VKMS: Virtual Kernel Modesetting

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About Us and Our Mentors

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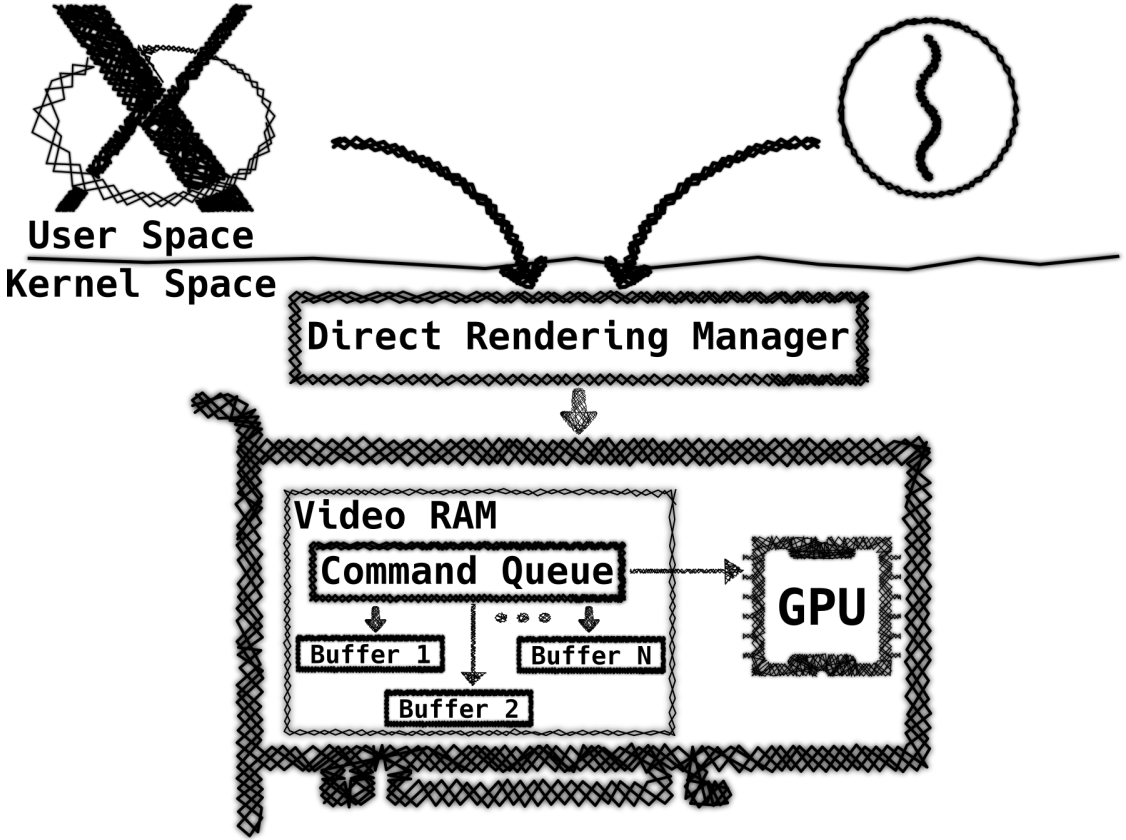
Google
Summer of Code

About Us and Our Mentors

Mentors:

- Daniel Vetter
- Gustavo Padovan
- Sean Paul
- All the dri-devel community (❤)

Kernel Mode-Setting



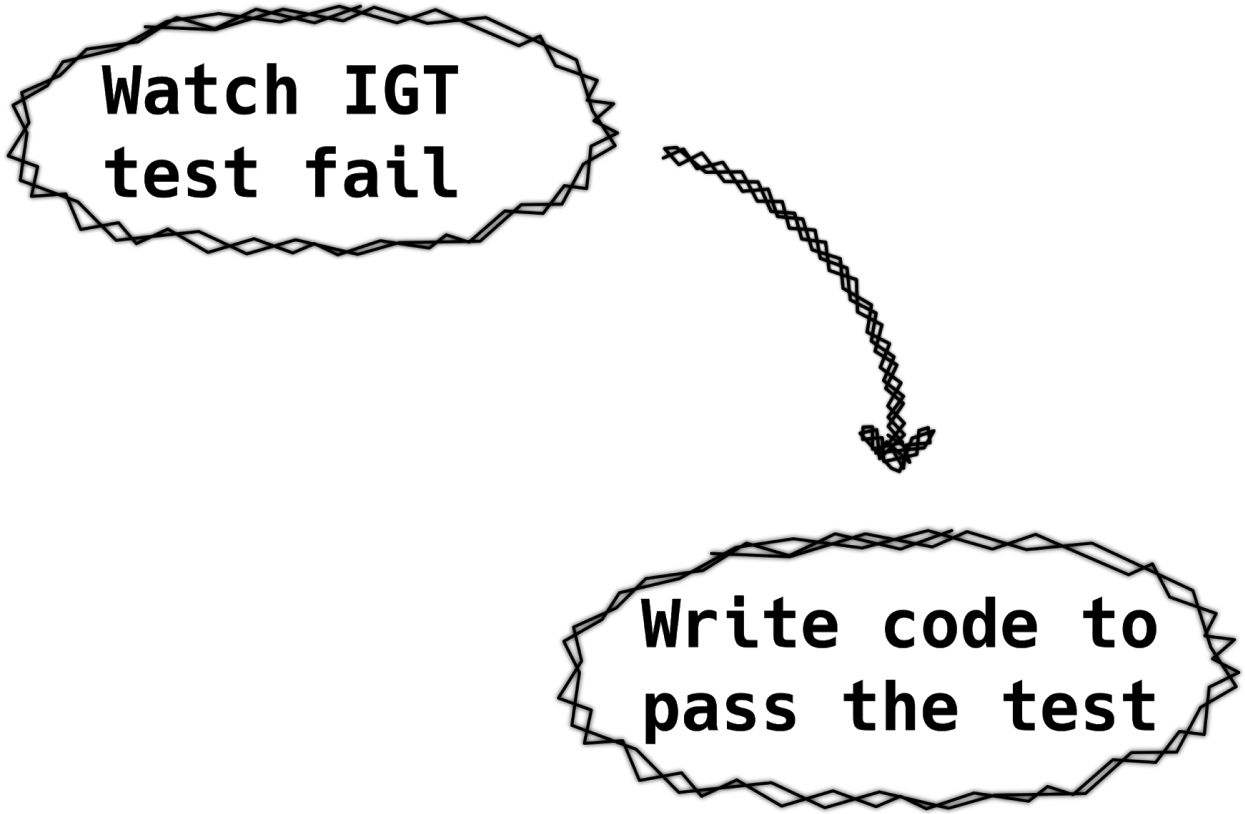
Why do we need VKMS?

