

# Tor: Internet privacy in the age of big surveillance

Antoine Beaupré, The Tor Project



# Tor Overview

Online anonymity: open source, open network

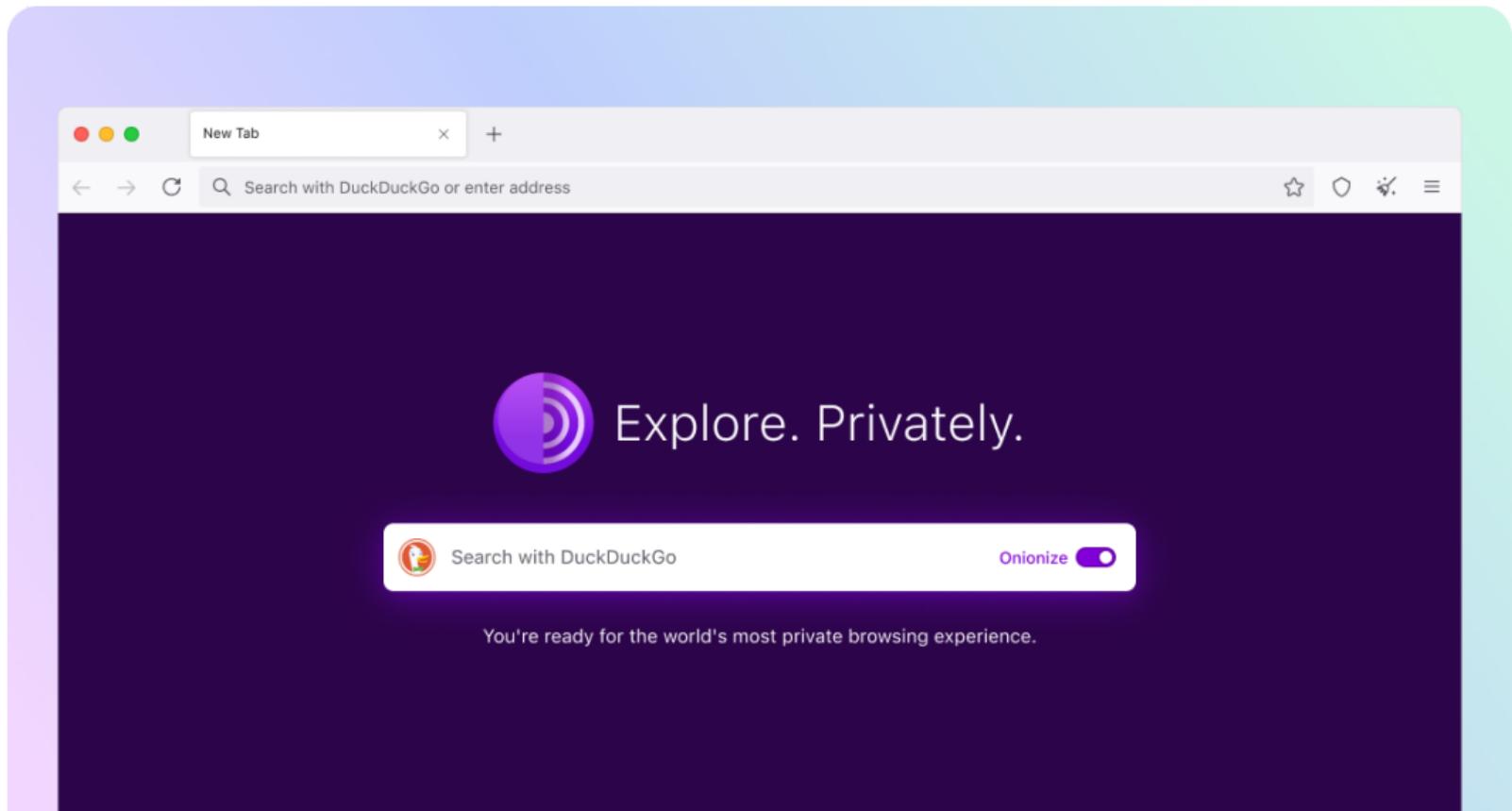
Community of devs, researchers, users, relay operators

US 501(c)(3) non-profit organization with 50ish staff

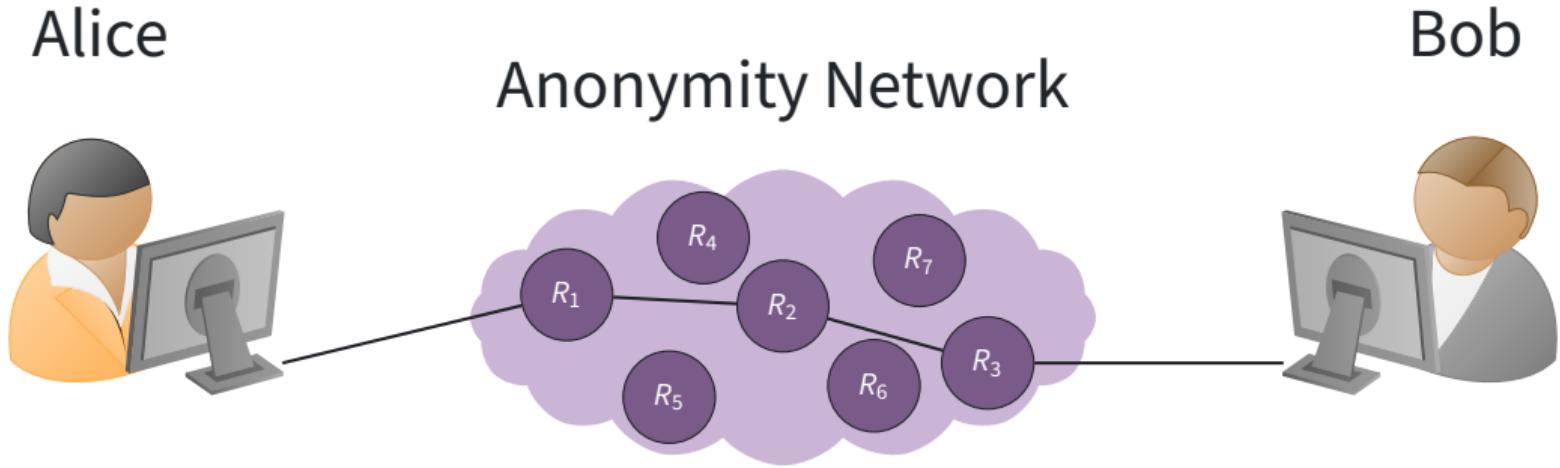
Estimated 2,000,000 to 8,000,000 daily users

Part of larger ecosystems: internet freedom, free software, censorship resistance, anonymity research

