HOME
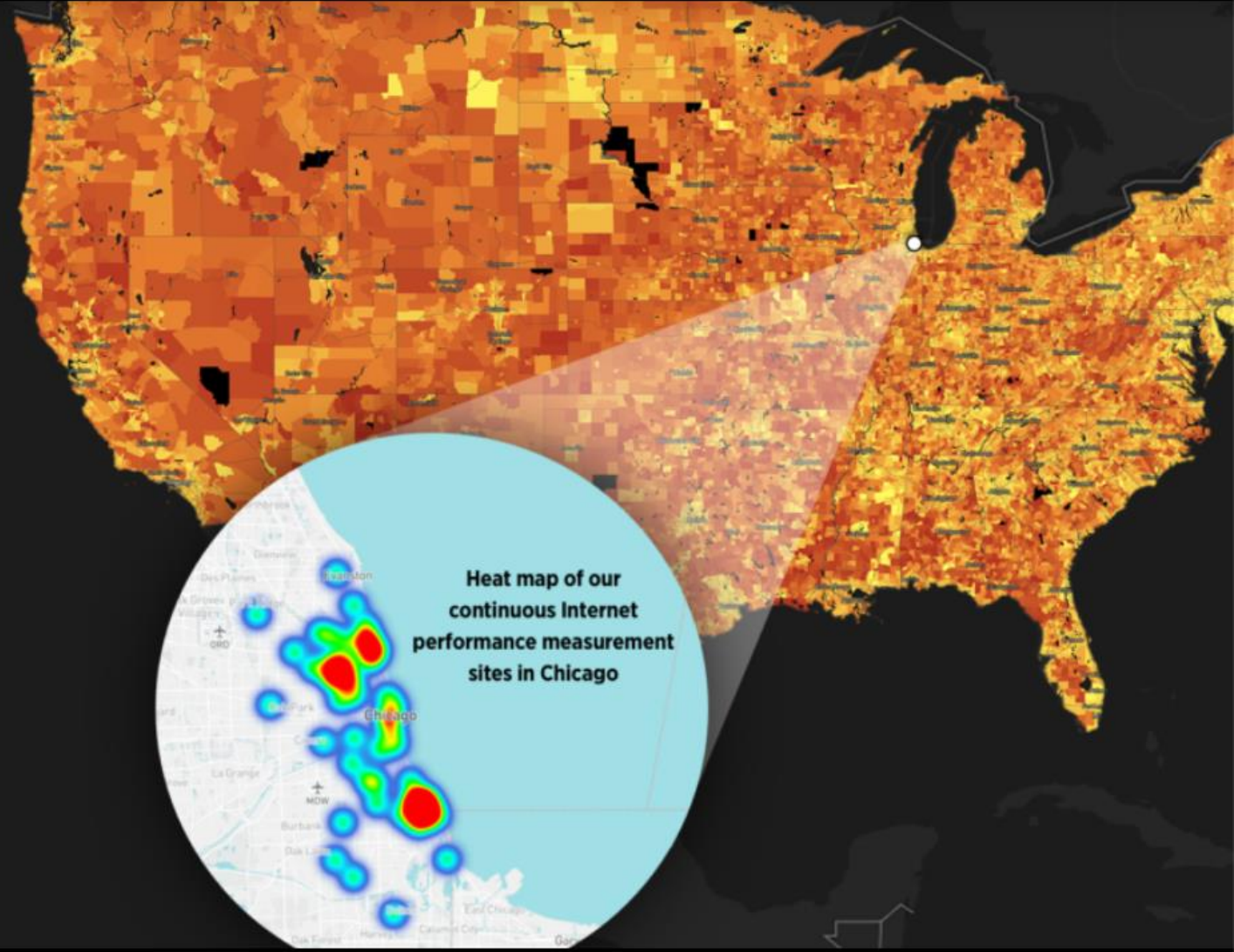
Internet Equity Initiative

Data about and analysis of Internet performance and reliability with actionable insights to address inequity in communities across the United States.

Explore the software and data >   View the map >

Heat map of our continuous Internet performance measurement sites in Chicago

Social scientists in Chicago have been taking note of spatial patterns of disadvantage and social problems for over a century

Clifford R. Shaw and Henry D. McKay, *Juvenile Delinquency in Urban Areas,* University of Chicago Press, 1942.

