



Caelum

TECHNICAL DOCUMENTATION

The software-defined NAS

SMB / NFS + S3 tiering

High-performance local storage on ZFS, transparent archiving to object storage, 2-node high availability and assisted migration — all in a single universal ISO image, sovereign and self-hosted.

Product · Caelum

Type · Software-defined NAS appliance

Deployment · Universal ISO (virtual & bare-metal)

Caelum is published by **GaLiLo**, a French storage software vendor. This document describes the product's technical capabilities.

01 Overview & positioning

Caelum turns a virtual machine or an x86 server into a complete enterprise filer: SMB/NFS shares, backing object storage, high availability and migration tooling — with no proprietary hardware and no per-node licensing.

The problem we solve

SMBs, mid-market companies and MSPs run ageing NAS (NetApp, Synology, Windows Server) whose volumes keep growing, whose hardware refresh is costly and whose migration is scary. Caelum lets you **audit** the existing estate, **migrate** painlessly, and **back cold data to the cloud** — while keeping hot data local and sovereign.

SOFTWARE-DEFINED

No proprietary layer between you and the disk. Storage is built on ZFS, sharing on Samba and NFS — proven building blocks, driven by a single orchestration layer.

SOVEREIGN & LOCAL-FIRST

Data lives on your infrastructure. Object tiering is optional and targets *your* S3 storage. No dependency on a mandated cloud, GDPR-friendly by design.

A SINGLE ISO

Hybrid BIOS+UEFI image, installed identically on a hypervisor or bare metal. Boot, install, finalise via the web wizard.

AUDIT BEFORE MIGRATION

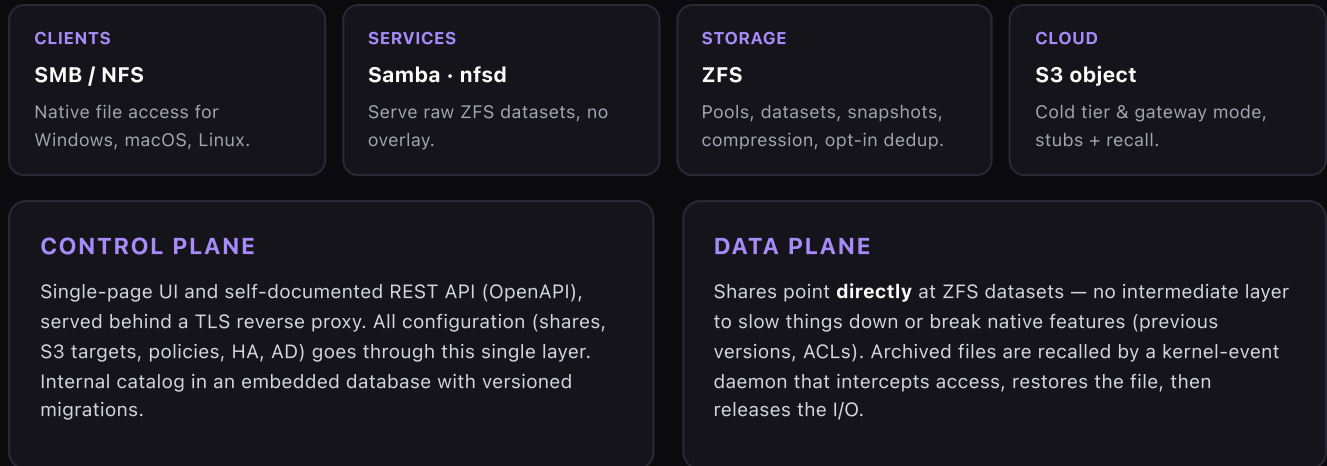
Map source shares (volume, file age, on-demand duplicates) to decide *what* to migrate and *what* to archive before moving a single byte.

Key differentiators

- › **Transparent S3 tiering** — cold files become stubs, recalled on demand with no perceptible difference for the user.
- › **Built-in anti-ransomware** — known-extension blocking at the SMB layer, immutable stubs, scheduled snapshots.
- › **Assisted SMB migration** — discovery, incremental copy, ACL preservation, guided cutover.
- › **Prod-grade HA** — 2-node cluster, failover in seconds, no per-node license.
- › **Sovereignty** — local-first data, tiering to *your* object storage, GDPR-friendly by design.

