



Roger Dingledine

# What is Tor?

Online anonymity 1) open source software,  
2) network, 3) protocol

Community of researchers, developers,  
users, and relay operators

Funding from US DoD, Electronic Frontier  
Foundation, Voice of America, Google,  
NLnet, Human Rights Watch, NSF, US  
State Dept, SIDA, Knight Foundation, ...

# The Tor Project, Inc.

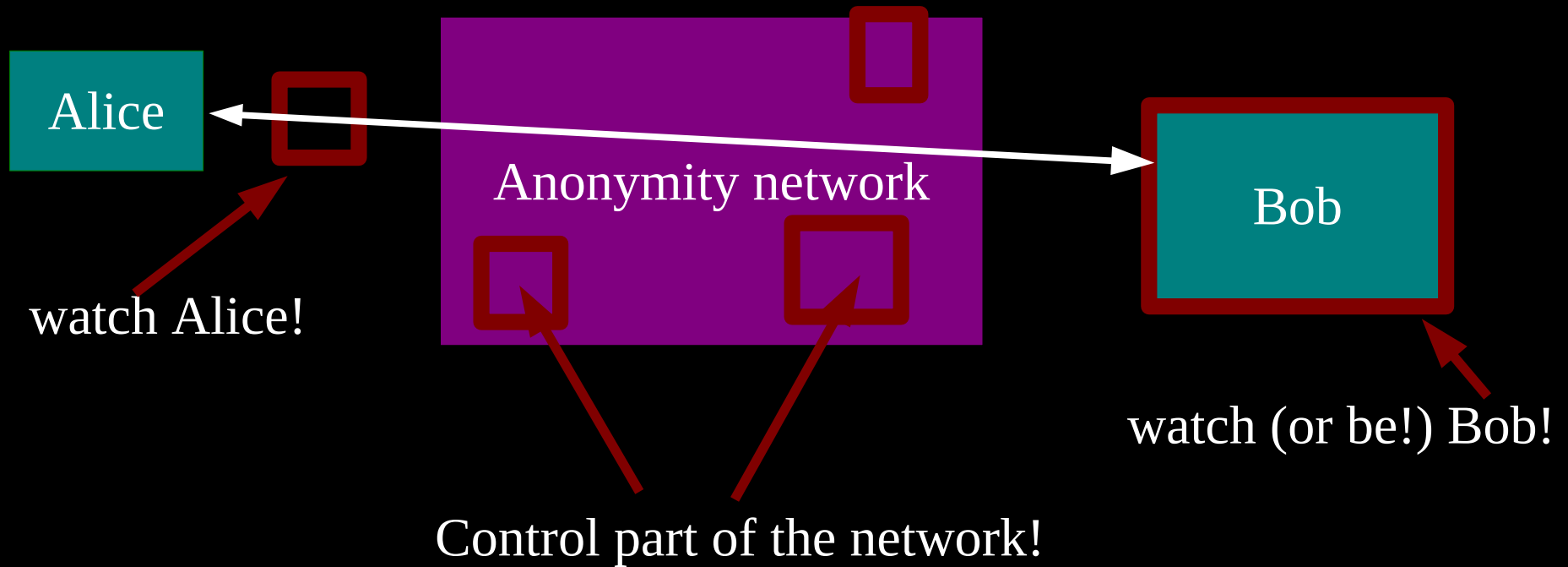


U.S. 501(c)(3) non-profit organization dedicated to the research and development of tools for online anonymity and privacy

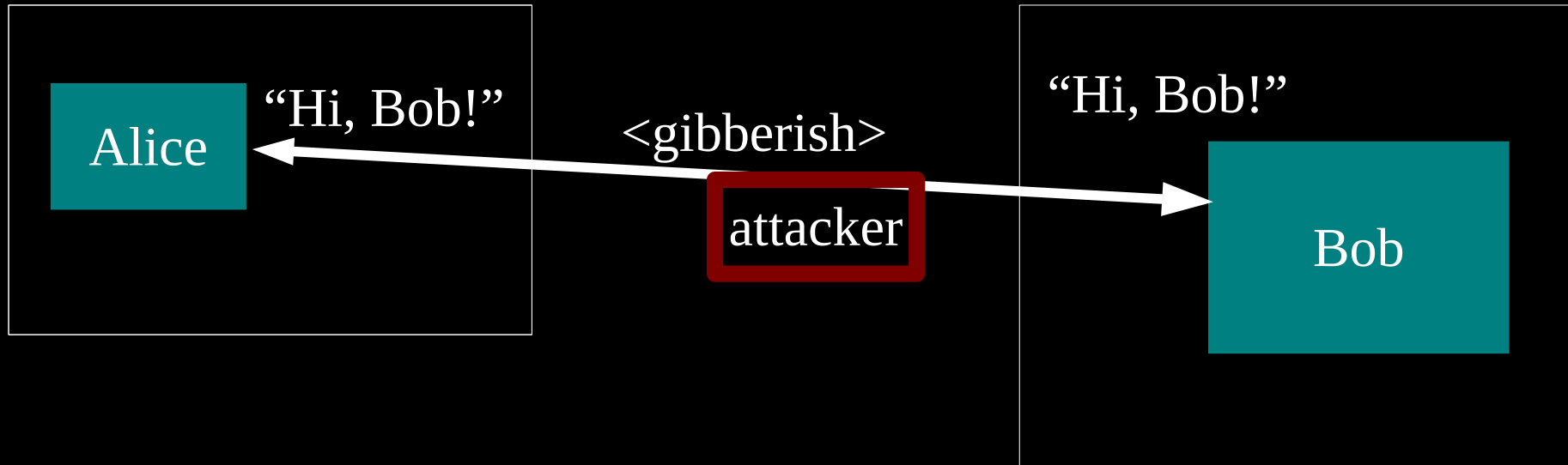


Estimated ~500,000?  
daily Tor users

# Threat model: what can the attacker do?



# Anonymity isn't encryption: Encryption just protects contents.



# **Anonymity isn't just wishful thinking...**

“You can't prove it was me!”

“Promise you won't look!”

“Promise you won't remember!”

“Promise you won't tell!”

“I didn't write my name on it!”

“Isn't the Internet already anonymous?”

# **Anonymity serves different interests for different user groups.**

*Anonymity*

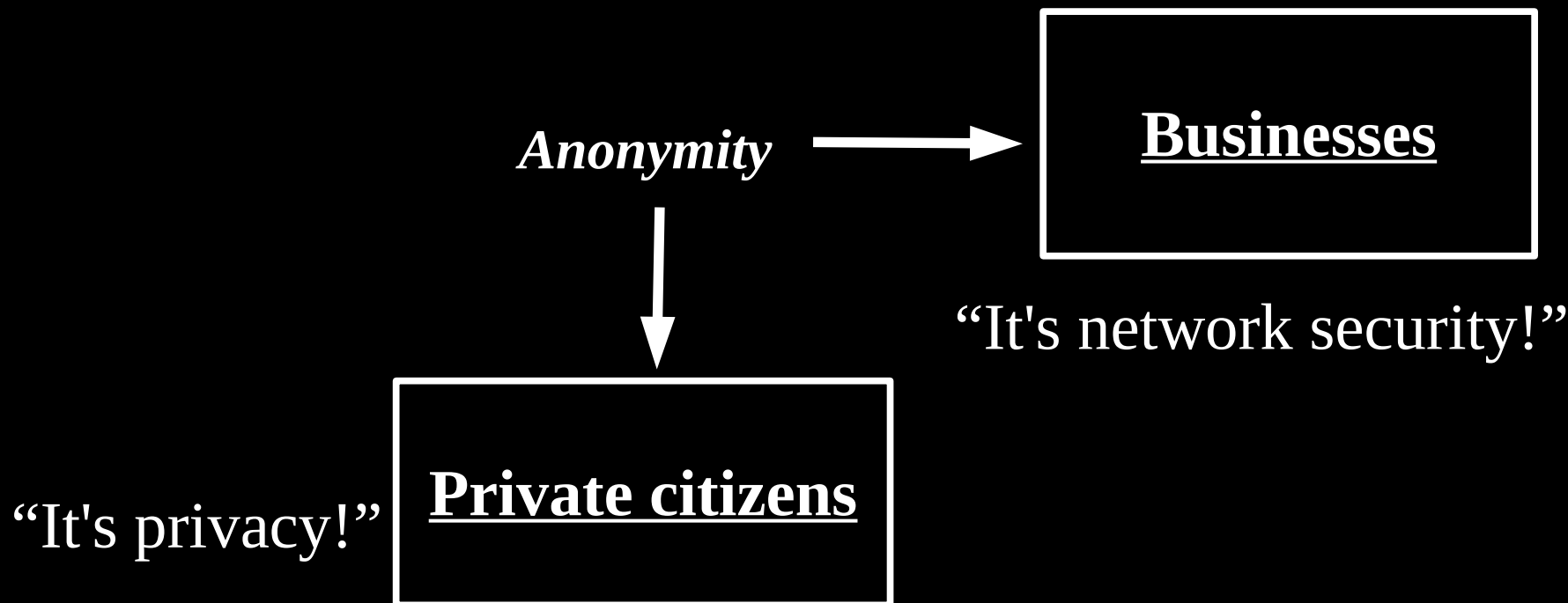


“It's privacy!”

**Private citizens**



# Anonymity serves different interests for different user groups.



# Anonymity serves different interests for different user groups.

“It's traffic-analysis resistance!”



*Anonymity*

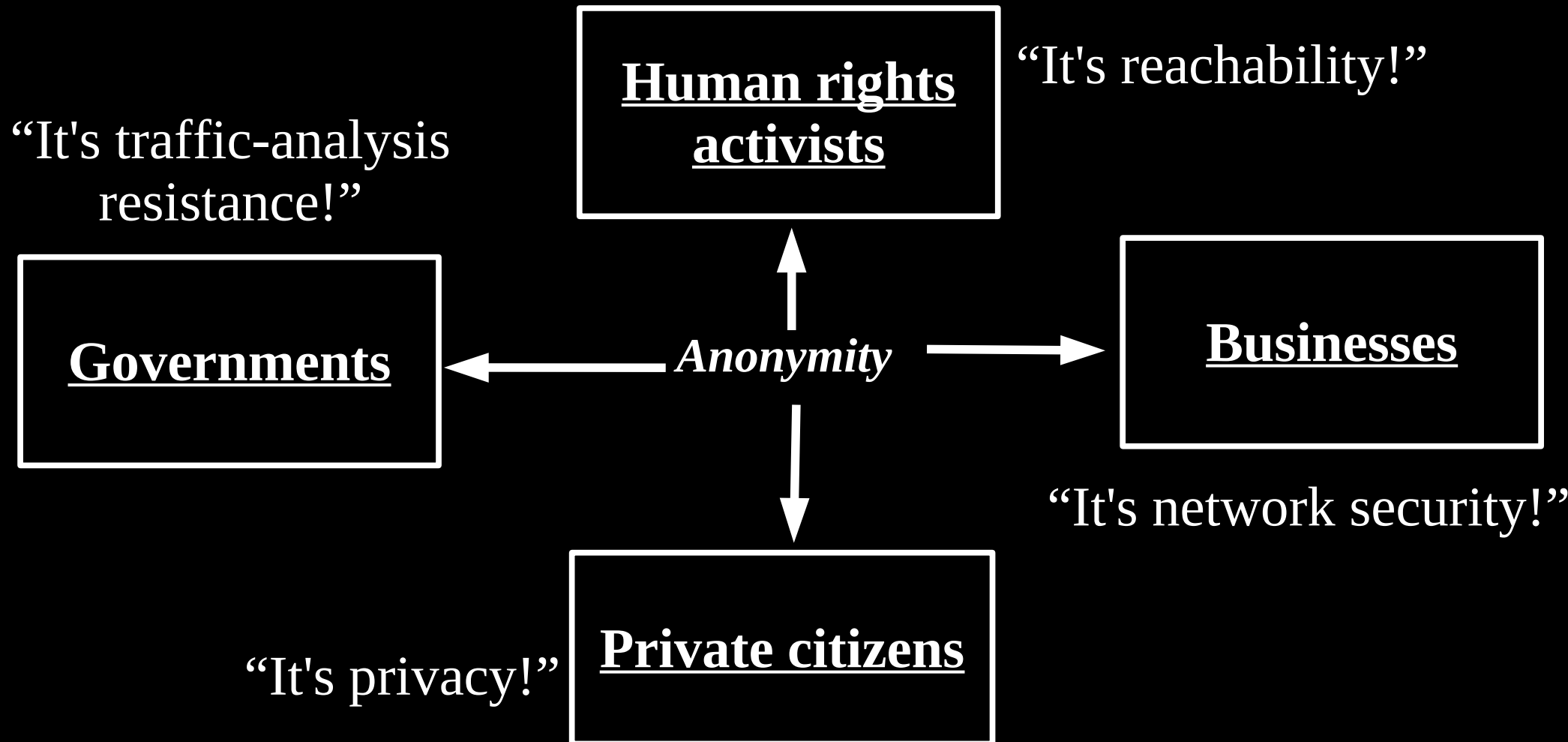


“It's network security!”

