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A Novel Approach for Monitoring Resources in Virtual Environment

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Abstract : Virtualization is the key concept being deployed in Cloud Data Centers to drive the efficiency and usefulness of computing resources. Managing and monitoring of resources is the challenging issue in such virtual environment to be addressed. Software Defined Networking (SDN) is one of the Programmable approaches to configure, monitor, and manage the virtual environment rapidly in response to the changing needs. Hence, SDN could be used to monitor and manage the resources more effectively and also to evaluate efficiency of virtual environment. In most of the Health care systems, all available medical resources and facilities are located at different points that need to be integrated, monitored and managed for effective utilization of available facilities. This paper proposes a novel software defined networking approach for monitoring resources in virtual environment and to achieve effective utilization of available resources. A case study has been considered to show the efficient utilization of available services in a health care organization using SDN.

Keywords : Software Defined Networking, Virtualization, Monitoring, Resource Management

1. INTRODUCTION

Cloud computing concept has gone through a major revolution over dedicated servers and is being replaced by virtualized cloud datacenters for better flexibility and lower costs. Cloud datacenters are instantiated dynamically and automatically with less time. In contrast, typical network management is done manually over static network. Deployment of Software Defined Network (SDN) is the key solution to map this dynamic configuration to the static network. The Virtual Switch, a software Network switch connects to each server and dynamically routes the packets from the virtual machines (VMs) on different static network. The network controller communicates with virtual machines through this virtual switch. API is used to implement the connectivity requirements and policies in the virtual Switch. The datacenter administrator has an API to communicate with the new connectivity requirements to the network controller using API such as Open Flow. Switch functions such as forwarding Rules and tunnel configuration are programmed via Open Flow using the datacenter central database.

The network administrators and forensic teams are working on SDN using which the network components can be controlled and managed using virtual infrastructure and suites. On the physical implementation viewpoint, the single error or oversight can damage the entire network integration. Now days, the advent of SDN products are being used in the research, development and corporate industry so that the effective control including routing, scheduling, security and related algorithms can be implemented on real networks. SDN is the approach towards computer networking which allows the network resources administrators in managing the network services using higher level abstraction with effective functionality. This process is implemented with the use of decoupling of system which makes the decisions where data traffic is to be sent with the use the control plane.SDN controller investigates and analyzes the state of network and updates the behavior of switches that is based on its deep analysis. Using these specific controlling systems, network dimensions including ports, bandwidth and wired lines, the systems are optimized to implement the reliable and suitable recovery from any type of malfunction or failure.

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In the current scenario and implementations, Open Flow [1] is deployed as SDN technology published by Open Network Foundation [2]. In SDN technology there is the decoupling of control and data planes in network [3] [4].

The remainder of the paper is organized as follows. Related work is discussed in section II.Proposed cloud based health care system with virtualization is explained in Section III. Experimental results are presented in section IV. Concluding remarks are given in section V.

2 RELATED WORK

To propose and defend the research work, a number of research papers are analyzed. Adrian Lara et. al proposed Open Flow based applications for the ease of network configuration for simplification of the network management. It is done by adding the security layers to virtualize the networks as well as data centers and for deploying the mobile systems. Such applications can be executed on the top of operating systems including Beacon, Maestro, Floodlight, Nox, Trema or Node Flow. This study calculated the performance of Open Flow networks using modeling and experimentation. The work depicts the challenges which are faced by the large scale deployment of Open Flow based networks [7]. Keisuke Nagase introduced Software Defined Network to university hospital. Suggested that the initial cost needed was almost the same as the conventional switch network but substantial reduction of operational cost is expected [11].

SDN can be realistic and ideal technology component for hospital computer network that face expanding on-line equipment and computers. As of late, idea of Software Defined Network has generally been acknowledged by system gear supplier and generation quality system hardware showed up in the business sector. SDN is an idea of programmable PC system fabric, as it was, system that can be powerfully reconfigured by downloading the settings from the controlling PC. This paper presented SDN in a healing facility system to assess its utility and security. After presentation of SDN, SDN section ended up being steady, and programmed rerouting maintaining a strategic distance from fizzled course was far speedier than routine innovation. The conclusion in this paper is SDN is exceptionally significant innovation in medicinal services, that is 24hr/365day mission basic business.

The authors introduce the EstiNet Open Flow network simulator and emulator. The work presents the support for testing the functions and evaluating the performances of software-defined networks, Open Flow controller's application programs. The simulator makes use of a kernel that is unique reentering simulation methodology to enable unmodified real applications to run on nodes in its simulated network. In this work, authors compare the EstiNet with ns-3 and Mininet regarding their capabilities, performance, and scalability [12].

