



Hop3

From Self-Hosting Complexity to Production-Ready Sovereignty

An Open-Source PaaS for Digital Autonomy

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Part 1: The Sovereignty Paradox



The Promise of Self-Hosting

Digital sovereignty is the ability to control your own digital destiny:

- Your data stays yours
- Your infrastructure, your rules
- No vendor lock-in
- Full transparency and auditability

Open source software should be the foundation of this sovereignty.

Yet most organizations **give up** and hand their data to hyperscalers.

Why?



The Reality: Operational Chaos

Self-hosting F/OSS applications means:

Constant Complexity:

- Infrastructure provisioning
- Configuration management
- Dependency hell
- Security patching

Operational Burden:

- Monitoring & alerting
- Backup & disaster recovery
- SSL certificate management



Our Thesis

The solution isn't to work harder – it's to build smarter platforms.

What if we could:

- Deploy any F/OSS app with a single click, CLI command or `git push`
- Automatic SSL, backups, monitoring
- One-click service provisioning (PostgreSQL, Redis...)
- Web UI for non-technical administrators
- Reproducible, deterministic environments

This is Hop3.



Part 2: Engineering a Sovereign PaaS



Introducing Hop3

Hop3 is an open-source Platform-as-a-Service that makes self-hosting practical.

What we deliver:

- **Complete lifecycle management:** build, deploy, maintain, secure, backup
- **Production-grade reliability** without DevOps expertise
- **Full control** over your infrastructure and data

License: Apache

Target users:

- SMEs deploying internal tools



Application Lifecycle



Architecture Philosophy

12-Factor App Foundation:

- Declarative configuration (`hop3.toml` or `Procfile`)
- Strict separation of config from code
- Backing services as attached resources
- Stateless processes, disposable environments

Beyond 12 Factors:

- **Security by design:** Fernet-encrypted credentials, JWT auth
- **Sustainability:** Runs on modest hardware, energy-conscious
- **Extensibility:** Plugin architecture (Pluggy + Dishka DI)



The Web Dashboard

For administrators who prefer GUIs:

- Real-time application status
- Live log streaming
- Service attachment visualization
- Backup management
- Environment variable editing

No CLI required for day-to-day operations.

Built with: Litestar, HTMX, Tailwind CSS



CLI Overview

```
$ hop help
```

```
USAGE
```

```
$ hop <command> <args>
```

```
COMMANDS
```

admin	Administrative commands
app	Commands for managing app instances
apps	List all applications
backup	Run a backup for an app
config	Manage an application config / env
deploy	Deploy an application
pg	Manage PostgreSQL databases
redis	Manage Redis instances



Declarative Configuration

hop3.toml - Your application's complete specification:

```
[metadata]
id = "my-nextcloud"
version = "1.0.0"

[run]
start = "php-fpm"

[env]
NEXTCLOUD_ADMIN_USER = "admin"
NEXTCLOUD_TRUSTED_DOMAINS = "cloud.example.com"
```



Backing Services: First-Class Citizens

PostgreSQL, Redis, MySQL... with full lifecycle management.

Operations:

- Provision with one command
- Attach to any application
- Automatic credential injection
- Backup & restore integration

Security:

- Fernet AEAD encryption at rest
- Credentials never in plaintext
- Per-service isolation



Backup & Restore: Built-In

Complete data protection, not an afterthought:

```
backup/
├── metadata.json      # SHA256 checksums
├── source.tar.gz     # Application code
├── data.tar.gz       # User data
├── env.json          # Configuration
└── services/
    └── postgres_mydb.sql
```

Features:



Plugin Architecture

Everything is extensible:

Build Strategies:

- Native (Python, Node, Go, Rust...)
- Docker (Dockerfile)
- Nix (coming soon)

Deployment Runtimes:

- uWSGI Emperor
- Docker Compose
- Systemd (planned)



Part 3: Live Demonstration

Demo: Deploying a Flask App

Scenario: Deploy a Python Flask app with PostgreSQL database.

