A Review of Quality of Service Issues in Internet of Vehicles (IoV)

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Abstract: Recent Years compared to the Current Scenario, The Explosive Growth of devices connected and controlled by Internet is the major significance of Internet of Things (IOT). One such big example is Automotive Industry. This industry has the potential to become an IOT Champion among other industries and fuel the IOT Cloud Services Adoption among Car owners and walkers alike. Vehicles are progressively being associated with the Internet of Things which empower them to give Universal Access to Data to Drivers and Travellers while Moving. As the connectivity of Vehicles keeps increasing in numbers,traditional concepts of Vehicles has to be introduced with new layers which includes Versatile data transfer among Vehicles, Consistency, Security, Toughness, Humans and roadside frameworks of Vehicular Systems shall be taken into consideration. In this Unique situation, the first idea of Vehicular Ad-Hoc networks(VANETs) is being changed into another idea called Internet of Vehicles(IOV).The advent of IOT has changed the Traditional vehicular networks in to intelligent vehicular networks called Internet of vehicles. Each entity in IOV is connected to the Internet. In IOV, each vehicle is responsible for transmitting and receiving the information. In an Environment where vehicles are mobile and at the same time exchanging information to ensure safe driving on the roads and to minimize road accidents. It is very necessary to provide better services within the limited accessibilities. Hence QOS plays a vital role in IOV. This paper addresses the QOS challenges and its significance in IOV. Also, this paper also discusses the measurement parameters that could deliberately effect the performance of IOV.

Keywords: Quality of service, Internet of Vehicles, Internet of Things, VANETS

I. INTRODUCTION

The Agglomeration of devicesin IOT environmentare interrelated with each other exchanging information without any human intervention potentially active with abilities of self-making decisions, reprogrammability and reconfiguring by themselves that has led them to lead the technology. Due to the existence of a plethora of IOT devices has led many concerns besides their tremendous technological benefits.Such Issues and concerns needs to be addressed to make it more effective and reliable. Due to Massive connectivity of objects wirelessly in IOT environment, there is a need of providing better service to the users.Some of the parameters that are considered while measuring Quality of service are Transmission Delay, Throughput, Packet Loss, Bit Rate, Jitter and Availability. Measurement of these parameters quantitatively to know the service performance is called Quality of service.As mentioned in, it is estimated that around 20 million devices would be connected to the Internet. Figure 1 shows the graoh of IOT market predicted for future. Having efficient and Effective Communication Exchange is one of the goals in Internet of Things. For achieving such effective and efficient communication, it is essential to Implement Quality of service to provide better IOT connectivity. An IOT is a Massive network that would connect a plethora of devices for Communication and control. Hence there is a need of Quality of service Implementation, Management and Optimizations. As mentioned in, due to the rapid growth of IOT devices connected to the internet, there is a need of improving several parameters such as Bandwidth, Storage optimization, Energy efficiency which are Critical important while considering QOS in IOT. From the figure,it can be seen that after Internet of Things, Connected cars shows rapid growth in future technology.

