

# Impact of geopolitical changes in the Internet

## The case of Crimea

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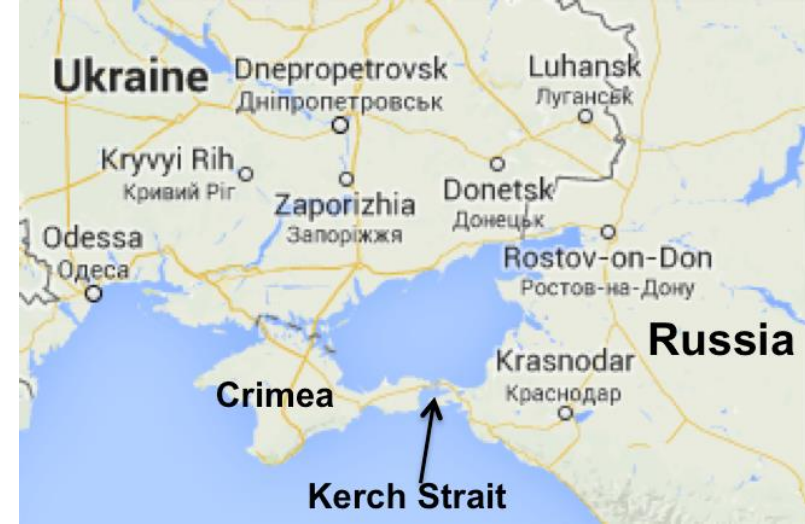
# Introduction

- Crimea used to be administrated by Ukraine
- From March 2014 it is administrated by Russia
- Goal: How this change impacts Internet connectivity?
- Approach:
  - Sociological fieldwork: 45 interviews with local ISPs, journalists, etc..
  - Internet measurements: analysis of BGP data



# Internet in Crimea (2014-2015)

- 2014 March: Referendum
- 2014 April: Completion of submarine link from Russia to Crimea (Kerch Strait cable)
- **2014 July:** Start of cable operation by **Miranda Media** (Rostelcom's local agent)
- 2014 December: Most Ukrainian ISPs left Crimea
- 2015: Price for Internet raised



# Internet in Crimea (2016-2017)

- 2016 May: Russia started the construction of a second Internet cable (in service from July)
- 2017 May: Ukrainian president orders to block access to popular Russian platforms
- 2017 May: Crimean users complain about Ukrainian blockpages when accessing these websites
- **2017 July: Ukraine stop providing Internet connectivity**

# Internet measurements

- **Finding Crimean ASes**

- Who is operating in Crimea?

- **Network dependencies**

- Who provides connectivity to Crimean networks?
  - How does it change over time?
  - How does it correlate with our timeline?



