Container Evolution

What is CoreOS?

What is CoreOS?

Container is HOT

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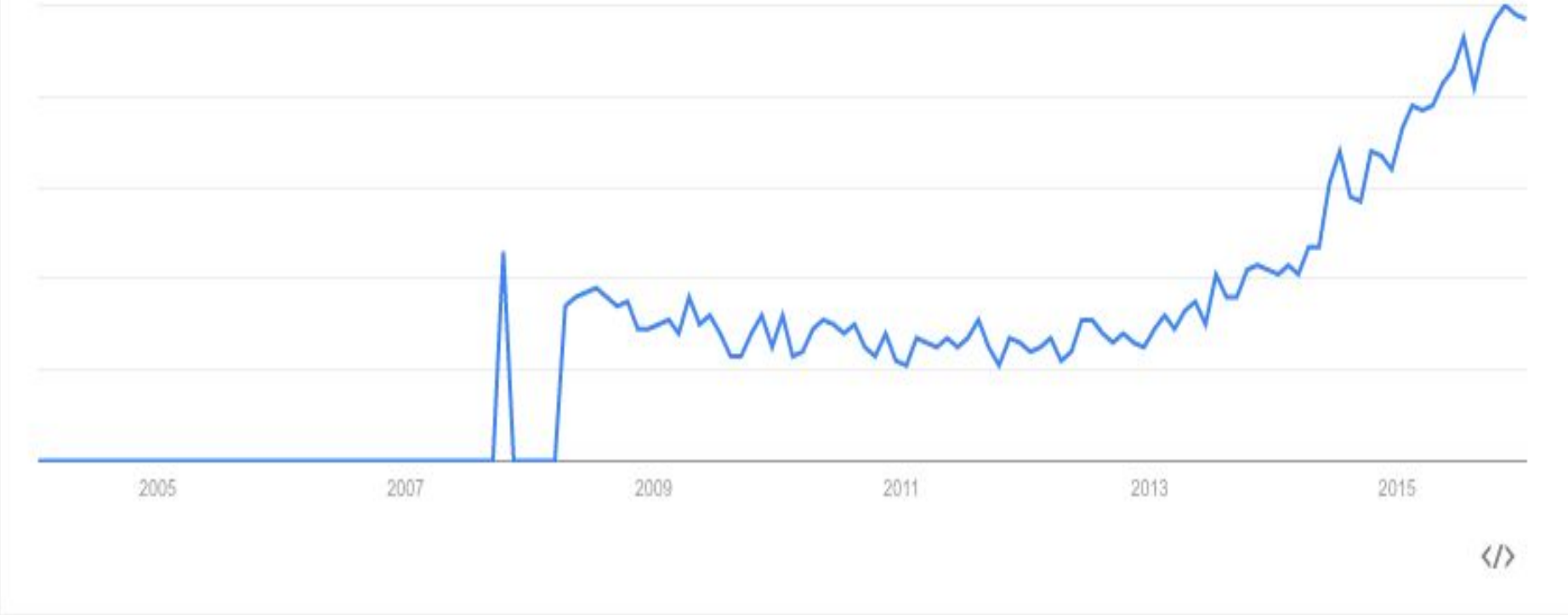
Search term

+ Add term

Interest over time

News headlines Forecast

Container is not a new technology



FreeBSD ~ 2000

FreeBSD®

Solaris Zones ~ 2005

Linux Container

Control group

- CPU
- Memory
- IO
- Devices
- ...

Namespaces

- Network
- IPC
- ProcessID
- ...

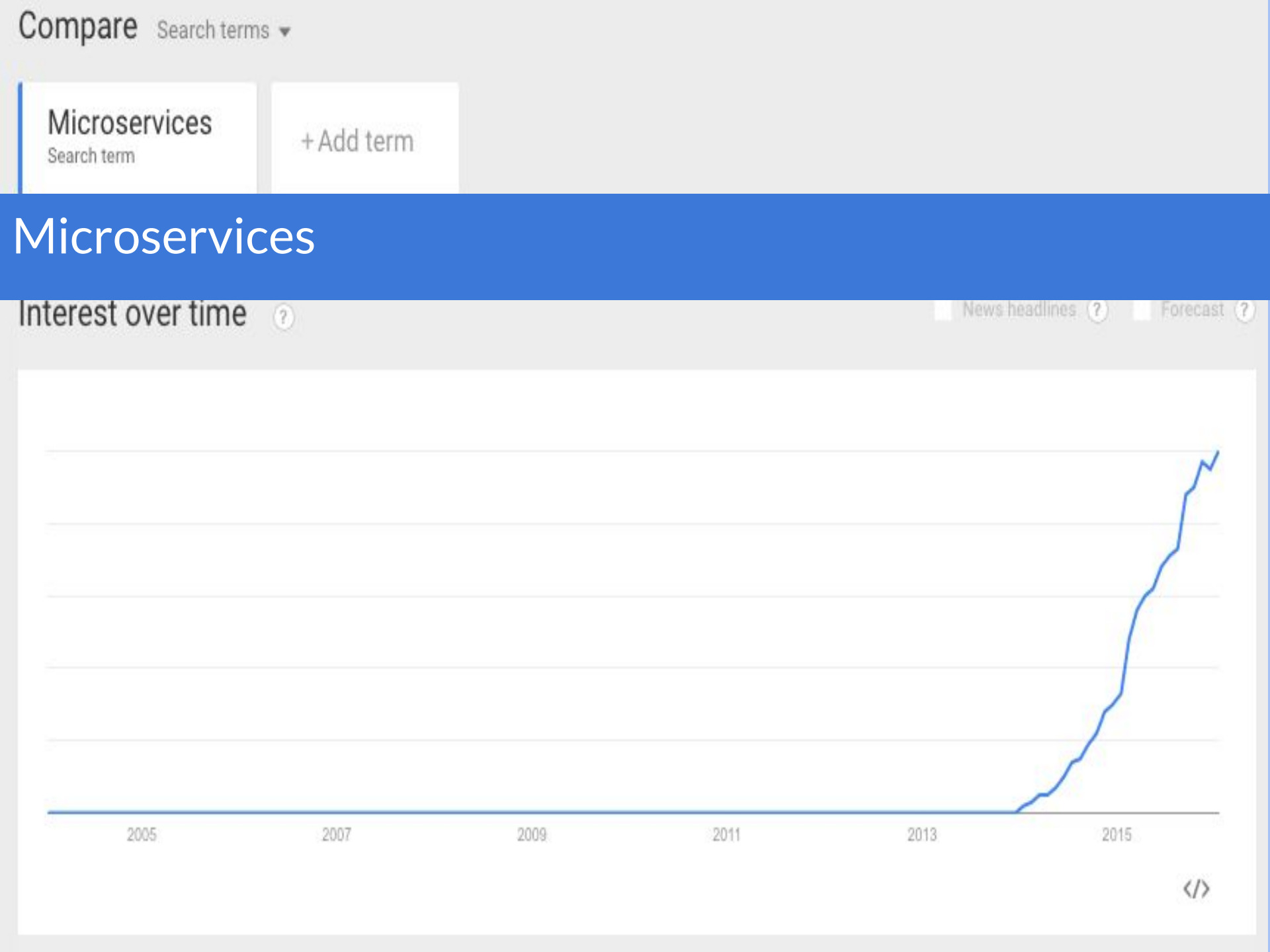
Linux

Borg at Google ~ 2005

Mesos ~ 2011

Heroku ~ 2008

dotCloud ~ 2010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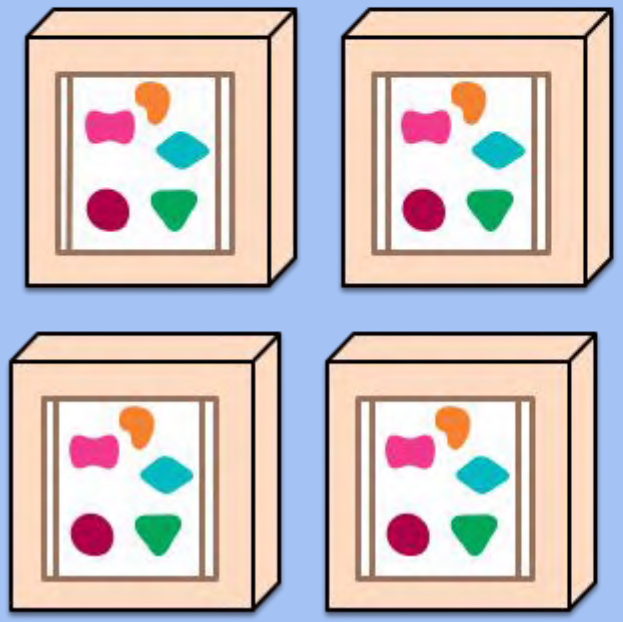
Microservices

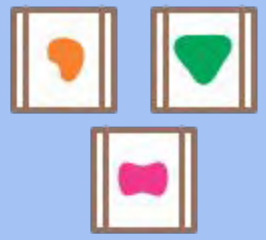
Microservices

A monolithic application puts all its functionality into a single process...

