

Simutrans zoom redraw — a two-slot scaled-image cache

Release SDL2 build, r12100 (be2c53104) · pak128.german, developed 512x512 map (heavy512) · 1280x1024 window · simulation paused. Candidate patch — measured, output-identical, memory-bounded.

The problem

Zooming the main map is the slow redraw. On this setup a zoom frame costs about 3.6x a normal frame, and the whole extra cost is sprite rescaling: each image keeps only one scaled buffer, so returning to a zoom level you just used rescales the same visible sprites from scratch. Static redraw, scrolling, GUI, event batching and viewport traversal are already efficient.

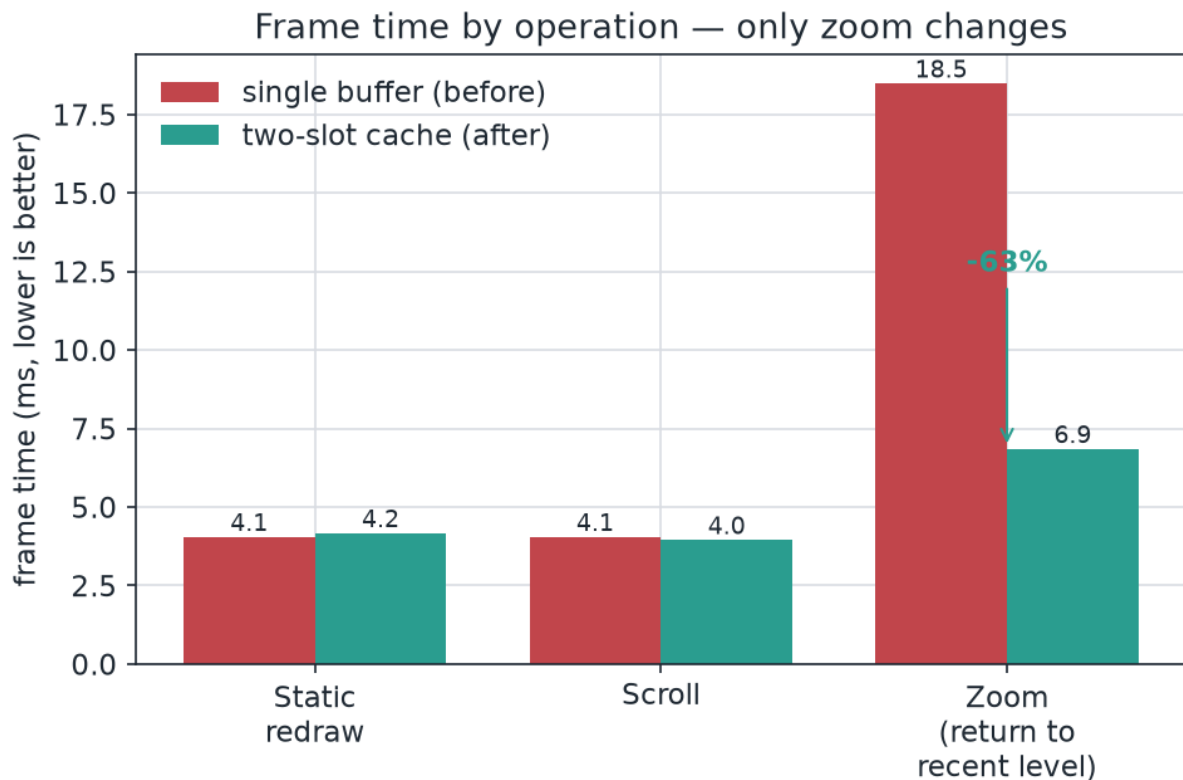


Figure 1 — Frame time by operation. Only zoom improves; static and scroll are unchanged.

The result

The patch keeps one previous non-neutral scaled buffer per image. On a return to that level the complete buffer and its geometry are restored instead of running the scaler again. Returning to a recently used level drops from 18.50 ms to 6.86 ms (-63%), and the number of sprites actually rescaled per frame drops from ~340 to ~8.7. The ~6.9 ms that remain are the player-colour / day-night recolouring, which is regenerated normally and is not what the cache targets.

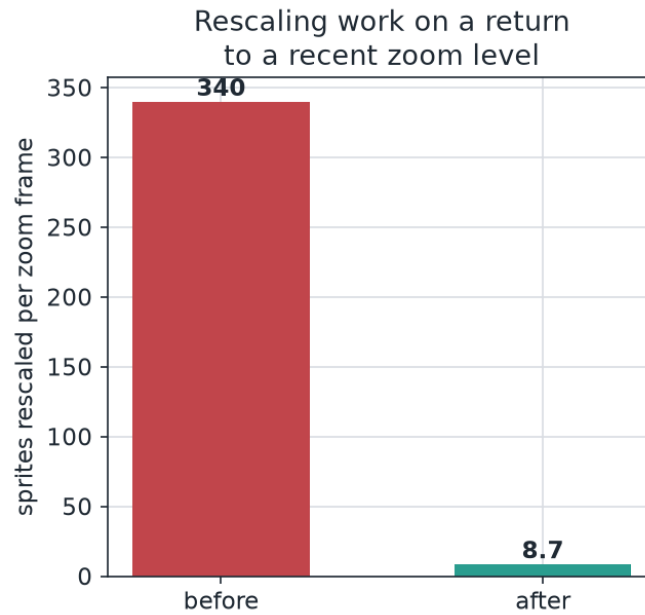


Figure 2 — Sprite rescaling work removed on a cache hit.

