IPV6 MATRIX PROJECT

Tracking IPv6 accessible content Worldwide

http://www.ipv6matrix.org

Dr. Olivier MJ Crépin-Leblond - ocl@gih.com
7 December 2018

Internet Society
UK England Chapter

IPV6 MATRIX PROJECT

ISOC England was awarded a Community Grants Programme award in November 2009

Design and implementation of an “IPv6 Crawler,” software on a computer that crawls through the DNS at regular intervals in order to detect and test:

- IPv6 DNS servers
- IPv6 compliant Web servers
- IPv6 compliant SMTP mailers
- IPv6 compliant NTP servers.

PROJECT RATIONALE

Today, more than 95% of Internet traffic is generated by a small number of data sources – i.e. the world's busiest Web Sites

Without IPv6 accessible content, IPv6 has no chance of being used – ever.

Take the 1 Million most popular Web site list from alexa.com as a starting point for the domains to be tested. Add more domains later.

Test them for IPv6 connectivity

This is equivalent to testing about 7+ million hosts worldwide

Use GeoIP database to estimate real host location

MEASURING IPV6 DEPLOYMENT

Some good examples out there already

- http://www.worldipv6launch.org/measurements/
- https://www.google.com/intl/en/ipv6/statistics.html
- http://6lab.cisco.com/stats/
- https://www.vyncke.org/ipv6status/

None of them are exact science

THE IPV6 MATRIX

A tool that measures IPv6 deployment by looking for and testing DNS entries in the Alexa top 1,000,000 domain list

Initial ‘crawler’ code was developed by ISOC England in conjunction with Nile University in 2009/10

- Started crawling the domains, with basic display mechanisms

Due to Arab Spring, the crawler moved to Telehouse

- The project now has three+ years of data

IMPROVING THE IPV6 MATRIX

In 2013/14, ISOC England acted as the 'customer' for a group of 4th year MEng students in Electronics and Computer Science at the University of Southampton

- Group Design Project (3/8ths of students' final year)
- Around 30 such projects run each year
- Very popular module with both students and industry

The ISOC customer brief was to improve the presentation of the crawler data

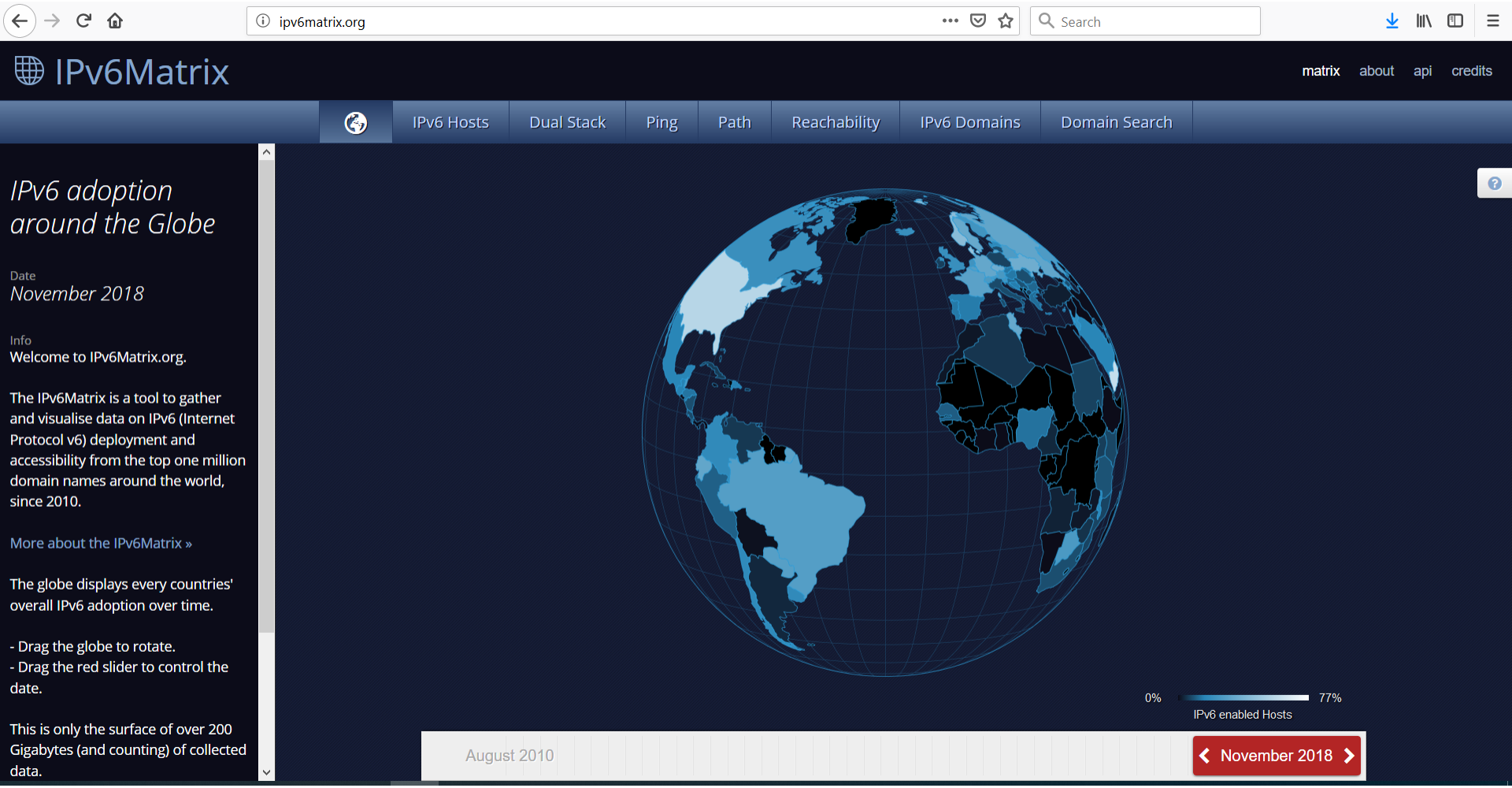
- And as a secondary priority to harden the crawler
- Included Open Data principles (see http://theodi.org)
- As part of project, crawler moved to Southampton
- Students had 10 weeks in total to solicit requirements, design and build a prototype to the customer's satisfaction

