

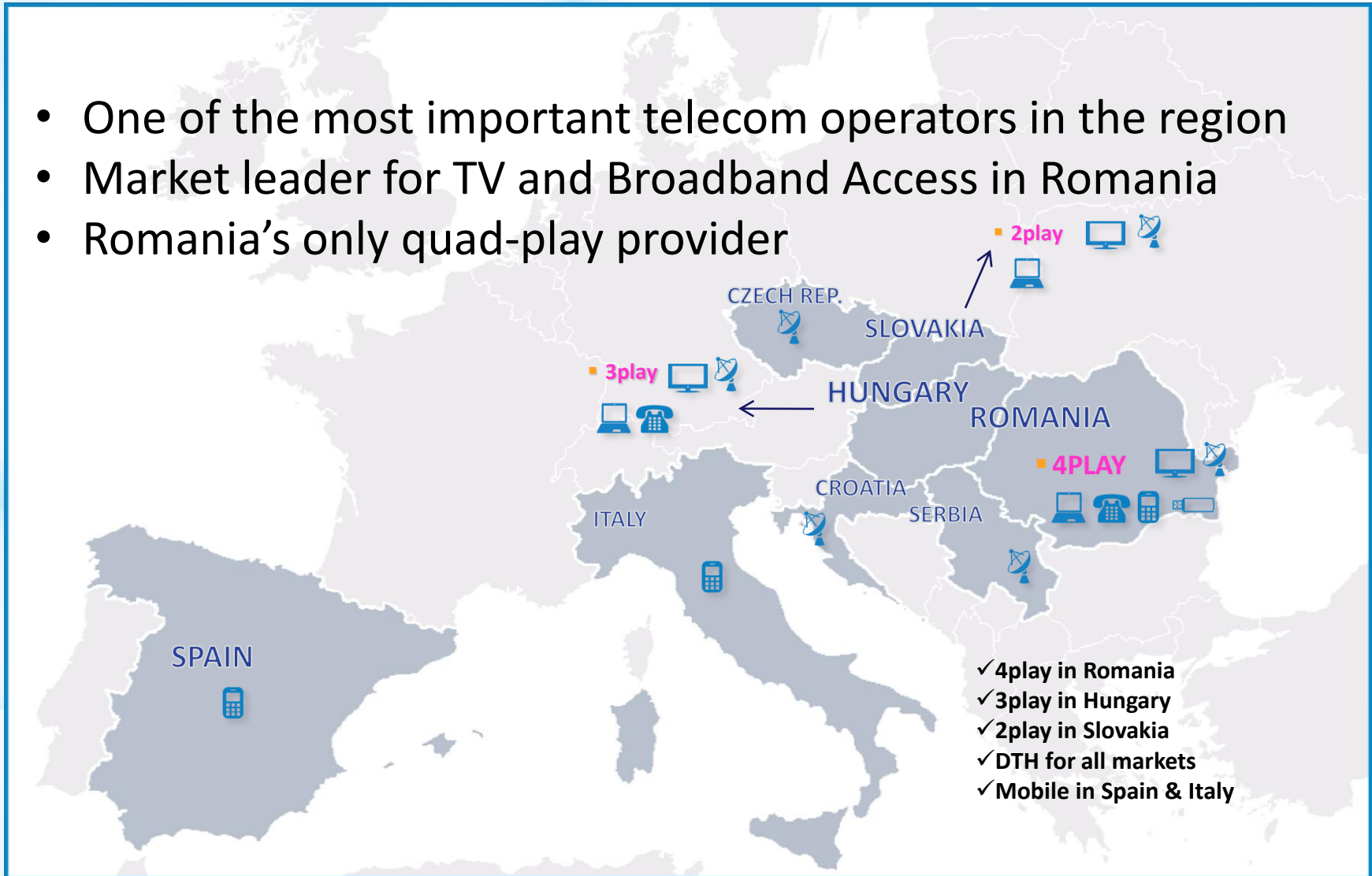
Implementing IPv6 in RCS & RDS Network



Liviu Pislaru
Chief Architect for IPv6


RCS & RDS: Who Are We ?

- One of the most important telecom operators in the region
- Market leader for TV and Broadband Access in Romania
- Romania's only quad-play provider



 Cable TV

 Satellite TV

 Broadband Access

 Mobile Data

 Fixed

 Mobile

IPv6: Why?

- Digi Net Fiberlink:
 - 1,5 Million customers
 - 750.000 simultaneously used IP addresses
 - 920.000 allocated IPv4 addresses
 - 82% usage rate
- Most recent allocation from RIPE (27th of April):
5.12.0.0/14 (262.144 IPv4 addresses)

Valid from 2012-04-27T09:14:42 to 2012-06-05T00:00:00.

[Show all fields](#)

