MLAB @ CS&S Code for Science & Society

Measurement Lab

Supporting Open Internet Research

Lai Yi Ohlsen laiyi@measurementlab.net

@measurementlab @laiyiohlsen

Supporting Partners

MLAB

Our Community

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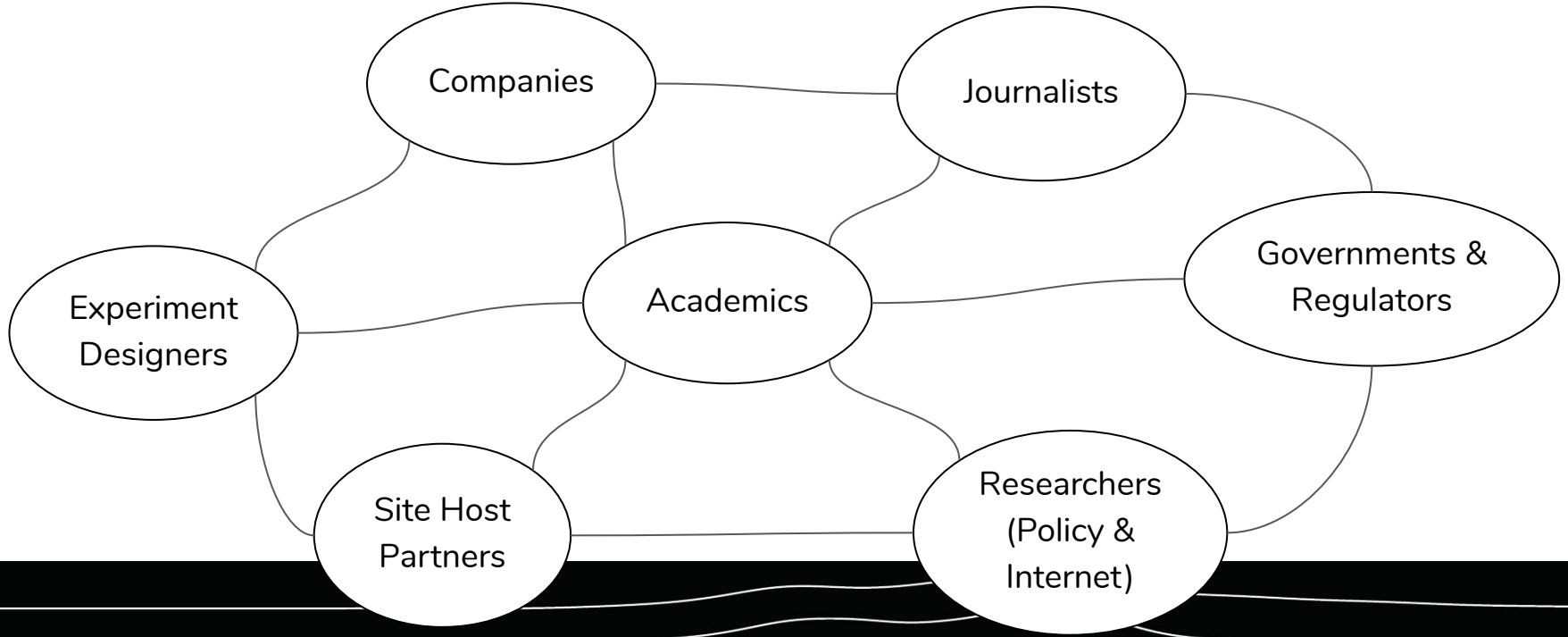

History

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In 2008, it was hard to measure the Internet.

M-Lab's Mission

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Measure the internet.

Save the data.

Make it universally accessible and useful.

History

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In 2008, it was hard to measure the Internet.

In 2019, it still is, but slightly less so.

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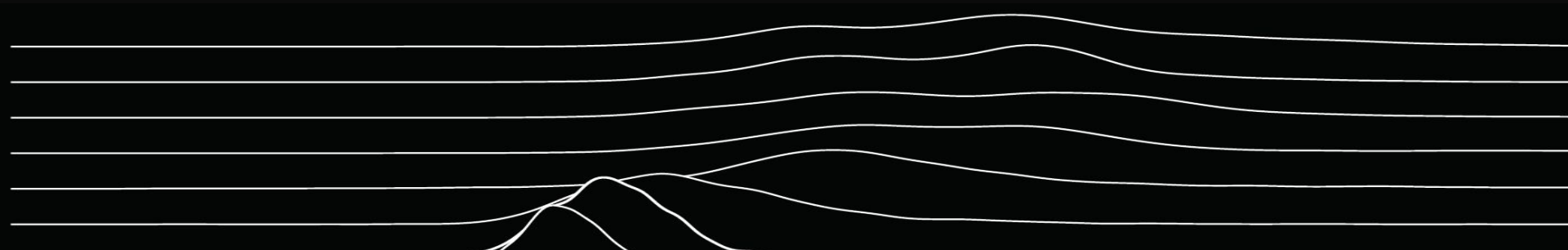
Measure the Internet



Measure the Internet: The Platform

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We run high capacity hardware in well connected data centers, where ISPs interconnect with one another.

