RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Monitoring the external Internet services in Central Asia with RIPE Atlas

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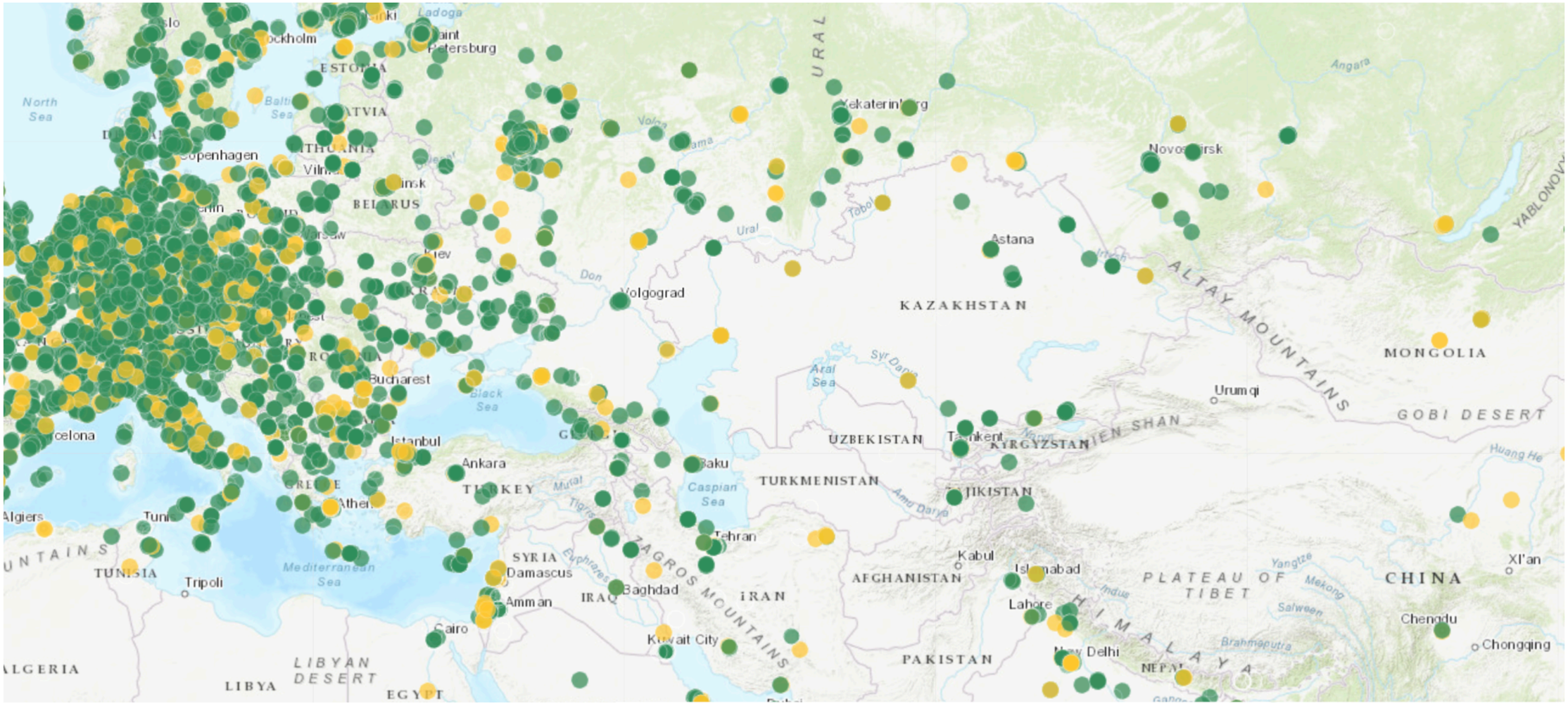
RIPE Atlas

RIPE Atlas

- The RIPE NCC began development of RIPE Atlas in late 2010
- RIPE Atlas is a global network of probes that measure Internet connectivity and reachability, providing an unprecedented understanding of the state of the Internet in real-time.
- RIPE Atlas probes are small, USB-powered hardware devices that hosts attach to an Ethernet port on their router
- Approx. 13000 probes are installed
  - 76 of them in Central Asia
- Approx. 68000 of users