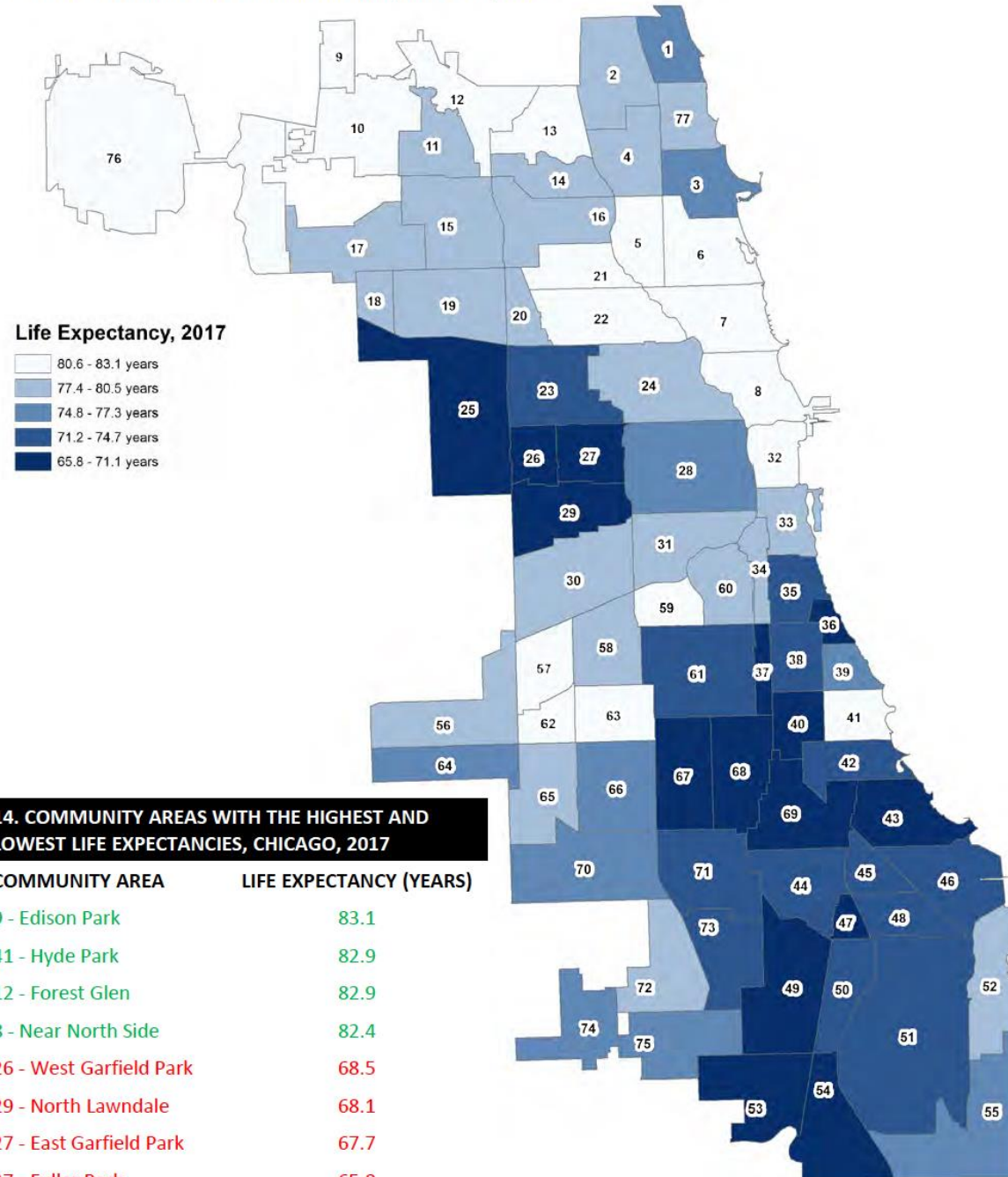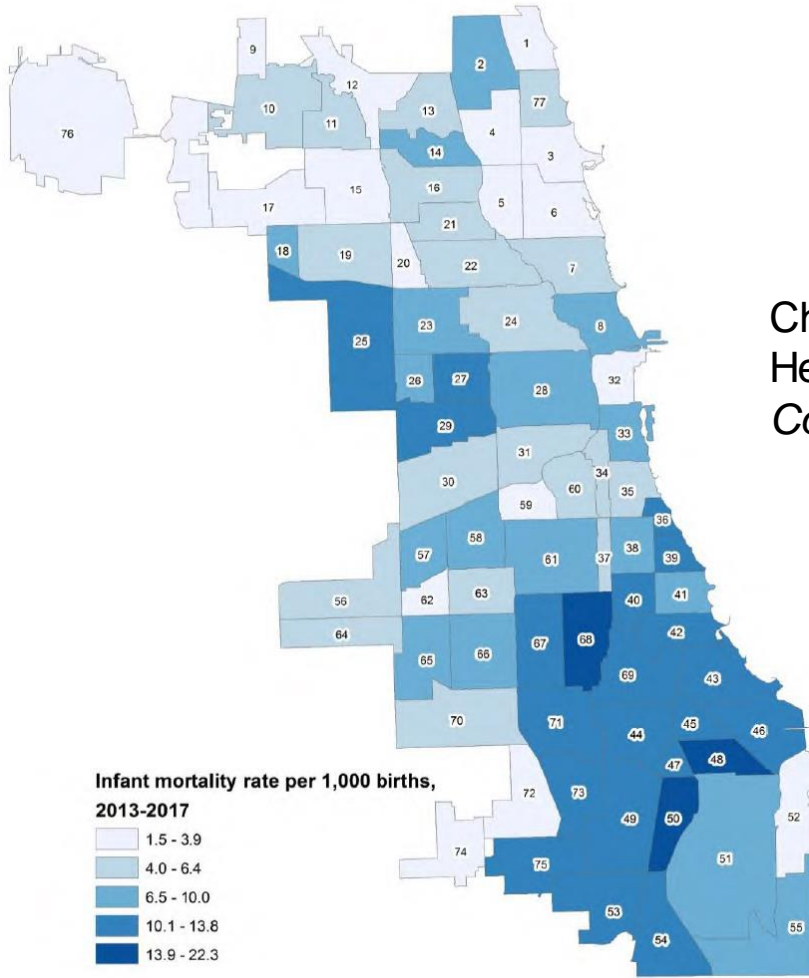**Spatial disadvantage has consistently followed the basic pattern documented in 1940, and is highly correlated with racial segregation**

