Group 10

Studying the Performance of IPv6 and IPv4

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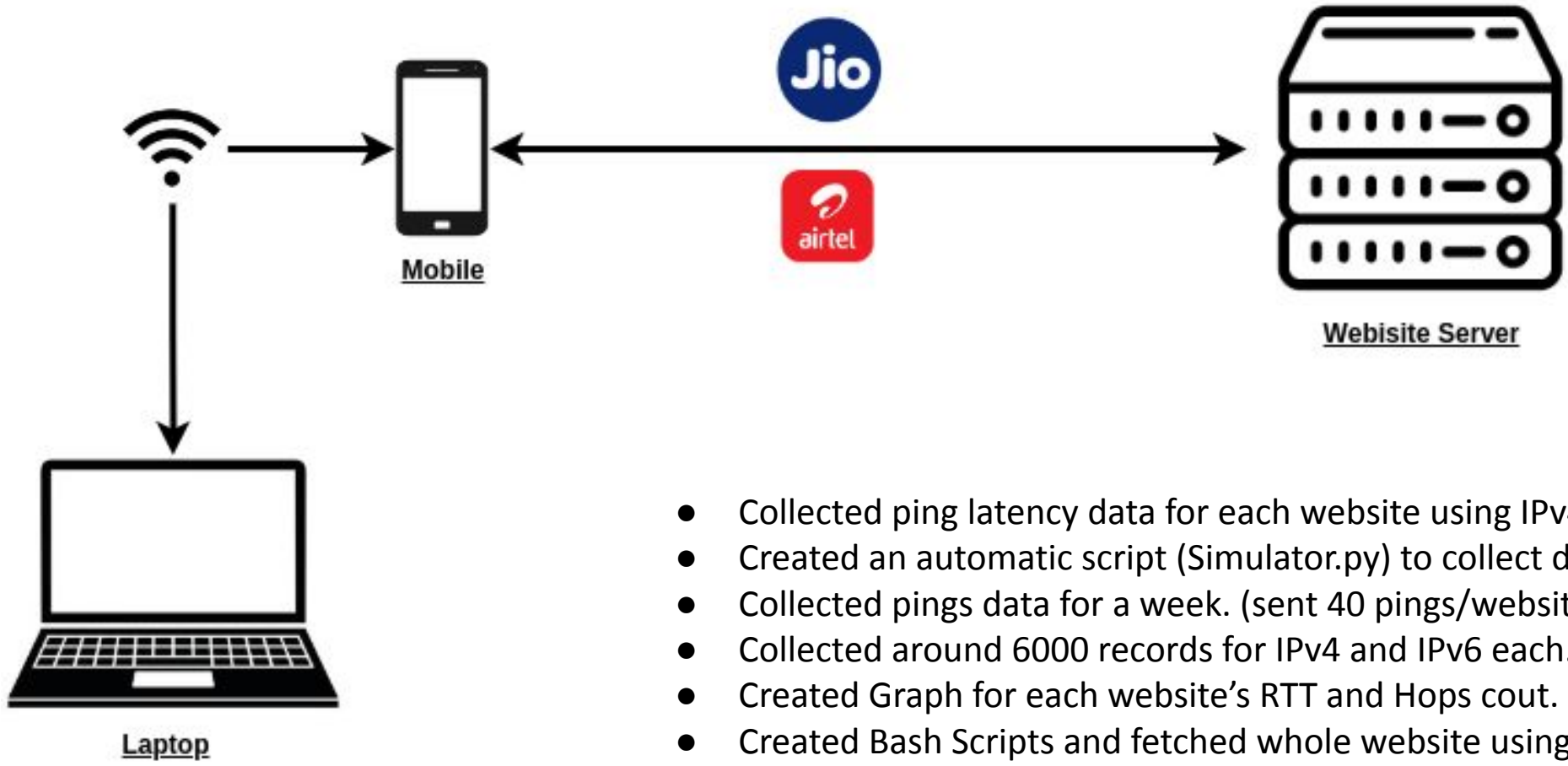
Problem Statement/Aim

This project aims to

- Assess and **compare the performance of IPv4 and IPv6** connections by **pinging, and fetching** a selected group of websites over 4G networks provided by different ISPs (Jio and Airtel) on different days.

- Analyze how **geolocation data**, estimated from the websites' IP addresses, correlates with connectivity performance, potentially how it offers insights about network efficiency and the impact of different Internet protocols.

Methodology



- Collected ping latency data for each website using IPv4 and IPv6.
- Created an automatic script (Simulator.py) to collect data.
- Collected pings data for a week. (sent 40 pings/website)
- Collected around 6000 records for IPv4 and IPv6 each.
- Created Graph for each website's RTT and Hops cout.
- Created Bash Scripts and fetched whole website using IPv4 and IPv6 addresses for whole week.

