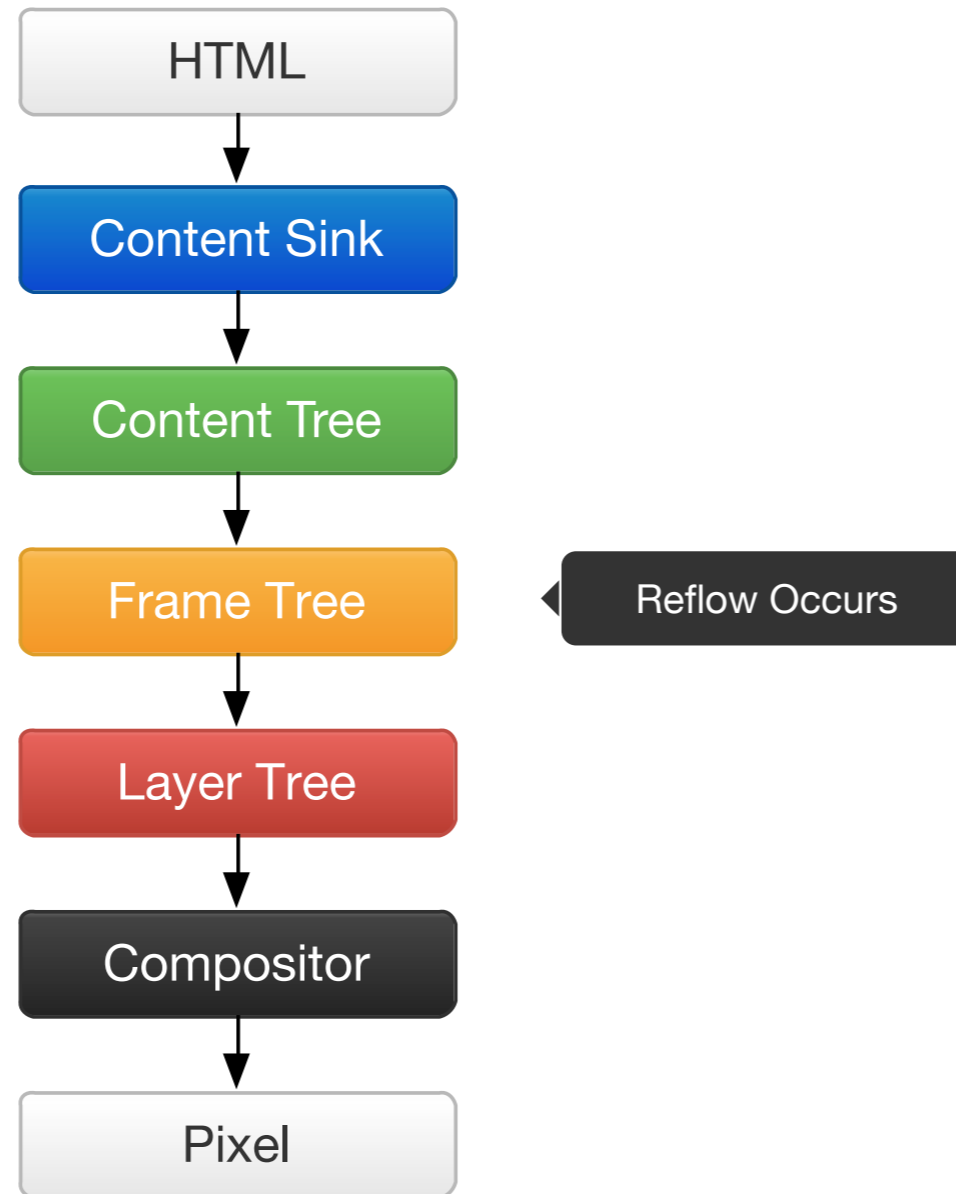


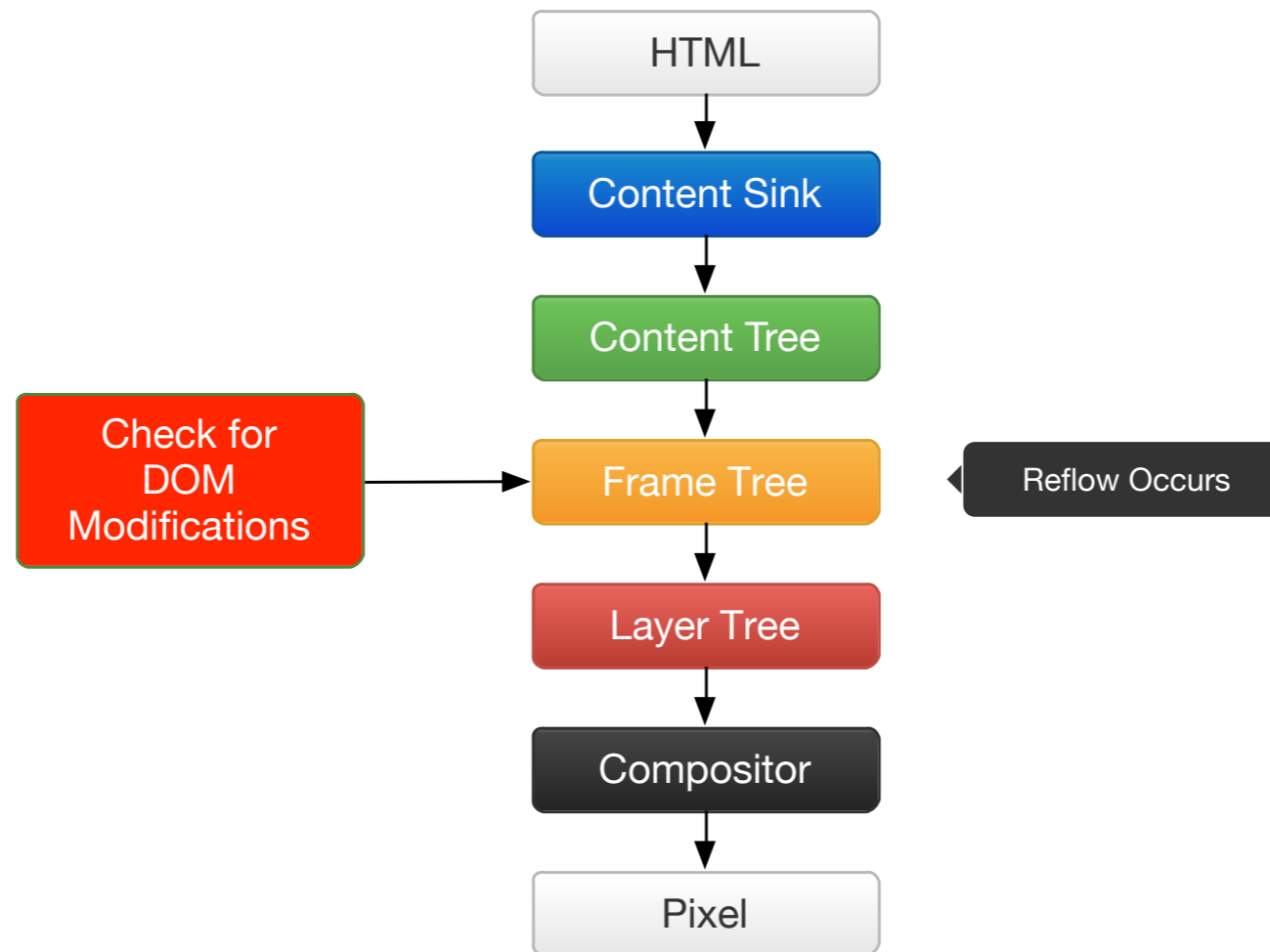
Graphics Subsystem

Part 2

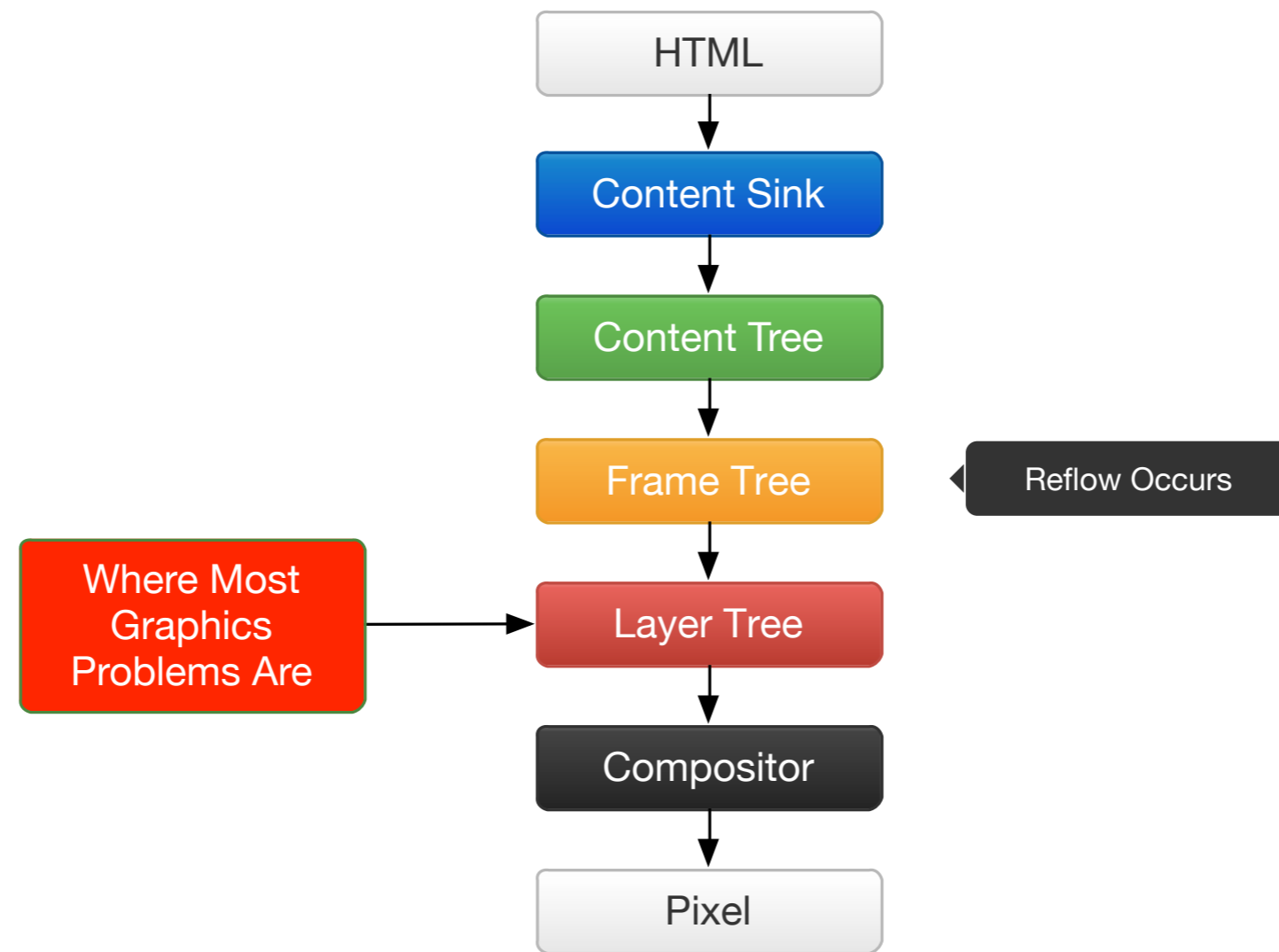
Graphics Architecture



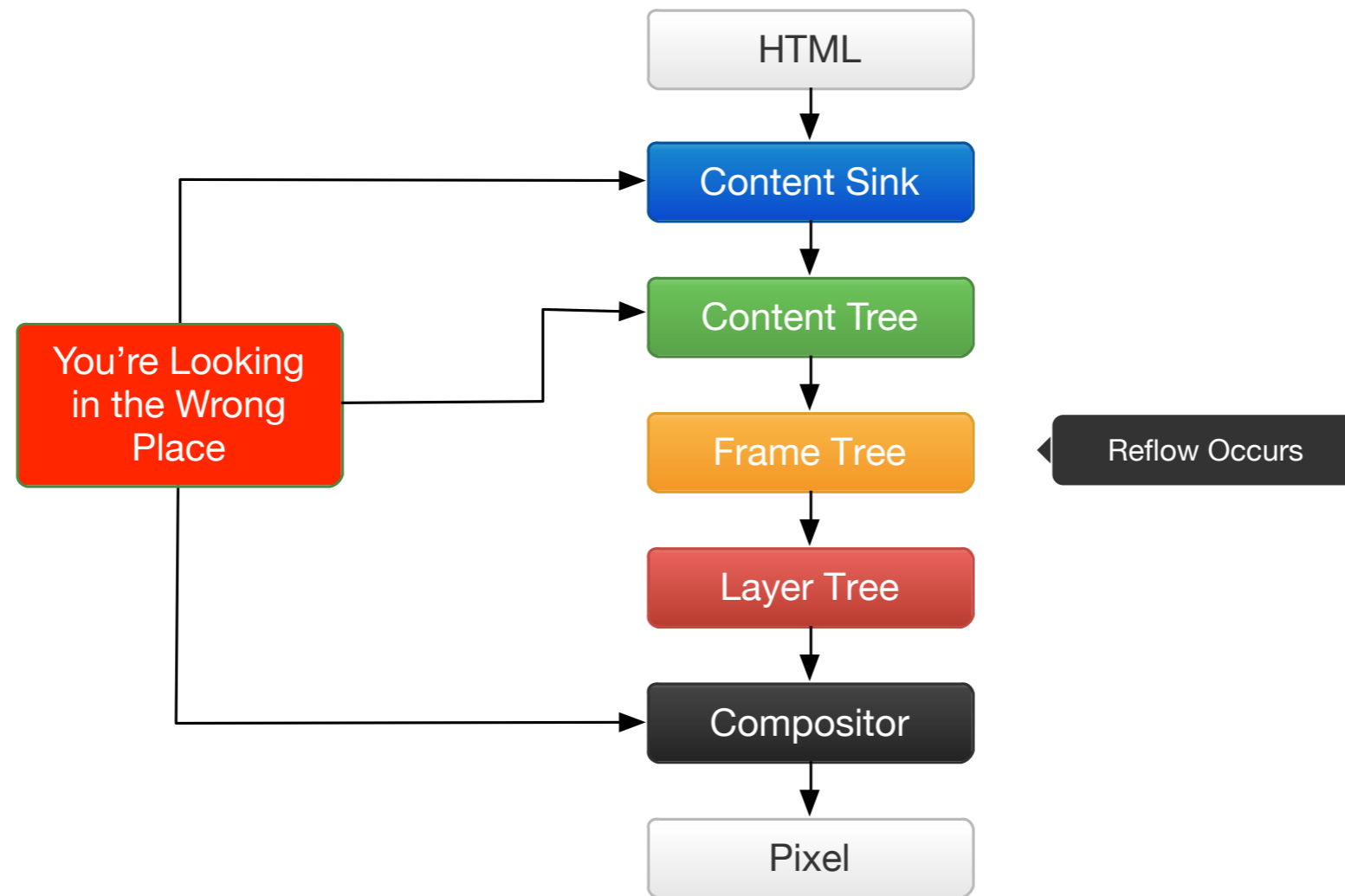
