

# Wayland & V4l2 performance proposal - V4l2 dma cache maintenance optimization

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# AGENDA

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- V4l2 performance proposal using wayland compositor
  - Introduction: About Wayland/Weston and V4l2
  - Performance target and issue
  - Our investigate result, and approaches ( for local patch ).
- Appendix
  - Show another requests for long term or middle term .
- Appendix 2
  - Introduce customer's requirement, and HW data flow.

# Introduction

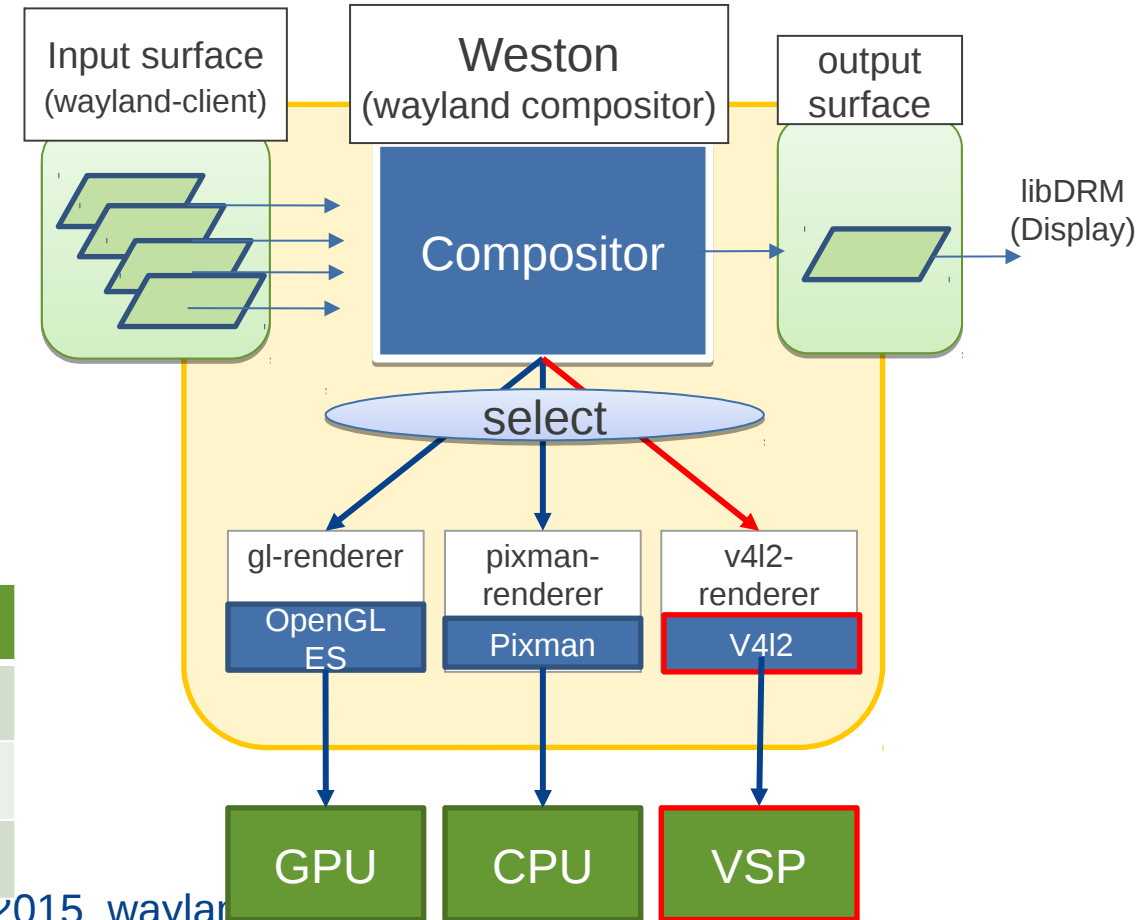
## - About Weston (Wayland compositor) & V4l2

- **Weston** is Window system.
- **Weston** is SW architecture as compositor.
  - It compose output surface from some input buffers.
  - It has rendering component, called “renderer”.
  - Weston can select one “renderer” to use HW resource.
- The figure shows typical renderers.

1. gl-renderer (GPU): OpenGL ES API, it is default renderer.

