

Measuring Internet stability: Czech Republic, Slovakia and beyond

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About us

Qrator Labs

- **DDoS** mitigation
- **Own Anycast network**
- Radar 0
 - Where to place nodes/PoPs?
 - **BGP** monitoring



National report?

Country position in the world Inner market variety **Global availability**



ISP2Country

Official information

- ftp://ftp.ripe.net/ripe/asnames/asn.txt
- https://stat.ripe.net/docs/data api#country-resource-list
- IP + GeoDB
 - Announced prefixes
 - Live IP/PTR/etc



ISP stats

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	Registered		Active			
	CZ	SK	CZ (v4)	CZ (v6)	SK (v4)	SK (v6)
ASN	712	196	585	309	158	56
Global %	0.80%	0.22%	0.94%	1.86%	0.25%	0.34%
Place	25	50	21	11	49	40



ISP stats

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Really good spreading of v6 (especially for CZ)

- More than 50% of ASNes are dual
- Even v6 only AS (AS204405, AS47867)



Address space

- material matrix tradeoutral laterial differential tradeoutral tradeoutrac

	CZ (v4)	CZ (v6)	SK (v4)	SK (v6)
ASN	585	309	158	56
Prefixes	2193	547	741	93
Global %	0.23%	0.45%	0.08%	0.08%
Place	50	28	86	62



Address space

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Very low fraction of prefixes to ASNes

Even in third hundred by this metric



Regional structure

 Which ISPs are big? Which ISPs are good? How strong is regional connectivity?



Big fish

Get money from Customers Indirect income? So also the size of Customer Cone (CC) Particular ISP is the only option? Became a critical point



Big in CZ region

	IPv4		IPv6	
ASN	Customers	CC	Customers	CC
AS6830	75	122	47	62
AS39392	72	218	43	125
AS5588	60	81	41	83
AS6939	4	113	41	95
AS1299	30	548	26	284

*Only ASN from the region were taken into account



Not good at numbers

LGI-UPC (AS6830) — broadband SuperNetwork (AS39392) — \(^_^)/ When you are a largest CDN in region GTSCE (AS5588) — aka T-mobile Czech Republic Where the hell is Seznam?

- Only 1 customer and 1 provider
- Current metric have limitations



Big in SK region

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	IPv4		IPv6	
ASN	Customers	CC	Customers	CC
AS5578	39	84	11	25
AS6855	29	34	7	8
AS6939	2	14	12	33
AS1299	7	157	6	49
AS3320	3	133	2	36

*Only ASN from the region were taken into account



Not good at numbers [2]

 AS-Benestra (AS5578) — GTS entity in Slovakia Have only one provider — GTSCE (AS5588) Slovak-Telekom (AS6855) — previously government, Since 1999 — biggest carrier? DTAG (AS3320) — owner of previous two ISP



Situation with Tier-1

Big transit is well connected with Tier-1 At least two providers Choses are independent All roads lead to Telia (AS1299) Size of CC is not best metric for Tier-1 Union of CC of their customers Top 5 places are belonging to them HE (AS6939) is really into IPv6



Graph example (SKv6)

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Leaves — non transit ISP
Stubs — only one provider
Multihomed — good redundancy



Leaves

يتقلقان والمنابع والمستقالة والتلافية والألبان والمتقال والمتلاقية والمتنافية والمتعادي والمتعادي

	CZ (v4)	CZ (v6)	SK (v4)	SK (v6)
ASN	585	309	158	56
Non transit	497	257	126	44
Stub	293	147	86	31
Clear stub	245	111	75	22

*Clear stub — stub without any peering relations



Leaves

المتشمالية والمتقار والمتعالية والتلافية والألبان والمتشال والمتشميل والمتشما المتحادين

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Stub	293	147	86	31
Clear stub	245	111	75	22

- Only 20% of ISPs providing transit
- Around 50% of ISPs are stubs
- Stubs also do not like to peer



Stub providers

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	CZ (v4)	CZ (v6)	SK (v4)	SK (v6)
ASN	585	309	158	56
Stub	293	147	86	31
Main stub providers	AS47232 AS39392	AS47232 AS39392	AS5578 AS6855	AS5578 AS6855

- Most customers of AS39392 are placed on peering.cz
 - And even those who stubs
- Who is AS47232?



ISP Alliance

 AS47232 (web-site) Alliance of small operators Parnership as a union with others Very interesting practice



Good citizen

Multiple providers **Peering relations**

- Hard to detect from observed routes
- Presenting on IX



Main regional IXes:
CZ (Nix.cz, Peering.cz: 100+ members)
SK (Nix.sk, Six.sk: around 50 members)
Less than 50% on both IX at the same time
HE on all of them
Local TIER-1 are also good presented
So the regional connectivity is good



Global connectivity

Main question - can everyone reach you? **Gao-Rexford model** Chain of several c2p, possible p2p and several p2c Sufficient - can you reach all of Tier-1 ISP?



Critical point

Sometimes ISP fails If all your routes to Tier-1 are going through it - DoS Local peering will not help enough If there is such a point for you — it's critical Trying to find the one that is critical for most Pretty often on national border



Who is?

	CZ (v4)	CZ (v6)	SK (v4)	SK (v6)
ASN	AS47232	AS39392	AS5578	AS5578
Outage %	7.24%	9.18%	20.33%	25.07%
Place	21	22	102	74

Outage % represents the dependence of a region on the biggest AS failure
We met those critical ASNes somewhere before...



Somewhere before...

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ASN	585	309	158	56
Stub	293	147	86	31
Main stub providers	AS39392	AS47232 AS39392	AS5578 AS6855	AS5578 AS6855

- It's obvious to some extent
 - But it's not always the case
- You do remember, that AS5578 have only one provider?



PTROutage

	CZ	SK
ASN	AS5610	AS6855
Outage	27.82%	41.15%
Place	13	53

If equal weight for AS is not good enough
We finally met O2 (AS5610)



Questions?

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