Managing resource pool in VFC using stack

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Vehicular Fog Computing(VFC) which utilizes the potential resources between the cloud and the edge of Vehicular Networks to improve the ability of computing for the edge in fog is a significant development of intelligent transportation. VFC has characteristics: low latency, high dynamic, a large number of nodes, heterogeneity and so on. Due to decentralization and high mobility, the resource is hard to manage. It has more challenges to manage, compared to cloud computing. This report proposes a resource pool model to manage vehicular resources and RSU fixed resources in VFC.

1 INTRODUCTION

Over the last two decades, mobile communication changed our lifestyle, which transmits more information quickly between more things. Meanwhile, the automotive industry is also developed by the technological innovations [5]. Vehicles have more sensors and stronger computing ability. Vehicular Cloud Computing which is controlled by the cloud is using vehicles as servers to provide computation resources and data. Vehicular networks are recognized as a significant component of intelligent transportation systems[3] and it support various mobile services. With the development of more advanced technologies and equipment, more applications and services come out(such as self-driving) that increase the demand for more computing and data with low latency.

Fog is a new layer between the cloud and the edge of the network. Vehicular Fog Computing (VFC) extends Vehicular Cloud Computing (VCC) paradigm to the edge of the vehicular network. VFC using vehicles as nodes has closer computing resources which do not need to communicate with the cloud bringing out low latency. Due to the dispersed of vehicles, aggregating idle computing resources of the individual vehicles and the computing resource of Road Sides Units(RSU) can enhance the Quality Of Services(Qos) greatly[2].

In this report, a resource pool model is proposed, which has fixed computation resources from RSU and idle resources from the vehicles. The vehicular resources will be put into a stack and serve to the request in a specific order.

2 BACKGROUND

2.1 Vehicular Network

Vehicular networks is a emerging network. In vehicular networks , the nodes are usually vehicles and the equipment on roads, which have high mobility. VANETs also called Vehicular Ad Hoc Networks is a subclass of the MANETs also called Mobile Ad Hoc Networks. VANETS provides wireless connection in: vehicles to vehicles (V2V); vehicles to infrastructure (V2I); mix V2I and V2V.

2.2 Vehicular Fog Computing

Vehicles covered the vehicular network as fog nodes while providing decentralized local resources. The main characteristics of the Fog are Low latency, Wide-spread geographical distribution, a large number of nodes and Heterogeneity[1]. Compared with cloud computing,

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fog computing has shorter communication distances, which come with less latency. Besides, fog computing has lower costs on deploy compared with cloud computing.

3 RELATED WORKS

Tang et al. [6] propose pooling the vehicles together to share their computing resources in a community. Meanwhile, whit the development of VFC, vehicles have more choices to join communities at the same time, they provide a genetic algorithm based strategy to optimize that process depending on how much benefit they can earn by joining the community.

Compared to other wireless networks, vehicular networks is highly dynamic topology, short transmission time and so on.Pereira et al. [5] propose an allocation and management resource policy for vehicular cloud(NANCY) to decide if allocate the available resource to the request, which is based on mathematical method Multiple Attribute Decision.

Lee and Lee [4] suggest utilizing parked vehicles to minimize service latency and present a heuristic algorithm which combines with reinforcement learning to solve the solutions the formulation set from the problem of allocating the limited fog resources.

4 PROBLEM STATEMENT

Moving Vehicles on roads are not always connected with the same RSU when RSU are as the controller in VFC, the resource pool controlled by RSU need to keep updating the status of the vehicle.

5 PROPOSAL

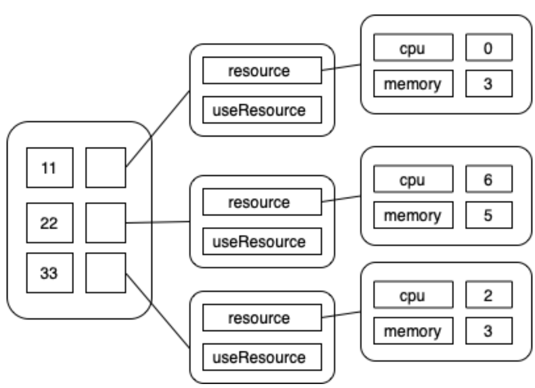

Fig. 1

In the resource pool, it will collect the resource that the vehicles agree to share, and make them into a stack(first come last out). RSU will send broadcast messages periodically to update if vehicles coming and willing to share resources and if vehicles leaving. When the vehicles are no longer in the range of RSU, they will be deleted from the resource pool. When a vehicle gets into the range of RSU and has some resources to share, it will be added to the end of the resource pool stack.

We can consider a scenario in figure1: There are three vehicles already in the resource pool. Then a request is received, which needs 10 on cpu, and 8 on memory. The controller of this resource pool will check fixed resources in RSU first, which have run out in this scenario. Then the resource of vehicles 3 and 2 will be taken. The remaining 2 on cpu will be sent to the other nearby resource pool by a request. If there not enough resources for the request, the RSU will send the request to the near resources controlled by the others RSU.

6 PERFORMANCE ANALYSIS

Usually, the last car that joins the resource pool will leave last, so it can increase the probability that the vehicle serves more requests. The process of joining resource pools and serving requests has the complexity of O(n), which will occupy not much computing resource in RSU.

7 CONCLUSION

The model above uses computation resources of moving vehicles, which need the resource pool updated frequently. Using a stack to maintain a resource pool is an efficient way in VFC. For further improvement, machine learning can be used to optimize the process of serving requests.

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