



RIPE NCC

RIPE NETWORK COORDINATION CENTRE

The Ethics of Internet Measurements

Using RIPE Atlas as an example

Vesna Manojlovic, Community Builder
BECHA@ripe.net

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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



- [r] Phillip Rogaway: “The Moral Character of Cryptographic Work” (2015)
- [p] Allison Parrish: “Programming is Forgetting: Toward a New Hacker Ethic” (2016)
- [ensr] “Philosophy meets Internet Engineering: Ethics in Networked Systems Research” (2015)
- [art] Langdon Winner: “Do Artefacts Have Politics?” (1980)
- [u] Ursula K. Le Guin: “A Non-Euclidean View of California as a Cold Place to Be” (1989)
- [rfc8280] “Human Rights Protocol Considerations” (2017)



Ethics in Science & Technology

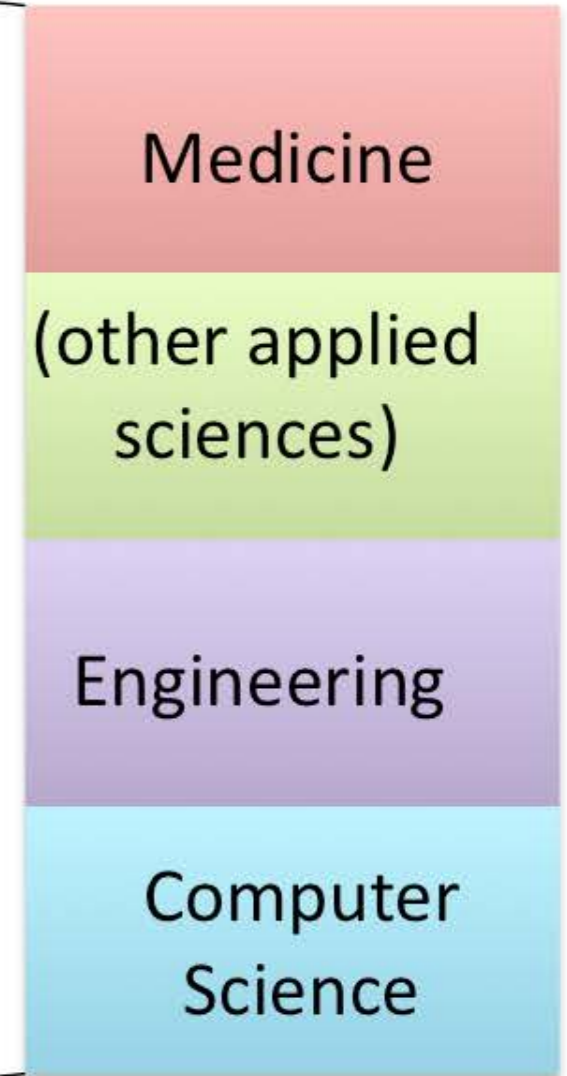
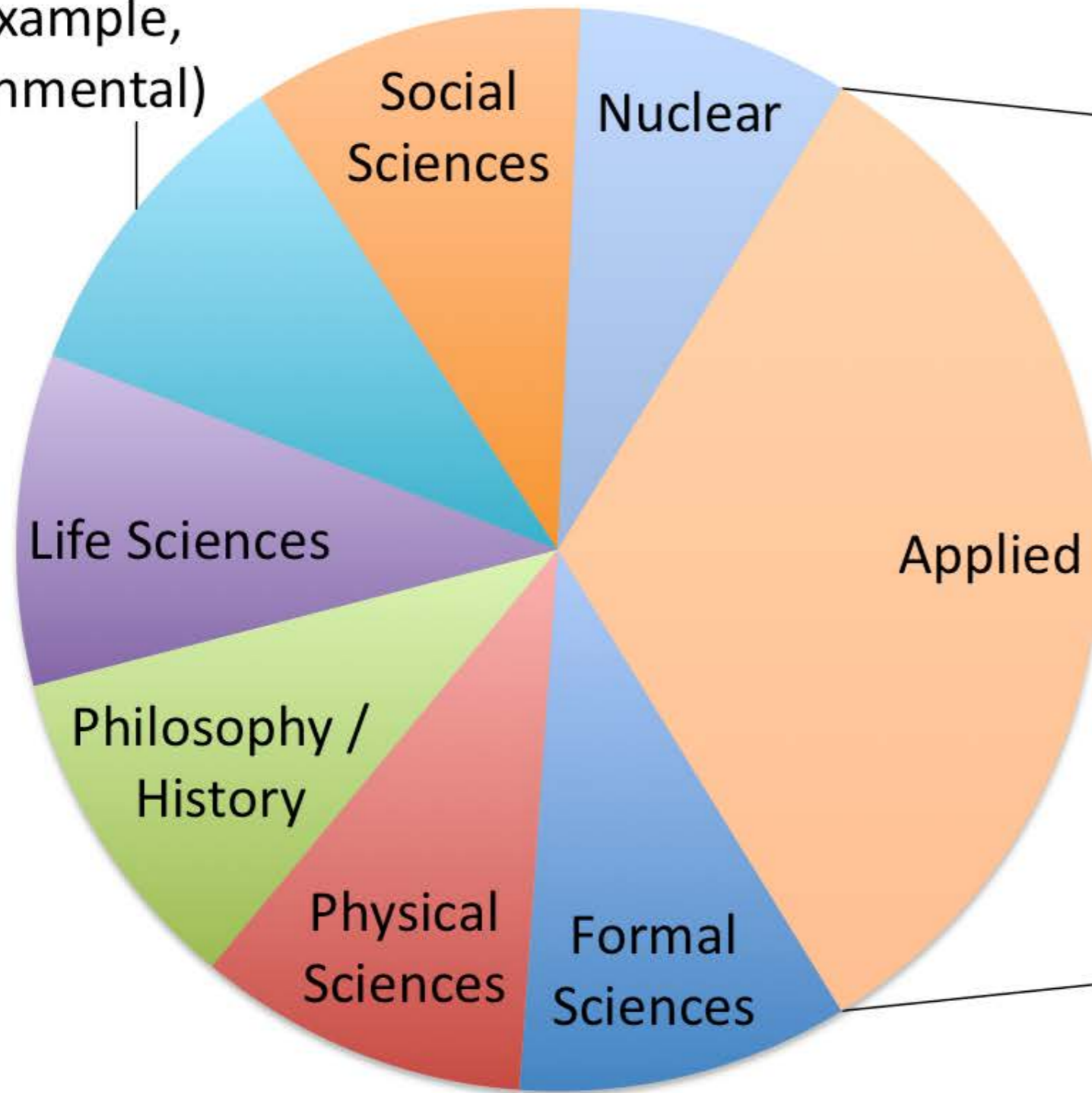
Ethics