inetnum: 5.12.0.0/14

netname RO-RDS-20120427

org ORG-RA18-RIPE

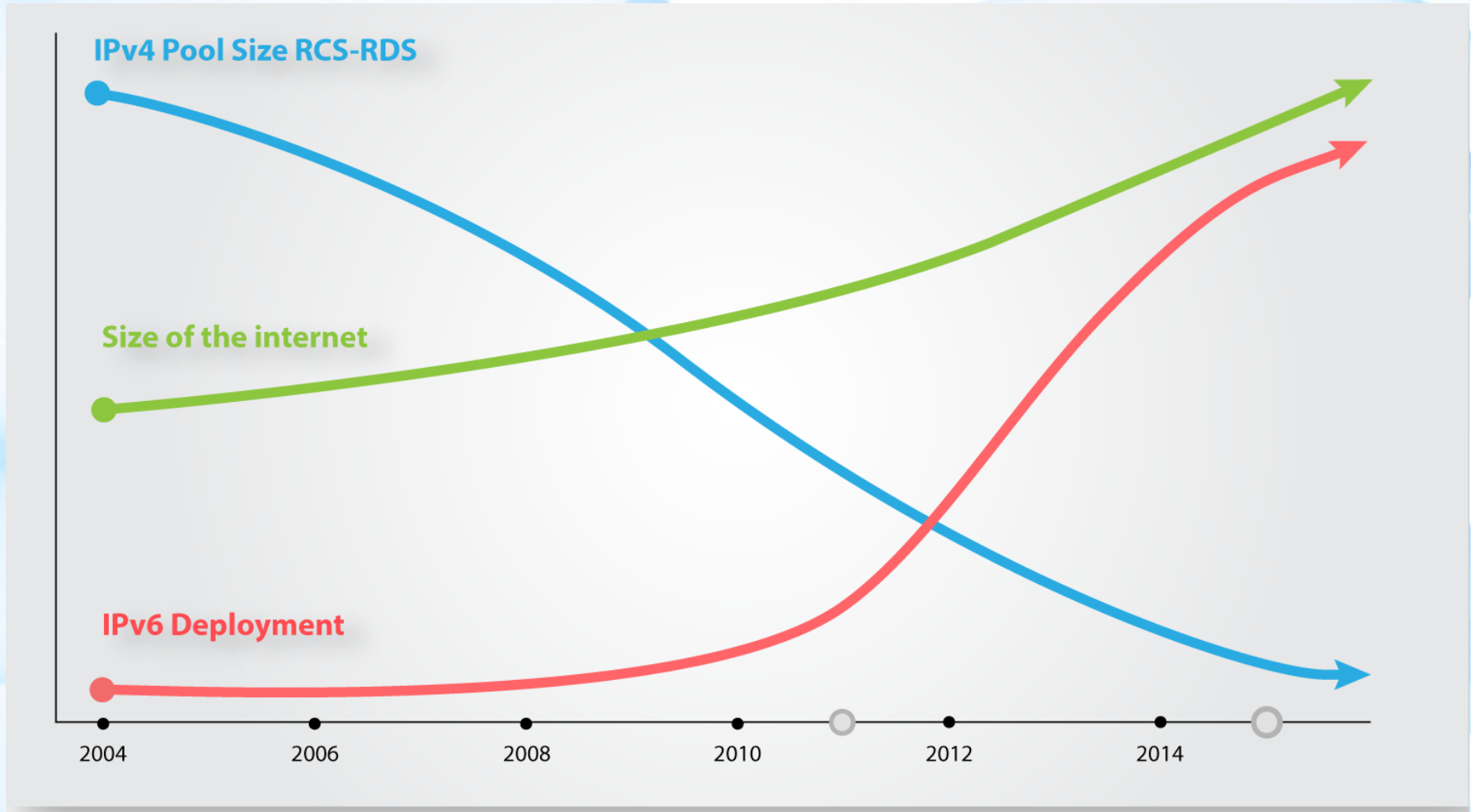
descr RGS & RDS SA

country RO

status ALLOCATED PA

mnt-by RIPE-NGG-HM-MNT

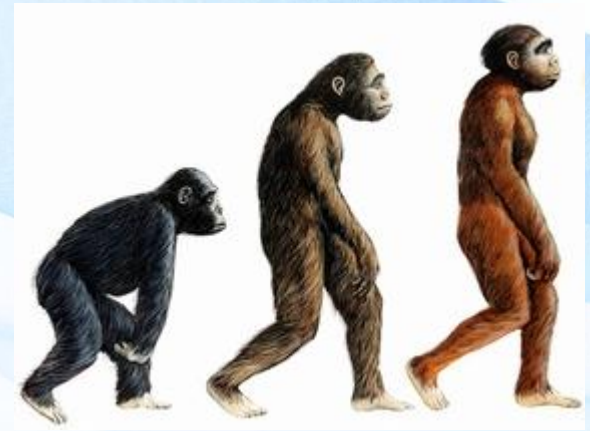
IPv6: Hopes & Expectations



Source of inspiration for graph: Geoff Huston's article "The End of IPv4 , Part 2"

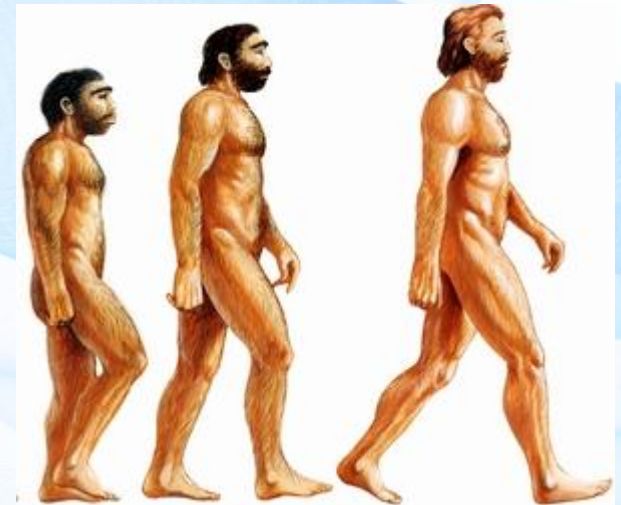
IPv6: History

- July 2003: our first IPv6 allocation from RIPE (::/32)
- 2006: first IPv6 peers in AMS-IX
- October 2008: DS turned on for backbone team in Bucharest
- March 2009: first IPv6 peering setup with Google
- June 2009: IPv6 enabled in DECIX, LINX & VIX (~500 current peering sessions in all IXs)
- July 2009: full IPv6 BGP routing table



IPv6: History

- 2010: Tested/ Qualified/ Shortlisted IP Routers with DS support: Cisco 6500, Cisco 7600, Cisco ASR9K, Cisco CRS & Juniper MX
- 2010: Built IPv6 addressing plan and exchanged the `::/32` prefix for a `::/28` prefix
- September 2010: Dual-stack enabled in Core & Distribution; still testing 6PE and 6VPE
- October 2011: Pilot project start-up
- April – May 2012: IPv6 mass deployment



IPv6: Deployment details



- Our goal: “IPv6 for every residential customer”
- Virtual IPv6 Team
- IGP: OSPFv2 & OSPFv3
- PPPoE Authentication
- Distributed, redundant, flexible and scalable BNG System
- DIY Business model
- DHCPv6 Prefix Delegation (RFC 3769)
- ::/64 Dynamic Prefix
- Biggest issue: Lack of IPv6 support on CPEs



