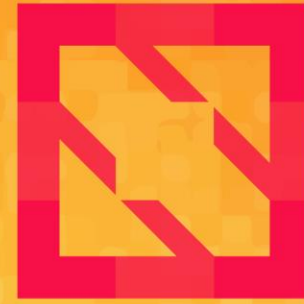




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KubeEdge

Kubernetes Native Edge Computing Framework

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Agenda



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- Why KubeEdge
- Architecture and major design considerations
- Join us!

From Cloud to Edge



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- **Low latency**

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

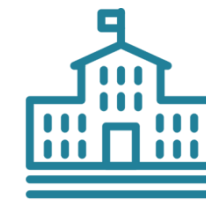
- **Massive data**

- 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.



- **Local autonomy**

- Cloud-free offline processing and self-recovery

Our view



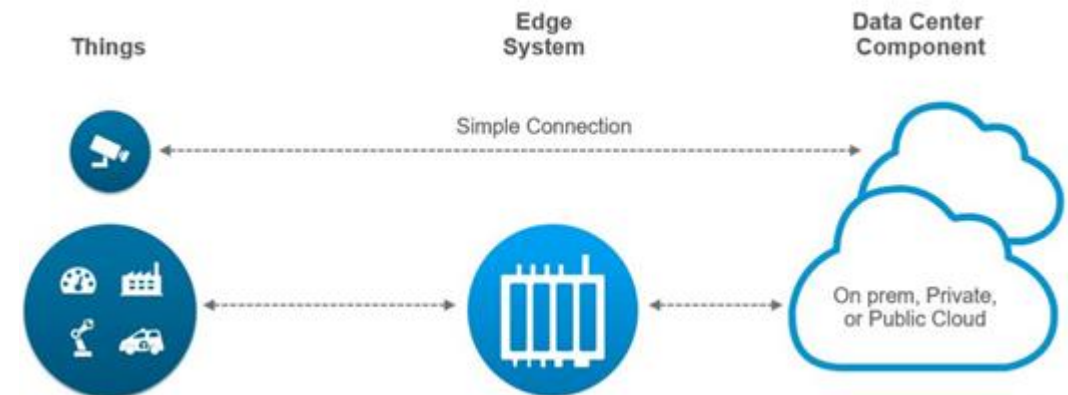
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- Edge is an extension of cloud
 - Resources/devices deployed at the edge and managed by the central cloud
 - Apps/functions scheduled by the central cloud
- Cloud-edge bidirectional communication
 - Private network, behind firewalls
 - Unstable network
 - Massive, distributed edge nodes
- Heterogeneous edge nodes
 - Limited resources
 - Large-scale device management
 - Diversified device protocols
- Edge-Cloud Synergy
 - Edge: autonomy: localized, fast reaction, reliable
 - Decentralized: edge-edge discovery
 - Cloud: heavy computing, management coordination, bigger view



Advantages & Challenges



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Benefits

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

Advantages & Challenges



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Gaps

- Limited resource at edge
 - Scenarios vary largely, from single node to small size cluster
- Complicated network condition
 - Private network, limited bandwidth, latency, etc. safety
- Need autonomy at Edge
 - Edge may get offline/disconnected often
 - Should not evict/migrate applications when disconnected
- Device management at Edge
 - Quite different requirement with current device plugin

KubeEdge Project



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- Built upon Kubernetes, 100% compatible with Kubernetes APIs
- Optimized node components and runtimes for edge
- Bidirectional multiplexing message channel
- Metadata persistence at the edge, local autonomy
- Support for extensive edge applications and protocols
- Simplified access and control of edge devices
- Unified management of cloud and edge applications and resources



