

OSINT work at Tor

Georg Koppen, The Tor Project

July 18, 2025

Bornhack 2025

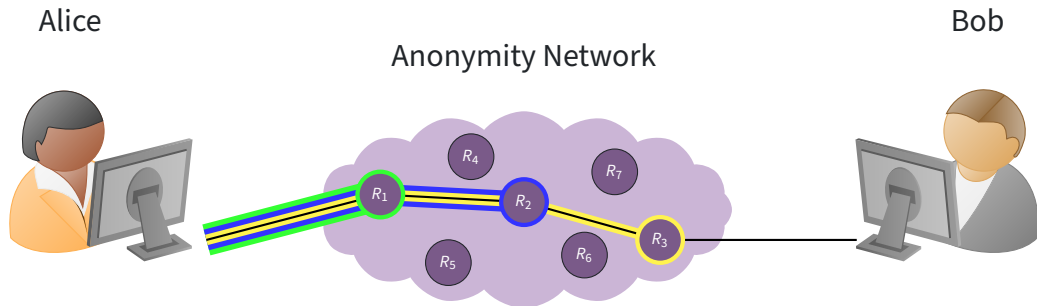


What is Tor?

- Online anonymity, and censorship circumvention
 - Free software
 - Open network
 - Open specifications
- Community of researchers, developers, users, and relay operators
- U.S. 501(c)(3) non-profit organization

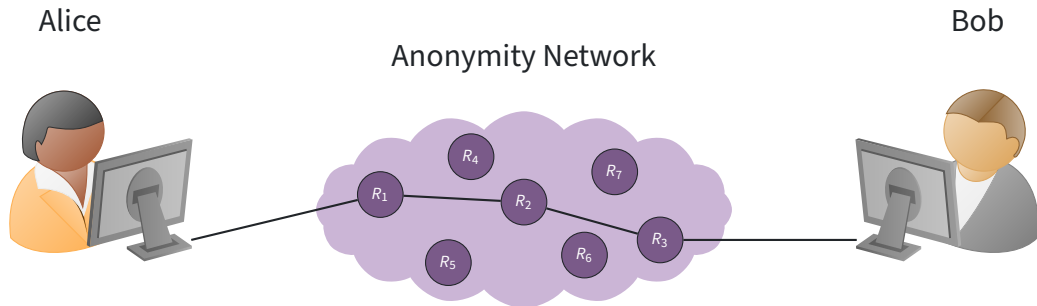


The Tor design



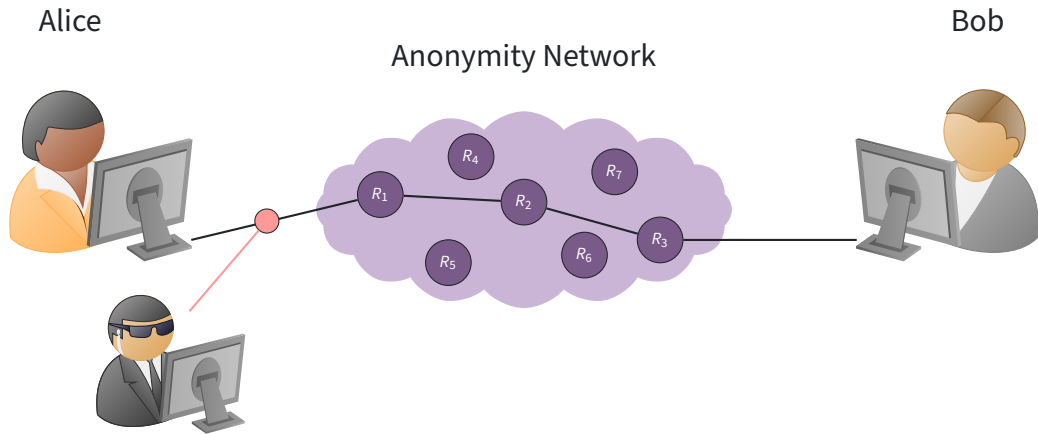
Multiple relays, so no single relay can link Alice to Bob

