Cell Vs. Wifi:

On the Performance of Metro Area Mobile Connections

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Overview

- We're analyzing crowd-sourced data
  - What is speedtest.net and why do we care?
- Cell vs. WiFi
  - Different, yes; "how" is interesting
- Stats galore
  - Can you ping me now?

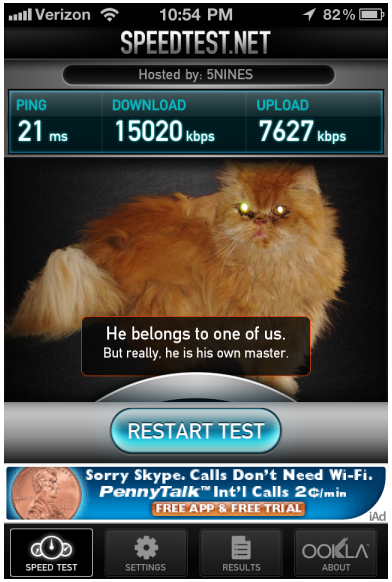
What is Speedtest.net?

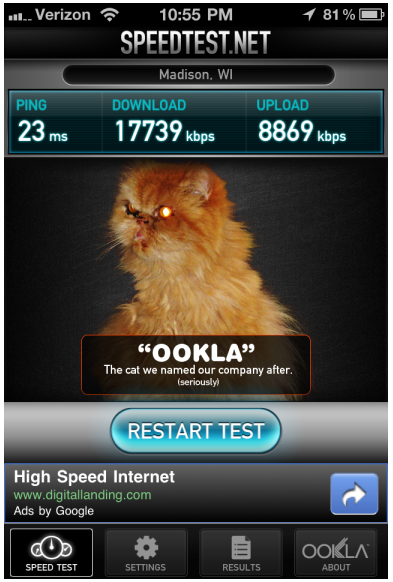
- A fine contrivance of Flash and JS
  - Measures “http” RTT (L7 ping-ish)
  - Measures upstream bits/sec
  - Measures downstream bits/sec
- Provides server operators statistical data
  - This is the only reward an ISP gets

PLATFORM	CLIENT_IP	ISP	TEST_DATE	TEST_UTC	DOWNLOAD_KBPS	UPLOAD_KBPS	LATENCY	LATITUDE	LONGITUDE	CONNECTION_TYPE
iphone	174.252.11.135	Cellco Partnership DBA Verizon Wireless	2/22/11 2:30	2:30	1396	841	357	42.8475	-89.0614	Cell
iphone	166.137.141.207	Service Provider Corporation	2/22/11 2:51	2:51	969	112	433	42.8526	-89.0313	Cell

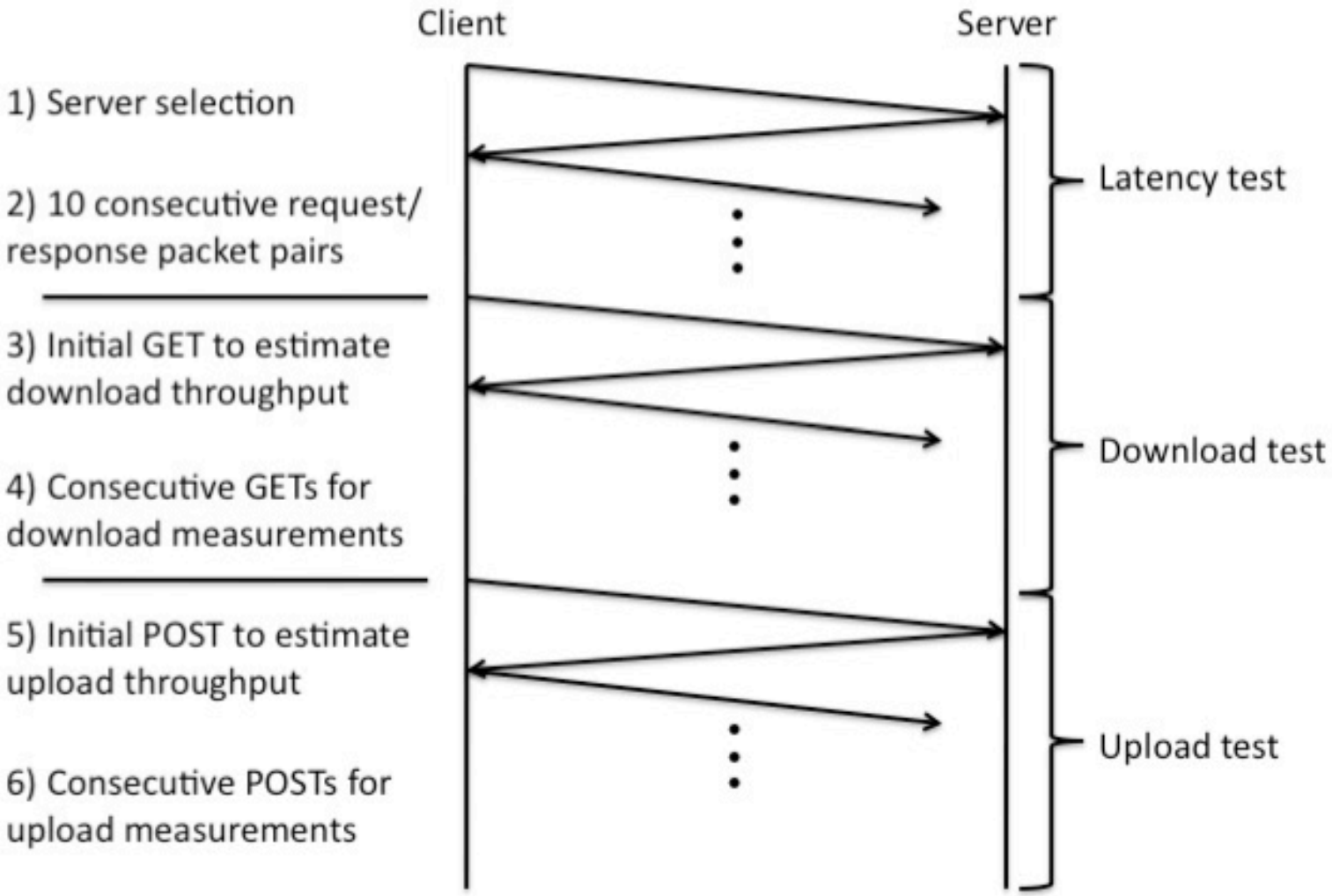
What runs speedtest.net?

