

Quality of Service Aware Data Dissemination and Resource Management in Internet of Vehicle using Fog and Cloud Computing

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Abstract

A brand new network paradigm, Vehicular Edge Computing (VEC), was introduced lately into the brand new system to fortify its calculating potential. The hurdle to match certain specifications of the computation and communicating is prominent, together with the debut of contemporary planetary software that are contemporary. With all the break through of VEC, agency providers straight sponsor services from near proximity to both smart phones such as decreasing latency and enhancing high quality of services (QoS). This newspaper exemplifies the VEC structure, combined with all the idea of software, its own services, communicating, and the car. We assessed all of the latest and relevant remedies and outlined of the problems. We nail prospective investigation issues and discard a little mild. This informative short article empowers viewers to have more thorough comprehension with the study area but in addition offers guidelines within VEC into one researchers' area.

I. INTRODUCTION

Electronic apparatus are enlarging their own capacity to build info, leading to the accumulation of a wide array of facts that range from dimensions of all-natural happenings into human-related behaviour. With all the expected enlargement of this Web of Items called Internet of Things (IoT) [1], it's forecasted in the foreseeable future the majority of things are going to be somehow attached. Together side the bond of what into the world wide web has the demand for moving, preserving, and processing on enormous levels of information, setting down a course for years of exploration linked to this sort of IoT prerequisites.

Cloud computing has developed and turned into a easy- to-use system for all both most software general to put away and procedure info. IoT gadgets usually count upon cloud computing systems to put away and procedure information, and producing knowledge and information for a consequence. However on one hand, the huge adoption of cloud computing computing has

been an effect of the speedy time to market to get various kinds of software because of this paradigm versatility and paid down null preliminary funding expenses. About the flip side, this exact identical huge adoption has subjected several limits of this paradigm at fulfilling all of requirements of several types of software, for example as for example for instance real time, very low latency, and cellular software. The cloud info centres have been frequently logically or physically remote by your cloud consumer, suggesting data and communication transports to traverse several jumps, which presents flaws and absorbs network bandwidth edge and core components [2]. The widespread adoption of cloud computing, together with ever increasing skill of advantage instruments to execute heterogeneous software which make and absorb an assortment of info from the selection of resources, necessitates innovative computing infrastructures which may deal with these kinds of hierarchical program prerequisites.

Computing infrastructures that enact software at border gadgets have begun to seem recently decades [4, 3], bettering attributes like reaction time and diminishing bandwidth usage. Mixing the capability of jogging smaller, more localized software in the border together using the untreatable out of the cloud, even fog computing has surfaced as a paradigm which may encourage heterogeneous specifications of little and massive software by way of a number of levels of the computational infrastructure that unites tools out of the border of their system in addition to from your cloud [5]. Inside this paper we aim in determining and identifying the principal facets and troubles which produce the mixture of cloud computing and also cloud computing computing acceptable for several sorts of software regulated with the Web of Matters. We talk facets from your infrastructure (processing, media, protocols, and infrastructure such as 5G supports) to software (wise metropolitan areas, city calculating (and business 4.0), passing throughout the direction sophistication of this spread IoT-fog-cloud platform (products and solutions and source allocation and optimisation, electricity intake, info direction and area, apparatus federation and confidence, along with service and business units). At another segment we present theories and definitions of Online Things (IoT), cloud computing systems, along with fog computing systems.

II. IOT, FOG, AND CLOUD: BASIC DEFINITIONS

This area presents the vocabulary and theories associated with the 3 aspects of this IoT-Fog- Cloud eco-system.

Internet of Things

Forecasts in regards to the Web of Matters are set forward within the literature. In case a consensus is different about IoT, then it's around the amount of attached apparatus: heaps of countless factors will probably be attached in

a couple of decades from today [1,6]. Such apparatus may comprise practically anything with embedded micro controller and communicating capacities (e.g., at a manner that is symmetrical, a pair of detectors and/or actuators).