Measure the Internet: The Platform

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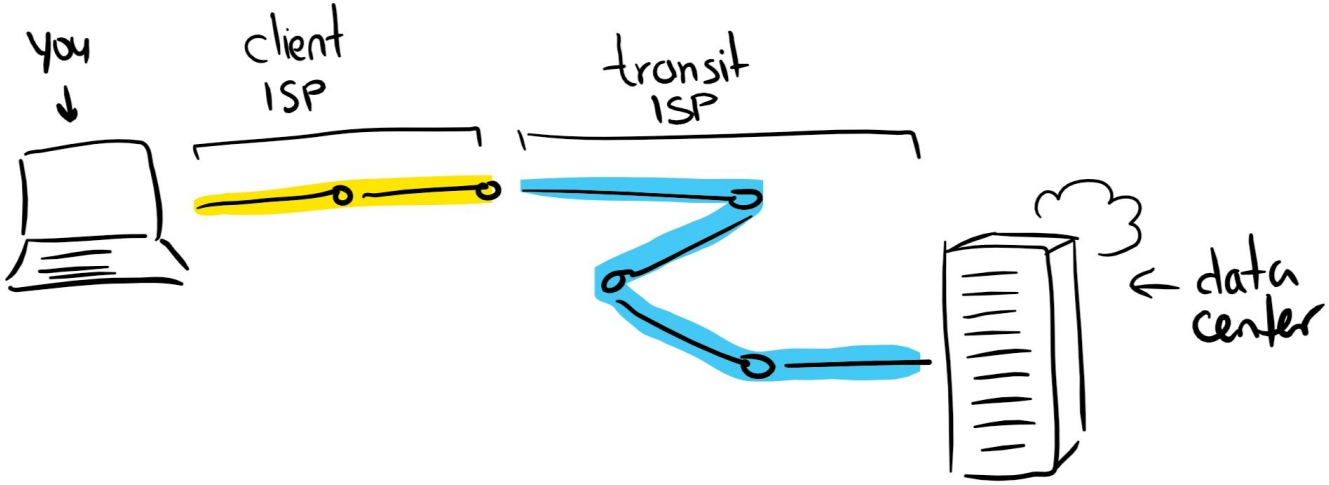
M-lab measures user experience of the **full route** from user to content



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Today — **500+** Servers in **130+** locations

Platform Upgrade:
https://www.measurementlab.net/blog/modernizing-mlab/

Measure the Internet: Host Experiments

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Glasnost
Max Planck Institute for Software Systems

MobiPerf
University of Michigan

Network Diagnostic Tool
Internet2

Neubot
Nexa Center for Internet and Society, Politecnico di Torino

NPAD
Pittsburgh Supercomputing Center

Paris Traceroute
University Pierre et Marie Curie

Project Bismark
Princeton University

Sharperprobe
Georgia Tech College of Computing

Windrider
Northwestern University

Reverse Traceroute
University of Washington

Measure the Internet: NDT

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NDT is a **single stream performance** measurement of a connection's capacity for **"bulk transport"** (as defined in IETF's RFC 3148). It reports **upload** and **download** speeds and **latency** metrics, and attempts to determine what problems limit speeds.

NDT: https://github.com/m-lab/ndt-server

Measure the Internet: NDT

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To run your own ndt-server, i.e. host your own speed test, run:

```
docker run --net=host measurementlab/ndt
```

on any Linux machine.

NDT: https://github.com/m-lab/ndt-server

Measure the Internet: NDT7

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NDT7 supports BBR (compatible with IETF RFC 8837), runs over TLS and uses Websockets.

NDT: https://github.com/m-lab/ndt-server

Measure the Internet: NDT

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Then point your browser to

`http://localhost:3001/static/widget.html`,

you can run tests using the original version of the protocol. If you pass a TLS cert and run on port 443, you can run on NDT7 using TLS/SSL.

NDT: https://github.com/m-lab/ndt-server

Measure the Internet: Experiments

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Other tests include DASH, reverse-traceroute, sidestream, paris-traceroute, BISMark, WeHe/diff-detect, SamKnows, and more.

Tests: https://www.measurementlab.net/tests/

Measure the Internet: Experiments

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Researchers designing server/client measurement experiments can apply to host with M-Lab and are accepted through our Experiment Review Committee.

Experiment Review Committee:
https://www.measurementlab.net/who/

Measure the Internet: Run Tests

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Users run active measurements through client integrations.