# Tor Browser

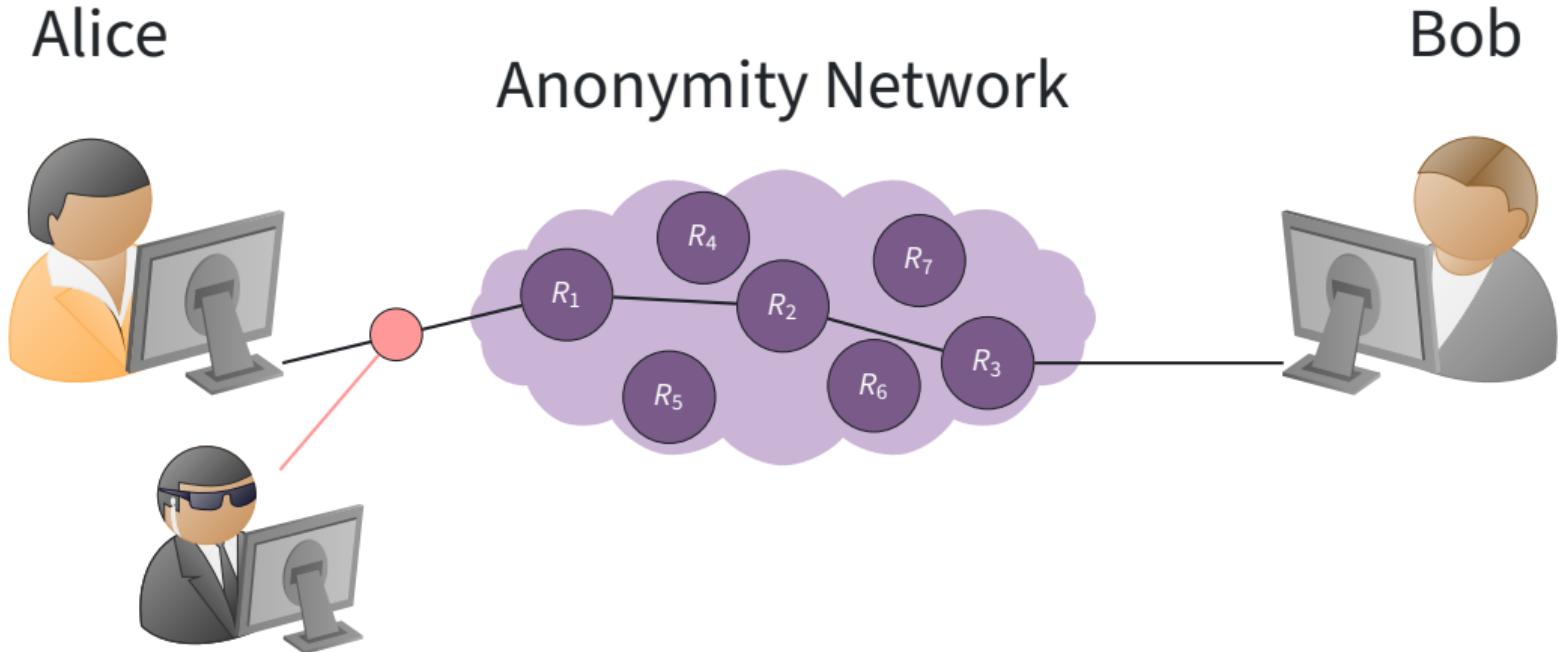


# Threat Model

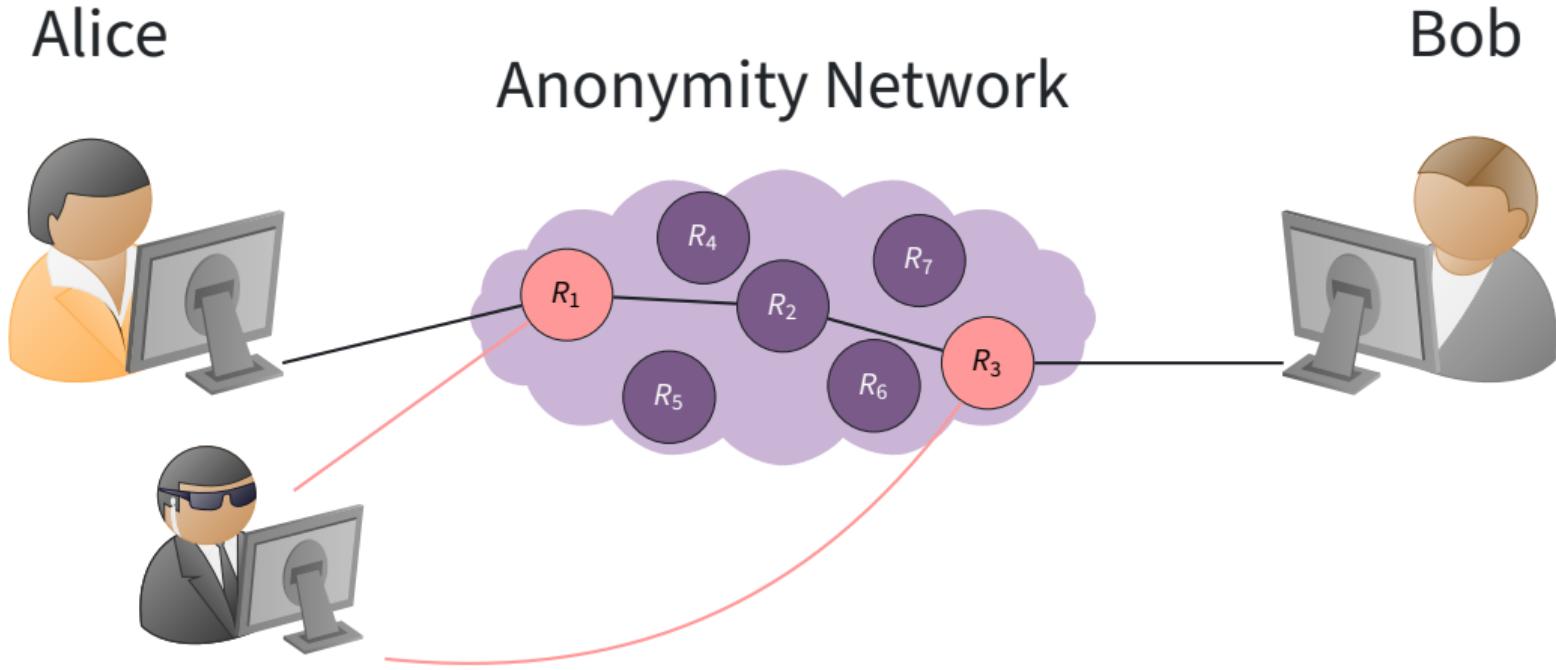


{What can the attacker do?}

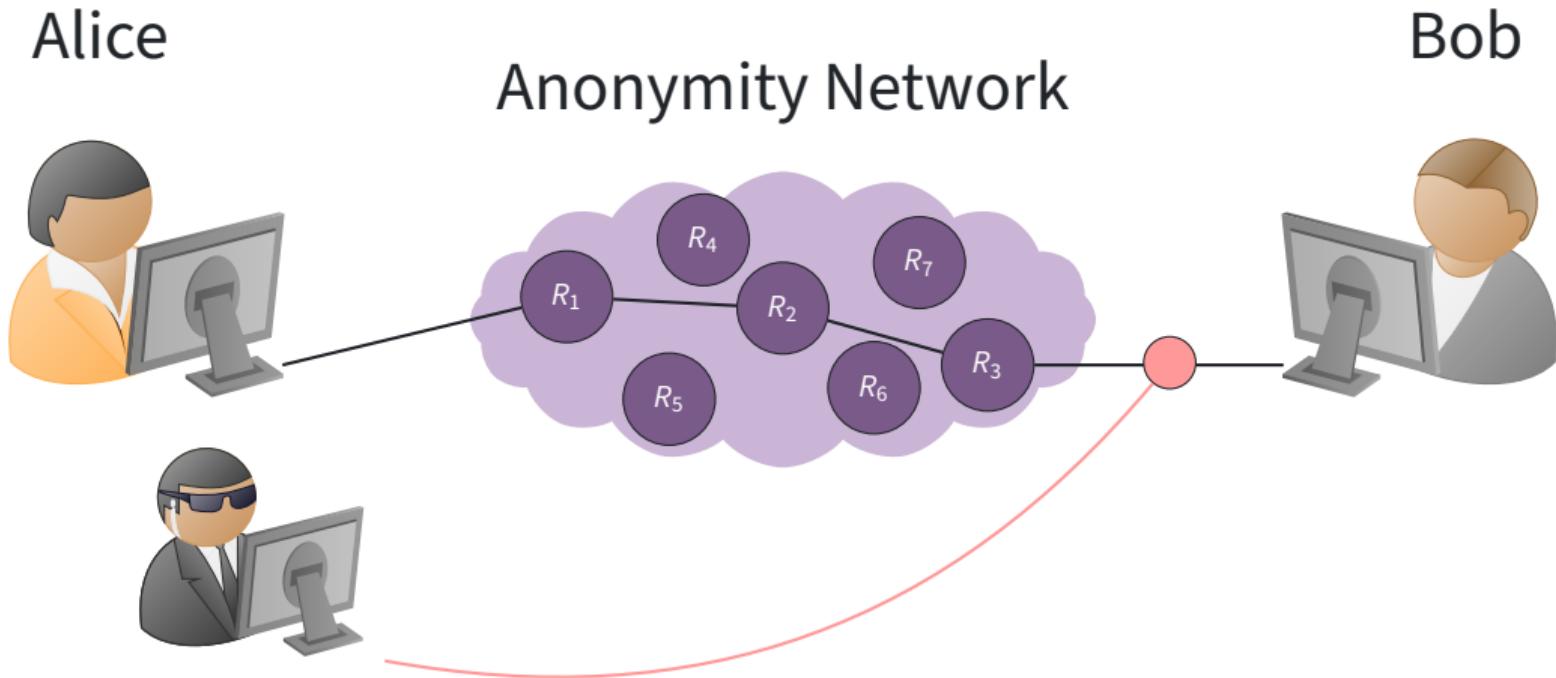
## Threat Model



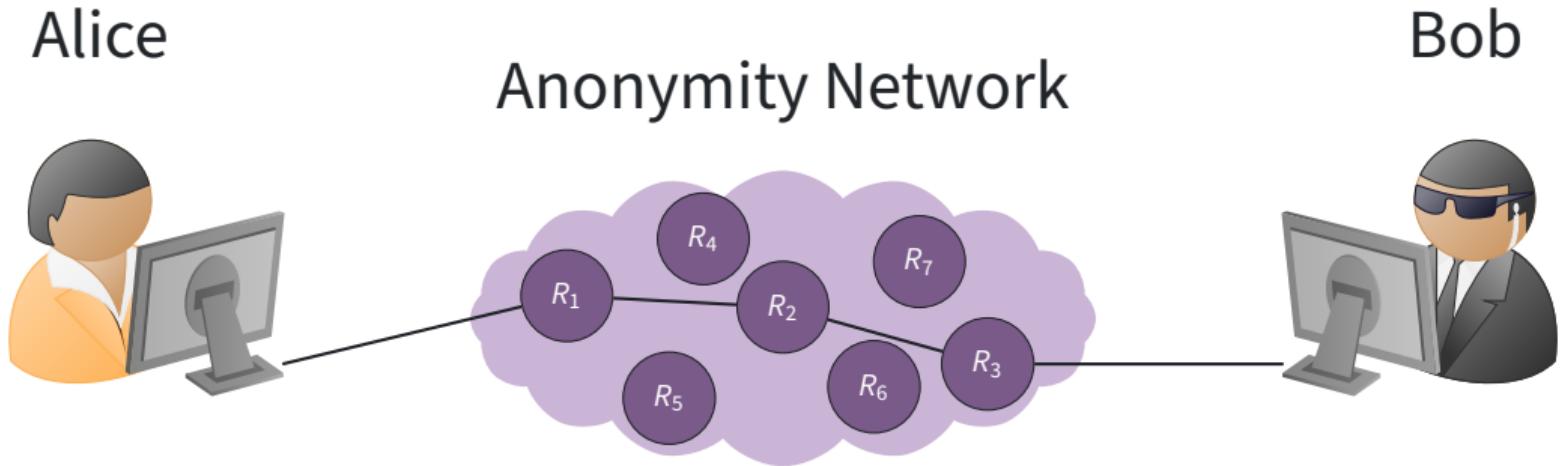
## Threat Model



# Threat Model



# Threat Model



# Anonymity isn't Encryption

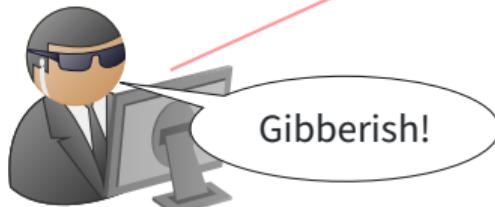
Alice



Bob



...RG9uJ3QgdXNlIGJhc2U2NCBmb3IgZW5jcnlwdGlvbi4...



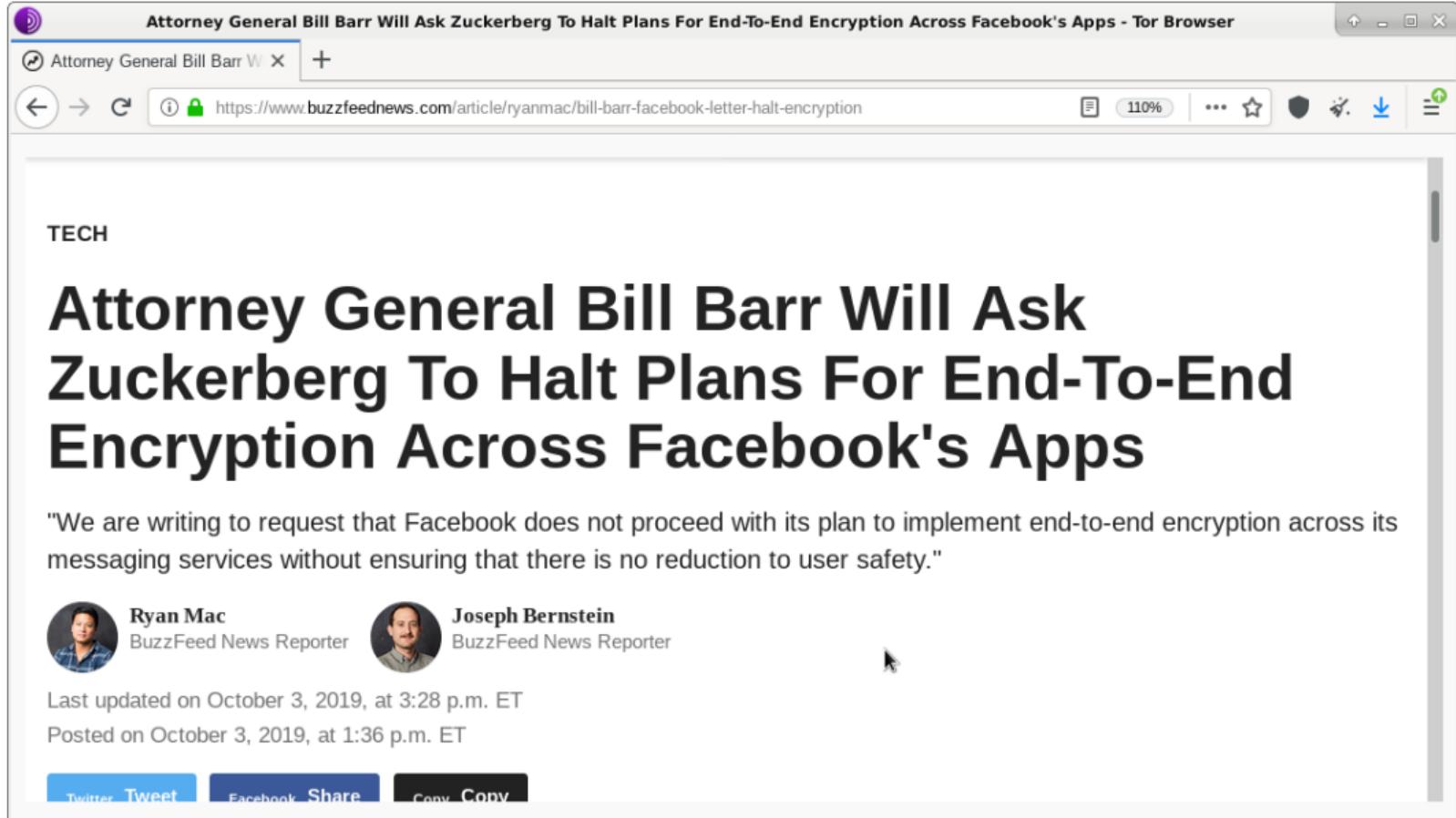
Encryption just protects contents.

