

Riccardo Stagni | 16 September 2022 | ITNOG6

### **Resilience Under** Pressure

Perspectives on the Ukrainian Internet in 2022 from RIPE and the RIPE NCC



# **RIPE & RIPE NCC**

- **RIPE NCC** is a Dutch membership association with around 20k members
  - Serves as the Regional Internet Registry for Europe, Middle East, parts of Central Asia Maintains a number of network measurement and analytical tools (RIPE Atlas, RIS) and
  - additional services (including k-root)
- **RIPE** is an open community of people with an interest in IP networks in this region
  - A venue for making policy, sharing information and best practices, coordinating on technical issues
  - 2x RIPE Meetings per year: RIPE 84 (Berlin, May 2022), RIPE 85 (Belgrade, Oct 2022) 12x currently active working groups, communicating via mailing lists

Riccardo Stagni | ITNOG6 | 16 September 2022



# What We See from the RIPE NCC



### **ISP Decentralisation**

- Absence of market concentration at end-user networks level
  - UA: 4th in the world!
  - Herfindahl–Hirschman Index of 0.052 (very low!)
- How Ukrainian end-user networks interconnect, as seen from RIPE Atlas
  - https://jedi.ripe.net/peer-to-peer/ua/2022/03/01
- 55% ISPs serve <1% of the market!</p>
  - Not visualised (the left half of the circle)
- (compare January with September)



# IXP Abundance

![](_page_4_Figure_1.jpeg)

### • 25 IXPs!

- As seen in PeeringDB
- 13 visible in RIPE Atlas data
  - IXP-country-Jedi probes mesh tool
  - visualising the paths between probes
  - <u>https://jedi.ripe.net/history/2022-03-01/UA/</u> ixplans/
- No single dominant IXP!
- (compare January with September)

Connected RIPE Atlas probes

![](_page_5_Figure_2.jpeg)

![](_page_5_Figure_3.jpeg)

### The number of RIPE Atlas probes online in Triolan AS13188.

- Top graph is the number of connected probes, the lower graph shows for each individual probe when it was online or offline.

Riccardo Stagni | ITNOG6 | 16 September 2022

![](_page_5_Figure_8.jpeg)

# Initial Outage in February/March (2)

![](_page_6_Figure_1.jpeg)

Riccardo Stagni | ITNOG6 | 16 September 2022

https://stat.ripe.net/ui2013/widget/atlas-probe-deployment#w.resource=UA

![](_page_6_Figure_5.jpeg)

![](_page_6_Picture_6.jpeg)

![](_page_6_Picture_7.jpeg)

### Takeaways

- The Ukrainian Internet is a very resilient Internet...
  - "Due to low market concentration at multiple levels and the relatively high number of interconnect facilities, there are no obvious chokepoints, or individual networks whose loss would have a crippling effect on the Internet in Ukraine." https://labs.ripe.net/author/emileaben/the-resilience-of-the-internet-in-ukraine/
- ...but any human-made system has a breaking point!
  - Power outages, physical disruption can have significant impact
- Observable with data we collect
  - RIPE Atlas: data plane (ping, traceroute, etc.) <u>https://atlas.ripe.net</u>
  - - RIPE RIS: control plane (BGP) <u>https://www.ripe.net/ris</u>

Riccardo Stagni | ITNOG6 | 16 September 2022

![](_page_7_Picture_9.jpeg)

# **Adding Further Resilience**

- Concerns about BGP/routing attacks
  - Ukrainian resources in mid-February
  - While it's not clear that BGP attacks have been widespread, there could well be incidents that go unreported
  - https://www.manrs.org/2022/03/did-ukraine-suffer-a-bgp-hijack-and-how-cannetworks-protect-themselves/
- The RIPE NCC hosted an online BGP security training in April, upon request from operators in Ukraine
  - https://labs.ripe.net/author/alex-semenyaka/rpki-training-for-ukrainian-networkoperators/

Riccardo Stagni | ITNOG6 | 16 September 2022

![](_page_8_Figure_8.jpeg)

Aftab Siddiqui on the MANRS blog looked into the possibility of a deliberate attack on

![](_page_8_Picture_15.jpeg)

### Did it Help?

![](_page_9_Figure_1.jpeg)

Riccardo Stagni | ITNOG6 | 16 September 2022

![](_page_9_Figure_3.jpeg)

https://stat.ripe.net/ui2013/widget/rpki-by-country#w.resource=UA

![](_page_9_Figure_5.jpeg)

![](_page_9_Picture_6.jpeg)

### Internet in Occupied Territories

![](_page_10_Picture_1.jpeg)

### Crimea 2014: From this...

![](_page_11_Figure_1.jpeg)

![](_page_11_Figure_3.jpeg)

![](_page_11_Picture_5.jpeg)

### ...to this (2017)

![](_page_12_Figure_1.jpeg)

![](_page_12_Figure_4.jpeg)

![](_page_12_Picture_5.jpeg)