KubeEdge

<https://kubedge.io>



KubeEdge Community



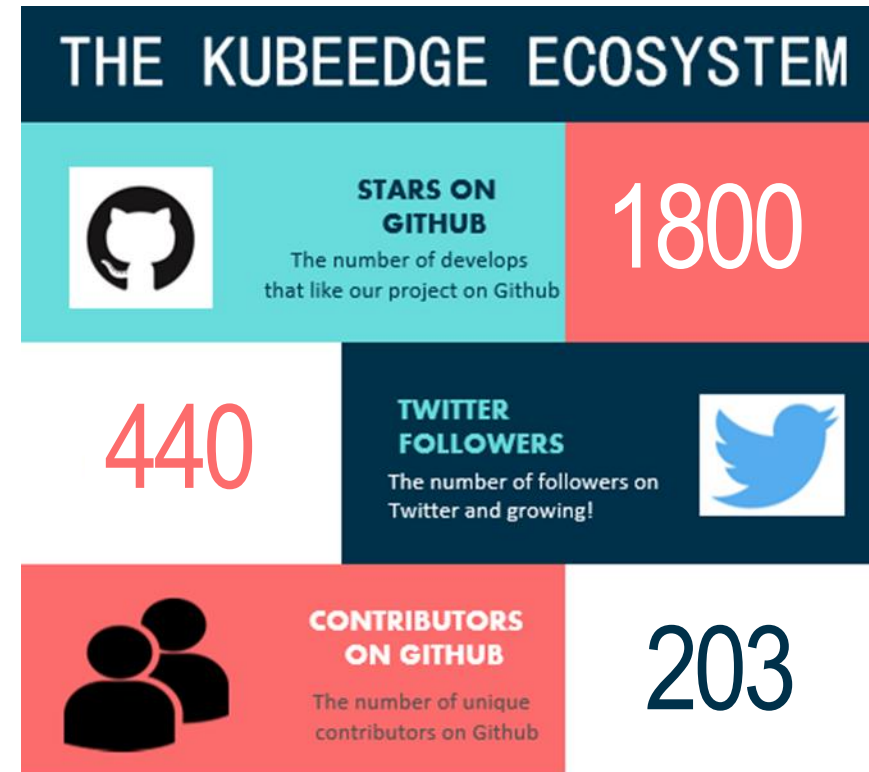
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- Contributing Companies/Orgs:
 - ARM
 - China Mobile
 - China Unicom
 - EMQ
 - JD.com
 - TenxCloud
 - Zhejiang University SEL lab



Major consideration



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- **Edge-cloud coordination**
 - Bidirectional communication
 - Connect anywhere
 - Secure messaging channel
- **Edge side autonomy**
 - Metadata persist locally, keeps business running
 - Efficient recovery without full list-watch, reduce service load
- **Light weight**
 - Concise Kubelet core (~70mb)
 - Support CRI with Containerd or CRI-O

