DIGISHAPE
DATASCIENCE
FOR
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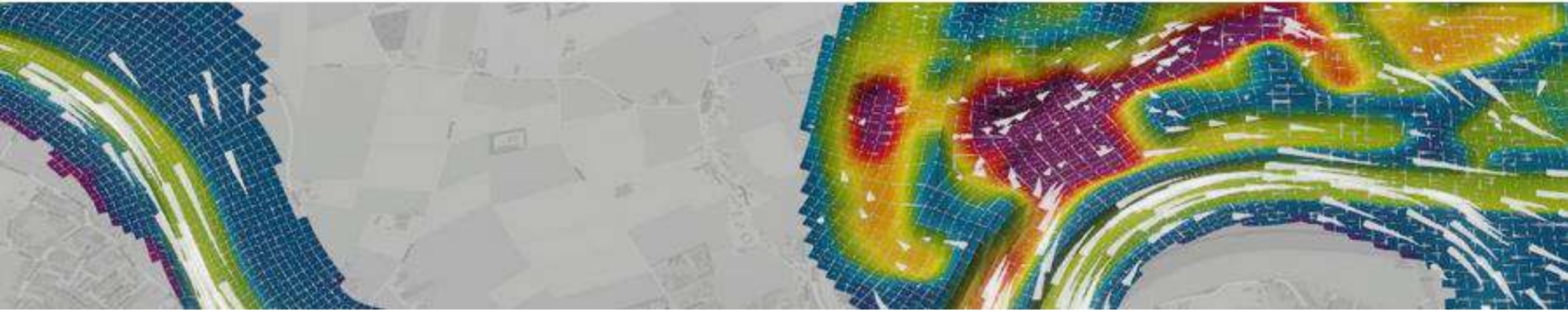


DigiShape - Open Source Platform

Building an Open, Interopable Platform

Floris Langeraert – Deltares – 15-10-2025

Welcome

Building an Open, Interopable Platform

- Review what has been done before by others
- Test relevant components
- From components to architecture

