



Chromium Overview

KOSSCON 2016, Jinho Bang, zino@chromium.org

Who am I?

- S/W에 소질없는 폭탄 제조 회사 근무 중 (Since 2011)
- Chromium/Blink Committer (Since 2014)
- Chromium/Blink WebPayments Owner (Since 2016)
- KOSSLAB Open Frontier 3기 (Since 2016)

Chromium/Blink?

- Chromium은 Chrome의 오픈소스
- Blink는 2013년에 WebKit에서 Fork한 웹브라우저 엔진
- 코드 크기는 대략 13GB, 빌드 시간 2시간, 메모리는 16GB 이상.
- 대략 55만 Commit(Since 2009), 5000여명의 Contributors
 - Linux Kernel의 경우 60만 Commit, 15000여명의 Contributors.
 - 이 자료는 Open Hub에서 나온 결과로 정확하지 않을 수 있음.

Contents

- Chromium Project는 어떻게 굴러가는가?
- Chromium Multiprocess Architecture
- Chromium은 어떻게 동작하나?
- Chromium과 Web Platform

*Chromium Project*는
어떻게 골라가는가?

Release Plan

- 6주에 한번 Release
 - Trunk (Chromium)
 - Dev (Chrome)
 - Beta (Chrome)
 - Stable (Chrome)
- 목표안에 문제를 해결 못하면?
 - 다음에 하는걸로..

Chrome Release Schedule

Release	Estimated week of stable
M54	2016/10/18
M55	2016/12/06
M56	2017/01/31
...	...

Development



Code Review

- Rietveld Review System 사용 (Chrome OS는 Gerrit)
- OWNERS File Policy
 - 각 디렉토리의 OWNER에게 반드시 리뷰를 받아야 함.
 - Committer든 Owner든 상관없고 무조건 리뷰 받아야 함.
- Security Review Policy
 - IPC를 타는 경우 무조건 Security Reviewer에게 리뷰를 받아야 함.
- 모든 파일에 대해서 LGTM되면 Landing 가능.

Code Review

☆ Issue [2472723003](#): PaymentApp: Add interfaces for PaymentAppManager. (Closed)

[Edit Issue](#)
[Publish+Mail Comments](#) (m)
[Start Review](#)

Created:
1 week ago by me

Modified:
2 days, 14 hours ago

Reviewers:
[haraken](#), [rousan](#)

CC:
chromium-reviews, blink-reviews,
sebg-paymentswatch_chromium.org,
rousan-payments_chromium.org

Target Ref:
refs/pending/heads/master

Project:
[chromium](#)

Visibility:
Private/Protected. Only viewable by @chromium and
@google accounts.

[More Reviews](#)

▼ Description

PaymentApp: Add interfaces for PaymentAppManager.

Just adding interfaces in blink side and implementing them in follow-up CL.
The interfaces are behind a new runtime flag.

Intent to implement:
https://crrev.com/a/chromium.org/forum/a/#topic=blink-dev/20190619_9

BUG=661608
Committed: <https://crrev.com/60a84ca8de638a26f850660ad8ba70ce2a41c>
Cr-Commit-Position: refs/heads/master#(430217)

► Patch Set 1 [\(edit\)](#)

Total comments: 14

► Patch Set 2 : PaymentApp: Add interfaces for PaymentAppManager. [\(edit\)](#)

▼ Patch Set 3 : PaymentApp: Add interfaces for PaymentAppManager. [\(edit\)](#)

Created: 6 days, 15 hours ago

Unified diffs	Side-by-side diffs	Delta from patch set	Stats (+245 lines, -0 lines)	Download [raw] [tar.bz2] Delete
► M third_party/WebKit/Layout/Tests/http/serviceworker/webexposed/global-interface-listing-service-worker-expected.txt	View	1	1 chunk +1 line, -0 lines 0 comments	Download
M third_party/WebKit/Layout/Tests/virtual/service-worker/navigation-preload/http/Tests/serviceworker/webexposed/global-interface-listing-service-worker-expected.txt	View	1 2	1 chunk +1 line, -0 lines 0 comments	Download
M third_party/WebKit/Layout/Tests/webexposed/global-interface-listing-dedicated-worker-expected.txt	View	1	1 chunk +1 line, -0 lines 0 comments	Download
M third_party/WebKit/Layout/Tests/webexposed/global-interface-listing-expected.txt	View	1 2	2 chunks +6 lines, -0 lines 0 comments	Download
M third_party/WebKit/Layout/Tests/webexposed/global-interface-listing-shared-worker-expected.txt	View	1	1 chunk +1 line, -0 lines 0 comments	Download
M third_party/WebKit/Source/modules/module_id_files.gni	View	1	4 chunks +8 lines, -0 lines 0 comments	Download
M third_party/WebKit/Source/modules/payments/BUILD.gn	View	1	1 chunk +4 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppManager.h	View	1	1 chunk +40 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppManager.cpp	View	1	1 chunk +37 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppManager.idl	View	1	1 chunk +12 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppManifest.idl	View	1	1 chunk +11 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppOption.idl	View	1	1 chunk +12 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppServiceWorkerRegistration.h	View	1	1 chunk +41 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppServiceWorkerRegistration.cpp	View	1	1 chunk +58 lines, -0 lines 0 comments	Download
A third_party/WebKit/Source/modules/payments/PaymentAppServiceWorkerRegistration.idl	View	1	1 chunk +11 lines, -0 lines 0 comments	Download
M third_party/WebKit/Source/platform/RuntimeEnabledFeatures.in	View	1 2	1 chunk +1 line, -0 lines 0 comments	Download

Trybot results: [win_chromium_x64_rel_ng](#) [winclang](#) [win_chromium_rel_ng](#) [win_chromium_compile_dbg_ng](#) [mac_chromium_rel_ng](#) [mac_chromium_compile_dbg_ng](#) [ios-simulator](#) [ios-device](#)
[linux_chromium_rel_ng](#) [linux_chromium_compile_dbg_ng](#) [linux_chromium_dlobber_rel_ng](#) [linux_chromium_chromeos_rel_ng](#) [linux_chromium_chromeos_ozone_rel_ng](#)
[linux_chromium_chromeos_compile_dbg_ng](#) [linux_chromium_asan_rel_ng](#) [chromium_presubmit](#) [chromeos_x86-generic_chromium_compile_only_ng](#) [chromeos_daisy_chromium_compile_only_ng](#)
[chromeos_amd64-generic_chromium_compile_only_ng](#) [cast_shell_linux](#) [blimp_linux_dbg](#) [linux_android_rel_ng](#) [cast_shell_android](#) [android_n5x_swarming_rel](#) [android_cronet](#) [android_compile_dbg](#)
[android_clang_dbg_recipe](#) [android_arm64_dbg_recipe](#) [More>>>](#)

Commit: ☐ (issue is closed) [CQ Status](#) [CQ not working?](#)
[Revert Patchset](#) [More info](#)

▼ Messages

Total messages: 29 (19 generated)

[Expand Messages](#) | [Collapse Messages](#) | [Show Generated Messages](#) | [Hide Generated Messages](#)

me PTAL

1 week ago (2016-11-02 17:53:55 UTC) #5

rousan Please update webexposed/global-interface-listing.html

6 days, 23 hours ago (2016-11-02 19:50:01 UTC) #6

rousan https://codereview.chromium.org/2472723003/diff/1/third_party/WebKit/Source/modules/payments/PaymentAppManager.h File third_party/WebKit/Source/mo

6 days, 22 hours ago (2016-11-02 20:08:31 UTC) #10

me I addressed your comments. Thank you for review. https://codereview.chromium.org/2472723003/diff/4/third_party/WebKit/Source/modules/payments/PaymentAppManager.h 6 days, 42 hours ago (2016-11-03 02:44:17 UTC) #15

Testing (코드 한줄 고치고 테스트 백줄)

- Browser Tests
 - Chrome Browser Tests
 - Content Browser Tests
- Unit Tests
 - Chrome Unit Tests (각 플랫폼 별로 별도 존재할 수 있음)
 - Content Unit Tests
 - Blink Unit Tests
- Layout Tests
 - HTML + JS로 작성
 - WebKit에서 넘어온 것, Chromium 전용, Web Platform Tests로 나뉠 수 있음.
- Performance Tests
 - Python으로 된 Telemetry Frameworks으로 작성

Testing (기타)

- ClusterFuzz
 - 기존 Layout Test 코드들을 마구마구 조합해서 사람을 괴롭히는데 사용
- Sheriff 정책
 - Performance, Memory 등 테스트 자동화를 감시하는 당번
- Bot
 - Trybot
 - Performance Bot
 - Prelanding Test Bot
 - Postlanding TestBot
 - Commit Bot
 - Bisector Bot

Intent & Web Standard

- 원가 다소 큰 변경을 하려면 intent를 mailing list에 날려야함.
 - Intent to implement: 월 구현할지 제안서를 써야함.
 - Intent to ship: Web Facing APIs를 포함하는 경우 API Owners로부터 LGTM > 3
 - Intent to experiment: experimental runtime flag에서 동작하도록 함.
 - Intent to deprecated: 삭제 전 통보
 - Intent to remove: 보통 UseCounter가 0.3% 이하인 경우
- Web Standard는 Implemenation을 필요로 하고, Implementation은 Web Standard를 따라야 함.
 - W3C의 경우 WD로 가기 위해서는 최소 2개 이상의 메이저 브라우저 벤더 구현이 필요함.
 - 표준이 정해지고 구현이 따라가는 것이 아니라 구현과 표준이 함께 움직임.

