Optimal Multi-Tenant Cloud Network Latency for Inter-Device Caching

(Short Paper Contribution)

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Multi-Tennant Networking

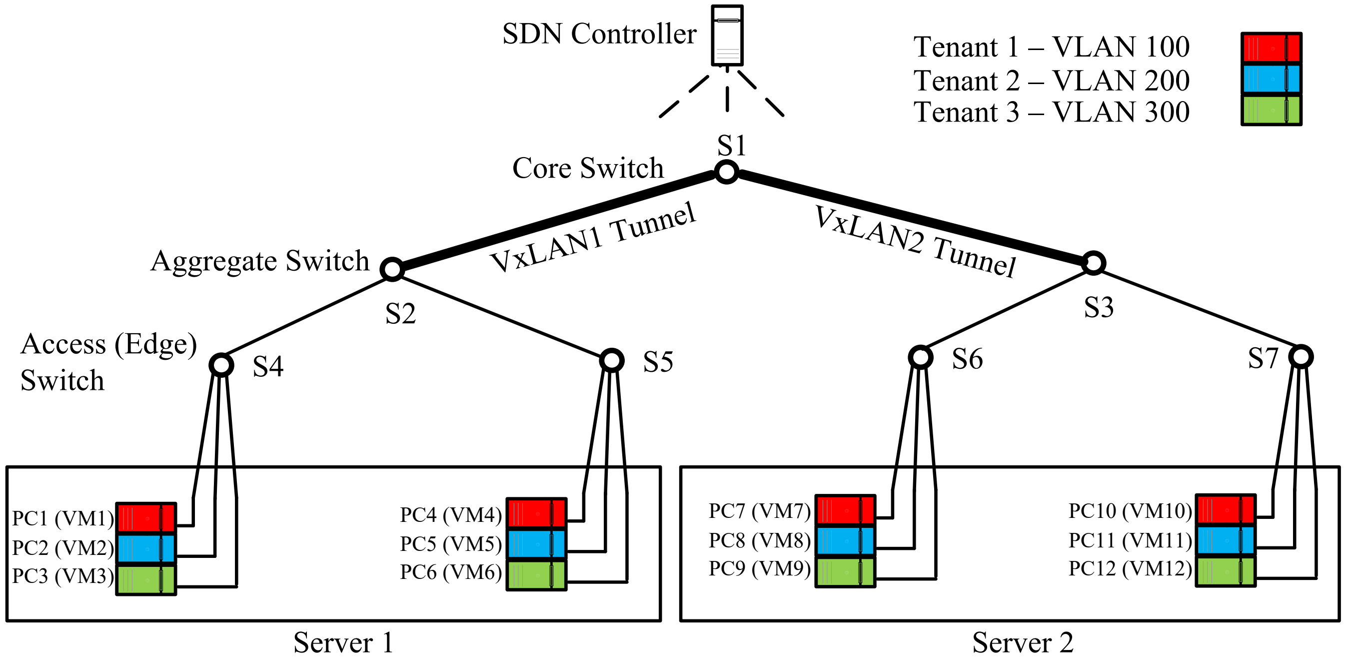

Figure 1. Topology with core, aggregate and access layer of switches in Mininet

- Implemented inter-VLAN communication on Mininet.
- Created VLAN Tags and Tunnels on the network.
- Could not access the consoles of the vSwitches to configure inter-VLAN communication.
- Used GNS3 for further progress.

Topology Configuration in GNS3

- Core Switch – S1
- Aggregate Layer Switches – S2 and S3
- Access (ToR) Layer Switches – S4, S5, S6 and S7
- PCs belonging to each VLAN were configured to separate subnets. Example :

  VLAN100 - 10.0.10.0/24

  VLAN200 - 10.0.20.0/24

  VLAN300 - 10.0.30.0/24

- Inter-VLAN communication is enabled.

