ISSN:0975-9646

Sai Krishna Patra et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 7 (6) , 2016, 2499-2501

Resource Efficient Network Management with Software Defined Networks

Sai Krishna Patra, Suri Srikar Charan, Pavan Dasari
CSE, GITAM University

Abstract— Network management is a provocative yet crucial task, even though various proposals were made to build an easily manageable network, they all have become a makeshift solution, since the toil lies in the rigidity of the underlying infrastructure. Network virtualization can be a reassuring technique for constructing an efficient network, as it enables integration of new features into existing network elements with a lower cost. It is the process of enforcing software programmable functionality to the available hardware. However, open issues in this are, how it will overcome some challenges like efficient resource management, scalability, and quality of service. It can be assessed by new archetype named Software Defined Networking (SDN), which abstracts the control plane from the data plane, which in turn enables for a centralized software program to control the flow of traffic in the network. We use SDN to evaluate the virtualized networks before we substrate it to existing hardware. We extend an SDN controller to monitor various parameters of the various southbound components of the network, like the resource utilization by the switches, the quality of service of these switches (throughput, delay).

For a better efficiency, we use energy efficient algorithms to control the flow of the packet through the switches. The switches are monitored and controlled by the SDN controller, and it can also be programmed to change the state of the switch to idle whenever necessary, in cases like when there is no incoming data flow through that switch to reduce the overall energy consumption there is no incoming data flow through that, and activate the switch when there is active data flow, hence reducing the total energy consumed by the switches. It can also be enhanced for an efficient way to manually control southbound components, as this can lead to an upper hand for network administrators in many corporate societies.

1. INTRODUCTION

It's no secret that data centers consume a huge amount of energy, US alone accounted about 70 billion kWh per annum, although this figure is achieved after taking many visionary steps, upgraded hardware, well ventilated room architecture and several Green procedures, we had almost cut down by fifty percent.

These ideas are well flourished in developed countries, but in developing countries like India it's not the case. Power consumption might not be a problematic issue in cities but it is a major issue in villages. To handle such issues alternate energy sources, like hybrid solar panels should be used. The amount power generated by the alternate sources is very less. The operation of network switches with low power is not possible if traditional network design is used. Hence we propose an energy efficient solution to operate the network switches. Many of the Data centers target for 0% fail rate. To achieve this milestone, they enforce much resources which in turn consume huge amounts of energy. Due to major issue of servers and their optimal temperature maintenance, about 60% of a data center's total power budget is toward cooling. Improvements include better components as well as better software. With energy management schemes for the largest power consumers well in place, we turn to a part of the data center that consumes 10-20% of its total power.

SDN is an emerging trend in computer networks which is based on the concept of decoupling of the control plane and the data plane and logically centralizing the control of a network and the abstraction of the underlying infrastructure for applications and network services by enabling programmable network devices. The control and the forwarding components are tightly coupled in the traditional network. This tight coupling is eliminated which assists in the elimination of drawbacks such as cumbersome network configuration and limited flexibility to changing requirements.

The basic agenda of SDN is to establish an agile and fluid control for network engineers and administrators to respond actively towards changing business requirements via a centralized control console. SDN is integrated with vast set of tools of network technologies intended to make the network to handle virtualized server and storage infrastructure without breaking sweat.

2. SYSTEM ANALYSIS

2.1 EXISTING SYSTEM

In the existing system, the instructions to the devices are pre-defined by vendors. These instructions cannot be modified dynamically. So, to reconfigure the network, the actual hardware has to be modified.

