IPv6 Performance Measurement

March 2019

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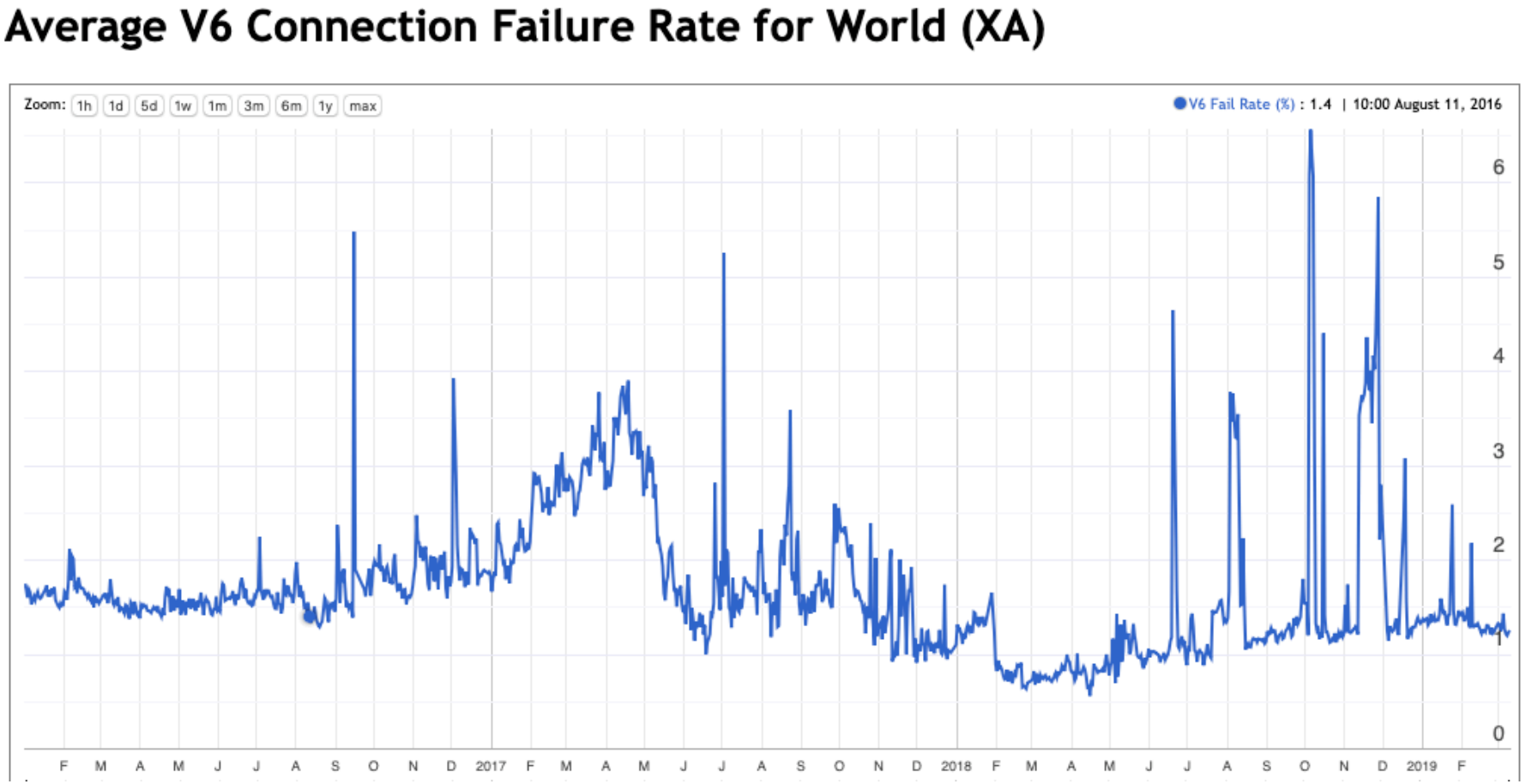
APNIC