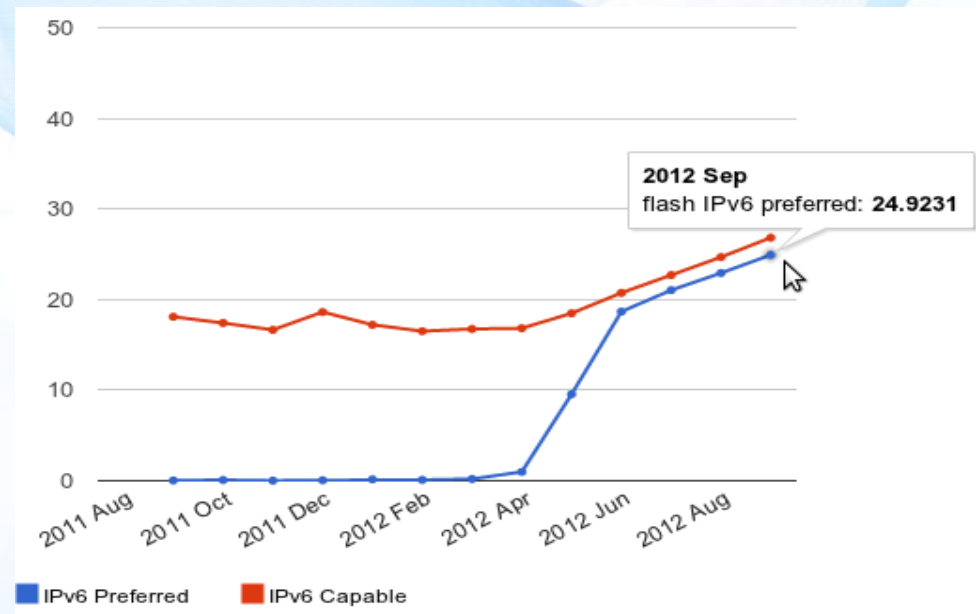
RCS & RDS: Start-up

- October 10th, 2011 (press release)
- “IPv6 test” – Start-up program
- Program available in 20 large cities in Romania
- Signup from customer portal
- 12.000 customers registered for IPv6 test in less then 6 months
- IPv6 dedicated section on www.rcs-rds.ro



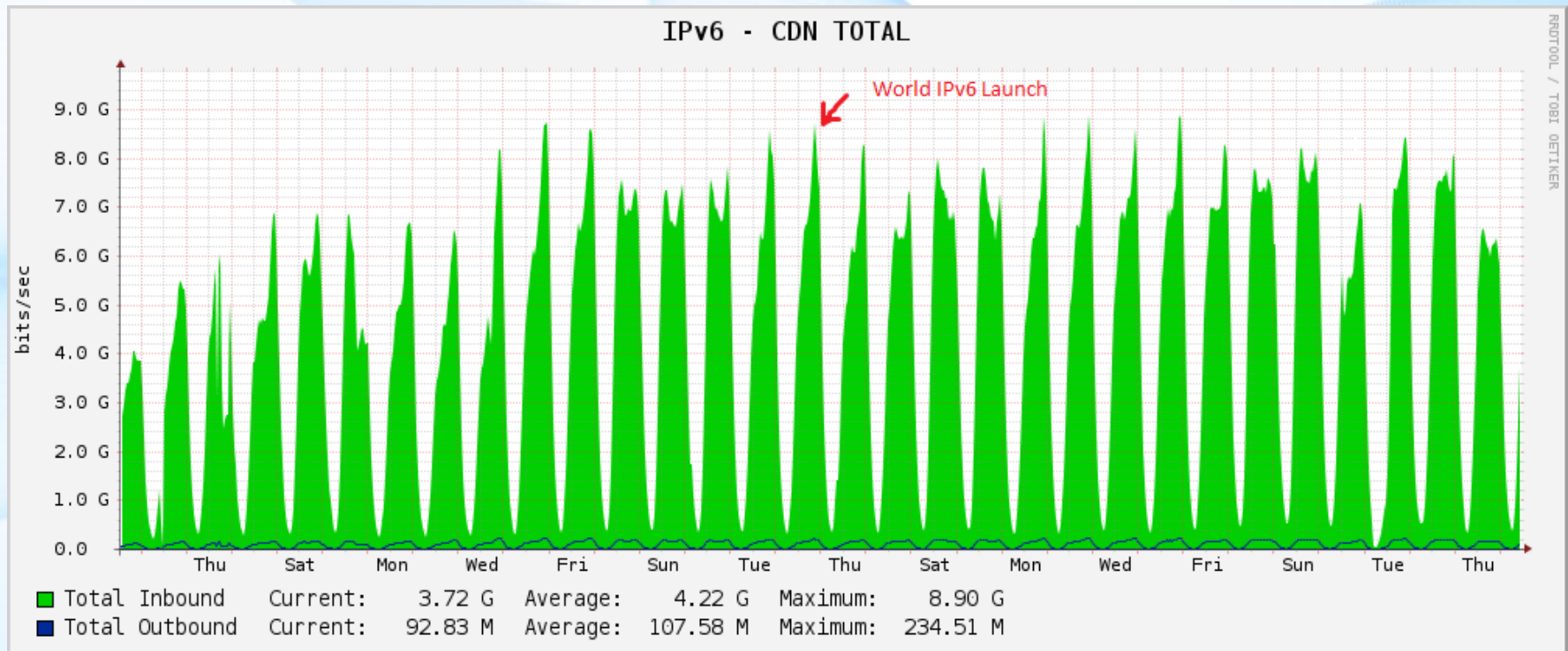
RCS & RDS: Follow-up

- IPv6 test pilot ends successfully in April 2012
- Starting May 2012 RCS & RDS offers IPv4 & IPv6 native dual stack unofficially
- June 6th, 2012: World IPv6 Launch
- IPv6 adoption rate percent evolution:
 - March 2012: 0,2%
 - April 2012: 0,98%
 - May 2012: 9,55%
 - June 2012: 18,6%
 - Sept 2012: 24.92%