Threat model

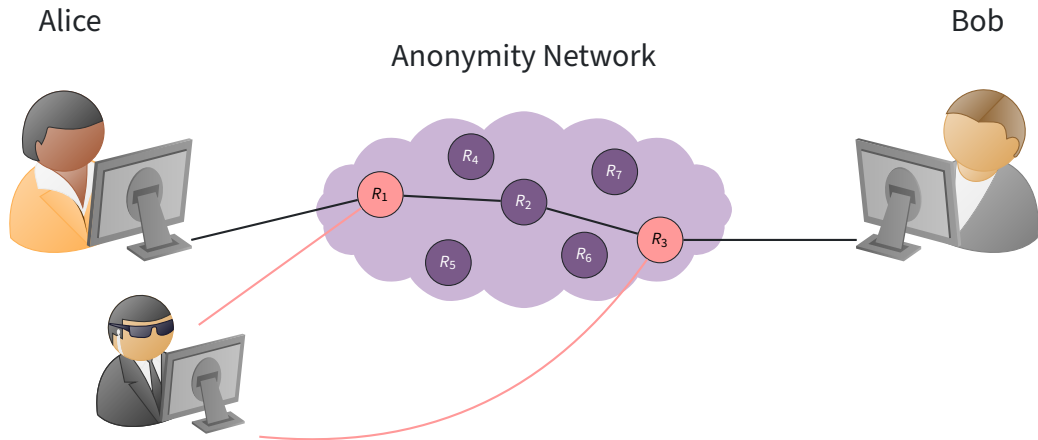


What can the attacker do?

