Arcan

Free (BSDv3+a little GPLv2)
portable, scriptable

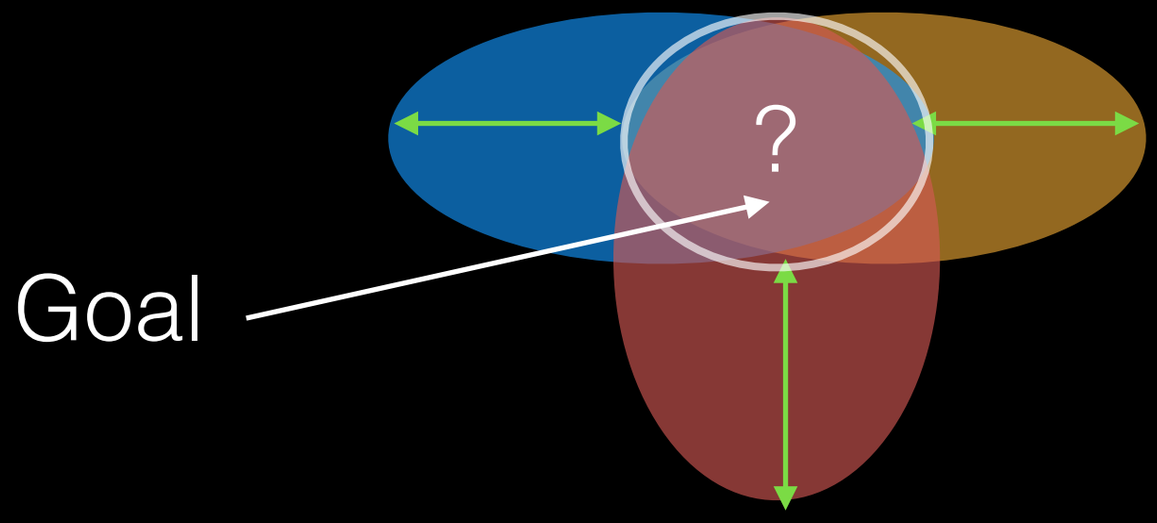
{ display “server”
game engine
realtime multimedia framework }

Forms of Contact ordered by estimated success-rate (high -> low)

Github	github.com/letoram/arcan
IRC	#arcan @ irc.freenode.net
Twitter	@arcan_fe
Web	arcan-fe.com
E-Mail	contact@arcan-fe.com

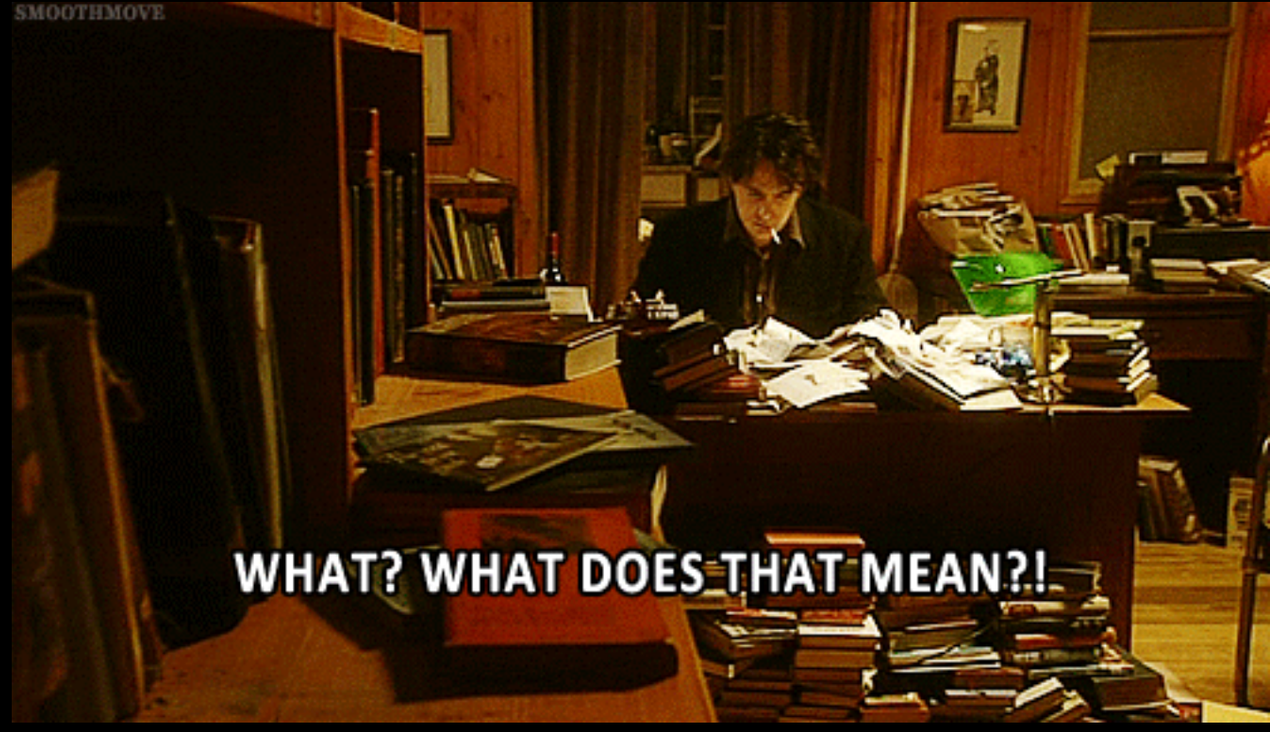
Idea

* Look for a useful intersection between *typically* distinct (display server, game engine, streaming multimedia processing / low- mid- level graphics)
* Make the ‘last mile’ scriptable
* Emphasize minimalism and portability



