The Ethics of Internet Measurements

Using RIPE Atlas as an example

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Overview

- Technical is political
- The ethics of Internet measurements
- RIPE NCC’s RIPE Atlas design
- An example of a “web measurements” workaround

- Conclusion: Question everything!

- Longer version at SHA2017: "Ethics in Technology"
  - lecture & video
Main Inspirations

Ethics (via Latin *ethica* from the Ancient Greek ἠθική [φιλοσοφία] "moral philosophy", from the adjective of ἔθος *ēthos* "custom, habit"), a major branch of philosophy, is the study of values and customs of a person or group. It in simplest terms is the philosophy on how to act. It covers the analysis and employment of concepts such as right and wrong, good and evil, and responsibility. It is divided into three primary areas: *meta-ethics* (the study of the concept of ethics), *normative ethics* (the study of how to determine ethical values), and *applied ethics* (the study of the use of ethical values).
Interdisciplinary (for example, Environmental)

- Life Sciences
- Philosophy / History
- Physical Sciences
- Formal Sciences
- Social Sciences
- Nuclear
- Medicine
- Engineering
- Computer Science
- (other applied sciences)
Technical is Political

• “Technological ideas and technological things are not politically neutral: routinely, they have strong, built-in tendencies. Technological advances are usefully considered not only from the lens of how they work, but also why they came to be as they did, whom they help, and whom they harm.” [r]

• “The machines, structures, and systems of modern material culture are (should be) judged for their:

  - contributions of efficiency and productivity,
  - positive and negative environmental side effects,
  - the ways in which they can embody specific forms of power and authority.” [art]
Classical Sciences Ethical Dilemmas

The oath of Hippocrates

which he gaue vnto his desiples and scollers, which pro-
fessing Phisicke and Chirurgerie is very worthie to
be obserued and kept faithfulle, of euerie true
and honest Artes, although he himselfe
were but a heathen man, and without
the true knowledge of the living God;
yet for his noble and excellent skill
in Phisicke and Chirurgerie, he
ought not to be forgotten
of vs his posterity, but
to be had in an hono-
urable remembrance
for euer.
Computer Sciences Ethical Dilemmas

- Programming
- Networking
- Cryptography
- AI
- Other areas of Computer Science
Internet Measurements
Ethics
Theory of Applied Ethics

• Consequentialism ("the ends justify the means")
  - Utilitarianism

• Deontology ("duty for duty’s sake")

• A mix: "Virtue Ethics"
  - The right actions are those chosen by an actor of virtuous character

• Principlism
  - Respect for autonomy, beneficence, non-maleficence, justice
  - But what if these are conflicting? What guides the action?

• Casuistry: practical, case reasoning
Measurements Ethics [ensr]

- “Ethics in Networked Systems Research”
- Internet as socio-technical system
- Responsibilities resulting from power imbalances
- Meaningful, informed consent
- Weighing risks, benefits and values for an ethical analysis
- Status of easily accessible data
- Not condoning potentially unethical research
Designing Ethical Measurements
Questions

- **Context:** How would you describe the context within which data is collected, information flows are created (or affected), or phenomena are measured?
- **Aims:** What are the aim and benefits of the project?
- **Benefits:** Why are the benefits good for stakeholders?
- **Purpose limitation:** Can the scope of data collection be limited whilst still achieving the project aim?
- **Politics and Power:** Are particular stakeholders empowered or disempowered as a result of this project?
- **Risk of Harm:** Could the collection of the data in this study be reasonably expected to cause tangible harm to any person’s well-being?
- **Law:** Which bodies of law are likely to be applicable to the operation of the project?
- **Values:** Which values will the project conceivable impact?
- **Burden:** Who carries the burden of harms or impacted values, and how?
- **Technology Ethics:** Can the harms and impacted values be traced to parts of the technological design of the project?
- **Function Creep:** Does the project potentially set a precedent for unethical methodologies that could be misused by others in the future?
- **Data Governance:** Using current techniques, can the data used in this study reveal private or confidential information about individuals?
  - If so, discuss measures taken to keep the data protected from inappropriate disclosure or misuse.
- **Data Retention:** When will the collected data be deleted?
- **Tech Alternatives:** Have you considered measures to mitigate the identified risk of harm or impacted values?
  - Can alternative technologies be employed or devised to mitigate some issues?
- **Limit Scope:** Can you limit the scope of the project (geography, knowledge generated, etc.)?
- **Methodology:** Have others used alternative methodologies to achieve similar ends?
- **Informed Consent:** Do you need to rely on informed consent from participants and stakeholders?
Measurements Platforms Comparison

