# Hercules Storage

What

Decentralized private storage environments at the edge or in core data centers in full scaleout mode. There is no scale limit to this storage platform. In its first iteration, an S3 storage interface is provided.

Features

- S3 compatible
- integration with zero-os overlay networking layer (efficient and encrypted network)
- can be easily deployed at the edge or in large scale datacenters
- integrated with scalable & capable monitoring system (Prometheus based), deployed by default
- can be integrated with our advanced billing/chargeback mechanism
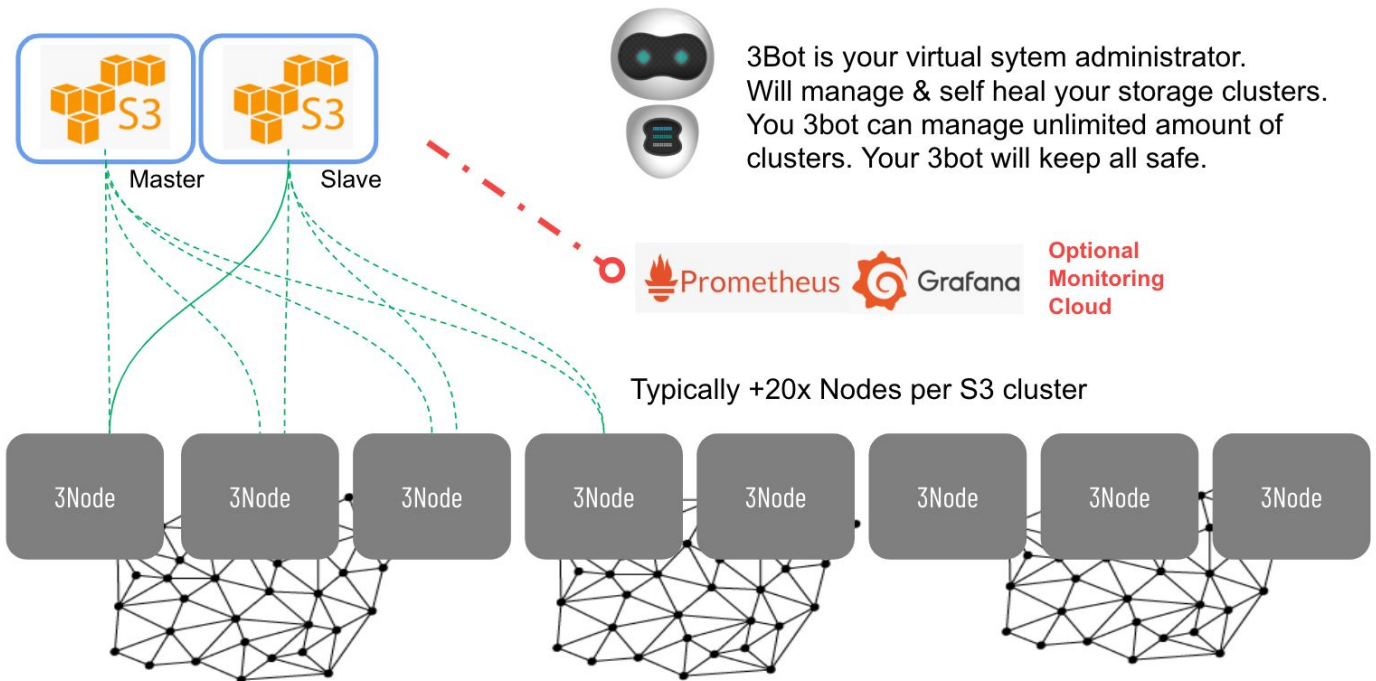
Architecture

