

*"It was the best of times, it was the  
worst of times..."*

## Hoe staat het met de IPv6-transitie en hoe nu verder?

Amsterdam, 8 jan 2013

Iljitsch van Beijnum

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Amsterdam, 8 jan 2013

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**There's nothing more annoying than Dutch people speaking English to other Dutch people.**

*"It was the best of times, it was the  
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## Hoe staat het met de IPv6-transitie en hoe nu verder?

Amsterdam, 8 jan 2013

Iljitsch van Beijnum

**So I'll be speaking Dutch.  
But don't worry, I'll be subtitled.**

# Status IPv4



**In early 2011 the IANA global IPv4 pool ran dry.**

# Status IPv4



**A few months later the Asia-Pacific region was out of IPv4 addresses**

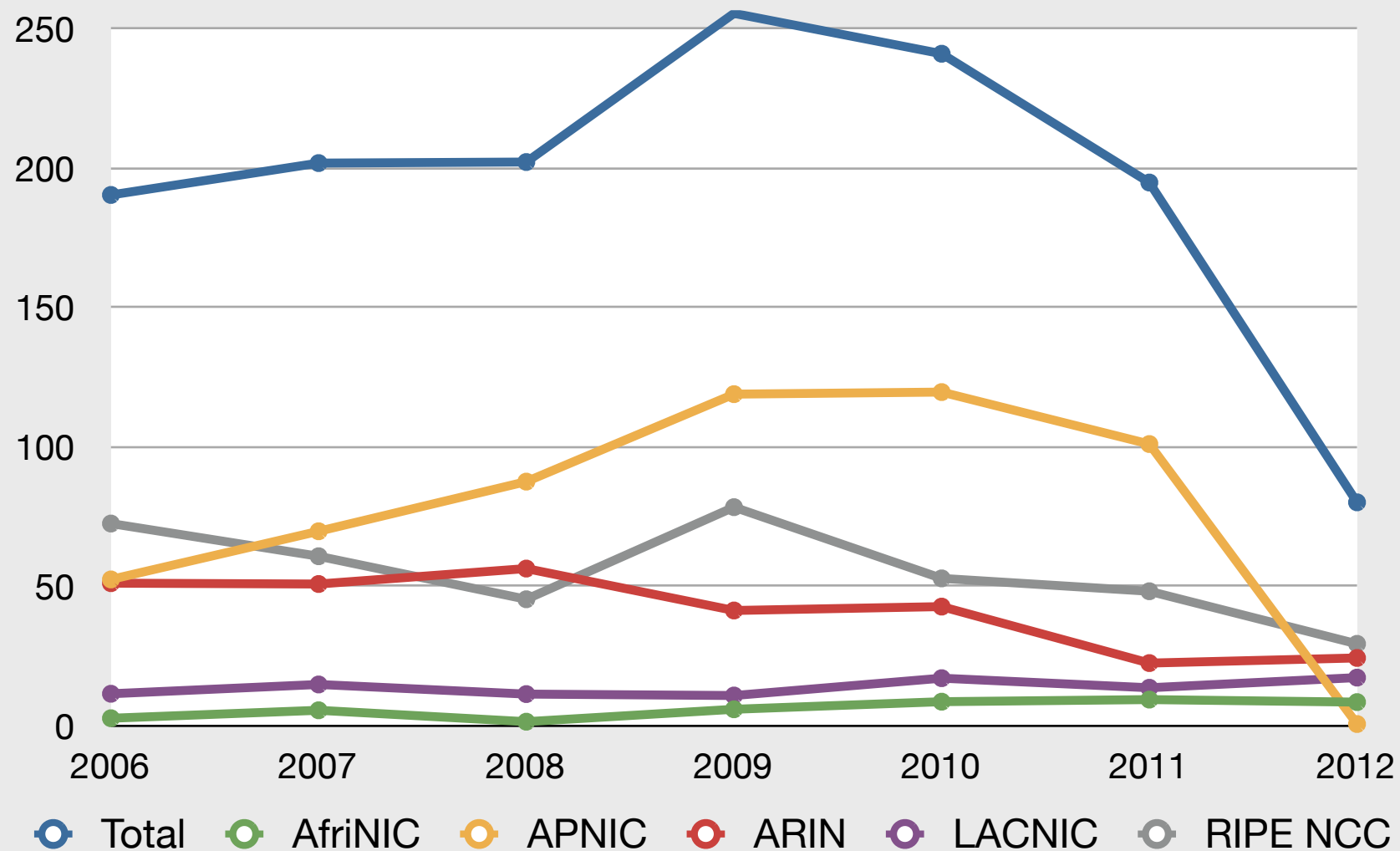


# Status IPv4



and last September Europe and the rest of the  
RIPE region ran out.

