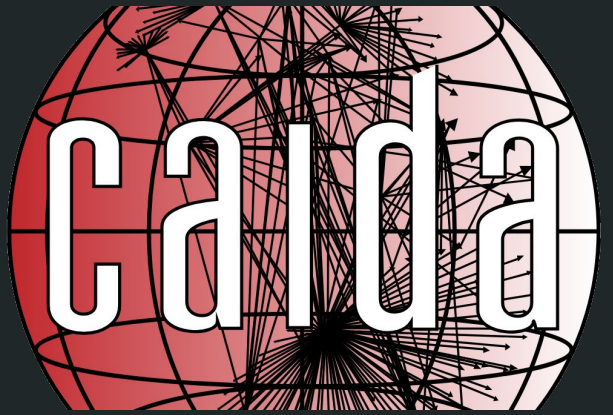
Who shuts down the Internet and why?

Philipp Winter
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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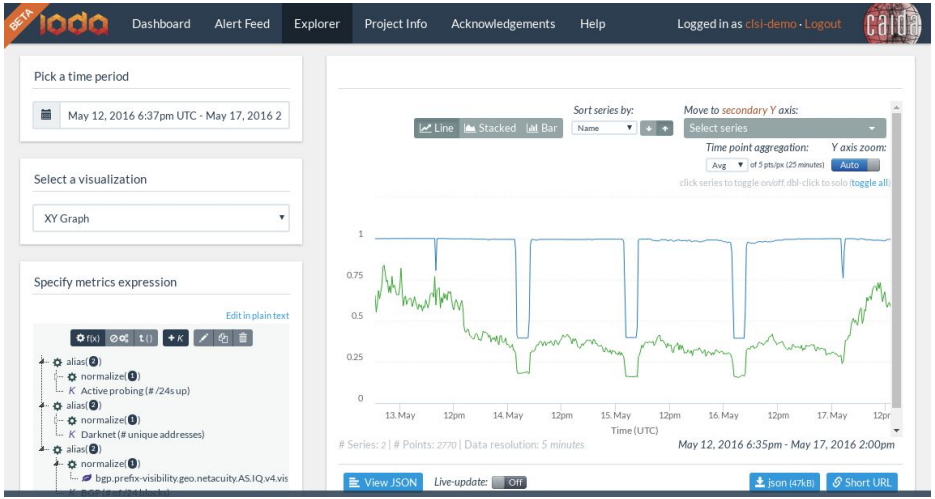

https://ioda.caida.org

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

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Select a time range:

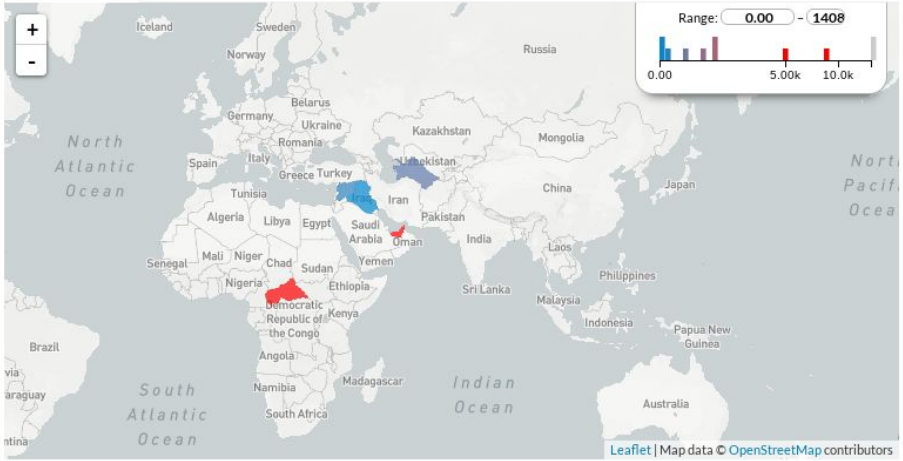
a day ago - Now

Outage Severity Overview

Country Outages

Tabbed

Overall Score | BGP | Active Probing



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June 10, 2018 9:31pm - June 11, 2018 9:31pm

Show entries — *Search:*

Country	Overall Score	Active Probing	BGP	Darknet
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Christmas Island	13.7k		13.7k	
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Central African Republic	222	222		
Turkmenistan	211	211		
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Syrian Arab Republic	19.1		19.1	

