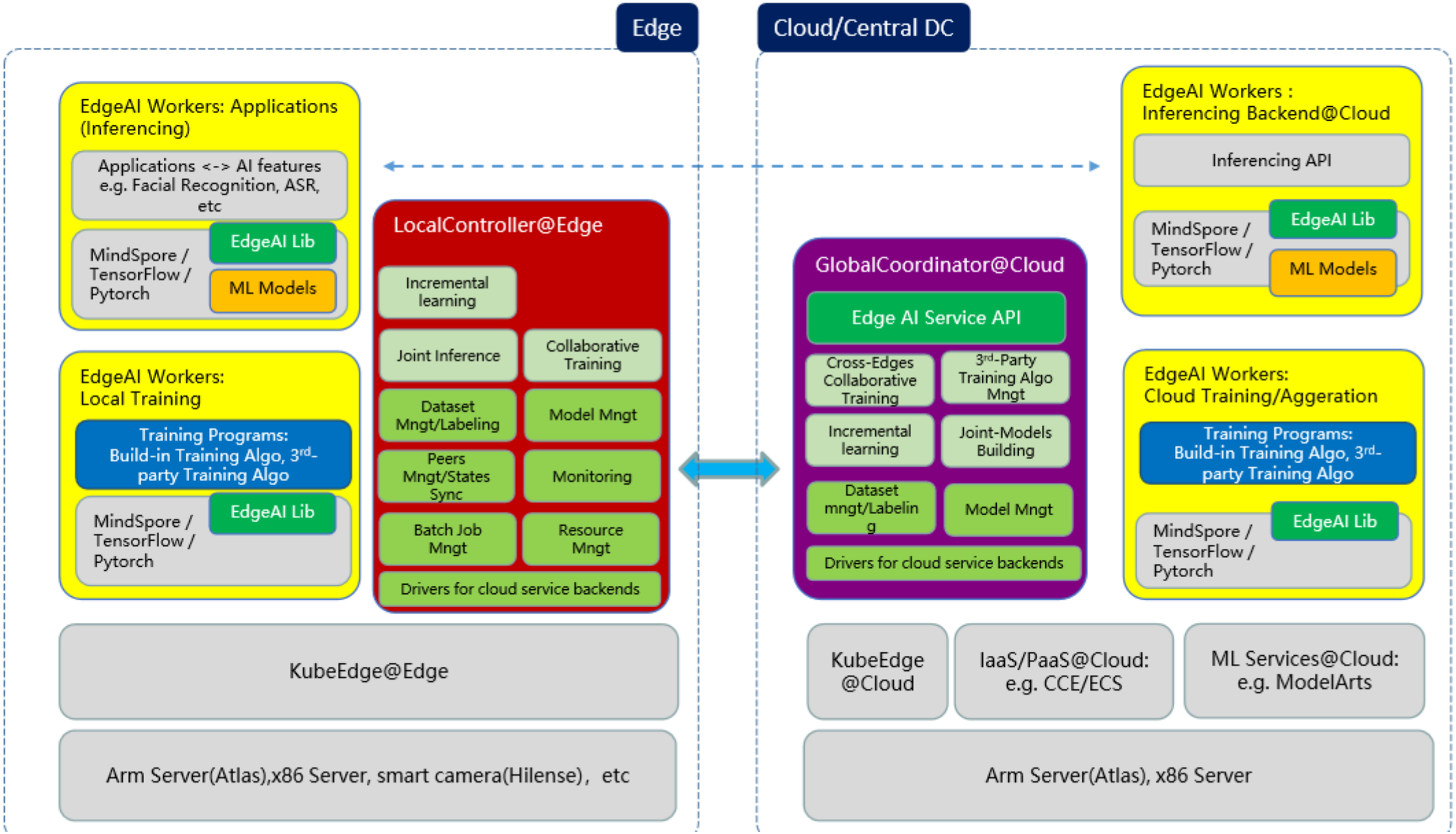
