

Impact of the First Months of War on Routing and Latency in Ukraine

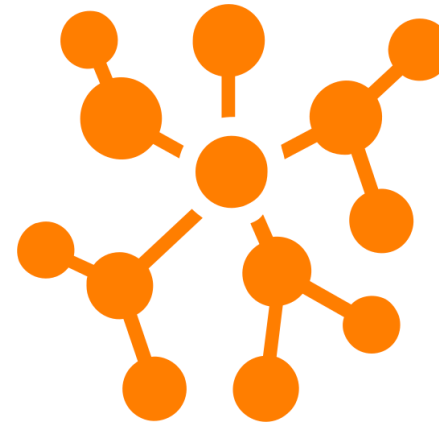
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Objective

Quantifying the impact of the war activities on the Ukrainian Internet

- Routing: How has the network adapted to events in the physical and digital world?



- Latency: Performance loss as perceived by end users

Datasets

- **RIPEstat**
 - Routed ASes and Prefixes of Ukraine and Russia
 - Geolocation of Ukraine and Russia ASes
- **RIPE RIS**
 - All BGP Updates
- **RIPE Atlas**
 - Anchoring measurements
 - Pings and Traceroutes performed by Ukrainian probes
- **Interval: 14 Feb 2022 – 07 May 2022**
 - 10 days before the start of the war, to have a baseline



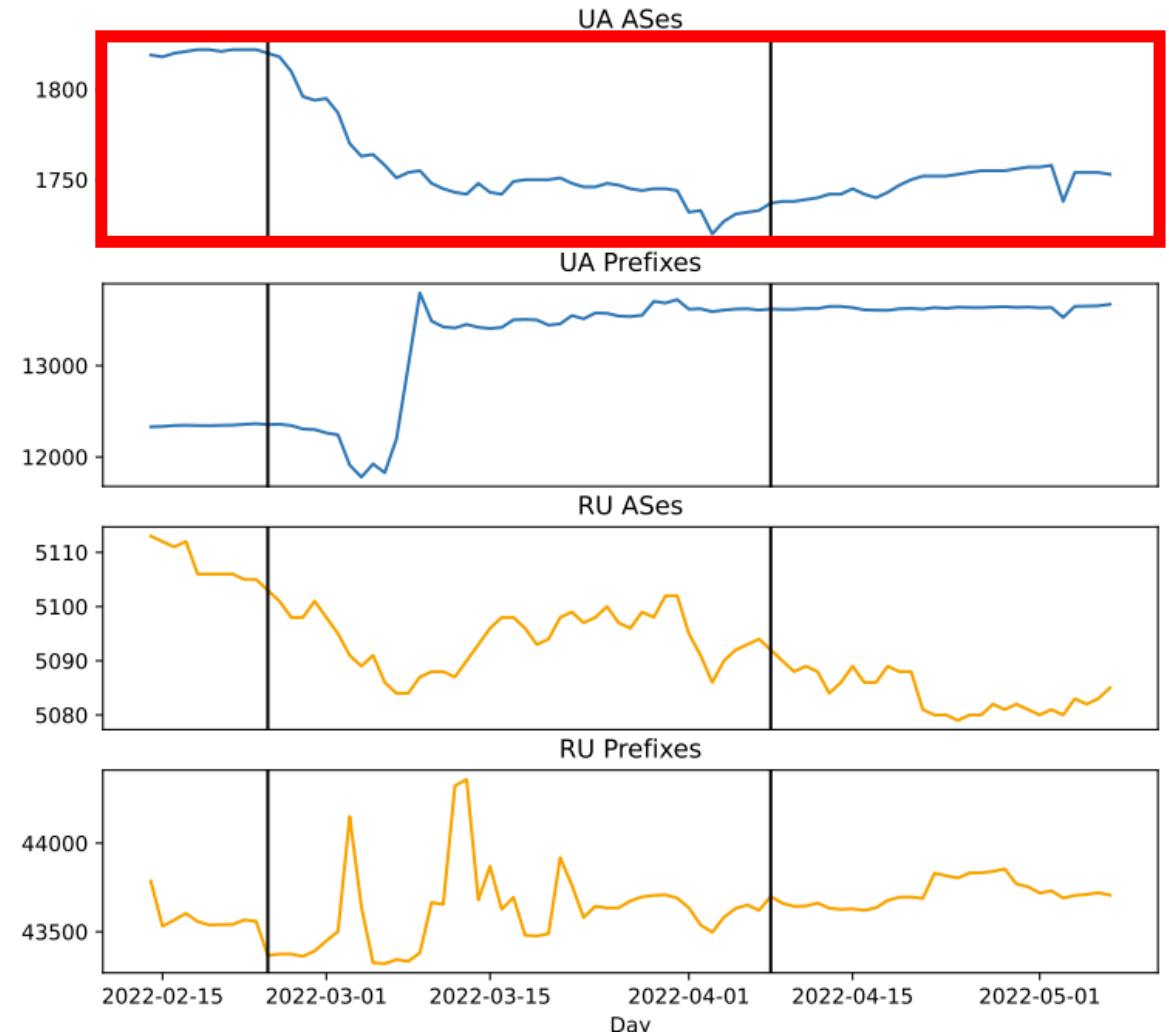
Over 800 GB!



