

Flexible Software-Defined Networking for Roadside Unit Clouds in support of the Internet of Vehicles

Dr.Padmaja.Pulicherla

Professor, Dept. of CSE, TKR Engineering College, Hyderabad, Telangana, India.

ABSTRACT: By tradition, the vehicle has been the extension of the man's ambulatory system, passive to the driver's commands. Contemporary advances in communications, controls and embedded systems have transformed this model, paving the way to the Intelligent Vehicle Grid. In this paper, we propose a novel vehicular cloud architecture called RSU cloud, which consists of traditional RSUs and specialized microscale datacentres. The RSU cloud hosts services to meet regularly changing demands from the vehicle grid. The modernisation of our RSU cloud architecture lies in promoting from the flexibility and deep programmability offered in software defined networking (SDN). In SDN, there are two communication planes, the physical data plane and an abstracted control.

KEYWORDS: Roadside Unit (RSU), Internet of Vehicles (IoV), Software-Defined Networking (SDN)

I.INTRODUCTION

The urban fleet of automobiles is rapidly evolving from a series of sensor structures that provide data to drivers and add filtered sensor data (e.g., GPS locality, road conditions, and many others.) to the cloud; to a network of self-reliant cars that change their sensor inputs among every other in order to optimize a nicely described application characteristic. This characteristic, within the case of independent automobiles, sparks off sending of the passengers to the destination with maximum safety and luxury and minimal effect on the surroundings. In other words, one is witnessing in the vehicle fleet the same evolution from Sensor Web (i.e., sensors are available from the Internet to get their data) to the Internet of Things (the additives with embedded sensors are networked with each different and make sensible use of the sensors). In the sensible domestic, the IOT shaped through the myriad of sensors and actuators that cowl the house internally and externally can manipulate all the utilities in the most low-priced manner, with maximum comfort to residents, with simply no human intervention. Similarly, in the present day power grid, the IOT shaped by using all additives large and small can control electrical loads in a secure and efficient manner, with the operators now playing the role of observers. In the vehicular community, like in all the other IOTs, while the human control is removed, the self-sufficient motors need to successfully cooperate to preserve easy traffic flow in roads and highways. Visionaries expect that the cars will behave a whole lot better than drivers allowing addressing more traffic with lower delays, fewer pollutants and certainly higher driver and passenger comfort. However, the complexity of the allotted manipulate of masses of heaps of cars cannot be taken gently. If a natural disaster suddenly happens, say an earthquake, the automobiles ought to be capable of coordinating the evacuation of essential areas in a speedy and orderly way. This requires the capability to effectively talk with every other and also to find out wherein the needed sources are (e.g., ambulances, police cars, information approximately break out routes, image about the harm that has to be prevented, etc.). Moreover, the communications need to be secure, to save our malicious attacks that in the case of self-sufficient vehicles should be actually deadly in view that there's no standby control and cut up the second chance of intervention by the driver (who can be surfing the web).

Moreover, the communications ought to be relaxed, to prevent malicious assaults that inside the case of self-sufficient motors can be literally deadly in view that there is no standby control and the cut up-second chance of intervention by using the driving force (who can be browsing the web). This green communications and disbursed processing the surroundings can be supplied by means of a new community and compute paradigm particularly designed for motors-

the Vehicular Cloud. This cellular cloud gives several critical offerings, from routing to content seek, spectrum sharing, dissemination, assault protection, etc., to self-sufficient vehicle packages via popular, open interfaces that are shared with the aid of all automobile producers. This article discusses the evolution from smart car grid to self-reliant, Internet-related motors and vehicular cloud. In specific, we spotlight the blessings of the Internet of Autonomous Vehicles and at the equal time expose its demanding situations stemming from networking for content distribution to possible adversarial assaults.

