

Workshop on Bridging the Divide — Workshop Report

Arpit Gupta, *UC Santa Barbara*

Tejas Narechania, *UC Berkeley*

Katherine Townsend, M-Lab

[Website](#)

Table of Contents

Motivation	1
Organization	3
Welcome Remarks	4
Research Questions	4
Keynote Address	5
Research Questions	5
Short-Term Challenges and Opportunities (Day 1)	6
Panel	6
Research Questions	6
Breakout Session	7
Research Questions	8
Long-Term Priorities and Strategies (Day 2)	9
Panel	9
Research Questions	10
Breakout Session	11
Research Questions	12
Recommendations	13
Appendix: Schedule and Attendees	13
Schedule	13
Attendees	14

Motivation

Many aspects of our lives have transitioned online, particularly after the Covid-19 pandemic. However, not everyone has equal access to the Internet, yielding significant disparities in digital equity. As a result, policymakers and researchers across disciplines are working to address questions regarding the state of internet access and digital equity. Answers to these questions can inform policy interventions, including consumer subsidy programs, rate regulations, and infrastructure funding.

While regulators might use existing datasets to answer these policy questions, these datasets present challenges and complications that often lead to misleading conclusions. The National Broadband Map dataset curated by the FCC is a prime example. Policymakers at the federal level have used this dataset to determine funding allocations for the Broadband Equity, Access, and Deployment (BEAD) program. However, because this dataset relies predominantly on self-reported information, its accuracy has been the subject of serious questions and concerns. Gaps and errors in

this data may yield misaligned funding decisions, with effects that are likely to be felt especially severely in historically or intentionally underserved areas. This is only one example. A large and widespread gap exists between policymakers' needs and currently available data.

The core digital divide is characterized by a glaring disparity in broadband access, underscored by gaps in both availability and quality. However, these matters are exacerbated by the absence of a unified and multidisciplinary research agenda that could point toward more comprehensive solutions. Hence, in our view, the digital divide encompasses multifaceted challenges not only in the domains of broadband access but also in matters of data quality and research cohesion. The workshop accordingly convened leaders from the academy, industry, and government to define pressing policy questions and discuss the tools and methods familiar (and new) to the network measurement community to launch new and collaborative approaches to solving these challenges and addressing inequities in internet access.

By bringing together experts from across domains, our primary goal was to catalyze new ideas, collaborations, and solutions to counter internet inequity within the U.S. and abroad. Specifically, we sought to formulate a comprehensive research agenda that would help identify pressing policy needs, enhance data quality, and develop research opportunities and practical tools to help address broadband access, affordability, and adoption questions.

The envisioned multidisciplinary research agenda encompasses all these dimensions of broadband equity: access, affordability, and adoption. This research agenda thus forms the bedrock upon which comprehensive research and policy discussions and explorations can be based. An essential component of this effort is the thorough understanding and characterization of existing data sources and gaps, including those pivotal to shaping policy interventions such as the [Broadband Equity, Adoption, and Deployment \(BEAD\) program](#). Complexity varies across these dimensions, with availability being comparatively more straightforward due to existing datasets, quality presenting challenges due to noisy data, and affordability standing out as the most intricate due to the absence of comprehensive datasets. Hence, possible matters of inquiry span identifying regions devoid of high-quality broadband, assessing the influence of competition on broadband costs, and unraveling the mechanisms behind broadband adoption. This research agenda enables experts across disciplines to address data gaps and digital inequities collectively, setting its sights on fundamental questions related to broadband availability, quality, affordability, and adoption.

Collectively, the workshop fervently advocated for a comprehensive, multidisciplinary, and longitudinal approach that addresses the digital divide head-on. By prioritizing data quality, fostering research collaboration, and steering policy actions, the workshop strove to pave the way for enhanced broadband access, affordability, and adoption, thus forging a fairer digital future for all.

Organization

We structured the workshop as a two-day event, with each day featuring a panel discussion followed by a breakout session. Day one focused on short-term challenges and opportunities, while day two delved into long-term priorities and strategies. Additionally, (former) FCC Chairwoman Mignon Clyburn delivered a keynote titled "Finding the Answers: The Role and Efficacy of Data in Bridging the Digital Divide" on the first day.

Participants were divided into five groups for the breakout sessions, including one that joined remotely via Zoom. This arrangement ensured an engaging environment and allowed all attendees to express their viewpoints. Each session had a designated discussion facilitator and a note-taker. The primary objective of these sessions was to foster connections across various disciplines and gather input from participants, and the groups were designed to reflect

that aim. Each group was asked to identify existing policy questions, challenges, data requirements, gaps, and potential solutions.

