INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Internet of Connected Vehicles (IoCV) comprises smart vehicles which communicate among themselves and are connected to the Internet through static infrastructure nodes. Infrastructure nodes may use heterogeneous network technologies like cellular networks, Wifi networks, or Dedicated Short Range Communication (DSRC) networks. Among these networks, cellular networks have limited resources and impose access costs. Therefore, reducing the number of simultaneous cellular connections in an IoCV is a requirement. Smart vehicles of IoCV need persistent Internet connections for various safety messages and infotainment services. Among the infotainment services, video type infotainment services are prevalent. As the major portion of the traffic carried by the Internet core is of video type, reducing video traffic is the need of the hour. To meet the high-quality and low-latency demands for video services, content originators use the services of Content Distribution Networks (CDN). While providing video infotainment services over IoCVs, the objectives of CDN providers are to reduce the traffic volume of the Internet core, reduce service costs, and increase service profitability. To reduce the traffic volume, CDN providers deploy replica servers to serve the demands locally. However, if several vehicles demand the same video content simultaneously, like in the case of a live video streaming, a CDN replica server may get overwhelmed by the number of concurrent and redundant flow requests. As the content demand is homogeneous, the number of one-to-one flows to the CDN replica server can be reduced by bringing the content further closer to an IoCV using edge servers. Using infrastructure nodes as edges incurs deployment costs or carrier partnership costs, whereas using vehicles as edges needs Vehicle-to-Vehicle (V2V) collaborations. To reduce the service cost, the CDN provider needs to minimize the usage of simultaneous cellular connections and maximize V2V collaborations while ensuring service quality and client satisfaction. To generate additional revenues, CDN providers offer multi-tier video services where higher-tier clients pay more for enhanced video quality. However, the dynamic connectivity among vehicles and the intermittent availability of different networks (Wifi, cellular, DSRC) make the above-mentioned tasks extremely challenging. Accordingly, the objective of this dissertation is to find cost-effective solutions for CDN providers to run video infotainment services over IoCVs. This dissertation has four contributions toward the objective. The first contribution

is focused on devising a centralized solution for reducing Internet bandwidth usage and the number of simultaneous cellular connections by minimizing the number of edge vehicles. The second contribution has proposed a distributed version of the first contribution, which helps CDN providers to reduce capital expenditure by avoiding setting up expensive servers of high-computing facilities. In the third contribution, a solution is provided for efficient Vehicle-to-Infrastructure (V2I) mode selection to increase CDN providers' profit in heterogeneous network scenarios. The fourth contribution of this dissertation devises an edge selection solution for CDN providers to provide multi-tier streaming services. The experiment results show that in comparison to existing solutions, the proposed solutions are the most cost-effective for CDN providers.