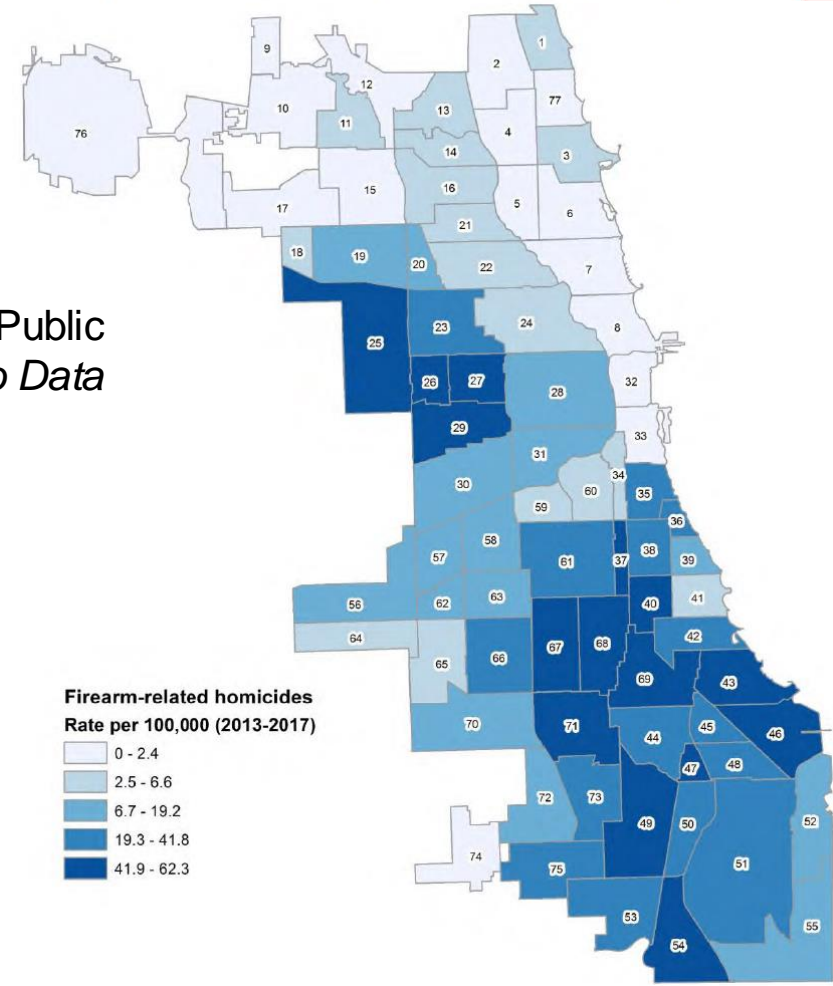Chicago Department of Public Health, *Healthy Chicago Data Compendium 2025.*

13. LIFE EXPECTANCY BY COMMUNITY AREA, CHICAGO, 2017

Life Expectancy, 2017

	80.6 - 83.1 years
	77.4 - 80.5 years
	74.8 - 77.3 years
	71.2 - 74.7 years
	65.8 - 71.1 years

14. COMMUNITY AREAS WITH THE HIGHEST AND LOWEST LIFE EXPECTANCIES, CHICAGO, 2017

COMMUNITY AREA	LIFE EXPECTANCY (YEARS)
9 - Edison Park	83.1
41 - Hyde Park	82.9
12 - Forest Glen	82.9
8 - Near North Side	82.4
26 - West Garfield Park	68.5
29 - North Lawndale	68.1
27 - East Garfield Park	67.7
37 - Fuller Park	65.8