KubeEdge Architecture

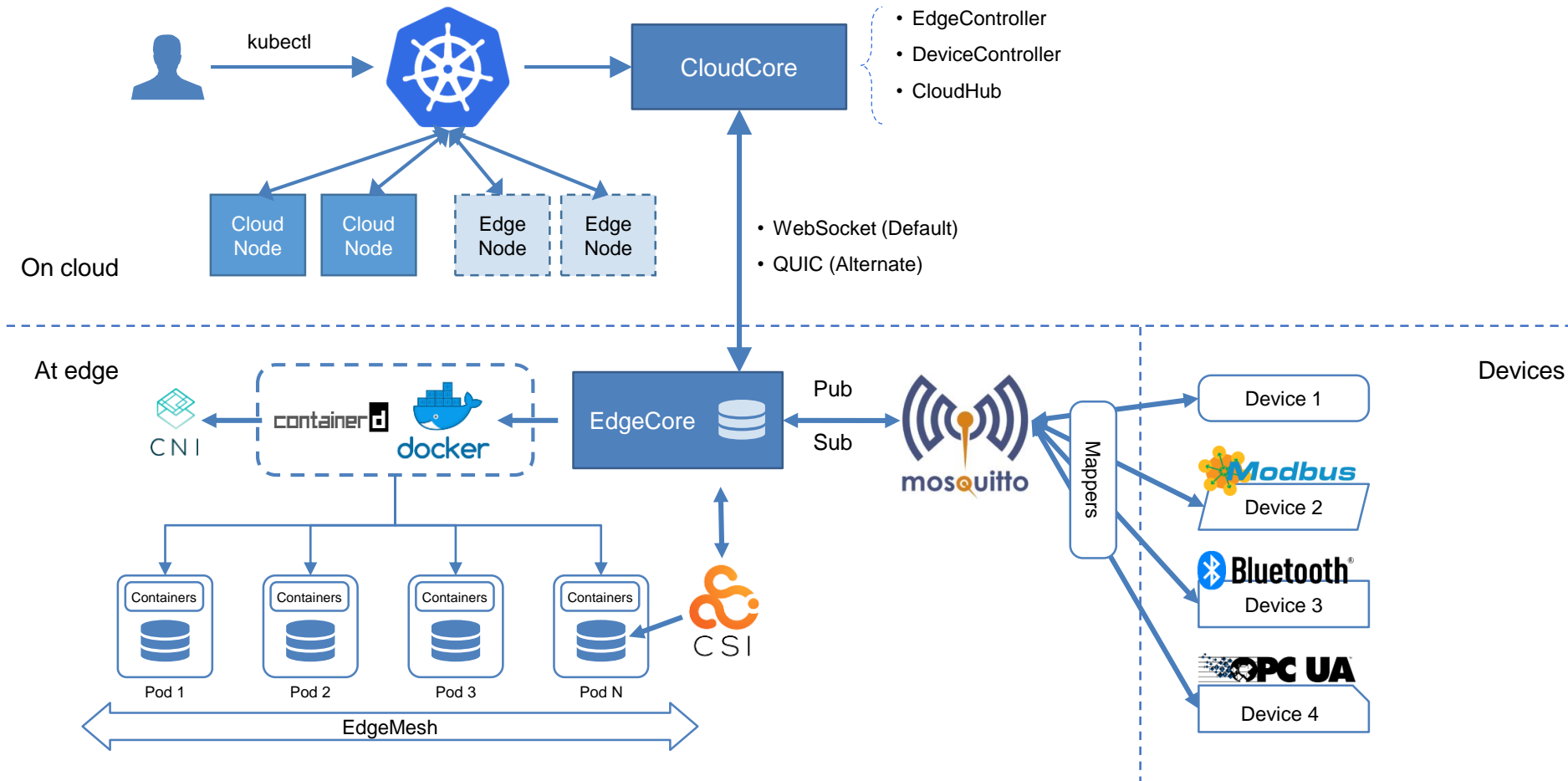


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KubeEdge Architecture – Cloud