[edit](#)

Ethics (via [Latin](#) *ethica* from the [Ancient Greek](#) ἠθική [φιλοσοφία] "moral philosophy", from the [adjective](#) of ἦθος *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)

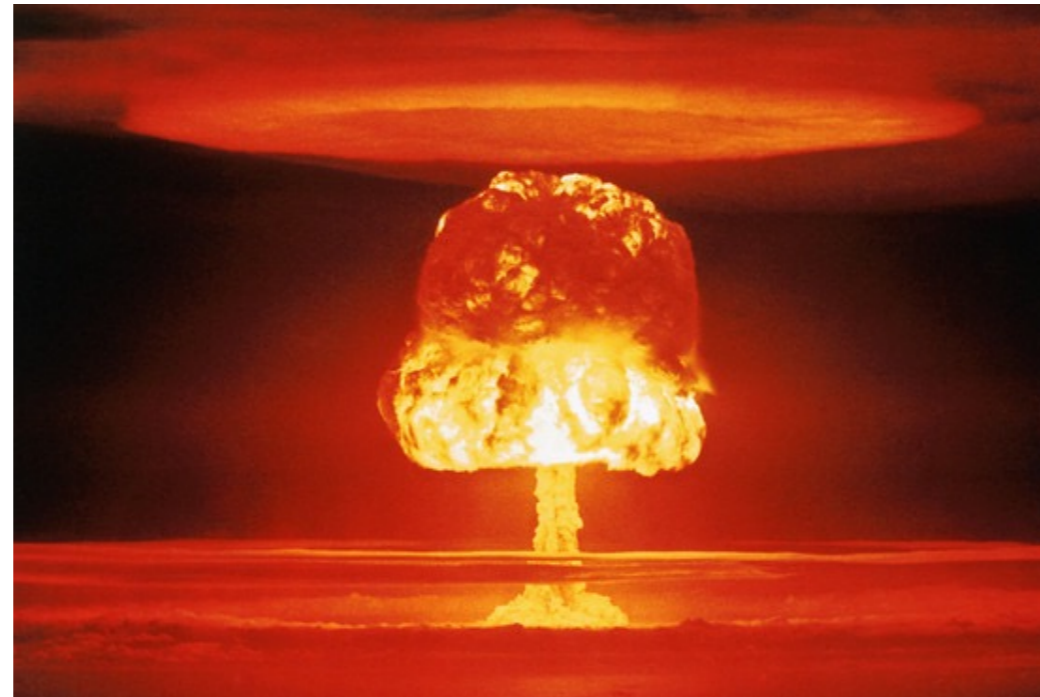


Technical is Political



- “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

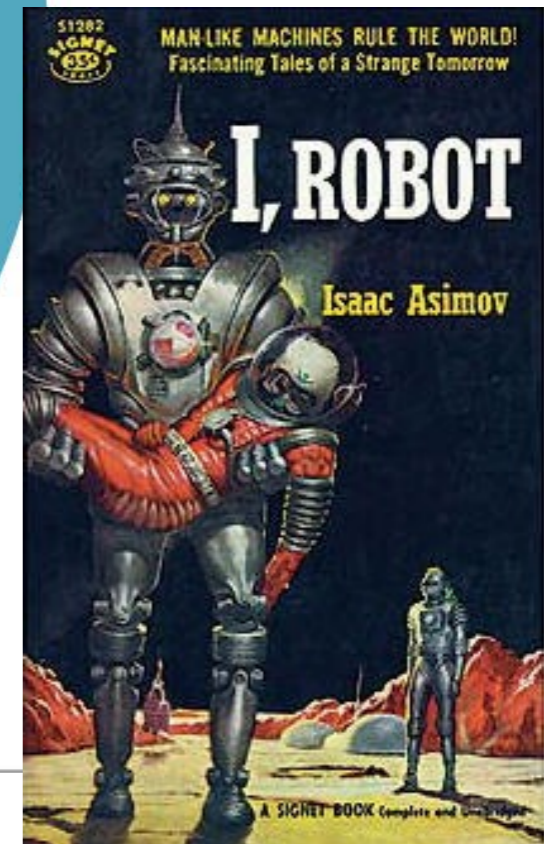
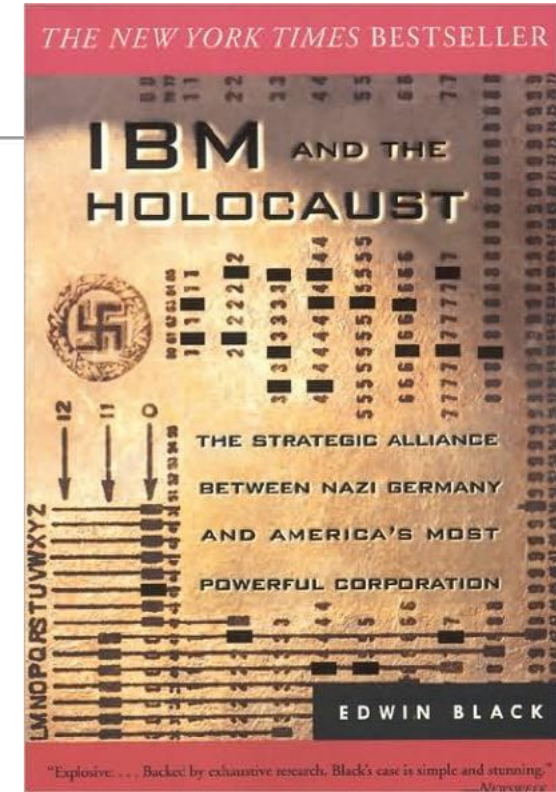
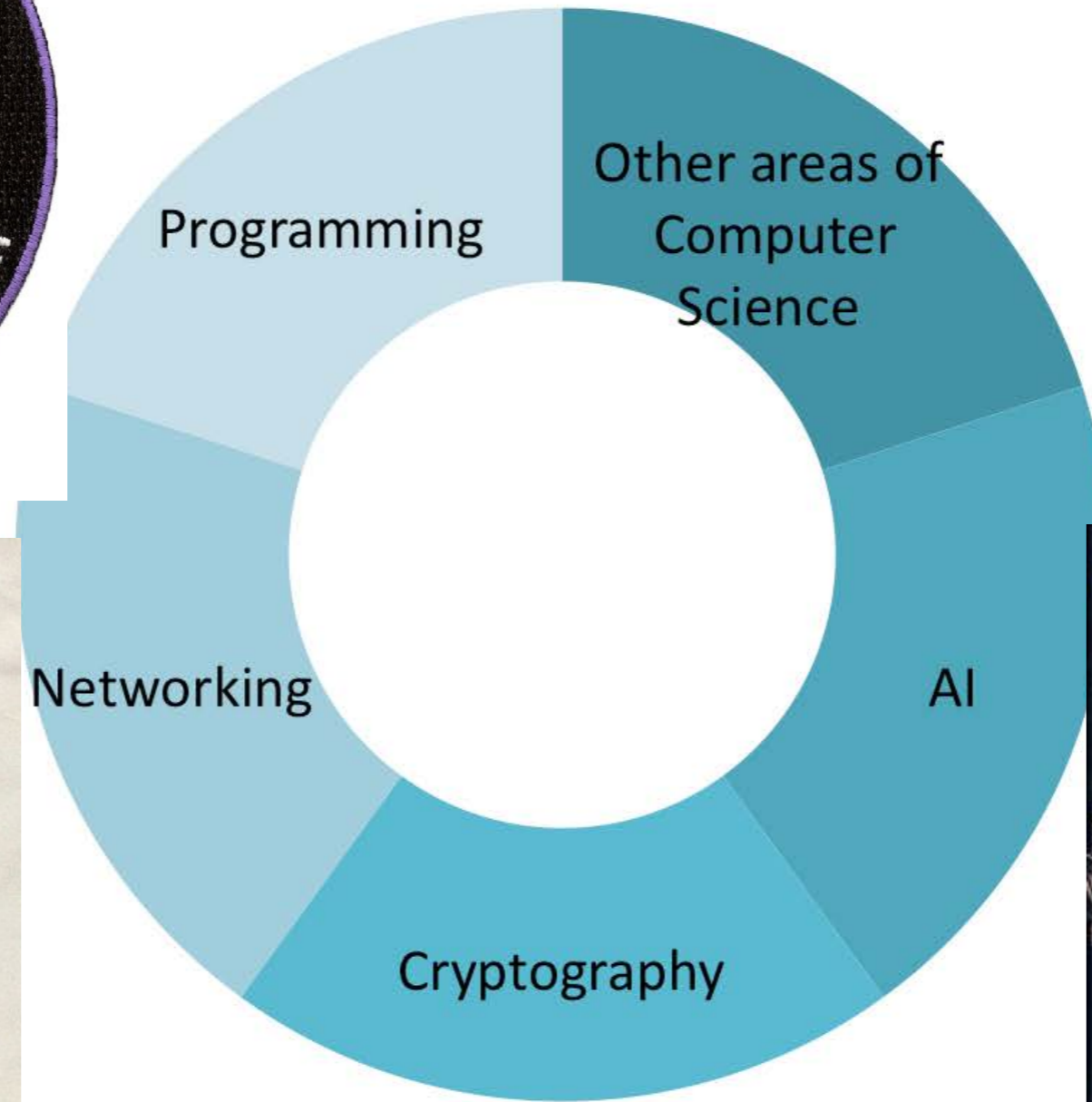


The othe of Hippocratus
which he gaue vnto his disciples and scollers, which pro-
fessing Phisicke and Chirurgerie, is very worthie to
be obserued and kept faithfullie, of euerie true
and honest Artests, although he himselfe
were but a heathen man, and without
the true knowledge of the liuing God,
yet for his noble and excellent skill
in Phisicke and Chirurgerie, he
ought not to be forgotten
of vs his posteritie, but
to be had in an hono-
rable remembrance
for euer.