# Communications Metadata



*“We Kill People Based on Metadata.”*

*—Michael Hayden, former director, NSA.*



UK urges Meta not to roll out end-to-end encryption on Messenger and Instagram | Reuters — Tor Browser

Ola Bini declared innocent: X UK urges Meta not to roll out X +

https://www.reuters.com/technology/uk-urges-meta-not-roll-out-end-to-end-encryption-messenger-instagram-2023-09-19/

Exclusive news, data and analytics for financial market professionals LSEG

REUTERS® World Business Markets Sustainability Legal More My View Sign In Register

Disrupted

# UK urges Meta not to roll out end-to-end encryption on Messenger and Instagram

By Paul Sandle

September 19, 2023 11:09 PM UTC · Updated 6 months ago

Feedback



Authorities reportedly ordered Google to reveal the identities of some YouTube videos' viewers — Tor Browser

Ola Bini declared innocent: " Authorities reportedly ordered Google to reveal the identities of some YouTube videos' viewers — Tor Browser

https://www.engadget.com/authorities-reportedly-ordered-google-to-reveal-the-identities-of-some-youtube-videos-viewers-140018019.html

engadget Sections Login

# Authorities reportedly ordered Google to reveal the identities of some YouTube videos' viewers

You apparently don't have to do anything illegal for law enforcement to ask for your Google data.



**Mariella Moon**

Contributing Reporter

Sat, Mar 23, 2024, 8:00 AM MDT • 2 min read



MORNING  
NEWS AND

the yodel



Ola Bini declared innocent: " X

Facebook gave police their p X

+



https://www.guardian2zotagl6tmjucg3lrhxdk4dw3lhbnkvkywawy3oqfoprid.onion/us-news/2022/aug/10/facebook-user-data-abortion-nc



## Analysis

# Facebook gave police their private data. Now, this duo face abortion charges

*Johana Bhuiyan*

Experts say it underscores the importance of encryption and  
minimizing the amount of user data tech companies can store

Wed 10 Aug 2022 12.00  
CEST

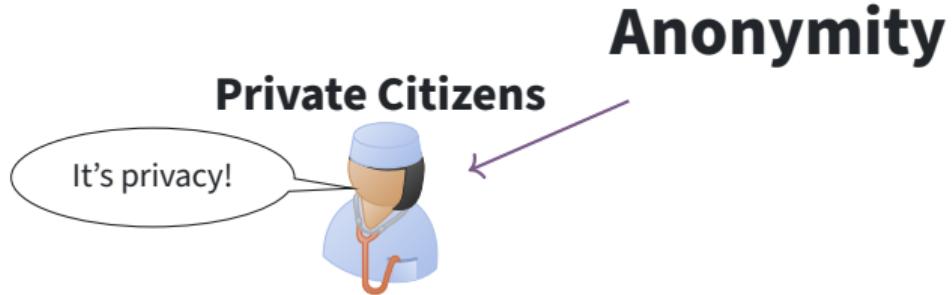
Share



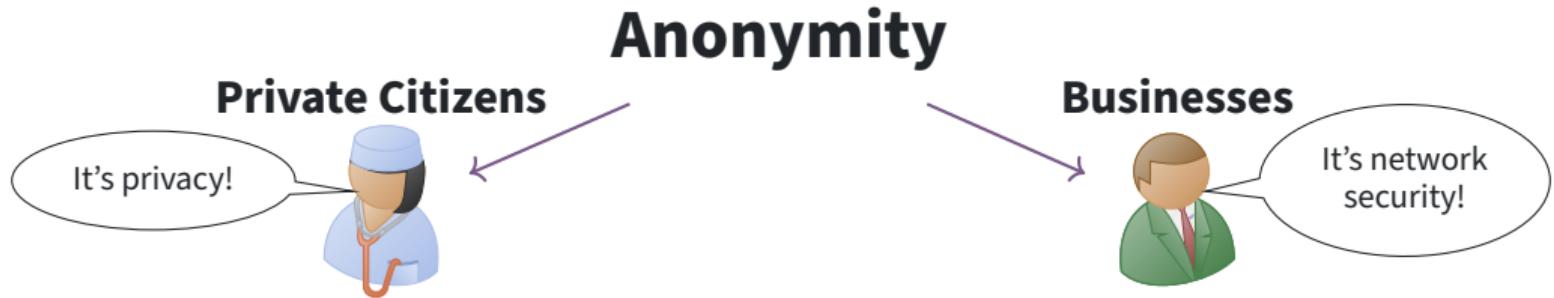
Court documents revealed how tech companies contribute to criminal prosecution of abortions.

Photography: Olivier Douliery/AFP/Getty Images

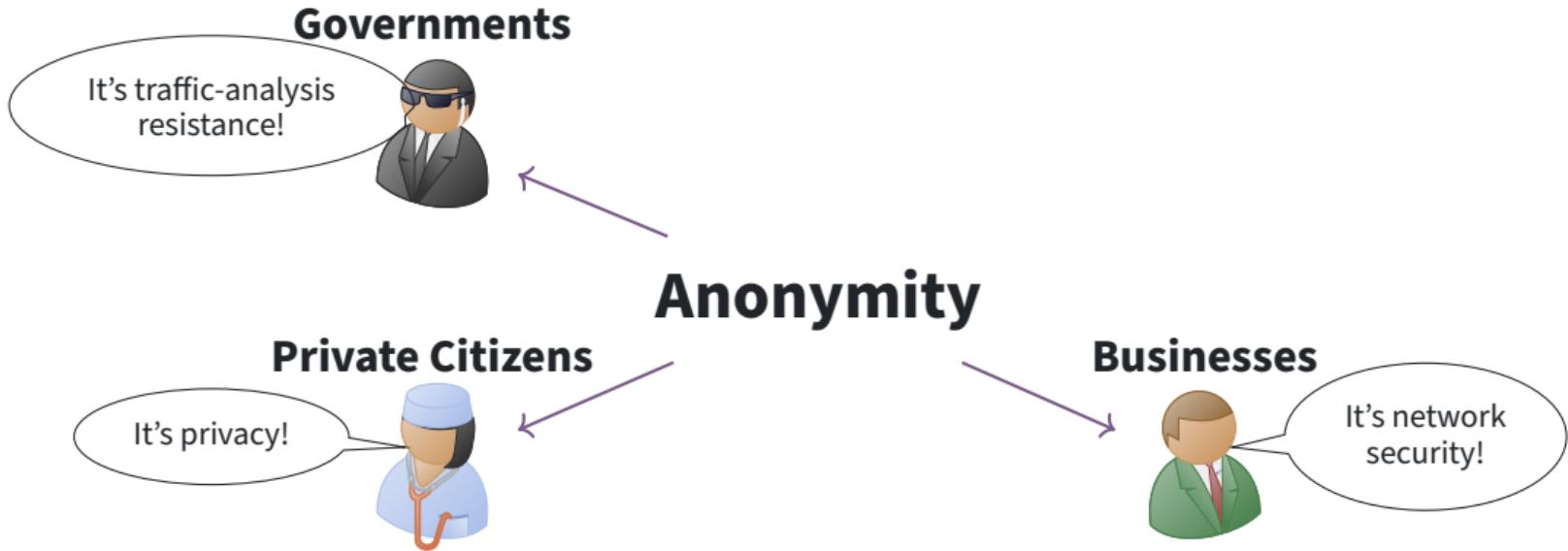
# Anonymity is different for each use case



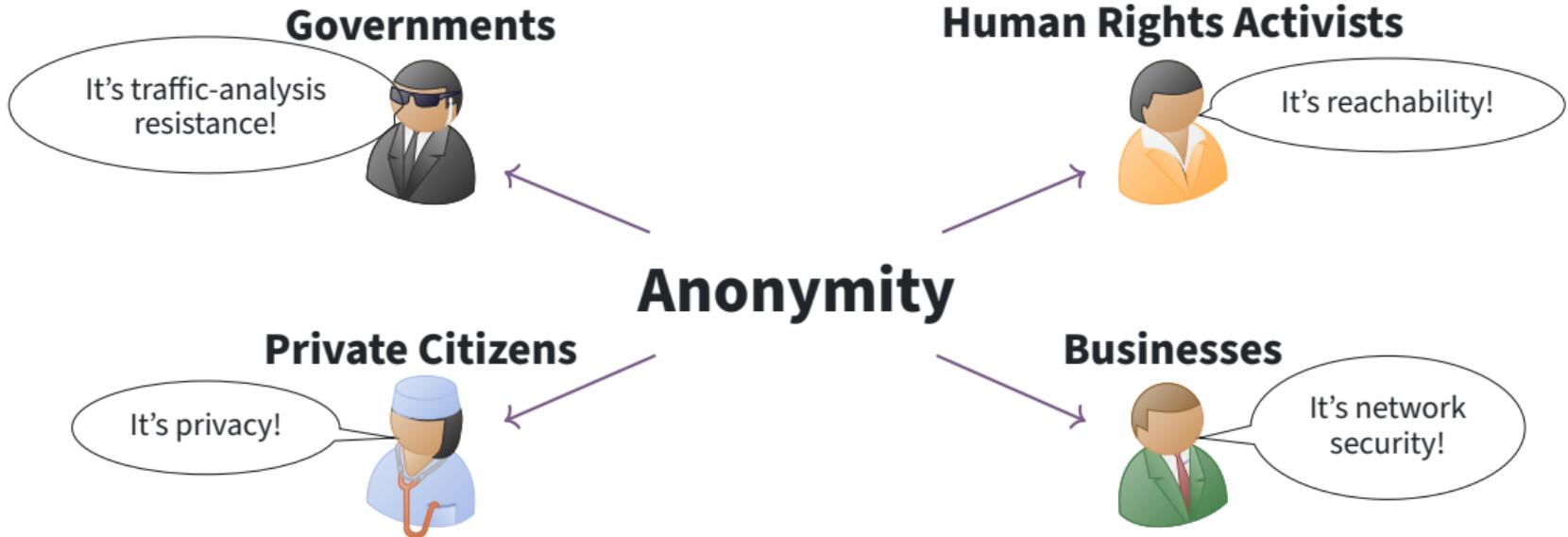
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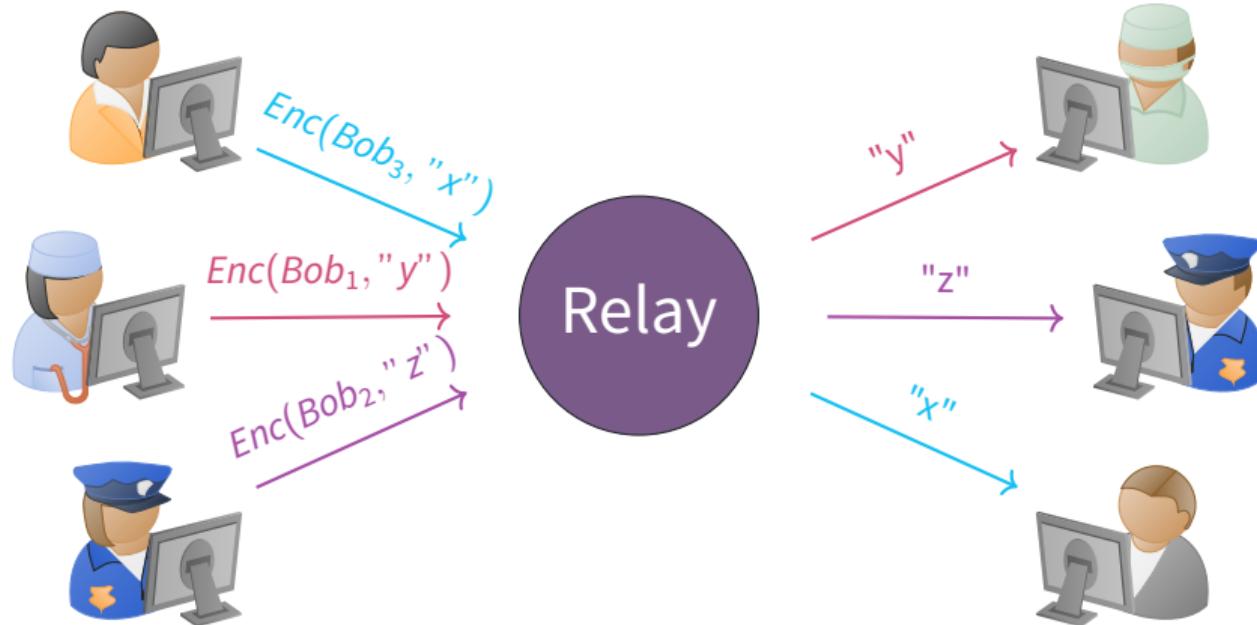
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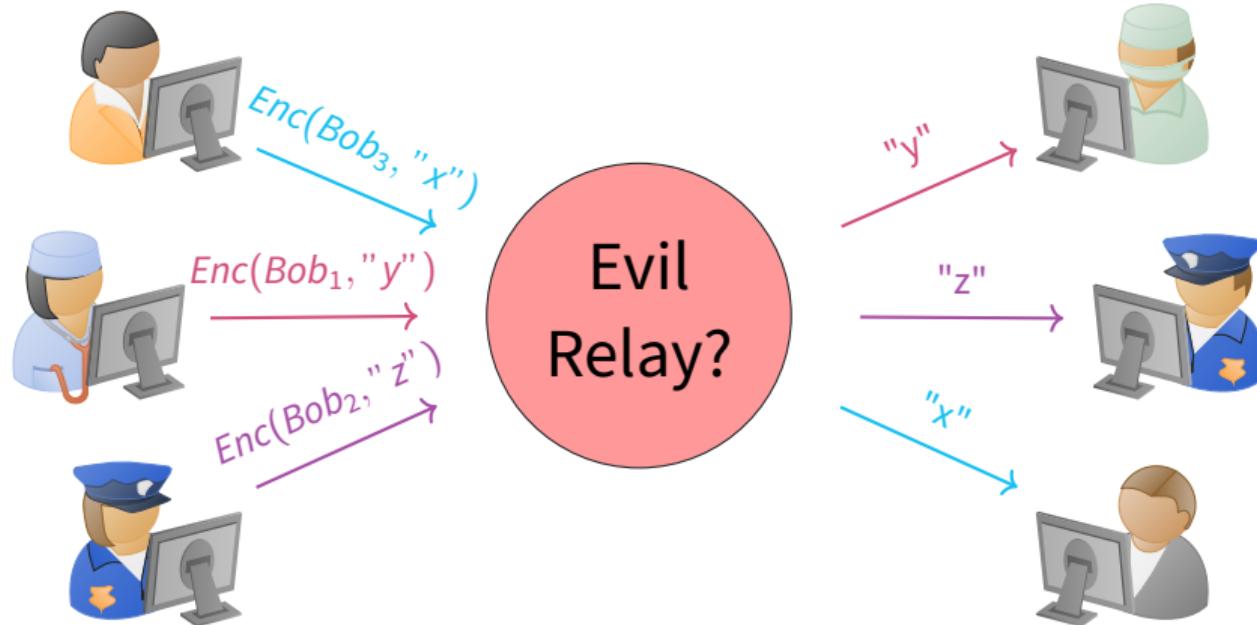