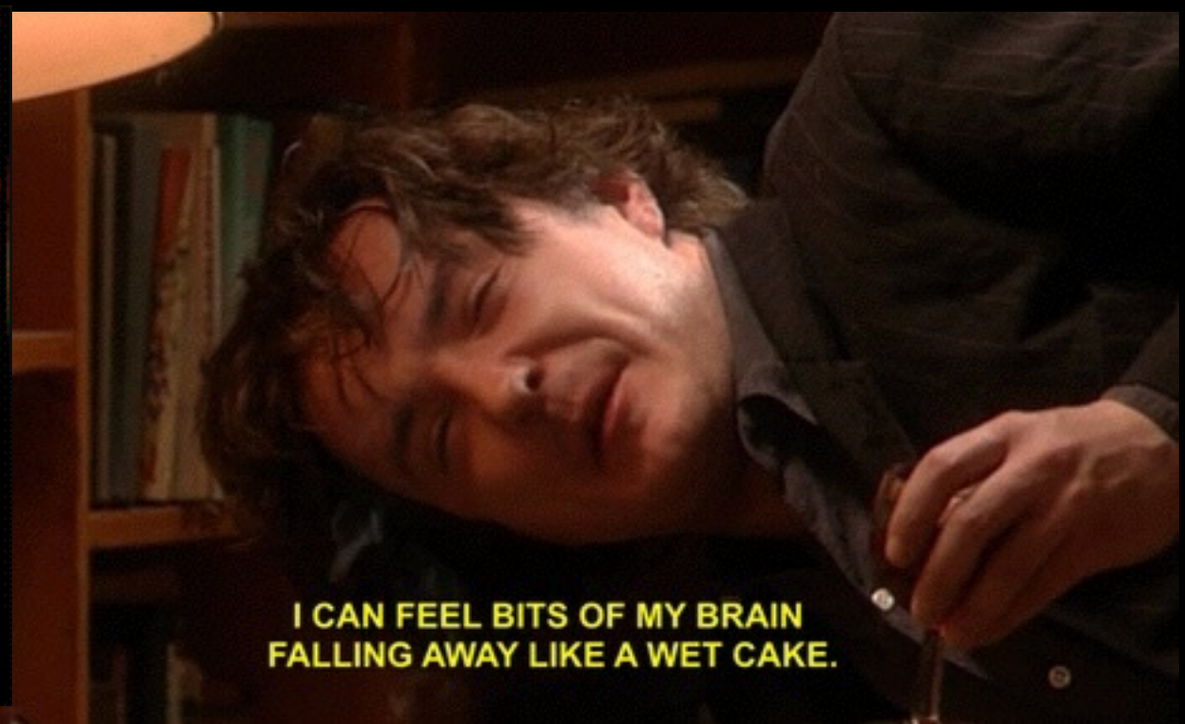
“Special” Challenges

* **Display Server** (X.org, DWM, Quartz, SurfaceFlinger)
  * Privileged (it’s not just about *root*)
  * External producers & consumers (bad mix with privileged)
  * Low level device integration (Monitors, Keyboards, ...)
  * Power Management
* **Game engine**
  * Complex input models
  * Adaptive soft realtime (Quality of Experience)
  * High variability in GPUs (and their drivers and APIs)
* **Multimedia processing**
  * Assymetric Loads
  * Complex / Insane Data Formats
  * Timing sensitive, stream de-multiplexation
  * Heavy / unsaitisfiable buffering requirements



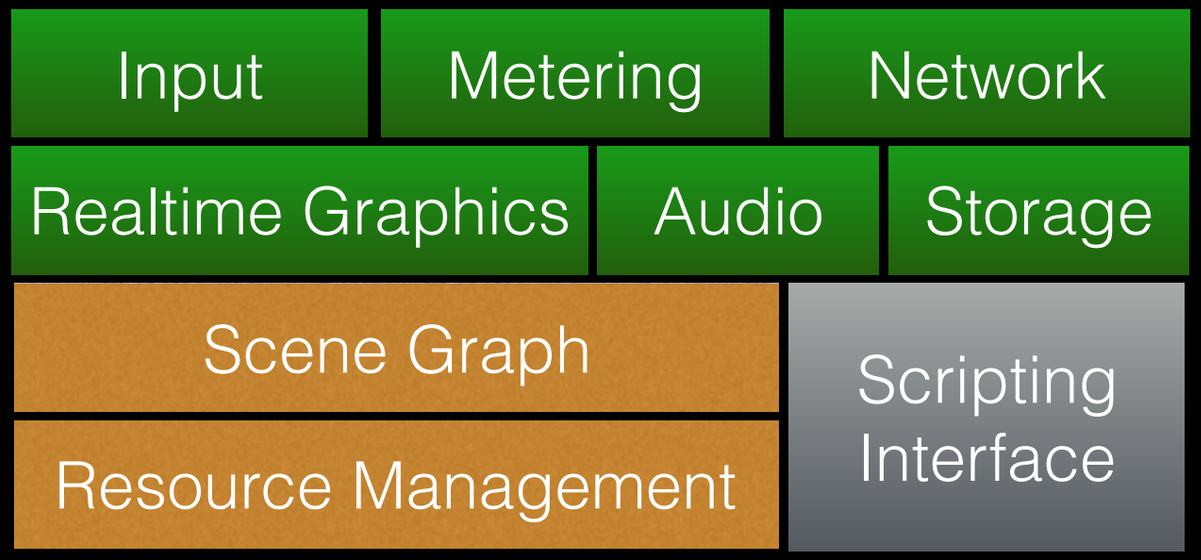
Fast Forward A Few Thousand Hours

(and a terrifying amount of wine and coffee)