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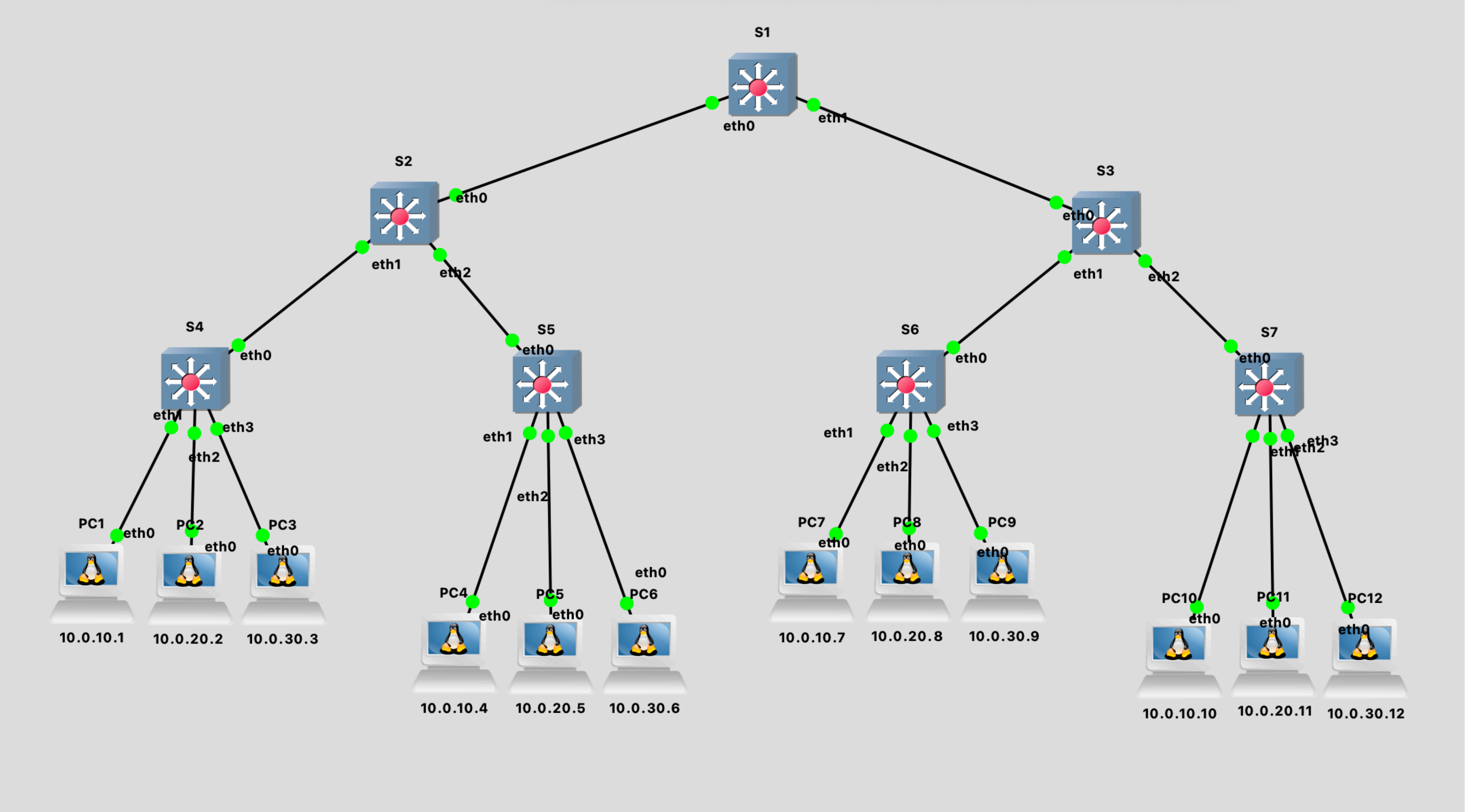
Topology with 3 layers of switches in GNS3



