扫码添加小助手，发送“KubeEdge”加群

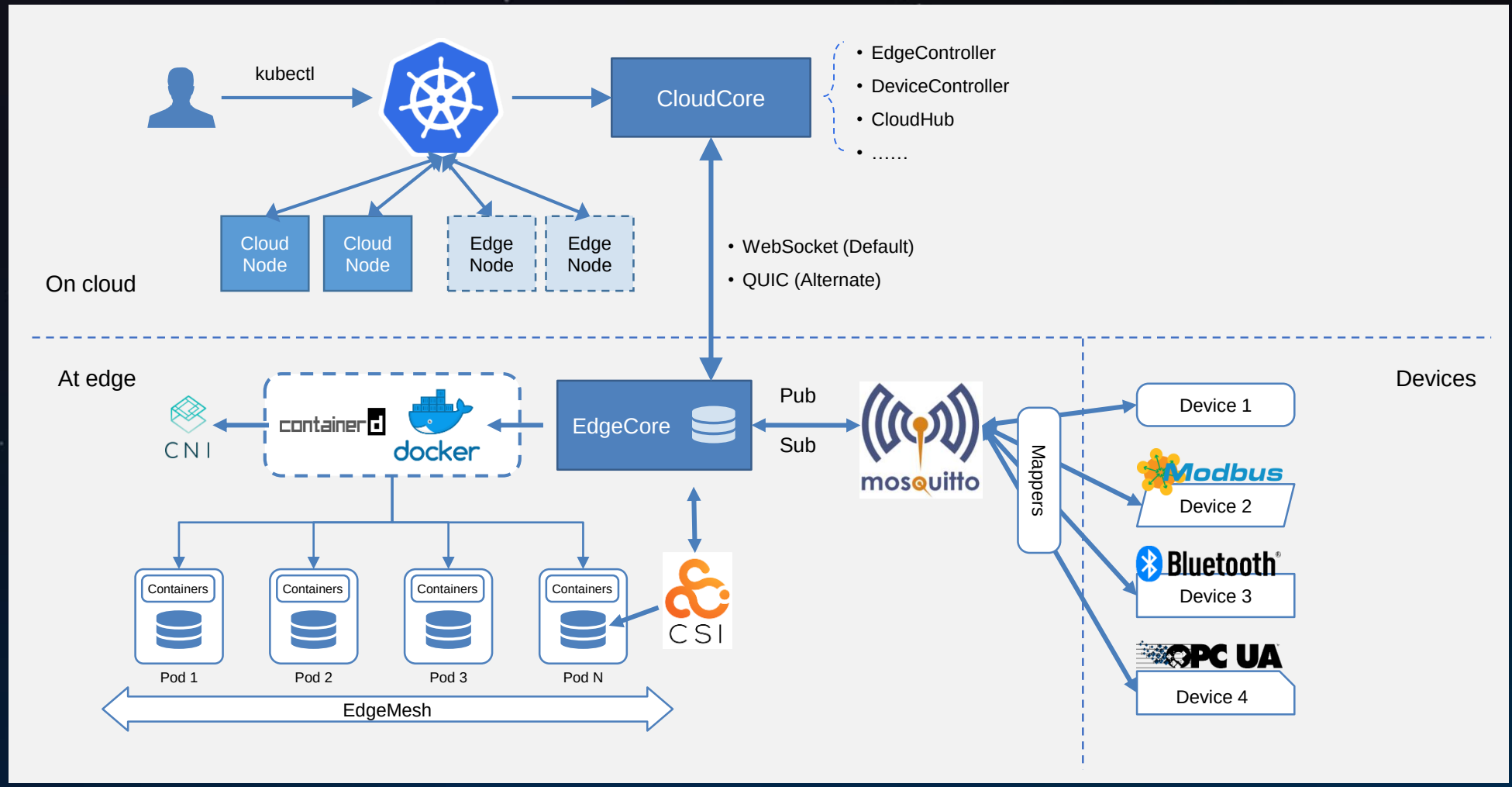
CloudNative Lives

KubeEdge技术详解与实战

KubeEdge云边协同&云端组件设计

华为云原生团队核心成员 & CNCF社区主要贡献者倾力打造

KubeEdge架构

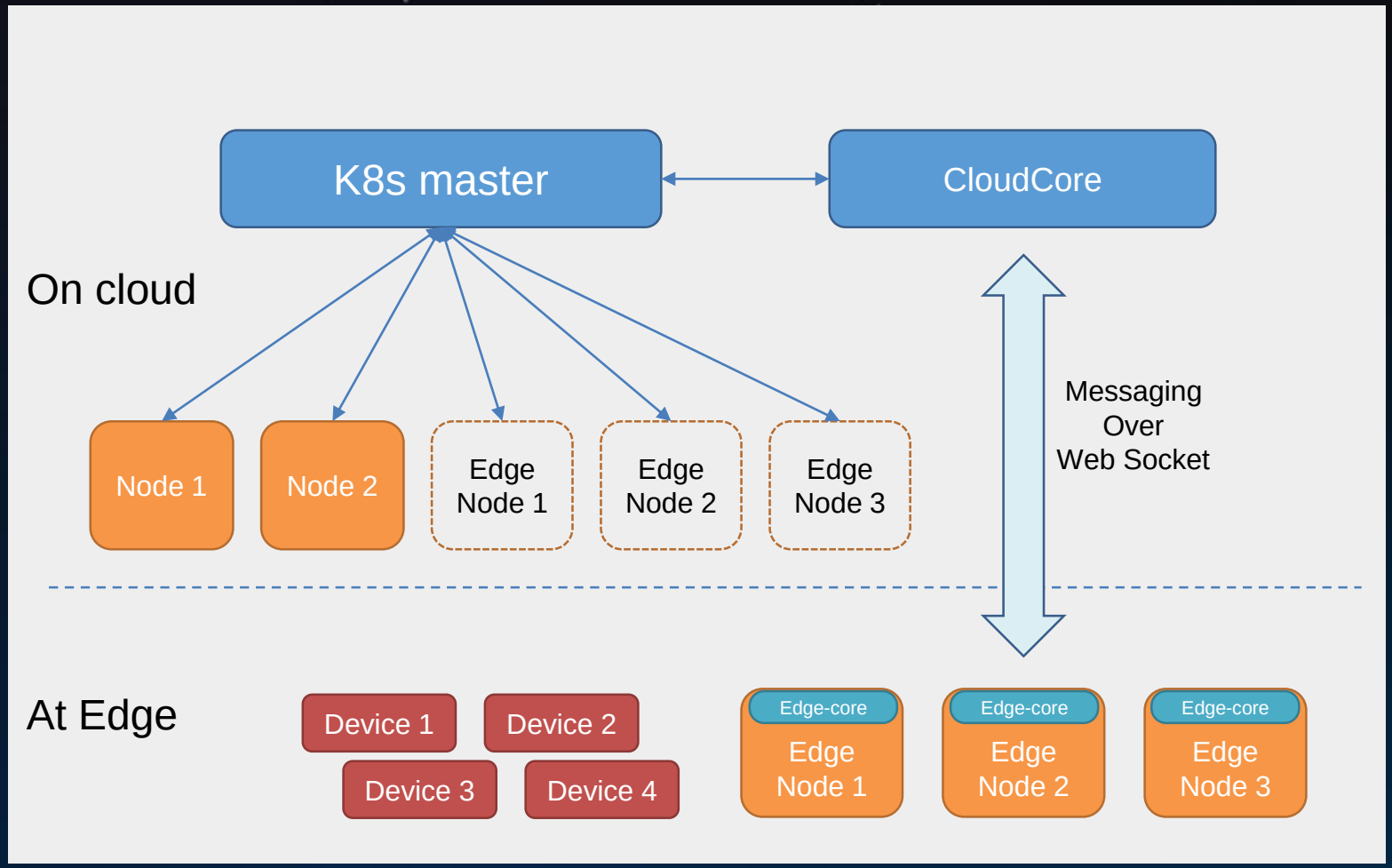

kubectl
CloudCore
• EdgeController
• DeviceController
• CloudHub
• ……
Cloud Node
Cloud Node
Edge Node
Edge Node
On cloud
• WebSocket (Default)
• QUIC (Alternate)