We began each breakout session by having everyone introduce themselves in no more than one minute. Our breakout sessions then primarily revolved around four core questions:

- *What Do You Need?* This question focuses on the participant's broadband-centered objectives within their current role or organization. What information do they need to make informed decisions about these goals? Moreover, what do they require to make various decisions concerning broadband programs like BEAD, the Connect America Fund (CAF), or the Affordable Connectivity Program (ACP), etc.?
- *What Do You Use?* Here, we will examine the current practices of the participants. Specifically, we want to know what data, tools, and infrastructure they utilize to make the decisions we discussed above.
- *What Are the Gaps?* This question aims to identify the pain points in current practices. We'll explore the participants' wishlist of data, tools, and features that could help address these pain points.
- *How Can We Bridge These Gaps?* The last question seeks to brainstorm possible solutions to bridge the gap between what's currently available and what's needed. What can we collectively do as a community to bridge this gap? We will encourage the participants to converge on practical solutions and identify if/how FCC, NSF, NTIA, etc., could support these ideas.

These questions were open-ended and were designed to stimulate thoughtful and productive discussions without straying from the main workshop agenda.

The rest of this report summarizes discussions that were held at UC Berkeley on June 20–21, 2023. The report appendix includes a summary of workshop attendees and agenda.

Welcome Remarks

Welcome remarks by the workshop's organizers set the stage for the workshop by highlighting the problems of the digital divide and elaborating on the policy and data challenges regarding broadband access and affordability, all while emphasizing the need for interdisciplinary collaboration.

One main theme of the welcome remarks was to describe the relationship between the digital divide, the gaps in our knowledge of broadband markets, and the siloed structure of existing broadband research. Greater interdisciplinary collaboration can help fill in our data gaps, and with better information, scholars and policymakers may be able to address the digital divide better.

Hence, the remarks highlighted the need for data and solutions across all three dimensions of the digital divide: broadband access, affordability, and adoption, proposing one possibility for each. On access, the remarks proposed simply verifying existing government datasets on broadband access, noting that those existing datasets (which have been critiqued for widespread errors resulting from poor data collection methods) are behind the allocations of billions of dollars of federal funds. Here, one organizer highlighted the potential for crowdsourced speed test data, such as from M-Lab or Ookla, to serve as a means for independently verifying claims about broadband access and service quality. On affordability, the remarks proposed measuring the efficacy of various federal programs aimed at subsidizing broadband access or controlling monopoly pricing. On adoption, the remarks proposed studying grants aimed at helping consumers sign up for affordability subsidies, such as ACP, to determine whether these programs improve uptake and adoption.

The welcome remarks also described one example of a fruitful interdisciplinary collaboration by two of the organizers on the subject of broadband affordability. Specifically, the remarks described the development of a [Broadband Plan Querying Tool \(BOT\)](#) that was used to develop and curate a first-of-its-kind dataset of broadband plans and prices. The remarks further described how that dataset was used to answer questions of critical importance to policymakers, such as the effect of competition on the cost and quality of consumer internet access. However, the remarks emphasized that this was only one example of such a collaboration, and there were many more gaps and opportunities to explore. Indeed, later conversations during the workshop pointed out that this work, while adding new, useful, and powerful information, was also limited in some important respects. It, for example, reflects the state of affordability at only one moment in time, and workshop participants emphasized the need for longitudinal studies, too.

Research Questions

- How can we verify public datasets on broadband access and availability?
- How effective are federal regulations requiring that certain grantees offer broadband access at “reasonable rates”?
- Are grant programs aimed at driving the adoption of broadband (as well as consumer broadband subsidies) effective?
- How can we develop mechanisms for conducting longitudinal studies and analyses of matters of access, affordability, and adoption?

Keynote Address

The keynote address delivered during the workshop focused on critical aspects of data requests, challenges, solutions, and opportunities in the context of bridging the digital divide and promoting equitable broadband access. The speaker highlighted key points that underscored the complexity and urgency of addressing internet inequity.

One of the central themes revolved around the importance of data in formulating effective policy interventions. The speaker presented various data requests that are essential to understanding the dynamics of internet access and affordability. These included data on the number of [Affordable Connectivity Program \(ACP\)](#) homes that are new broadband subscribers, data on individuals who had to suspend their broadband service due to financial emergencies, and data on the impact of enrollment campaigns. The goal was to gather insights into user behaviors, needs, and challenges to inform decisions regarding the ACP subsidy and affordable access.

A significant problem highlighted was determining the appropriate ACP subsidy, which had been reduced from \$50 (under the Emergency Broadband Benefit program) to \$30 due to a desire to demonstrate user investment in the service. To address this, the speaker emphasized the need for data on what ACP subscribers pay beyond the \$30/month subsidy, providing insights into the affordability gap and potential solutions.

Another challenge addressed was defining affordable access. The speaker emphasized the need for comprehensive data to establish the parameters of affordability, including a post-pandemic assessment of low-income households' willingness to pay for broadband services.

The keynote also delved into issues of data collection and gaps in advocacy. The speaker highlighted that organizations like NTIA, Public Knowledge, and Free Press often lack comprehensive research and data collection resources. To overcome this, the speaker proposed collaboration between academics and advocacy groups, enabling researchers to fill data gaps and present findings to policymakers and decision-makers.

