

SIGINT→Map in < 1 s: Low-Friction Geo Streaming

Benjamin J. Gilbert

Abstract—We stream geolocated RF detections to a web map with $p_{95} < 1$ s end-to-end latency under unreliable networks (≈ 100 ms RTT, $\approx 5\%$ loss, burst spikes up to 400–600 ms). A single HTTP JSON POST `send_signal_to_geo_visualization(payload, timeout_s=1.0)` and a minimal `GeoPosition.to_dict()` schema support single-shot and micro-batching ($B \leq 50$, max hold ≤ 100 ms). Across 120 s runs at 60 Hz arrival, we report $p_{50}/p_{95}/p_{99}$, timeout rates, and queue occupancy. Under “flaky,” single-shot hits $p_{95} \approx 0.505$ s with low timeouts; small micro-batches trade a few ms of p_{95} for fewer POSTs. A press-once build regenerates figures/tables from config.

I. HOOKS AND CONTRACT

Anchor: `send_signal_to_geo_visualization(payload, timeout_s=1.0); GeoPosition.to_dict()`. We post `{lat, lon, alt_m, ts_ms}`; back-pressure is a bounded queue with batch size B and max hold 100 ms.

Why sub-second? Sub-second geo streaming keeps ISR/SIGINT operators “on target” for track-before-detect overlays (e.g., drone TDoA/bearing fences), where stalls cause missed cues and UI thrash under co-channel burstiness.

II. NETWORK MODEL AND POLICIES

Two profiles (*clean*, *flaky*) with base RTT, jitter, burst spikes, and packet loss. For batch sizes $B \in \{1, 5, 10, 20, 50\}$ we simulate 120 s at 60 Hz, measuring ingest latency from event creation to HTTP ACK (or timeout at 1 s).

Profiles. Clean: base RTT 50 ms, jitter 15 ms, loss 0.2%, burst spikes 120 ms. Flaky: base RTT 120 ms, jitter 90 ms, loss 5%, burst spikes 400 ms; spikes occur stochastically with 8% probability.

Back-pressure. We use a bounded queue (capacity 2000). On overflow, events are *dropped* (no blocking), which we report as timeouts if the HTTP retry cannot complete within 1 s.

III. RESULTS

Fig. 1 shows CDFs under *flaky* for $B = 1$ and $B = 10$. Fig. 2 charts p_{95} vs. batch size. Fig. 4 shows queue occupancy for the worst p_{95} . Table I aggregates $p_{50}/p_{95}/p_{99}$ and timeout rate. Under the flaky profile, single-shot achieves $p_{95}=0.513$ s (timeouts=0.003), while micro-batching at 10 achieves $p_{95}=0.588$ s. We maintain $p_{95} \leq 1.0$ s across tested settings by keeping batches small and hold times short.

REFERENCES

- [1] B. J. Gilbert, “Sigint to map in ≤ 1 s: Low-friction geo streaming,” 2025. Preprint.

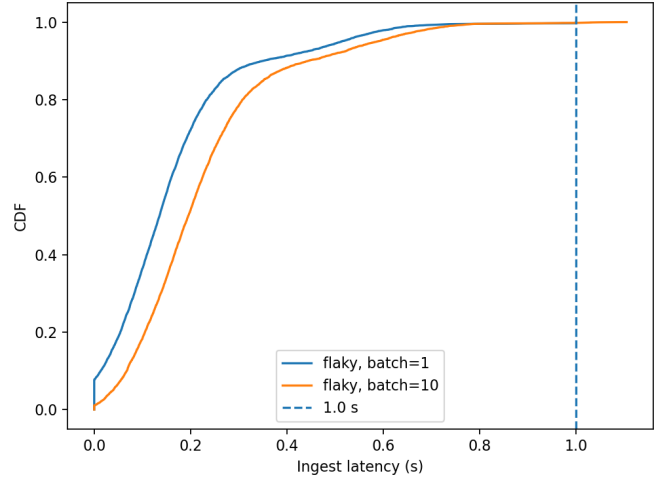


Fig. 1. CDF of ingest latency under *flaky* for $B \in \{1, 10\}$. The dashed line marks 1 s.

