



Kubernetes

An open platform for container orchestration

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Karlsruhe, 30.08.2017



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- › Software-Defined Datacenters
- › Infrastructure as Code
- › Cloud technologies
- › High Availability & Scalability
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How to manage millions of
containers/machines?

“Containers”

- cgroups and namespaces
- Application package management
- (nearly) Platform independent
- Resource separation
- Resource monitoring



kubernetes

by Google

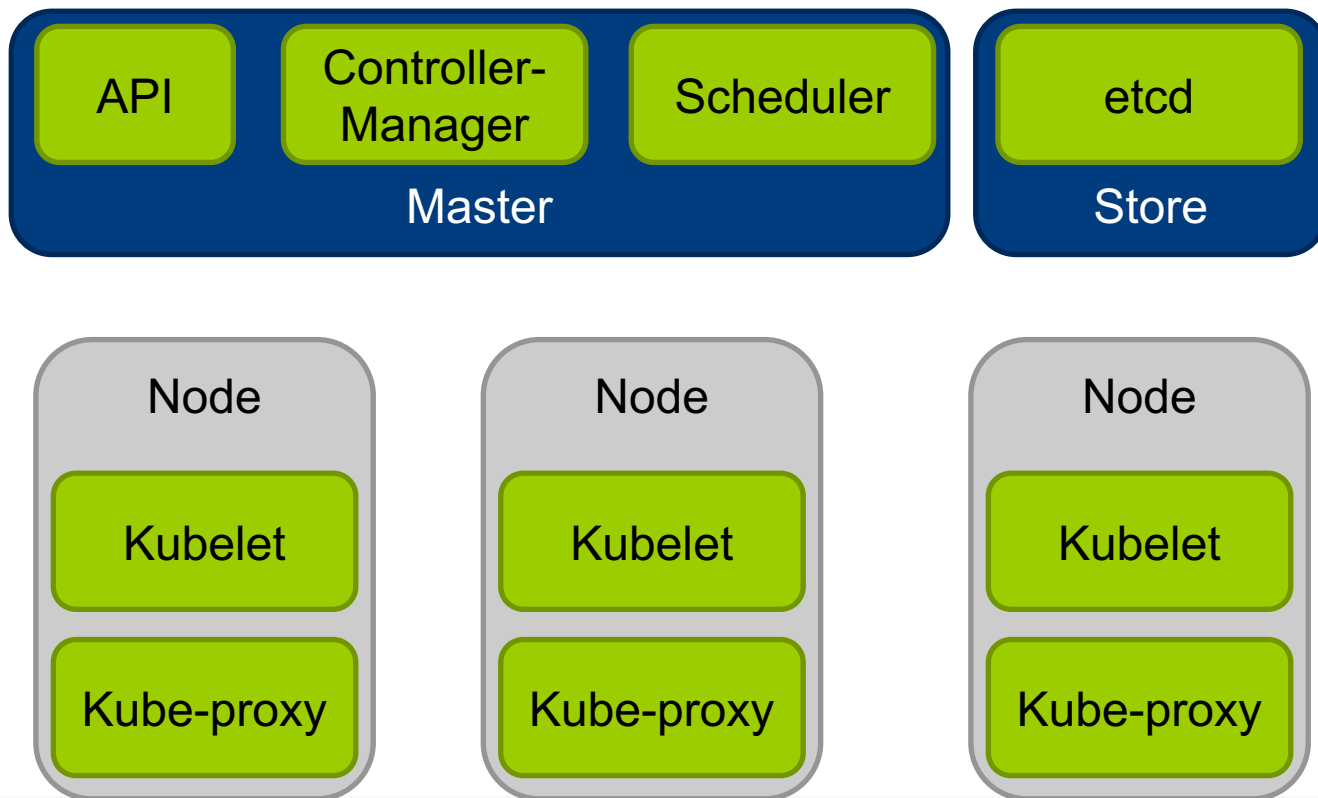
“History”

- Unified container-management Borg
 - Before: Babysitter + Global Work Queue
- Autopilot
 - predicting resource requirements
- Omega
 - Splitting parts of the control plane
 - Multiple Schedulers

The image shows the interior of a large, historic building, likely a museum. The most prominent feature is the vast, arched glass and iron roof, which is supported by a complex network of dark metal trusses. Sunlight filters through the glass panels, illuminating the space. Below the roof, the walls are made of light-colored stone or brick and feature multiple levels of arched windows and doorways. In the center, a wide staircase with ornate metal railings leads up to a platform. On the platform, there is a white statue of a person. Several people can be seen walking on the stairs and standing on the platform, providing a sense of scale to the massive architecture.

