



**RIPE NCC**

RIPE NETWORK COORDINATION CENTRE

# The Resilience of the Internet in Ukraine

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IETF113 GAIA WG | 22 March 2022



# Emile Aben & Alex Semenyaka



# More Info: in Original Articles

- **“The Resilience of the Internet in Ukraine” (2022-03-10)**

- <https://labs.ripe.net/author/emileaben/the-resilience-of-the-internet-in-ukraine/>

- **“The Ukrainian Internet” (2022-02-28)**

- <https://labs.ripe.net/author/emileaben/the-ukrainian-internet/>

- **2019, Kiyv: “State of the Internet in Ukraine”**

- [https://www.ripe.net/participate/forms/uploads/fobi\\_plugins/file/ripe-ncc-days-kyiv/2019-09-26%20NCC%20Days,%20State%20of%20Internet\\_v3\\_b0e1fc0b-eed7-417b-813c-0dbc83f3e82c.pdf](https://www.ripe.net/participate/forms/uploads/fobi_plugins/file/ripe-ncc-days-kyiv/2019-09-26%20NCC%20Days,%20State%20of%20Internet_v3_b0e1fc0b-eed7-417b-813c-0dbc83f3e82c.pdf)

- **“You are Not Alone: RIPE Community Resilience” (2021)**

- <https://labs.ripe.net/author/becha/you-are-not-alone-ripe-community-resilience/>

# Elements of Resiliency

- **Human Connections, Dedication, Courage, Perseverance**
- **ISP Decentralisation (absence of market consolidation)**
- **Diverse interconnections (abundance of IXPs)**
- **High independence, at transit networks level, according to IHR**
  - <https://ihr.ijilab.net/ihr/hegemony/countries/UA>
- **Diverse fibre paths, from multiple organisations**
  - <https://blog.telegeography.com/what-to-know-about-fibers-role-in-ukraines-information-war>

# ISP Decentralisation

- **Absence of market concentration at end-user networks level**

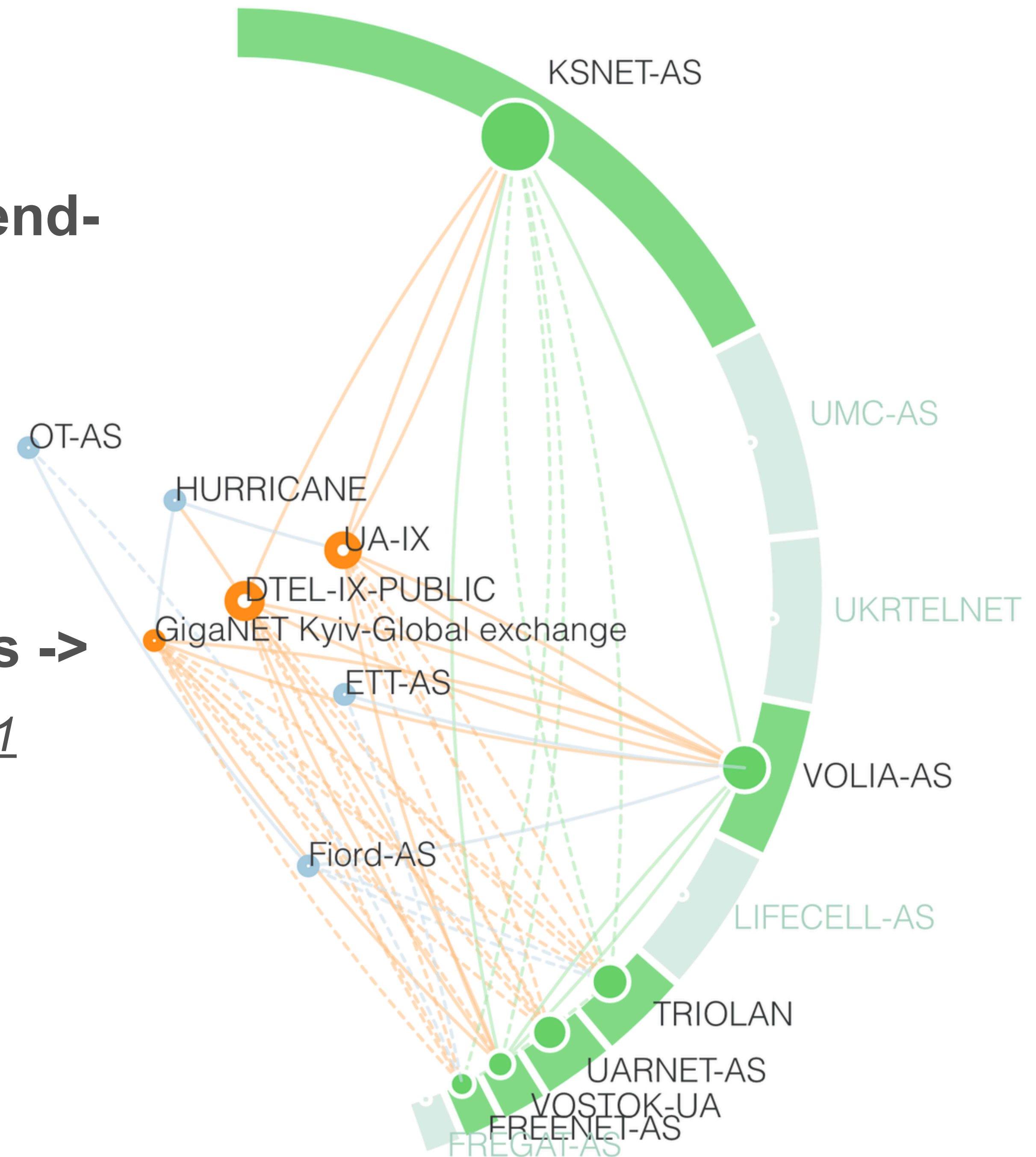
- UA: 4th in the world! HH Index of 0.052
- an economic indicator for market concentration (on the scale 0-1)