Clients:
https://www.measurementlab.net/data/tools/

Measure the Internet: Run Tests

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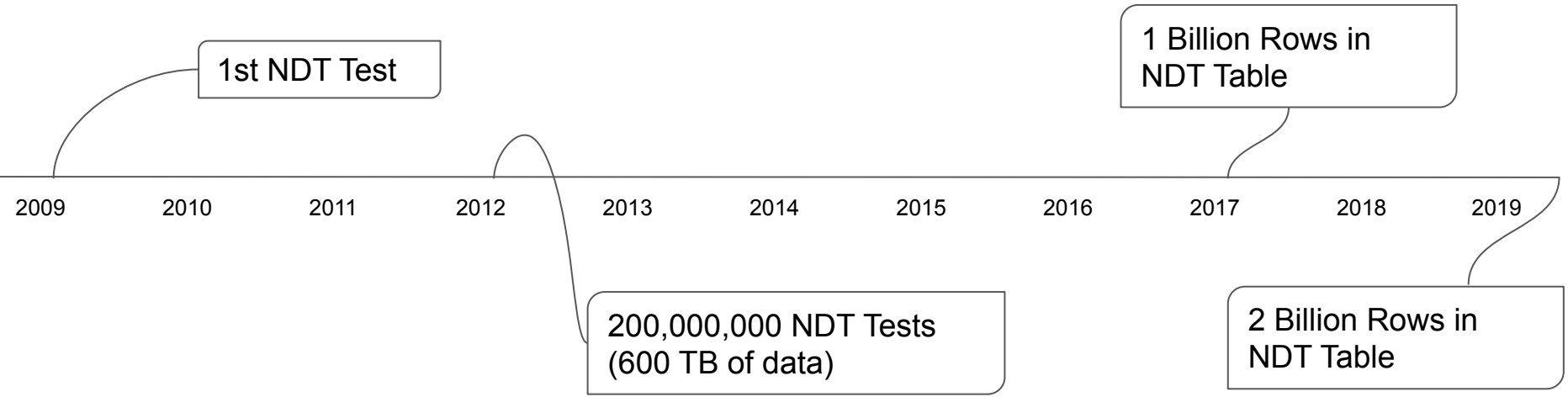
- Current Daily volume ~3,000,000 new NDT measurements per day
- Currently, 2 billion rows in NDT Table



2billion NDT:
https://www.measurementlab.net/blog/celebrating-2billion-ndt-tests/

Measure the Internet: Run Tests

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An easy way to run a speed test:

`speed.measurementlab.net`

Measure the Internet: Run Tests

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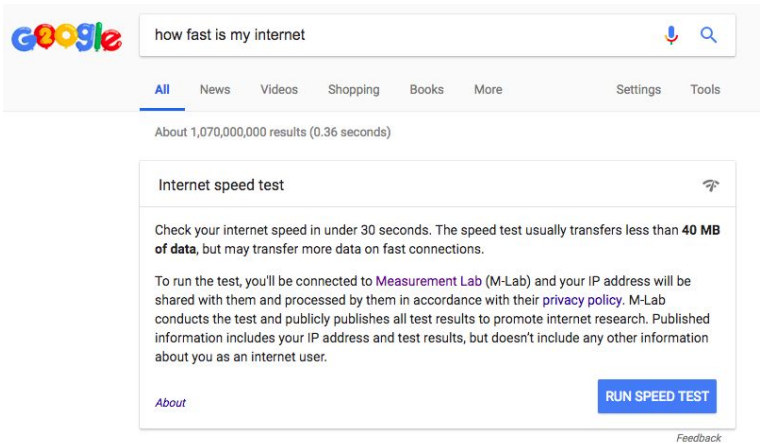

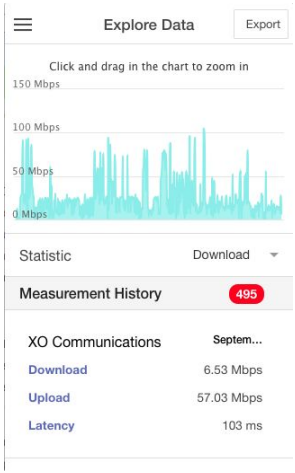

Google Search, Software Integrations, Router Integrations, Fingbox, Chrome Extension

Clients:
https://www.measurementlab.net/data/tools/

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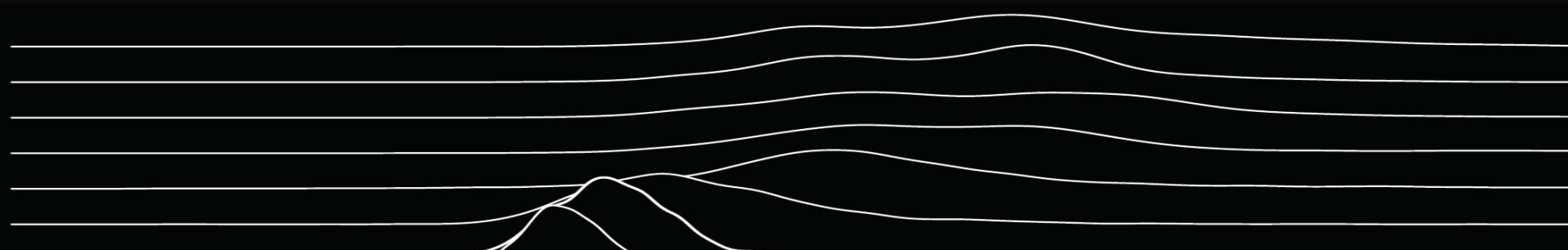
Save the Data



Save the Data

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Store everything in Google Cloud Storage. All of it. Including raw packet traces and metadata.

