IJCSE International Journal of Computer Sciences and Engineering Open Access
Survey Paper Volume-4, Issue-5 E-ISSN: 2347-2693

A Survey: Network Regeneration by Software Defined Network (SDN and SDWN)

Ruya j. Hussein[1*], Murat Iskefiyeli [2]

[1,2]Department of Computer Engineering, Sakarya university , sakarya, Turkey

Available online at: www.ijcseonline.org

Received: Apr/26/2016 Revised: May/06/2016 Accepted: May/14/2016 Published: May/31/2016

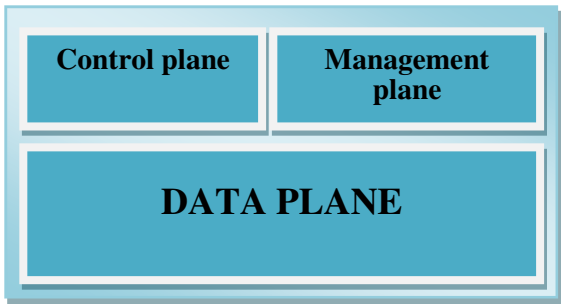
Abstract :-In the world of information and communication technologies (ICT) ,the up-and-coming trends like (mobile, cloud and big data)are imposing new challenges for coming internet technologies where the high bandwidth ,ever-present accessibility and dynamic management exist .however the dependency of traditional networks on the manual configuration for network devices made it very error prone and hard task to accomplish. Recently one of the most hopeful solutions for future is software defined networks (SDN) which considered important technology for the management of complex and large scale networks which requires re-policing and reconfiguration between whiles. SDN achieves the reconfiguration easily by decoupling the data plane from control plane which enables the network devices (switches/ routers) to easily forward the packets depending on the flow table rules set by control plane .but the implementation of SDN in the wired domain doesn't mean it will carry the same facility in the wireless domain as a wireless software defined (SDWN) which raises the radio –specific problems in relate to channel estimation and link isolation .

Keywords— Software defined networks(SDN), software defined wireless network (SDWN), OpenFlow, Computer networks, Network provisioning

I. INTRODUCTION

Before going in to understand the (wired and wireless) software defined network's its necessary to highlight on the traditional network .where the computer networks are typically consist of many devices like (routers ,switches ,hosts and different type of middle boxes which deals with packets for reasons other than forwarding like firewalls) in addition to many complex protocols performed on them .while the network operators liable of configuring the policies in order to respond to the tremendous innovation in network applications and events . they have to transform high level policies to configuration commands manually which made the network management task challenging and error prone . in addition to the fact that the network devices are vertically –integrated which mean that the control plane and data plane of the network are bundled together which made the configuration even more difficult[1] .

So in order to develop the traditional network it's important to know the characteristics of network devices which made the conventional network manual and hardware centric first of all the ASICs (Application Specific Integrated Circuit). that provide the network functionality evolve patiently and its function development is under the control of device provider ,second the devices are proprietary and configured individually, and the third one is that the Tasks like change management provisioning, and de-provisioning are very time consuming [2] .



Fig(1) traditional network device

As shown in the fig (1) the three basic components of a telecommunications network device , where The control plane is the part of a network which is responsible of signal traffic , routing and Control packets originate from or are destined for a router . Functions of the control plane include management and system configuration, The management plane, which carries administrative traffic, is considered a subset of the control plane because together they serve the data plane, which handles the traffic that the network exists to carry. So all three planes are implemented in the firmware of the switches and routers . as each network device has its own control plane and data plane, which are vertically integrated. This supposes extra cost . Moreover, each device has a

proprietary firmware/control software (Operating System to perform some protocols related to routing, switching, QoS, etc.),in this thesis the software defined networks will be illustrated in order to have a clear view and compare the new technology in both domains to realize the reasons led the way to SDN approach where in (II part)software defined networks is presented in wired domain then in (part III) in wireless domain as anew extend of software networks, while (part IV) declare the new extensions challenges [6].

