Measurement Lab

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M-Lab overview & the Internet Quality Barometer (IQB)

PIMF Indonesia

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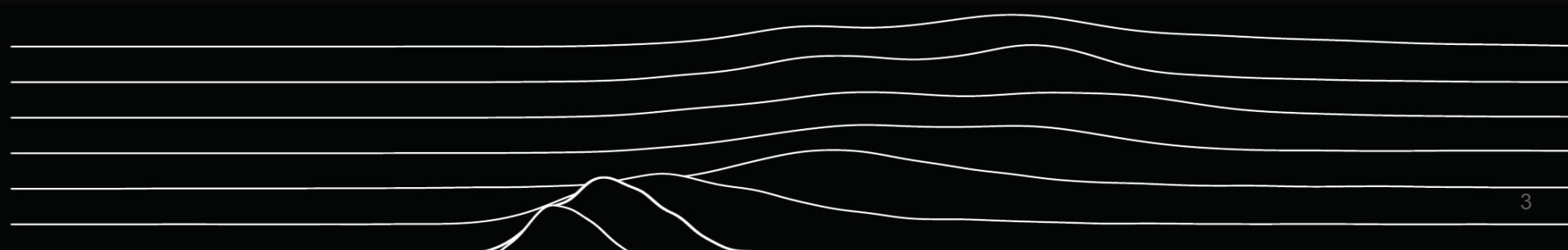
Measurement Lab … or, M-Lab

- Who we are?
  - M-Lab is an **open** source **non-commercial** project
  - Founded in 2009
  - We maintain a **worldwide server platform**
- What we do?
  - **Measure the Internet** with open-source experiments
  - Save the data **as open data**
  - Make it universally accessible and useful
  - Research

M-Lab’s platform



M-Lab's platform

- 400+ servers globally
  - https://www.measurementlab.net/status/
- 40+ countries / 100+ metros,
- 50+ transit providers

M-Lab measurements

- On the M-Lab platform, we host the server-side of “experiments” or “measurement services”.
- When clients run these measurements, they test against M-Lab servers.
- Every measurement is publicly archived and published in BigQuery.

NDT (Network Diagnostic Tool)
Tests your connection speed, and provides a sophisticated diagnosis of problems limiting speed.

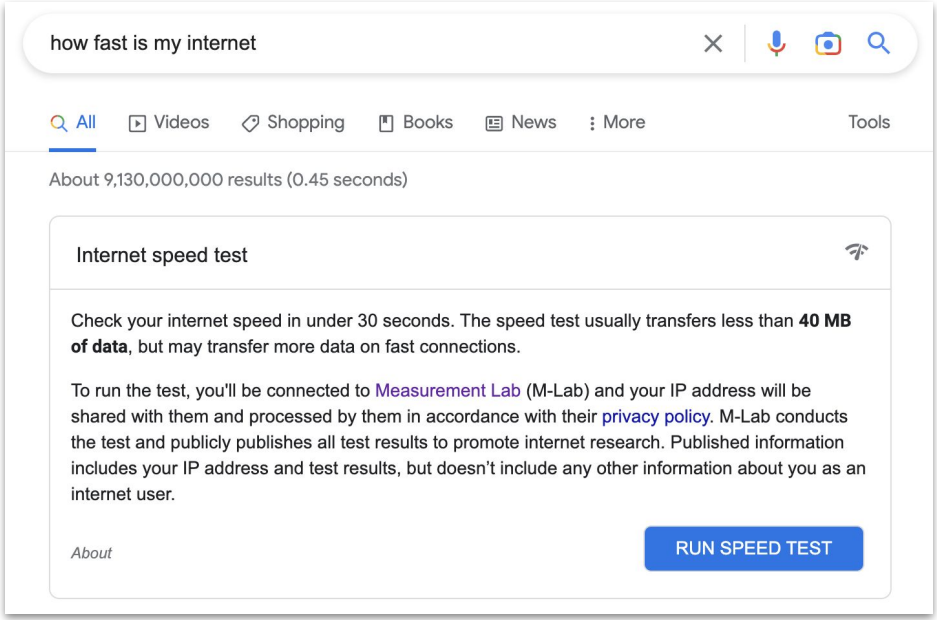
Neubot DASH
DASH is designed to measure the quality of tested networks by emulating a video streaming player.

