

The Efficacy of the Connect America Fund in Addressing US Internet Access Inequities

H.Manda, V.Srinivasavaradhan, L.Koduru, K.Zhang, X.Zhou, U.Paul,
E.Belding, A.Gupta and T.Narechania

Presentation by:
Haarika Manda

**Systems and
Networking Lab**



Does the “Net” Work for All?

Does the “Net” Work for All?

- **Prevalence of Internet Access Inequity**
 - 10% of population cannot **afford** Internet due to high subscription cost¹
 - 30M lack access to **performant** (high-speed) Internet; 40% in rural/tribal areas²

1. *How Can the United States Address Broadband Affordability?* Pew Charitable Trust Report, <http://tinyurl.com/ybyv9beh>

2. *FCC's National Broadband Map*, <https://broadbandmap.fcc.gov>

Does the “Net” Work for All?

- **Prevalence of Internet Access Inequity**
 - 10% of population cannot **afford** Internet due to high subscription cost¹
 - 30M lack access to **performant** (high-speed) Internet; 40% in rural/tribal areas²

Marginalizes underprivileged groups in the digital society

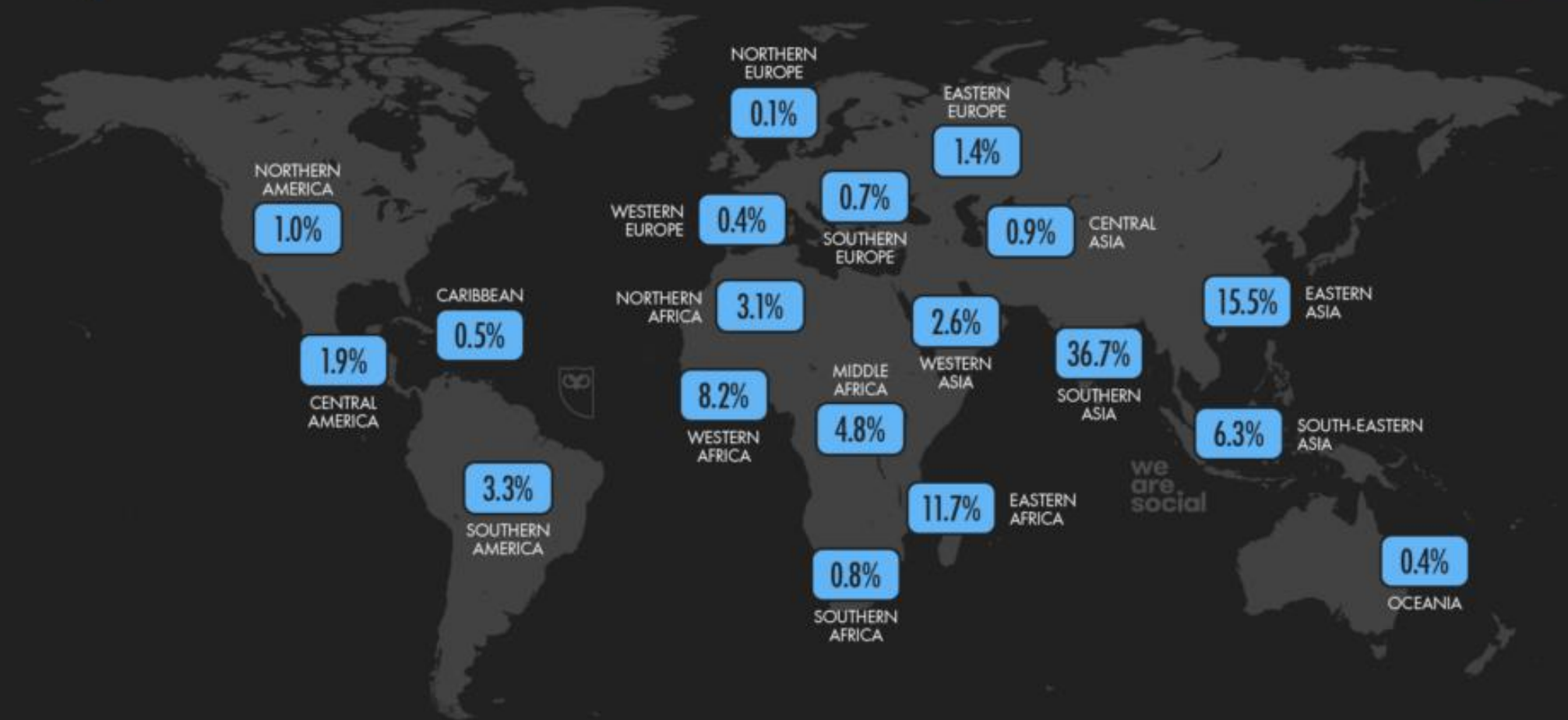
1. *How Can the United States Address Broadband Affordability?* Pew Charitable Trust Report, <http://tinyurl.com/ybyv9beh>

2. *FCC's National Broadband Map*, <https://broadbandmap.fcc.gov>

APR
2022

SHARE OF THE WORLD'S OFFLINE POPULATION

PERCENTAGE SHARE OF THE WORLD'S TOTAL OFFLINE POPULATION



23

SOURCES: KERIOS ANALYSIS; ITU; GSMA INTELLIGENCE; EUROSTAT; GWI; CIA WORLD FACTBOOK; CNNIC; APJII; LOCAL GOVERNMENT AUTHORITIES; UNITED NATIONS. **NOTE:** REGIONS BASED ON THE UNITED NATIONS GEOScheme. **COMPARABILITY:** SOURCE AND BASE CHANGES.

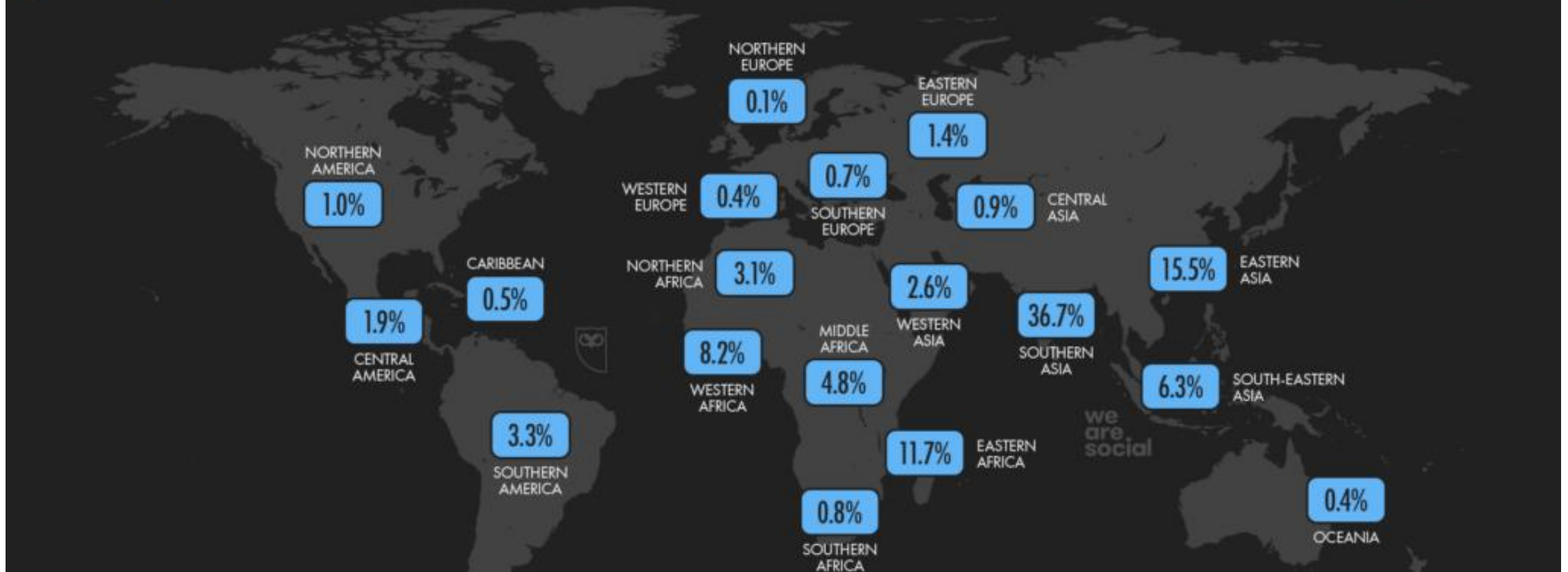
we
are
social

Hootsuite

APR
2022

SHARE OF THE WORLD'S OFFLINE POPULATION

PERCENTAGE SHARE OF THE WORLD'S TOTAL OFFLINE POPULATION



2.6 billion lack Internet Access ! (32% of the world pop.) ¹

1. International Telecommunication Union (ITU), <https://www.itu.int/en/mediacentre/Pages/PR-2024-11-27-facts-and-figures.aspx>

How Policymakers Influence Internet Access?

How Policymakers Influence Internet Access?

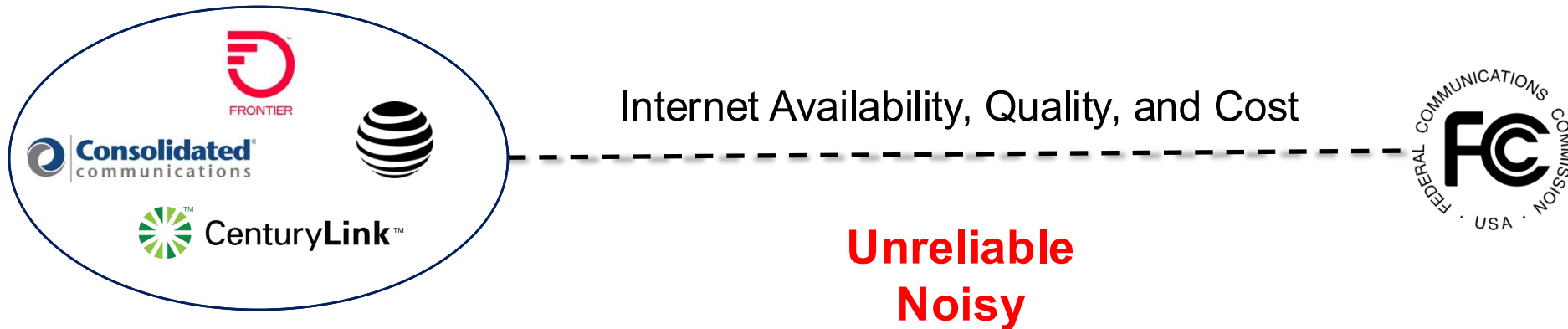
Multi-billion dollar policy interventions

Program	Funding	Description
Broadband Equity, Access and Deployment (BEAD) Program (2022-Present)	\$44 Billion	Fund new infrastructure deployments to ensure high-speed Internet for all
Connect America Fund (CAF) (2011-2021)	\$10 Billion	Subsidize new infrastructure in hard-to-serve areas
Affordability Connectivity Program (ACP) (2021-2024)	\$14 Billion	Subsidize high-speed Internet for low-income households
...