This unprecedented quantity of apparatus contributes to an unparalleled amount of information to be processed and transmitted. Greater than this, IoT linked apparatus are exceptionally heterogeneous at various degrees: info communication protocols, vitality prerequisites, calculating potential, freedom, etc. For that reason, IoT gadgets direction, through the duration of the info processing and communication pile, turns into challenging.

Uncooked data created from the Web of Matters as an entire might well not be straight helpful. These kinds of extraordinarily huge data collections need important processing and comprehension direction capacities to supply some enlightening info. IoT software is targeted toward achieving the endeavor: change accumulated data right into real data comprehension. Even though a plethora of new software will be empowered by IoT, additionally, this is an origin of greater heterogeneity: distinct software have various demands, that ought to really be fulfilled with the calculating platform amalgamating IoT apparatus making use of their software. From the upcoming sections we provide two calculating paradigms which may be used jointly to meet the needs requirements related to IoT software: fog and cloud computing.

Cloud computing

Cloud computing has realized a stable condition within the last 10 years, changing to some widely embraced computing paradigm for a lot of apps, as a result of the lively traits like durability and pay-per-use. In order to have the ability to supply such faculties, virtualization is just one of those handling columns for cloud hosting suppliers. Virtual containers and

machines enable suppliers to talk about with you pieces of these calculating tools, commonly deployed large data centres, one of end customers, leading to a logically dispersed platform for every single renter.

On-demand calculating is given by cloud hosting services predicated on both basic designs, specifically Infrastructure for a Support (IaaS), system for a Agency (PaaS), and computer software as a Service (SaaS) [7]. IaaS gives computing infrastructure for a service, even where in fact the user may access and take care of computing ability; PaaS provides a stage for both applications development together side the essential databases and libraries to both manually install and operate software, also SaaS gives the applications itself counting upon your own cloud provider's infrastructure to successfully Reduce data or computing. A number of cloud services amounts has surfaced, causing the That which for a Agency (XaaS) theory [8].

Cloud suppliers may likewise be labeled depending on their installation version: private, hybrid vehicle and network clouds. Manifeste clouds would be such receptive for the general public, commonly charged onto the pay-per-use foundation for everybody using an online relationship. Personal clouds have been confined to some of unread end consumers (e.g., by an organization or college). Hybrid clouds really are a makeup of private and public cloud computing tools, frequently written to match the energetic desire and prevent upfront expenditure decision for summit desire [9]. The network clouds [10], including the digital associations from grid computing [11] are a makeup of clouds that are private so as to talk about means.

CloudServices are also offered dependent on the Service Level Agreement (SLA), which determines what's supplied and by what method the consumer needs to really be billed to make utilize of the cloud hosting services. Frequent cases are pay-per-use units exactly wherever by charging chooses area by the time units (e.g.,

digital servers at a hour basis), by the amount of info (e.g., info transfers off the supplier or volume of info saved), or from quantity of asks (e.g., the range of situations per certain function/method has been predicted from the programming version of an SaaS supplier).

The aforementioned mentioned faculties cause properties which produce the cloud appealing to customers, for example on-require provisioning/deprovisioning, flexibility, omnipresent accessibility, decrease upfront investments using lower funding costs as a swap for more functional expenses, and speedier time to promote. Through the duration of this document we talk just how oceans may meet a portion of their applying requirements inside of the IoT picture. In addition, we share how exactly snowball computing, also set within the subsequent segment, may be put together with cloud to give an infrastructure that meets a broad scope of prerequisites for IoT software.

Fog Computing

Computing potential in the border grown with all personal devices' hardware development. The combi-state of computing power with all the development of border systems computing paradigms that indicate that software and store information to perform. The components development also enabled apparatus to shrink in proportion, leading to portable apparatus who possess sufficient computing and battery powered potential to conduct software using decent sophistication and caliber of services (QoS). Even the aggregation of advantage apparatus to the method infrastructure targets and includes different titles from the literature revealing traits that are different. By way of instance, the European Telecommunications Standards Institute (ETSI) not long ago transformed the title of cell Edge Computing into Multi-access border calculating, while still keeping precisely exactly the exact identical MEC acronym [1-2]. This shift has been an