Docs: https://measurementlab.net/data/docs/gcs/
GCS: https://console.cloud.google.com/storage/browser/archive-measurement-lab

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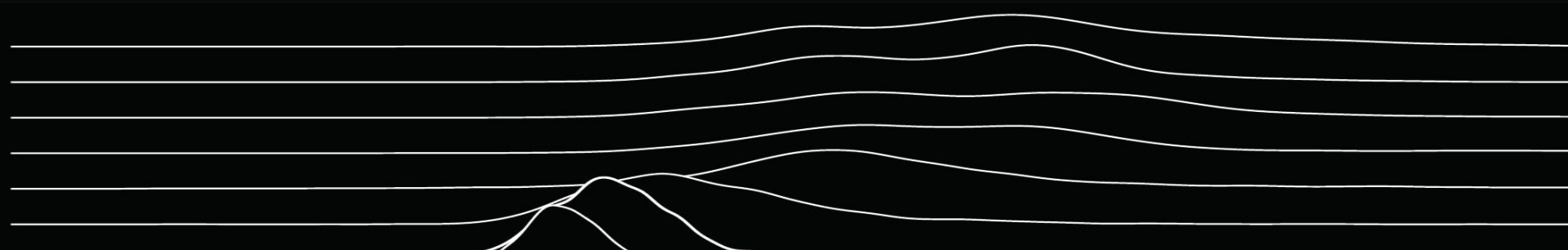
Make it Universally Accessible and Useful



Make it Universally Accessible and Useful: BigQuery

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For free and open access to the data, all you have to do is sign up for the M-Lab Discuss List.

Quick Start - www.measurementlab.net/quickstart/
Data Docs - www.measurementlab.net/data/docs/
Get help - support@measurementlab.net

Make it Universally Accessible and Useful: BigQuery

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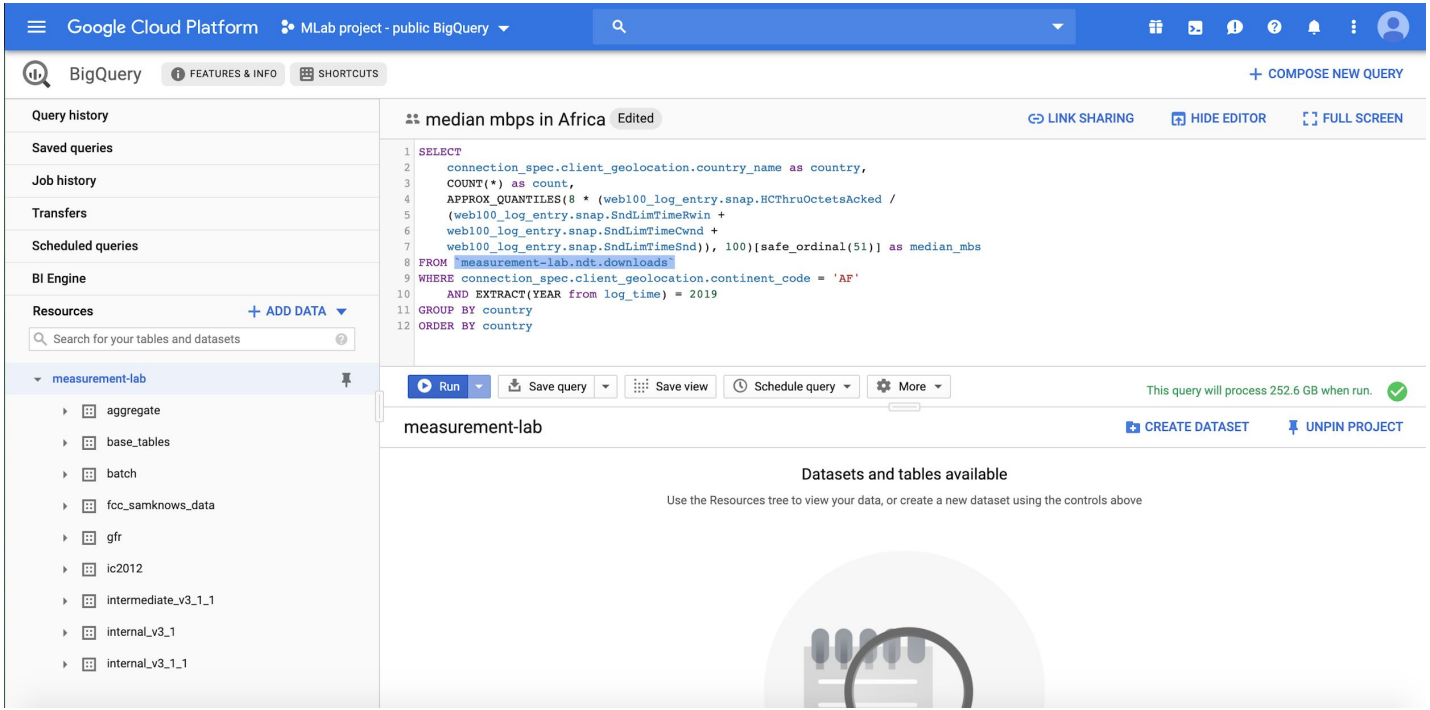

Make it Universally Accessible and Useful: BigQuery

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We’re always available for help with BigQuery or anything else at `support@measurementlab.net`.

Make it Universally Accessible and Useful: Visualization Site

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The easiest and most popular way to access the data is using the M-Lab Visualization Site.

