RIPE NCC
RIPE NETWORK COORDINATION CENTRE

Resilience Under Pressure

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

Chris Buckridge | 29 June 2022 | ENISA Telecom Security Forum

RIPE & RIPE NCC

- **RIPE NCC** is a Dutch membership association with around 20k members

  - Serves as 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 the open community of people with an interest in IP networks in this region

  - A venue for for making policy, sharing information and best practices, coordinating on technical issues

  - Two RIPE Meetings each year; RIPE 84 took place in Berlin, 14-18 May 2022

  - 12 currently active working groups, mailing lists

What We See From RIPE NCC

ISP Decentralisation

- Absence of market concentration at end-user networks level

  - UA: 4th in the world!

  - HH 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*
  - *https://atlas.ripe.net*

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

 - Not visualised (the left half of the circle)
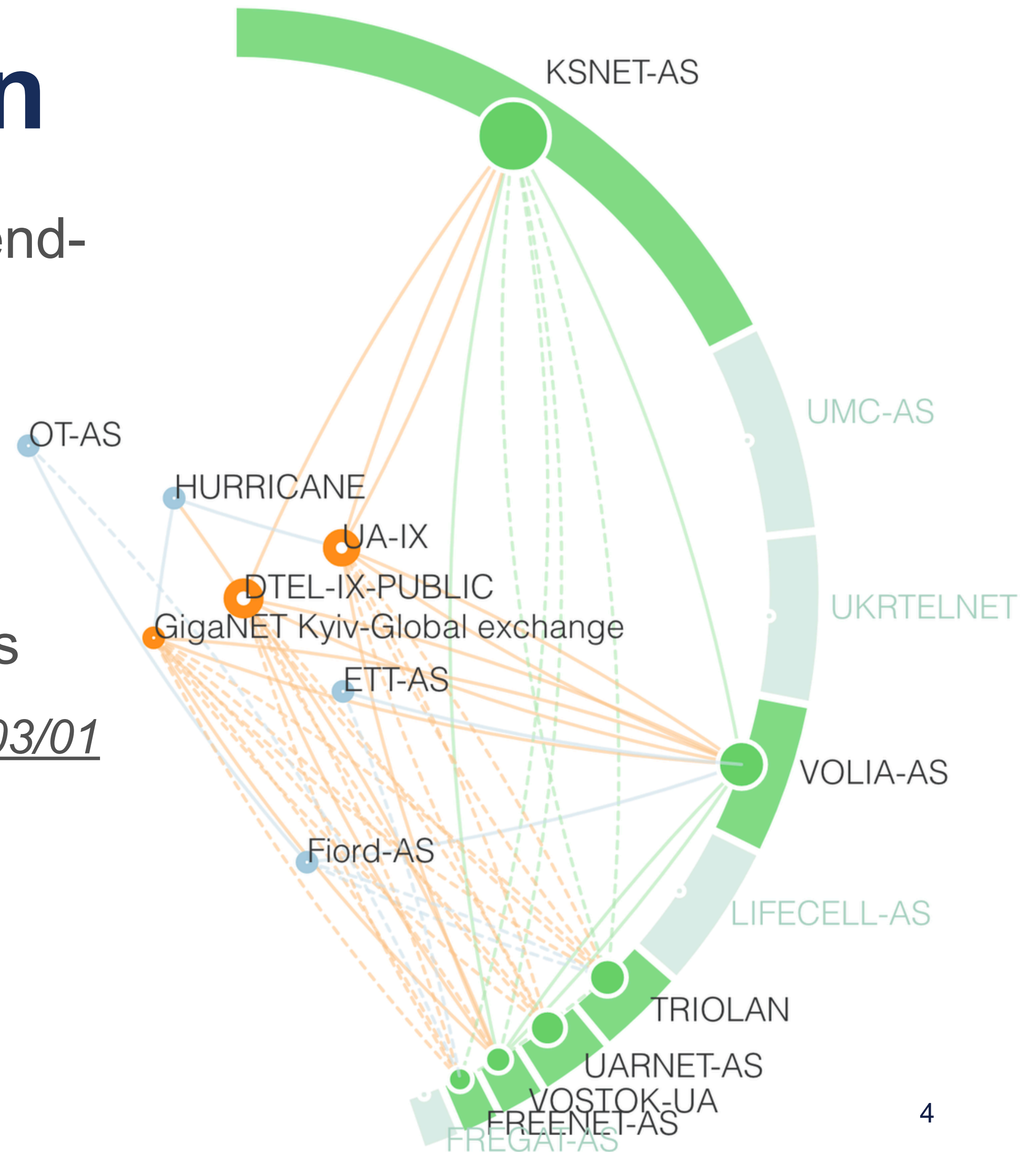
IXP Abundance

- 19 IXPs!
  - (Internet eXchange Points)
  - 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/

- No single dominant IXP!