02 Architecture — overview

A single application binary serves the web UI and the REST API behind a TLS reverse proxy. It drives ZFS, exposes the shares, manages object tiering and replication.



Transparent recall (no overlay)

When an archived file is opened, an access-interception daemon blocks the I/O, downloads the object from S3 (multipart download, integrity check before commit) and releases access. The user only experiences latency. This approach stays compatible with the Windows "Previous Versions" feature, because the share is served from the raw dataset.

Large files. Above a configurable threshold, recall switches to an asynchronous, job-tracked mode so SMB session timeouts are never exceeded.

Compatibility & integrity

- › Raw ZFS datasets → native snapshots, scrub, send/receive and ACLs preserved.
- › Automatic, idempotent pool import at boot (reboot resilience).
- › Checksum verification on every recalled object before serving the file.

03 Primary storage — ZFS

The storage foundation is ZFS: end-to-end integrity, instant snapshots, transparent compression and block-level replication.

PROTECTION TOPOLOGIES

- › Mirror, RAID 1 / 5 / 6 / 10
- › Separate protection groups per usage
- › Scheduled automatic scrub
- › Built-in SMART alerts

CAPACITY EFFICIENCY

- › Transparent compression
- › Opt-in deduplication
- › On-demand duplicate detection (separate, fast metadata pass)
- › Hierarchical quotas: volume / share / user / group

SNAPSHOTS & RETENTION

- › Scheduled immutable snapshots
- › Configurable retention policies
- › Exposed as Windows "Previous Versions"
- › Instant rollback

REPLICATION

- › Incremental block-level send/receive
- › To a DR site or a passive node
- › Tiering config replicated (archived files stay recallable on the remote)

Topology is set by design. In-place topology change (e.g. mirror ↔ raidz) is not supported: topology migration is done by creating a new pool and copying over — an assisted path is recommended.

Access control

POSIX ACLs and Active Directory ACLs coexist. The appliance can join an AD domain (winbind) or run with a local directory. Shares enforce an explicit, audited allowed users/groups policy.

04 S3 tiering & cloud gateway

Two complementary modes back your shares with object storage, reusing the same stub and transparent-recall mechanism.

TIERING MODE (COLD ARCHIVING)

ZFS stays the source of truth; inactive files (per-share policy, e.g. "inactive > 6 months") are pushed to S3 and replaced by stubs. On open, transparent recall. Ideal to free hot storage without breaking anything for the user.

CLOUD GATEWAY MODE (S3 CACHE)

S3 becomes the durable source of truth; local storage is just a write buffer trending toward empty. Writes are first acknowledged locally (low latency) then pushed to S3 on close, before being drained from local. A "cloud file gateway" pattern.

Shared mechanics

- › **Readable & immutable stubs** — an archived file is a truncated file carrying extended attributes pointing to the S3 object.
- › **Transparent recall** — access-triggered, integrity-checked before serving.
- › **Multi-target** — optional replication to two object providers.
- › **Auto-purge** — configurable retention.
- › **Rename tracking** — in gateway mode the S3 tree follows renames server-side (server-side copy, zero transfer through the appliance).

Production safeguards. Local draining honours a grace window (files being copied are protected), skips files open over SMB, and works in throttled waves — so it never disrupts an active client session.

Compatible object back-ends

Any S3-compatible API, including:

AWS S3

MinIO

Wasabi

Ceph (RGW)

Backblaze B2

+ any S3-compatible endpoint

05 High availability & migration

Prod-grade 2-node cluster

An HA orchestrator with quorum device and fencing ensures service continuity. Failover validated in seconds (target RTO ~5–7s), with no per-node license and no mandated hardware.

AUTOMATIC FAILOVER

- › On VM loss, kernel panic, network loss
- › Quorum device to prevent split-brain
- › Manual failover button (maintenance)

NETWORK & ROLES

- › Multi-VIP: management / data / replication on distinct IPs
- › Continuous block-level replication to the passive node
- › Tiering configuration replicated to the passive node

Assisted SMB migration

Move off NetApp, Synology or Windows Server over a weekend, with no third-party tool to buy.

1 · AUDIT

Discovery

Scan source shares, volume, file age.

2 · COPY

Incremental streaming

Resume-on-error copy, checksum validation.