- Increase DRM test coverage
- It may work as a tool to help graphics developers

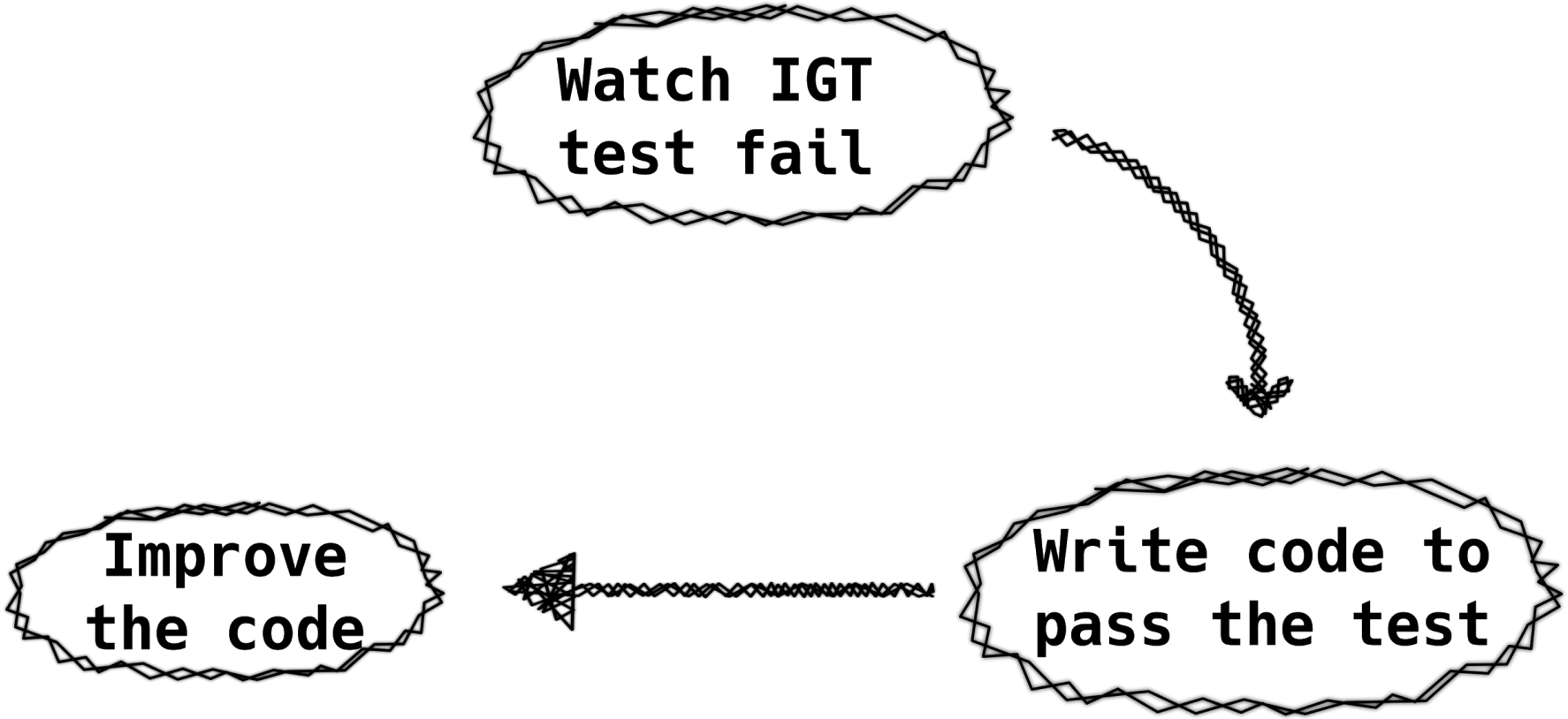
Development Cycle

Development Cycle

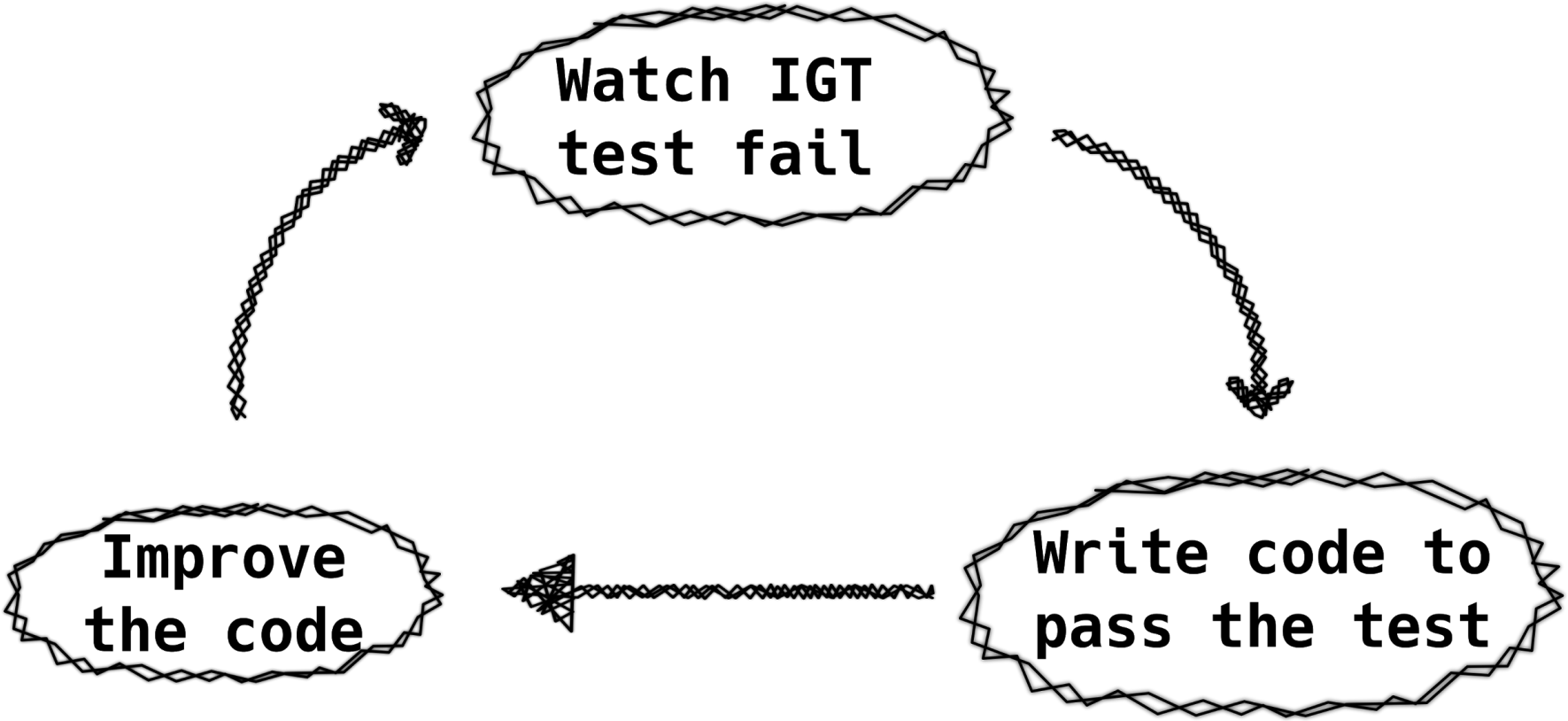
Development Cycle



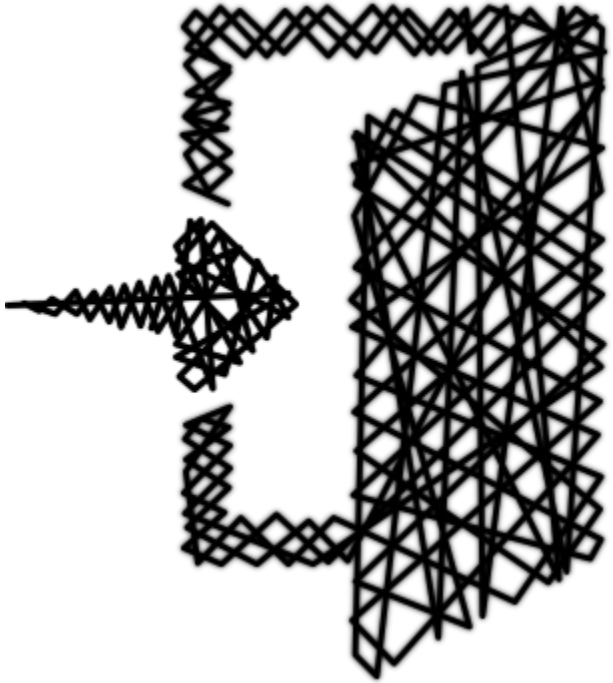
Development Cycle



Development Cycle



Inside VKMS



Basic Features