The Measurement

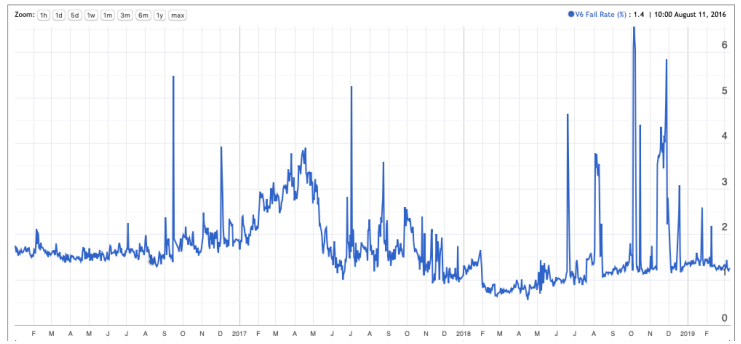
- The endpoint retrieves two URLs from the same remote server – one using IPv4 and the other using IPv6
  - Unique DNS names and TLS are used to ensure that caching does not play a role in the measurement
- We perform full packet capture at the server
- Data analysis
  - We look at the SYN/ACK exchange at the start of the TLS session
  - The time between receipt of the SYN and the subsequent ACK at the server is no less than one RTT between the server and the endpoint (and is a reasonable first order substitute for an RTT)
  - A received SYN with no subsequent ACK is interpreted as a failed connection attempt

IPv6 TCP Connection Failure



IPv6 TCP Connection Failure

Average V6 Connection Failure Rate for World (XA)



The global failure rate of some 1.2% is better than earlier data (4% failure in early 2017), but its still bad

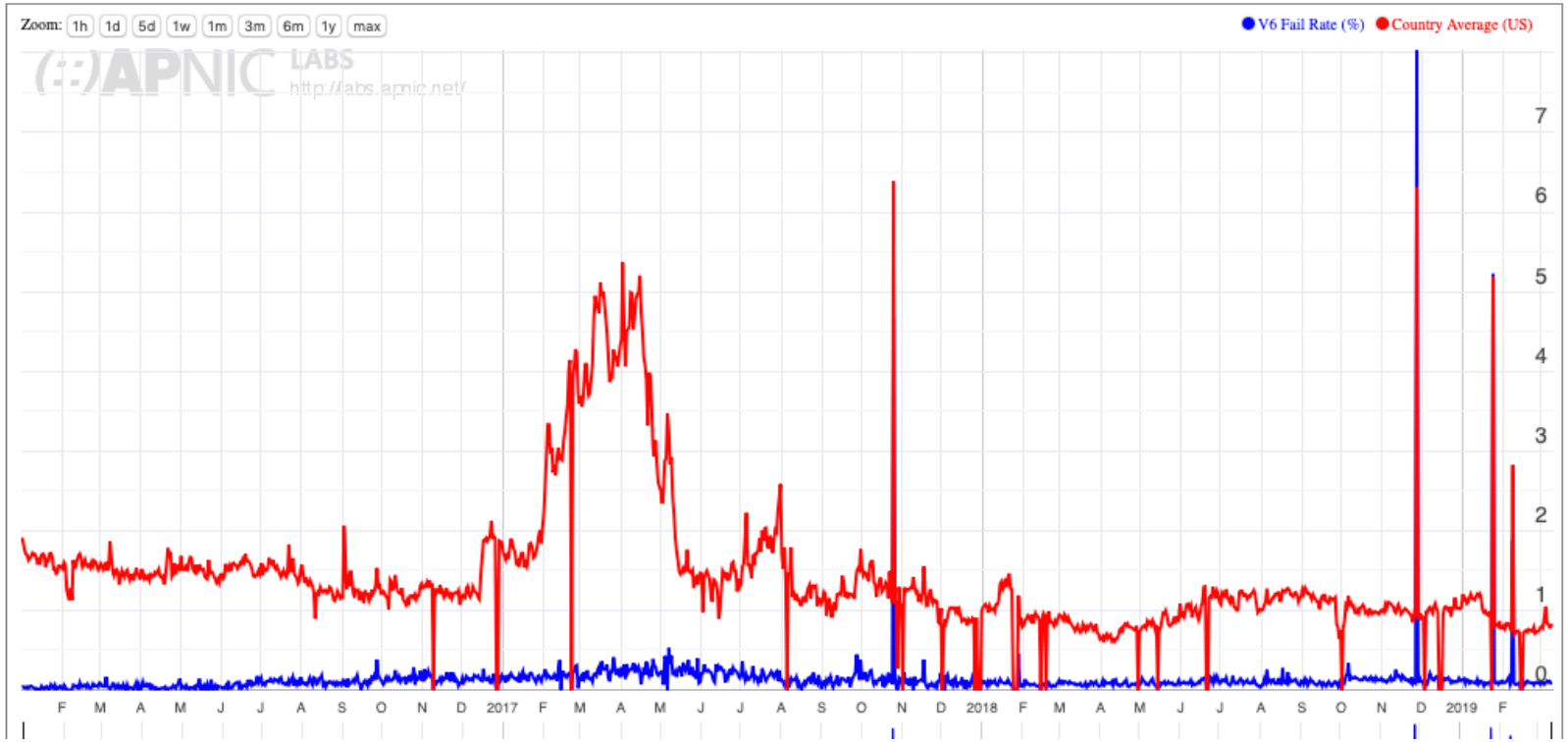
What we are seeing is most likely a failure to deliver an IPv6 packet from the server to the endpoint

Possible reasons:

- Endpoint using an unreachable IPv6 address
- End site firewalls
- ??

