Overview

I. Background
II. State of the art
III. Architecture of net-score
IV. Main observations
V. Remarks

Background

Why are measurement platforms important...

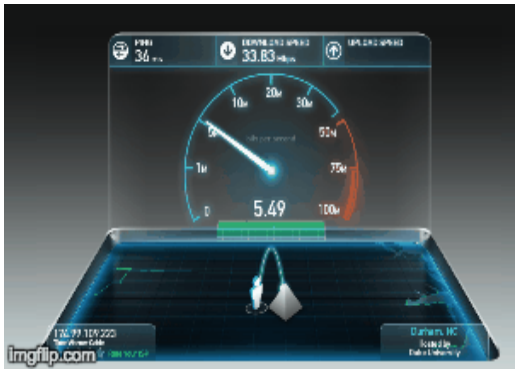
- For us as consumers?
- For government regulators?
- For researchers?

How can a platform reach a broad audience?

1. Low barrier to entry for clients
2. Scalable with low-cost for servers

Ookla Speedtests

- Browser based
- Select server, download images
- Tool reports:
  - Latency (ms)
  - Upload/Download throughput (Mb/s)



Animation of a Speedtest

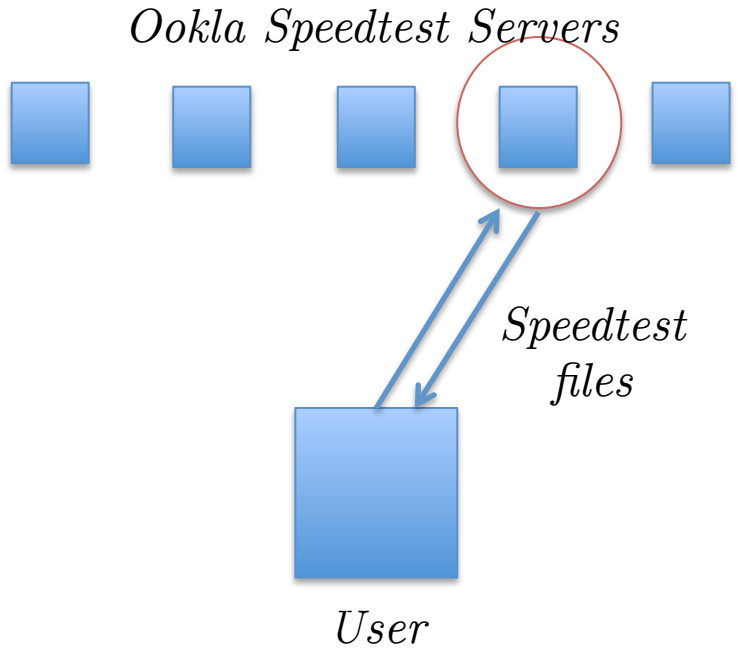


Diagram of Speedtest architecture

Ookla Speedtests

Most widely used measurement platform today.

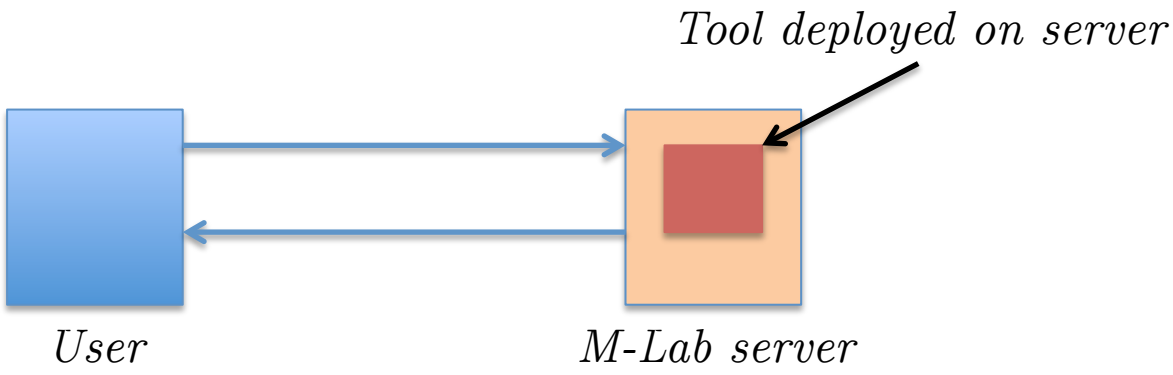
- Over 7 billion tests taken to date
- Used by Internet Service Providers (ISPs) to help customers diagnose connections

Possible biases

1. Selection bias favoring technical users
2. Conflict of interest when ISPs host Ookla servers

Measurement Lab

- Distributed server platform for deploying measurement tools
- Built for researchers
- Anyone can take tests
- Same selection bias as Ookla



