# The Story of Spin: Five Years Supporting Science with Container-Based Services at NERSC

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# Spin is CaaS in a Supercomputing Facility

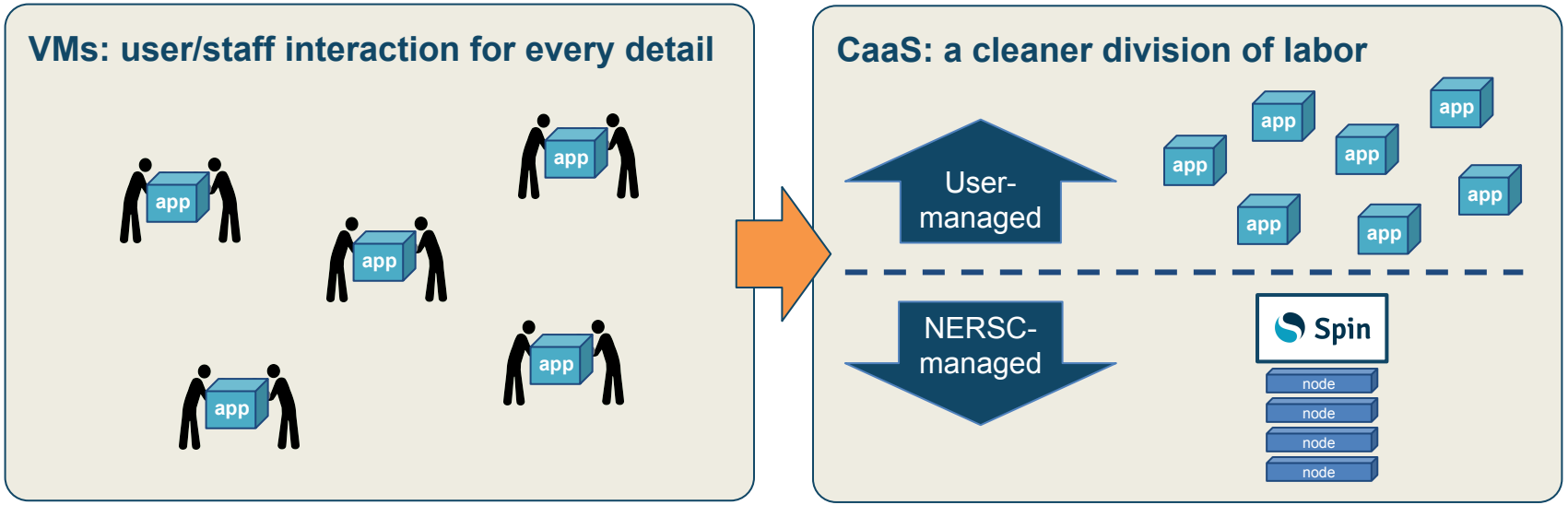
**“ How can I run services alongside HPC that can…**

… access file systems
… access HPC networks
… scale up or out
… use custom software

… outlive jobs (persistence)
… schedule jobs / run workflows
… stay up when HPC is down
… be available on the web