RIPE Atlas

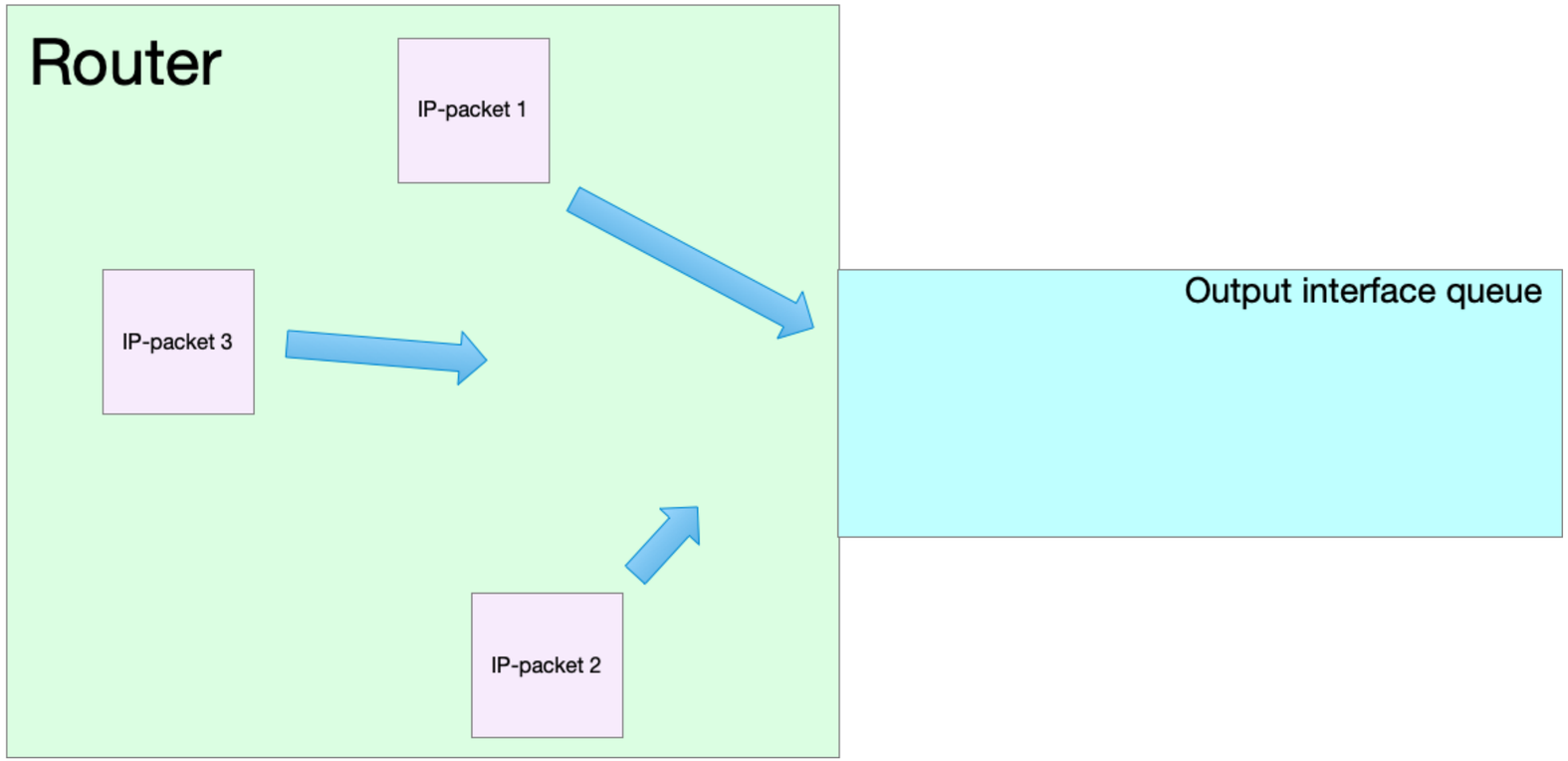

Ladoga
North Sea
Baltic Sea
ESTONIA
LATVIA
LITHUANIA
Vilnius
Minsk
BELARUS
Warsaw
Kiev
Copenhagen
Stockholm
Saint Petersburg
URAL
Yekaterinburg
Volga
Kama
Tobol
Ural
Novosibirsk
Angara
YABLONOVY
Astana
KAZAKHSTAN
Don
Volgograd
ALTAY MOUNTAINS
MONGOLIA
Irtish
Syr Darya
Aral Sea
Urumqi
GOBI DESERT
TIEN SHAN
UZBEKISTAN
Tashkent
KYRGYZSTAN
Black Sea
Bucharest
Istanbul
Ankara
TURKEY
Caspian Sea
Baku
TURKMENISTAN
TAJIKISTAN
Amu Darya
Huang He
Mediterranean Sea
Algiers
Tunis
TUNISIA
Tripoli
GREECE
Athens
Euphrates
Tigris
Mosul
SYRIA
Damascus
Amman
IRAQ
Baghdad
ZAGROS MOUNTAINS
IRAN
Tehran
Kabul
AFGHANISTAN
Islamabad
Lahore
PLATEAU OF TIBET
HIMALAYA
Yangtze
Mekong
Indus
Salween
Brahmaputra
CHINA
Xi'an
Chengdu
Chongqing
New Delhi
NEPAL
PAKISTAN
Kuwait City
Cairo
LIBYAN DESERT
LIBYA
EGYPT
ALGERIA

Network delay

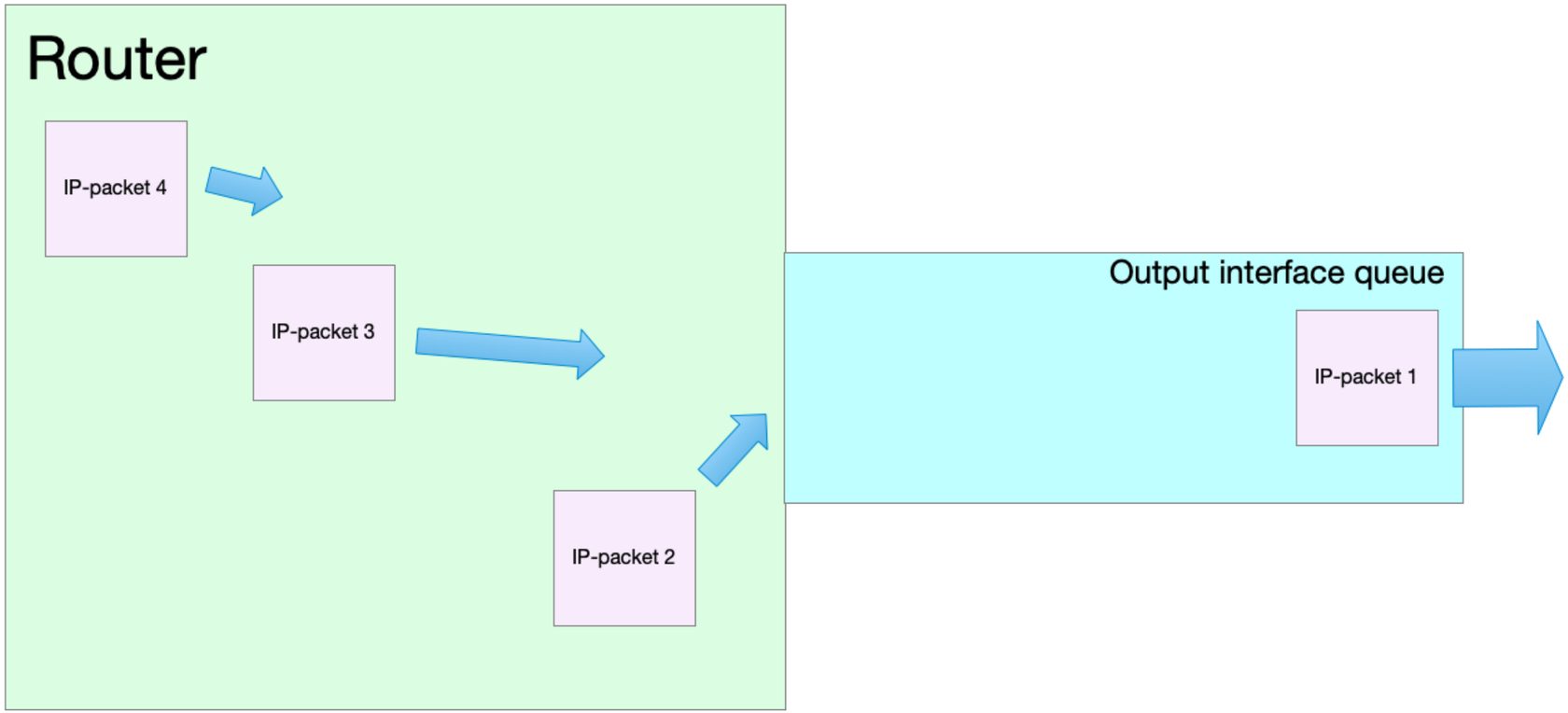
Nature of the network delay

- Many factors contribute to network latency
- The main ones are:
  - Signal transmission delay
  - Packet processing delay
  - Delay in interface queues
- The latter indicates that the data channels are significantly congested
- Route changes change the value of the delay!