net-score Architecture

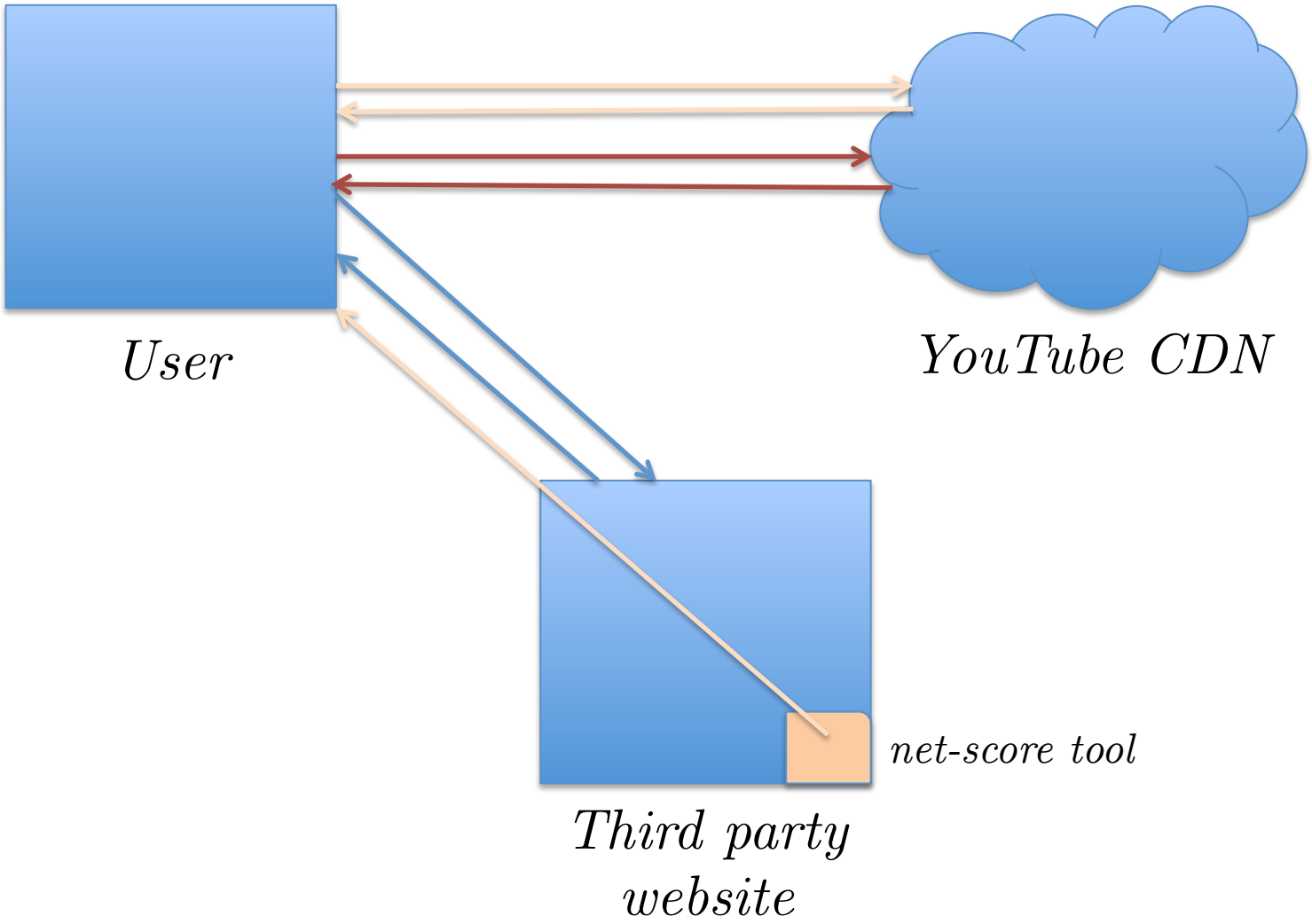
Low barrier to entry

- Users do not have to perform any action
- No additional software or hardware needed
- Not just for diagnosing connections

