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Moving VANET to Vehicular Cloud

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ABSTRACT: This conceptual paper seeks to put forth a novel vision, namely that advances in vehicular networks, embedded devices, and cloud computing can be used to set up what are known as vehicular clouds (VCs). The radio-equipped vehicles could keep the driversinformed about potential safety risks and increase their awareness of roadconditions. The view then expanded to include access to the Internet andassociated services. This position paper proposes and promotes a novel and morecomprehensive vision namely, that advances in vehicular networks, embeddeddevices, and cloud computing will enable the formation of autonomous clouds ofvehicular computing, communication, sensing, power and physical resources.A key features distinguishing VCs from conventional cloud computing is that mobile VCresources can be pooled *dynamically* to serve authorized users and to enable*autonomy* in real-time service sharing and management on terrestrial, aerial, oraquatic pathways or theatres of operations.

KEYWORDS: Vehicular networks, cloud computing, resource management, VANET

I. INTRODUCTION

Vehicular Cloud (VC) to refer to: a group of largely autonomous vehicles whose corporate computing, sensing, communication and physical resources can be coordinated and dynamically allocated to authorized users.In our view, the VC concept is the next natural step inmeeting the computational and situational awareness needs not only of the drivingpublic but also of a much larger segment of the population. A primary goal of theVC is to provide on-demand solutions to events that have occurred but cannot bemet reasonably with pre-assigned assets or in a proactive fashion.It is important to delineate the structural, functional and behavioral characteristicsof VCs. As a step in this direction, in this position paper, we identify autonomouscooperation among vehicular resources as a distinguishing characteristic of VCs.VC can dynamicallyadapt its managed vehicular resources allocated to applications according to theapplications' changing requirements and environmental and systems conditions.

Section 1: VANET

Recent years rapid development in wireless communication networks has made Inter-VehicularCommunications (IVC) and Road-Vehicle Communications (RVC) possible in Mobile Ad Hoc Networks (MANETs). This has given birth to a new type of MANET known as the Vehicular Ad Hoc Network (VANET) .

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VANET is a special case of MANET. Their resemblance is the rapidly moving nodes and the incessantly changing network topologies. However, their difference is that in VANET, the nodes are moving on predefined roads, and their trails aren't too complicated. In VANET, vehicle velocities are restricted by speed limits and the situation of road traffic and traffic control mechanism. Furthermore, future vehicles can equip with rechargeable energies or solar cells, so energy restriction, which exists in MANET, will not occur inVANET. It can be concluded that VANET is a special case of MANET, which is very flexible, and relatively easy tomanage.

The application of VANET includes the traffic control and share of multimedia information. When VANET is applied to the traffic control, it can distribute the information about theroad situation, such as traffic accidents and road congestion, and is helpful in avoiding accidents [2]. It can steer vehicles at some important sites, for example cross roads and the entranceto highway [3]. Therefore, it can effectively reduce road accidents, improve safety, and manage city traffic with high efficiency, which is shown in Figure 1. Moreover, VANETcan share some information between cars, such as weather forecast, gas station and restaurant addresses. When Connecting to Internet as terminal networks VANET can also provide music download serives.

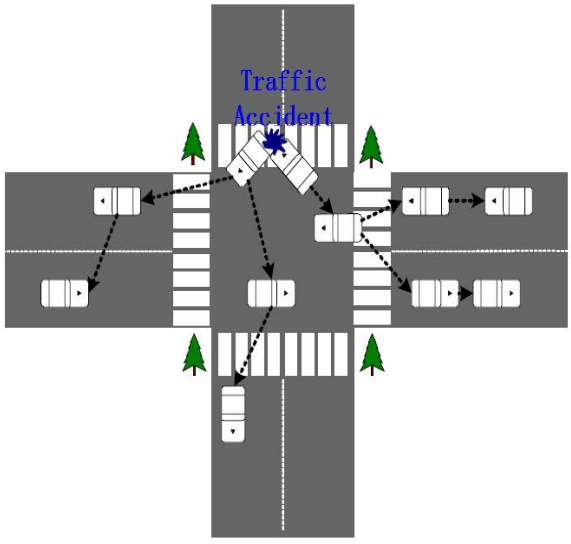

Figure 1. The application of VANET to traffic control

Section II. WHAT IS CLOUD COMPUTING

A. The background of cloud computing

In recent 10 years, Internet has been developing very quickly. The cost of storage, the power consumed by computer and hardware is increasing. The storage space in data center can't meet our needs and the system and service of original internet can't solve above questions, so we needbasic style on it. Its style is as follows: new solutions. At the same time, large enterprises have tostudy data source fully to support its business. The collection and analysis must be built on a new platform. Why we need cloud computing? It is to utilize the vacant resources of computer, increase the economic efficiency through improving utilization rate, and decrease the equipmentenergy consumption.

