Graphics tracing with Perfetto

Introducing gfx-pps

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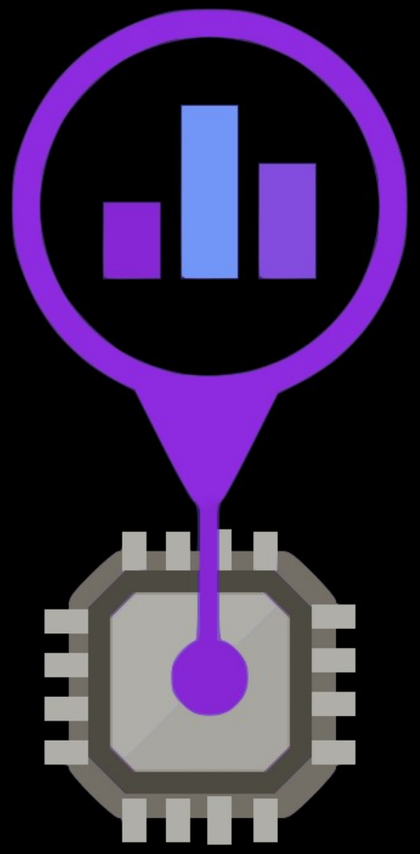
Open First

Overview

- GPU hardware counters
- Perfetto
- Gfx-pps
- Capture a trace

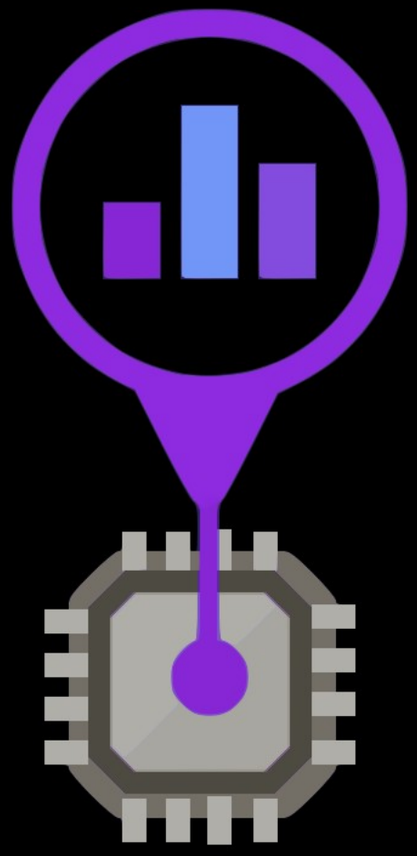
GPU hardware counters



Exposed by the GPU

- Updated every cycle/frame
- Reset after reading
- Logically grouped
- Different units