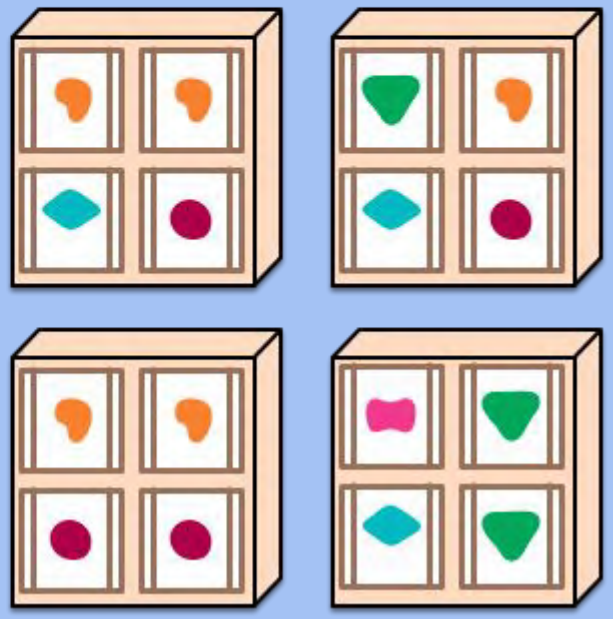
... and scales by replicating the monolith on multiple servers



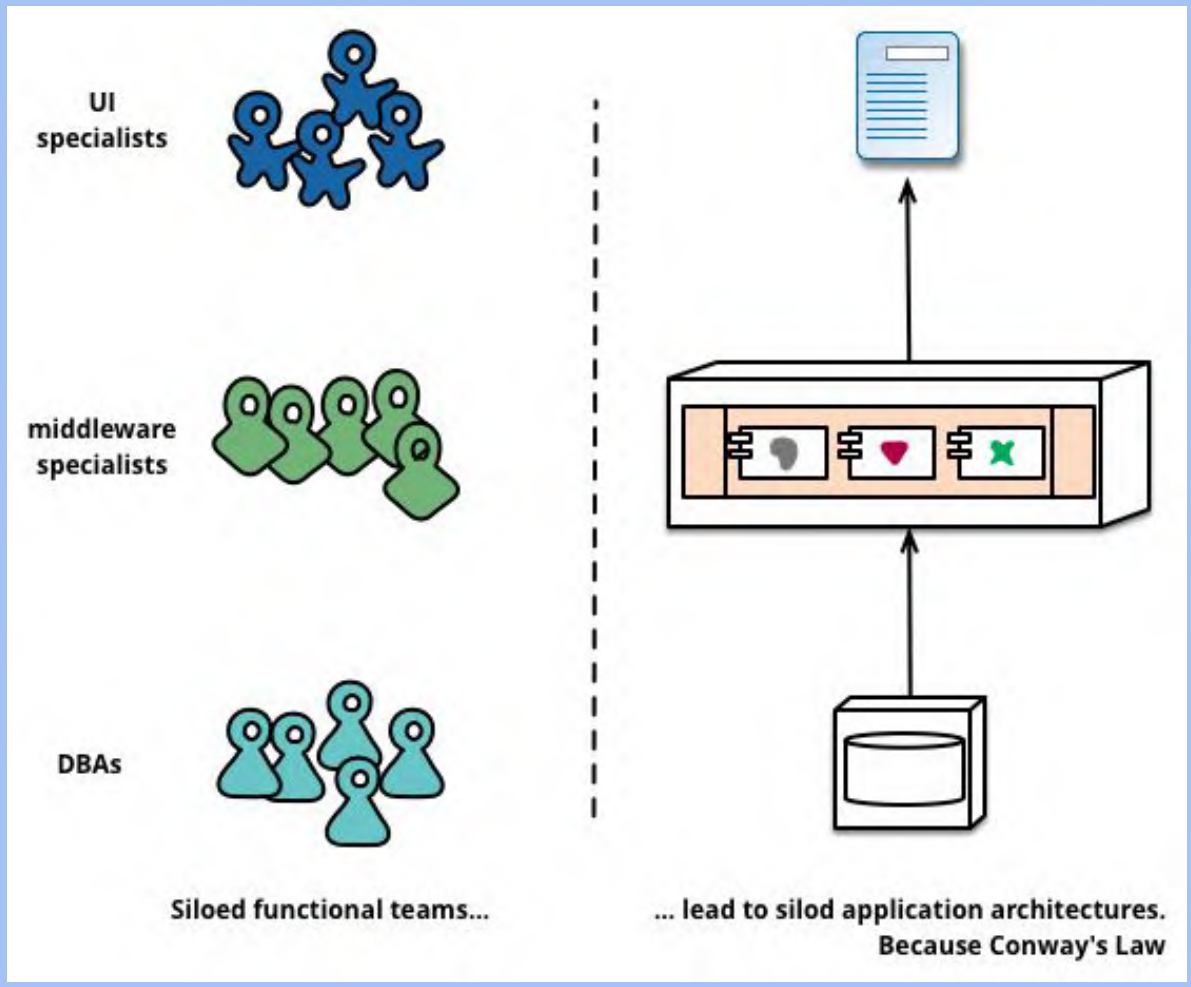
A microservices architecture puts each element of functionality into a separate service...



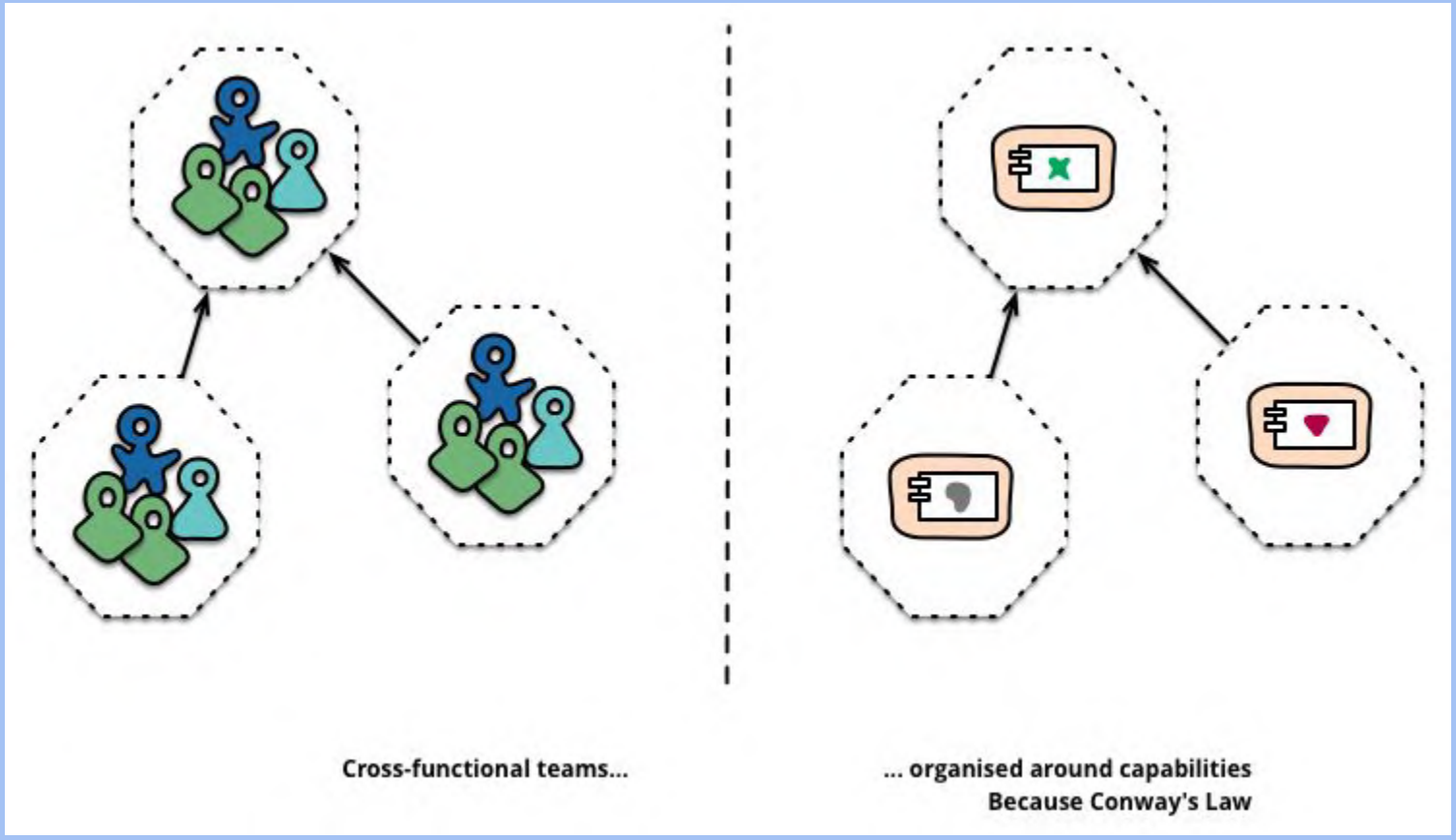
... and scales by distributing these services across servers, replicating as needed.