Reverse Traceroute
Measures the network path back to a user from selected network endpoints.

WeHe
Wehe uses your device to exchange Internet traffic recorded from real, popular apps like YouTube and Spotify, and attempts to tell you whether your ISP is giving different performance to an app's network traffic.

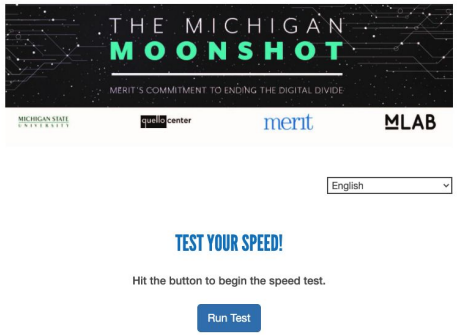
M-Lab measurements

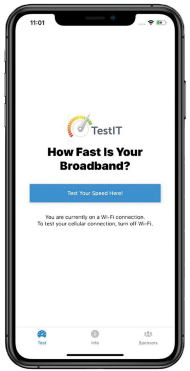
- Integrated into Google Search → majority of measurements

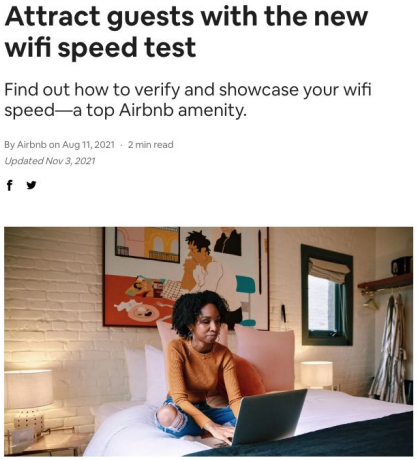


M-Lab measurements

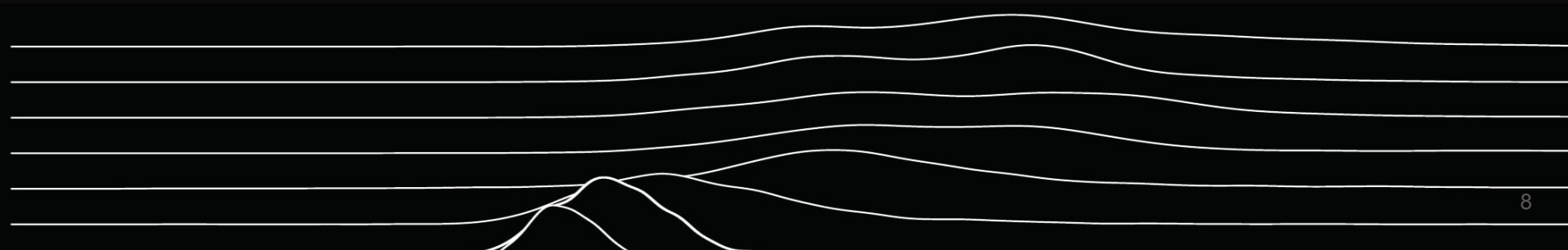
- Other integrators: Giga/UNICEF, AirBnB, CellWatch, etc.