- Floris Langeraert – Cloud Consultant Deltares

> *"Before building, look at what was done before…"*

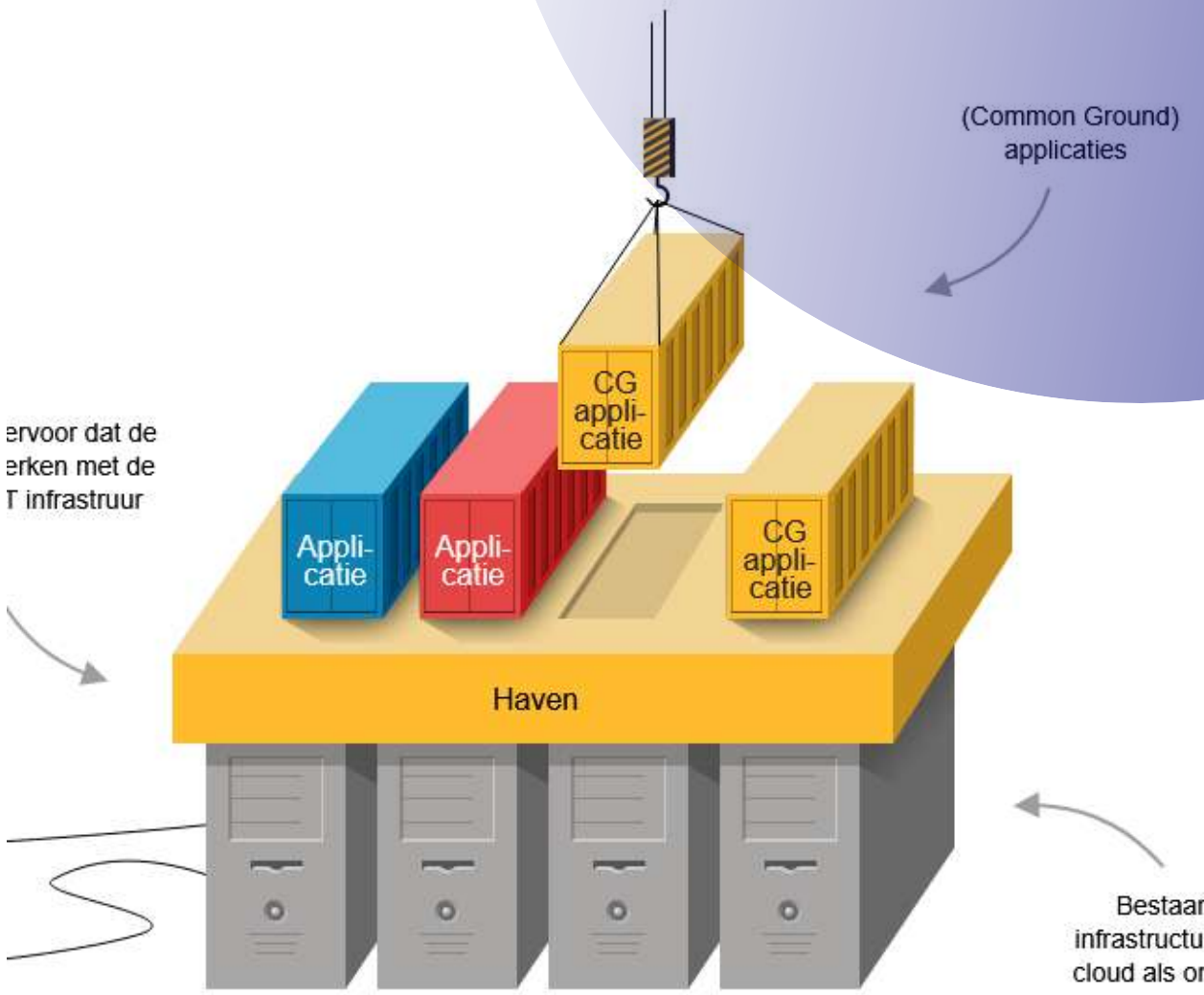
Haven

Key facts:

- Initiative by VNG (Dutch Municipalities)
- Started 2019
- 40+ municipalities, 8 vendors
- Part of Common Ground vision

What we Learned

- Kubernetes as foundation works
- Compliance checking is essential
- Community governance matters
- Platform-agnostic ≠ vendor-independent
- Haven+ needed for full sovereignty



