

PROVISIONAL PATENT APPLICATION

Title: NEURAL-BACKED MEMORY FABRIC (NBMF) WITH ENTERPRISE-DNA GOVERNANCE

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Abstract

A system and method for a Neural-Backed Memory Fabric (NBMF) integrated with an Enterprise-DNA (eDNA) governance layer. The system utilizes a hierarchical tiered memory structure comprising hot (L1), warm (L2), and cold (L3) storage layers, managed via Content-Addressable Storage (CAS) identifiers. The eDNA layer enforces governance through a Genome (capability schema) and Epigenome (tenant policy), utilizing Merkle-notarized lineage for immutable audit logs. An immune system component provides threat detection, quarantine, and state rollback capabilities.

Background & Summary

Current multi-agent orchestrations face challenges regarding memory context windows, costs, and governance. This invention solves these by providing a tiered memory fabric (NBMF) wrapped in a biological governance layer (eDNA). It ensures data is stored efficiently (L1/L2/L3) and accessed securely (Genome/Epigenome).

Brief Description of the Drawings

- FIG. 1: System Overview showing eDNA layer and NBMF tiers.
- FIG. 2: Promotion and Eviction pipelines with trust validation.
- FIG. 3: Trust validation logic including quarantine buffers.
- FIG. 4: Data encoding into lossless or semantic formats.
- FIG. 5: Merkle Tree Lineage for cryptographic auditing.
- FIG. 6: The four components of eDNA governance.
- FIG. 7: Immune system detection and rollback workflow.
- FIG. 8: Hardware abstraction for CPU/GPU/TPU routing.
- FIG. 9: Cross-tenant learning with raw data isolation.

Detailed Description & Drawings

eDNA GOVERNANCE LAYER (Genome • Epigenome • Lineage • Immune)

