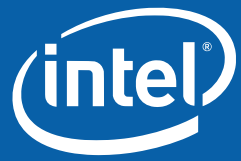

Making the GPU do its Job

Carl Worth

carl.d.worth@intel.com

Who am I (and why I am here)?

- Intel Linux Graphics
- Original author of the cairo graphics library

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Who am I (and why I am here)?

- Intel Linux Graphics
- Original author of the cairo graphics library

- This talk includes work from a whole team
  - Chris Wilson
  - Eric Anholt
  - Jesse Barnes
  - Keith Packard
  - Ian Romanick
  - Kristian Høgsberg

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Not a kernel talk

- All the kernel work is done!
  KMS
  GEM

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2D on the GPU

Characterizing 2D Graphics

- Text
- Video
- Tiny operations
- Mostly static

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Ivan Sutherland (1963)

Wheel of reincarnation

- General-purpose processor isn't fast enough
- Special-purpose co-processor is added
- Additional functionality added to the co-processor

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Wheel of reincarnation

- General-purpose processor isn't fast enough
- Special-purpose co-processor is added
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- General-purpose co-processor isn't fast enough

On the Design of Display Processors
T.H. Myer, I. E. Sutherland;
Communications of the ACM, Vol 11, No. 6, June 1968

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Graphics stacks

2D Graphics on Linux

2D App

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2D Graphics on Linux

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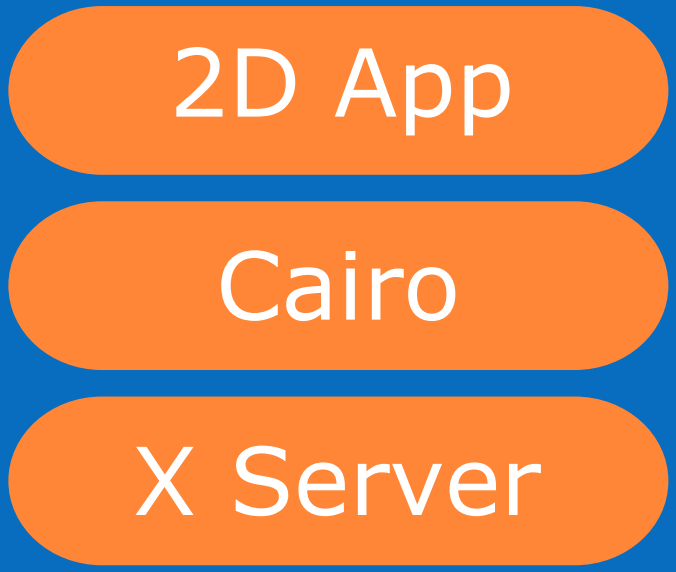
2D Graphics on Linux



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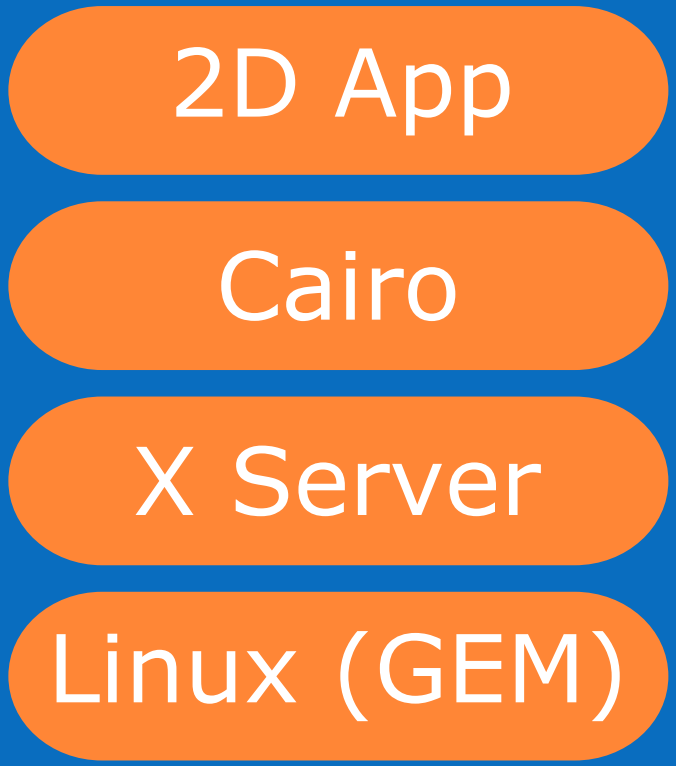
2D Graphics on Linux