M-Lab’s data



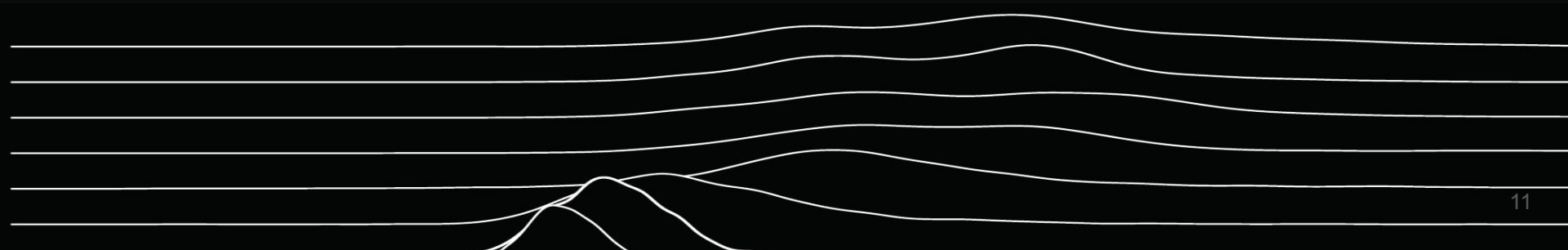
Network Diagnostics Tool (NDT)

- NDT is our most frequently run test
  - NDT measures the single-stream performance of bulk-transport capacity, more commonly referred to as a “speed test”
- 6+ billion tests total
- 4+ million tests per day, on average
- > 8 PiB of data total
  - Increase rate > 1 PiB since last year

Accessing M-Lab Data

- To access M-Lab's public data, you need to sign up for the discuss@ list
  - https://groups.google.com/a/measurementlab.net/g/discuss?pli=1
- Then you can access the data through BigQuery
  - Tutorial: https://www.measurementlab.net/data/docs/bq/quickstart/
  - BigQuery: https://console.cloud.google.com/bigquery?project=measurement-lab
  - Schema (for ndt7 dataset): https://www.measurementlab.net/tests/ndt/ndt7/
    - find details for other datasets https://www.measurementlab.net/data/
- Tools & Languages/Frameworks
  - BigQuery - SQL
  - CoLab - Python, Pandas (e.g., see IMC 2023 examples & Optima shutdown example)

How M-Lab data are used

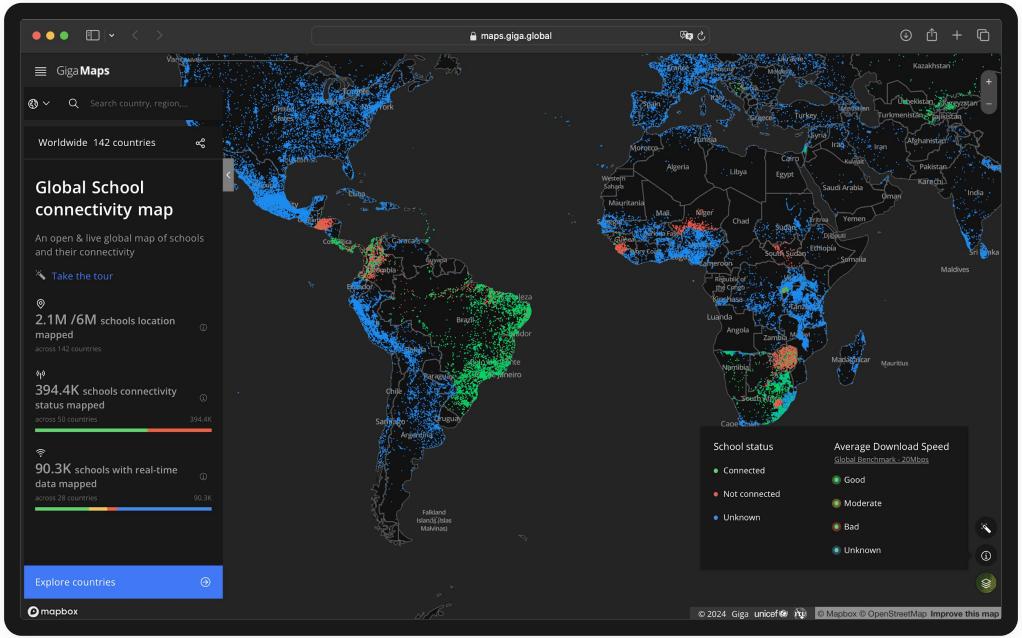


Giga

- Giga https://giga.global/
  - Giga is an initiative launched by UNICEF and ITU in September 2019 to connect every school to the Internet and every young person to information, opportunity and choice
- Giga Meter https://meter.giga.global/
  - Giga Meter is a powerful desktop application that allows school administrators to monitor and visualize the quality of their institution's connectivity