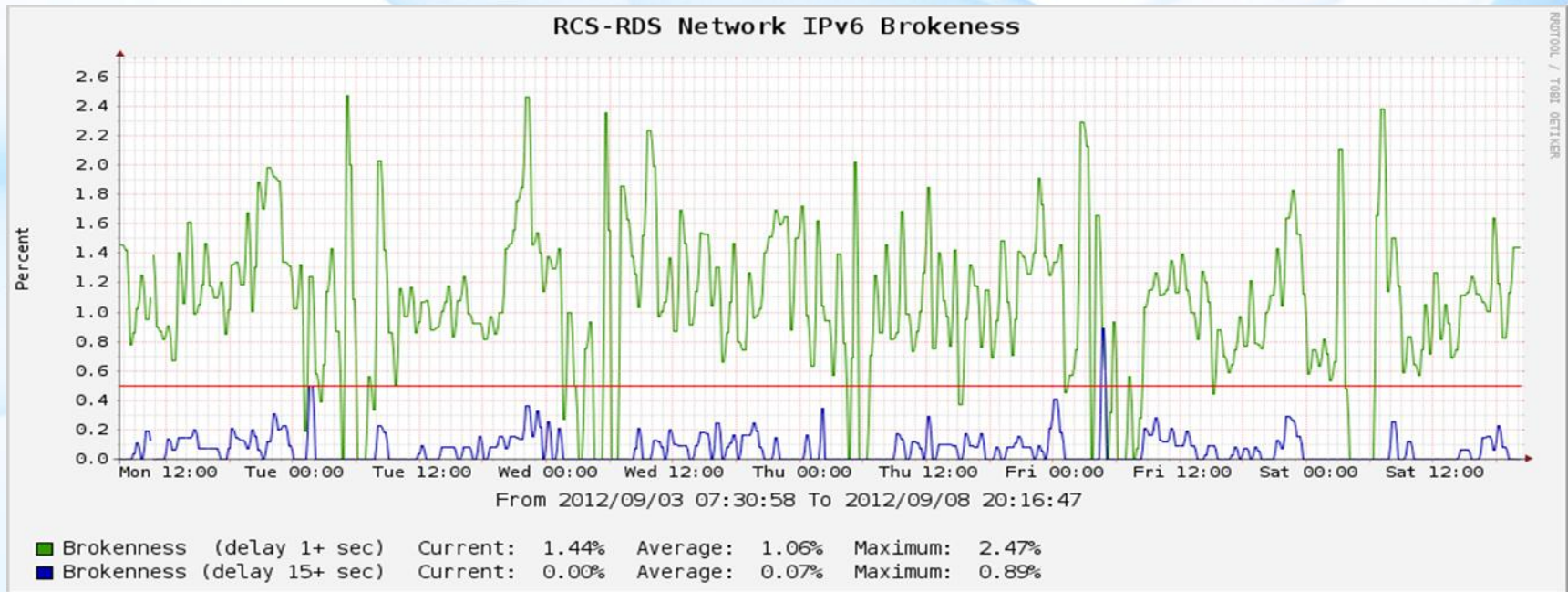
World IPv6 Launch: CDN

- IPv6 CDN traffic: Google (95%) & Akamai (5%)



World IPv6 Launch: CDN

- Google detected v6 brokenness and blacklisted our DNSes
 - Connection flapping on customer side (Link Local problem)
 - BGPv6 sessions down between IOS and Quagga



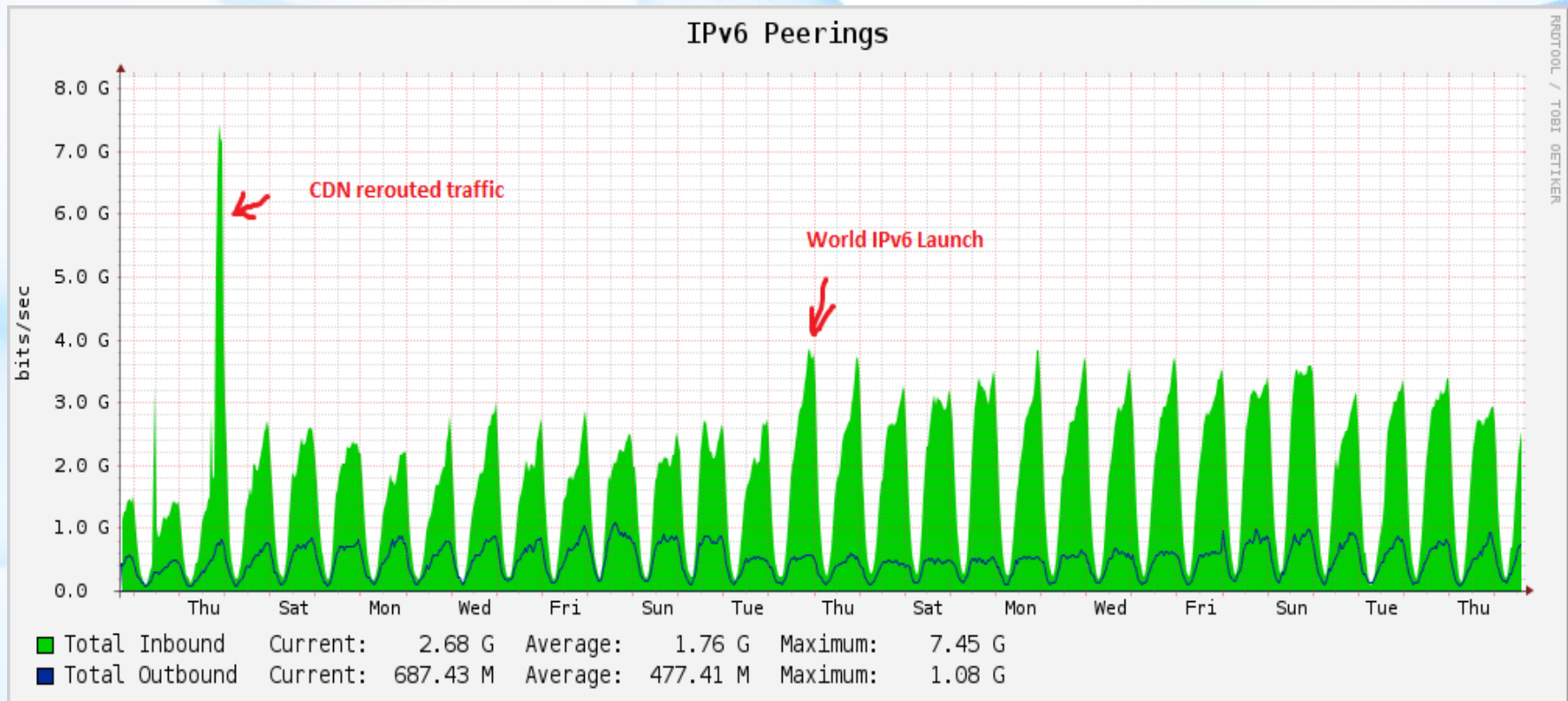
World IPv6 Launch: Traffic flow

- Akamai's v6 traffic not entirely served from our own data center and we have to pay for it !