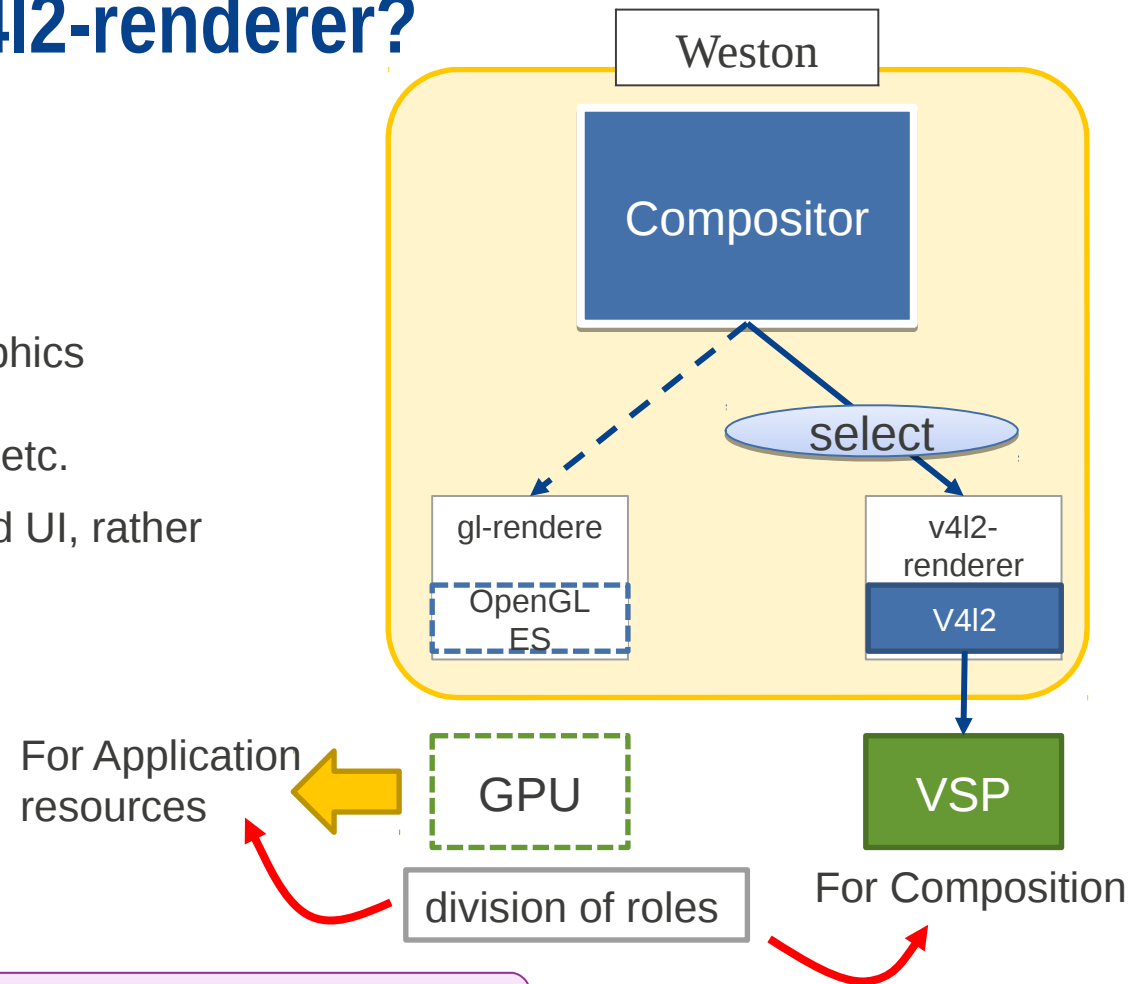
Name	HW	API	Remarks
gl-renderer	GPU	OpenGL/ES 2.0	Default renderer
pixman-renderer	CPU	Pixman library	For reference SW
v4l2-renderer	VSP	V4l2	Renesas Original SW

– [http://events.linuxfoundation.org/sites/events/files/slides/ais2015\\_wayland-weston-1.pdf](http://events.linuxfoundation.org/sites/events/files/slides/ais2015_wayland-weston-1.pdf)



# Why does we develop v4l2-renderer?

- GPU Offloading
  - Most of IVI Applications require high Graphics resource.
    - 3D Navigation System, HMI, 3D effect, etc.
  - User want to use GPU for more advanced UI, rather than a simple window composition.