At edge
CNI
containerd
docker
EdgeCore
Pub
Sub
mosquitto
Mappers
Devices
Device 1
Modbus
Device 2
Bluetooth
Device 3
OPC UA
Device 4
Containers
Containers
Containers
Containers
CSI
Pod 1
Pod 2
Pod 3
Pod N
EdgeMesh

HUAWEI

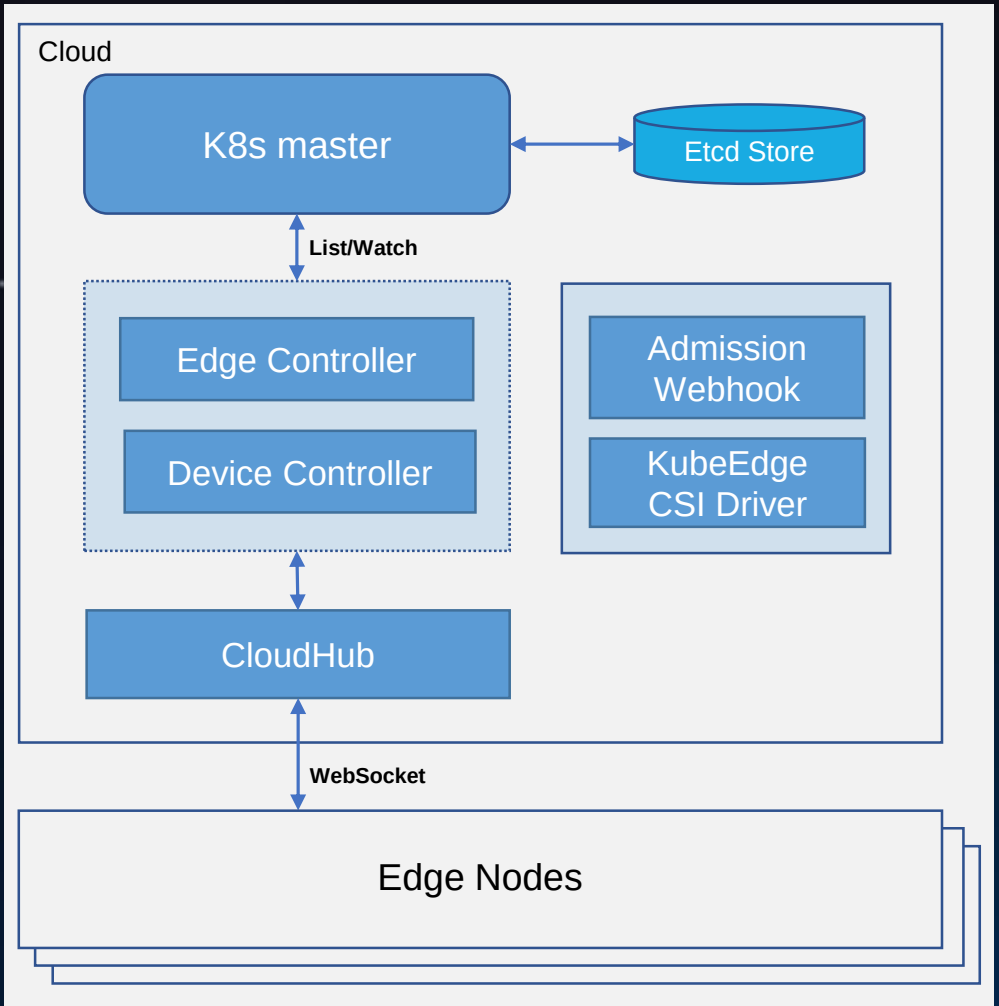
大纲

- 云端组件与K8s Master的关系
- EdgeController详解
- DeviceController详解
- 边缘存储的集成设计
- CloudHub与EdgeHub的通信机制