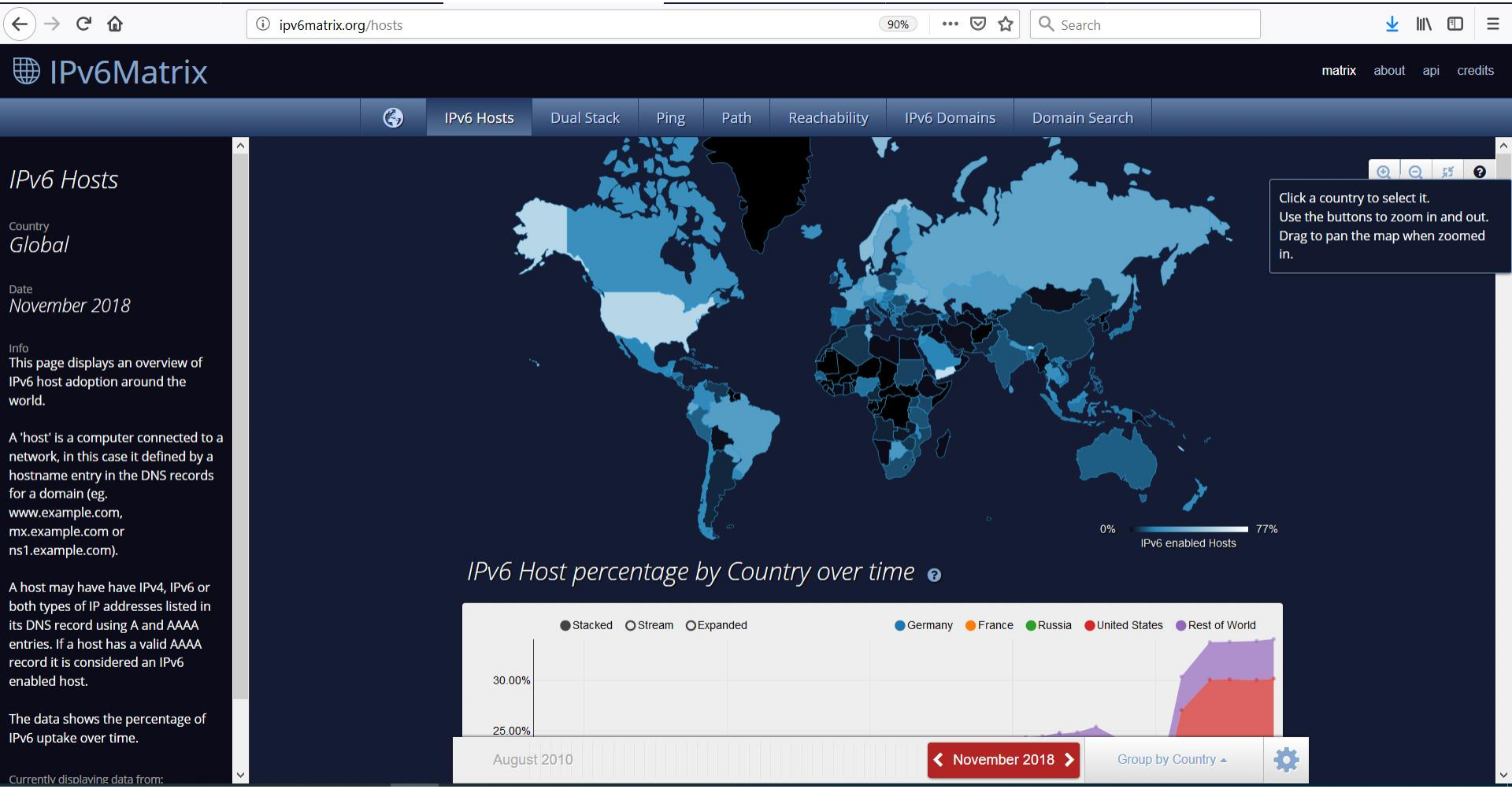
THE RESULT

A completely new visualization interface was built

- Uses data since 2010
- Gives global view, allows you to zoom in by country
- Can view any measured stats, and filter on various properties
- Can export stats in a variety of non-proprietary formats

- See http://www.ipv6matrix.org
- Crawls are continuing to run, and more frequently given the good IPv6 connectivity at Southampton
- Total database size 423Gb (December 2018)
- Some examples follow…


ipv6matrix.org
Search
IPv6Matrix
matrix
about
api
credits
IPv6 Hosts
Dual Stack
Ping
Path
Reachability
IPv6 Domains
Domain Search
IPv6 adoption around the Globe
Date
November 2018
Info
Welcome to IPv6Matrix.org.
The IPv6Matrix is a tool to gather and visualise data on IPv6 (Internet Protocol v6) deployment and accessibility from the top one million domain names around the world, since 2010.
More about the IPv6Matrix »
The globe displays every countries' overall IPv6 adoption over time.
- Drag the globe to rotate.
- Drag the red slider to control the date.
This is only the surface of over 200 Gigabytes (and counting) of collected data.
0%
77%
IPv6 enabled Hosts
August 2010
November 2018


ipv6matrix.org/hosts
90%
Search
IPv6Matrix
matrix
about
api
credits
IPv6 Hosts
Dual Stack
Ping
Path
Reachability
IPv6 Domains
Domain Search
IPv6 Hosts
Country
Global
Date
November 2018
Info
This page displays an overview of IPv6 host adoption around the world.
A 'host' is a computer connected to a network, in this case it defined by a hostname entry in the DNS records for a domain (eg. www.example.com, mx.example.com or ns1.example.com).
A host may have have IPv4, IPv6 or both types of IP addresses listed in its DNS record using A and AAAA entries. If a host has a valid AAAA record it is considered an IPv6 enabled host.
The data shows the percentage of IPv6 uptake over time.
Currently displaying data from:
Click a country to select it.
Use the buttons to zoom in and out.
Drag to pan the map when zoomed in.
0%
77%
IPv6 enabled Hosts
IPv6 Host percentage by Country over time
Stacked
Stream
Expanded
Germany
France
Russia
United States
Rest of World
30.00%
25.00%
August 2010
November 2018
Group by Country

ipv6matrix.org/hosts 90% Search

IPv6Matrix

matrix about api credits

IPv6 Hosts | Dual Stack | Ping | Path | Reachability | IPv6 Domains | Domain Search

IPv6 Hosts

Country
Global

Date
November 2018

Info
This page displays an overview of IPv6 host adoption around the world.