The authors share the supporting case studies over 100 users, at 18 institutions, who have developed Software-Defined Networks (SDN). The work reflect the greatest value of Mininet which support collaborative network research, by enabling self-contained SDN prototypes in which anyone with a PC can download, run, evaluate, explore and build upon[13].

Komail Shahmir examined the possibility of stochastic steering in a SDN domain and investigated the feasibility of stochastic routing in an SDN environment with focus on OpenFlow capabilities and constraints. The normal result of the work is to show the practicality, with or without expansions to OpenFlow [14].

Authors investigates Open Flow performance, compare the controllers' flow set-up strategies and experiments to compare their TCP and UDP performance. Author also introduced a new metric to measure UDP packet losses at the beginning of the flow. In this paper utilize open-source controllers that bolster system virtualization to assess how such postpone sways in ICMP, TCP and UDP movement. The work looks at the controllers' stream set-up methods and proposes a few trials to analyze their TCP and UDP execution. This work acquaints another metric with measure UDP bundle misfortunes toward the stream's start. The estimations' after effects demonstrate that there are expansive contrasts in execution in the middle of controllers, and that execution relies on upon switch-controller postpone and stream set-up procedure [15].

3. PROPOSED CLOUD BASED HEALTH CARE SYSTEM WITH VIRTUALIZATION

Multispecialty healthcare systems must accommodate different departments for the treatment to patients suffering from a diverse range of conditions. Additionally, hospital system must provide service for emergency cases which may arrive in both small and large numbers and should be aware of this dynamic uncertainty. Hence, patient management and monitoring in hospital environments with the provision of effective care represents a significant challenge. The existing healthcare system is based on classical virtualization and network components management in distributed environment is very complex and less cost effective. As the cost is directly associated with the turnaround time and complexity, it is very important to keep track of these issues to overcome the flaws in network infrastructure management. Hence, with SDN approach the complete set of network components can be managed efficiently and overall cost factor can also be reduced as shown in figure 1.

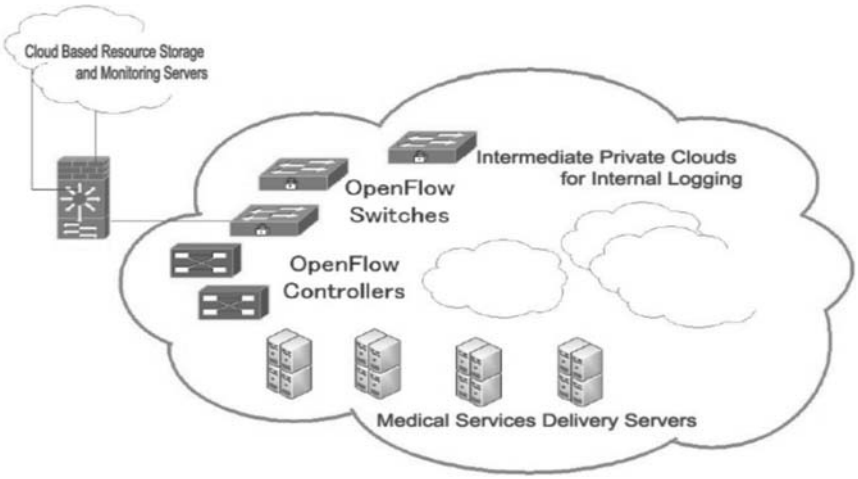

Fig. 1. SDN enabled cloud based virtual medical services

3.1. Components of the Proposed Health Care System with Virtualization

The Proposed Health Care System with Virtualization composed of three main components; first is the Central Database that represents the centralized controller. The second part is the open switch; this component act as mediator between controller and data repository of multiple resources and responsible for connecting and communicating between the controller and the virtualized medical service. Third component represents the web portal for the Cloud, it issues request messages and receives responses from the Cloud system via network connections as depicted in figure 2. This paper provides a performance analysis of virtualization technologies to evaluate the performance of the proposed system.