II. LITERATURE SURVEY

Mario Gerla and Eun-Kyu Lee advise [1] the evolution from Intelligent Vehicle Grid to Autonomous, Internet-connected Vehicles, and Vehicular Cloud. Recent advances in communications, controls and embedded structures have changed this version, paving the way to the Intelligent Vehicle Grid. The subsequent step on this evolution is simply across the nook: the Internet of Autonomous Vehicles. Pioneered through the Google automobile, the Internet of Vehicles may be a distributed transport cloth successful to make its very own choices approximately riding customers to their destinations. Like other crucial instantiations of the Internet of Things (e.g., the smart constructing), the Internet of Vehicles will have communications, storage, intelligence, and mastering abilities to count on the clients' intentions. The idea as a way to help transition to the Internet of Vehicles is the Vehicular Cloud, the equivalent of Internet cloud for cars, offering all the offerings required through the self-reliant motors.

Euisin Lee, Eun-Kyu Lee, Soon Y. Oh, and Mario Gerla recommend [2] how VANET evolves with two emerging paradigms - Vehicular Cloud Computing and Information Centric Networking. VCC brings the mobile cloud model to vehicular networks and there fore adjusts the manner of network provider provisioning, whereas ICN adjusts the perception of information routing and dissemination. They envision a new vehicular networking machine, Vehicular Cloud Networking, on pinnacle of them. The article scrutinizes its structure and operations and discusses its layout ideas.

Monica Mandal, Chaitrali Landge, Pramila Gaikwad, Uma Nagaraj, Ashwini Abhale [3] examine many studies papers on VANET, cloud computing and vehicular cloud. By analysing their limitations, demanding situations and goals, beneficial facts on vehicular cloud are received. Also, the services that are provided by VC and their security and privacy problems whilst it saved on cloud are mentioned in element.

C Shrvanthi, Dr. H S Guru Prasad [4] endorses the implementation of EMAP in cloud to enhance the computational efficiency and additionally to reduce the value, conversation, storage and upkeep overheads. The proposed VuC (VANET the usage of Cloud) which uses Expedite Message Authentication Protocol (EMAP) assures at ease conversation most of the automobiles. The concept of cloud computing used in VuC effectively will increase the computational performance. EMAP effectively reduces the message loss ratio with the aid of using the Certificate Revocation List. Also the proposed machine can be carried out to retrieve the other sort of documents such as image, video, audio.

Rasheed Hussain and Heekuck Oh Propose [5] CaaS (Cooperation as a Service) architecture for VANET clouds. Highly mobile vehicular nodes share their coarse-grained MVs (Mobility Vectors) with cloud infrastructure thru the stationary or cellular GTs (Gateway Terminals). Cloud, after processing and constructing great grained traffic data and caution messages based on the bodily segments of the street, sends it lower back to the subscriber cars thru GTs inside the respective avenue segments. The proposed scheme preserves conditional privacy and different security parameters consisting of authentication, integrity, and non frameability. Moreover, the proposed scheme is widespread from a number of perspectives which includes NLoS (NonLine-of-Sight) issues, powerful transmission variety, and creation of prolonged visitors view. The current solutions are afflicted by the aforementioned issues because of loss of LoS, height of cars, and obstacles parameters within the simulation tools. Besides, cloud is understood to offer limitless sources that could be utilized in truly each domain. Additionally, the facts generated from cars (for example, in step with the DSRC well known, beacons are generated so as of milliseconds) may be known as huge data with appreciate to the computing power of the individual automobiles.

III. PROPOSED ALGORITHM

In this paper, we propose a novel vehicular cloud architecture called RSU cloud, which consists of traditional RSUs and specialized microscale datacenters. The RSU cloud hosts services to meet frequently changing demands from the vehicle grid. The novelty of our RSU cloud architecture lies in benefiting from the flexibility and deep programmability offered in software-defined networking (SDN). In SDN, there are two communication planes, the physical data plane and an abstracted control plane. This decoupling of control and data planes enables the flexibility and programmability of the SDN. In the RSU clouds, virtualization via virtual machines (VMs) and SDN is employed to dynamically instantiate, migrate, and/or replicate services and dynamically reconfigure data forwarding rules in the network to meet the frequently changing service demands.