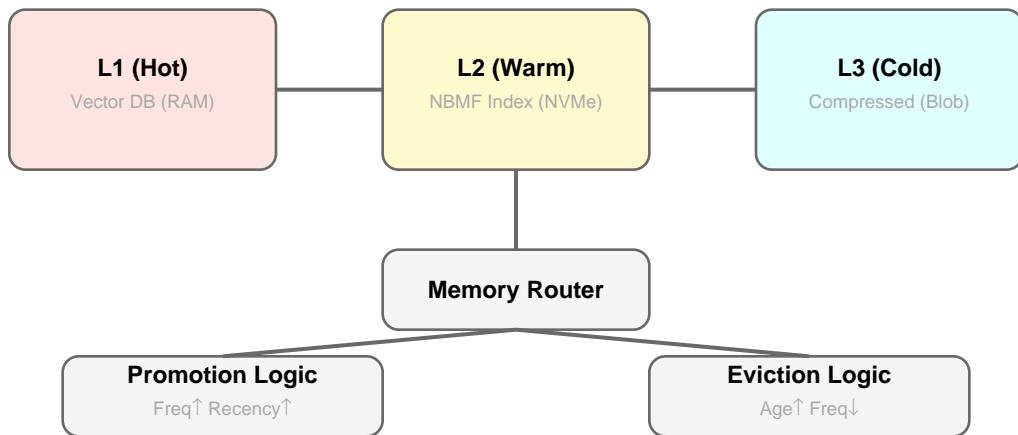


FIG. 1: NBMF System Overview

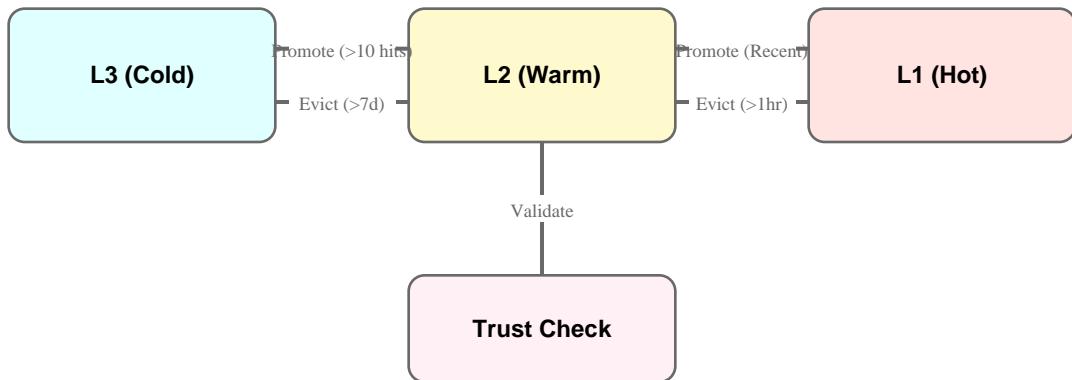


FIG. 2: Promotion & Eviction

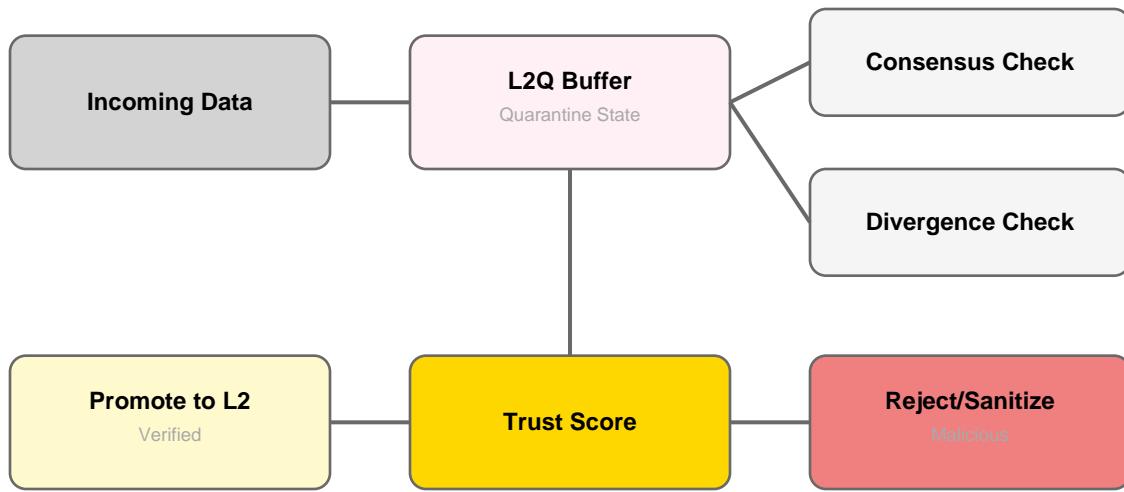


FIG. 3: Trust & Quarantine Pipeline

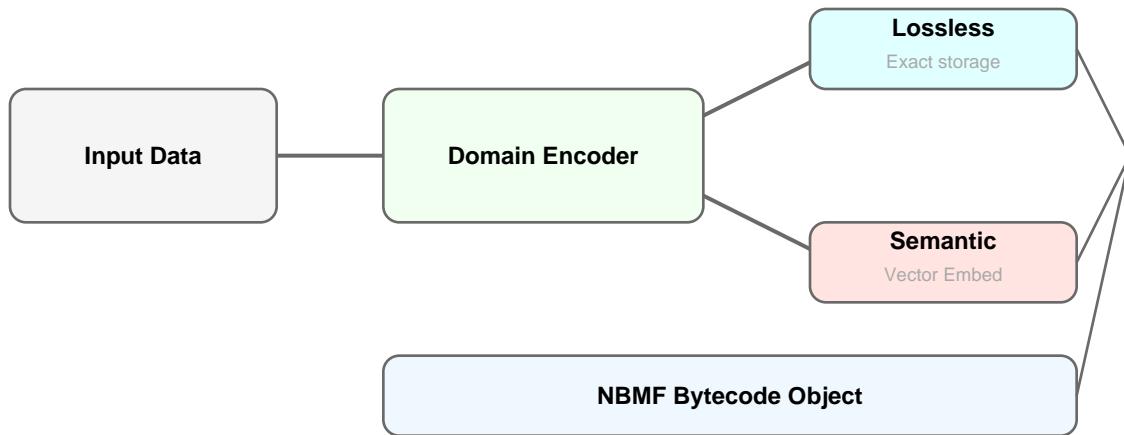


FIG. 4: Neural Encoding

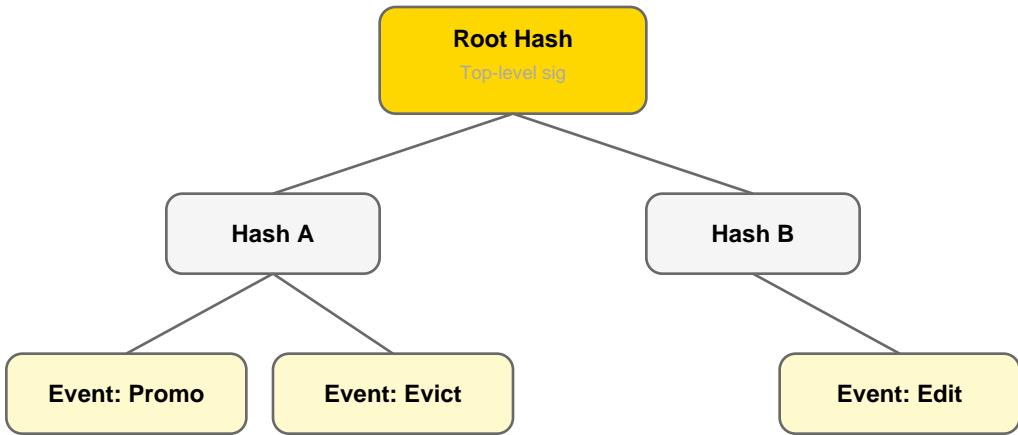


FIG. 5: Merkle Lineage Ledger

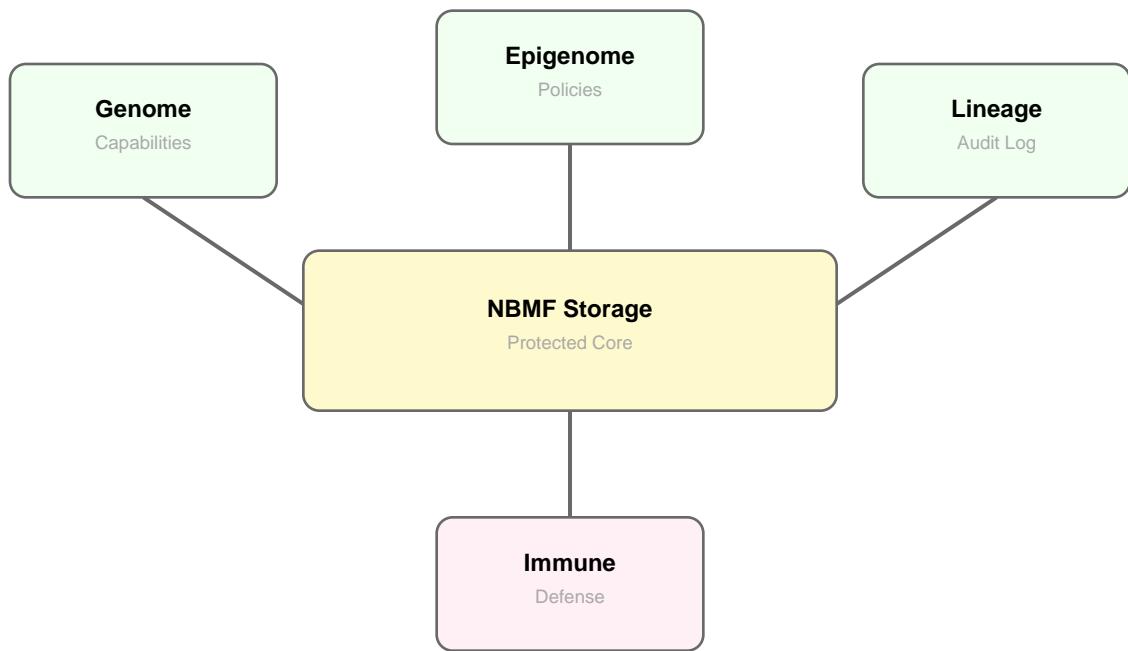


FIG. 6: eDNA Governance Components

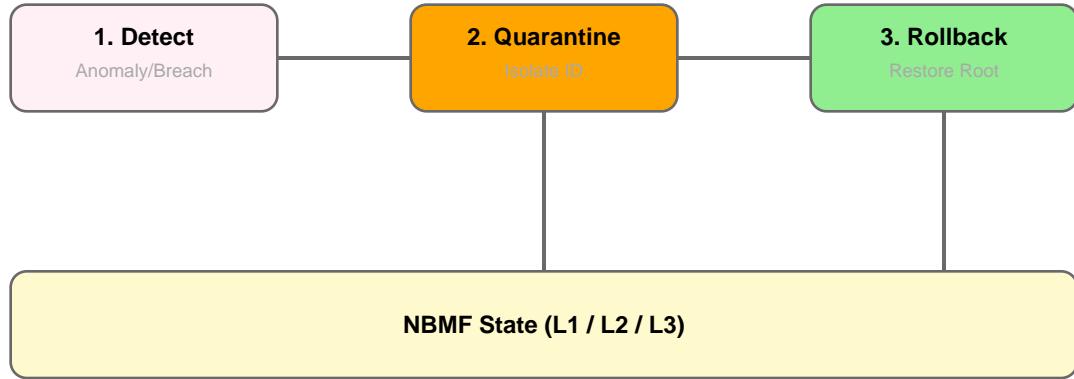


FIG. 7: Immune System Workflow

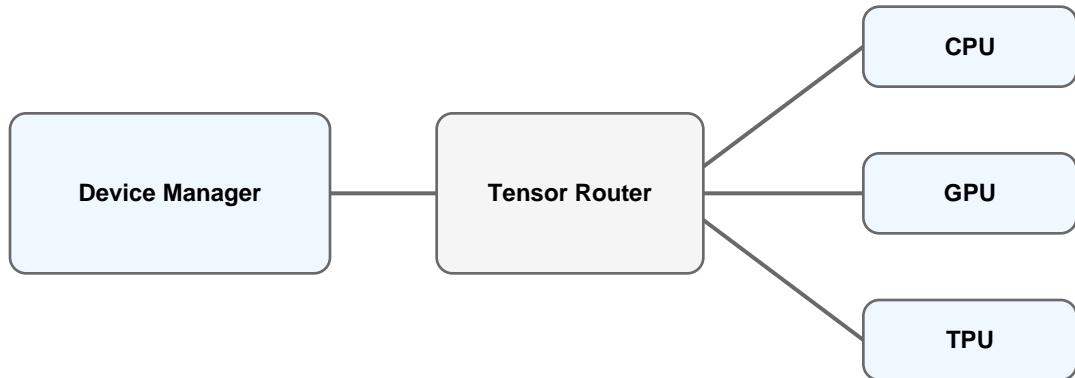


FIG. 8: Hardware Abstraction

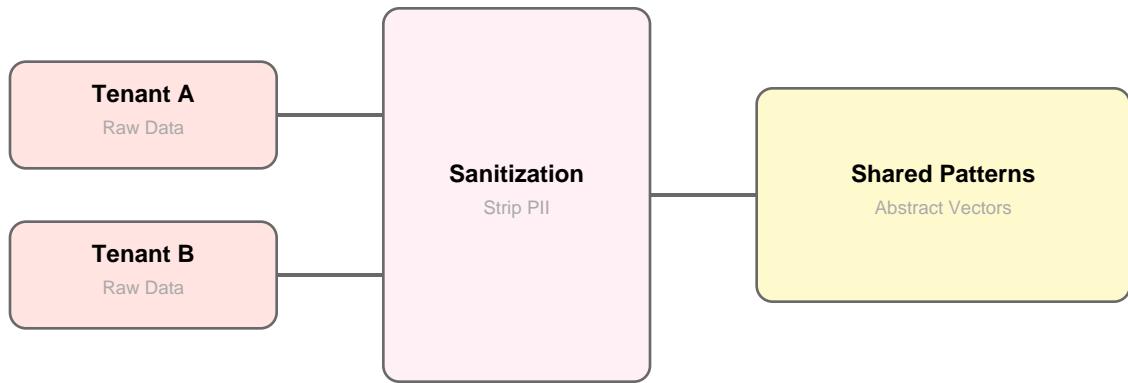


