



Online Censorship Measurements

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In collaboration with:

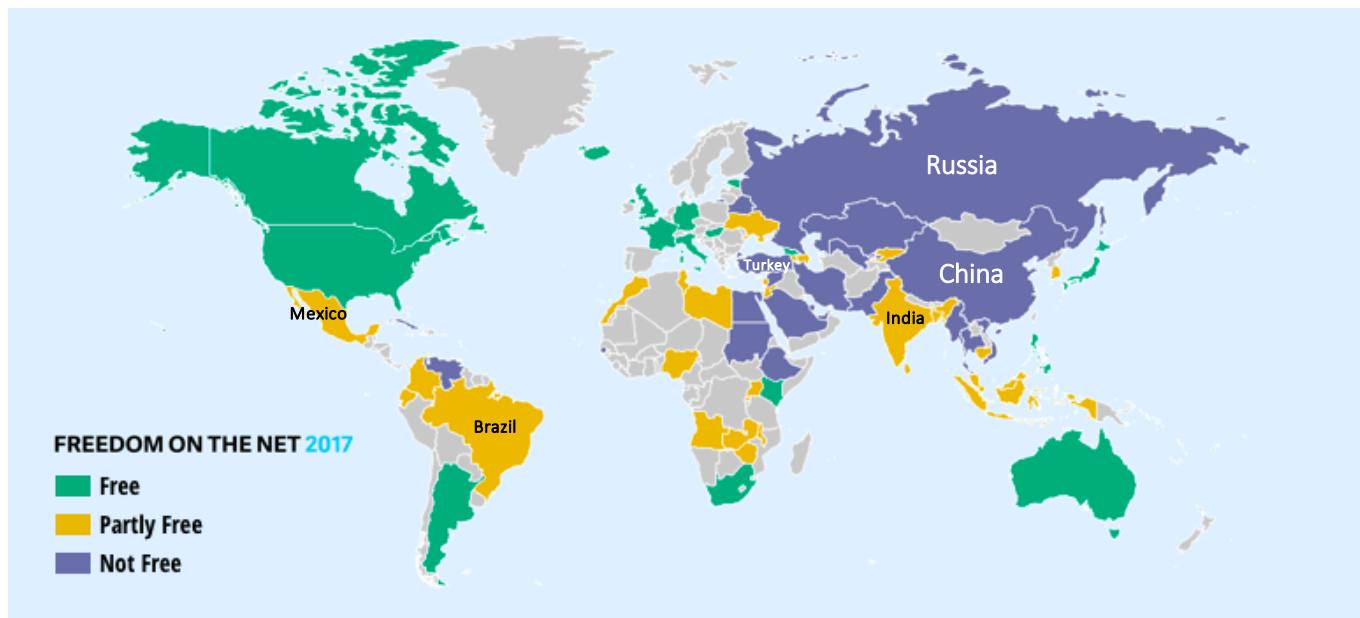
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Most materials from:

Niaki, A.A., Cho, S., Weinberg, Z., Hoang, N.P., Razaghpanah, A., Christin, N. and Gill, P., 2020, May. IClab: a global, longitudinal internet censorship measurement platform. In *2020 IEEE Symposium on Security and Privacy (SP)* (pp. 135-151). IEEE.

- Restrict access to specific web content
- “Content filters” existed as early as 1996
- China’s “Great Firewall” in development since 1997



Freedom on the Net 2017, Freedom House
<https://www.freedomhouse.org/reporting/2017>

Why Measure Censorship?

OVERT (APPARENT)

Done and shown openly

COVERT

Not openly acknowledged

Warning
 불법-유해 정보(사이트)에 대한 차단 안내

지금 접속하려고 하는 정보(사이트)에서 불법-유해 내용이 제공되고 있
 이에 대한 질적이 차단되었음을 알려드립니다.

해당 정보(사이트)는 방송통신심의위원회(KSCC)의 심의를 거쳐
 「방송통신위원회의 설치 및 운영에 관한 법률」에 따라 적법하게 차단된 것이오니
 이에 관한 문의사항이 있으시면 아래의 담당기관으로 문의하여 주시기 바랍니다.

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 (차단안내페이지는 개인정보를 요구하거나 프로그램 설치를 유도하지 않습니다.)

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불법 체육진흥투표권 판매	사행산업통합감독위원회	1855-0112
	국민체육진흥공단 콜린스포츠 통합콜센터	1899-1119
불법 승차투표권 구매대행	국민체육진흥공단 경륜-경정 총괄본부	1899-0707
불법 마권 구매대행	한국마사회	080-8282-112
불법 의약품 판매	식품의약품안전처 사이버조사단	(043)719-1921
불법 의약품 판매 및 허위과대광고	식품의약품안전처 사이버조사단	(043)719-1921
불법 식품 판매 및 허위과대광고	식품의약품안전처 사이버조사단	(043)719-1914
불법 건강기능식품 판매 및 허위과대광고	식품의약품안전처 사이버조사단	(043)719-1914
불법 화장품 판매 및 허위과대광고	식품의약품안전처 사이버조사단	(043)719-1906
불법 의약품 판매	식품의약품안전처 사이버조사단	(043)719-1906
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저작권(불법복제물 유통)	한국저작권보호원 온라인보호팀	(02)3153-2457
안보위협행위	사이버 경찰청	1566-0112
명예훼손, 초상권 침해	방송통신심의위원회	(02)3219-5341-4
전통·원도, 차별·비하 등	방송통신심의위원회	(02)3219-5161
디지털성범죄정보	방송통신심의위원회	(02)3219-5834

[Block page served by South Korea]

Sandvine's PacketLogic Devices Used to Deploy Government Spyware in Turkey and Redirect Egyptian Users to Affiliate Ads?