Multiprocess Architecture

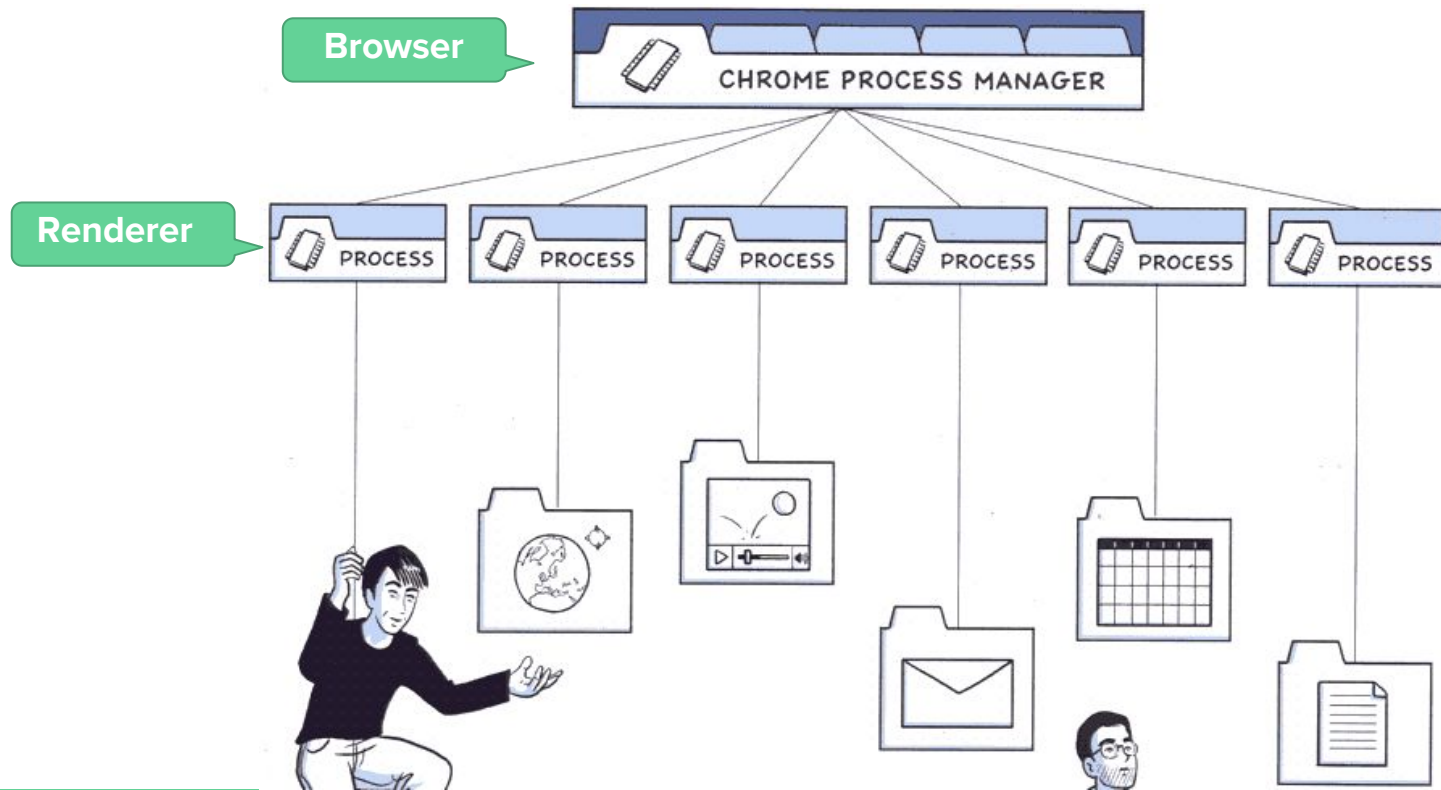
Why?

- 세상에 완벽한 렌더링 엔진이라는 것은 존재하지 않음.
- 세상에 완벽한 보안 따위는 없음.

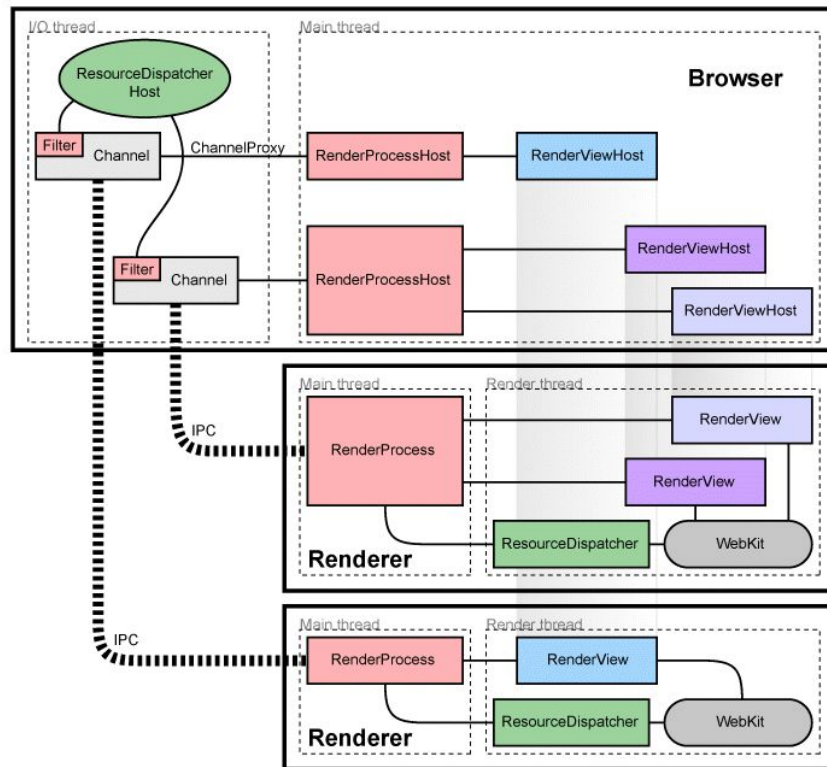
Why?



Browser & Renderer



Browser & Renderer



Threading

- Browser Process
 - UI Thread: main thread
 - IO Thread: IPC thread
 - File Thread
 - DB Thread
- Renderer Process
 - IO Thread: IPC thread
 - Render Thread: Blink Main Thread
 - Compositor Thread
 - Raster Thread

IPC (Browser <--> Renderer)

- 장점: 기본적으로 프로세스는 메모리 공유가 되지 않고, 필요한 데이터만 시큐리티 리뷰를 통해서 넣으므로 보안이 철벽
- 단점: 사람을 힘들게 함. (e.g. context menu에 save image 추가)
- 최근에는 사람을 좀 편하게 할려고 Mojo IPC로 넘어가는 중
 - Mojo는 유명한 Adam Barth, Eric Sidel 이런 놈들이 가서 만들고 나옴.
 - 최근 Blink 및 Chromium에서 이를 적용하기 위해 많은 일들을 하고 있음(e.g. Onion Soup)

*Chromium*은 어떻게
동작하나?

Browser의 동작 원리



Browser의 동작 원리

Loading

Parsing

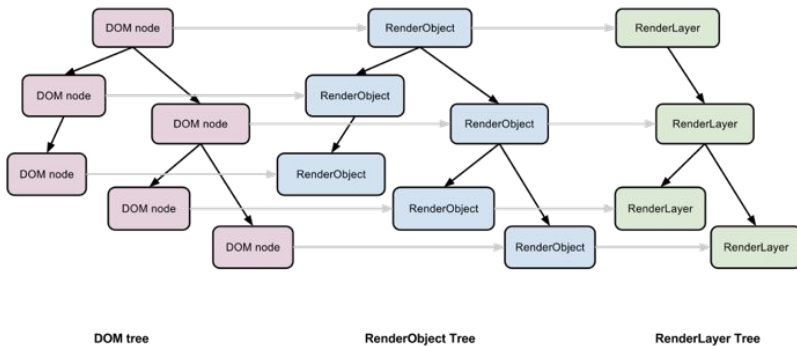
Layout

JS
Execution

Painting

UI Update

```
<html>
<head>
</head>
<body>
  
  <p>Chromium</p>
</body>
</html>
```