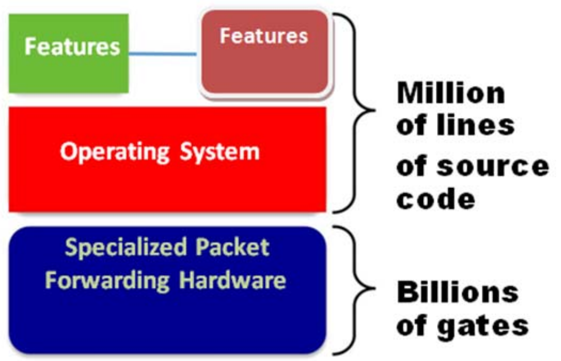

Fig. 1. STRUCTURE OF EXISTING SYSTEM

2.1.1 LIMITATIONS OF EXISTING SYSTEM

- As the switches cannot be programmed, testing complex and large networks under real world conditions is almost impossible.
- Managing these hardware-centric networks at a higher rate is difficult by managing each single device, which is the only method in these systems.
- As the networks are not manageable, there is no significant change in these networks for a long time.
- At a higher level, isolation of layers is absent in these networks.
- The instructions to switches in these networks are predefined by vendors. Hence, any type of innovation in these networks is open only for vendors.

To overcome this, we propose a new system by introducing an isolation of the network's control logic from the underlying routers and switches.

2.2 PROPOSED SYSTEM

In the proposed system Software Defined Networking (SDN) is used, in which there is an existence of isolation of control plane from data plane. Unlike the traditional networks, these networks are not hardware-centric, i.e., the devices in forwarding plane are controlled from a separate controller.

This reduces the complexities in organization and management of these networks, thereby making them more flexible.

2.2.1 ADVANTAGES OF PROPOSED SYSTEM:

- By isolating the control and data structures, it provides a centralization of the entire network and simplifies the network management.
- The SDN Controller centralizes the point of control so that the security and policy information are distributed consistently throughout the enterprise.
- Software defined networks makes it easier to centralize enterprise management and provisioning by providing a centralized view of the entire network
- It widens the scope for innovation.
- It reduces the operating costs.
- All types of networking devices along with physical and virtual switches can be managed by a centralized controller.
- Dynamic controllability of these networking devices makes intercalation of new layers of abstraction in these networks possible, which thereby makes network management easier.

3. IMPLEMENTATION

Since each and every switch of a network can be operated through a common controller we can achieve energy efficiency by following one of the methodologies in SDN termed traffic aware solution.

3.1 Traffic Aware Solution:

In this approach, energy consumption can be reduced by turning off some forwarding switches during low traffic load, or putting CPUs or ports at sleep mode. Whenever a source sends data to destination, only the switches that are present in the selected route are enabled, rest are kept in sleep or idle mode. The solutions in this group have the potential to significantly improve energy efficiency in SDN. Further analysis shows that if this technique is carried out properly then at data centers, we can achieve using 50% less energy during low load periods.

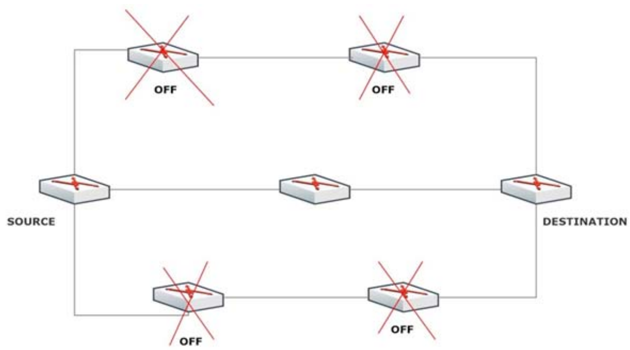

Fig. 2. TRAFFIC AWARE SOLUTION

Traffic aware solution can be operated in two ways.

3.1.1 Manual control:

In this mode of control, we have a group of dedicated network administrators who continuously monitor the network traffic, and decide which set of switches should be turned on and which all must be kept in sleep state. This can be mainly used in corporate business structures so that they can afford the network administrators, these administrations would simply control these switches by integrating REST API in the Openflow controllers, so that they can easily build a certain protocol to send the message to controller and depending on that code, it will carry out the desired functions like changing switch state to idle and active. This allows a flexible control over the network, making us to save almost 70% of energy during low load period. We can also cut off the link if any unauthorized access is detected. We can prepare ourselves to enforce more switches when we feel that demand would be high.