CloudCore与K8s Master的关系



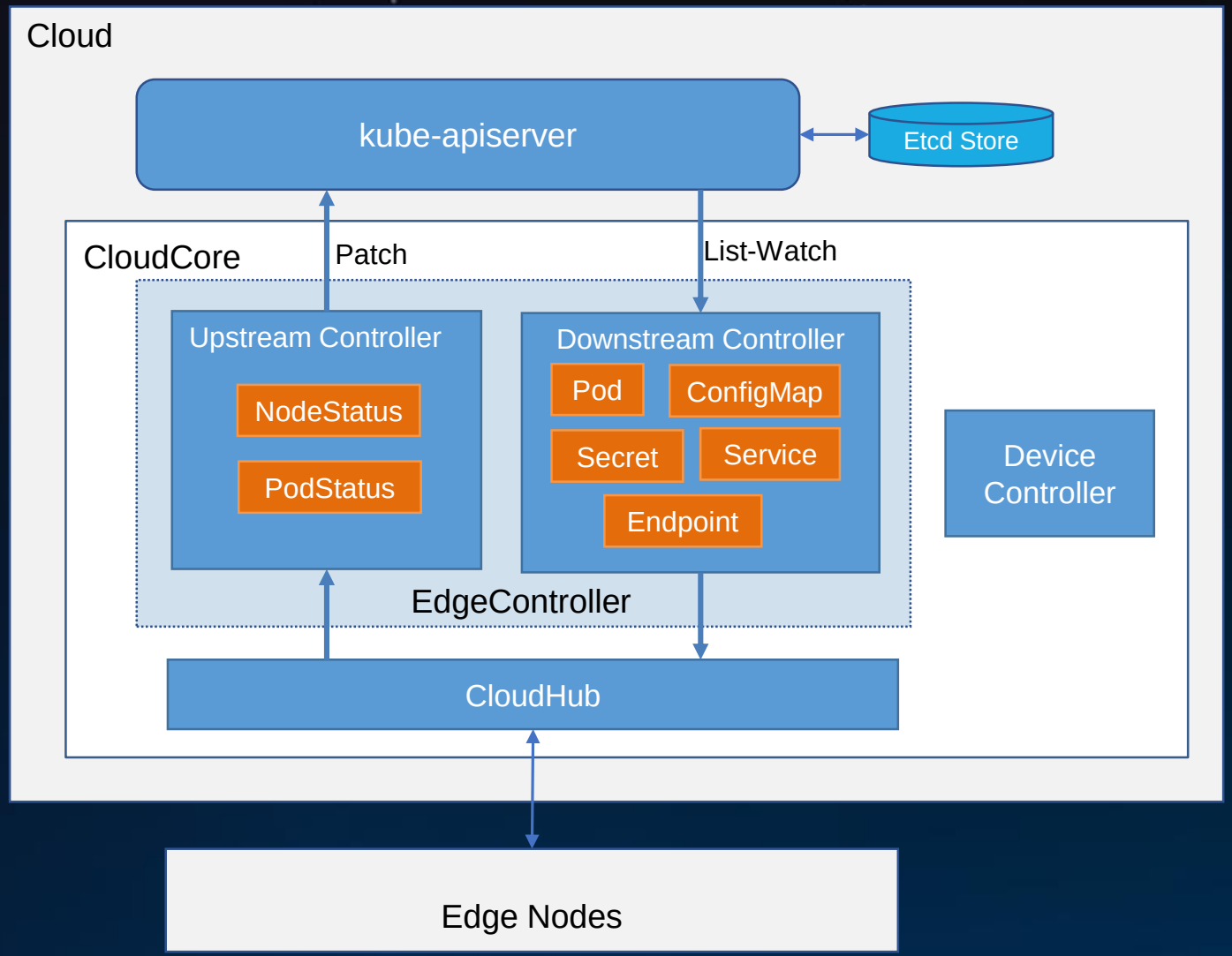
KubeEdge 云端组件



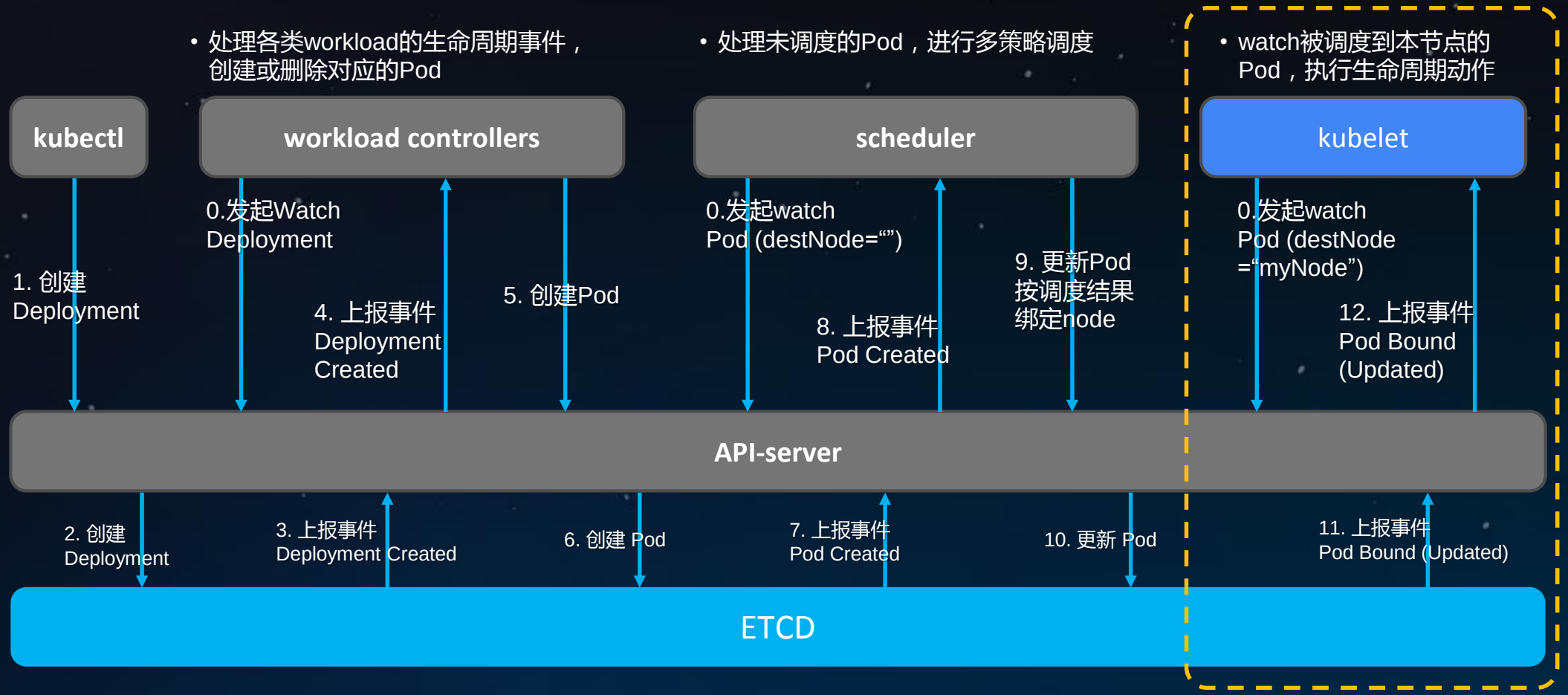
- EdgeController
  - 边缘节点管理
  - 应用状态元数据云边协同
- 设备抽象API/DeviceController
  - 接入和管理边缘设备
  - 设备元数据云边协同
- CSI Driver
  - 同步存储数据到边缘
- Admission Webhook
  - 扩展API合法性校验
  - Best Practice特性开关

