



KubeCon



CloudNativeCon

Europe 2020

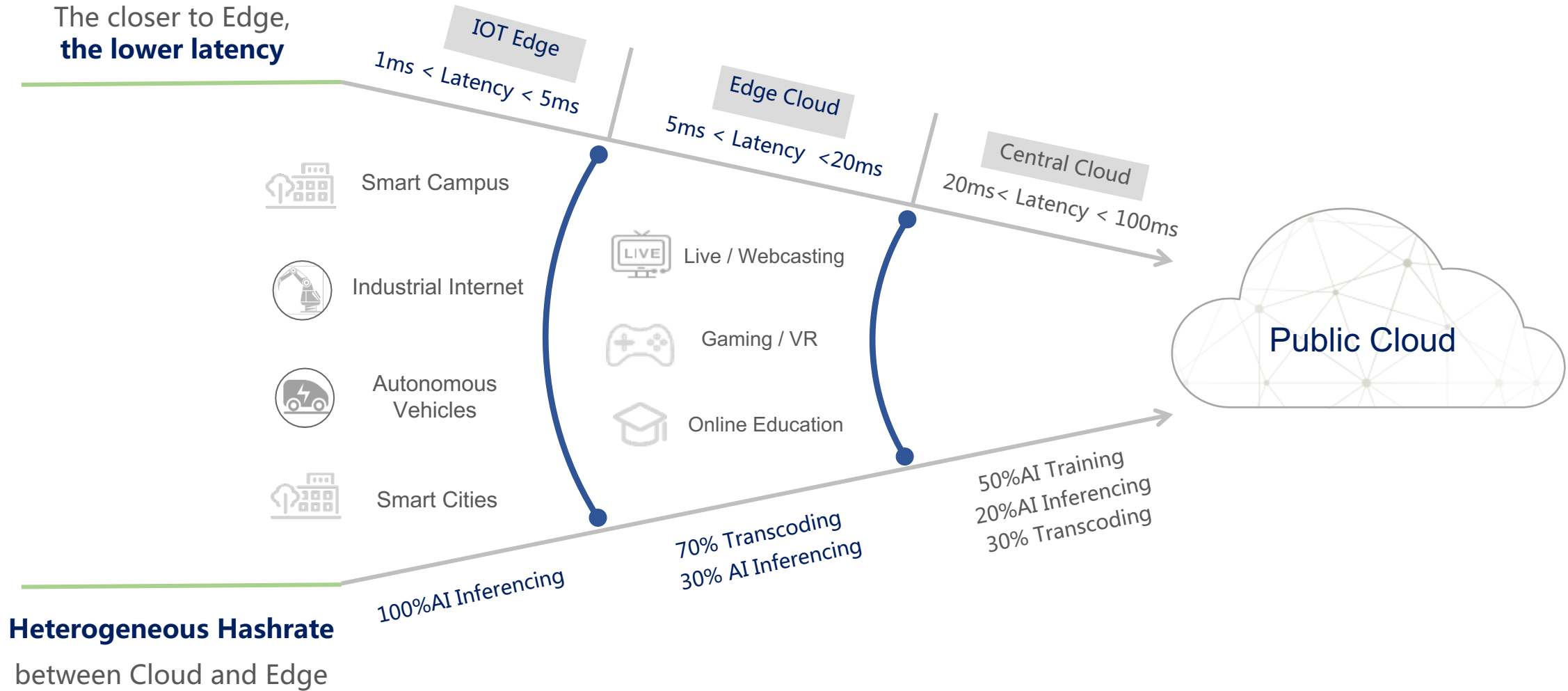
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# KubeEdge Hands on Workshop

## Build Your Edge AI App on Real Edge Devices

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# From Cloud to Edge



## Benefits

- Containerized Application
  - Build once, run anywhere
  - Lightweight base image
- General application abstraction
  - De facto standard
  - Same experience across cloud and edge
- Extendable Architecture
  - Extendable API machinery
  - Easy to add customized components

## Challenges

- Limited resources at Edge
  - Not enough for vanilla K8s, even just a Kubelet.
- Unstable network
  - Private network, limited bandwidth, latency, etc.
- Need autonomy at Edge
  - Edge may get offline/disconnected often
  - Should not evict/migrate applications when disconnected
- Heterogeneous Arch and Devices
  - Diversified IOT and industrial device protocols



# KubeEdge Provides



## Seamless Cloud-Edge Coordination

Bidirectional communication, able to talk to edge nodes located in private subnet.

Support both metadata and data

## Edge Autonomy

Metadata persistent per node, no list-watch needed during node recovery, get ready faster.

Autonomous operation of edge even during disconnection from cloud.

