소프트웨어 정의 모바일 에지 차량 네트워크(SDMEVN)의 센싱 데이터 수집 전략

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A Sensing Data Collection Strategy in Software-Defined Mobile-Edge Vehicular Networks (SDMEVN)

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ABSTRACT

This paper comes out with the study on sensing data collection strategy in a Software-Defined Mobile Edge vehicular networking. The two cooperative data dissemination are Direct Vehicular cloud mode and edge cell trajectory prediction decision mode. In direct vehicular cloud , the vehicle observe its neighboring vehicles and sets up vehicular cloud for cooperative sensing data collection, the data collection output can be transmitted from vehicles participating in the cooperative sensing data collection computation to the vehicle on which the sensing data collection request originate through V2V communication. The vehicle on which computation originate will reassemble the computation out-put and send to the closest RSU. The SDMEVN (Software Defined Mobile Edge Vehicular Network) Controller determines how much effort the sensing data collection request requires and calculates the number of RSUs required to support coverage of one RSU to the other. We set up a simulation scenario based on realistic traffic and communication features and demonstrate the scalability of the proposed solution.

키워드
Software-Defined Networks, sensing data collection, network topology, Vehicular ad hoc networks, optimal strategy

Ⅰ. Introduction

In order to solve the load computation of the cloud and decrease task computation latency, in this paper, we propose a novel sensing data collection strategy schemes which integrates the edge computing (fog computing) and the software defined networking (SDN) completely.

The Software Defined Network (SDN) is a growing computing and networking concept that has implicit ability to associate V2I and VANETS [1]. SDN separates control plane and data plane entities. It executes the control plane software on general purpose hardware. SDN permits self-supported deployment of control, traffic forwarding and computing devices. Fog computing is a extremely virtualized platform that provides compute, storage, and networking services between end users devices and existing cloud computing data centers, which has been considered as a cloud nearby to end users in order to provide computing and services with much less latency[2]. Nonetheless, edge network consists of several devices which configured with low computing capacity in general. Therefore, one standalone device may difficult to execute large amounts of data effectively. In fact, it is workable to execute computing tasks in fog network in distributed configuration by using network equipment with enough computation resources.

This paper presents the study on sensing data collection strategy in a Software-Defined Mobile Edge vehicular networking. The two sensing data collection schemes are Direct Vehicular cloud mode and edge cell trajectory prediction decision mode. In direct vehicular cloud , the vehicle observe its neighboring vehicles and sets up vehicular cloud for cooperative sensing data collection, the data collection output can be transmitted from vehicles participating in the cooperative sensing data collection computation to the vehicle on which the sensing data collection request originate through V2V communication. The vehicle on which computation originate will reassemble the computation output and send to the closest RSU. The SDMEVN (Software Defined Mobile Edge Vehicular Network) Controller determines how much effort the sensing data collection request requires and calculates the number of RSUs required to support coverage of one RSU to the other. In case the number of RSU required is more than 3, the edge cell trajectory prediction decision is selected. Thus, The RSU which extracts resources level and location information, then send that information to the SDMEVN controller to compute the movement trajectory of the candidate's vehicles. The SDMEVN forecasts and determines the position and then allows reconnecting to the following RSU of each vehicle. The goal is to maximize the number of vehicles that participate in executing a sensing data collection request (task) which consisting in sensing the environmental conditions towards vehicle¡¯s destination. We prove that dissemination cost of all types of vehicles when they choose sensing data collection strategy is a game problem to find an optimal strategy.

Ⅱ. Sensor data collection schemes in Software-Defined Mobile Edge Vehicular Network

Through Vehicle-to-vehicle(V2V communication mode, the vehicles running within a given On-Board Unit (OBU) can only access the RSU controller located in the corresponding segment. The vehicle in the RSU controller cell communicate with each other through wireless access vehicular environment (WAVE) communication or IEEE 802.11p. Each vehicle is equipped with computation storage with limited resources. For promising applications of cloud-based vehicular applications, such as video surveillance with storage resource sharing. Currently, urban buses in a city have installed High-Definition camera to monitor in-bus conditions [3]. The real-time storage of video on disk driver would rise additional issues such transmit these videos records to a remote data canter because of its size of the sensing data of video. To overcome the issue of size, the department of transportation is required to install hard-driver that have very large storage, which leads to a high cost [3]. In this scenario, the video content is uploaded in the RSU controller in the coverage area. When the bus moves far from the previous RSU controller. As the results, the video content is decoupled into several segments and stored separately in different RSU controller. To improve efficiently the computation of sensing data of environmental conditions by vehicular networks, the migration of virtual machine of the sensing service from one RSU controller to another cannot be performed efficiently if the resources of the destination RSU controller gave been intensively occupied, which leads to the loss of connectivity, then a failure on computation sensing data occurred.