`viz.measurementlab.net`

Make it Universally Accessible and Useful: Visualization Site

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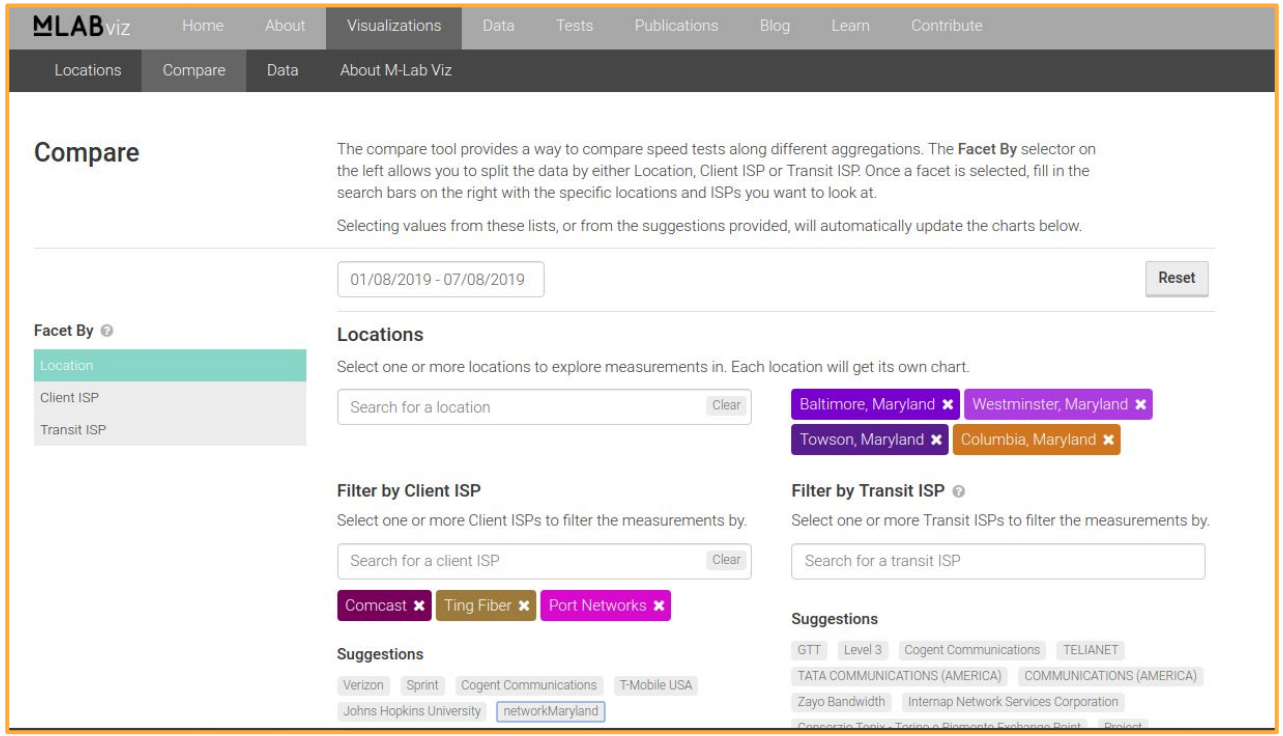

Make it Universally Accessible and Useful: Visualization Site

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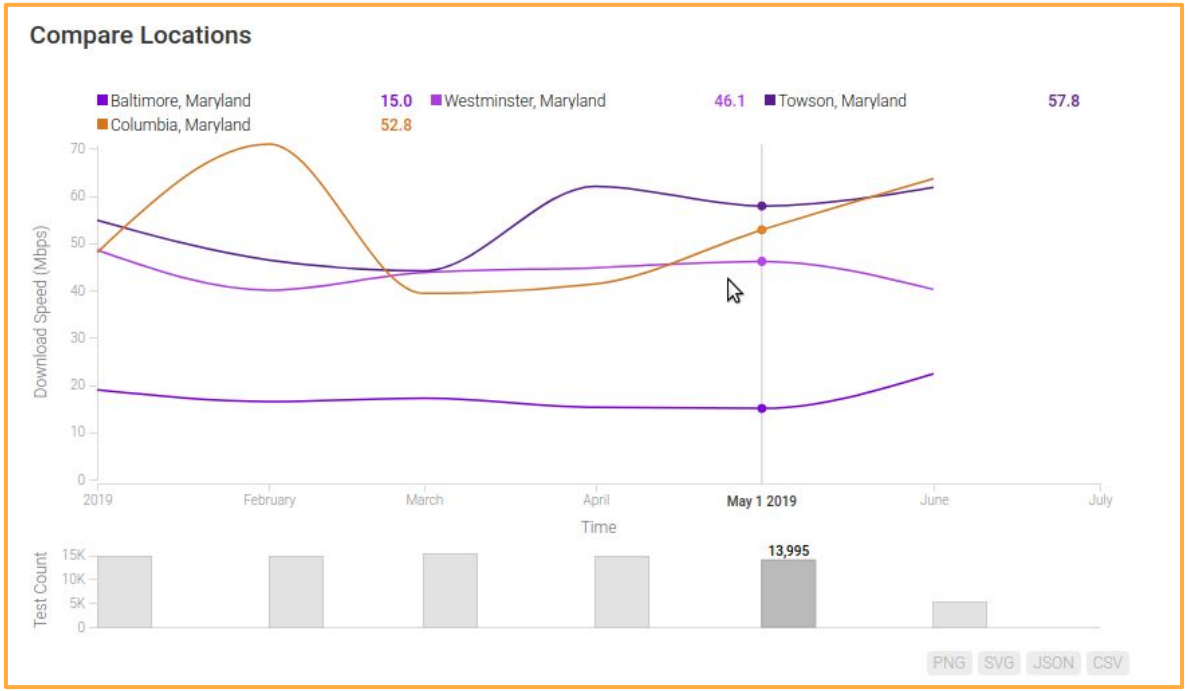