Microservices



Microservices

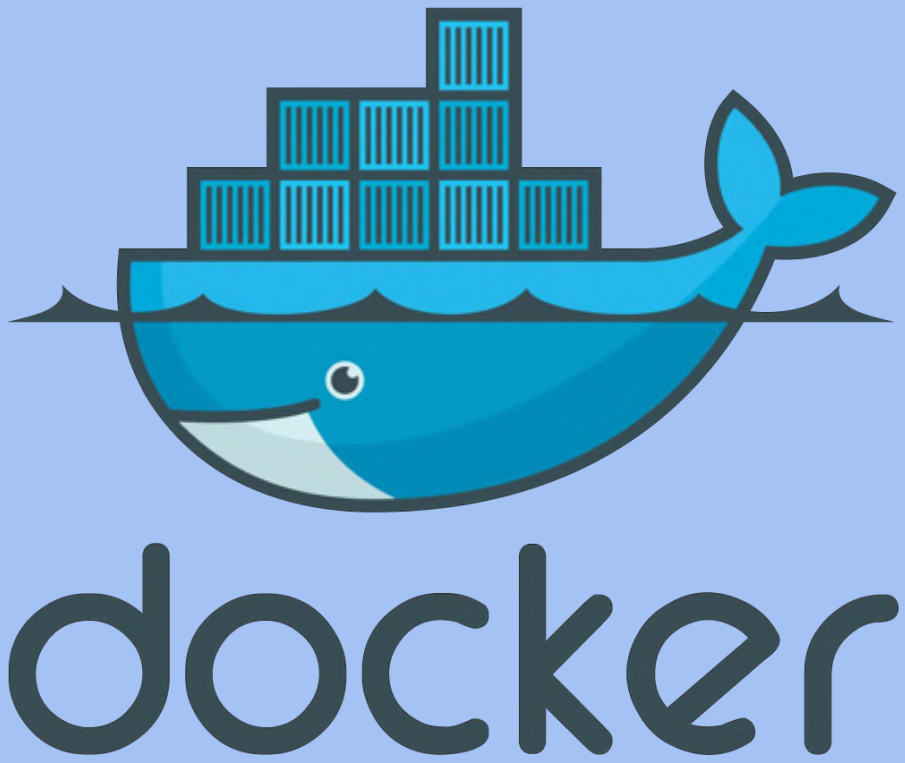


Microservices

Microservices

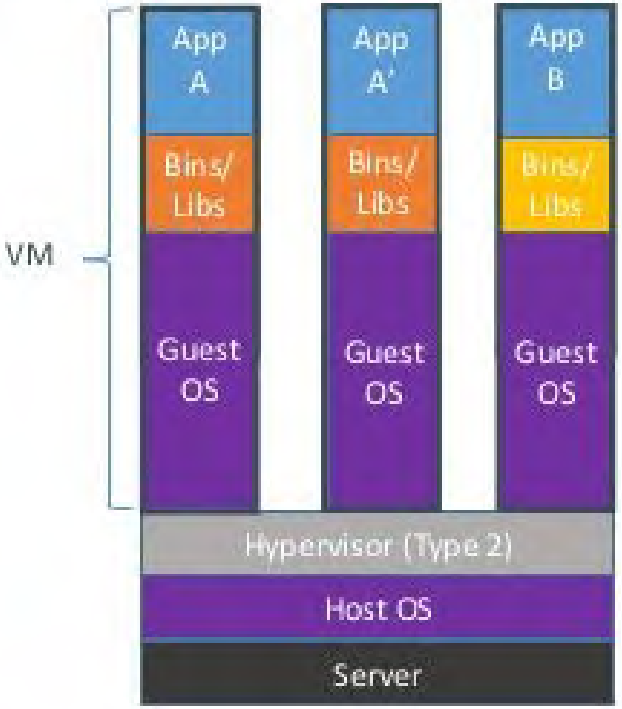

Ops problem
Dev and Ops
Works fine in Dev

Docker

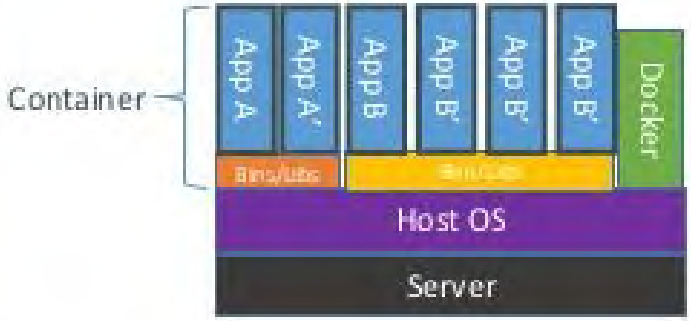


Docker

Containers vs. VMs



Containers are isolated, but share OS and, where appropriate, bins/libraries

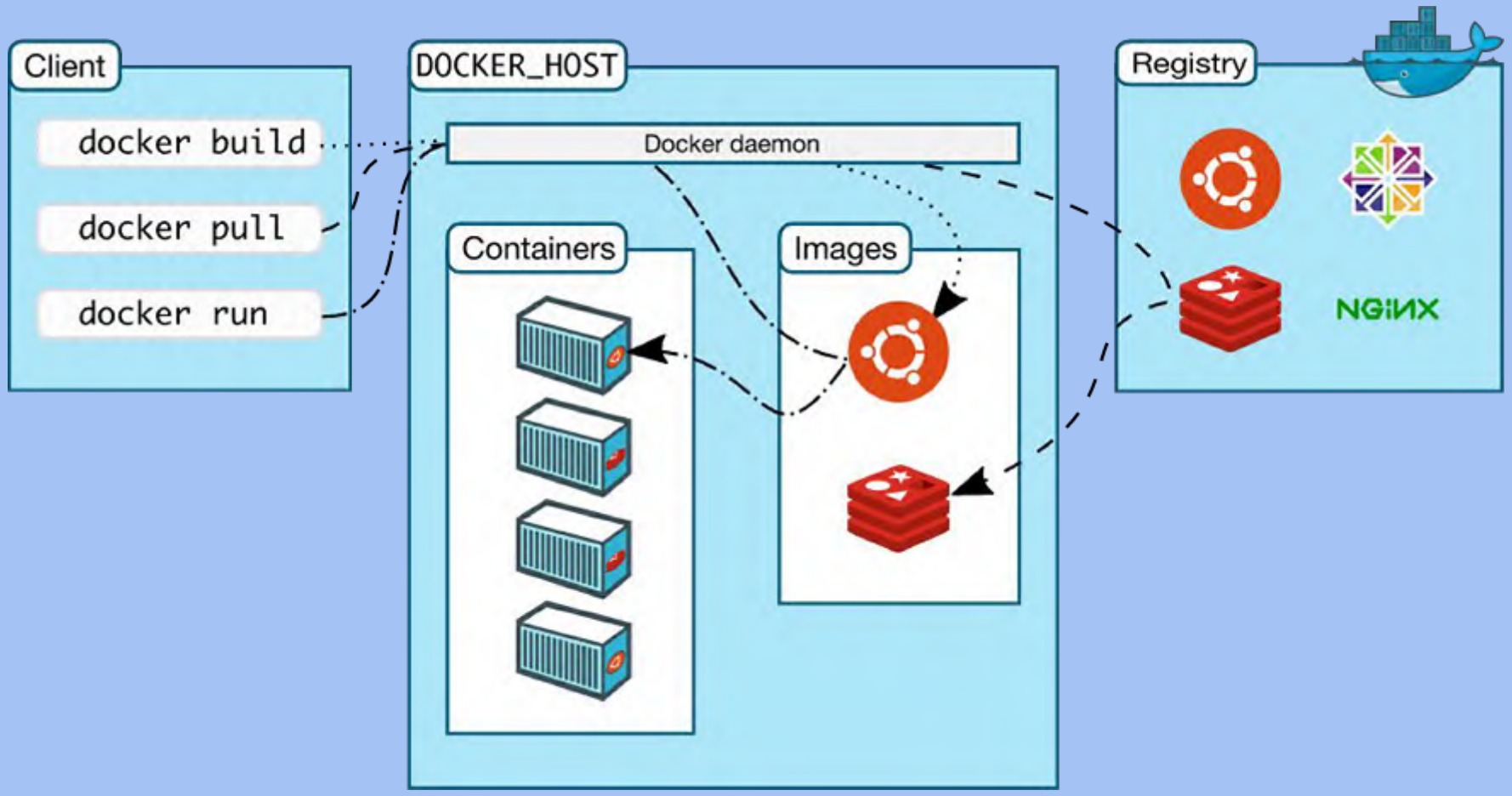


docker

Container ~ 1950

Container ~ 2010

Container Spec



Container Spec

Open Container Specifications

- A container spec
  - config.json
  - runtime.json
  - rootfs

Container Spec

App Container Specifications

- An image spec
  - compressed
  - encrypted
  - signed

Container Spec

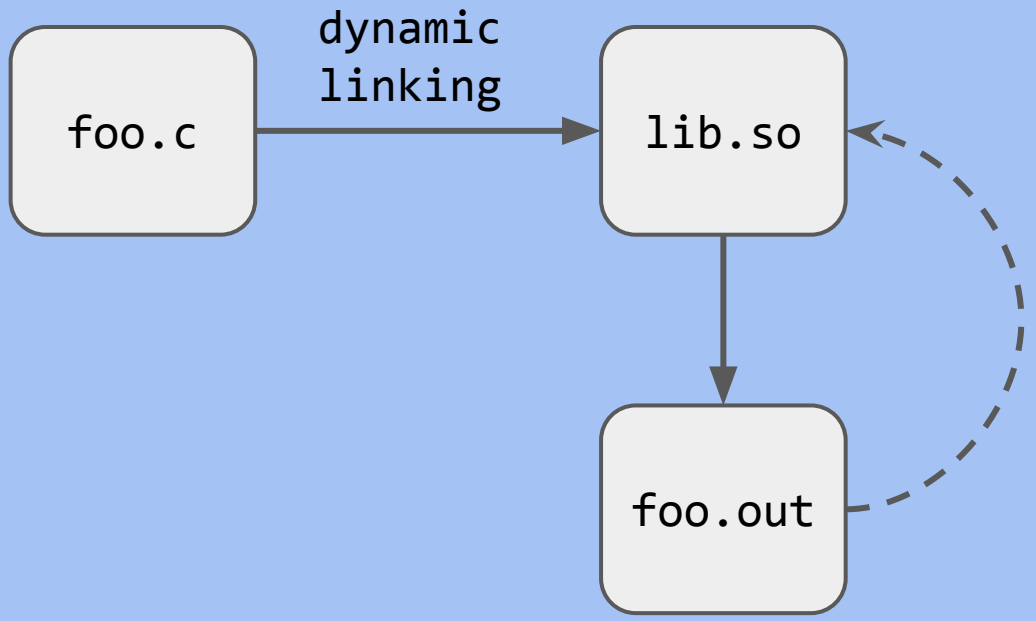
OCI and appc Intersections

	Standards		Container Runtimes		Portability
	OCI	APPC	DOCKER	RKT	EXAMPLES
Container Image	✗	✓	Docker Format v2	appc Image Spec Docker Format v2	User builds container once, can run in docker or rkt
Image Distribution	✗	✓	Docker Registry Protocol	appc Discovery Spec Docker Registry Protocol	Docker and rkt can share container registry mechanism
Runtime	✓	✓	libcontainer	appc Runtime Spec	Docker and rkt can share exec drivers (impl. using LXC, runc, systemd-nspawn, etc)
On-disk Image Format	✓	✗	Previously unspecified	Previously unspecified	Exec drivers share a metadata format and filesystem layout for how to execute a container