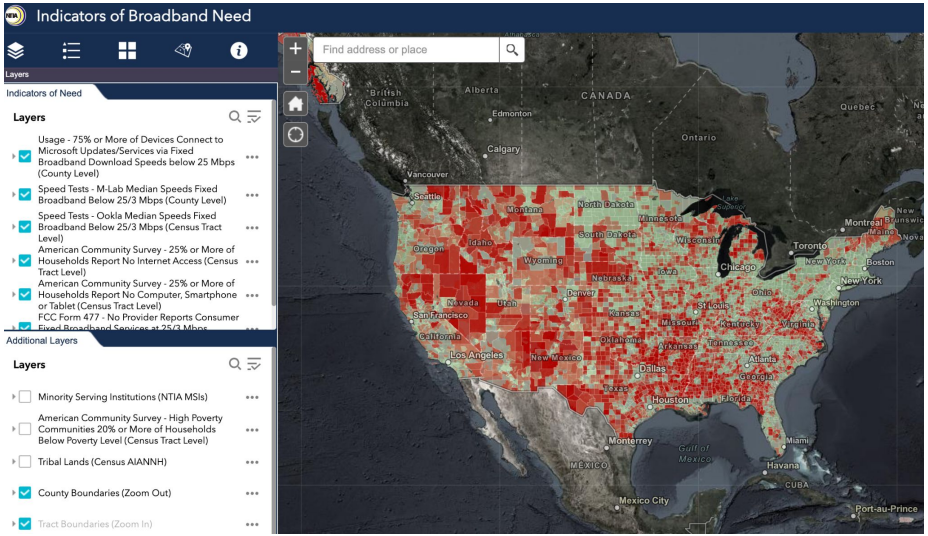
Giga maps

- Giga maps https://maps.giga.global/map
  - School locations and basic connectivity information (global map)
  - Real-time connectivity status (live map)



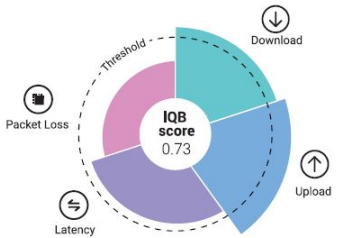
Broadband mapping

- NDT data is integrated into NTIA's Indicators of Broadband Need map, as well as the National Broadband Availability Map.

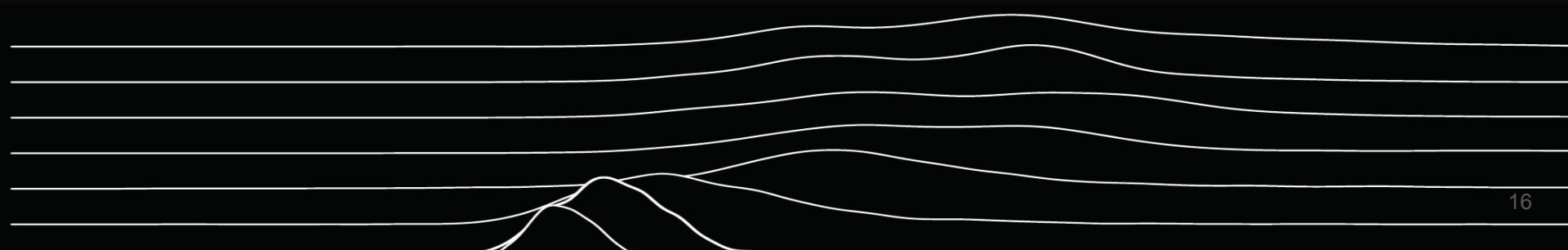


Research *(some recent examples)*

- M-Lab data @ ACM Internet Measurement Conference (IMC) 2025
  - PRIME workshop
    - The Policy Implications of Early Termination in Internet Speed Testing
    - CellWatch: Mobile Broadband Measurement Tool Suite Designed with and for Communities
    - A First Look at Starlink's Impact on Internet Equity
- The Internet Quality Barometer (IQB) https://github.com/m-lab/iqb
  - The goal of IQB framework is to calculate a score (i.e., a composite index) that characterizes the Internet Quality
  - IQB score → from 0 (low quality) to 1 (high quality)

