



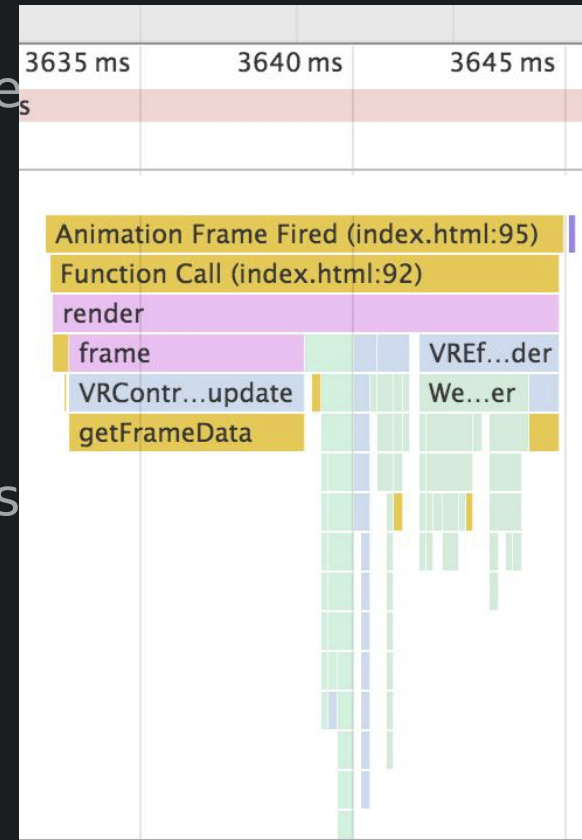
**oculus**

# Gear VR Performance Tweaks and Pitfalls

Mobile VR is Hard

# System Integration Issues

- Chrome IPC Performance is Crippled on Android vs PC
  - Use shared memory for transferring critical data like HMD poses
  - Saw 10ms delays on synchronous IPC
- Texture Mailboxes and Texture Copies Add Up
  - Necessary for separation of GPU and Compositor
- OVR Mobile SDK Scheduling Boosts
  - Bump CPU/GPU thread/process scheduling to meet frame rates
  - Downside, higher thermals, maybe thermal throttling, unpredictable
- Android Background Services, more unpredictability
- Chrome Rendering Pipeline Synchronization
  - Sporadic frame skip, offset by ATW, but not great





# Fixing Aliasing – Until we All Get It

- Most Gear VR Devices have Fast, High Quality MSAA 2x/4x
- Bugs in Chromium Prevented us from Using Initially
  - Content too, make sure antialias: true when initializing WebGL
- Smaller Eye Buffers w/ MSAA > Larger Eye Buffers w/o MSAA
- Seminal Carmack Talk
  - <https://news.ycombinator.com/item?id=12183340>
- WebGL Developers rarely forget mip maps (yay for Copy/Paste?)



# WebVR Content

- Oversized Textures – More on this in the WebVR Content Pipeline talk
  - Three.js warns & resizes, at a cost
- glBufferData/glBufferSubData overuse
  - Favor more GL\_STATIC\_DRAW buffers
  - Avoid uploading to a buffer in use by the GPU
  - Use glBufferSubData when just changing values
- Turn on anti-aliasing and reduce eye buffer sizes as necessary
- Turn OFF preserveDrawingBuffer when initializing WebGL
  - Requires more copying, not swap chain friendly
  - Causes some GPUs to fail (Samsung S6 on Android M)
  - See more in DrawingBuffer::finishPrepareTextureMailboxGpu

```
if (m_preserveDrawingBuffer == Discard) {
    // If we can discard the backbuffer, send the old backbuffer directly
    // into the mailbox, and allocate (or recycle) a new backbuffer.
    colorBufferForMailbox = m_backColorBuffer;
    m_backColorBuffer = createOrRecycleColorBuffer();
    attachColorBufferToReadFramebuffer();

    // Explicitly specify that m_fbo (which is now bound to the just-allocated
    // m_backColorBuffer) is not initialized, to save GPU memory bandwidth for
    // tile-based GPU architectures.
    if (m_discardFramebufferSupported) {
        const GLenum attachments[3] = {GL_COLOR_ATTACHMENT0, GL_DEPTH_ATTACHMENT,
                                        GL_STENCIL_ATTACHMENT};
        m_gl->BindFramebuffer(GL_FRAMEBUFFER, m_fbo);
        m_gl->DiscardFramebufferEXT(GL_FRAMEBUFFER, 3, attachments);
    }
} else {
    // If we can't discard the backbuffer, create (or recycle) a buffer to put
    // in the mailbox, and copy backbuffer's contents there.
    colorBufferForMailbox = createOrRecycleColorBuffer();
    m_gl->CopySubTextureCHROMIUM(
        m_backColorBuffer->textureId, colorBufferForMailbox->textureId, 0, 0, 0,
        0, m_size.width(), m_size.height(), GL_FALSE, GL_FALSE, GL_FALSE);
}
```



# Development Tools

- Mobile Debugging on Android is Challenging (more so for Web Devs)
- Lack of USB Debugging through the Gear VR is More Challenging
  - Enabling the Gear VR Service Developer Mode requires OSIGs
- Chrome Debugger and Profiler over Wifi to the Rescue
  - Full power of the Chrome Tools
  - Refresh/Navigation Support
  - Screen Mirroring (not AS useful on mobile, but you can put buttons there)
- Snapdragon Profiler
  - Needs latest drivers, challenging if you are on a mobile carrier
  - Works best on the Snapdragon 821 on the ... Note 7