# Ethical Internet measurement: From outages to anonymity

Philipp Winter
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# Venezuelan President Nicolas Maduro says power recovery will come 'little by little'

By Patrick Oppmann, Stefano Pozzebon and Susannah Cullinane, CNN

Updated 2017 GMT (0417 HKT) March 12, 2019

# Entire country taken offline for two days after undersea internet cable cut



# Iraq shuts down the internet to stop pupils cheating in exams

**The Iraqi government cuts off fixed-line and mobile broadband services to discourage children from smuggling mobile phones into state tests**

▲ Shutting down the internet is an efficient way of discouraging internet-based cheating – but the move has been criticised by human rights campaigners. Photograph: Ghaith Abdul-Ahad/Getty Images

# Wouldn’t it be great if we controlled peoples’ computer?

**Statement from the SIGCOMM 2015 Program Committee:** The SIGCOMM 2015 PC appreciated the technical contributions made in this paper, but found the paper controversial because some of the experiments the authors conducted raise ethical concerns. The controversy arose in large part because the networking research community does not yet have widely accepted guidelines or rules for the ethics of experiments that measure online censorship. In accordance with the published submission guidelines for SIGCOMM 2015, had the authors not engaged with their Institutional Review Boards (IRBs) or had their IRBs determined that their research was unethical, the PC would have rejected the paper without review. But the authors did engage with their IRBs, which did not flag the research as unethical. The PC hopes that discussion of the ethical concerns these experiments raise will advance the development of ethical guidelines in this area. It is the PC's view that future guidelines should include as a core principle that researchers should not engage in experiments that subject users to an appreciable risk of substantial harm absent informed consent. The PC endorses neither the use of the experimental techniques this paper describes nor the experiments the authors conducted.

# Encore: Lightweight Measurement of Web Censorship with Cross-Origin Requests

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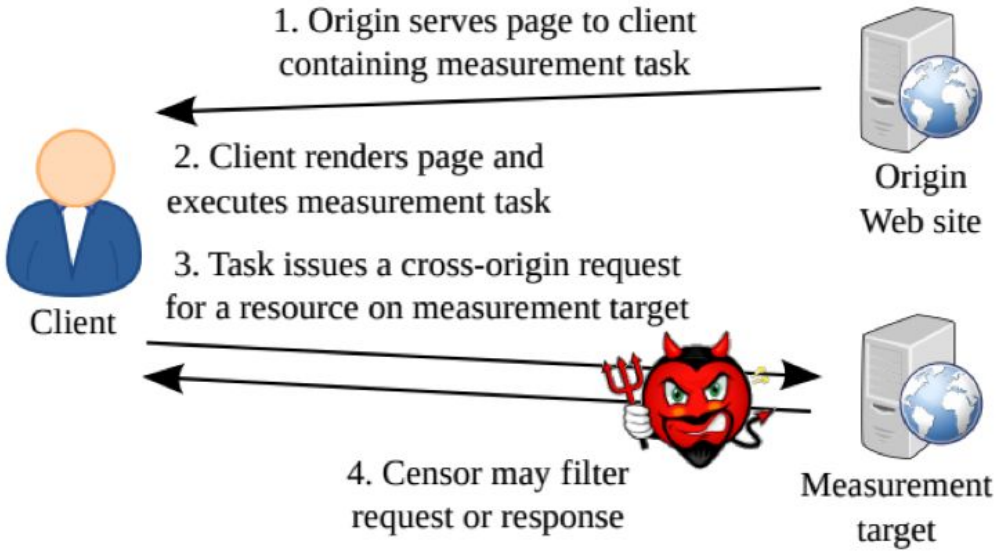
# Institutional Review Boards (IRBs)

- Common in the **U.S.** and some parts of **Europe**
  - Originally for **biomedical** and **behavioral** research
  - Goal is to prevent people coming to harm
- Oversight body **inside universities** for human subjects research
- Often **ill-informed** about technology
  - Level of involvement varies significantly

# Encore: How it works

1. Go to a **website**, e.g., news.com
2. Your browser **loads a script** from thirdparty.com
3. This script makes your browser connect to **adult-content.com**
4. Thirdparty.com then infers if your browser **could connect** to adult-content.com