Fundamental Problem

Internet Service Providers

Policymakers



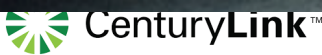
Fundamental Problem

BLOCKING COMPETITION —

ISP admits lying to FCC about size of network to block funding to rivals

ISP gave FCC false coverage information to prevent others from getting grants.

JON BRODKIN - 2/2/2023, 12:06 PM



Unreliable
Noisy

Policymakers

Cost



Fundamental Problem

DECEMBER 10, 2020

CAPITO CAUTIONS FCC ON RDOF FUNDING FOR FRONTIER

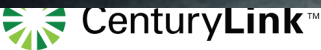
BLOCKING COMPETITION —

ISP admits lying to FCC to block funding to rivals

ISP gave FCC false coverage information to prevent others from getting grants.

JON BRODKIN - 2/2/2023, 12:06 PM

Cost



Unreliable
Noisy

Fundamental Problem

DECEMBER 10, 2020

CAPITO CAUTIONS FCC ON RDOF FUNDING FOR FRONTIER

BLOCKING COMPETITION —

ISP admits lying to FCC

TECHNOLOGY

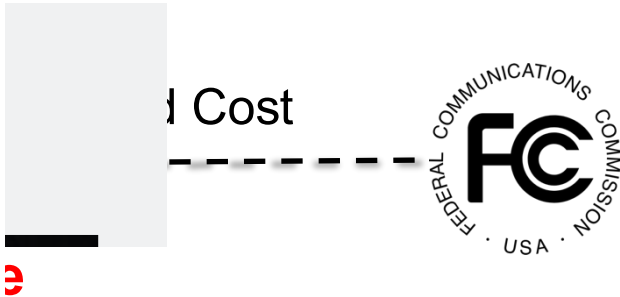
Colorado is challenging 13,000 speed inaccuracies in the new federal broadband map

More challenges are likely and if your broadband is subpar, the state's Broadband Office wants to hear from you



Tamara Chuang

4:12 AM MST on Dec 6, 2022 Updated 1:21 PM MST on Dec 7, 2022



Fundamental Problem

DECEMBER 10, 2020

CAPITO CAUTIONS FCC ON RDOF FUNDING FOR FRONTIER

BLOCKING COMPETITION —

ISP admits lying to FCC

TECHNOLOGY

Colorado is challenging 13,000 speed inaccuracies in the new federal broadband map

More challenges are likely and if your broadband is subpar, the state's Broadband Office wants to hear from you

Presley issues investigative subpoena to AT&T



Tamara Chuang

4:12 AM MST on Dec 6, 2022 Updated 1:21 PM MST on Dec 7, 2022

For the Monroe Journal Sep 10, 2020



Fundamental Problem

DECEMBER 10, 2020

CAPITO CAUTIONS FCC ON RDOF FUNDING FOR FRONTIER

BLOCKING COMPETITION —

ISP admits lying to FCC

TECHNOLOGY

Colorado is challenging 13,000 speed inaccuracies in the new federal broadband map

Cost



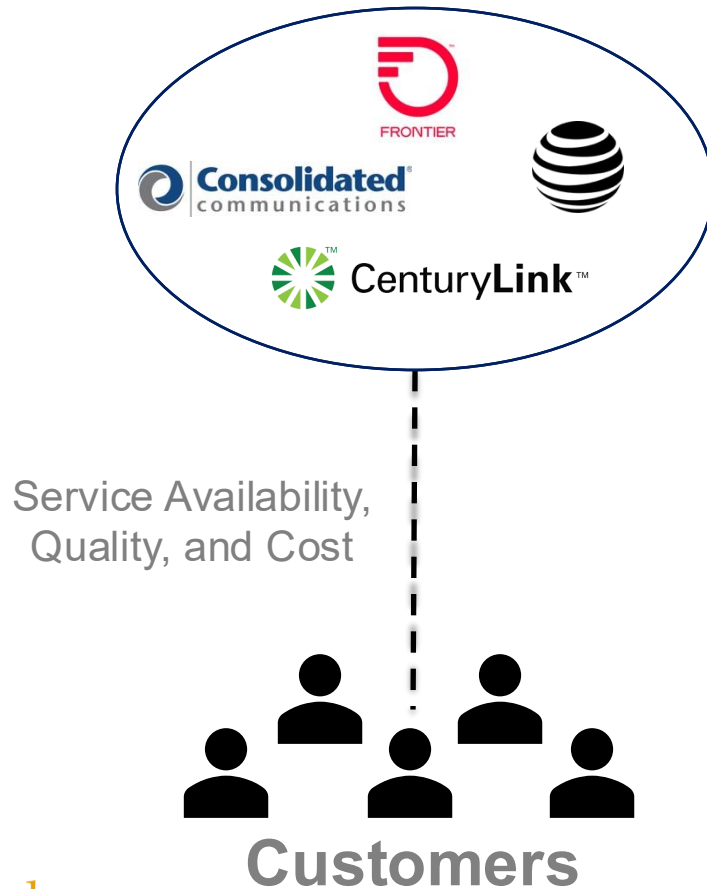
More challenges are likely and if your broadband is subpar, the

How to reduce reliance on self-reported data from ISPs?

4:12 AM MST on Dec 6, 2022 Updated 1:21 PM MST on Dec 11, 2022

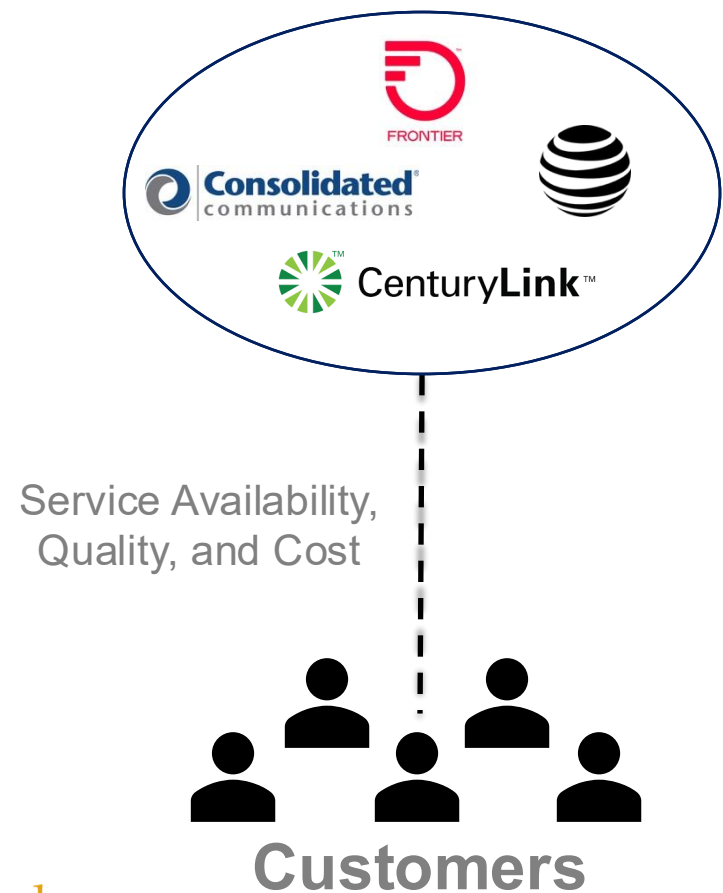
How can we address this ?

Leverage our prior work: **Broadband-plan Querying Tool (BQT) [SIGCOMM '23]**



How can we address this ?

Leverage our prior work: **Broadband-plan Querying Tool (BQT) [SIGCOMM '23]**



Availability

5663 Cielo Ave, #B, 93117

[Edit address](#)

Unlock extra savings on select Cox Internet plans and experience unbeatable 5G reliability on-the-go when you add Cox Mobile after purchase. [Find out how](#)

GET HIGH-SPEED INTERNET AT AN AFFORDABLE PRICE FROM A LEADING INTERNET PROVIDER

Delve into a realm of fast and consistent connectivity without breaking the bank. Our competitive pricing coupled with unparalleled customer service makes Cox the go-to internet provider for budget-friendly high-speed internet solutions.

SAVE \$15.00/mo. with Cox Mobile

INCLUDES Panoramic Wifi equipment

Quality

100 Mbps

Max download speed

Go Fast

Great for browsing the web, social media, email, and more

\$35.00/mo

with Cox Mobile, for 24 mos. No annual contract or cancellation fees.

\$50/mo

without Cox Mobile, no annual contract or cancellation fees.

Order now

Customize plan

Plan details

Cost

Berkeley
UNIVERSITY OF CALIFORNIA

UC SANTA BARBARA

6

What is the Broadband-Plan Querying Tool (BQT)?


Automates querying ISPs' web interfaces at scale to extract advertised (**reliable**) broadband **availability**, **quality** and **affordability** at street-level granularity (**fine-grained**).



What is the Broadband-Plan Querying Tool (BQT)?

Automates querying ISPs' web interfaces at scale to extract advertised (**reliable**) broadband **availability**, **quality** and **affordability** at street-level granularity (**fine-grained**).

	pricing	exec_time	service_status
{0: '500 Mbps\n500 Upload / 500 Download\n\$39....		60.02	Serviceable
{0: '25 Mbps\nSpeeds up to 25 Mbps\n\$39.99\n/m...		70.32	Serviceable
{0: '3 Mbps\nSpeeds up to 3 Mbps\n\$39.99\n/mo\...		86.06	Serviceable



Get notified about AT&T Fiber

We're still rolling out our faster internet experience. Get on our list so we can notify you if AT&T Fiber becomes available at your address.

Notify me

Service address

Enjoy AT&T Internet today

AT&T INTERNET

Simple, straightforward pricing

Get internet with no annual contract and no equipment fees.