Make it Universally Accessible and Useful: Visualization Site

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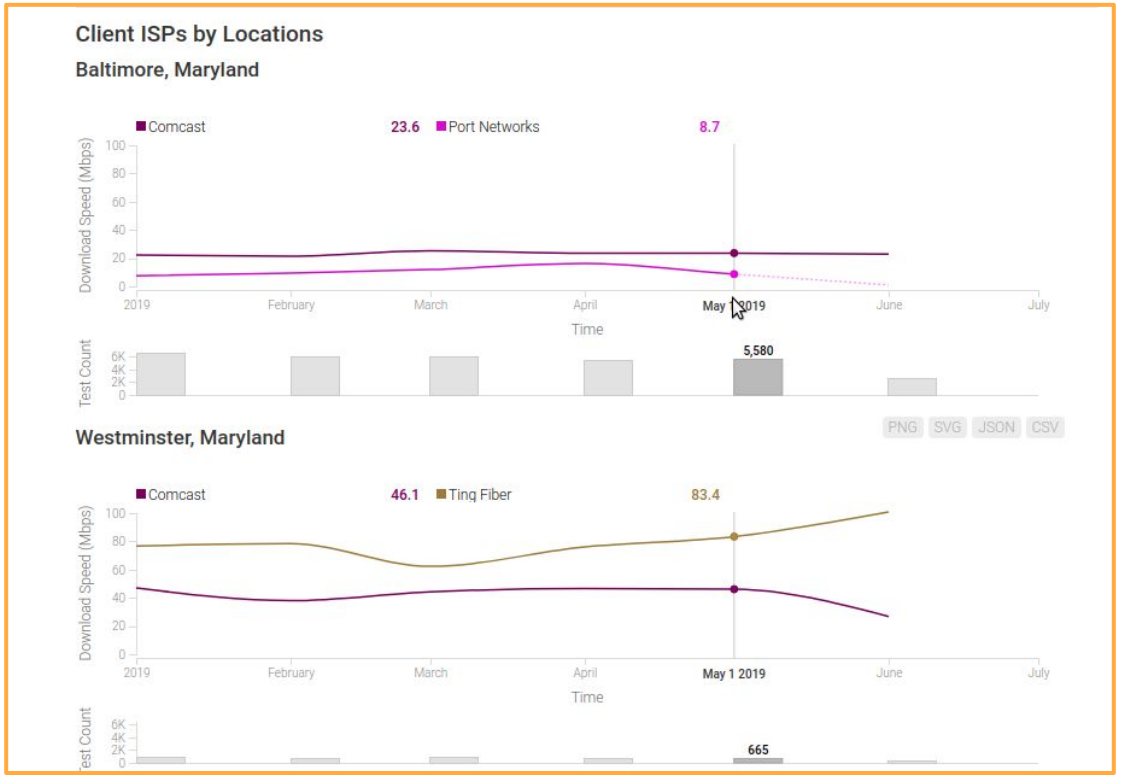

Make it Universally Accessible and Useful

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Running a speed test *once* gives you information about that one moment in time.

Collecting longitudinal, open data provides meaningful information about the behavior of the Internet over time.

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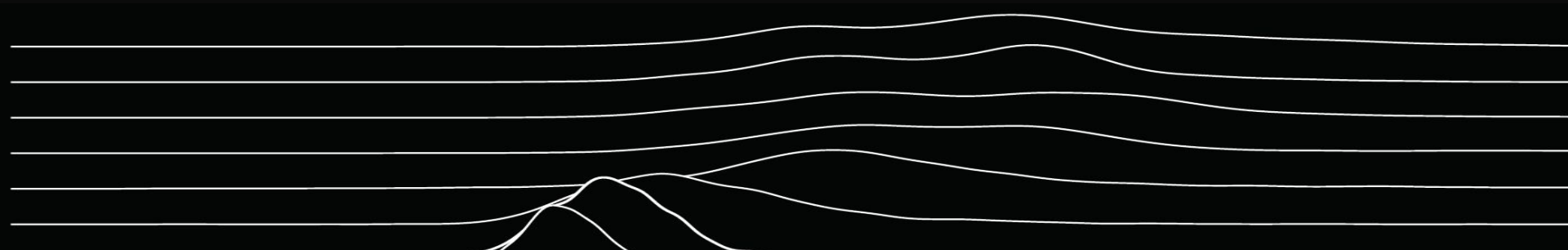
How Researchers Use M-Lab



How Researchers Use M-Lab

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Academic Publications

https://www.measurementlab.net/publications/

- Estimating Residential Broadband Capacity using Big Data from M-Lab
  - University of New South Wales, Sydney, Australia
- Access is more than cost: Measuring the quality of mobile broadband service
  - Web Foundation, Alliance for Affordable Internet
- Can Competition-Enhancing Regulation Bridge the Quality Divide in Internet Provision?
  - National University of Singapore
- NETPerfTrace – Predicting Internet Path Dynamics and Performance with Machine Learning
  - Université de Liège - ULiège