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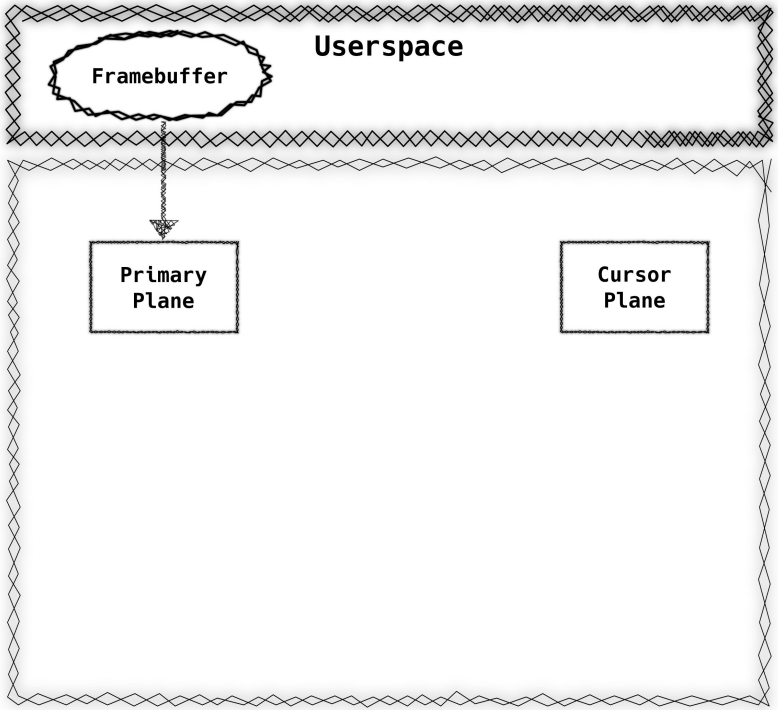

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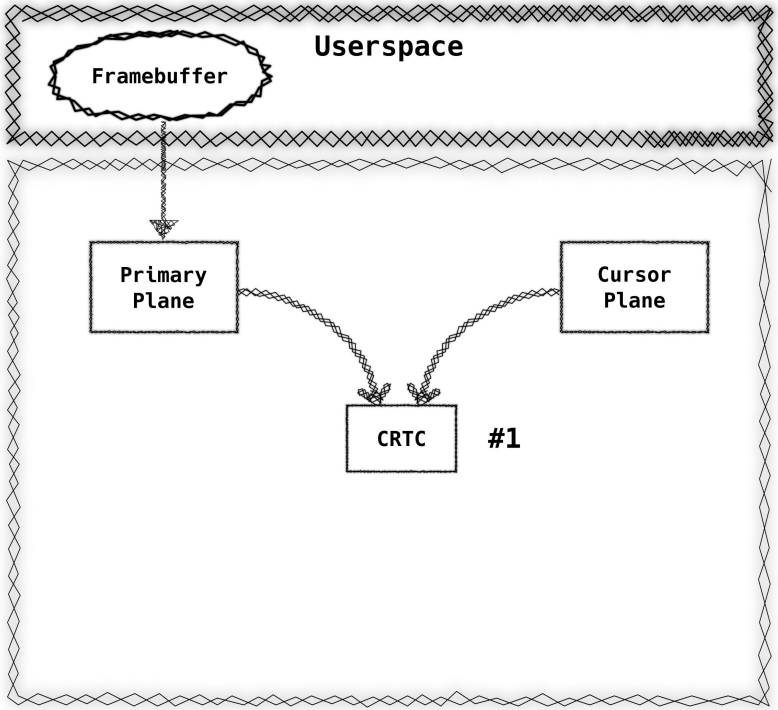
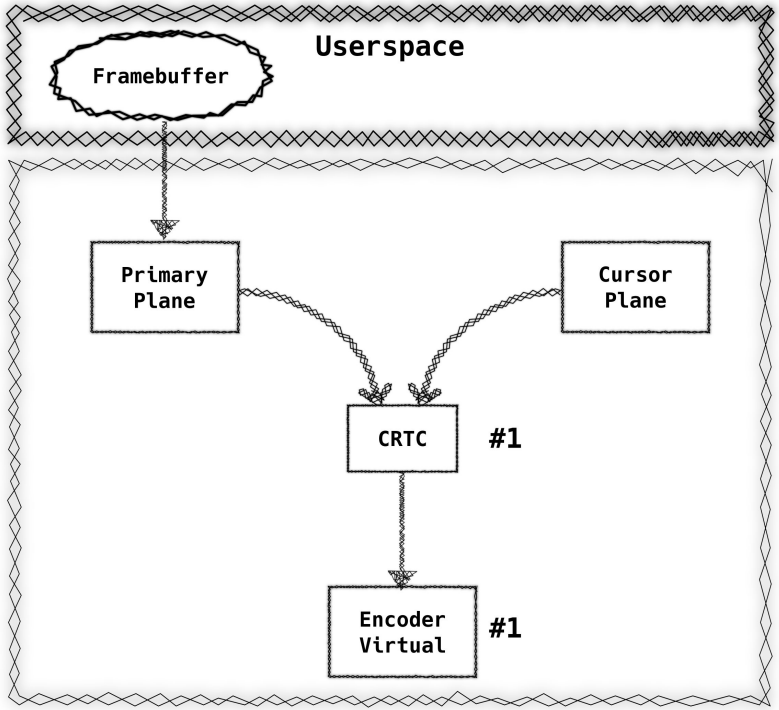


Basic Features



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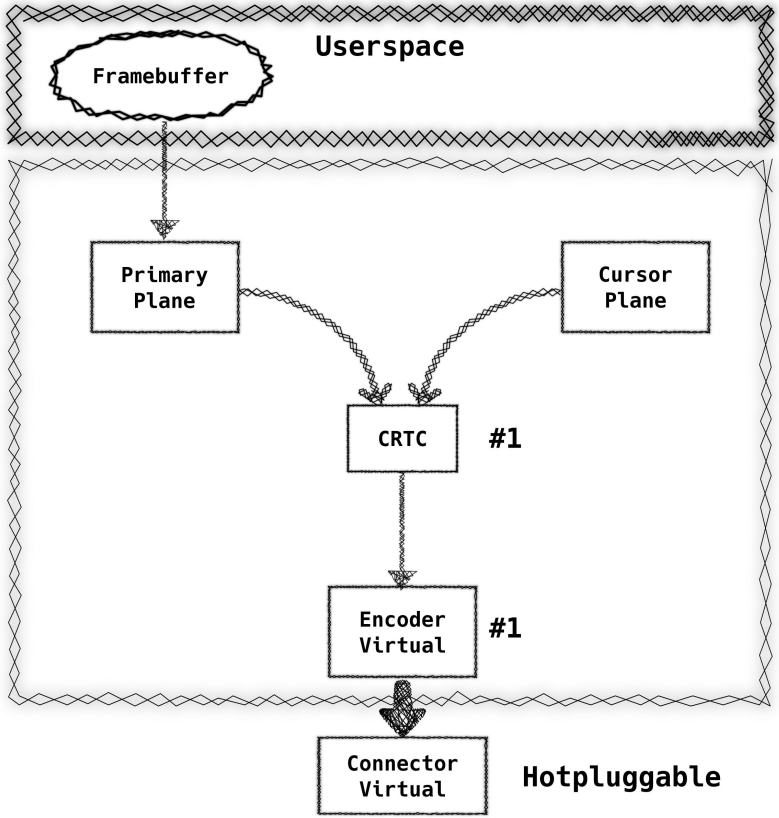
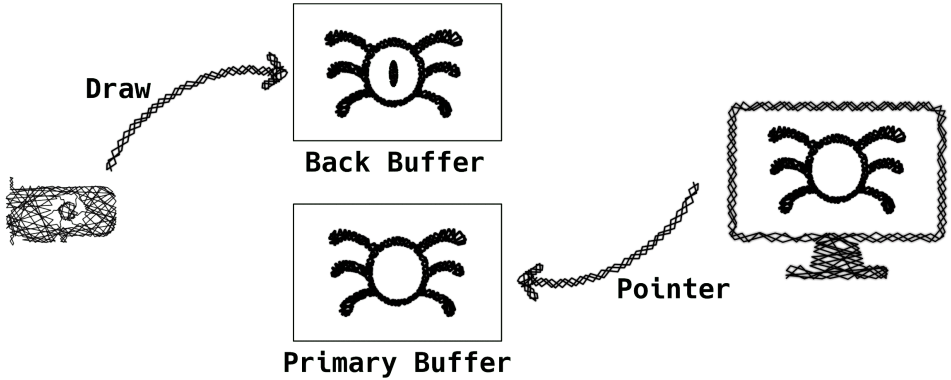
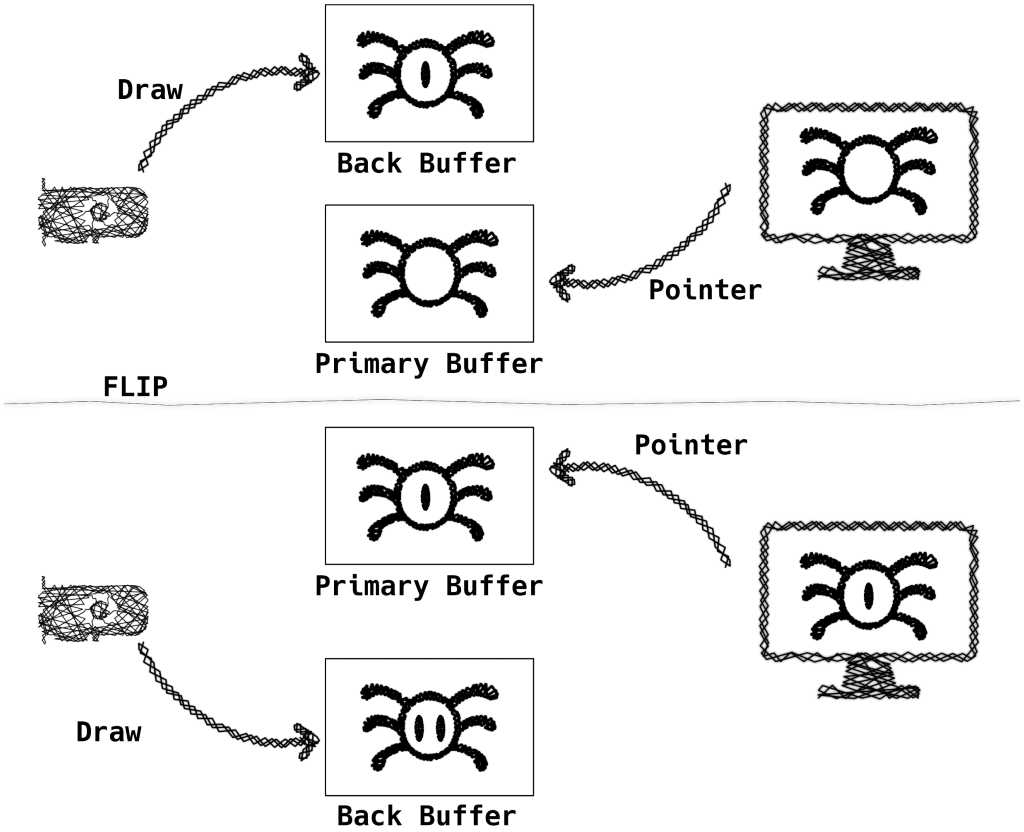


