

Impact of the COVID-19 pandemic on the Internet latency

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Thanks to my co-authors

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Info

- Presented in May at RIPE80 and released on arXiv
- Published in August in Computer Networks
- The first large scale study on the impact of the pandemic on the Internet



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Impact of the COVID-19 pandemic on the Internet latency: A large-scale study

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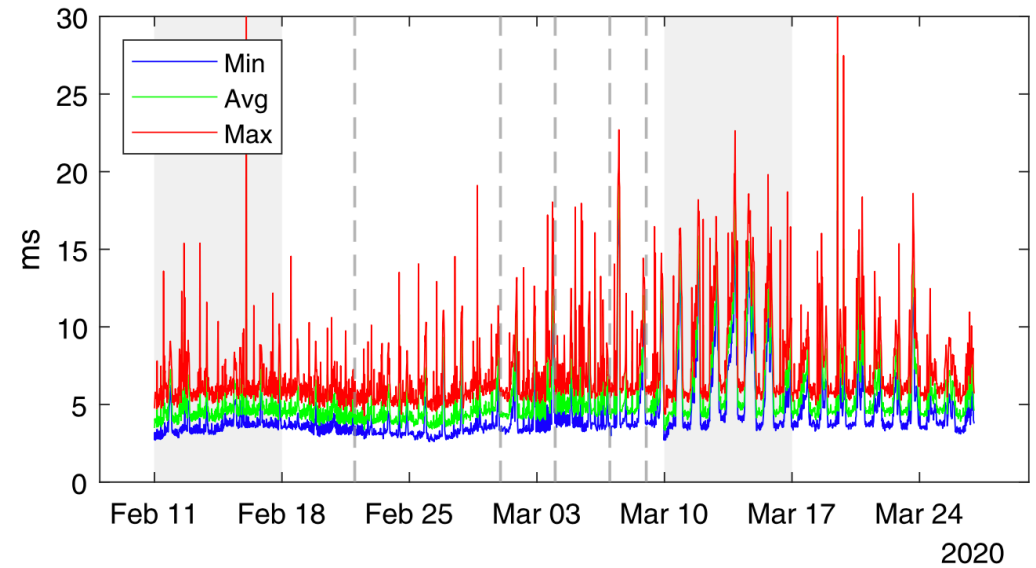
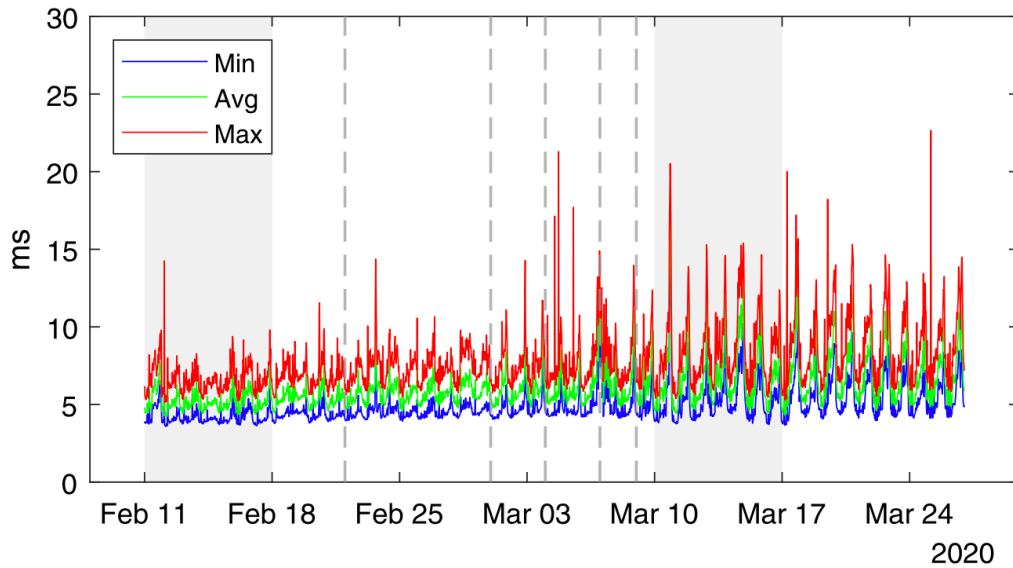
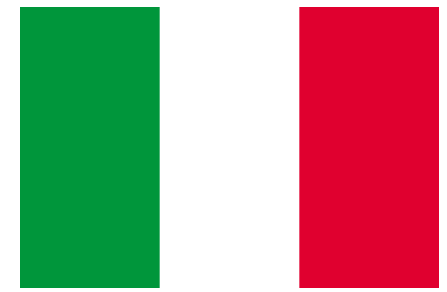
Goals