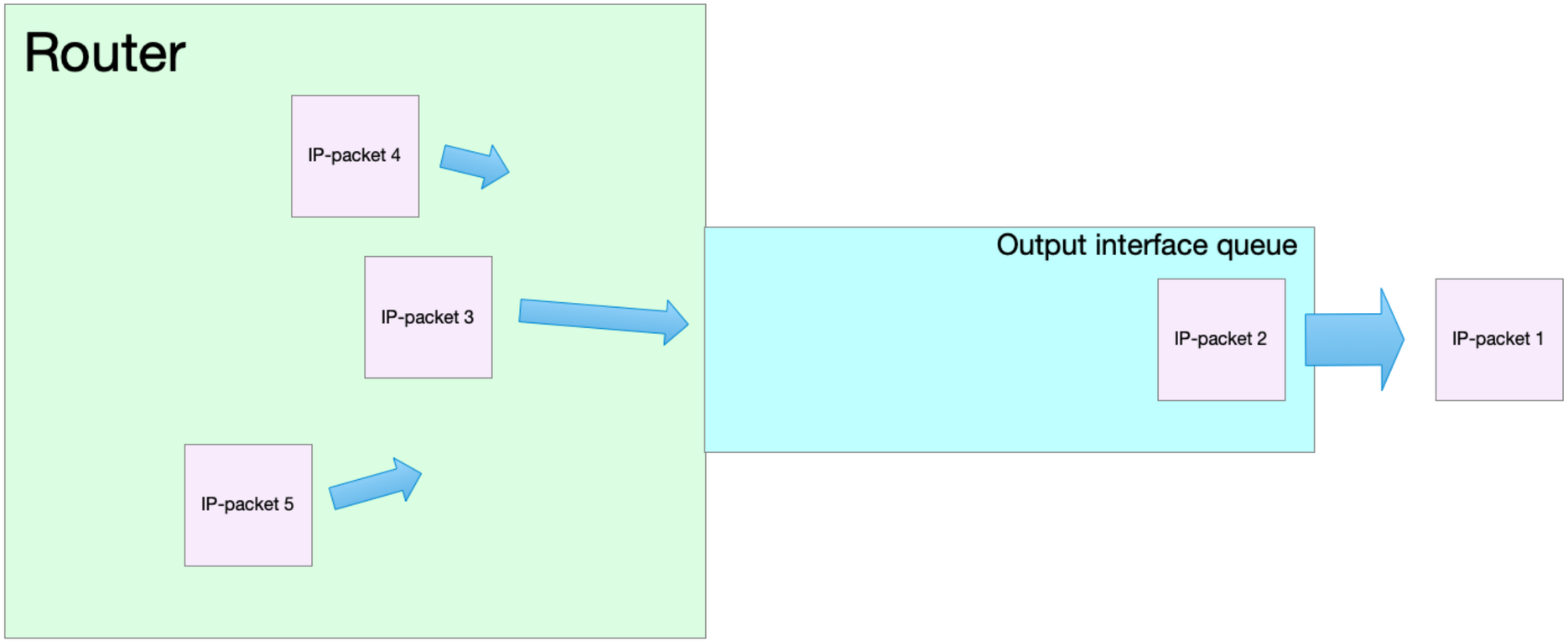
Interface queues



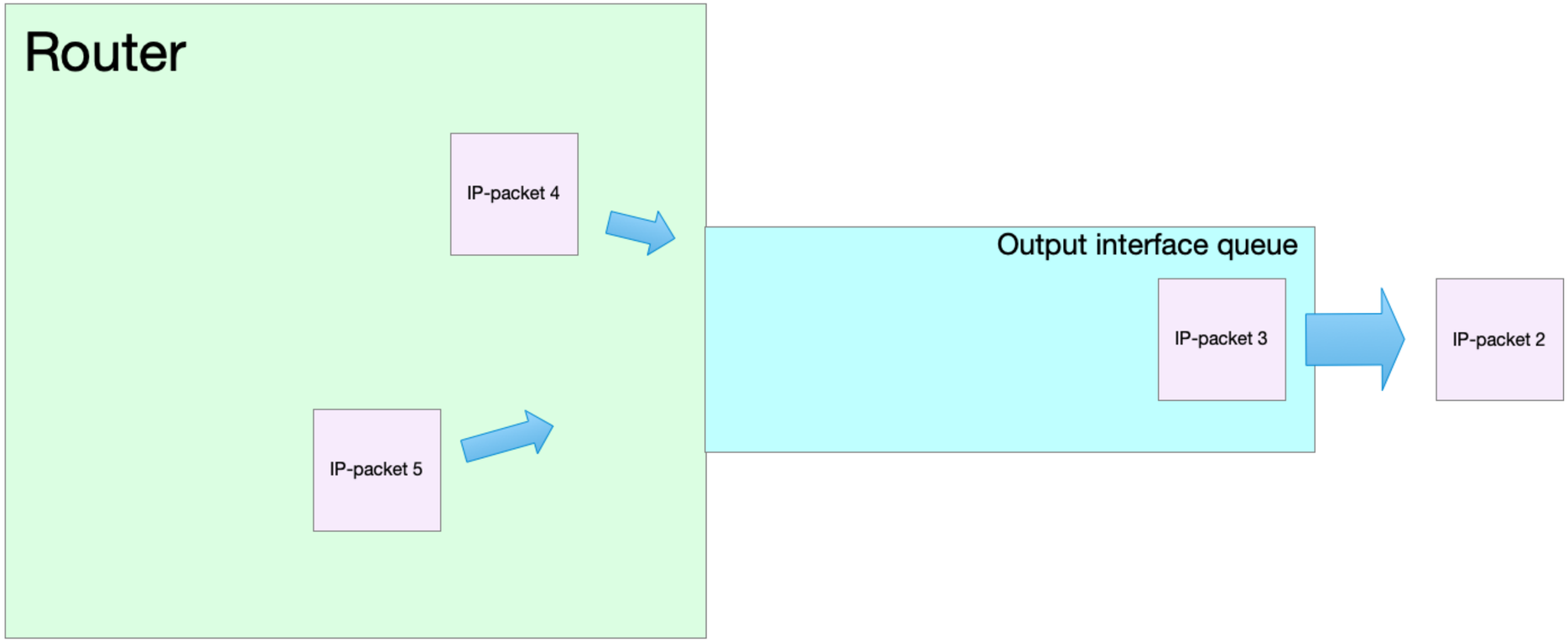
Empty queue, no delay



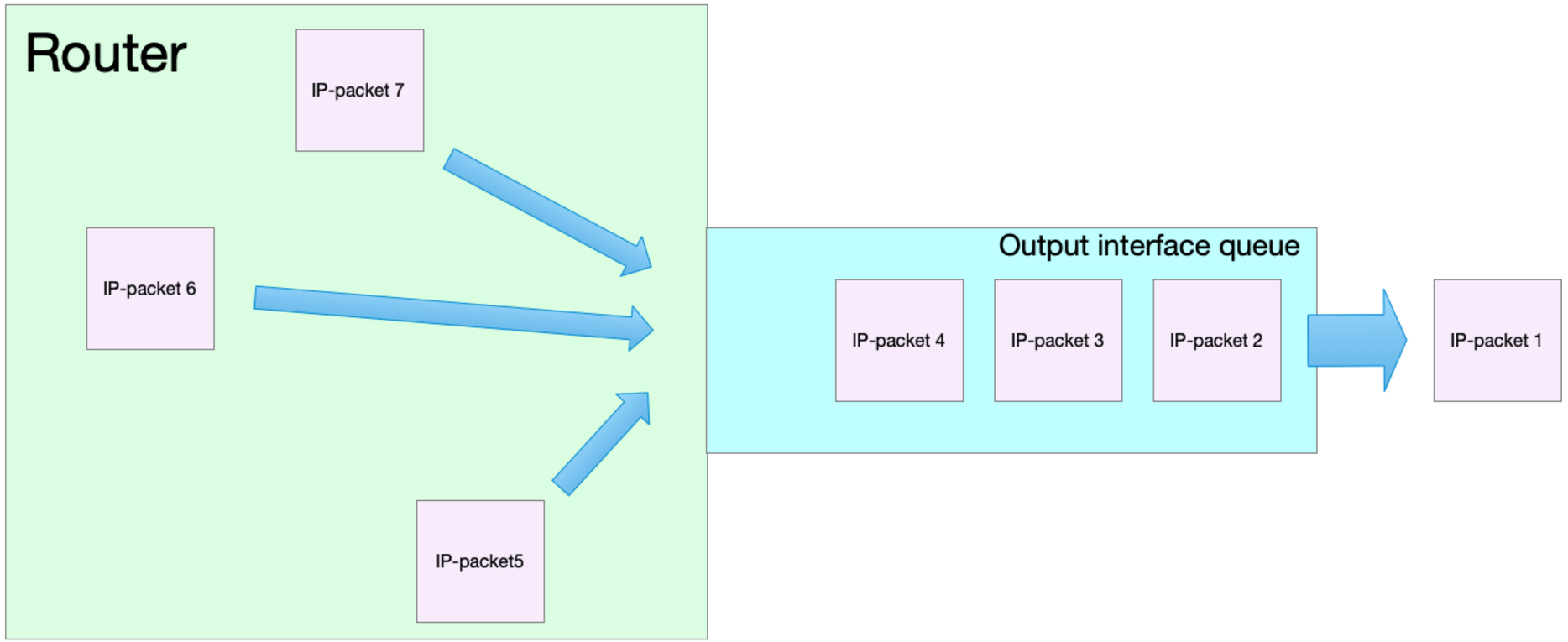