Page Flip and Vblank



Page Flip and Vblank

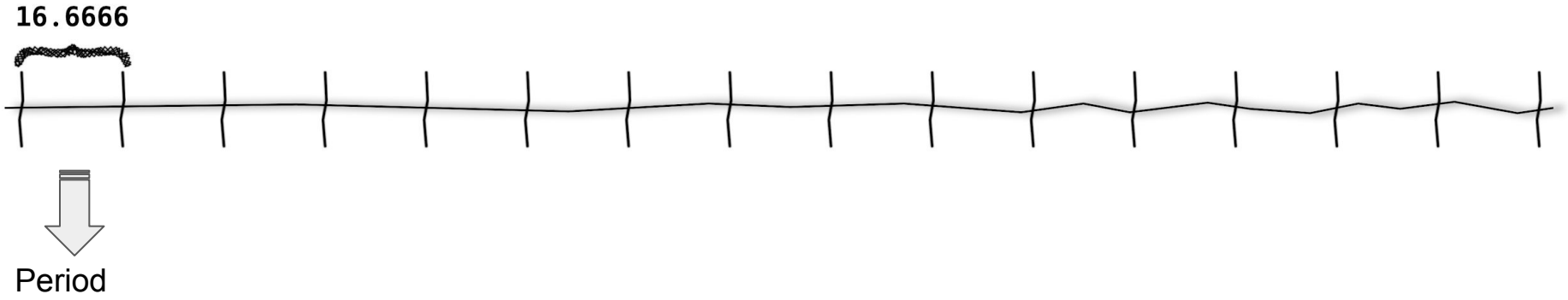


Vblank on VKMS

Simulating Vblank with Hrtimers

Vblank on VKMS

Simulating Vblank with Hrtimers



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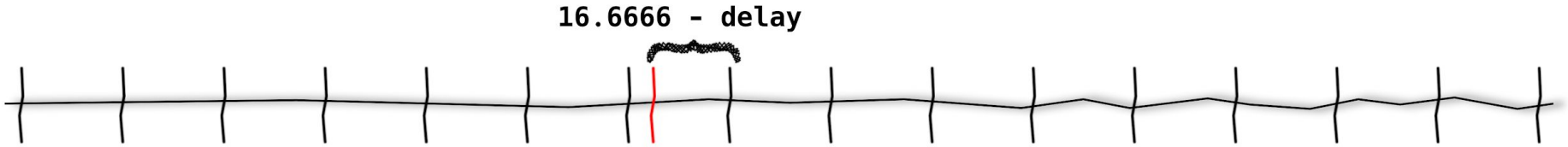
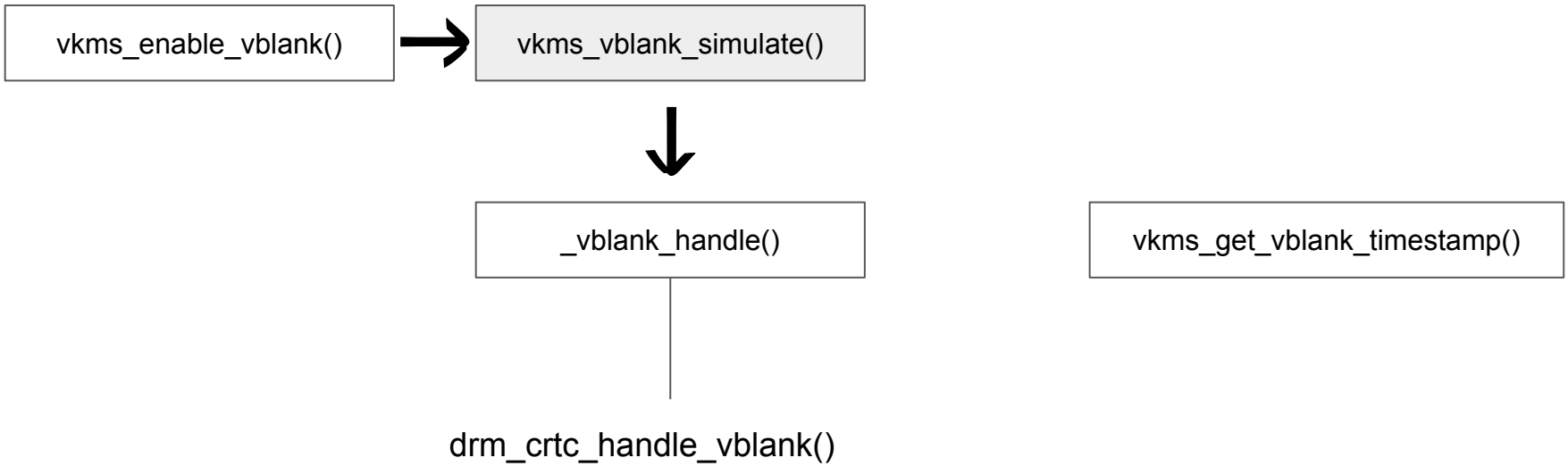
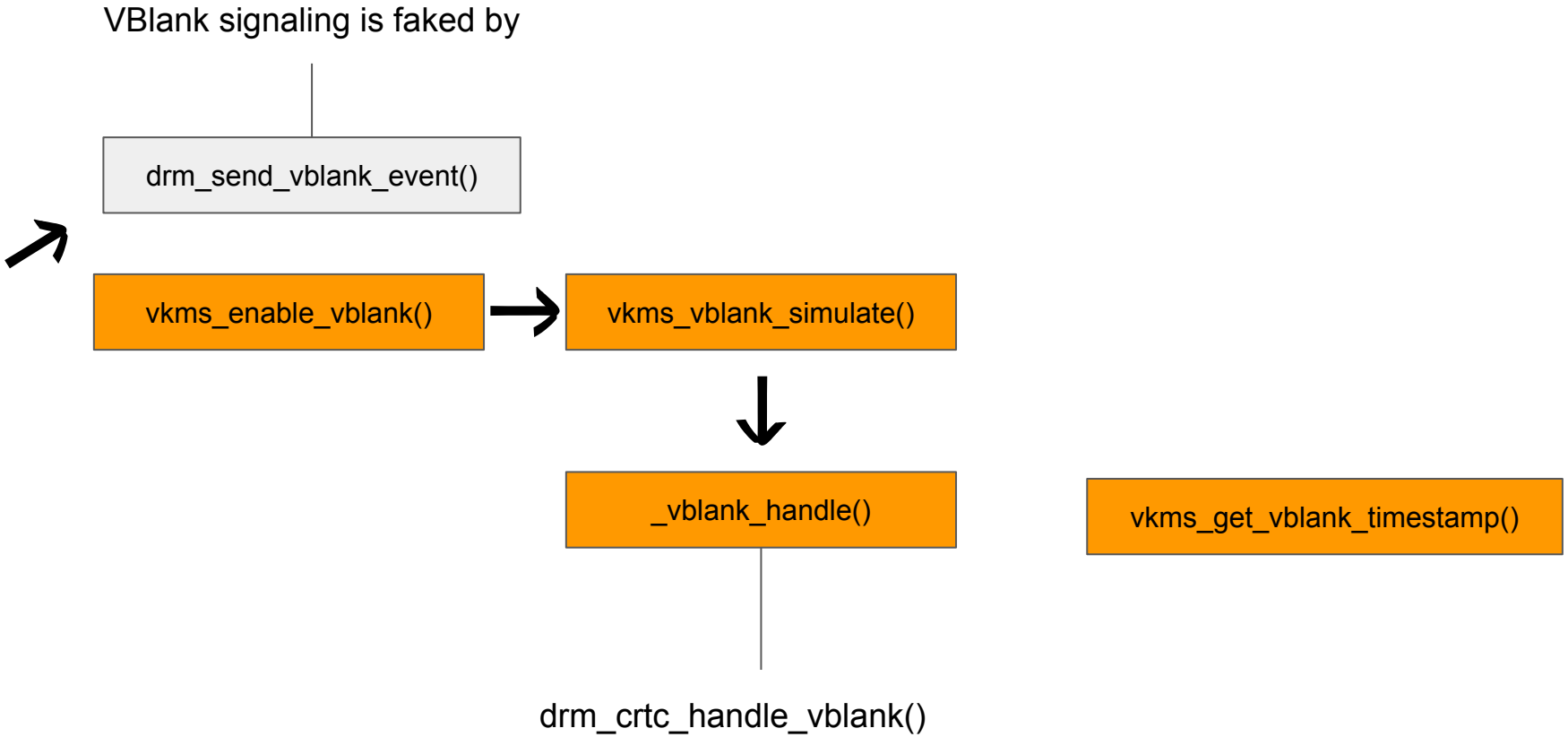


Vblank on VKMS



VKMS without VBlank (Patch)



Vblank on VKMS

```
[siqueira@atma igt-host]$ sudo ./tests/kms_flip  --run-subtest basic-plain-flip
IGT-Version: 1.22-ge29bd428 (x86_64) (Linux: 4.18.0-rc3-VKMS-RULES+ x86_64)
Using monotonic timestamps
DRM_IOCTL_I915_GEM_APERTURE failed: Invalid argument
Assuming 131072kB available aperture size.
May lead to reduced performance or incorrect rendering.
get chip id failed: -1 [22]
param: 4, val: 0
Beginning basic-plain-flip on pipe A, connector Virtual-1
  1024x768 60 1024 1048 1184 1344 768 771 777 806 0xa 0x48 65000
................................................................................
................................................................................
................................................................................
........................
basic-plain-flip on pipe A, connector Virtual-1: PASSED