Source: https://techscience.org/a/2015121501/

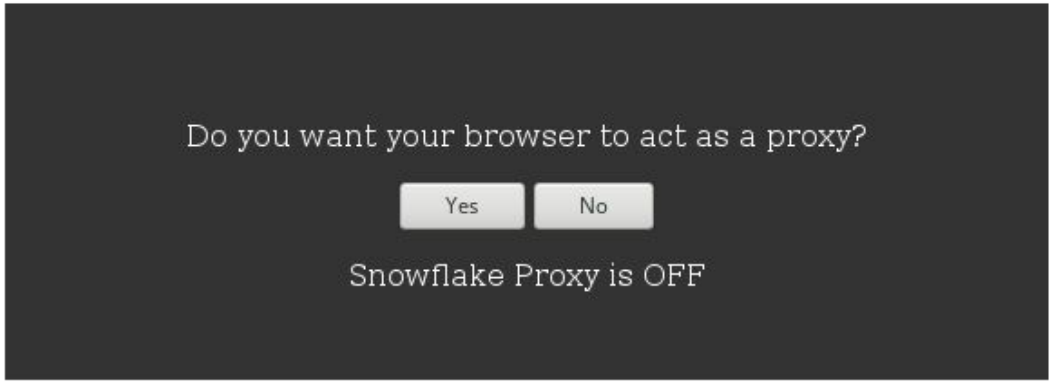
# What should we make of Encore?

- Princeton and Georgia Tech IRB: **Not** human subjects research
  - How would you obtain informed consent?
  - Are IP addresses personally identifying information?
- How do you define **risks** and **harms**?
- **No laws** were violated in the U.S.
  - But perhaps somewhere else?
- Opt-in vs. opt-out?
- Enables measurements at **significant scale**
  - Censorship can differ by region and autonomous system

# Snowflake

Snowflake is a WebRTC pluggable transport for Tor.

This page enables you to use your web browser as a proxy to help other Internet users in censored places. When you click yes, your browser will act as a censorship circumvention proxy as long as you are viewing a page with the snowflake badge.



# (Some) ethical frameworks

- **Belmont Report**
  - Issued in 1979
  - Concerns scientific and medical research involving people
  - “Respect for persons”, “beneficence”, and “justice”
- **Common Rule**
  - U.S. federal regulation
  - Instructs IRBs to make sure that research meets Belmont Report principles
- **Menlo Report**
  - Issued in 2012
  - Translates Belmont Report into computer science domain

# Case study: OONI

- Develops **tool** that measures **Internet censorship**
  - https://ooni.torproject.org
- Tests many **different types** of censorship
- Work with **partners** and communicates risks clearly
- **Makes available** anonymized censorship measurements
- Maintains **world-wide view** of censorship

**Forgive Us our SYNs: Technical and Ethical Considerations for Measuring Internet Filtering**

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[2]*Citizen Lab, University of Toronto*

No Encore for Encore? Ethical questions for web-based censorship measurement

Arvind Narayanan and Bendert Zevenbergen

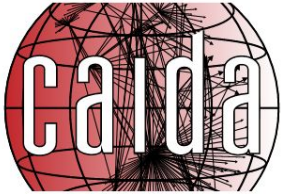
**Ethical Concerns for Censorship Measurement**

