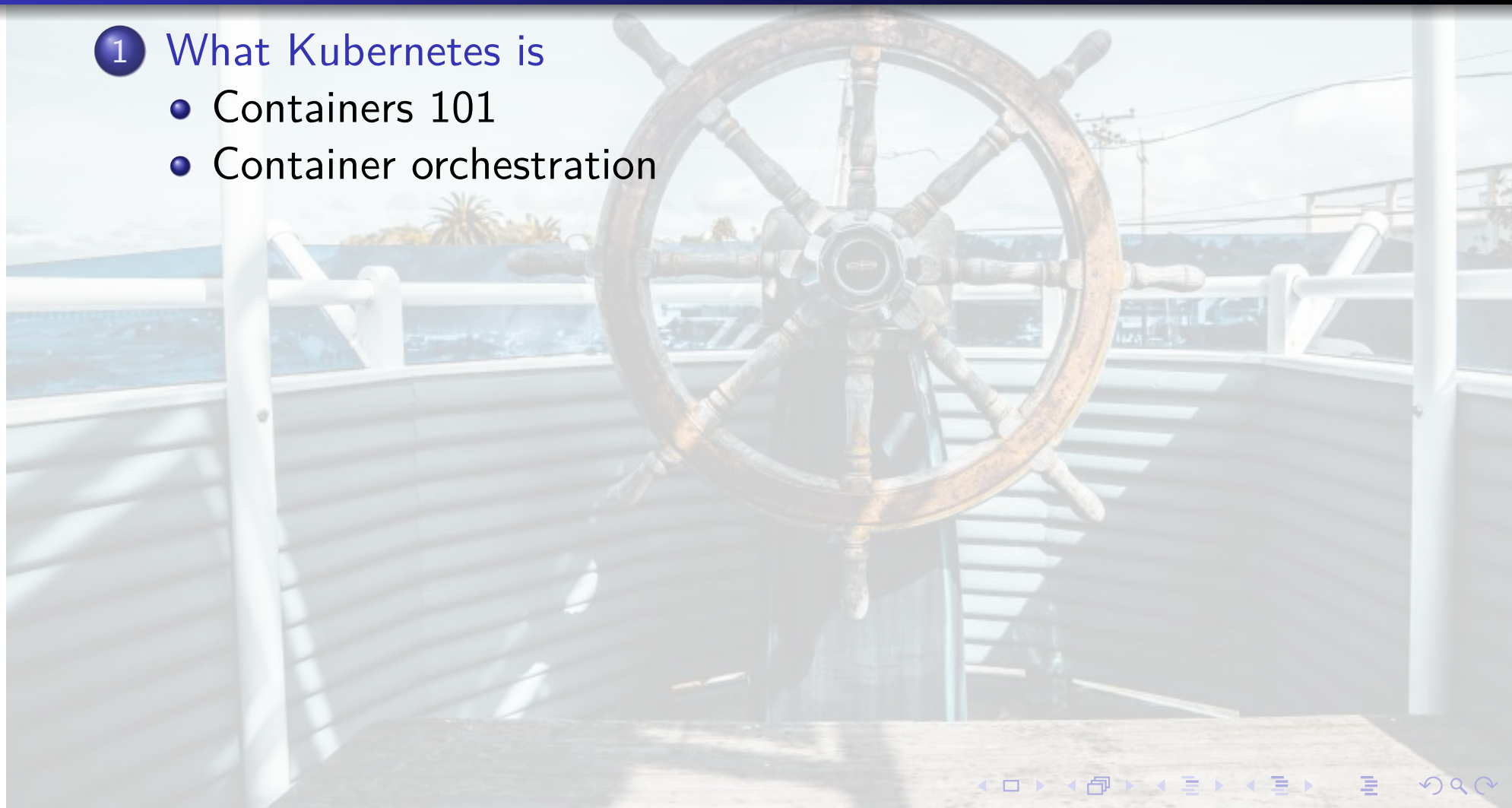
Beginning Kubernetes

Jacob W. Archambault

SAIC

September 11, 2025

Outline



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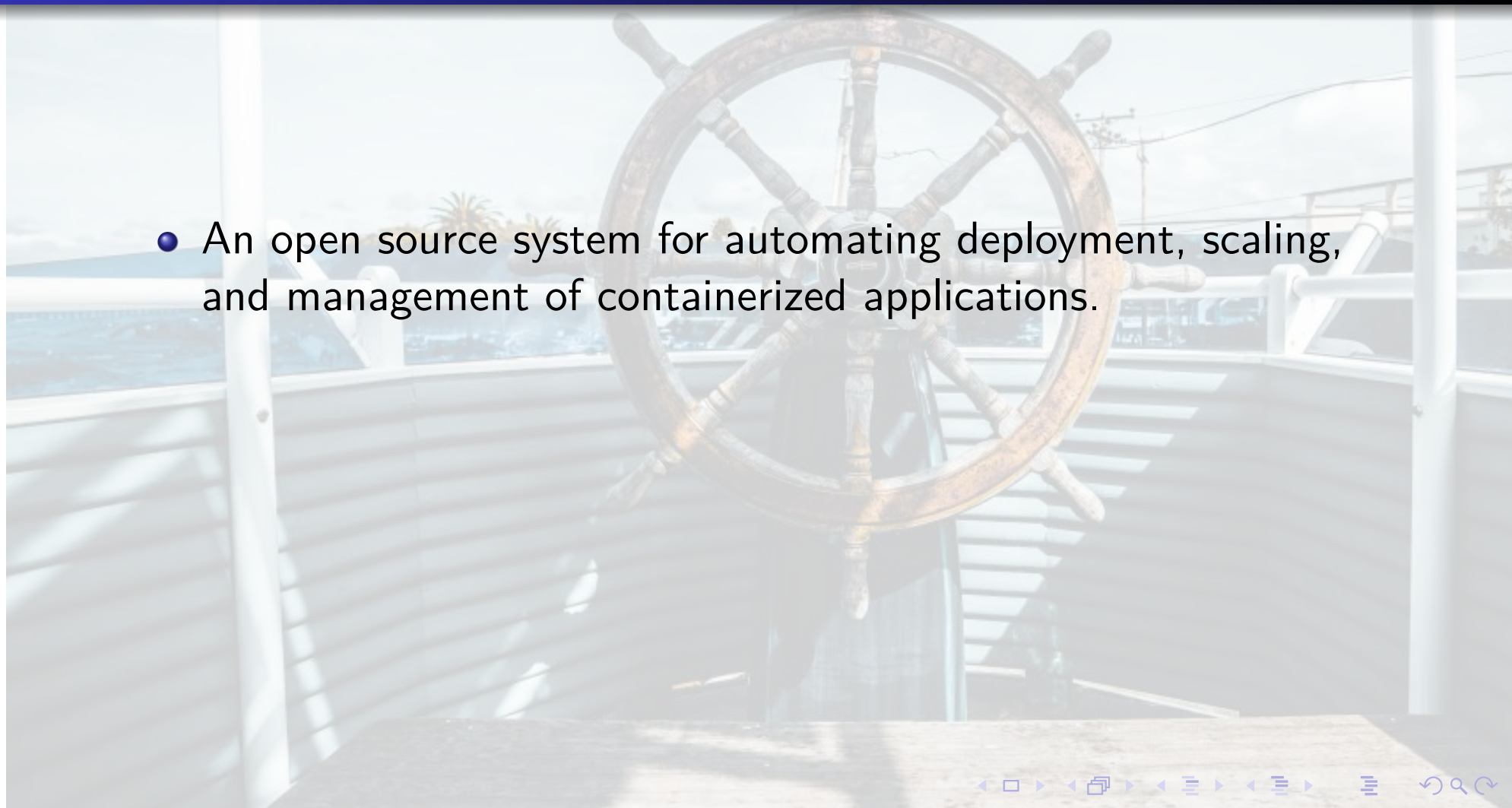
What Kubernetes is