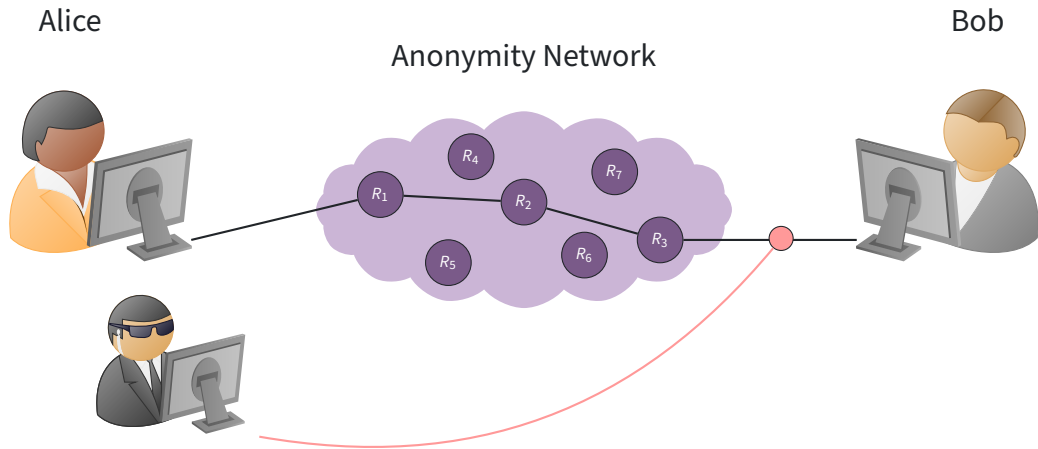
Threat model



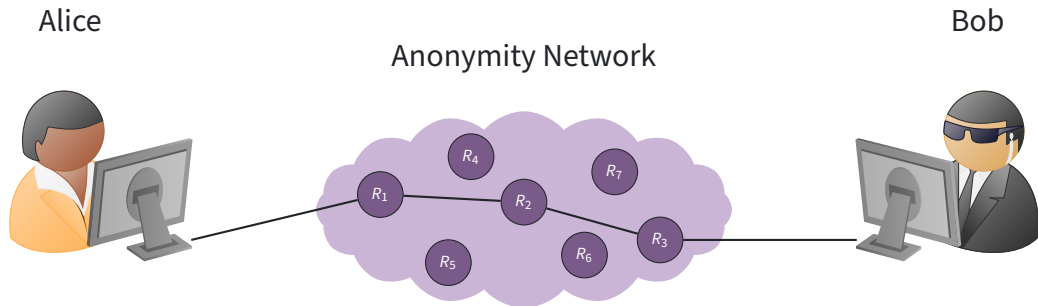
Threat model



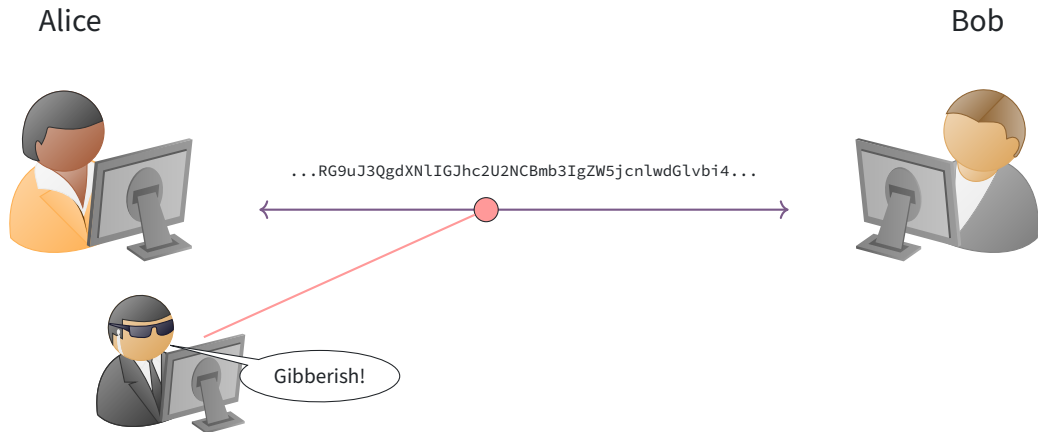
Threat model



Threat model

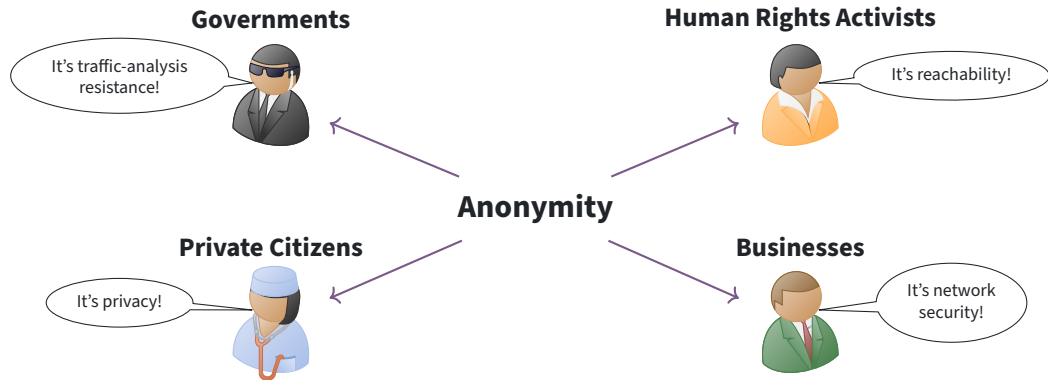


Anonymity isn't encryption



Encryption just protects contents

Anonymity is different for each use case



يالله بالستر...!

تصفح بأمان!

عزيزي، هذا الموقع غير متاح في دولة الإمارات العربية المتحدة.

تتشكل شبكة الإنترنت وسيلة للتواصل والمعرفة وخدمة متطلبات حياتنا اليومية. وقد تم حجب الموقع الذي ترغب بدخوله لاشتماله محتوى مرع لحد "فئات المحتويات المحظورة" حسب تصنيف "السياسة التنظيمية لإدارة النظم للإنترنت" لهيئة تنظيم الاتصالات بدولة الإمارات العربية المتحدة.

إذا كنت لديك وجهة نظر مختلفة، الرجاء انقر هنا.

Surf Safely!

This website is not accessible in the UAE.

The Internet is a powerful medium for communication, sharing and serving our daily learning needs. However, the site you are trying to access contains content that is prohibited under the 'Internet Access Management Regulatory Policy' of the Telecommunications Regulatory Authority of the United Arab Emirates.

If you believe the website you are trying to access does not contain any such content, please [click here](#).



خطراً!

تصفح بأمان!

عزيزي، هذا الموقع غير متاح في دولة الإمارات العربية المتحدة.
تشكل شبكة الإنترنت وسيلة للتواصل والمعرفة وخدمة متطلبات حياتنا اليومية. وقد تم حجب الموقع الذي ترغب بدخوله لاشتماله محتوى مرع لحد "فئات المحتويات المحظورة" حسب تصنيف "السياسة التنظيمية لإدارة النظم للإنترنت" لهيئة تنظيم الاتصالات بدولة الإمارات العربية المتحدة.

إذا كنت لديك وجهة نظر مختلفة، الرجاء انقر هنا.

Surf Safely!

This website is not accessible in the UAE.

The Internet is a powerful medium for communication, sharing and serving our daily learning needs. However, the site you are trying to access contains content that is prohibited under the 'Internet Access Management Regulatory Policy' of the Telecommunications Regulatory Authority of the United Arab Emirates.

If you believe the website you are trying to access does not contain any such content, please [click here](#).