A 'host' is a computer connected to a network, in this case it defined by a hostname entry in the DNS records for a domain (eg. www.example.com, mx.example.com or ns1.example.com).

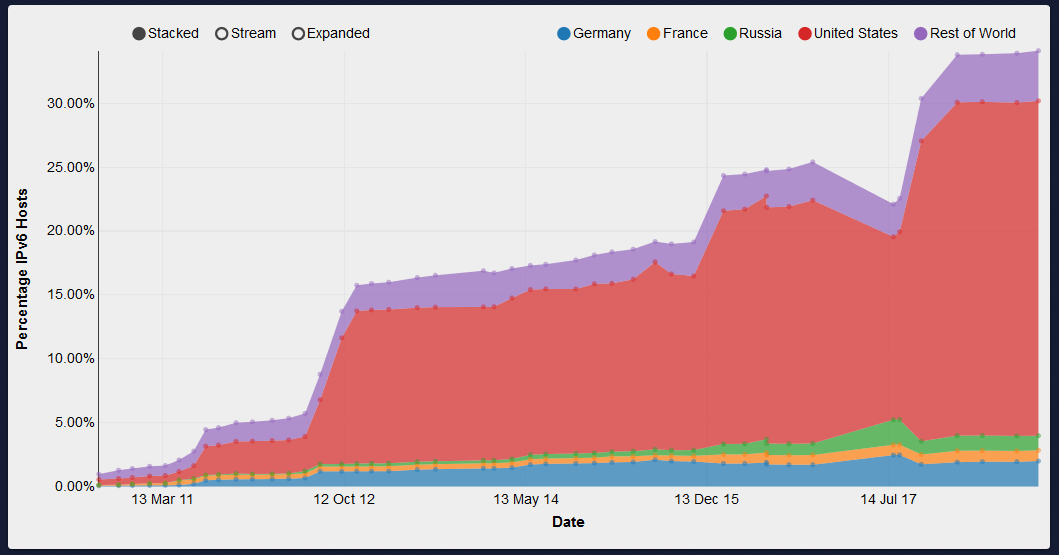
A host may have have IPv4, IPv6 or both types of IP addresses listed in its DNS record using A and AAAA entries. If a host has a valid AAAA record it is considered an IPv6 enabled host.

The data shows the percentage of IPv6 uptake over time.

Currently displaying data from:

0% 77%
IPv6 enabled Hosts

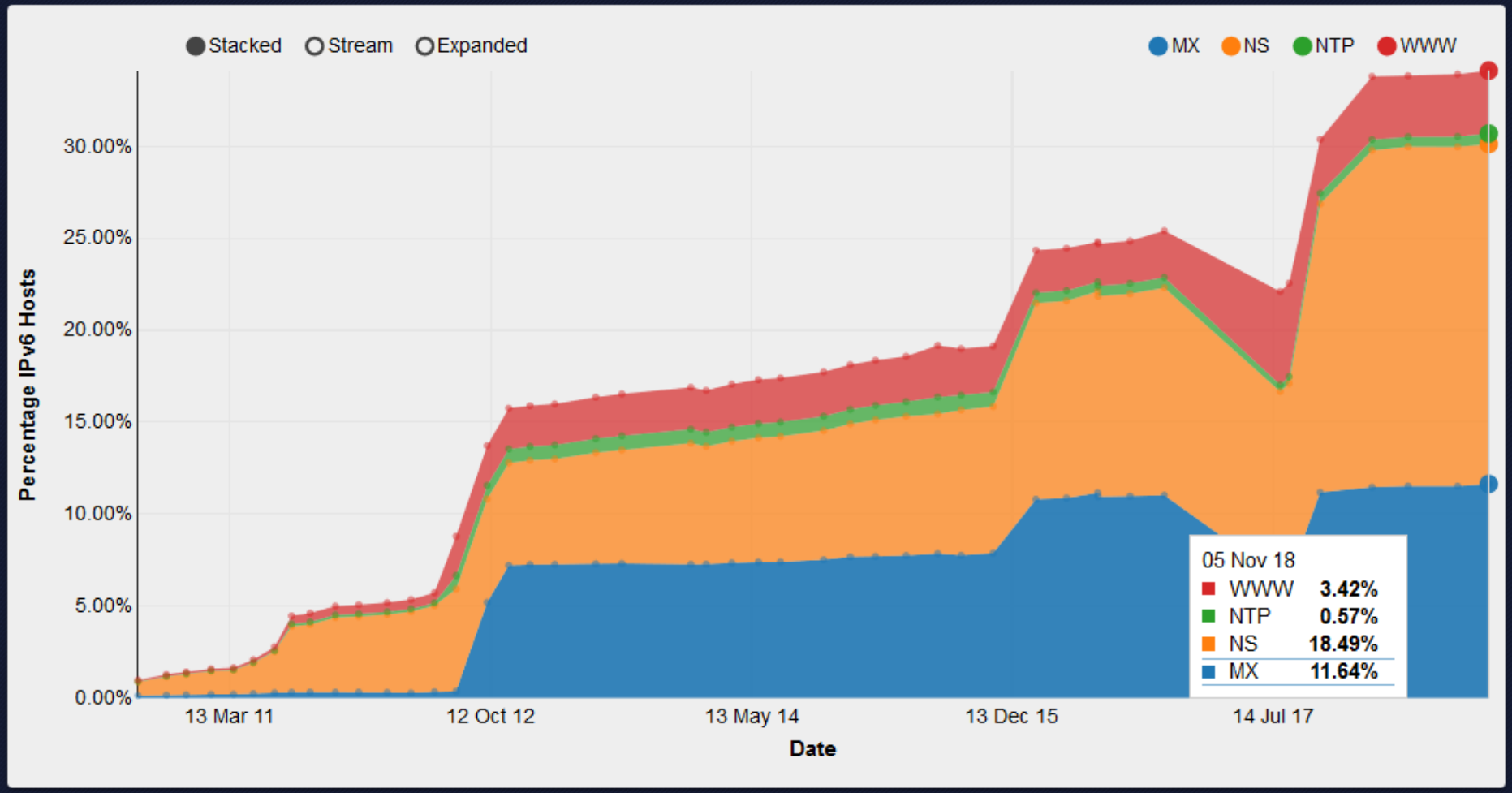
IPv6 Host percentage by Country over time



