Reality as a Streaming System: Memory, Compression, and the Persistence of Meaning

With consciousness added

Memory persists as long as:

Someone predicts it

Someone remembers it

Someone acts as if it's real

At that point, information is no longer stored —
it is maintained.

Abstract

This paper proposes an abstract model of reality as a causally constrained streaming system with finite local memory. Rather than treating memory as static storage, the model characterizes memory as the persistence of causal relevance over time. Three mechanisms are examined—compression, error correction, and conscious reference—which together extend the effective lifetime of information far beyond its raw causal window. The framework does not aim to replace physical theories, but to provide a conceptual vocabulary for understanding persistence, history, and meaning in an entropic universe.

1 Introduction

Physical theories describe how states evolve, but remain largely silent on why some information appears persistent while most vanishes almost immediately. Philosophical accounts of memory and meaning often treat them as subjective or epistemic, detached from causal structure.

This paper bridges that gap by modeling reality as a streaming process in which information retention is constrained by causality, but selectively extended by structural and cognitive mechanisms.

2 Reality as a Streaming System

We adopt three assumptions:

1. Reality updates continuously.
2. Causal influence propagates at a finite speed.
3. Only information capable of influencing future states can be said to persist.

Under these assumptions, reality is not an archive but a stream. Memory is not storage of the past, but the survival of relevance.

3 Local Memory and the Rolling Causal Window

Local memory is defined as the set of states within a region's backward causal cone that can still influence its future evolution.

Absent stabilizing mechanisms, this memory decays on the order of the region's causal crossing time. Forgetting is therefore not an anomaly, but the baseline behavior of reality.

4 Compression: Persistence of Pattern Over Detail

Compression preserves structure while discarding specificity. Physical laws, stable objects, and recurring processes function as compressed descriptions, enabling continuity without full historical retention.

Reality appears stable not because it remembers everything, but because it remembers efficiently.

5 Error Correction and Redundant Encoding

Compression alone is fragile. Persistence requires redundancy.

Information becomes robust when instantiated across multiple independent causal pathways. Feedback loops act as error-correcting codes, allowing patterns to survive local perturbations.

History persists not as a record, but as a constraint continually reasserted.

6 Consciousness as a Cache and Routing Layer

Consciousness is modeled not as a large memory store, but as a selective cache that prioritizes certain information for stabilization. Its intrinsic storage is minimal, yet its effect on persistence is profound.

3. Consciousness as a cache layer

This is the weird part — and the most powerful.

Definition

Consciousness is a low-latency, high-priority cache that:

Actively samples compressed state

Predicts future frames

Rewrites past meaning

Reinforces specific trajectories

It doesn't store much — but it decides what gets stored elsewhere.

Cache properties

Very small (relative to universe)

Extremely fast refresh

Selective

Self-referential

Why it matters

Anything observed, remembered, or anticipated gets:

Copied into matter

Copied into language

Copied into tools

Copied into other minds

Consciousness routes data into error-corrected channels.

In computing terms:

Consciousness is an L1 cache with write-back to distributed storage.

Philosophical Axiom. *With consciousness added*

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Proposition. *With consciousness added*

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Theorem. *With consciousness added*

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Consciousness extends memory primarily by increasing its lifetime rather than its size. It converts transient causal influence into durable reference.

7 The Heat Death of Reference

Total information loss occurs not when energy dissipates, but when reference collapses. When no system continues to model, predict, remember, or act upon a state, meaning vanishes even if structure remains.

This condition may be described as the heat death of reference.

8 Conclusion

Persistence is not fundamental. The universe forgets by default. Memory arises through compression, redundancy, and reference.

Reality does not store the past; it continuously renegotiates which parts of the past remain causally relevant.