Netalyzr for Android:
Challenges and opportunities

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Nicholas Weaver
Christian Kreibich
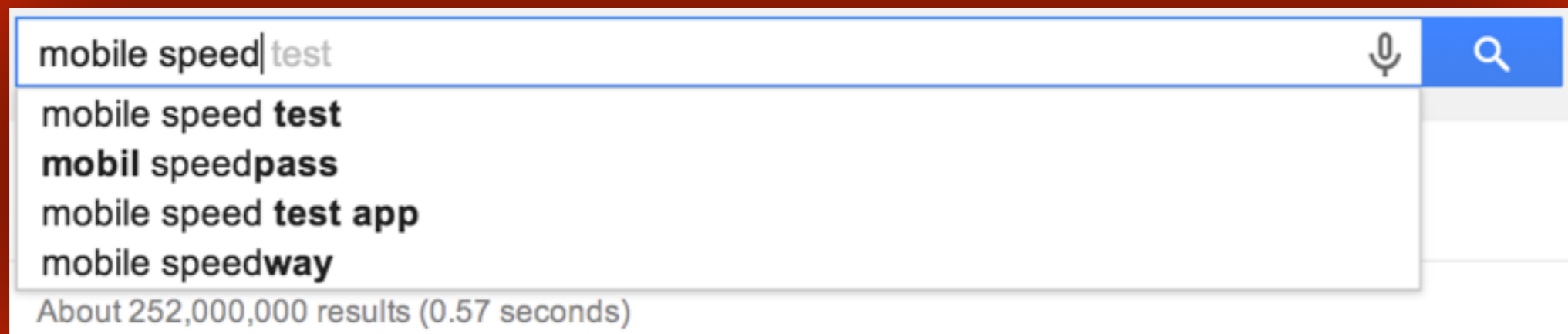Vern Paxson