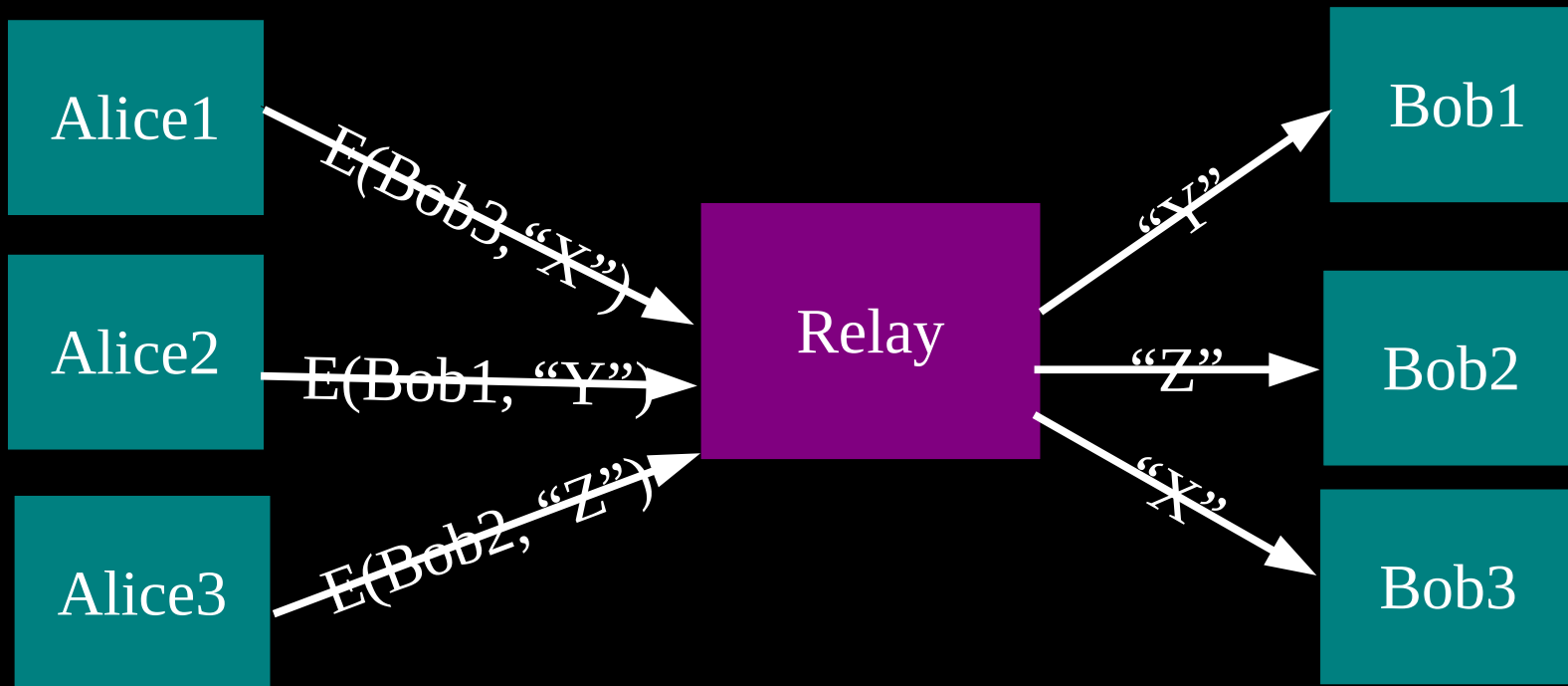
“It's privacy!”



# Anonymity serves different interests for different user groups.

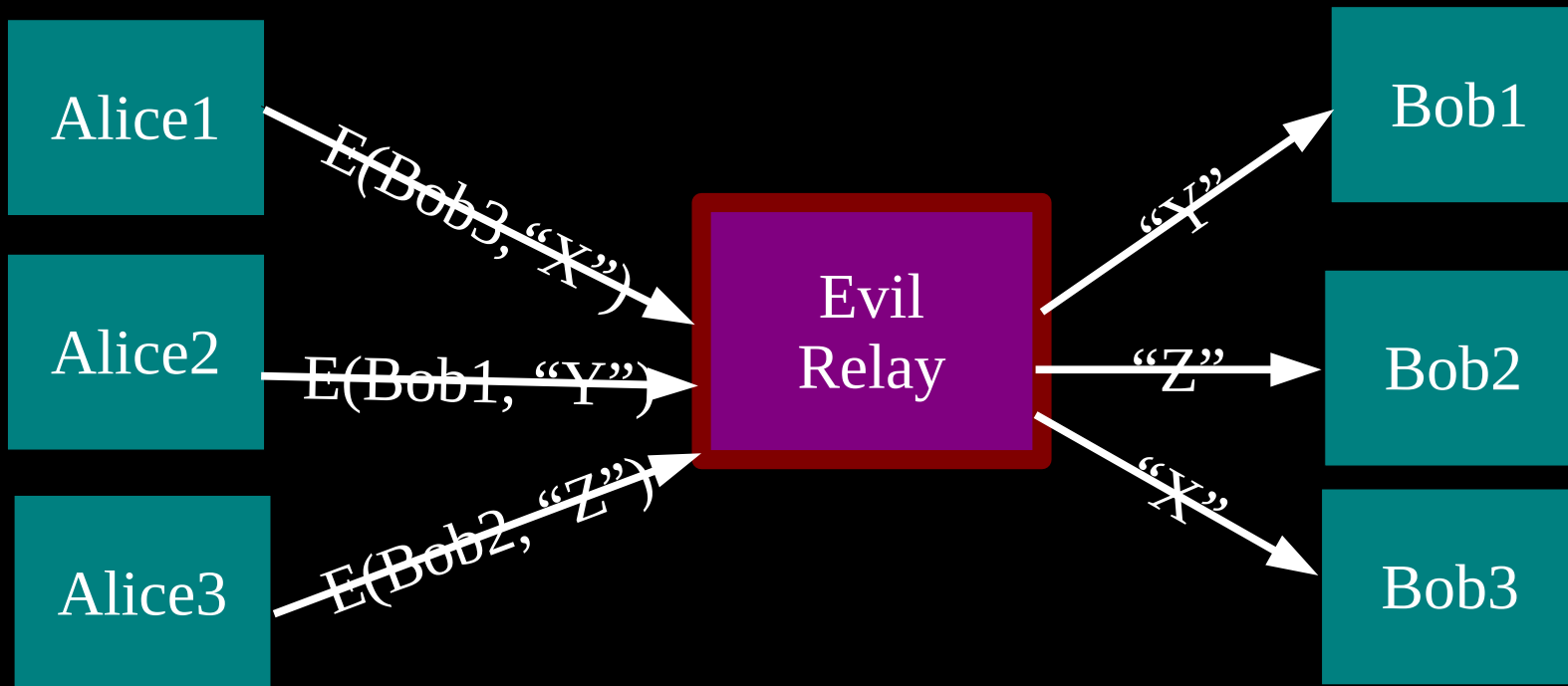


# The simplest designs use a single relay to hide connections.

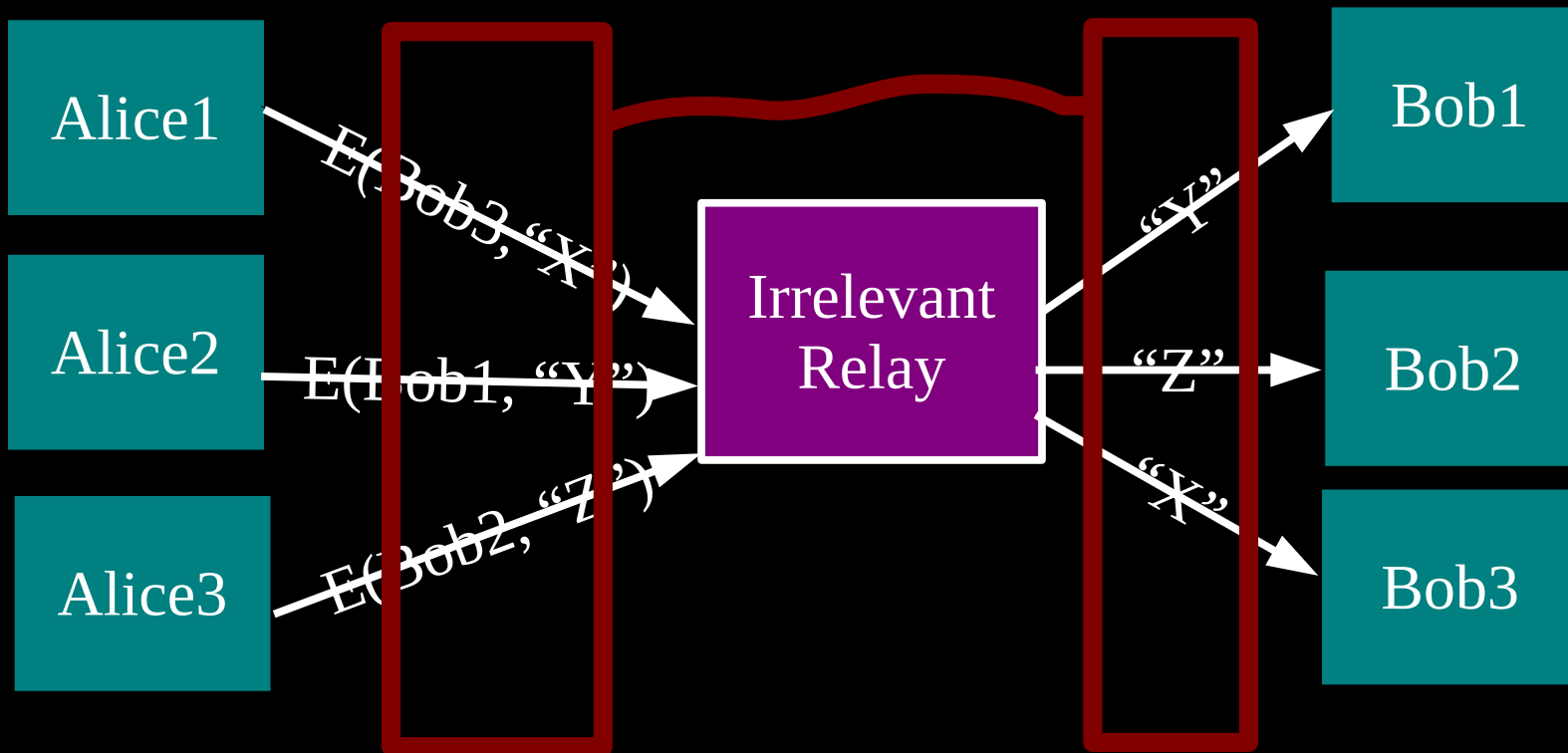


(example: some commercial proxy providers)

**But a single relay (or eavesdropper!)  
is a single point of failure.**

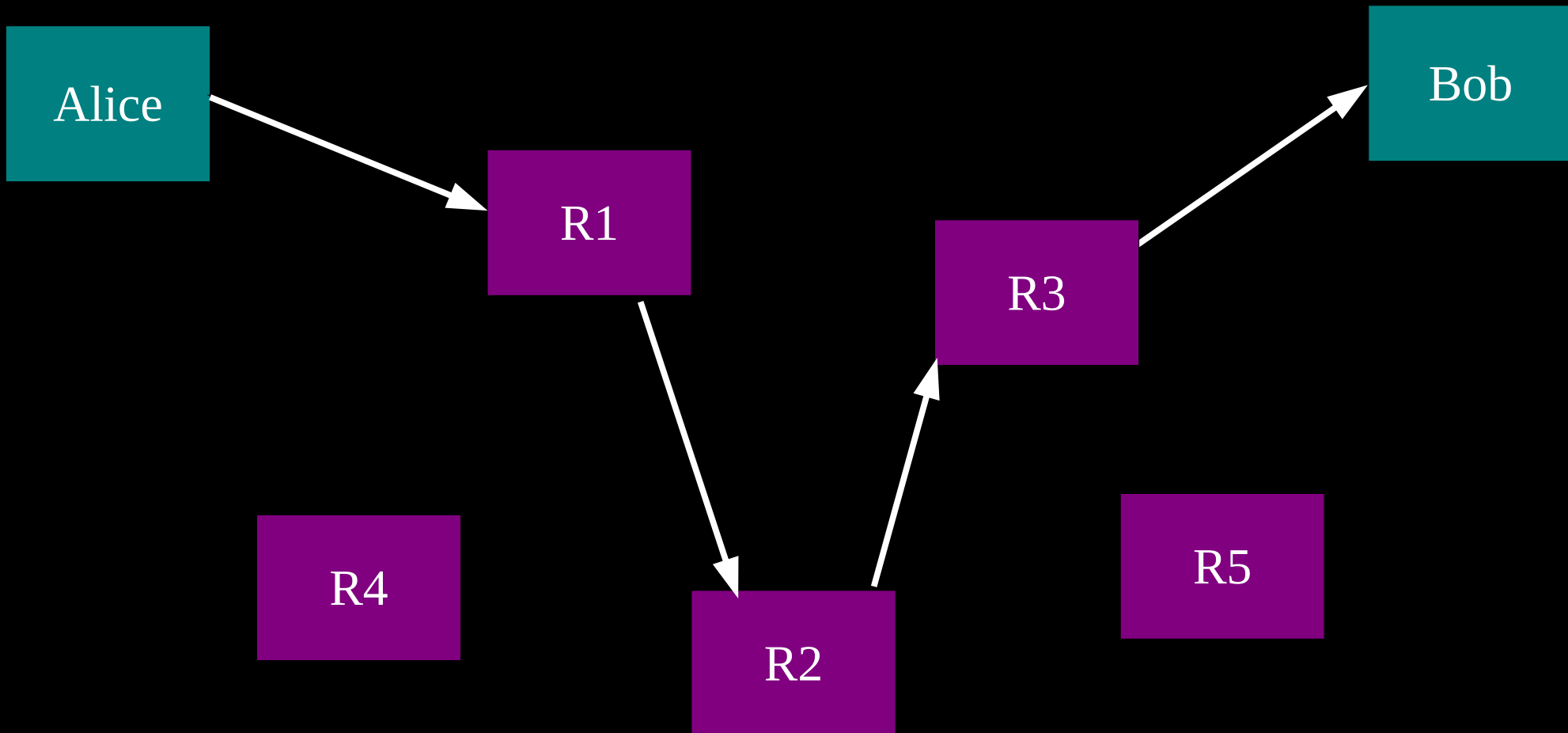


... or a single point of bypass.

