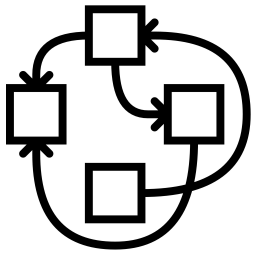
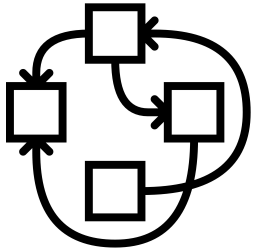


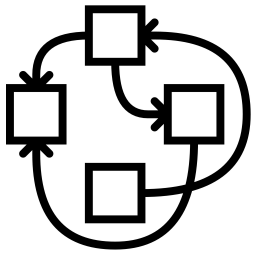
GNU/Hurd AKA Extensibility from the Ground

Samuel Thibault

2011 August 26th



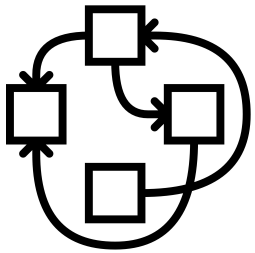
<marcus> Jeroen: you are a Hurd developer. Being
insane is part of the public image.



It's all about freedom #0

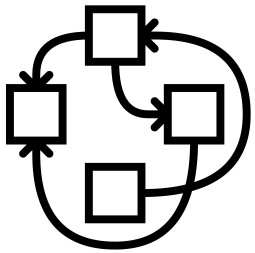
Extensibility for the user

- 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

- The big hammer
- Traditional monolithic layering
- Gvfs layering
- FUSE layering
- Micro-kernel layering



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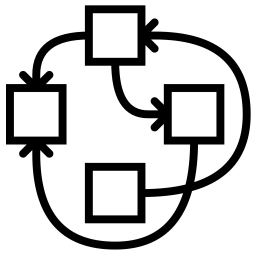

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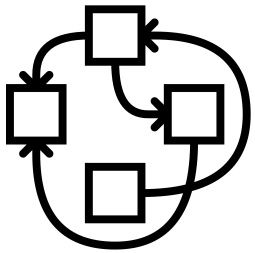
- So what?



Outline

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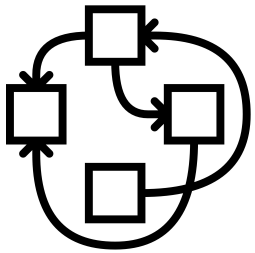
- FUSE layering
- Micro-kernel layering
- Hurd possibilities
- So what?
- Yet more fun

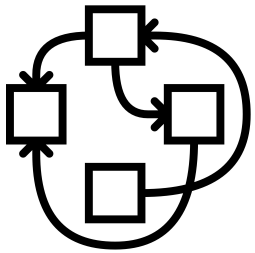


The big hammer

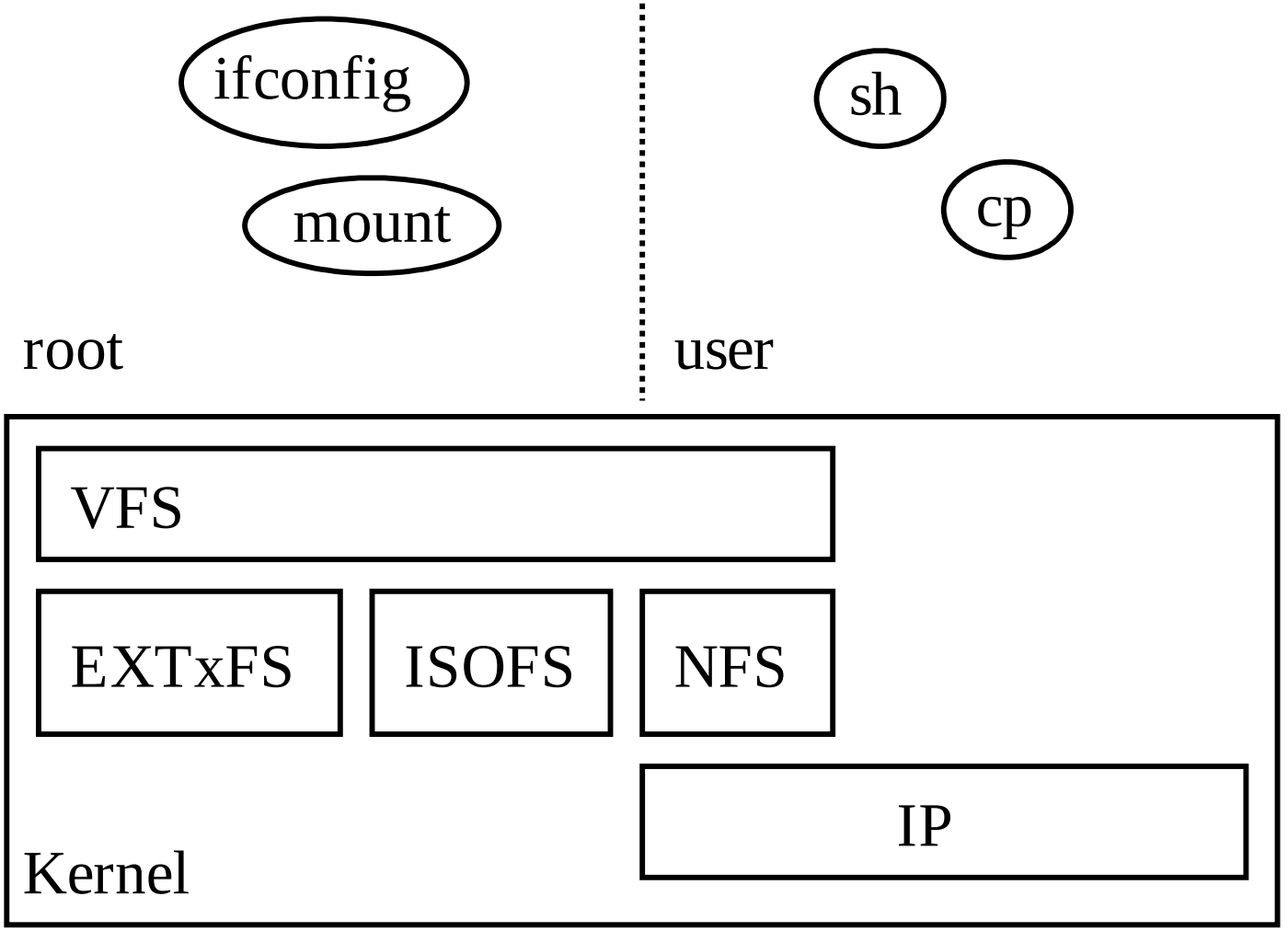
Just run KVM/qemu/virtualbox/whatever!

