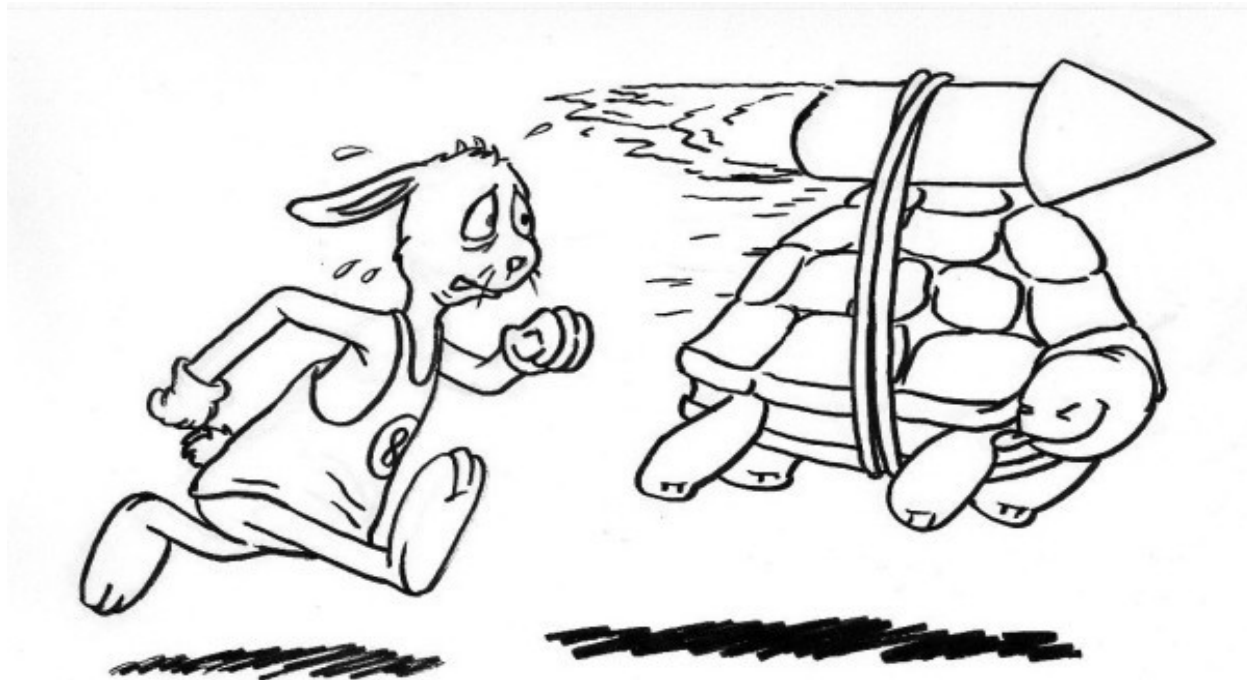


Performance comparison between IPv4 and IPv6 on the Internet.



May/2011 NAPLA
Antonio M. Moreiras
moreiras@nic.br

We asked ourselves:

What is the difference between IPv6 and IPv4 performances in today's Internet?

IPv4

```
$ ping -n -c3 ietf.org
```

```
PING ietf.org (64.170.98.30) 56(84) bytes of data.  
64 bytes from 64.170.98.30: icmp_req=1 ttl=73 time=227 ms  
64 bytes from 64.170.98.30: icmp_req=2 ttl=73 time=218 ms  
64 bytes from 64.170.98.30: icmp_req=3 ttl=73 time=220 ms
```

```
--- ietf.org ping statistics ---
```

```
3 packets transmitted, 3 received, 0% packet loss, time 2003ms  
rtt min/avg/max/mdev = 218.773/222.129/227.588/3.931 ms
```



IPv6

```
$ ping6 -n -c3 ietf.org
```

```
PING ietf.org(2001:1890:1112:1::1e) 56 data bytes  
64 bytes from 2001:1890:1112:1::1e: icmp_seq=1 ttl=49 time=363 ms  
64 bytes from 2001:1890:1112:1::1e: icmp_seq=2 ttl=49 time=295 ms  
64 bytes from 2001:1890:1112:1::1e: icmp_seq=3 ttl=49 time=383 ms
```

```
--- ietf.org ping statistics ---
```

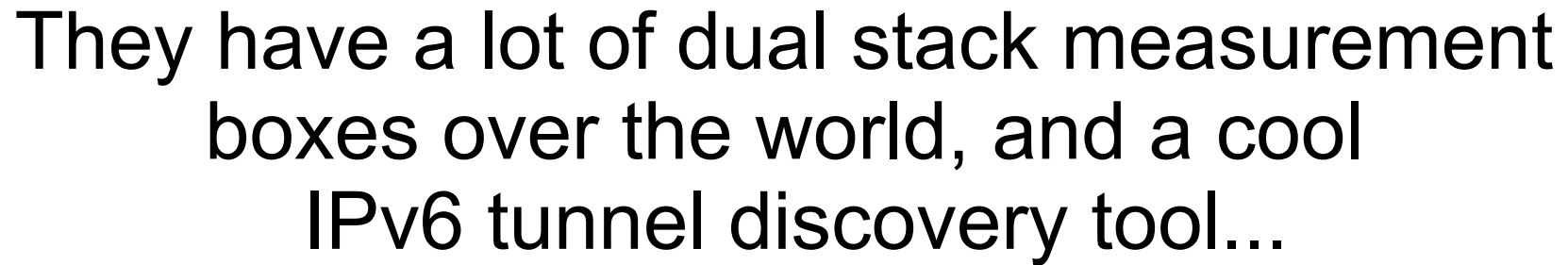
```
3 packets transmitted, 3 received, 0% packet loss, time 2002ms  
rtt min/avg/max/mdev = 295.438/347.414/383.311/37.632 ms
```

It seems that there is a problem...

Would it be a routing problem?
A configuration problem?

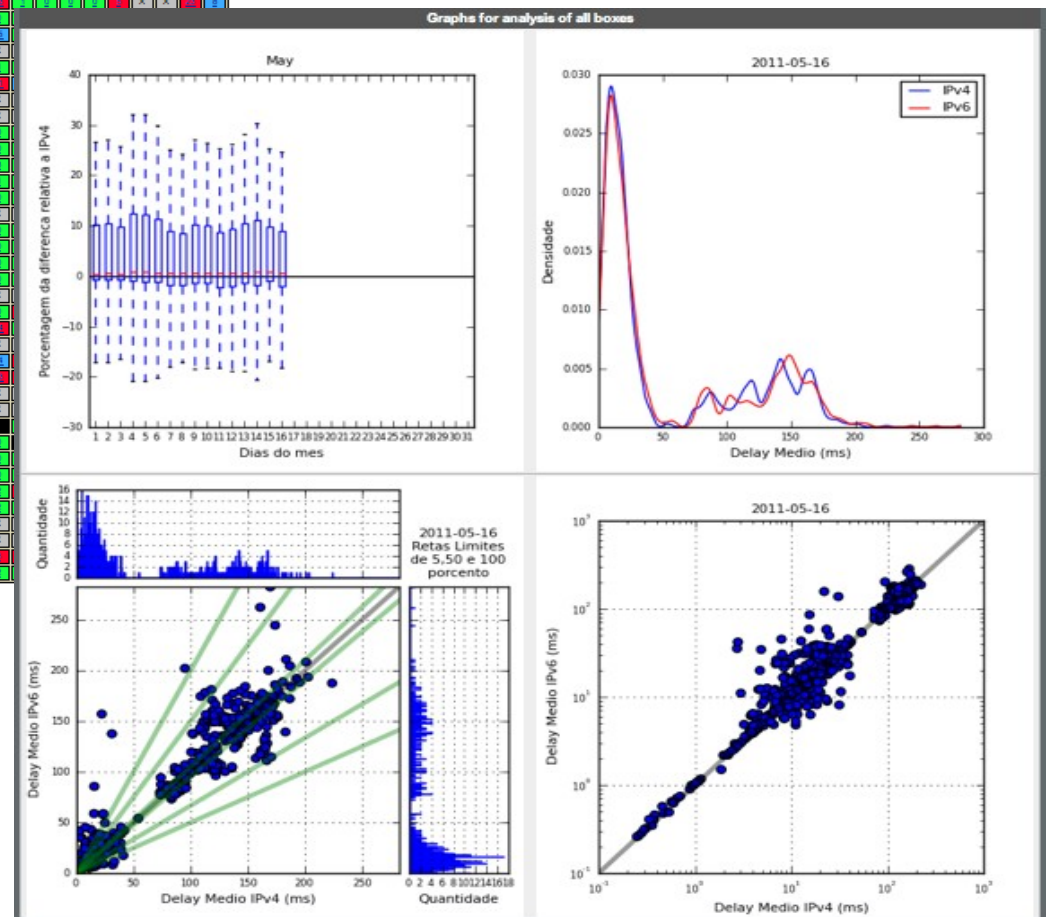
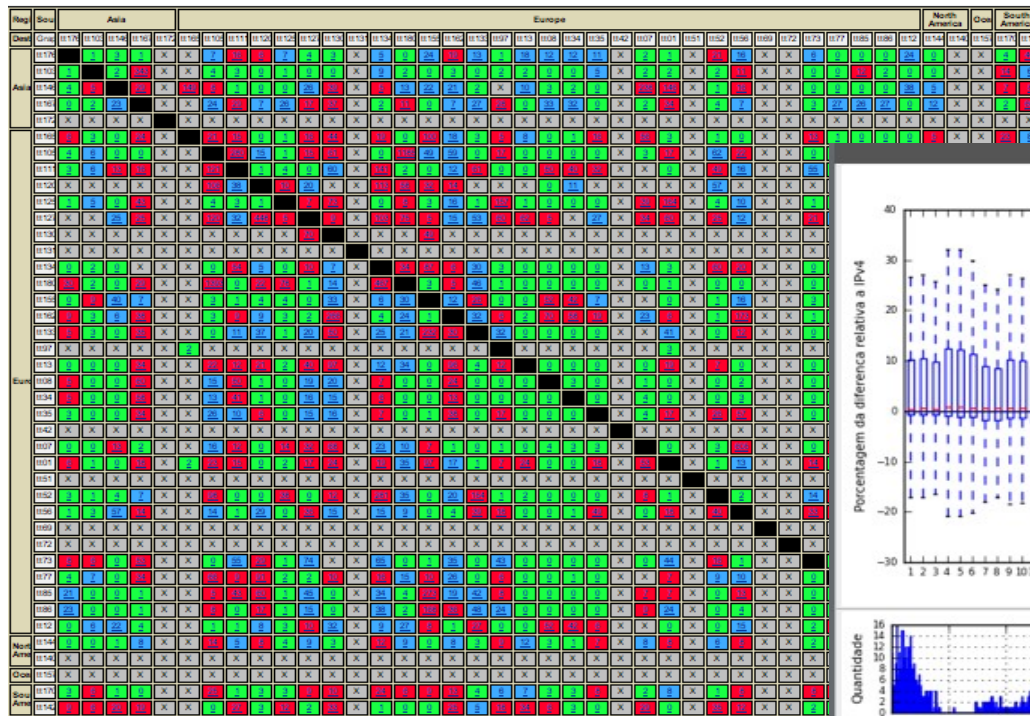
First things first...
We are not even testing it the right way...

