

# Virgil3D : a virtio based 3D GPU

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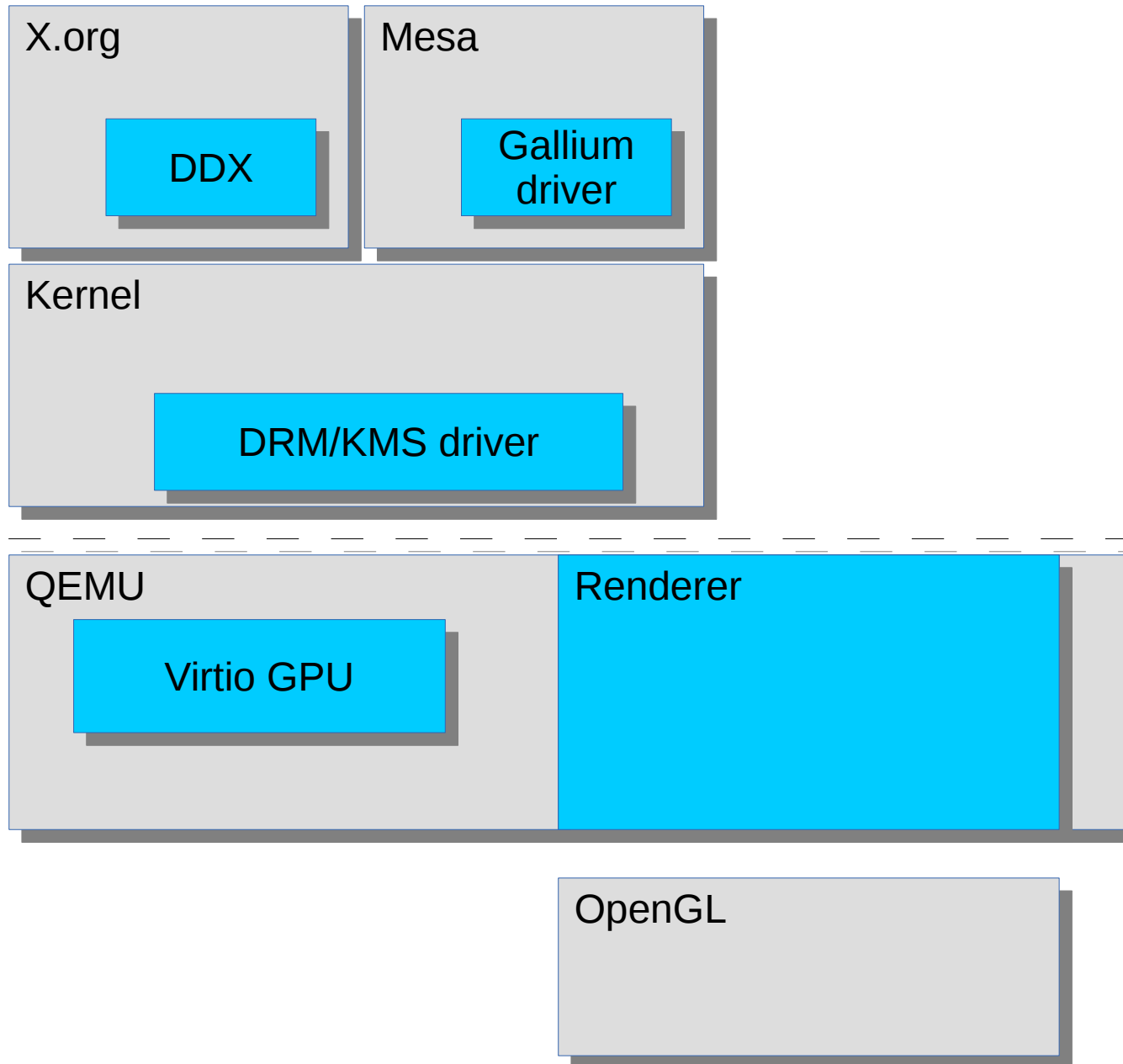
# Virgil3D

- Research project
  - Initial implementation just to see
- Focus
  - Work out the 3D side of a virtio GPU
  - Get familiar with virtio and qemu code
- Based on Mesa project Gallium 3D
- Linux focused

# Other projects

- Vgallium
  - relied on gallium drivers in host
  - Old version of gallium
  - Unmaintained
- VirtualBox GL passthrough
  - GL based is too large a surface area
  - Unknown security implications
- Vmware SVGAII
  - Closed source
  - Based on DX9 so limited capability

# Components (Linux)



# Virtio interface

- Single virtio ring
  - Context management
    - Create, Destroy, Attach Resource, Detach Resource
  - 3D Resource management
    - Create, Destroy, Flush, Attach SG, Detach SG
  - DMA-like transfer operations
    - Get, Put
  - Modesetting
  - Command stream submission
  - Capabilities
  - Fencing
- IRQ for fencing
- Config space for fencing and cursor handling

# Rendering Command stream

- Gallium state objects
  - Blend, rasterizer, dsa, shaders, samplers, queries etc.
  - Create, bind, destroy operations
- Non-state operations
  - Framebuffer, scissor, viewport, vbos.
- Rendering
  - Draw, clear, blit
- Queries

# Renderer

- Convert gallium states to GL interface
- Convert TGSI shaders to GLSL shaders
- GL host context per guest context
  - Required for proper conditional rendering operation
- Works out capabilities from GL version and extensions
- Currently uses GLSL 1.30 shader programs

# GL versions

- Guest currently at GL 2.1 + GLSL 1.20
- Host requires GL2.1 + GLSL1.30
- Up to GL3.0 in the guest mostly done
  - Issues with multisample textures and hibernate/migration
- 3.1 and above open a number of questions
  - Lack of ARB\_compatibility



# Issues

- How best to get 64-bit values back from host
  - Status page seems like my best answer
- How to get fence irqs?
  - Second vq instead – seems like overkill
  - Can a vq attach 0 elements?
  - Or maybe just attach status page all the time
- GL 3.x context creation
  - Due to deprecated features

# virtio-gpu

- Secondary project
- Produce a basic virtio gpu that the virgil renderer can attach to.
- Multi-head capable
- Unaccelerated
- PCI and VGA extras

# Port QEMU to SDL 2

- SDL 2
  - Multiple window support
  - ARGB cursor support
  - Better GL support
    - EGL
  - Very different input

# Qemu console multi-head

- Initial implementation
  - Add arrays of DisplaySurfaces to QemuConsole
  - Add `_idx` version of some interfaces
  - Use SDL2 multi-window support for demo
- TODO
  - Howto to work out num heads limits

# Beyond SDL

- Libvirt integration
- Security
- DRM render nodes
- Using EGL and dma-buf to share the final rendered image
- Viewer using GLX/EGL to composite final rendered image

# Demos

- Virgil3D rendering
- Virtio-vga multi-head