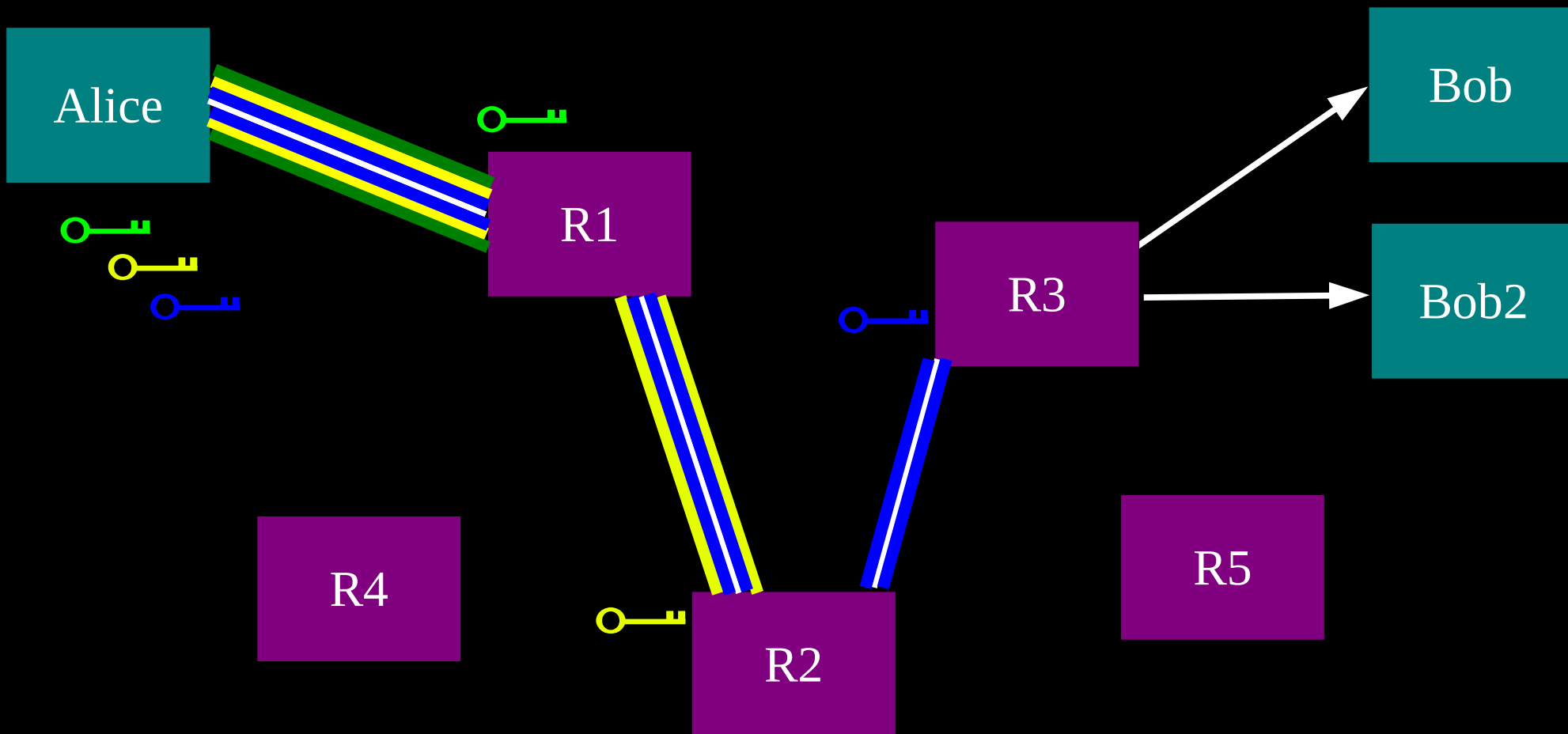


Timing analysis bridges all connections through relay  $\Rightarrow$  An attractive fat target

