Exploring Server-Side Blocking

Sadia Afroz
ICSI
Bank of America Sign In

Security Step

For your protection, you'll need to complete an additional security step.

Use this text code and enter the same in the text box below.

To continue, please enter the text you see above.

Continue to sign in  Return to home page
The dunderheads at Verizon block access to myverizon.com account if you are overseas. I plan to cancel my service. Idiots.
A website can be unavailable for many reasons

**Client-side**
- User-agent
- OS
- Browser config
- Hardware
- Location

**Network**
- IP address
- Paths (ISPs & ASs)
- Type e.g., educational
- Transient errors

**Server-side**
- Misconfiguration
- Transient errors
- Localization
- Geo-blocking
- CDNs
Server-Side Blocking of Tor (2015)
How **Regular** Users See the Web
How Tor Users See the Web

Access Denied
You don't have permission to access “http://www.foxnews.com/” on this server.
Reference #18.4d6e5668.1445538492.20b9c5ab

Error 403
Access denied. Your IP address [171.25.193.132] is blacklisted. If you feel this is in error please contact your hosting providers abuse department.

We're sorry, but we could not fulfill your request for / on this server.
You do not have permission to access this server. Before trying again, run anti-virus and anti-spyware software and remove any viruses and spyware from your computer.
Your technical support key is: 591f-3905-2b02-1b1f
You can use this key to fix this problem yourself.
If you are unable to fix the problem yourself, please contact webmaster at monticello.org and be sure to provide the technical support key shown above.
Difference w/ Traditional Censorship

User-side Censorship
Difference w/ Traditional Censorship

User-side Censorship

Publisher-side Censorship
How Do Websites Block Tor?
How Do Websites Block Tor?

Publicly known

(https://check.torproject.org/exit-addresses for example.)
Measuring Tor Blocking by the Web

• Network layer blocking
• Application layer blocking
• Blocking over time (OONI)
Network-layer Discrimination
Does An IP Address Block Tor?

SYN (port 80)

SYN-ACK

SYN (port 80)

RESET / NO RESPONSE
Measuring Tor Blocking at Scale

- IPv4 ~ over 3 billion addrs
- 4 Tor Exit Nodes (USA, Romania, Netherlands)
- 3 Control Nodes (Michigan, Cambridge, Berkeley)
..But What is The Web?

- Web Footprint—a set of IP addresses that respond **successfully** to our **control scans** on port 80
Challenges in Defining The Web

• What if a probe or response is lost?
  ✤ Redundant probing

• Temporal and spatial churn in the Web Footprint:
  ✤ Lax Web Footprint: IP addresses for which all control nodes see a response at least once (~96% of Web Footprint)
  ✤ Strict Web Footprint: IP addresses for which all control nodes received a successful response on all days (~50% of Web Footprint)
Challenges in Defining The Web

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At least 1.2% of the Web blocks Tor
AS distribution of Top 5 Tor Blockers (Lax Footprint)

ASN distribution (top 5) of IP addresses that block Tor across exit nodes.
AS distribution of Top 5 Tor Blockers (Strict Footprint)

ASN distribution (top 5) of IP addresses that block Tor across exit nodes.

- Axigy1 (1.91%)
- Axigy2 (1.23%)
- NForce2 (2.55%)
- Voxility1 (1.82%)

Exit Node (% of Strict Footprint that blocks the exit)

ASN distribution (%) of IP addresses that block the exit

- MCCl-AS, IR
- RMH-14-Rackspace, US
- RACKSPACE-Rackspace, US
- DREAMHOS...
- Rackspace Lt...
- KUNET-AS, KR
- REDSTATION...
- SINGLEHOP...
- BBIL-AP BH...
- OCN NTT, JP
- GO-DADDY...
- FBDC FreeBi...
Geo Distribution of Top 5 ASes that do wholesale Tor blocking
Application-layer Discrimination
Does a Website Block Tor?

HTTP GET

HTTP GET

HTTP GET
Does a Website Block Tor?

HTTP GET
200 OK

HTTP GET
Not 200
Does a Website Block Tor?

HTTP GET

Berkeley

HTTP GET

200 OK

Alexa Top 1000

HTTP GET

Not 200

All Tor Exits (~900)
3.67% of Alexa Top 1k block Tor

Sorry, you're not allowed to access this page.

Your IP address is: 46.28.110.136
Please retry your request and contact Yelp if you continue experiencing issues.

This IP has been automatically blocked.
If you have questions, please email: blocks-b145152393

Request denied

Sorry, we are unable to serve your request at this time due to unusual traffic from your network connection.
Please visit our help page and provide the information below for further assistance.