# IPv4-adressen per jaar



**IPv4 addresses per year:  
I think this graph speaks for itself.**

# Het goede nieuws: IPv6

- In 2012:
  - DE-CIX: 1 Gbps → 5 Gbps (0,3%)
  - Alexa top 500: 8% → 23%
  - Google: 0,4% → 1% (2,5 x)
    - in 2011: 0,2% → 0,4% (2 x)

**The good news: IPv6.  
However, there are many different statistics.**

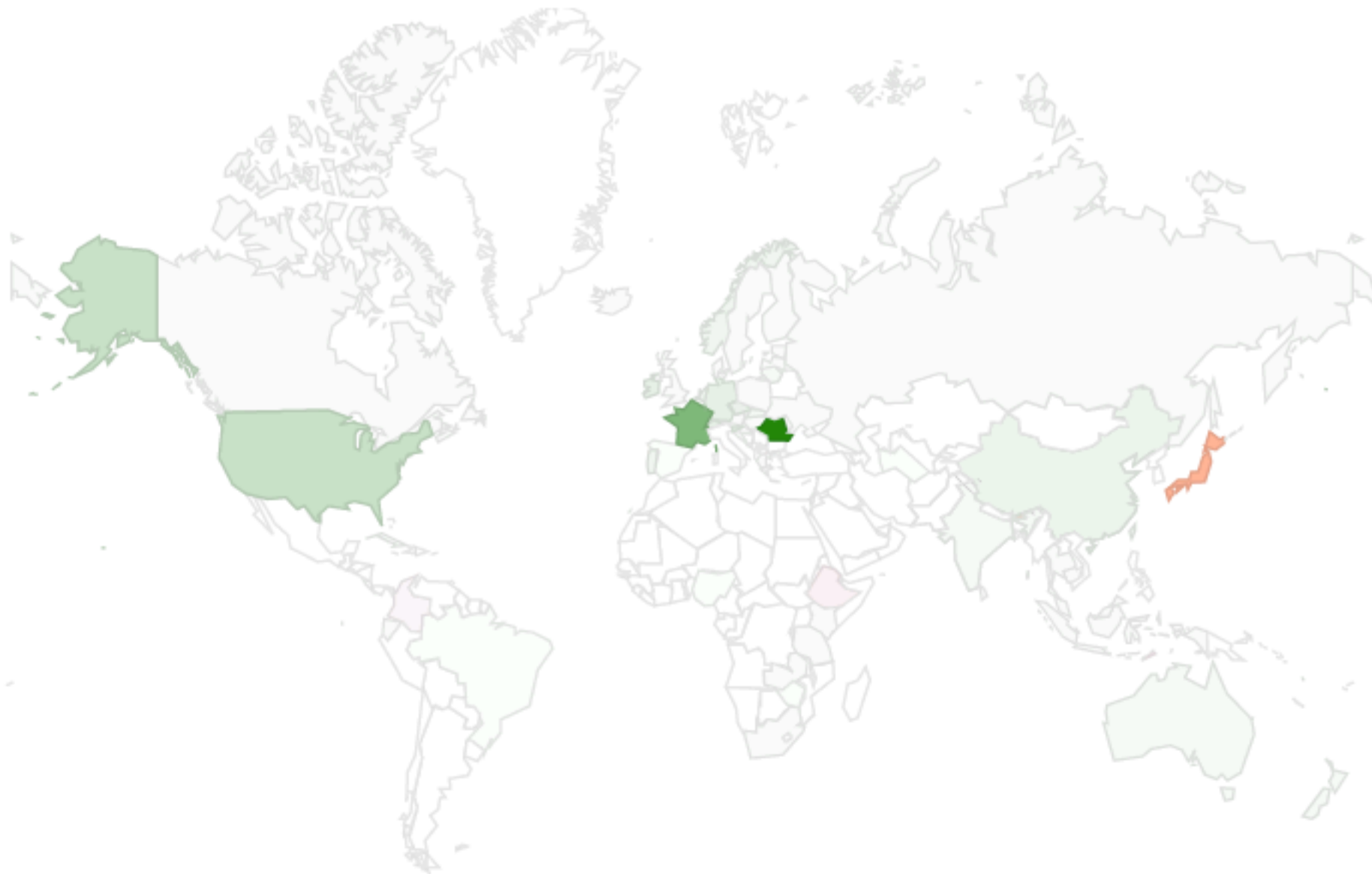


# Het goede nieuws: IPv6

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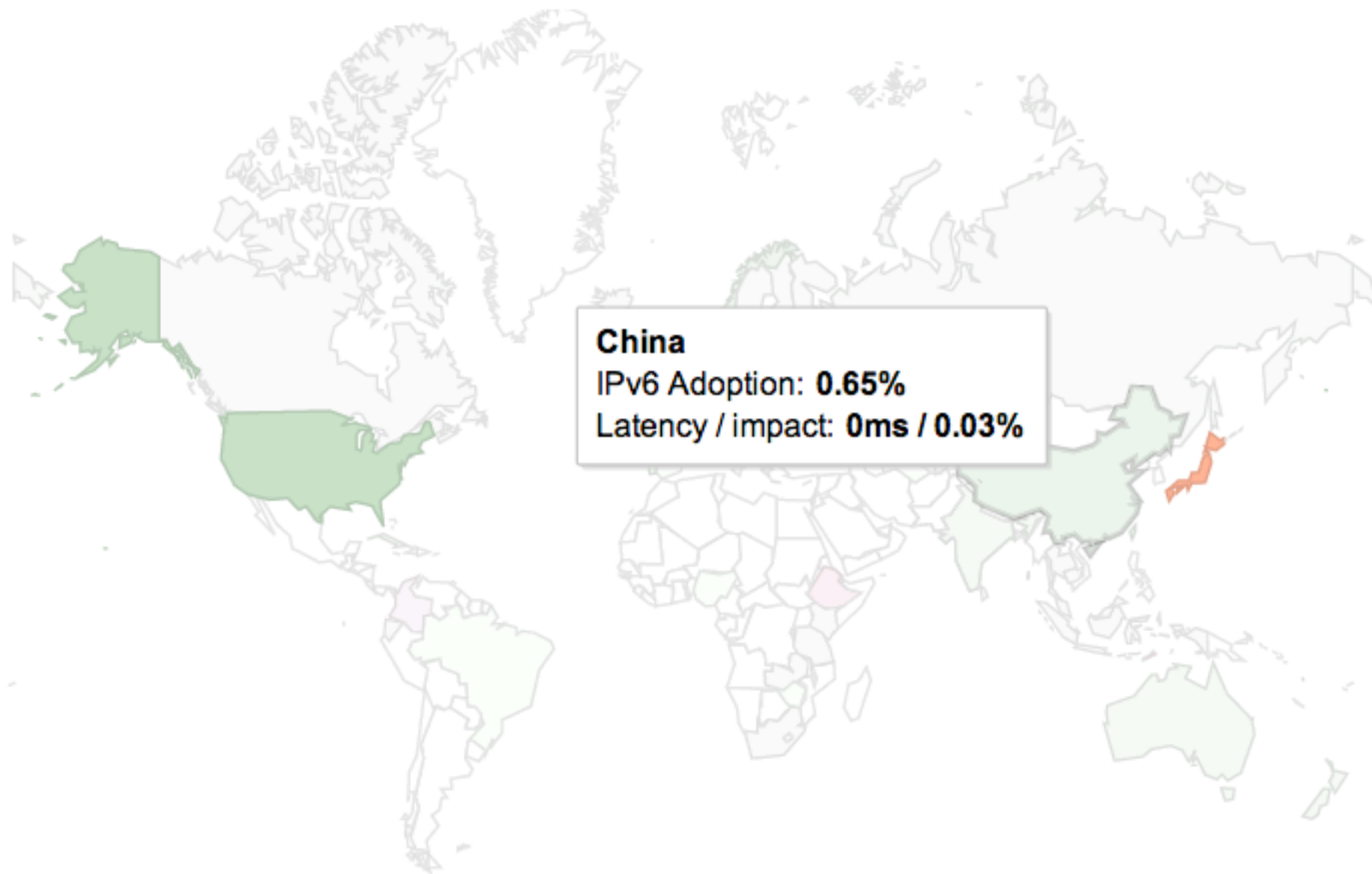
**If we can maintain Google's annual factor 2.5 increase, we'll be at 100% IPv6 in five years.**