- Answer: Cats

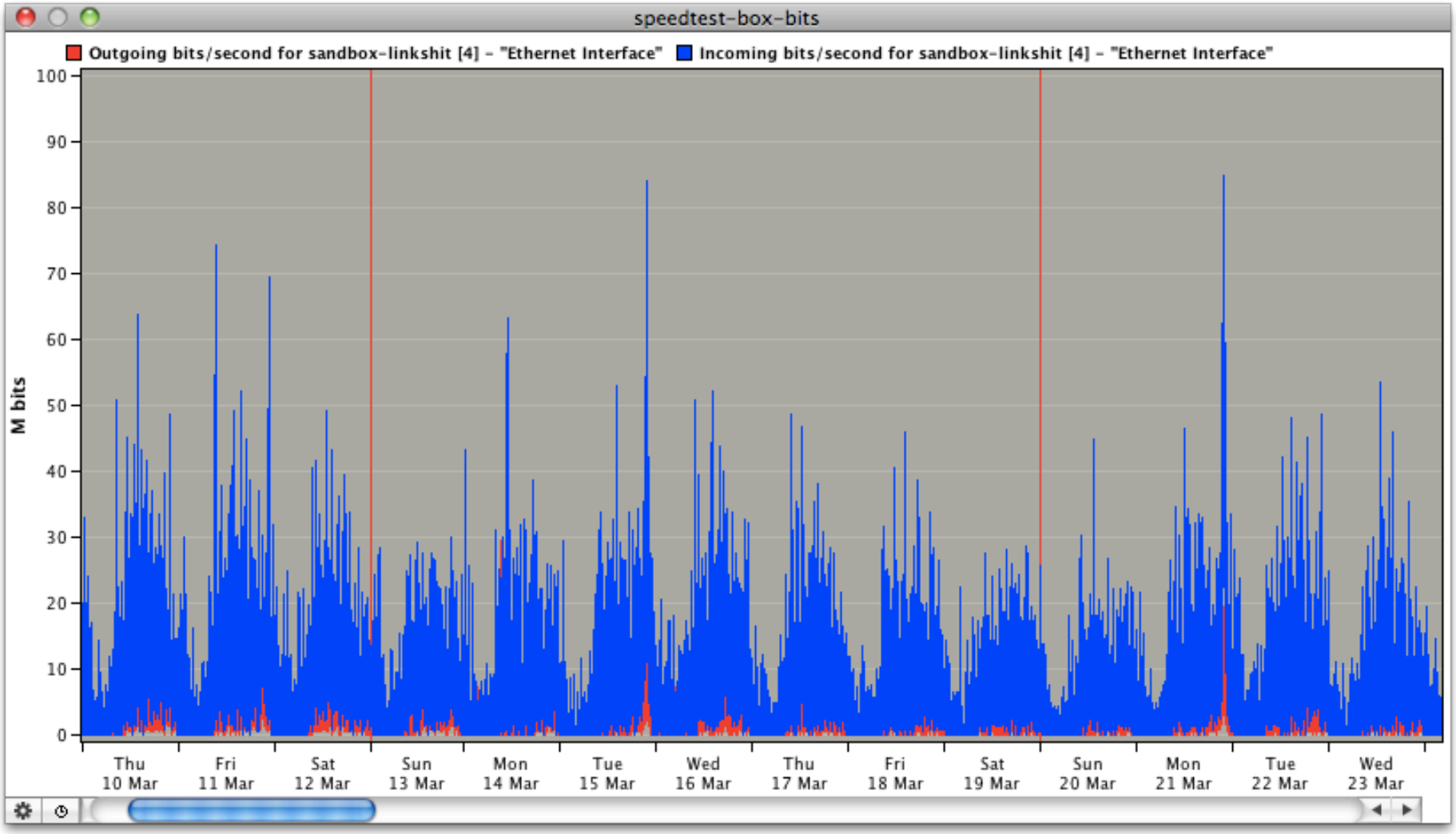




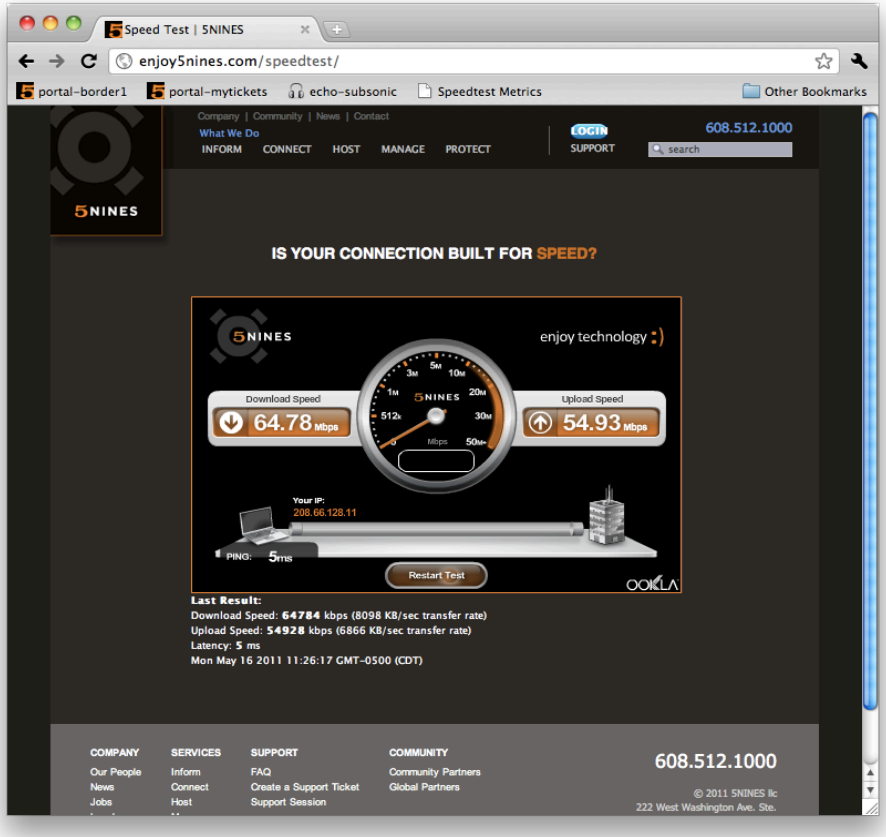
Speedtest.net Methodology



Transit is cheap, right?



Speedtest.net Web UI – Gibson effect



Paper; maybe CoNEXT, etc

Cell vs. WiFi: On the Performance of Metro Area Mobile Connections

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Over the last five years there has been an explosion in the availability and use of mobile devices that are both cellular and 802.11 WiFi enabled. The combination of a short range, high-speed capability and a longer range, lower speed capability is compelling and enables a wide range of new mobile applications. Driven by the popularity of applications that run on hybrid cell phones such as the iPhone and Andriod-based devices, there is a large and growing demand for bandwidth by mobile users.

A vexing problem for WiFi enabled cell phone users, service providers and application designers is seeking out the connectivity option that provides the best performance. Over shorter time scales issues that affect performance include local availability of services, load at a particular site, characteristics of the handset, and interference among others. Over longer time scales, performance is affected by issues such as the ongoing introduction of new technology and deployment of new service provider infrastructure.

To assist users in the effort of understanding their connectivity options, a number of commercial and open-source bandwidth testing applications are now available. When invoked, these applications attempt to determine the maximum bandwidth for both uploads and downloads to the target device. At basis, these applications send streams of random bytes (*e.g.*. data blobs through GET and POST methods) via HTTP with random characters between the target