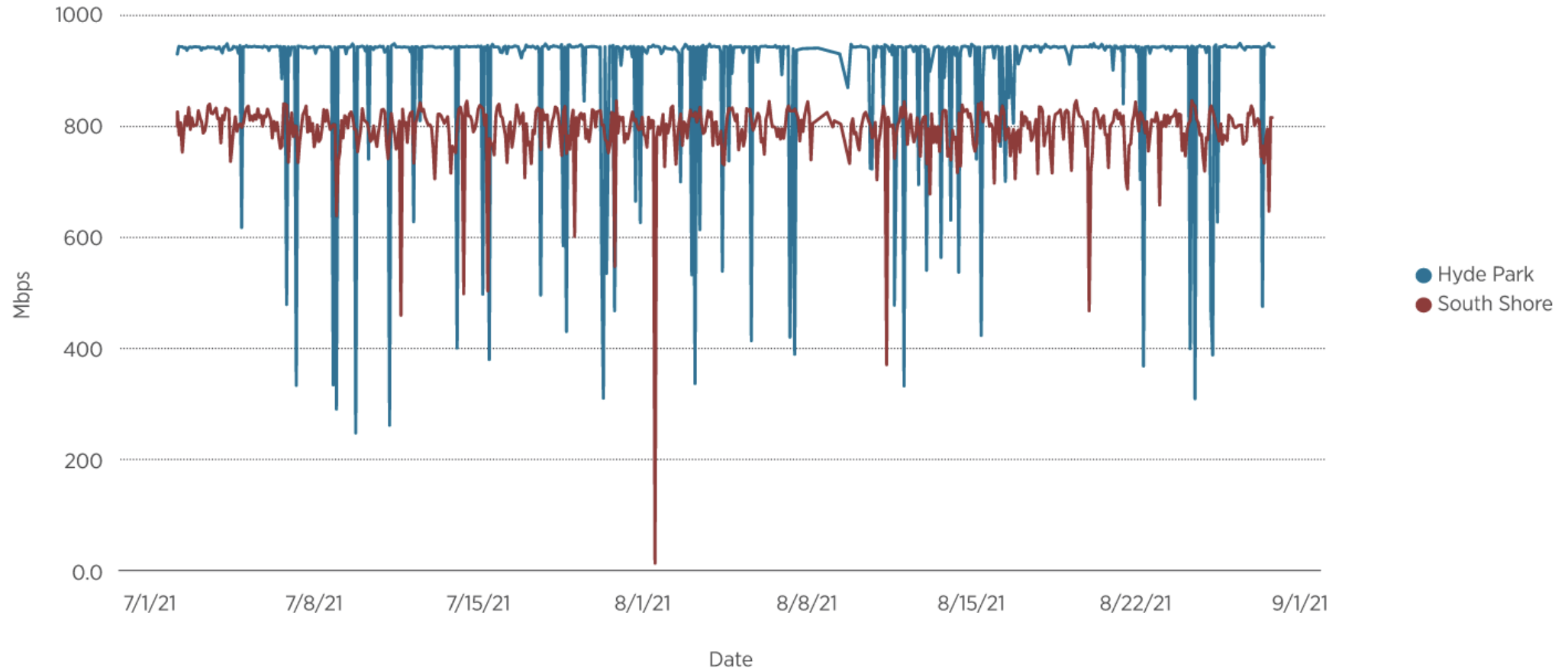22. INFANT MORTALITY BY COMMUNITY AREA, CHICAGO, 2013-2017

20. FIREARM-RELATED HOMICIDE RATES BY COMMUNITY AREA, CHICAGO, 2013-2017

Chicago Department of Public Health, *Healthy Chicago Data Compendium 2025.*

Infant mortality rate per 1,000 births, 2013-2017
- 1.5 - 3.9
- 4.0 - 6.4
- 6.5 - 10.0
- 10.1 - 13.8
- 13.9 - 22.3

Firearm-related homicides
Rate per 100,000 (2013-2017)
- 0 - 2.4
- 2.5 - 6.6
- 6.7 - 19.2
- 19.3 - 41.8
- 41.9 - 62.3

A Tale of Two Gigs

Socially Constructed Biases in Browser Based Speed Testing

- Sampling biases persist in both time and space

- Opt-in speed testing is unevenly distributed (biased sample)

- In Chicago, affluent neighborhoods have ~7x more opt-in speed tests than historically underserved neighborhoods

- Some underserved neighborhoods have no opt-in speed tests at all

Sampling bias

CHICAGO
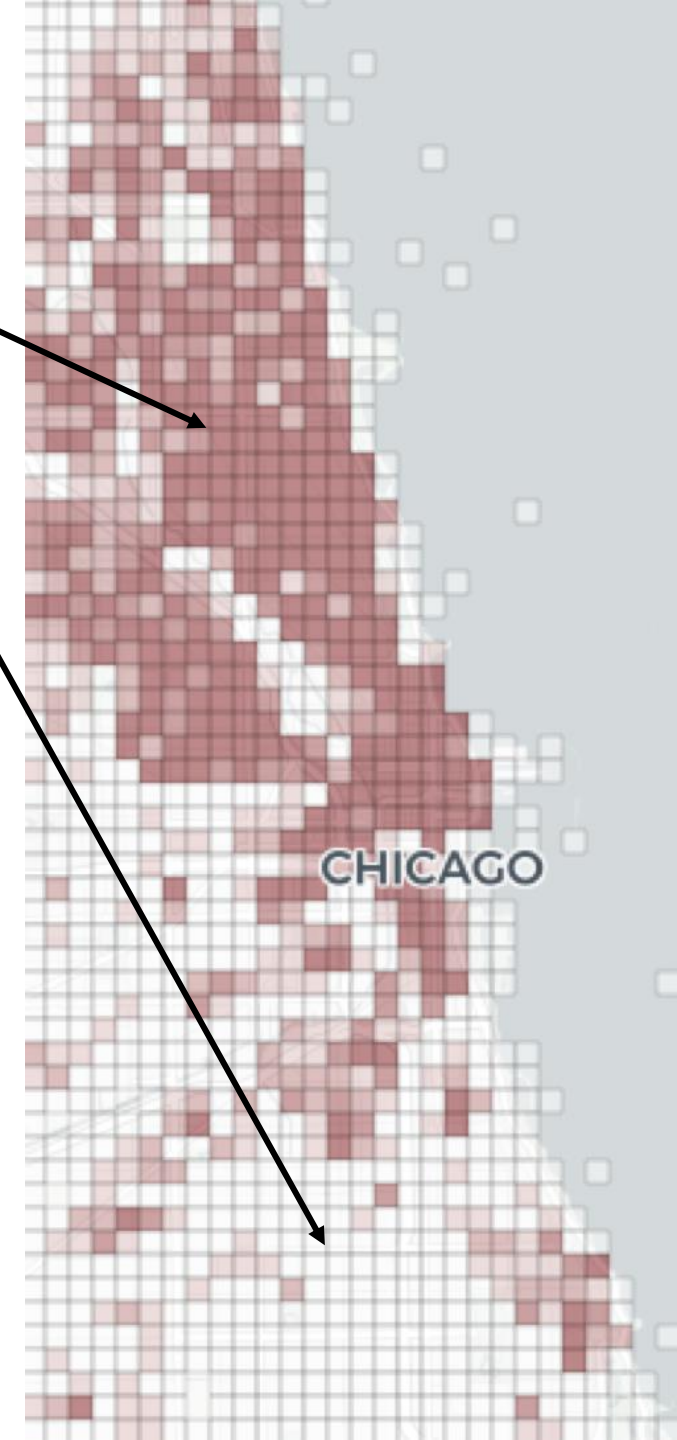
Technologically constructed biases in browser-based speed testing

