# Dependable Edge Computing Platforms and Applications

Zekun Du
Yulan Shen
Rui Chen
Tian Xu

## ABSTRACT

The development of artificial intelligence(AI) brings autonomous vehicle into reality.
However, for autonomous vehicle, a rigid real-time restrict of data processing need to be satisfied. Generally one Gigabyte data has to be processed in one seconds so that a reliable decision can be made. A planning service running on cloud sever with un-predicted round-trip time (RTT) is not feasible.

In this work, a computing service provided between data-source and cloud data center, i.e. edge computing, is to be introduced in and it can minimize latency. In our autonomous vehicle scenario, edge computing service handle the risks happen in the fleet management, and provide path planning service.

## CONTACT

Tian Xu
Email: tianxu@kth.se

## INTRODUCTION

The system is divided into two parts, which are Edge and Cloud. A digital twin built for the condition monitoring, which we focus on, is providing the quantized information (vehicles and map abstraction) as predicates for the edge computing service and remote planning service.

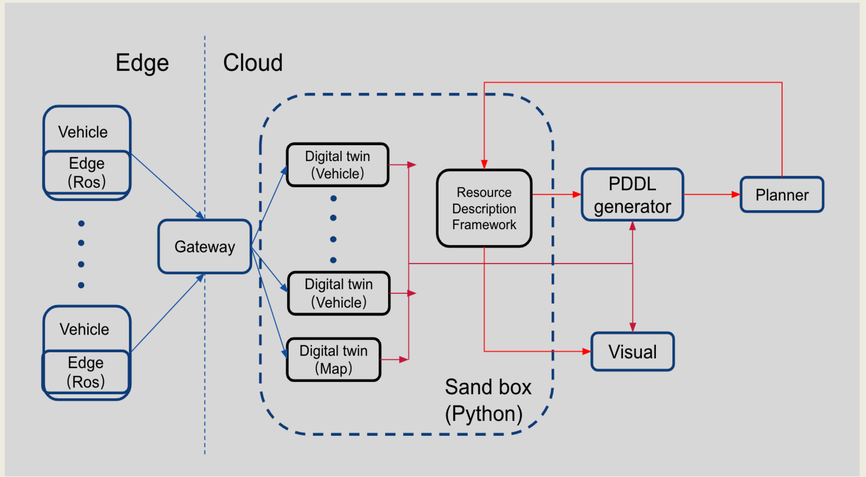


Figure 1. Project framework

Vehicles are running as well as calculating their risk zone around their bodies. When conflicts occur with others' risk zones, the vehicle will slow down or stop in a short instant, the action is in no need to communicate with cloud. Otherwise, the vehicles will travel to the destination by a series of path planning instructions given by the Planner in cloud.

Figure 2. Scenario on the edge

## METHODS

1. Using ROS to generate the data simulation ({ longitude, latitude, velocity}) of a real vehicle.
2. Unify the data format into Resource Definition Framework.
3. A remote planner based on PDDL and RDF will send back a series of actions with its cost when a new destination is set by the vehicle.
4. A algorithm based on friction coefficient and braking distance is composed to detect the risk zone.

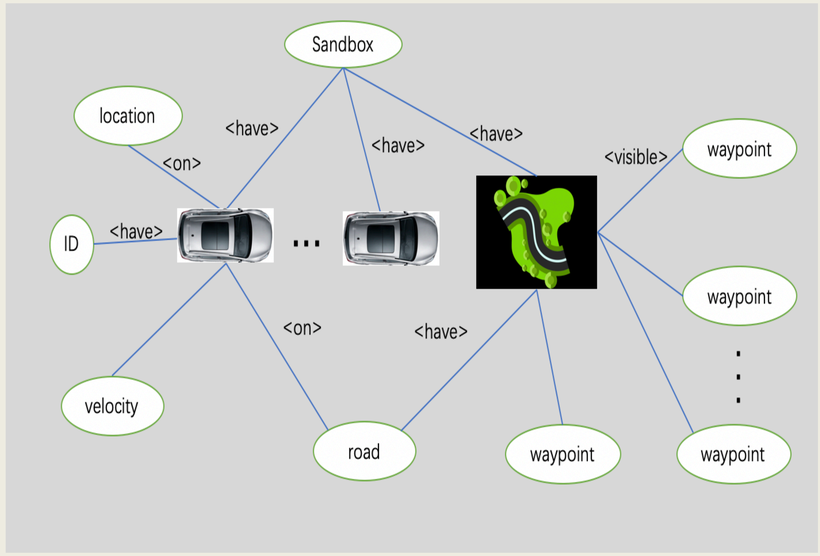


Figure 3. RDF framework in the project

## RESULTS

To make the process visible, this work build a dashboard to fulfill the visualization based on a open-street map. The path planning result can be shown as below:

Figure 4. Path planning

```
(:action move
  :parameters (v1 dest d)
  :precondition
    (and
      (vehicle-at v1 dest)
      (or
        (visible dest d)
        (visible d dest)
      )
    )
  :effect
    (and
      (vehicle-at v1 d)
      (not
        (vehicle-at v1 dest)
      )
      (increase moved 1)
      (increase total-moved 1)
      (when
        (not
          (= d dest)
        )
        (not
          (visible dest d)
        )
      )
    )
)
```

Figure 5. PDDL plan

The risk detection on the edge (vehicle) can be show as below:

Figure 6. Risk Zone detection