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Manage Edge Nodes with KubeEdge and Case Study

Yulin Sun, yulin.sun@huawei.com;

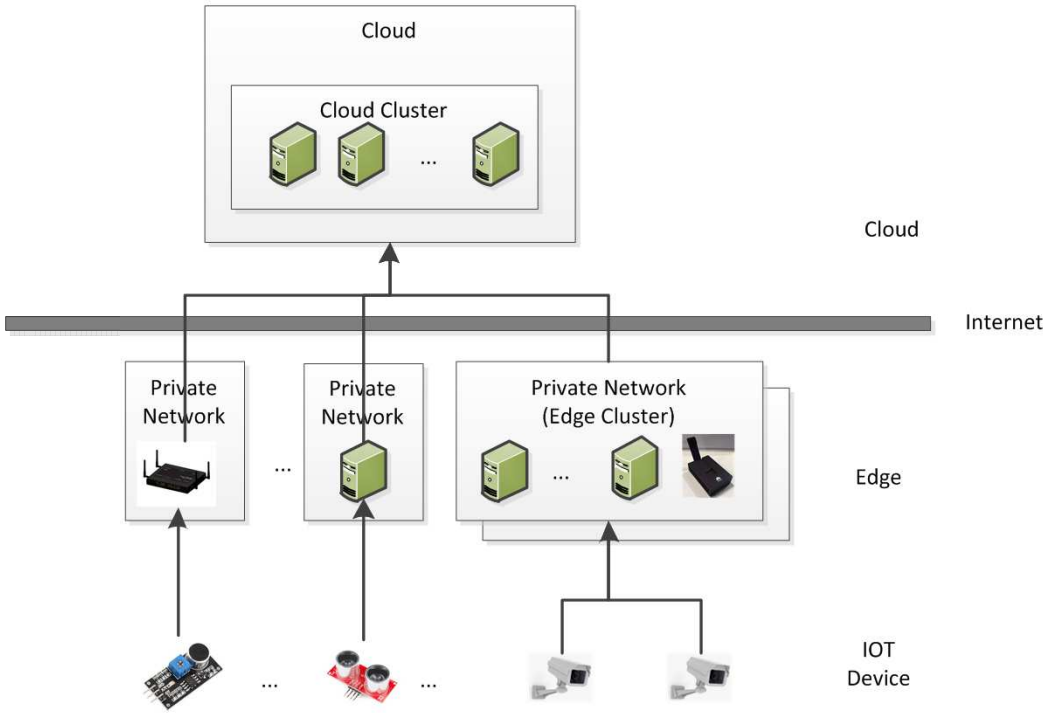
Li Xing, Li.xing1@huawei.com;