Low cost

- Inexpensive to all parties involved

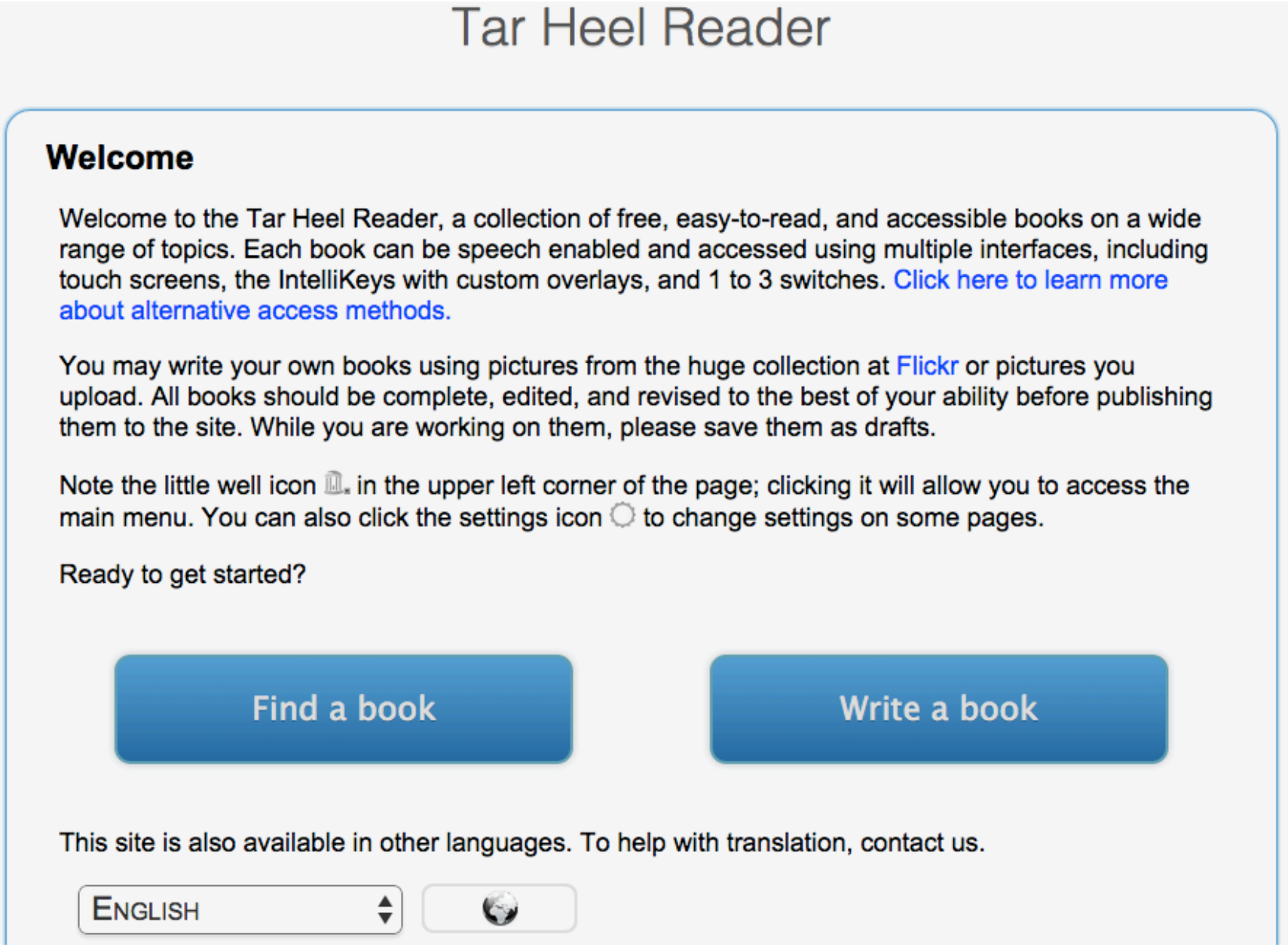
net-score Architecture



Deployment

Embedded on TarHeelReader.org

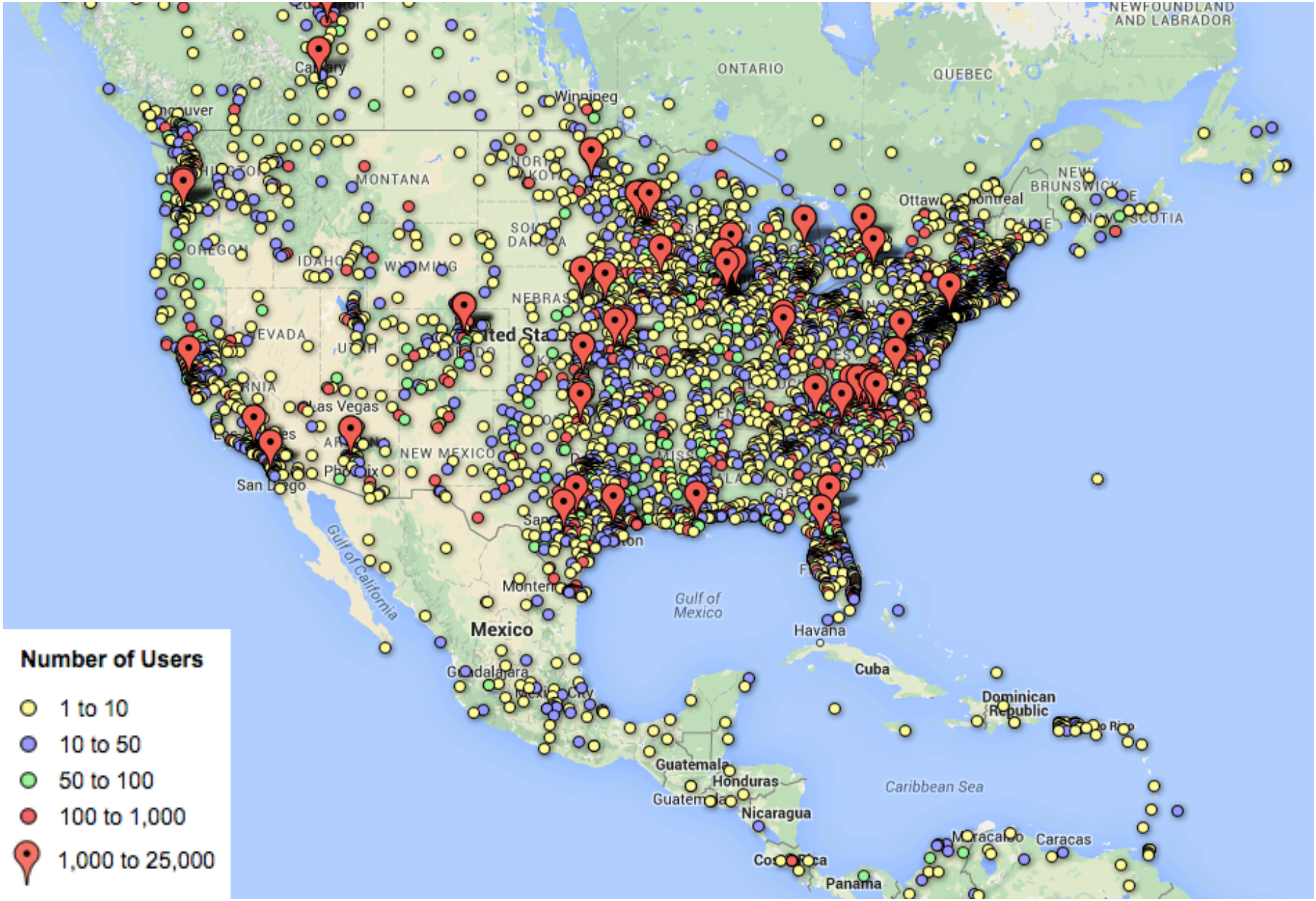
- Educational website for learning and practicing reading with short books
- Global audience of users on varying hardware
- Embedded on the landing page from January 1st, 2014 to August 1st, 2014



