

# Arcan

Developer Introduction

# Outline

- **Prelude**

- building / setting up
- Lua cheat sheet

- **Appl**

- skeleton
- images / transformations /  
...
- resources
- advanced example(1)
- frameservers
- advanced example(2)

- **Postlude**

- information  
sources
- moving forward

# Building / Setting up

- **Basic Dependencies:** cmake > 2.8.12, clang > 3.1 or gcc > 4.6,  
[can be built static / internally] sqlite3, openal-soft, lua5.1+ or luajit-2.0
- **Conditional / Optional Dependencies** (*video platform*, *frameserver support*):
  - frameservers: [decode: libvlc], [encode: ffmpeg, opt:libvncserver, opt:tesseract]  
[remoting: libvncserver], [net: libapr]
- **Quick build:**
  - git clone <https://github.com/letoram/arcan.git>
    - optional (static build here):
      - cd arcan/external/git
      - bash clone.sh ; cd ../../..
  - cd arcan/src/ ; mkdir build ; cd build
  - cmake -DVIDEO\_PLATFORM="sdl" -DSTATIC\_SQLITE3=ON -  
DSTATIC\_FREETYPE=ON -DSTATIC\_OPENAL=ON -DENABLE\_LWA=ON ../src
  - make -j 12

# Building / Setting up <cont>

- `-DVIDEO_PLATFORM="sdl"`
  - Video platform is *crucial* - determines input model, graphics acceleration model (can be overridden with `DAGP_PLATFORM=[gl21,gles2,gles3,vulkan]`)
- there are others:
  - **egl-dri** (native linux etc. graphics using egl/kms/drm)
  - egl-nvidia (similar to egl-dri but for use with nvidia binary drivers)
  - egl-gles (low powered arm boards e.g. raspberry pi, set `AGP_PLATFORM` to gles2 as well)
  - x11, x11-headless (specialized legacy, don't use)
- Statically / **Tightly coupled** and tracked with arcan version due to the volatile/bug- prone downsides to dealing with graphics

# Lua Cheat Sheet

## Necessary

```
function myfun()
  note = 4; -- default scope is global
  print(_G["note"]); -- gives 4
  local note = 5;
  print(_G["note"]); -- gives 4 again!
  a = function(b)
    print(b, note); -- find note in outer
    return 1, 2; -- multiple returns
  end
  a(); -- gives nil, 5;
end

local a = {b = function(c,d)
  print(c,d); end };
a:b(1); -- will print ref. to a, 1

-- use pairs not ipairs for a["bah"]=1;
for i,v in ipairs({4,3,2,1}) do
  print(i,v); -- 1,4 then 2,3 etc.
end

print(type(1), type(1.0)); -- all nums
have same type
```

## Gotchas

```
a = {1,2,3,4};
print(a[0]) -- nil, 1-indexed!

print(#a); -- 4
a["test"] = true;
print(#a); -- 4

~= instead of !=
no += -= %= ++ -- etc.
no switch/case/continue

b = (a ? 1 : 2); -- doesn't work
b = a and 1 or 2; -- does work
```

# Appl

*“something more than an app but less than an application”*

- pronounced like **app-** with a **deep depressive sigh** added at the end, or like **app-** and then ‘**blowing raspberries**’
- execution model (think node.js): *asynchronous* (primarily), *event-driven*, *imperative*
- **pick** a name here (e.g. **myappl**): restrictions = (1\*[a-Z0-9] n\*[\_a-Z0-9] )
- **create** a matching folder, a **.lua** script and a **function + function\_prefix**:

myappl\

myappl.lua

**contains at least:**

```
function myappl(args)
end
```

*arcan ./myappl* or *arcan /path/to/myappl* or, if myappl exists in *ARCAN\_APPLBASE* namespace (don't worry about that now), just *arcan myappl*

# Skeleton

## **myappl.lua**

```
function myappl(argv)
  — prepare initial model
end
```

```
function myappl_clock_pulse(ts, nticks)
end
```

```
function myappl_input(iotbl)
  — react to input (lots of info in iotbl)
end
```

```
function myappl_shutdown()
  — store / save settings
end
```