II. SOFTWARE DEFINED NETWORKS (SDN)

All issues mentioned a forehead is what made the shift to the software by the idea of (programmable networks) which proposed as a way to smooth the progress of network development, in particular software defined networks (SDN) a new paradigm which gives the hope to change the boundaries of current network infrastructures. by breaking the vertical integration of traditional network by untying the network's control Logic represented by (control plane) from the underlying routers and switches that forward the traffic (data plane). Whereby the separation of the control and data planes, network switches become simple forwarding devices and the control logic is performed in a logically centralized controller (network operating system),which simplifies the policing and network reconfiguration [3,4]. A simplified View of SDN architecture is shown in Figure 2.

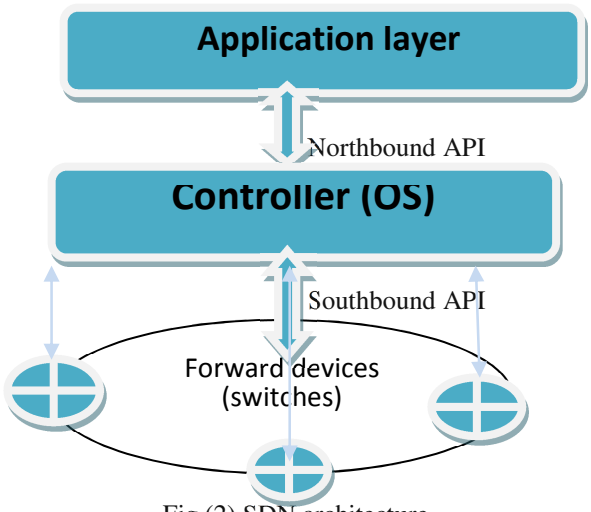


Fig (2) SDN architecture

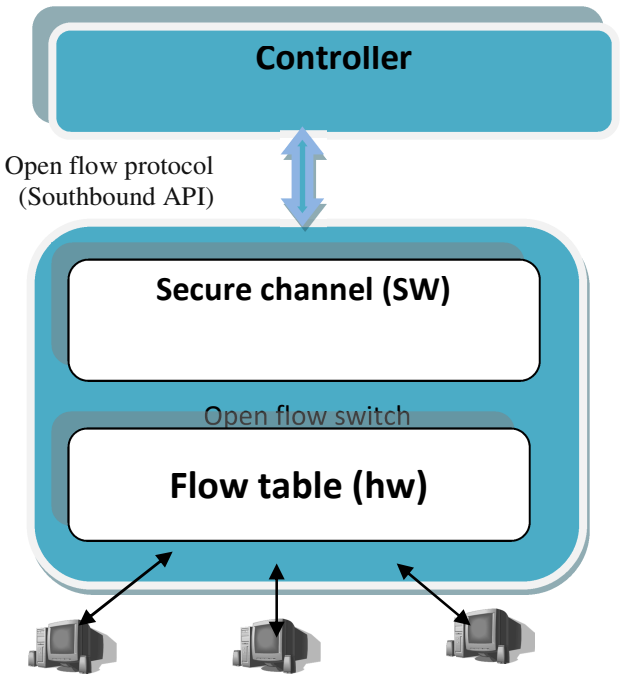
Because the decoupling of network control from forwarding functions made the network control directly programmable and the infrastructure layer under it abstracted for network services and applications. According to the open networking foundation (ONF) the SDN architecture is manageable , dynamic , cost effective ,and ideal for high bandwidth networks .in addition to it enables the various –vendor environment where the network operators does not need to wait the release of new features from network device vendors ,instead of that they can invent new services independently and set up these services without time- consuming operations[5].

