Building User-facing Platforms with Container Orchestration

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The Problem

- Enormous number of workflow management systems in scientific communities
- Incredible open source ecosystem around data science
- Impossible to support many different application workloads

How can we achieve parity with **service workloads** like we have with **batch workloads**?

What is Platform Engineering?

Platform engineering is the discipline of designing and **building toolchains and workflows** that enable **self-service capabilities** for software engineering organizations in the cloud-native era. Platform engineers provide an integrated product most often referred to as an “Internal Developer Platform” covering the **operational necessities of the entire lifecycle of an application**.

Luca Galante

https://platformengineering.org/blog/what-is-platform-engineering

Qualities of a Platform

User Workloads

Enabling self-service

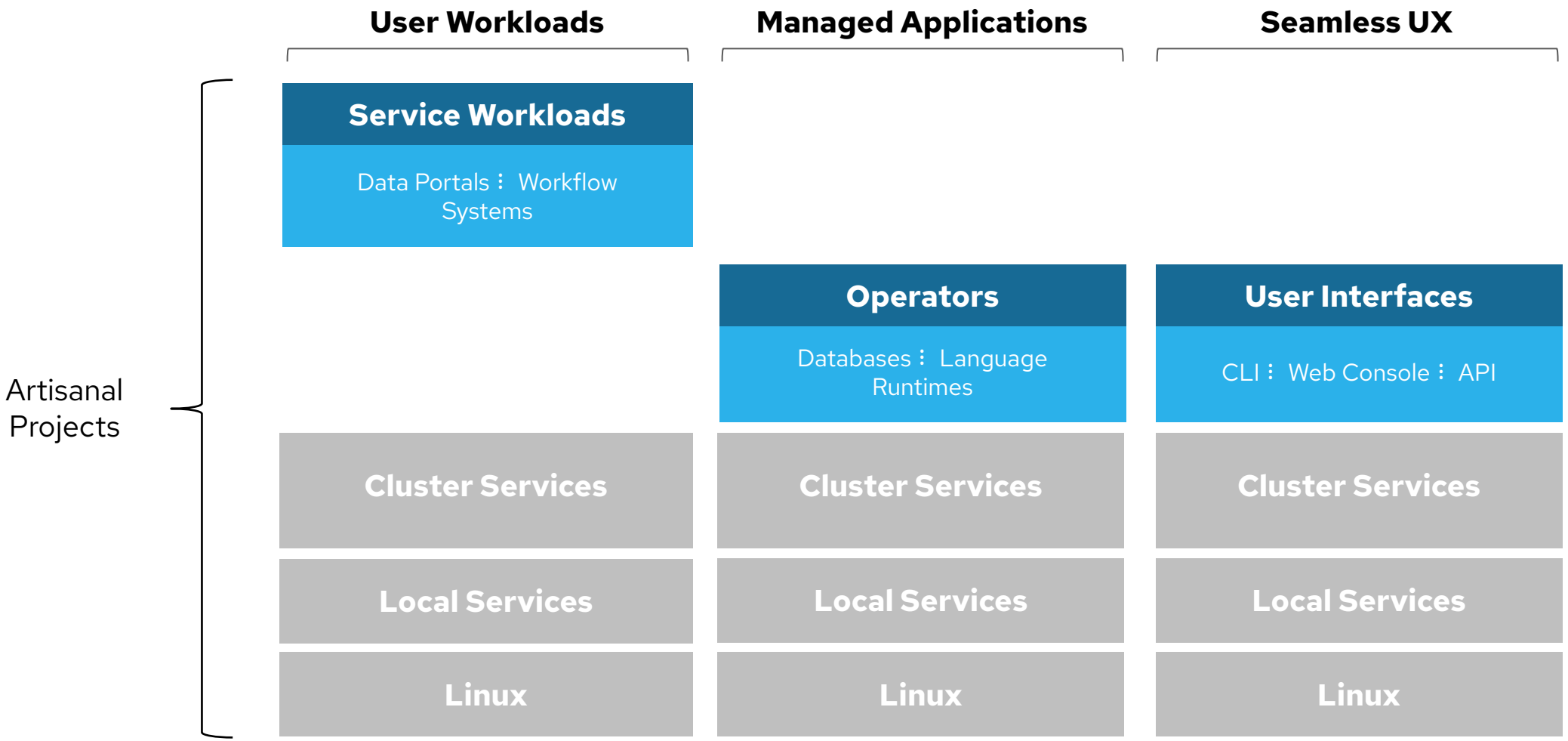
Managed Applications

Dependencies managed through service catalog

Seamless UX

Pulling it all together

Why Platform?