Architecture

Architecture



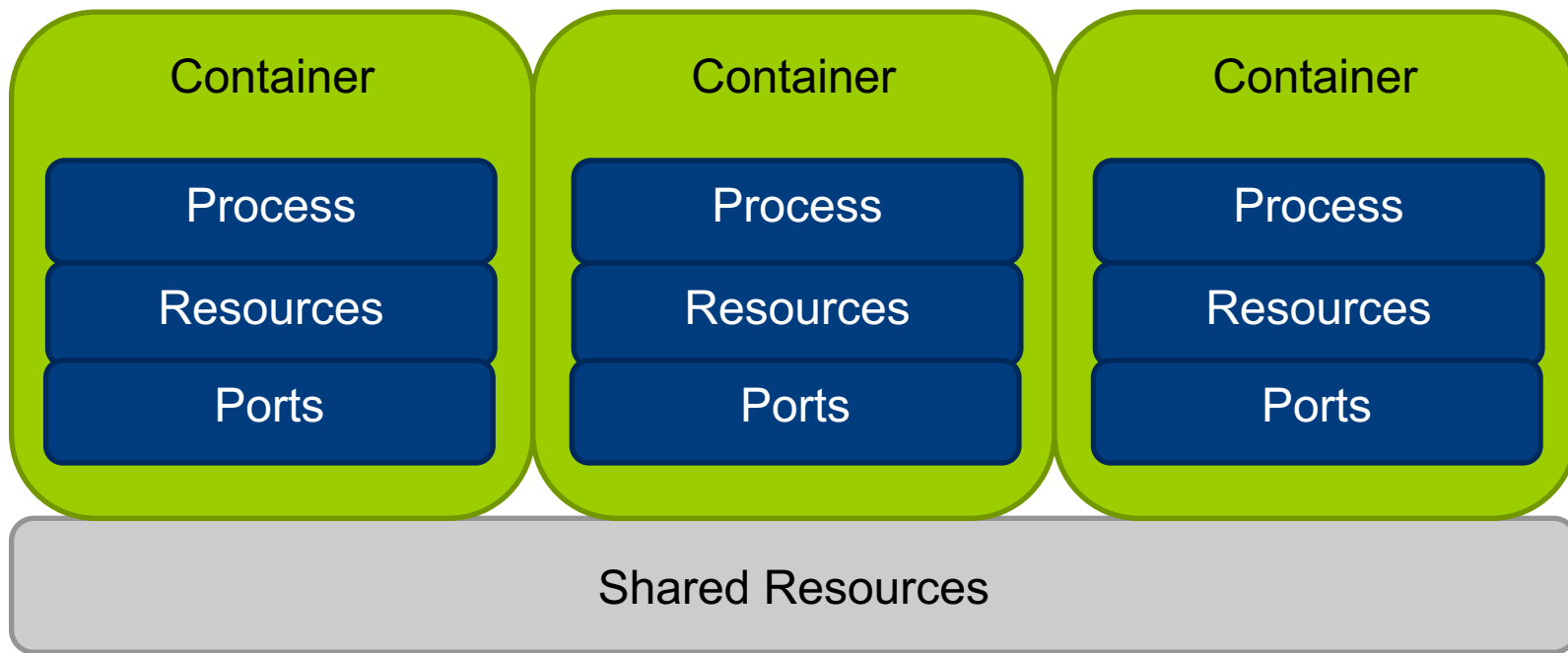
Design Goals

- Portable
- General-Purpose
- Flexible
- Extensible
- Automatable