Legend:
- kremen-IX
- UA-IX
- LVIV-IX-Main
- KM-IX-Main
- IF-IX-Ivano-frankivsk local exchange
- GigaNET Odessa-Odessa local exchange
- GigaNET Kyiv-Global exchange
- GigaNET Kharkov-Kharkov local exchange
- DTEL-IX-PUBLIC
- DN-IX
- Crimea-IX
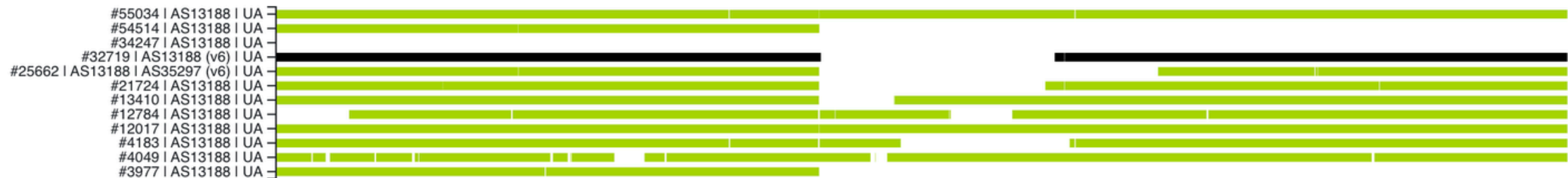- CLOUD-IX KIEV
- 1-IX Internet Exchange

Destination (North to South)
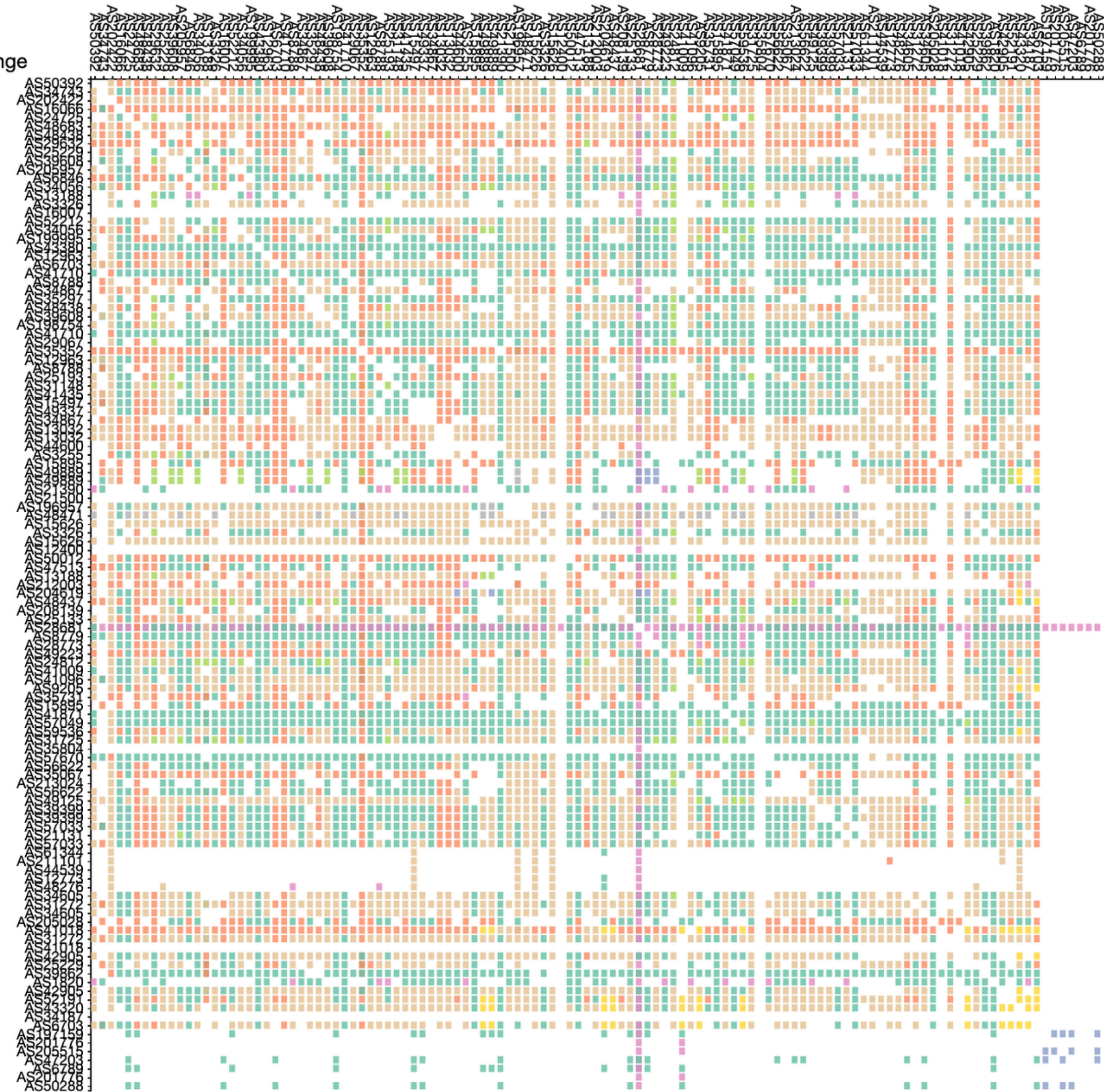
One View: Initial Outage in February

