WEBRENDER

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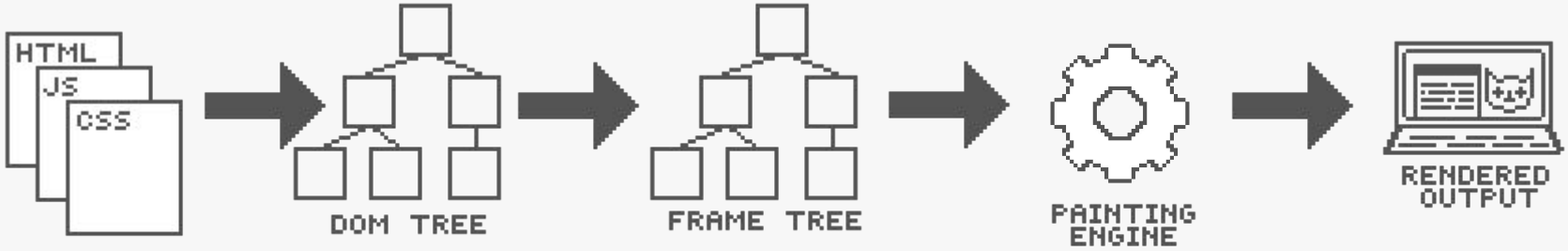
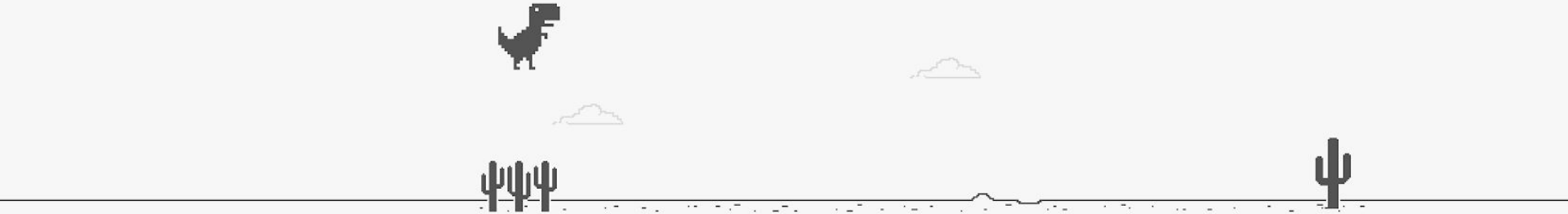
Page Rendering