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AS Outages

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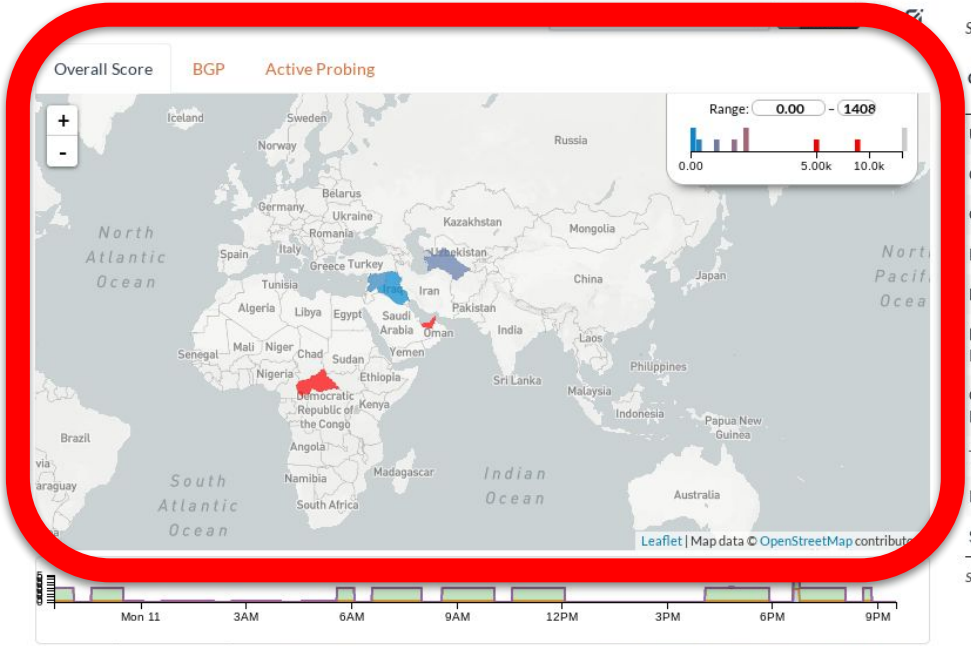