### Per-Country IPv6 adoption



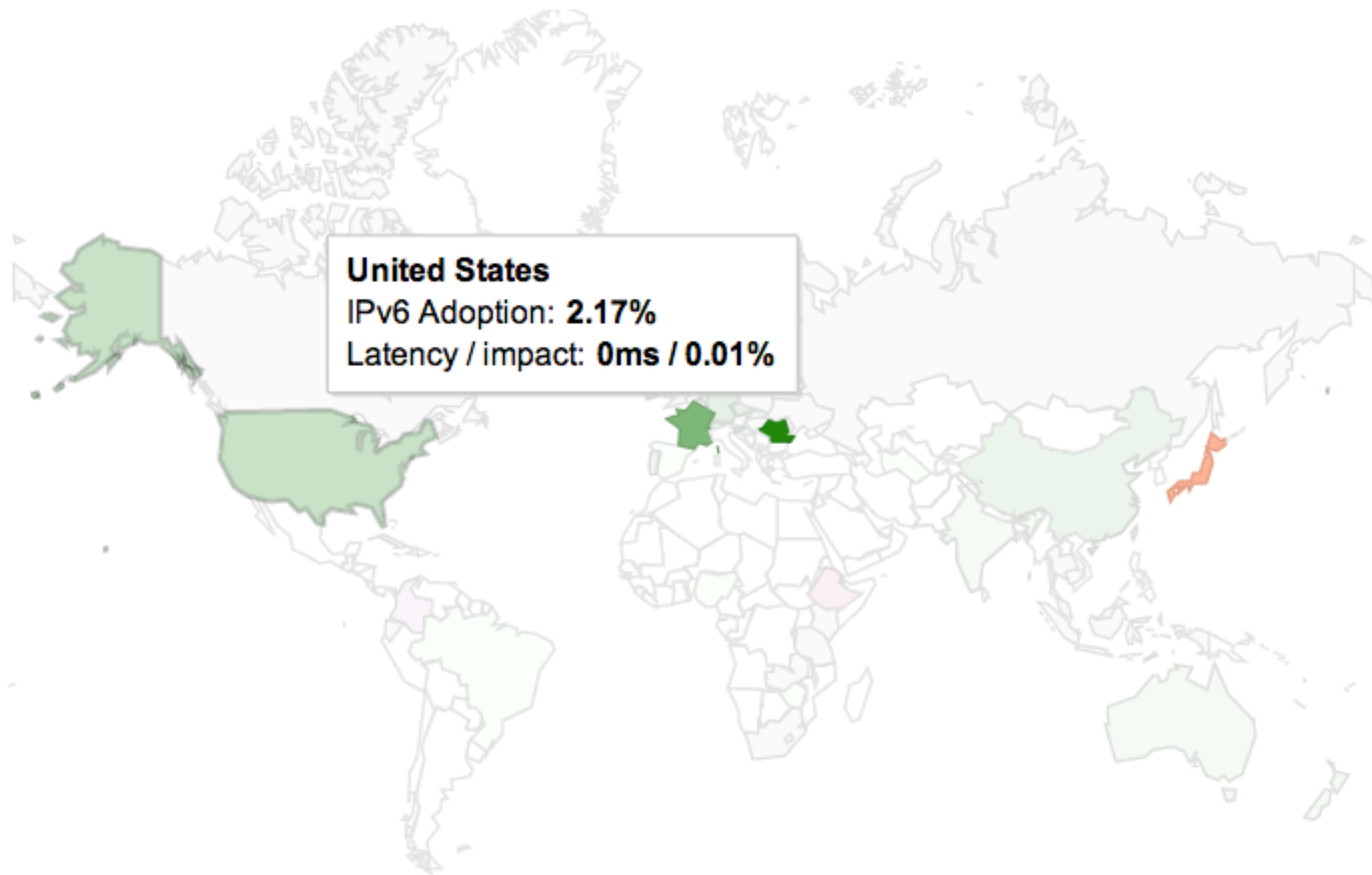
**This is the relative level of IPv6 capability that Google sees in different countries.**

### Per-Country IPv6 adoption



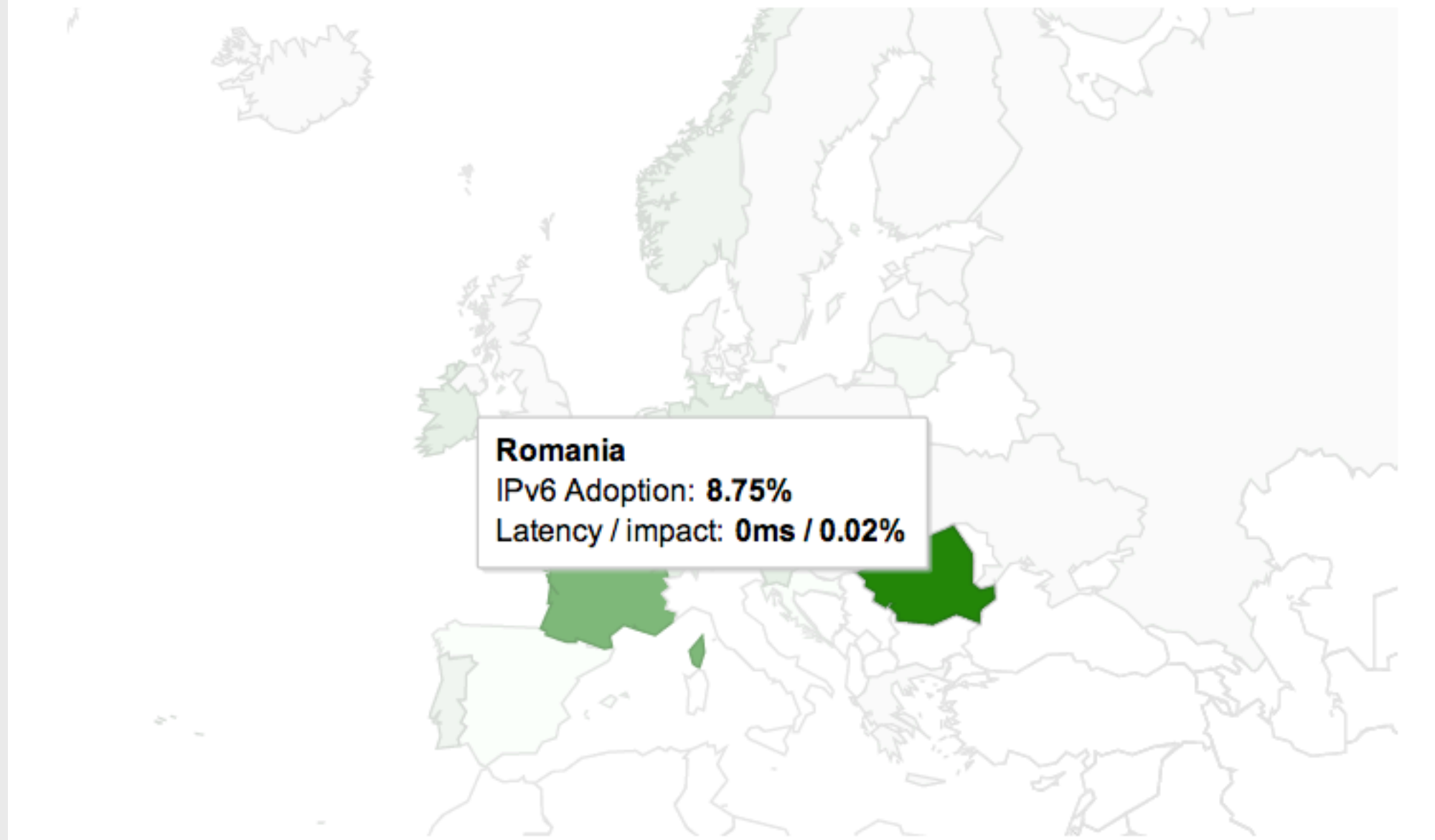
**Despite lack of IPv4, Asia is doing fairly poorly.  
Even China is below the world-wide average.**