IPv6 Host percentage by Country for November 2018

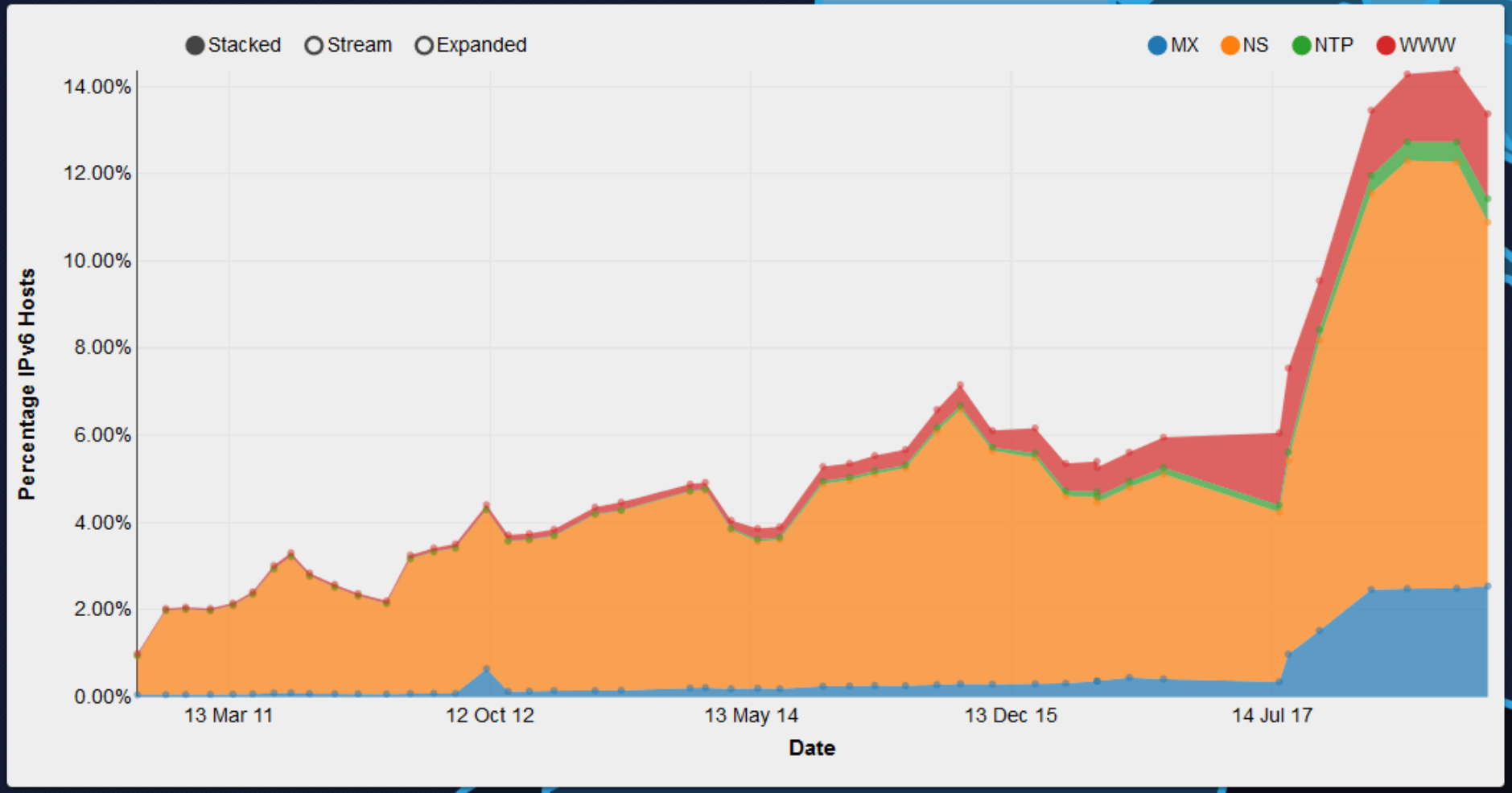
August 2010 | November 2018 | Group by Country

IPv6 Host percentage by Service Type over time



Country
United Kingdom (GB)

