

G o o g l e

# Life After Launch

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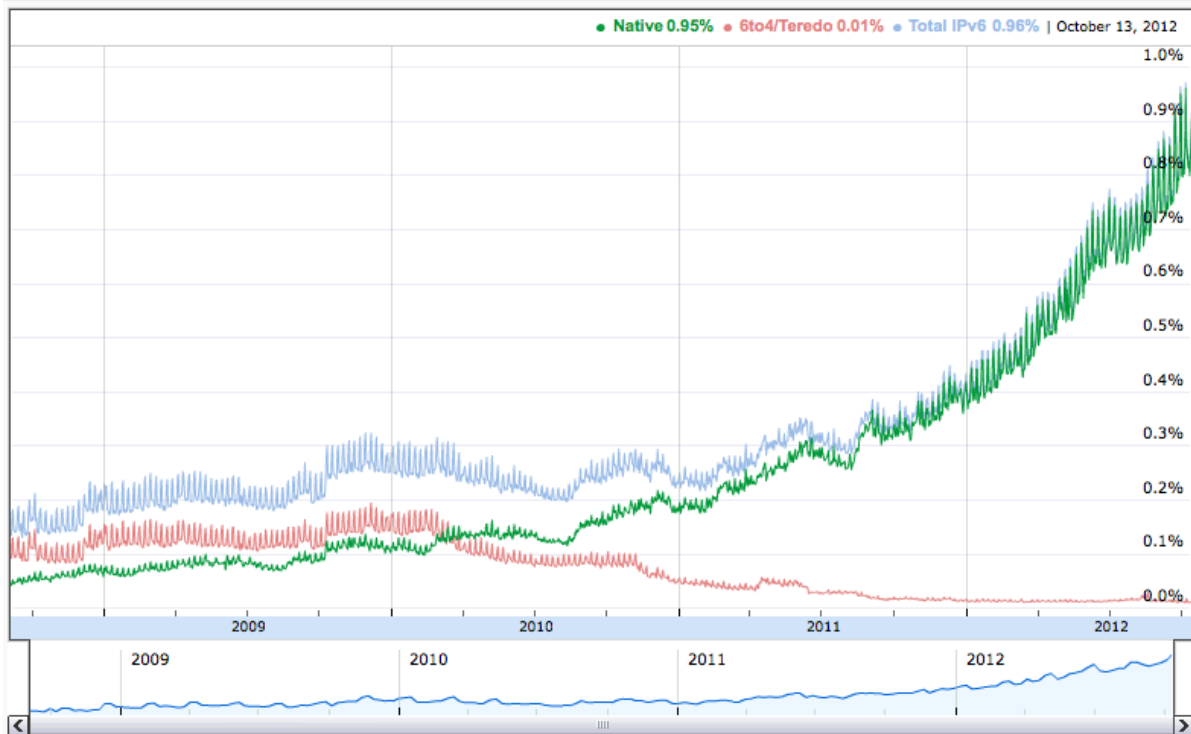
# Brief History

- 8/6/2011: World IPv6 Day  
Extremely successful  
Proved it can be done  
Measurable  
v6 was **turned off** after the day
  
- 6/6/2012: World IPv6 launch:  
"This time it's for real"  
IPv6 permanently enabled



# Preparation

# Adoption measurements



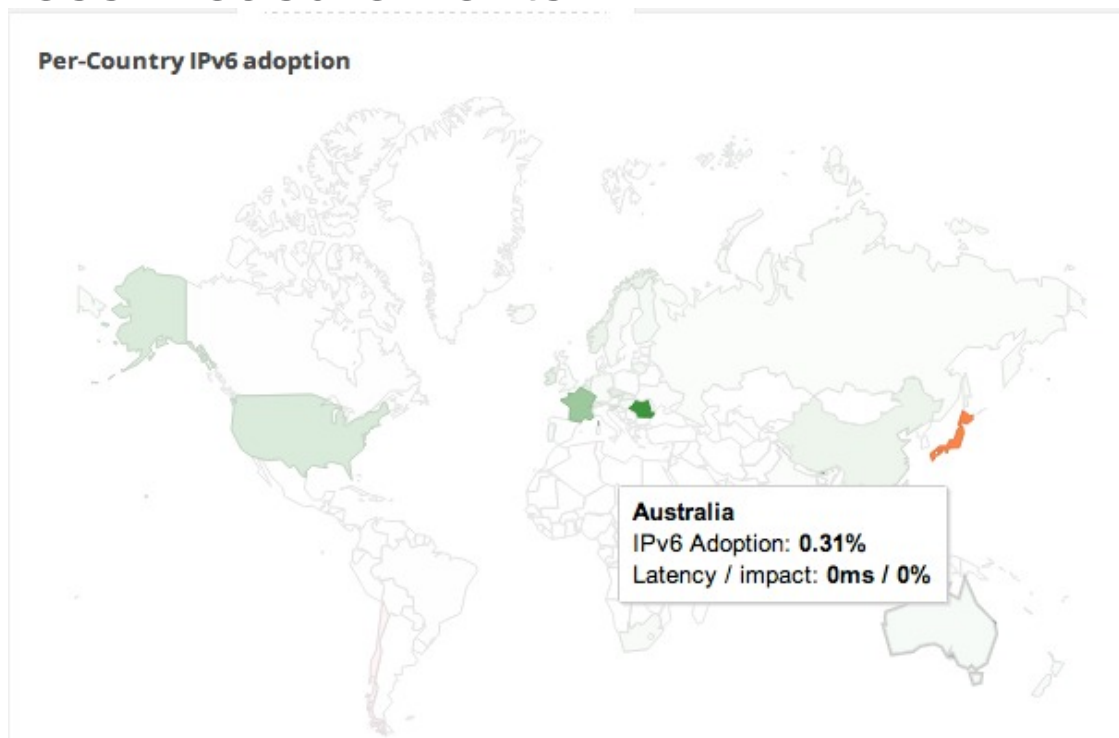
- Helped power World IPv6 launch:  
Wrote committee tool, provided data to [participant list](#) pages