GAIA-X

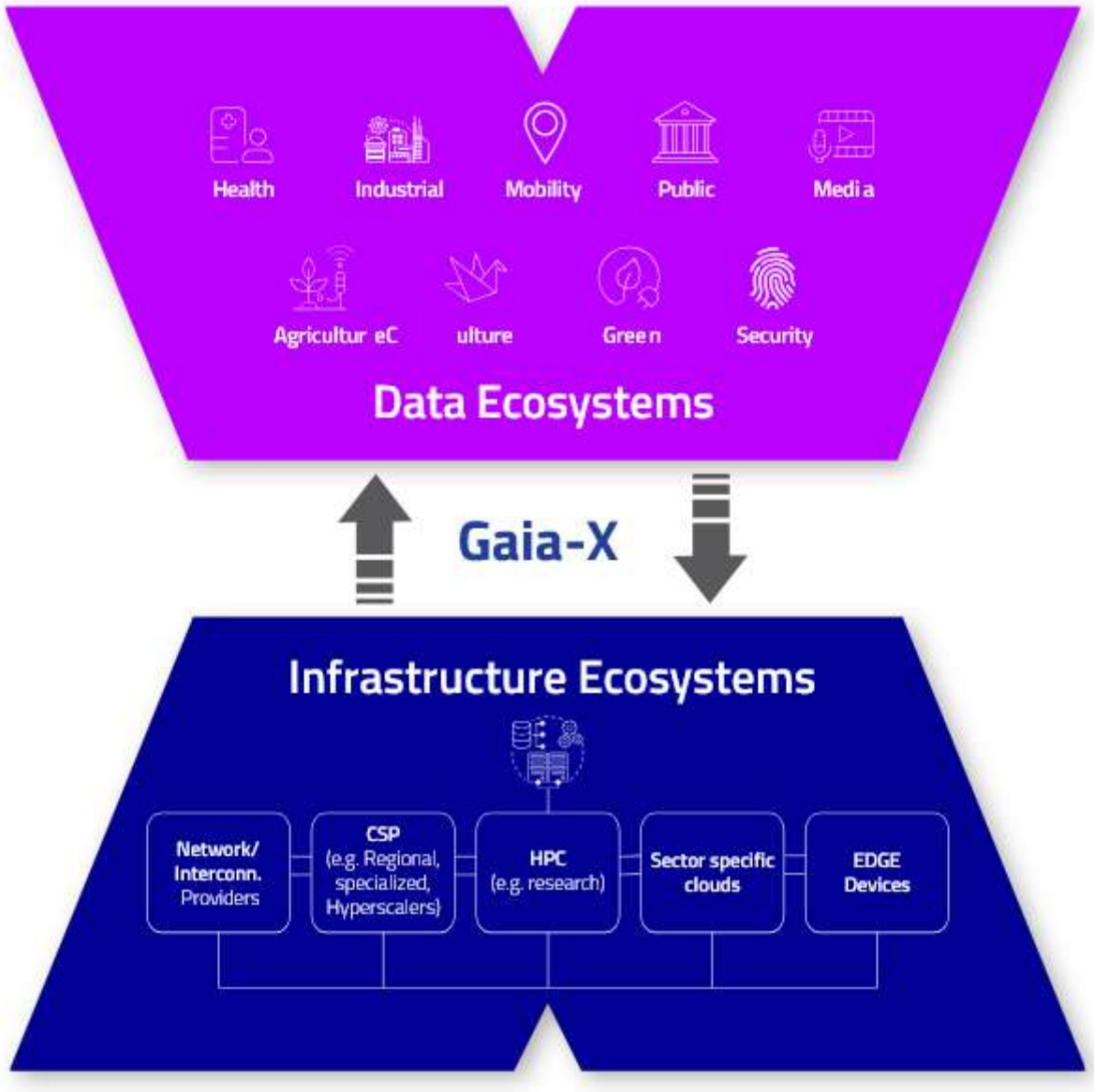
Key facts:

- European Commission backed
- Started 2020
- Data sovereignty & federation
- Not a cloud, but a federation framework

What we Learned

- Federation > Centralization
- Trust framework is critical
- Governance takes time
- Too complex for quick wins