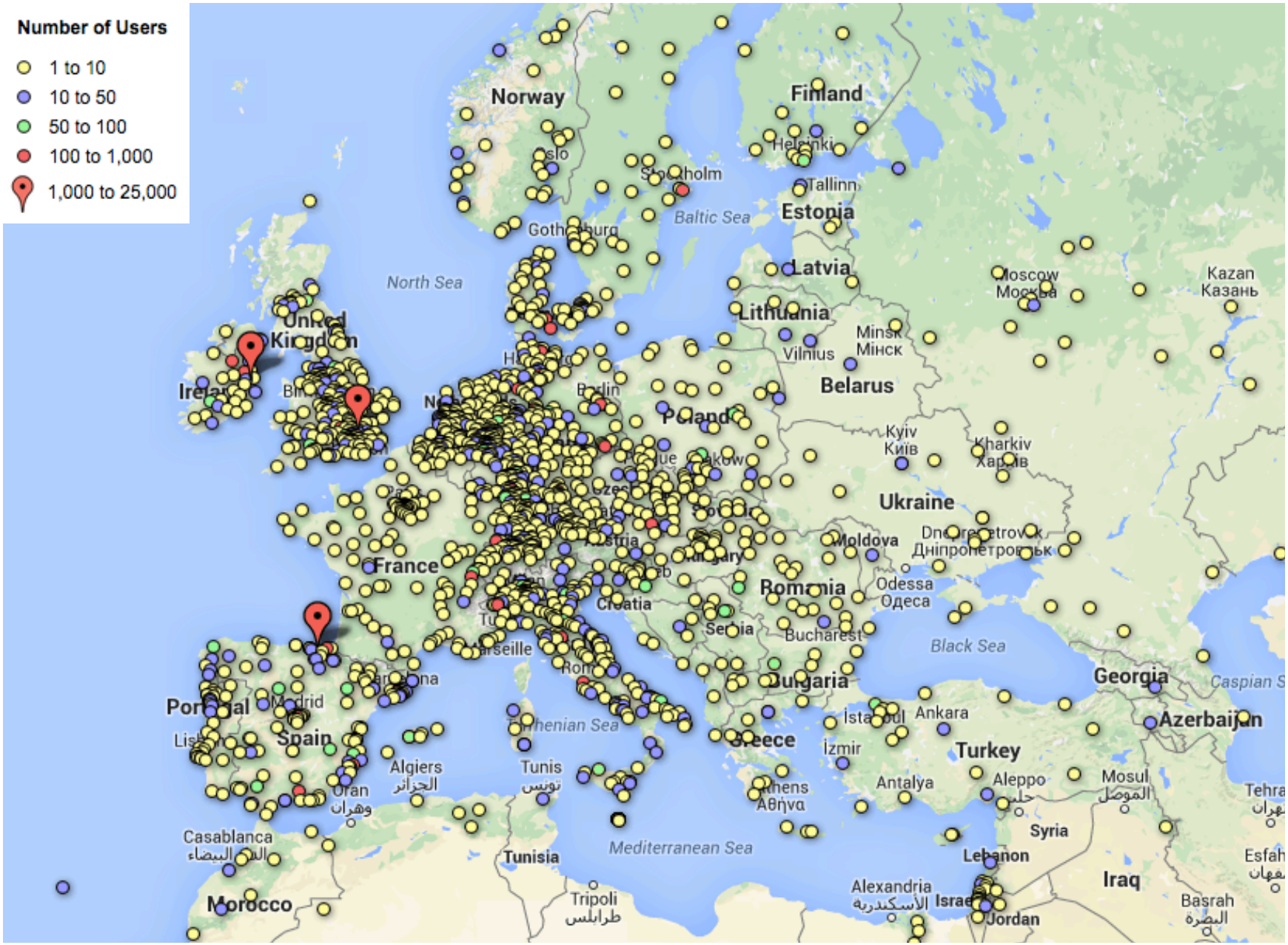
Landing page of Tar Heel Reader

Claimed advantages

I. Non-existent barrier to entry
II. Scalable to reach new populations
III. Global representation and minimal bias

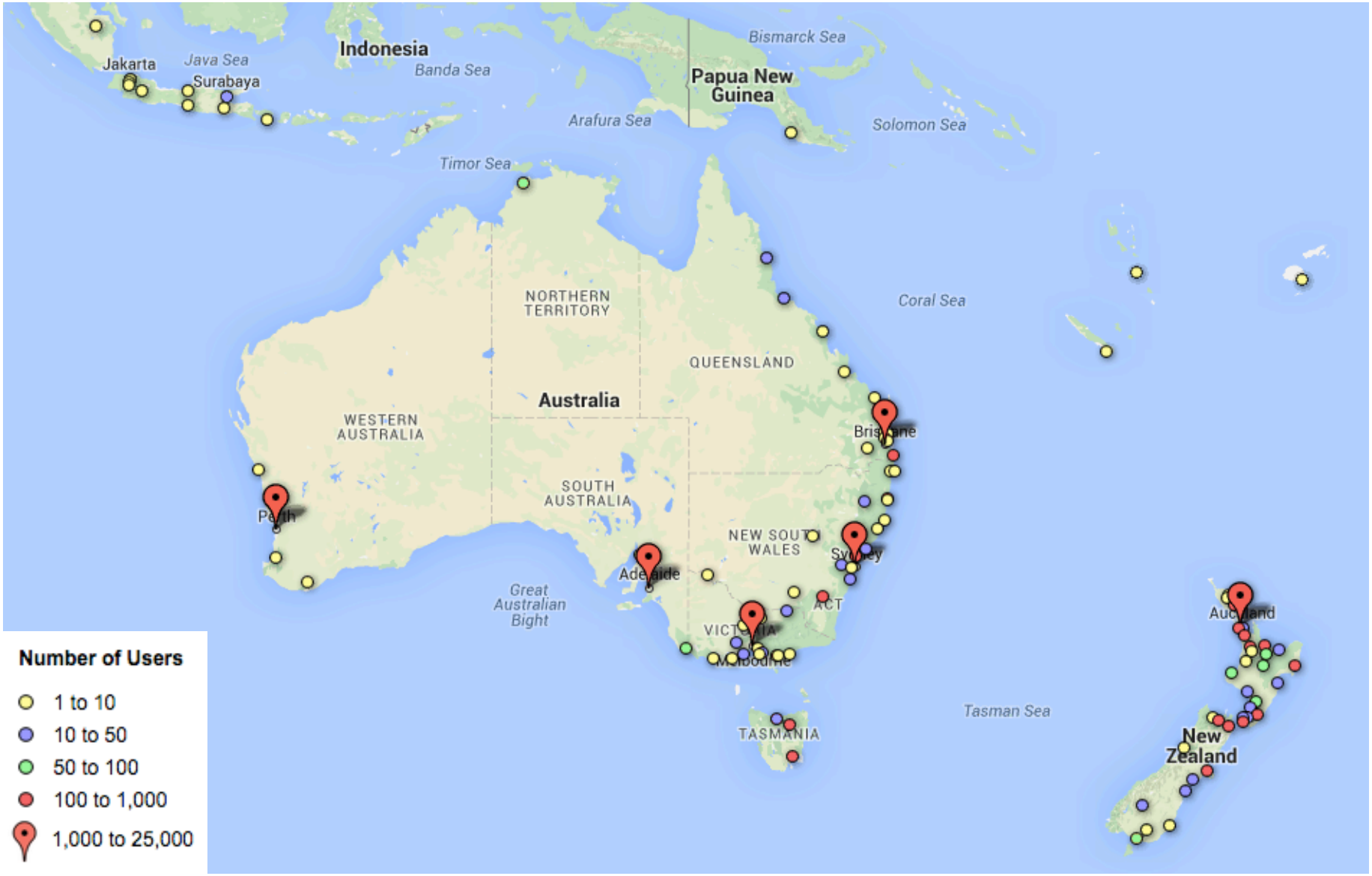


Representation in the US and Central America