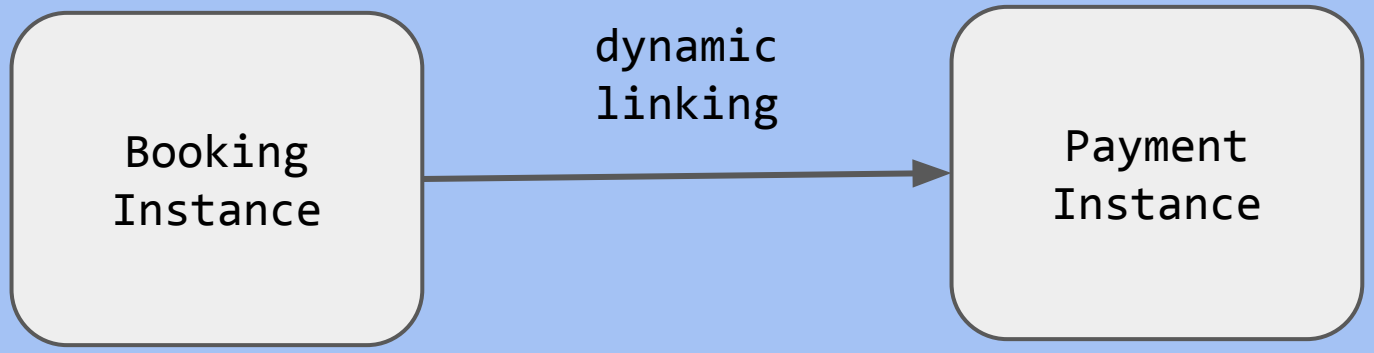
Container Management

Discovery System

Dynamic Linking



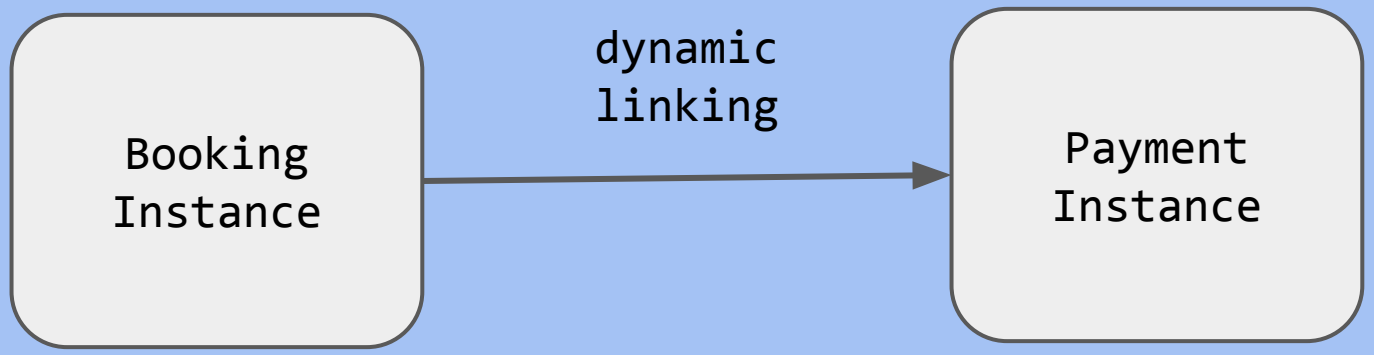
Discovery System




```
find_payment_service()
{
    return 10.0.0.1:1234
}
```

10.0.0.1:1234

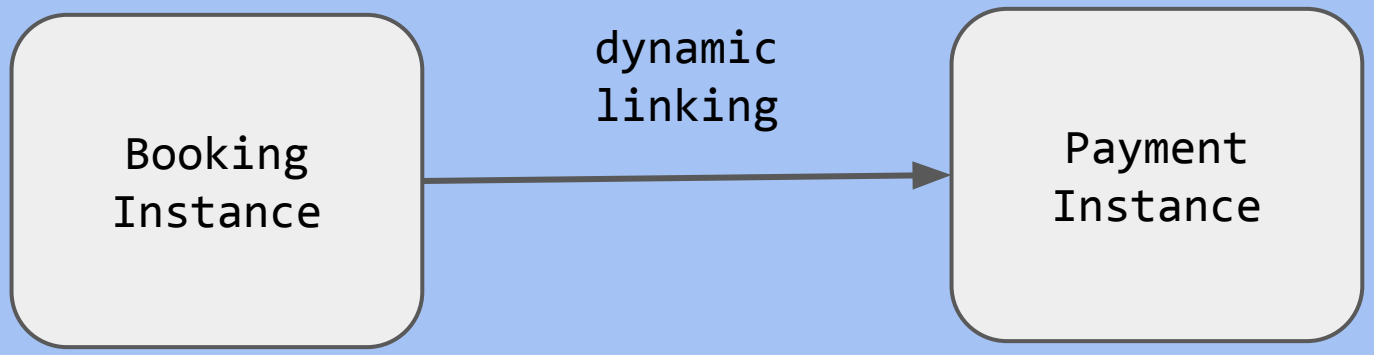
Discovery System




```
find_payment_service()
{
    return 10.0.0.100:1234
}
```