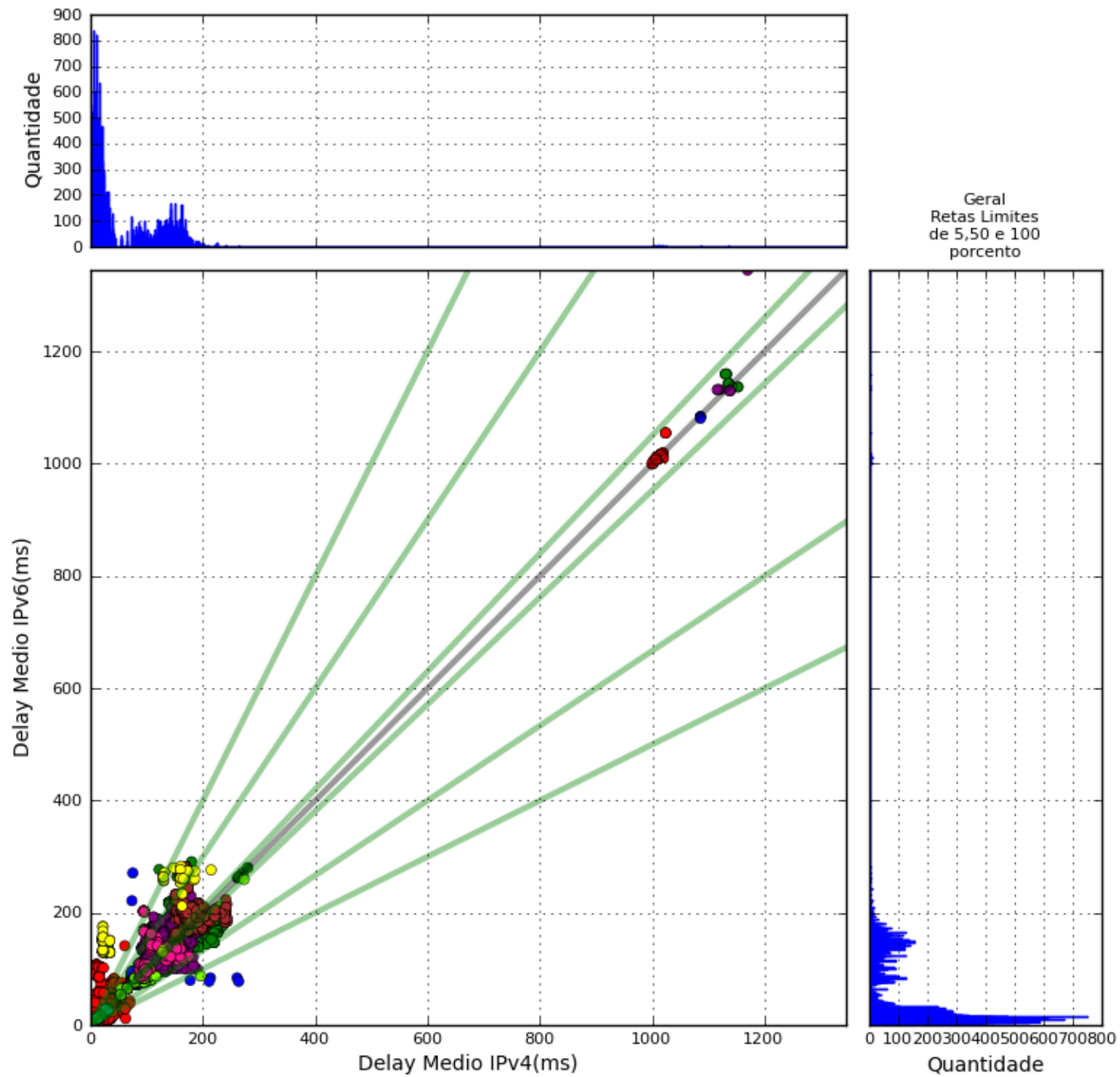
How can we measure it
in a more significative way?

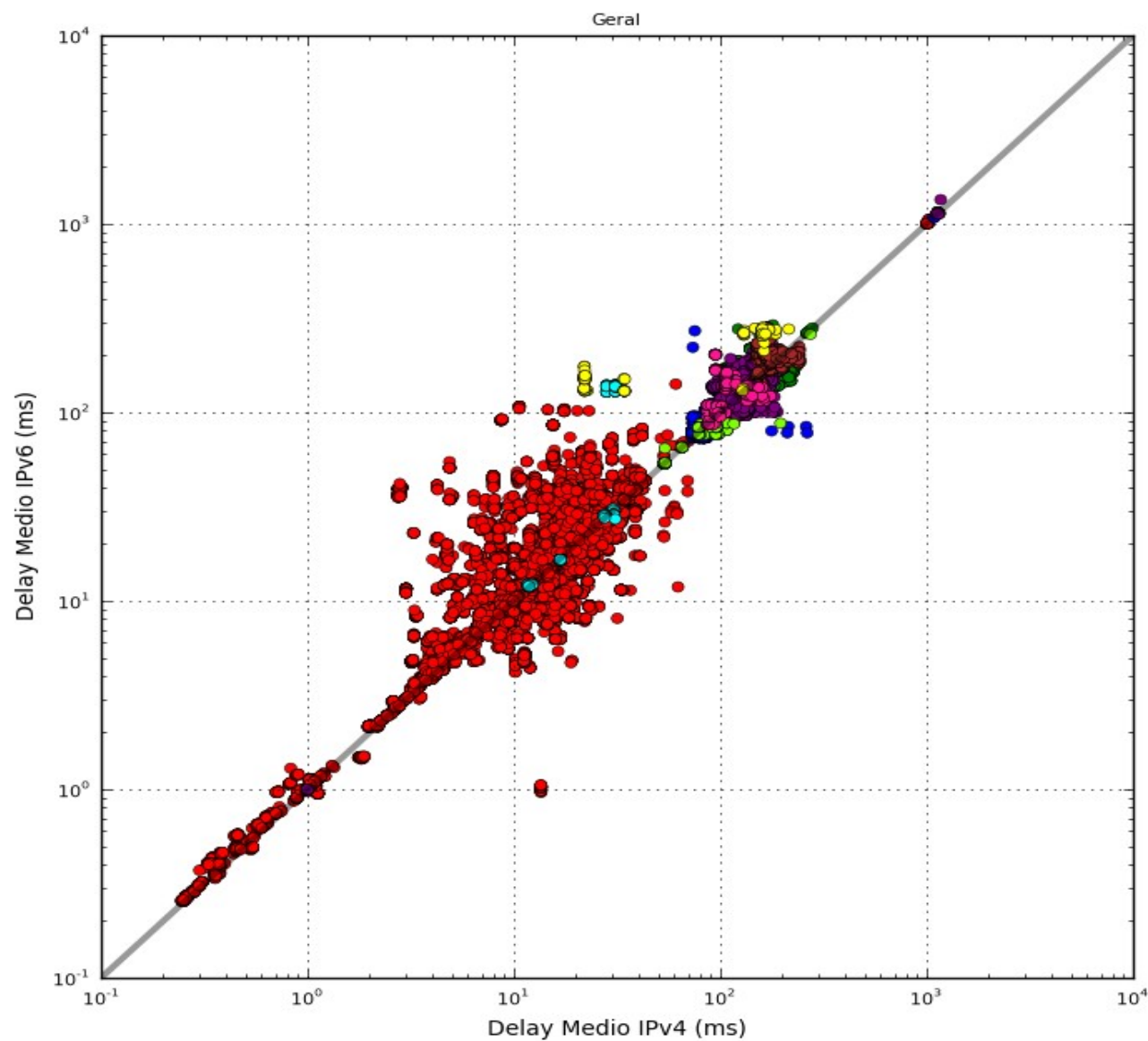
[Description and FAQ](#)