attempt to offer an even frame that goes past the prerequisites of the operator. The aim is the very exact same, which is, to present features that are cloudlike in this network's boundary, but it includes wired and wireless communication systems. Owing to the a wide selection of new layouts might be executed as, as an instance, IoT and also Vehicle-to-everything (V2X) networks. Fog computing delivers with the advantage apparatus and also the cloud computing, in addition to introducing an array of calculating potential (fog nodes, couplets or micro info centres) involving your border and also the cloud [13]. This capability might be sprinkled routing apparatus inside the system, both the system center at entry issues, etc. It's estimated the bigger from the system hierarchy that the fog node (couplet or micro info centre) will be also the more expensive it is calculating capacity as it needs to offer convenience of a bigger pair of end consumers downwards in the expectancy. Moreover, the reduced from the hierarchy that the gadget is, the closer into this advantage it's, ergo introducing lower communicating flaws to advantage apparatus (e.g., touch-screen apparatus, IoT detectors and actuators, autos, drones, etc).

III. SMART VEHICULAR LAYER

Autos are very likely to do greater communicating, market on-board providers, and extend storage [26]. The bright layer comprises a set of autos which are dangerously near and reveal storage and computing tools throughout the radio system. The bright stratum is trustworthy for abstracting info from embedded detectors, GPScamera, radar, lidar, and also other apparatus that autos may comprise. The accumulated information might be transmitted into the border cloud coating for it or storage functions as input for many services while inside the program coating. In wise vehicular coating, the car or truck will probably likely possess storage, communications, intellect, and studying

capacities to expect that the motorist's aims. The concept will probably help motor autos use products and providers from some different vehicles since smart, vehicular computing, even supplying the offloading centers such as vehicles offered by the border of their system and giving all of the professional services needed from the autonomous autos.

This coating may boost feeling of maybe perhaps not just the surroundings but likewise the behaviour of drivers and passenger . The most important part of the coating is that a car or truck; autos within this particular paradigm are thought of like a wise motor car or truck and so therefore are totally equipped forces with a number of the most recent detectors and communicating gear.

Smart Vehicle

The automobile that's able of calculating has storage in addition to communicating centers and certainly will learn out of its atmosphere by simply making conclusions so is referred to as a more wise motor car. With all the rising selection of wise automobiles armed with onboard wireless apparatus (3GPP, IEEE 802.11de, blue tooth, etc..) and detectors (radar, lidar, etc.)), productive direction and transportation software are planning in boosting flows of autos by simply decreasing the traveling length time plus preventing any visitors congestion.

Bright vehicles, even using a set of advanced functionalities (i.e., facts monitoring, placement advice, etc.), may encourage certain apps (i.e., basic protection messages and warnings, and gossip-based software, etc.). Mostly that the vehicles in just a VEC are built with the onboard electrical apparatus, specially OBU; such as instance, the onboard radar of wise car or truck has the capability to slowdown the automobile mechanically after discovering visitors congestion. In mishap systems, detectors are utilised to check whether the air bags had been deployed while the incident happened. This Info

Is Subsequently distributed via V2V/V2I inside the community. **Components of Smart Vehicle**

These gadgets can keep in touch together at a way. The vehicle's detectors to acquire the vehicle's advice. In the senior amount, info like detector input signal, navigation solutions, fever, behaviours detection, and graphic are automatically accumulated and kept in a storage device to get prospective processing. Depending on the advice, the car or truck will separately reach automatic-driving controller, for example environment detection, fundamental decision manufacturing mechanical along with also mechanical controller. This system's structure ought to be built to simply help drivers in order to prevent injuries. To reach dependable and considerable surround info, the wise car or truck is often designed with multi beam radars, microwave radars, high resolution cameras, and thus on. The communicating and software can be also employed. (2) Wireless transceiver: it transports info and info on one of the automobile to vehicles and vehicle to both infrastructure. (3) GPS receiver: it gets the International Positioning process's info and supplies assistance to give navigation providers. By integration having a communicative method, A-GPS could mechanically report the auto's precise location despite the precision of much less than 1m. This may provide info regarding injuries and thus on and accumulated information eases coordinating the creation of both platoons. (4) Sensors: assorted detectors are internally and in a car or truck to quantify various facets such as rate, space out of encircling autos, etc, for example, an ultrasonic detector predicated on noise waves, represented by those items. The reflected sound waves are utilised to recognize the exact distance and relative velocity of items that were neighboring. (5) I/O port: it offers person's favorable human-vehicle interaction. Radars are classified as radars and radars. Such detectors already are utilised in flexible cruise control procedures. (7)