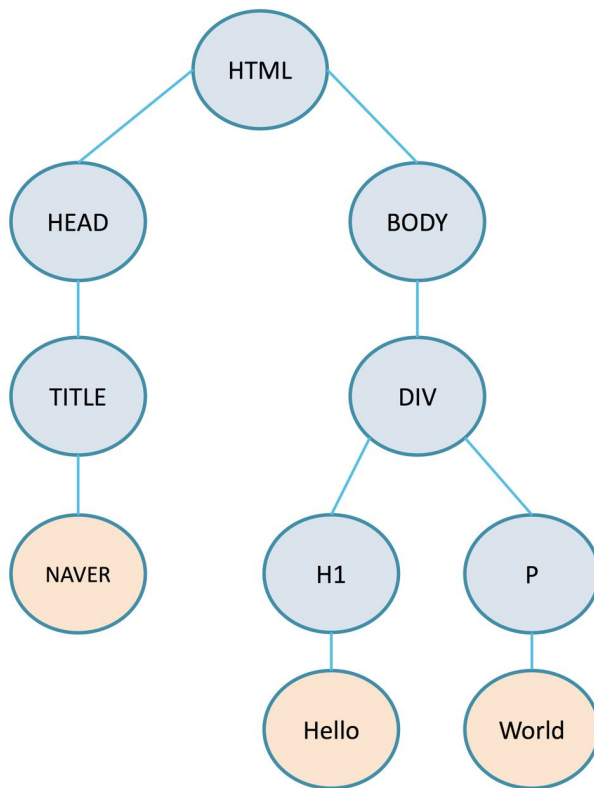


Parsing

- HTML Parsing
- CSS Parsing

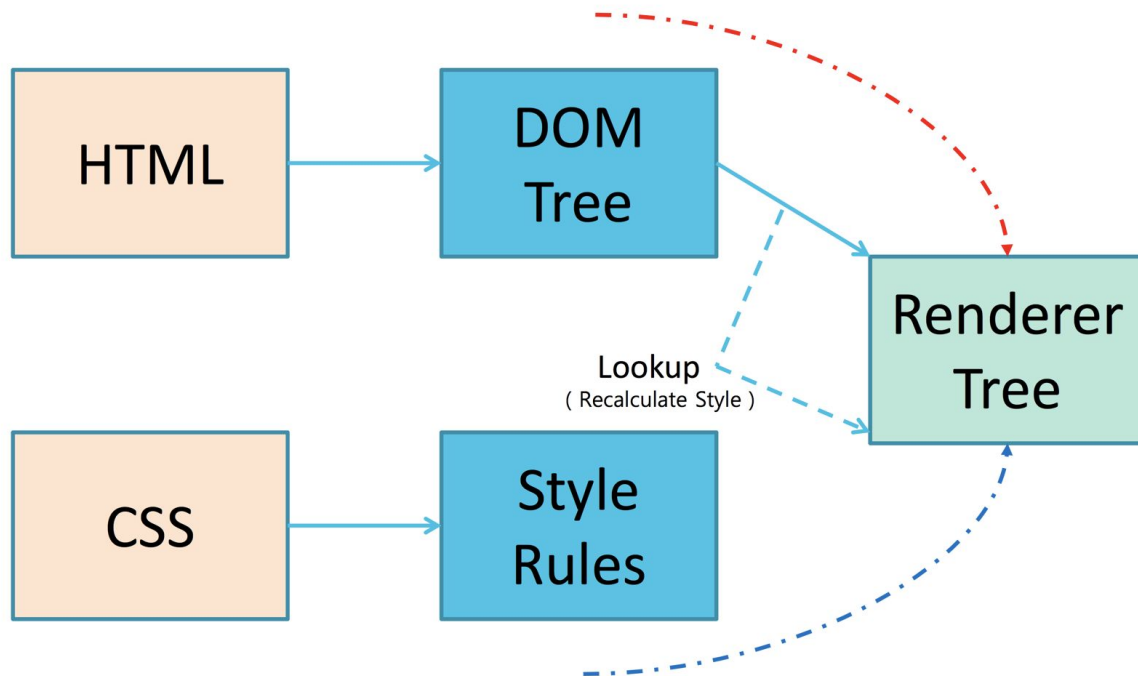
HTML Parsing

```
<html>  
  <head>  
    <title> NAVER </title>  
  </head>  
  <body>  
    <div>  
      <h1> Hello </h1>  
      <p> World </p>  
    </div>  
  </body>  
</html>
```

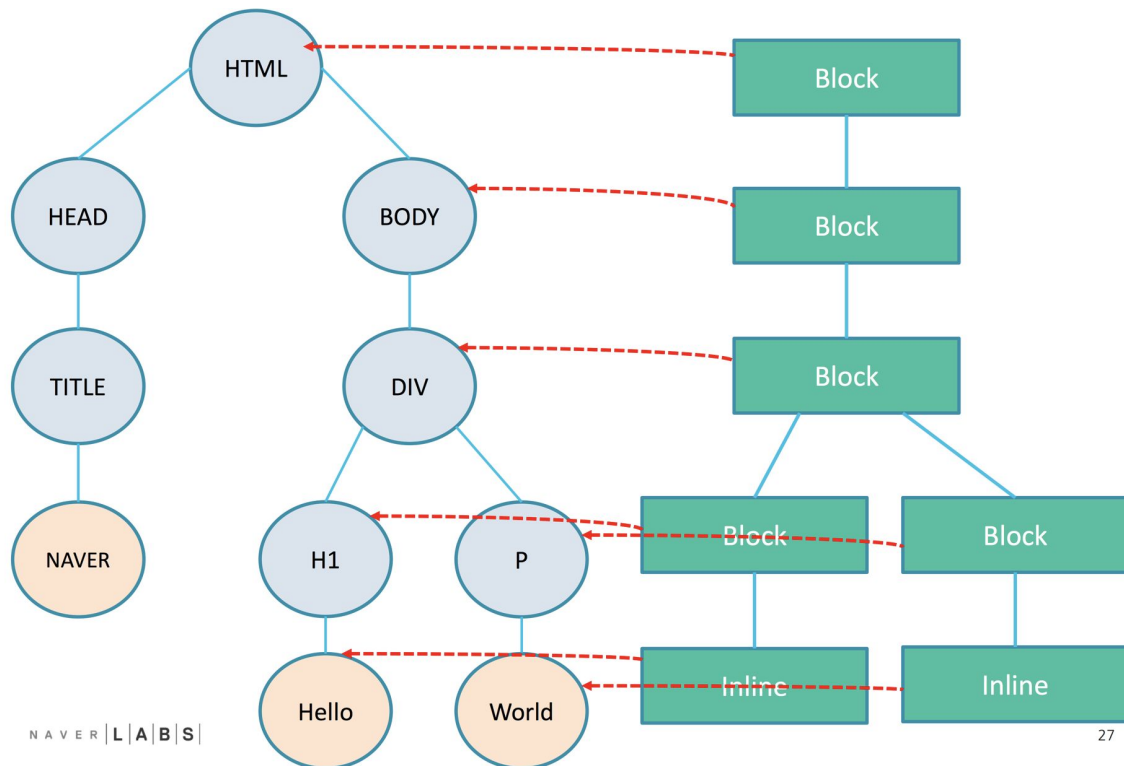


NAVER | L | A | B | S |

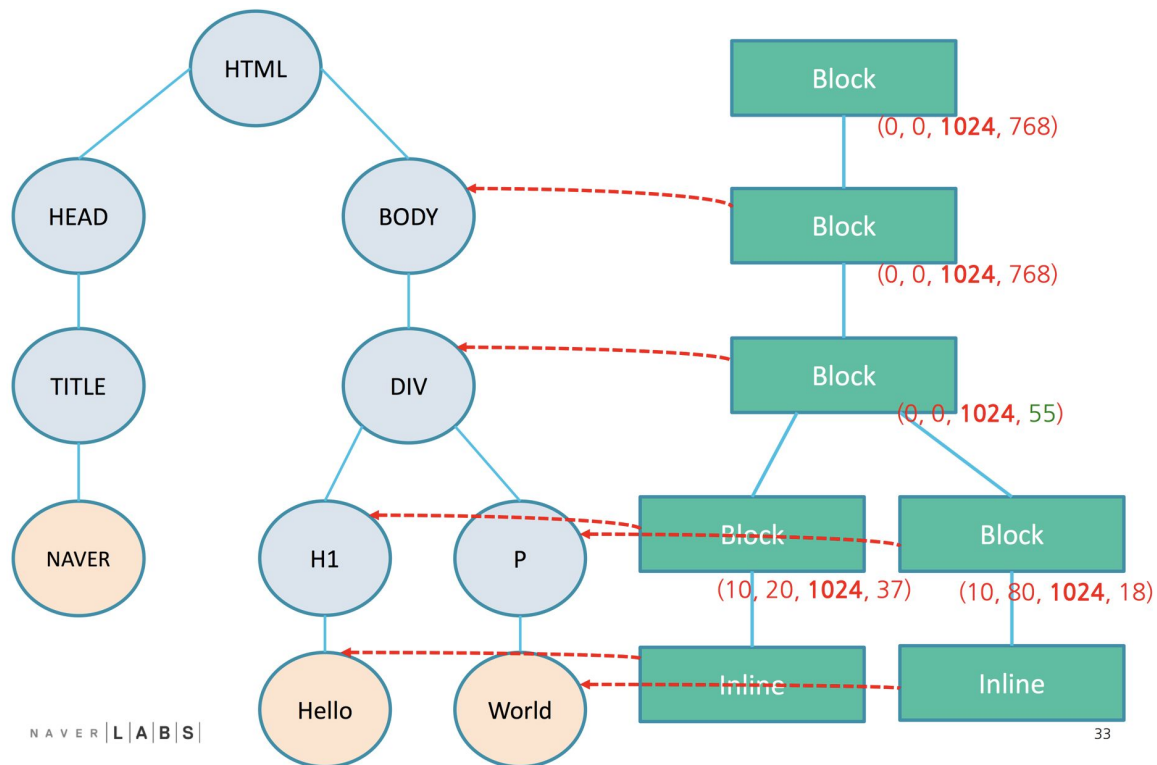
Construction Render Tree



Construction Render Tree



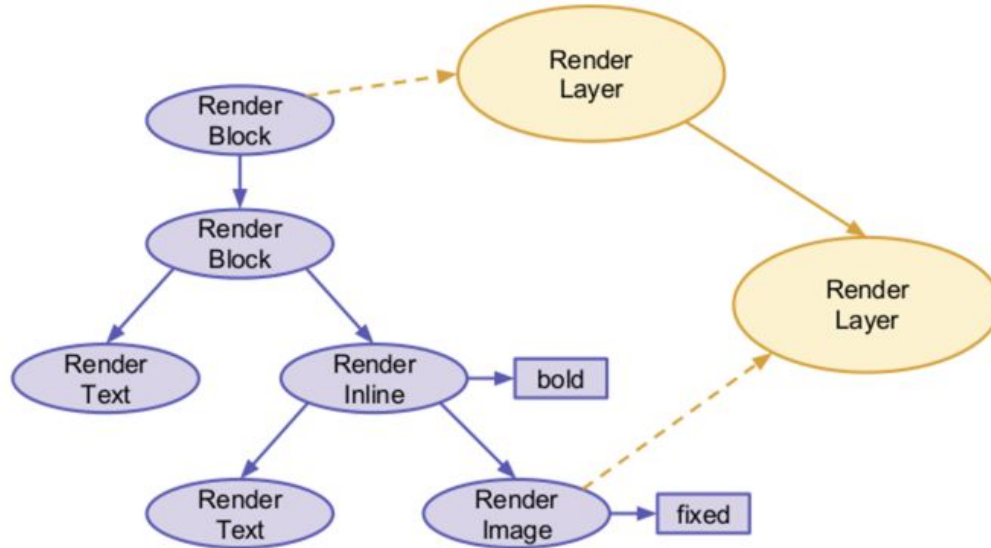
Layouting



Layouting은 언제 일어나나?

