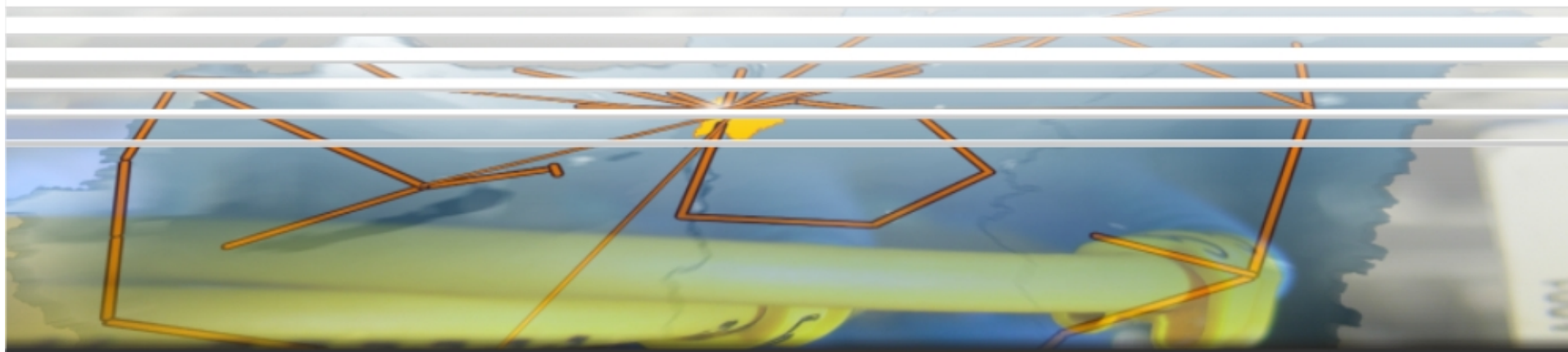


World IPv6 day experiences

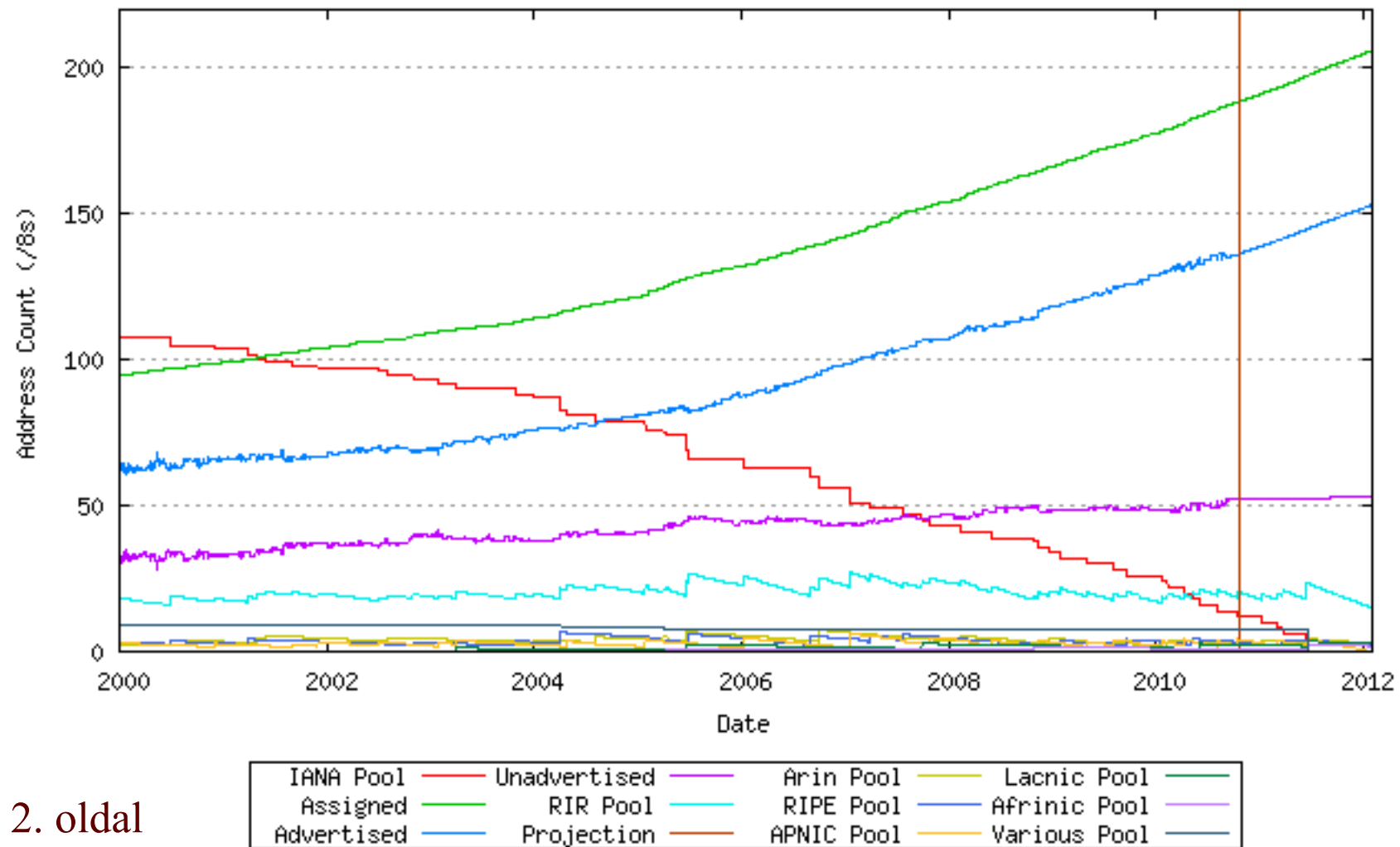


9th June 2011.

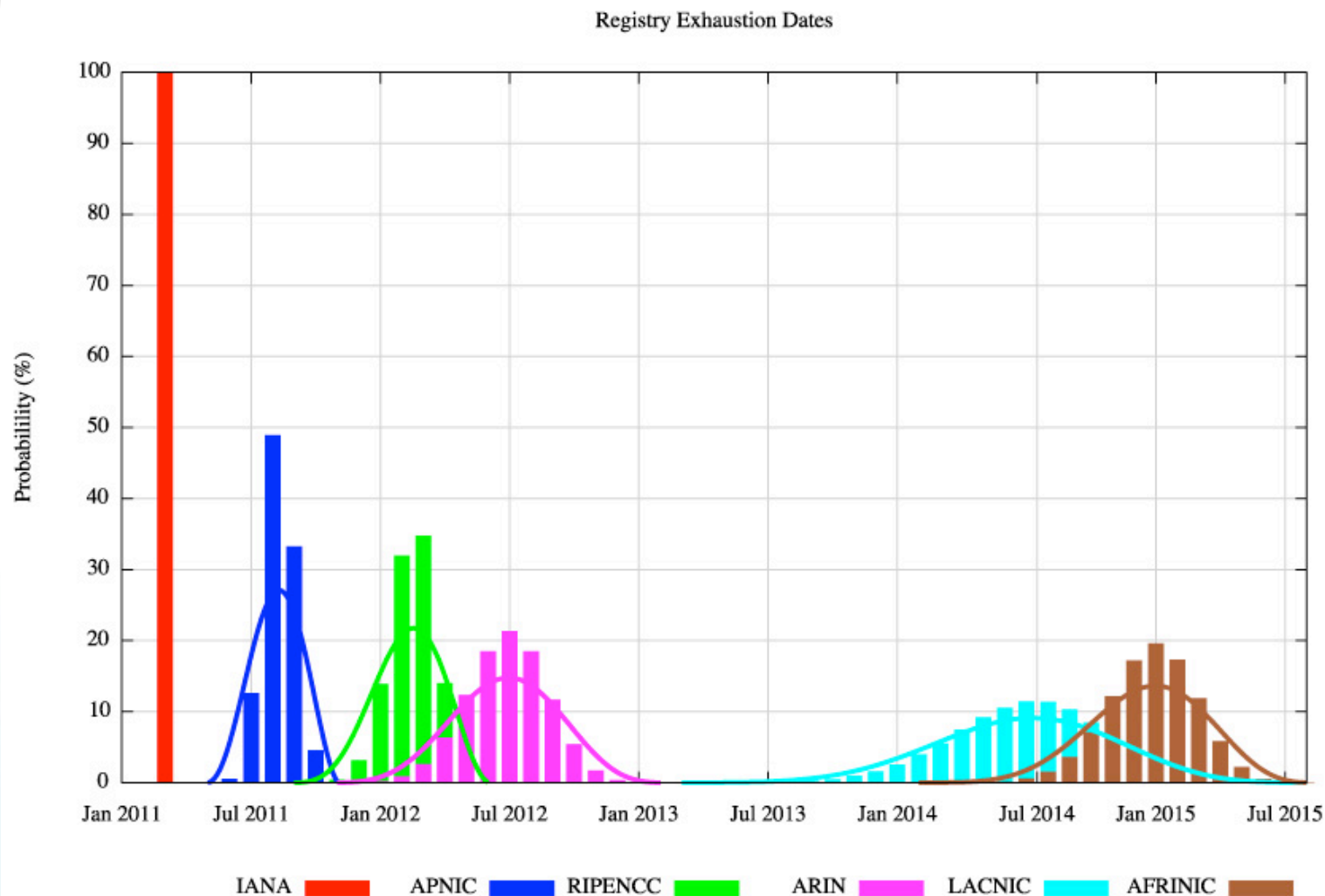
Mohácsi János
NIIF Institute



IP address run-out – Geoff Huston

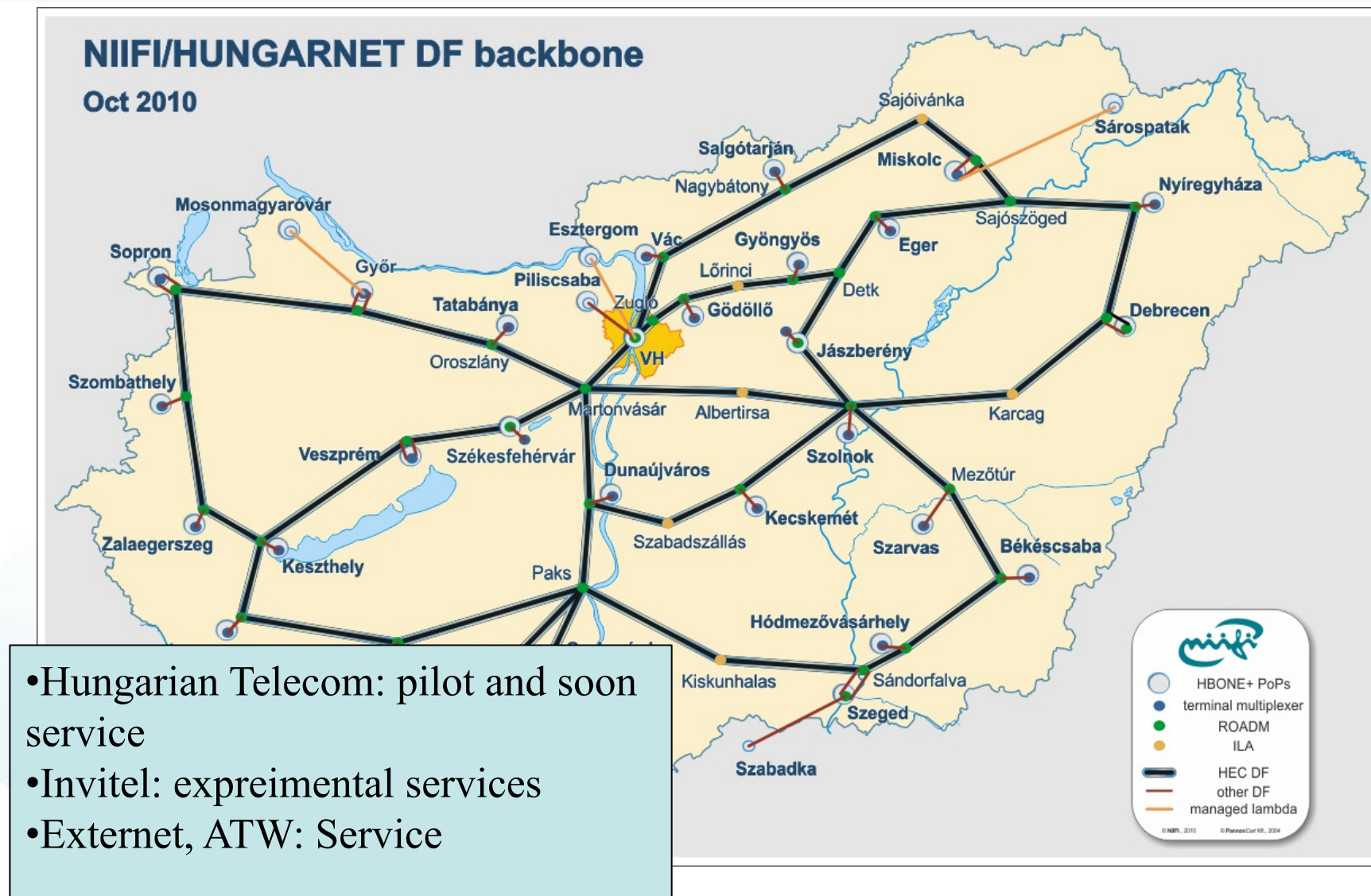


Address run out – dates /2



Forrás: Geoff Huston – 2011

NIIF Hungarnet IPv6 topology - 2011



IPv6 deployment in Hungary – traffic-level

SixXS - IPv6 Deployment & Tunnel Broker :: Ghost Route Hunter : IPv6 DFP visibility : All

http://www.sixxs.net/tools/grh/dfp/all/?sort=country

Most Visited Latest Headlines Apple News Macintosh Wiki Current FreeBSD pro... Hungarian Unix Portal FEDERICA [Federate... ZipTie.org GanttProject: Home thinkbroadband :: Br... opentracker - An op...

