Performance comparison of different topologies

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Introduction

- Focus on the reliability comparison of different topologies through a quantitative study
- Compare the data latency,throughput and delta time of following topolgies
  - Edge computing topology
  - Cloud computing topology
  - Edge plus cloud computing topology

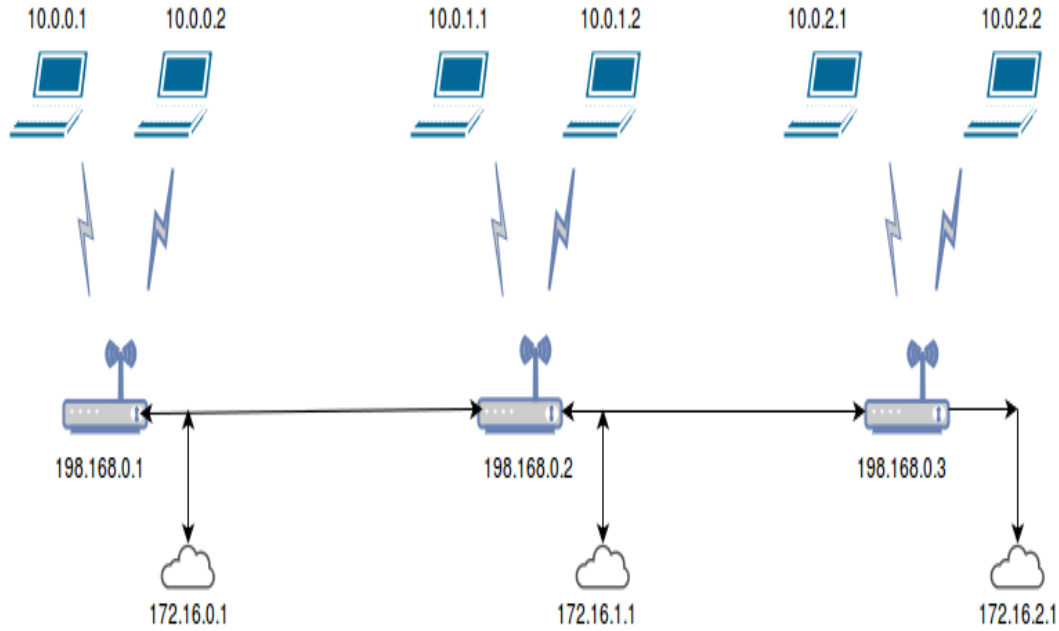
System Specification

- Used following system to test and evaluate the given task
  - Linux System
  - Memory:3.8 GB
  - Processor: Intel CoreTM i5-4210U CPU @ 1.70GHz
  - OS Type : 64-bit
- Software Specification
  - NS3 Network Simulator
  - Wireshark-Packet Analyser
  - Eclipse IDE

Configuration of three topologies

- Used csma channel in between the wifi access points(Network address:192.168.0.x)
- Used point to point connection between wifi ap and dedicated servers(Network address:172.16.x.x) and wireless connection between wifi station points and wifi ap(Network address:10.0.x.x)
- Used TCP stream at different data rates
- Csma channel
  - Data Rate:1000Mbps
  - Channel Delay :65600ns
- P2P channel
  - Data Rate:1000Mbps
  - Channel Delay :25000ns
- Wireless channel(802.11ac)
  - Data Rate:1040Mbps

Edge Computing Topology

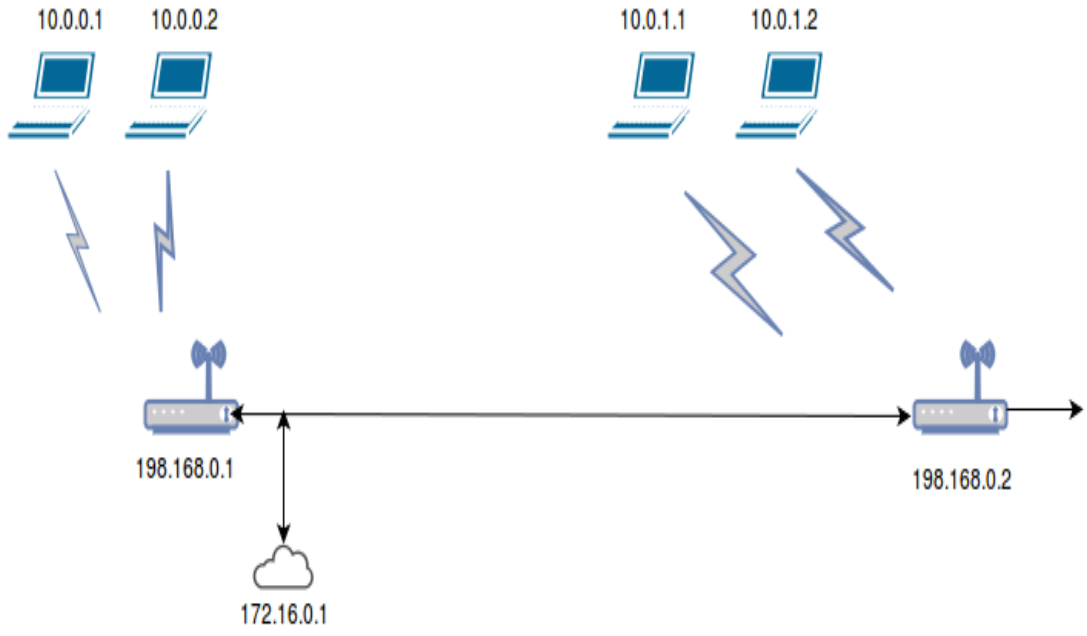


- Implemented 3 wireless networks(each contains 10 stations) and 3 local servers.
- Sent the TCP stream from each station to the corresponding local servers and measured the round trip time,latency,throughput
- Round trip time: Time taken between the source and destination to complete its conversation