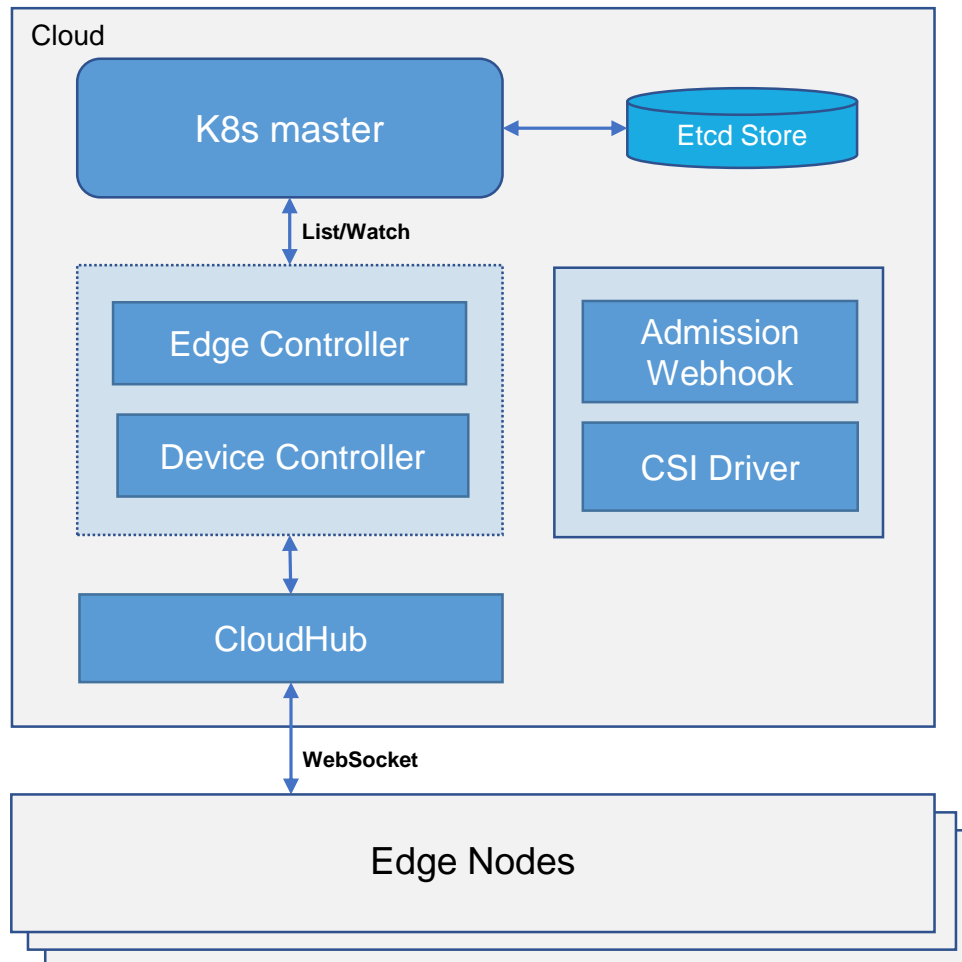


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- EdgeController
 - Node management
 - Application management
- DeviceController
 - Device connection and management
 - Device model
- CSI Driver
 - Storage provision
- Admission Webhook
 - Legitimacy verification