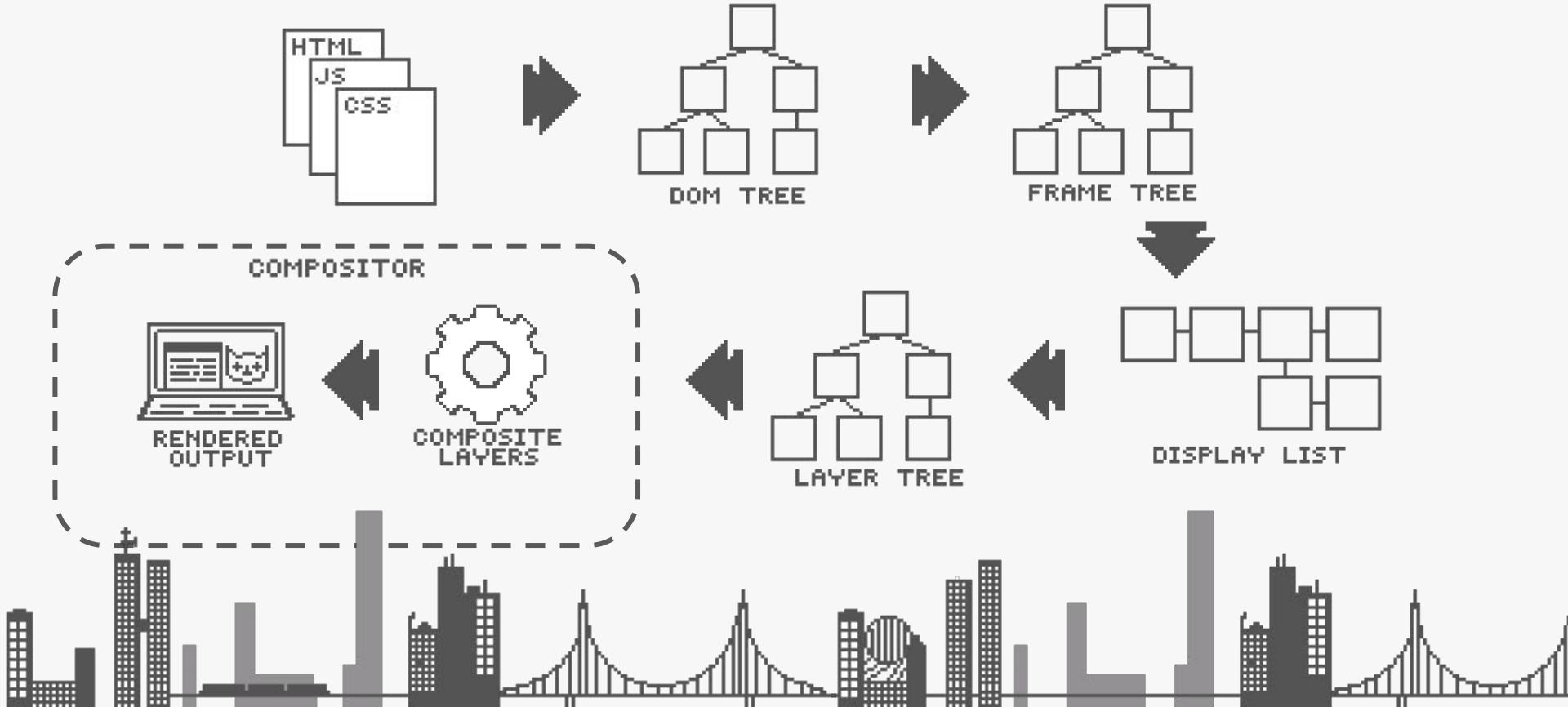
- Final stage in web engine pipeline
- Very performance sensitive
- Deeply integrated with input handling
- Competes with layout and script for CPU time
- Culprit in common web page problems
  - Slow frame rate
  - Scrolling jank
  - Rendering bugs

Ancient History





Modern Browsers



Pros and Cons of Layers

- Pros
  - Layers can move very quickly
  - Allows for 3D transformations
  - Re-rasterization can be limited to a single layer
- Cons
  - Overlapping layers lead to overdraw
  - Increased memory usage due to double or triple buffering
  - Still using the CPU to render content
  - GPU-usage not optimal
  - Deep rendering pipeline

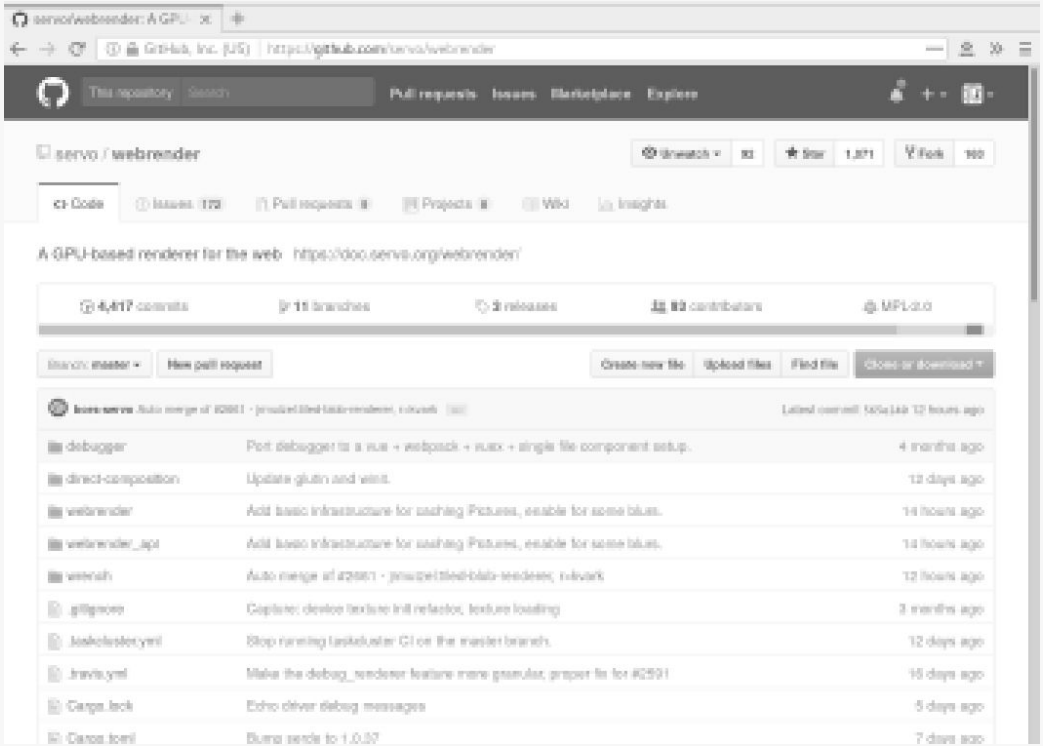
What is the ideal rendering engine for a browser?

