



## Internet Measurement Day Serbia

# SOX view on Serbian Internet

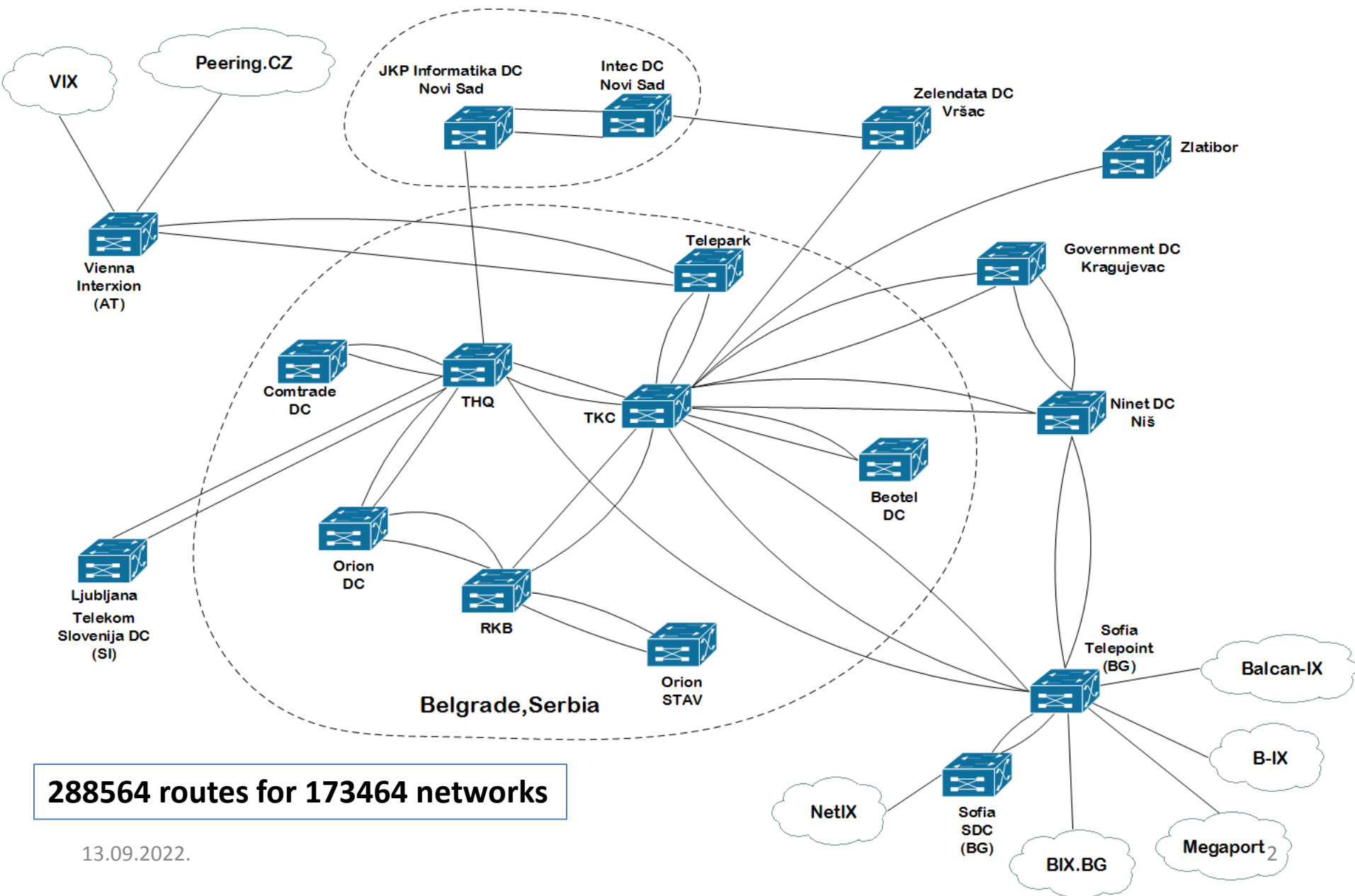
Dr Nenad Krajnović, CTO SOX

e-mail: [krajko@sox.rs](mailto:krajko@sox.rs)