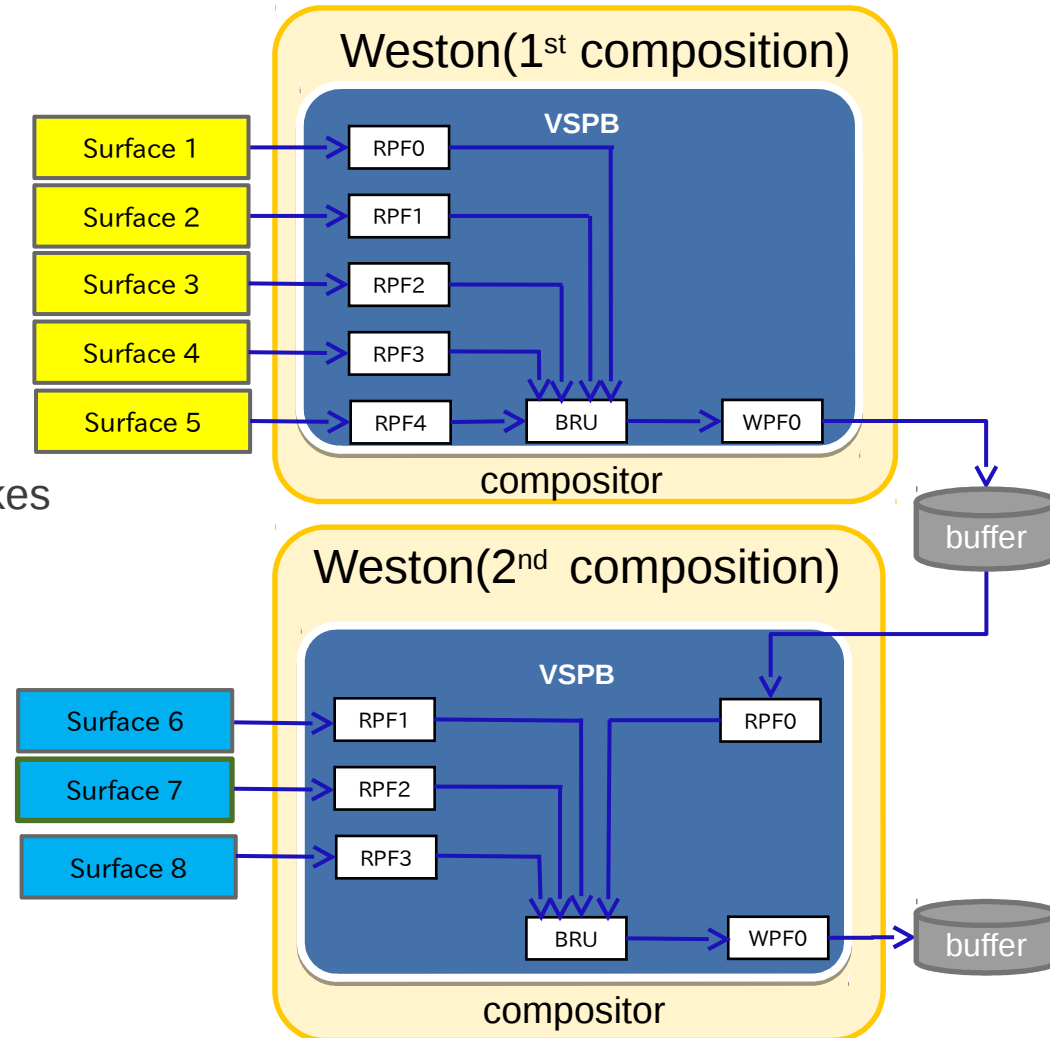
We use VSP to compose in order to reduce Total performance cost.

# Performance TARGET and issue

- Target : It must complete within 1vsync, i.e. within 16.6ms.

