



GPAC 1.0 Overview

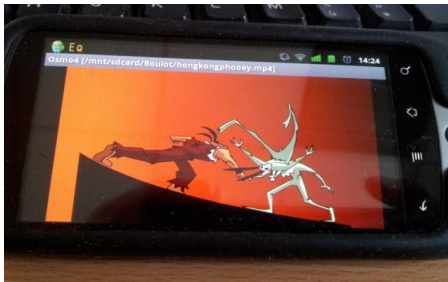
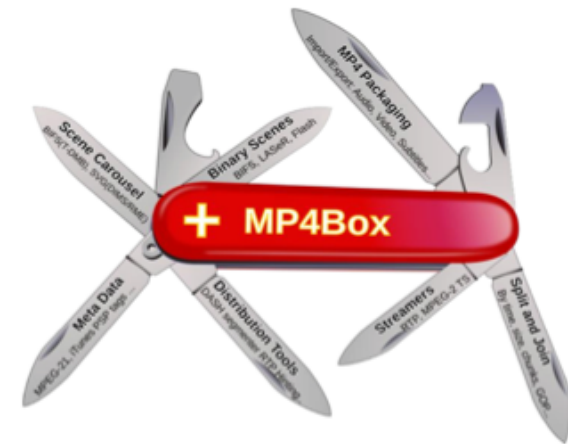
<http://gpac.io>



Jean Le Feuvre
jeanlf@gpac.io

What is GPAC ?

- Open-Source Multimedia Framework
- Our lab's research platform
- MP4Box
 - MP4/ISO-BMFF packager
 - DASH segmenter
 - MPEG-4 BIFS & LAsER encoder
 - Dump and analysis

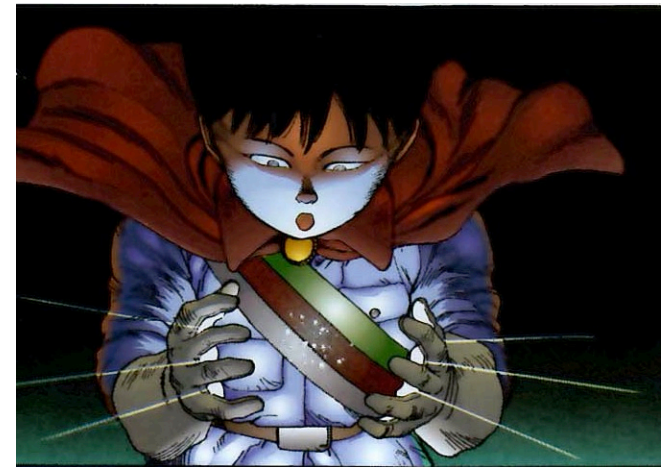


■ Osmo4/MP4Client

- A/V/Text/2D/3D interactive renderer
- JavaScript for SVG/BIFS/VRML (SpiderMonkey)
- Various network stacks (plugins)
- Various decoders (plugins)

GPAC History

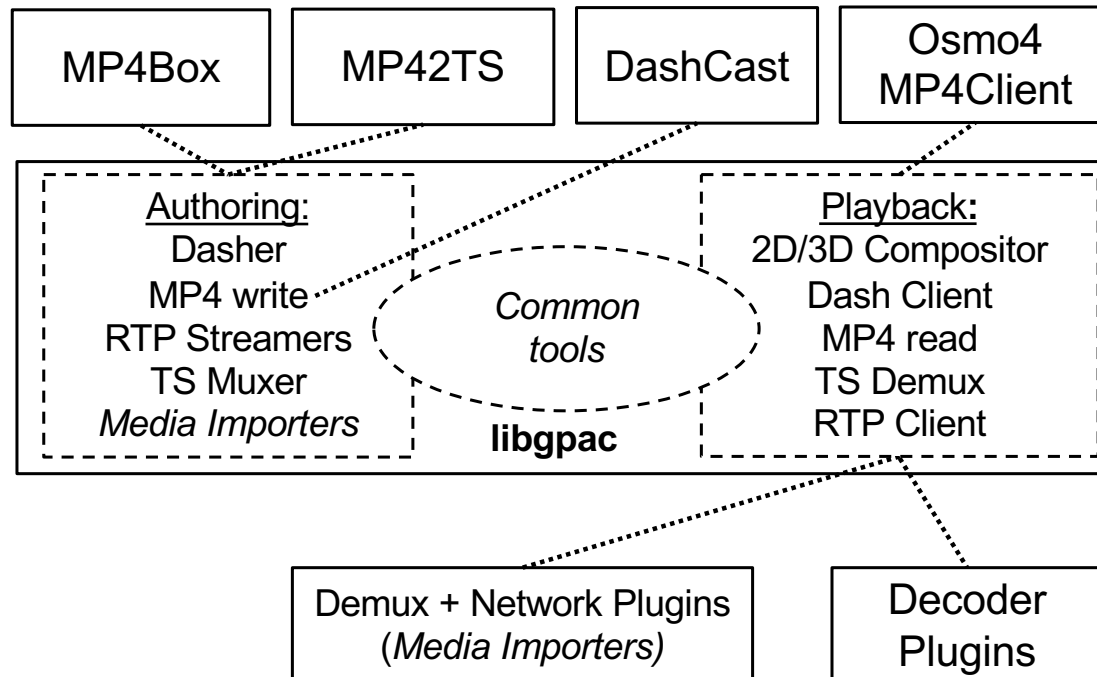
- **2001: first lines of libisomedia and player**
- **2003: First open-source GPAC release**
 - *“The only Open-Source MPEG-4 Systems player”*
- **2005: GPAC goes LGPL**
- **2005-2017**
 - **25+ EU and French R&D projects**
 - **Ever-increasing scope**
 - Broadcast, mobile broadcast
 - Digital Radio
 - DataCast (EPG, Apps, (e)MBMS)
 - IP Streaming, OTT
 - Content Protection
 - 3D, Auto-stereo displays, 360 VR
 - Scalable coding
 - Hybrid broadcast/broadband
 - UHD, HFR, HDR
 - Interactivity (SVG, MPEG-4 LAsER, Widgets, ...)
 - Image formats (HEIF)
 - Ad Insertion
 - ...