- To study the impact of the lockdowns on the Internet latency
 - Compare **before** and **after**
 - From a global point of view (no specific provider/IXP)
 - With a **large dataset** of measurements
- Additionally, to evaluate the impact on:
 - The time of the day
 - The type of target (belonging to a content delivery network or not)
 - The version of the Internet Protocol
 - On packet loss
 - On path changes
 - On HTTP-based latency
- We report numbers for the EU with a focus on Italy
- For this presentation there is an extra, dedicated to Argentina

Dataset

- We use RIPE Atlas
 - Anchoring Measurements and User defined measurements
 - From 11 February to 26 March
- We use only periodic measurements
 - Sending at least 3 packets every ping
 - Reporting values for at least 40 out of 45 days
 - With both source and target in Europe
- Size:
 - Anchoring measurements: 12 billion
 - User defined measurements: 1+ billion

Impact on Italy

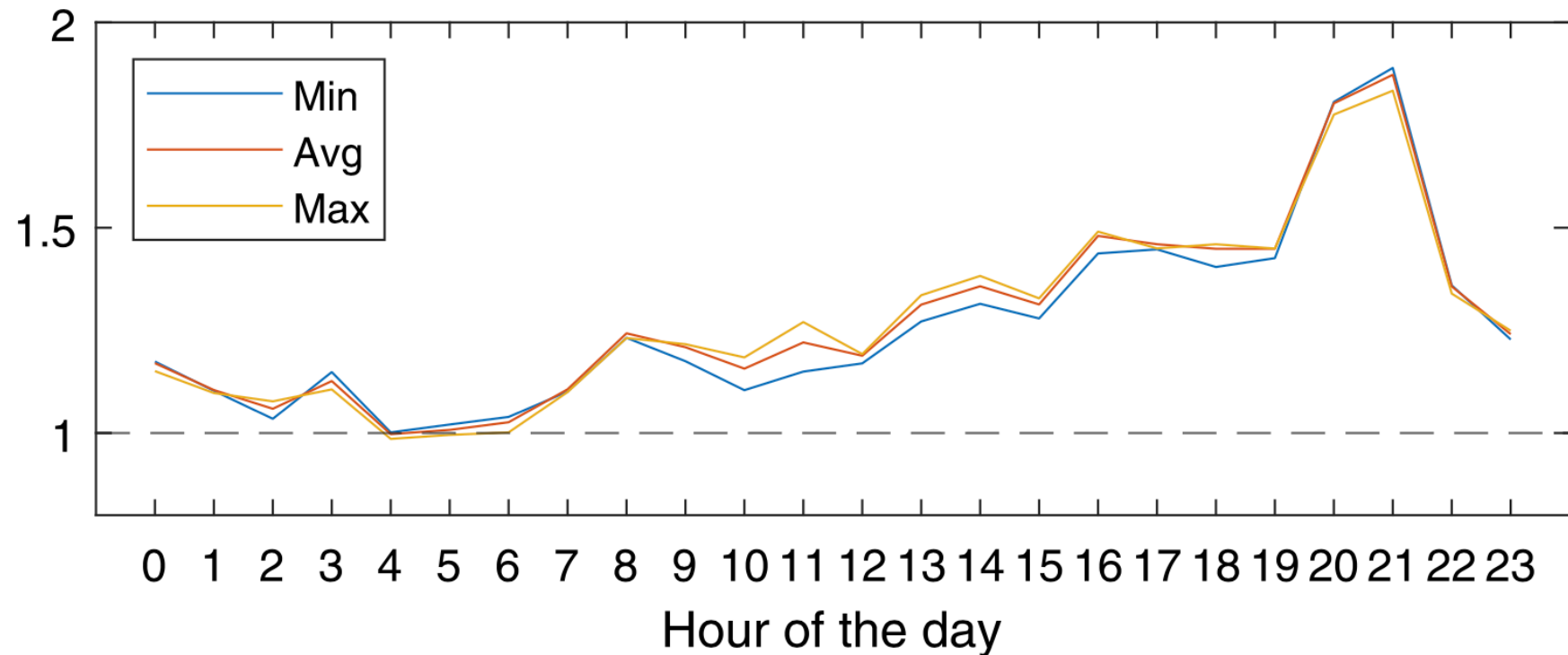


- We plot the increase of RTT above the minimum value collected for each source-target pair

