Evaluation of Multi-tier Network Architecture
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**Introduction**

Network evaluation may consider a range of questions and adopt a variety of options for undertaking the evaluation depending on factors such as the type, size, stage of development and purpose of the network. Networks may be closed (bound) or open (unbounded), web-based or located within a specified geographic area. Purposes can include information sharing, mutual support, and advocacy for social, economic, environmental or political change.

On-site network evaluations or network surveys are an important part of your business’s strategic and technological planning processes. Engineers need to assess your existing network’s infrastructure, systems, software, security and implementation in order to workaround failures.

Recent developments in the area of wireless communication have paved new era of internet of vehicles (IoV). Network Function Virtualization and Network Slicing are at the virtualization layer. Unlike previous standalone fog-based services adopted in vehicular networks, the designed virtualization layer smoothly bridges the gap between the logically centralized control at the SDN and the distributed services at the fog layer. SDN controller was used as an orchestrator, to route the packets throughout the network layers.

**Methodology**

Network Architecture

To simulate the network topology, we used OpNet simulation tool. To implement the network slicing concept, we created three layers of network, which consists of virtual devices to do the routing. SDN controller directs the route of a packet and make a slice of the network.

Here Client requests three applications, File transfer protocol (FTP), Email, and HTTPS to the server. Initially, the configuration of the SDN controller. If a packet is FTP request with port number 21. SDN controller assigns the Route Map 1 to the packet. If a packet is EMAIL request with port number 25, SDN controller assigns the Route Map 2 to the packet. If a packet is HTTPS request with port number 443 SDN controller assigns the Route Map 3 to the packet.

All the route maps are stored in the Static routing table. OpNet do not have the dynamic routing option. The Interface 0 connects the gateway router with an IP address of 192.0.0.3. As there is no option of SDN controller, the PPP server acts as an SDN controller in the network. Packets are destined to the final destination server, which has an IP address of 192.0.0.21.

**Analysis and Results**

The below figure depicts the Server Task processing time. The Server Task processing time is almost zigzag and irregular at the starting one hour. After an hour, processing time becomes constant as shown in the figure.

The figure below depicts the delay in the network when simulation of model for 2-hours takes place. From the graph, at starting the delay is 28 micro seconds as there are more number of requests from the different applications.

The below figure depicts the delay in the network for 8 hour simulation. Delay graph of 8-hour Simulation From the graph, the highest amount of delay is 27.5 micro seconds and least amount of delay is the 22 microseconds. In this simulation, the delay graph is step-wise and almost seems like a constant one after half time of the simulation.

From the graph, the highest processing time around 47.75 microseconds and least amount of task processing time is the 43.25 microseconds. The graph of task processing time for 8-hour simulation is completely zigzag and not constant any time.

**Summary/Conclusions**

As due to the more requests from the Email, HTTPS, and FTP applications, the graph is up and down all time during the simulation time.

**Key References**


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