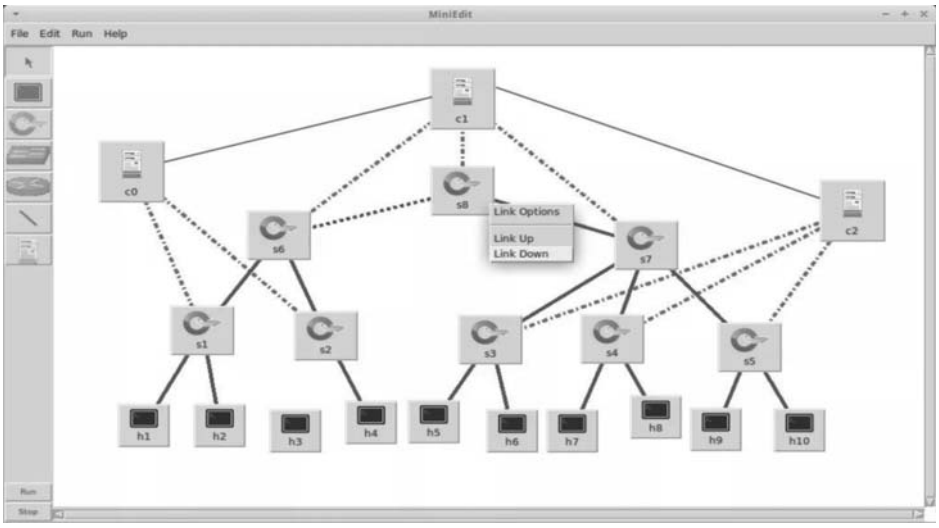

Fig. 2. Proposed Health Care system with virtualization

The available medical resources information is stored in controller and all the departments of the hospital can access available when needed. Suppose there are 10 operation theaters in a hospital and each needs the medical resources (blood supply, anesthesia, oxygen etc.) If a particular operation theatre needs more resources then available at that particular point, the server (controller) will analyze the requirements depending upon required resources the server (controller) will decide whether to deliver that resource or to provide the alternate resource.

SDN switch network connects monitoring end points and is automatically identified by SDN controller.

3.2 Algorithm

1. Initialize and activate the Server (Controller) C_i
2. Initialize and activate the intermediate switches S_i
3. Listen to every switch and link to establish flow-paths between every hosts
4. For each h_i(Operation Theatres)
   - h_1 initiates the request R_q to controller for the specific requirements
   - for each R_q, Si will forward the request to C_i
   - if $Rq -> A_j$ (A_j – Available resource) deliver alternate resource
     Else $R_j := h_1$
5. Analyze the Log Reports of each $h_i S_i$ matrix

4. EXPERIMENT AND RESULT

Different scenarios and topologies of the network infrastructure are modeled and simulated. Using MiniNet and Open Flow, the virtualization and remote connections are established as shown in figure 3. With the various topologies and simulations, following results are fetched and analyzed in tabular form which encapsulates the time as major parameter on multiple nodes topologies. For Database Integration on the Virtual Machines, Switches and Controller, the software implementation of Open vswitch database (OVSDB) is done so that the unique addresses of devices can be integrated. OVSDB is a management protocol in SDN environment.

The following operations are performed at Secure Shell (SSH) Client :

- Creation of 8 virtual hosts having separate IP addresses.
- Creation of single Open Flow switch in kernel having 3 ports.
- Establishment of connection with every virtual host to switch using virtual ethernet.
- Configuration of MAC address of each host equal to its IP.
- Configuration of Open Flow switches for connection to the remote controller.

Following tools are used for implementation of the complete virtualization scenario :

- Windows 7 (Host OS)
- Ubuntu 14.04 (Guest OS)
- MiniNet 2.2.1
- Floodlight Controller
- putty (SSH Client)
- Oracle VirtualBox (Installation of Guest OS)
- OpenFlow

The proposed scheme is simulated with various topologies.

Table 1. Performance based on the Efficiency Parameter

Simulation Scenario with different attempts	*Efficiency-Without Virtualization Enabled Medical Services*	*Efficiency-With Virtualization Enabled Medical Services*
Scenario 1	40	94
Scenario 2	30	89
Scenario 3	53	79
Scenario 4	47	90

Table 1 shows simulation scenarios with different attempts for varying resources with and without virtualized servers. In the first scenario, five delivery points and one virtualized server is deployed for the transmission of medical services. In subsequent scenarios we considered increasing number of servers with their respective delivery points. The results depict that there is consistency in terms of the performance of the proposed approach.

In figure 4, the efficiency and related simulation scenario is depicted. On the X-Axis, the parameter efficiency is depicted for each simulation attempt with respect to time. Results shows for different scenarios of efficiency and cost factor the proposed approach in virtual environment is more efficient compared to classical approach as shown in figure 4,5.