Reason codes:
3.67% of Alexa Top 1k block Tor

• “You don’t have permission to access this website”

• Shows CAPTCHA
LOOK AT ALL THE CAPTCHAS I'VE TO TYPE

WHEN USING TOR
On February 9th, 2016 Anonymous said:
Tor is DEAD!
And Cloudflare KILLED it!
RIP Tor!

#dontblocktor
On February 9th, 2016 Anonymous said:
Tor is DEAD!
And Cloudflare KILLED it!
RIP Tor

On January 24th, 2016 Anonymous said:
Every time I use Tor I want to KILL everyone who works for Cloudflare.

#dontblocktor
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RIP Tor

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On February 9th, 2016 Anonymous said:
What is the point of Tor any more when is seems like the whole web is on Clownflare!?
On February 9th, 2016

Tor is DEAD!
And Cloudflare KILLED it!
RIP Tor!

On January 13th,
Everyone who works for Cloudflare,

What is the point of

When using Tor

The whole web is on Clownflare!?
last night I had a dream that there were two new ways to solve cloudflare captchas: writing sentences w/ emoji & proving P = NP
How many of the ~900 Tor exits are blocked?
~20 of Alexa top 1k websites block > 50% of the exits
~20 of Alexa top 1k websites block > 50% of the exits

~60 of Alexa top 1k websites block < 25% of the exits
Why do exits get blocked?

- Two flavours:
  - Web services use **Tor specific blacklist**
    - **Block all** the Tor exits
  - Web services use **abuse-based blocking**
    - **Block only exits** with high abuse rate
Which exits are likely to have high abuse rate?

- Our hypothesis: high bandwidth and old age
Which exits are likely to have high abuse rate?

- Our hypothesis: high bandwidth and old age
- No statistically significant effect!
  - Except for few …
Which exits are blocked?

Old and high bandwidth

Tor blocked by 4chan.org
Which exits are blocked?

Old and high bandwidth

Tor blocked by change.org
Akamai blocks most exits

Tor blocked by bestbuy.com

Exit probability

Fraction of webpages blocked
Homepage unblocked but blocked activity

- Google homepage was never blocked but searching was blocked from 23-40% of the ~900 exits.

Response to https://www.google.com/#q=hello

Google Sorry...
We're sorry...

... but your computer or network may be sending automated queries. To protect our users, we can't process your request right now.

See Google Help for more information.
Exits that were never blocked

- 42 exits were never blocked
Exits that were never blocked

- 42 exits were never blocked

Uptime of one of the 42 exits
Historical Tor Blocking

• Open Observatory Network Interference (OONI)
  ✤ Studies censorship in different countries
  ✤ Visits website through Tor and without Tor
  ✤ Over 2300 websites visited (Sep’14-Aug’15)

http://explorer.ooni.io
6.8% of 2300 websites blocked Tor
Sites that explicitly block Tor

- Convio: Not Implemented Tor IP not allowed
- ezinearticles.com

It appears that you are using Tor anonymizing software

No Problem! We just need you to enter a Captcha so we can confirm that you are a person and not a bot.
<--- Tor exits (~900) --->

Aug, 2015

yelp.com
fruia.com
my2adolfibe.com.ve
kohls.com
northstrom.com
retailmenot.com
6pm.com
zappos.com
icash.com
ticketmaster.com
airbnb.com
asos.com
craiglist.org
expedia.com
zara.com
www.nike.com
staples.com
bestbuy.com
foxnews.com
avito.ru
barneysandnoble.com
redfin.com
macy.com
buzzill.net
zendesk.com
lapatilla.com
upwork.com
extratorrent.cc
infusionsoft.com
topx.com
agar.io
effagr.org
ptitll.cc
jpreviews.com
rijara.y.com
albarwahnews.com
gamepedia.com
el-trihad.com
elwatannews.com
thepiratebay.la
glassdoor.com
wikiswiki.jp
prntscr.com
change.org
vetogate.com
ashleymadison.com
2ch-2.net
elaosboap.com
ashleymadison.com
sabq.org
meetup.com
thepiratebay.gd
elance.com
thepiratebay.mn
glycat.com
lt.dfcounter.com
nmixx.com
tubecup.com
feedly.com
4chan.org
prppwpa.age
yallakora.com
youn7.com
aliwusryaliyoun.com
cixsense.com
what-character-are-you.com
subscene.com
conservativetribune.com
likes.com
leagueoflegends.com
crunchylol.com
t뼶ppaca.com
hitjcank.com
hctips.com
bomb01.com
elmgauz.com
kimogo.co
urlipoint.com
neobux.com
2ch.net
r10.net
groupon.com
pinterest.com
hilton.com
flickr.com
target.com
wayfair.com
match.com
jumia.com.ng
e-hentaia.org
atme.ru
milanuncios.com
gamespot.com
faukei.com
jcpenny.com
lovers.com
sears.com
dix.com.br
pantip.com
# Functionality Blocking (2017)

