IPv6 in practice

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Address space

32-bit address: 192.168.1.13
Netmask: 255.255.255.0
CIDR notation: 192.168.1.13/24

One /24 network can have 254 hosts

IPv4 has room for 4 294 967 296 addresses (in theory)

128-bit address with CIDR notation:
2600:1f16:7a1:1300:e6de:9c41:cbb5:c8cc/64

One standard /64 network can have 18 446 744 073 709 551 616 addresses

IPv6 has room for 340 282 366 920 938 463 463 374 607 431 768 211 456 addresses (in theory)

IPv4 is depleted!

IANA (assigns top-level IP blocks)	Ran out in 2011
APNIC (Asia-Pacific)	Ran out in 2011
RIPE (Europe)	Ran out in 2012
LACNIC (South America)	Ran out in 2014
ARIN (North America)	Ran out in 2015
AfriNIC (Africa)	Expected to run out in 2018

NAT is terrible

- P2P connections require complicated port forwards

- Hosts don't know their own IP address
  ```
  $ curl http://169.254.169.254/latest/meta-data/public-ipv4
  ```

- FTP and other protocols require error-prone package rewrites in firewall

- Cannot ban one user if many users use the same IP

- Performance is hurting!

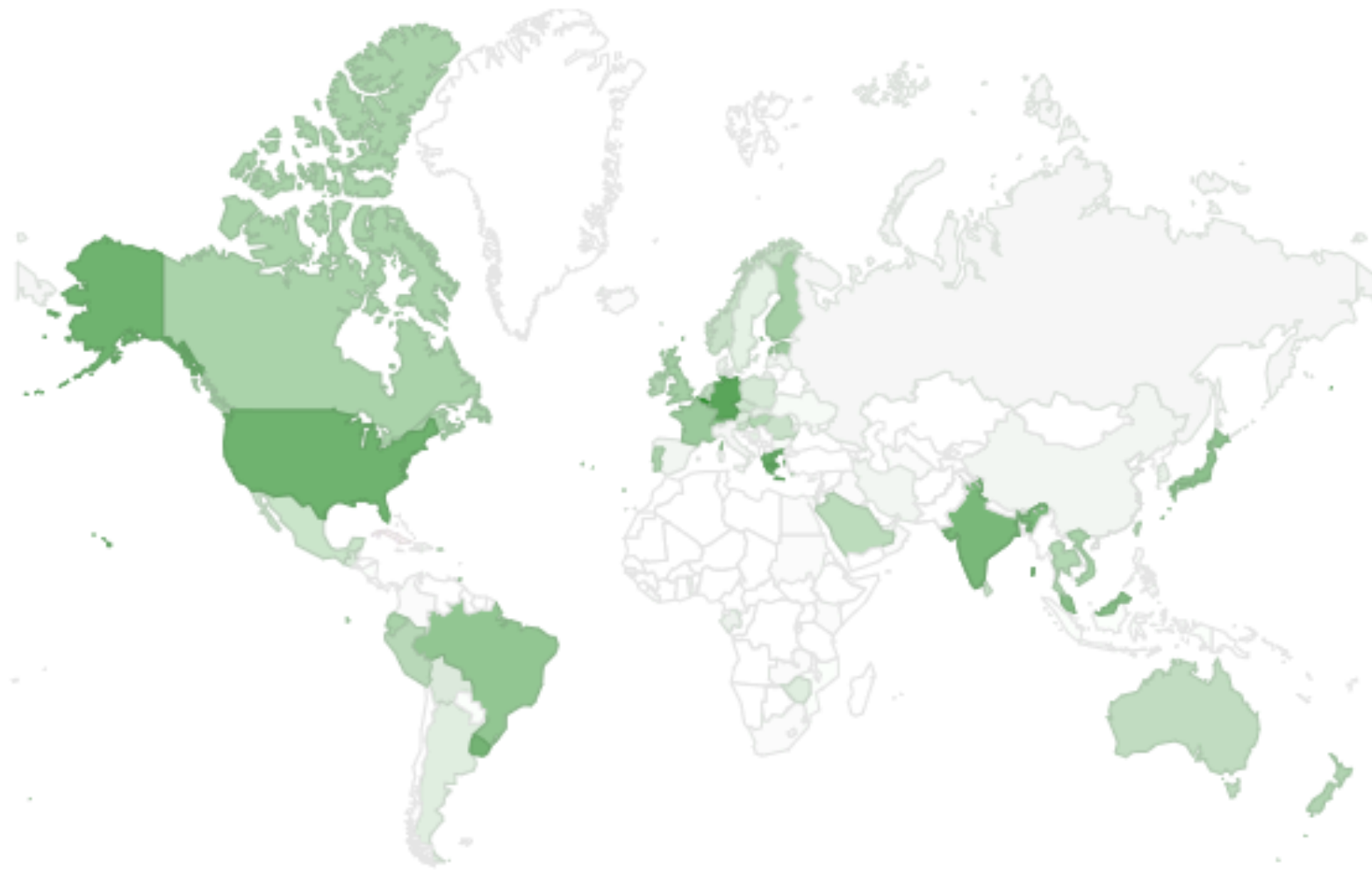# Yes, people DO use IPv6

IPv6 Adoption

We are continuously measuring the availability of IPv6 connectivity among Google users. The graph shows the percentage of users that access Google over IPv6.