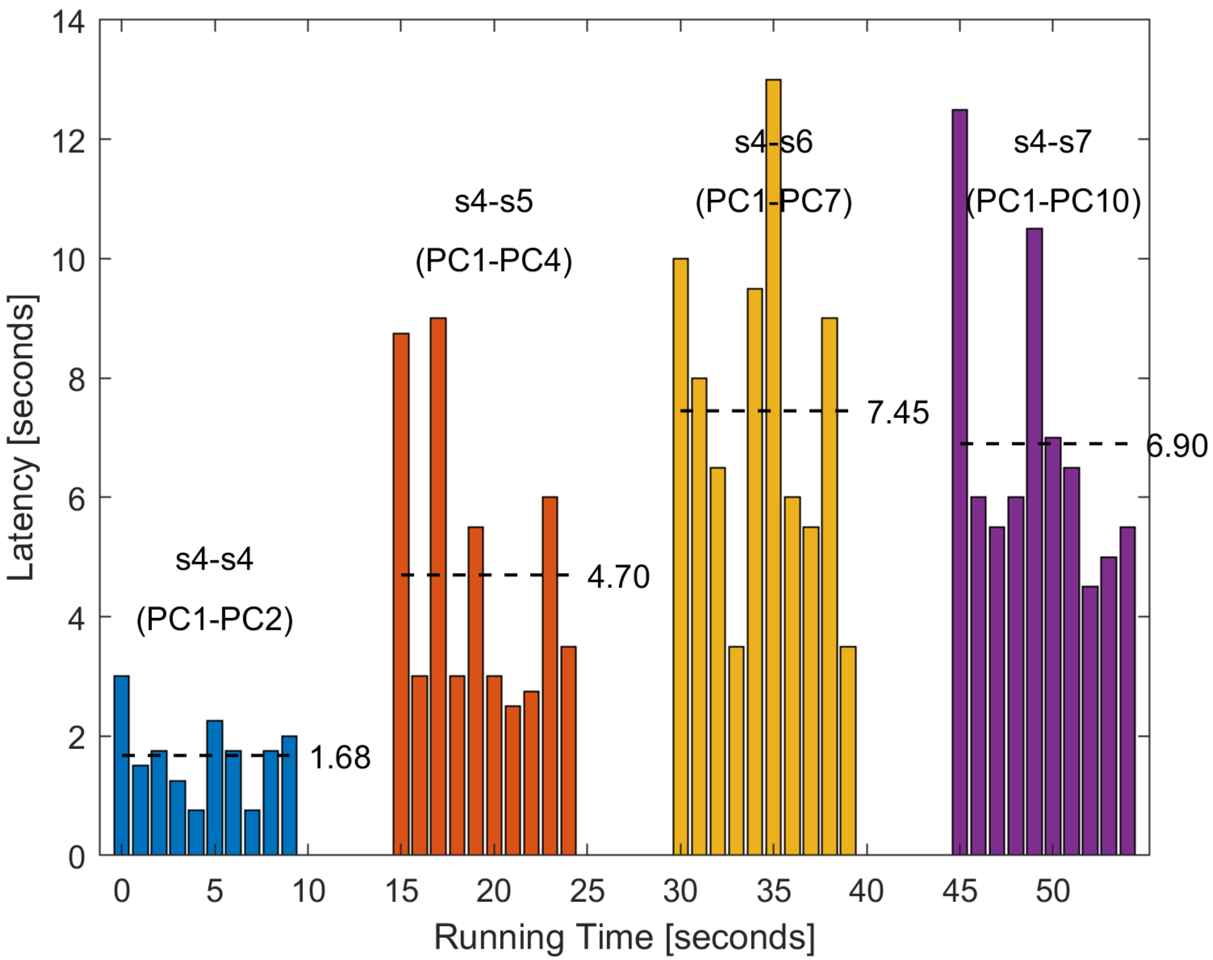
Scenario I : Intra-VLAN Communication

- The effects of packet traffic between the same VLAN throughout the network is measured.

- Different parameters under consideration:
  1. Latency
  2. Throughput
  3. Throughput during multiple intra-VLAN communication.

- All graphs were plotted from the Wireshark captures.

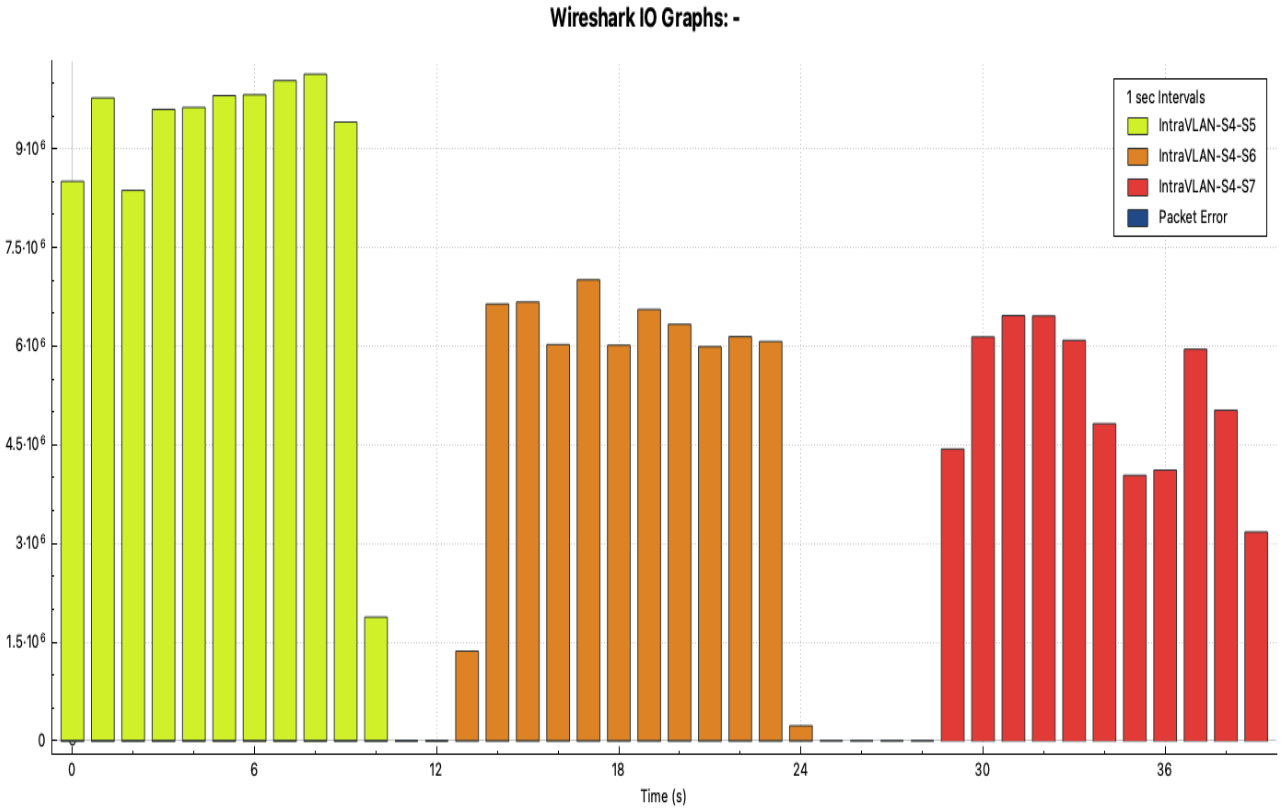
Figure 2. Latency analysis for the intra-VLAN communications