Each point is a city

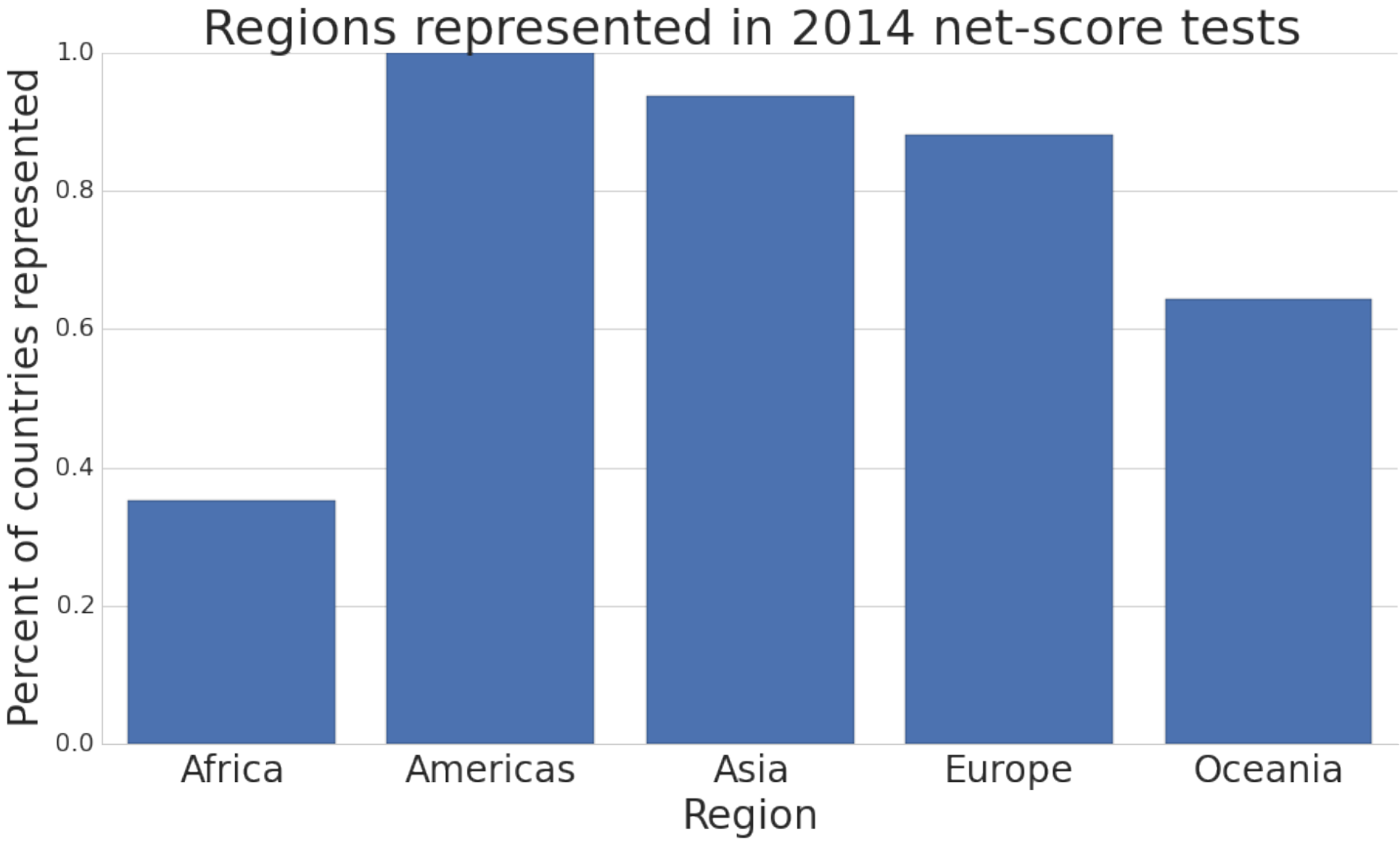


Representation in Europe and North Africa

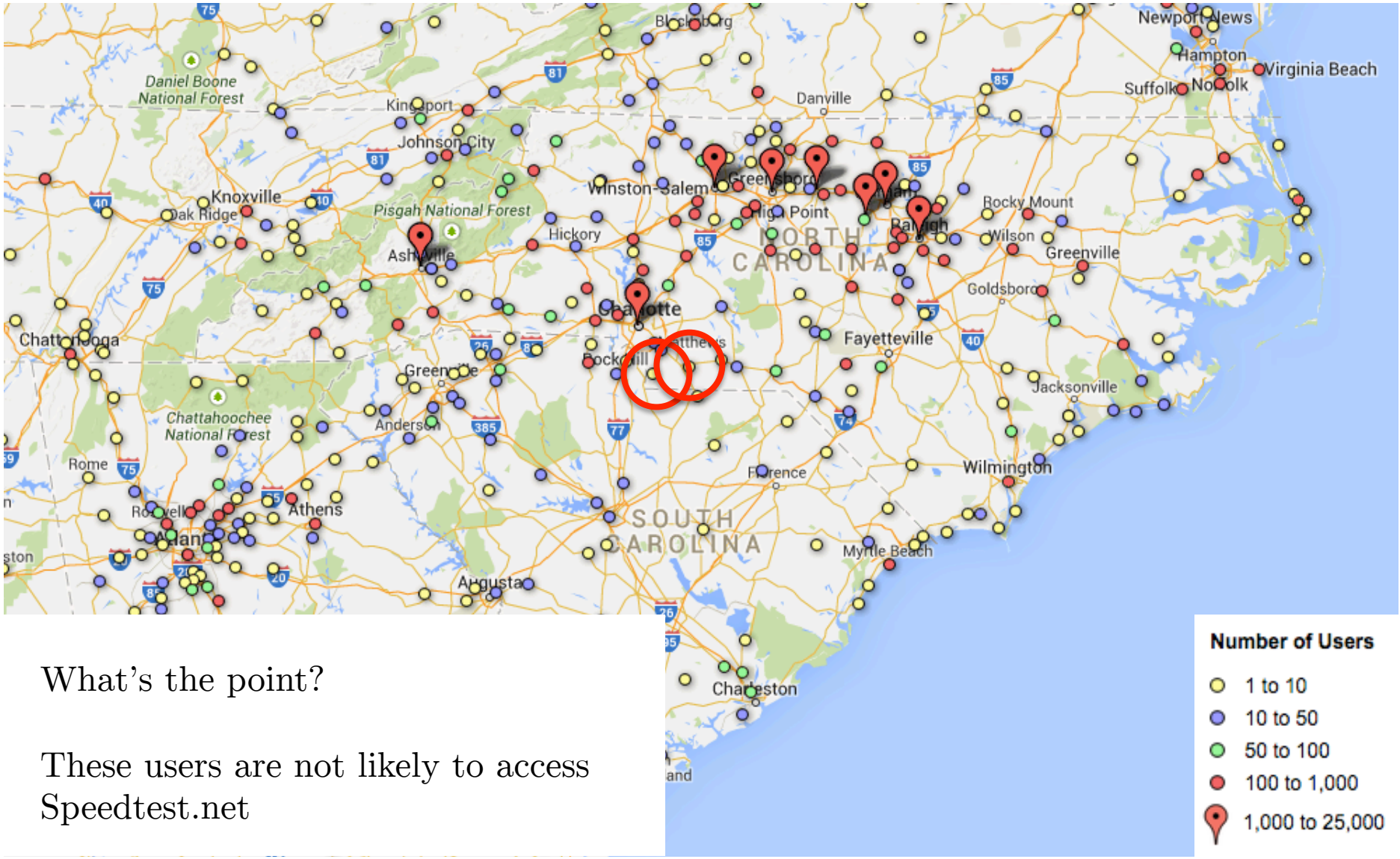
Representation in East Asia



Representation in Oceania



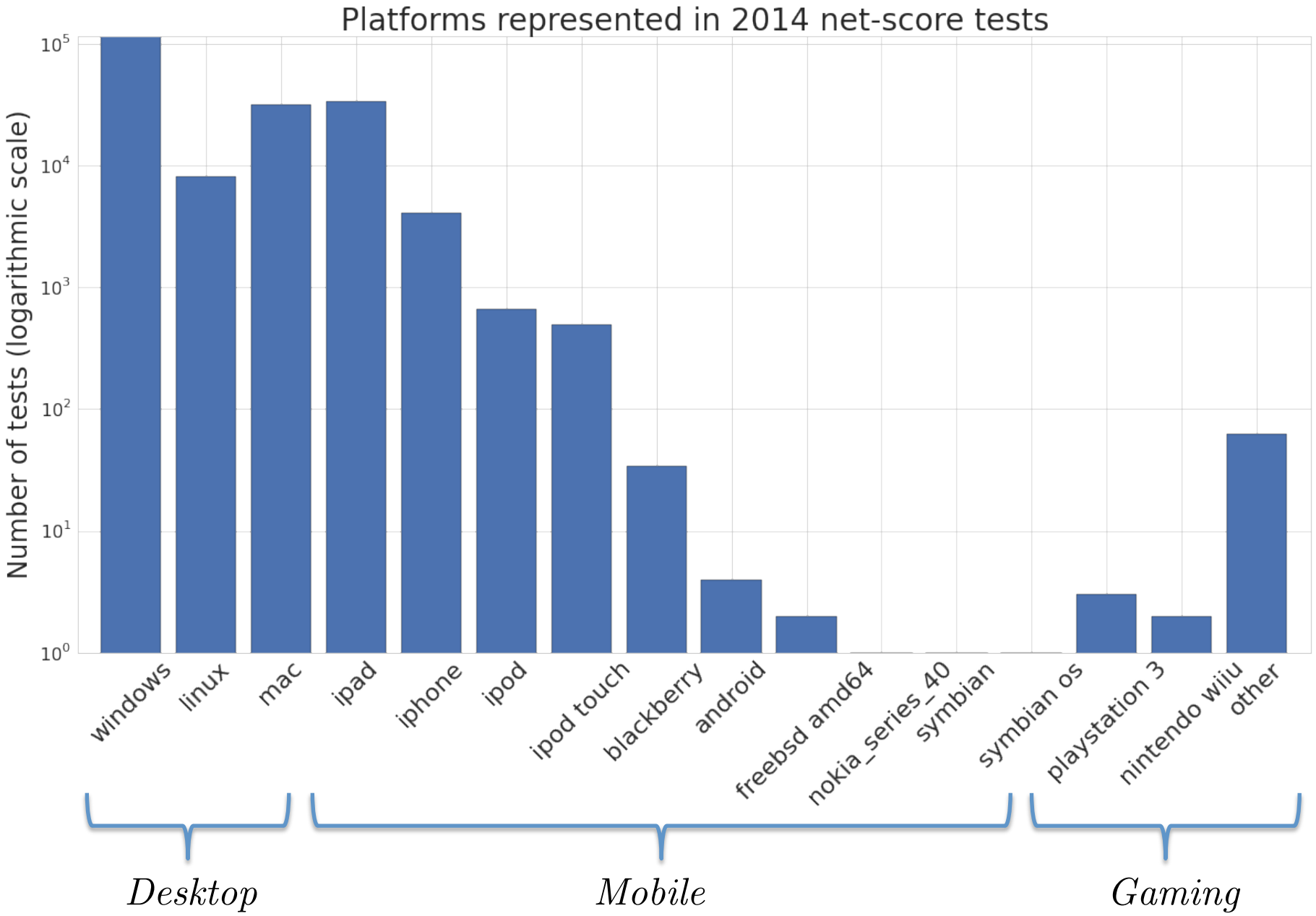
Ratio of countries represented by region



What's the point?