such as: what is the relative performance of cell/WiFi in a given geographic area? How does cell/WiFi performance vary in sub-regions within the metro area? How does cell/WiFi performance vary temporally in the metro area and in sub-regions? Are there any specific features in the data that differentiate performance? and how does cell/WiFi performance compare and contrast in different metro areas? The long-term goal of our work is to formulate conclusions about the spatio-temporal aspects of WiFi enabled cell phone performance that will lead to improvements in the relevant protocols, configurations, and infrastructure.

We are unaware of any prior empirical studies that compare and contrast cellular and WiFi performance in metro areas. However, there are bodies of work that examine the performance of each technology in relatively constrained settings. For example Birk et al. describe the first detailed empirical analysis of a commercial WiFi mesh network in [1]. Similarly, Tan et al. describe an empirical study of 3G cellular networks that includes an examination of throughput and other performance characteristics [3]. Finally, Speedtest.net data has been used in several manuscripts that provide a general analysis of broadband capabilities (*e.g.*, [4]).

Speedtest.net has servers deployed throughout the globe, which facilitate client performance tests. User requests initiated through their client applications are directed to local servers based on geolocation estimates. Each speed test re-

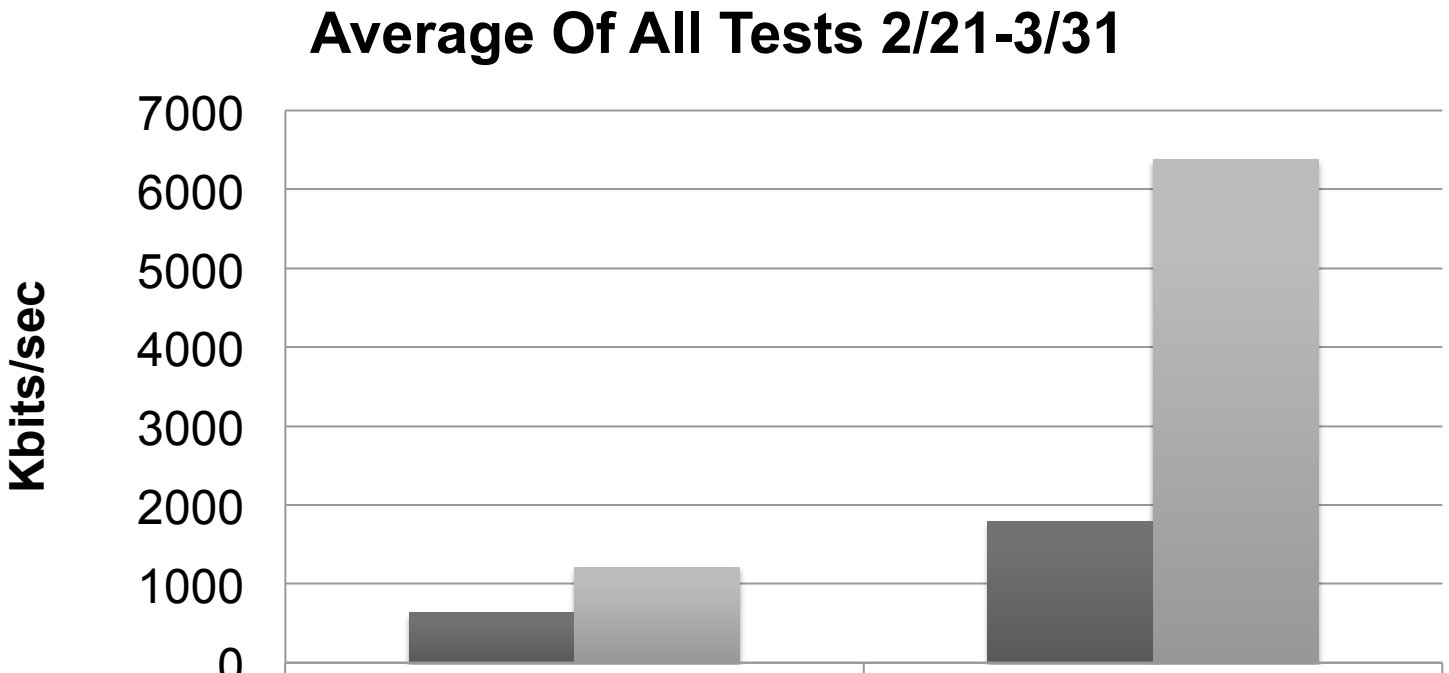
Cell vs. WiFi: Different, But How?