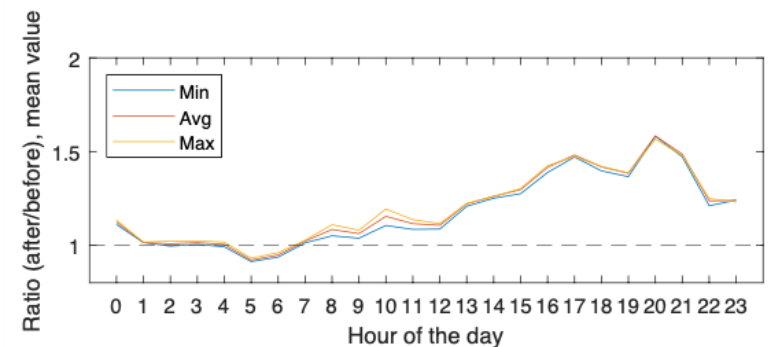
- The grey areas are:
 - On the left, a week without lockdowns
 - On the right, first week of total lockdown

Date	Event
February 22	Some Italian municipalities involved in the COVID-19 outbreak are quarantined (~ 50 thousand people)
March 1	A larger number of Italian municipalities are quarantined (the so called "red zone"), while in others (the "yellow zone") schools, cinemas, sport events, and other gatherings are suspended
March 4	Schools and universities are shutdown nationwide
March 7	Several northern Italian regions are put on lockdown (approximately 16 million people)
March 9	All Italy is put on lockdown
March 14	Spain is put on lockdown
March 16	France is put on lockdown
March 22	Germany is put on lockdown

Remote working?

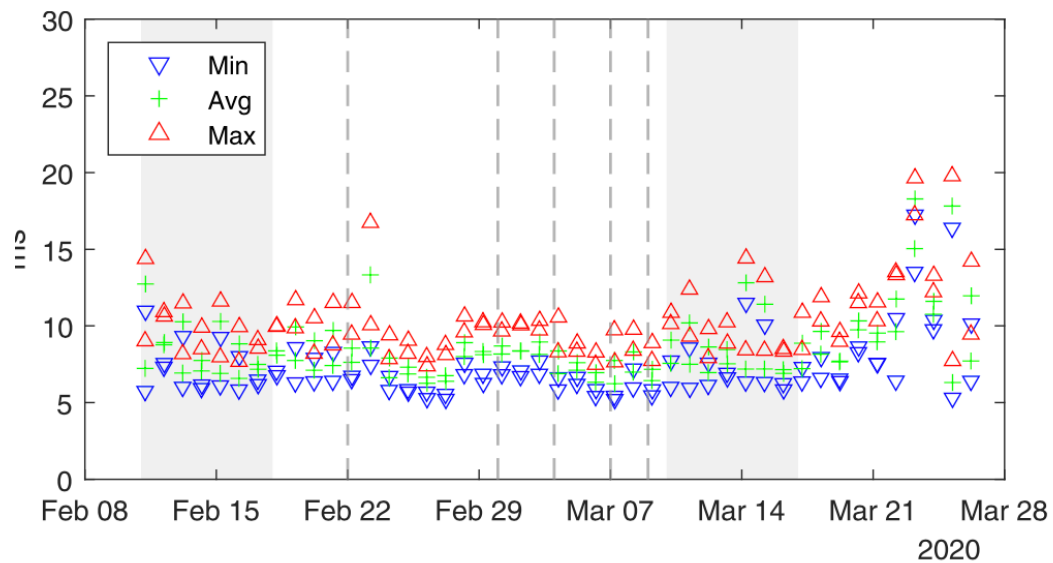
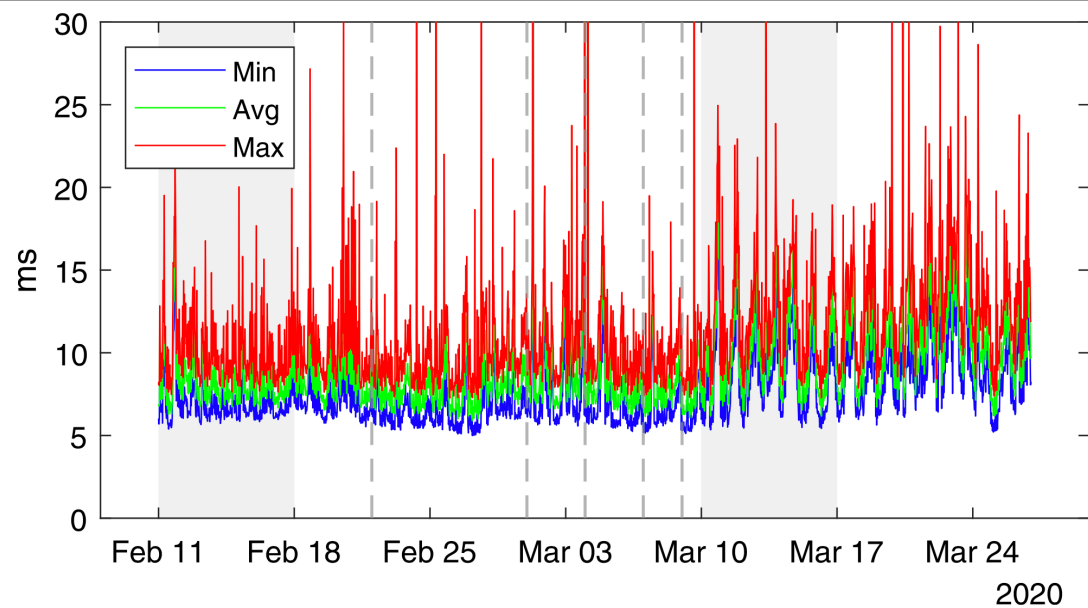