The Good

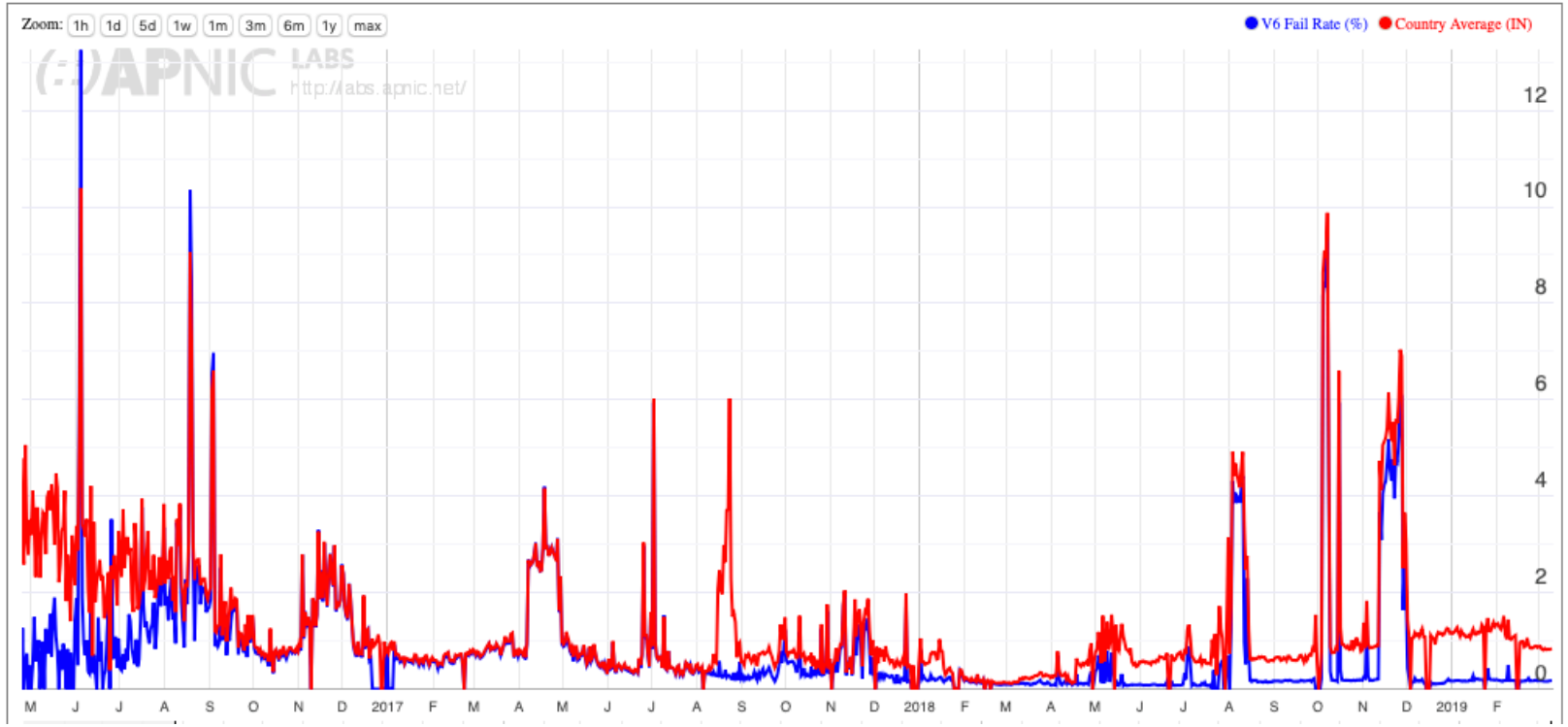
V6 Connection Failure Rate for AS21928: T-MOBILE-AS21928 - T-Mobile USA, States of America (US)