Seattle Cloud Lab, Huawei R&D USA, Bellevue WA

Agenda

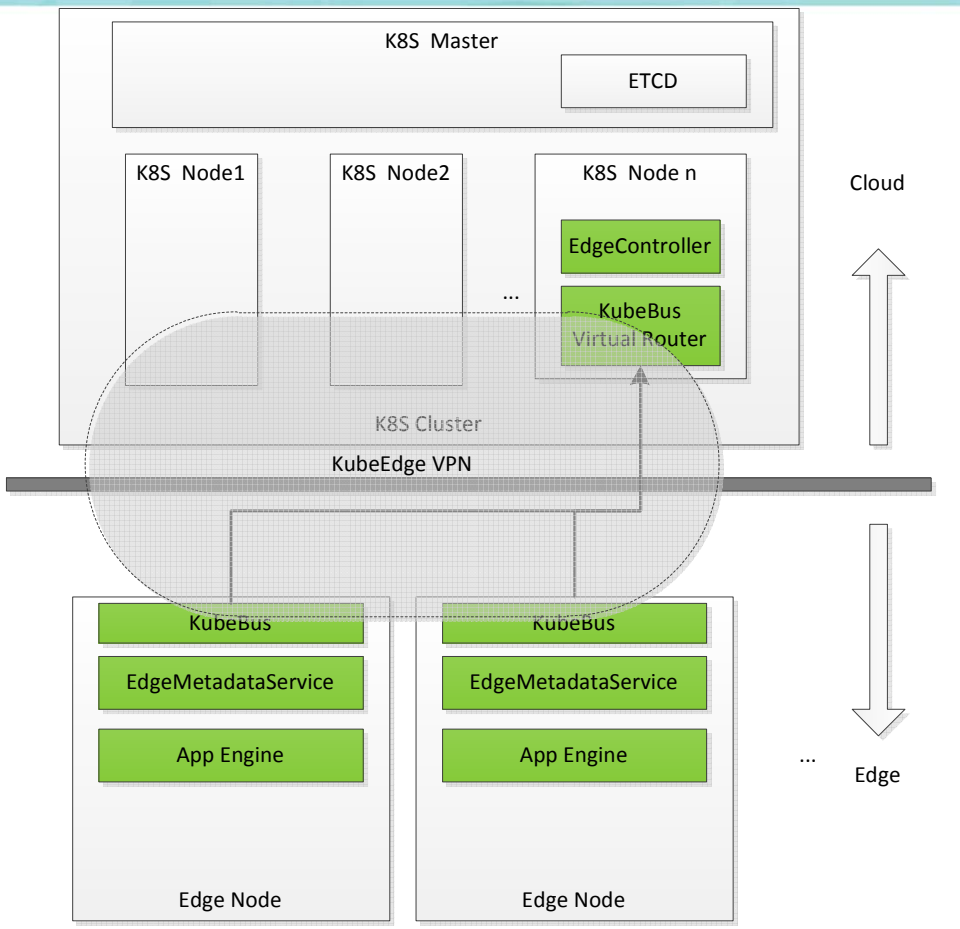
- Edge scenarios/characters
- KubeEdge Architecture
  - KubeBus
  - Edge metadata service
  - Kubernetes extension
- Case study
  - Water utility management
  - Campus surveillance system

Edge Scenario/Characters (vs Data Center)



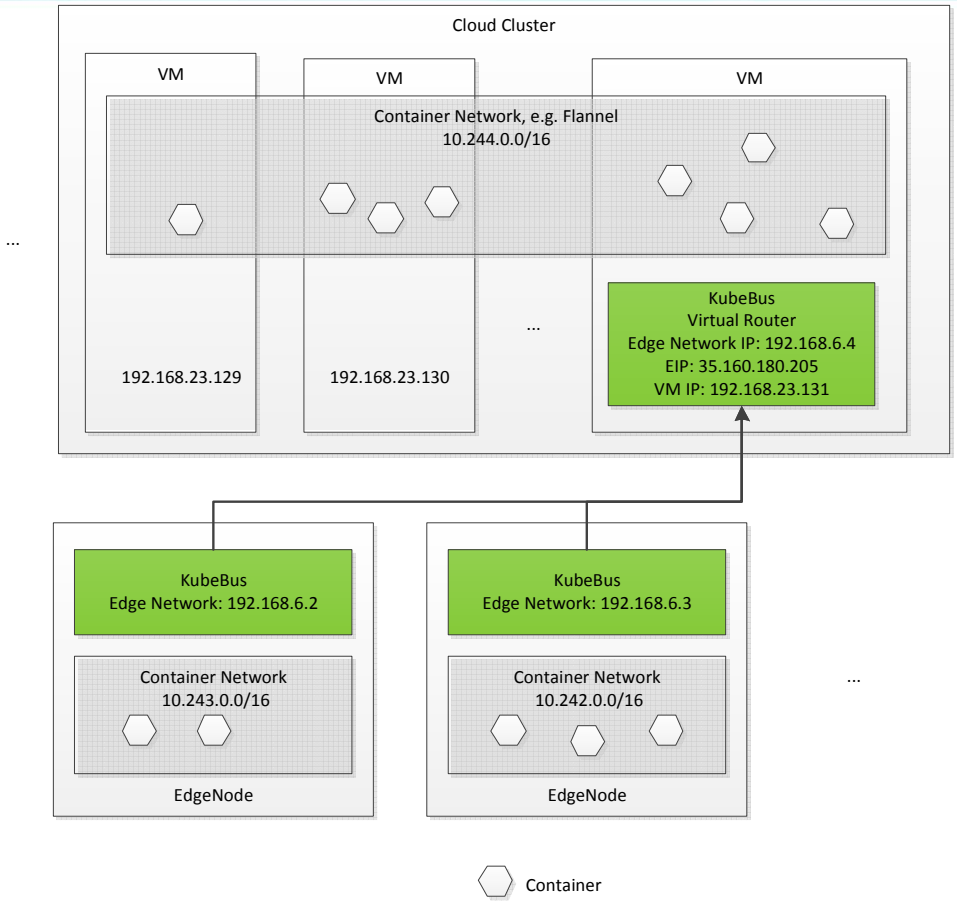
- Similar requirement
  - Edge/Cloud nodes management
  - Application management
  - Inter-service communication
  - …
- Edge special characters
  - Edge node running in private network
    - connect to Cloud behind NAT
  - Edge node's connect to Cloud through Internet
    - Low bandwidth/High latency
    - Unstable connectivity
  - Heterogeneous hardware
    - Memory: 64MB ~ 100+ GB
    - CPU: AMD64/ARM/MIPS…