💡 Start simple, add governance later



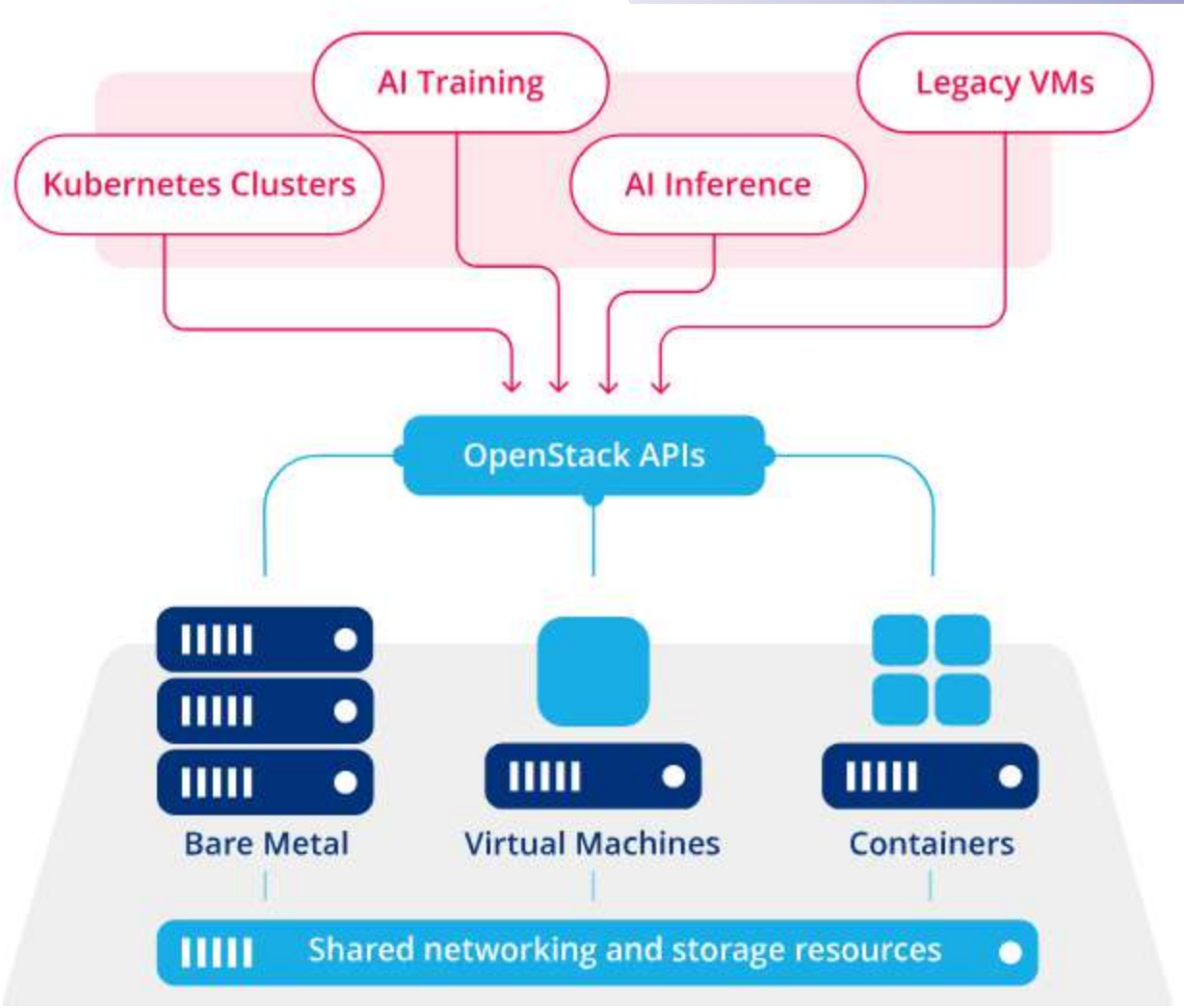
OpenStack

Key facts:

- Global open source project
- Started 2010
- Build your own cloud infrastructure
- Modular component architecture

What we Learned

- Proven at scale
- Resource abstraction patterns
- Multi-tenancy design
- Steep learning curve and operational overhead
- 💡 Use patterns, not the platform



Comparative Analysis

Three Approaches, Different Strengths

Aspect	Haven	GAIA-X	OpenStack
Scope	NL Municipalities	EU Federation	Organization Cloud
Maturity	Growing	Emerging	Mature
Complexity	Medium	High	Very High
Governance	VNG	Association	Community
Best Feature	Compliance Checker	Trust Framework	Technical Depth

What we are taking forward

From Haven

- Kubernetes foundation
- Compliance checking approach
- Community-driven development

From GAIA-X

- Federation architecture
- Self-description concept
- Trust & identity framework

From OpenStack

- Resource abstraction patterns
- Multi-tenant design
- API-first thinking

Cloud Storage comparison

> *"We tested 4 different storage backends…"*

Storage Providers Tested

Azure Blob Storage	Google Cloud Storage	LeafCloud	On-Premise (MinIO)
• 🌍 Location: West Europe • 💰 Cost: €€€ • ⚡ Performance: Fast • 🔧 Complexity: Medium	• 🌍 Location: europe-west4 • 💰 Cost: €€ • ⚡ Performance: Very Fast • 🔧 Complexity: Medium	• 🌍 Location: Netherlands • 💰 Cost: €€ • ⚡ Performance: Good • 🔧 Complexity: Low • ♻️ Bonus: Sustainable	• 🌍 Location: Own datacenter • 💰 Cost: € (one-time) • ⚡ Performance: Variable • 🔧 Complexity: High • 🔒 Bonus: Full control