Empty queue, no delay



Empty queue, no delay



Packets are queued up…



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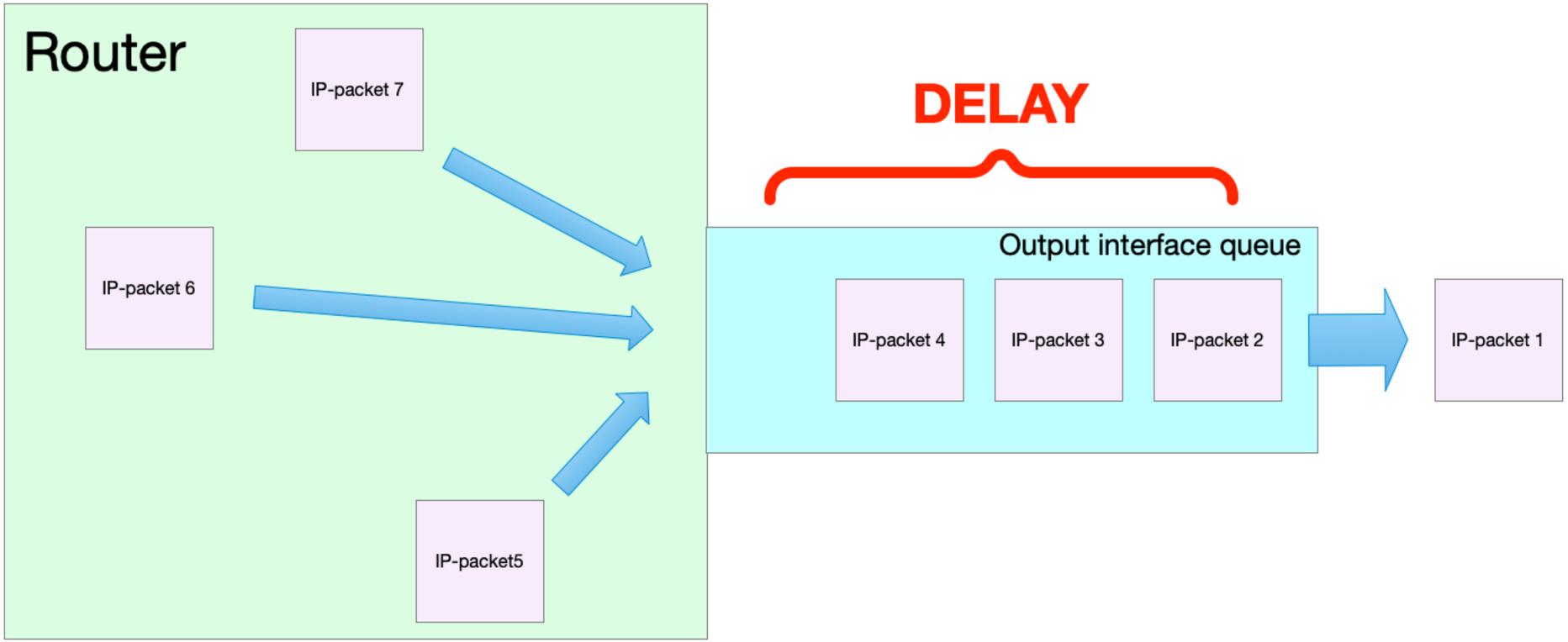