		Destination Testbox																																								
		tt01	tt07	tt08	tt103	tt105	tt111	tt12	tt120	tt125	tt127	tt13	tt130	tt133	tt134	tt142	tt144	tt146	tt155	tt157	tt162	tt165	tt167	tt170	tt172	tt176	tt180	tt34	tt35	tt42	tt52	tt56	tt69	tt72	tt73	tt77	tt85	tt86	tt97			
Source Testbox	tt01																																									
	tt07	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1480	1500	1500	1500	1500	1400	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	
	tt08	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1480	1480	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt103	1500	1500	1500		1500	1500	1500	1500	1500	1450	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt105	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt111	1500	1500	1500	1500	1476		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt112	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt120	1500	1500	1500	1500	1476	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt125	1500	1500	1500	1480	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1480	1500	1500	1480	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1480	1500	1500	1500	1500	1500
	tt127	1500	1500	1500	1500	1476	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt13	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt130	1500	1500	1500	1500	1476	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt133	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt134	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
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	tt146	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt155	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt157	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	tt162	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
tt165	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	
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tt170	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	
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tt176	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	
tt180	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500																										

Table ordered by region, and colored by the percentual difference between v6 and v4 delays.







Europe-Europe



Asia-Asia



South America-South America



Europe-Asia



Asia-North America



North America-North America



Europe-North America



Asia-South America



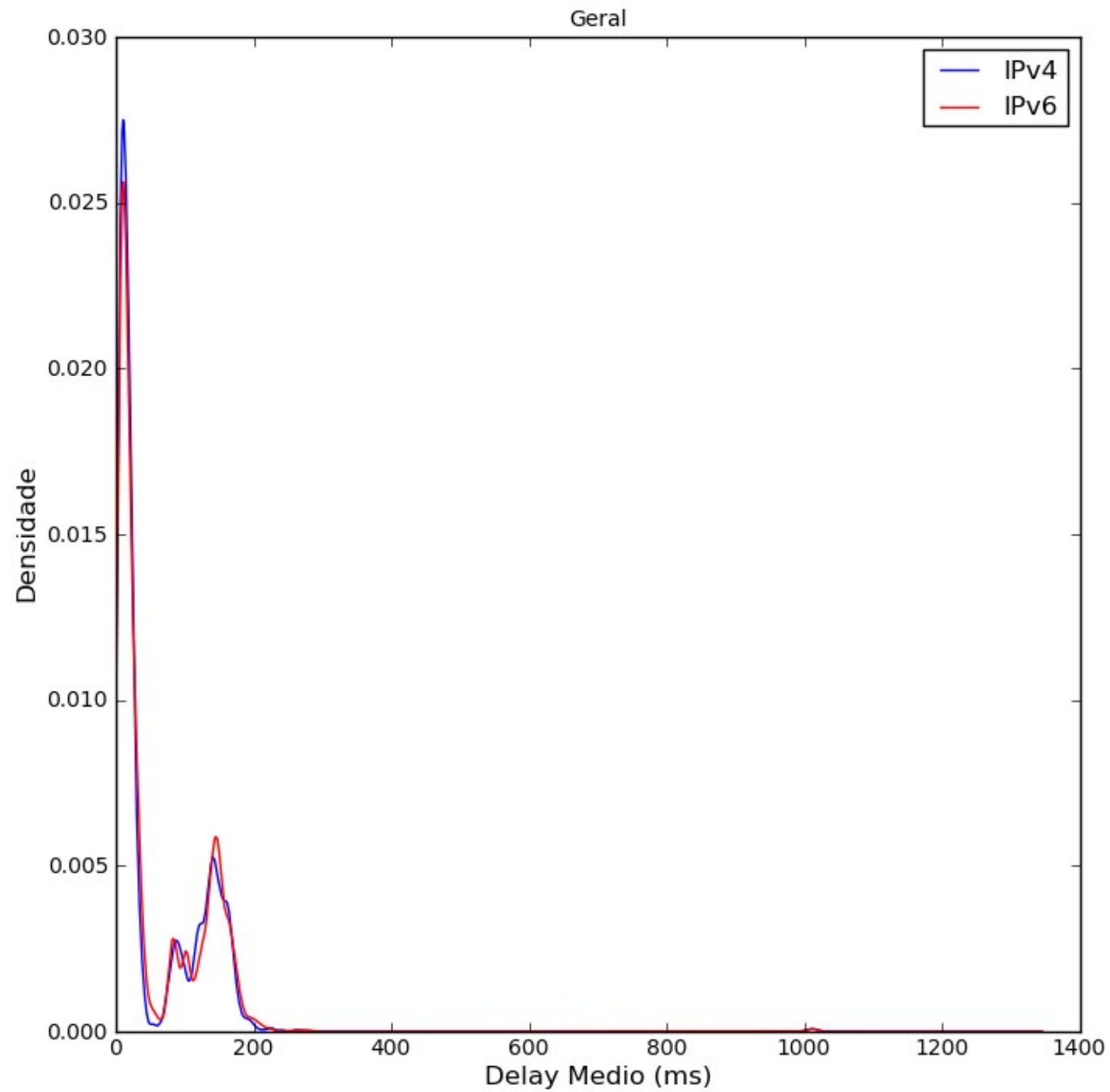
Others

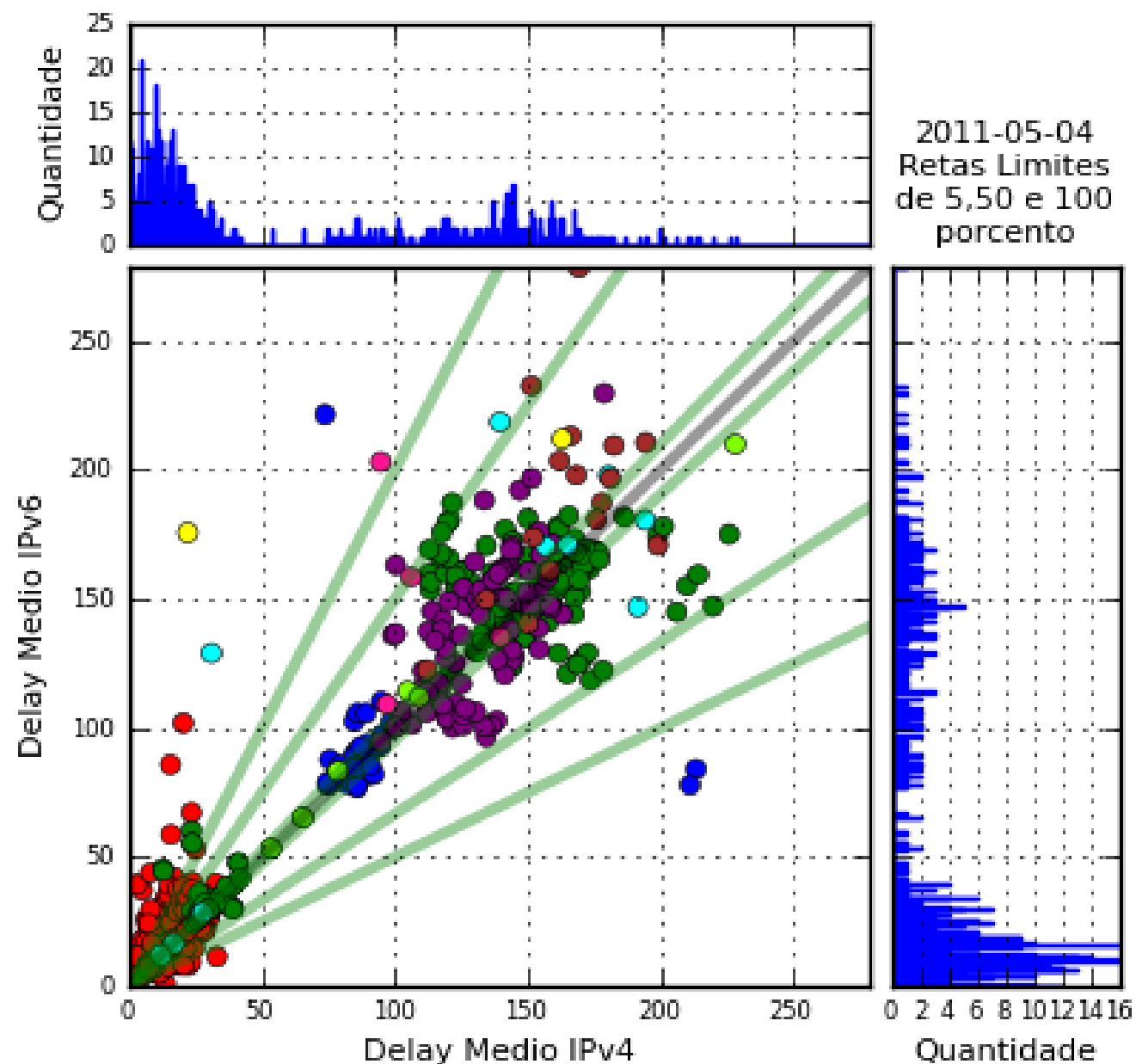


Europe-South America

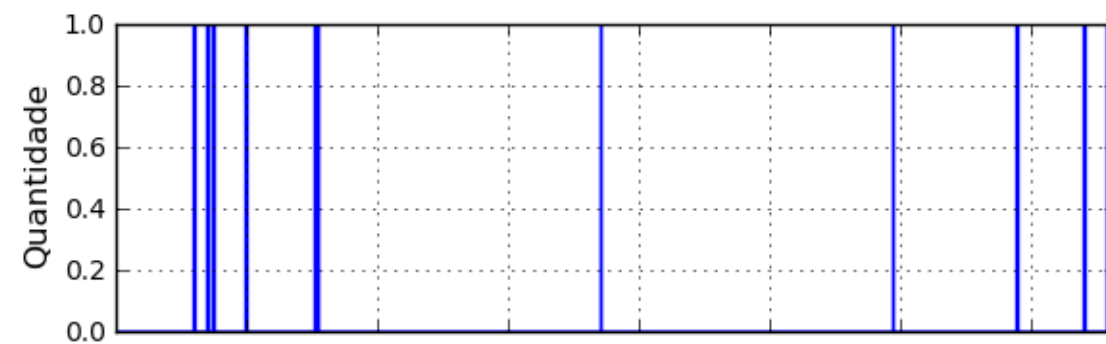


North America-South America

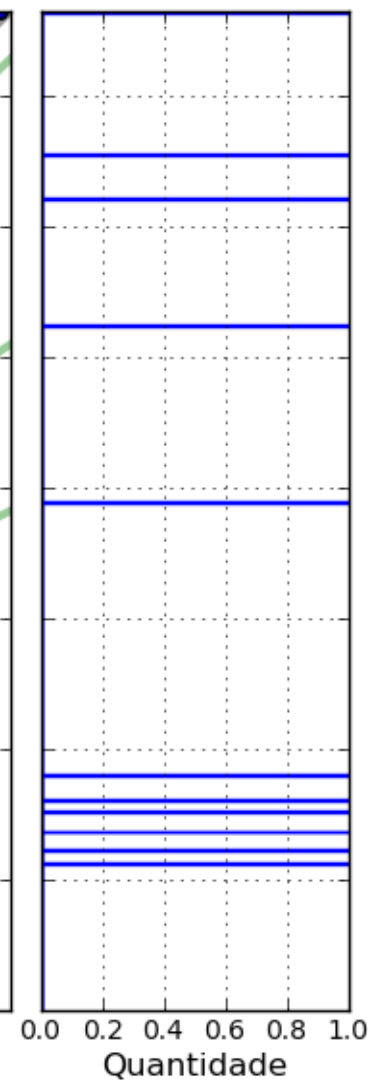
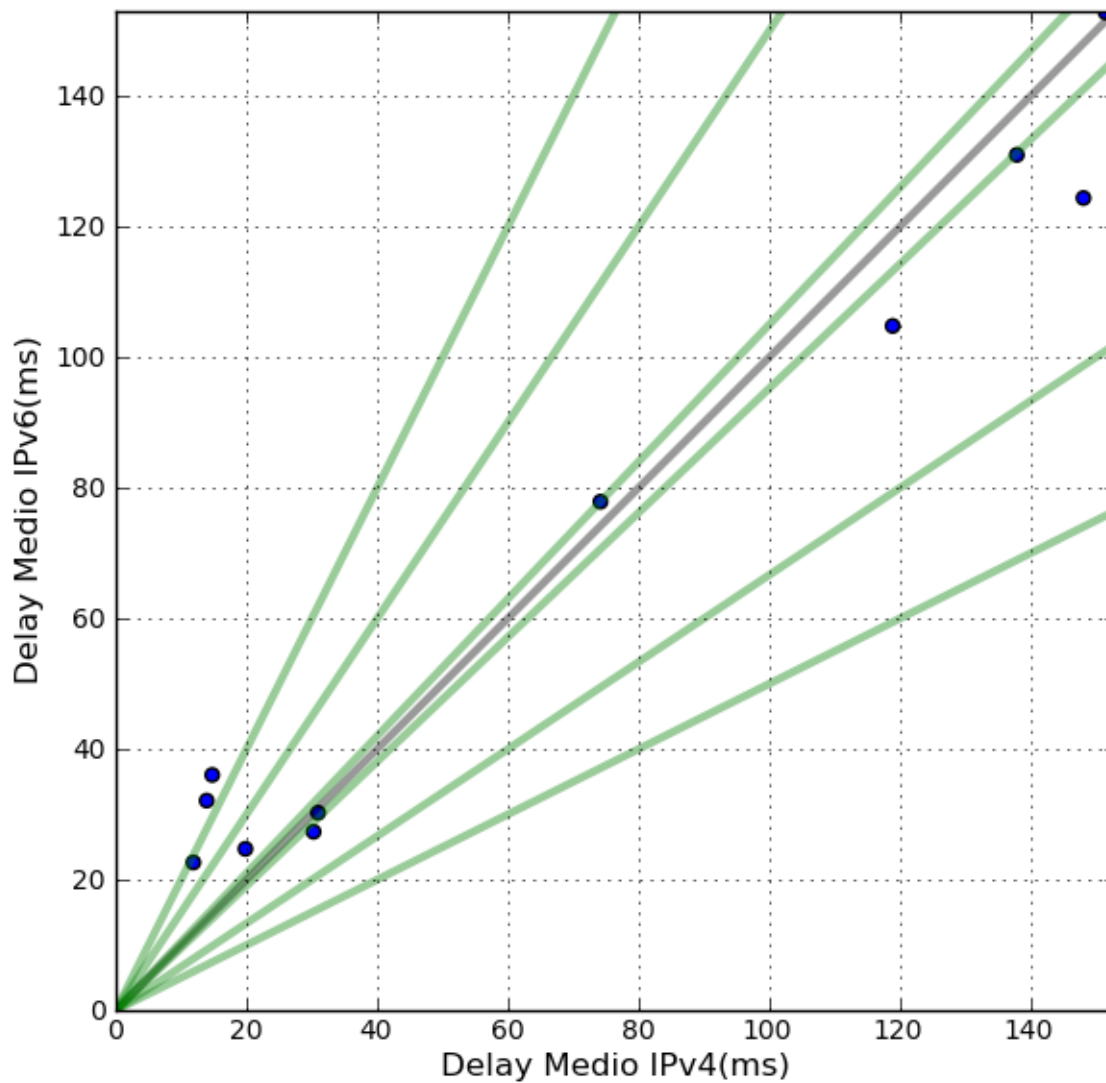