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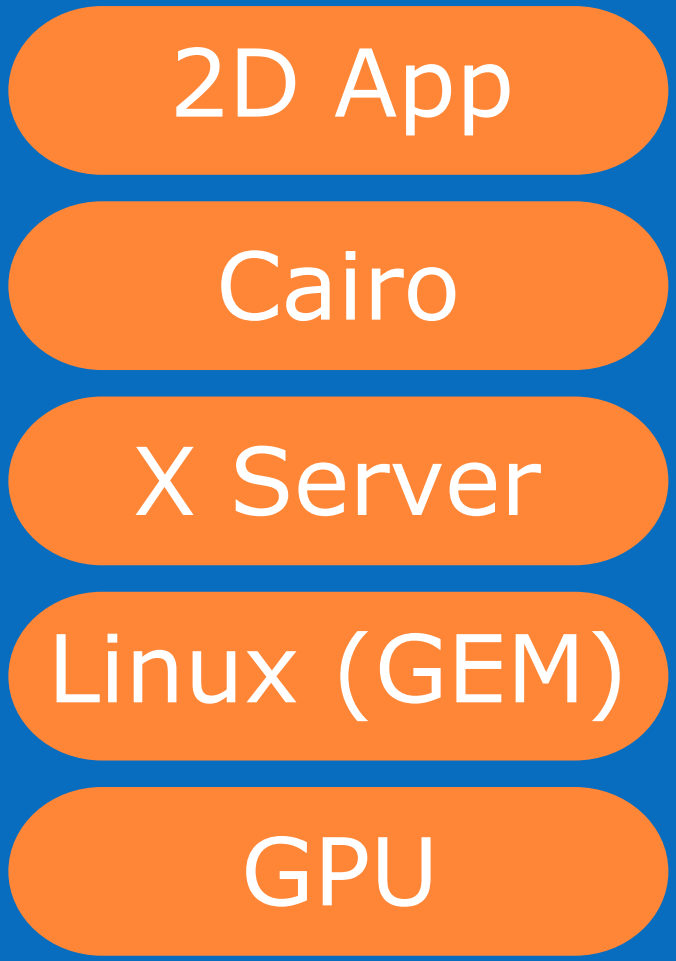
2D Graphics on Linux



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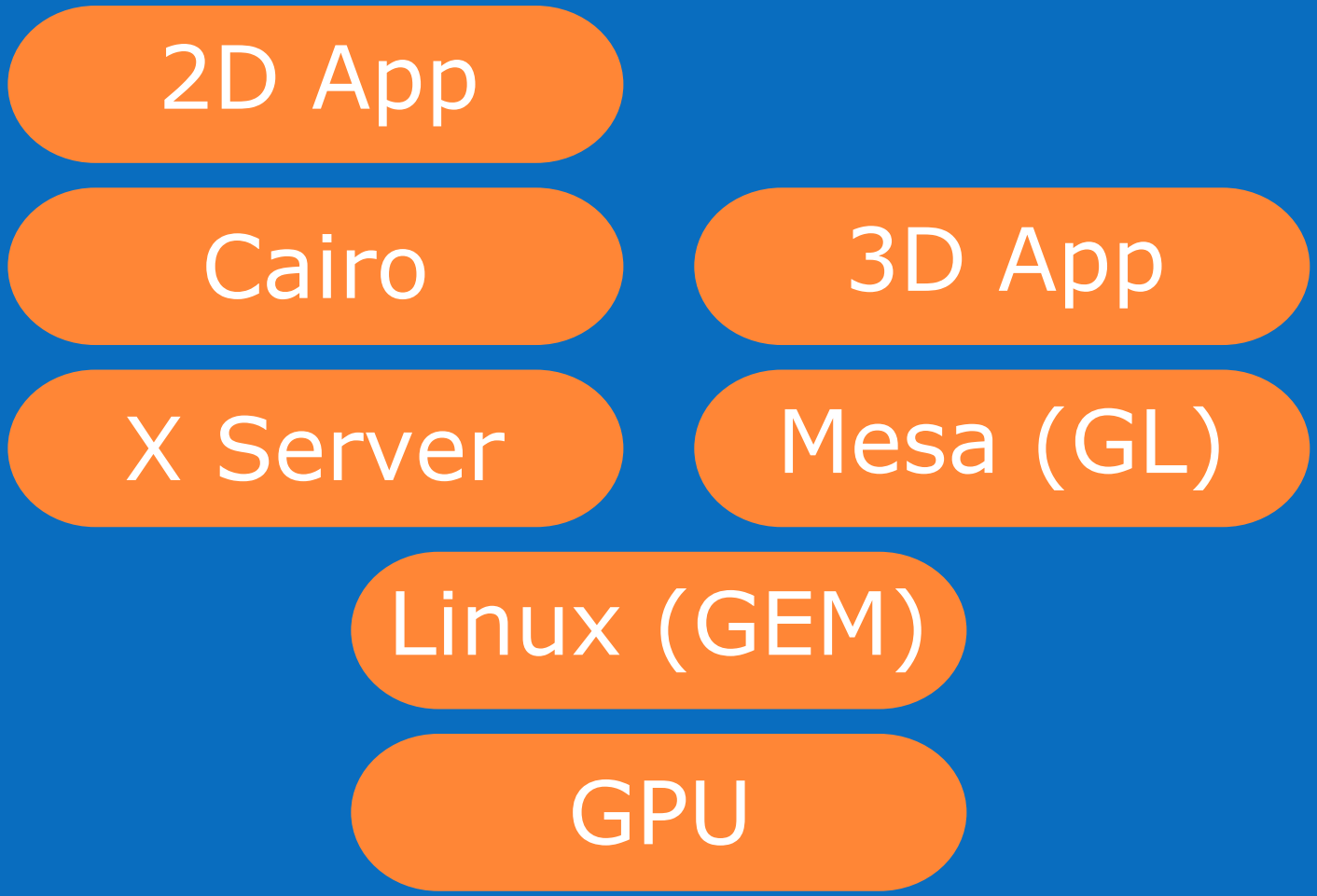
2D and 3D Stacks