Opportunities were also outlined, particularly in the context of the new working group to study Universal Service Fund reforms (USF) reforms. This development, coupled with the use of (new) maps at the FCC, provided an avenue for research findings to be scrutinized and considered by policymakers, thus shaping future interventions.

In conclusion, the keynote addressed the collective responsibility to reshape and improve the way society approaches digital equity. The speaker emphasized the power of affirmative thinking and the need to approach the challenge with the mindset of "this can be done." The keynote urged participants to recognize the potential to connect communities, narrow divides, and improve overall societal well-being. The speech concluded with a call to action, emphasizing that participants have a vital role to play in this endeavor, with the potential to effect meaningful change through their collective efforts.

Research Questions

- How can we accurately determine the optimal subsidy amount for the Affordable Connectivity Program (ACP) and assess its impact on affordability?
- What strategies can effectively measure the outcomes of enrollment campaigns and distinguish between new enrollment and individuals no longer eligible?
- How can affordable access be redefined and measured post-pandemic, considering diverse willingness-to-pay data and factors influencing broadband adoption?
- What innovative methods and datasets can be employed to comprehensively understand market failures and adjust cost models for equitable broadband access?
- How can interdisciplinary collaborations between academia, advocacy groups, and policymakers reshape societal perspectives and bridge data gaps for impactful policy interventions that address digital equity?

Short-Term Challenges and Opportunities (Day 1)

Panel

The panel discussion focused on various aspects of broadband access, challenges, and potential solutions. Participants emphasized the need to break down silos between researchers and stakeholders to tackle broadband inequities effectively. The discussion covered several key points:

- Mapping Infrastructure and Regulatory Hurdles: The panel underscored the importance of accurately mapping private critical infrastructure and emphasized the removal of regulatory barriers to enable smoother broadband expansion efforts.
- Connectivity and Outages: The discussion touched on the significance of consistent connectivity, particularly the disruptions faced by individuals for varying durations. Concerns were raised about the lack of comprehensive data on outages and the need for such information to be available.
- ACP Impact Assessment: Participants considered the impact of the Affordable Connectivity Program (ACP) on previously unconnected households and the broader implications for education and socioeconomic development.
- Barriers to ACP Enrollment: The conversation revolved around exploring why households did not enroll in the ACP. Issues like address validation, eligibility criteria, and the high abandonment rate of ACP applications were examined.
- Identifying Underserved Areas: The discussion highlighted the necessity of identifying areas lacking adequate broadband coverage and streamlining access to broadband services for residents.

- **Broadband Affordability and Adoption:** The importance of affordable access and digital literacy beyond specific job needs was acknowledged. Research into affordability, adoption, and digital skills was deemed pivotal.
- **Advocacy through Data:** Collaborative efforts between academics and advocacy groups were considered as a means to bridge data gaps and effectively influence policy decisions.
- **ISP Data Transparency:** Transparency in Internet Service Provider (ISP) data, especially subscription levels and service tiers, emerged as a concern for researchers and policymakers alike.
- **Broadband's Utility Status:** The notion of broadband as a utility and strategies to communicate its value to policymakers and the public were explored.
- **Future Research and Data Collection:** Participants voiced the need for sustained data collection on meaningful internet use and quality indicators. Questions arose around defining meaningful internet use and devising effective measurement methodologies.

Research Questions

- What are the main barriers preventing households from enrolling in the Affordable Connectivity Program (ACP), and how can these barriers be addressed to improve enrollment rates?
- How can we comprehensively map private critical infrastructure and regulatory barriers to facilitate broadband expansion?
- What are the most meaningful indicators of internet use, and how can researchers gather data to measure these indicators accurately?
- How can researchers and policymakers collaborate to improve the transparency of ISP data, particularly subscription levels and service tiers?
- What key factors influence meaningful internet adoption beyond specific job-related needs, and how can digital skills be integrated into broader societal participation?
- What strategies can be employed to identify unserved and underserved areas more effectively, and how can access to broadband be made easier for residents in these areas?
- How has the Affordable Connectivity Program (ACP) impacted previously unconnected households, education, and socioeconomic aspects, and what factors contribute to its success or challenges?
- How can researchers collaboratively bridge data gaps with advocacy groups to influence policy decisions effectively and address issues of digital equity?
- How can the perception of broadband as a utility be reinforced, and what strategies can be used to convey its value to policymakers and the public?
- In the context of evolving technology and connectivity, what are the most relevant indicators of broadband quality and accessibility that must be consistently monitored and measured?

Breakout Session

The first breakout sessions focused on short-term challenges and opportunities in bridging the divide. Specifically, it focused on defining broadband equity, related data needs, and potential solutions to bridge the divide. Participants from diverse backgrounds, including academia, policy, law, and infrastructure, engaged in dialogue to explore challenges, data sources, gaps, and potential remedies to ensure equitable broadband access and address disparities in underserved areas.