ICSI-UC Berkeley

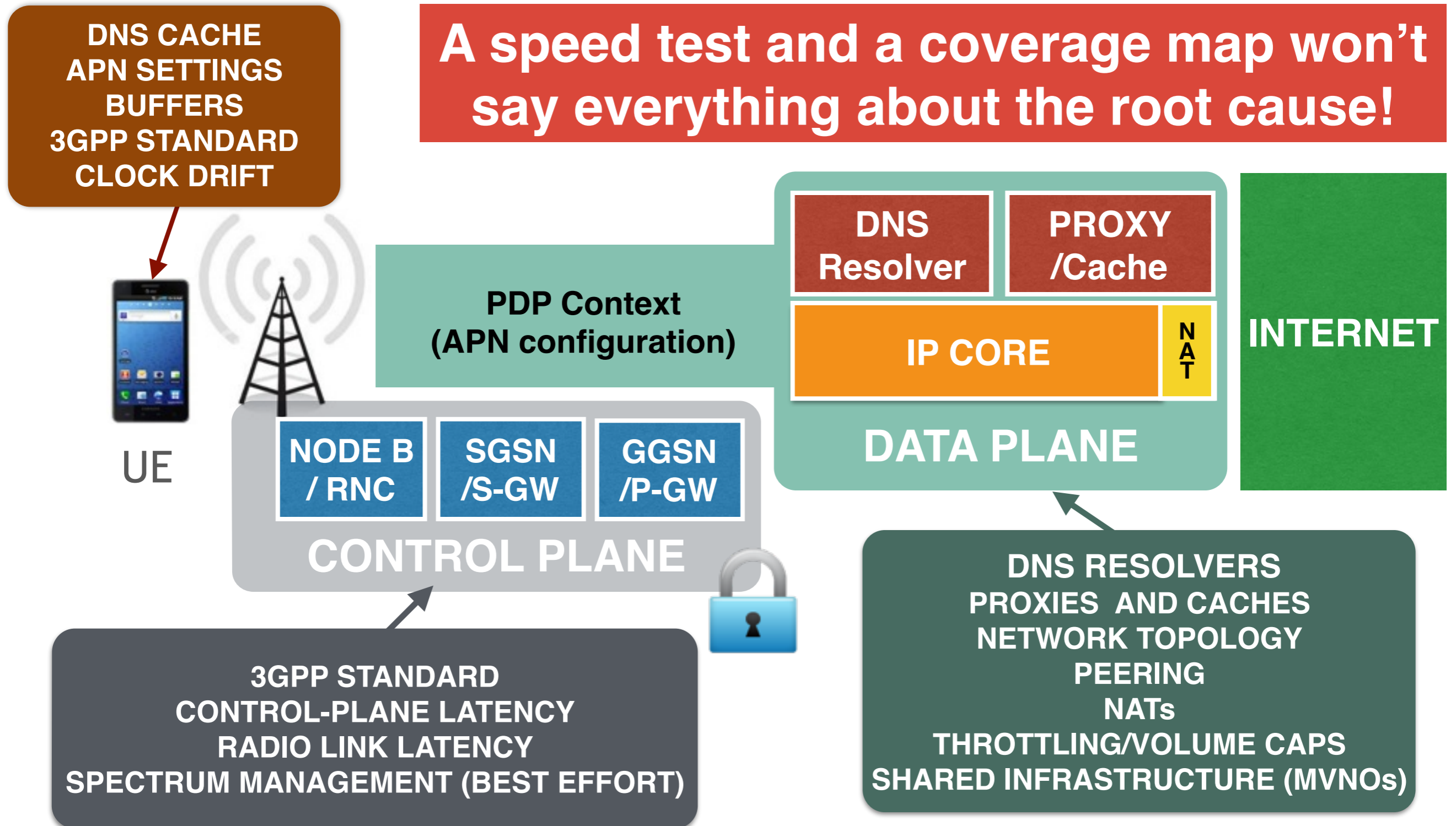**AIMS**
CAIDA, San Diego
03/26/2014

The problem:

People care about their cellular network performance … (and security)

mobile speed|test 🎤 🔍

mobile speed **test**
mobil speed**pass**
mobile speed **test app**
mobile speed**way**

About 252,000,000 results (0.57 seconds)

… but cell nets are complex. We don't really know what they look like/behave

**DNS CACHE
APN SETTINGS
BUFFERS
3GPP STANDARD
CLOCK DRIFT**

A speed test and a coverage map won't say everything about the root cause!

