Continuous analytics for traffic monitoring and applications to CDN

The need of an intelligent measurement plane for the internet

mPlane

CoNEXT TPC workshop
Barcellona, 5/9/13

SEVENTH FRAMEWORK PROGRAMME

Something **ISPs** “watch”

Something we observe

SUBNET
173.194.18
173.194.19
173.194.2
173.194.20
173.194.208
173.194.5
173.194.6
173.194.62
173.194.9
208.117.236
208.117.248
208.117.250
208.117.252
208.117.254
74.125.105
74.125.13
74.125.14
74.125.216
74.125.218
74.125.4
74.125.99

Something we observe

SUBNET	NAME with AIRPORT code
173.194.18	fra02s08.c.youtube.com
173.194.19	fra02s15.c.youtube.com
173.194.2	mil01s12.c.youtube.com
173.194.20	par08s06.c.youtube.com
173.194.208	par08s06.c.youtube.com
173.194.5	lhr14s08.c.youtube.com
173.194.6	fra07s13.c.youtube.com
173.194.62	fra07s19.c.youtube.com
173.194.9	par03s06.c.youtube.com
208.117.236	par03x04.c.youtube.com
208.117.248	mia02s11.c.youtube.com
208.117.250	ams09x06.c.youtube.com
208.117.252	dfw06x02.c.youtube.com
208.117.254	fra07x03.c.youtube.com
74.125.105	lhr22s16.c.youtube.com
74.125.13	zrh04s03.c.youtube.com
74.125.14	mil02s01.c.youtube.com
74.125.216	bru02t11.c.youtube.com
74.125.218	fra07t13.c.youtube.com
74.125.4	lhr22s11.c.youtube.com
74.125.99	fra07s03.c.youtube.com

Something we observe

		5-May	
SUBNET	NAME with AIRPORT code	#flow	Tru avg
173.194.18	fra02s08.c.youtube.com	-1	-1
173.194.19	fra02s15.c.youtube.com	-1	-1
173.194.2	mil01s12.c.youtube.com	17054	1333.46
173.194.20	par08s06.c.youtube.com	-1	-1
173.194.208	par08s06.c.youtube.com	-1	-1
173.194.5	lhr14s08.c.youtube.com	449	1819.57
173.194.6	fra07s13.c.youtube.com	-1	-1
173.194.62	fra07s19.c.youtube.com	-1	-1
173.194.9	par03s06.c.youtube.com	-1	-1
208.117.236	par03x04.c.youtube.com	179	164.18
208.117.248	mia02s11.c.youtube.com	-1	-1
208.117.250	ams09x06.c.youtube.com	41430	679
208.117.252	dfw06x02.c.youtube.com	-1	-1
208.117.254	fra07x03.c.youtube.com	838	667.29
74.125.105	lhr22s16.c.youtube.com	1829	1551.78
74.125.13	zrh04s03.c.youtube.com	719	1074.15
74.125.14	mil02s01.c.youtube.com	48366	1234.82
74.125.216	bru02t11.c.youtube.com	-1	-1
74.125.218	fra07t13.c.youtube.com	8697	1355.33
74.125.4	lhr22s11.c.youtube.com	1496	1846.25
74.125.99	fra07s03.c.youtube.com	-1	-1

Something we observe

		5-May		6-May	
SUBNET	NAME with AIRPORT code	#flow	Tru avg	#flow	Tru avg
173.194.18	fra02s08.c.youtube.com	-1	-1	-1	-1
173.194.19	fra02s15.c.youtube.com	-1	-1	-1	-1
173.194.2	mil01s12.c.youtube.com	17054	1333.46	15470	1276.31
173.194.20	par08s06.c.youtube.com	-1	-1	-1	-1
173.194.208	par08s06.c.youtube.com	-1	-1	-1	-1
173.194.5	lhr14s08.c.youtube.com	449	1819.57	283	1658.45
173.194.6	fra07s13.c.youtube.com	-1	-1	-1	-1
173.194.62	fra07s19.c.youtube.com	-1	-1	-1	-1
173.194.9	par03s06.c.youtube.com	-1	-1	-1	-1
208.117.236	par03x04.c.youtube.com	179	164.18	4250	540.16
208.117.248	mia02s11.c.youtube.com	-1	-1	77	552
208.117.250	ams09x06.c.youtube.com	41430	679	49437	656.39
208.117.252	dfw06x02.c.youtube.com	-1	-1	51	285.63
208.117.254	fra07x03.c.youtube.com	838	667.29	2130	852.53
74.125.105	lhr22s16.c.youtube.com	1829	1551.78	1655	1185.94
74.125.13	zrh04s03.c.youtube.com	719	1074.15	499	2264.09
74.125.14	mil02s01.c.youtube.com	48366	1234.82	37968	1253.01
74.125.216	bru02t11.c.youtube.com	-1	-1	-1	-1
74.125.218	fra07t13.c.youtube.com	8697	1355.33	12579	1338.71
74.125.4	lhr22s11.c.youtube.com	1496	1846.25	2488	1034.78
74.125.99	fra07s03.c.youtube.com	-1	-1	-1	-1