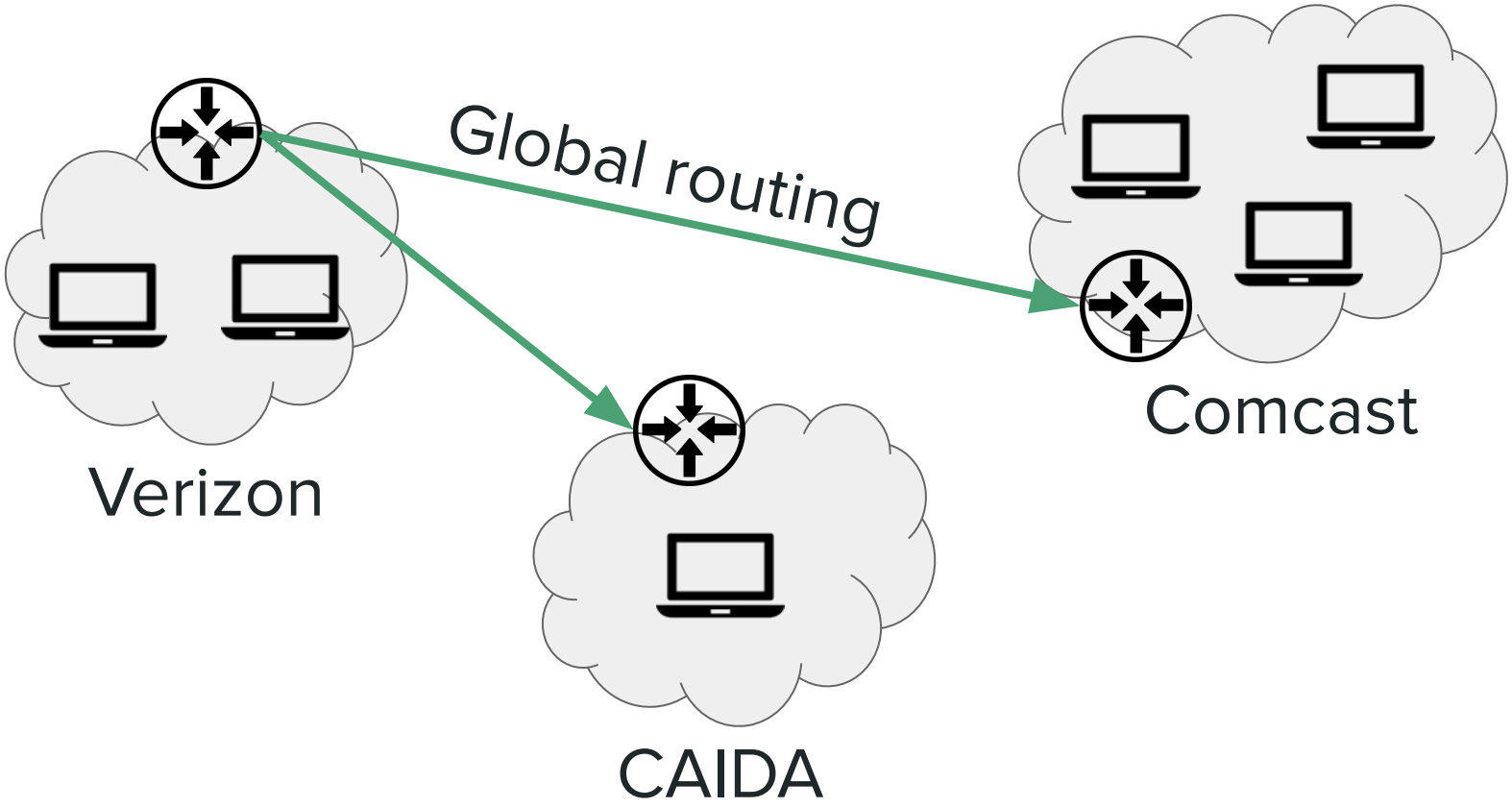
Ben Jones, Roya Ensafi, Nick Feamster, Vern Paxson, Nick Weaver