- Ratio (after/before), mean value
- **No! It's probably entertainment**
- Time is UTC

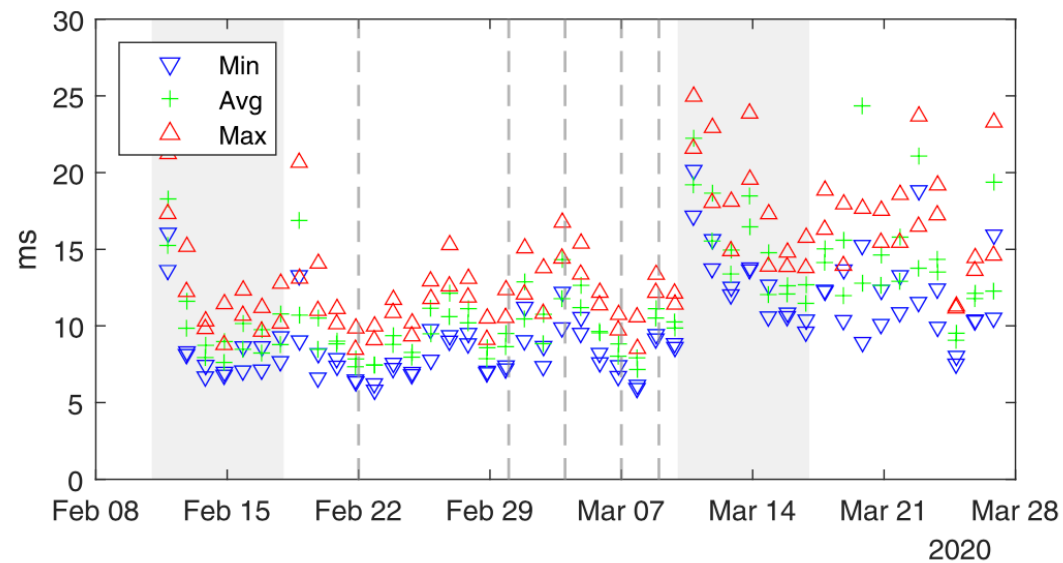


(b) AMD, measurements with source in Italy and target in Europe.