- When elements are attached
 - When first loaded
 - When HTML chunk is added (by script)
- When element's dimension is modified
- When sub resource (e.g. image) is loaded

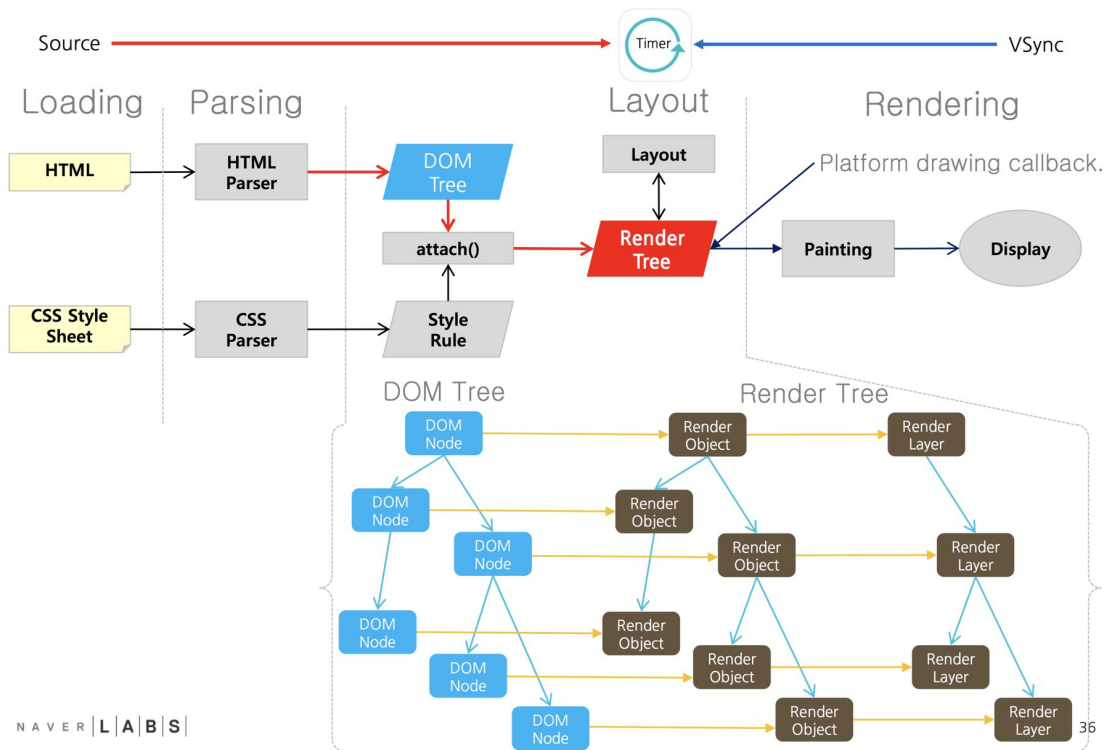
Construction Render Layer



From RenderObject to RenderLayer (좌표계 따라)

- It's the root object for the page
- It has explicit CSS position properties (relative, absolute, transform)
- It is transparent
- Has overflow, an alpha mask or reflection
- Has a CSS filter
- Corresponds to <canvas> element that has a 3D context or accelerated 2D context
- Corresponds to a <video> element

Blink Rendering Summary



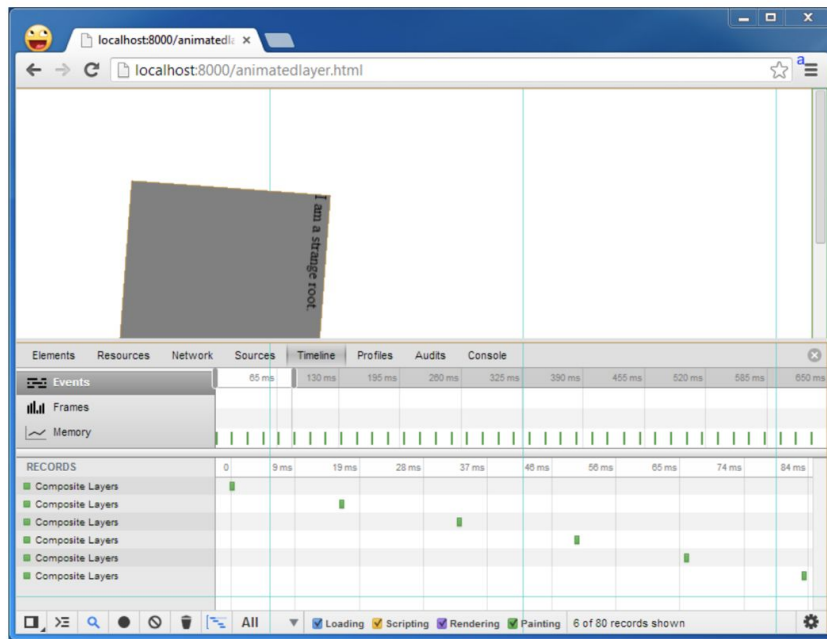
Chromium Rendering 관련 용어

- Texture: Bitmap이라고 생각하면 편함.
- Painting: RenderObject에서 GraphicsContext를 호출하는 것
- Recording: Blink관점에서 Painting, 실제 그려질 내용을 기록함.
- Rasterization: Back Buffer에다가 그리는 행위
- Compositing: Texture들을 합쳐서 최종적인 Image를 만드는 행위
- Drawing: 최종 이미지를 화면에다가 표시하는 행위.

GPU 가속의 장점

- Texture를 가지고 이미지를 빠르게 그릴 수 있음.
- 이미 업로드 된 Texture는 Raster 없이 재활용 가능.
- 회전, 확대, 축소, 기울임, 반투명 등을 Raster 없이 할 수 있음.
- 각 요소를 한번에 처리하는 것도 매우 빠름. (그래픽스 파이프 라인)

Compositing



Compositing 이란? = **GPU Texture Upload** + 각 레이어 합성
(Image Upload to GPU Memory)

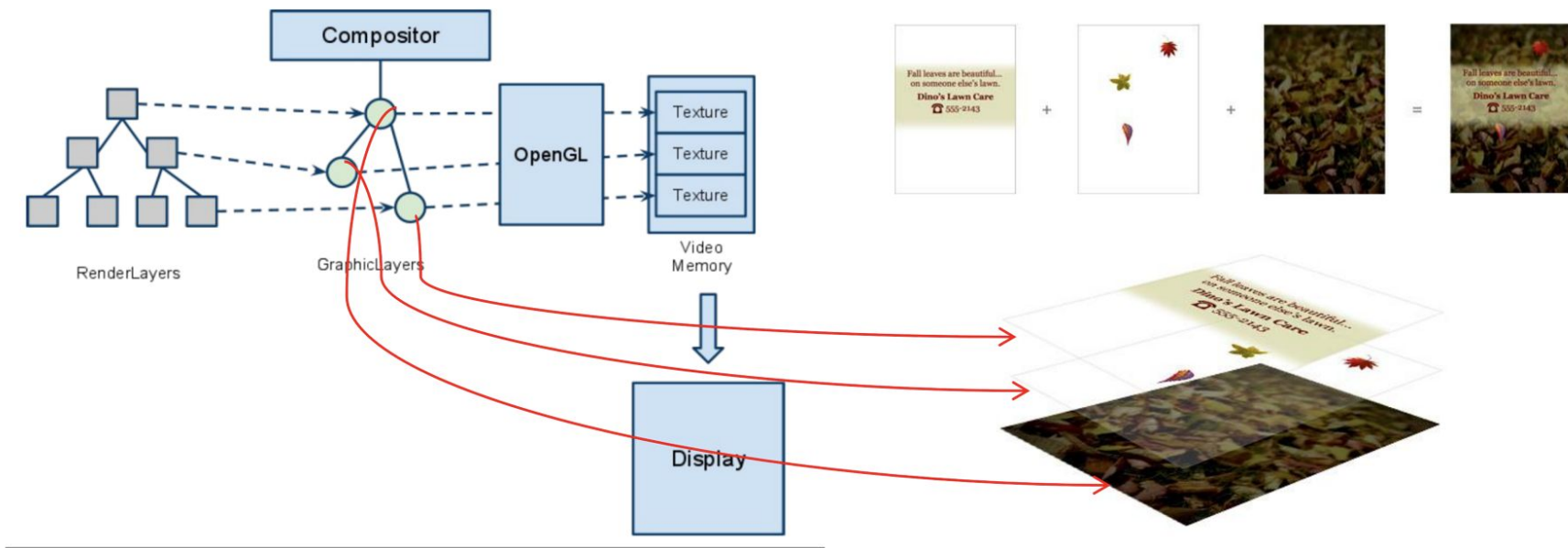
From 이형욱님: http://rtcc.hanyang.ac.kr/sitedata/2015_2_ISP/howbrowserswork_20150915.pdf