<table>
<thead>
<tr>
<th>Websites</th>
<th>Interaction</th>
<th>Discrimination observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-500</td>
<td>Front page</td>
<td>20.03%</td>
</tr>
<tr>
<td>S-243</td>
<td>Front page</td>
<td>17.44%</td>
</tr>
<tr>
<td></td>
<td>Front page + Search</td>
<td>21.33% (+3.89%)</td>
</tr>
<tr>
<td>L-62</td>
<td>Front page</td>
<td>17.08%</td>
</tr>
<tr>
<td></td>
<td>Front page + Login</td>
<td>24.56% (+7.48%)</td>
</tr>
</tbody>
</table>
Why blocking happens?

<table>
<thead>
<tr>
<th>Exit Family</th>
<th># Exits</th>
<th>% Tor Traffic</th>
<th>Email Dates</th>
<th># Complaints</th>
<th>Top Complaint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torervers.net</td>
<td>10–20</td>
<td>7.05%</td>
<td>2010/06–2016/04</td>
<td>2,987,017</td>
<td>DMCA Violation (99.74%)</td>
</tr>
<tr>
<td>apx</td>
<td>3</td>
<td>1.94%</td>
<td>2014/11–2016/05</td>
<td>293</td>
<td>Automated Scan (38.49%)</td>
</tr>
<tr>
<td>TorLand1</td>
<td>1</td>
<td>0.75%</td>
<td>2011/12–2016/10</td>
<td>307</td>
<td>Malicious Traffic (16.99%)</td>
</tr>
<tr>
<td>jahjah</td>
<td>1</td>
<td>0.17%</td>
<td>2016/1–2017/1</td>
<td>75</td>
<td>Unauthorized Login Attempts (34.17%)</td>
</tr>
<tr>
<td>Our exits</td>
<td>10</td>
<td>3.14%</td>
<td>2016/9–2017/2</td>
<td>650</td>
<td>Network Attack (48.68%)</td>
</tr>
</tbody>
</table>
Why blocking happens?

<table>
<thead>
<tr>
<th>Category</th>
<th>Includes</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network abuse</td>
<td>DDoS, botnet, compromised machines</td>
<td>38.03%</td>
</tr>
<tr>
<td>Unauthorized access</td>
<td>Failed login attempts, brute-force attacks, exploits for gaining access</td>
<td>26.45%</td>
</tr>
<tr>
<td>Automated scan</td>
<td>Port scans, vulnerability scans, automated crawling</td>
<td>14.15%</td>
</tr>
<tr>
<td>Spam</td>
<td>Email, comment, and forum spam</td>
<td>9.01%</td>
</tr>
<tr>
<td>Harassment</td>
<td>Threats, obscenity</td>
<td>1.05%</td>
</tr>
<tr>
<td>Other</td>
<td>(unreadable encrypted emails, emails not reporting abuse)</td>
<td>11.31%</td>
</tr>
</tbody>
</table>

Table 3: Categories of the Non-DMCA Email Complaints (Total 8,370 emails)
A lot has changed for the Tor users

- Cloudflare added Tor as a “country”
- Privacy pass
- Cloudflare onions
What about other forms of server-side blocking?
How to measure Regional Blocking?

USA

Some other country
How to measure Regional Blocking?

USA

Successful loads

HTTP GET

Some other country

Unsuccessful loads

HTTP GET

HTTP GET
How to measure Regional Blocking?

- HTTP GET
  - USA: Unsuccessful loads
  - Some other country: Successful loads
How to measure Regional Blocking?