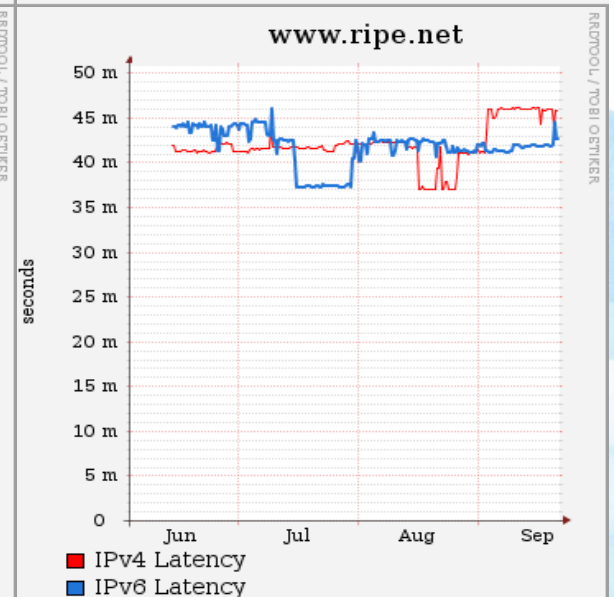
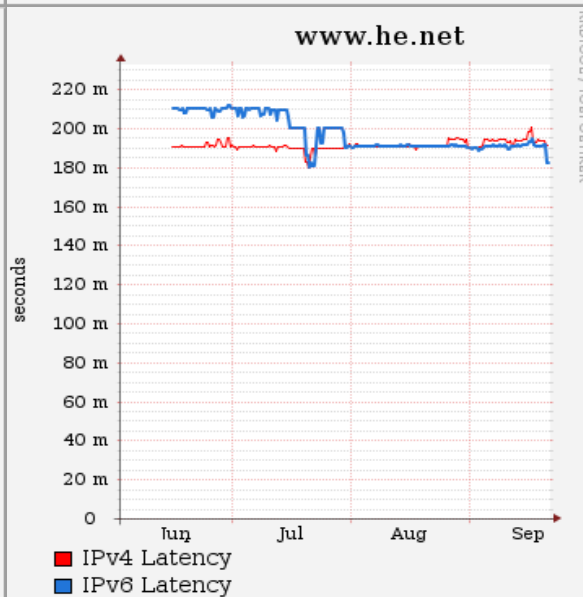
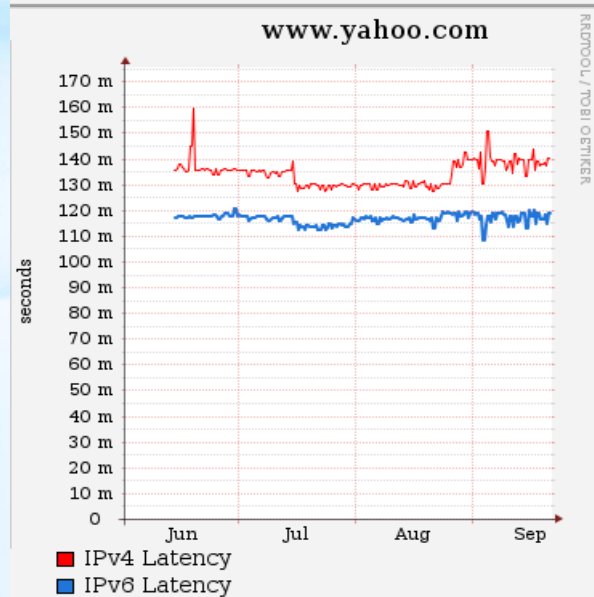
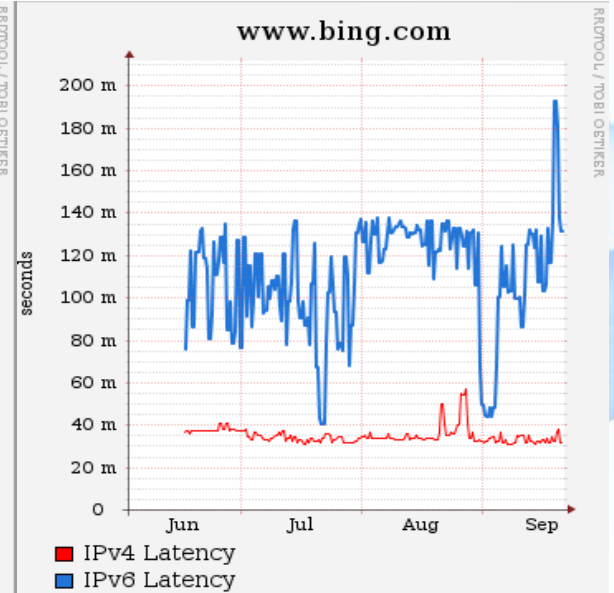
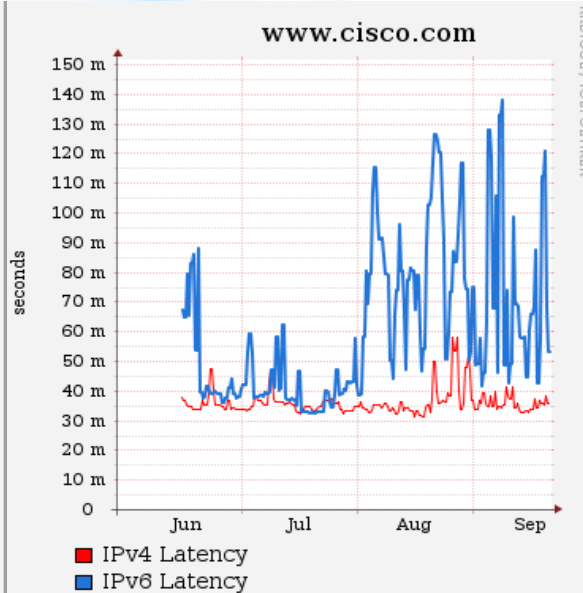
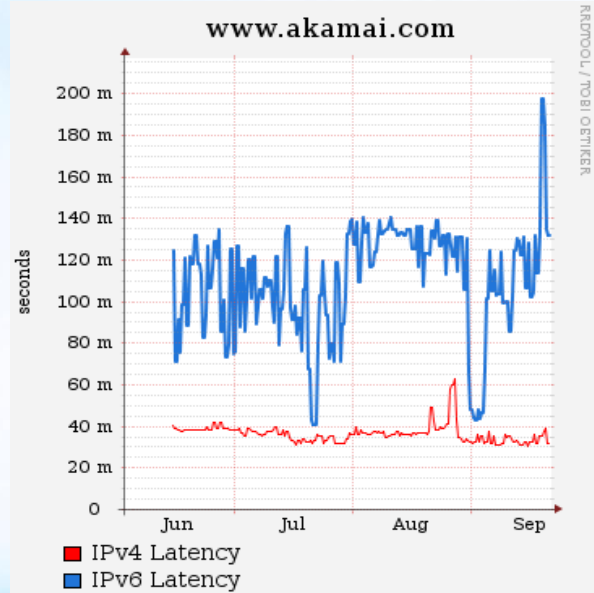
Remote				
6 (9)	www.facebook.com	2a03:2880:2110:3f01:face:b00c::	[Hide]	
		2a03:2880:2110:3f02:face:b00c::		
		69.171.247.53		
6 (52)	static.ak.fbcdn.net	2a02:2f01:30:3::51c4:1ab0	[+3]	
6 (10)	external.ak.fbcdn.net	2a02:2f01:30:3::51c4:1a93	[+3]	
6 (5)	creative.ak.fbcdn.net	2a02:2f01:30:3::51c4:1aa2	[+3]	
6 (5)	pixel.facebook.com	2a03:2880:2110:3f02:face:b00c:0:2	[+1]	
6 (62)	profile.ak.fbcdn.net	2a02:2f01:30:3::51c4:1a98	[+3]	
6 (2)	photos-g.ak.fbcdn.net	2001:2030:0:6::50ef:c81a	[+4]	
6 (3)	a4.sphotos.ak.fbcdn.net	2a02:26f0:11::5c7b:44a1	[+5]	
6 (5)	a3.sphotos.ak.fbcdn.net	2a02:26f0:11::5c7b:446b	[+4]	
6 (2)	a2.sphotos.ak.fbcdn.net	2a02:26f0:11::5c7b:44ab	[+9]	
6 (2)	a6.sphotos.ak.fbcdn.net	2a02:2f01:30:3::51c4:1ab9	[+3]	
6 (5)	a7.sphotos.ak.fbcdn.net	2a02:26f0:7::5c7b:4192	[+7]	
6 (2)	a8.sphotos.ak.fbcdn.net	2a02:26f0:7::5c7b:418a	[+10]	
6 (3)	a5.sphotos.ak.fbcdn.net	2a02:2f01:30:3::51c4:1a9b	[+3]	
6 (2)	a1.sphotos.ak.fbcdn.net	2a02:26f0:11::5c7b:44a9	[+5]	
6 (1)	photos-f.ak.fbcdn.net	2001:2030:0:6::50ef:c80b	[+4]	
6 (1)	photos-c.ak.fbcdn.net	2001:2030:0:6::50ef:c823	[+3]	