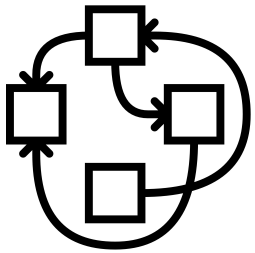
- Quite slower
  - and kvm not available to users by default
- Communication between guest and host is a burden

Goal: having extensibility simply at the shell prompt



Traditional monolithic layering

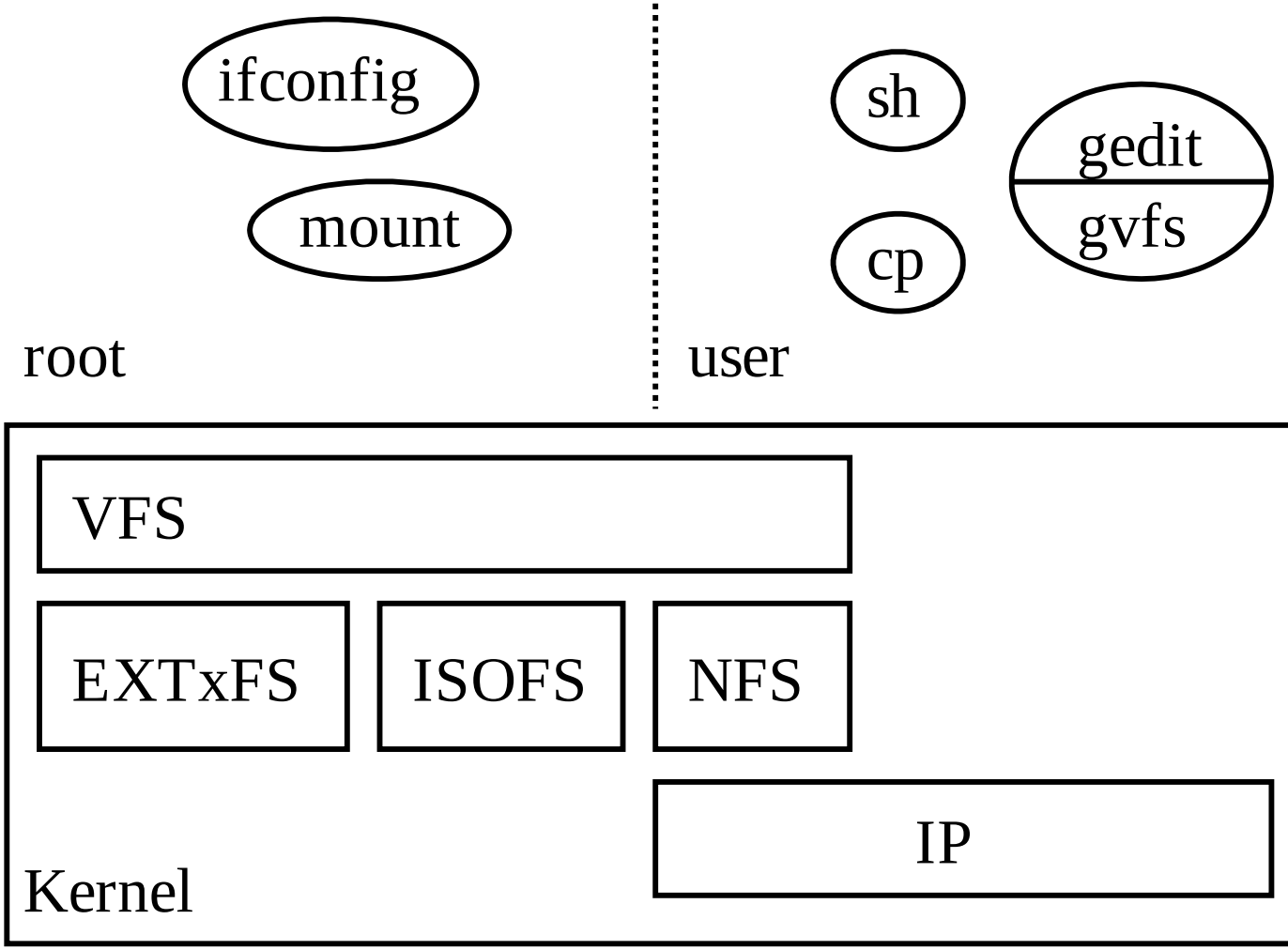


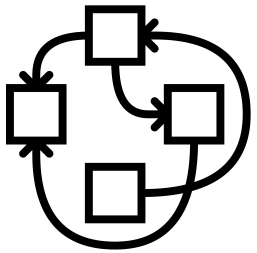


Traditional monolithic layering

- User mounts through “users” option
  - Need to ask root
    - and frowned upon
  - Only kernel-provided filesystems
- User network through tap
  - Need to ask root
  - No firewall tuning support

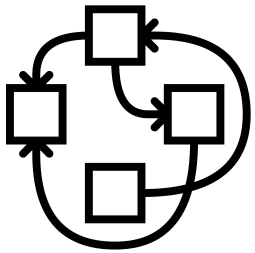
gvfs layering



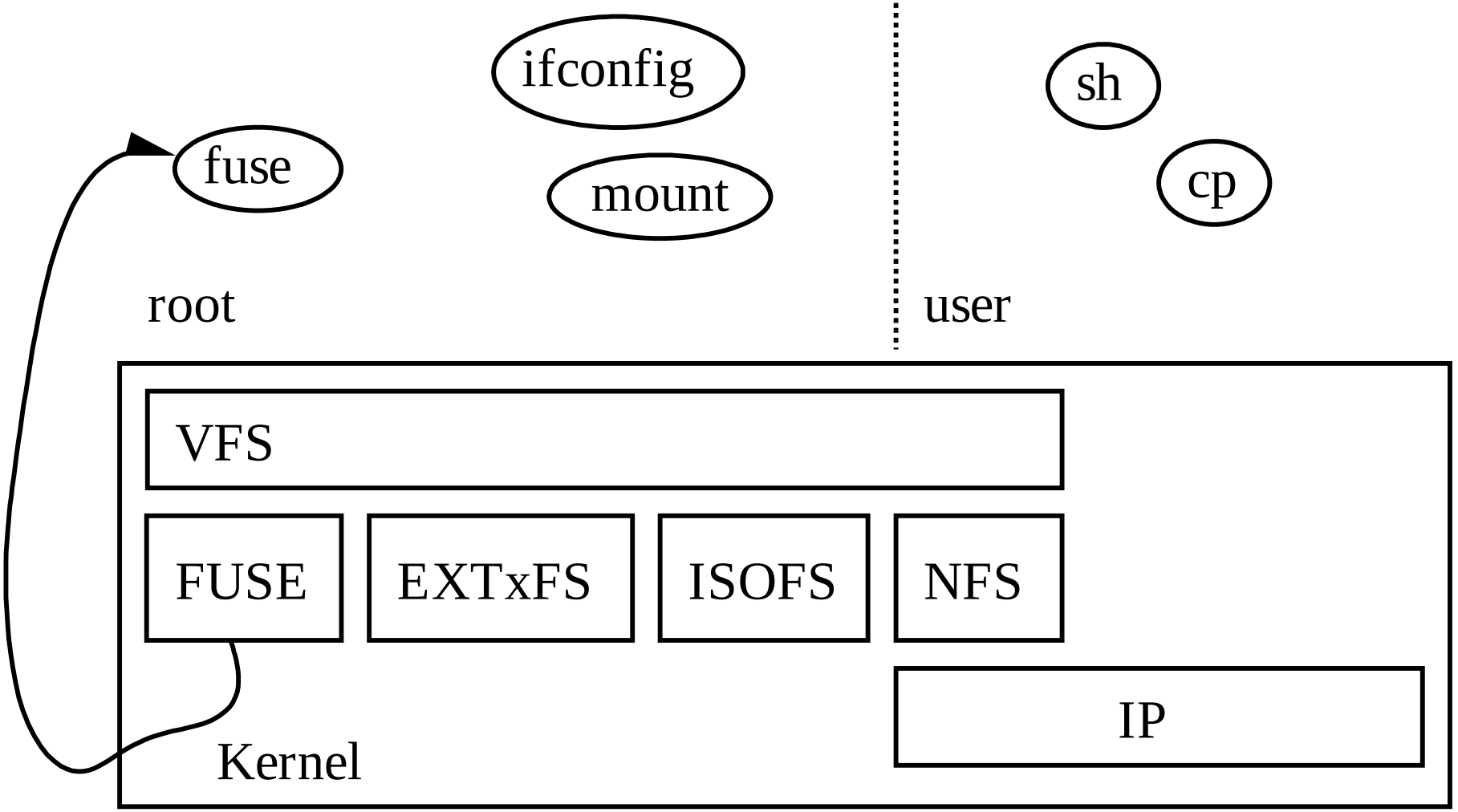


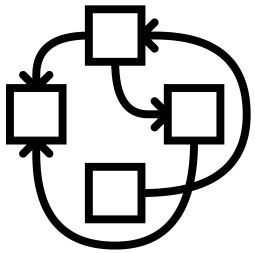
gvfs layering

- Supports a lot of nice features
  - Transparent ftp, webdav, smb, ...
- Only works for gnome applications
  - Not even in gnome-terminal shells
  - Not easily extensible
- i.e., does not compose well.