- Analyzed data from 2/22 to 3/31/2011
  - Sampled via madison.speedtest.net server
- Browsers/Desktops dominate
  - ~155k tests
- Mobile tests outnumbered ~4:1
  - ~38k tests
- Mobiles using WiFi dominate
  - ~24k from wifi, ~14k from cellular

Processed a bit…

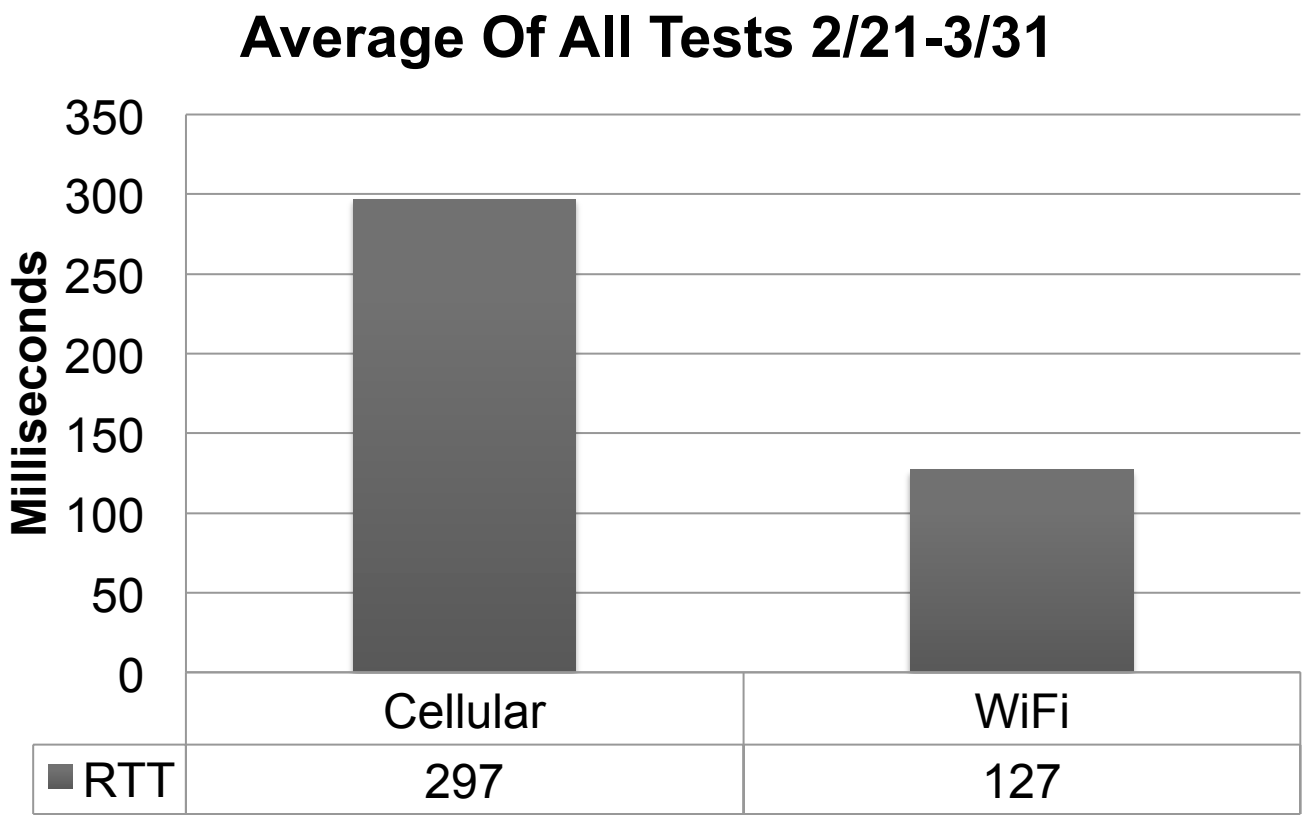
- 7718 Mobile tests within Dane County
  - ~42.845’ to 43.294’ and -89.841’ to -89.004’
- 7628 non-error-ed results
  - Failure of any sub-test: ~1.1%
- ~2k via Cellular IP
- Verdict: wifi is faster, more nines’
  - Until it isn’t (lte, 4g, etc)

