
# TG-Gallium Driver Stack

# Softpipe, Cell and Beyond

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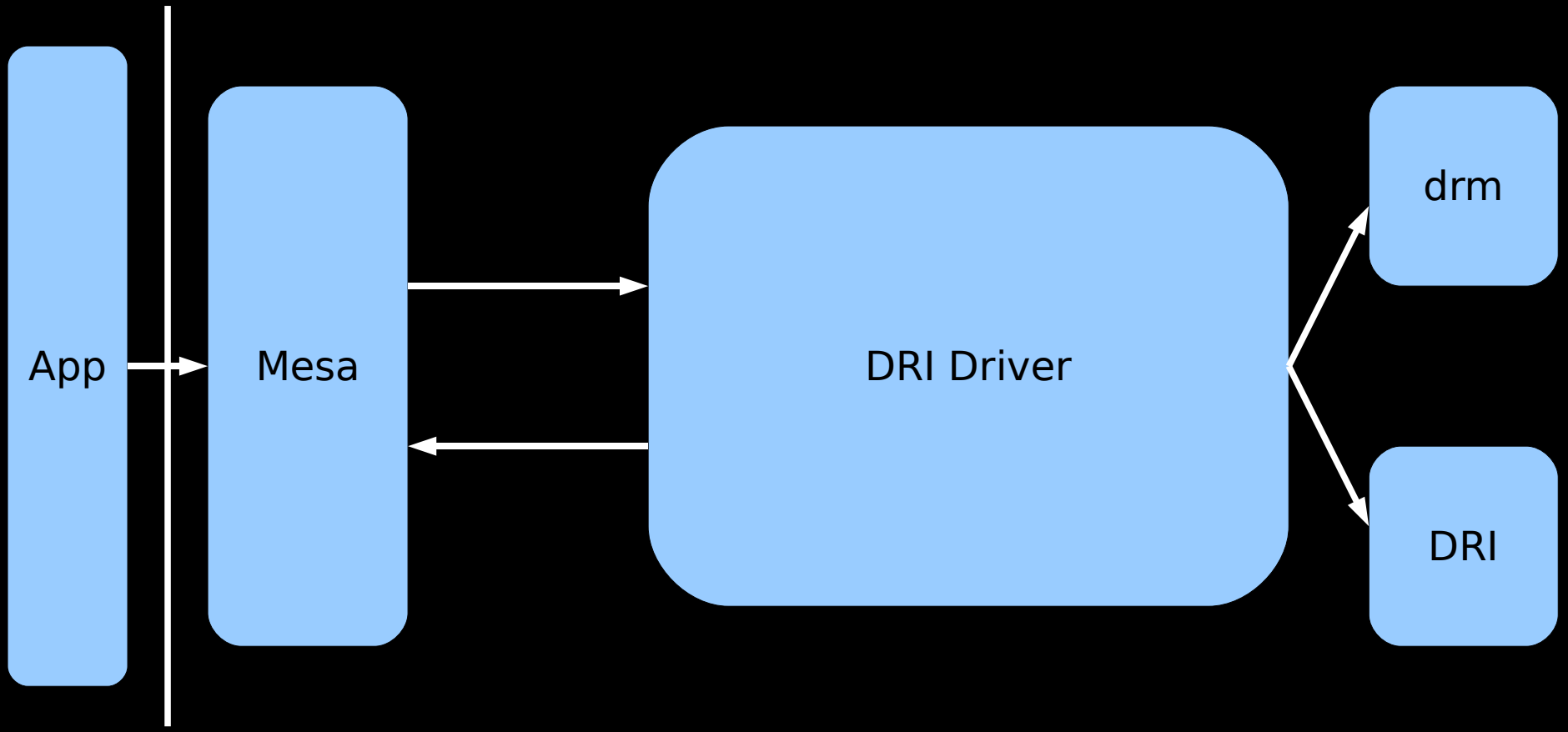
# DRI Driver Model




- Leaky interface between Mesa and driver.
- Drivers getting bigger, more complex.
- API, OS dependencies encoded in driver.

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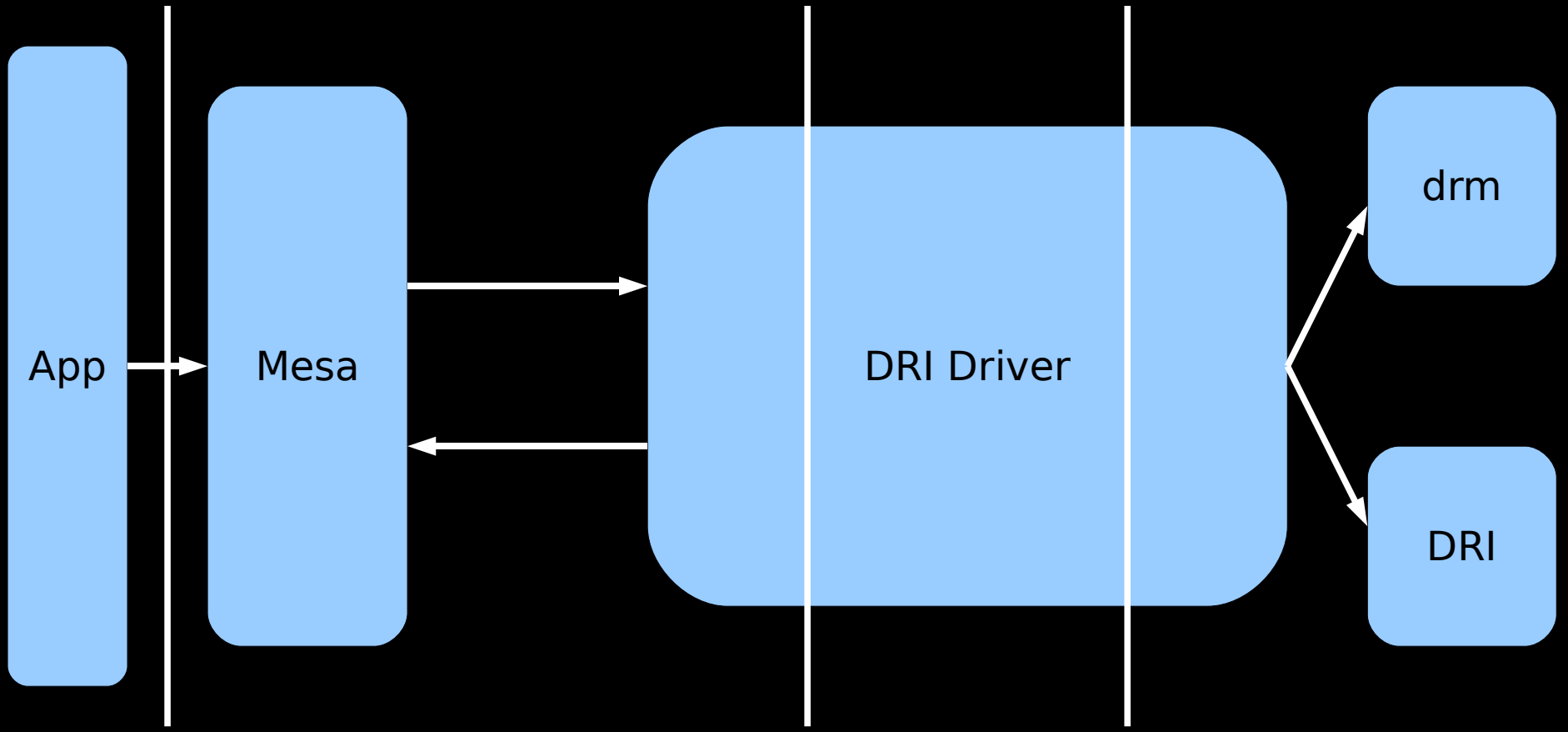
# Impose new interfaces