## Low Resource Readiness

Can work in constrained resource situations, memory footprint ~70mb (v1.3)

Support CRI, integrate with Containerd, CRI-O , less runtime overhead

## Simplified Device Communication

Easy communication between application and devices for IOT and Industrial Internet



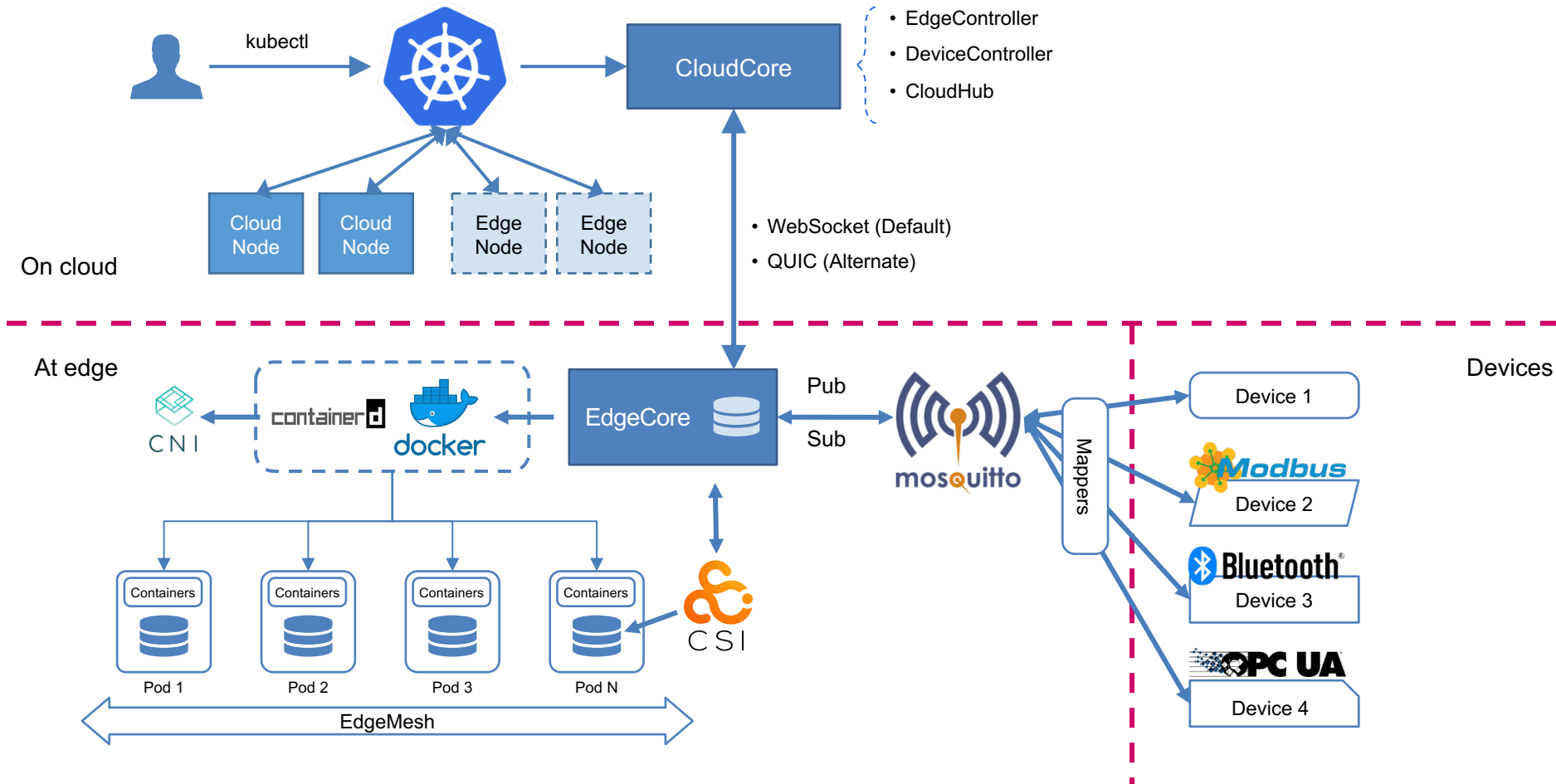
**KubeEdge**

<https://kubedge.io>

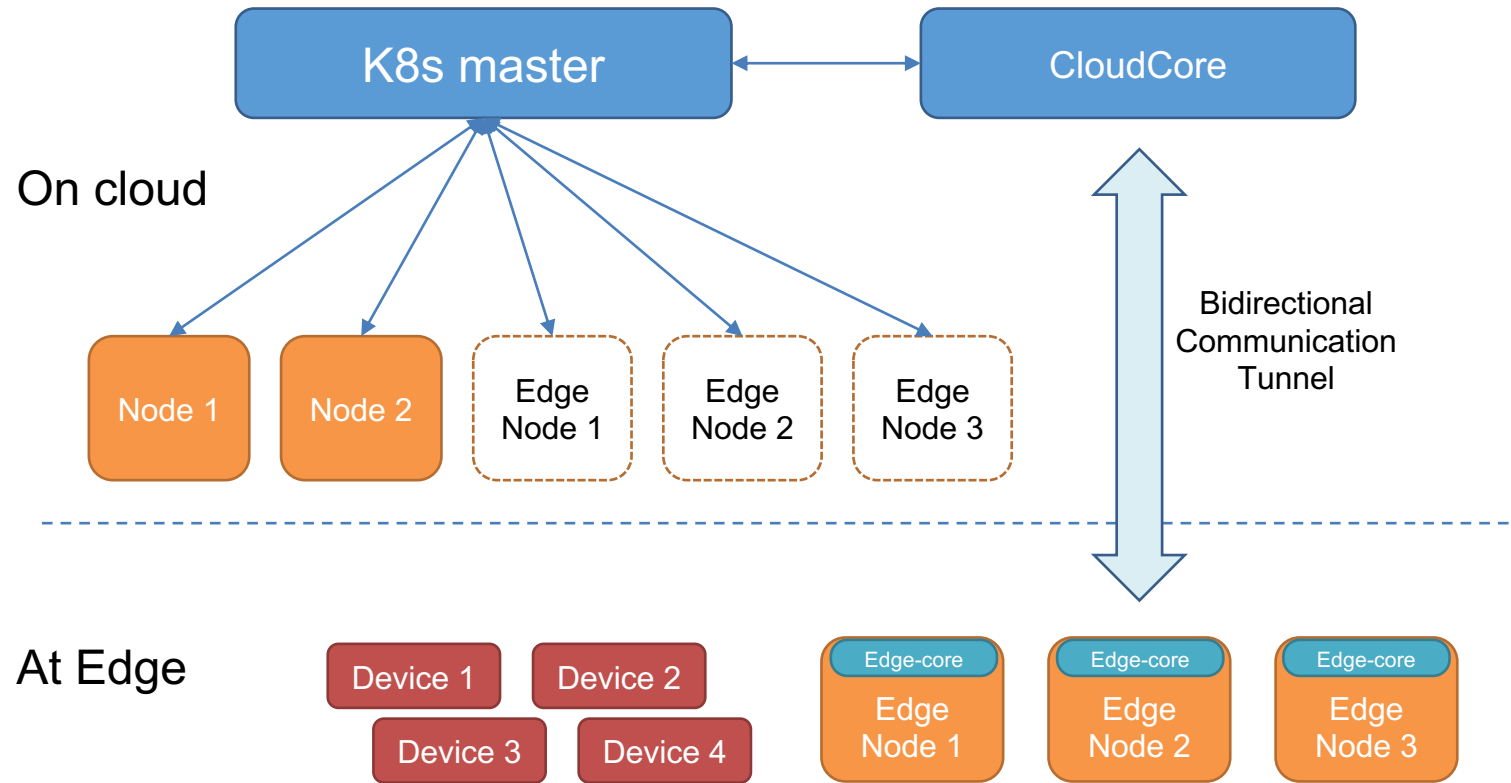


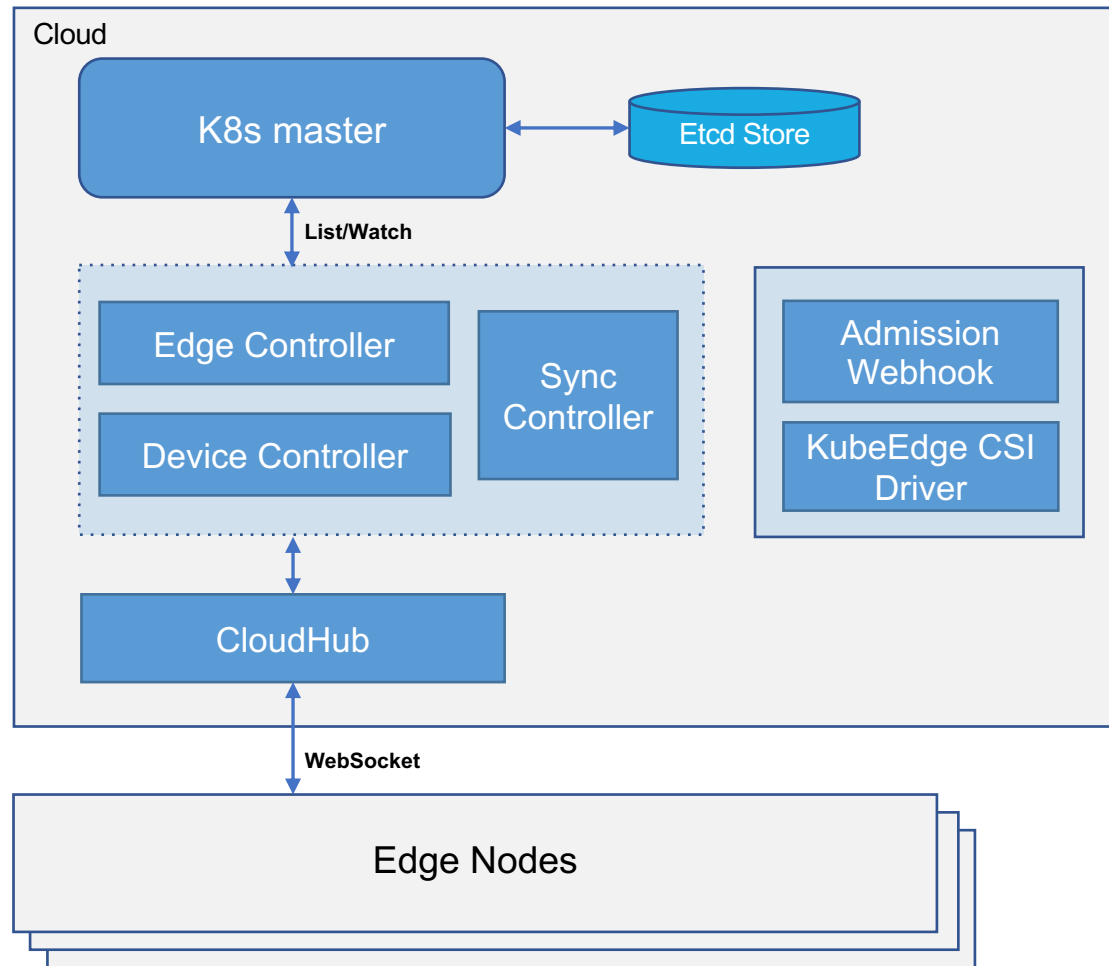


# KubeEdge Architecture



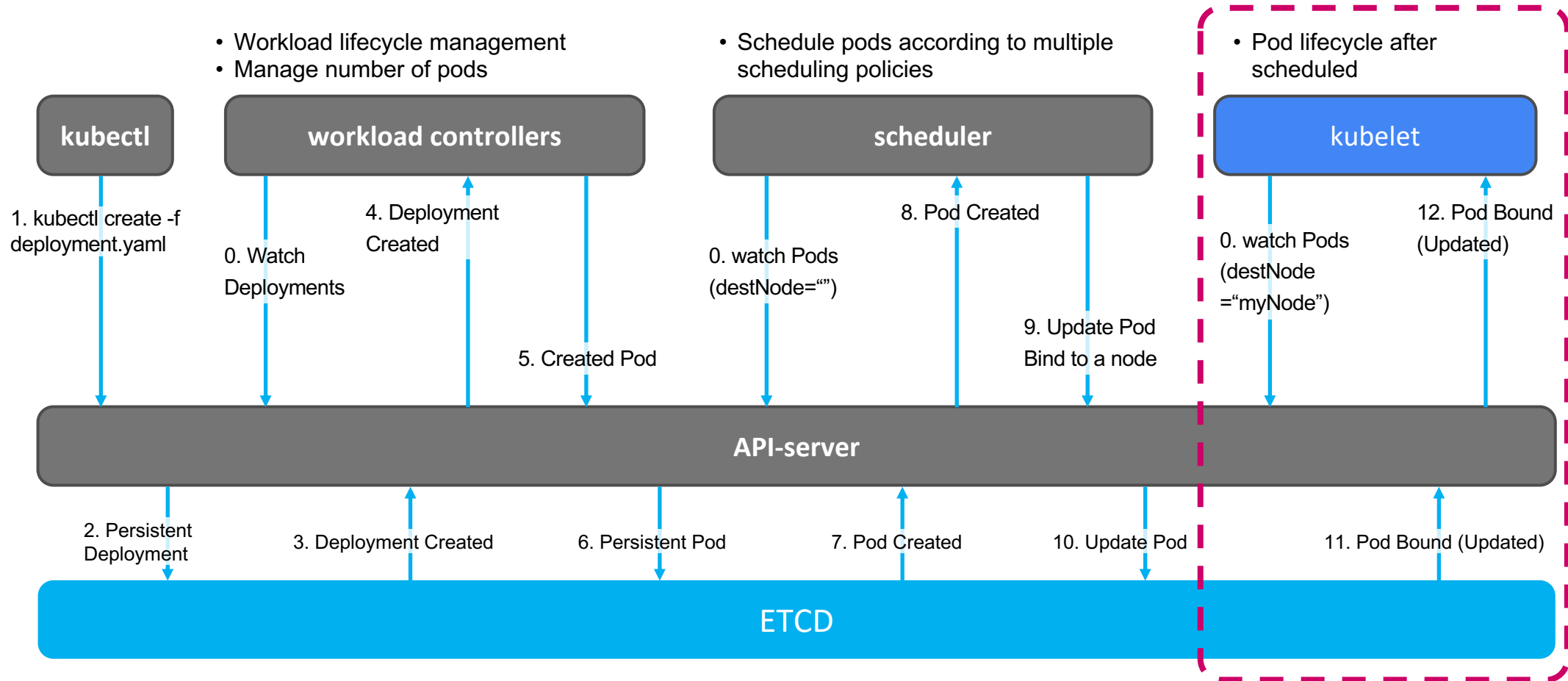
# KubeEdge CloudCore

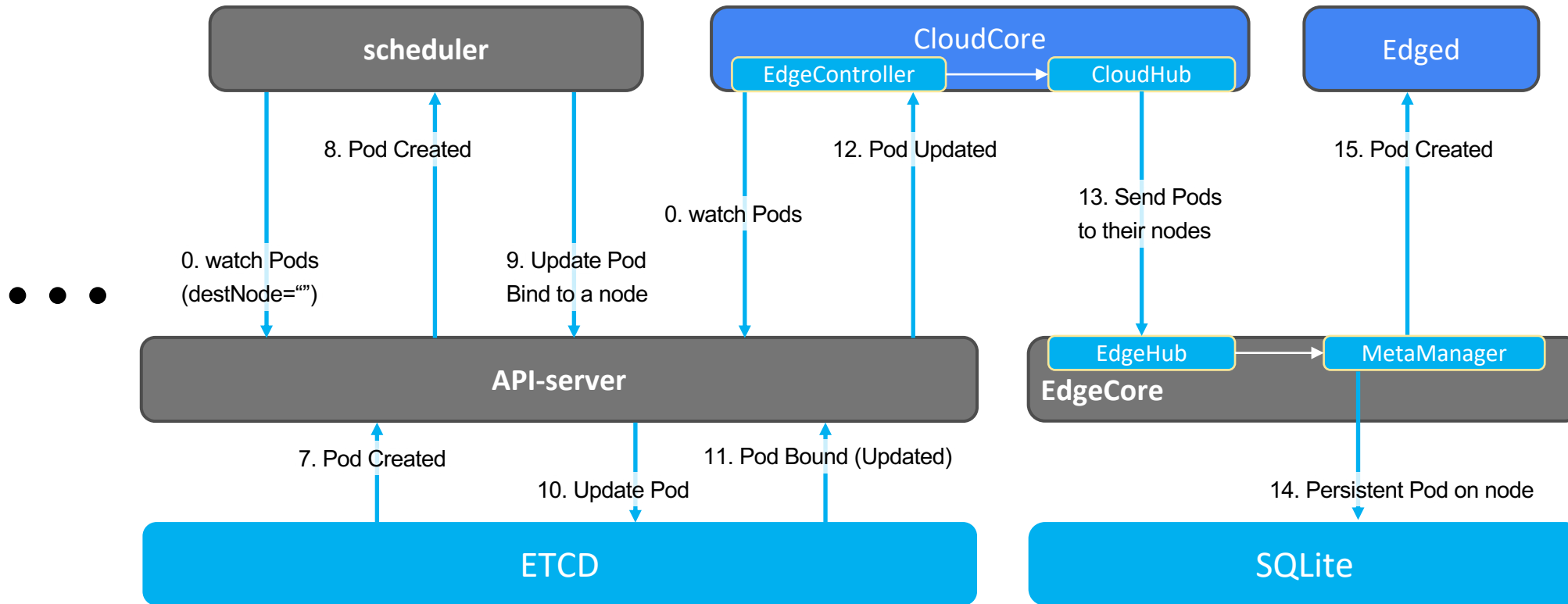