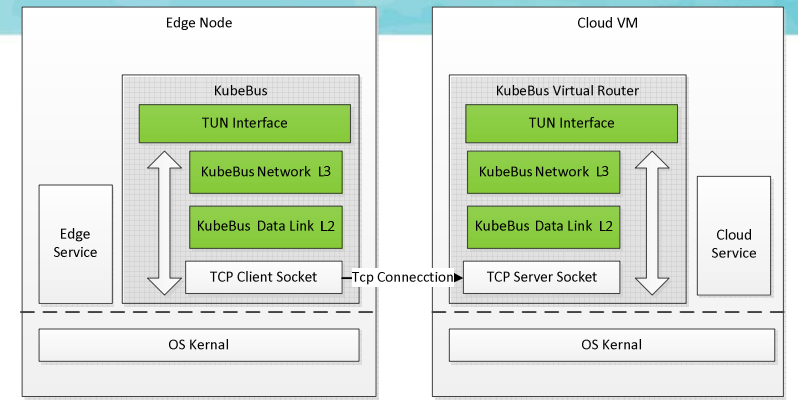
Manage Edge Nodes with KubeEdge



- Goal
  - Manage Edge Nodes together with Nodes in cloud as one Cluster
  - Address the Edge special characters
    - Edge nodes and cloud nodes in one VPN
    - Edge nodes offline execution autonomously
    - Lightweight edge agent
- Components
  - KubeBus: Edge Network
  - EdgeMetadataService
  - Kubernetes extension
    - Edge Controller
    - App Engine