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- An open source system for managing containerized applications across multiple hosts.
- An open-source container orchestration platform.

Outline

Container images

- created from a Containerfile (usually)

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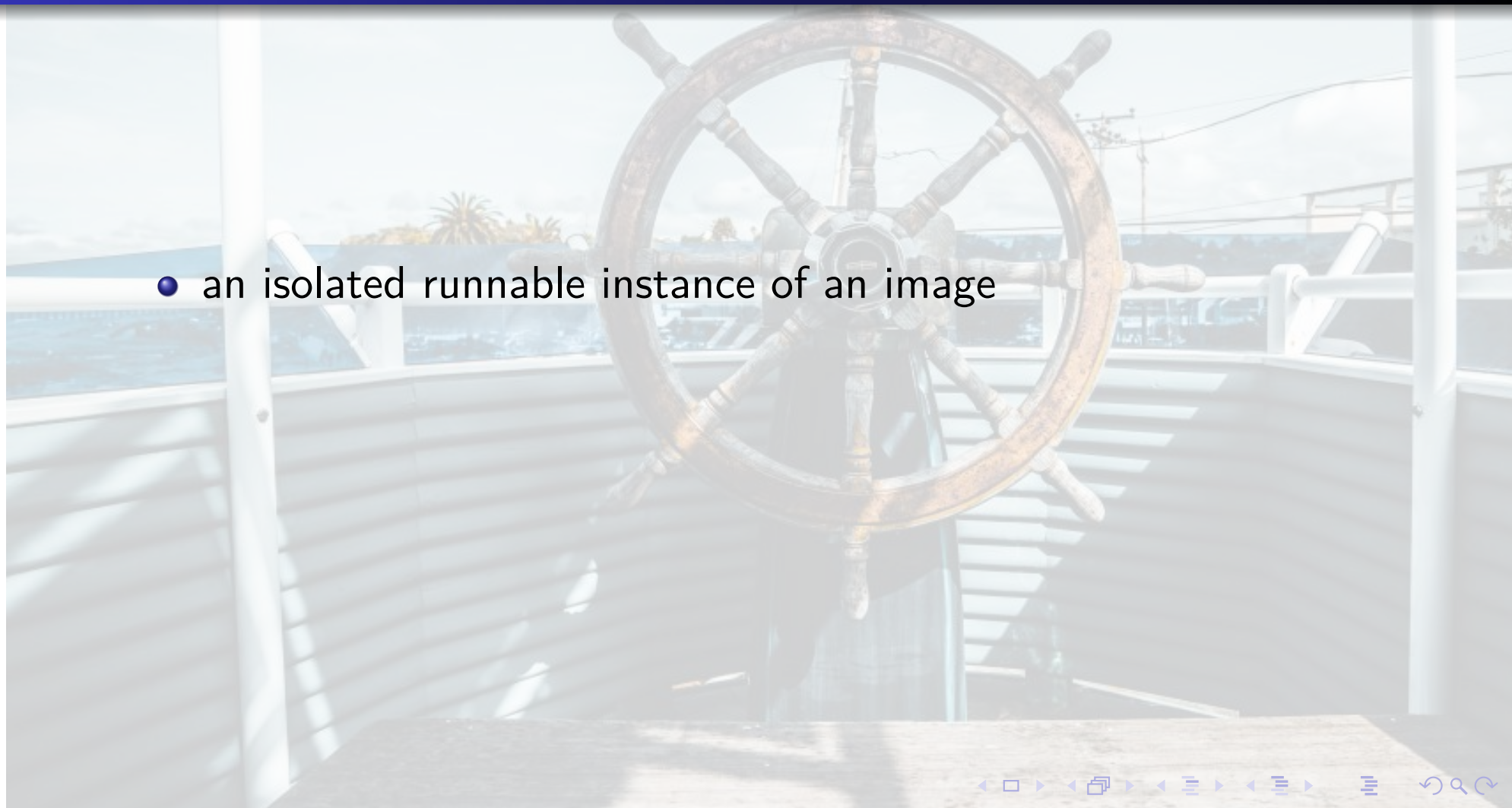
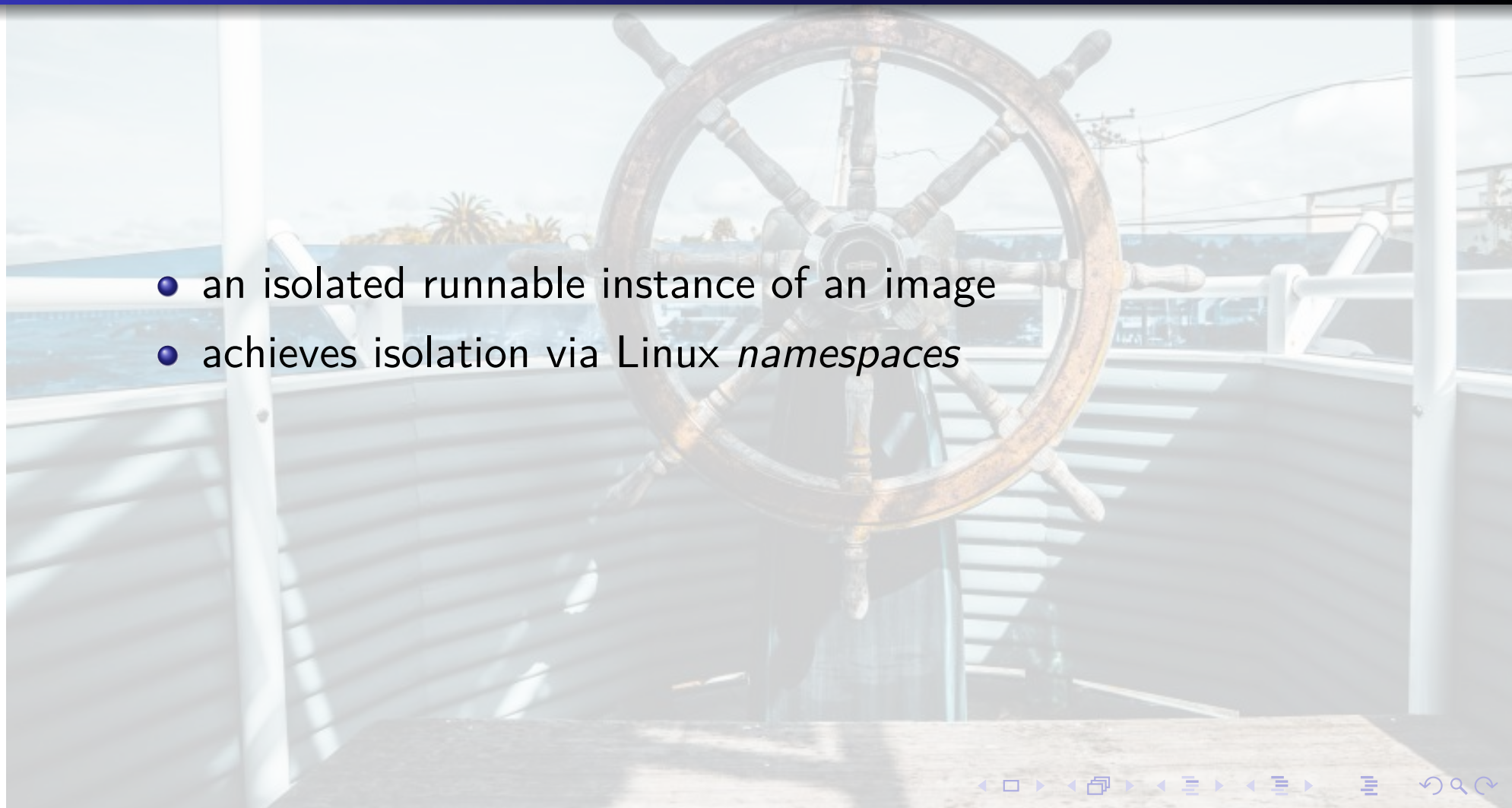
- can also be created from a running image via `docker commit`

