Hacking the Linux Kernel to get moar FPS

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Linux kernel development model

- Linux kernel development has no roadmap, people develop as they need
- Use case driven
- If no developer/company cares about something, it will never appear on Linux
- People need to push new use cases
Play on Linux

- People have been always playing on Linux, but struggling at times
- Some native ports along the years (with some troubles), notably Source Engine
- BioShock Infinite: Proton version way better than native one
- On and off
- Slow progress, no clear financial interest
Proton Era

- Announced in August 2018 by Valve
- Valve paying community developers and consultancies to enhance Linux gaming
- Linux, Mesa, Wine, DirectX translation layers, etc
- Big speed up
Proton Era

Windows Games Compatibility on Linux: Unique Games with Platinum Rating Over Time
Proton Era

Linux market share on Steam over time

Percentage of Steam users

Sep-2018 to Nov-2022

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Kernel features

- Linux gaming has pushed kernel development to new use cases
- Other uses benefits from this as well, mainly desktop Linux
Kernel features
Filesystem

- Case insensitivity in ext4
  - Then supported at F2FS
- Unicode subsystem
Futex

- futex is used for userspace mutex, semaphores, etc
- Wait on multiple futexes (WaitForMultipleObjects)
- futex2
Syscall user dispatch

- Use a different "backend" for syscalls in a memory region
GPU driver

- Numerous bugfixes, documentation, and improvements in DRM drivers, like amdgpu
- New DRM features (async page flip in atomic, better GPU reset handling)
- HDR, 3D LUT
Error handling/crash report

- Graphical kernel panic ("Windows blue screen")
- Pstore and kdump on SteamDeck
Hardware enablement

- Support for Steam Deck drivers
- Joysticks, controllers
Many bug fixes and improvements

- Split lock detector handling
- HID bottleneck for VR use case
- Unix sockets, TSC, PTE, timestamps
- Panic refactor
- Lots of documentation
Out of tree

- Task schedulers (PDS, MuQSS)
- A lot of work-in-progress patches
  - https://xanmod.org
  - https://liquorix.net
What's Next?

- Power management
- Layers and layers of GPU abstraction
Patches

- Case-insensitive
  https://lore.kernel.org/all/20181206230903.30011-1-krisman@collabora.com/

- futex2
  https://lore.kernel.org/all/20210915140710.596174479@infradead.org/

- Syscall user dispatch
  https://lore.kernel.org/all/20201127193238.821364-1-krisman@collabora.com/
Patches

- Split lock
  
  https://git.kernel.org/pub/scm/linux/kernel/git/torvalds/linux.git/commit/?id=727209376f49

- GPU reset:
  
  https://lore.kernel.org/amd-gfx/20221125175203.52481-1-andrealmeid@igalia.com/
  
  and

  https://lore.kernel.org/dri-devel/20230123202646.356592-1-andrealmeid@igalia.com/
Patches

• HID mutex bottleneck:
  
  https://lore.kernel.org/all/20211130132957.8480-1-
  andrealmeid@collabora.com/

• More precise info on PTE:
  
  https://lore.kernel.org/all/20230202112915.86740
  9-1-usama.anjum@collabora.com/

• Panic notifier:
  
  https://lore.kernel.org/all/20220819221731.48079
  5-1-gpiccoli@igalia.com/