Internet quality in Iran

Analytical report on disruptions, limitations, and Internet speed in Iran

TEHRAN
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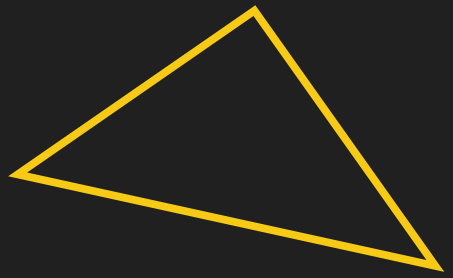
Summury

The Internet is the root of the digital economy. Without a high quality Internet connection, the formation of a digital economy is impossible. The widespread recession and large scale closures of technology companies, migration of technology experts, and transfer of startups to neighboring countries, although for various reasons, certainly one of the main reasons is the problems related to the quality of the Internet. The declining state of the Internet in Iran, in addition to technical problems, has caused widespread despair among technology experts and has destroyed the hope of building a powerful technology ecosystem at a global scale. To better illuminate this issue and for a precise examination of the quality of the Internet, we have divided it into three indices: "disruption", "limitation", and "speed", and have separately examined each.



Internet quality

The quality of the Internet in Iran is in a "crisis" state.
The Internet in Iran is disrupted, limited, and slow.
To put it more precisely, among the 100 countries in the world with the highest Gross Domestic Product, Iran has the second most disrupted Internet after Myanmar, the second most limited Internet after China, and is among the top 5 countries with the slowest Internet globally.(1)

SPEED

"Speed" refers to high bandwidth and low latency in loading a website or Internet content. This index is one of the drivers for the emergence and prevalence of new technologies in the digital economy.

CENSORSHIP

Censorship refers to the filtering of domains and Internet IPs and is one of the main reasons for the inefficiency of the Internet in a geographical area.

DISTRUPTION

Distuption Means the loss of part of the information in an Internet connection. Disruption is the main reason that causes ordinary users, without understanding why, to have a bad experience in using the Internet and generally in online services.

(1)-In the comparison tables, we have tried to compare two important neighboring countries, namely Turkey and the UAE, as well as two Asian countries, Malaysia and South Korea. These countries have had remarkable economic growth in recent years, relying on technology. While half a century ago, Iran had a higher Gross Domestic Product than all four countries, it currently has the weakest economy.

Distruption in Iran's Internet

Verified based on 3 independent sources
(OONI data - Arvan Cloud Radar - Case Studies)

DISTRUPTION Rank in the world

Under the current circumstances, the main problem with the Internet in Iran is its extensive and permanent disruption on almost all IP addresses and websites worldwide. In fact, instead of a blacklist being specified for unauthorized websites, websites and IP addresses have been divided into 3 categories:

1- Domains and IPs that are filtered - Blacklist
2- Domains and IPs that are selectively allowed - Whitelist
3- Other domains and IPs, which cover almost all of the Internet and are subject to deliberate disruption - Greylist

Our investigations into the domains and IPs on the greylist, which constitutes the majority of the Internet, show that government equipment intentionally causes disruption, leading to about 50% of the data sent to these destinations encountering problems. This is the main reason for the noticeable and strong dissatisfaction of users these days in using the Internet.

Rank in the world		Anomaly (10% - 50% fail)		Filter (> 50% fail)		Normal (< 10% fail)	
		count	%	count	%	count	%
	Czechia	0	1%	1	1%	99	99%
	⋮						
	Turkey	1	1%	5	5%	94	94%
	South Korea	2	2%	0	0%	98	98%
	Malaysia	2	2%	0	0%	98	98%
	⋮						
	UAE	7	10%	6	9%	55	81%
	⋮						
	Pakistan	12	12%	0	0%	88	88%
99	Iran	14	14%	45	45%	41	41%
	Myanmar	15	15%	1	1%	84	84%

To compare Iran with other countries and broaden our tests, we analyzed disruptions on 100 selected domains in 100 different countries based on data from OONI(1). We focused on websites that showed more than a 10% disruption over a month. The result revealed that Iran, following Myanmar, demonstrated the highest level of disruptions. In Iran, in addition to 45 websites that were inaccessible in at least 50% of instances, 14 websites showed disruption between 10% to 50%.
In order to increase our sample size, we had to reduce the number of countries(2). Eventually, we managed to assess 300 websites in the top 50 countries worldwide in terms of GDP. Yet again, Iran led the chart with 100/300 (33.3%) websites experiencing filtering and 54/300 (18%) showing disruptions.

The main reason for these disruptions is the implementation of a new and flawed "intelligent filtering" policy by the Ministry of Communications (Communications Infrastructure Company - Supervision Committee). This policy has caused widespread disruptions and limitations for most websites and IP addresses worldwide. In fact, currently, any type of Internet traffic, unless specifically whitelisted by authorized entities, automatically faces disruptions.

(1)-We extracted and examined the top 100 countries based on GDP as announced by the World Bank.
However, the OONI system did not provide sufficient information for certain countries such as Angola (69), Panama (75), Congo (88), and Turkmenistan (93). Additionally, the number of erroneous measurements was lower in Cuba and the United Arab Emirates compared to other countries.
(2)-Considering our expectation of having the list of websites examined in at least 80% of the countries, we modified the list to include the top 50 countries based on GDP ranking.

Distruption in Iran's Internet

It has been tested based on four independent sources, including OONI data, Freedom House report, Similar Web data, and Surfshark data

CENSORSHIP Rank in the world

In the conducted study among the top 100 websites globally (selected based on SimilarWeb rankings), over 33% of them are inaccessible (filtered) in Iran. This percentage remains the same for the top 200 websites as well. The investigation, based on OONI data, sampled 100 and 300 different websites among 100 different countries worldwide. Iran, with 50% of filtered websites, has the most restricted internet access, following China with 45% of websites filtered. Egypt, Russia, and Oman rank third to fifth, respectively, in terms of having the most limited Internet access globally. Although pornographic websites such as xvi***.com and por***.com are publicly filtered in South Korea, Turkey, and Malaysia, the extensive filtering, arbitrary blocking, and numerous filtered websites without legal grounds have led to widespread restrictions on the Internet in Iran. Iran, China, and Turkmenistan are the only countries among the top 100 countries globally where each of the six most used social networks is blocked. The expansion of these restrictions has reached a point where using the Internet without a VPN has become practically impossible. According to a monthly report by Peivast.com, 96% of Iranian users rely on VPNs on a daily basis.

Social media Censorship

Iran	✗	✗	✗	✗	✗	✗
UAE[1]	✓	✓	✓	✓	✗	✗
Turkye	✓	✓	✓	✓	✓	✓
Malaysia	✓	✓	✓	✓	✓	✓
South Korea	✓	✓	✓	✓	✓	✓

Rank in the world		Filter (C %)	
	South Korea	0	0 %
	Malaysia	0	0 %
⋮			
	Turkye	5	5 %
	UAE	6	9 %
⋮			
	Egypt	22	22 %
99	Iran	45	45 %
	China	50	50 %

The main reason for this issue is the policies pursued by the country's authorities and the decentralized decisions made by:
1- Judicial authorities and the judiciary system. 2- The Commission for Determining the Instances of Criminal Content.
3- The Supreme National Security Council, the National Security Council, and ultimately,
4- Non-transparent decisions made by some security institutions.

1-In the United Arab Emirates, voice and video calls on Telegram and WhatsApp are restricted, and their public use is limited without restrictions.

Speed in Iran's Internet

Tested based on four independent sources, including data from cloudflare,
data from meter.net, and data from two Iranian FCPs (Fixed Communication Providers)

SPEED Rank in the world

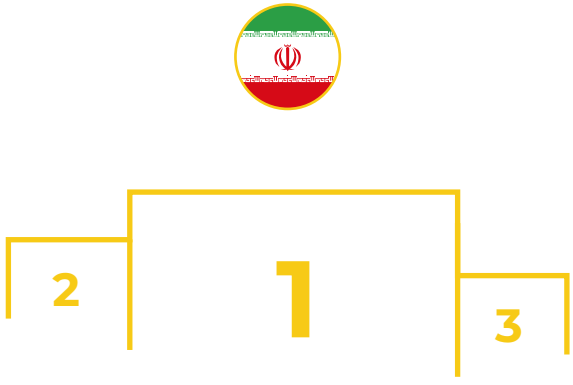
Based on the information from cloudflare radar data and corroborating with the meter.net platform, the average Internet speed in Iran is 4 Mbps with an average latency of 145 ms. In terms of speed, Iran ranks 97 out of 100 countries worldwide, and in terms of latency, it ranks 96 out of 100. In this ranking, only Sudan (3.4 Mbps), Cameroon (3 Mbps), and Cuba (2.3 Mbps) have worse speed performance than Iran.

A look at Iran's neighboring countries in Asia reveals a correlation between economic growth and growth in digital technology indicators, including quality and speed of Internet. The average speed in Turkey is 12 Mbps, Malaysia is 22 Mbps, the United Arab Emirates is 26 Mbps, and South Korea is 60 Mbps.

Rank in the world

rank	Country	50% Avg (Mbps)
1	Singapore	67.4
2	Korea	60.3
3	Hong Kong	47.6
4	Sweden	41.1
5	Switzerland	40.3
⋮		
26	UAE	26.7
39	Malaysia	22.7
54	Turkey	12.6
⋮		
96	Ghana	4.2
97	Iran	4.1
98	Sudan	3.4
99	Cameroon	3.0
100	Cuba	2.3

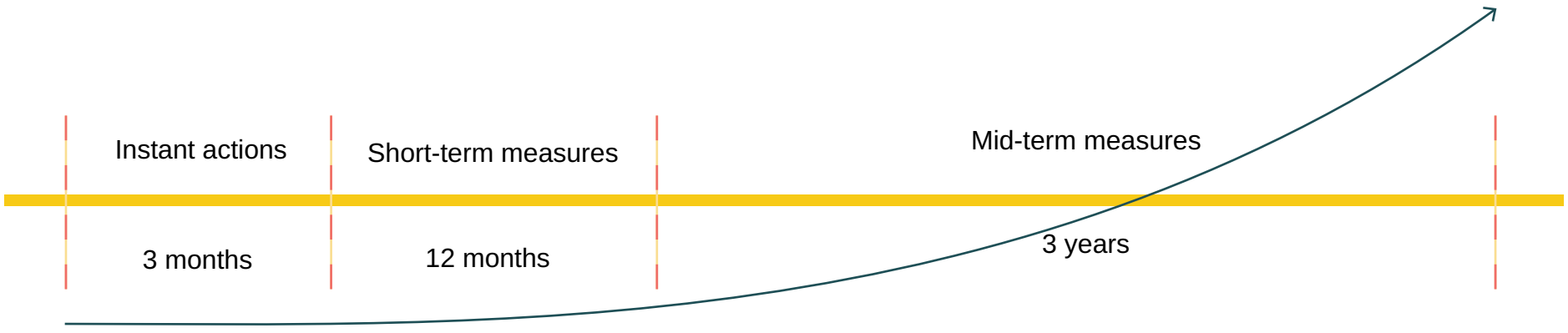
The main reasons for the low Internet speed in Iran include the poor and inefficient performance of the Iranian Telecommunication Company in the Access layer, reduced investment in telecommunication infrastructure by the "Telecommunications Infrastructure Company", slow development in 5G and fiber optic technologies, and ultimately, the poor and inefficient performance of the infrastructure communication company in the Core layer. However, it should be noted that without any changes in the Access layer and communications, and only by making improvements in the Core layer, Internet speed in Iran can be increased up to 8 times in mobile Internet and up to 3 times in fixed Internet.



The world's lowest quality Internet is in Iran!

Overall, with two runner-up positions, one honorable diploma, and a score of -294, Iran should be considered the champion of low-quality Internet in the world.

Even among Myanmar, with the highest Internet disruptions, only 1% of websites are filtered, and the average Internet speed in Myanmar is 8.8 Mbps, which is twice as fast as Iran. The average latency in Myanmar is 69 ms, significantly lower than Iran.



Requests and practical solutions to improve the quality of the Internet

In the report, we have taken steps to shed light on a crisis and make efforts to address the problem, which is an important part of the solution. This is the path we have taken in this report. In future reports, which will be publicly released, we aim to provide our practical and proposed solutions in detail and step-by-step, making them available to policymakers, government officials, and the public. In short, we have classified ten requested solutions into three categories: immediate, short-term, and medium-term actions for the private sector.