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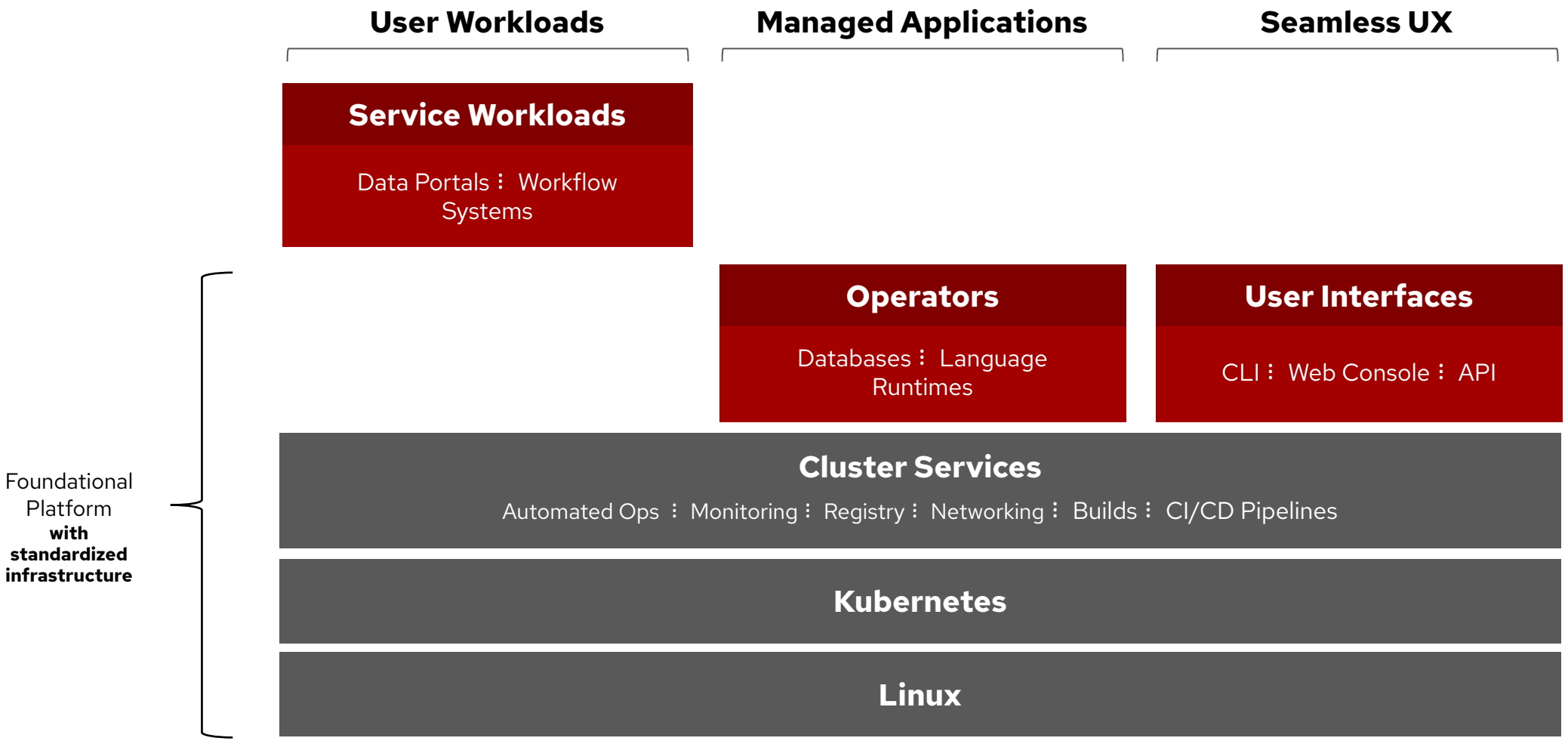
Platform for Innovation



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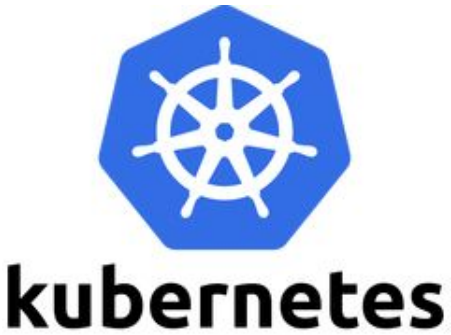
Why Kubernetes?

