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The IXP landscape in the SEE region

And Romania's Role as a Regional Interconnection Hub

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Report Introduction

- **Purpose:**
  - Assess the evolution and state of the IXP ecosystem in the SEE region to identify trends, challenges, and opportunities
- **Goals:**
  - Identify areas of growth or stagnation
  - Highlight internal and external challenges
  - Propose actionable recommendations, address identified challenges and leverage opportunities

Region is not Homogeneous

- Regulatory disparities (EU and non-EU)
- Regional hub influence (north and south)
- Geographic location (landlocked and coastal)
- Intra-region connectivity (Ex-YU and rest)

Initial Findings

IXP Landscape

Data source: PeeringDB

Romanian IXP Landscape

Name	City	Networks
InterLAN-IX	Bucharest, Arad, Cluj-Napoca, Constanta, Craiova, Iasi, Suceava, Targu Secuiesc, Timișoara	119
RoNIX	Bucharest	32
Balcan-IX	Bucharest	30
ROPN-IX	Bucharest	27
LNK-IX	Targoviste	0
RO-IX	Bucharest	2
RO-CIX	Braila	5
DSIX	Bucharest	4
DoljNET IX	Craiova	0
EE-IX	Timișoara, Bucharest	3?

Source: PeeringDB, Euro-IX, bgp.he.net

IXP Governance

- **Diverse Governance Models:**
  - NREN-operated, ISP association, commercial, led by the regulator
  - Large number of IXPs run by NRENs
  - Different levels of membership involvement
- **Impact on Growth:**
  - Governance and business models influence access to funding for critical equipment upgrades
  - Affects the ability to attract new members and shape growth strategy
  - Lack of focused personnel inhibiting growth potential

Market Dynamics

- **Incumbents' role:**
  - Incumbent ISPs often hold significant influence over local IXPs
  - Not all ISPs engage in open peering at the local IXP, limiting traffic exchange opportunities
- **Market Concentration:**
  - IXPs are typically more useful for small and medium sized ISPs
  - Larger ISPs may prefer private peering or rely on international hubs
- **Regional Investment Challenges:**
  - The lack of a sustainable cross-border market makes it harder to draw in major players or to secure large-scale infrastructure investment (E-commerce, Media, Finance, Content)

Proximity to Major Data Hubs

- **Pros:**
  - Good access to a larger digital ecosystem
  - Low(-ish) latency
  - Low cost transit (for some countries)
- **Cons:**
  - Dependency on foreign hubs
  - Underdevelopment of local IXPs and peering
  - Export of capital from domestic economy
  - Lack of localisation