3 · ACL

Permission fidelity

Windows ACLs preserved via AD mapping.

4 · CUTOVER

Guided switch

DFS-N namespace or DNS switch.

NTFS ACL fidelity. Replication of domain security descriptors (real owner, allow and deny entries) is supported on migrated shares via a domain administrator session; without admin rights the appliance falls back to a safe, accessible data-only mode. The object-side permission model remains the authority for Windows fidelity.

06 Security & enterprise networking

Anti-ransomware & hardening

DATA PROTECTION

- › SMB veto on ~130 known ransomware extensions
- › Immutable S3 stubs (signed attribute)
- › Scheduled immutable snapshots retained per policy
- › Email alerts on suspicious events

HARDENING & IDENTITY

- › Exportable hardening audit report (CIS-like)
- › Built-in firewall and secure defaults
- › Active Directory join or local directory
- › Console support access gated by cryptographic challenge-response

Enterprise networking

AGGREGATION & SEGMENTATION

- › 802.3ad (LACP) bonding across N interfaces
- › 802.1Q VLAN
- › Per-interface jumbo MTU

PER-ROLE BINDING

- › Management on admin VLAN
- › Data on production VLAN
- › Replication on a dedicated link
- › HA multi-VIP: one IP per role

Sovereignty. Data stays on your infrastructure. Object tiering targets *your* S3 storage (on-prem or the provider of your choice). No data is exfiltrated to a mandated third-party service.

07 Management, deployment & prerequisites

Administration

WEB UI

Single-page, setup wizard, CPU/RAM/storage dashboards and real-time metrics.

REST API

Self-documented (OpenAPI), scriptable, for automation and integration.

CLI & WEB SHELL

Full CLI and built-in web shell for advanced operations.

- › Updates from the UI (pre-update snapshot + one-click rollback).
- › Central, exportable logs.
- › Email alerts: SMART, storage, jobs, audit.

Deployment — a single universal ISO

Hybrid BIOS+UEFI image, installed identically on:

VMware / vSphere
ESXi 7+

Proxmox VE
7+

Hyper-V
Gen2, Server 2019+ / Windows Pro

KVM / libvirt
standard

Bare-metal
x86_64

Workflow
Boot → install → web wizard

Hardware prerequisites

RESOURCE	RECOMMENDATION
vCPU	4 minimum, 8 recommended
RAM	8 GB minimum, 16 GB recommended (32 GB for large deployments)
System disk	32 GB minimum, dedicated
Data disks	Per sizing (separate protection groups)
Network	1 management NIC + 1 data NIC (LACP supported)

08 Licensing model

Caelum comes in several editions depending on usage (discovery, evaluation, production, partners). **Commercial terms are provided on a quote basis.**

Editions

EDITION	CAPACITY	USAGE
Free	Up to 1 TB	Perpetual — discovery, small volumes, homelab
Trial	Unlimited, 30 days	Full evaluation, no commitment
Production	Quote-based	Production deployments
Partner / NFR	Demo-dedicated	Integrators & MSPs (resale / demonstration)

Offline & air-gapped. Licenses are cryptographically signed and work offline; air-gapped environments are supported.

09 Summary

Caelum, the NAS appliance that audits, migrates and backs data to the cloud — sovereign and readable.

WHAT CAELUM DELIVERS

- › Fast local storage on ZFS, no proprietary layer
- › Transparent S3 tiering & cloud gateway mode
- › Prod-grade 2-node HA, failover in seconds
- › Assisted SMB migration with ACL fidelity
- › Built-in anti-ransomware and hardening
- › Full enterprise networking (LACP, VLAN, multi-VIP)
- › UI / REST API / CLI administration
- › Several license editions (discovery → production) — quote-based

WHO IT'S FOR

- › SMBs & mid-market with ageing NAS to refresh
- › IT teams who want to own their storage and cloud
- › MSPs & integrators seeking a multi-tenant platform
- › Organisations focused on sovereignty and GDPR compliance

Learn more. Request free early access, download the universal ISO and get started in minutes. The concise datasheet and trial access are available on the Caelum website.

This document describes the technical capabilities of the Caelum product as of its publication date and may evolve. Features are described as shipped; license amounts are provided on quote. Caelum is published by GaLiLo.