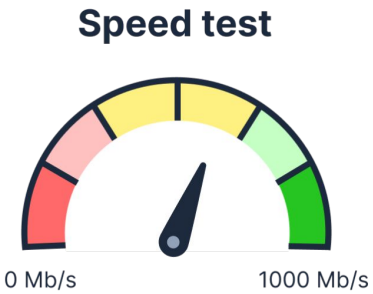


Internet Quality Barometer (IQB)



IQB main goal

→ Redefine Internet quality beyond “speed” ←



Project funded by the Internet Society Foundation Research Grant Program

Quality Internet ≠ “High-speed”

- Internet quality depends on the use case
  & it’s not always about “speed”

- E.g.,
  Web browsing  → latency is important
  vs.
  Online gaming  → latency & download/upload throughput
  vs.
  Online backup  → download/upload throughput

IQB

Measurement Lab

If decision-makers want to make data-driven decisions about improving the quality of the Internet, what metric(s) should they use?

→ welcome to the IQB framework!

IQB score

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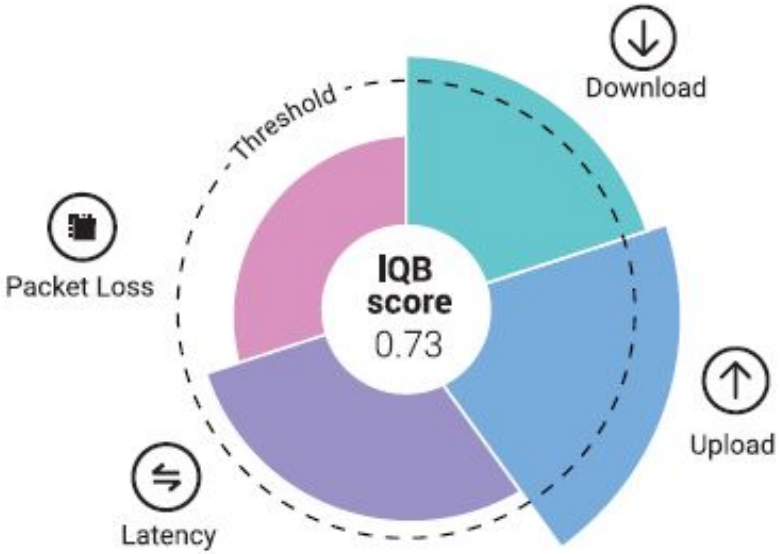
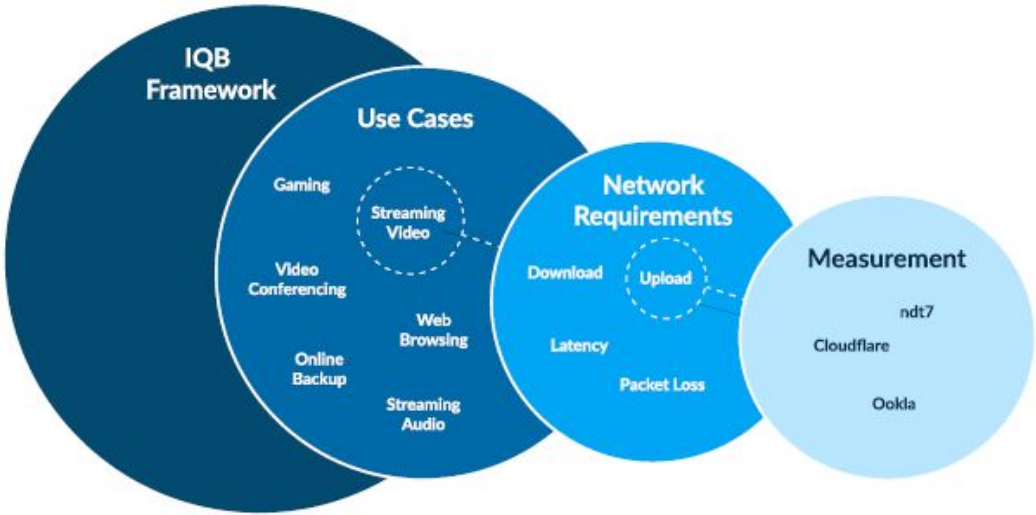