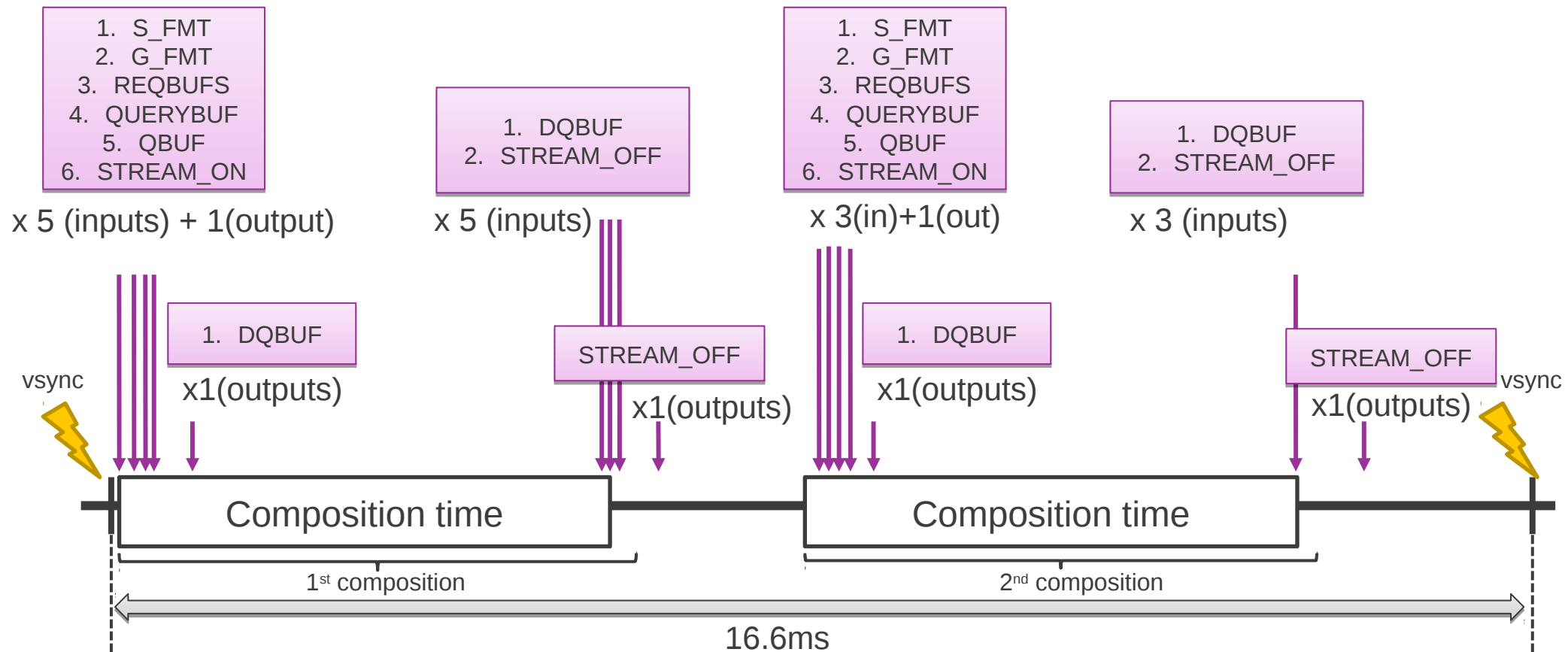
However,

- HW processing time for composition increase in proportion to resolution. (Full HD size : about 8000us.)
- VSP has only 5 inputs (Gen2 vsp has 4 inputs).
  - When the number of surface is over 5, VSP composition should takes twice or over. When there is 8 surface images,
    - 1st : 5 surface is composed.
    - 2nd : 3 surface and one output buffer.
- Not only HW over head, but also SW overhead should be reduced.  
( Panasonic said “100us or less” )  $\leq 1\%$  of 16.6ms



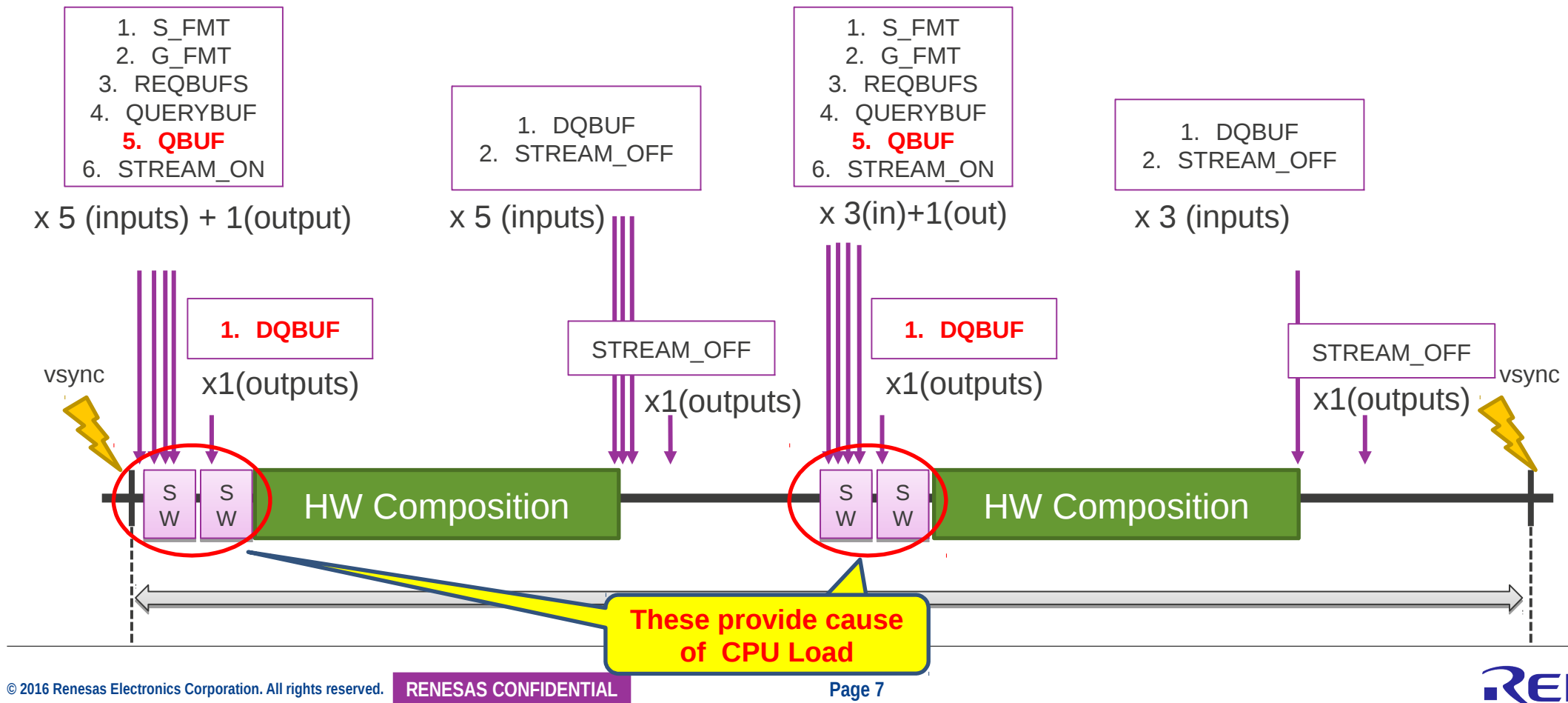
# Example (Timing Chart)

- When there are 8 input surfaces, so VSP should run twice in 1vsync.
  - Surface information (size/position) changes. These parameter should be set every time.



