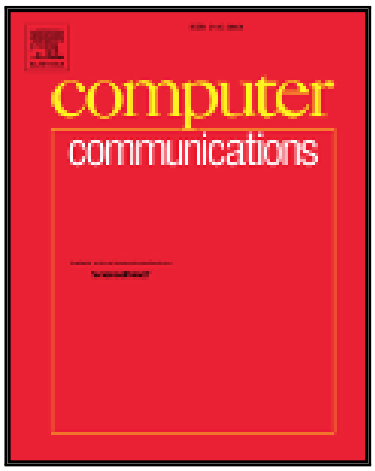

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Latency Estimation Based on Traffic Density for Video Streaming in the Internet of Vehicles

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Abstract: Many applications, such as intelligent transportation systems and mobile multimedia, use Internet of Vehicles (IoV). In IoV, users often access multimedia content from anywhere using Internet connectivity to remote video streaming servers. Due to the high mobility of the nodes in IoV, however, maintaining quality of service (QoS) for these video streaming applications with respect to parameters such as jitter, throughput, buffering, and transmission delays is a challenging task. Especially in the urban environment, the performance of a video streaming protocol is significantly affected by the variation of the traffic density. As a result, how to effectively analyze the impact of traffic density as well as vehicular mobility on the QoS of video streaming is the key for the routing protocol design in IoV. In this paper, based on the relationship between the traffic density and the latency characteristics in urban environment, two models are proposed to accurately estimate the video streaming latency according to the average inter-vehicle distance and radio range. After that, an optimal routing strategy is given by selecting the path from all available paths to minimize the experienced latency for video streaming. Numerical results show that in urban environments, our proposed model has high accuracy under different configurations.

Keywords: Internet of Vehicles, video streaming, latency model, traffic density

1. INTRODUCTION

The Internet of Things (IoT), as the name implies, "things connected to the Internet", is an important part for the new generation information technologies. Generally, it has two meanings: first, the IoTs is an extension and expansion of the network whose core and foundation is still the Internet. Second, the extension and expansion of the IoT can achieve the intelligent identification of goods, positioning, tracking, monitoring and management of a network based on information exchange and communication between any items[1, 2]. As a special case of IoTs, the Internet of Vehicle (IoV) is quickly developing from a series of sensors which offer information to chauffeurs and upload the filtered sensed data to centralized processing equipment; to define performance metric functions and optimize them through exchanging sensor inputs among vehicles. These functions, in the autopilot system, can achieve the maximum safety and efficiency of the vehicles and reduce the environmental impact. That is, the introduction of IoV will definitely improve the road safety with advanced sensor technology[3], expanded environmental awareness and timely information exchange[4].

In summary, the main goal of IoV is providing safety guarantee and comfort improvement for passengers. In IoV, the video streaming is a desired application, which is more complicated than others since it has strict QoS limitations and a greater amount of information to be transferred. Video files can have large volumes depending on their corresponding applications. A vehicle is able to send its view of forward path to the behind vehicles as an online video stream to assist them in overtaking processes for safety enhancement. It is also possible for a vehicle to share a video clip with other vehicles or request them a video chat as an entertainment application for comfort and UE (user experience) improvement.

As a result, the video streaming over IoV is an important and attractive service. However, compared with traditional wireless networks, vehicles are highly dynamic in IoV, making the underlying network topology change rapidly[5, 6]. As a result, the probability for network partitions is high thereby the end-to-end connectivity cannot