RIPE NCC
RIPE NETWORK COORDINATION CENTRE

IPv6-only Internal Services

A Story of a Failed Attempt

Ondřej Caletka | RIPE 90 | 15 May 2025

Internal Services?

What Is an Internal Service

- Something **accessible only for employees**

- **Historically**: **onsite services** accessible only from **onsite machines**

- **Then**: **onsite services** accessible only **over VPN**

- **Now**: mix of **onsite** and **cloud-based** services accessible only to **authorised users**

The Network of the RIPE NCC

- No **privileged network** in the office

- **Always-on VPN** on each company owned laptop

  - Very handy during *(unexpected)* **work from home**

  - **Split tunneling** is used (we have an **office in Dubai** as well as **remote employees**)

  - **IPv4 and IPv6** both **inside and outside** of the VPN tunnel

- Ongoing migration from LDAP-based login to a **Single Sign-On solution**

  - SSO assertion is **much stronger** than IP address-based authentication

  - IP address based authentication is **useless and broken** with cloud-based services

IPv6-only Logical for Internal Services

- Only employees are allowed to access them

- Every employee has a VPN client that **provides IPv6 access** to the internal services

- What could **possibly go wrong**?

The Story

- A new employee joins the RIPE NCC. He remembers the IPv6 Act Now t-shirt from 2010.

- He ask his coworkers: "**Can we do this new service IPv6-only?**"

- Their response: "**I guess so.**"

First Roadblocks

- Our configuration management **assumed dual-stack**

- Our monitoring system assumed **every host has an IPv4** address

- Employee: "**This can be fixed!**"
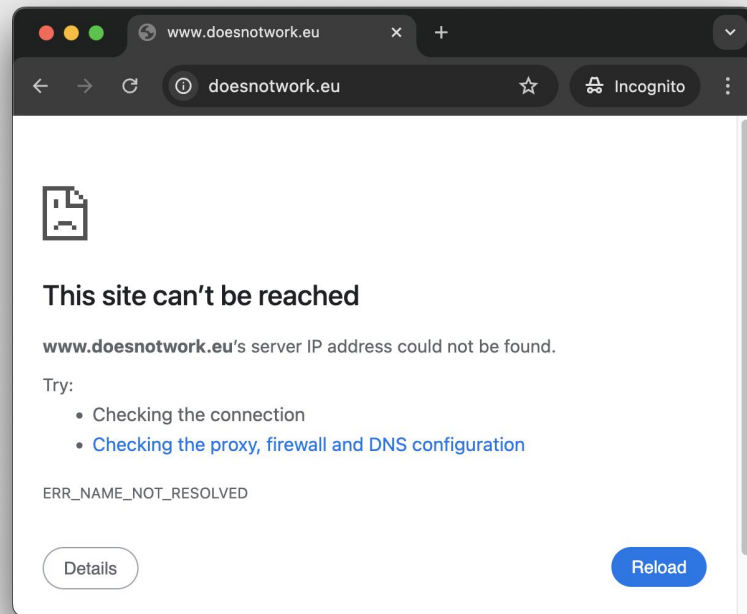
A Prototype Deployed!

Employee: "**A new version of the tool is ready. Can you try it?**"

Coworker 1 (in the office): "**Works well!**"

Coworker 2 (at home): "**Works well!**"

Coworker 3 (at home): "**Does not work at all!**"

It's Always DNS!

```
$ ping6 www.doesnotwork.eu
PING6(56=40+8+8 bytes) 2001:67c:2e8:1200::b20 --> 2001:1528:132:70::d0e5
16 bytes from 2001:1528:132:70::d0e5, icmp_seq=0 hlim=56 time=99.158 ms
16 bytes from 2001:1528:132:70::d0e5, icmp_seq=1 hlim=56 time=148.704 ms
^C
--- www.doesnotwork.eu ping6 statistics ---
2 packets transmitted, 2 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 99.158/123.931/148.704/24.773 ms

$ curl https://www.doesnotwork.eu
curl: (6) Could not resolve host: www.doesnotwork.eu
```

Stub Resolvers Are Trying to Be Smart

Connected to an IPv4-only network

```
$ scutil --dns | head
DNS configuration

resolver #1
  search domain[0] : ripe.net
  nameserver[0] : 10.248.43.64
  if_index : 14 (en0)
  flags    : Request A records
```

Connected to a dual-stack network

```
$ scutil --dns | head
DNS configuration

  search domain[0] : ripe.net
  nameserver[0] : 2001:67c:2e8:11::c100:1365
  nameserver[1] : 193.0.19.101
  if_index : 14 (en0)
  flags    : Request A records, Request AAAA records
```

Filtering AAAA Queries in Stub Resolvers

- Present at least in **macOS** and **Windows**

- **No clear documentation** of the rules

- Inconsistent behaviour depending on resolver API used (`ping6` vs. `curl`)