Ethics
in the Environmental Movement



Computer Sciences Ethical Dilemmas





Internet Measurements Ethics

Theory of Applied Ethics



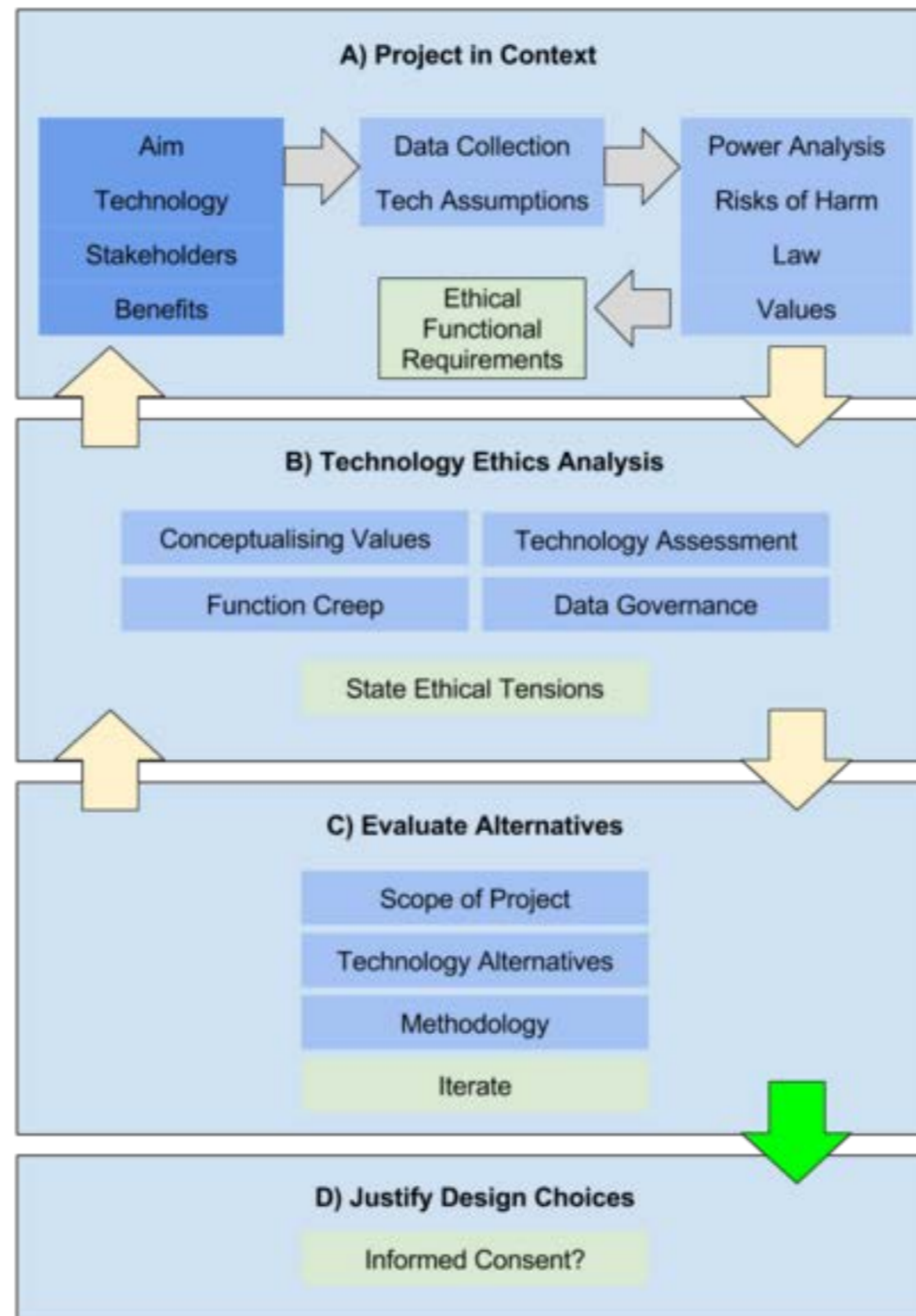
- Consequentialism (“the ends justify the means”)
 - Utilitarianism
- Deontology (“duty for duty’s sake”)
- A mix: “Virtue Ethics”
 - The right actions are those chosen by an actor of virtuous character
- Principlism
 - Respect for autonomy, beneficence, non-maleficence, justice
 - *But what if these 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





- **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?
- **Burdens:** 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



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

Table 1: Comparison between several popular filtering analysis platforms.

- “Global Network Interference Detection over the RIPE Atlas Network” (FOCI14)

2017

ENSURING A FUTURE FOR DETECTING INTERNET DISRUPTIONS

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



Category & Characteristics

Requirements

Example[s]

ECONOMIC

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



ARIN
American Registry for Internet Numbers

 **RIPE NCC**
RIPE NETWORK COORDINATION CENTRE

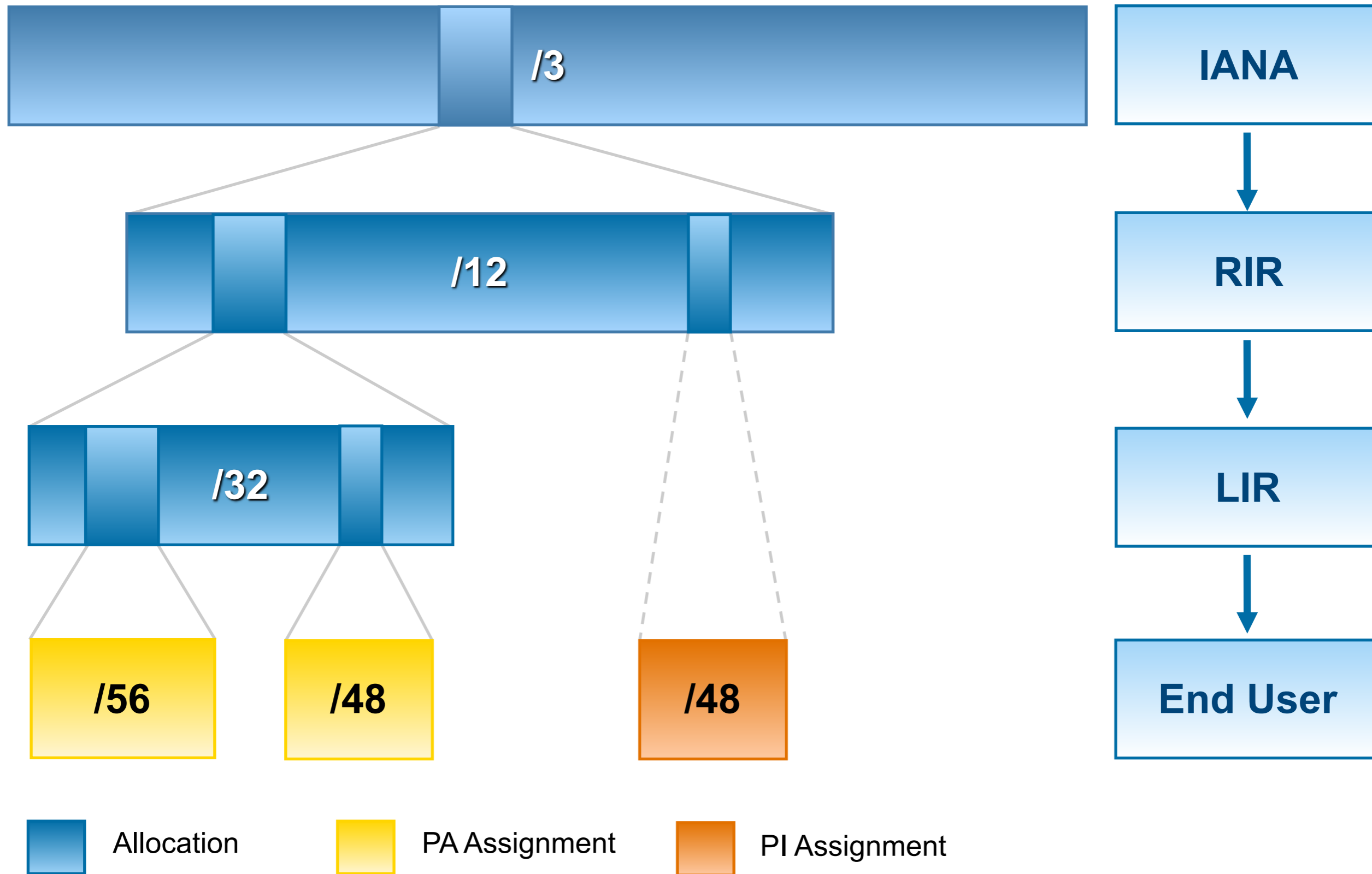


lacnic 

AFRINIC
The Internet Numbers Registry for Africa 

 **APNIC**

IPv6 Addresses Distribution



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



RIPE ATLAS

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
- Personal data not revealed
- No passive measurements
- No HTTP measurements
- “Gratis” devices
- Consenting volunteers
- Existence of “non-public” measurements
- Data, API, source code, tools: **free and open**



