Complex Lab – Operating Systems

Graphical Console

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Last assignment

- Any questions?
- Any bug reports, whishes, etc.?

We are here

Paddle Client 1

Paddle Client 2

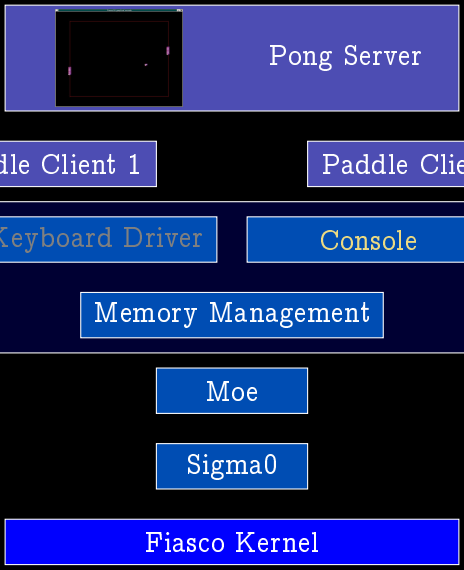
Memory Management

Moe

Sigma0

Fiasco Kernel

Today's goal

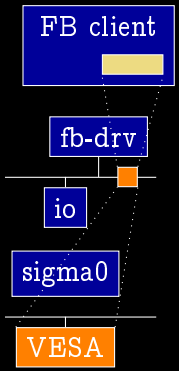

Pong Server
Paddle Client 1
Paddle Client 2
Keyboard Driver
Console
Memory Management
Moe
Sigma0
Fiasco Kernel

Graphics (VESA)

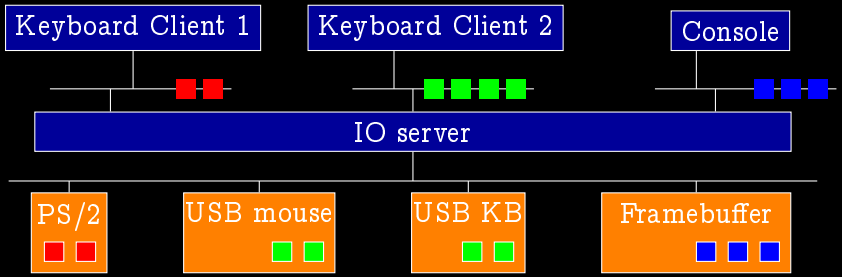
- Using VBE/XGA BIOS extension
- Put computer into XGA mode:
  - Requires evil real-mode code
  - L4 FBDRV: command line option -m <mode>
  - mode: 0x100 - 0x11F, see e.g. Wikipedia on VBE
- Get access to hardware frame buffer
- Render graphics into frame buffer

VESA on L4Re

- IO server manages all I/O resources
- fb-drv server provides a frame buffer interface.



IO configuration



IO Configuration files:

- Hardware description file (src/l4/pkg/io/io/config/x86-legacy.devs)
- vbus configuration file (x86-fb.io)

Lua example

```
local L4 = require("L4");
local ld = L4.default_loader;
local vbus = ld:new_channel();
local fbdrv = ld:new_channel();

ld:start({cap = {fbdrv = vbus:svr(), icu = L4.Env.icu,
            sigma0 = L4.cast(L4.Proto.Factory, L4.Env.sigma0)
               :create(L4.Proto.Sigma0)},
          log = {"IO", "yellow" }},
        "rom/io␣rom/x86-legacy.devs␣rom/x86-fb.io");

ld:start({caps = {vbus = vbus, fb=fbdrv:svr() },
          log = {"fbdrv", "red"}},
         "rom/fb-drv␣-m␣0x117");

ld:start({caps = {fb = fbdrv}},
         "rom/your_fb_client")
```

L4Re Framebuffer Interface

Headers are at

- `src/l4/pkg/l4re-core/l4re/include/video/goos`, and
- `src/l4/pkg/l4re-code/l4re/util/include/video/goos_fb`

Iterface to Goos_fb

- `Goos_fb(char const *name)` – Create FB using capability name (channel to fb-drv)
- `Goos_fb::view_info()` – FB information
- `Goos_fb::attach_buffer()` – Get FB data space
- `Goos_fb::refresh()` – refresh, not necessary for physical FB.

Example: Drawing Pixels

```
auto base = fb.attach_buffer();

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

auto addr = base + y * (info.pixel_info.bytes_per_pixel()
                        * info.width)
                 + x * info.pixel_info.bytes_per_pixel();

// details about color encoding in info.pixel_info
*static_cast<unsigned*>(addr) = value;
```

Rendering Text

Use C library: `libgfxbitmap`

- Initialize: `gfxbitmap_font_init();`
- Render text:

```
gfxbitmap_font_text
  (void *fb_base, l4re_video_view_info_t *fbinfo,
   gfxbitmap_font_t font, char const *text,
   unsigned len, unsigned x, unsigned y,
   gfxbitmap_color_pix_t foreground,
   gfxbitmap_color_pix_t background);
```

  - `fb_base` – base address of FB
  - `fbinfo` – L4Re::Framebuffer::Info struct, cast
  - Colors are `unsigned int`
  - Useful constants: `GFXBITMAP_DEFAULT_FONT`, `GFXBITMAP_USE_STRLEN`

Drawing graphics

- There is a libpng, contact me if you need/want it.
- Consult your favorite Computer Graphics reference for drawing algorithms.
- None of these is necessary for this assignment, as Pong can already draw itself.

Assignment: Graphical text console

- Make your echo server render text into the physical framebuffer (direct access for now)
- Scroll down when the screen is full, as in a terminal.
- When we are going to have input, you might want to scroll up, so keep history.