<table>
<thead>
<tr>
<th>Platform</th>
<th>Flexibility</th>
<th>Coverage</th>
<th>Blocking resistance</th>
<th>Main use</th>
</tr>
</thead>
<tbody>
<tr>
<td>PlanetLab [16]</td>
<td>High</td>
<td>Low/Medium</td>
<td>Medium</td>
<td>Network measurements</td>
</tr>
<tr>
<td>Atlas [18]</td>
<td>Low</td>
<td>Medium/High</td>
<td>Medium</td>
<td>Network measurements</td>
</tr>
<tr>
<td>M-Lab [6]</td>
<td>Low</td>
<td>High</td>
<td>Medium</td>
<td>Network measurements</td>
</tr>
<tr>
<td>Tor [5]</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>Low-latency anonymity</td>
</tr>
<tr>
<td>OONI [10]</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>Interference analysis</td>
</tr>
<tr>
<td>Herdict [11]</td>
<td>Low</td>
<td>Low/Medium</td>
<td>Low</td>
<td>Interference analysis</td>
</tr>
<tr>
<td>OpenNet [14]</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>Interference analysis</td>
</tr>
</tbody>
</table>

**Table 1:** Comparison between several popular filtering analysis platforms.

- “Global Network Interference Detection over the RIPE Atlas Network” (FOCI14)
### ENSURING A FUTURE FOR DETECTING INTERNET DISRUPTIONS

**A Field Survey of the Ecosystem Around Internet Censorship, Disruptions, and Shutdowns**

<table>
<thead>
<tr>
<th>Category &amp; Characteristics</th>
<th>Requirements</th>
<th>Example(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECONOMIC</strong></td>
<td></td>
<td></td>
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</tbody>
</table>
| Protecting business access | • Attribution  
• Contextual      | Online services combating censorship/disruption targeting their services or companies |
| Ensuring large-scale access| • Attribution  
• Contextual  
• Compelling  
• Comparative | Department of State, international telecommunications bodies/groups [e.g., ITU, ICANN], [RIPE Atlas, M-Lab] |
RIPE NCC, RIPE Atlas, Ethics Implemented
Regional Internet Registries
IPv6 Addresses Distribution

IANA

RIR

LIR

End User

Allocation

PA Assignment

PI Assignment

/3

/12

/32

/56

/48

/48
RIPE Atlas

From Wikipedia, the free encyclopedia

RIPE Atlas is a global, open, distributed Internet measurement platform, consisting of thousands of measurement devices that measure Internet connectivity in real time.

https://atlas.ripe.net
Most Popular RIPE Atlas Features

- Six types of measurements: ping, traceroute, DNS, SSL/TLS, NTP and HTTP (to anchors)
- APIs to start measurements and get results
- Powerful and informative visualisations: “Time Travel”, LatencyMON, DomainMON, TraceMon
- CLI tools
- Streaming data for real-time results
- Roadmap shows what’s completed and coming
Ethics Design Decisions

• Active measurements only
  - probes do not observe user traffic

• Low barrier to entry
  - gratis probes, funded by LIRs and sponsors

• Hosted by volunteers
  - informed consent (accepting T&C)
  - personal data never revealed

• Data, API, source code, tools: free and open

• Measurements sets limited
Ongoing Moral Dilemmas

• 2013: Opening-up source code
• 2014: Keeping “non-public” measurements available
• 2015: Not allowing HTTP measurements to random targets
• 2016: Security audit
ENSR Checklist

- Responsibilities resulting from power imbalances
- Meaningful informed consent
- Weighing risks, benefits and values for an ethical analysis
- Not condoning potentially unethical research methods

- Low barrier to entry
- Data, API, source code, tools: free and open
- Probes hosted by volunteers (accepting T&C)
- Existence of “non-public” measurements
- No HTTP measurements
- No passive measurements
# Human Rights Considerations