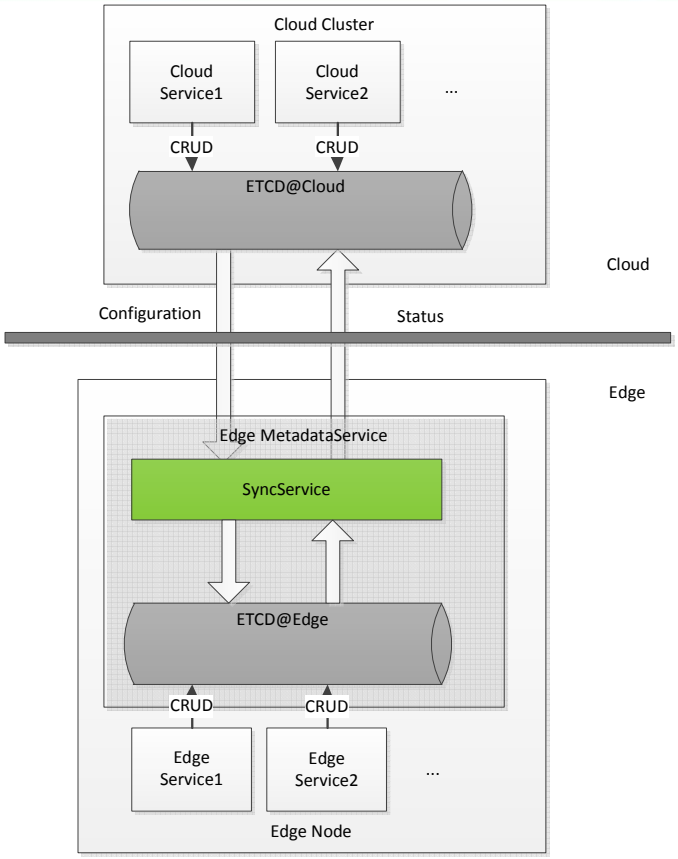
KubeBus





- Scenario
  - Edge Nodes have no external IP and running behind NAT
  - One VM in Cloud Cluster has EIP
  - No direct connection between Edge nodes
- Goal
  - Cloud VM and Edge nodes run as in one cluster
- KubeBus Virtual Router
  - Public Endpoint for Edge connection
  - Router to connect
    - Cloud VM subnet
    - Cloud Container subnet
    - Edge Node virtual subnet
    - Edge Container subnet

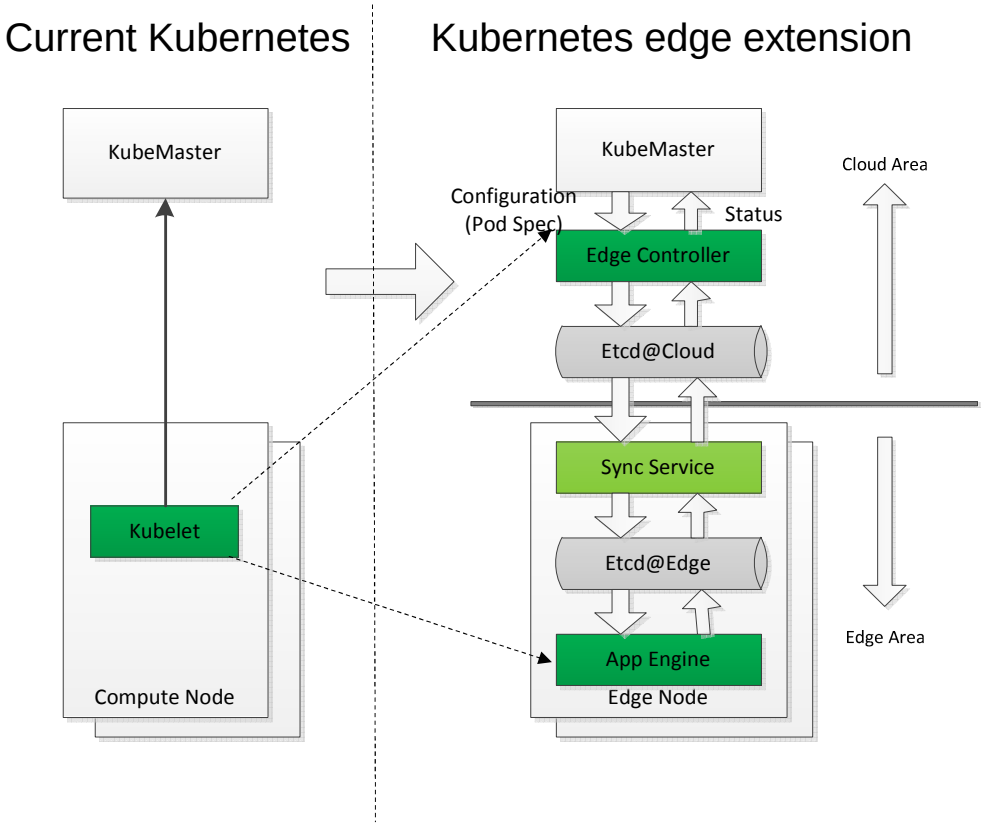
Edge Metadata Service



- Goal
  - Offline Edge Metadata Store
  - Cloud/Edge metadata bi-direction sync
- Component
  - Edge Metadata Store: Etcd
  - Sync Service:
    - Mirror data between Etcd@Cloud and Etcd@Edge
    - Base on Etcd watch/get
- Sync Algorithm
  - Eventually consistent
  - Atomic

```
Func SyncFromCloudToEdge(CloudStore, EdgeStore) {
        while true {
                LastSyncRevision = ReadLastSyncRevision(EdgeStore)
                Changes, NewRevision = ReadDelta(CloudStore, LastSyncRevision)
                TransactionalWrite(EdgeStore, Changes, NewRevision)
        }
}
```

