Auditing net neutrality violations globally

-or-

What happened when Apple said no

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Problem statement

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EFF Confirms: T-Mobile's Binge On Optimization is Just Throttling, Applies Indiscriminately to All Video

TECHNICAL ANALYSIS BY JEREMY GILLULA | JANUARY 4, 2016

Back in November, T-Mobile announced a new service for its mobile customers called

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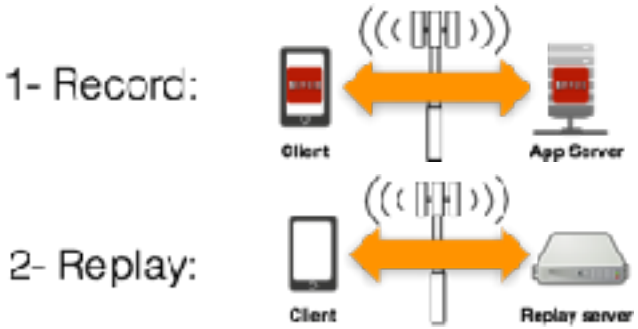
Key measurement questions/challenges:

- Which **apps** are affected?
- How do you obtain **strong confidence** that an ISP is violating net neutrality?
- How do you obtain **ground truth**?
- Can we **crowdsource** measurements of net neutrality violations?

Addressing challenges: TL;DR

Which apps are affected?

- We dont know a priori
- **Record and replay** real app traffic



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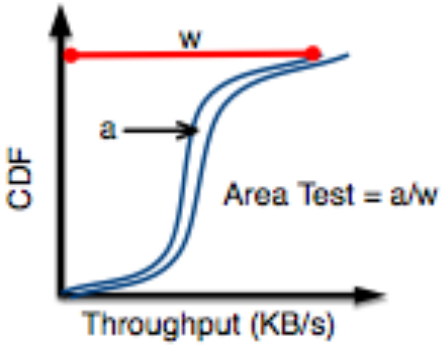
- Developed **new type of KS-Test** statistic



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Ground truth

- Bought a DPI middlebox off eBay
- Found **matching rules** surprisingly brittle

Header	Example Value	Example Application
URI	site.js{…}-**nbcsports**-com	NBC Sports
Host	Host: www.**spotify.**com	Spotify
User-Agent	User-Agent: **Pandora** 5.0{…}	Pandora
Content-Type	Content-Type: video/**quicktime**	QuickTime

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Can we crowdsource?

- Yes! **Wehe** requires no special permissions
- Works on Wifi/cell via Android/iOS apps

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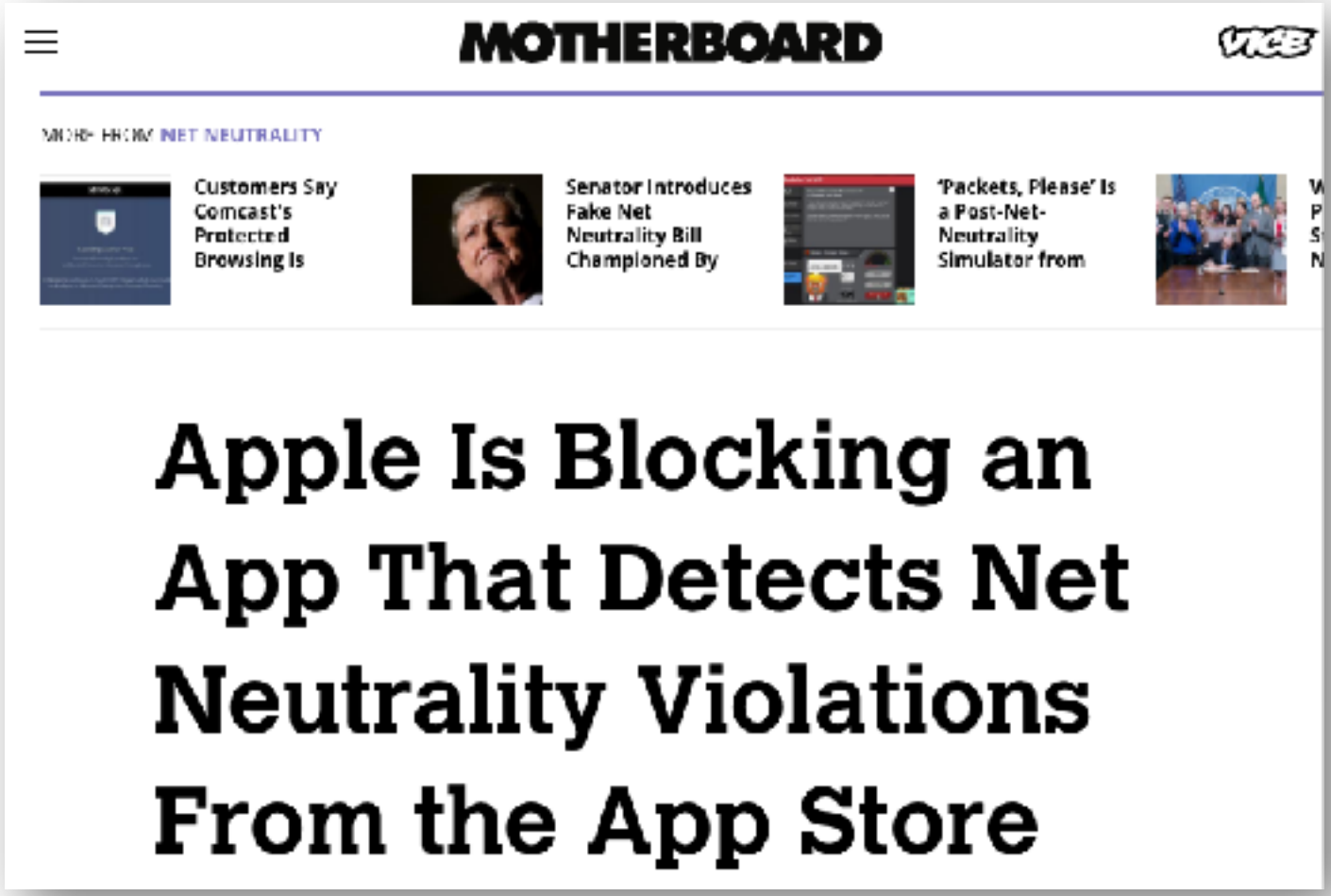