**So, add multiple relays so that no single one can betray Alice.**

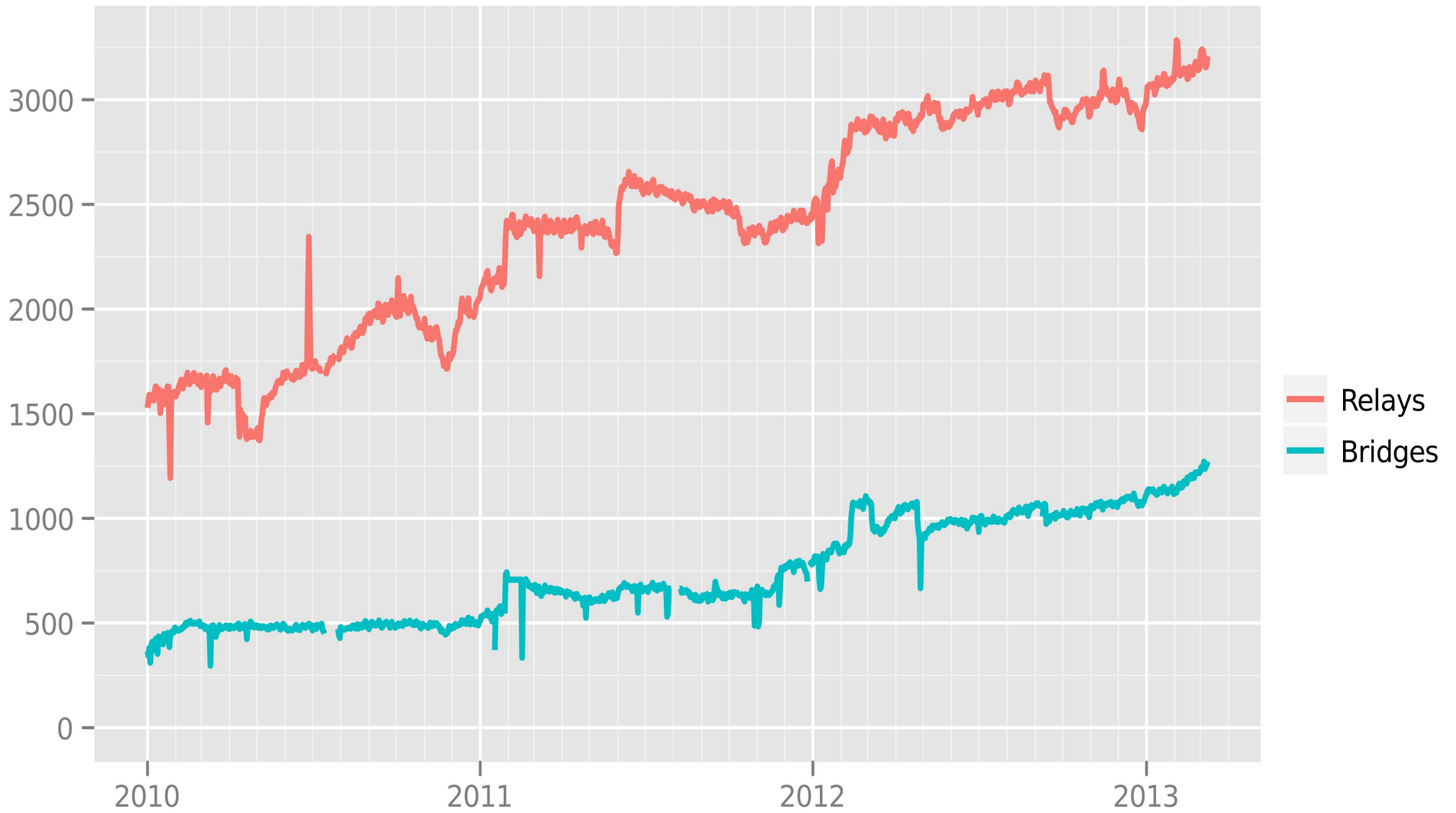


**Alice makes a session key with R1  
...And then tunnels to R2...and to R3**





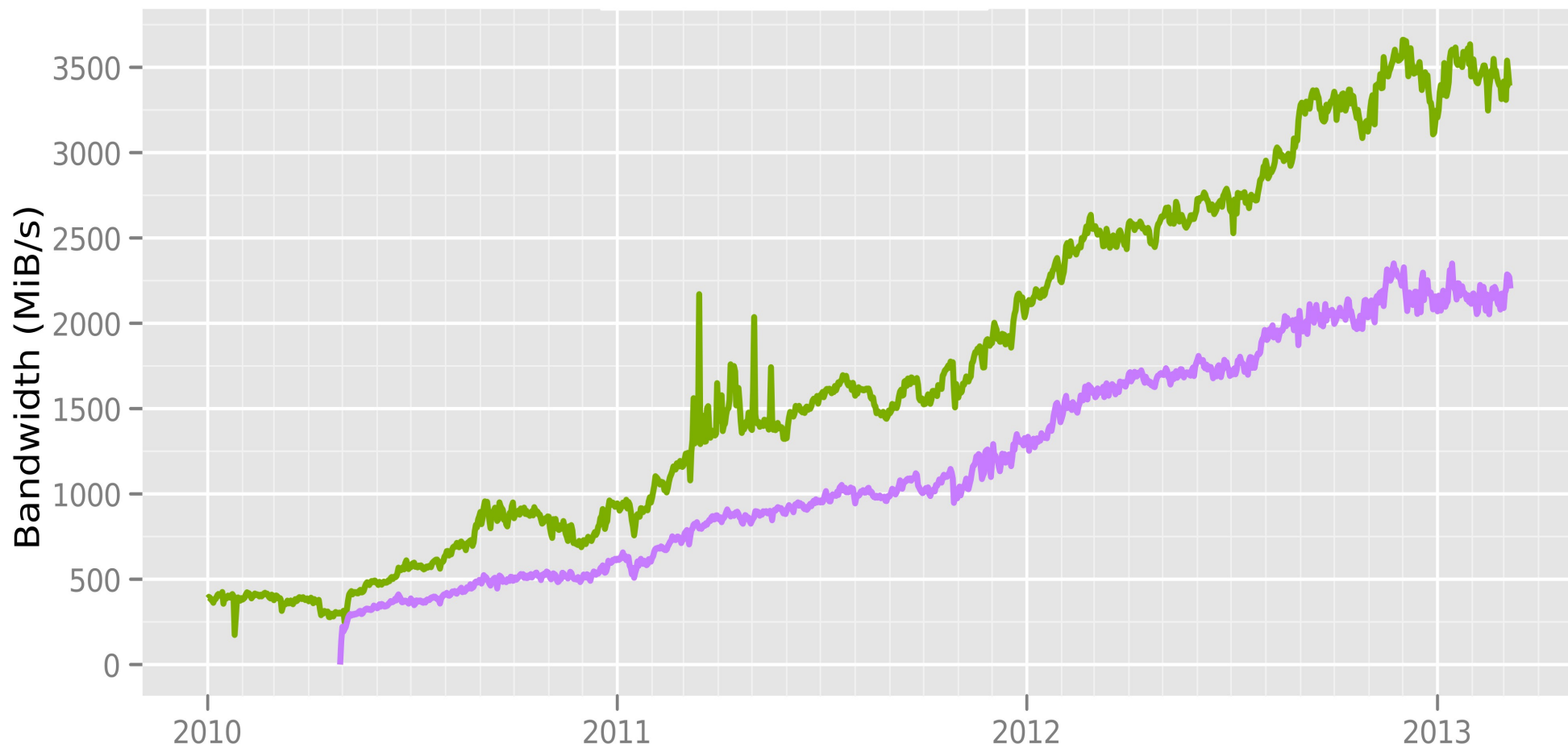
# Number of relays



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

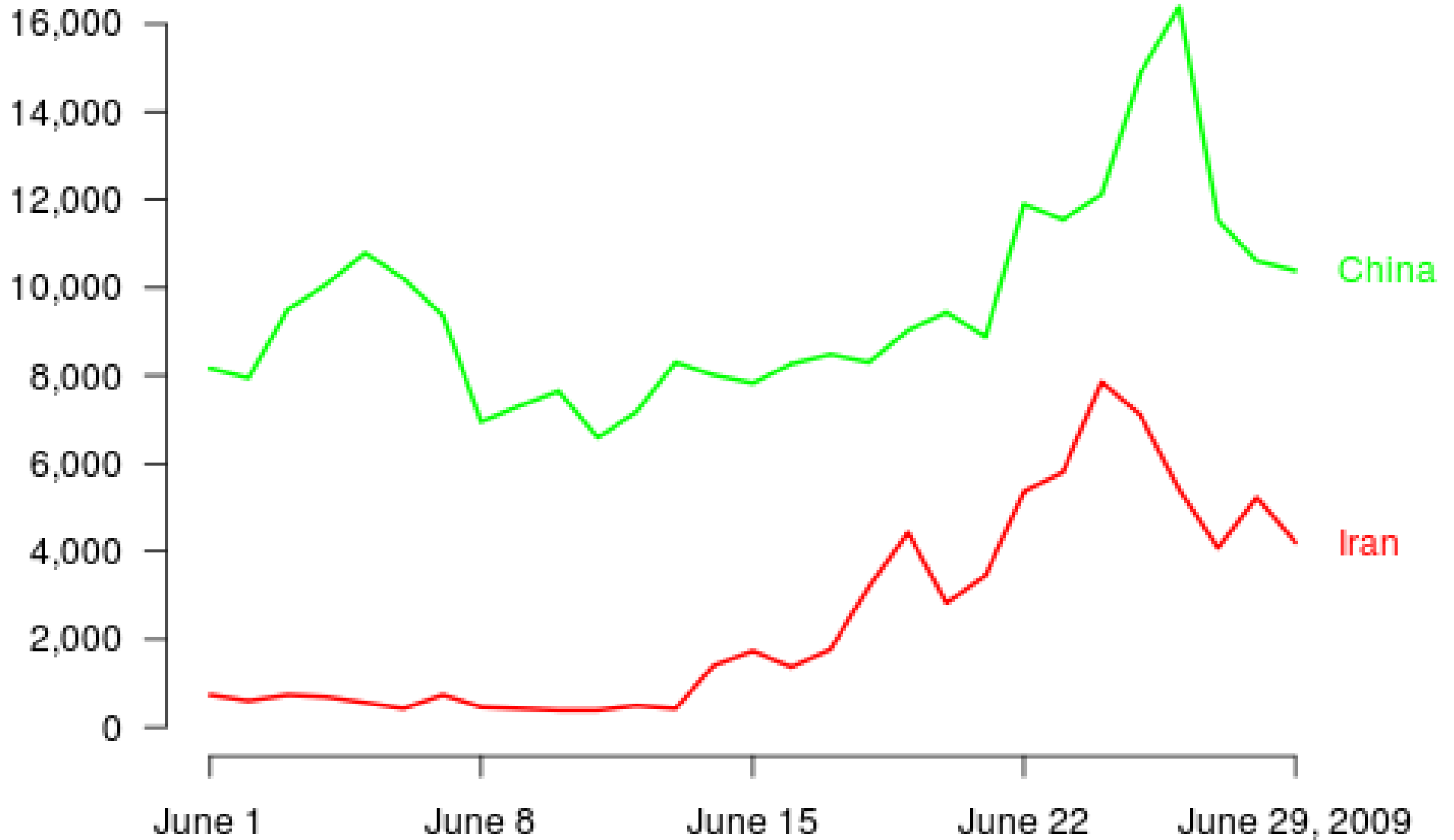
# Total relay bandwidth

- Advertised bandwidth
- Bandwidth history



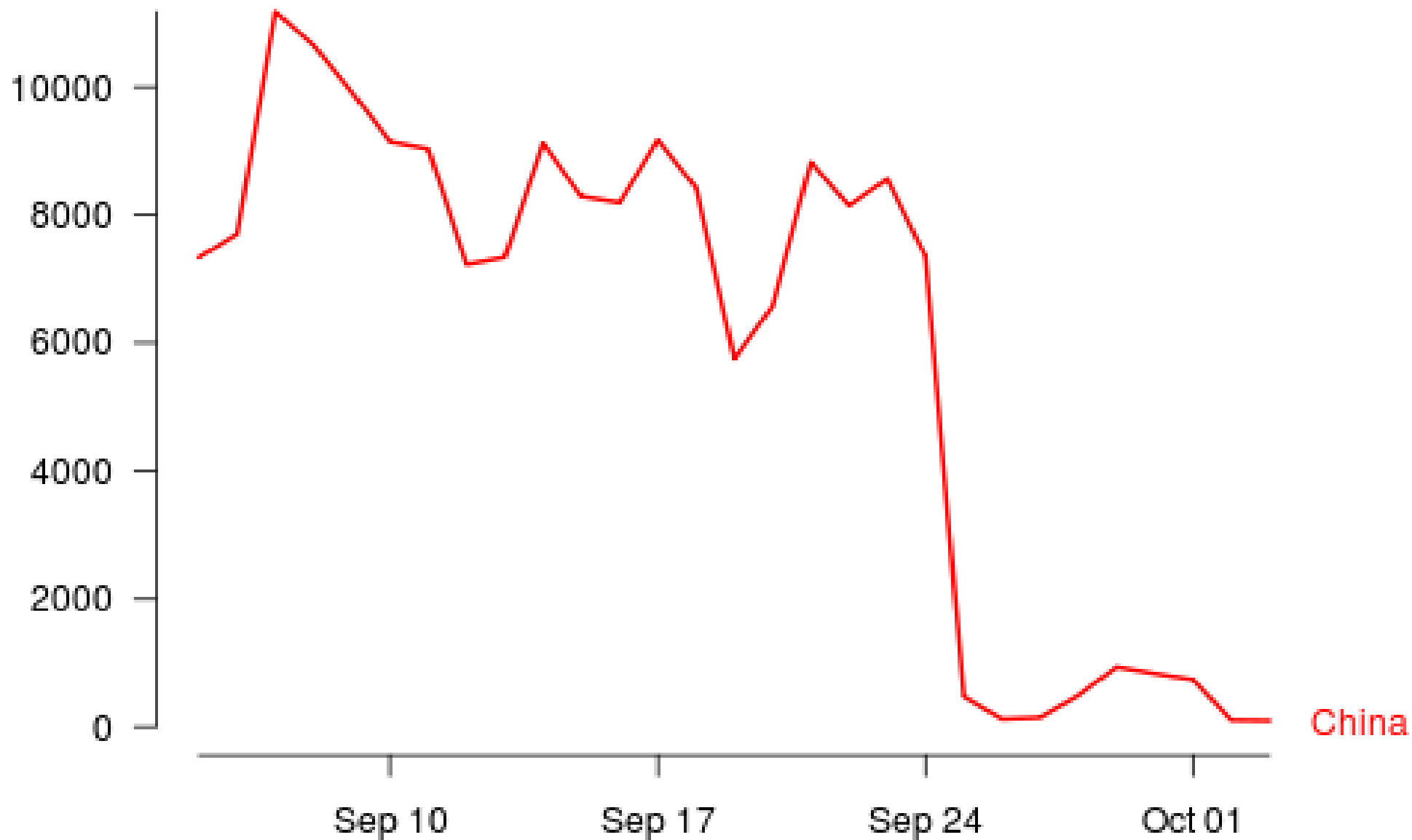
The Tor Project - <https://metrics.torproject.org/>

## New or returning Tor clients per day



<https://torproject.org>

# Number of directory requests to directory mirror trusted



<https://torproject.org>

# Attackers can block users from connecting to the Tor network

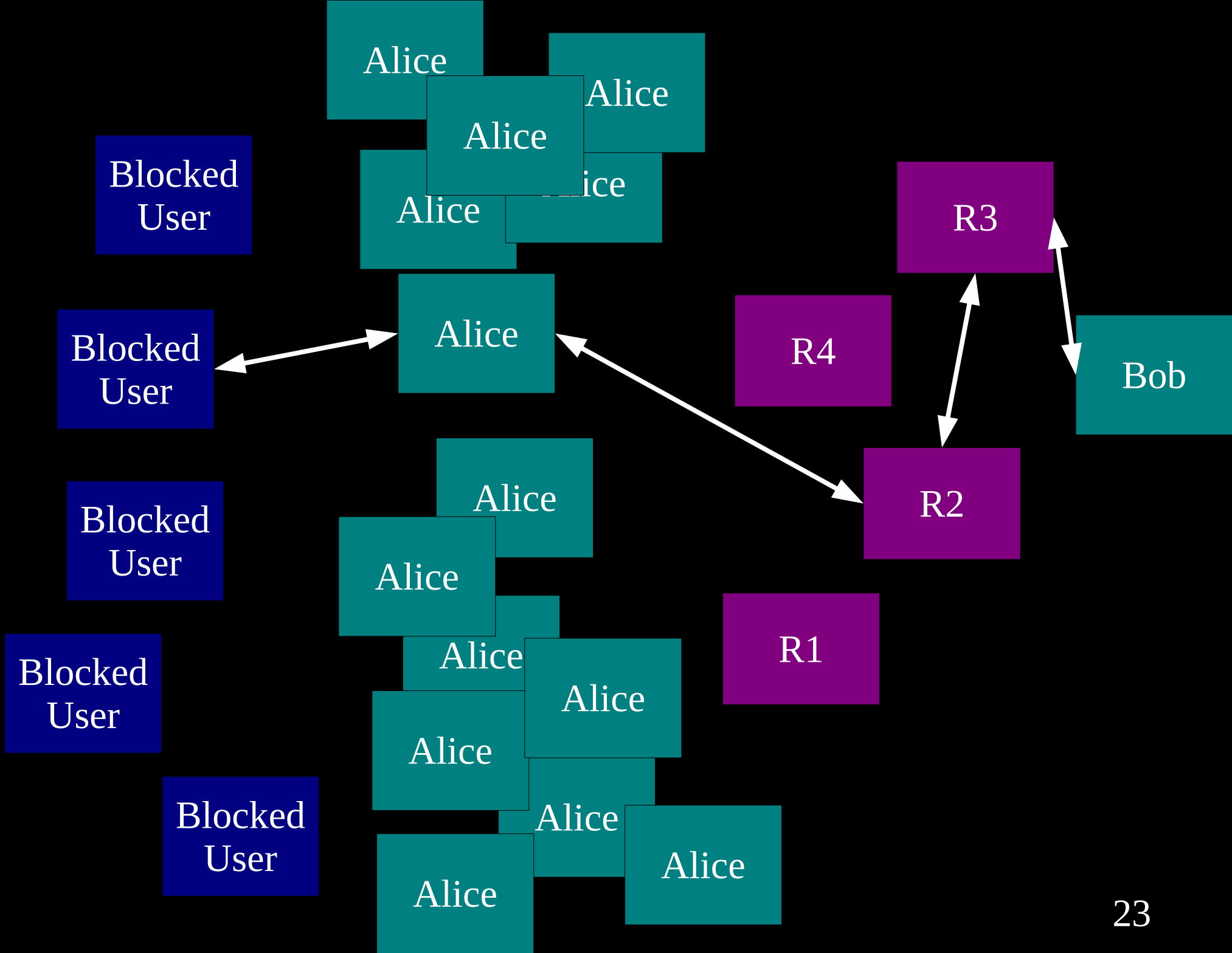
- 1) By blocking the directory authorities
- 2) By blocking all the relay IP addresses in the directory, or the addresses of other Tor services
- 3) By filtering based on Tor's network fingerprint
- 4) By preventing users from finding the Tor software (usually by blocking website)

# Relay versus Discovery

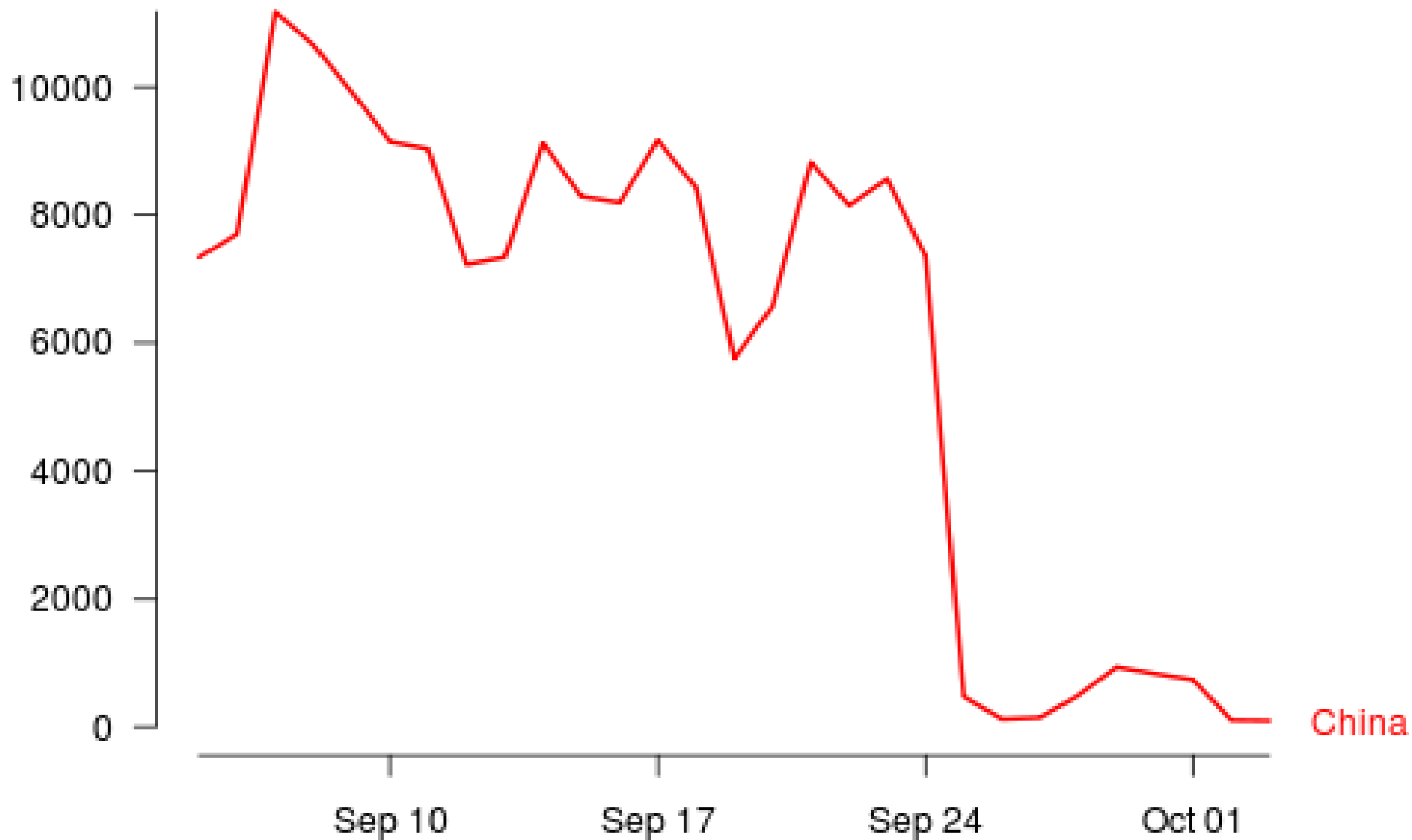
There are two pieces to all these “proxying” schemes:

a **relay** component: building circuits, sending traffic over them, getting the crypto right

a **discovery** component: learning what relays are available



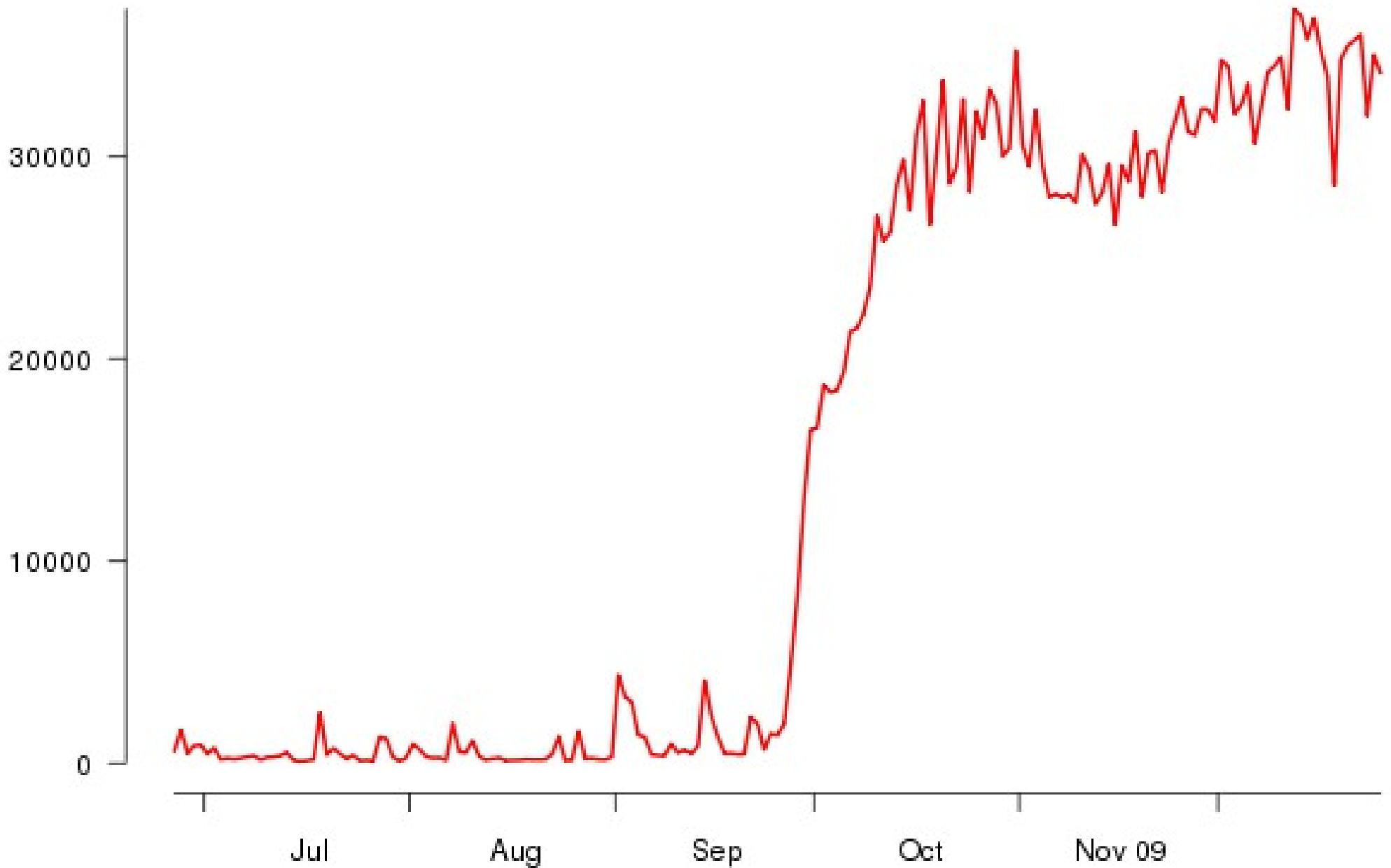
# Number of directory requests to directory mirror trusted



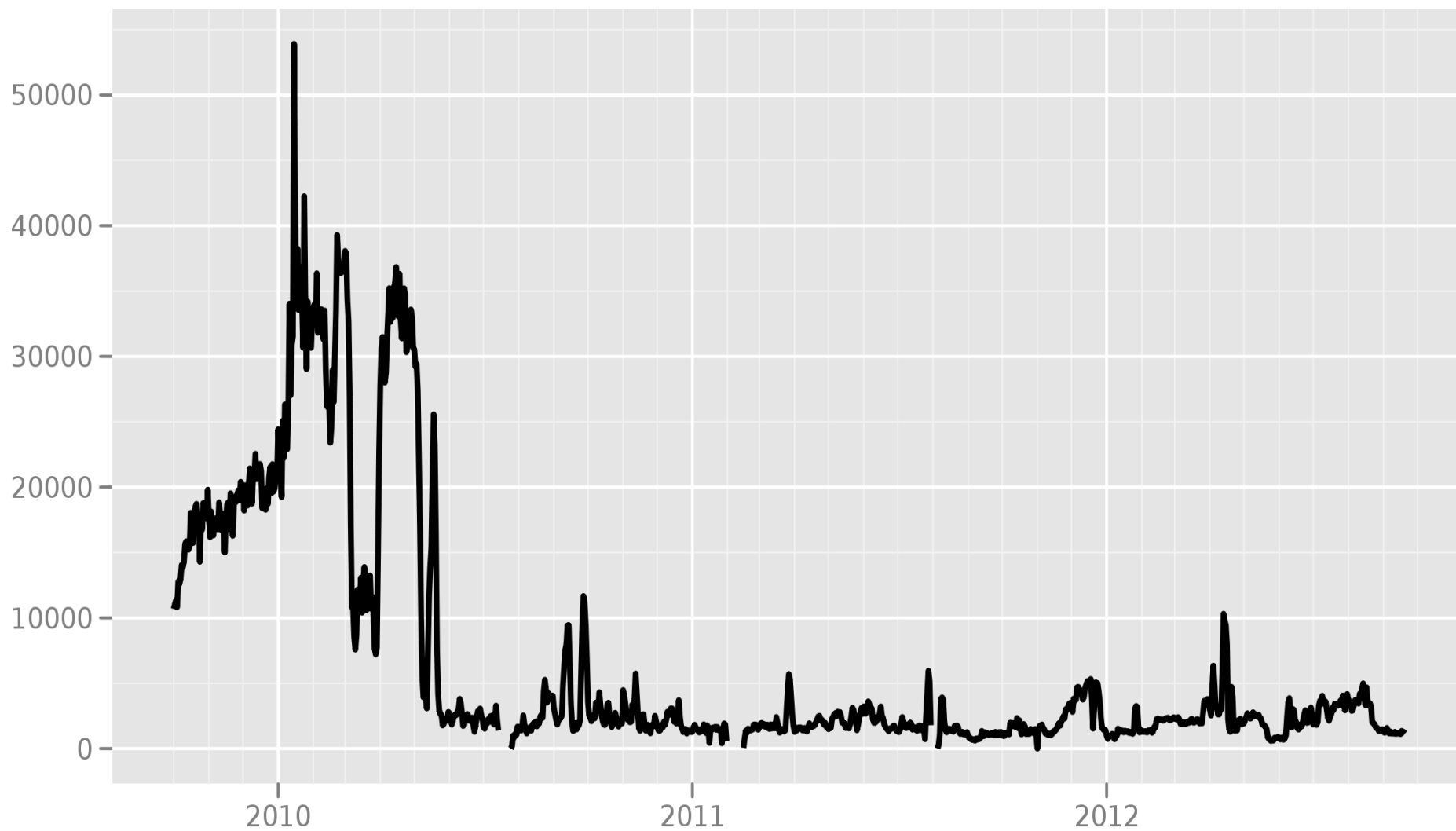
<https://torproject.org>



## Chinese Tor users via bridges



## Bridge users from China



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

# خطراً!



## تصفح بأمان!

عذراً، 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 مدرج تحت "فئات المحتويات المحظورة" حسب تصنيف "السياسة التنظيمية لإدارة النفاذ للإنترنت" لهيئة تنظيم الاتصالات بدولة الإمارات العربية المتحدة.

إذا كانت 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](#).

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# يالله بالستر...!



ببني المتحدة.

وخدمة متطلبات بدخوله لاشتماله "ة" حسب تصنيف "ة تنظيم الاتصالات

## Surf Safe

This website is

The Internet is a p serving our daily le access contains con

Your request was denied because of its conte



ء على اللوائح والقوانين مع unblock.kw@kw.zain

<http://torproject.org/>

<http://torproject.org/>

## Notice...

تم حظر هذا الموقع بسبب احتوائه على محتويات تعارض مع قوانين السلطنة. عليه يرجى تعبئة الاستمارة أدناه اذا كنت تعتقد بان الموقع لا يتضمن أي من هذه المحتويات.

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WebSite\*

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Comments\*

غير متاح.

بي أن لا تُحجب

المملكة العربية  
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## Site Blocked

Web site has been blocked for violating regulations and laws of Kingdom of Bahrain.

نوابين في مملكة

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

تحتاج تفصل [بالضغط](#)

10:00 AM

Blocked URL

Sorry, the requested page is unavailable.

قـع المـطلـوب غير متـاح.

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

هـذه الصـفـحة يـنبـغي أن لا تـحـجب فـضل بالـضـغـط هـنا.

For more information about internet service in Saudi Arabia, please click here: [www.internet.gov.sa](http://www.internet.gov.sa)

لـمـخـبـرة مـا عـن خـدـمـة الـإنـتـرنـت فـي الـمـمـلـكـة العـرـبـيـة الـسـعـودـيـة، مـن الـمـوقـع الـتـالـي: [www.internet.gov.sa](http://www.internet.gov.sa)

KT WATA... 9:21 ص 87%

Tweet Blocked by Mada Com...

هذا الموقع محظور  
This site is blocked

الوصول إلى هذا الموقع غير مسموح به حالياً لأنه مصنف ضمن فئات المحتويات المحظورة بموجب أحكام السياسة التنظيمية لإدارة النفاذ إلى الإنترنت في دولة الإمارات العربية المتحدة.

Access to this site is currently blocked. The site falls under the Prohibited Content Categories of the UAE's Internet Access Management Policy.

مـدى الـإـصـلـات  
mada Mada Communications

ان الموقع الذي تحاول زيارته محجوب  
Access to this website is prohibited

ان الموقع الذي تحاول زيارته محجوب وذلك طبقاً للقوانين واللوائح المتبعة بهذا الشأن. اذا كنت تعتقد ان هذا الموقع قد تم حجبه عن طريق الخطأ يرجى تعبئة الاستمارة التالية وارسلها للقيام بمعالجة الموقع. شكراً جزيلاً

This site is blocked according to the government filtering policy.  
If you feel this page has been blocked in errors, kindly fill out the form and we will investigate.  
Thank You.

Required fields are denoted by (\*)

Full Name \*  الاسم

Email \*  العنوان العردي

Blocked URL \*  www.  .com اسم النطاق

Comments  استفسارك

Submit

oops رفا

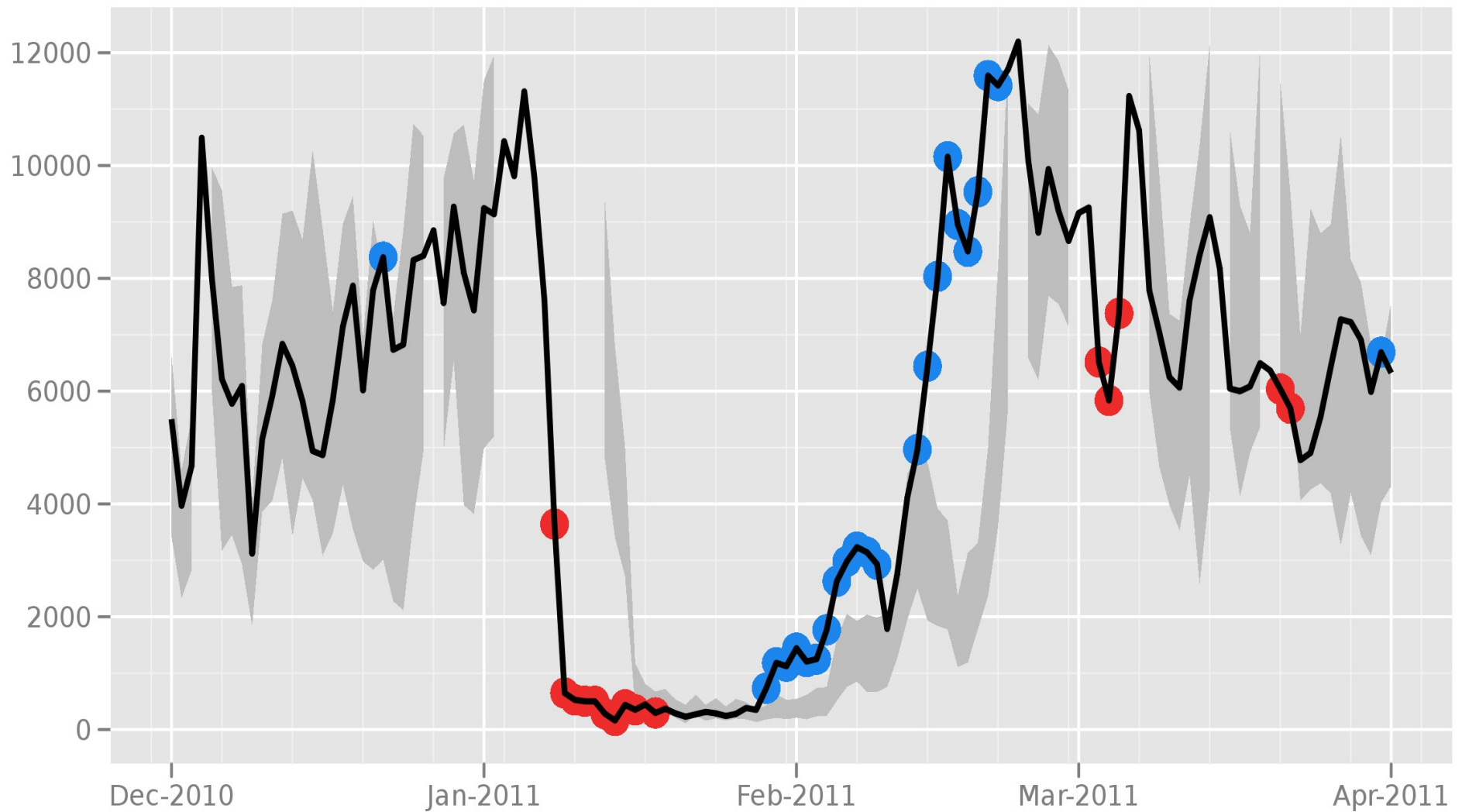
لقد تم منع الدخول إلى هذا الموقع  
This site has been blocked