- Right to security (safety)
- Right to political participation
- Right to non-discrimination
- Right to freedom of expression
- Right to education

<table>
<thead>
<tr>
<th>• Personal data not revealed</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No passive measurements</td>
</tr>
<tr>
<td>• No HTTP measurements</td>
</tr>
<tr>
<td>• “Gratis” devices</td>
</tr>
<tr>
<td>• Consenting volunteers</td>
</tr>
<tr>
<td>• Existence of “non-public” measurements</td>
</tr>
<tr>
<td>• Data, API, source code, tools: free and open</td>
</tr>
</tbody>
</table>
Web Measurements: The Ethical Way
Measuring Reachability of Web Servers

• Users have been asking for HTTP measurements

• Due to ethical reasons, in 2015 we’ve decided:
  - not possible to target arbitrary websites with probes
  - “standard” HTTP measurements are ONLY possible towards RIPE Atlas anchors

• September 2017: a proven workaround
  - https://labs.ripe.net/Members/wilhelm/measuring-your-web-server-reachability-with-tcp-ping
  - https://www.youtube.com/watch?v=liaql4xk-GI
Workaround: Using a “TCP Ping”

• traceroute (TCP) to the targeted web server
  - towards IP address: port 80
  - 3 packets; a packet size of zero
  - “maximum hops” = 64; initial time-to-live (TTL) = 64
  - long enough for the first traceroute attempt to immediately reach the destination address

• Mimics the behaviour of the TCP handshake
  - that takes place when setting up an HTTP connection

• This measures the same network delays!
  - RTT turns out to be equivalent to HTTP connect times
How to: Web UI

- Go to “Measurements”
- Click on “New msm”
- “Advanced options”
- Add up to 1000 probes
- Choose “one off”
  - or continuous / repeated
- Done!
  - you need to have “credits”
How to: Command Line (CLI)

# ripe-atlas measure traceroute --target 82.94.235.165 --protocol TCP --size 0 --first-hop 64 --max-hops 64 --port 80

• CLI tools:
  - Source: https://github.com/RIPE-NCC/ripe-atlas-tools/
  - Documentation: https://ripe-atlas-tools.readthedocs.org/
  - Included in many Linux / BSD distributions
Results

- Reachability Map
  - colour-coded for latency
- List of probes and latencies

<table>
<thead>
<tr>
<th>3rd TCP Ping measurement to 82.94.235.165 (unciv.nl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Information</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Probe</td>
</tr>
<tr>
<td>10150</td>
</tr>
<tr>
<td>10782</td>
</tr>
<tr>
<td>24605</td>
</tr>
<tr>
<td>13538</td>
</tr>
<tr>
<td>31178</td>
</tr>
<tr>
<td>16274</td>
</tr>
</tbody>
</table>

- Download as JSON
  - https://atlas.ripe.net/api/v2/measurements/9412863/results/?start=1506988800&stop=1507075199&format=json
Detailed Technical Information

- Rene Wilhelm on RIPE Labs
- For 68% of the probe/destination pairs, median values differ by less than 1ms
- Interdecile ranges differ by less than 6ms
- When compared to RTT of 100 milliseconds, a difference in spread of 5-15ms may still be acceptable to assess network performance
RIPE Atlas References

- https://atlas.ripe.net
- https://labs.ripe.net/hackathons
- “Global Network Interference Detection over the RIPE Atlas Network”
- “Ethics in Network Measurements” (2017)
- “A Field Survey of the Ecosystem Around Internet Censorship, Disruptions, and Shutdowns” (June 2017)
More Concrete Examples

• Meddling with the Internet in Turkey: March 2014, Emile Aben
• DNS related censorship in Iran: July 2016, Babak Farrokhi
• Orange Blacklisting: Oct 2016, Stéphane Bortzmeyer
• Detecting Network Outages, Aug 2017, Anant Shah
• Measurements as the Key to Transparency: Jan 2018, Alexander Azimov
Strong Community Involvement

• Join the RIPE Atlas community!
  - Host a RIPE Atlas probe!
  - Use our (open) measurements data!
  - Use, modify & improve our (FLOSS) software!
  - Come to our hackathons!