- Isolate interactions with API, OS, HW.
- Identify new interfaces.
- Split the driver.

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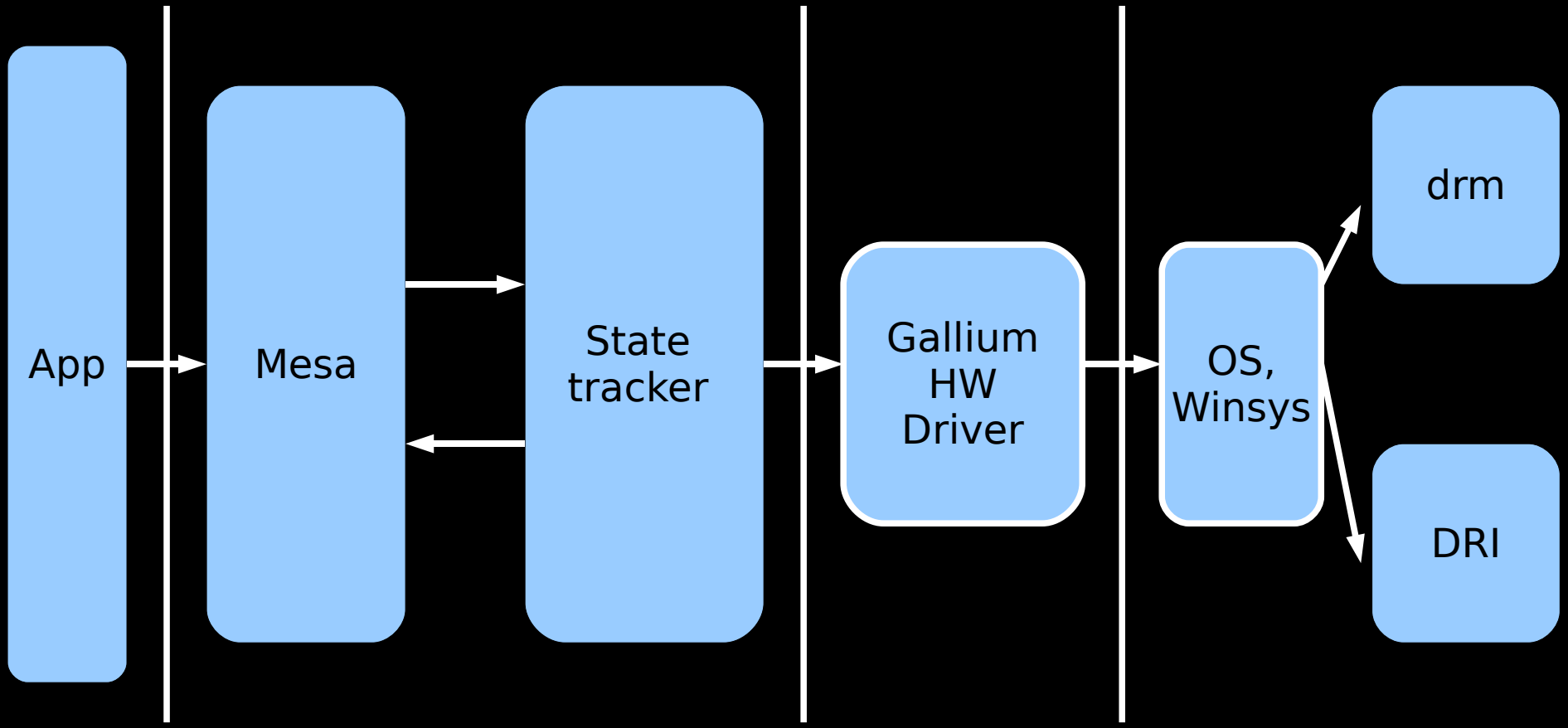
# A New Model




- New components:
  - State tracker, HW driver, Winsys.
- The TG-Gallium driver stack.

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# Gallium Driver Model

- Driver interface inspired by GL3, NV_GPU4, i965 hardware, etc.
- Constant state objects.
- Simple drawing interface.
- Unified shading language, as bytecode.
- Private buffers as render targets.
- Ability to re-target HW drivers to new APIs (eg. GL3, GLES, ???).
- Ability to re-target HW drivers to new window systems, OS's.

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# Gallium Driver Model

- Driver interface inspired by GL3, NV_GPU4, i965 hardware, etc.
- Constant state objects.
- Simple drawing interface.
  - DrawArrays, DrawElements
- Unified shading language, as bytecode.
- Private buffers as render targets.
- Fullscreen clears.
- Other blits??  Maybe subject to strict restrictions.