Wish List

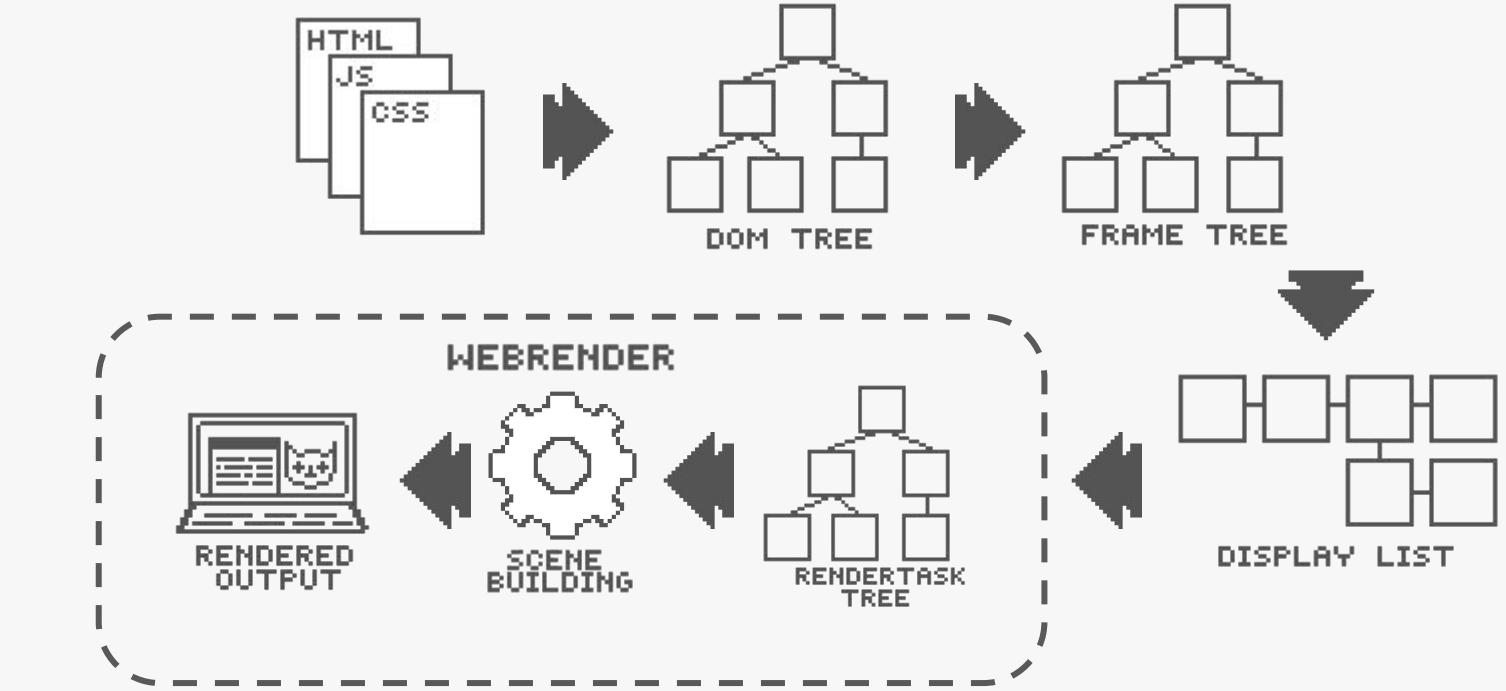
- Fast (60fps, especially when scrolling)
- Use the GPU as much as possible
- Use the CPU efficiently (Rust!!)
- Limit overdraw
- Limit memory usage