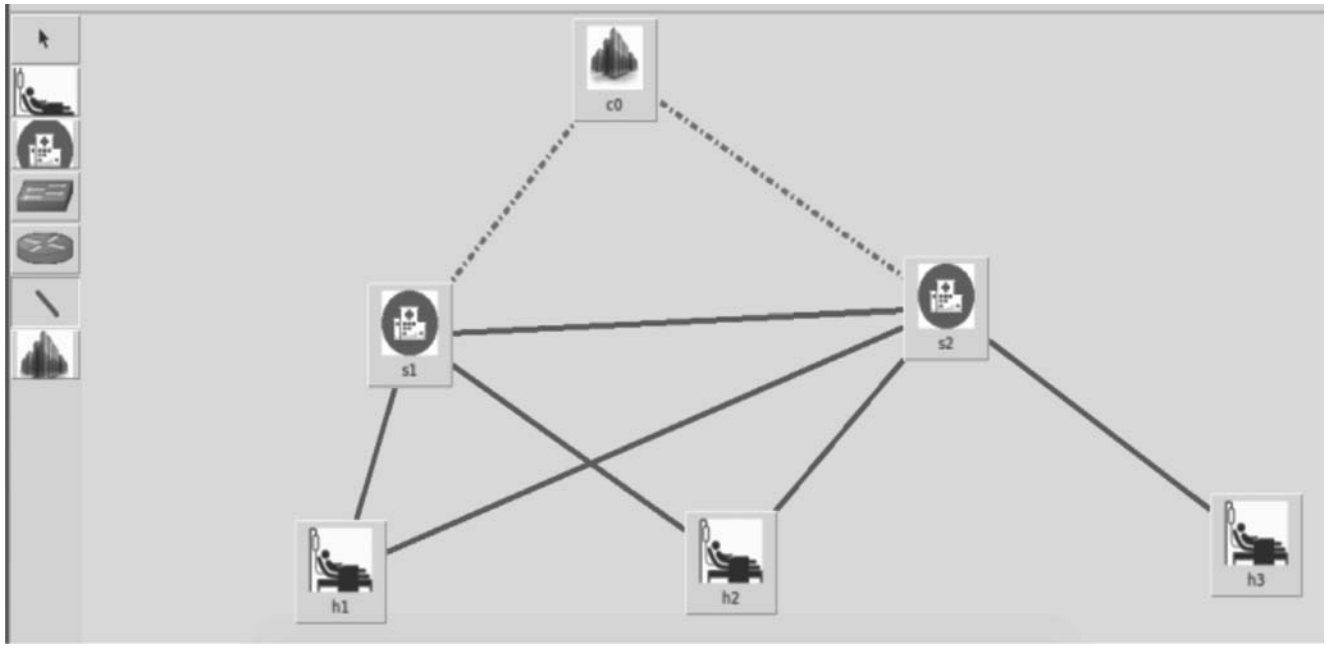

Fig. 3. Implementation Scenario of Medical Services

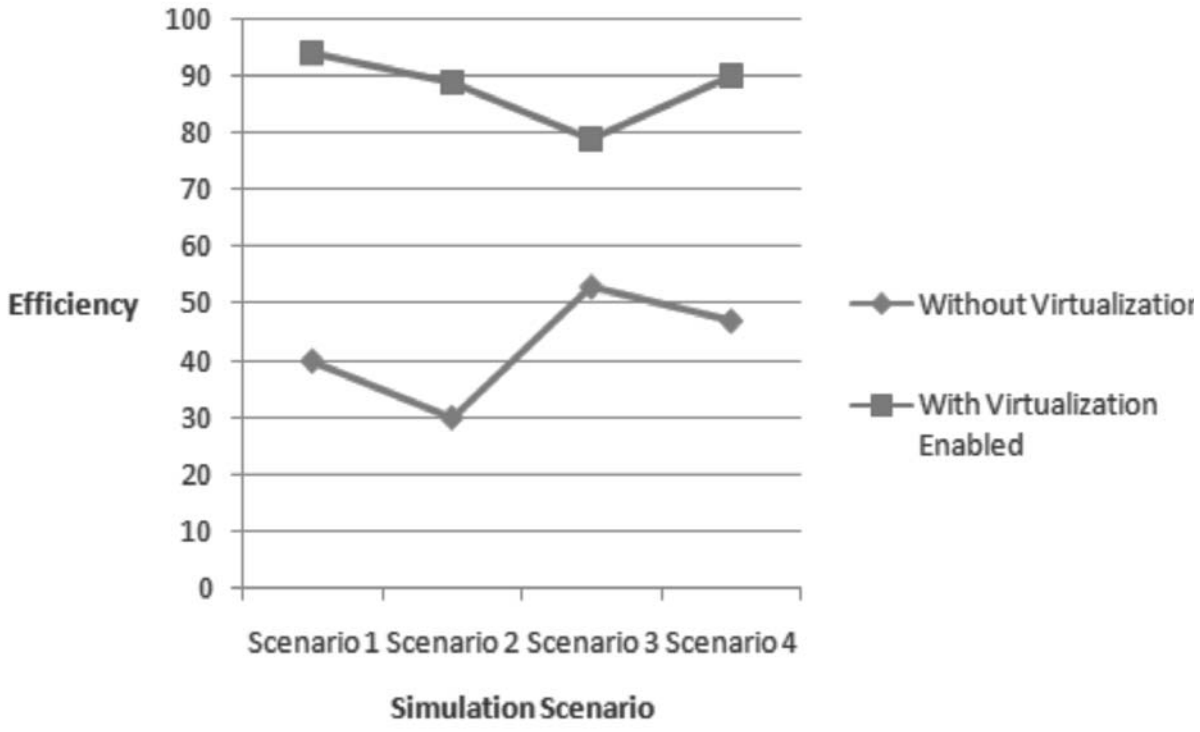

Fig. 4. Comparative Analysis of Classical and Proposed Approach

Using the code snippet in Python, the efficiency is measured for the proposed scenario

```
if __name__ == '__main__':
set Log Level ('info')
my time = (time. time() – start_time)
Efficiency = ((1/mytime)%100);
Print ("— %s Efficiency —" % (efficiency))
```

The efficiency and execution time is measured using the above mentioned formula

Table 2. Performance based on the Cost Factor

No. of Nodes in the Scenario	*Existing Approach*	*Proposed Approach*
5	86	40
8	84	45
10	75	23
15	73	30