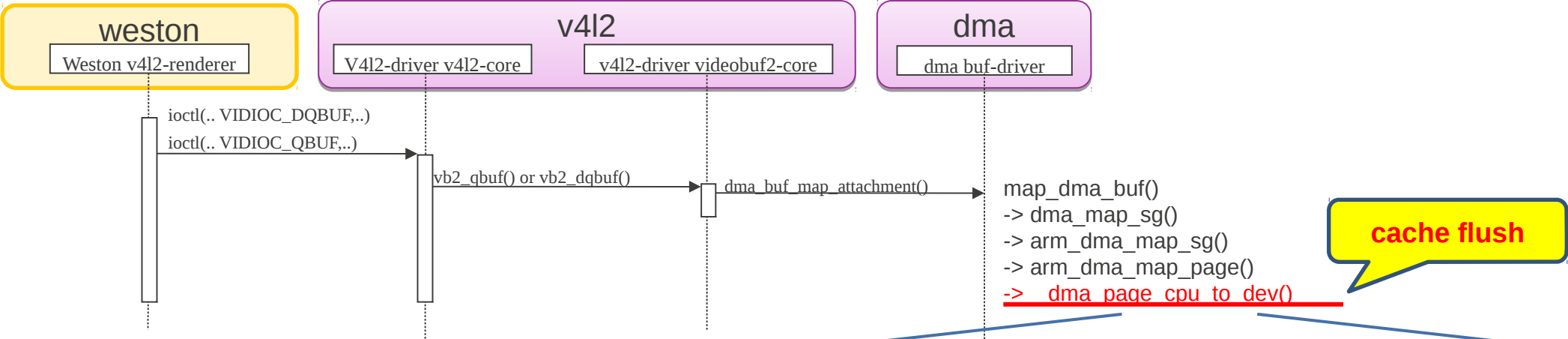
# Example (Timing Chart) : problems

- There is extra process time except HW.  
In out investigation, it is cased QBUF/DQBUF. It takes long time.



# Why this CPU load is problem?

- We found out V4l2 CPU load is caused CPU cache flush process. But, this memory area is non-cached.



- Another case :
  - 800x480:100µs/oneQBUF
  - 1280x480:160µs/one QBUF.

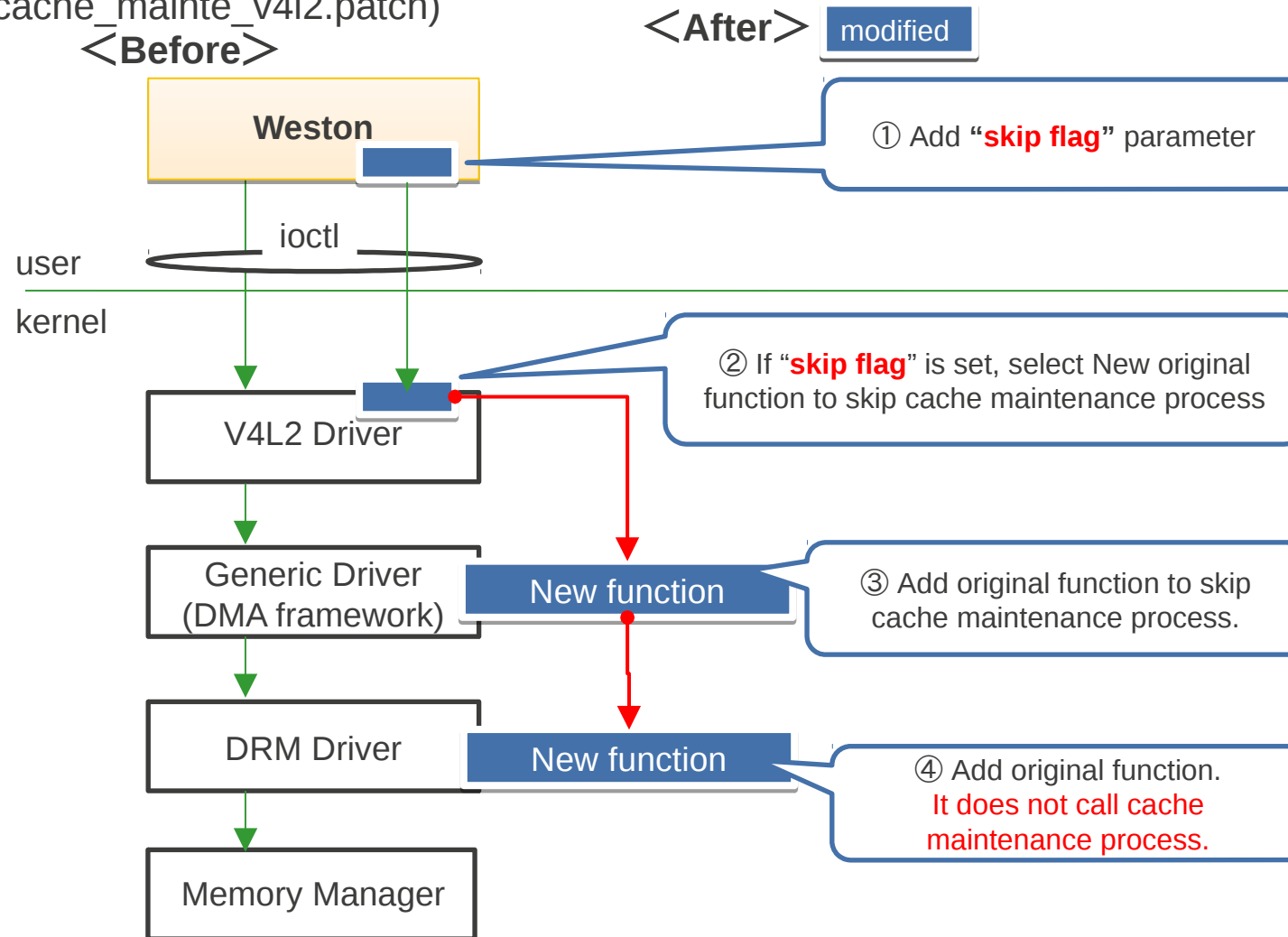
=> The progress time increases in proportion to display resolution.  
In 4K display case, it will take 7ms over only this CPU load.