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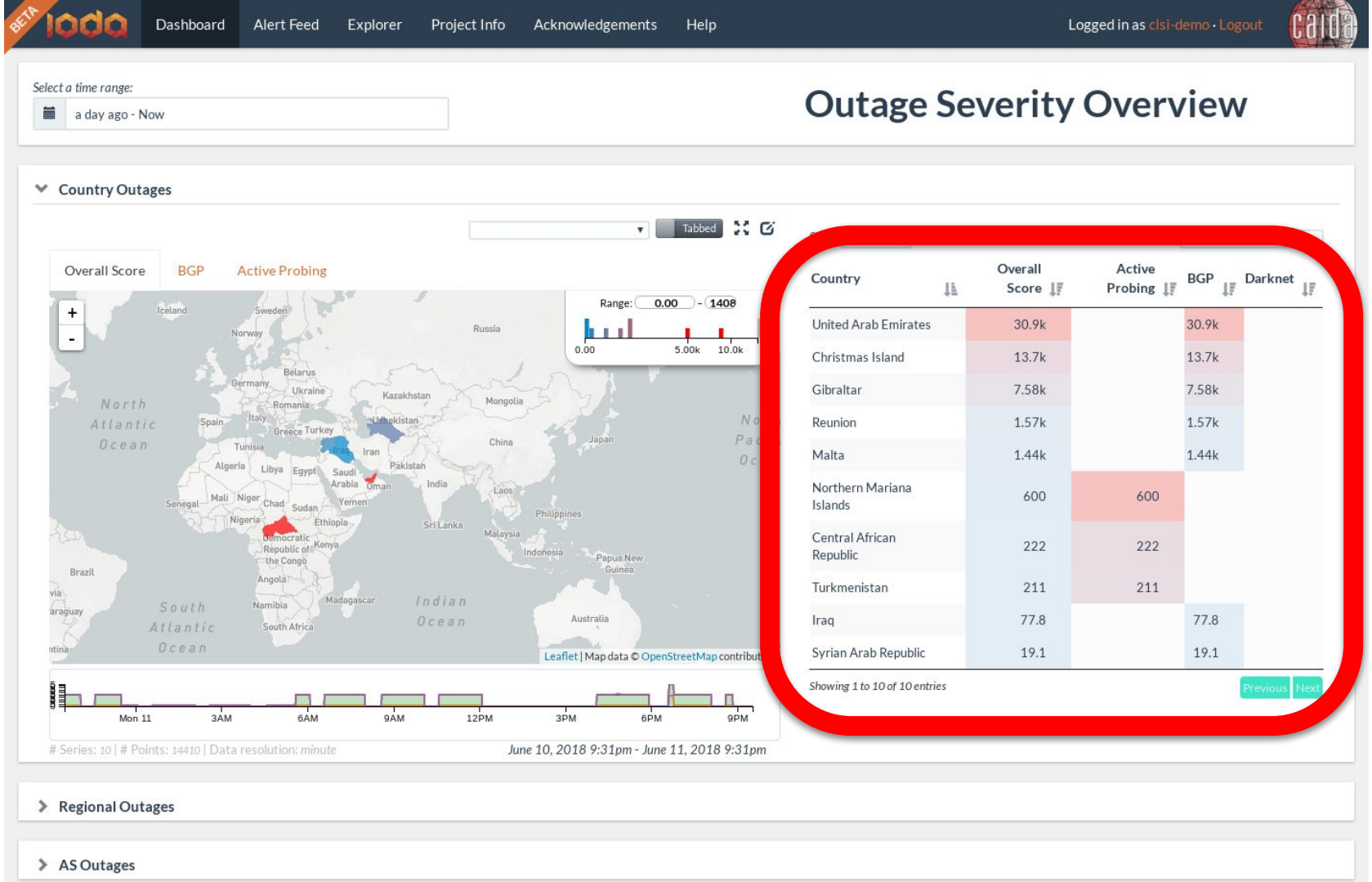
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Overall Score
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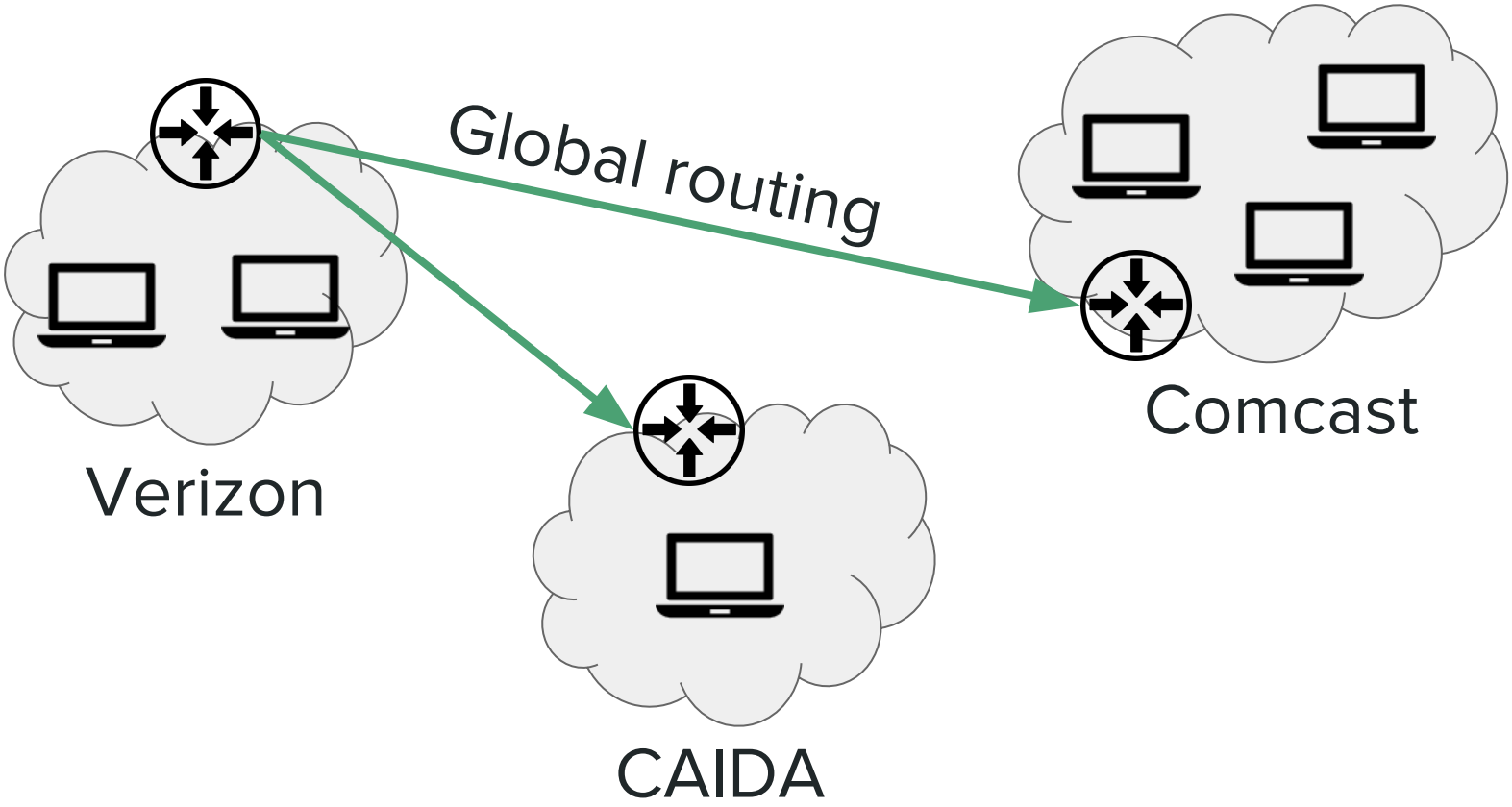
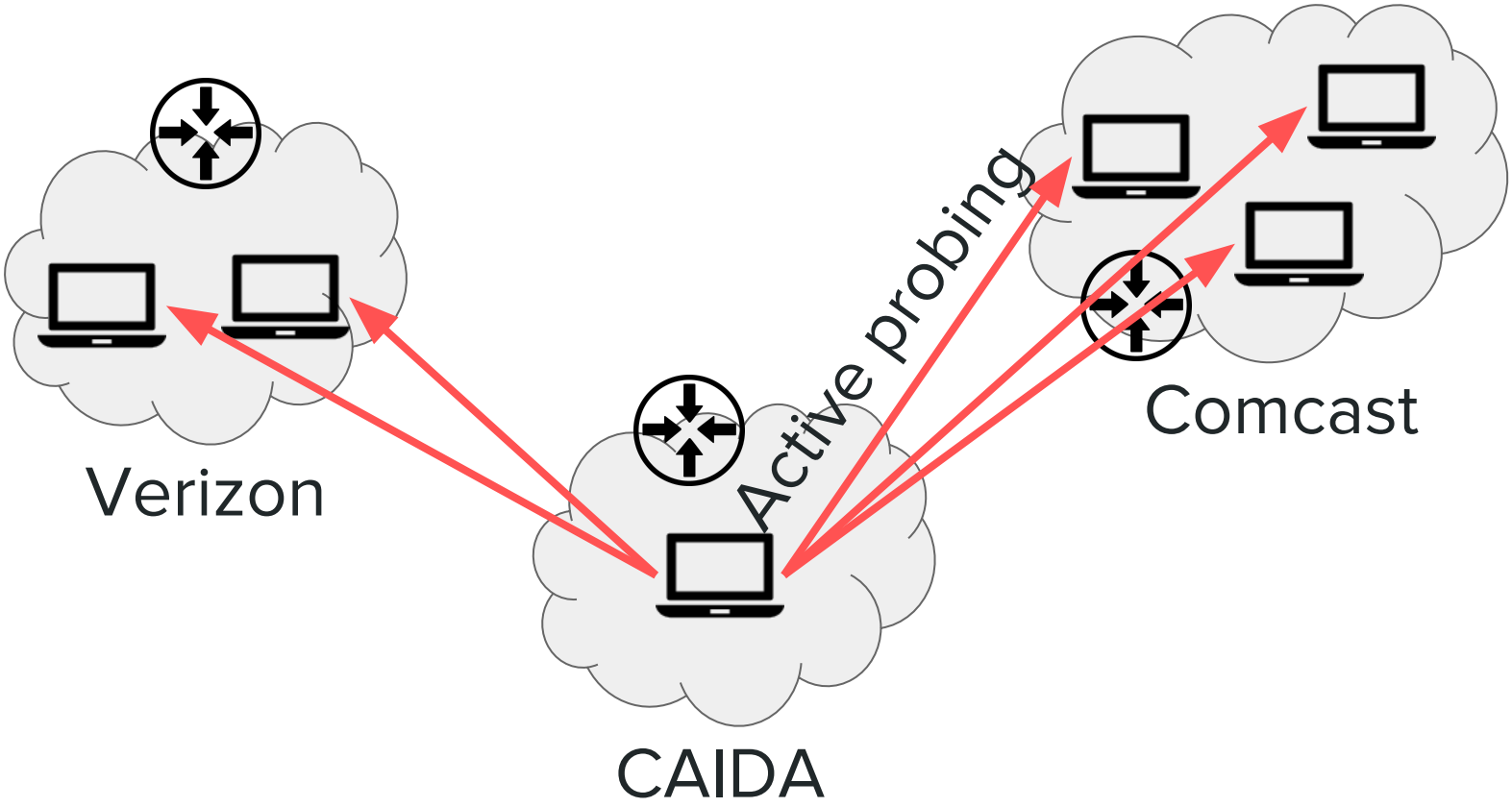