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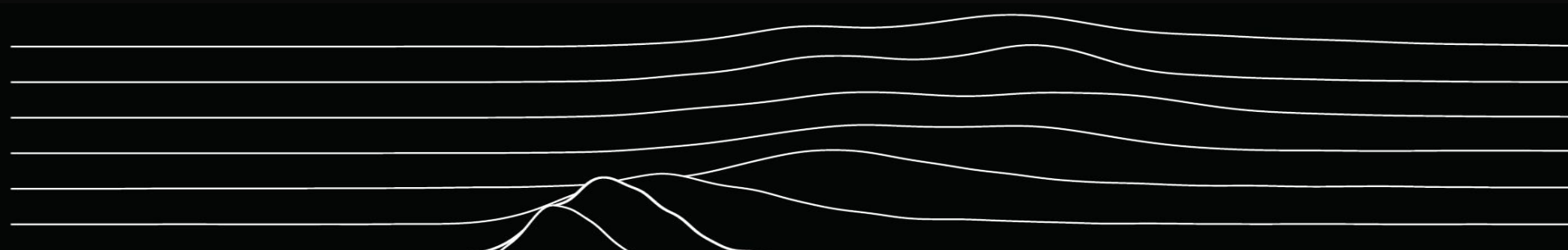
How Researchers Use M-Lab



How Researchers Use M-Lab

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We support community-based research initiatives that provide an accurate depiction of Internet performance.

Community Based Research

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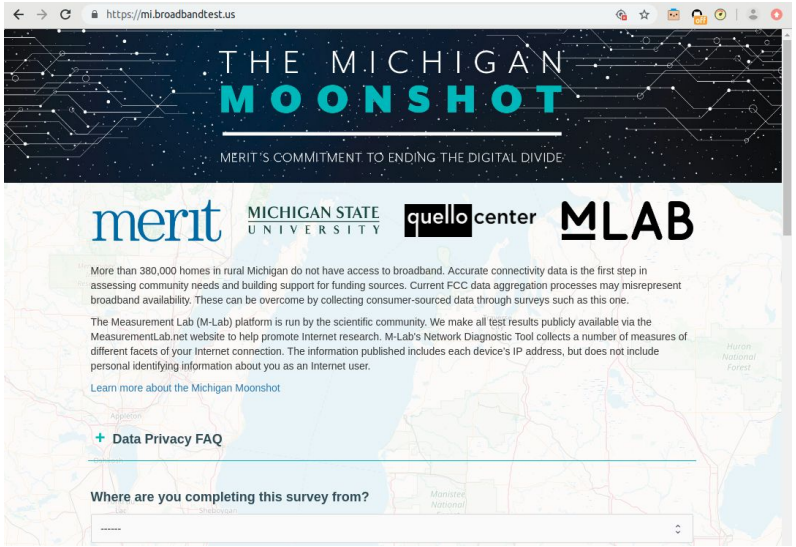
Survey & Mapping Initiatives



- Michigan / MERIT - broadband testing & mapping with a homework gap hook
  - R&E network, K12 statewide systems
  - Homework assignment to run a test
- https://mi.broadbandtest.us/

Community Based Research

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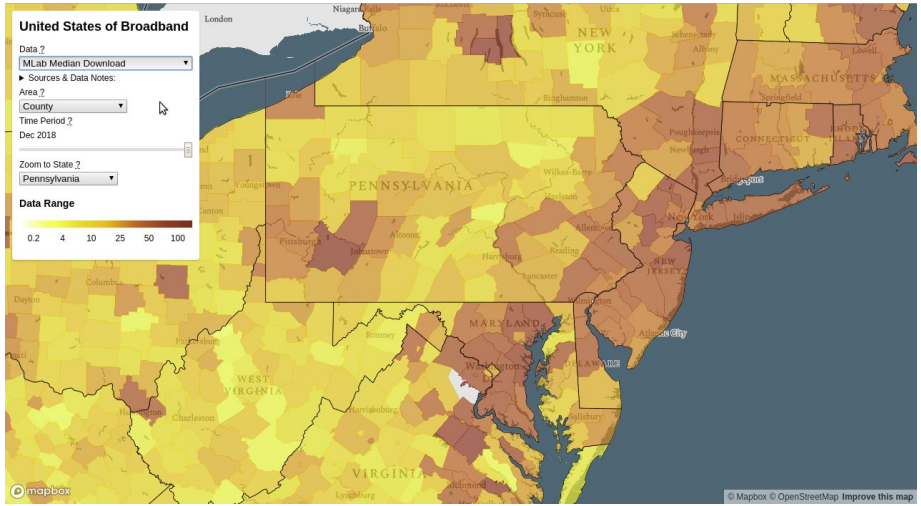
Survey & Mapping Initiatives



- M-Lab prototyped community tool used to conduct broadband survey, speed test, & aggregation: *Piecewise*

- City of Seattle, WA
- Stevens County & Ferry County, WA
- Clearwater County, ID