Subtest basic-plain-flip: SUCCESS (10.185s)
[siqueira@atma igt-host]$
```

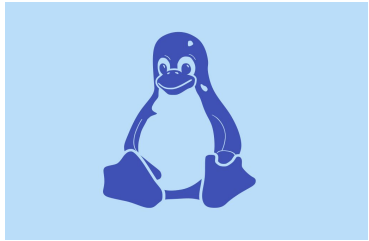
Vblank on VKMS

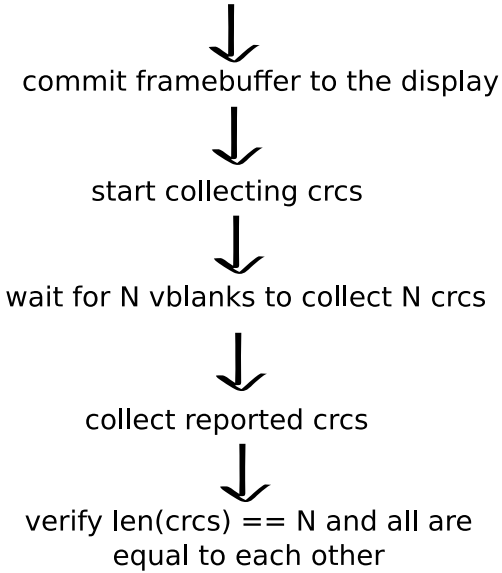
```
[siqueira@atma igt-host]$ sudo ./tests/kms_flip  --run-subtest wf_vblank-ts-chec
IGT-Version: 1.22-ge29bd428 (x86_64) (Linux: 4.18.0-rc3-VKMS-RULES+ x86_64)
Using monotonic timestamps
DRM_IOCTL_I915_GEM_APERTURE failed: Invalid argument
Assuming 131072kB available aperture size.
May lead to reduced performance or incorrect rendering.
get chip id failed: -1 [22]
param: 4, val: 0
Beginning wf_vblank-ts-check on pipe A, connector Virtual-1
  1024x768 60 1024 1048 1184 1344 768 771 777 806 0xa 0x48 65000
Expected frametime: 16666us; measured 16665.6us +- 0.500us accuracy 0.01%
................................................................................
................................................................................
..................
wf_vblank-ts-check on pipe A, connector Virtual-1: PASSED

Subtest wf_vblank-ts-check: SUCCESS (30.582s)
[siqueira@atma igt-host]$
```

CRC API Support With VKMS

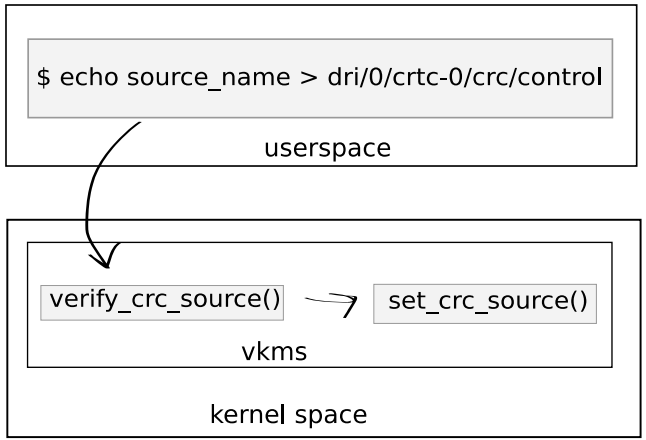
- value = **crc**(displayed frame)
- Goal: Pass the following tests from the IGT test suite
  - **kms_pipe_crc_basic**
  - **kms_cursor_crc**

