Managing Drivers with Kubernetes

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Drivers? For What?

Drivers Enable New Workloads and Cost Saving (Perf and $$)

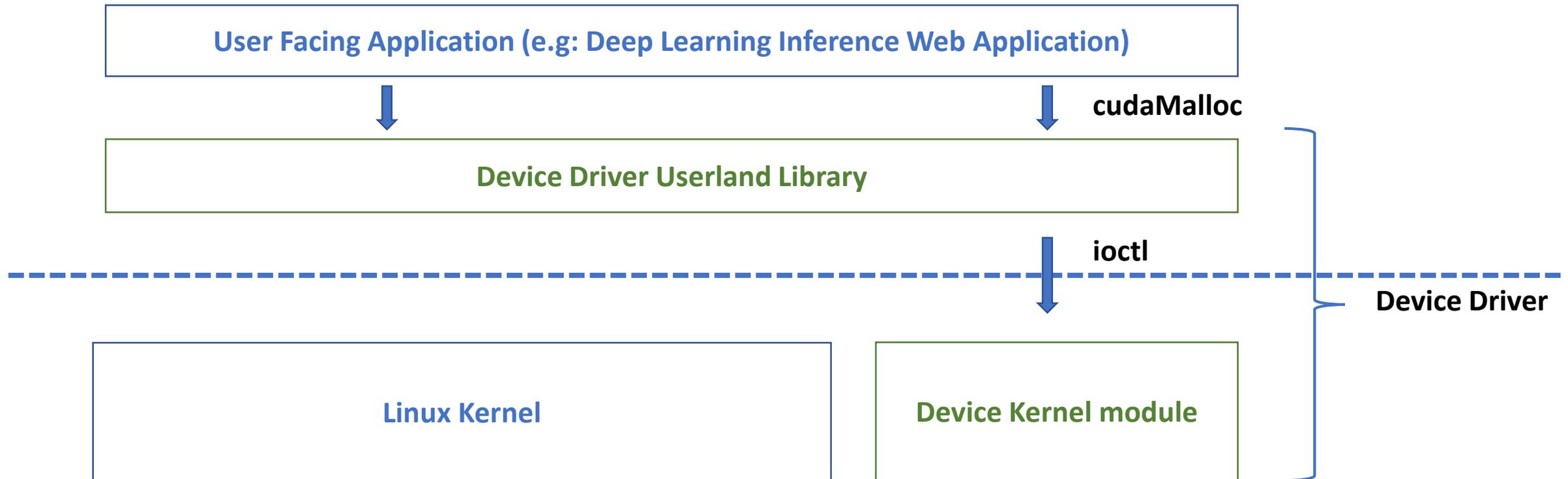| Virtualization Driver	RDMA Over Converged Ethernet ROCE	NVIDIA Drivers
Purpose: Use Virtual Machines and Virtualized Workloads. **Benefits:** Increase security, reduce costs.	**Purpose:** Faster Data Transfer across nodes (e.g: in data centers). **Benefits:** Enable High Speed Applications, reduce Data Center Costs	**Purpose:** Interact with NVIDIA GPUs. **Benefits:** Accelerate Compute Intensive Workloads that would not be possible on CPUs.

Drivers? What are they?

User Facing Application (e.g: Deep Learning Inference Web Application)

cudaMalloc

Device Driver Userland Library

ioctl

Device Driver

Linux Kernel

Device Kernel module

Drivers? How?