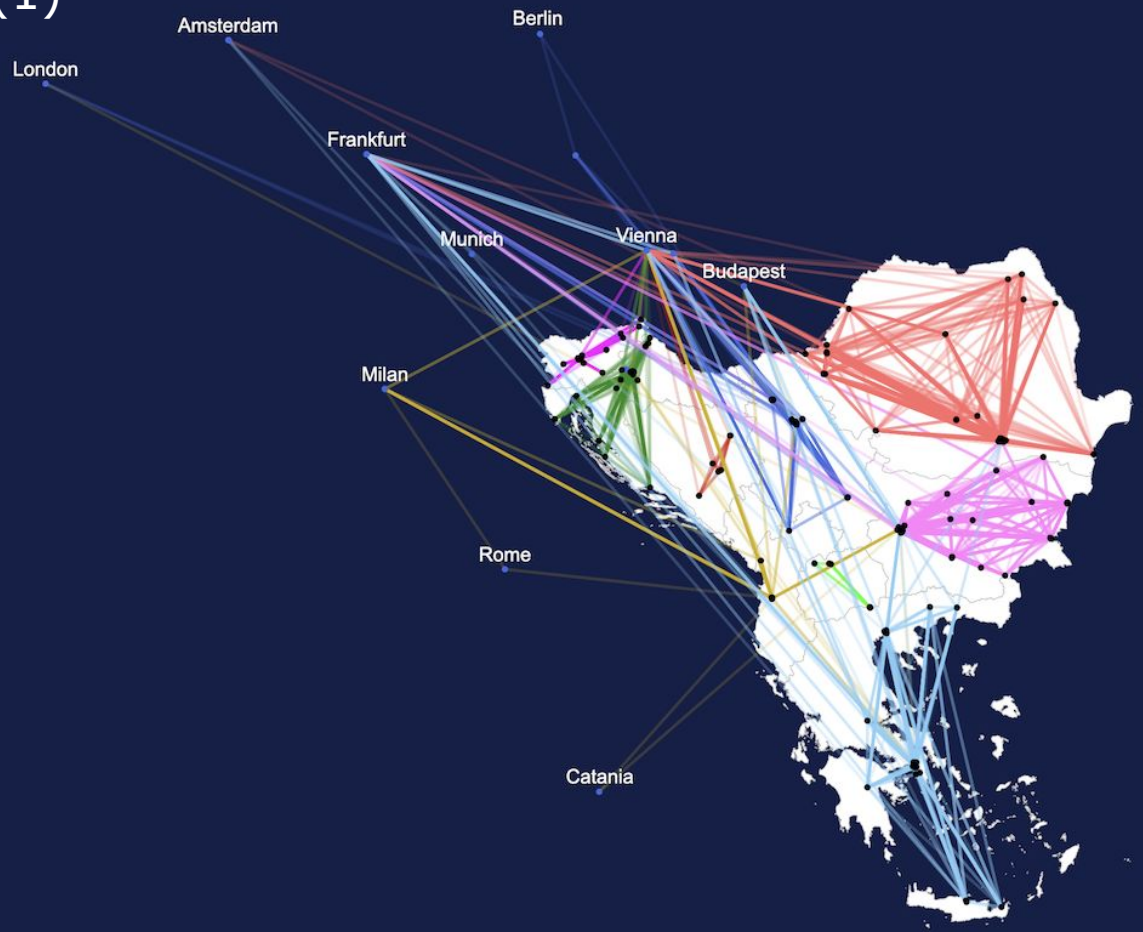
Criteria for Success

The Four Criteria for Success

1. Keeping local traffic local
2. Facilitating inter-region traffic
3. Attracting global hyperscalers and content providers
4. Supporting economy digitisation

In-Country Connections (1)

Country	Total number of paths	Out-of-country number of paths	Out-of-country paths %
AL	72	19	26.39%
BA	28	3	10.71%
RS	455	31	6.81%
GR	754	27	3.58%
RO	1544	29	1.88%
SI	418	6	1.44%
HR	592	6	1.01%
BG	2031	15	0.74%
MK	25	0	0.00%