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.

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."*

- …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.) https://atlas.ripe.net

    - RIPE RIS: control plane (BGP) https://www.ripe.net/ris
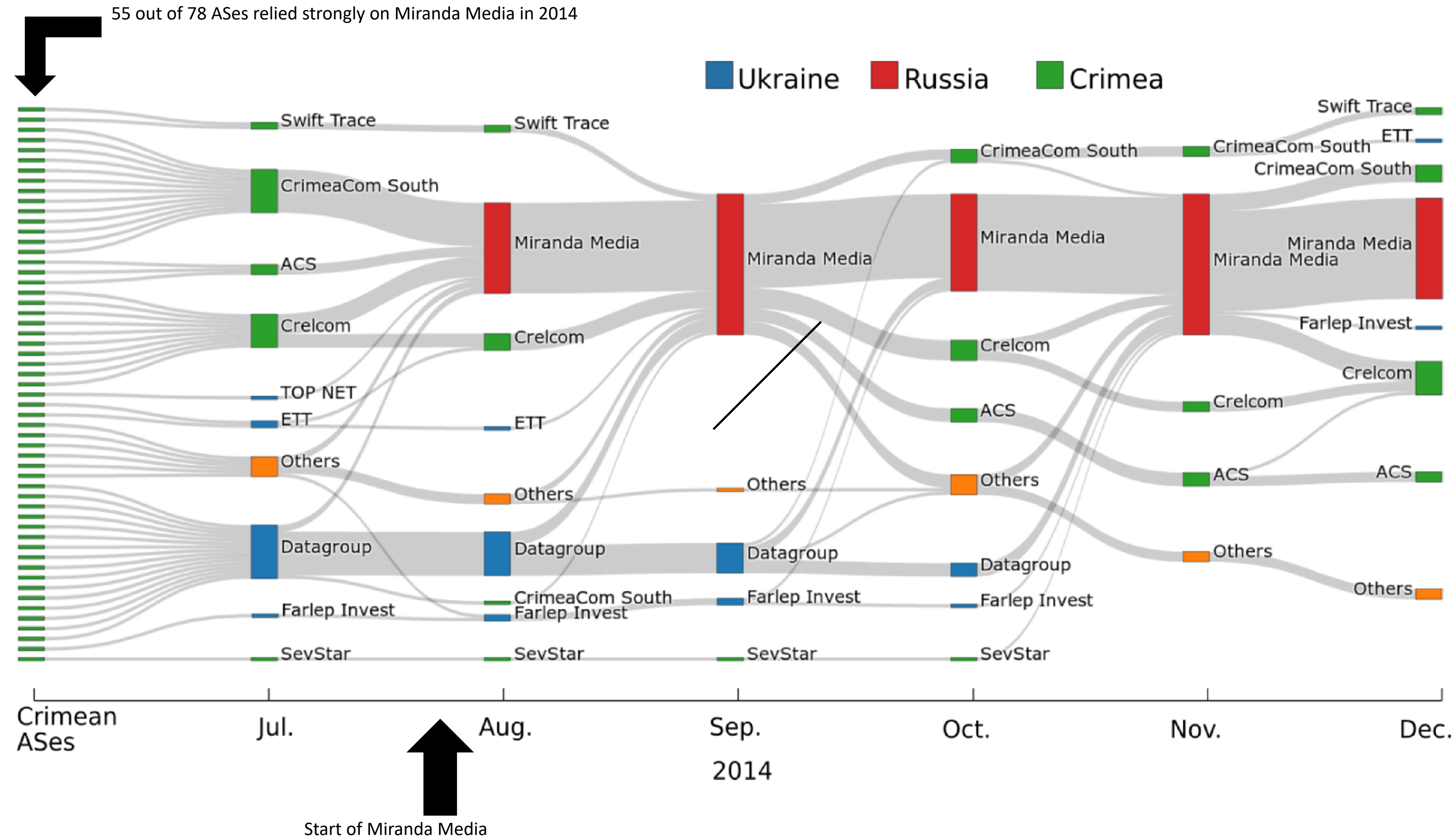
Adding Further Resilience