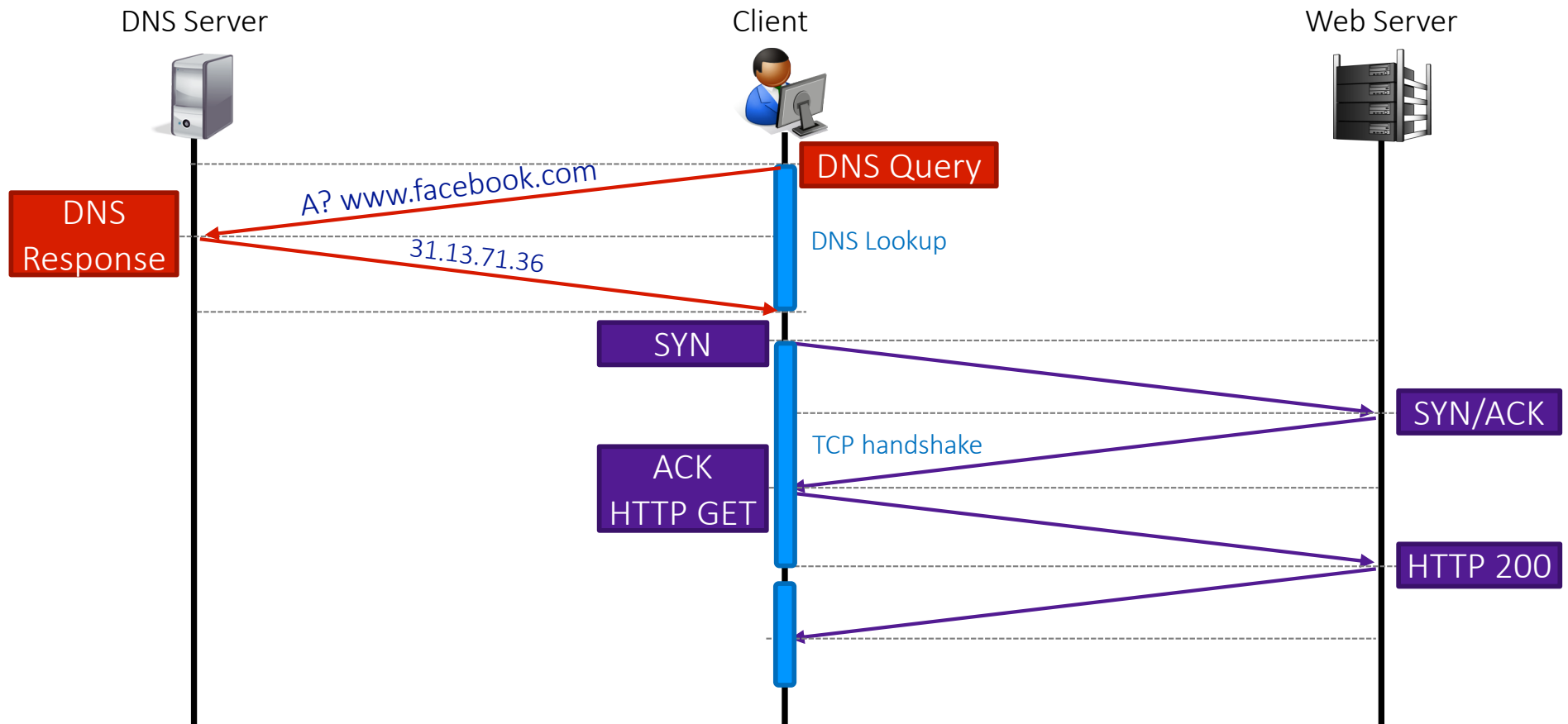
By Bill Marczak, Jakub Dalek, Sarah McKune, Adam Senft, John Scott-Railton, and Ron Deibert

March 9, 2018 [أزمة مصرية \(Arabic translation\)](#), [KÖTÜ TRAFİK \(Turkish translation\)](#)