- **How Ukrainian end-user networks interconnect, as seen from RIPE Atlas ->**

- <https://jedi.ripe.net/peer-to-peer/ua/2022/03/01>
- <https://atlas.ripe.net>

- **55% ISPs serve <1% of the market!**

- not visualised (left half of the circle)



# IXP Abundance

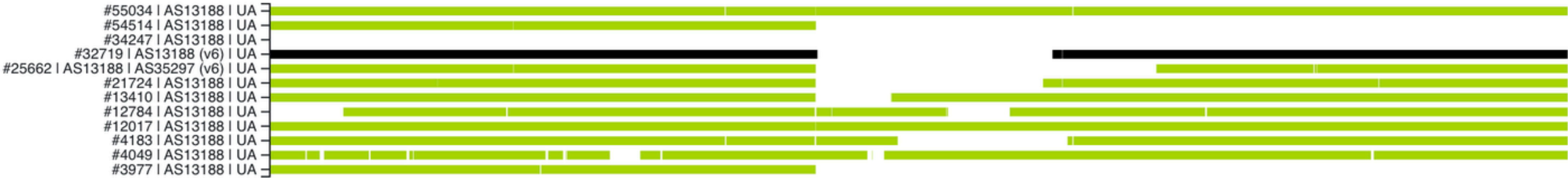
- **19 IXPs!** (Internet eXchange Point)
  - as seen in PeeringDB
- **13 visible by RIPE Atlas**
- **IXP-country-Jedi probes mesh tool**
  - visualising the paths between probes
  - <https://jedi.ripe.net/latest/UA/>
- **Not one single dominant IXP!**