GPU hardware counters



Mali Midgard counters

- Job Manager
- Shader Core
- Tiler
- L2 Cache

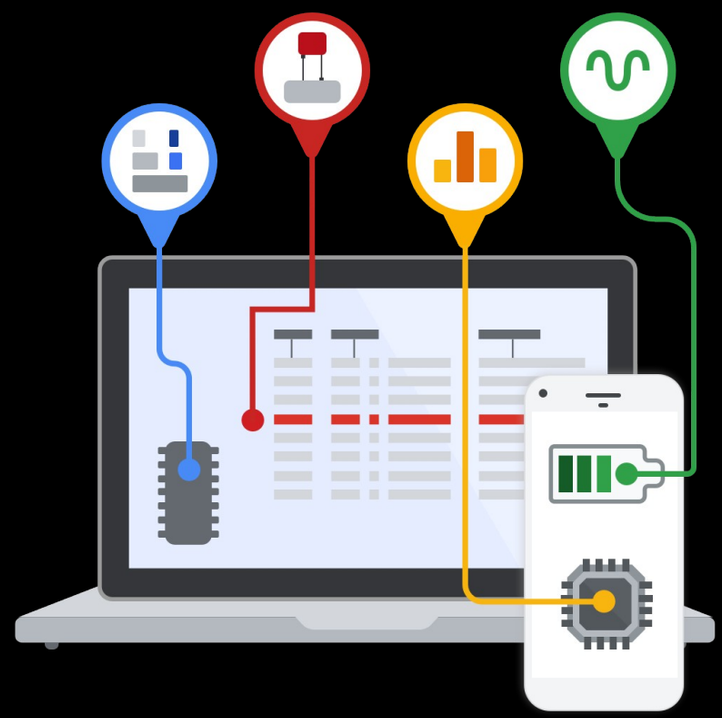
Panfrost - Hardware counters ioctls

- `drmIoctl( fd,`
  `DRM_IOCTL_PANFROST_PERFCNT_ENABLE,`
  `&perfcnt );`
- `drmIoctl( fd,`
  `DRM_IOCTL_PANFROST_PERFCNT_DUMP,`
  `&dump );`

Perfetto

Profiling, tracing, trace analysis

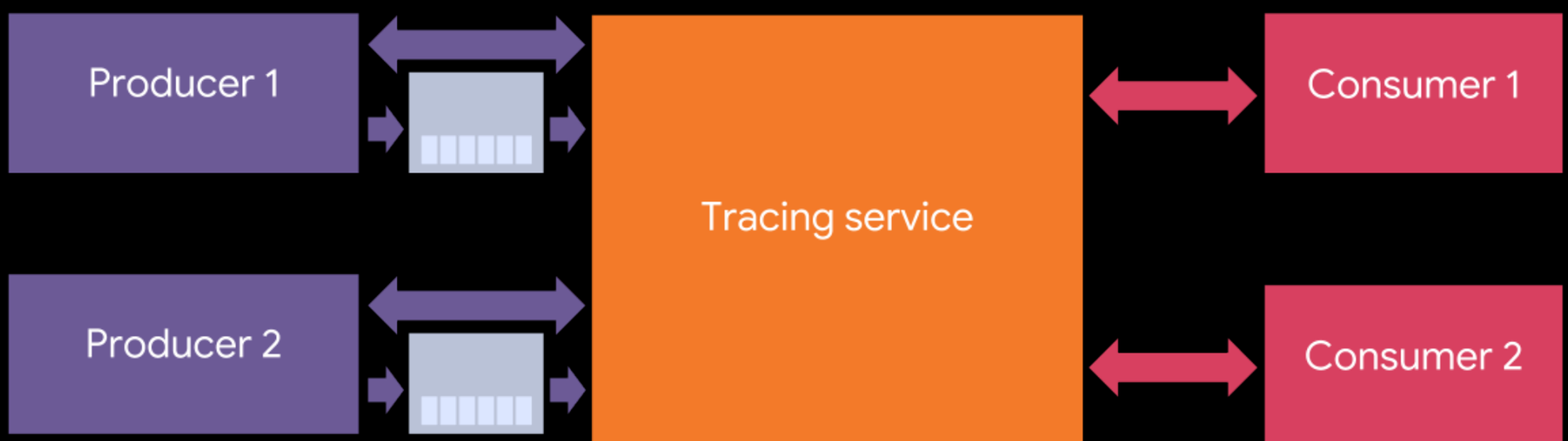
- CPU, events, GPU, memory, …
- Ftrace, procfs, sysfs
- Perfetto.dev