In other words, each RSU controller and its computing server only executes the computation sensing data received from the RSU controller with which it connects. However, because the computation sensing output data is done in cooperative manner with a certain group of vehicles, the cooperative sensing data collection approach, the vehicle observe its neighbouring vehicles and sets up vehicular cloud for cooperative task computation, the computation output can be transmitted from vehicles participating in the cooperative sensing data computation to the vehicle on which the cooperative sensing data request originate through V2V communication. The vehicle on which computation originate will reassemble the computation output and send to the closest RSU controller along the road

As describe in the algorithm on the Figure 1, direct vehicular cloud, the vehicle observe its neighbouring vehicles and sets up vehicular cloud for cooperative sensing data collection, the vehicle which receives the sensing data collection request is elected as master. This vehicle sent a resource computation request to the neighbouring vehicle. Vehicles which receive the resource computation request responds by sending the level of the their storage , computation processing the master vehicle which will in turn validate the cooperative sensing data collection request through V2V communication. The vehicle on which computation originate will reassemble the computation output and send to the closest RSU. The SDMEVN (Software Defined Mobile Edge Vehicular Network) Controller determines how much effort the sensing data collection request requires and calculates the number of RSUs required to support coverage of one RSU to the other. In case the number of RSU required is more than 3, the edge cell trajectory prediction decision is selected. Thus, The RSU which extracts resources level and location information, then send that information to the SDMEVN controller to compute the movement trajectory of the candidate's vehicles. The SDMEVN determines the position and then allows reconnection to the following RSU of each vehicle. The goal is to maximize the number of vehicles that participate in executing a sensing data collection re-quest (task) which consisting in sensing the environmental conditions towards vehicle¡¯s destination. We prove that dissemination cost of all types of vehicles when they choose sensing data collection strategy is a game problem to find an optimal strategy

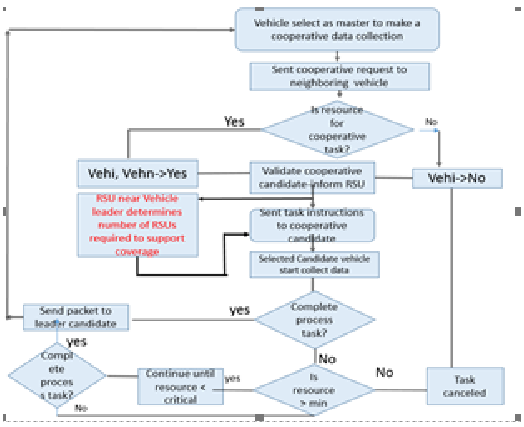

Figure 1 Algorithm for the sensing data collection strategy in Software-defined Mobile edge vehicular network

III. Evaluation

In this section, we show illustrative results to demonstrate the performance of our proposed optimal sensing data collection schemes. We consider ten RSUs located along four-lane one-way road and use Simulation of Urban Mobility to simulate the road traffic and Mininet-wifi [4] The density of the vehicles on the road is set as m = 0.4. , and the vehicles are running at speed 80 km/h. The computation of sensing collection tasks of these vehicles are grouped into five modes with the probabilities {0.04, 0.15, 0.3, 0.4, 0.1}. As resource requirement is the most important factor affecting the sensing data collection performance

Figure 2 evaluates the total computation sensing data collection costs in terms of the density of the vehicles on the road. We compare the performance of our proposed edge cell predictive trajectory decision mode and direct vehicular cloud transmission scheme. It can be seen that the edge cell predictive trajectory decision mode scheme reduces greatly the cost when the road seems to have highly vehicle density. Therefore, the cost-saving operative is low when vehicle density is

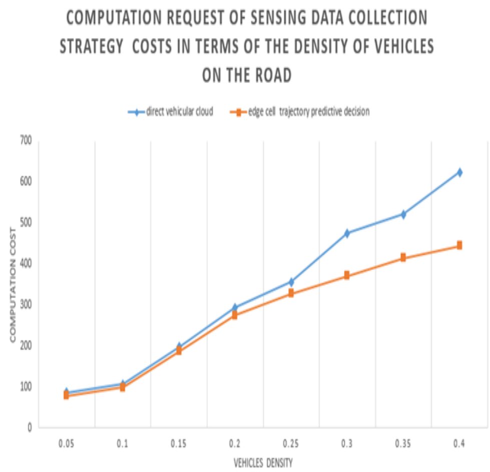

Figure 2 Computation request of sensing data collection strategy costs

low, because with lower traffic density, the total number of vehicles on the road is approximately small.

Furthermore, a large portion of the off-loaded sensing data collection tasks on the Mobile edge computing SDN controllers can be accomplished within the defined period when the vehicles accessing RSU controller have not been altered. Therefore, there is no need to adopt direct vehicular cloud strategy.

IV. Conclusions and Future Works

In this article, we proposed a sensing data collection schemes in Software defined mobile edge vehicular networks. Based on the schemes, we discussed the strategy based on the number of RSU controller needs to accomplish the sensing data task completion and the request task cost of direct vehicular cloud or edge cell trajectory prediction modes. The results demonstrated that our scheme greatly reduces the sensing data collection cost

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