Containers 101



- an isolated runnable instance of an image

Containers 101

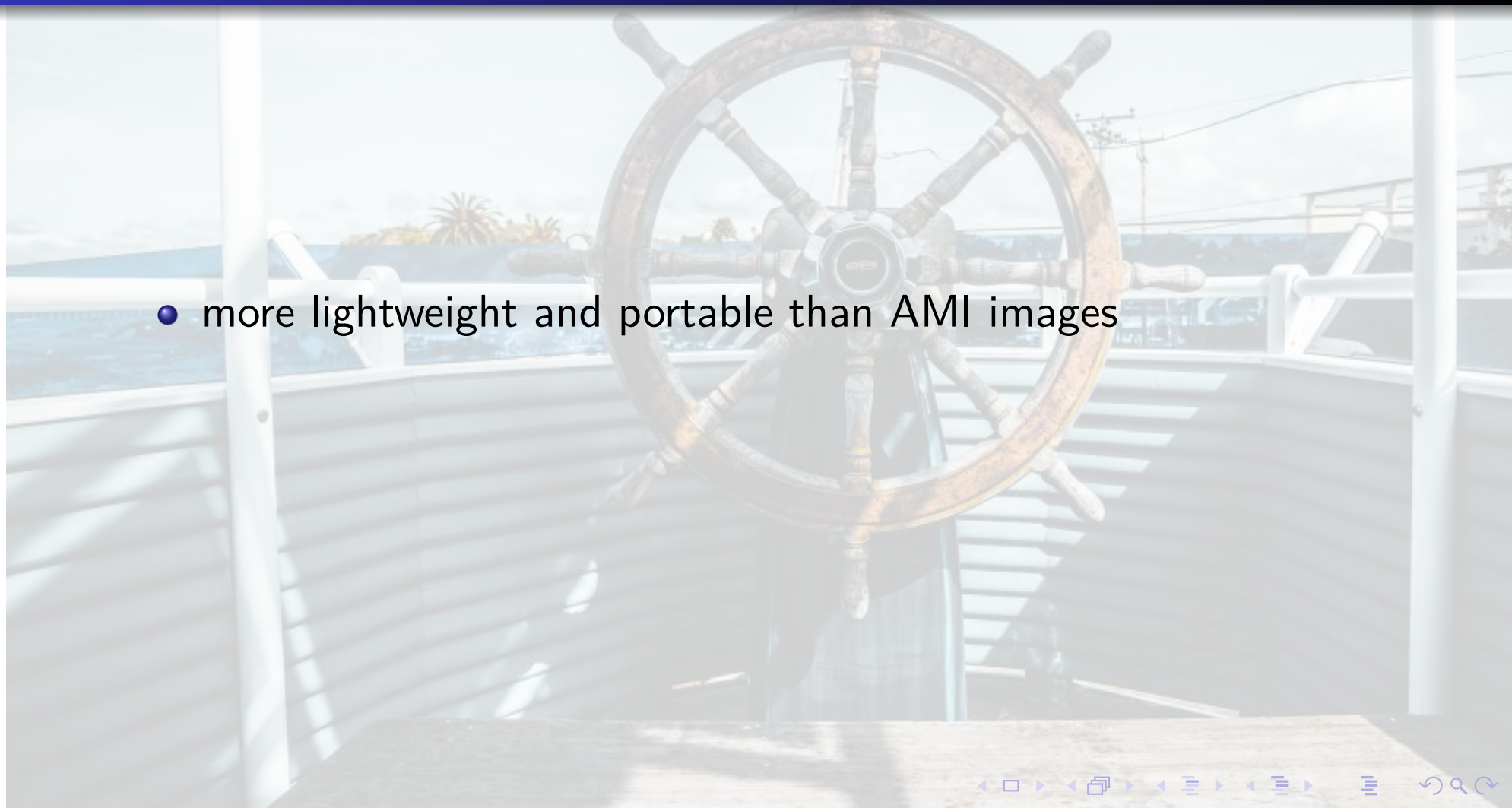


- an isolated runnable instance of an image
- achieves isolation via Linux *namespaces*

