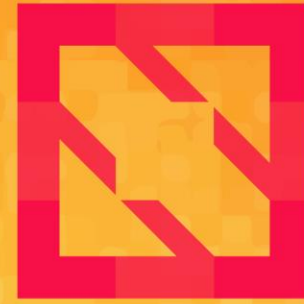




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# KubeEdge Deep Dive

Sean Wang <[swang54@gmail.com](mailto:swang54@gmail.com)>



# Agenda



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- Key Functionalities Deep Dive
- Application Scenarios Deep Dive



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Sean Wang



Kevin Wang

# From Cloud to Edge



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- **Low Latency**

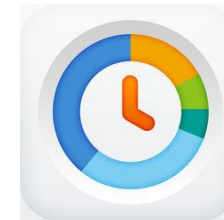
- A solution is developed at the edge to reduce the latency.

- **Massive Data**

- An explosive growth in edge data; data migration to the cloud causes high costs.
- Local data analysis and filtering saves network bandwidth.

- **Privacy & Security**

- Sensitive, personal privacy data handled at edge, to protect production and business security.





# KubeEdge Architecture

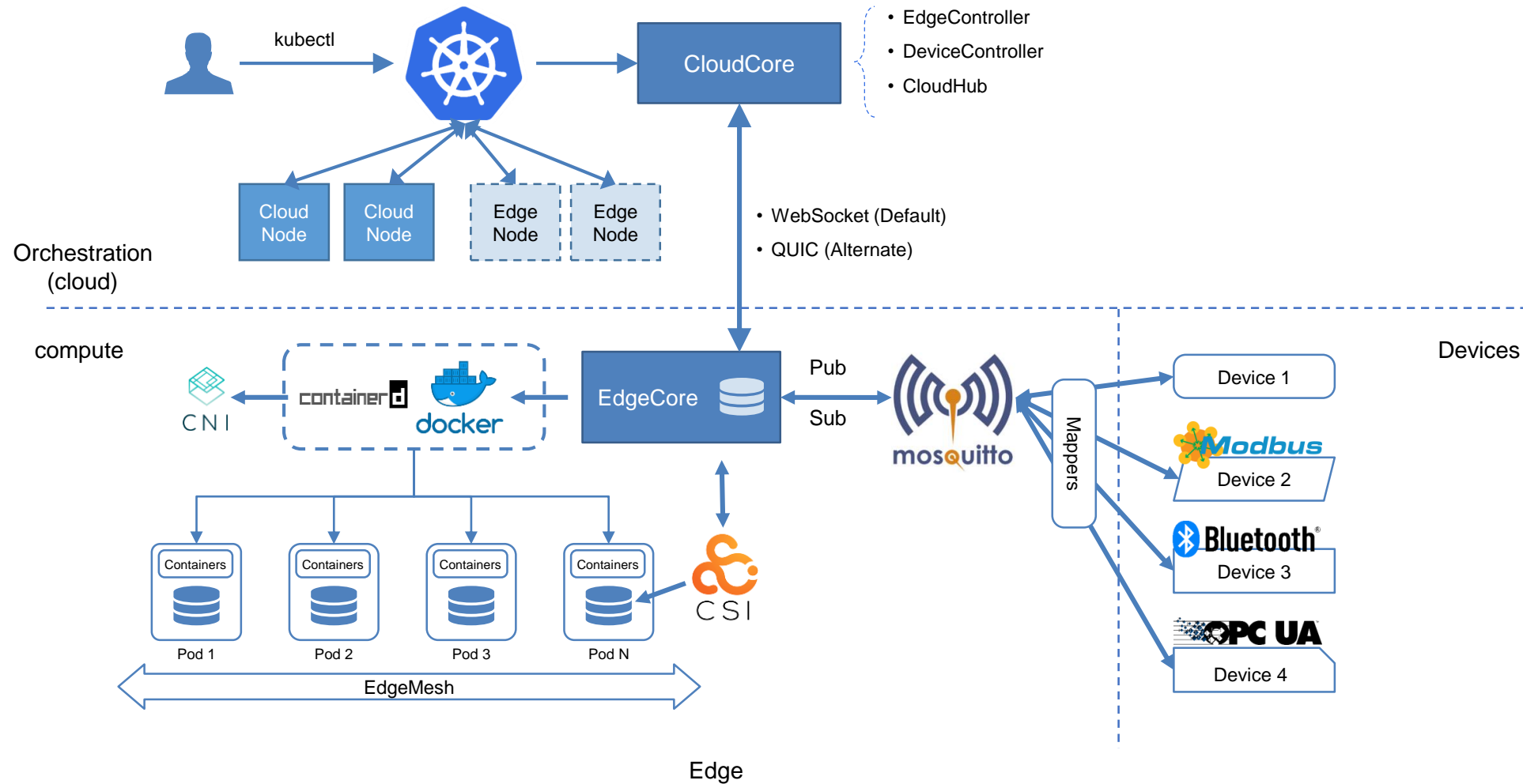


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# Basic Framework



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One of the design goals for KubeEdge is to build a modularized computing platform at edge, this applies to its own core component design as well.

Kubeedge/Beehive is a messaging framework based on go-channels for communication between modules of KubeEdge.

//each module need to implement the following interface

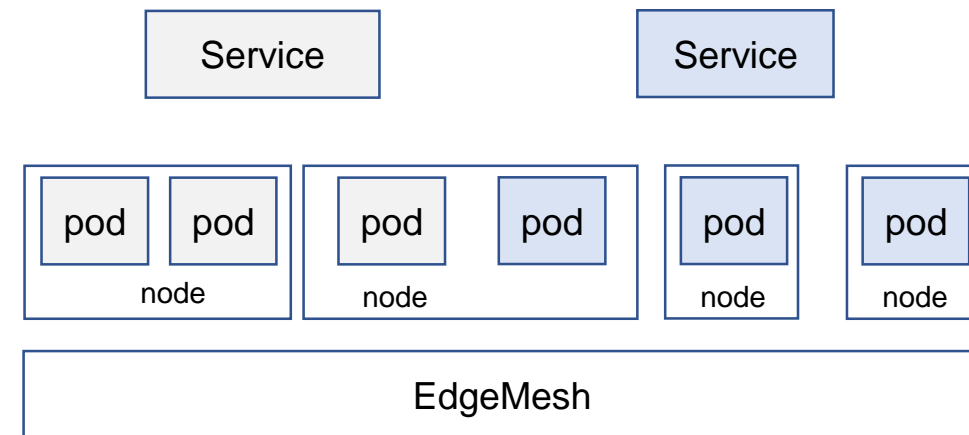
```
type Module interface {  
    Name() string  
    Group() string  
    Start(c *context.Context)  
    Cleanup() }
```

```
//Register the module to Beehive  
core.Register(& cloudHub{}
```

```
//Use Channel Context to communate between modules and groups  
coreContext.Send("edged",message)  
msg, err := coreContext.Receive("edged")  
.....
```