Something we observe

		5-May		6-May		7-May	
SUBNET	NAME with AIRPORT code	#flow	Tru avg	#flow	Tru avg	#flow	Tru avg
173.194.18	fra02s08.c.youtube.com	-1	-1	-1	-1	-1	-1
173.194.19	fra02s15.c.youtube.com	-1	-1	-1	-1	-1	-1
173.194.2	mil01s12.c.youtube.com	17054	1333.46	15470	1276.31	13655	**1259.63**
173.194.20	par08s06.c.youtube.com	-1	-1	-1	-1	-1	-1
173.194.208	par08s06.c.youtube.com	-1	-1	-1	-1	-1	-1
173.194.5	lhr14s08.c.youtube.com	449	1819.57	283	1658.45	-1	-1
173.194.6	fra07s13.c.youtube.com	-1	-1	-1	-1	-1	-1
173.194.62	fra07s19.c.youtube.com	-1	-1	-1	-1	-1	-1
173.194.9	par03s06.c.youtube.com	-1	-1	-1	-1	-1	-1
208.117.236	par03x04.c.youtube.com	179	164.18	4250	540.16	957	496.91
208.117.248	mia02s11.c.youtube.com	-1	-1	77	552	-1	-1
208.117.250	ams09x06.c.youtube.com	41430	679	49437	656.39	57675	**653.81**
208.117.252	dfw06x02.c.youtube.com	-1	-1	51	285.63	-1	-1
208.117.254	fra07x03.c.youtube.com	838	667.29	2130	852.53	-1	-1
74.125.105	lhr22s16.c.youtube.com	1829	1551.78	1655	1185.94	3957	942.47
74.125.13	zrh04s03.c.youtube.com	719	1074.15	499	2264.09	82	1302.03
74.125.14	mil02s01.c.youtube.com	48366	1234.82	37968	1253.01	37182	**1162.85**
74.125.216	bru02t11.c.youtube.com	-1	-1	-1	-1	-1	-1
74.125.218	fra07t13.c.youtube.com	8697	1355.33	12579	1338.71	8560	1239
74.125.4	lhr22s11.c.youtube.com	1496	1846.25	2488	1034.78	4146	**1363.63**
74.125.99	fra07s03.c.youtube.com	-1	-1	-1	-1	-1	-1

Something we observe

A complicated technology…

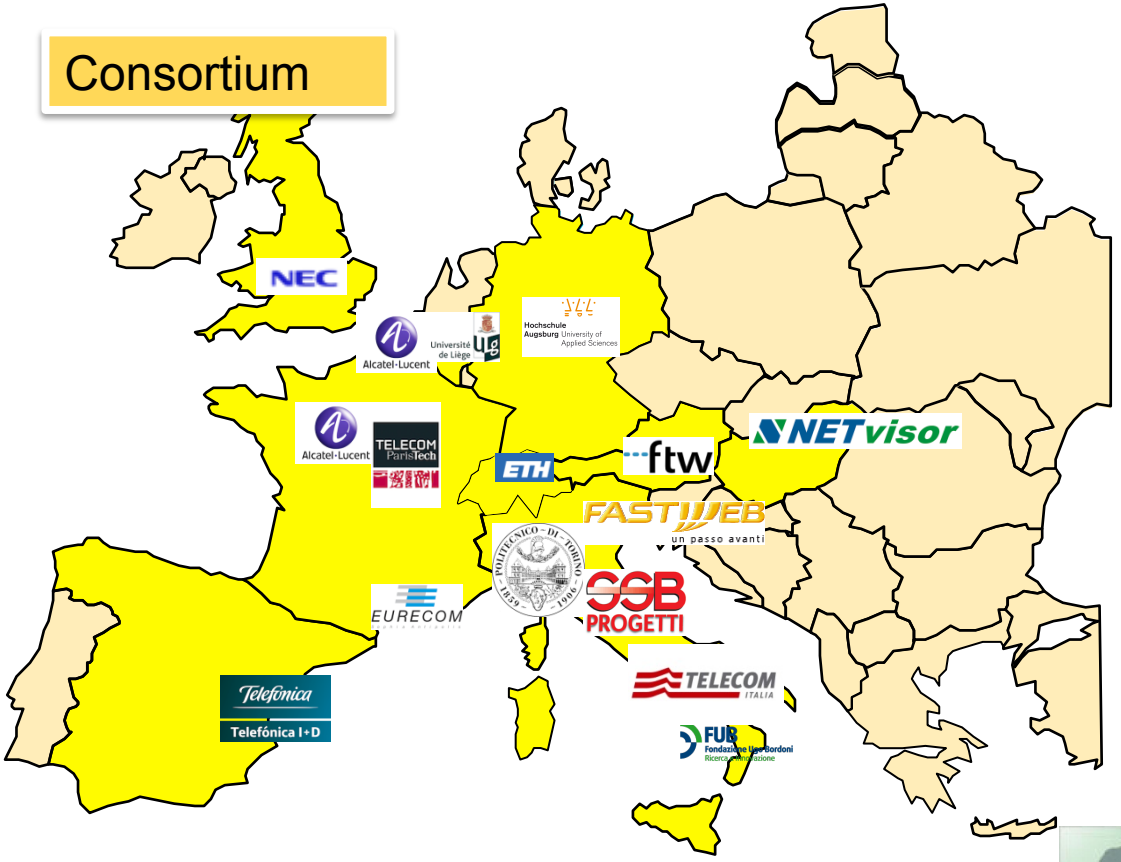
The internet is a key infrastructure where different technologies are combined to offer a plethora of services. It's horribly complicated.
We sorely miss the technology to understand what is happening in the network and to optimize its performance and utilization.