KubeEdge Architecture – Edge

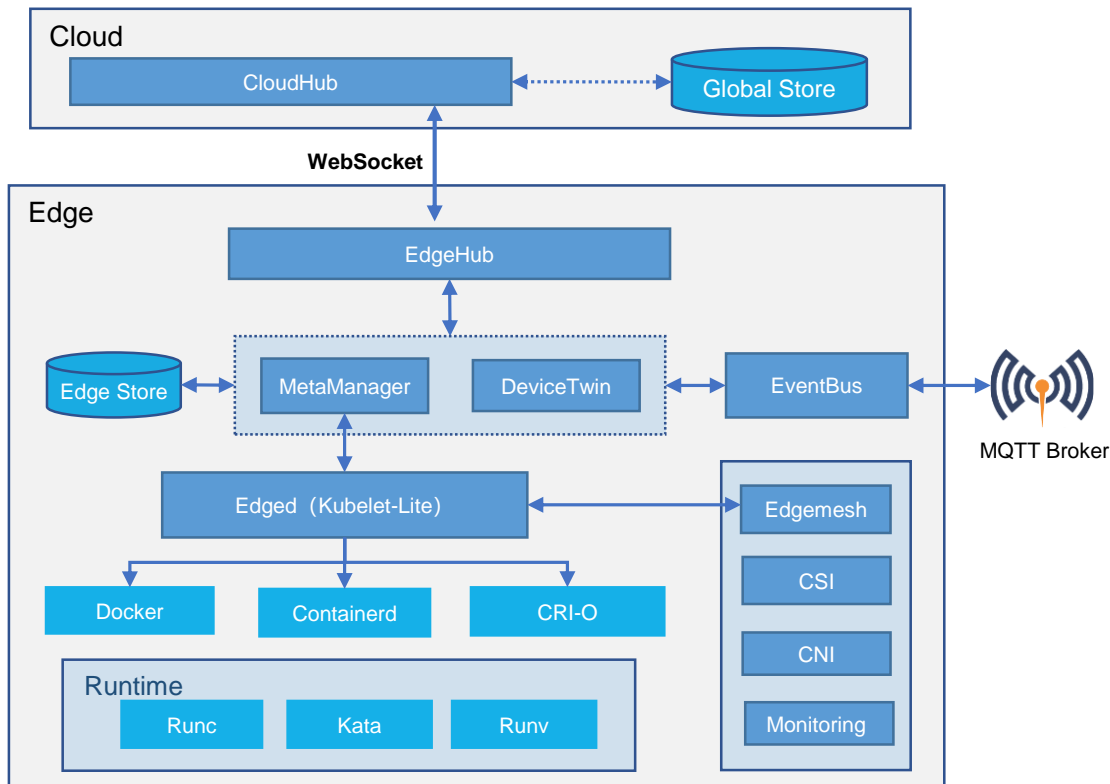


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- EdgeHub
 - Messaging
- MetaManager
 - Local persistent metadata control
- Edged
 - Kubelet-lite
 - Lightweight pod lifecycle management
- DeviceTwin
- EventBus
 - MQTT client
- ServiceBus
 - HTTP client

Edge Device Management



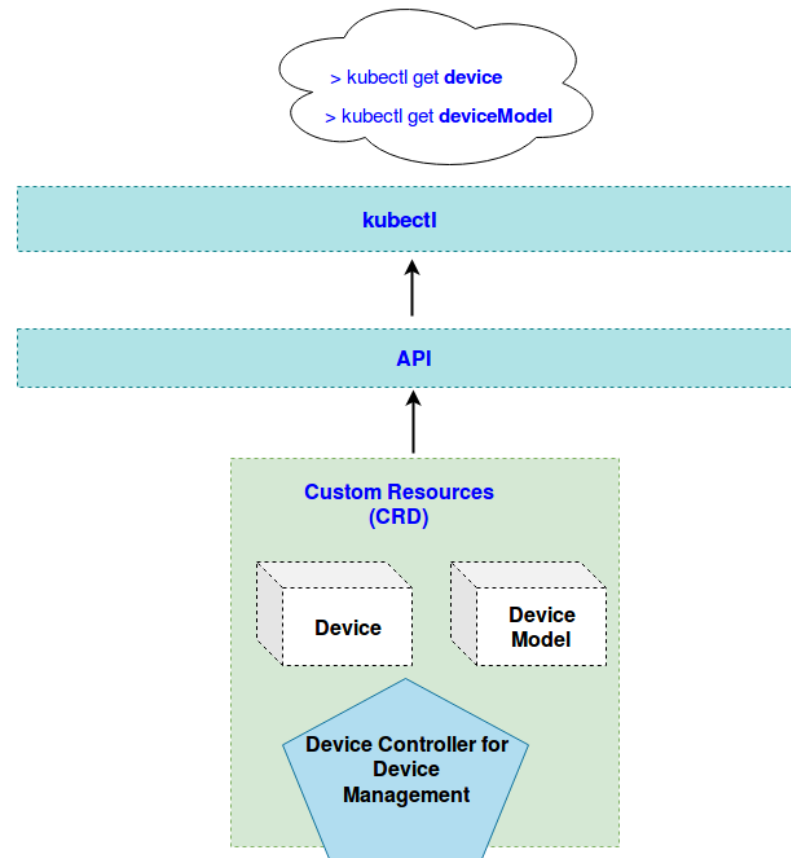
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- Edge Device APIs registered as K8s CRD
 - Same experience with K8s core APIs using kubectl
 - DeviceModel: template of devices
 - Defines common device properties including data type, read-only, default value, and max/min values, and communication 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.