- One process containing all modules
- simple configure to enable/disable, decide which modules to run at runtime

EdgeMesh provides ServiceMesh at edge, enabling services running on different pods, nodes, locations to Mesh



# KubeEdge is More Than Kubelet



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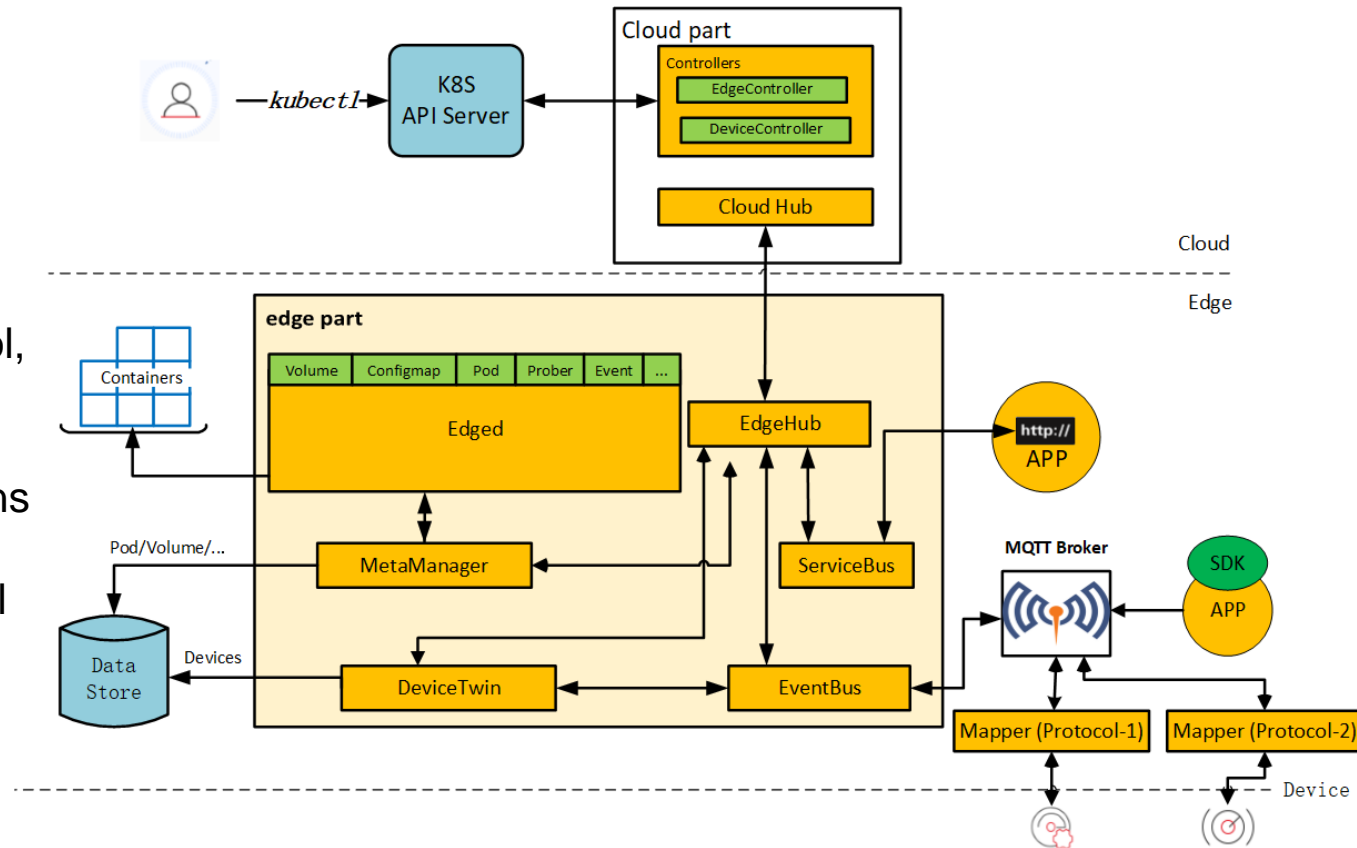
An extensible framework to maximize the compute power at edge