mPlane

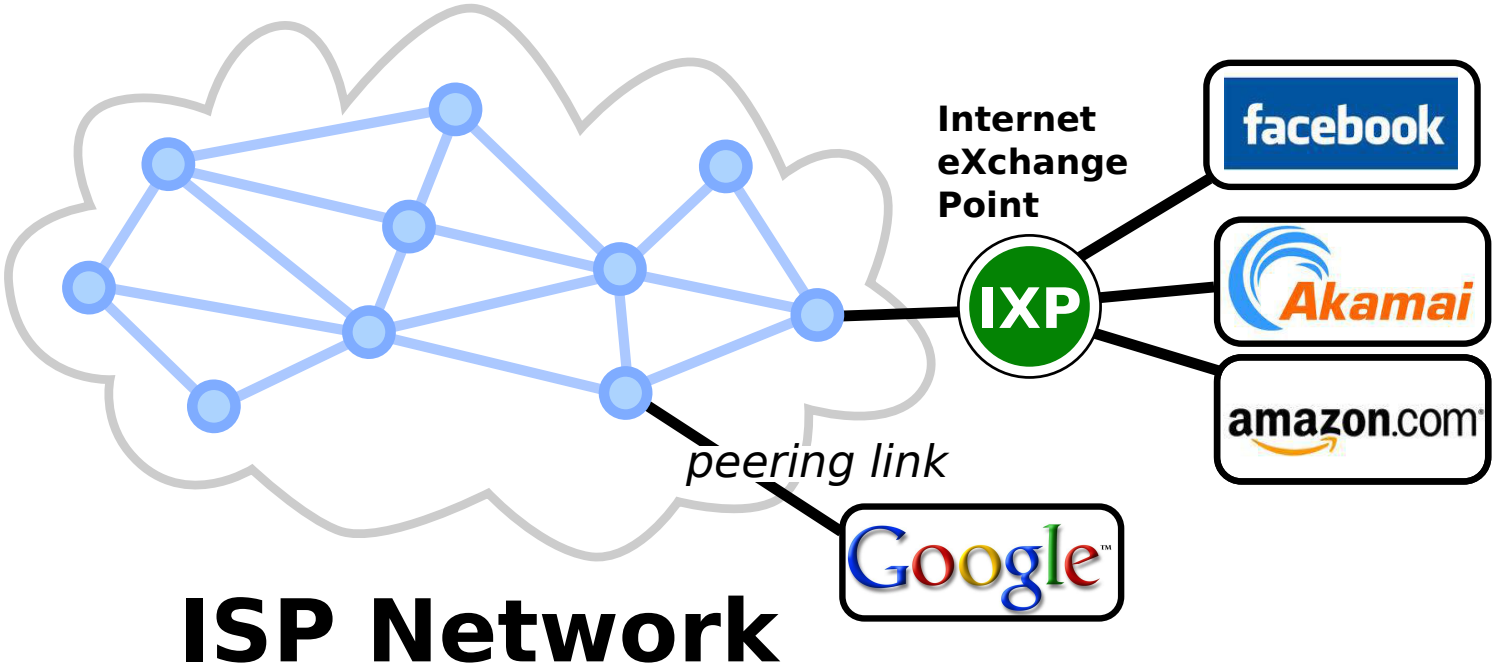
- mPlane is an FP7 Integrated Project
  - Large scale
  - Collaborative
- About the design and demonstration of an "intelligent measurement plane for the Internet"
  - 3 years
  - 16 partners
  - 11.2+Meuros