CPU load:	Time(us)	
QBUF(RPF: input)	600us + other	Full HD display and other input surfaces. e.g.) 250x250 surface takes 20us
QBUF(WPF:output)	600us	Full HD display
DQBUF(WPF:output)	600us	Full HD display
Total	1.8ms over	



# Modification overview in Gen2 (It is just for customer's patch)

It shows the block diagram in our Gen2 solution. Please refer the attached patch file (skip\_cache\_mainte\_v4l2.patch)



# Conclusion

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- We investigate and resolved in Gen2. We confirmed that It is effective.
- However, the patch is released for only 1 customer. Neither renesas BSP nor upstream.
- It is related for v4l2 framework and v4l2 interface, not related platform driver (vsp1), so that we have requested for you.

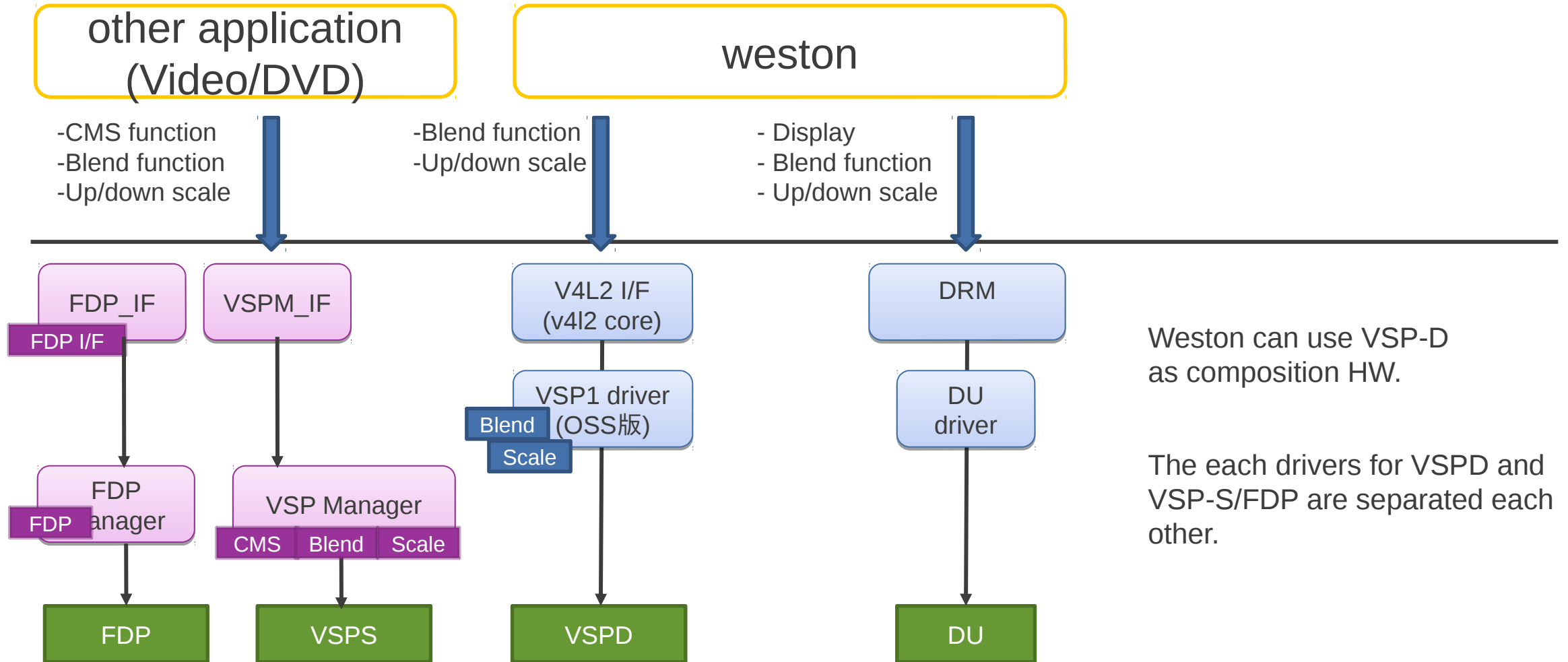
# Appendix

## - Another Request For Media

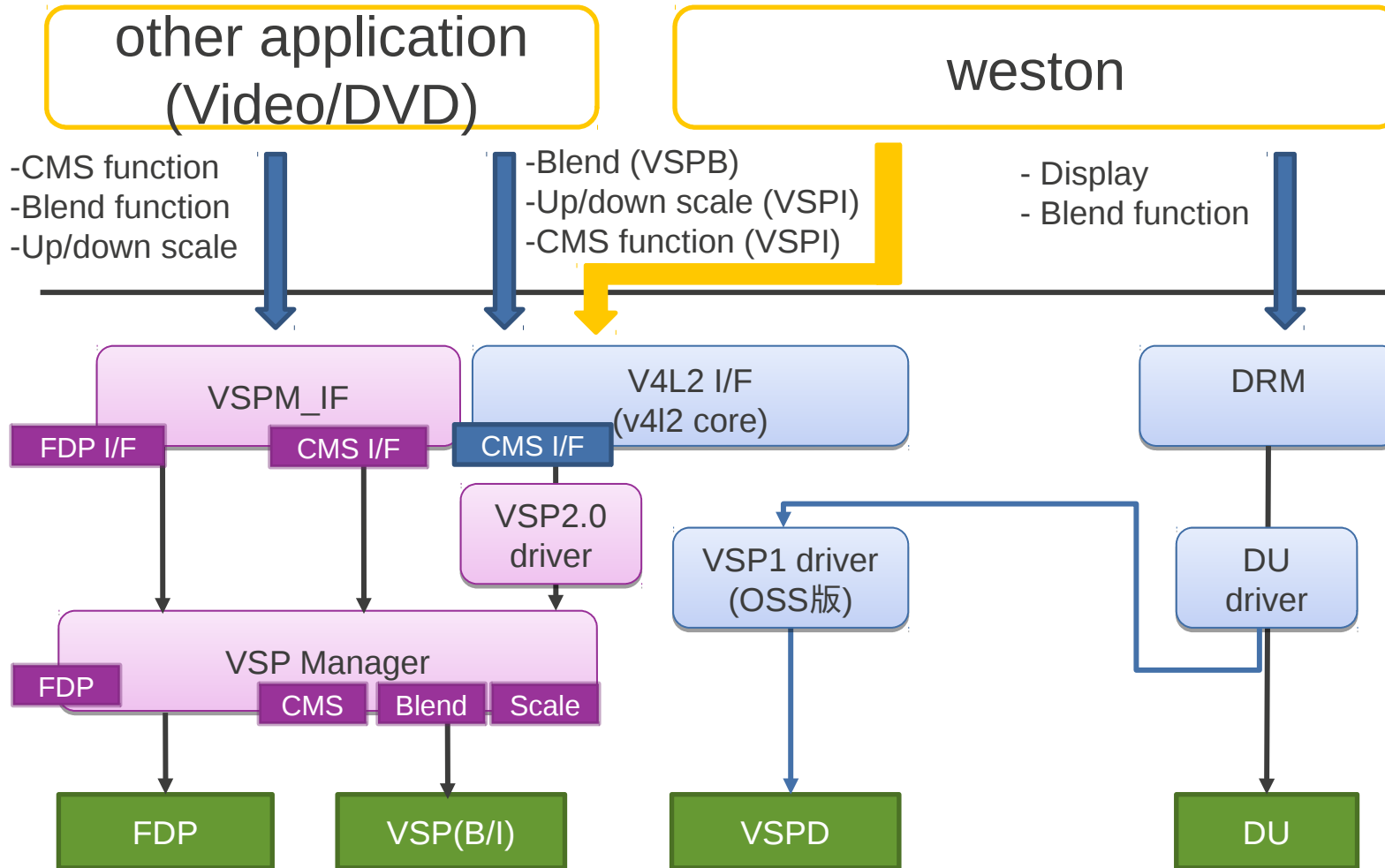
# Background of many requests for VSPs



# SW component for Gen2 ( VSP-D / VSP-S /FDP)



# Current Renesas BSP component in Gen3



[Gen3]

