The state of video offloading on the Linux Desktop

About convergence and longer battery life

FOSDEM'24
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What am I even talking about?
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- Hardware video decoders (VA-API, V4L2, Vulkan) decode to **YCbCr/YUV formats**
- **Display controllers** often can convert to **RGB**, scale and rotate
- Needed to get the maximum out of your hardware
What am I even talking about?

- Embedded: apps can use KMS/DRM directly
  - Gstreamer: kmssink
  - MPV: --vo=drm
  - QT: QT_QPA_PLATFORM=eglfs
  - Kodi: --windowing=gbm
  - Various proprietary solutions
- X11: Xvideo
  - Never really took off
What am I even talking about?
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• Wayland:
  - First publicly demonstrated video offloading in 2014
  - Gstreamer: waylandsink / gtkwaylandsink
  - MPV: --vo=dmabuf-wayland
  - Limited compositor and client support, practically constrained to embedded
What am I even talking about?

- Wayland matured on the desktop
- Apps/toolkits started to use GL/Vulkan
- Atomic-KMS:
  - DRM_MODE_ATOMIC_TEST_ONLY
- DMABuf:
  - Explicit modifiers (tiling/compression)
Current state and recent developments
Current state and recent developments

- Mutter / Gnome-Shell:
  - YCbCr support (Gnome 45)
  - KMS scaling support (Gnome 46)

- GTK4:
  - GtkGraphicsOffload (GTK 4.14)
  - Light Video / livi
  - Gtk4paintablesink
Current state and recent developments
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- ChromeOS
  - Is witching to Wayland (Lacros/Exo)
  - Experimental patches for non-ChromeOS Wayland backend exist
  - `--enable-hardware-overlays=single-fullscreen,single-on-top,underlay`
  - Sommelier lacking behind (Linux apps in containers)
Current state and recent developments

- Compositors:
  - Weston: Good hardware plane support
  - Mutter: Fullscreen only
  - Kwin: NV12 support landed for Plasma 6.0 / Fullscreen only
- wlroots:
  - Sway: scene graph API support landed
  - Wayfire, Hyprland: not using wlroots scene graph / render API
Current state and recent developments

- Missing Wayland protocols:
  - Color representation protocol (10bit content/BT.2020)
  - Color management protocol (HDR)
  - 2024?
Current state and recent developments

- Most compositors have at least basic support for YCbCr formats and fullscreen playback
- Lots of positive dynamics
- Some features still missing
- Good moment to join the effort!
Demos and benchmarks
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- Current GTK4 players: > 10W
- MPV default: > 15W
- MPV -vo=dmabuf-wayland: ~5.5W
- Livi / upcoming GTK4 players: ~5.5W
Demos and benchmarks

- Offloading has significant resource consumption advantages on most hardware
- Complex toolkits and apps can be best in class
- Linux Desktop users help with finding bugs and improving quality!

Conclusions
Notes

- DRM. That other one. **Digital Rights Management**.
- Technically becomes easy: just another modifier
- When not possible: place-holder
Notes

• Experimental patches for V4L2 stateless:
  – Gstreamer
  – Chromium

• Experimental patches for V4L2 stateful:
  – Gstreamer (Raspberry Pi 4)
Notes

- Upcoming hardware will benefit both **more and less** than current generations
  - More powerful/efficient hardware → less impact
  - More independent hardware blocks → turn off parts completely → more impact
Notes

- Mesa:
  - `OES_EGL_image_external` only on GLES → Gstreamer + GTK4 switched
  - OpenGL only inofficially supported
  - Vulkan will make things better

- Nvidia
  - 550.40.07: “Added support for R8, GR88 and YCbCr GBM formats.”
Questions?
Thank you!
Contact

- Follow me on Mastodon: https://floss.social/@rmader
Sources

- https://www.youtube.com/watch?v=GtXQJ0c5q0k