Why is it important?

- Measurement of delay in different directions allows us to trace the moments of high channel utilization
- High utilization can occur not only on the first hop but on any one of them
- In any case, the fact of high utilization of a channel in some direction degrades the user perception

Research

Methodology

- We measure round-trip time from all Altas probes in Central Asia to the most popular "external" resources in the region
  - Popularity data obtained through Open.Trends service
  - Measurements are taken over several weeks to get numerous results and ensure statistical confidence
- Domain names were used as targets, and resolving was performed on the probe
- The data is averaged to obtain a typical "portrait" of delays on weekdays and weekends.
  - Median averaging is used
- Then, additional averaging is performed for the country and the region as a whole

Services tested

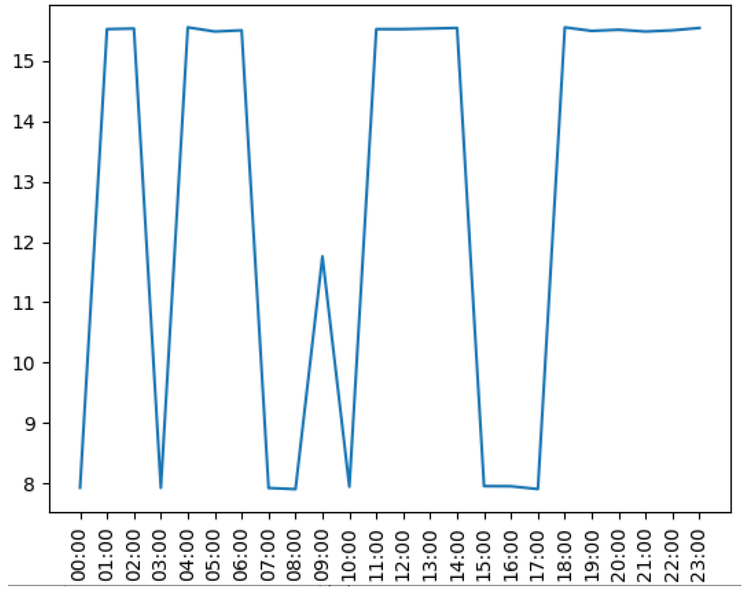
- Google:
  - Google DNS
  - Google Authorisation Server
  - Google Fonts storage
- Facebook
  - Facebook frontend
  - Instagram
- Telegram
- TikTok
- Aliexpress/Akamai
- Yandex
- VK
- Rezka.ag
- Wikipedia

Biases

- Not every autonomous system has probes
  - Especially not every network prefix.
- Frequently changing routes or geo-optimization of the service significantly blur the picture
- Additional factors may influence RTT
  - E.g., the complex internal structure of the service in question

“Baseline” and rejected data

- AliExpress uses Akamai with a cumbersome structure inside
  - RTTs are just random
  - AliExpress data were excluded from the further research