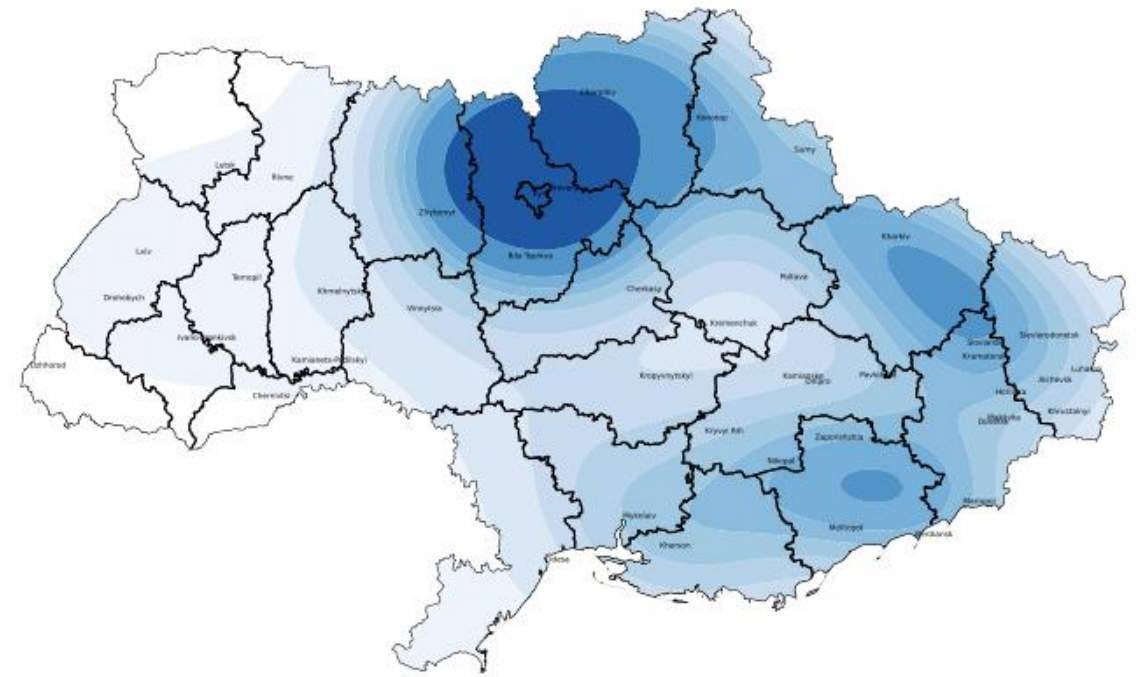
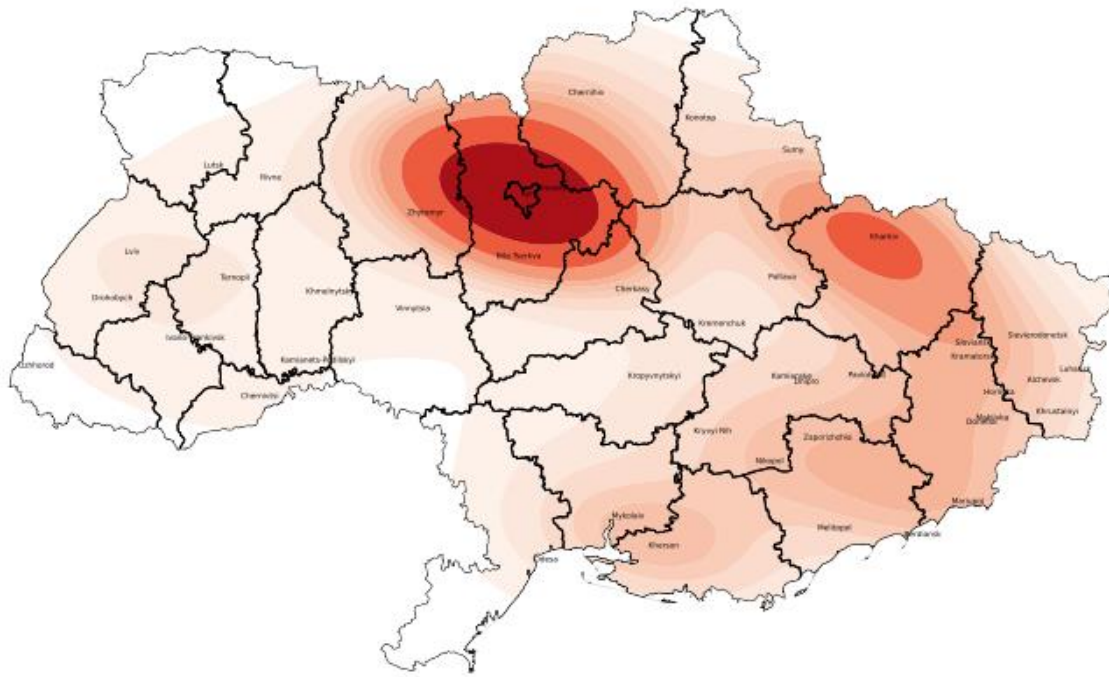
Routed ASes and Prefixes