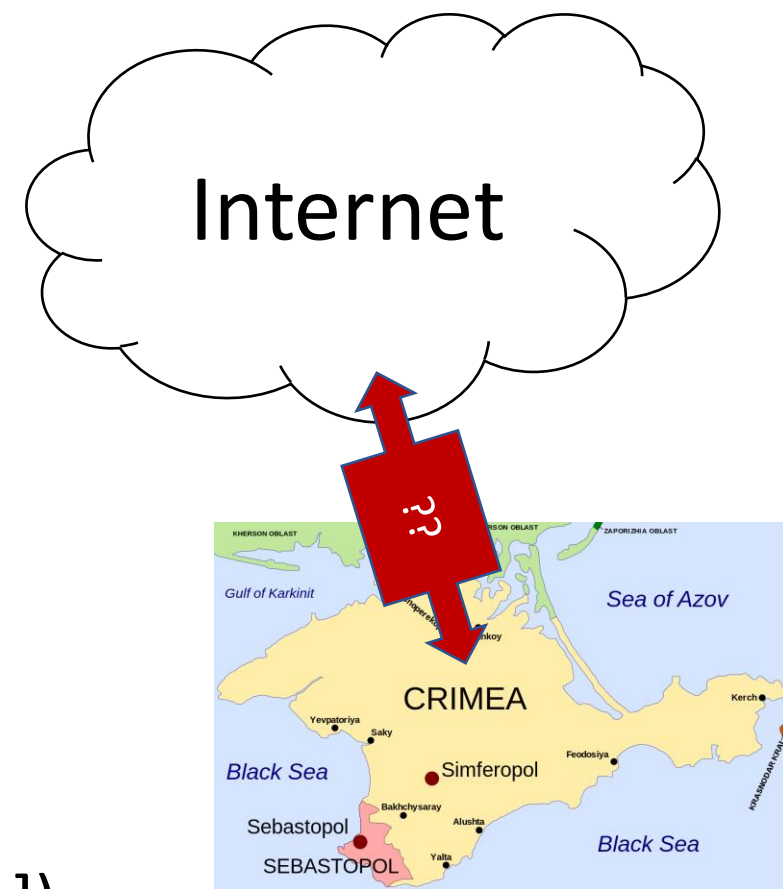


# Locating ASes

- Geolocation of IP space is hard (even more for disputed area)
- A lot of different manual inspections:
  - RIPE Atlas / OONI probes
  - Manually checked upstream networks
  - IXP information (Crimea IX)
  - Manual validation with whois/forums/interviews
  - BGP data: downstream of Miranda-Media
- **Found 111 ASNs** that were active between 2012-2019