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# Gallium HW Driver

- Significantly simpler than a DRI driver.
- Interface:
  - Create/Bind/Delete state objects
  - Draw – one or two entrypoints.
  - Buffer management and fencing.
  - Flush
- Each Gallium driver defines its own OS-level (current name: winsys) interface.
- Re-target driver by re-implementing the winsys layer, eg. miniglx, EGL, etc.

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# Mesa State Tracker

- Implements current Mesa driver model.
- ...in terms of the new HW driver interface.
- Hardware independent, reusable.
- Converts GL state to constant objects.
- Deals with all the obscure GL concepts:
  - All the different GL drawing paths.
  - Pixel path operations (DrawPixels, Bitmap, CopyTexSubImage, etc).
  - GL texture semantics.
  - Texture Environments, GL1.5 shaders, GLSL.

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# O/S Dependencies

- Each Gallium driver defines its own OS-level (current name: winsys) interface.
- Retarget driver by swapping out the winsys layer.

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# Winsys Layer

- Implements two interfaces
  - DRI driver interface.
    - CreateDevice, CreateContext
    - SwapBuffers (**)
  - HW driver's winsys interface.
    - Buffer management
    - Command submission.
- Encapsulates knowledge about:
  - DRI lock and cliprects
  - Swapbuffers, page flipping.
  - The operating environment generally.

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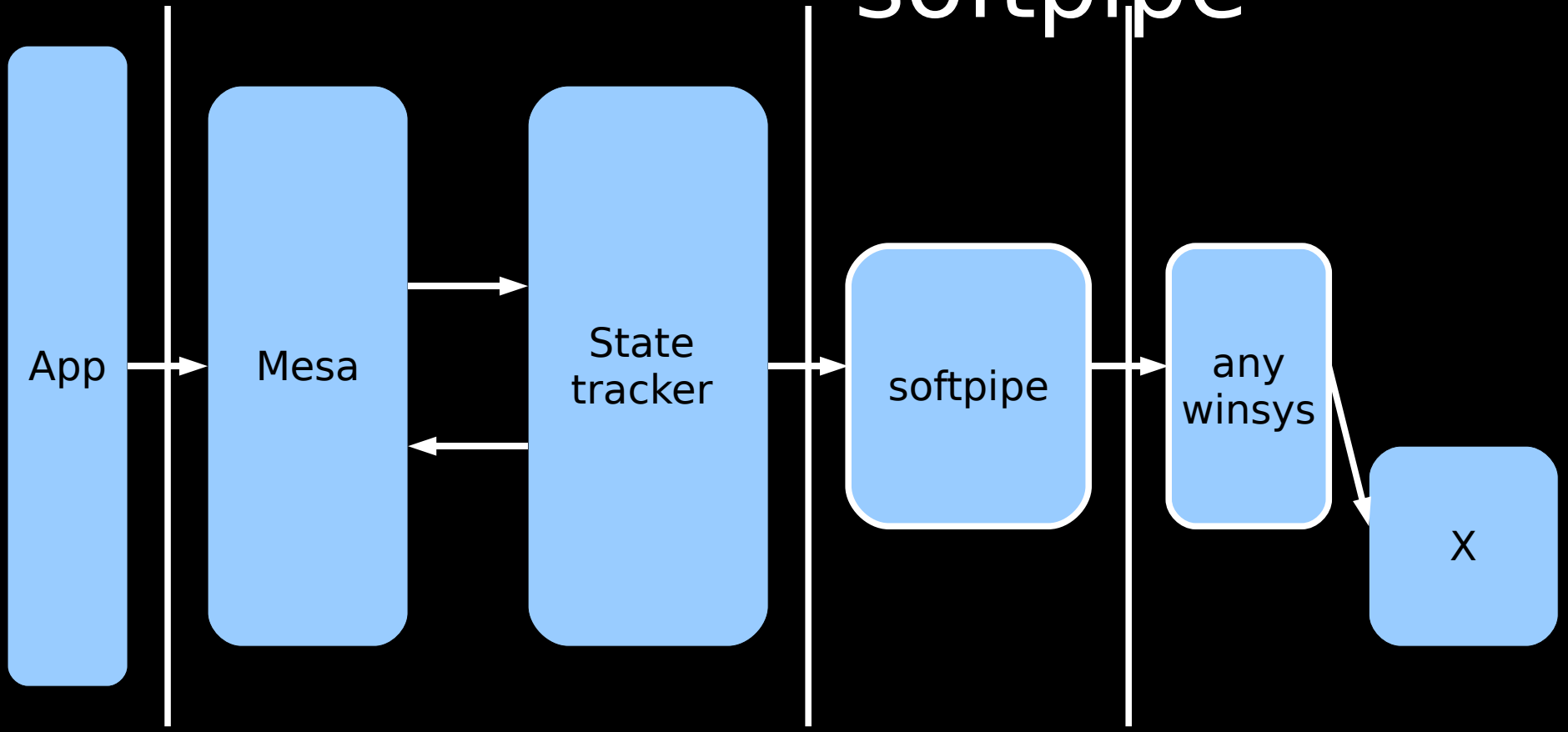
# Reference driver: softpipe




- Softpipe is a full Gallium driver for a CPU.
- Simple codegen for shaders.
- Closely model hardware behavior, arch.