Specifically, different breakout sessions covered the following themes.

- **Policy and Data Needs**
 - Identified the need to convince politicians about potential threats to major ISPs, advocating for diversification of digital economy assets through public funds.
 - Emphasized data requirements encompassing surges, outages, throttling, and real-time usage patterns, cross-referenced with demographic information at the block level.
 - Explored leveraging existing adoption data from fiber deployments to challenge the argument of economic infeasibility in underserved communities.

- Discussed the competitive impact of fixed wireless in rural areas, similar to the evaluation of DSL's competition.
- Noted the possibility of using data regarding underserved or overcharged communities to highlight market opportunities for new providers and entrants.
- Highlighted the need for a “clearinghouse” of datasets and resources, which are otherwise difficult to find, often of uncertain quality, and scattered across academic and government institutions.
- **Data Granularity and Definitions**
 - Discussed challenges related to granular household data, emphasizing data reliability and the necessity to standardize metrics.
 - Underlined the importance of accurately defining the unserved population to address disparities.
 - Explored the need for standardized concepts of access and affordability definitions to ensure consistency and transparency.
- **Collaboration and Resource Sharing**
 - Focused on addressing data scarcity through collaboration among organizations, suggesting coordination to pool available resources.
 - Acknowledged the significance of, and need for, sustaining routine data collection efforts that may not be perceived as groundbreaking but are essential.
- **ISP Transparency and Influence**
 - Stressed the importance of holding ISPs accountable for transparent network deployment, interconnection practices, and sharing relevant data.
 - Highlighted the role of technical experts in influencing FCC policies and bridging the gap between technical understanding and policymaking.
 - Suggested the possibility of equipment-based continuous measurements.
- **Service Quality and Affordability**
 - Addressed gaps in data regarding network shutdowns and service quality, acknowledging the need for metrics beyond upload and download speeds.
 - Linked service quality to user experience, digital skills, and internet usage patterns.
 - Discussed the affordability challenge, particularly with the expiration of the ACP funding.
- **Interdisciplinary Collaboration**
 - Reflected on the value of interdisciplinary collaboration, recognizing mutual learning and a commitment to maintaining the working relationship for policy advancement.

Research Questions

The discussions across the breakout sessions led to a set of critical research questions the community needs to explore:

- **Data Collection and Metrics**
 - What comprehensive data metrics are crucial for understanding broadband quality, including surges, outages, throttling, and usage patterns, cross-referenced with demographic data?
 - How can accurate ISP data, especially for multi-dwelling units (MDUs), be obtained to ensure coverage is accurately represented?
 - How can sampling methodologies be improved to provide more representative and reliable data on broadband access and adoption?
 - How can data collection efforts be improved to ensure accurate, diverse, and representative data, considering factors like denoising and debiasing?
 - How can inter-agency collaboration be enhanced to pool existing data resources and improve data quality for broadband equity analysis?
 - What innovative measurement techniques can be used to understand user experience better?
- **Metrics Standardization and Analysis**

- How can strategies be employed to standardize metrics for accurately assessing the unserved population's broadband needs, ensuring consistency and transparency?
- How can methodologies measure network shutdowns, service quality, and their impact on user experience and usage patterns?
- What methods can be employed to overlay various data sources effectively to gain insights into consumer behavior and prioritize policy actions?
- What are the best practices for creating user-friendly, plug-and-play data analysis tools that facilitate effective policy decision-making?
- **Broadband Adoption and Affordability**
 - Can existing adoption data from fiber deployments challenge the argument of economic infeasibility for fiber expansion in underserved communities?
 - How can the competitive impact of fixed wireless in rural areas be evaluated, similar to the assessment of DSL's competition?
 - How can affordability challenges be tackled, particularly in light of the ACP funding expiration, and how do they impact digital equity?
 - How can open-access models be effectively implemented to improve competition and sustainability in tribal and underserved areas?
- **Policy Influence and Advocacy**
 - How can policymakers be convinced of the imminent threat to major ISPs to encourage diversification of digital economy assets?
 - How can technical experts advocate for ISP transparency and effectively influence FCC policies to bridge the technical-policy gap?
 - What regulatory changes can strengthen the effectiveness of funding programs to ensure their proper use and transparency?
 - How might regulatory bodies evolve their focus to better serve end-users and address service quality and affordability gaps?
- **Collaboration and Implementation**
 - How can interdisciplinary collaboration be sustained to ensure the continued advancement of broadband policies across various domains?
 - How can states effectively leverage their resources and play a larger role in data collection, analysis, and broadband equity initiatives?
 - What strategies can be employed to address data scarcity through collaboration and resource sharing among organizations?
 - What strategies can be implemented to shift the burden of data collection from consumers to more equipped ISPs?
 - What types of infrastructure audits are most effective, especially for fixed wireless, and how can they inform policy decisions?