Where The Problems Are



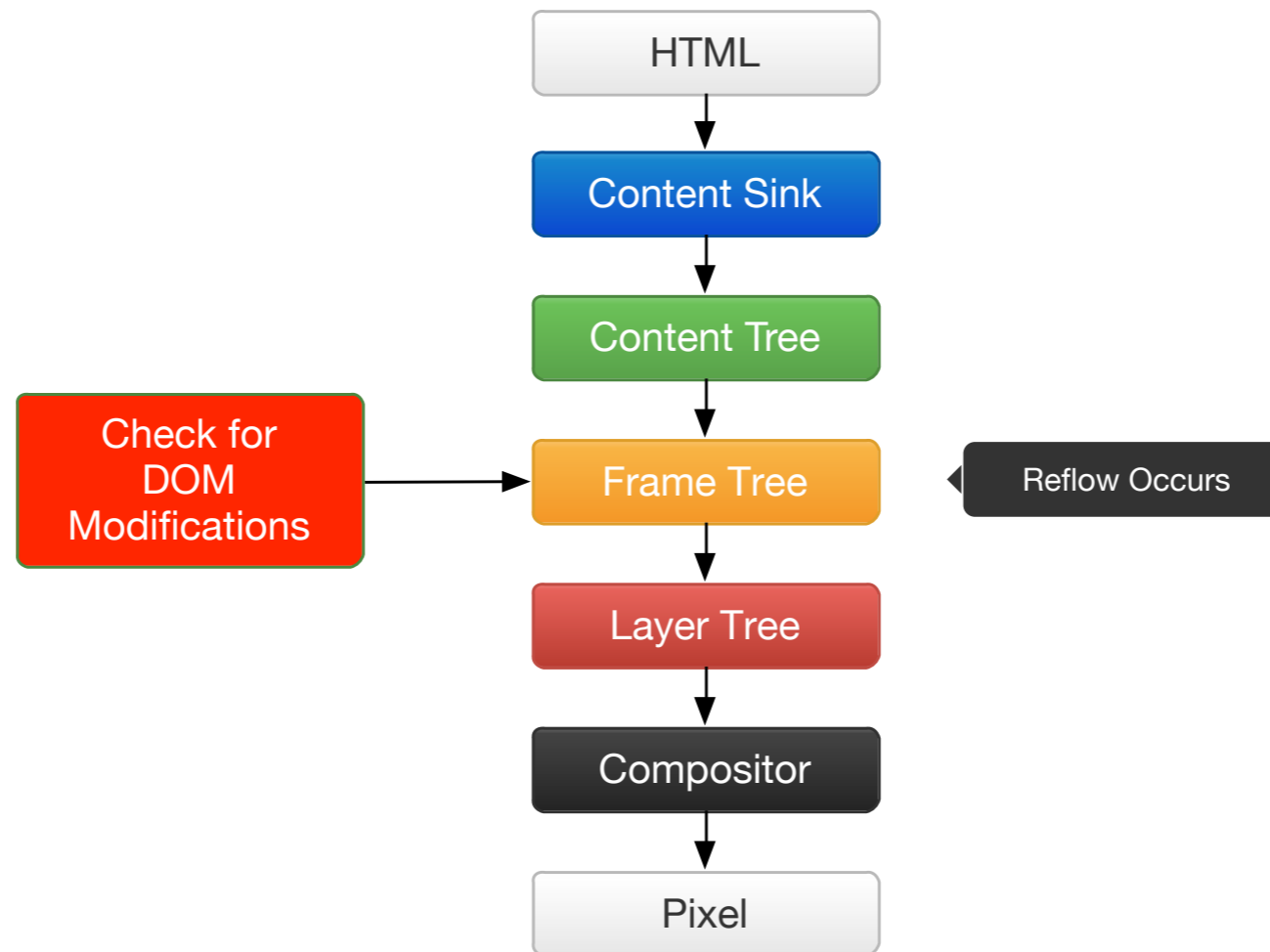
Where The Problems Are



Where The Problems Are



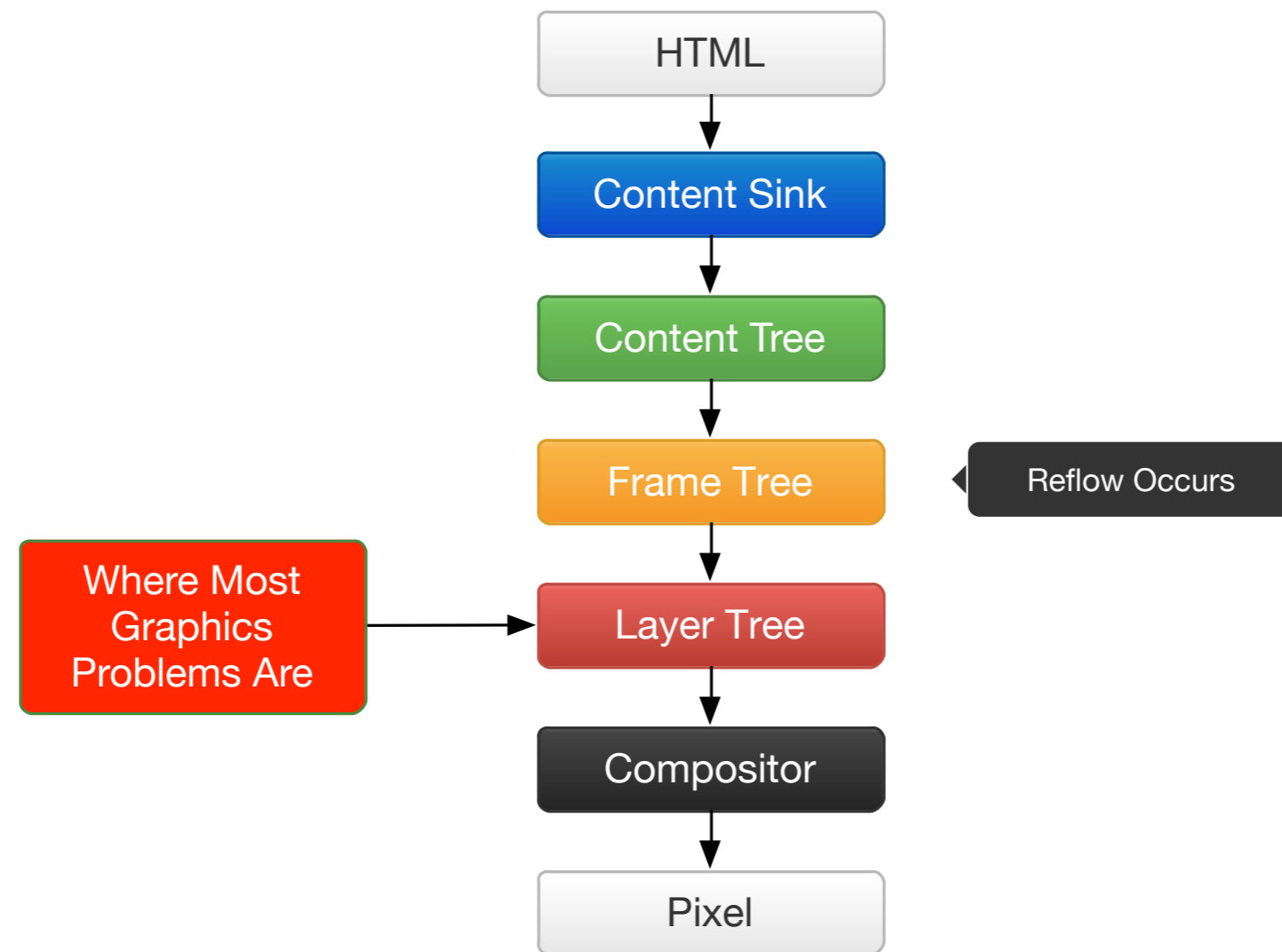
Reflow Optimizations



Reflow Optimizations

- In a profile, you should see lots of time spent in `nsFrame::Reflow` or one of the subclasses of `nsFrame` (e.g. `nsTextFrame::Reflow`).
- Can check how much time is spent in reflow w/ devtools, CSS > Log - Enable this option.
- General Solution: Find out where DOM modifications are hiding and batch them or try not to do them, try not to use `display:none`.
 - If you use `display:none` and add DOM nodes, you won't have the reflows.