Perfetto

Service-based

- Service
- Producer
- Consumer



Custom Data Source

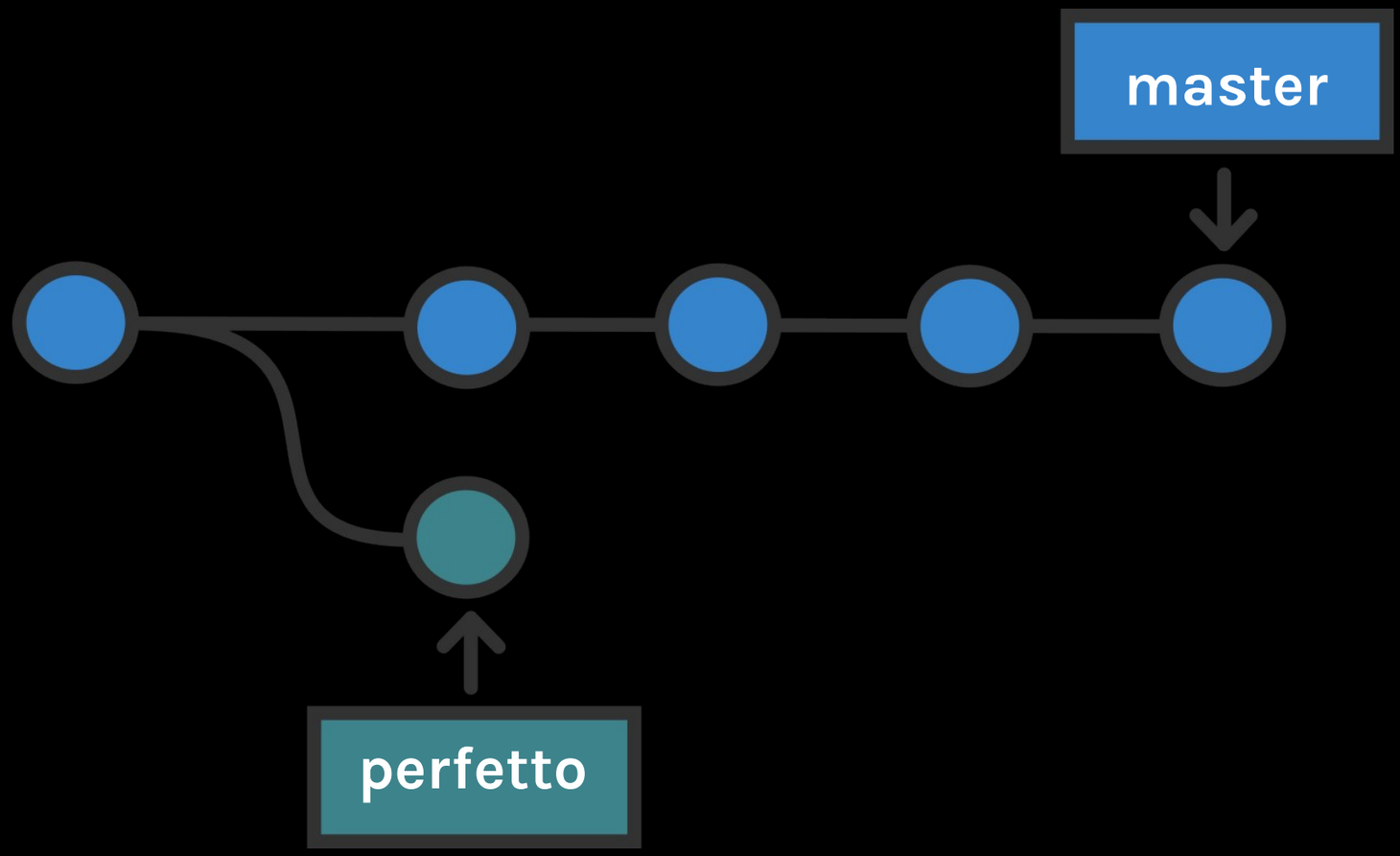
Amalgamated C++ sources

- `virtual DataSource::OnSetup( args )`
- `virtual DataSource::OnStart( args )`
- `virtual DataSource::OnStop( args )`
- `DataSource::Trace( callback )`

Gfx-pps

- Perfetto producers
  - Midgard hardware counters via Panfrost
  - Weston debug timeline
- Helper tool gpu-perf-cnt
  - Dump counters
  - List counters names

Download binaries



Capture a trace

```
> traced

> traced_probes

> producer-gpu

> perfetto --txt -c gpu.cfg -o trace
```