10.0.0.100:1234

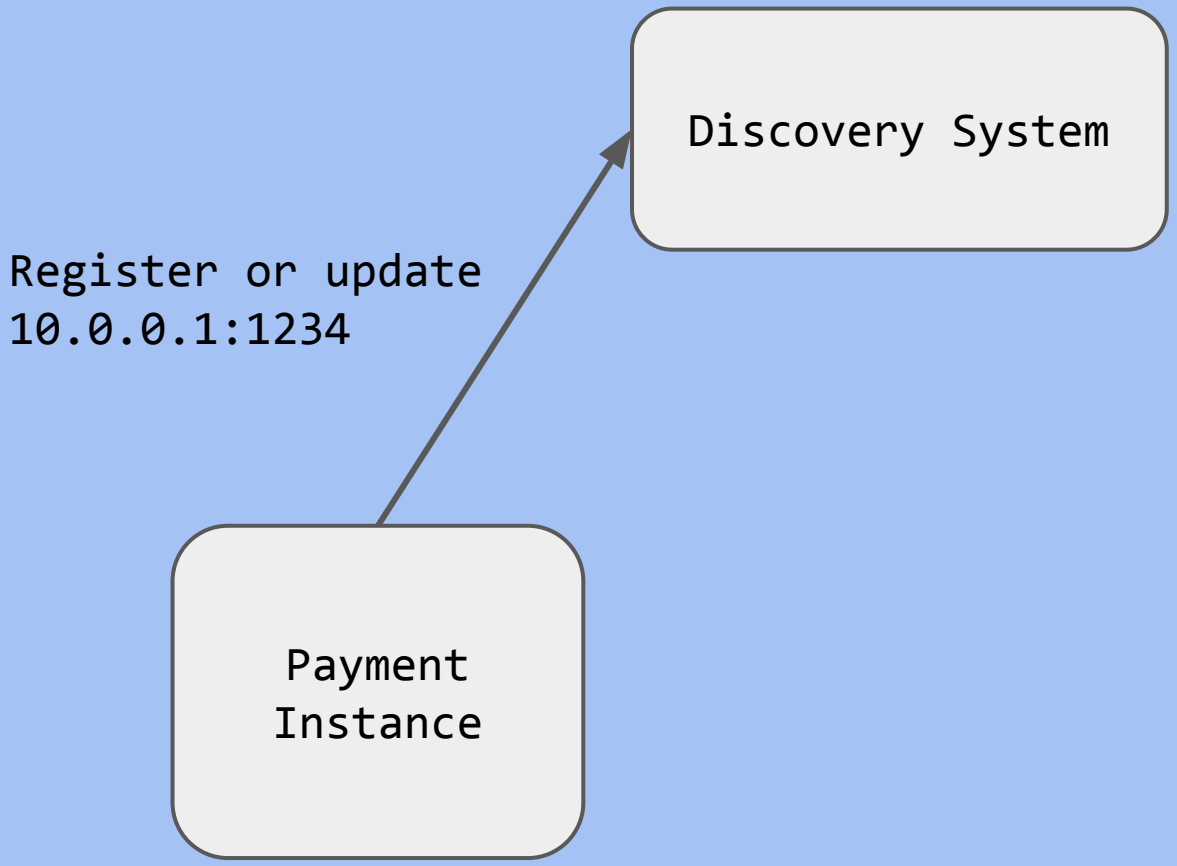
Discovery System



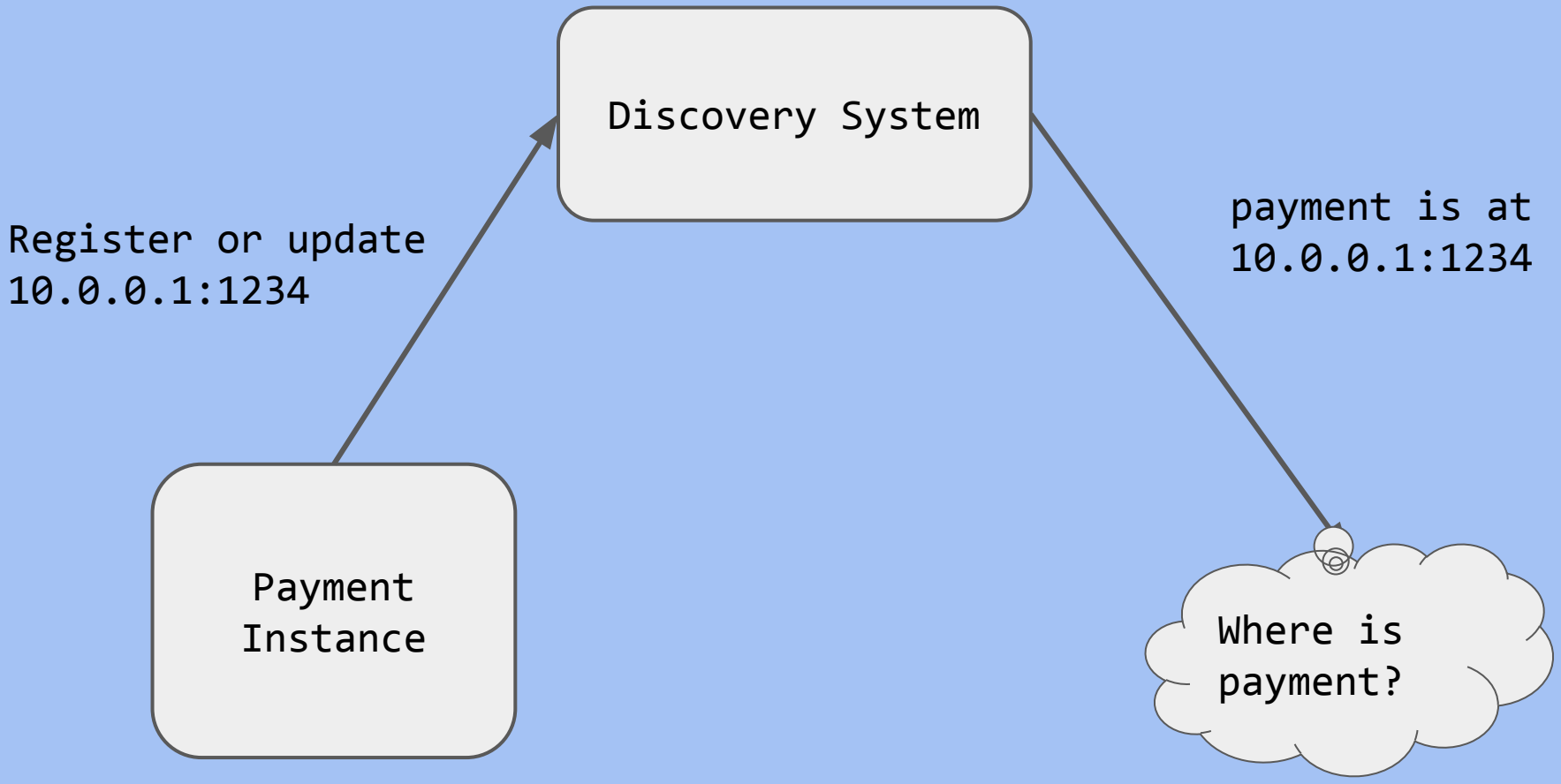

```
find_payment_service()
{
    return payment.example.com
}
```

10.0.0.1:1234

Discovery System



Discovery System



Discovery System

Real problems

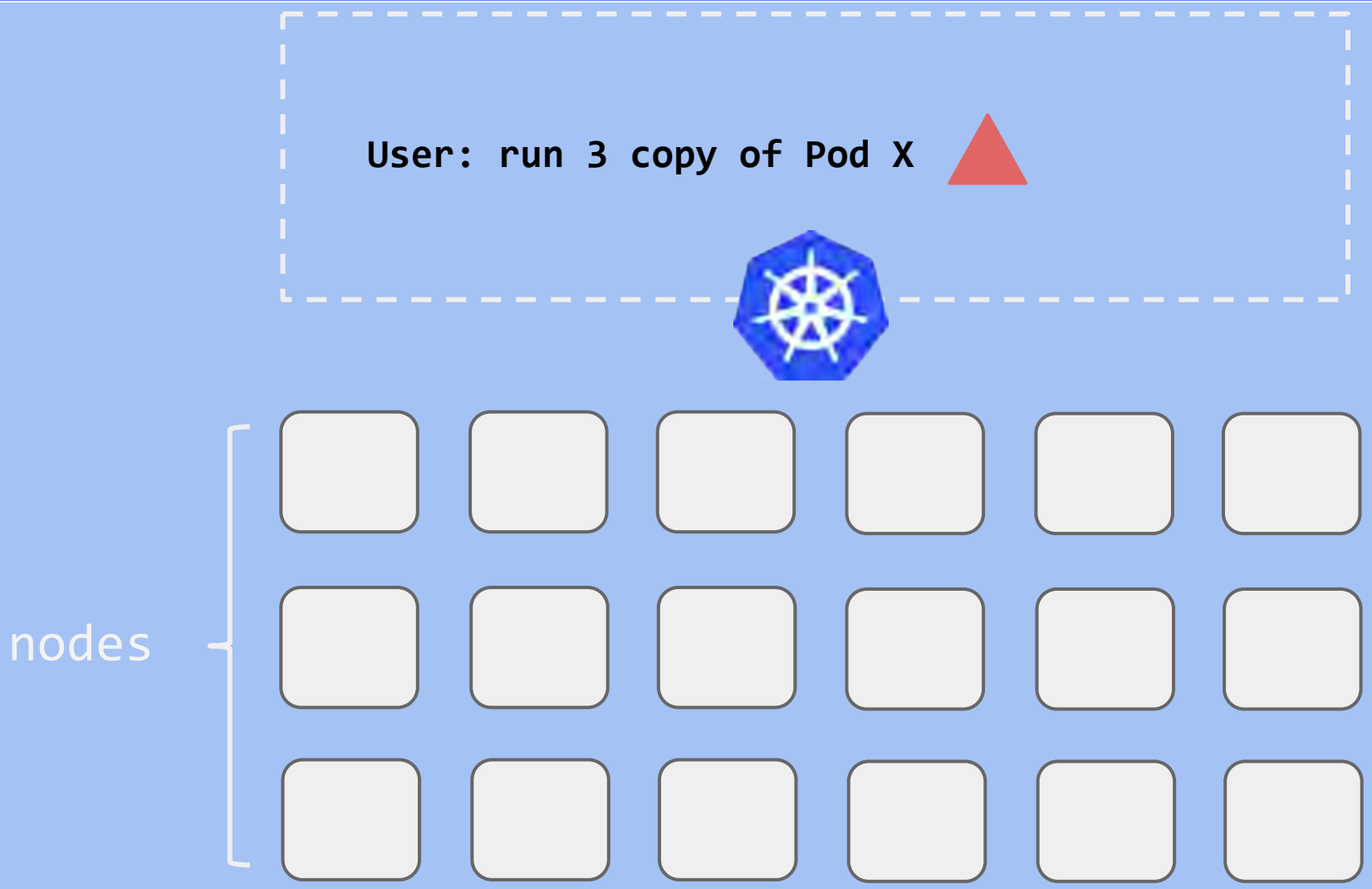
- Load balancing across multiple instances
- Auto removal dead instances
- Rolling upgrades

Cluster Management

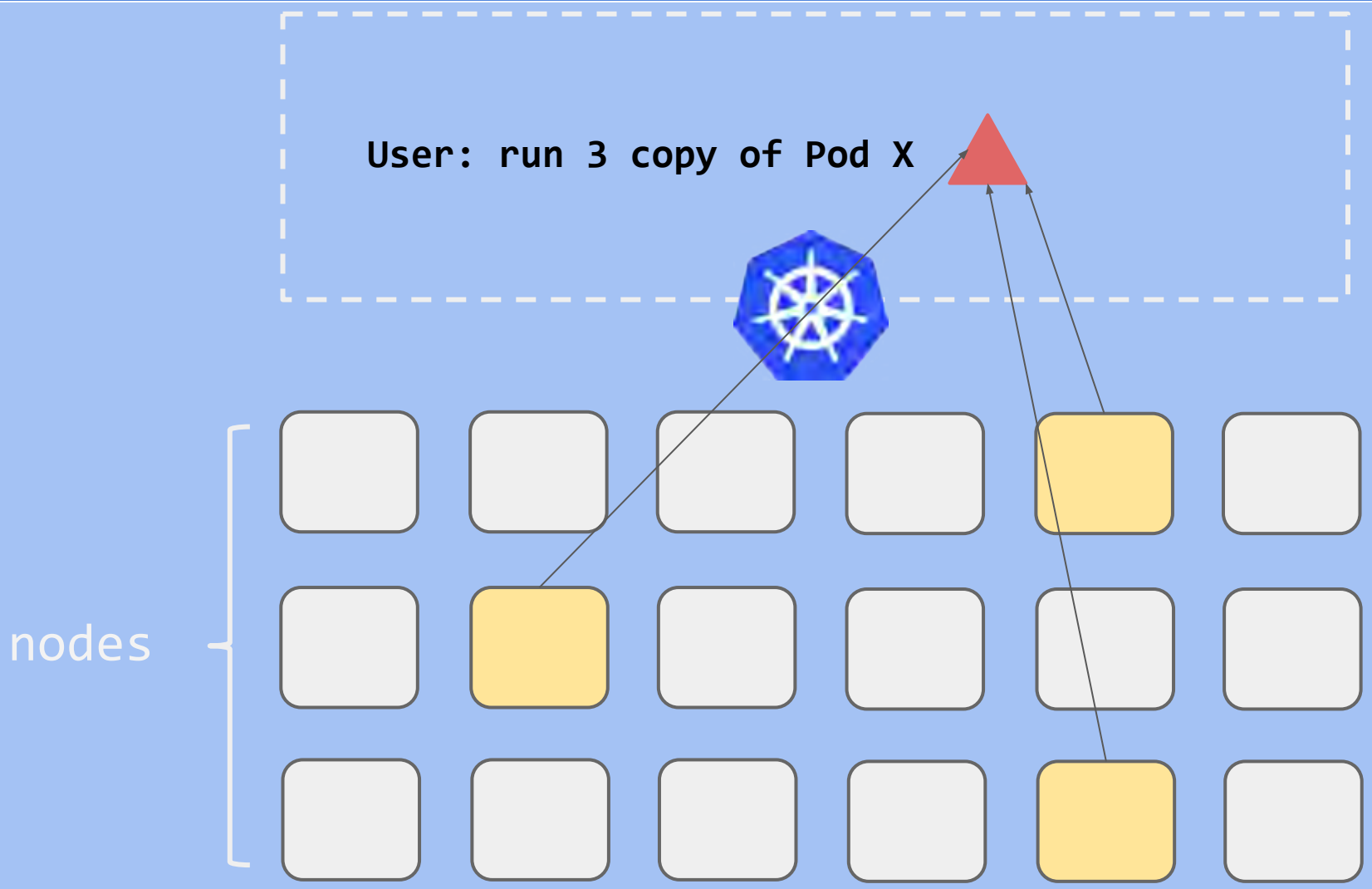
Scheduler

- Schedule pods to run on nodes
  - Global state
  - Multiple schedulers
  - Pluggable
  -