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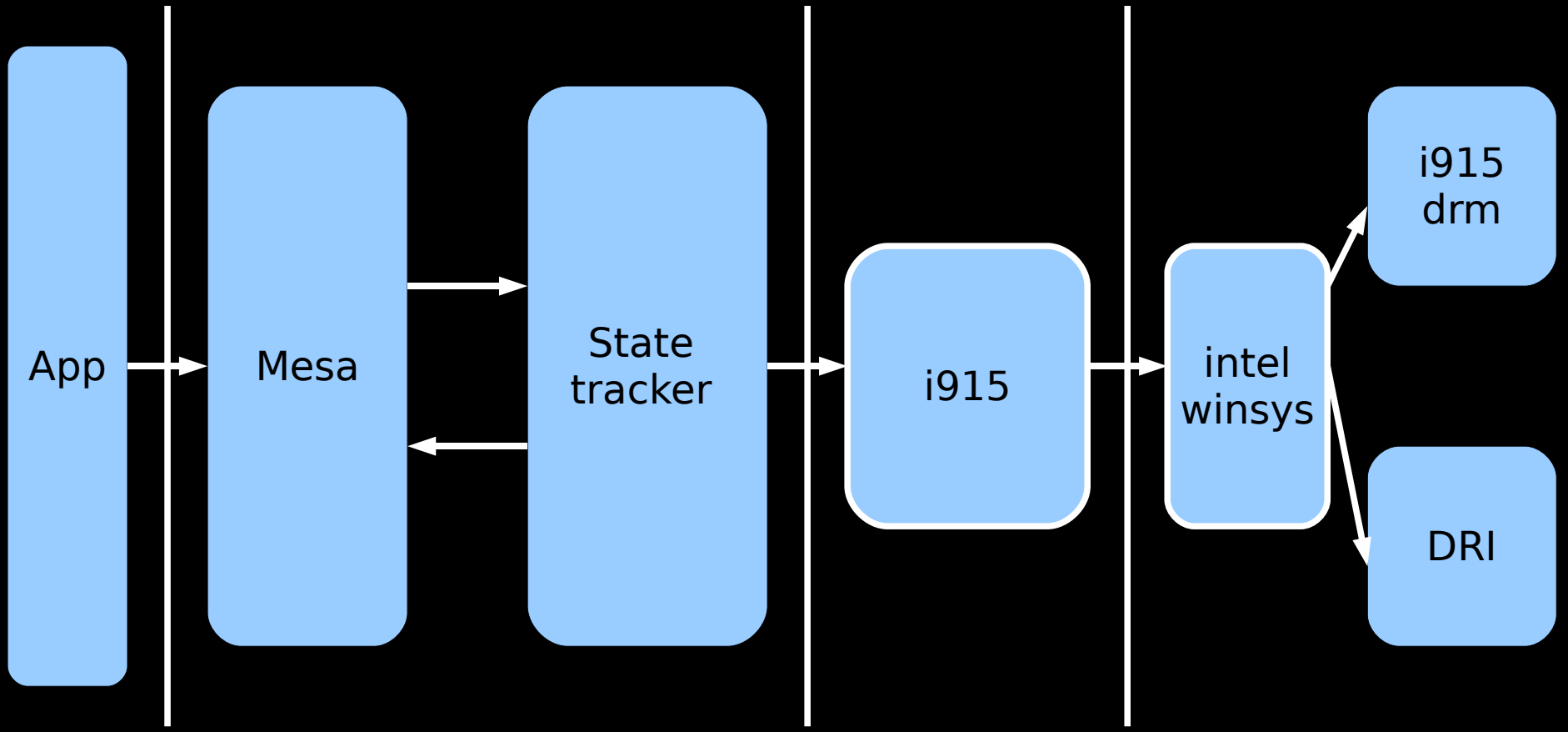
# Proof of concept: i915




- Builds another i915tex.so.
- Anticipate finished driver ~10kloc.

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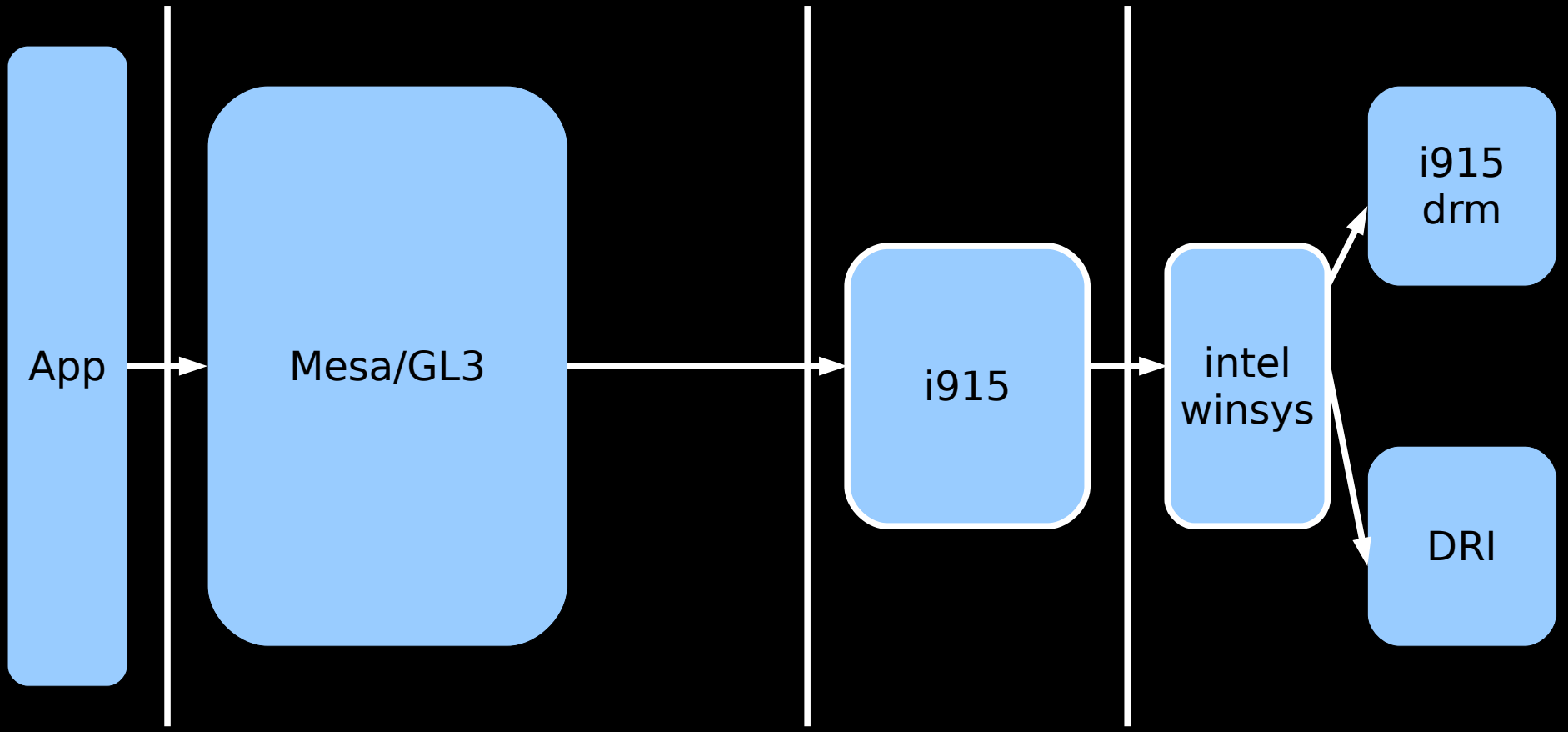
# Futures: GL3




- Mesa/GL3 talks to Gallium drivers natively, no need for a state tracker.
- Reuse driver and winsys without rework..?