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Current problems

- Performance is not adequate
- Better performance means better power usage
- Writing two drivers is not fun (Render and GL)

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Measurement

Capturing real-world test cases

- cairo-trace
- Available in cairo 1.9.x snapshots

- Simply run:

```
cairo-trace my-application
```


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Measuring with these cases

- cairo-perf-trace
- Again, available in cairo 1.9.x

- Simply run:

```
cairo-perf-trace my-application
```


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A real-world graphics suite

- cairo-traces

  git://git.freedesktop.org/git/cairo-traces

- Traced applications:
  - firefox
  - poppler
  - swfdec
  - gnome-terminal
  - epiphany
  - evolution
  - gnome-system-monitor

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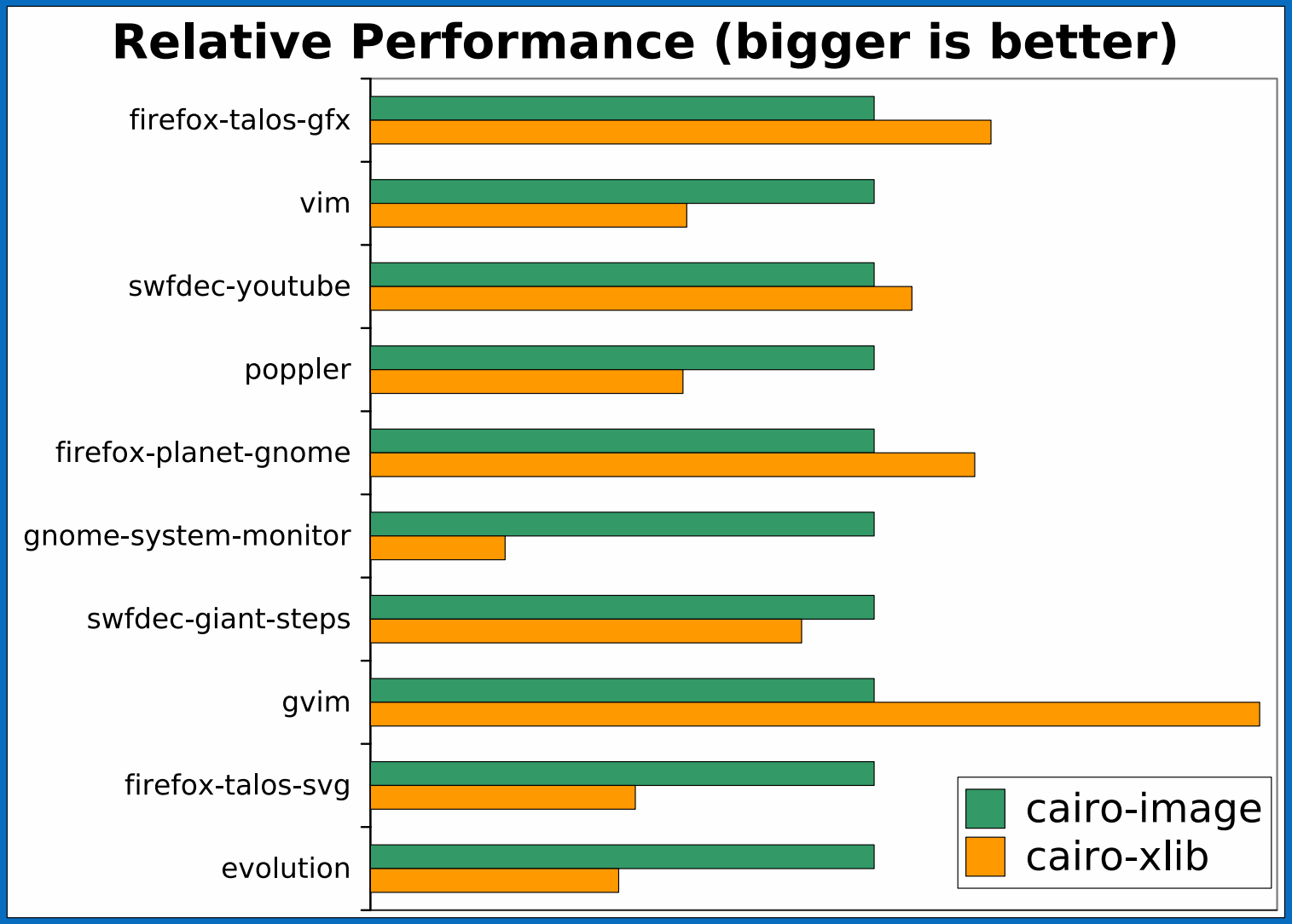
Performance of cairo-xlib