Dane County WiFi vs. Cell – Raw Speed

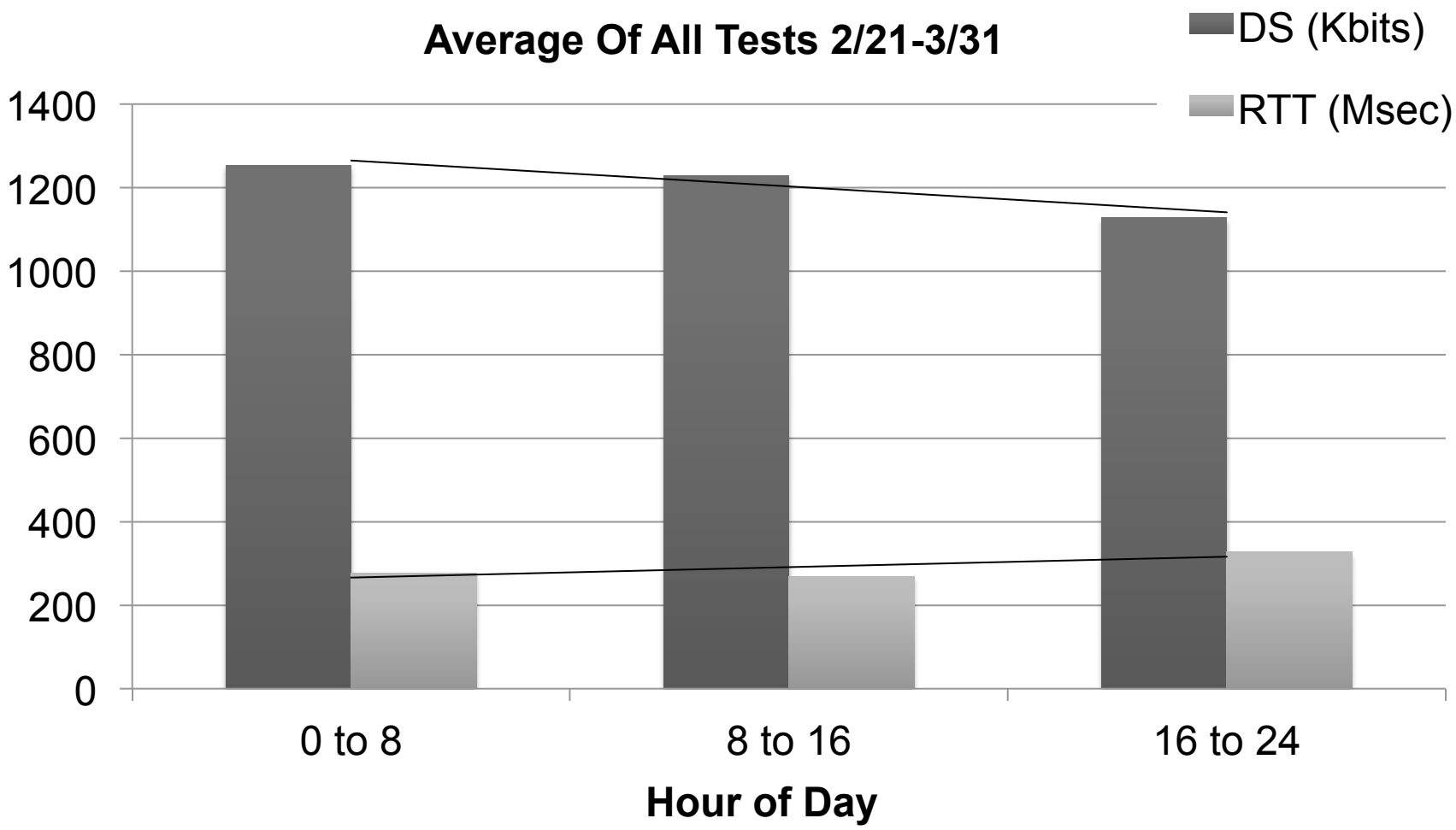


	Cellular	WiFi
Upload	634	1792
Download	1212	6383

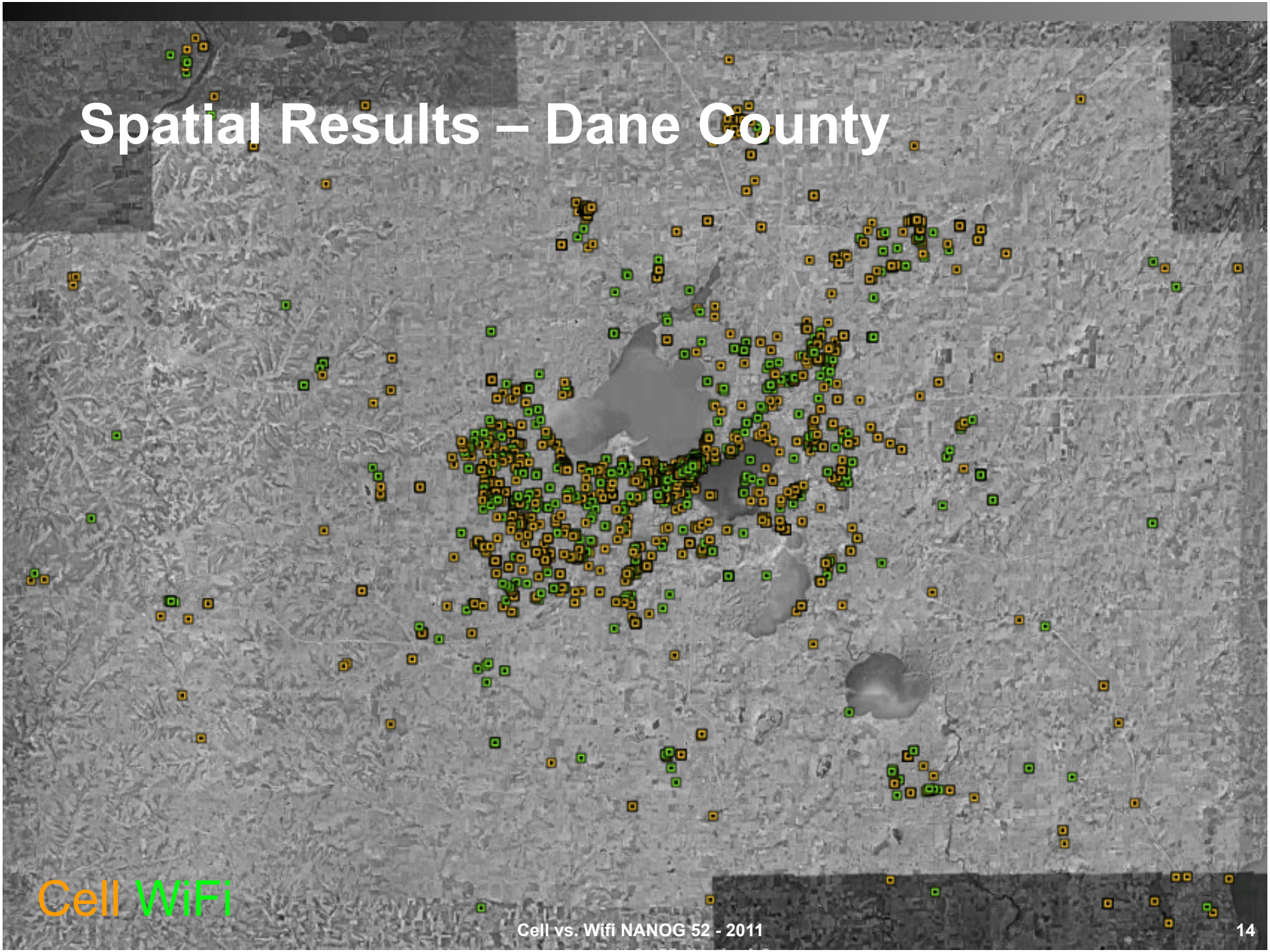
Dane County WiFi vs. Cell RTT



