

Is 2019 finally the Year for Linux on the Desktop? Or for v6-only Networks?

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#whoarewe

- Old-school networking guys, with a special focus on security (www.ernw.de)
- Doing quite some stuff in the IPv6 space
 - <https://insinuator.net/2019/01/ipv6-talks-publications>
- Operating a (medium-size) conference network with v6-only+NAT64 in the default SSID since 2016



Background of This Talk

- An increasing number of organizations currently consider implementing IPv6 in a specific mode often called “v6-only + NAT64”.
- Some conferences already implement this in their WiFi networks:
 - Troopers ;-)
 - FOSDEM
 - Cisco Live (but somewhat “experimental”)

<https://insinuator.net/2019/02/some-notes-on-the-ipv6-properties-of-the-wireless-network-cisco-live-europe/>



This Raises a Crucial Question

- What breaks? ;-)
- Let's be more precise
 - Which stuff that we (or they = customers) actually need breaks?
 - Do (should) we care?
 - Technical alternatives / solutions?



Faust and Gretchen in the garden
(painting by James Tissot, 1861)

- There's a case study/project behind this talk.
 - We'll provide some details in our talk in the IPv6 wg on Thursday.
- For the moment let's focus on the 1st question.
 - From a "WiFi hotspot for consumers" perspective (as opposed to, e.g., "a corporation's guest WiFi")
- To find out we built a test lab.

The Lab Infrastructure – Overview

- Pretty small and basic setup:
 - Cisco ISR 4321 as NAT64 GW
 - Unbound as DNS64
 - WLC + AP for Wifi Connectivity





Testbed

- Windows 10 – Build 1809 / Windows 7
- macOS 10.14 – Mojave
- Apple iOS – 12.1.4
- Arch Linux – Kernel 4.19
- Android 9 Pie (API 28)



The Lab – Methodology

- Group applications in categories.
 - e.g. Social Media, Communication etc.
- Define first set of (potential) relevant applications to be tested.
- Define test cases for each app
- Perform the tests
- (Try) to evaluate root cause for failed test cases



Stuff Tested (I)

- Social Media
 - Signal
 - Instagram
 - Snapchat
 - Tik Tok
 - Twitter
 - WhatsApp
 - Tinder
 - Threema
- Streaming
 - Spotify
 - Twitch
 - Amazon Music
 - Amazon Prime Video
 - Netflix
 - Apple Music



Stuff Tested (2)

- Communication
 - Microsoft Teams
 - Discord
 - Skype
 - Slack
 - Facetime
 - Skype for Business
 - Cisco WebEx
- Games
 - Fortnite
 - PUBG
 - Pokemon Go
 - Steam



Display of Sample Categories / Test cases

<i>Social</i>	<i>Test</i>	Windows 10	Windows 7 or lower	Linux	MacOS	Android	iOS
Signal							
	Send a message	Green	Orange	Green	Green	Green	Green
	Receive a message	Green	Orange	Green	Green	Green	Green
Instagram							
	Test if login works	Green	Orange	Orange	Orange	Green	Green
	Follow someone	Green	Orange	Orange	Orange	Green	Green
	Comment a picture	Green	Orange	Orange	Orange	Green	Green
	Watch a story	Green	Orange	Orange	Orange	Green	Green
	Receive a private message	Green	Orange	Orange	Orange	Green	Green
	Send a private message	Green	Orange	Orange	Orange	Green	Green
Snapchat							
	Send a message	Orange	Orange	Orange	Orange	Green	Green
	Send a picture	Orange	Orange	Orange	Orange	Green	Green
	Test if Login works	Orange	Orange	Orange	Orange	Green	Green
	Receive a picture	Orange	Orange	Orange	Orange	Green	Green
	Create a story	Orange	Orange	Orange	Orange	Green	Green
	Receive a message	Orange	Orange	Orange	Orange	Green	Green

Results / Overview

- OS-wise iOS apps successfully completed all test cases
 - Maybe not a surprise given Apple's strategy
- Most categories worked quite nicely, e.g.
 - Social Media
 - Communication
- Issues were mostly identified in two areas
 - Games
 - Streaming