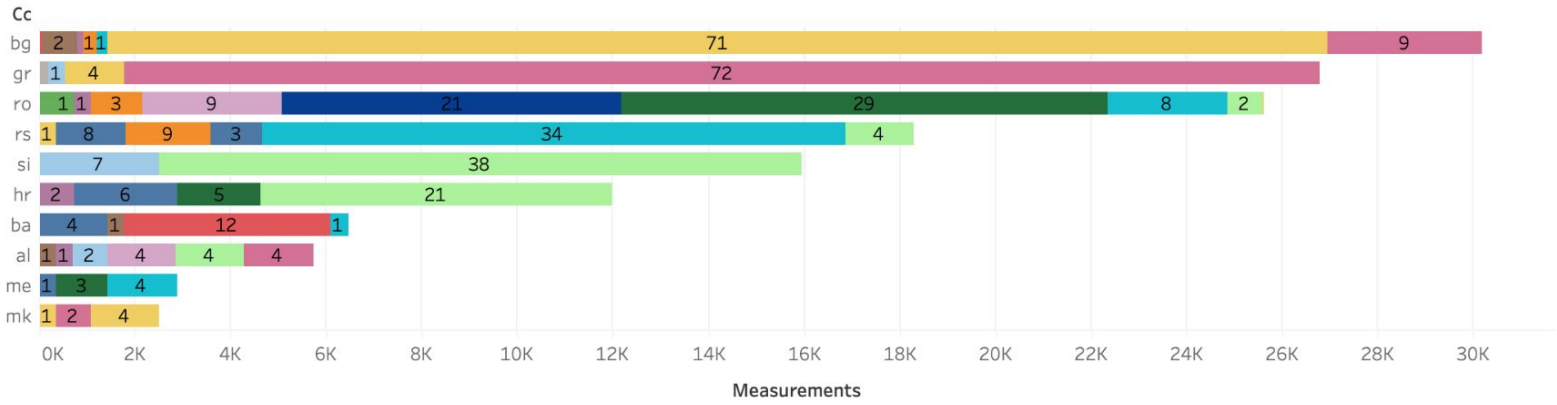
Data source: RIPE Atlas

In-Country Connections 1

In-Country Connections 2

DNS Hits on k-root Instances

K-root Locations reached by country - 2025-02-06 - IPv4



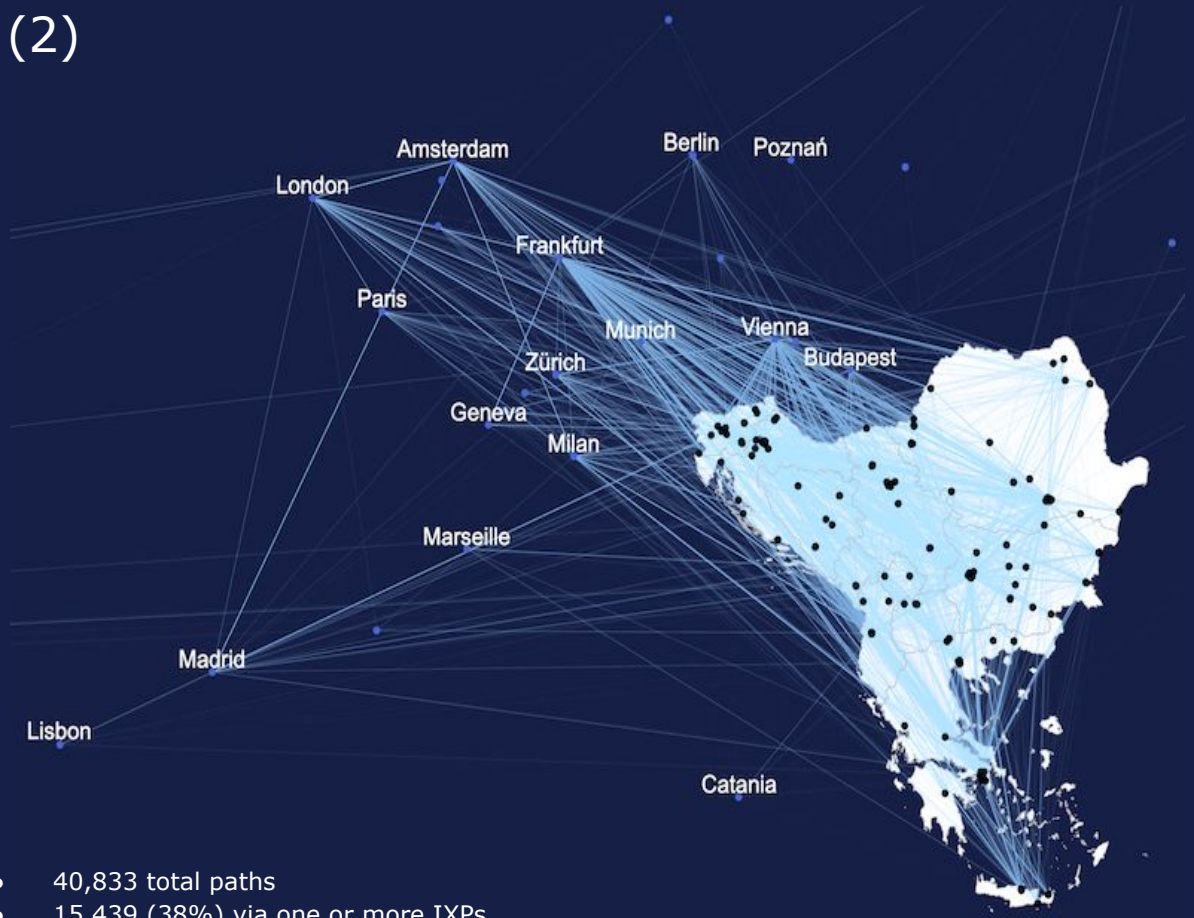
Inter-region connections (2)

