MassBrowser: Fighting Internet Censorship in a Mass!

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Introduction and Motivation

- Internet censorship is a global threat to Internet freedom.
- Existing censorship circumvention systems suffer from the following weaknesses:
  - **Easily Blocked**: The majority of circumvention systems are proxy-based. The proxies are easily blacklisted by the censors.
  - **High Cost of Operation**: To evade IP blacklisting, some circumvention systems host their proxies on "domain fronted" services (like CDNs). This is however prohibitively expensive at scale.
  - **Poor QoS**: Some academic circumvention systems offer impractically poor QoS.
  - **Hard to Deploy**: Several suggestion circumvention systems are hard to deploy as they require cooperation from oblivious technology third-parties like ISPs and content publishers.

  The Table below demonstrates such weaknesses for major classes of circumvention systems.

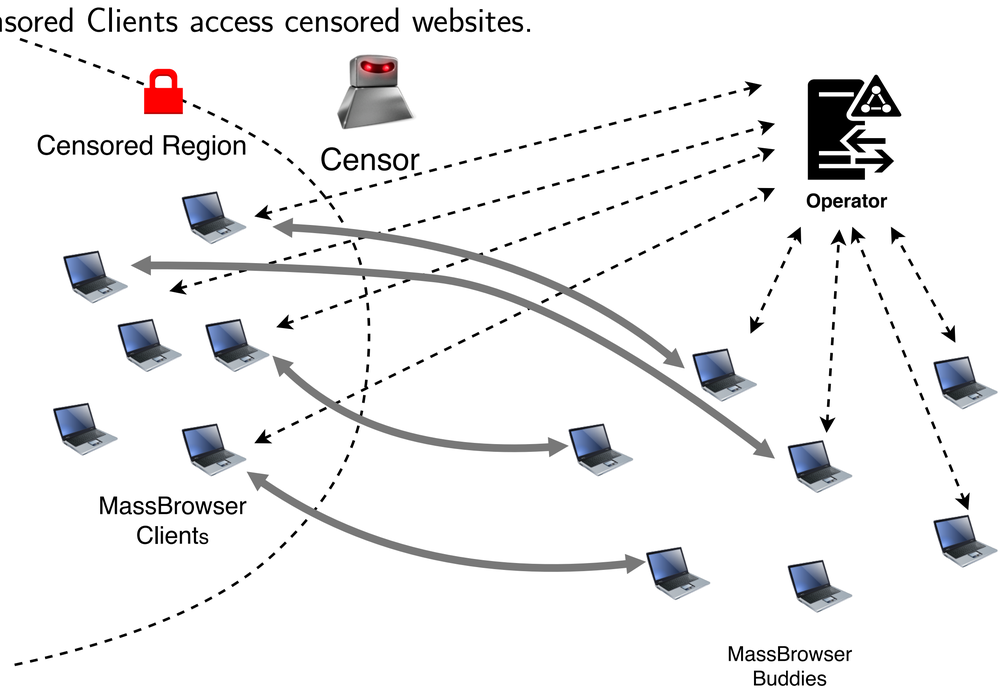
Table: Weaknesses of major types of circumvention systems

Category	Easily blocked	Costly	Poor QoS	Deployability
Proxy-Based	●	◐	●	○
Domain Fronting	○	●	○	○
CacheBrowsing	○	○	●	○
Tunneling	○	◐	●	◐
Decoy Routing	○	◐	○	●

- Our Goal: Design and deploy a censorship circumvention system that provides strong blocking resilience while offering a practical balance between QoS and cost of operation.

Design Principles

- MassBrowser's design is based on the following principle:
  - The **Separation of Properties (SoP) Principle**: the key feature targeted by an effective circumvention system should be blocking resistance, and other features such as anonymity and browsing privacy should be left as optional to the users.
- The SoP principle allows us to optimize MassBrowser's performance around blocking resilience than additional privacy properties like anonymity.
  - In-the-wild observations show that the majority of ordinary censored users do not care about such additional features.
  - Users who care about such additional features can obtain them by cascading MassBrowser with a system like Tor.
- **Key Architecture:** MassBrowser is a volunteer-run proxy-based circumvention system. As shown in the figure below, volunteer proxies, called Buddies, help censored Clients access censored websites.