Access Denied

Your request was denied because of its content categorization: "Computers/Internet/Proxy Avoidance"

عزيزي العميل : تم حجب هذا الموقع بناء على القوانين

بأن هناك خطأ يرجى إرسال رسالة على البريد الإلكتروني unblock.kw@kw.zain.com مع ذكر عنوان الموقع الذي تم حجب.

Dear Customer: This site has been blocked for categorizing this site, please

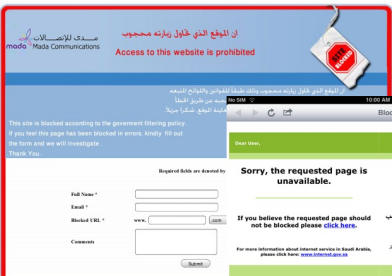
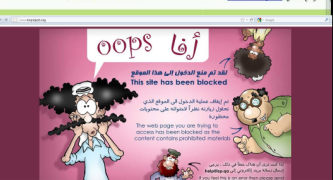


If you believe the requested page should Not be blocked please [click here](#).

إذا كنت ترى أن هذه الصفحة ينبغي أن لا تحجب فضلاً [انقر هنا](#).



<http://torproject.org/>



Du var på vej ind på en ulovlig hjemmeside

Vi vil meget gerne hjælpe dig med at finde den film eller serie, du søger.

Søg med FilmFinder →

Hvis du er på udkig efter musik, bøger eller møbler

Gå til  SHARE WITH CARE →



SHARE
WITH
CARE

Hjemmesiden er blevet blokeret, fordi den er dømt ulovlig ved en dansk domstol. Brug Share With Care til at finde det, du leder efter, lovligt. På den måde passer du både på dig selv og på kulturen. **Læs mere om Share With Care**

What is OSINT?

Open-Source Intelligence (OSINT), broadly defined, involves gathering and analyzing publicly accessible information to produce actionable insights.
([Wikipedia](#))

But what does that mean in a Tor context?

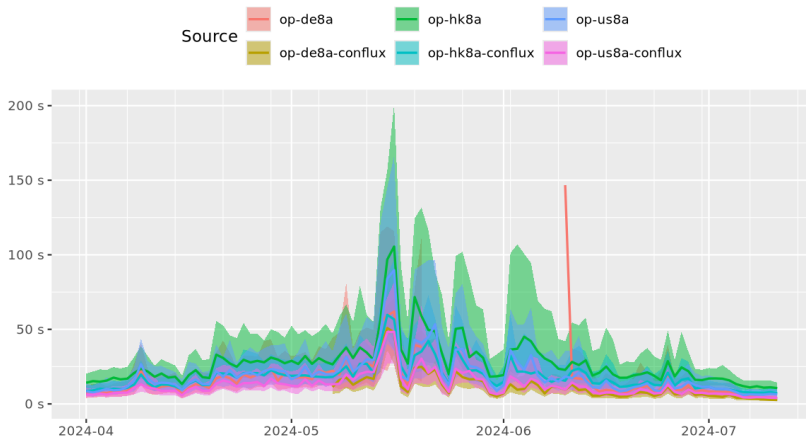
Network health investigations

From time to time we need to do network health investigations which aim at:

- Performance issues (potentially caused by denial of service (DoS) attempts)
- Attackers targeting Tor relays/users
- Network mysteries

Network health investigations

Time to complete 5 MiB request to public server



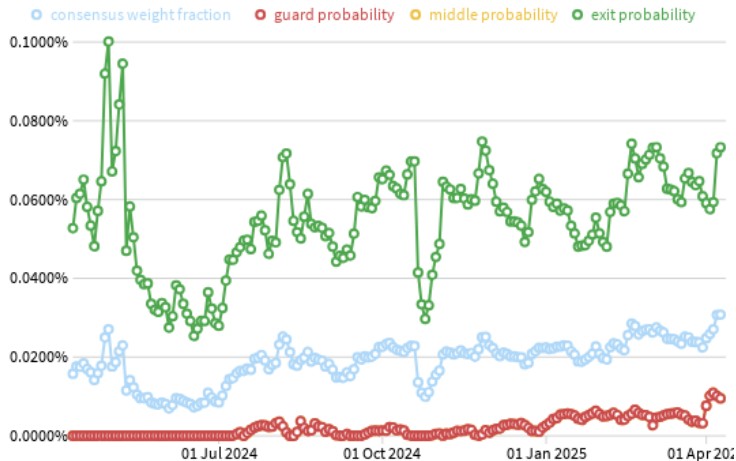
The Tor Project - <https://metrics.torproject.org/>

Network health investigations

From the [tor-relays@ mailing list](#):

I've noticed a new kind of possible attack on some of my relays, as early as Dec.23 which causes huge spikes of outbound traffic that eventually maxes out RAM and crashes Tor. The newest one today lasted for 5 hours switching between two of the three relays on the same IP.