- Our research shows that commonly used speed tests can report widely different results
  - MLab (NDT)
  - Ookla
  - And others
- There are many sources of variation in these tests
- Browser and device variability, user edge equipment, ad blockers and browser extension
- Network management: congestion, traffic management, caching, geographical and peering biases
- Network quality: improvements or declines in network infrastructure

The BEAD state challenge process relies on households running browser-based speed tests to challenge ISPs on whether an area is served or unserved

- In the areas that are most in need of data, households have the least available time and bandwidth to participate

- In the areas that are most in need of data, community-based organizations say that while broadband is important, there are a lot of other issues higher on their list of priorities
  - Employment
  - Housing
  - Public safety
  - Schools
  - Etc.

An inclusive BEAD challenge process means finding ways to make it easier to gather data in the areas that most need it

A suite of network performance measurements based on over a decade of network measurement research by University of Chicago scholars

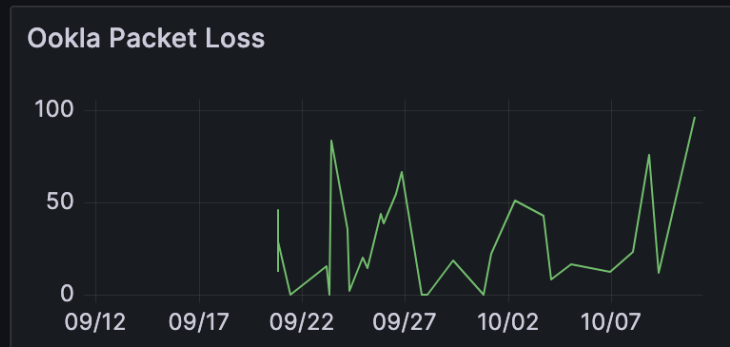- Multiple testing protocols
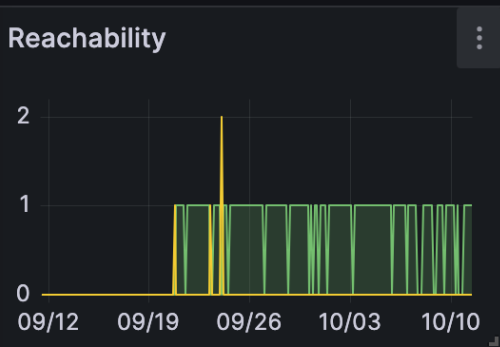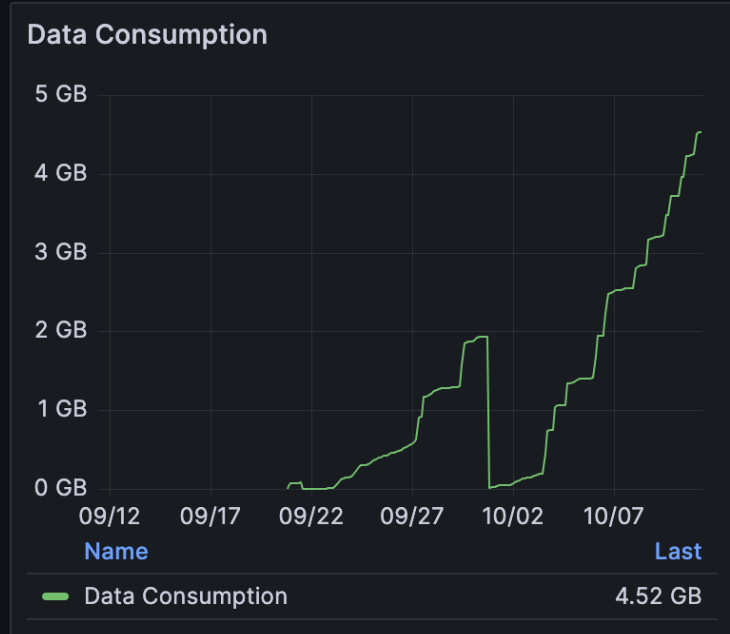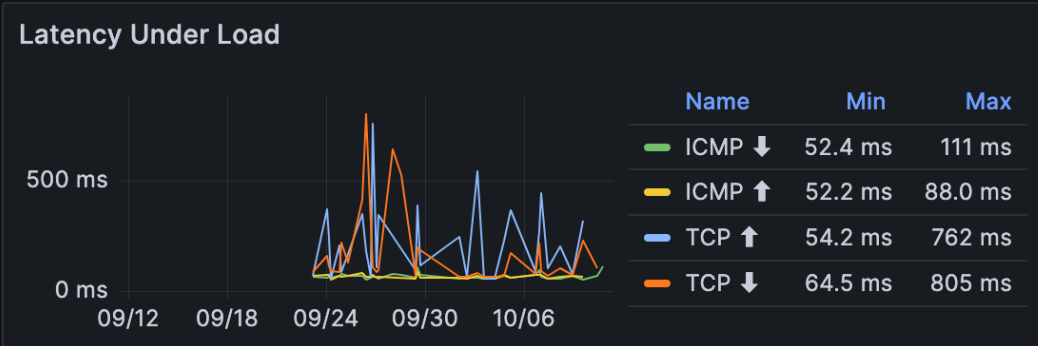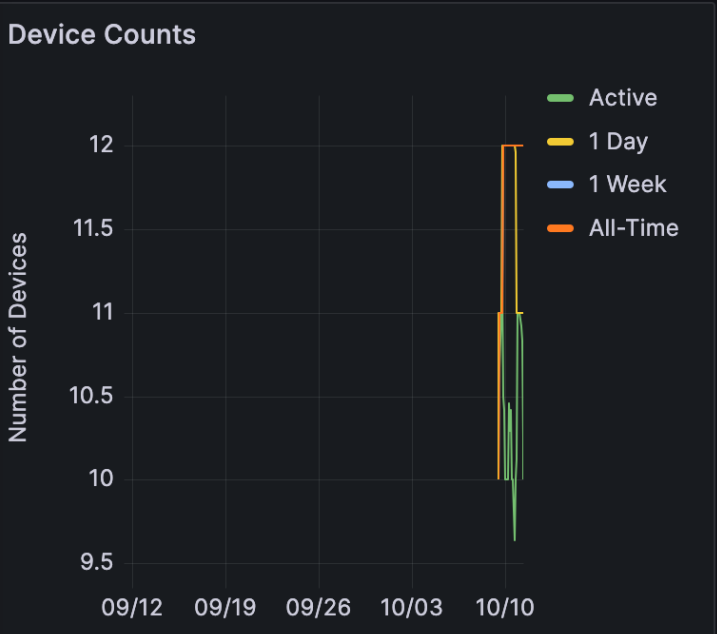- Continuous measurement for longitudinal data
- Plug-and-play interface to allow distributed, automated collection of network performance data