Test Methodology & Key Findings

Key findings:

GCP: Fastest overall

LeafCloud: Best value/performance

On-Premise: Most flexibility

Azure: Consistent performer

Upload Performance

- 1GB NetCDF file
- 1000 small files
- Results: Latency & throughput

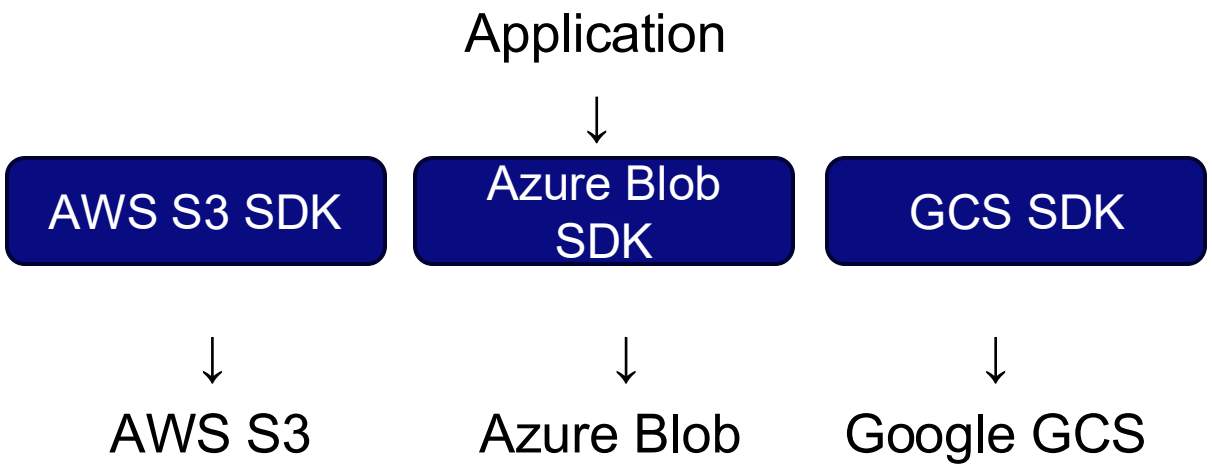
Download Performance

- Sequential reads
- Random access patterns
- Results: Time to first byte

Cost Analysis

- Storage costs (€/GB/month)
- Transfer costs (€/GB)
- API operation costs
- Results: Total Cost of Ownership