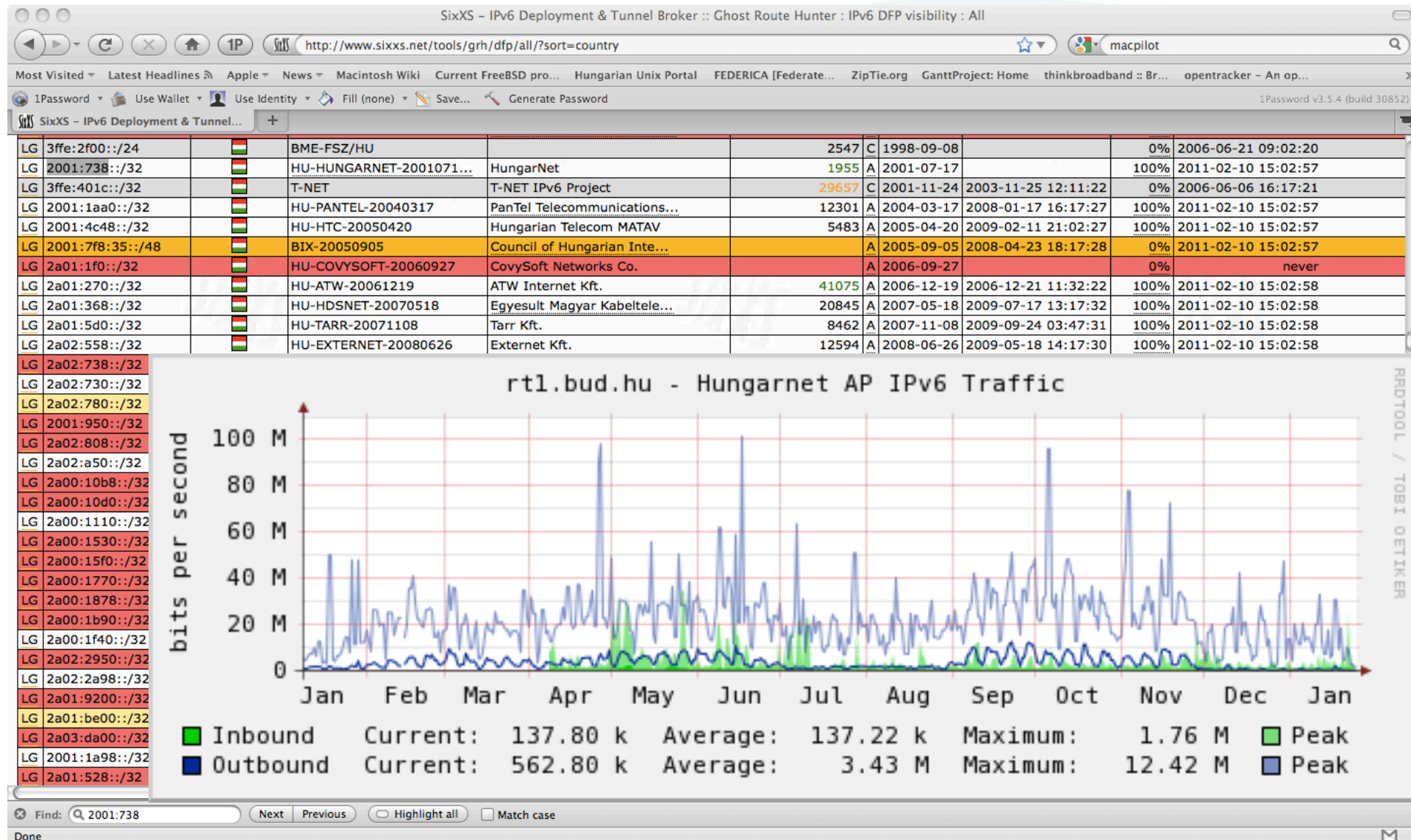
1Password Use Wallet Use Identity Fill (none) Save... Generate Password 1Password v3.5.4 (build 30852)

LG	3ffe:2f00::/24		BME-FSZ/HU		2547	C	1998-09-08		0%	2006-06-21 09:02:20
LG	2001:738::/32		HU-HUNGARNET-2001071...	HungarNet	1955	A	2001-07-17		100%	2011-02-10 15:02:57
LG	3ffe:401c::/32		T-NET	T-NET IPv6 Project	29657	C	2001-11-24	2003-11-25 12:11:22	0%	2006-06-06 16:17:21
LG	2001:1aa0::/32		HU-PANTEL-20040317	PanTel Telecommunications...	12301	A	2004-03-17	2008-01-17 16:17:27	100%	2011-02-10 15:02:57
LG	2001:4c48::/32		HU-HTC-20050420	Hungarian Telecom MATAV	5483	A	2005-04-20	2009-02-11 21:02:27	100%	2011-02-10 15:02:57
LG	2001:7f8:35::/48		BIX-20050905	Council of Hungarian Inte...		A	2005-09-05	2008-04-23 18:17:28	0%	2011-02-10 15:02:57
LG	2a01:1f0::/32		HU-COVYSOFT-20060927	CovySoft Networks Co.		A	2006-09-27		0%	never
LG	2a01:270::/32		HU-ATW-20061219	ATW Internet Kft.	41075	A	2006-12-19	2006-12-21 11:32:22	100%	2011-02-10 15:02:58
LG	2a01:368::/32		HU-HDSNET-20070518	Egyesult Magyar Kabeltele...	20845	A	2007-05-18	2009-07-17 13:17:32	100%	2011-02-10 15:02:58
LG	2a01:5d0::/32		HU-TARR-20071108	Tarr Kft.	8462	A	2007-11-08	2009-09-24 03:47:31	100%	2011-02-10 15:02:58
LG	2a02:558::/32		HU-EXTERNET-20080626	Externet Kft.	12594	A	2008-06-26	2009-05-18 14:17:30	100%	2011-02-10 15:02:58
LG	2a02:738::/32		HU-INTERWARE-2008090...	InterWare Ltd.		A	2008-09-01	2008-11-06 14:02:37	0%	2010-08-17 02:47:43
LG	2a02:730::/32		HU-DENINET-20080901	Deninet KFT	29278	A	2008-09-01	2009-05-27 06:17:31	100%	2011-02-10 15:02:58
LG	2a02:780::/32		HU-HOFF-20080910	HostOffice Informatikai S...	47885	A	2008-09-10	2008-09-17 02:18:01	96%	2011-02-10 15:02:58
LG	2001:950::/32		HU-JASMIN-20080926	Jasmin Media Group zRt.		A	2008-09-26		0%	never
LG	2a02:808::/32		HU-PRTELECOM-2008121...	PR-TELECOM Rt.	35311	A	2008-12-17		0%	never
LG	2a02:a50::/32		HU-AHOL-20090217	HunNet Kft	20742	A	2009-02-17	2010-03-12 08:02:38	100%	2011-02-10 15:02:58
LG	2a00:10b8::/32		HU-IPPARK-20090707	IP-Park Kft.		A	2009-07-07	2010-01-22 16:17:36	0%	2011-02-04 14:32:54
LG	2a00:10d0::/32		HU-DATANET-20090709	GTS - DataNet Telecommuni...		A	2009-07-09		0%	never
LG	2a00:1110::/32		HU-WESTEL900-2009071...	T-Mobile Hungary Telecomm...	5513	A	2009-07-16	2009-10-02 14:02:33	100%	2011-02-10 15:02:58
LG	2a00:1530::/32		HU-BUSINESSSTEL-20091...	Business Telecom Kft.		A	2009-10-22		0%	never
LG	2a00:15f0::/32		HU-AZONNAL-20091105	Azonnal Kft.		A	2009-11-05		0%	never
LG	2a00:1770::/32		HU-SZABINET-20091130	UPC Magyarorszag Kft.	6830	A	2009-11-30		0%	never
LG	2a00:1878::/32		HU-PANNON-20091215	Pannon GSM Telecommunicat...		A	2009-12-15		0%	never
LG	2a00:1b90::/32		HU-MAGIC-20100217	RLAN96 Tavkozelesi Szolgal...		A	2010-02-17		0%	never
LG	2a00:1f40::/32		HU-GIGANET-20100415	Giganet Internet Szolgalt...	42864	A	2010-04-15	2010-05-07 12:02:40	100%	2011-02-10 15:02:58
LG	2a02:2950::/32		HU-INFOTECHNA-201011...	Infotechna Ltd.	15566	A	2010-11-12		0%	never
LG	2a02:2a98::/32		HU-UUNET-20101024	Verizon Hungary, Internet...	702	A	2010-11-24	2011-01-07 03:02:50	100%	2011-02-10 15:02:59
LG	2a01:9200::/32		HU-FIBERNET-20110201	FiberNet Communication Co...		A	2011-02-01		0%	never
LG	2a01:be00::/32		HU-DRAVANET-PECS-201...	Dravanet Co Ltd.	21229	A	2011-02-02	2011-02-05 17:47:52	97%	2011-02-10 15:02:58
LG	2a03:da00::/32		HU-DATATRANS-2011020...	Datatrans Internet Ltd		A	2011-02-08		0%	never
LG	2001:1a98::/32		IS-ICENET-20040312	Iceland Telecom	6677	A	2004-03-12	2004-09-17 18:17:15	100%	2011-02-10 15:02:57
LG	2a01:528::/32		IS-ICECELLEHF-200710...	IceCell ehf	44432	A	2007-10-22		0%	never

Find: 2001:738 Next Previous Highlight all Match case

Done

IPv6 deployment in Hungary – traffic-level



IPv6 deployment in Hungary /2

IPv6 Deployment Status

http://www.vyncke.org/ipv6status/detailed.php?country=hu

Most Visited Latest Headlines Apple News Macintosh Wiki Current FreeBSD pro... Hungarian Unix Portal FEDERICA [Federate... ZipTie.org GanttProject: Home thinkbroadband :: Br...

1Password Use Wallet Use Identity Fill (none) Save... Generate Password 1Password v3.5.9 (build 30884)

IPv6 Deployment Status

keprentes.hu whois	04/37424	FAILED	FAILED	FAILED
mindenkilapja.hu whois	65/38070	FAILED	FAILED	FAILED
mav-start.hu whois	66/38460	FAILED	FAILED	FAILED
bme.hu whois	67/38694	FAILED	nic.bme.hu 2001:738:2001:2001::2 2011-02-28	ns.bme.hu nic.bme.hu 2001:738:2001:2001::2 2/3 2011-02-28
tv2.hu whois	68/41294	FAILED	FAILED	FAILED
moovie.hu whois	69/41745	FAILED	FAILED	FAILED
unideb.hu whois	70/72313	FAILED	FAILED	FAILED
niif.hu whois	71/90669	www.niif.hu 2001:738::420:0:0:b 2011-02-28	mail.ki.iif.hu 2001:738::411:0:0:241 2011-02-28	ns2.sztaki.hbone.hu 2001:738::302:0:0:116 1/2 2011-02-28
pte.hu whois	72/121208	FAILED	FAILED	FAILED
eumet.hu whois	73/170096	www.eumet.hu 2001:738::700:0:0:73 2011-03-04	FAILED	ns2.sztaki.hbone.hu kubiak.iif.hu 2001:4c48:2:a000:: 2/3 2011-03-04
uni-miskolc.hu whois	74/198895	www.uni-miskolc.hu 2001:738:6001:b0b0::2000 2011-03-01	gold.uni-miskolc.hu 2001:738:6001:b0b0::2000 2011-03-01	silver.uni-miskolc.hu dns.uni-miskolc.hu hera.iit.uni-miskolc.hu 2001:738:6001:500::4 3/4 2011-03-01
noilapozo.hu whois	75/223472	FAILED	FAILED	FAILED
kfk.hu whois	76/409828	www.kfk.hu 2001:738:5001::2:6 2011-02-28	smtp-in.kfk.hu 2001:738:5001::26 2011-02-28	bifur.rmki.kfk.hu sunserv.kfk.hu ext-dns-2.cern.ch ubul.kfk.hu 2001:738:5001::1 4/6 2011-02-28
karolyrobert.hu whois	77/994541	www.karolyrobert.hu 2001:738:6100::240 2011-02-28	mail.karolyrobert.hu 2001:738:6100::241 2011-03-31	ingate.karolyrobert.hu ns.karolyrobert.hu 2001:738:6100::240 2/3 2011-02-28
inf.u-szeged.hu More whois	/	FAILED	FAILED	FAILED
www.mtmt.hu				ns2.sztaki.hbone.hu