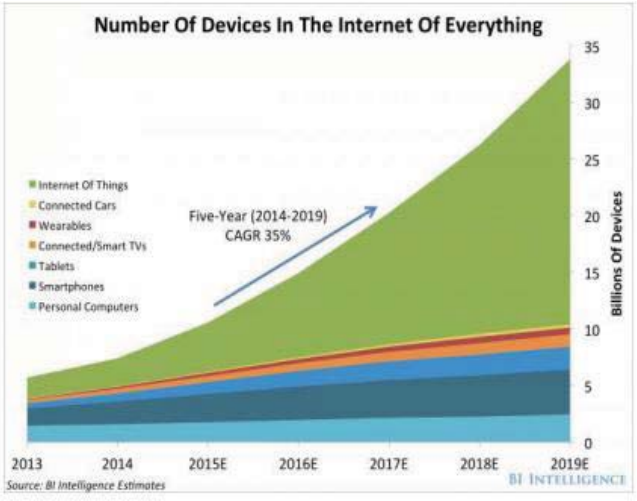

Fig. 1. IOT market future prediction

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One of the consolidations of IOT where plenty of research is focussed in Internet of Vehicles (IOV), an emerging vehicular technology that integrates IOT and Intelligent Transportation System (ITS). Undoubtedly, It is one of the key technologies that enables transportation in to smart transportation with tremendous features fuelled by wireless technologies. However, besides these benefits, IOV faces several issues and challenges that needs to be addressed. Some of the issues and challenges that needs to be addressed are IOV Architectures, IOV Resource Management, IOV applications, IOV protocols, Interoperability in IOV due to lack of standardization, Security and Privacy in IOV, Communication technologies in IOV etc . As mentioned in, it is predicted by 2050, over 6 billion people from sub urban and cities are expected to live, hence to survive on a platform that is wellbeing to them, a city needs to be smart. To endeavour such goals IOT technology has emerged with plethora of devices. One of the fundamental needs of people in smart cities is Smart Transportation with Intelligent traffic management and reducing traffic congestions. One such domain of IOT is IOV that leverages the Traffic with open wireless technologies, Smart communication between vehicles, infrastructures, people and Road side units. However, despite these benefits End to End delivery of information is critically important in IOV environments. The IEEE communication protocols and standards that enables IOV to exchange information among different interfaces such as Vehicle to vehicle, vehicle to infrastructure and vehicle to internet are IEEE 802.11p, Dynamic medium access control(DMAC), Vehicular co-operative medium access control (VC-MAC), Ad-Hoc on demand distance vector(AODV), Dynamic source routing(DSR), General packet radio service(GPRS). Quality of service is a critical factor in an environments where massive amount of sensors and devices connected and communicated with one another. Like discussed earlier in Table 2, it is necessary to provide optimal Quality of service in an environment like IOV. As mentioned in, In IOV each car/vehicle is treated as a Mobile device which exchange information with other cars. The information exchange is a digital data exchanged among people, vehicles, business, companies, Industries and Organisations. The feature of Exchanging information more intelligently makes the IOV different from VANETS. IOT integrated with ITS to bring IOV to support several functions such as Intelligent traffic management system, Intelligent Vehicle Control, Dynamic Information Services etc. In , Evaluation methods for Quality of services for next generation telecommunication services have been suggested. The implementations are done using MATLAB. However, the implementation techniques are not specific to IOV domain and can be used as a benchmark for QOS solutions in IOV. IOV is a dynamic networking environment that includes wired, wireless and Hybrid system protocols, hence it is very vital to present Quality of service requirements in the context of IOV. In , one of the most fundamental networking problems is Quality of service. Hence there is a need to pay attention for both wired and wireless networks in IOV scenario. As mentioned in , some of the Quality of service areas focussed are End-End Signalling protocols, Resource reservation control mechanisms. Still a massive amount of research is ongoing in Quality of service for wireless networks. Quality of service is defined as quality of data link service. It describes the transmission characteristics between two data link users.The quality of service parameters are applied to both connection less and connection oriented modes. Due to exponential growth of devices in IOT generates a huge amount of data critically requires quality of service such as High delivery rate, service delays and Massive connections. Table 2 shows some of the on-board devices that requires Quality of service. Some of the QOS parameters that shows high implications in IOV are Delay, Jitter, Bandwidth, Latency and Safety.

TABLE 1: On board Quality of service requirement

ON-BOARD UNITS	QUALITY OF SERVICE
Global positioning system(GPS)	Ubiquitous connection
Driving State	Large Bandwidth
ECU	Higher delivery rate
Road Accidents events	Higher data volume

TABLE 2: Protocols for IOT

II. IOT PROTOCOLS

LAYERS	PROTOCOLS
SESSION	MQTT, SMQTT, CoRE, DDS, AMQP, XMPP, CoAP
NETWORK	ENCAPSULATION LAYER – 6LoWPAN, 6TiSCH, 6Lo, Thread,
	ROUTING LAYER – RPL, CORPL, CARP,
DATA LINK	Wi-Fi, Bluetooth Low Energy, Z-Wave, Zig Bee Smart, DECT/ULE, 3G/LTE, NFC, Weightless, Home Plug GP, 802.11ah, 802.15.4e, G.9959, Wireless HART, DASH7, ANT+, LTE-A, LoRAWAN,……..

The above protocols have been organised in to sub layers to get deeper understanding of each one. Such layers are listed below

INFRASTRUCTURE LAYER: This layer includes some of the layers like 6LowPAN, IPV4 / IPV6, RPL

IDENTIFICATION LAYER: This layer includes EPC, uCode and URL's

COMMUNICATION/TRANSPORT LAYER: Example protocols of this layer includes Wi-Fi, Bluetooth and LPWAN

DISCOVERY LAYER: This layer includes Physical Web, mDNS

DATA PROTOCOLS: Examples of this layer includeMQTT, CoAP

DEVICE MANAGEMENT: Examples of this layer TR-069, OMA-DM

SEMANTIC LAYER: Examples of this layer includes JSON-LD, Web Thing Model

MULTI LAYER FRAMEWORKS: This layer includes Home kit, AllJoyn

III. TAXONOMY OF QOS SPECIFICATIONS

Quality of service parameters are generally classified using the taxonomy shown in figure 2.

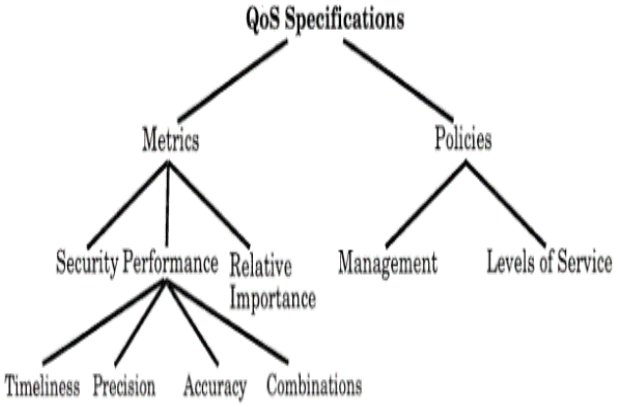

Fig. 2. QOS Taxonomy

Quality of service specifications are generally classified in to two categories. Metric and Policies. Metrics are further classified in to three groups security, Performance and Relative Importance. Performance metrics are further classified in to four. They are Timeliness, Precision, Accuracy and Combinations. Policies are grouped in two Management and Levels of service.