- Concerns about BGP/routing attacks

  - Aftab Siddiqui on the MANRS blog looked into the possibility of a deliberate attack on 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-can-networks-protect-themselves/

- On 6 April, responding to feedback from operators in Ukraine, RIPE NCC hosted an online BGP security training

  - https://labs.ripe.net/author/alex-semenyaka/rpki-training-for-ukrainian-network-operators/
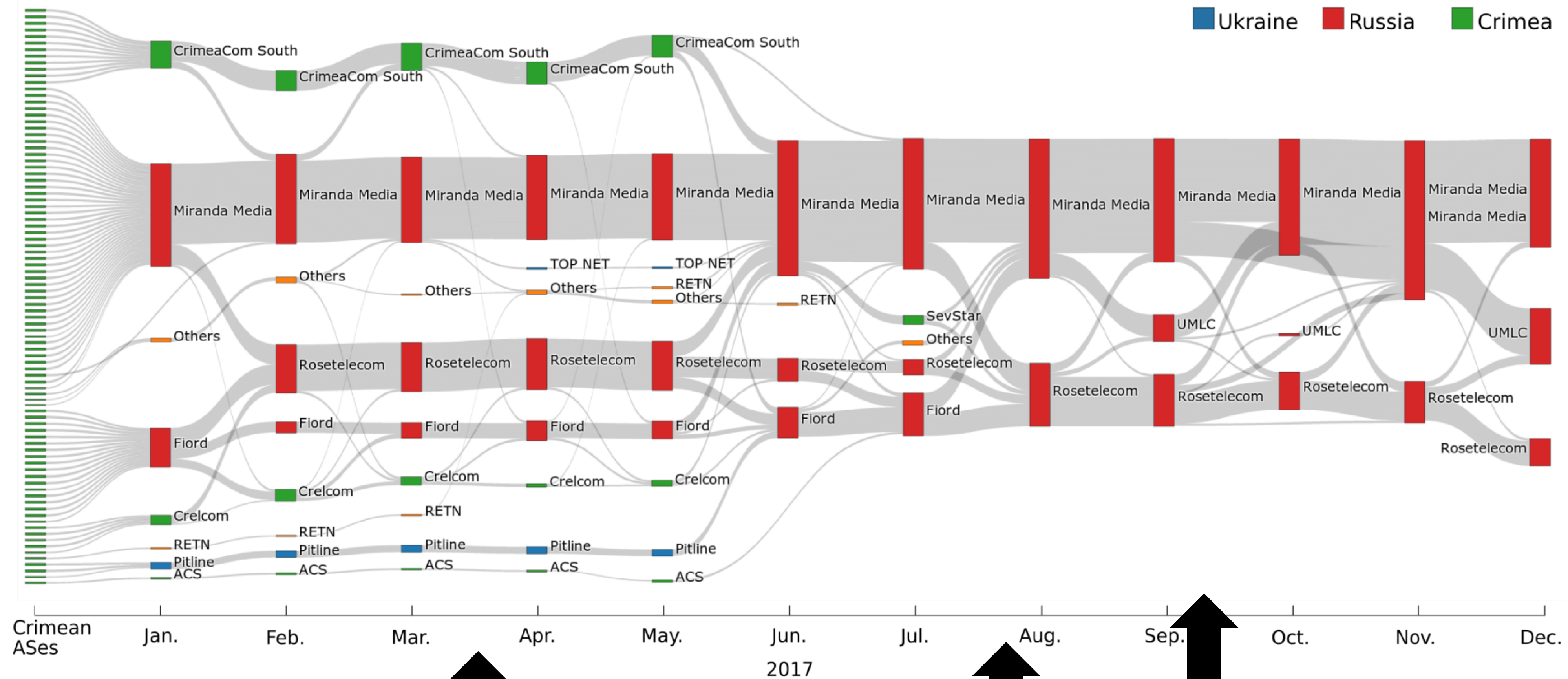
Internet in Occupied Territories