IPv6 Host percentage by Service Type over time

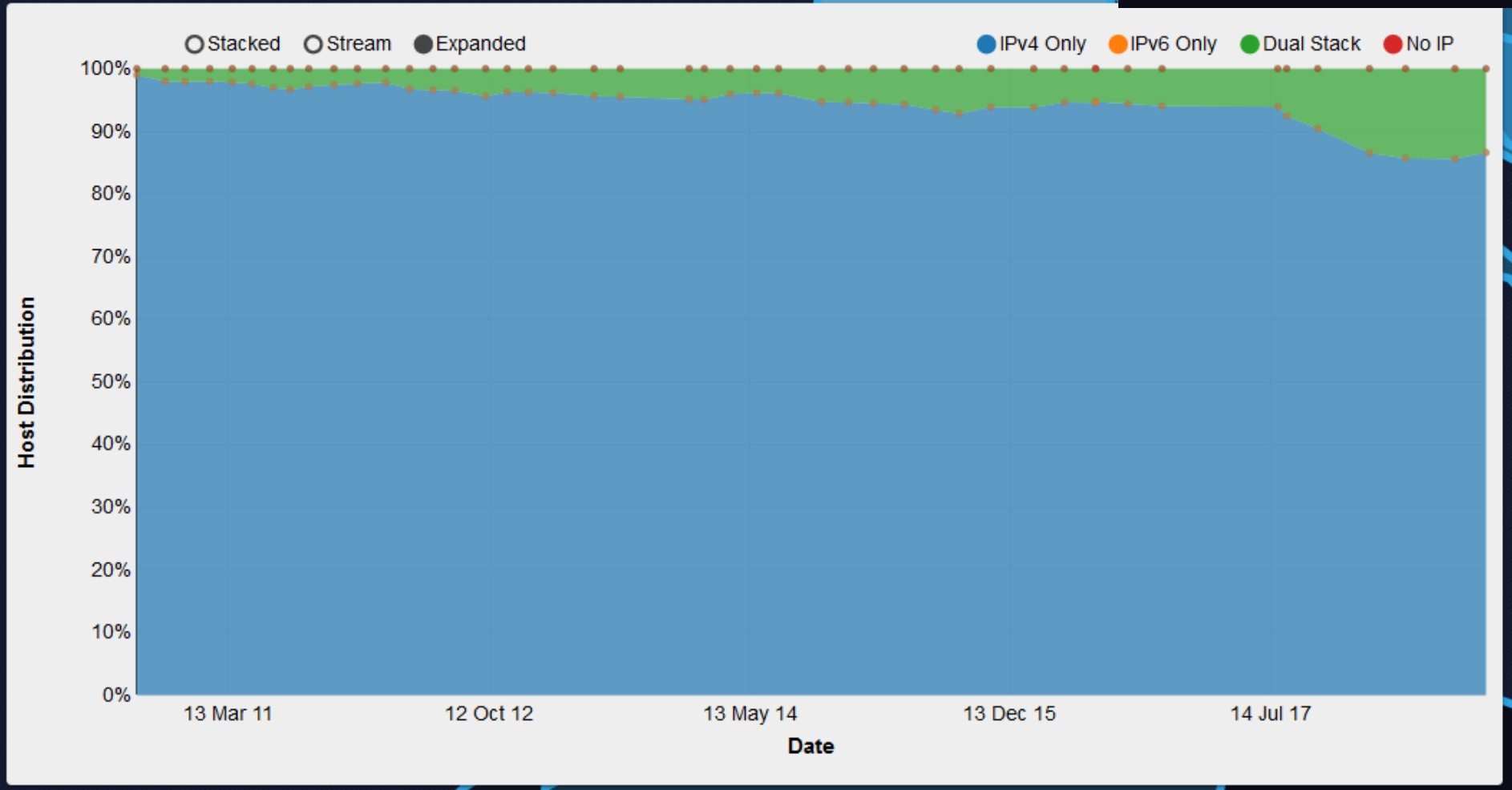


Dual Stack Hosts

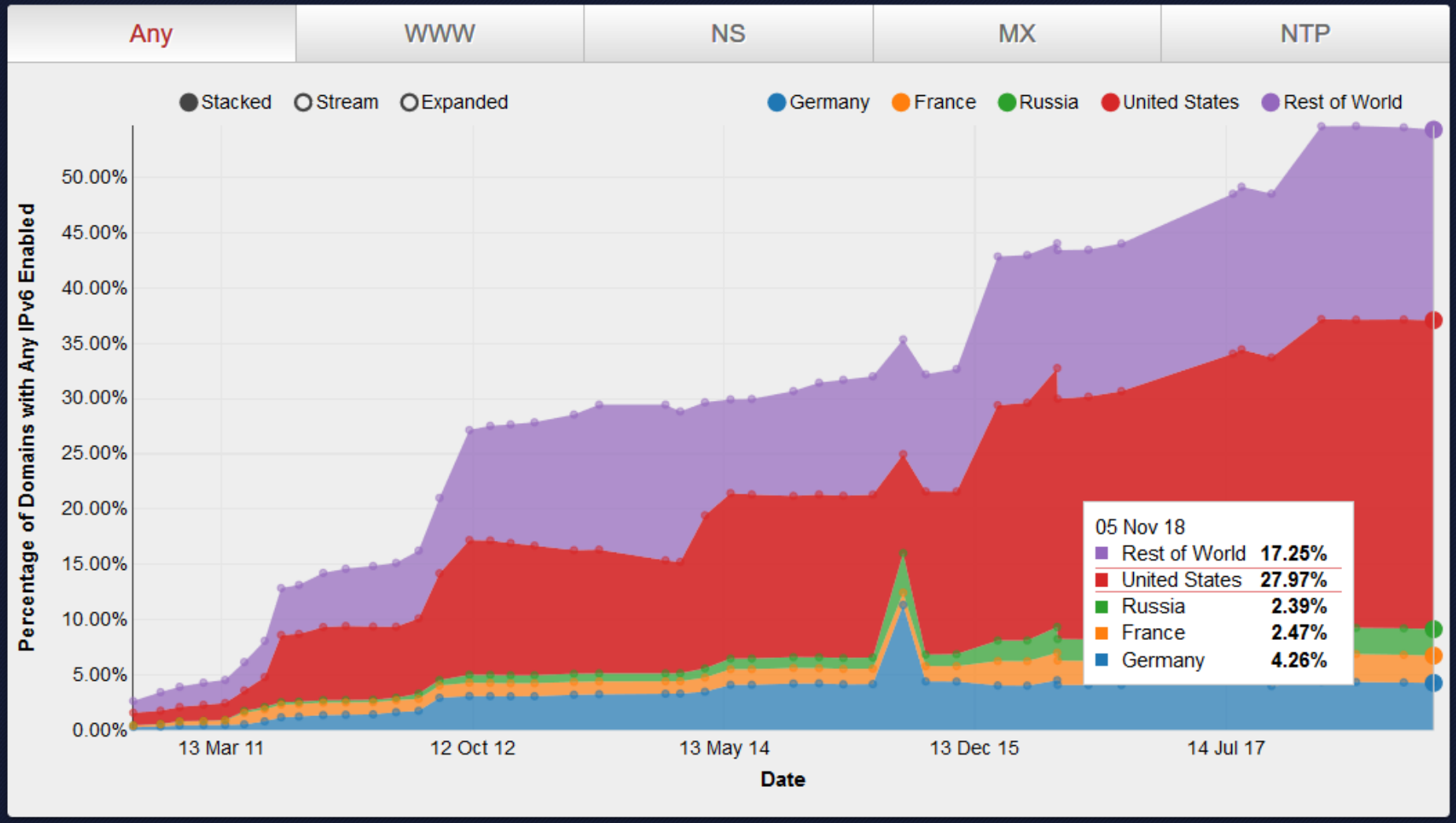
Country

United Kingdom (GB)

