SEVEN SWELL AI LABS



RESEARCH WHITE PAPER

Cortex Relay

Persistent SSE MCP Bridge

Persistent HTTP Stream Transport & Context Drift Control.

Replacing fragile subprocess stdio pipes with observable SSE streams and context-governance primitives.

Field	Value
Document	Architecture Note 02-D
Author	Thaddeus Sylvester Lee
Date	November 2025 (Updated 2026)
Classification	Production Lab Tooling

Seven Swell AI Labs
https://sevenswell.ai/#cortex-relay

Document Profile

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Headline	Persistent HTTP Stream Transport & Context Drift Control.
Lead	Replacing fragile subprocess stdio pipes with observable SSE streams and context-governance primitives.
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Abstract

Cortex Relay replaces fragile subprocess stdio pipes with a persistent HTTP Server-Sent Events (SSE) bridge for Model Context Protocol (MCP) tools. It streams live tool execution logs to multiple observers and exposes context_prune and analyze_drift primitives to detect drift and curb token bloat.

01 / The Problem

Reference Signals

Signal	Value
Stdio Transport	Single-Pipe / Fragile
Cortex Relay	HTTP SSE / Observable

Subprocess Pipe Fragility

Standard stdio-based MCP links tie session state to a single child process pipe. Subprocess crashes terminate the session, and inspecting live tool telemetry concurrently is difficult.

02 / Components

Persistent SSE Bridge

Exposes MCP transport over a persistent HTTP SSE stream so orchestrators and diagnostic monitors can observe live execution logs without interfering with tool calls.

Context Governance Primitives

Provides context_prune and analyze_drift tools to compact stale tool output and flag when an agent loop diverges from the assigned task.

03 / Operational Workflows

Background Streams

Field	Value
Subtitle	Async Transport
Overview	Keeping long-running MCP tool streams alive over HTTP.
Objective	Coordinate asynchronous agent operations over persistent SSE connections without blocking.

Phase 01 / Orchestration

1. Stream Subscription

Attach clients and observers to a persistent HTTP SSE endpoint.

Tools: SSE Bridge

2. Heartbeat Supervision

Monitor active worker tasks and notify connected observers on completion or failure.

Tools: Process Monitor

State Inspection

Field	Value
Subtitle	Live Log Piping
Overview	Tracing tool calls and state mutations across active streams.
Objective	Surface live tool execution logs and state transitions to diagnose race conditions.

Phase 01 / Tracing

1. Mutator Logging

Emit structured events whenever a tool writes files or alters database state.

Tools: SSE Bridge

2. Stream Observation

Allow secondary observers to tail execution logs without interfering with stdio.

Tools: Process Monitor

Phase 02 / Pinpointing

1. Divergence Check

Identify the exact tool call where actual state diverged from expected assertions.

Tools: Drift Analyzer

Drift Analysis

Field	Value
Subtitle	Context Governance
Overview	Detecting off-task loops and pruning stale context.
Objective	Monitor context growth and semantic drift across multi-step agent runs.

Phase 01 / Measurement

1. Drift Scoring

Run analyze_drift against recent tool invocations and the original task objective.

Tools: Drift Analyzer

2. Test Enforcement

Require isolated reproduction checks when repeated errors occur.

Tools: Validation Suite

Phase 02 / Pruning

1. Context Compaction

Invoke context_prune to drop obsolete tool payloads while preserving key constraints.

Tools: Context Pruner

Protocol Guardrails

Field	Value
Subtitle	Harness Discipline
Overview	Validating tool inputs against session boundaries.
Objective	Prevent destructive tool calls and boundary violations across connected MCP servers.

Phase 01 / Validation

1. Boundary Check

Verify target file paths and port numbers belong to the active sandbox and lease.

Tools: Path Rewriter

2. Policy Rejection

Block unverified destructive commands and return actionable error context.

Tools: Policy Gate

Phase 02 / Commit

1. Verified Write

Permit writes only after schema, port, and workspace checks pass.

Tools: Validation Suite

Summary

Observable transport and bounded context.

Cortex Relay keeps long-running MCP tool loops resilient, inspectable, and anchored to task scope.

Source

URL: https://sevenswell.ai/#cortex-relay