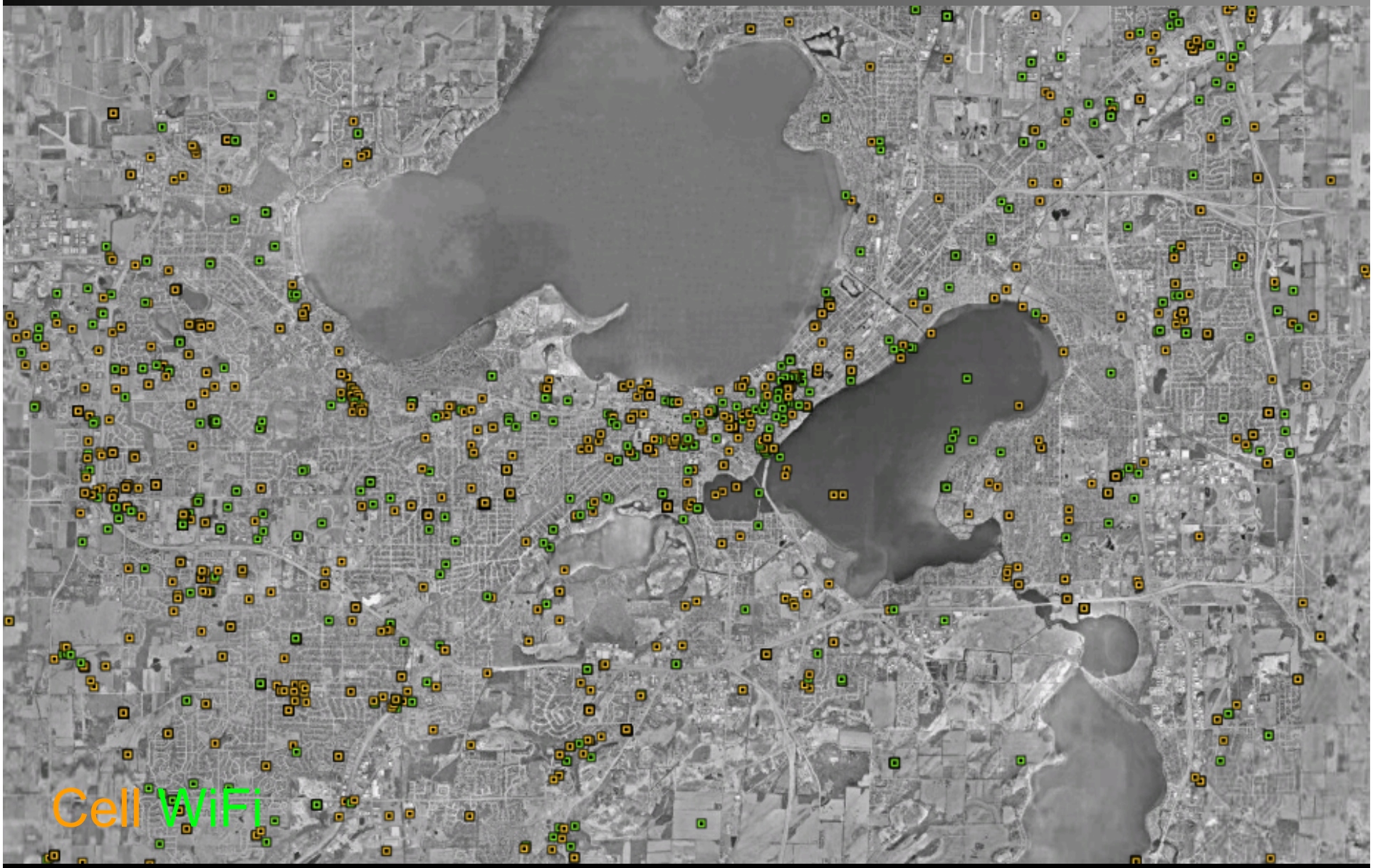
Dane County Cell Perf vs. Time of Day



Spatial Results – Dane County

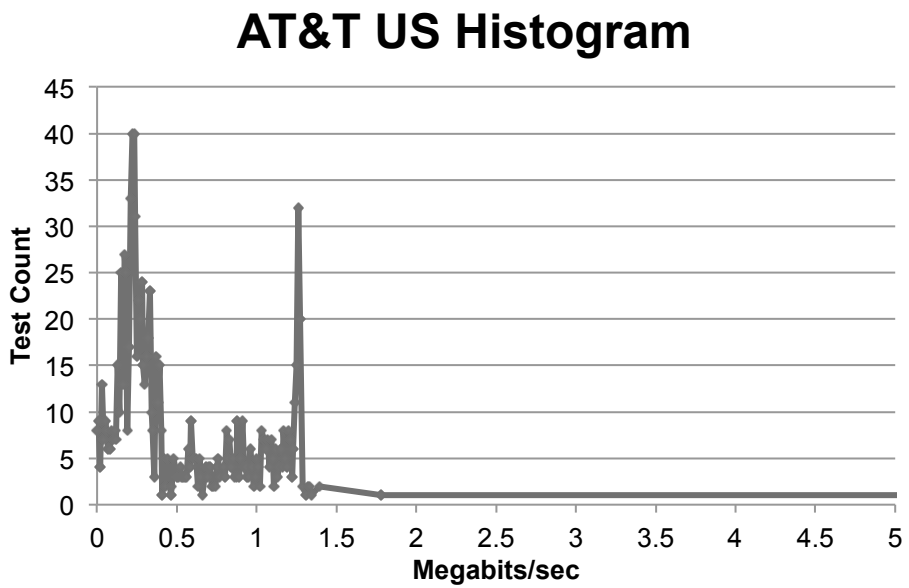


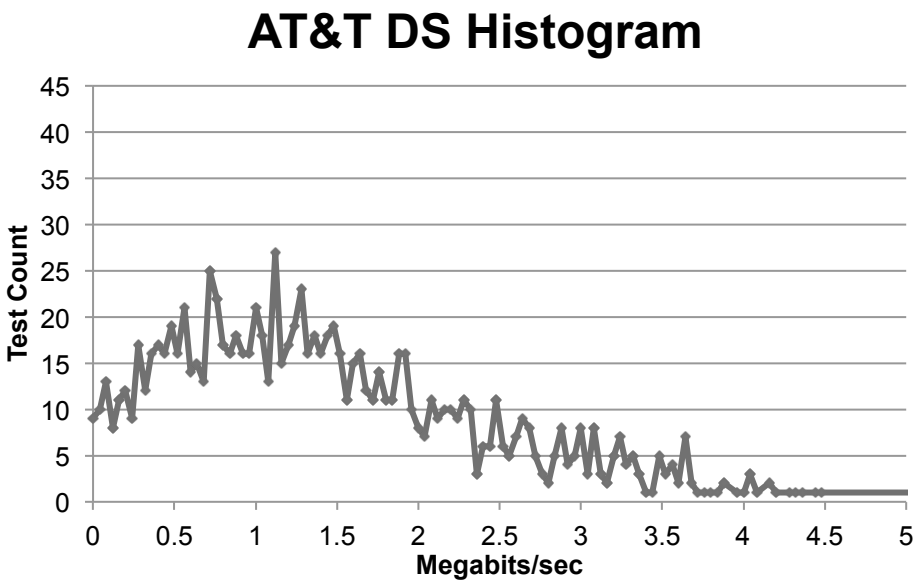