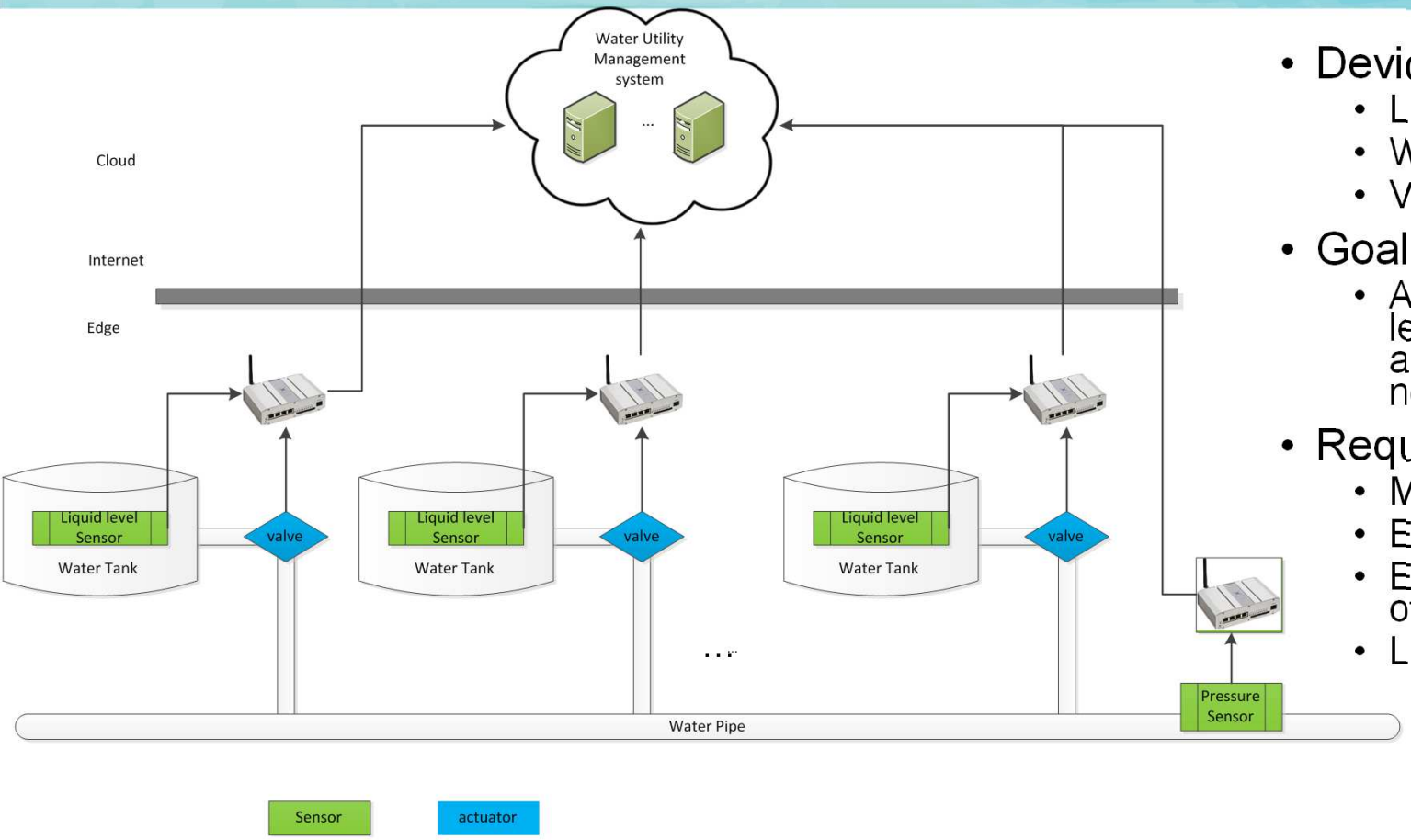
Edge Controller/App Engine



- Goal
  - Offline autonomous – network connectivity
  - Only sync change data – network performance
  - Lightweight Kubelet – resource constrain edge node
- Components
  - Edge Controller: representative of Edge nodes to talk to KubeMaster
    - Get configuration (e.g. pod spec)
    - Reports Edge nodes status
  - AppEngine: Control containers

