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Overview of Various IOT Traffic Management Techniques Using SDN

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Abstract:

IoT has taken over the industry by storm. It's evolution in the field of developing forthcoming network chains is quite significant. But along with it, there are numerous problems associated with it. Some of them are like controlling the consistently expanding traffic, rise of considerable chunk of networking nodes in order to control serviceability etc., There are many cases where IoT takes a very important role like monitoring the traffic on roads, manipulating the machine hands(robots) in case of remote surgery, monitoring the manufacturing units in industry etc., These systems need extreme care and maintaining minimal delay of services from beginning-to-end is of atmost importance. These units generate crucial amounts of traffic and thus are to be given exceptional care, notably in matters where their latency can be troubled e.g., glitches in the functioning of nodes of network, bottleneck arising due to network congestion etc., In this work we have a tendency to analyse various technical prospect measures that manage the traffic delay for vital knowledge. Also, we described about the various SDN-IoT techniques and technologies that are in present use along with their limitations. In our proposed model, we try to solve a few challenges that are in existence in field of IoT traffic management. We made use of Ryu Controller(SDN) that can help in solving problems like identifying the network path with low end-to-end latency, delay and properly route the vital traffic data onto this routing path. Mininet emulations showing physical variations in delay in link formation routes can confirm the validity of our approach. They can also indicate the conditions under which the solution can be implemented.

Keywords — **SDN, IoT, Latency Management, End - End Delay, Network congestion**

I. INTRODUCTION

The TRADITIONAL network infrastructure includes multiple network devices, some of which are routers,switches, and middle devices, where specific integratedapplication circuits are deployed to perform requiredactions. [1], [2]. With regard to these devices, they are preprogrammed with unique complicated rules (protocols), which can not be altered in real-time, in order to meet the requirements of the present. In addition, because of the limited nature and complexity of these devices resources, they can not be programmed with different set of rules that provide peak network services in the present. As a result, old network technologies can not adapt strategy to the needs of the IoT application in real-time.As the number of Internet of Things devices are designed to grow amid 21 and 47 billion by the next few years, In the future any garages and industrial systemswill be able to connect to almost each and everyone.

To overcome these shortcomingsoforthodox network, brand new concept is proposed called Software Defined Network or SDN. Software Defined Networkingwhich is a still a developing architecture of network , through this control of network could be comprehendedin place of classical hardware devices and tools. [3]. Hence, the foremost importantpurposeposed by SDN is that ofdecouplingthe data plane from the control plane that involve transfer devices or machines. Thatas a result, it is possible to implement appropriate control logic in the devices which are physical , so therefore that depends on the required concern of the realtime application. Now at a general viewpoint, the SDN has three levels: application, control andinfrastructure . [4]. In extension to thelevel architecture of SDN , there are also several application program interfaces or in-short APIs which mainly are Eastbound, Westbound, Northbound and Southbound. TheAPI which is Northbound is put in use to connect the layer of application to control level so they can communicate between them. Thanks to of the northbound API, the abstracted network view is provided at the application level too.TheAPI of southbound also is responsible for the interface among the infrastructure and control levels, which allows controllers to apply different rules on transfer devices, such as routers and switches, and establish a communication in real time with the controller. The APIs of thewestbound and eastbound are mainly responsible because of the interface among the different controllers and devices, allowing them to makedecisions which are coordinated.OpenFlow[5] which is the mostly used protocol for the communication between data and control planes. By incorporating the division between data and control planes, application meet the specific objectives, likethe security method, traffic engineering, quality of service, monitoring solution and network measurement. In addition, the driver helps applications achieve their goal through the control of the switches of SDN with the help of staging tables. So in different words, the network meets the needs of users and, using the API and the controller, administrators of networkare able to monitor the capabilities of network and are able to add features which are new to control plane without making any significant changes particularly to the plane of data.