Observations:

- Latency is minimum when PC1 pings PC4.
- As the hop count increases, the latency also increases.
- E.g. - When PC1 pings either PC7 or PC10, the traffic has to traverse through the core switch.

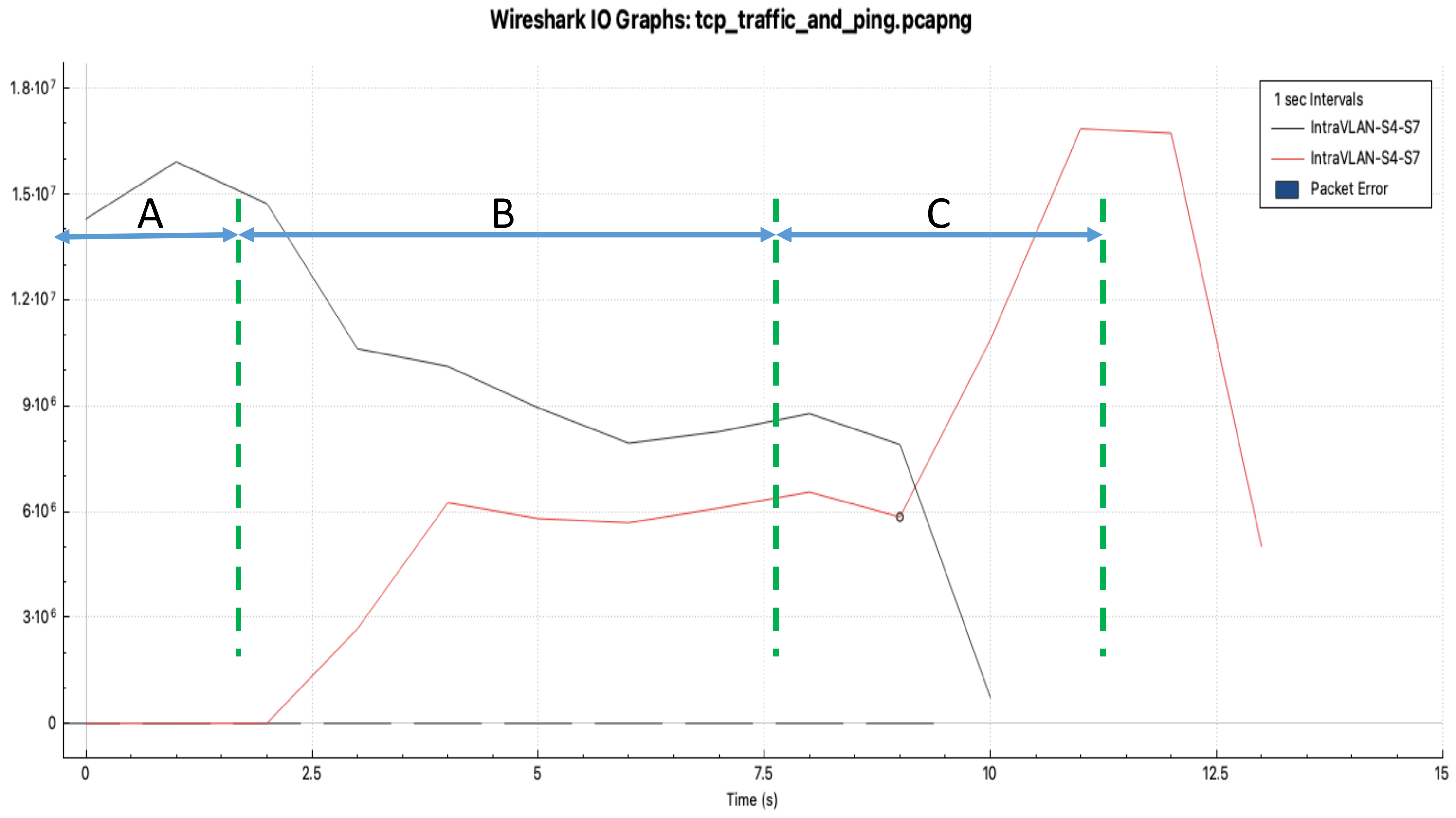
Figure 4. PC2 sending TCP traffic to PC5, PC8, PC11 (VLAN 200)