Local persistent metadata management

An Edge-Cloud channel not just for node control, but also for application

Enables node-cloud, node-node communications

Enabler for digital transformation of the physical world





# Creating a CSI Volume

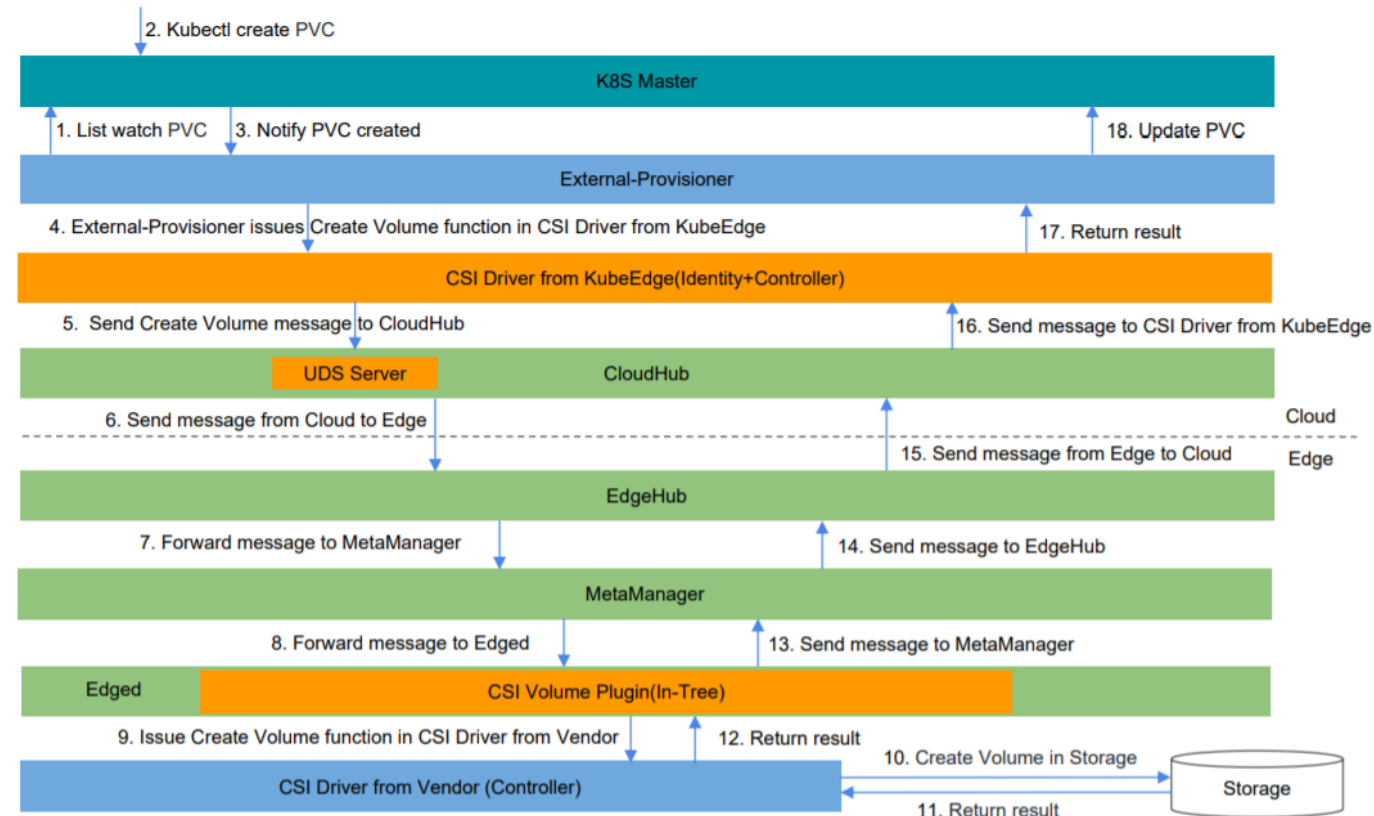


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# Deleting a CSI Volume

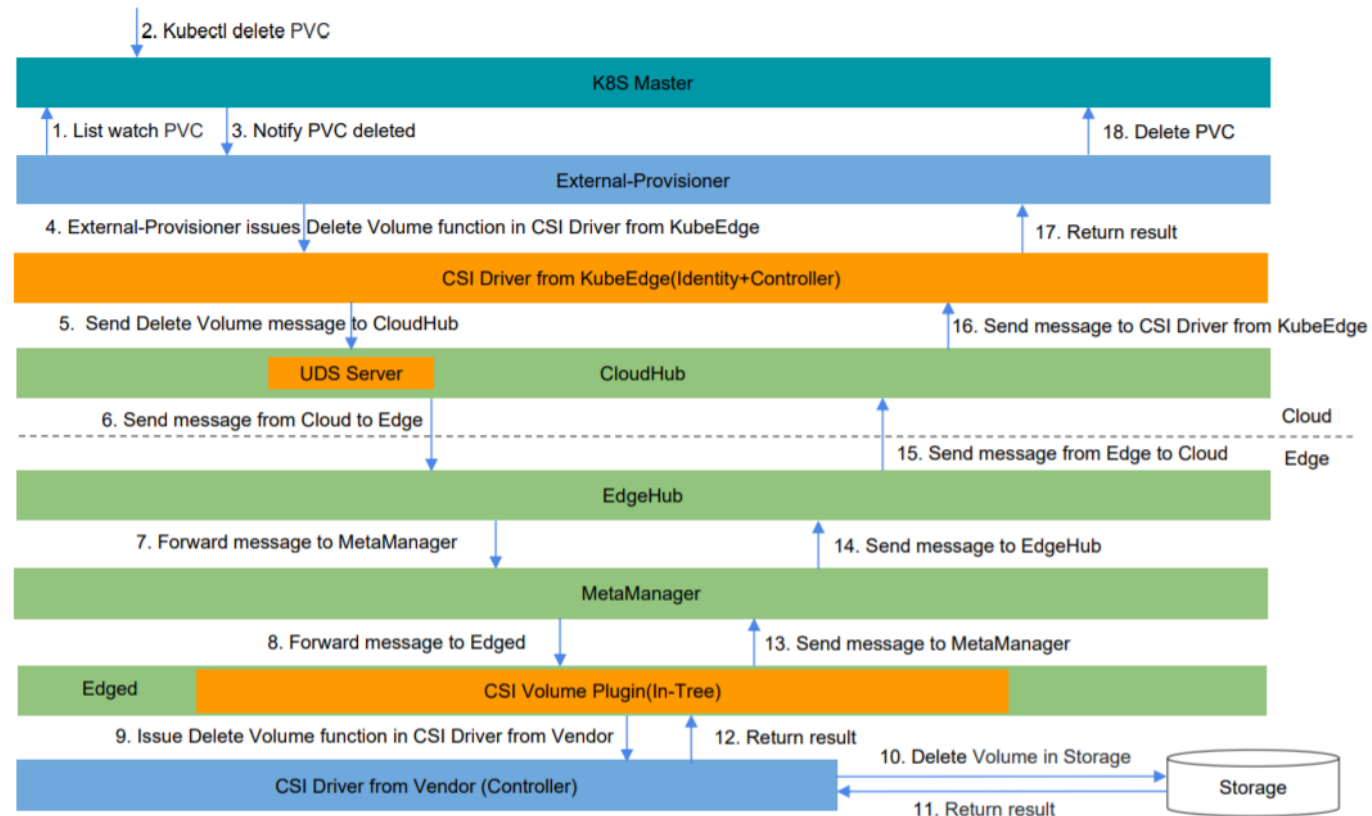


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# Edge Device Management



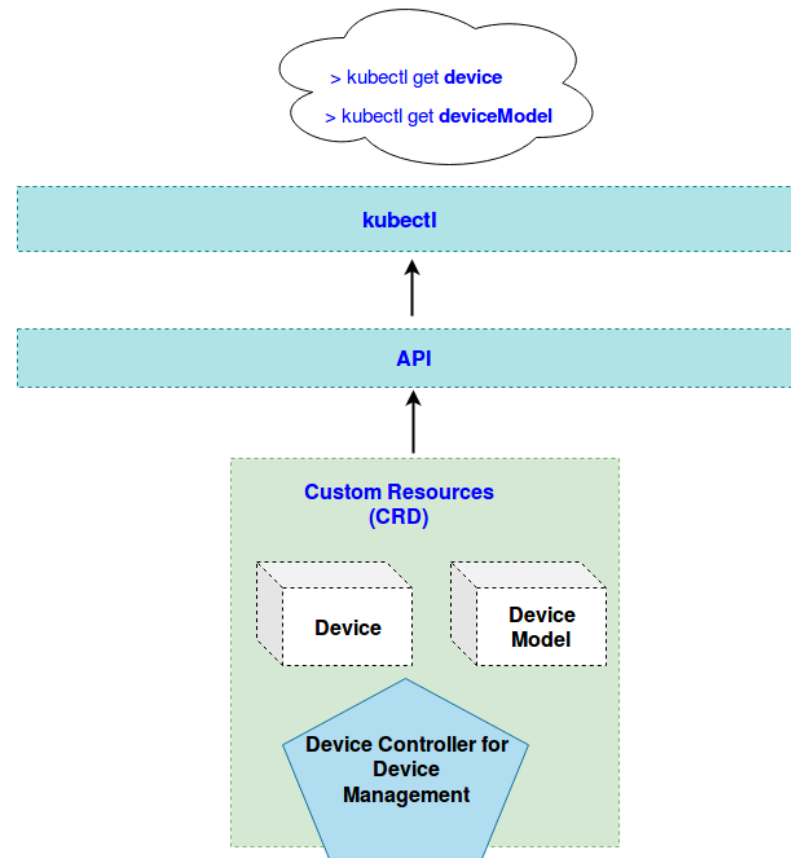
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- Edge Device APIs registered as K8s CRD
  - Same experience with K8s core APIs using kubectl
  - DeviceModel: template of devices