**PDP Context
(APN configuration)**

DNS Resolver

PROXY /Cache

IP CORE

N A T

INTERNET

DATA PLANE

UE

NODE B / RNC

SGSN /S-GW

GGSN /P-GW

CONTROL PLANE

**3GPP STANDARD
CONTROL-PLANE LATENCY
RADIO LINK LATENCY
SPECTRUM MANAGEMENT (BEST EFFORT)**

**DNS RESOLVERS
PROXIES AND CACHES
NETWORK TOPOLOGY
PEERING
NATs
THROTTLING/VOLUME CAPS
SHARED INFRASTRUCTURE (MVNOs)**

Netalyzr

ICSI - February 21, 2014

Tools

Installed

ⓘ This app is compatible with all of your devices.
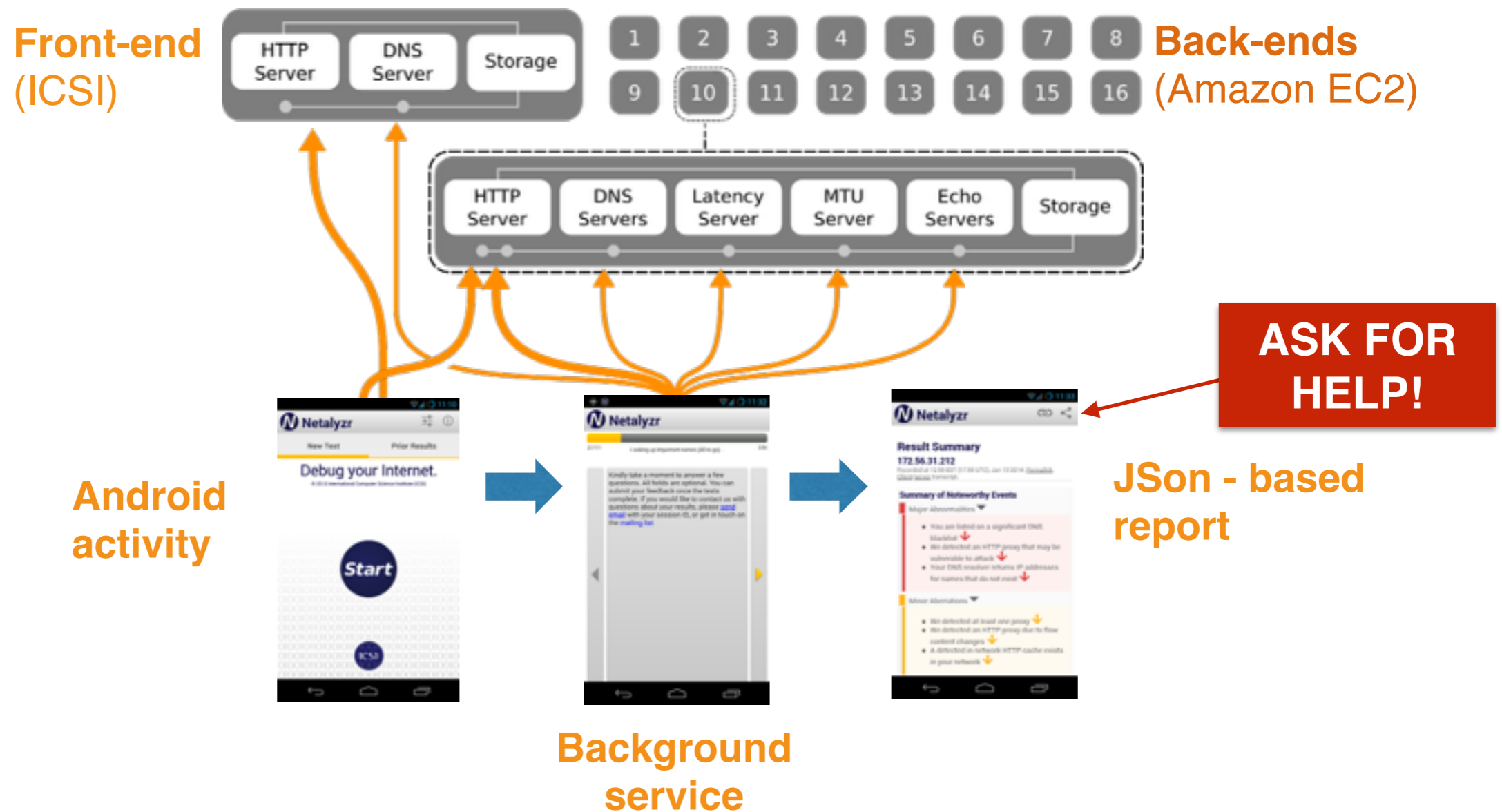
★★★★½ (👤 157)

g+1 +162 Recommend this on Google

The ICSI Netalyzr for **Android**

- Native tool to diagnose connectivity characteristics and study the health of the Internet from the edge of the network

- Checks for behavioral anomalies and security issues

- Helps **any user** to understand and fix their network

- User-driven analysis

- Continuous evolution!

  - Desktop version launched in 2009 (Java applet)

  - **Android** native version launched in late 2013

The (current) test suite

- **Addressing**: NAT detection, port renumbering, network interfaces, gateways, …

- **IPv4/IPv6**: fragmentation, path MTU, dual-stack support, latency comparison, ..

- **Network Performance:** latency (including control-plane), bandwidth

- **DNS:** resolver identification, port randomization, glue policy, wildcarding, DNS MTU, lookup integrity, EDNS support, RTYPE behaviour, IPv6 support, performance, …

- **HTTP:** Hidden proxies, in-path caches, header manipulation, image transcoding, compression, HTTP type filtering …

- **Reachability and connectivity:** port filtering, traffic differentiation, fragmentation, SNR, WiFi/Cellular configuration,…

- **Network topology**: traceroute

- **Security:** TLS handshake, UPnP vulnerabilities on WiFi APs, …

- **Handset configuration**: clock drift, TLS default certificates, APN configuration, …

Mobile app design

Front-end (ICSI)

Back-ends (Amazon EC2)

Android activity

Background service

JSon - based report

ASK FOR HELP!

Advantages over other approaches

- Large footprint (large number of operators and countries)

- High fidelity data:

  - "You measure what you see"

 - Ability to collect contextual information

  - Cross-layer

Limitations, technical and research challenges

- Accessing control-plane information:
  - Hacking radio drivers [**_RILAnalyzr_**, IMC'13 (open source)]
  - Offline analysis of operator traces (privileged access)

- App maintenance can be hard. Do not trust anything!