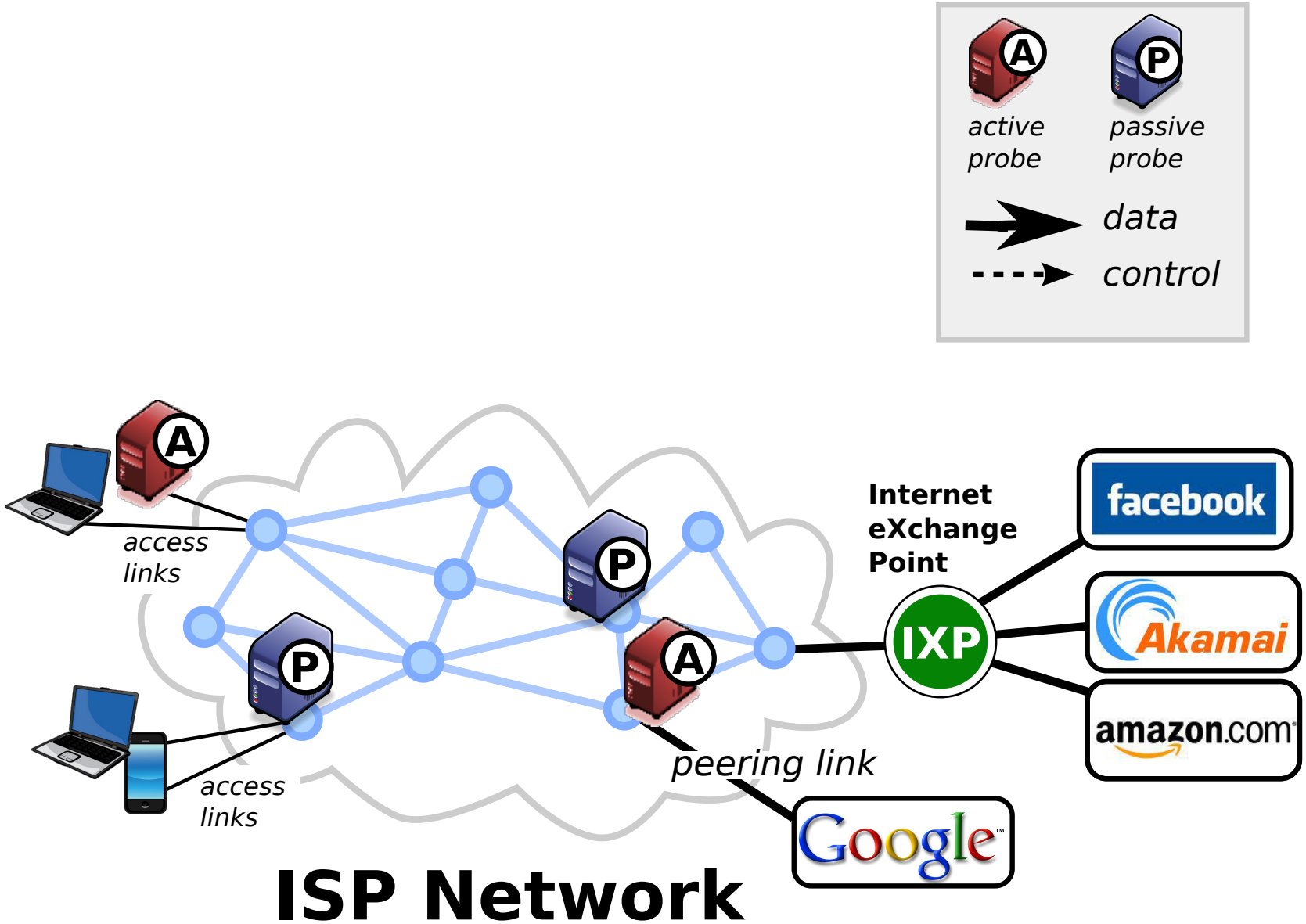
Who we are

Consortium

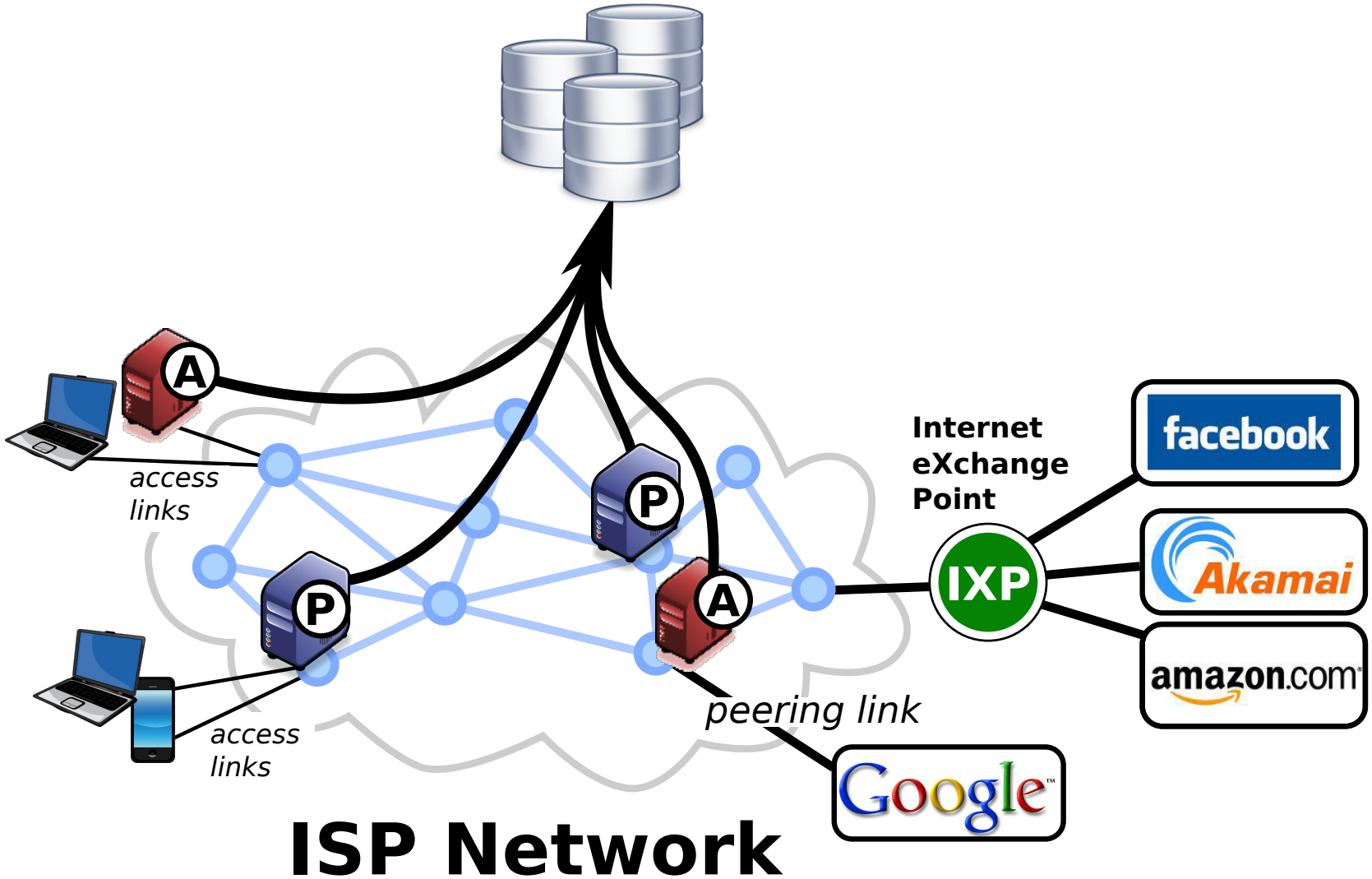


mPlane architecture



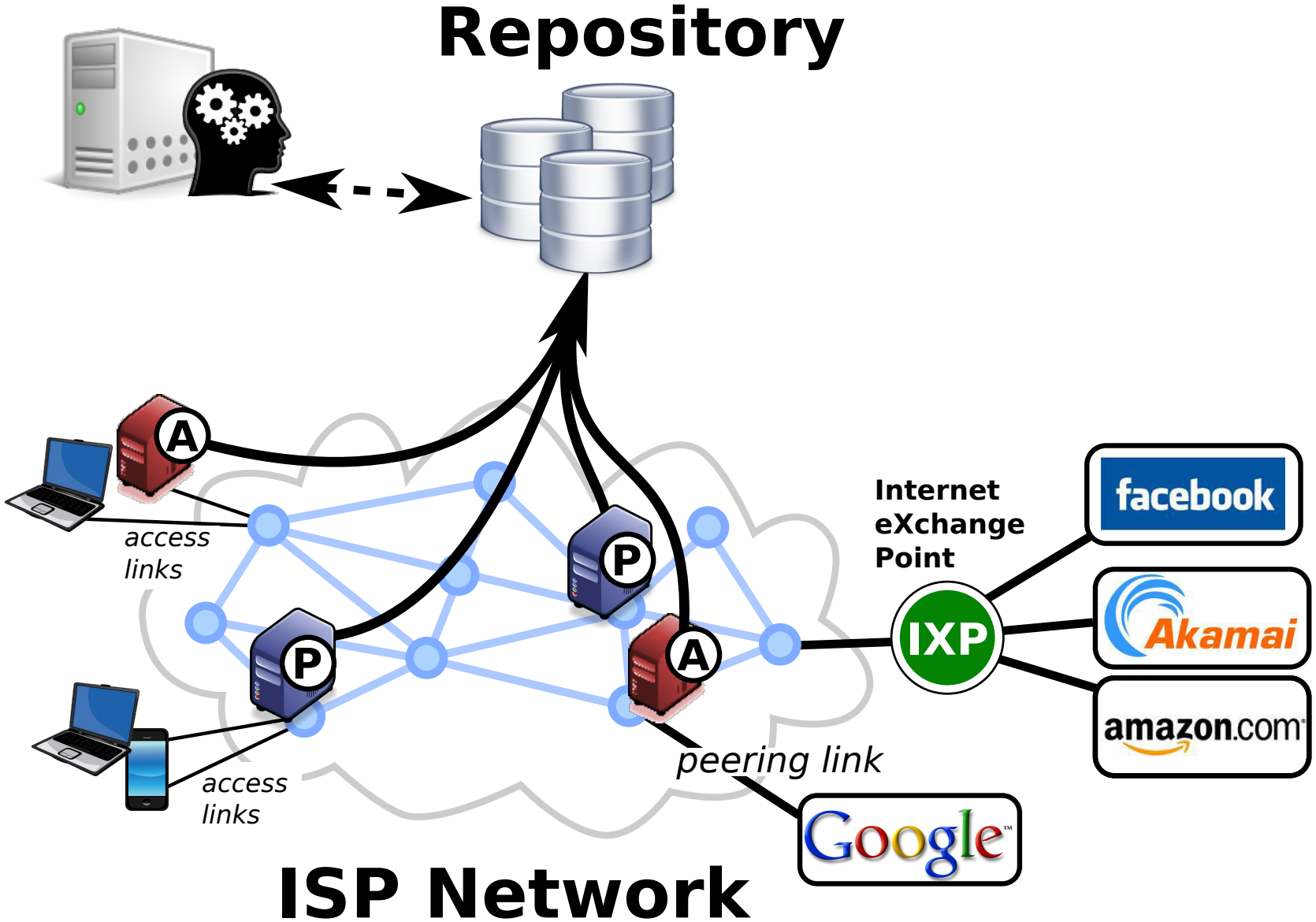

active probe
passive probe
data
control
access links
access links
peering link
Internet eXchange Point