- Good portability and consistency across environments
- Reduce overhead and operational costs
- Increased security
- Increased user productivity
- Similar semantics with HPC



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User Workloads

Use similar semantics that exist for HPC batch jobs to additionally support all kinds of service-type workloads

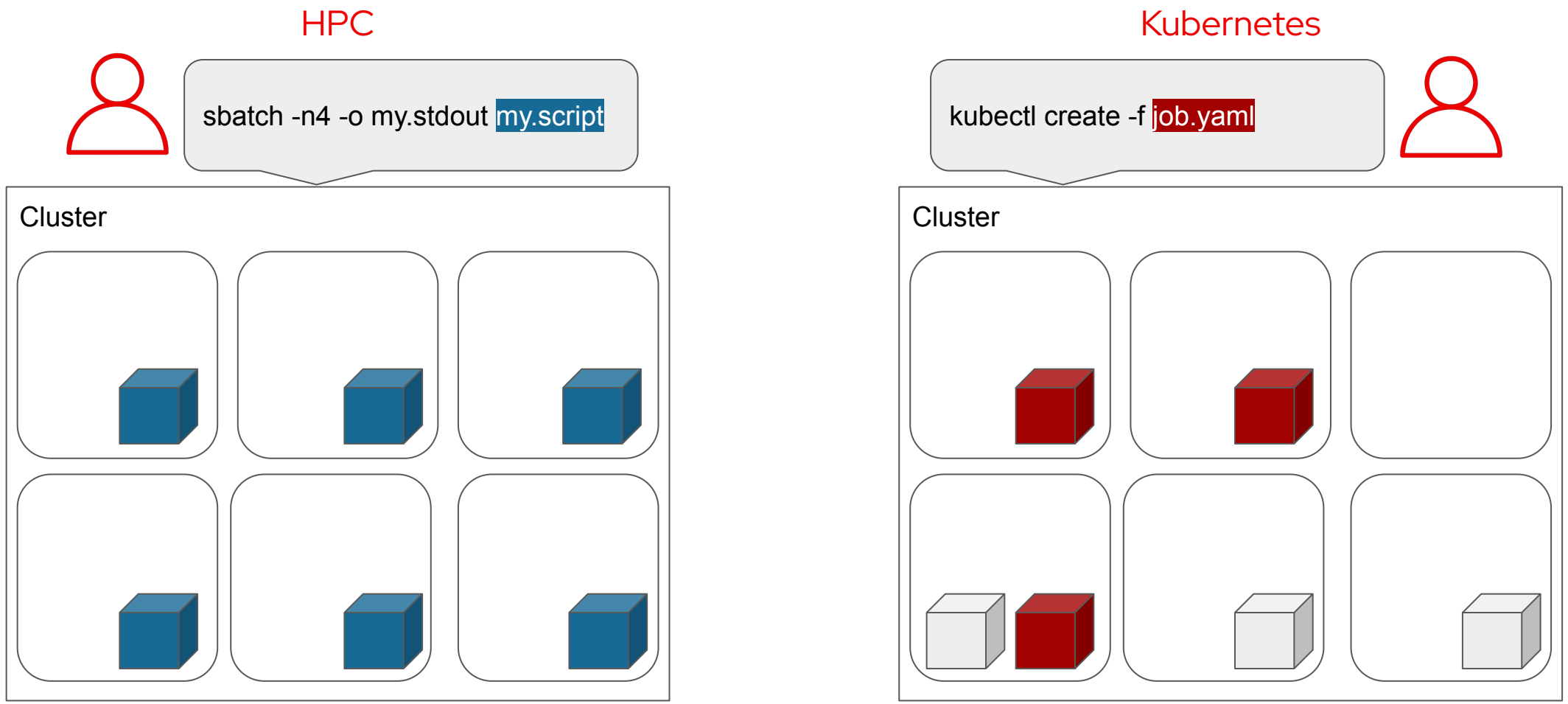
"I want to run this 512 task job somewhere on this cluster with access to the shared file system"