Instant actions 1 to 3 months

- Preventing Internet disruptions under the pretext of combating circumvention tools
- Transparent and comprehensive report from the Ministry of Communications regarding international gateways and the restoration of online monitoring systems, including Tehran-IX
- Permanent prohibition of government agencies from implementing "Iran Access" policies. (Blocking access from out of the country)

Short-term measures 3 to 12 months

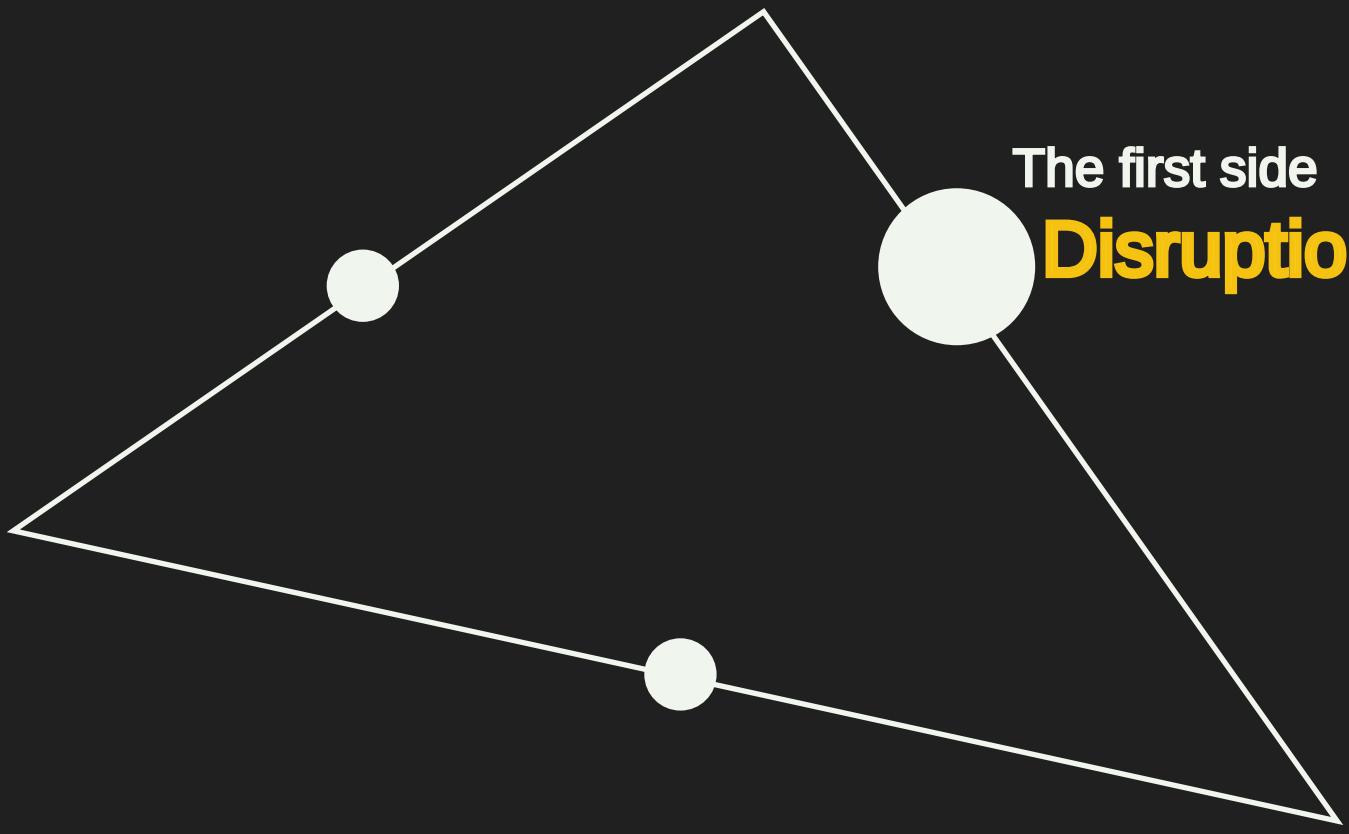
- Removing filters on public websites that are essential to the people and improving the Internet freedom index in Iran.
- Increasing international bandwidth and transparent reporting of it to the public.
- Establishing transparency systems regarding filtering policies, allowing for inquiries, complaints, and follow-ups on the removal of IP addresses and domains from the filter. (black list)

Mid-term measures 12 to 36 months

- Removing the monopoly of the Telecommunications Infrastructure Company and granting import licenses for Internet by the private sector. (International transit license)
- Investing in the expansion of fiber optics and the development of fixed communications.
- Investing in the expansion of 5G communications.
- Creating mutual international interests and establishing sustainable relationships with international technology companies, with maximum participation from the private sector.

Detailed description of the report

D I S T R U P T I O N



The first side

Disruption in Iran's Internet

The first side
Disruption in Iran's Internet

In the current circumstances, the main problem with the Internet in Iran is widespread and persistent disruptions that affect almost all IPs and websites worldwide. Instead of having a predefined blacklist for unauthorized websites, websites and IP addresses are divided into three categories:

1- Filtered domains and IP addresses - Blacklist
2- Domains and IP addresses that have been individually authorized - Whitelist
3- Other domains and IP addresses that cover almost the entire Internet and face intentional disruptions - Greylist

While we strive to provide a clear picture of the current state of the Internet in Iran without diving into its historical context in this report, it is essential to remind that the current conditions of quality and persistent disruptions in Iran have gradually emerged over the past two years due to new filtering policies implemented in the country.

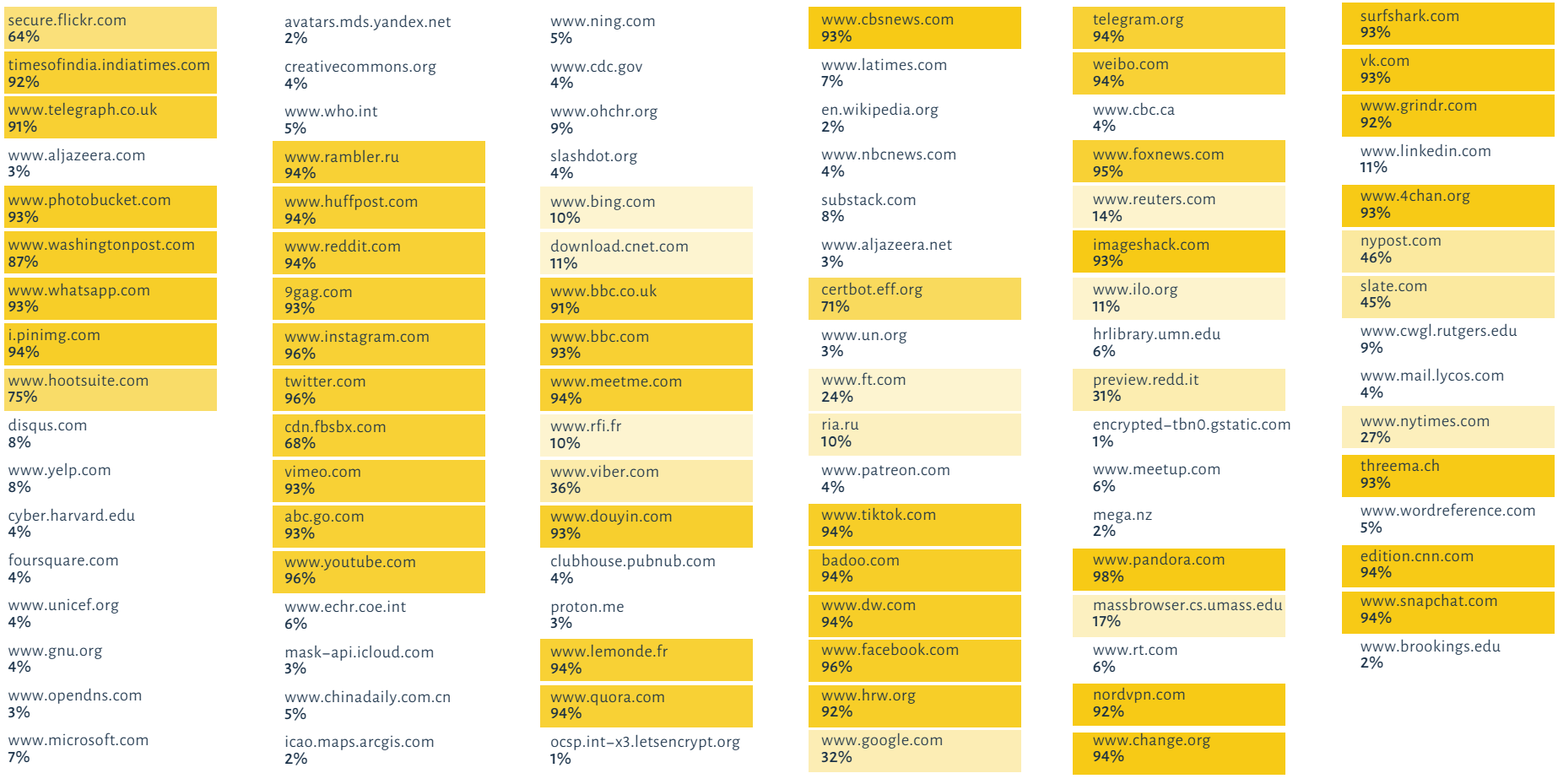
Initial review

In the initial investigation, we referred to the data from the website https://ooni.org. This website operates to detect anomalies and censorship worldwide. We extracted the raw data from this website for the past month (from 2023/06/09 to 2023/07/09) and conducted an initial evaluation. During this period, 5 million tests were performed by probes in 165 countries. Among the top 100 countries in terms of GDP, we had sufficient information for comparison in 96 countries. We considered websites that were among the top 3,000 websites (1) globally based on Tranco data and had been examined in at least 80% of these countries. We compared the countries with each other.

We considered any website that had a failure rate between 10% and 50% of the total requests as an anomaly, and cases where the failure rate exceeded 50% as filtered.

(1)https://tranco-list.eu

	Country	Anomaly Count	%	Filter Count	%	Normal Count	%	Total Count	Total%
	Czechia	0	0%	1	1%	99	99%	100	100%
	...								
	TURKIYE	1	1%	5	5%	94	94%	100	100%
	KOREA	2	2%	0	0%	98	94%	100	100%
	MALAYSIA	2	2%	0	0%	98	98%	100	
	...								100%
	CAMEROON	5	5%	1	1%	94	94%	100	100%
	BELARUS	5	6%	4	5%	72	89%	81	100%
	EGYPT	6	6%	22	22%	72	72%	100	100%
	BANGLADESH	6	6%	2	2%	92	92%	100	100%
	INDONESIA	6	6%	4	4%	90	90%	100	100%
	UAE	7	10%	6	9%	55	81%	68	100%
	ESTONIA	7	7%	1	1%	92	92%	100	100%
	NIGERIA	7	8%	1	1%	79	91%	87	100%
	PAKISTAN	12	12%		0%	88	88%	100	100%
99	IRAN	14	14%	45	45%	41	41%	100	100%
	MYANMAR	15	15%	1	1%	84	84%	100	100%



Among the websites that have experienced anomalies in Iran, notable websites include Binance, Google, Reuters, LinkedIn, The New York Times, iCloud, SourceForge, Cnet, GitLab, Reddit, and Let's Encrypt.

To ensure the reliability of our investigation, we increased the evaluated sample of websites to 300. In order to have a fair comparison and examine websites that have been evaluated in at least 80% of these countries, we narrowed down the list of countries to the top 50 countries in the world based on GDP. Iran still ranks first among the most censored countries. If we arrange the table based on the "total anomalies and restrictions" from the least to the highest, we will arrive at the following table:

#	Country	Anomaly Count	%	Filter Count	%	Normal Count	%	Total Count	Total%
1	United States	2	0.67%	2	0.00%	298	99.33%	300	100.00%
2	Czechia		0.00%	1	0.67%	298	99.33%	300	100.00%
3	Brazil	2	0.67%		0.33%	297	99.00%	300	100.00%
4	Canada	4	1.33%		0.00%	296	98.67%	300	100.00%
5	Mexico	4	1.33%		0.00%	296	98.67%	300	100.00%
45	Russian Federation	4	1.33%	41	13.67%	255	85.00%	300	100.00%
46	UAE	7	9.33%	6	8.00%	62	82.67%	75	100.00%
47	Cuba		0.00%	3	18.75%	13	81.25%	16[1]	100.00%
48	Egypt, Arab Rep.	19	6.33%	62	20.67%	219	73.00%	300	100.00%
49	China	23	7.67%	125	41.67%	152	50.67%	300	100.00%
50	Iran, Islamic Rep.	54	18.00%	100	33.33%	146	48.67%	300	100.00%

1. Among the 50 countries examined, the samples of three countries Cuba (16), UAE (75) and Nigeria (145) were less than 200 cases.

? Do internal sources also confirm the existence of this volume of widespread disturbances?

In addition to the data obtained from OONI, ArvanCloud's radar information also indicated widespread disturbances in recent months, particularly on the Bing website. Case studies in various data centers also confirmed these widespread disturbances. We will continue to examine these disturbances and their reasons in detail.

Hypothesis

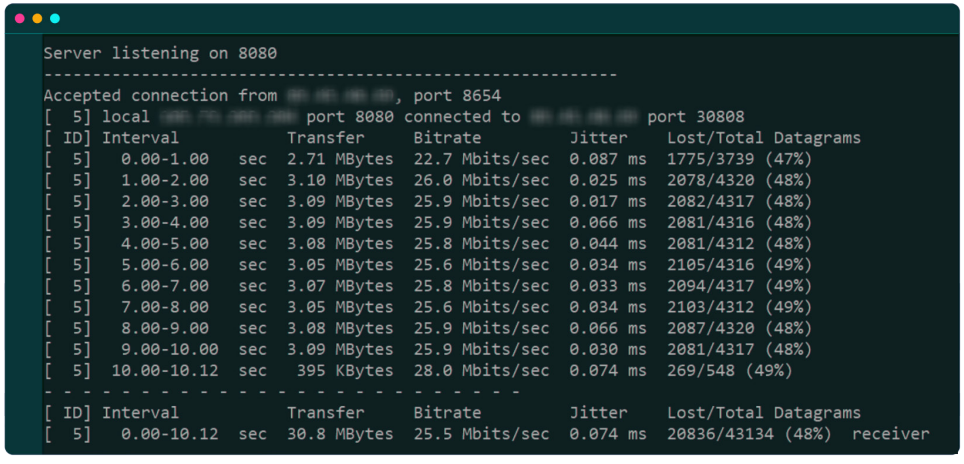
It appears that there are deliberate disturbances on all IPs and communications in the country's network under the pretext of combating VPNs. Some websites, due to public sentiment sensitivities, and others for business reasons, are whitelisted, and disturbances are deliberately imposed on all other websites and IPs.

Hypothesis Investigation Using MCI (Hamrah-e Aval)

In a simple test(1) using the iperf3 tool(2), we established a connection between one node as a server in Turkey and another node as a client in the Hamrah-e Aval data center. For this investigation, we used a clean IP for the server in Turkey, meaning this IP was unfiltered and hadn't been used in the past year. We even used a different IP to connect to the server(3).We initially conducted the test with a 50Mbits/sec bitrate and UDP protocol. The upload speed on Hamrah-e Aval was 50mbps, and the download speed in Turkey was 25Mbps. It is clear that more than 50% of the traffic was lost on the route from Iran to Turkey!