IXP
facebook
Akamai
amazon.com
Google
ISP Network

Repository



ISP Network

Supervisor


Repository
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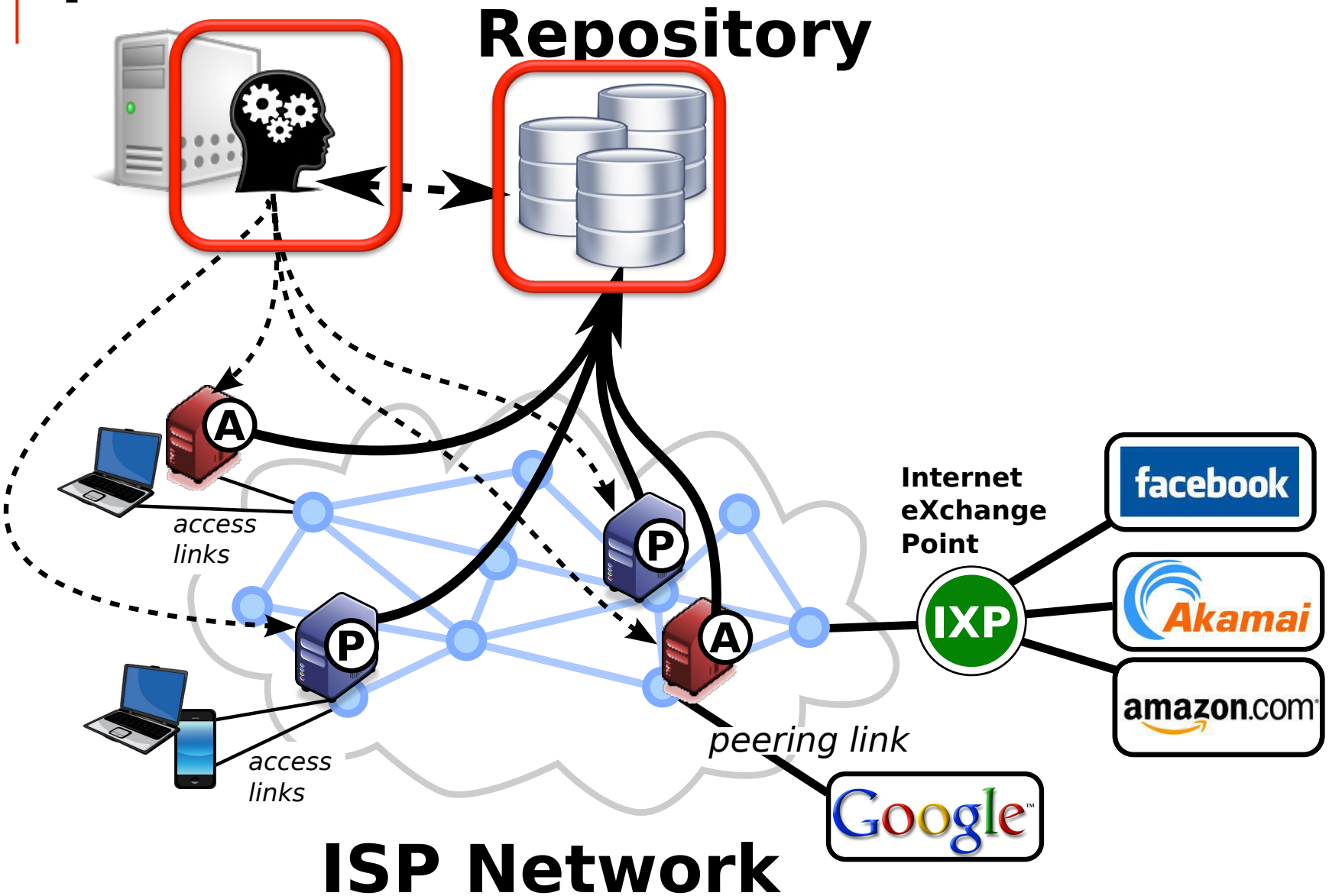
eXchange
Point
IXP
facebook
Akamai
amazon.com
peering link
Google
ISP Network