• [https://atlas.ripe.net](https://atlas.ripe.net)

• [atlas@ripe.net](mailto:atlas@ripe.net)

• [@RIPE_Atlas](mailto:@RIPE_Atlas)
“Technological advances are usefully considered not only from the lens of how they work, but also why they came to be as they did, whom they help, and whom they harm.” [r]
Additional Slides
Internet Ethics: FLOSS, Hackers, Cryptographers
“Free Software” Values

• Individual freedoms
  - to use the software as you wish;
  - to study the program and how it works (perusing its source code);

• At a collective level:
  - the freedom to distribute exact copies of the program, so you can help your neighbour; and
  - the freedom to modify the source code and distribute these modified versions under the same conditions.

• [https://gnu.org/philosophy/free-sw](https://gnu.org/philosophy/free-sw)

• Open Source vs Free / Libre Software?
Everybody needs a hacker
Hackers Ethics

Levy's Hacker Ethic

- Access to computers should be unlimited and total.
- All information should be free.
- Mistrust authority—promote decentralization.
- Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race or position, gender
- You can create art and beauty on a computer.
- Computers can change your life for the better.
Tips for Academic Cryptographers

• ⪗ Attend to problems’ social value. Do anti-surveillance research.
• ⪗ Be introspective about why you are working on the problems you are.
• ⪗ Think twice, and then again, about accepting military funding.
• ⪗ Regard ordinary people as those whose needs you ultimately aim to satisfy.
• ⪗ Use the academic freedom that you have.
• ⪗ Be open to diverse models. Regard all models as suspect and dialectical.
• ⪗ Get a systems-level view. Attend to that which surrounds our field.
• ⪗ Design and build a broadly useful cryptographic commons.
• ⪗ Take adversaries seriously.
8. The Critical Engineer looks to the history of art, architecture, activism, philosophy and invention and finds exemplary works of Critical Engineering. Strategies, ideas and agendas from these disciplines will be adopted, re-purposed and deployed.

9. The Critical Engineer notes that written code expands into social and psychological realms, regulating behaviour between people and the machines they interact with. By understanding this, the Critical Engineer seeks to reconstruct user-constraints and social action through means of digital excavation.

10. The Critical Engineer considers the exploit to be the most desirable form of exposure.
Beyond Hacker Ethics
Question Everything!
this is what a hacker looks like.

or is it?

the image of the white, male hacker in a hoodie is harmful and exclusive to people who don’t fit that mold.

what if you could change that image?

http://linnytu.com/hacker
Hacker Ethic Questions

• Access to computers should be unlimited and total. Who gets to use what I make? Who am I leaving out? How does what I make facilitate or hinder access?

• All information should be free. What data am I using? Whose labor produced it and what biases and assumptions are built into it? Why choose this particular phenomenon for digitization/transcription? What do the data leave out?

• Mistrust authority—promote decentralization. What systems of authority am I enacting through what I make? What systems of support do I rely on? How does what I make support other people?

• Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race or position. What kind of community am I assuming? What community do I invite through what I make? How are my own personal values reflected in what I make?

Allison Parrish: “Programming is Forgetting: Toward a New Hacker Ethic” (2016)
With Great Power Comes Great Responsibility
With great power…

At a time when science plays such a powerful role in the life of society, when the destiny of the whole of mankind may hinge on the results of scientific research, it is incumbent on all scientists to be fully conscious of that role, and conduct themselves accordingly. I appeal to my fellow scientists to remember their responsibility to humanity.\textsuperscript{210}

• … great responsibility
• to humanity…
• to the planet…
• and to squirrels!
Possible Alternatives

Additions to Hacker Ethics
http://feministinternet.net

1. A feminist internet starts with and works towards empowering more women and queer persons – in all our diversities – to dismantle patriarchy. This includes universal, affordable, unfettered, unconditional, and equal access to the Internet.

2. A feminist internet is an extension, reflection, and continuum of our movements and resistance in other spaces, public and private. Our agency lies in us deciding as individuals and collectives what aspects of our lives to politicize and/or publicize on the internet.

3. The internet is a transformative public and political space. It facilitates new forms of citizenship that enable individuals to claim, construct, and express our selves, genders, sexualities. This includes connections across territories, demands for accountability and transparency, and significant opportunities for feminist movement-building.