Long-Term Priorities and Strategies (Day 2)

Panel

The Workshop's second day began with a panel discussion moderated by a legal scholar and featuring a communications scholar, an internet measurement scholar, a representative from the federal government, a representative from a local (city) government, a leader in local community organizing.

The panel's conversation began with discussing the most pressing policy needs. Panelists first identified the need for consistent, reliable, and affordable broadband internet access. Some panelists asserted that, in California, approximately two-thirds of residents have at most one option for broadband internet access. Hence, given the vast potential for the well-established downsides of monopoly-provided service (namely, higher costs and lower service quality), exacerbating the digital divide, panelists identified a need to understand how to induce market competition better or, alternatively, draft better regulatory measures.

Building on these remarks, other panelists noted the digital divide's various dimensions. Decades of research establish that there are dozens of dimensions to the digital divide: Reliable access to communications technologies depends on one's race, class, address, educational achievement, and so much more. While we have studied these individual divides at particular moments in time, we still lack a comprehensive and longitudinal view of the digital divide. Panelists noted the need for longitudinal studies that examined which interventions most effectively improved broadband access and adoption, as well as for studies that examined whether broadband access or adoption gave rise to positive outcomes on measures we might care about, such as educational achievement, income, or health. Panelists noted that our current data and data collection systems did not support this research well.

The panel's conversation thus turned to matters of data collection and analysis. The representative from the federal government explained that new regulatory requirements regarding consistent labeling of broadband ISP's offerings should help to enable more systematic data collection. Each provider must post a machine-readable "broadband nutrition label" with identifiers, allowing the researcher to connect these offerings to specific providers.

Panelists noted that a public repository of pricing data would be intensely valuable to new and ongoing research efforts. Likewise, a survey of the population that is eligible for various federal and state broadband subsidies would help policymakers better target policy interventions. Uptake in these programs is surprisingly low, and policymakers (and researchers) struggle to understand whether these subsidies go to users who would have purchased broadband access anyway or whether they are critical to making the internet accessible to new users; such a study could similarly help researchers and policymakers better understand the impediments to adopting these programs: e.g., is it a lack of awareness, or lack of access to computing devices, or digital literacy, or a belief that one does not need internet access.

Beyond affordability and adoption, other panelists commented on the lack of good information about broadband providers' performance and reliability. Some panelists explained that studies that rely on speed tests suffer from large selection effects since consumers only selectively use speed tests. Again, we do not have consistent longitudinal measurements to assess network performance and improvement over time. Moreover, collecting these metrics alongside geography is particularly challenging.

Finally, the panel turned to questions from the audience. One audience member noted the long history of regulatory programs aimed at improving broadband internet access and noted that, anecdotally, some locations seem to have received multiple iterations of funding. The questioner wondered whether there was an opportunity here to assess the efficacy of these programs. Another questioner asked about the FCC's maps of broadband internet access, noting that they seemed widely inconsistent with the lived experiences of members of her community.

Panelists responded to both questions by noting the challenges and opportunities they present. On funding programs, for example, one panelist noted that one of the challenges in studying these programs is that they often have many different sources. Some locations receive state and federal funding, and even within the federal government, multiple agencies have responsibility for different programs that fund broadband infrastructure. Hence, one obvious opportunity is to simply collate information from all these sources into one large funding dataset. That, coupled with other access and affordability data, might tell us how these funds have been used and to what effect.

Research Questions

- **Long-Term Solutions and Problem Definition**
 - How can robust definitions of digital divide problems be established and researched to ensure accurate problem-solving?
 - What strategies can effectively address long-term market competition and state regulation issues in bridging the digital divide?
- **Data Needs and Affordability**
 - What data metrics are crucial for evaluating broadband quality, including surges, outages, throttling, and usage patterns, and how can they be cross-referenced with demographic data?
 - How can data on affordability be effectively collected and analyzed to address challenges related to access and usage?
- **Equity and Impact Assessment**
 - How can equity-focused research be integrated into digital divide studies, including analyzing impacts on racial and socioeconomic disparities?
 - What methodologies can measure the relationship between infrastructure investment and equity outcomes, particularly in terms of access to services like telehealth and AI?
- **ISP Transparency and Regulation**
 - What strategies can be employed to advocate for ISP transparency, particularly in relation to performance and reliability data?
 - How can regulatory bodies ensure that ISPs provide accurate, comprehensive, and accessible data that reflects the true state of broadband access?
- **Data Collection and Availability**
 - How can data scarcity be addressed through collaborative efforts, including inter-agency collaboration and resource sharing?
 - What strategies can improve data collection accuracy, diversity, and representation while considering denoising and debiasing techniques?
- **Affordability and Participation Barriers**
 - What factors contribute to low participation rates in broadband assistance programs like Lifeline and ACP, and how can these gaps be bridged?
 - How can research aid in identifying and addressing barriers such as awareness, access to devices, and digital literacy that hinder program enrollment?
- **Policy Impact Evaluation**
 - What methodologies can be implemented to assess the effectiveness of policies aimed at bridging the digital divide, quantifying impact per dollar spent?
 - How can a comprehensive database be developed to track and analyze funding initiatives across different levels (local, state, federal, and non-profit)?
- **Interdisciplinary Collaboration and Data Accessibility**
 - How can interdisciplinary collaboration be fostered to ensure research advancements in broadband policies across various domains?
 - What tools and platforms can be developed to make data more accessible and usable for social scientific research, especially for non-data science users?
- **Mapping and Accuracy**
 - How can mapping inaccuracies and misrepresentations in broadband coverage be prevented, and what collaborative efforts are needed to ensure accurate mapping?
 - How can the research community work together to challenge misleading representations and provide accurate data to address the digital divide effectively?