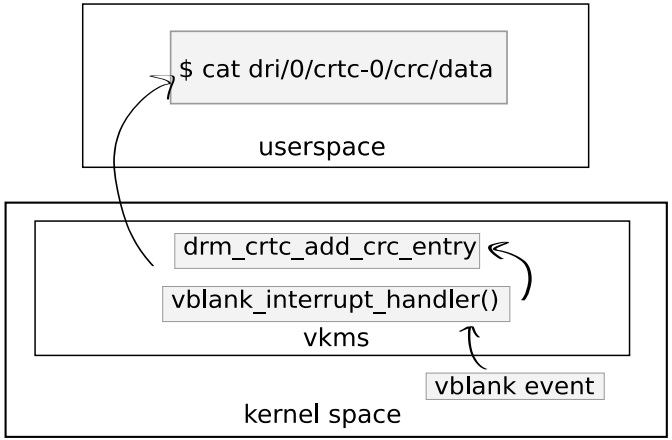




CRC API Support in DRM

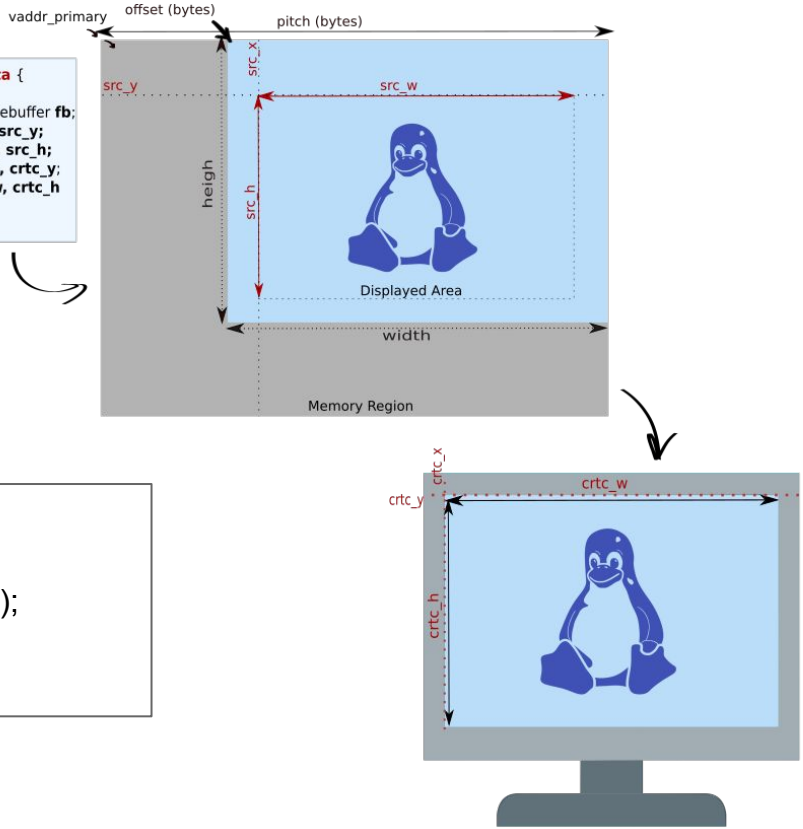
- Add the following to the drm_crtc vfuns table:
  - **verify_crc_source**()
  - **set_crc_source**()
- **drm_crtc_add_crc_entry**()
- CRC API exposed at **/sys/kernel/debug/dri/0/crtc-N/crc** -> **control** and **data** files





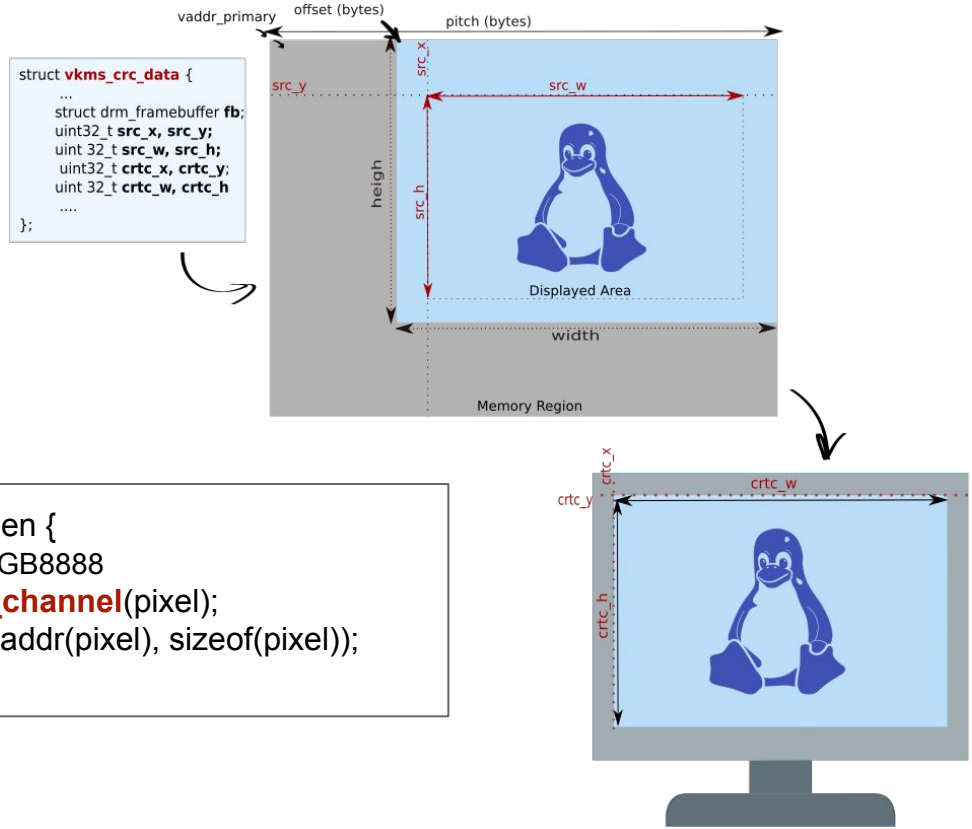
Computing CRC

```
struct vkms_crc_data {
        ...
        struct drm_framebuffer fb;
        uint32_t src_x, src_y;
        uint 32_t src_w, src_h;
         uint32_t crtc_x, crtc_y;
        uint 32_t crtc_w, crtc_h
         ....
};
```



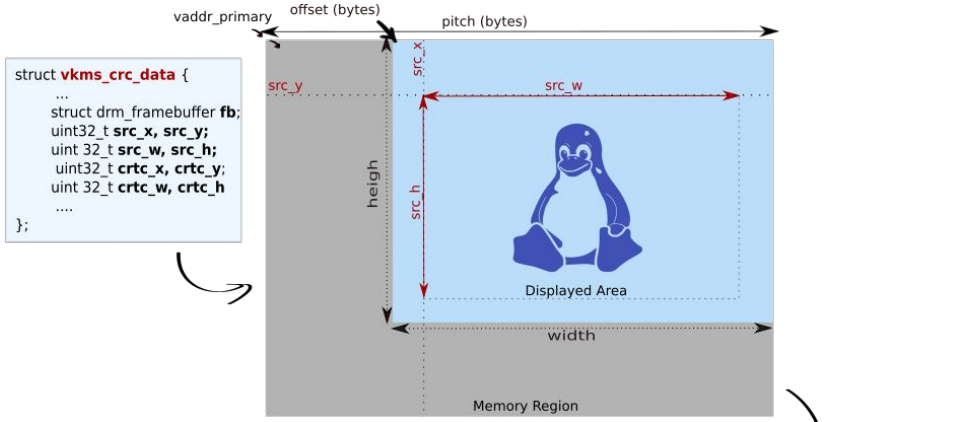

```
for each pixel visible in screen {
        // DRM_FORMAT_XRGB8888
        pixel = clear_alpha_channel(pixel);
        crc = compute_crc(crc, pixel);
}
```