4. Violence online and tech-related violence are part of the continuum of gender-based violence. The misogynistic attacks, threats, intimidation, and policing experienced by women and LGBTQI people are real, harmful, and alarming. It is our collective responsibility as various internet stakeholders to prevent, respond to, and resist this violence.

9. The internet's role in enabling access to critical information - including conversations on health, pleasure, and risks - is essential, and must be supported and protected.

10. Surveillance by default is the tool of patriarchy to control and restrict rights both online and offline. The right to privacy is a critical principle for a safer, open internet for all. Equal attention needs to be paid to surveillance practices by individuals against each other, as well as the private sector and non-state actors, in addition to the state.

11. We have the right to access all our personal data online and to be able to exercise control, which includes knowing who has access to the data and under what conditions and being able to delete it forever. However, this is only possible against the right to accountability, transparency, and access.

12. We strongly object to non-state actors to control our sexual lives of consent expressed and practiced this as part of the larger policing, censorship, and rights.
(Tech) Ethics of Nonviolence

- Nonviolent resistance philosophy of Gandhi & Martin Luther King Jr

- Algorithmically-geeky “Non-violent Communication” by Marshal Rosenberg

- “Guide to Empathetic Technical Leadership" [Link](http://empathetictechincalleader.com)
  - FREE to read online: [Link](https://leanpub.com/littleguide/read)

- Open Source and Feelings (#OSSfeel)
  - [Link](http://www.osfeels.com/)
The Internet of Empathy

• Positive freedom of connectivity, interaction and involvement
  - Instead of libertarian “freedom” as independence and self reliance
• This freedom comes at the price of greater responsibility
• “the intrinsic value of a network does not lie in the sovereignty and independence of its nodes, but in their connectedness,”
• Empathy is willingness to engage with the Other, and willingness to enrich network with our contributions
• From: “To Our Friends” by The Invisible Committee
  https://mitpress.mit.edu/books/our-friends
Beyond Techno-Optimism
A NATURAL PAIRING: A data center in Ashburn, Va., seen past a Dominion Virginia Power substation serving it. Worldwide, such centers use the roughly equivalent of the output of 30 nuclear power plants.

Brendan Smialowski for The New York Times

1 MILLION WORKERS.
90 MILLION IPHONES.

17 SUICIDES.
Squirrels Winning the Cyber-War ;-) 

<table>
<thead>
<tr>
<th>Agent</th>
<th>Success</th>
</tr>
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<tbody>
<tr>
<td>Squirrel</td>
<td>879</td>
</tr>
<tr>
<td>Bird</td>
<td>434</td>
</tr>
<tr>
<td>Snake</td>
<td>83</td>
</tr>
<tr>
<td>Raccoon</td>
<td>72</td>
</tr>
<tr>
<td>Rat</td>
<td>36</td>
</tr>
<tr>
<td>Marten</td>
<td>22</td>
</tr>
<tr>
<td>China</td>
<td>0</td>
</tr>
<tr>
<td>Russia</td>
<td>0*</td>
</tr>
<tr>
<td>USA</td>
<td>1</td>
</tr>
</tbody>
</table>

- [https://wiki.techinc.nl/index.php/Hackers_tribes#Squirrels_against_technology](https://wiki.techinc.nl/index.php/Hackers_tribes#Squirrels_against_technology)
Acknowledgements & References
More references

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- Philosophy of Hacking, by Groente
- Digital Tailspin: Ten Rules for the Internet After Snowden
- Tor, Technocracy, Democracy
- Heather Marsh
- [how] Software Freedom your Way
- Sebastian Olme
- http://guymcpherson.com/2013/12/hackers-ethic-for-the-world-after-collapse/
Even more references, July 2017

- IETF & Human Rights & https://www.rightscon.org/
- “To Our Friends”, by The Invisible Committee
  - https://mitpress.mit.edu/books/our-friends
- “I Hate the Internet” http://weheardyoulikebooks.com/releases/i-hate-the-internet/
- Geoff Huston: "The Internet's Gilded Age" (March 2017) http://www.potaroo.net/ispcol/2017-03/gilding.html
Main Inspirations

- [ensr] “Philosophy meets Internet Engineering: Ethics in Networked Systems Research”