IPv6 adoption grew by 150% (2.5x) in the last year

On top of already rapid IPv4 growth

At this rate, 50% of users will have IPv6 in ~6 years

# Brokenness measurements



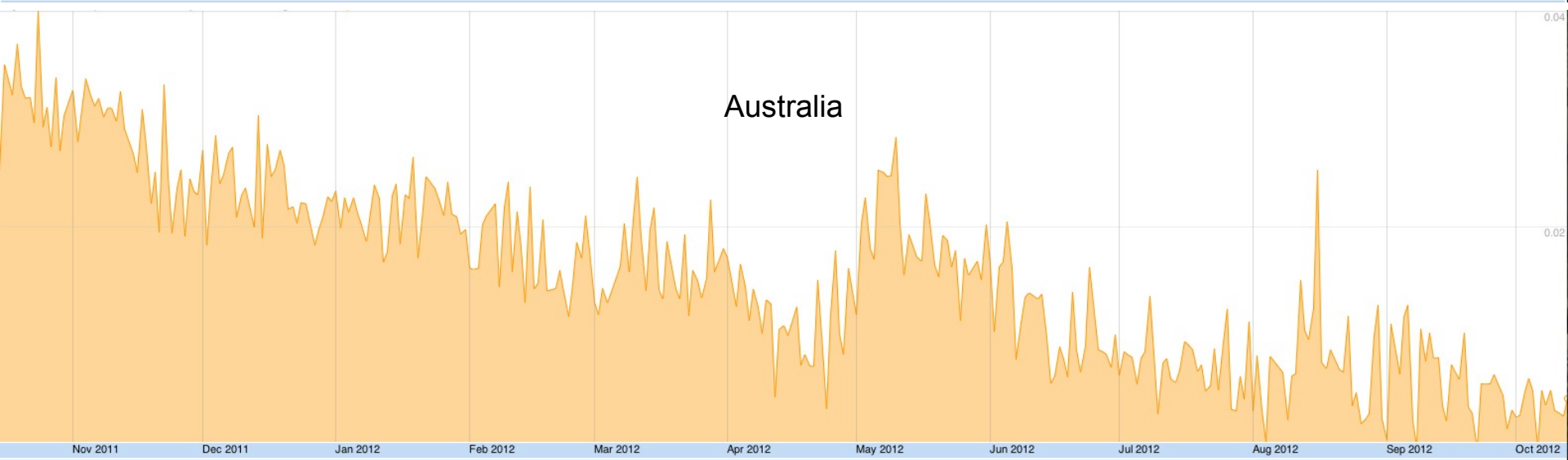
- Worked with major IPv6 networks to identify / fix issues before launch
  - Not scalable, but necessary before launch
- Warned users with connectivity problems
- Publish and update [list of networks](#) Google does not enable IPv6 for

