Research Topics of Task Offloading in Vehicular Edge Computing

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***Abstract*—With the rapid development of vehicular networks, more and more vehicles become smarter and vehicular applications become computation-intensive. Vehicular edge computing (VEC) has emerged as a promising technology, where vehicles can offload these tasks to VEC servers (VECSs) to reduce latency and network congestion. In this paper, we describe several typical research topics of offloading.After that, we discuss future research directions.**

Keywords—Vehicular edge computing; task offloading

I. INTRODUCTION

With the advent of smart vehicles, various vehicular applications such as autonomous driving and auto navigation have emerged in the 5G era [1]. Most of these application services have stringent requirements in terms of computation and delay. Cloud server provides sufficient and fast computation resources, but massive data delivered to the cloud server can cause network congestion and unpredictable delay. Therefore, VEC deployed on road side units (RSUs) at the edge of network has emerged as one of promising solutions. Vehicles can offload their tasks to VECSs to reduce latency and alleviate network congestion. Many researches have been conducted to investigate task offloading in VEC. In this paper, we present the topics of offloading research and then discuss future research.

II. RESEARCH TOPICS OF OFFLOADING METHOD

This section describes the research topics of offloading methods in VEC system by classification.

Full offloading with migration: Vehicles offload their entire tasks to the nearest VECS from vehicle's current location or to the nearest VEC which is closest to the location of the vehicle when their tasks are completed. These can cause the load imbalance of computation resources among VECSs, resulting in bottlenecks on the servers and violating the delay requirements. To address these issues, ones consider load balancing and migration to other VECSs [2].

Partial offloading with resource allocation: Offloading to VECS has many advantages. However, channel condition during offloading is dynamic and uncertain due to channel interference among the vehicles, and path loss due to the mobility of vehicles. Moreover, the task arrival of vehicles is actually stochastic, so it is hard to determine how much the task should be offloaded in dynamic environment. To address these issues, ones consider partial offloading with resource allocation, e.g., power allocation and CPU resource allocation [3].

Partial offloading with V2I (Vehicle-to-Infrastructure) and V2V(Vehicle-to-Vehicle) links: Vehicles offload tasks to neighboring vehicles with idle computing resources. As the number of vehicles within the coverage of an RSU increases, VECS can effectively alleviate the loads by offloading to vehicles when the limited computing capacity of VECS cannot meet the computing requirements of vehicles. Moreover, the duration of the link between vehicles moving in the same direction is longer than that with the fixed-position VECS, because the difference in relative speed between vehicles is small. However, vehicles offload their tasks to unfamiliar vehicles, making it difficult to ensure the latency constraints and reliability of the task when sharing their computing resources. To improve this, ones optimally manage interference and channel quality by allocating communication resources on V2I and V2V link [4].

III. FUTURE RESEARCH DIRECTIONS AND DISCUSSION

In this paper, we present a survey on the topics of existing work in VEC. The research on VEC still has many issues to be solved. One example of open research issues is security and privacy. It is because the tasks offloaded to edge servers usually include sensitive and private data. It is expected that more efforts can be devoted into the research field of VEC.

IV. REFERENCES

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