The scope of this paper and our contributions are as follows:

- 1) Provide the architecture for the RSU cloud and its micro datacenters;
- 2) Present the network reconfiguration overhead analysis by emulating an Open Flow-enabled SDN in Mininet.
- 3) Define the RSU cloud resource management (CRM) multiobjective Integer Linear Programming (ILP) model and systematically solve it to achieve a Pareto optimal frontier (POF) of solutions;
- 4) design an efficient heuristic for RSU CRM;
- 5) Use the Markov decision process (MDP) and reinforcement learning to select a Pareto optimal solution, which minimizes the costly service migrations over the long term.

Flowchart for Overall System Architecture

We propose a system with following advancements:

- The deep programmability of SDN to dynamically reconfigure the services hosted in the network and their data forwarding information to efficiently serve the underlying demand from the vehicle grid.
- Reconfiguration of network which takes more cost has been modified.

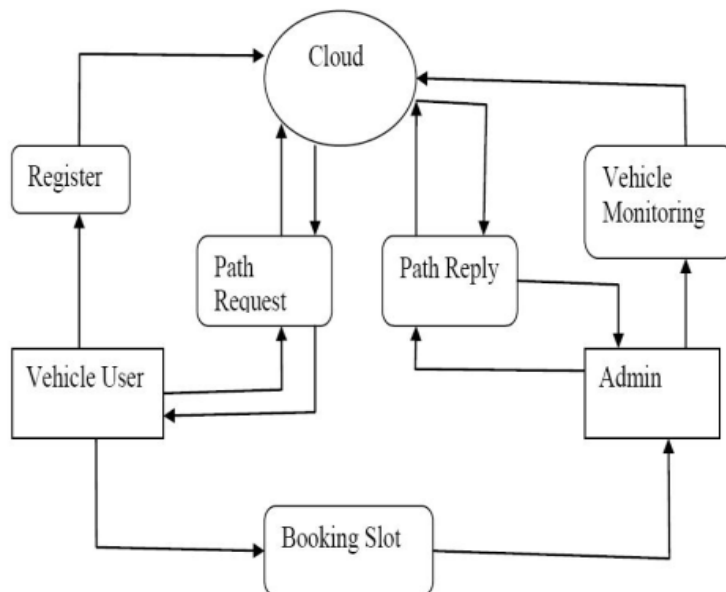


Figure 1: System Architecture

The proposed architecture is implemented using Java Programming Language, Apache Tomcat Server 6.0, Oracle database, MATLAB 7.6.0 (R2008a) and MySQL 5.0.

Communication from OBU to RSU-Cloud module: A mandatory registration is done for the drivers. The cloud keeps track of the drivers and constantly obtains details like seat belt status, driver stability status (alcoholic or not) and the current location status.

Vehicles Mining Services module: Here, the mining algorithm is used to quickly detect dangerous road situations, issue early warning messages, and assist drivers to make informed decisions to prevent accidents. The drivers are comforted with routes of their choice like safest path, fastest path and a comfortable path.

Requesting Services to RSU-Cloud module: The OBU can request RSU-cloud for number of services. Here user requests cloud for number of hotels, hospitals, petrol bunk, and alcoholic drivers travelled and non-alcoholic drivers travelled etc. Based on the user request, RSU cloud will respond to OBU's.

Intelligent Parking RSU-Cloud Service module: Background Subtraction is a computational vision process of extracting foreground objects in a particular scene. Decision Process deals with the Car Parking Area. It means it is defined as "Occupancy" for the car parking space that is not free and "Vacancy" if it is vacant. This decision is updated to server. The Android application collects all information from server through web server, and it calculates total number of slots, engaged and free slots. It shows graphical view for engaged and free slots via app.

VI.CONCLUSION

The urban fleet of cars is evolving from a collection of sensor structures to the Internet of Autonomous Vehicles. Like different instantiations of the Internet of Things, the Internet of Vehicles may have communications, storage, intelligence and gaining knowledge of competencies to count on the clients' intentions. Thus, we premeditated and developed the IoV and integration of sensors and microcontrollers in the vehicles and fixed roadside infrastructure to form an intelligent vehicle grid in order to obligingly increase traffic flow and road safety.

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