Scheduler

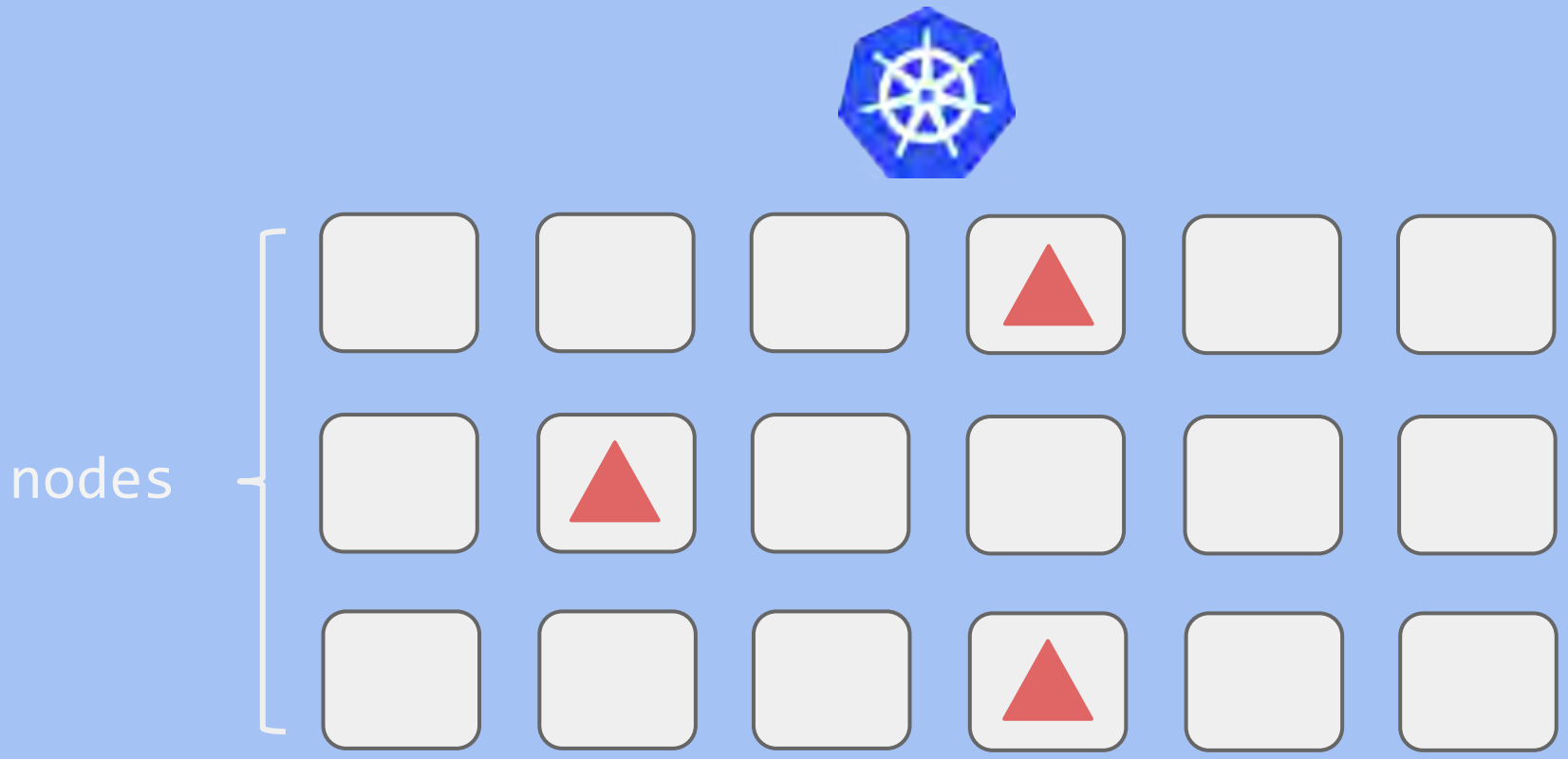


Scheduler



Scheduler

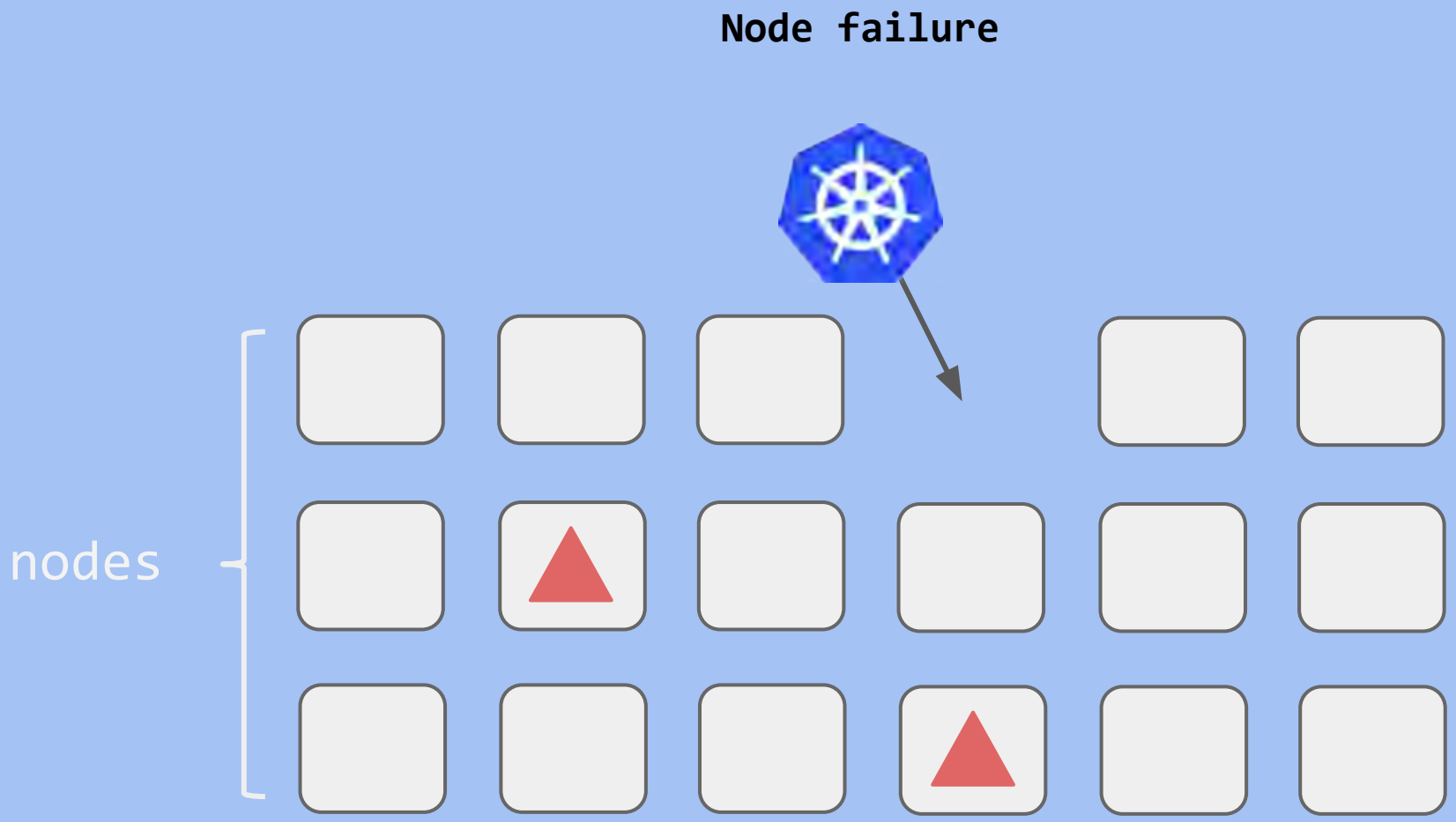
User: what is the status of X Pod?