### Per-Country IPv6 adoption



**The United States now has three times as many IPv6 users as China.**

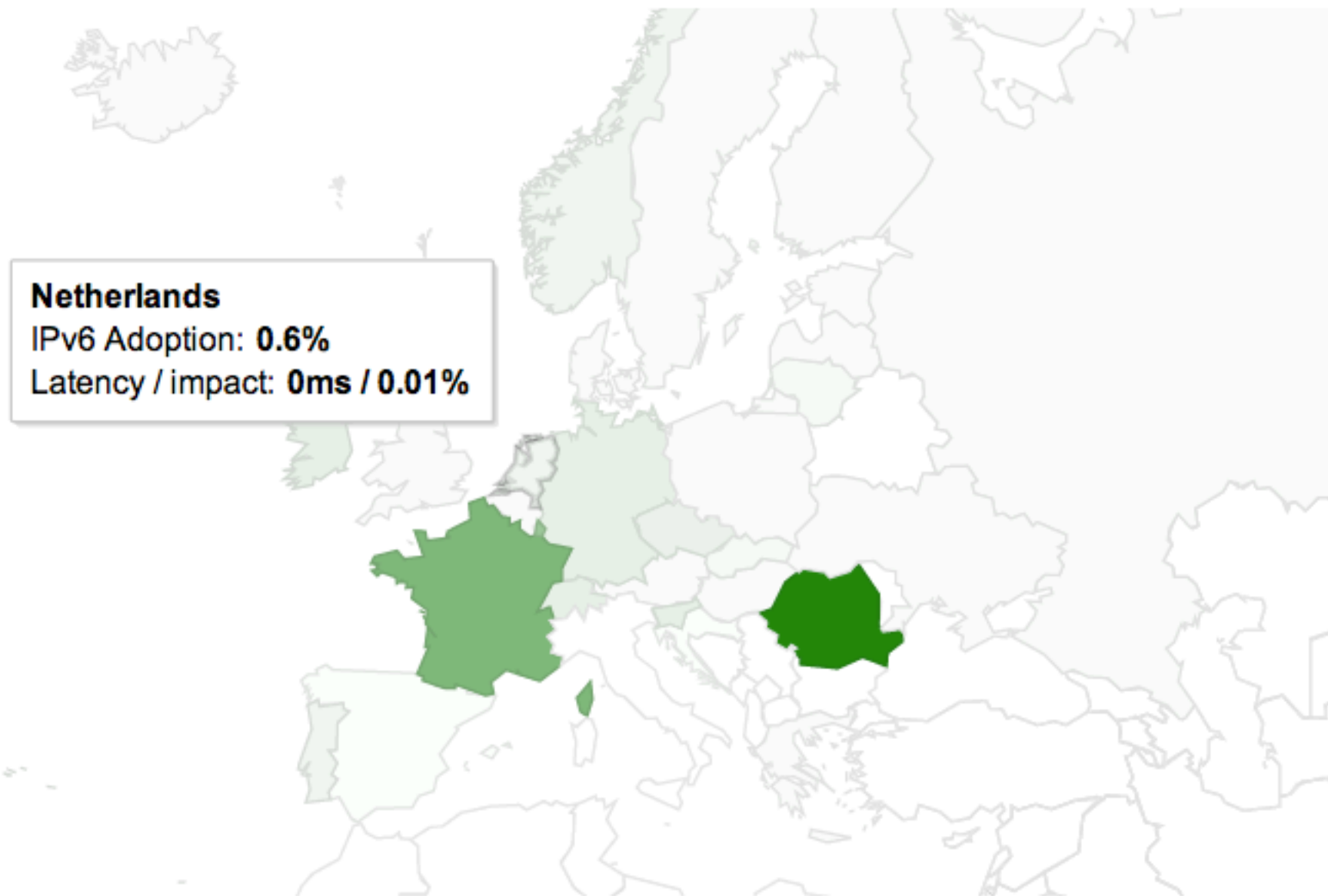
### Per-Country IPv6 adoption



**A few countries in Europe are doing very well.  
Only one or two ISPs make all the difference.**

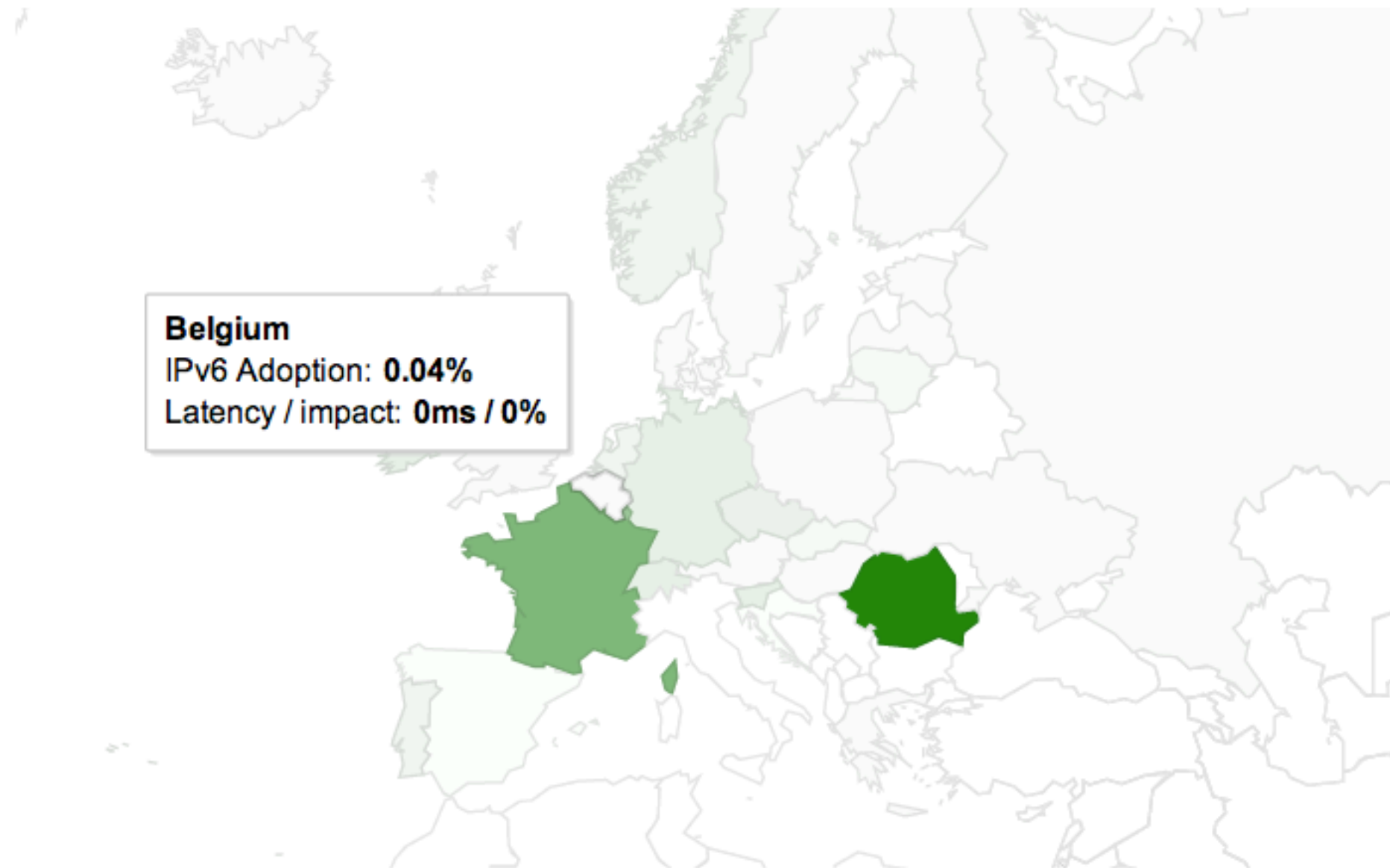


### Per-Country IPv6 adoption



**We are not doing that great.**

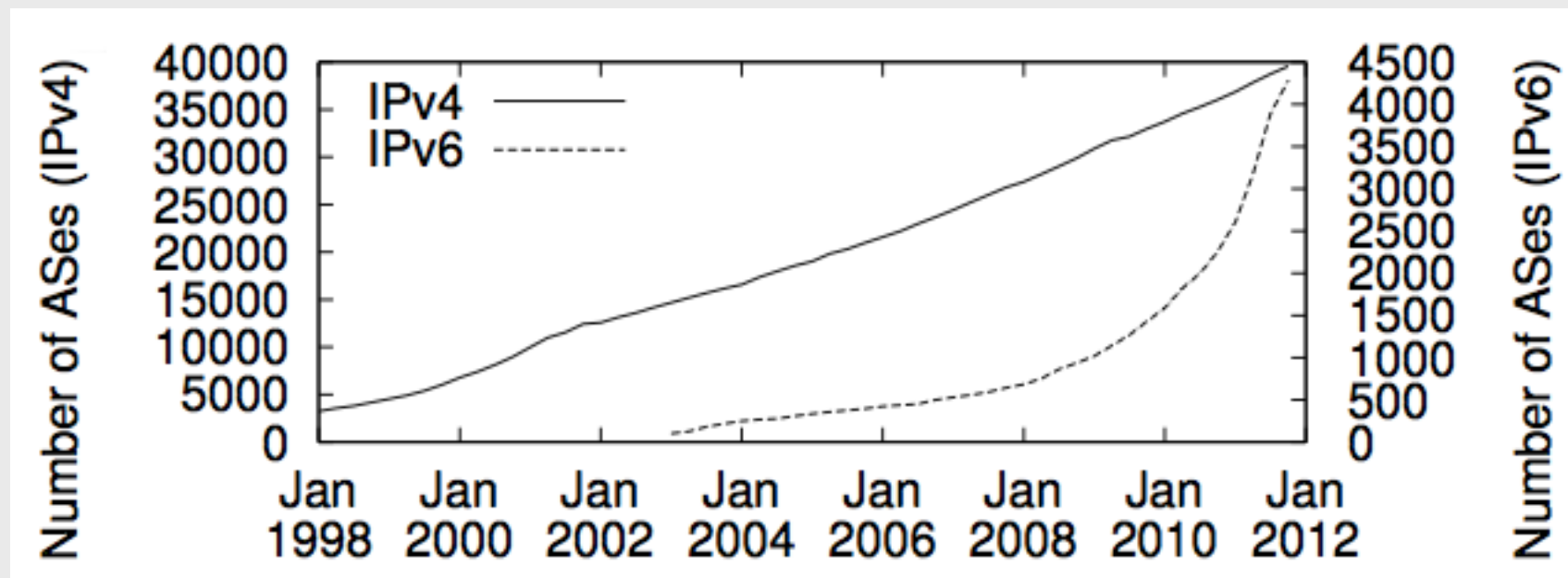
