Who shuts down the Internet and why?

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UC San Diego / CAIDA
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
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https://ioda.caida.org
Goals of this talk

1. Introduce you to IODA
   - How does it work?
   - What can it do (for you)?

2. Present the IODA research project
   - What’s done and what’s left to do?
   - How do the pieces fit together?

3. Get feedback!
Introduction to IODA
Active probing

Verizon

CAIDA

Comcast
Outage Severity Overview

Country Outages

Overall Score  BGP  Active Probing

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<th>Active Probing</th>
<th>BGP</th>
<th>Darknet</th>
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Showing 3 to 10 of 10 entries
Data sources / methodologies

Control plane

● BGP
  ○ Very reliable and stable
  ○ Many monitors
  ○ Supports IPv4 and IPv6
  ○ Propagation takes time
  ○ Doesn’t reveal if actual data is flowing

Data plane

● Active probing
  ○ Highest granularity
  ○ Relatively clean and reliable
  ○ Pings often blocked
  ○ Many hosts don’t reply to pings

● Network telescope
  ○ Works despite blocked pings
  ○ Data available very quickly
  ○ Highly dependent on Internet penetration
  ○ Noisy signal

We gain confidence when data sources agree on blackout!
A bird’s-eye view
IODA is not perfect

- Data sources often **noisy**
- **Large volumes** of data
- Data is highly **heterogeneous**
- Lots of **tooling** necessary
- **Complex** infrastructure to develop and maintain
- Limited **funding** and few **people**
  - Let us know of potential funding!
Case studies

● Malicious cable cut in Western **Venezuela**
  ○ [https://ioda.caida.org/ioda/dashboard#from=1528298411&until=1528384811](https://ioda.caida.org/ioda/dashboard#from=1528298411&until=1528384811)

● Series of government-mandated shutdowns in **Iraq**
  ○ Oct 1–Oct 8, 2016
  ○ [https://ioda.caida.org/ioda/explorer#from=1475328815&until=1475933615](https://ioda.caida.org/ioda/explorer#from=1475328815&until=1475933615)
The research project behind IODA
The many faces of “outages”

- **Department of Homeland Security**
  - Funding over PARIDINE project (focus on methods, rigor)
  - Performance, reliability, national security
  - May provide service to Federal Communications Commission

- **Open Technology Fund**
  - Waiting for funding decision (focus on usability, usefulness)
  - Human rights, monitoring shutdowns

- **Other angles**
  - Natural disasters
Where do we want to get?

- Reliable, scalable, and usable service to the public
  - Incorporate new data sources
  - Annotation tools
  - Context tools (Twitter etc.)

- Computer science research paper
  - IMC? SIGCOMM?
  - Bolstered by rigorous PoliSci analysis

- Political science research paper
  - Bolstered by rigorous CS foundation

- Additional, long whitepaper
  - Target audience: policy makers, activists, civil society?
What we already have

- **Prototype implementation** of IODA ➔ [https://ioda.caida.org](https://ioda.caida.org)
  - Collecting data since many years
  - Three data sources
  - Functional user interface

- **Data for potential** case studies
  - Yearly, exam-related shutdowns in Syria and Iraq

- **Handful of IODA users**
  - Work with OTF fellows

- **Outreach**
  - #KeepItOn mailing list
  - Citizen Lab Summer Institute
  - Social media (Twitter, CAIDA blog)
What we still need

- **Fix flaws and bugs in IODA**
  - Better outage detection
  - Eliminate data source-specific issues

- **Case studies**
  - Understand a handful of shutdowns in-depth and across disciplines

- **Evaluate IODA**
  - Quantitative and qualitative analysis

- **Political science analysis**
  - CS can only tell us **how** shutdowns happen but not **why**

- **Use OTF’s usability lab**
Improve IODA
- Fix design flaws
- Improve scalability
- Improve reliability
- Improve UI

Evaluate IODA
- Obtain ground truth
- False positives/negatives?
- Are alerts actionable?

Cherry-pick events
- What’s interesting?
- What’s important?
- Study from PoliSci and CS PoV

Longitudinal analysis
- Look at two years worth of IODA alerts
- Correlate with other data:
  - Mozilla telemetry
  - Akamai
  - Twitter
  - What else?

“Big picture” analysis
- “High-level” messages, statistics, and trends
- Geography-based breakdown

Operational experience
- How do we interact with IODA?
- What do our users think?
- Is it useful?
- Maintaining infrastructure is hard
Democracy Index vs. Net Freedom Score

Correlation: 0.864