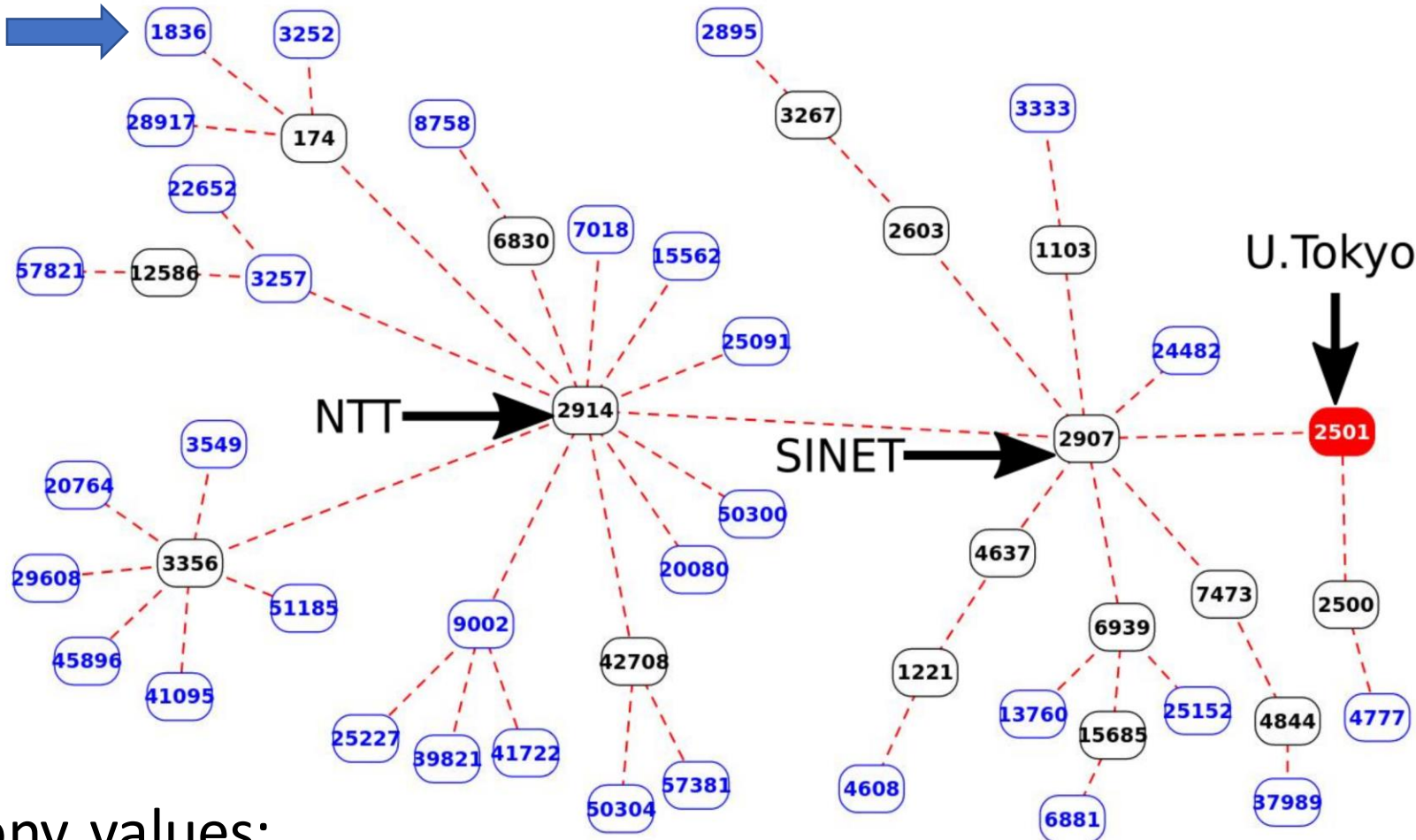
# Network dependency

- What are the main transit networks for Crimea?
- **AS Hegemony** [PAM18]
  - Take AS paths from BGP data
  - Make graph with all paths to a selected AS
  - Compute node centrality (values range in  $[0,1]$ )
  - Account for sampling bias
  - Weight paths by prefix size



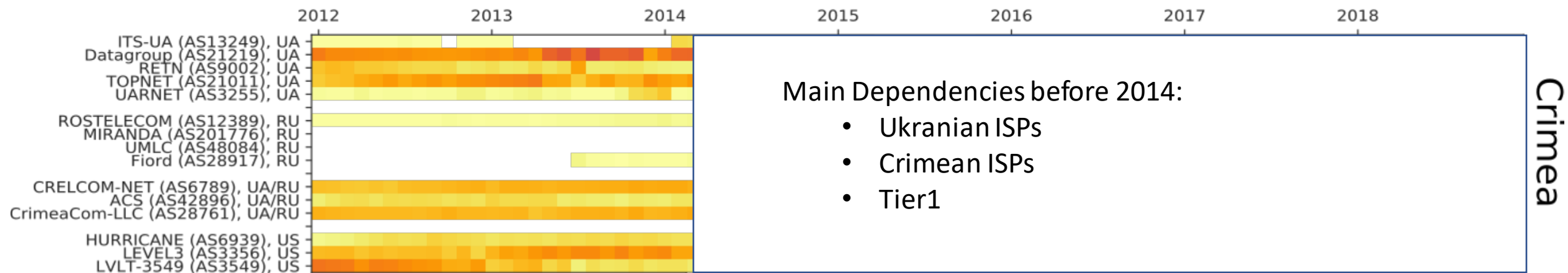
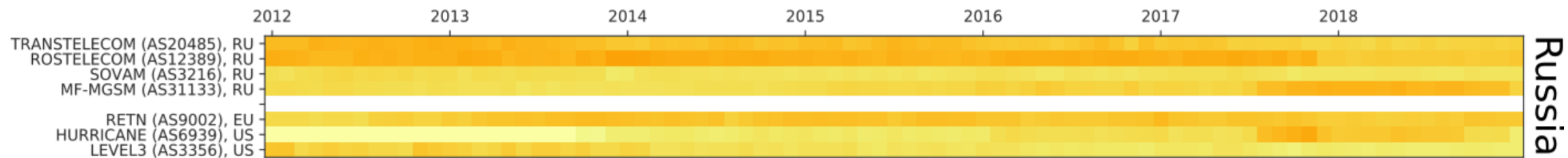
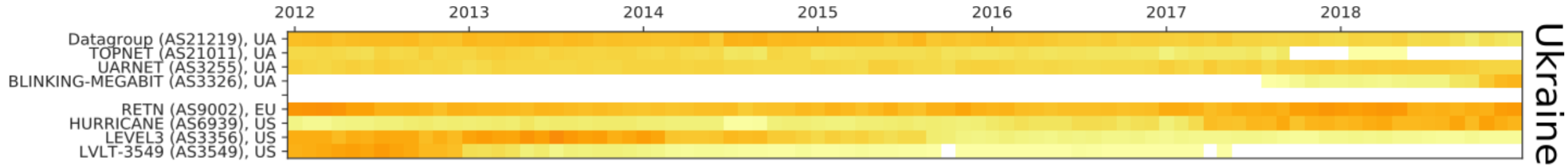
# Example: U. Tokyo dependencies