© Katsuhiko Ōtomo

GPAC after 15 years

■ Architectural nightmare



© Katsuhiro Ôtomo

Rearchitecture required !

■ Get rid of

- Duplicated functionalities
- Inconsistent configuration and documentation

■ Do not modify

- MP4Box and MP4Client usage
- Existing APIs
- Binary results for packagers

■ Add

- User-defined media pipelines
- Many tools we had in mind for 10+ years!



2+ years
3000+ commits
filters branch « 0.9.0-DEV »

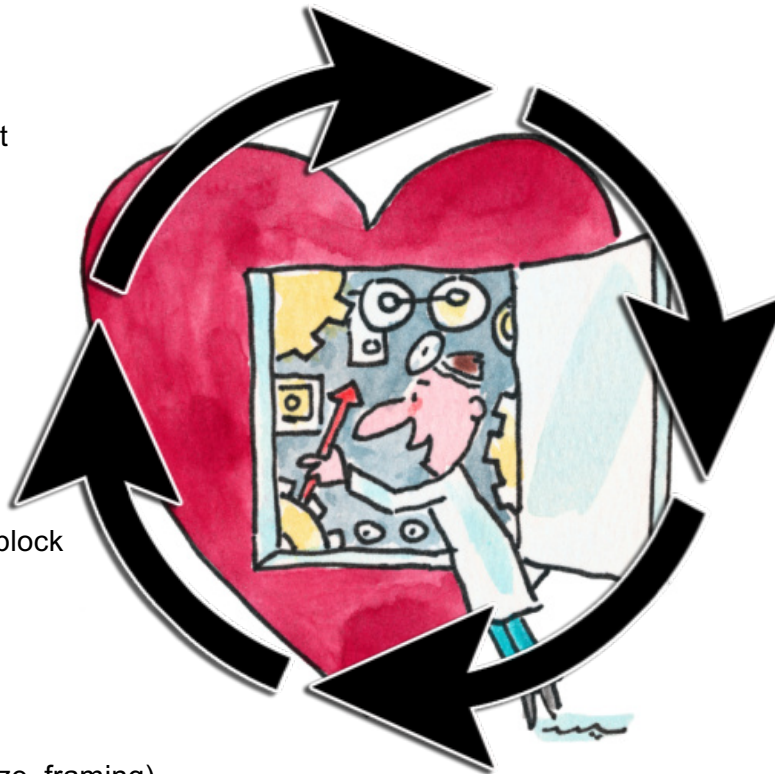
GPAC 1.0 Streaming Core Overview

■ GF_FilterSession

- Task-based scheduler
 - RT when desired/required
- Memory GC, buffer management
- [0,N] threaded, lock-free queues
- Dynamic graph resolution
- Blocking/ non-blocking modes
- Events management

■ GF_FilterPacket

- Reference-counted processing block
 - full/partial frame, file ...
- Associated data
 - Managed (recycled) memory
 - Shared (filter internal) memory
 - interface object (HW codecs)
- Static properties (timestamps, size, framing)
- Dynamic properties (CENC info, user-defined, ...)



■ GF_Filter

- Same API for all types
- I/O capabilities
- Single-threaded
- Dynamic stream reconfiguration
- Defines its own options, documentation
- Can load input or output filters
 - HAS client, segmenter

■ GF_FilterPid (PIDs)

- Data link between filters
- Packet IO
- Blocking/buffering management
- Dynamic properties
 - codec, samplerate, ...
- User-assignable properties
 - ServiceID, custom...