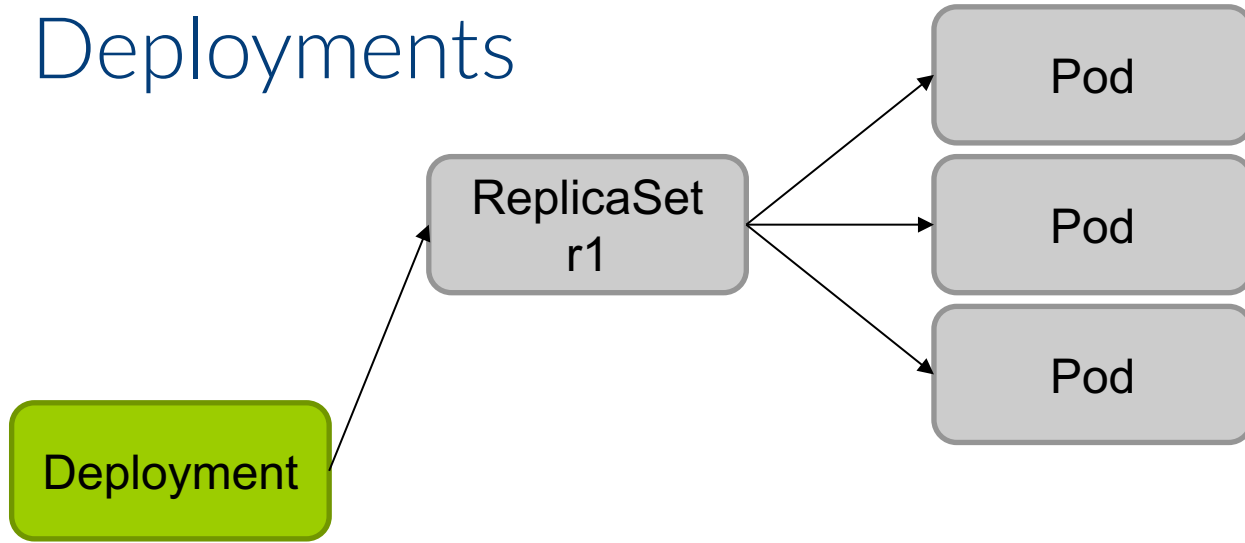
Principals



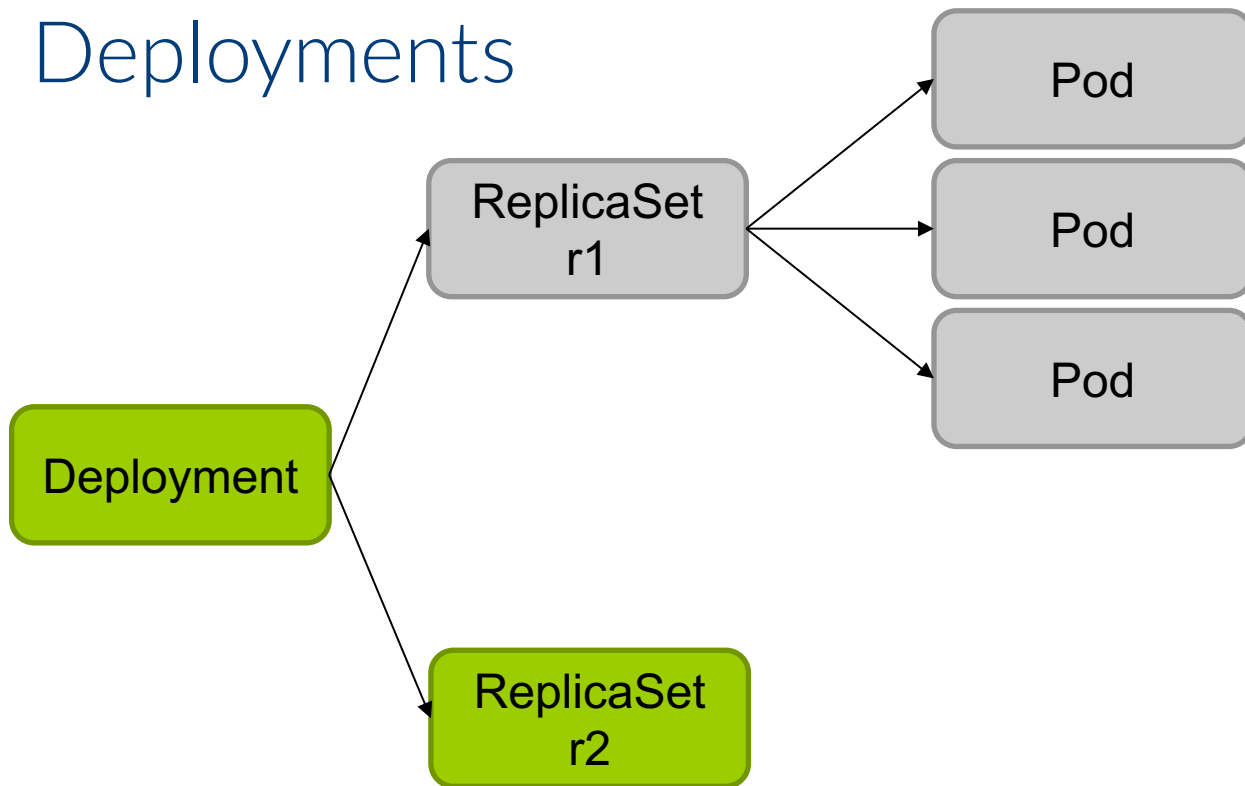
Pods



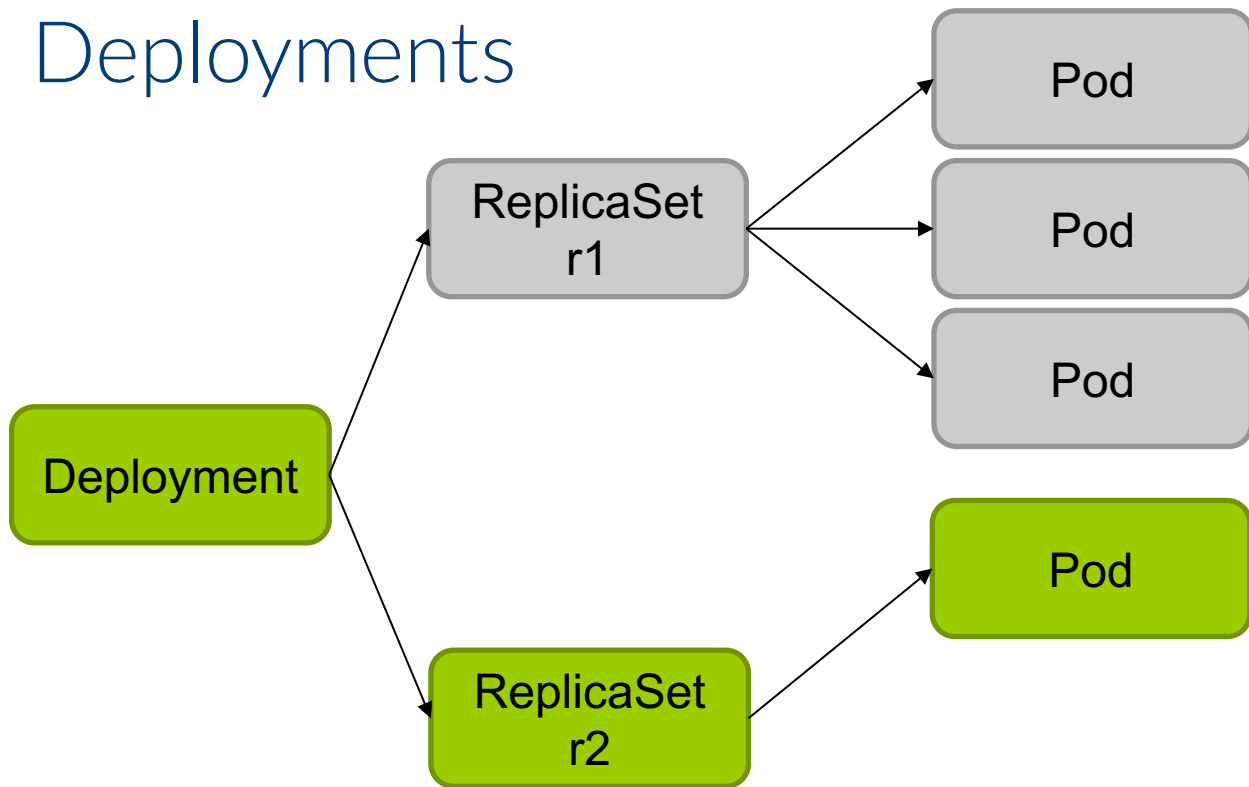