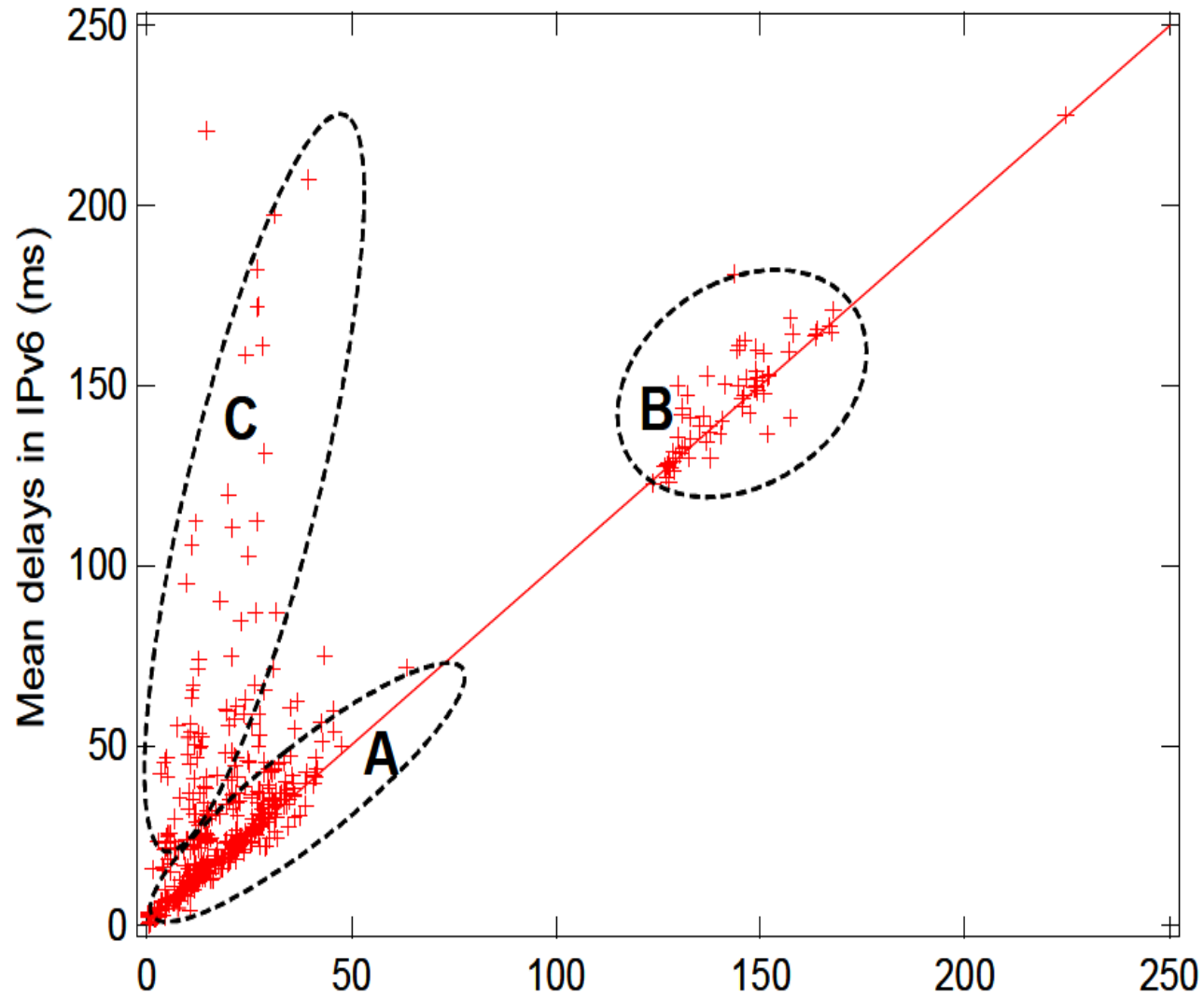
- Europe-Europe
- Europe-Asia
- Europe-North America
- Europe-South America
- Asia-Asia
- Asia-North-America
- Asia-South-America
- North America-South America
- South America-South America
- North America-North America
- Others



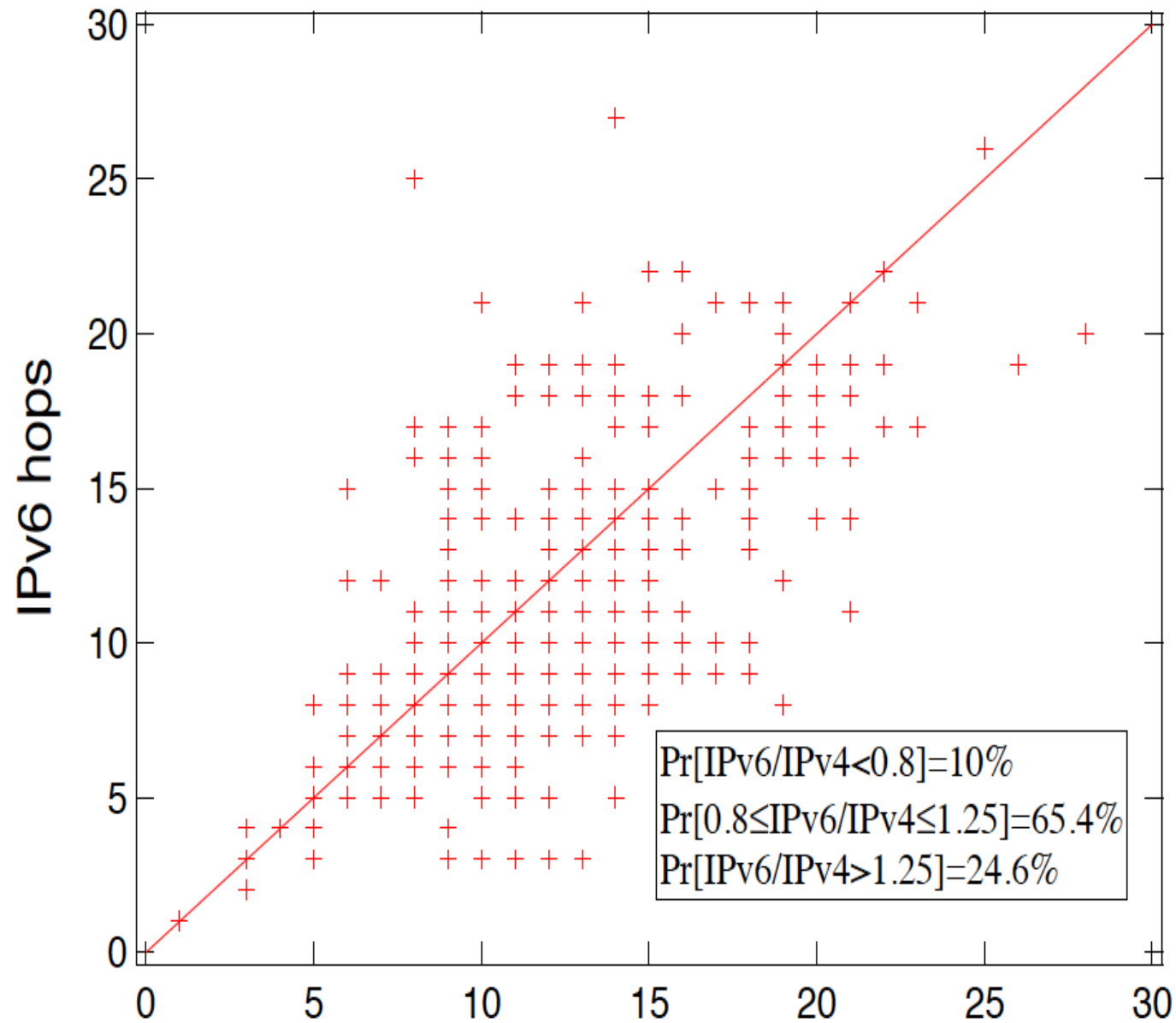
Com tunel 2011-05-09
Retas Limites
de 5,50 e 100
porcento



Hopcount and E2E Delay: IPv6 Versus IPv4
Xiaoming Zhou and Piet Van Mieghem
Delft University of Technology
2005



Hopcount and E2E Delay: IPv6 Versus IPv4
Xiaoming Zhou and Piet Van Mieghem
Delft University of Technology
2005



OK

It seems a lot better than the pings...

Why?

Do we have a problem
within the Brazilian networks?

Would this data be distorted because TTM boxes
are generally in the core of the networks?

Get our own data...



From:



+ some VPS in
USA, europe and
asia

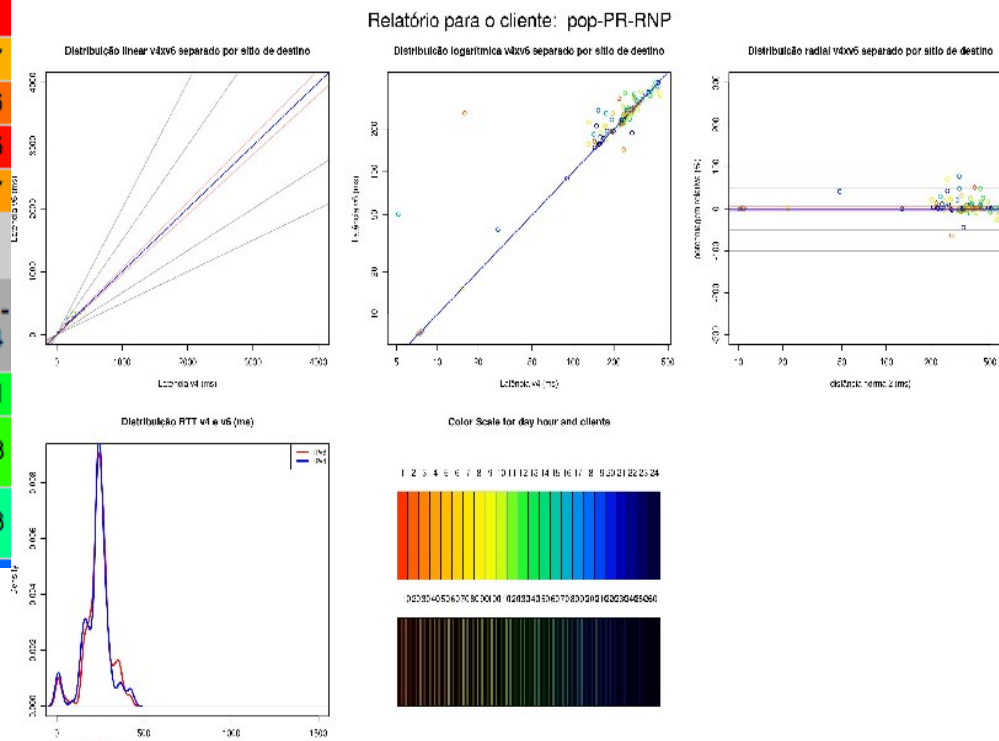
Against:

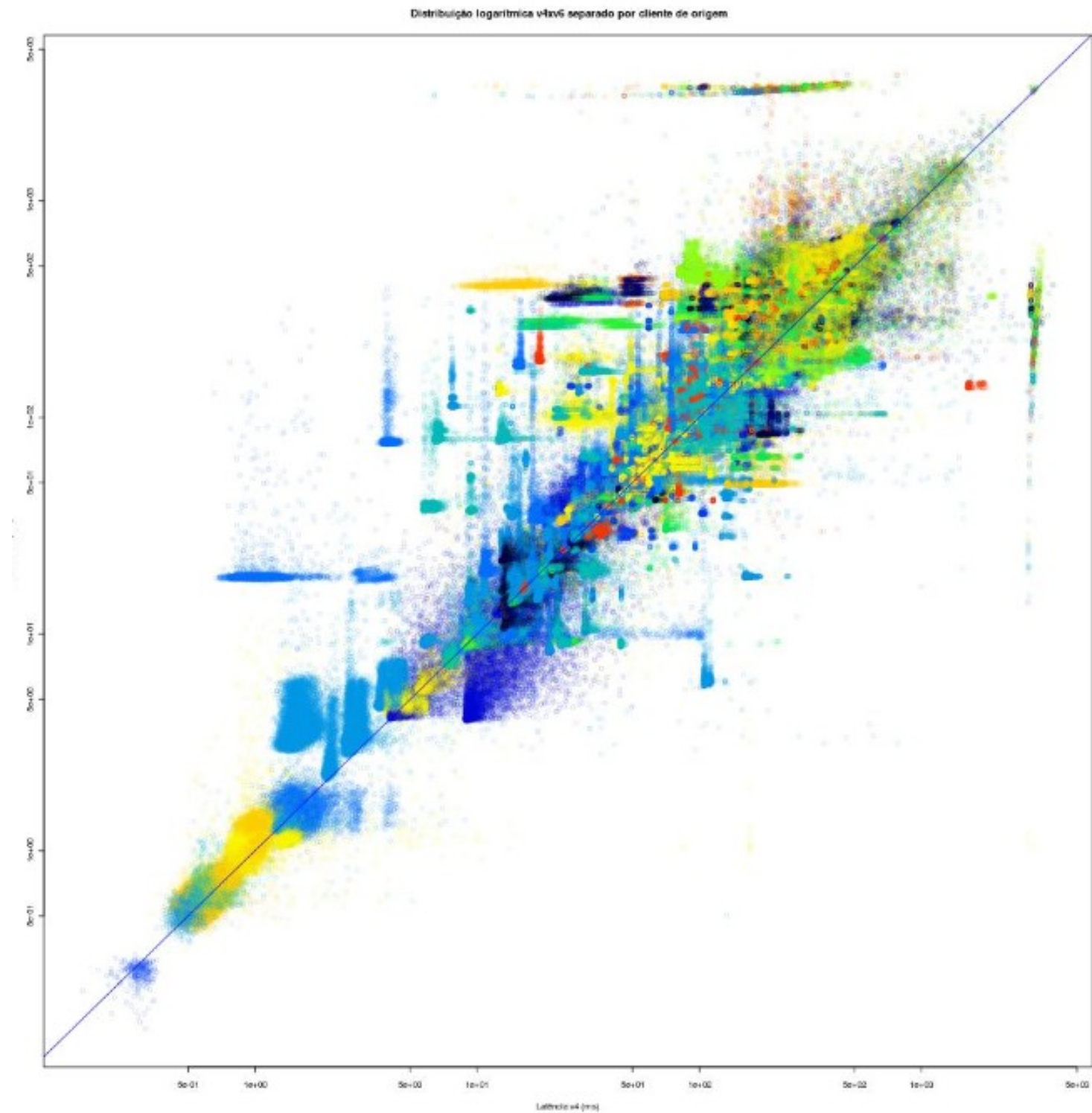
- TTM boxes (UDP)
- Websites (TCP)

<http://labs.ceptro.br/simonv6>

Origem (Origin)	ASN	Latência IPv4 (ms) (Latency IPv4)	Latência IPv6 (ms) (Latency IPv6)	IPv6 - IPv4	IPv4/IPv6	(IPv4-IPv6)/IPv4 (%)	Amostras (Samples)	País (Country)	Mais (More)
CTBC	16735	249.29	255.36	6.08	0.98	-2.44%	1727	BR	
DECEX	28301	235.76	261.63	25.87	0.9	-10.97%	1696	BR	
IBTelecom	28346	255.91	293.75	37.84	0.87	-14.78%	1736	BR	
NIC.br	22548	232.81	260.02	27.21	0.9	-11.69%	1708	BR	
pop-PR-RNP	10881	233.25	241.55	8.3	0.97	-3.56%	1834	BR	
SCW	28138	248.26	262.17	13.91	0.95	-5.6%	1553	BR	
NIC.cl	27678	241.74	246.14	4.39	0.98	-1.82%	2746	CL	
CEDIA - EC	27947	272.46	274.02	1.56	0.99	-0.57%	1537	EC	
Amsterdam-NL	35017	99.43	101.05	1.63	0.98	-1.64%	937	US	
Coimbatore-IN	38743	239.06	261.49	22.43	0.91				
NYC-US	32748	112.97	116.74	3.77	0.97				
Portland-US	14613	159.3	165.85	6.55	0.96				
SanJose-US	33597	151.55	159.46	7.91	0.95				
LACNIC	28000	319.59	331.12	11.53	0.97				

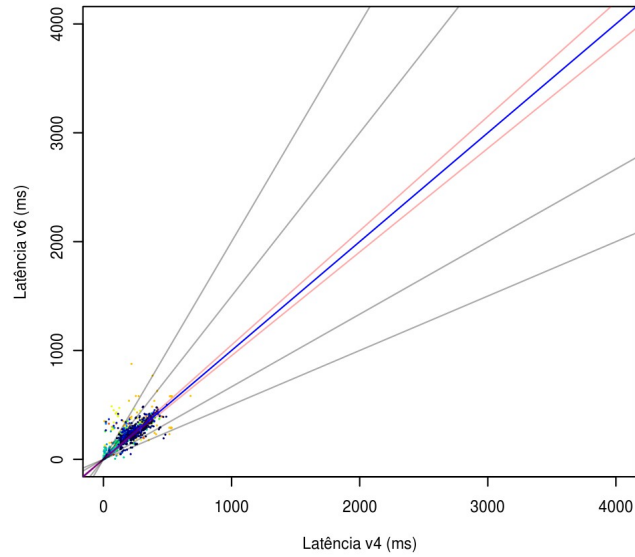
Destino (Destiny)	Tipo (Type)	ASN	Latência IPv4 (ms) (Latency IPv4)	Latência IPv6 (ms) (Latency IPv6)	IPv6 - IPv4
tt73.ripe.net	NTP	1853	234.82	232.21	-2.61
www.nextlayer.at	HTTP	1764	228.45	228.07	-0.38
monash.edu.au	HTTP	56132	354.46	346.14	-8.33



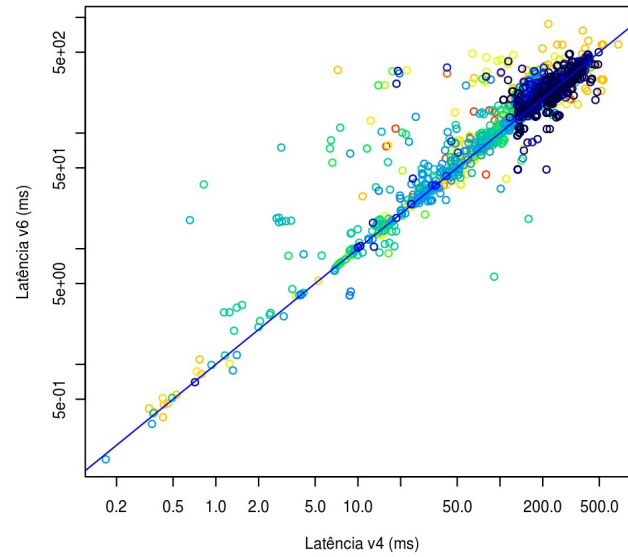


Valores mínimos para todos os sites e clientes

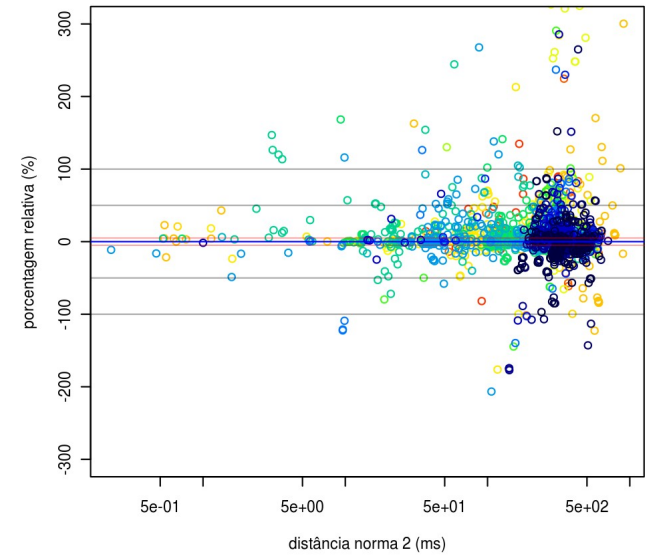
Distribuição linear v4xv6 separado por cliente de origem