Observations:

- Maximum bandwidth is utilized when PC2 sends traffic to PC5.
- As the hop count increases, the throughput decreases.
- E.g. - When PC2 sends traffic either to PC8 or PC11, the traffic has to traverse through the core switch.

Figure 3. Throughput during multiple traffic in the network



Observations:

- Interval A, PC1 sending tcp traffic to PC10:
  - ➢ High throughput is observed.
- Interval B, PC1 and PC2 sending tcp traffic to PC10 and PC11 respectively.
  - ➢ The effective throughput decreases for both the traffic.
- Interval C, PC1 stops sending traffic to PC10 and PC2 continues to send traffic to PC11.
  - ➢ The throughput again increases.

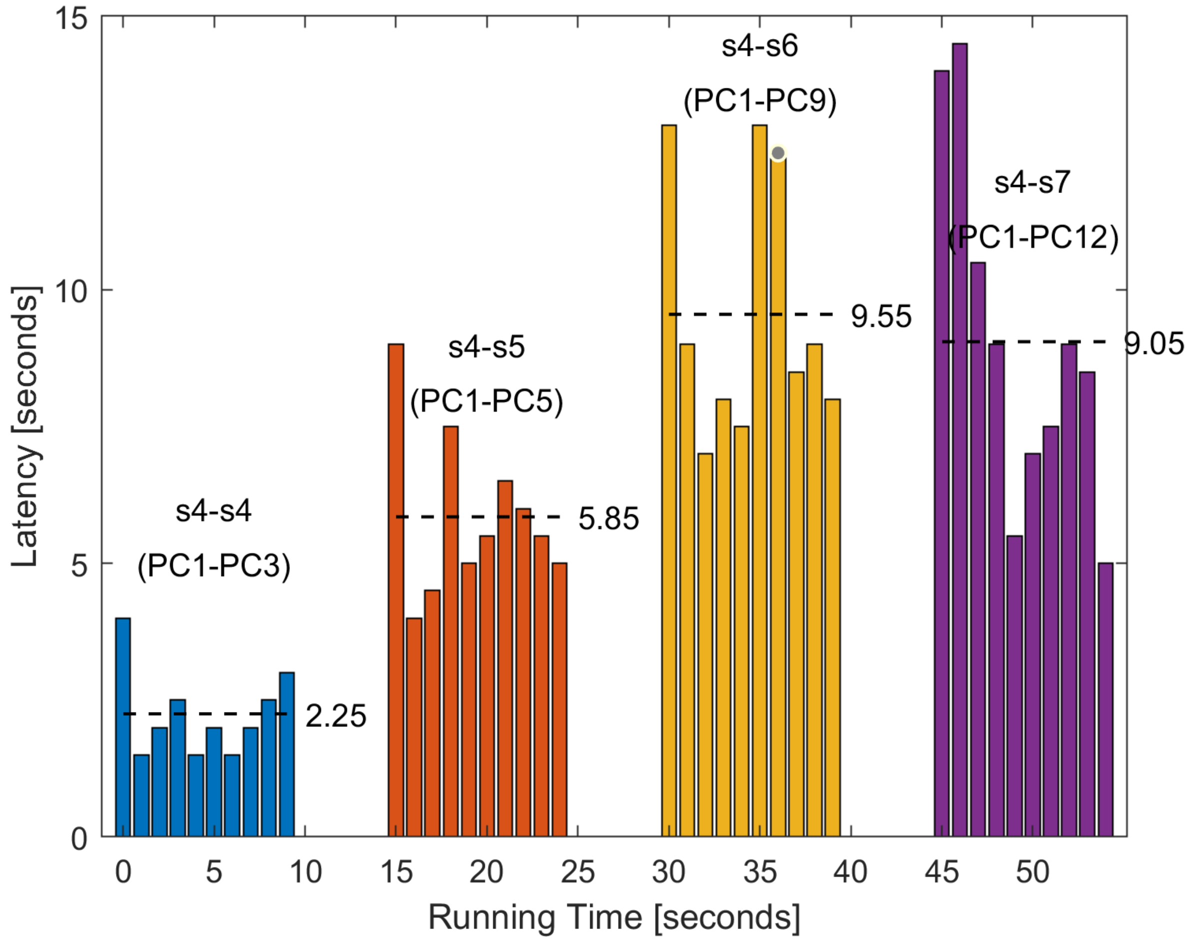
Scenario II : Inter-VLAN Communication

- The effects of packet traffic between different VLANs throughout the network is measured.