Community Based Research

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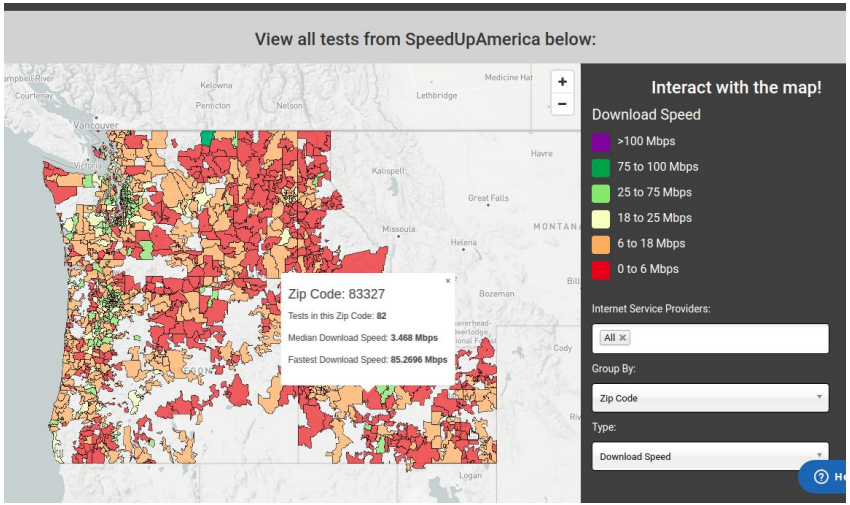
Survey & Mapping Initiatives



- Speedup Louisville
  - Developed by Louisville, public/private partnership
  - Supported by M-Lab
- Speedup *America*
  - Further development at Technology Assoc. of Oregon

Community Based Research

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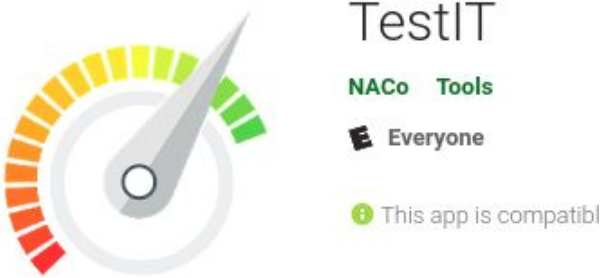
App / Client for Data Collection

- National Association of Counties (NACo) using a branded app integration of NDT to collect data for rural areas
- Uses the M-Lab platform as a measurement service
- NDT test results are sent to M-Lab

- ***Enhanced location data*** is saved in NACo's database, with a copy of the standard test results



Community Based Research

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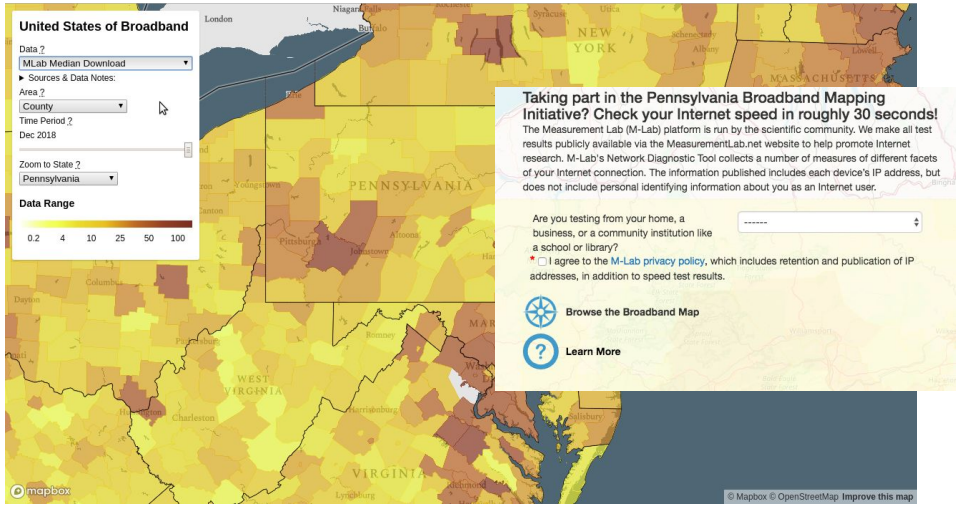
Survey & Mapping Initiatives



- Study conducted by Penn State, compares measured speeds with each FCC 477 data release
- Select M-Lab speeds & metrics, FCC, or +/- difference layers
- Aggregate by county, state house/senate, zipcode, census tract
- https://pa.broadbandtest.us

How Researchers Use M-Lab

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Measuring Library Broadband Networks

Simmons UNIVERSITY

- Partner in research program to build structured data collection tools
- IMLS Measuring Library Broadband Networks
  - Partners: Internet2, Simmons University
  - Year 1: 10 Libraries / Year 2: +50 Libraries
  - NDT, speedtest.net, and more
  - https://slis.simmons.edu/blogs/mlbn/
- Goal: Open source code, automated testing via on-premise devices, data visualization, local/regional data comparison

INTERNET2®

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Potential Research Questions

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- Paris-Traceroute data offers lots of opportunity for research on Routing.
- Key Performance Indicators for cities.
- Metrics for municipally run networks.
- Enabling the detection of throttling and Internet shutdowns.

M-Lab Principles

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- All measurements are active measurements
  - All the data is synthetic data, we take user privacy seriously.
  - Client initiated tests only, Servers do not start tests on their own.
- Clients are built by and for the community.
  - Anyone can develop them.
- Openness
  - All of the data is released CC0.
  - All of the code is open source.

Learn more about M-Lab: 10th Anniversary Convening blog post, videos: https://www.measurementlab.net/blog/mlab-10year-wrapup/

How to Get Involved

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- Propose an experiment.
- Use the data in your research and planning
- Integrate NDT into various clients (apps, hardware, etc.)
- Host M-Lab in your data center or Internet Exchange

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