# A Simple Design

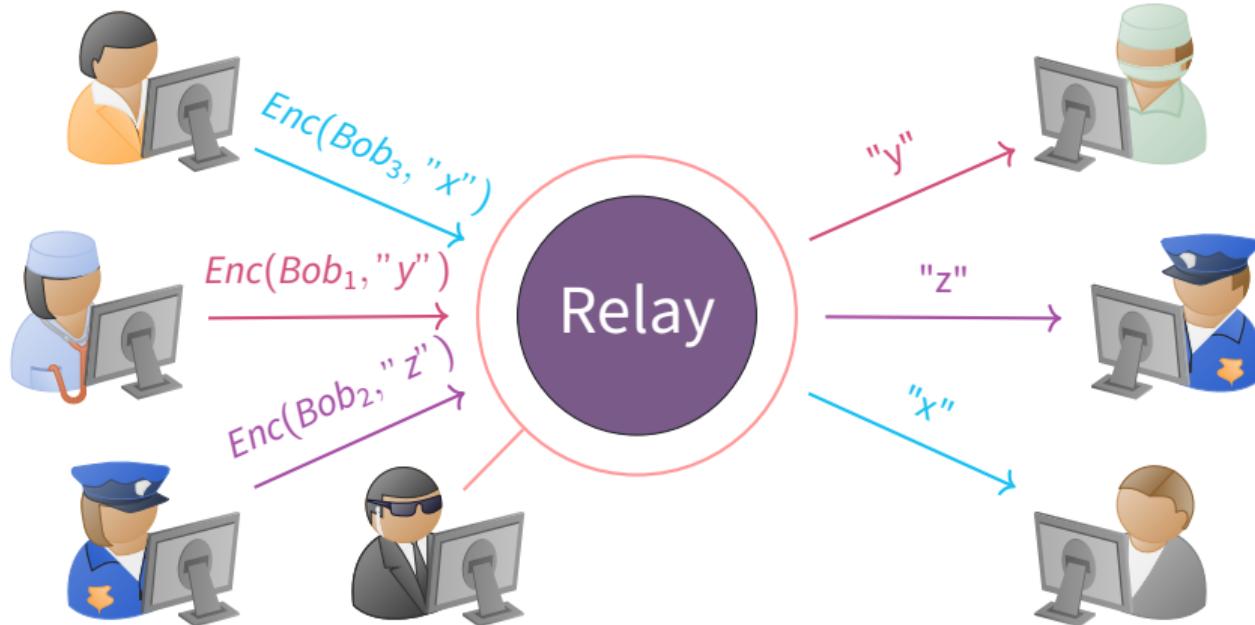


Equivalent to most commercial proxy/VPN providers.

# A Simple Design

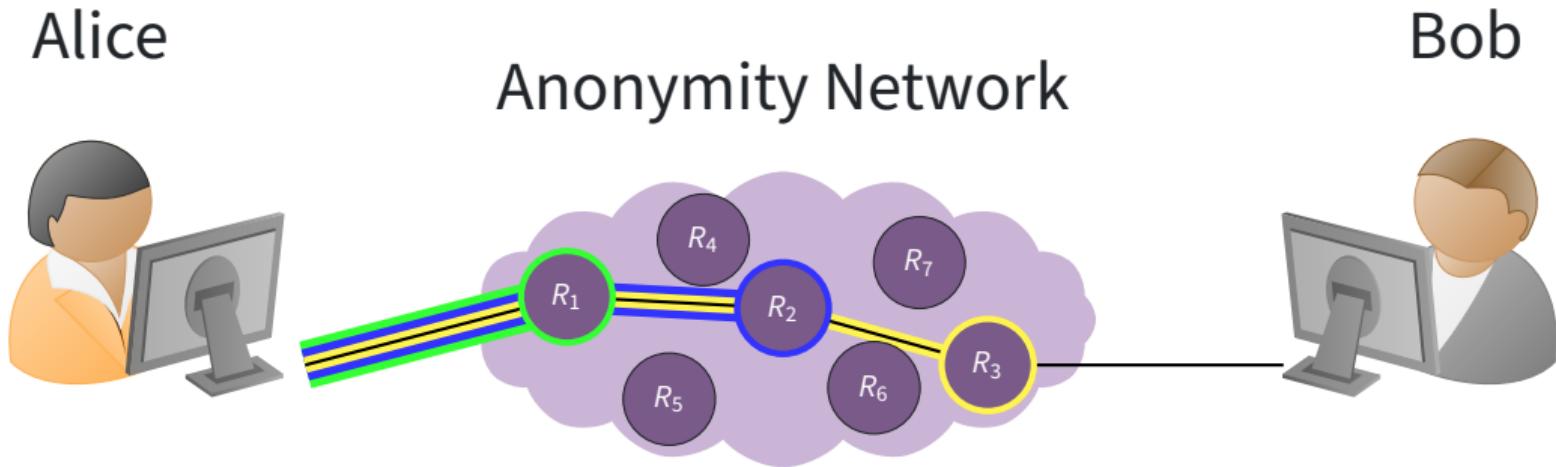


# A Simple Design



Timing analysis lets an observer match up connections.

# The Tor Design



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

## **I'm a political activist, part of a semi-criminalized minority.**

In my younger years I entered the public debate openly, and as a result got harassed by government agencies. I later tried to obfuscate my identity, but I found that my government has surprisingly broad powers to track down dissidents.

Only by using anonymizing means, among which Tor is key, can I get my message out without having police come to "check my papers" in the middle of the night. **Tor allows me freedom to publish my message to the world without being personally persecuted for it.**

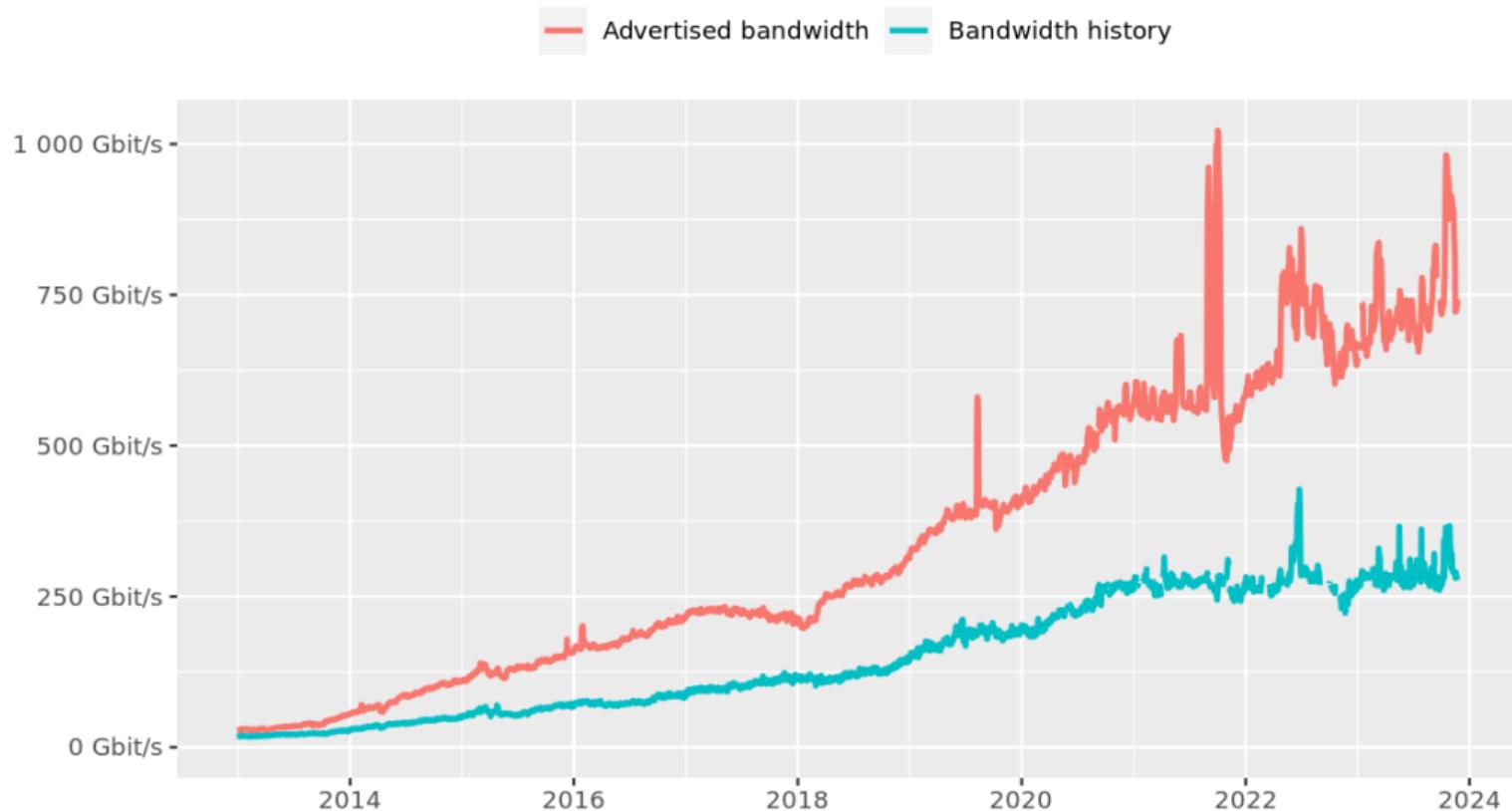
—Anonymous Tor User

**I'm a doctor in a very political town.** I have patients who work on legislation that can mean billions of dollars to major telecom, social media, and search concerns.