1. Drivers are usually installed through package managers

```
$ apt-get install virtualbox-6.0
```

2. Drivers need to be compiled against your current kernel version

3. Driver also need to be recompiled when your kernel changes
   a. Dynamic Kernel Module Support (DKMS) will enable automatic recompilation of your kernel modules when this happens.
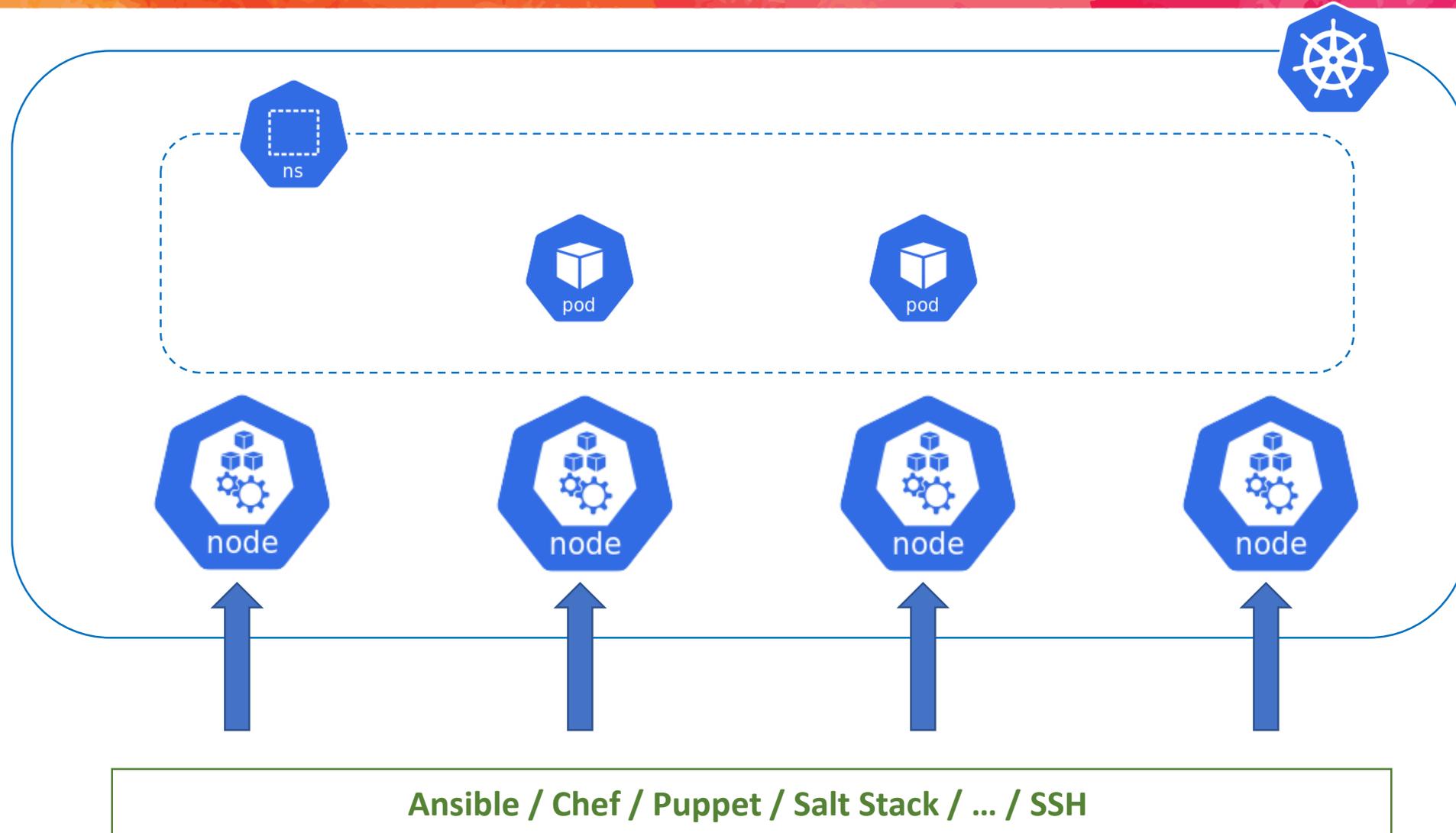
Drivers in Kube, Using SSH