Multiple speed tests, latency to multiple destinations
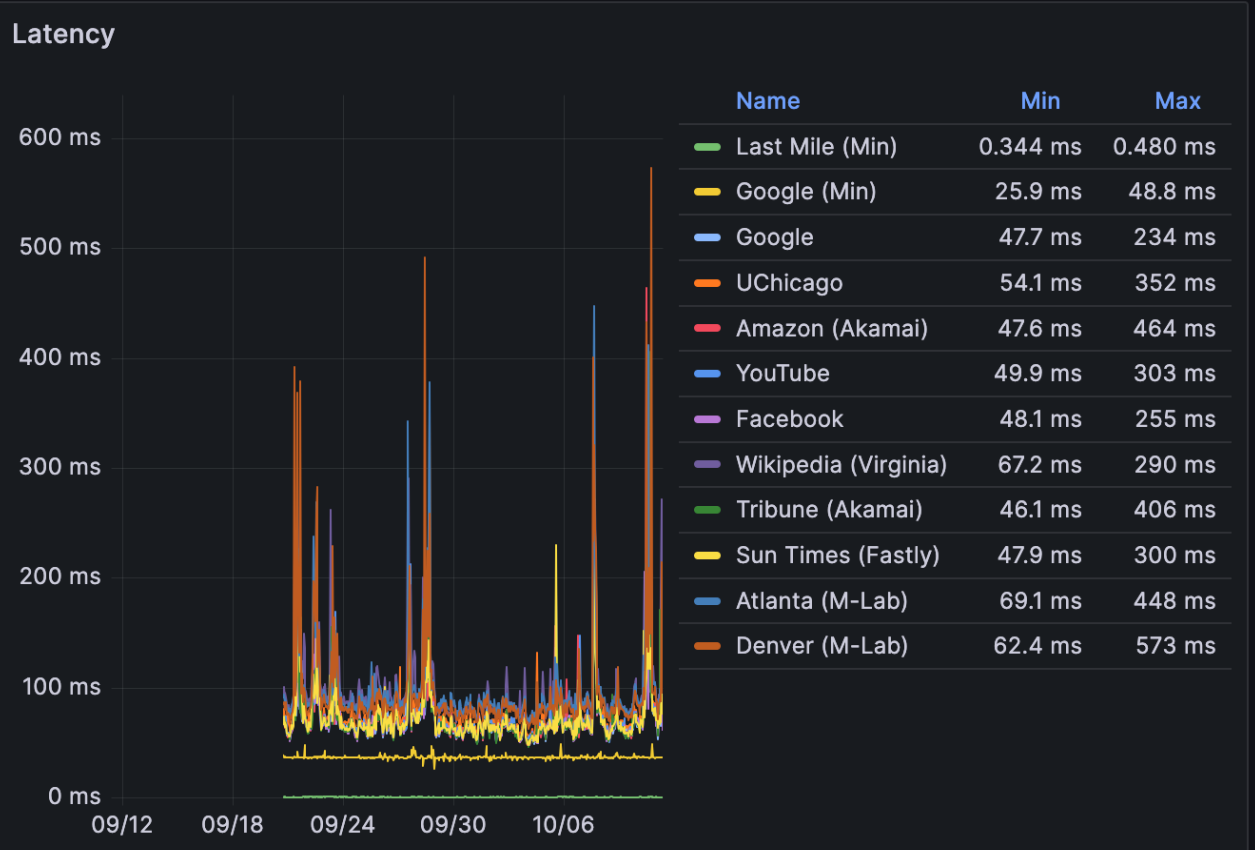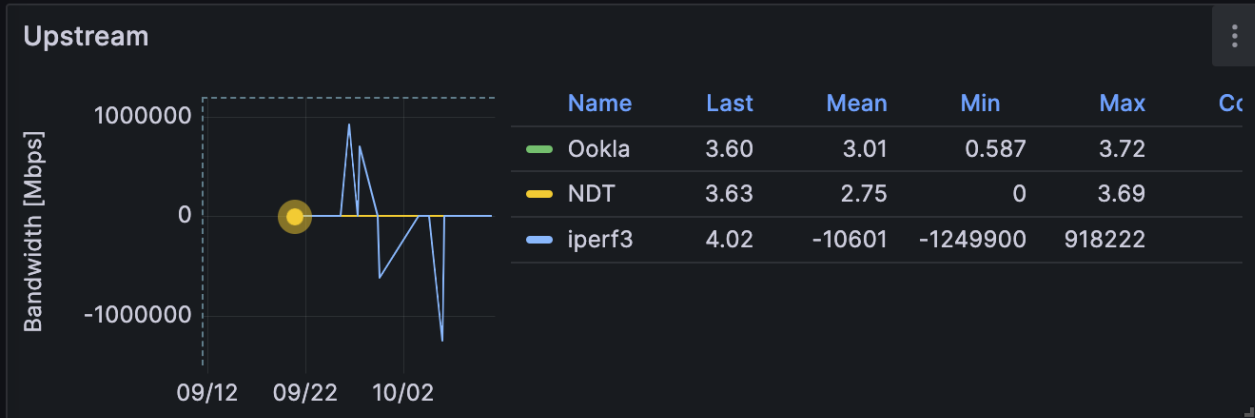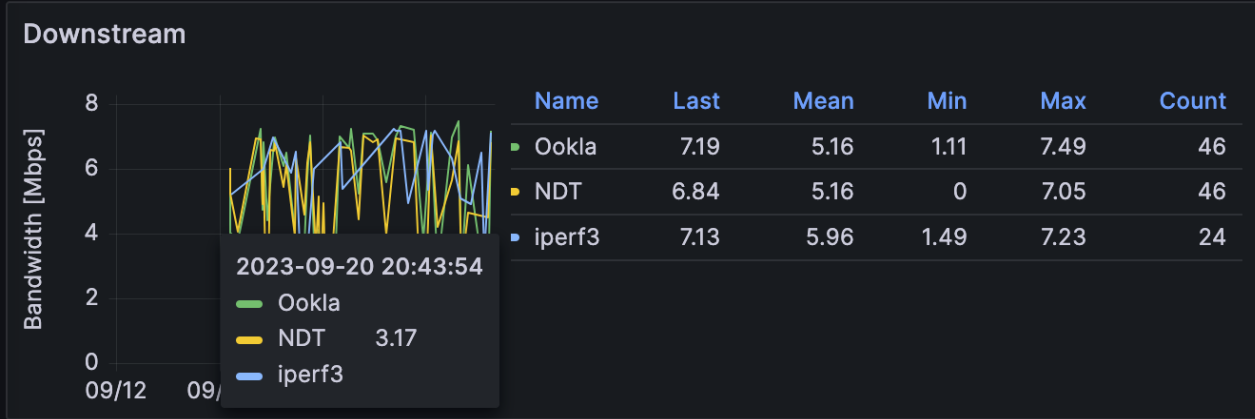
Counts of connected devices, hops, retransmissions, packet loss
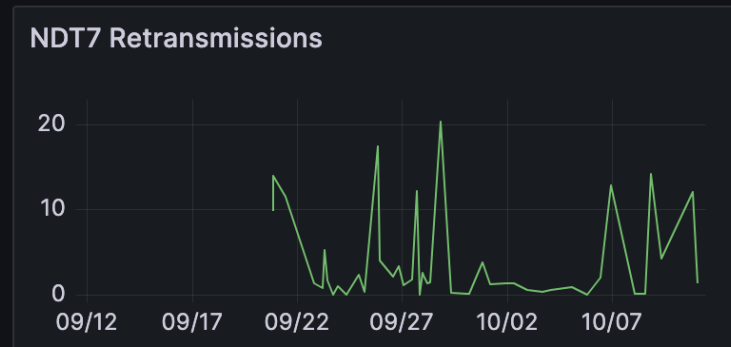
Median speed test results over 3 weeks: average of 150 tests/device