When I have to do research on diseases and treatment or look into aspects of my patients' histories, I am well aware that my search histories might be correlated to patient visits and leak information about their health, families, and personal lives. **I use Tor to do much of my research when I think there is a risk of correlating it to patient visits.**

—Anonymous Tor User

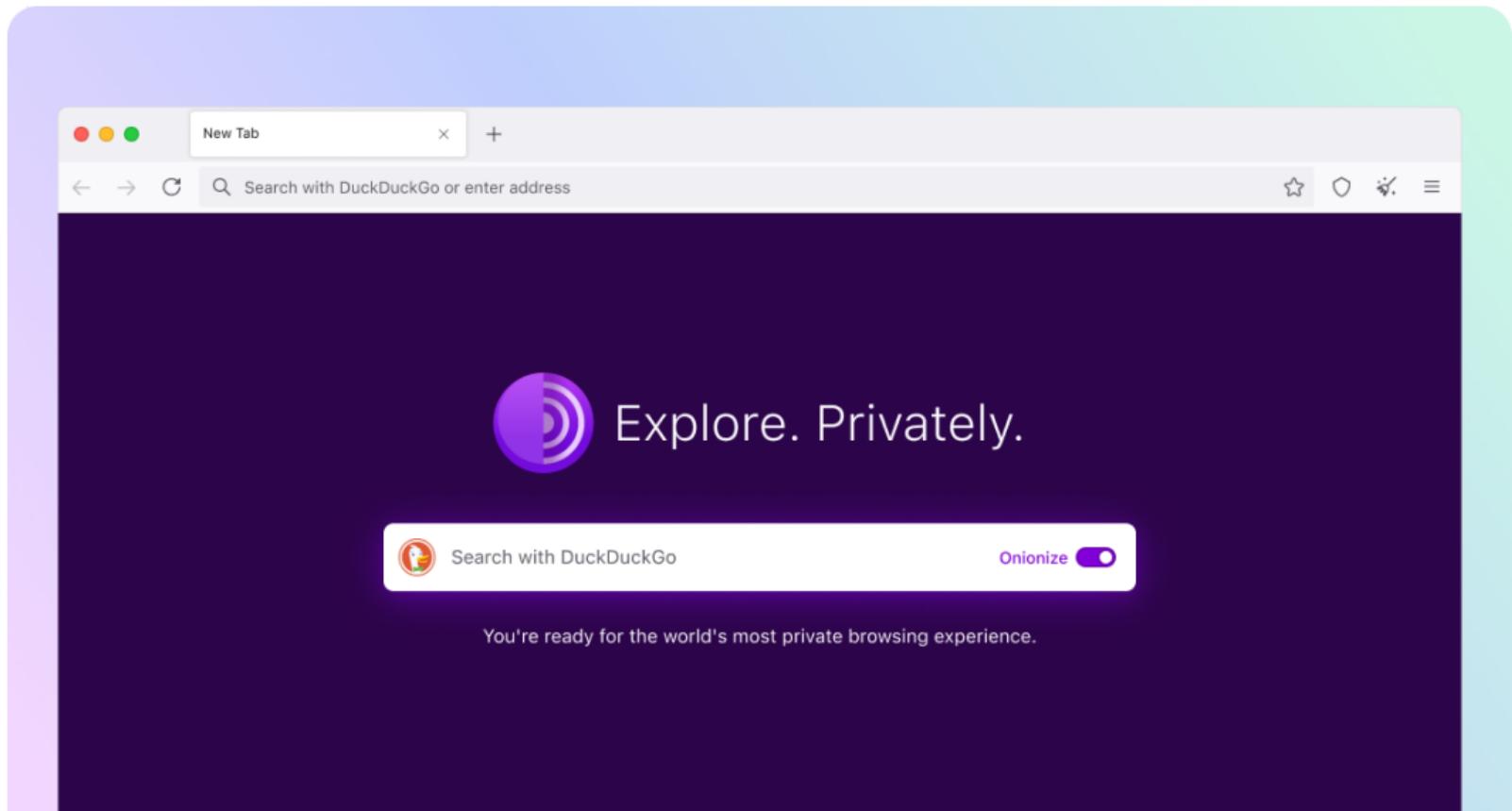
## Total relay bandwidth



# Tor's **safety** comes from **diversity**

1. Diversity of relays. The more relays we have and the more diverse they are, the fewer attackers are in a position to do traffic confirmation. Research problem: How do we measure diversity over time?
2. Diversity of users and reasons to use it. 50000 users in Iran means almost all of them are normal citizens.

# Tor Browser



A Study on Private Browsing - Alt.pages - Private\_Browsing.pdf - Tor Browser

A Study on Private Browsing

https://duckduckgo.com/download/Private\_Browsing.pdf

13 of 25

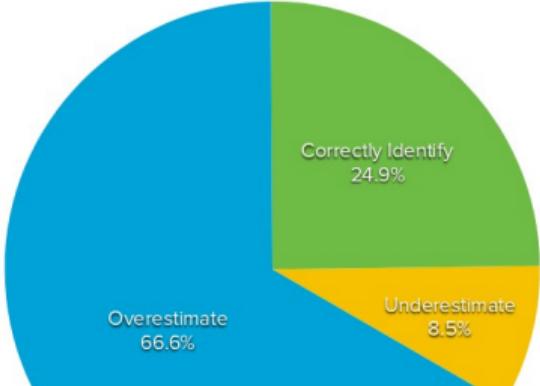
Automatic Zoom

76% of Americans who use Private Browsing mode cannot accurately identify the privacy benefit it provides.

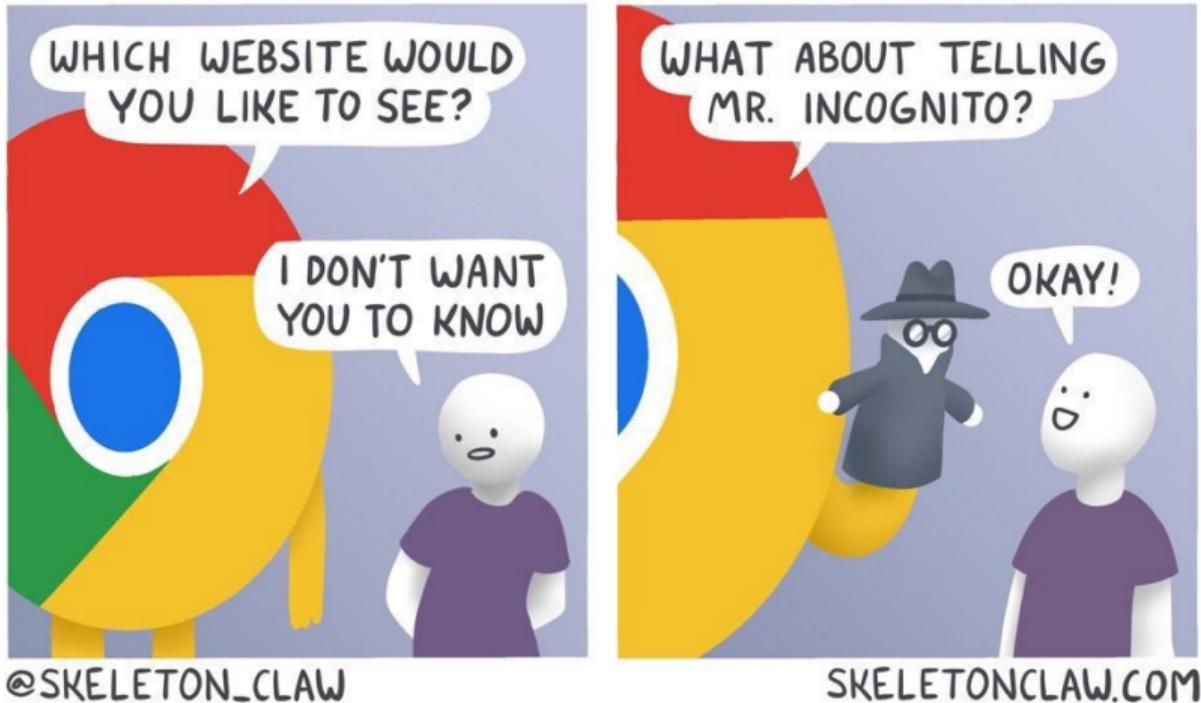
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75.8 ±2.2% of people who use Private Browsing mode cannot accurately identify the privacy benefit it provides. Of that group, 66.5 ±2.5% overestimate the protection that Private Browsing provides.

Awareness of Private Browsing Privacy Protections (USA)



Category	Percentage
Overestimate	66.6%
Underestimate	8.5%
Correctly Identify	24.9%



# Transparency for Tor is key

- Open source / free software
- Public design documents and specifications
- Publicly identified developers

# Transparency for Tor is key

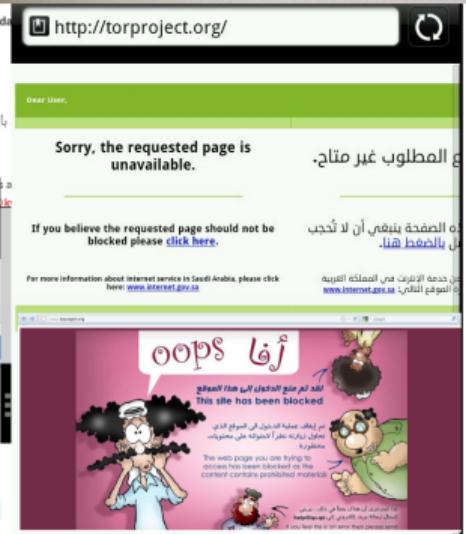
- Open source / free software
- Public design documents and specifications
- Publicly identified developers
- Not a contradiction: privacy is about choice!



# Technology is not neutral

Power imbalances are central to Tor: it's more useful to vulnerable people than those who already have power.

Technology is inherently political!