Compositing



[Source: WebKit.org]

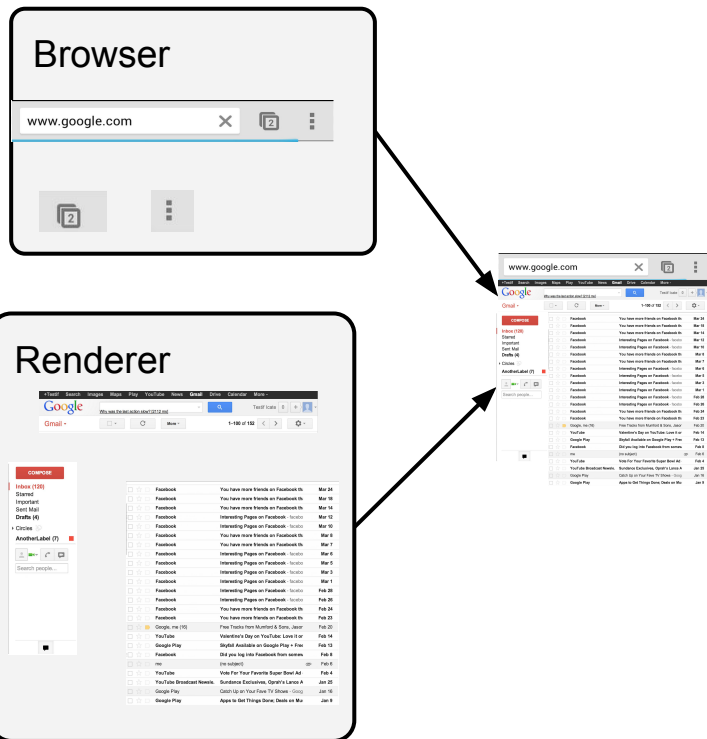
Compositing



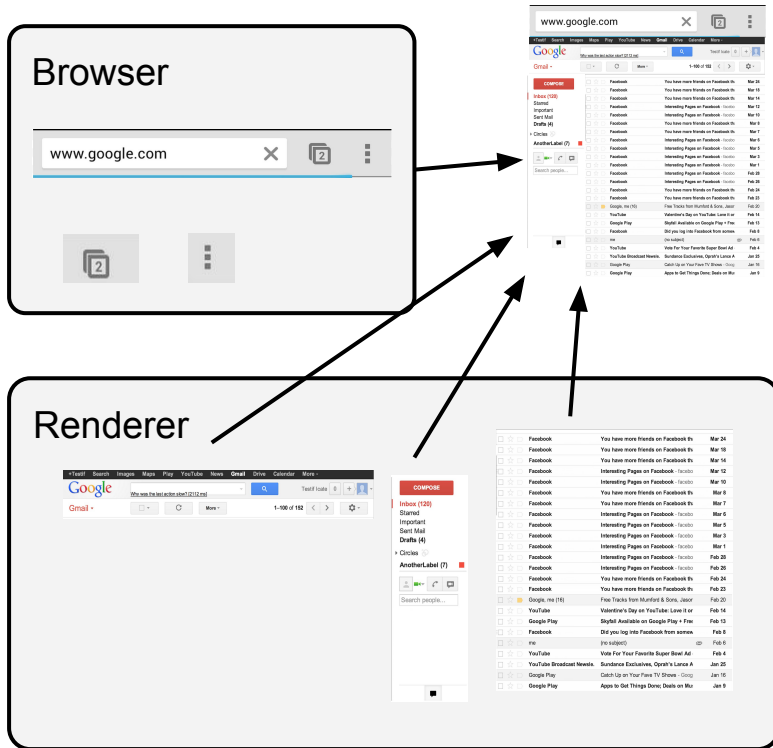
From RenderLayer to GraphicsLayer

- Layer has 3D or perspective transform CSS properties
- Layer is used by <video> element using accelerated video decoding
- Layer is used by a <canvas> element with a 3D context or accelerated 2D context
- Layer is used for a composited plugin
- Layer uses a CSS animation for its opacity or uses an animated transform
- Layer uses accelerated CSS filters
- Layer has a descendant that is a compositing layer
- Layer has a sibling with a lower z-index which has a compositing layer