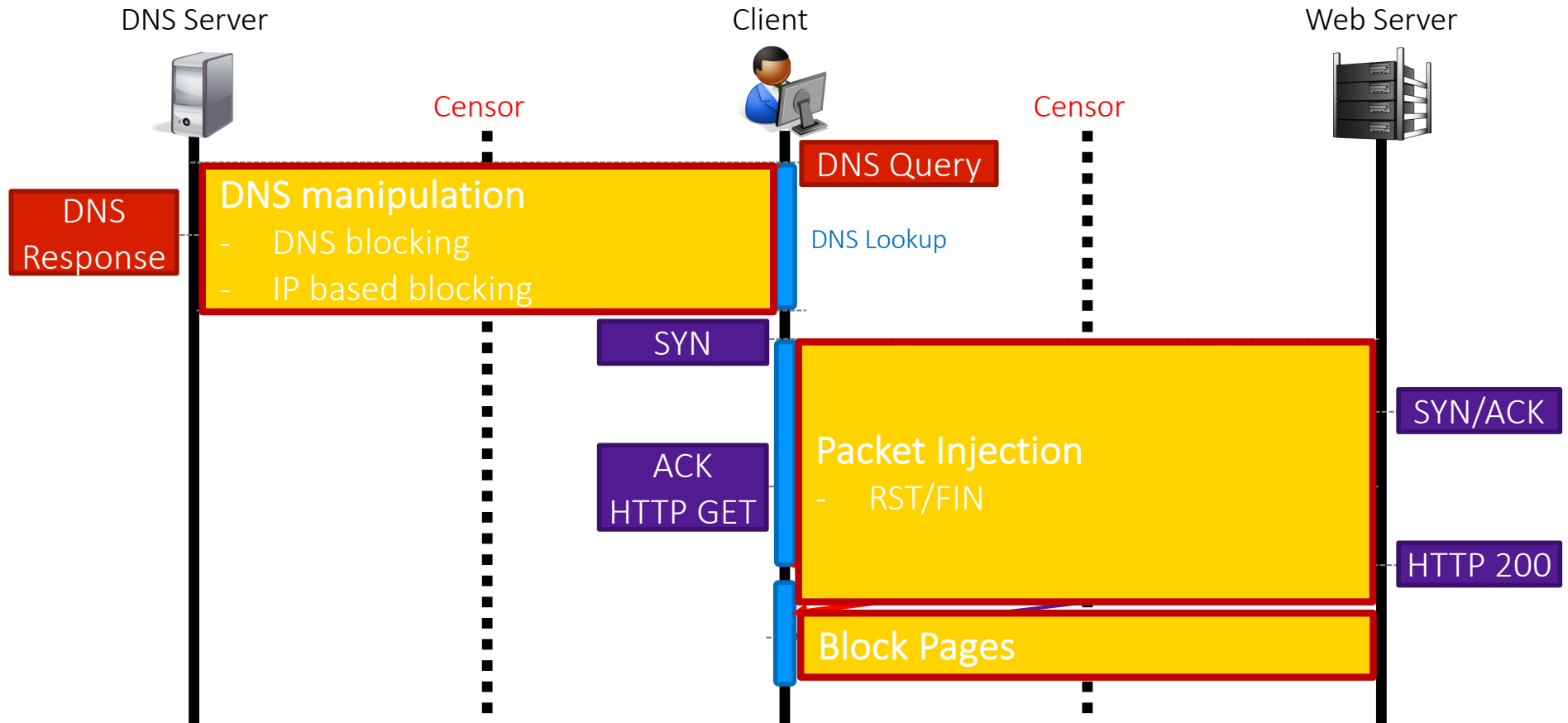


<https://citizenlab.ca/2018/03/bad-traffic-sandvines-packetlogic-devices-deploy-government-spyware-turkey-syria/>