Unlimited Scalability
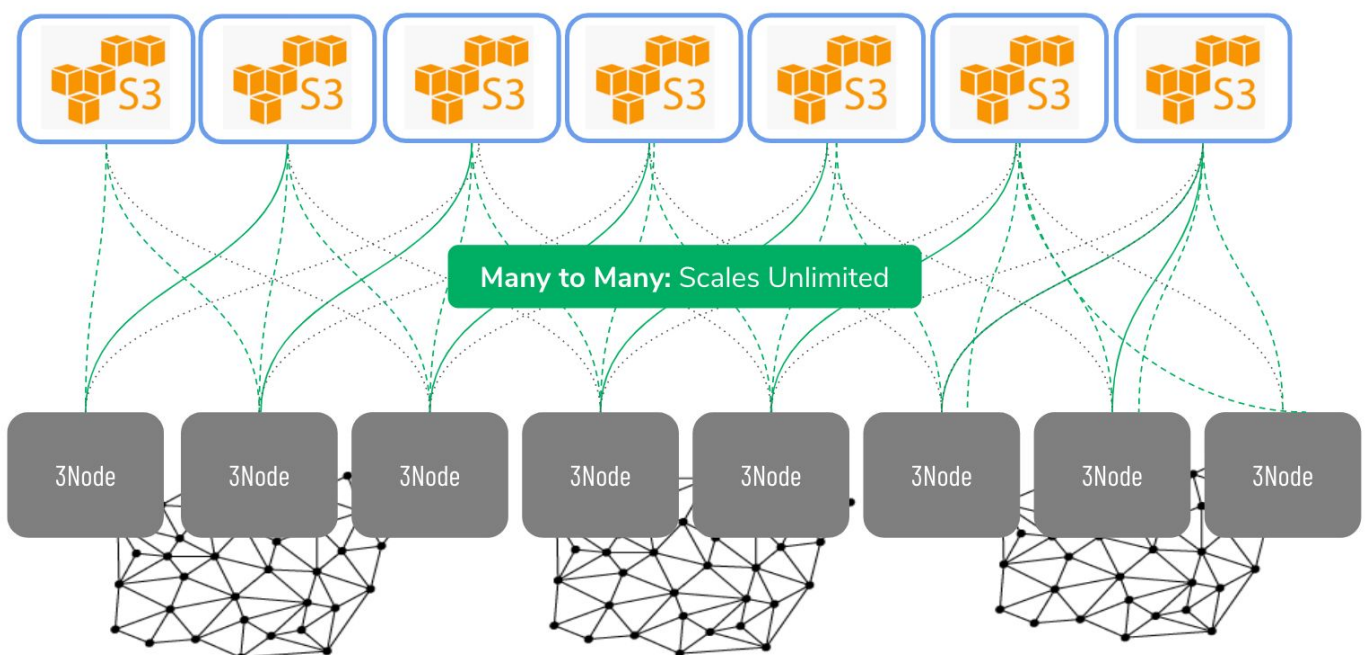
The system is a pure scale-out storage system, it can scale to unlimited size, there is simply no bottleneck inside this system. Each S3 system is independent and uses our ThreeFold Space Codec to store the data

distributed over typically 20 3nodes. Only 20% overhead is required to come to reliability which allows losing any 4 nodes at the same time per S3 storage system (this can easily be changed to even more redundancy).

Private (not multitenant)

3Bot is your virtual sytem administrator.
Will manage & self heal your storage clusters.
You 3bot can manage unlimited amount of clusters. Your 3bot will keep all safe.

Optional Monitoring Cloud

Typically +20x Nodes per S3 cluster

Each S3 deployment has 1 master and 1 slave S3 front end server.
Each customer is using their 3bot of a child of their 3bot to manage the S3 cluster.
At least 20 nodes are required per S3 cluster.
Prometheus and Grafana monitoring is optional and can be enabled.

The user brings his storage cloud life by means of a simple storage wizard.
All required encryption keys and storage policies are managed by the private 3bot.

This design leads to ultimate security, privacy and scale.

100% Self Healing Possibility (v2.1)

In v2.1 we have added 100% self healing possibility which means that any automation software can interact and e.g. failover when required between master & slave frontends.

Storage Efficiency

Legacy Storage World

= abcdefghijk   (16 blocks)

4 copies + original
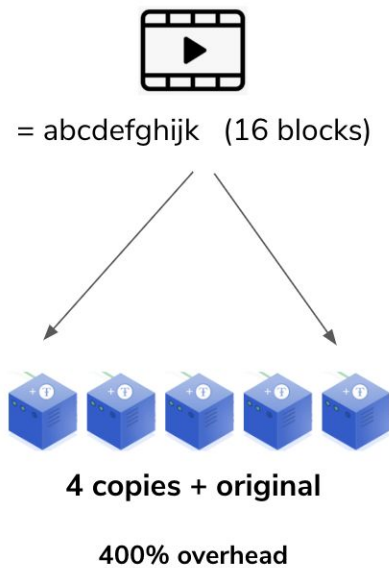
400% overhead

Requirements

- Reliable: allow any 4 nodes to be unavailable
- Data Privacy

Solution

- Reliable: make 4 copies
- Data Privacy: encrypt

Disadvantages

- 400% overhead because of 4 copies
- 5x bandwidth required to store on multiple locations
- Hacker only needs to have 1 copy = 1 location

Data gets copied 5 times if you want to be able to lose 4 copies of your data, this is not efficient.
Security provided by encryption.