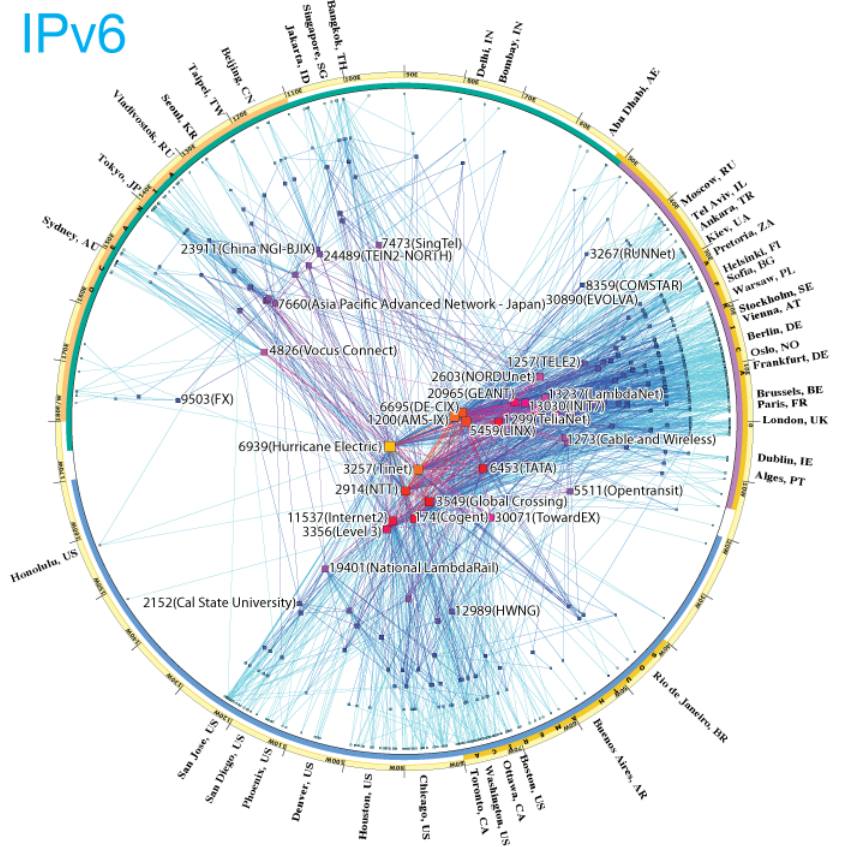
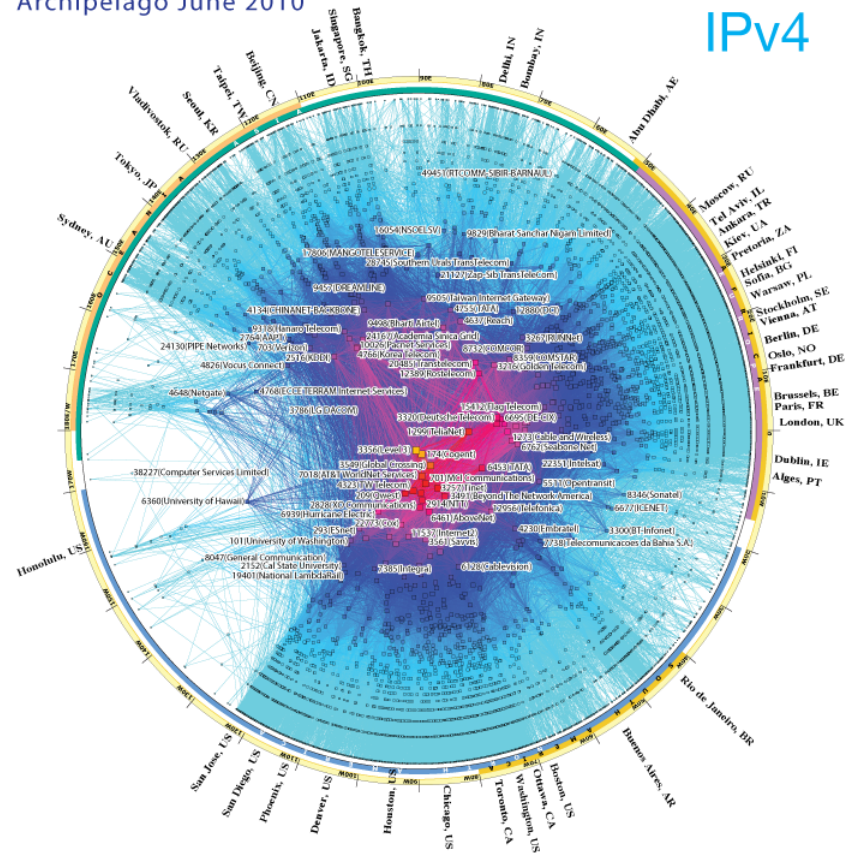
Find: google Next Previous Highlight all Match case

Transferring data from www.vyncke.org...

IPv6 deployment /3

CAIDA's IPv4 & IPv6 AS Core AS-level INTERNET GRAPH

Archipelago June 2010



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World IPv6 day - ISOC

- 8th June 2011. – 24 hour test

<http://isoc.org/wp/worldipv6day/>

- Provide IPv6 service – coordinated!
- Collect experiences
- *"...some of the major organisations that will offer their content over IPv6 for a 24-hour "test flight"....*
- Lots of participants:
 - Google, Facebook, Yahoo!, Akamai, Limelight Networks
 - Cisco, Meebo, Genius, W3C, Universidad Nacional Autonoma de Mexico, Rensselaer Polytechnic Institute, NYI NET, Host Europe, Xiphiastec, Tom's Hardware, NUST School of Electrical Engineering and Computer Science, Twenga, Plurk, Terra (Brazil), Jolokia Networks, Juniper Networks, Microsoft Bing, Gigatux, Voxel, LemonEntry, 2g2u, 2020Media, Vonage, sapo.pt, Tagadab.com, Mercury Z, Outpost10f, Public Interest Registry, Sesame Workshop, Arces

Reaction

- RIPE-Meeting, May 2011
 - Support and fascination
 - dDOS attack against the (production) Internet!
 - “prepare your personal schedule! ...or take a break from the Internet?”

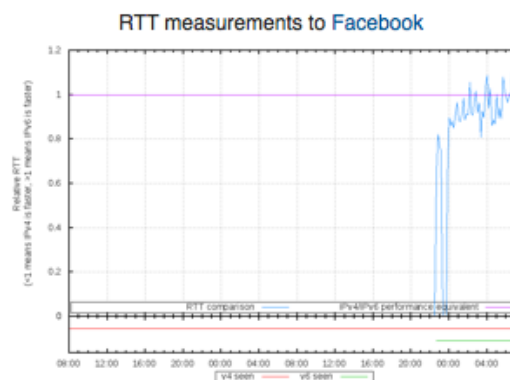
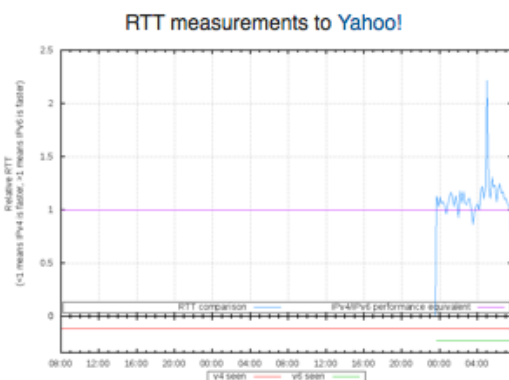
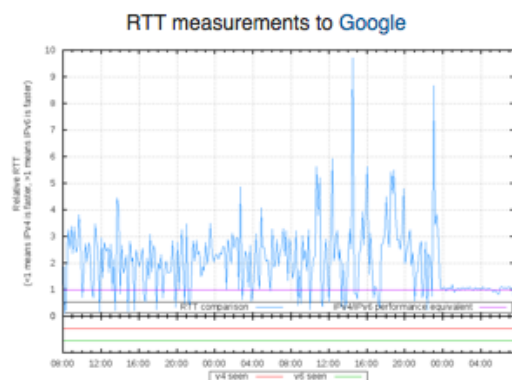
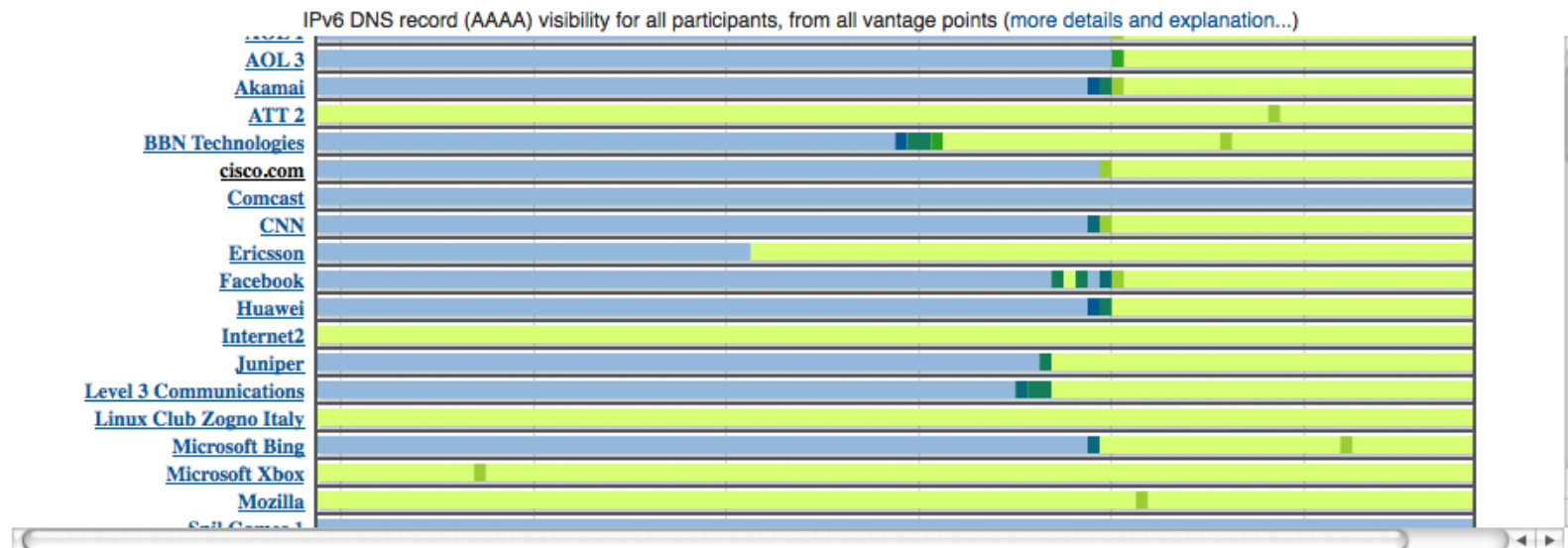
NIIFI preparation

- IPv6 supported since beginning of 2006
- Services are IPv6 ready (mostly)
- Briefing of operators
- Informing the users – for the opportunity
- **IPv6 readiness check**
 - <http://go6.se/check>
 - <http://test-ipv6.com/> and <http://test-ipv6.sth.sze.hu/>
 - <http://netalyzr.icsi.berkeley.edu/m=testv6>

What did work?

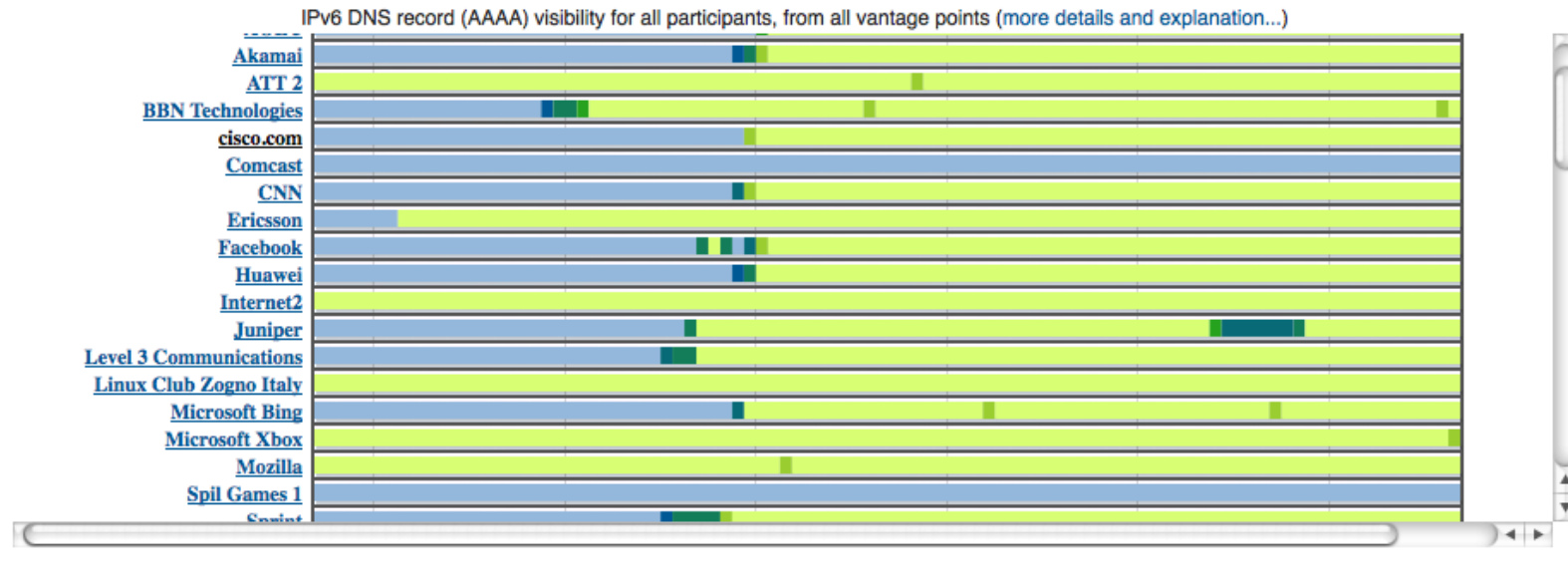
- Google (gmail, picasa, googldocs)
 - Not on IPv6:
 {smtp,imap,pop}.gmail.com
- Youtube
- Facebook
- Cisco (Akamai)
- CNN
- freemail.hu