Global routing
Verizon
Comcast
CAIDA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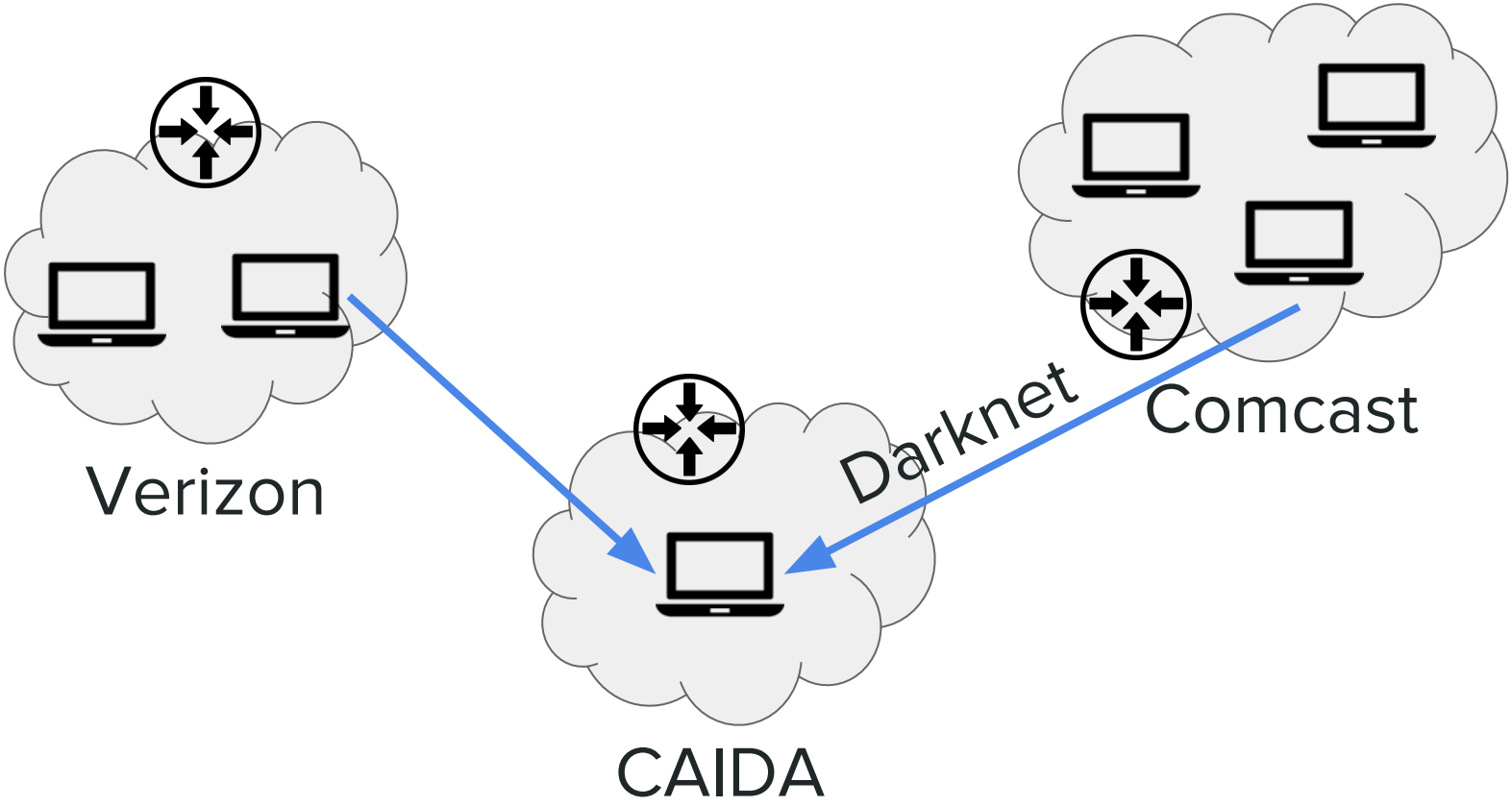
Verizon
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Darknet
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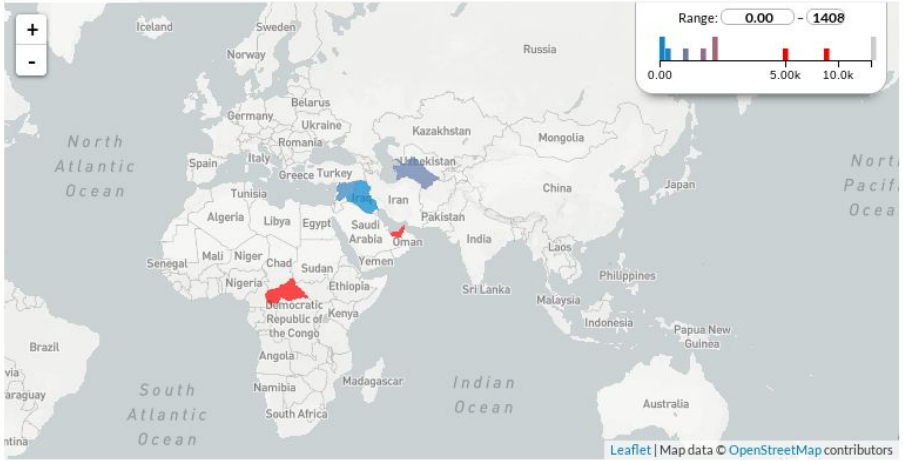

