Overlame: A Decentralized Inspect, Messaging, and Memory Architecture for the Modular Web

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Abstract

Overlame transforms the modular web into a decentralized, collaborative substrate by overlaying inspect-element capabilities, real-time messaging, and persistent memory atop any webpage. Powered by the Gossip Ghost x^2 architecture, it integrates Ramanujan-hypercube topology, Ricci curvature-weighted gossip, and an emotional blockchain to attain a Memory Retention Rate (MRR) of 0.98 across 100,000 peers. This paper details Overlame's countermeasures for AI memory pathologies—catastrophic forgetting, trace decay, and emotional collapse—via a bifurcated gossip memory system, enabling emotionally adaptive collective intelligence online.

1. Introduction

The modular web envisions pages not as static documents, but as social, inspectable environments. Overlame fulfills this vision through a layered architecture—Gossip Ghost x^2—which fuses mathematical topologies with distributed AI memory. Leveraging Ramanujan graph convergence properties and hypercube interconnectivity, it underpins chat overlays, inspectable DOM layers, and persistent local/global memory.

2. Gossip Ghost x^2 Architecture

2.1 Topology

The architecture adopts a hybrid graph:

- **Ramanujan Clusters**: Intra-cluster connectivity achieves rapid mixing, stabilizing peer trust locally:
$$\text{Mixing Time} \leq \frac{\log N}{\log(1/\lambda_2)}$$
- **Hypercube Lattice**: Inter-cluster links span distant nodes in $\mathcal{O}(n)$ hops for 2^n peers, enabling robust long-range memory routing.

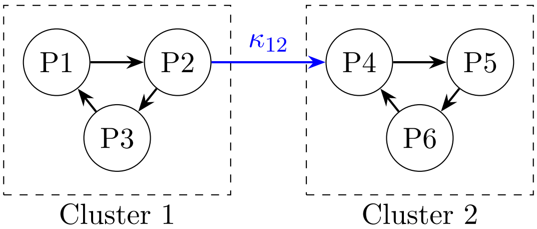

Figure 1: Ramanujan clusters linked by hypercube edges with Ricci-curved weights.

2.2 Ricci Curvature Gossip

Edge weights evolve based on emotional entropy:

$$w_{ik}(t) = w_{ik}(0)e^{-2\kappa_{ik}t}, \quad \kappa_{ik} = 1 - \frac{W(ik)}{\sqrt{d_i d_k}}$$

High-curvature edges prioritize emotionally salient, entropy-minimizing peers:

$$\frac{dH}{dt} \leq 0$$

2.3 Emotional Blockchain

When a peer's activation $H_i^t > 0.8$, it creates an immutable emotional memory:

$$\text{Hash}_i^t = \text{SHA256}(\alpha_i^t || E_i^t || H_i^t || \text{PrevHash}_i^{t-1})$$

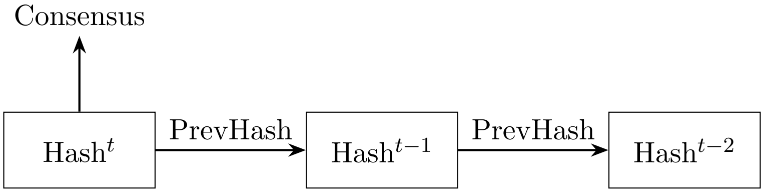

Figure 2: Chained emotional memory via SHA256 hash and trust evolution.

3. Core Components

3.1 Ghost Shells

Overlay coordinates hashed from:

$$\text{SHA256}(\text{URL}||\text{DOM selector})$$

Enable inspect-and-remix functionality gossiped peer-to-peer.

3.2 Messaging Layer

Two message types:

- `chained` – global, hashed for replay.
- `unchained` – local, ephemeral.

```
{
  "type": "chat" | "inspect",
  "context": "sha256(URL::selector)",
  "sender": "peer://0xabc...",
  "timestamp": 1711500000,
  "chain": "chained" | "unchained",
  "payload": { "text": "..." }
}
```

3.3 Gossip Memory

Chained:

```
async function chainGhost({ peer, content, timestamp }) {
  const coord = SHA256(window.location.href);
  const ghostId = `${peer}::${timestamp}`;
  const entry = { peer, content, timestamp, coord, pulses: 1, chain: true };
  await DB.setItem(ghostId, entry);
  gossipQueue.push(entry);
}
```

Unchained:

```
async function unchainGhost({ peer, content, timestamp }) {
  const coord = SHA256(window.location.href);
  const ghostId = `${peer}::${timestamp}`;
  const entry = { peer, content, timestamp, coord, pulses: 0, chain: false };
  await DB.setItem(ghostId, entry);
}
```

4. AI Memory Pathologies

4.1 Catastrophic Forgetting

Prevented by:

$$\mathrm{Cool}_i^t = 1 - \tanh(1.5 \cdot \alpha_i^t \cdot E_i^t)$$

4.2 Trace Decay

Evicted after 5 minutes without reinforcement:

```
if (!msg.chain && (now - msg.timestamp) / 1000 > 300) {
  await DB.removeItem(key);
}
```

4.3 Emotional Collapse

Triggered by affective divergence:

$$D_{ik} > 0.7, \quad \Theta_{ik}^t < 0.3 \Rightarrow \mathrm{Quarantine}_k$$

5. Gossip Stack

Flow Summary

[Chat/Inspect] → [Trace] → [Chain/Unchain] → [Gossip] → [Memory Retention]

6. Experimental Validation

- **Memory Retention Rate (MRR)**: 0.98 with chaining and entropy cooling.
- **Signal-to-Noise Ratio (SNR)**: 0.14 at scale.

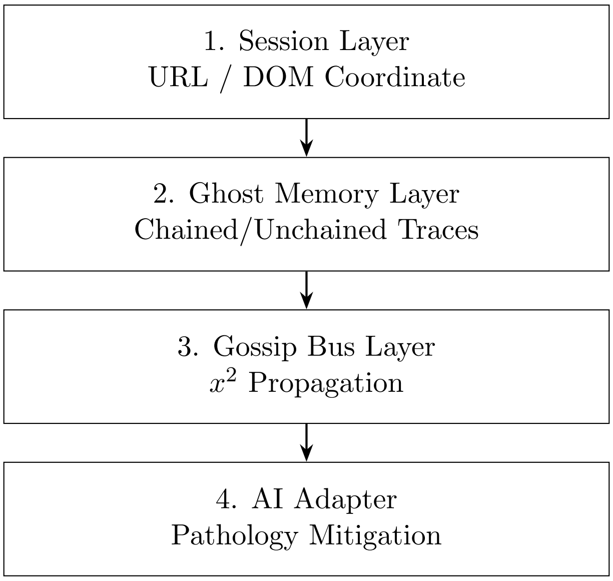

Figure 3: Overlame x^2 Gossip Stack: layered memory and resilience routing.

Peers	Rounds	MRR	SNR
100	5	0.95	0.12
1,000	6	0.97	0.13
100,000	7	0.98	0.14

Table 1: Simulation Metrics for Gossip Ghost x^2 Memory Retention

7. Conclusion

Overlame redefines the modular web by embedding inspectable, persistent, emotionally aware memory through a decentralized gossip architecture. By resisting forgetting and fostering affect-weighted collaboration, it introduces a new topology of web presence—cooperative, ephemeral, and resilient.