RIPE IPv6 dashboard - morning

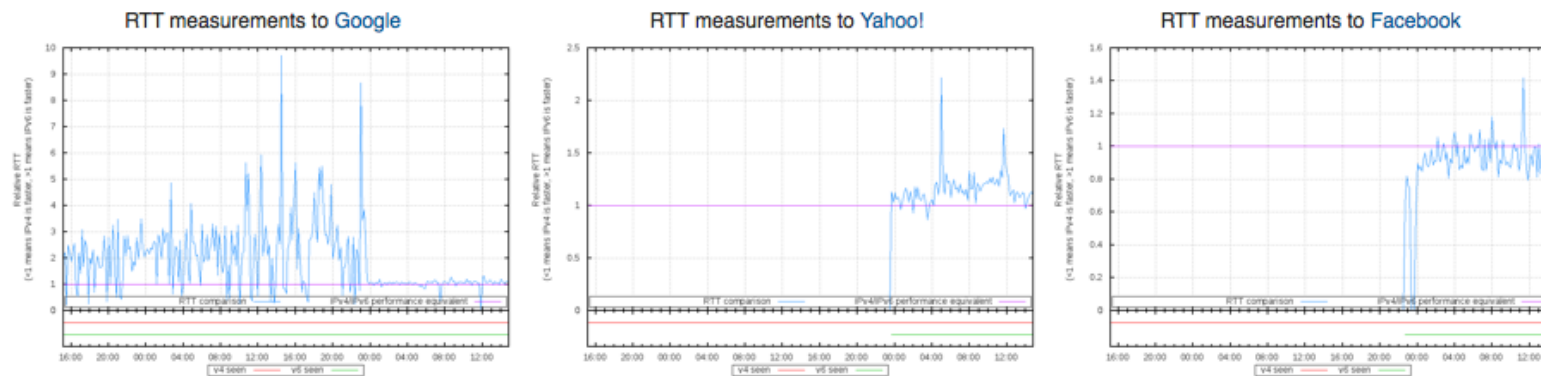


More RTT measurement results...

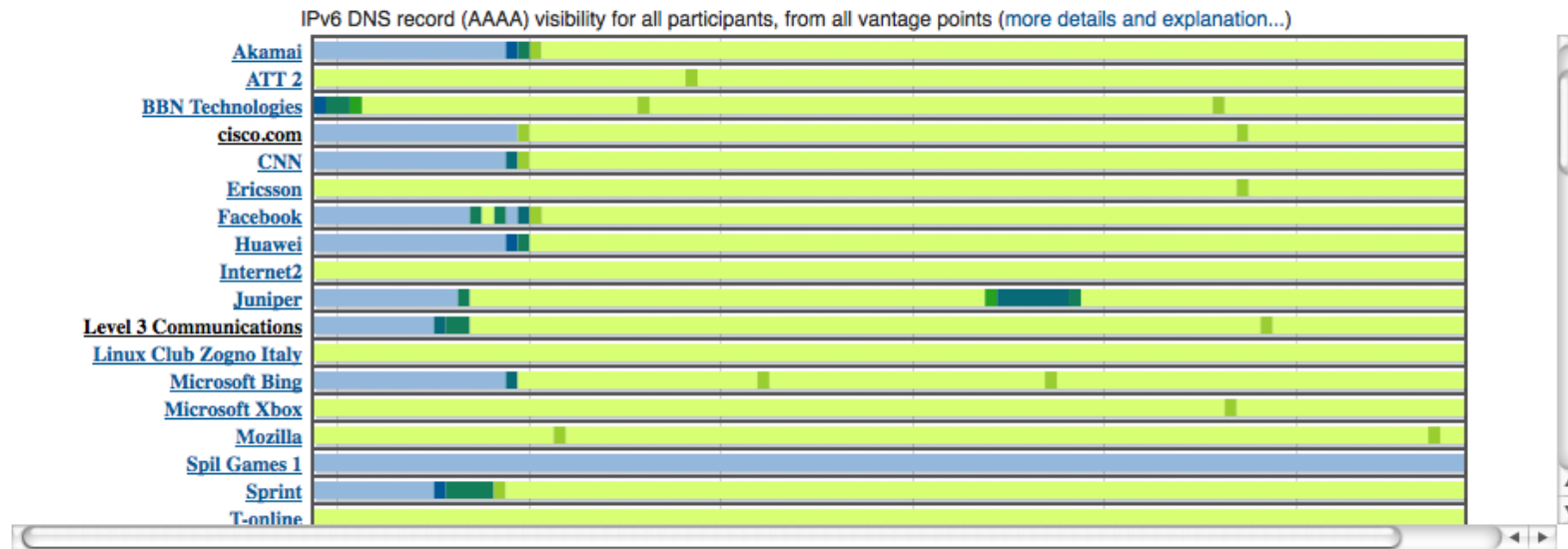
RIPE IPv6 dashboard - afternoon



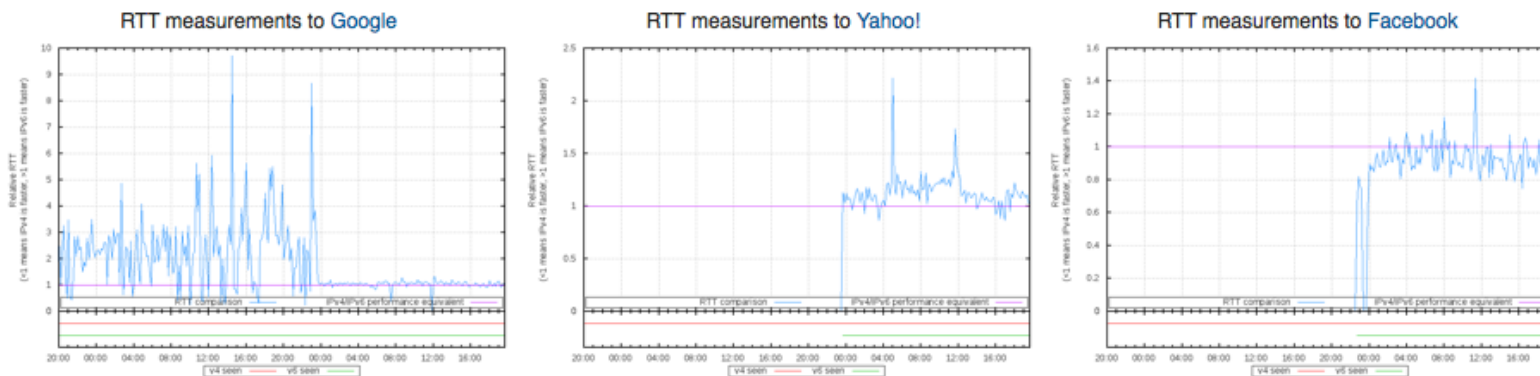
IPv4/IPv6 comparison to some sites (more RTT measurement results and explanation...)



RIPE IPv6 dashboard - evening



IPv4/IPv6 comparison to some sites ([more RTT measurement results and explanation...](#))



Akamai IPv6 statistics - morning

Akamai IPv6 Statistics

225 IPV6 HITS
PER SECOND

IPV6 LATENCY

IPV6 PACKET LOSS

Akamai IPv6 Statistics

225 IPV6 HITS
PER SECOND

IPV6 LATENCY

IPV6 PACKET LOSS

Akamai IPv6 Statistics

8am

225 IPV6 HITS
PER SECOND

IPV6 LATENCY

IPV6 PACKET LOSS

8am 6/6

5pm 6/6

2am 6/7

11am 6/7

8pm 6/7

12am 6/8

7am 6/8

69 hits/sec

59 hits/sec

49 hits/sec

39 hits/sec

30 hits/sec

20 hits/sec

10 hits/sec

59 hits/sec
Peak
(6/8 - 07:30am GMT)

Overall

North America

South America

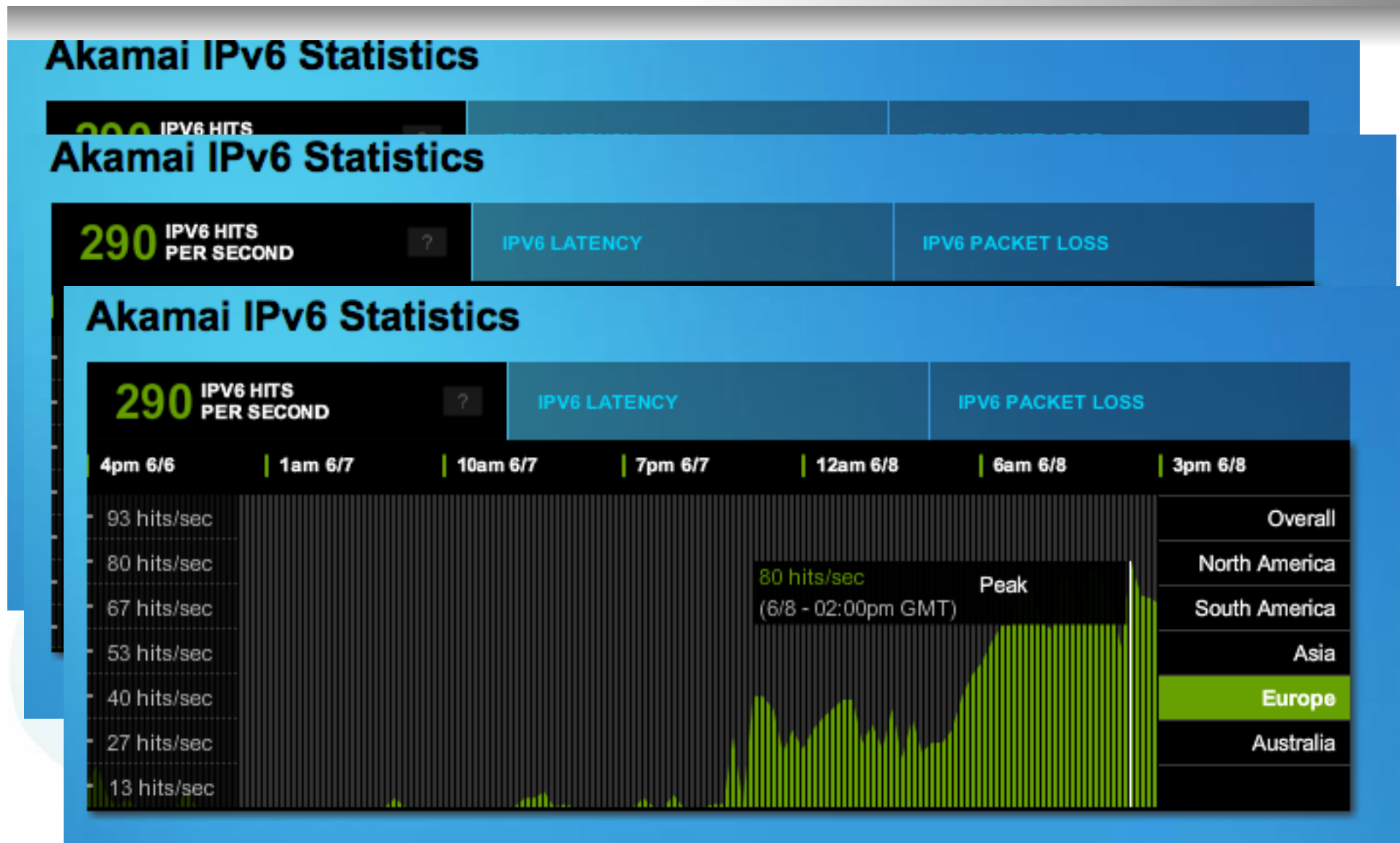
Asia

Europe

Africa

Australia

Akamai IPv6 statisztika – afternoon



Akamai IPv6 statisztika - evening

Akamai IPv6 Statistics

250 IPV6 HITS
PER SECOND

IPV6 LATENCY

IPV6 PACKET LOSS

Akamai IPv6 Statistics

250 IPV6 HITS
PER SECOND

IPV6 LATENCY

IPV6 PACKET LOSS

Akamai IPv6 Statistics

250 IPV6 HITS
PER SECOND

IPV6 LATENCY

IPV6 PACKET LOSS

9pm 6/6

6am 6/7

3pm 6/7

12am 6/8

2am 6/8

11am 6/8

7pm 6/8

109 hits/sec

94 hits/sec

78 hits/sec

62 hits/sec

47 hits/sec

31 hits/sec

16 hits/sec

94 hits/sec
(6/8 - 06:00pm GMT)