Most Graphics Issues



Graphics Pipeline

- Most of the graphics issues are due to layout issues. Every single frame must traverse the layer tree. Minimizing the layer tree improves performance at every single frame composition, which we try to do 60 times a second.
- When things are slow, it probably means we blew up the layer tree somewhere.

Layer Manager (Parent / System)

Container

Thebes

Color

Container

Thebes

Textures

Container

Thebes

Color

RefLayer (Client / App)

Container

Thebes

Container

Thebes

Textures

Container

Thebes

Textures

Container

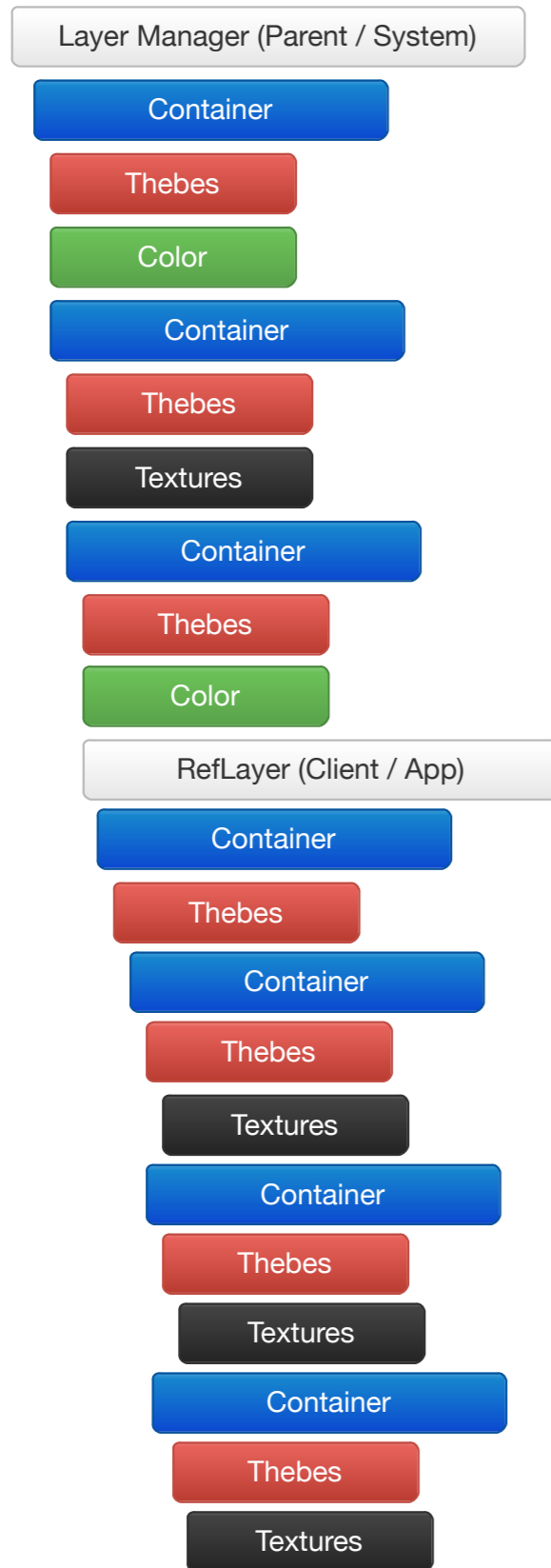
Thebes

Textures

Layer Tree For the Settings App

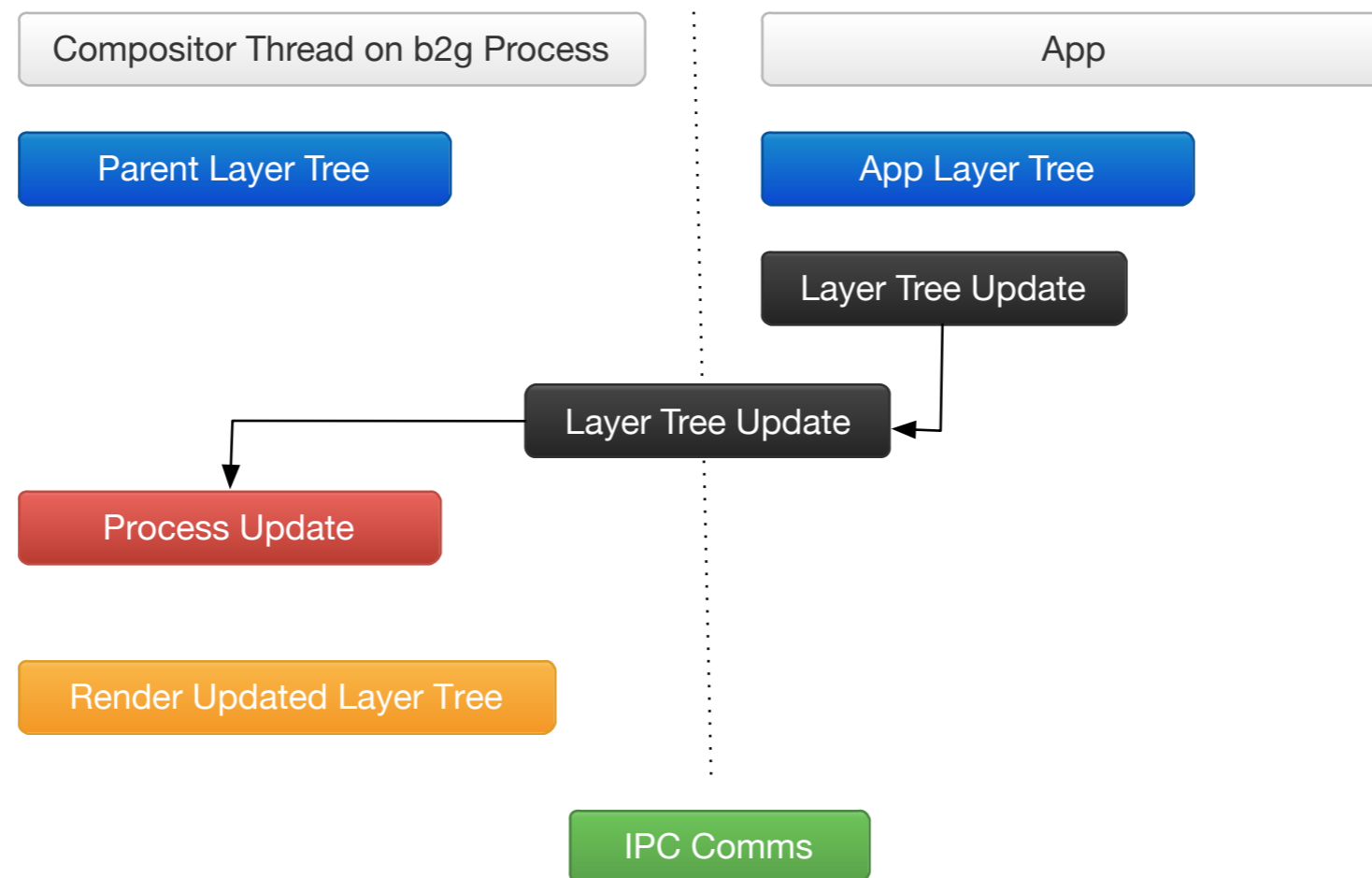
Layers above the RefLayer are in the System app / b2g process. Such as the status bar.

