

An Introduction to the Tor Ecosystem for Developers

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FOSDEM



About Me

- Core Developer at The Tor Project since early 2017.
- Free Software developer since 2006.
- Worked with distributed systems in the Erlang programming language, WebKit-based mobile web browsers, consulting, and firmware development.
- Co-organizing the annual Danish hacker festival **BornHack**.



What is Tor?

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

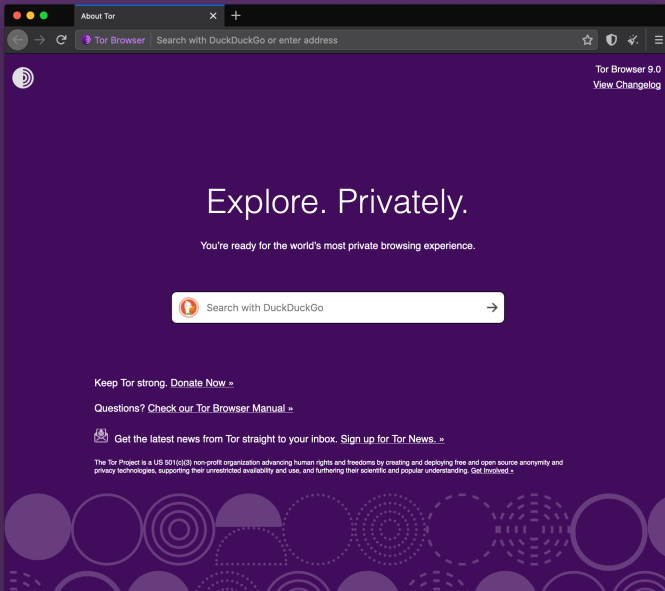


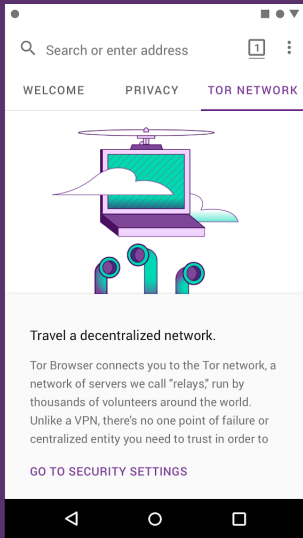
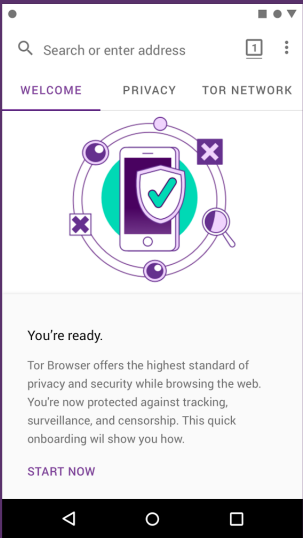
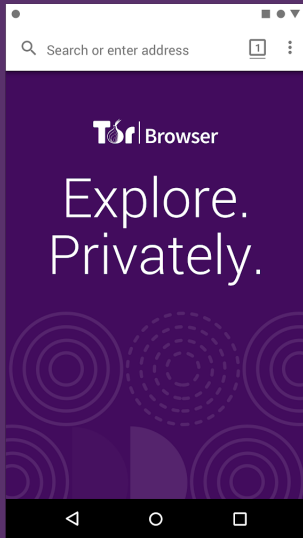
History

Early 2000s	Working with the U.S. Naval Research Laboratory.
2004	Sponsorship by the Electronic Frontier Foundation.
2006	The Tor Project, Inc. became a non-profit.
2008	Tor Browser development.
2010	The Arab spring.
2013	The summer of Snowden.
2018	Anti-censorship team created.
2019	Tor Browser for Android released.
2020	Network Health team created.

Somewhere between 2,000,000 and 8,000,000 daily users.