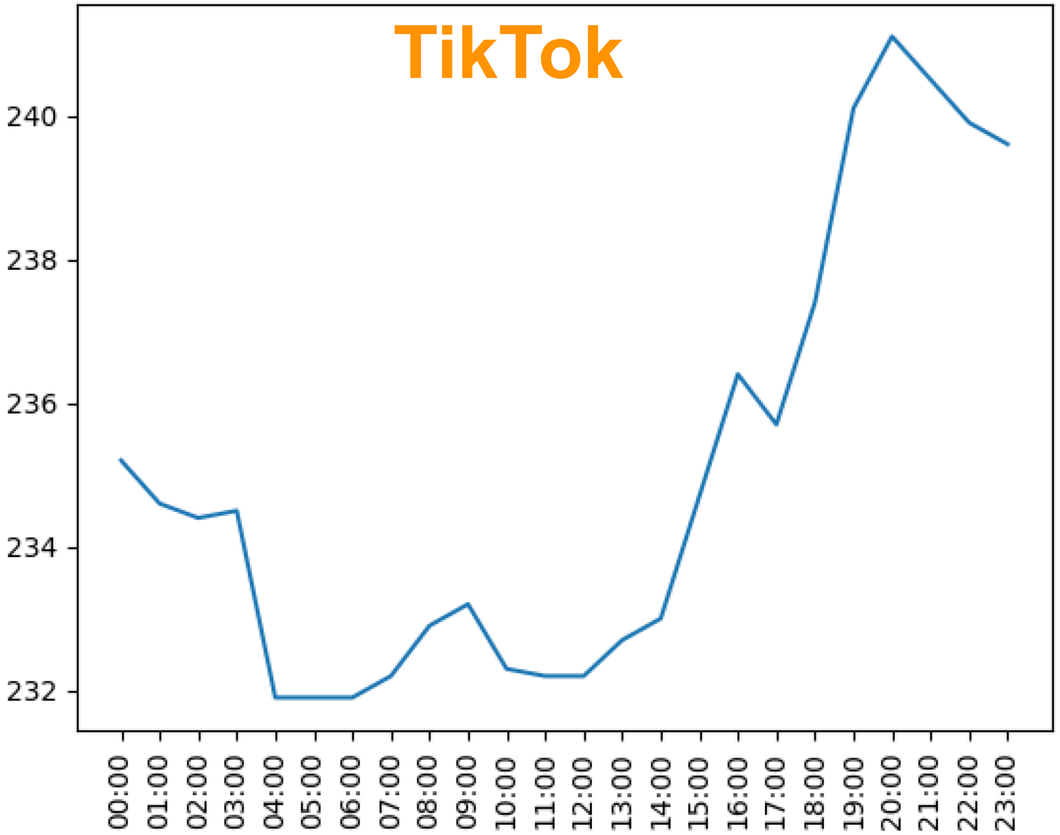


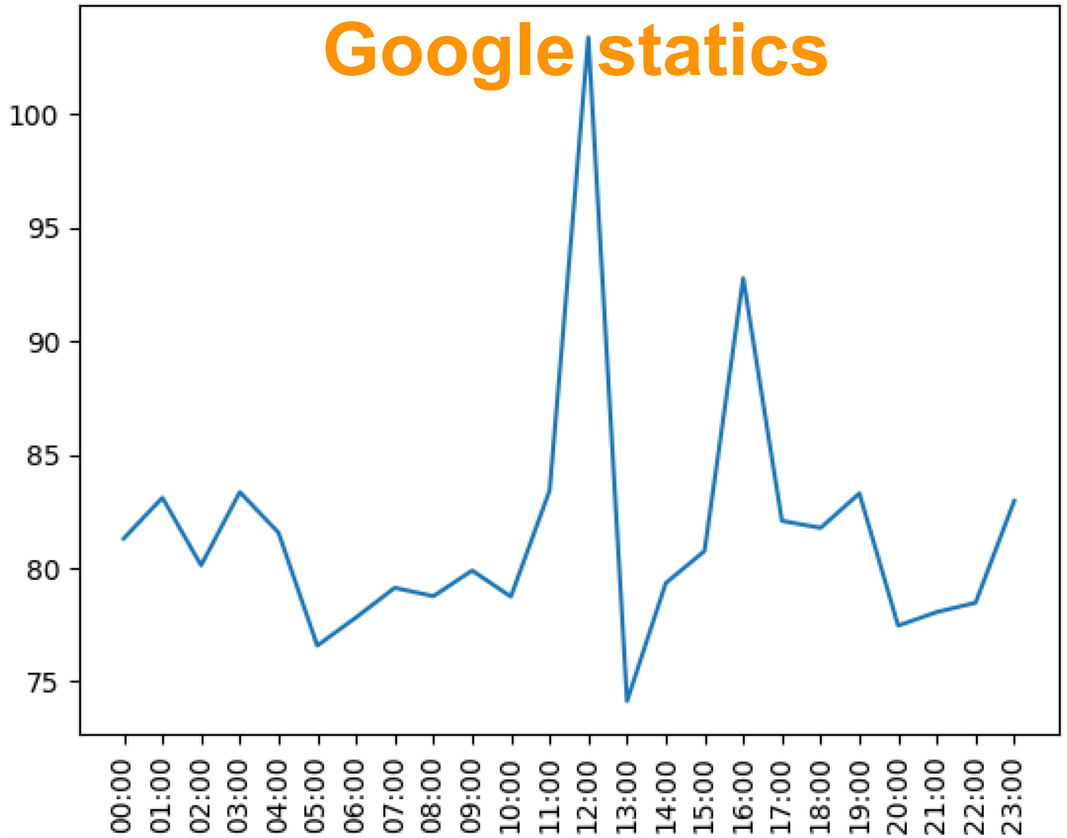
- Measurement in Europe as the reference
  - Daily fluctuations on the other services do not exceed 3ms, and usually below 1ms
  - That is, delays in queues at the interface along the route do not seem to occur

Results: Kazakhstan

- RTT graphs are as expected, with the best values during typical off-peak hours (around 4am)
- There is no fundamental difference between weekdays and weekends
- For most services, the difference between the minimum and maximum RTT during a day is small
- Exceptions:
  - TikTok - the difference is slightly more than normal, 8ms during weekends
  - Static Google content (fonts) - the difference is quite large, about 25ms