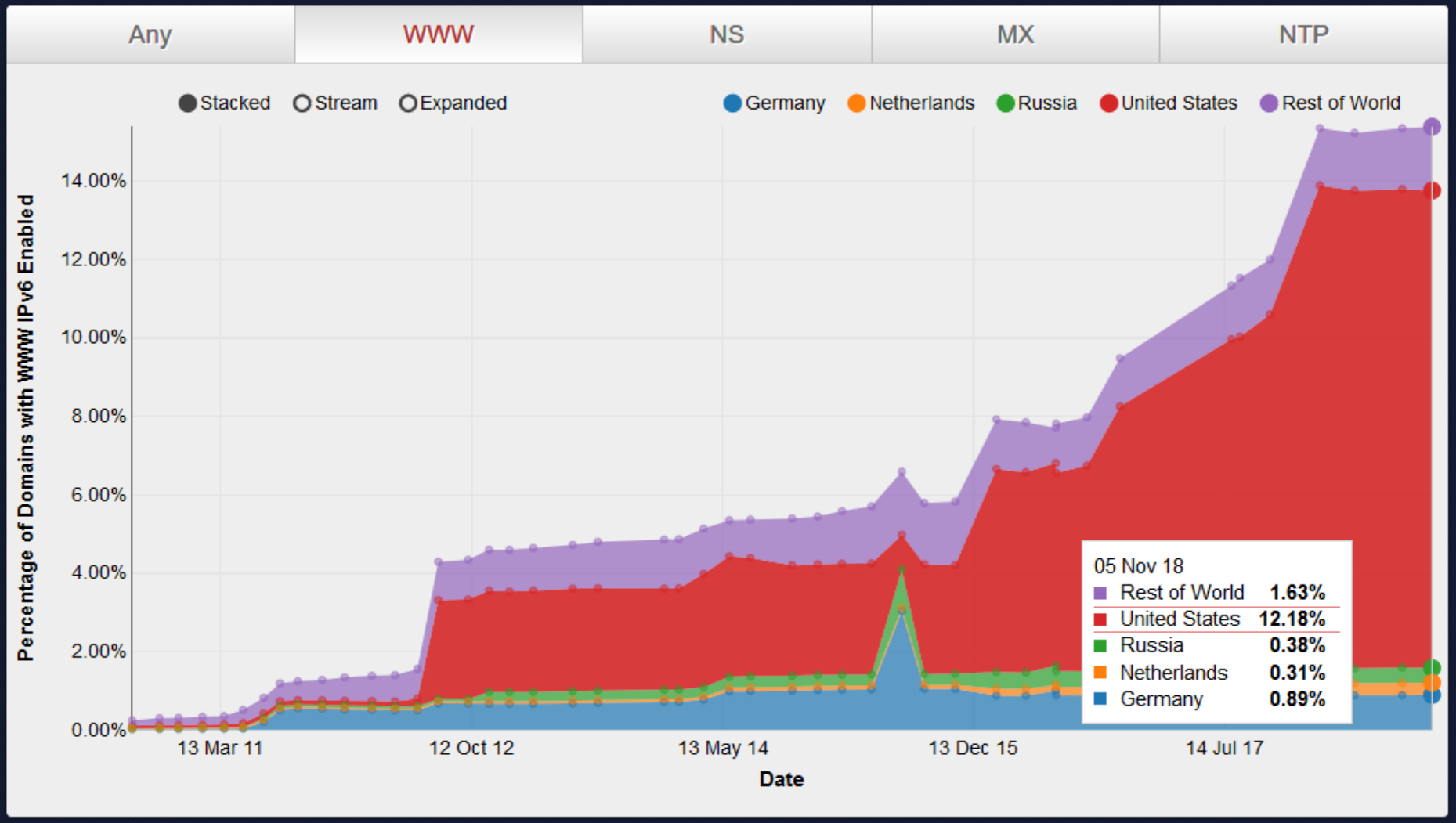
Distribution of Host types over time



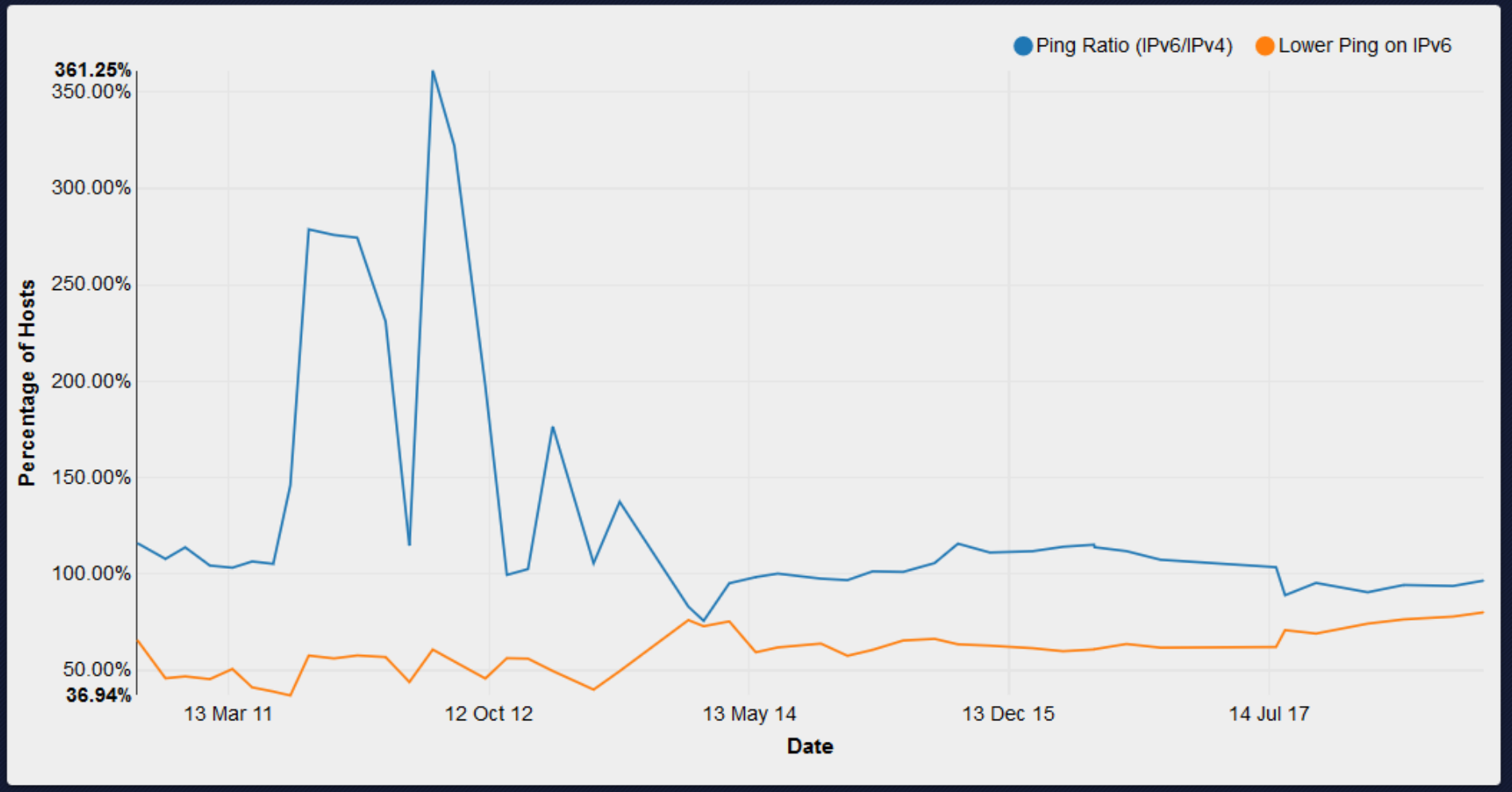
IPv6 enabled Domains by Country over time



IPv6 enabled Domains by Country over time



Lower Ping on IPv6 and Ping Ratio over time



Fewer IPv6 Hops and Path Ratio over time

Raw Data file for WWW using comma separated values

```
WWW,google.co.uk,www.google.co.uk,216.58.213.99,2a00:1450:4009:809::2003
WWW,amazon.co.uk,www.amazon.co.uk,52.85.63.210,n/a
WWW,bbc.co.uk,www.bbc.co.uk,212.58.244.68,n/a
WWW,bbc.co.uk,www6.bbc.co.uk,n/a,2001:4b10:bbc::2
WWW,bbc.co.uk,ipv6.bbc.co.uk,n/a,2001:4b10:bbc::1
WWW,ebay.co.uk,www.ebay.co.uk,92.122.166.107,n/a
WWW,dailymail.co.uk,www.dailymail.co.uk,23.214.154.30,n/a
WWW,telegraph.co.uk,www.telegraph.co.uk,23.214.131.63,n/a
WWW,independent.co.uk,www.independent.co.uk,151.101.17.184,n/a
WWW,independent.co.uk,www6.independent.co.uk,52.214.144.222,n/a
WWW,independent.co.uk,ipv6.independent.co.uk,52.214.144.222,n/a