    - Defines common device properties including data type, read-only, default value, and max/min values, and communication protocols and arguments supported by each property.
  - DeviceInstance: instance of a device
    - Inherits properties from DeviceModel.
    - Obtains necessary arguments based on the protocol that used in reality.
    - Manages desired and reported states through DeviceTwin.



# Edge Device Management



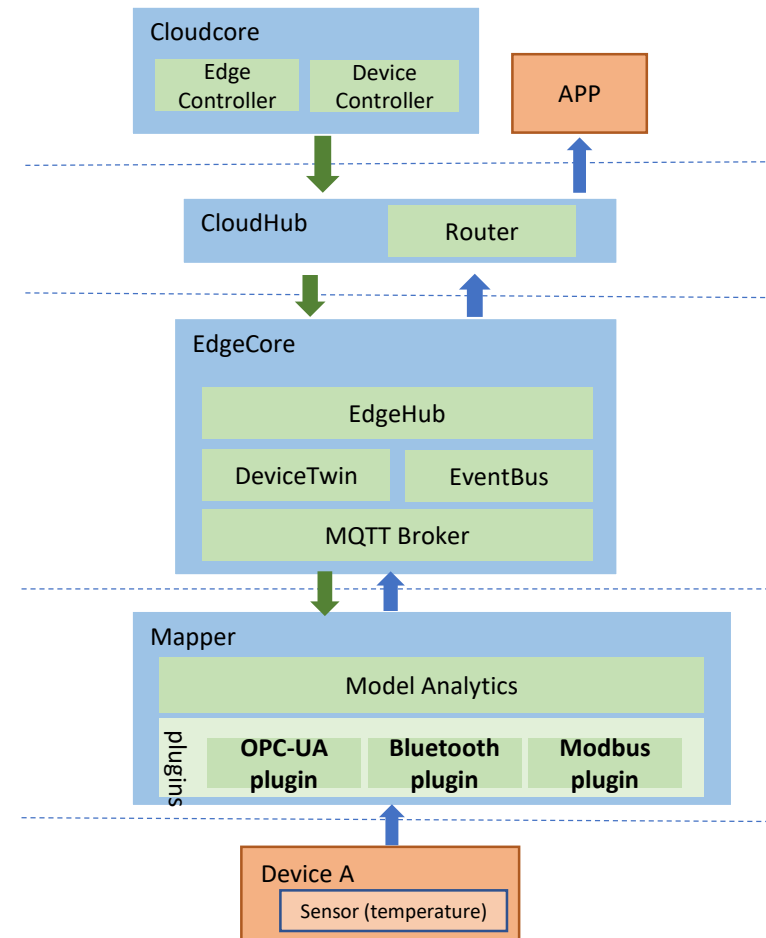
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- Pluggable Device Mapper framework
  - Easy to extend and customize
  - Mappers are managed by K8s DaemonSets, and easy to deploy, upgrade and roll back.
  - Mapper runs in its own container, ensures security and is still flexible to manage and organize
  - MQTT protocol for easy adaption



