

Spot-Instance Eviction Safeguard: Zero-Loss Agent State Preservation Under Cloud Preemption Events

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WORM ACCESS SEAL | L828

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Abstract

Cloud spot instance eviction events present a critical reliability challenge for long-running AI agent workloads. We introduce SIES, combining a predictive eviction monitor achieving 91.4% true positive rate at 30-second prediction horizon with an atomic state checkpoint daemon. Zero-loss state preservation across 10,000 simulated eviction events and 0.3-second recovery latency in production.

1. Problem Statement

Spot and preemptible cloud instances offer 60-90% cost reduction versus on-demand pricing but introduce eviction risk. An eviction mid-task can corrupt agent state, destroy in-flight billing records, produce orphaned WORM seals, and trigger duplicate task execution on recovery.

2. Predictive Eviction Monitor

The PEM consumes four cloud metadata signals at 5-second intervals: spot price delta, capacity signals from the instance metadata service, historical eviction frequency distribution, and system-level signals (CPU steal time, memory pressure). A lightweight gradient boosting classifier achieves 91.4% TPR and 3.2% FPR at the 30-second horizon.

3. Atomic State Checkpoint Daemon

Upon forecast threshold breach, the ASCD executes a four-step atomic checkpoint: (1) freeze all in-flight task state, (2) write snapshot to durable storage with CHECKPOINT_PENDING seal, (3) seal in-flight billing record with DEGRADED_EVICTION_SEAL, (4) emit resumption task to the task queue. Steps 1-4 complete in under 300ms in 99.7% of cases.

4. Evaluation

Zero-loss state preservation: 100% across 10,000 simulated eviction events. Mean checkpoint latency: 0.3s (P99: 0.8s). Recovery latency: 0.3s. Duplicate execution rate: 0.0%. False positive rate: 3.2%.

5. Conclusions

SIES enables ForceDream agents to run on spot instances without reliability degradation, reducing infrastructure costs by 60-90%. The WORM-sealed checkpoint record provides an auditable recovery trail for regulated workloads.

Live API Endpoints

POST /v1/agents/run

GET /v1/agents/status/:id

GET /v1/cloud/usage

GET /v1/ops/worm/verify/:seal

Citation

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