# Pluggable transports



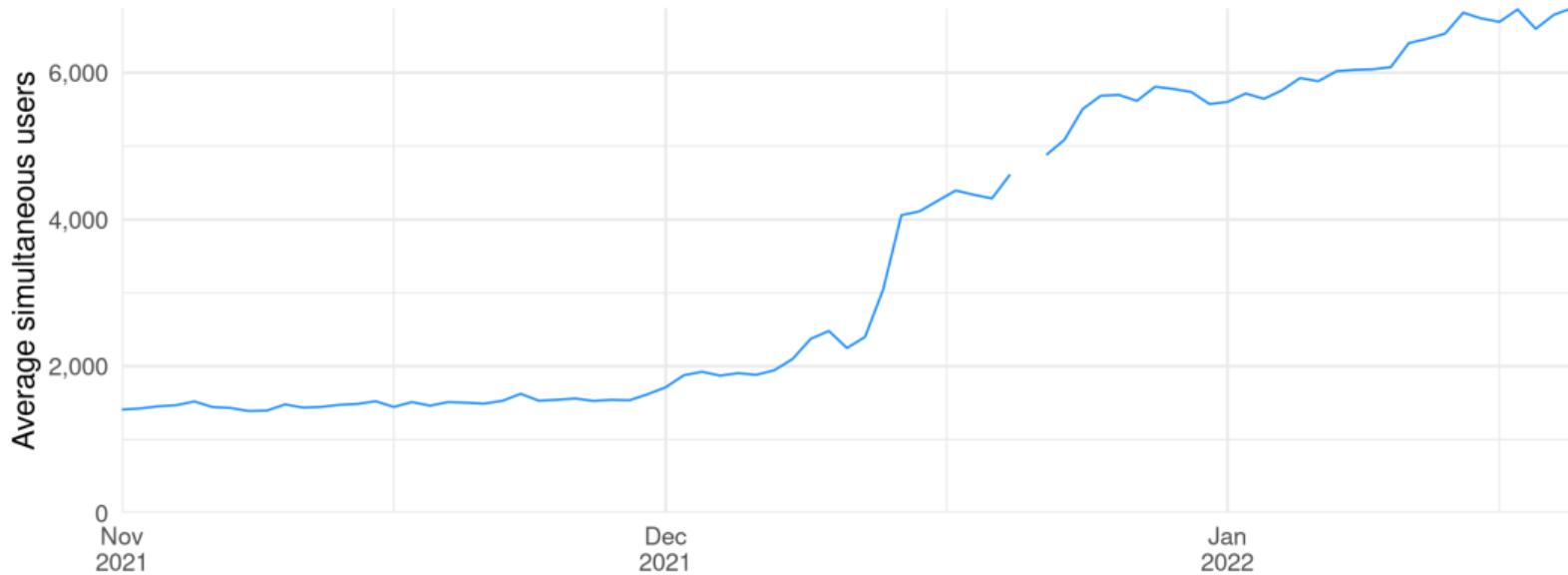
# Snowflake pluggable transport

Snowflake makes your traffic look like a WebRTC (zoom, jitsi, skype, signal, etc) call, and those are allowed in many parts of the world.

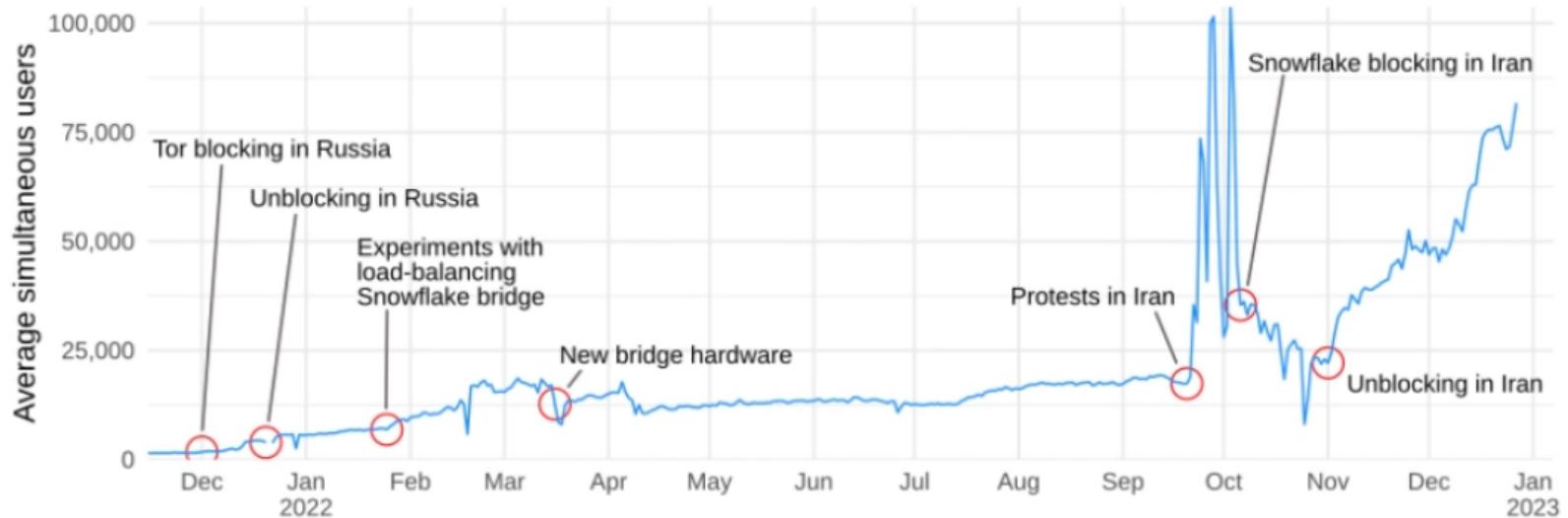
People can volunteer as Snowflake proxies simply by installing an extension in their browser.

The resulting volume and variety of volunteers gives us more options on how to distribute them to users.

# Daily snowflake users



## Daily Snowflake users in 2022



# Arms races

Censorship arms race is bad

Surveillance arms race is worse

...and centralization of the internet makes it worse still

# Censorship implies surveillance

Recurring theme where western companies build the oppression tools

Censorship becoming more widespread in the west  
(e.g. RT.com in europe)

europe's "chat control"

Iran's "halal internet" dreams, Russia's splinternet



# Canada's Supreme Court Denies TekSavvy's Site Blocking Appeal

March 29, 2022 by Ernesto Van der Sar

[HOME](#) > [ANTI-PIRACY](#) > [SITE BLOCKING](#) >

*The first pirate site blocking order in Canada remains in place. Internet provider TekSavvy petitioned the Supreme Court to hear the case but this request was denied. Copyright holders are pleased with the outcome, but Teksavvy fears that it will open the floodgates to more site blocking requests.*

In 2018, Canada's Federal Court approved the country's [first pirate site-blocking order](#).

Following a complaint from major media companies Rogers, Bell and TVA, the





Ola Bini declared innocent: "

Australia: Freedom on the Net

+



Our Issues

Perspectives

Policy Recommendations

Explore the Map

Donate



## FREEDOM ON THE NET 2023

## Australia

FREE

76  
/100

## A. Obstacles to Access

23 /25

## B. Limits on Content

28 /35

## C. Violations of User Rights

25 /40

LAST YEAR'S SCORE &amp; STATUS

76 /100 Free

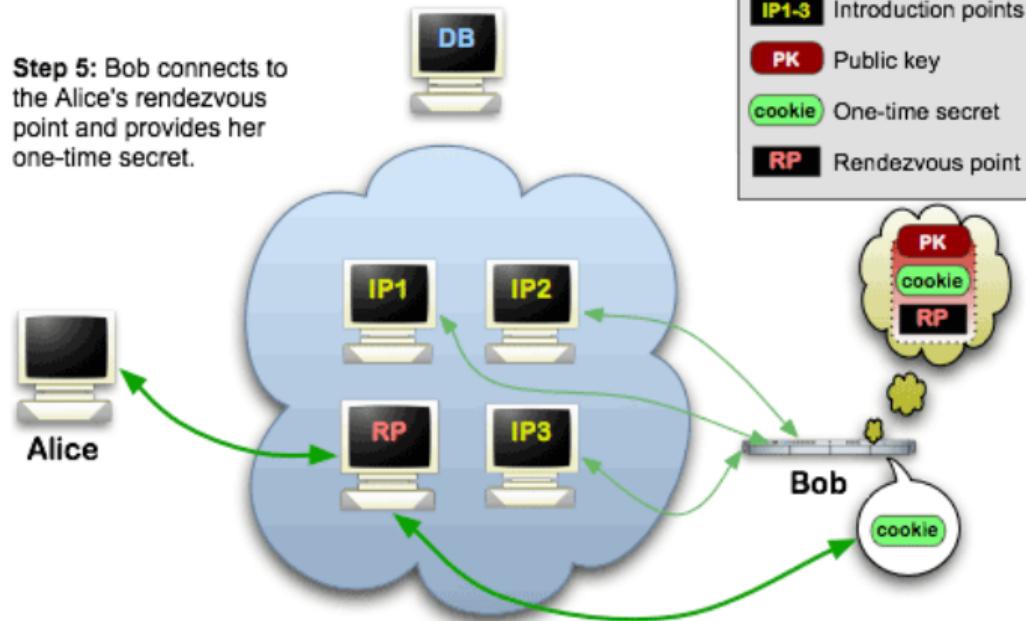
Scores are based on a scale of 0 (least free) to 100 (most free). See the





## Onion Services: Step 5

Step 5: Bob connects to the Alice's rendezvous point and provides her one-time secret.





BBC Home - Breaking News X

BBC Home - Breaking News X

BBC - Home

X +

<https://www.bbcweb3hytmzhn5d532owbu6oqadra5z3ar726vq5kgwwn6aucdccrad.onion>

BBC

[Home](#) [News](#) [Sport](#) [Business](#) [Innovation](#) [Culture](#) [Travel](#) [Earth](#) [Video](#) [Live](#)

**LIVE** Boeing whistleblower: Staff 'jumped like Tarzan' on jet parts to fit them

The engineer has said he wouldn't let his family fly on 787 planes because of safety concerns.

[NEWS](#)

## 50,000 Russian soldiers confirmed dead by BBC

Israel makes own  
Netanyahu tells

The UK foreign secre  
not to risk escalating  
East.

1 hr ago | NEWS UK

Biden treads dip  
on Israel-Iran

Iran's unprecedent  
Israel has changed th  
the region.

16 hrs ago | NEWS US &

Guns and gold se  
bullion heist prob

Alleged driver and g  
probe into C\$20m of g

# Onion service properties

- Self authenticated
- End-to-end encrypted
- Built-in NAT punching
- Limit surface area
- No need to “exit” from Tor

A photograph of a large iceberg floating in the ocean. The visible portion above the water's surface is labeled "World Wide Web". The submerged portion below the water's surface is labeled "Deep Web". A significant portion of the iceberg is hidden from view beneath the dark blue water, representing the "Dark Web".

**World Wide Web**

**Deep Web**

**Dark Web**



**CAMADAS DA  
INTERNET**

**SUPERFICIE DA WEB  
DEEP WEB  
DARKWEB**



**RANI PASSOS**  
INFORMÁTICA PARA CONCURSOS



# 1 Million People use Facebook over Tor

 FACEBOOK OVER TOR · FRIDAY, APRIL 22, 2016 

People who choose to communicate over Tor do so for a variety of reasons related to privacy, security and safety. As we've written previously it's important to us to provide methods for people to use our services securely - particularly if they lack reliable methods to do so.

BBC Blogs - Technology & Creativity Blog - Leveraging the Tor Network to circumvent blocking of BBC News content - Tor Browser

BBC Blogs - Technology & +

https://www.bbc.co.uk/blogs/internet/entries/936e460a-03b3-41db-be96-a6f2f27934e6

BBC Sign in News Sport Reel Worklife Travel Future More Search

# Technology + Creativity Blog

Previous Home Next

## Leveraging the Tor Network to circumvent blocking of BBC News content

Wednesday 30 October 2019, 8:18



**Abdallah al-Salmi**  
Strategy Analyst, BBC News

Tagged with: BBC News, BBC World Service, Media Distribution, Public Service

COMMENTS

The BBC World Service's news content became available on the Tor Network last week in a move that attracted wide media attention.