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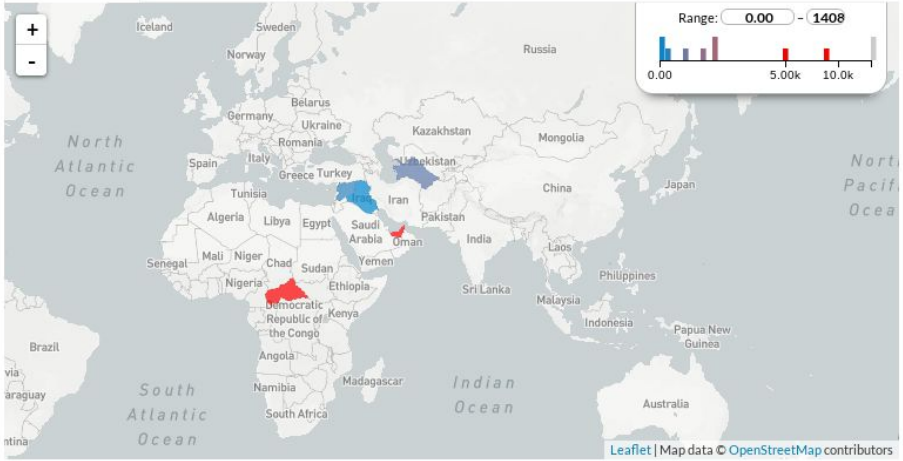

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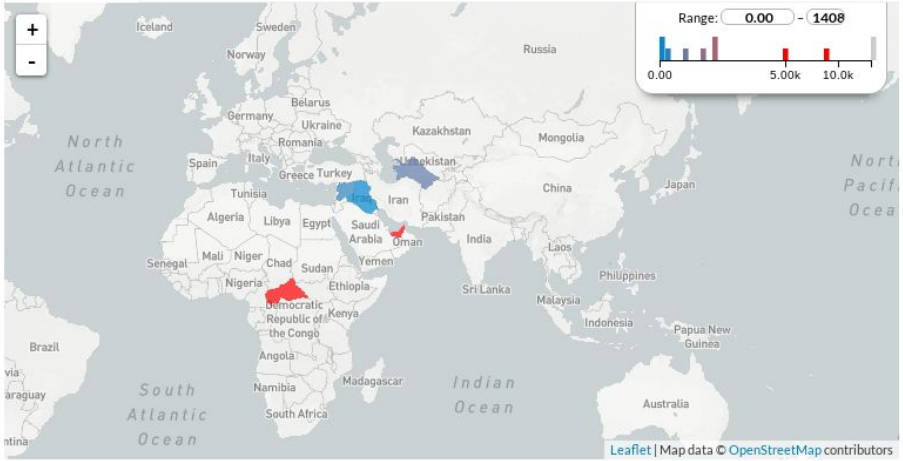