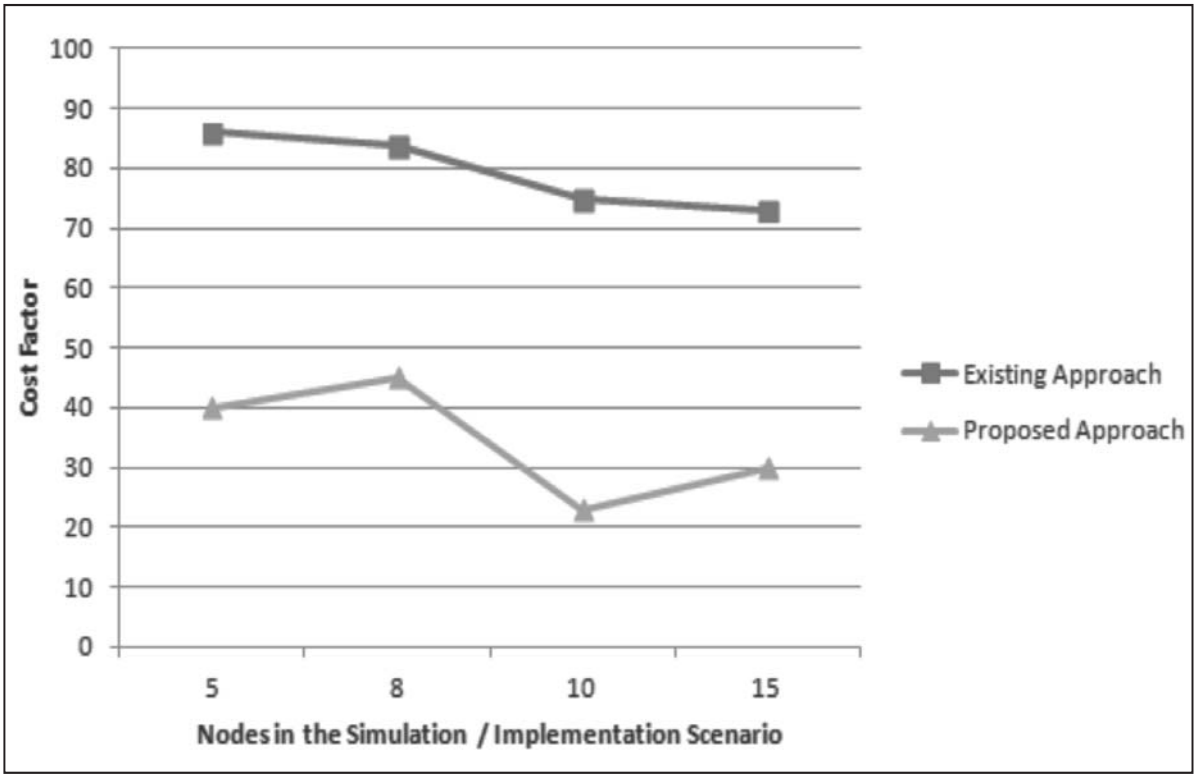

Fig. 5. Evaluation of Cost Factor in the Classical and Proposed Approach

4. CONCLUSION

Virtualized network is a vital factor in delivering high performance in cloud environment. Traditional approach was not very effective for utilization of resources. Hence, the virtual environment with multiple simulation scenarios with different number of nodes, switches and controllers have been considered. In this research work, the medical service is automated and implemented using SDN. Since healthcare organizations need the facility to turn out services rapidly. Results have shown that SDN approach in virtualized environment is the better approach to achieve efficient utilization of available resources. Proposed Virtualized approach will resolve the resource requirement issues, at the same time increases the efficiency and reduces the cost which help the Health care organization.

5. REFERENCES

1. N. McKeown, T. Anderson, H. Balakrishnan, G. Parulkar, L. Peterson, J. Rexford, S. Shenker, and J. Turner, "Openflow: enabling innovation in campus networks," SIGCOMM Computer Commun. Rev., vol. 38, no. 2, pp. 69–74, 2008.
2. J. Tourrilhes, P. Sharma, S. Banerjee and J. Pettit, "The Evolution of SDN and OpenFlow: A Standards Perspective," ONF, 2014.
3. S.Azodolmolky, Software Defined Networking with OpenFlow, Packt Publishing, 1st edition, October 2013.
4. Lantz, B., Heller, B., & McKeown, N, "A network in a laptop: rapid prototyping for software-defined networks, " In Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks, pp. 19, Oct. 2010.
5. Msahli, M., Pujolle, G., Serhrouchni, A., Fadlallah, A., & Guenane, F, "Openflow and on demand Networks, " In Network of the Future, Third International Conference on the pp. 1-5, Nov. 2012.
6. Salsano, S., Ventre, P. L., Prete, L., Siracusano, G., Gerola, M., & Salvadori, E, "OSHI-Open Source Hybrid IP/SDN networking," In Software Defined Networks Third European Workshop on pp. 13-18, Sept. 2014.