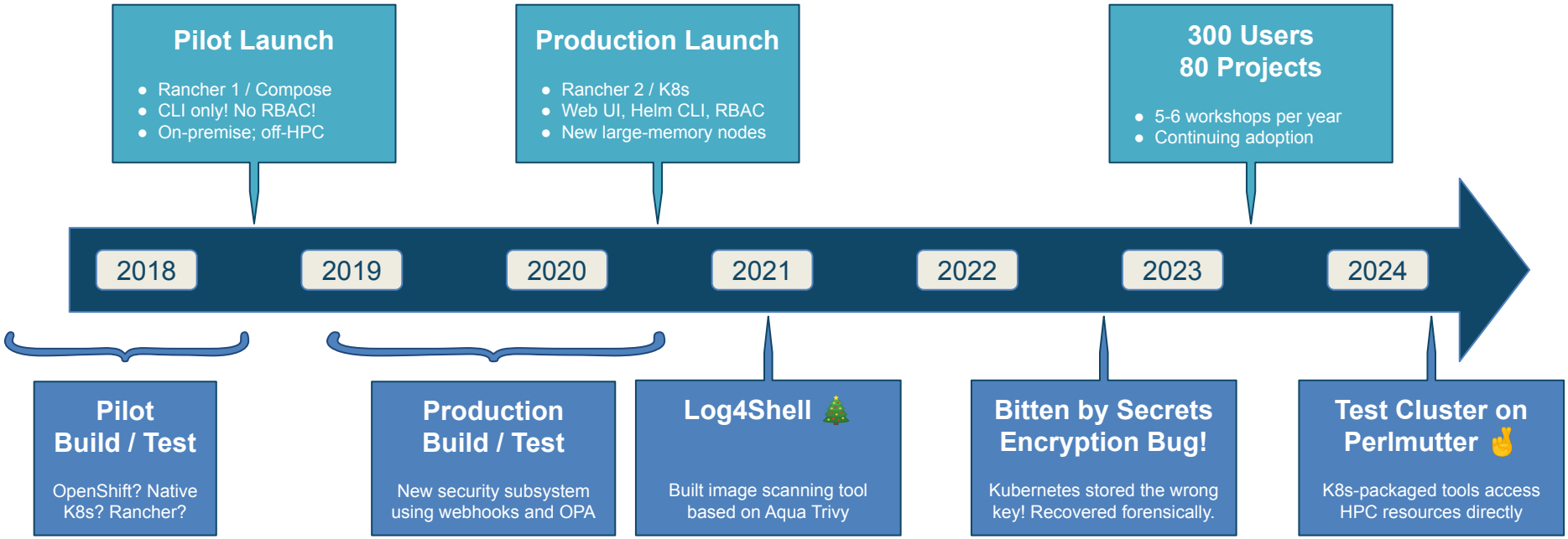
**and are managed by my project team? ”**

# Spin Let Us Scale Up Support for Services




CaaS empowers users to build the services they need while NERSC staff manage and secure the underlying platform.

# Timeline and Evolution



# Key Challenges and Achievements

## Continuous Upgrades

- Versions increment rapidly
- Many dependencies; breaking changes are often hidden; integration testing is *critical*
- Keep it simple (if you can!)


## Multi-Tenancy

- RBAC is key!
- Rancher project = NERSC project
- Resource usage at container granularity is difficult on a multi-tenant platform

## Security

- Minimum privilege model
- Dynamic rulesets (is storage mounted?)
- K8s Admission Controllers critical for security
- Security *must* be automated

## Training and Support

- Helping users design workflows and applications, not just tune HPC codes
- Interactive workshop, tickets, office hours
- Interdisciplinary team across NERSC staff

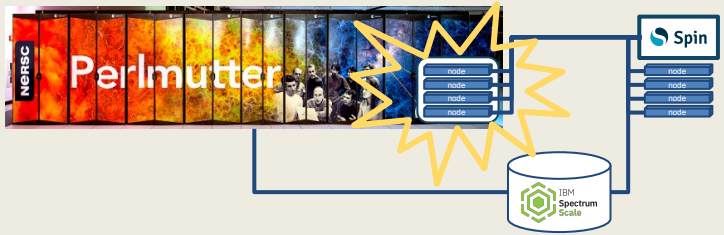
# Future: Hybrid Model, New Low-Level Tech

## Current: Off-HPC

- Separate COTS deployment
- Indirect access to HPC resources
- Equivalent access to common resources
  - Networks
  - Global File Systems


## Future: Hybrid On/Off-HPC

- Semi-separate COTS & On-HPC deployment
- K8s workload cluster on dedicated nodes
- Multiple modes of access to HPC resources
  - Off-HPC: as before
  - On-HPC: native, but containerized




Technologies we plan to explore:

- **cgroups v2** for granular resource limits on *everything*
- **eBPF** for low-level network and security monitoring
- **K8s / Slurm integration** for portability and workflow support
  - *over* vs *under* vs *adjacent*...the latter is more exciting!