Mobile SDN: Urban Transportation with Vehicular Cloud

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***Abstract*—We propose a Mobile SDN framework to prompt the future intelligent transportation system with cloud assistance. The proposed framework consists of three layers and involves virtualization, software defined network, wireless communication, vehicular cloud integration, service composition and Internet of vehicles. The authors' brief background is provided in the end.**

I. Collaborative surveillance for autonomous vehicular cloud

A collaborative surveillance scenario can be implemented in the proposed vehicular cloud that is abstracted to a *virtual car*, in which each vehicle can obtain the complete road situations based on the video sensing results. The key idea is to use the autonomous cars in a virtual car as a surrogate nodes to provide video sensing services to other vehicles. Only if a surrogate device can provide mobile sensing or computing services within a given delay threshold (e.g., the response time for the system taking actions to avoid collisions) will the surrogate service entity be used for the cars within the group. Additionally, each vehicle can utilize (or control) sensors from its neighboring vehicles within a given time period. A Mobile Software Defined Networking (MSDN) service model is used to support the realtime surveillance and control among autonomous vehicles. By collecting the processed or sensed information from multiple vehicles, an autonomous vehicle can derive road travel situations with bigger scope such as a bird view or panoramic view, and prepare or react to road traffic situations promptly. Furthermore, automatic collaborative control among vehicles can be performed, such as adjusting camera directions among multiple vehicles in order to have better surveillance coverage.

II. Driving in the Cloud

We propose an open and distributed mobile cloud computing framework called Dr.Cloud, derived from the term "Driving-in-the-Cloud", for inter-vehicle surveillance and control applications.

The Dr.Cloud is an open and distributed mobile cloud computing framework, which consists of three layers: The bottom layer is the MSDN layer, which supports efficient, time sensitive content-based pull and push services, and distributed messaging for cloud applications. One major component in the MSDN layer is virtual mobile SDN-enabled in-vehicle device. This device interacts with vehicle on board unit to access vehicle control system and sensor system to collect data and build virtualized service latyer. The middle layer is Virtualization Service Layer (VSL), which provides virtualized interfaces to Dr.Clouds basic services including data, applications, resource, sensing, and trust. These standardized interfaces help organize distributed smart devices, sensors, mobile platforms and dedicated Internet clouds, into a seamless, secure, self-managed, and optimized fabric of computing and communication resources. VSL also interfaces with the MSDN to access the fabric status information and to provide resource availability awareness to federation and cloud applications. The upper layer is application layer, where the applications are developed based on the MSDN and VSL functions. The example application in the previous section runs in this layer.

III. Authors' background

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