- Total IPv4 paths: 40,833
- Out-of-region paths: 8,507 (20.83%)
- In-region paths: 32,326 (79.17%)

Data source: RIPE Atlas

Inter-region connections (2)

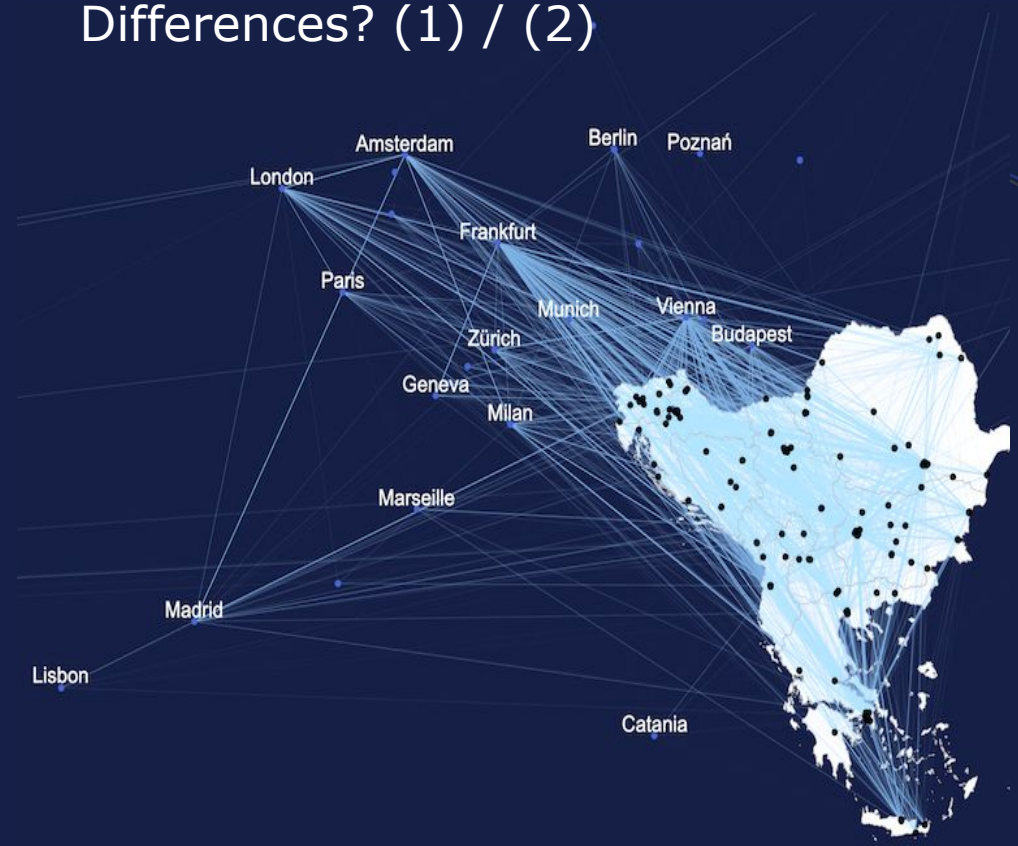
Number of in-region IPv4 paths	Regional IXP in the path
8645	NetIX Sofia
8640	InterLAN
8438	SOX
7944	BIX.BG
4526	CIX
4424	SIX
3567	GR-IX::Athens
2394	B-IX BG
2359	Balcan-IX
878	NetIX GR
702	GR-IX::Thessaloniki
543	RoNIX
455	MegaIX Sofia
318	IXP.mk
305	VarnaIX
258	T-CIX
36	BHNIX
21	ANIX
6	MIXP