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B. Cloud computing principle

It is difficult to define the cloud computing. Computing is a virtual pool of computing resources. It provides computing resources in the pool for users through internet. Integrated cloud computing is a whole dynamic computing system. It provides a mandatory application programenvironment [4]. It can deploy, allocate or reallocate computing resource dynamically and monitor the usage of resources at all times. Generally speaking cloud computing has a distributed foundation establishment, and monitor the distributed system, to achieve the purpose of efficient use of the system[5].

Cloud computing collects all the computing resources and manages them automatically through software. In the process of data analysis, it integrates the history data and present data to make the collected information more accurate and provide more intelligent service for users andenterprises. The users need not care how to buy servers, software's, solutions and so on. Users can buy the computing resource through internet according to their own needs. Cloud computing does not depend on special data center, but we can look it as the inevitable product of gridcomputing and efficiency computing. However, compared with general network service, cloud computing is easy to extend, and has a simple management style. Cloud is notonly simply collect the computer resource, but also provides a management mechanism and can provides services for millions of users simultaneously.

Nowadays, virtualization is entering every field of data center. It has become useful tool and improved service capacity. When the storage and computing capacity of the server cluster are surplus, we need not purchase servers, all we need to be to add a virtual machine running on the server. If the cluster is large enough,the request of adding server will have marginal effect, and then we can save the money that should be used in purchasing new servers. At the same time, cloud computingprovides powerful supports for SAAS (software as a service). It integrates all the companies that provide similar services in the internet in order that users can compare and select service providers.

Cloud computing provides dependable and secure data storage center, providesimmense possibility for internet application, provides infinite space for storing and managing data, provides powerful computing capacity for users to complete all kinds ofapplication. Future computer may only be used for connecting internet to implement services based on cloud computing. Users will change their habit of using computer totally, from services centered by desktop to services centered by Web. Cloud computing's blueprint is coming: in the future, we only need a notebook pc or a mobile phone, then we can complete what we want through net service including the huge tasks such as supercomputing. So end-user is the trueowner of cloud computing. The aim of application of cloud computing is to combine all the resources, and let anyone can use it. From the most basic significance, cloud computing is to utilize software and data of the internet. [6].

C. Cloud computing style

Though people have different views on the cloud computing, they have already reached an agreement on the

1 SAAS(Software as a service)

This kind of cloud computing transfer programs to millions of users through browser. In the user's views, this can save some cost on servers and software. In the provider's views, they only need to maintain one program, this can also save cost. Salesforce.com is so far the most famous company that provides this kind of service. SAAS is commonly used in human resource management system and ERP(Enterprise Resource Planning). Goole Apps and Zoho Office is also providing this kind of service.

2 Network service

Net service has a close relation with SAAS. The service providers can help programmers develop applications based on internet instead of providing single machine procedurethrough providing API(Application Programming Interface).

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3 PAAS(Platform as a service)

Platform as a service, another SAAS, this kind of cloud computing providing development environment as a service. You can use the middleman's equipment to develop yourown program and transfer it to the users through internet and servers.

Section III: Building VANET Cloud

A. Proposed System:

This is a new concept for which a smallscale prototype is being built. No largescale prototype exists at the moment. Practical implications VCs are a novel concept motivated by the realization of the fact that, most of the time, the tremendous amount of computing and communication resources cavailable in vehicles is underutilized. Putting these resources to work in a meaningful way should have a significant societal impact.

The trend in the car manufacturing industry is to equip new vehicles with majorsensing capabilities in order to achieve efficient and safe operation.

For example,Honda is already installing cameras on their Civic models in Japan. The cameras trackthe lines on the road and help the driver stays in lane.

A vehicle would thus be amobile sensor node and a VC can be envisioned as a huge wireless sensor networkwith very dynamic membership. It would be beneficial for a vehicle to query thesensors of other vehicle in the vicinity in order to increase the fidelity of its ownsensed data, get an assessment of the road conditions and the existence of potentialhazard ahead.

For example when the tire pressure sensor on a vehicle reports the lossof air, vehicles that are coming behind on the same lane should suspect the existenceof nails on the road and may consider changing the lane. The same happen when avehicle changes lane frequently and significantly exceeds the speed limit; vehicles that come behind, and which cannot see this vehicle, can suspect the presence ofaggressive drivers on the road and consider staying away from the lanes and/orkeeping a distance from the potentially dangerous driver. The same applies whendetecting holes, unmarked speed breakers, black ice, etc. Contemporary VANETdesign cannot pull together the required solution and foster the level of coordinationneeded for providing these safety measures.