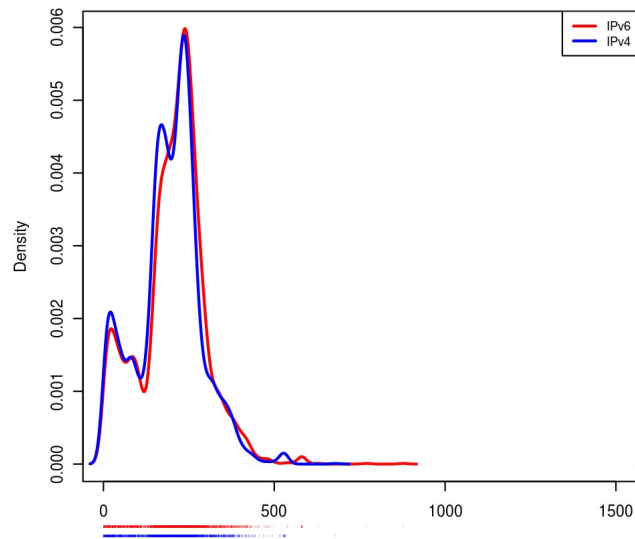
Distribuição logarítmica v4xv6 separado por cliente de origem



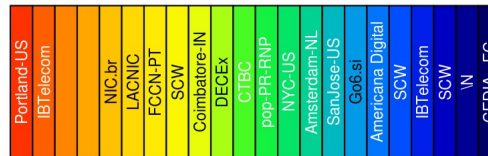
Distribuição radial v4xv6 separado por cliente de origem



Distribuição RTT v4 e v6 (ms)

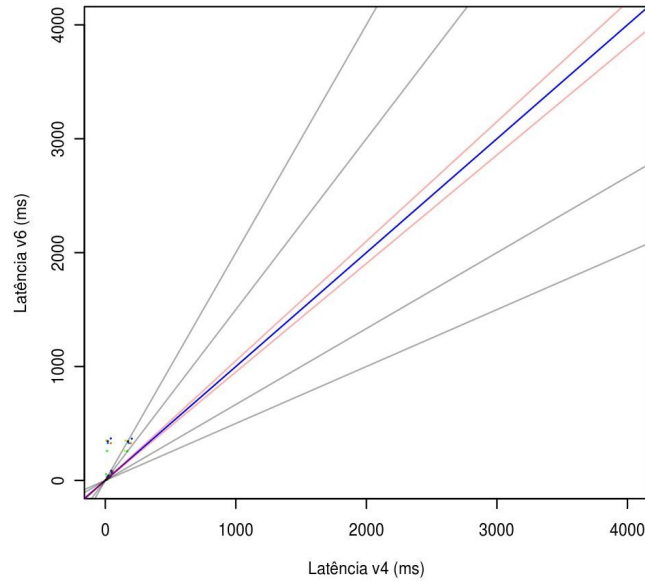


Color Scale for clients

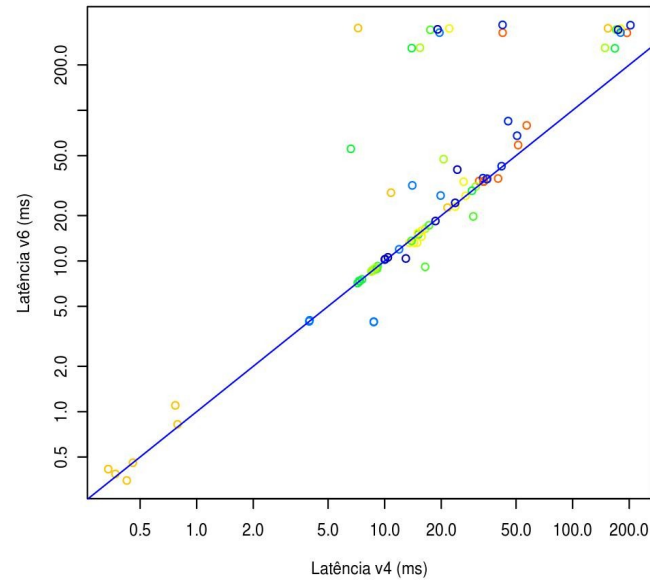


Todos os sites de BR e clientes de BR

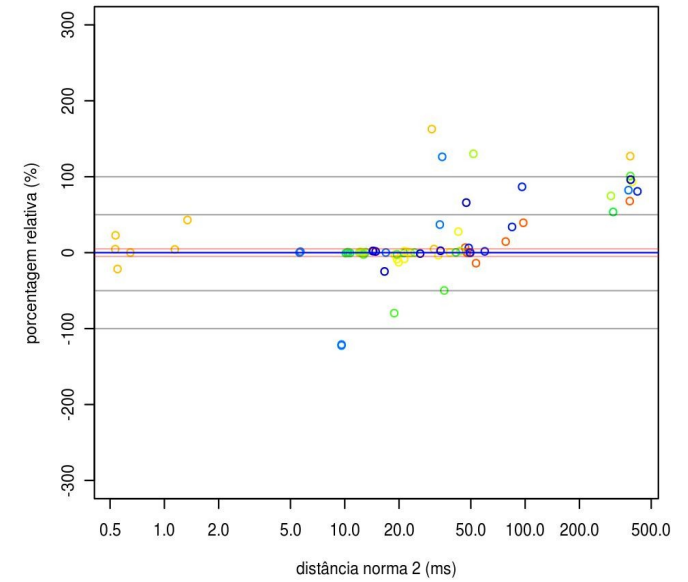
Distribuição linear v4xv6 separado por cliente de origem



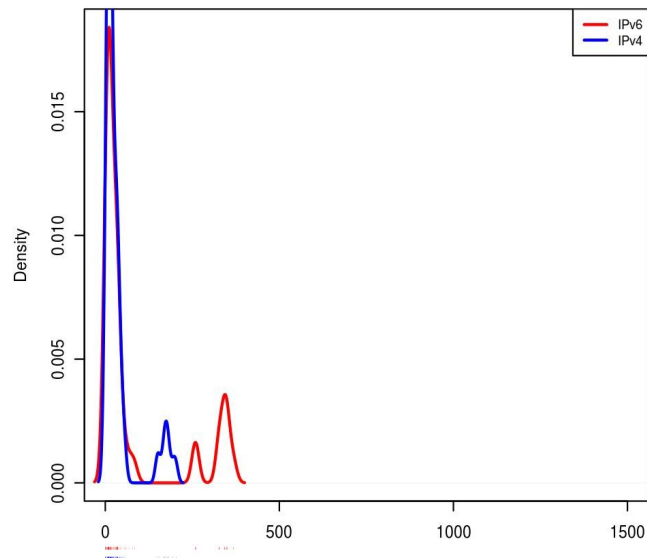
Distribuição logarítmica v4xv6 separado por cliente de origem



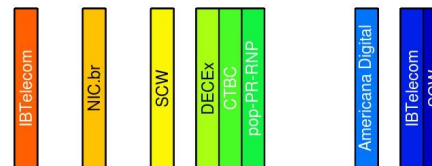
Distribuição radial v4xv6 separado por cliente de origem



Distribuição RTT v4 e v6 (ms)