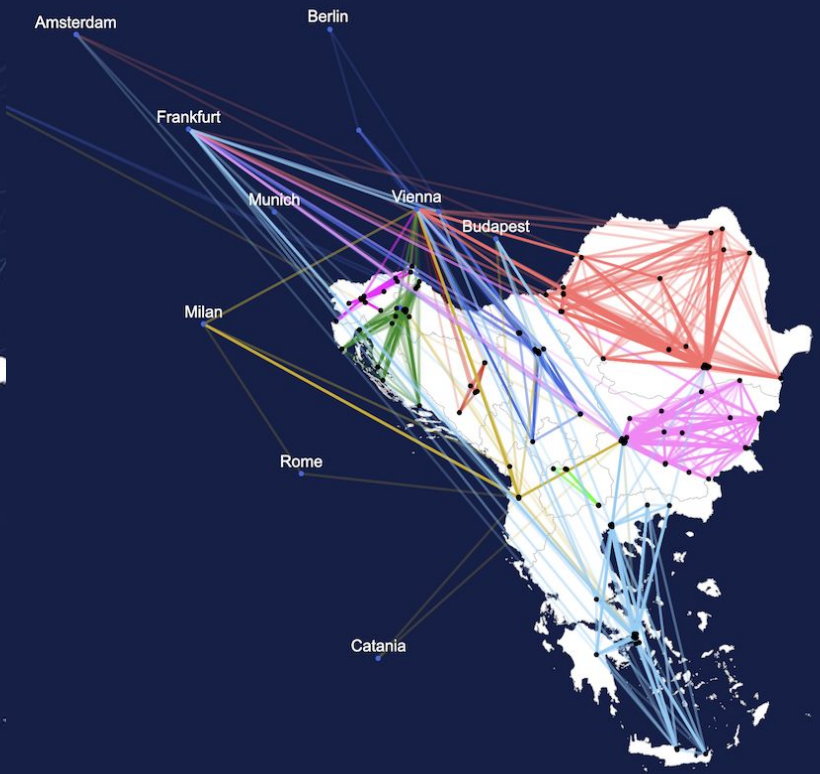


- 40,833 total paths
- 15,439 (38%) via one or more IXPs
- 1,392 (3%) via IXP and out of region

Data source: RIPE Atlas

Differences? (1) / (2)





Data source: RIPE Atlas

Presence of SEE ISPs at regional IXPs

Country	Total Foreign Regional Operators at IXP(s)	Total Capacity (in G)	# Countries of Foreign Regional Operators
Albania	0	0	0
Bosnia and Herzegovina	0	0	0
Bulgaria	6	191	4
Croatia	3	40	2
Greece	1	1	1
Kosovo*	0	0	0
Montenegro	0	0	0
N. Macedonia	2	20	2
Romania	1	20	1
Serbia	1	10	1
Slovenia	0	0	0

Source: PeeringDB

Cloud, CDN and OTT leaders in IXP Participation - Regional View

Company	Total Capacity (in G)	# IXPs	# Countries
Akamai	340	3	2
Amazon	400	2	2
Anexia	30	3	3
BelCloud	72	5	3
ByteDance	400	3	3
Cloudflare	1080	15	6
Google	1380	8	3
M247	110	5	3
Meta	2090	10	4
Microsoft	790	8	4
Riot Games	50	5	2
Valve	400	3	3
Yahoo!	40	3	2