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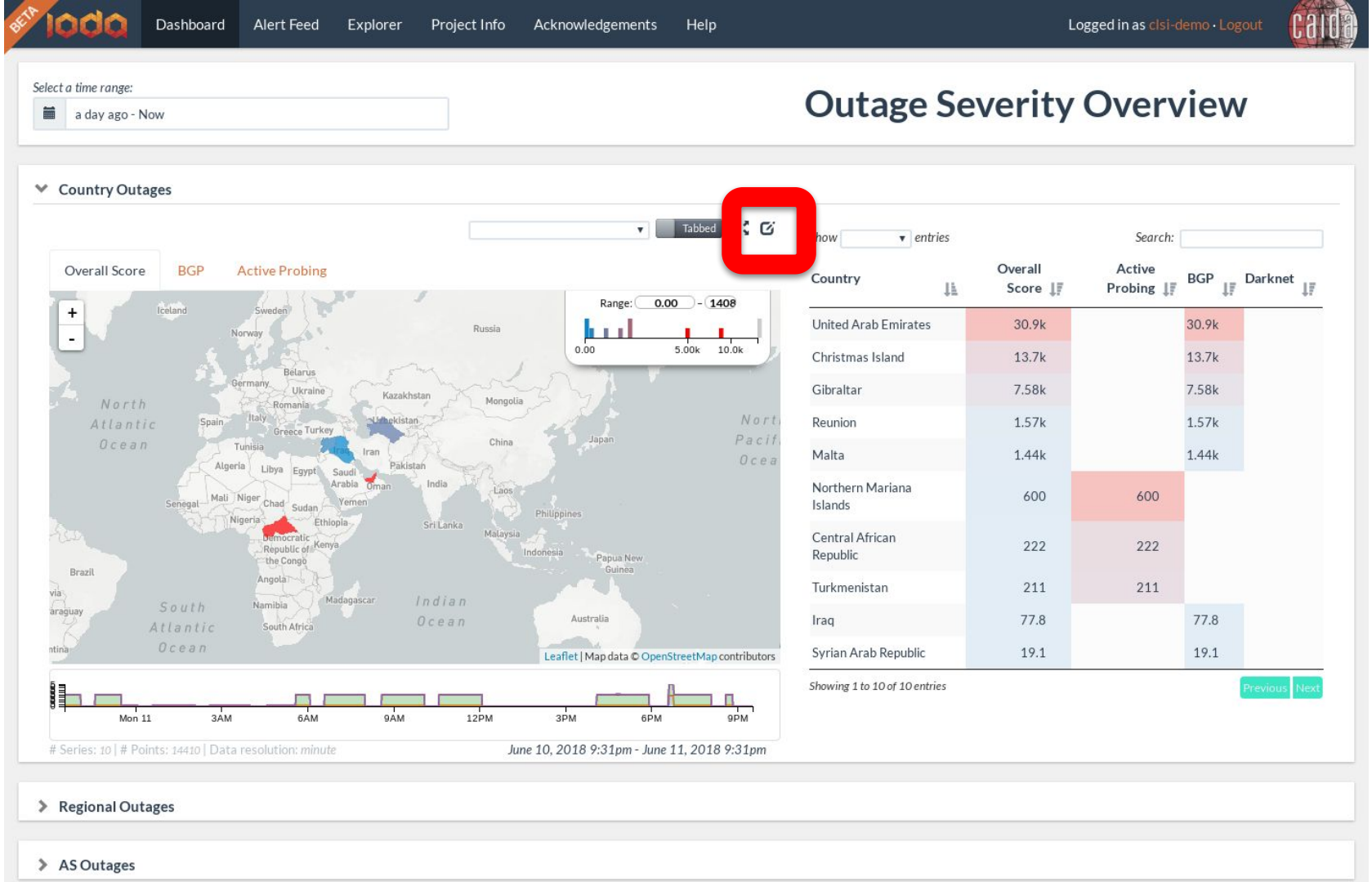
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Data sources / methodologies