QOS Metrics: Examples include performance, security, fidelity, cost and reliability that are used to describe QOS characteristics. Some of the primary performance metrics include Delay, Loss probability and Data Rate.

QOS Policy: There are few instances where there is a need to balance network load as traffic increases. However, it is very difficult to manage network loads. There are many sensitive applications that needs to compete for network bandwidth. QOS policies are essential in providing management tools that could control network bandwidths. Some of the advantages of QOS policies are flexibility, security, performance and manageability.

IV. QUALITY OF SERVICE ISSUES AND SIGNIFICANCE

Agglomeration of devices are deployed in IOV systems for sensing, Processing, Integrating and communicating with other vehicles through several open wireless technologies. Due to plethora of devices connected and communicated, there will be a massive Load on the network and hence there is a need of providing optimal End to End delivery without compromising with any kind of QOS parameters such as Delay, Jitter, Latency, Bandwidth etc. Some of the applications that put load on the networks are Voice, Video and Multimedia applications since IP connectivity does not ensure for data delivery over mediums. Another requirement for providing QOS in IOV scenario is optimized delay services as customers need best services. Hence there is a need to provide QOS Mechanisms to deal with such challenges in an environment surrounded with billions of devices involved in Information Exchange. In order to optimize network resources, improved network services and integrated QOS mechanisms are essential in IOV. In IOV, Communication networks play a vital role to handle communication of billions of devices and to satisfy its users. Hence there is a need to achieve global efficiency in utilization of the networks. As mentioned in , Quality of service is a network capability to provide customer satisfied network services over several technologies. Providing controlled Jitter, delay sensitive services, dedicated bandwidths and improved packet loss characteristics are some of the primary goals of QOS. In IOV environments, there is a need of going beyond Best effort services to provide Reliability, throughput, delay, latency, bandwidth, availability, jitters when the network delivers data.In IOV, since the vehicles are mobile and dynamic and are moving with varying speeds, efficient management of Network resources is one of the challenges that needs to be focussed. Hence efficient handling of QOS parameters is essential. It could be more emphasized as handling of Network traffic.Moreover,the network resource requirements is unpredictable since the vehicles are mobile and moving with varying speeds. Hence there is a need of developing High efficient QOS schemes. To tackle multimedia applications there is a need of providing reliable connectivity, High data rates, and high speed processing units. However, it is very difficult to incorporate and integrate all these features in a network and providing services to IOV which is purely dynamic and Mobility nature. Multimedia traffic is classified in to two types one is delay sensitive and the latter is Tolerant to large delays. Examples of High delay sensitive class is Voice and Video whereas examples of latter is Text data transfer and TCP protocols. Another major challenge in IOV is when vehicles are moving with High speeds from one network to another network, there could be a packet loss when the vehicles are mobile and network is autonomous. Figure below showstypes of multimedia traffic characteristics with respect to bandwidth usage and delays. It is noticeable from the figure that QOS becomes more challenging as the traffic varies significantly with a wide range of parameters.

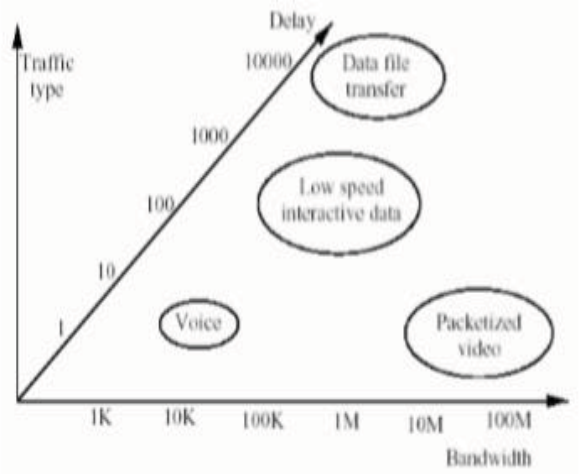

Fig. 3. Traffic types vs. Bandwidth

It is really important to adapt the services of the users providing them the better QOS considering the problems faced by the state of the art technologies mainly limited bandwidth and other parameters. Considering specific domain such as IOV, It is really important to deliver Best End to End services in collaboration with networks since the vehicles treated as nodes are dynamically changing with varying network conditions Hence there is a need of developing optimized solutions to deal with mobile nodes e.g. vehicles.

V. CONCLUSION

In this paper, we have reviewed about Quality of service challenges in IOV and exploited the significance of delivering End to End Services in a scenario like IOV where the vehicles are mobile, moving with varying speeds with various network conditions considering QOS parameters that are necessary to deal with in order to satisfy the user needs and to prevent from any kind of packet losses which could even lead to disastrous results.

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