تم إيقاف عملية الدخول إلى الموقع الذي تحاول زيارته نظراً لاحتوائه على محتويات محظورة

The web page you are trying to access has been blocked as the content contains prohibited materials

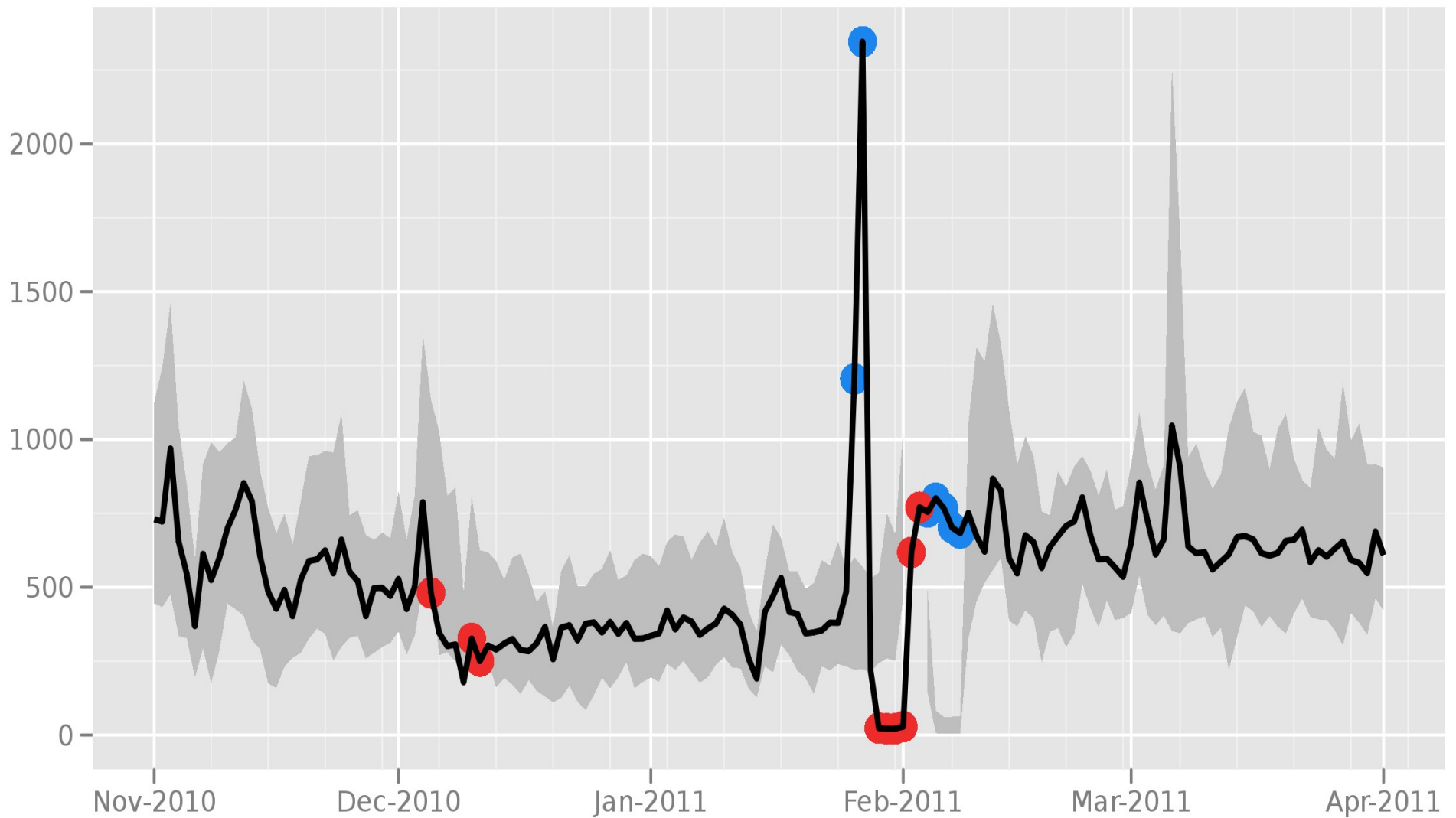
إذا كنت ترى أن هناك خطأ في ذلك - يرجى إرسال رسالة بريد إلكتروني إلى [help@isp.qa](mailto:help@isp.qa)  
if you feel this is an error then please send

# Directly connecting users from the Islamic Republic of Iran



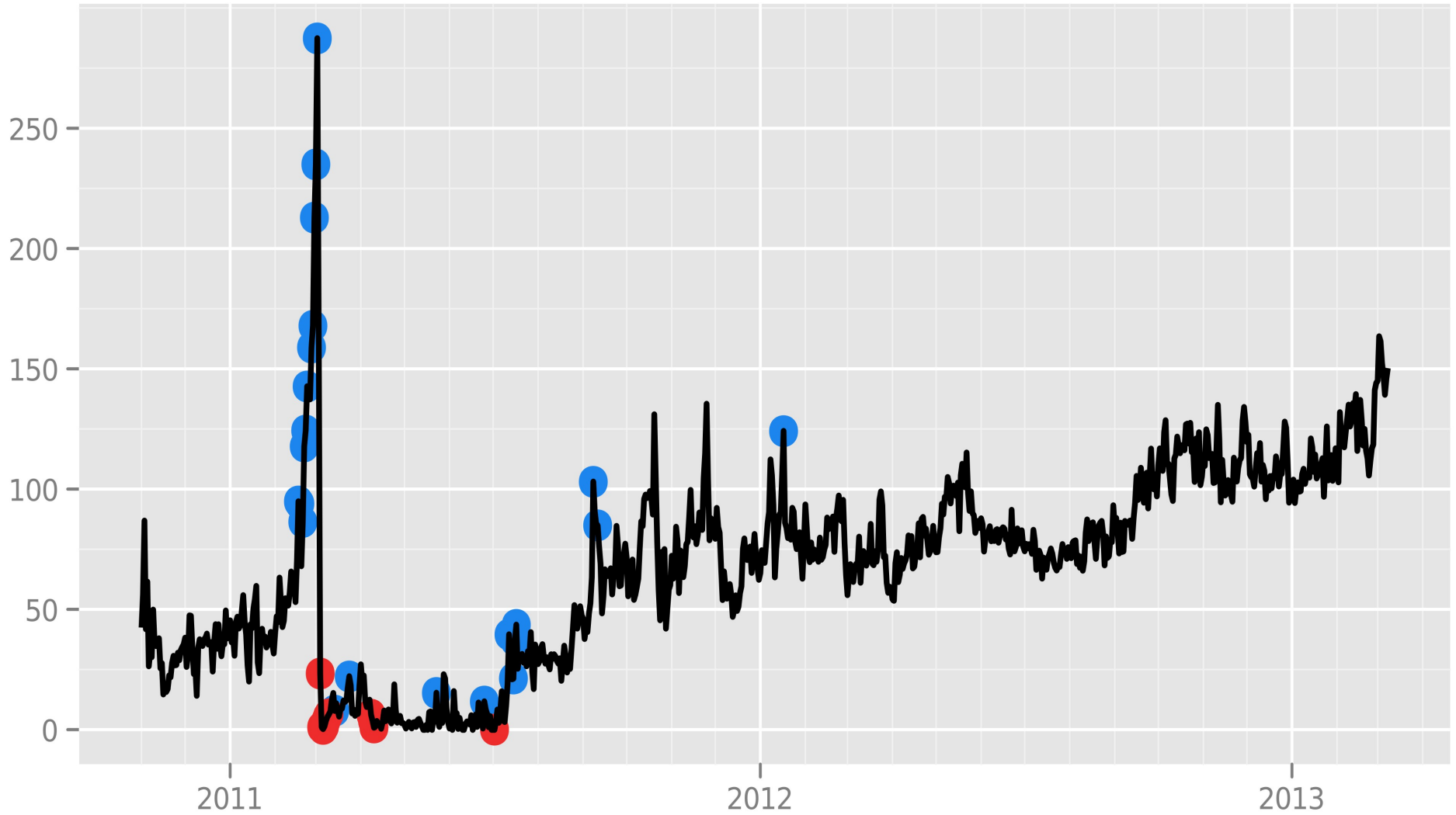
The Tor Project - <https://metrics.torproject.org/>

# Directly connecting users from Egypt



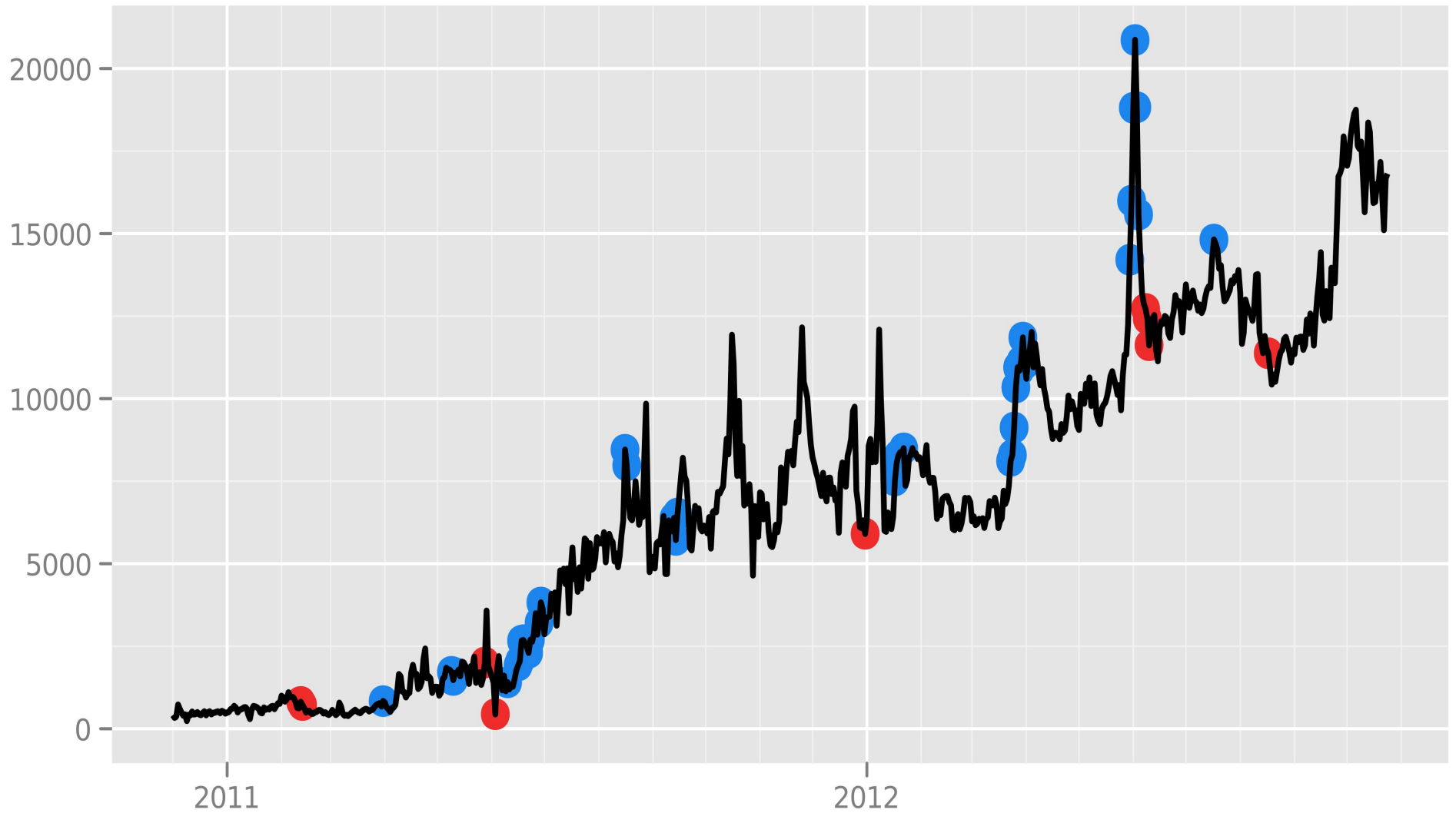
The Tor Project - <https://metrics.torproject.org/>