deviceid	ookla_down	ookla_up	ndt7_down	ndt7_up	avg devices connected	
HIDDEN	192.15	29.805976	158.0214922	25.90379089	3	
HIDDEN	104.82	5.666152	100.1374328	5.568595001	6	All upload/download values in Mbps
HIDDEN	41.15	4.179016	37.55485089	2.634816612	3.113846154	download < 100 = Yellow
HIDDEN	4.45	3.454356	6.027629777	3.134049648	7	download < 25 = Red
HIDDEN	70.15	9.942424	66.10107397	10.70734842	5.441358025	upload < 20 = Yellow
HIDDEN	5.25	0.499848	5.185338204	0.500384438	4.15408805	upload < 5 = Red
HIDDEN	6.44	0.677264	6.375509456	0.6503679541	11.61111111	
HIDDEN	195.61	20.110172	175.3879837	18.66440891	8.981132075	
HIDDEN	127.01	17.297172	111.1949498	17.01498093	6	
HIDDEN			27.53973144	2.003803124	7.090342679	
HIDDEN	466.80	15.645296	189.5507095	14.41329502	5.308176101	
HIDDEN	60.94	4.830628	15.40437637	3.181639295	2.113564669	
HIDDEN	104.85	5.633584	100.3385234	5.58402147	12.31132075	
HIDDEN	200.80	13.71068	189.0249656	13.24578889	7.253918495	
HIDDEN	34.08	12.308456	28.6170624	12.99132656	4.959375	
HIDDEN	18.56	8.623732	18.4216	9.193760865	4.08045977	
HIDDEN	16.46	9.060048	14.924663	8.729378865	8.609375	
HIDDEN	154.85	19.571192	126.7430377	15.54716762	8	

DEVICE ID	DIRECTION	ISP	SPEEDTEST	TIMESTAMP
FCC3	DOWNLOAD	TMOBILE	124.018944	9/28/23 1:10:00
	DOWNLOAD	TMOBILE	146.695664	9/21/23 15:25:16
	DOWNLOAD	TMOBILE	155.851544	9/25/23 16:09:56
	UPLOAD	TMOBILE	5.97652	9/28/23 19:09:58
	UPLOAD	TMOBILE	9.274752	9/28/23 1:10:00
	UPLOAD	TMOBILE	16.487136	9/26/23 4:09:53
2D31	DOWNLOAD	ZITO	101.391496	9/22/23 13:02:49
	DOWNLOAD	ZITO	102.957648	9/24/23 13:03:27
	DOWNLOAD	ZITO	103.589608	9/25/23 16:02:46
	UPLOAD	ZITO	5.368672	9/29/23 16:02:50

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DEVICE ID	ISP	LATENCY	TIMESTAMP
FCC3	TMOBILE	101.589	9/26/2023 1:09:05
2D31	ZITO	413.079	9/27/2023 16:31:28
72EB	HUGHESNET	1992.719	9/26/2023 20:12:11
5F81	4SIWI	912.662	9/22/2023 13:42:09
15F2	VERIZON	116.659	9/29/2023 21:36:15
027A	FRONTIER	1131.875	9/21/2023 4:51:17
62F1	FRONTIER	914.113	9/24/2023 16:16:18

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The state challenge process is tied to universal service commitments

High-stakes game for residents and communities: ISPs are innocent until proven guilty
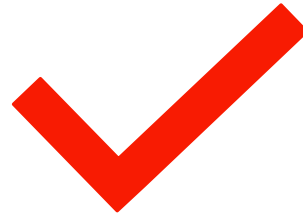
Change requires irrefutable proof of underservice

One-and-done challenge process: user challenge, ISP rebuttal

Overcoming Technologically and Socially Constructed Biases

- **High-stakes state challenge process requires sound, irrefutable data**

- **Reduce barriers to entry for participation in BEAD challenge process**

- **Independently validate if ISPs deliver quality of service**

- **Require independent Quality of Service Validation as part of RFP process**

Thank you!

Supplemental: Terms of Measurement

Download	Download Speed: This measures how quickly data can be downloaded from the internet to your device. It's often represented in megabits per second (Mbps).
Upload	Upload Speed: This measures how quickly data can be uploaded from your device to the internet. It's also represented in Mbps.
Ping	Ping (Latency) : This measures the time it takes for data to travel from your device to a server and back. It's often measured in milliseconds (ms) and indicates the responsiveness of your connection.
Jitter	Jitter: Jitter measures the variation in latency or ping times. A consistent and low jitter indicates a stable connection.
Packet	Packet Loss: This measures the percentage of data packets that are lost during transmission. Lower packet loss is better for internet reliability.