YouTube

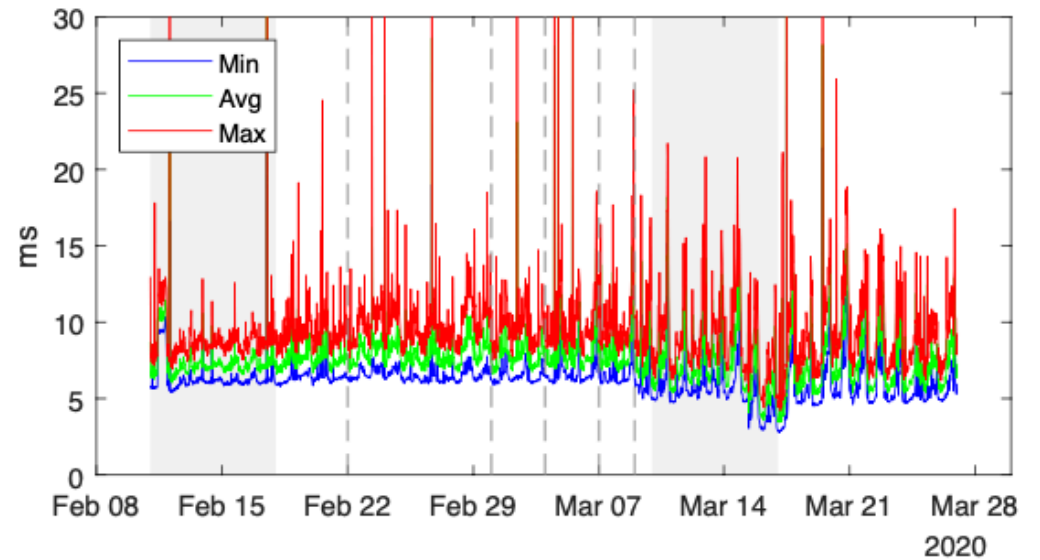
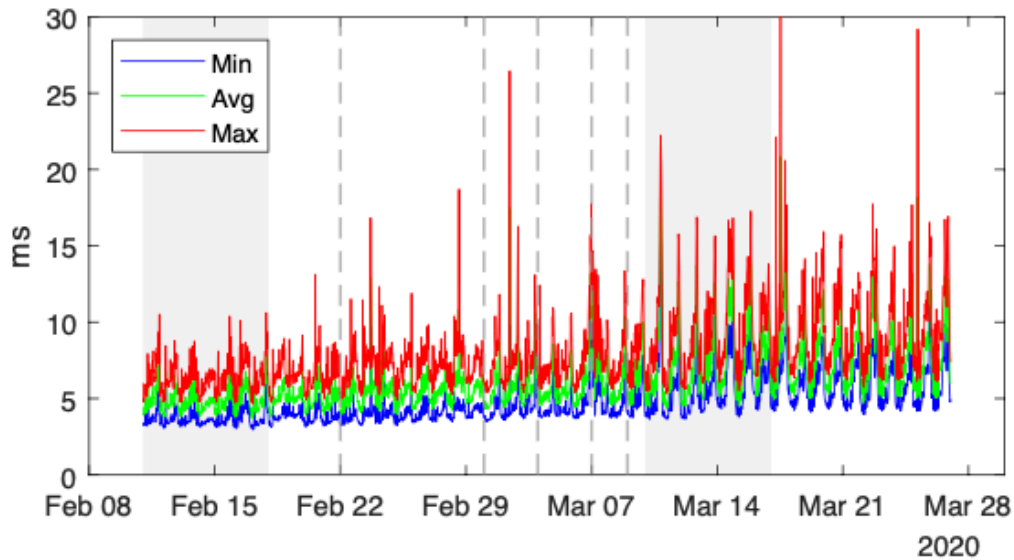