Containers 101

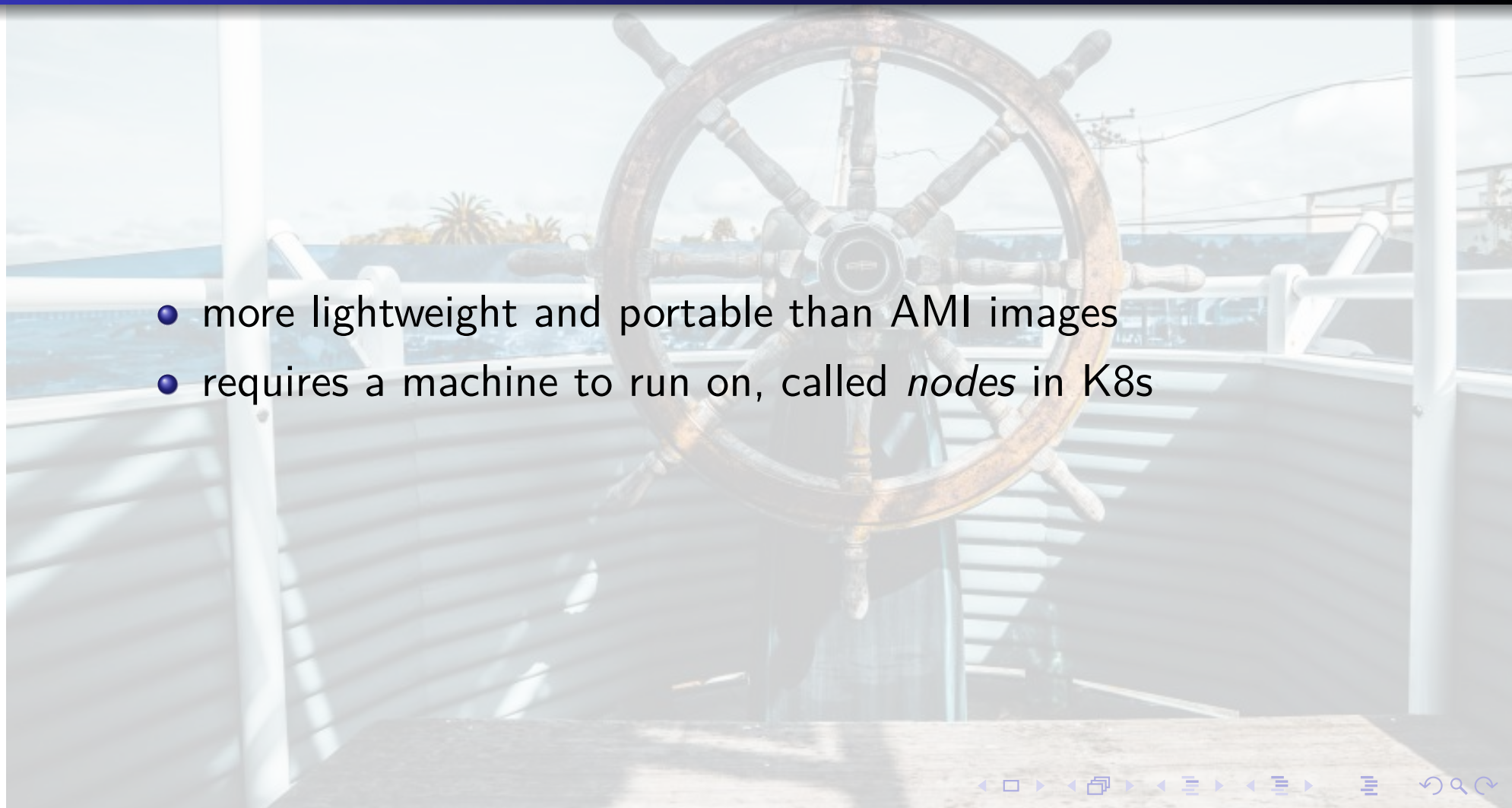
- an isolated runnable instance of an image
- achieves isolation via Linux *namespaces*
- limits resource usage (e.g. CPU usage) via Linux *cgroups*