# Setting Desired State from Cloud to Edge



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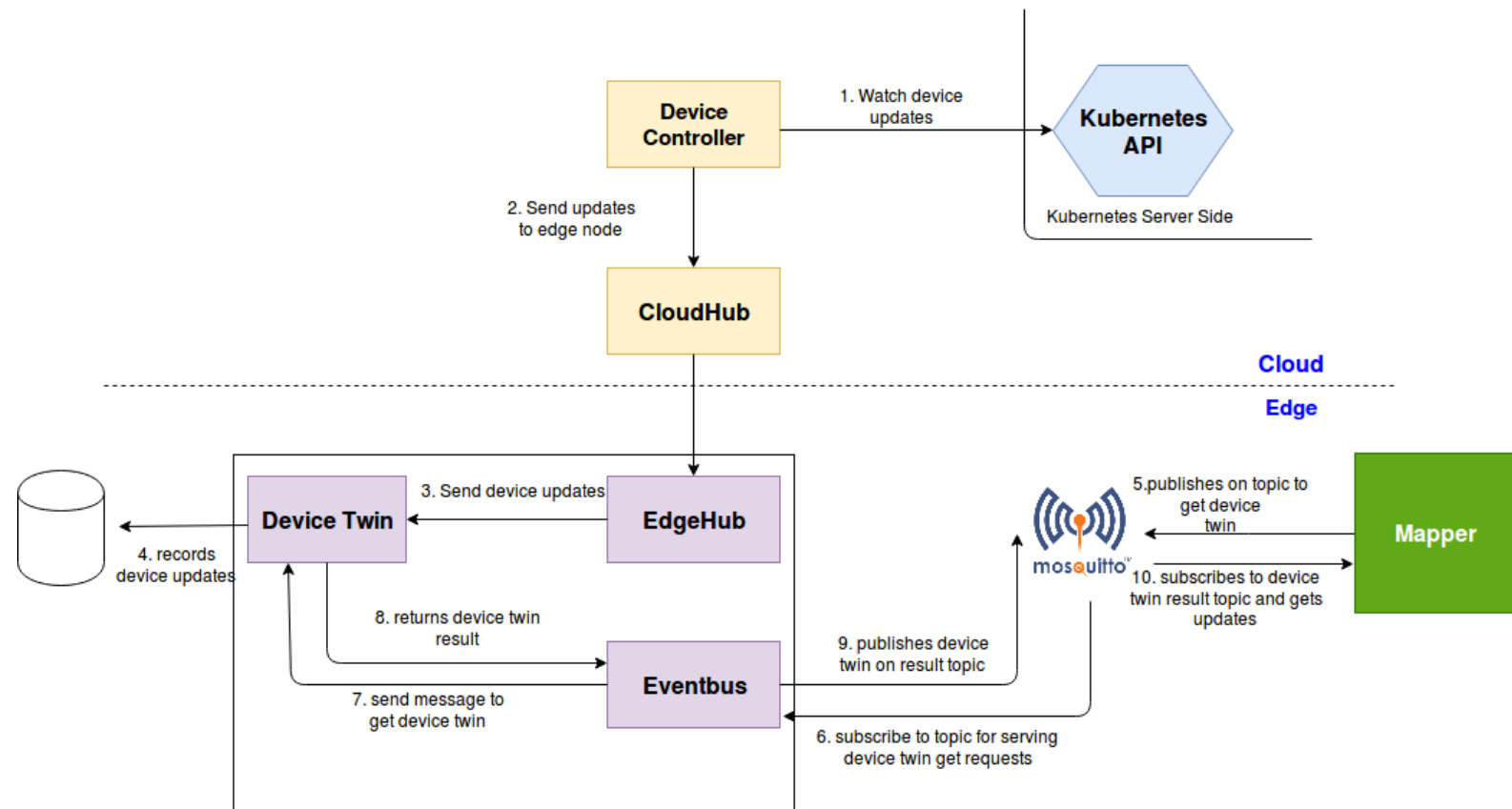


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Device twin models:

- Device
- DeviceAttr
- DeviceTwin
  - Expected
  - Actual



# Reporting Actual State from Edge to Cloud

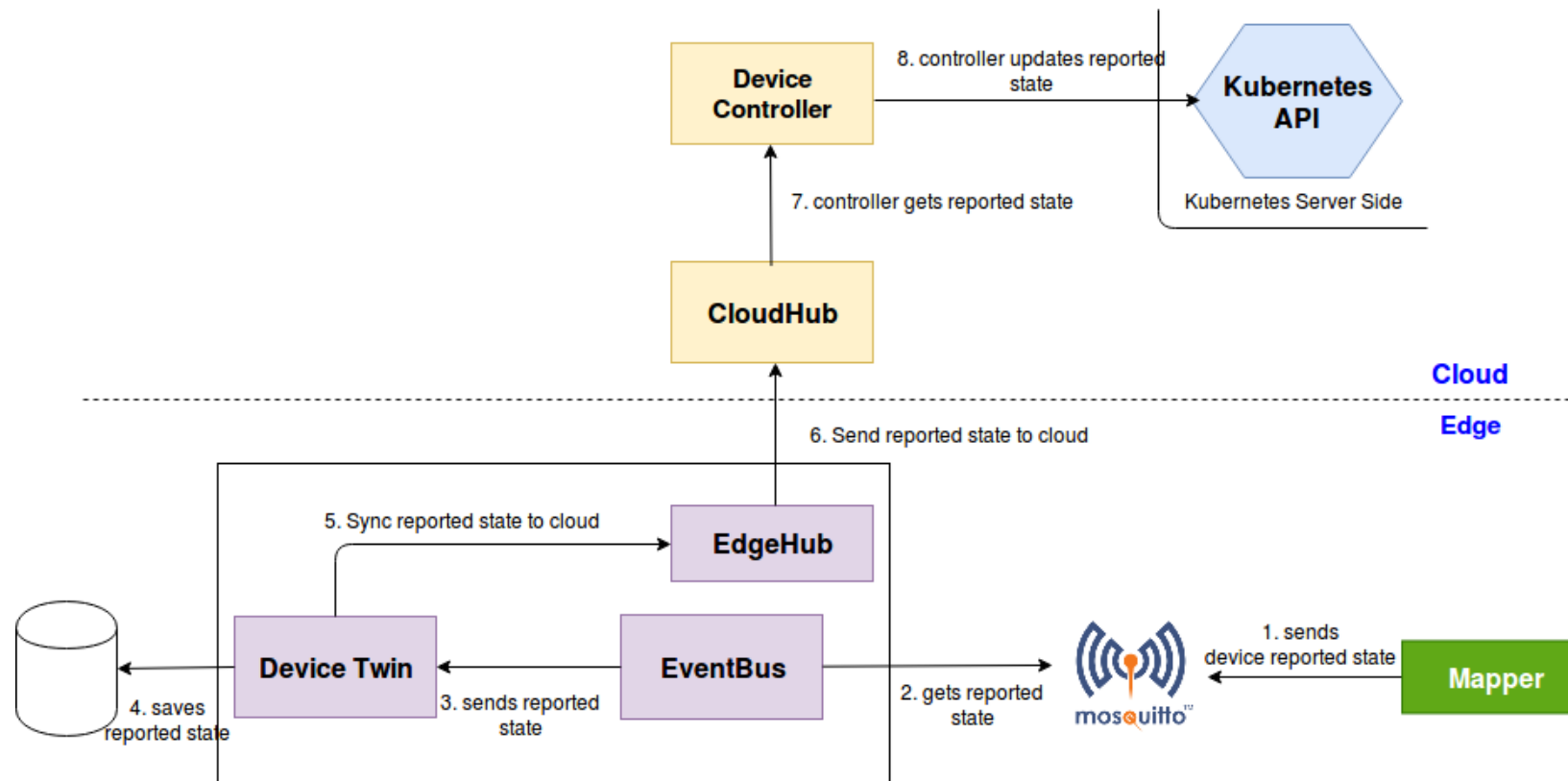


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# EdgeMesh: ServiceMesh in KubeEdge