These users are not likely to access Speedtest.net

Representation in the rural Southeast
First circled yellow dot is Waxhaw – population 9,859, 4 tests taken
Second yellow dot is Wingate – population 3,689


Platforms represented in 2014 net-score tests
Number of tests (logarithmic scale)
10^5
10^4
10^3
10^2
10^1
10^0
windows
linux
mac
ipad
iphone
ipod
ipod touch
blackberry
android
freebsd amd64
nokia_series_40
symbian
symbian os
playstation 3
nintendo wiiu
other
Desktop
Mobile
Gaming

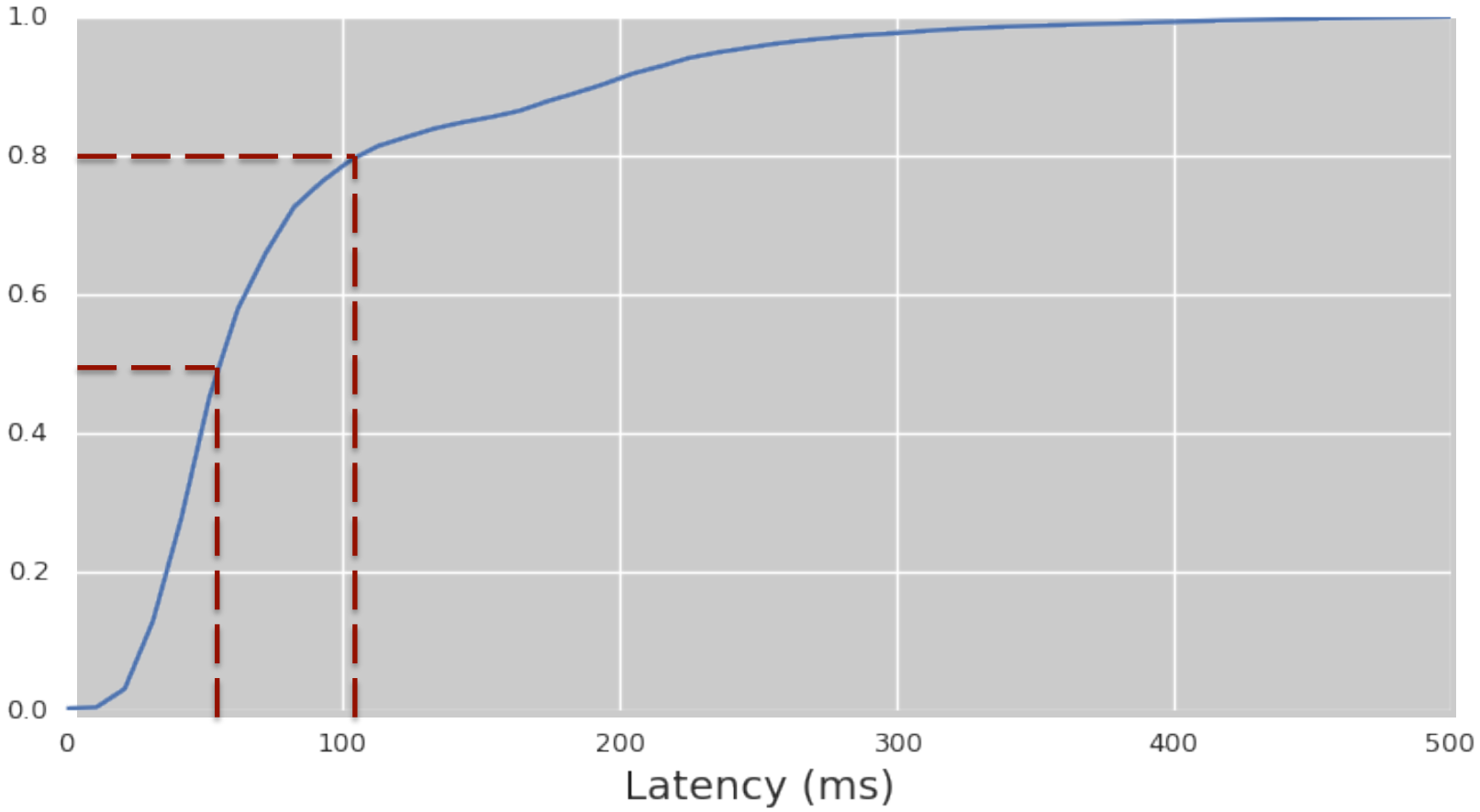
Autonomous Systems

There are currently about 22,000 Autonomous Systems that are reachable through the Internet.

- We reached 3,540 unique systems
- Equates to 16.71% of the advertised and publically reachable Autonomous Systems

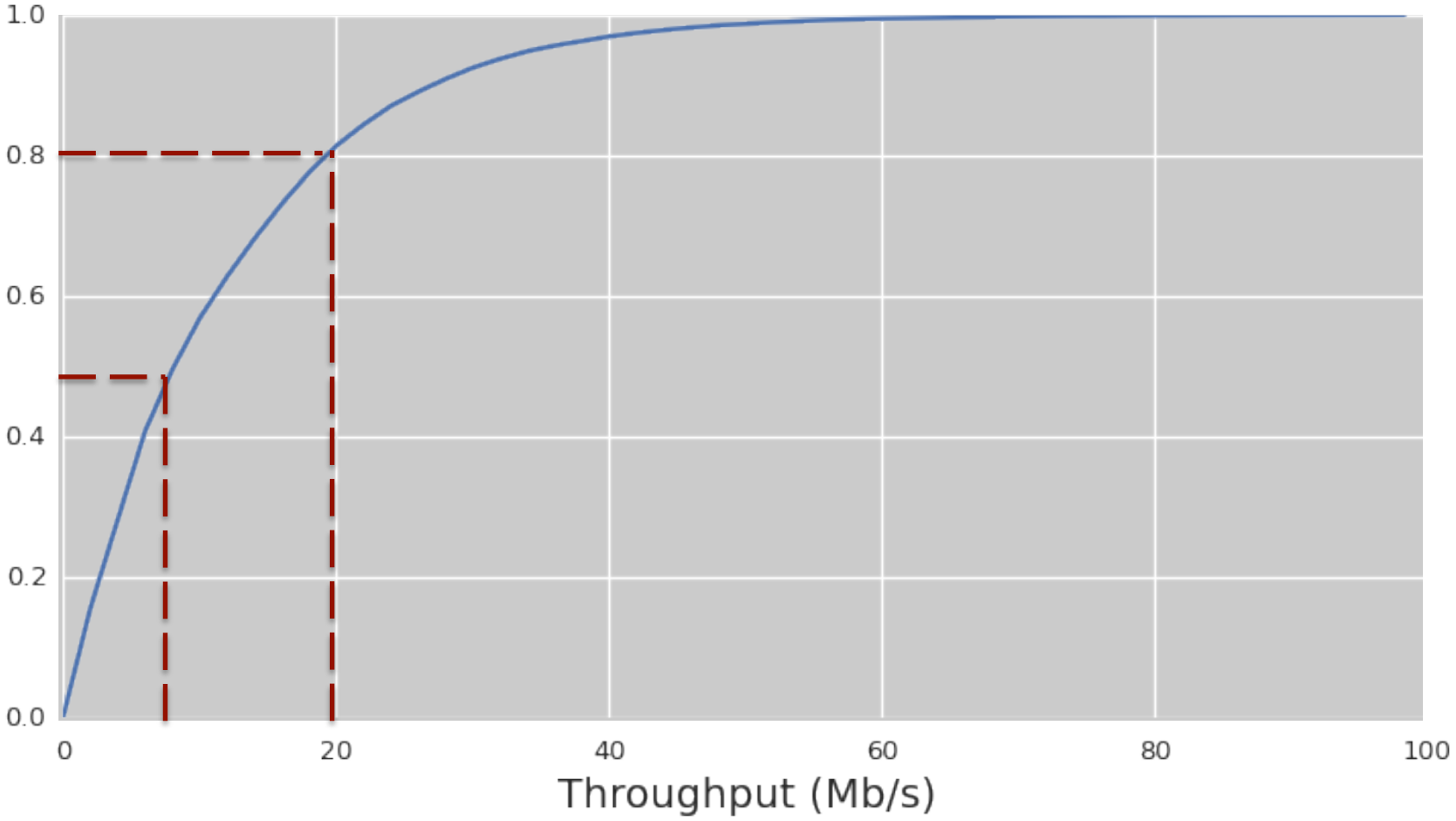
AS Number	*Name*	*Organization*	*Count*
7018	ATT-INTERNET4	AT&T Services, Inc., US	9799
81	NCREN	MCNC, US	6942
21704	NYCBOE-BGPNET	New York Board of Education, US	6433
701	UUNET	Verizon Business, US	5672
22773	ASN-CXA-ALL-CCI-22773-RDC	Cox Communications Inc., US	5112