Results: Kazakhstan

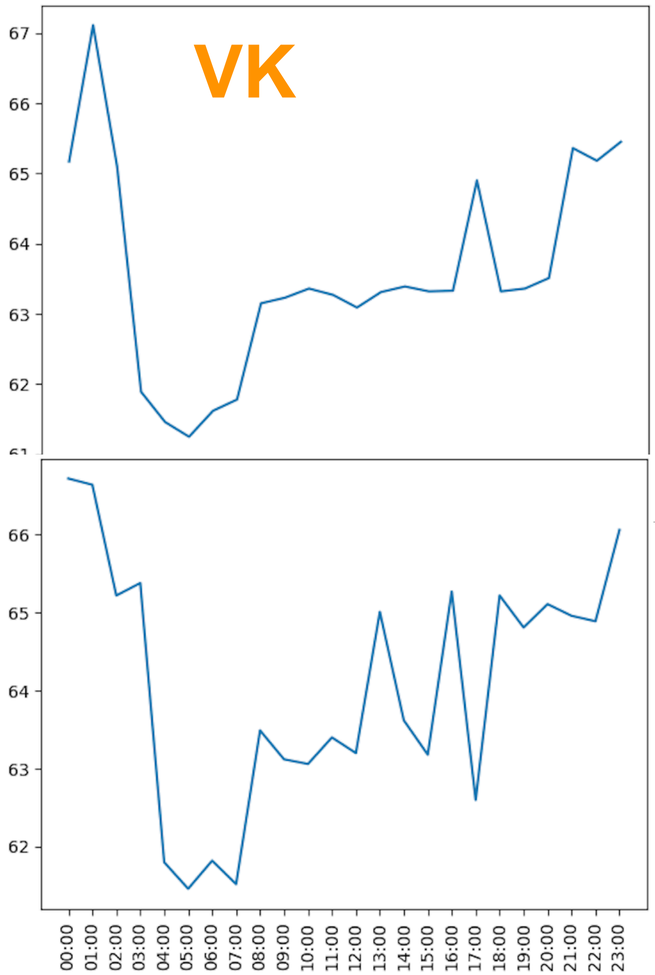




Results: Kyrgyzstan

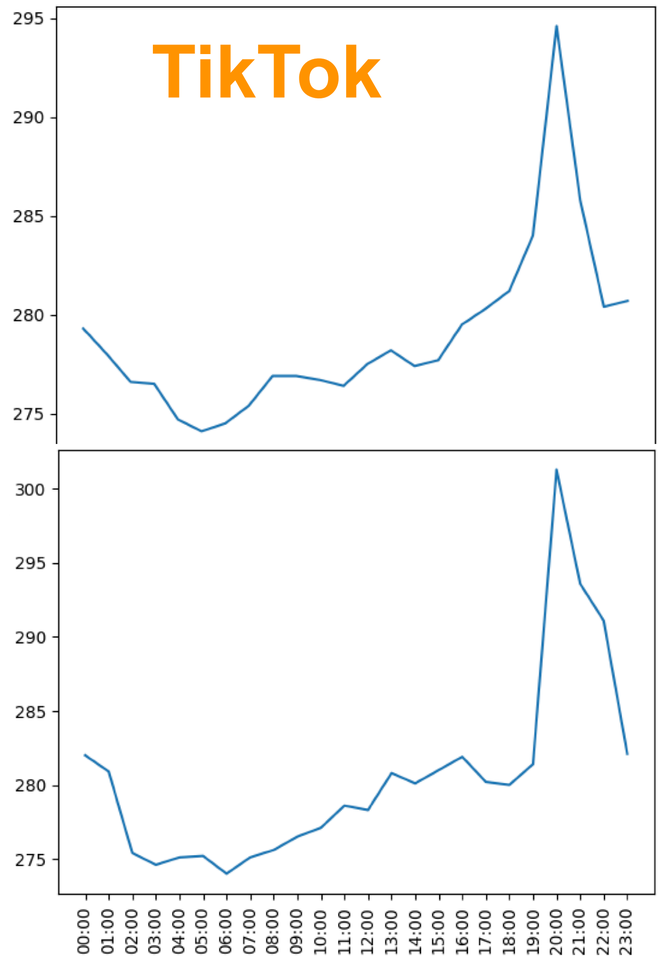
- RTT graphs are as expected, with the best values during typical off-peak hours (around 4am)
- There is no fundamental difference between weekdays and weekends
- For most services, the difference between the minimum and maximum RTT during a day is small
- Exceptions:
  - Yandex - the difference is a little more than normal, 4ms
  - VK - the difference is slightly more than normal, 6ms
  - TikTok - the difference is quite large, about 20ms

Results: Kyrgyzstan



Weekdays

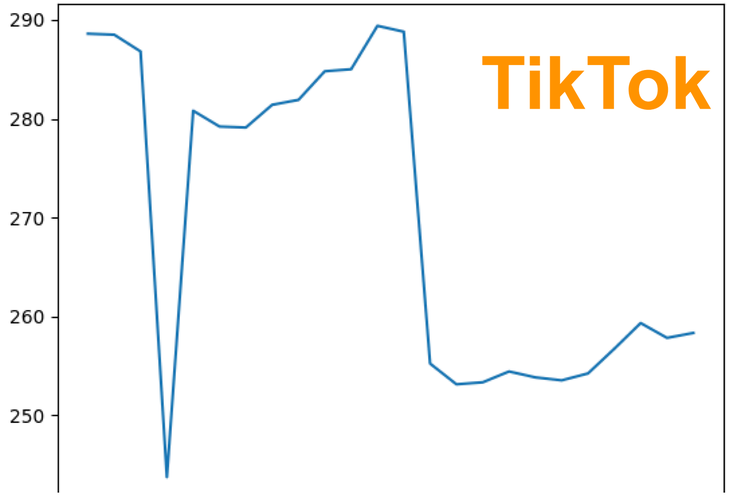
Weekends

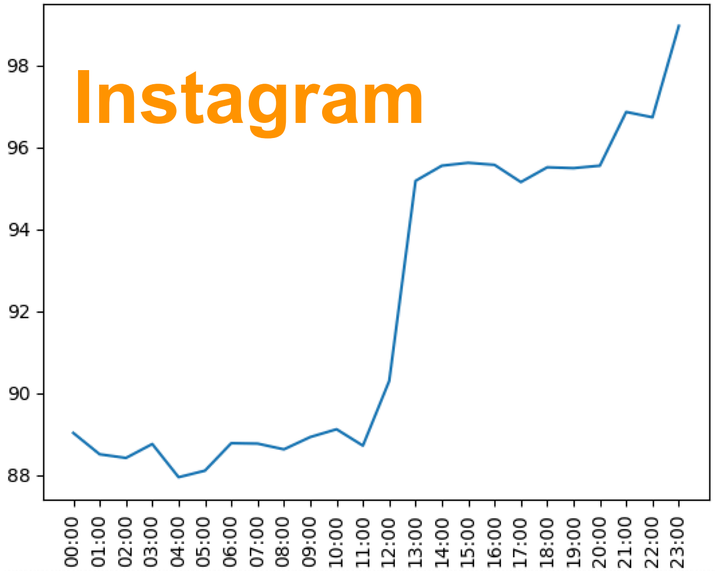


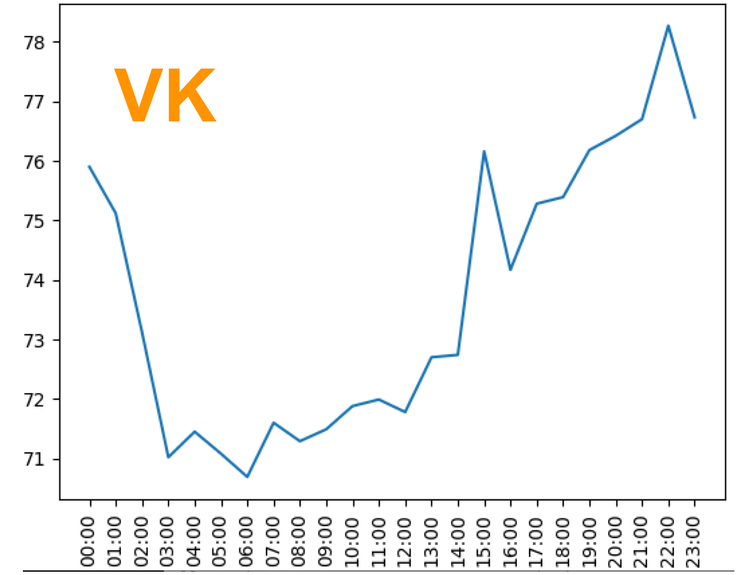
Results: Tajikistan

- RTT graphs are as expected, with the best values during typical off-peak hours (around 4am)
- For most services, the difference between the minimum and maximum RTT during a day is small
- Exceptions:
  - Rezka.ag and Google Authorization - the difference is a little more than normal, 4-5ms
  - VK - the difference is slightly more than normal, 6ms
  - Facebook and Instagram during weekends - the difference is large, about 10ms
  - TikTok - the difference is quite large, around 40ms