This 464XLAT mobile network (T-Mobile) has remarkably small failure rates – the endpoints are connected via native IPv6 and as this is a mobile network there is only a small amount of customer-operated filtering middleware

The Good

V6 Connection Failure Rate for AS55836: RELIANCEJIO-IN Reliance Jio India (IN)



Similar story in India with Reliance JIO – the endpoints are connected via native IPv6 and as this is a mobile network there is only a small amount of customer-operated filtering middleware

The Bad

Average V6 Connection Failure Rate for Vietnam (VN)

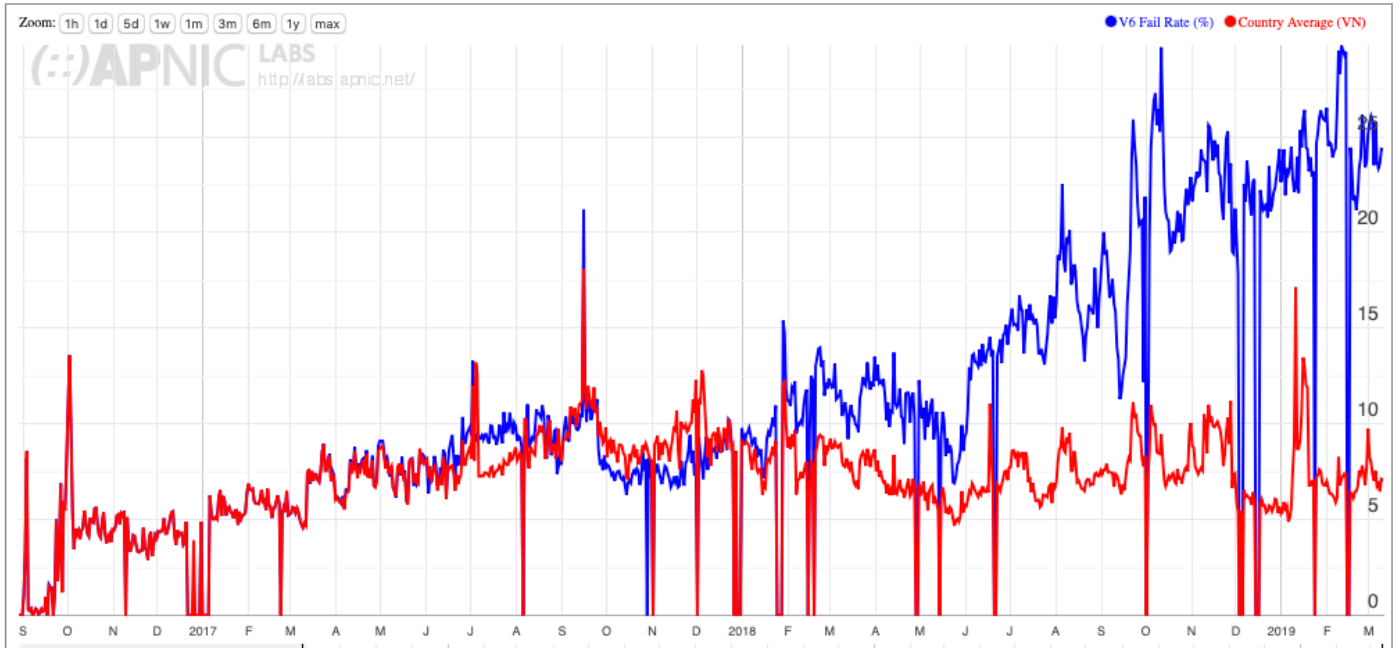
Seriously?

A 6%-10% IPv6 connection failure rate is bad enough

A sustained failure rate for over 2 years seems worse!

The Appalling!

V6 Connection Failure Rate for AS18403: FPT-AS-AP The Corporation for Financing Promoting Technology, Vietnam (VN)



Comment

- For many end users in Vietnam, Panama, Morocco, Turkey, Venezuela, China and Bangladesh their IPv6 service looks pretty broken
  - The combination of Dual Stack and Happy Eyeballs masks the problem so that the user does not experience a degraded service
  - But this only will work while Dual Stack is around
- Other ISPs have managed to do a much better job, such as in the United States, Sweden, Thailand and Korea and the IPv6 connection failure rates are close to experimental noise levels
- What's happening in the second set of countries and ISPs that is NOT happening in the first set?

Possible Issues

- IPv6 routing stability
- End site IPv6 address assignment
- Local Firewalls
- Partially broken Hotspots
- ???

Discussion