Zoran Perović, CEO SOX

e-mail: [info@sox.rs](mailto:info@sox.rs)

# SOX network



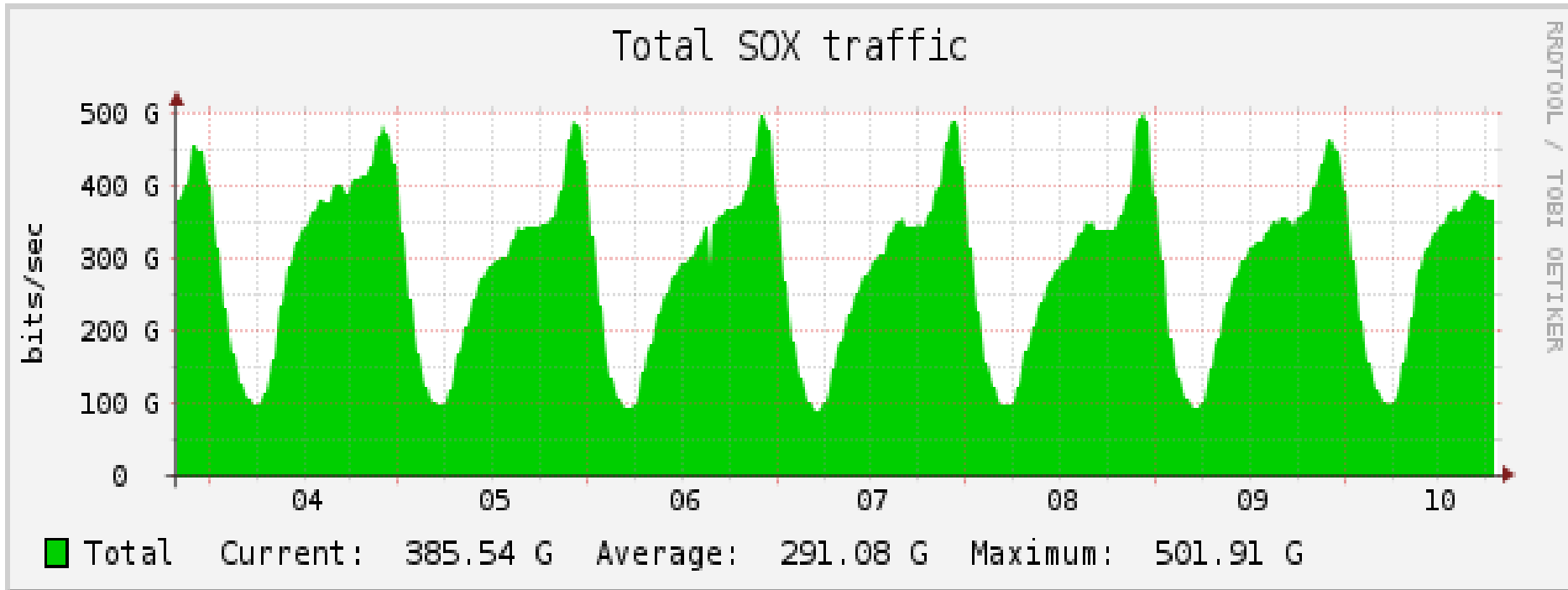
**288564 routes for 173464 networks**

13.09.2022.

# Network capacity

- All backbone links are redundant with full path and capacity redundancy ( $N \times 100\text{Gbps}$ ).
- Real traffic is up to 50% of nominal capacity of the links.
- SOX does not have bottleneck in the backbone part of the network.
- SOX is “pushing” customers to follow the same 50% rule regarding traffic and to have redundant links to SOX network.