# Brokenness for the last 12 months

Worldwide



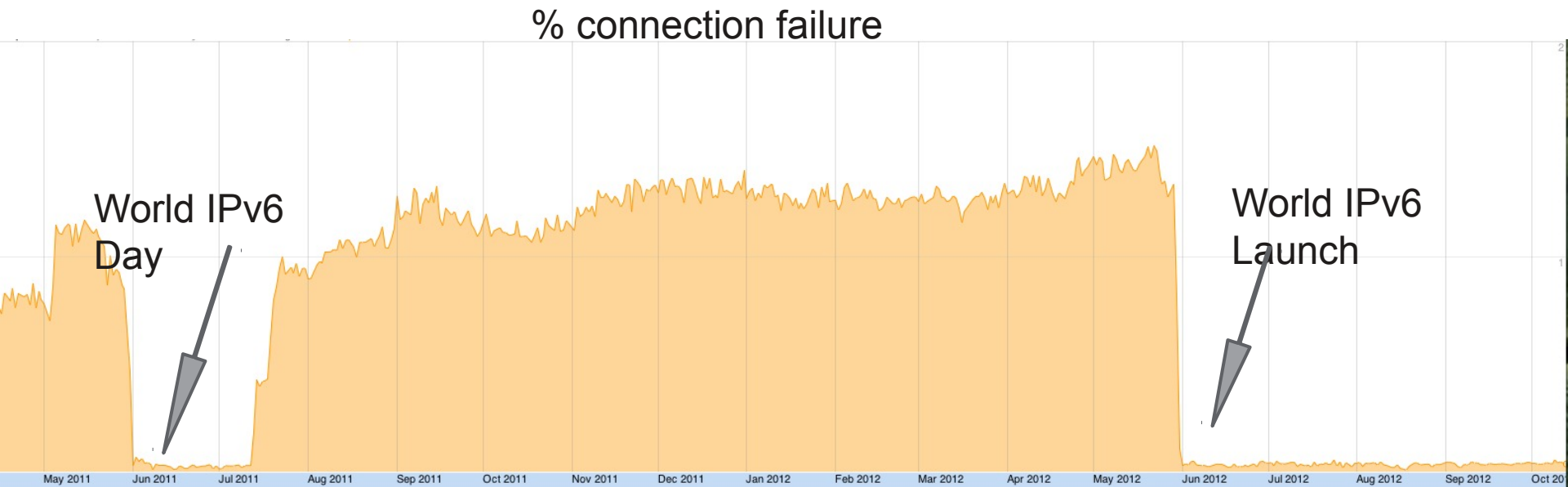
Australia



# AAAA filtering

## Not a real fix

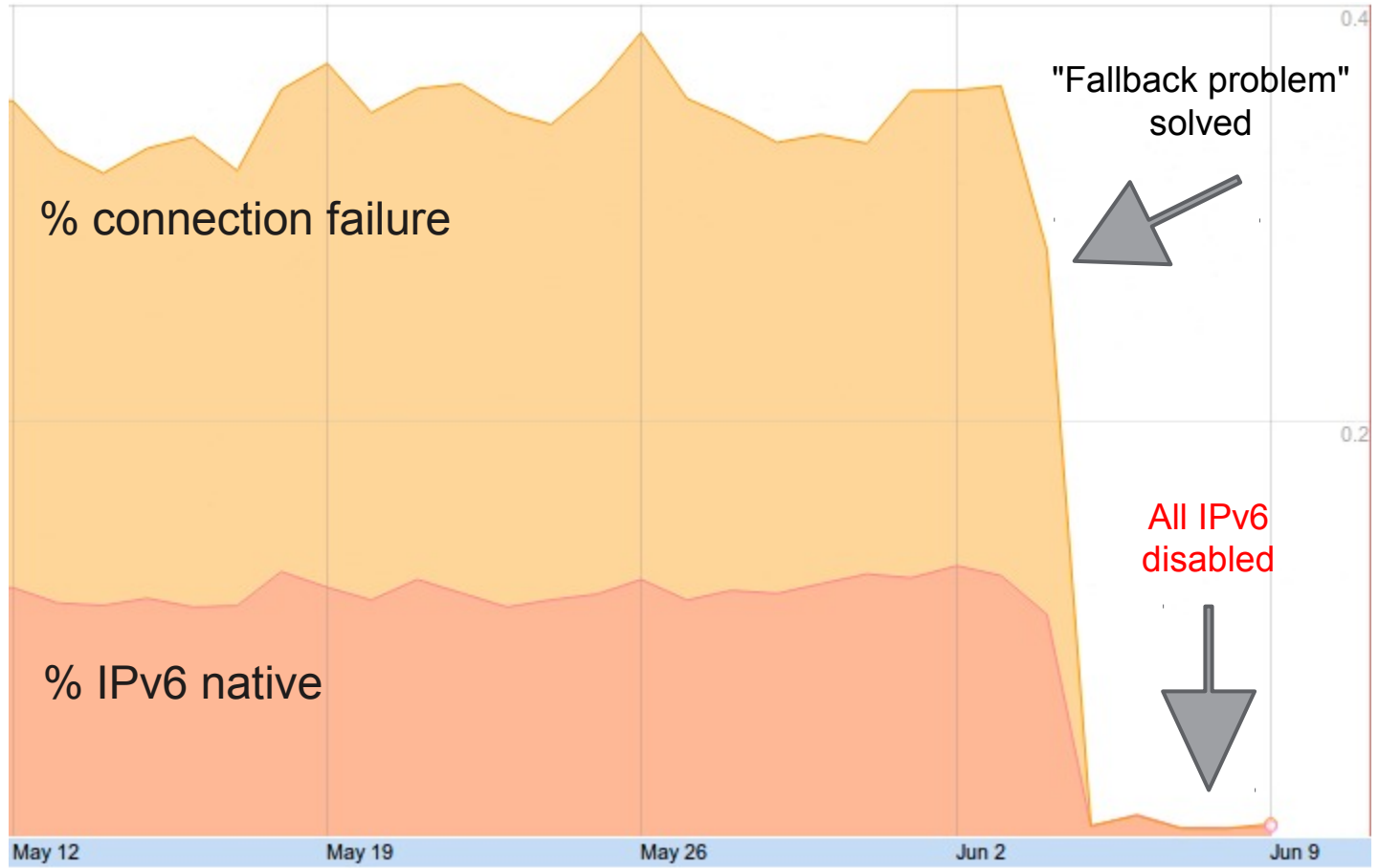
- Many ISPs with IPv6 connectivity problems used AAAA filtering
  - The underlying problem doesn't go away
  - Disables measurements, so impossible to know when to stop filtering
  - Policy/censorship issues