Control plane

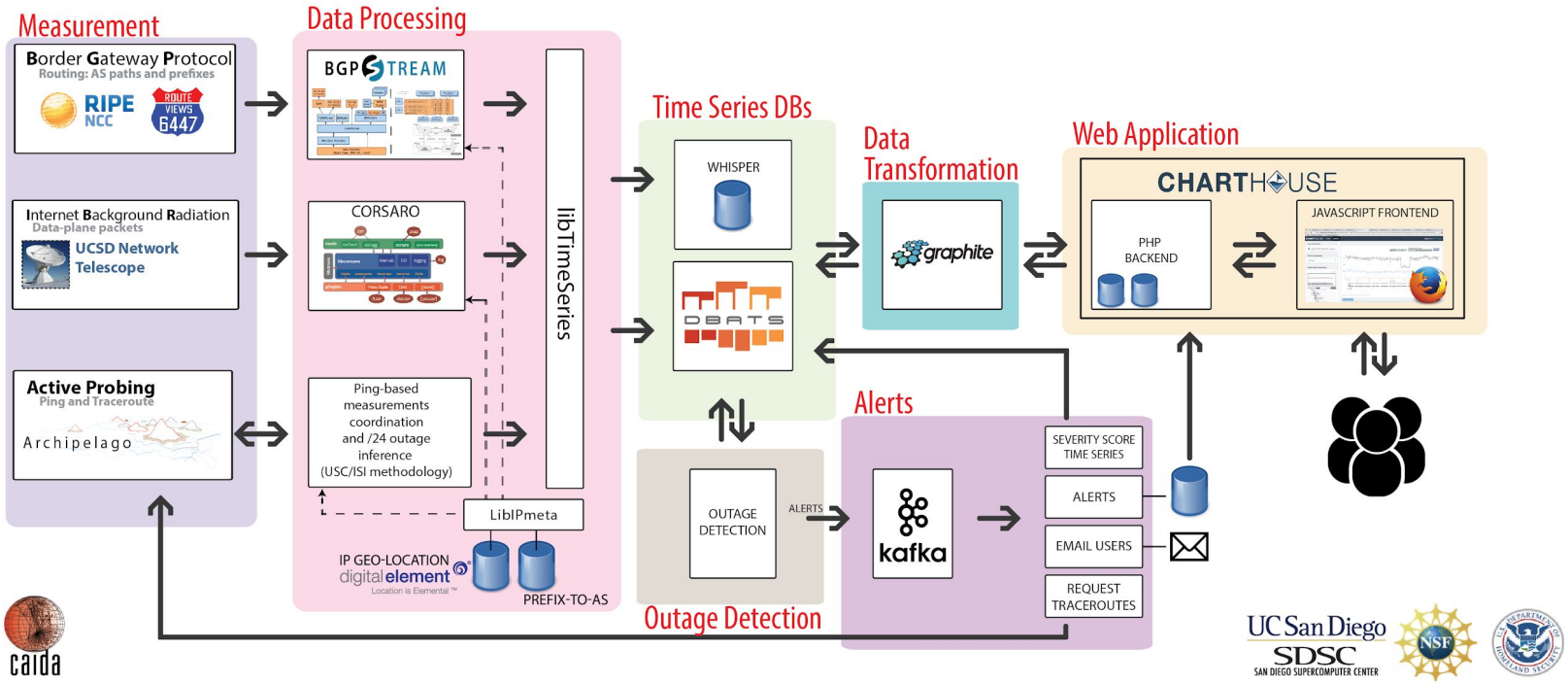
- BGP
  - Very reliable and stable
  - Many monitors
  - Supports IPv4 and IPv6
  - Propagation takes time
  - Doesn’t reveal if actual data is flowing

We gain confidence when data sources agree on blackout!

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

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
- Series of government-mandated shutdowns in **Iraq**
  - Oct 1–Oct 8, 2016
  - 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?

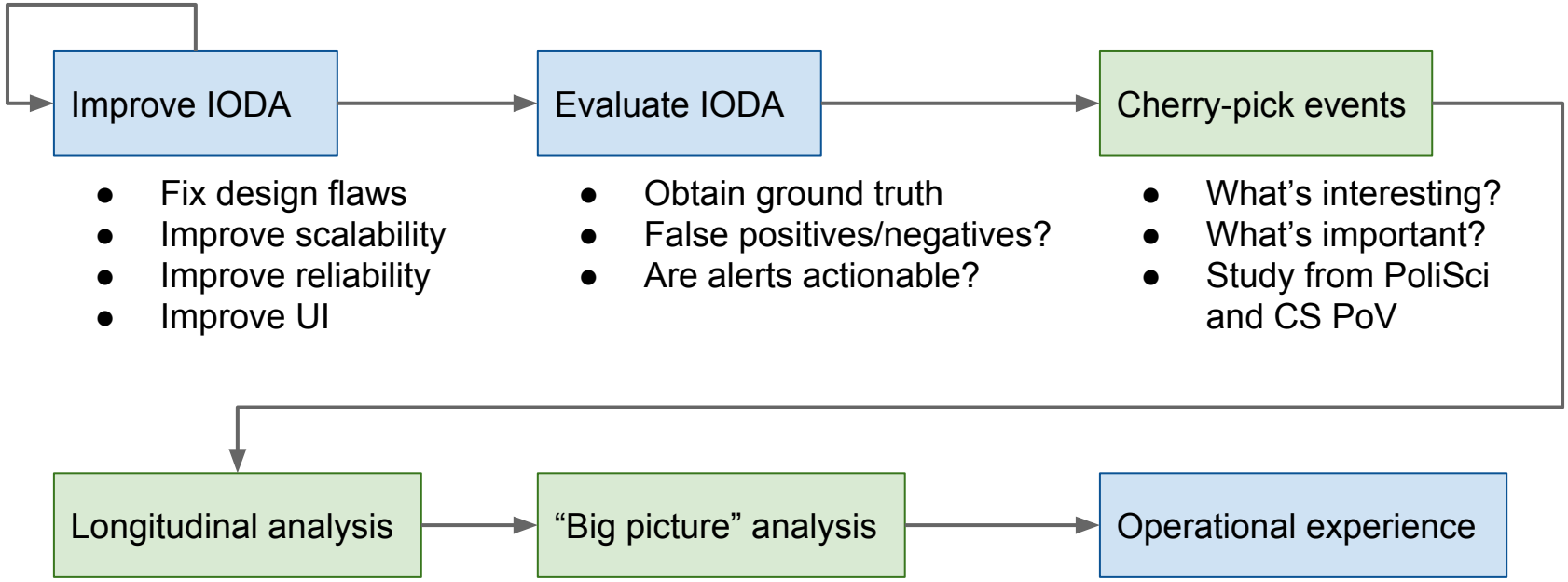
- Reliable, scalable, and usable **service to the public**
  - Incorporate new data sources
  - Annotation tools
  - Context tools (Twitter etc.)
- **Computer science** research paper
  - IMC? SIGCOMM?
  - Bolstered by rigorous PoliSci analysis
- **Political science** research paper
  - Bolstered by 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
  - 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**