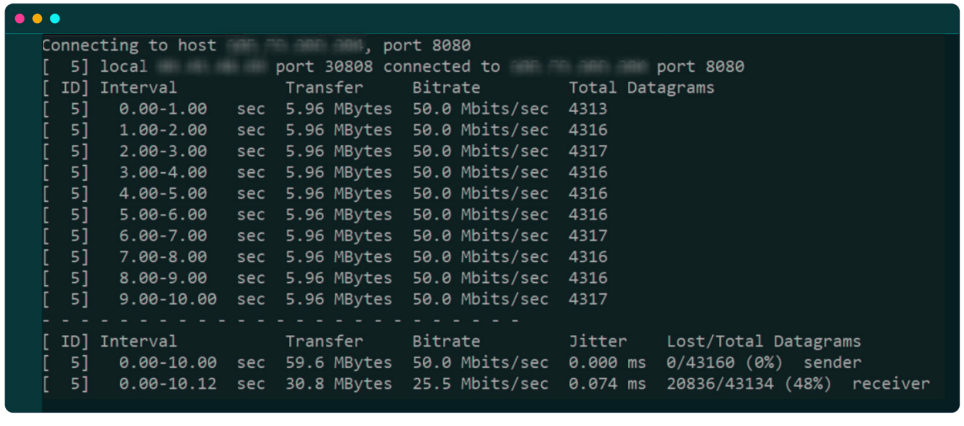
(1)-In the tests performed for this report, using the objdump tool, the evaluated traffic has been carefully examined and stored at the network layer to ensure further analysis of the obtained results.
(2)-https://github.com/esnet/iperf.
(3)-Traffic related to SSH and management protocols were routed through a different IP range.

```
$ iperf3 -c x.x.x.x -p 80808 -y -b 50m
```



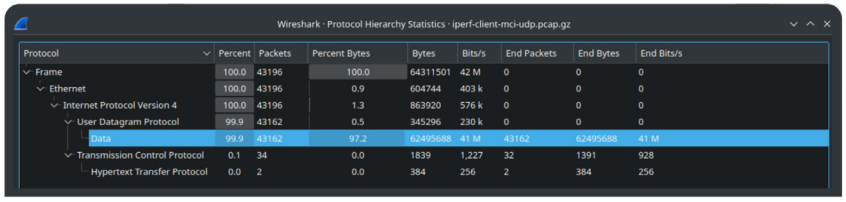
```
Server listening on 8080
-----------------------------------------------------------
Accepted connection from [redacted], port 8654
[  5] local [redacted] port 8080 connected to [redacted] port 30808
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-1.00   sec  2.71 MBytes  22.7 Mbits/sec  0.087 ms  1775/3739 (47%)
[  5]   1.00-2.00   sec  3.10 MBytes  26.0 Mbits/sec  0.025 ms  2078/4320 (48%)
[  5]   2.00-3.00   sec  3.09 MBytes  25.9 Mbits/sec  0.017 ms  2082/4317 (48%)
[  5]   3.00-4.00   sec  3.09 MBytes  25.9 Mbits/sec  0.066 ms  2081/4316 (48%)
[  5]   4.00-5.00   sec  3.08 MBytes  25.8 Mbits/sec  0.044 ms  2081/4312 (48%)
[  5]   5.00-6.00   sec  3.05 MBytes  25.6 Mbits/sec  0.034 ms  2105/4316 (49%)
[  5]   6.00-7.00   sec  3.07 MBytes  25.8 Mbits/sec  0.033 ms  2094/4317 (49%)
[  5]   7.00-8.00   sec  3.05 MBytes  25.6 Mbits/sec  0.034 ms  2103/4312 (49%)
[  5]   8.00-9.00   sec  3.08 MBytes  25.9 Mbits/sec  0.066 ms  2087/4320 (48%)
[  5]   9.00-10.00  sec  3.09 MBytes  25.9 Mbits/sec  0.030 ms  2081/4317 (48%)
[  5]  10.00-10.12  sec   395 KBytes  28.0 Mbits/sec  0.074 ms  269/548 (49%)
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-10.12  sec  30.8 MBytes  25.5 Mbits/sec  0.074 ms  20836/43134 (48%)  receiver
```

The client has sent data at a bitrate of 50 megabits per second.

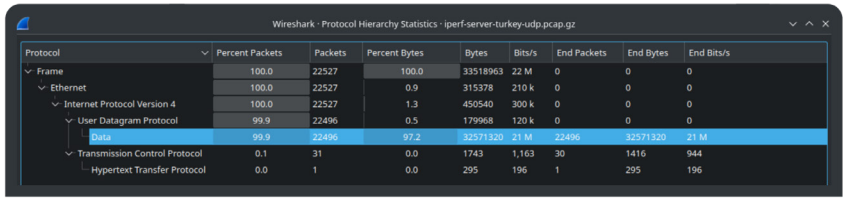


```
Connecting to host [redacted], port 8080
[  5] local [redacted] port 30808 connected to [redacted] port 8080
[ ID] Interval           Transfer     Bitrate         Total Datagrams
[  5]   0.00-1.00   sec  5.96 MBytes  50.0 Mbits/sec  4313
[  5]   1.00-2.00   sec  5.96 MBytes  50.0 Mbits/sec  4316
[  5]   2.00-3.00   sec  5.96 MBytes  50.0 Mbits/sec  4317
[  5]   3.00-4.00   sec  5.96 MBytes  50.0 Mbits/sec  4316
[  5]   4.00-5.00   sec  5.96 MBytes  50.0 Mbits/sec  4316
[  5]   5.00-6.00   sec  5.96 MBytes  50.0 Mbits/sec  4316
[  5]   6.00-7.00   sec  5.96 MBytes  50.0 Mbits/sec  4317
[  5]   7.00-8.00   sec  5.96 MBytes  50.0 Mbits/sec  4316
[  5]   8.00-9.00   sec  5.96 MBytes  50.0 Mbits/sec  4316
[  5]   9.00-10.00  sec  5.96 MBytes  50.0 Mbits/sec  4317
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-10.00  sec  59.6 MBytes  50.0 Mbits/sec  0.000 ms  0/43160 (0%)  sender
[  5]   0.00-10.12  sec  30.8 MBytes  25.5 Mbits/sec  0.074 ms  20836/43134 (48%)  receiver
```

The server has received data at a bitrate of approximately 25 megabits per second.

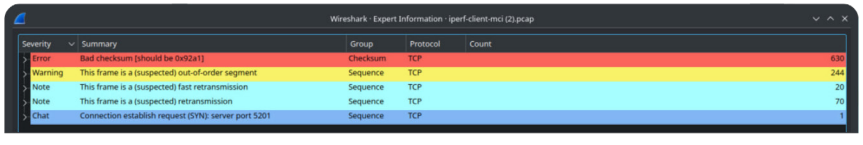


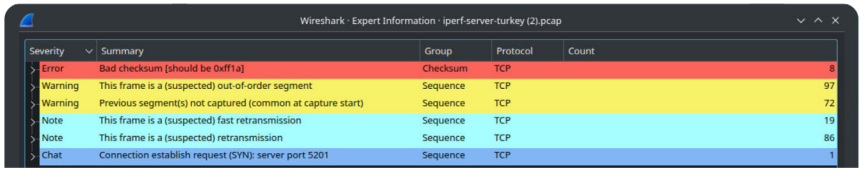
Analysis of the pcap file on the Hamrah-e Aval node, which sent 62,495,688 bytes of data.



The analysis of the pcap file on the server node in Turkey, which received 32,571,320 bytes of data. That's half of the sent bytes!

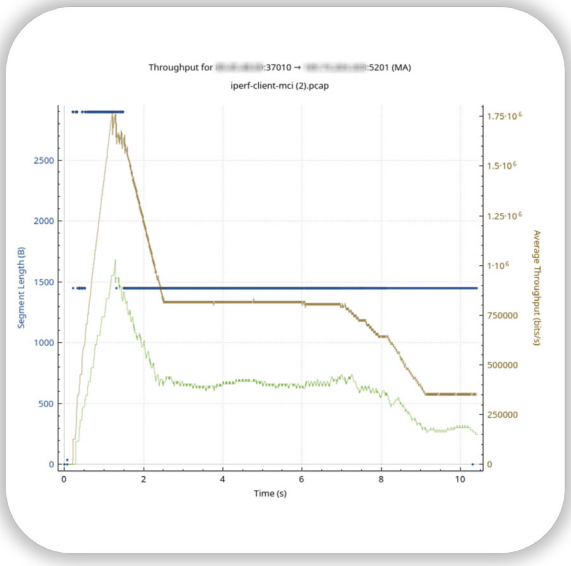
This test was repeated through Hamrah-e Aval's Data - LTE Internet and also via an Android client, and similar results were obtained.
We also examined the test with various destinations in other countries in Europe, America, and Asia, and obtained similar results.
In the next step, we repeated the test via the TCP protocol. Similar results were obtained, with the difference that in the TCP protocol, due to its structure, the TCP Retransmission process is used for retransmitting packets.
Upon examining the pcap data recorded by the server and client, we come to the following conclusions:



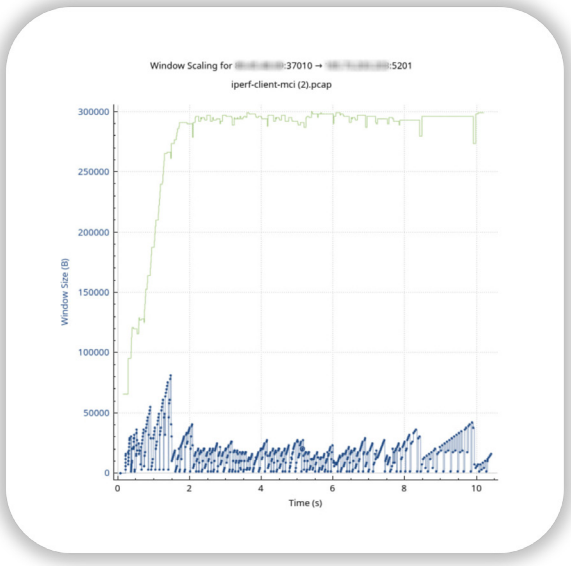


Statistical view of two servers

As a result of this event, with the activation of the Congestion Control mechanism, significant interruptions in traffic transmission occur. In fact, if a user wants to upload a file, even if successful after several attempts, they have to pay more than twice as much to their operator and spend several times the amount of time to complete the task.



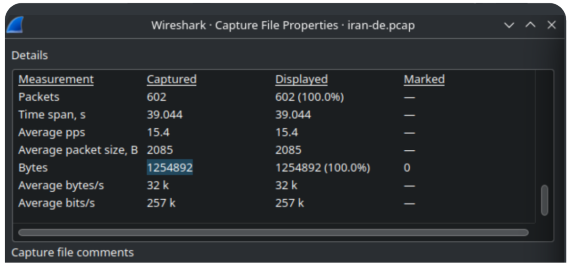
Graph of data sent (yellow) and data sent received by the server (green)

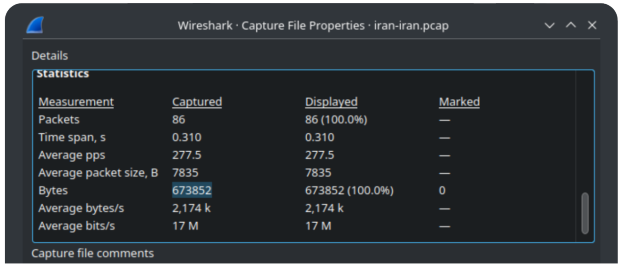


The graph of output bytes (blue) against time.

As it is clear in the picture above, similar to the UDP protocol, there is also a 50% disruption on TCP.

The financial impact of this disruption to end user





(Right) Iran to Iran (Left) Iran to Germany - the result of one of the tests where the bytes have increased by 1.8.

The presence of these disruptions causes the bytes (traffic) exchanged with servers outside the country to double on average due to numerous retransmissions. This issue, being the main factor behind the extraordinarily low quality of the internet in the country, directly affects the Internet consumer as well. For example, at the time of writing this article, a one-month 7-gigabyte mobile Internet package from Hamrah-e-Avval costs 28,200 Tomans(1). However, to consume 7 gigs in a month, the user is forced to purchase this package twice, meaning they will have to spend double, which is 56,400 Tomans.

If transparent information about international gateways were published, we could precisely say that the people of Iran are paying thousands of billions of Tomans monthly for a penalty they didn't commit and are enduring disruptions that have been illegally imposed on them.