Breakout Session

The first breakout sessions focused on long-term challenges and opportunities in bridging the divide. Specifically, it focused on suggestions for dataset development, research projects, and other sustained efforts that would be needed to bridge the digital divide. Again, these sessions involved participants from diverse backgrounds.

Different breakout sessions covered the following themes.

- **Policy and Data Needs**
 - Explored the relationship between municipally-provided broadband and consumer rates and service quality.
 - Discussed the possibility of conditioning federal grant money on a promise to support equipment-based continuous measurement.
 - Highlighted the importance of bringing academic work to the attention of federal policymakers, including the FCC and NTIA, through public comments on proposed regulations.
 - Noted the differential burden between ISPs and the public in participating in the federal regulatory processes, including commenting on proposed regulations or challenging federal maps of broadband availability.
 - Noted the importance of both quantitative and qualitative studies.
 - Suggested beginning longitudinal research now that is aimed directly at measuring the efficacy of new federal funding (BEAD).
- **Data Granularity and Definitions**
 - Underscored the need for a robust and standardized measure for network performance and the importance of correlating such information with socio-economic data.
 - Noted the possible trade-offs between granularity and privacy and emphasized the need to assure consumers about the types of data collected and the permissible uses of that data.
- **Collaboration and Resource Sharing**
 - Highlighted the need to collate and organize existing resources (akin to the “clearinghouse” suggested above).
- **ISP Transparency and Influence**
 - Identified the possibilities for tracking and measuring ISP influence over policymaking and regulation, including through public datasets of campaign contributions.
 - Discussed the need for greater state and federal regulatory powers over ISP practices.
 - Noted the challenges for ISPs of sharing transparent data with policymakers (for purposes of policy design) that may have other negative repercussions (such as for purposes of regulatory enforcement).
 - Noted the differential burden between large ISPs and smaller competitors imposed by data transparency requirements.
 - Suggested incentives, such as grants or tax relief, for greater transparency.
- **Service Quality and Affordability**
 - Identified the need to measure data caps or limits across a single provider’s network and to link those measures to demographic data as well as data on user experience and internet usage.
 - Noted the possibility of measuring and monitoring “tier flattening” in ISP service plans.
- **Interdisciplinary Collaboration**
 - Reflected on the value of interdisciplinary collaboration, recognizing mutual learning and a commitment to maintaining the working relationship for policy advancement.
 - Highlighted the importance of longitudinal work and organizational structure for long-term studies.

Research Questions

The discussions across the breakout sessions led to a set of critical research questions the community needs to explore:

- **Data Collection and Metrics**
 - How can we implement, support, and leverage equipment-based continuous measurements?
- **Metrics Standardization and Analysis**
 - What are best practices for measuring network performance consistently, across providers and over time?
 - How can we complement quantitative studies with surveys and interview-based research on consumers' broadband experiences?
 - What other dimensions of a user's broadband experience, aside from price and speed, matter the most, and how can we measure and evaluate those features?
- **Broadband Adoption and Affordability**
 - How does variation in provider and technology types affect the efficacy of competition in broadband markets?
 - How have ISP pricing strategies changed over time, and how have those changes affected federal and state affordability programs?
- **Policy Influence and Advocacy**
 - How can experts best present their findings to policymakers and otherwise participate in critical broadband policy discussions?
 - How can we persuade consumers to participate in data collection and transparency efforts?
 - How can we persuade ISPs to participate in data collection and transparency efforts?
 - Can we measure and track the political influence of ISPs?
- **Collaboration and Implementation**
 - What institutional structures are best suited to enabling long-term, longitudinal studies of the digital divide?
 - What datasets and assets exist, and what are the best ways to combine them into a single repository of broadband research resources?

Recommendations

We conclude this report by attempting to distill the many ideas, recommendations, and research questions that arose out of this two-day convening. Given the wide-ranging nature of our conversations, we note that we cannot possibly cover all the suggestions we received over the course of the workshop without rehashing the entire event. But some common themes did emerge.

