

# **NilStore Litepaper: The Sealing-Free Storage Network**

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## Technical Overview v2.6

### 1. Introduction & Value Proposition

NilStore is a high-throughput, verifiable decentralized storage network designed to democratize access to the storage economy while delivering cloud-grade performance.

By utilizing a **Performance Market** (Tiered Rewards) and **System-Defined Placement**, NilStore enables a diverse marketplace of Storage Providers (SPs) to provide instant, verifiable data retrieval. This architecture ensures data is always available for high-performance workloads without the latency or hardware overhead of legacy “Sealing” protocols.

#### Value for Storage Providers

- **Commodity Hardware Access:** No GPU sealing. Providers are judged on **Response Time**, incentivizing standard NVMe/SSD storage.
- **Fair Competition:** Deterministic placement ensures that even small providers get assigned deals, preventing monopolies.
- **Unified Revenue:** Earn rewards for both **Storage** (Liveness) and **Bandwidth** (Traffic) in a single flow.

#### Value for Data Owners

- **Instant Availability:** Data is stored in 8 MiB Mega-Data Units (MDUs) for efficient retrieval.
  - **User-Funded Elasticity:** Viral content automatically scales using **Stripe-Aligned Scaling** to meet demand, funded by the deal’s escrow.
  - **Configurable Resilience:** Users define ServiceHints (Hot/Cold) to optimize placement for cost (Archive) or speed (Edge).
  - **Enterprise Privacy:** Data is encrypted client-side. Scaling is “Zero-Touch” (network replicates ciphertext). Deletion is guaranteed via **Crypto-Erasure**.
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### 2. The Core Innovation: Unified Liveness

Instead of separate “Storage Audits” and “Retrieval Requests,” NilStore unifies them.

#### A. The “User is the Auditor”

- **Hot Data:** When a user downloads a file, they sign a receipt. This receipt **counts as the Storage Proof** for that epoch. The SP gets paid double (Storage Reward + Bandwidth Fee).
- **Cold Data:** If no user asks for the file, the **System** acts as the “User of Last Resort,” issuing a random challenge. The SP responds to prove liveness.

## B. The Performance Market (Tiered Rewards)

We don't ban S3. We just pay for speed. \* **Platinum (Block H+1)**: 100% Reward. (Requires Local NVMe). \* **Gold (Block H+5)**: 80% Reward. \* **Fail (>H+20)**: 0% Reward + Slash. (Glacier/Offline).

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## 3. The Architecture: A Hybrid Approach

### Layer 1: Consensus (Cosmos-SDK)

- **Role**: The “Dispatcher.”
- **Function**: Manages the **Active Provider List**, executes **System-Defined Placement**, and verifies **KZG Proofs**. It calculates reward tiers based on proof inclusion height.

### Layer 2: Settlement (EVM)

- **Role**: The “Bank.”
  - **Function**: Hosts the **\$STOR** token, Deal NFTs, and DAO governance.
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## 4. The Lifecycle of a File

### Step 1: Ingestion

1. **Deal**: User sends `MsgCreateDeal(Hint: "Hot", MaxSpend: 100)`.
2. **Placement**: The Chain deterministically assigns 12 Providers for **8 MiB MDUs**.
3. **Upload**: User streams data to the assigned nodes.

### Step 2: The Loop

- **Traffic**: Users request data. SPs serve it and submit receipts.
- **Silence**: Chain issues challenges. SPs submit proofs.

### Step 3: Scaling

- **Saturation**: If a Platinum node is overwhelmed, it signals the chain.
  - **Action**: The Chain checks the User's MaxSpend budget. If funds exist, it spawns **Hot Replicas** using **Stripe-Aligned Scaling** on new Edge nodes to absorb the load.
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## 5. The Economy (*STOR – Only*) \* **\*\*STOR Token:\*\*** The single medium for Staking (Security) and Bandwidth (Utility).

- **Burn Mechanism**: A portion of every retrieval fee is **burned**.
- **Real Pricing**: Storage and bandwidth are priced by the market to reflect physical infrastructure costs.

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## 6. Enterprise Features

- **Zero-Knowledge Cloud:** Providers store encrypted 8 MiB MDUs (AES-256). They cannot read your data.
- **Proof of Deletion:** You hold the key. Destroy the key, and the data is globally erased (Crypto-Erasure).