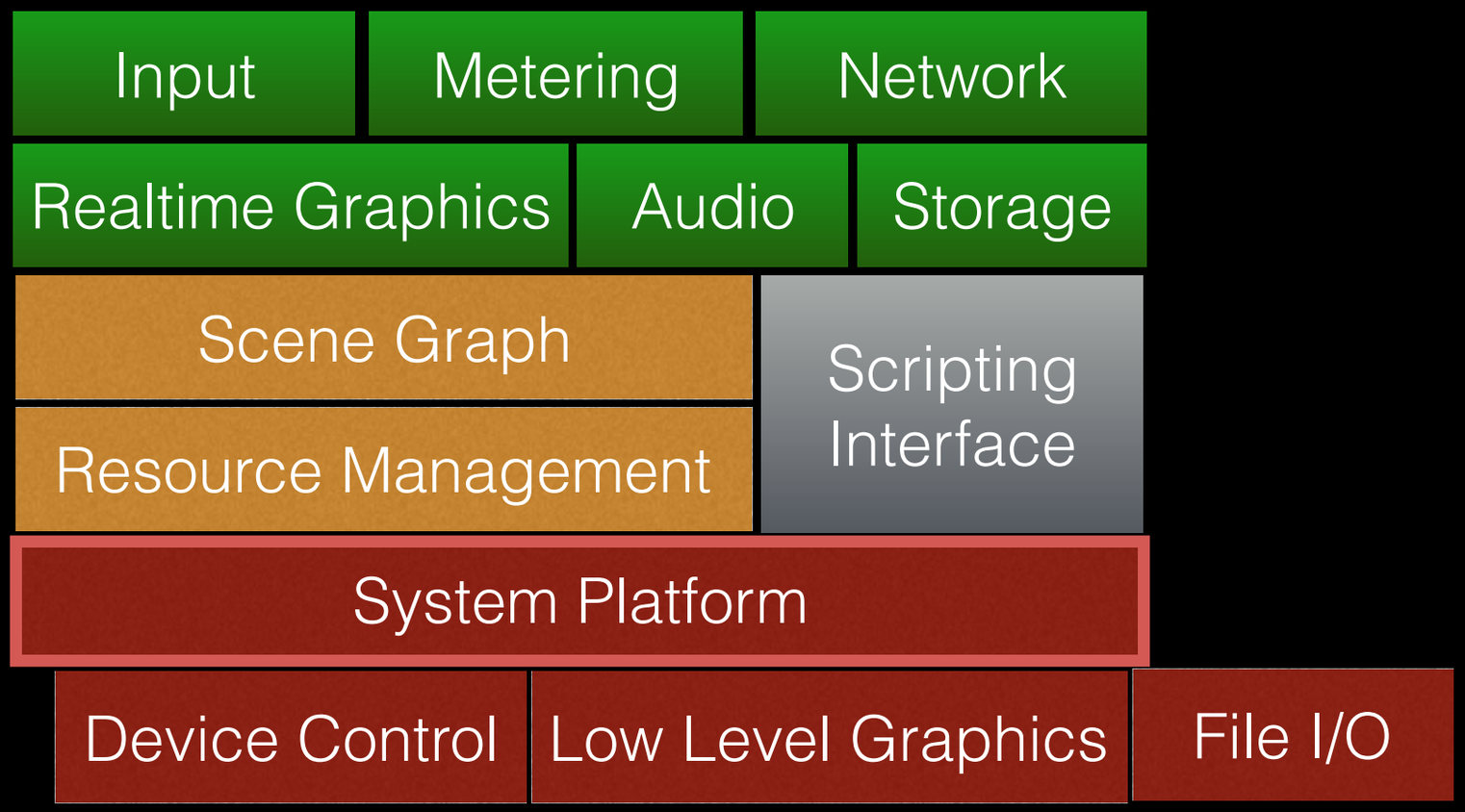


Recipe

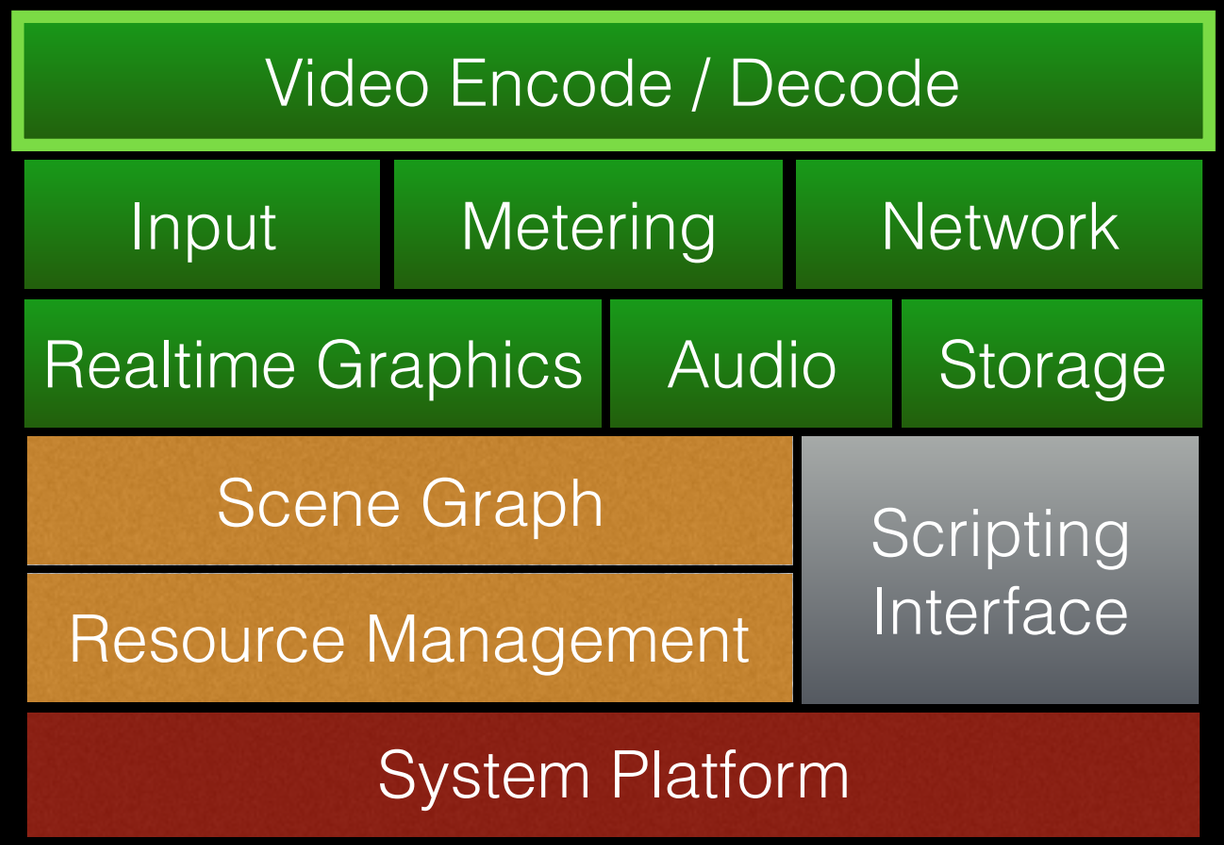
1. Take a game-engine



Recipe
2. Make it **Portable**

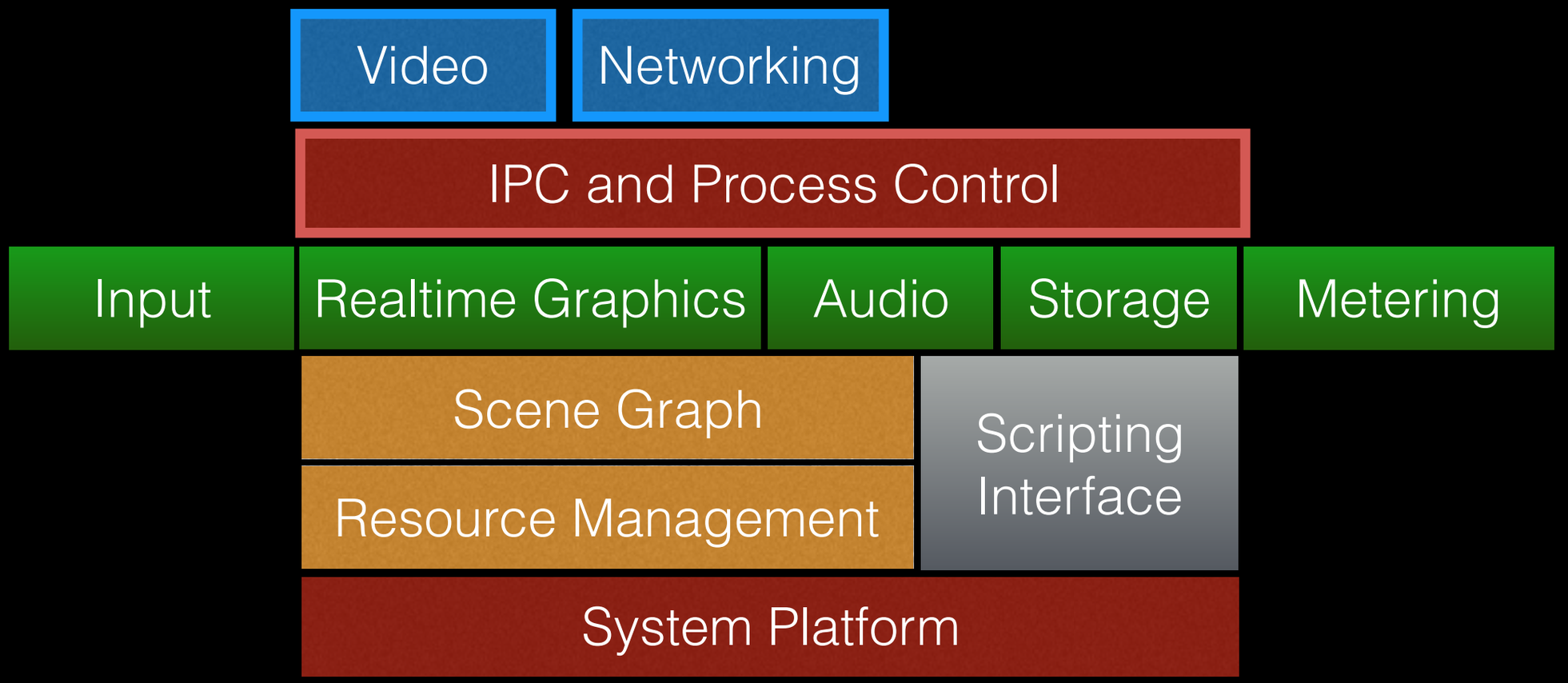


Recipe
3. Add **Streaming Media** Support