IQB framework

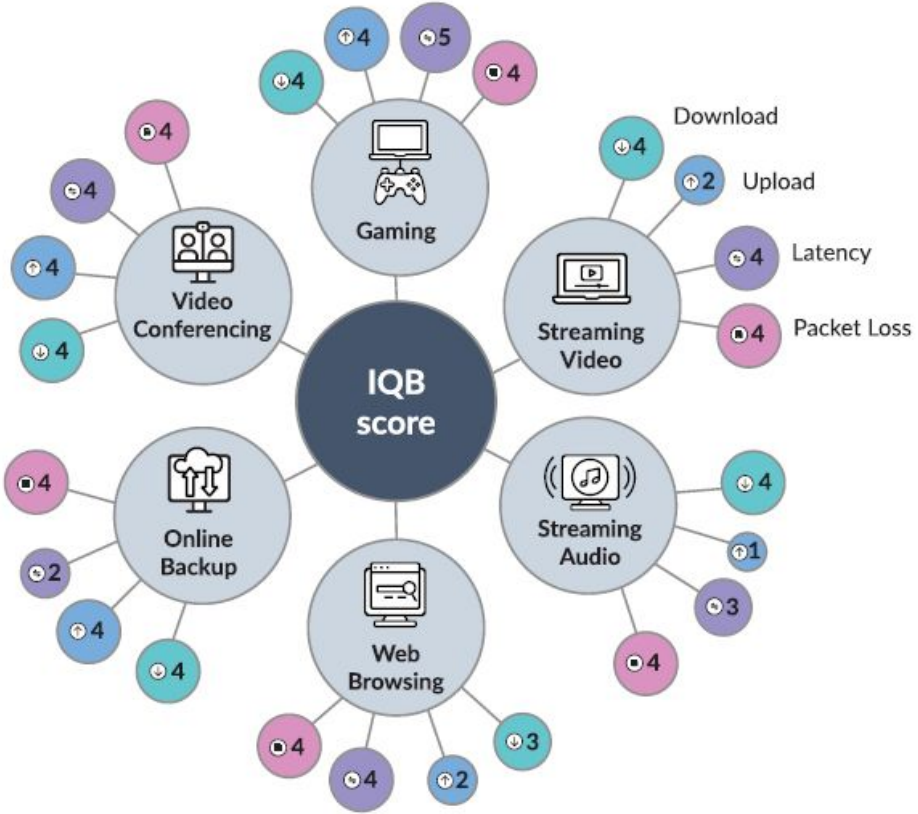
What should we take into account?

- Multiple use cases (video streaming, web browsing, etc.)
- Multiple network requirements (throughput, latency, etc.)
- Multiple measurements/datasets

