Blueprint: Robotaxi

Baidu
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General Blueprint Introduction

- The Robotaxi Blueprint focuses on establishing an open source MEC platform combined with AI capacities 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
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

Road-side Computing Unit
LTE/5G
I2V(C-V2X)

5G base station
RSU

MEC / IDC
IaaS & PaaS

V2X Platform

Road-side Computing Mode

5G core network
5G UPF

Real-time AI Computing
IaaS & PaaS

Network Components
RoToTaxi Network Architecture

1.1 video capturing

1.2 traffic lights collecting

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

2 real-time AI computing

MEC / IDC

APP
RoboTaxi Network Architecture

3rd party system

Internet

10 Gigabit switch

Traffic lights signal collector

Gigabit NIC

100Mbps Cable

Camera

RSU

RSCU

RSCU

RSCU

Telecom operator private line

MEC/ Edge site
RoboTaxi MEC platform software architecture
Robotaxi uses x86 as Edge Infrastructure

- **Lightweight App orchestration**
  - Knative
  - Kubeflow
  - EdgeX

- **Infra Orchestration**
  - Kubernetes
  - Containerized Compass

- **Networking Software**
  - Linux System Networking
  - VPP, OVS

- **Controller**
  - Calico
  - xConnect
  - Contiv/VPP
  - OVN-K8s

- **Edge Servers or Networking Edge Platform**
  - Acceleration
    - Integrated Accelerators
    - Smart NICs
    - FPGA/GPU

- **Network Equipment**
  - Switch/GW

- **Service management**

- **Web**

- **OpenAPI**

- **OTE PaaS**
  - OTE Micro-Service Framework
  - OTE Root ClusterController

- **3rd Edge Cluster Controller**
  - Adapter for 3rd Edge Cluster

- **ICN - API**
  - OTE-ClusterController
  - ICN-Shim
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

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