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”

Step 1 Definitions

Traceroute measurement to dk-blp-as39839.anchors.atlas.ripe.net

Target*:
dk-blp-as39839.anchors.atlas.ripe.net
An IP address or hostname

Description:
Traceroute measurement to dk-blp-as39839.

Address Family*:
IPv4

Protocol*:
TCP

Timeout (ms):
4000

Interval:
600
How often this should be done (seconds between samples). Note that this value is ignored for one-off measurements.

Resolve on Probe:
Force the probe to do DNS resolution

Advanced Options

Packets:
3

Size:
0
Size of the packet

First Hop:
64
Start measuring the traceroute at this hop.

Maximum Hops:
64
Stop measuring the traceroute at this hop.

Spread:
0
Spread of uniformly distributed random probe start time phase

Port:
80

Paris:
16
Number of different variations for paris traceroute. Set 0 for standard traceroute.

Destination Extension Header Size:
0
The size of the destination extension header to include in the IPv6 packet.

Hop-by-hop Extension Header Size:
0
The size of the hop-by-hop extension header to include in the IPv6 packet.

Don't Fragment:

Skip DNS check:
Disables target DNS check on measurement creation

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



⚡ 3rd TCP Ping measurement to 82.94.235.165 (unciv.nl)

General Information	Probes	Map	TraceMON (beta)	OpenIPMap Prototype	Results	Mod		
Probe	↕ ASN (IPv4)	↕ ASN (IPv6)	↕	↕	↕ Time (UTC)	↕ RTT	▲	↕ Hop
10150	6830	6830	🇳🇱	🟢	2017-10-03 11:51	23.829	🟢	1
10782	3265	3265	🇳🇱	🟢	2017-10-03 11:51	18.605	🟢	1
24605	3265	3265	🇳🇱	🟢	2017-10-03 11:51	18.090	🟢	1
13538	6830		🇳🇱	🟢	2017-10-03 11:51	17.560	🟢	1
31178	6830		🇳🇱	🟢	2017-10-03 11:51	16.069	🟢	1
16274	28685		🇳🇱	🟢	2017-10-03 11:51	14.752	🟢	1

- Download as JSON

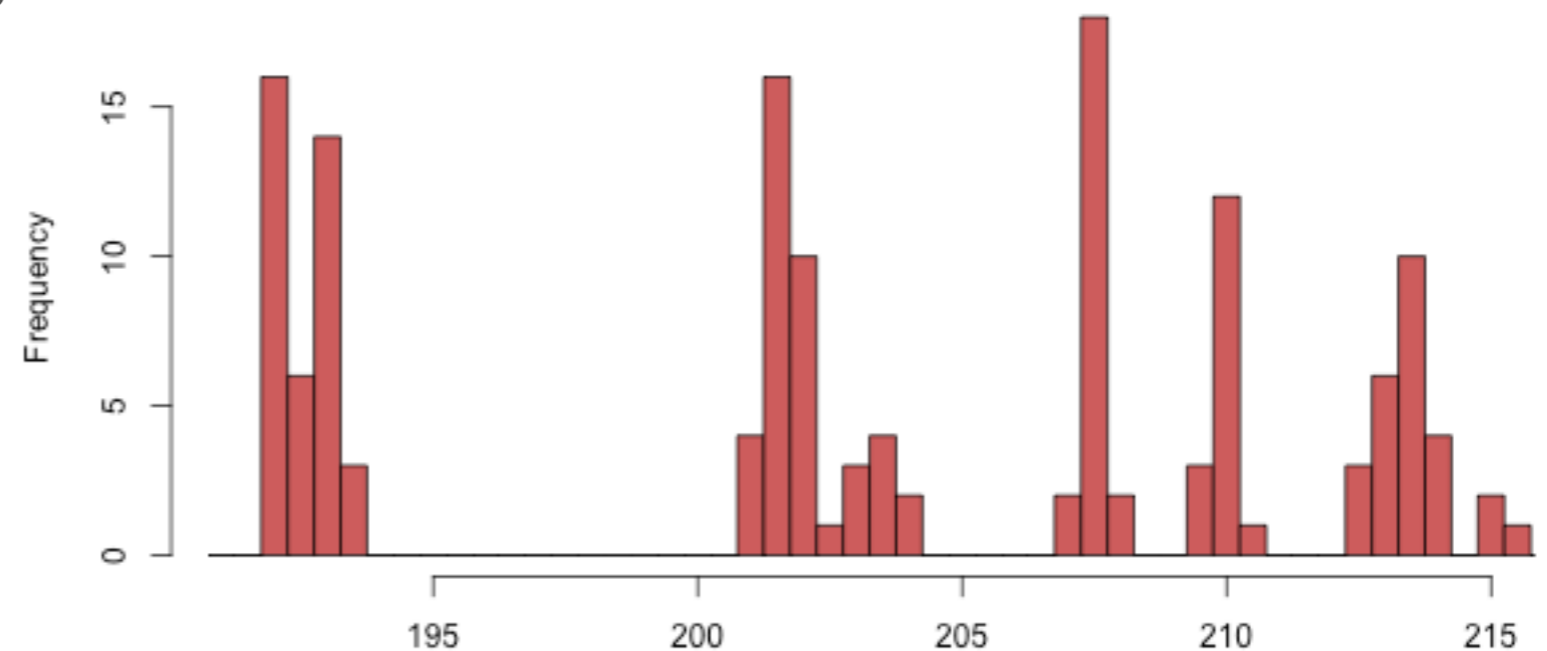
- <https://atlas.ripe.net/api/v2/measurements/9412863/results/?start=1506988800&stop=1507075199&format=json>