Since the start of the war, the number of Ukrainian routed ASes decreased consistently.

~300 ASes disconnected (not all together).



Routed ASes and Prefixes



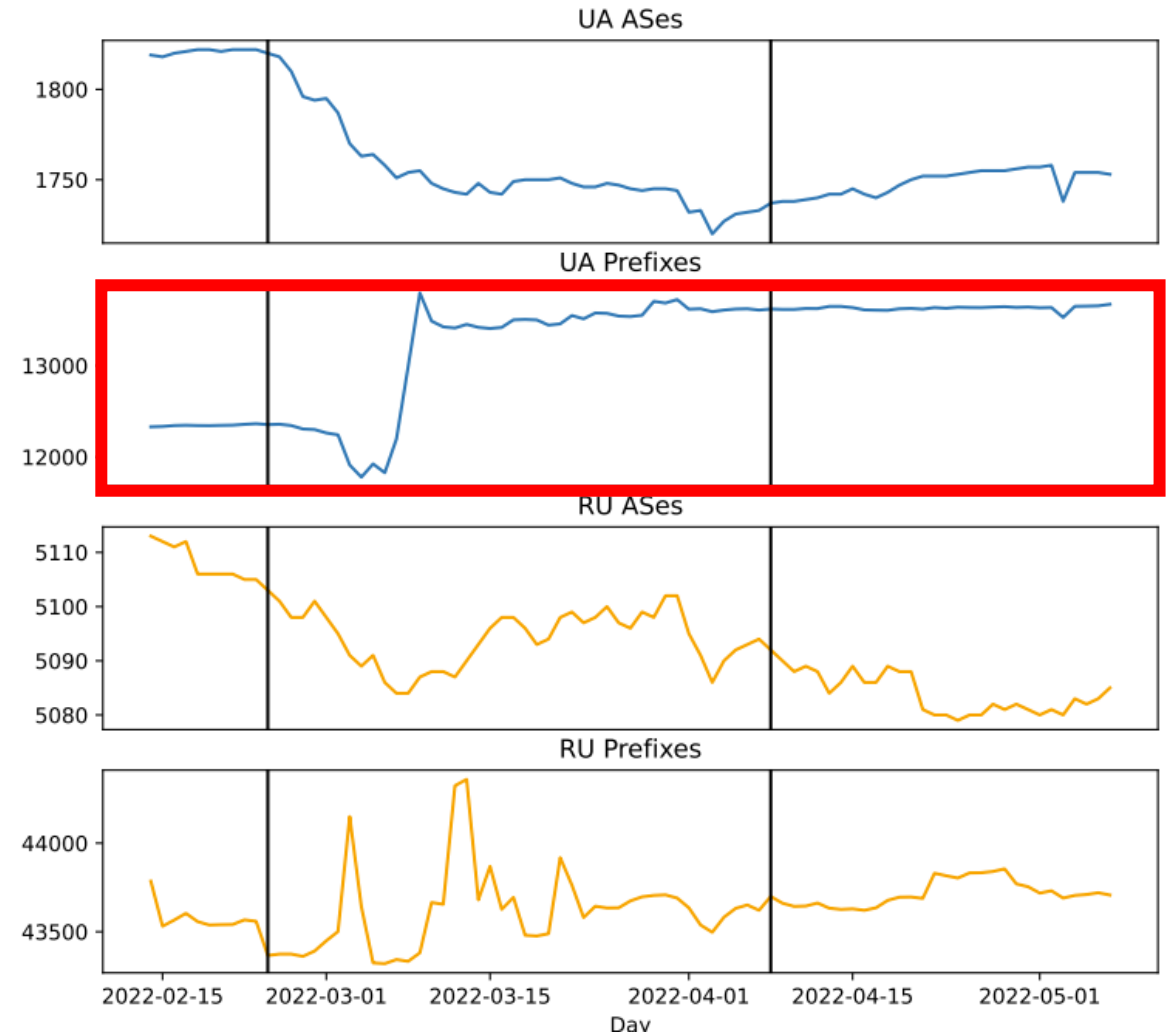
Geographic correlation between the geolocation of the **disconnected ASes** and the war activities.