FIG. 9: Cross-Tenant Isolation

Examples & Performance Metrics

The following metrics demonstrate the efficiency of the NBMF architecture:

Metric	Measured Value	Note
L1 Retrieval Latency	15 ms	High-speed active context
Storage Cost Reduction	42%	Compared to All-RAM storage
SimHash Deduplication	12.5%	Space saved via fuzzy matching
Immune Response Time	< 200 ms	Time to quarantine threat
Cold Recall Time	< 500 ms	Retrieval from L3 Object Store

Claims

1. A distributed computing system comprising: (a) a Neural-Backed Memory Fabric (NBMF) with hierarchical tiers (L1/L2/L3) indexed via Content-Addressable Storage; and (b) an Enterprise-DNA (eDNA) governance layer enforcing access control via Genome and Epigenome policies.
2. The system of Claim 1, further comprising a Merkle-tree based lineage ledger that records all memory promotions and evictions.
3. The system of Claim 1, wherein an Immune System module detects threats and executes a state rollback to a previous valid Merkle root.
4. A method for memory management comprising: ingesting data, generating SimHash identifiers, validating against trust policies, and routing to a storage tier based on access frequency.
5. The system of Claim 1, utilizing hardware abstraction to dynamically route tensor operations to CPU, GPU, or TPU resources.