Recipe

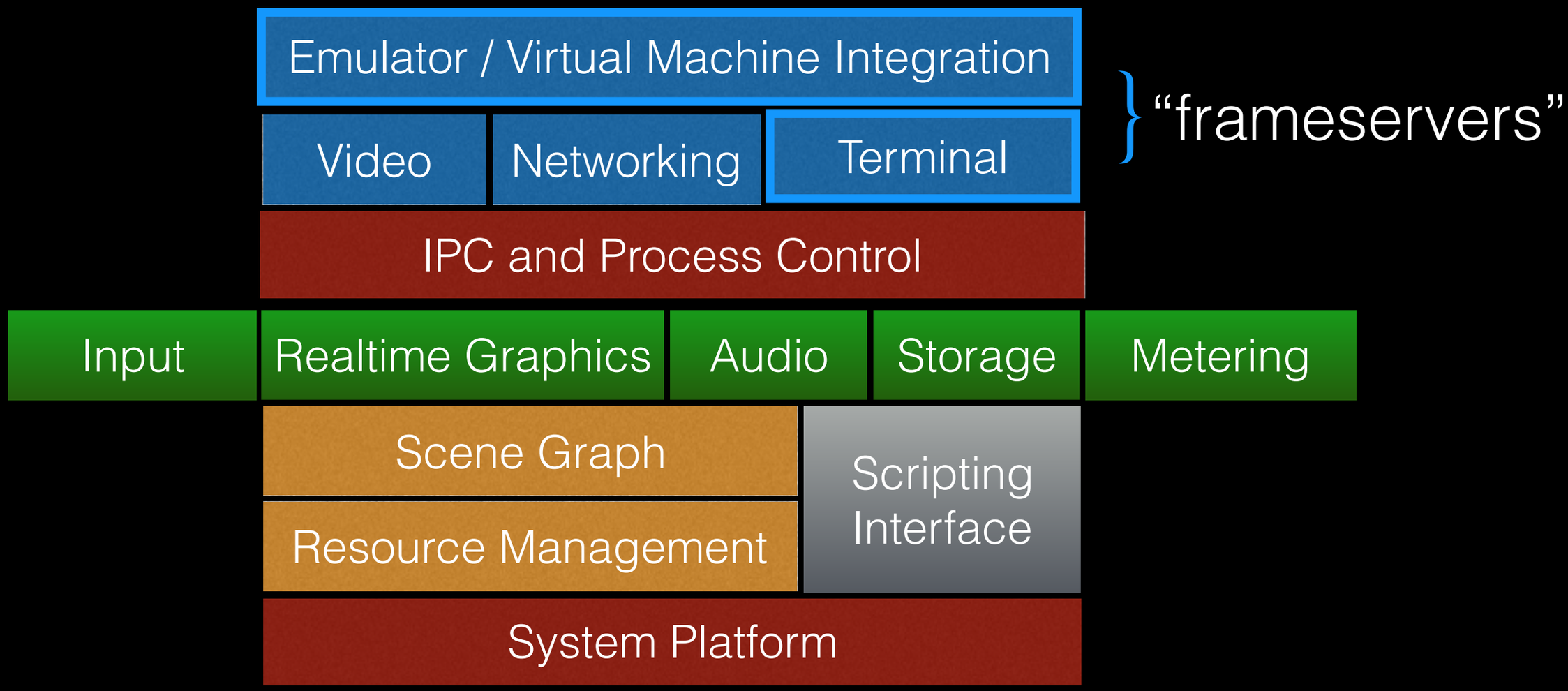
4. Add **Process Separation** (for resilience)



Recipe

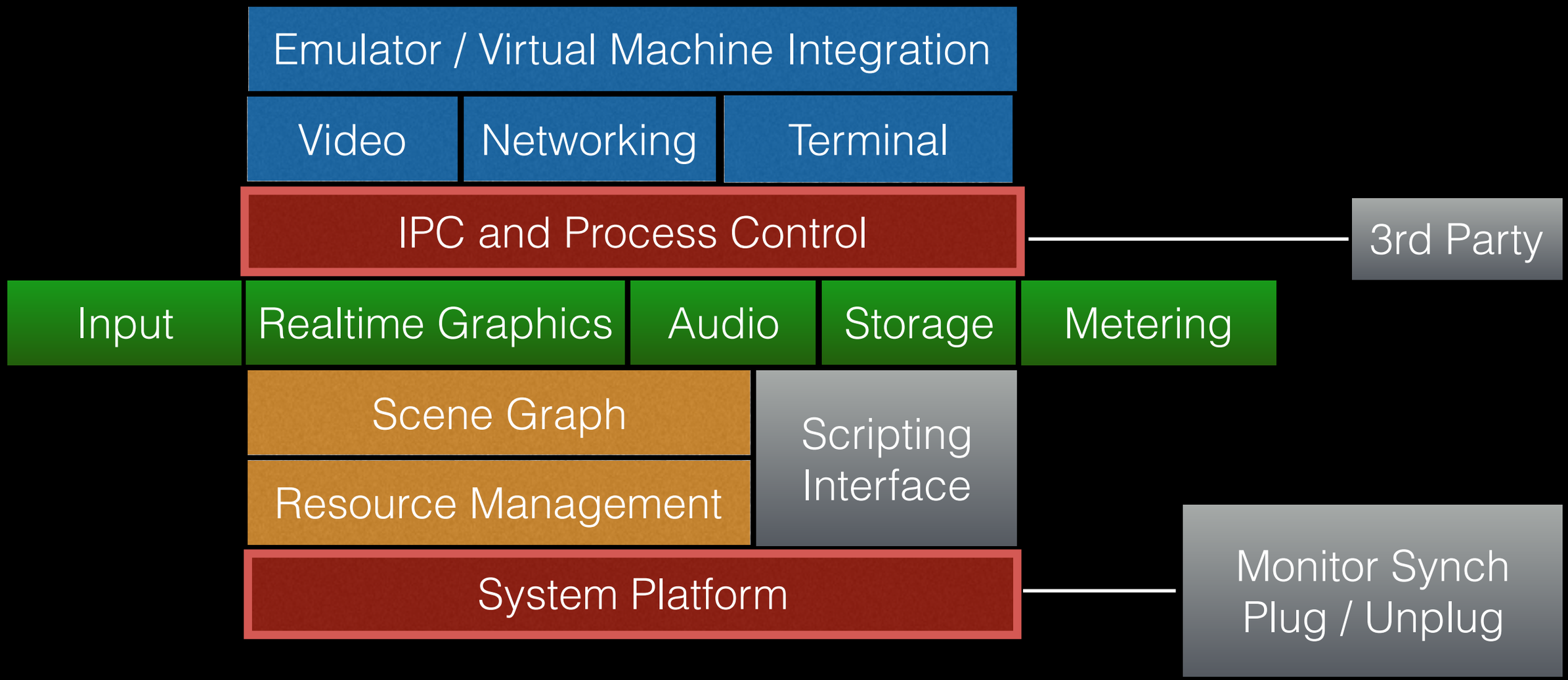
5. Expand Feature Set

[indirectly improve and harden IPC and related API]