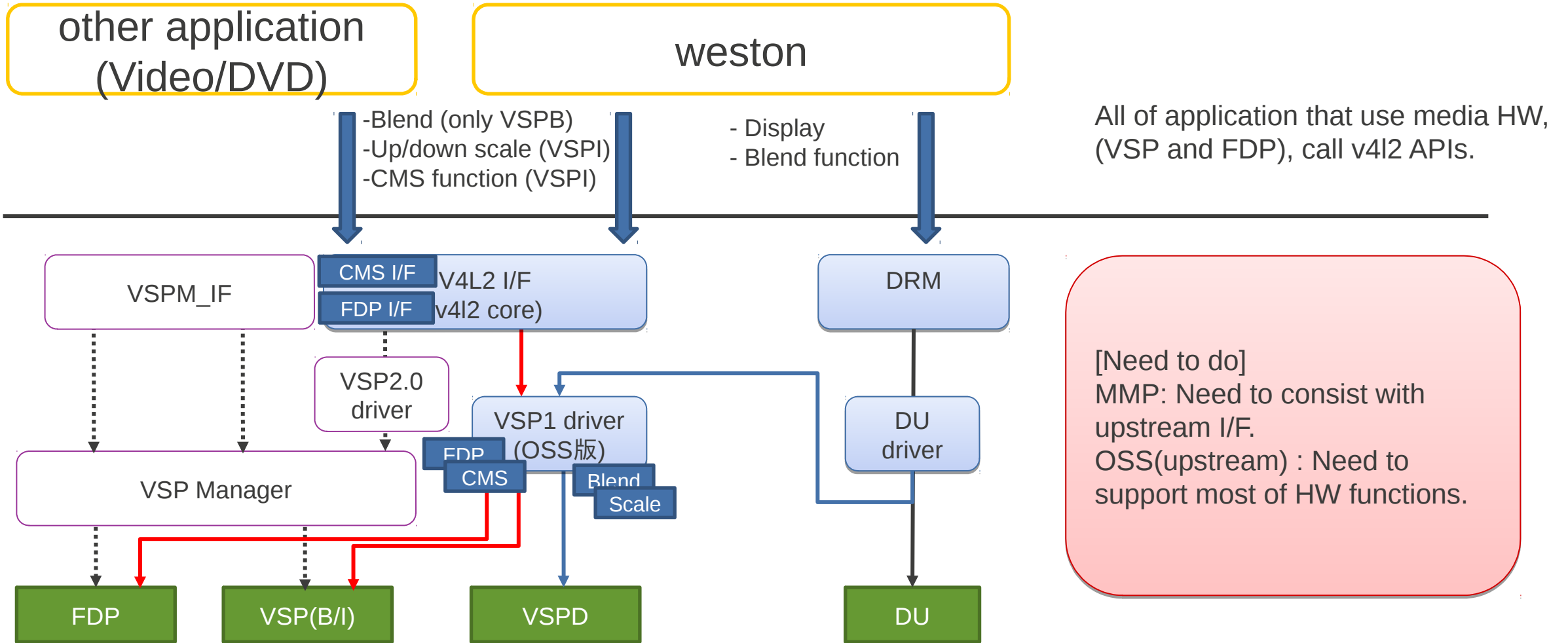
VSPD should be used for Display together with DU, and it is controlled by libdrm.

**Then, all of application need to share VSPB or VSPI.**

- ① Most of application/Library use VSPM\_IF. Because it should keep compatible Gen2 API, and some functions are supported.
- ② CMS library what is Renesas proprietary library use v4l2 API, step by step
- ③ Weston use v4l2 to blend by VSPB.

There are two types of I/F, VSPM\_IF and V4l2 I/F. We should unify I/F to V4l2 in order to upstream for v4l2-rendere.

# Finally Gen3 platform propose



# FUTURE REQUEST (SHORT /MIDDLE TERM)

Problem/request	Term	Category	Priority	Status/remarks
To be fix VSP CMS I/F	on going	New function	High	Already requested.
FDP driver	on going	New driver	Middle	Already requested.
UDS/WPF Image Partition	Short/Middle term	Function expand	High	Already requested.
Request API	Short/Middle term	Performance	High	Already requested.
New I/F for Virtual Input (RPF via V4l2&libDRM)	Short/Middle term	Function expand (Add I/F) (based on Customer Use-case)	Middle	Not yet request.
Up/down scale video surface during stream-on.	Short/Middle term	Customer Use-case. (based on Customer Use-case)	Middle	Not yet request
FCP Lossless (VSP(WPF) + FCPV)	Short/Middle term	Function expand (Add I/F)	Low	Low priority.
FCP Lossless (FDP + FCPC)	Short/Middle term	Function expand (Add I/F)	Low	Low priority.



# FUTURE REQUEST (LONG TERM)

Problem/request	Term	Category	Priority	Remarks
Dma-cache reduce	Middle	Performance	Middle	Already requested.
Change the proper media_device_info value	Middle	Function expand	Middle	driver, model, bus_info etc. string is not proper.
VSPD Write-back	Middle	Function expand	Low	BSP has improved already. To be upstream
H3 ES2.0 and M3N /E3 VSPD-DU	Middle term	New SoC	Middle	BSP will improve at first in Japan. To be upstream soon.
Compatible support format between VIN and VSP.	Middle term	System/Customer Use-case	Middle	Complete today
Multi process	Long term	System/Customer Use-case	High	Already discuss at Nov/2015.

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[www.renesas.com](http://www.renesas.com)