Spatial Results – City Only



Dane County Carrier Statistics

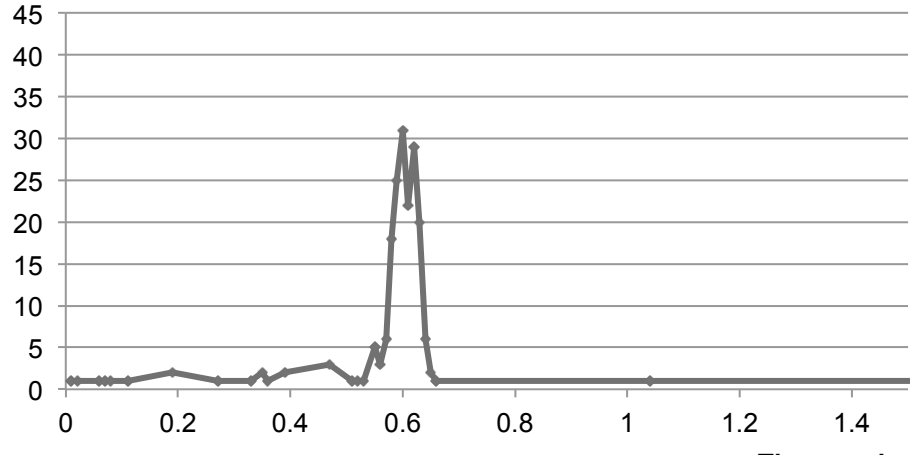
- Distributions reveal DS bias, US impairments
  - DS longer-tail than US