# Directly connecting users from Libya



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

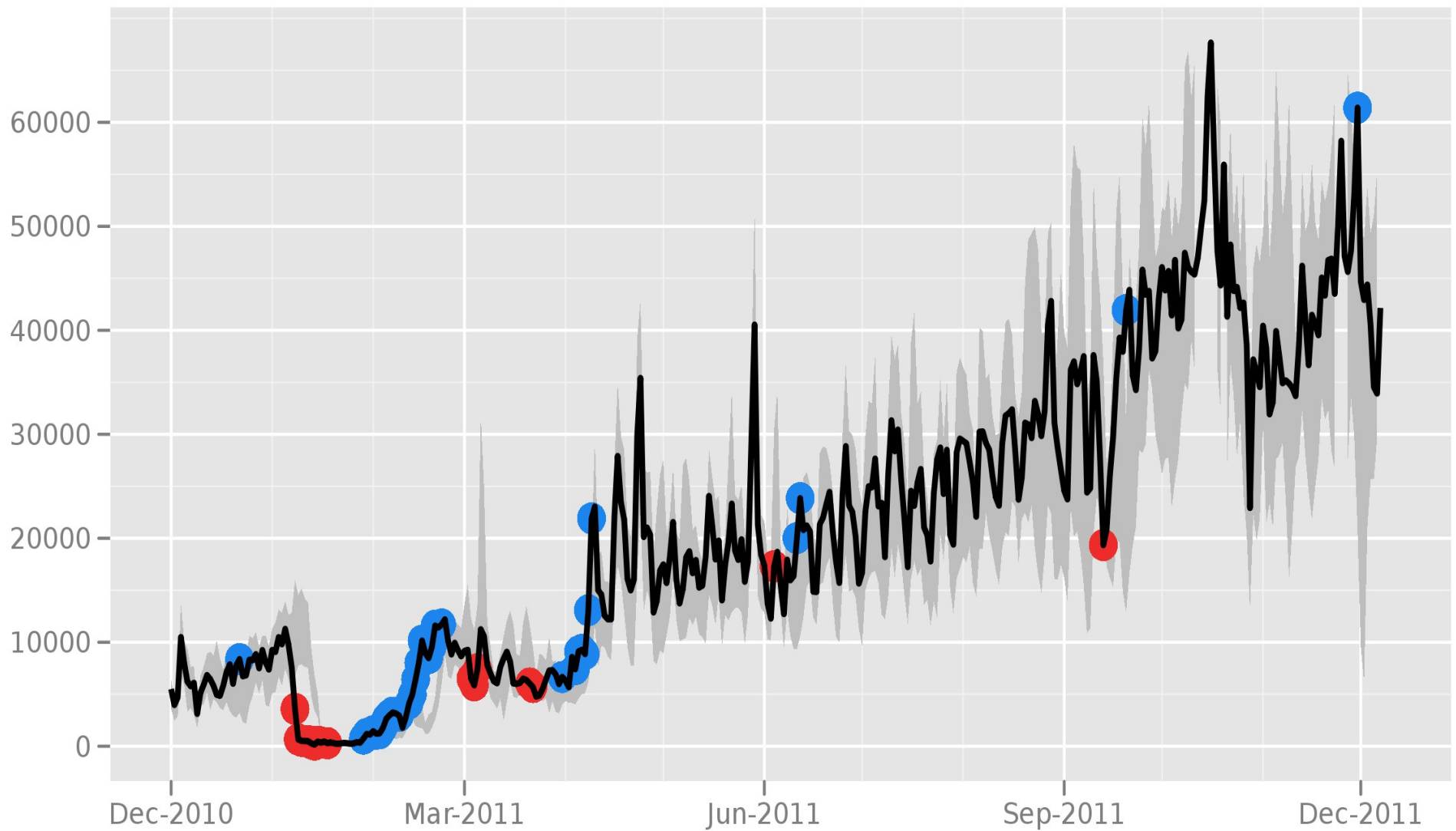
# Directly connecting users from the Syrian Arab Republic



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



# Directly connecting users from the Islamic Republic of Iran



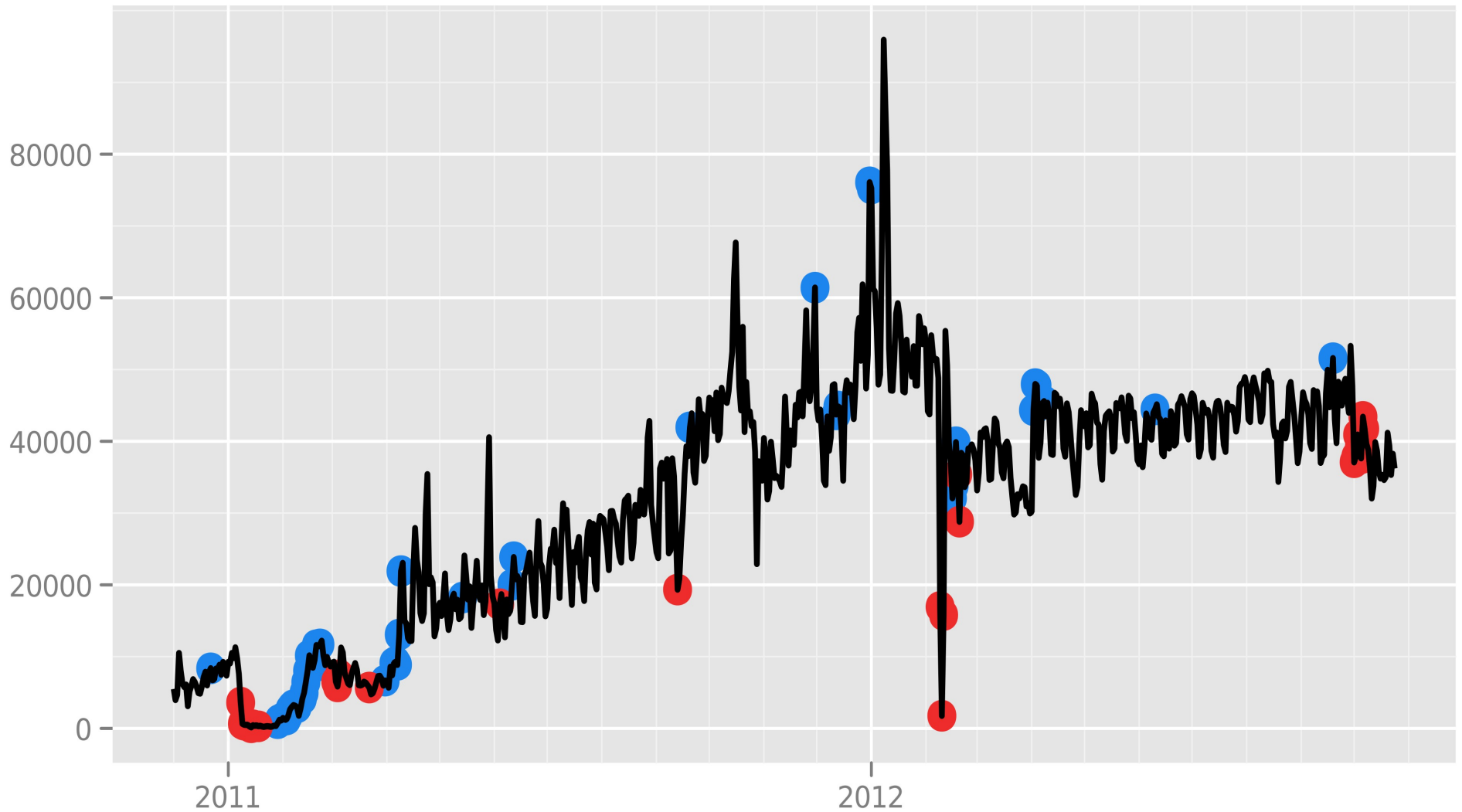
The Tor Project - <https://metrics.torproject.org/>

## Top-3 countries by directly connecting daily Tor users



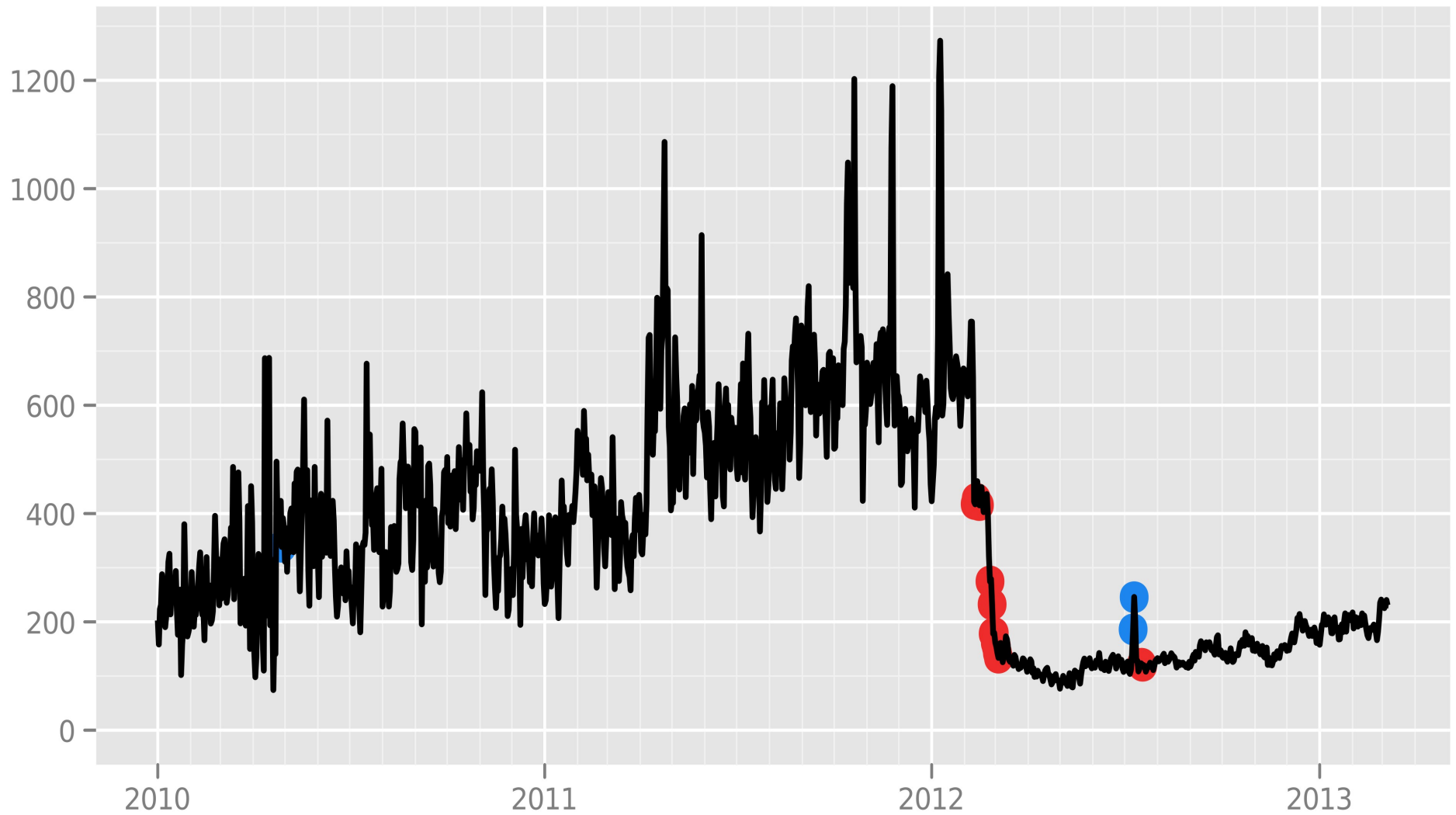
The Tor Project - <https://metrics.torproject.org/>

# Directly connecting users from Iran



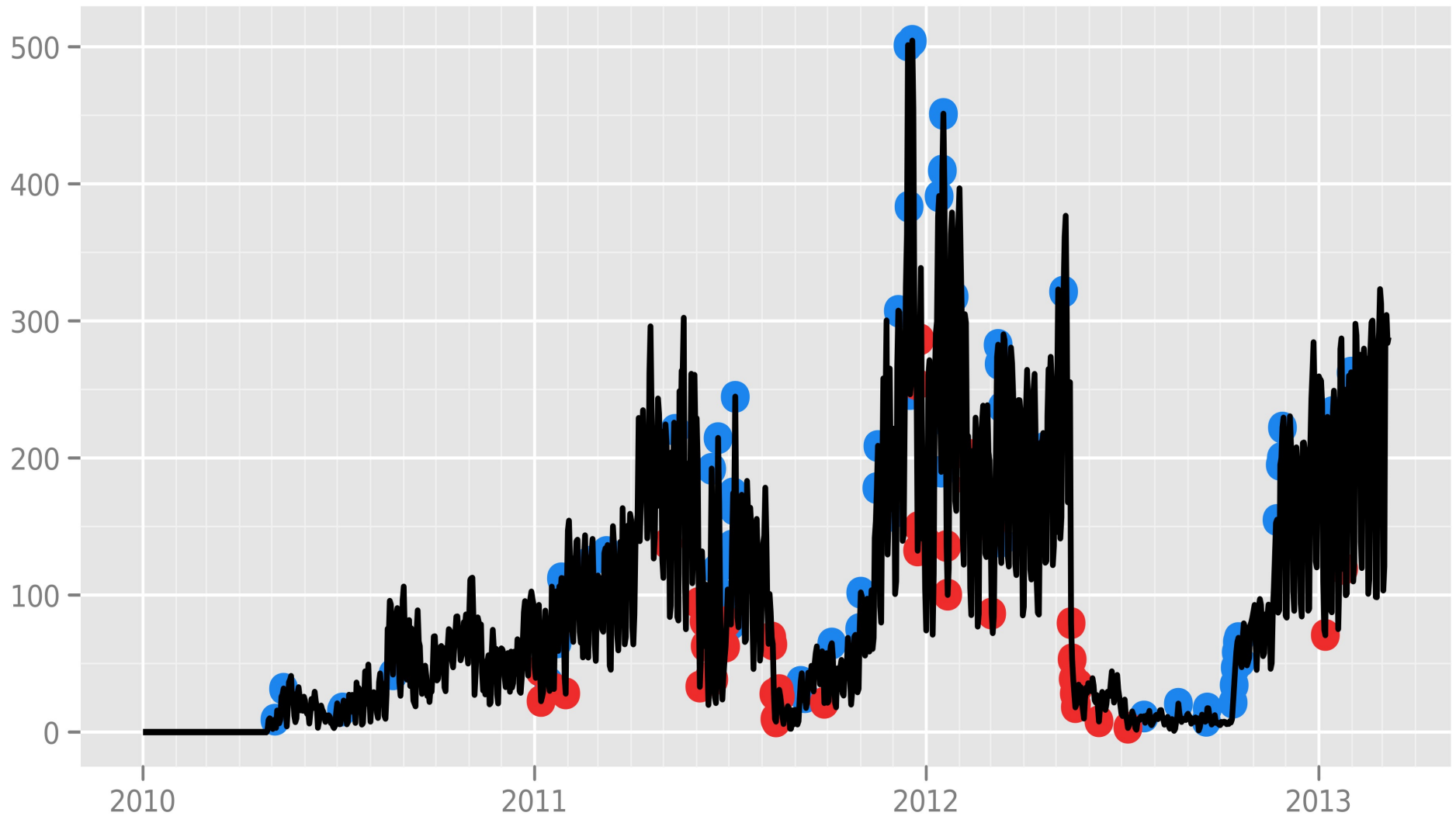
The Tor Project - <https://metrics.torproject.org/>