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Review: Current problems

- Performance is not adequate
- Better performance means better power usage
- Writing two drivers is not fun (Render and GL)

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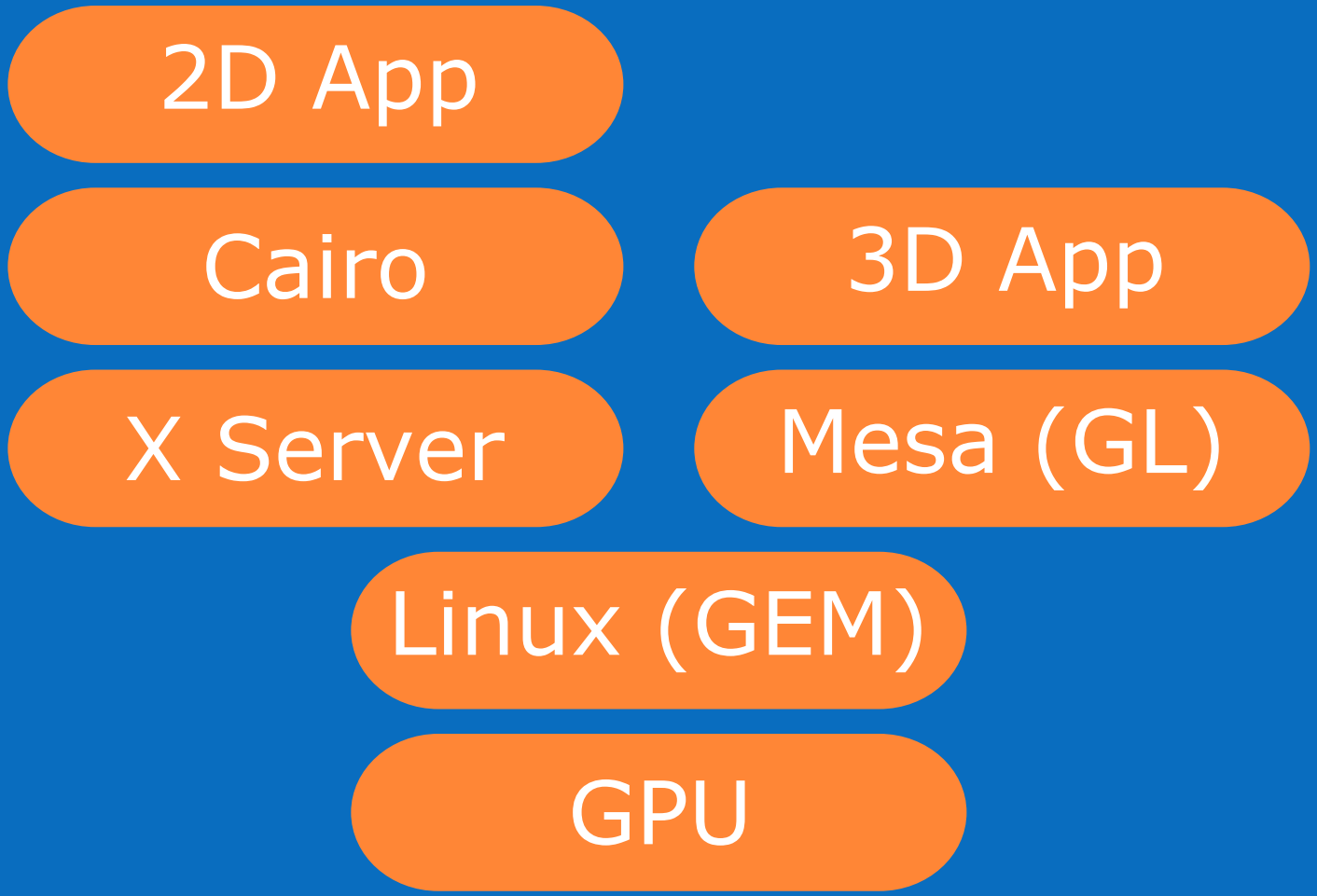
cairo-drm