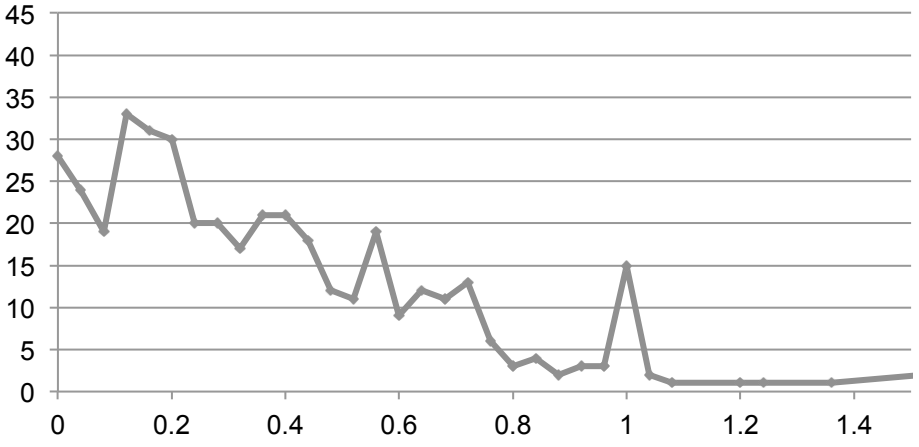


Dane County Carrier Statistics – US in Mbps

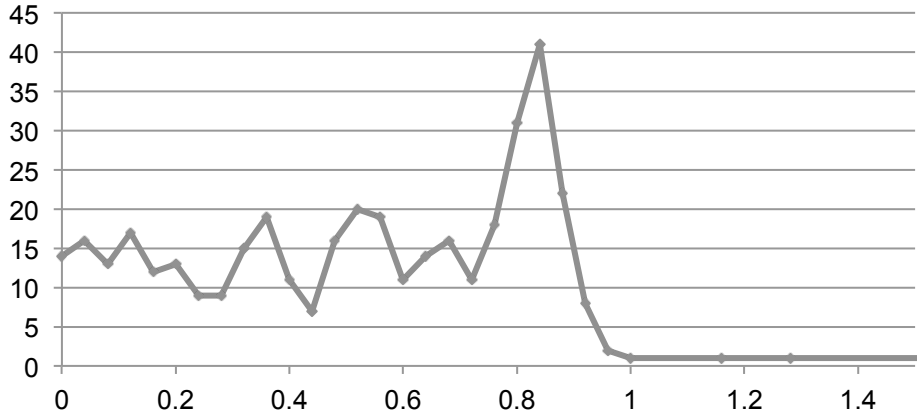
T-Mobile



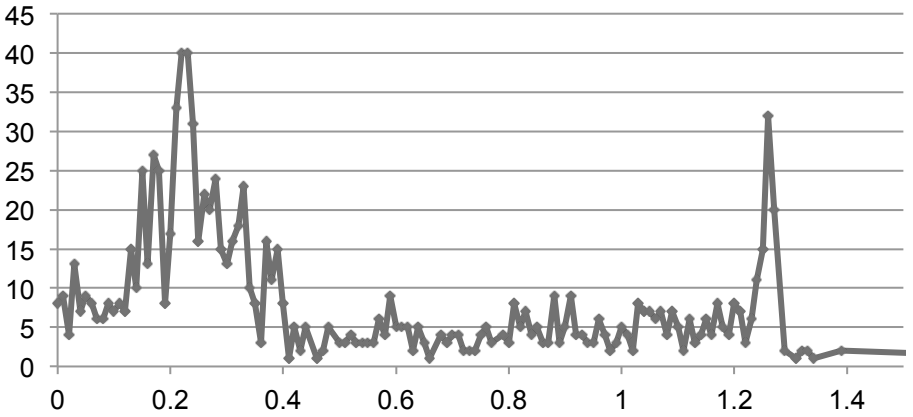
Sprint



Verizon Wireless



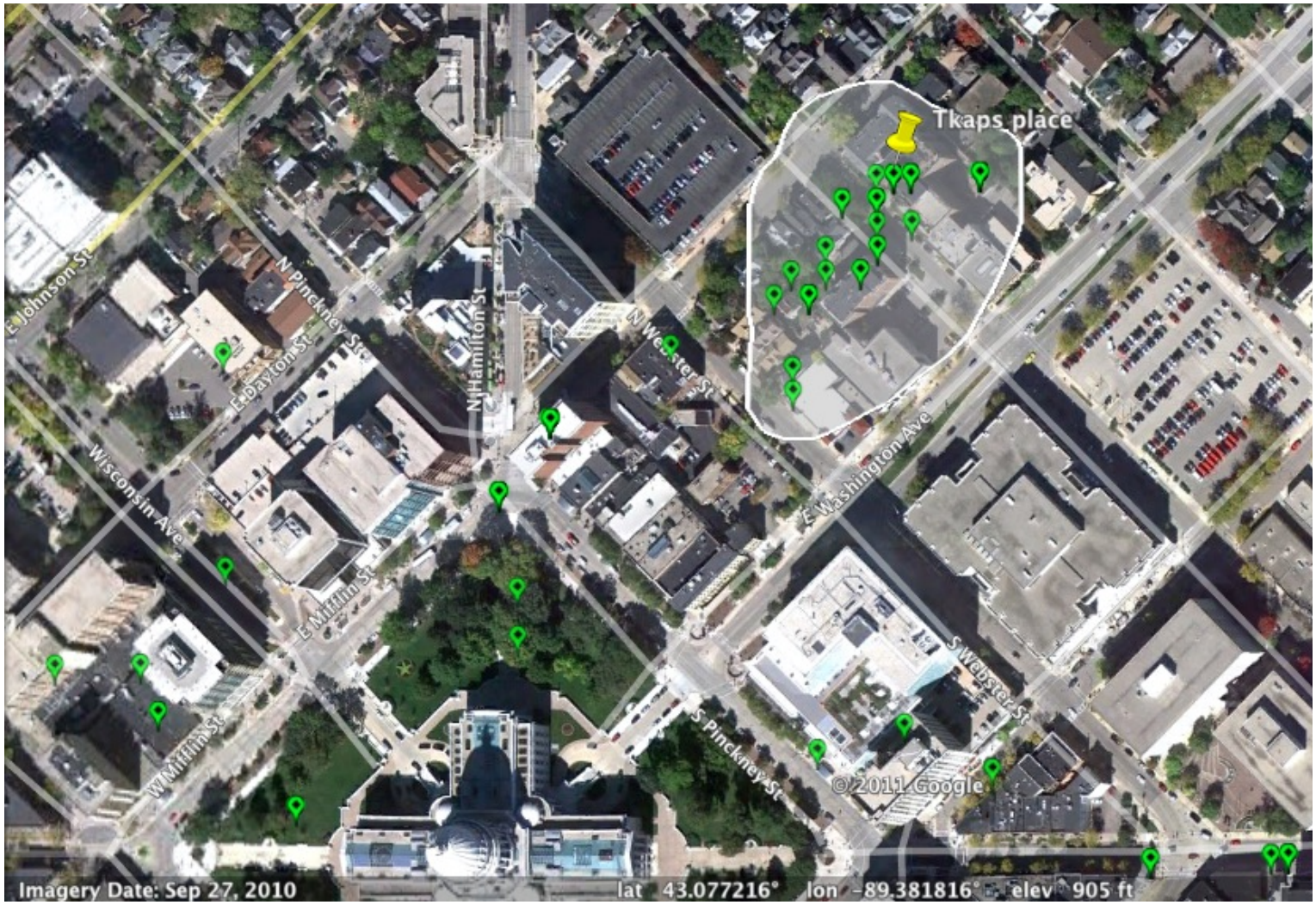
AT&T



Data Forensics

- GPS = Global Positioning “Suggestions”
  - Speedtest App doesn’t filter GPS data
  - Confirmed: GPS only sampled at application *load*
    - Hey, you’re saving batteries, man
  - Device may report same coordinates until app is closed → exec’d again
- Active testing confirms
  - (cont..)

Where's that centroid again…



Send questions, comments, complaints, etc:

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