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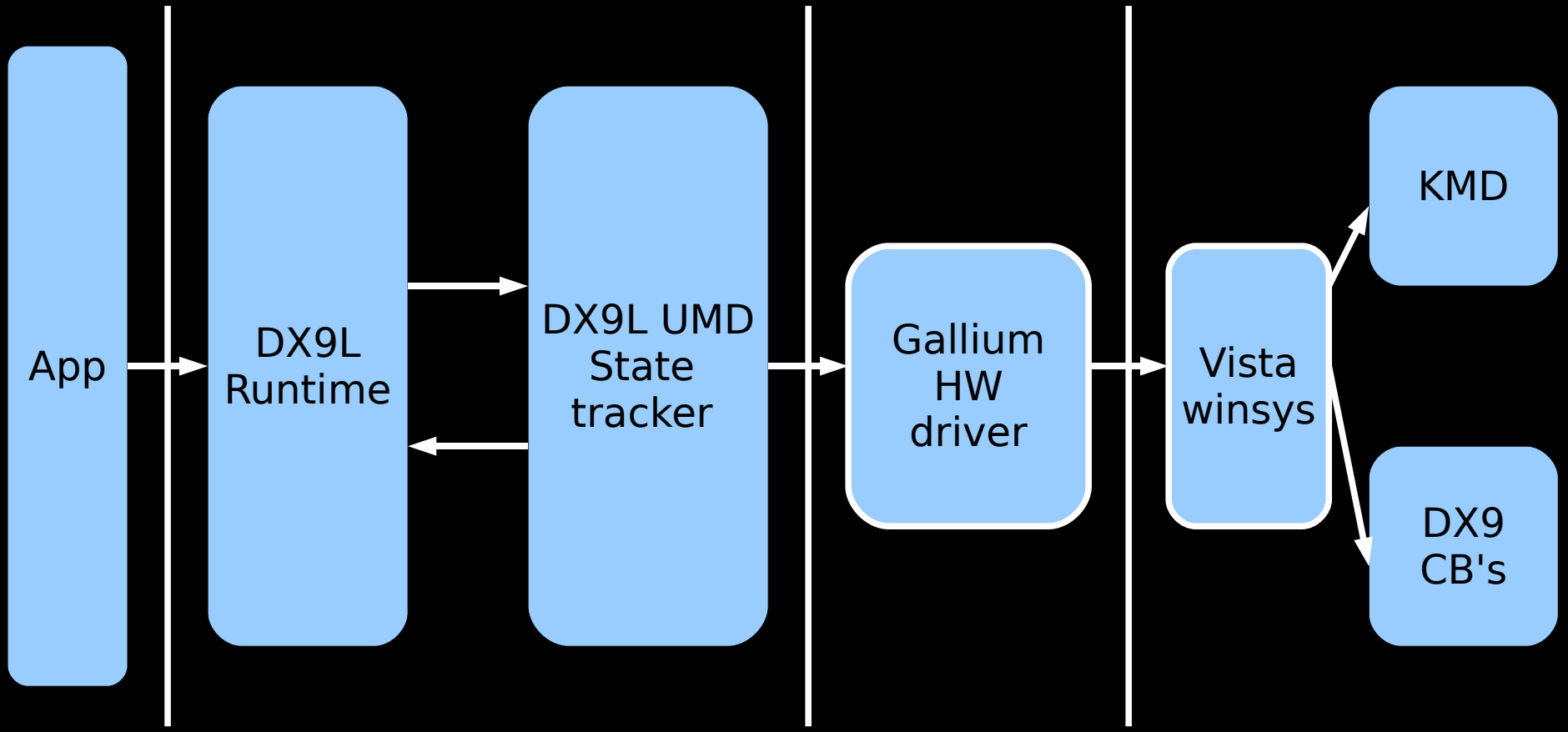
# Futures: Other APIs




- TG can now offer a common driver code-base across platform boundaries.