Steps:

- 1 Create app files and deploy
- 2 Check status and configure environment
- 3 Create and attach PostgreSQL database
- 4 View logs and create backup
- 5 Generate SBOM for compliance



Step 1: Create & Deploy

```
# app.py
from flask import Flask
app = Flask(__name__)

@app.route('/')
def hello():
    return '<h1>Hello, World!</h1>'
```

```
$ hop deploy demo-app ./app-dir
> Starting deployment for app 'demo-app'
-> Build successful
```



Step 2: Check Status

```
$ hop app:status demo-app
```

Property	Value
Name	demo-app
Status	RUNNING
Instances	1
Local URL	http://127.0.0.1:53329

```
$ hop app:ping demo-app  
✓ App 'demo-app' is responding
```



Step 3: Configure Environment

```
$ hop config:set demo-app APP_NAME=Hop3Demo  
Updated configuration for 'demo-app':  
• Set APP_NAME=Hop3Demo
```

```
$ hop config:show demo-app
```

Key	Value
APP_NAME	Hop3Demo



Step 4: Create PostgreSQL Database

```
$ hop addons:create postgres demo-db  
Addon 'demo-db' created successfully.
```

```
$ hop addons:attach demo-db --app demo-app  
Addon 'demo-db' attached to app 'demo-app'.
```

Environment variables:

- Added DATABASE_URL

- Added PGDATABASE, PGUSER, PGPASSWORD

- Added PGHOST, PGPORT



Step 5: Create Backup

```
$ hop backup:create demo-app  
Creating backup for app 'demo-app'...
```

✓ Backup created successfully!

```
Backup ID: 20251211_062736_3beb5f  
Total size: 270.0 B
```

```
$ hop backup:list demo-app
```

BACKUP ID	SIZE	STATUS
20251211_062736_3beb5f	270.0 B	COMPLETED



Web UI: Marketplace

Rich app ecosystem - Browse and deploy pre-configured applications.



Web UI: One-Click Deployment

View app information, requirements, and deploy with a single click.



Web UI: Application Overview

Full control - Manage configuration, view logs, control lifecycle.



Web UI: Application Details

Real-time status - Monitor with logs and live updates.



Web UI: Backup Management

View all backups across your applications.



Part 4: The Open Internet Stack

Hop3 in the European F/OSS Ecosystem

Funded (in part) by European research programs:

NEPHELE (Horizon Europe)

- Cloud-edge orchestration research
- Docker / Kubernetes / Karmada backend
- **Pure research (TRL 3-4)**

NGI Zero Commons Fund (NLnet)

- Security & resilience
- "Nix Integration for Hop3"
- Robust testing infrastructure
- **TRL 5-8: Experimental development**

NGI0: Towards Reproducible Sovereignty

Security & Resilience (90% complete):

- Encrypted credential storage (Fernet AEAD)
- Web Application Firewall (LeWAF)
- Database migrations (Alembic)
- Backup/restore system
- Comprehensive testing (435+ tests)
- Web UI dashboard with SSE logs

What it enables:

- Trustworthy deployments for public institutions
- Auditable infrastructure for compliance
- Sustainable self-hosting for SMEs



LeWAF: Web Application Firewall

LeWAF = Lightweight Web Application Firewall

What it is:

- Pure Python WAF engine
- ModSecurity SecLang compatible
- **92% OWASP CRS** rule support
- Prevents: SQL injection, XSS, path traversal...

Performance:

- Sub-millisecond latency (~0.1ms)
- 12,000+ requests/second

Why Nix Matters for Sovereignty

- **Reproducibility:** Same inputs → identical outputs, forever
- **Auditability:** Complete dependency graph
- **Security:** Immutable builds, instant rollback
- **Sustainability:** Builds work years later

Roadmap:

- Nix builder plugin for apps
- Nix-based Python/Node builders
- Goal: **Bit-perfect, reproducible deployments**

The Open Internet Stack Vision

NGI has funded hundreds of F/OSS building blocks. Who deploys them?

Hop3 aims to be the **operational layer** that:

- Makes NGI-funded software deployable by anyone
- Provides the "glue" between components
- Enables sustainable self-hosting

The vision: From individual tools → integrated, sovereign infrastructure.



Roadmap: 2025-2026

Q4 2025 (now):

- Single-server PaaS
- CLI + JSON-RPC API
- Docker and native builds
- Web admin dashboard
- PostgreSQL, Redis, MySQL addons
- Backup/restore, WAF

Q1 2026:

- Identity management (LDAP, OIDC...)
- Nix builder and runtime plugins
- More addons (MongoDB, S3...)



Why Hop3 Matters

For Digital Sovereignty:

- Full control, no lock-in
- Transparent, auditable
- OSS-licensed

For the F/OSS Ecosystem:

- Makes self-hosting viable
- Bridges the "deployment gap"

For Europe:

- Concrete implementation of digital autonomy



Get Involved

Try it:

- Documentation: hop3.cloud
- Source: github.com/abilian/hop3
- LeWAF: github.com/abilian/lewaf

Contribute:

- Code, documentation, testing
- Application packaging
- Feedback and bug reports



Questions?

Thank You!

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