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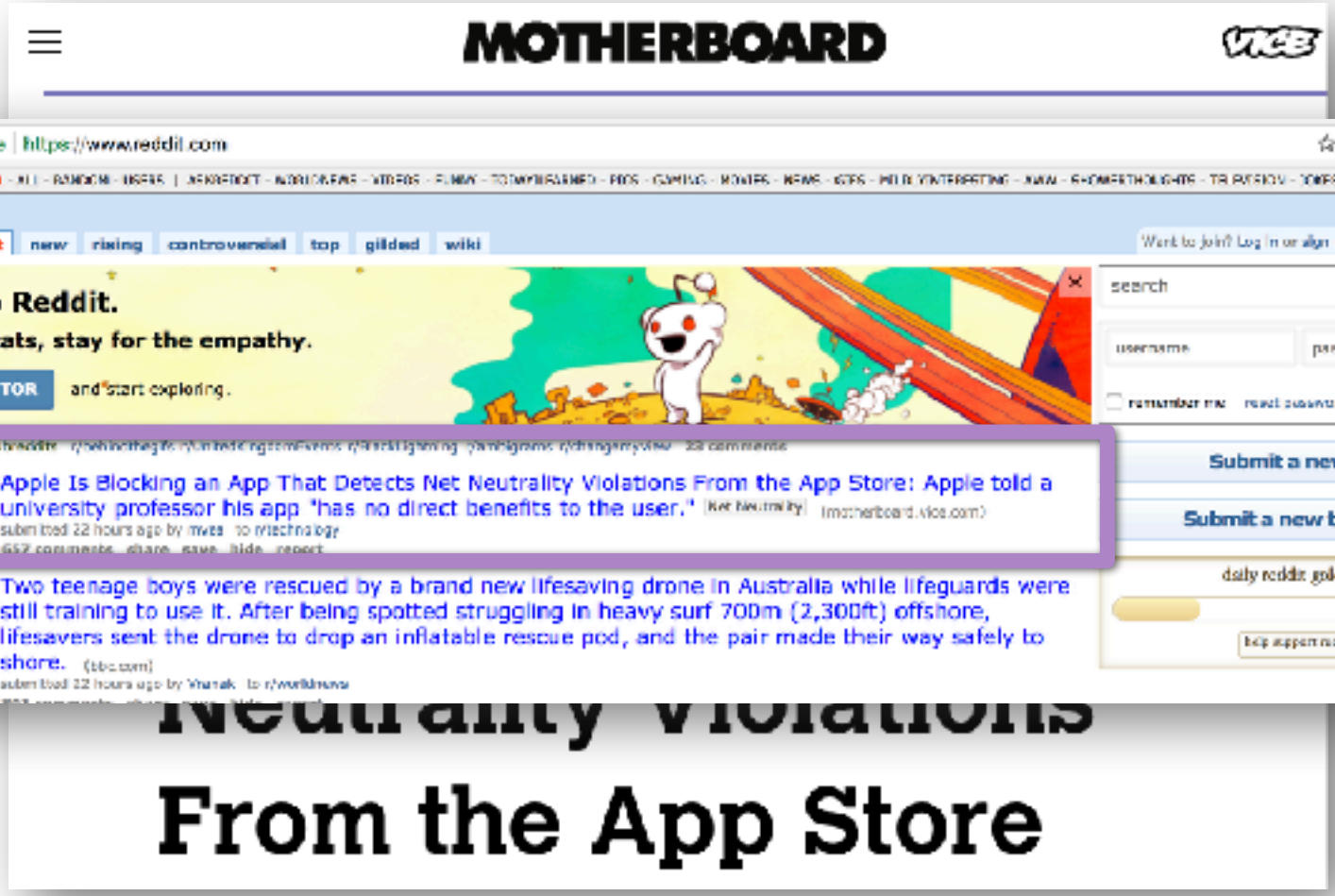