The Affordable Connectivity Program (ACP) is a federal government program that provides a benefit on internet service for eligible low-income households. [Learn more or apply your benefit](#)

Internet Basic 768kbps

768Kbps speed

Price excludes taxes and is after \$5/mo. AutoPay and paperless bill discount (w/in 2 bills). Monthly state cost recovery charge applies in TX, OH, and NV. One-time install charge may apply. [See offer details](#)

~~\$76.00/mo.~~


\$55.00/mo.

for 12 mos. Plus taxes Autopay & paperless bill req'd.


Continue (\$55/mo.)



Feedback

Example of a “serviced” landing Page




DealsWirelessInternetAccessoriesPrepaidBusiness


I'm looking for...


SupportMy AT&T 

Looks like AT&T Internet isn't available at your address.


Need help? Call us. 833.403.8784



Your address



Already have an AT&T account? Sign in for special offers. [Sign in](#)


Other available options

AT&T Internet is not available at your address.

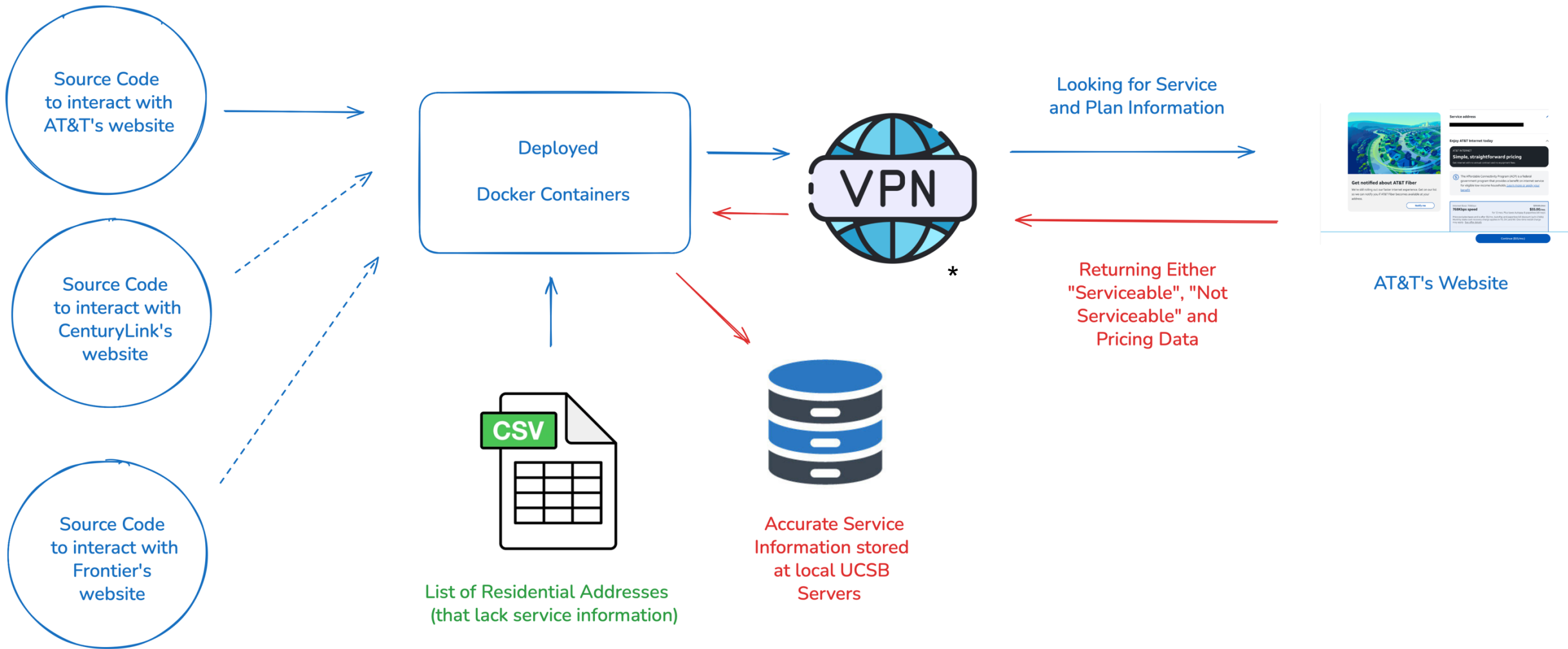
INTERESTED IN AT&T FIBER®?
Want more speed? Get Notified.

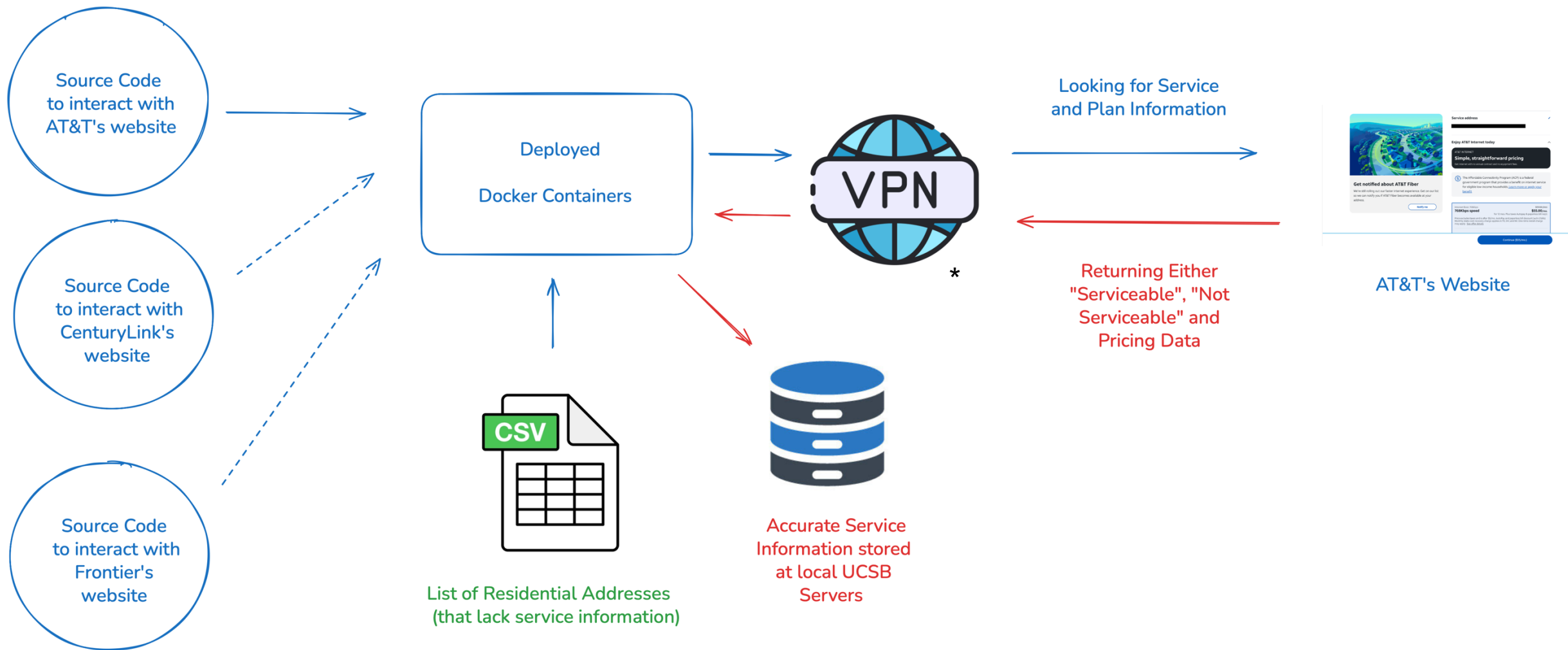
We're continuing to expand our next generation of internet. Get on our list so we can notify you if AT&T Fiber® or other home internet products become available at your address.

Notify me



Example of a “Not serviced” landing Page





How can BQT assess CAF's "true" success?

Connect America Fund (CAF) Program

Connect America Fund (CAF) Program

- **Goal**
 - To address the disparity in access to affordable and performant Internet services in high-cost regions (rural areas with lower population density)

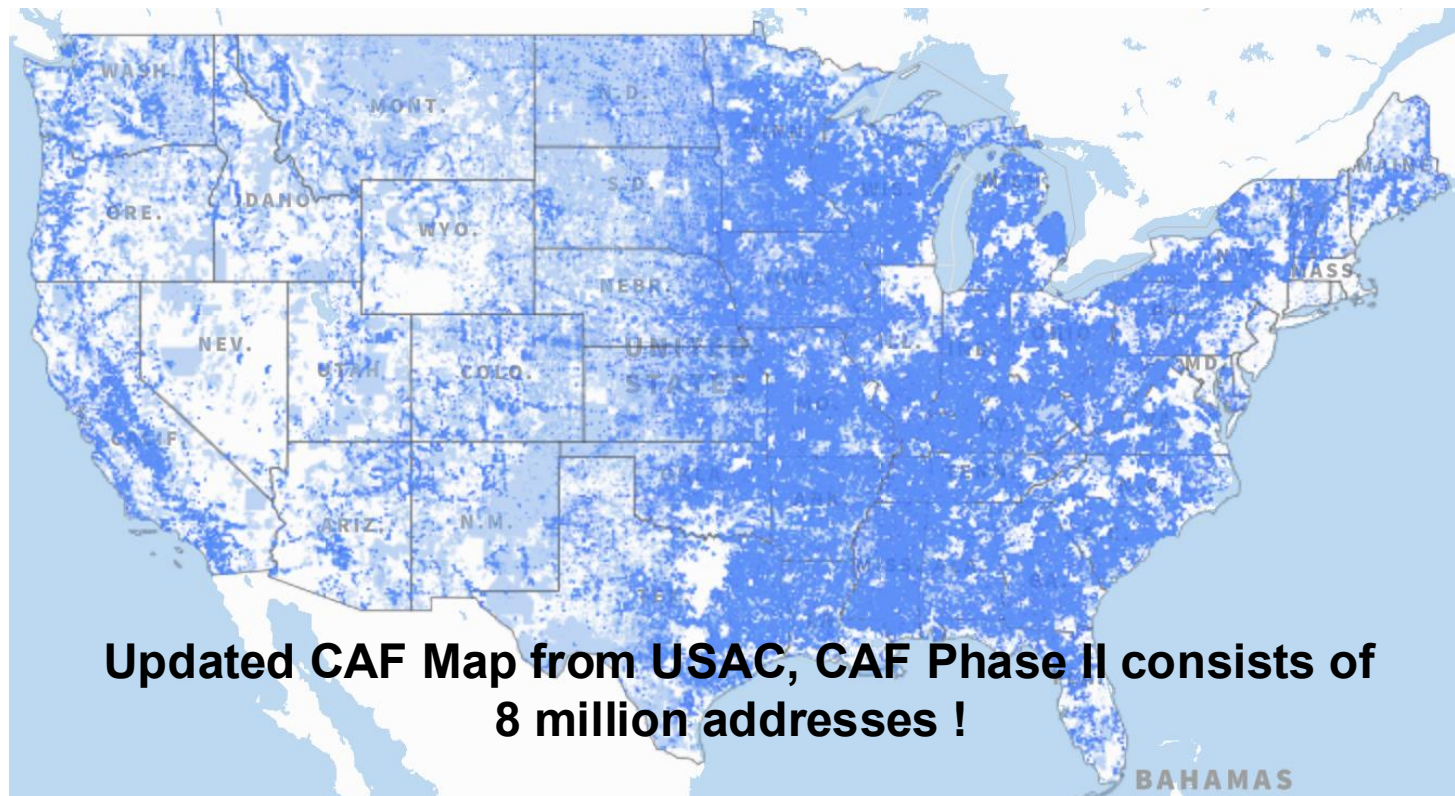
Connect America Fund (CAF) Program

- **Goal**
 - To address the disparity in access to affordable and performant Internet services in high-cost regions (rural areas with lower population density)
- **Mechanism**
 - CAF subsidized ISPs in regions that lacked broadband internet access (6+ million addresses)
 - FCC specified expected service quality (10/1 Mbps) and price requirements