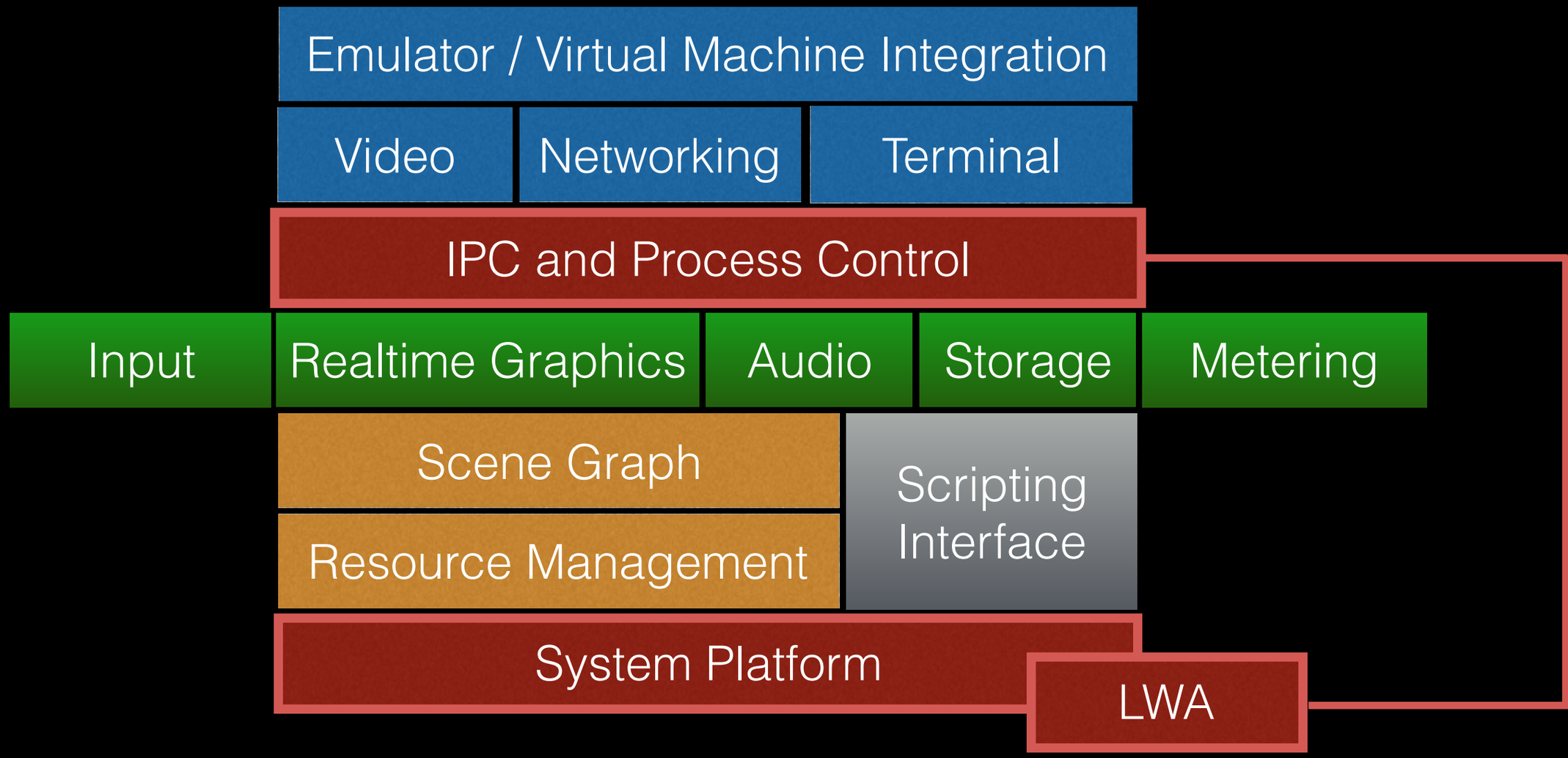


Recipe

6. Display Control + External Connections



Recipe
7. Allow nesting, chaining

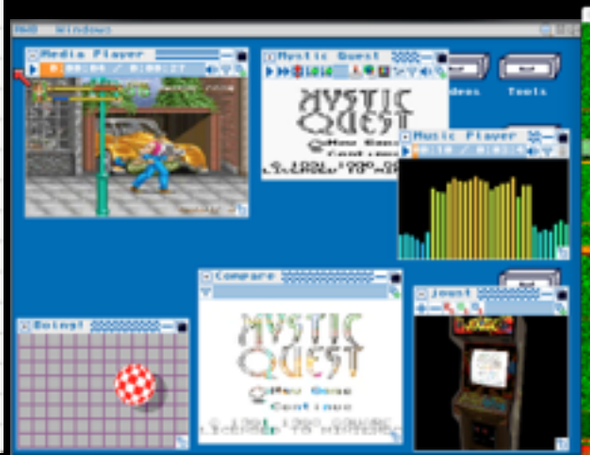
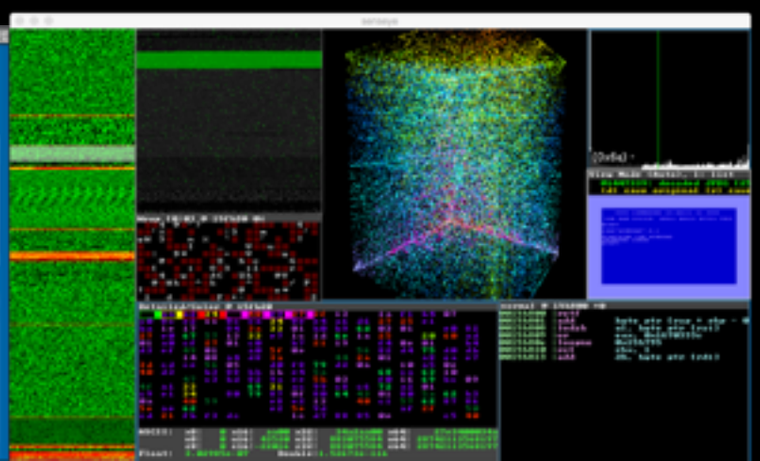
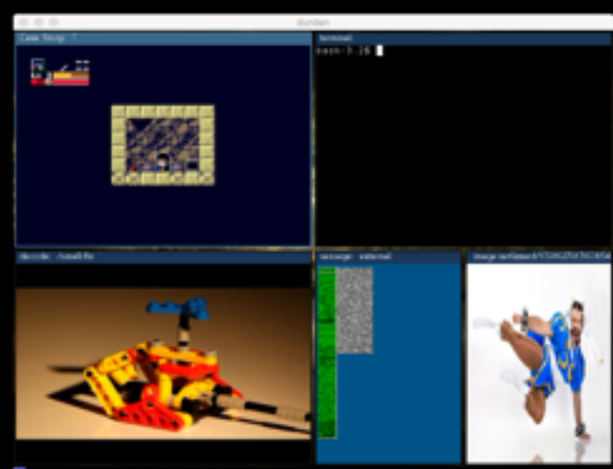


"Lightweight Arcan"
- build where A/V/I platform outputs to IPC interface

Meanwhile…

* Iteratively develop proof-of-concepts
  * to (de,re)fine scripting interface
  * establish support- scripts, code patterns
  * locate, evaluate and improve design rough spots

PoC Name:	Role:	Status:
Gridle	*Home-theater / Graphical FE*	Abandoned
AWB	*Classic “Fun” Desktop Interface*	
Senseye	*Debugging / Reversing tool*	Supported
Durden	*Desktop Environment*	