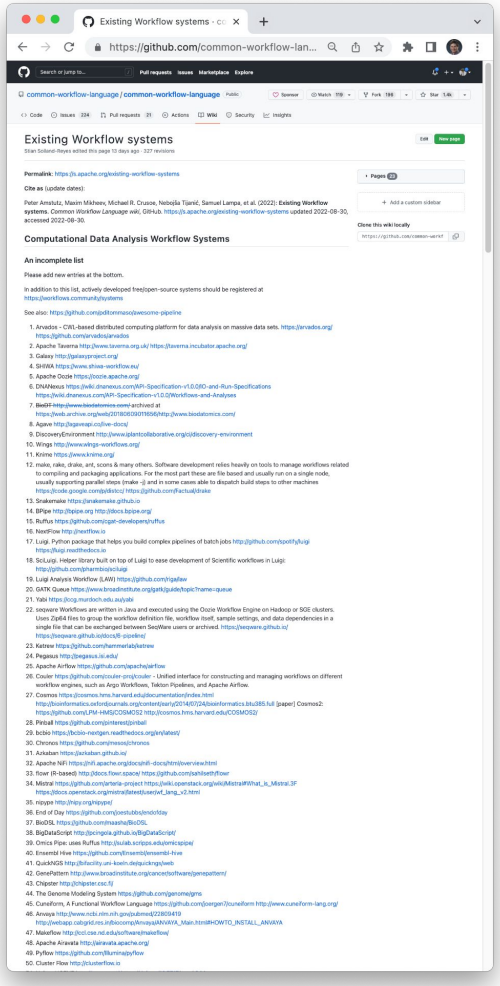
- HPC User

"I want to run 10 copies of this container image and route traffic into the cluster at this address"

- Kubernetes User

User Workloads





Existing Workflow Management Systems: 322 (an incomplete list)

https://s.apache.org/existing-workflow-systems

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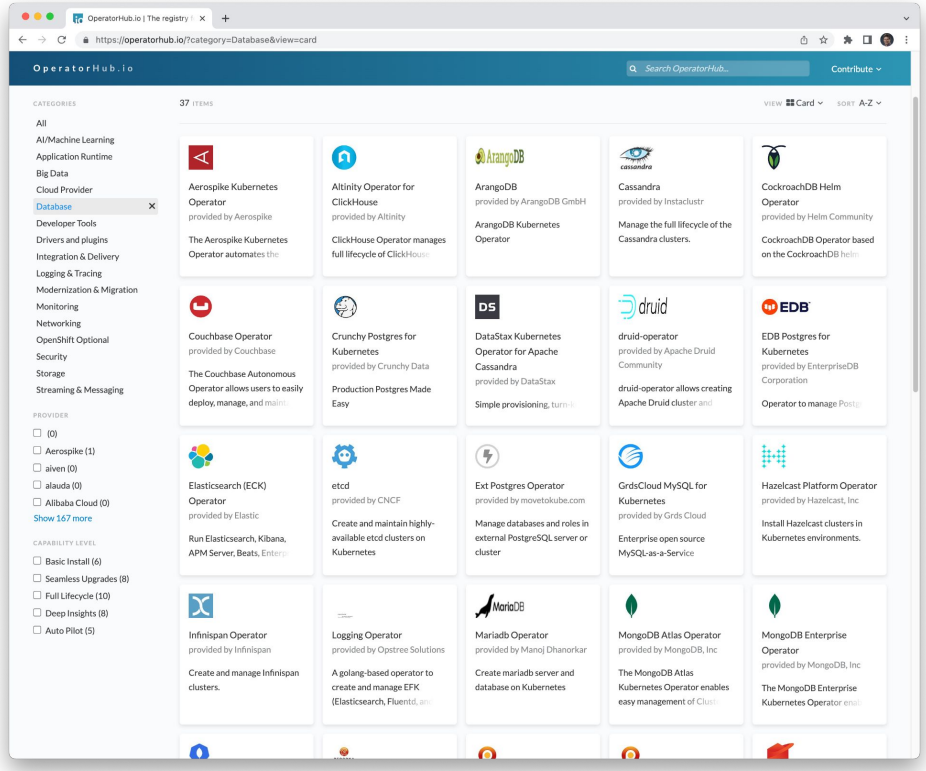
Managed Applications

OPERATOR FRAMEWORK

The Operator Pattern helps developers and admins deliver better user experiences based on the Kubernetes Controller concept.