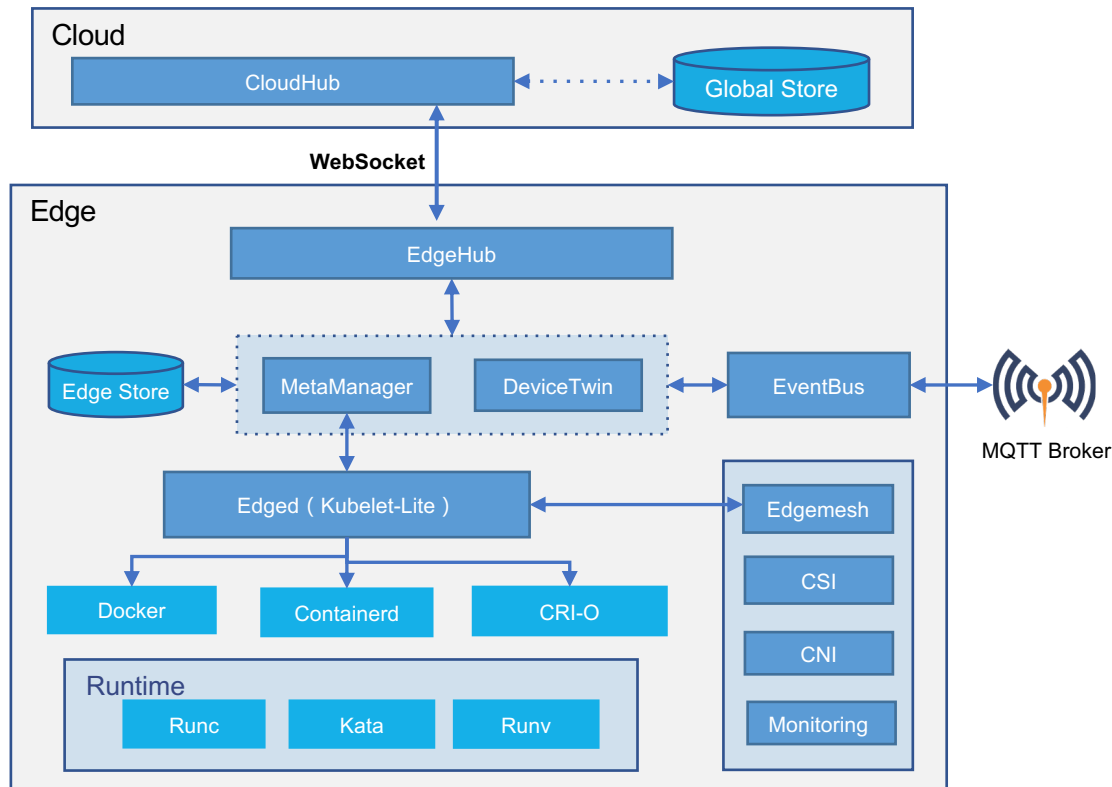
- **EdgeController**
  - Shadow management for nodes, pods, configmap etc, at edge
- **Device API/DeviceController**
  - IOT/Edge device modeling
  - Shadow management for devices at edge
- **Sync Controller**
  - Reconcilement for inconsistency detected
- **KubeEdge CSI Driver**
  - Plugin to hook storage provisioning etc. to edge
  - Easy to integrate with existing CSI Drivers on edge
- **Admission Webhook**
  - Extended API validation
  - Best practice enforcement