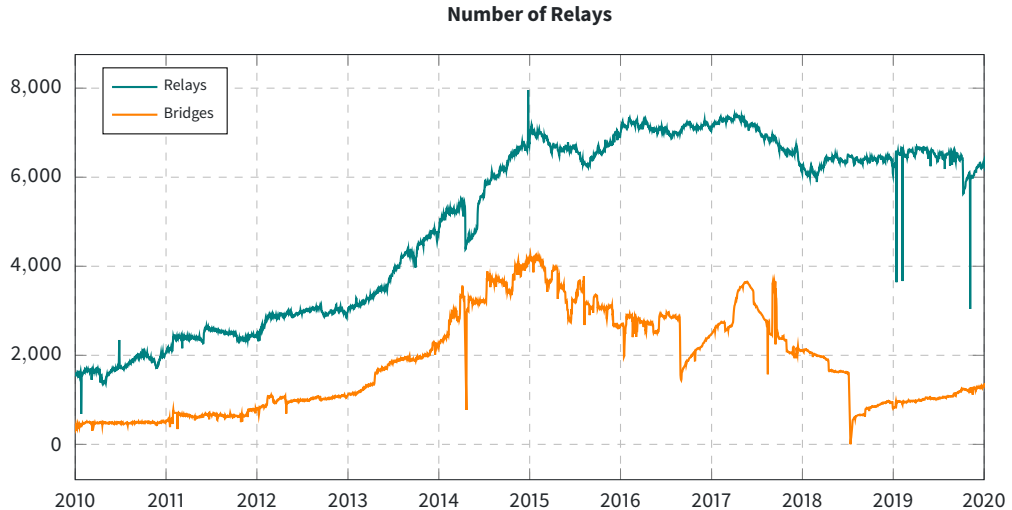




But we also ship Tor to others:

- We have our own Debian mirror on deb.torproject.org.
- Other free software distributions. This is often where the relay operators get their Tor version from.
- Brave's "Private Tab" feature uses Tor.
- OnionShare, SecureDrop, etc.

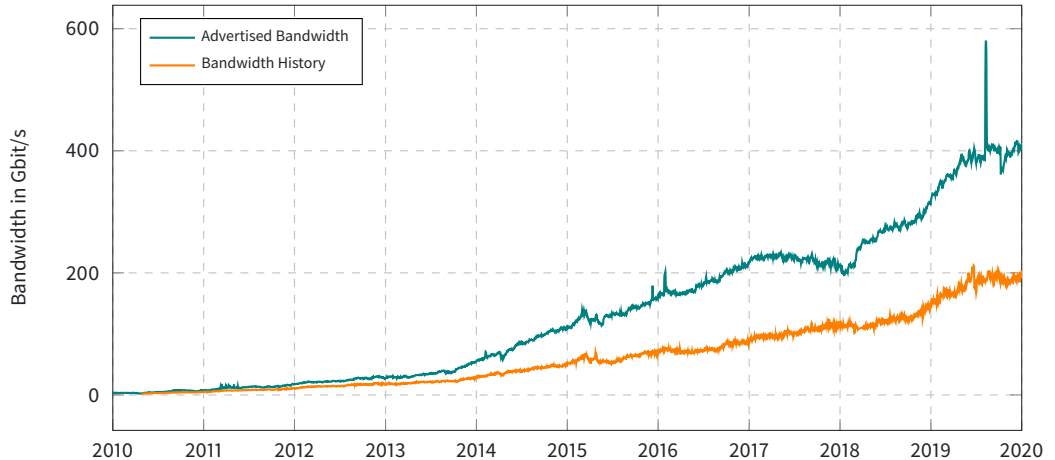
The Tor Network



Source: metrics.torproject.org

The Tor Network

Total Relay Bandwidth



Source: metrics.torproject.org

The Tor Network

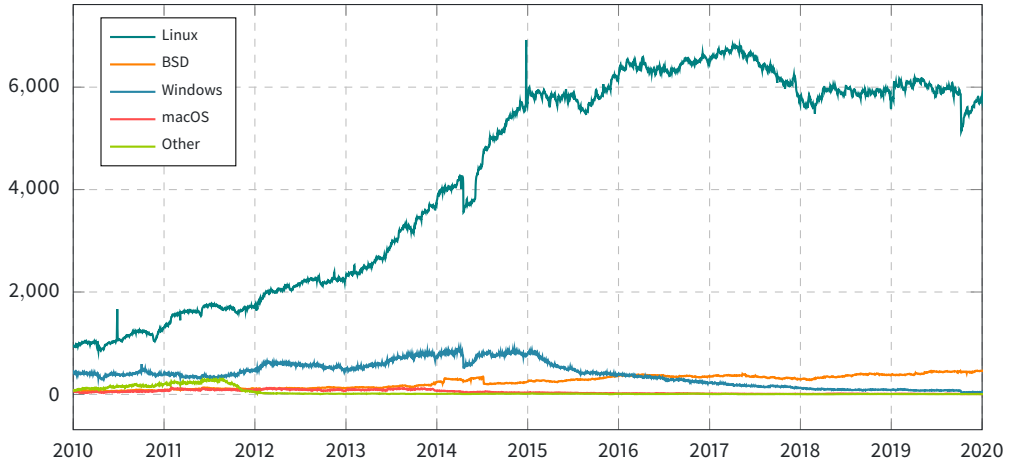
Tor's **safety** comes from **diversity**:

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.
2. Diversity of users and reasons to use it. 50,000 users in Iran means almost all of them are normal citizens.

Research problem: How do we measure diversity over time?

The Tor Network

Number of Relays per Platform



Source: metrics.torproject.org



<https://trac.torproject.org/>



Network Team

The team dedicated to develop and maintain the “Tor” codebase.
Internally, we often refer to “Tor” as “little-t-tor”.
Deal with everything that “impacts the network”.

Network Team

- The reference Tor implementation is written in C.
- Ongoing experiments with Mozilla's Rust programming language.
- Follow best practices: high coverage for tests, integration tests, coverity, static code analysis, and code review policies.
- The team is responsible for: feature development, code reviews, auditing, working with downstream projects (Tor Browser and distro packagers), and specification design and implementation.

A round of applause to the Tor project

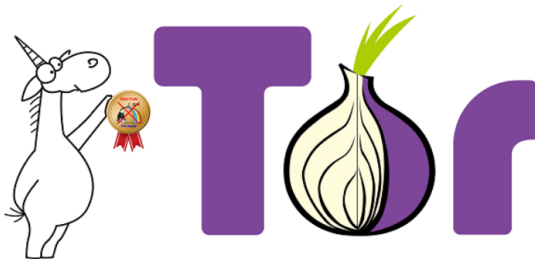


Andrey Karpov

Articles: 368

© May 12, 2017

My congratulations to the authors of the Tor project. I didn't manage to find any errors after the analysis by PVS-Studio static code analyzer. We write such words very rarely, so the authors may really be proud. They do deserve a medal for the high-quality code.



Tor Releases

Version	Merge Window	Feature Freeze	Release	End of Life
0.3.5 (LTS)	15/6/2018	15/9/2018	7/1/2019	1/2/2022
0.4.0	15/10/2018	15/1/2019	2/5/2019	2/2/2020
0.4.1	15/2/2018	15/5/2019	20/8/2019	20/5/2020
0.4.2	10/6/2019	15/9/2019	9/12/2019	15/9/2022
0.4.3	11/10/2019	15/1/2020	15/4/2019	TBD
0.4.4	15/2/2020	15/5/2020	15/8/2020	TBD
0.4.5	15/6/2020	15/9/2020	15/12/2020	TBD

Contributing to Tor

1. Find a ticket on <https://trac.torproject.org/> that you are interested in hacking on.
2. Hack on it until you think it's time to share your work.
3. Ensure that tests and various other code requirements are satisfied using `make check`.
4. Write a "changes" file.
5. Open a PR on <https://github.com/torproject/tor> and await review.

Contributing to Tor

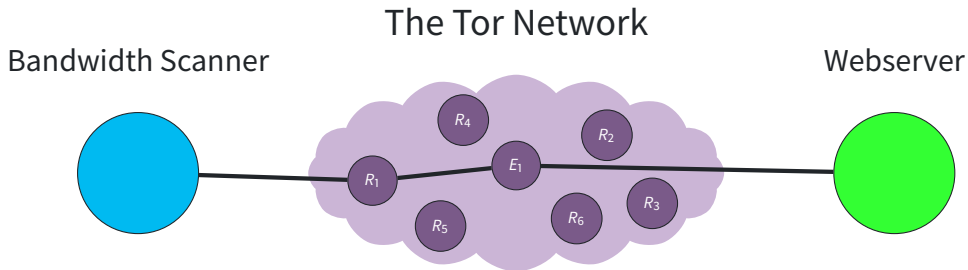
- For “upfront CI” we use a mixture of Travis and AppVeyor. This covers (some of) Linux, macOS, and Windows.
- Once a patch lands, we have a setup of Jenkins builder too.
- Check whether “changes” file is included, whether functions become overly complex, etc.