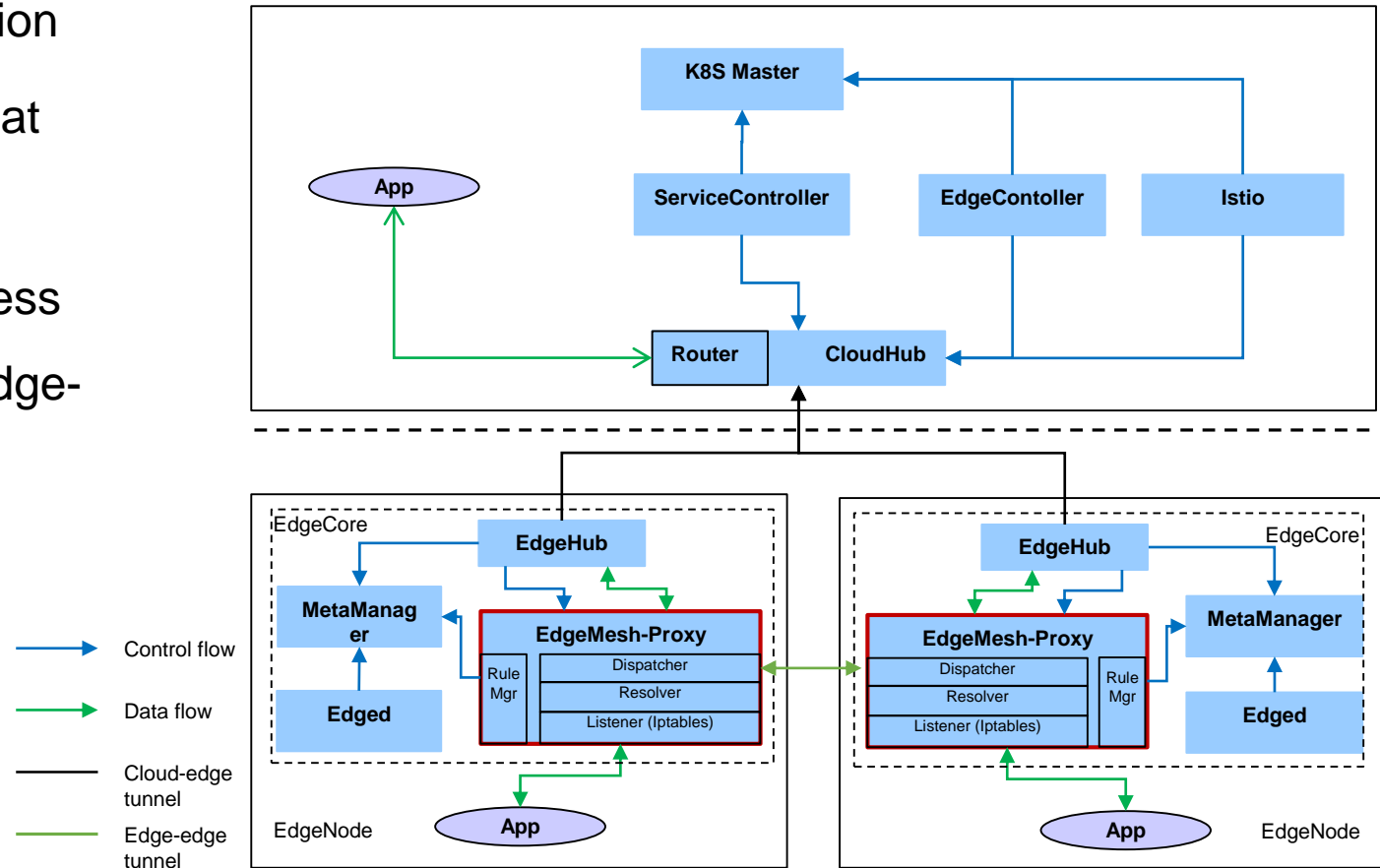
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- Service governance with Istio integration
- EdgeMesh-proxy forwards data flows at the edge
- Consistent service discovery and access experiences across edge-edge and edge-cloud
- P2P tech is used for communication across subnets