Ansible / Chef / Puppet / Salt Stack / ... / SSH

Drivers in Kube, Using SSH

Why?
Using SSH is traditional, reliable and well-known

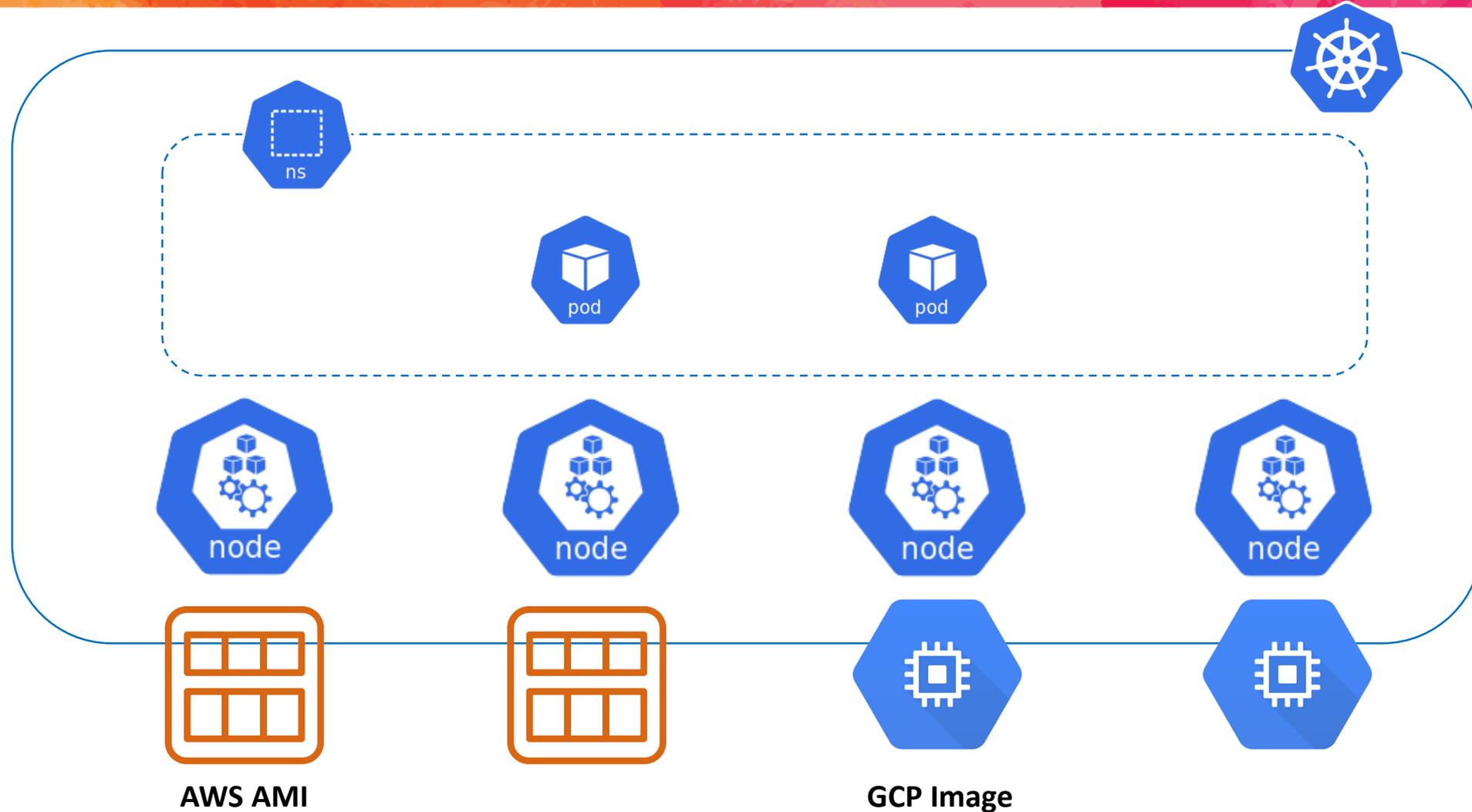| Disadvantages |
| :---: |
| • Parallel control plane required

• Hard to reuse your existing infrastructure (e.g: logging, …)

• Error prone and requires a lot of work |

Drivers in Kube, Base Image

AWS AMI   GCP Image

Drivers in Kube, Base Image

Why?

**Your Trust Boundary is your AMI
Simple and Intuitive Model**

Disadvantages

- **Less Flexibility,**
  This is the same process as before containers. Needs to be thoroughly vetted, slower to update.