Routed ASes and Prefixes

The number of Ukrainian prefixes started decreasing, then increasing significantly over the starting value.

Some Ukrainian ASes started splitting their prefixes in /24 or smaller prefixes (up to /32).

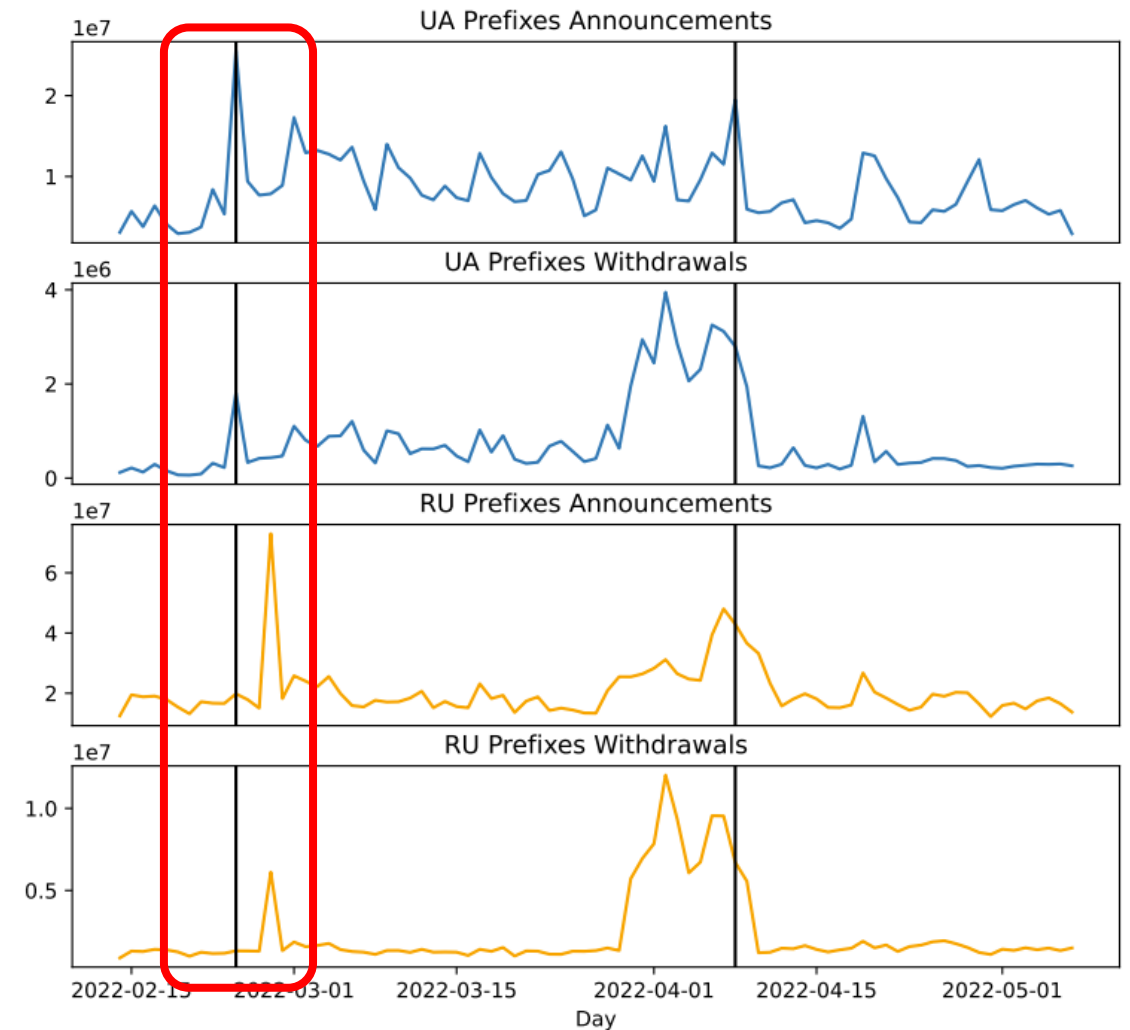
Possible BGP hijacks or defense against BGP hijacks.