1. engine sets things up, init.
2. loads / parses appl
3. injects api into lua- context
4. invokes main entry point
5. main engine loop {
  1. process event loop
  2. update render model
  3. preframe hook
  4. synch to output
  5. postframe hook
  6. if (~monotonic) time:  
clock\_pulse}

(advanced) entry points: `_preframe_pulse` `postframe_pulse` `display_event`

# Images, Transformations...

*“fade in a 64x64 px red square”*

```
function myappl()  
  local vid = color_surface(64, 64, 255, 0, 0); ← starts out hidden!  
  blend_image(vid, 1.0, 100, INTERP_SINE); ← reach 1.0 in 100 pulses  
end
```

*“load ‘logo.png’, scale to 64x64x px and move / pulse around the edges of the screen for infinity”*

```
function myappl()  
  local vid = load_image(“logo.png”, 64, 64);  
  if not valid_vid(vid) then return shutdown(“missing logo.png”); end  
  blend_image(vid, 1.0, 40);  
  blend_image(vid, 0.0, 40);  
  move_image(vid, VRESW - 64, 0, 20);  
  nudge_image(vid, 0, VRESH - 64, 40);  
  move_image(vid, VRESH - 64, 0, 80);  
  move_image(vid, 0, 0, 40);  
  image_transform_cycle(vid, true);  
end
```

*wait, ‘logo.png’ comes from where?*



# Resources

(simplified)

## Action

input\_function  
(system\_load, load\_image, ...)



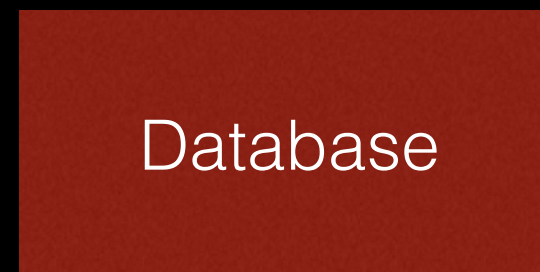
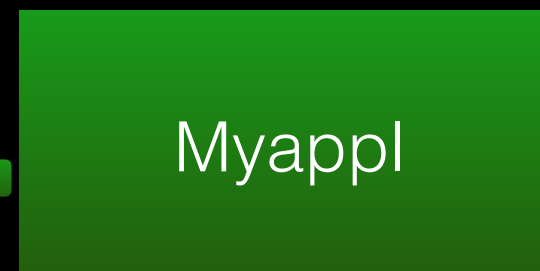
not found? fallback.



key/value  
store/load



## Datastore



## Properties

unique to each appl and is (default)  
read/write, but can be restricted to  
read-only

1. for appl- specific settings
2. read-only execution model for loading  
other programs (separate tool, arcan\_db  
to modify).

fonts, state snapshots, debug logs and other sensitive data  
all have separate namespaces that can be remapped before starting  
but defaults to being mapped to subpaths in resources)

# Input Example

click-drag square

```
function myappl()  
  system_load("mouse.lua")(); -- copy this one from data/resources/scripts)  
  red = color_surface(64, 64, 255, 0, 0);  
  green = fill_surface(8, 8, 0, 255, 0);  
  show_image({red, green});  
  mouse_setup(green, 2, 1, false);  
  mouse_addlistener({own = function() return true; end,  
    drag = function(ctx, vid, dx, dy)  
      nudge_image(vid, dx, dy);  
    end}, {"drag"}  
  );  
end  
  
function myappl_input(iotbl) -- iotbl is complex, covers lots of cases  
  if (iotbl.mouse) then  
    if (iotbl.digital) then  
      mouse_button_input(iotbl.subid, iotbl.active);  
    else  
      mouse_input(  
        iotbl.subid == 1 and 0 or iotbl.samples[1],  
        iotbl.subid == 1 and iotbl.samples[2] or 0);  
    end  
  end  
end  
end
```