Arcan<Gridle>

~2011

HTPC- like interface

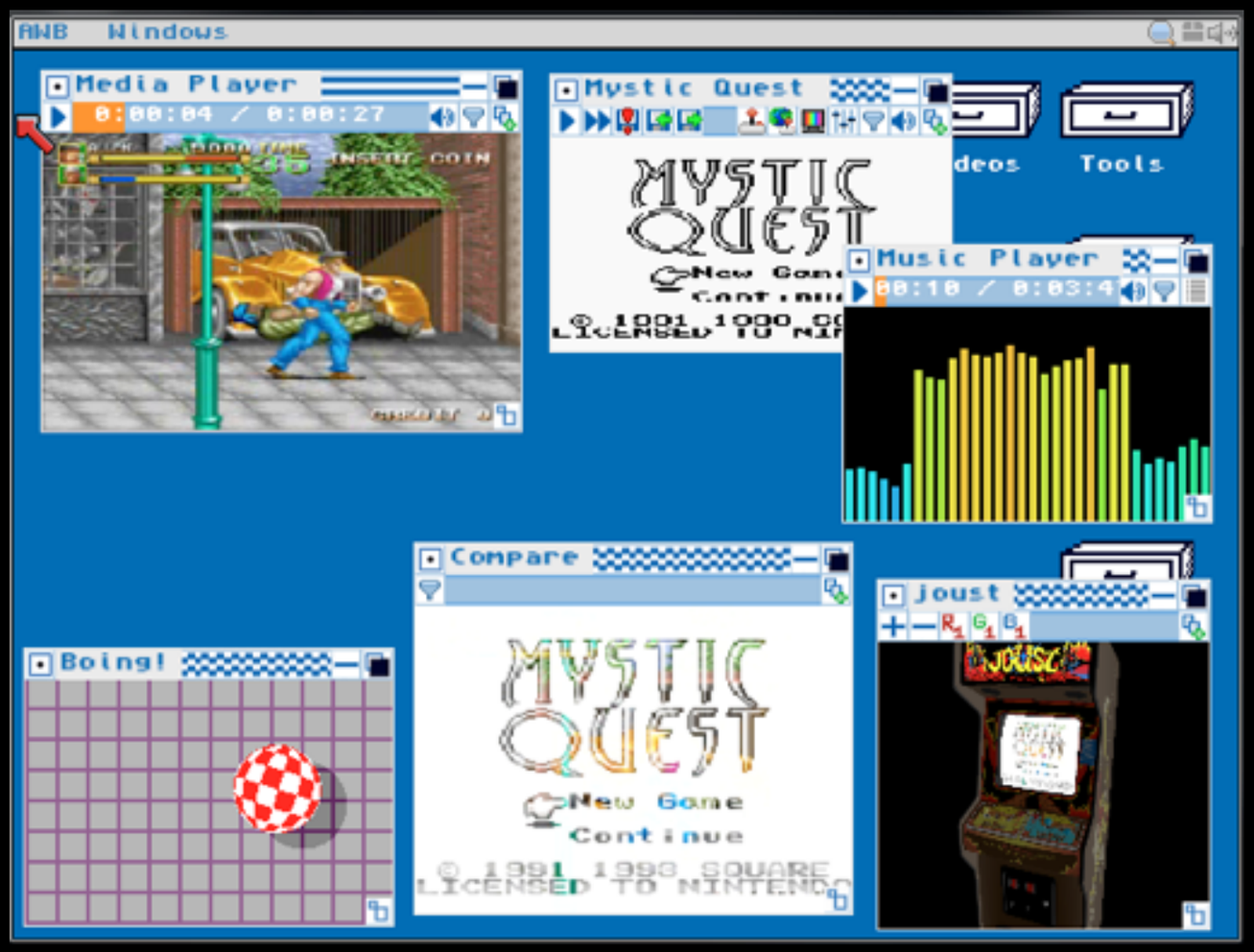
Improved:

- Input Model (support custom usb gamepads, multiple keyboards)
- Tons of asynchronous- related bugs squashed (background tiles are all videos from separate processes)
- State Management (suspend/ resume/serialize external processes, minimizing resource footprint)
- Helped Define the graphics API that was needed for the advanced effects (simulating damaged CRTs, ..)

Arcan<AWB>

~2013

Inspired by some desktop from a more *civilized* age



Improved:

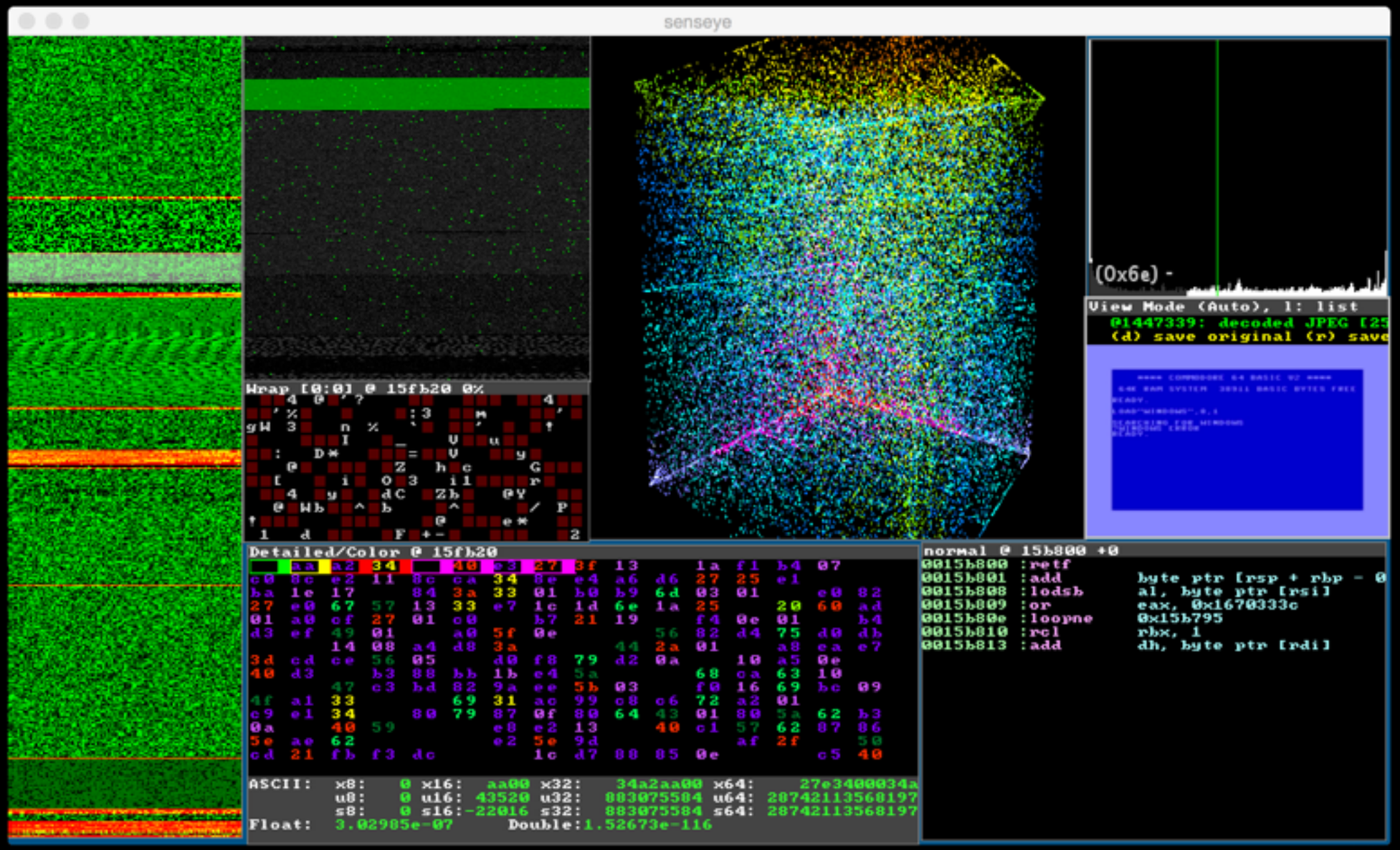
- Performance / caching for complex hierarchies
- Analog device management
- Synchronization between multiple producers/ consumers
- Mouse gesture scripts
- API simplification
- A/V mixing when recording/ streaming/sharing

