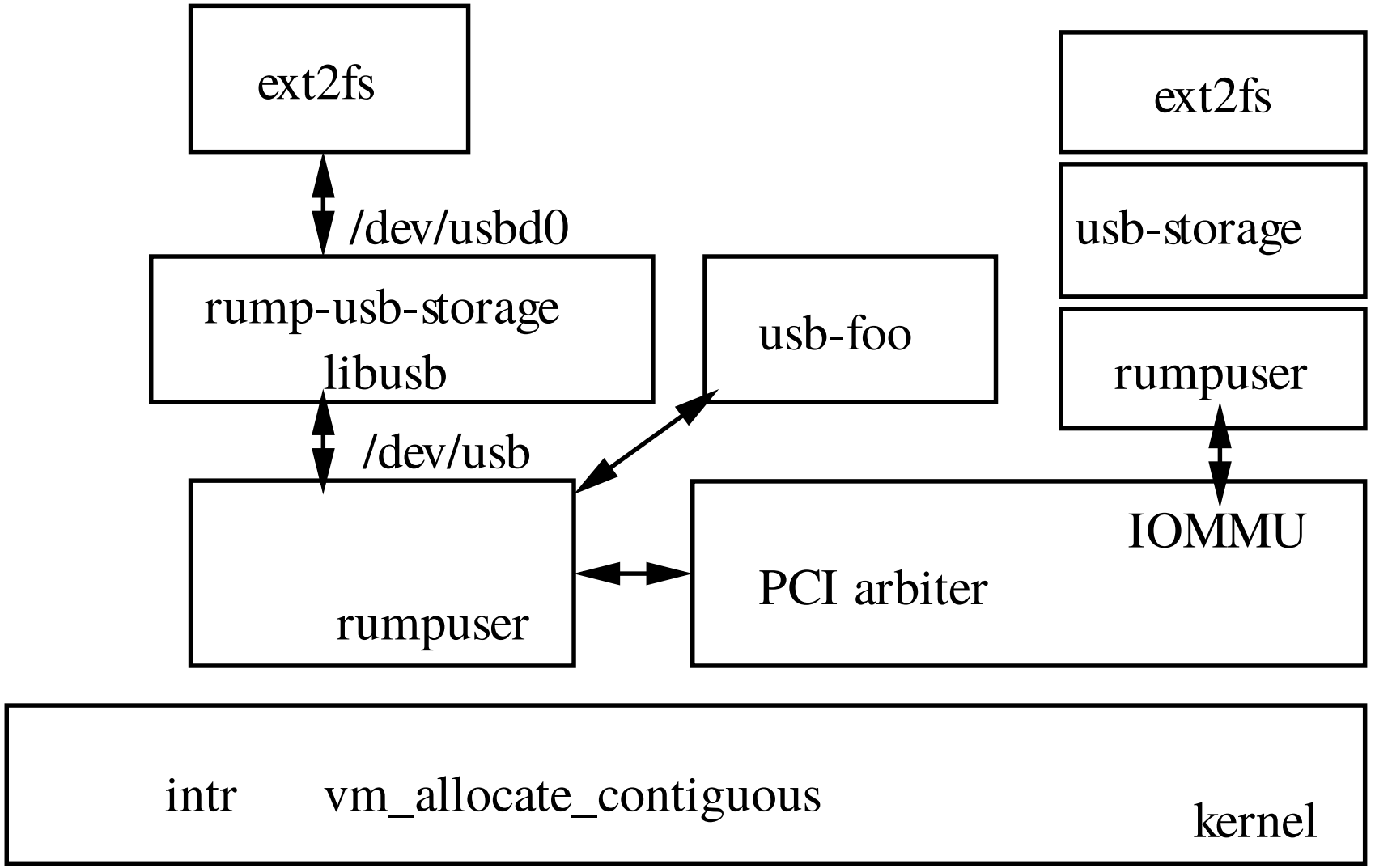


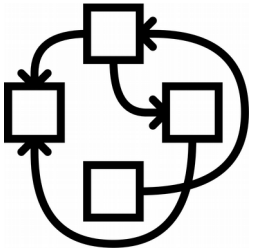
Rump USB support



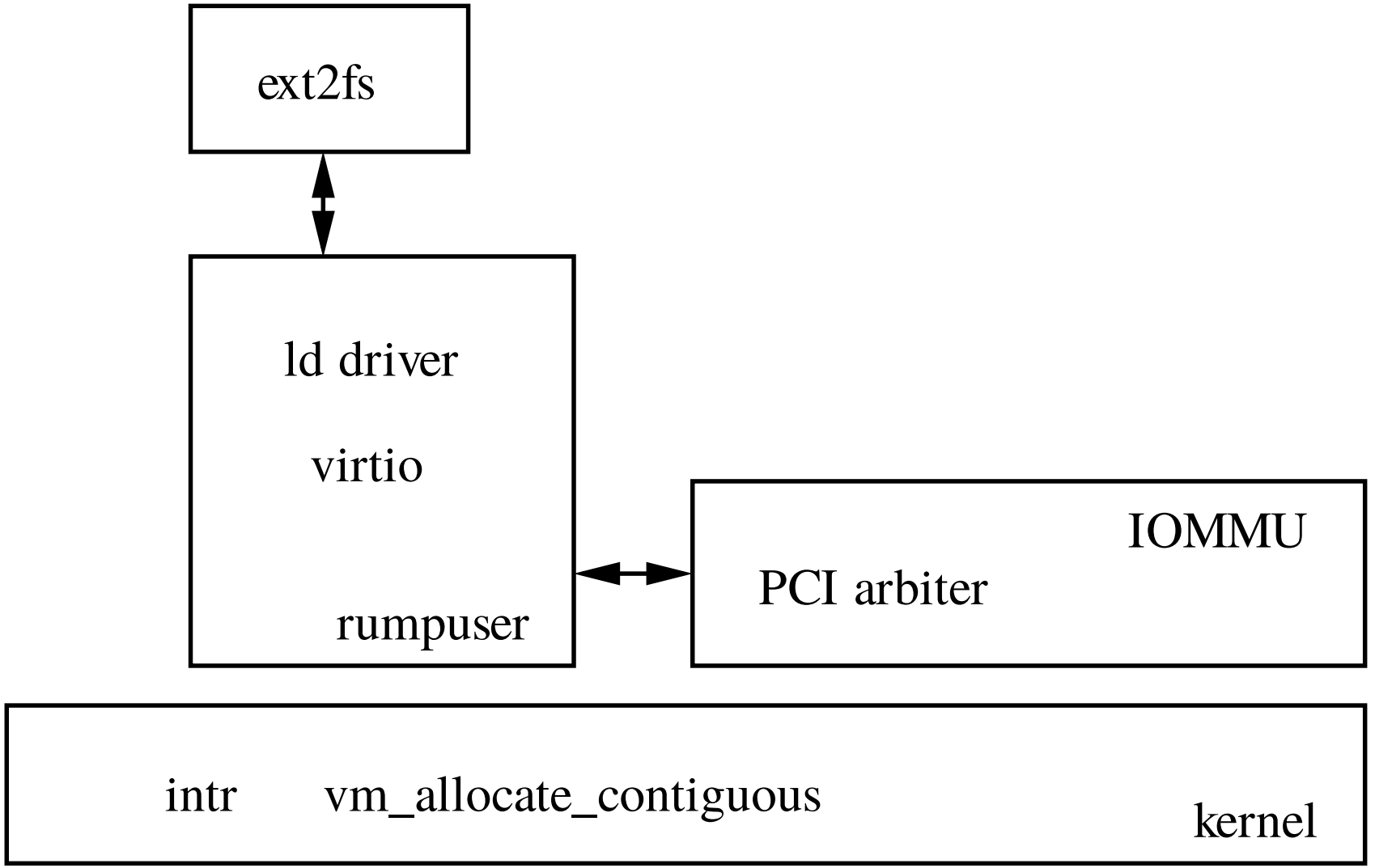


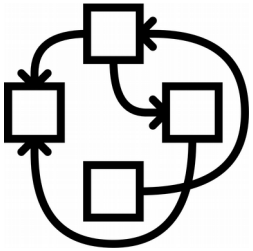
Rump USB support





Rump virtio disk support

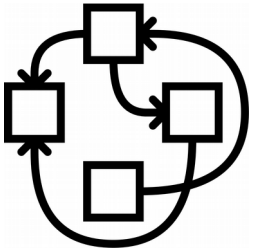




Current State

Hardware support

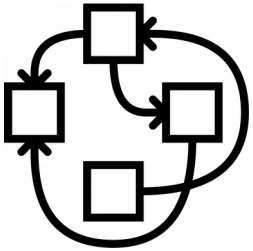
- i686
- start of 64bit support
  - Kernel boots completely, now missing RPC 32/64bit translation
- DDE Linux 2.6.32 drivers layer for network boards
  - In userland netdde translator!
- IDE, Xorg, …
- AHCI driver for SATA
- Xen PV domU
  - Required GNU Mach changes only
- Preliminary sound support through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



Current State

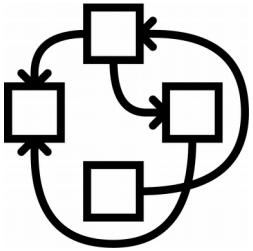
Software support