World IPv6 Launch: Peerings

- Traffic increased on peering connections
- Latency also increased













World IPv6 Launch: Latency



IPv6 Adoption Rate: per ISP

- Measurements: June.2012 -> Sept.2012

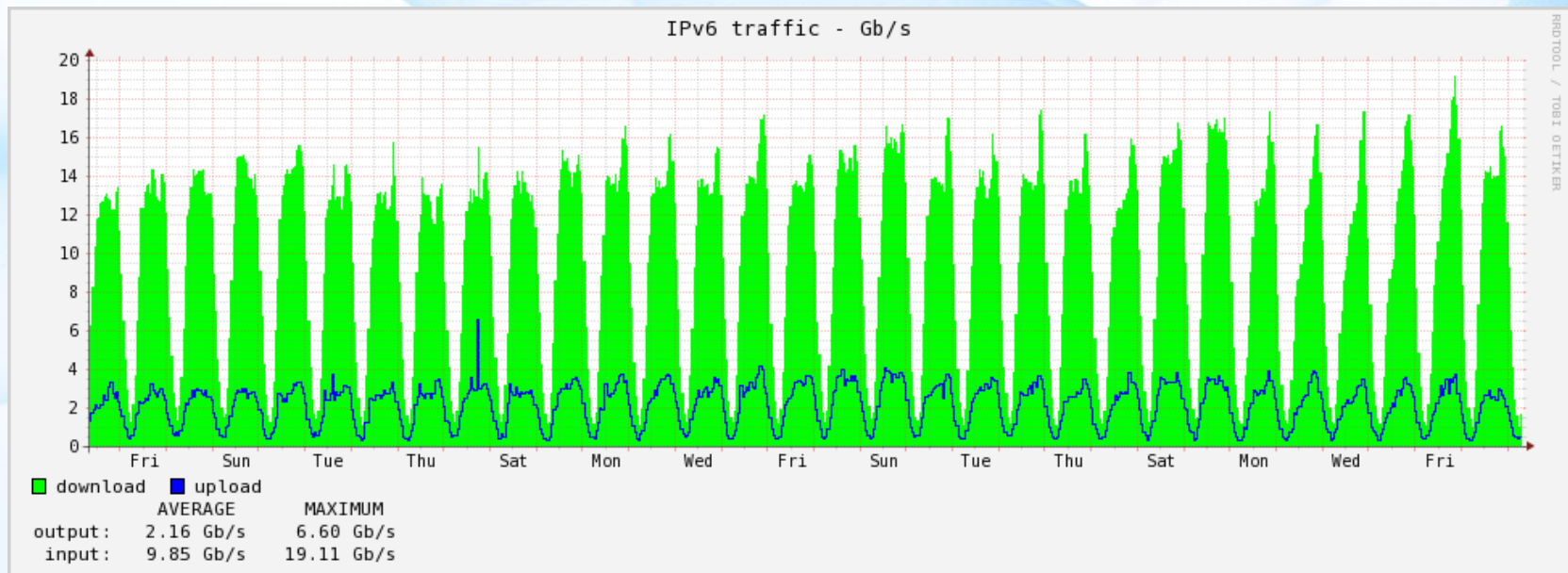
- RCS & RDS: 18.6% -> 24.92%
- KDDI Corp (JP): 17.5 % -> 20,64%
- PROXAD Free (FR): 15.27 -> 16,00%
- AT&T (US): 5,95% -> 10.77%