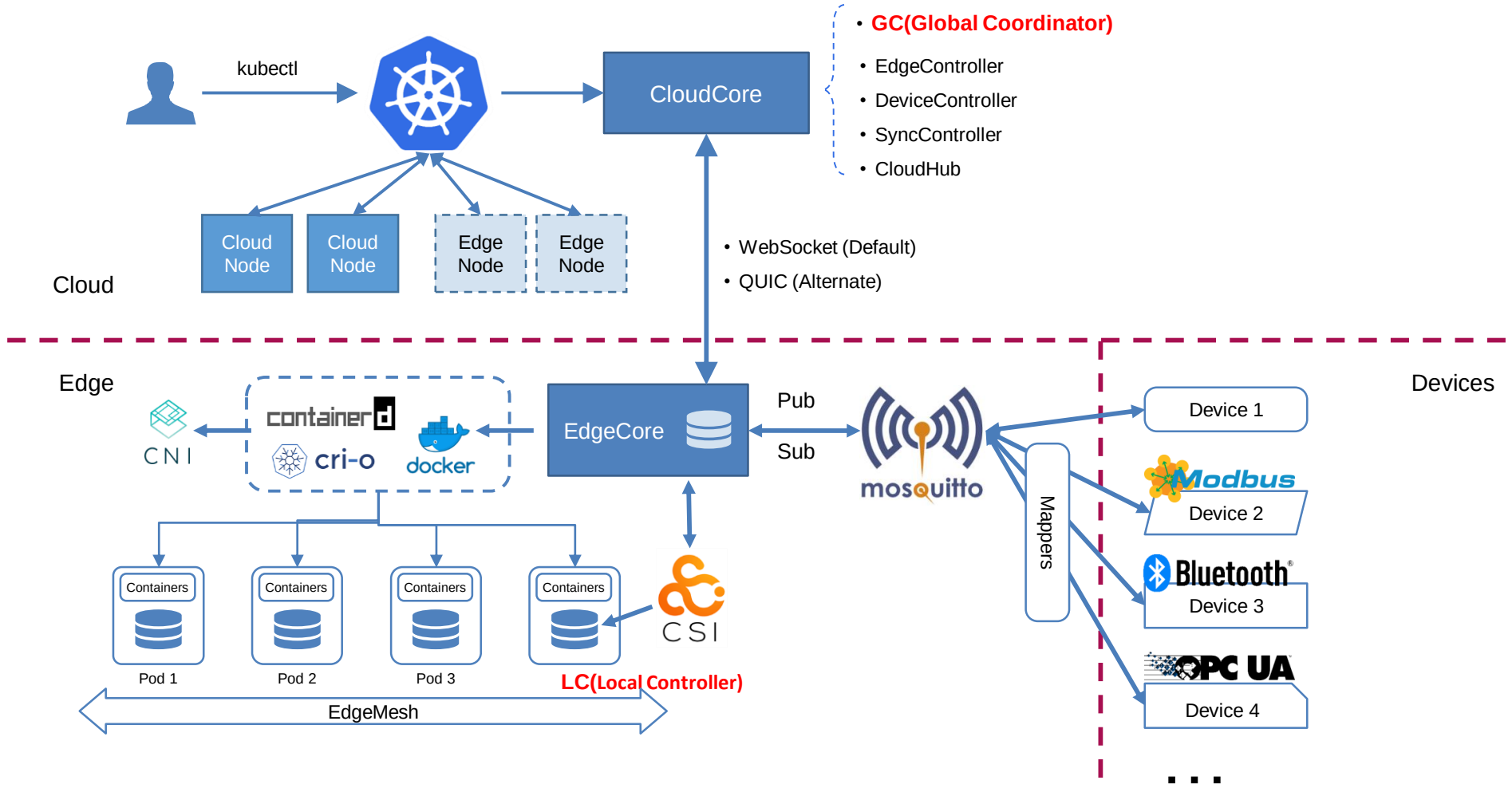
KubeEdge-AI Architecture