CDF of Median Latencies

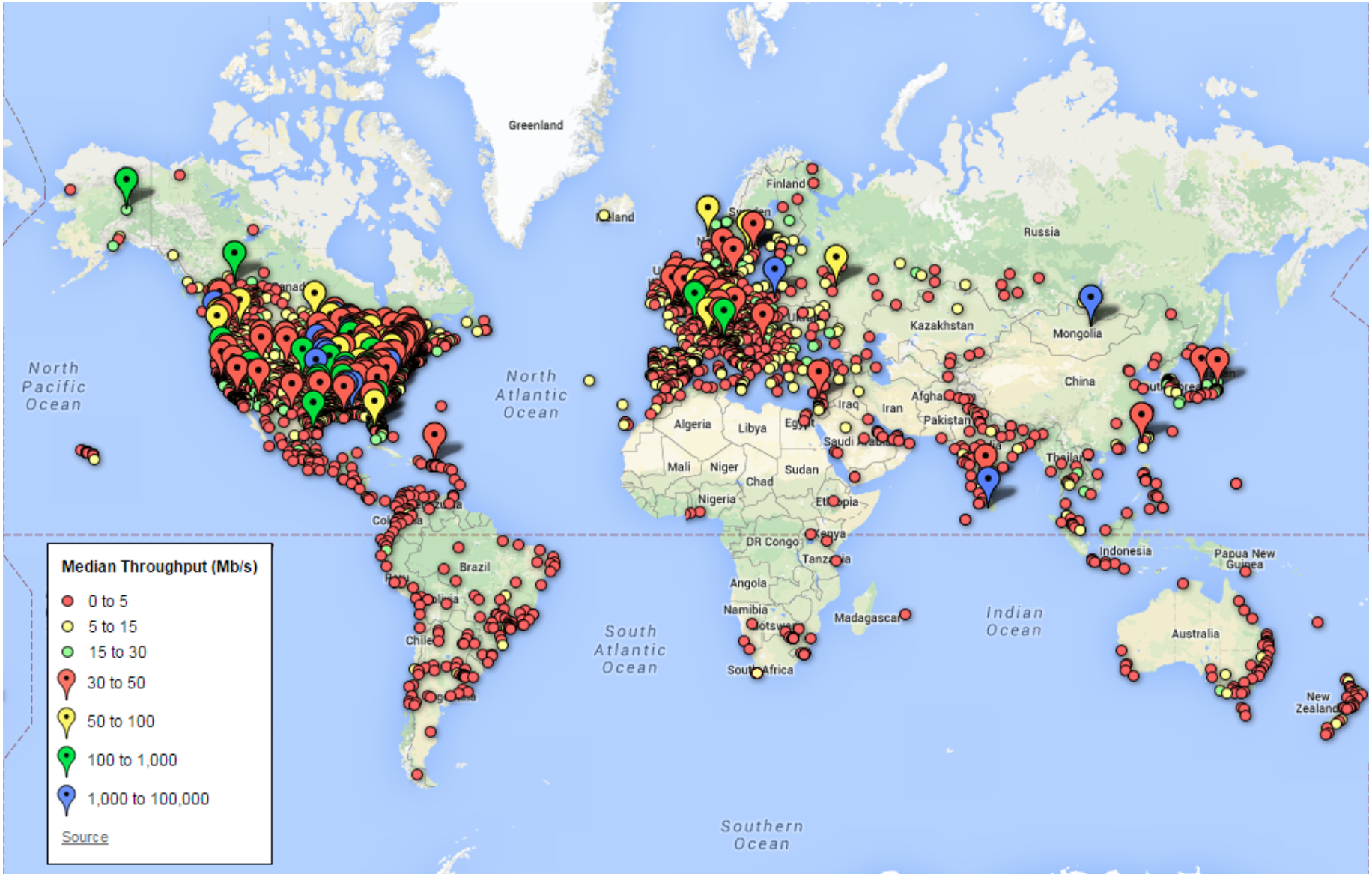


- We measured latency based on elapsed wall clock time of retrieving a small image
- The median latency in our data set was 57ms
- 80% of our recorded latencies were under 120ms