How containers differ from VMs



- more lightweight and portable than AMI images

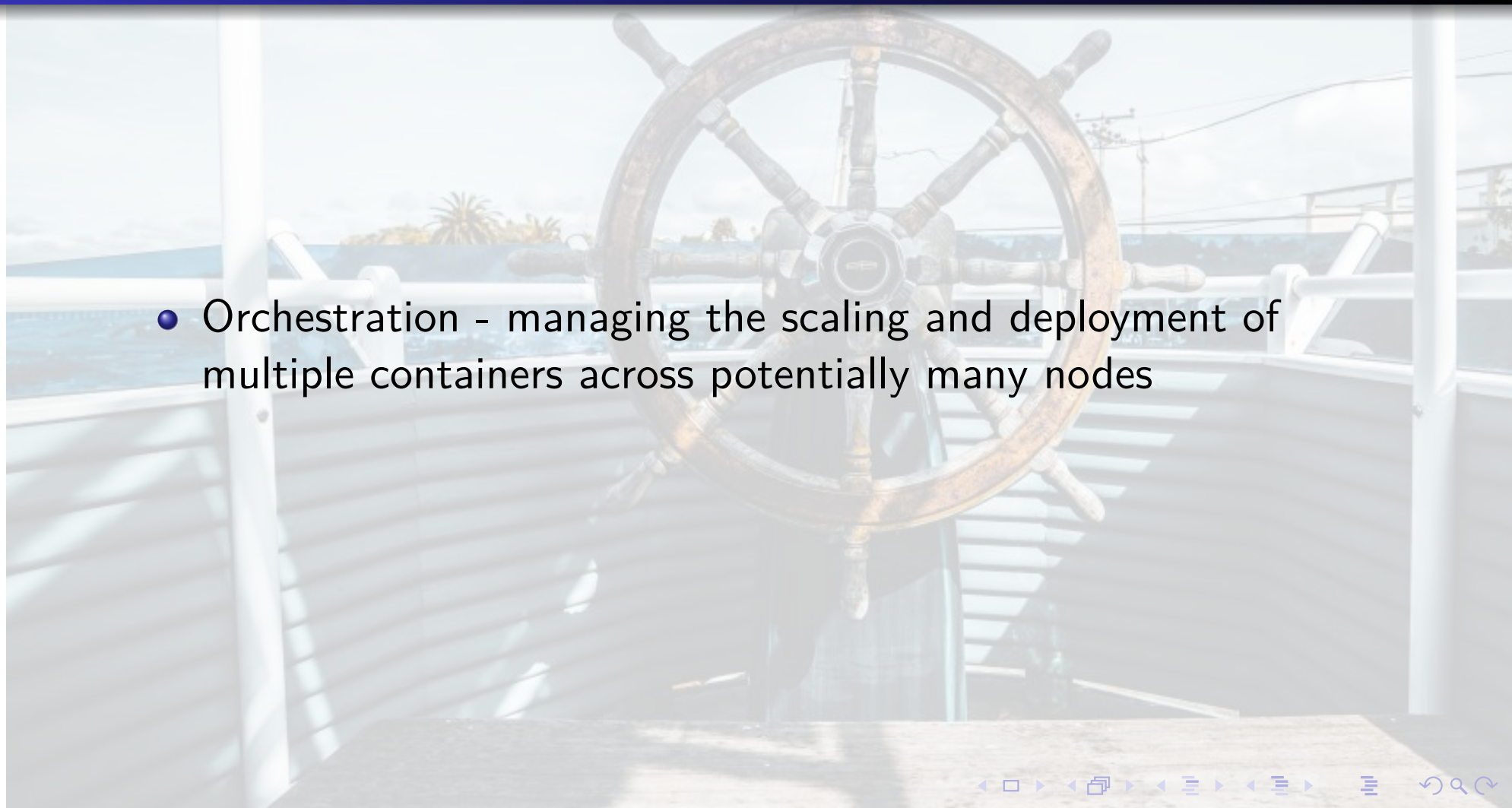
How containers differ from VMs



- more lightweight and portable than AMI images
- requires a machine to run on, called *nodes* in K8s

Outline

What is orchestration



- Orchestration - managing the scaling and deployment of multiple containers across potentially many nodes

Why use Kubernetes

Yes

Where to use Kubernetes: Cloud providers

- Google Cloud - Google Kubernetes Engine (GKE)

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- Google Cloud - Google Kubernetes Engine (GKE)
- Azure - Azure Kubernetes Service (AKS)
- AWS Elastic Kubernetes Service (EKS)

Where to use Kubernetes: Local environment

- Docker Desktop

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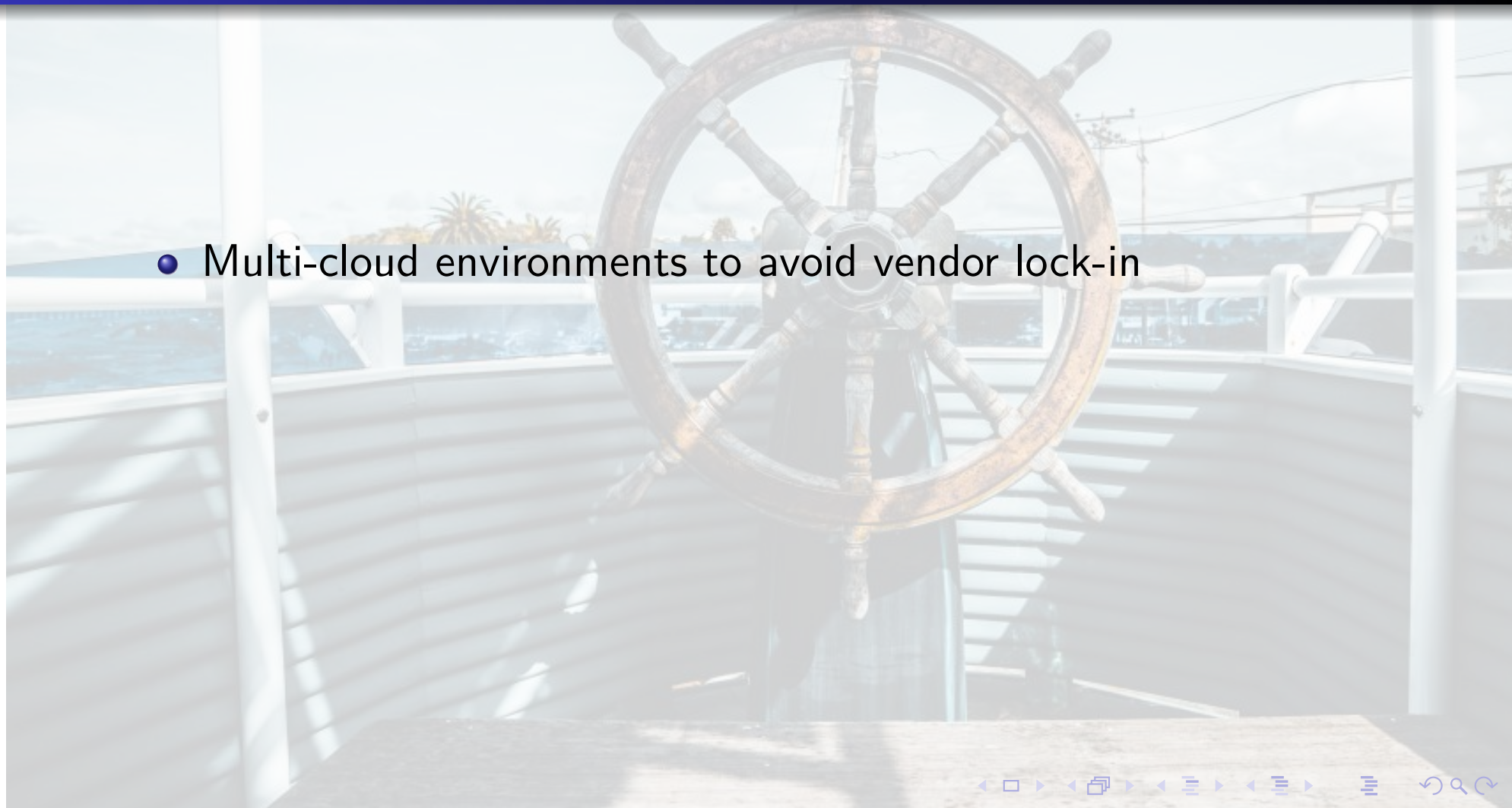
- minikube