7. Lara, A., Kolasani, A., & Ramamurthy B , "Network innovation using openflow: A survey, " IEEE Communications Surveys & Tutorial, 16(1), 493-512, 2014.
8. B. Boughzala, R. Ben Ali, M. Lemay, Y. Lemieux and O. Cherkaoui, "OpenFlow supporting inter-domain virtual machine migration," *Eighth International Conference on Wireless and Optical Communications Networks, Paris,* pp. 1-7,2011.
9. Wang, S. Y, "Comparison of SDN Open Flow network simulator and emulators: EstiNet vs. Mininet, " In IEEE Symposium Computers and Communication, on pp. 1-6, June 2014.
10. H. Kim, J. Kim and Y. B. Ko, "Developing a cost-effective OpenFlow testbed for small-scale Software Defined Networking," *16th International Conference on Advanced Communication Technology,* Pyeongchang, pp. 758-761,2014.
11. Shie-Yuan Wang, Chih-Liang Chou, Chun-Ming Yang, " EstiNet OpenFlow Network Simulator and Emulator, " IEEE Communications Magazine,pp.110-117 , September 2013.
12. Shahmir Shourmasti, K., Stochastic Switching Using OpenFlow, 2013.
13. Turull, Daniel, Markus Hidell, and Peter Sjödin, "Performance evaluation of openflow controllers for network virtualization." IEEE 15th International Conference on High Performance Switching and Routing, 2014.
14. Mao Yang, et al., "Software-Defined and Virtualized Future Mobile and Wireless, A Survey, " ACM/Springer Mobile Networks and Applications, vol. 20, no. 1, pp. 4–18, 2015.
15. Y. Liu, Y. Li, Y. Wang, A. V. Vasilakos, and J. Yuan, "Achieving Efficient and Fast Update for Multiple Flows in Software-Defined Networks, " in Proc. DCC14, pp. 77–82,2014.
16. Zhou J, Cao Z, Dong X, Xiong N, Vasilakos AV, " 4S: A secure and privacy-preserving key management scheme for cloud-assisted wireless body area network in m-healthcare social networks." Information Sciences, 255–276 , 2015.