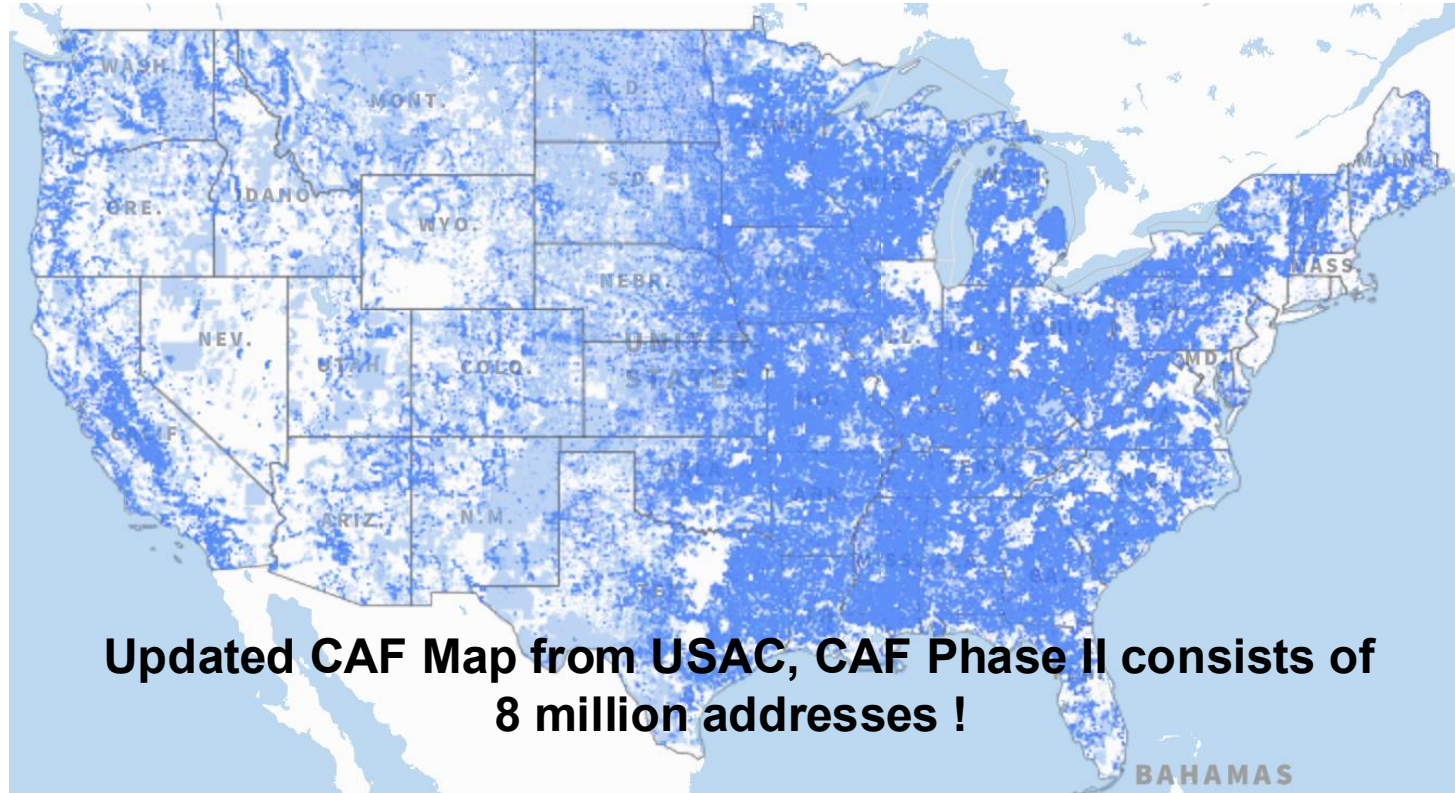
Connect America Fund (CAF) Program

- **Goal**
 - To address the disparity in access to affordable and performant Internet services in high-cost regions (rural areas with lower population density)
- **Mechanism**
 - CAF subsidized ISPs in regions that lacked broadband internet access (6+ million addresses)
 - FCC specified expected service quality (10/1 Mbps) and price requirements
- **Certification**
 - ISPs certified addresses they served and speeds they offered (**self-reported!**)

Connect America Fund (CAF) Program



Connect America Fund (CAF) Program



How effective was the CAF program in expanding Internet access?

How to Measure Success of CAF ?

Key Policy Questions

- **Question 1:** Are some ISPs **truthful** about the addresses they certify as served?
- **Question 2:** Do some ISPs always **comply** with FCC's service quality and rate requirements?
- **Question 3:** Do regulated monopolies offer **better value** to users than unregulated ones?

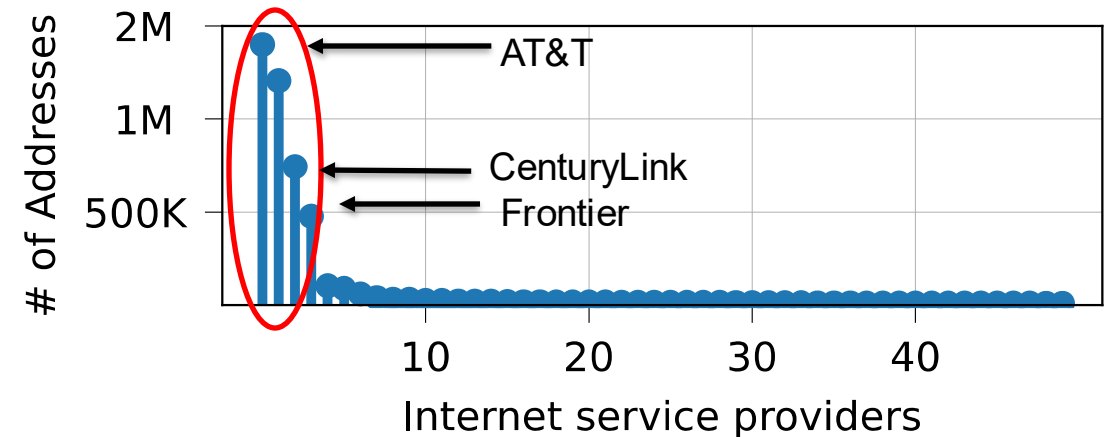
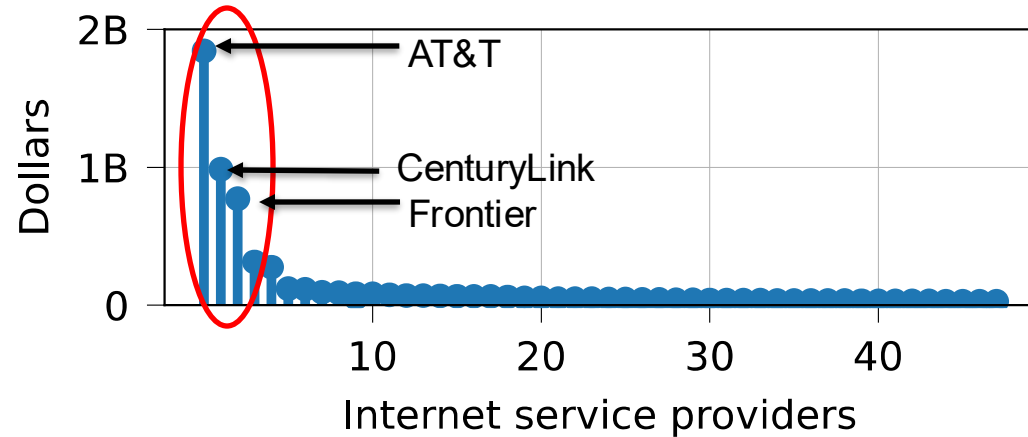
New CAF Dataset: Certified vs. Advertised Information

New CAF Dataset: Certified vs. Advertised Information

Which ISPs and addresses to query?