Deployments



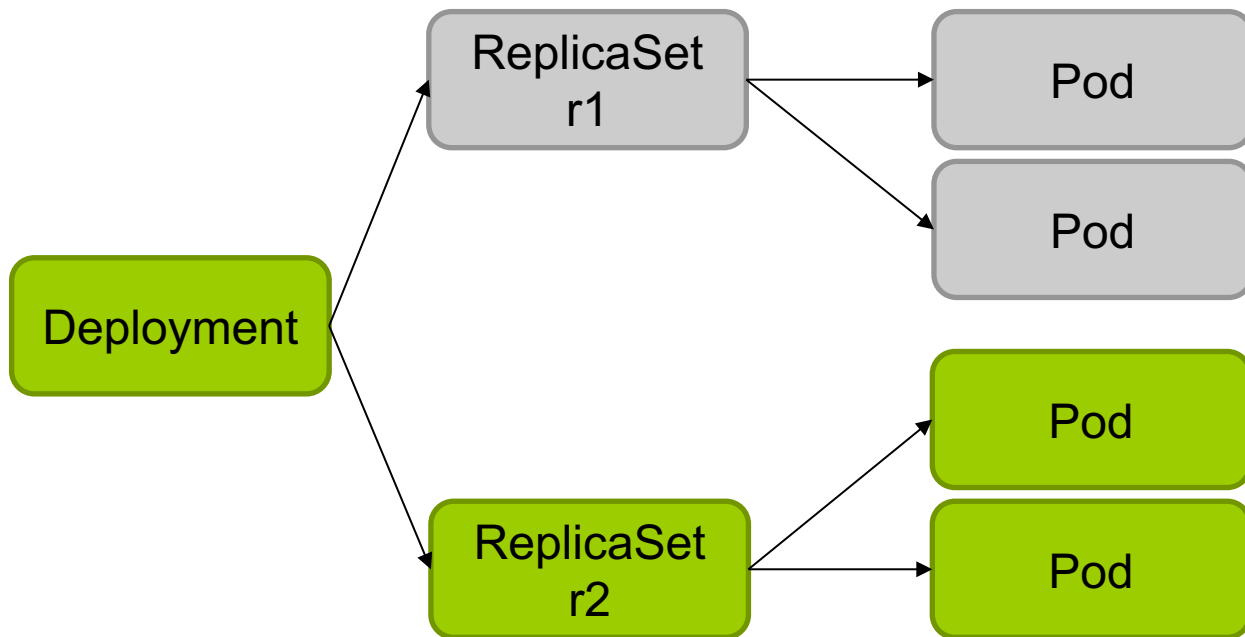
Deployments



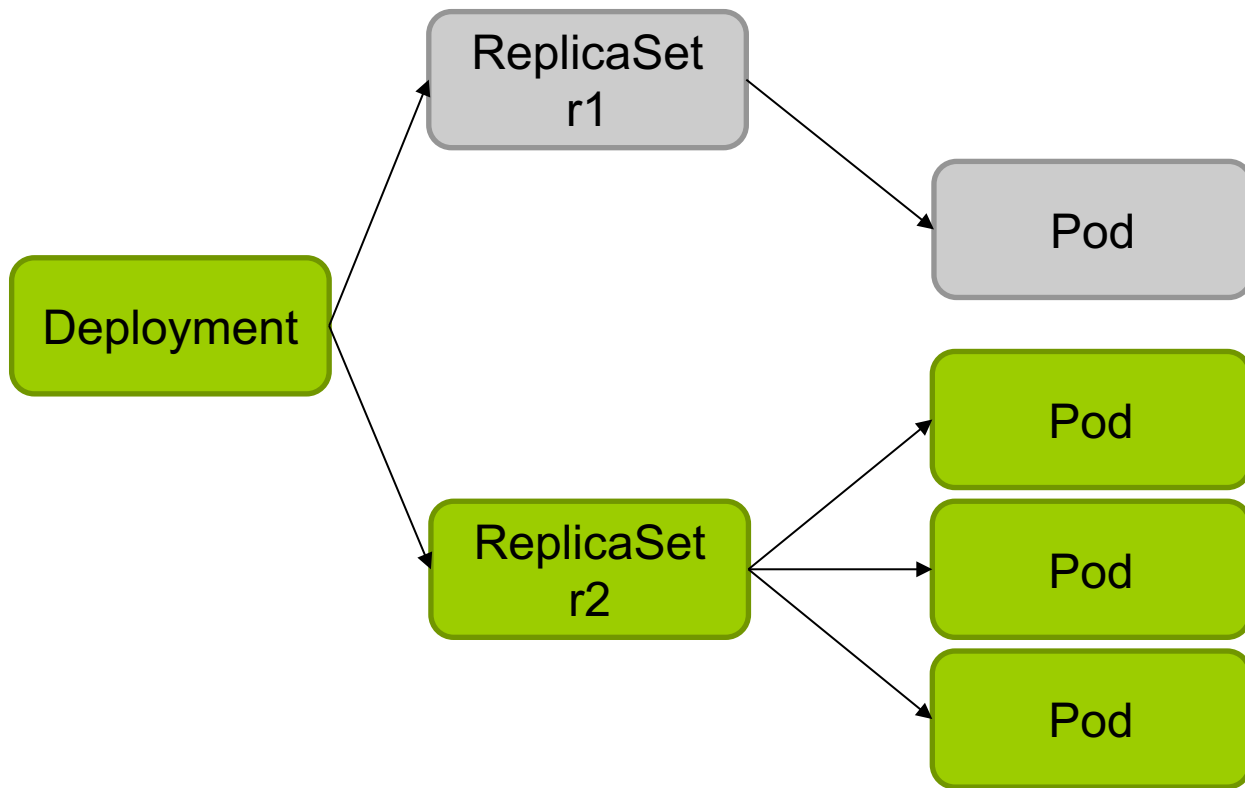
Deployments



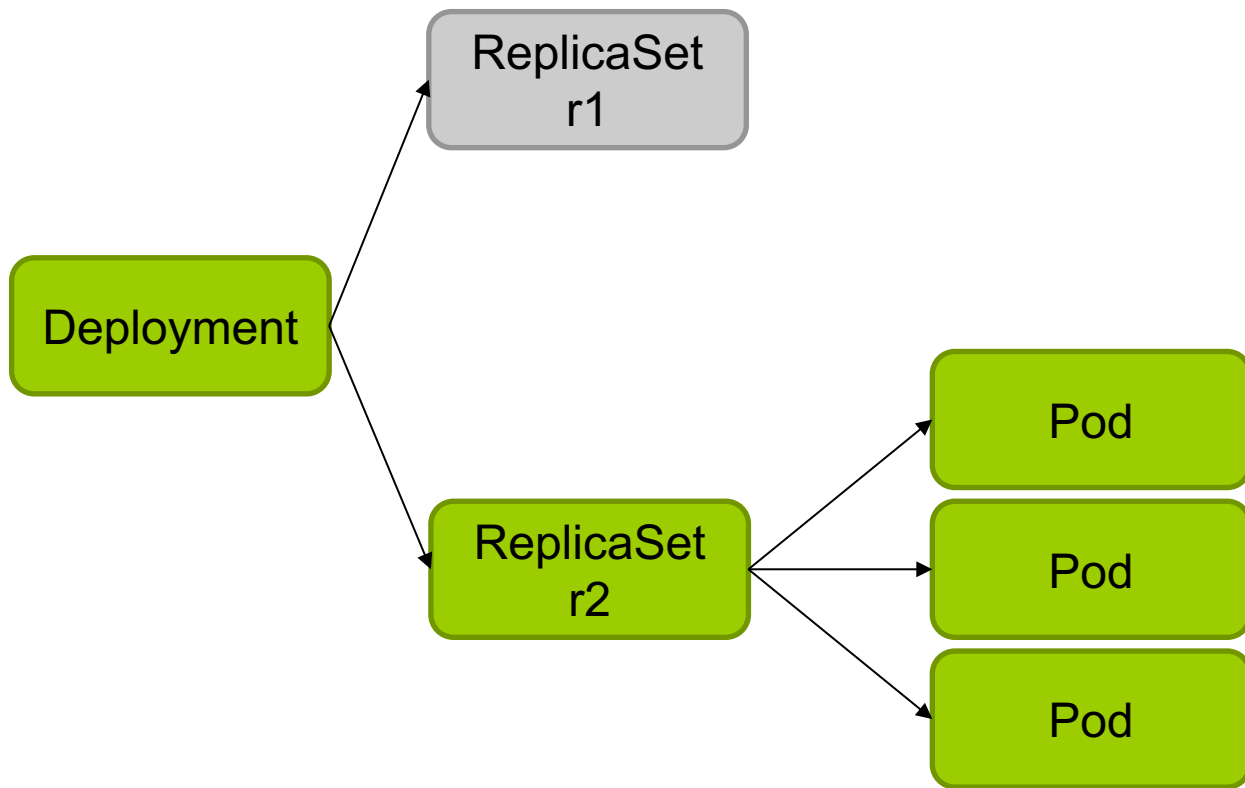