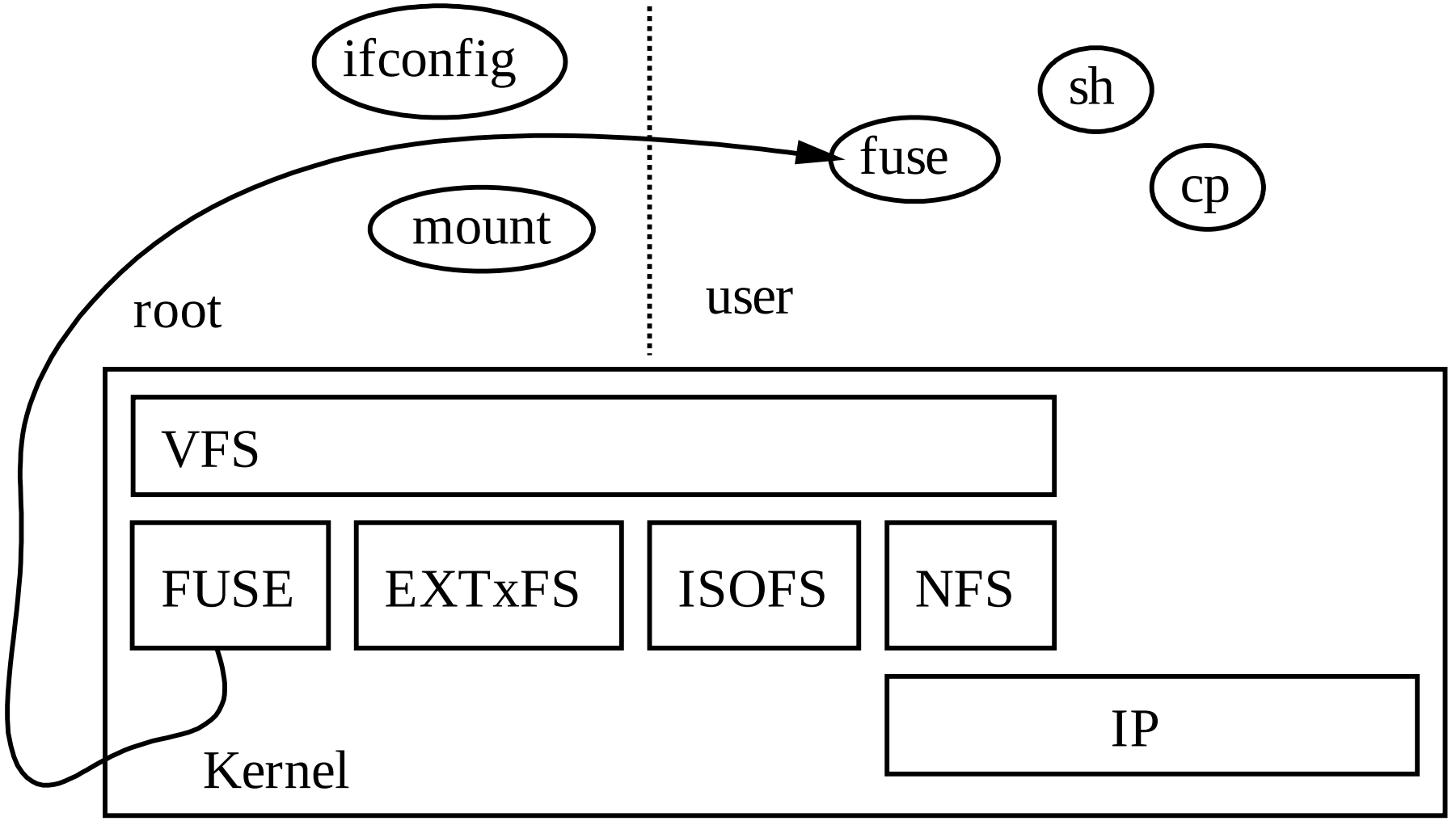


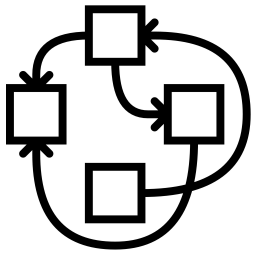
FUSE layering





FUSE layering, user

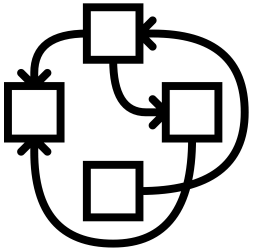




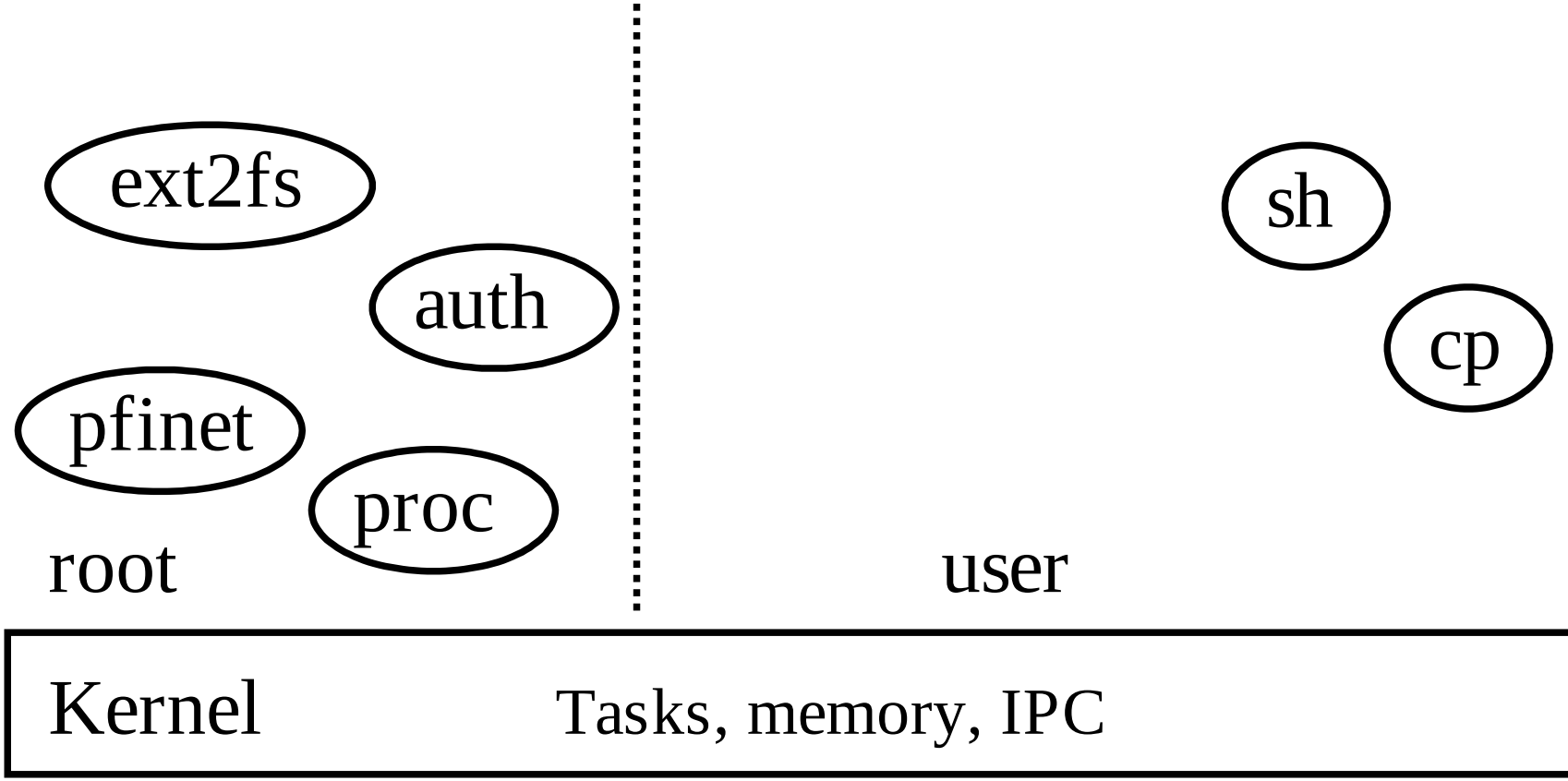
FUSE layering

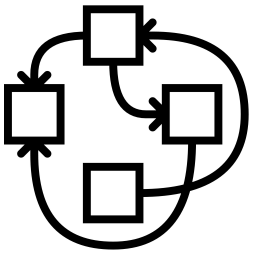
- Provides a lot of nice features, but
- Does not combine well by default
  - `cd ~/.avfs/#ftp:ftp.gnu.org/.../coreutils-6.9.tar.bz2#`
  - does not work
- Does not optimize well by default
  - `fuseiso9660 ~/.avfs/#ftp:ftp.gnu.org/.../foo.iso ~/mnt`
  - downloads it all!
- Does not provide all root features by default
  - How to deal with partitioned disk image?
  - `e2fsck what?`