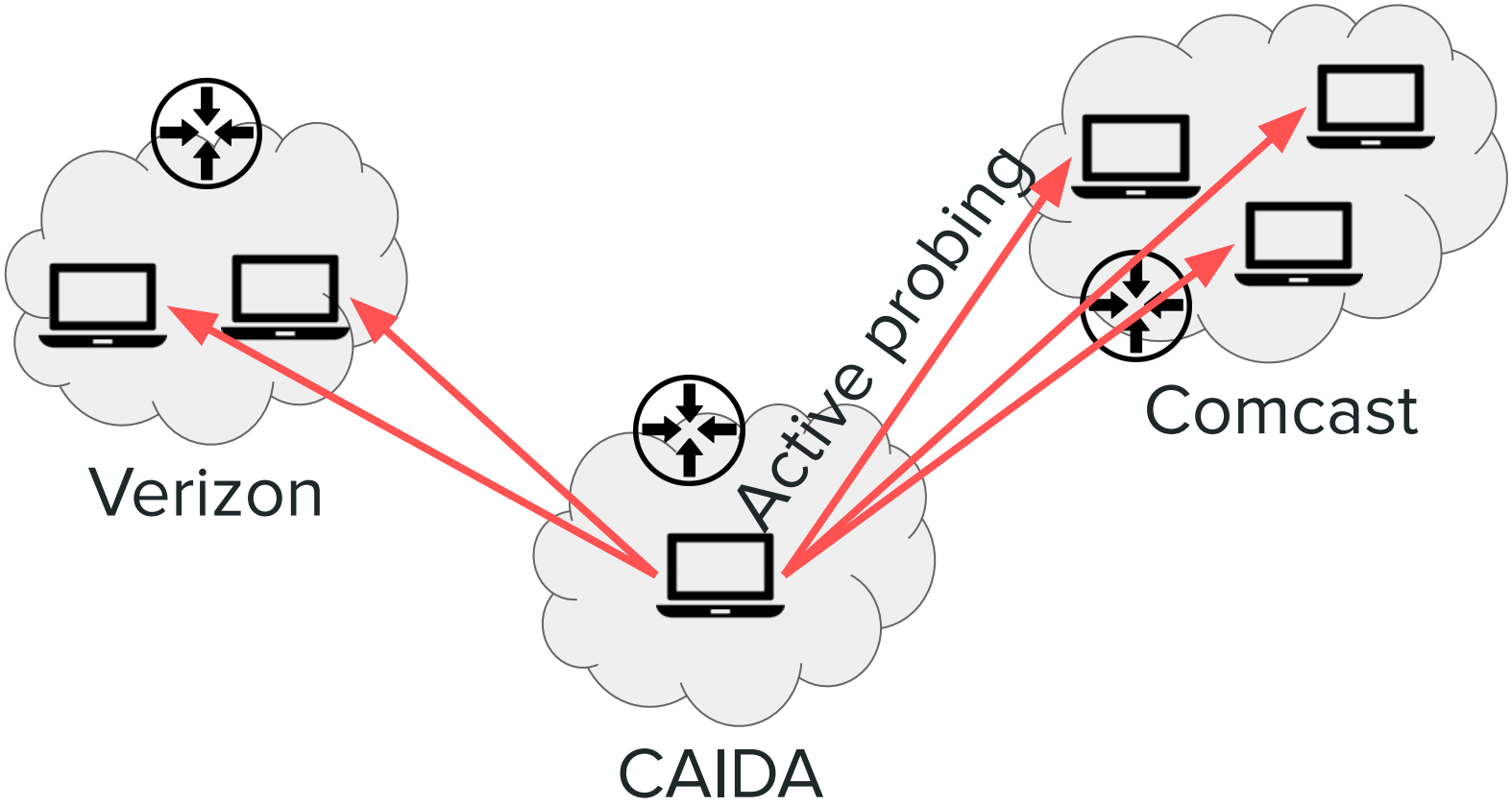
Princeton University, UC Berkeley, International Computer Science Institute