### **Current Observations**

- Spring and early summer:
  - via Russian networks (Miranda Media/Rostelecom or UMLC/Fiord)
  - -

- Why is this... Dangerous? Important?
  - https://www.kentik.com/blog/rerouting-of-kherson-follows-familiar-gameplan/
  - https://ihr.iijlab.net/ihr/en-us/countries/UA

Riccardo Stagni | ITNOG6 | 16 September 2022

![](_page_13_Picture_8.jpeg)

![](_page_13_Figure_9.jpeg)

RIPE NCC measurements saw some routes from Kherson networks changing to route

Then other prefixes originated by ASNs registered with an physical address in newly occupied territory shifted to a strong dependency on Miranda Media (AS201776)

# RIPE Community Perspectives

![](_page_14_Picture_1.jpeg)

![](_page_15_Picture_0.jpeg)

Riccardo Stagni | ITNOG6 | 16 September 2022

![](_page_15_Figure_3.jpeg)

https://nogalliance.org/ our-task-forces/keepukraine-connected/

![](_page_15_Picture_5.jpeg)

# Keep Ukraine Connected (1)

- Presented at RIPE 84 (May 2022)
  - Global Nog Alliance (GNA) Supply & Demand **Database** works very well. Anyone who wants to donate equipment can get a login from us, and can specify what they want to donate.
  - Using this database, we can manage which donations we've received. This makes it easier for us to keep track of everything, and means we can show people from Ukraine who need equipment what we have in the system.
- First delivery of equipment: 8-14 April
  - 3132 kilometres, 44 Hours driving

Riccardo Stagni | ITNOG6 | 16 September 2022

![](_page_16_Picture_7.jpeg)

### Our Vision & Mission

We want to be the facilitator linking the Disaster Region and the global community.

We have contacts in the community and also with the manufacturers, so we want to use these contacts to do good things.

### **Strategy Development**

We received many offers for donations and also many requests for equipment.

In order to be able to map this properly, we have implemented a custom made Supply & Demand Database.

![](_page_16_Figure_18.jpeg)

### Keep Ukraine Connected (2)

![](_page_17_Figure_7.jpeg)

- 1. Working on a stable Concept for the Future
- 2. Conversations with Donators (around 15 Mio €)
  - 3. Conversations with Partners
- 4. Conversations with PO & UA Government/ Customs/ BC
  - 5. normal daily work and Family

![](_page_17_Picture_13.jpeg)

# **Keep Ukraine Connected (3)**

The current	needs of	FISP pro	oviders
-------------	----------	----------	---------

### 1. Optical splicers

For trunk optical lines

Inno Instrument - View 5, 7, 8 - FSM-60, 70, 80, 86S, 41S Fujikura - T-57 , TYPE-72C, 81C Sumitomo - S-177, 178, 179 Fitel

Current quantity needed 20 pcs

• For subscribers, FTTH, last mile networks

Inno Instrument - View 1, 3, M7 - FSM- 19S, 22S, 23S, 36S Fujikura - TYPE-71BS, T-400S, 502S Sumitomo - S- 153A Fitel

Current quantity needed 40 pcs

### Most requested tool !!!

We are collecting donations to buy fiber optic splicers and send them to areas where repairs are most needed!!! We already sent 4 of them!

> **Keep Ukraine Connected** Help us get more splicers! €4,998 How much a decent splicer costs **€1130** How much we've raised for the next splicer

2/20 Number of splicers purchased \*2nd splicer successfully purchased! Thank you all. 3 May 2022

https://nogalliance.org/our-task-forces/keep-ukraine-connected/fundraising/

![](_page_18_Picture_16.jpeg)

### Riccardo Stagni | ITNOG6 | 16 September 2022

### Now: 17/40 splicers

- "Amazing support from NAMEX. 22 June 2022"
- A key concern now:
  - Fear that donated equipment will fall into the hands of occupying forces is starting to dissuade donations

### Mail: <u>ukraine@nogalliance.org</u>

![](_page_18_Figure_24.jpeg)

![](_page_18_Picture_25.jpeg)

### The Case of .ua

- Dmitry Kohmanyuk, of Hostmaster.UA, presented at RIPE 84
- 15 February: major DDoS attack on .ua services
- 24 February: military attack on Ukraine
  - Massive undertaking to ensure business continuity for .ua services
  - Support drawn on a huge range of partners, many abroad
    - 6connect, Anycast DNS: CloudNS, CDNS, -Cloudflare, Gransy, Netnod, Packet Clearing House, RcodeZero, CZNIC, many others

An important case study in disaster recovery/management

![](_page_19_Picture_9.jpeg)

Priorities		
1.	PEOPLE	
2.	DATA	
3.	SERVICES	
4.	MONEY	

![](_page_19_Picture_13.jpeg)

# Questions

rstagni@ripe.net

![](_page_20_Picture_2.jpeg)

![](_page_20_Picture_3.jpeg)