# Frameservers

- Semi-trusted **separate processes** managed through related functions (**launch\_avfeed**, **launch\_target**, **target\_\*** ...)
- Also used for **controlling external connections** (next example)
- Build-time probed configuration of available **archetypes** (terminal, game, avfeed, decode, encode, removing, ...), see design slideset
  - relates to **event handling**, **sandboxing profile**, **firewall rules** etc.
  - available ones are shown in the global **FRAMESERVER\_MODES**
- Can be **replaced** with **custom set** of **other implementations**: **in-house** / **custom** / even proprietary
  - **default** ones are 'simple references'

# Advanced Example (1)

(allow **one** active **external connection** *once*)

```
function myappl()
    ext = target_alloc("example", external_event);
    show_image(ext);
end

function external_event(source, status)
    if (status.kind == "resized") then
        resize_image(source, status.width, status.height);
    elseif (status.kind == "terminated") then
        delete_image(source);
        ext = target_alloc("example", external_event);
        show_image(ext);
    end
end

function myappl_input(iotbl)
    if (valid_vid(ext, TYPE_FRAMESEVER)) then
        target_input(ext, iotbl);
    end
end
```

1. set up an external listening connection

2. synch video object with the size of the connected client

3. forward all input to any connection (if alive)

to test: arcan ./myappl &  
ARCAN\_CONNPATH="example" afsrv\_terminal

# Advanced Example (2)

(offscreen render video input)

```
function myappl()  
  if not string.find(FRAMESERVER_MODES, "decode") then  
    return shutdown("built without decode support", EXIT_FAILURE);  
  end  
  ext = launch_decode("test.avi", function(source, status)  
    -- don't care  
  end );  
  if not valid_vid(ext) then  
    return shutdown("missing test.avi", EXIT_FAILURE);  
  end  
  square = color_surface(64, 64, 0, 255, 0);  
  rotate_image(square, 45);  
  show_image({ext, square});  
  buf = alloc_surface(VRESW, VRESH);  
  define_rendertarget(buf, {ext, square}, RENDERTARGET_DETACH);  
  blend_image(buf, 1.0, 50);  
  blend_image(buf, 0.0, 50);  
  image_transform_cycle(buf, true);  
end
```

(and a pulsating square even if decoder or video is broken)

# Information Sources

- **Doc/ folder**

- All exposed Lua API functions have a corresponding file in doc/\*.lua
- These can be converted to man-pages (cd doc; ruby docgen.rb mangel; will fill doc/mantmp)
  - Installed with normal: make install from build dir to man- accessible destinations ( man 3 load\_image), though might not want installed for namespace- pollution reasons

- **Wiki sources** (<https://github.com/letoram/arcan/wiki>)

- Overview of functions, terminology, detailed design descriptions, ...

- **arcan -g -g** <- increase debug level to get more verbose execution output

- if respath (e.g. arcan -p res) has a subdirectory 'logs', it will be populated with both \_warning.txt, \_error.txt, crash states and frame server log output.
- `system_snapshot("dstfile.lua");` <— explicitly generate a snapshot of existing data-model, helpful to understand internal representation

# Doc example

```
-- load_image
-- @short: synchronous load supported image
-- @inargs: resource, *startzv*, *desw*, *desh*
-- @outargs: VID, fail:BADID
-- @longdescr: lots of text goes here
-- @note: use- comments, special cases etc.
-- @group: image
-- @cfunction: loadimage ( see engine/arcan_lua.c )
-- @related: load_image_asynch
```

```
function main()
```

```
#ifdef MAIN
```

```
    vid = load_image("demoimg.png");
```

```
    show_image(vid);
```

```
#endif
```

```
-- C preprocessor (cpp) used to generate good and bad examples for
```

```
-- automated testing and for manpages
```

```
#ifdef ERROR
```

```
    vid = load_image();
```

```
#endif
```

```
end
```

# Moving Forward

- IRC, [#arcan](#) on freenode ([chat.freenode.net](http://chat.freenode.net))
- Exercises on wiki ([github.com/letoram/arcan/wiki/Exercises](https://github.com/letoram/arcan/wiki/Exercises))
  - Solutions appear in tests/exercises
- Design Slides @ <https://speakerdeck.com/letoram/arcan-design>