In order to offer the communication needed between the forwarding devices and SDN controller the first implemented protocol in SDN architecture is(**open flow**) where the type of the information need to be communicated between these two layers includes Packet handle instructions, arrival notifications of packet to network nodes, Static changes information (a link goes up or down),and statistic information of flow counters, all these information are exchanged over southbound interface. so the open flow protocol is most talked about protocol for SDN on the southbound interface for packet handling instruction .as its being an open API(application program interface) which provides a standard interface for programming the data plane switches. and for remotely controlling the forwarding table of a switch or router [6] .

Open Flow protocol can instruct switches and routers to direct the traffic by providing software-based access to flow tables that can be used to quickly change the network layout and traffic flows as per users requirements. As an SDN standard protocol the open flow architecture shown in fig (3) includes three important components :switches ,controllers ,flow entries.

1. Switches:- Open Flow defines an open source protocol to monitor/ change the flow table in different switches and routers ,where an open flow switch has at least three components

- Flow Table: The entry of the Flow-Table has three fields :A packet header that defines the flows ,The action, defines how the packets should be processed ,and Statistics which keep track of the number of packets and bytes for each flow, and the time since the last packet matched the flow (to help with the deletion of inactive flows).
- Secure Channel :-that connects the switch to a remote control process (called the controller) allowing commands and packets to be sent between a controller and the switch using open flow protocol.
- Open Flow Protocol:- which provides an open and standard way for a controller to communicate with a switch. By specifying a standard interface(the open
- Flow Protocol) through which entries in the Flow Table can be defined externally.



Fig(3) open flow protocol architecture

2. Controllers :- A controller can update (revise, add or delete) flow-entries from the Flow Table on user side experiments. a static controller (versus dynamic) can be a simple software unit running on a computer to statically set up a packet path between a group of test computers during a scientific experiment the existing Open Flow standard assumes **centralized control[7]** , Which is a single-point controller that manage all flow tables in different switches. This concept works very well in a small scale (cable-based LAN). However, if many switches are distributed in a large area, it is difficult to use a single-point control. mainly when wireless media have to be used to connect distant devices where wireless signals fade away quickly in long distances [5] ,In addition to single-point failure issue .To solve this concern, we can utilize **distributed controllers** in different locations. Each controller only manages the local switches. on the other hand, all controllers keep highly reliable communications .

3- Flow entries :- open flow dependable networks extracts all traffic as flows. each flow has an entry in the flow table. where different rules can be defined for each one. In One flow it could be all traffic using one specific TCP protocol. Another could be packets travelling between two defined MAC addresses or all data with one IP address destination.
As its possible to define a non standard header to recognize traffic of a specific entry. This allows to manage different types of flows by using the same control element.
the basic flow entries that all Open Flow switches must support are:

a. Forward this flow's packets to a specific port (or ports).This allows routing the packets through the network.
b. Encapsulate and forward this flow's packets to a controller. Packet is sent to Secure Channel, where it is encapsulated and sent to a controller. Usually used for the first packet in a new flow, so a controller can make a decision if the flow should be added to the Flow Table. Or in other cases, it could be used to forward all packets to a controller for processing.
c. Drop this flow's packets. Can be used for security, to control the rejection of service attacks

III. SOFTWARE DEFINED WIRELESS NETWORK (SDWN)

The world population is becoming more and more connected every day .as it was mentioned by (internet world stats) about a third of the world inhabitants was connected to the Internet at the end of 2011 and the total data exchanged increased by 40%. Because People are uploads and downloads data on cloud services increasingly every single day , like wise they access large multimedia contents .This growth of demand drive the networks evolutions starting with wired networks, where new links and devices are installed frequently to enlarge the capacity of the network. As it was mentioned forehead in SDN but This re-dimensioning has a price, as it needs digging for new cables , in addition to the limits of increasing the network complexity .However, it prepares a good flexibility to extend to the next technology upgrade. that's what made the implementation of SDN in wired networks is comparatively easy, Nevertheless, in the wireless domain the SDN bears the highest potential, as it provides functions that could enhance a better participation between access points to reduce interferences and foster the security .so by talking about the (SDWN) we essentially take the main belief of (SDN) about the parting of data and control planes, and extend it with equally main principle which is the separation of service definition and radio access. As the radio access means transferring information (bits) to a mobile device through an air interface (wireless), while the service definition summarize the concept of network identification , address assignment ,authentication , processing at higher levels.