WWW,independent.co.uk,www.ipv6.independent.co.uk,52.214.144.222,n/a
WWW,independent.co.uk,six.independent.co.uk,52.214.144.222,n/a
WWW,express.co.uk,www.express.co.uk,143.204.192.108,n/a
WWW,gov.uk,www.gov.uk,151.101.16.144,2a04:4e42:4::144
WWW,thesun.co.uk,www.thesun.co.uk,23.214.135.92,n/a
WWW,mirror.co.uk,www.mirror.co.uk,23.214.163.19,n/a
WWW,mirror.co.uk,www6.mirror.co.uk,54.228.202.0,n/a
WWW,mirror.co.uk,ipv6.mirror.co.uk,54.228.237.176,n/a
WWW,mirror.co.uk,www.ipv6.mirror.co.uk,54.228.202.0,n/a
WWW,mirror.co.uk,six.mirror.co.uk,54.228.237.176,n/a
WWW,pinterest.co.uk,www.pinterest.co.uk,151.101.16.84,n/a
WWW,rightmove.co.uk,www.rightmove.co.uk,213.161.77.102,n/a
WWW,metro.co.uk,www.metro.co.uk,192.0.79.33,n/a
WWW,tripadvisor.co.uk,www.tripadvisor.co.uk,192.229.182.189,n/a
WWW,hsbc.co.uk,www.hsbc.co.uk,91.214.6.22,n/a
WWW,lloydsbank.co.uk,www.lloydsbank.co.uk,141.92.90.142,n/a
WWW,argos.co.uk,www.argos.co.uk,2.22.141.38,n/a
```