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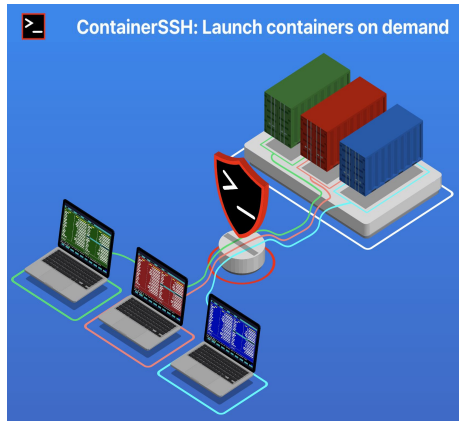
Databases and data science have huge communities. Using the Operator Frameworks, the platform can provide a self-service interface to create service instances that users need.



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User Experience

Self-service workload management that can be tuned to the right level of abstraction for the user community

clutch

https://github.com/backstage/backstage
https://github.com/lyft/clutch

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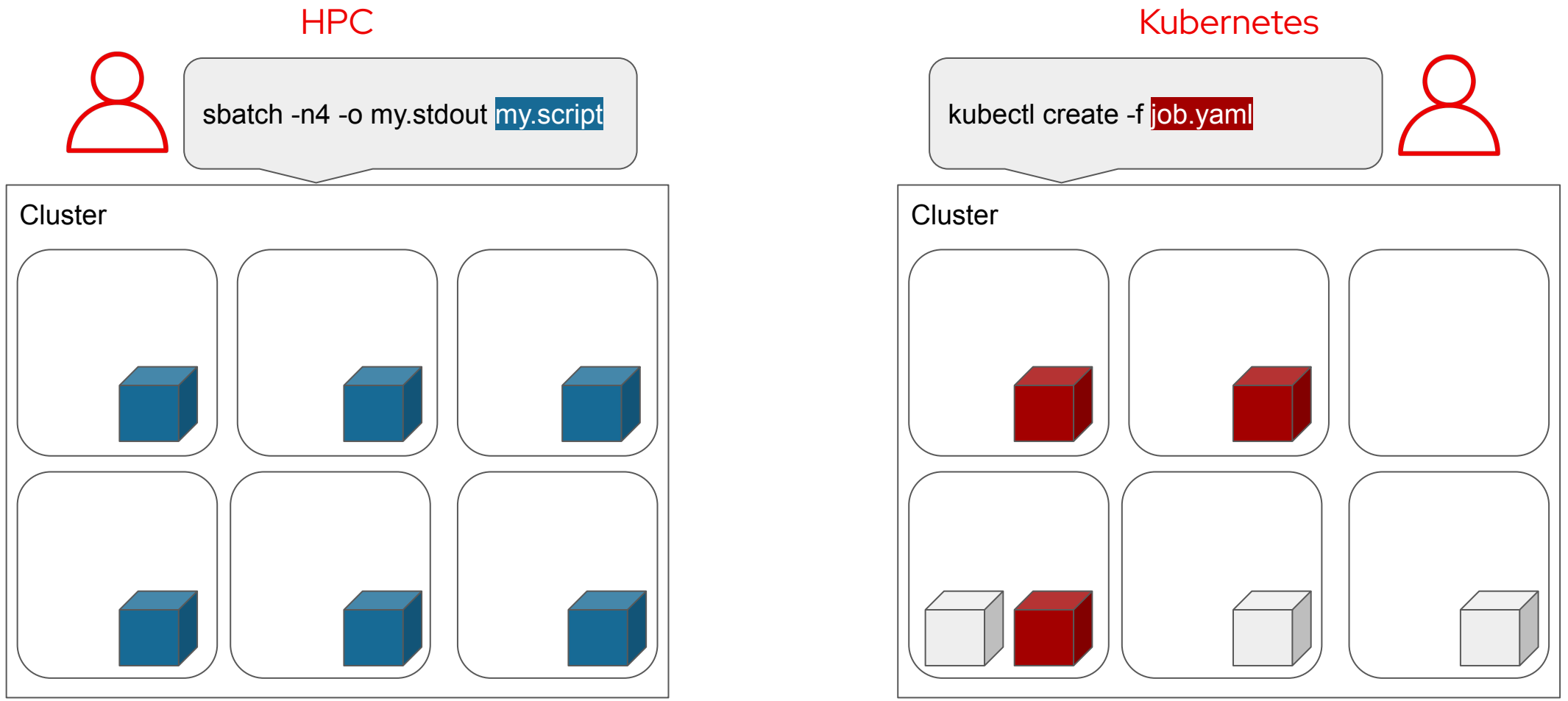
Target: Converged HPC and Kubernetes running all kinds of workloads