Where the separation of these two fundamentals considered essential because the radio access and service definition are the most complex problems in wireless domain .
Unlike the wired communication , the wireless technologies deals with the hard limits of nature ,so the packet delivery from and to mobile devices throgh air interfaces is noticeably hard to accomplish mission.

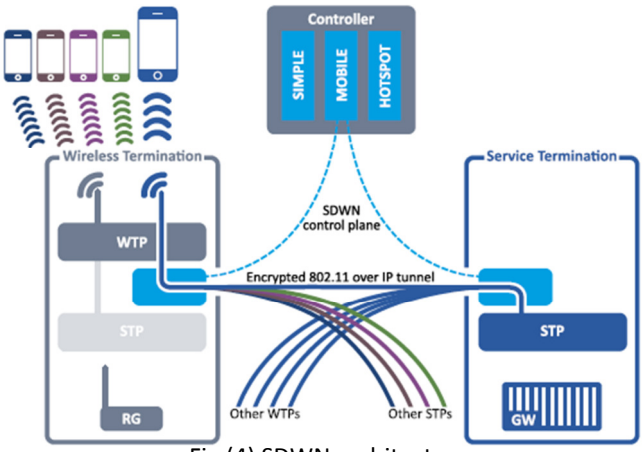


Fig (4) SDWN architecture

As shown in the fig(4) based on ONF foundation view where A residential gateway is playing the role of wireless termination point (WTP) for a total of five clients. The blue client is connected to a Gateway acting as the service termination point. Note that radio access (left) is separated from service definition (right).

In practice SDWN architecture requires a repartitioning of wireless protocol stacks. where the wireless termination point (WTP) contains one or more radios, and relays raw radio frames between its wired network port and these air interfaces. The forwarding data plane consists of IP packets carrying the raw encrypted wireless frames. All higher level processing, like. authentication and encryption, are performed at the service termination point (STP) which is a separate network element at the other end of the SDWN data plane tunnel [4,6].

The SDWN architecture preserves the strong mutual authentication property of underlying wireless protocols by extending both authentication and encryption across the wired network, ensuring that they both terminate in the service termination point. This provides strong cryptographic guarantees for user data plane integrity and confidentiality, even against an attacker in complete control of the wireless termination point.

So SDWN technology seems like the solution which comes to stay and organizations are showing interest to progress towards it because of what it provided for cost-saving and solutions for energy-consumption.

SDWN target is to simplify network management of wireless networks in order to work with wired network faultlessly. through dealing with spatial management [11].

security and privacy, QoS control and mobility management and interference management . in addition to one more aspect that it should be an overlay architecture with IP tunneling as a essential part of its architecture. Whereby, wireless access providers and hosting service providers can interconnect, which enable users to connect from anywhere anytime as a result [12] .

SDWNs Deployment Challenges

Still we have many open challenges in SDWN where Obviously, the SDN implementation with wired networks is relatively easy, because user face a lot of issues while dealing with radio-specific problems in wireless domain, which are associated to link isolation or to channel estimation .these Challenges includes allocation of AP channels so that nearby APs can use different channels, loss or delay can be faced in case of multimedia data flow due to A, B and C frames issues, with SDWNs, we have to configure APs in such a way that A frames should be sent with finest channel following with B and C channels . Energy consumption issue is also a major issue while deploying SDWNs, we should configure access points so that they can firmly linked to power control (with other APs / switches) and can address coverage issues , can be in asleep mode in case of no traffic. Well-organized slicing issue is also critical where we have to establish multiple virtual networks from a single physical network[4,11,14].