(1)-https://mci.ir/internet-plans

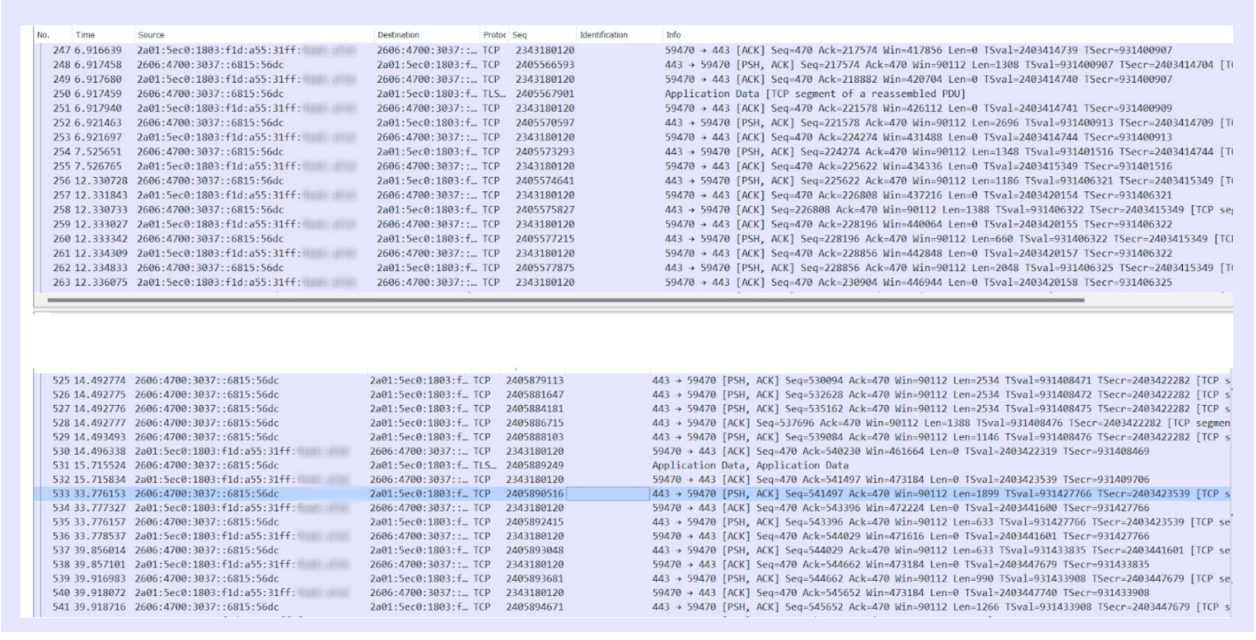
Testing the Hypothesis on IranCell's Internet

The Internet in Iran is monopolized by the Infrastructure Communications Company. The assumption is that the filtering equipment is also installed within the network of this company. However, as specified in the resolution number 4 of the 313th meeting of the Regulatory Authority(1) on the date 1399/11/12, Internet operators are allowed to invest, purchase filtering equipment, and install it within their own network to benefit from a 10% to 15% discount on Internet bandwidth purchases. Both Hamrah Avval and IranCell, by installing these devices within their own network, have intensified disruptions and inflicted damage on the domestic network and inter-operator traffic.

Hamrah Avval uses the filtering equipment of Yafatar Company, and IranCell uses the filtering equipment of the Doran Company. Therefore, the behavior of these companies and their policies are different from each other.

In the IranCell network, it is even impossible to run tests using iperf or iperf3, as packets are completely filtered in the inbound-to-outbound route. Also, the use of the SSH protocol in IranCell is practically impossible due to its extreme latency.

(1)-https://tic.ir/Content/media/image/2021/02/56230_orig.pdf

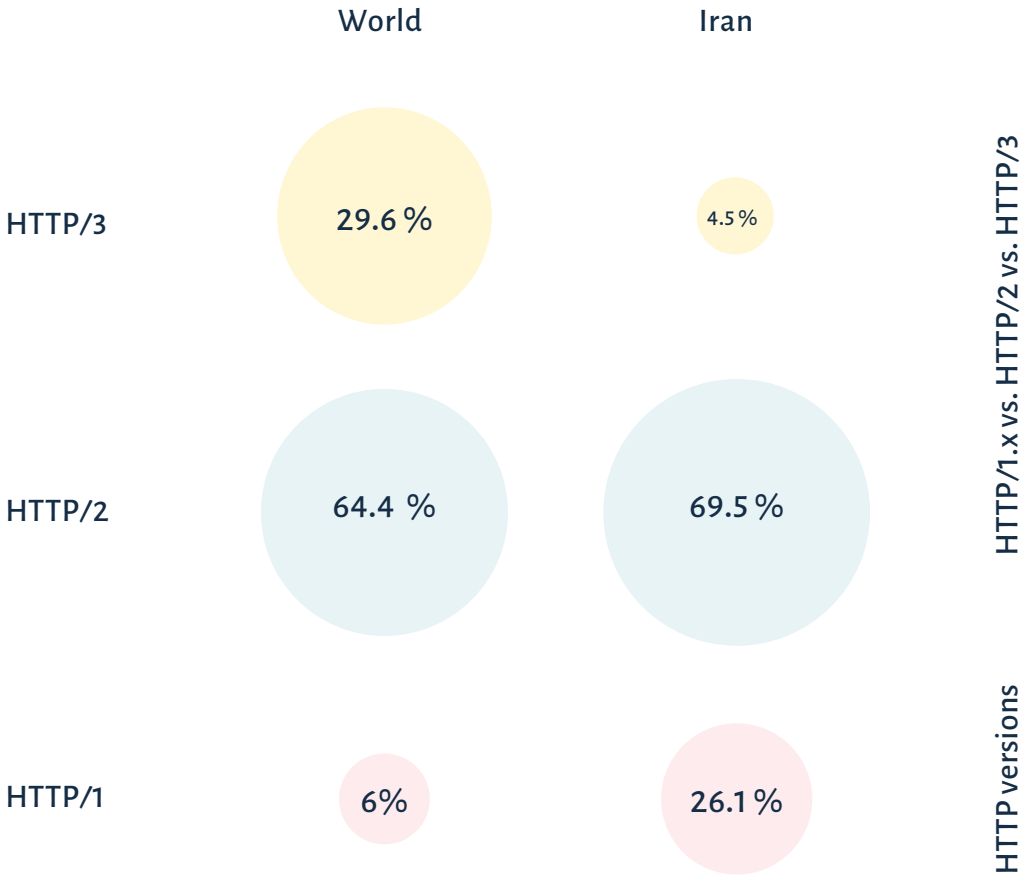


No.	Time	Source	Destination	Protoc	Seq	Identification	Info
247	6.916639	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=217574 Win=417856 Len=0 TSval=2403414739 TSecr=931400907
248	6.917458	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405566593		443 → 59470 [PSH, ACK] Seq=217574 Ack=470 Win=90112 Len=1308 TSval=931400907 TSecr=2403414704 [T
249	6.917680	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=218882 Win=420704 Len=0 TSval=2403414740 TSecr=931400907
250	6.917459	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TLS…	2405567901		Application Data [TCP segment of a reassembled PDU]
251	6.917940	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=221578 Win=426112 Len=0 TSval=2403414741 TSecr=931400909
252	6.921463	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405570597		443 → 59470 [PSH, ACK] Seq=221578 Ack=470 Win=90112 Len=2696 TSval=931400913 TSecr=2403414709 [T
253	6.921697	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=224274 Win=431488 Len=0 TSval=2403414744 TSecr=931400913
254	7.525651	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405573293		443 → 59470 [PSH, ACK] Seq=224274 Ack=470 Win=90112 Len=1348 TSval=931401516 TSecr=2403414744 [T
255	7.526765	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=225622 Win=434336 Len=0 TSval=2403415349 TSecr=931401516
256	12.330728	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405574641		443 → 59470 [PSH, ACK] Seq=225622 Ack=470 Win=90112 Len=1186 TSval=931406321 TSecr=2403415349 [T
257	12.331843	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=226808 Win=437216 Len=0 TSval=2403420154 TSecr=931406321
258	12.330733	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405575827		443 → 59470 [ACK] Seq=226808 Ack=470 Win=90112 Len=1388 TSval=931406322 TSecr=2403415349 [TCP se
259	12.333027	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=228196 Win=440064 Len=0 TSval=2403420155 TSecr=931406322
260	12.333342	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405577215		443 → 59470 [PSH, ACK] Seq=228196 Ack=470 Win=90112 Len=660 TSval=931406322 TSecr=2403415349 [TC
261	12.334309	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=228856 Win=442848 Len=0 TSval=2403420157 TSecr=931406322
262	12.334833	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405577875		443 → 59470 [PSH, ACK] Seq=228856 Ack=470 Win=90112 Len=2048 TSval=931406325 TSecr=2403415349 [T
263	12.336075	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=230904 Win=446944 Len=0 TSval=2403420158 TSecr=931406325
525	14.492774	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405879113		443 → 59470 [PSH, ACK] Seq=530094 Ack=470 Win=90112 Len=2534 TSval=931408471 TSecr=2403422282 [TCP s
526	14.492775	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405881647		443 → 59470 [PSH, ACK] Seq=532628 Ack=470 Win=90112 Len=2534 TSval=931408472 TSecr=2403422282 [TCP s
527	14.492776	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405884181		443 → 59470 [PSH, ACK] Seq=535162 Ack=470 Win=90112 Len=2534 TSval=931408475 TSecr=2403422282 [TCP s
528	14.492777	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405886715		443 → 59470 [ACK] Seq=537696 Ack=470 Win=90112 Len=1388 TSval=931408476 TSecr=2403422282 [TCP segmen
529	14.493493	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405888103		443 → 59470 [PSH, ACK] Seq=539084 Ack=470 Win=90112 Len=1146 TSval=931408476 TSecr=2403422282 [TCP s
530	14.496338	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=540230 Win=461664 Len=0 TSval=2403422319 TSecr=931408469
531	15.715524	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TLS…	2405889249		Application Data, Application Data
532	15.715834	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=541497 Win=473184 Len=0 TSval=2403423539 TSecr=931409706
533	33.776153	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405890516		443 → 59470 [PSH, ACK] Seq=541497 Ack=470 Win=90112 Len=1899 TSval=931427766 TSecr=2403423539 [TCP s
534	33.777327	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=543396 Win=472224 Len=0 TSval=2403441600 TSecr=931427766
535	33.776157	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405892415		443 → 59470 [PSH, ACK] Seq=543396 Ack=470 Win=90112 Len=633 TSval=931427766 TSecr=2403423539 [TCP se
536	33.778537	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=544029 Win=471616 Len=0 TSval=2403441601 TSecr=931427766
537	39.856014	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405893048		443 → 59470 [PSH, ACK] Seq=544029 Ack=470 Win=90112 Len=633 TSval=931433835 TSecr=2403441601 [TCP se
538	39.857101	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=544662 Win=473184 Len=0 TSval=2403447679 TSecr=931433835
539	39.916983	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405893681		443 → 59470 [PSH, ACK] Seq=544662 Ack=470 Win=90112 Len=990 TSval=931433908 TSecr=2403447679 [TCP se
540	39.918072	2a01:5ec0:1803:f1d:a55:31ff:	2606:4700:3037::…	TCP	2343180120		59470 → 443 [ACK] Seq=470 Ack=545652 Win=473184 Len=0 TSval=2403447740 TSecr=931433908
541	39.918716	2606:4700:3037::6815:56dc	2a01:5ec0:1803:f…	TCP	2405894671		443 → 59470 [PSH, ACK] Seq=545652 Ack=470 Win=90112 Len=1266 TSval=931433908 TSecr=2403447679 [TCP s

Generally, the disruptions in IranCell occur as intermittent connection losses at short frequencies. This type of disruption manifests itself in protocols such as HTTP as download freezes, in SSH as command transmission delays, and in multimedia as data stream interruptions (for example, audio and video skipping during a call).
In the image below, a few seconds of disconnection in the IranCell network can be observed during the performed test. From second 7 to 12.3, no data reaches the Iranian user, then the download continues, and again from second 15.7 to 33.7, everything stops. This periodic interruption in connectivity could impact various applications that rely on a stable Internet connection, including video conferencing, streaming, online gaming, and even some cloud-based software. It would be particularly disruptive for real-time activities that can't tolerate delays, like live video or audio.

The world is moving forward, we are moving backward

The HTTP/2 protocol solves the Head of Line blocking issue at the Application layer, allowing multiple HTTP requests (streams) to be sent simultaneously over a single connection. HTTP/2 uses the TCP protocol; therefore, the Head of Line blocking problem still exists in the transport layer. Meaning, if the network quality is low and we experience packet loss, due to the guaranteed order of packet arrival by the TCP protocol, even packets that were sent earlier must wait for the retransmission of lost packets.
HTTP/3 protocol uses QUIC instead of TCP (which is designed over the UDP protocol) and completely solves this problem. So if a request (stream) experiences packet loss, it won't cause the other requests to wait. In theory, the existence of such a protocol could be very helpful on the Iranian network. However, in Iran, due to a 50% disruption except for the DNS protocol, the use of the UDP protocol faces significant difficulty and disruption. Therefore, the use of the HTTP/3 protocol by Iranian users is very low.

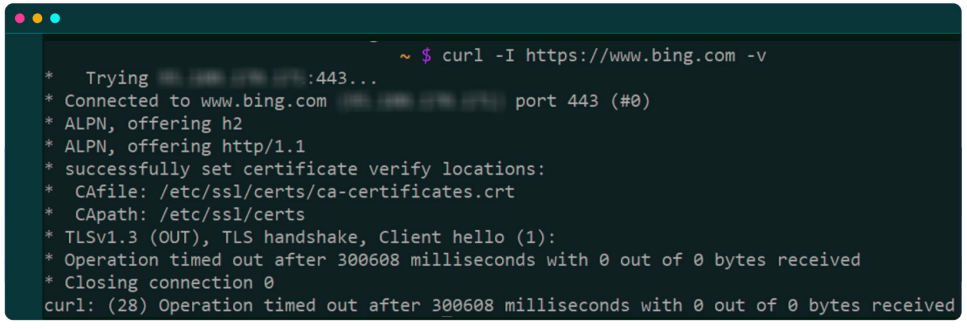


In conclusion, due to various restrictions, we can't fully utilize the benefits of HTTP 2 and HTTP 3 not only in Iran but also around the world. In fact, real-world tests show that HTTP 1.1, due to its use of more TCP Connections, performs better in Iran! To put it more accurately, the HTTP 2 and HTTP 3 protocols, instead of increasing performance in Iran, often lead to a decrease in performance.

Arvan Cloud Radar Info on Bing.com Problems

ArvanCloud's radar was continuously displaying widespread disruptions on Bing for a long period. These disruptions, similar to the analyzed behavior above, were happening randomly but frequently across the entire country and in various data centers.(1)

(1)-Display of bing malfunction in 8 different data centers all over Iran - 22 June 2023



Technical investigations showed that, generally, intentional disruptions have been created on all IP addresses of Akamai, the world's largest Enterprise CDN, except in cases that are whitelisted on a case-by-case basis. Bing is just one of hundreds of thousands of essential services that use Akamai.
Skype (4.6% disruption), Apple (8.4% disruption), Pinterest (4.8% disruption), Yale (21% disruption), and Microsoft (6.7% disruption) are other major websites that receive services from Akamai.
User requests were getting halted at the TLS Handshake Client stage with some operators, and in some cases, no response was received to the packets sent by the user to this significant search engine.