# Edge - edge communication

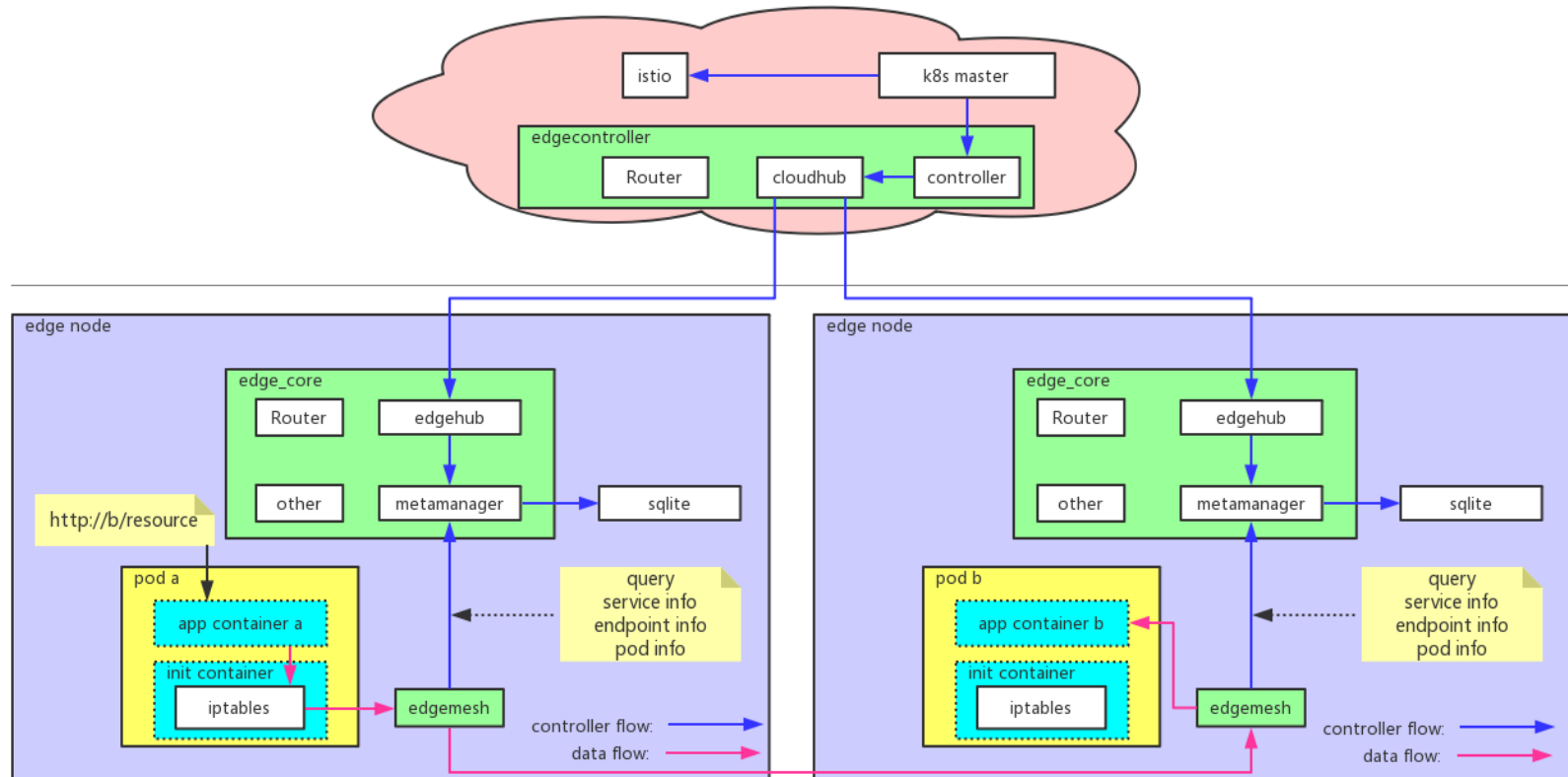


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# Edge - Cloud communication

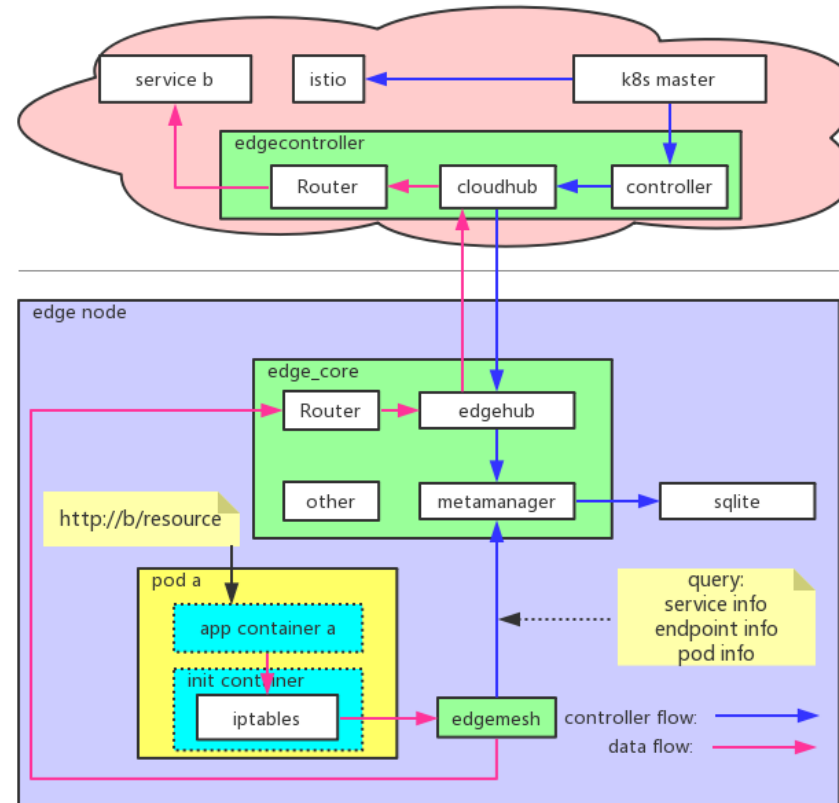


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# What Customers Want

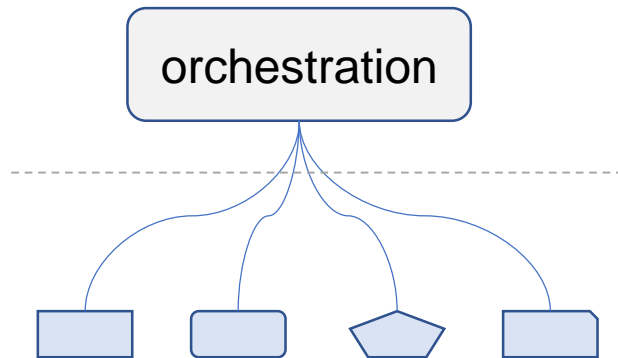


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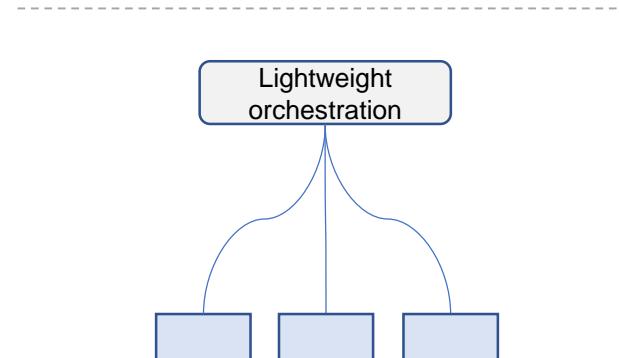


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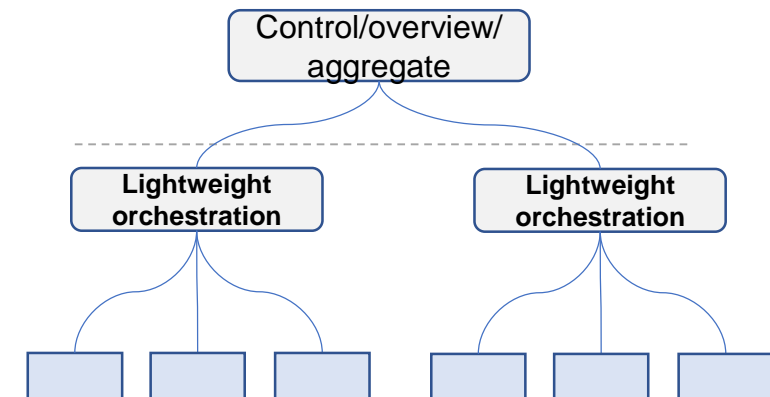
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Heterogenous compute resources  
from remote locations