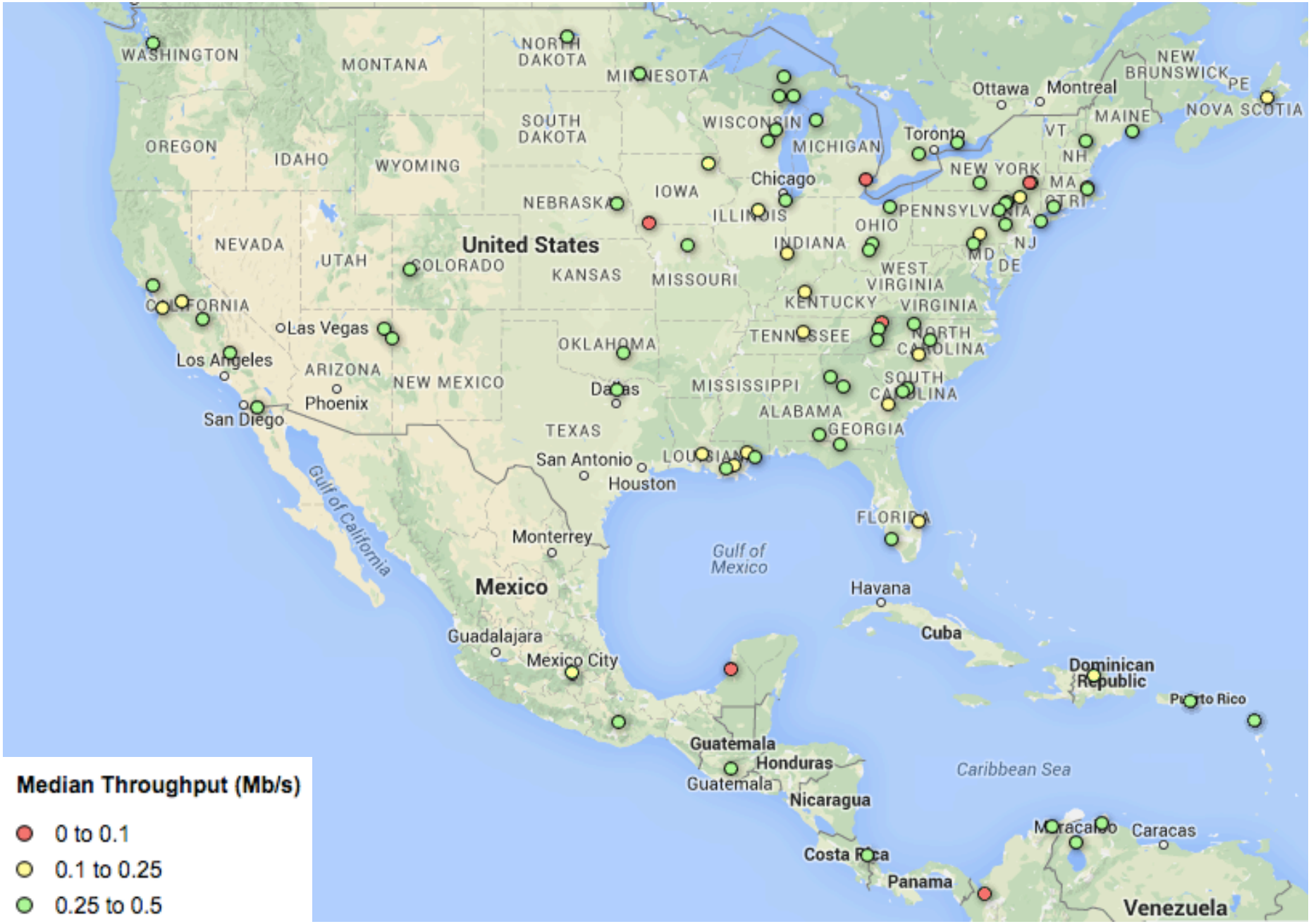
CDF of Median Throughput



- We measured throughput based on elapsed wall clock time of retrieving several large images
- The median throughput in our data set was 8.03Mb/s
- 80% of our recorded throughput values were under 20Mb/s

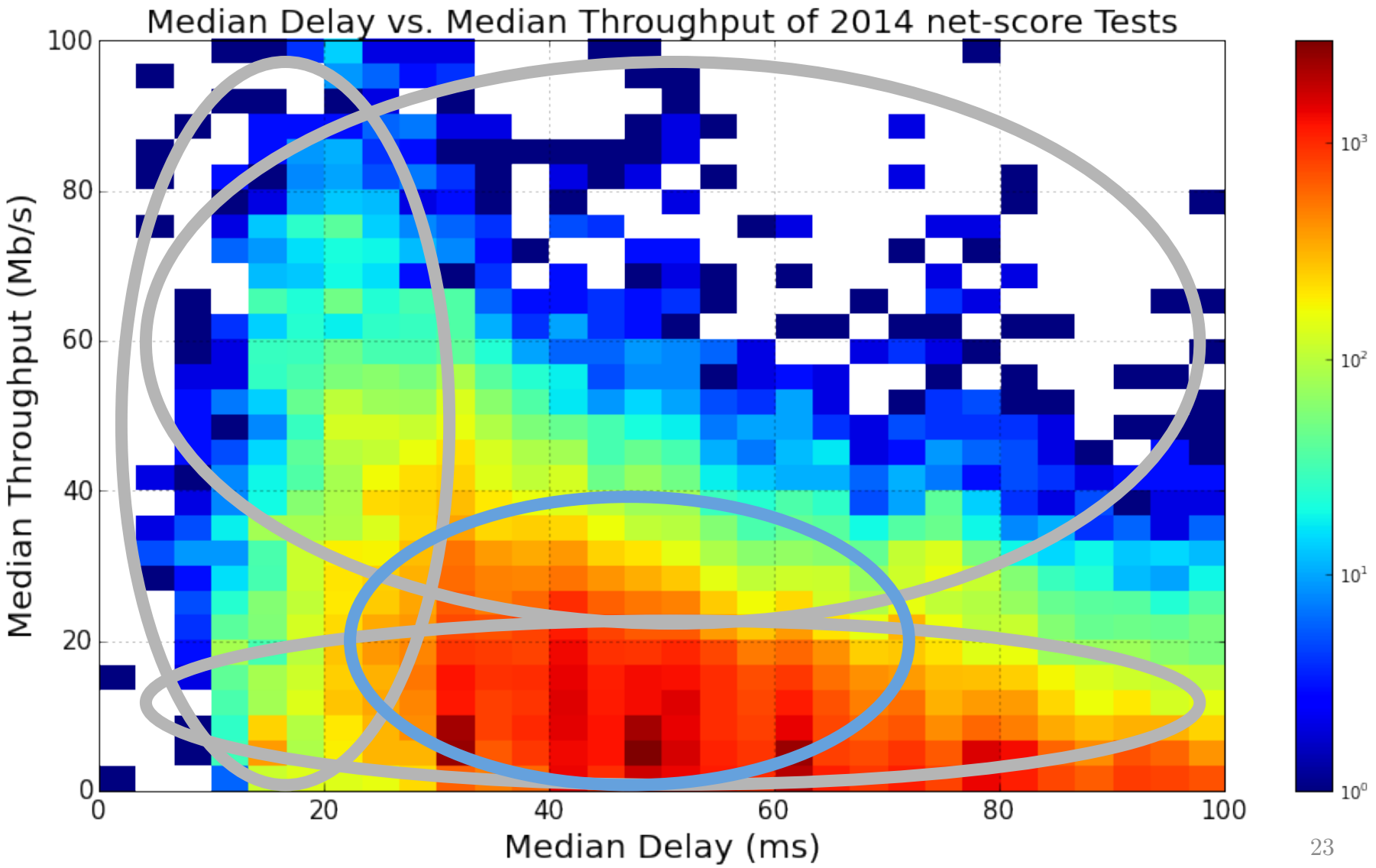


Median throughputs across the globe



Throughputs < 500 Kb/s in North America

Density coded heat map



Concluding remarks

Low barrier to entry

- No additional hardware/software needed

Inclusiveness

- Test takers across globe on minimal hardware

Low cost

- Server costs around $1/day
- No cost to host

Scalability

- Embed the tool in another website, pay YouTube, and do nothing

Future work

Embedding on more websites

- We want to test our deployment on multiple sites

Formulating a score

- We want a new test taker to see where they compare to previous test takers

Questions?

James Martin
cs.unc.edu/~jamesml
jamesml@cs.unc.edu