  - Bugs are very common, there are many corner cases!

  - Handset idiosyncrasies (… APN misconfiguration)

- Flexibility and extensibility
  - Support new technologies (eg SPDY, IPv6)
- Multi-dimensionality of analysis: **HARD TO MAKE SENSE OF WHAT YOU COLLECT!**
- Market peculiarities: shared networks and MVNOs

# "Crowdsourcing" means … "users"!

- +15K **Android** installs as of today
  - 290 operators in 90 countries
  - +25K sessions
- Geek bias (~60 % have rooted handsets)
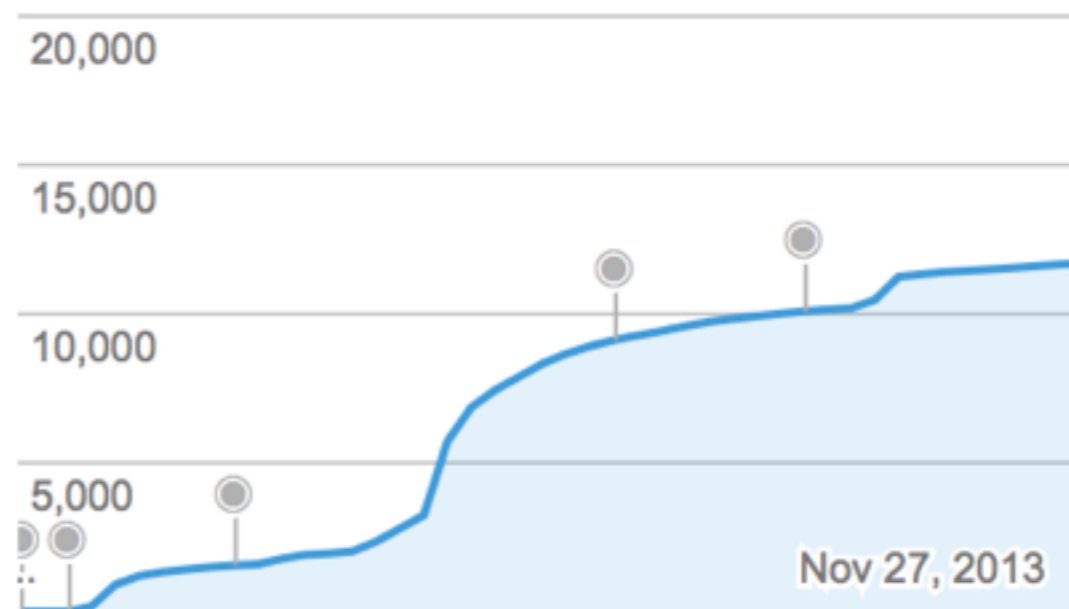
Attracting and keeping users

- Loyalty (#installs **!=** #active users)
- Publicity is really important!
- Internationalization
- Go beyond Google Play coverage
- Clearer explanation of results
- Gamification and sharing capabilities
- Improve GUIs and reduce testing time
- Privacy and app permissions! Gain users' trust!