- We deploy various mechanisms to encourage wide adoption by volunteers. Importantly, Buddies have full control and transparency over what they proxy.

Acknowledgements

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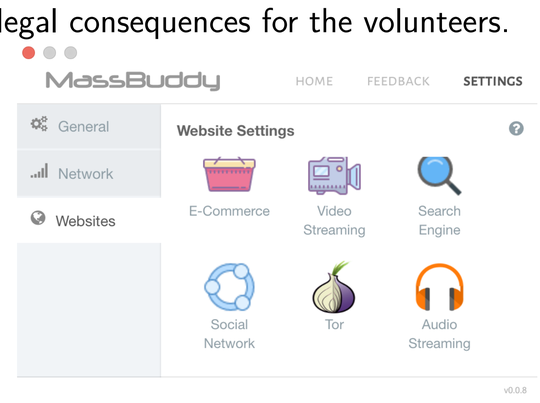
The Key Techniques Used

MassBrowser uses the following techniques to achieve core circumvention requirements.

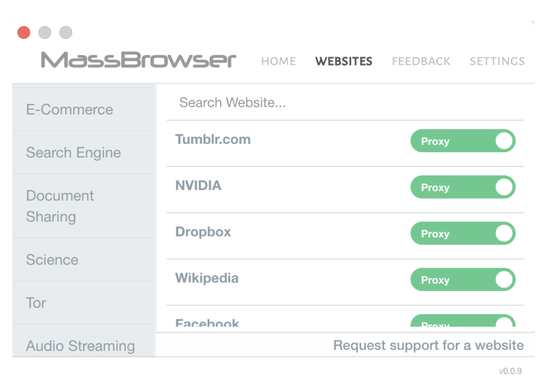
- **Blocking Resistance**:
  - **Shared and dynamic IPs**: MassBrowser proxies are run by normal Internet users who connect from shared and dynamic IP addresses (i.e., NATed IPs). Therefore, blocking them is costly and prone to collateral damage.
  - **Traffic obfuscation and encryption**: MassBrowser communications are encrypted to prevent deep-packet inspection. Also, MassBrowser uses traffic obfuscation to prevent fingerprinting.
  - **Domain fronting**: The central component of MassBrowser (called the operator) is hosted as a domain fronted service to resist blocking.
- **Optimizing Cost and QoS**:
  - **Censored-content only proxying**: Tunneling non-censored content puts additional burden on the proxies.
  - **CacheBrowsing**: MassBrowser clients directly fetch censored CDN browseable contents, not through proxies.
  - **Strategic proxy assignment**: To prevent Sybil attack and load balancing, MassBrowser's operator uses a strategic proxy assignment algorithm.
  - **Buddy software operates transparently**: The MassBuddy software does not interfere with the volunteers' normal activities.
  - **MassBuddies can set bandwidth limits**: Volunteers can specify the bandwidth the devote to MassBrowser.
  - **MassBuddies can whitelist destinations**: Volunteers can specify what type of destinations they are willing to proxy traffic to.
- **Deployment**:MassBrowser has recently been released in beta version to limited number of users. We have built user-friendly GUI software for both MassClients and MassBuddies for the major operating systems.

MassBrowser's GUI Software

- We have build user-friendly GUI software for clients and volunteers.
  - As shown below, a volunteer has full control and transparency over what she proxies for censored clients. This is to encourage wide voluntary participation by minimizing the legal consequences for the volunteers.



  - As shown below, a client can decide what websites and services are proxied through MassBrowser. For instance, a client can tunnel Tor traffic through MassBrowser.



We need your help!

- Help us fight censorship by becoming a Buddy!
- Contribute to our open source **code** https://github.com/SPIN-UMass/MassBrowser
- **Website**: `http://massbrowser.cs.umass.edu/`
- Email your **feedback** to `massbrowser@cs.umass.edu`

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