Native: **20.74%** 6to4/Teredo: **0.00%** Total IPv6: **20.74%** | **25 May 2018**
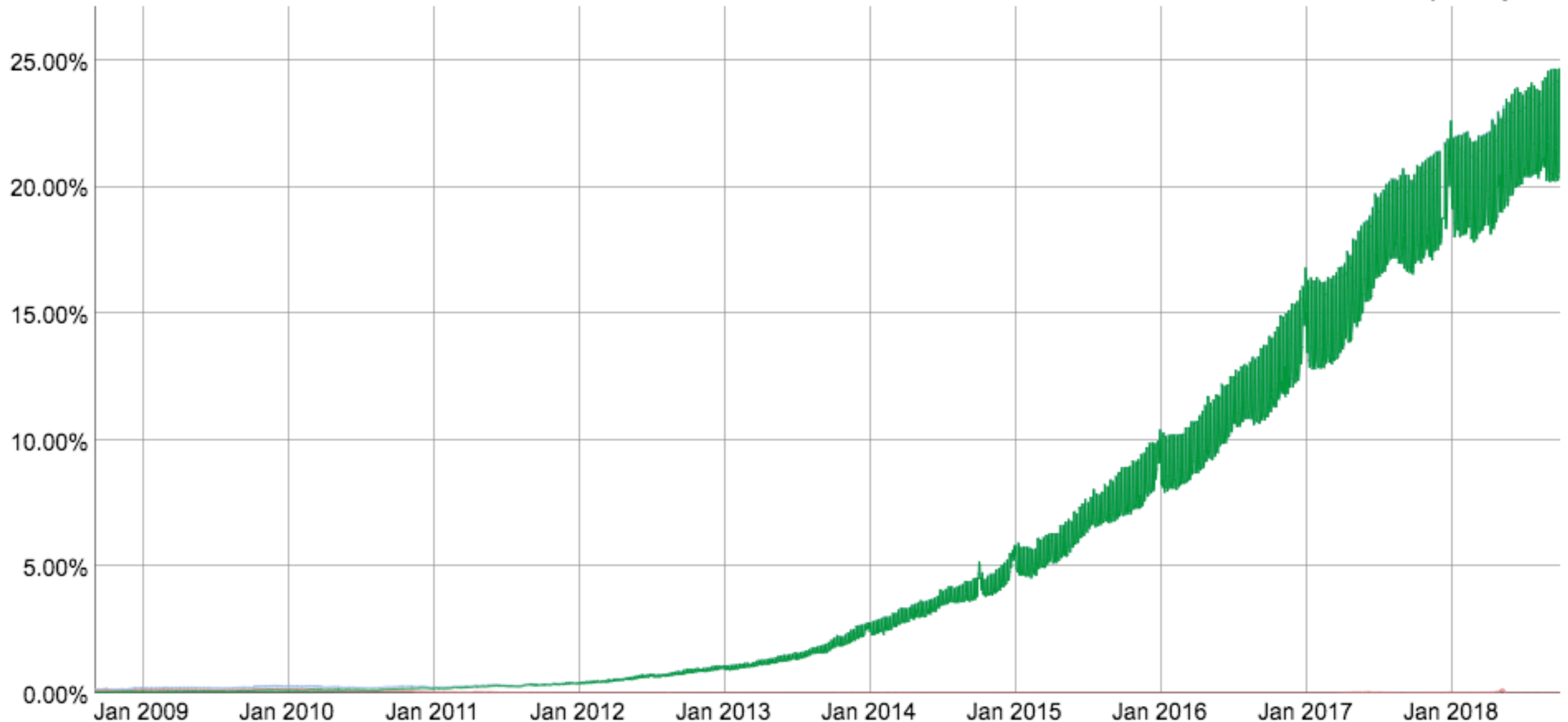
Yes, people DO use IPv6

Per-Country IPv6 adoption

Address assignment

- Stateless address autoconfiguration (SLAAC)

- DHCPv6

- Static

How to get IPv6

- Native

- Tunnel (6in4)

  - tunnelbroker.net

- 6to4

Let's set up an IPv6-enabled web server in AWS

Common problems

- No firewall (iptables only applies to IPv4 - use ip6tables!)

- Firewall that blocks all ICMP

- Security and logging built for IPv4 needs to be updated

- Forgetting to add IPv6 monitoring

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github.com/p-blomberg/ipv6talk-2018-10