Layers below the RefLayer are in the actual app like the Settings App.



- Container Layers - contains other layers
- Thebes - Used for drawing / textures.
 - Textures - Shared mem for the GPU
- Color - Simple opaque background-color layers. Cheap!
- RefLayer - The Child Process

Layer's Architecture



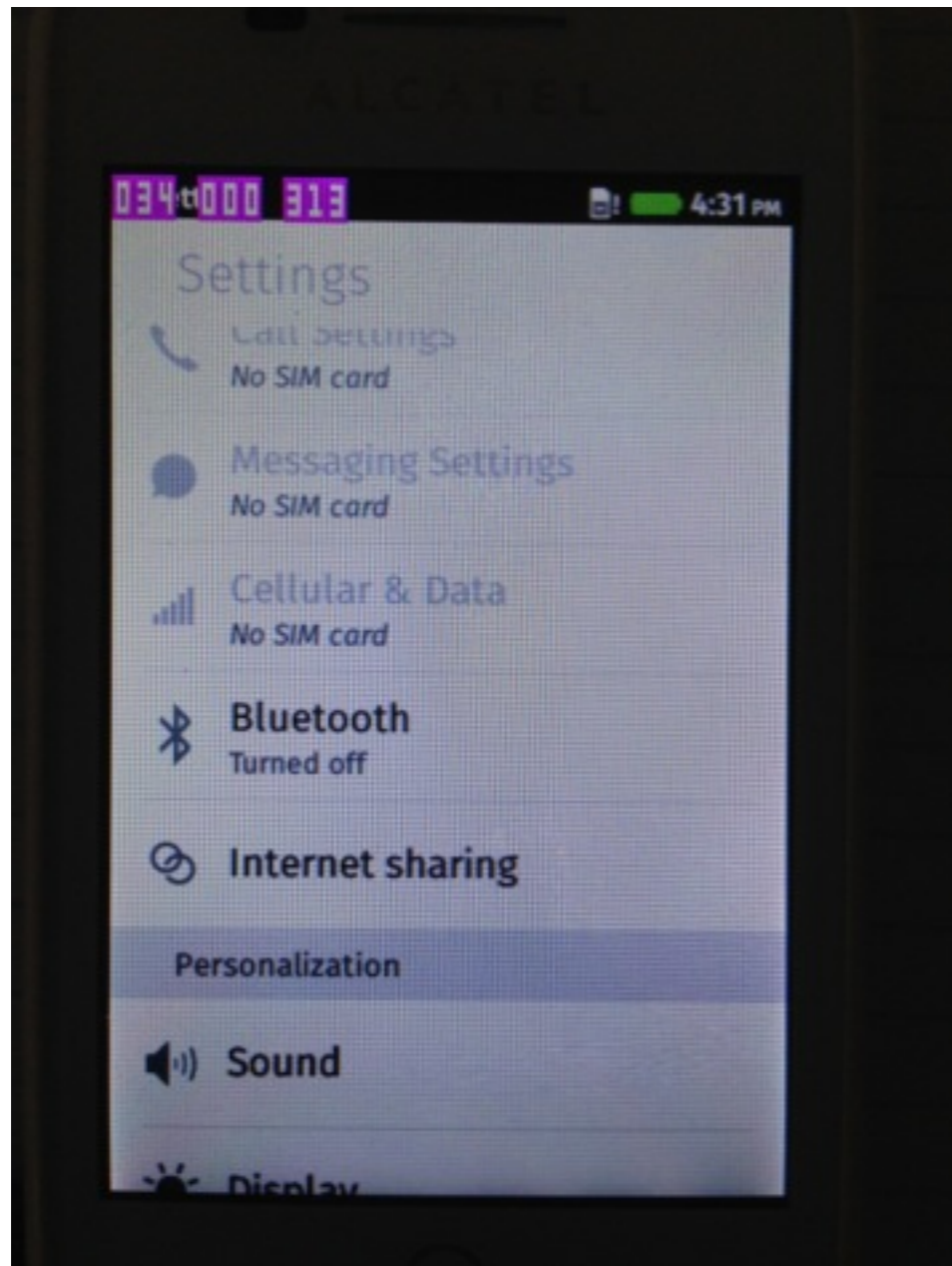
Layers.dump

I/Gecko (1010): LayerManager (0x43fc6500)

```
I/Gecko (1010): ContainerLayerComposite (0x46a9b800) [shadow-visible=< (x=0, y=0, w=320, h=480); >] [visible=< (x=0, y=0, w=320, h=480); >] [opaqueContent]
[metrics={ viewport=(x=0.000000, y=0.000000, w=320.000000, h=480.000000) viewportScroll=(x=0.000000, y=0.000000) displayport=(x=0.000000, y=0.000000, w=0.000000, h=0.000000)
scrollableRect=(x=0.000000, y=0.000000, w=320.000000, h=485.000000) scrollId=0 }]
I/Gecko (1010): ThebesLayerComposite (0x48dc6800) [shadow-clip=(x=0, y=0, w=0, h=0)] [clip=(x=0, y=0, w=0, h=0)] [not visible]
I/Gecko (1010): ColorLayerComposite (0x483cc000) [not visible] [opaqueContent] [color=rgba(0, 0, 0, 1)]
I/Gecko (1010): ContainerLayerComposite (0x483cb400) [shadow-clip=(x=0, y=0, w=320, h=480)] [shadow-visible=< (x=0, y=0, w=320, h=480); >] [clip=(x=0, y=0, w=320, h=480)]
[visible=< (x=0, y=0, w=320, h=480); >] [opaqueContent]
I/Gecko (1010): ThebesLayerComposite (0x483cb800) [shadow-visible=< (x=0, y=0, w=320, h=20); >] [visible=< (x=0, y=0, w=320, h=20); >] [opaqueContent] [valid=< (x=0, y=0,
w=320, h=20); >]
I/Gecko (1010):      DeprecatedContentHostDoubleBuffered (0x45d62970) [buffer-rect=(x=0, y=0, w=320, h=480)] [buffer-rotation=(x=0, y=0)]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x4627a580) [size=(width=320, height=480)] [format=SurfaceFormat::B8G8R8X8] [flags=TEXTURE_USE_NEAREST_FILTER]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x4627a600) [size=(width=320, height=480)] [format=SurfaceFormat::B8G8R8X8] [flags=TEXTURE_USE_NEAREST_FILTER]
I/Gecko (1010): ContainerLayerComposite (0x46292800) [shadow-clip=(x=0, y=20, w=320, h=460)] [clip=(x=0, y=20, w=320, h=460)] [visible=< (x=0, y=20, w=320, h=460); >]
[opaqueContent]
I/Gecko (1010): ThebesLayerComposite (0x46292c00) [shadow-clip=(x=0, y=0, w=0, h=0)] [clip=(x=0, y=0, w=0, h=0)] [not visible]
I/Gecko (1010): ColorLayerComposite (0x46293000) [shadow-visible=< (x=0, y=20, w=320, h=460); >] [visible=< (x=0, y=20, w=320, h=460); >] [opaqueContent] [color=rgba(255, 255,
255, 1)]
I/Gecko (1010): RefLayerComposite (0x46291c00) [shadow-clip=(x=0, y=20, w=320, h=460)] [shadow-transform=[ 1 0; 0 1; 0 20; ]] [shadow-visible=< (x=0, y=0, w=320, h=460); >]
[clip=(x=0, y=20, w=320, h=460)] [transform=[ 1 0; 0 1; 0 20; ]] [visible=< (x=0, y=0, w=320, h=460); >] [id=4]
I/Gecko (1010): ContainerLayerComposite (0x45ec6400) [shadow-visible=< (x=0, y=0, w=320, h=460); >] [visible=< (x=0, y=0, w=320, h=460); >] [opaqueContent]
[metrics={ viewport=(x=0.000000, y=0.000000, w=320.000000, h=460.000000) viewportScroll=(x=0.000000, y=0.000000) displayport=(x=0.000000, y=0.000000, w=0.000000, h=0.000000)
scrollableRect=(x=0.000000, y=0.000000, w=640.000000, h=460.000000) scrollId=2 }]
I/Gecko (1010): ThebesLayerComposite (0x4477c000) [not visible] [opaqueContent]