Computing CRC

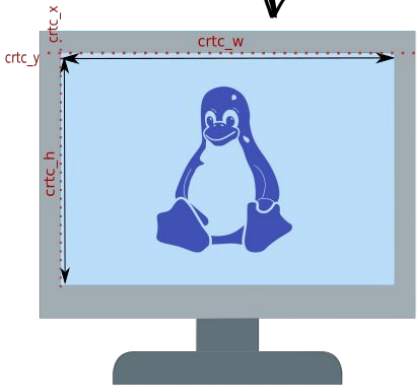



```
for each pixel visible in screen {
        // DRM_FORMAT_XRGB8888
        pixel = clear_alpha_channel(pixel);
        crc = crc32_le(crc, vaddr(pixel), sizeof(pixel));
}
```

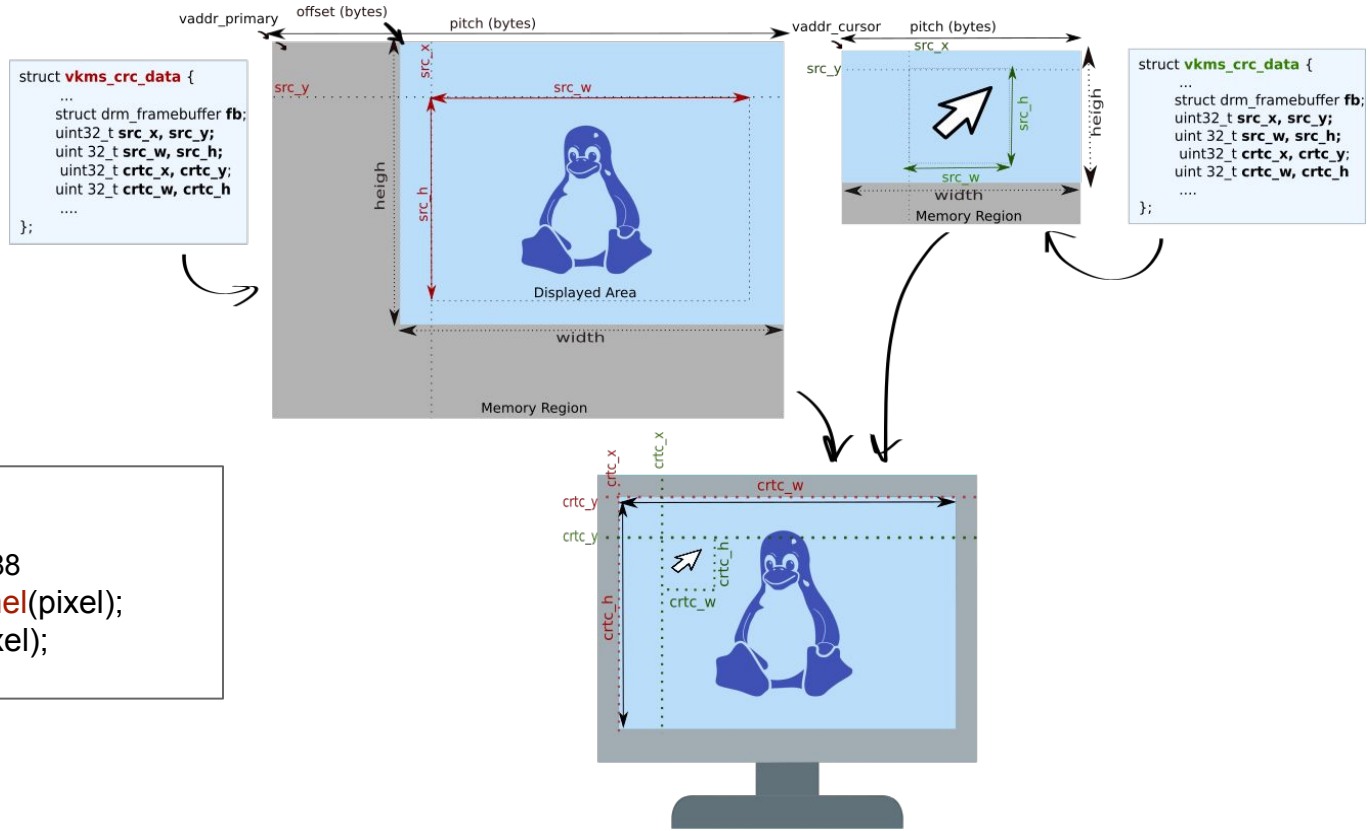
Computing CRC




```
for (i = src_y; i < src_y + src_h; ++i) {
        for (j = src_x; j < src_x + src_w; ++j) {
                v_offset = i * pitch;
                h_offset = j * cpp /* bytes per pixel */;
                src_offset = offset + v_offset + h_offset;
                memset(vaddr, src_offset + 24, 0, 8);
                crc = crc32_le(crc, vaddr + src_offset, sizeof(u32));
        }
}
```



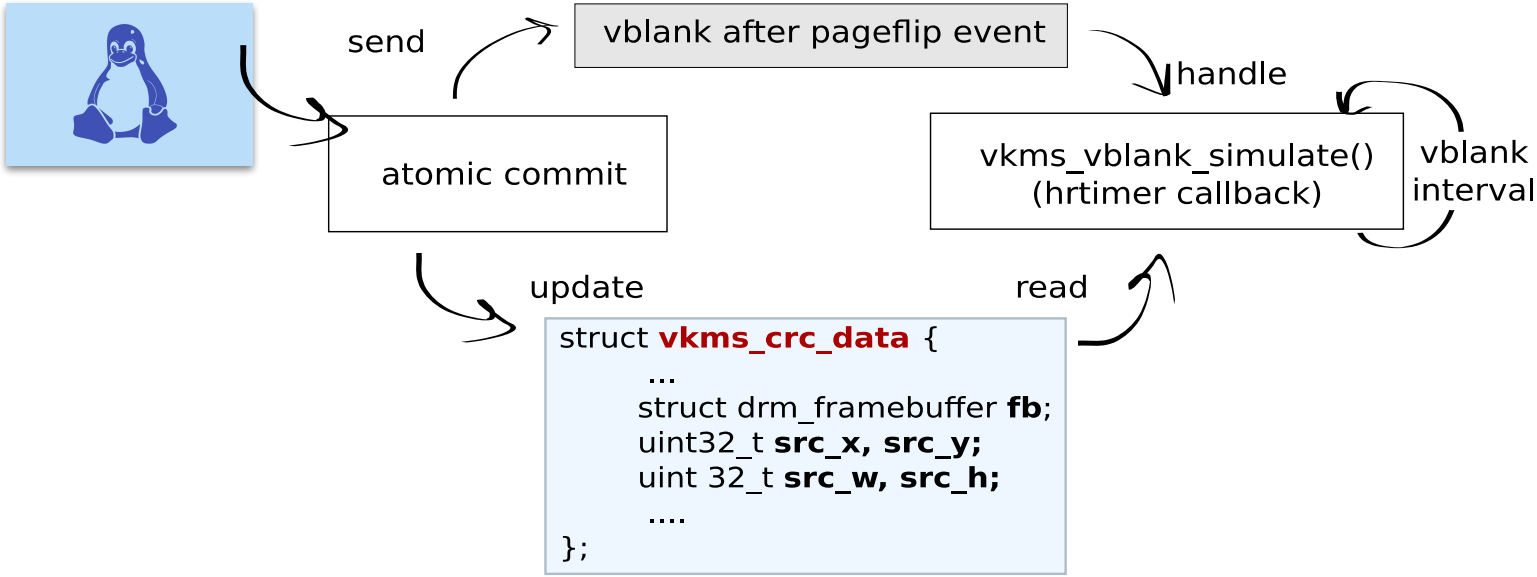
Computing CRC



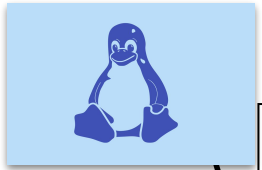

```
blend(primary, cursor);
for each pixel visible in screen {
        // DRM_FORMAT_XRGB8888
         pixel = clear_alpha_channel(pixel);
         crc = compute_crc(crc, pixel);
}
```