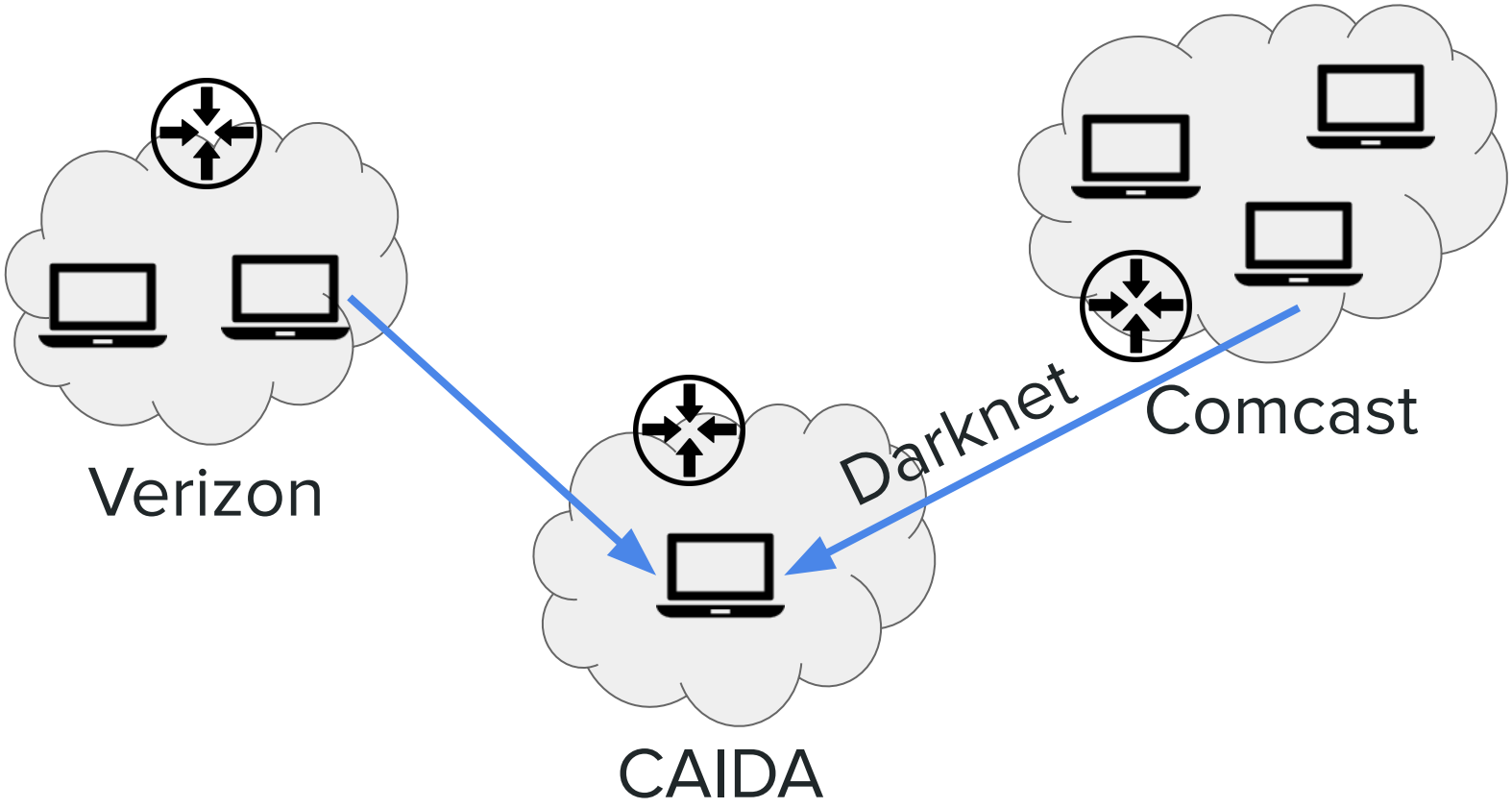
# Brief overview of IODA

- “Internet Outage Detection and Analysis”
- Platform that **detects Internet outages** and **facilitates analysis**
- Takes as input **three** data sources (BGP, active probing, darknet)
- Finds outages on **country**, **region**, and **autonomous system** level
- https://ioda.caida.org





Global routing
Verizon
Comcast
CAIDA


Verizon
Active probing
Comcast
CAIDA


Verizon
CAIDA
Darknet
Comcast

## IODA Signals for United States

Normalized | Alert Bands

*Time point aggregation:* Avg of 5 pts/px (25 minutes)

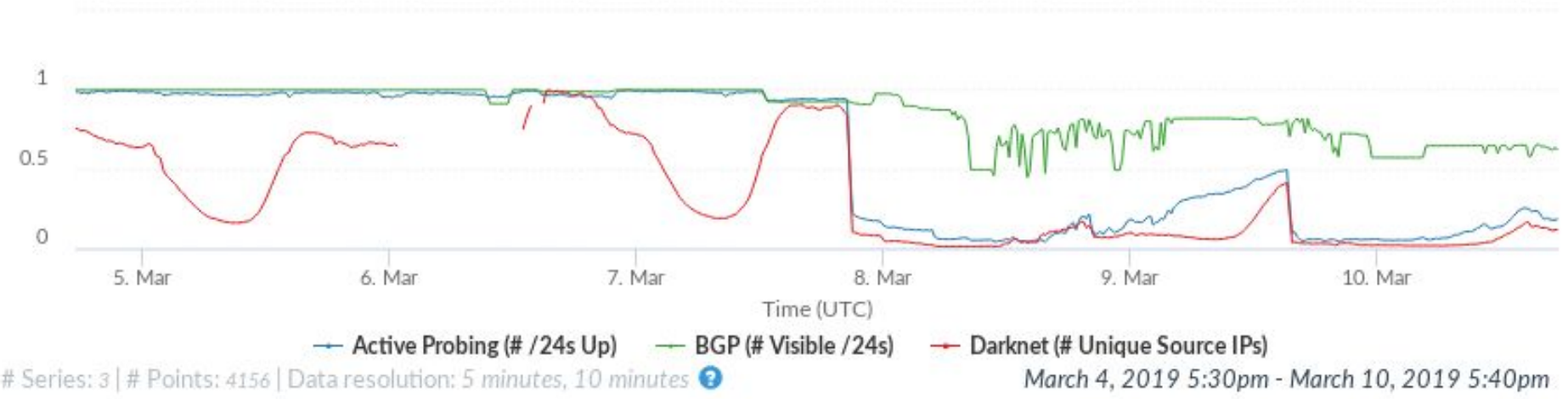

# Series: 3 | # Points: 4326 | Data resolution: 5 minutes, 10 minutes

*February 24, 2019 6:30pm - March 2, 2019 6:50pm*

## IODA Signals for Venezuela

Normalized | No Alerts

*Time point aggregation:* Avg of 5 pts/px (25 minutes)