Supervisor


Repository
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access links
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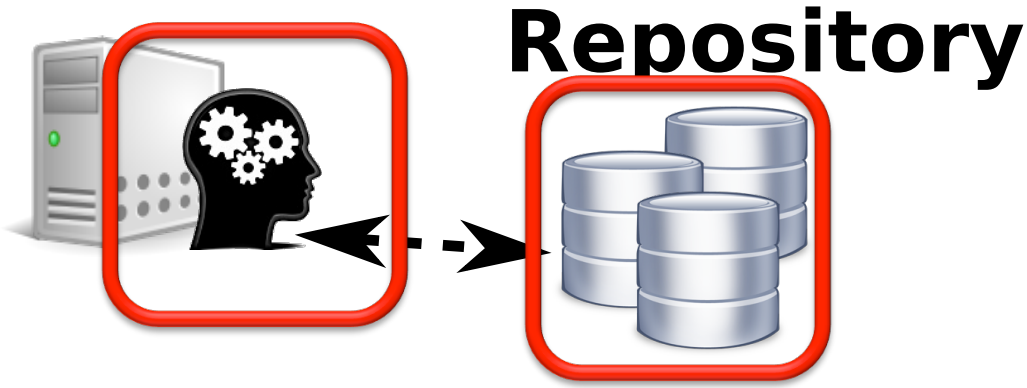
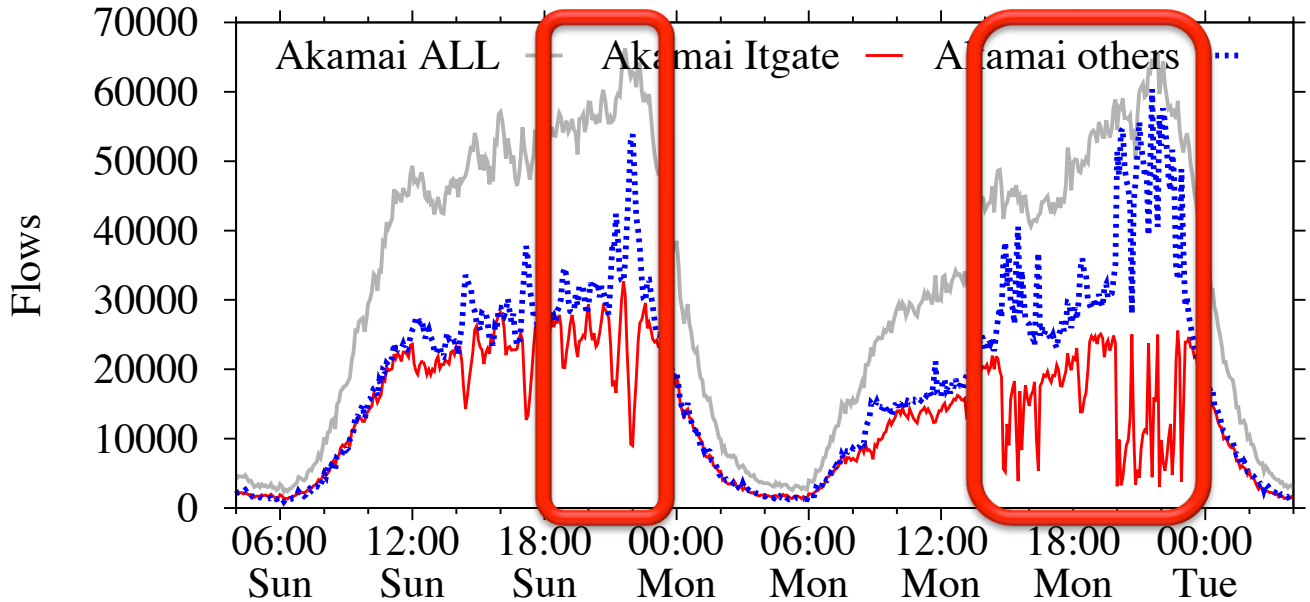
IXP
facebook
Akamai
amazon.com
Google
ISP Network

Supervisor



CDN makes complicated things

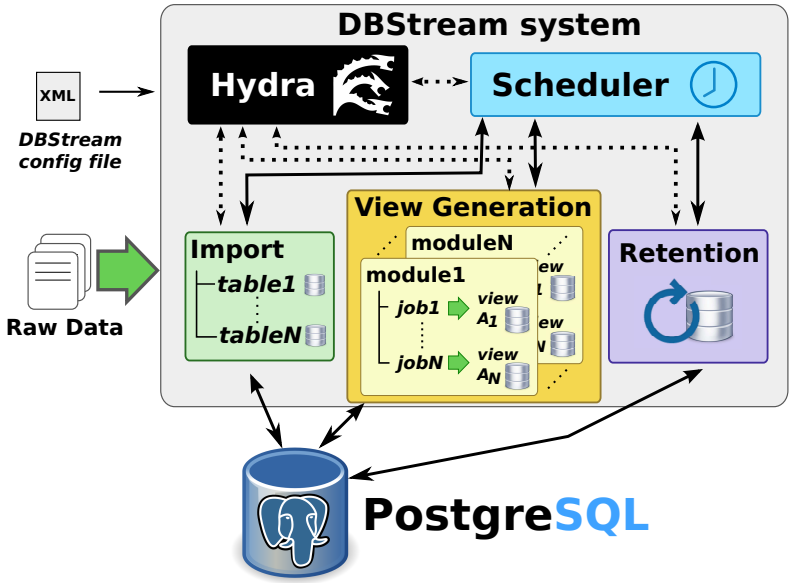
- We have seen this for YouTube …
- … the same applies for Akamai even in shorter time frames…