B. Service-Oriented Architecture

A service-oriented architecture is a flexible set of design principles used during the phases ofsystems development and integration. A deployed SOA-based architecture will provide a loosely-integrated suite of services that can be used withinmultiple business domains. The OASIS (Organization for the Advancement of Structured Information Standards) defines SOA as the following: A paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations.

As shown in Fig.2 , there are three roles in SOA. The service provider provides services according to contract, and publishes them to service broker. The service consumer is alsonamed service user, which finds services on the broker and calls them on the providers. The service broker stores the information of services from providers. This model showsthe most important characteristic of SOA, that is, the loosely coupled architecture.

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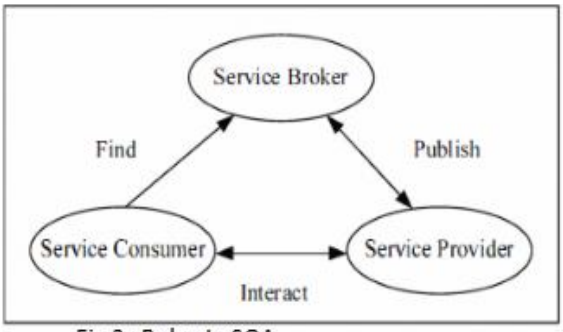

Fig 2 : Roles In SOA

C. Layers of VANET Cloud

We illustrate the layers of the whole cloud conferencing system in Fig. 3. We can divide the whole system into four layers from bottom to top in the print. They are physics layer, virtualization layer, platformlayer and application layer.

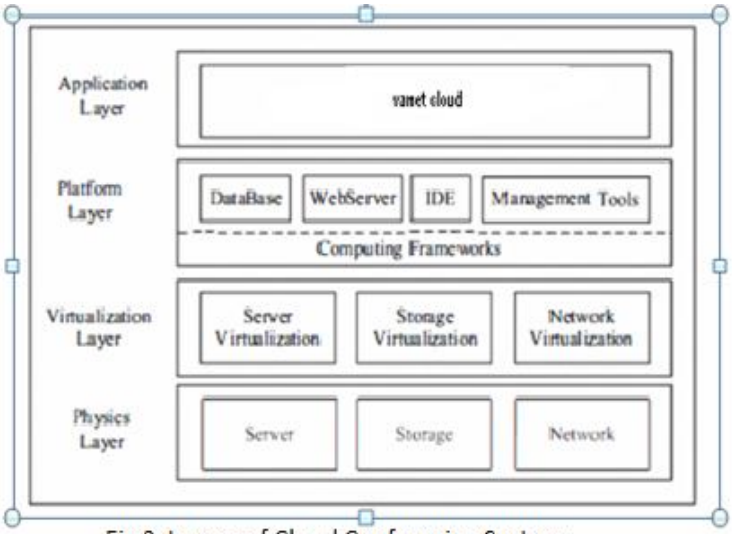

Fig 3: Layaer of Cloud Conferncing System

The physics layer is the hardware layer which is composed of physical computing, storage and networking resources. The virtualization layer is composed of virtualized computing, storage and networking resources. The IaaS, which delivers computer infrastructure, includes both those layers. The IaaS is typically billed on a utility computing basis and amount of resources consumed will typically reflect the level of activity. It is an evolution of virtual private server offerings. The platform layer can be divided into two sub layers. One is the computing frameworks, which manage the transaction dispatching and task scheduling. The other sub layer is application capability layer, which includes basic tools for applications. The PaaS, which is the service for this layer, delivers a computing platform and solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. It facilitates deployment of applications without the

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cost and complexity of buying and managing the underlying hardware and software layers. The application layer is the top layer of this framework. It is the layer for SaaS, which delivers the conferencing application as a service over the Internet.

D. Services of VANET cloud

1. Allows clusters of vehicles traveling together to track each other along the journey.
2. Provides drivers with real-time feedback about fuel economy and driving habits based on past drivers on a specific route.
3. Listen. Speak. Rate. Share. Provides users with in-car audio reviews for various points of interest, and also allows drivers to share their thoughts on visited locations, connecting through Facebook, Twitter, LinkedIn and other social media sites.
4. Collects data about road and traffic conditions, giving drivers advance notice about accidents, construction, poor surfaces and other hazards.

IV.CONCLUSION

The advances in vehicular networks, embedded devices, and cloud computing can be used to set upwhat are known as vehicular clouds(VCs).Full implementation of Vehicular Clouds will provide the better Vehicular network.

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