Deployments



Deployments



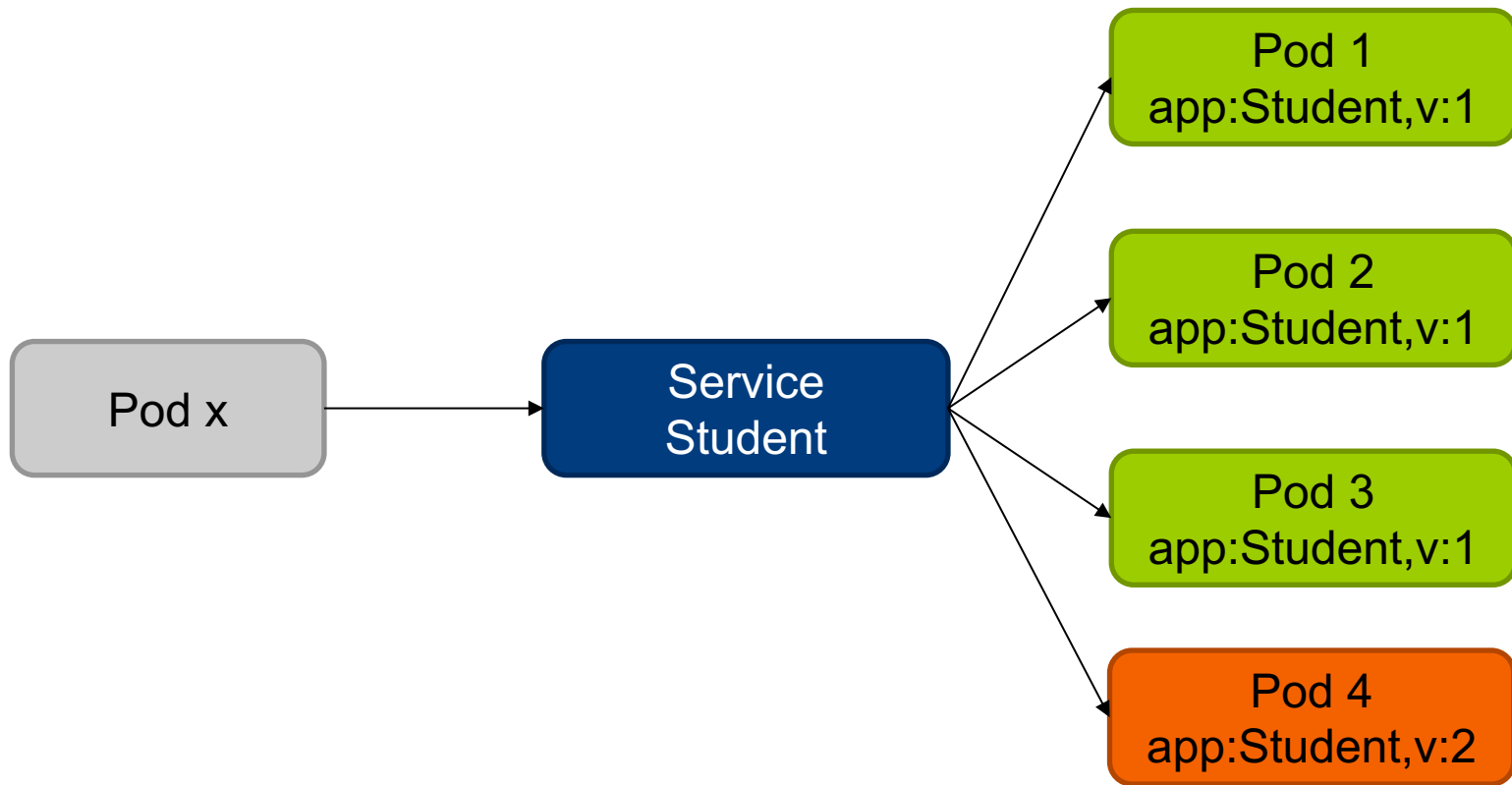
Deployments



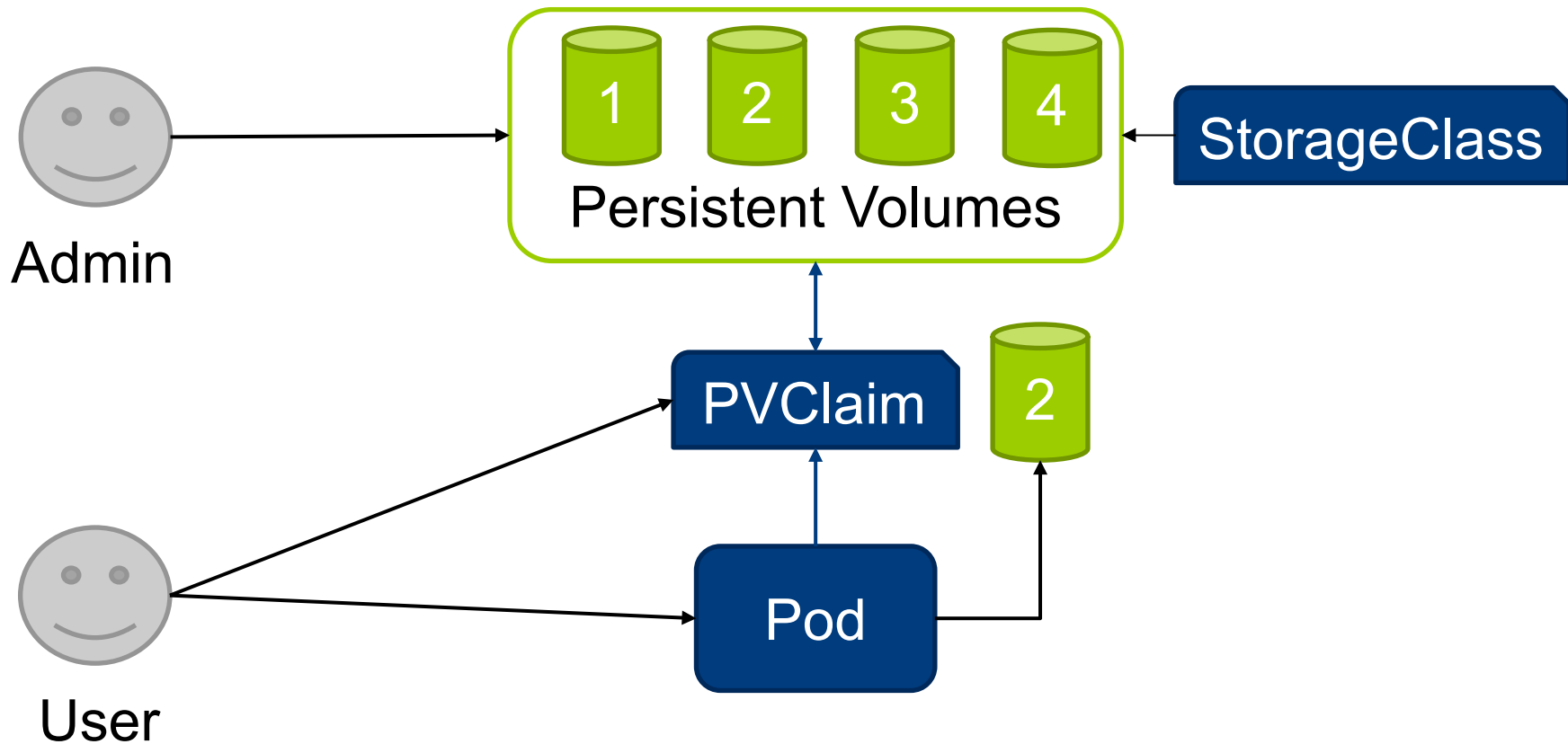
The magic glue - Labels

- Simple Key-Value pairs
- Can be attached to anything
- LabelSelectors used for selection
- Can be used for scheduling choices
- Extremely simple and mighty

Services



Persistent Volumes



Further principals

- Namespaces
- StatefulSet
- DaemonSet
- Batch/Scheduled Jobs
- Ingress
- ...