# February Outage



Connected RIPE Atlas probes



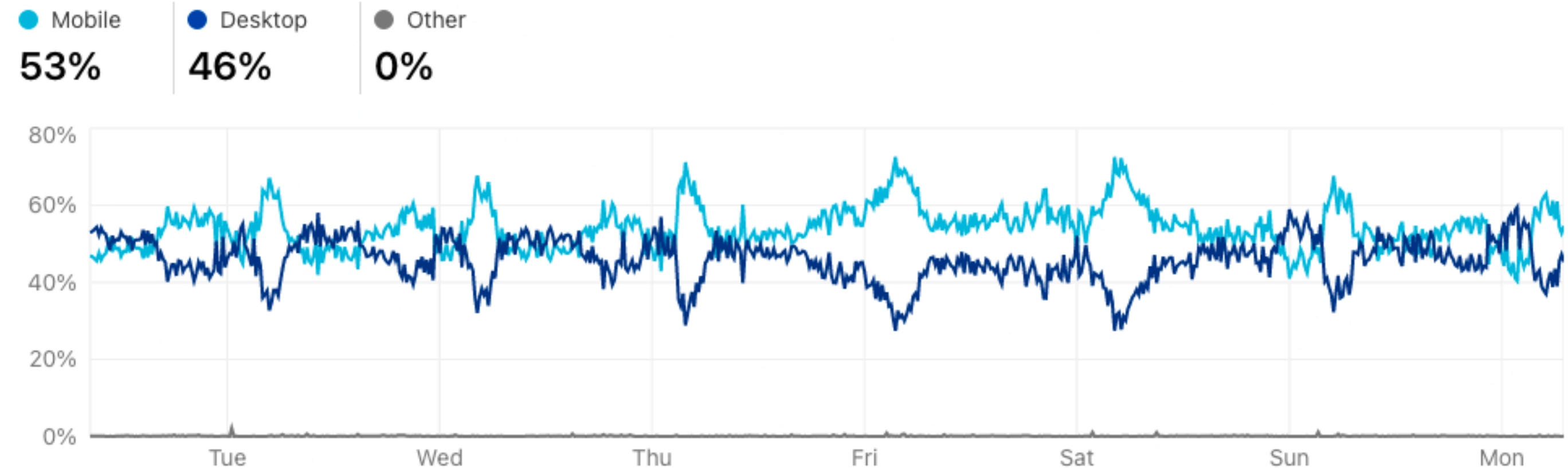
- **The number of RIPE Atlas probes online in Triolan (AS13188). Top graph is the number of connected probes, the lower graph shows for each individual probe when it was online or offline.**
- <https://labs.ripe.net/author/emileaben/the-ukrainian-internet/>



# More Outages

- [ioda.live](#) / [@gatech\\_ioda](#)
- Moved away from fixed, towards mobile connectivity
  - CloudFlare data ->
- Decreasing number of connected RIPE Atlas probes, over time

## Mobile vs. Desktop — Ukraine (Excluding Bots / Last 7 days)

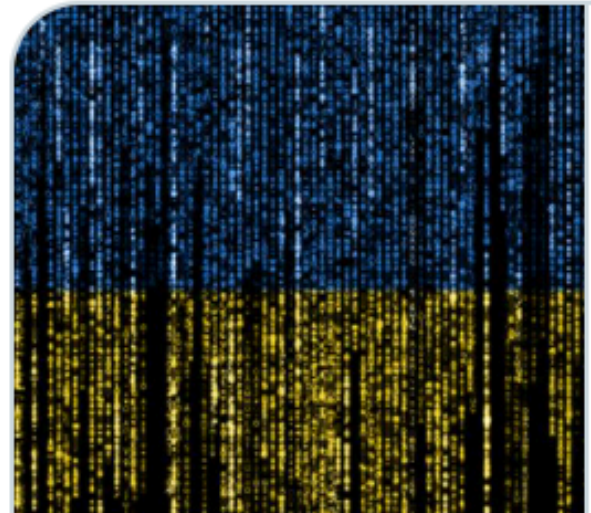


Data shown from Feb 21, 2022 8:30 AM (UTC) to Feb 28, 2022 7:00 AM (UTC)  
Source: <https://radar.cloudflare.com>