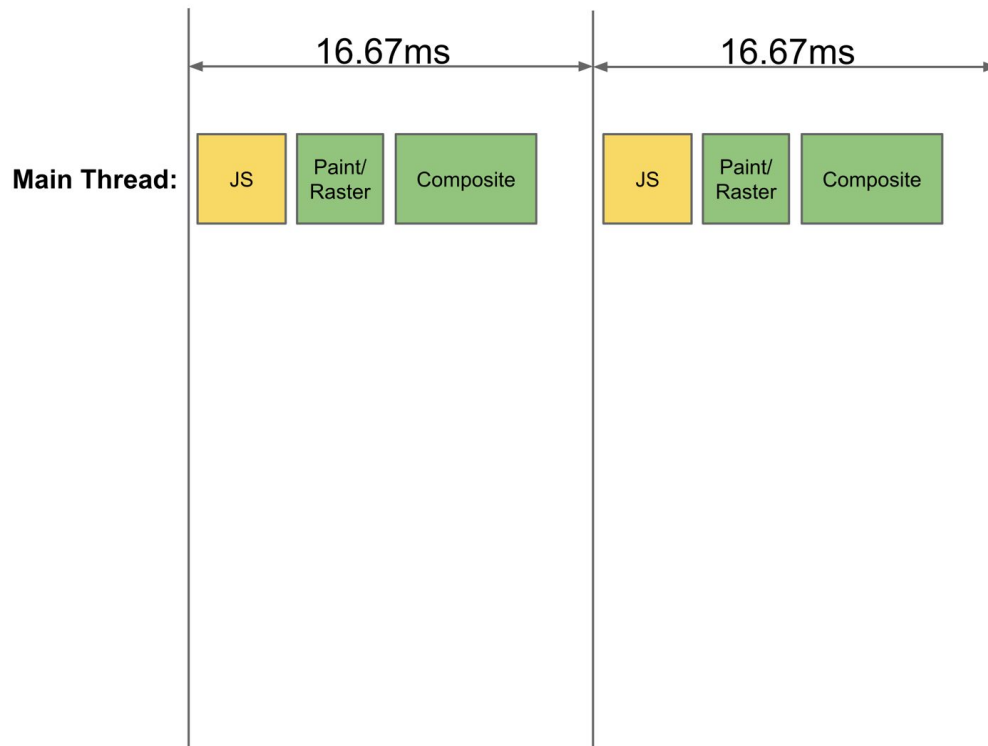
Ubercompositor



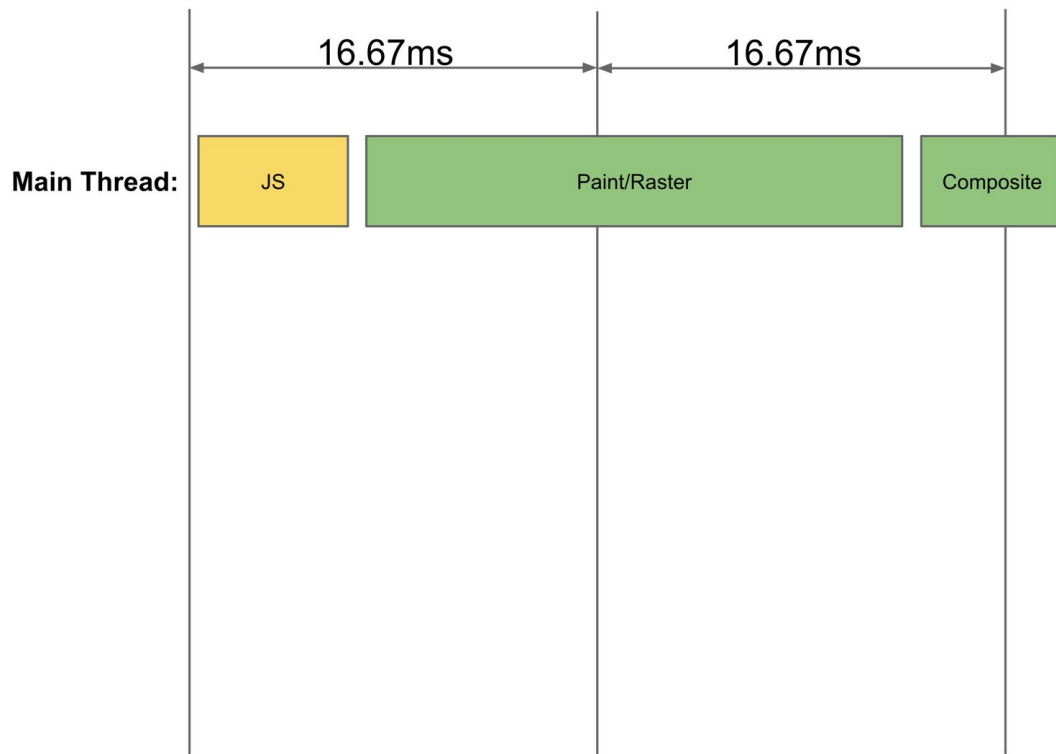
Ubercompositor



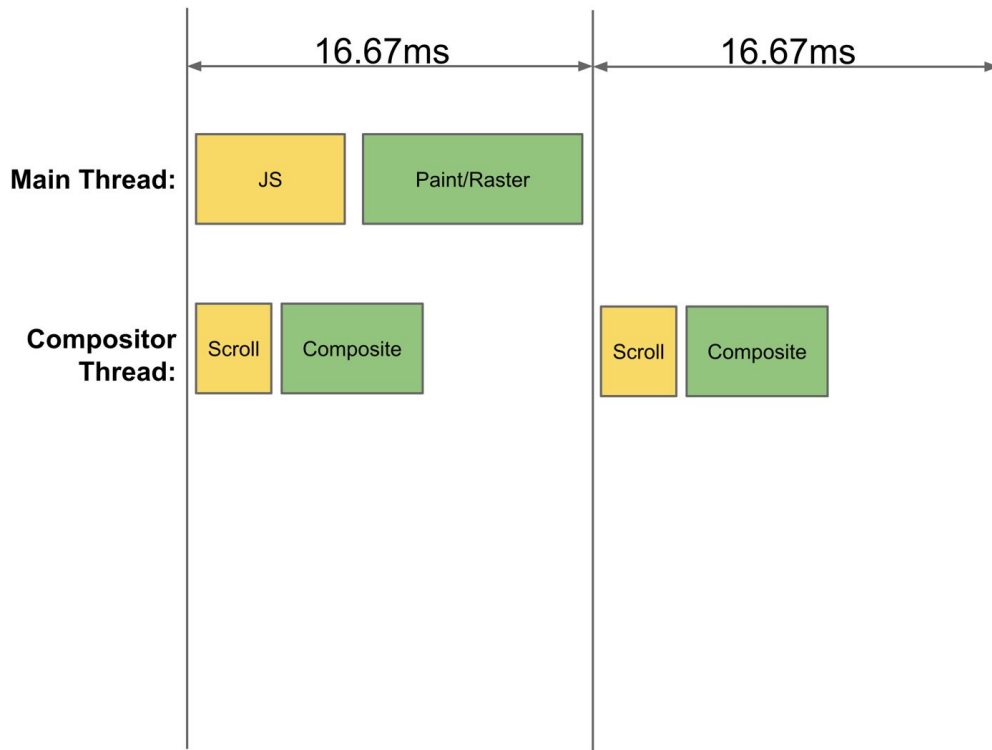
Threaded Compositing



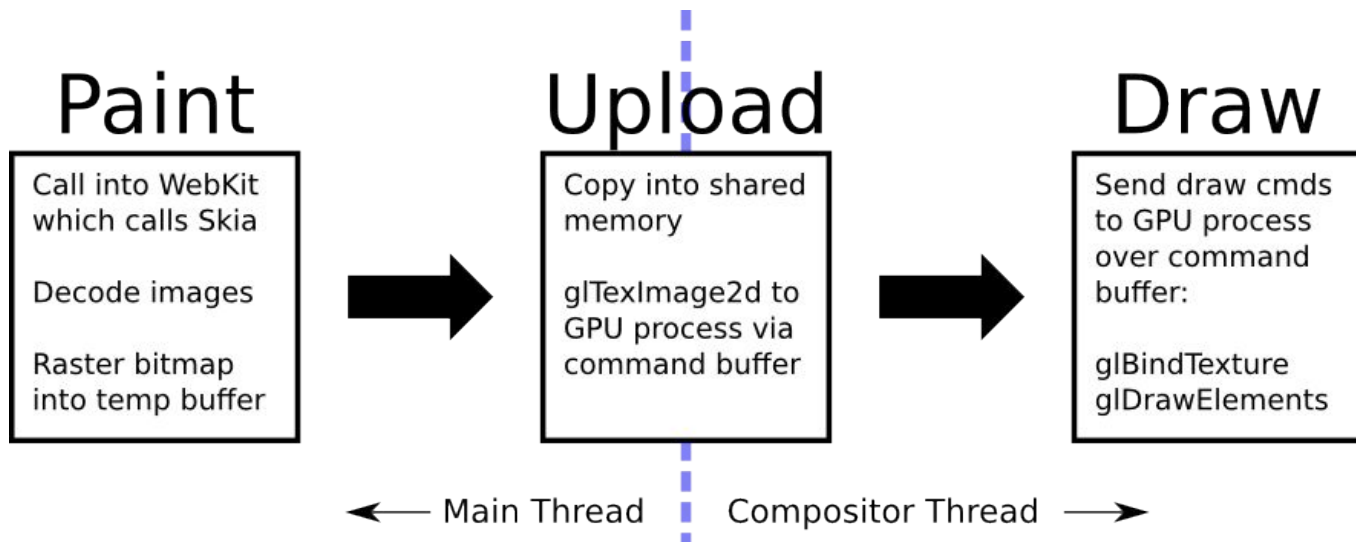
Threaded Compositing



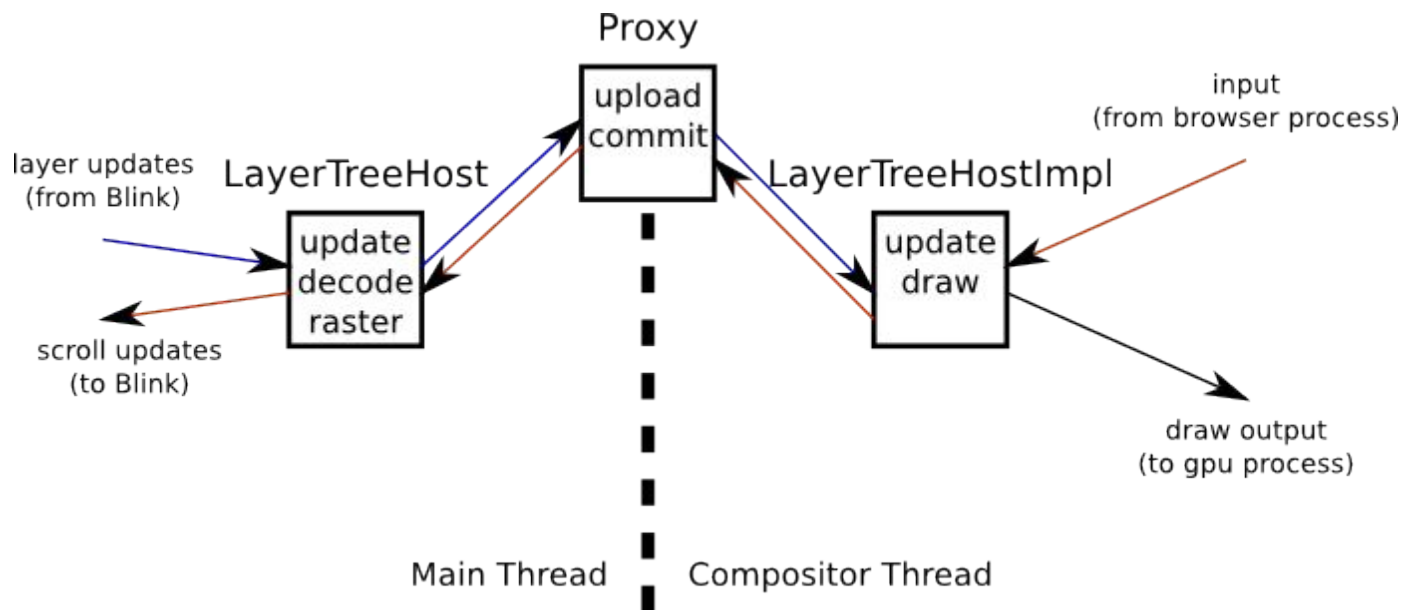
Threaded Compositing



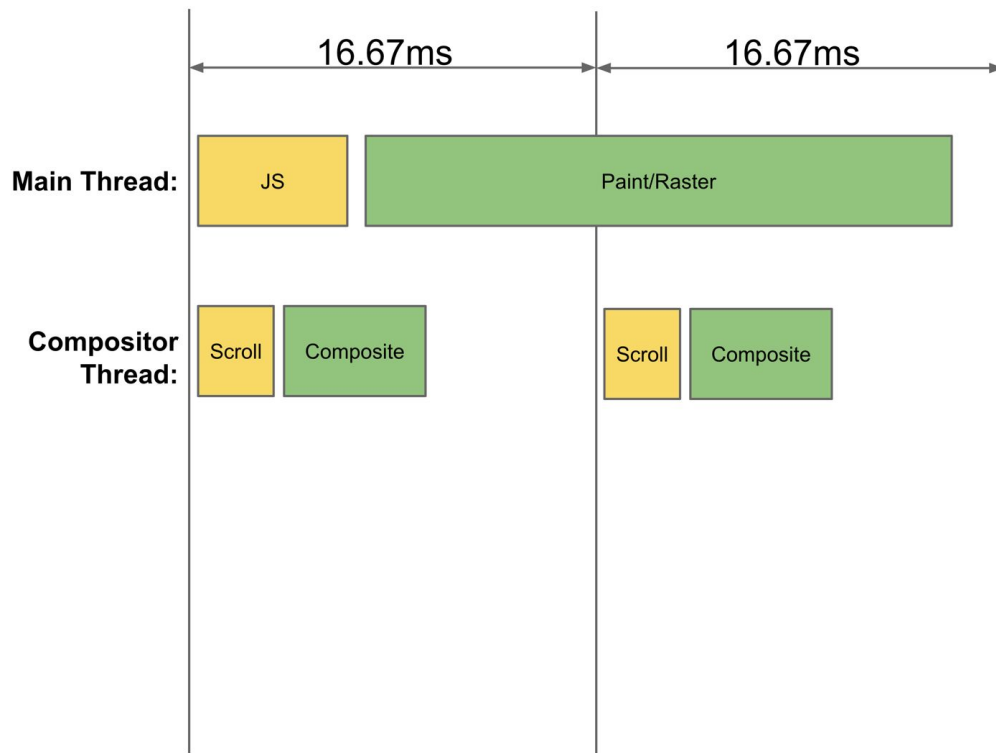
Threaded Compositing



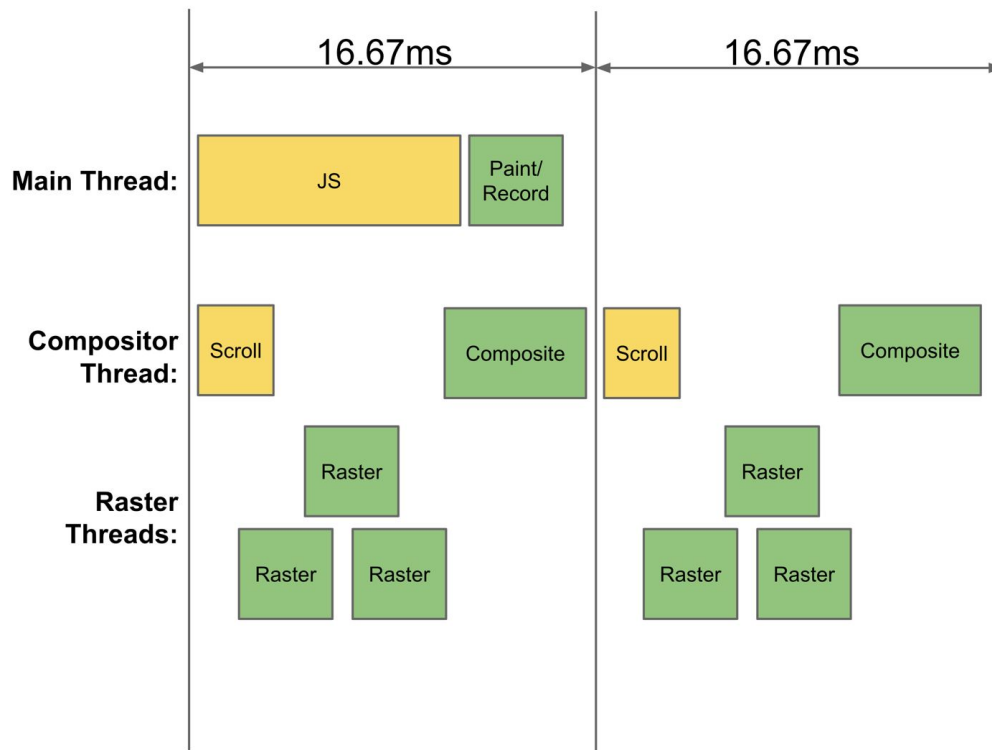