Intentional disruption of Asymmetric traffic

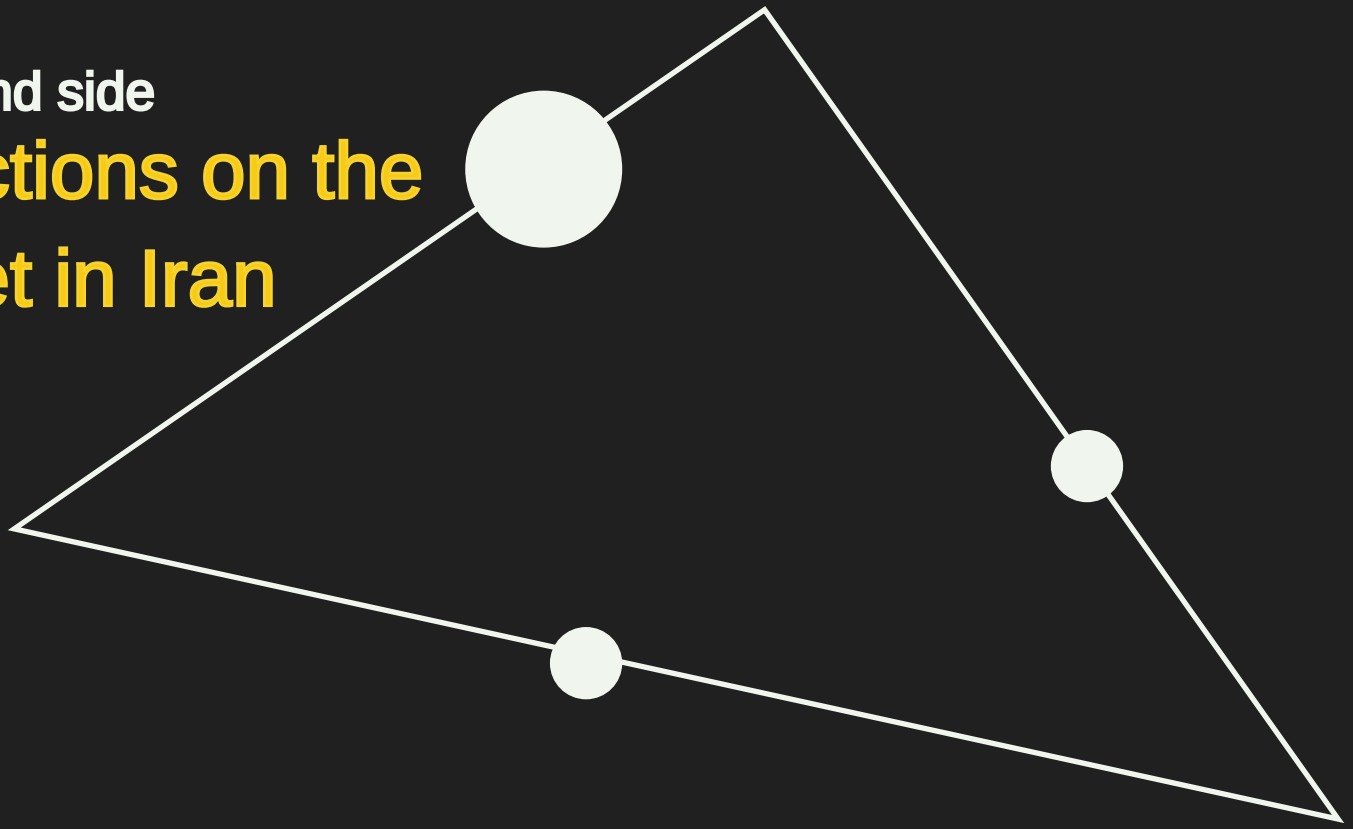
Another quality issue with the country's Internet is the deliberate disruption of Asymmetric traffic.
It is common in the world for various commercial / technical reasons for an internet operator to use one Internet link for sending and another for receiving information. Internet Service Providers (ISPs) should be allowed to use different routes for Internet routing based on their technical, political, and revenue policies. This issue is a resolved matter in the world of the Internet, and different operators globally do this for technical / financial reasons.
However, filtering in Iran has become stateful in the network. In this state, if the return packets enter the filtering module from a different path than the outgoing route, they will be automatically dropped. Simply put, if the outbound and return traffic inadvertently isn't identical, or if the operator routes a portion of the traffic asymmetrically for economic reasons, Internet disruptions increase. This situation, as indicated, is not uncommon in the country's network.

In conclusion, it seems that despite all the investments made in smart filtering, none of the technology contractors have been able to detect HTTPS - based proxies (like v2ray and trojan). To compensate for this issue, the Infrastructure Communications Company has illegally caused widespread disruptions in layer 4 of the network.

C E N S O R S H I P

The second side

Restrictions on the Internet in Iran



The second side of Iran's internet is very limited

As stated in the introduction, after China, Iran has one of the most restricted Internets in the world. Based on the data extracted from OONI, we compared the filtering status of 100 websites in various categories in the top 100 countries in terms of Gross National Product. Ultimately, it was determined that China, Iran, Russia, Egypt, and Saudi Arabia, in that order, have the highest proportion of filtered websites.
In this study, as is evident from the categories, there are no websites with pornographic content.

Country	Anonymization and circumvention tools	Communication Tools	Culture	Human Rights Issues	Intergovernmental Organizations	LGBTQ+	Media sharing	News Media	Public Health	Search Engines	Social Networking	Grand Total
China	4	4	1	3		1	5	18		2	12	50
Iran	3	3		3		1	7	14			14	45
Egypt	3	2		3	1		2	8		1	2	22
Russian	2			1			2	5			6	16
Oman	1	2									5	8
Saudi Arabia	2	1				1	1				2	7
UAE	2			1		1					2	6
Jordan	2						1				3	6
Turkey	1						1	1	1		1	5
MALAYSIA												0
KOREA												0

#	Country	count	%
1	China	125	41.67%
2	Iran, Islamic Rep.	100	33.33%
3	Egypt, Arab Rep.	62	20.67%
4	Russian Federation	41	13.67%
5	Indonesia	14	4.67%
6	Saudi Arabia	13	5.68%
7	Turkiye	12	4.00%
8	India	12	4.00%
9	Vietnam	11	3.67%
10	Venezuela, RB	9	3.00%
...	...		
43	Switzerland	0	0.00%
44	United States	0	0.00%
45	Norway	0	0.00%
46	Singapore	0	0.00%
47	Canada	0	0.00%
48	Poland	0	0.00%
49	Mexico	0	0.00%
50	Japan	0	0.00%
	Grand Total	485	3.42%

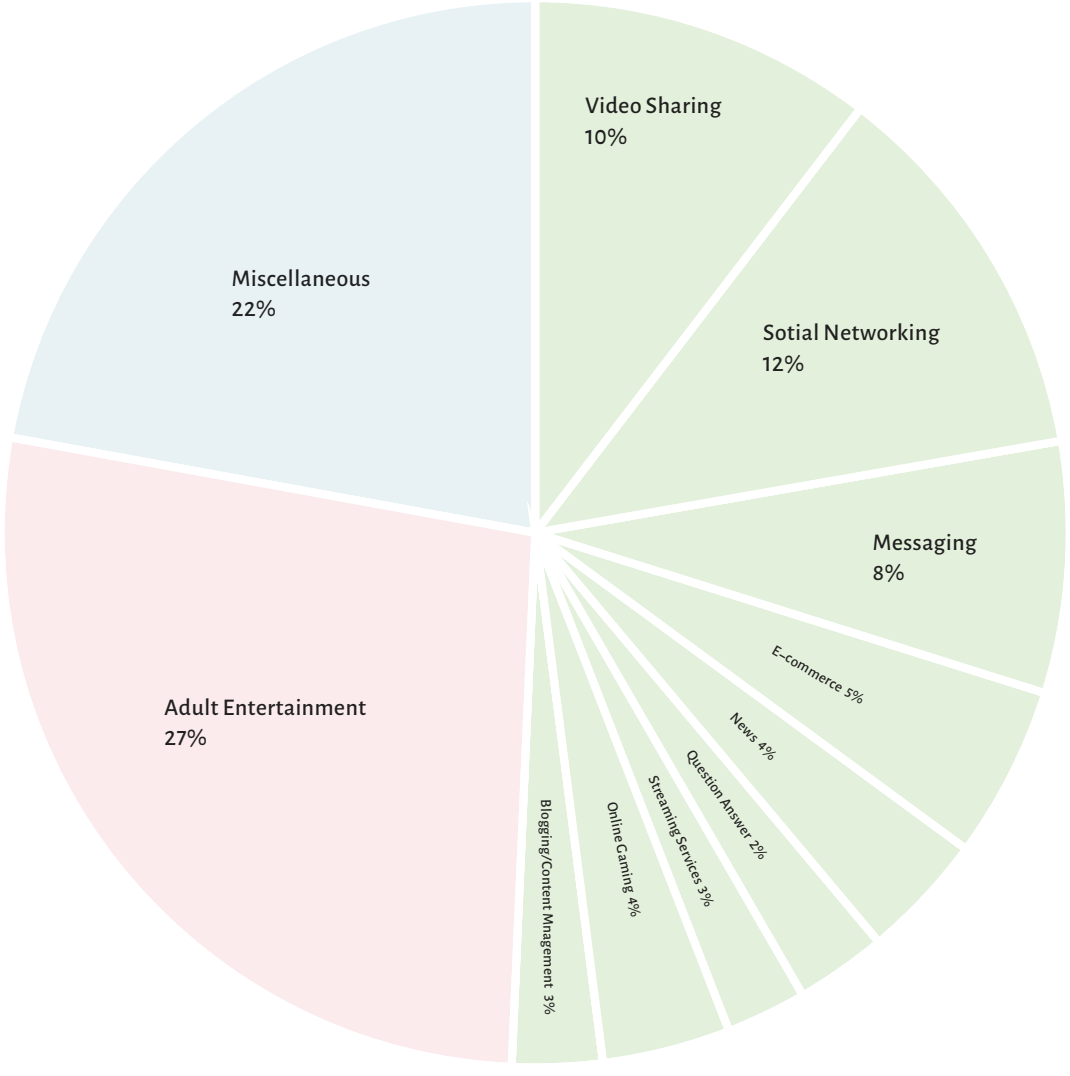
To increase confidence in the classification performed, we tripled the statistical population and increased the number of websites to 300. Although the position of Russia swapped with Egypt and the position of Indonesia swapped with Saudi Arabia, China and Iran maintained their champion and runner-up positions respectively.

Corroborating data by reviewing the top 200 SimilarWeb

In the previous section, 100 and 300 websites were sampled, chosen by OONI.
For more assurance of the sample's validity, we extracted the top 200 global websites (based on the Similar Web report) and examined whether their primary domain is blocked in Iran using a script. We found that 65 websites, representing 32.5% of this list, are filtered in Iran. (1)
This list is primarily composed of websites related to social life functionality.

Category	Similar	Domain
Video Sharing	2	youtube.com
Social Networking	3	facebook.com
Social Networking	4	instagram.com
Social Networking	5	twitter.com
Adult Entertainment	7	xvid****
Adult Entertainment	10	por****
Adult Entertainment	11	xnxx****
Video Sharing	14	tiktok.com
Social Networking	17	vk.com
Social Networking	18	reddit.com
Messaging	20	whatsapp.com
Adult Entertainment	22	xham****
Video Sharing	28	bilibili.com
Streaming Services	30	netflix.com
Miscellaneous	33	turbopages.org
Adult Entertainment	34	span****
Adult Entertainment	46	strip****
Online Gaming	48	twitch.tv
Miscellaneous	51	fandom.com
Adult Entertainment	52	chat****
Question and Answer	61	quora.com
E-commerce	67	ozon.ru
E-commerce	68	wildberries.ru
Messaging	71	t.me
Adult Entertainment	84	nhen****
Miscellaneous	88	pixiv.net
E-commerce	91	taobao.com
E-commerce	96	shein.com
Question and Answer	97	zhihu.com
Messaging	100	messenger.com
Adult Entertainment	106	rule****
Messaging	114	telegram.org
Adult Entertainment	115	epor****
Adult Entertainment	116	miss****
Miscellaneous	121	wp.pl
Adult Entertainment	130	xvide****
Adult Entertainment	131	fc2****
Miscellaneous	136	noodlemagazine.com
News	140	foxnews.com
Miscellaneous	142	jw.org
Blogging	146	wordpress.com
Adult Entertainment	153	xham****
Messaging	156	line.me
Adult Entertainment	157	livej****

1. Due to sub-domain integration, the domain rank is listed from 1 to 230 in the table.



Miscellaneous	159	diretta.it
Miscellaneous	162	onet.pl
Adult Entertainment	164	youp****
Online Gambling	167	bet365.com
Adult Entertainment	170	bong****
Miscellaneous	175	sohu.com
Online Gaming	176	fmkorea.com
Messaging	178	snapchat.com
Adult Entertainment	179	hitom****
Miscellaneous	180	zoro.to
Miscellaneous	182	wattpad.com
Miscellaneous	184	interia.pl
Miscellaneous	201	nicovideo.jp
Adult Entertainment	202	ixx****
Adult Entertainment	212	por****
Streaming Services	213	hotstar.com
E–commerce	214	shopee.co.id
Miscellaneous	224	163.com
Adult Entertainment	228	tnaf****
Miscellaneous	229	kinopoisk.ru
Adult Entertainment	230	redt****

Checking the status of social networks based on Surfshark data

Social media Censorship

	Facebook	Twitter	YouTube	Instagram	Telegram	WhatsApp
Iran	✗	✗	✗	✗	✗	✗
UAE[1]	✓	✓	✓	✓	✗	✗
Turkye	✓	✓	✓	✓	✓	✓
Malaysia	✓	✓	✓	✓	✓	✓
South Korea	✓	✓	✓	✓	✓	✓

Surfshark is a website that focuses on aggregating data on internet outages and censorship around the world. We extracted the information recorded in this database and compared the top 100 countries in the world based on Gross Domestic Product (GDP) in terms of social network filtering.(1)

In this analysis, six of the world's most popular social networks were evaluated, including Facebook, Twitter, YouTube, Instagram, Telegram, and WhatsApp.

