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

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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.
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.

Do you want your browser to act as a proxy?

Yes  No

Snowflake Proxy is OFF
(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](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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No Encore for Encore? Ethical questions for web-based censorship measurement

Arvind Narayanan and Bendert Zevenbergen

Ethical Concerns for Censorship Measurement

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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

CAIDA

Comcast
Active probing

CAIDA

Verizon

Comcast
IODA Signals for United States

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

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

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

February 24, 2019 6:30pm - March 2, 2019 6:50pm
The two components of IODA

- **Dashboard** provides overview of outages over last **seven days**
  - Publicly available
  - [https://ioda.caida.org/ioda/dashboard](https://ioda.caida.org/ioda/dashboard)

- **Explorer** allows in-depth investigation of outages
  - Requires an account (contact me!)
  - [https://ioda.caida.org/ioda/explorer](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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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
Tor Research Safety Board

- What is the Tor Research Safety Board?
- What are the safety guidelines?
- How can I submit a request for advice?
- What are some examples of research that is in-scope?
- Who is on the Board?
- FAQ
Case study: # of DNS requests
Security research inherently political

The Moral Character of Cryptographic Work*

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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”