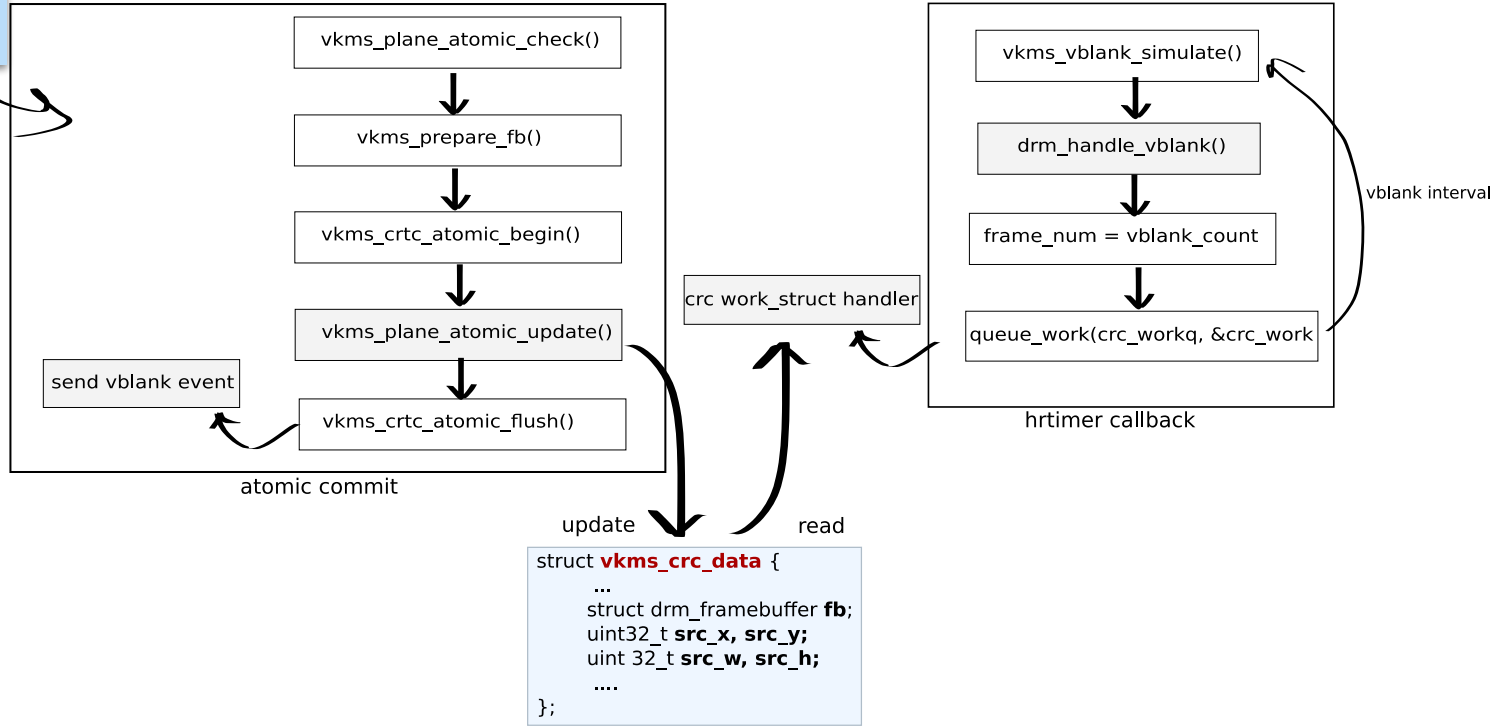
10000 Foot View

- How to synchronize framebuffer update with crc computations and flip event?

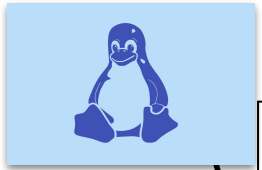


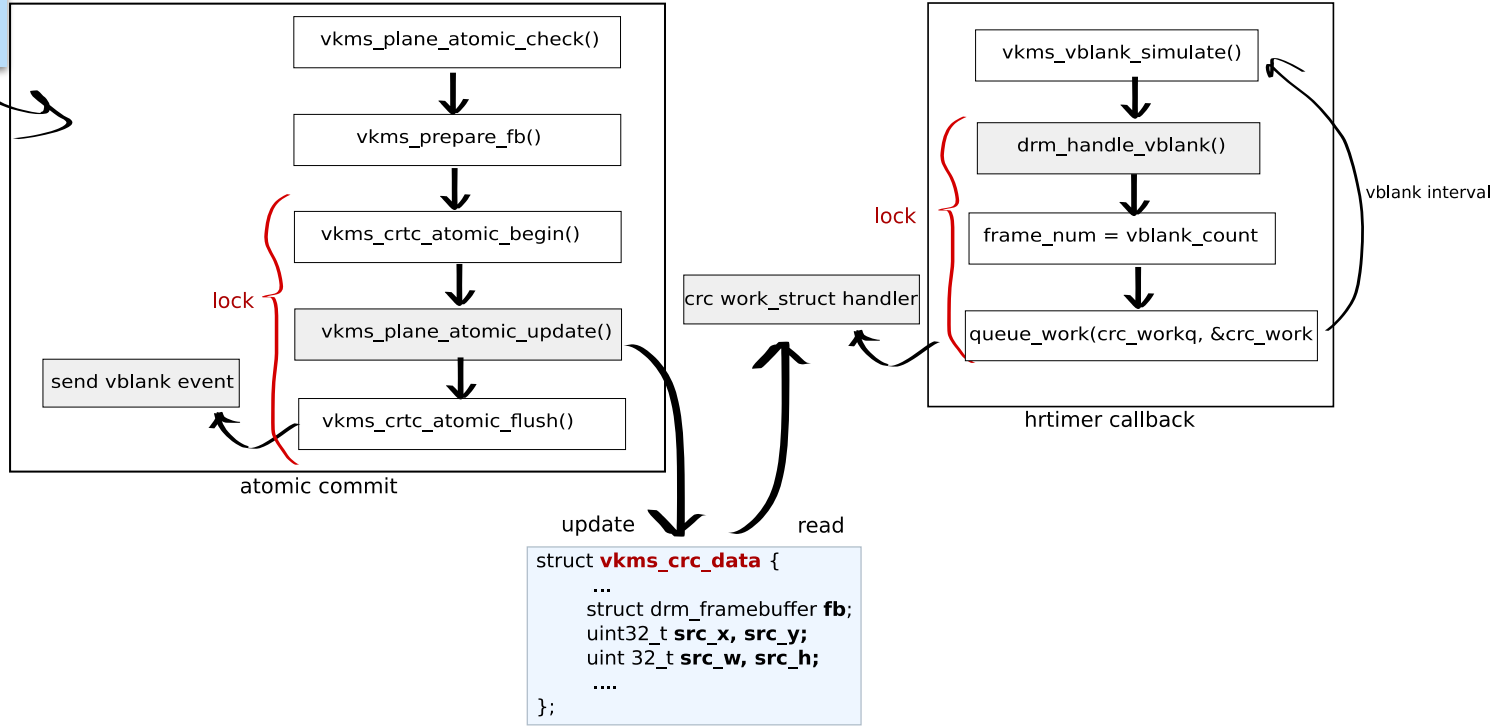
CRC API Support With VKMS (Challenges)





CRC API Support With VKMS (Solution)





CRC API Support With VKMS (results)

kms_pipe_crc_basic	kms_cursor_crc
1. bad-source 2. read-crc-pipe-A 3. read-crc-A-frame-sequence 4. nonblocking-crc-pipe-A 5. nonblocking-crc-pipe-A-frame-sequence	1. cursor-size-change 2. cursor-64x64-onscreen 3. cursor-64x64-offscreen 4. cursor-64x64-sliding 5. cursor-64x64-random 6. cursor-64x64-dpms

Conclusion and Future Works

VKMS is a working in progress project. We still have to improve:

- There are some tests related to kms_flip that fails
- There are some improvements to make at the CRC part
- Make Wayland run on top of VKMS
- Many other features

Future works:

- Probably I will get 5 extra months of work in VKMS

THANKS

Recab:

1. Development workflow
2. VBlank Support
3. CRC API Support

Questions?