Measuring the Internet during Novel Coronavirus to Evaluate Quarantine
https://ant.isi.edu/minceq

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joint work with Guillermo Baltra, Asma Enayet, Yuri Pradkin, and Xiao Song

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How Is the World Reacting to COVID-19?

- Wuhan
  - quarantine 2020-01-23 to -04-08
- the United States:
  - response varies by state
  - all declared state of emergency by 2020-03-16
  - stay-at-home varies, most by Mid-March or early April
- the rest of the world
  - many reports

global lockdowns as of 2020-03-30 source; Wikipedia

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Reactions Vary: What is *Really* Happening?

- *many* different reactions
- timing varies
- compliance often uncertain

- can we evaluate response centrally? globally?
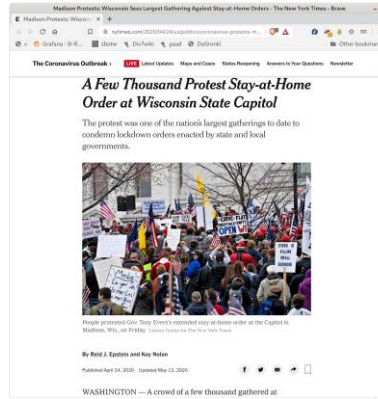
uncertainty over what is happening on the ground, domestically and abroad
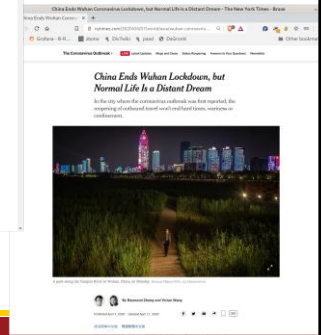
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Our Prior Work: Examining the IPv4 Internet

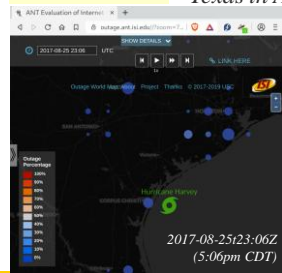Since 2006, we regularly scan the Internet (IPv4, like 192.200.1.2, but *.*.*.*)

https://ant.isi.edu/ address/browse/

(map as of June 2019)

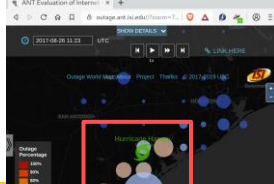Since 2014 we have been tracking Internet outages

https://outage.ant.isi.edu/

(data from Hurricane Harvey hitting Texas in August 2017)

before landfall: **few outages**

2017-08-25t23:06Z (5:06pm CDT)
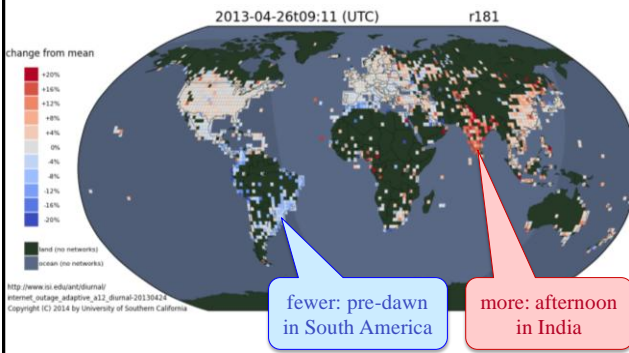
serious outages (red circles). N. of Corpus Christi

2017-08-26t11:56Z (5:56am CDT)

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The Dynamic Internet

insight: can see the Internet sleep?

=> can see the Internet
   work-from-home!

fewer: pre-dawn in South America

more: afternoon in India

animation:
https://ant.isi.edu/diurnal/

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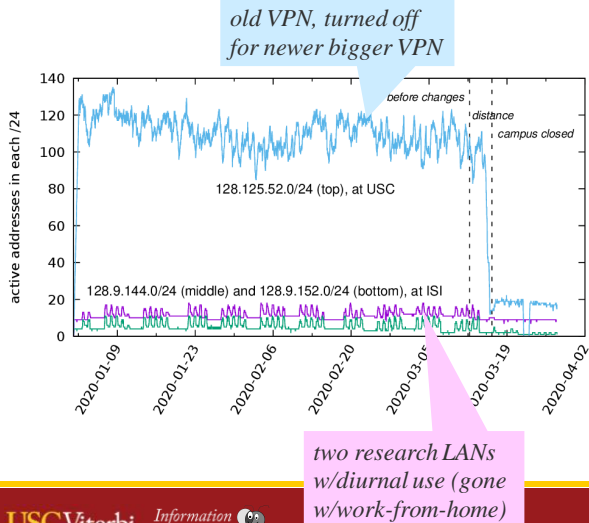
Mining Our Outage Data

- reuse existing Trinocular scanning for outages
  - ICMP echo requests
  - to some addresses in 5M blocks
  - every 11 minutes
- re-analyze to track address use

- will compare to regional traffic data
  - from FRGP (IXP in Colorado)

- pros:
  - broad coverage: >5M /24s
  - timely: 24x7 every 11 minutes
  - global coverage
- cons:
  - *not designed for virus hunting*
  - scanning rate varies per block
    - more probes when negative response
    ⇒must remember prior state
  - only see public, non-firewalled IPv4
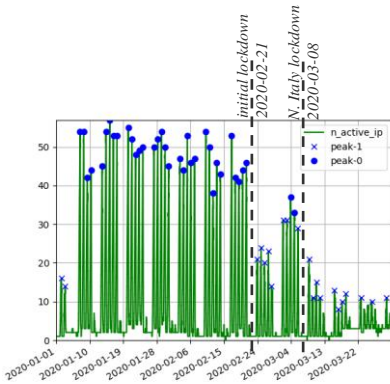   => likely less sensitive in U.S.

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Early Results at USC

old VPN, turned off for newer bigger VPN

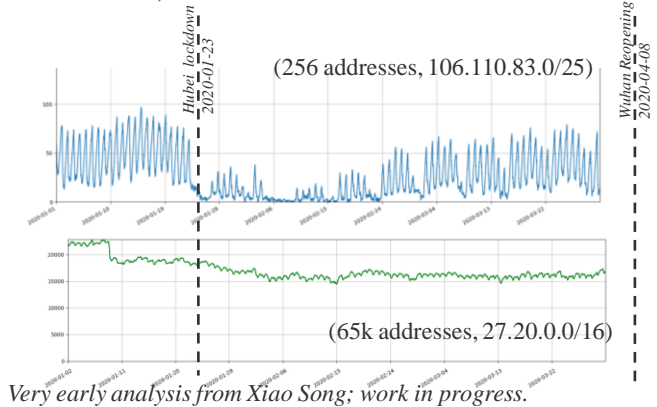*two research LANs w/diurnal use (gone w/work-from-home)*

- data of 3 networks at USC and ISI
- talked to network operators about ground truth

- => confirms we can see changes due to COVID-19 WFH

Early Results from the World

Milan, Italy (149.132.172.0/24)

Wuhan, China

(256 addresses, 106.110.83.0/25)

(65k addresses, 27.20.0.0/16)

Very early analysis from Xiao Song; work in progress.

Open Questions and Next Steps

- algorithm to automate finding changes?
- how much does coverage vary?
- comparing to traffic data
  - early results in "Do You See Me Now?..." by Mirkovic et al, IEEE TMA 2017
  - can we do similar w/Corona?
- updates at https://ant.isi.edu/blog or contact me at johnh @ isi.edu

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