LIDAR: Lighting Detection and stalks, at which in fact the detector includes a high- value scanning capacity which may accurately measure the relative space of the automobile by cutting on the flat surface together with laser beams. The detector employs high speed beams of this laser to both automatically move infra red light pulses using a wavelength, including 850 to 950 nm [2-9]. (8) OBU: on-board device, at which each car or truck inside this machine is equipped using the OBU, that regulates communicating of car or truck SRSUs, SMBs, along with also different autos by way of DSRC/LTE-V [25

]. (9) LCS: Neighborhood digicam Sensor may be your detector that examines the behaviour of their motorist plus provides true and dependable thing discovery.

Technically that the vehicle needs to have the ability to produce authentic and dependable environment understanding predicated on unclear and incomplete data from multi-modal and heterogeneous onboard sensors. By turning of predictable and also learning-based to decision- making solutions to deal with obstacles targeted visitors analysts, a more vehicle that is sensible could find a way to respond and to earn a choice.

a. Network of the Smart Vehicles

The social networks present many obstacles which were not known in yesteryear utilizing communicating techniques that are conventional. The simple point is actually just really a consequence of the QoS demands and the energetic vehicular environment. The next Generation Partnership Project (3GPP) has pioneered endeavors lately that encourage car or truck to all (V2X) products and solutions in long-term Evolution systems and also the 5G mobile networks [30,31]. Each car can obtain entry to this advice of this setting using the assistance of infrastructures and real life information-sharing software. This creates the

foundation for road traffic and safety efficacy software [32]. There are two sorts of communicating communication: V2V and V2I. Additionally, other things like cars, pedestrians, and road-side transport may collect data of these encompassing setting (e.g., acquire advice from various different vehicles along with alternative detector gear in ranges) to procedure and also reveal it accordingly that smarter services can possibly be given. These solutions incorporate autonomous and collision warning. A one of a kind digital vehicle manipulation frame was discussed within our preceding step by step summary of fog and enormous information significance, that can help from the installation of prospective cities that are smart. Determine 4 reflects the total communication procedure for vehicles that are smart.

b. Intravehicle Communication

The word has been coined expressing messages. Even the OBUs, that can be installed from the vehicles, which can communicate inside of the car or truck (i.e., assorted detectors offer advice such as traffic congestion(brakes, accelerator, along with alternative neighboring items).

c. Intervehicle Communication

It means communications in amongst vehicles or among detectors and vehicles which can be put on or in such as roadways, parking lots, areas that are distinct, etc. Communication implies troubles that are greater whether they've been currently still moving and whilst the car communicating should be encouraged if the cars have been static. There may be communication involving cars. The communicating with this type enables the sharing of info in amongst vehicles regardless of the infrastructure. Nevertheless communicating relates to some small selection. Determine 5 symbolizes the V2V style of communication. The software like Road-Accident and also Street roadside assistance V2V communicating to improve the conversation reach of the vehicular system.

Once they aren't at the scope of one another these programs share data between cars and roadside components. In this procedure motor cars behave as intermediaries; advice is received by them and forwards it to input the reach of this SRSU.

d. Extravehicle Communication

The expression extravehicular communicating reflects the communicating in amongst the vehicle along with also the surface universe, in other words, V2I (car or truck to border nodes, SRSU, SMBS, etc.).

Deploying border computing environments may ensure conversation involving the cars. An automobile may socialize with all one coming vehicles also also inform them just in the event there is any traffic or risk bottle neck and also the variety of pedestrians in your way. More over, advantage computing eases reachable, dependable, and dispersed surroundings which come in synchronization using the regional detectors.