Contributing to Tor

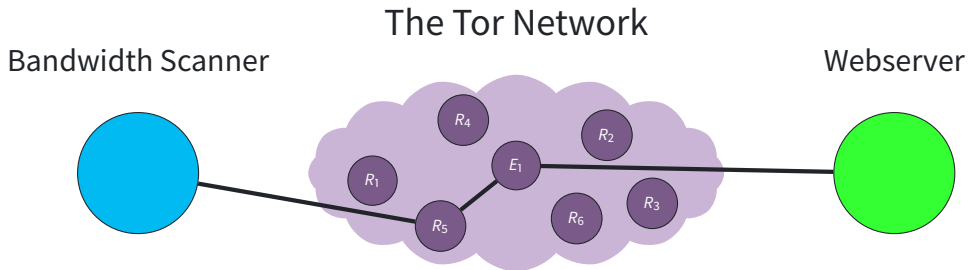
Protocol changes require a specification proposal and discussion before implementation.

Specifications can be found at gitweb.torproject.org/torspec.

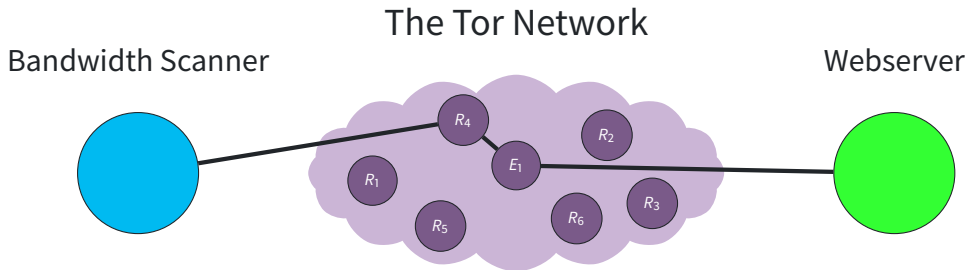
Bandwidth Scanning



Bandwidth Scanning



Bandwidth Scanning



Simple Bandwidth Scanner

- Bandwidth Scanner implemented in the Python programming language.
- Well-documented internals.
- Used by 3 out of 6 of the Directory Authorities that use input from Bandwidth Scanners.
- Could benefit from more contributors :-)
- Written by juga0, Matt Traudt, and teor.

<https://sbws.readthedocs.io/>

Anti-censorship Team

- New team created in early 2019 to handle all anti-censorship work that was previously handled by the network team.
- Develops and maintains the Pluggable Transports that are shipped with in Tor Browser.
- Focus on Snowflake, BridgeDB, and Gettor.

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 النفاذ 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!

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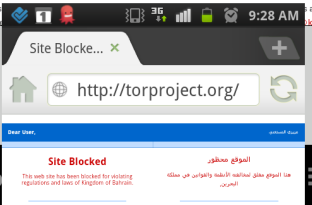
Access Denied

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

عزيزي العميل : تم حجب هذا الموقع بناء على القوائم والقوانين

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

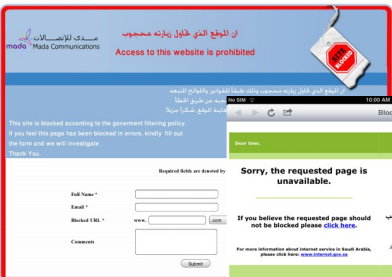
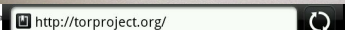


If you believe the requested page should not be blocked please [click here](#).

الموقع محظور

هذا الموقع محظور لاشتماله الأنظمة والقوانين في مملكة البحرين.

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



عفواً، للوفع المطلوب غير متاح.

إن كنت ترى أن هذه الصفحة ينبغي أن لا تحجب [تفضل بالضغط هنا](#).

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

Sorry, the requested page is unavailable.