BGP Activity

Generally increased BGP activity in both Russia and Ukraine. The activity is distributed on all the routed prefixes.

Peak corresponding to the start of the war.



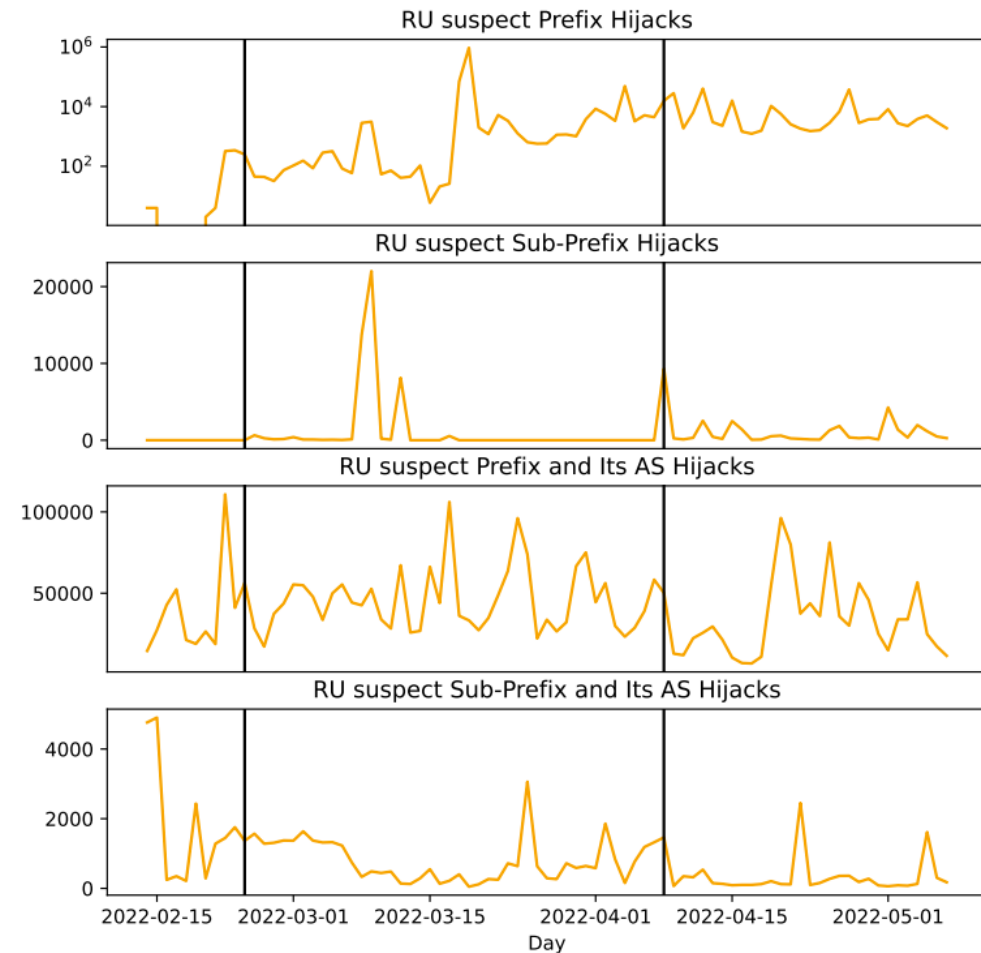
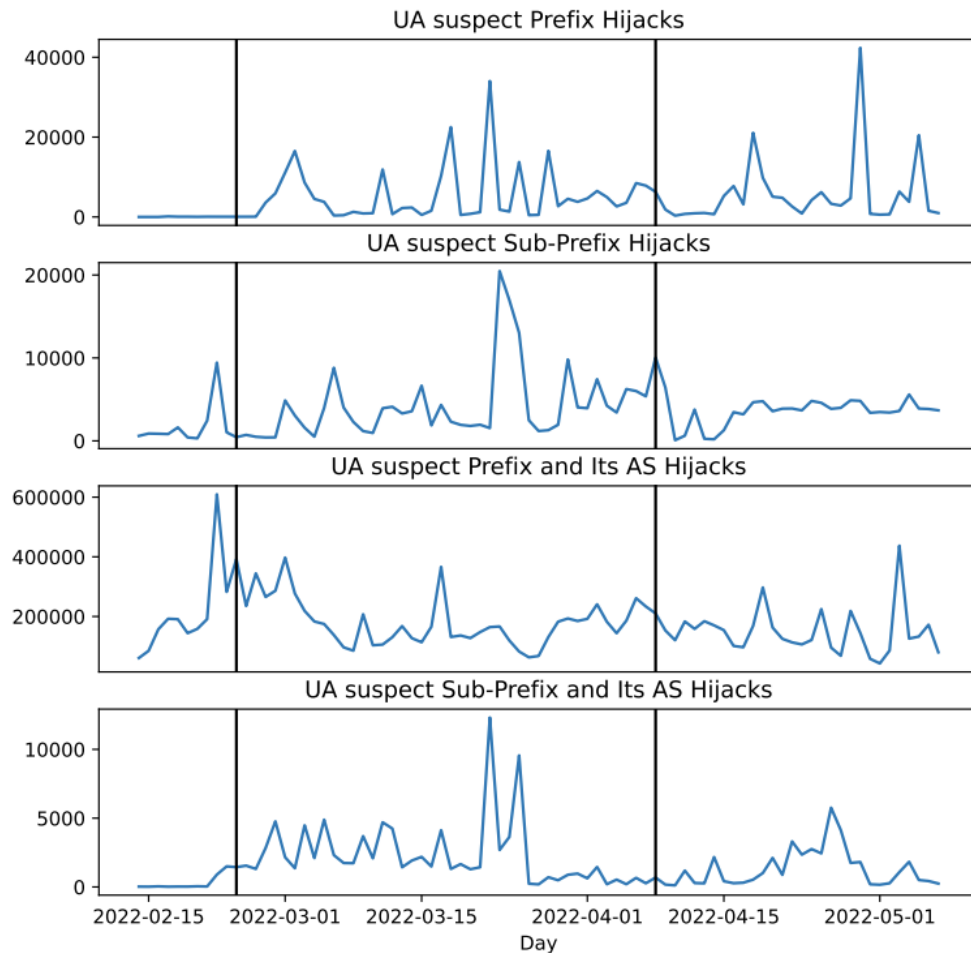
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Bump between 28 Mar 2022 and 09 Apr 2022.