 **Julian Oliver**  
@julianOliver

Very interesting piece on how factors like lack of market concentration, large number of exchanges (IXPs), diverse underground cable/fibre paths, and the raw determination of operators has helped keep the Ukranian Internet up



labs.ripe.net

The Resilience of the Internet in Ukraine

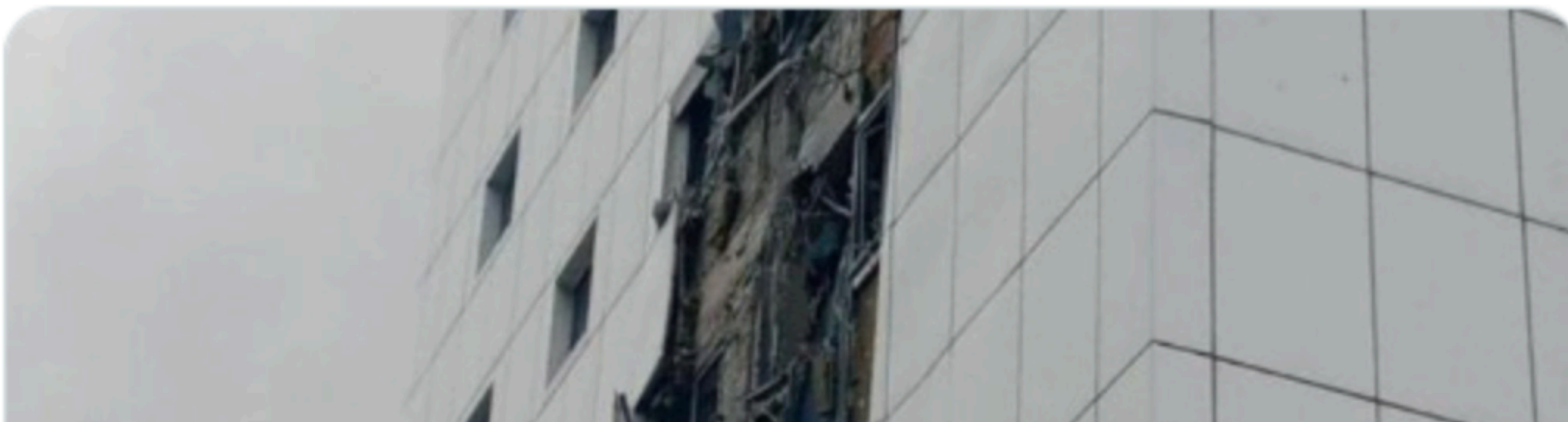
We look at the structure of the Internet in Ukraine and how it may be helping the country stay connected.



**Thomas Brewster** ✓ @iblametom · Mar 15

NEW - They're fixing internet in bombed out buildings, finding rogue operators providing Russians with mobile connections and thwarting hackers...

The telecom companies of Ukraine and their employees are being hailed as heroes in the war with Russia.



 **SSSCIP Ukraine** ✓  
@dsszzi

The [#War](#) unites [#Ukrainian](#) competitors

Thus, two small local providers [Gigabit.net](#) and [brd.net.ua](#) restored the main cable (was damaged by the occupiers), so [#Chernihiv](#) oblast is connected again!

More: [bit.ly/3MYTdTO](https://bit.ly/3MYTdTO)