blue nodes are  
vantage points



- AS Hegemony values:
  - SINET= 1.0
  - NTT = 0.8





Referendum

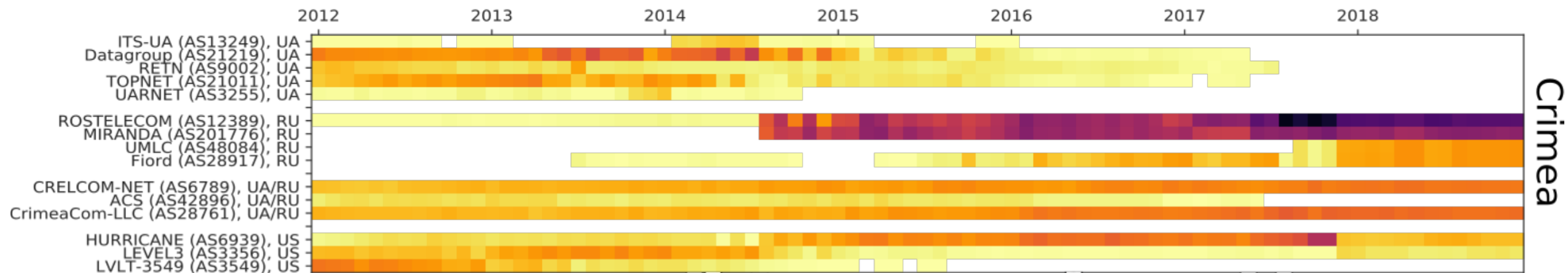
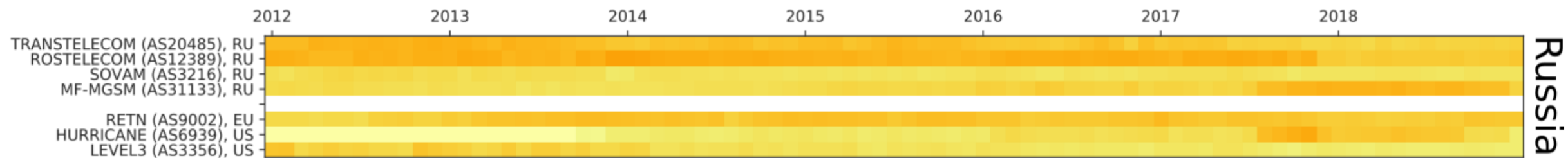
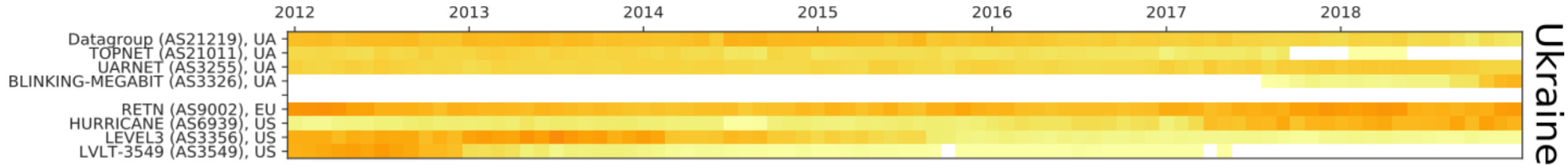
Kerch Strait Cable  
completed