List of unavailable websites → Traceroute → Manual Analysis
Measurement Around the World
Websites that block the African Region

<table>
<thead>
<tr>
<th>URL/Country</th>
<th>BWA</th>
<th>KEN</th>
<th>ZAF</th>
<th>PAK</th>
<th>BGR</th>
<th>UKR</th>
<th>IND</th>
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<td>kirklands.com</td>
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<tr>
<td><a href="http://www.allconnect.com">www.allconnect.com</a></td>
<td>CE</td>
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<td>safeway.com</td>
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<td>cgg.gov.in</td>
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<td>lendingtree.com</td>
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<td>TO</td>
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Websites that block Pakistan

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<td>peapod.com</td>
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<td>northernool.com</td>
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<td>odeon.co.uk</td>
<td>TO</td>
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<td>hud.gov</td>
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<td>tax.virginia.gov</td>
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<td>indianbank.net.in</td>
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</table>
Websites that block the USA

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<thead>
<tr>
<th>URL/Country</th>
<th>USA</th>
<th>IND</th>
<th>GBR</th>
<th>BGR</th>
<th>BWAKEN</th>
<th>ZAF</th>
<th>UKR</th>
<th>PAK</th>
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<tbody>
<tr>
<td>joinpaknavy.gov.pl</td>
<td>TO</td>
<td>TO</td>
<td>CE</td>
<td>TO↑</td>
<td>TO</td>
<td>TO</td>
<td>TO</td>
<td>TO↑</td>
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<tr>
<td>joinpakkarmy.gov.pl</td>
<td>TO</td>
<td>TO</td>
<td>CE↑</td>
<td>TO</td>
<td>TO</td>
<td>TO↑</td>
<td>TO</td>
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<tr>
<td>parfums.ua</td>
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<tr>
<td>24video.sexy</td>
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<tr>
<td>subscene.com</td>
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<td>200</td>
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</tr>
<tr>
<td>jrrj.com.cn</td>
<td>TO</td>
<td>200↑</td>
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</table>
Websites Blocked Due to GDPR

<table>
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<tr>
<th>URL/Country</th>
<th>Before</th>
<th>After</th>
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</thead>
<tbody>
<tr>
<td>bismarcktribune.com</td>
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<td>DE</td>
</tr>
<tr>
<td>collegian.psu.edu</td>
<td>200</td>
<td>403</td>
</tr>
<tr>
<td>dailynebraskan.com</td>
<td>200</td>
<td>403</td>
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<tr>
<td>dailyprogress.com</td>
<td>200</td>
<td>403</td>
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<tr>
<td>fredericknewspost.com</td>
<td>200</td>
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<tr>
<td>fredericksburg.com</td>
<td>200</td>
<td>403</td>
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<tr>
<td>globegazette.com</td>
<td>200</td>
<td>403</td>
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<tr>
<td>greensboro.com</td>
<td>200</td>
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</tr>
<tr>
<td>gwinnettdailypost.com</td>
<td>200</td>
<td>403</td>
</tr>
<tr>
<td>havasunews.com</td>
<td>200</td>
<td>403</td>
</tr>
<tr>
<td>heraldtimesonline.com</td>
<td>200</td>
<td>403</td>
</tr>
<tr>
<td>host.madison.com/wsj</td>
<td>200</td>
<td>403</td>
</tr>
<tr>
<td>journalnow.com</td>
<td>200</td>
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<tr>
<td>journalstar.com</td>
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<tr>
<td>journaltimes.com</td>
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<tr>
<td>lacrossetribune.com</td>
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<tr>
<td>lancasteronline.com</td>
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<tr>
<td>napavalleyregister.com</td>
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<tr>
<td>nwitimes.com</td>
<td>200</td>
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<tr>
<td>omaha.com</td>
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<tr>
<td>pantagraph.com</td>
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<tr>
<td>pilotonline.com</td>
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<tr>
<td>postandcourier.com</td>
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<tr>
<td>postbulletin.com</td>
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<td>403</td>
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<tr>
<td>pressofatlanticcity.com</td>
<td>200</td>
<td>DE</td>
</tr>
</tbody>
</table>
Blocking mechanisms: GEO blocking

JCPenney

We Are Currently Unable to Provide a Shopping Experience for This Country

Please try again later
Blocking mechanisms: GEO blocking
Blocking mechanisms: GEO blocking

This site has been blocked by the network administrator.

Block reason: **Gateway GEO-IP Filter Alert**

IP address: 39.53.47.73

Connection initiated from country: **Pakistan**
Types of GEO blocking

- USA: Cloudflare: country or region blocked (1009), SonicWall Geo-IP filter, Other blockpage mentioning geo-blocking (403), Other blockpage mentioning geo-blocking (200), Unavailable For Legal Reasons
- Scotland: Cloudflare: country or region blocked (1009)
- Ukraine: Cloudflare: country or region blocked (1009), SonicWall Geo-IP filter, Other blockpage mentioning geo-blocking (403), Other blockpage mentioning geo-blocking (200), Unavailable For Legal Reasons
- South Africa: Cloudflare: country or region blocked (1009), SonicWall Geo-IP filter, Other blockpage mentioning geo-blocking (403), Other blockpage mentioning geo-blocking (200), Unavailable For Legal Reasons
- Pakistan: Cloudflare: country or region blocked (1009), SonicWall Geo-IP filter, Other blockpage mentioning geo-blocking (403), Other blockpage mentioning geo-blocking (200), Unavailable For Legal Reasons
Blocking mechanisms: Security