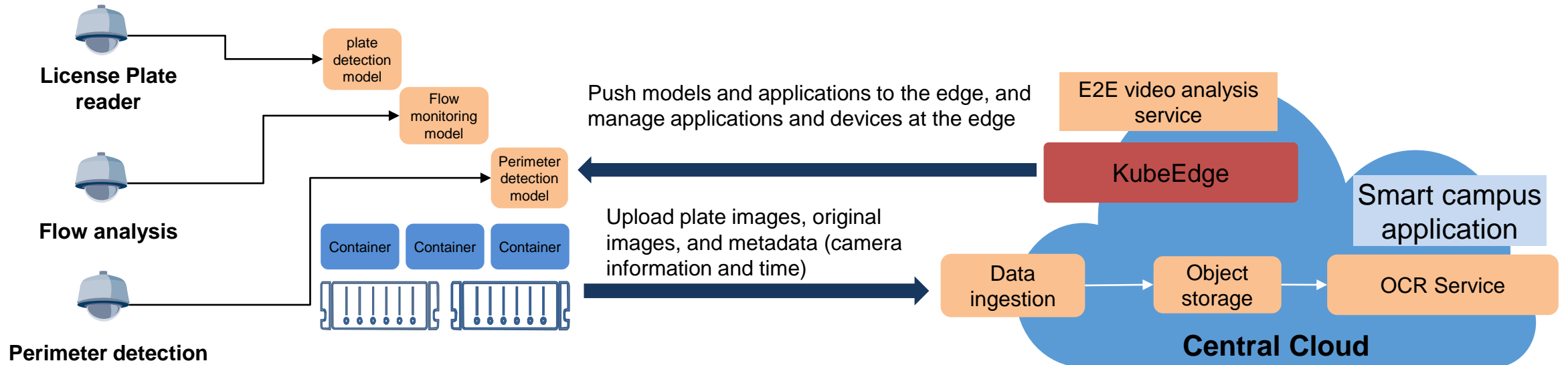
Lightweight Kubernetes for a private  
setup



Edge-cloud coordinated  
orchestration

more

# Smart City with KubeEdge



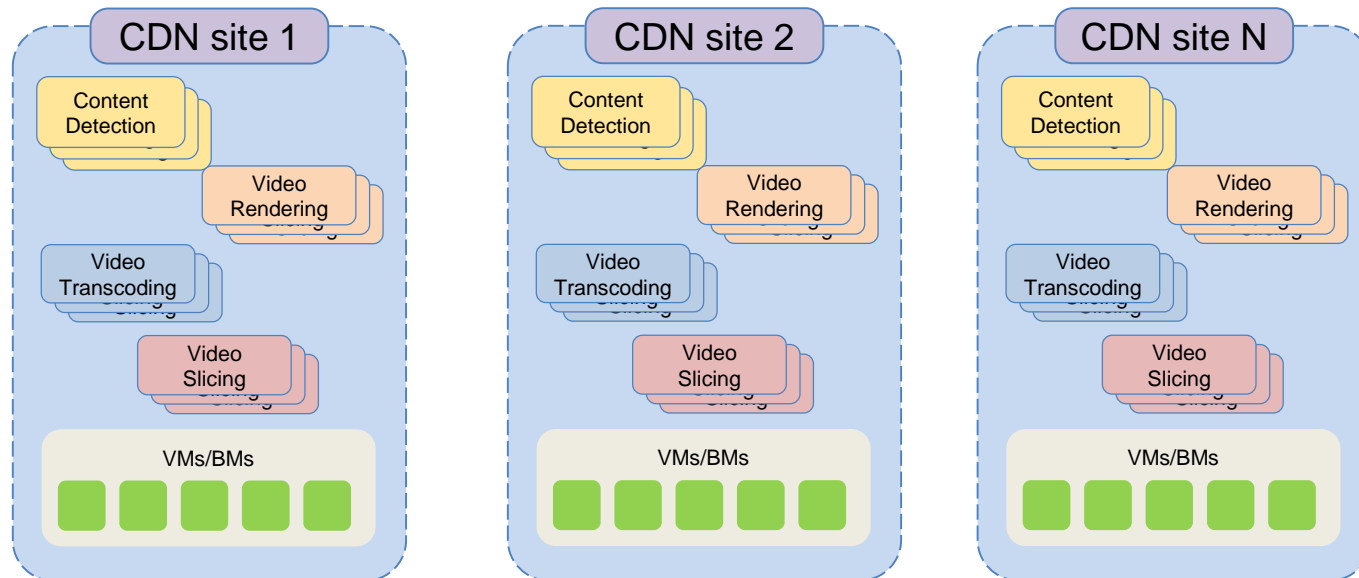
## What we learned:

- **Low latency:** video flow analyzed at the edge, cutout useful pictures to upload
- **Business value:** reliable service, proactive response model, low cost
- **Edge-cloud coordination:** edge application lifecycle management and rolling update
- **Training in the cloud:** automatic training, easy to scale in/out and update
- **Camera compatibility:** compatible with legacy IP cameras, which act like smart cameras with edge-cloud coordination

# Building Edge CDN with KubeEdge

K8s control plane +  
KubeEdge (CloudCore)

Cloud  
Edge



## Typical requirements:

- CDN sites controlled by the central cloud
- Workloads dispatched by the central cloud
- Mainly run video transcoding, rendering, and slicing at the edge, managed as jobs and Deployments
- Additional value-added services such as content detection
- Elasticity

## Learning:

- Autonomy for CDN sites at the edge
- Low system overhead at the edge
- Elasticity desired by limited due to resource constraint



# Join Us



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- Github: <https://github.com/kubeedge/>
- Slack channel: <https://kubeedge.slack.com>
- Twitter: <https://twitter.com/KubeEdge>
- Mailing group: [kubeedge@googlegroups.com](mailto:kubeedge@googlegroups.com)
- Bi-weekly community meeting:
- <https://zoom.us/j/4167237304>
- Documentation:
- <https://docs.kubeedge.io/en/latest/>
- Website: <https://kubeedge.io>





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# Thank you!