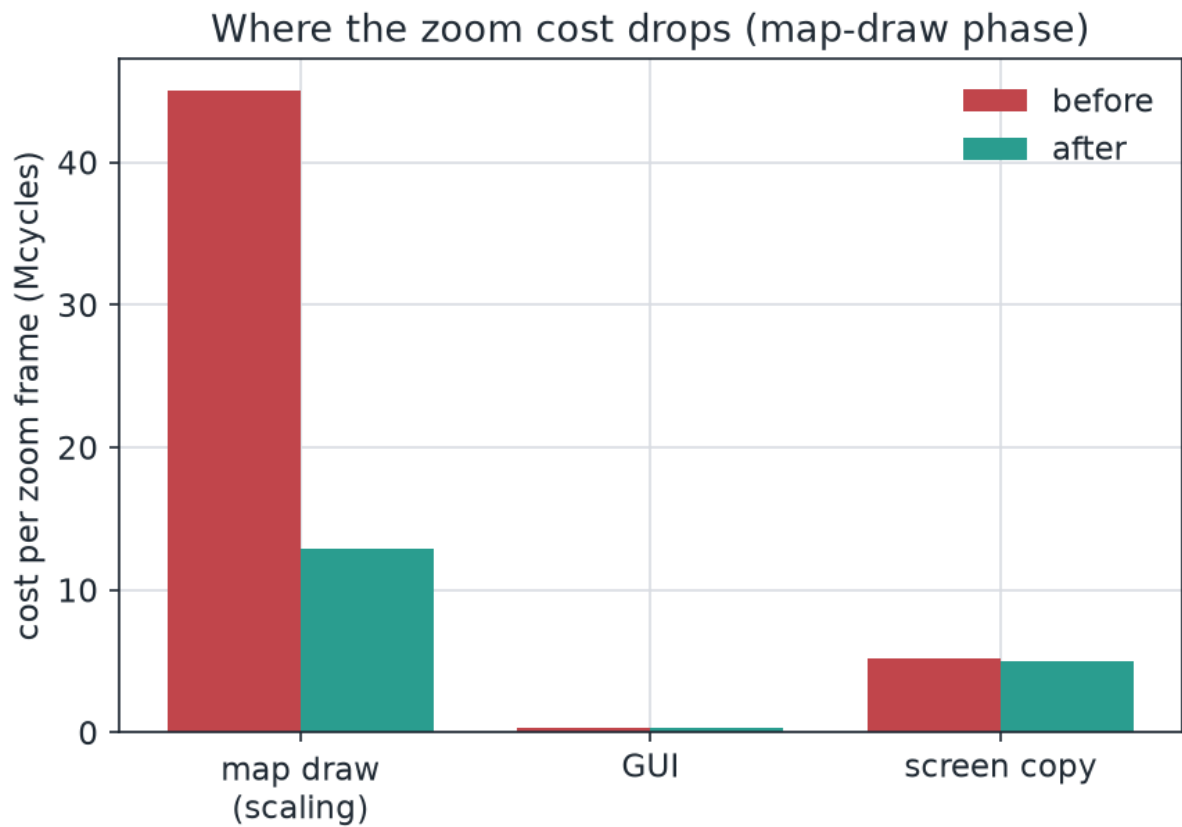


Figure 3 — The saving is entirely in the map-draw (scaling) phase; GUI and screen copy are unchanged.

Why two slots

Two slots per image capture the cases that actually hurt — alternating between two levels (90% hit) and pinch jitter (60%). A third slot only helps bursts and deep excursions, which are cheaper anyway, so two slots are the smallest design that captures most of the avoidable work.