I/Gecko (1010): ContainerLayerComposite (0x45772800) [shadow-clip=(x=0, y=0, w=320, h=460)] [shadow-visible=< (x=0, y=0, w=320, h=460); >] [clip=(x=0, y=0, w=320, h=460)]
[visible=< (x=0, y=0, w=320, h=460); >] [opaqueContent]
I/Gecko (1010): ThebesLayerComposite (0x45774c00) [shadow-visible=< (x=0, y=0, w=320, h=50); >] [visible=< (x=0, y=0, w=320, h=50); >] [opaqueContent] [valid=< (x=0, y=0,
w=320, h=50); >]
I/Gecko (1010):      DeprecatedContentHostDoubleBuffered (0x45a15d30) [buffer-rect=(x=0, y=0, w=320, h=50)] [buffer-rotation=(x=0, y=0)]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x45939b40) [size=(width=320, height=50)] [format=SurfaceFormat::B8G8R8X8] [flags=NoFlags]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x44fc8800) [size=(width=0, height=0)] [format=SurfaceFormat::UNKNOWN] [flags=NoFlags]
I/Gecko (1010): ContainerLayerComposite (0x44fad000) [shadow-clip=(x=0, y=50, w=320, h=410)] [shadow-transform=[ 1 0; 0 1; 0 0.362061; ]] [shadow-visible=< (x=0, y=-463,
w=320, h=1435); >] [clip=(x=0, y=50, w=320, h=410)] [visible=< (x=0, y=-463, w=320, h=1435); >] [metrics={ viewport=(x=0.000000, y=50.000000, w=320.000000, h=410.000000)
viewportScroll=(x=0.000000, y=518.000000) displayport=(x=0.000000, y=-512.866638, w=320.000000, h=1435.000000) scrollableRect=(x=0.000000, y=0.000000, w=320.000000,
h=1812.000000) scrollId=18 }]
I/Gecko (1010): ThebesLayerComposite (0x46a99400) [shadow-transform=[ 1 0; 0 1; 0 -468; ]] [shadow-visible=< (x=0, y=5, w=320, h=1435); >] [transform=[ 1 0; 0 1; 0 -468; ]]
[visible=< (x=0, y=5, w=320, h=1435); >] [valid=< (x=0, y=5, w=320, h=1435); >]
I/Gecko (1010):      DeprecatedContentHostDoubleBuffered (0x45d611d0) [buffer-rect=(x=0, y=5, w=320, h=1435)] [buffer-rotation=(x=0, y=0)]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x44fc8880) [size=(width=320, height=1435)] [format=SurfaceFormat::B8G8R8A8] [flags=NoFlags]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x45939b00) [size=(width=320, height=1435)] [format=SurfaceFormat::B8G8R8A8] [flags=NoFlags]
I/Gecko (1010): ContainerLayerComposite (0x469a0400) [shadow-clip=(x=0, y=0, w=320, h=460)] [shadow-transform=[ 1 0; 0 1; 0 -0.0819232; ]] [shadow-visible=< (x=312, y=167,
w=6, h=85); >] [clip=(x=0, y=0, w=320, h=460)] [visible=< (x=312, y=167, w=6, h=85); >] [vscrollbar=18]
I/Gecko (1010): ContainerLayerComposite (0x46a99800) [shadow-clip=(x=0, y=0, w=320, h=460)] [shadow-visible=< (x=312, y=167, w=6, h=85); >] [clip=(x=0, y=0, w=320, h=460)]
[visible=< (x=312, y=167, w=6, h=85); >]
I/Gecko (1010): ThebesLayerComposite (0x46a9c000) [shadow-transform=[ 1 0; 0 1; 312 168; ]] [shadow-visible=< (x=0, y=-1, w=6, h=85); >] [transform=[ 1 0; 0 1; 312 168; ]]
[visible=< (x=0, y=-1, w=6, h=85); >] [valid=< (x=0, y=-1, w=64, h=85); >]
I/Gecko (1010):      DeprecatedContentHostDoubleBuffered (0x45d61240) [buffer-rect=(x=0, y=-1, w=64, h=85)] [buffer-rotation=(x=0, y=0)]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x45939e00) [size=(width=64, height=85)] [format=SurfaceFormat::B8G8R8A8] [flags=NoFlags]
I/Gecko (1010):      GrallocDeprecatedTextureHostOGL (0x45939cc0) [size=(width=0, height=0)] [format=SurfaceFormat::UNKNOWN] [flags=NoFlags]
```