V. CONCLUSION

In this survey i have identified the chances that software defined networking can bring to wireless and mobile networks. I have started by defining the traditional network architecture and the main functions that should be supported by network operators to extend it to SDN architecture, and the specifics required like interfaces and some of the interactions As I reviewed ongoing standardization efforts around SDN topics, identifying the future needs to ensure a successful practical deployment of SDN mechanism in the wireless area

REFERENCES

[1] P.Rajput and P.Kulkarni “Survey on Wireless Malevolent Access Point Detection Methods”, Int. Journal of Computer Sciences and Engineering, Volume-04, Issue-04, Apr 2106

[2] W. Xia, Y. Wen, Seni, C. HengFoh, H Xie “ A Survey on Software-Defined Networking”, IEEE COMMUNICATION SURVEYS & TUTORIALS, VOL.17, NO.1, FIRST QUARTER 2015

[3] P. Calhoun, IETF tool reference,”Control and provisioning of wireless access points (capwap)protocol specification”. RFC 5415, Mar. 2009.

[4] A. Bianco, R. Birke, L. Giraudo, and M. Palacin. “Openflow switching: Data plane performance”. Int IEEE Conference on Communications (ICC),ISBN: 978-1-4244-6402-9, Page No (1-5), may 23-27, 2010.

[5] P. Dely, A. Kassler, and N. Bayer,” Openflow for wireless mesh networks”. In 20th International Conference on Computer Communications and Networks (ICCCN),ISBN: 978-1-4577-0637-0, page(1-6),July 31/2011 – Aug4. 2011.

[6] N. Gude, T. Koponen, J. Pettit, B. Pfaff, M. Casado, N. McKeown, and S. Shenker.” Nox: towards an operating system for networks”. SIGCOMM Computer Communication Review, July 2008.
[7] M. Jarschel, S. Oechsner, D. Schlosser, R. Pries, S. Goll, and P. Tran-Gia.” Modeling and performance evaluation of an openflow architecture”. In 23rd International Teletraffic Congress (ITC), sept. 2011.
[8] N. McKeown, T. Anderson, H. Balakrishnan, G. Parulkar, L. Peterson, J. Rexford, S. Shenker, and J. Turner. “Openflow: enabling innovation in campus networks”. SIGCOMM Comput. Commun .Rev., 38(2), Mar. 2008.
[9] K.-K. Yap, S. Katti, G. Parulkar, and N. McKeown. “Delivering capacity for the mobile internet by stitching together networks”. In ACM workshop on Wireless of the students, by the students, for the students, 2010.
[10] K.-K. Yap, M. Kobayashi, D. Underhill, S. Seetharaman,P. Kazemian, and N. McKeown.” The stanford openroads deployment”. In 4th ACM international workshop on Experimental evaluation and characterization (WINTECH ’09), Beijing, China,Sept. 2009.
[11] A. Dixit et al. “Towards an elastic distributed SDN controller,” in Proceedings of the second ACM SIGCOMM workshop on Hot topics in software defined networking (HotSDN '13). ACM, New York, NY,USA, 7-12.
[12] Open Network Foundation, “Conformance Test Specification for OpenFlow Switch Specification”, v1.0.1, June 13, 2013.
[13] R. Marks, A. de la Oliva and J.C. Zuñiga, “Proposed OmniRAN SDN Use Case for External Communication”, August 2013.
[14] IEEE P802.16r, “View of Connection-Oriented Software-Defined Networking for Wireless Backhaul of Small Cells”, July 2013.
[15] 3GPP, TS 32.500, Telecommunication Management; “Self-Organizing Networks (SON); Concepts and requirements”, December 2011.

Authors Profile

Ruya Jaafar Hussein, Master Student in Sakarya university, Department of Computer and IT engineering , Sakarya, Turkey ,She had completed graduation in master of engineering in Computer ,Science Engineering from SAKARYA, University,TURKEY.

Dr. Murat Iskefiyeli , supervisor of the master thesis that the first author prepared under his supervision in sakarya university ,college of engineering ,computer and IT Dept. ,SAKARYA, TURKEY