Peak

Overall

North America

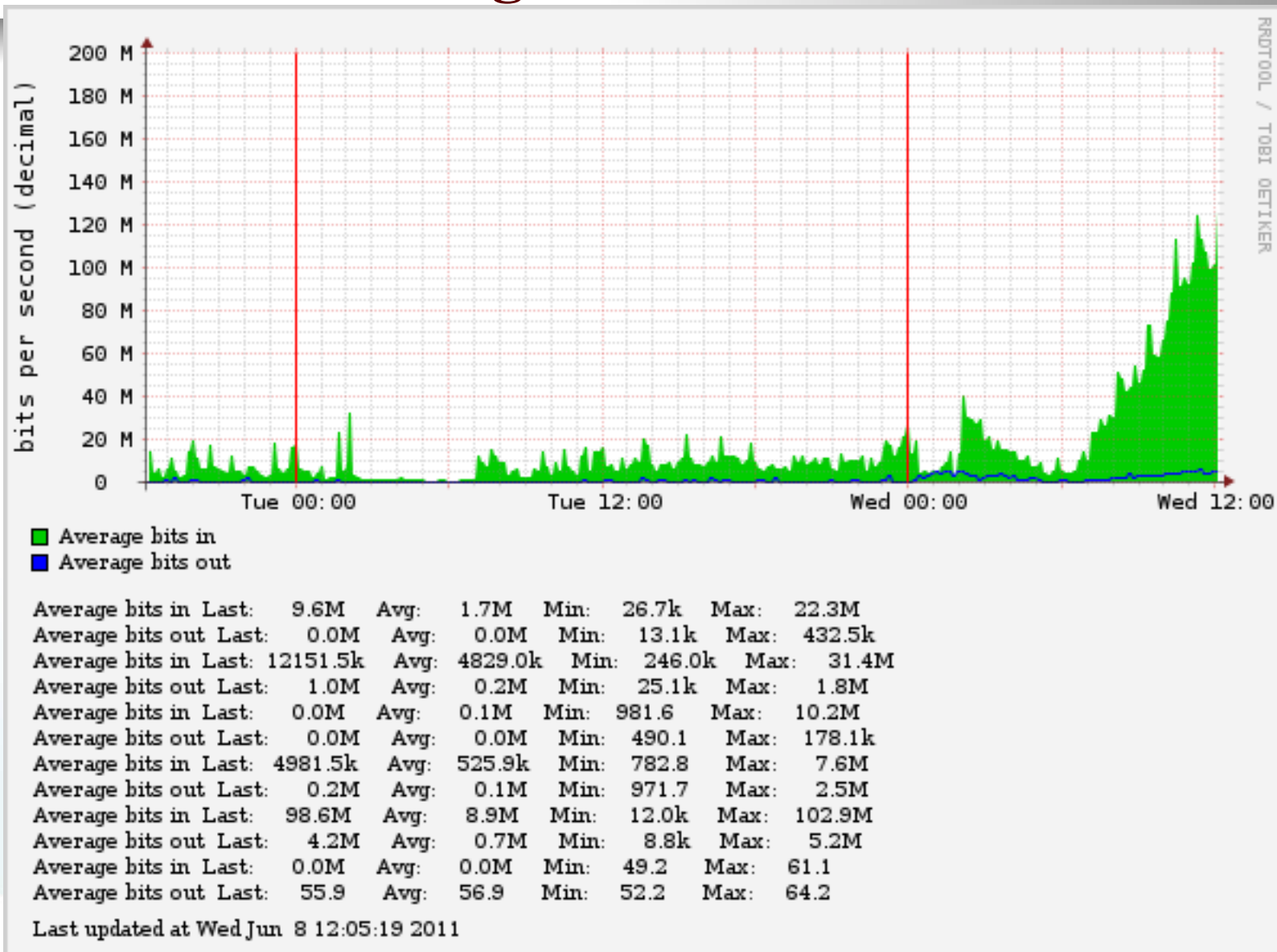
South America

Asia

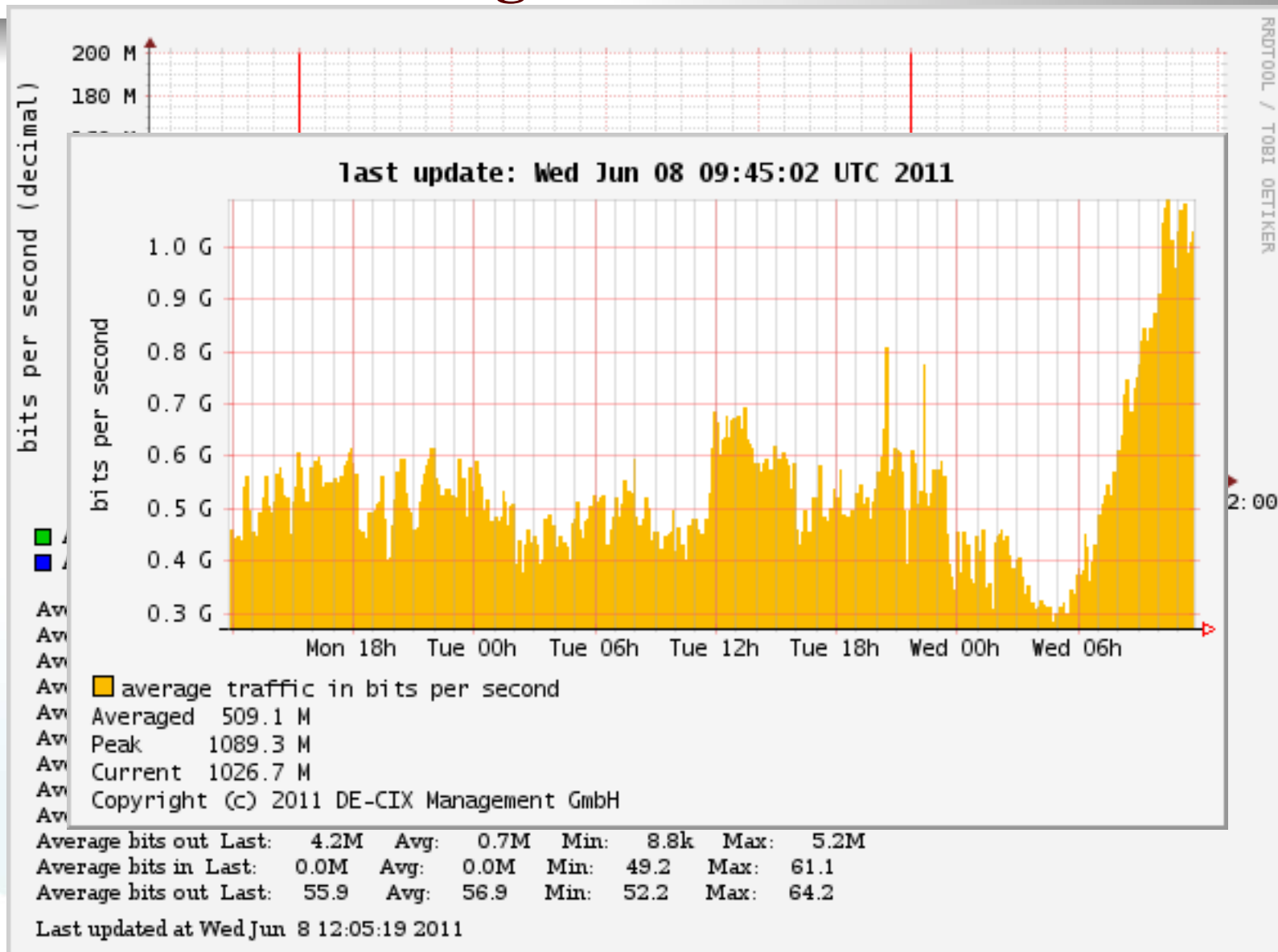
Europe

Australia

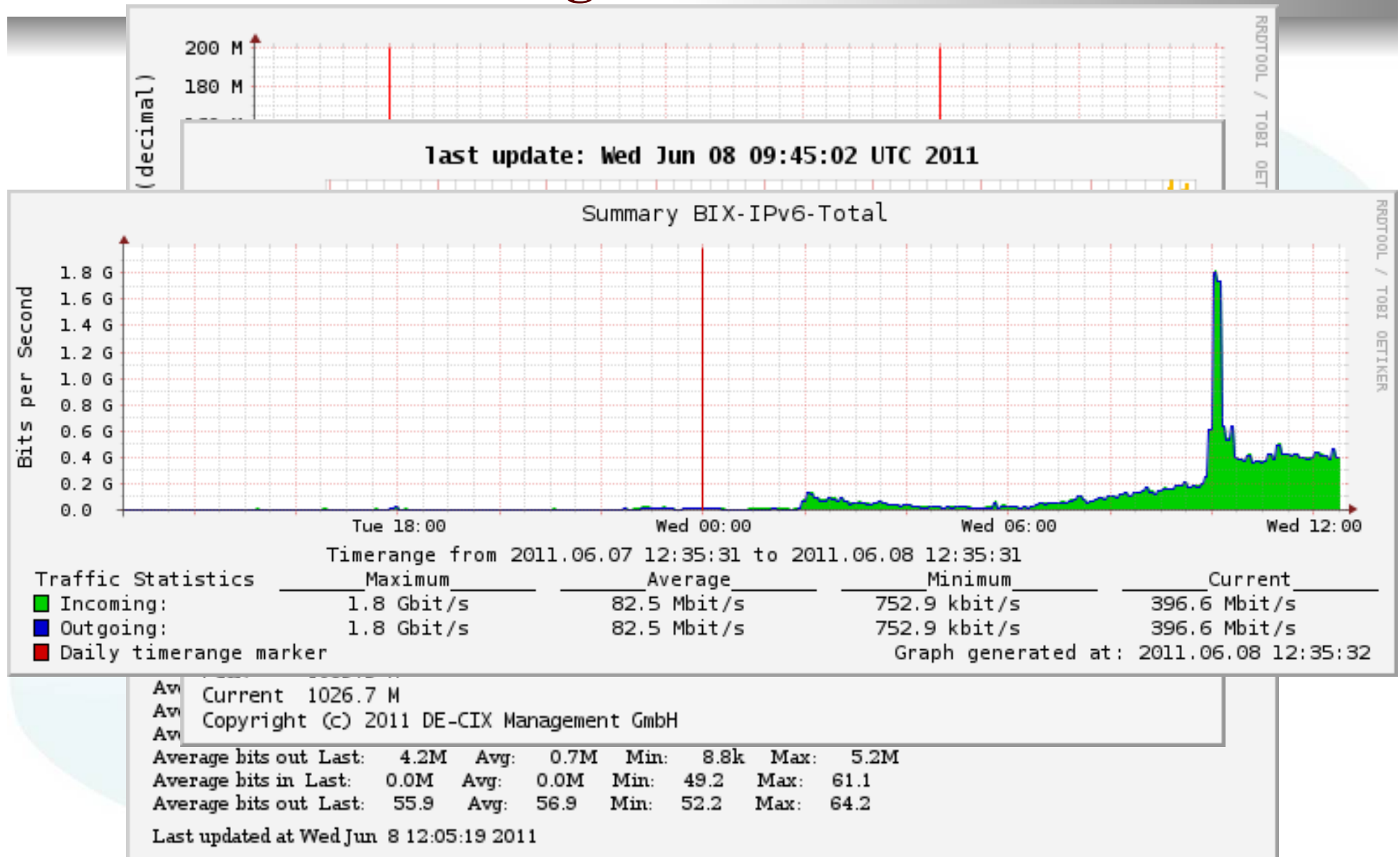
IPv6 traffic -morning



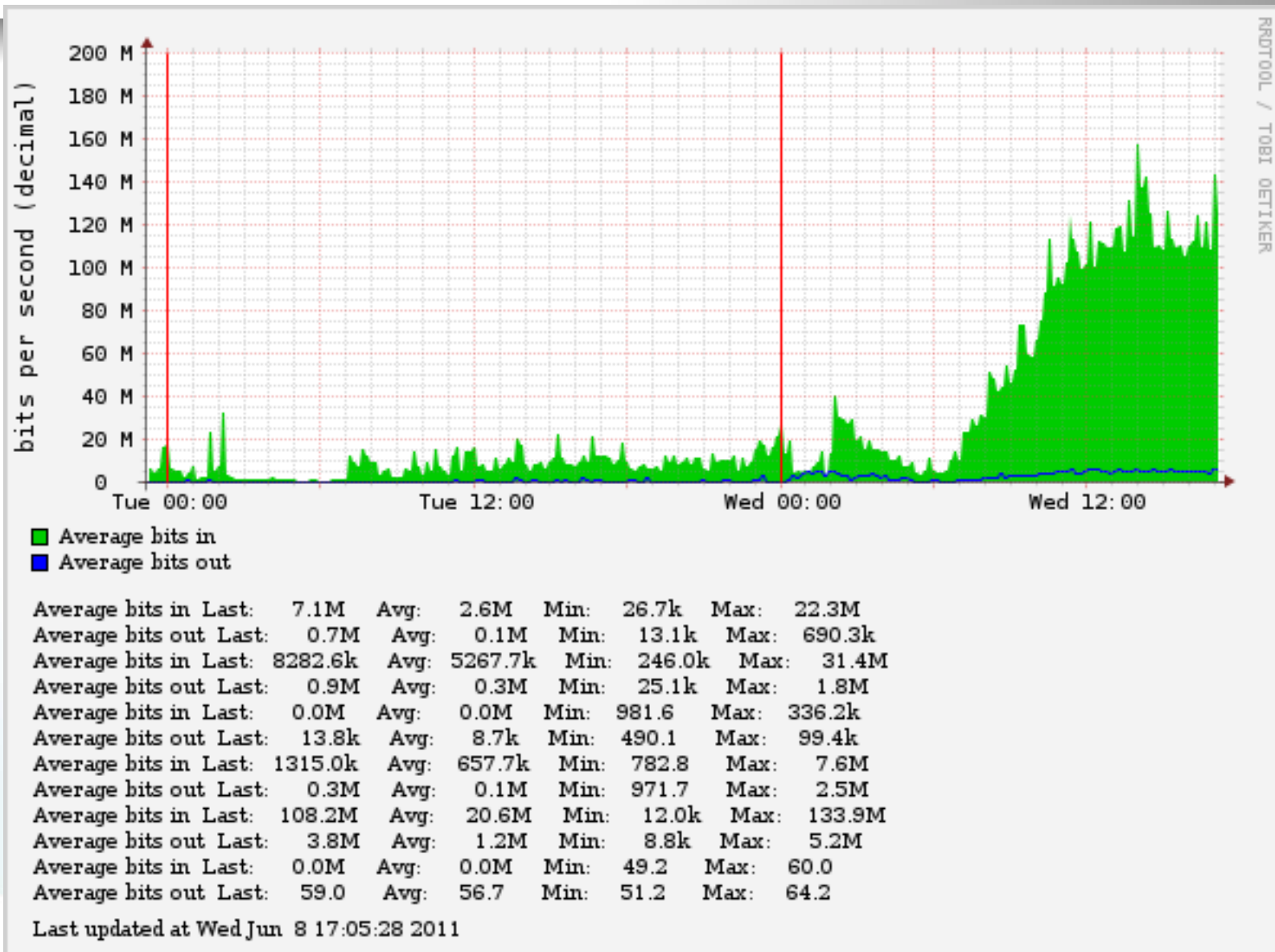
IPv6 traffic -morning



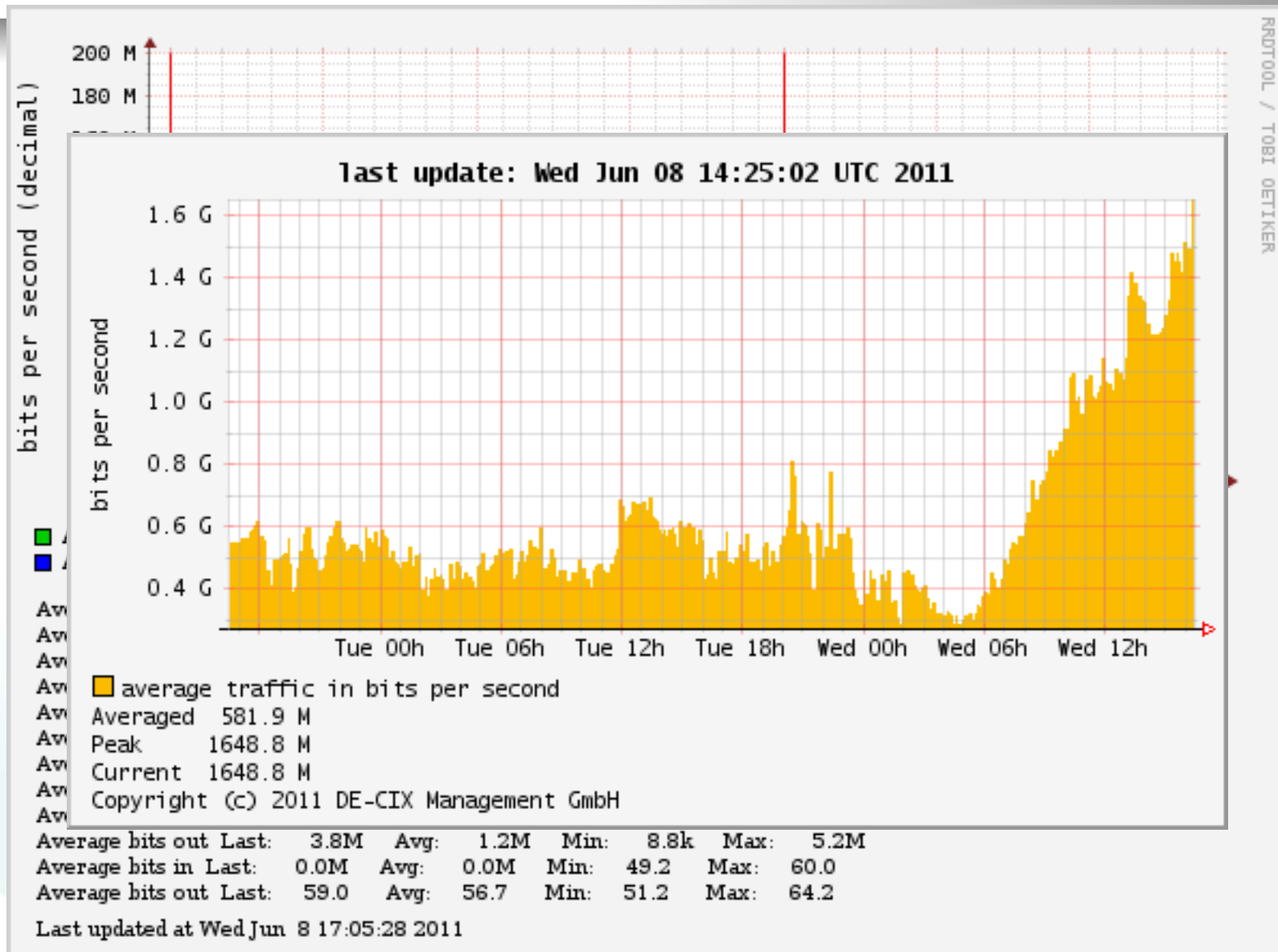
IPv6 traffic -morning



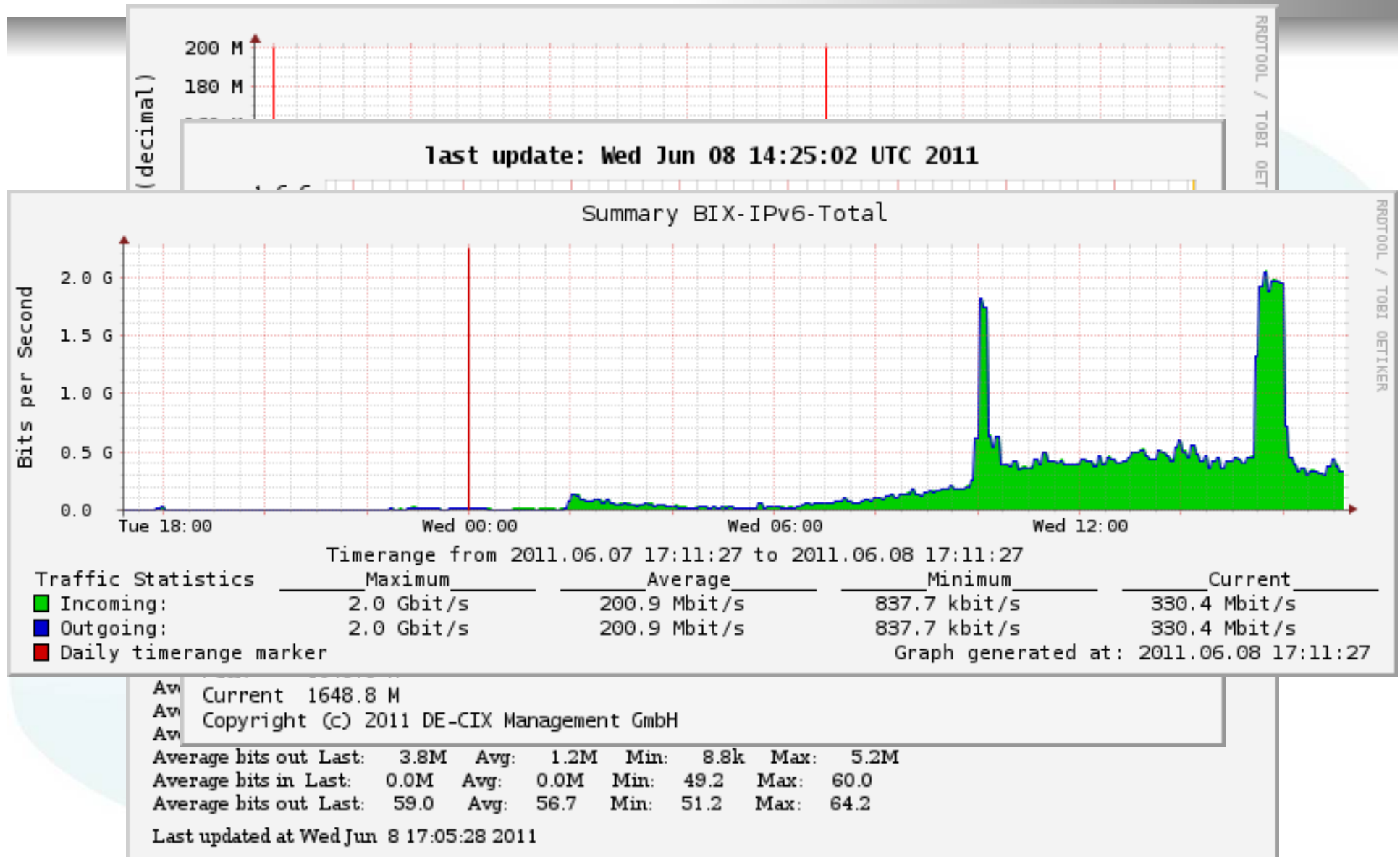
IPv6 traffic - afternoon



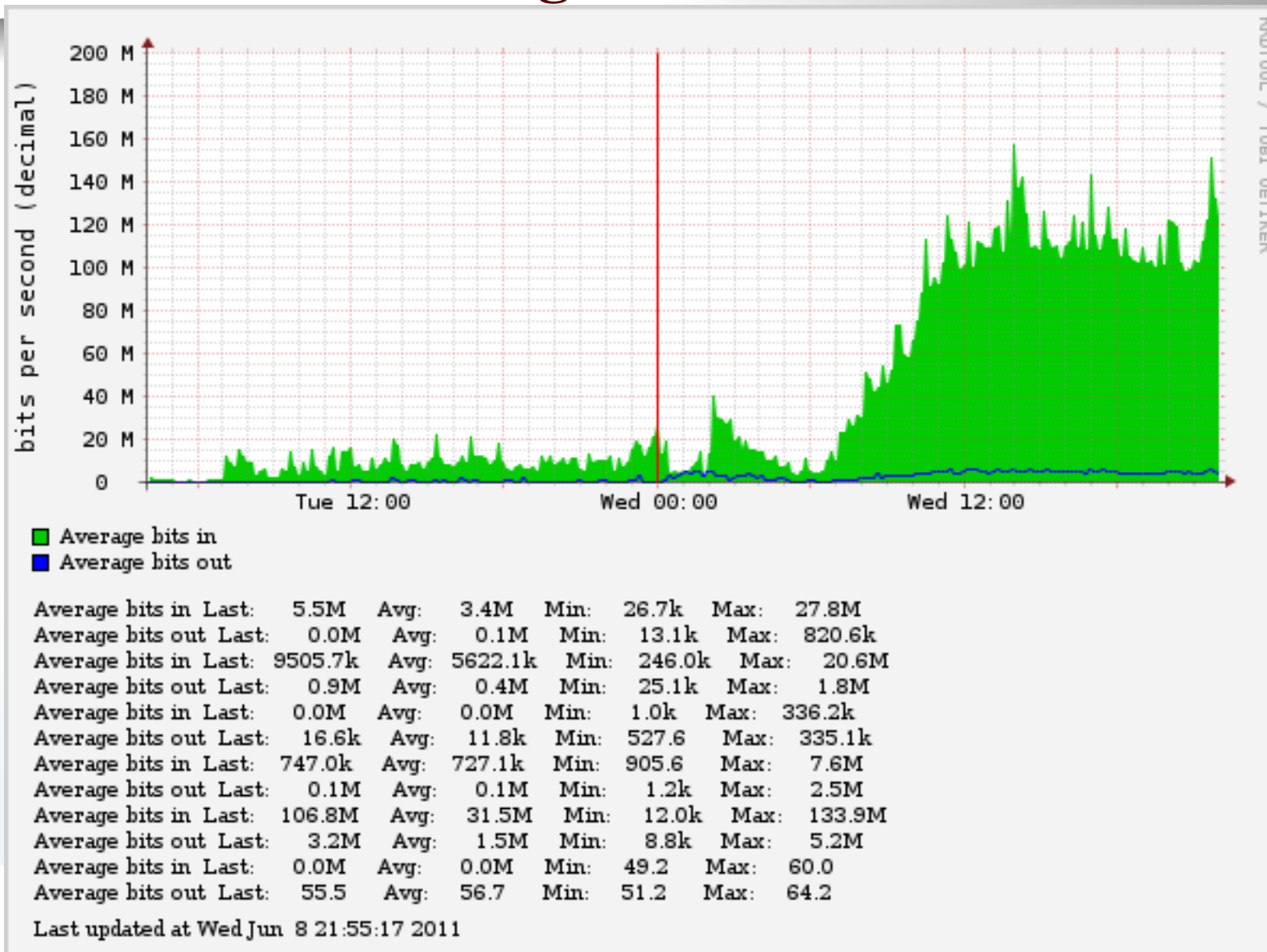
IPv6 traffic - afternoon



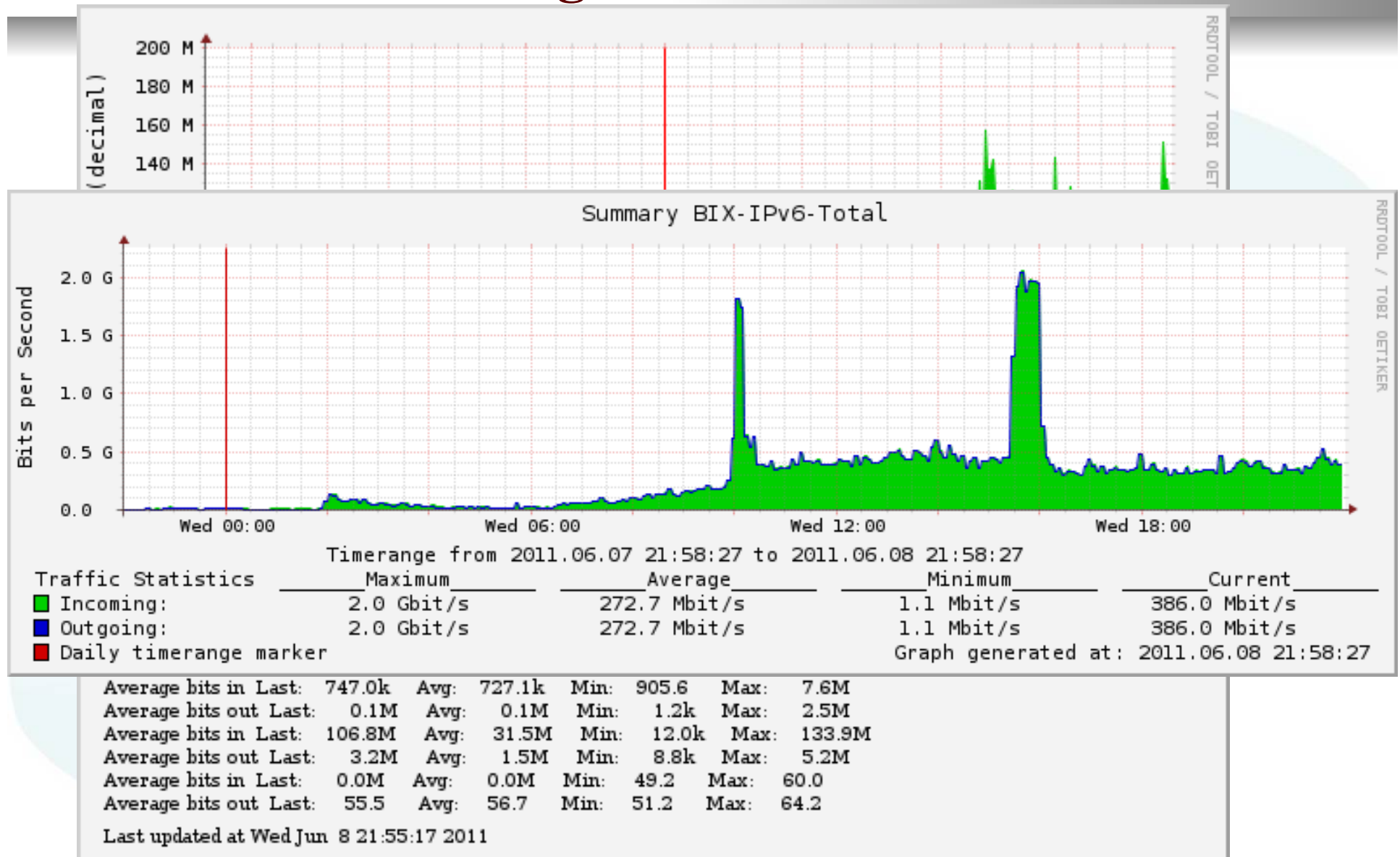
IPv6 traffic - afternoon



IPv6 traffic - evening



IPv6 traffic - evening



Problems

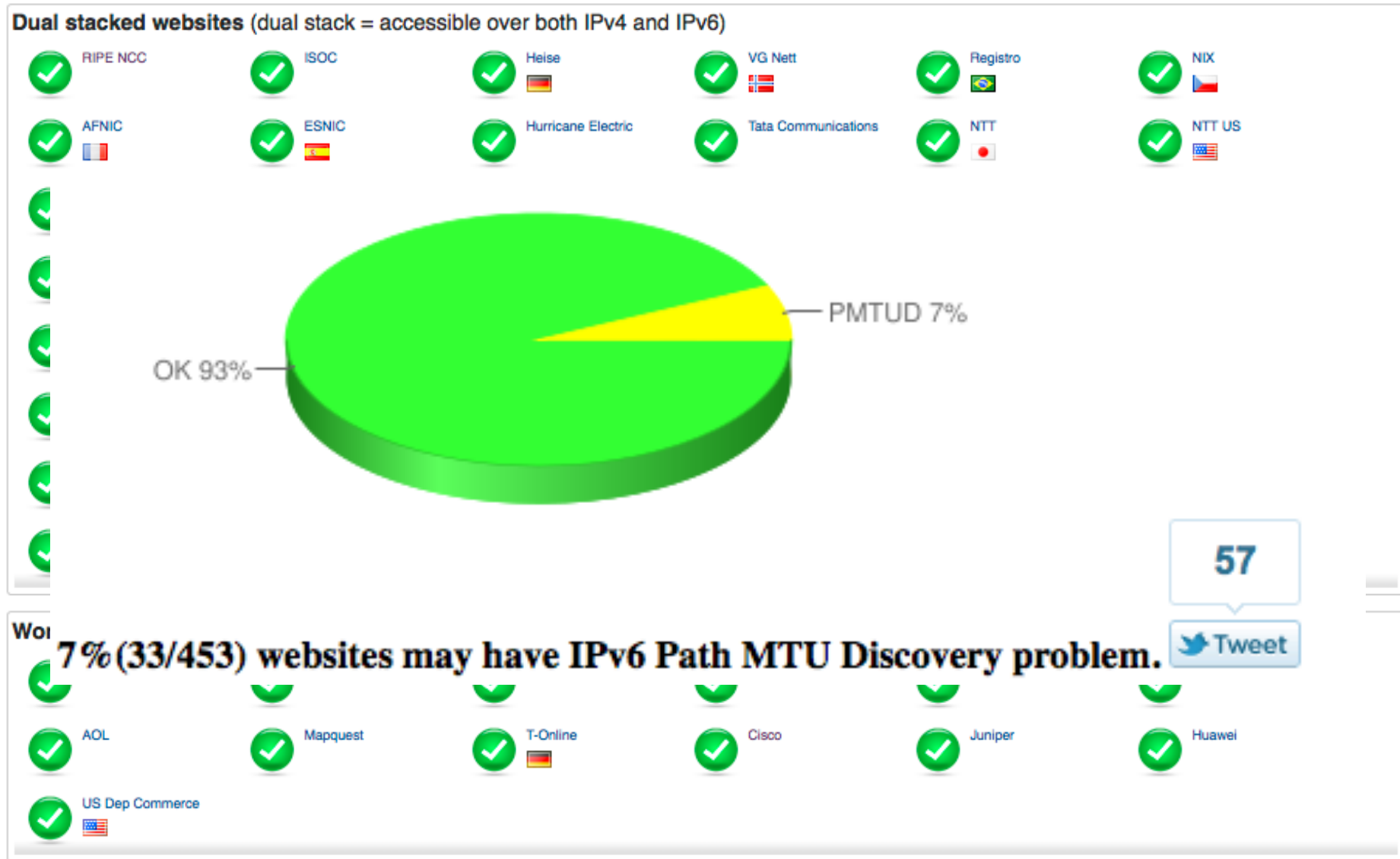
- freemail (T-com routing?) IPv6 reachability around 10:00 – after 30 minute resolved
- Mac OS X – AAAA non caching
- Strange routing at Level3:

```
traceroute to ipv6.test.Level3.com (2001:1900:2018:3000::105) from 2001:738:0:1:206:5bff:fef3:4366, port 33434, from port 42608, 30 hops max, 60 byte packet