EdgeController

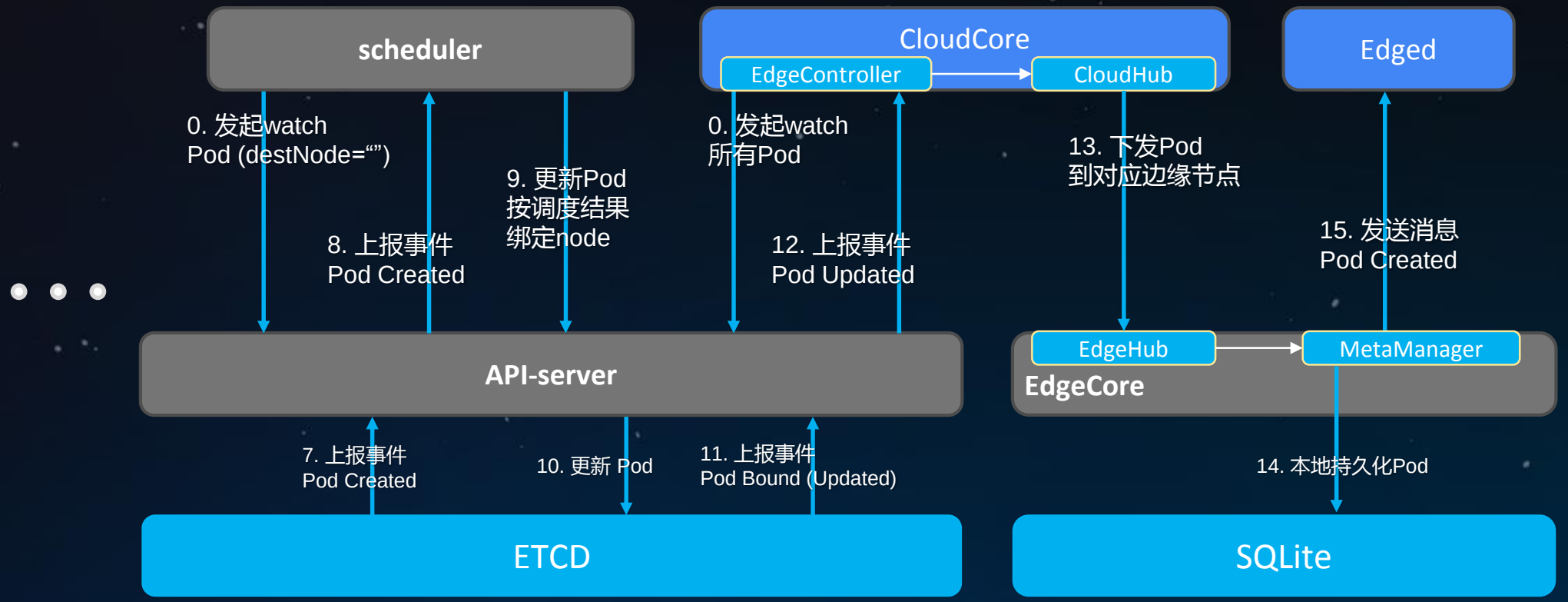
EdgeController内部结构



Kubernetes中拉起应用



KubeEdge拉起边缘应用



Device CRD和DeviceController的设计

DeviceModel 设备模板抽象

```yaml
apiVersion: devices.kubeedge.io/v1alpha1
kind: DeviceModel
metadata:
  name: cc2650-sensortag
  namespace: default
spec:
  properties:
  - name: temperature
    description: temperature in degree celsius
    type:
      int:
        accessMode: ReadOnly
        maximum: 100
        unit: degree celsius
  - name: temperature-enable
    description: enable data collection of temperature sensor
    type:
      string:
        accessMode: ReadWrite
        defaultValue: 'ON'
  propertyVisitors:
  - propertyName: temperature
    bluetooth:
      characteristicUUID: f000aa0104514000b000000000000000
      dataConverter:
        startIndex: 1
        endIndex: 0
        shiftRight: 2
        orderOfOperations:
        - operationType: Multiply
          operationValue: 0.03125
  - propertyName: temperature-enable
    bluetooth:
      characteristicUUID: f000aa0204514000b000000000000000
      dataWrite:
        "ON": [1]
        "OFF": [0]
```

定义设备通用支持的属性

- 数据类型
- 是否只读
- 默认值、最大值最小值
- ……

每种属性字段访问方式

- 支持的读写协议
- 读写参数
- 数据格式转换
- ……

DeviceInstance 设备实例定义

```yaml
apiVersion: devices.kubeedge.io/v1alpha1
kind: Device
metadata:
  name: sensor-tag-instance-01
  labels:
    description: TISimplelinkSensorTag
    manufacturer: TexasInstruments
    model: cc2650-sensortag
spec:
  deviceModelRef:
    name: cc2650-sensortag
  protocol:
    bluetooth:
      macAddress:  "BC:6A:29:AE:CC:96"
  nodeSelector:
    nodeSelectorTerms:
    - matchExpressions:
      - key: ''
        operator: In
        values:
        - edge-node1  #edge node name
status:
  twins:
    - propertyName: temperature-enable
      reported :
        metadata:
          type: string
          timestamp: '1574326968'
        value: OFF
      desired:
        metadata:
          type: string
          timestamp: '1574326814'
        value: OFF
    - propertyName: temperature
      reported :
        metadata:
          type: int
          timestamp: '1574326968'
        value: 25
```