Threaded Compositing



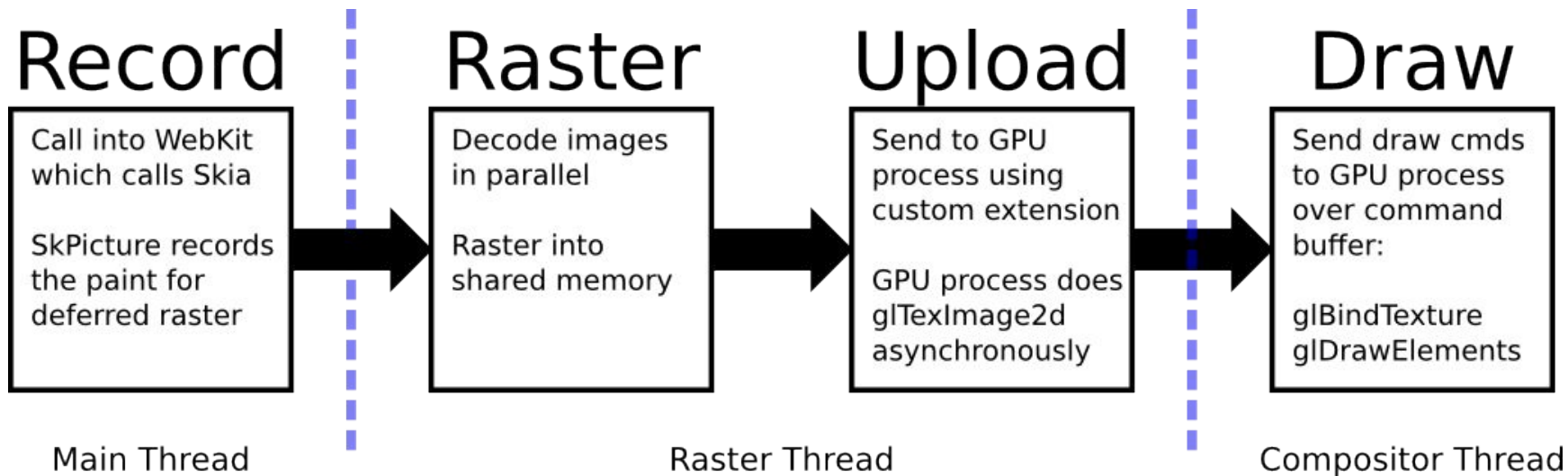
Impl Side Painting



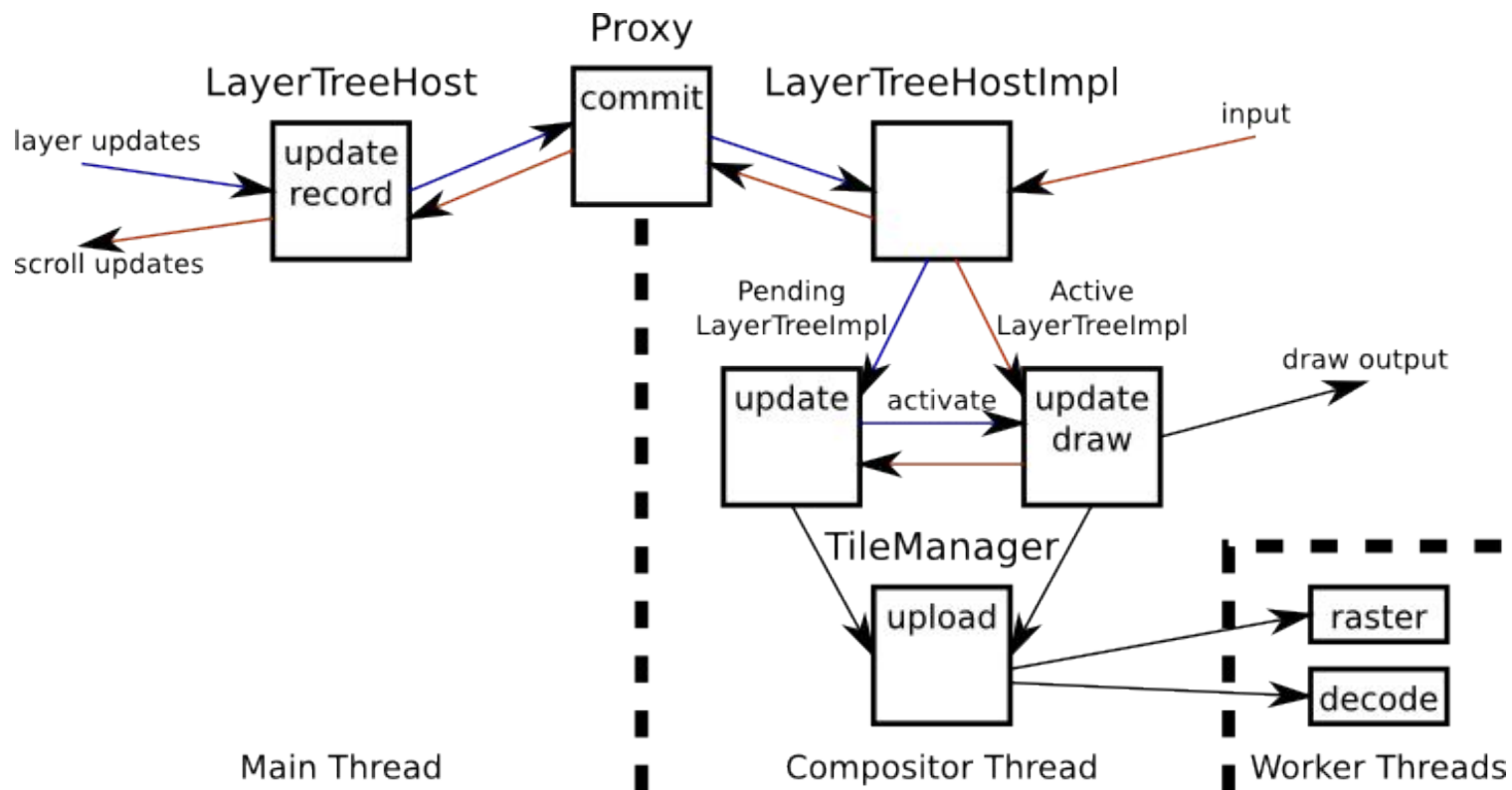
Impl Side Painting



Impl Side Painting



Impl Side Painting

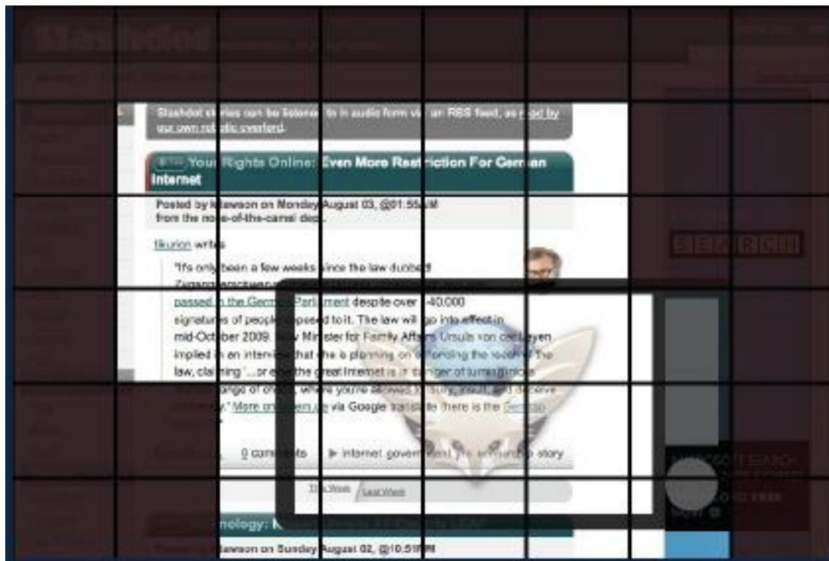


Tiled Backing Store



< Single Backing Store >

- 예전 방식으로 요즘은 거의 사용하지 않음



< Tiled Backing Store >

[Source : <http://www.slideshare.net/joone/webkit-at-future-web-forum-2010>]