- We haven't figured out how to force requesting AAAA records

- On macOS, some *undocumented* `scutil` *magic* can help with a **full tunnel VPN**
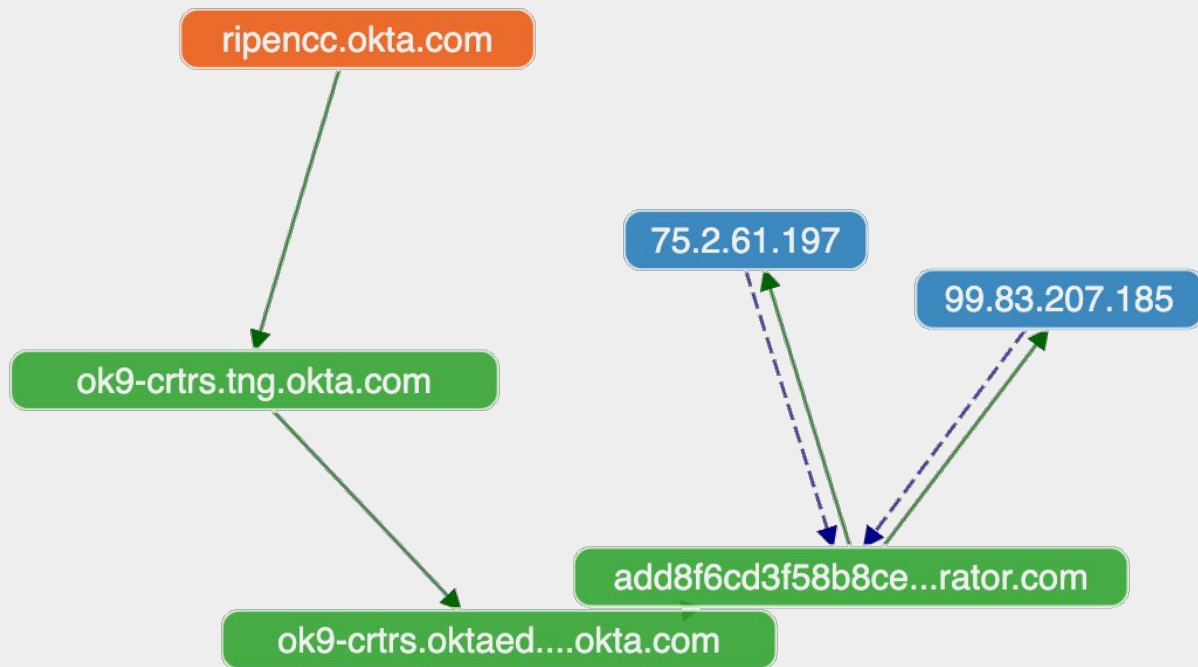
Not So Happy Ending

- We **rolled back** to dual-stack

- It is accessed over IPv6 VPN by employees with IPv6 connectivity and over IPv4 VPN by employees without IPv6 connectivity

- At least our tooling is now **prepared for IPv6-only servers**

- We identified some **additional roadblocks**

Additional Roadblocks

Single Sign-on: Okta

Single Sign-on: Okta

We asked

Damiano Albani (RIPE NCC) asked a question.
March 9, 2022 at 5:28 PM

IPv6 support

Hello,

As far as I know and can see from a simple DNS resolve, Okta doesn't seem to support IPv6 connectivity.
Do you plan add support for it in the short (to medium) term?
I found a single question in the Help Center regarding IPv6, about the IP zone policy functionality:
https://support.okta.com/help/s/question/0D50Z00008C3jm1SAB/ipv6-support-for-ip-zone-policy
Could you give an update?

Thanks!

Deactivated User (ojovp)
Edited March 10, 2022 at 4:41 PM

Hello **@Damiano Albani** (RIPE NCC)
I hope you are having a great day

Thank you for posting, Currently IPV6 its not fully supported but we are continually hoping to provide the best customer experience, so perhaps you would like to share your use case to implement this functionality in a future release. The best method for getting our Product Managers' attention is to submit an idea to the community site. Once ideas are submitted, they are visible to other Okta admins, who can vote on them to provide more visibility and allow you to monitor the potential for future enhancements.To Create an Idea:
1. Go to https://ideas.okta.com/
2. Enter your Okta tenant name and click "Go" (if necessary)
3. Sign in and search the Ideas page for existing feature requests to upvote, or click "Make a suggestion" to submit your own
4. Encourage the other admins in your org to upvote the idea as well
https://support.okta.com/help/s/article/Okta-Ideas-Overview-FAQ

Henry E.
Okta Inc

Single Sign-on: Okta

We submitted an idea

It got **zero upvotes** from other Okta users. 😔

Single Sign-on: Okta

Okta reached to us to pilot IPv6 support

- We are the **first customers asking for it**

- They are trying hard to **find a business case** for the IPv6 support project

- They mostly fear of the US Government IPv6-only Mandate

- They don't want to lose government customers

SIEM System: Rapid7 InsightIDR

Tiny issue that falls in between RIPE-772

- We are **required to do security monitoring** (NIS2, SOC2, ISO 27001, etc.)

- We install **an agent on every server**

- The agent collects logs about both **IPv4 and IPv6 incidents**

- The agent **needs IPv4** to talk to its backend 😔

Somebody asked

IPv6 Proxy for InsightVM agents

■ InsightVM

aobersteiner armin   Mar 2024

How can I use an IPv6 proxy (can proxy IPv4) with the Insight VM agent?
Our servers are in an IPv6 environment with a proxy for IPv4 needs.

176 views

↩ Reply

Is It Just Us?

Are We THAT Unique?

- Not a single issue presented here is **unique to the RIPE NCC**

- We are not even early adopters. **It's 2025 already**

- The US government already requires "**at least 50% of IP-enabled assets** on Federal networks are operating in IPv6-only environments"

We Keep Trying

- Our backend systems are now **ready for IPv6-only** hosts

- We are trying hard to **remove last IPv4 dependencies**

- Some products (like SSO or SIEM) have **extremely small markets** and even we cannot afford trading IPv6 support for **other important features**

Questions
& Comments ?

✉ Ondrej.Caletka@ripe.net

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THANK YOU!