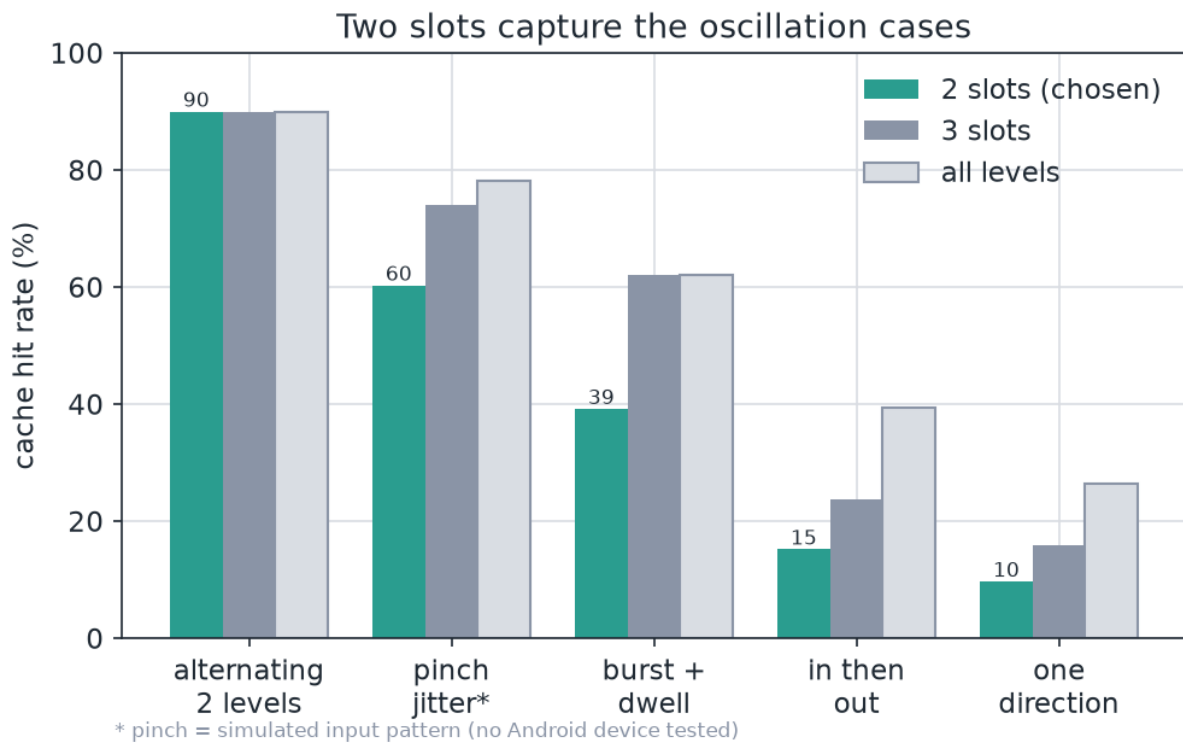


Figure 4 — Theoretical hit rate by zoom pattern (per-image MRU model).

The cost

The secondary buffers are allocated lazily; only the visible sprites are ever scaled. On this map they add about 5 MiB of scaled data plus ~1.2 MiB of fixed per-image metadata — about 6 MiB, roughly 1.5% of total image memory and negligible next to the 394 MiB of base image data. Memory stayed bounded through 800 zoom transitions across all levels.

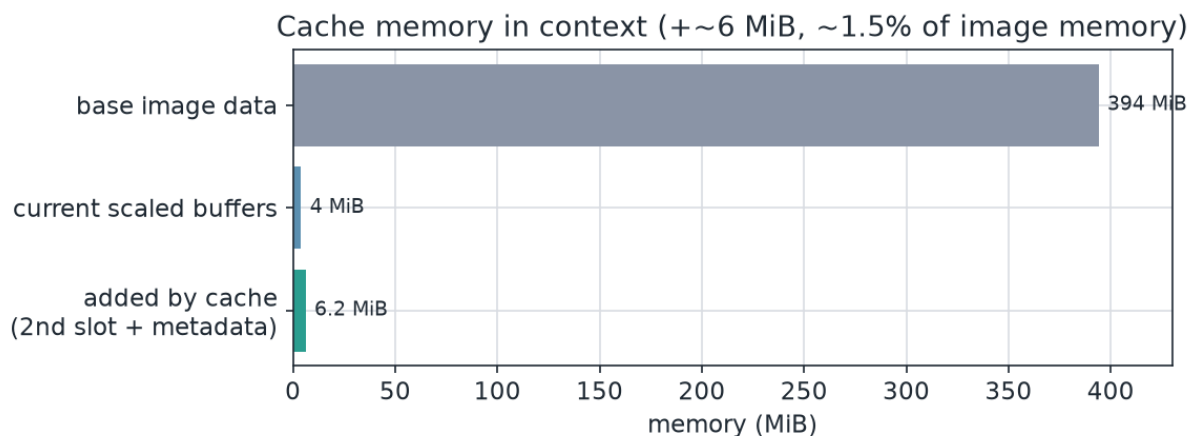


Figure 5 — Cache memory in context.

Correctness

- Framebuffer byte-for-byte identical with the cache enabled and disabled, throughout the full zoom test.
- The live ground/climate texture-regeneration path (which frees and re-registers images) was exercised: the secondary slots are freed correctly and the output stays identical.
- No crash, no leak, memory bounded. The patch changes only `simgraph16.cc` (+45/-1) and applies clean to `r12100`.

Status

READY AS CANDIDATE PATCH. The only item left for a confirmed patch is validation on a real Android device (the code is in the shared renderer, so the path is identical). The optimisation helps only when returning to a recently used zoom level; it does not speed up the first visit to a new level.