### Per-Country IPv6 adoption



**But at least we're well ahead of Belgium.**

# IPv6-groei nu exponentieel

- IPv4 ASen: exponentieel tot 2002, daarna lineair
- IPv6 ASen: lineair tot 2008, sindsdien exponentieel



bron: CAIDA

**The number of BGP autonomous systems with IPv6 is growing exponentially since 2008.**

# Wat nu?

**What now?**

# Wat nu?

**There's a gap between "peak IPv4" (2010) and  
"full IPv6" of some five years...**



# Lessen APNIC-regio



*Gryllus bimaculatus*

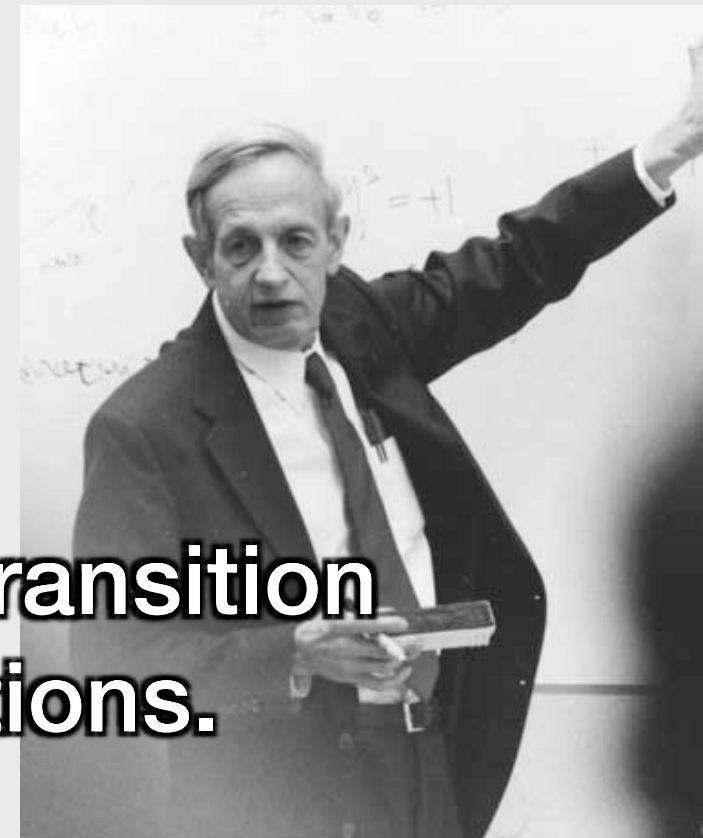


**APNIC region has been very quiet. (Crickets...)  
Word on the street: ISPs buying big NAT boxes.**

# Nash equilibrium

- Voordelen en kosten transitie naar IPv6 verschilt enorm per organisatie, dus:
  - sommigen willen snel
  - anderen helemaal niet
- Werkt alleen als iedereen meedoet...
- Nash equilibrium: niemand kan eenzijdig de situatie verbeteren