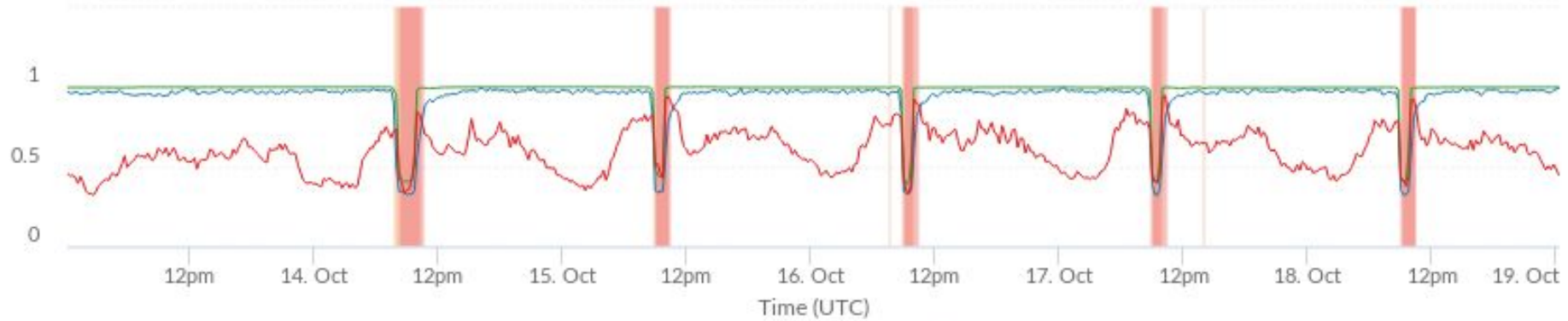

# Series: 3 | # Points: 4156 | Data resolution: 5 minutes, 10 minutes

*March 4, 2019 5:30pm - March 10, 2019 5:40pm*

## IODA Signals for Iraq

Normalized | Alert Bands

*Time point aggregation:* Avg of 5 pts/px (25 minutes)



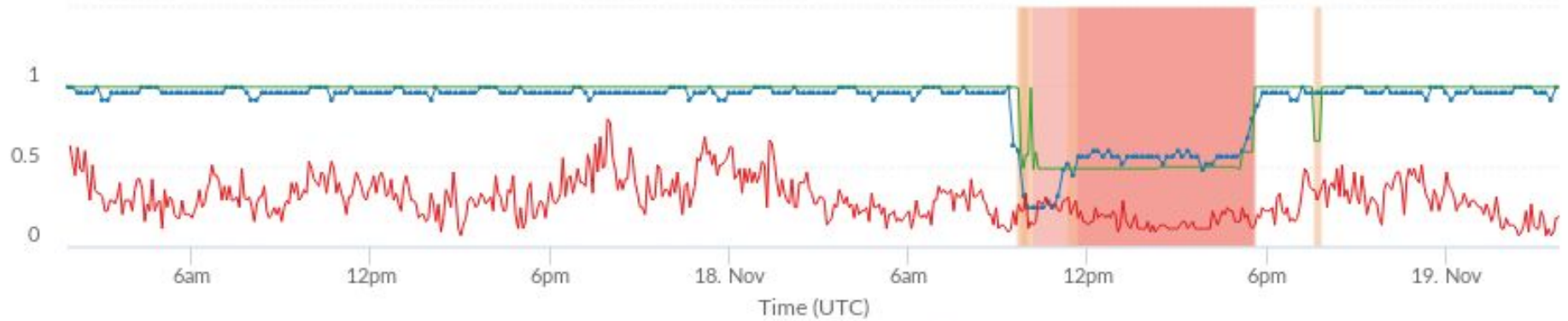

# Series: 3 | # Points: 4323 | Data resolution: 5 minutes, 10 minutes

*October 13, 2018 12:20am - October 19, 2018 12:30am*

## IODA Signals for Sierra Leone

Normalized | Alert Bands

*Time point aggregation:* Avg of 8 pts/px (8 minutes)




Active Probing (# /24s Up) — BGP (# Visible /24s) — Darknet (# Unique Source IPs)