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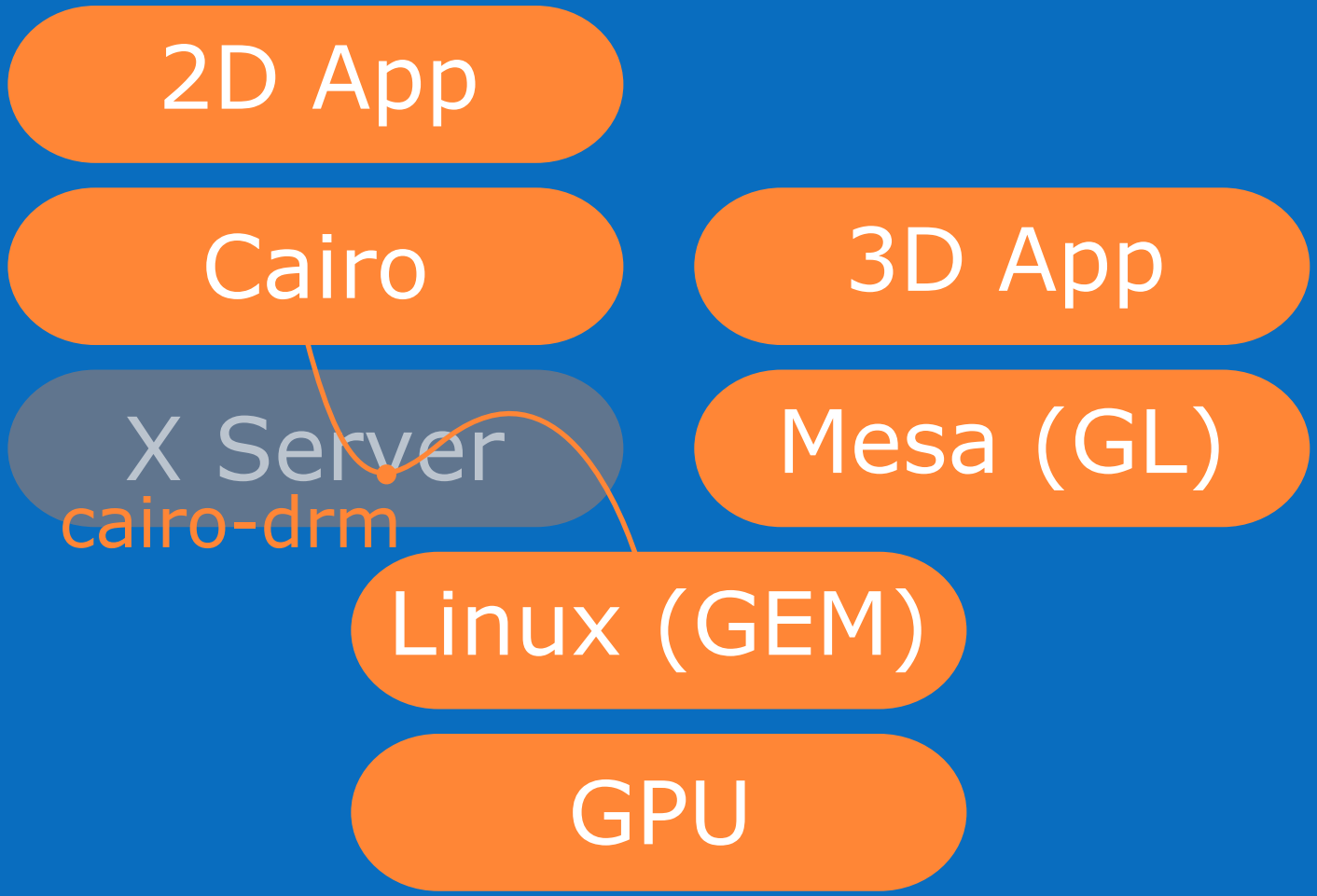
cairo-drm