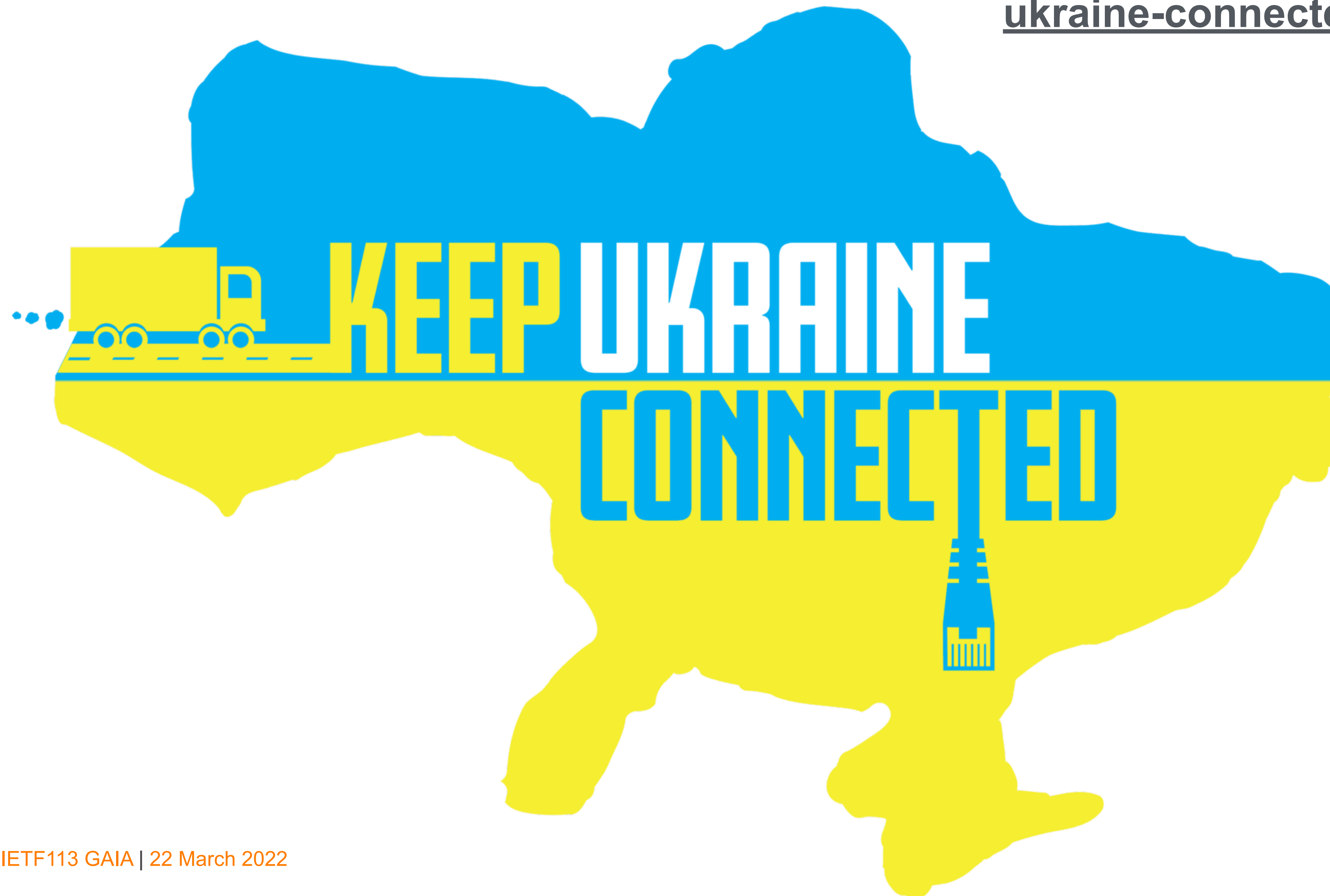
[#WARINUKRAINE](#) [#StopRussia](#)