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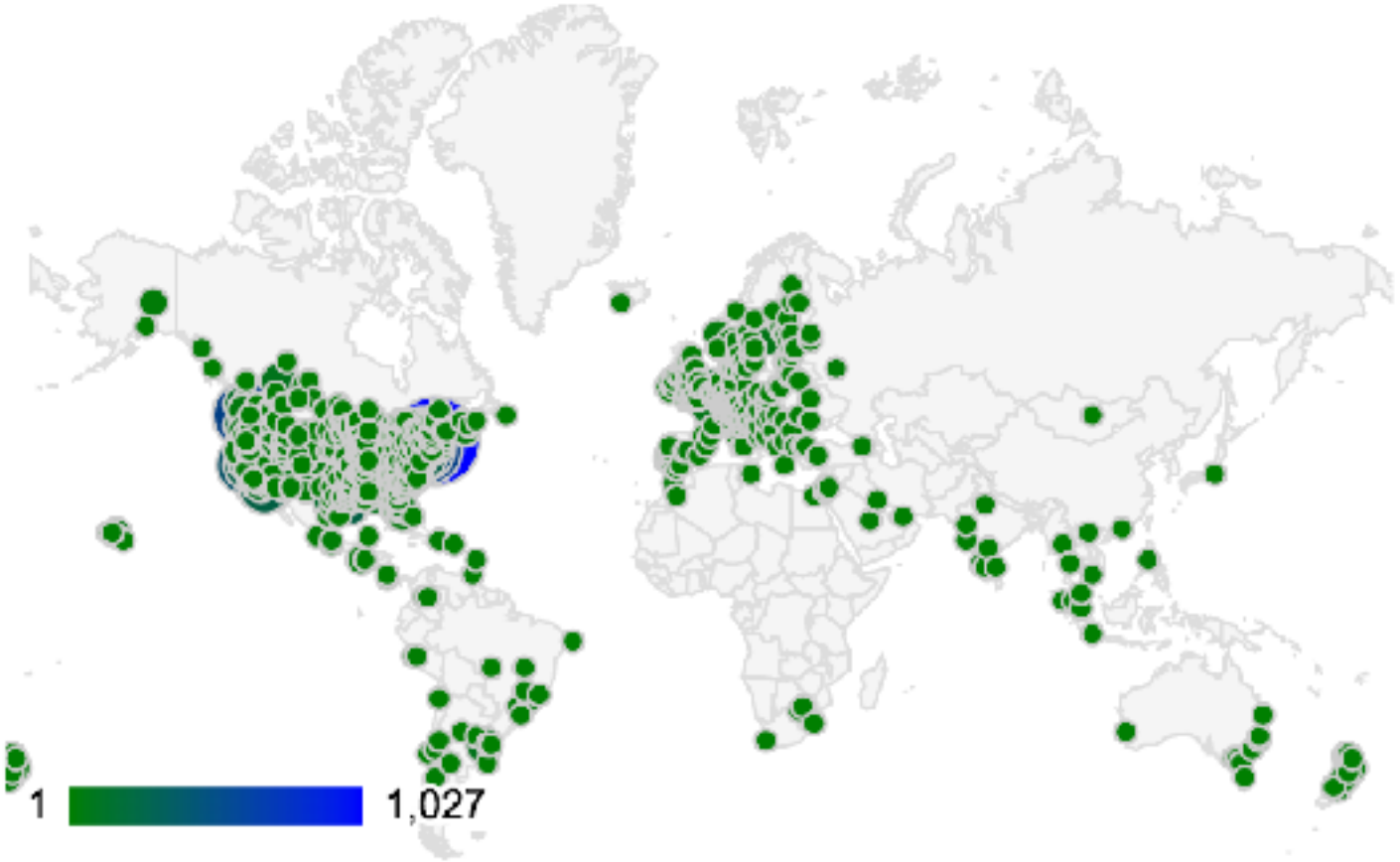