- Different parameters under consideration:
  1. Latency
  2. Latency during multiple traffic
  3. Throughput
  4. Jitter

- All graphs were plotted from the Wireshark captures.

Figure 4. Latency in inter-VLAN communications



Observations:

- PC1 pings PC3, latency observed to be minimum.
- PC1 pings PC5, increase in hop count causing latency to increase.
- PC1 pings either PC9 or PC11, the traffic traverses through the core switch.
  - A considerable increase in latency is observed.

Figure 5. Latency during multiple caching traffic in the network

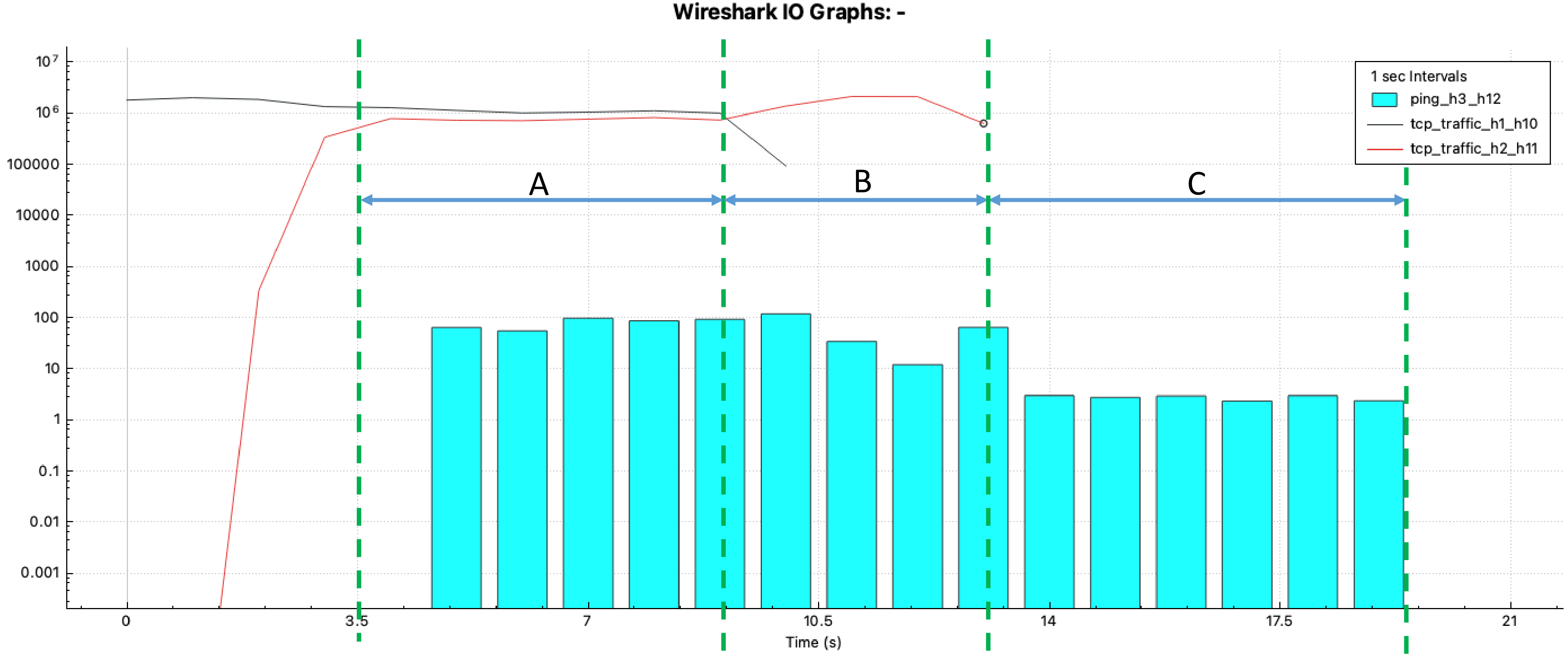


Figure 7. Latency in Inter-VLAN

Observations:

- Interval A, both PC1 and PC2 sending TCP traffic to PC10 and PC11 respectively. At the same time, we sent ping requests from PC3 to PC12.
  - ➢We experience maximum latency as shown in the bar graph.