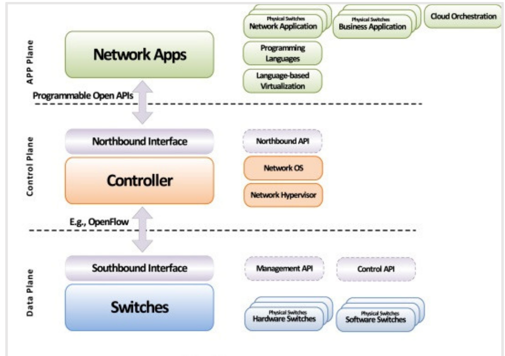

Fig 1. Rahim Masoudi [6], SDN Architecture

Normally, an Internet of Things network is a junction of actuator networks, sensors along with end users having smartphones acting as a edge network. In addition, edge networking is compatible with certain access points and gateways, called access networks. At the access networks and higher level, the vital role is played by the backbone in routing the detected and activated data to the DC's network for processing them. As a result, the DC network plays a crucial part in the storage and to process the detected and activated information from the device. In addition, the DC's network architecture is distinct from that of networks, edge networks and access networks. Presenting a general description of current efforts of researchers, we here present in this paper a description of IoT technologies basing on SDT in various phases of networks such as access networks, core networks, and DC's. For Peripheral Networks, we fundamentally examine how SDN based advancements can be utilized in sensor systems to proficiently oversee sensor hub assets. Also, here we analyze the drawbacks of embedded network scenarios based on existing SDNs in Internet of Things. On the Basis of these drawbacks, many of the furthur steps of research are presented here. Access Network plays a crucial part in adding the detected information from these devices.Accordingly, unique SDN-based information conglomeration plans are inspected, which can be utilized to address the different difficulties identified with access to IoT systems, while specifying various issues. At long last, we present the necessities and difficulties present in the DC and DC network in IoT , quickly talking about existing methodologies from parts of the center's systems and the DC of the IoT.

As the fifth generation of mobile technology (5G), the Internet of Things also requires storage centers (DCs) and cloud computing to perform internet-based analysis of data collected from sensors and data sources and actuators. The number of central central controllers can not be resized, especially since the quantity of IoT gadgets and the volume of information ought to explode. [7]

An as of late proposed answer for meet the new IoT prerequisites, for example, such as high traffic dense processing, huge number of connections, advanced traffic processing, and low latency processing, is to deploy the IoT treatment. 'analysis. IoT from the backbone for micro-Data Centers and small Data Centers at the edge network, called integrated IoT analysis [8].

In short, the this work contributes in the following way.

1) An overview of IoT using SDN is presented.

2) Explaining how technologies based on SDN are used for solving various problems related to access,edge and DC networking techniques.

3) Rest of the work is formulated as follows. Section II is related with works of IoT devices using SDN, which is how Software Defined Networking can solve various requirements as well as challenges of Internet of Things based applications. Section III presents the Proposed system and Section IV presents the Conclusion.

II. RELATED WORKS

The themes of SDN and the Internet of Things have attracted a lot of attention from researchers, but to our knowledge, much less effort has been expended to study the conjunction of the two.

In [9] and [10], surveys of SDN can be found, its innovative features and its use to support futurity networking environments, and in [11], history of networks that are programmed is examined. Although these study is exhaustive of SDN treatment, there is no description of whatsoever their application to Internet of Things.

Al--Fuqaaha .et. al [12] provides an extensive IOT study, however a little description of SDN, Virtualization as emerging trends is mentioned. The other study described in [13], but it is very much focused on WSN-Virtualization than the multiple IoT design structures, various critical cases, deployment tools, or how SDN will-be used in the long run.