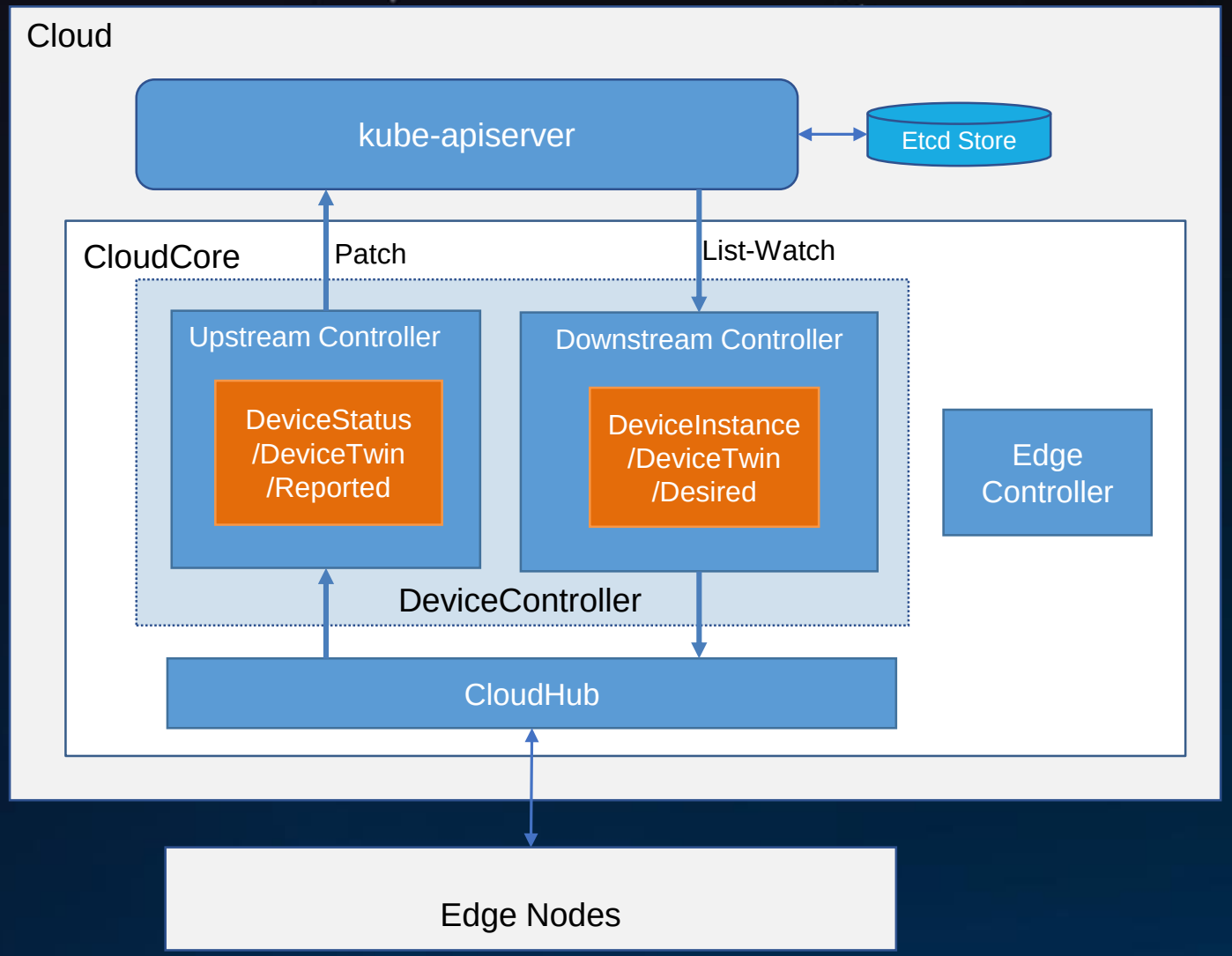
从设备模板继承属性字段

实际使用的访问协议及相关信息

设备关联的节点信息

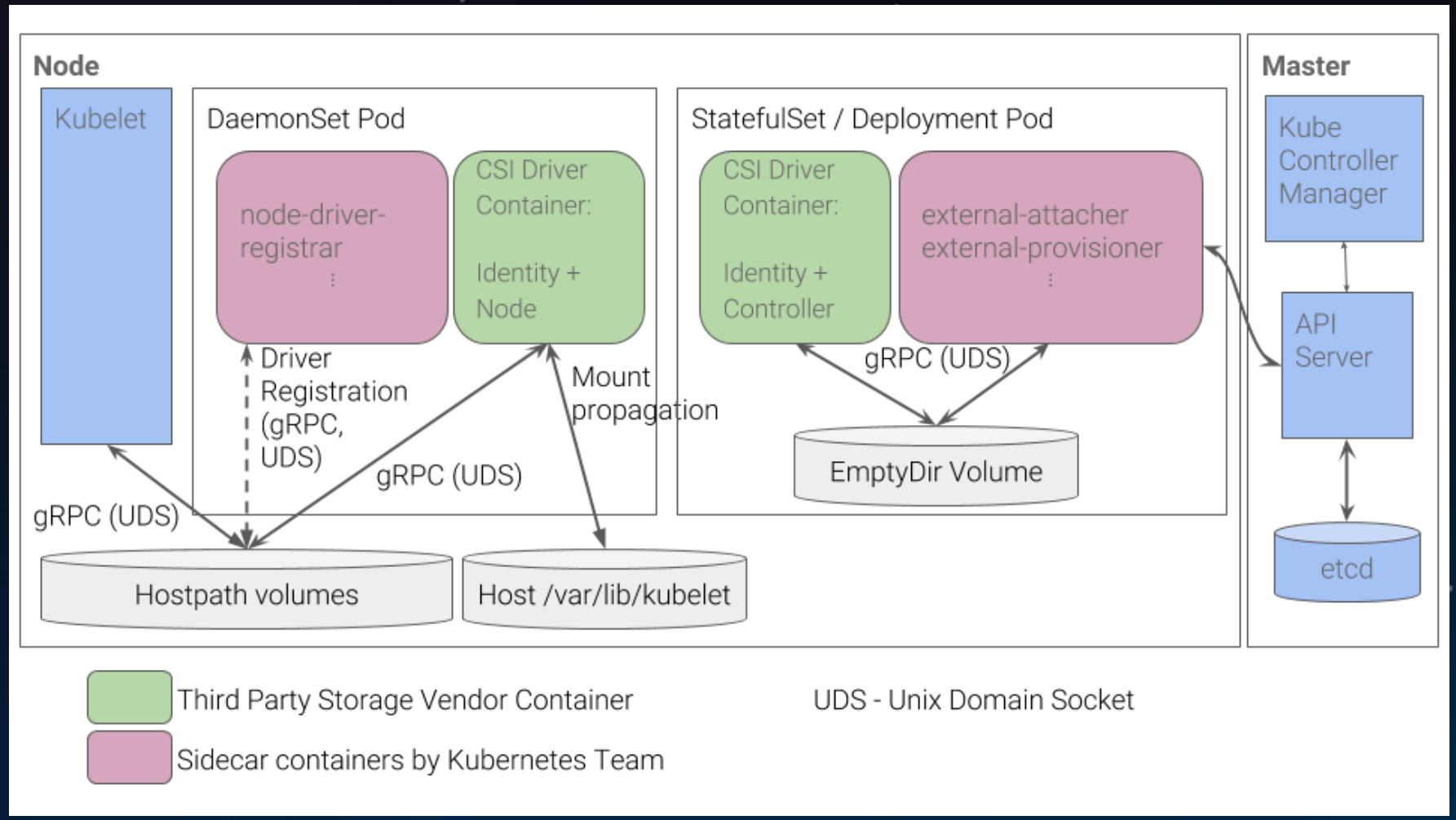
- 从设备获取到的属性字段
  （只包含当前所用协议支持的字段）
- Desired用于设置期望值
- Reported用于记录设备当前实际状态