- Fix design flaws
- Improve scalability
- Improve reliability
- Improve UI

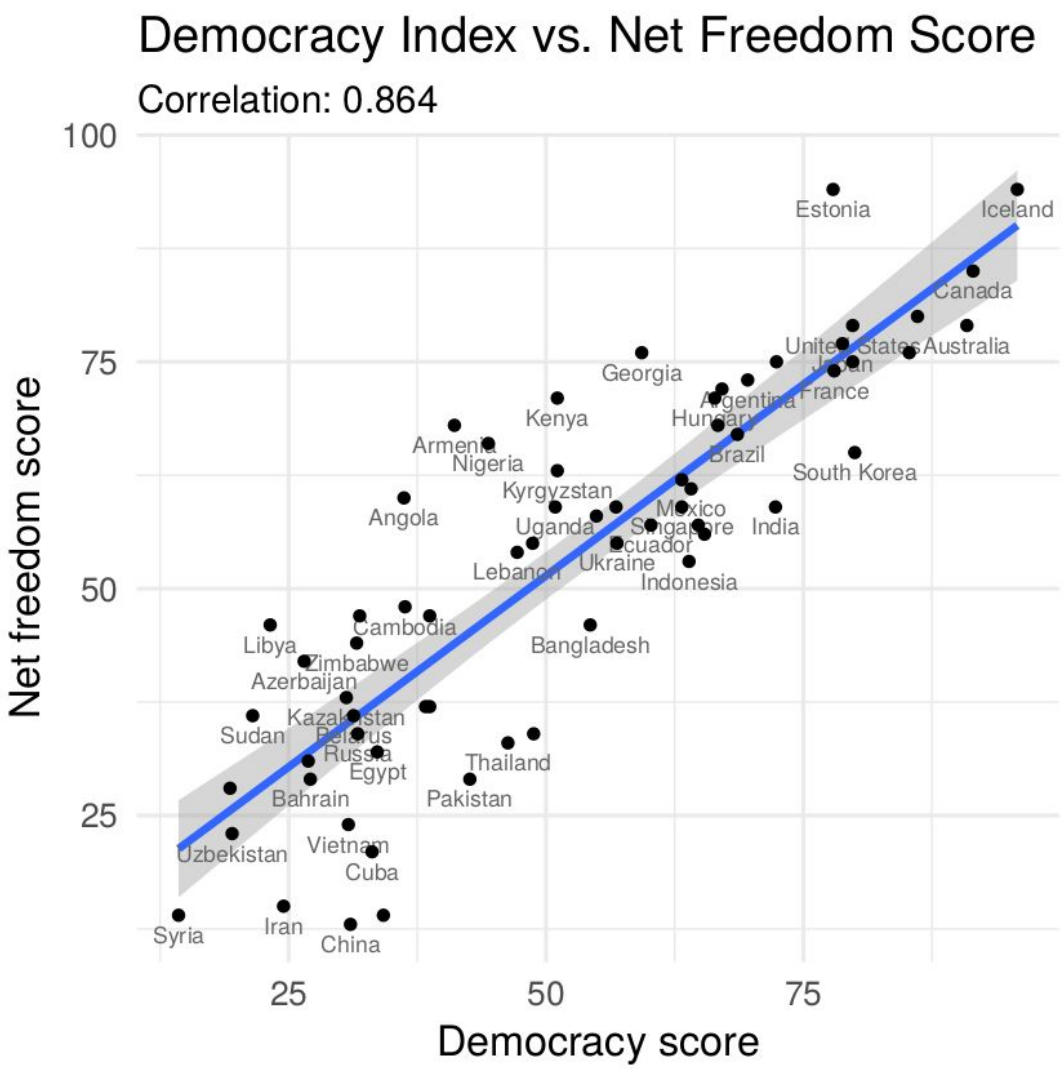
- Obtain ground truth
- False positives/negatives?
- Are alerts actionable?

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

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

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

- How do we interact with IODA?
- What do our users think?
- Is it useful?
- Maintaining infrastructure is hard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Correlation: 0.864
Net freedom score
Democracy score
100
75
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Canada
Australia
France
Georgia
Kenya
Armenia
Nigeria
Brazil
South Korea
Kyrgyzstan
Angola
Uganda
Mexico
India
Ecuador
Lebanon
Ukraine
Indonesia
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