 1  c6513-2-vlan150.vh.hbone.hu (2001:738:0:1::1)  0.456 ms  0.245 ms  0.398 ms
 2  be2.rtr1.vh.hbone.hu (::ffff:195.111.96.60)  0.694 ms  0.572 ms  0.567 ms
 3  2001:2000:3080:17::1 (2001:2000:3080:17::1)  0.228 ms  0.225 ms  0.230 ms
 4  ldn-b5-v6.telia.net (2001:2000:3018:b::1)  38.152 ms  36.232 ms  38.066 ms
 5  * * *
 6  vl-4086.car1.NewYork1.Level3.net (2001:1900:6:1::12)  106.838 ms  106.080 ms  106.225 ms
 7  vl-4083.car2.SanJose1.Level3.net (2001:1900:4:1::ee)  104.267 ms  165.523 ms  691.354 ms
 8  vl-4060.car2.NewYork2.Level3.net (2001:1900:4:1::fe)  115.120 ms  115.138 ms  115.773 ms
 9  vl-4061.car1.Chicago1.Level3.net (2001:1900:4:1::21)  136.240 ms  136.943 ms  136.156 ms
10  * * *
11  vl-4041.car2.Denver1.Level3.net (2001:1900:4:1::35)  212.448 ms  166.424 ms  166.655 ms
12  vl-4081.car1.Denver1.Level3.net (2001:1900:4:1::31)  173.636 ms  317.868 ms  162.589 ms