## Directly connecting users from Kazakhstan



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

## Directly connecting users from Ethiopia



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

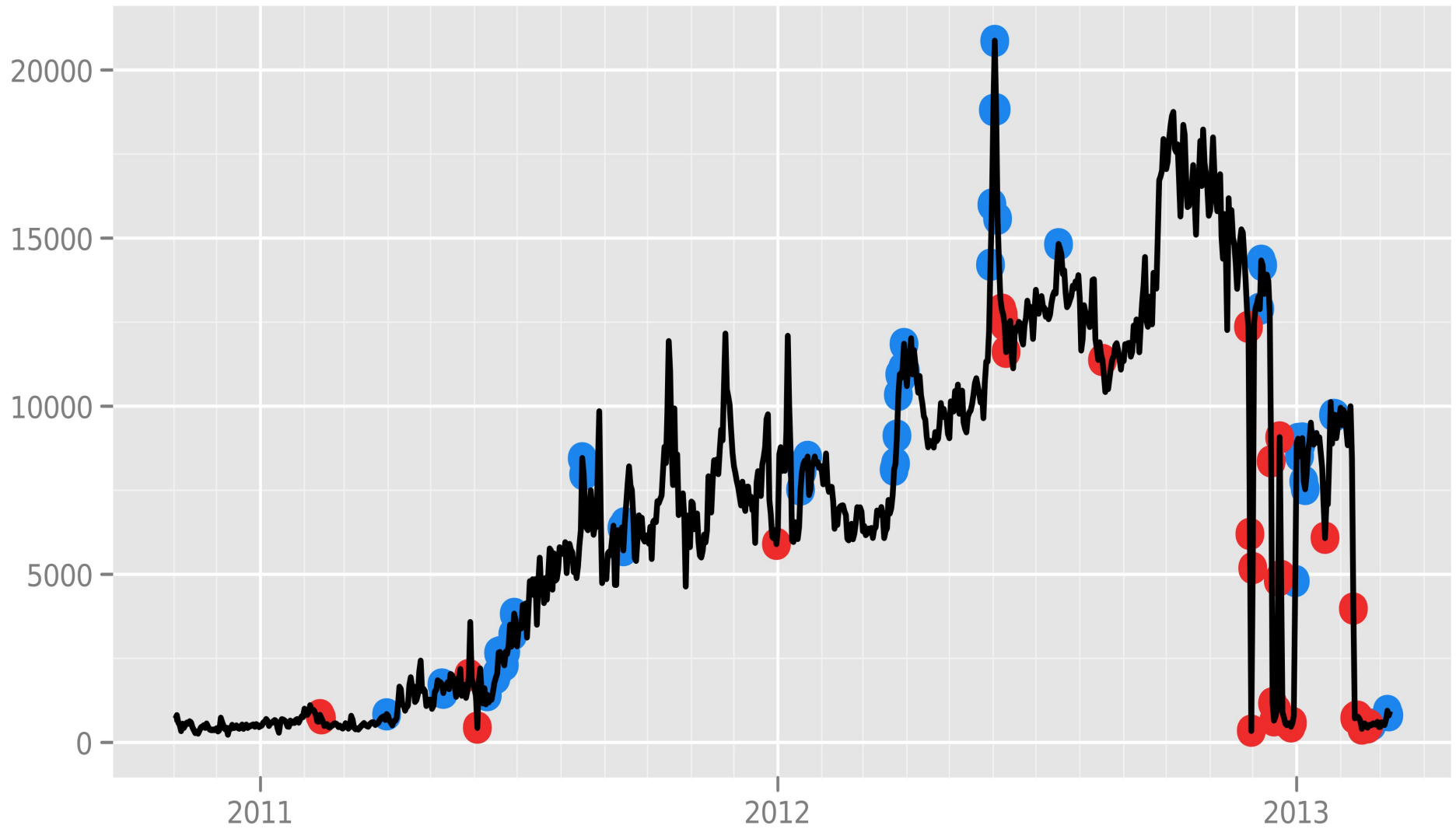
# What we're up against

Govt firewalls used to be stateless. Now they're buying fancier hardware.

Burma vs Iran vs China

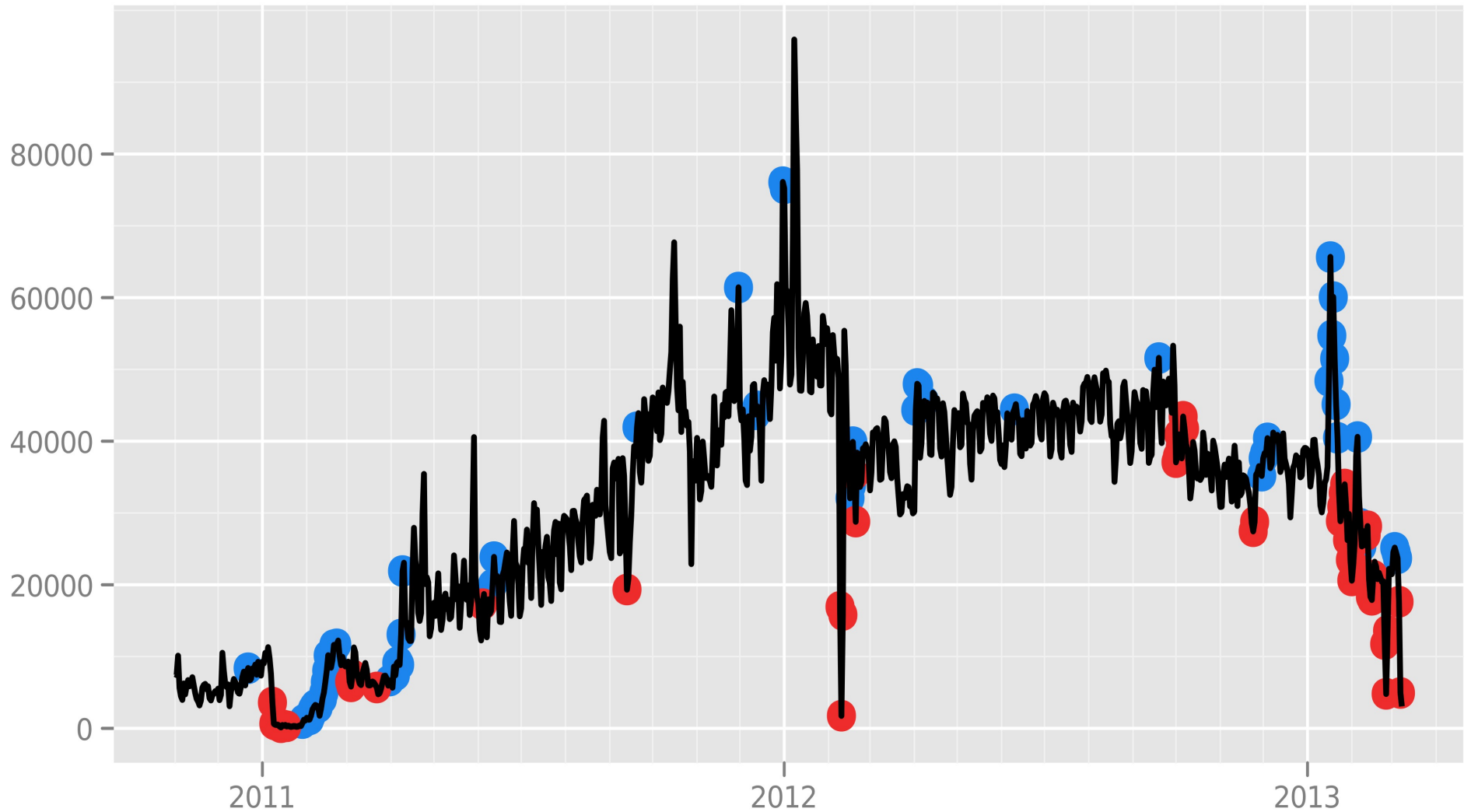
New filtering techniques spread by commercial (American) companies :(

# Directly connecting users from the Syrian Arab Republic



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

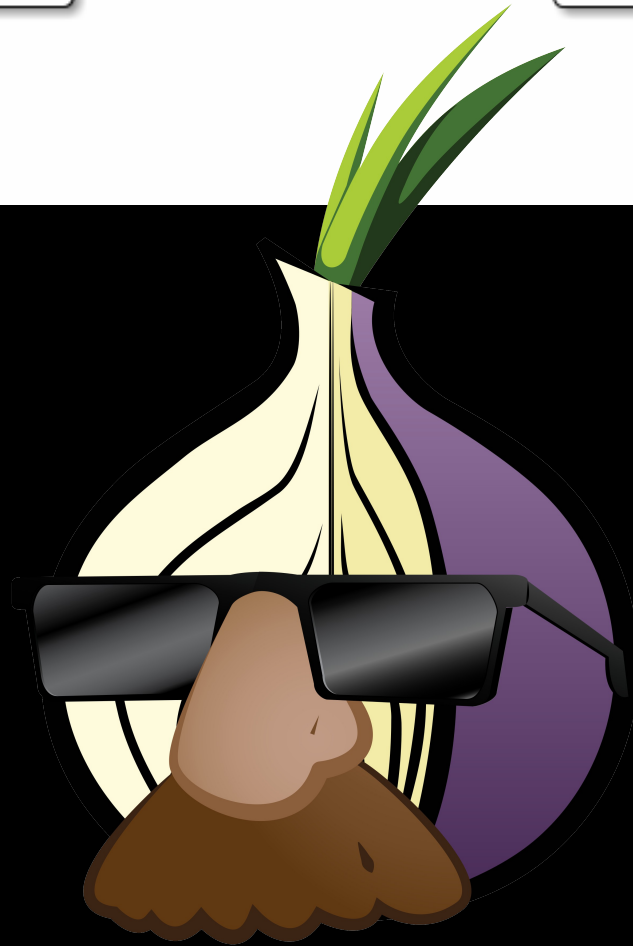
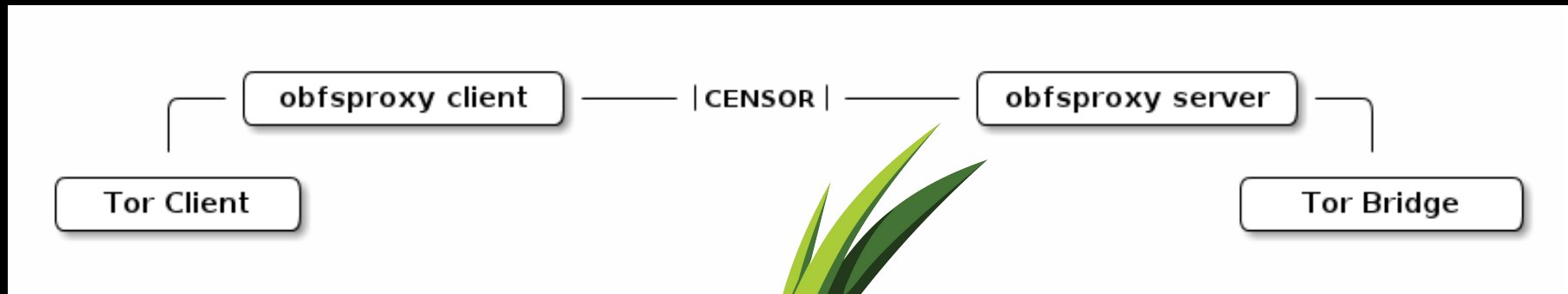
# Directly connecting users from Iran



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



# Tor pluggable transports



# 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: measuring diversity over time)
- #2: Diversity of users and reasons to use it. 50000 users in Iran means almost all of them are normal citizens.

# Only a piece of the puzzle

Assume the users aren't attacked by their hardware and software

No spyware installed, no cameras watching their screens, etc

Users can fetch a genuine copy of Tor?

I CAN HAZ  
FREEDOM?



# What we spend our time on

Performance and scalability

Maintaining the whole software ecosystem

Blocking-resistance (circumvention)

Basic research on anonymity

Reusability and modularity

Advocacy, education, and trainings around the world

Metrics, data, and analysis

# Next steps

- Technical solutions won't solve the whole censorship problem. After all, firewalls are *socially* very successful in these countries.
- But a strong technical solution is still a critical puzzle piece.
- You should run a relay! Non-exit relays are easy and safe to set up.