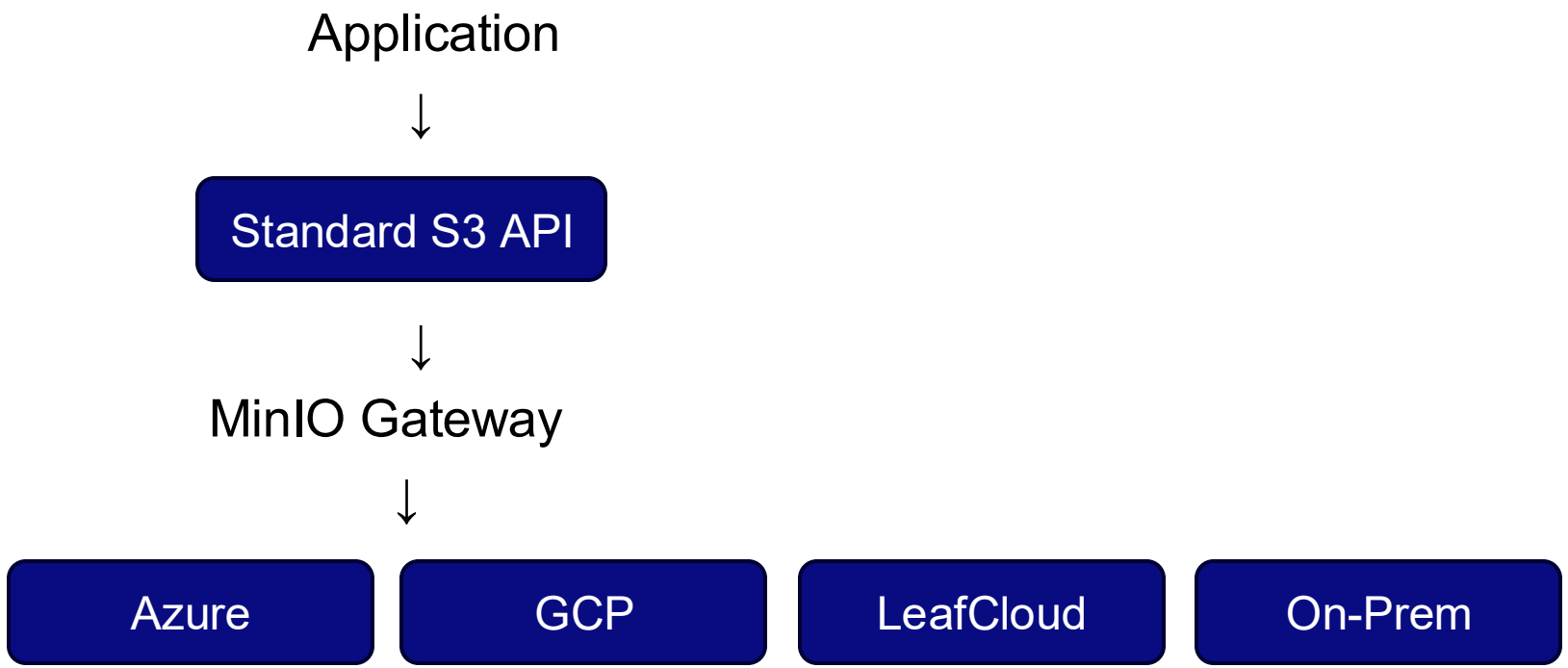
The S3 API problem



Problems:

- ❌ Different authentication methods
- ❌ Different API calls
- ❌ Different error handling
- ❌ Vendor lock-in through code

One API to Rule Them All



Benefits:

- ✅ Write once, deploy anywhere
- ✅ No vendor lock-in
- ✅ Easy to switch/add providers
- ✅ Consistent developer experience

Storage Decision Matrix

Choosing the Right Provider per Use Case

Use Case	Recommended	Reasoning
Hot Data (Active simulations)	GCP / Azure	Performance critical
Warm Data (Recent archives)	LeafCloud	Balance cost/speed
Cold Data (Historical)	On-Premise	Lowest long-term cost
Sensitive Data	On-Premise	Data sovereignty
Public Datasets	Any with CDN	Global access

"We use ALL providers - each for their strengths"

> *"From components to complete architecture...”*

Design Principles

1. Federation over Centralization	• No single point of failure • Partners keep autonomy
2. Open Source First	• No vendor lock-in • Community support
3. Layered Architecture	• Separation of concerns • Easy to upgrade parts
4. Security by Design	• Zero trust model • Audit everything
5. Developer Friendly	• Modern tooling • Good documentation
6. Cost Conscious	• Right tool for each job • Optimize continuously

Architecture Overview

What Works Today

Green checkmarks:

- ✅ Kubernetes running on Azure + On-Prem
- ✅ Keycloak SSO functional
- ✅ MinIO serving data
- ✅ Jupyter Hub accessible

In progress (orange):

- 🟧 Multi-cloud data replication
- 🟧 Data Catalog setup
- 🟧 API Gateway configuration

Planned (gray):

- ⬜ Dataset publications

Stay in touch

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