Miranda Media  
activated

Russia starts construction  
of second cable

Ukraine bans  
Russian websites

Ukraine stops providing  
Internet to Crimea



Referendum  
Kerch Strait Cable completed  
Miranda Media activated  
Russia starts construction of second cable  
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Ukraine stops providing Internet to Crimea

# Discussions



- Significant changes to Crimea's Internet connectivity
- **Long transition** (3+ years)
- Good match with compiled timeline
- Now all paths are going through Miranda Media/Rostelecom or UMLC/Fiord
- **Topological chokepoint** reflecting geo-politic in the region

# Community contributions

- Data: AS Hegemony values available on Internet Health Report
  - REST API: <https://ihr.iijlab.net/ihr/en-us/api>
  - Python library: <https://pypi.org/project/abondance/>
- Tool: Country AS Hegemony
  - <https://github.com/InternetHealthReport/country-as-hegemony>
  - Fetch AS Hegemony values per country
  - Merge values weighted by IP space or eyeballs



# https://ihr.iijlab.net/

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## Russian Federation

3-day report ending on October 13, 2021 📅



### Network Dependency

BGP Data / APNIC Population Estimates



#### SUMMARY

#### API

Autonomous System		Population coverage ?			AS coverage ?
	🔍 Search	Total ↓	Direct	Indirect	Total
AS12389	ROSTELECOM-AS PJSC Rostelecom, RU	27.3%	16.4%	10.0%	17.9%
AS3356	LEVEL3 - Level 3 Parent, LLC, US	19.4%	0.0%	19.4%	10.6%
AS8359	MTS MTS PJSC, RU	17.3%	9.1%	7.7%	7.9%
AS31133	MF-MGSM-AS PJSC MegaFon, RU	15.0%	2.9%	12.0%	11.3%
AS3216	SOVAM-AS PJSC "Vimpelcom", RU	10.9%	1.1%	9.7%	12.5%
AS1299	TELIANET Telia Company AB, EU	9.8%	0.0%	9.8%	8.8%
AS16345	BEE-AS Public Joint Stock Company "Vimpel-Communications", RU	7.7%	7.3%	0.0%	0.0%
AS9049	ERTH-TRANSIT-AS JSC "ER-Telecom Holding", RU	6.9%	0.0%	6.9%	4.5%

# Summary

- Investigated Crimea's topological changes during interregnum
- Cross referenced BGP measurements and survey data
- Significant changes to Crimea's Internet connectivity
- Long transition (3+ years)
- Data and tool available:
  - <https://ihr.iijlab.net/>
  - <https://github.com/InternetHealthReport/country-as-hegemony>
- **Paper: The Internet in Crimea: a Case Study on Routing Interregnum**, Global Internet Symposium 2020

# Backup

# Sociological fieldwork



- 45 semi-structured interviews of 1 to 2 hours with:
  - ISPs from Crimea and Ukraine
  - journalists and human rights defenders
  - members of the Ministry of Communications of Ukraine
  - digital security trainers
- Focusing on infrastructure transitions between March 2014 and July 2017