Some of our findings

116,000 tests and growing (~2k per day)

Countries	ISPs
US	Verizon Wireless, MetroPCS, HOME, T-Mobile, cricket, CSpire, Boost Mobile, AT&T, iWireless
UK	O2, giffgaff
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Apps	
YouTube (10)	T-Mobile, Verizon Wireless, MetroPCS, AT&T, HOME, O2 - UK, cricket, CSpire, giffgaff, Boost Mobile
Netflix (6)	T-Mobile, Verizon Wireless, MetroPCS, O2 - UK, AT&T, Boost Mobile
Amazon Prime Video (5)	Verizon Wireless, MetroPCS, HOME, ,T-Mobile, MetroPCS
NBCSports (4)	T-Mobile, MetroPCS, AT&T, iWireless

Wehe for public policy

Currently working w/ ARCEP (equivalent of FCC in France)

- **Strong** net neutrality laws
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Our goal: improve **transparency**, serve as a **model** for other jurisdictions

ARCEP contract

Deliver a tool to monitor net neutrality in France

- Translate to French language
- Provide fully functional apps
  - Along with infrastructure to support them
    - Using M-Lab, EC2, will add more providers
  - Regular updates to include latest traffic samples from relevant apps
- Reverse engineering of DPI rules
- Interface to submit complaints directly to ARCEP from the app

Operational challenges

False positives

- We run multiple tests back-to-back to reduce probability
- Issues with incomplete tests
- Support interface to show what others have seen

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False negatives

- Sometimes cellular bandwidth is terrible
- If less than throttled rate, there is no differentiation applied
- Needs a way to automatically infer throttling rate

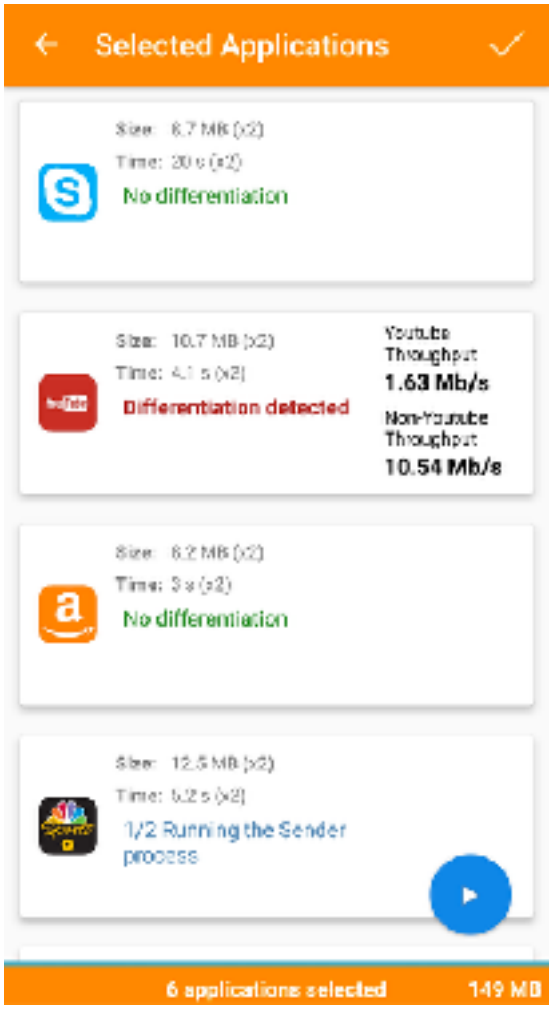
Operational challenges (2)

User perception

- ”What if I don’t have a Netflix account?”
- “Wow, AT&T is slowing my video by 10x!”
- “Wait, I can turn off throttling?”
- “How do I test my fixed-line connection?”

User requests

- Please add app X
- Please provide Windows support
- Please provide the source code (soon!)



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Testified at MA State Senate Hearing

- Described much of what I covered at TPRC this year
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- What if we gave ISPs “grades” for neutrality?
  - Who measures?
  - How to define the grades?
  - How to avoid subversion?

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  - Who measures?
  - How to define the grades?
  - How to avoid subversion?
- Other carrots/sticks discussed
  - Relationship between ISPs and various jurisdictions is complicated
  - No silver bullet here

Going forward

Continue to improve our tests

Engage with more jurisdictions

Tackle some thorny measurement/policy questions

Be vigilant

https://dd.meddle.mobi