Anatomy of a cfg

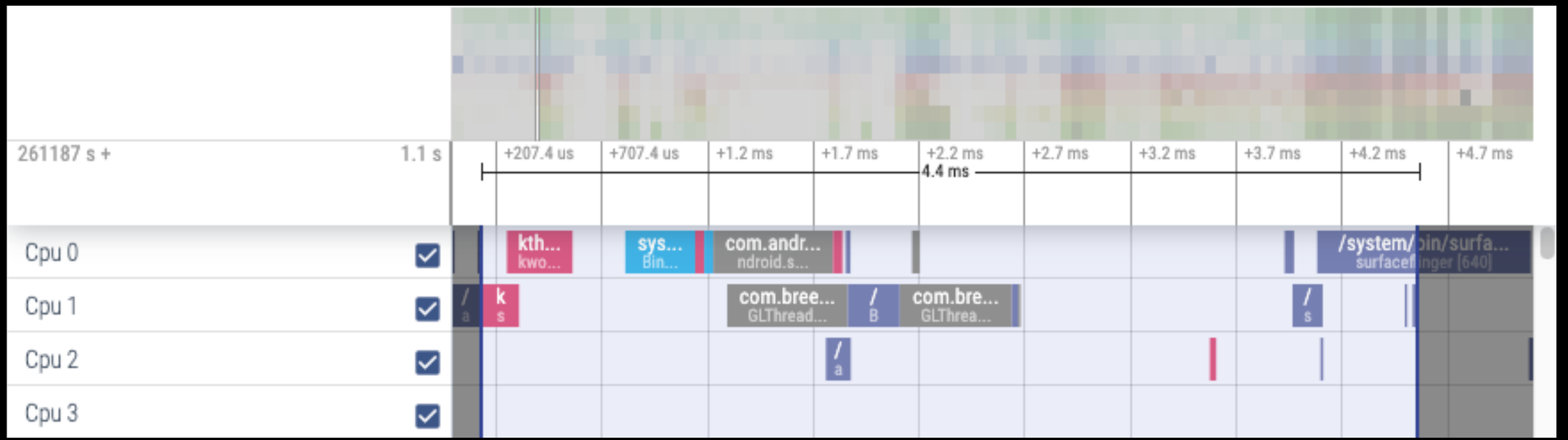
```
buffers {
  size_kb: 1024
  fill_policy: RING_BUFFER
}

data_sources {
  config {
    name: "gpu.metrics"                // name of the data source
    gpu_counter_config {
      counter_period_ns: 1000000000 // sample every second
    }
  }
}

duration_ms: 16000                     // trace for 16 seconds
```

Trace visualizer

- Available at ui.perfetto.dev
- Modern web technologies
- Once opened it works fully offline




0 s
801.4 ms
1.6 s
2.4 s
3.2 s
4 s
4.8 s
5.6 s
3336.4 s +
0 s
+46.5 ms
+96.5 ms
+146.5 ms
+196.5 ms
+246.5 ms
+296.5 ms
+346.5 ms
+396.5 ms
+446.5 ms
Compute tasks
0.25 M
Compute threads
5 K
Compute usage
50
Frag cycles no tile
0.25 M
Frag dummy threads
25
Frag num tiles
2.5 M
Frag primitives
2.5 K
Frag primitives dropped
0
Frag quad rasterized
2.5 K
Frag quads EZS killed
0
Frag quads EZS test
5
Frag threads
0.25 K
Frag threads LZS killed
5 M
Frag threads LZS test
0.5 M
Frag transaction eliminations
0.5 M
Fragment usage
1
Front-facing triangles
50 K
GPU active
5 M
IRQ active
1 M
JS0 usage
100
JS1 usage
100
JS2 usage
0
L2 external read stalls
75 K
L2 external read usage
10
L2 external reads
25 M
L2 external write stalls
5 K
L2 external write usage
0.25