Source: PeeringDB

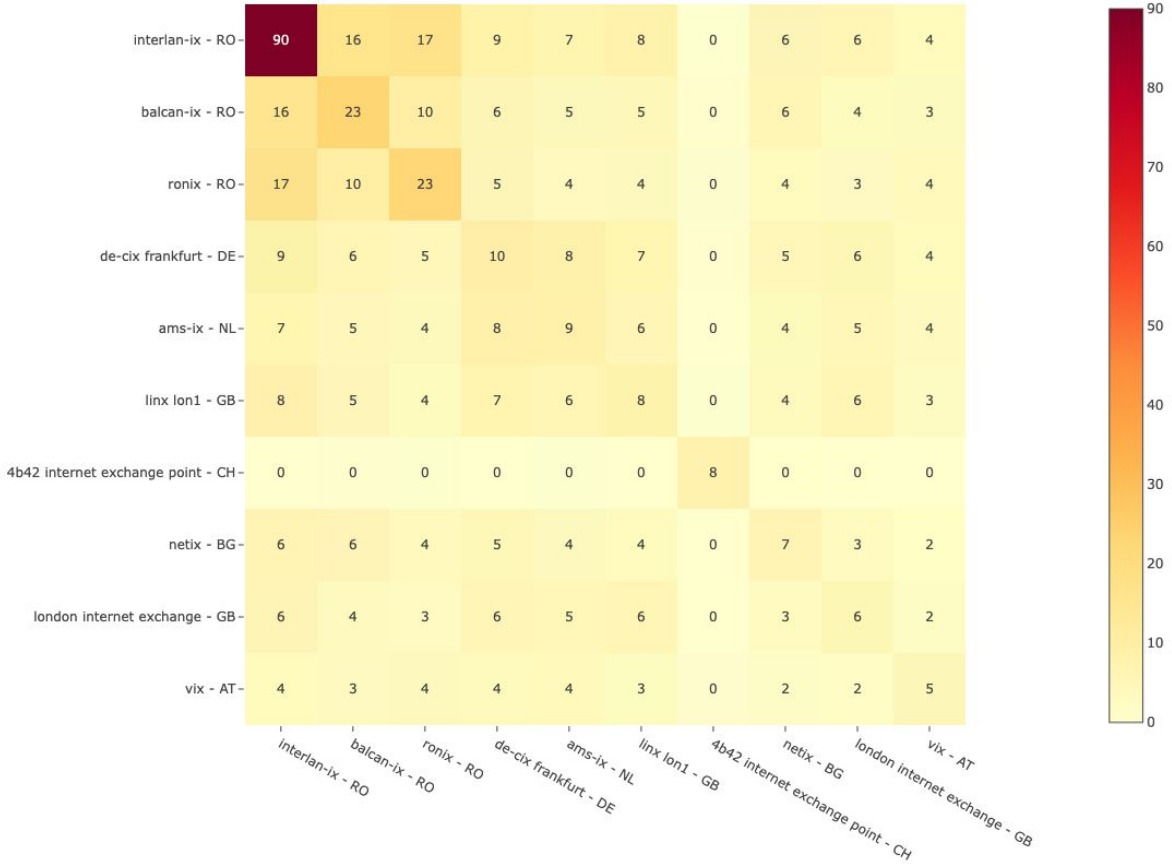
Cloud, CDN and OTT leaders in IXP Participation - Romania

	InterLAN	RoNIX	BALCAN-IX
Akamai	200		
Anexia	10G		
BelCloud	20G		
ByteDance	100G		
Cloudflare	100G	10G	10G
Google	200G	40G	
M247	20G	10G	60G
Meta	200G	200G	200G
Microsoft	20G		200G
Valve	100G		
Yahoo!			10G
i3D.net	100G		10G
Netflix	100G	100G	
Huawei		20G	