Detailed Technical Information

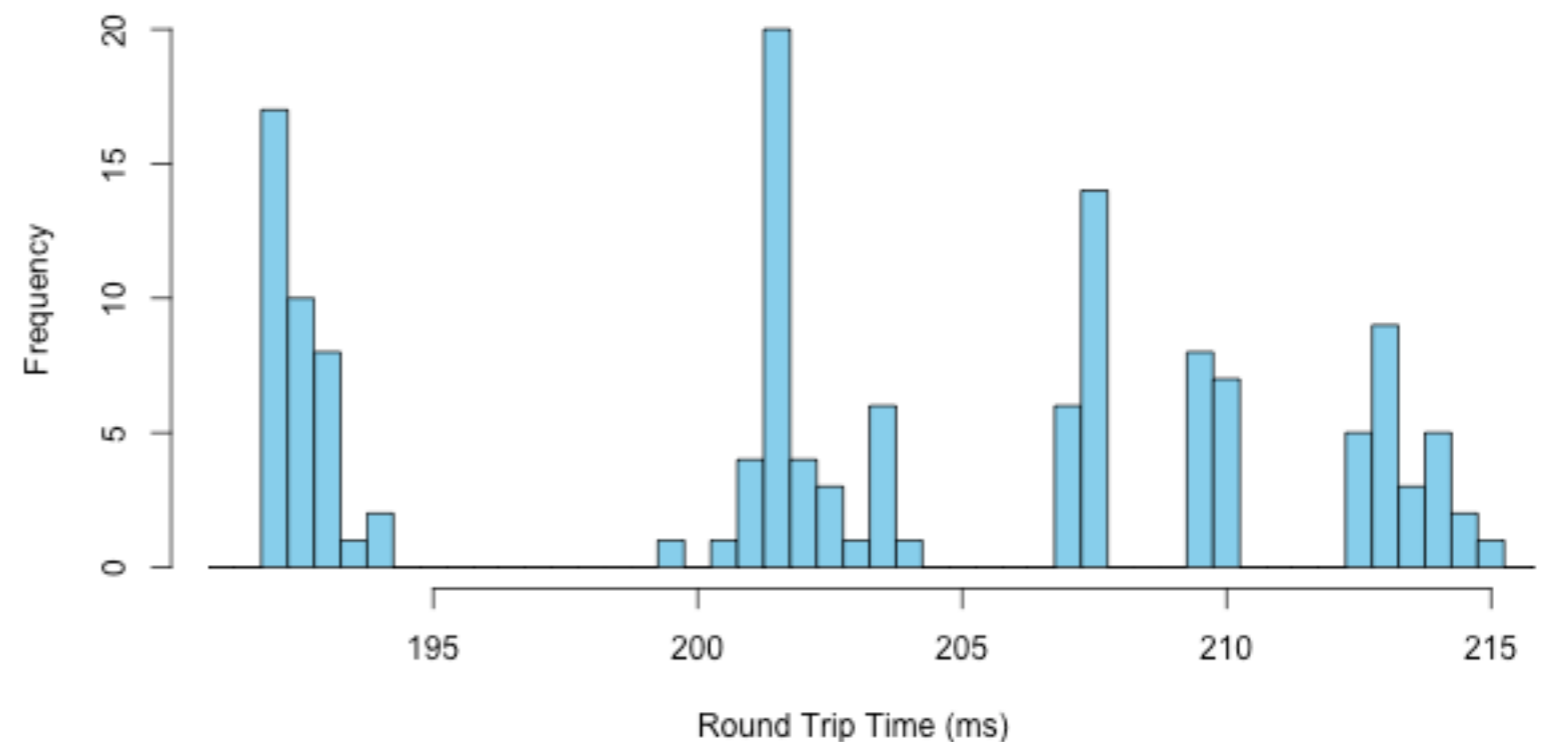


- Rene Wilhelm on RIPE Labs
- For 68% of the probe/destination pairs, median values differ by less than 1ms
- Interdecile ranges differ by less than 6ms
- When compared to RTT of 100 milliseconds, a difference in spread of 5-15ms may still be acceptable to assess network performance

HTTP Time to Connect to 210.4.72.46 from probe 25717



TCP RTTs to 210.4.72.46 from probe 25717



RIPE Atlas References



- <https://atlas.ripe.net>
- <https://labs.ripe.net/hackathons>
- [“Global Network Interference Detection over the RIPE Atlas Network”](#)
- [a] [“Ethics of RIPE Atlas Measurements”](#) (2016)
- [“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>
- atlas@ripe.net
- @RIPE_Atlas

Question Everything!



“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>
- Open Source vs Free / Libre Software?

Everybody needs a hacker





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!

<http://linnytu.com/hacker>



linnytu.com/hacker

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?