- Viewport를 Tile로 나눔
- 한번 그린 영역은 보관
- 보이지 않는 주변 영역을 미리 그림

Tiled Backing Store

Pending Tiling



Main thread frame $n+1$

Layer Invalidation



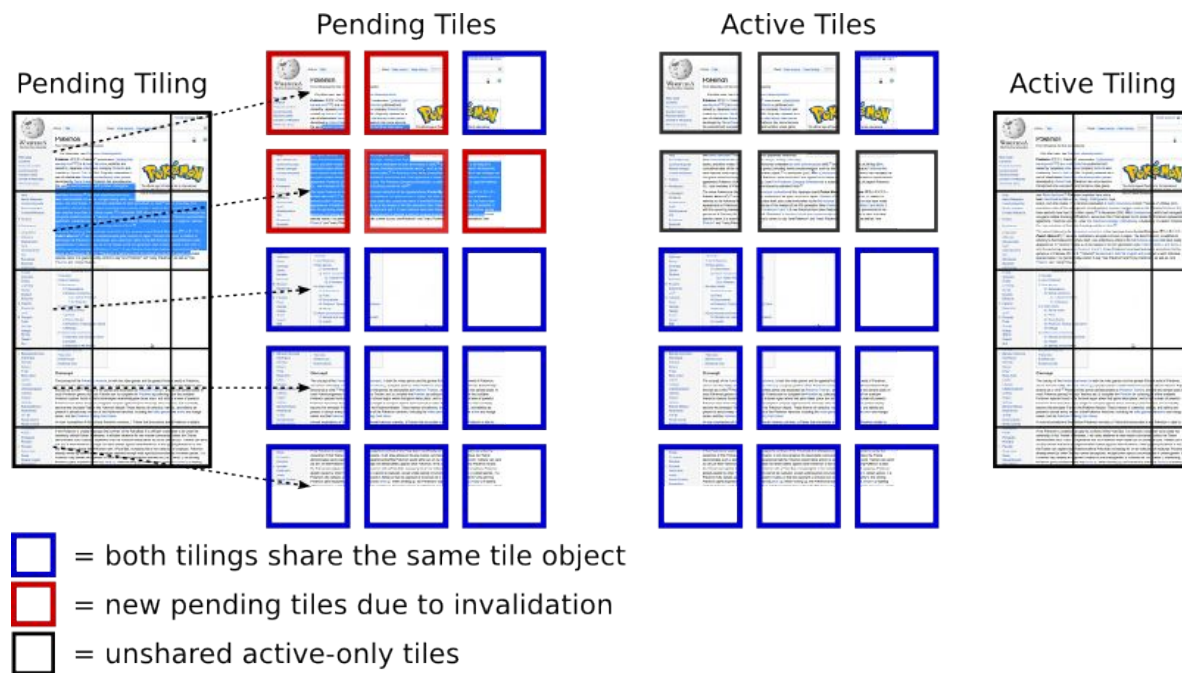
Diff between frames

Active Tiling

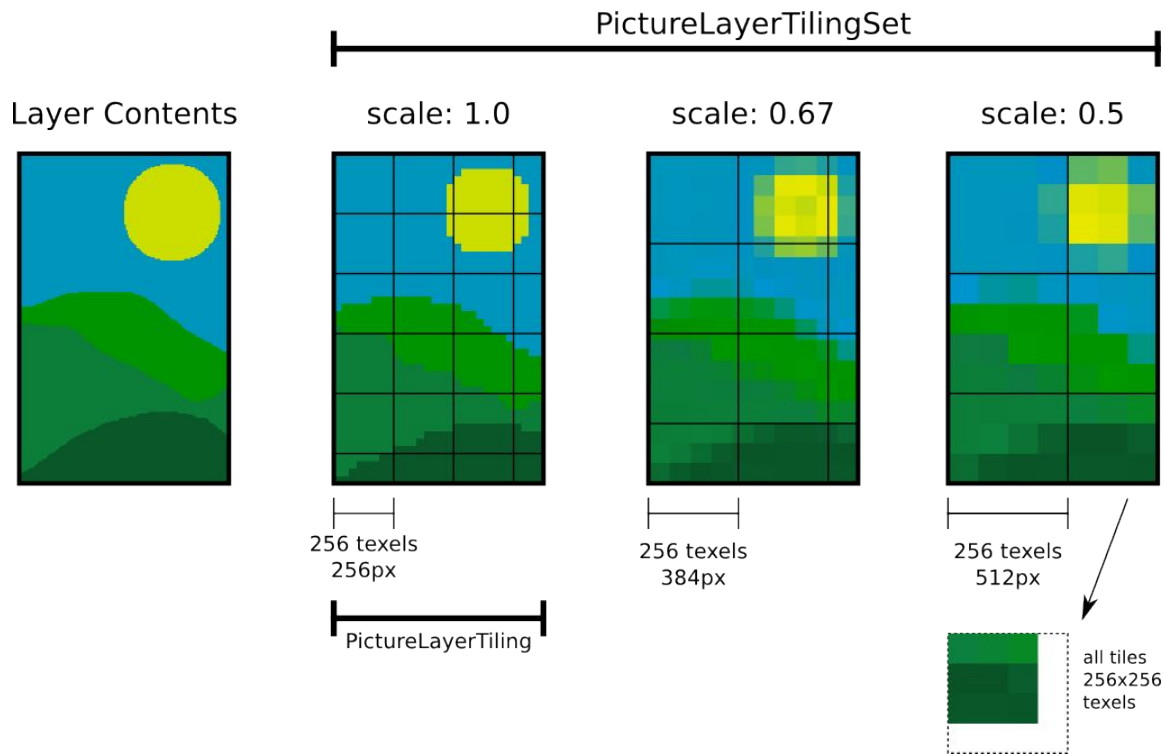


Main thread frame n

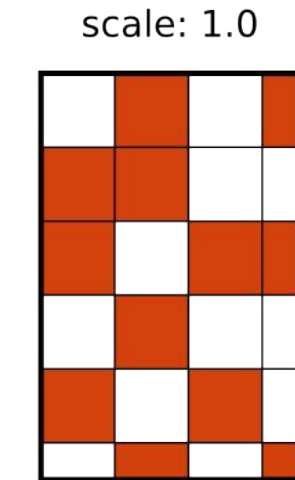
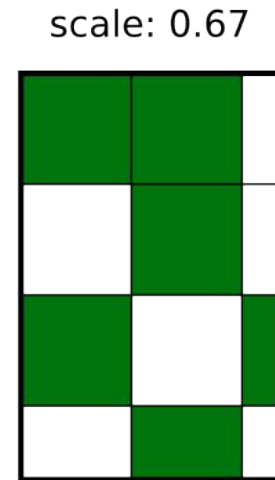
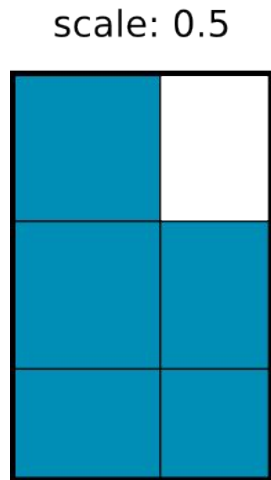
Tiled Backing Store



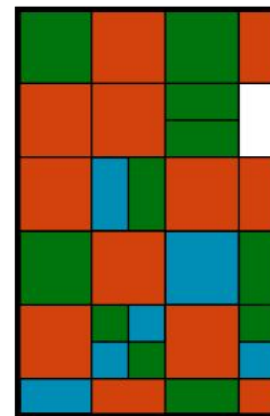
Tiled Backing Store



Tiled Backing Store



coverage iteration
ideal scale = 0.8



12 quads from scale 1.0
11 quads from scale 0.67
6 quads from scale 0.5
1 checkerboard quad

Chromium & Web Platform

Chromium is..

- Chromium Project는 어떻게 굴러가는가?
- Chromium Multiprocess Architecture
- Chromium은 어떻게 그림을 그리나?
- Chromium과 웹 표준(부제: Web Platform으로서의 Chromium)

Progressive Web App

- Chromium Project는 어떻게 돌아가는가?
- Chromium Multiprocess Architecture
- Chromium은 어떻게 그림을 그리나?
- Chromium과 웹 표준(부제: Web Platform으로서의 Chromium)

Hot Feature1: Service Worker & Family

- Chromium Project는 어떻게 굴러가는가?
- Chromium Multiprocess Architecture
- Chromium은 어떻게 그림을 그리나?
- Chromium과 웹 표준(부제: Web Platform으로서의 Chromium)

Hot Feature2: Web Payments