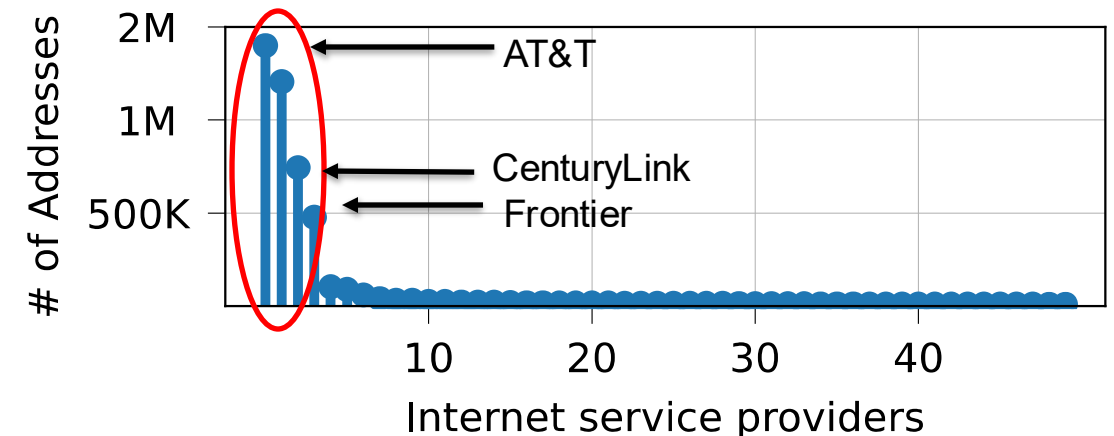
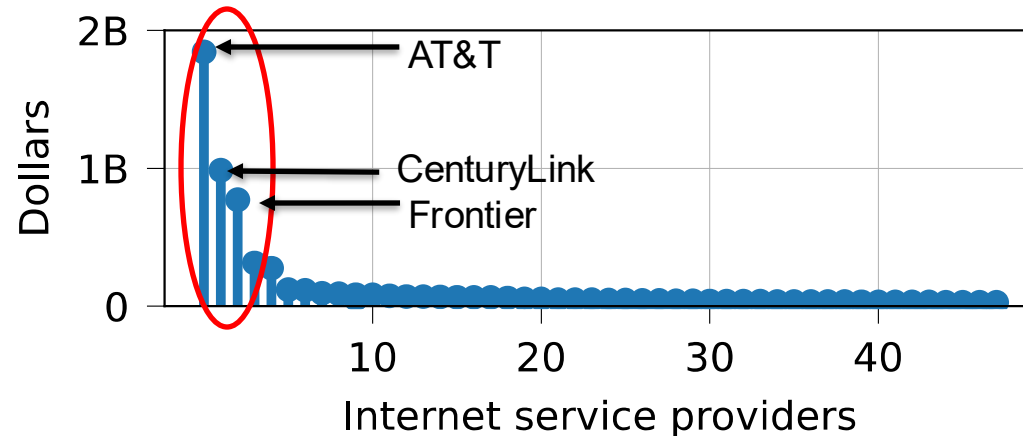
New CAF Dataset: Certified vs. Advertised Information

Which ISPs and addresses to query?



New CAF Dataset: Certified vs. Advertised Information

Which ISPs and addresses to query?



- Targeted **top-3 ISPs** (AT&T, CenturyLink, Frontier) and a smaller ISP (Consolidated) covering more than 50% of CAF addresses
- Selected **15 states** for geographic diversity where these ISPs are primary providers
- Randomly chose **30+ addresses (at least 10%)** from each census block group

New CAF Dataset curated with BQT

ISPs	CAF Addresses Collected
AT&T	233,247
CenturyLink	111,841
Frontier	169,766
Consolidated	22,806

Broadband plan data for **687k** street addresses:

- **537k** CAF addresses
- **149k** non-CAF addresses

Question 1: Are ISPs Truthful?

After collecting data using our BQT tool, there was an overall serviceability rate of only **55%**.

Question 1: Are ISPs Truthful?

After collecting data using our BQT tool, there was an overall serviceability rate of only **55%**.

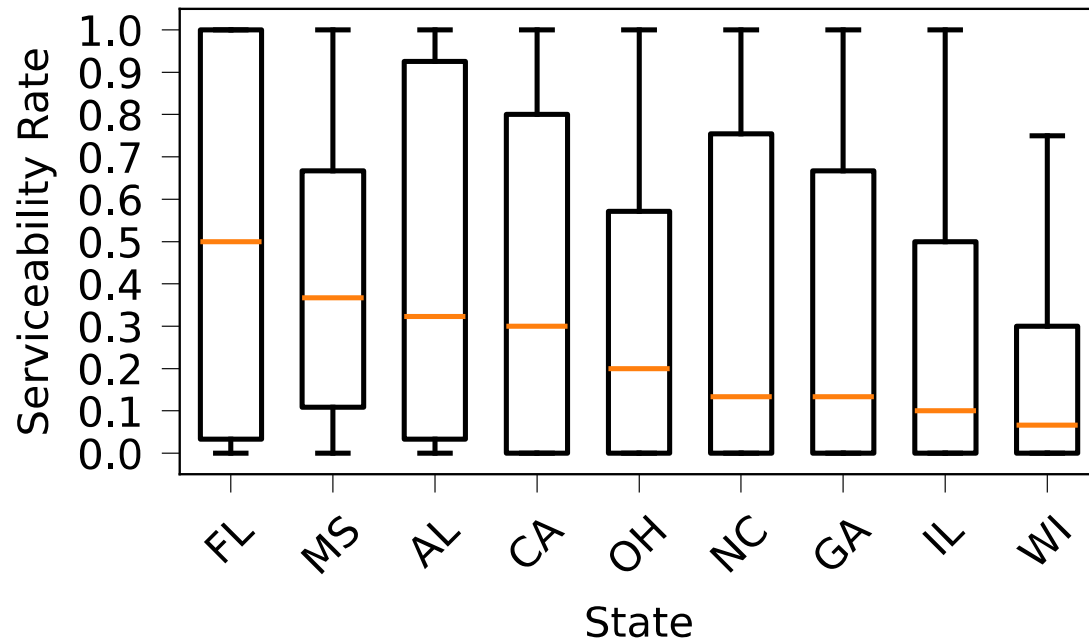
ISPs	Serviceability Rate (%)
AT&T	31
CenturyLink	90
Frontier	70
Consolidated	84

Question 1: Are ISPs Truthful? – let's focus on AT&T

AT&T received around **\$1 billion** through the CAF program.

Question 1: Are ISPs Truthful? – let's focus on AT&T

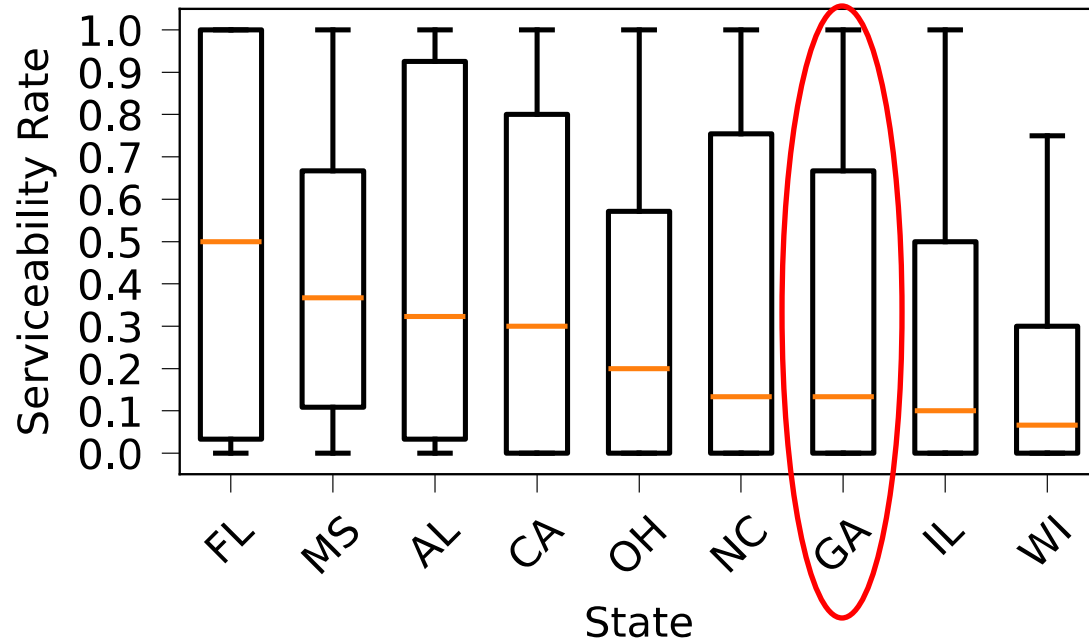
AT&T received around **\$1 billion** through the CAF program.



AT&T

Question 1: Are ISPs Truthful? – let's focus on AT&T

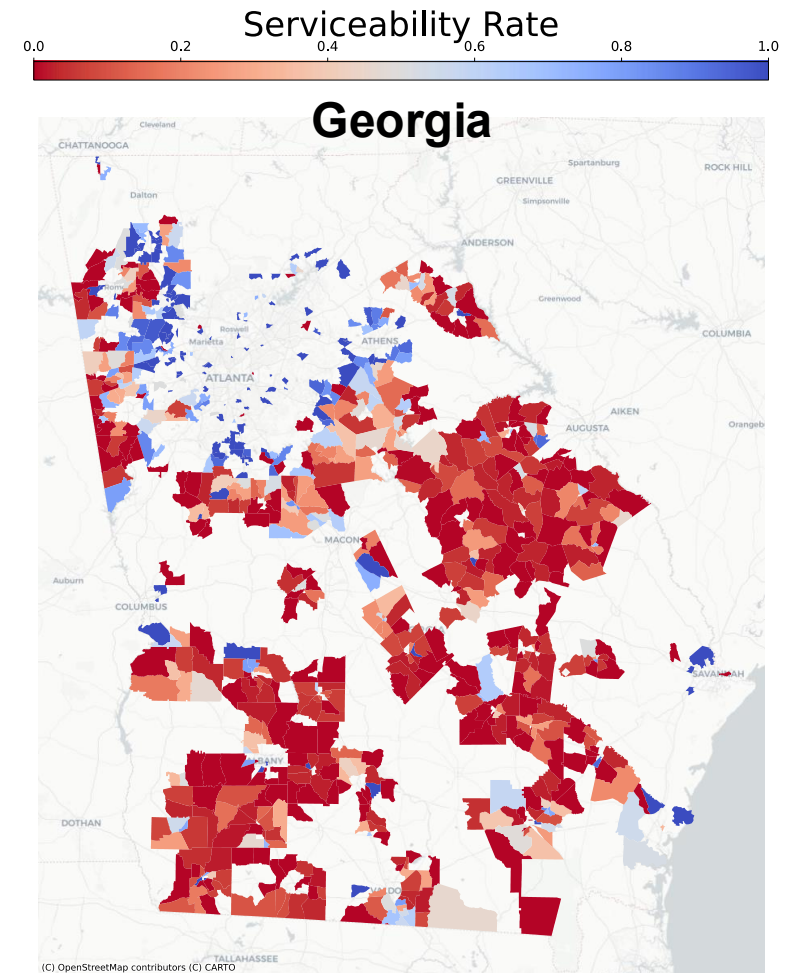
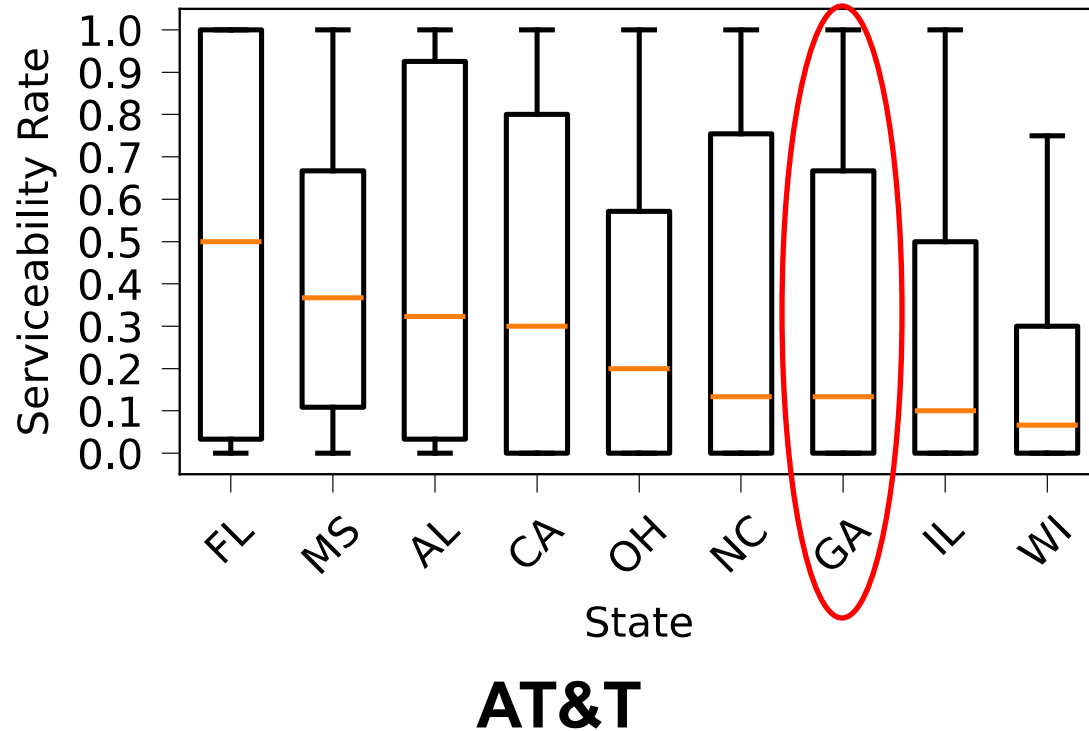
AT&T received around **\$1 billion** through the CAF program.