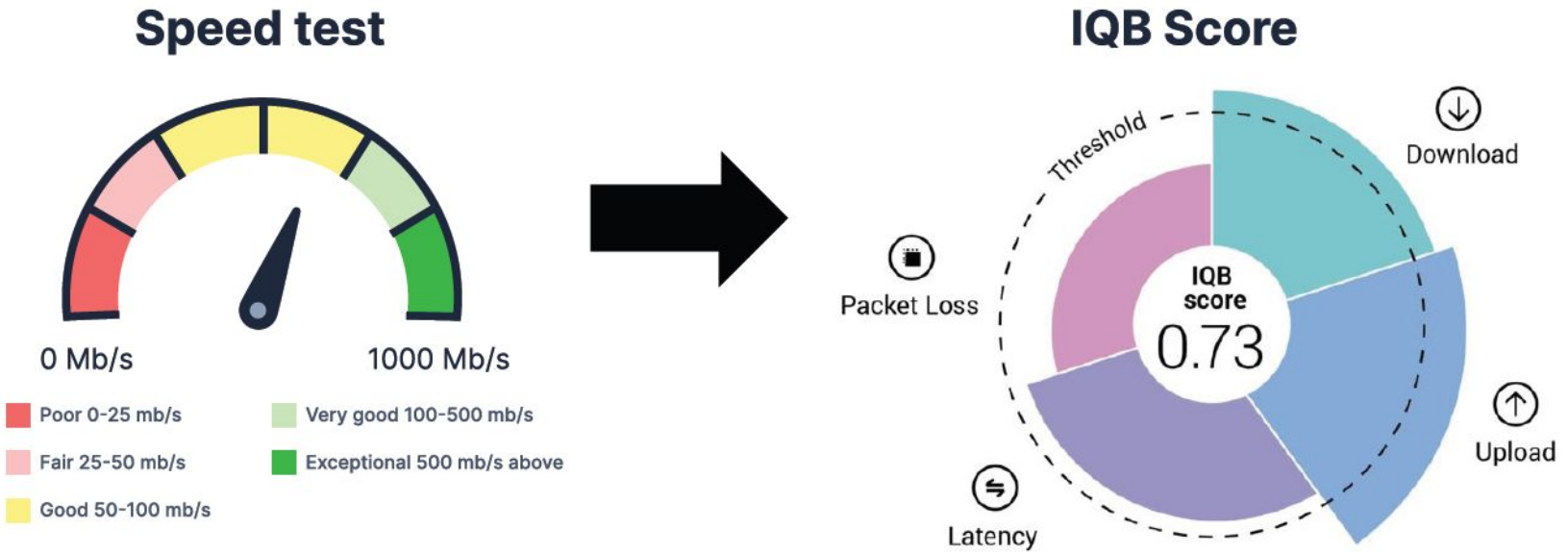


IQB framework

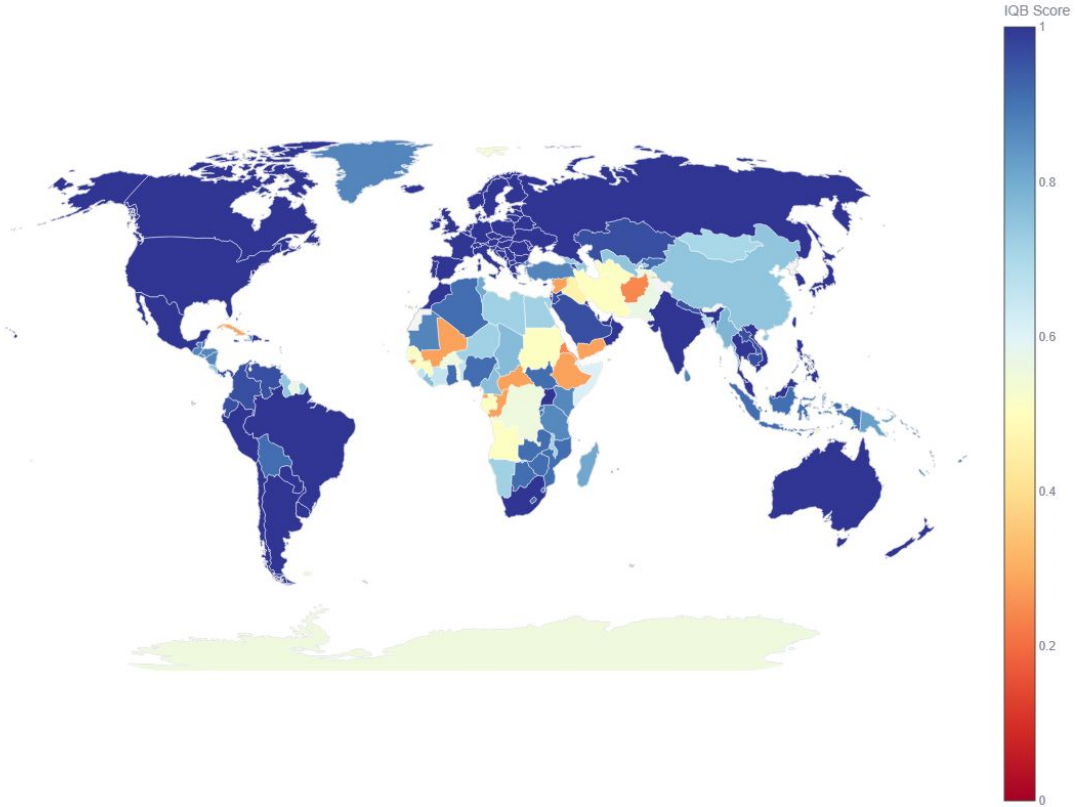
- Network requirements contribute to use cases
- Use cases contribute to the IQB score
- Different weights per requirement and use case



