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A Software Defined Network for IOT

Supriya Dicholkar[1], Deepthi Sekhar[2], Jyoti Gurav[3], Akansha Bhargava[4]
[1](Department of Electronics and Telecommunication, Atharva College of Engineering, India)
[2] (Department of Electronics and Telecommunication, Atharva College of Engineering, India)
3(Department of Electronics and Telecommunication, Atharva College of Engineering, India)
[4](Department of Electronics and Telecommunication, Atharva College of Engineering, India)

Abstract: *Software-defined networking (SDN) is an architecture that aims to make networks agile and flexible which is used for network configuration and monitoring. With drastic growth of Industry 4.0, it is very difficult to manage IOT traffic manually. In software Defined Network, SDN controller which is brain of network management is kept in control plane and used for centralized network management. Software-defined networking provides dramatic increases in the flexibility and scalability of network management by decoupling the network"control plane"—the part of the system that controls where information is sent—from the "data plane," the portion that forwards information to predetermined locations. With SDN centralized controller, prioritizing or even blocking specific types of packets with a granular level of control and security becomes easy. Data packet forwarding is carried out by data plane. SDN Applications are programs that directly and programmatically communicate their network requirements through SDN Controller via North Bound Interface (NBI) and SDN Datapath is used for forwarding and processing of data.*

I. Introduction

The growing interest in the Internet of Things (IoT) has resulted in a number of wide-area deployments of IoT subnetworks, where multiple heterogeneous wireless communication solutions coexist: from multiple access technologies such as cellular, WiFi, ZigBee, and Bluetooth, to multi-hop ad-hoc and MANET routing protocols, they all must be effectively integrated to create a seamless communication platform. Managing these open, geographically distributed, and heterogeneous networking infrastructures, especially in dynamic environments, is a key technical challenge. Main objective of SDN-IoT is to design two separate layers: Control plane and Data plane as below:

1) Control plane which will optimize automatically based on the actual "things" that connect to it.
2) Data plane to provide a smart and evolving allocation of data forwarding and network resource allocation.

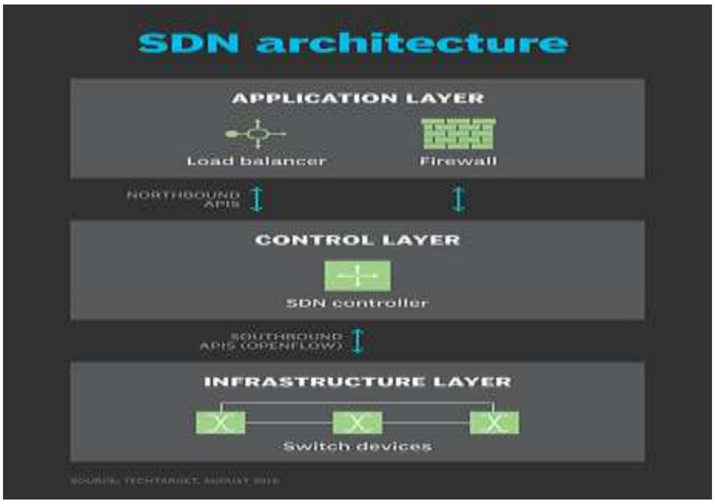
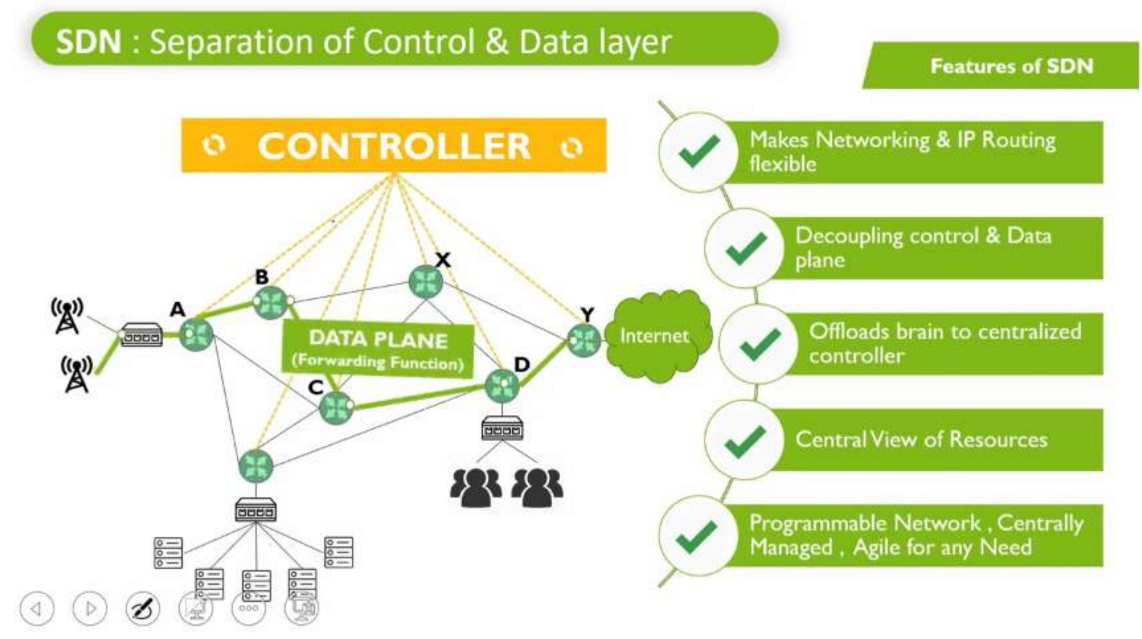