Demo Video @: https://www.youtube.com/watch?v=3O40cPUqLbU

Arcan<Senseye>

~2015

Intersection between rev.eng, data-vis, debugging, forensics …



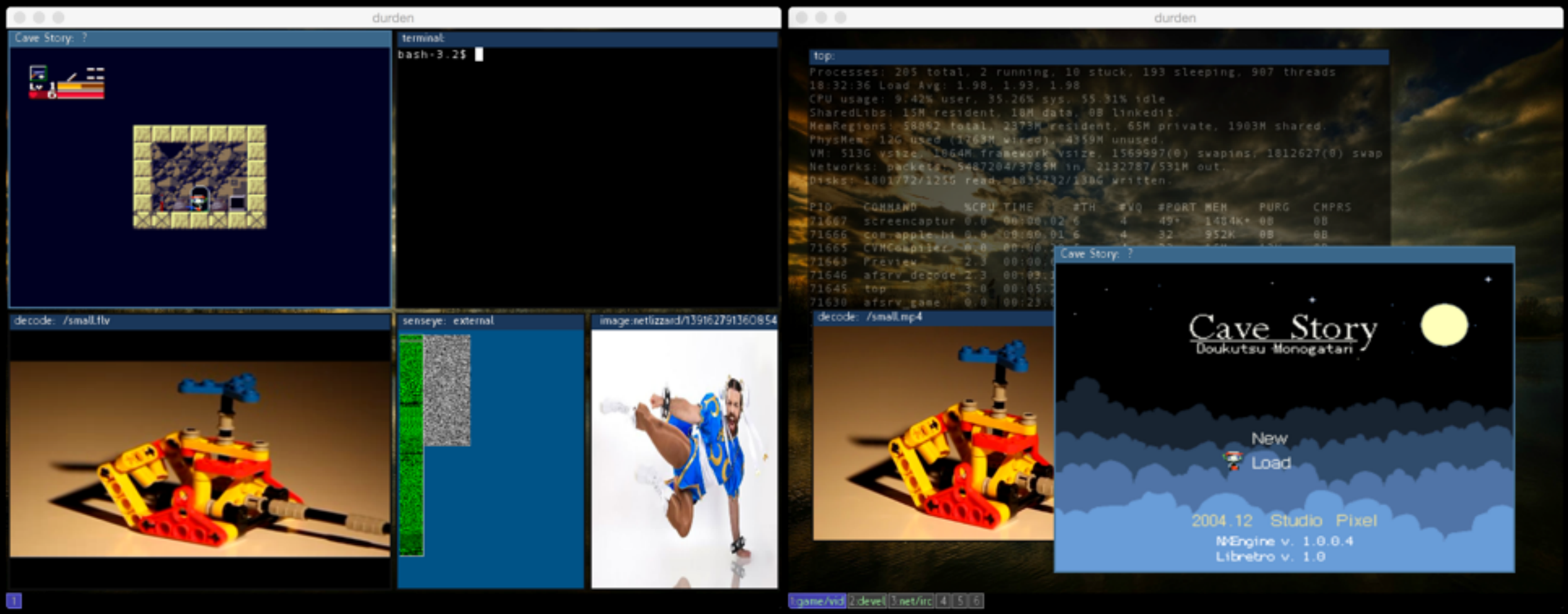
Presentation: https://speakerdeck.com/letoram/senseye

Details: https://github.com/letoram/senseye/wiki

Arcan<Durden>

~2015

(*primarily*) tiling++/keyboard driven desktop environment



Presentation: https://speakerdeck.com/letoram/durden

Features (rough overview)

Basic Graphics
- Rotate/Blend/Scale
- Animations
- Hierarchical Relations
- Clipping
- 3D Models & basic geometry
- Picking, Measuring
- Image Loading / Saving
- Draw Order Control
- Filtering / Blending Controls

Moderately Advanced Graphics
- Shaders + Uniform Mgmt
- Offscreen Rendering
- Streaming transfers
- Recording
- Allocation Contexts
- Custom Resampling
- Transform Scheduling

Audio
- Streaming Sources
- Sample Playback
- Gain Control
- Input Mixing

Process Control
- State transfers
- Life tracking
- Configuration
- Launching

Database
- Key / Value
- Execution Model

Display Management
- Hotplug
- Resolution Switching
- Mapping Output
- Synchronization

Device Control
- Keyboards, Gamepads, Mice, Touch
- Configurable Filtering
- LEDs

Media Control
- Video Playback
- Video Recording
- Webcams, Streams, …

Networking (*experimental*)
- Client / Server
- Local Discovery
- Simple Messaging
- Block Transfer
- Streaming

Hopes & Ambition

or “what would this (ideally) be used for/bring”

- Key Component for “different” Desktop Environments:
  - Customizing support for Specific / Complex Disabilities
  - Losely coupled support scripts, pick and place / share
  - Virtual Reality (useful ones, not *just* ‘lets make it 3D’)
  - Increasing public interest for graphics on (*BSDs* & Linux)
  - Enabling the Security Paranoid *e.g.alpine-linux (good: grsec, musl-libc, minimal), direct boot to signed/static arcan on ro- base-system, dev whitelist, that’s how I use it...)*

- Embedded And Specialized Graphics Applications:
  - Lightweight Computer Vision
  - UI for low-end (raspberry pi-level) electronics projects
  - Research Targets e.g. Secure UI design - data sharing in sandboxed environments, Data Visualization, Monitoring Systems, Debugging)

Status / Roadmap

(past releases, roadmap @ github.com/letoram/arcan/wiki)

(2012) emulators via “libretro” (see libretro.com)

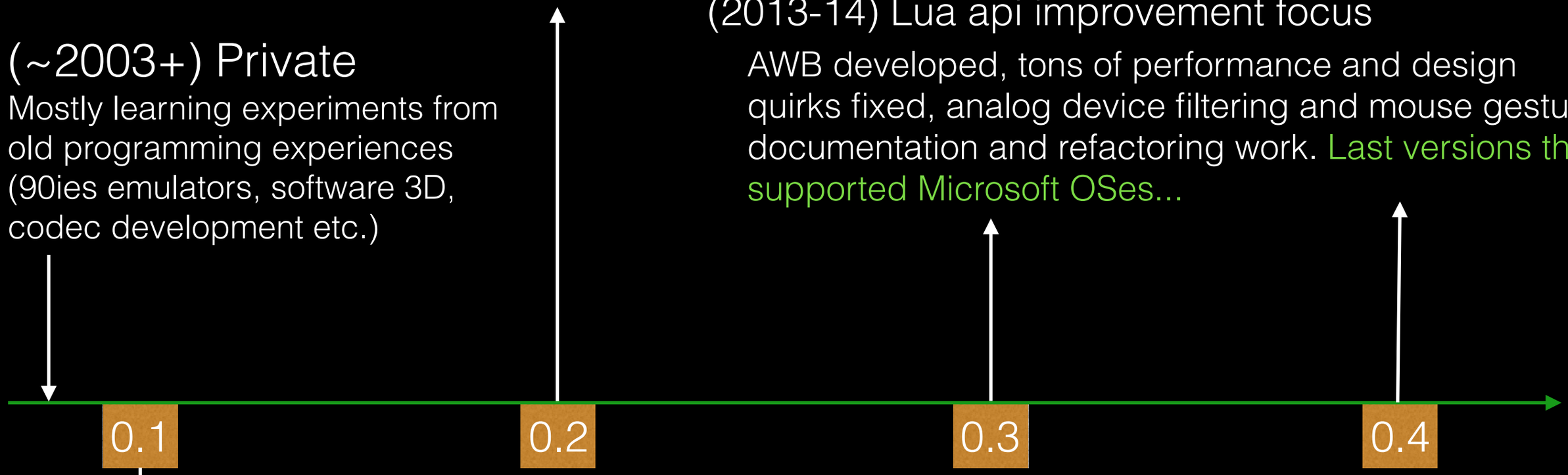
used as testing model for performance, latency, audio, I/O
video encoding (offscreen gpu + readback over IPC)

(2013-14) Lua api improvement focus

AWB developed, tons of performance and design quirks fixed, analog device filtering and mouse gestures documentation and refactoring work. Last versions that supported Microsoft OSes...

(~2003+) Private

Mostly learning experiments from old programming experiences (90ies emulators, software 3D, codec development etc.)