User Workloads



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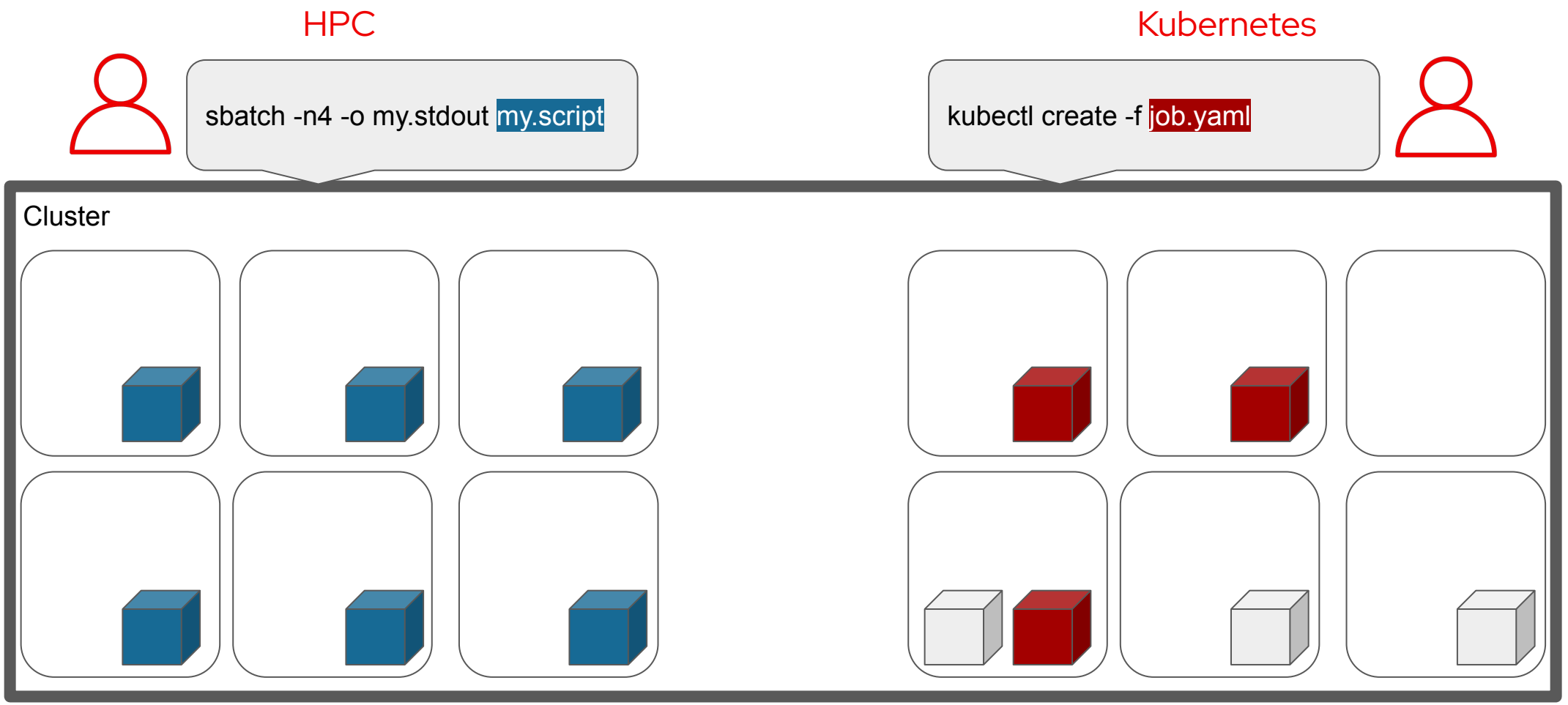
Converged Workloads