ThreeFold Space Algorithm

= abcdefghijk   (16 blocks)

How to visualize?

$a+2b+c+d+e+f+g+h+i+j+k = 100$
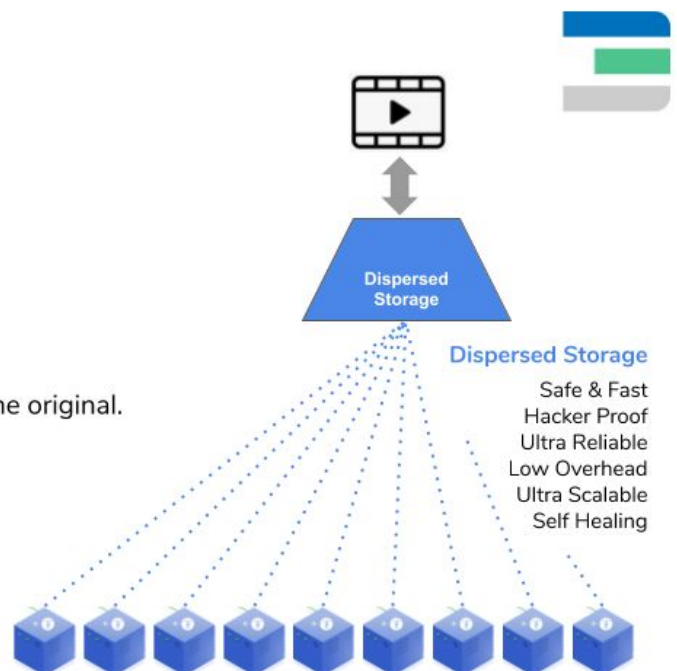$a-3b-c+d+e+f+g+h+i+j+k = 4$
$-a+b-4c+d+e+f+g+h+i+j+k = -8$

... do this 20 times. Now remember these equations.

Any of the 16 equations allow you to calculate back the original.

Super Efficient: only 20% overhead
= 20x less overhead compared to classic systems

Efficient: Order of retrieval does not matter

Hacker proof: hacker needs to be on 16 locations physically + have encryption key before possible to reconstruct.

Dispersed Storage

Dispersed Storage
Safe & Fast
Hacker Proof
Ultra Reliable
Low Overhead
Ultra Scalable
Self Healing

The ThreeFold approach leads to 20x less overhead compared to the traditional storage system.
It's also a much more safe system.

Main Benefits

Reliable / Secure
- Hercules Space Algorithm:
    - only 20% overhead for the ability to lose any 4 location/nodes
    - hacker needs to hack 20 locations at once, need to know encryption keys & space algorithm
- Hercules Protect:
    - no hacking surface to the Zero-Nodes, integrate silicon route of trust
- Hercules Network:
    - encrypted overlay network connects the storage to users when required
- Hercules Filesystem:
    - dedupe, zero-install, hacker proof deployment of all required components
- Hercules Web Gateway:
    - the intelligent connection between web (internet) and storage services
- Hercules Audit (oem): on request, all file changes audited in blockchain
- Hercules Compliance (oem): on request, ultra-strong compliance can be proven
                (location, write once - read many time, remove data, privacy, …)

Strong
- Hercules Scale: Unlimited Scalability (IT capacity & deployment layer scales independently)
- Hercules Green: 10x less energy usage for storage, 3x less hardware required, 2x more lifetime.

Smart
- Hercules Smart Contract:
    - blockchain supported deployment of storage services
    - fine-grain control over where to deploy
    - multi-signature
    - Verification of location, governance steps
    - Auditability
- Hercules Monitoring: Prometheus/Grafana based
- Hercules Admin (oem):
    - On request, manage one million instances as easy as 1
- 3Bot Hercules Chatbot (oem):
    - On request, talk with your private virtual system admin assistant to repair, manage your deployment
- Hercules Boot:
    - +5 different ways how to boot the zero-nodes (ready for global deployments)
    - blockchain support in bios (Zero-OS TBD version)
- Hercules Charge-Back:
    - By default there is already chargeback based on TFT
    - on request, any chargeback mechanism can be integrated super easily

Roadmap

v2.1: Active (all features as described above are available)

OEM release: on request of customers

- Filemanager Integration (web based)
- Webdav access
- Full text indexing capabilities
- Full auditing & workflow management for file changes.