Networking 101: HTTP Transaction

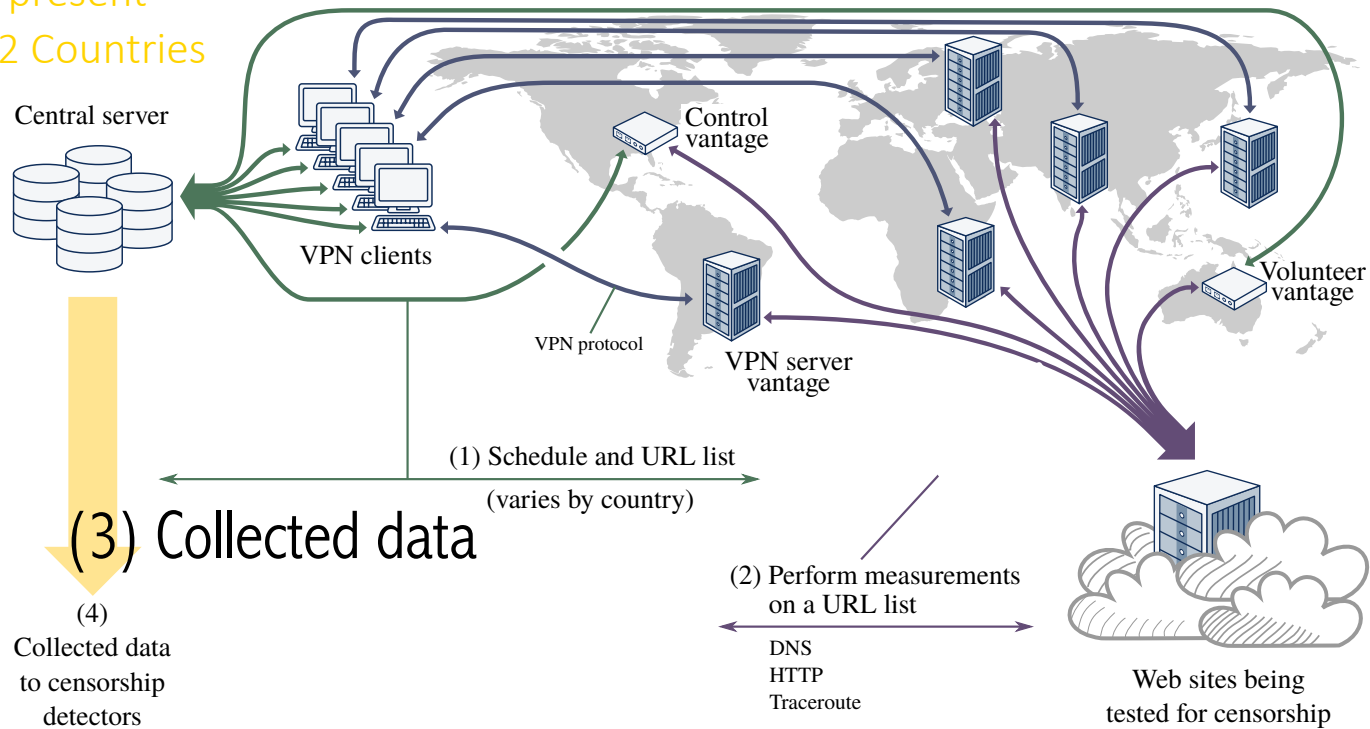


How does censorship work?



ICLab: Global and Continuous Monitoring

★ Global and Continuous
Oct. 2016 ~ present
234 ASes, 62 Countries

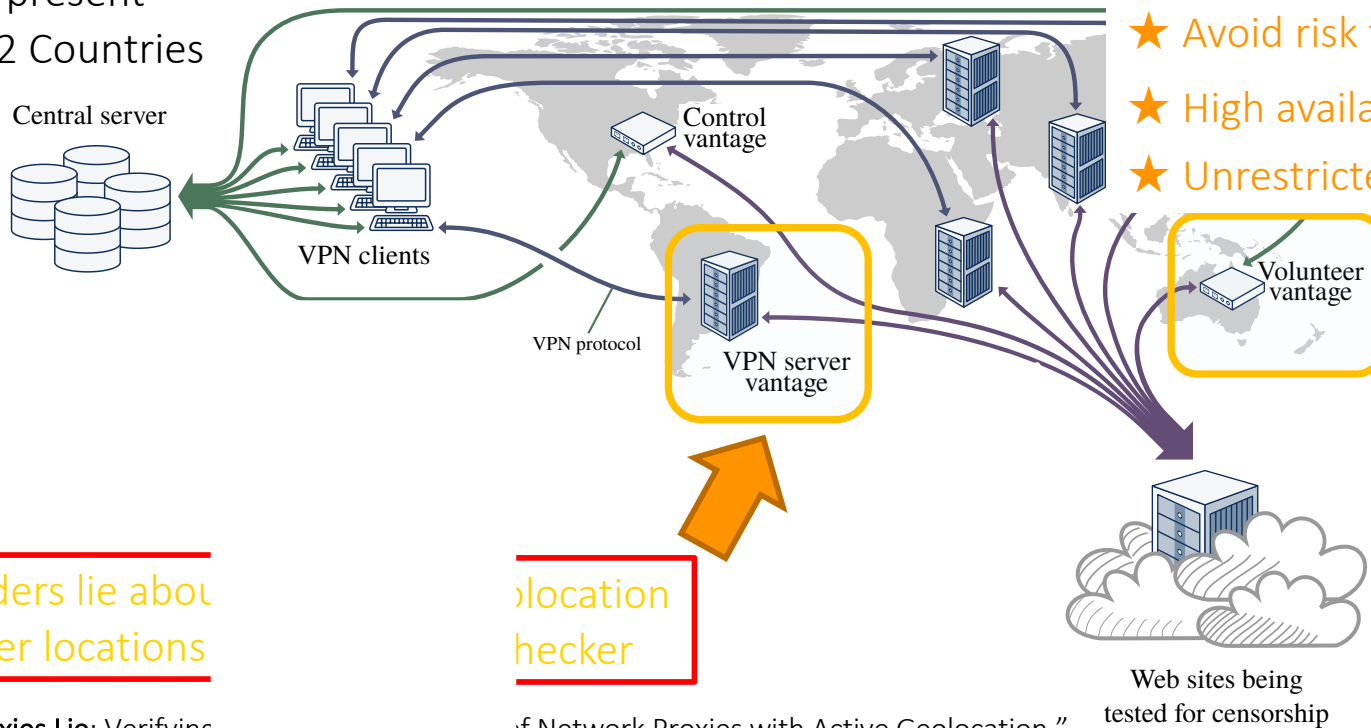


ICLab: Vantage Points

★ Global and Continuous

Oct. 2016 ~ present

234 ASes, 62 Countries



VPN providers lie about their server locations

“How to Catch when Proxies Lie: Verifying the Location of Network Proxies with Active Geolocation,”
Zachary Weinberg, Shinyoung Cho, Nicolai