AT&T

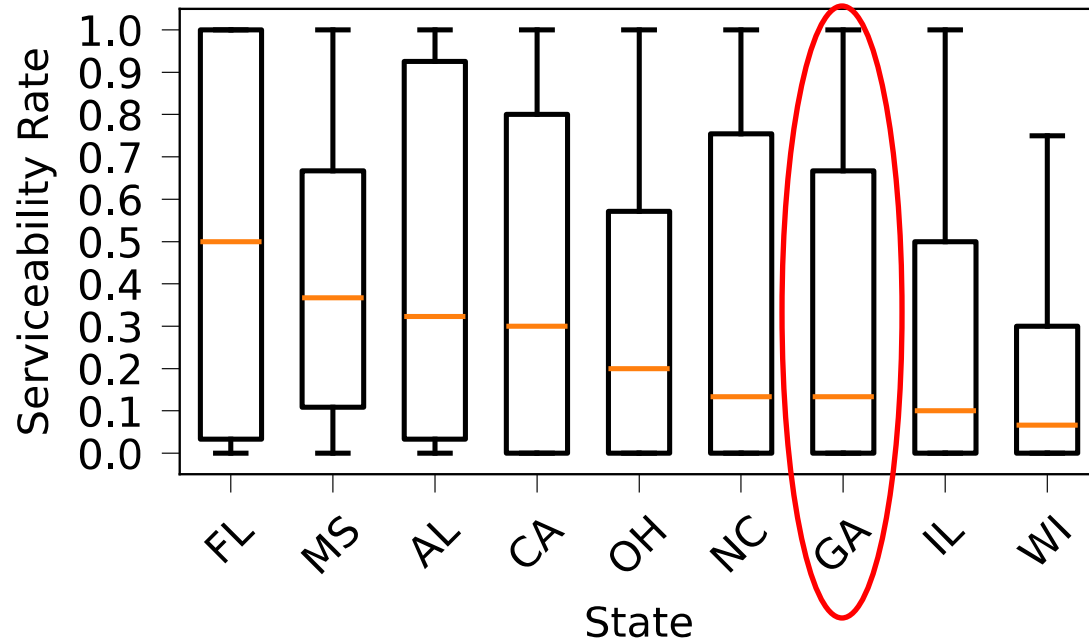
Question 1: Are ISPs Truthful? – let's focus on AT&T

AT&T received around **\$1 billion** through the CAF program.

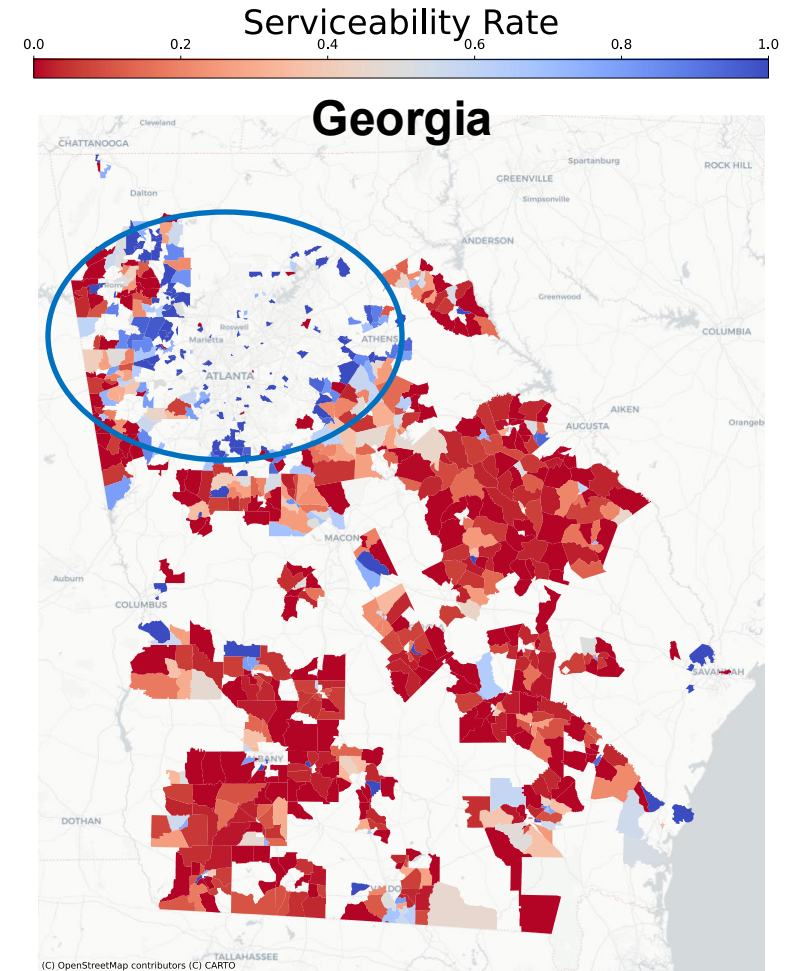


Question 1: Are ISPs Truthful? – let's focus on AT&T

AT&T received around **\$1 billion** through the CAF program.