Service Architecture

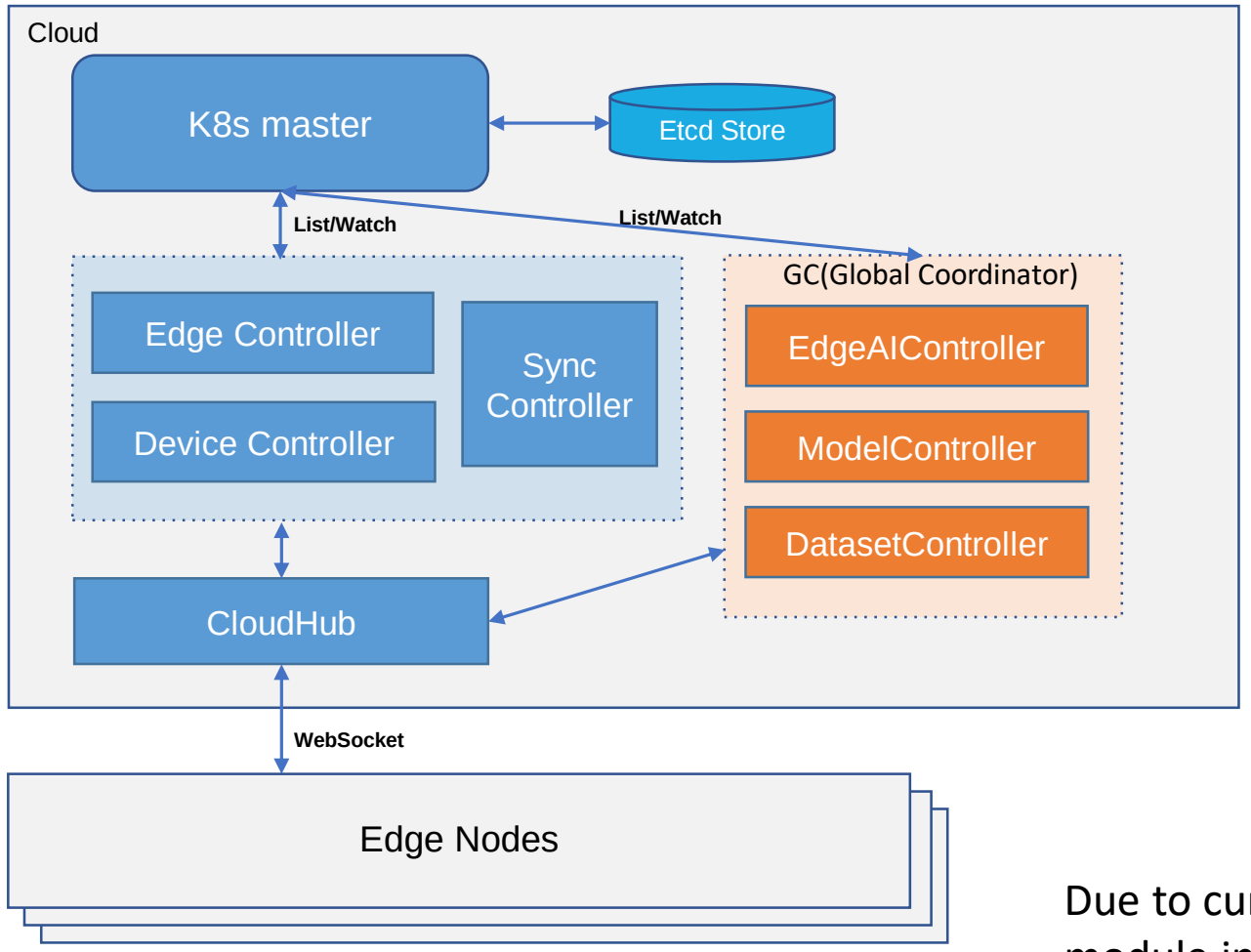
- **GlobalCoordinator @ Cloud:**
  1. uniportal of EdgeAI,
  2. across-edges coordination
- **LocalController @ Edge:**
  1. local controller
  2. manage local dataset and models
- **Workers:**
  1. do inferencing or training, based on existing ML framework;
  2. launch on demand, imagine they are docker containers;
  3. different workers for different features;
  4. could run on edge or cloud.
- **Lib:**
  1. expose the Edge AI features to applications, i.e. training or inferencing programs.