→ Users are still second-class citizens

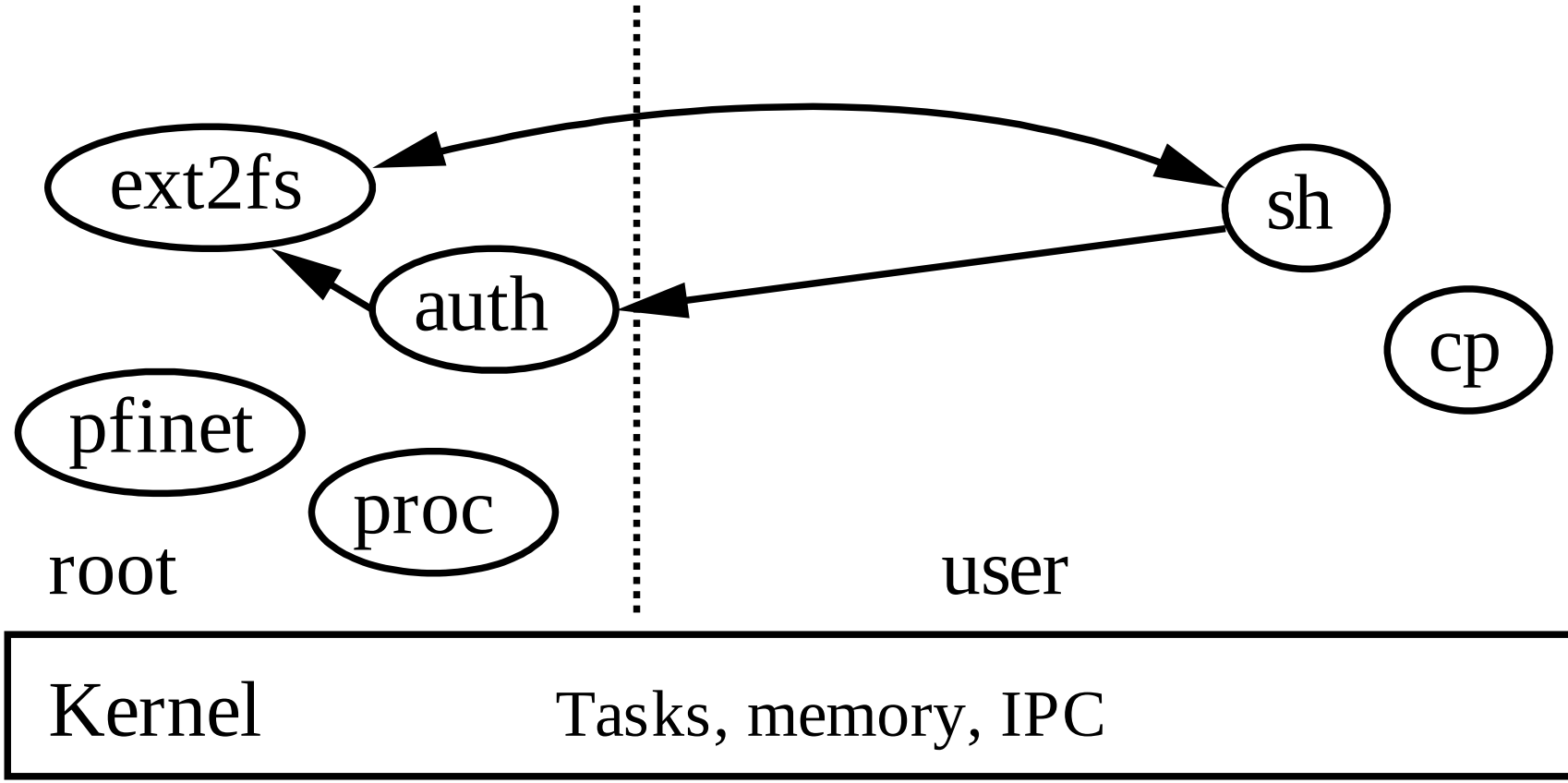


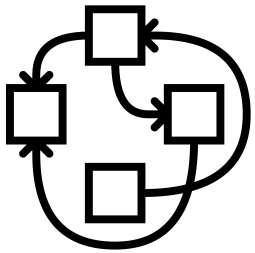
Micro-kernel layering





Micro-kernel layering

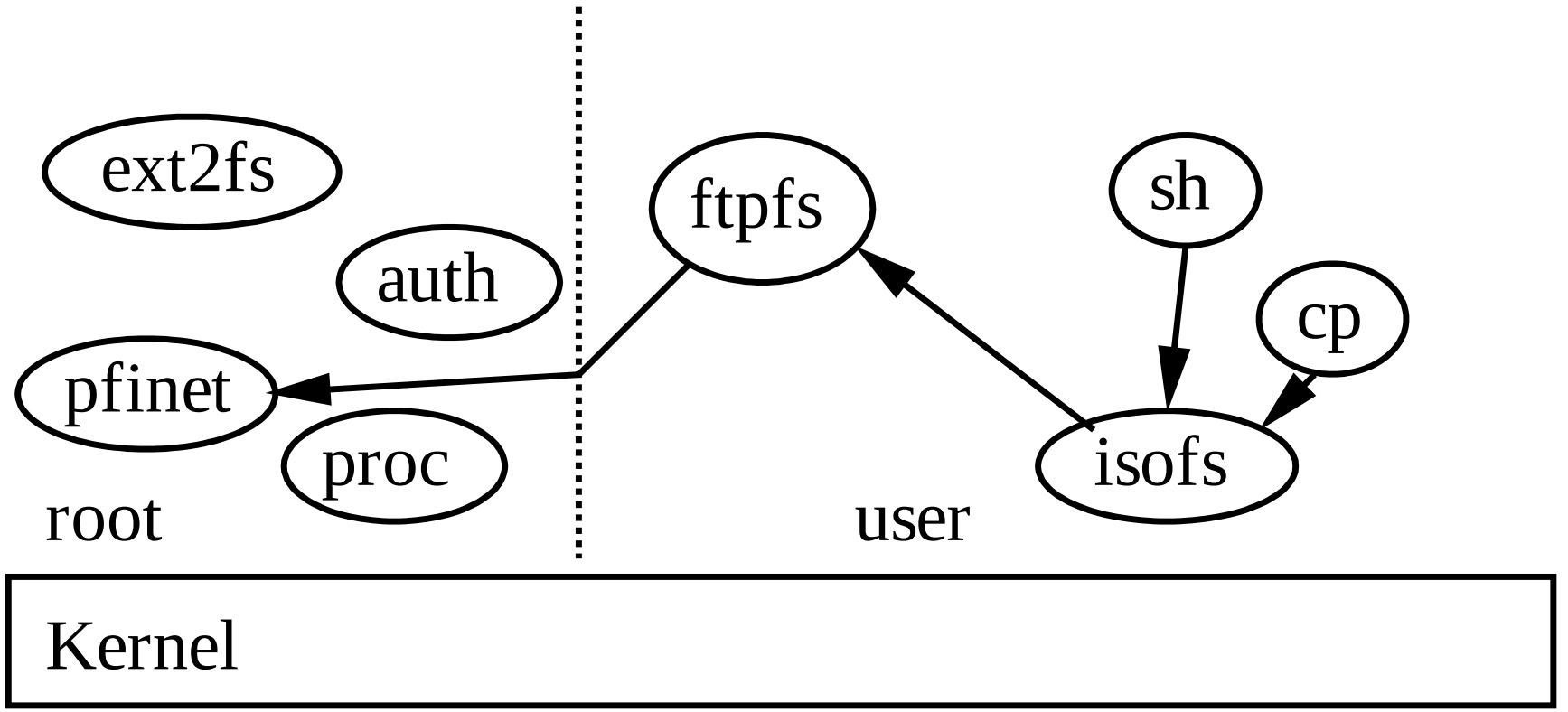


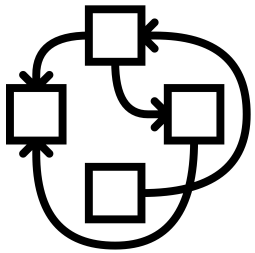


Micro-kernel layering

- 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 of Debian installer.
- Kernel only handles Tasks, memory, IPC