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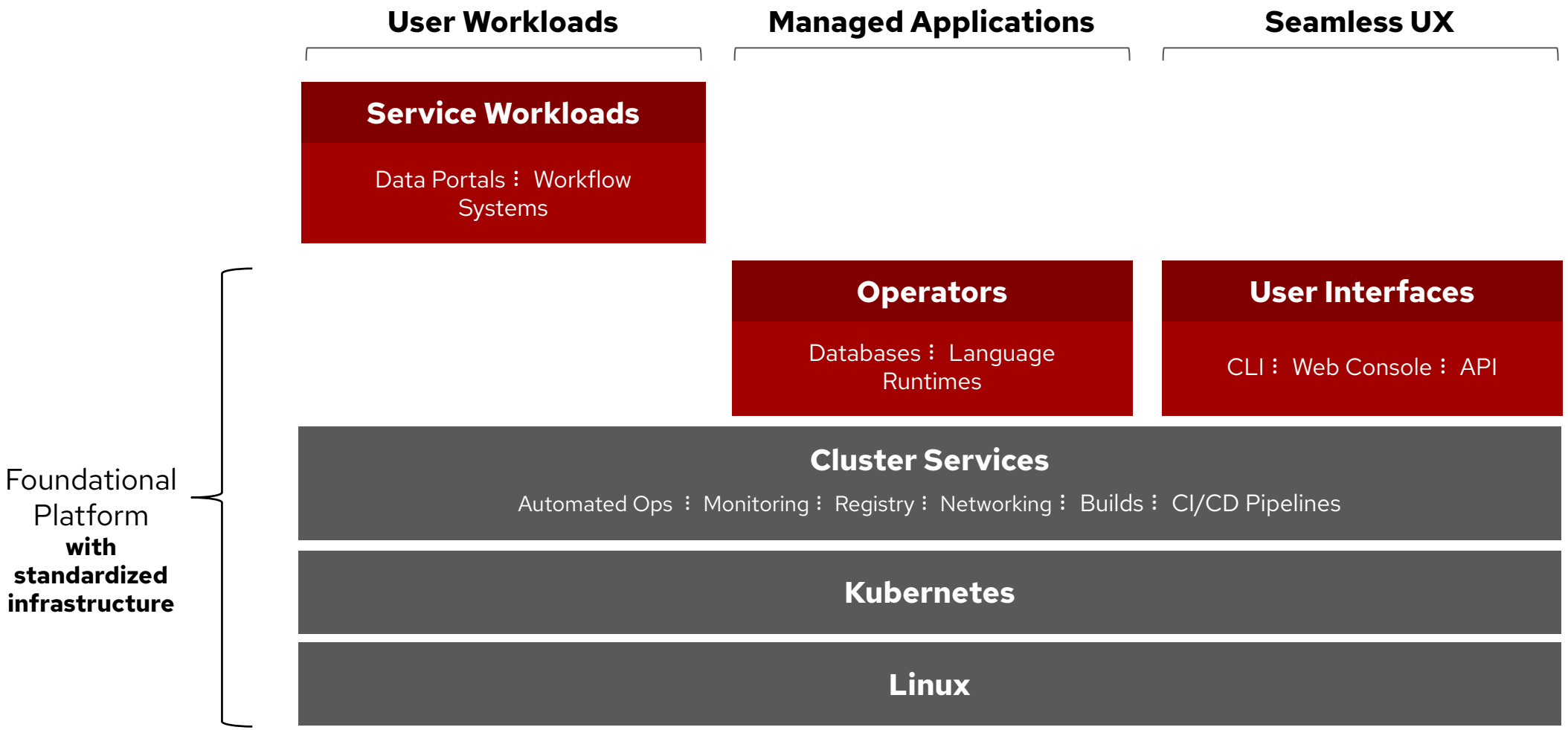
User-Facing Platforms



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