and Phillipa Gill, In ACM IMC, Nov. 2018

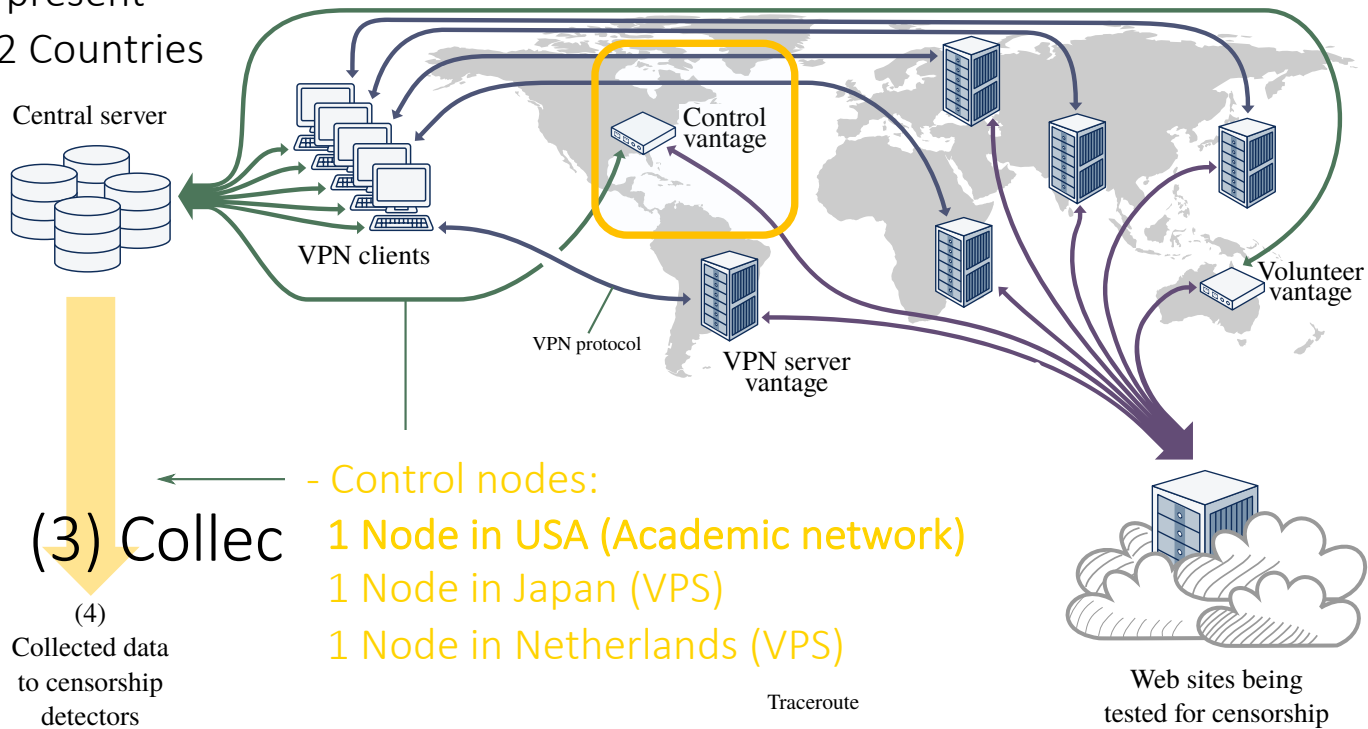
ICLab: Control Node

★ Global and Continuous

Oct. 2016 ~ present

234 ASes, 62 Countries

Vantage Points: (worldwide: 264 VPNs, 17 volunteers)