Edge Computing Topology

- Maximum round trip time
- Round trip time taken by nodes ranges from 34.97sec(ip address:10.0.0.5) to 35.293(ip address:10.0.2.6)
- Delta time: time difference between the previous and current frames
- Maximum delta time is .0532sec
- Total Packets(Packets A $\rightarrow$ B and Packets B $\rightarrow$ A) sent and received ranges from 5698(2849 in one direction) to 7000(3500 in one direction)
- Throughput ranges from 570k bps to 843k bps
- Average Throughput is 776k

Edge Cloud Topology

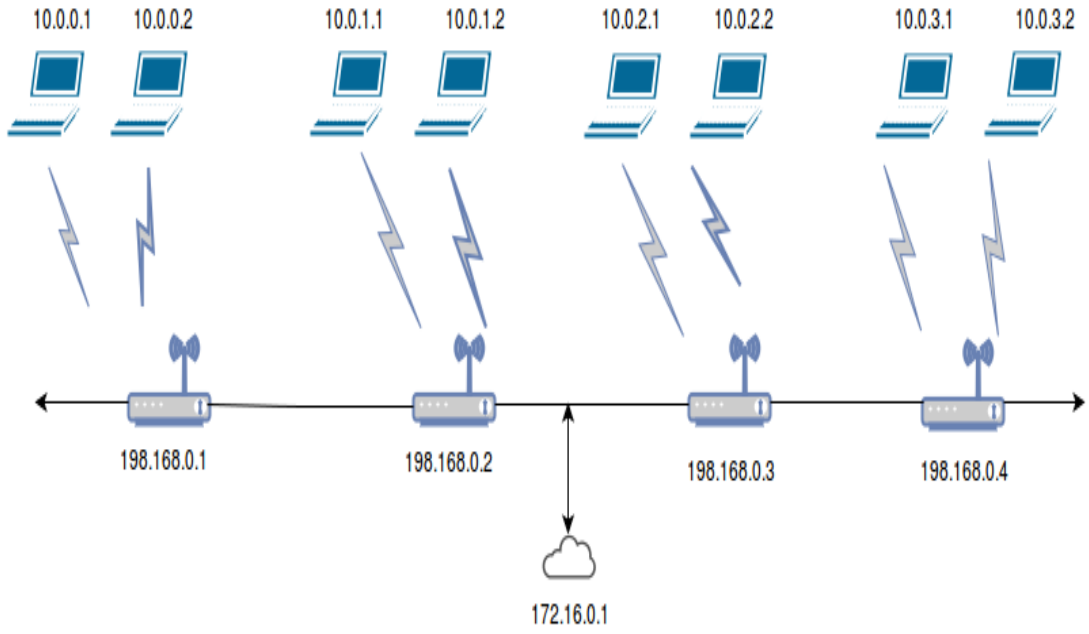


- Here stations belong to two different wireless networks share a common cloud
- Implemented six wireless networks(each contains 4 stations) and 3 local servers.
- Maximum round trip time taken by node with ip address(10.0.0.7) is 38.137sec

Edge Cloud Topology

- Round trip time taken by nodes ranges from 34.99sec(ip address:10.0.0.1) to 38.137(ip address:10.0.3.5)
- Maximum delta time is .1032sec
- Total Packets(Packets A $\rightarrow$ B and Packets B $\rightarrow$ A) sent and received ranges from 632(316 in one direction) to 7000(3500 in one direction)
- Throughput ranges from 70k bps to 843k bps
- Average Throughput is 454k

Cloud Computing Topology



- Here all stations share a common cloud
- Implemented 3 wireless networks(each contains 6 stations) and a main server.
- Maximum round trip time taken by node with ip address(10.0.0.4) is 40.311sec

Cloud Computing Topology

- Round trip time taken by nodes ranges from 38.06sec(ip address:10.0.2.7) to 40.311(ip address:10.0.0.4)
- Maximum delta time is .832sec
- Total Packets(Packets A $\rightarrow$ B and Packets B $\rightarrow$ A) sent and received ranges from 698(349 in one direction) to 6276(3138 in one direction)
- Throughput ranges from 79k bps to 758k bps
- Average Throughput is 283k

Results

Table 1: Comparison of different attributes

	Edge computing	Edge Cloud	Cloud Computing
Total Packets	3293675	4200985	4294923
TCP Retransmission (packets)	294	5973	8586
Lost Packets	294	1794	2822
Maximum Throughput(Mbps)	10.8	10.7	10.7
Minimum Throughput(Mbps)	9.57	2.63	1.06
Maximum Latency	1.03	3.0	4.01

Conclusion

- As expected,edge computing topology showed better throughput,less round trip time and delta time
- Cloud computing could not perform well since the limitations of the channel bandwidth and high number of stations