Hurd possibilities



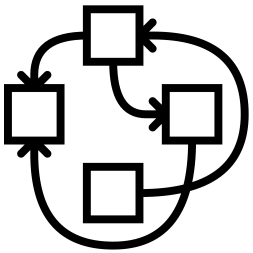


Hurd possibilities

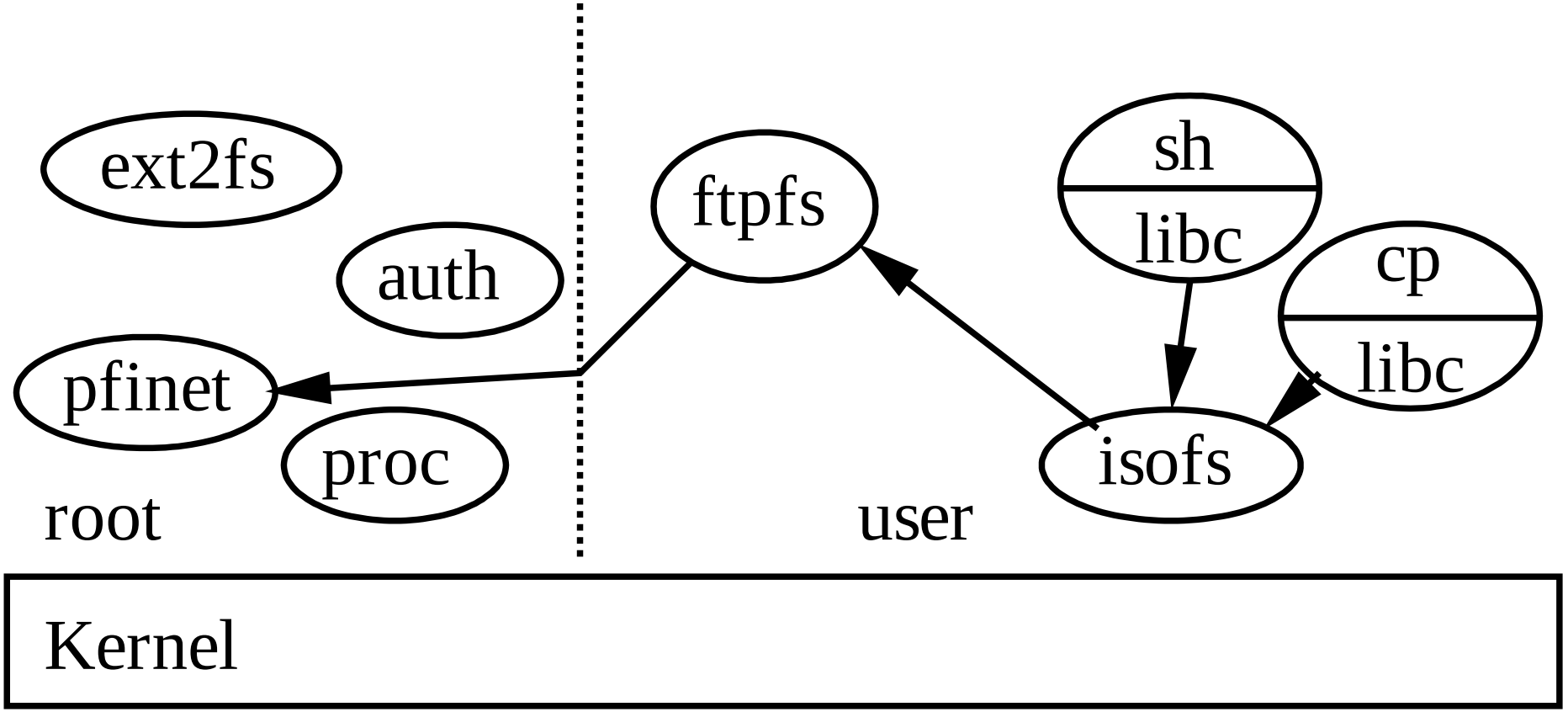
```
$ settrans ~/ftp: /hurd/hostmux /hurd/ftpfs /

(just once for good)

$ settrans ~/mnt /hurd/iso9660fs
~/ftp://ftp.gnu.org/old-gnu/gnu-f2/hurd-F2-main.iso

$ ls ~/mnt

README-or-FAIL

…
```

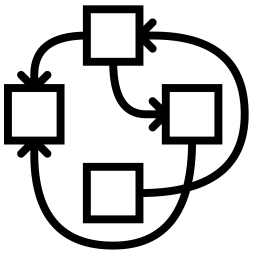
- Only downloads what is needed.
- Can be permanent