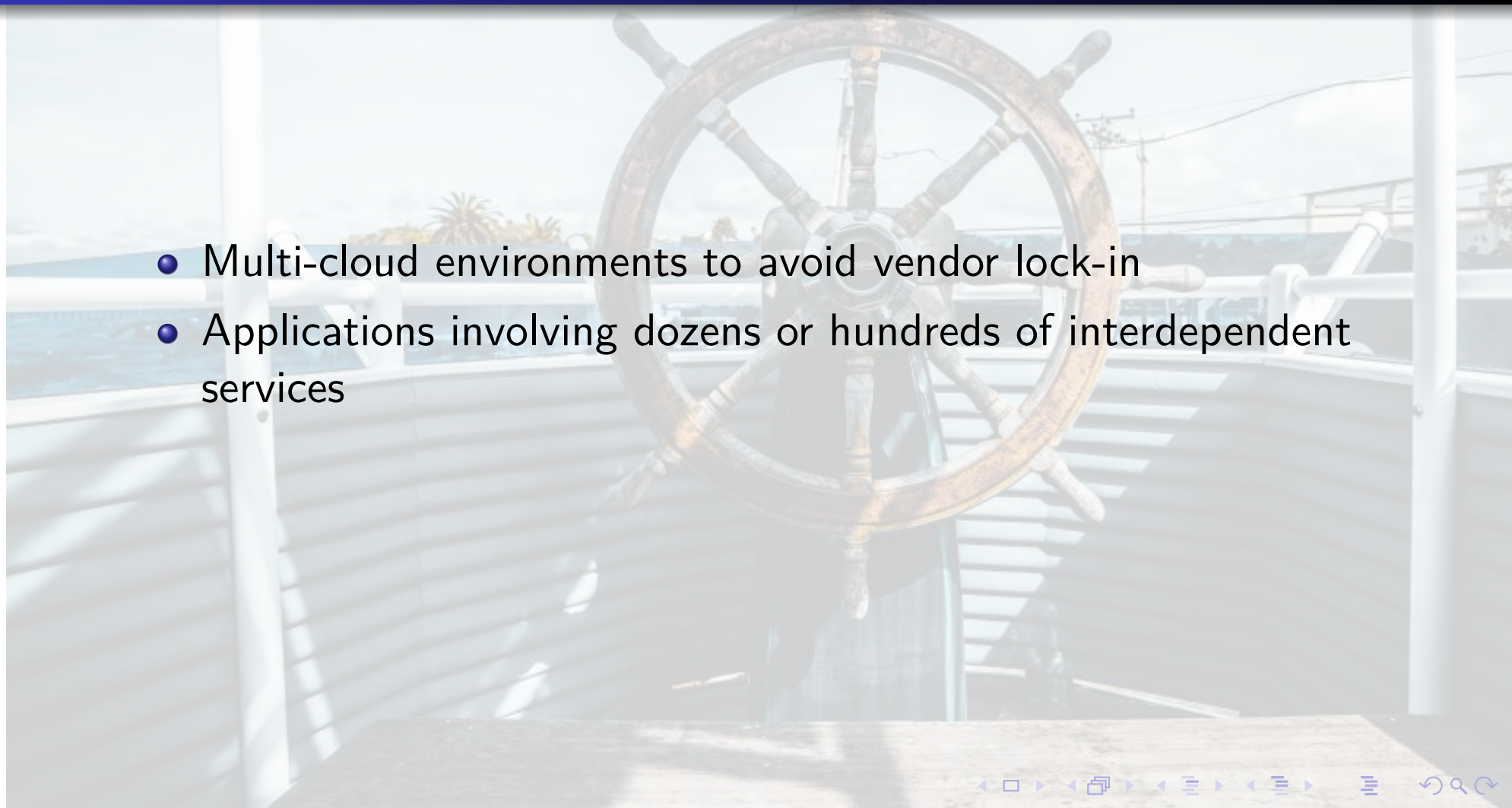
- static websites (S3 with CloudFront/load balancing)
- single container applications (Azure App Service, Elastic Beanstalk)

When to use Kubernetes



- Multi-cloud environments to avoid vendor lock-in

When to use Kubernetes



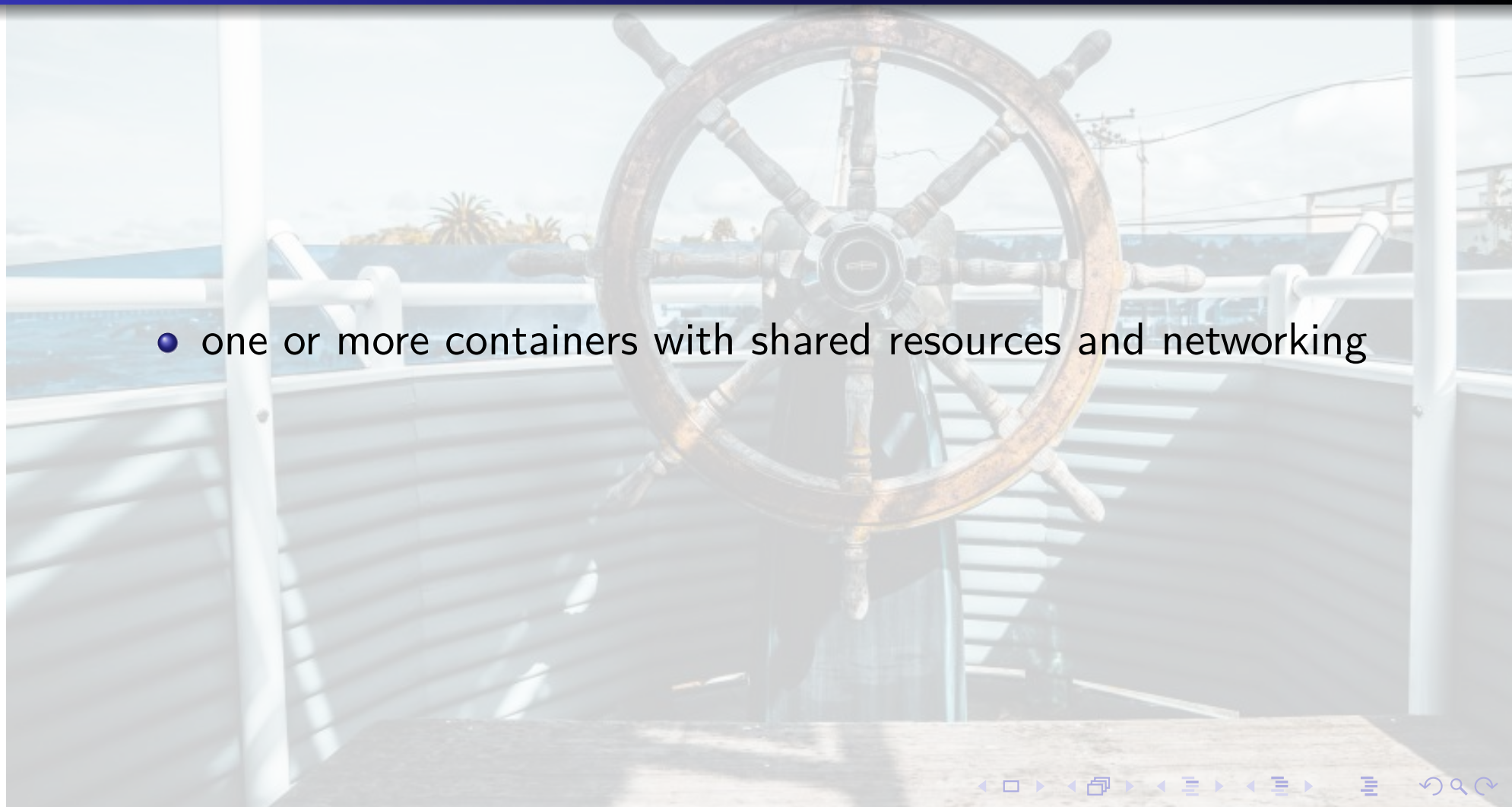
- Multi-cloud environments to avoid vendor lock-in
- Applications involving dozens or hundreds of interdependent services