High-level impact on GPAC

■ New application “gpac”

- Generic pipeline assembler (command-line)

■ MP4Box

- *GF_FilterSession* for importers, exporters, encryption, fragmentation and dashing
- AV RTP Streamer removed (use *gpac*)

■ Players (MP4Client/Osmo4)

- All demux and decoder plugins moved to *GF_Filter*
- Player ⇔ *GF_FilterSession* running the compositor filter
- AVI and image export removed (use *gpac*)

■ MP42TS and DashCast

- Removed (use *gpac*)



Features ...

■ I/O

- Pipe (Linux/OSX/Windows) in/out
- Socket (UDP, TCP, Unix Domain) in/out
- File in/out
- HTTP in/out/server
- RTP in/out and RTSP server

■ Raw Data

- Most YUV and RGB formats
- All PCM formats

■ Compositor Filter

- SVG/BIFS/VRML graphics in a filter chain



... features ...

■ FFMPEG Support

- Demux and Mux (*libavformat*)
- **Encoders** and decoders (*libavcodec*)
- Grabbers (*libavdevice*)
- Simple and complex filters (*libavfilter*)
- Direct mapping of options

■ Distributed Processing

- Internal serialization format *GSF*
- Compatible with all GPAC I/O (file, pipe, socket, HTTP)
- AES-128 CBC encryption
- *WiP: events*



... features ...

■ JavaScript Filters

- QuickJS (ES2020)
- Complete JS bindings of the filter API
- EVG (GPAC 2D and text software rasterizer) API
- XMLHttpRequest
- WebGL 1.0 Core
- More APIs to come



... features ...

- **Encryption**
 - On-the-fly encrypt/decrypt
 - HAS Segment-based encryption
- **More HEIF support**
 - Batch conversion HEIF->JPG/PNGs trivial
- **VR**
 - HEVC tiles splitting and merging
- **Inspection**
 - With basic media analyzer
 - Anywhere in the graph
- **HAS**
 - HLS and dual DASH/HLS output
- **ISOBMFF customization**
 - Generic box insert/delete in movie and movie fragments
- **[GPAC 0.8](#)**
 - AV1, VP9, ATSC 3.0 demux, 360 video, HW decode, ...



... features !

- Audio and Video output
 - Compositor no longer required
- M2TS split
 - Split programs without demultiplexing
- Video cropper
 - Zero memory copy mode
- Source concatenator
 - Raw or compressed inputs
- Misc
 - Video flip
 - Audio resampler
 - Video rescaler (FFMPEG for now)
 - A/V rewinder (experimental)
 - ...



Some examples

■ Output file templating

```
gpac -i collection.heif -o dump_${ItemID$.jpg:clone
gpac -i source_ts tssplit @#ServiceID= -o prog_${GINC(10,2)}.ts
```

■ Multi-dump of h264 RTP

```
gpac -i session.sdp -o dump.264 -o dump.mp4 -o dump.ts -o dump.mpd
```

■ Encoding

```
gpac -i raw.yuv:size=1280x720:fps=30 enc:c=avc:b=1m -o output.mp4
```

■ Dual HLS and DASH

```
MP4Box -dash 1000 -profile onDemand source -o output.mpd:dual
```

■ Distributed processing

```
gpac -i source enc:c=avc:b=1m -o pipe://test:ext=gsf:mkp &
gpac -i pipe://test:ext=gsf -o dest.mp4
```

■ Analyzing

```
gpac -i source inspect:deep:analyze
```



Tests and coverage

Current view: [top level](#)

Test: [0.8.0-rev167-gcccb740f-master](#)

Date: [2020-01-20 14:28:28](#)

	Hit	Total	Coverage
Lines:	65340	271168	24.1 %
Functions:	3702	13042	28.4 %

■ Per-commit build and tests

- Installers: <http://gpac.io/downloads/gpac-filters-branch>
- Status: <https://buildbot.gpac.io>
- Tests: <https://tests.gpac.io>

■ New test suite repo

- <https://github.com/gpac/testsuite>

Current view: [top level](#)

Test: [0.9.0-DEV-rev3158-g8d3af941-filters](#)

Date: [2020-01-21 23:48:07](#)

	Hit	Total	Coverage
Lines:	218251	287533	75.9 %
Functions:	12051	13004	92.7 %

Documentation

■ Automatic Generation

- <http://wiki.gpac.io>
- '-h' and man pages

■ HOWTOs

- <http://wiki.gpac.io/Howtos>
- WiP ...

■ Improved DEV doc for libgpac

- <http://doxygen.gpac.io>



What's next



■ Final merge and release 1.0 !

- March/April 2020



■ On-going work

- Automated Fuzzing

■ Future roadmap

- More HW codecs
- Remote session monitoring
- Higher level APIs
- ...



GPAC 1.0 Overview

<http://gpac.io>



THANKS !

Jean Le Feuvre
jeanlf@gpac.io