# Series: 3 | # Points: 3890 | Data resolution: *minute, 5 minutes, 10 minutes*

*November 17, 2018 1:50am - November 19, 2018 3:50am*

# The two components of IODA

- **Dashboard** provides overview of outages over last **seven days**
  - Publicly available
  - https://ioda.caida.org/ioda/dashboard
- **Explorer** allows in-depth investigation of outages
  - Requires an account (contact me!)
  - https://ioda.caida.org/ioda/explorer

# Who worries about outages?

- **Internet shutdowns** are a **human rights** problem
  - Bringing transparency and holding actors accountable
- Some parties bound by **service level agreements**
  - What networks are offline?
- Protection of **critical infrastructure**
  - Power grid etc.




# Measuring the Tor network

# Understanding Tor

- **How many** people use Tor?
- For **how long** do people use it?
- **What** do people do over Tor?
- **What websites** do Tor users visit?

# Shining Light in Dark Places: Understanding the Tor Network

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# Possible to measure the network safely

## Safely Measuring Tor

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## Privacy-Preserving Dynamic Learning of Tor Network Traffic

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Nicholas Hopper
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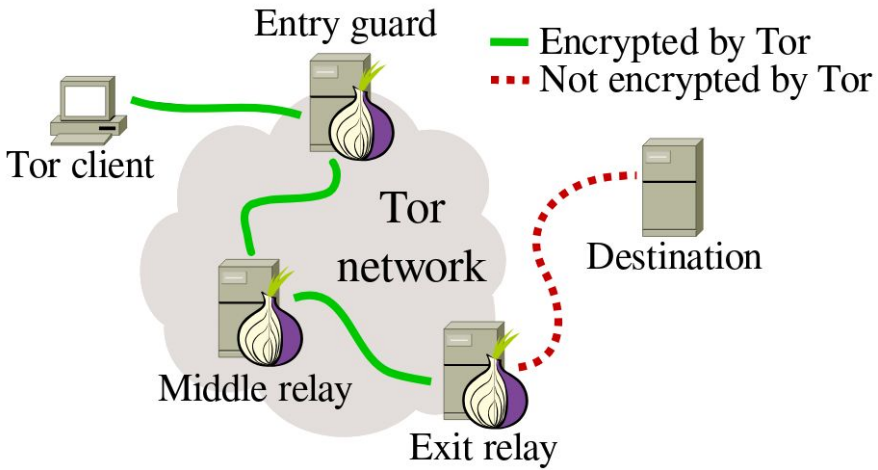
# Data collection is easy

- Nothing stops you from doing unethical data **collection**
- Design of Tor Browser should **minimize attack surface**