V2I permits the swap of wireless facts between infrastructure and vehicles (e.g., SRSU, SMBS etc.). A few software require the border servers Whilst the OBU of these vehicles includes limited storage and processing capability. In certain instances communicating is forecast to obtain info, as an instance. A few programs might extract visitors congestion along with Climate Info through communicating that is V2I.

e. Autonomous Vehicle

With all the development of the vehicles toward driving, then a requirement is to own connectivity one of those cars. Hence, the vehicular networks are thought of because the absolute most important component within the evolution of the transportation system along with cities that were smart. The social systems are predicted to present assorted luxury software, that vary between road security to progress from the site visitors efficacy also out of computerized driving to uninterrupted

accessibility into the Web products and solutions [30, 31]. Automated autos are getting to be popular round the planet, that includes generated a revolution at the auto industry recently. There are impediments such as protection, dependability, and solitude whereas using created fully automatic variants of cars. This simple truth may not be missed in which the automatic vehicles have a tendency toward several security dangers; as an instance, if the AV applications is still reflective, subsequently one attack may result in many accidents. Likewise the programs which can be attached as a result of the Web may be hacked with the handicapped users also there are several more dangers which are not known. The automobile was made such a manner it may expect the safety-critical dilemmas and accomplish roles so while tracking the street requirements at an identical time throughout the whole travel. Such a design presumes the motorist will supply the navigation or destination although she/he is probably not going to become Therefore control through the full holiday season. Hence, protected and sound performance could be the role of the automatic osmosis methods [25]. Although automated osmosis technique is very distinctive from your associated vehicular technological innovation, it's associated with this latter. The networked systems that are attached permit information to be shared by the cars. Vehicles can additionally share detector information with all the vehicles that are nearby, that may actually yield present an AV with extra info regarding the decision which is established. Pros from your global discussion such as small business Insider and also earth Economic Forum foresees the effect of the automatic vehicles to the general economic route along with the changeover of this manner of relocating in 1 place into the next. Later on we could observe a switch over from your vehicles involving the trip of those automatic vehicles such as Uber or even Lyft [22].

IV. CHALLENGES

The closeness and decentralization of this ceremony infrastructure into the border provide various gains for networks such as non latency and efficient electricity use, and increased throughput. The most recent vehicles have been embedded together using various detectors for processing and wireless communication capacities. That has allowed many prospective advantages to become manipulated like basic protection, efficacy, and relaxation while they've been around the street diverse obstacles.

a. MOBILITY

A static atmosphere is considered by types of detector networks. Likewise advertising hoc community additionally targets on confined freedom predicated on notebooks and handheld units taken by users. Freedom is really actually just a standard for vehicular networks. Liberty for those vehicles' routines possess a significance. Each automobile in the trail using a consistently shifting pair of neighbours, a number which it's not encounter earlier and can be quite improbable to own a interaction in the future. This ever changing temperament of the dynamics may interfere with the usefulness of reputation-based strategies. To speed different autos predicated about the efficacy in the reports is more debatable to establish invaluable; this can be, any particular vehicle might possibly well not have adequate advice out of an identical car or truck to generate its selection relating to this motor car. Additionally, since two autos will be inclined to become from the communicating scope to get a couple seconds, we couldn't believe protocols, that demand interaction between receiver and sender. An updated mobility version is necessary so that it provides data regarding the precise climatic behaviours, such as vehicular rate, forecast of their vehicular standing, and also distributions in the time and space. Specifically, we must come up with an even more fancy freedom version, which

examines both the freedom routines precisely and just for diverse surroundings which can be employed for applications that are practical. Awareness of vehicular behaviours that are commonplace and freedom routines helps run source usage and communicating. Freedom between edge and amongst border nodes and cloud may be examined. In contrast to data centres, advantage apparatus are deployed in excess of platforms. The QoS throughout programs also have to be optimized.