Focus on CSS Primitives

- Boxes
- Borders
- Images
- Text
- Shadows
- Gradients
- Stacking Contexts
  - Transformation
  - Blending
  - Filters



WebRender


HTML
JS
CSS
DOM TREE
FRAME TREE
DISPLAY LIST
WEBRENDER
RENDERTASK TREE
SCENE BUILDING
RENDERED OUTPUT

Z-Culling

- Every object assigned a z-index in the z-buffer
- Opaque objects are rendered from front-to-back
- Translucent objects are rendered back-to-front
- The GPU uses z-buffer to avoid painting occluded pixels

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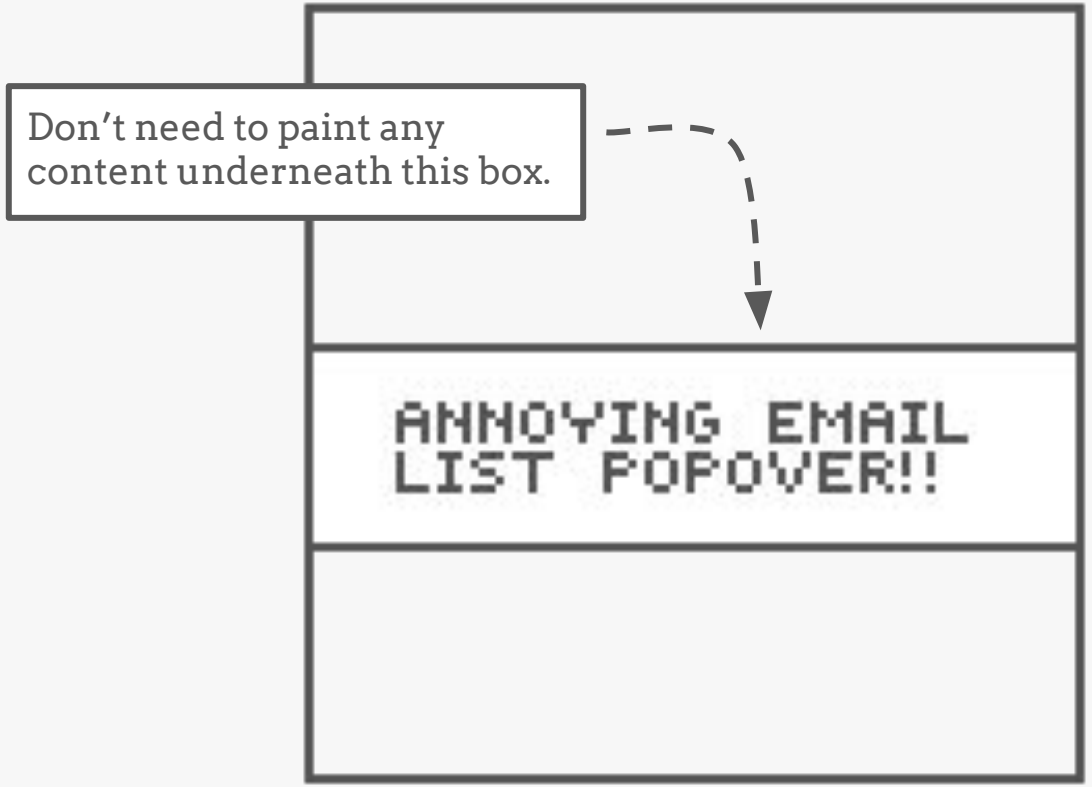

Batching

- Render similar things together
- Avoid GPU state changes
- Find a good balance between aggressive batching and opportunities for using the depth buffer

Caching

- We are re-rendering everything every frame
- Cache expensive primitives
  - Font glyphs
  - Shadows
  - Blurs

Trying WebRender

- If you use Servo, you are always using WebRender
- Firefox Nightly
  - about:config → layers.acceleration.force-enabled=true
  - Enable WebRender (3 options)
    - about:config → gfx.webrender.enabled=true
    - Environment variable: MOZ_WEBRENDER=1
    - Build with ac_add_options --enable-webrender

Collaborate

- Find us on Github: http://github.com/servo/webrender
- File bugs
  - Firefox specific bugs @ Bugzilla
  - WebRender specific bugs @ Github
- IRC (irc.mozilla.org)
  - #gfx
  - #servo
- Open bugs

Questions & Comments