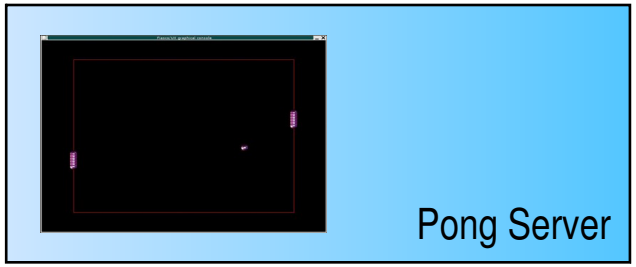
Complex Lab — Operating Systems

Graphical Console

2nd Assignment

- Any comments? Questions?

You are here



Paddle Client 1

Paddle Client 2

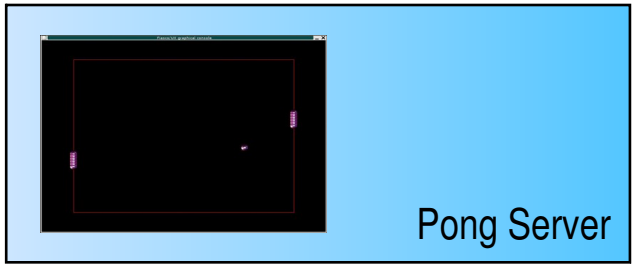
Memory Management

Moe

Sigma0

Fiasco Kernel

Today's Goal



Paddle Client 1

Paddle Client 2

Keyboard Driver

Console

Memory Management

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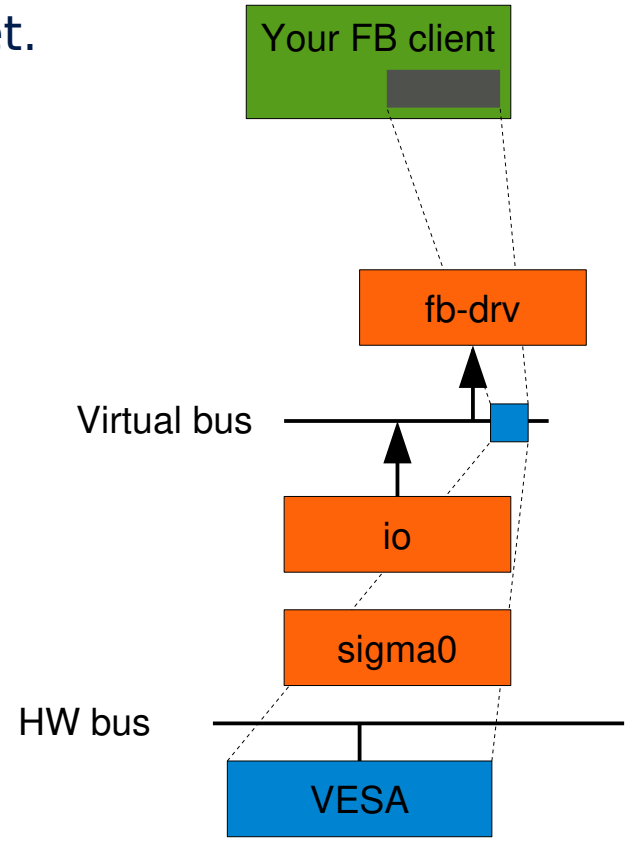
Graphics

- VESA – Video Electronics Standards Association
- Standard: XGA BIOS extension
  - Put computer into XGA mode
    - At bootup or at runtime
      - Requires execution of wicked real-mode code
      - GRUB: vbeset <mode>
      - L4 FB-DRV: command line option -m <mode>
    - Mode: 0x100 – 0x11F → see e.g., Wikipedia on “VESA BIOS extensions”
  - Get access to HW frame buffer
    - Physical address
    - Size and color info
  - Render graphics into frame buffer