- Interval B, PC1 stops sending traffic to PC10 whereas PC2 continues to send traffic to PC11.
  - ➢Latency slightly improves.

- Interval C, no other traffics going on in the network.
  - ➢The latency further decreases.

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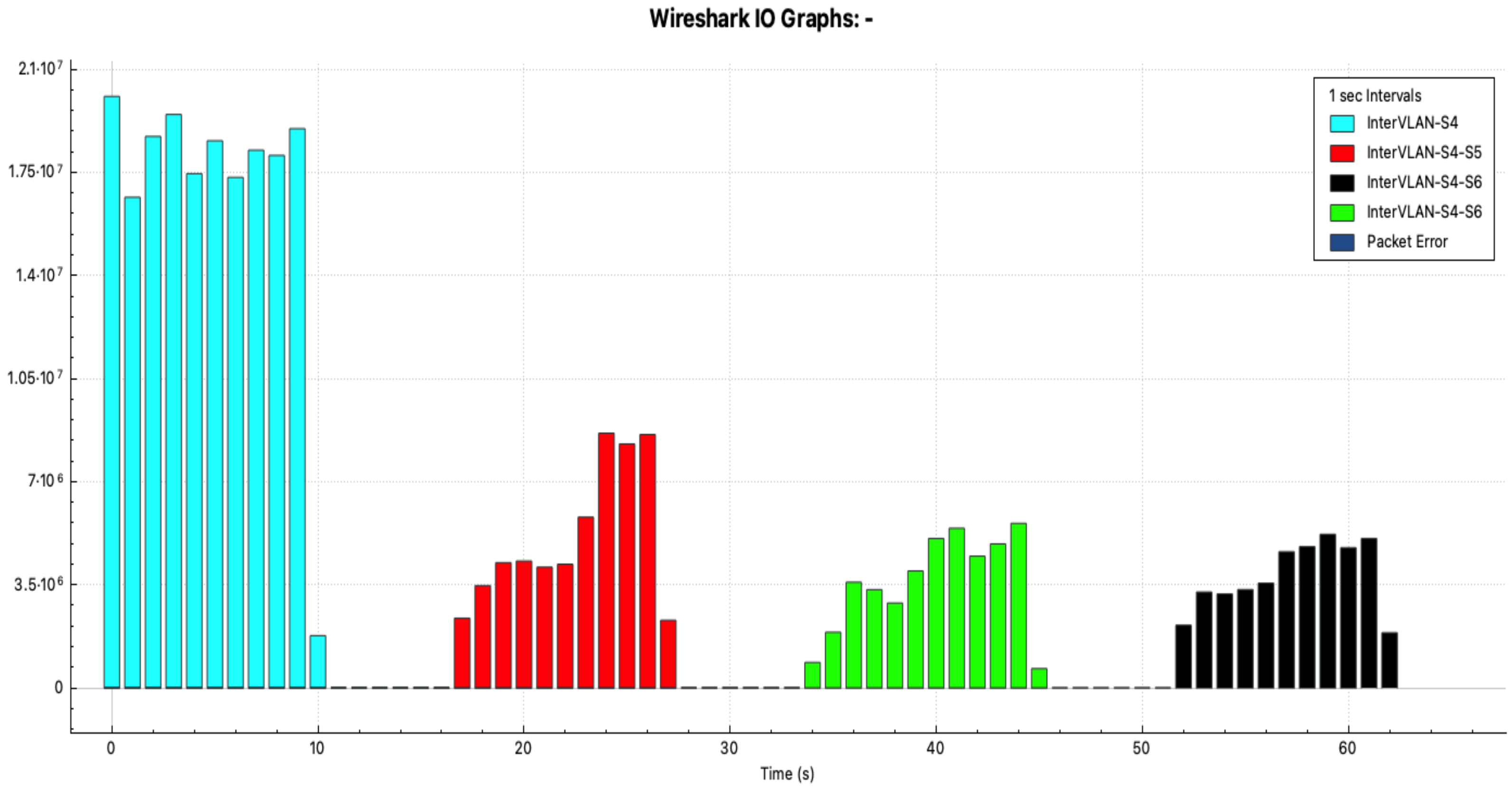
Throughput between PC1 (client) and PC3, PC5, PC8, PC9 (servers)



Observations:

- Maximum bandwidth is utilized when PC1 sends traffic to PC3, hosts connected to the same access layer switch.
- Throughput decreases drastically when the traffic traverses through aggregate/ core layer switches.