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

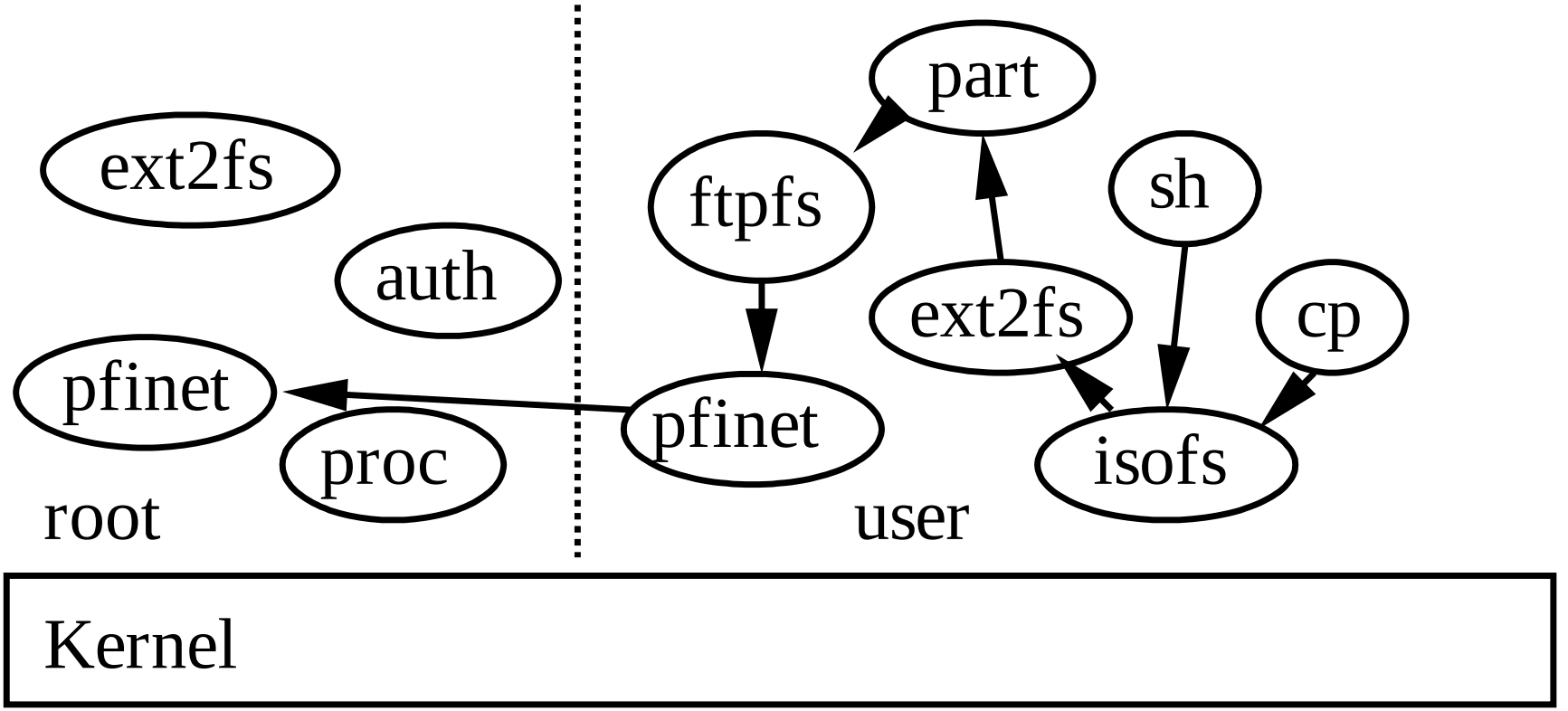


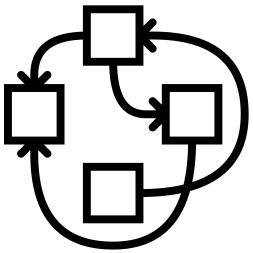
How does it work?





Hurd possibilities (cont'ed)





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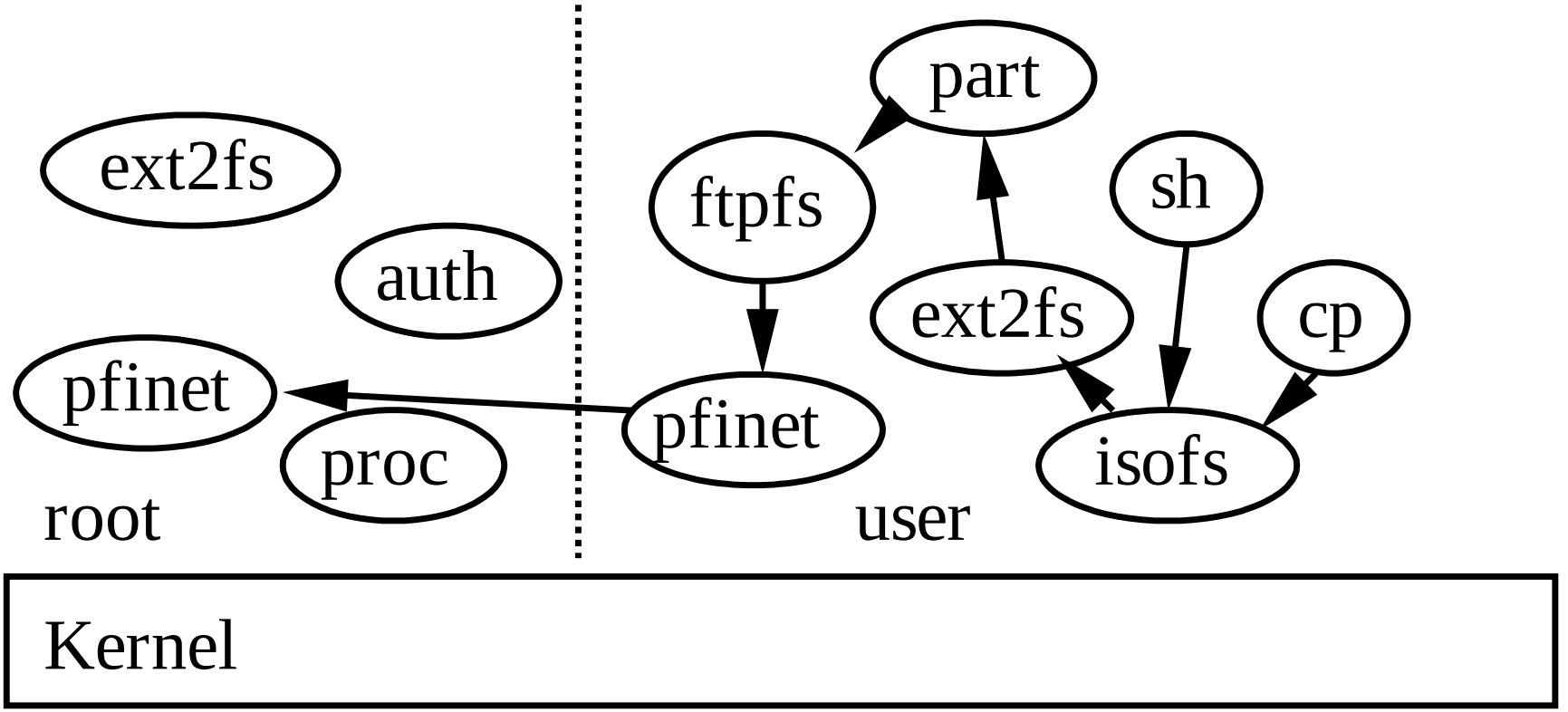
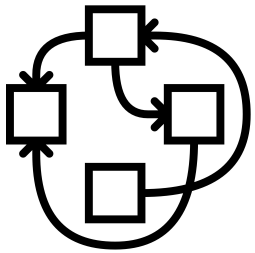
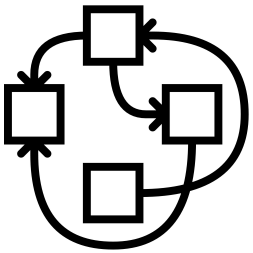


i.e. ISO image inside a disk image on ftp over a VPN



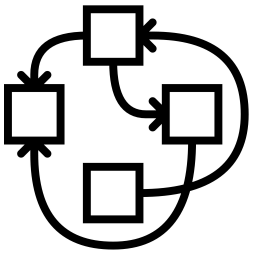
Hurd possibilities (cont'ed)

- VPN running as user
- Parted running as user
- Chroot as user
- ...
- No less power than root
  - Since root uses the same mechanism anyway!
  - Except hardware access, of course
    - 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, ...