When to use Kubernetes

- Multi-cloud environments to avoid vendor lock-in
- Applications involving dozens or hundreds of interdependent services
- Integrating non-cloud-specific services via Helm

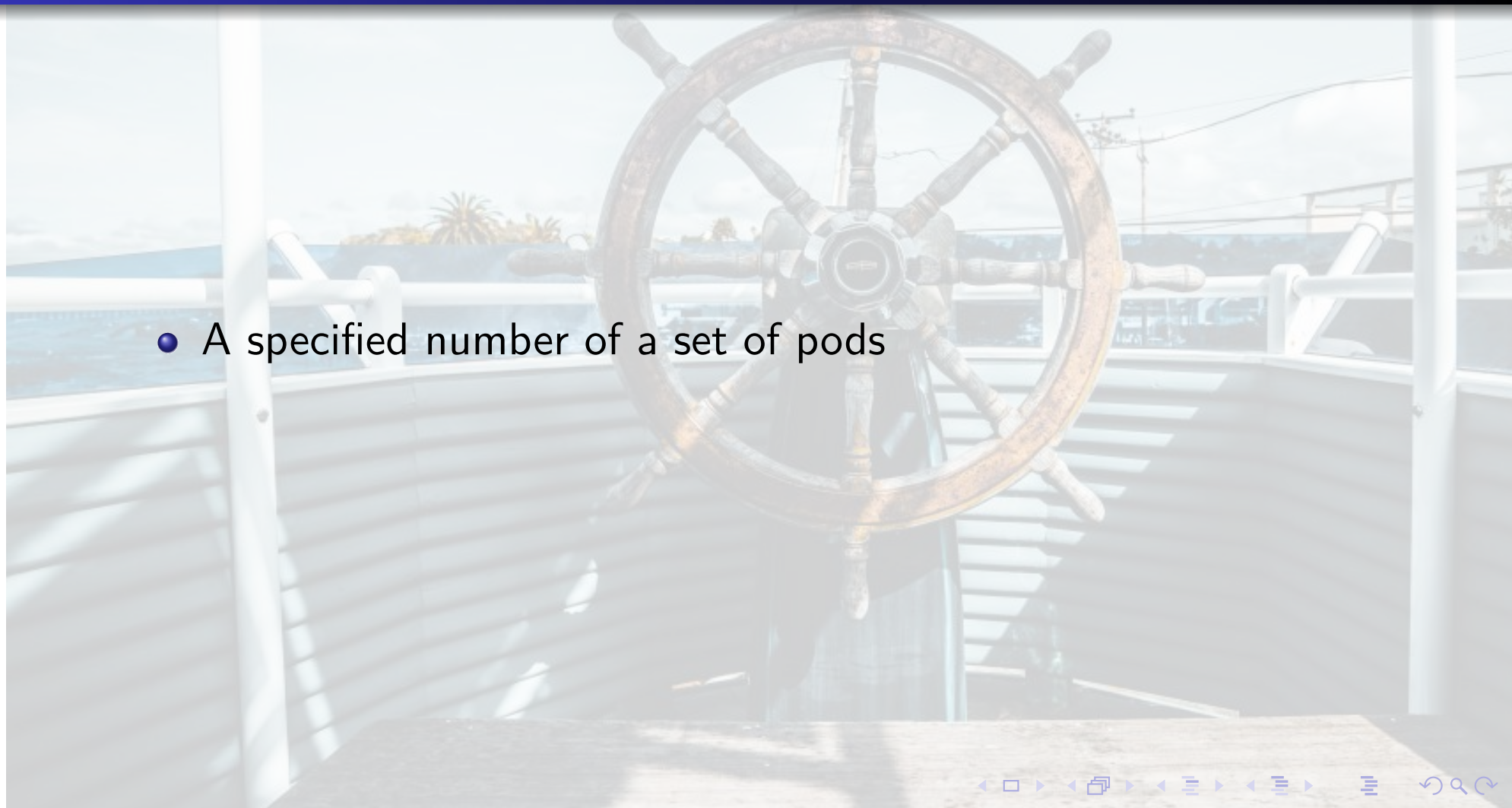
Outline

Kubernetes components: Pods



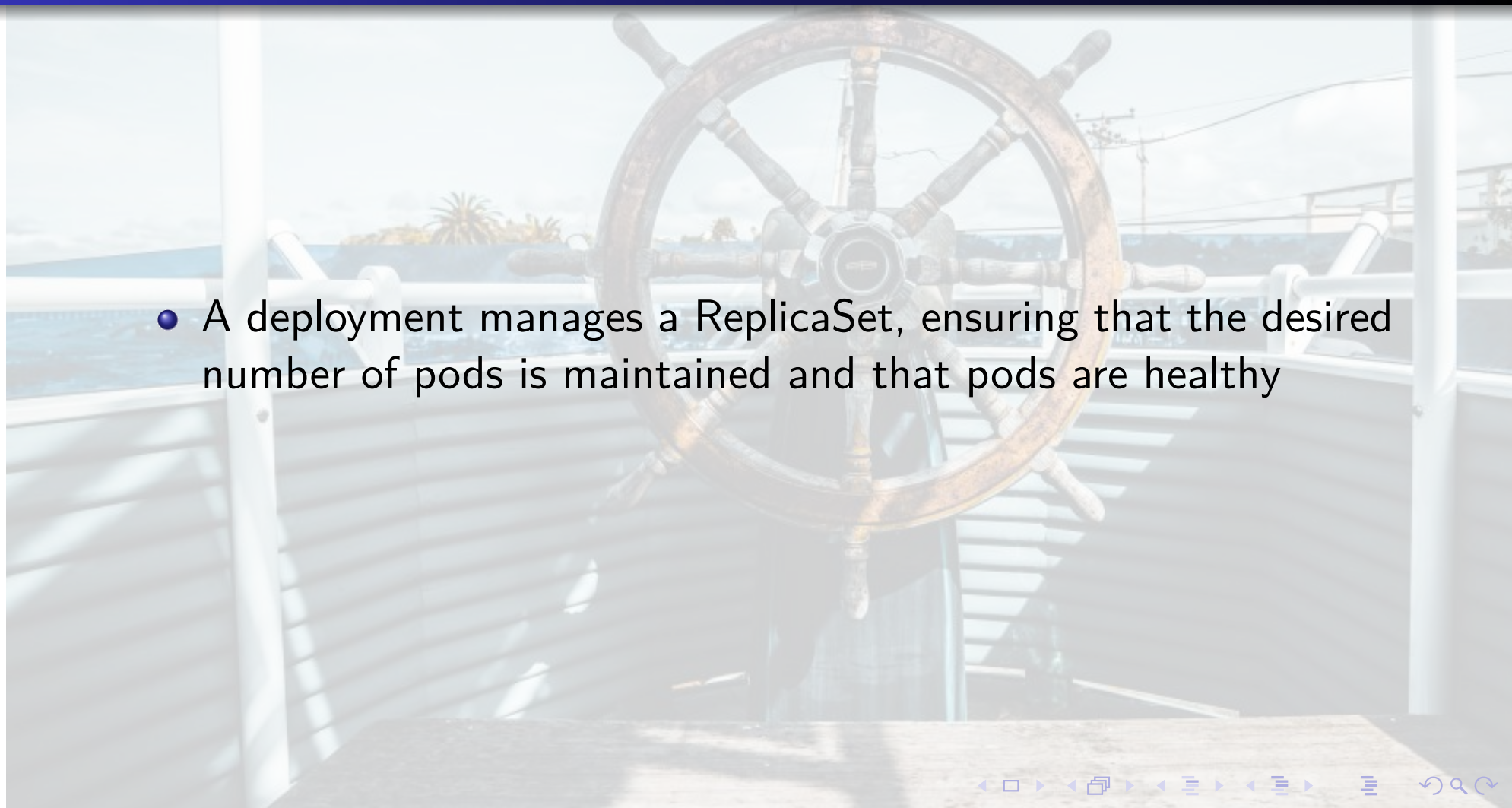
- one or more containers with shared resources and networking

Kubernetes components: ReplicaSets



- A specified number of a set of pods

Kubernetes components: Deployments



- A deployment manages a ReplicaSet, ensuring that the desired number of pods is maintained and that pods are healthy