Source: PeeringDB

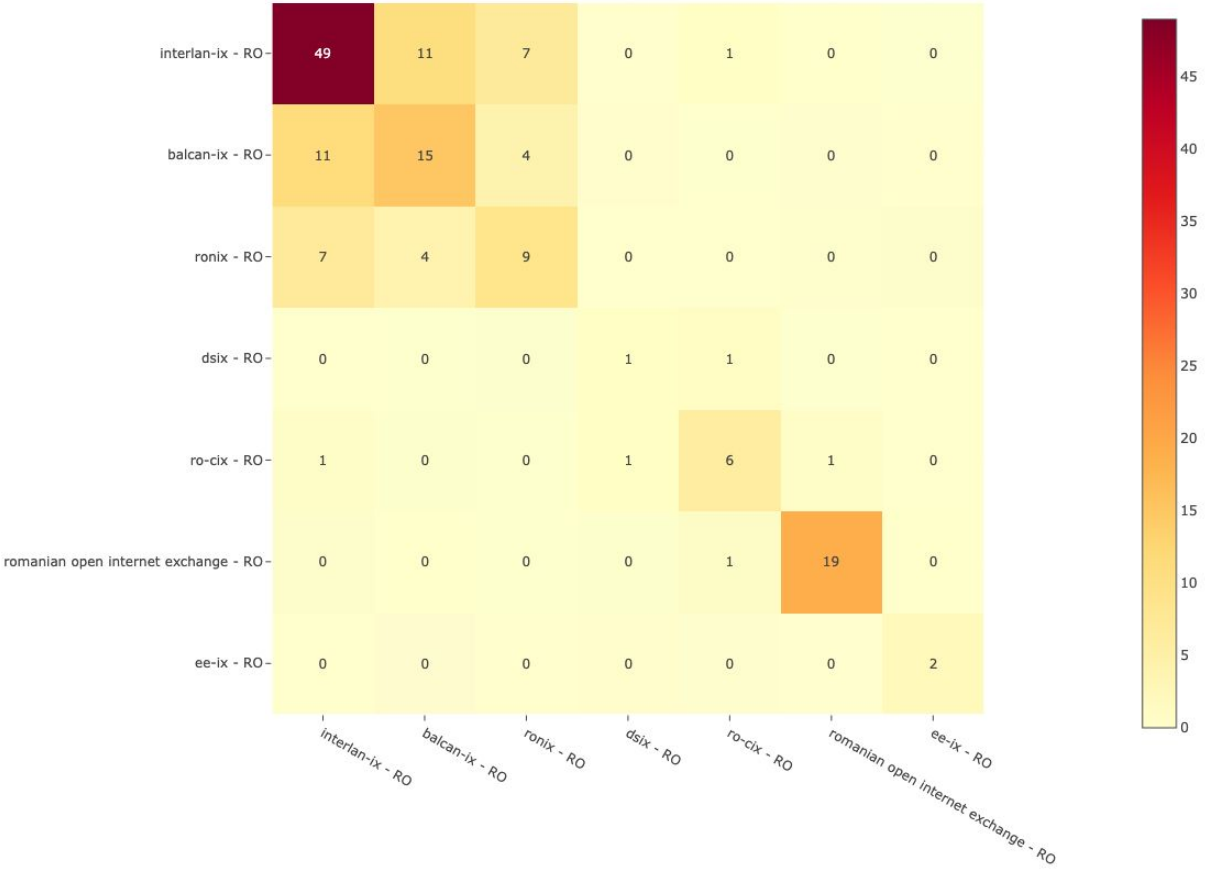
Digitalisation of the Local Economy

Domestic ASes: IXP Membership for ASes Registered in RO



https://www.ihr.live/en/country/RO

International ASes: IXP Membership in RO



https://www.ihr.live/en/country/RO

Takeaways

Call for Action 1 - On the IXP Level

- **Evaluate Governance Structures:**
  - Ensure IX operations are optimised from both policy and operational perspectives
- **Build Strong Communities:**
  - Successful IXPs often foster active communities (e.g., hosting NOG meetings)
  - Communities help attract new members and enhance collaboration
  - Especially critical for small IXPs: community advocacy can drive growth and relevance

Call for Action 2 - Better Regional Peering

- **More Attractive to Global Players**
  - Companies can/may serve multiple countries from a single hub
- **Stronger Security**
  - Less distance = fewer risks for data in transit
- **Lower Latency**
  - Crucial for gaming, fintech, and real-time apps
- **Greater Resiliency**
  - Less dependence on hubs like Frankfurt or Vienna
- **Cost Savings**
  - Reduced transit needs can lower overall costs

Call for Action 3 - We Need Data!

- **Help us Produce Accurate Reports:**
  - Keep your **PeeringDB** records up-to-date
  - Provide access to public **membership data, traffic stats, looking glass and governance policies**
  - Deploy more **RIPE Atlas Probes** and **Anchors** in the region to cover more diverse ASNs

Questions & Comments

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THANK YOU!