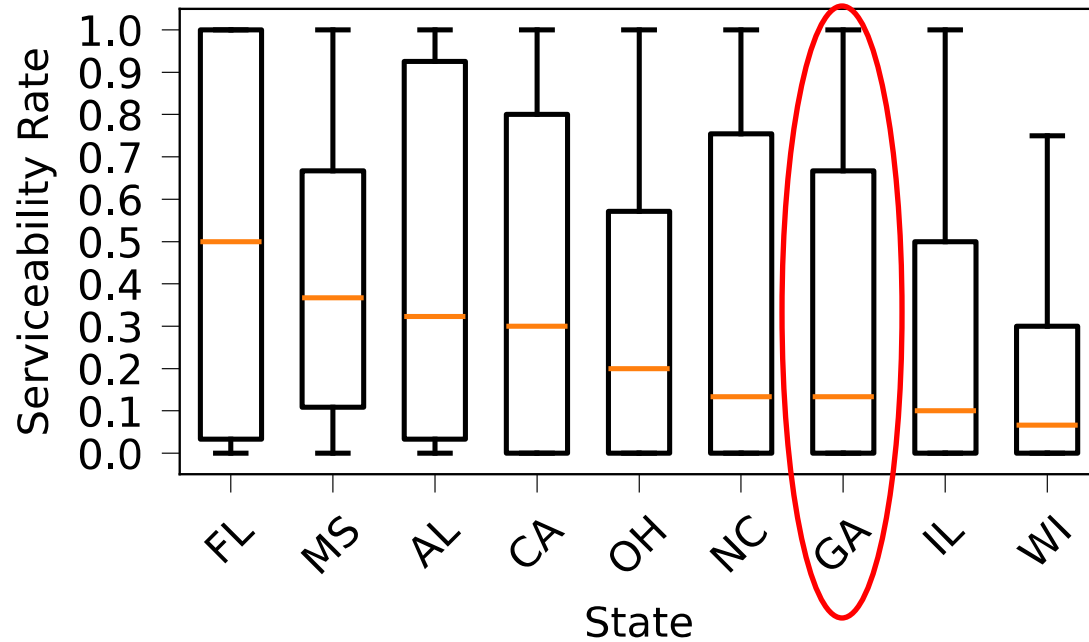


AT&T

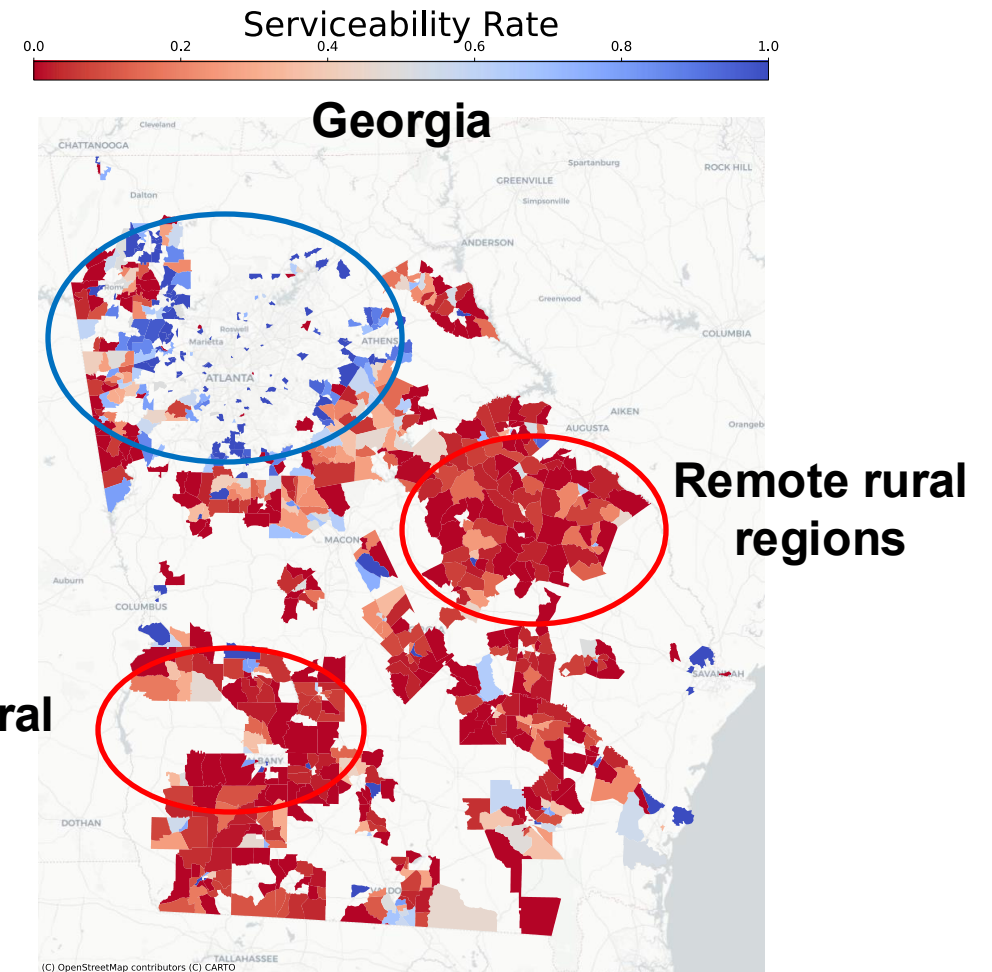


Question 1: Are ISPs Truthful? – let's focus on AT&T

AT&T received around **\$1 billion** through the CAF program.



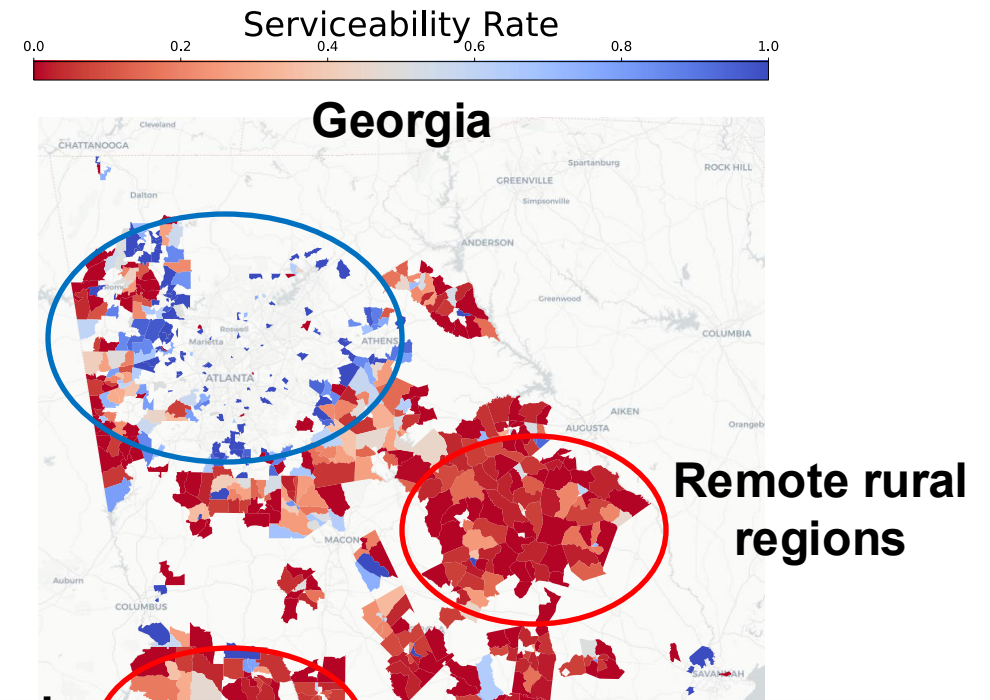
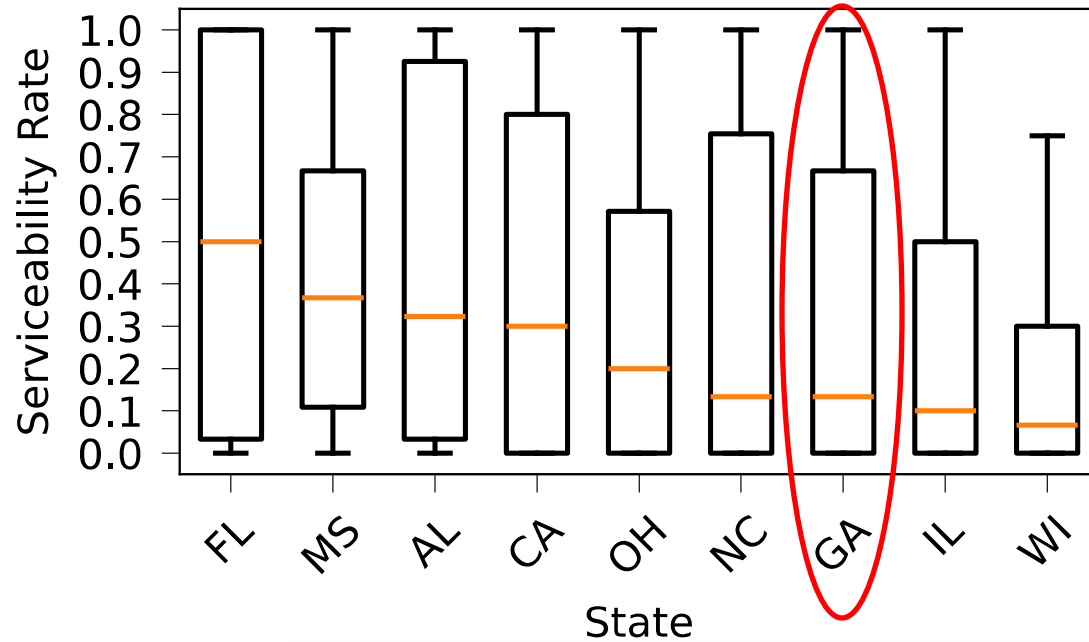
AT&T



Remote rural
regions

Question 1: Are ISPs Truthful? – let's focus on AT&T

AT&T received around **\$1 billion** through the CAF program.



AT&T ignores the primary targets for the CAF program at least in Georgia --- **remote rural regions**

Question 2: Are ISPs compliant with speed and price requirements?

Question 2: Are ISPs compliant with speed and price requirements?

We observe an aggregate compliance rate of only 33%.

Question 2: Are ISPs compliant with speed and price requirements?

We observe an aggregate compliance rate of only 33%.

ISPs	Serviceability Rate (%)		Compliance Rate (%)
AT&T	31%	➡	17%
CenturyLink	90%	➡	69%
Frontier	70%	➡	15%
Consolidated	84%	➡	84%

Question 2: Are ISPs compliant with speed and price requirements?

We observe an aggregate compliance rate of only 33%.

ISPs	Serviceability Rate (%)		Compliance Rate (%)
AT&T	31%	➡	17%
CenturyLink	90%	➡	69%
Frontier	70%	➡	15%
Consolidated	84%	➡	84%

Among the addresses served, all ISPs offer substandard broadband plans. AT&T and Frontier are the worst offenders.

Question 2: Are ISPs compliant with speed and price requirements?

Frontier Internet service is not provided based on speed tiers or other level of performance and Frontier does not guarantee that you will be able to perform any particular Internet activity with the service. For details see: frontier.com/internetdisclosures. Requires Auto Pay or \$10/mo fee applies. Printed bill available for \$2.99/mo. Fee does not apply to select customers. Installation (\$100) and other applicable charges, additional services and taxes are extra & subject to change during & after the promo period. A \$50 equipment restocking fee per household applies when Internet is disconnected. A fee up to \$150 per device also applies if equipment is not returned. Service subject to availability. Price and terms subject to change. Cannot be combined with other offers. Other restrictions, Frontier policies and service terms apply.



download at least
10Mbps/upload at
least 1Mbps

Among the addresses served, all ISPs offer substandard broadband plans. AT&T and Frontier are the worst offenders.

Question 3: Are Regulated Monopolies Better?

Steps:

- Examine the plans received by people covered by monopolies to those received by unregulated monopolies (CAF)
- Determine whether the plans are on par with those in areas with multiple providers (competition)
- Focus on 7 states and collect non-CAF residential data from a dataset provided by Zillow
 - Remove addresses receiving no service
- Consider three types of CAF-served census blocks
 - Type A: CAF ISP is only operating in CAF and monopoly modes
 - Type B: CAF ISP is only operating in CAF and competition modes
 - Type C: CAF ISP is operating in all three modes

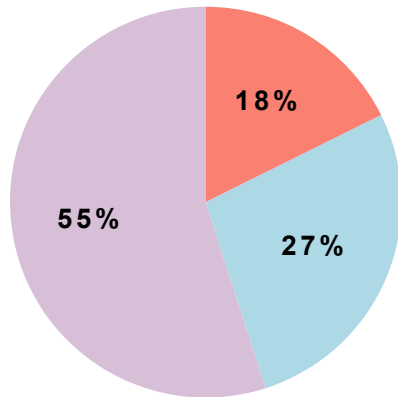
Question 3: Are Regulated Monopolies Better?

Do regulated monopolies offer better value to end users than unregulated ones?

Question 3: Are Regulated Monopolies Better?

Do regulated monopolies offer better value to end users than unregulated ones?