Replication Controller

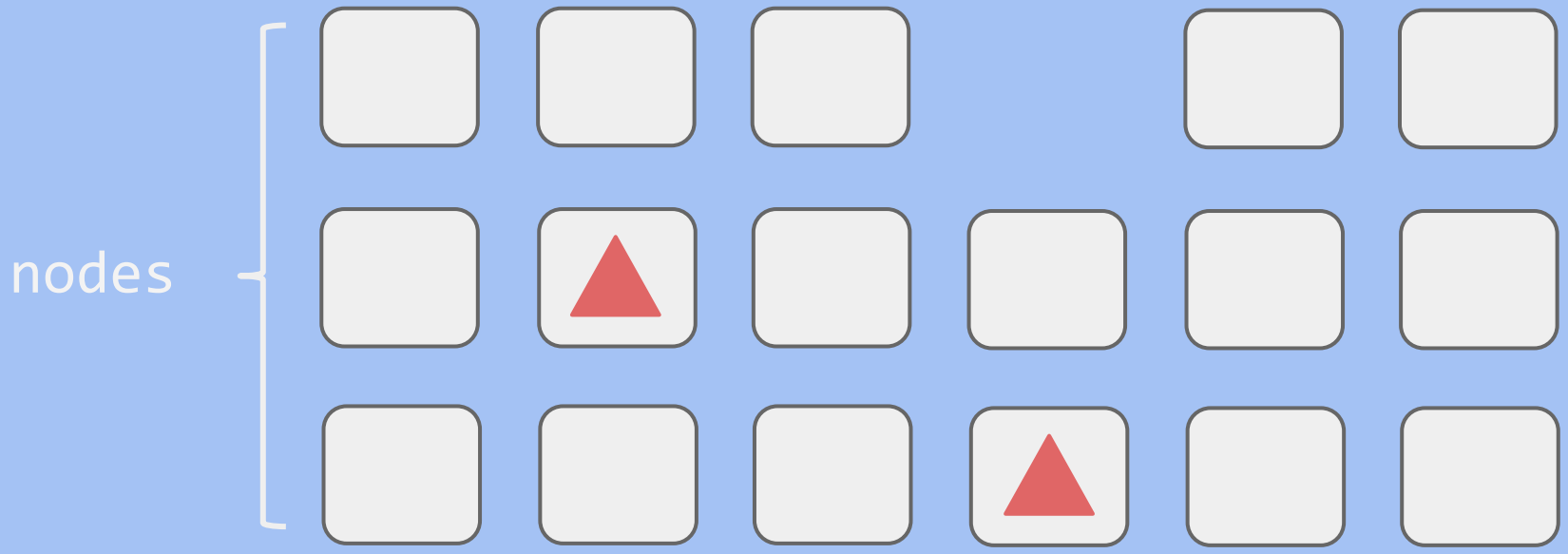
- Manage a replicated set of pods
  - ensure the desired number
  - resizing
-

Replication Controller



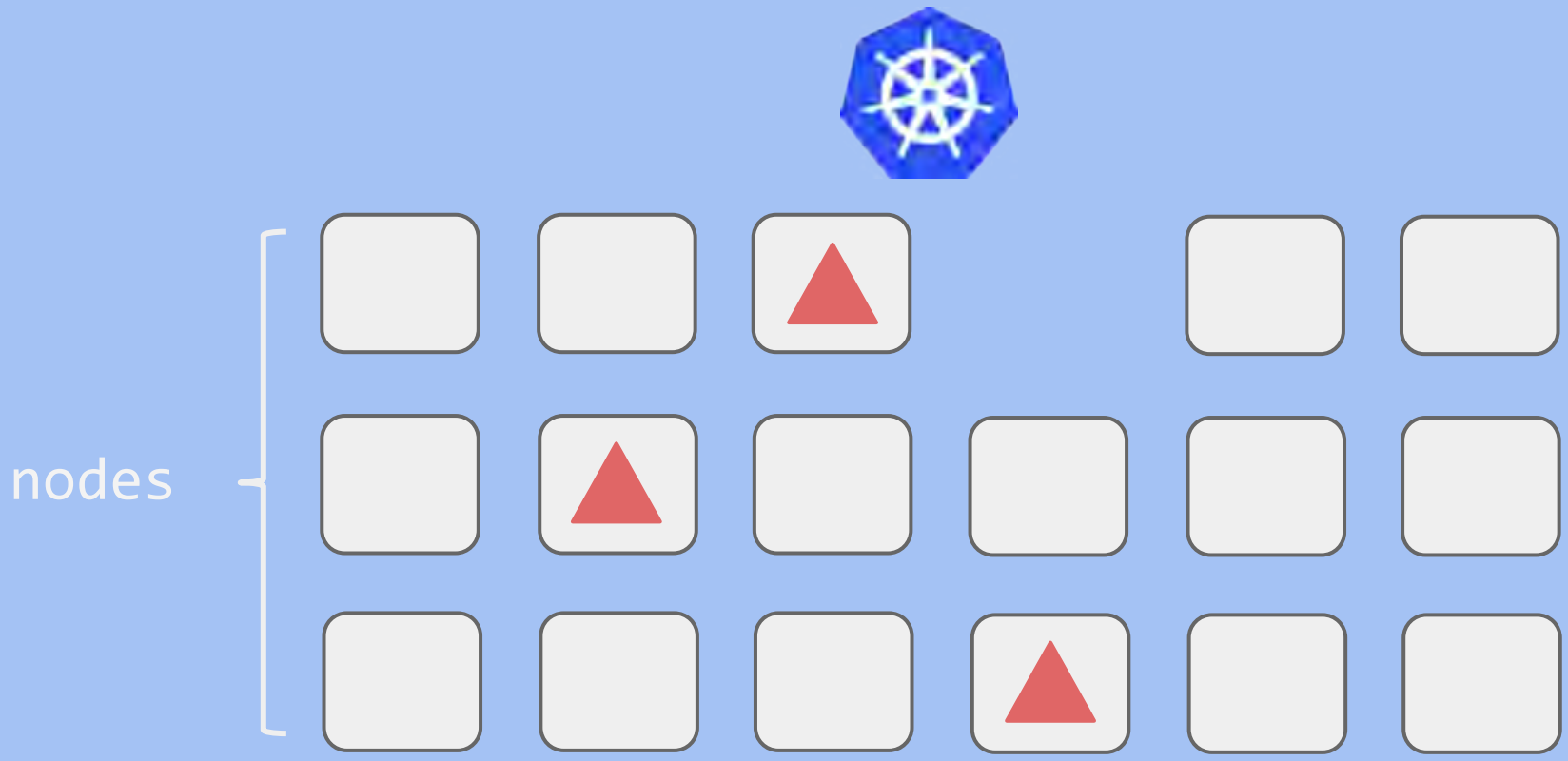
Replication Controller

Need to replicate one more X



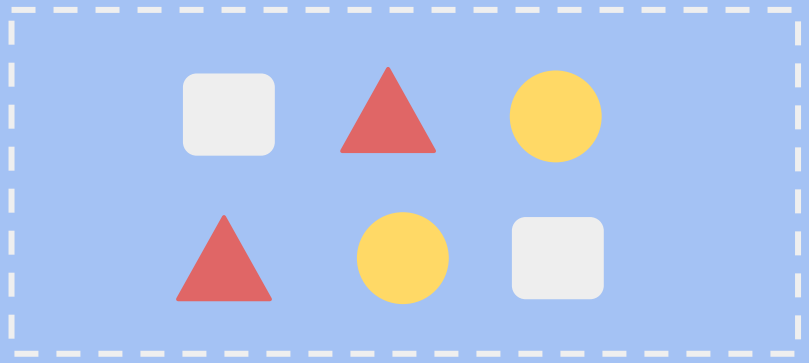
Replication Controller

Need to replicate one more X



Service

- A dynamic collection of pods
  - select by label query



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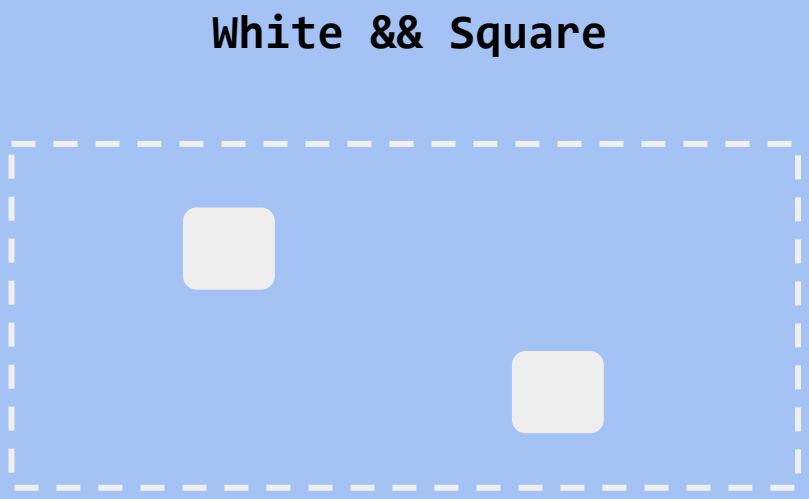
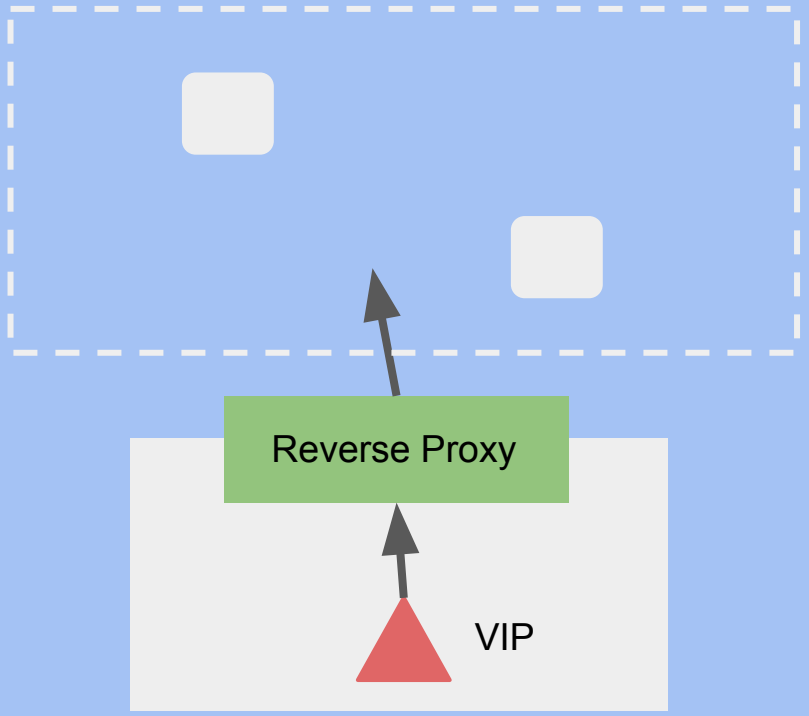