# Total SOX traffic in network



**Peak traffic at 586 Gbps!**

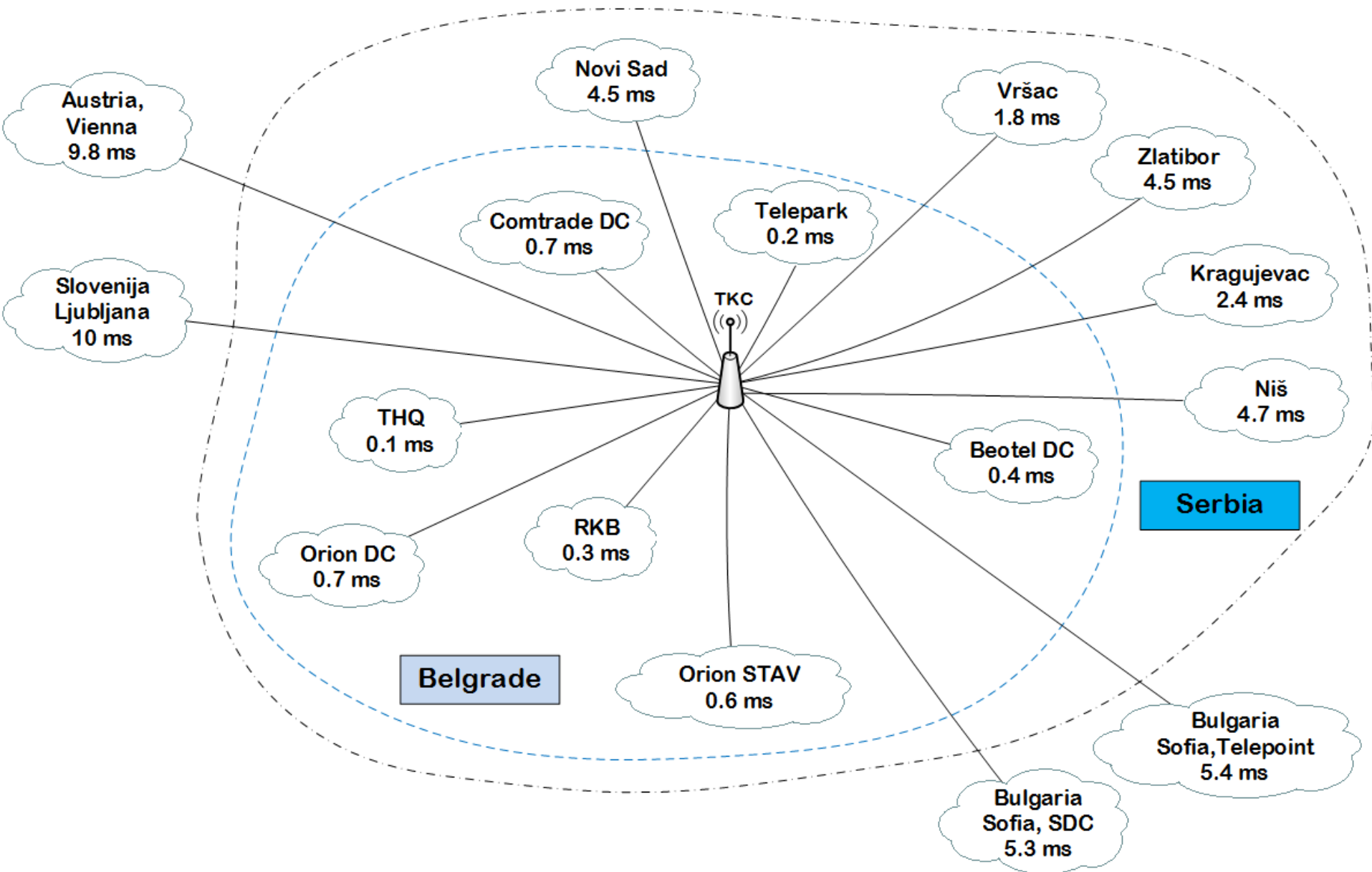
# Network latency

- Measuring latency heavily depends on end-point.
- SOX network is L2 network, so, first customer device is router.
- Router load heavily affects measurement results.
- Presented measurements were made with network devices in SOX network.