Before Midsem Results

1. Average Latency

- IPv4 = 148.576274ms
- IPv6 = 140.2348971ms
- Average latency for IPv6 is lesser

2. Average Latency per Operator

Airtel

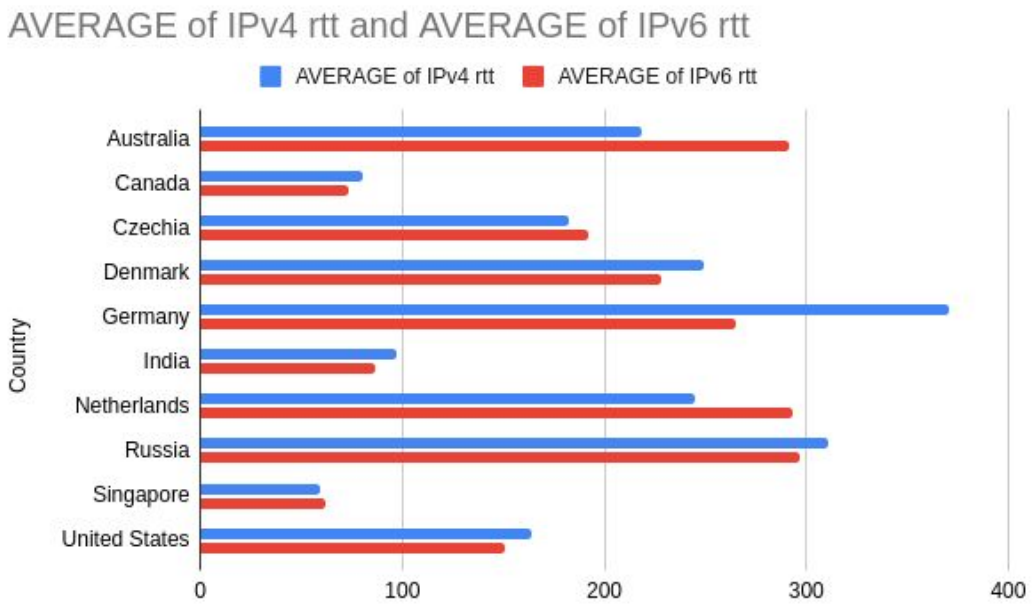
- IPv4 = 179.2746858ms
- IPv6 = 173.1834829ms

Jio

- IPv4 = 121.3572111ms
- IPv6 = 111.020694ms

Jio outperforms Airtel in both IPv4 and IPv6.
In both operators, IPv6 has lower latency than IPv4

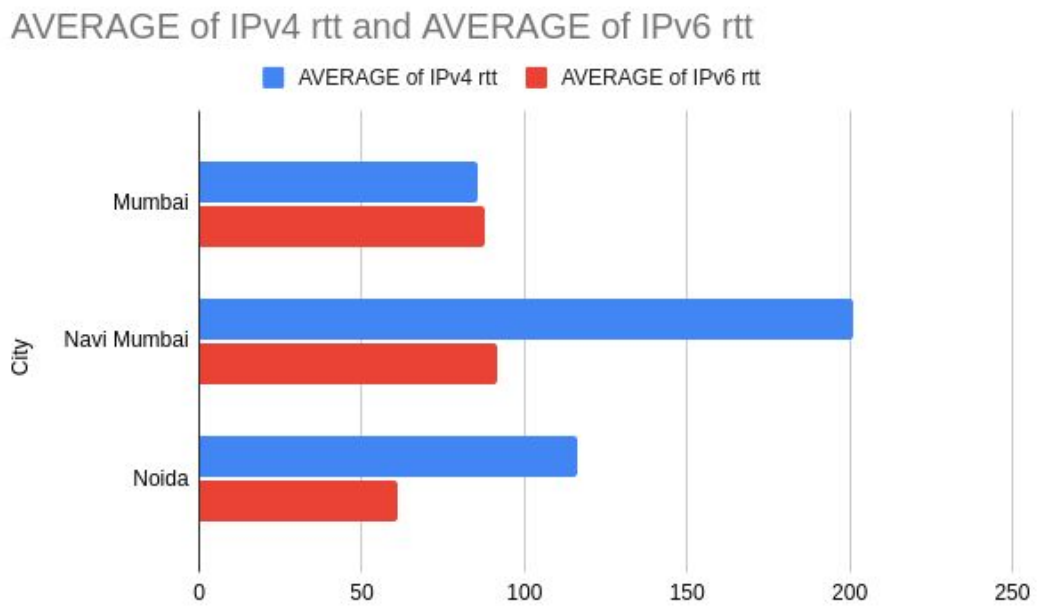
3. Average Latency per Country



- 6 out of 10 countries have smaller average latency in case of IPv6.
- All major advanced countries like India, US, Russia, Germany have lower average latency for IPv6