DeviceController

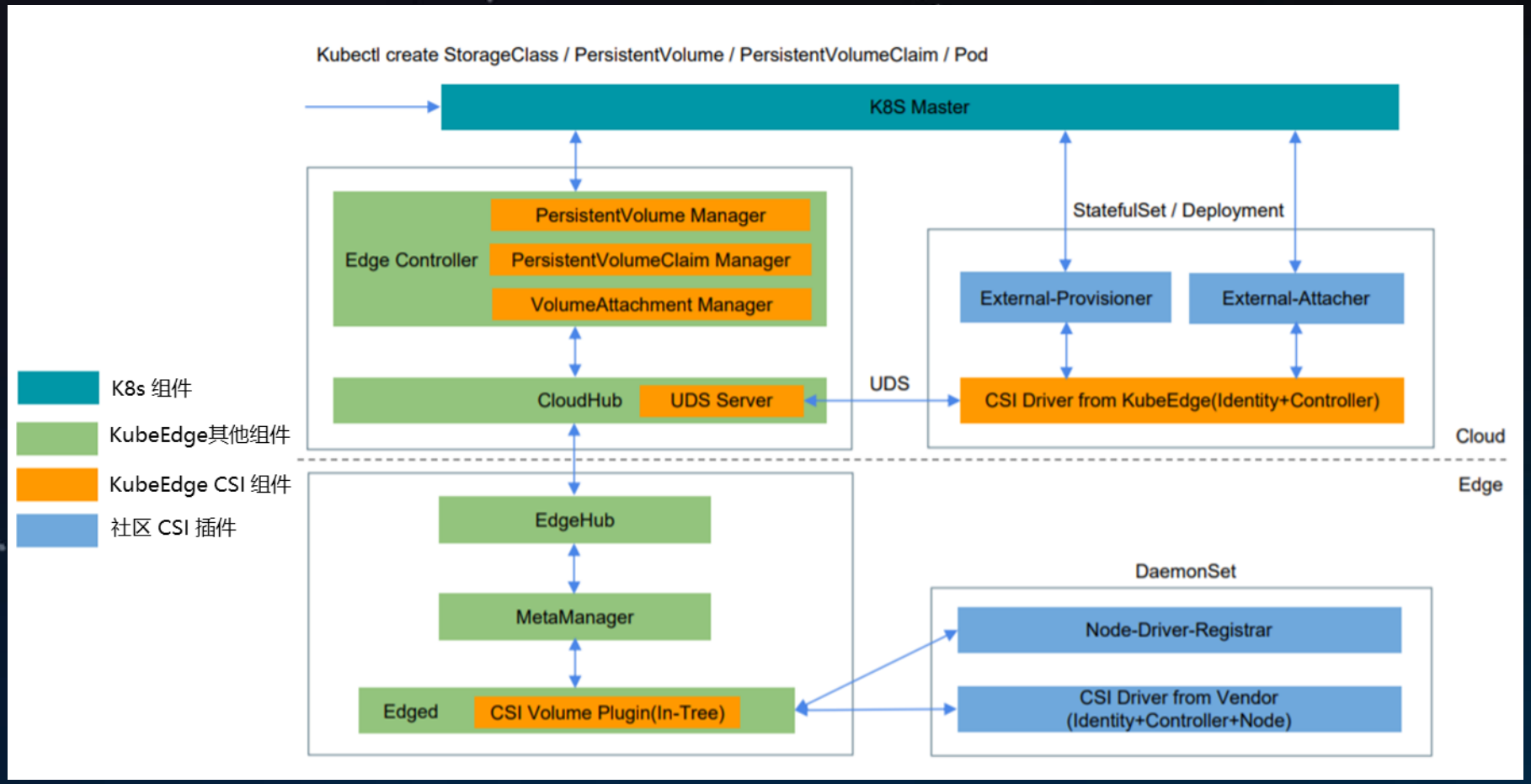


边缘存储的集成与设计

K8s推荐的CSI部署方式

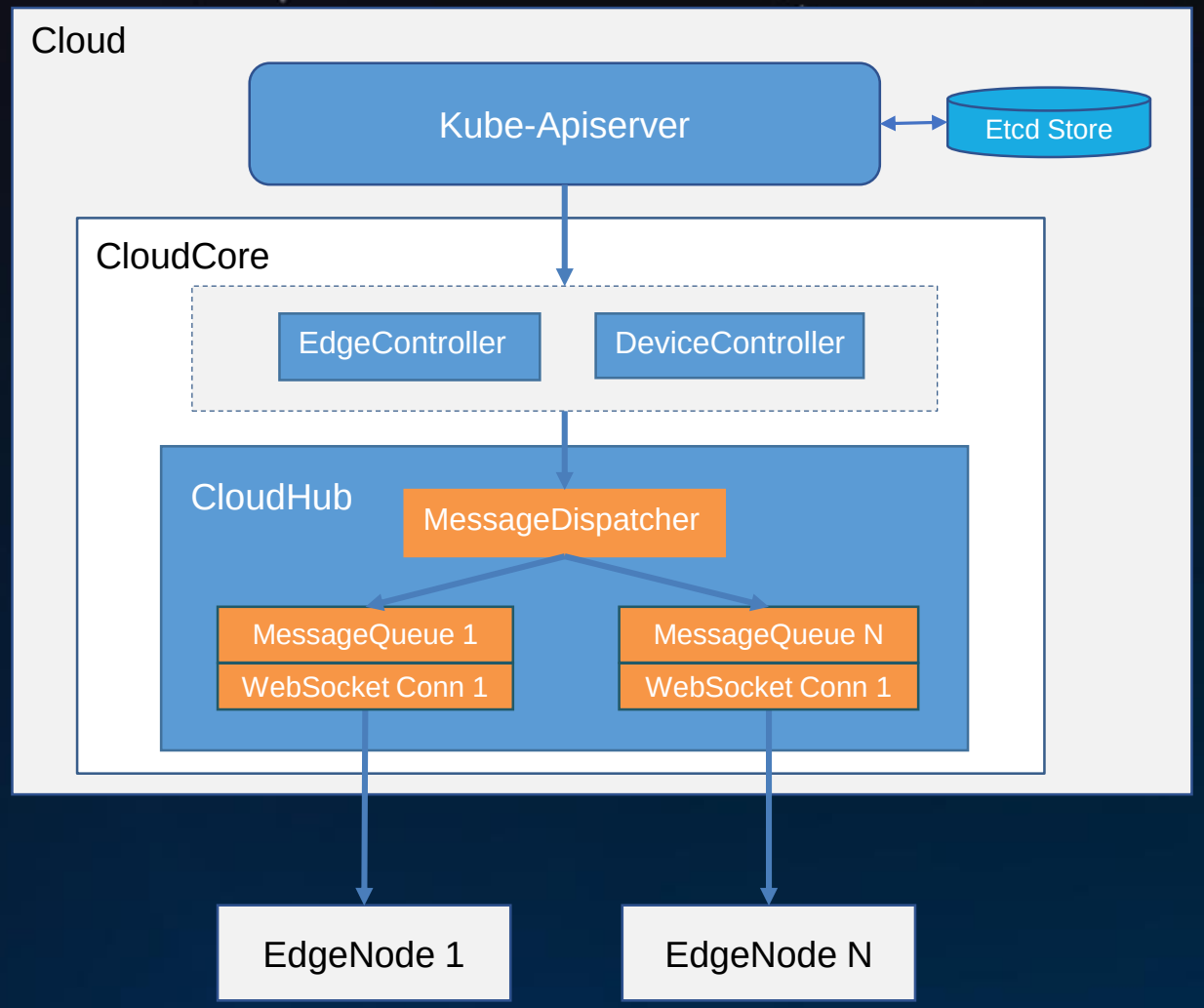


KubeEdge中的CSI部署方案

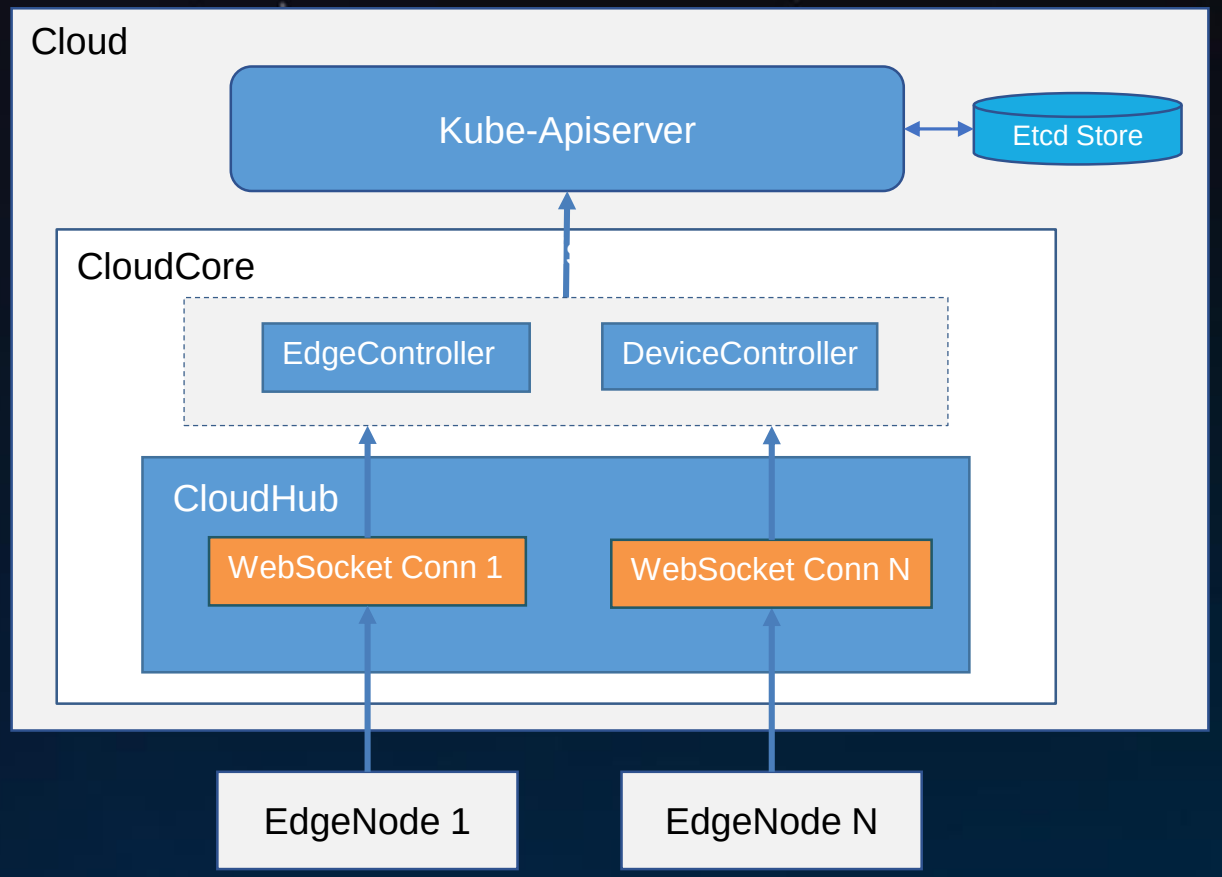


CloudHub与EdgeHub的通信机制

下行 – 通过CloudHub下发元数据



上行 – 通过CloudHub状态刷新状态



消息的封装

```go
type Message struct {
    Header  MessageHeader `json:"header"`
    Router  MessageRoute  `json:"route,omitempty"`
    Content interface{}   `json:"content"`
}

type MessageHeader struct {
    // the message uuid
    ID string `json:"msg_id"`