A major Japanese ISP

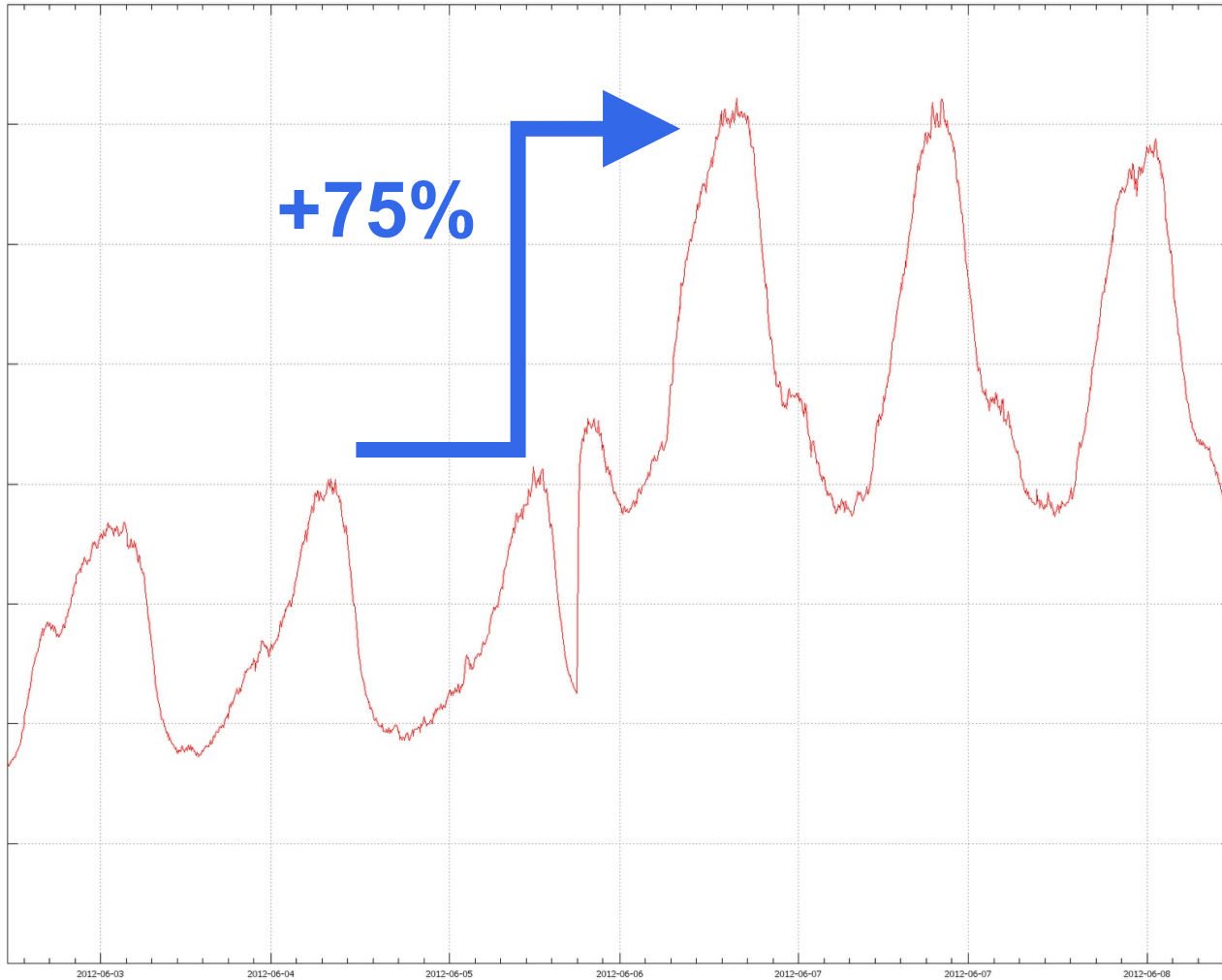


# Collateral damage

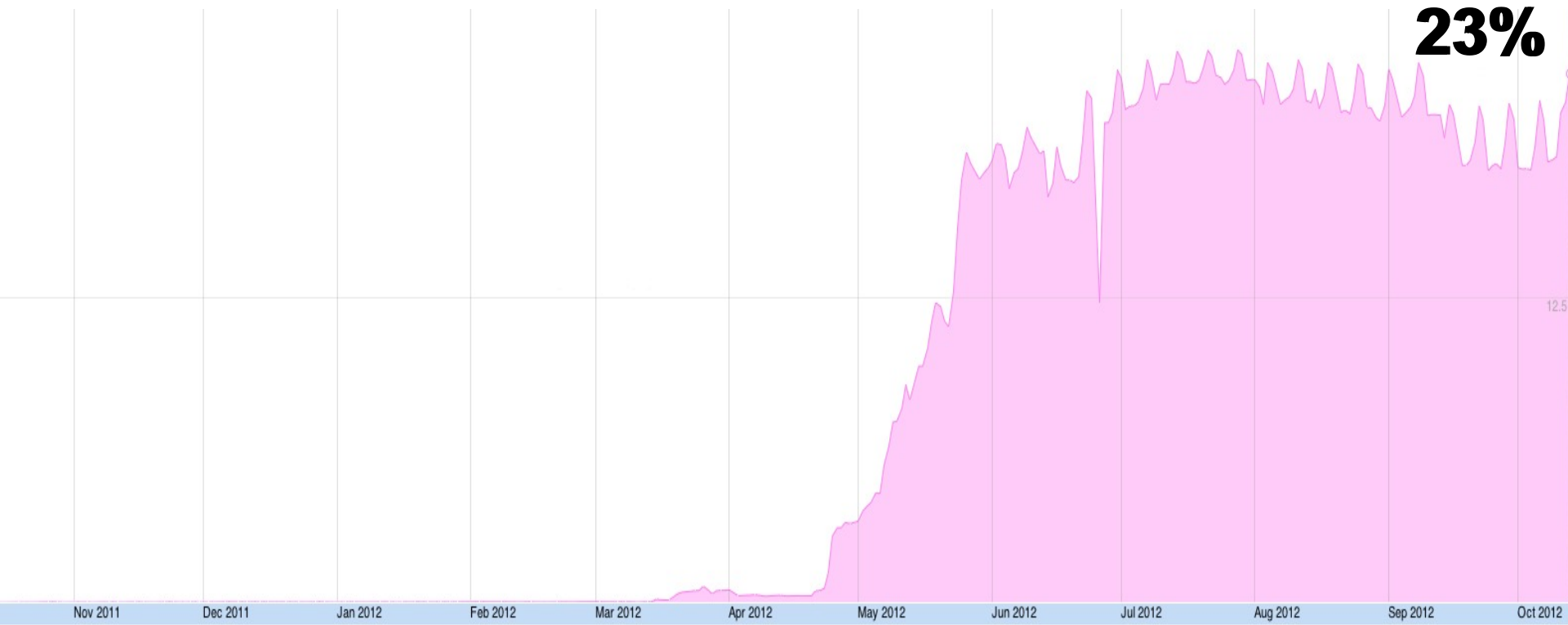


# Launch!