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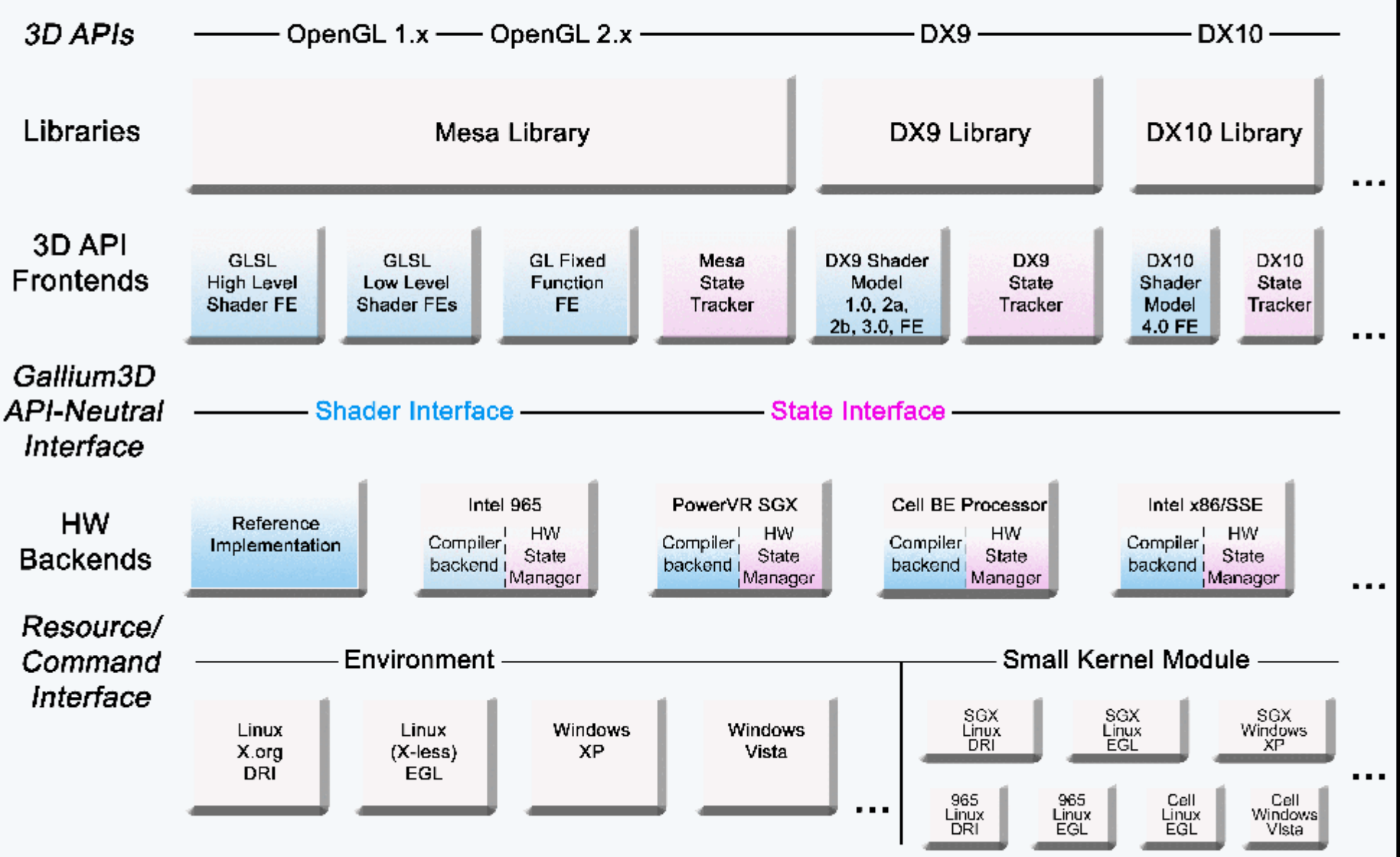
# TG-Gallium3D Driver Stack



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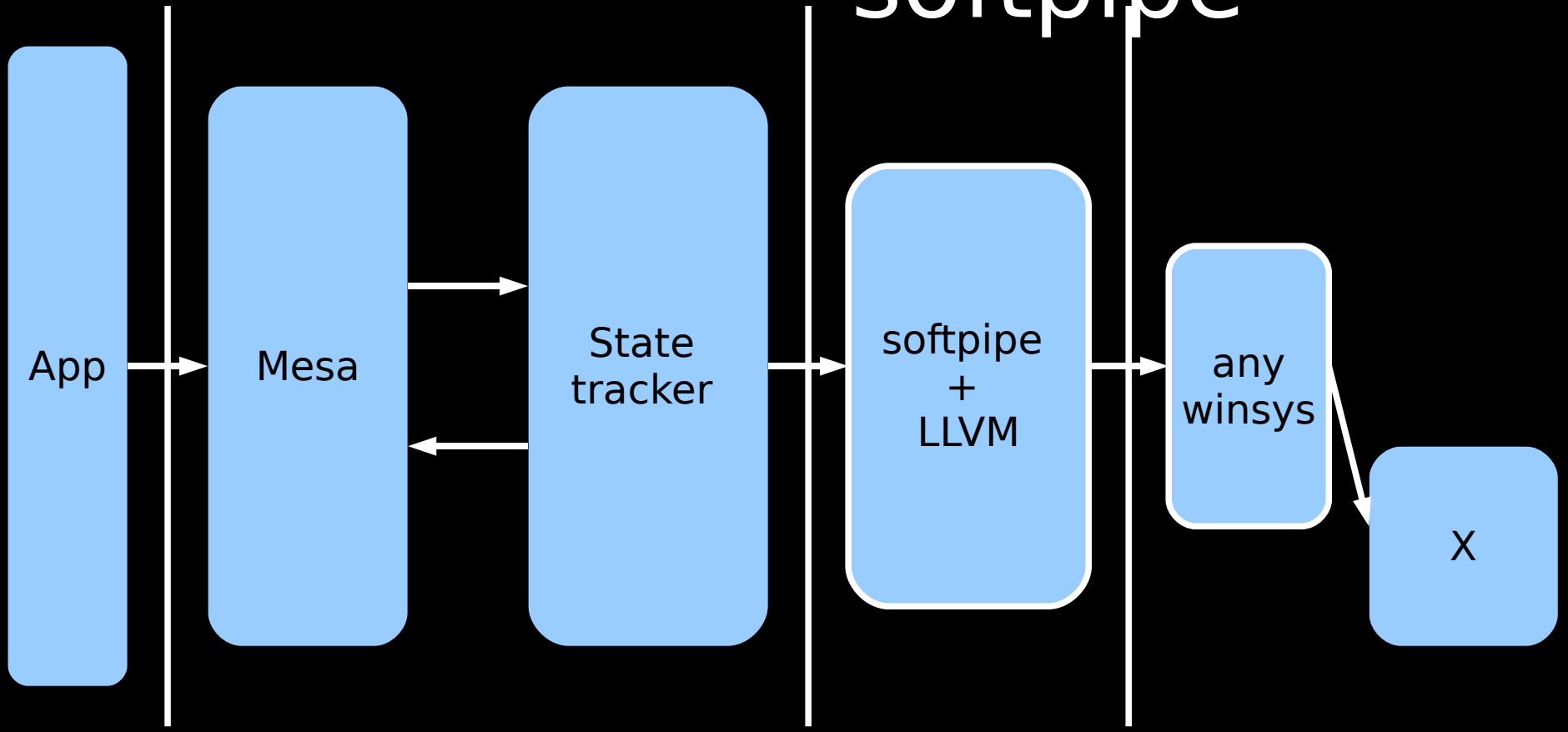
# Futures: Faster softpipe




- Pervasive codegen for softpipe:
  - Vertex fetch, Shaders, Clipper, Tri-setup, samplers, blend, scheduling, etc.
  - LLVM