Results: Tajikistan



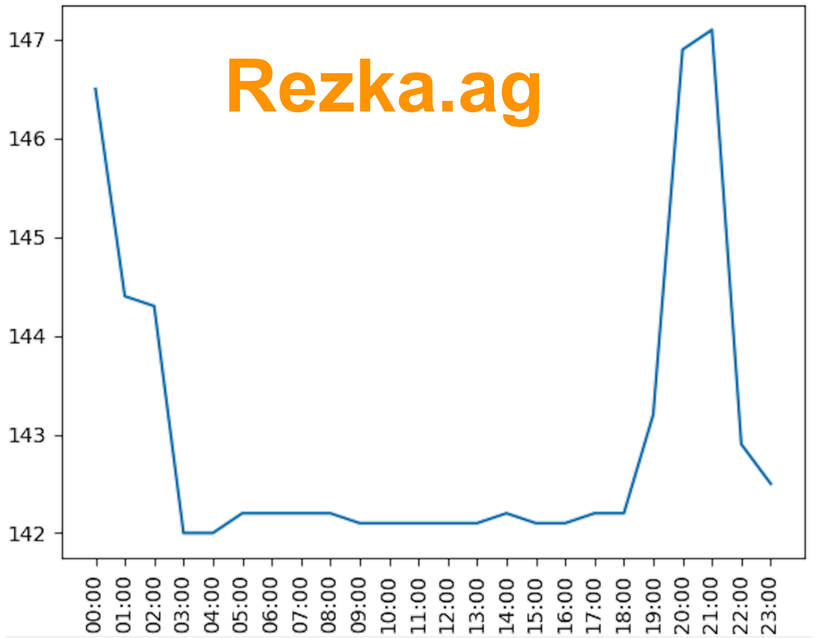


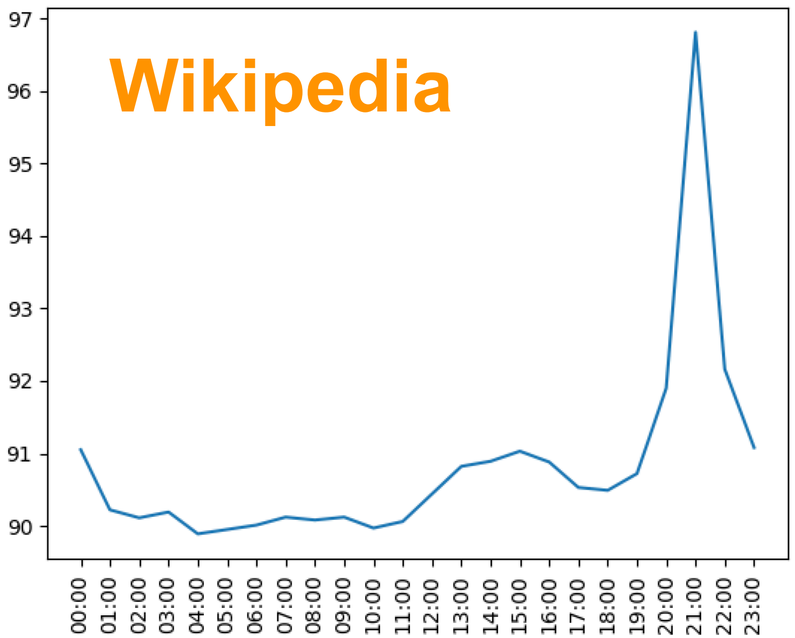


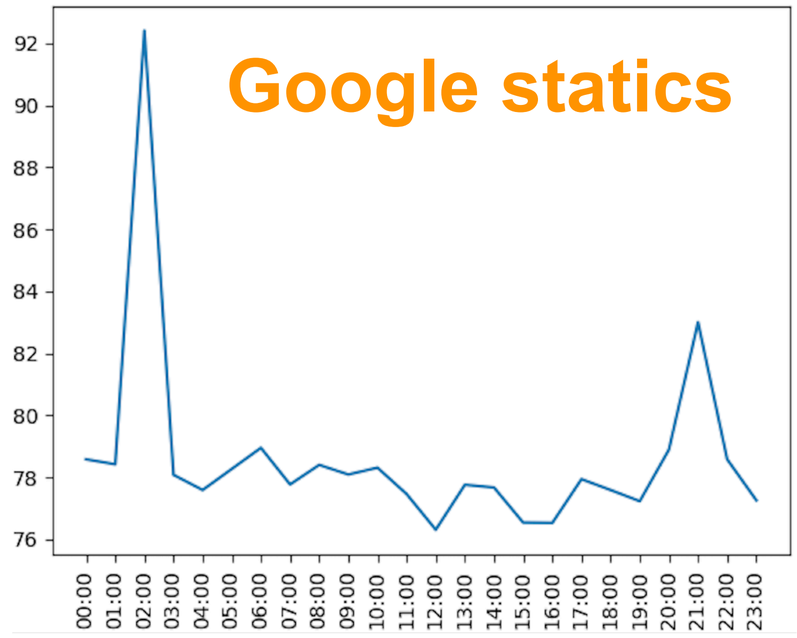
Results: Uzbekistan

- RTT graphs are as expected, with the best values during typical off-peak hours (around 4am)
- There is no fundamental difference between weekdays and weekends
- For most services, the difference between the minimum and maximum RTT during a day is small
- Exceptions:
  - Rezka.ag - the difference is little more than normal, 5ms
  - Wikipedia - the difference is slightly more than normal, 6ms
  - Static Google content (fonts) - the difference is quite large, up to 30ms

Results: Uzbekistan







Some conclusions

- Not all services can be monitored in this way
  - Akamai-based services as an example
- RTT by time during the day is uneven, which may indicate the influence of channel utilization
- At the same time, RTT fluctuations during the day on average in the region are small, which is definitely good
- Each country has its own peculiarities
- Interaction of operators with service providers may further improve the picture observed

Questions

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