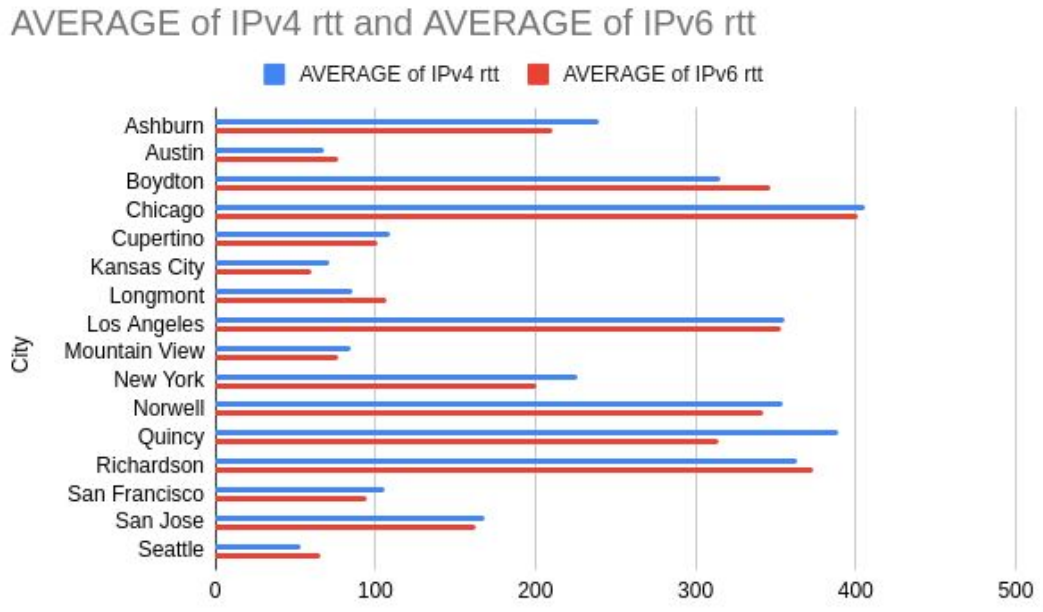
Before Midsem Results

4. Average Latency per City in India



- For 2 of 3 cities, average latency for IPv6 is significantly smaller (around half) than for IPv4.

5. Average Latency per City in USA



- 12 out of 16 cities have lower average latency for IPv6.

Results

1. Average Ping Latency

- IPv4 = 128.745 ms
- IPv6 = 126.121 ms
- Average latency for IPv6 is lesser

2. Average Ping Latency per Operator

Airtel

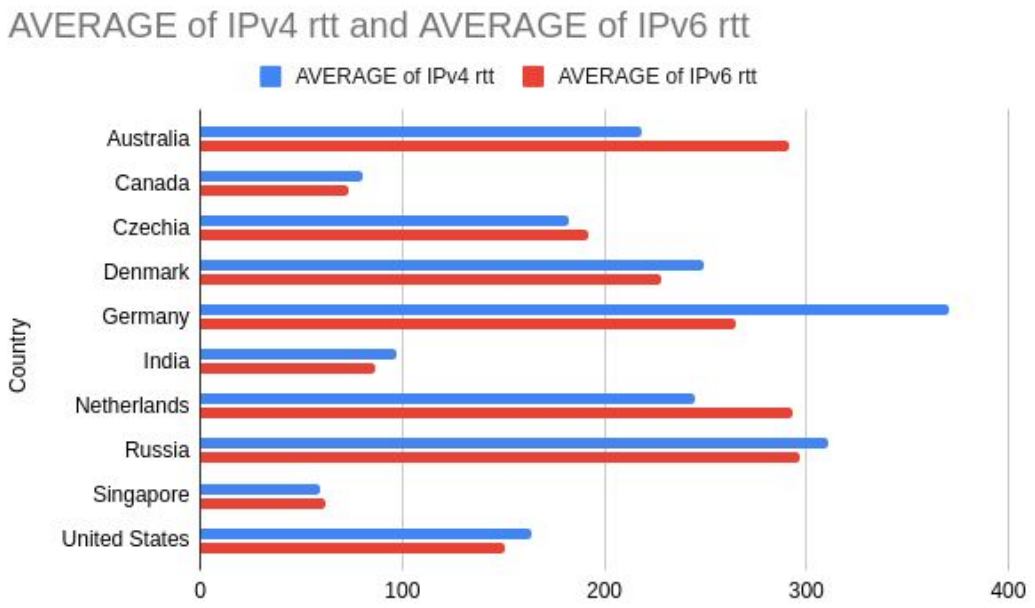
- IPv4 = 132.17 ms
- IPv6 = 137.08 ms

Jio

- IPv4 = 125.32 ms
- IPv6 = 115.16 ms

Again, Jio outperforms Airtel in both IPv4 and IPv6.
In both operators, IPv6 has lower latency than IPv4

