Dynamic Blanking for VR Warp

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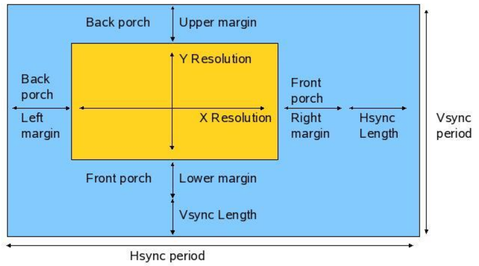
Motivation

Motion to photon latency
- IMU Tracking : 4-15ms
- Rendering : 8-16ms
- Persistence : 2-16ms

Typical latency of non-optimized system : 30ms+

Can we reduce motion to photon latency without introducing any additional latency?

Dynamic Blanking



Blanking is a legacy requirement of raster displays.
Many new displays transmit audio/CC data during blanking.
None of these are required for VR.

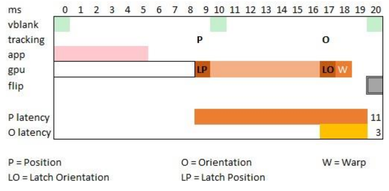
By dynamically adjusting the length of the front porch and back porch, we can adjust the position of the active pixel data on the screen with no change in pixel clock and no additional latency.

Image Source: http://processors.wiki.ti.com/index.php/LCD_RGB_640x480_VGA_Addition

Related Work

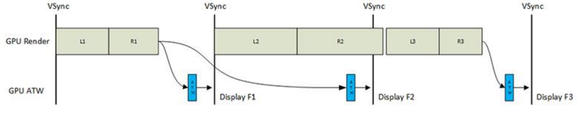
Oculus: Late Latching

https://developer.oculus.com/blog/optimizing-vr-graphics-with-late-latching/



Oculus: Asynchronous Timewarp

https://developer.oculus.com/blog/asynchronous-timewarp-on-oculus-rift/



Experimental Results and Future Research

Results:

Horizontal warp successful with occasional artifacts.

Warp can be updated on each frame during VSYNC.

Vertical warp desyncs the HDMI signal, is this monitor dependent?

Remaining Questions:

Can this be done as a pass-through to existing systems for simple addition to existing HMDs?

How do different display technologies affect this approach?

Can we introduce a higher pixel clock to provide more blanking area and still sync the active data?