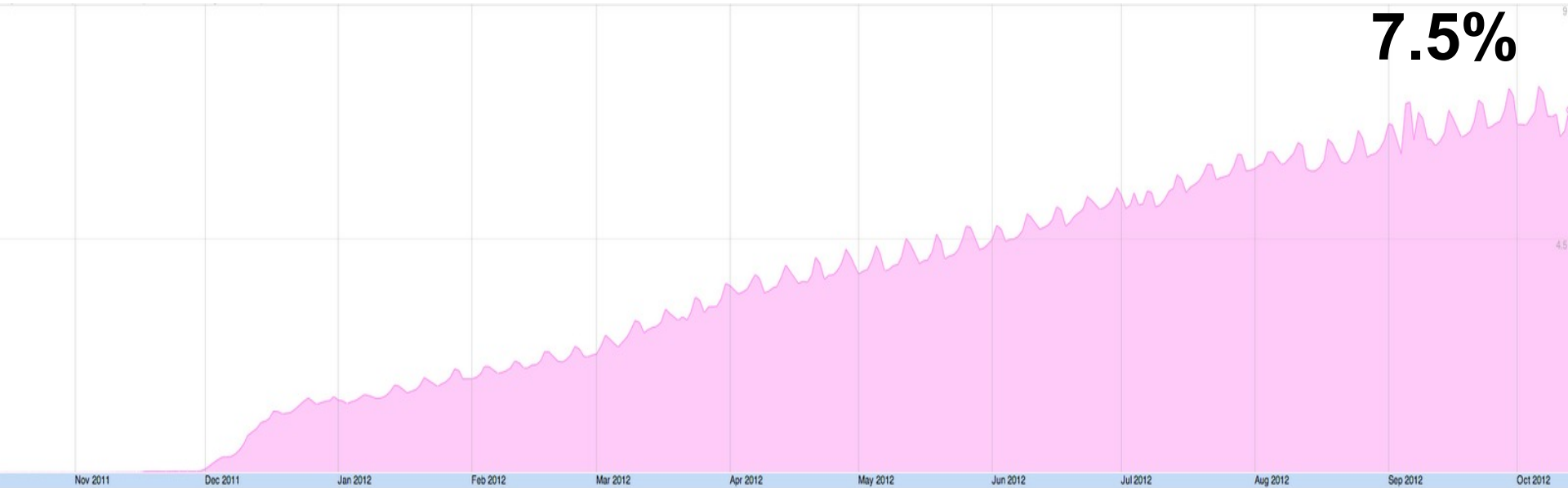
# IPv6 QPS



# Fiber, cable: RCS & RDS

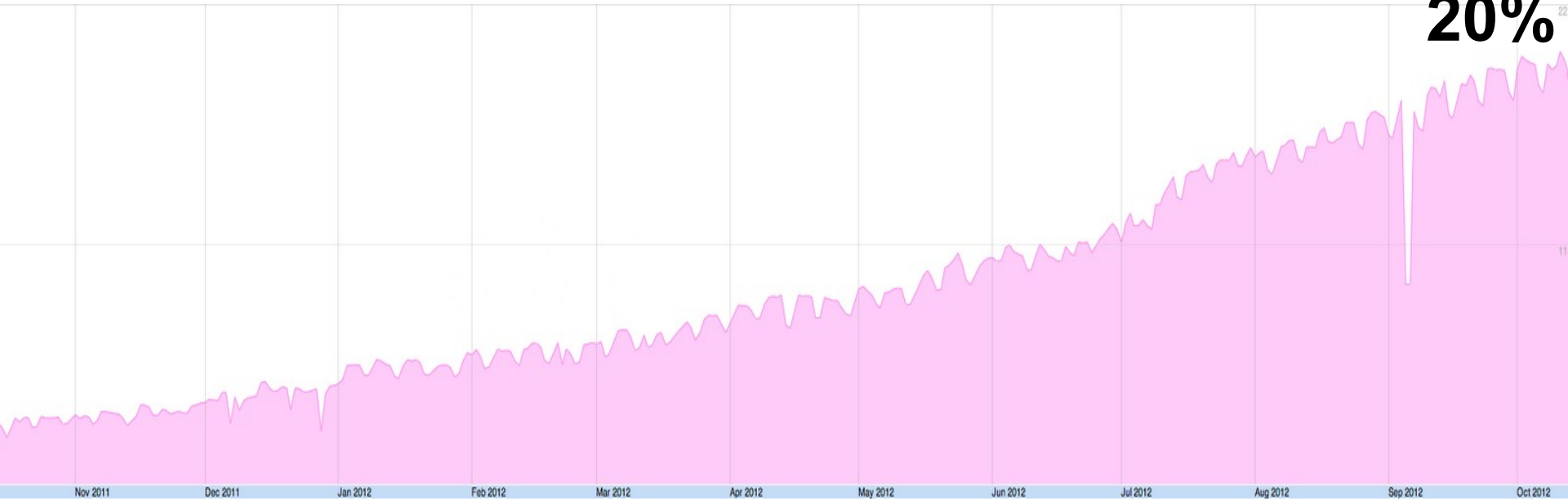


## DSL 6rd: AT&T



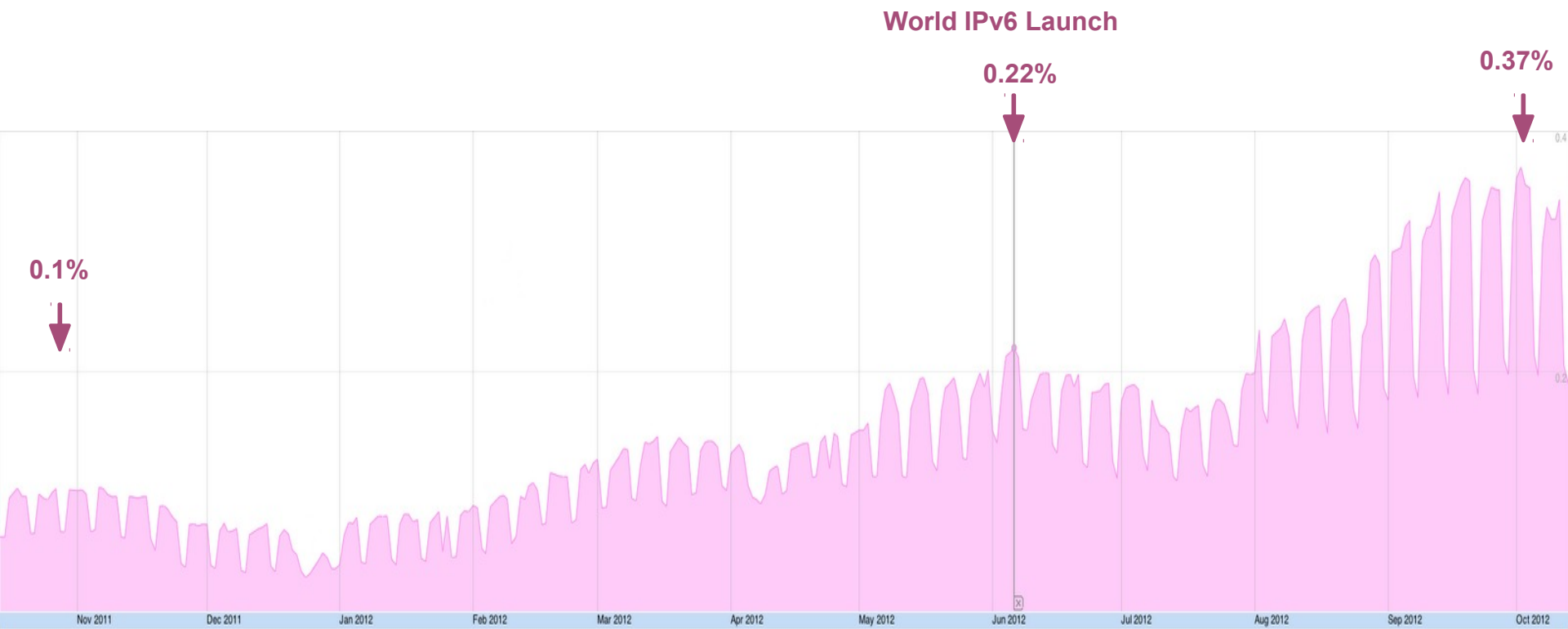
- Enabled IPv6 for 1 million subscribers
  - Could reach [5 million by EOY 2012](#)
  - IPv6-enabled customers see 20% of traffic on IPv6