Fig.1 SDN Architecture

II. Material And Methods

With SDN centralized controller, prioritizing or even blocking specific types of packets with a granular level of control and security becomes easy. Data packet forwarding is carried out by data plane. SDN Applications are programs that directly and programmatically communicate their network requirements through SDN Controller via North Bound Interface (NBI) and SDN Datapath is used for forwarding and processing of data. Below figure shows the advantages of SDN for Network Management.



Introduction to SDN (Software defined network) - SDN and Openflow Architecture

III. Discussion

Given the heterogeneity of IoT Multinetworks, it is challenging to coordinate and optimize the use of the heterogeneous resources with the goal of satisfying as many tasks as possible. We conjecture that the SDN paradigm is a good candidate to solve the resource management needs of IoT environments for multiple reasons:

• SDN allows for a clear separation of concerns between services in the control plane (that makes decisions about how traffic is managed) and the data plane (actual mechanisms for forwarding traffic to desired destinations). The decoupling encourages abstractions of low-level network functionalities into higher level services and consequently simplifies the task of network administrators;

• SDN mechanisms aim to provide a balance between the degree of centralized control/coordination through the presence of an explicit SDN controller and decentralized operations through flow-based routing and rescheduling within the network components; this balance is realized via interactions between controllers and controlled devices.

However, the current realization of SDN technologies are still far from addressing the heterogeneous and dynamic needs of IoT Multinetworks. The popular use of SDN technologies today is in DCNs [7][8], where the focus is on the collection of specific network statistics (e.g., bandwidth consumption) from nodes networked via fast interconnections within the datacenter. In contrast, a typical IoT Multinetworks setting gathers state information from devices distributed over a moreloosely coupled (and possibly wide area) network. Second, performance metrics of interest in IoT Multinetworks gobeyond bandwidth consumption; with more heterogeneous and time-sensitive traffic as it is the case in IoT Multinetworks, it is equally important to reduce the collection overhead and to keep the effectiveness of the overall data needs. Unlike the case of DCNs, whose network requirements primarily revolve around link utilization and throughput, IoT Multinetworks settings present additional timing related needs - such as delay, jitter, packet loss, and throughput. Third, unlike the situation in a DCN, link and node capabilities in IoT Multinetworks are very heterogeneous and the application requirements are also different. This implies that the single objective optimization techniques in DCN flow scheduling, such as bin packing [7] and simulated annealing [8], are not directly applicable in IoT Multinetworks. Finally, the nature of interactions in current realizations of SDN (e.g., OpenFlow [9]) is limited to south-bound, i.e., lower layer interactions between controller and devices such as switches. The so-called north-bound interactions between applications/service and controller have received much less attention and are not standardized [10].Although there are proposals [11], [12] that advocate the use of a network configuration language to express policies such as ”ban a device if its usage over the last five days exceeds 10 GB”, these policies still focus on lower layer parametersof the network stack. More recently, SDN techniques are being applied to wireless networks. OpenRadio [13] suggests the idea of decoupling the control plane from the data plane to support ease of migration for users from one type of network to another easily, in PHY and MAC layers. CellSDN [14] enables policies for cellular applications that are dictated by subscriber needs, instead of physical locations - providing finer control of network flows than previously possible. The OpenWireless [15] prototype supports seamless handover between WiFi and WiMax networks when video data is streamed, using OpenFlow controllers.The wireless SDN solution provides the necessary building blocks for managing IoT Multinetworks, but they are not sufficient. The south-bound approach retains its focus on connecting to a specific lower-level access network; its application to IoT Multinetworks must support mechanisms that abstract out the network heterogeneity. Furthermore, the framework must support north-bound, higher layer interactions,i.e., to the heterogeneous applications and their requirements.In this paper, we propose a novel IoT Multinetworks controller architecture to overcome these limitations. As shown in Fig. 1, the data collection component collects network/device information from the IoT Multinetworks environment and stores it into databases. This information is then utilized by the layered components in the left side.The controller also exposes the Admin/Analyst APIs, which enable the control processes to be governed not only by the

IV. Conclusion

In this paper, we have presented an original SDN controller design in IoT Multinetworks whose central, novel feature is the layered architecture that enable flexible, effective, and efficient management on task, flow, network, and resources.

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