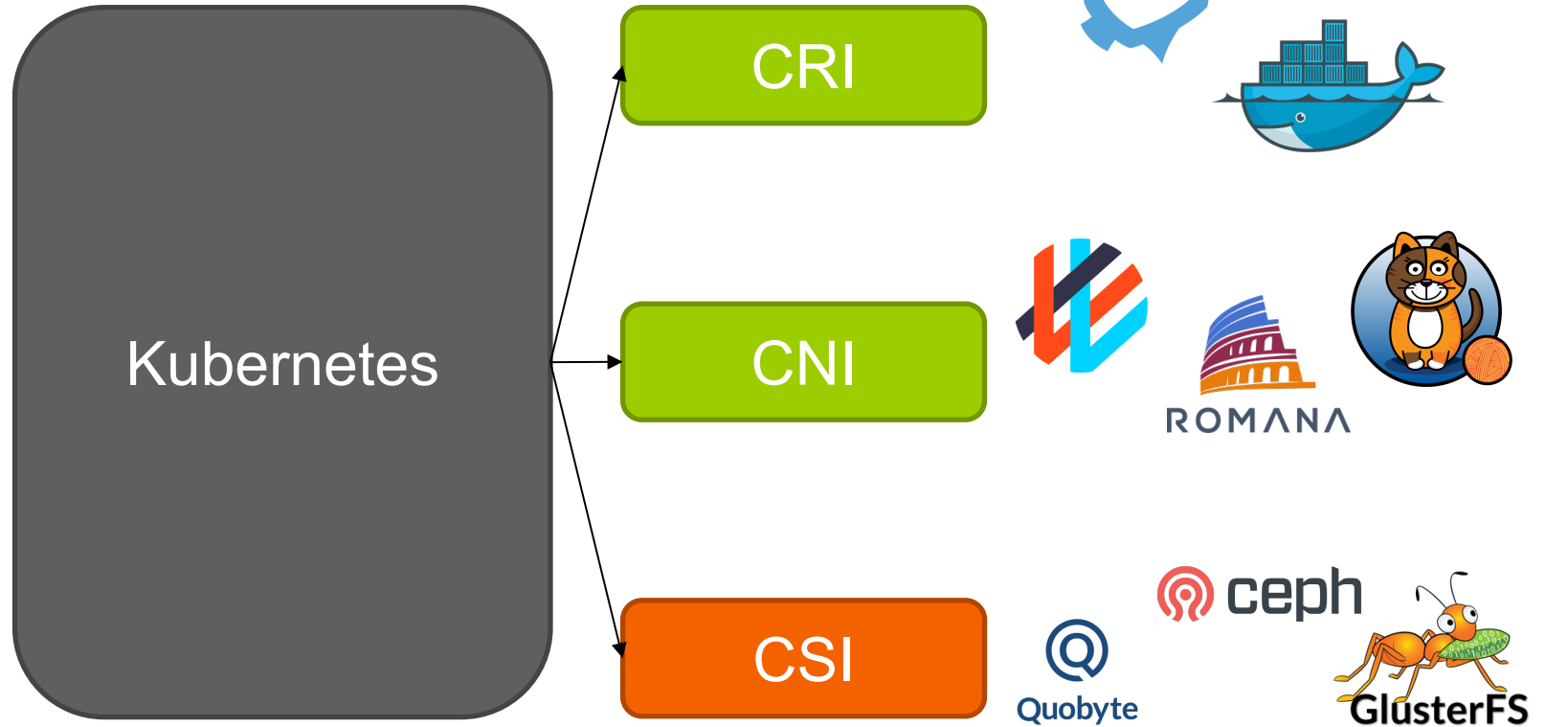


An open platform

API driven

- Complete communication over API's
- Well defined API's
- gRPC
- Extensible platform
 - Custom Resource Definitions
 - Custom Schedulers
 - API aggregation layer

Built on standards (plugins)



Core Infrastructure

- Flexible infrastructure as building block
- Cluster add-ons
 - Logging / DNS / Monitoring
- Spark on Kubernetes
- Everything deployed as containers
- Service Mesh on top
 - <https://istio.io> / <https://linkerd.io>

A photograph of chess pieces on a light-colored board. In the foreground, two dark chess pieces, likely kings or queens, are in sharp focus. In the background, a white chess piece is blurred. A semi-transparent blue horizontal band is overlaid across the middle of the image, containing the text 'Cloud-vendor neutral' in white.

Cloud-vendor neutral

Platform independent

- No dependency to any cloud provider
 - Doesn't care if running on bare-metal or in the cloud
- Cloud provider will be moved out-of-tree
- Kubernetes can make use of the underlying infrastructure
- Basically needs only an OS that runs containers
 - Linux and Windows support (arm/amd64)



Outlook

Kubernetes Federation

- Manage multiple Kubernetes clusters
- One federated control plane
 - On-premise or multi-cloud
- Running global services
- Some known issues
- High Availability
- Challenge -> Storage

Kubernetes 1.8+

- Focus on security and stability
- Allowing more customization
- Improve cluster federation
- Kubernetes and Big Data

A photograph of a person with long blonde hair, wearing a blue shirt, sitting at a desk and writing in a spiral-bound notebook with a black pen. The scene is dimly lit, with a bright light source in the background creating a strong glow. On the desk, there is a white mug on a saucer, another notebook, and a laptop. A semi-transparent blue rectangular overlay covers the middle portion of the image, containing the word "Conclusions" in white text.

Conclusions

Conclusions

- Open platform (OSS)
- Can be used to run simulations/tests
 - Is used in some academic fields
 - e.g. <https://lasp-lang.readme.io>
- Can be extended for special needs
- Growing eco-system

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A large crowd of people, mostly men, are gathered at what appears to be a conference or trade show. They are wearing lanyards and some are looking towards the camera. A semi-transparent blue rectangular overlay is positioned in the center of the image, containing the text "Q&A" in a white, serif font. The background is slightly blurred, emphasizing the people in the foreground.

Q&A

Further reading

<https://research.google.com/pubs/pub44843.html>

<http://queue.acm.org/detail.cfm?id=2898444>

<https://research.google.com/pubs/pub41684.html>

<https://speakerdeck.com/thockin/kubernetes-understanding-pods-vs-containers>

<https://kubernetes.io/docs/concepts/api-extension/custom-resources>

Further reading

<https://www.opencontainers.org/about>

<https://containerd.io>

<https://github.com/kubernetes/community/blob/master/contributors/devel/container-runtime-interface.md>

<https://docs.microsoft.com/en-us/azure/container-service/kubernetes/container-service-kubernetes-windows-walkthrough>

Further reading

<https://research.google.com/pubs/pub45499.html>

<https://github.com/kubernetes/kubernetes/issues/38893>

<https://docs.google.com/spreadsheets/d/1AFksRDgAt6BGA3OjRNliO3IyKmA-GU7CXaxbihy48ns/edit#gid=0>

<https://github.com/apache-spark-on-k8s>

<https://github.com/kubernetes-incubator>

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