EdgeMesh: ServiceMesh in KubeEdge



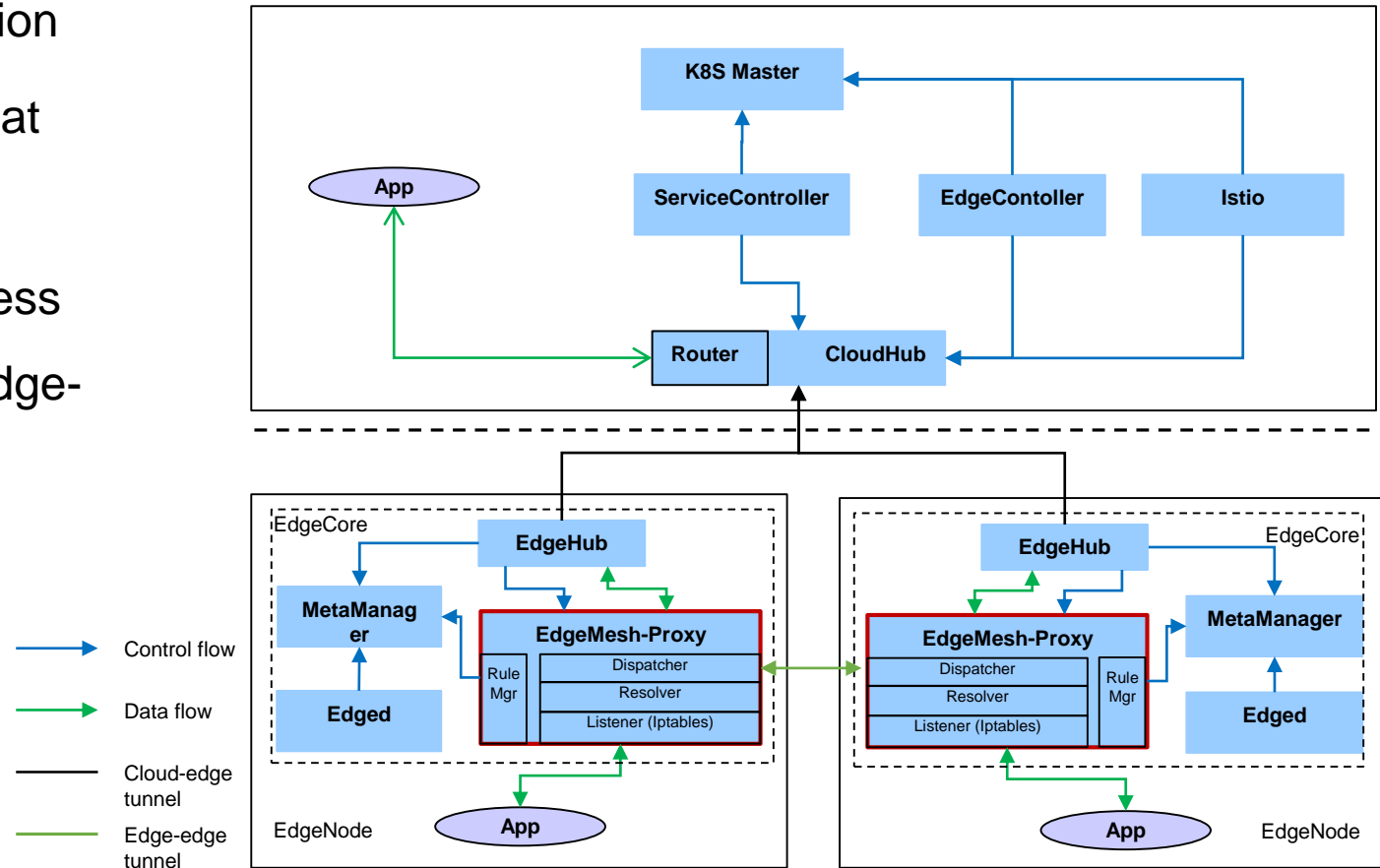
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- Service governance with Istio integration
- EdgeMesh-proxy forwards data flows at the edge
- Consistent service discovery and access experiences across edge-edge and edge-cloud
- P2P tech is used for communication across subnets