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cairo-drm

Cairo talks to GPU directly

Makes our driver situation worse, not better

Provides a nice performance target

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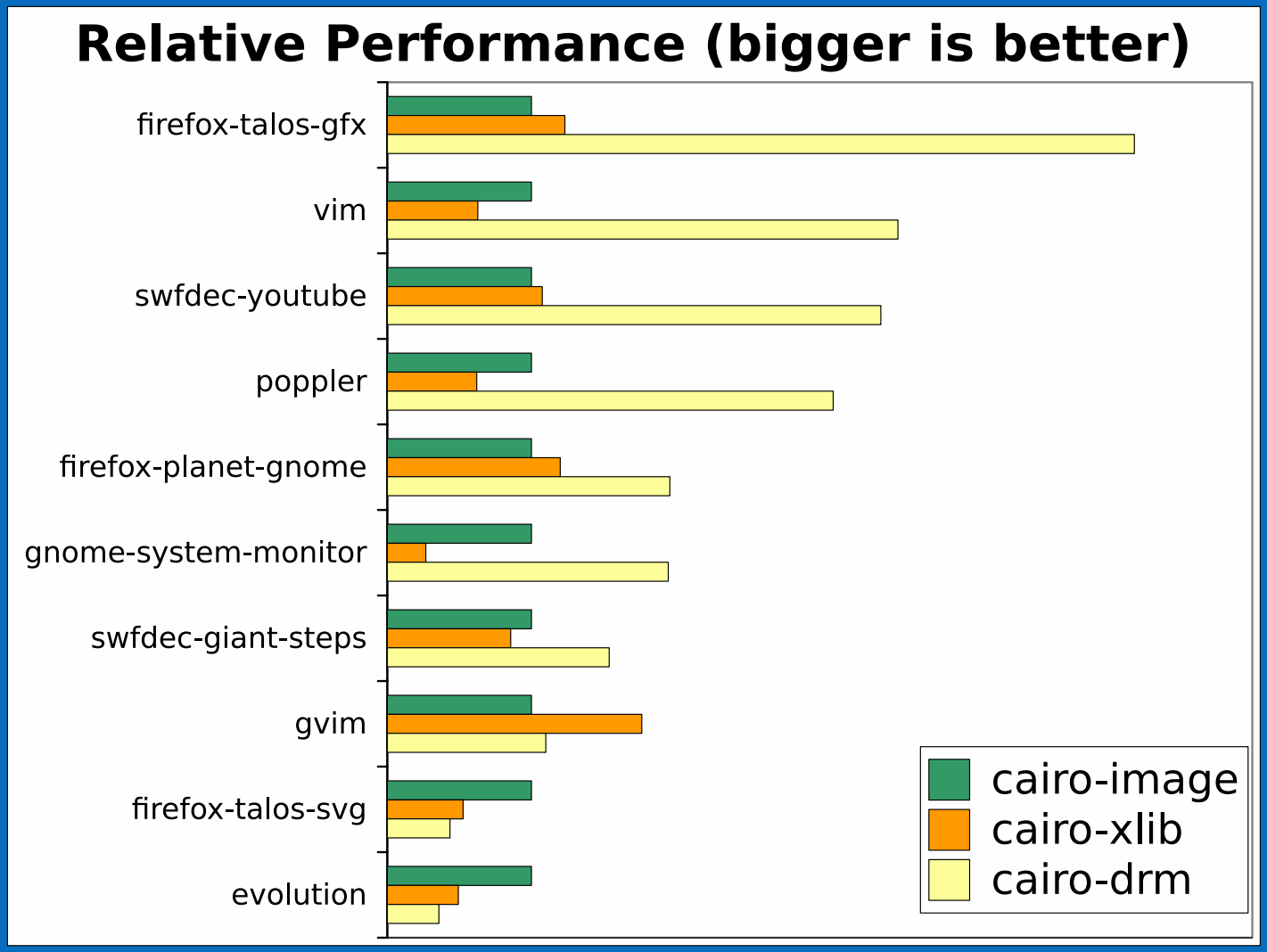
Performance of cairo-drm



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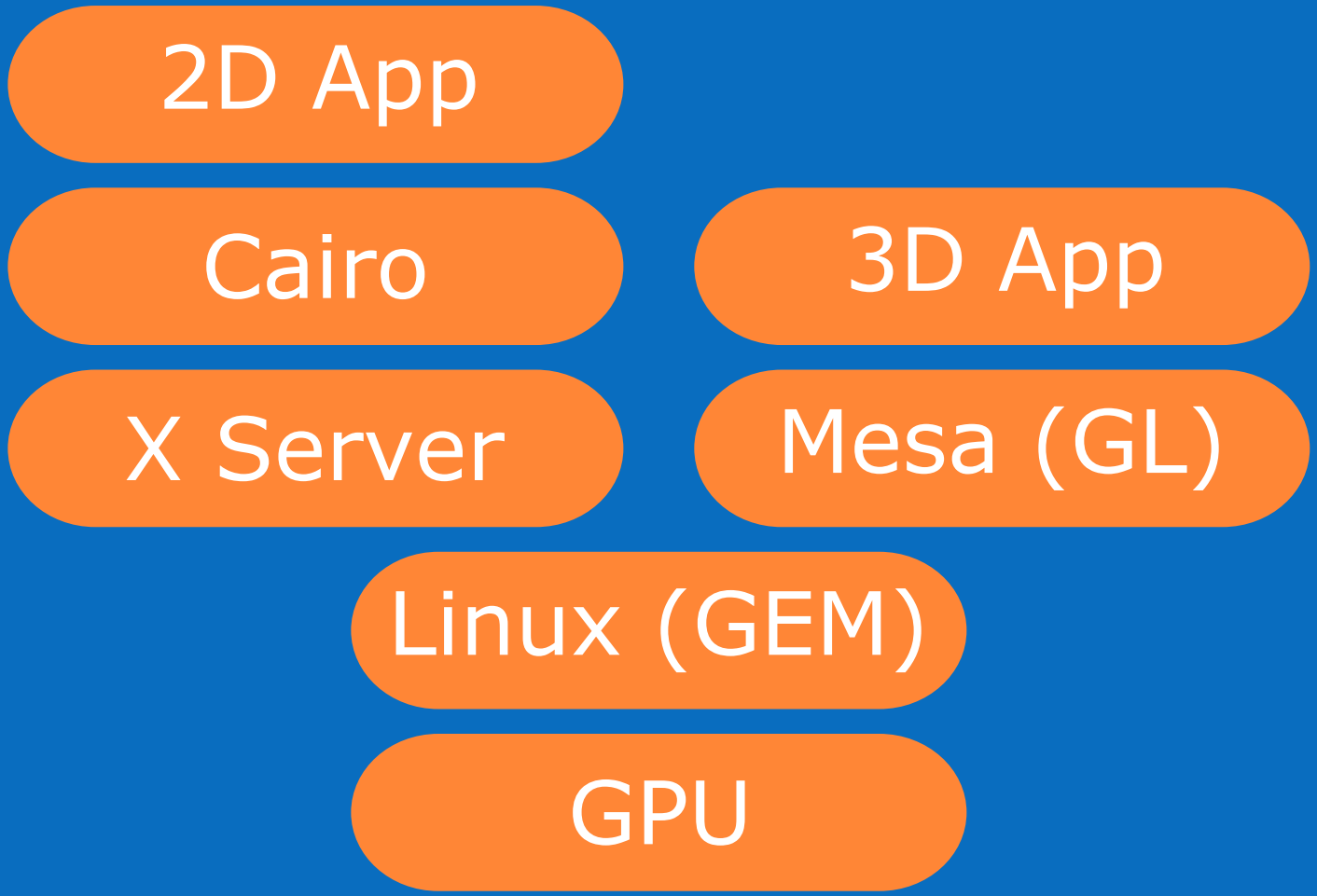
cairo-gl