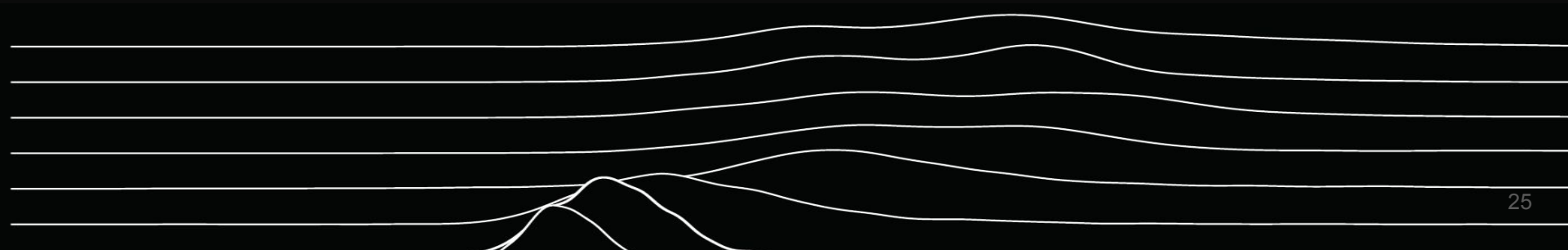
IQB score


Speed test
0 Mb/s
1000 Mb/s
Poor 0-25 mb/s
Fair 25-50 mb/s
Good 50-100 mb/s
Very good 100-500 mb/s
Exceptional 500 mb/s above
IQB Score
Threshold
Download
Packet Loss
IQB score
0.73
Upload
Latency

IQB prototype



IQB for Education (IQB-Edu)



IQB for Education (IQB-Edu)

Goal: Assess “good connectivity for pedagogical needs”

- **What?** → We don’t know (exactly)! We need to define it!
- **How?** → Using a customized version of the IQB framework
- **Why?** → To help decision making

IQB vs IQB-Edu

- Different context for connectivity: from user to facility
  - Speed tests per user vs per facility (multiple users and devices)
  - Facility characteristics/“profile”: type of connections, nominal bandwidth, number of students/users/computers
- Customization of IQB for education:
  - Different use cases
  - Different network requirements (per use case)
  - Different types of measurements / datasets
  - Different framework parameters (weights, thresholds, etc.)

Connectivity Community of Practice

- **Join our Community of Practice (CoP)!**
  - **Who:** We seek Internet measurement experts, and stakeholders from industry, policy, education, development, and advocacy.
  - **Why:** To bring together shared expertise and apply open, rigorous Internet measurement to real-world connectivity challenges — especially for schools and underserved regions.
- Our goals:
  - **Strengthen credible, global measurement** of school & public-facility connectivity
  - **Address measurement gaps** (ex: adding servers to the M-lab platform, other data sources)
  - **Generate actionable insights** by combining available data (e.g. IQB, Pulse, other telemetry)
  - **Develop IQB-Edu framework** to support evidence-based planning and investment
- What's next:
  - Attend our formal launch in early 2026
  - sign up to join the Connectivity CoP!

Measurement Lab

Thank you!