Case Study#1

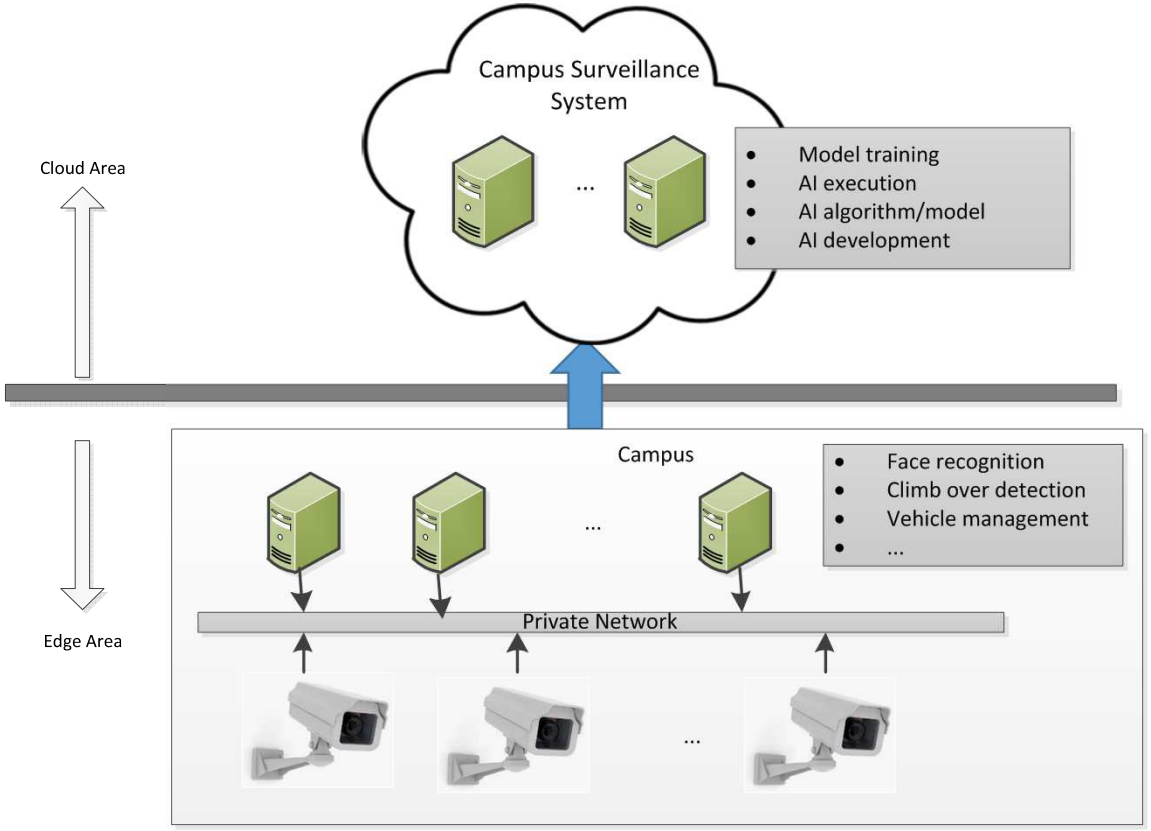
--Water utilities management



- Device
  - Liquid level sensor
  - Water pressure sensor
  - Valve actuator
- Goal
  - Adjust valve based on water level of water tank in the area and water pressure nearby
- Requirement
  - Management plane in Cloud
  - Edge to edge communication
  - Edge autonomous when offline
  - Lightweight edge node

Case Study#2

--Campus surveillance system



- Goal
  - Cloud/Edge collaborated campus surveillance system
- Requirement
  - Workload balance between Edge/Cloud
  - Edge autonomous
  - Edge Cluster

Reference

1. Extend cloud execution environment to edge with KubeEdge, Yulin,Sun; Ying Xiong; Li Xing, Ying Huang, https://schd.ws/hosted_files/kccncchina2018chinese/cb/KubeEdge.pdf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