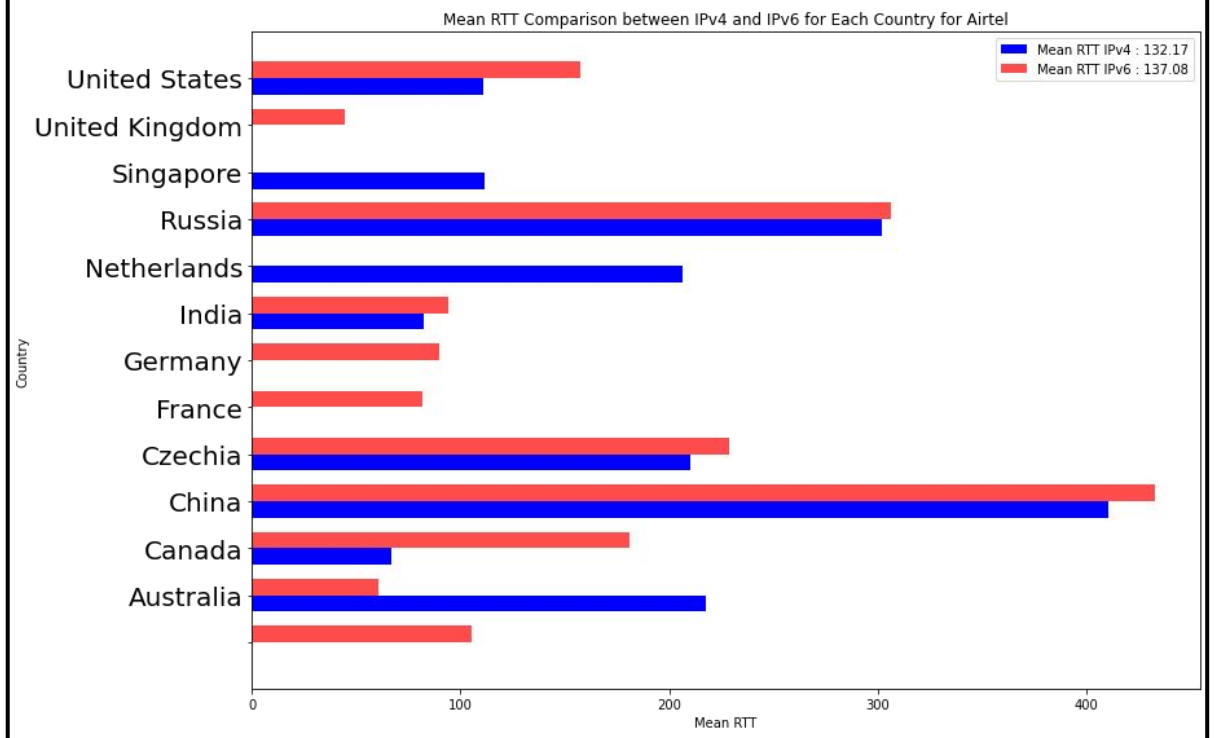
3. Average Ping Latency per Country



- In post-midsem analysis we again observed the similar kind of trends.
- All major advanced countries like India, US, Russia, Germany have lower average latency for IPv6

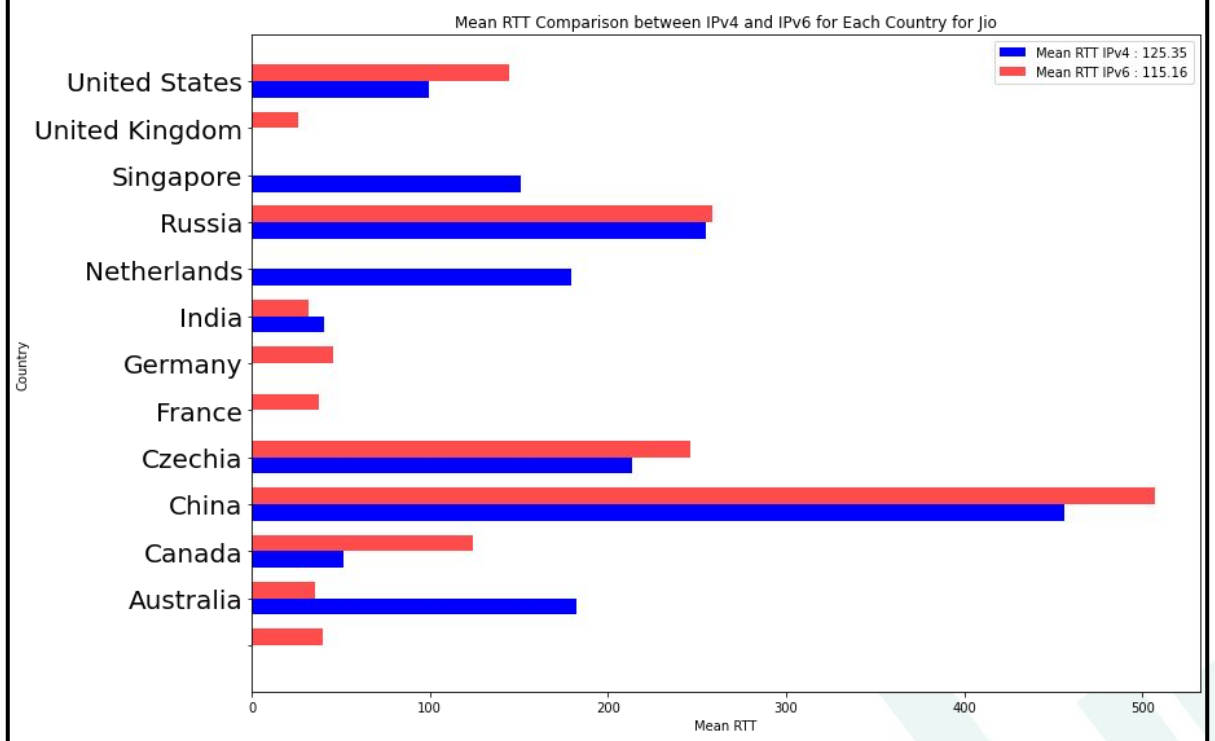
Results

4. Average Latency for different Countries for Airtel



- For India IPv4 has **less** latency.

