Blueprint: Robotaxi

Baidu
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General Blueprint Introduction

- The Robotaxi Blueprint focuses on establishing an open source MEC platform combined with AI capabilities at the autonomous driving scenario.
- The first release of the Robotaxi Blueprint is targeted at Q2, 2020.
- The Robotaxi Blueprint is sponsored by Baidu, Intel, Arm, and Vmware.
- Contact: Hechun Zhang (zhanghechun@baidu.com)
- Refer to: https://wiki.akraino.org/display/AK/The+AI+Edge%3A+RoboTaxi
Blueprint Use cases

Urban Scenarios with autonomous driving vehicles

Avoiding blind spots or safer autonomous driving and accelerating efforts in implementing driving fleet solutions.

- Autonomous drive sharing: reducing the cost-per-kilometer by 50% compared to current private car and taxi costs
- Low-speed unmanned logistics vehicles
- Unmanned minibuses in closed parks
- Unmanned buses on city roads

autonomous ride sharing  low-speed unmanned logistics vehicles  unmanned minibuses  unmanned buses
Blueprint Use cases

Use cases for Valet Parking

- Deploy sensors on vehicles and parking lots, combined with high-precision positioning, allowing vehicles to engage in fully autonomous parking.

Regional upgrade for autonomous driving vehicles

- With roadside sensing equipment, the vehicles can get more road condition information and make the driving mode more intelligent.
RoboTaxi Network Components

- **5G base station**
- **RSU**
- **V2X Platform**
- **MEC / IDC**
- **IaaS & PaaS**
- **Road-side Computing Unit**
- **LTE/5G**
- **I2V(C-V2X)**
- **5G core network**
- **Road-side Computing Mode**
- **Real-time AI Computing**
- **RoboTaxi**

Network Components include:
- **V2X Platform**
- **MEC / IDC**
- **IaaS & PaaS**
- **Road-side Computing Unit**
- **LTE/5G**
- **I2V(C-V2X)**
RoboTaxi Network Architecture

1.1 video capturing

1.2 traffic lights collecting

2 real-time AI computing

3.1 data sending to RSU

3.2 data sending to server

4.1 data sending to autonomous car

4.2 data for third-party service

MEC / IDC

APP
RoboTaxi Network Architecture

- Camera
- RSU
- Traffic lights signal collector
- Gigabit NIC
- 100Mbps Cable
- RSCU
- Telecom operator private line
- 10 Gigabit switch
- MEC/Edge site
- Internet
- 3rd party system
RoboTaxi MEC platform software architecture

Service Layer
- V2X Client
- V2X AI Perception
- OTE
- Baetyl
- OpenNESS

PaaS
- Network Platform
  - Virtual Switch
  - DPDK
  - Visualization Platform
  - Operating System

IaaS
- Baidu RSCU

Hardware
- X86 Server

Road-side Computing Unit
- V2X Service
- Baetyl

Server
- OTE
- OpenNESS
- Baetyl
Physical Topology of OTE Stack MEC Platform

Cluster Controller maintains tree topology
1. selector, cluster label screening;
2. Operator& scheduler, sub-cluster task scheduling assignment;
3. edge-tunnel& edge-handler, connect parent node and process command
4. Router, maintain routing table of all descendant clusters
5. cloud-handler& cloud-tunnel, command conversion and subcluster connection

Cluster adaptation layer, responsible for accessing different types of clusters
1. Provide multiple runtime nodes to support the generation of various IaaS resources
2. Provide high performance, container network components that support network policies
Future Plan

- The first demo of the RoboTaxi Blueprint is targeted at Q1, 2020.
- The first Akraino version will be released in Q2, 2020.
# The Robotaxi Blueprint Criteria

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<thead>
<tr>
<th>Case Attributes</th>
<th>Description</th>
<th>Informational</th>
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<tbody>
<tr>
<td><strong>Type</strong></td>
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<td><strong>Blueprint Family - Proposed Name</strong></td>
<td>The AI Edge</td>
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<td><strong>Use Case</strong></td>
<td>Autonomous driving taxi</td>
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<td><strong>Blueprint proposed Name</strong></td>
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<td><strong>Initial POD Cost (capex)</strong></td>
<td>Leverage Unicycle POD - less than $150k</td>
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<td><strong>Scale &amp; Type</strong></td>
<td>Up to 4 servers, x86/Arm server or deep edge class With nVIDIA Tesla P4/T4 GPUs</td>
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<tr>
<td><strong>Applications</strong></td>
<td>Autonomous driving taxi</td>
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<td><strong>Power Restrictions</strong></td>
<td>Less than 10Kw</td>
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<td><strong>Infrastructure orchestration</strong></td>
<td>Docker 1.13.1 or above K8s 1.12.5 or above- Container Orchestration OS – CentOS 7.0 or above</td>
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<td><strong>PaaS</strong></td>
<td>OTE Stack + OpenEdge + OpenNESS</td>
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<td><strong>SDN</strong></td>
<td>Calico container networking, or OVS-DPDK</td>
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<td><strong>Additional Details</strong></td>
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