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+Blueprint+Family
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
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

MEC / IDC

4.1 data sending to autonomous car

4.2 data for third-party service

APP

RSCU

RSU
RoboTaxi Network Architecture

Internet

3rd party system

10 Gigabit switch

Telecom operator private line

Traffic lights signal collector

Gigabit NIC

100Mbps Cable

Camera

RSU

RSCU

RSCU

RSCU

MEC/ Edge site

RSU

RSU

RSU
RoboTaxi MEC platform software architecture

Service Layer
- V2X Client
- V2X AI Perception

PaaS
- OTE
- Baetyl
- OpenNESS

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

Hardware
- Baidu RSCU

Road-side Computing Unit

Server
- V2X Service
- Baetyl

Network Platform
- Virtual Switch
- DPDK
- Visualization Platform
- Operating System
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 AI Apps**
  - Bare metal
  - Container

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

- **Network Equipment**
  - Switch/GW

- **Service management**
  - Service Orchestration
    - OTE Micro-Service Agent
    - OTE PaaS
    - OTE Root ClusterController

- **Real Time Linux distribution**
  - SR-IOV, DPDK
  - Real Time Linux distribution

- **Controller**
  - OpenAPI
  - 3rd Edge Cluster Controller Adapter
  - ICN-Shim
  - OTE-ClusterController

- **Networking**
  - OVN-K8s
  - Kubernetes
  - Containerized Compass

- **Service management**
  - Web
  - OpenAPI
  - OTE Root ClusterController

- **3rd Edge Cluster Controller Adapter**
  - 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>
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<tbody>
<tr>
<td><strong>Type</strong></td>
<td>New</td>
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<tr>
<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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<tr>
<td><strong>Blueprint proposed Name</strong></td>
<td>Robotaxi</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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<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>
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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>Workload Type</strong></td>
<td>Containers</td>
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<td><strong>Additional Details</strong></td>
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