Iran, China, and Turkmenistan are the only countries where all six social networks are blocked. Ultimately, there are only 11 countries where at least one social network is blocked. This report once again shows that the internet in Iran is one of the most restricted in the world.

(1)-https://surfshark.com/research/internet-censorship

#	Country	Total Score
1	Iceland	95
2	Estonia	93
3	Costa Rica	88
4	Canada	87
5	Taiwan	79
.	.	.
.	.	.
.	.	.
66	Vietnam	22
67	Cuba	20
68	Iran	16
69	Myanmar	12
70	China	10

Do other reports confirm these data:

Another report examining Internet restrictions worldwide is the "Freedom on the Net" report by Freedom House. This report also indicates that among the 70 countries surveyed in 2022, China, Myanmar, and Iran have the most restricted Internet access globally.(1)

(1)-https://freedomhouse.org/sites/default/files/2022-10/FOTN_2022_Country_Score_Data.xlsx

Extensive domestic filtering and self-sanctions

شاپرک	shaparak.ir
ایران خودرو	ikco.ir
بانک ملی ایران	bmi.ir
تامین اجتماعی	tamin.ir
میز خدمت عملیات الکترونیکی مالیاتی	tax.gov.ir
ای‌نماد	enamad.ir
پرتال مخابرات ایران	tci.ir
وزارت آموزش و پرورش	medu.ir
سازمان ثبت اسناد و املاک کل کشور	ssaa.ir
خدمات الکترونیک انتظامی	پلیس+۱۰	epolice.ir
سامانه جامع تجارت ایران	ntsw.ir
سامانه تدارکات الکترونیکی دولت	setadiran.ir
ساماندهی	samandehi.ir
وزارت تعاون، کار و رفاه اجتماعی	mcls.gov.ir
بانک مرکزی ایران	cbi.ir

سامانه اطلاع رسانی ناشران کدال	codal.ir
وزارت راه و شهرسازی	mrud.ir
سازمان سنجش آموزش کشور	sanjesh.org
معاونت علمی و فناوری و اقتصاد دانش بنیان ریاست جمهوری	isti.ir
سازمان بیمه سلامت ایران	ihio.gov.ir
صفحه اصلی – وب سایت بانک مسکن	bank-maskan.ir
وزارت فرهنگ و ارشاد اسلامی	farhang.gov.ir
وزارت بهداشت	behdasht.gov.ir
مجلس شورای اسلامی	majlis.ir
گمرک جمهوری اسلامی ایران	irica.ir
درگاه ملی قوه قضاییه	eadl.ir
سازمان برنامه و بودجه کشور	mporg.ir
خبرگزاری خانه ملت	icana.ir
دبیرخانه هیت عالی نظارت	iranianasnaf.ir
پلیس راهنمایی و رانندگی	rahvar120.ir

Stranger than filtering foreign sites is filtering domestic sites for users outside the country. Many Iranian government websites and banks are not accessible to international users.
In a conducted survey, out of the top 100 Iranian government websites, 57 are not accessible from outside the country. We hope we do not simply bypass this disaster. Important national websites, including the Parliament, ministries, large country organizations, Shaparak (Iran's national payment system), etc., are not accessible for the people worldwide, for Iranians outside the country, and for the 96% of Iranian people who use VPN on a daily basis!
In this list, you can see the names of 57 government websites (out of the top 100 government websites) that are not accessible from outside the country:

شرکت ملی پخش فرآورده های نفتی ایران	niopdc.ir
سازمان تنظیم مقررات	cra.ir
صندوق نوآوری و شکوفایی	inif.ir
سازمان اسناد و کتابخانه ملی ایران	nlai.ir
گمرک جمهوری اسلامی ایران	irica.gov.ir
پست بانک ایران	postbank.ir
پورتال رسمی سازمان امور مالیاتی کشور	intamedia.ir
سازمان هواپیمایی کشوری	caa.gov.ir
وزارت ارتباطات و فناوری اطلاعات	ict.gov.ir
مرکز سنجش آموزش پزشکی	sanjeshp.ir
سازمان تامین اجتماعی نیروهای مسلح	esata.ir
سازمان بازرسی کل کشور	bazresi.ir
وزارت میراث‌فرهنگی، گردشگری و صنایع‌دستی	mcth.ir
پایگاه ملی اطلاع رسانی قوانین و مقررات کشور	dotic.ir
شرکت سهامي مديريت توليد، انتقال و توزيع نيروي برق ايران	tavanir.org.ir

دیوان عدالت اداری	divan-edalat.ir
اخبار ایران‌خودرو	ikcopress.ir
هواپیمایی جمهوری اسلامی ایران	iranair.com
سازمان مدارس و مراکز غیردولتی و توسعه مشارکت های مردمی	mosharekatha.ir
اداره کل آموزش و پرورش شهر تهران	tehranedu.ir
سازمان توسعه و نوسازی معادن و صنایع معدنی ایران (ایمیدرو)	imidro.gov.ir
شرکت آب و فاضلاب استان تهران	tpww.ir
شهرداری کرج	karaj.ir
وزارت آموزش و پرورش	medu.gov.ir
وزارت جهاد کشاورزی	maj.ir
استانداری گیلان	gilan.ir
سمپاد	sampad.gov.ir

It is unfortunate that the Ministry of Communications is leading this strange behavior. The websites of the Ministry of Communications and Information Technology, the Regulatory Authority, and the Infrastructure Communications Company are all inaccessible from outside the country. The fact that the Ministry of Communications still updates its websites in English is one of the strange paradoxes.

Location	Status	Packets sent/rec/lost(%)	Replies	Partner
	30 Fail 0 Ok			
Berlin, Berlin, Germany	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	IRANVPS
Prague, Czech Republic	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	is*hosting
Erfurt, Thuringen, Germany	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	Keyweb
Kyiv, Ukraine	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	uaVPS
Caracas, Venezuela	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	EXservers
Mumbai, India	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	OneProvider
Zürich, Switzerland	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	4VPS
Kyiv, Ukraine	Bad	4/0/4(100%)	#1: Ping error: TimedOut #2: Ping error: TimedOut #3: Ping error: TimedOut #4: Ping error: TimedOut	IT Army

For experts, it is clear that excuses such as DDoS attacks and other cyberattacks are unjustified and used to justify public opinion. For years, there have been various solutions to prevent DDoS attacks, which are extensively provided by various companies in Iran and used in the private sector. Ultimately, in the event of unforeseen occurrences, geographic restrictions are only acceptable for a few minutes, not implemented broadly with a general directive.

Note that many of the hacks and information leaks that have occurred over the past year have been related to government systems that were "Iran Access" enabled.

Prevalence of using of VPNs

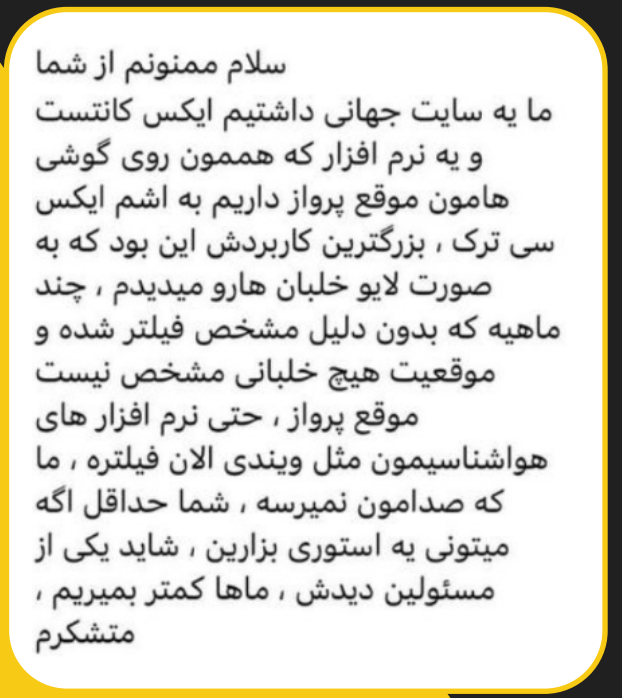
Widespread filtering has made VPNs and other bypass methods an inseparable part of online life for users in Iran. According to a report by peivast.com, 96% of Iranian users utilize VPNs or various methods to bypass filtering.(1)

The government's demonstrative policies have also led to the imposition of widespread and nationwide disruptions to the country's Internet under the pretext of combating VPNs. This issue was discussed in detail in the previous chapter. One could examine in detail the cultural, security, and economic damages caused by the widespread use of VPNs in the country, but the important point here is that in order to bring VPN usage statistics closer to the global average and limit its use to necessary situations, we must end unreasonable restrictions and Internet disruptions, rather than expanding Internet disruptions under the pretext of fighting against it.

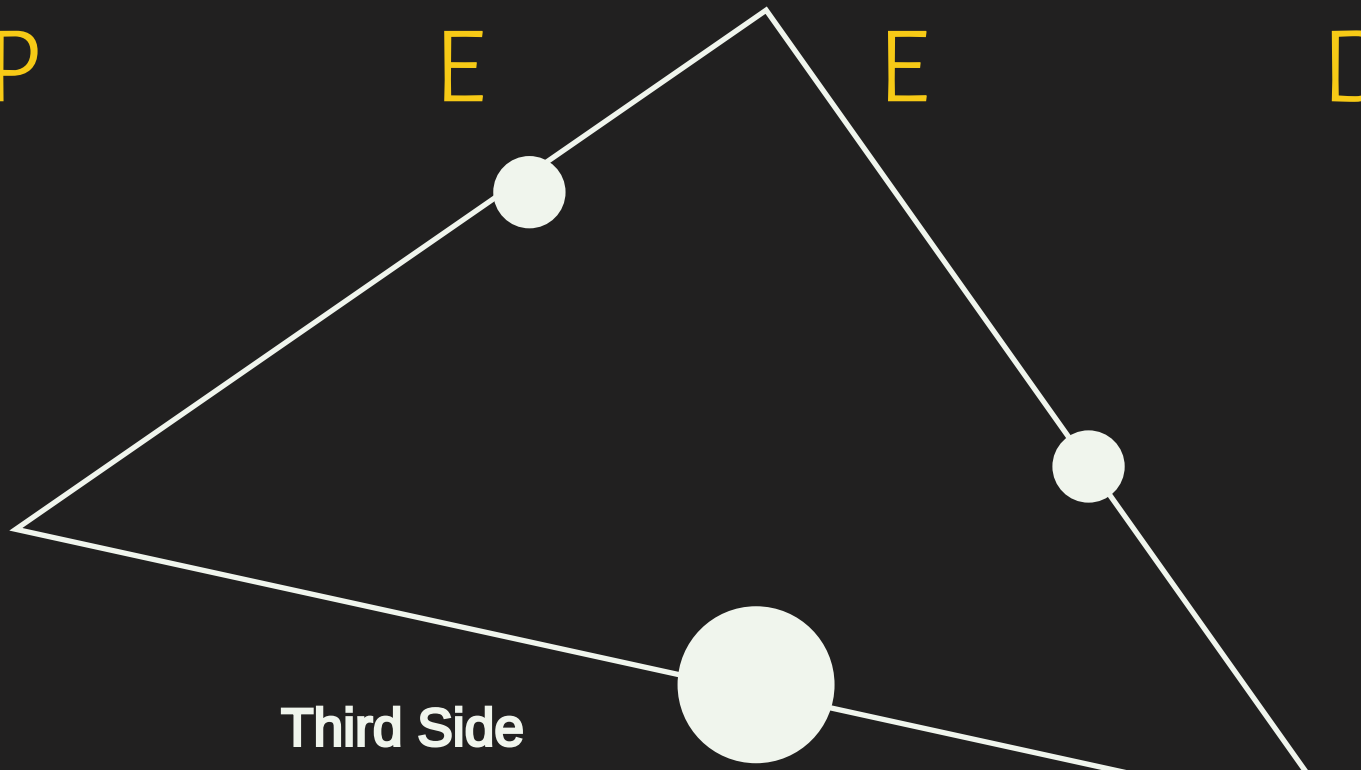
(1)-https://peivast.com/p166552

Unbridled filtering takes its toll

In June 2023, a tragic incident led to the death of "Hesam Goodarzi", a 42-year-old paraglider pilot. This message was from one of Hesam Goodarzi's friends who had posted it in a specialized telecom infrastructure group. There are thousands of examples of websites and IPs that are restricted and filtered in Iran without any legal and logical justification, without a process for redress.