Applications with Issues / Overview

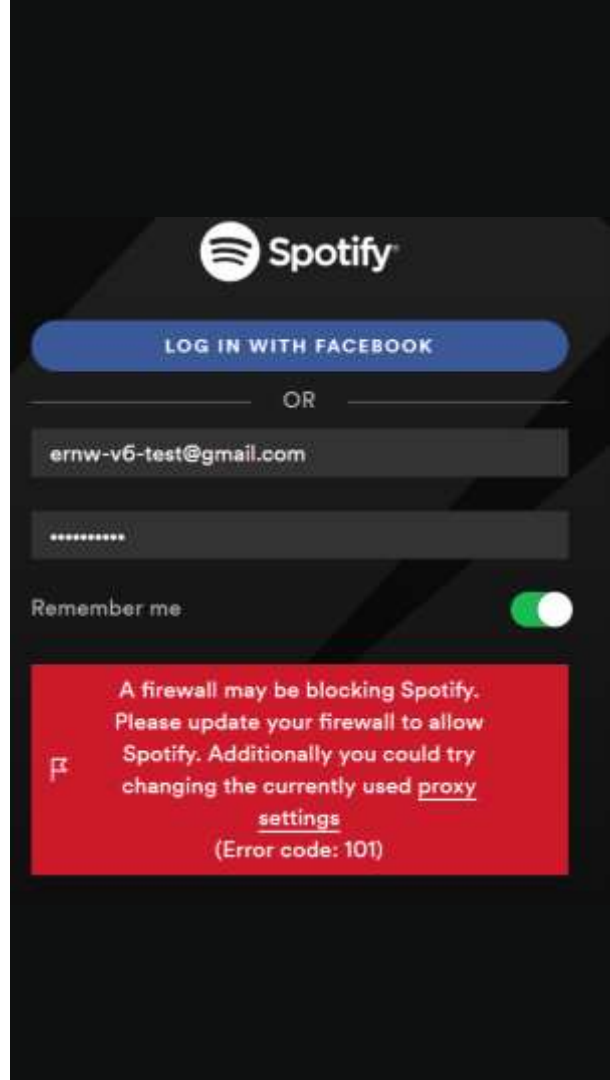
- In general, we could observe two failure scenarios:
 - Either the app just doesn't work at all without IPv4
 - In general the app works but some functionality is limited.





Streaming - Spotify

- Unfortunately, the Spotify app on Windows 10/7/macOS does not work.
 - The web client works as intended
- No network activity could be observed. We assume the client tries to open a IPv4 socket, which of course fails.



Games – Fortnite

- “Hottest” Battle Royal game for a year or two.
- Based on the Unreal engine developed by Epic.
- To play Fortnite, one has to install the Epic Games Launcher.



Turns out...XMPP client only
asks for an A record ☹️

▼ Queries

› xmpp-service-prod.ol.epicgames.com: type A, class IN

▼ Answers

› xmpp-service-prod.ol.epicgames.com: type CNAME, class IN, cname xmpp-service-prod-weighted.ol.epicgames.com

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.195.135.176

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.202.107.122

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.199.177.138

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.200.66.169

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.197.247.209

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.196.225.72

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.202.23.197

› xmpp-service-prod-weighted.ol.epicgames.com: type A, class IN, addr 34.192.117.58



For future reference

New: Improved IPv6 Support

Support for IPv4 and IPv6 has been merged into a single socket subsystem, where previously support for each protocol was isolated to a specific subsystem. This allows platforms that used one of the BSD subsystems to support both IPv4 and IPv6 at the same time, and do it transparently to the calling code.

<https://www.unrealengine.com/en-US/blog/unreal-engine-4-21-released> Nov 2018

Interim Conclusion (i)

- We tested around 35 different applications with a total of 120 test cases
 - On (if available) six different operating systems.
- Only three applications didn't work at all on non-mobile operating systems.
- Two applications had some feature limitations
 - E.g. not able to join a voice channel @Discord



Interim Conclusion (ii)

- While we still see some (minor) breakage (that was to be expected) it is lower than we initially anticipated.
- Apps on mobile devices (Android/iOS) work just fine in an IPv6-only environment.
- Still, there is some work to do primarily for applications installed on your “typical” workstation.



Lab / Next Steps

- Validate / further investigate failure cases
- Vendor communication!
- Probably even easier when the vendor is the only failing one in a group of similar apps ;-)
- In parallel / very soon we will release the full results (incl. sanitized pcaps)





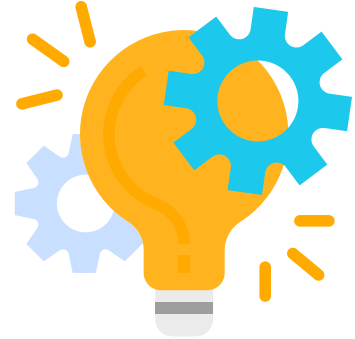
Next Steps (II)

- Test more/other categories
 - Corporate applications besides HTTP[S]-based north-south traffic
 - VPN clients
- We see this evaluation as a permanent ongoing activity and are happy about suggestions.



Conclusions

- We see an increasing interest in deploying v6-only + NAT64 networks.
 - For reasons...
- Testing creates #transparency ;-) & hence well-informed decision making...
- Overall less issues than expected
 - Apple's strategy seems to work.
 - Communication strategy will be crucial, with management, users & vendors.





Thank you for your Attention!



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Sources

As indicated on slides.

Image Sources

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