An overview of Vehicular Cloud Computing

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ABSTRACT

Cloud computing is one of the most beneficial technologies of the recent century. A variant of cloud computing spans other technologies like mobile computing, intelligent transport system, multimedia systems and many other Information Communication Technologies. Vehicular Cloud Computing integrates cloud computing with a Vehicular ad-hoc Network. Vehicular Cloud Computing aims to combine cloud computing services leverages to enhance Vehicular Ad-hoc Network applications. This research deals with the study of vehicular cloud computing, its types and usage. Cloud computing is a vastly emerging technology used in various aspects of life. VCC deals with traffic management, resource allocation to vehicles, collision prevention and communication among vehicles for the sake of comfort and security on roads. Following is the basic introduction of VCC.

I. INTRODUCTION

Cloud computing has been proven to hurt the modern communication network[1-4]. With the merge of cloud computing, the Internet of Things offers new ways of communication. The merge of IoT and cloud computing technologies introduce new horizons of technologies. Vehicular cloud computing is one of them[5]. Vehicular cloud computing is an emerging technology that uses vehicular ad hoc networking such as VANETs for better traffic control and road safety by integrating sensors and data carriers vehicle nodes. A VANET is a vehicular networking technique in which vehicles are made independent nodes and connected wirelessly. This network provides traffic control, collision prevention, safety, and comfort to drivers. Vehicular cloud computing provides better traffic management by providing resources such as storage, communication, computing and the internet. In simple words, vehicular cloud computing is an intelligent traffic control system that allows drivers to have a safe, collision-free experience. The cloud service provider or cloud controller will register the vehicular resources, and the nodes can utilize those resources by registering to the system. There are generally three levels of the vehicular cloud computing system.

- Central cloud
- Roadside cloud
- Vehicular cloud

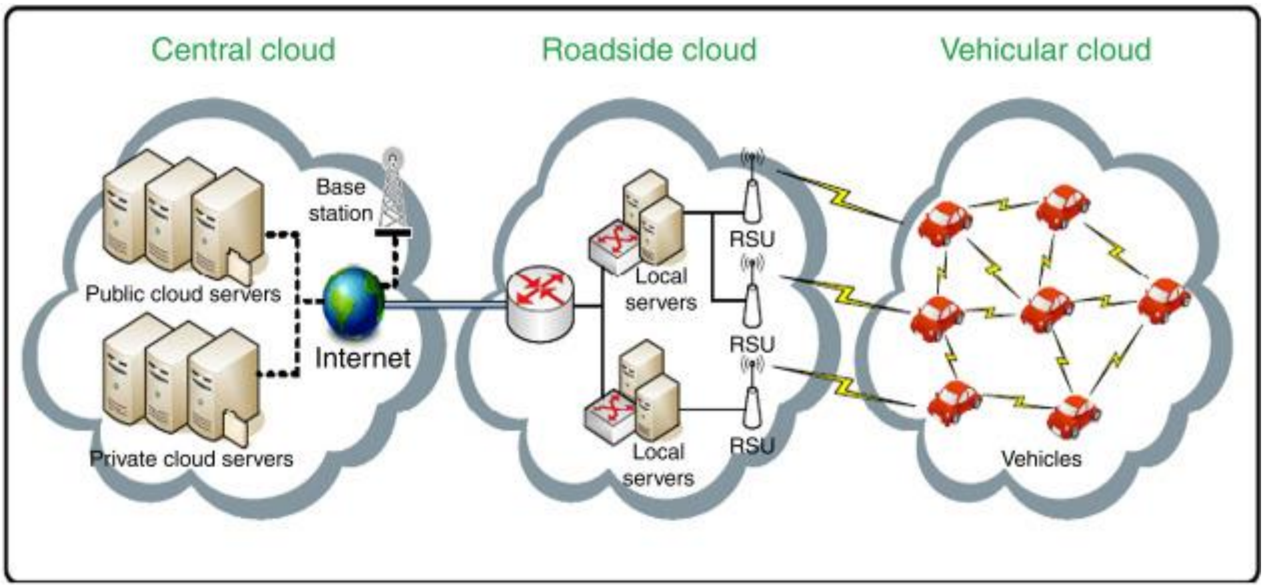

Fig 1: vehicular cloud system

The central cloud contains large public and private cloud servers that store registered resources and vehicular nodes. If a vehicle wants to utilize a cloud resource, it must register it in the cloud provider. It will be stored in the public cloud server. These servers provide internet and communication facilities to the vehicles. There is a base station that connects the servers to the system.

The roadside cloud server consists of local servers and radio interface stations called RSUs. The local servers are dedicated to a particular area and provide virtualized resources. The RSUs provide radio interfaces used by the vehicles to access cloud resources. This level of the system acts as a cloudlet, for example, a group or cluster of servers connected over the internet and all the nearby devices can access the cloud by using the cloudlet.

The third level of VCC is a vehicular cloud that contains vehicles and physical nodes. It connects all the nodes to the system, and the sensors used in the nodes can sense other nearby vehicles. Since physical nodes/ vehicles are unstable, it requires machine management to control the nodes. Moreover, when a vehicle travels out of the range of its cloud system, it becomes harder to control and manage it.

We will explore further how these levels of VCC technically work.

II. Working of Vehicular cloud computing

This section will reveal the working of vehicular cloud computing. Essentially there are two types of vehicular cloud computing networks:

- GVCC (generalized vehicular cloud computing)
- SVCC (Specified vehicular cloud computing)

In GVCC, a cloud controller manages and allocates all the resources to the vehicles. The cloud controller is responsible for scheduling the resources. Vehicles do not have to concern with their respected cloud sites as resources are allocated by the controller. The vehicles apply for resources, and the controller provides them with them. If a vehicle uses its connection with the cloud site due to mobility, the controller schedules another cloud site to it.

In SVCC, however, there is no controller. Hence, the vehicles have to manage resources their selves. The vehicles consider another vehicle as their cloud site and apply and maintain resources independently.

GVCC is a widely used technique since it has better resource management, but it takes much extra computation for the cloud controller to manage and schedule resources. SVCC does not overload the system with extra computations and could be more efficient.

In the roadside cloud, the local servers act as cloud sites. The RSUs provide radio interfaces, but only nearby vehicular nodes can access the network because RSUs have a radio range. When a vehicle gets out of the radio range, it loses access to the cloud.

In the vehicular cloud, the most challenging task is vehicular machine management. As the vehicles are immobile ad run along a roadside, they pass through different RSUs. The vehicles have to be shifted from one RSU to another, called vehicular migration. Suppose a vehicle passes the range of a particular RSU and does not get in the range of another RSU. Alternatively, a vehicle may get in the range of two or more RSUs. Rifaat Et El proposes one solution. This algorithm works so that the migration is attempted again if there is no capacity for an additional vehicle in the host. The host with no additional capacity is omitted from the target list.

Conclusion

VCC is efficient traffic management, but it takes a lot of effort and resources. Public, private and local servers, RSUs and advanced sensors must be implemented to achieve the desired goal. It is not cost-effective and works more efficient in areas with relatively more minor traffic and smooth roads.

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