First, participants across disciplines repeatedly emphasized the need for (and the importance of) high-quality and actionable empirical research that is focused on pressing policy questions. Many of these questions are listed above, and we discussed in our panel discussions and breakout sessions both possible methods for addressing such questions and the policy outcomes that such research might inform. We have also collated these questions into a single, synthesized document, attached as an Appendix to this Report. However, participants also noted that simply writing a comprehensive research agenda is insufficient. Advancing the goal of broadband equity depends on a sustained research effort that reaches across disciplines to identify urgent and salient research questions and answer them, using interdisciplinary methods as appropriate and bringing those results to policymakers.

Second, several participants noted the need for greater community infrastructure across disciplines. Many participants, for example, lauded the workshop's interdisciplinary approach, explaining that they greatly appreciated the chance to identify internet measurement resources that might help serve policy needs (or, conversely, the chance to identify policy questions that internet measurement resources might help address). But these same participants lamented that they had never met before and worried that there was no obvious plan to continue to convene this community.

Finally, and perhaps most significantly, several participants described the need for an interdisciplinary institute or hub that could help identify salient policy questions and data requirements, serve as a resource for existing datasets, and help coordinate engineering and research projects to collect and analyze new and existing data. For example, one participant noted that while there is an existing array of datasets and resources, those resources are scattered across institutions, difficult to locate, and of uneven quality. Likewise, we have received multiple requests for access to the BQT, the tool described in our Welcome Remarks, from a range of policy advocacy organizations for various policy-facing purposes. However, supporting these *ad hoc* requests is not easily scaled, especially alongside active research projects.

Consistent with these recommendations, we imagine developing an **interdisciplinary institution** to help achieve all three goals. Specifically, we have in mind an institution that serves as an **operating entity** for a sustainable **digital infrastructure** that aggregates and then facilitates access to novel and extant broadband-related datasets for a range of stakeholders across research, civil society, and policy communities. We imagine that this institution would help advance our knowledge of broadband access, affordability, and adoption by collating existing datasets with original research tools. More concretely, the envisioned digital infrastructure will facilitate the synthesis of robust empirical evidence that (1) enables policymakers to make critical policy decisions, (2) does not rely on potentially erroneous and self-serving self-reported ISP data, and (3) empowers marginalized communities and related advocacy groups to make progress, at both federal and local levels, to address digital inequity.

We imagine that this institution would support various outreach activities. Specifically, it will facilitate hosting regular convenings and would serve as a coordination point for the community of researchers and advocates focused on matters of broadband equity. These workshops will also help identify new use cases, data needs, and existing data gaps. Such efforts will offer opportunities to get feedback from different domain experts on leveraging the existing digital infrastructure and enhancing the infrastructure itself to address various data gaps. It will also support various educational efforts (e.g., online lectures, tutorials, etc.) to enable stakeholders to learn how to leverage the proposed digital infrastructure and customize the analysis to suit their specific policy and advocacy needs.

How would it achieve this goal? We imagine that the institution's foundation would be composed of a research engineering core responsible for operating a digital infrastructure that facilitates access to novel and extant broadband-related datasets for different stakeholders.

Specifically, this digital infrastructure will support various data processing pipelines that transform existing publicly accessible datasets into easy-to-query database systems. We will consider extensible data schemas that simplify merging different datasets. For example, merging broadband availability data with M-Lab's broadband quality, BQT's broadband plan, and Census' socioeconomic datasets at different spatial (e.g., census block) and temporal (for a specific month) granularities. These processing pipelines will employ different state-of-the-art data cleaning and denoising techniques.

We will also develop new and augment existing data-collection tools to address various data-quality issues. For example, as part of this digital infrastructure, we will augment the Broadband-plan Querying Tool (BQT) to extract broadband plans for semi-urban and rural areas. BQT currently only supports data access from seven major ISPs in the US, primarily serving users in urban/semi-urban areas. This limitation makes assessing the broadband affordability issues in rural areas difficult. As part of this effort, we can enhance BQT to support querying for smaller ISPs that serve rural America, improving its coverage. Similarly, [previous work](#) has demonstrated the need to identify the context for crowdsourced measurements. We can use existing techniques or develop new techniques to augment existing datasets with additional contextual information, making it easier to leverage these datasets for policymaking.

Overall, this digital infrastructure would provide data collection (for active data, such as that generated by BQT) and aggregation (for passive data, such as data provided by the Federal Communications Commission), data processing (e.g., denoising), and analytics. Moreover, those data pipelines would be shaped by input from the academic and policy communities: As those communities identify new data priorities in the face of, say, changing legal regimes, engineering might respond by developing new tools to collect different or better information. At the bottom, we

imagine an institution that can provide useful, publicly accessible queryable databases composed of clean, processed, and usable data that researchers and policymakers can employ easily, at scale, and with minimal restrictions.