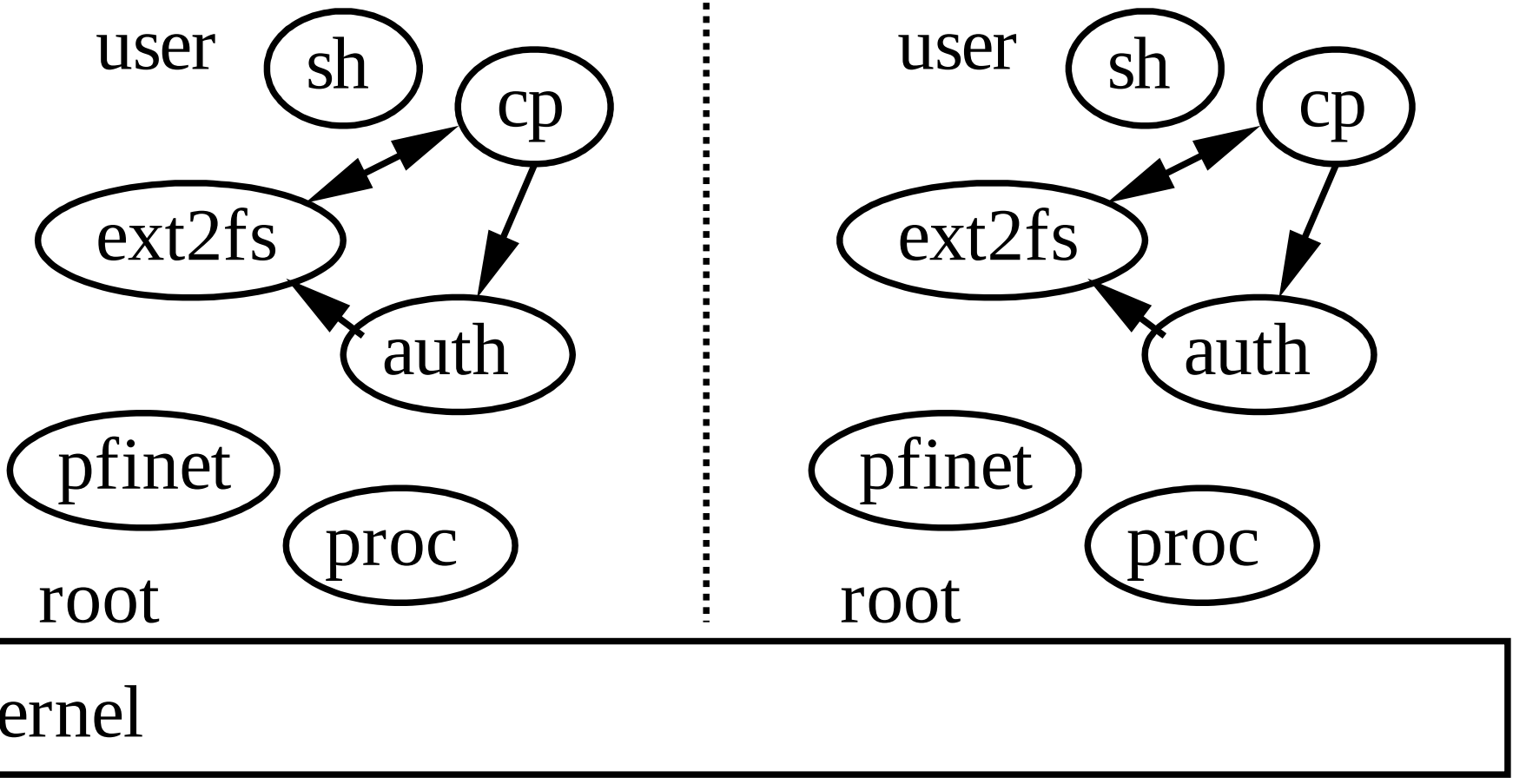


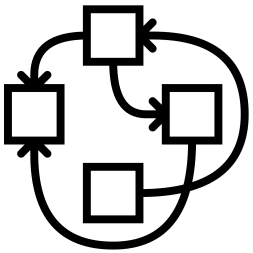
So, FUSE vs Hurd?

- FUSE is here
  - At last!
  - Not available by default on Linux installations
  - Does not permit everything to users
- Hurd is here too
  - At last!
  - Provides everything by default
    - Including ioctls, arbitrary RPCs actually, could have a node which is a file, AND a directory, AND a CD drive,...
  - Permits everything to users
    - Hardware access is controlled