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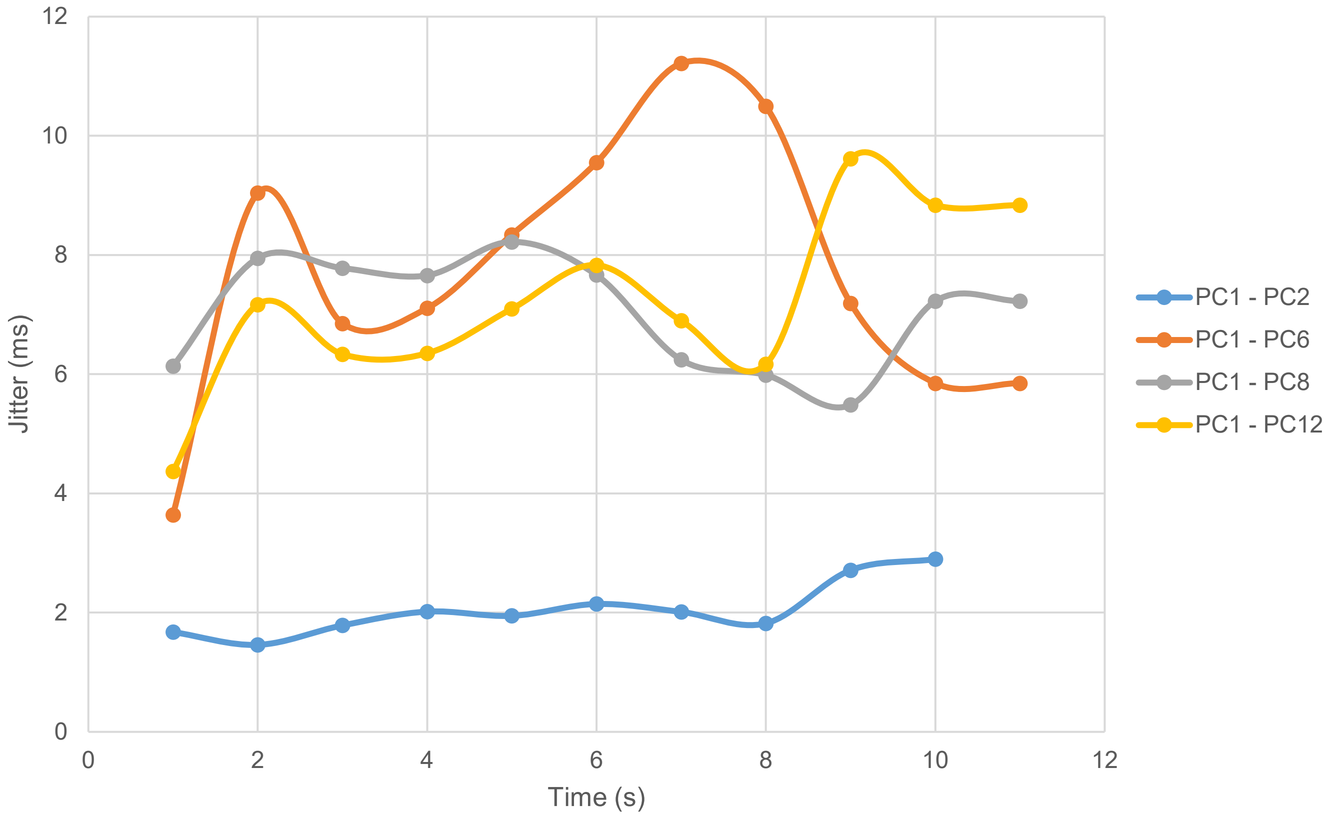
Figure 6. Jitter during multiple caching traffics in the network



Observations:

- Low Jitter when PC1 sends traffic to PC2.
- The jitter increases when PC1 sends traffic to PC6 connected to the access switch S5.
- When PC1 sends traffic either to PC8 or PC12, there is considerable difference in jitter compared to that of traffics between same access layer switch.

Table 1. The impact of moving a VM (PC) from outside of VLAN to inside

	PC1-PC7 (Intra-VLAN)	PC1-PC7 (If PC7 is moved to Server1)	PC1-PC9 (Inter-VLAN)
Average Latency	7.45 s	6.35 s	9.55 s
Average Throughput	3.5 Mb/s	4.75 Mb/s	1.75 Mb/s


Thank you!