Service

- Native support for service discovery
  - Local proxy on each node
  - Virtual IP per service

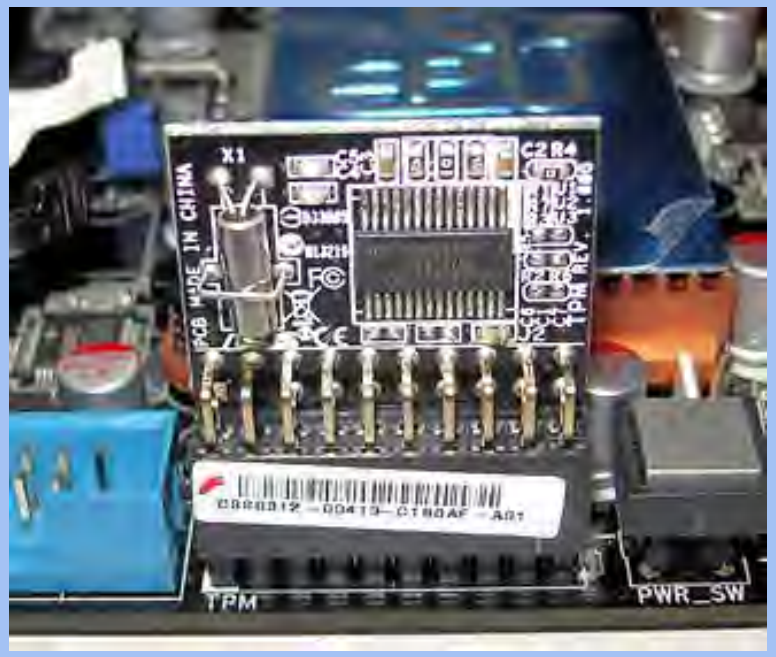


Distributed Trusted Computing

Distributed Trusted Computing

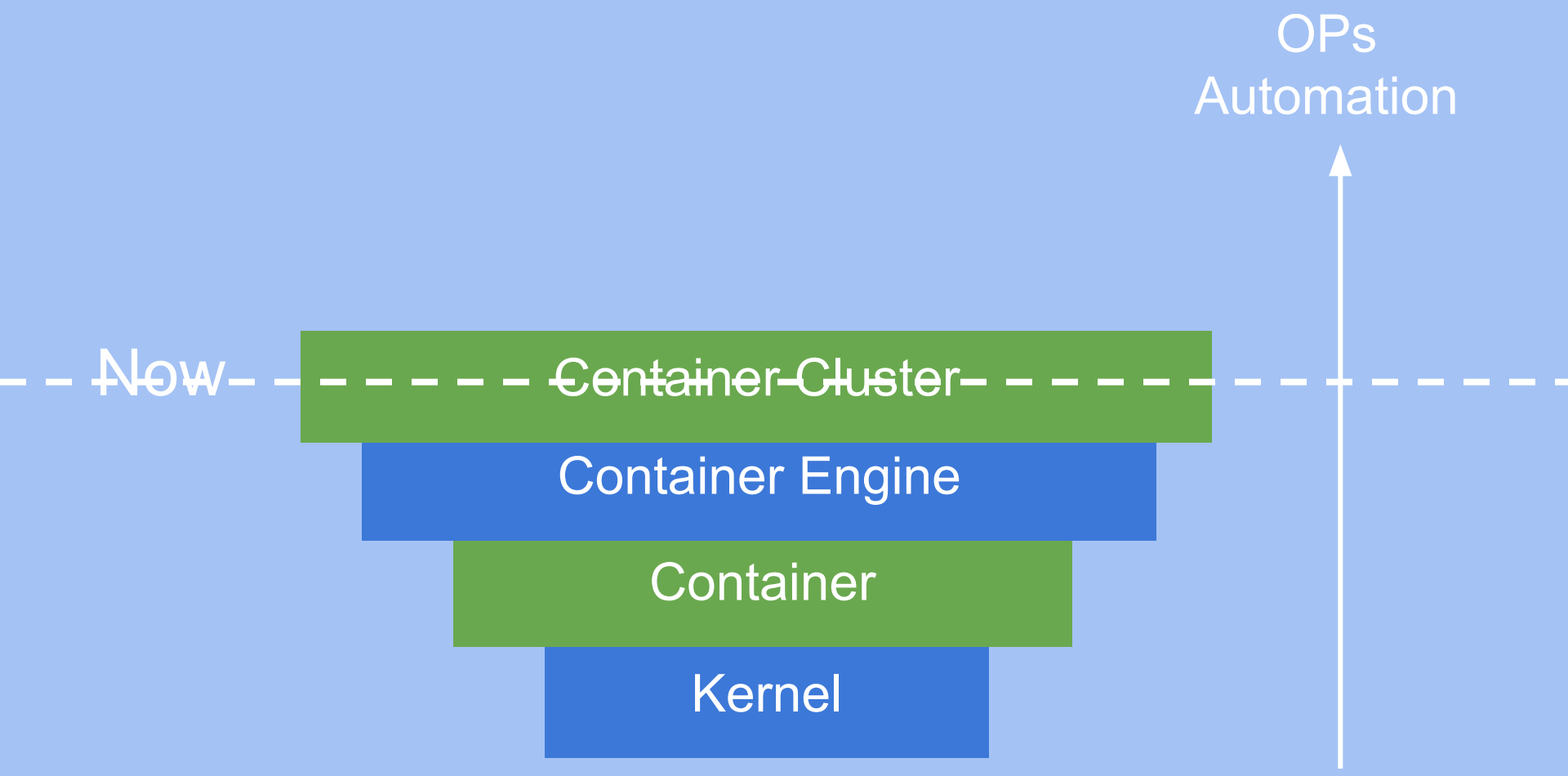
TPM

- Store and generate RSA keys
- Records measurements
- Provide Attestation

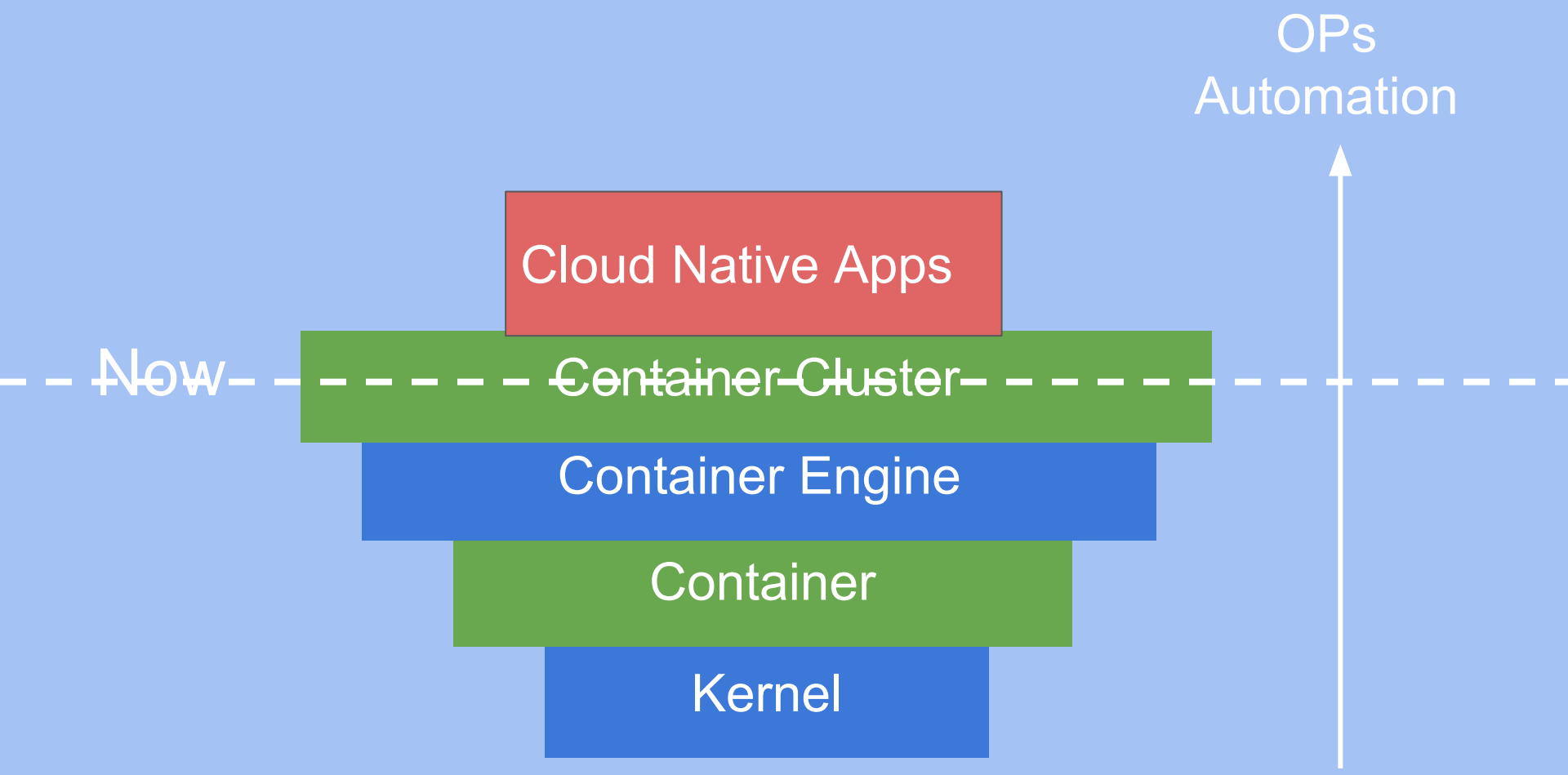


Distributed Trusted Computing

Evolution


OPs
Automation
Now
Container Cluster
Container Engine
Container
Kernel

Evolution


OPs
Automation
Cloud Native Apps
Now
Container Cluster
Container Engine
Container
Kernel

Thanks

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