EdgeSite: Clusters at edge



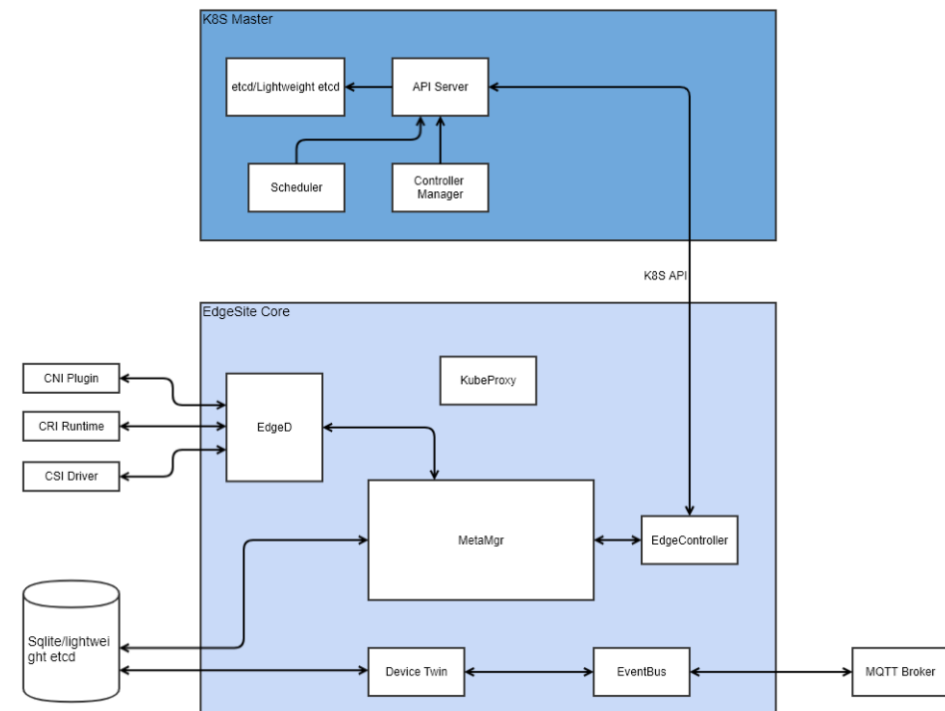
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- Enable customers to run a lightweight K8s cluster at the edge where the control plane can support HA.
- KubeEdge pluggable module framework with edged devices, edgemesh integrated
- Conformant K8s APIs/functionalities



Cluster vs. Nodes at the Edge?