• 05:00 - 06:00

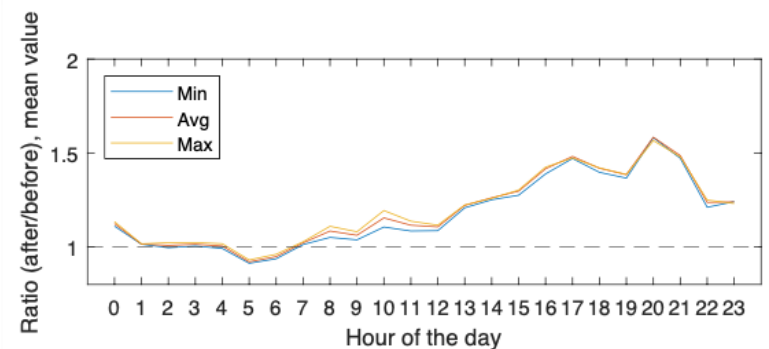


20:00 - 21:00

IPv4 and IPv6

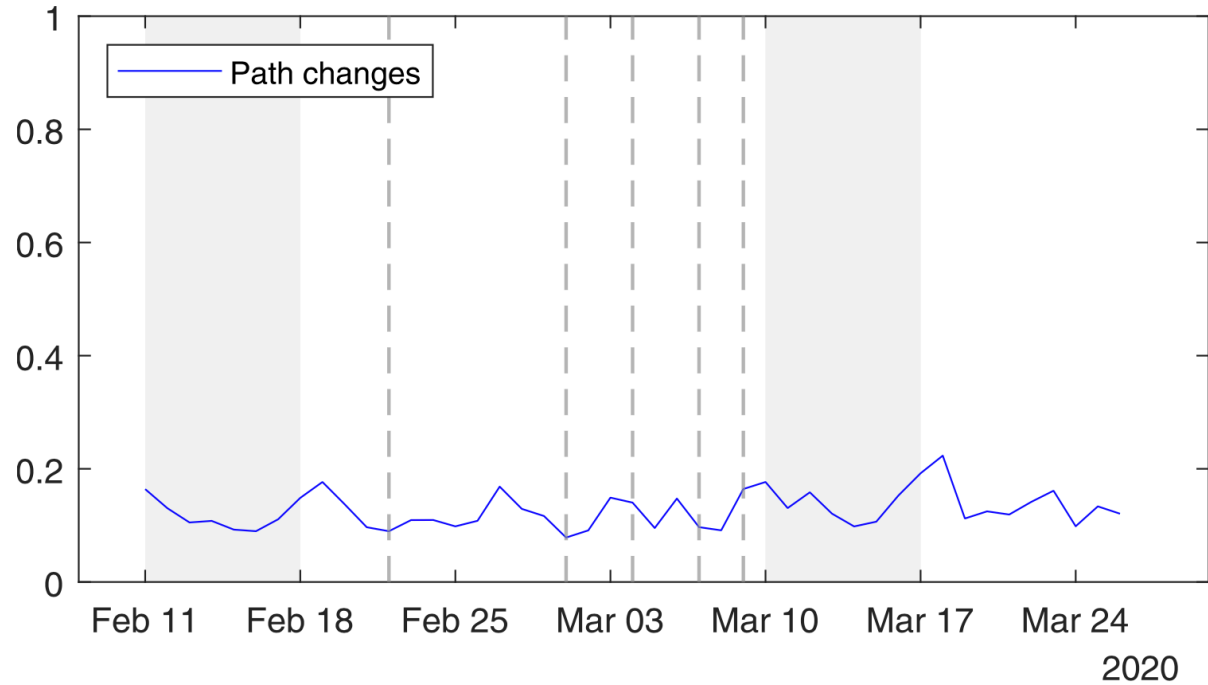


- Increase of RTT doubles for IPv4
- Only dual stack probes
- IPv6 is slightly impacted
 - IPv6 is less available at home



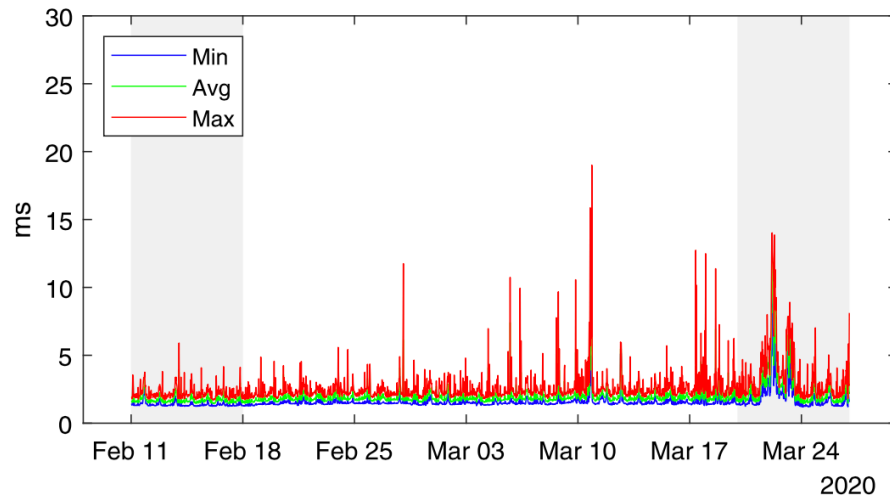
(b) AMD, measurements with source in Italy and target in Europe.