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

For more information about Internet service in Saudi Arabia, please click here: www.internet.gov.sa

Pluggable Transports

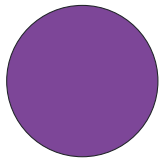
Censored Region

Alice



PT Client

Bridge Relay



PT Server

Obfuscated Protocol



Step 1 Download [Tor Browser](#)

Step 2 Get [bridges](#)

Step 3 Now [add the bridges to Tor Browser](#)

What are bridges?

[Bridges](#) are Tor relays that help you circumvent censorship.

I need an alternative way of getting bridges!

Another way to get bridges is to send an email to bridges@torproject.org. Please note that you must send the email using an address from one of the following email providers: [Riseup](#) or [Gmail](#).

Source: bridges.torproject.org

BridgeDB access via Moat

☒ Tor is censored in my country

☐ Select a built-in bridge ?

☒ Request a bridge from torproject.org

☐ Provide a bridge I know

☐ I use a proxy to connect to the Internet ?

☐ This computer goes through a firewall that only allows connections to certain ports

Solve the CAPTCHA to request a bridge.





Snowflake

Censored Region

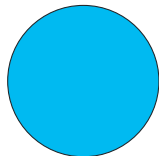
Alice



Snowflake PT Client

Snowflake Broker

Bridge



Snowflake PT Server



Snowflake

Censored Region

Alice

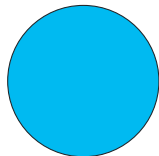


Snowflake PT Client

Snowflake Broker

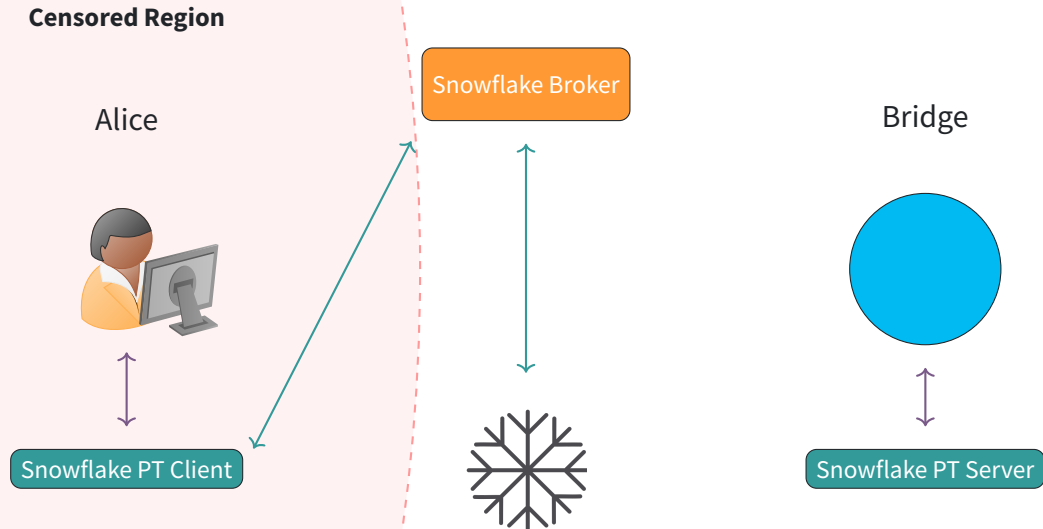


Bridge



Snowflake PT Server

Snowflake



Snowflake

Censored Region

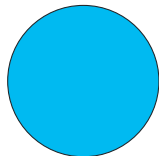
Alice



Snowflake PT Client

Snowflake Broker

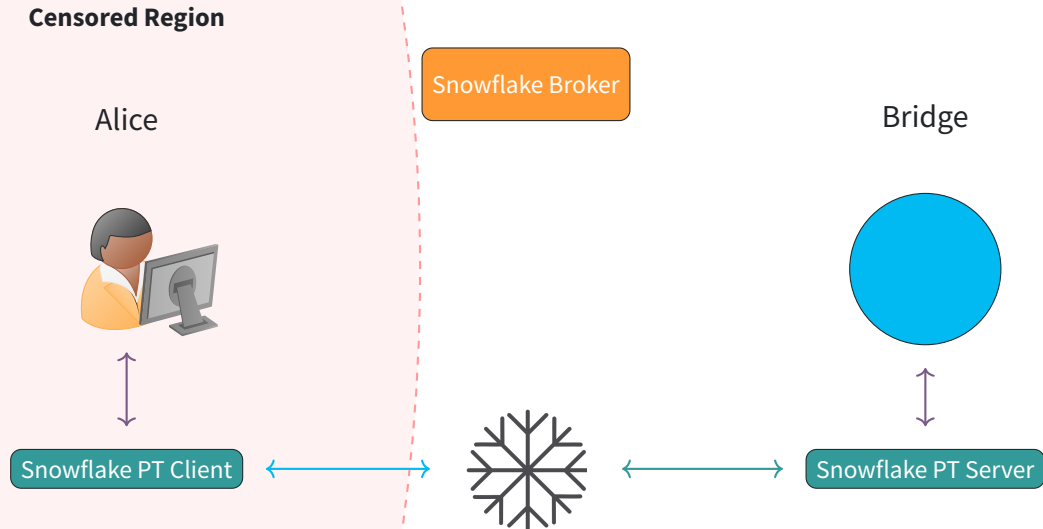
Bridge



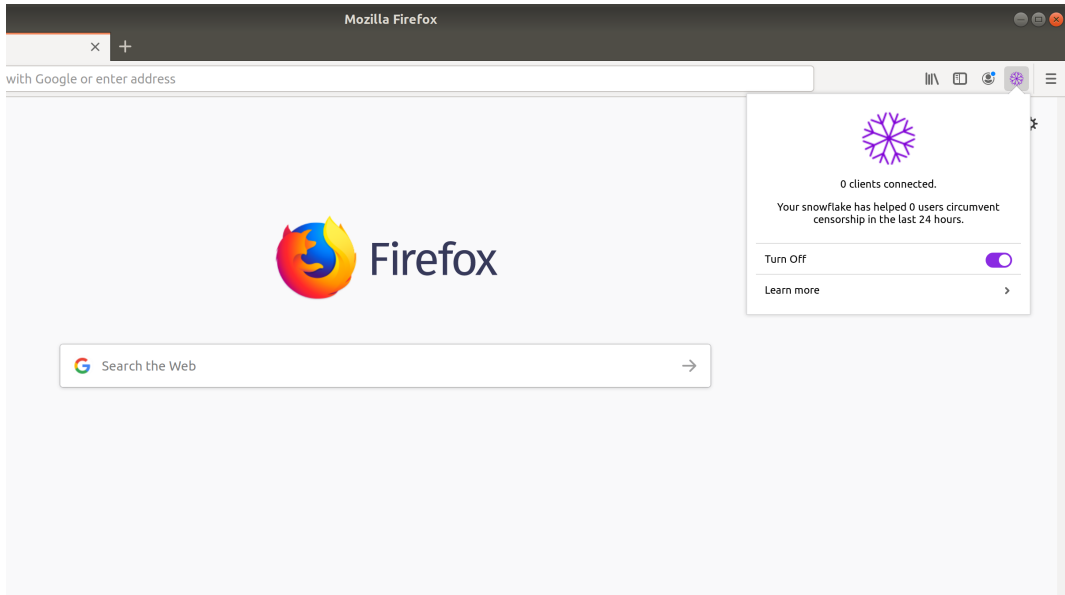
Snowflake PT Server



Snowflake



Snowflake



Snowflake

- The Client and Broker component written in Google's Go programming language.
- Proxy WebExtension written in JavaScript.
- Go version exists of the Proxy for more static deployments.