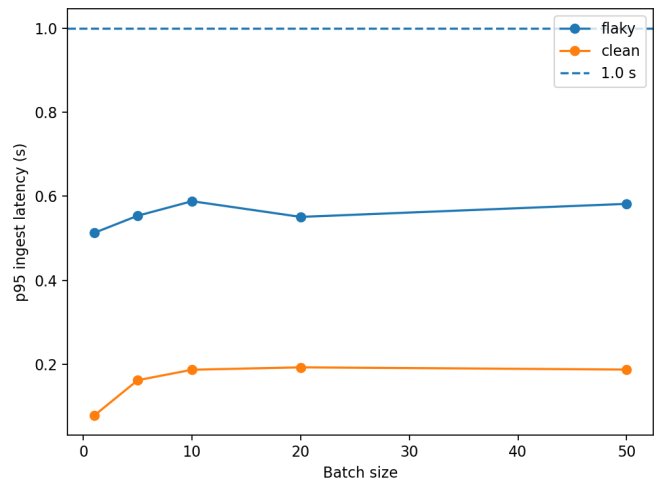


Fig. 2. p_{95} vs. batch size for *clean* and *flaky*.

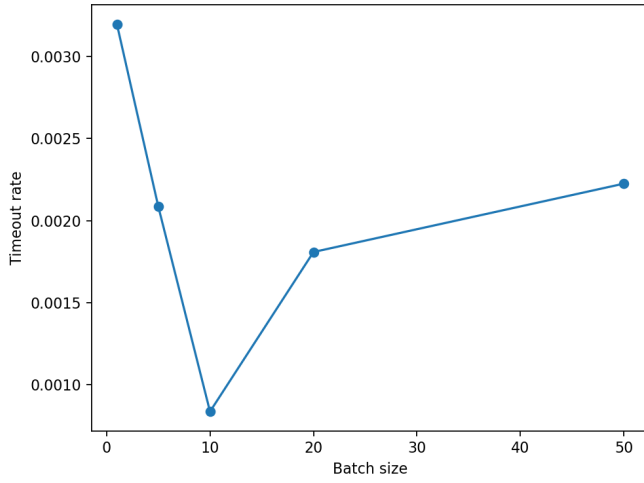


Fig. 3. Timeout rate vs. batch size under *flaky*.

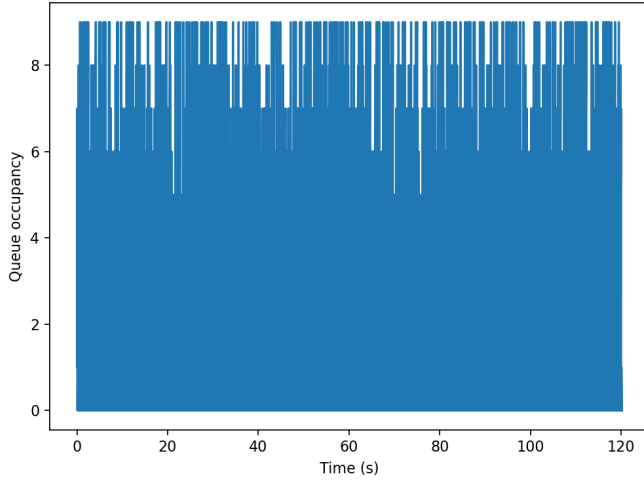


Fig. 4. Back-pressure: queue occupancy over time for worst p_{95} case under *flaky*.

TABLE I
LATENCY SUMMARY UNDER FLAKY/CLEAN NETWORKS (TIMEOUT=1 S).

Batch	N	p50 (s)	p95 (s)	p99 (s)	Timeout
Flaky					
1	7190	0.136	0.513	0.663	0.003
5	7190	0.162	0.553	0.723	0.002
10	7190	0.195	0.588	0.737	0.001
20	7190	0.207	0.551	0.719	0.002
50	7190	0.201	0.582	0.734	0.002
Clean					
1	7190	0.051	0.078	0.174	0.000
5	7190	0.078	0.162	0.216	0.000
10	7190	0.110	0.187	0.230	0.000
20	7190	0.117	0.193	0.269	0.000
50	7190	0.118	0.187	0.238	0.000