Economy	ASN	Details	Current Monthly v6pref	Average samples/mo
RO	AS8708	RDSNET RCS & RDS S.A.	 24.9231	27257
JP	AS2516	KDDI KDDI CORPORATION	 20.6460	9332
FR	AS12322	PROXAD Free SAS	 16.0024	17655
JP	AS18126	CTCX Chubu Telecommunications Company, Inc.	 11.7506	1476
US	AS7018	ATT-INTERNET4 - AT&T Services, Inc.	 10.7741	5922
CN	AS4808	CHINA169-BJ CNCGROUP IP network China169 Beijing Province Network	 2.5763	10255
US	AS7132	SBIS-AS - AT&T Internet Services	 2.2255	7718
US	AS7922	COMCAST-7922 - Comcast Cable Communications, Inc.	 1.8202	17684
DE	AS13184	HANSENET HanseNet Telekommunikation GmbH	 1.6713	3945
CN	AS17816	CHINA169-GZ China Unicom IP network China169 Guangdong province	 1.2618	3251

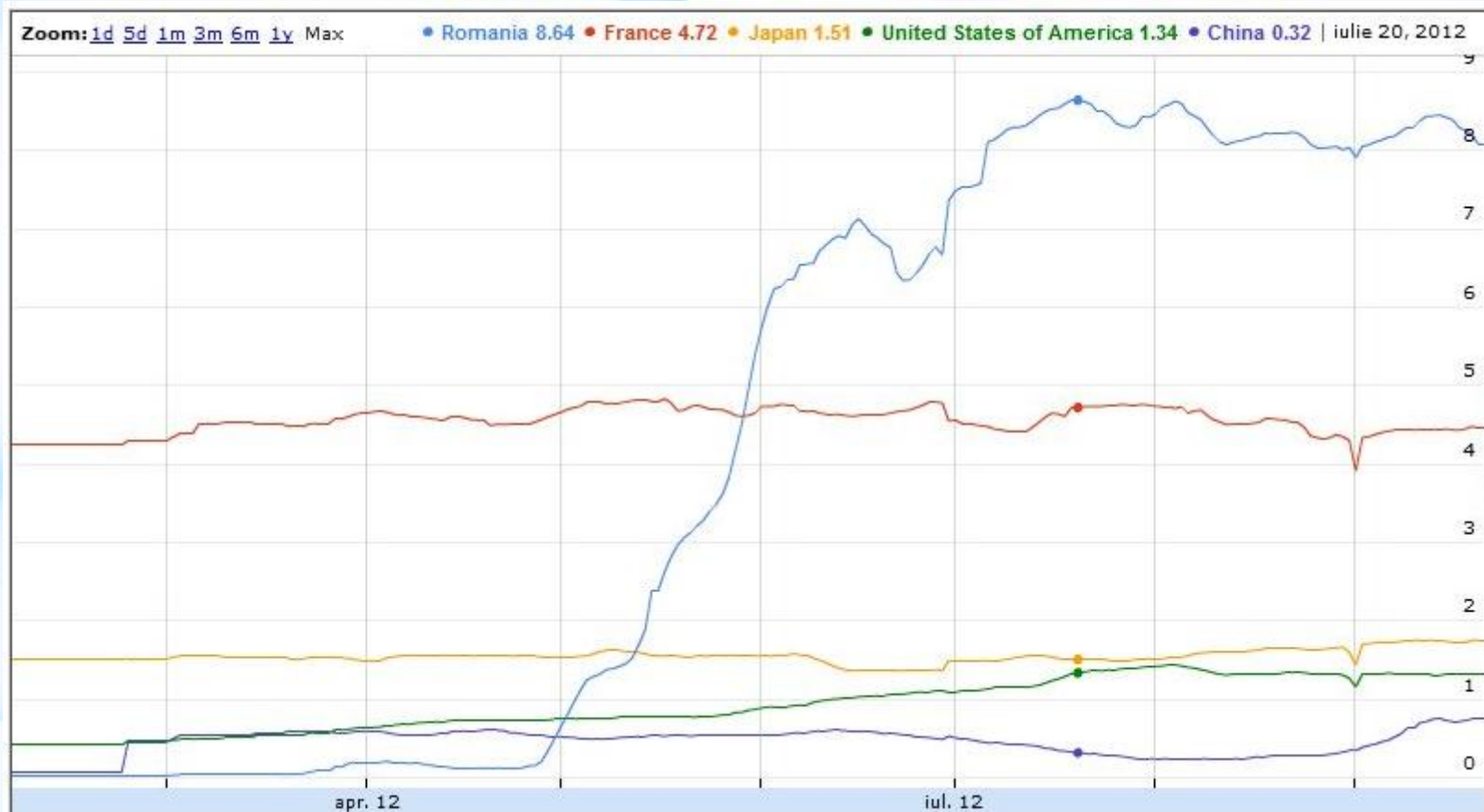
IPv6 Adoption Rate: per ISP


We almost reached 20G of IPv6 traffic:

- CDN, especially Google (~ 10Gbps)
- IPv6 peerings (~6Gbps)
- RDS network / client2client (~3Gbps)