Path changes

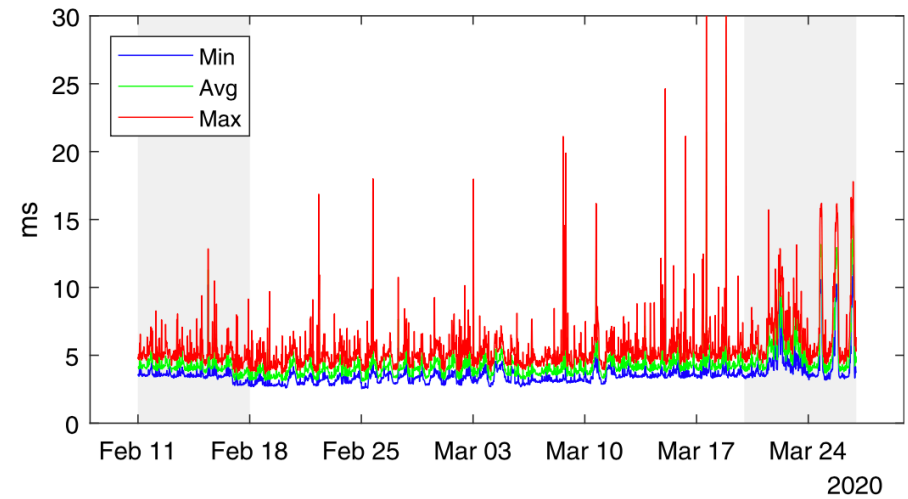


- Number of path changes increased but nothing considerable.

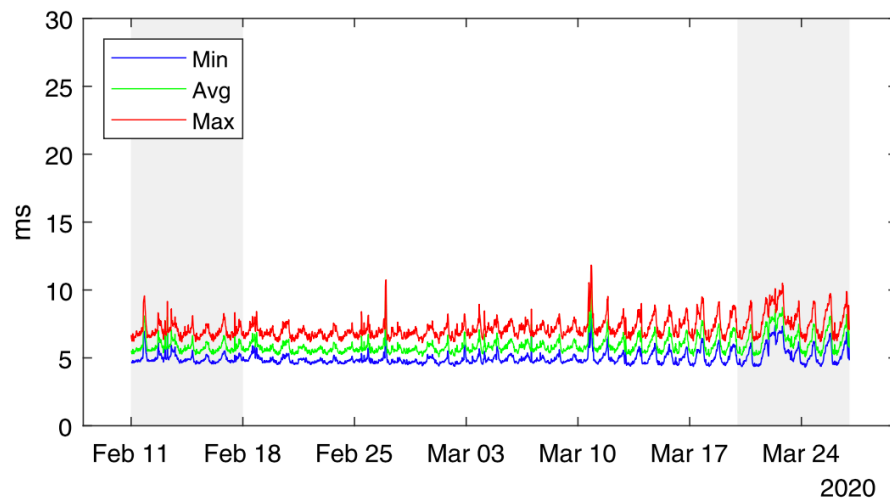
Sweden and rest of Europe



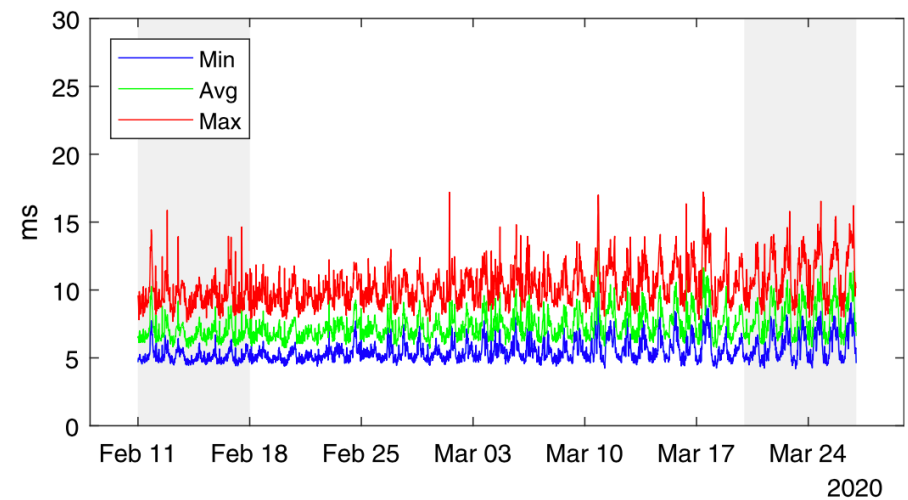
(g) AMD, from SE to SE.