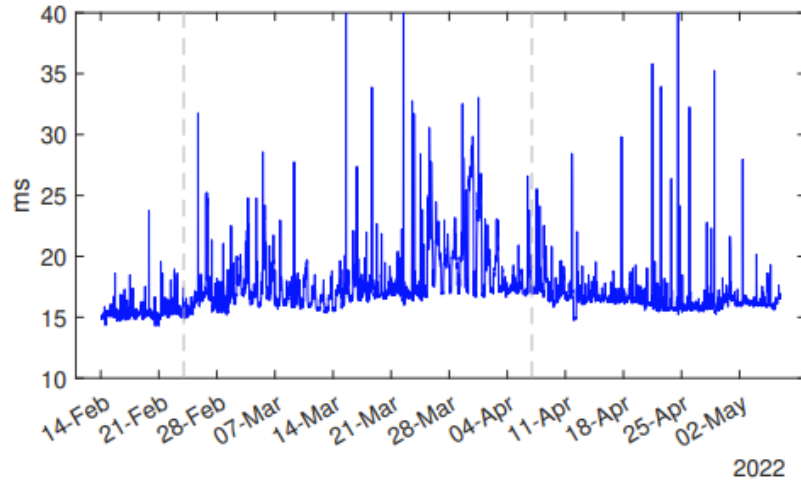


Suspect BGP Hijacks

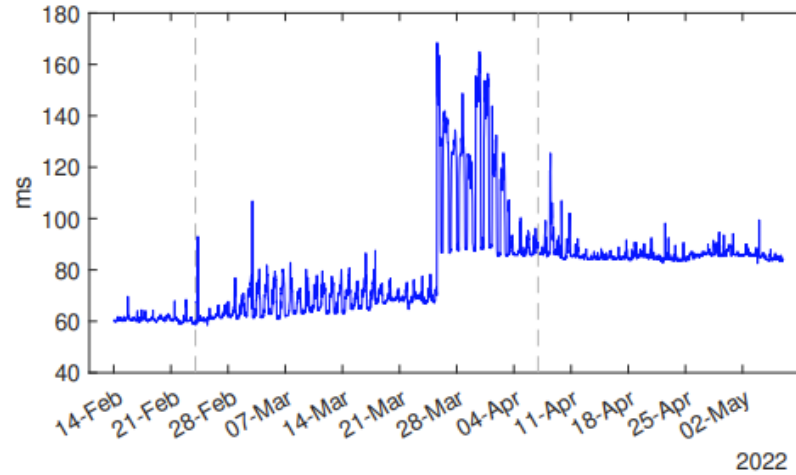


Increased activity from both sides.