Appendix: Schedule and Attendees

Schedule

<p style="text-align: center;">Day 1 Tuesday, June 20 <u>Goldberg Room, 297 Law Building</u></p>	
12:00 – 1:00 PM	Lunch
1:00 – 1:30 PM	Welcome
1:30 – 2:00 PM	<p>Keynote Address: Former Commissioner and Acting Chairwoman Mignon Clyburn, Federal Communications Commission</p> <p><i>Finding the Answers: The Role and Efficacy of Data in Bridging the Digital Divide</i></p>
2:00 – 3:00 PM	<p>Panel Discussion: Short-Term Challenges and Opportunities</p> <p><i>Moderator: Elizabeth Belding</i></p> <p><i>Panelists:</i></p> <ul style="list-style-type: none"> • <i>Agarwal, Shubhika (Illinois Broadband Lab)</i> • <i>Aquino, Kat (Education Superhighway)</i> • <i>Friend, Zach (Second District Supervisor for Santa Cruz County)</i> • <i>Schulzrinne, Henning (NTIA / Columbia University)</i> • <i>Schwantes, Jonathan (Consumer Reports)</i>
3:00 – 3:30 PM	Break
3:30 – 4:30 PM	Breakout Sessions: Short-Term Challenges and Opportunities (Rooms 123, 129, 130, and 136)
4:30 – 5:00 PM	Group Report Outs
5:30 PM	Reception & Dinner (Warren Room, 295 Law Building)

<p>Day 2 Wednesday, June 21 <u>Goldberg Room, 297 Law Building</u></p>	
8:00 – 8:55 AM	Breakfast
8:55 – 9:00 AM	Welcome
9:00 – 10:00 AM	<p>Panel Discussion: Long-Term Priorities and Strategies</p> <p><i>Moderator: Tejas Narechania</i></p> <p><i>Panelists:</i></p> <ul style="list-style-type: none"> • Bauer, Johannes (Michigan State University) • Feamster, Nick (University of Chicago) • Fister, Joanna (Federal Communications Commission) • Sangalang, Miguel (City of Los Angeles) • Savage, Georgia (#OaklandUndivided)
10:00 – 10:30 AM	Break
10:30 – 11:30 AM	Breakout Sessions: Long-Term Priorities and Strategies (Rooms 123, 129, 130, and 136)
11:30 – 12:00 PM	Group Report Outs
12:00 PM – 12:15 PM	Closing Remarks
12:15 PM	Lunch To-Go

Attendees

- | | |
|------------------------|---|
| Agarwal, Shubhika | Illinois Broadband Lab |
| Aneja, Abhay | UC Berkeley |
| Aquino, Katherine | EducationSuperHighway |
| Barton-Garcia, Jordana | Connect Humanity |
| Bauer, Johannes | Quello Center & Michigan State University |
| Baxter, Stacey | Next Century Cities |
| Belding, Elizabeth | UC Santa Barbara |
| Bischof, Zachary | Georgia Tech |
| Choffnes, David | Northeastern University |
| Coffin, Jane | Connect Humanity |
| Deacon, Dan | University of Michigan Law School |

Diot, Christophe	Google
Douglas, Matthew	Hoopa Valley Public Utilities District
Feamster, Nick	University of Chicago
Fister, Joanna	Federal Communications Commission
Friend, Zach	County of Santa Cruz
Gamero-Garrido, Alexander	Northeastern University
Garcia, Nick	Public Knowledge
Gill, Phillipa	Google
Ghosh Monisha	University of Notre Dame
Gupta, Arpit	UC Santa Barbara
Heidemann, John	USC
Katz-Bassett, Ethan	Columbia University
Kiselev, Eugene	Federal Communications Commission
Kouyoumijan, Hrag	Education SuperHighway
Lee, Amanda	Ready.net, Inc
Lewis, Chris	Public Knowledge
Lima, Isis	Anatel
Loup, Dustin	National Broadband Mapping Coalition
Mangla, Tarun	University of Chicago
Marre, Alex	National Telecommunications and Information Administration
Narechania, Tejas	UC Berkeley School of Law
Ochillo, Francella	Next Century Cities
Ohlsen, Lai Yi	Measurement Lab
Paul, Udit	UC Santa Barbara
Reeder, Dave	Ookla
Riley, Megan	EducationSuperHighway
Rowe, Gabriella	Grow Associates
Sandoval, Catherine	US Chemical Safety Board
Sangalang, Miguel	City of Los Angeles
Savage, Georgia	#OaklandUndivided
Schrubbe, Alexis	Internet Equity Initiative
Schulzrinne, Henning	NTIA / Columbia University
Schwantes, Jonathan	Consumer Reports
Shenker, Scott	UC Berkeley & ICSI
Siegel Singh, Caroline	The Greenlining Institute
Silverman, Peter	Adaptive Spectrum and Signal Alignment, Inc. (ASSIA)
Srinivasavaradhan, Varshika	UC Santa Barbara
Stallman, Erik	UC Berkeley School of Law
Stuyvesant, Amy	Merit Network

Tavares, Danilo
Townsend, Katherine
Whitacre, Brian
Woroch, Glenn
Zacher, Corian
Zegura, Ellen

Anatel
Measurement Lab
Oklahoma State University
University of California
Next Century Cities
Georgia Tech