5. Average Latency for different Countries for Jio

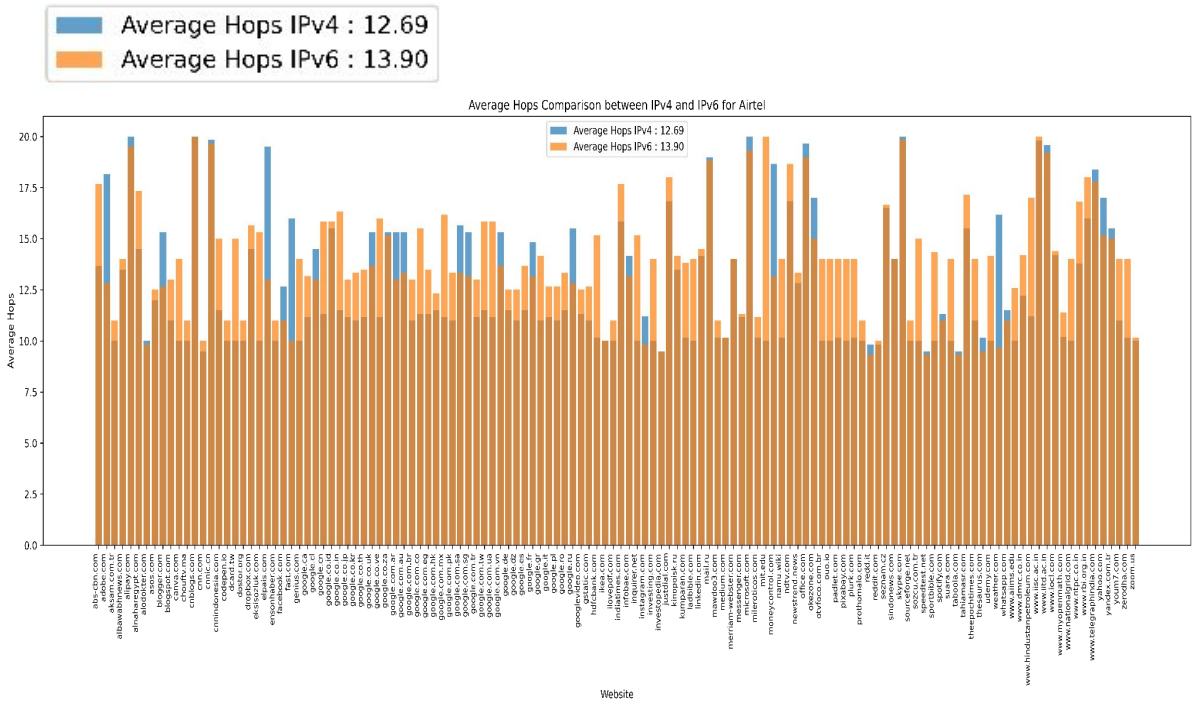


- For India IPv4 has **more** latency.

- Jio performed better with IPV6 vs IPV4 on average over Airtel specially in India and Australia.

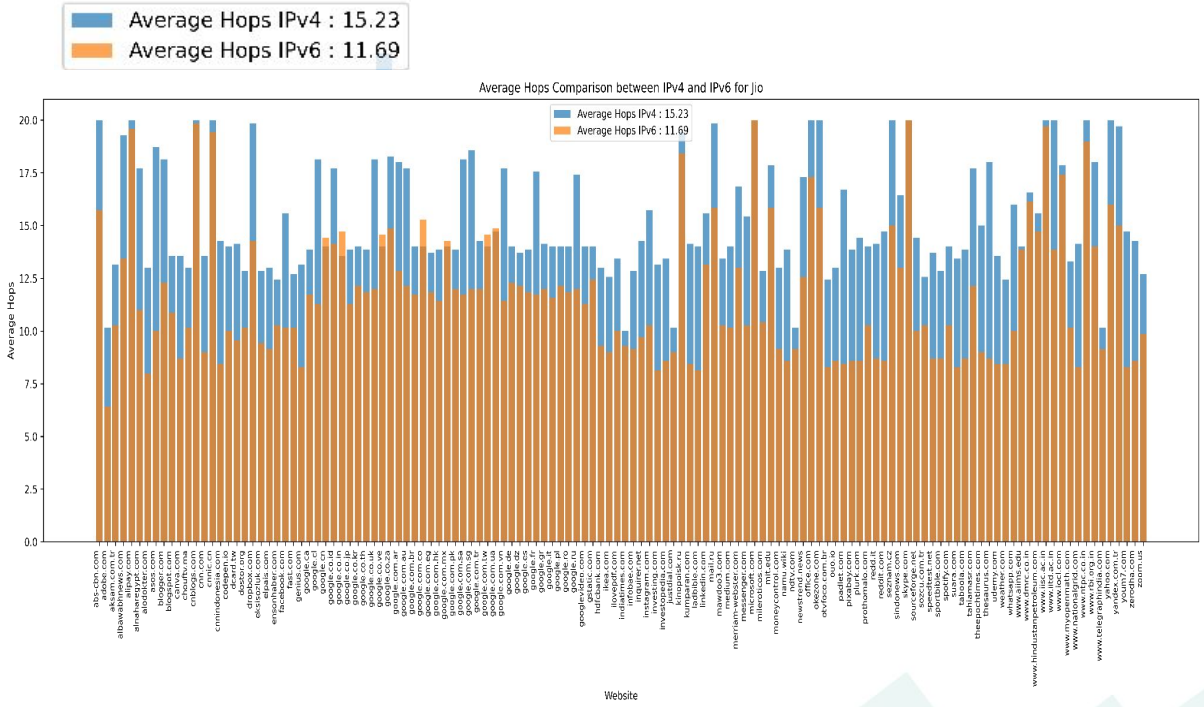
Results

8. Average Hops Count for Airtel



- For Airtel Average IPv4 Hops Count is **less**.