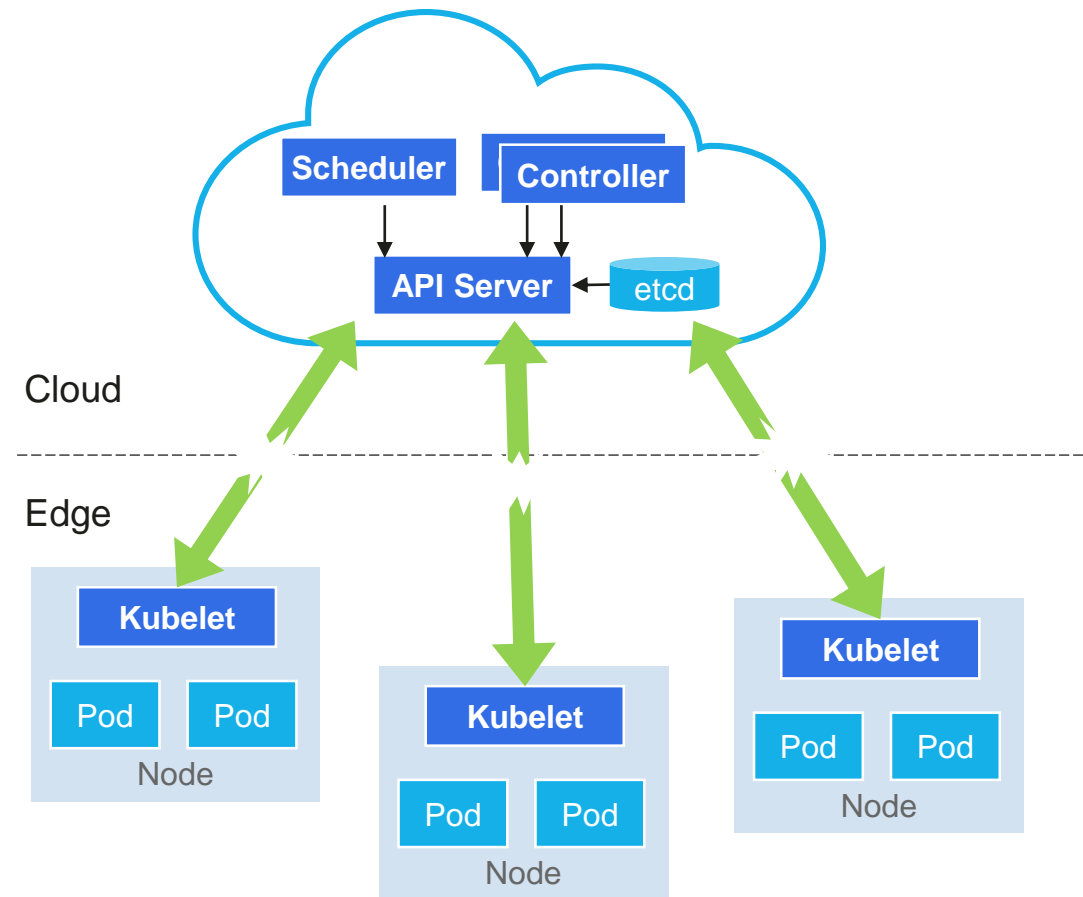
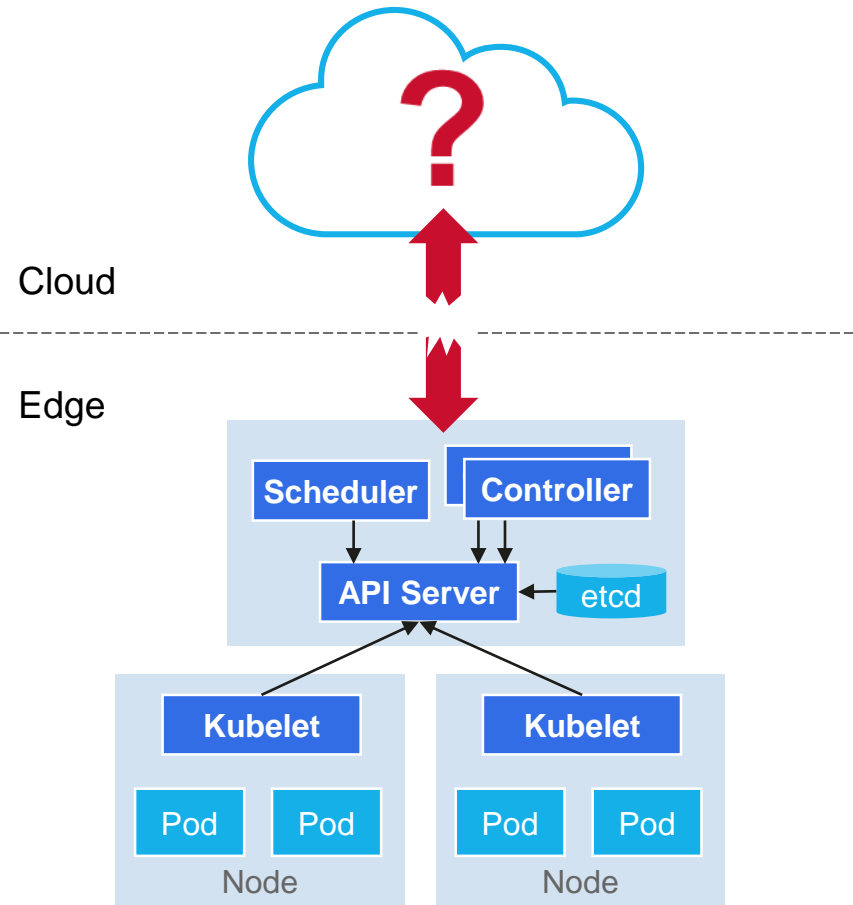


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Deep Dive



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- KubeEdge Deep Dive
 - Wednesday November 20, 2019 10:55am - 11:30am
 - [Roon 33ABC - San Diego Convention Center](#) *Upper Level*

Join Us



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- Website: <https://kubedge.io>
- Github: <https://github.com/kubedge/>
- Slack channel: <https://kubedge.slack.com>
- Mailing group: <https://groups.google.com/forum/#!forum/kubedge>
- Bi-weekly community meeting: <https://zoom.us/j/4167237304>
- Twitter: <https://twitter.com/KubeEdge>
- Documentation: <https://docs.kubedge.io/en/latest/>



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Thank you!