سلام ممنونم از شما
ما یه سایت جهانی داشتیم ایکس کانتست
و یه نرم افزار که هممون روی گوشی
هامون موقع پرواز داریم به اشم ایکس
سی ترک ، بزرگترین کاربردش این بود که به
صورت لایو خلبان هارو میدیدم ، چند
ماهیه که بدون دلیل مشخص فیلتر شده و
موقعیت هیچ خلبانی مشخص نیست
موقع پرواز ، حتی نرم افزار های
هواشناسیمون مثل ویندی الان فیلتره ، ما
که صدامون نمیرسه ، شما حداقل اگه
میتونی یه استوری بزارین ، شاید یکی از
مسئولین دیدش ، ماها کمتر بمیریم ،
متشکرم

S P E E D

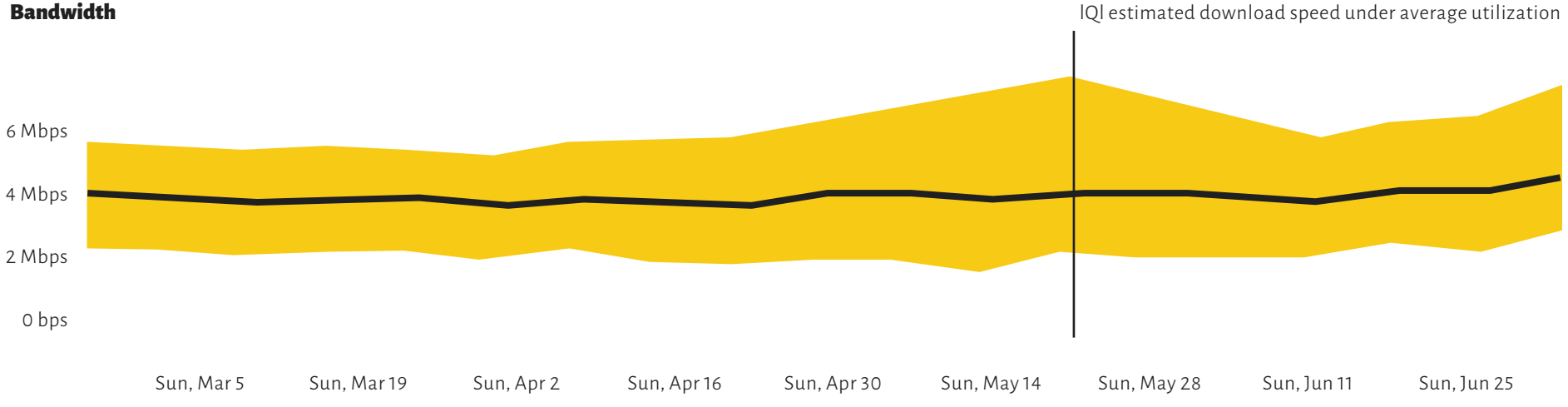


Third Side

Speed in Iran's Internet

Third Side
Speed in Iran's Internet

According to the cloudflare Radar report, the average speed of Iranian users has been around 4Mbps.(1)



(1)https://radar.cloudflare.com/quality/ir?dateRange=52w

Rank in the world

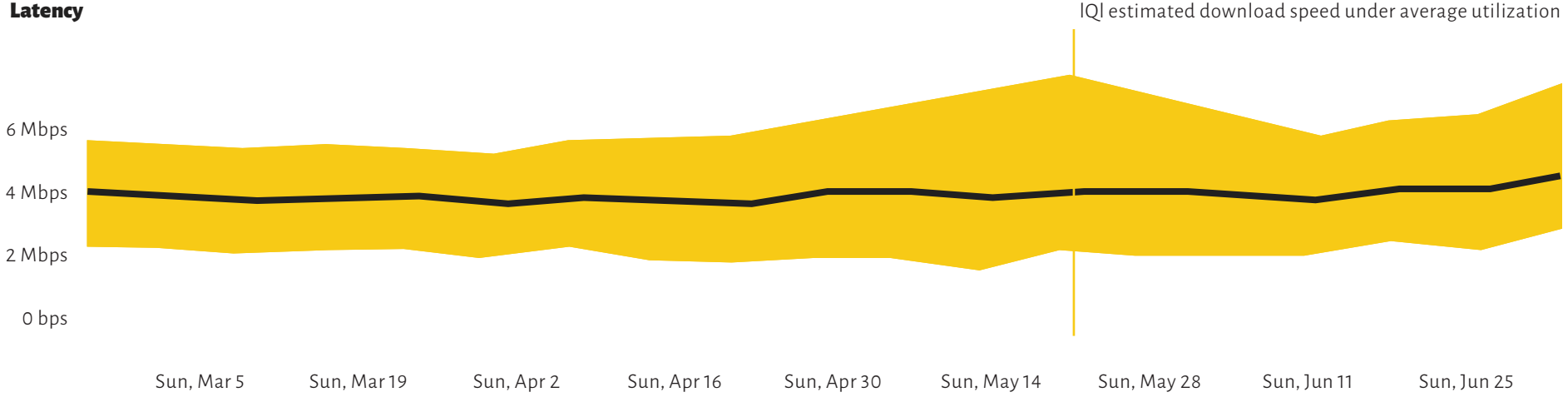
rank	Country	Country	50% Avg (Mbps)
1	sg	Singapore	67.4
2	kr	Korea	60.3
3	hk	Hong Kong	47.6
4	se	Sweden	41.1
5	ch	Switzerland	40.3
		⋮	
26	ae	UAE	26.7
39	my	Malaysia	22.7
54	tr	Turkey	12.6
...		⋮	
96	gh	Ghana	4.2
97	ir	Iran	4.1
98	sd	Sudan	3.4
99	cm	Cameroon	3.0
100	cu	Cuba	2.3

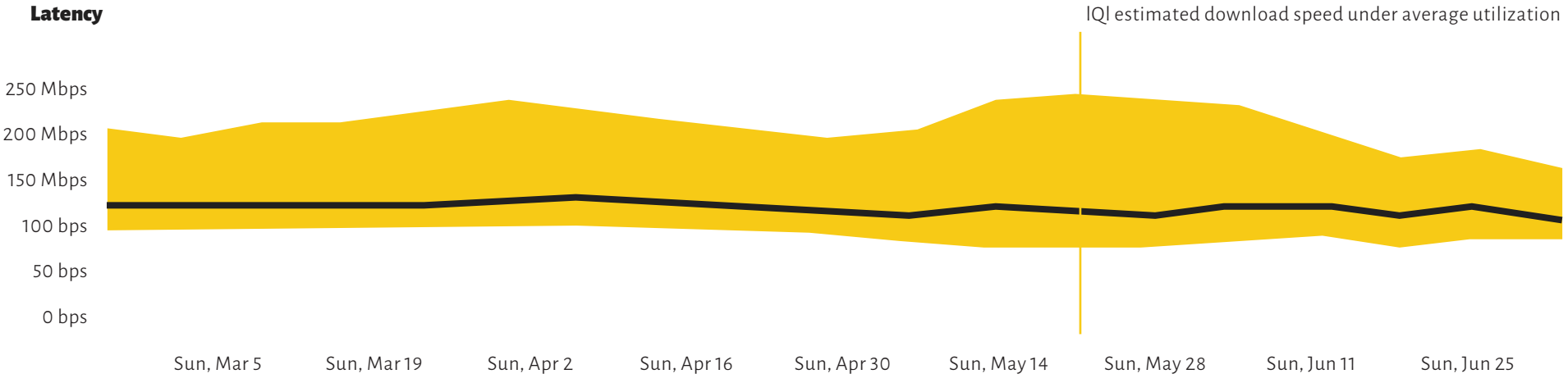
Rank in the world

To investigate the speed of the Internet in Iran, we extracted data from Cloudflare Radar and proceeded to examine it. Similar to the first and second quarter reports, we selected the 100 countries with the highest Gross National Product (GNP) and ranked them in order of speed: a look at countries ranked alongside Iran in Asia shows that the increase in Internet speed is an essential indicator of economic development. The average speed in Turkey is 12Mbps, in Malaysia 22Mbps, in the UAE 26Mbps, and in South Korea 60Mbps."

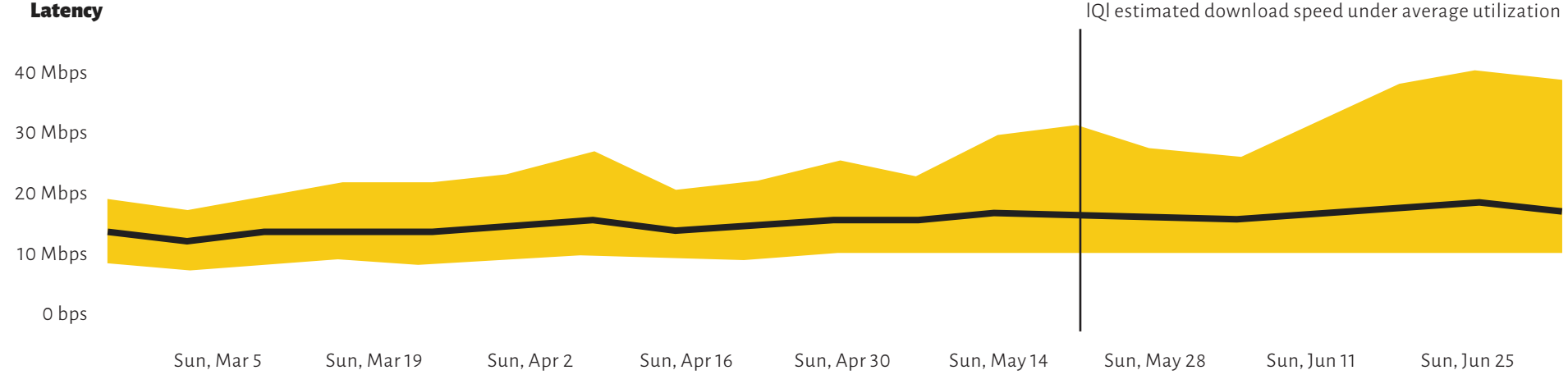
Network latency

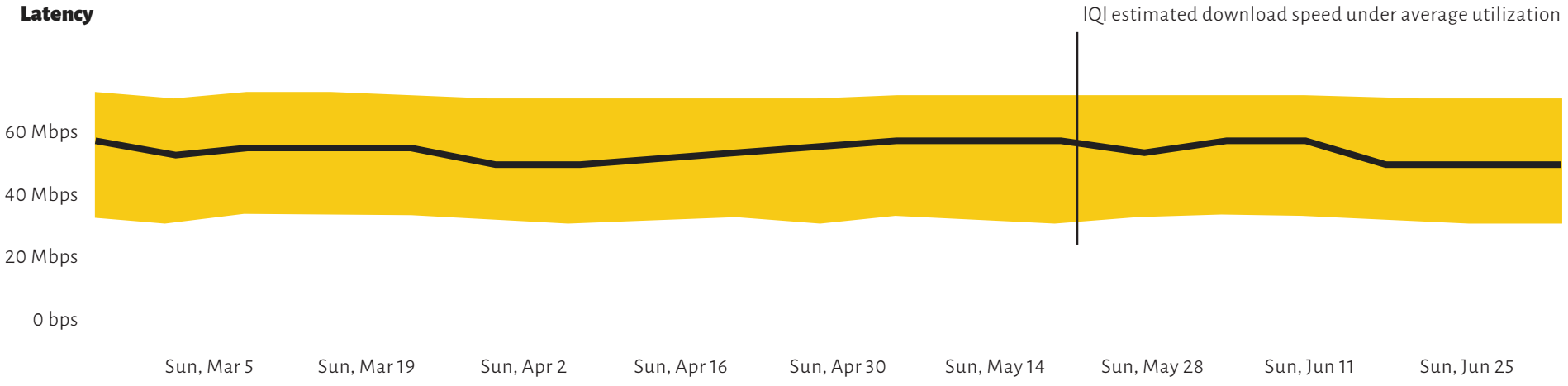
When examining network speed, in addition to measuring bandwidth, we must also measure network latency. The average latency of Iranian users accessing various websites from around the world is about 145ms, which is one of the highest delays in global Internet.



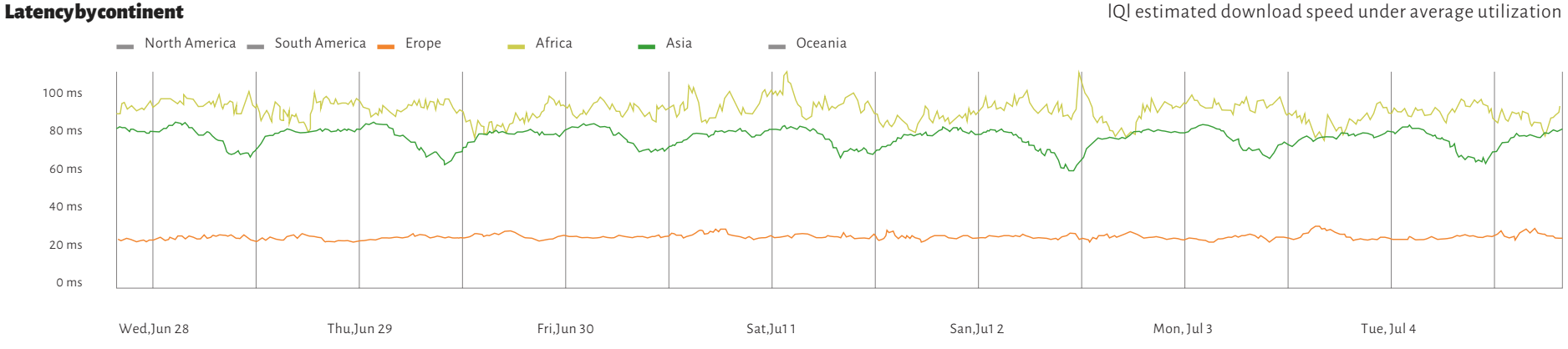


In South Korea, the average latency for users is 14ms, and in Turkey, it is 60ms.





The average latency in Iran is even higher than the average latency in less developed African countries:



Rank in the world

rank	Country	Country	50% Avg (Ms)
1	kr	Korea	14.9
2	se	Sweden	16.7
3	ch	Switzerland	18.1
4	es	Spain	19.4
5	no	Norway	19.8
		⋮	
31	ae	UAE	28.8
42	my	Malaysia	36.4
59	tr	Turkey	56.6
		⋮	
96	ir	Iran	145.6
97	ng	Nigeria	158.3
98	sd	Sudan	160.8
99	cu	Cuba	180.4
100	cm	Cameroon	197.9

Latency Rank in the world

Once again, we extracted the list of the 100 countries under review and compared the average latency of these countries. In this ranking, Iran does not have a better position than 96 out of 100: If we disregard the limitation of examining only 100 countries, among all 237 countries studied in the Cloudflare Radar data, Iran has a dismal ranking of 203 in terms of latency and in terms of average speed (bandwidth), it has a ranking of 211.