Outline

Volumes and Volume claims

- A PersistentVolume is an actual data storage entities created and used by deployments

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- PersistentVolumeClaim is a request for storage by a user

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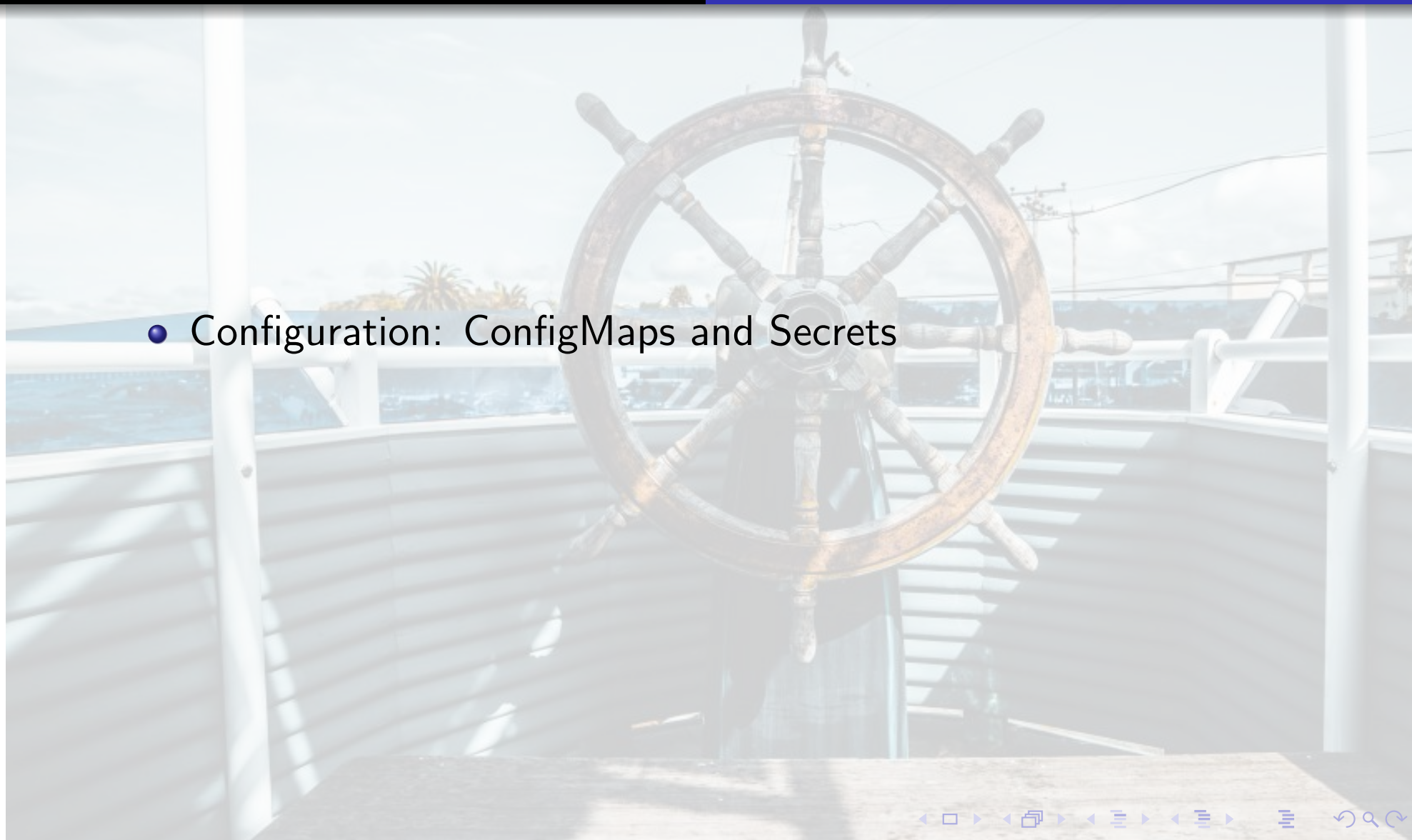

- Configuration: ConfigMaps and Secrets

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- Finite tasks: Jobs and CronJobs

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