Reasoning about the problem

- How to investigate this kind of events?
  - You need a flexible, scalable, intelligent supervisor and repository

- **DBStream**[1]:
  - Continuous big data analytics
  - Flexible processing language
  - Full SQL processing capabilities
  - Processing in small batches
  - Storage for post-mortem analysis



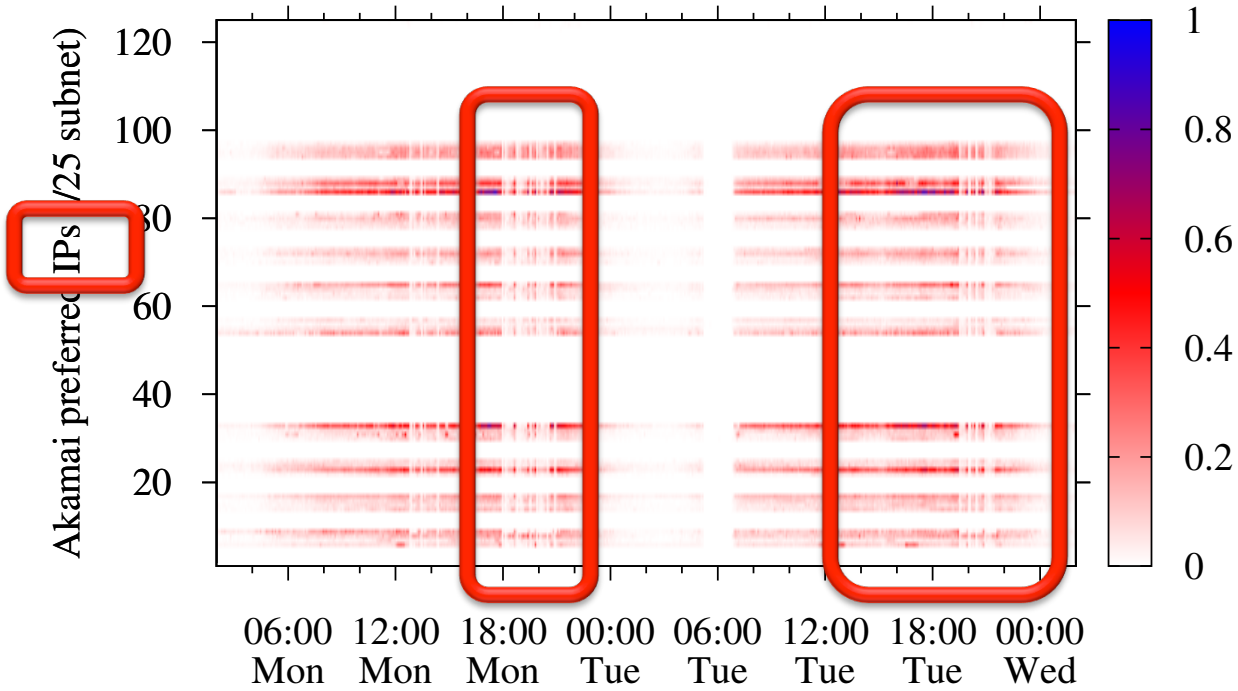
[1] A.Bar, A. Finamore, I. Bermudez, L. Golab, M.Mellia, P.Casas, "Continuous analytics for traffic monitoring and applications to CDN", Under submission

Reasoning about the problem

- Is the change related to single servers?
- Is this affecting only some services?
- Was this triggered by CDN performance issues?
- …
- …