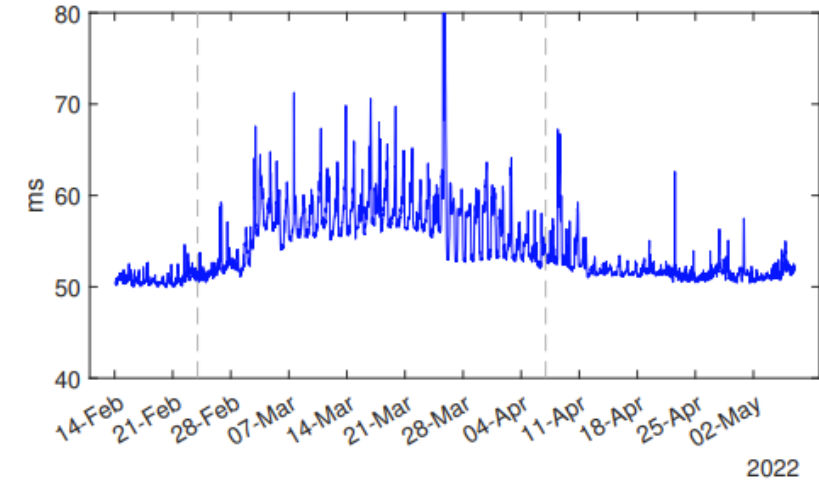
Latency



UA – UA



UA – RU

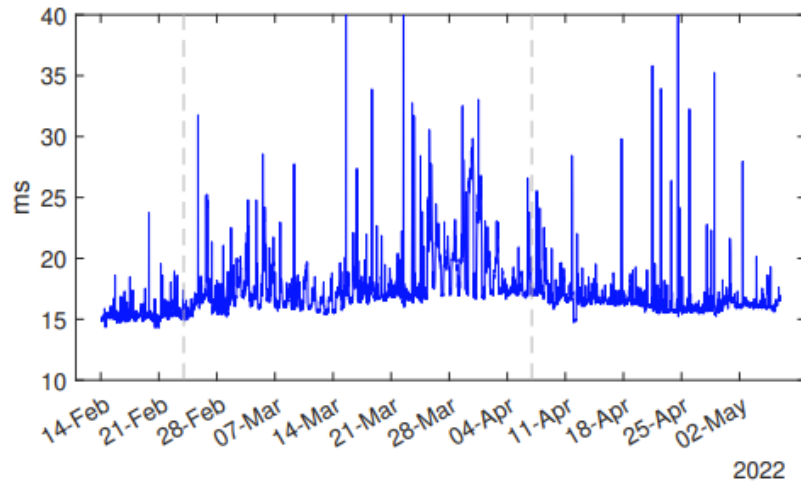


UA – EU

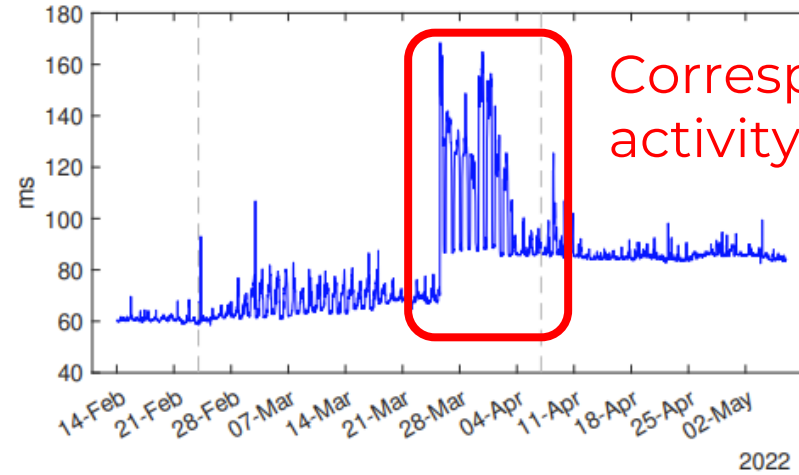
Measurements from Ukrainian RIPE Atlas probes to Ukrainian, Russian, and European RIPE Atlas anchors