(h) UDMD, from SE to SE.



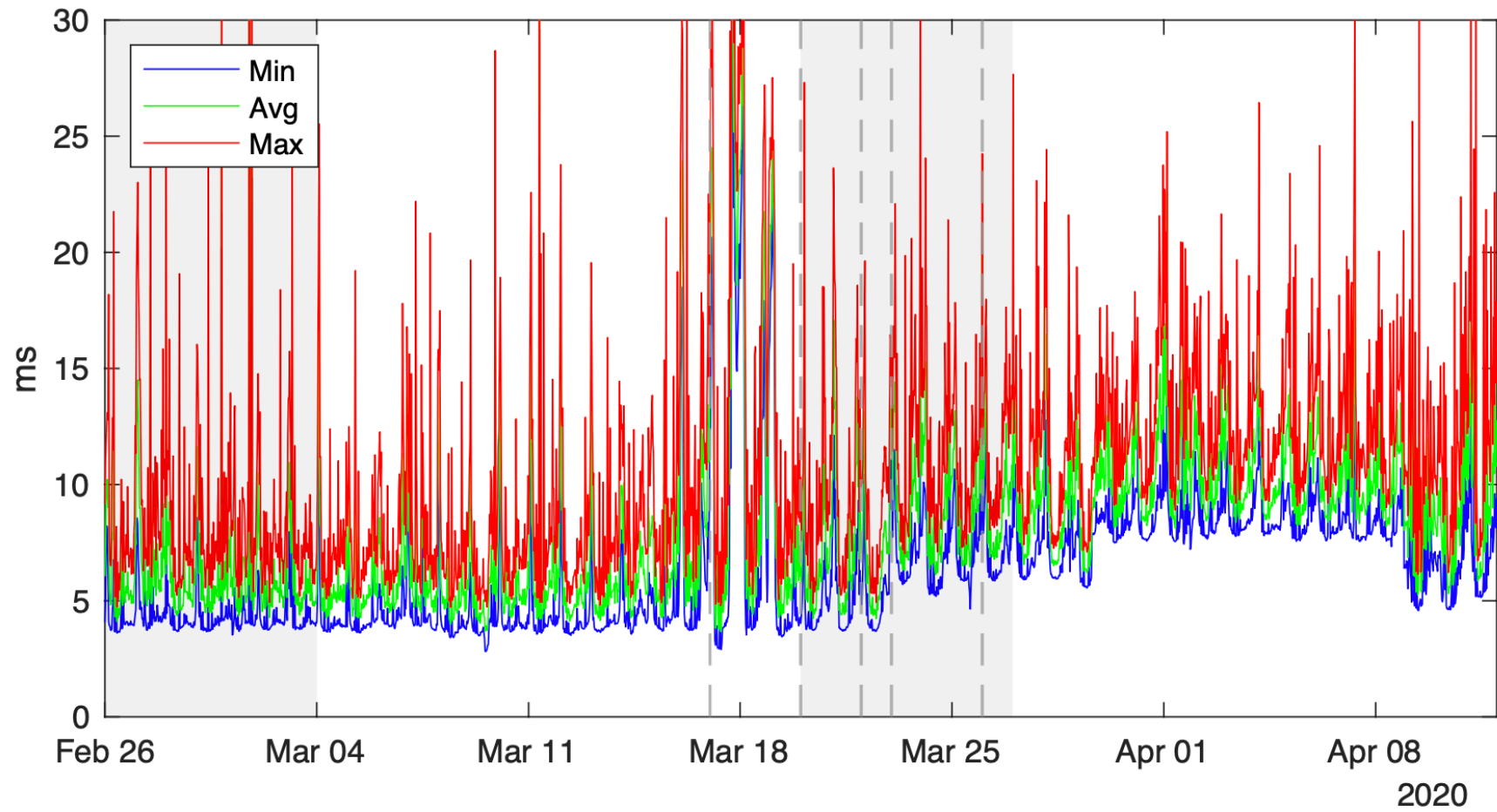
(i) AMD, from EU to EU.



(j) UDMD, from EU to EU.

Results for Argentina

Argentina



Questions?

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