7. Average Hops Count for Jio

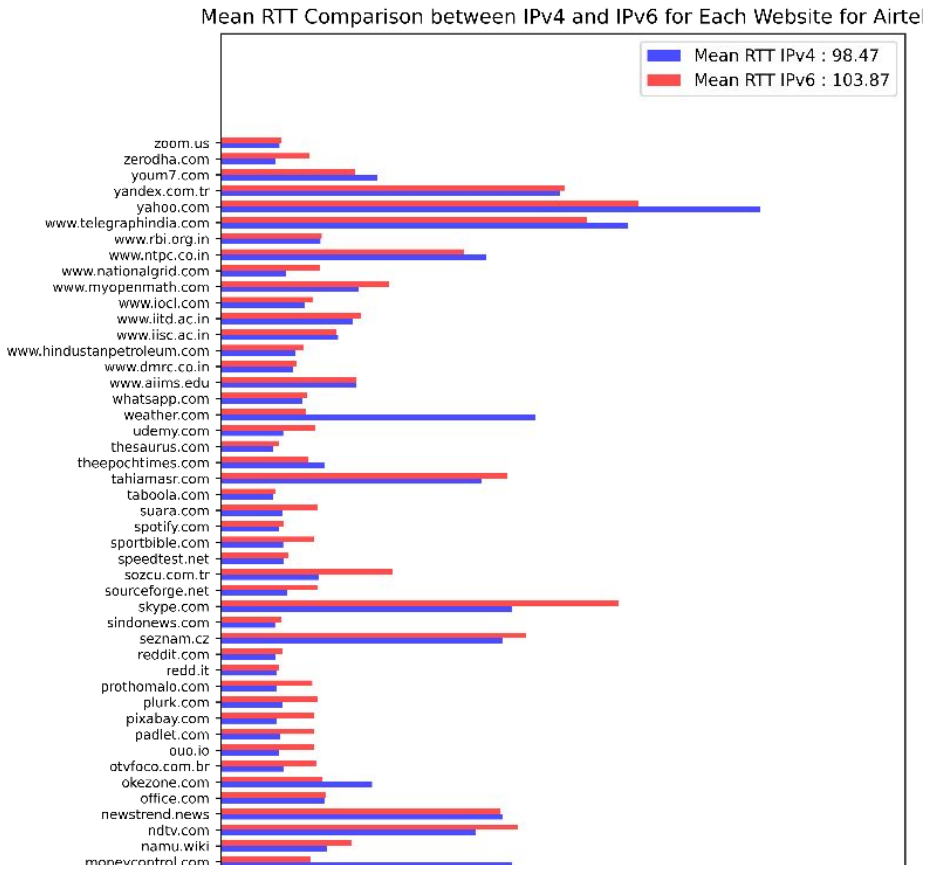


- For Jio Average IPv4 Hops Count is **more**.

- Jio had lower hops for IPV6 as compared to Airtel.