13  Level3-MOSS.vl-956.car1.Denver1.Level3.net (2001:1900:4:2::fa)  159.885 ms  160.297 ms  160.744 ms
```

- Citrix Netscaler fragmentation crash
bug

World IPv6 day participants

World IPv6 Day Connectivity Chart



IPv6 eyechart – via NIIF ADSL

World IPv6 Day Connectivity Chart

Dual stacked websites (dual stack = accessible over both IPv4 and IPv6)

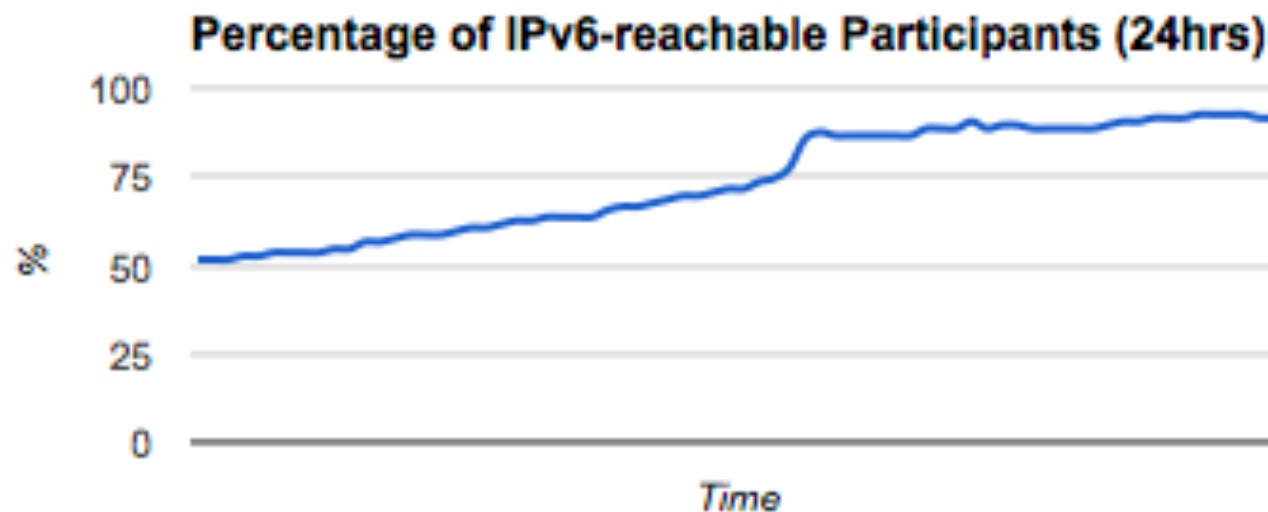
RIPE NCC	ISOC	Heise	VG Nett	Registro	NIX
AFNIC	ESNIC	Hurricane Electric	Tata Communications	NTT	NTT US
APNIC	LACNIC	AfriNIC	FreeBSD	ISC	Python lang
NTP.org	Soliton	PTS	xkcd	IETF	TUNIX
Campaya	World IPv6 Day DK	IPv6 Matrix	Orange Sonatel	UCLA	Ames
RedIRIS	JANET	FUNET	Picpaste	Go6 SI	Akamai dual-test
Adista	Belnet	Dedic GPTI	CNR-IMAA	The Soap Trail	IPv6 Council DE
Hochschule Darmstadt	Carpathia	Hostmaster UA	RoEduNet	UAIC	Gigatux

World IPv6 day participants (dual-stacked today)