App reviews and feedback

Reviews

4.4

★★★★½

👤 157 total

★ 5	103
★ 4	33
★ 3	12
★ 2	2
★ 1	7
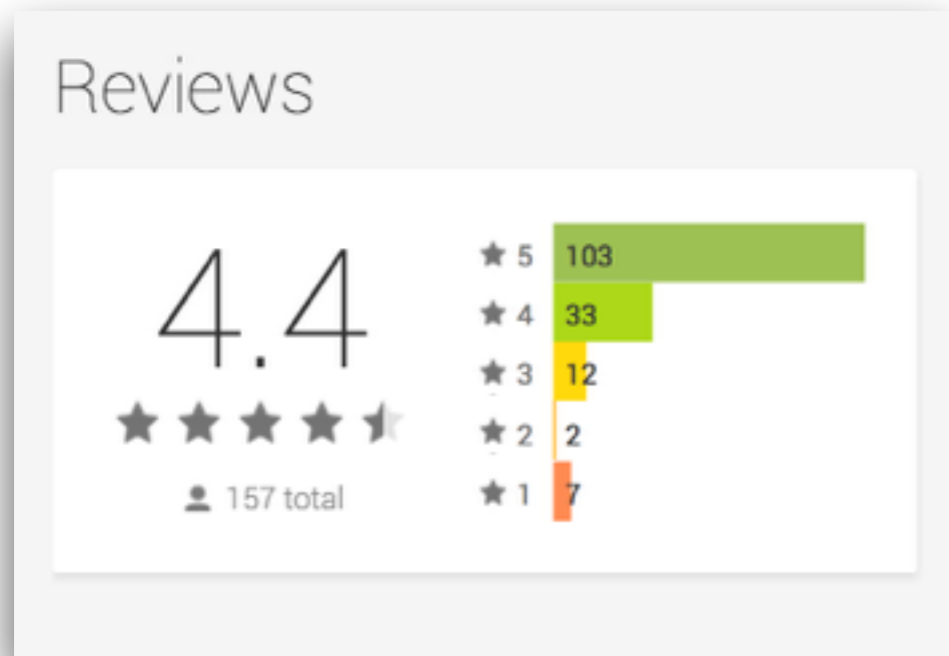
Reviews

User reviews

Fehmi Ben Abdesslem November 1, 2013
★★★★★

Very useful Clear, fast, and complete. Very well implemented, and good UI. Extensive explanation of the results.

Ólafur Guðmundsson February 13, 2014
★★★★★

The best network connectivity app! I have used this service since it started to evaluate networks. It just keeps getting better.

Stephen Webb February 22, 2014
★★★★★

**Must have!** Helped diagnose an issue with DNS settings on my router.

Seth Cummings February 3, 2014
★★★☆☆

Crashes after ~15 tests... Data wipe only fix
After ~15 or so test results, the app will not open.... Steps to reproduce: 1)run multiple scans... could be over weeks, or days... only the total number of scans matter. It appears to be more than 15, but idk exact number 2) re-open Netalyzer (it will show solid full screen color for ~5-10 sec, then FC) 3)Wipe apps DATA, re-open... And it is fixed! GREAT APP... But this issue is very frustrating

February 4, 2014
Hi Seth, thanks for your review and for letting us know! We'll check that for the next release. Drop us a note at netalyzr-help@icsi.berkeley.edu if you have any other questions or if you see that the problem continues.

James Ksiazek October 27, 2013
★★☆☆☆

Appears to be for mobile/cellular only See above.

:)