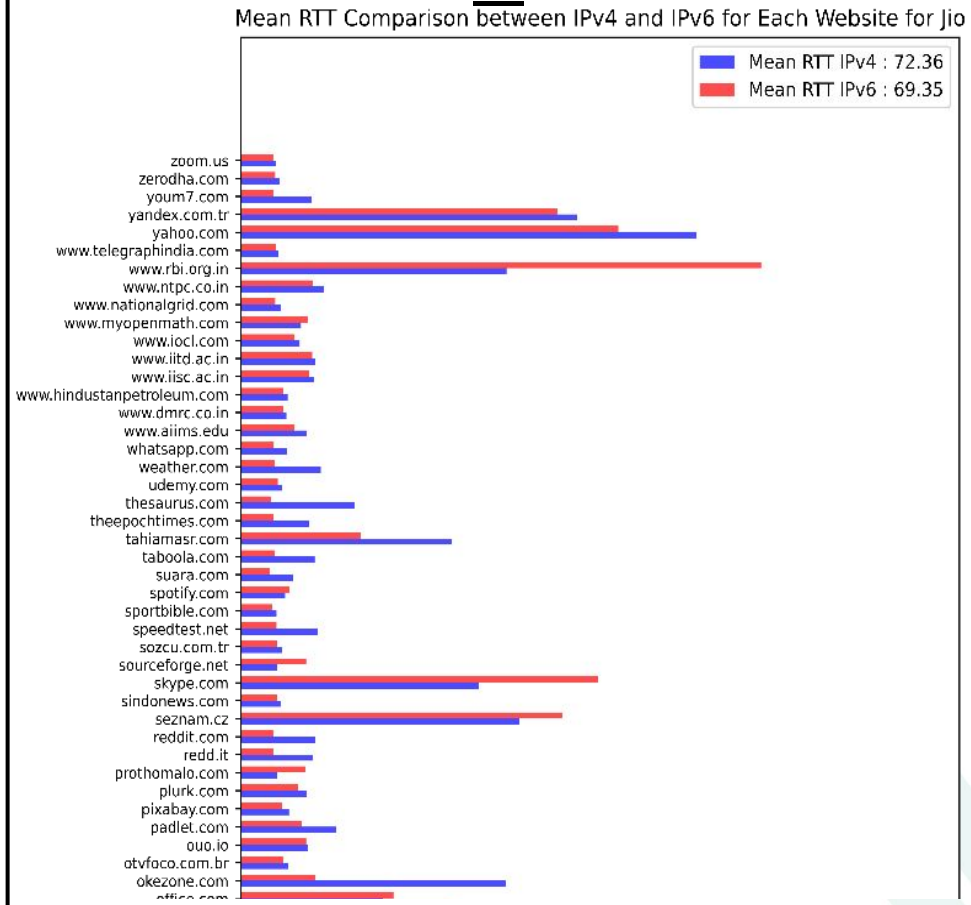
Results

9. Average Latency for each Website Latency for Airtel



- Except three-four websites IPv4 has less RTT for Airtel

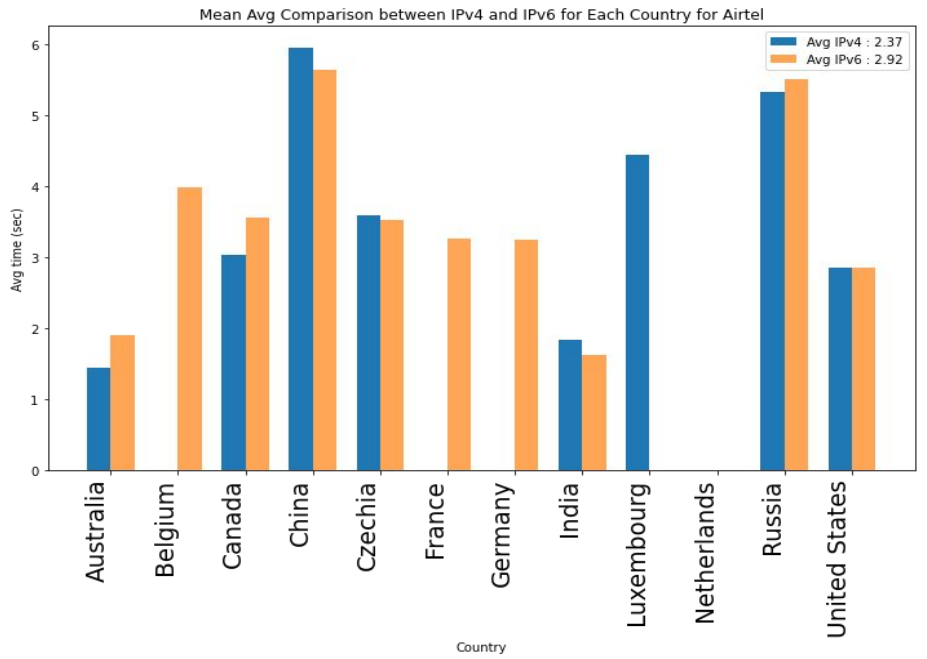
10. Average Latency for each Website Latency for Jio