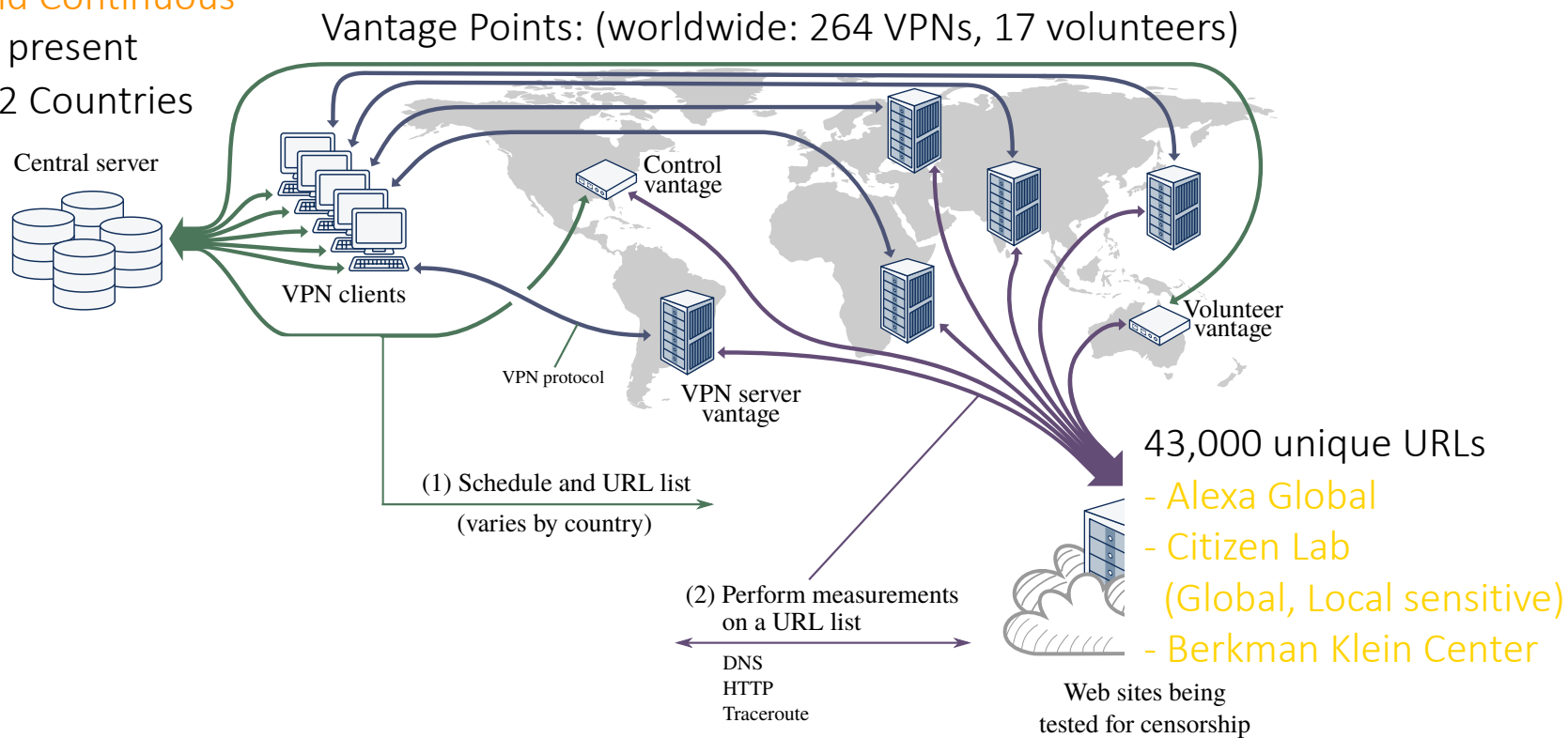


ICLab: Test Lists

★ Global and Continuous

Oct. 2016 ~ present

234 ASes, 62 Countries



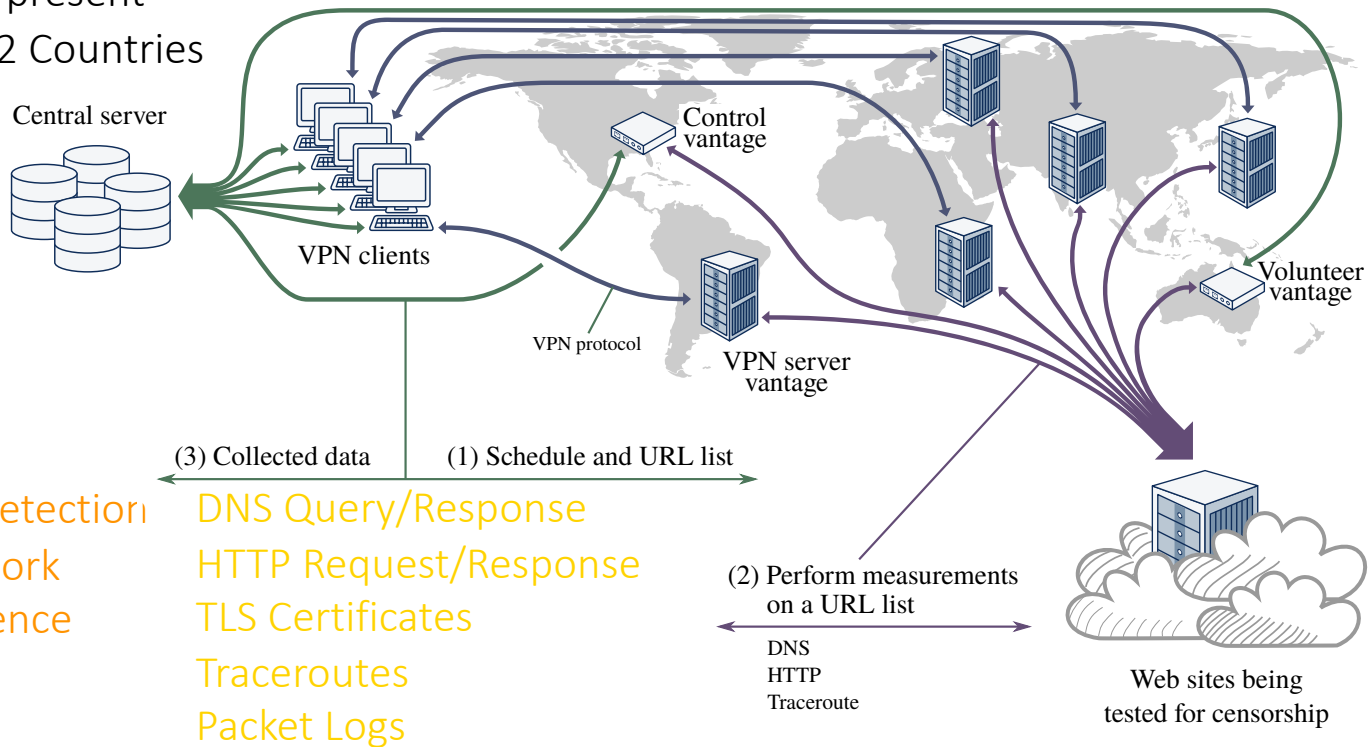
ICLab: Data Collection

★ Global and Continuous

Oct. 2016 ~ present

234 ASes, 62 Countries

Vantage Points: (worldwide: 264 VPNs, 17 volunteers)