    // the response message parentid must be same with message received
    // please use NewRespByMessage to new response message
    ParentID string `json:"parent_msg_id,omitempty"`
    // the time of creating
    Timestamp int64 `json:"timestamp"`
    // the flag will be set in sendsync
    Sync bool `json:"sync,omitempty"`
}

type MessageRoute struct {
    // where the message come from
    Source string `json:"source,omitempty"`
    // where the message will broadcasted to
    Group string `json:"group,omitempty"`
    // what's the operation on resource
    Operation string `json:"operation,omitempty"`
    // what's the resource want to operate
    Resource string `json:"resource,omitempty"`
}
```

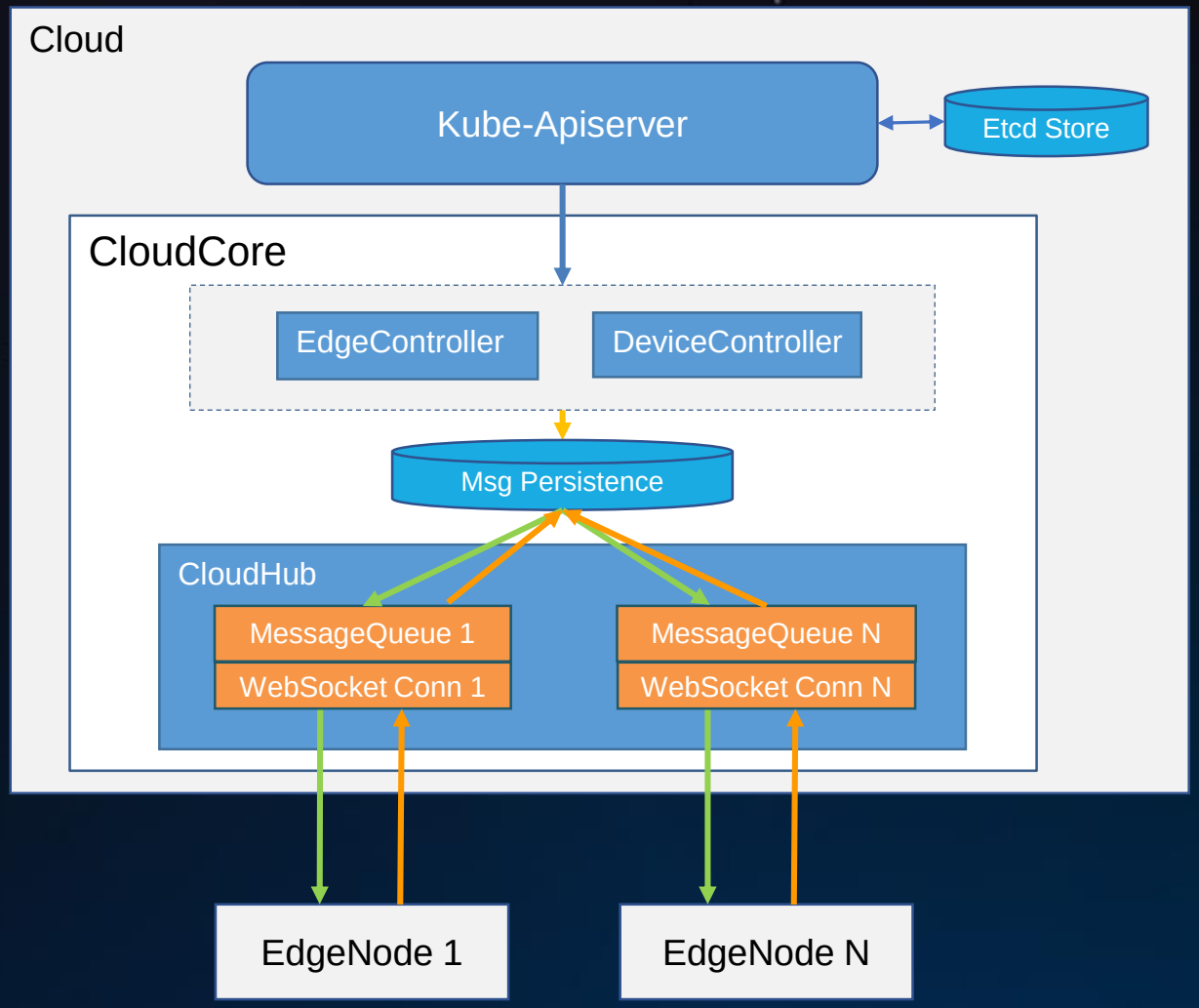
K8s API对象

所响应的事件ID (如果有)

是否同步 (处理响应消息)

消息源、目的模块，支持进程内/外模块间通信

消息可靠性的设计



- 消息丢失和重复发送下的行为
- 基于ACK的Retry
- 发送任务管理（未同步消息持久化）

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Thank You

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