- **Cloud Specific,** needs to be done for all clouds
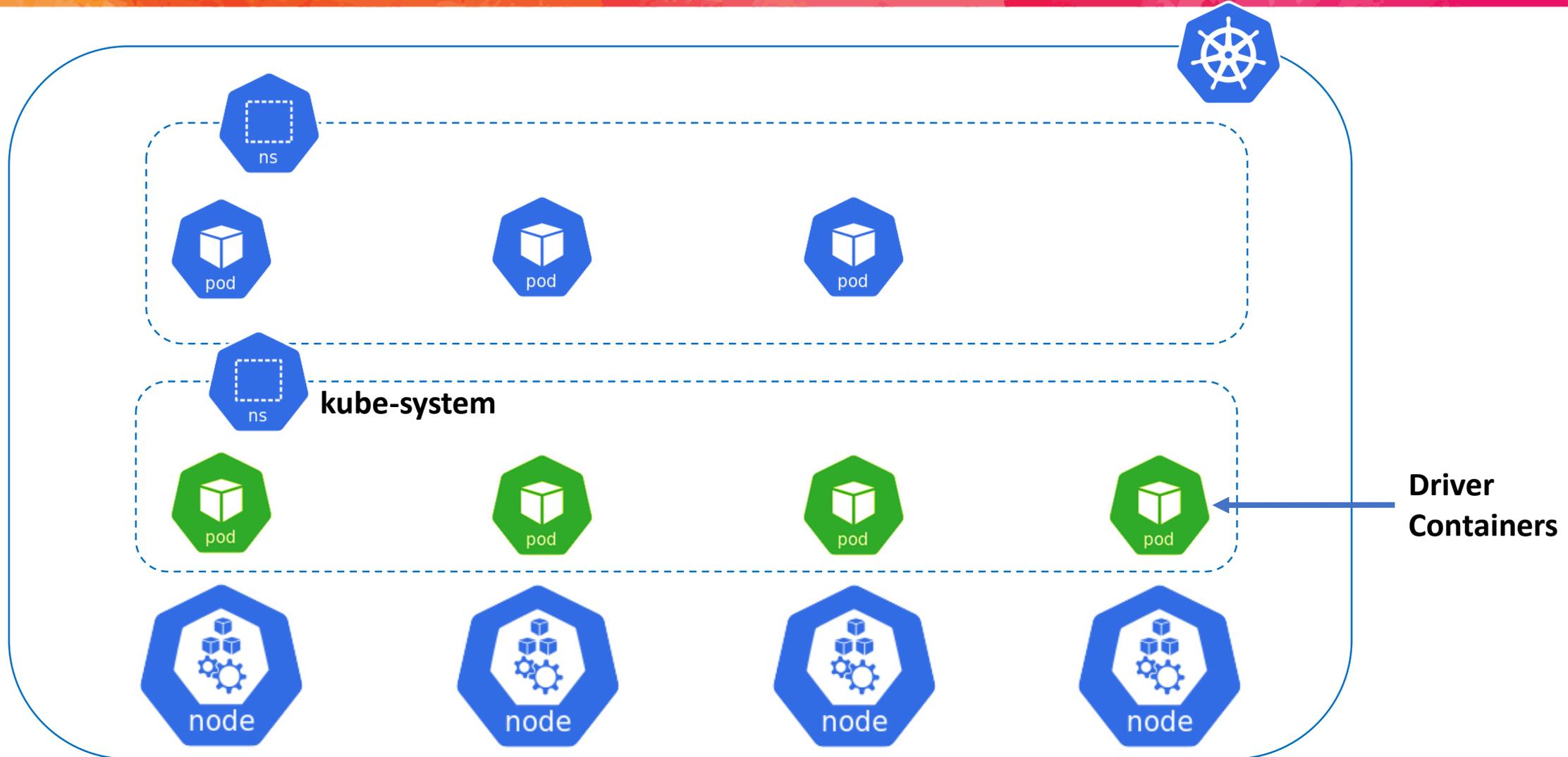
- **Lots of work**

Drivers in Kube, Containers

kube-system

Driver Containers

Drivers Containers?

nvidia-driver-container.sh

```
_compile_driver
trap "_shutdown" EXIT
modprobe nvidia
_write_kernel_update_hook
sleep infinity
```

Drivers in Kube, Base Image

Why?	Things I don't have Time to Talk About

Upgrades! Operators! Kube constructs!