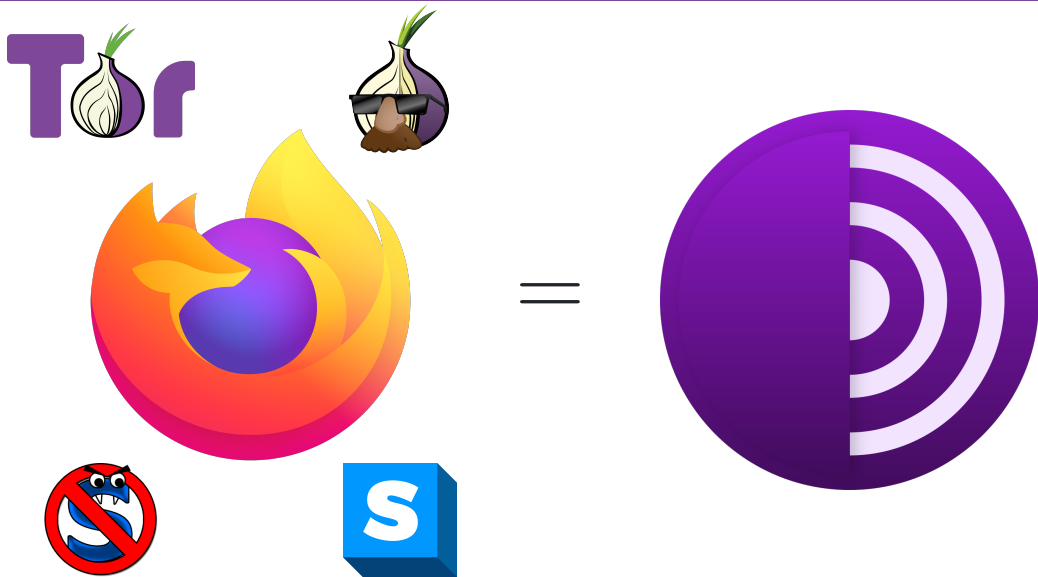
<https://snowflake.torproject.org/>

Applications Team

The team responsible for the user-facing applications such as Tor Browser.

Works closely with the UX team on analysing and improving the user experience of our products.

Tor Browser



Tor Browser

Anti-Censorship Team

- FTE.
- Meek.
- Obfs 3 and 4.
- Scramblesuit.

Applications Team

- Tor Launcher.
- Tor Button.

Network Team

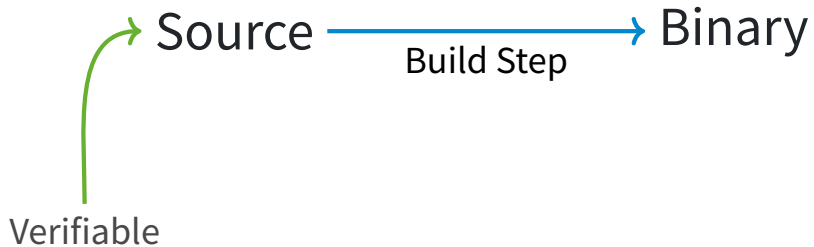
- Tor ("little-t-tor")



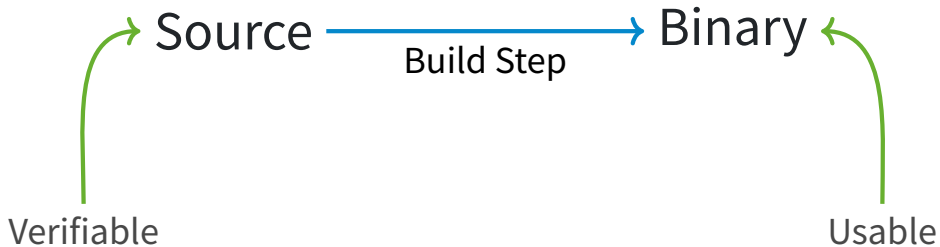
Reproducible Builds



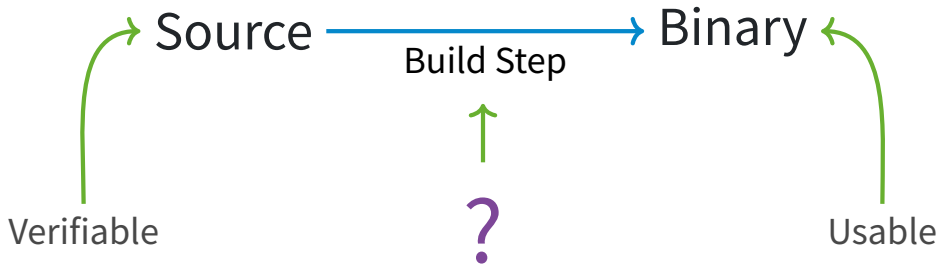
Reproducible Builds



Reproducible Builds



Reproducible Builds



Other Projects

Unfortunately, we don't have time to go over everything we do in the Tor Project in this talk. We also have teams doing amazing work in areas such as:

- Infrastructure.
- UX.
- Handling metrics in a safe manner.
- And much more!

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.
- Donate at donate.torproject.org



Questions?



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