Checking For Too Many Layers

- If you don't want to read the layers.dump....



The Third Number on the FPS counter shows us how many times we're overpainting a pixel. If it is over 300 - 400, we have too many layers. Disable HWC to get a better FPS Count.

Removing Layers

- Having a Scrollable Opaque Background. This involves playing with the CSS, but you can try to add a picture as the background. If it scrolls with the content, you're good. If it is fixed, try putting the scrollable content in a opaque background-color. The Layer FPS count should drop by ~100
- Opaque Content = Good. Transparent items == two layers. The transparent item + the item behind it.

APZ Controller and Scrolling

Top of Scroll:

```
ContainerLayerComposite (0x468ea000) [shadow-clip=(x=0, y=50, w=320, h=410)] [shadow-transform=[ 1 0; 0 1; 0 0.243332; ]] [shadow-visible=< (x=0, y=-9, w=320, h=1435); >] [clip=(x=0, y=50, w=320, h=410)] [visible=< (x=0, y=-9, w=320, h=1435); >] [opaqueContent] [metrics={ viewport=(x=0.000000, y=50.000000, w=320.000000, h=410.000000) viewportScroll=(x=0.000000, y=59.000000) displayport=(x=0.000000, y=-59.000000, w=320.000000, h=1435.000000) scrollableRect=(x=0.000000, y=0.000000, w=320.000000, h=1812.000000) scrollId=18 }]
```

```
ThebesLayerComposite (0x468ea400) [shadow-transform=[ 1 0; 0 1; 0 -9; ]] [shadow-visible=< (x=0, y=0, w=320, h=1435); >] [transform=[ 1 0; 0 1; 0 -9; ]] [visible=< (x=0, y=0, w=320, h=1435); >] [opaqueContent] [valid=< (x=0, y=0, w=320, h=1435); >]
```

Bottom of Scroll:

```
ContainerLayerComposite (0x468ea000) [shadow-clip=(x=0, y=50, w=320, h=410)] [shadow-transform=[ 1 0; 0 1; 0 0.293457; ]] [shadow-visible=< (x=0, y=-463, w=320, h=1435); >] [clip=(x=0, y=50, w=320, h=410)] [visible=< (x=0, y=-463, w=320, h=1435); >] [metrics={ viewport=(x=0.000000, y=50.000000, w=320.000000, h=410.000000) viewportScroll=(x=0.000000, y=559.000000) displayport=(x=0.000000, y=-512.799988, w=320.000000, h=1435.000000) scrollableRect=(x=0.000000, y=0.000000, w=320.000000, h=1812.000000) scrollId=18 }]
```

```
ThebesLayerComposite (0x468ea400) [shadow-transform=[ 1 0; 0 1; 0 -509; ]] [shadow-visible=< (x=0, y=46, w=320, h=1435); >] [transform=[ 1 0; 0 1; 0 -509; ]] [visible=< (x=0, y=46, w=320, h=1435); >] [valid=< (x=0, y=46, w=320, h=1435); >]
```

The transform tells us how many pixels we've scrolled (509px). The display port tells us how much we've drawn.

RenderTrace

- Enable Rendertrace by `APZC_ENABLE_RENDERTRACE` in `AsyncPanZoomController.cpp`.
- Copy / paste the RenderTrace output for a scrollable layer id into <http://people.mozilla.org/~kgupta/rendertrace.html>
- Example: `I/Gecko (136): (5,2,23)viewport RENDERTRACE 13479.466661 rect red 0.000000 0.000000 320.000000 460.000000`
- Red - What we're currently viewing
Brown - What is in the webpage.
Yellow - What APZ has requested to draw.
Green - What APZ has actually drawn.
- Checkerboarding occurs when the Red is outside the Green rectangle.