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A PRAGMATIC EVALUATION AND INTEGRATION OF TELEMEDICINE ON CLOUD ENVIRONMENT

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Abstract

The network administrators and forensic teams are working on Software Defined Networking (SDN) by virtue of which, the network components can be controlled and managed using virtual infrastructure and suites. From the view point of the physical implementation, a single error or oversight can jeopardize the entire network integration. Now-a-days, the SDN products are being used in the research, development and corporate sector so that the effective control that covers routing, scheduling, security using related algorithms can be implemented on real networks. In this research work, a unique and pragmatic implementation of the virtualization is proposed using Mininet-OpenFlow integration to evaluate the performance of network and data packets transmission of real time delivery of Health and Medical care services with higher degree of integrity, security and performance on effective dimensions.

Keywords : Cloud Based Health Services, Health Automation, Software Defined Networking

Introduction

Software Defined Networking (SDN) [1], also known as programmable networks. Software-defined networking (SDN) is a new networking model. SDN changes the limitations of current network Architecture. It decouples the network's control logic (the control plane) from the networking devices like switches routers etc., that forward the traffic (the data plane). With the separation of the control and data planes, network switches become simple forwarding devices. The control logic is implemented in a logically centralized controller.

The main function of the control plane is to determine where traffic is to be sent. Data plane is responsible for forwarding traffic based on instructions provided by control plane. The separation of the control plane and the data plane can be done by using well-defined programming interface between the switches and the SDN controller [2].

With this well-defined application programming interface, the controller has direct control over the data plane elements [3]. Open Flow is one of the best examples of such an API.

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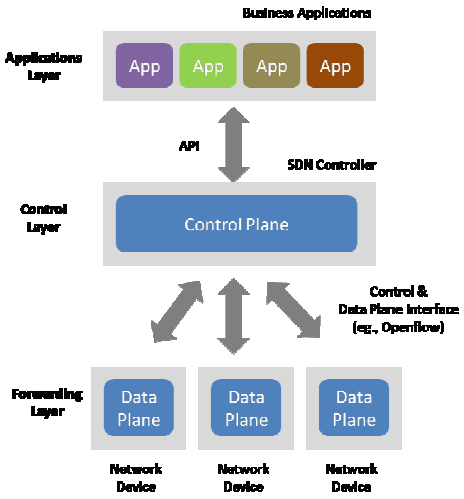

Fig. 1. Simplified View of SDN Architecture

Key Perspectives

The existing implementations of the classical virtualization and network components management in a grid and distributed environment are 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 [4]. There is the need of software defined networking using which the complete set of network components can be managed with efficiency and overall cost factor can be reduced a lot [5].

Following are the research objectives in this work which are accomplished the simulation:

- To evaluate the performance of SDN suite and associated virtualization
- To implement a real life case scenario of SDN in medical domain so that the dynamic delivery of resources can be done.
- To perform the experiments on varying number of nodes and network devices
- To calculate and analyze the turnaround time and round trap time in each simulation iteration so that the effectiveness can be measured.

Health and Medical Care Services Delivery using SDN

Healthcare is the maintenance or improvement of health via the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in human beings. Health care is delivered by health professionals (providers or practitioners).

Health and Medical Care Services are classically delivered using traditional methods. In such approaches, the operation theatres take the quota of blood, anesthesia, oxygen and other medical resources in static aspects. By this approach, there is scarcity of resources for other operation theatres which should be updated using research and optimization based values. This static medical resource allocation is required to be delivered dynamically using optimized algorithms which we have done in this work.

In the proposed work, we have developed the approach to dynamically deliver the medical and health services to each end point operation theatre so that the resource allocation can be done dynamically using cloud technologies and software defined networking. By this algorithmic approach, there is dynamic allocation of health services to each end point depending upon the requirements without any delay and minimum turnaround time achieving higher level of accuracy and efficiency.

The key purpose and goal of this research work is to automate the health dimensions in a medical point using software defined networking on cloud platforms. Using such approach, it is easy to

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optimize, control and predict the dynamic requirements. The overall performance of the approach is higher than the classical work done earlier. The work is based on the development and deployment of software defined networking using mininet and openflow based libraries so that the real time cases and scenarios can be fully optimized with higher accuracy.The case used in the work is dynamic medical services including oxygen, anesthesia and blood which are very important for any operation theatre. By using our proposed optimized approach, the overall performance is improved and enhanced.

MiniEdit is an experimental tool created to demonstrate how Mininet can be extended. By using MiniEdit we can create and run network simulations [6][7].

Fig. 2. MiniEdit canvas

Creating a Medical Services Delivery Network in MiniEdit

Let us start by making a network in the MiniEdit. Figures shows two controllers c0 and c1, two switches s1 and s2 and four hosts namely h1, h2, h3 and h4. By dragging and dropping various hosts, servers and switches we can connect them with provided connections.

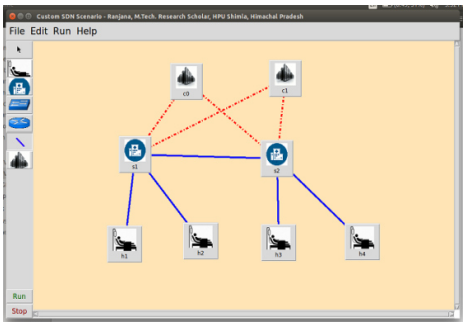

Fig. 3. Network Formation in MiniEdit

We can configure our controllers' switches and hosts as per requirement of the networks as shown in the figure. The right hand side small window in the figure shows the different variables of the scenario which can be customized in the MiniEdit.

