Nowadays, enterprises accelerate their adoption of network virtualization by focusing on Software Defined Networking and Network Functions Virtualization. The era of distributed storage and storage access presents everyone’s challenges in the computer network domain. Any efficient solution should support data center network architectures to operate various data center tenants and handle the immense amount of traffic that comes with it. Ensuring availability and low latency is a vital challenge to solve in this scenario. Recently, Multi-tenant data centers offer an improved uptime, redundancy and a level of efficiency to clients looking for better support for growth. MTDCs give enterprises the opportunity to serve clients and end users better [1]. The article outlines the simulation and performance analysis of multiple tenants in a data center network that helps in planning and implementing fault-tolerant and low latency networks. Fig. 1 represents a conventional data center architecture.

**Objective**

The paper discusses a MTDC architecture implemented in both Mininet and GNS3 and gains detailed insights into the overall network performance in different scenarios. The network is flooded with ICMP, TCP, and UDP packets. Further, the traffic is analyzed in Wireshark by capturing the packets at corresponding interface to evaluate the performance impact on latency, throughput and jitter. The plots with Wireshark help in drawing a relationship with the performance metrics.

The first SDN based testbed for DCN topology is built using Mininet and Ryu Controller on Ubuntu Virtual Machines. Multiple instances of the mininet VMs (different servers), running the topologies acts as the data plane while the Ryu controller acts as the control plane. Creating VXLAN tunnels between the switches running on different servers enabled the underlying hosts to communicate with each other. The second architecture is adopted on a GNS3 VM to enable inter-VLAN routing.

**Methodology**

**Architecture I**

This initial architecture was built on mininet but did not support inter-VLAN routing capability between the tenants. Hence developed another architecture on GNS3 for further analysis.

**Architecture II**

The architecture in Fig. 2 shows the implementation of a Multi-Tenant data center on a single GNS3 VM. This MTDC architecture consists of a core switch (S1), two aggregate switches (S2 & S3), and four access layer switches (S4, S5, S6 & S7).

**Scenario I – Intra-VLAN Communication**

Here, the effects of packet traffic between the same VLAN throughout the network is measured. Fig. 5 shows the difference in latency as the hop count increases. Fig. 6 shows the throughput in the network during multiple intra-VLAN communication.

**Scenario II – Inter-VLAN Communication**

The effect of packet traffic between different VLANs throughout the network is measured. Fig. 7 shows the variation in latency in the presence of TCP traffic. Fig. 8 shows the considerable change in throughput when the traffic traverses through different layer of switches.

**Analysis and Results**

**Conclusion**

The project initially involved the construction of a backbone base as a testbed for a small-scale data center using simulation tools such as VMware Fusion and GNS3. Multiple tenants were created by assigning the hosts to different VLANs. A tree topology consisting of a core layer switch, two aggregate layer switches and four access layer switches were created to emulate a small-scale data center. After proper configuration various traffic like ICMP, TCP and UDP packets were sent across the network to deduce some relations on a few network parameters. From both the Wireshark capture and simulation results, multiple graphs showing how the inter/intra VLAN communication affects the throughput, latency and jitter in a DCN were plotted. It is found that these parameters depend on the number of hops counts during the network traffic. As the hop count increases, the latency and jitter increase whereas the effective throughput decreases. As the network becomes more congested due to multiple traffics, the network performance decreases considerably.

**Key References**


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