JSON text format


```
{"Sat Oct 23 2010 01:00:00 GMT+0100 (BST)":{"AT":{"hosts":70,"hosts6":2},"AU":{"hosts":320,"hosts6":0},"BE":
{"hosts":61,"hosts6":0},"BG":{"hosts":50,"hosts6":0},"CA":{"hosts":1188,"hosts6":0},"CH":{"hosts":110,"hosts6":11},"CZ":
{"hosts":114,"hosts6":1},"DE":{"hosts":11069,"hosts6":18},"DK":{"hosts":894,"hosts6":2},"ES":{"hosts":84,"hosts6":1},"EU":
{"hosts":463,"hosts6":125},"FR":{"hosts":953,"hosts6":88},"GB":{"hosts":78001,"hosts6":941},"HK":{"hosts":62,"hosts6":0},"IE":
{"hosts":856,"hosts6":6},"IN":{"hosts":68,"hosts6":0},"IT":{"hosts":154,"hosts6":0},"JP":{"hosts":76,"hosts6":6},"LU":
{"hosts":130,"hosts6":0},"NL":{"hosts":1511,"hosts6":40},"NO":{"hosts":106,"hosts6":2},"PL":{"hosts":85,"hosts6":0},"SE":
{"hosts":205,"hosts6":0},"SG":{"hosts":174,"hosts6":74},"US":{"hosts":32741,"hosts6":531},"ZZ":{"hosts":3040,"hosts6":5}},"Mon Dec 06
2010 00:00:00 GMT+0000 (GMT)":{"AT":{"hosts":69,"hosts6":2},"AU":{"hosts":308,"hosts6":0},"BE":{"hosts":69,"hosts6":0},"CA":
{"hosts":1214,"hosts6":0},"CH":{"hosts":116,"hosts6":11},"CZ":{"hosts":114,"hosts6":4},"DE":{"hosts":11359,"hosts6":30},"DK":
{"hosts":860,"hosts6":2},"ES":{"hosts":97,"hosts6":1},"EU":{"hosts":466,"hosts6":125},"FR":{"hosts":939,"hosts6":114},"GB":
{"hosts":76318,"hosts6":960},"GG":{"hosts":50,"hosts6":0},"HK":{"hosts":62,"hosts6":0},"IE":{"hosts":860,"hosts6":4},"IN":
{"hosts":68,"hosts6":0},"IT":{"hosts":158,"hosts6":0},"JP":{"hosts":92,"hosts6":6},"LU":{"hosts":150,"hosts6":0},"NL":
{"hosts":1751,"hosts6":57},"NO":{"hosts":106,"hosts6":2},"PL":{"hosts":84,"hosts6":1},"RU":{"hosts":72,"hosts6":0},"SE":
{"hosts":204,"hosts6":0},"SG":{"hosts":176,"hosts6":74},"US":{"hosts":33852,"hosts6":692},"ZZ":{"hosts":3276,"hosts6":6}},"Sun Jan 30
2011 00:00:00 GMT+0000 (GMT)":{"AT":{"hosts":69,"hosts6":2},"AU":{"hosts":302,"hosts6":0},"BE":{"hosts":70,"hosts6":0},"BG":
{"hosts":53,"hosts6":0},"CA":{"hosts":1248,"hosts6":0},"CH":{"hosts":115,"hosts6":11},"CZ":{"hosts":104,"hosts6":4},"DE":
{"hosts":11320,"hosts6":38},"DK":{"hosts":848,"hosts6":2},"ES":{"hosts":93,"hosts6":1},"EU":{"hosts":475,"hosts6":128},"FR":
{"hosts":937,"hosts6":119},"GB":{"hosts":76990,"hosts6":1010},"HK":{"hosts":62,"hosts6":0},"IE":{"hosts":844,"hosts6":4},"IN":
{"hosts":69,"hosts6":0},"IT":{"hosts":158,"hosts6":0},"JP":{"hosts":97,"hosts6":6},"LU":{"hosts":158,"hosts6":0},"NL":
{"hosts":1726,"hosts6":63},"NO":{"hosts":111,"hosts6":2},"PL":{"hosts":84,"hosts6":1},"RU":{"hosts":71,"hosts6":0},"SE":
{"hosts":221,"hosts6":0},"SG":{"hosts":180,"hosts6":73},"US":{"hosts":32911,"hosts6":776},"ZZ":{"hosts":3685,"hosts6":18}},"Mon Mar 21
2011 00:00:00 GMT+0000 (GMT)":{"AT":{"hosts":69,"hosts6":2},"AU":{"hosts":309,"hosts6":0},"BE":{"hosts":60,"hosts6":0},"CA":
{"hosts":1262,"hosts6":0},"CH":{"hosts":114,"hosts6":11},"CZ":{"hosts":84,"hosts6":4},"DE":{"hosts":11266,"hosts6":41},"DK":
{"hosts":854,"hosts6":2},"ES":{"hosts":95,"hosts6":1},"EU":{"hosts":476,"hosts6":128},"FR":{"hosts":942,"hosts6":125},"GB":
{"hosts":75889,"hosts6":1032},"HK":{"hosts":64,"hosts6":0},"IE":{"hosts":850,"hosts6":4},"IN":{"hosts":68,"hosts6":0},"IT":
{"hosts":157,"hosts6":0},"JP":{"hosts":97,"hosts6":6},"LU":{"hosts":158,"hosts6":0},"NL":{"hosts":1810,"hosts6":63},"NO":
{"hosts":117,"hosts6":2},"PL":{"hosts":92,"hosts6":1},"RU":{"hosts":59,"hosts6":0},"SE":{"hosts":216,"hosts6":0},"SG":
{"hosts":180,"hosts6":73},"UA":{"hosts":56,"hosts6":0},"US":{"hosts":33927,"hosts6":786},"ZZ":{"hosts":3824,"hosts6":20}},"Wed May 04
2011 01:00:00 GMT+0100 (BST)":{"AT":{"hosts":56,"hosts6":2},"AU":{"hosts":312,"hosts6":0},"BE":{"hosts":68,"hosts6":0},"CA":
{"hosts":1338,"hosts6":12},"CH":{"hosts":108,"hosts6":11},"CZ":{"hosts":86,"hosts6":5},"DE":{"hosts":11229,"hosts6":56},"DK":
{"hosts":832,"hosts6":4},"ES":{"hosts":99,"hosts6":1},"EU":{"hosts":499,"hosts6":138},"FR":{"hosts":946,"hosts6":163},"GB":
{"hosts":75030,"hosts6":1195},"HK":{"hosts":65,"hosts6":0},"IE":{"hosts":930,"hosts6":8},"IN":{"hosts":68,"hosts6":0},"IT":
{"hosts":153,"hosts6":0},"JP":{"hosts":96,"hosts6":6},"LU":{"hosts":147,"hosts6":0},"NL":{"hosts":1833,"hosts6":62},"NO":
{"hosts":104,"hosts6":2},"PL":{"hosts":88,"hosts6":2},"RU":{"hosts":62,"hosts6":0},"SE":{"hosts":220,"hosts6":3},"SG":
```

SUMMARY / QUESTIONS

Crawler reaching its 9th year of data collection

- Need to virtualize the server in a VM environment
- Need to diversify the location of crawls

Why is there a slowdown in growth?

We need your feedback

- Send to contact@isoc-e.org

THANK YOU

Contact: ISOC England – contact@isoc-e.org