Crimea 2014: From this...

55 out of 78 ASes relied strongly on Miranda Media in 2014

Start of Miranda Media

Legend: Ukraine (blue) | Russia (red) | Crimea (green)

...to this (2017)

Legend: Ukraine (blue), Russia (red), Crimea (green)

Timeline (2017): Jan., Feb., Mar., Apr., May., Jun., Jul., Aug., Sep., Oct., Nov., Dec.

Crimean ASes

Nodes: CrimeaCom South, Miranda Media, Others, TOP NET, RETN, SevStar, Rosetelecom, Fiord, Crelcom, Pitline, ACS, UMLC

Major ISPs still rely on Ukrainian ISPs

Most paths go via Miranda Media/Rostelecom

UMLC/Fiord provides connectivity to Crimea

Current Observations

- ## As of May 2022:

  - RIPE NCC measurements see some routes from Kherson networks changing to route via Russian networks (Miranda Media/Rostelecom or UMLC/Fiord)

- ## In the month leading to 16 June 2022:

  - 30 Ukrainian IP address prefixes originated by 12 ASNs shifted to a strong dependency on Miranda Media (AS201776)

  - *"AS201776 is observed in the AS paths for each prefix by a large majority, if not all of the full feed, default free, peers."*

  - All but one of these ASNs is registered with an physical address in newly occupied territory

RIPE Community Perspectives

Supporting the UA community

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

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.

Keep Ukraine Connected (2)

PLANS

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

An Important Takeaway

The current needs of ISP providers

1. **Optical splicers**

- For trunk optical lines

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

Current quantity needed 20 pcs

- For subscribers, FTTH, last mile networks

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

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/

- A key concern now:

  - Fear that donated equipment will fall into the hands of occupying forces is starting to dissuade donations

Mail ukraine@nogalliance.org

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

Priorities

1. PEOPLE

2. DATA

3. SERVICES

4. MONEY

Additional Reading

- "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 RIPE NCC event in Kyiv: "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

RIPE 84 Presentations

- **Resiliency of the Internet in Ukraine, Emile Aben**

  - PDF: https://ripe84.ripe.net/presentations/23-ukraine-internet.emileaben.ripe84.pdf

  - Video: https://ripe84.ripe.net/archives/video/738/

- **Global NOG Alliance: Taskforce to Keep Ukraine Connected, René Fichtmüller**

  - PDF: https://ripe84.ripe.net/presentations/12-KUC_Presi_final.pdf

  - Video: https://ripe84.ripe.net/archives/video/739/

  - Short YouTube video about KUC: https://youtu.be/GktlErJpn3I

- **Domain Defense in Depth, Dmitry Kohmanyuk,**

  - PDF: https://ripe84.ripe.net/presentations/39-UA-CCTLD-INFRA-RESILIENCY.pdf

  - Video: https://ripe84.ripe.net/archives/video/753/

- **RIPE NCC Update, Hans Petter Holen**

  - PDF: https://ripe84.ripe.net/presentations/97-RIPE-NCC-Update.pdf

  - Video: https://ripe84.ripe.net/archives/video/808/

Questions

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