www.lendingtree.com - Access Denied

Error code 16
This request was blocked by the security rules

2018-05-23 09:03:55 UTC
Your IP 39.45.233.157 | Proxy IP 45.60.28.117 (ID 10407)
Incident ID: 407001860088678508-402561825777322917

Powered by Incapsula
Types of Security Based Blocking

- USA
  - Cloudflare: IP Blocked (1006/1007/1008) (403)
  - Cloudflare: Browser Verification (503)
- Scotland
  - Cloudflare: IP Blocked (1006/1007/1008) (200)
  - Cloudflare: Browser Verification (200)
- Ukraine
  - Cloudflare: CAPTCHA Challenge
- South Africa
  - Cloudflare: Browser Verification (200)
- Pakistan
  - OctoNet HTTP filter: VPN / TOR Block
Access Denied

You don't have permission to access "http://www.format.com/" on this server.

Reference #18.97a51002.1533190068.5a7c90
The requested URL was rejected. Please consult with your administrator.

Your support ID is: 5527351751160471927
Blocking mechanisms:
Non-HTTP errors

Timeouts
Connection resets
Connection refused
Blocking mechanisms:
Slow down page loading

Checking your browser before accessing [redacted].

This process is automatic. Your browser will redirect to your requested content shortly.
Please allow up to 5 seconds...

DDoS protection by Cloudflare
Ray ID: 421a43cf50f43e86
Limitations
# Why Blocking Happens: Economic Reason

## Bandwidth & requests

<table>
<thead>
<tr>
<th>Region</th>
<th>North America</th>
<th>Europe</th>
<th>Asia</th>
<th>Australia &amp; New Zealand</th>
<th>Brazil</th>
<th>South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bandwidth (per GB per region)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>First 10 TB</td>
<td>$0.12</td>
<td>$0.12</td>
<td>$0.19</td>
<td>$0.19</td>
<td>$0.28</td>
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<tr>
<td>Next 10 TB</td>
<td>$0.08</td>
<td>$0.08</td>
<td>$0.14</td>
<td>$0.14</td>
<td>$0.24</td>
<td>$0.24</td>
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<tr>
<td><strong>Requests (per 10,000 requests)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>All requests</td>
<td>$0.0075</td>
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<td>$0.0090</td>
<td>$0.0090</td>
<td>$0.0160</td>
<td>$0.0160</td>
</tr>
</tbody>
</table>

We bill our customers a minimum of $50 per month based on the combined total of your bandwidth and request usage.

**Bandwidth** for content delivery and streaming delivery is measured as Gbytes delivered from Fastly caches by region. Fees are calculated at the bandwidth rates. Rate reductions are applied automatically with greater usage.

**HTTP and HTTPS requests** are accumulated in units of 10,000 by region. Fees for content delivery and streaming delivery are calculated at the request rates.
Why Blocking Happens: Security reason

How can I block African (Nigerian) traffic from my site?

I am so fed up with these darn African fraudsters. Not only do they order and try to get stuff shipped to them, but they order using the stolen credit cards real address just to be annoying. I've had up to $5,000 in fraudulent orders in a single day.

Is it possible to block african traffic by IP? What's it called, Geo Targetting or something? What's a good company that offers this?
Why Blocking Happens: Security reason

How to block traffic from other countries in Linux

Preventing site attacks from offending countries

It’s a sad fact that the majority of malicious web traffic to US sites originates from the same handful of foreign countries. If your site doesn’t benefit from actual users living in those countries, you may resolve to block them from accessing your site entirely in order to prevent repeated attacks. Here’s how to blacklist entire countries under Linux using iptables and ipset.
Implications for Censorship measurements

Looked at one year of OONI measurements:

* 479,378 pairs of access from 111 countries in a year
* 1.7% (8111) server-side blocking

* **GEO blocking:**
  * [fordfoundation.org](http://fordfoundation.org) inaccessible from Russia

* **Security based blocking:**
  * [plannedparenthood.org](http://plannedparenthood.org) inaccessible from 29 countries
Thanks!

sadia@icsi.berkeley.edu

internet-freedom-science.org/website-unavailability/