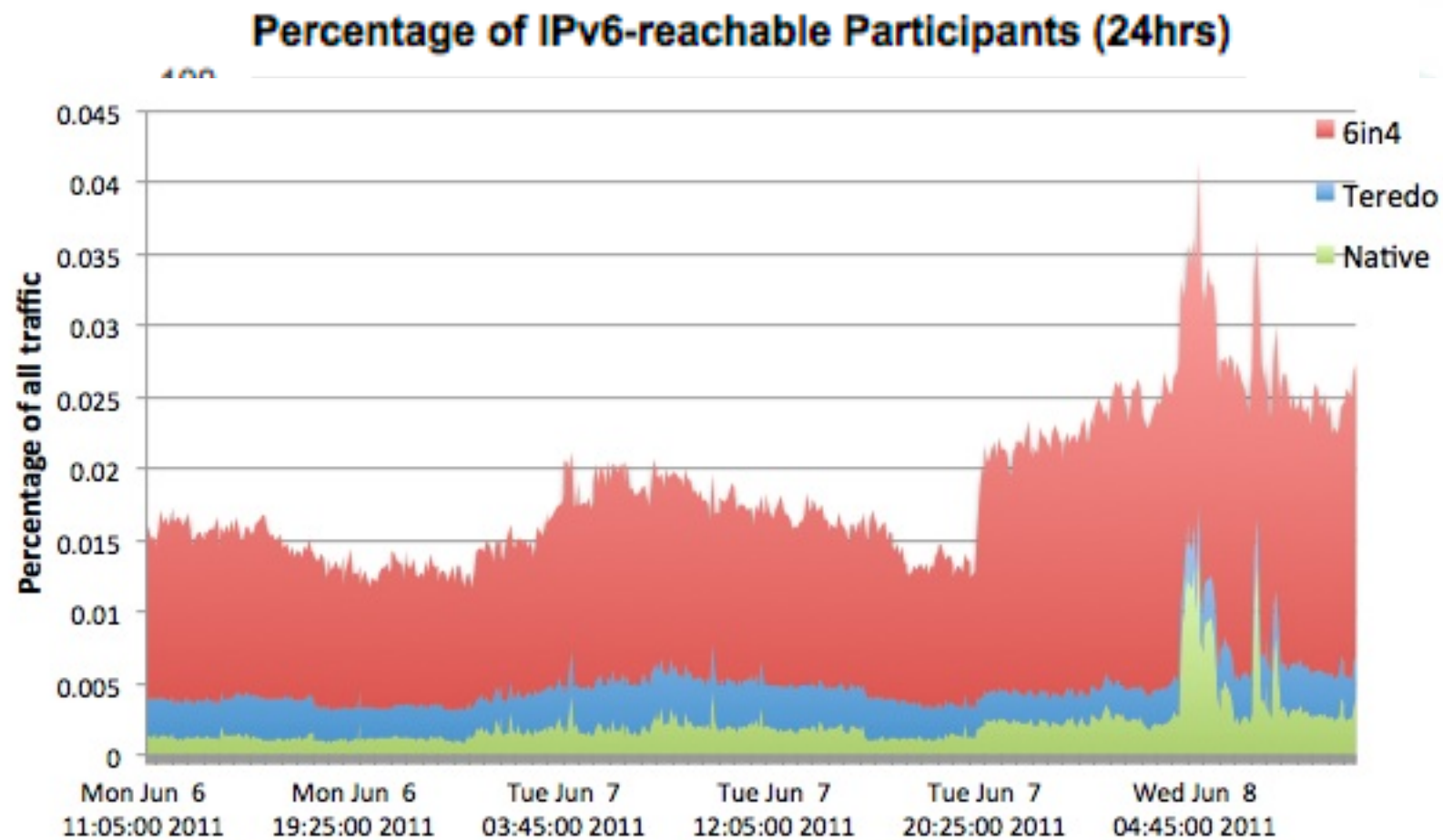
Google	Yahoo	Facebook	YouTube	MS Bing	MS Xbox
AOL	Mapquest	T-Online	Cisco	Juniper	Huawei
US Dep Commerce					

All websites reached successfully! No problems expected for World IPv6 Day from this computer at this location.

ISOC Dashboard



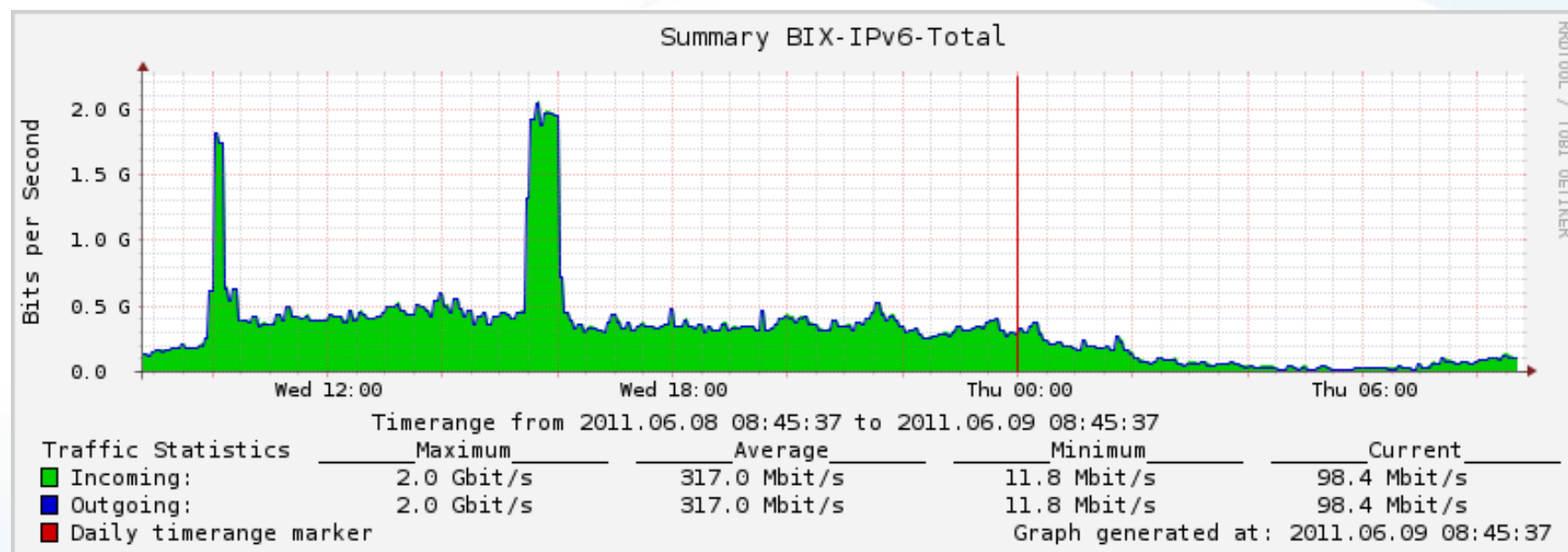
ISOC Dashboard



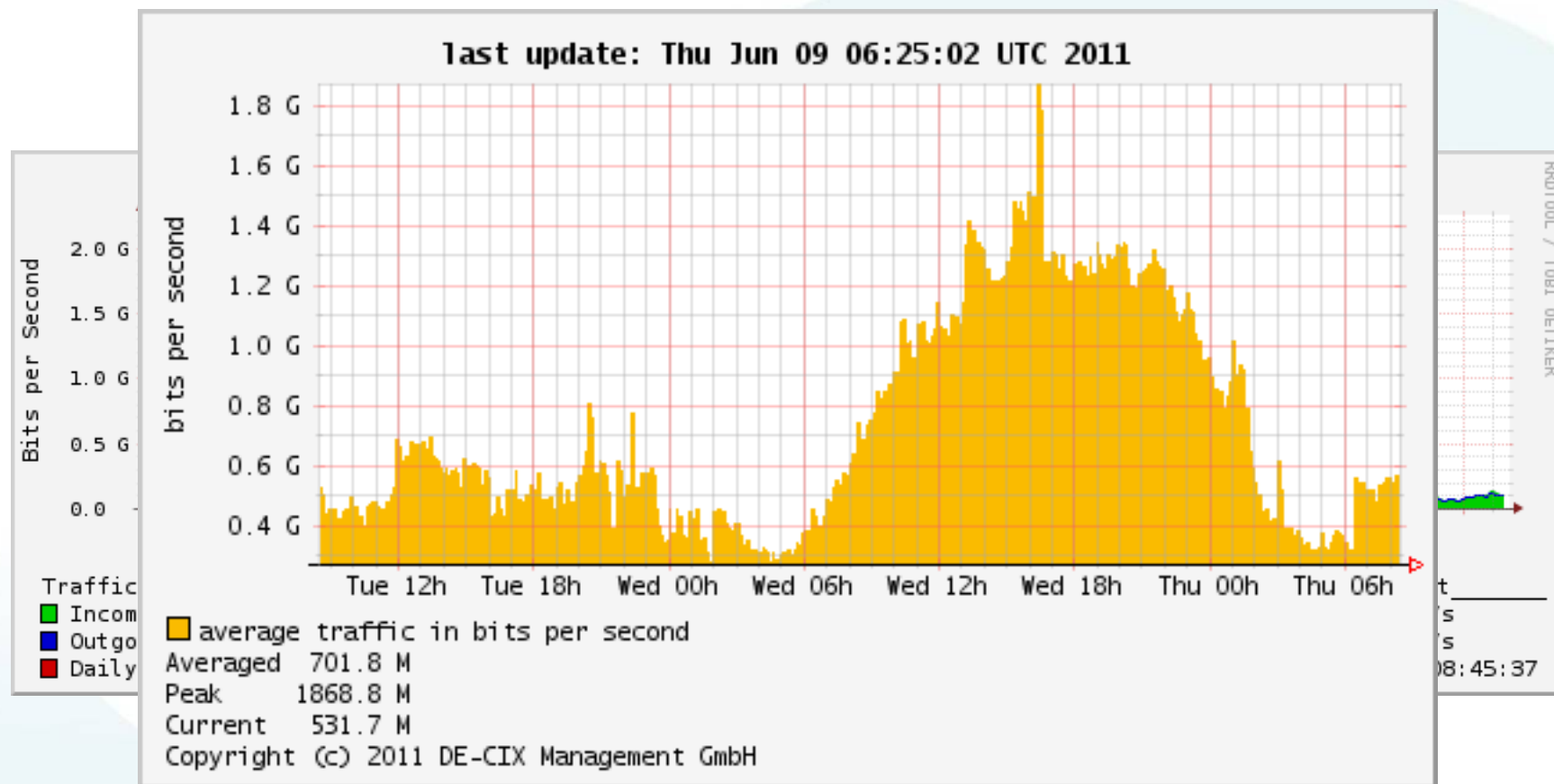
Conclusion based on the traffic statistics

- IPv6 traffic level could be
 - 3x at European level
 - 5x at Hungarian level
 - 5-10x at NIIF level
 - Probably lots of IPv6 capable clients
- IPv6 content is missing

2011 jun 9. – After World IPv6 day



2011 jun 9. – After World IPv6 day



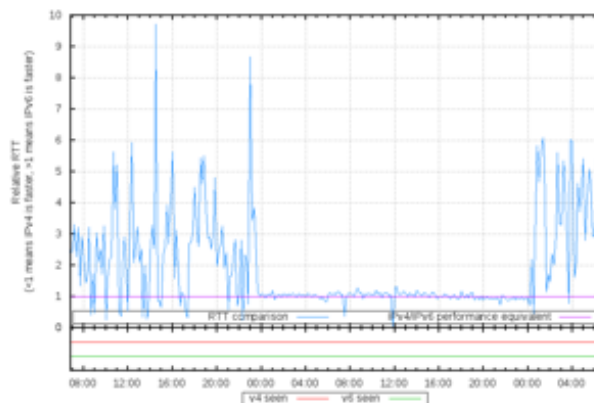
2011 jun 9. – After World IPv6 day

IPv6 DNS record (AAAA) visibility for all participants, from all vantage points ([more details and explanation...](#))

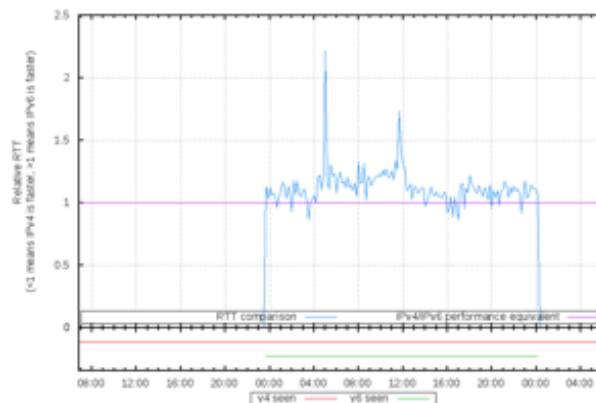


IPv4/IPv6 comparison to some sites ([more RTT measurement results and explanation...](#))

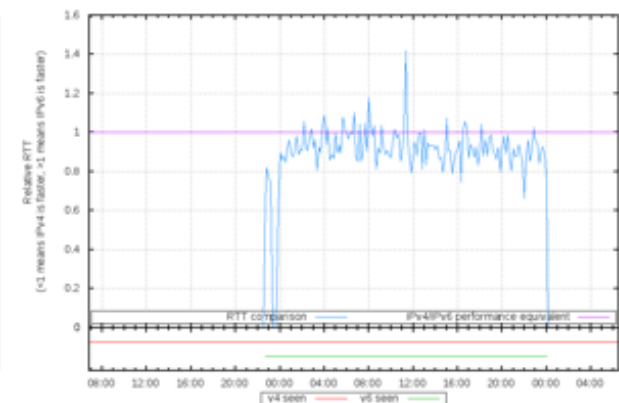
RTT measurements to Google



RTT measurements to Yahoo!



RTT measurements to Facebook



Conclusions

- World IPv6 day – Well prepared
- The potential problems were known before
- Detailed analysis needed from content providers side – their experiences
 - What worked, what not
 - CDN?
- Further World IPv6 day needed – learning from problems
- My view: participants of world IPv6 day could introduce IPv6 service in a year
- Facebook left their developer website as dual-stack due to good experience

Thanks!
Questions?



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