# LTE: Verizon Wireless

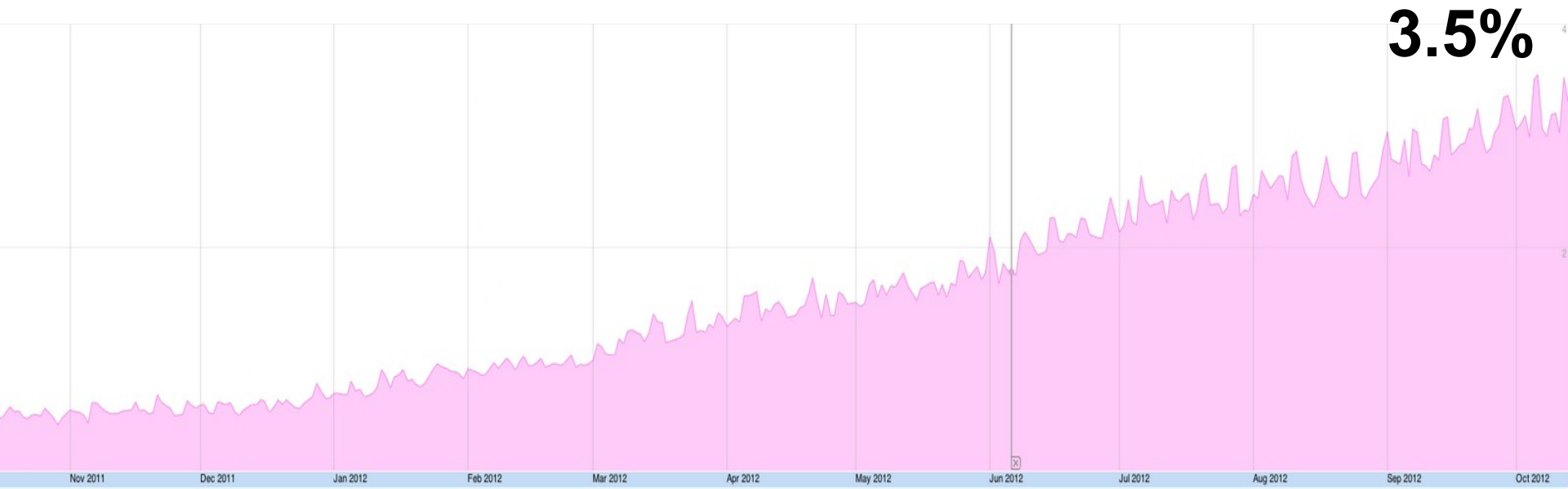


**20%**

# Australia



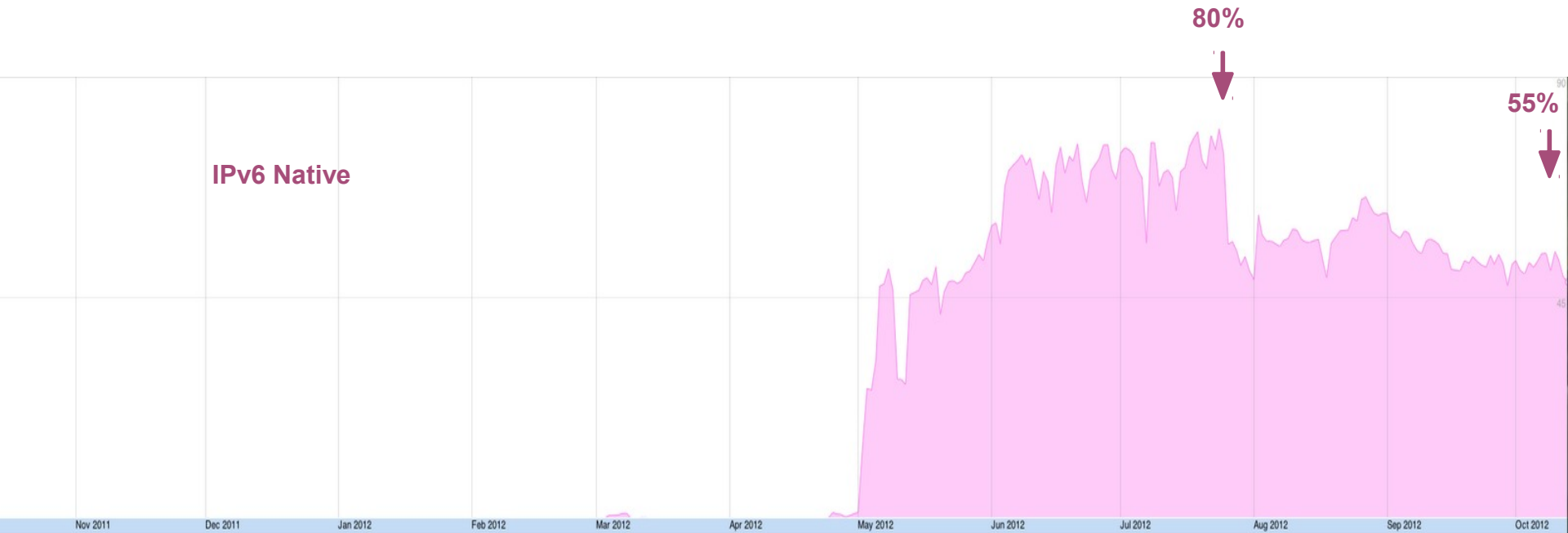
# Internode



World IPv6 Launch founding member in Australia



# One Australian University: Very Rapid Deployment

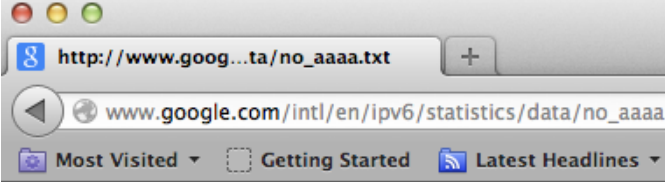


# Process Changes

- Google over IPv6 program retired
- Return AAAA to all resolvers by default
- Monitoring brokenness
- Automatically:
  - Stop returning AAAA to resolvers where users experience problems;
  - Start returning AAAA when problem goes away

Are your resolvers listed?

[http://www.google.com/intl/en/ipv6/statistics/data/no\\_aaaa.txt](http://www.google.com/intl/en/ipv6/statistics/data/no_aaaa.txt)



The screenshot shows a web browser window with the address bar containing the URL `http://www.google.com/intl/en/ipv6/statistics/data/no_aaaa.txt`. The page content is as follows:

```
# Resolvers to which Google may not return AAAA
# Copyright 2012 Google Inc. All Rights Reserved
# Last updated: 2012-10-14.

192.0.2.0/24
2001:db8::/32
200.28.4.129/32      # AS7418 Chile
200.28.4.130/32      # AS7418 Chile
201.228.140.4/30     # AS3816 Colombia
201.228.139.162/32  # AS3816 Colombia
201.228.139.161/32  # AS3816 Colombia
```

# Conclusions

# Real impact on whole ecosystem

- World IPv6 Launch participants
  - 3000+ websites
  - 60+ ISPs
  - 4 home router vendors
- Real traffic
  - Comcast: "IPv6 enabled users see **up to 40% of traffic** on IPv6"
- Real deployments
  - everywhere around the world
  - on every access technology

# Questions?