IPv6 Adoption Rate: per country



- Reference period: Feb – Sept 2012
- Source: 


IPv6 Adoption Rate: per country

Economy	v6pref ▼	3month avg hits/month
RO	7,40%	98229
FR	4,03%	111408
LU	2,59%	1502
EU	2,14%	12283
JP	1,75%	119748
SI	1,07%	3730
CN	1,01%	633488
US	1,01%	135567

<- June 2012

September 2012 ->

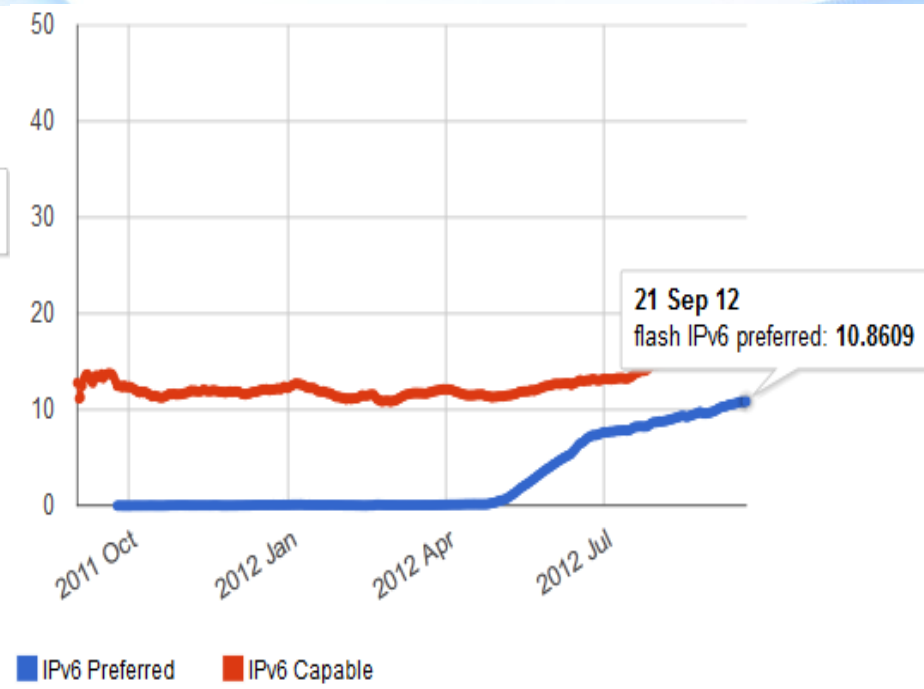
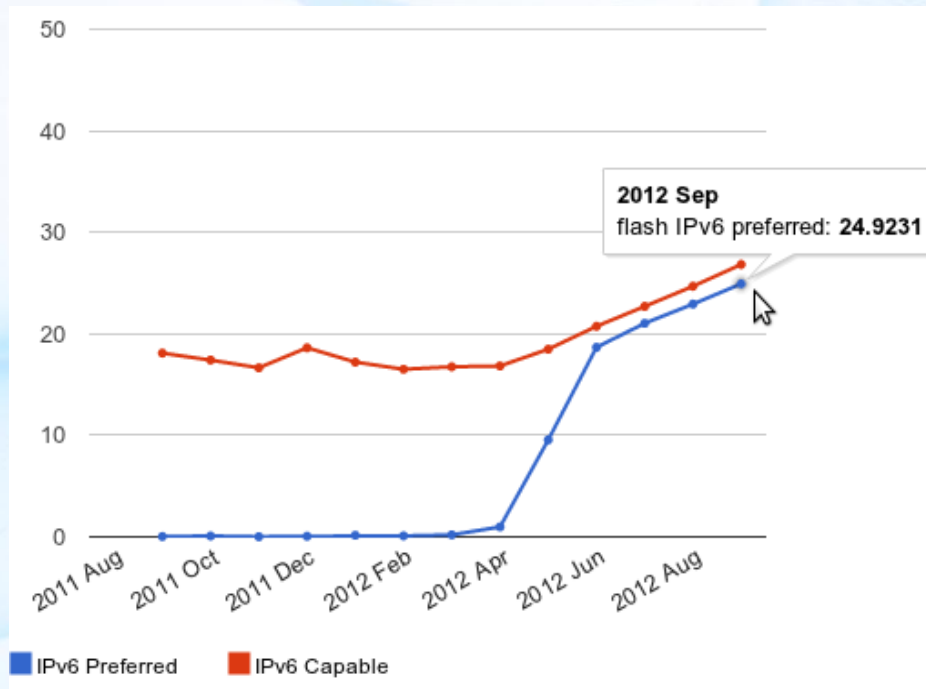
Economy	v6pref ▼	3month avg hits/month
RO	10.94%	71846
EU	7.27%	440
FR	4.30%	100707
LU	3.50%	1365
JP	2.39%	221336
US	1.71%	186401
SI	1.16%	9760
CH	1.09%	10212


- Reference period: June – September 2012
- Source:  **APNIC**

IPv6 Adoption Rate: Romania

RCS & RDS: 24.92%

Romania: 10.86 %



- Reference period: September 2012
- Source:  **APNIC**

Conclusions:

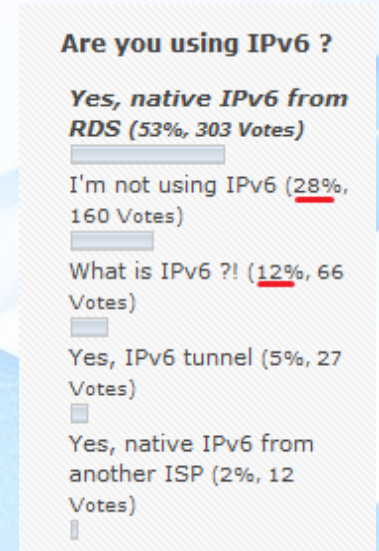
IPv6 transition in RCS & RDS was smooth. Some customers didn't realize they are actually using IPv6

Short term plans (end of this year):

- replace `::/64` with `::/56` for residential customers
- provide IPv6 to all customers (B2B)

Long term plans:

- Delay as much as possible any sort of CGN



Questions?