Latency increases in all scenarios

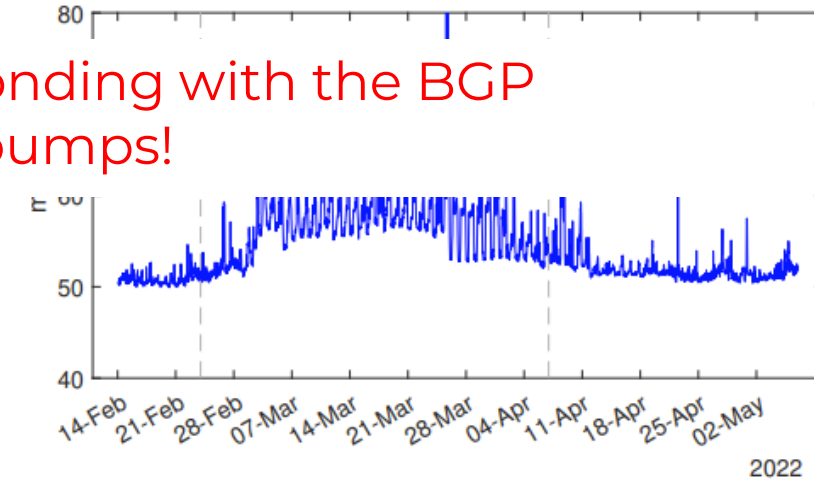
Latency



UA – UA



UA – RU

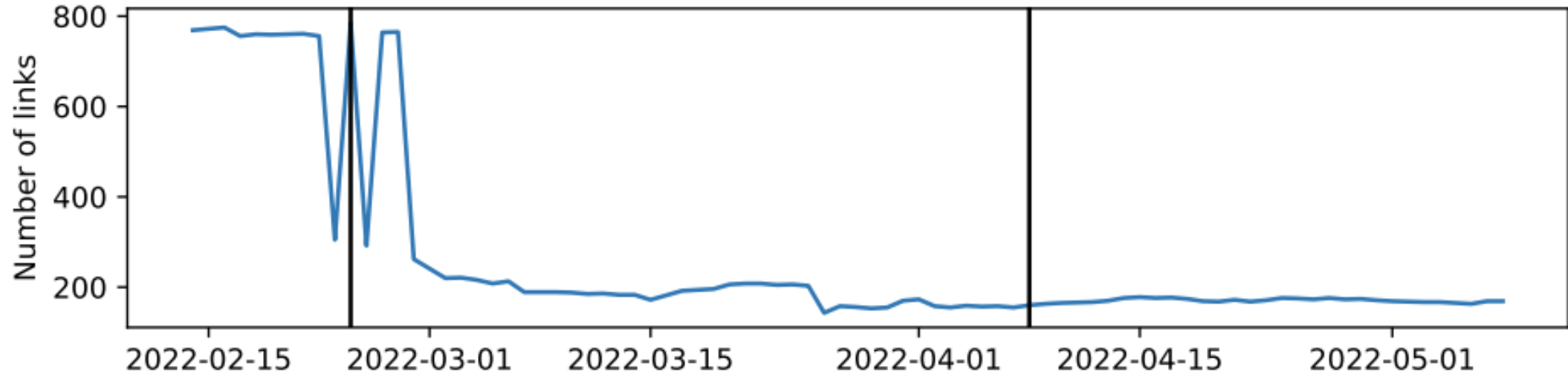


UA – EU

Measurements from Ukrainian RIPE Atlas probes to Ukrainian, Russian, and European RIPE Atlas anchors

Latency increases in all scenarios

Disconnections Between Russia and Ukraine



The number of AS links between Russia and Ukraine decreases significantly. In Traceroutes we saw disappearing IXPs like MSK-IX, and appearing Tier-1 ASes as Lumen, Cogent, or Arelion.

Takeaways

- War deeply influences the digital domain
 - Disconnections due to physical damages
 - Increase in the BGP activity and of suspicious activity
 - Increase in the countermeasures to mitigate attacks
 - Performance degradations
 - Disconnections between countries at war
- The Internet is resilient
 - Even after intense war activity in the physical and digital domain, most of the connectivity is still maintained
 - ~83% of the RIPE Atlas probes are online at the end of the considered period
- Data provided by RIPE NCC is **priceless**



Thank You!

QUESTIONS?

Our work has been submitted to Elsevier
Computer Networks

You can find a preprint at
<https://arxiv.org/abs/2208.09202>

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