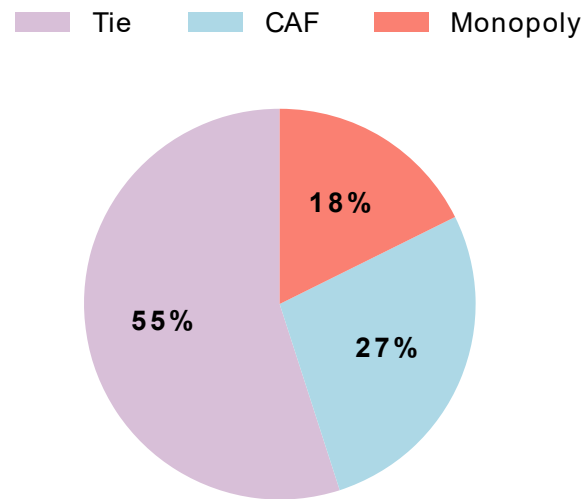
Tie CAF Monopoly



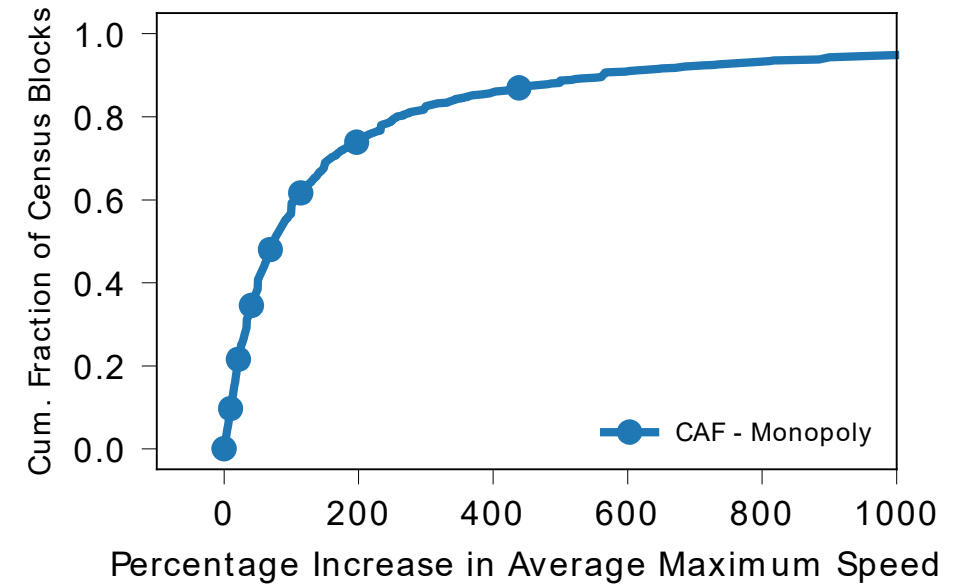
Regulated monopolies (CAF) are better (27%) or at par (55%) in **82%** of total census bocks

Question 3: Are Regulated Monopolies Better?

Do regulated monopolies offer better value to end users than unregulated ones?



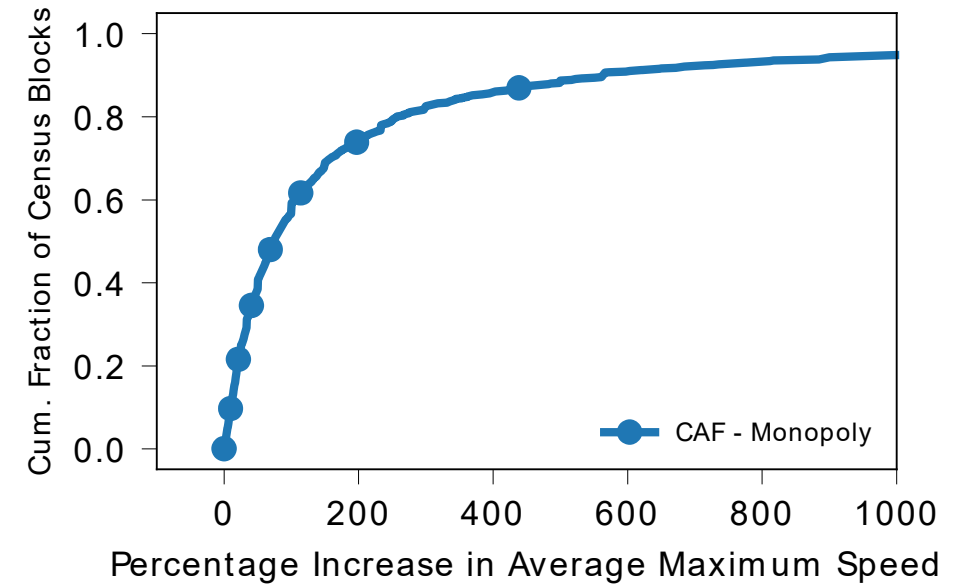
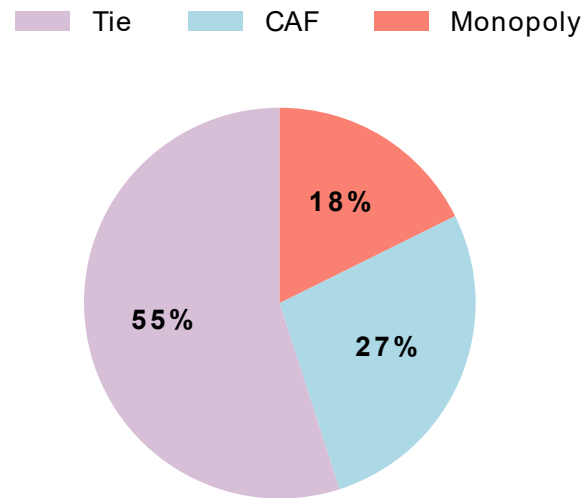
Regulated monopolies (CAF) are better (27%) or at par (55%) in **82%** of total census blocks



For the 27% census blocks, where CAF is better, improvement is significant

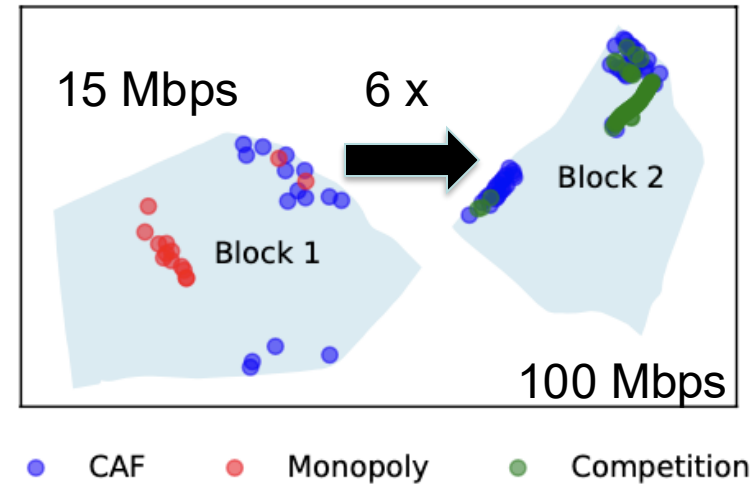
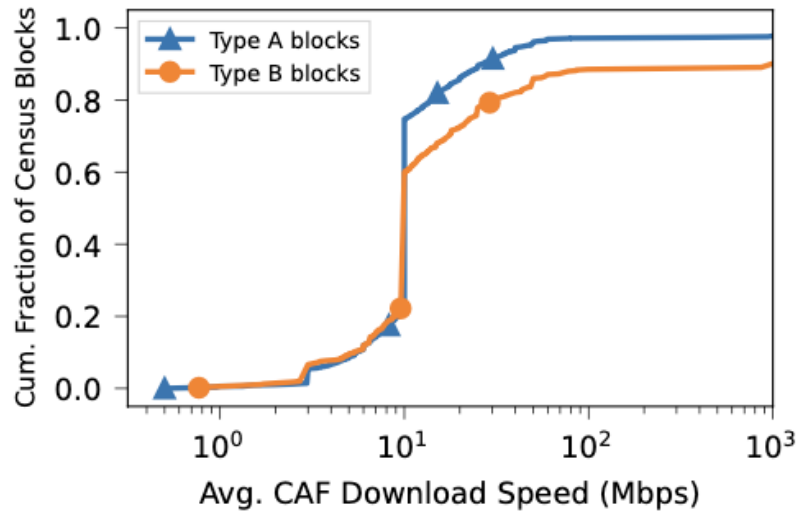
Question 3: Are Regulated Monopolies Better?

Do regulated monopolies offer better value to end users than unregulated ones?



Regulated monopolies are better only in a few census blocks.

Question 3: Are Regulated Monopolies Better?



Comparing the performance of CAF addresses across Type A (CAF+Monopoly) and Type B (CAF+Competition) blocks

Let's Revisit Our Questions ...

Let's Revisit Our Questions ...

- **Question 1:** Are some ISPs **truthful** about all the addresses they certify as served?
 - No, only 55% of addresses we surveyed received service from the ISP

Let's Revisit Our Questions ...

- **Question 1:** Are some ISPs **truthful** about all the addresses they certify as served?
 - No, only 55% of addresses we surveyed received service from the ISP
- **Question 2:** Do some ISPs always **comply** with FCC's service quality and rate requirements?
 - No, the overall compliance rate for service quality was 33%

Let's Revisit Our Questions ...

- **Question 1:** Are some ISPs **truthful** about all the addresses they certify as served?
 - No, only 55% of addresses we surveyed received service from the ISP
- **Question 2:** Do some ISPs always **comply** with FCC's service quality and rate requirements?
 - No, the overall compliance rate for service quality was 33%
- **Question 3:** Do regulated monopolies offer **better value** to users than unregulated ones?
 - Users received an improvement in broadband service, even if inconsistently (27% of the time)

Current and Future Efforts

Ongoing Work

- Assessing other policy interventions:
 - NY's affordable broadband act
 - Internet access in Colorado
- Expanding BQT to more ISPs
- Working with State government organizations in Virginia and California
- Working with Pew Research and the Institute for Self Reliance (ILRS)

Press and other coverage

- Harvard Law Review blog July 16, 2024
- Broadband Breakfast coverage July 12, 2024
- US Supreme Court Brief Submitted, Oct 12 2024
- Internet Society blog post, Nov 3rd 2024



Current and Future Efforts

Ongoing Work

- Assessing other policy interventions:
 - NY's affordable broadband act
 - Internet access in Colorado
- Expanding BQT to more ISPs
- Working with State government organizations in Virginia and California
- Working with Pew Research and the Institute for Self Reliance (ILRS)

Press and other coverage

- Harvard Law Review blog July 16, 2024
- Broadband Breakfast coverage July 12, 2024
- US Supreme Court Brief Submitted, Oct 12 2024
- Internet Society blog post, Nov 3rd 2024

Reach out to me:

Haarika Manda, hmanda@ucsb.edu

Project website: address.cs.ucsb.edu