(2011) “Public” Release

First refactor into ‘not entirely embarrassing’ state
API feature set @ gridle level
no 'real' dissemination: upload to sforge
preload- hacks on SDL1.2 for games + video decode

Status / Roadmap

(current + future releases, roadmap @ github.com/letoram/arcan/wiki)

(2016 - may) current release

* Nested (arcan_lwa connecting to arcan disp. server)
* Remoting, (VNC client + server)
* Heavy refactoring (db/namespace/platforms)
* tons of doc / Q&A work
* non-auth connections
* much improved egl/dri/kms (multimonitor, …)

(q2-q3 2016)

* Qemu (soon, Bhyve?) integration
* Shmif- improvements (proxy, monitor, debug)
* New backends: Vulkan

(q2 2017)

"feature complete"

* Audio rework / improvements
* HMD integration /support scripts
* 3D pipeline improvements
* Wayland Client / Server

(q1 2018)

"secure"

* memory allocations type-pooled
* image/font parsers sandboxed
* reproducible builds
* lib-ify engine components
* fuzzers and models for all privsep interfaces
* critical path CFG enforcement

0.5 — 0.5.1 — 0.6 — 0.7 — 0.8 — 0.9

Durden 0.1

Senseye 0.1 - 0.3

(q4 2016)

* Finish Networking Support
* Package Format / Loader
* FUSE- based i/o intercept
* Seccmp, CloudABI, Capsicum …

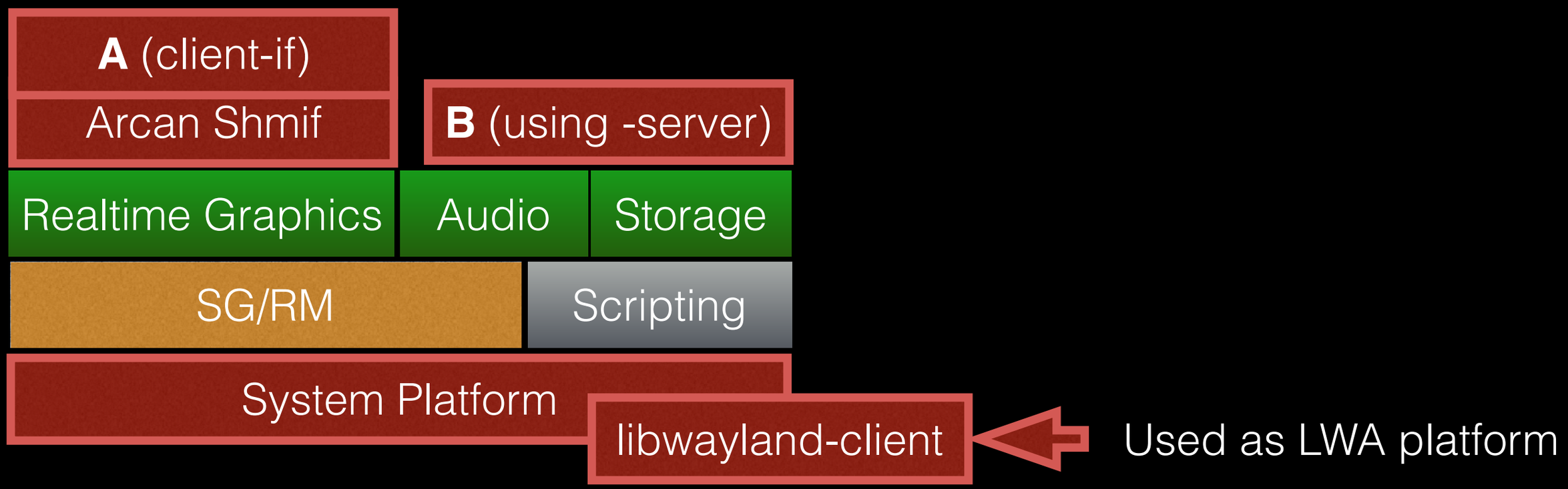
(q3 2017)

"optimal"

* all testing automated
* profile- based optimization builds
* heavy functions all vectorized
* structures reordered and compacted for cache

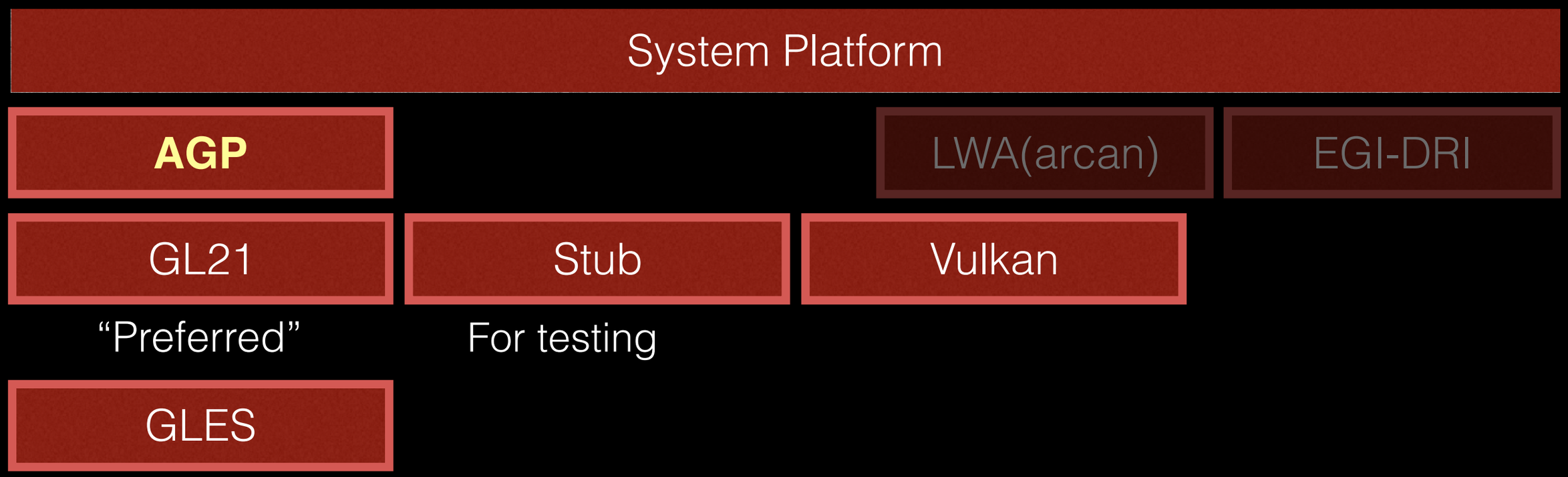
Obvious Questions #1 - Wayland

- Support ***Planned***, lack of resources / time / motivation / ... / - contributors welcome :-)
  - Tight QEmu/KVM integration higher priority as means for legacy X/etc. support
- Heavy lifting (API model, input device management, EGL/KMS/DRI) done
- Arcan internal IPC (Shmif), feature superset - same internal code-paths can be used
  - Either by adding support for an optional libarcan_shmif build path that enabled libwayland-client needed- entry points (**A**) and have clients dynamic link to that *or* mapping engine features to libwayland-server ("proper" but interface- design mix very poorly with engine codebase)



Obvious Questions #2 - Vulkan

- Planned for arcan- side support in next release
- Used graphics operations already abstracted as part of AGP platform layer
  - With GL21, GLES2, GLES3 backends
- Vulkan benefits will primarily be in GPU<->CPU transfer coordination and storage management, where current GL cost is bad/broken to “insane” but still(?) missing things for ideal conditions (MAP_SHARED)



“Works” *as long as decent FBO/PBO isn’t needed, full feature-set not available*

Other References

Slides

Online:

Design: https://speakerdeck.com/letoram/arcan-design
Devel-intro: https://speakerdeck.com/letoram/arcan-appl

or offline in the arcan-git @:

doc/slides_devintro.pdf
doc/slides_devmodel.pdf
doc/arcan_presentation.pdf (these slides)

Much More @ Wiki

https://github.com/letoram/arcan/wiki