Edge AI Architecture based KubeEdge



Architecture@cloud

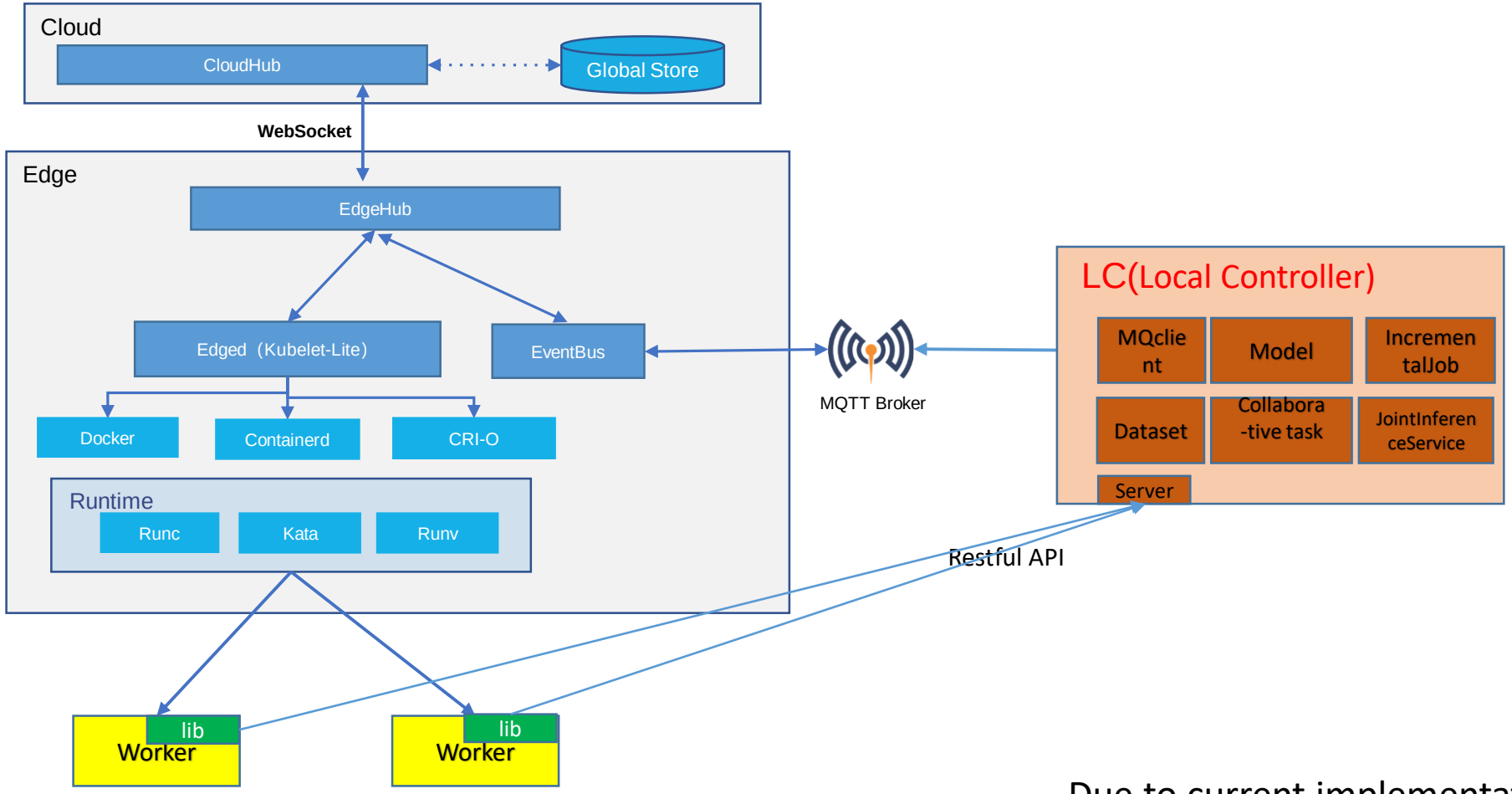


- EdgeAIController
  - Management for edge-AI feature:
    - collaborative-training-task
    - incremental-learning-job
    - joint-inference-service
- Dataset API/Controller
  - Manage dataset at edge
- Model API/Controller
  - Manage model at edge

Due to current implementation of kubeedge, GC will be as a module in cloudcore of kubeedge.

Another choice: standalone controllers out of cloudcore for decoupling.

Architecture@edge



Due to current implementation of kubeedge, we use mqtt in LC to **interact with GC.**
Better choice: edgemesh?