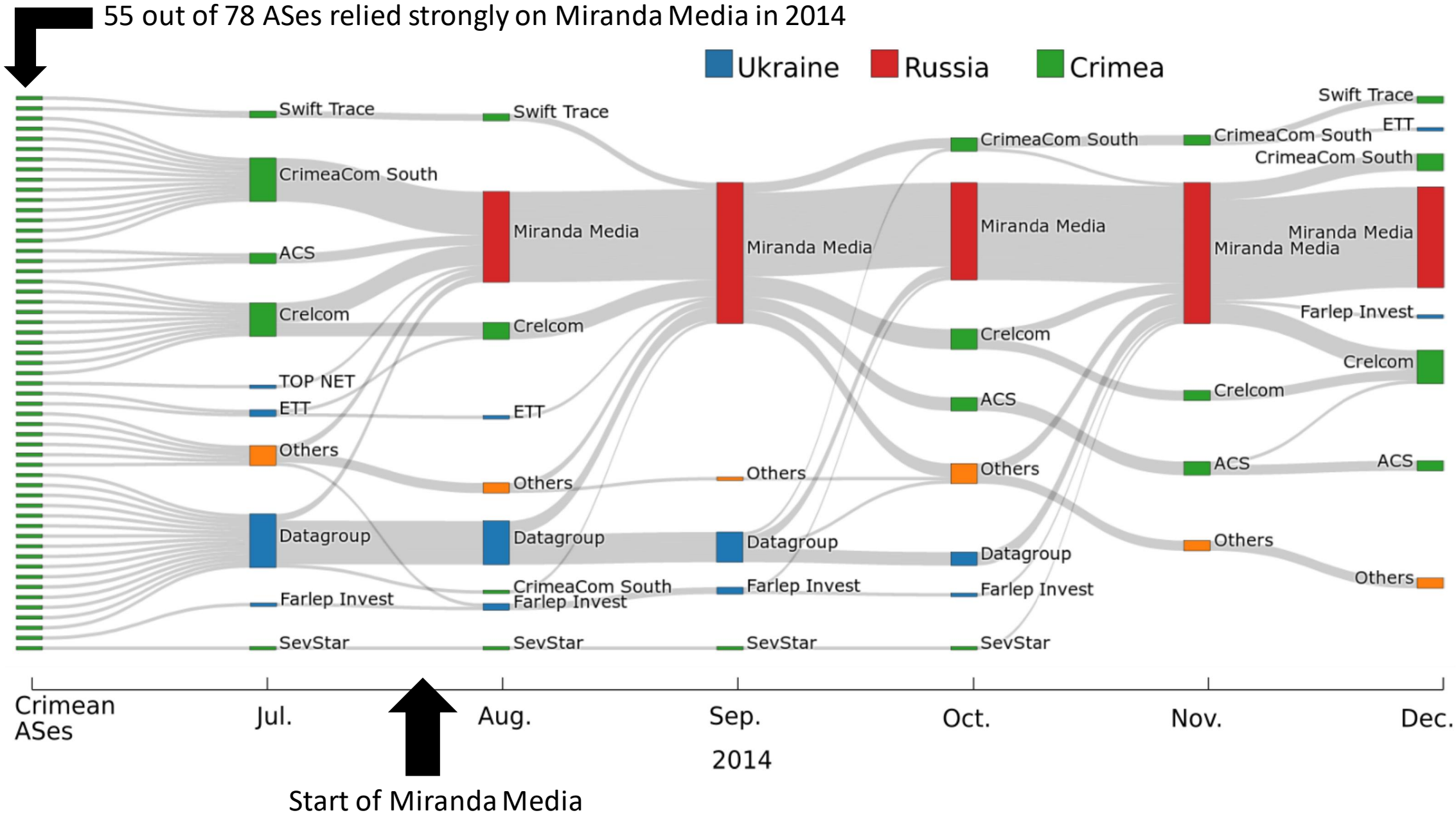


# Network dependency of multiple ASes

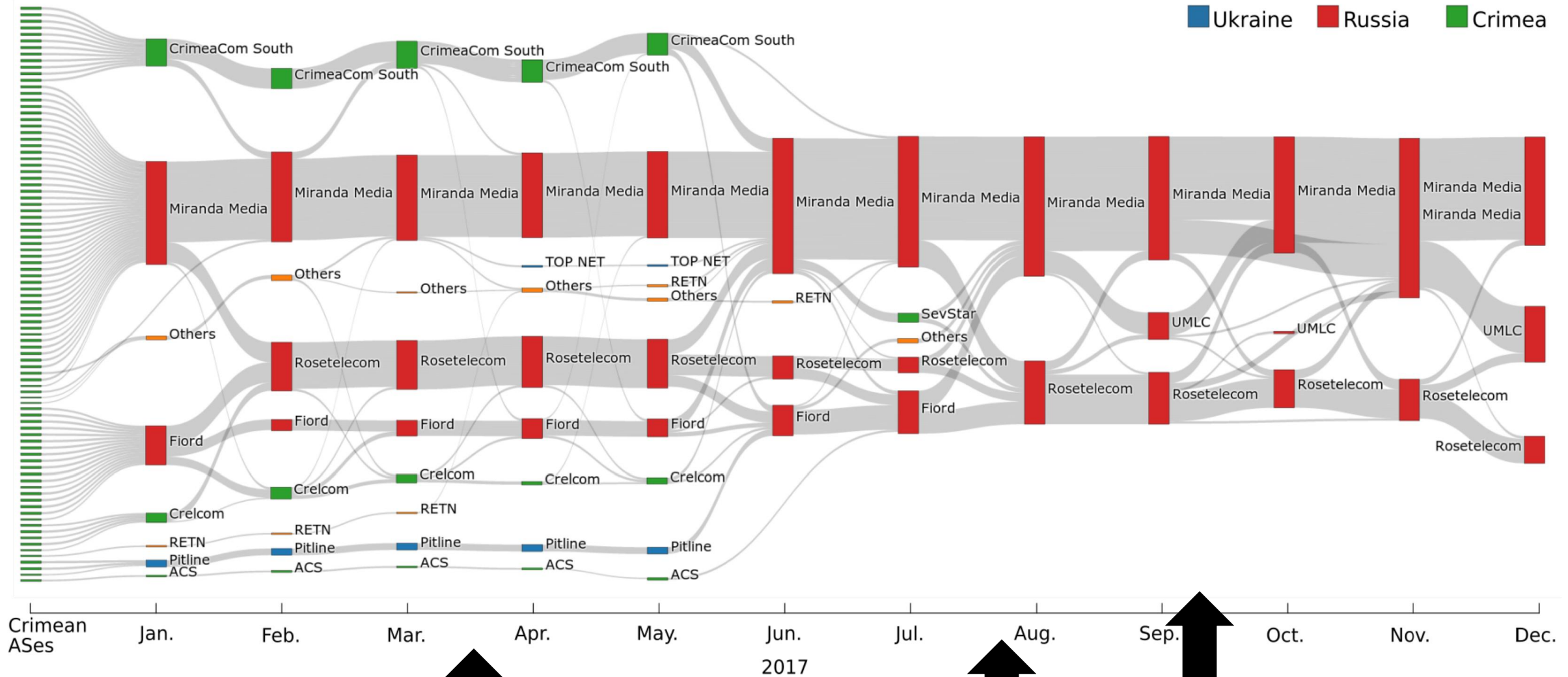
- Compute AS Hegemony for each AS (weight by IP space)
- Mean AS Hegemony across all ASes (weight by AS)
- Obtain typical network dependency for selected ASes
- Pros/Cons:
  - + Recycle AS Hegemony results from PAM18
  - + Small ASes are equally important
  - Not accounting for AS sizes

# Adoption of Miranda Media

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



# End of transition



Major ISPs still rely on Ukrainian ISPs

Most paths go via  
Miranda Media/Rostelecom

UMLC/Fiord provides  
connectivity to Crimea

# Examples

- Iranian networks depend on 3 ASes from the state-owned ISP (TCI)
- Second upstream for North Korea