:(

Real case: T-Mobile's Proxy
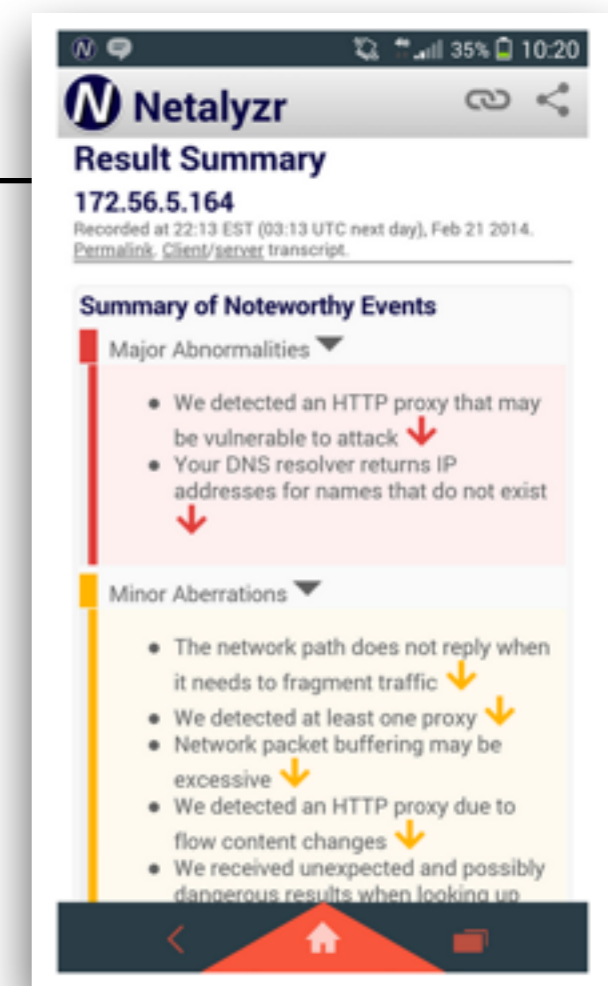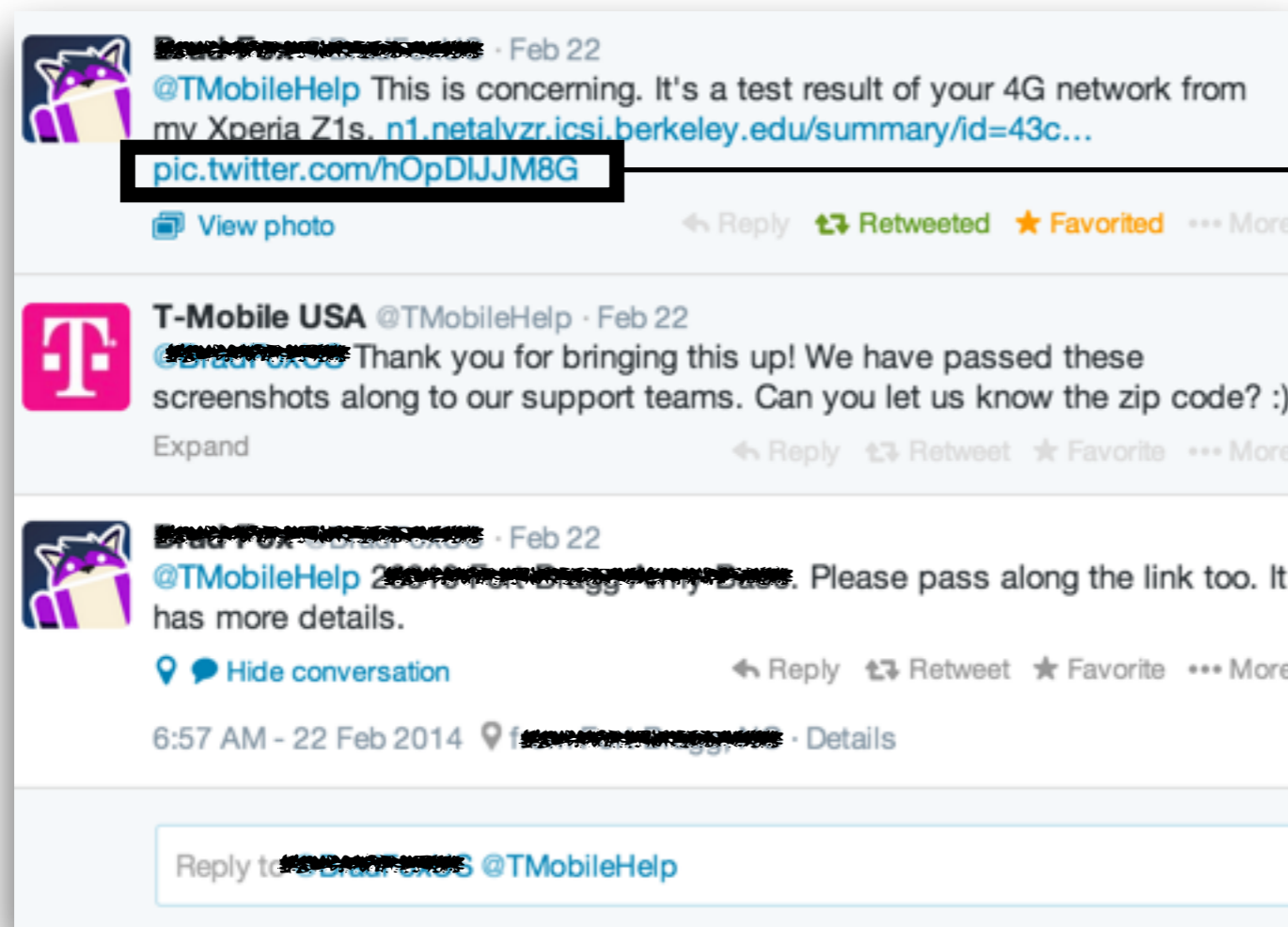
"I have the senior engineers at T-Mobile using the app now. They are impressed with it."

— a Netalyzr user

Thanks for your attention!

Q&A

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