# Inside EdgeCore



- EdgeHub
  - Messaging over WebSocket
- MetaManager
  - Node level metadata persistence
- Edged
  - Kubelet-lite
  - Pod lifecycle management etc.
- DeviceTwin
  - Sync device status between cloud, edge node and device
- EventBus
  - MQTT client



## ComponentConfig

- Added Kubernetes style API to simplify component configuration.
- Added `--minconfig` and `--defaultconfig` commands to generate config with defaults.

## Node setup

- Added auto registration, automatic TLS bootstrapping; Automatic certificate rotation

## keadm (the installer)

- Added CentOS support, Raspbian support

## Highly availability of CloudCore

- Active-standby mode and integration with readinessGates

## Reliable Message Delivery

- ACK-based reliable message delivery and periodic reconciliation.





## More Runtime Support

- Added support of cri-o and kata containers.
- Both x86 and ARM have been verified

## Edge Pod Logs

- Users are now able to use *kubectl logs* to fetch logs from pods on the edge.

## Edge Pod Metrics

- Added metrics interfaces on the edge.
- Added metrics-server support for collecting metrics from both nodes in the cloud and on the edge





- New in v1.4
- Simplified custom industrial protocol configuration / integration
- Added new fields collectCycle and reportCycle in Property Visitors
- `Data` section introduced aside `twins` for data pipeline cases on the edge
- Property visitors moved from DeviceModel to Device

Proposal: <https://github.com/kubeedge/kubeedge/blob/master/docs/proposals/device-management-enhance.md>



# Community release development



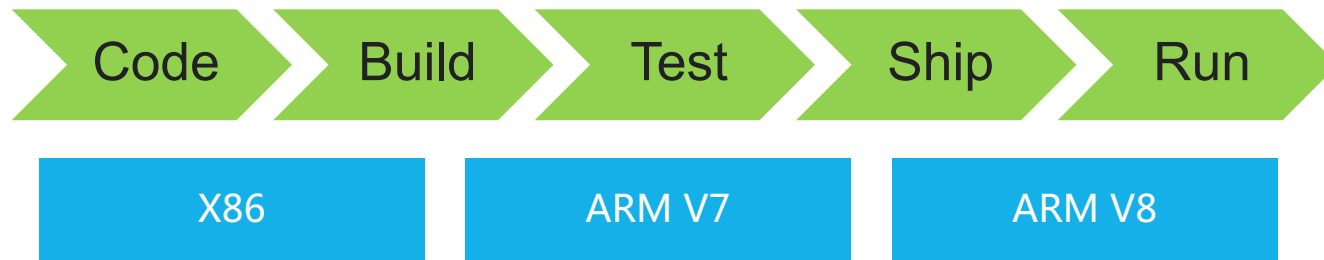
Version Scheme: semantic versioning spec -- x.y.z