- Except three-four websites IPv6 has less RTT for Jio

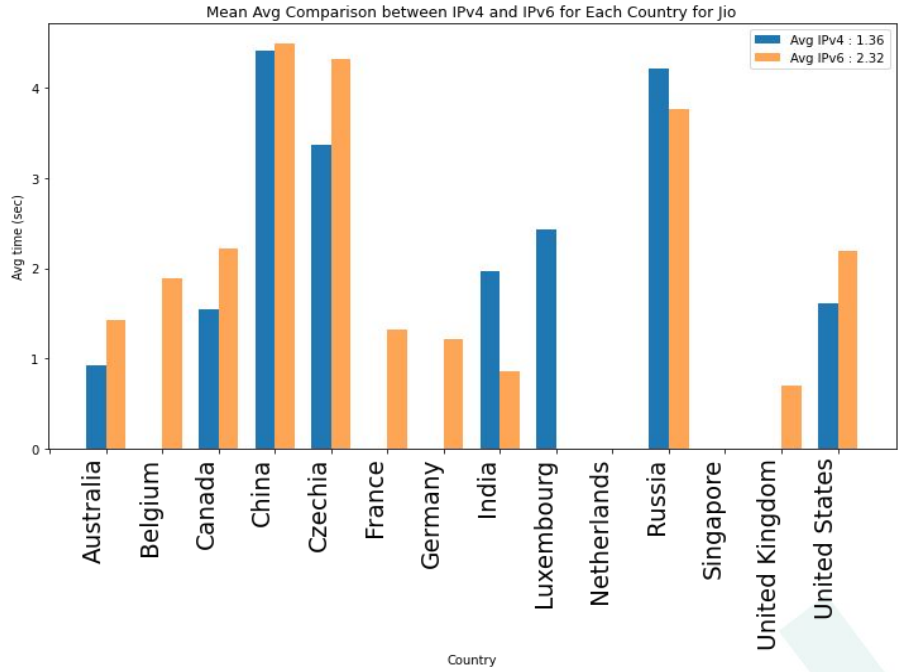
Results: wget

11. Average Page latency for different Country for Airtel



- For Airtel difference between IPv4 & IPv6 latencies is very small

12. Average Page latency for different Country for Jio

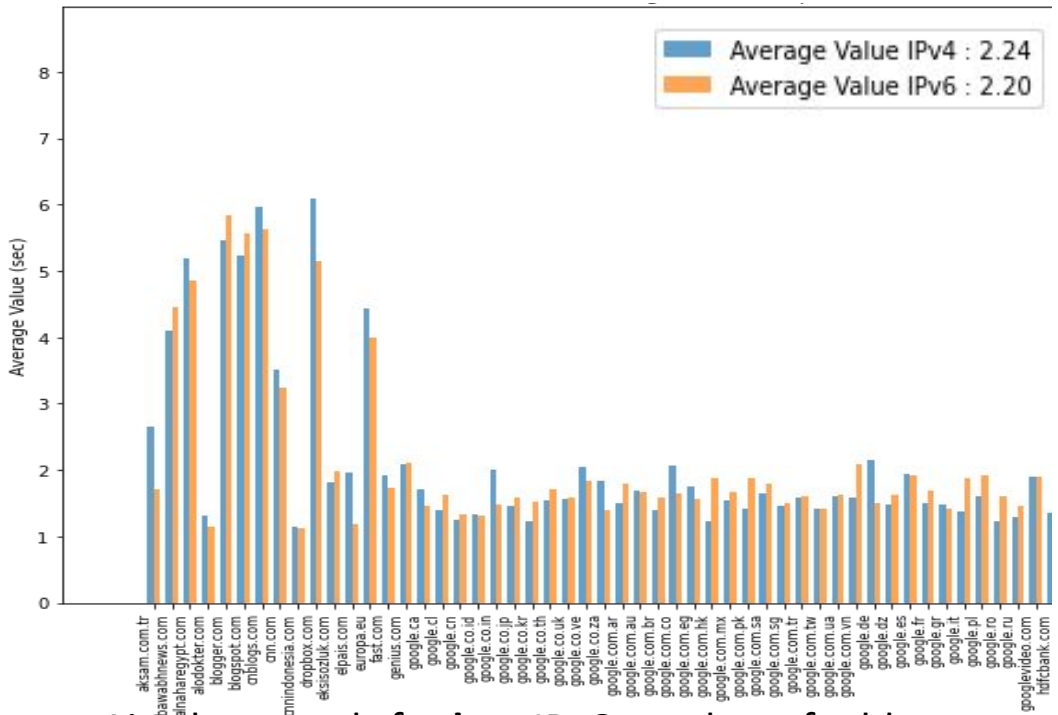


- For Jio difference between IPv4 & IPv6 latencies is noticeable

- As Compared to Airtel, Jio performed better overall for IPv4 and IPv6 but, IPv4 was better in this scenario for both ISP's.

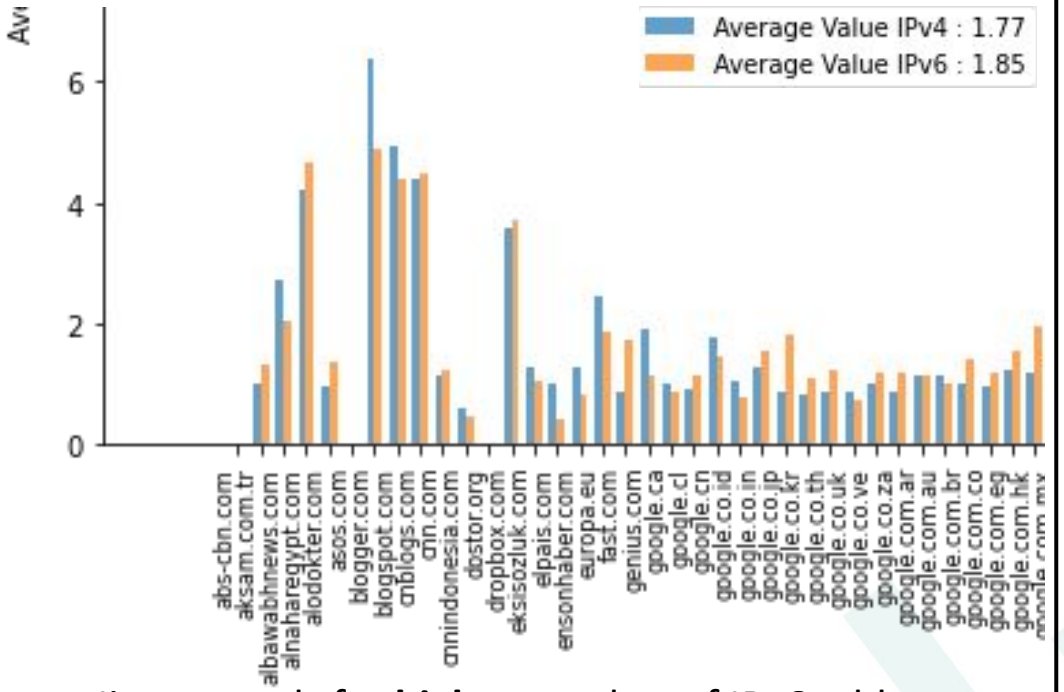
Results: wget

13. Average Page Download latency for Airtel



- Airtel responds for **less** IPv6 number of addresses.

14. Average Page Download latency for Jio



- Jio responds for **higher** number of IPv6 addresses.

- Jio outperforms Airtel in a per website based case as well.
- Jio also had more websites for IPV6 that it connected to.

Interesting Findings & Outcomes

- We have successfully collected data for pinging and fetching 130 websites.
- We have analyzed the data and found out that with good integration from ISP's **IPv6 outperforms IPv4** in most factors even if by a small amount.
- **Poor integration of IPv6 from an ISP like Airtel** clearly decrease its performance as compared to Jio
- The difference between IPv6 and IPv4 performance wise decreases as we move to much real world scenarios such as website fetches as we did over simple pings.
- **Geolocation data for IPV6 was hard to find** and usually not maintained by most in a database.
- Overall there was very **little transfer rate gains between both IPV4 and IPV6** and it is hard to say which is better even with all this information as it varies very much on service providers, infrastructure and geolocation for the IP's. But between ISP's **Jio performed better and clearly supports IPv6 protocols better.**

Contributions

- Akshat Tilak
  - Data collection and data analysis
- Jahanvi Bakshi
  - Data collection and report generation.
- Yogesh Kaushik
  - Scripting and data analysis
- Shubham Sharma
  - Data collection and analysis

Thank You