Network health investigations



<https://gitlab.torproject.org/tpo/network-health/analysis/-/issues/95>

Accessible information sources

- Collection of data and metrics produced by Tor itself
 - Tor network and relay statuses
 - Output of scanning tools
 - ...
- Collection of data provided by external tools
 - Internet infrastructure information
 - Social media posts
 - ...

The world of descriptors and metrics

Descriptor Type	Description
Relay server descriptor	Information that relays publish about themselves
Network status vote	View of a Directory Authority on known relays
Network status consensus	Hourly consensus created by Directory Authorities
Network status entry	Relay information provided by Directory Authorities
Exit list	Exit relays and their IP addresses while using them
OnionPerf analysis file	Tor network performance measurement data

Table 1: Tor descriptor types

Current metrics tooling

- CollecTor
 - collects descriptors and makes them available at <https://collector.torproject.org/archive/>
 - it's loads of monthly compressed tarballs 😞
- Onionoo
 - web-based protocol which allows someone to learn about currently running Tor relays
 - Onionoo clients send HTTP GET requests to Onionoo server which responds with JSON-formatted replies
 - for a specification and all the endpoints available, see: <https://metrics.torproject.org/onionoo.html>

Relay search

← → ↺

🔒

https://metrics.torproject.org/rs.html#details/50485E03CA39D393BD54D315CEBA65E6DD0FDD89

📄 ☆ .onion.tlgangelig 🌐 ⚙️ ☰

Relay Search

Details for: d2d4 ●

Configuration

Nickname 🔍
d2d4

OR Addresses 🔍
185.129.61.129:443
[2001:67c:89c:666::1]:443

Contact
gk@torproject.org

Dir Address
none

Exit Addresses
185.129.61.129

Advertised Bandwidth
22.07 MiB/s

IPv4 Exit Policy Summary
accept
20-23
43
53
79-81
88
110
143
194
220
389
443
464
531
543-544
554
563
636

Properties

Fingerprint
50485E03CA39D393BD54D315CEBA65E6DD0FDD89

Uptime
29 days 23 hours 52 minutes and 46 seconds

Flags
⬆️ Exit ⚡ Fast ⚙️ Running ⬤ Stable ⬢ Valid

Additional Flags
⚠️ Not Recommended ⚙️ Experimental 📁 FallbackDir 🔄 ReachableIPv6
👇 IPv6 Exit

Host Name
relay-02.torproject.net

Country
🇩🇰 Denmark (📍)

AS Number
AS210731

AS Name
Forening for DotSrc

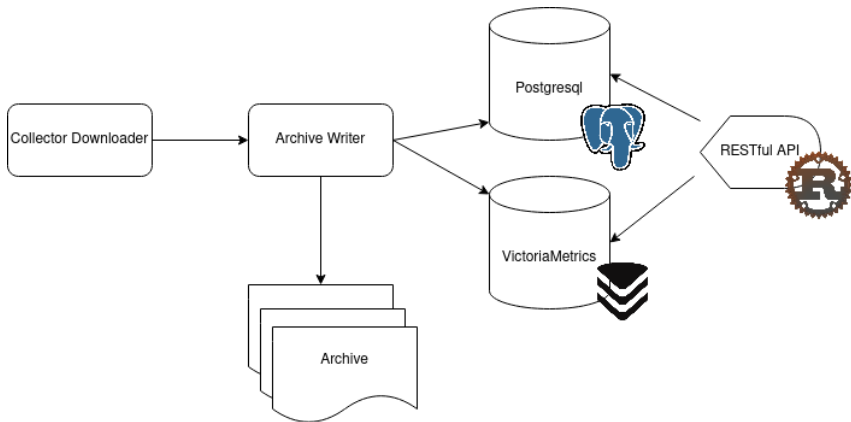
First Seen
2021-11-24 00:00:00 (3 years 230 days 14 hours 28 minutes and 53 seconds)

Last Restarted
2025-06-11 14:36:07

Consensus Weight
30000

Platform
Tor 0.4.9.1-alpha-dev on Linux

Metrics pipeline 2.0



External data sources

Non-Tor data sources are important in investigations to enrich and refine data provided by the Tor eco system itself. Their overall usefulness depends on the actual type of investigation, though. Examples are:

- Censys (internet scan data)
- SecurityTrails (historical domain data)
- WHOIS (domain/IP address ownership data)
- BGP routing information
- Snapshots of websites (e.g. archive.org)

How to do network health investigations?