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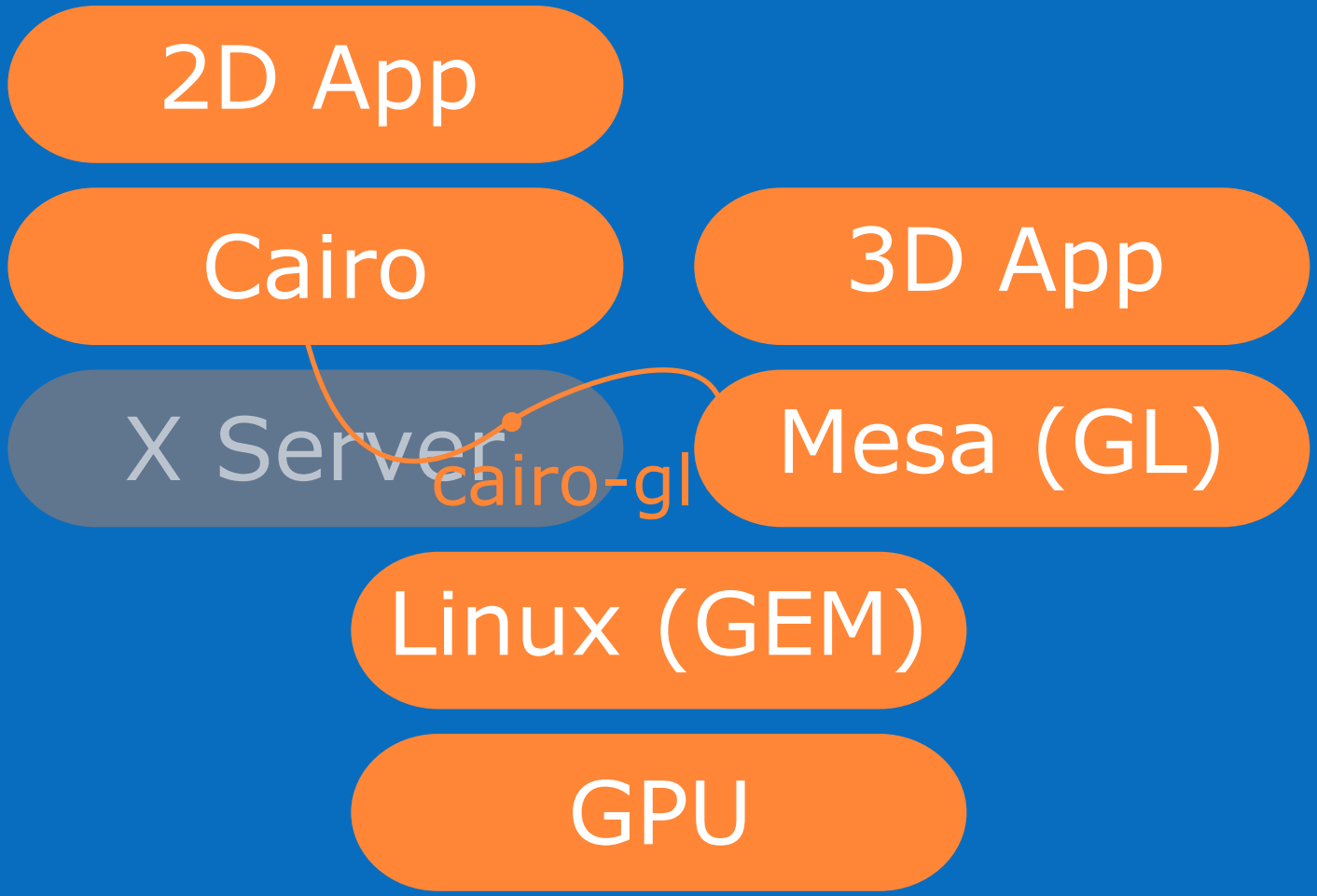
cairo-gl