Corroborating with Meter.net

In network speed assessments, we must measure not only the bandwidth but also the network latency. The average latency for Iranian users when accessing various websites from around the world is around 145ms, which is one of the highest latencies on the global Internet.

Country	Download (Mbits)				Download (Mbits)				Download (Mbits)			
	AVG	Q1	Median	Q3	AVG	Q1	Median	Q3	AVG	Q1	Median	Q3
Iran	4,31	0,60	1,96	4,98	1,36	0,21	0,36	1,32	326	196	235	285

The data from Meter.net also shows that the average download speed in Iran(1) is 4.31 Mbps, which confirms the data from Cloudflare. In this report, the average upload speed is 1.36 Mbps and the average latency is even worse than in the Cloudflare report, at 326ms.

Furthermore, Iran is not on the list of the top 100 countries with the highest internet speeds. In this list, Japan, Korea, Denmark, Israel, and Canada are the five countries with the highest registered Internet speeds. The lowest rank in the table (position 100) belongs to Tunisia, with an average download speed of 13.55Mbps, which is still three times higher than the average download speed in Iran.(2)

(1)-https://www.meter.net/stats/country/iran
(2)-https://www.meter.net/stats/country

Iran's ranking in the Speedtest website report is also not acceptable.
Iran ranks 64th in mobile internet speed and 146th in fixed Internet speed.

The average speed stated in this report for mobile internet is 35.6Mbps and for fixed Internet it's 12.6Mbps. In fact, the reported speed for Iran is 3 to 8 times the speed reported by Cloudflare. A similar discrepancy can be observed when considering other countries. For example, for the UAE, which has a speed of 26Mbps in the Cloudflare report, an average of 200Mbps is reported in this report.

However, the reason for this is due to the structure of speed calculation and measurement by these systems. Although Speedtest allows manual selection of the test server location, by default it connects the user to the nearest server in the same country, so instead of measuring internet speed, it measures the speed of domestic communications. In fact, with Speedtest, rather than measuring the quality of Internet service, it reviews the quality of the access network of the country, which is quite different from the expected quality of internet experience for people.

Why does Speedtest by Ookla show different numbers?

(1)-https://www.speedtest.net/global-index

In conclusion, the comparison of these numbers shows that despite all the problems existing in the country's Access layer, if the Infrastructure Communications Company addresses the existing obstacles, including quality issues and capacity enhancement, there is the potential for a multiple increase in internet speed in Iran in the short term.


Who is
responsible?

Who is responsible?

In this report, we have tried to delineate the triangle of Internet poor quality. The three main sides of this triangle are frequent disruptions, widespread limitations, and low internet speed. Here, we briefly examine which institution is responsible for each side, and as citizens and private sector businesses, which institutions we should pursue our demands from.

1
Widespread disorders

The biggest crisis of the Internet in Iran today is its widespread disruptions, a problem that is entirely the responsibility of the Ministry of Communications, the Infrastructure Communications Company, and ultimately, the Committee for Network Protection and Security, which is in charge of filtering execution in Iran.

2
Extensive restrictions

Some limitations, such as filtering, have been commanded by the judiciary (Telegram), some by the working group for identification of crimes (Twitter), and some by the National Security Council (Instagram and WhatsApp). A large number of disruptions and filters have taken place without any order or law, merely due to pressure from security institutions. For example, the disruption of Clubhouse towards the end of the previous term of the Ministry of Communications was illegally executed by IranCell, Hamrah-e-Avval, and Telecommunications Company of Iran, leading to a government resolution for a daily fine of 50 billion Tomans from them, a complaint that ultimately remained unresolved due to the interference of security institutions.

Another example was the introduction of the social network Threads, which was filtered in Iran from the beginning, without approval from any legal institution.(1)

Considering that the President, who is in charge of the Supreme National Security Council and the Supreme Council of Cyberspace, and the government, which in total has half of the seats of the committee for determining criminal examples(2), a working group appointed by the President to solve the problem of internet quality has an appropriate opportunity for role-playing and problem-solving in this field.

(1)-As mentioned, the widespread filtering on Akamai, the complete filtering of Meta Company's CDN, and the widespread disruptions on Cloudflare have caused millions of websites worldwide to be filtered or suffer widespread disruptions.
(2)-The Minister of Communications, Minister of Culture, Minister of Science, Minister of Education, Minister of Justice, and the Minister of Information.

3
Low speed

Compared to the previous two sides, this section requires more planning, time, and investment. In this section, there are several serious weaknesses, and as a result, there are several different responsibilities.

وزارت ارتباطات و فناوری اطلاعات
شرکت ارتباطات زیرساخت

Infrastructure Communications Company. (TIC)

5G

The development of fiber optics and 5G

شرکت مخابرات ایران

Telecommunication Company of Iran

1 -3
Telecommunication Company of Iran

One of the biggest problems with internet speed in Iran is the use of outdated ADSL technology. In addition to the inherent limitations of this technology, which severely limits upload speed, the anti-competitive behavior and extremely low quality of Iran's Telecommunication Company in Last Mile communications has caused ADSL in Iran to be problematic with low quality.

If there wasn't a monopoly of a governmental company delivering low-quality service, perhaps this technology could have been upgraded to VDSL years ago, and home internet with speeds up to 80Mbps would be in a better condition. This would make the wait for users for fiber optic communications less painful.

(1)-Detailed articles can be written about the anti-competitive behaviors of Iran's Telecommunication Company, or about the various restrictions imposed on private companies by municipalities, which are beyond the scope of this report.

2- 3
The development of fiber optics and 5G

The country's delay in developing fiber optics is one of the main obstacles to the leap in Internet speed in Iran. However, widespread internet disruptions and other factors have caused a severe recession in the digital economy and, consequently, a slowdown in investment in the country's telecom infrastructure.

Despite government promises, unofficial reports indicate that the total consumption of the telecom industry in the country has prevented new serious investments. To put it simply, we are not only not developing the country's infrastructure, but the previous infrastructure is also being worn out.

Despite all this, within the triangle of the quality of the Internet in Iran, this section is the only area that the Ministry of Communications apparently has a serious plan for and has taken practical actions to develop fiber optics and expand 5G in the country.

3 - 3
Infrastructure Communications Company

The Internet in the country is exclusively provided by the Infrastructure Communications Company and a very limited portion for university purposes by the Institute for Research in Fundamental Sciences (IPM). The monopoly of the Infrastructure Company in providing and distributing the Internet in the country, along with its inefficiency and low productivity, has led to high internet prices in addition to quality issues. The Infrastructure Company sells the Internet to distributing companies in Iran at approximately 60 times(1) the price of the Internet in Europe(2). This company does not provide a transparent report on the routes and capacities of the Internet in the country and does not take responsibility for the disruptions and slow internet speed.

(1)-Based on the decision of the Regulatory Commission, the price of 100Gbps monthly internet is 6 billion Tomans. However, the price of 100Gbps internet from the company Cogent in Europe is around 2000 dollars (equivalent to 100 million Tomans). (https://www.fdcservers.net/100gbps-special/) Considering transfer costs and other hidden expenses and the generally high price of internet in the Middle East, it cannot be expected for the price of internet in Iran to decrease by 60 times, but this comparison demonstrates the impact of the monopoly of a state-owned company in the country.

(2)-The high price of international internet should not be confused with the low price of domestic internet, which has been based on mandatory policies of the Regulatory Organization and imposed on private companies. According to internet operators, one of the factors hindering investment in network development in Iran is related to this pricing paradox.

Transparency and data-driven behavior

It is obvious that the first step to improve an index is to measure it. In the new round, not only has the Ministry of Communications taken no serious step towards transparency, online monitoring, and providing less frequent reports, but even the previous mechanisms existing in the country have disappeared.

Clear reporting of the status of IXP points

In Iran, there are five main Internet Exchange Points (IXPs) located in the cities of Tehran, Mashhad, Shiraz, Tabriz, and Isfahan. The real-time traffic of each of these points was reported online on the website tehran-ix.ir. After several widespread disruptions in Tehran's IXP, which were reflected in the media based on data from the website tehran-ix.ir, the Ministry of Communications, instead of providing precise responses about these disruptions, removed this website from circulation!

Clear and data-driven report of the country's international bandwidth

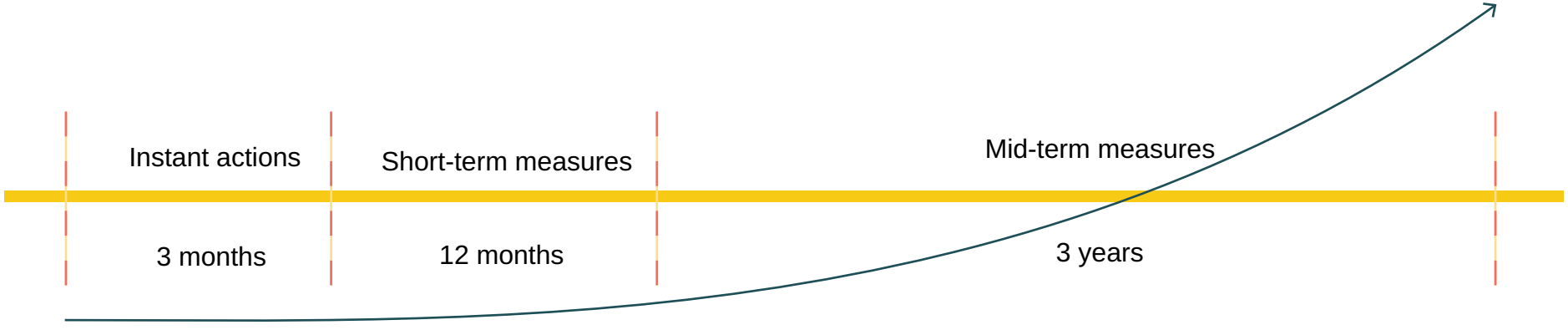
Since the beginning of the new term of the Ministry of Communications, no precise report on the country's bandwidth capacity, consumption rate, and its increase or decrease has been published

Clear reporting of policies and performance of filtering equipment

Unfortunately, there is no transparency mechanism in relation to the policies and performance of filtering equipment in the country. The website Internet.ir was hacked in November 2024 and hundreds of thousands of emails from the system were published in public. After 8 months, this system never became accessible again. As a result, there is no recourse for businesses and the Iranian people to protest, follow up on, and investigate the filtering of an IP or domain. While the Internet.ir system had minimal transparency and responsiveness during its time, and most requests and protests remained unresolved, even that minimal access no longer exists.

Citizens and businesses should be able to check online whether their IPs are filtered or disrupted, and they should be able to protest against it. If the IP or domain of a natural or legal person is erroneously filtered, there should be a possibility for people and businesses to legally complain and receive compensation for damages, perhaps through which this chaotic situation could be somewhat controlled.

Practical solutions to improve the quality of the Internet



Practical solutions to improve the quality of the Internet

Shedding light on a crisis and mitigating the problem is an essential part of the solution. This is the path that we have tried to follow in this report. In the continuation and in the upcoming reports, which we will also publish publicly, we will strive to detail our practical and proposed solutions, stage by stage, and make them available to the public, policy-makers, and governmental implementers. Briefly, these solutions can be categorized into three groups: immediate actions, short-term, and medium-term measures.

Instant actions
1 to 3 months

- Preventing internet disruptions under the pretext of combating circumvention tools
- Transparent and comprehensive report from the Ministry of Communications regarding international gateways and the restoration of online monitoring systems, including Tehran-IX
- Permanent prohibition of agencies from implementing "Iran Access" policies. (Blocking access from out of the country)

The President can immediately instruct the Ministry of Communications to put an end to the intentional disruption of the country's Internet. Monitoring systems such as Tehran-IX should be reactivated and the Ministry of Communications should provide a comprehensive and transparent report on the state of the country's Internet. Moreover, it should be communicated to all government agencies that blocking websites or declaring access to them as criminal or prohibited is not permissible.

Short-term measures

3 to 12 months

- Removing filters on public websites that are essential to the people and improving the Internet freedom index in Iran.
- Increasing international bandwidth and transparent reporting of it to the public.
- Establishing transparency systems regarding filtering policies, allowing for inquiries, complaints, and follow-ups on the removal of IP addresses and domains from the filter.

In the next step, it is expected that influential bodies, especially the Supreme Council of Cyberspace, will start the process of unblocking public websites needed by the people through enlightenment and negotiation. Thousands of websites have been filtered without any legal justification; given the principle of innocence, if there is not sufficient legal documentation about a specific website or IP, all of them should be unfiltered. The next step should be to start a conversation to review the status of websites that the Iranian people need extensively.

Ending the monopoly of the Infrastructure Communications Company and allowing competition by the private sector, increasing international bandwidth, the necessity of creating online monitoring systems and transparent reporting to the people of Iran, as well as creating transparency over all restrictive and filtering mechanisms in the country, will be the next executive steps in improving the quality of the Internet in Iran.

Mid-term measures

12 to 36 months

- Removing the monopoly of the Telecommunications Infrastructure Company and granting import licenses for Internet by the private sector.
- Investing in the expansion of fiber optics and the development of fixed communications.
- Investing in the expansion of 5G communications.
- Creating mutual international interests and establishing sustainable relationships with international technology companies, with maximum participation from the private sector.

In the medium term, we need to accelerate our investment in the country's infrastructure and remove obstacles to the expansion of fiber optics and 5G communications in the country, and take more serious steps towards liberating the country's internet and moving towards a free, high-speed, and quality internet for businesses and people. A quality internet for all the people of Iran.

Another key point is the activation of cyber diplomacy. Writing a one-sided letter to the largest platforms in the world and expressing unreasonable and unilateral demands does not mean cyber diplomacy. We must be able to define common interests with various countries around the world in the first step and then on a larger scale engage in negotiation with technology companies and large platforms in the world.

TEHRAN
انجمن
تجارت
الکترونیک
تهران

Analytical Report on Disruptions, Limitations, and Internet Speed in Iran

June2023