Guidelines for how to do network health investigations at Tor are meant to be for a diverse audience:

- volunteers and Tor community members wanting to help
- Tor Project staff
- other organizations or interested third parties (media/governments etc.)

How to do network health investigations?

Tor's mission statement:

To advance human rights and freedoms by creating and deploying free and open source anonymity and privacy technologies, supporting their unrestricted availability and use, and furthering their scientific and popular understanding.

How to do network health investigations?

How do we deal with attackers that don't care about the human rights of those involved or targeted in their attacks or about the Tor network?

- risk of subverting Tor's ethical foundation
- "risk of ruthlessness" ("ruthlessness" being: *"both a feature of action and a quality of thought and feeling that rejects all scruples, doubts, hesitation, and remorse in pursuing some ultimate purpose or serving some paramount principle"* [Cherniss 2021, p.2])

How to do network health investigations?

Our proposal is modeled after the *Berkeley Protocol on Digital Open Source Investigations*, but with adaptations as:

- the Berkeley Protocol is *"conducting online research of alleged violations of international criminal, human rights, and humanitarian law"* but the context at Tor is different
- evidence collection covered by the Berkeley Protocol (but not in Tor's context) has to pass scrutiny in courts
- researching human rights abuses, breaches of international criminal and humanitarian law comes with potentially serious personal risks involved, contrary to Tor network health investigations

How to do network health investigations?

We created a *Framework for running Tor Network Health open source investigations* which is

- following the guiding principles of the Berkeley Protocol (chapter II. Principles)
 - professional principles (accountability, objectivity, operational security...)
 - methodological principles (accuracy, data minimization, preservation...)
 - ethical principles (dignity, humility, independence, transparency...)

How to do network health investigations?

- adopting the investigation cycle (chapter VI. Investigation Process):

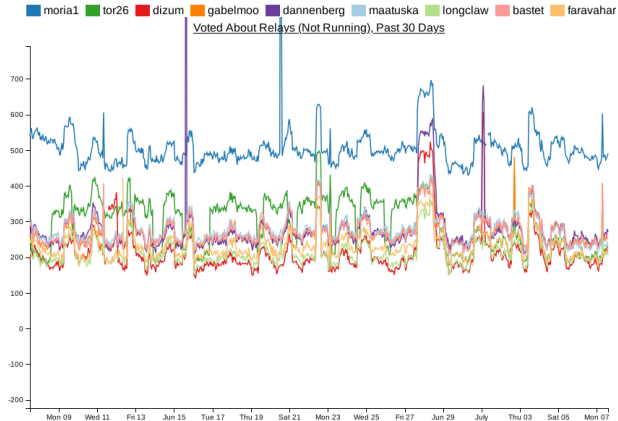


How to do network health investigations?

Reporting findings can be done via different venues, depending e.g. on the type of investigation:

- Gitlab bug tracker (optionally making the ticket confidential)
- public mailings lists, IRC/Matrix, our forum
- private [bad-relays@ mailing list](#)

tor26 voted "not running" for a lot of relays but then dropped again. Why?



<https://gitlab.torproject.org/tpo/network-health/analysis/-/issues/92>

There are different ways to start investigating this:

- CollecTor has the votes and consensuses... but it's monthly compressed tarballs
- PostgreSQL dumps for the win!
 - Votes, consensuses and server descriptors can be found at:
<https://people.torproject.org/gk/bornhack2025/>
 - The table schemes are collected in our [metrics-sql-tables](#) repository

References

-  Cherniss, Joshua L.: Liberalism in Dark Times. The Liberal Ethos in the Twentieth Century. Princeton, Oxford 2021.

How can you help?

- Hack on some of our cool projects.
- Find, and maybe fix, bugs in Tor.
- Test Tor on your platform of choice.
- Work on some of the many open research projects.
- Run a Tor relay or a bridge!
- Teach others about Tor and privacy in general.



Questions?



This work is licensed under a

Creative Commons
Attribution-ShareAlike 4.0 International License