Edge AI Feature: Federated training

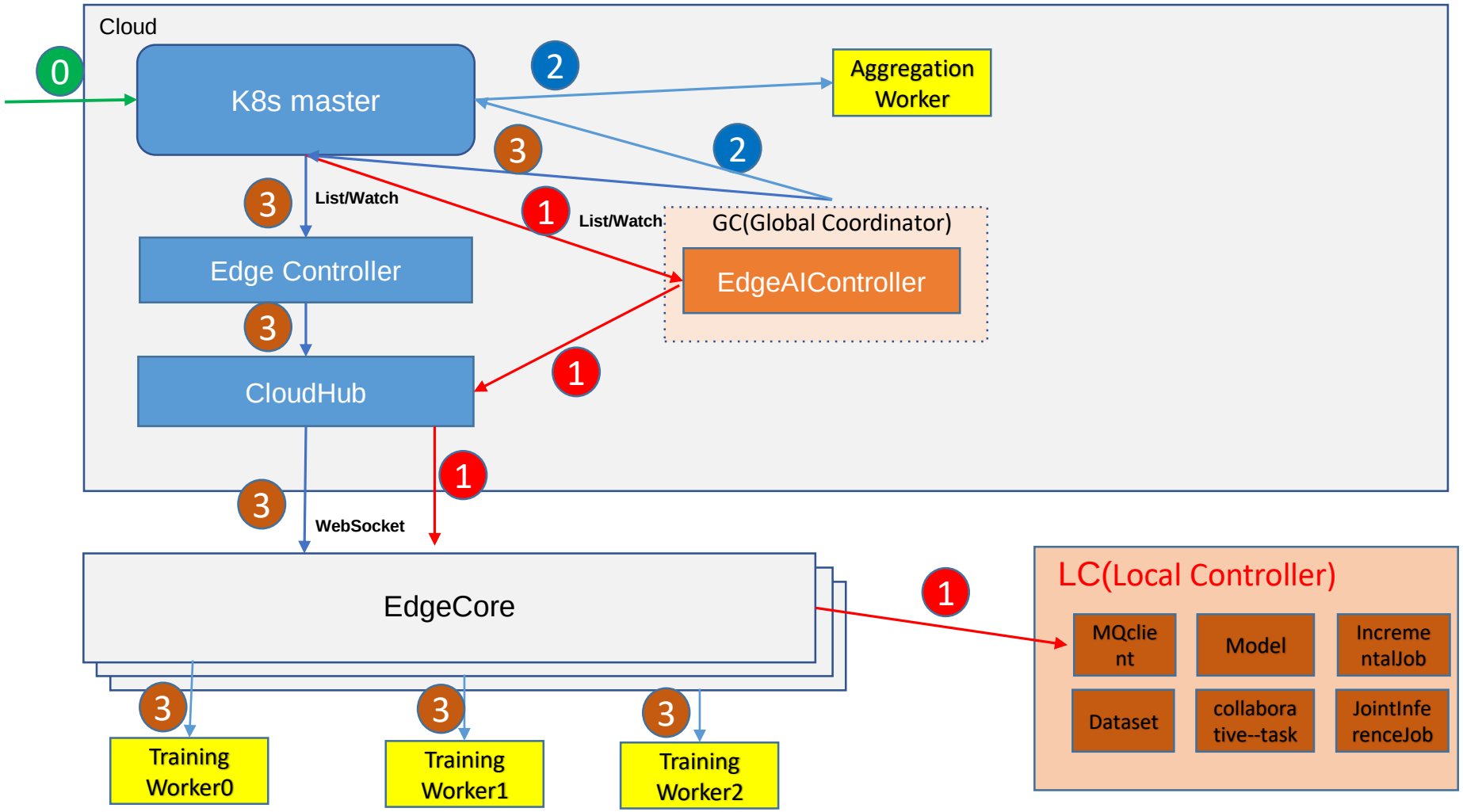
```yaml
apiVersion: edgeai.io/v1alpha1
kind: FederatedTask
metadata:
  name: example-federatedtask
spec:
  aggregationWorker:
    name: aggregation-worker
    model:
      name: resnet50
    workerSpec:
      aggregationAlgorithm: FedAvg
      parameters:
      - key: batch_size
      - key: learning_rate
      - key: min_node_number
      - key: rounds_between_validations
  trainingWorkers:
  - name: work0
    nodeName: edge0
    workerSpec:
      dataset:
        name: dataset0
      trainScriptDir: /code/
      trainScriptBootFile : /code/main.py
      frameworkType: tensorflow
      frameworkVersion: 1.12
      parameters:
      - key: batch_size
        value: 32
      - key: learning_rate
        value: 0.001
  - name: work1
  - name: work2
```

Federated training CRD

Aggregation worker learning CRD

Edge training workers

Edge AI Feature: Federated learning



0. User creates a federated-task crd
1. GC watches this crd, syncs to LCs.
2. GC creates the aggregation worker, and publishes it as a service.
3. GC creates these edge training workers
4. GC waits these workers' to complete (not showed in diagram)

Thank You