**Advantages / disadvantages of IPv6 transition are different for different organizations.**

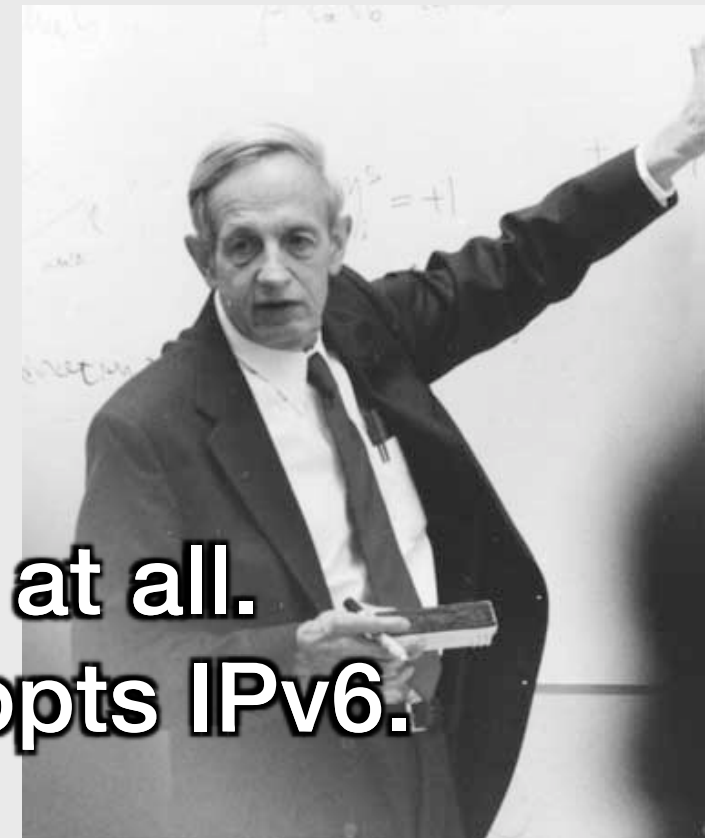




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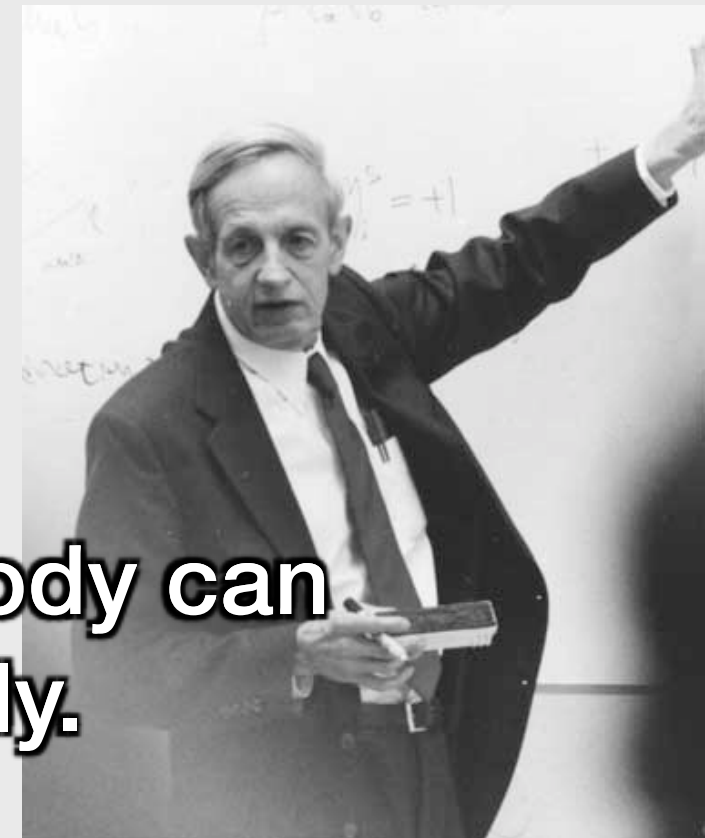
**Some want to do it fast, others not at all.  
But it only really works if everyone adopts IPv6.**



# Nash equilibrium

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**So we have a Nash equilibrium: nobody can improve the situation unilaterally.**



# Geen plan B

- We hebben een paar moeilijke jaren voor de boeg:
  - veel NAT
  - veel onduidelijkheid
  - nog steeds mensen in ontkenningsfase
- Maar uiteindelijk komt dat IPv6 internet er wel
  - 2017...?

**Difficult years ahead: lots of NAT, FUD; some still in denial. But we'll get there. In 2017...?**



- Het hele verhaal in meer detail:
  - <http://arstechnica.com/business/2013/01/ipv6-takes-one-step-forward-ipv4-two-steps-back-in-2012/>

*That's all Folks!*

- [www.bgpexpert.com](http://www.bgpexpert.com): contact info, meer BGP/IPv6

**Thanks for listening!**

**See the Ars Technica link for the long version.**