3.1.1.1 Disadvantages OF MANUAL CONTROL*:*

- Requires continuous monitoring
- Not 100% efficient at all the times.
- Minor mistake can cause a huge impact.

3.1.2 HEURISTIC SEARCH ALGORITHMS:

To address traffic aware solution, in large scale where person can't operate due to vast and complex network, we need to deploy automation. For that case we depend on various heuristic algorithms like A* and Dijkstra's to find the shortest path between two nodes in the network. Since we used heuristic algorithms, the interconnections gradually increase with increase in network load, but it doesn't decrease automatically so we need to refresh the active set generated by the algorithms in certain intervals, which is calculated by some basis. Each path is assigned with a value as weight, so that we can get an optimal path. This is simulated like a physical network with the help of Mininet which is a network virtualization tool, where we can almost generate physical simulation of different southbound devices.

4. RESULT

In the analysis using we have chosen two different searching techniques A* and Dijkstra's, we had observed that Dijkstra's works better in less load. As the traffic increases, we have observed a rapid increase in consumption of energy. On other hand when it is implemented with A* even though initial power consumption is more than that of Dijkstra's it eventually ended up using less energy than the former one. The fig 3 is an instance of one the simulation where we can observe that the switch consumes lower amount of energy but gradually increases as traffic increases.

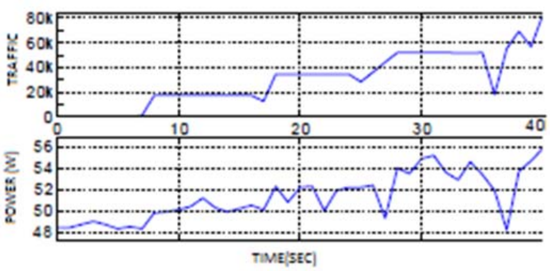

Fig. 3. ENERGY CONSUMPTION UNDER SDN

5. CONCLUSION

In this paper, we have addressed the reason why we need to consider energy efficiency of networks and how it is achieved with the help of software defined networks. Since we can see a major difference in terms of energy saving, SDN model become indispensable.

We had proposed two different approaches in traffic aware solutions and listed their drawbacks and scope. we further aim to enforce it in real time and make an experimental comparisons and

6. DISCUSSION

In our study we have considered delay as the QOS parameter to determine the most optimal path. There are various other parameters like throughput, latency, collisions etc. Therefore, in addition to delay other parameters may also be considered to determine the optimal path so that the optimal path would be optimized with respect to all the factors, so that we can establish a more stabilized network in the market without any unforeseen errors. Also the security issues need to be addressed by working on middleware. Middleware is used to provide better security to applications which use the SDN application to monitor and control the network. SDN, by its nature, is oriented toward joining different pieces of technology via the orchestration mechanism of a logically centralized controller. In fact, a unique SDN protocol, does not exist— users can combine various technologies. Therefore, in consideration of the technical solutions of SDN, it will be increasingly important to study the end-user's benefit from a system wide perspective to ensure the final configuration supports the user's objectives.

REFERENCES

[1] "Design and Implementation of a Framework for Software-Defined Middle Box Networking" by Aaron Gember, Robert Grandl, Junaid Khalid, Aditya Akella University of Wisconsin-Madison, Madison, WI, USA {agember, rgrandl, junaid, akella}@cs.wisc.edu.

[2] "Improving Network Management with Software Defined Networking" by Hyojoon Kim and Nick Feamster, Georgia Institute of Technology.

[3] "Are we ready for SDN? - Implementation Challenges for Software-Defined Networks" by Sakir Sezer, Sandra Scott-Hayward, Pushpinder Kaur Chouhan CSIT, Queen's University Belfast Barbara Fraser, David Lake - Cisco Systems Jim Finnegan, Niel Viljoen – Netronome Marc Miller, Navneet Rao - Tabula

[4] "State-of-the-art Energy Efficiency Approaches in Software Defined Networking" by Beakal Gizachew Assefa and Oznur Ozkasap, Department of Computer Engineering, Koc University, Istanbul, Turkey.