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cairo-gl

This is distinct from cairo-glitz

Current code is still fixed-function

Shader-based code appeared very recently

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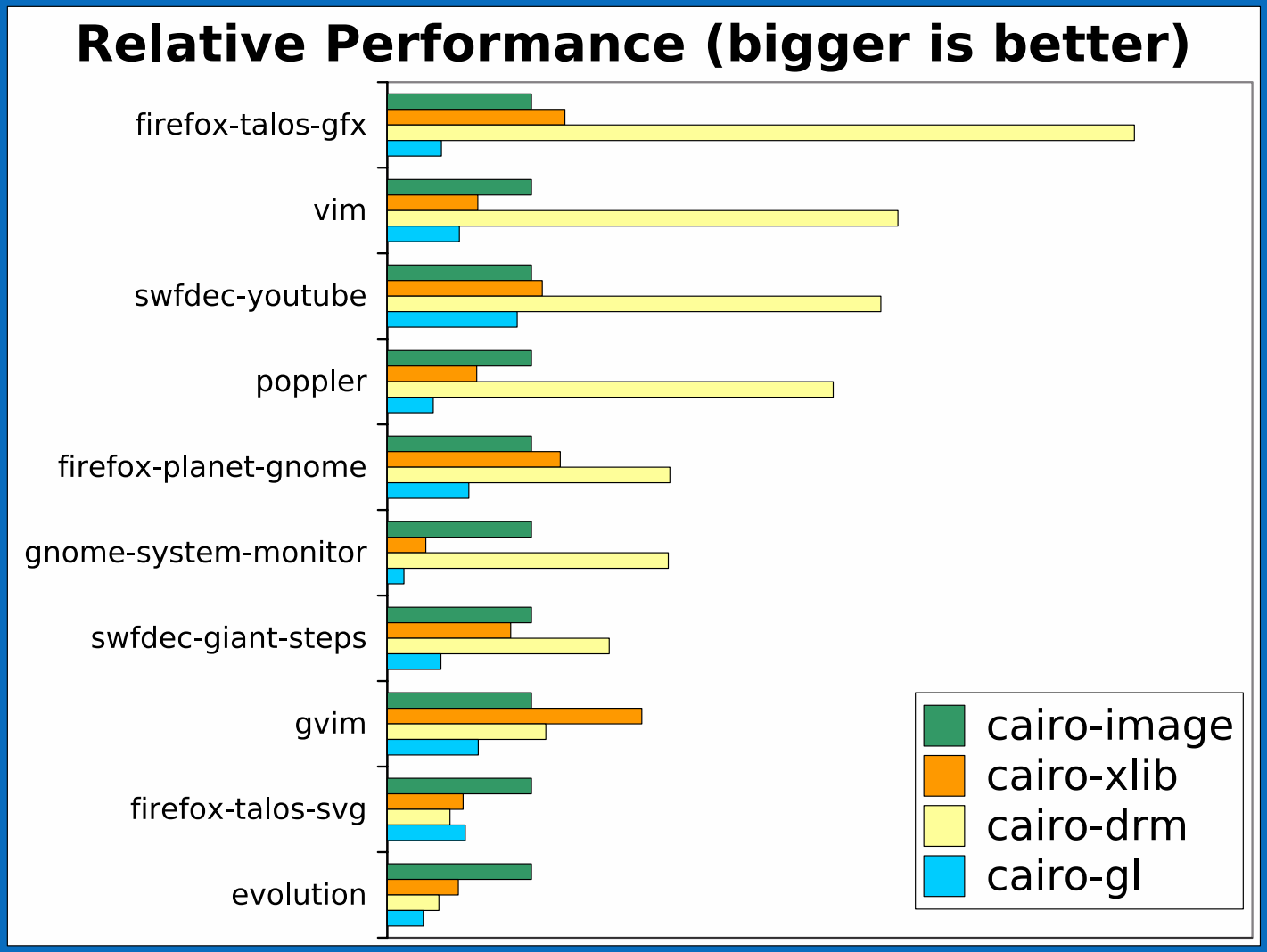
cairo-gl
reflection

Performance of cairo-gl



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Non-cairo Render applications?

Punt them all to software?

Move X to OpenGL (Glamor)?

Make the X server depend on cairo?

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Cooperating with other GPU users

- GPU-assisted video decode
- Application using OpenGL directly

- GEM in the kernel makes sharing possible

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Future changes for cairo

- Cairo is still very fixed-function
- Users want general features (SVG filters) with GPU assist
- Add a GLSL interface to cairo?
- We're missing lots of compiler tech here (want to help?)

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