# Ping RTT on network devices

- Since SOX network is L2 network, devices are ethernet switches.
- Different switches have different CPU, typically not very powerful, because traffic forwarding is done by ASIC chips.
- Results can vary from device to device.
- Presented RTT doesn't mean that customer traffic will have that latency.

# Latency in SOX network



# Latency toward SOX customers

- These are results of ping RTT of customers router.
- Router traffic load and router model have significant impact on the results.
- Connection point in SOX network has major impact on latency – how far from measuring source point.



# SOX customers (with routers in Serbia)

AS num.	IPv4 ping RTT [ms]	IPv6 ping RTT [ms]
12459	0.07	0.07
211612	0.09	0.12
35779	0.16	
35779	0.16	0.21
47267	0.18	0.47
213306	0.19	
213306	0.21	
51859	0.23	0.27
15958	0.25	0.23
63293	0.25	0.27
211612	0.25	0.27
25431	0.31	
47267	0.32	0.49
13091	0.33	
51859	0.33	0.45
47479	0.33	
13335	0.34	0.34
3856	0.34	0.42
205201	0.38	0.53
60592	0.42	0.5
39311	0.49	
9009	0.5	0.51

AS num.	IPv4 ping RTT [ms]	IPv6 ping RTT [ms]
31042	0.53	0.66
205620	0.55	
6700	0.56	0.57
205313	0.59	
41897	0.63	0.43
9119	0.63	0.7
9125	0.64	0.73
44143	0.66	0.63
31042	0.73	0.6
6939	0.79	0.64
8400	0.82	0.83
56452	0.87	
9125	0.93	0.83
41937	1.07	1.42
213306	2.1	
213306	2.17	
44252	4.32	4.31
198371	4.4	4.39
13303	4.87	4.78
44252	5.05	
198371	5.11	4.42

# SOX customers (with routers outside of Serbia)

AS num.	IPv4 ping RTT [ms]	IPv6 ping RTT [ms]
198371	5.11	4.42
15169	5.4	5.46
31287	5.52	5.48
57463	5.52	5.54
32934	5.67	5.55
31287	5.68	5.79
15169	5.8	5.42
34224	5.99	
43061	8.41	8.39
22822	9.17	9.18
32590	9.63	11.17

# SOX is hosting root DNS servers

AS num.	Root DNS server	IPv4 ping RTT - SOX rs [ms]	IPv6 ping RTT - SOX rs [ms]
20144	L-root DNS server	0.11	0.18
26415	J-root DNS server	0.2	0.24
25152	K-root DNS server	0.19	0.2
8674	I-root DNS server	0.35	0.44
42	PCH root DNS servers	0.77	0.84

# Connections with neighboring IXPs

ping from SOX router toward IXP route-servers

AS	IXP	IPv4 ping RTT [ms]	IPv6 ping RTT [ms]
61195	Peering.cz	20.84	19.52
61195	Peering.cz	19.98	21.54
59900	B-IX.bg (local)	5.47	
59900	B-IX.bg (local)	5.35	
59900	B-IX.bg (regional)	5.46	5.3
59900	B-IX.bg (regional)	5.28	5.22
15669	BIX.bg	5.7	5.66
15669	BIX.bg	5.44	5.35
24745	Balcan-IX.ro	12.84	12.72
24745	Balcan-IX.ro	12.8	12.8
59899	Megaport.bg	5.26	5.22
59899	Megaport.bg	5.45	5.3
1121	VIX.at	11.07	11.06
1121	VIX.at	10.95	11.02
57463	NetIX.bg	5.44	5.35
57463	NetIX.bg	30.08	30



**Internet Measurement Day  
Serbia**

# **SOX view on Serbian Internet**

Dr Nenad Krajnović, CTO SOX

e-mail: [krajko@sox.rs](mailto:krajko@sox.rs)

Zoran Perović, CEO SOX

e-mail: [info@sox.rs](mailto:info@sox.rs)