# WAM: an embedded web runtime history

## Introduction and retrospective

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# About me (1/3)

José Dapena Paz “dape”

Software engineer at Igalia for 21 years, and one of its founders.



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# About me (2/3)

From Galicia, Spain.

Galicia in Europe | By David Sebastian Liuzzo, Alexandre Vigo | CC BY-SA 3.0



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# About me (3/3)

Member of Igalia Chromium team.

Some projects:

- LG webOS web engine integration (2012-today)
- WAM for AGL (2018-2022)
- Nokia Meego and Maemo (2005-2011)



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# Igalia

- Open source consultancy, focused on the web ecosystem.
- +100 engineers all around the world.
- 2nd main contributor to Chrome, right after Google.
- 2nd main contributor to WebKit, right after Apple.
- Teams around web engines and platform, graphics, compilers, ...

# Why this talk?

I started working on webOS in October 2012 (10 years ago!).

10 years feels like a good time to write about history.

# Agenda

- What is WAM?
- Where is it used?
- How it works?
- What is good about WAM?
- Retrospective
- Future



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# What is WAM

# What is WAM

**WAM** = **W**eb **A**pplication **M**anager



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- LG webOS web runtime.



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- LG webOS web runtime.
- On top of Chromium.



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# What is WAM

## webOS

An Operating System for embedded products.

It is **web** centric: web applications are first class citizens.

# What is WAM

## webOS

Yocto / Openembedded Core.

Wayland / QML / Maliit.

Unified media server.

Luna bus for IPC.



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# What is WAM

**WAM** = **W**eb **A**pplication **M**anager

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# What is WAM

**WAM** = **W**eb **A**pplication **M**anager

- LG webOS web runtime.
- On top of Chromium.

WAM is the center piece of web experience in webOS.



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# Where is it used?

# Where WAS it used?

- HP Touchpad
- Some Palm phones

# Where is it used?

LG webOS TV, from 2013.




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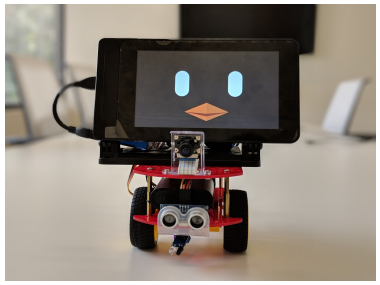
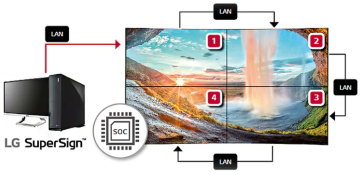
# Where is it used?

Some LG products and experiments that use or used webOS and WAM:





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# Where is it used?

LG webOS Open Source Edition, from 2018.

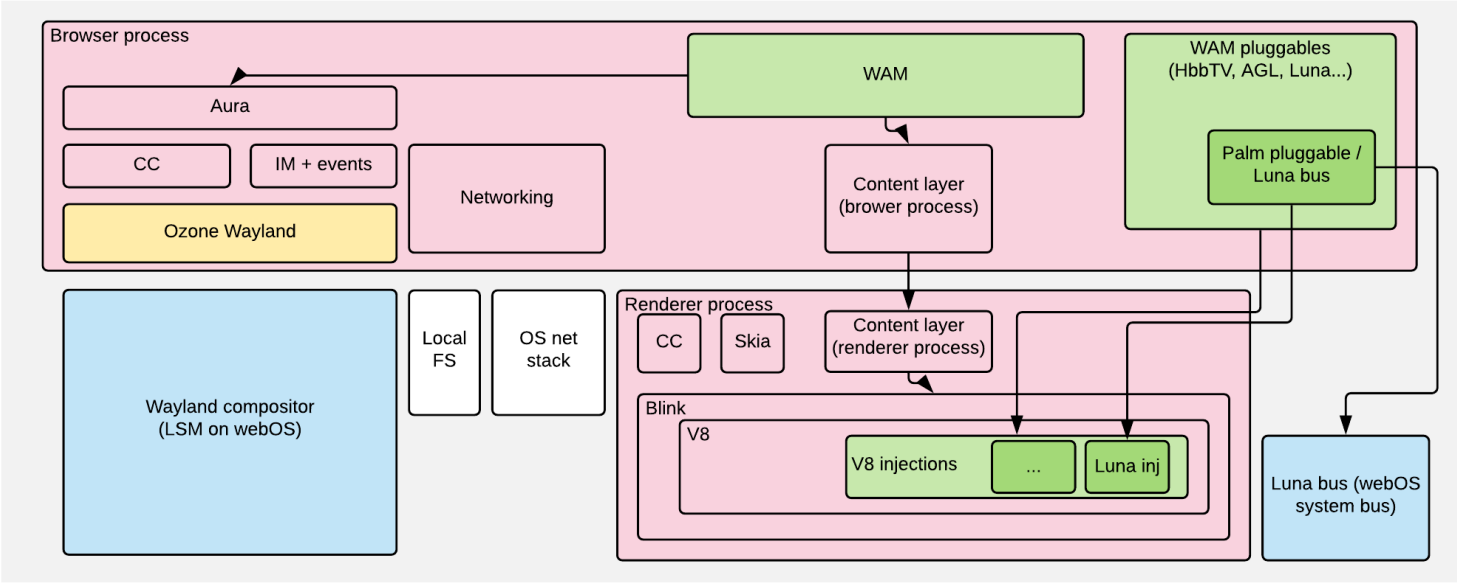
# Where is it used?