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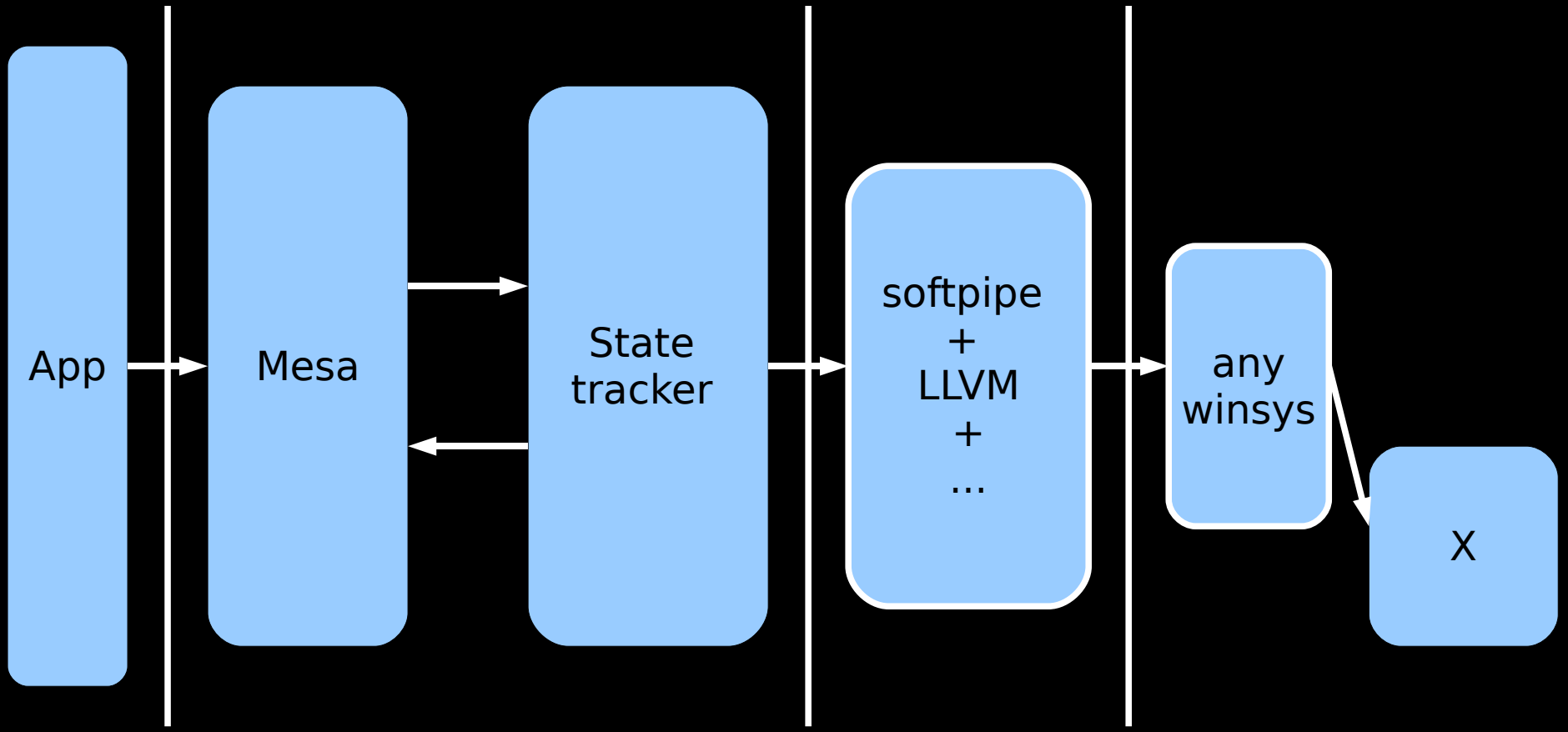
# Futures: Cell Driver




- Cell is very close to a GPU shader core.
- Add multicore scheduling to softpipe.
- Optimize...

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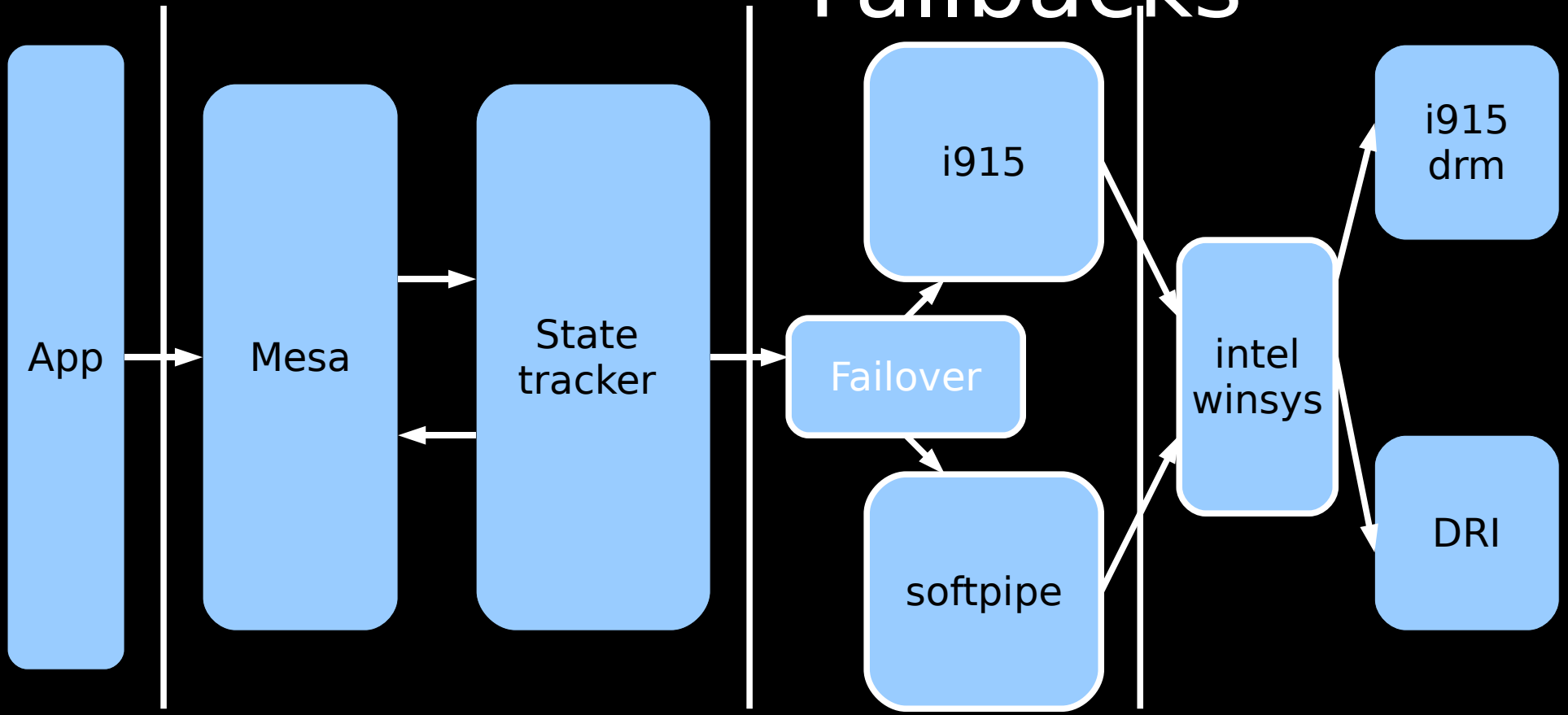
# Complications: Fallbacks