lights

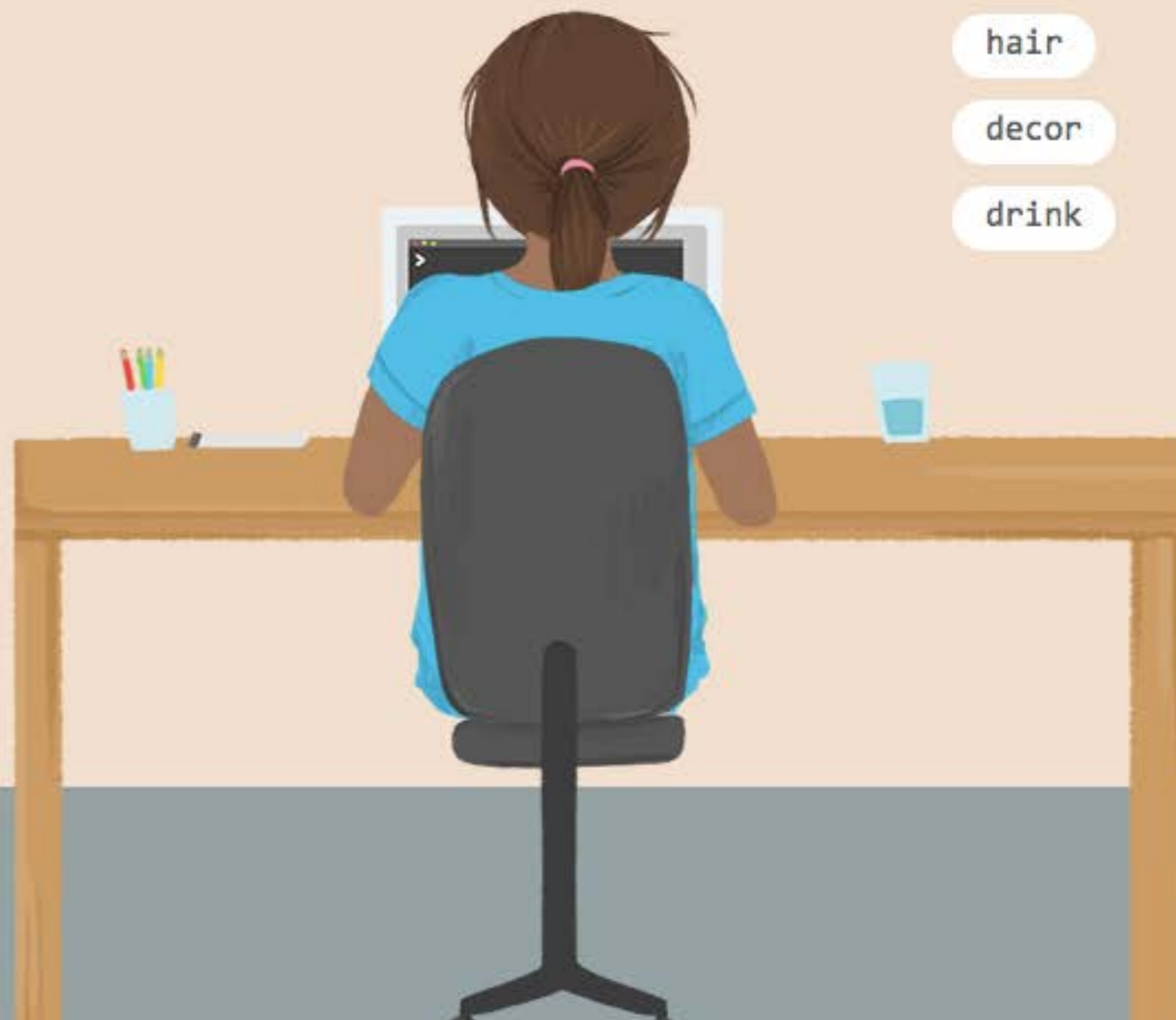
clothing

skin

hair

decor

drink



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.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 in tension with the right to a transparent, and accountable, internet.

12. We strongly object to the use of surveillance by non-state actors to control the sexual lives of consensual partners. This is expressed and practiced as part of the larger system of policing, censorship, and rights.



(Tech) Ethics of Nonviolence

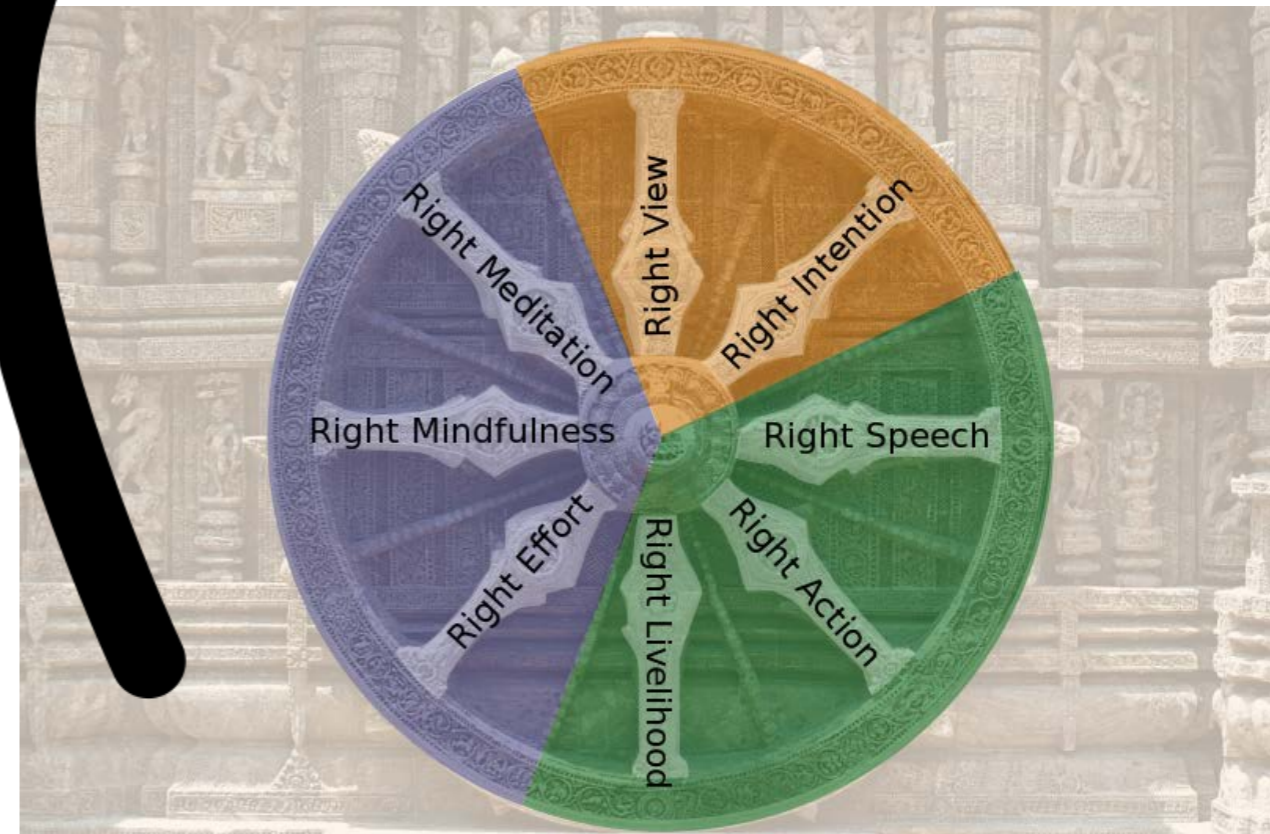


- Nonviolent resistance philosophy of Gandhi & Martin Luther King Jr
- Algorithmically-geeky “Non-violent Communication” by Marshal Rosenberg
- “Guide to Empathetic Technical Leadership”
<http://empathetictechnicalleader.com>
 - FREE to read online: <https://leanpub.com/littleguide/read>
- Open Source and Feelings (#OSSfeel)
 - <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 rough equivalent of the output of 30 nuclear power plants.
Brendan Smialowski for The New York Times