★ Reliable detection of network interference

- DNS Query/Response
- HTTP Request/Response
- TLS Certificates
- Traceroutes
- Packet Logs

ICLab: Censorship Detection

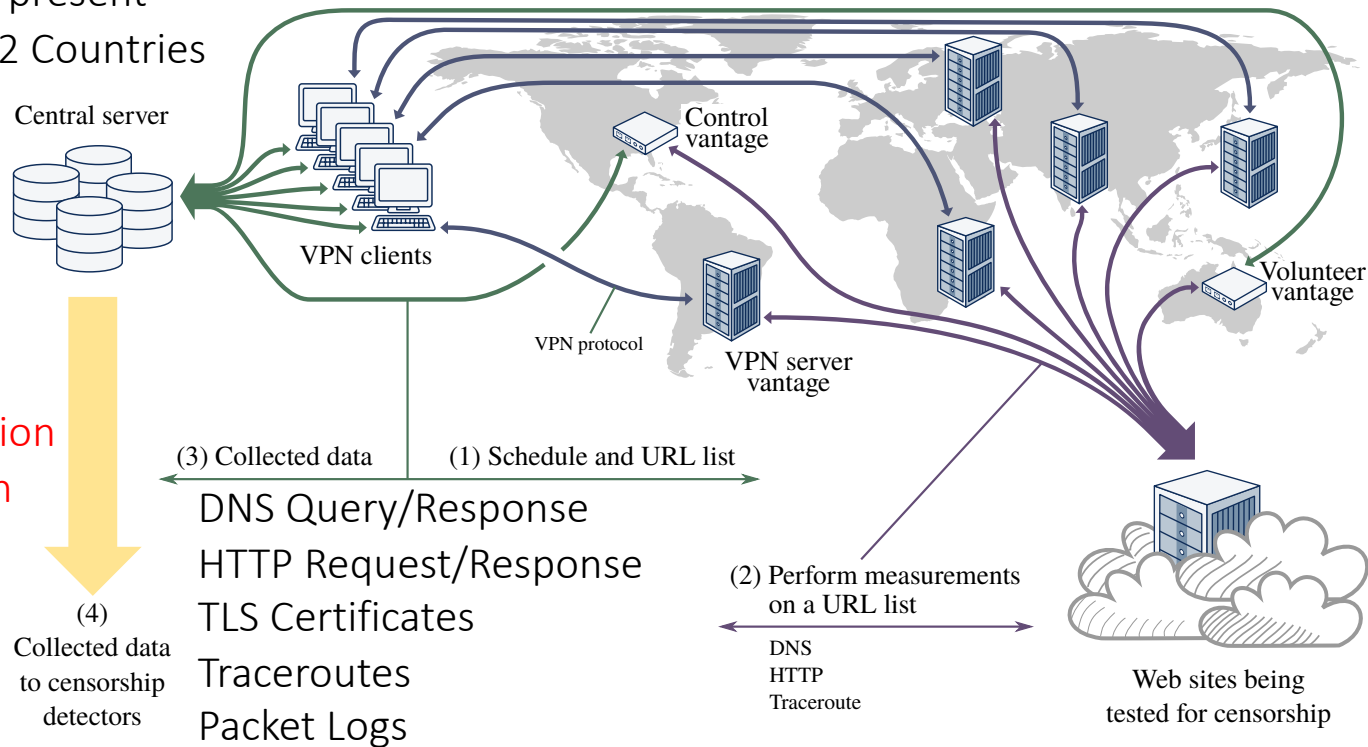
★ Global and Continuous

Oct. 2016 ~ present

234 ASes, 62 Countries

Vantage Points: (worldwide: 264 VPNs, 17 volunteers)

DNS manipulation
Packet injection
Block pages



Scope of This Talk

Censorship Detection

- DNS manipulation
- TCP packet injection
- Block page : Detection & discovery

Key Findings

- Analysis by test lists
- Analysis by methods
- Longitudinal analysis
- Other network attacks

Results

Censorship Detection

- **15,007 DNS Manipulation**
across 56 countries, 489 unique URLs
- **143,225 Packet Injection**
across 54 countries, 1,205 unique URLs
- **232,183 Block Pages**
across 50 countries, 2,782 unique URLs

Central server



Oct. 2016 ~ present

53,906,532 measurements

234 ASes, 62 Countries

43,000 unique URLs

Results

Censorship Detection

- 15,007 DNS Manipulation
across 56 countries, 489 unique URLs
- 143,225 Packet Injection
across 54 countries, 1,205 unique URLs
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Key Findings

- Analysis by test lists
- Analysis by methods
- Longitudinal analysis
- Other network attacks