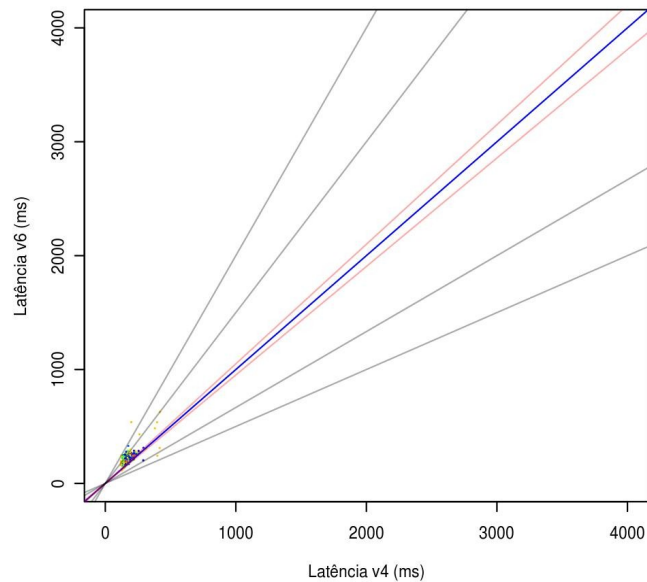


Color Scale for day hour and clients

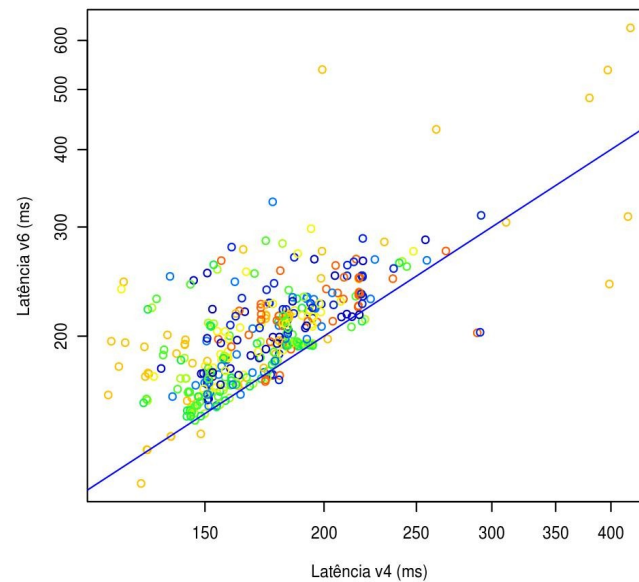


Todos os sites de US e clientes de BR

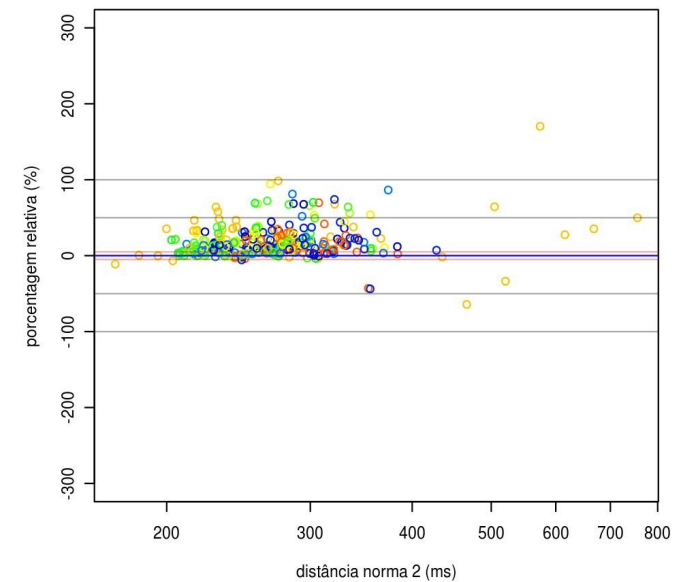
Distribuição linear v4xv6 separado por cliente de origem



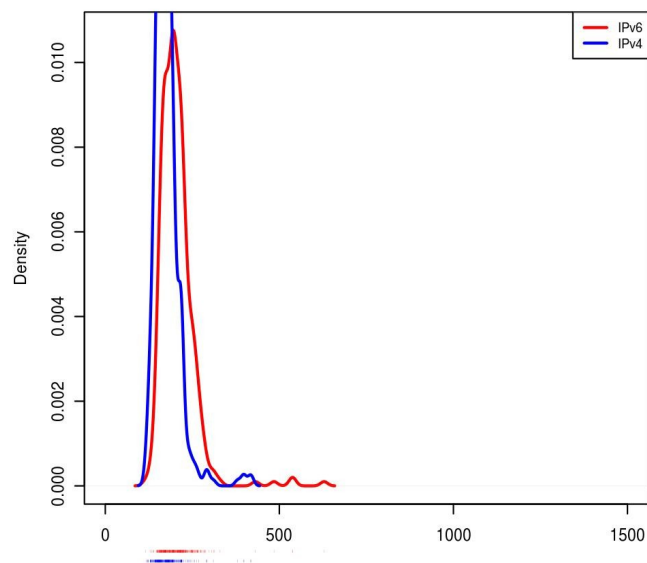
Distribuição logarítmica v4xv6 separado por cliente de origem



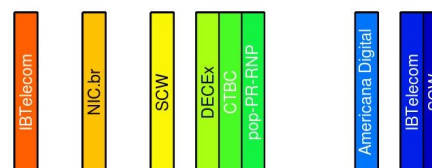
Distribuição radial v4xv6 separado por cliente de origem



Distribuição RTT v4 e v6 (ms)

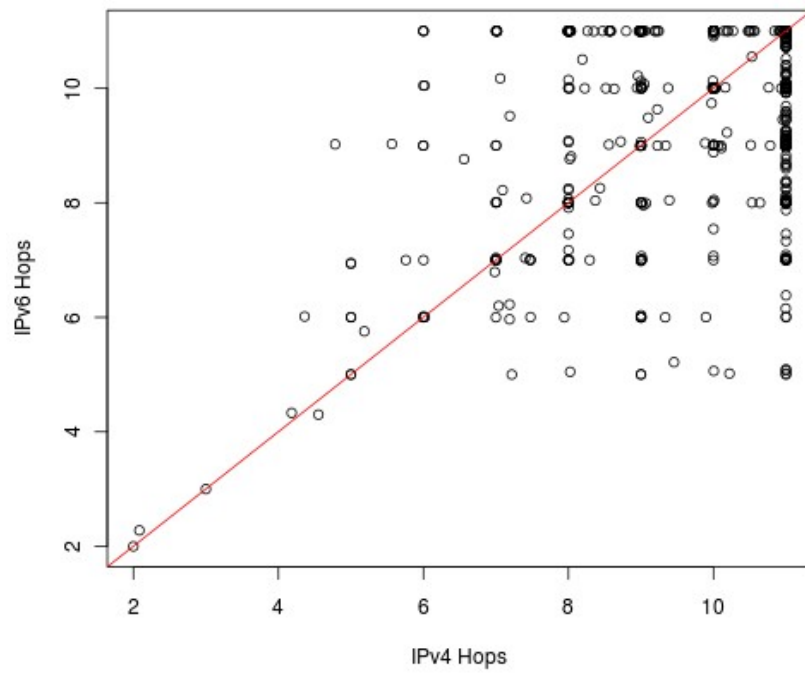


Color Scale for day hour and clients

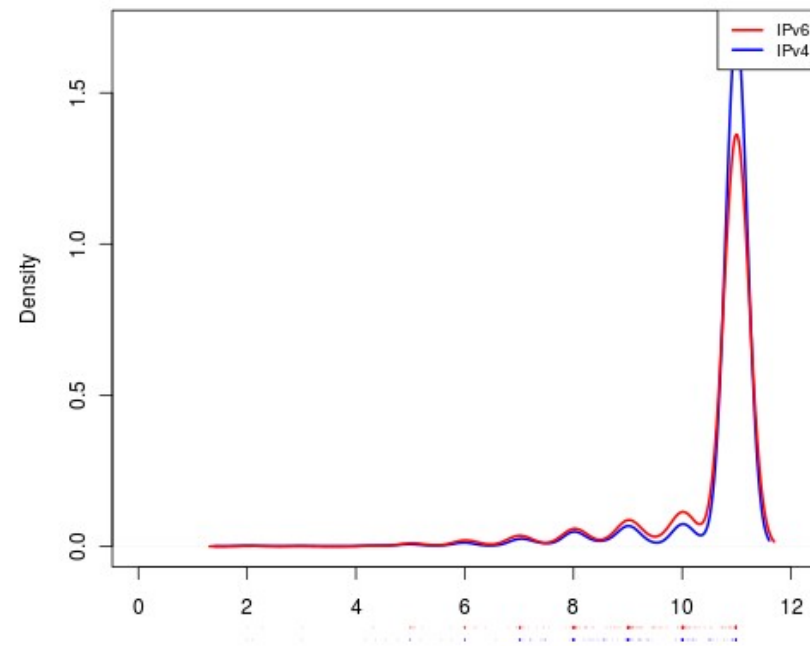


Number of hops for each site and client

Average number of hops for each client and site



Number of hops for each client and site



Comments and questions

- Good news: in the general picture, IPv6 is production quality!
- Not so good news: “production quality” for IPv6 and IPv4 could be a bit alike and better...
- Yes, it seems we do have a problem with Brazilian upstreams and specific destinations, for example US. Why? We do not know yet.
- Why IPv4 is worst sometimes? Why so many differences in the hop number (routes) comparing v4 and v6?

Next steps...

You can access the data:

<http://labs.ceptro.br/ccl-ipv6>

<http://labs.ceptro.br/simonv6>

We can discuss it:

napla@lacnic.net

lactf@lacnic.net

You can host a measurement point,
and/or help us integrate this with SIMON.

Antonio M. Moreiras

moreiras@nic.br

ipv6@nic.br