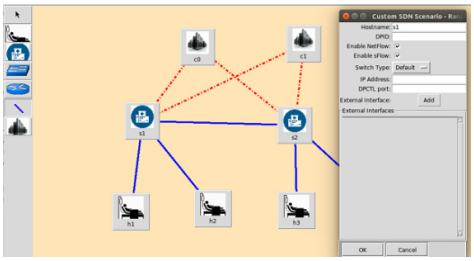

Fig. 4. Customized SDN Scenario

Architecture for Medical Services

Here are the Controllers, hosts and virtual Switches, as we know that switches can be used for multiway connection. Thereby forward ping is when the controller interacts or forward the data to hosts by switch and backward ping is when host send request. Here in medical services, controller is server and hosts are operation theatre where online services can be provided to theatre as per request.

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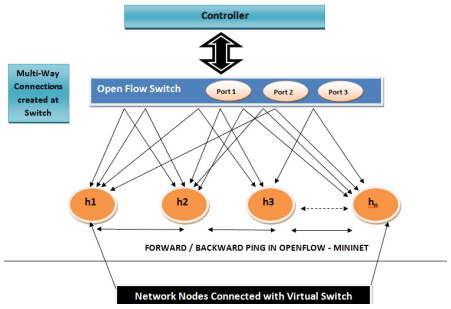

Fig. 5. Network Nodes Connected with Virtual Switch

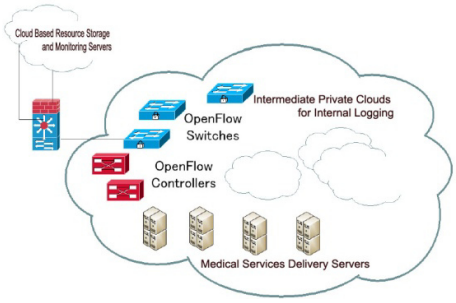

Fig. 6. Architecture for Hospital

In our Virtualization enabled hospital automation, the case of anesthesia injection in the hospital operation theatres is taken. Suppose there are 10 operation theaters in a hospital and each block needs the anesthesia injection to some extent by taking the constraint of limited anesthesia in the hospital.If a particular operation theatre needs more delivery, the server (controller) will analyze the requirements depending upon assorted parameters of the patient including blood pressure and other aspects. The server (controller) will decide whether to deliver that anesthesia or to provide the alternate resource.

PseudoCode

1. *Activate and Initialized the Server (Controller) C_i*
2. *Activate and Initialized the Intermediate Load Balancers (Switches) S_i*
3. *Generate the Delivery Points (Operation Theatres) h_i*
4. *in each h_i*
    a. *h_i initiates the request R_j to specific injection to be injected from the server point*
    b. *for each R_j, $S_i$will forward the request to C_i*
    c. *if $R>A_j$ (A_j> Available Injection) deliver alternate resource else R_j := h_i(Delivery to be implemented)*
5. *Analyze the Log Reports of each h_iS_i matrix*

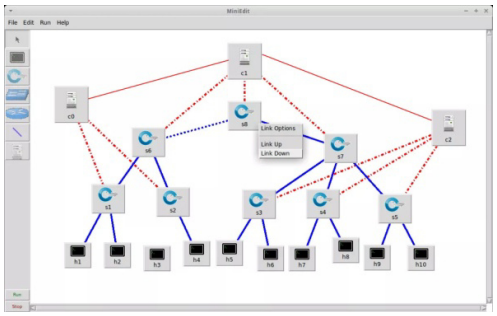

Fig. 7. Scenario of the Virtualization Enabled Medicare Services

Each virtual machine created maintain data base inside it including blood, oxygen, anesthesia and related aspects. Controller is directly connected to the doctor. Group virtual machine into different departments whenever necessary or scarcity in particular department these VM contents has to be moved to other VM through controller.

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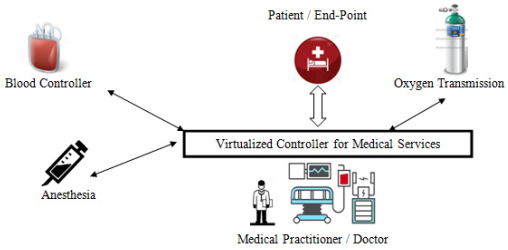

Fig. 8. Virtualized Controller for Various Medical Services

Components of the Proposed Hospital System with Virtualization

1. Centralized Server with Sub-Controllers (c_0-c_2)
2. Intermediate Modules for Load Balancing and Routing (s1 - s8)
3. Operation Theatres (h-h10)

Conclusion and Scope of Future Work

From literature survey we concluded that traditional networks were inflexible in nature and were hard to handle. Traditional networks are cumbersome as data and control plane are vertically integrated and it is hard to program them. SDN has emerged as a new technology which is flexible and can be implemented programmatically. It solves almost all problems related to traditional networks. We can emulate the SDN networks using emulation tool like Mininet and check various parameters related to a proposed network. This means we can check the fidelity of the emulation that how SDN will behave on a real network. Using software defined networking, the actual implementation and management of the network infrastructure is made easy. The base technologies behind the scenario are the virtualization and remote clients. In this manuscript, the implementation is done based on multiple simulation scenarios having different number of nodes, switches and controllers to analyze the performance. In this research work, the medical services delivery is automated and implemented using software defined networking. There exist another approach hyper-heuristic that can be integrated for deep learning of cloud services and predictive analysis. The key demarcation line between metaheuristics and hyper-heuristics is that nearly all the implementations in metaheuristics makes search in the search space in the span of solutions of problem. The hyper-heuristics takes the cases and search space within the range and domain of heuristics.

Acknowledgements

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