Cedric Morin [14] aims at enforcing QoS policies with the following objectives. The northbound application specifies cost and bandwidth constraints. QoS must be guaranteed anytime. Network resources should be fully exploited, reducing wasted bandwidth to the minimum. The control plane must not be flooded by information. Queues are not dynamically created. Their number depends on the precision requested by the QoS policy, and is limited by the equipment's capabilities. To meet these objectives the solution must address resource management and packet handling

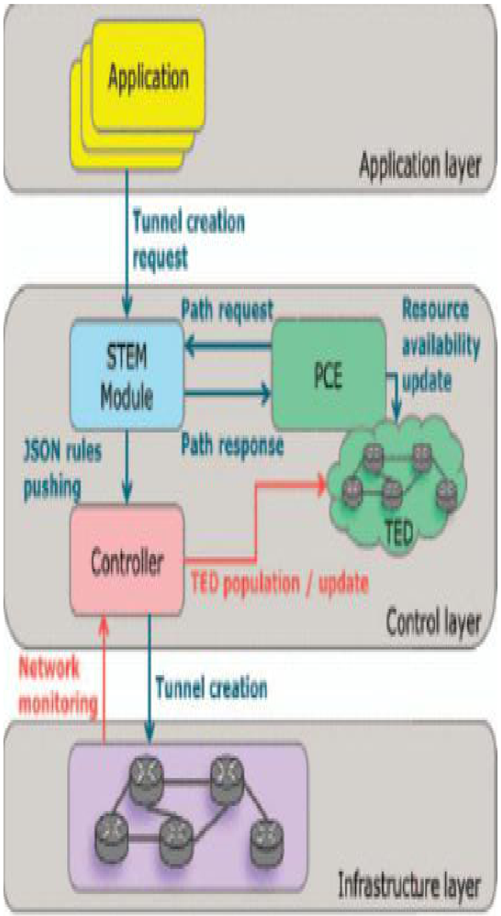

Fig 2. Cedric Morin [14], Architecture

Michael Baddeley [15], introduces µ SDN, which is a lightweight SDN implementation; written entirely for Contiki OS, in order to describe SDN control traffic, and also show various traffic control types effects on network traffic that is regular. After that he proposed that, to address the SDN overhead effects within the 802.15.4-2015 TSCH networks(IEEE), utilization of 6TiSCH tracks helps in providing a network slice that is isolated, to the SDN traffic control, thus delivering SDN controller communication with minimal latency, low jitter, and thus putting the disruption to the rest of the network minimal.

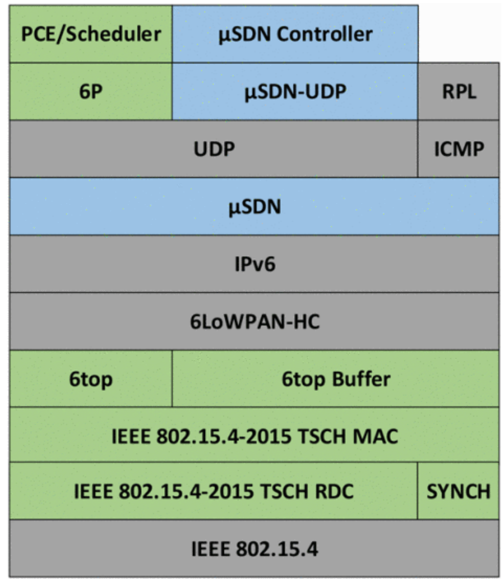

Fig 3. Michael Baddeley[15], µ SDN and 6tisch protocol stack.

R. Mu˜noz et al. [16], presents the IoT analytics platform integration with the cloud orchestrator and global network, for the first time. This integration mainly targets at efficiently using network resources by providing an Congestion avoidance and IoT-traffic control technique, which thus helps in enabling the distribution of IoT processing dynamically to the network edge based on the actual IoT flows monitoring in the network.

Ping Du [17], has made a plan for trailer slicing [18] that helps in carrying out the meta-info - which further helps in packet classification to distinct MVNO networks application slices. This meta-info might be a straightforward string data type (e.g., sensor device name) or an MPLS-like tag. If we can make adjustments to the Layer-3 and Layer-4 header fields, the trailer packets can be easily obtained through existing network appliance since the trailers are considered as Layer-7 data bits. Comparing this trailer identifier with storing data identifier in header option fields, the former could pass all the network appliances while removing non-standard header option during transmission.