b. ROUTING AND FORWARDING

Within the instance of routing and adware, lots of questions appear as the shifting of advantage servers along with also their services out of origin to location in line with this movements of the car. (1)Edge machine changing: motor autos usually create conclusions of these second movement around in a brief length of period whilst the autos are consistently in movement in a predetermined pace. Because of this, it's hard to foresee that vehicle will require its solutions by which you of those beds bottom channels or advantage servers, dependent on visitors and general transport information which makes the changeover routines of autos migration to get calling vehicle's second position. In spite of how a number of methods are implemented to fix the problem, yet this can be a open research issue and far work is must be accomplished. (2)Service shifting: discussed previously, the moment the automobile alters its location by 1 border machine into the other, subsequently the employment, which it absolutely had been with against the prior edge host, will be moved to some different border host. In [9-6] an algorithm to anticipate the QoS for assistance advice has been suggested. Even though this algorithm functions economically to your user, maybe it does possibly well perhaps not be rather efficient at an windy atmosphere. This really can be a rather challenging and sensitive job to get timely and dependable assistance

transmission between both autos and advantage servers to be able to keep the QoS at a windy atmosphere.

c. DEPLOYMENT OF NETWORK ELEMENTS & RESULTS

A decent quantity of system elements improve the system's operation on the big scale. Considering that the installation of this system gear incurs a higher price tag, is critical to carefully install a suitable variety of those system things. The most significant consideration is always to discover the right location therefore that the efficacy of social systems might be improved. Along with the, the fee has to be optimized along with additionally the border servers and also SRSUs needs to really be set up at this kind of points at which in fact the available tools might be handled. From the places servers have been located As a result of diverse visitors supply inside the surroundings. As servers perform a critical function in delivering targeted visitors jams, the SRSUs existing adjacent into the servers induce the site visitors jams to go into the infrastructure with no demand for multihop messages. Into additional nodes from the system, all such programs are moved Throughout the infrastructure. By obtaining, the infrastructure by way of fewer jumps exceptionally cuts the time of servers which are delivering messages into one additional nodes. For this reason, it's eventually needed to build up the best version, which actions the minimal requirement of advantage servers in addition to SRSUs to become set up as a way to minimise the installation price and optimize the QoS.

d. SECURITY AND PRIVACY

The dynamics of these networks, their own versatility, and also non rigidness have placed the protection and solitude of information in to question together using all the prime barrier function as the authentication safety [2-2]. Whilst the vehicular border, nodes behave as

entry points into the clouds that are hybrid, that include border nodes and also the fundamental cloud, thus there's a danger of breach of stability and solitude. A hacker could send prohibited orders and proscribed messages even though using some one of those border nodes. This could cause the unreliability of all the companies offered from the system [7-9]. Along with the user's solitude is additionally at an increased risk inside the instance of of this system currently getting hacked whilst the hackers also can gain accessibility to this individual facts of their customers. From the wise grid components, diffiehellman crucial trade [ninety eight] and people key infrastructure [ninety nine] augmented frameworks for its authentication problems. Additionally, syllable et al. [ninety] analyzed publication multiauthority CP-ABE strategy having the best decryption to get data accessibility controller within an social system and also designing a reliable user and also feature revocation methodology. But there continue to be lots of security problems which will likely appear as a result of this elevated expansion pace of edge systems. More lively frameworks have to get shown to encrypt the information in order for the stability and solitude may not be breached and also the advantage calculating grows safer.

V. CONCLUSION

The enlargement of Things' Web necessitates fresh paradigms for processing and information collection. Fog computing has emerged as a means of managing the data. The mixture of cloud and fog calculating systems is a more direction of supplying capacities that are complete to encourage its particular own broad scope of needs and IoT, from low-latency/real-time into processing- or - even software. New software designed as a consequence of your IoT growth necessitate aid within the circumstance that was geo-distributed, very low latency, and location knowledge. This newspaper discussed situations of fog and advantage computing and

facets in addition to the way exactly they could expand and match the cloud natural surroundings and defined. Facets of cloud and fog computing systems have been completely addressed from the literature; this newspaper has talked about some are still hard to give an infrastructure for both storage and IoT info processing. As fog computing lookup evolves using IoT plus a few of these challenges have been resolved, we all expect problems to emerge regarding resource control along with its own efficacy whilst the number of apparatus along with also software maintain developing.

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