The decision to go ahead with setting this service up came at a time when BBC News is either blocked or restricted in several parts of the world.

For example, in Egypt, Iran and China, our audiences are finding it either impossible or difficult to access our content without the use of a circumvention tool, such as a VPN.

The Tor Network is an overlay network on the internet, which provides increased security and is resistant to blocking.

### About this Blog



Staff from the BBC's online and technology teams talk about BBC Online, BBC iPlayer, BBC Red Button and the BBC's digital services. The blog is reactively moderated. Your host is Jonathan Murphy.

Follow [Technology & Creativity Blog](#) on Twitter

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Speed & Reliability

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Developers

Deep Dive

Life @Cloudflare



# Introducing the Cloudflare Onion Service

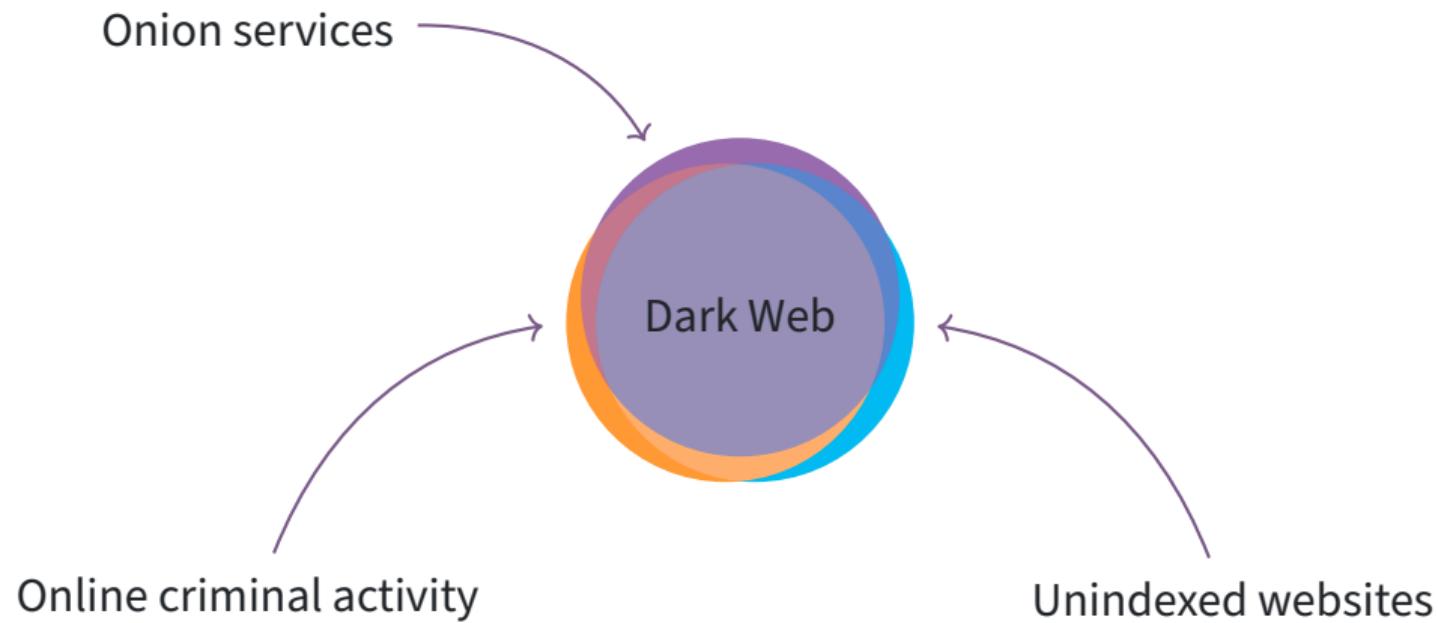
[Tweet](#)