Different Observations from Different Test Lists

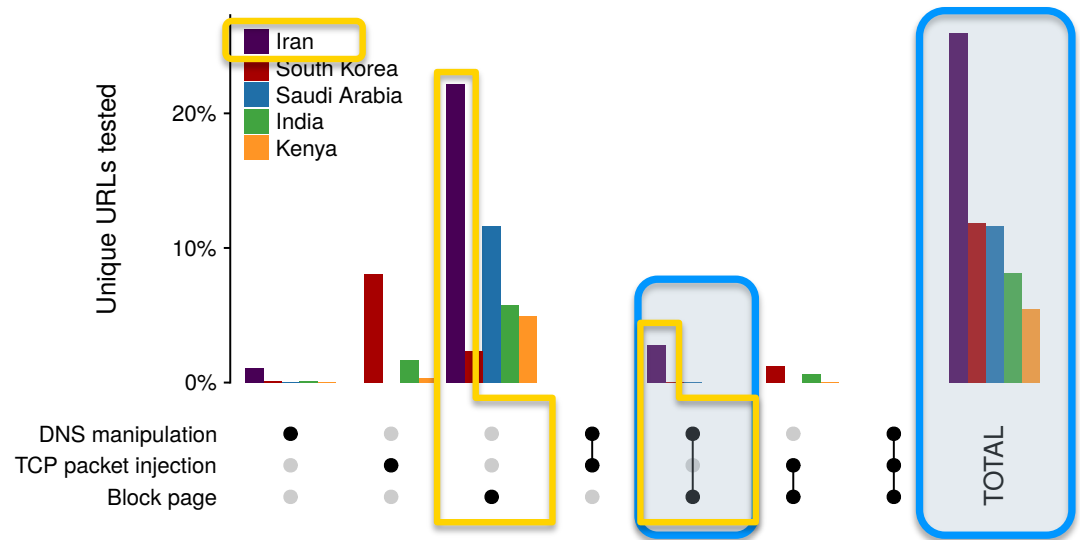
[Censorship by test list]

Overall			Alexa Global (ATL)			Globally Sensitive (CLBL-G)			Per-Country Sensitive (CLBL-C)		
Country	Category	Pct.	Country	Category	Pct.	Country	Category	Pct.	Country	Category	Pct.
Iran	NEWS	13.1%	Iran	NEWS	14.0%	Iran	PORN	11.6%	Iran	NEWS	21.0%
	PORN	9.2%		PORN	12.7%		NEWS	9.4%		BLOG	17.6%
	BLOG	7.5%		ENT	10.3%		PROX	6.8%		POL	7.2%
South Korea	PORN	15.4%	South Korea	SHOP	14.2%	Saudi Arabia	PORN	31.0%	India	ENT	19.0%
	NEWS	8.4%		PORN	13.7%		GAMB	13.5%		STRM	14.3%
	ORG	7.4%		NEWS	10.8%		PROX	12.2%		NEWS	10.8%
Saudi Arabia	PORN	29.5%	Saudi Arabia	PORN	70.0%	South Korea	PORN	15.6%	Saudi Arabia	NEWS	54.0%
	NEWS	11.3%		ILL	6.6%		ORG	10.4%		POL	7.7%
	GAMB	10.1%		GAMB	6.6%		NEWS	5.7%		RELI	7.7%
India	ENT	13.3%	Turkey	PORN	66.0%	Kenya	PORN	14.5%	Russia	BLOG	16.5%
	STRM	10.8%		ILL	4.0%		GAMB	10.8%		NEWS	14.4%
	NEWS	10.4%		FILE	4.0%		PROX	9.0%		GAMB	12.4%
Kenya	PORN	15.5%	India	ILL	35.5%	Turkey	PORN	47.0%	Turkey	NEWS	29.4%
	GAMB	10.1%		IT	8.8%		GAMB	22.6%		PORN	13.7%
	PROX	8.3%		STRM	6.6%		ILL	3.2%		GAMB	9.8%

Different Methods for Different Content

[Censorship by method]

Technique	Country	Categories	Pct.
Block page	Iran	NEWS, PORN, BLOG	24.95%
	Saudi Arabia	PORN, NEWS, GAMB	11.1%
	India	ENT, STRM, NEWS	6.4%
	Kenya	PORN, GAMB, PROX	4.8%
	Turkey	PORN, GAMB, NEWS	4.6%
DNS manipulation	Iran	BLOG, PORN, PROX	5.5%
	Uganda	PORN, ADUL, LING	1.7%
	Turkey	ILL, GAMB, STRM	0.3%
	Bulgaria	ILL, ARM, DOM	0.2%
	Netherlands	ILL, IM, DOM	0.2%
TCP packet injection	South Korea	PORN, ORG, NEWS	9.3%
	India	NEWS, ILL, IT	2.3%
	Netherlands	NEWS, SEAR, GAME	0.9%
	Japan	NEWS, GAME, SEAR	0.9%
	Australia	SEAR, NEWS, ILL	0.8%



ILL: illegal or unethical

STREAM: streaming media and download

[Combination of methods]

Censorship Changes over Time



[Observed censorship rates]

Detected Other Network Attacks

- Geo-blocking
 - HTTP 451 “Unavailable for Legal Reasons”
 - 23 Unique websites across 21 countries
- User tracking injection
 - Fingerprinting the client prior to loading the page
- Cryptocurrency mining injection
 - A botnet infecting MikroTick routers (exploiting CVE-2018-14847)
 - First observed on July 21st, 2018

Summary

Key Findings

- Each test list shows different censorship policy
- Different methods used to block different web categories
- How censorship has changed over time
- Other network interferences are detected



<https://iclab.org/>

Thank you!