Child miner in Burkina Faso - PBS NewsHour



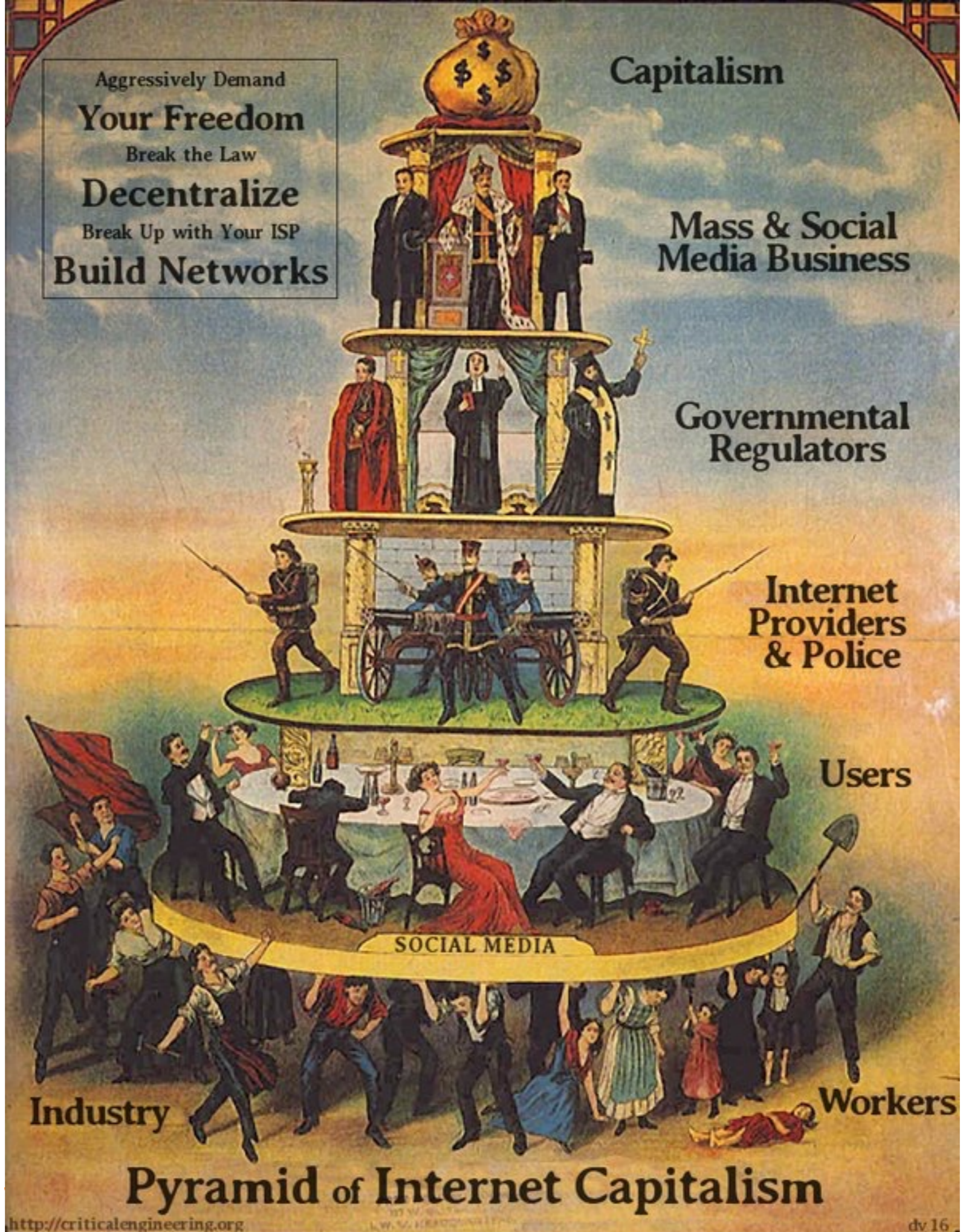
1 MILLION WORKERS.

90 MILLION iPHONES.

17 SUICIDES.

THIS IS WHERE YOUR GADGETS COME FROM. SHOULD YOU CARE?

enr inside | mAY 2012





📷 A child at the Agbogbloshie electronic waste dump in Ghana. Photograph: Andrew McConnell/Alamy





Squirrels Winning the Cyber-War ;-)



TOTAL SUCCESSFUL CYBER WAR OPS
AS OF 2017.01.08 - 1748

Agent	Success
Squirrel	879
Bird	434
Snake	83
Raccoon	72
Rat	36
Marten	22
China	0
Russia	0*
USA	1



- https://wiki.techinc.nl/index.php/Hackers_tribes#Squirrels_against_technology



Acknowledgements & References

More references



- [w] <http://networkedsystemsethics.net/>
- 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/>
- <http://becha.home.xs4all.nl/hackers-philosophers-utopian-network-dec-2012-becha.pdf>

Even more references, July 2017



- IETF & Human Rights & <https://www.rightscon.org/>
 - <https://www.ietf.org/proceedings/99/slides/slides-99-hrpc-presentation-milton-mueller-requiem-for-a-dream-00.pdf>
 - <https://www.article19.org/resources.php/resource/38819/en/ethical-approaches-to-artificial-intelligence-and-autonomous-systems-at-ieee-seas-2017>
 - <https://datatracker.ietf.org/doc/html/draft-nottingham-for-the-users-05>
- “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



- [r] Phillip Rogaway: “The Moral Character of Cryptographic Work” (2015)
- [ensr] “Philosophy meets Internet Engineering: Ethics in Networked Systems Research”
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