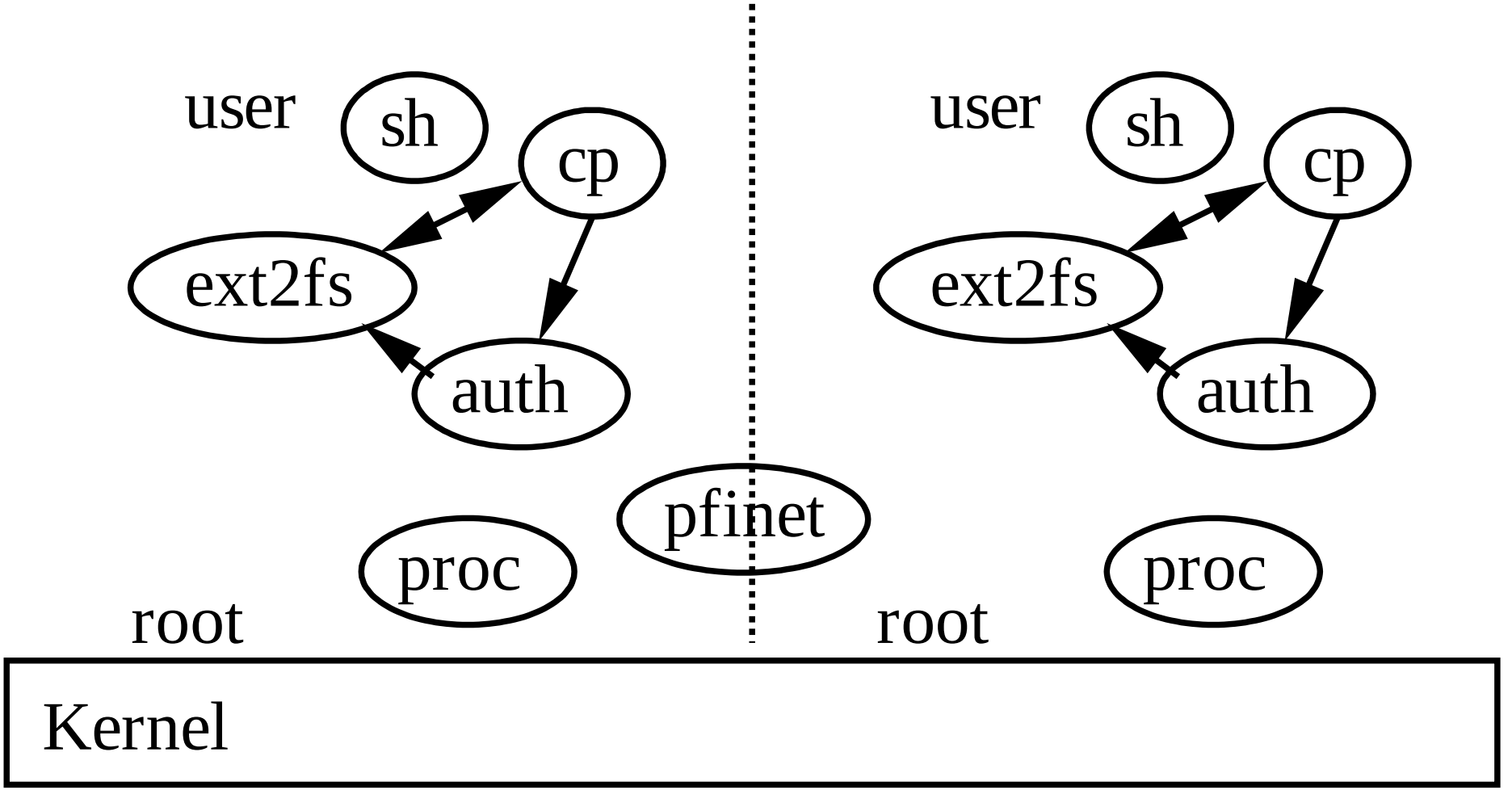


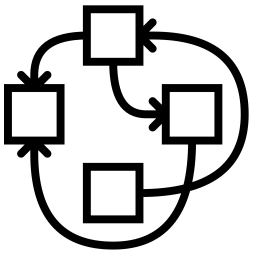
Neighbour Hurds



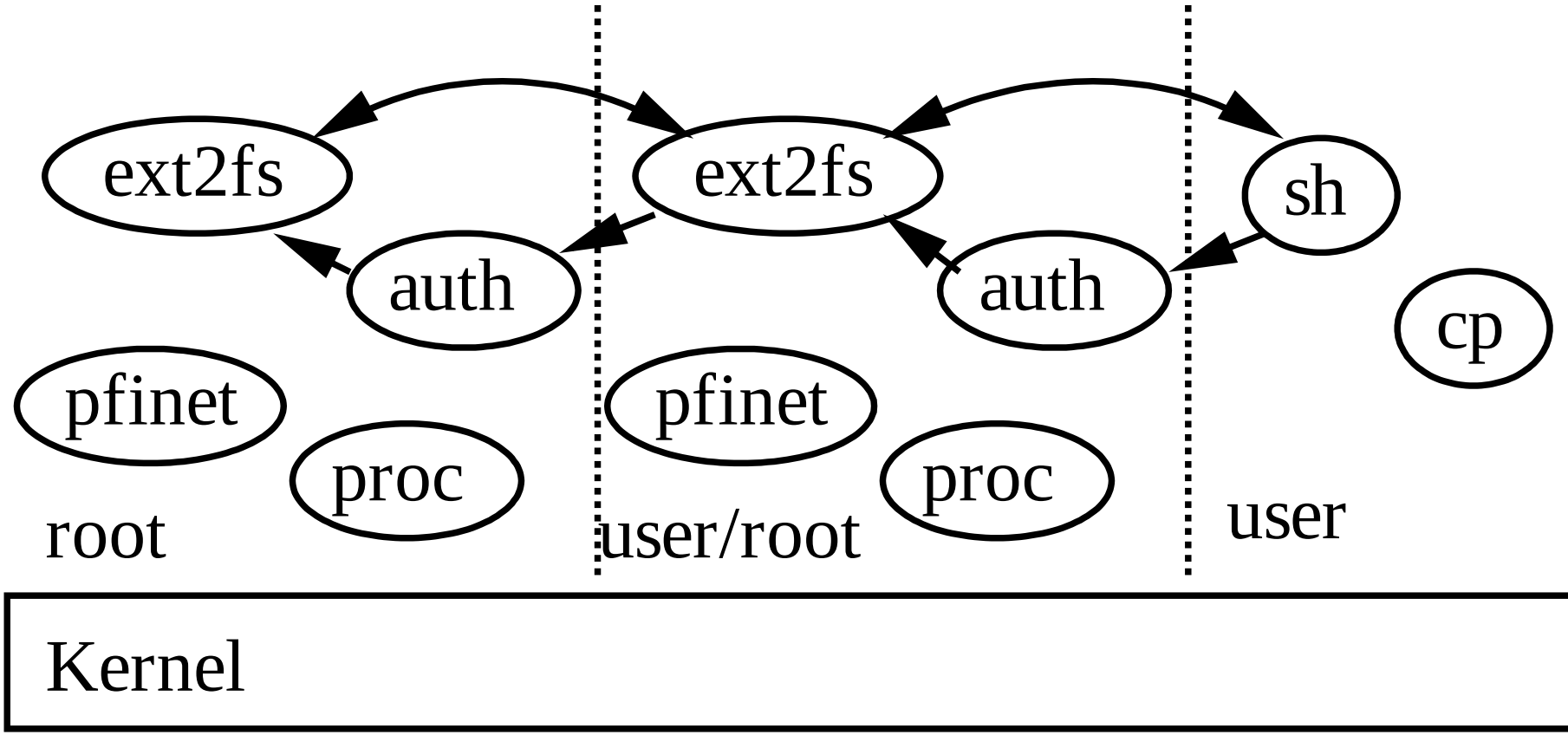


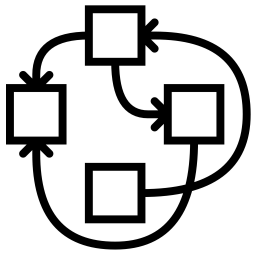
Neighbour Hurds





Sub-Hurd

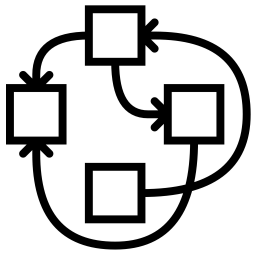

ext2fs
ext2fs
sh
auth
auth
cp
pfinet
pfinet
proc
proc
root
user/root
user
Kernel



Neighbour/Sub-Hurd

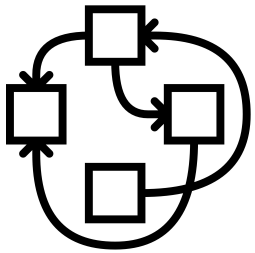
Looks like Linux containers

- Except they can be combined in many ways, including recursive
  - Since it is simply the standard features in the Hurd
  - Since it is safer, because ext2fs, pfinet, etc. are not shared
- And complete
  - Since that's how a normal Hurd system is structured already.
    - Linux containers have a hard time being completely contained, e.g. sound?



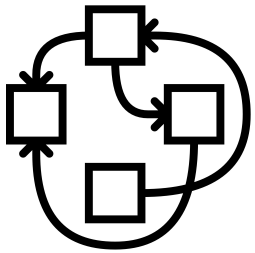
Current State

- Hardware support
  - DDE Linux 2.6 drivers layer for network boards
  - IDE, SCSI, PCMCIA, Xorg, ...
  - Xen domU
- Software support
  - ~68% of Debian archive
    - XFCE, almost gnome, almost KDE
    - Firefox (aka iceweasel), gnumeric, …
  - Standard Debian Installation CD
  - Plan to release in Debian Wheezy
  - Arch Hurd LiveCD and GHAMP



People at work nowadays

- Emilio Pozuelo Monfort : gnome
- Jeremie Koenig : glibc, openjdk
- Olaf Buddenhagen : community, mentor
- Pino Toscano : KDE
- Samuel Thibault : debian installer, autobuilders
- Thomas Schwinge : GNU gdb, gcc
- And various porters : Gabriele Giacone, Svante Signell, …
- You're welcome!



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