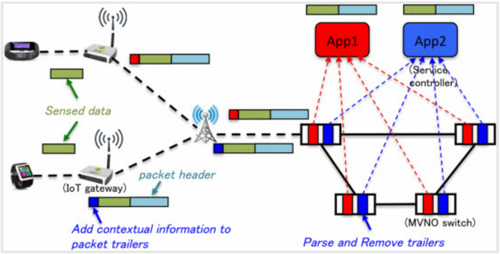

Fig 4. Ping Du [17], Context-aware forwarding/processing through trailer-slicing for IoT network

Sándor. et. al. [19], has studied the performance from beginning-to-end of a IOT networking transmission in the sight of various abnormalities that exist in communication. He designed a network infrastructure which is hybrid (i.e., both non-SDN, SDN combination) in order to enhance working efficiency of network. On the basis of necessities and statistics on network, these hybrid techniques are to be deployed.

M. M. Hassan [20], proposed a system which mainly consists of three entities—an IoT application client/user, a central entity (core network), an IoT application provider. This core network may be considered as a cloud, which offers the IoT WSN applications the SaaS access.

Zhijing Qin [21], has administered a controller prototype above the Simulation platform-Qualnet [22]. It provides a thorough environment for network protocols designing, and also permits the creation and animation of various network environments, so that the protocols performance can be analysed. He made adjustments and injected an OpenFlow-like protocol in IP layer, thus customizing Qualnet with SDN features. In every network scenario, only one node acts as controller and remaining nodes act as all other controlled devices. Moreover, the performance results achieved already demonstrates the proposed approach feasibility, we aim to further investigate our proposed solution by extending the simulated environment considering the case of an real vehicular scenario served by multiple controllers.

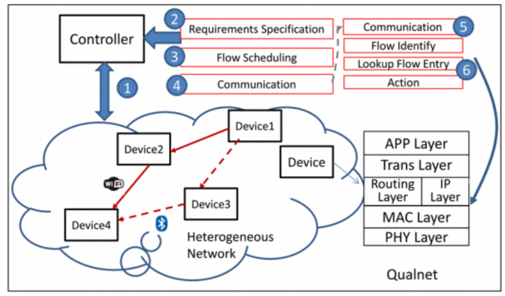

Fig 5. Zhijing Qin [21], Operational flow diagram

Jayashree [23], proposed a software-defined WSN architecture that helps minimizing the sensor nodes energy consumption. She presumed two things: one is the nodal points can behave as a switch(es), the other that these nodes can interact with a controller that is centralized, which is located at Base-Station. Thus the sensor nodes in real-time can be dynamically programmed depending on the necessity. Furthermore, we can choose the cluster-nodes in dynamic manner, and various rules of flow that are associated with it can be deployed at the nodes. Nevertheless, when the network is being controlled in a centralized manner, the sensor nodes that are having the resource constrained nature should be taken into account.

III. PROPOSED MODEL

Ryu SDN Controller

It is an opensource SDN Controller which is mainly designed to enlarge the network agility by making it easier in managing and adapting how traffic data is handled.

It is written in Python entirely. It is available under the Apache 2.0 license and openly available for any individual to use.

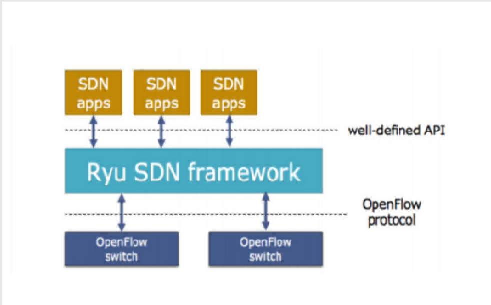

Fig 6. Ryu SDN framework

IV. CONCLUSION

This paper, consists of an elaborate survey of various existing IoT Traffic Management techniques that are using SDN, in order to provide flawless, cost-efficient, and trustworthy serviceability to clients. Various IoT network phases like access networking, edge networking are discussed here. Also we distinguished some significant technical problems and mentioned the scope for future-research in these paths.

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