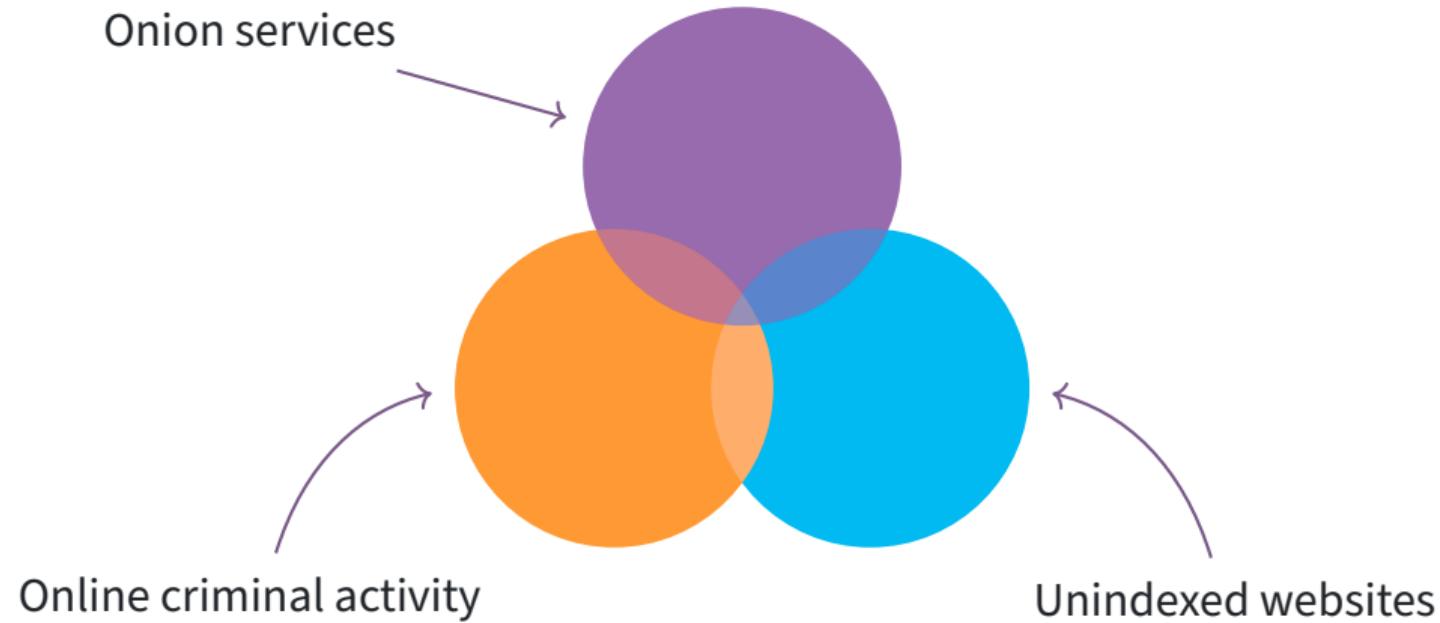
Mahrud Sayrafi

September 20, 2018 12:00PM

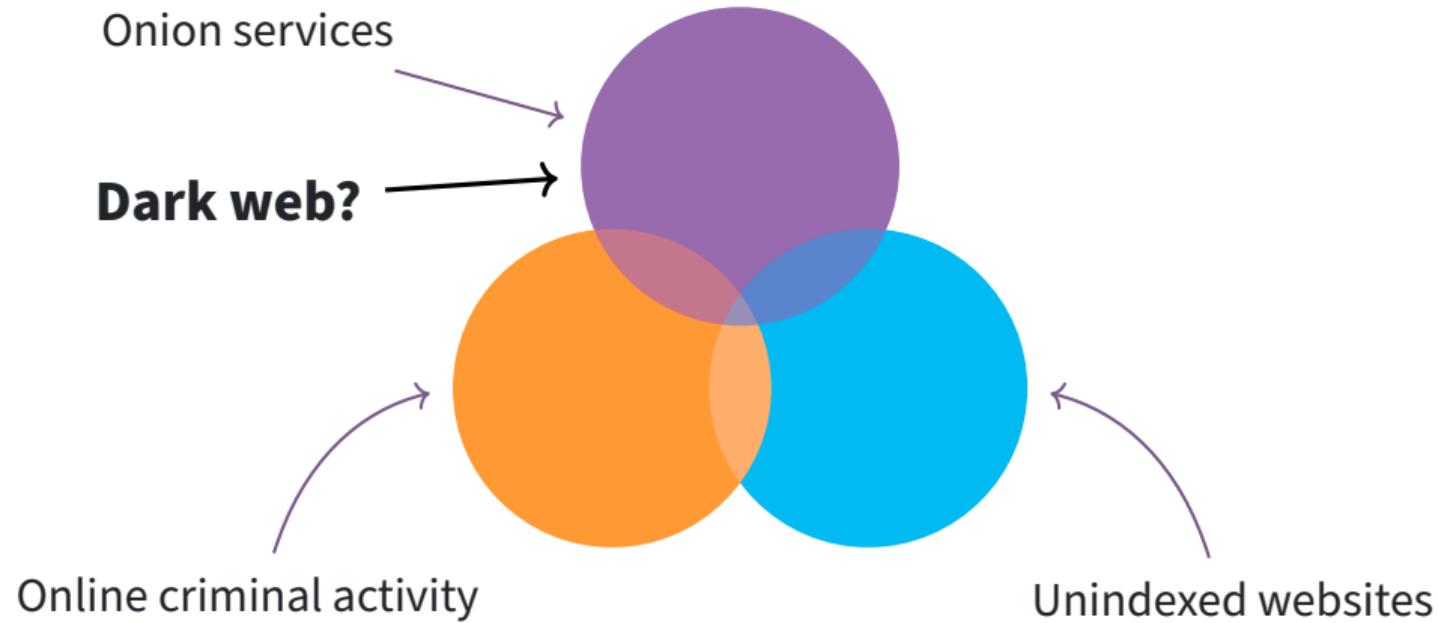




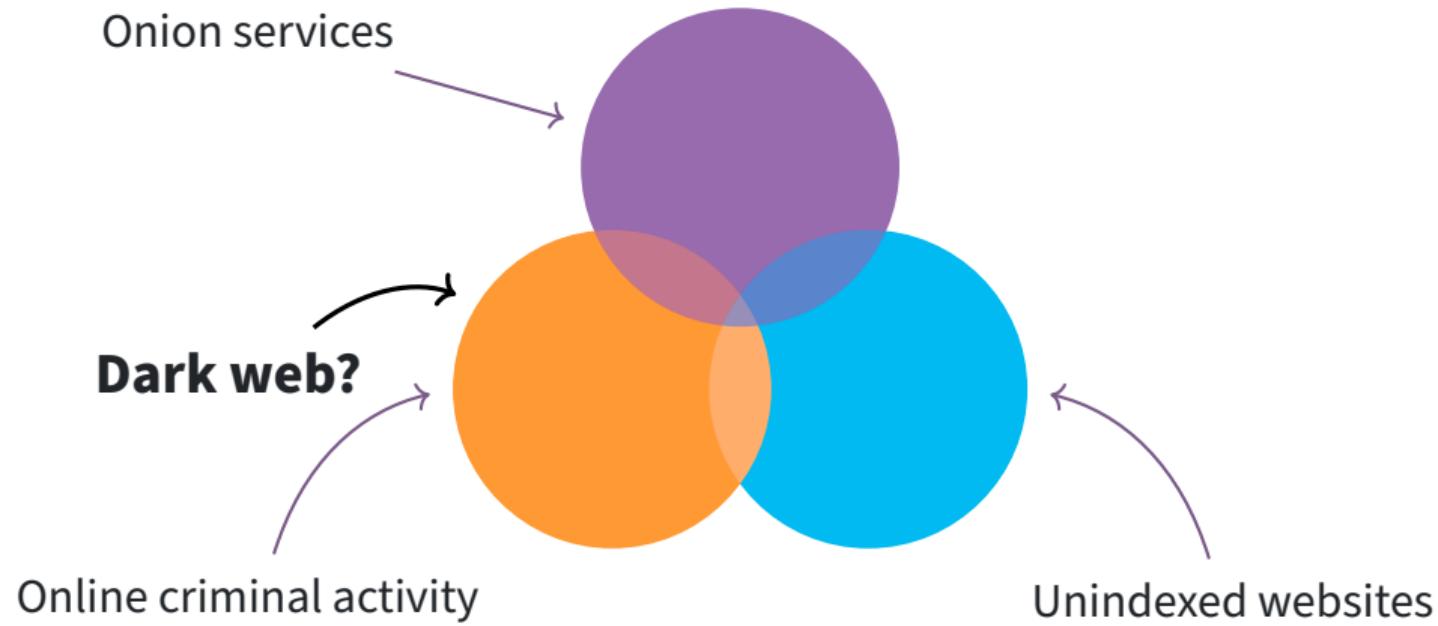
The "Dark Web" as popularly depicted



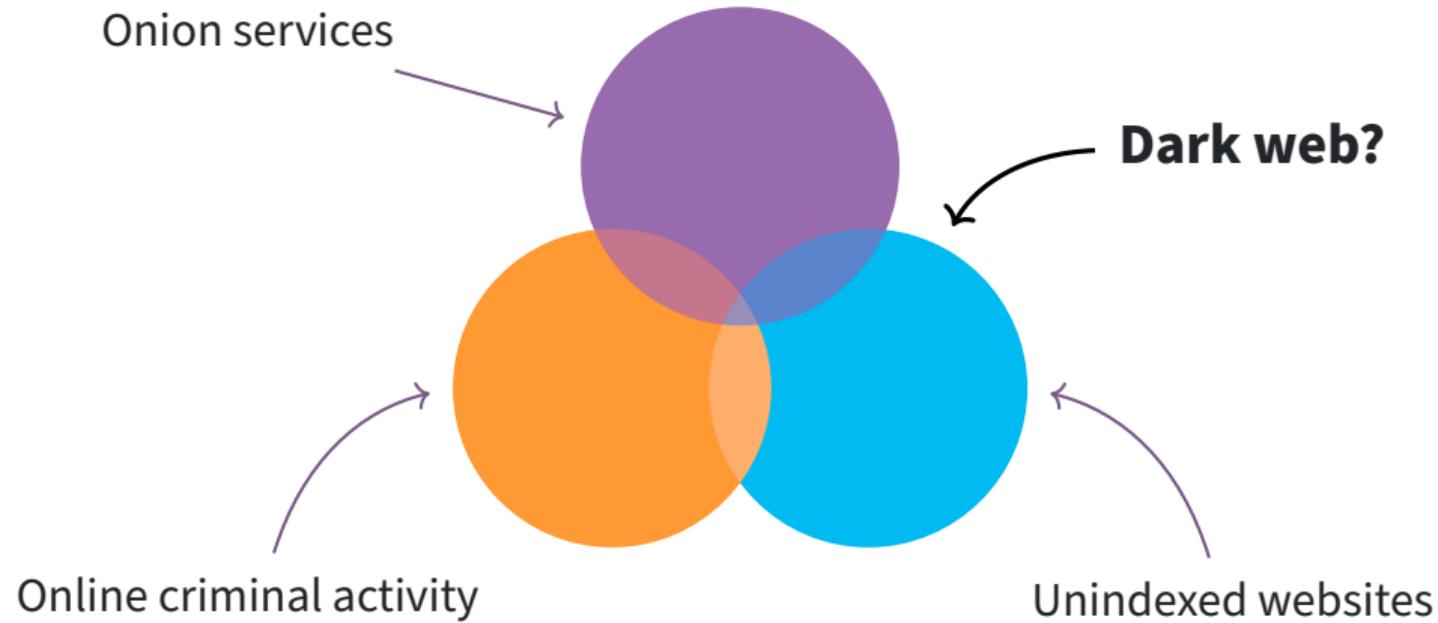
Closer to reality



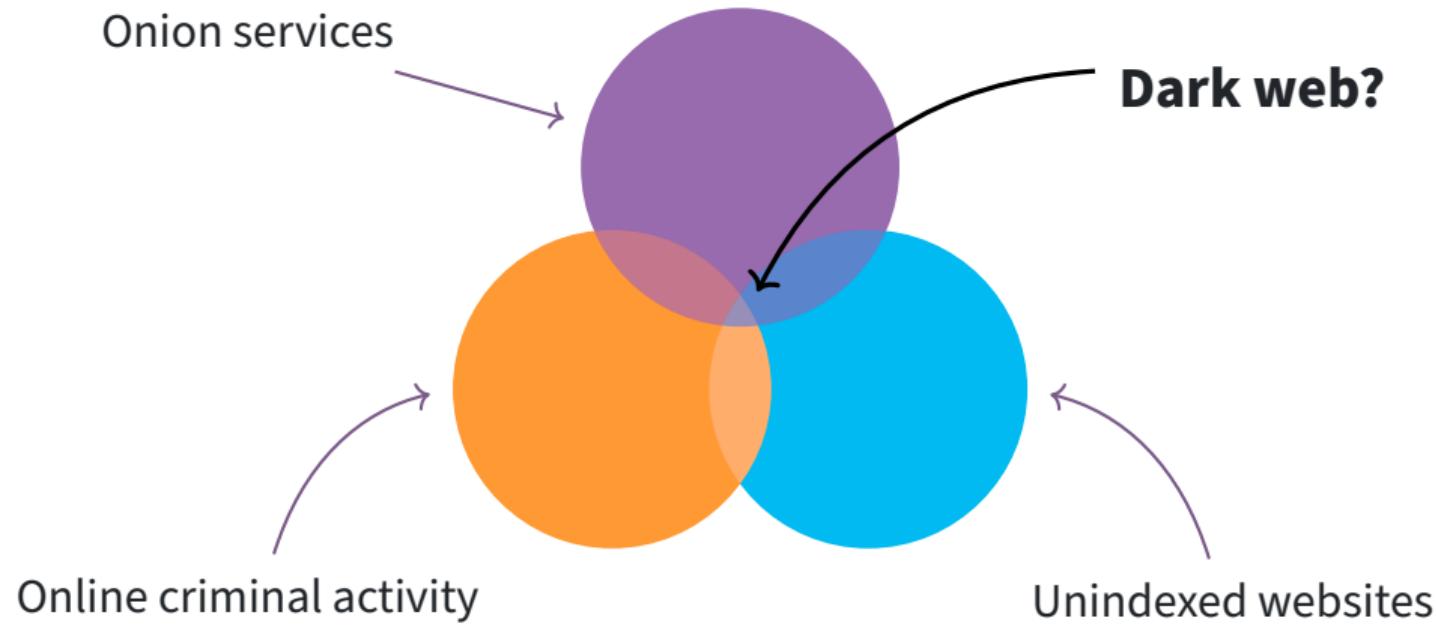
Closer to reality



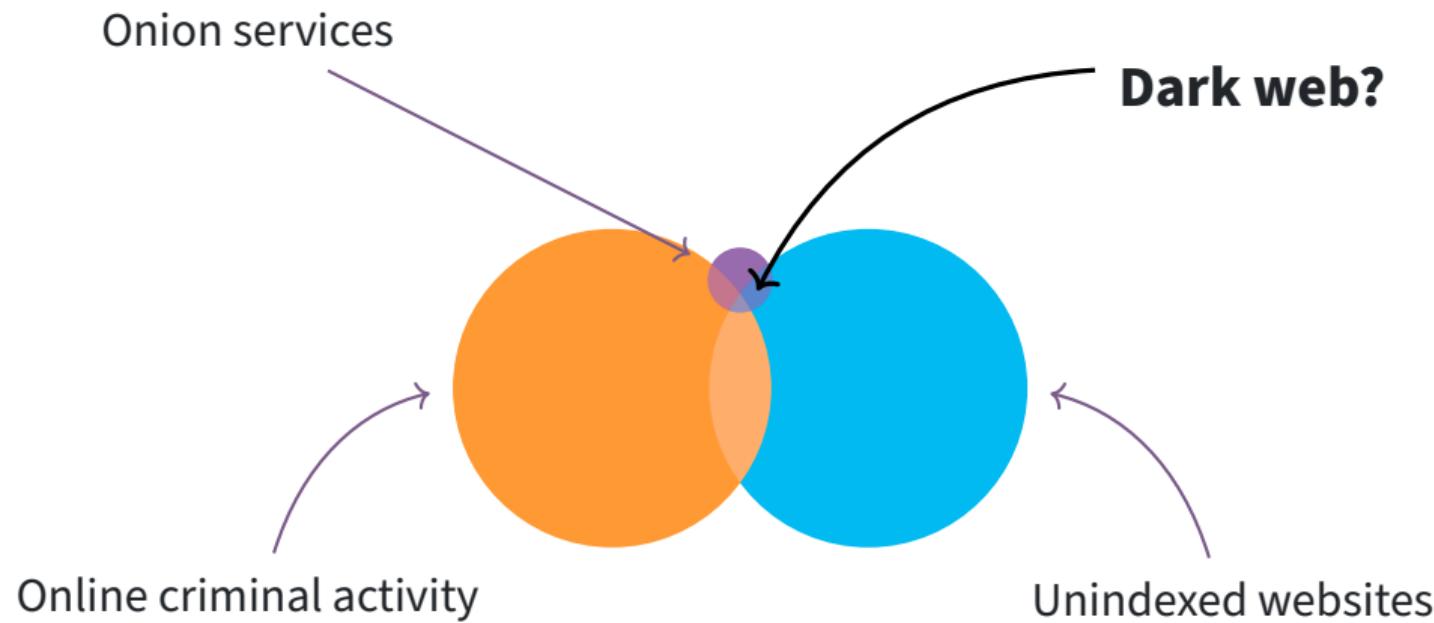
Closer to reality



Closer to reality



Closer to reality



Scale also matters



Share



21 files, 992.8 KiB



	2009-11-06_SIDToday_-_Innovative_Super_Sized_SIGINT_Facility_Openes_in_Afghanistan.pdf	47.8 KiB
	2011-04-12_SIDToday_-_New_Policy_for_the_Coalition_in_Afghanistan_Is_Signed.pdf	32.7 KiB
	2011-09-20_SIDToday_-_Its_OK_to_Have_a_Personality_Most_of_the_Time.pdf	45.7 KiB
	2012-04-09_SIDToday_-_The_Chisel_and_the_Vision.pdf	46.1 KiB

Stop Sharing (3d, 4m, 25s)

**Anyone** with this OnionShare address and private key can **download** your files using the **Tor Browser**: ⓘ

First, send the OnionShare address below:

`http://plfdow6ib364q3dc3cizg7eyw3gx3cprqqqnzhvqixwlxxjpxc3kheyd.onion`

Next, send the private key to allow access to your OnionShare service:

`*****`

# Ricochet



# Tor isn't foolproof

- Opsec mistakes
- Browser metadata fingerprints
- Browser exploits
- Traffic analysis



## I WANT TO RUN A RELAY

YOU'LL NEED TO DO THE FOLLOWING

1

CHOOSE A RELAY

2

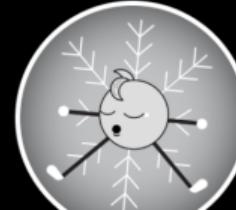
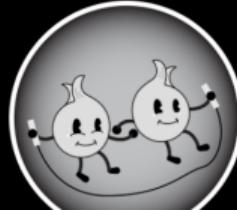
FIND ALLIES

3

GET A PRIZE

1

### CHOOSE YOUR RELAY



*That's all folks!*

# Calls to action

Understand the risks of centralized architectures

Participate in privacy / censorship research:

<https://petsymposium.org/>

<https://foci.community/>

Volunteer as a relay, a bridge, or a snowflake!