- Failover module can switch between HW and softpipe drivers.
- Keeps fallback policy out of driver, stack.

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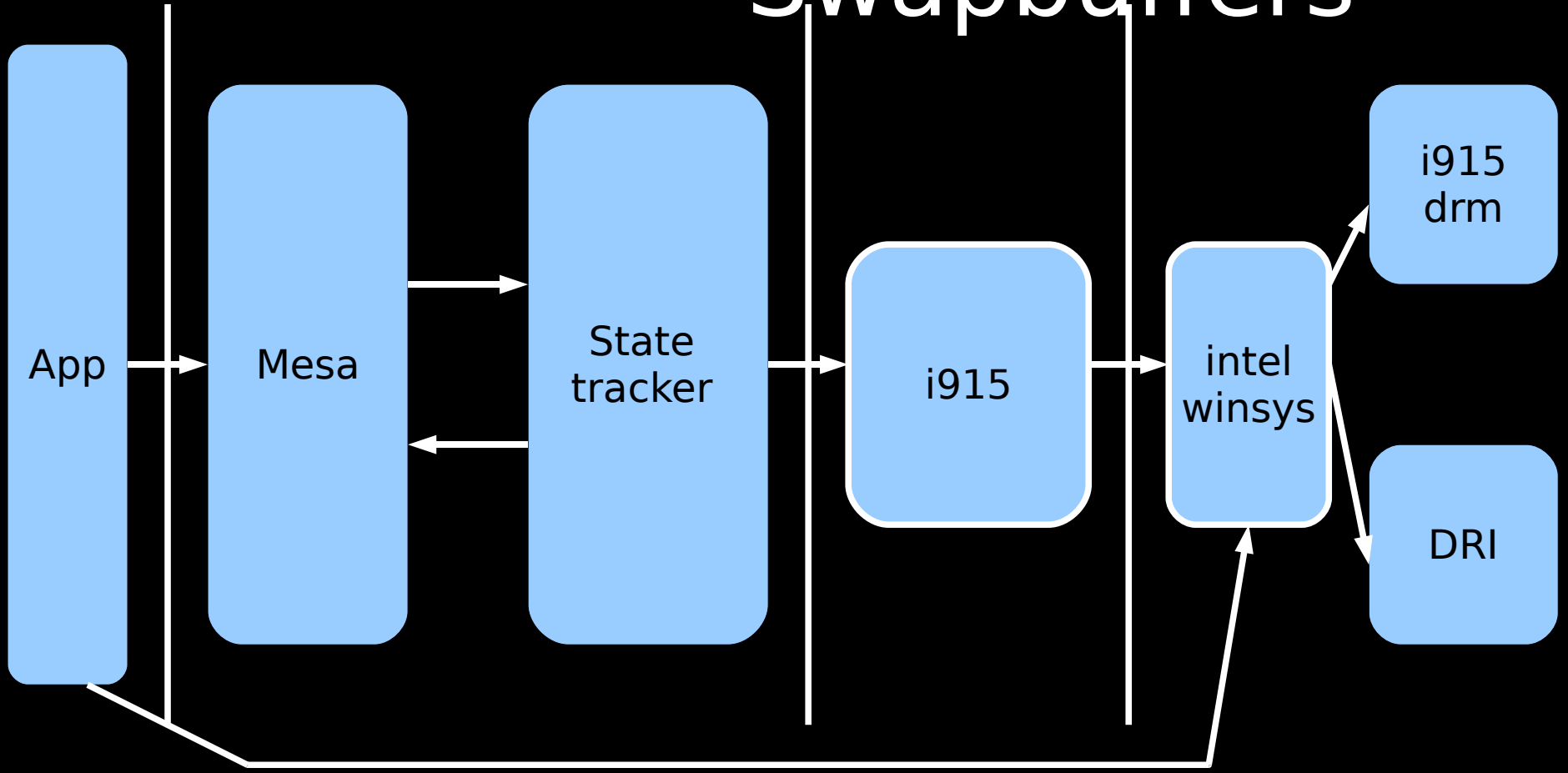
# Complications: Swapbuffers




- GLX implemented by the Winsys layer
- Requires some level of cooperation across the stack – flushing, etc.

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# Current Projects

- Softpipe, fast softpipe, Cell driver.
- Hardware drivers: i915-swz, others.
- Glucose: new interface requirements?
- LLVM integration, teach LLVM about GPU instruction sets.
- TTM improvements
  - Tiled buffers, redirected rendering, etc.
- And all the work to flesh out and finalize the driver stack.
- More front ends – GLES, OpenVG, GL3…

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# Final word: Cliprects

- Cliprects as we know them would violate the layering implicit in this model.
- No surprise – they also break the old driver model, we just hide it better.
- Cliprects are bad:
  - Major state-changes just because you grabbed the lock.
  - Potentially invalidate crucial decisions made earlier and encoded in the command buffer.
  - Not great for performance either.
  - Just get over it, we don't need them.