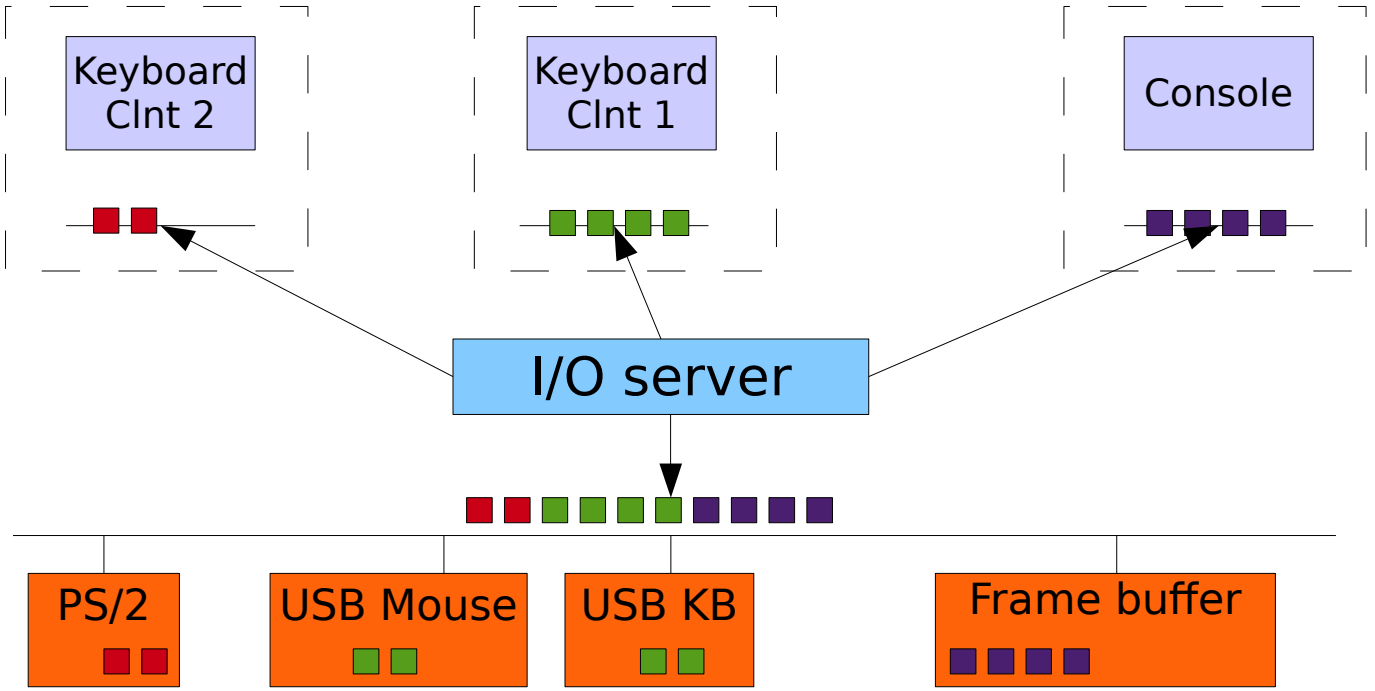
VESA on L4Re

- VESA belongs to legacy x86 device set.
- IO server manages all I/O resources.
- fb-drv server provides a frame buffer interface to its clients

- In your app:
  - Query “fb” to get an L4Re::Goos_fb
  - Get FB info and FB memory
  - Directly render into FB mem



Configuring IO services



Setting it up

- Package in SVN: fb-drv
- IO
  - IO service
  - Configured through IO config files passed on command line
  - You'll need two:
    - src/l4/conf/x86-legacy.devs → static configuration of some common x86 devices
    - src/l4/conf/examples/x86-fb.io → description of a “virtual” PCI bus containing the VGA device
- Fb-drv
  - Maps VESA fb to an L4Re::Util::Video::Goos_fb

Starting services from Lua init

```
require (“L4”);

local l = L4.default_loader;

fbdrv_vbus = l:new_channel(); -- for IO's virtual device bus
fbdrv_fb = l:new_channel();  -- for FB-DRV's server interface

l:start( { caps = { fbdrv = fbdrv_vbus:svr(),
                    icu = L4.Env.icu,
                    sigma0 = L4.cast(L4.Proto.Factory,
                                     L4.Env.sigma0):create(
                                        L4.Proto.Sigma0) },
           log = { “IO”, “y” }},
           “rom/io rom/x86-legacy.devs rom/x86-fb.io”);

l:start( { caps = { vbus=fbdrv_vbus, fb=fbdrv_fb:svr() }
           log = {“fbdrv”, “B” },
         “rom/fb-drv -m 0x117” );

l:start( {caps = {fb=fbdrv_fb}},
         “rom/your_fb_client” );
```

L4Re Framebuffers

- `l4/pkg/l4re/include/video/view/goos`
  `l4/pkg/l4re/util/include/video/goos_fb`
  - `Goos_fb(char const *name)` → setup a Goos frame buffer using a named FB capability (channel to fb-drv)
  - `Goos_fb::view_info()` → get FB info (`struct L4Re::Video::View::Info`)
  - `Goos_fb::attach_buffer()` → get FB data space attached to memory
  - `Goos_fb::refresh()` → as the name says
    - This is **not** necessary for a physical fb. Why?

Rendering Pixels

- Framebuffer base address:

```
base = fb->attach_buffer();
```

- Address of a pixel (x,y):

```
L4Re::Video::View::Info info;
int r = fb->view_info(&info);
if (r != 0) error(..);

addr = base
       + y * (bytes per line :=
                info.pixel_info.bytes_per_pixel
                  * fb_info.width)
       + x * info.pixel_info.bytes_per_pixel
```

Colors

- Setting a pixel:
  `*addr = <color>`
- Colors:
  - l4re/include/video/colors
  - Pixel (`Pixel_info`) := set of `Color_components`
  - Color_component:
    - Size in bits
    - Shift within containing type

Rendering text

- `l4/pkg/libgfxbitmap` – C library to render strings into a frame buffer
  - At startup: call `gfxbitmap_font_init();` once
  - Render string to framebuffer:
    ```
    gfxbitmap_font_text(void *fb_address,
                        l4re_fb_info_t *fbinfo,
                        gfxbitmap_font_t font,
                        const char *text, unsigned len,
                        unsigned x, unsigned y,
                        gfxbitmap_color_pix_t foreground,
                        gfxbitmap_color_pix_t background);
    ```
  - fb_address → the address the FB data space is mapped to
  - fbinfo → your `L4Re::Framebuffer::Info` struct, can just be cast
  - Colors are `unsigned int`
  - Rest clear?
- Useful enum values:
  `GFXBITMAP_DEFAULT_FONT, GFXBITMAP_USE_STRLEN`

Graphics

- For graphics, see your favorite Computer Graphics text book (or copy the relevant algorithms from Wikipedia...)
- There's a libpng port in our non-public SVN, contact me if you want access.
- All not necessary to solve the assignment.

Assignment: Graphical text console

- Make your echo server to render text into the physical framebuffer
  - Direct access for now, no need to have virtual screens
- Use libgfxbitmap for font rendering
- Keep track of where text is
  - Scrolling as in a terminal
  - History
    - We don't have input, so we can't scroll upward yet.
    - But we'll have input after the next assignment...

Next

- Next meeting: February 2nd 2016
- Keyboard device driver & Putting it all together