- Quite stable
  - Have not reinstalled boxes for a decade.
  - Debian buildds keep building packages, no hang after weeks!
- ~80% of Debian archive builds out of tree
  - XFCE, almost gnome, almost KDE
  - Firefox (aka iceweasel), gnumeric, …
- Standard *native* Debian Installer



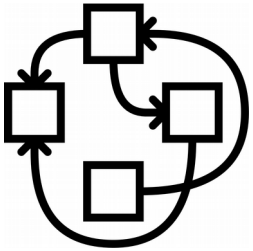
Recent work

- GNU Guix and GuixSD
  - Guix used daily on Debian GNU/Hurd
  - A pure GNUish GNU/Hurd distro!
  - Proper bootstrap of the Hurd chain
    - Used by Debian GNU/Hurd rebootstrap effort
  - Proper isolation of builds
    - fakeroot+firmlinks instead of fakeroot+bind
  - A bit more work to be bootable
- Fixed native fakeroot
- Using xattr for storing translators



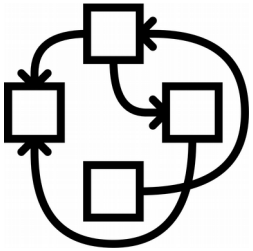
Recent work (2)

- SCM_CREDS
- Various optimizations and stabilization
  - Protected payloads
  - Paging management
  - Message dispatch
  - Gsync ~= futex, used in glibc & libpthread
- Automatic code checking
  - Port references: static analysis, runtime check?



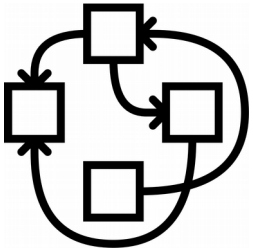
Releases

- Nice 0.401 release on April 2011.
- Arch Hurd LiveCD release on August 2011.
- Hurd 0.8, Mach 1.7, MIG 1.7
- Released Debian-unofficial
  - wheezy/sid snapshot CDs on May 2013 \o/
  - jessie/sid snapshot CDs on May 2015 \o/



Future work

- Highmem support
- X86_64 support
- Read-ahead
- {sound,usb} Rump drivers
- GNU system: Guix/Hurd?
- Startup in scheme?
- Your own pet project?



Thanks!

- For listening
- And to the people working on all this
- 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