Reuse your existing infrastructure (logging, monitoring, labels, …).

- **Device Plugins**

- **Container Runtime plugins**

- **Userland libraries,** in your container or in your driver container?
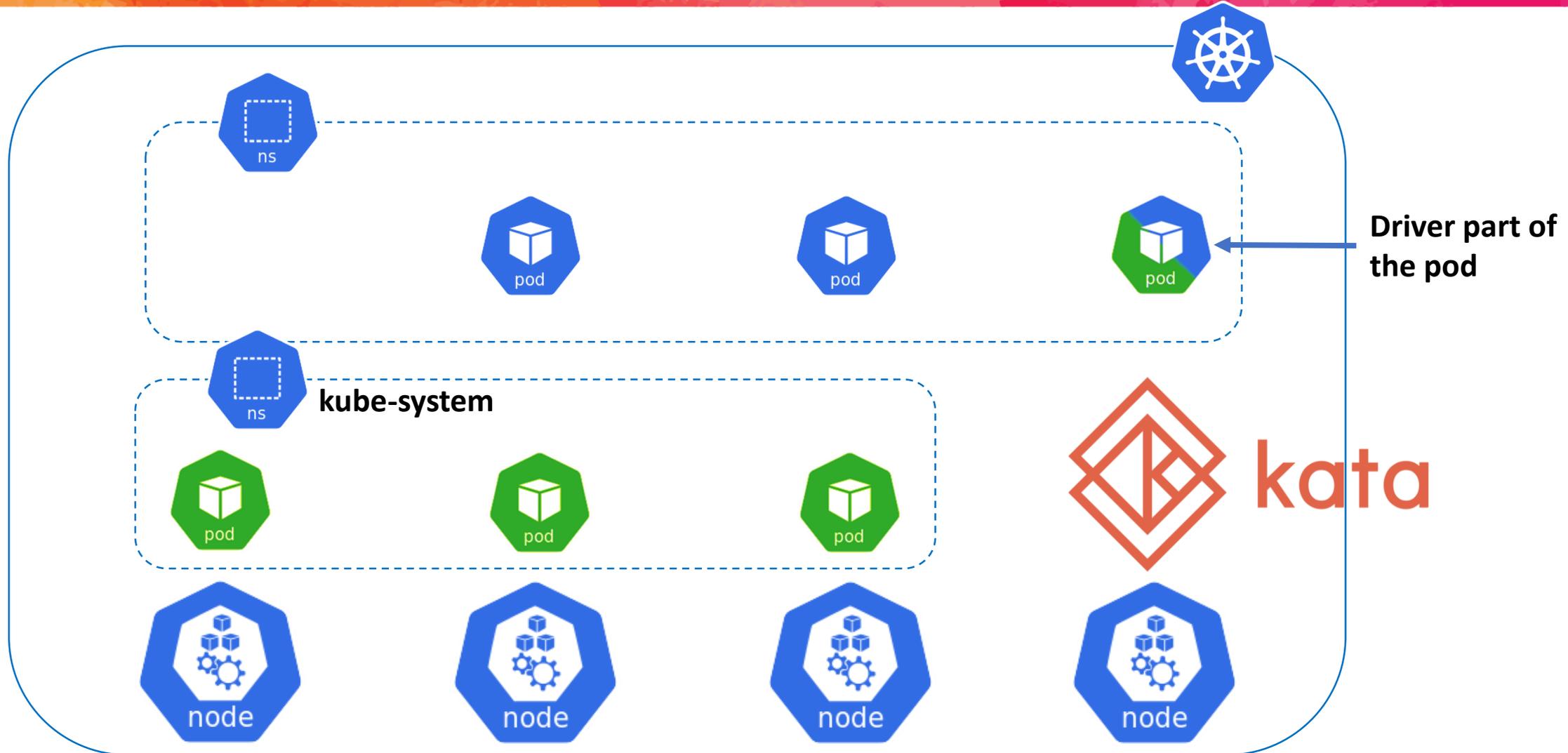
Drivers in Kube, Future?

Driver part of the pod

kube-system

Call to Action

Go Checkout the NVIDIA Driver Container

https://gitlab.com/nvidia/driver

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