6:32 PM · Mar 16, 2022 · Twitter for iPhone

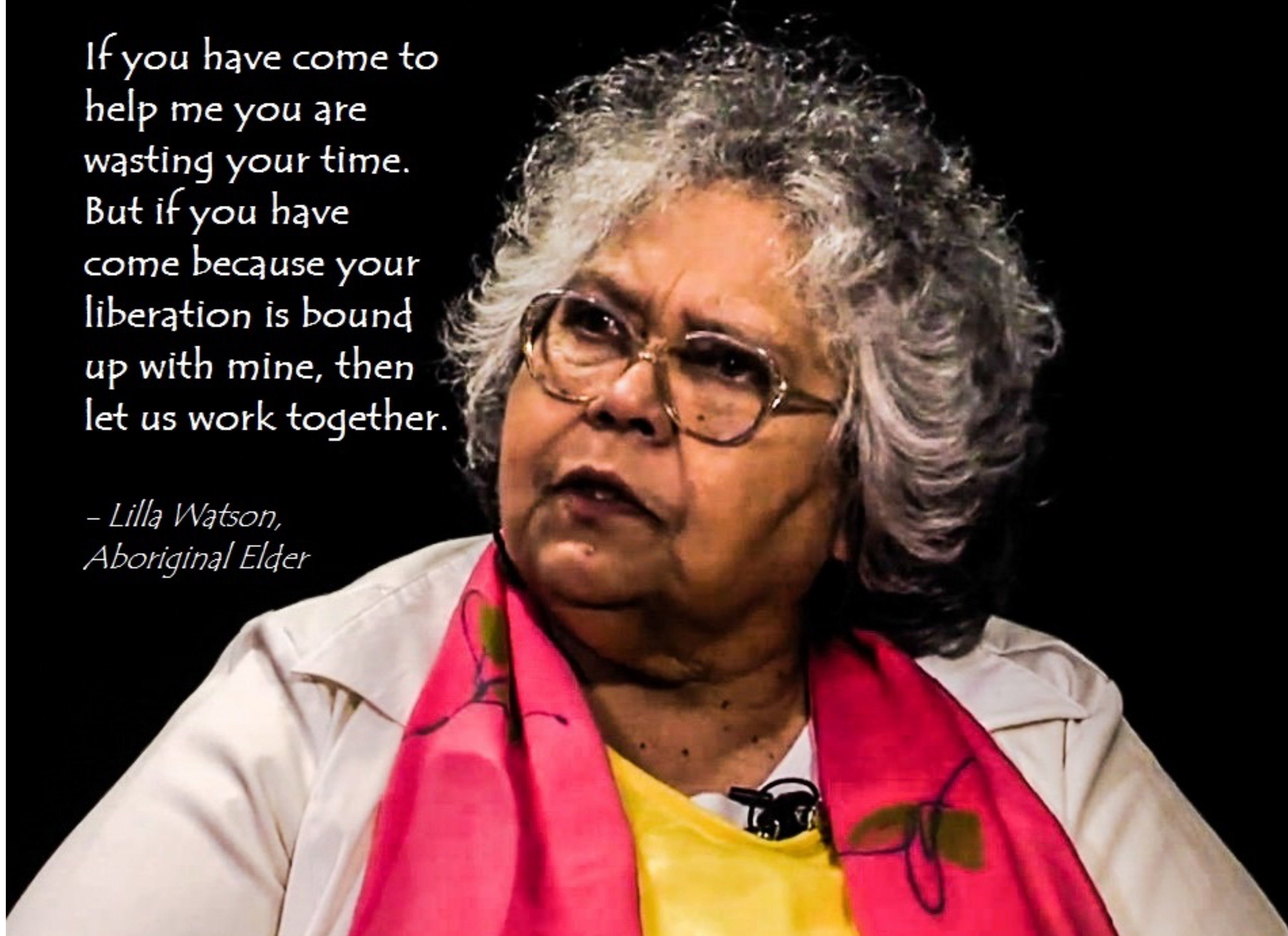
# NOGs for Networkers

[https://nogalliance.org/  
our-task-forces/keep-  
ukraine-connected/](https://nogalliance.org/our-task-forces/keep-ukraine-connected/)



If you have come to  
help me you are  
wasting your time.  
But if you have  
come because your  
liberation is bound  
up with mine, then  
let us work together.

*– Lilla Watson,  
Aboriginal Elder*





# Questions



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# More Measurements

- [https://labs.ripe.net/author/stephane\\_bortzmeyer/internet-network-shutdowns-in-russia/](https://labs.ripe.net/author/stephane_bortzmeyer/internet-network-shutdowns-in-russia/)
- <https://blog.mozilla.org/data/2022/03/09/mozilla-opens-access-to-dataset-on-network-outages>
- <https://ooni.org/post/2022-russia-blocks-amid-ru-ua-conflict/>

# More Articles

- <https://www.forbes.com/sites/thomasbrewster/2022/03/15/internet-technicians-are-the-hidden-heroes-of-the-russia-ukraine-war/?sh=1a709c9c2884>
- <https://9to5mac.com/2022/03/16/ukraine-mobile-carriers-work-together/>
- <https://www.platformer.news/p/the-internet-is-a-force-multiplier>
- <https://techcrunch.com/2022/02/28/ukrainians-turn-to-encrypted-messengers-offline-maps-and-twitter-amid-russian-invasion/>
- <https://labs.ripe.net/author/waehlich/secure-personal-communication-in-the-event-of-crisis/>