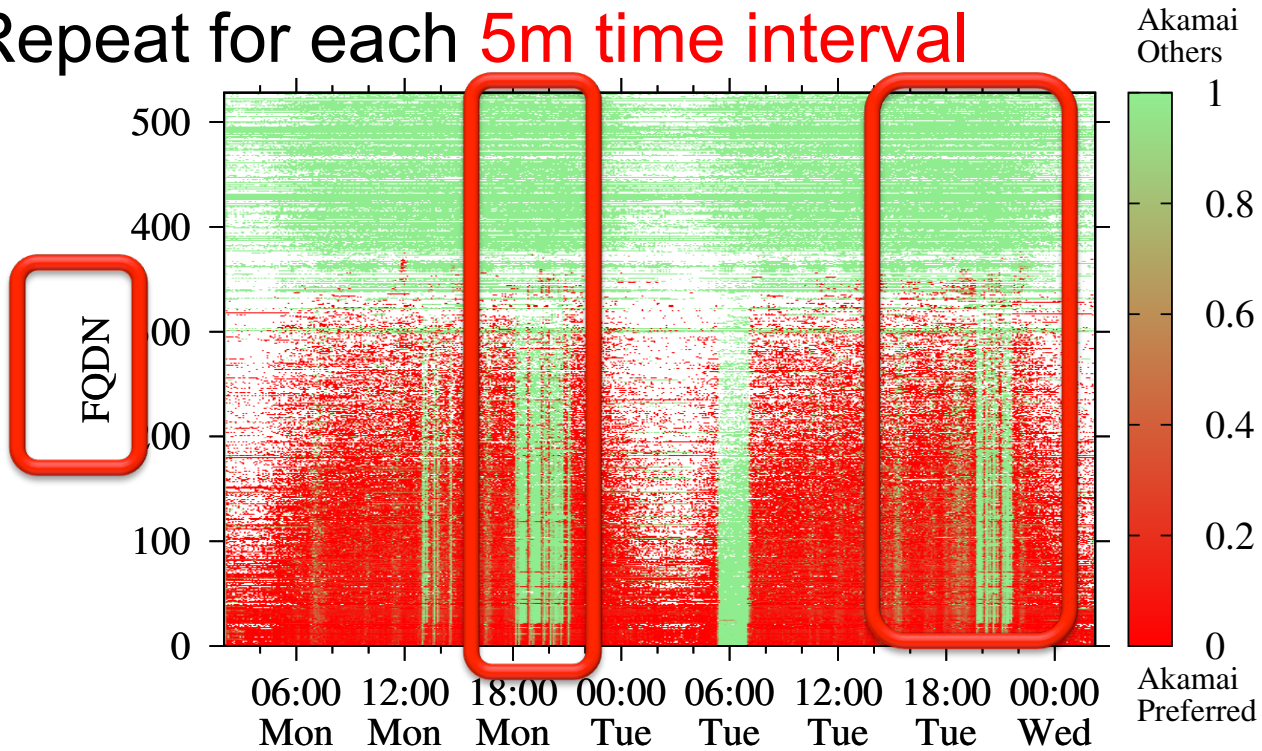
Reasoning about the problem

- Is the change related to single servers? **NO**
  - Compute the traffic volume per IP address for every 15m time intervals



Reasoning about the problem

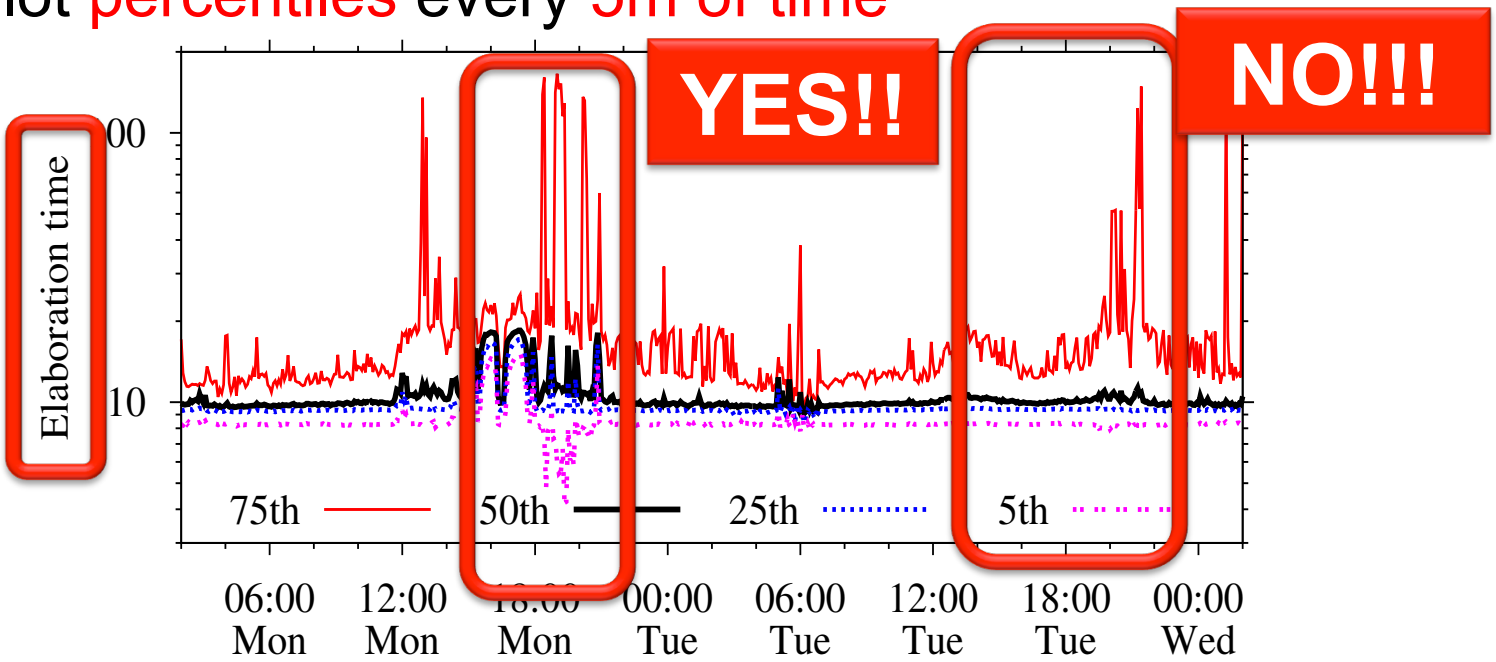
- Is this affecting only some services(*)? **NO**
  - Select the top 500 services served by Akamai
  - Order by frequency
  - Repeat for each 5m time interval



(*) Service == FQDN

Does this have effects on the QoE?

- Was this triggered by CDN performance issues?
- For services served by Akamai preferred cache
  - Compute the distribution of server elaboration time
  - Plot percentiles every 5m of time



Reasoning about the problem

- Is the change related to single servers? **NO**
- Is this affecting only some services? **NO**
- Was this triggered by CDN performance issues? **NO**
- …
- …

- **Any good suggestion?!?!? ☺**

Conclusions/WIP

- We are working to design an intelligent measurement plane
- We are now working on a scalable repository
- And on an (un-)supervised supervisor that can (automatically) learn and find the root cause of events

- We are open to collaborations => ask me

mPlane

Project acronym: mPlane
Project full title: "mPlane – an Intelligent Measurement Plane for Future Network and Application Management"
Grant agreement no: 318627
Staring Date: November 1st 2012
Total Cost: 11,274,908.00Euros
Duration: 3 years
Partners: 16
Coordinator: **Prof. Marco Mellia** – Politecnico di Torino - IT

mPlane

SEVENTH FRAMEWORK PROGRAMME