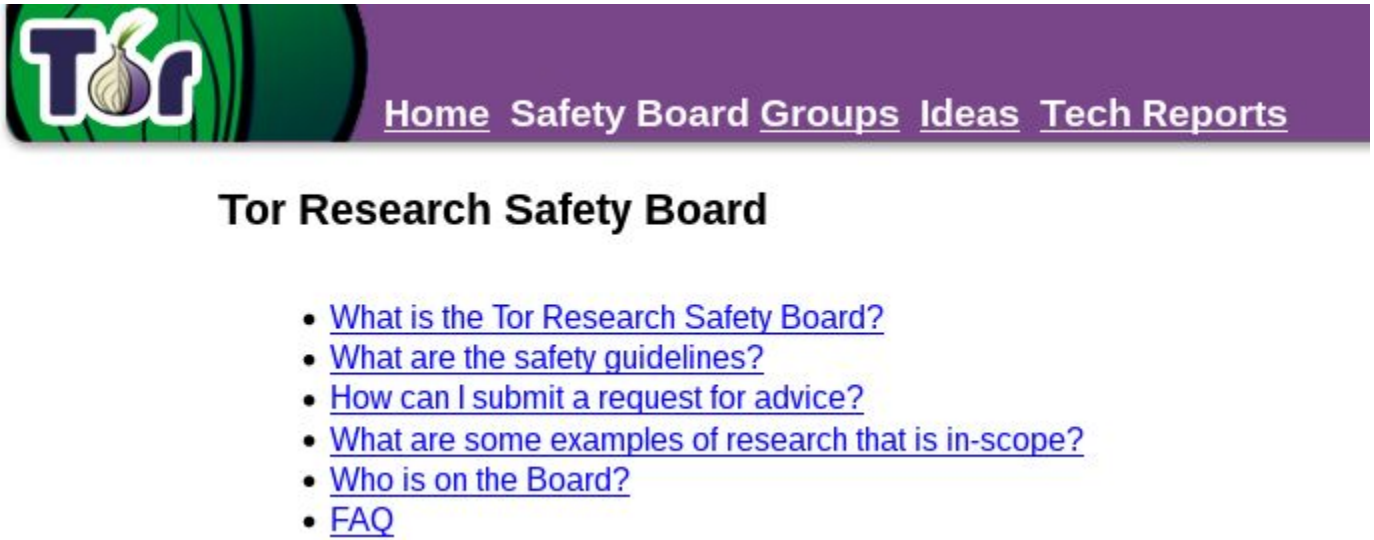
# Finding malicious Tor relays

- Scanning with exitmap:

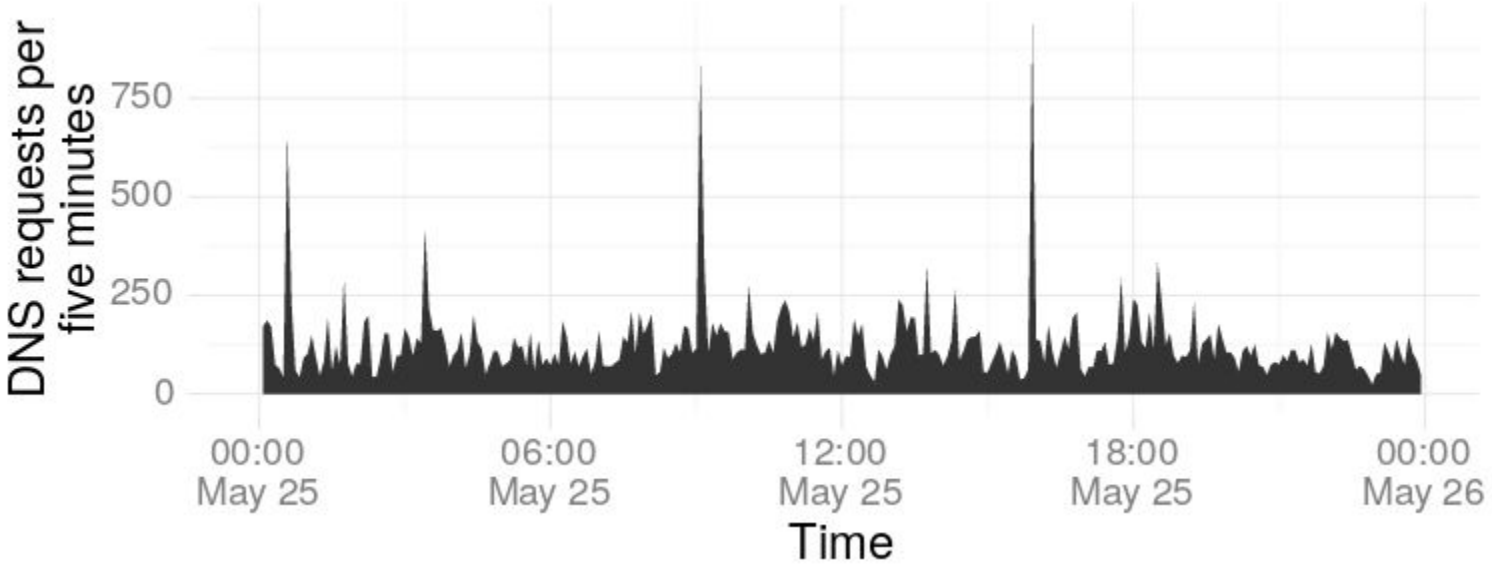
  https://github.com/NullHypothesis/exitmap

- Performs a task over all ~1,000 Tor exit relays
- The Tor Project uses tool to **hunt malicious exit relays**
- Can detect **many kinds of MitM** attacks
- Malicious exit relays are then **blocked** by Tor Project

# https://research.torproject.org/safetyboard.html



# Case study: # of DNS requests



# Security research inherently political

## The Moral Character of Cryptographic Work*

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December 2015
(minor revisions March 2016)

# Ethics in computer science

- Unlike **physics**, computer science hasn't had an "**atomic bomb**" moment
  - We're increasingly having many smaller "bomb" moments
- "Anything goes" attitude **not uncommon**
- **Universities** share blame
  - How many curricula incorporate ethics courses?
- Dogmas sometimes **imply recklessness**
  - "Move fast and break things"

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