Every 3 month Release cadence -- from x.y to x.(y+1)

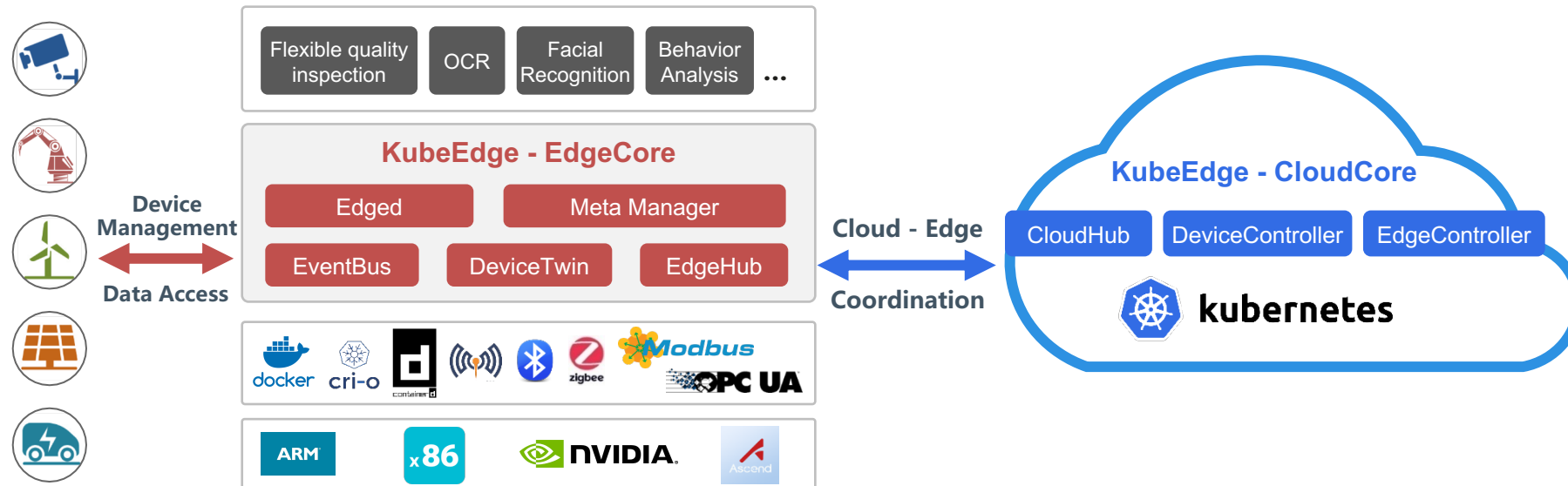
Feature planning at the beginning of each release cycle

Code freeze at -2 weeks, accept only bug fixes and doc updates until release out.

Both x86 and ARM are supported as native architecture through whole release lifecycle.



# KubeEdge Community Updates



2.7k+ Stars, 700+ Forks on github

400+ Contributors, 130+ code contributors

30+ Organizations

New Maintainers: @chendave, @kadisi, @fisherxu

Checkout [Community Open Governance Doc](#) for more details

## New SIGs!

- SIG Device IOT
  - Device management CRD
  - Integration support with more industrial protocols
- SIG MEC
  - Reference architecture that use KubeEdge to enforce MEC
  - Collaborate with CNCF TUG, LF Edge projects, etc.



# Contributors and Adopters



- 30+ contributing organizations including:

- **IOT & Hardware:**



- **Carriers/Telco:**



- **IT Service Providers:**



- **Cloud Providers:**



- **Academic:**



- 20+ Adopters:

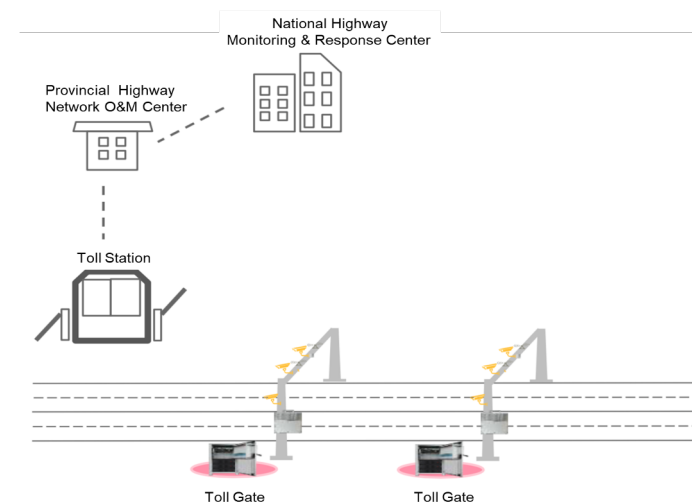
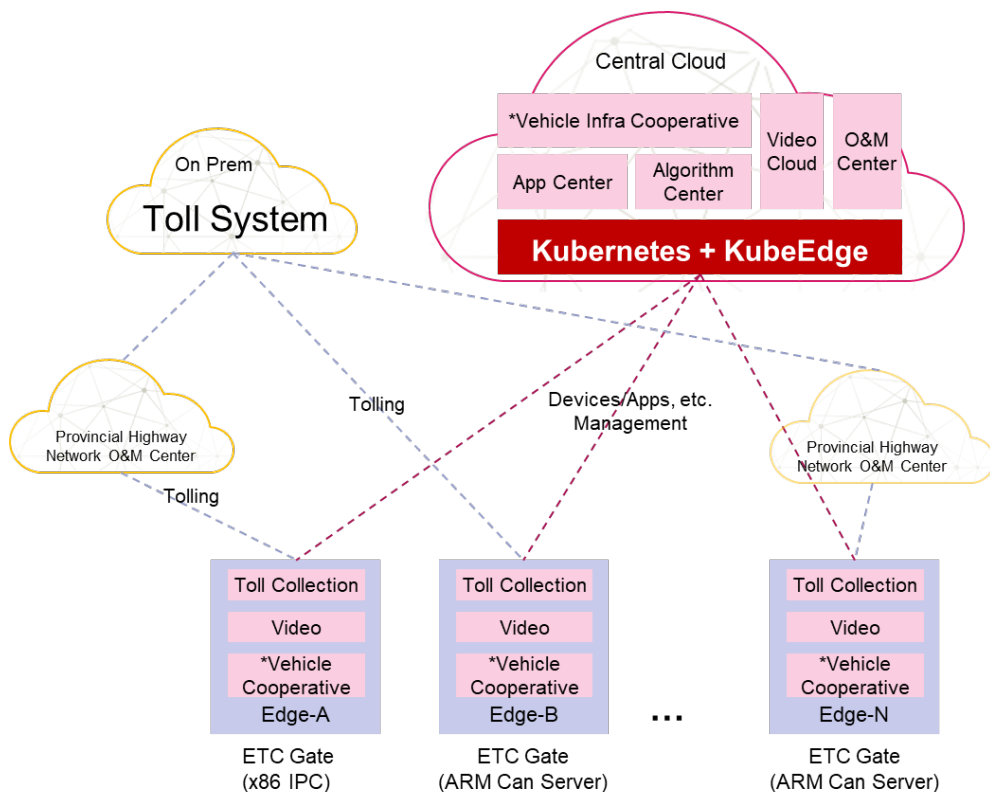
- <https://github.com/kubeedge/kubeedge/blob/master/ADOPTERS.md>

- **Already in production:**

- China Highway provincial ETC system
- Raisecom
- WoCloud
- Xinghai IoT
- KubeSphere
- HUAWEI CLOUD



# Use Case – China Provincial Highway ETC System



## Benefits

- **50k+ edge nodes** Managed by KubeEdge
- **500k+ containers** in total
- 300 million data records per day
- Time used passing through toll station
  - **15s => 2s** in avg. per car
  - **29s => 3s** in avg. per truck



## Technical

- Remote debug support from cloud to edge.
- Provide cross subnet communication support on the edge.
- Support edge-cloud communication integrating with CNI and Envoy.
- Improve edge device management extensibility, support to define/integrate custom device protocol.
- Provide decentralized Security for applications on the edge.

## Community

- **Move to Incubation level under CNCF**
- Better Contributor Experience
- More contributor events
- More cross community collaboration



# Join us!



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- Website: <https://kubedge.io>
- **Github:** <https://github.com/kubedge/>
- **Slack channel:** <https://kubedge.slack.com>
- SIG Device-IOT slack : <https://kubedge.slack.com/archives/C01239D6PM4>
- SIG MEC slack: <https://kubedge.slack.com/archives/C0120QT37PD>
- Mailing List: <https://groups.google.com/forum/#!forum/kubedge>
- **Weekly community meeting:** <https://zoom.us/j/4167237304>
- Twitter: <https://twitter.com/KubeEdge>
- Documentation: <https://docs.kubedge.io/en/latest/>



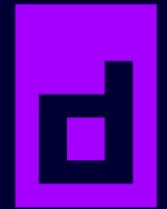
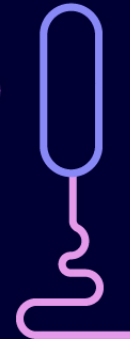


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