Linux Foundation Automotive Grade Linux (AGL) web runtime.

Port done adapting to the AGL application framework.

# How it works?

# How it works?



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# What's good about WAM?



# What's good about WAM?

## Support of web platform standards

**WAM** is based on Chromium: high support for web platform standards.

- Document model, JS, CSS.
- Device APIs.
- Graphics APIs.
- Media, WebRTC
- Storage, security

# What's good about WAM?

## Application lifecycle

**WAM** runtime manages the running web applications:

- Launching, closing
- Suspend/resume
- Recovery



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# What's good about WAM?

## Performance

A **goal** of **WAM** is using the system resources efficiently:

- CPU and GPU memory.
- CPU usage.
- Launch time optimization.

# What's good about WAM?

## Security

Local packaged applications and remote web applications.

Following web security origin model.

Application manifest permissions.



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# What's good about WAM?

## Developer tools

- Web inspector and developer tools
- Chromium tracer



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# What's good about WAM?

## Proven technology

Shipped in millions of LG smart TVs...

... and +10 years of experience.

Nowadays also adopted for the AGL reference platform.



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# What's good about WAM?

## Open source license

**https://webosose.org**

**https://github.com/webosose/wam**

Apache 2.0 license



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# Retrospective



# Retrospective

## Caveat

I have been working on webOS web integration since October 2012.

History of WAM seems to start around 2008.

I will mostly focus on what I lived.

# Retrospective

## From HP/Palm to LG TV

2010: HP bought Palm...

2011: ... Then HP decides to cancel new webOS products. Last device: HP Touchpad.

# Retrospective

## From HP/Palm to LG TV (2/2)

2012: partnership LG+HP for using webOS on LG SmartTV.

2013: LG acquires Palm software development unit from HP: LG Silicon Valley Labs is born.

2014: LG webOS based TV are introduced in CES Las Vegas. TV are released a few months later.

# Retrospective

## webOS and Open Source: Open WebOS (1/2)

June 2012: HP/Palm releases OpenWebOS

Code still available at **https://github.com/openwebos**

2012: after LG acquisition, OpenWebOS is not maintained anymore!



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# Retrospective

## webOS and Open Source: Open WebOS (2/2)

So:

- I guess it was useful to attract LG to invest in webOS.
- LG preferred to focus on making LG webOS TV happen.

My view: the webOS TV effort was a **huge** challenge.

No time for anything else.



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# Retrospective

## Open Source: webOS OSE (1/3)

June 2018: LG releases webOS Open Source Edition

See **https://webososе.org**

Focus:

- Allow prototyping ideas and products.
- For students, independent developers.
- Create a community around it.



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# Retrospective

## Open Source: webOS OSE (2/3)

It is active nowadays.

Hardware target: Raspberry PI (nowadays PI 4 models).

My view:

- It simplified testing new ideas.
- Integration of parts for AGL for automotive, ROS for robotics.

# Retrospective

## Open Source: webOS OSE (3/3)

Do you want to integrate web UI in your experimental product? webOS OSE can help!



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# Retrospective

## From webOS to AGL (1/2)

Collaboration LG + Igalia + Linux Foundation.

Before 2018: Igalia assisted Chrome browser work with Wayland

May 2018: LG Silicon Valley Labs experiment to port WAM to AGL



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# Retrospective

## From webOS to AGL (2/2)

The 2018 experiment proved it was possible.

Focus on a web-only demo:

- System UI + web applications
- Integration of third party applications.
- Integration with system services.

In last 4 years WAM evolved with AGL.

# Retrospective

## From QtWebKit to webOS WebView (1/2)

2012: WAM was based on QtWebKit

2012-2013: Moved to QtWebKit2 (multiprocess architecture).

2014-2015:

- Moved to Blink following market trend after Blink forked from WebKit.
- Based on QtWebEngine.

# Retrospective

## From QtWebKit to webOS WebView (2/2)

2015-today:

- Created webOS WebView layer and dropped QtWebEngine.
- Why?
  - No strong QWE specific use cases.
  - Qt started moving towards commercial and tighter open-source licensing policies

# Retrospective

## From Qt to Qt-less (1/2)

WAM has been based on Qt for a long time.

But...

- GPLv3 licensing of Qt was problematic for some stakeholders (but not LG).
- C++, STL and Chromium C++ libraries grew better and better. Not much benefit on Qt.

# Retrospective

## From Qt to Qt-less (2/2)

From 2021, WAM does not depend on Qt anymore.

- Based on STL and other C++ libraries + Glib.
- QMake -> CMake.



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# Retrospective

## Stability (1/2)

But... essentially, main ideas of WAM did not change in last 10 years.

# Retrospective

## Stability (2/2)

It proved useful, and architecture flexible enough to adapt to:

- Web engine changes.
- Dependencies changes.
- New products
- Even OS changes.

# Future

# Future

webOS is here to stay!

LG is increasing the bet for webOS on SmartTV through **webOS Hub**.



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# Future

Some topics...

- GCC or Clang?
- How to improve upgrade cycles?

# Final remarks

# Final remarks

- +10 years of project. More to come!
- Proved useful for many products and millions of users.
- A great piece to make web a first class citizen of a platform.

Thanks!




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